

From every point of view



the 'Alpha' leads

Of the new and revolutionary 'Alpha' Reproducer, the "Wireless World" states—"a distinct advance in the reliability of M.C. Units."

The 'Alpha' incorporates a unique and patented method of mounting the diaphragm independently of the chassis, thus ensuring complete freedom from the ill-effects of chassis distortion through damage or other causes which often result in the speech coil fouling the magnet gap. This construction ensures permanent and trouble-free operation.

Two models are available, viz. STANDARD with 6 ratio transformer, and MODEL 'B' with universal transformer for Class B operation **52/6**

Ask your dealer to demonstrate, and write us for new 1934 Leaflet.

REPRODUCERS & AMPLIFIERS LTD. WOLVERHAMPTON.

& RA 'ALPHA'
P.M. MOVING COIL REPRODUCER DE-LUXE

Holdens



EDISWAN

The name that means 'EXCELLENCE'

This Ediswan H.T. Battery cell reveals the secrets of extra H.T. service

A brass cap tightly affixed to the carbon rod forms the positive connection.

The cell is sealed by means of a waxed washer over which paraffin wax is poured. This washer assists in centralising the sac in the cell.

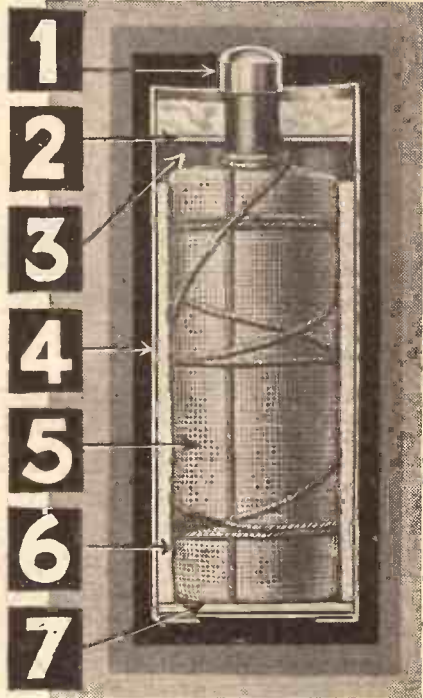
An air space is left between the top of the sac and the washer to allow for the expansion of the electrolyte during discharge.

A substantial zinc container which forms the negative pole of the cell.

The sac consists of a highly efficient depolariser, tightly compressed round the carbon rod, the whole being securely wrapped and tied.

Electrolytic paste of a special chemical composition which fills the space between sac and zinc container and activates the cell.

A waxed paper disc which insulates the sac from the bottom of the zinc container.



Don't risk wasting your money on inferior batteries. Insist on Ediswan. You can get them in all standard sizes including portable types—Standard or Super Capacity—at the usual prices.

EDISWAN
H.T. BATTERIES



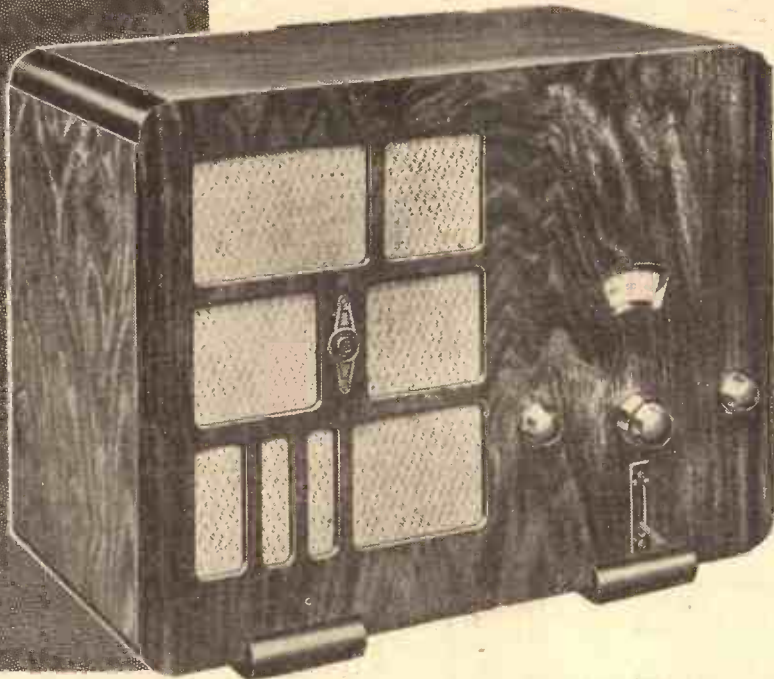
THE EDISON SWAN ELECTRIC CO. LTD.
PONDERS END, MIDDLESEX

EDISWAN the Better Service Batteries

B.254



NEVER BEFORE SUCH RANGE . . .
 SUCH SELECTIVITY . . . SUCH
 TRUE-TO-LIFE TONE AT SUCH
MODEST PRICES



The **COSSOR** MELODY
MAKER

VARIABLE-MU
 SCREENED GRID
 CIRCUIT

PENTODE, CLASS "B" or
 MAINS POWER OUTPUT

BALANCED ARMATURE
 or
 MOVING COIL
 LOUD SPEAKER

BATTERY
 or ALL-ELECTRIC

Up-to-the minute in design, incorporating Variable-Mu S.G. stage, fully shielded high-efficiency coils, single dial tuning etc., this remarkable new Cossor Melody Maker is exceptional value. Capable of bringing in a wide choice of programmes this powerful Receiver is, in every way, equal to much more costly Sets. Yet, in spite of its efficiency, it is so simple that you can build it at home. No wireless knowledge necessary. Send at once for Constructional Chart—use the coupon.

SPECIFICATIONS

**BATTERY MODEL 341
 PENTODE OUTPUT**

Balanced Armature Loud Speaker
 Complete Kit of Parts for assembling Cossor Melody Maker, Model 341, similar to illustration, including Cossor Variable-Mu Screened Grid, Cossor Detector, and Cossor Pentode Valves. Fully screened coils, Double-Gang Condenser, Combined Volume Control and On-Off Switch, all-metal chassis, and all the parts for simple home assembly. Handsome cabinet 18 1/2" x 13 1/2" x 10", space for batteries and accumulator. Balanced Armature Speaker: provision for Gramophone Pick-up Plug and Jack.
 Wave-length range 200/530 and 900/2,000 metres. **Price £6.7.6**

Hire Purchase Terms 16/- deposit and 10 monthly payments of 12/6 or alternatively 20/- deposit and 6 monthly payments of 20/-.

**BATTERY MODEL 342
 MOVING COIL LOUD SPEAKER**

Complete Kit of Parts similar to Model 341 described above, except that it is supplied with a Permanent Magnet Moving Coil Loud Speaker. **Price £7.2.6**

Hire Purchase Terms 17/6 deposit and 9 monthly payments of 15/6.

**BATTERY MODEL 344
 CLASS "B" OUTPUT**

Complete Kit of Parts as Model 341 described above, but with four Cossor Valves, Class "B" Output Stage and Permanent Magnet Moving Coil Loud Speaker. **Price £8.2.6**

Hire Purchase Terms 20/- deposit and 10 monthly payments of 16/-.

ALL-ELECTRIC MODEL 347

Complete Kit of Parts, similar to Model 341 described above, but with four Cossor A.C. Mains Valves. Factory-built and tested Power Unit and Mains Energised Moving Coil Loud Speaker. For A.C. Mains only 200/250 volts (adjustable) 40/100 cycles. **Price £8.19.0**

Hire Purchase Terms 20/- deposit and 9 monthly payments of 20/-.

Prices do not apply in I.F.S.

To A. C. Cossor Ltd., Melody Dept., Highbury Grove, London N.5

Please send me a Constructional Chart which tells me how to build a Cossor Melody Maker Model No.

NAME

ADDRESS

P.W. 7/10/33

POPULAR WIRELESS

THE FIRST AND FOREMOST RADIO WEEKLY
 Scientific Adviser : Chief Radio Consultant :
 SIR OLIVER LODGE, F.R.S. P. P. ECKERSLEY, M.I.E.E.
 Editor : N. F. EDWARDS.
 Technical Editor : G. V. DOWDING, Associate, I.E.E.
 Assistant Editors : P. R. BIRD and A. JOHNSON-RANDALL
 Chief of Research Department : K. D. ROGERS.

The Paper that Made Wireless Popular

THE PERFECT PIANO A SHORT-WAVE CLUB WIRELESS CONTROL GLASGOW'S EXHIBITION

Silence is Perfect.

THE piano with the perfect tone, which some genius sought to design and eventually did design, was found to be scarcely audible. This provides material for lots of cheap jests about the little girl next door and her daily "practice," etc., but to me it is a source of interesting speculation.

The more perfect the tone the less the sound, and so the "music of the spheres" is inaudible. Quality, not quantity! The profounder the silence the more one experiences the feeling that one can hear it! But, anyway, how awful it must be to have to play on an instrument which one cannot hear!

The "Valvonium."

WHICH brings me straight to that ingenious "P.W." device, the "Valvonium." I hope that many of you have constructed this novel music-maker as a bit of a lark to introduce to your folk as a Christmas surprise. Then they will regard your tinkering with more favour, less sarcasm and perhaps some interest.

I hope also that Mr. Dowding will give us a broadcast performance on this new engine of his, "compèred" by, say, Leonard Henry and Mr. Honegger. That's the sort of turn which would make Mr. Maschwitz's reputation as a provider of light entertainment!

A Fourth Birthday.

CONGRATULATIONS to the International Short-Wave Club, which celebrates its fourth birthday this month. Its little monthly magazine must be equivalent to a "thriller" for short-wave enthusiasts; it certainly is a revelation of the world-wide interest which is taken in short waves.

In the September issue I notice that Mr. C. S. Wells, 15, Academy Street, Concord, New Hampshire, U.S.A., would like to correspond with fellow-members in the British Empire. I wonder if Mr. Wells would let me know what Thoreau's Walden Lake looks like now.

RADIO NOTES & NEWS

RADIO IN CANADA
 AT THE SEASIDE
 A MIXED AUDIENCE
 THOSE CRYSTAL SETS

Radio Remote Control.

THOSE of you who had the luck to see Major Raymond Phillips demonstrate his wireless-controlled model airship may be interested to know that he has written a book, "Ray-Controlled Mechanism," which is all about how to control model trains, boats and airships by wireless.

Here is a new avenue for the home constructor to enter. The way in which Major Phillips sent that airship sailing round a large hall, turning and dropping bombs, all at the behest of a spark coil, was wonderful. I shall never forget it. And the book which reveals how it is to be done costs half a crown.

Scottish Radio Success.

THE Scottish Radio Exhibition at Glasgow was just as great a success, relatively, as

You must not miss the special announcement concerning—

AN
 IMPORTANT
 ANNOUNCEMENT

JOHN SCOTT-TAGGART

F. Inst. P., A.M.I.E.E.

—the World-Renowned Set Designer, which appears on page 146 of this number.

Radiolympia. In eight days 200,000 visitors were registered, and it is calculated that the total value of the sales effected was about a million and a half pounds sterling.

One manufacturer of batteries actually had £50,000 worth of orders in one day. So someone has some money north of the Border. Well, the tide seems to be on the turn from all accounts and nowhere will prosperity be more welcome or more deserved than in Scotland.

Another Picture.

TURNING to Canada, however, the reports for 1932 show that there were 133,454 radio sets sold, valued \$6,758,959, as against 286,122 sets, valued \$18,141,347, sold in 1931. These figures

mean that there was a drop of 53 per cent in the sale of receivers and of 63 per cent in the receipts of those sales.

Canada is suffering, as the rest of the world, from trade depression, but it is one of the countries with a future. May those pioneers who are sticking out the lean years now have their full share of the fat ones to come!

Fibre Needles Again.

I WAS surprised to see that P. P. Eckersley, in his September 23rd article, indicates that he uses, or would use, fibre gramophone needles. If he knows of a fibre needle which will "bring out" of a record what a steel one can, and which can stand up to heavy orchestral music I wish he would give me news of it.

I began with fibre in order to reduce surface noise, but gave it up for steel, and since I have had a radiogram I have found the metal quite pleasing in effect. Has agate ever been tried as needle material? It should make an admirable "permanent."

A Few More "Howlers."

"SATURATION is when everybody has one." One wouldn't saturate me!

"A waveband is a band which broadcasts such as Jack Pain and Sir Henry Hall." Oh, what wood Henry Hall say! "A short circuit is a quick way round for electricity." "Cross lots," as the Americans say.

"A busbar is a resteront for busmen, formerly known as a pull-up for carmen." "Frequency means how often a thing occurs." If a thing happens once, is it a

frequent occurrence? "Radiation is transmitting by wireless, or a patent gas-fire, or radium." This lad meant to hit the "bull," even if it took three shots.

Lectures on Loudspeakers.

A SERIES of twelve lectures and demonstrations on "Loudspeakers and Acoustic Problems" began on October 2nd at the Borough Polytechnic, Borough Road, London, S.E.1. The lecturer is Mr. N. W. McLachlan, D.Sc., M.I.E.E., a well-known authority on these subjects.

(Continued on next page.)

TURN
 TO
 PAGE 146

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

(Continued from previous page.)

A syllabus of this course and other details may be had on application to the Principal. The fee is ten shillings, which is nominal, considering the range of the course and the authority of the lecturer.

A Seaside Snapshot.

WHILST staying in the Isle of Wight this summer I saw this pretty and unique picture in real life: A handsome woman between forty and fifty years of age, with greying hair beautifully waved, clothed to some extent in the newest edition of bathing-dress (consisting apparently of two coloured handkerchiefs and a few tapes), sat gracefully on the sand. She had a monocle in her left eye and a nine-inch gasper tube between her teeth. In front of her was a portable wireless set, and she was accompanying broadcast songs on a banjo! She seemed to be perfectly happy, self-absorbed and unconscious of the ebb and flow of the crowds. A most pleasing sight!



Echo of the Great War.

ONE of the more pleasant echoes of the war, and a happy interlude in the somewhat turbulent European overture, is to be provided by the decoration of Major Gladstone Murray by the Germans with the flying Order of Chivalry.

It was Major Murray who, after the shooting down of Baron von Richthofen, the German air "ace," flew over the German

lines and dropped a wreath and a message describing the death and burial of the baron. What a mix-up life is, to be sure!

Progress in Percentages.

RECENT statistics show that during 1932 the number of homes wired for electricity supply increased to 43.6 per cent from 38.5 per cent as for 1931. The actual percentage increase of 1932 over 1931 was about thirteen, a very healthy figure. So much for the "all-mains" sets sales possibilities.

But there are still some six million homes which lack mains electricity, so what a mighty market lies open to the makers of batteries and battery-operated sets! By James! Give me a chunk of zinc and some whatsitname! I'm going to be a battery magnate. (*Lie down, Tower!*—Ed. P.W.)

So Now We Know.

EXTRACT from radio page of an American newspaper: "Radio humor can never be either subtle or risqué. The comedian on the air must always bear

in mind that his audience probably includes a clergyman, a chorus girl, a schoolboy, a spinster and perhaps a blasé man-about-town." From which one infers that all American chorus girls are married.



But that is by the way. The point to deplore is that American radio humour must be poor "custard-pie, slapstick" stuff if it can never be subtle. So like their films!

"Say It With Music."

AWFULLY sorry that dear old Jack Payne had to lay off work for several weeks on account of poor health. I have noted before this that Jack always seems to be a bit short in the wind when he announces the next item.

When I saw him in a talkie film conducting his "boys" I thought that he was too strenuous in his movements. He almost danced. But perhaps all that is part of his recipe for success. Certainly he seemed to lift the band up and carry it along by his vivacious and compelling movements.

Poor Old Radio!

IN all the din of America's economic struggle radio is one of the villains. It is described in American

papers as "taking the rap" for depression. Music publishers, parents and teachers' associations and other bodies are "out gunning" for poor ole man radio.

The films, the "legitimate" stage and the vaudeville interests are also in the man-hunt. Well, radio has come to stay, and if its competitors cannot exist alongside of it they must drop out of the fight—like stage coaches and sailing ships.

Crystallography.

WELL, well! We live and learn—as the ex-tadpole said when it caught a fly on the wing and then jumped four times its own length. Messrs. Lawrie & Co., of Bournemouth, in a crystal-clear statement, crystallise the crystal position in that town.

They estimate that there are some 3,000 crystal-set users there; they have sold to local dealers during the last four years about 1,500 crystal sets—and had an order for another in August! So Bournemouth has for me two claims to distinction: it once harboured Robert Louis Stevenson and it is a crystal diehard!



Abbreviated Answers.

T. L. F. (Chester).—Your scheme for remote control of a receiver is orthodox and will work, but your sudden and searching questions about chilled beef perplex me. I am not an amateur butcher—and I like my beef hot. J. S. (Slough).—Yes, I believe that radio, in various ways, will revolutionise human life, but that it will not alter human nature or beliefs.

C. N. (Didcot).—Learn to hasten slowly, friend; the higher the top rungs the longer the ladder. Study radio as though your life depended on it, and you will win. Bread and butter first, then the cake. S. Y. (Leicester).—Take a lemon! The fellow who said his lead-in was clogged with "atmospherics" eggs was pulling your leg.

More Crystal Confession.

MR. P. (Parkstone, Dorset) writes that his district, which isn't Bournemouth but is as near as makes no odds, is crystal-ridden, but explains that they suffer from bad local quality and from trams. The two together are enough to turn a listener into a halma player, I should think. As compensation the victims "go abroad."



That the B.B.C. should allow "bad local quality" is sadder than the six pips at eventide. That the B.B.C. should drive loyal listeners abroad rouses the blood in every English heart. Rally round Bournemouth! ARIEL.

SHORT WAVES

"What will come after the wireless?" asks a scientific writer. Demands for the instalments, we fear.—"Punch."

Love is not dead while the wireless widow continues to keep her husband's radio set clean and bright.

CONFESSION.

I was much amused, writes "H." when paying my own wireless licence, to hear the young woman next me inform the postal official at the counter: "I am afraid you will have to date it a month back, as we have had the wireless since then."—*Liverpool Post and Mercury.*

"Concert Party 'Tripe' on the Radio," runs a headline. It's food for thought, anyway.

Host (after tuning in about half-a-dozen foreign stations—rather unsuccessfully): "What would you like to hear now?" Bored Listener: "The gentle sound o' switching off."

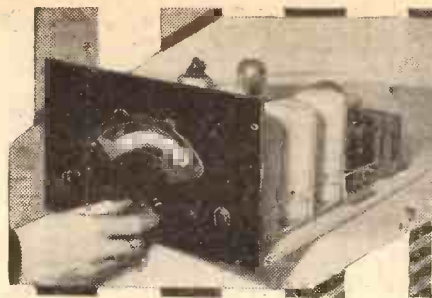
THE PROM CONCERTS.

... Though on the opening night I was not there, I listened to the concert on the air. Somewhere in Surrey in an easy-chair, And joined in the prolonged, tumultuous shout Greeting Sir Henry's "39 not out."

Still, while our debt must gratefully be paid To wireless for its wide and welcome aid, It cannot be too strenuously averred "Proms" gain by being seen as well as heard.

This better part on Tuesday night was ours, Watching, around the fountain and the flowers, The so-called promenaders, lured by "Tchai," By freakish Goossens and by Nicolai.

The B.B.C.'s great band, ninety in all, Responded nobly to Sir Henry's call And made a gorgeous and stupendous roar In the Finale of "Tchai's" No. 4.—"Punch."



THE ECONOMY SUPER

“P.W.” AGAIN LEADS

WITH this set you can obtain a complete mastery of the European stations. It uses six valves, but although each one pulls its full weight the set completely justifies its title.

It is economical both to build and to maintain. Undoubtedly it is the most powerful outfit the battery user could construct without exceeding the limits of reasonable H.T. and other costs.

Remarkably Selective.

There is every essential for a first-class, hot-stuff performance and an entire absence of “refinements” of debatable value.

Great selectivity and a freedom from re-radiation are two outstanding features, and the volume is controllable between extremely wide limits owing to the use of an ingenious new scheme evolved in the “P.W.” Research Dept.

It is a combination of aerial potentiometer feed and variable-mu control, and it works in this way. As the bias on the variable-mu valve is increased to reduce volume, automatically and simultaneously the aerial feed is lowered, so that the first detector is not left to overload. Also, of course, the control is exceedingly effective. Notice, too, that

Specially designed for economical operation from dry H.T. batteries, this magnificent superheterodyne receiver has among its outstanding features, single-knob tuning, band-pass input, an ingenious method of dual volume control, and Class B output. It is as simple to build as it is to operate, and has a performance both in range and power which will satisfy the most critical—a set which definitely takes its place in the front rank of receiver designs.

Designed and Described by the “P.W.” RESEARCH DEPT.

the H.T. consumption of the variable-mu drops as the volume control is operated. This economy feature is supplemented by

ANOTHER TRIUMPH!

special anode, bend and Class B measures—so despite its colossal power, our “Economy Super” takes an almost fantastically lower over-all H.T. current.

There is a separate oscillator valve (V2 in the diagram) and an S.G. intermediate stage.

The inherent bass-emphasising propensities of the superheterodyne principle are partially offset by the Class B stage, and a compensating L.F. transformer completes the work.

Single Dial Control.

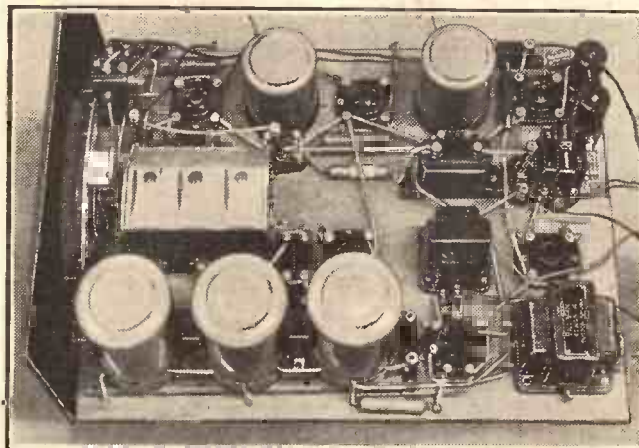
So, instead of the boominess usually associated with superhets, the output is clean and clear-cut. In fact, it is a revelation as to what can be done with a scientifically designed super.

The tuning is accomplished with a single control, and this in itself is an achievement, for it would have been quite impossible a year or two ago.

The operation of the set is further simplified by the combination of the on-off and volume controls. The tuning adjustments call for no skill whatever—not even the skill such as is needed to work the few controls of the simplest ordinary set.

All that has to be done is to
(Continued on next page.)

UNIQUE IN DESIGN AND PERFORMANCE



THE COMPONENTS

AND THEIR MAKES

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.	Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Superhet coil assembly	Colvern K.61, K.62, K.63	—	2 1-mfd. fixed condensers	T.C.C., type 250	Dubilier
1 Three-gang .0005-mfd. tuning condenser	British Radio- phone, type 604	—	1 .001-mfd. fixed condenser	T.C.C., type 34	Dubilier, Lissen, Telsen
2 Intermediate transformers	Colvern 110 K.C.	—	1 .002-mfd. fixed condenser	Dubilier, type 620	Telsen, T.C.C.
1 Binocular H.F. choke	Telsen W.74	—	1 .0005-mfd. fixed condenser	Dubilier, type 620	T.C.C., Lissen, Telsen
1 50,000-ohm potentiometer with three-point on/off switch	Lewcos	—	1 .0003-mfd. fixed condenser	T.C.C., type 34	Lissen, Dubilier, Telsen
1 Class B driver transformer	Lissen	Varley, Ferranti, R.I., Telsen, Benjamin	1 .0003-mfd. fixed condenser	Dubilier, type 620	T.C.C., Telsen
1 Class B output choke	Telsen W.345	Wearite, Sound Sales, Varley, Telsen, Benjamin	2 .0003-mfd. fixed tag condensers	Igranic	Dubilier
1 L.F. transformer (compensating)	R.I. “Varitone”	Varley D.P.35	5 Four-pin valve holders	Benjamin “Vibro- broad”	W.B., Telsen, Ferranti, Wearite
1 2-megohm grid leak with terminals or wire ends	Graham Farish “Ohmite”	Dubilier, Telsen, Bulgin, Lissen	1 Seven-pin valve holder	Benjamin	Telsen, W.B., Ferranti
1 2-megohm grid leak with vertical holder	Graham Farish “Ohmite”	—	1 Vernier dial for tuning condenser	Radiophone, type 583A	—
1 100,000-ohm resistance with vertical holder	Graham Farish “Ohmite”	—	1 Panel, Ebonite, 12 in. x 7 in.	Goltone	Peto-Scott
1 25,000-ohm resistance with vertical holder	Graham Farish “Ohmite”	—	1 Metaplex baseboard, 12 x 16 in.	Peto-Scott	—
1 2-mfd. fixed condenser	Lissen	T.C.C., Dubilier, Igranic	1 Cabinet to suit above	Peto-Scott	—
2 1-mfd. fixed condensers	Dubilier, type 4404	T.C.C.	1 Terminal strip	Bulgin P.30 A.E.	—
			2 Anode connectors	Belling-Lee	—
			8 Wander-plugs	Eellex	Clix, Belling-Lee
			1 Wander-fuse	Belling-Lee	—
			2 Accumulator spades	Clix	Belling-Lee, Eellex
			4 yards insulated sleeving	Goltone	—
			6 yards 18-gauge tinned copper wire	Goltone	—
			Flex, screws, etc.	Peto-Scott	—

THE ECONOMY SUPER

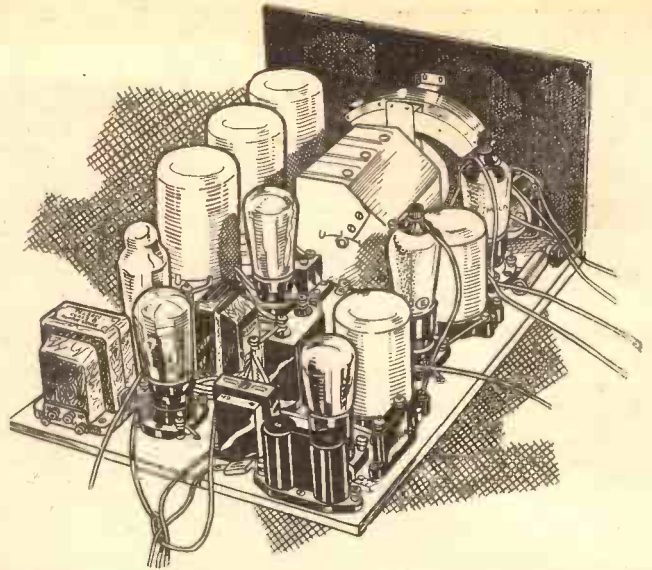
(Continued from previous page.)

rotate the one tuning knob until the station desired is heard and twist the volume control for the required loudness. Anybody could do it without previous experience quite successfully.

The layout of the set is on the most straightforward lines, but it gains rather than loses by its simplicity. As an examination of the photos and wiring diagram will

Don't let this task frighten you. It is really quite easy, especially as the big hole's edge doesn't show, and therefore need not be cut with meticulous precision.

Ebonite is very easy stuff to work. You could drill right round the marked-out area in a comparatively short time. But don't forget that ebonite is a somewhat



THESE ARE THE VALVES TO USE

Make.	1st Det.	Oscillator.	Intermediate	2nd Det.	Driver	Output
Mullard	P.M.12A.	P.M.1.H.L.	P.M.12M.	P.M.1.H.L.	P.M.2A.	—
Cosor	220S.G.	210H.F.	220V.S.	210H.F.	220P.A.	—
Mazda	S.G.215	H.L.210	S215V.M.	H.L.210	P.220	—
Osram	S.22	H.L.2	V.S.24	H.L.2	L.P.2	B.21
Marconi	S.22	H.L.2	V.S.24	H.L.2	L.P.2	B.21

show, the leads are all short, for the components adopt an orderly sequence.

The components need to be carefully selected, and if you use any others than the makers specified, that is your own risk.

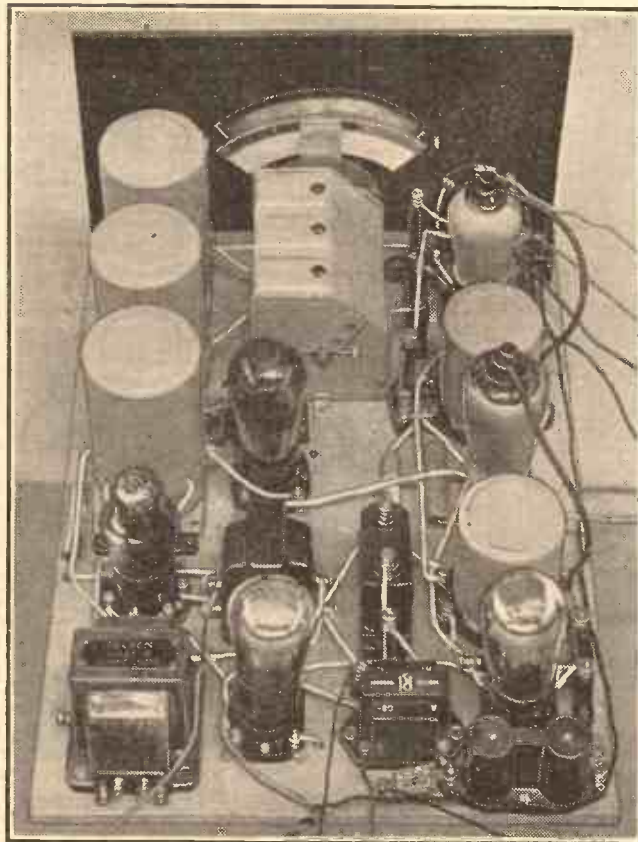
Built up with recommended parts in close approximation to our plans, the set will work at once; but anything might happen with some odd pieces of gear whose characteristics fail to suit the circuit.

We strongly advise the use of "Metaplex" for the baseboard. Ordinary ply, covered with copper foil, could be used, but it is much more difficult to handle.

It Simplifies Wiring.

We have adopted a metallised baseboard, not only to create stability (that was hardly necessary, anyway), but also to reduce the wiring. This it has done to an almost extraordinary extent. And at the same time the overall efficiency of the set was probably increased.

The panel drilling includes the making of an aperture for the gang-condenser dial. A template is provided by the makers of the component.



The few panel controls and the nature of the circuit make possible the use of a deep but not very wide baseboard. This greatly assists in placing the components so that short wiring is possible throughout, a feature which is well illustrated by the artist's sketch above and the photograph on the left, both of which show the completed receiver.

brittle material and is apt to crack badly if handled roughly.

Fit the panel components before proceeding with the mounting of the others. Get the panel erected complete, with the gang condenser and coil unit in position. This will ensure that the controls of these items operate properly and that the condenser is not fouled by the other baseboard parts.

When fixing these latter be careful that they are orientated correctly, so that their terminals assume the right positions for the wiring. This applies particularly to the transformers and to the valve holders.

No Wasted Space.

And it should be noted that while there is adequate room for everything there is no space to waste, so it will be rather advisable to arrange all the components in their respective

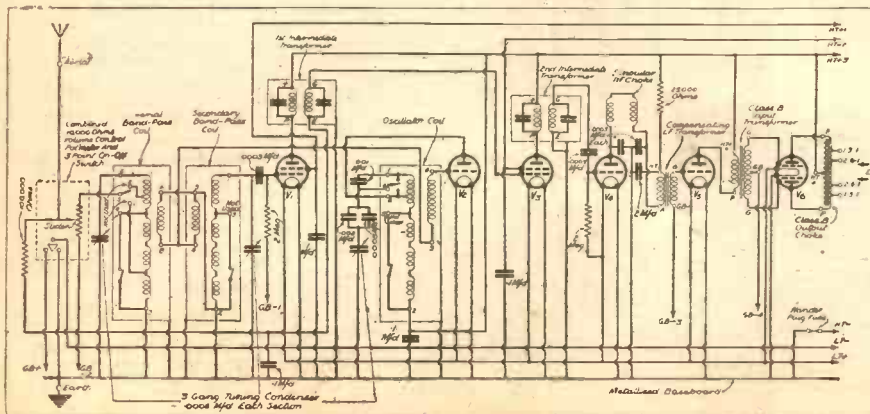
positions before finally screwing them down.

In certain cases we have employed "wire-end" condensers. These do not need to be secured to the baseboard, except in so far as their connections to the baseboard surface are concerned.

These, as in the case of the other leads joined to the baseboard, can be connected merely by means of small wood screws.

(Continued on next page.)

CIRCUIT DETAILS



The arrangement of the six valves used in the receiver is given in this circuit diagram. The first S.G. valve acts as mixer, the local oscillations from the second valve being fed into its grid circuit. Then follow the intermediate, second detector, driver and Class B valves in that order.

THE ECONOMY SUPER

(Continued from previous page.)

Soldering tags and washers will assist to make round connections, though they are by no means essential.

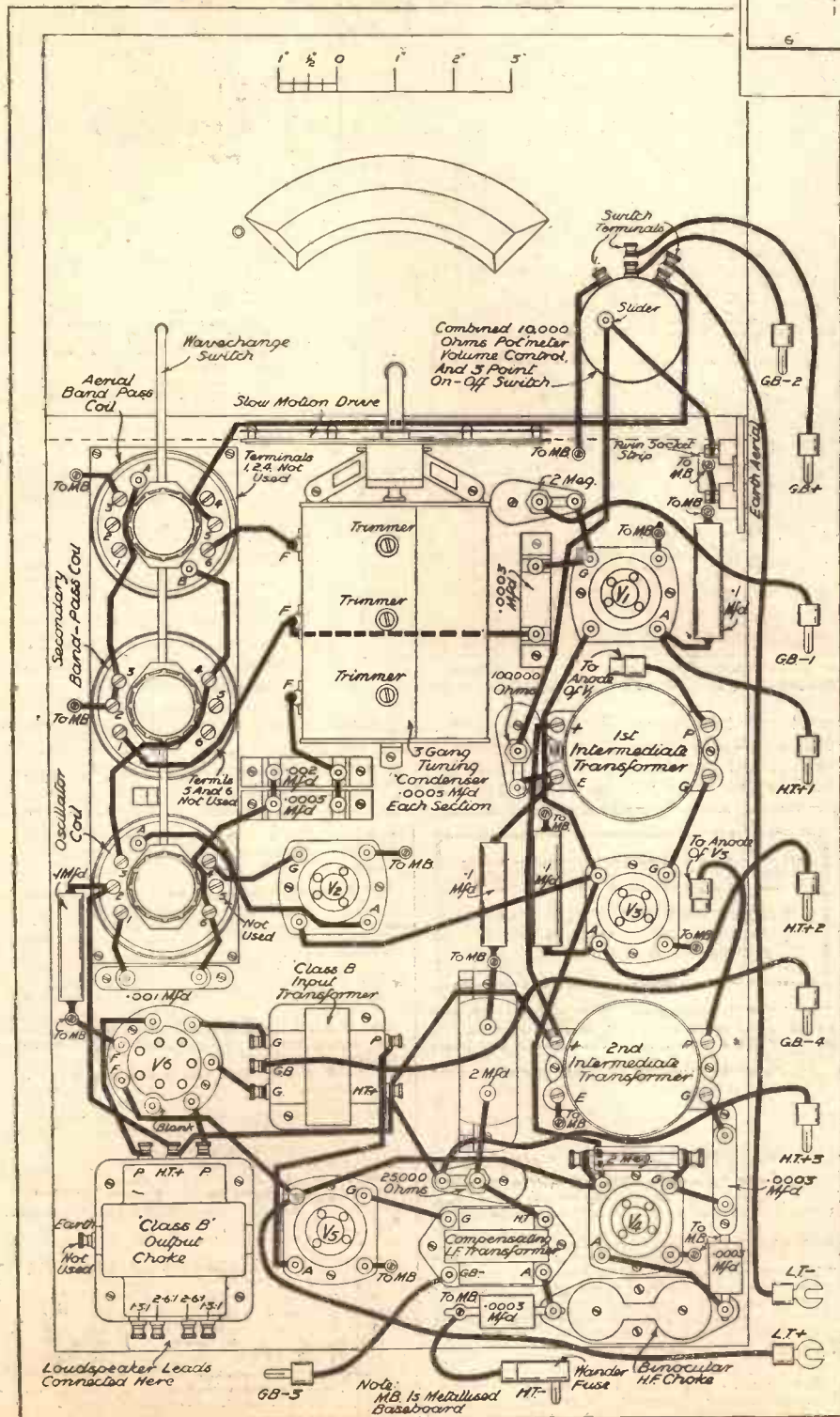
Be economical with your wire when you do the wiring. Generally speaking, the less wire you can use for each of the leads the better.

As for the wire itself, several alternatives present themselves. We are rather partial to the British Radiophone "Pull-Back" ourselves, for it is easy to handle and is electrically and mechanically sound.

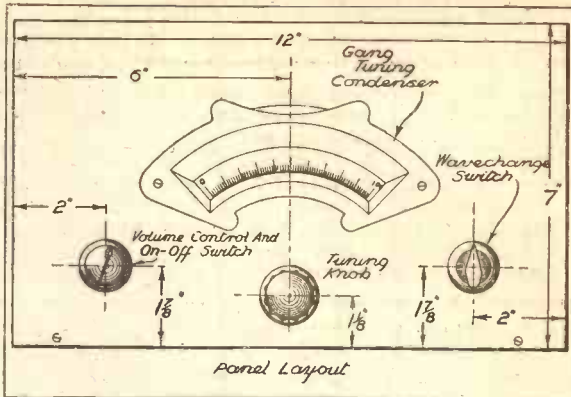
Flex Leads.

Of course, it is advised for permanent connections

A SKILFULLY PLANNED LAYOUT



YOUR PANEL DIMENSIONS



The two diagrams on this page, drilling and wiring, give all the essential details for the construction of the "Economy Super." Note that a number of leads, marked M.B., are connected direct to the metallised baseboard.

only. The flexible leads for the batteries and S.G. valve anodes need to be of rubber-covered stranded wire.

The H.T. plus 3 serves the anodes of the Class B valve. Obviously, then, it demands the maximum voltage. H.T. plus 1 and H.T. plus 2 merely connect to the screens of the S.G.'s. These, then, are not critical, but must be at least 20 or 25 volts below the maximum.

Grid Bias Requirements.

G.B. minus 1 and G.B. minus 2 serve V1 and V3 (the two S.G.'s) respectively. As the first one (V1) is on the anode-bend principle, it will require at least 4 1/2 volts.

V3 is a short-base variable-mu valve, and needs at least 6 volts G.B.

The loudspeaker connections will vary with different makes: that is, the connections to the output terminals of the Class B output choke.

If your choke or loudspeaker leaflet doesn't give you the required information, you will have to try the different connections until you can decide which one sounds best.

Trimming the ganged condenser is an easy matter. Leave the two trimmers nearest the panel at approximately middle settings and concentrate on adjusting the back trimmer until the best effect is achieved. Then a slight adjustment of the one nearest to the panel will complete the operation satisfactorily.

SUITABLE ACCESSORIES

BATTERIES.—H.T. 120 volts.: Lissen, Marconiophone, Pertrix, Ever Ready, Ediswan, Drydex, Siemens, G.E.C., Block.

G.B. 9 volts.: Ediswan, Siemens, Ever Ready, Pertrix, Marconiophone, Lissen, Drydex.

L.T. 2 volts.: Block, Oldham, Exide, Lissen, Pertrix.

LOUDSPEAKER.—W.B., Marconiophone, Magnavox, Rola, R. & A., Ferranti, Blue Spot, Celestion, Amplion, G.E.C., H.M.V., Ormond, Atlas.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite" Radiophone "Receptru" download, Bulgin lightning switch; Graham Farish "Filt" earthing device.

THE MIRROR OF THE B.B.C.

By O. H. M.

THE N.B.C. AND THE B.B.C.

The Great Reorganisation—More Professional Entertainment—Choosing the "Good Causes"—Separating Creation and Administration.

THE "Modern Columbus" idea, or the rediscovery of America for British listeners through regular talks on the spot by Mr. Mais, had its origin with the B.B.C., but it could not have been carried out in the absence of the wholehearted co-operation of the National Broadcasting Company of America. Incidentally, American listeners in their vast numbers will listen to Mr. Mais with at least as much keenness as British listeners.

These being the facts, I am not surprised that N.B.C. officials in New York are a little hurt at the almost complete absence from B.B.C. publicity of the important part which the N.B.C. has played. I suggest to Broadcasting House that it is important in the interests of future co-operation with America to try to make good what was no doubt an oversight.

Jobs in the B.B.C.

In the great reorganisation still in progress, and with normal expansion going on simultaneously, new jobs are turning up in various departments of B.B.C. work. It is right that posts should be filled on the lines of business practice rather than according to civil service rules. This, however, does not relieve the B.B.C. of the special responsibility imposed upon it by virtue of its monopolistic position and public-service character.

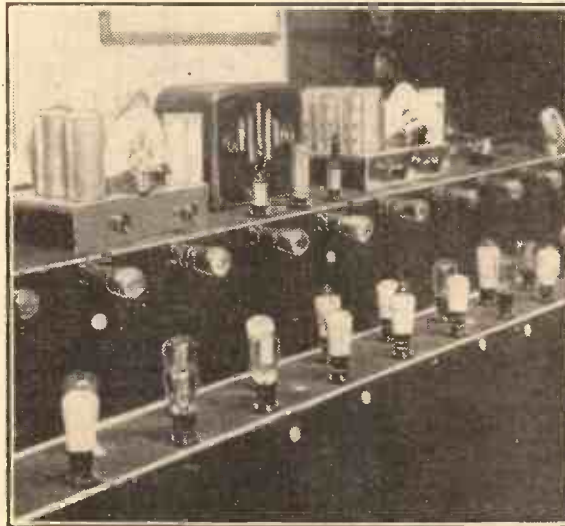
In other words, the actual machinery of selecting and appointing staff should be made known. Are jobs advertised? Is there an Appointments Committee? What safeguards exist to ensure the appointment of the most highly qualified and most suitable candidates

for vacant posts? I commend these questions to the attention of the Board of Governors of the B.B.C.

More Professional Entertainment.

The return of André Charlot to the microphone after an absence of five years forecasts the introduction of more professional entertainment into the B.B.C. transmissions this winter. This will be

AND NOW THE PARIS SHOW



A novel display of valves and sets at the Radio Exhibition in Paris. The great popularity of superhets is one of the features of this show.

good news to listeners all over the country. Present plans include most of the leading theatre and music-hall producers who now for the first time will be offered rewards

big enough to attract their serious interest in the microphone.

Overhauling Appeals.

The five-minute period at 8.45 on Sunday evening which the B.B.C. allots to approved good causes has now become an important and permanent part of the machinery of British charity. Many thousands of pounds are collected annually in this way. Nor does there seem to be any tendency for the flow to dry up, although as time goes on the advantage of the skilled broadcaster is increasingly reflected in the monetary return.

There is a feeling, however, that something is to be desired in the selection of the charities that benefit. This difficult and thankless task is in the hands of a representative Appeals Committee. An examination of the lists over the past few years reveals a considerable proportion of good causes that are primarily local.

No doubt there are good reasons in support of these local causes, but if so they should be explained. It is a good thing, therefore, that Mr. Iremonger, the new official in charge of this work at Broadcasting House, is engaged on a thorough overhaul and review.

Creative versus Administrative.

In theory the new organisation scheme of the B.B.C. separated creation from administration in order to give the former all-important function greater scope and opportunity. But, like so many other excellent theories, it is not so easy to translate into practice.

The trouble about the separation of creative and administrative functions is that the administrative tend to act primarily as a check and brake on the creative.

Then, again, the really competent creator loathes to entrust the application of his ideas to other people; he fails to draw a distinction between originating and

(Continued on page 177.)

IT isn't all compères of light entertainment who are privileged to be "uncle" to their listeners. I don't know what claim André Charlot has to this relationship with us, but somehow I fancy it has a value to him. We are inclined to accept him and his show without a thought of adverse criticism. We—or some of us—like the intimacy of his remarks between the turns, and that, I think, provided the major enjoyment of the hour.

While many listeners will be ready to think his the hour of the week, I shall condemn it for its lack of "go." There was a thinness about it which contrasted greatly with the same sort of entertainment the B.B.C. is putting on these days. Clearly, Uncle André still relies on the same technique as he employed years ago, even to the use of a gong as a substitute for a curtain.

The B.B.C. has worked hard on this question of technique, and rapidly approaches a phase in its development which places broadcast variety on a level with stage variety. Anyone who heard the music-hall from the riverside studio will agree that the B.B.C.'s attempt to transport listeners from their fireside chairs to a seat in the theatre was a most successful one.

A real theatre atmosphere was perceptible in varying degrees throughout the performance. It began to gather as soon as the curtain rose. It thickened with Alexander and Mose, but before Lily Morris had finished her turn it enveloped everything.

Whether this was due to Alexander and Mose, or Lily Morris, or the compère, or the large studio audience I wouldn't like to say; but if I were forced to formulate an opinion I wouldn't leave the large studio audience out of my considerations. This was the best variety we've had since Olympia.

One realised the value of the new presentation as one listened to the artistes appearing in the first

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

Saturday variety matinée. With nothing whatever to help them get it over, they did, I'm sure, as well as many stars would have done under the same conditions.

Joseph Spree was undaunted, however, and favoured us with the longest turn I have ever listened to in a variety bill. I liked Katie Kay rather, though there was nothing novel in her act. This was the fault of the whole bill. It was featureless, as the Stock Exchange reports say.

There will be considerable satisfaction over the first of the "Anywhere-for-a-News-Story" series. We've waited long enough for a worthy successor to the "Escape" and "Hazard" talks, and I really believe we've got it this time.

Mr. Ward Price painted a very vivid picture of the "Burning of Smyrna." It is too much to hope, after this gripping story, that the best wine is being kept till last. But, whatever the case, I shall look forward to Saturday evenings this autumn with the same pleasure as I did a few years ago. Isn't 7.5 p.m. a bit early for these talks?

Speaking to the schools the other afternoon, Professor Lloyd-James said: "Any way of speaking that can be easily or quickly understood is a good way. If it doesn't hurt or shock people, then it is a better

way; and if it is the speech of a sensible and modest person, free from affectation or swank, then it is the best way."

Professor Lloyd-James wasn't at all dogmatic about it; he just gave it as his opinion, at the same time wondering whether his listeners would agree with him. How school-children would appreciate the compliment he paid them by speaking to them as man to men! There's no question about his holding their attention.

Adult listeners could spend a very profitable half-hour listening to Professor Lloyd-James talking to the schools. He is a great broadcaster! I shall long remember the comparison he drew between a uniform of speech and a uniform of clothing. And the children will, too. Such teaching must have good results.

It is interesting to see how far the many speakers on the air fulfil the professor's dictum. While I think all are easily and quickly understood and do not shock or hurt people, I can't say that they are all always free from affectation or swank.

I think all speakers will have passed the test this week. Yet how different—but all vocationally correct—have been their modes of speech!

First there was the mines secretary talking on mine dangers just as you'd expect a mines secretary to speak. Then Tom Newman, on science and poultry, speaking ideally as a poultry expert. Mr. Newman's talk was more interesting in view of the British Association's verbal activities at Leicester recently.

While acknowledging a debt of gratitude to science for the help it has given the poultry keepers, he hinted a warning against possible failures when science didn't go hand in hand with common sense.

(Continued on page 174.)

ECKERSLEY EXPLAINS-



WHY do you listen to a loudspeaker? You see, I am asking you a question. I shall try to give some answers by myself to myself.

I can't really tell you why you listen to a loudspeaker. It frequently amazes me to realise that some just keep a loudspeaker as they keep dogs—for company. It is questionable which causes more annoyance to neighbours, a dog or a loudspeaker.

So I take unreason No. 1 for listening to a loudspeaker. "A" listens to a loudspeaker "for company"—whether it's good, whether it's bad, whatever the programme, whenever the hour, on and on and on—and on—for company. It takes all sorts to make a world, they (who are they?) say, but look at the world they've made, and so small, too!

"—Fills Streets and Gardens."

They make it a more awful world when its loudspeaker fills streets and gardens, its bathing-pools and its public-houses, its hotels and its living-rooms, blaring on and out and forth, whether it's good, whether it's bad, whatever the programme, whenever the hour. I must start a new "Don't-do-it" campaign. So please don't do it. Not that you would, you who are keener on experimenting than "just listening."

"WHY DO YOU LISTEN . . . ?"



Well, we've finished with Mr. "A." Now Mr. "B." From the ridiculous Mr. "A" (and sometimes Mrs. or Miss) to the sublime Mr. "B." Mr. "B" is one who has no interest in musical reproduction unless it gives him pleasure "as music." Mr. "B" and I are one. I practically never listen to the reproduction of music because, on the whole, it doesn't sound (to me) like music. The interesting technical

"I must start a new 'Don't-do-it' campaign," writes our Radio Consultant-in-Chief this week in describing types of listeners and their various requirements. It is a most unusual contribution, full of truth and written from a "new-angle" viewpoint.

question is: Can it ever sound like music?

I think it might be made to sound so like music as to give one pleasure. You see, reproduction of orchestral music must always be incomplete in some degree. If the room where repro-

duction takes place has acoustical properties which do something new to the reproduced sounds, you have two reverberations in series, as: (1) the reverberation of the studio or concert hall, and (2) the reverberation of the room in which the sounds are reproduced. But this is a detail which may fade into insignificance when and if transmission and reception can be improved.

Concerning "Top."

There are two great weaknesses to-day in wireless and sound reproduction generally. They are both concerned with "top" reproduction, which is so sadly lacking. The loudspeaker of ordinary everyday use fails to reproduce "top," even if it was there, and receivers have to be so selective that it isn't there to reproduce.

I had another demonstration of this the other day. I made a wireless system which was "flat" from 50 to 10,000 within a db. or so, and played gramophone records at it. I mean, through it. There it was! Just "reproduction," varying in excellence with the record, but just reproduction.

Then I got a good microphone and put that in another room. The improvement was

This week P. P. Eckersley starts his discourse by asking, "Why do you listen to a loudspeaker?" Some people, he avers, "listen to a speaker for company—whether it's good, whether it's bad, whatever the programme, whenever the hour, on and on and on—for company."

"fantastic" in comparison. Wireless reproduction was fair; but give me a loudspeaker and I could astonish you. The thing to do is to develop—trailing the Americans—a dual loudspeaker and give the "top" reproducer some top to reproduce.

I used to say that we must develop the "art" of reproduction and find what distortions we can make to make a speaker pleasing. I think the theory sound, but the practice (so far as I am concerned) has found a best "art," but one that does NOT please me.

Far Less Critical.

One last thing, Mr. "B"! Do you notice that "musicians" are far less critical of loudspeakers than unmusical people such as you and I, who *must* have perfection? You see, the "musicians" can interpret the sounds that are not there, and so get pleasure. We can't—and—I don't know about you, Mr. "B," but I don't!

I can spend a little time with Mr. "C." Mr. "C" is interested in his set as a hobby. He wants to go searching the ether for maximum noise, and he doesn't care what the noise is at all. Well, well! It takes all—but I said that before.

The Case of Mr. "C."

I don't see why Mr. "C" shouldn't have a hobby. I envy him, because I don't really thrill over it much now. But I think short-wave listening is fun. You hear all sorts of interesting things. But I forgot; we are talking to Mr. "D."

Mr. "D" is one who listens to a speaker because he is interested in the programme as such. He cares for talks and variety and children's hours and—or all or some.

I am with Mr. "D," because reproduction doesn't matter once there is intrinsic interest in the programme. I can listen to short-wave programmes and forgive noise and fading if the programme itself is interesting. I can listen to jazz and so on when I know the tune and can revive memories.

Poor reproduction, again, doesn't matter. I am become "musical" because I interpret what isn't there. Mr. "D" and I are, therefore, fundamentally critical (and that doesn't mean carping) about programmes because, with the lack of good

(Continued on page 174.)

JOHN SCOTT-TAGGART

Important Announcement

The Editor is delighted to announce that the Autumn star set of this journal is to be designed by John Scott-Taggart, F.Inst.P., A.M.I.E.E., Britain's leading designer.

Full details of his magnificent new receiver—the S.T.500—will appear in a fortnight's time exclusively in—

Popular Wireless



The RADIO PLAY COMPETITION

By VAL GIELGUD

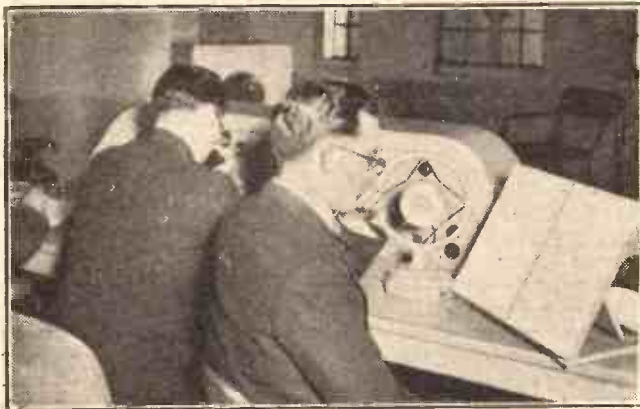
IN my former article relative to the Radio Play Competition sponsored by POPULAR WIRELESS I gave a number of general hints which I feel are worth bearing in mind by all would-be authors of plays for broadcasting. In this article I wish to draw the attention of intending competitors specifically to certain aspects of the twelve plays which are being revived by the B.B.C. between October and December of this year.

Now, as I said elsewhere, this series is intended to be a survey, and not a jubilee. In urging you to listen to all, or at least to

Last week the B.B.C.'s Productions Director gave some excellent and practical advice to intending competitors in the "Popular Wireless" Radio Play Competition.

In this, his second article, Mr. Gielgud advises you to listen to the Radio Play Festival which will be broadcast during the next twelve weeks, and tells you what you can learn from a comparison of the twelve plays which have been chosen for production.

IN THE DRAMATIC-CONTROL ROOM



The nerve-centre of a radio play is the dramatic-control (or D.C.) room; high up in the tower of Broadcasting House. This picture, taken during the broadcasting of a play, shows the producer following the script and, at the D.C. panel itself, his assistant who, by carrying out the producer's instructions, fulfils the functions of the stage-manager of a theatre play.

as many of these revivals as you can, I am not saying that after hearing them you will have heard the best—dramatically speaking—that can possibly come from a loud-speaker. You will probably learn rather what to avoid in finding the mistakes in these revivals than you will learn positively how to write a broadcast play, for I may as well state at once that, in my opinion, you cannot put a broadcast play together synthetically.

An Historical Survey.

It may be true that if you could combine all the best features of these twelve plays you would have, if not the best radio play, at any rate a very good radio play. But such a combination is obviously out of the question, for it would imply that you put aside your own personality—which must be the essential motive muscle of any author's output—in favour of a mixture of a second-hand Guthrie-Peach-Richard Hughes-Dulcima Glasby and so on.

It is, in the first place, worth your while to follow this series purely from an historical angle: to watch the progress of the radio

play from Mr. Hughes' one-acter, laid in the darkness of underground, through the period of violent—even excessive—knob-twiddling represented by "Pursuit" and the first "Kaleidoscope," to the crystallisation of the multiple-studio technique and the resulting search rather for the content of plays than for the methods of how to produce them that is apparent in the later plays of the series.

A Model.

From such an historical survey do not jump to any false conclusions. Don't think that because Mr. Hughes' play is the first, it is therefore necessarily out of date. The tautness of his dialogue, the essential drama of his basic situation, re-

example, the adaptations of the novels of "Carnival," "Romance" and "The Three Musketeers." You will observe that Mr. Marvell has adapted freely so long as he preserved the spirit of Mr. Mackenzie's book and maintained the feeling of the period behind it. On the other hand, Mr. Creswell very wisely, faced by an enormous canvas, confined himself for the most part to compression and atmosphere, leaving to Conrad the plot and the story development; while Mr. Guthrie, in "The Three Musketeers," reproduces the speed and action of the original Dumas. And it is interesting in a further comparison to see how that high-speed rhythmic production is simply a logical growth from his earlier original play, "The Flowers are Not for You to Pick."

Virtues of Omission.

I would like particularly to call your attention to this last play for another reason. It is in many scenes a model of taut, ascetic writing. I doubt if anything better of its kind has ever been written for the microphone than the love scene in the rowing boat, and its excellence is due for the most part for what is left out, not what

(Continued on next page.)

HOW THEY GET REALISM



The murder scene from that very successful show "Cabaret," broadcast recently, shows how realism enters into a radio play. Note the microphones suspended in many places over the "stage" to secure the right effect.

main models of their kind. In the second place, don't be unduly alarmed by the phrases "multiple-studio technique" and "dramatic-control panel." It is no more essential for the ordinary author to understand multiple-studio technique than it is for an author who is writing a film story to understand the ins and outs of camera work.

No doubt it will help him if he does, but he can write a perfectly good story without exhaustive knowledge of this kind, and may easily write a better one; for if you think too much of the means of the production of your play you are more likely to lose sight of the end at which that play should aim.

You will probably find a comparative method as useful as any. Compare, for

CONTROLLING AERIAL INPUT

By A. W. YOUNGMAN.

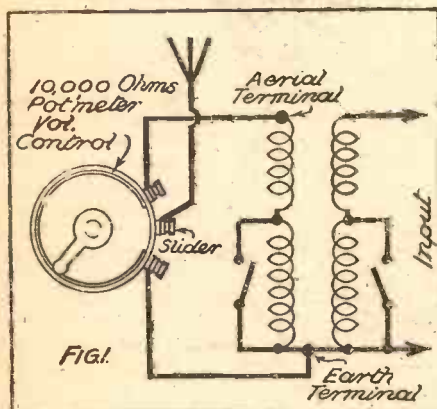
Overloading of the pre-detector stages of a receiver is often responsible for distortion, but can be very easily prevented.

A POTENTIOMETER, to a great number of listeners, is regarded only as a method of L.F. volume control, but in many cases it can be used more advantageously as a pre-H.F. control.

Actually, if a moderately large aerial is used and the receiving apparatus is within the service area of the transmitter, it is no uncommon occurrence to experience overloading of the screened-grid valve, accompanied by subsequent distortion in the output.

In practice it is an easy matter to remedy this by incorporating a potentiometer with a value of approximately 10,000 ohms in the aerial circuit.

SIMPLE TO APPLY



How potentiometer control of the aerial input is effected.

The connections of this arrangement are shown diagrammatically in Fig. 1.

The aerial lead is first of all disconnected from the coil and joined to the centre, or slider, terminal of the potentiometer. One side terminal is connected to the earth terminal on the coil, and the remaining side terminal to the position on the coil previously occupied by the aerial lead.

By adjusting the slider it is then possible to control the input to the H.F. valve, and consequently the output of the receiver.

In the event of the above method of pre-H.F. control being applied to a ganged receiver employing a single-winding, tapped aerial coil, the connections must be slightly modified, as illustrated in Fig. 2.

Direction of Control.

The aerial lead is disconnected from the coil and joined to the slider terminal of the potentiometer. One fixed terminal goes to the earth side of the coil, and the remaining fixed terminal to one side of a .0001-mfd. or .0003-mfd. fixed condenser, the other side of which is connected to the tapping point on the coil. The .0005-mfd. tuning condenser must be connected across the whole of the coil in the usual way.

The control should operate in a clockwise direction to increase volume, and this is a point that must be remembered in wiring up. If it is found that the volume increases when the potentiometer knob is turned

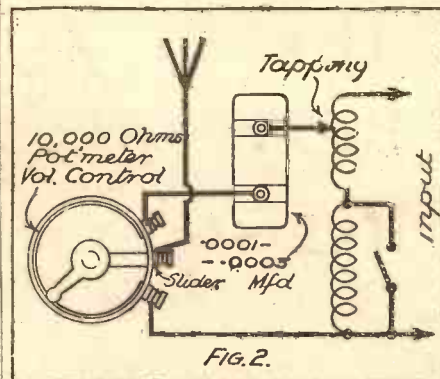
anti-clockwise, the connections to the two outside terminals should be reversed.

Listeners who are not troubled with aerial overloading can utilise a potentiometer in the screening-grid lead of the H.T. valve as a means of pre-detector volume control instead of the above method, although in this instance a potentiometer having a value of approximately 50,000 ohms should be used.

Varying Screen Volts.

The H.T. + lead connecting the S.G. terminal must first of all be disconnected from the latter point and joined to one side terminal on the potentiometer. The slider is now connected to the S.G. terminal on the valve holder and the remaining side terminal to earth. By adjusting the position of the slider it is possible to vary the degree of amplification given by the valve, which, in turn, limits the input to the detector and so prevents any overloading in this stage.

FOR GANGED RECEIVERS



This modification of the potentiometer connections should be employed with ganged tuning.

THE RADIO PLAY COMPETITION

(Continued from previous page.)

is put in. Save in rare cases it is a golden rule for a broadcast play that it should be spared both padding and "purple patches." The microphone shows up insincerity quite mercilessly, and the revelation of insincerity will knock the bottom out of the most promising play.

In the treatment of content you may find helpful a comparison of the different ways in which the great subject of war has been handled in "The White Chateau," "Red Tabs" and "The Path of Glory." The first play speaks for itself; the second is an experiment—admittedly not altogether successful—of using a dramatised debate as the focal point of a broadcast play, though in this instance it is rather too ponderous to be satisfactory.

Plays of Discussion.

There is, in my belief, a definite opening at the microphone for what may be termed plays of discussion. It has been said of Mr. Bernard Shaw that in many of his plays the characters do nothing but "sit around and talk." This may look dull enough in print; but if what the characters have to talk about is interesting, if the subject which they are discussing is one which is

of vital importance to the ordinary listener, if the author has something to say and the knowledge of how to say it, that mere "sitting around and talking" can make a very good drama indeed.

If you don't believe me, either remember when you saw "Saint Joan" or take that play down from a shelf and open it at the one scene in the play in which the central figure does not appear. That scene—the scene in the Earl of Warwick's tent—was, in my view, and in the view of many better judges, the finest of the whole piece.

Mr. Peach's "The Path of Glory" has

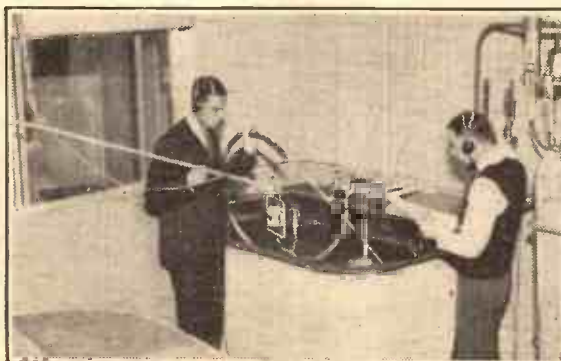
the enormous advantage of not only being unexceptionably constructed and written, but also of being extremely amusing on a serious subject. The satiric quality of this play is its greatest recommendation, while for straightforward construction and popular theme, though not to the same degree for actual writing, I commend your attention to Miss Glasby's "Obsession."

Whatever plays you miss, I would urge you to make a point of hearing "The Path of Glory," "Matinée" and "The Flowers are Not for You to Pick." I have left "Matinée" to the end because it is the sole—and accordingly almost a pathetic—example of that original radio farce for which there is such a demand and of which there has been no supply before or since.

Therefore I urge you to listen to "Matinée" and appreciate its delicious irrelevances, its fantastic absurdity, its easy passage from the sublime to the ridiculous and in turn from the ridiculous to the sublime.

It is unlike any of the other plays. I do not say it is the best of the series; I simply say that it is the lone representative of a dynasty which I should wish to see perpetuated.

THE "EFFECTS" STAFF AT WORK



An important part of every radio play is the Effects room, where every conceivable noise, from a sneeze to a sinking ship, can be faithfully reproduced.

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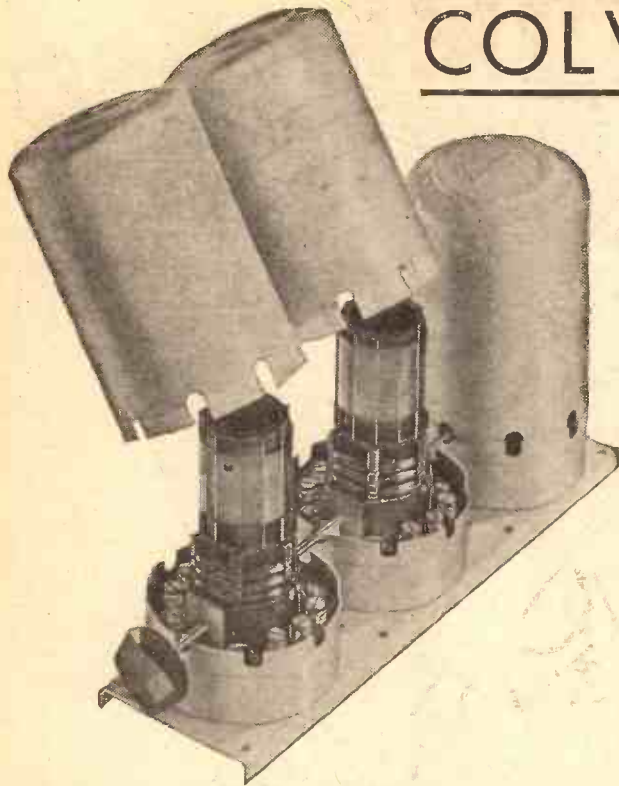
Safe maximum current carrying capacity of "Ohmites."

100° F Temperature Rise			
Ohms.	Milliamps.	Ohms.	Milliamps.
1,000	40	20,000	8
2,000	35	30,000	6.75
3,000	29	40,000	6
4,000	24	50,000	5.5
5,000	20.25	60,000	5
10,000	12	80,000	4.24
Other values pro rata		100,000	3.5

Safe maximum current carrying capacity of "Ohmites" Heavy Duty Type.

100° F Temperature Rise			
Ohms.	Milliamps.	Ohms.	Milliamps.
1,000	80	20,000	16
2,000	70	30,000	13.5
3,000	58	40,000	12
4,000	48	50,000	11
5,000	40.5	60,000	10
10,000	24	80,000	8.48
Other values pro rata		100,000	7

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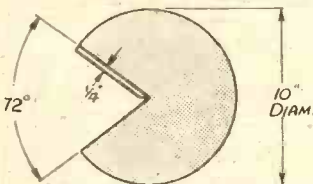
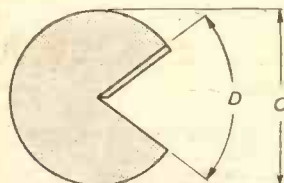
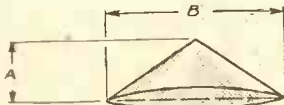
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Write for CATALOGUE.

RECOMMENDED WRINKLES

CONE DIMENSIONS.

The serious home constructor who likes his finished set to look as "professional" as possible has no doubt at some time or other endeavoured to make a paper cone for a loudspeaker. In the majority of cases the "hit-or-miss" method is adopted. The dimensions are guessed approximately, and if it "works out" reasonably correct, all well and good! If not, it means a series of trials until the job does come right. All this guesswork can be avoided by making use of a few simple calculations, and a suitable cone can be produced at the first attempt if the following instructions are carried out. Suppose we wish to construct a cone as illustrated, 3 in. high (A) and 8 in. diameter (B). The first dimension required is the diameter of the cone when laid flat (C). This is given by the simple formula, $2\sqrt{A^2 + (\frac{1}{2}B)^2}$. There-



How to cut the material.

fore, in the case which we are considering, the diameter is:

$$\begin{aligned} & 2\sqrt{3^2 + (4)^2} \\ &= 2\sqrt{9 + 16} \\ &= 2\sqrt{25} \\ &= 2 \times 5 = 10 \text{ in.} \end{aligned}$$

The 10 in. is the required diameter (C). If we cannot find the square root easily in this manner, we can square various numbers until we get one that is approximately correct. As an example, suppose we want the square root of 30. We find that $5\frac{1}{2}$ squared ($5\frac{1}{2} \times 5\frac{1}{2}$) comes to 30 $\frac{1}{4}$, which is sufficiently accurate for our purpose.

We now require the angle (D) that we have to cut out. This is given by the formula $\frac{C - B}{C} \times \frac{360}{1} = \text{angle to be cut}$.

In the case which we have taken the angle to be cut will be $\frac{10 - 8}{10} \times \frac{360}{1}$ therefore, angle to be cut = 72 degrees. This angle can be marked out with a protractor and then cut out but do not forget to leave about $\frac{1}{4}$ in. for sticking purposes, as shown in the sketch, which also shows the dimensions we have worked out.

SOFTENING THE SURROUND.

WHEN the cone of a loudspeaker is suspended by thin leather it may be found that after prolonged use in a

dry room the leather tends to become hard and taut.

If a dressing of olive oil is applied evenly all over the leather suspension ring and allowed to soak in it will be found that the leather is made soft and supple, thus giving greater freedom to the cone.

A STOPPING FOR NAIL HOLES

COLLECT the sawdust from the wood you are working on and mix with liquid glue or "Secotone." This forms a smooth paste. Press into the holes or build up the defective part with this and allow to set hard; afterwards sandpaper off the surplus stopping. This should be done before varnishing or polishing the finished job.

The advantage of using the sawdust of the wood you are using is that a natural repair is effected, and when finished does not show because you are replacing the actual wood.

MAKING ANODE TESTERS

IN your August 12th issue I saw a method of making an anode tester with a panel-mounting valve holder and a valve base. As I do not possess a suitable drill for boring the valve holder, I hit on the idea of joining

ONE GUINEA FOR THE BEST WRINKLE!

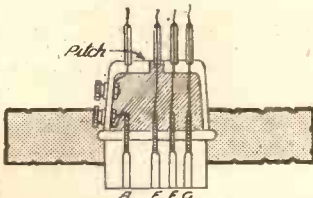
Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 ls. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

The best Wrinkle last week was sent by Mr. L. Clear, Bridge Street, Sturminster Newton, Dorset, to whom a guinea is being awarded.

them with pitch. This was poured, while hot, through the hole in the valve base and clings firmly to the screw-pins of the valve holder.



Pitch is used as a joining material.

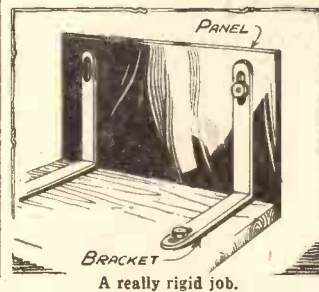
SCREENED PICK-UP LEADS.

RECENTLY I was experimenting with a gramophone pick-up and I found it was necessary to employ rather lengthy leads from the pick-up terminals on the set to the record volume control on the gramophone. In doing this I set up interaction with some extension speaker leads leading to another room. After trying various remedies for this trouble it occurred to me to try screened leads between the two points mentioned above. Now the problem was how to screen these leads, as I did not want to buy specially screened leads. Well I had to think again. This time I thought of an effective screening which put me to no expense. I procured some tinfoil and wound it round the two wires, allowing an inch overlap for each piece of foil to make good contact. After this was finished I took the screened leads and,

starting at the end at which I had begun the screening, I proceeded to tightly twist the foil so that all the joins became moulded into each other. A piece of No. 20 D.C.C. wire was bared and firmly twisted round one end of the screening for the connection to earth, and the whole was given a coat of clear varnish and left to dry.

IMPROVED PANEL BRACKETS.

IT is a good plan to make U-shaped slots at the ends of panel brackets if the pair you are using are not already so constructed. This enables you to



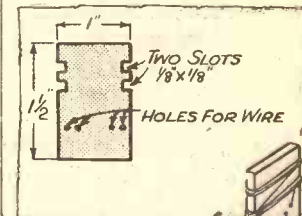
A really rigid job.

worthis), rather larger than the adaptor, is fitted with screw eyes and cords (thin blind cord), ending in hooks made from stiff wire (Glazite), as shown in sketch. The end of the board, which is padded with baize or felt to prevent scratching, rests on the ledge below the panel. The hooks engage in screw-eyes fixed into the woodwork above the panel.

CONSTRUCTING A REACTION CHOKE.

MATERIALS required: One piece of ebonite, 1 in. wide, $\frac{1}{2}$ in. long; one old valve base; one valve holder; one pitch; 250 turns of No. 36 gauge enamelled wire.

Shape ebonite as per sketch, drilling holes for wire. Clean out valve base and drill holes. Wind 125 turns of the wire in each slot, the windings being opposed. Leave about 3 in. over at each end.



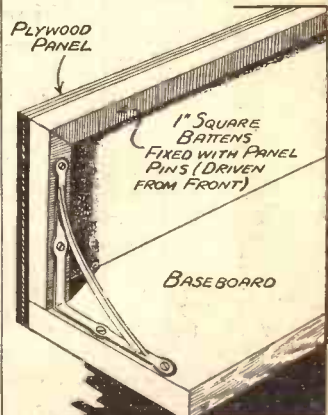
Efficient and inexpensive.



Place choke in valve base, passing wire through holes. Now melt the pitch and pour in. Then solder the wire to two pins and clean them.

TO STRENGTHEN PLYWOOD PANELS.

MANY panels nowadays are made from plywood, and, unless precautions are taken to prevent it, warping will nearly always take



Protection against warping.

place after a week or two, especially in mains sets, where the valves give off considerable heat.

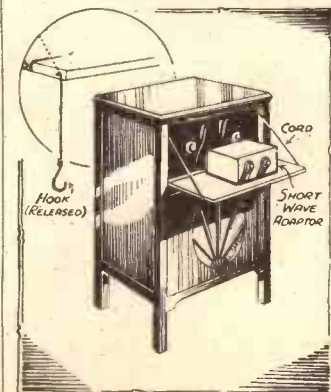
A good way to prevent warping, without spoiling the appearance of the panel, is by "framing" the top edge and the sides with battens about 1 in. or $\frac{3}{4}$ in. square, as shown in the sketch.

mount the brackets very accurately in position and so ensure that they are pressed firmly against panel and baseboard when mounting the two at right angles.

The tip is of particular value when a metal panel or baseboard is used if there is an inaccuracy in the drilling.

SUPPORTING AN ADAPTOR.

THE following idea for supporting an S.W. adaptor has proved very useful to me. It applies only to pedestal type sets, of course, and panels must be well recessed. A thick piece of plywood (such as a pastryboard sold by Wool-



Fitted in a moment.

SHORT-WAVE NOTES

BY W. S. KELSEY

All the interesting news and views of current short-wave practice.

SEVERAL queries about new and unidentified stations have reached me this week. Among them are the following: T. C. (Wakefield) reports a station giving talks in Swedish and English on about 42.8 metres between 7.30 and 8 p.m. Subject of talks, political; type of politics, communistic! Has anyone else heard him?

A whole batch report a station, apparently speaking in Spanish, just above the limit of the 19-metre broadcast band. I have mentioned him before, and unless it is X D A (Mexico) I can't spot him. The rest of the queries are so vague about wavelength that I can't do anything with them. Please note, new readers, that the information that a station comes in at 95 degrees on your dial conveys absolutely nothing to me unless you give me the settings for some of the well-known stations.

More Radio "Shorthand."

A Southsea reader takes me to task for not including the mysterious formulae "R6/FF/X" and "R7/N/X," and the like, in my recent article on "This Radio Language." The fact of the matter is that I never use them and don't consider them particularly enlightening. For the benefit of those who don't know them, however, I will explain.

The first space after the "R" strength deals with fading. "F" means ordinary fading; "FR," rapid; "FS," slow; "FF," severe; "FFF," very severe; and so on. "N" means "none."

The second space deals with static in exactly the same way—"N" for none, "X" for ordinary static, "XX" for "double-strength" static, and as many "X's" as you like can be used.

Thus the two examples quoted above mean "R6, bad fading, some static," and "R7, no fading, some static," respectively.

The only reason why I don't use them in my "P.W." notes and articles is that I regard fading and static as variable factors that will always be with us, and I candidly don't think we shall learn very much by following their variations from day to day. I sometimes see long published lists of stations with "XX" against one and "N"

interesting items of news is the fact that the Colombian station—J-3 A B F (Bogota)—is coming over regularly on 48 metres late in the evenings. His signal is a cock-crow, and he puts out a frequent time signal from a four-toned clock gong.

Grid Condenser Values.

Another interesting piece of reception is that of V E 9 B J (St. John's, New Brunswick) on 49.22 metres, also late in the evenings. Other good stations, according to W. H. R., are W 3 X L (46.69 metres) and W 2 X E (49.02 metres).

It certainly is time that we heard a little more from the 49-metre band. The evenings are drawing in, which is very good for radio enthusiasts but rather disconcerting for those fond of fresh air and games.

W. H. G. (Dewsbury) calls to my attention the fact that 00005 grid condensers are procurable nowadays, and generally give better results on short waves than the more usual 0001. I think it depends largely upon the valve, W. H. G. I have had valves that want 0003 before they start behaving themselves. On the other hand, as you say, sometimes one has to use something very small to get the best out of them.

Regarding your suggestion of a "mush filter" for super-regens.—no! I intend to cut out the mush by cutting out the super-regenerator and making a real receiver instead. I have never been very fond of them, but they are the best things we can produce for the 5-metre job at short notice. Plenty of development work is being done behind the scenes.

MOVING MARCONI'S MUSEUM



Parts of a spark transmitter that was used in early experiments by Marconi being removed to the new offices of the Marconi Company on the Embankment. They form part of a museum of historical radio apparatus.

against another, 2 of a metre away and five minutes later. One can only congratulate the perpetrators on their imagination.

My old friend W. H. R., of Plymouth, has blossomed out once more with a beautiful list of stations heard. One of his most

out the super-regenerator and making a real receiver instead. I have never been very fond of them, but they are the best things we can produce for the 5-metre job at short notice. Plenty of development work is being done behind the scenes.



The LINK BETWEEN

BY G. T. KELSEY

Weekly jottings of interest to buyers.

SEVERAL people have written to me recently to find out what I think of battery-operated radiograms. To be quite honest, those that I have heard have impressed me so much that I am rather surprised to find that the market, comparatively, is so poorly covered.

After all, there is every reason why modern battery-operated radiograms should be good, what with Class B and the various other output schemes which have been developed to provide "mains results" from batteries.

A Superb Instrument.

In this connection I am constrained in passing to call attention to one particular instrument which is in itself a significant answer to those who might have reason

to doubt the efficiency of battery-operated radiograms. The Columbia C.Q.A. Battery Four (Model 1,003) is a superb instrument, and it compares very favourably with many of the leading mains radiograms of the new season.

For those who are interested, a review of this particular instrument will shortly be appearing in "P.W." Take my advice and watch out for it!

Two Up For Manchester.

Manchester may not have a very high reputation in the South for the kind of weather to which it subjects its London visitors, but there is one Southerner at least who takes off his hat to the way in which the Mancunians run their Radio Exhibition!

Yes, I take off my hat (at some risk of getting my hair wet, I know, for I am still in Manchester!) to the introduction of demonstration rooms at the City Hall. They were always a popular diversion at the Olympia Show, but this year, for reasons best known to the powers that be, they were absent from London's Exhi-

bition. In my humble opinion, I am afraid it is definitely one up for Manchester this year.

Point number two. In London the competition for the best stand is judged by a committee appointed for the job; in Manchester, the visitors themselves are invited to participate. I may be wrong, but I think there is something very much

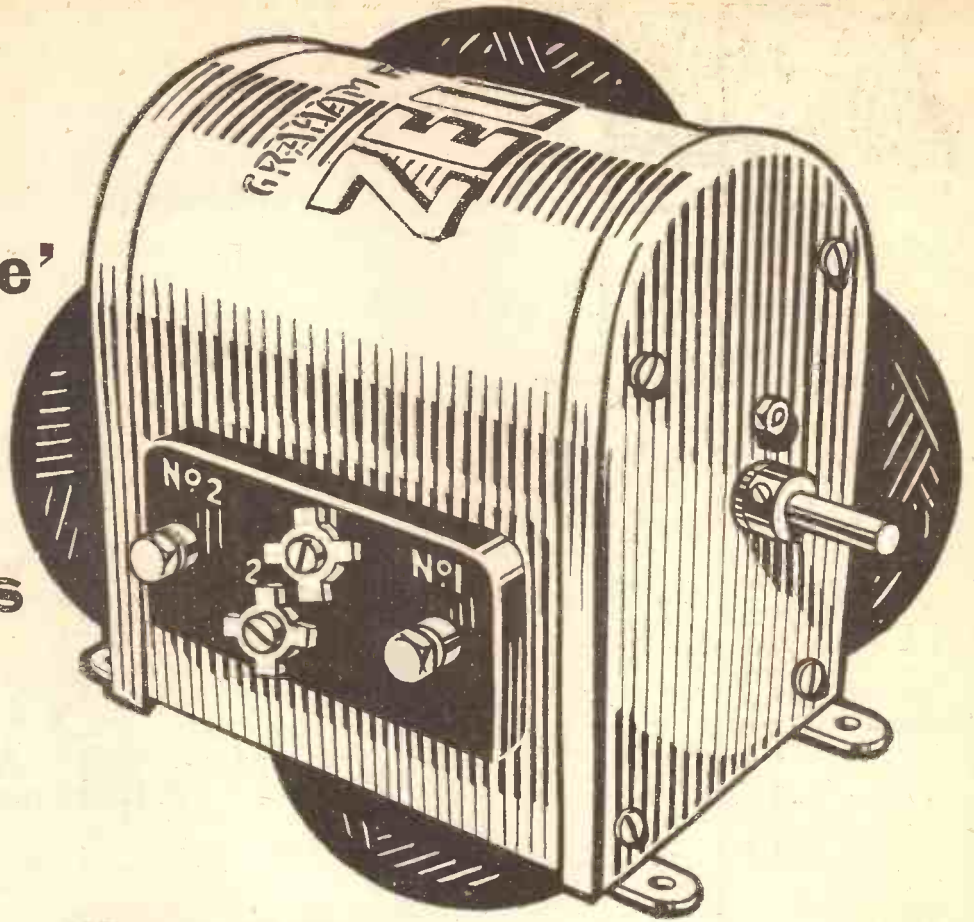
(Continued on page 177.)

OLD FAVOURITES LISTENING-IN



Clapham (in hammock) and Dwyer (smoking pipe) enjoying, with Mr. Somny, of Celestion's, a programme from one of the latest-type speakers made by that firm.

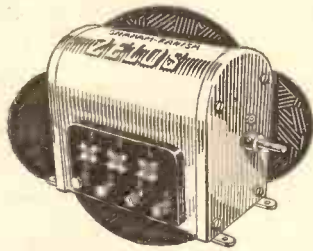
The
'Rolls Royce'
of
Condensers



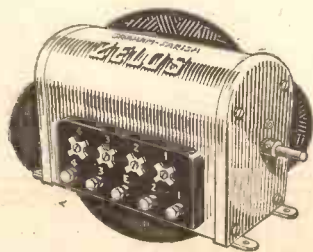
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The Condenser supreme for the modern Receiver, giving precise and simultaneous tuning for two circuits. Accurately spaced, carefully matched and efficiently screened. Fitted with low-loss trimming Condenser and star-wheel adjustment. Each set of fixed vanes attached to its own terminal, moving vanes connected to terminal on case. Rigid frame. Beautifully finished in frosted aluminium.

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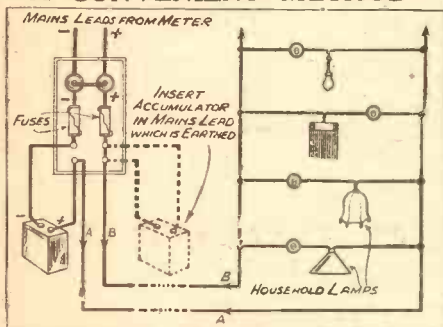
Any way of saving battery costs has an irresistible appeal for wireless enthusiasts, who will welcome this practical method of reviving their dilapidated accumulators.
By J. H. HALES.

ALTHOUGH accumulators are comparatively cheap nowadays, it is often possible to save the expense of a renewal by the method detailed below.

The method applies chiefly to the "mass-plate" accumulators. The only other necessity is a supply of D.C. current or a trickle charger.

The plates are first removed from the batteries, and, as only the negative plates are required, these are inspected for any signs of sulphation. If there is any present, the white deposit should be scraped off with an old knife, and the plates should

A CONVENIENT METHOD



Where D.C. mains are available, the long charge required to convert a negative plate into a positive may be conveniently given by connecting the modified cell in series with the house-lighting supply. Connection can easily be made at the main fuse-board, as shown diagrammatically above.

then be washed to remove any loose particles of lead, etc.

The negative plates are composed of lead in a porous condition, and the next step is to convert one of them into a positive plate.

The best one is selected and placed in the positive side of one of the old containers. If these are made of glass it is quite probable that it will not fit, owing to a moulding at the bottom which is intended to keep the plates in one position and also to separate them. If this happens, a piece is cut off each side (at the bottom only) of the selected plate so that it makes a fairly tight fit.

Ready for Charging.

The negative plate is then placed in its side of the cell, which is now filled up with acid of a specific gravity of 1.250. The top of the accumulator should not yet

be replaced, but to prevent the acid creeping the shanks of the plates and the terminals should be liberally smeared with vaseline. The object of not replacing the cover at this juncture is to allow an easier inspection of the plates.

Do It Gradually.

The battery is now connected to an electricity supply, either a trickle charger or D.C. mains, and current is passed through at a rate somewhat below its usual charging rate. It should then be charged for anything up to a hundred hours, but this need not be done all at once; in fact, it is probably an advantage to pass the current through for only a few hours each day.

It may be mentioned in passing that one of the best methods of charging the cell is to connect it in series with the house-lighting supply or with the supply to one room, when the current will only flow through for a few hours each day, i.e. when the lights are in use. Of course, in this method, as well as the others, the negative plate of the accumulator should be connected to the negative main, and the plate which is to be made positive should be joined to the positive main.

When it has been charged for the time mentioned, or very likely before, it will be noticed that the plate connected to the positive main will have become red on the edges, and some of the active material may also be going this colour. If the current is now stopped and a voltmeter connected to the terminals of the cell, it will, providing the charging has been carried out correctly, show a reading of about two volts.

The Voltage Test.

If the meter fails to show two volts, the accumulator should be connected in circuit again until the required reading is obtained.

The plates should now be removed from the container and washed as before, care being taken to prevent them touching each other, for they are now positive and negative, and although all the material in the converted plate has not yet become positive, this plate, for convenience, will hereinafter be called the positive plate.

The next process is to empty the acid out of the container and remove any particles of material which may have fallen off the plates. This is best done by washing

it in water. The case should then be dried and, together with the plates (which may be placed in position), heated gently in an oven until they are quite warm. The battery can now be sealed up again, and to do this melt enough pitch to fill the space remaining after the vulcanite cover has been replaced. This cover should not, however, be replaced until the battery is removed from the oven, and this is done as soon as the pitch commences to bubble.

Before the glass cools the pitch must be poured in, and as it contracts on cooling care should be taken to fill the space so that the level of the liquid pitch is slightly higher than the sides of the container, and then when it has set it will be found that the pitch and the sides are in line. The object of heating the battery is to prevent the hot pitch cracking the glass, and it also results in a better joint between the pitch and the parts of the accumulator which it touches.

An Effective Barrier.

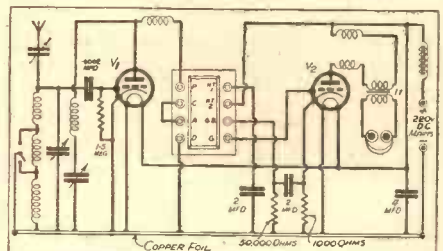
The vulcanite cover, being cold, cools the pitch which touches it, and so, if there are any spaces between it and the glass sides or the plates, prevents the pitch from running down into the inside of the battery. The vent plug should also be in position while this operation is being carried out.

The accumulator is now filled up with acid of the same specific gravity as before and charged again. It may be given a full charge, but a better way is to do it gradually, as previously explained, and when no current is being passed through it may be put into service and used as an ordinary accumulator.

As time goes on it will be found that the battery is holding a longer and longer charge, and when all the material on the positive plate has changed colour it will not be far short of its original capacity.

★.....★
FROM A READER IN SWEDEN
 Describing how he has successfully used high-voltage mains valves on short waves.
 ★.....★

The Editor, POPULAR WIRELESS.
 Dear Sir—I must congratulate you on your very fine magazine and all the good tips in it. The last set I have hooked up was "The Overseas". Two, but with some modification. As you see, by the circuit, I have used high-voltage "Ostar" valves. The mains are 220 v. D.C.
 I finished the set last night, and the first station I heard was J A N, R, 8, and dead silent background. It was Morse. I also heard, among many others, speech from Khabarovsk. The English short-wave transmitters are not so good here as the Russian.



All parts in the set except the valves are those you recommended. The mains choke and the condensers are, too, English.

Yours faithfully, N. HOLMBERG.
 P.S.—My hobby is two-valve, so the next set will be the "Airsprite" Two. I think it shall work splendid with "Ostar" valves.
 I hope you can understand my English. It is home constructed, and the teacher's name is POPULAR WIRELESS.
 Kungälvatan 34,
 Malmö, Sweden.



*“This is undoubtedly the best battery
I have ever had”* (Sgd.) F. V., Cricklewood, N.W. 2.

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FROM THE TECHNICAL EDITORS' NOTE BOOK

TESTED
AND
FOUND?

A NEW R.I. CHOKE

I HOPE that one of these days a standardised system of component rating will be adopted by manufacturers. At the present moment the public has to take many of its radio parts on trust, to some extent.

Of course, guidance as to general quality and reliability is afforded in ample measure by the reputation of the firm concerned. But what I have been agitating for for some time now are informative and comparative performance ratings.

I freely admit that there are difficulties, and in some cases it is going to take great courage on the part of those who make the first move!

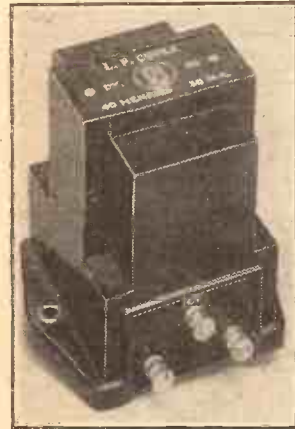
However, it will come: is, in fact, already coming, though in a rather patchy manner. And there have been rather warped attempts, too. For example, take the L.F. choke. A familiar and passable rating is to quote inductance and current. So many henries, so many milliamperes. But I don't like that trick of quoting maximums.

I have encountered chokes marked, say, "50 henries, 30 milliamperes," which, when 30 milliamperes are passed through them, do not need measurement and calculation to prove that they don't rise much above 15 henries!

Probably there was no intentional dishonesty—just a failure to realise that 50 henries at 30 milliamperes would be expected, whereas it was intended to show only that the choke would handle 30 milliamperes (and not necessarily give its full inductance) and rise to 50 henries providing the current were kept low.

Obviously, Radio Instruments, noted for their sound engineering methods, are not likely to indulge in ambiguous ratings.

Their new DY50 L.F. Choke has "40 henries, 30 m/a" marked on it. And it measures up to 40 henries at 30 milliamperes. At 10 milliamperes it rises to 45 henries.



The new Radio Instruments' DY 50 L.F. Choke is distinctive in appearance and has particularly good regulation.

Now this is good. "Regulation" in chokes is a mark of good design, speaking very generally. I hate those whose inductances fly all over the place with comparatively minor current variations.

That is instability, and plays havoc with a circuit, as is plain to see.

This R.I. DY50 is of unusual construction—at least, in so far as its design is concerned. Some might not find it particularly attractive, but it is different, and

that is an advantage in itself, in my opinion, in these days.

And, as you will have gathered, it is good as a choke and performs its duties with every satisfaction.

"METAPLEX" ADVANCES

A very good method of judging the success of a proprietary article is to note the extent to which its name becomes a common word.

Examples are Vaseline and Thermos. When you speak about "applying a little Vaseline" or of a "Thermos Flask," you refer to trade-marked, proprietary articles.

Radio is not yet quite old enough to have developed similar terms, but if I were asked to name

some probables I would certainly include "Metaplex." It has all the qualities which make for universality of use and familiarity of reference.

It is so inexpensive that it is almost competitive with ordinary ply-wood, and it is infinitely easier to handle than ply-wood plus metal foil. (You know, although I have had to employ foil-covered baseboards in the past, I have always hated to do so. It's nasty. They aren't too easy to fake up and they look untidy.)

I could easily eulogize at great length about Peto-Scott's "Metaplex," because I do think it is an important—a very important—contribution to home construction.

And now the idea has been extended to the whole of a radio cabinet. In future Peto-Scott can supply a wooden cabinet which is effectively equivalent to a metal box, because of its lining by the Metaplex process.



Completely screened cabinets, metalised on the inside by the "Metaplex" process, are now obtainable from Messrs. Peto-Scott, Ltd.

ISN'T it wonderful how these dance-number composers keep it up? A dance tune will last about three months in the public affection unless it is a particularly good hit, when it may do five or sometimes six months. Rarely has a modern number scored more.

And yet we have always a goodly selection of well-varied fare, and nearly always there is one outstanding number which is receiving more acclaim than the others, and incidentally more plugging by dance bands. Or is it that the plugging causes the high reading of the popularity barometer?

Some Popular Numbers.

Anyway, here we are, having come safely through "Stormy Weather" and a rather rapid rise and fall of "I Cover the Waterfront," watching the meteoric rise to prominence of "Lazybones."

At the moment of writing we have had some three or four weeks of gradually increasing radio plugging of this admittedly haunting melody—almost every band plays it once in every programme—and the records are following on with regular salvoes.

First to reach me were three from the Crystalate Record Manufacturing Co., who handle the "Imperial," "Broadcast,"

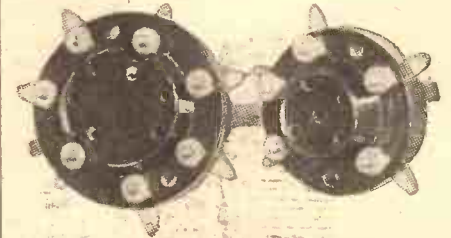
That, I suggest, is a further real step forward, and for originality and utility the idea deserves the highest commendation. Designers for home-constructors have now yet another great asset at their command.

BENJAMIN VALVE HOLDERS

Although Benjamin manufactures a fairly wide variety of articles, it is, I fancy, as valve holder makers that their name is most greatly famed.

The reason is, of course, that Benjamin Electric, Ltd., were pioneers in the true sense in the development of the valve holder.

Now, that means more than some may at first think. The valve holder may ostensibly appear to be one of the most elementary of radio parts, but it is in fact one of the most vital, and has been the cause of endless trouble in the past.



The latest Benjamin five- and seven-pin valve holders are worthy successors of the long range of famous components of this type made by the same firm in the past.

It is difficult now to visualise pre-Benjamin days, when valve holders as such hardly existed. Instead, it was the common practice to employ separate valve sockets, one for each pin of the valve—an I trust to luck that they were not so far out in their positioning that the valve couldn't be forced in!

Largely, I fancy, it was Benjamin that changed all that. Certainly it was Benjamin that produced the first "anti-microphonic" valve holder and at once paved the way for the general high standard of efficiency and accuracy and ease of fitting that mark the valve holders of 1933.

And I can see that they are holding their place in the van of this by no means cloistered branch of the art.

Their latest 5- and 7-pin types, with special nickel-silver "snap" contacts, are worthy descendants of an honourable line.

ROUND THE RECORDS

A review of some of the more outstanding of the recently released records, of special interest to all users of radiograms or pick-ups.

perial and on a "Four-in-One" record. A good start, and of the former pair I do not know which I like the better—they are both excellent renderings.

But though new numbers arrive by the dozen every week or so, there is also a pleasing tendency among record makers to revert occasionally to old favourites. Thus we have comparatively recently had recordings of "Dinah" (will this tune be numbered among the immortals eventually?) by the Cole Brothers on Regal Zonophone, made shortly before the sad decease of one of the pair.

An Old Tune Revived.

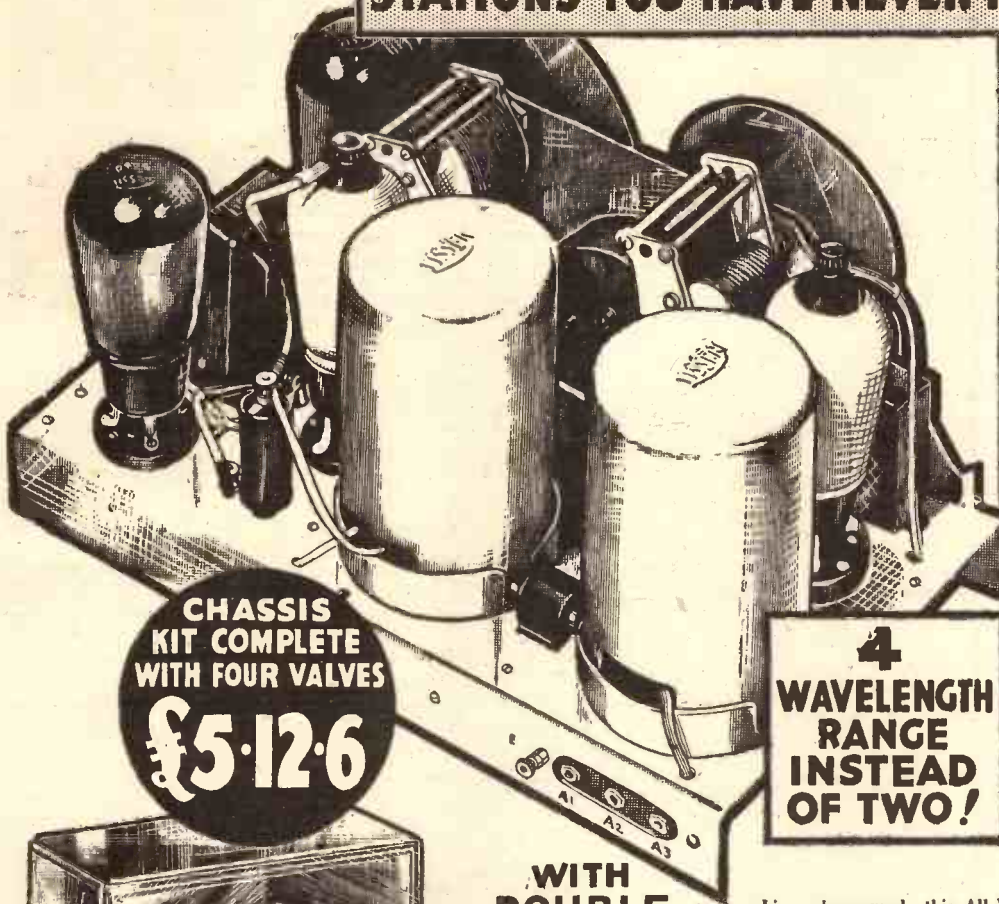
Then we were reminded of the "Rhapsody in Blue" (another immortal, and rightly so), followed quite recently by a saxophone solo of "Ah, Sweet Mystery of Life," which first arrived, I believe, some five years ago. This latter is by Howard Jacobs on Columbia, accompanied by the organ—an excellent combination.

Recently the "St. Louis Blues" has claimed the attention of several dance
(Continued on page 175.)

ALL-WORLD RADIO RECEPTION ON ULTRA-SHORT-SHORT-MEDIUM & LONG WAVES

Metres.	On Ultra Short Waves.
58. BANDOENG, Java.	30. MADRID.
50-26. VATICAN CITY, Rome.	25-63. PARIS.
50. MOSCOW.	Radio Colonial.
49-83. ZEESEN, Berlin.	25-6. WINNIPEG, Canada.
49-67. MIAMI.	25-57. BEND.

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CHASSIS KIT COMPLETE WITH FOUR VALVES
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WITH DOUBLE BALANCED PENTODE OUTPUT AND MOVING COIL SPEAKER

WITH WALNUT CABINET & MOVING COIL LOUDSPEAKER
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Lissen have made this All-Wave All-World Radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia *direct* on a set you have built yourself; it makes you an enthusiast to realise what a wonderful thing you have created!

When you see the Great Free Chart of the All-Wave All-World "Skyscraper 4," which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory-assembled receiver which cannot give you these new and intriguing short-wave stations. The FREE CHART simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. **YOU CAN'T GO WRONG!** But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper 4," the SET THAT SPANS THE WORLD!

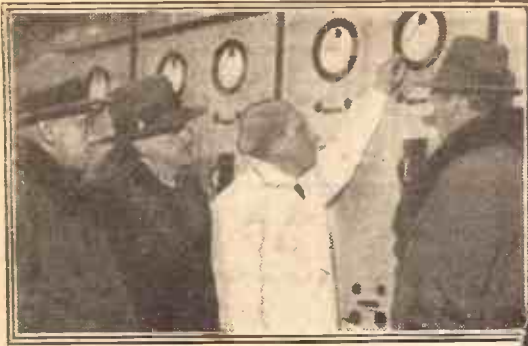
BEACH, Florida.	HOVEN, Holland.
49-5. CINCINNATI, U.S.A.	25-53. DAVEN-TRY, GSD.
49-5. NAIROBI, Kenya.	25-51. ZEESEN, DJD.
49-18. BOUND-BROOK, New Jersey.	25-4. ROME, PRO.
49-18. CHICAGO, U.S.A.	25-28. DAVEN-TRY, GSE.
49. JOHANNESBURG, S. Africa.	25-27. PITTSBURG, W8XK.
48-86. PITTSBURG, U.S.A., W8XK.	23-39. RABAT, Morocco.
48. CASABLANCA, Morocco.	19-48. VATICAN CITY, Rome.
32-26. RABAT, Morocco.	19-82. DAVEN-TRY, GSF.
31-55. DAVEN-TRY, GSB.	19-73. ZEESEN, DJE.
31-55. MELBOURNE, Australia.	19-72. PITTSBURG, W8XK.
31-48. SCHEDULETADY, N.Y.	19-56. SCHE-N E C T A D Y, W2XAD.
31-38. ZEESEN, Berlin, DJA.	16-89. ZEESEN, DJE.
31-35. SPRING-FIELD, Massachusetts.	16-88. DAVEN-TRY, GSG.
31-3. DAVEN-TRY, GSO.	16-87. BOUND-BROOK, N.J., W3XAL.
31-25. SYDNEY, Australia.	13-93. PITTSBURG, U.S.A., W8XK.



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VIENNA'S *New* STATION

THE Bisamberg, an insignificant hill about half an hour from the centre of Vienna, until recent times not even known to the average citizen of the Austrian capital, now enjoys unexpected popularity as the site of Austria's new high-power station transmitter.

The station, which bids fair to become one of the most powerful and most important in Europe, has just been completed. As regards size, it will probably hold the record, for, instead of deriving its current from some existing system, it will generate it itself. In fact, it will accommodate a power station of fair dimensions, comprising three mammoth Diesel engine sets of 1,400 h.p. total output.

Produced on the Premises.

The Diesel Hall, which also accommodates the dynamos for generating the current, is the first room entered by the visitor, but is only one of a number of halls containing all the various installations characteristic of an up-to-date power house rather than a radio transmitting station. There is, for instance, a water-softening plant destined to prevent deposition of boiler scale, and a valve cooling plant.

An idea of the dimensions of this transmitting station can be formed when considering that upwards of 12,300 cubic metres of earth had to be dug out to prepare the site and carry out the construction of waterworks, draining systems and roads. No less than 1½ million kilogrammes of cement, ¾ million bricks, nearly 1½ million armoured-concrete round steel bars, 80,000 kilogrammes of white lime, 7,000 cubic metres of broken stone and 150,000 cubic metres of sand were used in building the transmitting station.

Six thousand litres of gas oil have been stored in the fuel tank, corresponding to the amount required for a month's opera-

This Austrian station is one of the most powerful in Europe, and yet it does not run from the mains, but makes all its power "on the premises." This short general description of the transmitter has been drawn up specially for "Popular Wireless" by Dr. Alfred Gradenwitz.

tion, while the daily allowance of cooling water for the three Diesel engines is no less than 285,000 litres, supplied by a pit

THE TOWERING MASTS



An interesting feature of the station (working on 517 metres) is that one mast only is used for the aerial, the other acting simply as a reflector.

in the Danube valley, 150 metres below the station building.

Crystal Controlled.

The transmitter, which is, of course, "quartz-steered," is the first to use the new 300 kw. valves designed by Telefunken (all German transmitters, so far, had to be content with 150 kw. valves). Its initial energy is 150 kw., of which, however, only 100 or 120 kw. will be radiated, provision being made for a further increase in power.

An oblong building at right angles to the station house comprises permanent dwelling-rooms for all the officers attached to the station.

The most interesting feature, however, is the aerial system, made up of two steel masts, between which, in opposition to present practice, no aerial wires have been stretched out, one of the masts being both aerial carrier and aerial, while the other serves as reflector, throwing back westward a considerable portion of the emitted wave energy, and thus ensuring an improvement of about 40 per cent in the western parts of the country.

No Earth Needed.

This arrangement has been chosen so as to make up for the non-symmetrical location of the transmitter, which is situated in the eastern section of Austria.

The antenna masts, being 130 metres high to begin with, can readily be raised to 150 metres. Both masts are located on gigantic insulators and kept in position each by four steel wire cables 90 metres long and 42 millimetres in thickness.

A counterpoise is used in place of an "earth." This is made up of 36 masts, grouped round the antenna and carrying a widely stretching network of wire 3-4 metres above the ground.

SPECIAL aeriels and counterpoises, designed to give maximum efficiency over a particular portion of the short-wave band, are often advocated; and they are certainly desirable if one is anxious to squeeze the "last ounce" out of a short-wave set.

But, for the everyday requirements of the average short-wave listener, an ordinary broadcast receiving aerial is quite satisfactory, provided that certain precautions are taken.

It is important, for instance, to see that the entire aerial, right from the terminal of the set to the farther extremity of the wire, is kept as taut as it can be without risk of strain or breakage. The slightest tendency to sway or quiver will often spoil reception by causing artificial "fading"

SHORT-WAVE AERIAL HINTS

Some tips of interest to all amateurs.

By B. WILLIS.

effects, as the movements of the wire bring about slight capacity changes which upset the critical tuning of a short-wave receiver.

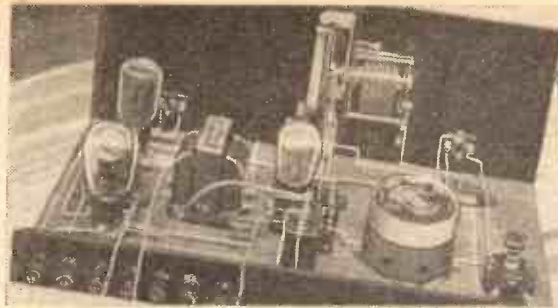
As any movement of the earth lead or counterpoise relative to the aerial is likely to have a similar effect, the lead from the earth terminal of the set should be kept taut, too.

In order to avoid body-capacity effects, the aerial wire should be arranged well to

the rear of the set, so that it is as far as possible from the operator's hands when manipulating the controls.

When an aerial of normal length is used for short-wave work, it is essential to couple it very loosely to the set. If the aerial coupling is too tight, it is often impossible to obtain oscillation or correct reaction effects over the whole wavelength range covered by the set. Moreover, a number of troubles, such as hand-capacity effects, threshold howl, etc., are likely to be introduced.

Most of the foregoing remarks apply particularly to short-wave sets of the detector and L.F. type; if a stage of screen-grid H.F. amplification precedes the detector, the various precautions suggested are not always so vital.



MODERNISING THE COMET



THE original "Comet" Three was described in POPULAR WIRELESS, dated February 14th, 1931, and was undoubtedly one of the most successful and popular sets of its day. It is still an excellent receiver, and models of it remain in daily use in thousands of homes.

But radio progress has marched steadily on since the date the "Comet" was fired into the etheric heaven, and though still burning brightly its luminosity is naturally paling against some of the more recent stars in the radio firmament.

The "Comet" Three has for two and a half years been giving faithful service to many thousands of "Popular Wireless" readers. It can be truly said to be one of the most successful home-constructor designs ever published. Here is a 1933 version incorporating the very latest developments in radio technique. One of the most important of these is the inclusion of an H.T. battery economiser which reduces the running costs by as much as forty per cent. Among other new features introduced are an iron-cored coil and matched transformers.

Described by K. D. ROGERS.

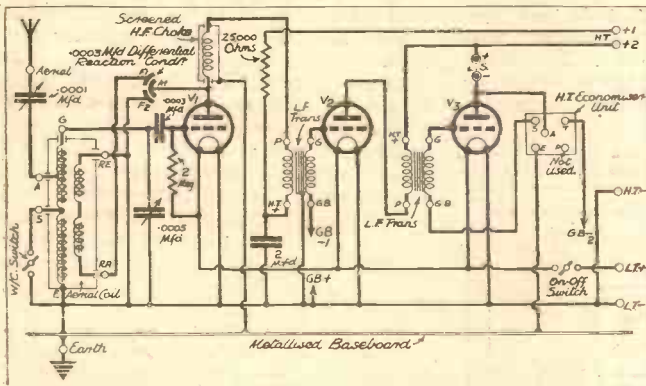
L.F. stages are employed, and where the necessity for separate biasing of the output valve would have been inconvenient. This new circuit has been incorporated in the Benjamin Economiser we have used in our 1933 "Comet."

The addition of the Economiser to an existing "Comet" is quite straightforward. It connects between anode of the last valve and earth, with connections for the G.B. side of the

unit, which incorporates the very latest method of reducing H.T. consumption, enabling the "Comet" to be run with no loss of power but with a saving of something like 40 per cent in H.T. current.

second transformer, which terminal is now disconnected from G.B.—2.

RIGHT UP-TO-THE-MINUTE



The basic circuit remains the same as the original model, with just those little additions and alterations that make it a right up-to-the-minute receiver.

We are, therefore, firing a new and still brighter "Comet" to blaze the trail across the sky and to replace the old favourite whose work has been so well and consistently done during the last 2½ years.

Replete with many modern refinements, the newcomer very closely resembles its forerunner, and owners of the original "Comet" will find it easy to convert their sets into the new type, either in toto or by taking one or other of the improved modifications, leaving the others to a future date.

Lowering Running Costs.

Now let us see exactly what we have done to bring the "Comet" right up to date. The original set was a detector and two-transformer-coupled L.F. receiver, using a resistance "choke" for reaction, a "P.W." dual-range coil for tuning, and a pre-set condenser control of selectivity, fitted on the baseboard.

As a start towards modernisation we have added a component that has only just arrived on the market, and which is the result of an adaptation by "P.W." of the new Westinghouse H.T. economising circuit. It is the Benjamin Economiser

unit, which incorporates the very latest method of reducing H.T. consumption, enabling the "Comet" to be run with no loss of power but with a saving of something like 40 per cent in H.T. current.

This is a most important modification, and should strike home to all set owners, not merely those who own "Comets," for the economiser can be added to any battery receiver.

"Comet" owners will more than welcome this small addition to the components in the set, for the saving of

This grid-bias tap goes instead to the terminal on the Economiser marked T. The terminal marked P is not used. These two terminals, T and P, refer to sets using "triode" or "pentode" output valves, and, according to whether a triode and small pentode or a large pentode is used, so T is employed alone for the connection to G.B.—, or the two terminals are shorted together and are taken to G.B.—.

No Operating Complications.

In the operation of the set the Economiser takes no part. Everything works just as before, the only difference being that G.B.—2 is now set as great as possible consistent with undistorted results. Thus, if a bias of some 12 volts were used before,

(Continued on next page.)

IRON-CORED EFFICIENCY

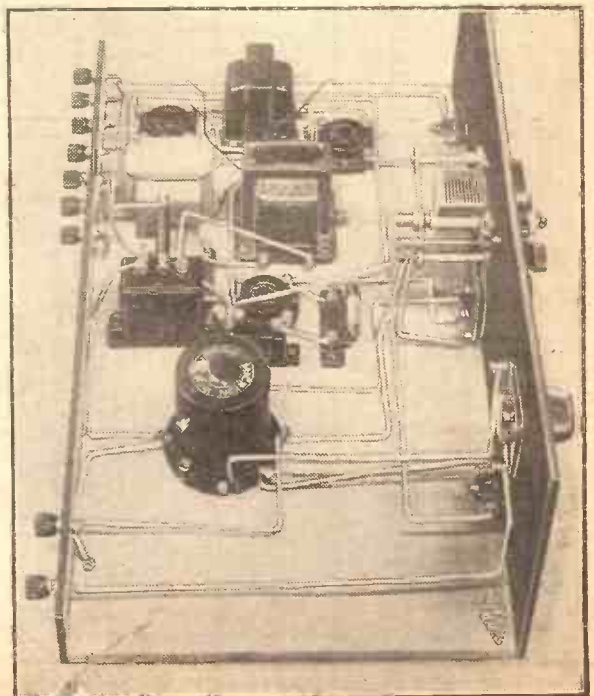
H.T. current obtained is very real. Incidentally, many will have read of the economiser unit we described recently in POPULAR WIRELESS, the first unit for that purpose ever described, and it will be remembered that a separate bias battery for the last valve had to be used.

Single Bias Battery.

Since then further research into the method has been carried out, with the result that a circuit has been evolved which enables a bias battery common to any number of valves to be employed, thus doing away with the need of a separate bias battery for the last valve.

This is particularly useful in the "Comet," where two

One of the main features of the remodelled set is a greatly improved dual range coil of the iron-cored type. This modification, among other things, results in improved selectivity and sensitivity.



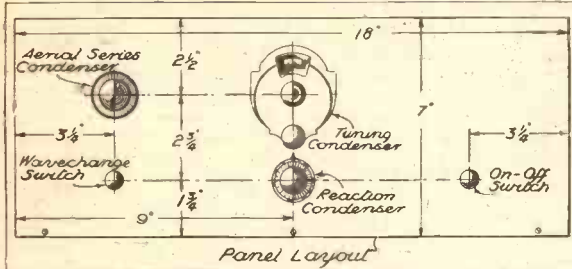
MODERNISING THE "COMET"

(Continued from previous page.)

it should now be possible to use 16-5, or even more, resulting in a great saving of H.T. current, as might be imagined.

As explained previously in POPULAR WIRELESS (see last week), this over-biased state of the valve would result in

THE NEW PANEL LAYOUT



There is now an additional control on the panel. This is the knob which occupies the top left-hand position, and it operates a series aerial condenser, thus enabling selectivity to be adjusted to suit local requirements.

its capacity to handle only weak inputs without distortion; strong "signals" would of necessity be badly distorted, due to anode-bend rectification.

This is where the Economiser comes in, for it operates as an automatic bias control (A.B.C.) and adjusts the bias in accordance

with the input to the valve. The result is that, on the loudest "signals" of which the valve is capable of handling when properly biased, the A.B.C. unit reduces the biasing till it reaches the correct value and the valve operates perfectly efficiently. Intermediate strengths are provided with intermediate bias voltages, but in all cases the voltage is such that the valve can operate efficiently and without causing distortion.

The Economiser, then, is the main feature of the new "Comet." The next is the substitution for the old coil of a modern iron-cored coil and a panel-controlled selectivity adjustment, which, of course, can also be used as a convenient volume control.

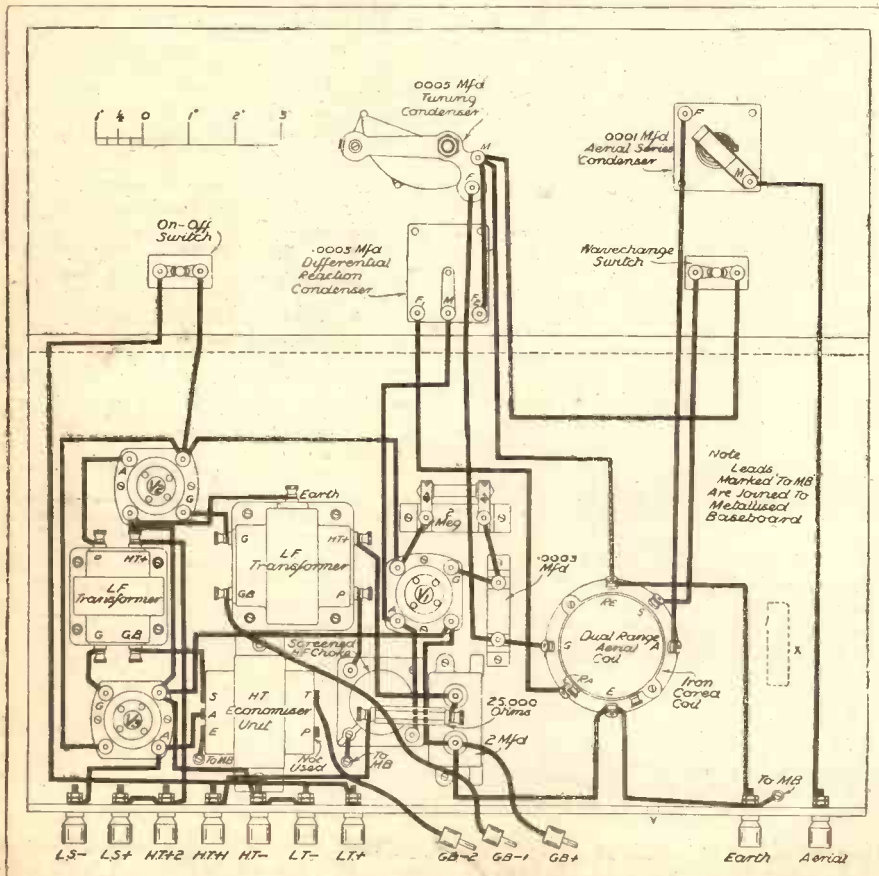
Easy Alterations.

Again the alterations are not difficult, and a comparison of the old blueprint and the new wiring diagram will show which leads have to be altered. As a matter of fact, as the "Comet" is some 2 1/2 years old, it will not do anything but good to rewire the whole set when the alterations are made, thus renovating any

impoverished joints and ensuring future reliability.

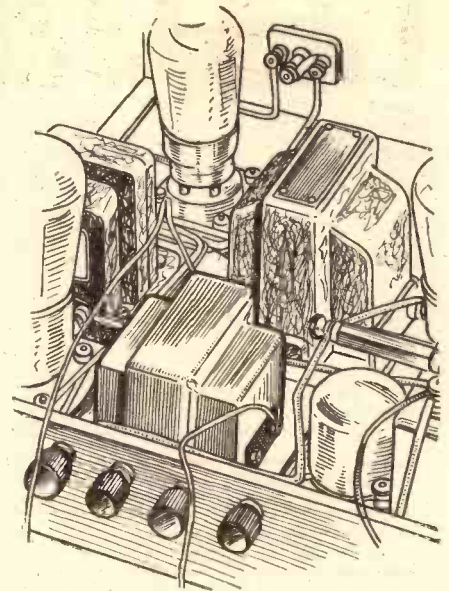
It will be noticed that in the new "Comet" different transformers are used from those in the original set. This is not an essential alteration made necessary by any of the other refinements, but a sug-

NO NEED TO ALTER ALL THE WIRES



If you compare this diagram with the original blueprint you will have no difficulty in differentiating between the old wires and the new. The alterations are perfectly straightforward.

THE L.F. END



Both the L.F. stages are transformer coupled; the third unit that looks very similar to a transformer is in reality an H.T. economiser.

gestion that may prove useful to many owners of the set, and also a guide to the construction of the new set for those readers who will be building it for the first time.

In the days of the old "Comet" such things as tone compensation were not seriously contemplated other than in elaborate receivers of the superhet type or sets employing several stages of H.F. The compensating L.F. transformer had not arrived—it was brought out later, when the "Airsprite" and "A.T.B." were designed—so that no one had any idea of making provision for tone compensation in ordinary small sets.

In the new "Comet" we have taken advantage of the compensating transformer to overcome loss of high notes and

RECOMMENDED ACCESSORIES

- BATTERIES.**—H.T. 120 volts: Lissen, Marconiophone, Ediswan, Pertrix, Ever Ready, G.E.C., Drydex, Siemens, Block, G.B. 181 volts: Drydex, Lissen, Ediswan, Ever Ready, Siemens, Marconiophone, Pertrix.
- L.T. 2 volts: Lissen, Exide, Ediswan, Oldham, Block, Pertrix.
- LOUDSPEAKERS.**—Blue Spot, Ormond, Atlas, Rola, R. & A., Marconiophone, W.B., Celestion, H.M.V., Magnavox, Ferranti, Epoch, G.E.C., Amplion.
- AERIAL AND EARTH EQUIPMENT.**—Electron "Superial," Goltone "Arkrite," Bulgian lightning switch, Radiophone "Receptor" down-lead, Graham Farish "Fit" earthing device.

have chosen two makes of transformers which operate well together, giving a very clean response.

Care has to be taken in the use of the compensating transformer that its team mate shall have the right sort of characteristic, otherwise the overall response curve will not be satisfactory. The two transformers we have chosen operate excellently together; but should you decide to

(Continued on page 162.)

PETO-SCOTT

EVERYTHING RADIO—CASH C.O.D. or EASY TERMS


Peto-Scott are pioneers in Radio and Television. Our Service to the British Public was introduced in 1919 and during 14 years of Solid Service and Satisfaction we have established a reputation for fair dealing that defies competition. Customers in all parts of the globe come to us regularly for all their radio requirements—Sets, Kits of all descriptions, Part Kits, Miscellaneous Components, Speakers, Eliminators

and Accessories. Purchases can be made for Cash, C.O.D., or on Easy Payments. WE DEAL WITH YOU DIRECT—Peto-Scott's Easy Way System, with its strict privacy and no third-party collections, will bring radio to your home by convenient monthly payments. Send list for quotation; no obligation.

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- NEW LISSEN SKYSCRAPER FOUR ALL-WAVE CHASSIS MODEL**, in Sealed Carton. Cash or C.O.D. Carriage Paid, **£5/12/6**. Balance in 11 monthly payments of 10/3.
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- LISSEN "SKYSCRAPER 3" BATTERY MODEL**, Chassis model with (Lissen) S.G., Detector and Pentode valves. Cash or C.O.D. Carriage Paid, **£4/9/6**. Balance in 11 monthly payments of 8/3.

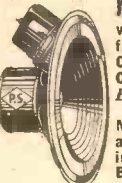
- NEW BLUE SPOT PERMANENT MAGNET MOVING-COIL SPEAKER 29-P.M.** With input transformer. Cash or C.O.D. Carriage Paid, **£1/12/6**. Balance in 6 monthly payments of 5/-.
- BLUE SPOT 99P.M. PERMANENT MAGNET MOVING-COIL SPEAKER**. Complete with tapped input transformer. Cash or C.O.D. Carriage Paid, **£2/19/6**. Balance in 10 monthly payments of 6/-.



NEW W.B. P.M.4.A. MICROLOBE PERMANENT MAGNET SPEAKER

complete with switch controlled multi-ratio input transformer. Cash or C.O.D. Carriage Paid, **£2/2/0**. Balance in 7 monthly payments of 5/9.

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PETO-SCOTT PERMANENT MAGNET MOVING-COIL SPEAKER

with tapped input transformer for power or pentode. Cash or C.O.D. Carriage Paid, 15/-. Balance in 2 monthly payments of 5/6.

Mounted on ply baffle baseboard assembly. Ready to fit into cabinet. Cash or C.O.D. Carr. Paid. Balance in 3 monthly payments of 5/-.

"Class B" Type, 22/6. —Cash or C.O.D. or 4 monthly payments of 6/3.

- NEW FERRANTI M.S.T. MOVING-COIL SPEAKER** with input transformer, suitable for Power, Pentode or "Class B" output. Cash or C.O.D. Carriage Paid, **£1/17/6**. Or 7 monthly payments of 5/-.

- NEW FERRANTI "CLASS B" SUPER-POWER CONVERTOR**. Instantly converts your set to "Class B." Complete with Valve. Ready assembled. Cash or C.O.D. Carriage Paid, **£3/3/0**. Balance in 11 monthly payments of 5/9.

- F6P.M. PERMANENT MAGNET MOVING-COIL SPEAKER**, with input transformer. Cash or C.O.D. Carriage Paid, **£2/9/6**. Balance in 8 monthly payments of 6/3.

NEW ROLA "CLASS B" PERMANENT MAGNET MOVING-COIL SPEAKER AND AMPLIFIER

Complete with Valve and Input Transformer. Two models: A for PM2B, PD220 and 220B; B for 240B and HP2 (state which when ordering). Cash or C.O.D. Carriage Paid, **£3/11/0**. Balance in 11 monthly payments of 6/6.

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- KIT "B."** As Kit "A." but with Valves only. Cash or C.O.D. Carriage Paid, **£11/17/3**.
- KIT "C."** As Kit "A." but including Valves and PETO-SCOTT Metaplexed Cabinet. Cash or C.O.D. Carriage Paid, **£12/17/3**.
- YOURS FOR 15/6**
Balance in 11 monthly payments of 15/6.

MODERNISE YOUR COMET 3

- KIT "A."** Author's Kit of FIRST SPECIFIED Parts, including drilled Panel and Peto-Scott Metaplex Baseboard, but less Valves and Cabinet. Cash or C.O.D. Carriage Paid, **£4/14/3**.
- KIT "B."** As Kit "A." but with Valves only. Cash or C.O.D. Carriage Paid, **£6/0/3**.
- KIT "C."** As Kit "A." but including Valves and Cabinet. Cash or C.O.D. Carriage Paid, **£6/18/9**.
- YOURS FOR 8/9**
Balance in 11 monthly payments of 8/9.

These are the parts the Author used:

- 1 PETO-SCOTT panel, 12" x 7"
 - 1 PETO-SCOTT "Metaplex" baseboard, 16" x 12"
 - 1 COLVERN superhet coil assembly, K.61, K.62 and K.63
 - 1 BRITISH RADIOPHONE three-gang -0005-mfd. tuning condenser, type 693
 - 2 COLVERN intermediate transformers, type 110 K.C.
 - 1 TELSEN type W.74 binocular H.F. choke
 - 1 LEWCOS graded type 50,000-ohm potentiometer, with three-point on/off switch
 - 1 LISSEN Class B driver transformer
 - 1 TELSEN W.345 Class B output choke
 - 1 R.L. Varitone L.F. transformer (compensating)
 - 1 GRAHAM FARISH "Ohmite" 2-megohm resistance
 - 3 GRAHAM FARISH "Ohmite" resistance, with vertical holders: 2-megohm grid leak, 100,000 and 25,000 ohms
 - 1 LISSEN 2-mfd. fixed condenser
 - 2 DUBILIER type 4404 1-mfd. fixed condensers
 - 2 T.C.C. type 250 1-mfd. fixed condensers
 - 1 T.C.C. type 34 .001-mfd. fixed condenser
 - 1 DUBILIER 620 .002-mfd. fixed condenser
 - 1 DUBILIER 620 .0005-mfd. fixed condenser
 - 1 T.C.C. type 41 .0003-mfd. fixed condenser
 - 1 DUBILIER 620 .0002-mfd. fixed condenser
 - 2 IGRANIC .0003-mfd. fixed tax condensers
 - 5 BENJAMIN "Vibrolder" 4-pin valve holders
 - 1 BENJAMIN seven-pin valve holder
 - 1 POLAR "Arcuate" vernier dial
 - 1 BULGIN P.30 A.A. terminal strip
 - 2 BELLING-LEE anode connectors
 - 2 BELLING-LEE wander plugs
 - 1 BELLING-LEE wander fuse
 - 2 BELLING-LEE accumulator spades
 - PETO-SCOTT, 4 yds. insulated sleeving, 6 yds. 18-gauge tinned copper wire; flex, screws, etc.
- KIT "A." CASH OR C.O.D. £8/9/6**

These are the parts the Author used:

- 1 PETO-SCOTT panel, 18" x 7" x 1/2"
 - 1 PETO-SCOTT "Metaplex" baseboard, 18" x 10"
 - 1 L.F. "Micron" dual-range iron-cored coil
 - 1 GRAHAM FARISH "Zelus" .0005-mfd. tuning condenser
 - 1 TELSEN "Oyster" slow-motion drive
 - 1 GRAHAM FARISH "Litlos" .0001-mfd. solid dielectric variable condenser
 - 1 TELSEN .0003-mfd. differential reaction condenser
 - 1 TELSEN "Audioformer" compensating L.F. transformer
 - 1 LISSEN "Hypernik" L.F. transformer
 - 1 BENJAMIN H.T. economiser unit
 - 1 T.C.C. type 50 2-mfd. fixed condenser
 - 1 DUBILIER type 620 .0003-mfd. fixed condenser
 - 1 GRAHAM FARISH H.M.S. screened H.F. choke
 - 1 GRAHAM FARISH "Ohmite" 30,000-ohm resistance with terminals
 - 1 LISSEN 2-megohm clip-in grid leak
 - 1 DUBILIER grid leak holder
 - 3 BENJAMIN "Vibrolder" valve holders, four-pin
 - 1 BULGIN S.22 two-point push-pull switch
 - 1 BENJAMIN RADIOGRAM two-point push-pull switch
 - 9 BELLING-LEE type "R" terminals
 - 5 BELLING-LEE wander plugs
 - 1 BELLING-LEE wander fuse
 - 2 BELLING-LEE accumulator spades
 - PETO-SCOTT, 5 yds. insulated sleeving, 7 yds. 18-gauge tinned copper wire; flex, screws, etc.
- KIT "A." CASH OR C.O.D. £4/14/3**

EXCLUSIVELY SPECIFIED

PETO-SCOTT NEW UNIVERSAL CABINET in oak, hand french polished. Size 18"x7"x10" **18/6**

PILOT "CLASS B" CONVERSION KIT

Converts your present Battery Set to "Class B" Amplification. Complete with all necessary components, including driver transformer, "Class B" output choke, W.B. 7-pin valve holder B.V.A. 240B valve, wire and screws, etc. Full-size Blueprint assembly instructions and diagrams. Cash or C.O.D., **37/6**. Balance in 7 monthly payments of 5/6.

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PETO-SCOTT ECONOMY SUPER CABINET in beautifully finished hand polished walnut. **20/-**

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THE NORTHERN STAR

- KIT "A"** Author's Kit of First Specified Components including Ready-drilled Panel, Metaplex Baseboard and W.A. Westector. **YOURS FOR 9/-**
- Balance in 11 monthly payments of 9/-.

- ATLAS C.A.25, for Mains, "Class B" and Q.P.P., four tappings 60/80, 50/90, 120, 150, 25 m.a. Cash or C.O.D. Carriage Paid, **£2/19/6**. Balance in 10 monthly payments of 6/-.

- NEW GARRARD MODEL 202A**, 12-in. Turntable. Electric Motor for A.C. Mains. Cash or C.O.D. Carriage Paid, **£2/10/0**. Balance in 8 monthly payments of 6/-.

STRICT PRIVACY GUARANTEED—WE DEAL WITH YOU DIRECT

MODERNISING THE "COMET"

(Continued from page 160.)

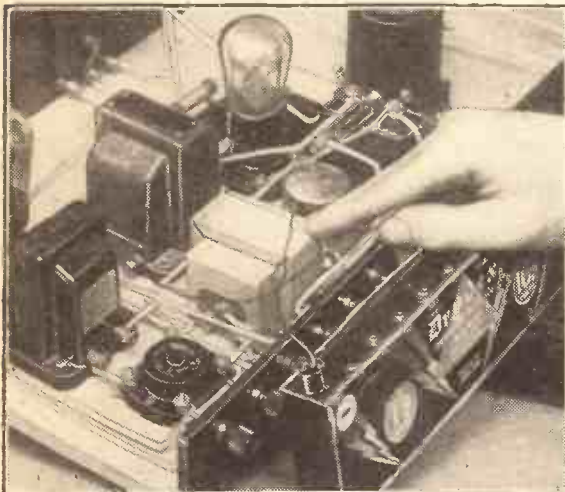
change only one of them you should move warily if the reproduction is not to be spoiled. It is better to use both new ones or leave well alone.

THE VALVES WE RECOMMEND

Make	Detector	1st L.F.	Output
Mullard	P.M.H.L.	P.M.2D.X	P.M.202
Cossor	210.H.F.	210L.F.	230X.P.
Mazda	H.L.2.	L.2.	P.220A.
Marconi	H.L.2.	L.210	P.2
Osram	H.L.2.	L.210	P.2
Hivac	H.210	L.210	P.P.220
Eta	B.Y.1814	B.Y.1210	B.W.602

Another modification that has been introduced is a screened H.F. choke instead of a resistance for reaction, and this will be found to give very much better results

IT SAVES YOUR H.T.



This little unit will cut down the running costs of your set. It reduces the H.T. consumption by approximately 40 per cent.

with the new transformers. If the old transformers are retained it is hardly worth while altering this component, unless choke-reaction feed is desired instead of

the resistance type. Incidentally, an Ohmite resistance now replaces the spaghetti used in the original set for decoupling.

On the wiring diagram will be seen two points marked respectively X and Y. These are of interest only to those constructors who live near a powerful station and are troubled with break-through of the medium-wave programmes when they are tuned to the long waves.

At X one of the Lissen anti-break-through chokes is inserted in series between the aerial terminal and the selectivity condenser on the panel. A convenient place is outlined on the baseboard for this component.

Alongside the earth terminal of the set is the mark Y, where the shorting switch for the break-through choke can be situated. This switch is the usual on-off type, and is connected across the choke. When on long waves the switch is in the "off" position, and when the set is tuned to the medium waves the switch is placed in the "on" position to short the choke.

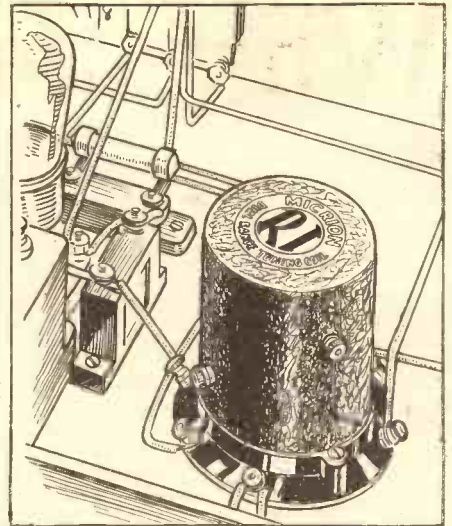
Earth Connections.

It will be noted that a metallised baseboard has been used and that two or three of the earth return leads are taken direct to the board. This simplifies the wiring, and should be followed carefully, washers being placed between the screwheads and the wires at the points in question. This is essential for the making of really reliable connections to the metal surface of the board.

The operation of the new "Comet" is exactly the same as that of the old, with the exception of the bias adjustment, which has been discussed already, and of the

selectivity control. This latter is on the panel, and the selectivity is increased as the condenser control is turned anti-clockwise, being decreased as the knob is

CONTROLLING INPUT



The small variable condenser seen towards the top of the picture provides a control of input to the iron-core tuning coil shown in the foreground.

rotated to the right. The valves used with the new "Comet" can be the same as those used in the original "Comet," but naturally better results can be obtained with a new combination of valves, so we have listed a selection of types which will be found suitable.

Worth-while Additions.

Although the main operating procedure for the modernised "Comet" needs no comment, the same cannot be said about performance. When a set has been giving satisfaction for two and a half years some misgivings may justifiably be entertained as to whether renovations are likely to be worth while.

There should, of course, be no doubts in the minds of any "Comet" owners regarding the matter of fitting the Economiser. This, if not literally worth its weight in gold, is certainly as good as money in pocket for those who adopt this modern innovation.

The saving in running costs will become more apparent the longer the set is in use, and the enhanced selectivity of the new "Comet" will keep thousands in commission for a long time to come.

PARTS REQUIRED FOR THE COMPLETE CONVERSION

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer	Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer
1 dual-range iron-cored coil	R.I. "Micron"	—	1 grid-leak holder	Dubilier	Lissen, Ready Radio, Telsen
1 .0005-mfd. tuning condenser	Graham Farish "Zelos"	Polar, J.B., Utility, Ormond	3 four-pin valve holders	"Dumetohm" Benjamin "Vibrold" Bulgin S.22	W.B., Telsen, Lissen, Ferranti
1 slow-motion drive	Telsen W.141	Ormond	1 two-point push-pull switch	Ready Radio	Telsen, W.B., Lissen, Ready Radio
1 .0001-mfd. solid dielectric variable condenser	Graham Farish "Littos"	Polar, Telsen, J.B., Ready Radio	9 terminals	Belling-Lee type R	Bulgin, Telsen, Lissen, W.B. Bulgin, Clix, Igranic, Goltone, Eelex
1 .0003-mfd. differential reaction condenser	Telsen W.351	Graham Farish, J.B., Polar	5 wander-plugs	Goltone	Belling-Lee, Igranic, Clix, Bulgin
1 compensating L.F. transformer	Telsen "Audio-former"	Varley D.P.35, R.I. "Vari-tone" (see text)	1 wander-fuse	Belling-Lee	—
1 L.F. transformer	Lissen "Hypernik"	(See text)	2 accumulator spades	Clix	Goltone, Belling-Lee, Igranic, Eelex
1 H.T. Economiser unit	Benjamin	—	5 yards insulated sleeving	Lewcoos	Goltone
1 2-mfd. fixed condenser	T.C.C. type 50	Lissen, Dubilier, Telsen, Igranic, Ferranti	7 yards 18-gauge tinned copper wire	Goltone	Lewcoos
1 .0003-mfd. fixed condenser	Dubilier type 620	T.C.C., Graham Farish, Lissen, Telsen, Ferranti	1 panel 18 in. x 7 in. x 1/8 in.	Peto-Scott	—
1 screened H.F. choke	Graham Farish H.M.S.	Telsen, Bulgin, Wearite	1 Metaplex baseboard 18 in. x 10 in.	Peto-Scott	—
1 30,000-ohm resistance with terminals	Graham Farish "Ohmite"	—	1 cabinet to suit above	Peto-Scott	—
1 2-megohm clip-in grid leak	Lissen	Dubilier, Telsen, Igranic, Ready Radio	Flex, screws, etc.	Peto-Scott	—

Why do

Pertrix Batteries

last so long?..

Aug. 15, 1933
Dear Sirs,
It may interest you to know I have had a "Pertrix" 100 volt battery Bat. No. 272, in continual use, on a two-valve set, since November 1931 until now. I have replaced it with one of your 120 volt batteries, and am anticipating equally good results.
Yours faithfully,
Morris.

Newcastle.
Dear Sir, Mar. 1, 1933.
On February 1st, 1932, I bought a Pertrix—100 V Six Valve H.T. Battery, for my three-valve S.G. set, and now for the time in 13 months it is showing no signs of age. It is really remarkable.
Yours,
Batterley.

Oldham, Lancashire.
Aug. 5, 1933.
I bought one of your H.T. Batteries on the 1st August, 1932. It is still going me as good service as any I have bought. I bought a Three Valve set.
Yours,
Hove, Sussex
Feb. 11, 1933
I purchased on 1st Feb. a Pertrix 120 V battery. It is now exactly 1 year old. Reception is in spite of the really First Class battery. Such as a Pertrix, could successfully withstand such a severe test.
I am, yours sincerely,
Albert E. Burrows.

Feb. 25, 1933
Dear Sirs,
I am writing to tell you I am using one of your 60-volt High tension batteries on a 3-valve wireless for this last 2 years and it is working my set. I have spoken to my friends about the wonderful battery we have and they think it marvellous.
Yours truly,
G. Madin.

Letters like these keep rolling in. Users tell us *how* their Pertrix Batteries have lasted—let us tell you *why*.

Pertrix Batteries use a **neutral electrolyte** that is patent to Pertrix alone, which conserves the inside of the battery—there is no 'shorting' between the cells—there are no resistance crystals formed. You can listen every day or only once a week—your Pertrix will give the same hours of service: a Pertrix Battery does not waste away when the set isn't working, in fact **it gathers power for the next time its service will be needed.**

For keeping your set in good voice, fit a Pertrix—the Battery that keeps on keeping on. There's a Pertrix to fit every set; and for tireless Low Tension work, fit a Pertrix Accumulator.

FIT PERTRIX FOR GOOD

TRADE MARK

VALVES AND THEIR CONNECTIONS

4-H CROSS

Home constructors—especially those who like to experiment on their own account—are often confused as to what connections to make to the several terminals on a valve holder when employing the various multi-electrode valves now available to the experimenter.

THE different types of valves now available are so numerous that, apart from the difficulty of selecting the correct type of valve for any particular purpose, considerable confusion exists as to the actual connections of the various elements to the base pins.

Fortunately, the peculiarities of this latter point are more simple of assimilation since the connections in each type are definitely standardised and the subdivision of types are less numerous.

Two Distinct Groups.

For the present consideration it is extremely convenient to separate valves into two distinct sections: (a) those which have base pins arranged to fit into the more common four- or five-socket holder; (b) and those which have pins arranged quite differently to suit the new type of seven-socket valve holder.

This division at once simplifies investigation, and the type in section (a) will therefore be dealt with first.

In this section, as in the other, two further broad classifications may conveniently be assumed—namely, mains valves and battery valves. In each category, of course, valves with parallel purposes will be found. Roughly speaking, a valve will have one of three purposes. It will be a pre-detector (high-frequency) amplifier, a detector, or a post-detector amplifier (low-frequency).

The simplest type, and that with which most are familiar, is the battery detector. The pins are not symmetrical, the grid being that nearest the filament pins and opposite the plate.

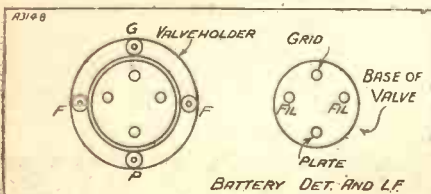
Safety First.

The disposition of these pins is actually the same for all this class of valves, while certain types have additional pins or extra terminals.

In the case of the battery S.G. valve it is important to remember that the pin equivalent to the plate pin of the detector is actually connected to the screening grid, the plate connection being taken from a terminal in the top of the bulb.

An ordinary L.F. valve is connected internally exactly in the same manner as

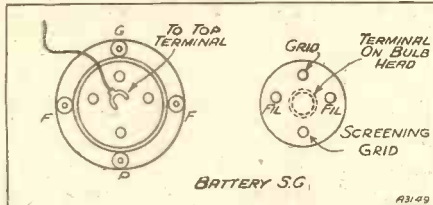
PREVENTS ACCIDENTS



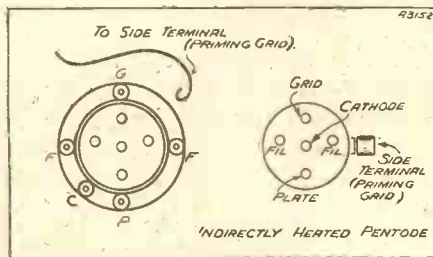
The "staggered" arrangement of the sockets on the familiar four-pin valve holder is to prevent incorrect insertion of the valve.

the detector. The pentode, while having actually three grids, has only one extra

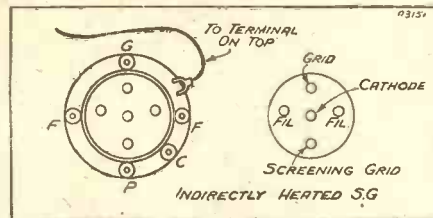
HOW THE CONNECTIONS GO



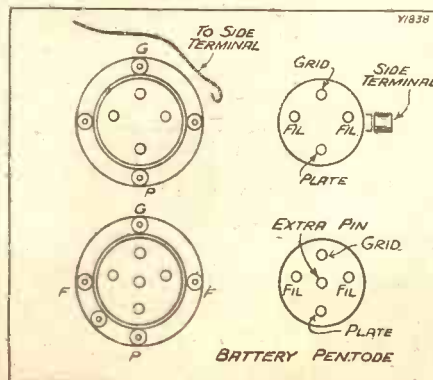
For battery-operated screen-grid valves a four-pin valve holder is required, and the connection to the valve's actual anode is by means of a terminal on the bulb head. The screening grid is joined to the pin which plugs into the "anode" socket of the holder.



With an indirectly-heated pentode six separate connections have to be made to the internal electrodes. This is accomplished by providing the valve itself with a priming-grid terminal on the side of its base and employing a five-pin holder.



The sketch above shows how matters are arranged for connecting to an indirectly-heated S.G. valve, from which it will be seen that an extra terminal on the valve itself is also employed. With battery pentodes (below) the side terminal method is sometimes used so that they can be plugged into an existing four-pin holder, but the five-pin battery pentode is more general.



terminal, one being the normal control grid, the second being joined internally to the filament, while the third, the priming grid, is connected to a terminal on the side of the valve base, or a fifth pin.

This list exhausts the types of battery valve bases, and it will be seen that, thus classified, there is no cause for confusion.

An Additional Pin.

One diagram shows the base of an indirectly heated mains detector or L.F. valve and it will be observed that the disposition of the pins is similar to the battery valve, with an additional pin in the centre. This latter is the cathode pin, and in all cases where bias circuits are affected is regarded as the actual filament. Directly-heated mains valves do not really need special classification, since they are the same as battery-operated valves.

The mains S.G. valve has, as in the case of the battery S.G. valve, its P pin joined to the screening grid, the actual plate being joined to the terminal on the bulb head. The centre pin again is the cathode.

The indirectly-heated multi-mu S.G. valve and the Ferranti indirectly-heated H.F. multi-mu pentode are connected in the same way as the ordinary indirectly-heated S.G. valve.

The final type, and that which probably, but unrightly, affords the most confusion, is the mains-operated pentode. Here we have in all six external connections, five in the base and one at the side. The side terminal is that joined to the priming grid, while the five base projections are the same as the other types of mains valves.

It is as well to mention here the valve rectifier. This has four pins, the two filament pins being in their normal positions and the grid and plate pins being, in the case of the full-wave rectifier, each joined to one plate. In the half-wave rectifier only the plate pin is employed.

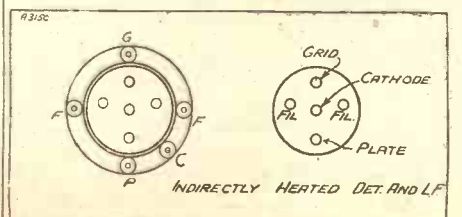
The Metallised Type.

As a final point it should be remembered that when battery metallised valves are employed the metal coat is connected to the left-hand filament pin, assuming the anode pin to be nearest when the valve is inverted. The relative filament terminal of the valve holder should therefore be joined to L.T. negative.

The matter is somewhat different when metallised A.C. valves are employed, since the coating is connected to the cathode pin.

In the second section we have valves in which the base pins are arranged for the seven-socket holder. Among these may be mentioned the Class B valve, the double-diode triode and the double-diode multi-mu pentode. The connections for valves of this type will be given in a further article.

THE EXTRA ELECTRODE



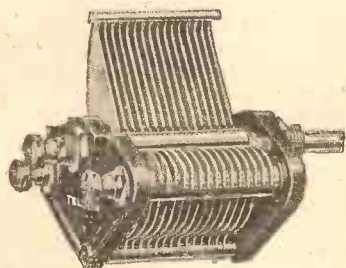
Triode valves with indirectly-heated cathodes are simply dealt with by using a five-pin holder, connection to the cathode being via the extra pin.

TELSEN

TUNING

CONDENSERS

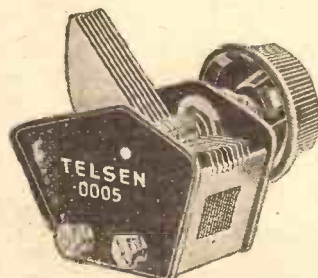
cover every requirement



**TELSEN
AIR-DIELECTRIC
TUNING CONDENSERS**

The precision and sturdy construction of this component ensure years of faithful service. Its frame is braced by three solid pillars, and the vanes clamped at three points, making distortion impossible. The rotor is also built into a rigid unit, generous bearings preventing backlash or end-play.

Capacity	Price
•00025 mfd. ..	2/6
•00035 " ..	3/6
•0005 " ..	3/6



**TELSEN BAKELITE
DIELECTRIC TUNING
CONDENSERS**

Represent really remarkable value at the new reduced prices.

Very rigid construction, with high grade dielectric, ensuring permanently accurate spacing with minimum losses. Exceptionally compact. Complete with knob.

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•0005 " ..	2/-



**TELSEN
DIFFERENTIAL
CONDENSERS**

Similar in design and construction to the reaction condensers. Supplied complete with knob.

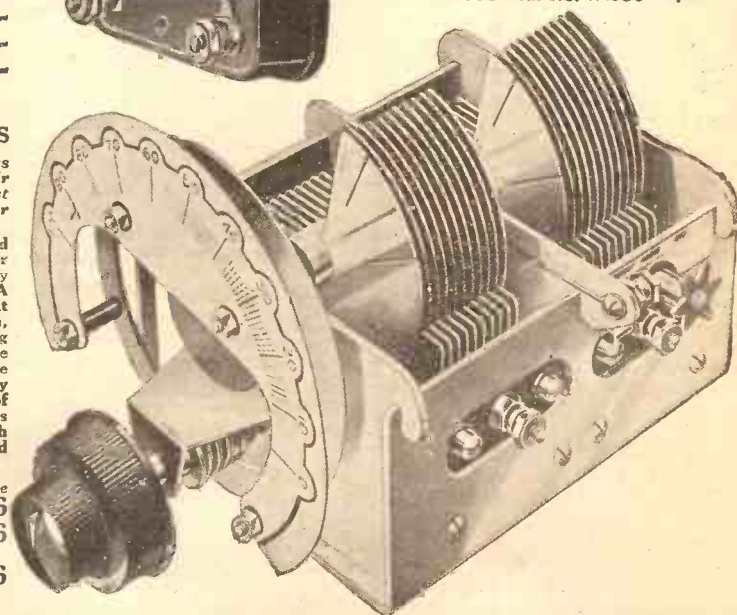
Capacity	Price
•0003 mfd. W.351 ..	2/-
•00015 " W.352 ..	2/-
•0001 " W.353 ..	2/-

**TELSEN
GANGED CONDENSERS**

The finest ganged condensers ever produced, and, at their new reduced prices, the finest value ever offered in their class.

For use where accurate and simultaneous tuning of two or three circuits is obtained by the rotation of one dial. A pressed steel frame of great rigidity eliminates distortion, the rotor and stator vanes being let into one-piece high accurate die castings to ensure accurate spacing. All sections are very carefully matched by means of split end vanes, and trimmers are provided. Complete with knob, pilot light escutcheon and two alternative tuning scales.

	Price
Single Unit	7/6
Twin Ganged	12/6
With dust cover 2/- extra	
Triple Ganged	17/6
With dust cover 2/6 extra	



**TELSEN REACTION
CONDENSERS**

Entirely re-designed. Now incorporate several valuable improvements with no increase in price, the whole unit being also now enclosed in a strong dust-proof bakelite case. Supplied complete with knob.

Capacity	Price
•0003 mfd. W.354 ..	1/9
•00015 " W.355 ..	1/9
•0001 " W.356 ..	1/9
•00075 " W.357 ..	2/-
•0005 " W.358 ..	2/-



**TELSEN AERIAL
SERIES CONDENSER
With Switch**

Built on similar lines to the new reaction condensers, providing an ideal selectivity and volume control. Supplied complete with knob.

Max. Cap.	Price
•0003 mfd. No. W.350	2/-

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

ELECTRON COUPLING

THE most familiar type of coupling is that in which energy is transferred from one circuit to another by the magnetic flux or field passing between two adjacent coils. One coil, for instance, may be in the plate, and the other in the grid circuit of a thermionic valve; or one may form the primary and the other the secondary of an ordinary transformer.

In the other well-known type of coupling the energy transfer takes place across the plates of a condenser, whether the latter is one deliberately provided for the purpose (as in the case of an intervalve coupling) or whether it is more or less accidental, as when back coupling occurs between the electrodes inside the bulb of a valve.

"Electron" coupling is, however, something quite separate and distinct from either of these types. It has been developed to meet a particular problem, which is for the moment confined to the superhet circuit,

USING AN H.F. PENTODE

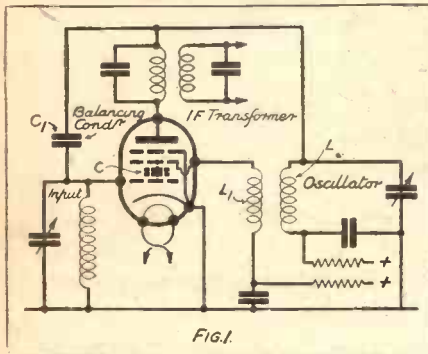


FIG. 1
A separate oscillator valve can be avoided by using an H.F. pentode as combined oscillator and mixer. The circuit used would be on the lines of the above, but there are certain drawbacks due to the internal capacity of the valve.

though it is likely to find other and wider applications in the near future.

In order to explain some of the practical advantages of electron coupling it will be useful, in the first place, to consider the normal type of superhet circuit in which one valve is used as local oscillator and a second or separate valve as "mixer."

The Duty of a Valve.

Now it will be generally admitted that the first duty of a valve in any wireless set should be to amplify the received signals, either on the high-frequency side or after rectification. But neither the "local generator" nor the "mixer" valve in a superhet can be said to earn full marks in this respect. The former does not handle the signals at all, whilst the latter is so fully occupied with the job of mixing the signal and local oscillations together—so as to produce the intermediate frequency—

★ **Coupling in electrical circuits by means of capacity or inductance is familiar to all, but here are details of an entirely new system. The electron stream inside the valve is used to provide the link, and the scheme is particularly useful in superhet circuits, as explained in this contribution**

By **CARDEN SHELLS.**

★ that it does practically nothing by way of amplification.

~ This makes a serious point in weighing up the merits of the superhet as against the "straight" type of circuit, where every valve is brought directly into the chain of amplification.

Oscillator and "Mixer."

It led, in fact, to the introduction of the H.F. pentode as a combined oscillator and mixer valve—a development which helped to put matters right in some degree, though not altogether.

For instance, as shown in Fig. 1, the anode and screening grid are back coupled through the coils L, L1 to produce the local oscillations. It will be seen that the grid taking the incoming signals lies close to the screen grid inside the valve, and since the screen grid carries a fluctuating potential there will be undesirable back coupling between the two circuits across the capacity marked C. In order to prevent this it is necessary to provide a balancing condenser C1, otherwise the local oscillations are likely to get into the aerial circuit and cause interference with other listeners.

In order to produce a "beat" frequency the oscillator and signal circuits must, of course, be tuned to slightly different frequencies. This introduces difficulties in "ganging," because if the two circuits react on each other the original "balance" is upset as the tuning of the set is varied from one station to another.

A New System.

The new system of "Electron Coupling" completely overcomes all difficulties of this kind. Actually the local oscillations are mixed with or superposed on the received signals *inside* the valve instead of outside. There is no external coupling between the signal and oscillator circuits, and therefore feed-back into the aerial, and no tendency to upset the overall "matching" required for single-knob control.

This effect is secured by using a five-grid valve known as the Pentagrid Converter—or Heptode. The bulb contains seven electrodes in all—five grids, plus the cathode and anode. The first British valve of this type—the Ferranti V.H.T.4—was shown at the Radiolympia Exhibition.

The electrode arrangement is shown in

Fig. 2. The cathode 1, grid 2, and electrode 3 together form a three-electrode "oscillator" group, which is separated by an "artificial cathode" and a special screening grid 4 from the second or "mixer" group 5, 6, 7.

The grid 2 is an open spiral wire, whilst the electrode 3 (although it carries a high voltage and therefore acts as the anode of the "oscillator" group 1, 2, 3) is also made "open" in structure, so that it allows a part of the main electron stream to escape through into the space between it and the next electrode.

This latter electrode 4 is connected inside the valve to a counterpart electrode labelled 6, so that 4 and 6 together act as a double screening grid. The signal input grid 5 is inserted between the two arms of the double grid 4, 6. The anode of the "mixer" group is marked 7.

An Artificial Cathode.

Now the peculiar action of the valve depends upon the fact that beyond the "anode" 3 of the oscillator group of electrodes, the continuity of the main electron stream is broken up. Actually an

IT EMPLOYS FIVE GRIDS

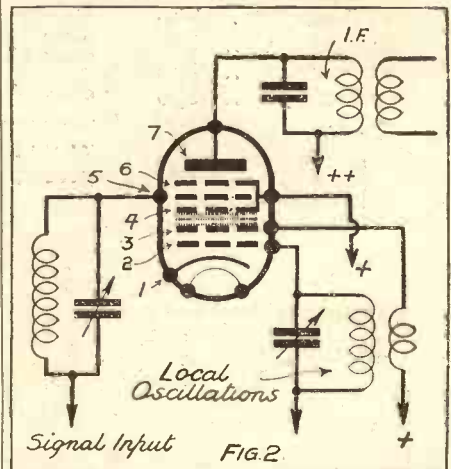


FIG. 2
The arrangement of the pentagrid valve, which makes electron coupling possible, is here shown diagrammatically in a combined oscillator and mixer circuit.

electron "block" is created in the space shown shaded, and this acts as an artificial cathode (or reservoir of electrons) from which the "mixer" group of electrodes draw their supply as and when required.

It is not difficult to see how this cloud of free electrons (or space charge) is set up if one remembers that the steady H.T. voltage on the screening grid 4 is sometimes higher and sometimes lower than that of the oscillator "anode" 3. The voltage on the

(Continued on page 175.)

This Lissen 7 valve Superheterodyne is absolutely **UNIQUE!**

NO KIT SET EVER BEFORE HAD 6 STAGE BANDPASS FILTER

NO KIT SET EVER GAVE EXACT 9/Kc TUNING CHANNELS

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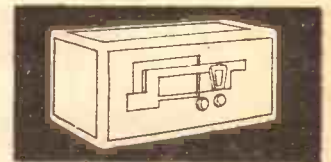
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"SKYSCRAPER" SEVEN VALVE SUPERHET

Never before has there been any receiver for Home Constructors on such an ambitious scale as this new Lissen "Skyscraper" Seven Valve Superhet. It embodies every up-to-the-minute advance and refinement of the most luxurious factory-built superhets—it gives the constructor the opportunity to build a £20 receiver for less than half that price. The circuit of the Lissen "Skyscraper" Seven Valve Superhet incorporates a 6-stage bandpass filter giving exact 9-kilocycle channels and therefore providing a standard of selectivity never before achieved by a home constructor's kit set and very rarely found except in laboratory apparatus. Amplified Automatic Volume Control is provided, a special valve for this purpose having been produced by Lissen for use in this receiver. The use of this Amplified Automatic Volume Control constitutes an entirely new experience in listening; no "fading" no "blasting"—you will find yourself enjoying every word of every programme, however near or however distant, without the slightest temptation to interfere with the receiver once you have tuned it. This is radio listening as it should be enjoyed!

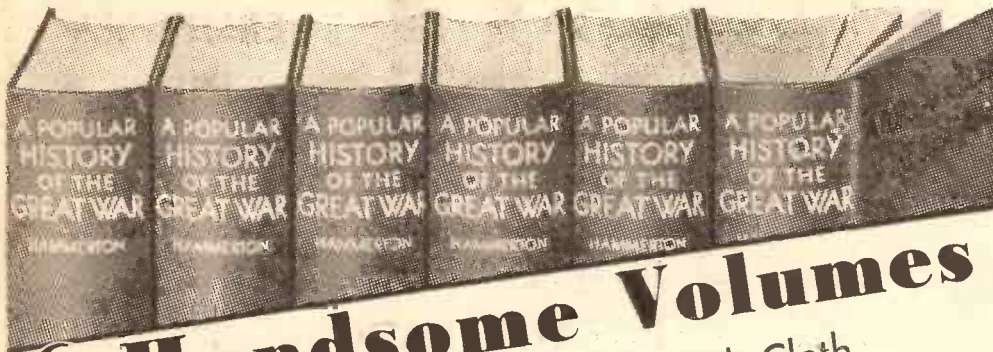
Lissen Class "B" Output through a new full-power Lissen (Moving-coil Loudspeaker—glorious rich tone and majestic volume, actually more faultless in its reproduction than anything you ever heard from even the most powerful mains receiver, yet working economically in this Lissen "Skyscraper" from H.T. batteries.

Lissen have published for this great new "Skyscraper" Seven Valve Superhet a most luxurious Chart which gives more detailed instructions and more lavish illustrations than have ever before been put into a constructional chart. It makes success certain for everybody who decides to build this set; it shows everybody, even without previous constructional experience, how they can have a luxury receiver and save pounds by building it themselves. A copy of this Chart will be sent FREE in return for coupon on the left, or your radio dealer can supply you. Get your FREE CHART now!



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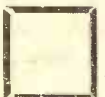
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The Westector is simply fitted in the detector by-pass circuit, and the D.C. component developed across it by the H.F. present, is used, after passing through a suitable resistance-condenser filter, for controlling the bias applied to the variable- μ H.F. valve. Full particulars and circuits are given in the 1934 edition of "The All-Metal Way." Send 3d. in stamps for a copy.

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RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.



Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

A MAINS-DRIVEN SET THAT WORKS FROM D.C. OR A.C.

L. H. (Beckenham, Kent).—"Have you ever given in 'P.W.' the details for making a three-valve set that can be worked from both types of electric light mains—direct current or alternating? If so, please say where the description can be obtained, and if possible blueprint?"

Details for making a set of this kind were given in "P.W." No. 584 (dated August 12th, 1933), under the title "The Universal Three." No blueprint was issued, but the set is quite easy to build from the details given.

(Back numbers of "P.W." which are still in print can be obtained from The Amalgamated Press, Ltd., Back Number Dept., Bear Alley, Farringdon Street, E.C.4, price 4d. per copy, including postage.)

FITTING A LOUDSPEAKER FILTER CIRCUIT.

W. N. C. (Pontefract).—"The 'Airsprite' is so good that I have decided not to change to a new set this season unless I see something that will do the seeming impossible and beat it. But I should like to run it with a loudspeaker filter circuit, as I am putting in an upstairs loudspeaker and don't like long leads which are alive with H.T. running over the house.

"As there is no room to spare on the baseboard, I should be pleased if you will say the best method of placing and wiring the new components."

The extra components needed are a 2-mfd. fixed condenser of the usual paper type and a good output choke. Instead of fixing them to the baseboard, you can mount them on the inside of the cabinet above the loudspeaker terminals.

The following are the alterations to the wiring: First remove the lead from the plate of V3 valve holder to the L.S. — terminal, and also remove the lead from H.T. + 3 to L.S. + terminal.

Then connect plate of V3 valve holder to one terminal of the output choke (a Bulgain L.F.16 type choke was used for the original model) and also connect this terminal of the output choke to one terminal of the new 2-mfd. condenser.

The remaining terminal of the output choke goes to H.T. + 3. The remaining terminal of the fixed condenser goes to the L.S. — terminal.

Finally, connect the L.S. + terminal to the negative filament terminal of the V3 valve holder, and run the loudspeaker leads from the set's L.S. terminals in the usual way.

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

- (1) About how much inductance is possessed by an average good outdoor receiving aerial?
- (2) Several of the European countries have broadcasting facilities with a power out of all proportion to the needs of their population. Which is the most outstanding example?
- (3) What is the cause of "dead spots"—those portions of a short-wave set's tuning range where reaction becomes ineffective?

ADDING AN EXTRA TUNED CIRCUIT FOR INCREASED SELECTIVITY.

B. N. (Plumpton).—"With the idea of increasing the selectivity of a detector and 2 low-frequency set (built-in semi-portable) I wish to add an extra tuned stage covering both wavebands.

"The set is built into a handsome cabinet and works well enough to please anybody, with the sole disadvantage that it is non-selective. As it is going to be used at Bridg-

(Continued on page 172.)



SPECIFICATION

5 Valves and Rectifier. Band-Pass I.F. Couplings. Six tuned circuits with single-knob control.

Automatic Volume Control.

Sockets for Pick-Up. Provision for using an external speaker

Undistorted Output:

1,600 Milliwatts.

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Overall Dimensions: 18½ ins. high x 11 in. deep x 13 in. wide.

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For A.C. Mains only, 100/220 volts or 200/250 volts.

40/100 cycles.

PRICE 18 GNS.

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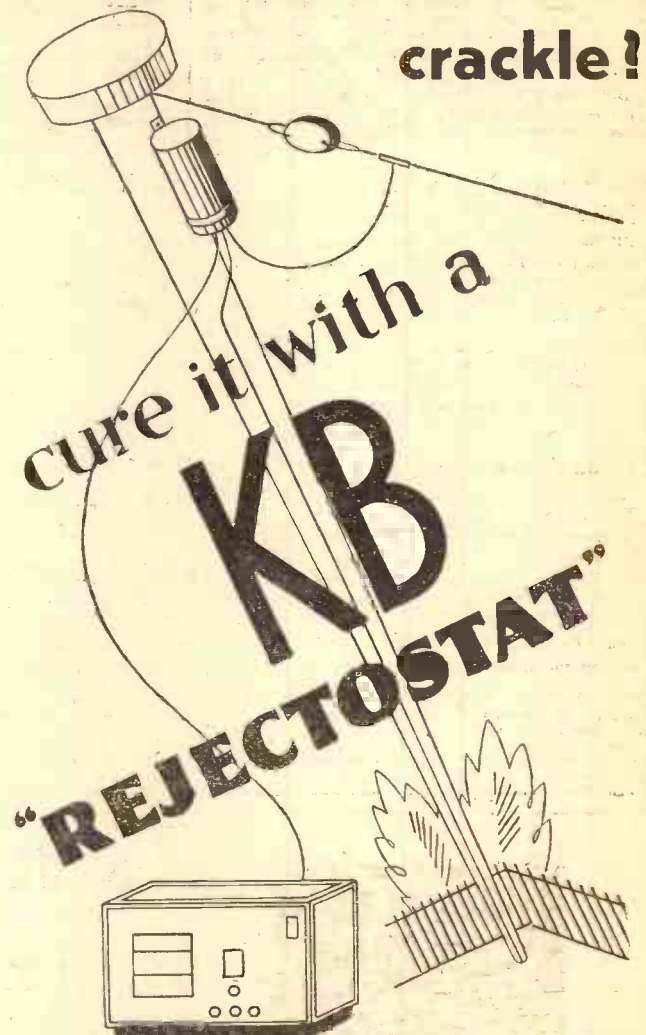
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Post in an unsealed envelope using 1d. stamp

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 170.)

water, quite close to the West Regional, this must be cured, and my idea is to put a tuning unit in front of it, something like the Eckersley Tuner, but not necessarily resistance-coupled.

"I have another coil unit like the one in the set and also several small neutralising condensers, so will these be suitable? Also small cabinet and three-point wavechange switch.

"The present coil-unit connections are No. 1, to grid condenser and tuning condenser (-0005); No. 2, to wavechange switch; No. 3, to wavechange switch, earth terminal, moving vanes of tuning condenser, etc.; No. 4, not used; Nos. 5 and 6 are aerial terminals; No. 7, to wavechange switch; No. 8, to reaction condenser.

"I am not quite clear how to follow a similar arrangement with the separate unit, so please give new wiring in words if you think it would be a satisfactory method of improving selectivity."

It will be quite satisfactory to add an external tuned circuit in this way, and it is probably the best method of improving the selectivity without alterations to the present set wiring.

Connect up as follows: No. 1 terminal of the coil unit to one side of a small neutralising-type condenser and to the fixed plates of the new variable condenser.

The other terminal of the neutralising-type condenser goes to the set's aerial terminal, from which, of course, the aerial lead will be removed to go to the new unit instead.

Nos. 2 and 7 of the coil unit will go to separate terminals of the new three-point wavechange switch, the other terminal of this switch being joined to No. 3 terminal of the coil unit, to the moving vanes of the new tuning condenser and to the set's earth terminal, etc.

No. 4 terminal is again left vacant, and the aerial lead can go on either No. 5 or 6 terminal, according to which proves better in practice.

The No. 8 terminal will not be used.

To be successful, the new unit must not be placed so close to the set that the coils interact, but it is probable that this condition will be fulfilled by placing the new unit in the separate box. If, however, selectivity is not found to be really good, accidental coupling between the two coil units is a point to suspect.

Another important factor governing the degree of selectivity obtainable with the arrangement is the value of the coupling capacity. If the neutralising-type condenser does not seem to be small enough in capacity to provide sharp separation (shown by insufficiently sharp tuning, even when the coupling condenser is set "all out") you can reduce its effective capacity by inserting another condenser of the same type in series with it.

To do this, merely break the lead between aerial terminal on the set and the condenser in question and insert a second neutralising-type condenser there. The connections for this part of the circuit will then be: No. 1 terminal of coil unit and fixed vanes of new tuning condenser to one side of first

small condenser; its other terminal to second small condenser; and the vacant terminal on this to the set's aerial terminal.

As the coil units are similar you should find it an easy unit to keep in tune, because the dial readings will be more or less the same over the greater part of the tuning ranges.

AUTOMATIC SWITCHING OF THE H.T. CIRCUIT.

"CLICK OVER" (Guildford, Surrey).—
"How does a 'thermo-delay' switch work? I saw one in action for the first time the other day, but all the owner knew about it was that it switched on the H.T. after the valves had warmed up, and so prevented damage due to high voltages.

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 170
ARE GIVEN BELOW

- (1) About fifteen or sixteen microhenries.
- (2) Luxembourg. It is one of the very smallest countries, but its station's power is excelled only by Moscow.
- (3) The cause is nearly always the aerial circuit coming into tune with the grid circuit. And the trouble can usually be removed by altering the aerial clip's position or resetting its series condenser.

DID YOU KNOW THEM ALL?

"This one went over with a good positive click about half a minute after the set had been switched on, and from its name I suppose something had warmed up in the meantime. But how that can be done has 'got me guessing,' and I should like to know the method used."

(Continued on page 174.)

"P.W." PANELS, No. 139.—NAPLES.

"Radio Napoli" is the Italian name for this station, which works in conjunction with Rome, and is therefore generally announced as "Radio-Roma-Napoli."

The distance from London is almost exactly 1,000 miles. Wavelength, 319 metres. Power, 1.5 kw. Usually woman announcer.

Naples shares its wavelength with Dresden and Sofia (Rodno Radio), so the programme is generally better obtained from Rome, on 441 metres. Closes down with "Buona notte a tutti" (Good-night, Everybody.)

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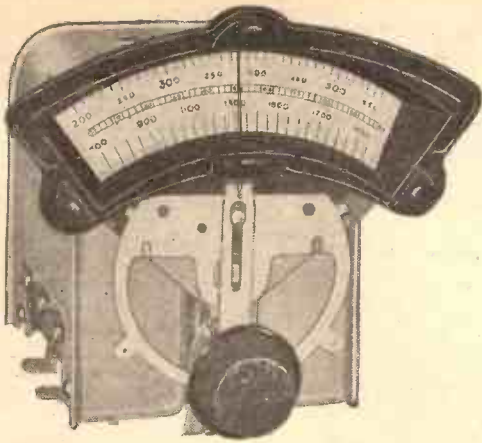
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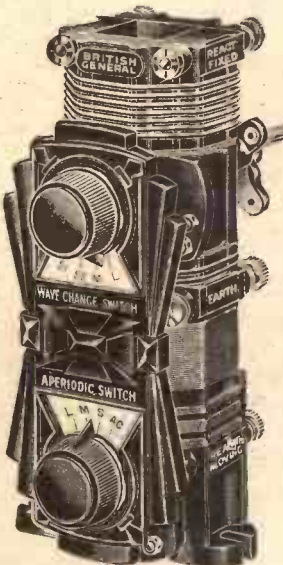
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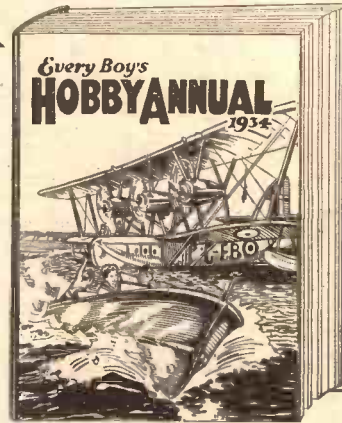


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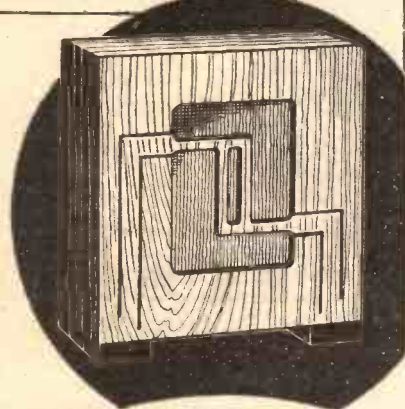
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Ask your dealer for a demonstration, or write for full details.

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MODEL P.P.M. 39



CELESTION

The Very Soul of Music

THE FOREMOST NAME
IN SOUND REPRODUCTION

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 172.)

The principle upon which these ingenious switches work is a very interesting one. It depends upon the unequal expansion of different metals when heated. The switch is arranged so that a two-metal strip is heated when the switch of the set is turned on. As the two metals expand unequally the strip bends.

Assisted by a spring, this bending action is sufficient, after a few seconds, to close a pair of contacts and thus complete the high-tension circuit. When the set is switched off the process is reversed.

In this way the high-tension can never be applied until the heating effect has taken place, which gives ample time for the valves in the set to heat up. And thus they are able to take the H.T. safely when the thermal-delay switch joins up the high-tension circuit.

USING A PENTODE IN A "LOCAL-STATION" SET.

J. M. (Newcastle).—"I thought I would get big volume and good quality on the local station only, so I built the set without any attempt at getting selectivity and long distance.

"It is a simple circuit. First valve leaky-grid detector, next an R.C. stage, and finally a 3:1 transformer stage.

"All the components are standard values, tried and found to be successful in other sets.

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service. Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4. A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by phone or in person at Fleetway House or Tallis House.

But no arrangement that I can find will give good quality when using a small pentode for extra volume, though perfect with ordinary output valve. Please say how this difficulty can be overcome."

We are afraid that you are attempting the impossible. In supposing that the pentode is capable of high magnification you are correct, but it can handle only a comparatively small input.

With the arrangement you describe you are expecting it to handle the output of a sensitive detector stage that has been amplified at low frequency before reaching the pentode. This magnification is too great to feed to a pentode such as you are using, although it could be handled without distortion by other types of output valve.

WHEN THE REACTION CONTROL WORKS BACKWARDS.

R. R. G. (Pangbourne, Berks).—"The only thing I have got wrong is, the reaction, which works well but has to be turned to the left to increase, instead of to the right.

"The condenser used is a proper differential type of the correct marking, but the terminals are not arranged the same as on the diagram. Should I have to get a new condenser of the correct make or can it be put right on this one?"

It is very easy to alter the direction of rotation and make it increase, instead of decrease, when turned to the right. All you have to do is to leave the connection to the moving plates as at present, but change over the wiring of the differential condenser's other two terminals. This will put the matter right

"PEAK" AND "R.M.S." VOLTAGES

T. D. L. (Cheshunt).—"The output valve I was thinking of using (D.O.24) is one of the high-magnification type, and the makers say 'it will give a very large output for a grid-input voltage of 24V. R.M.S.'

"Does this mean that 24 volts is the highest voltage that the grid will be called upon to handle during reception?"

No. The highest (or "peak") voltage may be greater than 24, because an R.M.S. voltage is only $\sqrt{2}$ x maximum (or "peak") voltage.

If the R.M.S. voltage is 24, the peaks of the alternating voltages will thus be approximately 34 volts.

THE LISTENER'S NOTEBOOK

(Continued from page 144.)

The great problem now with poultry keepers, according to Mr. Newman, is to replace the one-year sprinter by the long-distance stayer. This was a typical remark of Mr. Newman's.

Next there was Mr. Vernon Bartlett reading from his carefully prepared script—this time to children—on the meaning of recent political events in Germany. It was a remarkably lucid account, and no school-boy should be hazy about the Nazi movement now. This was the second talk to schools to appeal to me strongly this week.

Dr. Fred Stoker on "Soil and the Garden" and the Production Director on the "Radio Drama Festival" represent yet other types of talkers with characteristics common to each other. Among the rest were a number of the old gang, besides several newcomers all pleasing to listen to, despite the fundamental differences in type.

It is good for talks that there are these differences. If broadcast speech were moulded to one pattern it would lose much of its appeal, for listening would become a boring occupation. It is because of these differences that talks seldom lose their freshness.

ECKERSLEY EXPLAINS

(Continued from page 145.)

reproduction, we must hear something worth while to make us forget the technicalities.

I hope, when my obituary comes to be written, that someone will say that I worked my hardest in the interests of Mr. "B" and Mr. "D"; that I strove as a technician, to improve the art so that the sounds issuing from the speaker were in themselves pleasing as music; and that I strove as a publicist-journalist—what you will—to bring constructive criticism to bear upon authority so that our programmes might make us more easily forget that the technics of the art were still imperfect.

I sometimes wish I had more support from Mr. "B" and Mr. "D." Goodwill and good luck to Mr. "C," and bad cess to ye, Mr. "A"!

ELECTRONIC MUSIC.

The Editor, POPULAR WIRELESS.

Dear Sir—we should like to congratulate you on publishing the articles on the Valvonium. It is somewhat surprising to find how little interest has been shown in this country in electronic music. In most other countries an enormous amount of research has been and is being carried out on the subject. It may surprise your readers to know that there are some three hundred patents covering various types of electronic musical instruments. There can be little doubt that this method of sound production will play a very important part in the design of musical instruments of the future. In giving a lead in the way you have done, we feel that you have rendered real service. We are exhibiting the Electrone, another type of electronic musical instrument, at the International Inventions Exhibition in London from 4th to 14th October. We should like to extend a very cordial invitation to your readers to visit us there.

Yours faithfully,
The Electronic Music Development
Co., Ltd.
F. HARWOOD Director.

ROUND THE RECORDS

(Continued from page 156.)

combinations quite a lot, so I should not be surprised if this "classic" were to stage a come-back on somebody's record. The last I remember is the banjo version of Eric Peabody on a ten-inch Columbia.

Ray Noble is as good as ever—if not better—in "Roll Back the Carpet" and others in the recent H.M.V. lists, while I was glad to hear Joe Venuti again, on Columbia, playing "Hiawatha's Lullaby."

The "hot merchants" will like the Louis Armstrong selections on the recent twelve-inch H.M.V., but to the normal-minded twelve inches is too much at a time. I wonder why "Ain't Misbehavin'" one of Louis' best, was omitted.

Sandler chooses a peculiar rendering of Liddell's famous "Abide With Me" when he plays a violin solo to the accompaniment of a cinema organ on a Columbia disc. The organ reproduction is magnificent, and though the record is extremely good I wish that it had been given those extra two inches. It is a ten-incher, and deserves more playing time.

Well Worth Hearing.

Brass-band lovers will welcome "Colonel Bogey" on Regal Zonophone. It is excellently played and perfectly recorded. Try it on your radiogram, and if it is not really good look to the set—it's not the record.

The Four Musketeers are excellent in "Shuffle Off to Buffalo," a recent Columbia record of the film hit. The voices blend perfectly, and the recording is a joy to listen to. Get it just for that, even if you are not keen on that type of number.

Two organ discs of Grieg's "Peer Gynt" suite, on H.M.V., will find a ready sale. The organist is Thalben Ball, and the rendering is naturally excellent—so is the recording. I did not relish the idea of "Peer Gynt" on an organ before I heard these records, but I think differently now.

K. D. R.

ELECTRON COUPLING

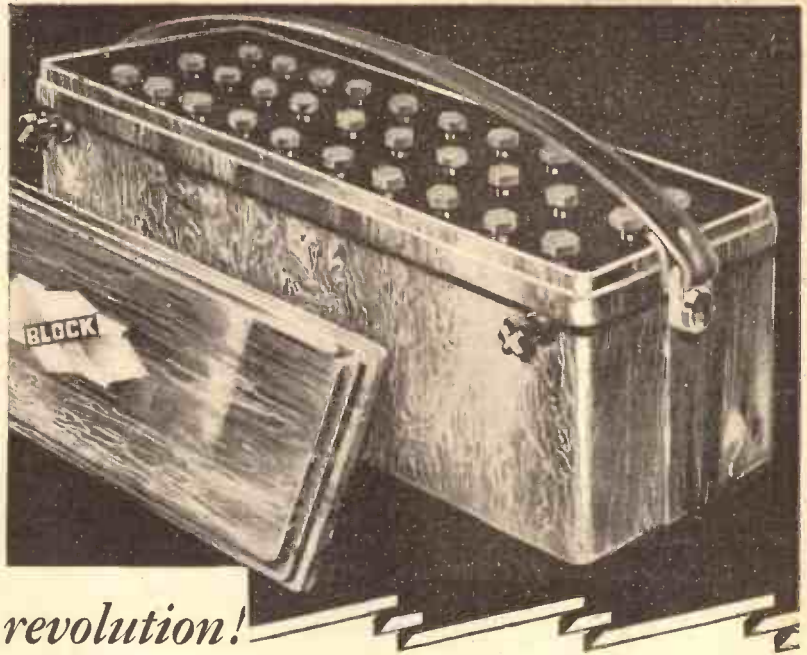
(Continued from page 166.)

latter must clearly rise and fall in accordance with the local oscillation output.

In other words, the local oscillations are "mixed" with the signal oscillations through a coupling which is purely electronic in action and does not involve either inductance or capacity.

Bearing in mind that the shaded portion really forms an extra cathode, we see that complete electrode system consists of a three-electrode "oscillator" 1, 2, 3, coupled to a four-electrode group operating as a combined mixer, detector and amplifier (the three electrodes 5, 6, 7, plus the "shaded cathode"). In addition to the extra screening grid 4 serves to prevent any undesirable capacity coupling between the upper and lower group of electrodes.

This latter point is of considerable importance, since it means that a large negative grid bias can be applied to the signal grid 5, for the purpose of automatic volume control, without interfering in any way with the operation of the "local oscillator" group of electrodes.



revolution!

Now★

YOU CAN GIVE UP
dry battery
EXPENSE

MANCHESTER
STAND
54



PLATE-LESS-NESS REMOVES ALL OBJECTIONS TO H.T. ACCUMULATORS



Double capacity
L.T. 80 a.h. 11/6
2 v.

1. YOU endured the constant expense of dry batteries—because H.T. accumulators were so unwieldy. Or perhaps you put up with the existing type of accumulator?

2. To-day there is no need for either. The invention of the Block plate-less cell, with its double capacity, permits a H.T. accumulator that is half the usual bulk—60 v., 5,000 m.a.h. from a coloured bakelite casket hardly bigger than a dry battery!

3. Give up the old expense, the old nuisance. Give yourself the economy (and comfort) of H.T. in its modern, most perfect, cheapest form.

This Block L.T. accumulator is no bigger than an ordinary 40 a.h. type, yet lasts twice as long per charge! As in all Block cells, its cylindrical negative is also the cell's container, the positive being a central column. No grids needed, therefore more "active material" and less weight; also its circular form ensures far more thorough action.

60 v. 5000 m.a.h. 14 $\frac{3}{4}$ " x 4 $\frac{1}{2}$ " x 5 $\frac{1}{2}$ " lid. **37/6**
Weight 16 lbs.

30 v. 5000 m.a.h. 8-3/16" x 4 $\frac{1}{8}$ " x 5 $\frac{1}{2}$ " lid. **21/=**
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The I.C.S. Radio Courses cover every phase of radio work, from the requirements of the youth who wishes to make wireless engineering his career to the man who wants to construct and maintain a broadcasting set for his home.

The Radio industry is progressing with amazing rapidity. Only by knowing thoroughly the basic principles can pace be kept with it. Our instruction includes American broadcasting as well as British wireless practice. It is a modern education, covering every department of the industry.

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Included in the I.C.S. range are Courses dealing with the Installing of radio sets and, in particular, with their Servicing, which to-day intimately concerns every wireless dealer and his employees. The Operating Course is vital to mastery of operating and transmitting.

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We will be pleased to send you details of any or all of these subjects. Just fill in, and post the coupon, or write in any other way, stating which branch of Wireless interests you—the information you require will be forwarded at once.

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Without cost, or obligation, please send me full information about the Courses I have marked X

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- WIRELESS ENGINEERING
- WIRELESS OPERATORS'

Name..... Age.....

Address.....

EUROPEAN BROADCASTERS

For the benefit of readers who listen to distant transmissions we give below a list of European broadcasting stations, together with their wavelengths and the names of the countries in which they are situated. This information will be brought thoroughly up to date and republished fortnightly in "Popular Wireless." Next week we shall be giving a list of the short-wave stations that are receivable in this country, and this will subsequently appear in revised form each month.

Metres.	Station.	Metres.	Station.
196	Karlskrona (Sweden)	364	Bergen (Norway)
201.3	Jönköping (Sweden)	369.1	Fredriksstad (Norway). (Relays Oslo)
263	Kristinehamn (Sweden)	368.1	Seville, EAJ5 (Union Radio); Galicia EAJ4 (Spain); Bolzano (Italy); Helsinki (Finland) (relays Lahti); Kharkov, RV20 (Russia)
204	Gävle (Sweden)		
205.5	Ornsköldsavik (Sweden)	370.4	Radio, LL, Paris
207	Boras (Sweden)	372	Hamburg (Germany)
209.8	Magyarovar and Miskolc (Hungary)	376.4	Scottish Regional (Falkirk)
211.3	Newcastle	381	Lwow (Poland)
214.3	Aberdeen	385.1	Stalino, RV26 (Russia)
216	Halmstad (Sweden)	385	Toulouse (Radio) (France)
217	Karlstad (Sweden)	369.6	Leipzig (Germany)
217	Königsberg (East Prussia). (Relays Heilsberg)	394	Bucharest (Roumania)
218.5	Salzburg (Austria). (Relays Vienna)	398.9	Midland Regional (Daventry)
218.5	Plymouth	403	Sottens (Radio Suisse Romande) (Switzerland)
219.9	Béziers (France)		
222.9	Hülksvall (Sweden)	408	Katowitz (Poland)
224.4	Cork (Irish Free State)	413	Athlone (Irish Free State)
225.9	Fécamp, Radio-Normandie (France)	416	Rabat (Morocco)
227.4	Hanover (Germany). (Relays Hamburg)	419.5	Berlin (Germany)
227.4	Flensburg (Germany). (Relays Hamburg)	424.3	Moscow, Stalin (Russia)
231	Malmö, Helsingborg and Umea (Sweden)	424.3	Madrid, EAJ7 (Union Radio)
232.2	Kiel (Germany). (Relays Hamburg)	430.4	Belgrade (Yugoslavia)
235	Lodz (Poland). (Experimental Station)	435.6	Stockholm (Sweden)
235.5	Kristiansand (Norway)	441	Rome (Italy)
237.2	Bordeaux, Sud-Ouest (France)	447.1	Paris, Ecole Supérieure, PTT; Rjukan (Norway), Notodden, Alesund (Norway)
237.2	Nîmes (France)	450.3	Madona (Latvia). (Relays Riga)
239	Nürnberg (Germany). (Relays Munich)	453	Agen (France)
240.6	Stavanger (Norway)	453.2	Milan (Vigentino) (Italy). (Relays Rome)
242.3	Belfast (N. Ireland)	453.2	San Sebastian, EAJ8; Pori (Finland); Danzig; Klagenfurt (Austria) (relays Vienna); Porsgrum (relays Oslo), Tromsø, Bodø (Norway) Uppsala (Sweden) (relays Stockholm)
244.1	Basle (Switzerland). (Relays Beromünster)		
245.9	Berne (Switzerland) (relays Beromünster); Eskilstuna, Säfte (Sweden) (relays Stockholm); Cassel (Germany) (relays Frankfurt); Linz (Austria) (relays Vienna); Turku (Abo) (Finland) (relays Helsinki)	459	Beromünster (Schweizerischer Landessender) (Switzerland)
247.7	Trieste (Italy). (Relays Turin)	465.8	Lyons la Doua, PTT (France)
249	Juan-les-Pins, Nice (France)	473	Langenberg (Germany)
252	Barcelona, EAJ15 (Assoc. Nat.) (Spain)	480	North Regional (Manchester)
253	Gleiwitz (Germany). (Relays Breslau)	488.6	Prague (Czechoslovakia)
255	Toulouse, PTT (France)	495.8	Trondheim (Norway)
257	Hörby (Sweden). (Relays Stockholm)	500.8	Florence (Italy)
259.3	Trier (Germany). (Relays Frankfurt)	509	Brussels No. 1 (Belgium)
259.3	Frankfurt-am-Main (Germany)	517	Vienna (Bismberg) (Austria)
261.6	London National and West National	525	Riga (Latvia)
263.8	Moravska Ostrava (Czechoslovakia)	533	Munich (Germany)
265.4	Lille, PTT (France)	537.6	Palermo (Italy)
267.4	Nyiregyhaza (Hungary).	542	Sudsvall (Sweden)
267.6	Valencia (Spain)	550.5	Budapest No. 1 (Hungary)
269.8	Bremen (Germany). (Relays Hamburg)	560	Kaiserslautern (Germany) (Relays Munich)
269.8	Bari (Italy)	560	Augsburg (Germany). (Relays Munich).
272	Rennes, PTT (France)	563	Wino (Poland)
273.7	Turin (Italy)	566	Grenoble (France)
276.5	Heilsberg (Germany)	570	Freiburg-im-Breisgau (Germany). (Relay Station)
279	Bratislava (Czechoslovakia)	574.7	Ljubljana (Yugoslavia)
281	Copenhagen (Denmark)	680	Lausanne (Switzerland). (Relays Sottens)
282.2	Lisbon CT 1AA (Portugal)	690	Oulu (Uleaborg) (Finland)
283	Innsbruck (Austria). (Relays Vienna)	720	Moscow, (Experimental) (Russia)
284.8	German Relays (Berlin, Magdeburg, Stettin)	760	Geneva (Switzerland)
284.8	Lyons (Radio-Lyon) (France)	825	Sverdlovsk, RV5 (Russia)
286	Montpellier (France)	840	Budapest (Hungary)
288.5	Bournemouth (Relay Station)	857	Leningrad (Russia)
288.5	Scottish National (Falkirk)	937	Kharkov (Russia)
291	Viiipuri (Viborg) (Finland). (Relays Helsinki)	1000	Moscow (Russia)
293	Kosice (Czechoslovakia)	1034.5	Kiev (Russia).
293	Limoges, PTT (France)	1071.4	Tiflis (Russia)
298.1	Hilversum (Holland)	1083	Oslo (Norway)
298.8	Tallinn (Estonia)	1117	Moscow, Popoff RV58 (Russia)
301.5	North National (Manchester)	1153.8	Kalundborg (Denmark). (Relays Copenhagen)
304	Bordeaux Lafayette, PTT (France)	1171.5	Tashkent, RV11 (Russia)
307	Zagreb (Yugoslavia)	1191	Luxembourg
309.9	West Regional (Washford Cross)	1200	Reykjavik (Iceland)
312.8	Genoa, (Italy)	1200	Istanbul (Turkey)
312.8	Cracow (Poland)	1229.5	Boden (Sweden). (Relays Stockholm)
312.8	Radio Vitus (Paris).	1304	Moscow, WZSPS (Trade Union) (Russia)
315	Marseilles, PTT (France)	1350	Tunis-Kasbah (Tunisia)
318.8	Naples, INA (Italy). (Relays Rome)	1354.4	Motala (Sweden). (Relays Stockholm)
319	Dresden (Germany). (Relays Leipzig)	1380	Novosibirsk (Russia)
322	Göteborg (Sweden). (Relays Stockholm)	1411	Warsaw I (Poland)
325	Breslau (Germany)	1445.7	Eiffel Tower, FL, Paris
328.2	Poste Parisien (France)	1481	Moscow (Old Komintern) (Russia)
331.5	Milan (Italy).	1538	Ankara (Turkey)
333.5	Poznan (Poland)	1554.4	Daventry National
335	Cadiz (Spain)	1635	Berlin (Deutschlandsender) (Germany)
338.2	Brussels II (Belgium)	1725	Radio Paris
341.2	Brno (Brunn) (Czechoslovakia)	1798	Lahti (Finland)
345	Strasbourg, PTT (France)	1875	Radio-Kootwijk (Holland) (Hilversum programme)
348.8	Barcelona, EAJ1 (Spain)	1935	Kaunas (Kovno) (Lithuania)
351	Leningrad, RV70 (Russia)		
352.1	Graz (Austria). (Relays Vienna)		
356	London Regional (Brookmans Park)		
360.5	Mühlacker (Stuttgart) (Germany)		
364	Algiers (N. Africa)		

THE MIRROR OF THE B.B.C.

(Continued from page 144.)

carrying out. This cleavage is already so serious that I prophesy an early revision of the whole elaborate scheme.

Better Empire Programmes.

Letters from overseas provide evidence that the short-wave transmissions of the B.B.C. are becoming much more acceptable where they can be received in the Dominions and Colonies. I believe the reason for this is that those responsible for the Empire programme are no longer so conscious of their special responsibilities and are dealing with their work in much the same way as do their colleagues in the home-programme service.

Much depends on steady development of the Empire programme, and it is good news in this direction that Captain Cecil Graves does not propose to give them up in order to manage the estates left to him by his late uncle, Viscount Grey of Fallodon.

THE LINK BETWEEN

(Continued from page 152.)

more "homely" about the Manchester way of doing it. However, that is just by the way.

The main point is that, fresh from a tour of Manchester's own Show, I feel compelled to urge all our North Country readers to make a special point of going along to the City Hall. It is certainly the most ambitious Show that Manchester has ever seen, and very well worth a visit.

Class "W.B."

My periodical "pat-on-the-back" goes this week to W.B. with particular emphasis on the "B"! For the Whiteley Electrical Radio Co., Ltd., not content to rest on the laurels that they have justifiably earned in the speaker world, have recently produced a range of Class B components which does them credit.

W.B. "Microloids" moving-coil speakers are already firm favourites. That their new range of Class B apparatus will meet with equal success is obvious from the excellence of the lines available.

The new W.B. Class B products include a heavy duty tapped output choke, a heavy duty "driver" transformer and two completely self-contained units for converting any ordinary battery set to Class B.

I am not quite certain whether literature is yet available for these new W.B. lines, but if interested readers will kindly send me the usual postcard, I shall be pleased to make arrangements (No. 55) for full details to be forwarded.

Another Fine Catalogue.

The catalogue standard this year is higher than it has ever been, and many of the booklets now being offered are almost small text-books in themselves.

The latest one to reach me—the 1934 version of the Westinghouse "All-Metal Way"—is no exception, in fact, if anything, I should feel strongly inclined to place it among the first half-dozen of the most worth-while catalogues available.

It really is an excellent effort, and one which, in my opinion, should be in the hands of every home constructor. The subjects dealt with are instructional as well as constructional, and the circuits alone are of the greatest interest.

Naturally, it is eminently suitable for inclusion in "P.W." postcard literature scheme, and since I am confident that the demand will be a heavy one, I strongly advise you to make (No. 56) early application.

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way just quote the number or numbers.

THE NORTHERN STAR

In the list of components for the Northern Star two 100,000 ohm resistances with terminals or wire ends were specified. This should have read one 100,000 ohm resistance with terminals or wire ends.

The VALUE of T.C.C. RESEARCH to YOU....



EVERY T.C.C. announcement has been a plain statement of fact—of achievement. No extravagant claims have been needed. Year by year T.C.C. research has been going on, large sums of money have been expended on pioneer work, the best brains employed. The T.C.C. efforts have been rewarded. Every development of note in condenser practice has emanated from the T.C.C. laboratories.

The following facts provide the reason for the wonderful confidence held by set designers, serious experimenters and amateurs in T.C.C. Condensers.

MILESTONES IN RADIO HISTORY

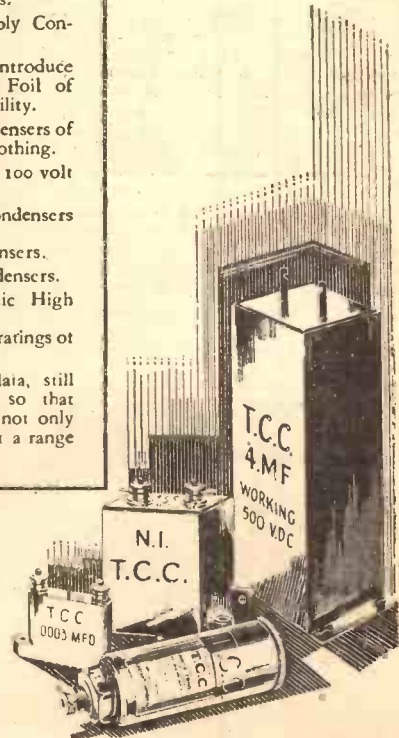
- 1906 T.C.C. founded with factory operating solely on Condensers and artificial line for submarine cable work.
- 1914 T.C.C. introduce Mansbridge Condensers, and manufacture under original licenses.
- 1915 T.C.C. working on Condensers for War Office, to Admiralty—Air Service—etc.
- 1918
- 1920 T.C.C. manufacture heavy duty Transmitting Condensers.
- 1922 T.C.C. manufacture Power Condensers.
- 1926 T.C.C. contract with B.B.C. to supply Condensers for 2LO.
- 1927 T.C.C. discard Mansbridge type, and introduce Rolled Condensers using Aluminium Foil of higher conductivity—and greater reliability.
- 1928 T.C.C. introduce Dry Electrolytic Condensers of very high capacity for low tension smoothing.
- 1929 T.C.C. introduce Dry Electrolytics for 100 volt working.
- 1930 T.C.C. introduce Moulded-in Mica Condensers—the now famous "M" Type.
T.C.C. introduce Non-inductive condensers.
- 1931 T.C.C. introduce Wet Electrolytic Condensers.
- 1932 T.C.C. manufacture Dry Electrolytic High Voltage Condensers—(350v. peak).
T.C.C. first to publish Surge Voltage ratings of paper condensers.
- 1933 T.C.C. research still building up data, still adding to its specialised knowledge so that Radio Technicians may have available not only a "pedigree" range of condensers, but a range ahead of time.

T.C.C.

ALL-BRITISH

CONDENSERS

The Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton, W.3





Instantly you get astonishing new clarity of reception by connecting up the AIR-CLIPSE in place of your present aerial. Selectivity is amazingly improved. The Airclipse is not another gadget—not a condenser. It is an auto-inductive aerial that filters incoming signals. It eliminates lightning danger; disposes of untidy wires; fits inside or outside the set.

A delighted user writes:—"Sensitivity was far above what I expected from it. My friends are also much impressed."

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 FOR A.C. MAINS AND BATTERY SETS

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Here is an EXPERT—that's plain to see! We're SURE of a welcome—Fluxite and me!"

See that Fluxite and Solder are always by you—in the house—garage—workshop—anywhere where simple, speedy soldering is needed.

ALL MECHANICS WILL HAVE FLUXITE
 IT SIMPLIFIES ALL SOLDERING

All Ironmongers sell Fluxite in tins; 4d., 8d., 1s. 4d., and 2s. 8d. Ask to see the FLUXITE POCKET SOLDERING SET—complete with full instructions—7s. 6d. Ask also for our leaflet on HARDENING STEEL with Fluxite.

FLUXITE LTD. (Dept. 324), Rotherhithe, S.E. 16

FOR ALL REPAIRS!



TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Motor-Car Radió.

ONE of the coming developments of radio is undoubtedly its application to motor-cars, and, as you no doubt know, a number of motor-car manufacturers are at this moment making arrangements for the fitting of radio sets as standard equipment in their cars next season. At the Radio Show a number of sets and also various components and fittings were on view designed for this object.

The use of a radio set in a car presents a number of peculiar difficulties which would not, perhaps, occur to you at first. For one thing, the question of the controls of the set obviously has to be carefully thought out, because it is desirable that the driver, even if in the car alone, can operate the set without his attention being distracted from the controls of the car itself. This means having the set tucked out of the way but the controls readily available either on the dashboard or close to the steering wheel.

Noise Suppressors.

On the purely technical side there is the important question of interference from the electrical system of the car. A D.C. generator with sparking commutator, an high-tension system and a set of four or six sparking plugs in full blast present, as you can well imagine, a nice little battery of interference generators, and the high-frequency radio waves sent out from the various leads want a bit of cutting out when they reach the radio set.

Already, however, manufacturers are busy on the job, and amongst other things the Dubilier Condenser Company have produced a set of specially designed motor-radio "suppressors." These consist of resistances placed in series with each sparking plug and with the distributor to the sparking plugs.

The "suppressor" acts by choking out the radio oscillations generated by the spark. In the case of a four-cylinder car there will be five of these suppressors, one to each plug and one to the distributor, whilst in the case of a six-cylinder car there will be seven suppressors.

Local Interference.

In addition to this, special condensers are made for getting rid of the interference from the D.C. generator and also that from the ignition-coil interrupter.

Quite apart from discovering how to cut out these interferences in what you may call ordinary "indoor" conditions, you have in actual practice mechanical vibration when the engine is running, also high temperature, moisture and weather conditions, and the suppressing devices have to be manufactured with one eye on the electrical conditions and the other on all those other conditions to which they will be subjected when on the road.

Battery Load.

Before leaving the question of radio in motor-cars I should mention another little

point, which is really very obvious when you think of it, but which is sometimes overlooked; the point is the additional load which is thrown upon the car battery in supplying the current for the valve filaments.

Already most car batteries are overloaded, especially in the winter-time, and you will see that several hours a day of extra current for the set is going to make matters worse rather than better. The voltage of the average car battery jumps about quite a lot, and this in itself presents another problem for the valve designer, because the efficiency and performance of the valve must remain reasonably constant even with quite appreciable variations in the low-tension voltage.

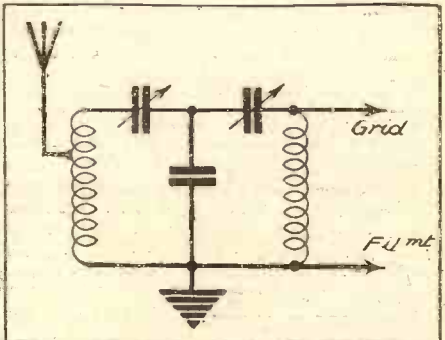
The electric generator on the car can, as a rule, be adjusted fairly simply to give a somewhat increased output, and this ought to be attended to if an extra load is going to be thrown upon the battery.

You will see from what I have said already that it is not all beer and skittles just putting a radio set into a car, and there are plenty of other points that are being cleared up which I have not mentioned above.

Capacity-Coupled Band-Passing.

When you are troubled with lack of selectivity you can use a wave-trap, but, as a rule, this means loss of signal strength. If, however, a two-circuit tuner is used it can be arranged so that there is really little

A "COMMON" CONDENSER



The fixed condenser is common to both tuned circuits, and so provides the coupling necessary to produce band-pass tuning.

or no loss of signal strength, whilst sharp separation of stations may be obtained.

There are several band-pass tuning circuits, which differ from one another mainly in the arrangement for coupling the two tuned circuits. In the arrangement shown in the accompanying figure the first tuned circuit is the ordinary aerial circuit, whilst a similar one is connected to the grid circuit of the valve. Since these two tuning condensers are to be operated together, they can be ganged. It will be noted that the mid-point of the two circuits is connected through a fixed condenser to earth, this

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

fixed condenser having a capacity of about .01 microfarad. There is a little disadvantage in this latter part of the arrangement, in that it puts the ganging out of gear at the ends of the range. However, this is not, as a rule, a serious drawback and only involves some small amount of loss owing to the unequal tuning. At the middle of the dial the effect will not be so noticeable.

Choke-Capacity Filter.

In order to use a choke-capacity filter in a modern type of receiver the choke is introduced into the anode circuit of the power valve, whilst the loudspeaker is connected one terminal to earth and the other terminal to the anode of the valve via a fixed condenser.

If the choke-capacity filter is not actually incorporated in the set itself and is to be used as a separate unit, it will be necessary to provide several terminals in order to facilitate connecting it in. For one thing, a pair of terminals will be necessary for the loudspeaker and two terminals connected to the ends of the actual choke, these two terminals being connected respectively to H.T. plus and to the anode of the valve, whilst it is useful to have a further terminal for connecting to earth. The terminals connected directly to the ends of the choke coil should be connected to the loudspeaker terminals of the receiver, this having the effect of putting the choke in series with the high-tension supply to the anode of the power valve, as already mentioned.

Connecting the Unit.

There is, however, an important point to be noted here, in that the ends of the choke coil must be connected the right way round to the loudspeaker terminals of the set. The loudspeaker terminal which is directly connected to the anode of the power valve is the one which must go to the end of the choke in the unit which is connected to the fixed condenser and (via the loudspeaker) to earth. If the connections to the set are reversed by mistake you will have the anode of the power valve getting its H.T. supply through the choke as before, but the H.T. will be connected at the same time via the condenser and loudspeaker to earth.

Accordingly you should make sure which way round the output terminals of the set are connected with regard to the anode of the power valve and the H.T. supply, and also it is a good plan to mark the terminals of the choke-capacity unit in such a way that there can be no mistake in the connection to the set.

Fading Due to a Bad Earth.

Without going into the merits of the different types of earth, I still think that the best and most convenient earth is a sound connection to a cold-water pipe where this runs well into the ground.

There are, however, some cases where a cold-water pipe does not really form a good earth, and in such a case it is well worth while to try one of the chemical earths as an alternative and see whether any improvement is obtained.

The earth, like the aerial, comes in for a good deal of neglect, and I know of innumerable cases within my own experience

(Continued on next page.)

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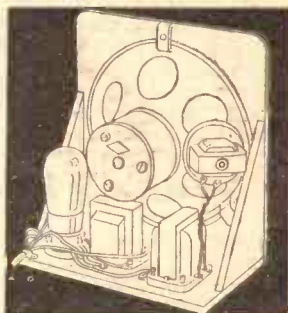
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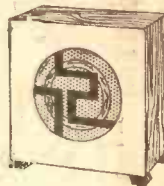
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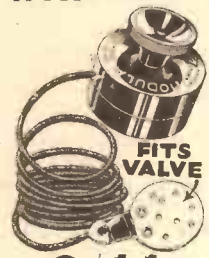
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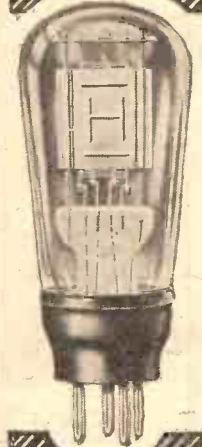
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TECHNICAL NOTES

(Continued from previous page.)

where sets have been improved out of all recognition by a little attention to the aerial or earth—or both. Incidentally, fading on foreign stations, as well as crackling and various other types of interference, are liable to be much increased if you are using an inefficient earth.

Converting to Class B.

Some of you who are desirous of converting an ordinary receiver for Class B output may not perhaps know that you can get the whole of the necessary components all complete and mounted on a chassis for the conversion. Such a unit can be mounted in the receiver if there is room, or, if not, it can be put in the cabinet of the loudspeaker or even, at a pinch, secured at some convenient point of the baffleboard of the loudspeaker.

It is, however, preferable to keep it in, or upon, the cabinet of the receiver itself rather than to mount it in the loudspeaker cabinet.

Crackle Eliminators.

Concerning interference due to static and all kinds of noises from electric signs, motors, lifts, etc., several devices have from time to time been put on the market for cutting out these noises.

I think you will agree that there are few things more irritating than the various sorts of interference mentioned above, and some sets are peculiarly liable to pick them up. If, therefore, a real eliminator of local interference could be obtained, at a reasonable price, it would undoubtedly be a great boon.

Anti-Interference Units.

Some of the devices at present available are fairly good, whilst one or two that I have tried have been of no use at all. I have never tried anything yet which completely eliminates the interference, but perhaps I should hasten to add that it is by no means a simple problem—in fact, it is a very difficult one—to cut out all these interferences.

Some people maintain that they cannot be cut out altogether at the receiver itself and must be dealt with at the source—that is, for example, by fitting something to the lift-motor or to the electric-sign machine and so on. This latter involves co-operation with another party, and from the point of view of the radio listener is not nearly so convenient as a device for simply fitting to his own set.

The Dubilier people, by the way, have designed and manufactured various kinds of "anti-interference units" and filters suitable for use in connection with electric motors, refrigerators, violet ray and electro-medical apparatus, etc., and if you are troubled seriously with local interference of this kind it is worth while getting into touch with them.

Mains and Battery Sets.

We see and hear so much of all-electric sets that we are rather apt to get the impression that these sets are in the majority. On the contrary, I know from friends in the trade that battery sets still very much outnumber electric sets, and this no doubt accounts for the great prosperity of the various battery makers in the industry!

Of course, as time goes on the all-electric set is undoubtedly the ideal to be aimed at, but there are lots and lots of people who have no electric-light supply available or who, for some other reason, are unable to use an all-mains set.

A Common Practice.

For the same sort of reasons there are large numbers of people who use electrical reproduction for their records, but who play them through the amplifier of the radio set. With all the various radiograms upon the market you might think that everybody who wanted electrical gramophone reproduction would go in for a radiogram; but in point of fact there are large numbers of people who, as I say, use the pick-up and the amplifier of the set.

The Solution.

The radiogram operated from batteries has not up to the present been quite so popular as might have been expected, but with the coming of quiescent push-pull and Class B amplification there seems no reason why the battery radiogram should not take the place of the ordinary pick-up

STARTING NEXT WEEK

A Special Supplement for Beginners

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RADIO STEP-BY-STEP

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In the same number

HOW TO BUILD

THE NON-BOOM BAFFLE

Simple but Effective

reproduction via the radio-set amplifier. There is no doubt that to have the whole thing in the combined form of a radiogram, quite apart from the question of the convenience, is a great advantage technically, because all the leads are correspondingly shorter and everything can be arranged so as to get over the various interference and distortion effects which are so liable to creep in when using an outside pick-up.

Screens.

When you are passing leads through the holes in a screen, remember that the sharp edge of the hole is very liable to cut through the insulation of the lead and a short circuit may easily result. I have actually seen this sort of thing happen many a time. It is no good assuming that the lead will remain stationary, because all the parts of the set are liable to shift even a little owing to vibration; and if this goes on long enough, and the edge of the hole happens to be particularly sharp, the insulation will be cut through.

It is better to slip a short length, say an inch or two, of systoflex over the conductor at the part where it passes through the screen, as this is pretty tough and, in any case, gives an additional thickness of insulation. The really "professional" way to do the thing is to insert a nice ebonite bush into the hole in the screen, but this is rather more trouble and is not absolutely necessary if you use the extra thickness of insulation as mentioned above.

PUSH-PULL CIRCUITS OF THE FUTURE

Writing for the Microphone

Popular Wireless

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TO A.C.

No. 593.
Vol. XXIV.
October 14th,
1933.

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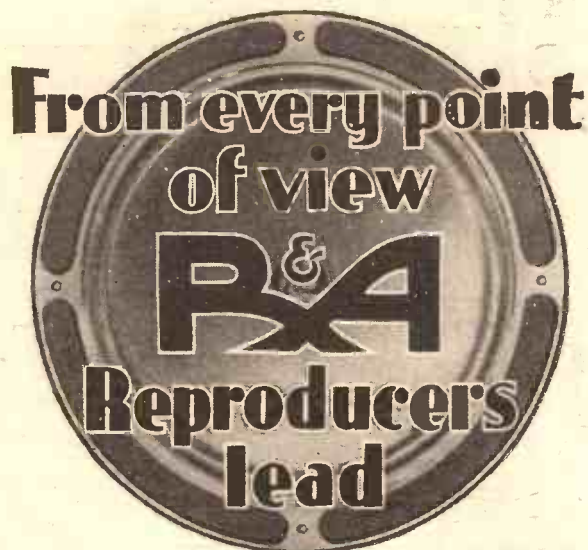
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Mum always has it first (that's to say after Dad has finished Candidus) for she wouldn't miss a word of Modestina's household hints . . . thus allowing Gran plenty of time to study the most lucid wireless page published, before the music starts. That leaves all the rest of the day for all the others—unless of course they have *two Daily Sketches*—which really isn't such a bad idea!

And above all, those magnificently produced exclusive newspictures that almost talk as they show you the world at a glance.



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a habit...
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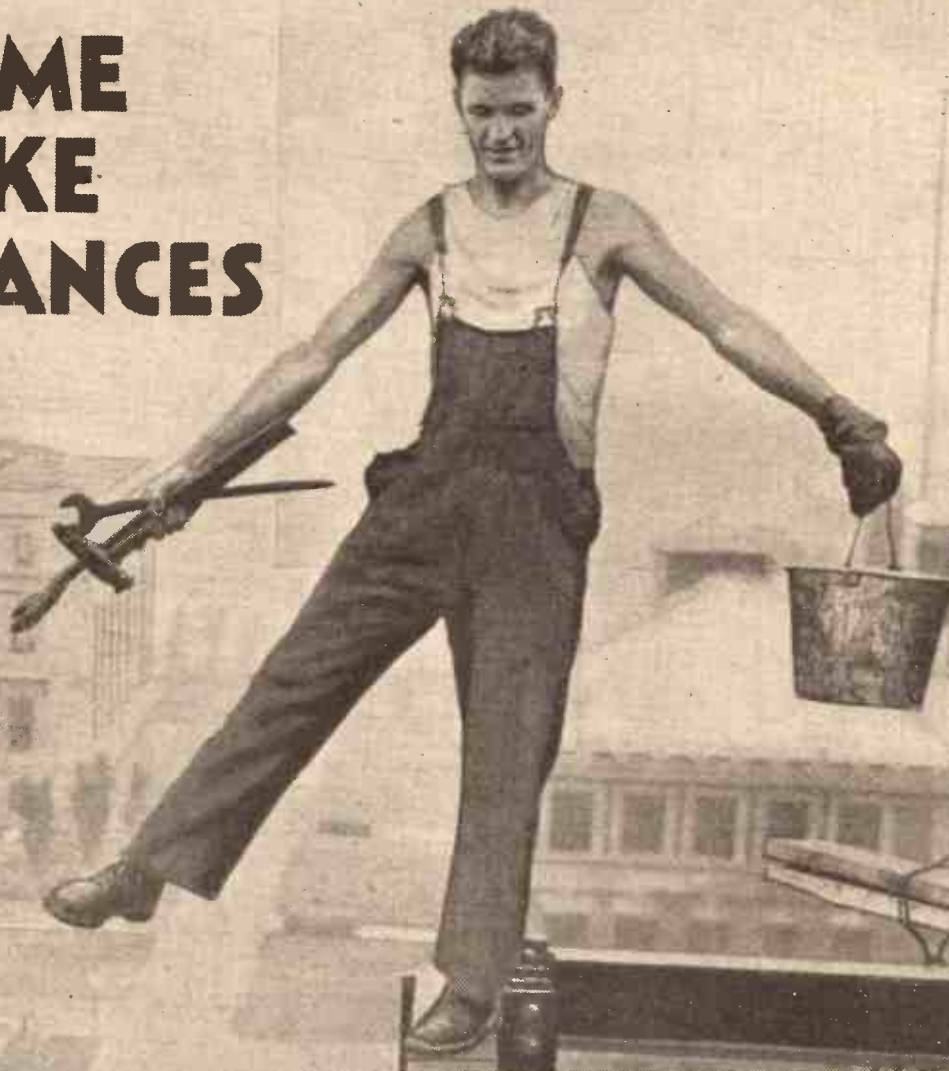
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SOME TAKE CHANCES

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(31)

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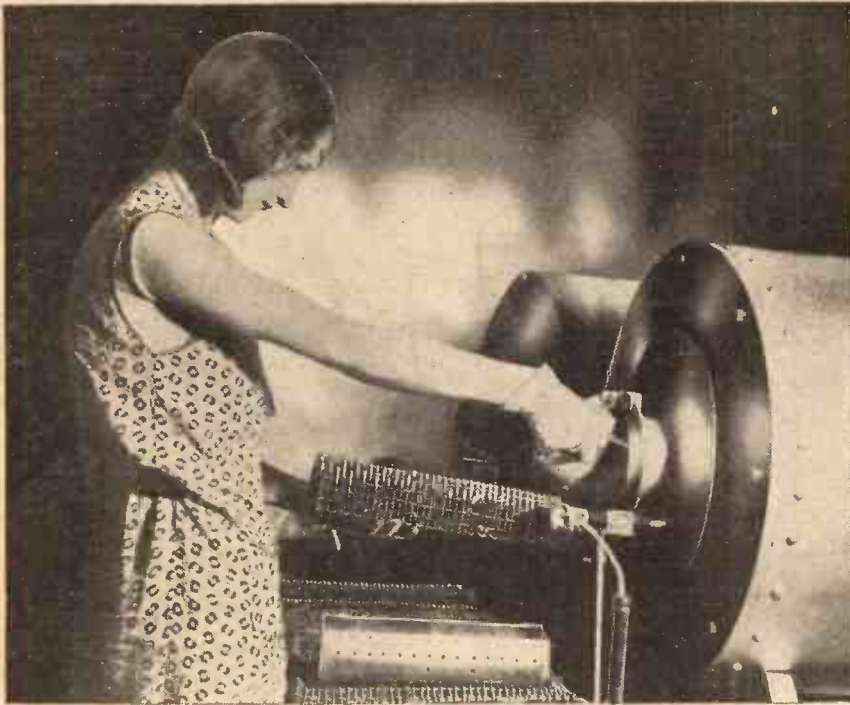
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The Paper that Made Wireless Popular



**A "P.W." SUGGESTION
 MODERN SET TESTING
 WARNING THE CROOKS
 WHAT WE WANT**

RADIO NOTES & NEWS

**WAVES NEVER DIE
 A NEW RADIO TERM
 GOOD WORK
 HIGH-SPEED MORSE**

Why Overlooked?

WHY has the B.B.C., in its search for broadcasters of merit, overlooked D. B. Wyndham Lewis, that cultured wit, satirist and "skittist" of the "Daily Mail's" Crazy News Reel? Perhaps D. B. W. L. cannot or would not appear before the microphone; but surely he would write for it. To read his paragraphs about S—dn—y L—d P—sf—ld, Mabel Porchester, tricycles, Jack Hobbs, etc., is to drain the heart of sorrow and wipe all tears from the eyes.

"P.W." Crashes Through Again!

MENTION of a News Reel reminds me that on October 14th the B.B.C.'s new feature, the "News Reel," is to begin. The news is to be embellished with eye-witness accounts or enlarged upon by "special correspondents."

A distinct score for "P.W.," for I suggested this in "Notes and News" a long time ago, only I wanted the news to be illustrated by records made "on the spot," as future television news will be recorded.

When a film star lands here she should be "Blattnered" on the quay and dished up in the late news programme, unless she is willing to come in person to the "mike" and tell us how cute our policemen are!

A Language Difficulty.

I UNDERSTAND that the puzzle in South African broadcasting is to steer a middle course between those who cry for more Afrikaans and those who want more English.

It seems to me that, as South Africa is constitutionally a bilingual country, the broadcasting people ought to pay scrupulous regard to the spirit which is at the back of the constitution in regard to the language question. I wonder how Montreal gets on, a French town to all intents and purposes.

"Heap Big Medicine."

I HAVE just been looking at a photograph of a brawny African native, bristling with spears, round whose neck is suspended a valve of a well-known make.

Doubtless this is only one "shot" of a film which has been made in order to demonstrate that if you buy this type of valve you have an article which will work

normally after being butted by buffalo, rammed by rhinoceri, sat on by elephants, hated by hippo, chewed by cheetahs, loathed by lions and loved (on the chest of) "Lo! the poor African." Oh—and kicked by kangaroos.

Rough-Housing the Set.

I WONDER why the manufacturers of valves and sets lay so much stress upon the ability of their goods to stand rough treatment. Dash it all, we are not *all* railway porters! (I wish I were in as safe a job and backed by as powerful a Union!)

IMPORTANT ANNOUNCEMENT

To Every Reader of "Popular Wireless."

This week we give details of a radio development which is of the greatest importance to all our readers. Please turn to page 198.

The Editor

In pursuance of the idea that we kick the set round the house when the programmes are rotten, the H.M.V. people actually submit their sets to an ordeal which might be called the "third degree."

Dropping on the floor and chucking down the steps are but the gentle preludes to the acid tests which their unhappy receivers pass through. I begin to feel that I treat my set too kindly. Let me drink a quart of hot blood and gunpowder and try for New Zealand!

"Bring Out Your Dead."

THAT was the cry in the streets during the Great Plague of London, and it is being repeated, in effect, by programme sponsors in America, where undertakers, or "morticians," compete for corpses "on the air"—there being no limits to the shamelessness of some Americans hot on the trail of a dollar.

I read that one particular mortician sponsors a news service, and after the announcement of the ghastlier sort of items trots out his modest invitation to patronise his coffins and other dolorous paraphernalia.

Give me England, the B.B.C. and a sense of the fitness of things.

A Few High Spots.

MR. ARTHUR HENDERSON'S speech from Geneva on October 16th will be an historic occasion. Hear it if you can. After the "Proms" at Queen's Hall there comes the B.B.C.'s winter season, beginning on October 18th, when Adrian Boult will conduct an orchestra of 117 players.

On October 31st the new harbour at Haifa will be opened; you may hear a description of the scene and messages exchanged between the Colonial Secretary and the High Commissioner for Palestine.

Concerning Record-Changers.

I HEAR of a new record-changing device which enables one to play a bank of ten records on one side and then on the reverse side. This is an advance, I think, on anything available up to the present; but we still need a record-changer which will allow us to play, firstly, the two sides of a record; next, the two sides of a second record, and so on.

In a word, I want to be able to sit down and hear a complete symphony, on five, seven or even ten records, without changing a record. I hope that some unemployed mechanical genius will solve this problem and make his fortune.

Bolero for the Balearics.

THE news is that the Balearic Islands, those delectable isles off the east coast of Spain, are to have a broadcasting station all to themselves—to wit, EA J 13, situated in Palma, the capital of Majorca. Times change, indeed! When I was in Majorca in 1911 wireless was looked upon by the inhabitants as a sort of black magic, hardly to be tolerated.

I have seen the country folk cross themselves as they passed the wireless station, and the only woman I could induce to live
 (Continued on next page.)

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

there as our cook imagined herself to be lost for ever—and even *she* would not accept the job unless I employed her *pa* also. She used to say to me: "Dios, what will the priest say when I confess?" And now—E A J 13 and the bolero!

The Quest Magnificent.

A CHANCE remark of mine to the effect that an ether wave never really dies has set one of my friends off on a quest which, I fear, will end only with his life. In my omnipotent manner I



was only expressing the immortality of a sine wave with a logarithmic decrement, which, mathematically and on paper, never can exist without amplification.

But my literal friend has interpreted this to mean that, if he can only amplify them enough, the 1922 programmes of the B.C.C. can be received now. As a matter of reasoning or philosophy, an effect produced in the ether, which is infinite in extension, must be infinite too, but—well, he ought to concentrate on dahlias or sweet peas!

"Came the Dawn."

THE radio correspondent of a daily paper describes the perplexity with which, he says, the B.C.C. is confronted in its attempt to weave a love story into the film which is being made in Broadcasting House to illustrate the story of British broadcasting.

They ask, he says, "Is there anywhere in Broadcasting House where two people might fall in love?" The answer is, obviously, "Yes—almost anywhere;" but why there should have been even a mild flirtation with the notion of investing an educational film with love interest beats me.

Not a Bad Idea.

THE French have had a "say good-bye" to a favourite woman announcer who has retired to a convent and will devote her life to comforting the poor.



There can be no doubt that the lady has chosen a more useful sphere of labour.

This incident, however, suggests that there are plenty of vacancies in the world of ministration and that they might

attract some of the B.C.C. people who, apparently, consider that their mission is to uplift and redeem the unlettered masses. We should give them a hearty send-off.

A Book Note.

MR. RONALD F. TILTMAN, author of "Baird of Television," tells us that he sent a copy of this book to the Prime Minister, who in acknowledging it wrote: "I am very glad that you have done this service to a man remarkable not only for his scientific attainments but for his great modesty of personality. He deserves the best service we can give him."

These Here Foreign Valves!

THE Standing Committee of the Board of Trade recommends that an Order in Council be made requiring the marking of imported valves with the name of the country of origin.

In particular it is recommended that the Order should apply to (1) thermionic valves having an anode dissipation not exceeding 50 watts and (2) rectifying valves not exceeding a capacity of 60 volt amperes (60 V.A.), or passing a current of more than 1 ampere. Buy British! What luck that we do not import announcers! Terrible job to mark them!

Sec.: Mr. F. J. Bubear, 67, Nassau Road, Barnes, S.W.13. Headquarters: 72a, North End Road, West Kensington, W.14. Dr. C. G. Lemon, F.Ph.Soc. (Lond.), A.M.I.R.E., has kindly granted laboratory facilities, including 42 metre and a 5-metre transmitters, to the society. Long life and success to the newborn!

Amateur to the Rescue.

WE certainly must "hand it to" these American radio amateurs! Now, Ed. Stevens, radio ham, was "talking" to the operator at Aiaktalik, Kadiak Island, near the Aleutians, and heard of a sick five-year-old boy.

Ed. got the symptoms and passed them to a Seattle doctor, who diagnosed peritonitis, advising that the boy be rushed by air to Anchorage, Alaska. Aiaktalik was unable to "get" Anchorage by radio, so Ed. kindly stepped in again and got a message to the army radio, Seattle, which passed it on to Anchorage, whence an aeroplane was despatched to pick up the kid with the pain in his "tummy." It makes radio "worth while."



New Morse Champion.

IF you fancy yourself as a Morse sender, what about this? At the world-wide radio amateurs' convention, held in Chicago on August 5th, Mr. J. W. Chaplin, of Long Island, was proclaimed champion because he transmitted by Morse at a speed of 57.3 words a minute, in code, thereby licking 199 other competitors, including professional telegraphists.

The ex-champion, Mr. R. McElfay, of Boston, won his laurels with 56.6 words per minute, so he was beaten by 0.7 words per minute—a narrow margin indeed.

SHORT WAVES

A German professor tells us that worms can sing. Every effort should be made to keep this bit of news a secret from the B.C.C.

"Punch."

"Willy says he can't do his homework while you're making such weird sounds on the wireless, dad."

"Can't do his homework, can't he? Well, you just ask him which is more important—his homework or mine?"

Judge: "Do you understand fully the nature of an oath?"

Prisoner: "Do I? Wasn't I sent round recently to help you put your wireless set right, your worship?"

"Weather forecasts for the day can be obtained by placing a coin in a slot-machine in Frankfurt," we read.

It is not true, however, that people inserting counterfeit coins will invariably receive a forecast for rain and fog.

"Punch."

Angry Captain of Liner: "But why did you strike the radio operator?"

Passenger: "I gave him a radio message to send, and he read it!"

When Doctor Brown's X-ray machine
Made static in our block,
The neighbours lost their patience and
The patients lost their Doc.

"Some of the so-called humour broadcast these days makes me sigh," writes a correspondent.

Too E-B-C-rious, we suppose!

Standards of Components.

PROBABLY many home constructors will welcome the news that definite standards for radio components have been laid down by the Radio Component Manufacturers' Association.

The recommendations include screws for radio work, bushes, nuts, spindles, condensers, transformers and chokes. The proposal to write "p.F." instead of "mmfd." does not stagger me by its brilliance, even though p.F. stands for a new name, "Picafarad." However, the work done on standardisation is of distinct value to the great human race.

The Phoenix.

I AM very pleased to hear that the late Radio and Television Society has been rejuvenated. It began its new life on September 22nd under the name "Radio, Physical and Television Society." Hon.

Radio and Rum.

AFTER searching for two years, the U.S. Department of Justice called in the aid of a wireless direction-finder and then located and seized a motor-car, with its occupants, which was equipped with radio, and was said to have been in communication with rum-runners at sea.

The Department alleges that this particular transmitter was responsible for landing 28,000 cases of liquor during the past few months. A properly organised gang would, no doubt, have located the direction-finder!





THE NON-BOOM Baffle

L OUDSPEAKERS of both the moving-coil and of the moving-iron type have improved to such an extent that to-day, for even a modest sum, quite an efficient unit of either type is within the reach of every listener.

When, however, the question of a suitable cabinet in which to mount the loudspeaker arises, it is found that there are very few suitable or in keeping with the efficiency of the loudspeaker units.

Three Classes.

Present-day loudspeaker cabinets may be roughly divided into three classes:

- (A) Thin three-ply;
- (B) Thicker ply or solid wood, 1 in. or so thick;
- (C) Special cabinets lined with sound-absorbing material.

★.....★

Here is an ingenious baffle which will enable you to obtain better loudspeaker reproduction. There are two styles, both built on very compact lines, and remarkable for their natural low-note response, with entire freedom from all resonance effects so prevalent with many loudspeaker baffles. Inexpensive and unusually simple in construction, the "Non-Boom" baffle cannot fail to exercise a strong appeal to every quality enthusiast.

Designed and Described
by J. R. WHEATLEY.

★.....★

the framework was "killed" by the inner lining, then an almost resonance and boom-free cabinet would result. This is actually what the "Non-Boom" baffle sets out to do, and does actually accomplish.

There are several substances which would possibly make excellent lining mediums, but unfortunately they are not capable of preventing resonance; in other words, they themselves would either vibrate at some frequency within the normal musical range or they would merely act as sound carriers. Water, for example, although apparently a dead substance, is an excellent carrier of sound.

Suitable Substances.

A liquid is mentioned at this point, since it should be realised that for a really satisfactory liner the substance must be capable of being poured or placed into sections of the cabinet which cannot be reached by the hands.

A powder is the most satisfactory material, and it only remains to find a suitable powder having the requisite properties, and, strange to say, one of the easiest obtainable powders, namely sand, is one of the most efficient substances for the lining.

A Useful Alternative.

In the initial tests several substances in powder form were tried and found equally suitable, but their price was several times that of sand. If, however, you are unable to readily obtain sand—and practically any type of sand is suitable providing that it is dry and free from stones—sandy soil, finely powdered and sifted so as to remove stones, etc., and then dried in an oven is quite satisfactory.

Do not, however, attempt to use soil which is light in nature, such as that containing a large percentage of leaf mould, for such soil is unsuitable.

One cabinet and one baffle are described in this article, each being equally efficient, although, due to the larger baffle surface, the box type is recommended. The latter is, however, more difficult to construct than the flat baffle.

The flat baffle consists of a piece of thin three-ply wood with a hole in the centre to suit the loudspeaker on hand. Four 1-in. wooden battens are attached to the sides, and to the centre is either screwed or nailed a circular wooden ring 1-in. thick and 1½-in. wide. The outside and inside diameters will, of course, depend on the size of the hole previously cut in the front panel.

Cutting The Ring.

A wooden ring of such a thickness may offer difficulties to the home constructor, but providing that a soft wood is chosen little difficulty should be experienced in cutting the hole with a keyhole saw.

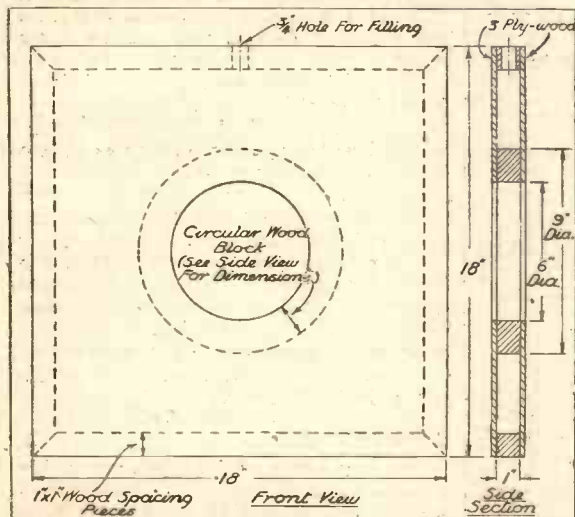
The outside rim of the ring need not be cut with such care, for this need only be of sufficient size and within the necessary limits to cover the lugs of the loudspeaker unit. A square block, with the corners removed and roughly shaped with a rasp, is quite satisfactory.

Secondly, the ring may be built up of two or more thinner rings, so as to bring the resultant up to the specified dimensions.

Again, most timber merchants will cut the ring for quite a small charge; do not forget to raise this point when buying the remainder of wood required.

(Continued on next page.)

ALL THE MAIN MEASUREMENTS



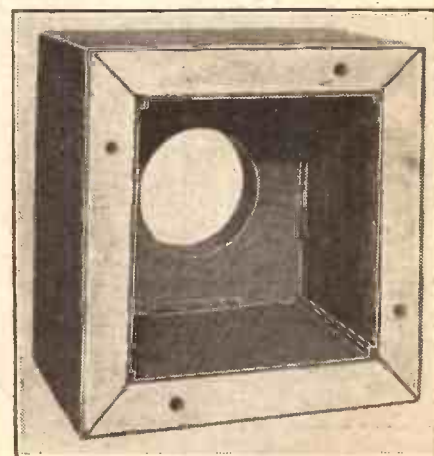
A plain "non-boom" baffle is illustrated by this diagram. The frontal dimensions are seen to the left, and a section is illustrated to the right. The dimensions of the hole for the speaker will naturally depend upon the particular unit employed.

In practice it is found that both A and B suffer in a similar manner under actual operating conditions—both result in resonance over a fairly wide range of the musical scale, the thin three-ply at the upper end and the thicker wooden cabinet towards the lower end of the bass.

In the case of C, all present versions suffer to a certain extent from the faults found in B, for, due to the nature of the lining, the materials must be tightly packed by force. This necessitates a solid foundation for the actual framework. The effect of the lining is, therefore, to a certain extent nullified, and the shape of the cabinet is also limited.

If it were possible to build a cabinet with a very thin shell, so that the mass of

READY FOR THE SPEAKER



The remarkable solidity of the speaker cabinet is well emphasised by this view taken from the back. The two sides, top, bottom and front are all filled with sand, thus completely eliminating all resonance.

THE NON-BOOM BAFFLE

(Continued from previous page.)

A hole is drilled in one of the battens, through which the sand may be poured. The three-ply back, with a similar size hole to that in the front, is fixed into position, nailing or screwing where necessary (do not forget to glue, as well as otherwise fix, all surfaces, so that there is no possible fear of sand getting into the loudspeaker).

Where it is stated above that the wooden ring is $1\frac{1}{2}$ -in. wide, it must be understood that this measurement will also depend on the lugs for fixing the loudspeaker coming within this limit, otherwise a slightly wider ring will have to be cut.

A Point to Remember.

If, in the case of the box baffle (to be described later), the extremity of the ring is close to the limits of the inner container—i.e. the ring has to be made more than 10 in. in diameter—it is strongly advised that the inner container be increased so as to bring the distance between the outside of the ring and the inside of the inner jacket to a minimum distance apart of $\frac{1}{2}$ in. The outside container will also have to be correspondingly increased in size so as to make the distance between the two walls adequate.

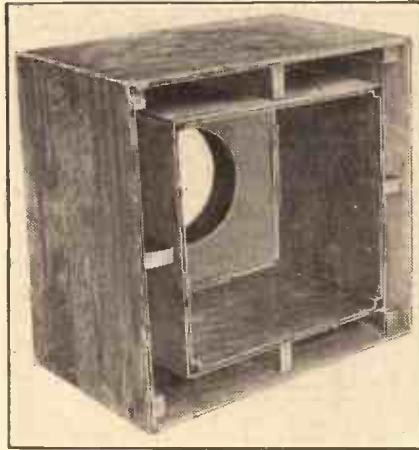
Having made quite certain that the glue is set hard and the centre ring is firmly attached to both the front and back panels, and that both panels are securely attached to the various battens, the sand—just ordinary dry, fine sand (it must be dry)—is poured through the hole already drilled in the top batten. The framework should be slightly rocked so as to ensure packing of the sand; then, by means of a cork, plug the hole and seal with glue.

It now only remains to examine the baffle for sand leaks and to fix the loudspeaker into position. The baffle could, of course, be made with veneer ply, in which case no additional veneer facing will be necessary.

The Cabinet Arrangement.

The box baffle is slightly more complicated, and consists essentially of two thin three-ply boxes, one inside the other, with a

WHERE THE SAND GOES



The sand is accommodated in the cavity between the outer and inner walls of the cabinet. It effectively damps any resonances which the woodwork might otherwise have.

complete jacketing of sand between them. With the exception of the front wooden ring—which is of similar size to that of the flat baffle—a complete sand jacket is formed.

The inner box should first be constructed, and, since only thin three-ply is needed, corner supports are really necessary, so as to ensure a fairly rigid framework. It will be seen from the

photographs and drawings that this inner container has a front panel with a similar size hole to that of the $1\frac{1}{2}$ -in. thick ring; the latter is glued and nailed to the front of the front panel of the inner box.

To prevent bulging of the outer walls during filling, thin battens are nailed to the outer four sides of the inner box, and this results in the jacket being split into four sections.

The battens referred to are of sufficient length so as to enable four pieces seen in the photographs to be dropped into position and seal the space between the inner and outer sections of the framework. The battens are, therefore, $\frac{5}{8}$ in.—assuming $\frac{5}{8}$ -in. thick wood for the “sealing pieces”—shorter than the sides of the inner container.

The outer container, also of three-ply—veneer-faced, if you wish—is now built round the inner jacket and the corners strengthened with either square- or triangular-sectioned wood.

Supports for the Corners.

Suitable material for the corner supports is 1 in. \times 1 in. square-section wood, although triangular section would probably be quite as satisfactory.

It must not be forgotten, however, that these corner supports carry the four “sealing” battens and must therefore be of sufficient size for nailing or screwing the battens into position. Make quite certain when fitting the corner supports that the two sides of the wood which are to fit into the corners are quite smooth and form a true right angle, otherwise the resultant cabinet will not be truly square.

Gluing, as well as otherwise fixing, all joints is essential if the sand is to be kept from getting into the inner compartment.

The four top pieces are now placed into position, the edges nailed and glued, and then, by means of four holes drilled through these top pieces, the sand is poured into the four sections of the jacket. A slight rocking of the cabinet is advisable so as to ensure that the sand is evenly packed, and the four holes can then either be plugged with corks or blocks of wood. Make sure, however, that these are securely in position and the cabinet is free from sand leaks before fixing the loudspeaker.

Appearances Count.

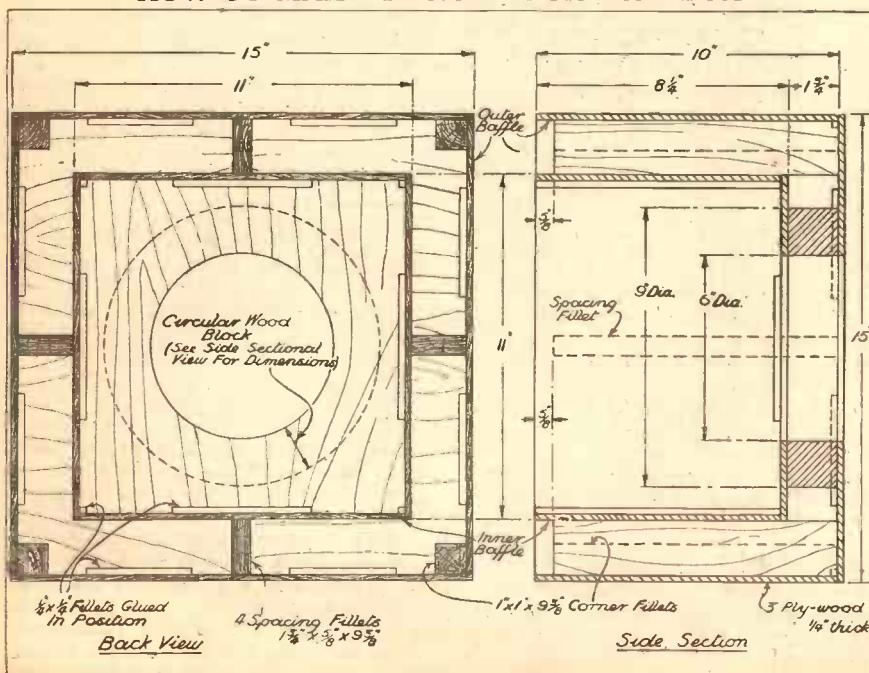
The box baffle, as described, may either be stained or, if you wish, the outer container could have been constructed from veneer-faced plywood.

As an alternative finish it is suggested that moulding be fitted round the bottom of the box baffle, and after a suitable undercoat and, where necessary, plastic wood employed, the whole should be given one or more coats of enamel. The colour should, of course, be chosen to harmonise with the local surroundings.

There is also the possibility of covering the completed baffle with imitation leather and, if carefully carried out, even a very roughly-made cabinet will look quite professional.

Before, however, any refinements are made to the cabinet it is suggested that any tests to be made with the loudspeaker should be carried out, and then the filling emptied through the four filling holes. The loudspeaker is then easily handled, for when empty the baffle weighs only a few pounds.

HOW-TO-MAKE DETAILS FOR THE BOX



From this diagram you can obtain the measurements for making the box-type baffle. When different sizes of loudspeakers are used, the ring of wood at the cone opening will have to be adjusted to suit the different cone diameters. This point is covered very fully in the text.



MAINS VALVE DEVELOPMENTS

The problem of designing a receiver suitable either for D.C. or A.C. mains has its solution in the use of valves with heaters which operate at the full mains voltage. Details of the high-voltage valves at present available in this country are given below.

By K. D. ROGERS.

THE change-over from D.C. to A.C. power supply is gradually being carried out throughout the country, and in consequence numbers of D.C. receivers are being scrapped or altered to bring them in line with the new conditions.

Potential set purchasers or home constructors who are on D.C. are now apt to sit on the fence waiting for the change of mains before they decide on a receiver. "It's no good getting a D.C. set if we're going on A.C." they argue.

Gradually the position of the "border-line" mains user is being cleared up, however, for there are many D.C. types of valves now on the market capable of being used [quite well on A.C.]. Thus sets can be constructed, as was shown recently in our "Universal" Three, for use on either D.C. or A.C. mains, thus obviating the need for any big alteration when the change from D.C. to A.C. takes place.

Parallel Connection.

The Mullard 18-amp. valves, the Marconi and Osram 25's and the Mazda 1-amp. types are illustrative of valves that can be used for universal mains sets. All these valves are, of course, low-voltage heater types and require a series resistance or barretter to break down the supply voltage to the heaters, which are connected in series.

We are still waiting for the British full-voltage indirectly-heated valves, which will enable parallel-heater connection to be carried out, and will not necessitate any mains breakdown resistance or barretter. On the Continent these valves are being made, and they are available in this country in the Oster Ganz high-voltage types.

They have been known here for some time, and many months ago we published a circuit of a simple two-stage universal (D.C. or A.C.) receiver that could be made very easily with these valves.

Two Advantages.

The two big attractions which the Oster Ganz valves hold are, of course, the fact that no mains resistance with its energy losses is required, and also that no circuit change is required for A.C. over the D.C. "hook-up." True, the rectifier valve used for the H.T. supply from A.C. is not required for D.C., but it can be shorted out quite easily or even left in position without the slightest detriment to the operation of the receiver. No power transformer is required for A.C. mains, a fact that at once means a saving of cost and conserving of power.

Since the introduction of the high-voltage valve some time ago many more types have been produced, with excellent characteristics and enabling the admittedly small scope in set design hitherto possessed by the Oster Ganz valve to be greatly increased.

For instance, there are now two S.G. valves of normal type and two multi-mu valves. These are the S.100 and S.25 and the M.S.18 and M.S.70. The former multi-mu valve is designed for normal bias control and the latter for automatically controlled volume, where a wide variance

5,000 milliwatts of undistorted A.C. output. This, with a mains input, and therefore maximum H.T. voltage of only 200-250 volts, is exceedingly gratifying.

The impedance of the K.3560 is only 500 ohms, so that the obtainance of good bass reproduction is not difficult, even though an anode current of some 50-60 milliamps is taken. The amplification factor is 3, giving a mutual conductance of 6 ma./v.

The price of the K.3560 is 25s. 6d. and that of the D.130 57s., the latter being rather high compared with our ordinary indirectly-heated valves.

There is another full-voltage valve in the list, besides the rectifiers for A.C., and that is the P.T.3, a pentode of undoubted excellence, having the reasonable price of 19s. 9d. It has a good output, but is not the "beefy" valve that the K.3560 is.

The Rectifiers.

Regarding the rectifiers, these are obtainable in two "sizes," for 50 and 125 milliamp maximum output respectively. These are the E.G.50 and E.G.100, and cost 14s. 6d. for the former and 15s. 6d. for the latter.

In these rectifiers the reservoir condenser plays a big part in the determination of the output voltage at a given current, the higher the capacity of the condenser the higher the voltage, and vice versa. In most cases a value of some 6 mfd. is most suitable as giving an average voltage-current curve for the rectified output, but up to 16 mfd. can be used when the voltage is to be maintained to a high level, even though some 100 or more milliamps are to be taken.

In addition to the new valves we have mentioned there are, of course, a number of Oster Ganz types that were brought out some time ago and which are designed for normal detector and L.F. operation. These are the A.520, W.310, U.920 and L.1525.

Detector and L.F. Types.

The A.520 has a mutual conductance of 2.5 ma./v., with an impedance of 8,800 ohms, while the W.310 has an impedance of 31,000 ohms and a mutual conductance of 1 milliamp per volt.

The two output valves are both smaller than the new K type we have previously mentioned, being of 3,700-ohms impedance in the case of the U.920 and 1,850 ohms in the L.1525. The mutual conductance is 3 in each case, but the output is nothing like as large as that given by the K. 3560. These valves are ideal for a small set where a large power is not required.

EMPLOYING HIGH-VOLTAGE HEATERS



Here is a group of Oster Ganz high-voltage valves. The valve in the foreground is a screen-grid. These are available in both standard and multi-mu types.

of control is obtainable. These four are priced at 18s. 9d. and are available for any mains voltage up to 250.

A fairly high impedance, high-mu detector is supplied in the D.130, which has a slope of 3.5 ma./v. and an impedance of some 40,000 ohms. Thus we see that the amplification factor is round about 100, making the valve excellent for resistance-coupled receivers.

Where transformer coupling is used—especially where the valve is employed in an amplifying capacity, with negative bias—the transformer should be of good design, with as high a primary inductance as possible.

Large Power Output.

We have ourselves just used this valve in the design of a universal two-stage gramophone amplifier which will shortly be described in POPULAR WIRELESS.

Coupled by a good transformer to the K.3560, a new Oster Ganz valve of undual merit, one is enabled to get round about

THE MIRROR OF THE B.B.C.

By O. H. M.

THAT CHRISTMAS BONUS

A Feature Programme—Reviving Radio Plays—Trouble for Licence Dodgers—An Attractive Series of Programmes.

WITH Christmas not so many weeks off, B.B.C. officials are wondering whether a seasonable spirit of generosity will inspire the Board of Governors to grant the ten per cent Christmas bonus which was given last year to mark the tenth anniversary of broadcasting. At the moment the signs are not too good. The Governors are afraid that the staff may soon begin to expect a bonus as a kind of right.

And why not? Most of the real workers are underpaid.

End of B.B.C. Control Board.

I hear that Major Guy V. Rice, formerly Secretary of the now defunct B.B.C. Control Board, has been invited by a well-known publisher to prepare a book on the inside history of this interesting body, the workings of which he was in an exceptionally favourable position to observe.

I am certain that if this book materialises from his subtle pen it will provide piquant reading.

A "Black Watch" Programme.

National as well as Scottish listeners are to hear a feature programme to be presented in the Edinburgh studio on October 24th to mark the anniversary of that famous Scottish regiment, "The Black Watch."

The programme will take the form of a chronicle play covering incidents in the history of the regiment between 1740 and 1917.

Drama Festival Dates.

The Radio Drama Festival progresses on October 16th (Regional) and 17th (National)

with performances of Cecil Lewis's play, "Pursuit," in which there are no stage directions or word pictures. Instead, it starts with six telephone conversations, all

FOR "THE NEXT TIME"



Henry Hall, the leader of the B.B.C. Dance Orchestra, snapped on the way back to England after his recent visit to America. He is looking over some of the new tunes he brought back with him.

designed to familiarise listeners with the principal characters.

The Festival will continue on October 27th (National) with Lance Sieveking's "Kalei-

doscope," which was first heard by listeners in the early years of broadcasting.

Mr. Thomas Again.

Mr. "Jimmy" Thomas is appearing before the microphone on October 26th, when he gives the third of the series of talks in the National programme, entitled "The Debate Continues."

"London Bells."

John Macdonell, the man who started the "Surprise Items" in the broadcast programmes and has since devoted his persuasive abilities to getting stage and film stars to appear before the microphone, is producing a revue called "London Bells" for the programmes on October 16th and 17th. The show has been specially written by Ashley Sterne for Elsie and Doris Waters.

Attack on Tyneside Pirates.

Are there many wireless pirates on the north-east coast of England—in Newcastle, Gateshead, Sunderland and South Shields? The Post Office must think there is, because it is to those towns that the dreaded detector vans of the Department were despatched at the beginning of October.

So look out for trouble, ye licence dodgers of Tyneside. Or, better still, hie ye off to the nearest post-office and hand over your ten bob.

From The Midland Regional.

It is doubtful whether any other Region could arrange such an attractive series of programmes as that now running in the Midlands of the music of composers who were either born within its area or have close associations in other ways.

In the third week of October two composers will be represented, Sir Edward Elgar on Thursday, October 19th, and Dorothy Howell on the following day. Sir Edward Elgar is very close to being the greatest living English composer (some say he is the greatest), and the concert of his music, which Leslie Howard is to conduct, is sure to be eagerly anticipated.

(Continued on page 217.)



The LINK BETWEEN

BY G.T. KELSEY

Weekly jottings of interest to buyers.

AS most of you will know, although it is usual to refer to the detector valve in a set, rectification is not the only function that it performs. It is, in addition, an L.F. amplifier, and although in this dual rôle it can be made to function quite satisfactorily, the operating conditions most favourable for good detection are not the best suited for distortionless amplification.

Consequently to obtain satisfactory results when using just the one valve to perform these two functions it is necessary to compromise. For instance, if reaction is applied to the detector valve, then more often than not in order to obtain smooth control it is necessary to keep the H.T. down to about 60 volts. But, generally speaking,

60 volts is inadequate for L.F. amplification, so that the only way to get over the trouble is to strike a happy medium. But it is true to say that neither function is performed so efficiently as it would be under ideal conditions.

Obviously, the ideal way out of the difficulty would be to have two separate sets of electrodes in the one glass bulb: one set for detection and the other for amplification.

To cut a long story short, that is exactly what Mullards have done in the very latest of their valve to be released, the type T.D.D.4. But they have gone one better, for in addition to providing separate sets of electrodes for detection and amplification they have also included a third set for applying one or another of the various forms of automatic volume control.

The new Mullard double-diode triode, as it is called, is really three valves in one. It is an indirectly-heated valve for use in A.C. mains receivers and it takes 1.2 amperes at 4 volts.

It is, in short, a striking tribute to the resourcefulness and enterprise of a very famous valve organisation.

H.T. Battery Progress.

In a year of so many outstanding developments it is gratifying to find that the

all-important question of H.T. supply for battery users has not been overlooked.

The G.E.C. are the latest people to make a contribution to H.T. battery progress, and a very important contribution it is, too. The new G.E.C. H.T. batteries, which are available at extremely popular prices carry with them a 144,000-milliwatt-hour, guarantee. They are constructed under a new process known as the "stabilised electrolyte" process, and they are made in all the usual voltage ranges.

An Invitation.

Readers desirous of obtaining further details of these new batteries can do so through the medium of "P.W.'s" postcard literature scheme. On receipt of the usual postcard we shall be pleased to make the necessary arrangements for (No. 57). full details to be forwarded.

(Continued on page 217.)

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.

WRITING FOR THE MICROPHONE

By LOUIS GOODRICH
in an interview with PATRICK CAMPBELL.



I HAVE an idea that Mrs. Beeton—or is it Mrs. Marshall?—might be able to supply the necessary information. After all, there isn't such a wealth of difference between those who cater for the body and those who supply food for the mind. I do not intend to pursue the analogy.

Another Person's Opinion.

Your audience? Who are you going to write for, or to? I saw in the "Daily Telegraph" the other day that Mr. Sydney Carroll, writing on "Broadcast Drama," with the sub-title of "Inadmissible Claims" (for which we should be duly grateful!), states:

"In its present undeveloped state, without any assistance from television, the radio dramatist is compelled to cater for 'snipped minds'—mob minds, the feeble intelligence of crowds, debased as they are by impatience and ignorance."

There! What do you think of that? There's encouragement for you! However, do not be disheartened. It would appear to me that Mr. Carroll has not studied his subject.

The "snipped" minds debased by ignorance are not your audience! As a matter of fact, the snippets are the people who, on the announcement of a radio play, ejaculate "Gosh!" hurl themselves at the instrument and switch over to a jazzy hot number.

So don't be discouraged by Mr. Carroll. There is an audience for you, and they are really quite pleasant people, intelligent and reciprocative.

Some of them may not be able to afford to go to the playhouse; some may be so circumstanced that the theatre is too far distant; some—alas! I fear they may be many—are chained to sick-rooms, and some are in the winter of their lives. So be of good courage and take the drama to them and give them of your very best, for they deserve and appreciate it.

Are Radio Plays Too Long?

The length of your play? I think it is generally agreed that most radio plays are far too long, but not by the B.B.C. They still seem to be insistent that the limit of human endurance is one hour, and that on high days and festivals they may even go beyond that. But not long ago I came to the definite conclusion that no radio play should exceed twenty minutes.

Here is a further article in the series intended to give practical help to entrants for the "Popular Wireless" Radio Play Competition. Louis Goodrich is the author of "Ann and Harold," "Ship-Wrecked," "The Old and the Young," and other radio plays, besides being a regular actor for the B.B.C. The opinions expressed in this interview, although controversial, are based upon a long and successful experience of the microphone and its whims.

129 *Concerning Maize and the General*
Maize: But, Gen.—Richard! I never dreamed—
General: There's nobody else, is there?
Maize: Not one well! I enjoy, soon—
General: Of course, a pretty girl like you has the world at her feet.
Maize: Not really! I've served—
General: Expect I've been a bit abrupt! Sorry! Look here! I don't give me your answer now. Think it over! And just remember that I love you.
Maize: Oh!
General: What's the matter?
Maize: Did you that the garden gate?
General: What's that got to do with it?
Maize: A rabbit!
General: A rabbit?
Maize: A rabbit!
General: What!
Maize: On that path.
General: Where did it go?
Maize: In behind the ribberth.
General: Budget! Budget! (His voice dies away in the distance)
Maize: Oh! I did say myp.



Above is a reproduction of a page from "Ann and Harold," one of the most popular plays ever broadcast and the author's greatest radio success. On the right is Louis Goodrich himself, author, dramatist and actor for the stage, the films and—radio!



it was my intention that each episode should be broadcast separately on six consecutive days. However, this was pooh-poohed by the B.B.C. and my experiment was nipped in the bud. Of course, the B.B.C. may have been right, but, on the other hand, how can we tell?

How to write a radio play? It isn't easy, is it? I mean, we haven't got very far, and we're up against Mr. Carroll and the

B.B.C. already! Still, we are making progress. We have discovered that there is an audience; and I didn't include that vast body of people, not necessarily professional, who of an evening prefer their own homes to any outside inducement. And I am sure we are in agreement about the length of the play.

Study Your Listeners.

The choice of topic and its treatment must be left to yourself. But when you take pen in hand try to make it clear, as soon as you can, where your scene is taking place. Above all, do not make too many characters and see that they are of well-contrasted types. Put yourself in the listener's place and remember that it is her or his imagination that is supplementing your deficiencies.

Also bear in mind that a stage play does not make a good radio play, and that a good radio play could not be performed in the theatre.

Well, there you are! You've written your play—and good luck to you. For the rest, leave it in the safe hands of the producer; and if you are so fortunate as to secure the services of Mr. Howard Rose, who presented "Ann and Harold" for me, then your peace of mind is assured.

By the way, if it would help you to study another man's methods, "Ann and Harold" has been published. Read it—and disagree with me!

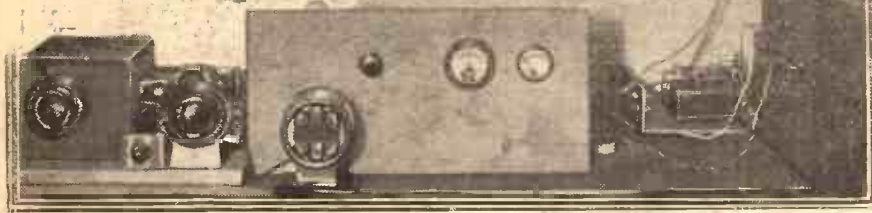
Such, then, are the opinions of Louis Goodrich. His success as a radio playwright has been due to his ability to write about ordinary people and ordinary things, and yet to invest his stories with the romance, the spirit of make-believe and the whimsicality which are the secret of successful comedy.

For this reason the advice of Mr. Goodrich is doubly interesting to the would-be radio dramatist, for he is one of the very few authors who have provided comedy for wireless listeners. And those who are writing plays for the POPULAR WIRELESS Competition might be well advised to study the vast field which this branch of radio drama offers them. Microphone comedies are few and far between.

A £50 PRIZE

is offered by "Popular Wireless" for the best original radio play written by a reader. In addition, the B.B.C. will undertake to broadcast the winning play. Full details will be found in the issue of "Popular Wireless" dated September 30th, 1933.

Short-Wave Notes *WLS*



READERS who do me the honour of following these notes so closely that they can "come down on me," armed with chapter and verse every time that I contradict myself would be amused if they knew how the last week had been occupied.

I have been building a short-wave set with the following characteristics: number of valves, three—S.G., det. and pentode; size of tuning condenser, .0003; size of cabinet, 12 in. by 15 in.; both condensers mounted back from panel and controlled by extension handles (Ugh!); resistance-reaction control.

No, gentle reader, I have not succumbed to the mental strain of listening to too much modern music; the set is intended for someone else. The gentleman who asked me to make it for him knows very definitely what he wants, and I therefore built it to his specification, scrupulously keeping all my own ideas out of it. Sufficient to say that it works, but it's not *my* idea of a headphone set.

Concerning Components.

I must deliver myself of another grouse about short-wave components. As I have said before, the variable condenser seems to be the only one that is made to a really good design by more than one firm in this country. I only know of two makes of slow-motion dial that can be trusted not to make sand-papery noises after six months' use.

Short-wave coils are all right in their way, but when I see the bewildering selection of really efficient, compact, beautifully finished short-wave coils that are available in America I can't resist heaving a gentle sigh.

The fact remains that in this country the short waves are still the Cinderella of radio (someone has probably said that before, but I can't help it!), and the keen short-wave man has to ferret round all over the place before he finds a complete set of components that really please him.

New Type of Receiver.

Don't misunderstand these remarks. I am not implying that *any* of the short-wave components on our market can be classed as "no good"; but that poor creature, the "connoisseur," who really wants to use the best of everything, has to have a jolly good hunt round to find it.

The famous "single-signal" receiver, so popular amongst the amateurs in the States, seems to be invading our territory. I know of one or two London amateurs who have ordered complete sets.

This receiver is a very sharply tuning superhet, employing a "quartz-crystal-gate" rather after the manner of the Stenode receiver which caused such a stir a few years back. The I.F. stages are arranged in a "lop-sided" manner, so that the beat with a C.W. signal is several times stronger on one side than the other.

This implies that C.W. signals (and carrier waves) will only take up half the room that they do on an ordinary receiver. Instead of the well-known swoop down to the silent point and up on the other side there is either an "up" or a "down," but not both.

The receiver is primarily intended for use by amateur transmitters in their own bands, where congestion is becoming such a serious matter that a receiver of this type is a real advance. It should be productive, however, of some very interesting results on telephony.

Claiming a Record.

Conditions have not been worthy of comment just lately. The higher-powered broadcasters, as is usual with these "medium" conditions, have been up to their normal strength, but the more unusual

His activities during the last week, a chat about modern components and a description of a new type of single-signal receiver, are among the subjects dealt with by our contributor this week. He also touches on 5-metre work, and suggests that 2½ metres should be the next step "downward."

stations have been conspicuously absent. "A. M." (Richmond) claims a new record, having heard all nine districts of the U.S.A. in the space of 40 minutes on 20 metres. Can anyone beat this?

I don't like to say it, "A. M.," as I have no proof, but I have an idea at the back of my head that I heard them all in a very few minutes 'way back in 1928, when conditions were good. That certainly wasn't in the evening, though—it was round about 6 a.m., also on 20 metres.

The insatiable "T. C." of Wakefield, still dense in logs that seem to show that he doesn't miss much. Like several other old correspondents of mine, he has completely succumbed to the spell of the amateur bands nowadays. It is very striking to note the sudden alteration that takes place in the character of readers' logs when once they have mastered Morse.

Continued 5-metre Activity.

I published a note a little while back to the effect that "T. C." used a .00035-mfd. condenser in series with a .00013 for tuning. He corrects me and says that the former should be .000035 (four noughts three five). Sorry, T. C.!

One still reads about plenty of five-metre activity. It's wonderful how our little Crystal Palace test started them all off! I have just been reading an interesting cutting concerning the tests run by Mr. Norman Blackburne (G 2 F X), of Bexhill, who set up a station at North's Seat, a very high spot just behind Hastings.

Three minutes after the station was set up communication was established with G 2 I C, of Folkestone. G 5 J Z, of Heathfield, was also contacted, and the transmissions were heard at loudspeaker strength in Bexhill.

G 2 F X is working hard to establish the first cross-Channel contact on 5 metres, but, short of sending someone over the other side on the "Brighton Belle" or one of the other pleasure steamers, it doesn't seem as

(Continued on page 218.)

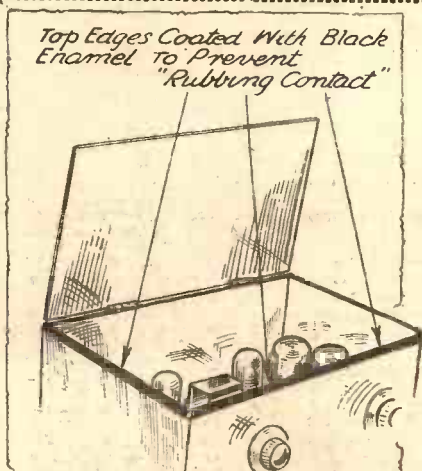
"SILENCING" METAL BOXES

WHEN a short-wave set is built into a metal box it is obviously essential that all contacts between the different metallic parts should be extremely good. A box equipped with a lid that lifts right off will produce bad crackles unless the flanges of the lid fit really tightly; if they do not they should be bent in slightly, as shown in the sketch.

Insulating the Lid.

Boxes with hinged lids are even more troublesome, as the lid cannot be made to fit really closely on to the top of the front panel. The surest remedy here is to go to the other extreme and to give the top edges of the front panel and sides of the box a thick coat of black enamel, so that they are insulated from the lid when it closes on them.

This will completely cure the grating noises that can be caused by a loose contact of this kind. The lid is still, of course, metallically connected to the rest of the box.



Two methods of preventing "cabinet" noises due to rubbing contact between the lid and box.

ECKERSLEY EXPLAINS-



"IS there," writes a questioner, "any way of overcoming atmospherics? I live in the country and have to rely upon Daventry for most of my British service. The Regionals come in well, but at night they are jammed by other stations, and no station is ever free from atmospheric interference."

I think my correspondent exaggerates a bit when he (or she) says that "no station is ever free from atmospherics," but after a long and hot summer it must seem like that. Of course, atmospherics "drive me to—my switch. I cannot bear that crunching sound time after time; it's just maddening.

And there is no way to overcome atmospherics—not to overcome them completely. Every wireless engineer

has probably gone through a phase when he "invents" circuits to "get over" atmospherics; but it's rather like trying to "get over" first principles.

A Matter of Ratio.

An atmospheric is composed of all sorts of frequencies if you analyse it out; therefore, a component (part of the energy) of the atmospheric is a wave having the same frequency as the waves to which the receiver is tuned. Therefore, if the atmo-

spheric energy is comparable with the energy in the signal you want to receive, obviously it cannot be eliminated without eliminating the signal.

If you are listening to an orchestra in the Queen's Hall, let us say, and someone at the back of the stage was to blow a police-whistle hard at intervals, there would be no method by which the orchestra could be heard without the police whistle unless, of course, the blower was removed.

But you cannot remove thunderstorms, and so you cannot hear the broadcast without the atmospheric.

On the other hand, to go back to the police-whistle analogy, if the whistle was a very feeble whistle and the orchestra a very strong orchestra, you might not hear the whistle. Thus,

if you tune in to a very powerful station, you do not hear the relatively feeble atmospherics. It's all a question of the ratio of the signals you want to hear to those you don't want to hear.

If the atmospherics are loud but the signals louder, all can be well; if the atmospherics are very weak but the signals weaker, you must hear the atmospherics if you are to hear the signal. The question is not directly concerned with the sensitivity of the set; it is concerned only with that

Atmospherics, the bugbear of radio reception, form our Radio Consultant-in-Chief's subject this week. And he sums up the difficulties of overcoming them in a typically cryptic manner when he writes: "Ever wireless engineer has probably gone through a phase when he 'invents' circuits to 'get over' atmospherics; but it's rather like trying to 'get over' first principles."

fundamental ratio—signals wanted to noise unwanted.

Now I said that an atmospheric can be analysed as lots of different frequencies. It's as if a gun went off and made low notes, medium notes, high notes and supersonic notes. So when you have a "tuned" receiver which is only responsive over a certain frequency band width, it only picks up part of the atmospheric.

High Selectivity Helps.

The narrower you make the band width of response the less the noise due to the signal. But we all know that we have to make a receiver responsive over a certain band width to get good quality. So we must pick up a certain amount of atmospheric whatever happens, but there's no need to have a receiver which is responsive over a wider range than is necessary to give good quality. Some Daventry receivers may not be selective enough.

I would advise those troubled by atmospherics that they might get a slight improvement by assuring themselves adequate selectivity. Indeed, however, the station-jamming situation has probably assured that long ago.

A FLYING "SCHOOL" FOR RADIO OPERATORS



Taken in a giant Vickers bomber, this scene depicts a class in radio reception. The machine is fitted with five independent receivers, one for each pupil, and even then there is room for the instructor to walk up and down the cabin.

I love this word "efficiency"—D.C. to A.C. efficiency! People say they put so many watts into a valve (D.C.) and get so many watts out (A.C.). They give a loudspeaker 2 watts and feed in, say, 10 watts to the last valve and say that the efficiency is 20 per cent.

But let's look at it as an engineer would do. He says that you measure the power efficiency of a machine by taking the ratio of watts got out of it divided by the watts put into it.

Take a typical 3-valve battery receiver. Its high-tension consumption for decent quality is, I suppose, 15 to 20 m.a. at 150 volts. This is being conservative. It means 3 watts, anyway. Then filaments take, at very minimum, 1 watt. So that's 4 watts.

I don't expect that the maximum power delivered to the loudspeaker is more than 0.5 watts, and that only for an instant. So the efficiency is really of the order 12 per cent, not 20 per cent. And in a battery set watts cost money.

Moreover, loudspeakers are only about 1 per cent efficient!

FROM THE TECHNICAL EDITOR'S NOTE BOOK

TESTED
AND
FOUND?CHEAPER
BULGIN COMPONENTS

THE components used by manufacturers in their sets cost less to make than those produced specially for home constructors. In some cases there may not be a great deal of difference, but in others the differences are considerable.

The reason is not that they are less efficiently made, but they are devoid of the finishing touches given to constructors' components.

For example, transformers for commercial sets are often without any kind of casing and have no terminals. It is unnecessary that they should have. It is the completed set itself which is neatly encased and artistically finished.

But do even constructors want their components each to be a polished, finished entity?

Now this is a question that at first sight looks easy to answer, but in fact it is not. Let us examine the pros and cons of the whole matter in more detail.

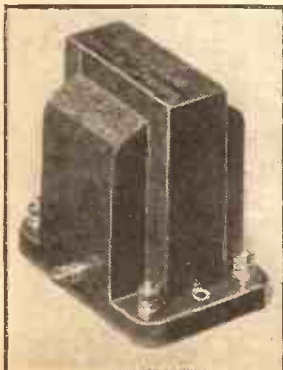


A group of the "Skeletonised" components being sold by Messrs. Bulgin at prices considerably below those of their ordinary lines. These parts are similar to "manufacturers' components" in that they are largely without terminals and cases.

In favour of the "raw" component is the one fact that it may be considerably cheaper. Note, we say "may." It is contended by some manufacturers that little or nothing is saved by, for instance, eliminating a case or cover.

One or two have been reported as saying that with certain components a case can be an integral portion of an essential, economical construction.

As for terminals, they add, these in the mass cost very little to supply and fit.



A high-grade Class B output choke of British Radiogram make which we recently tested and found to give good results.

On the other hand, others state that there are alternative and decidedly less expensive methods of assembly than those which demand the provision of "costly moulded cases."

And that, to us, seems reasonable enough.

The man who buys components to use first in one set and then in another—the experimenting constructor, in fact—probably prefers his radio components to be terminalised, finished pieces of apparatus.

But the one set type of construc-

tor, the man who has his mind set on the building of just the one receiver for home use, and has little thought of future reconstruction, would not mind his components in the "raw."

At least, that is what we think. Until recently the whole question was a purely theoretical one, far removed from practical politics, because constructors were offered no alternative.

That, however, is not now the case. Messrs. Bulgin have taken the original and courageous step of making available to constructors numerous "manufacturers'" models of components. The accompanying photo includes a good selection of them.

Note the three H.F. chokes in the foreground. These are priced at 1/6, 1/9 and 4/6 respectively. Fitted with cases and terminals, the equivalent types cost 2/3, 3/6 and 5/6.

Above them is a group of "skeleton" L.F. chokes, ranging in price from 8/6 to 13/6. Two shillings is saved on each of these.

And it should be noted that they are identical in quality and technical efficiency to the ordinary constructor's components of the same type sold by Bulgin. Bulgin style them "Skeletonised" components. But we don't consider that is a quite appropriate term, because there is not so much missing from them that they deserve to be considered as mere skeletons. Their skins may certainly be absent, but the "meat" is there!

We hope this new Bulgin policy will at least be given very close consideration by constructors, for it is among the most important that have been initiated.

Full details of the quite extensive range of skeletons available is given in the new Bulgin catalogue.



Another British Radiogram component, this L.F. transformer is compact, inexpensive, and in keeping with the most up-to-date technique.

IF Jay Laurier proved a less brilliant star in the "Fire Station" than he did in "Waltz Time," it was because, this time, he was one of a constellation of stars, all of whom refused to be out-shone. Therefore I still regard him as an acquisition to broadcasting, and I hope that his third appearance before the microphone will not be any longer delayed than his second was.

"The Fire Station" must have satisfied those listeners who crave for their one huge laugh per day. Every line was funny, though the humour may not, in every case, have passed muster with subscribers to our more exclusive humorous papers.

Clapham and Dwyer were irresistible and almost unchallengeable—till Leonard Henry came along. As Leonard was at his best as "our representative," I was prompted to transfer my vote to him. But Clapham and Dwyer came on again, which put me in a quandary. So I decided to split my vote.

Dan Leno, junr., must have been in a very funny mood when he wrote the book—for it was packed with nonsense. I'm not certain, however, that a spot of seriousness here and there wouldn't have helped the nonsense a bit. As it was, we were surfeited with the latter to such a degree of satiation that when the show was faded out (it having already overshoot scheduled time) in favour of Mr. Baldwin we were not greatly distressed.

Another bright feature of the show was the excellent playing of Marius B. Winter's band. This was particularly noticeable in some of the accompaniments, I thought.

I have often urged the B.B.C. to do something for the amateur actor. Imagine my satisfaction, then, to find billed in the "Radio Times" a series of informal half-hour conversations between representative amateurs and a professional producer. But

We have said little about their individual characteristics, but, as we have indicated, they are equal in all respects to the standard Bulgin equivalents, and the high quality of these will be well known to readers.

Among the "skeletons" are H.F. and L.F. chokes, potential dividers, D.C. mains resistances, valve holders, captive screw strips (for use instead of terminals), fuse holders, mains plugs and sockets, short-wave H.F. chokes and coils and various other items.

Real money-savers all!

BRITISH RADIO GRAMPHONE
TRANSFORMERS

For some time past I have been watching the development of British Radiograms with considerable interest. They started in a quite modest way a few years ago, but their history has been one of steady and substantial progress.

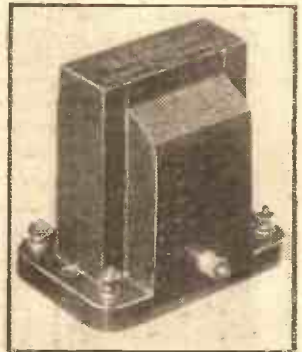
And now, this season, they have added numerous new lines to their catalogue, and must be numbered among the most important manufacturers of radio components.

Their range of transformers is complete. There is a good L.F. intervalve type, compact and inexpensive. In keeping with the most up-to-date technique it is encased in a strong, well-finished bakelite moulding, on the top of which the terminal markings appear in bold relief. A sound, practical point that.

There is also a British Radiogram Class B driver transformer and a Class B output choke.

These we tested in combination with a Cossor Class B valve. They gave good results, and it was evident that their characteristics were especially suited to this particular valve.

We have also employed these British Radiogram Class B components in one of our publication sets with complete success. They can be recommended to all constructors.



The Class B driver transformer of British Radiogram make is similar in appearance to their Class B output choke, and likewise similar in its excellent performance.

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

one's interest in a topic is so great that it can only be listened to under the best conditions. I suppose I shall have to continue grousing until the B.B.C. sees the wisdom of transmitting all novel items on the National wavelength.

Lord Dunsany's new radio play, "The Use of Man," wasn't the epoch-making play I expected it to be. Really, it didn't strike me as being anything more than an elaborate fairy-story, and very suitable for the Children's Hour. As such I would have lauded it to the skies, especially those clever farmyard, jungle and summer-evening noises that filled the ether for the best part of forty minutes.

The idea behind it all wasn't big enough for a good play. The dialogue was just a tiresome repetition of the same question and answer; only the background noises varied. It is a fact that I almost forgot I was listening to a play; it was more like a super-quality variety turn.

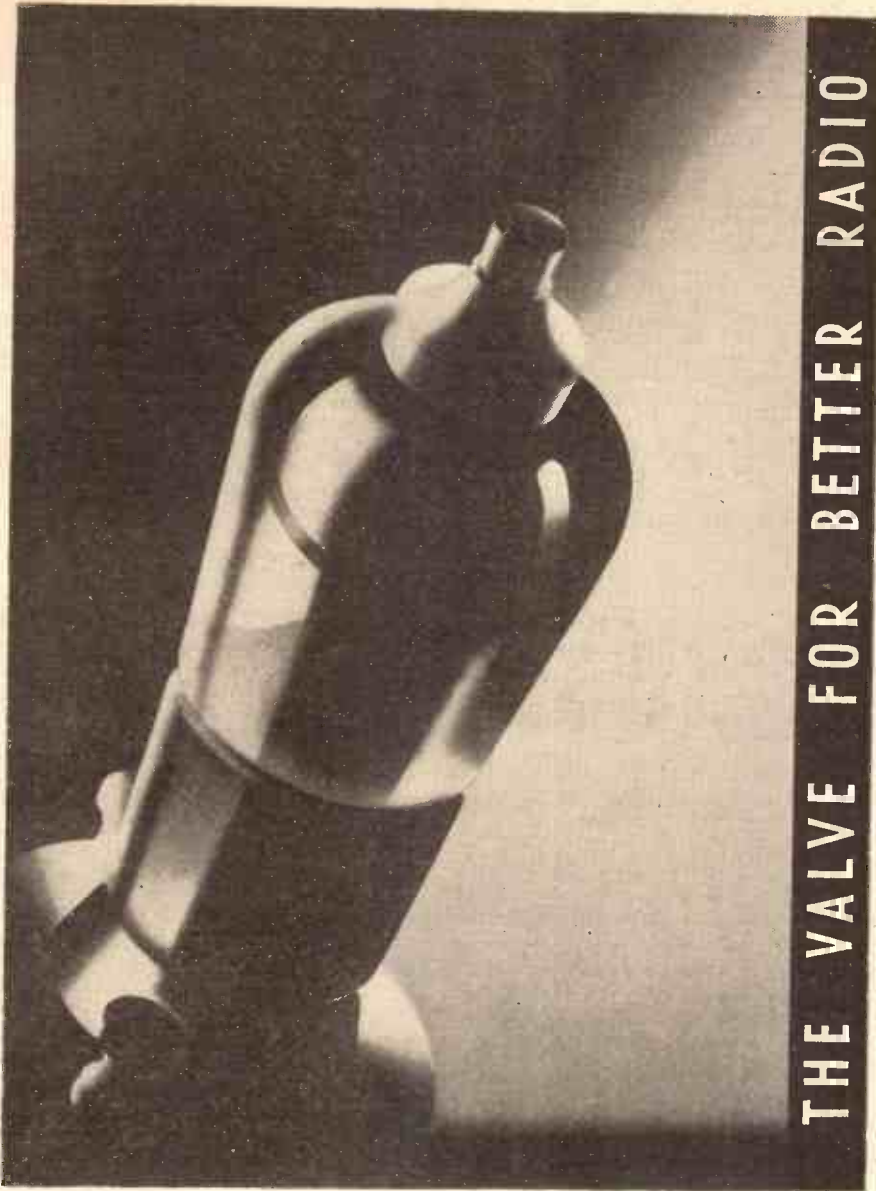
I think the play was produced as well as it could be, but you can't make a silk purse out of a sow's ear. Part I, which was very short, was just rattled off, and only succeeded in irritating one. When one recalls the preliminary notices about "The Use of Man," one is inclined to think that this was a case of much ado about nothing.

Notices of talks, with explanatory notes on their contents, fairly litter the programmes these days.

(Continued on page 218.)

alas! These conversations are exclusive to West Regional listeners.

I say exclusive because I'm pretty certain that no other listener can take these talks without suffering interference from unwanted stations. Interference is too often a bugbear, particularly when



Mullard Master Valves are chosen by discriminating radio enthusiasts in greater numbers than any other type of valve. That is because previous results have shown them superior in design, construction and performance. Today three million aerials lead down to Mullard Master Valves—and three million aerials can't be wrong.

ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You're under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. .P.R.

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S.T.500.

COMPLETE CONFIDENCE

ALL readers of radio journals know that when they build a set designed by

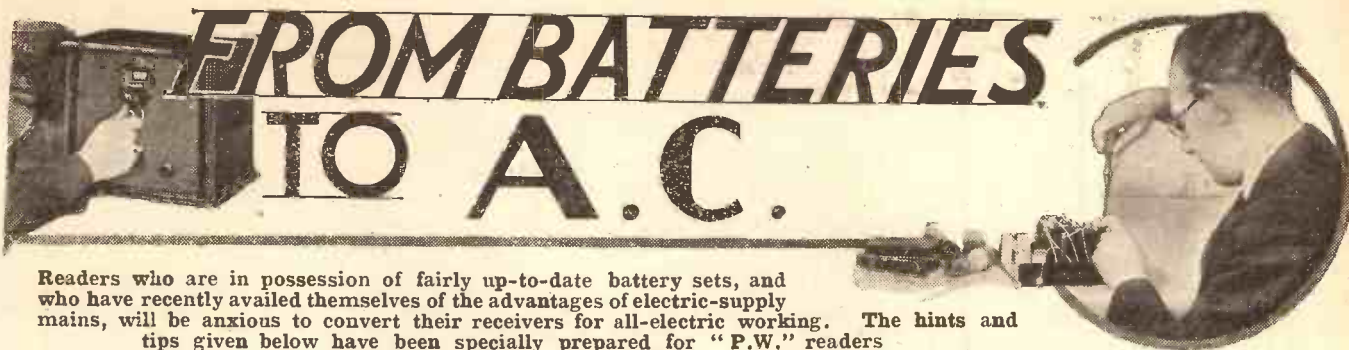
JOHN SCOTT-TAGGART
SUCCESS IS CERTAIN

To ensure outstanding performance and reliability use Colvern Coils as incorporated in S.T.'s original design... Every Colvern Coil is thoroughly tested and guaranteed to be identical with those employed in the original receiver.

Think of the "S.T.300"... the "S.T.400"... remarkable achievements in set design... both employing Colvern Coils... pin your faith to Colvern Coils for the "S.T.500."

COLVERN

REMEMBER, COLVERN SPECIALISE IN COILS



Readers who are in possession of fairly up-to-date battery sets, and who have recently availed themselves of the advantages of electric-supply mains, will be anxious to convert their receivers for all-electric working. The hints and tips given below have been specially prepared for "P.W." readers
 By M. G. SCROGGIE, B. Sc., A.M.I.E.E.

GONE are the days when we need hang our heads in shame because ours is "only a battery set." What with Class B, iron-core tuning coils, really efficient P.M. moving-coil speakers and a general improvement in battery valves the A.C. mains man no longer has a monopoly of interesting and attractive receivers or even radiograms. So when we move into a house where A.C. is laid on (or when the A.C. moves into our house) it is by no means a foregone conclusion that the battery set will have to be scrapped.

Unless it is of antiquated design the only real grouse we may have against it is

done away with, the L.T. battery remains a nuisance. It requires little bits of attention that are only too often forgotten or put off till the next day; result, the battery which started off by giving perhaps 10 ampere hours per charge is found to be doing only 5, then 3, 2, 1 and eventually next to nothing, and a new one has to be bought. Distilled water isn't very expensive, but it is too much trouble to go to the chemist; and so we use tap-water or nothing at all. Then we go away for months and let the L.T. stand discharged. And so on.

You ask, Why not make a battery eliminator for L.T., too? It is perfectly possible, but quite expensive. And unless an accurate low-reading voltmeter is used it is not at all easy to make sure that we have just the right voltage on the valve filaments. Even then, every time a valve is thoughtlessly pulled out with the power on, the voltage on the others goes up; and so they are not what the insurance companies call a "first-class life."

Eliminating H.T.

The best thing is to change over to A.C. valves, and then both cost and trouble of providing L.T. are virtually eliminated, for a transformer with an L.T. winding costs very little more than one without it, and all that has to be done to get L.T. is to connect the transformer

L.T. terminals up to the valve heaters. Another decided advantage is that it is a much easier matter to arrange for "free" grid bias than in any system using battery valves.

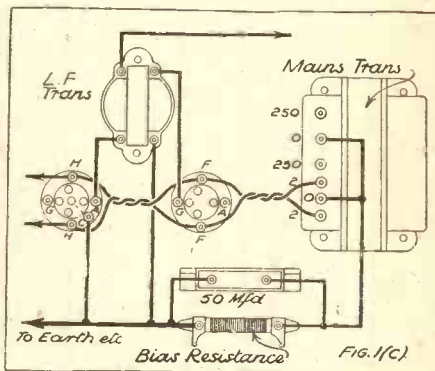
The first thing to be done in changing over is to replace the 4-pin valve holders by 5-pin, with the possible exception of the one occupied by the power valve. Some types of A.C. power valves are directly heated, so require no more connections than the corresponding battery valve.

Next it must be clearly understood that the filament of a battery valve combines two jobs,

and these must now be separated. One job, is to act as a cathode—that is to say, the negative jumping-board for the current through the valve; the other is to develop the heat necessary to stir up the electrons or current carriers into sufficient activity to enable them to cross the gap separating them from the anode.

All the connections dealing with the first job—H.T. negative, earth and low-potential ends of most of the coils and condensers (variable and fixed)—which are usually

AFTER ALTERATION

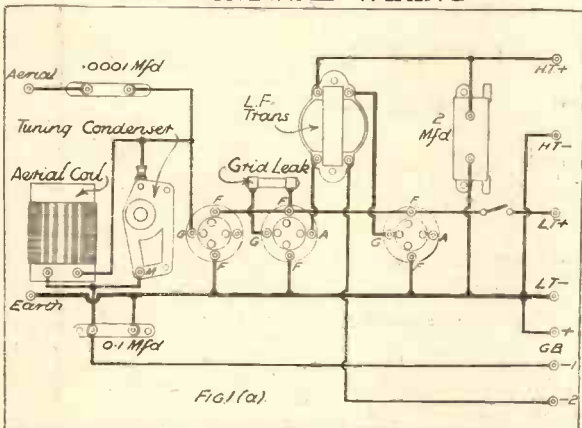


If it is desired to use a directly-heated output valve a four-pin holder will be needed in the last stage. The grid-bias connections will also have to be modified slightly.

brought to L.T. negative, must be separated from the L.T. leads proper. The first lot are connected instead to the cathode sockets—the central ones—of the valve holders, and the heater sockets are left with no connections at all except for a pair of thick wires joining them all up in parallel to the 4-volt winding on the transformer (this must, of course, be entirely separate from any that may be used for a valve-rectifier filament).

(Continued on next page.)

THE ORIGINAL WIRING



Here is a diagram showing the usual arrangement of the filament wiring in a battery set. In order that indirectly-heated mains valves may be used it is necessary to replace the four-pin valve holders with the five-pin variety and also alter the wiring somewhat.

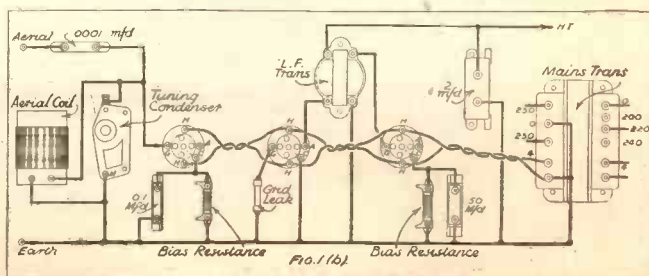
upkeep and cost. Even Class B doesn't claim to reduce this; all it does is to give bigger and better results for the same running expense.

Of course, the H.T. battery bill is easily abolished by buying or making an H.T. power unit. "P.W." has told us all about this on many occasions. It may cost a good deal more than an H.T. battery, but as the running cost is negligible it is pretty certain to pay in the long run. There is still the L.T. battery. The cost of recharging and the arm-ache of carrying it about can be stopped by including in the H.T. unit a small metal rectifier for trickle charging; so that when the set is switched off the charger is switched on and replenishes the L.T. for the next time.

Theory and Practice.

That may be all very well to talk about, but in practice it is not quite so ideal as it can be made to sound. The fact is that, even when the cost of charging has been

FOR INDIRECTLY-HEATED VALVES



After five-pin valve holders have been added this diagram will be useful in assisting you to make the necessary alterations to the wiring. Automatic grid bias is provided and no batteries are required.

FROM BATTERIES E.O. A.C.

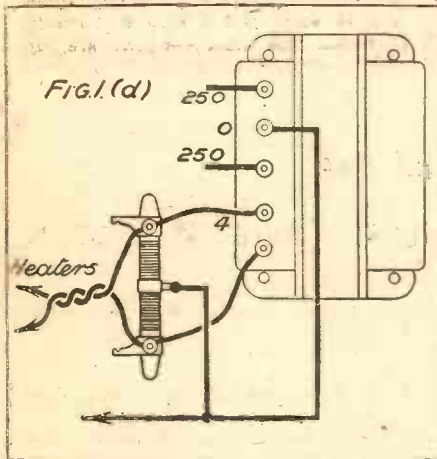
(Continued from previous page.)

The wires must be thick, because each valve takes one amp., and it is most important to make sure that no appreciable voltage is lost in carrying this heavy current to several valves.

Neutralising Hum.

Another precaution is to twist the wires together wherever possible, so that any hum that might be caused by the current flowing in one of them is nearly neutralised by that flowing oppositely in the other. Fig. 1 (a) shows the principal connections associated with the filament circuit of a simple 3-valve receiver, and 1 (b) the same connections rearranged for A.C. working. Note that the grid leak, which usually goes

PREVENTING HUM

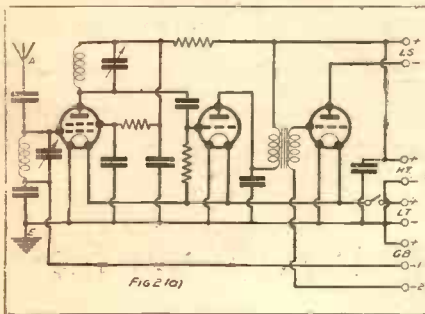


When making use of a directly-heated output valve it is essential that the centre point of the L.T. winding is earthed. If there is no centre tap on the transformer an artificial one must be provided by means of a centre-tapped resistance.

to L.T. +, joins all the return leads that were previously brought to L.T. -

If all the valves are indirectly heated it is not absolutely essential to connect the heaters to anything other than the trans-

A TYPICAL CASE



Shown in theoretical form above is a typical three-valver which lends itself very well to conversion for all-electric working.

former; but the usual thing is to make one connection from earth: it doesn't much matter where, either to one side or to a centre tap.

If a directly-heated power valve is used, however, we must earth the centre of the heater supply; if no centre tap is provided on the transformer we must make one by using a centre-tapped resistor or, better still, one of the adjustable-tap "hum-balancing" resistors that some component firms supply. Fig. 1 (c) shows part of (b) modified for a directly-heated power valve, and (d), is an alternative centre tap. In (a) to (c) the heavy line marks the earth line or "common negative."

It is quite possible to carry on with the old grid-bias battery arrangements, the + being now connected to cathodes instead of L.T. -; but that would be throwing away one of the chief advantages of A.C. valves. Instead, all the points that were formerly joined to G.B. - can now be brought straight to the common negative and a bias resistor inserted between this and the cathode of each individual valve needing bias.

Bias Decoupling.

The valve makers tell us exactly the value of the resistor to use and how to connect it. In each case it is necessary to decouple the bias; and although there are various filter systems that are sometimes perfectly satisfactory, the simplest and safest scheme is to shunt the bias resistor with a condenser: 0.1 mfd. for H.F. valves and 25 to 50 mfd. (electrolytic, of course) for L.F. The bias alterations also are shown in Fig. 1. A special point to notice is that, with directly-heated power valves, all the valve current passes through the bias resistor, which must be proportionately lower in resistance.

Generally speaking, there are no A.C. valves that are exactly equivalent to the battery types. Obviously the nearest should be chosen, and when that has been done it is likely that they will all be rather more lively; in other words, the "slope" will be higher. One effect of that is to increase the

amplification all round, which no doubt will be quite welcome.

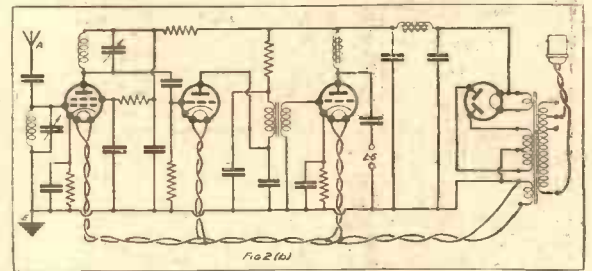
But there is a possibility that less desirable effects may appear—uncontrollable oscillation, motor-boating and distortion or overloading. If that is so it means that we must pay more attention to screening and decoupling: increasing decoupling resistors and condensers and seeing that coils and H.F. leads are well screened.

Before and After.

Another thing is that, even with the correct bias as recommended by the valve makers, the anode current may be considerably higher than when batteries were used and economy was the ruling motive. So it will be necessary to consider whether any transformers are in danger of being saturated or anode resistors overheated, and either to reduce the current by increasing the bias or to use a larger resistor or parallel-feed the transformer.

Fig. 2 (a) and (b) shows the circuit of a three-valve set before and after conversion to A.C. Details such as waveband switching have been omitted for clearness. The changes are practically the same as those already illustrated in Fig. 1, but in addition you will see that decoupling has been inserted in the detector stage, which previously managed without it, and the loudspeaker is choke-fed. It is wise to isolate the speaker by either choke or transformer when mains-driven.

ALL FROM THE MAINS



Here you see the same set as shown in Fig 2 (a) after alteration for mains working. The high-voltage rectifier and power transformer are on the right.

WHEN an A.C. H.T. unit is worked with a receiver using battery valves it is always advisable to ensure that the filament circuit is completed before the mains are connected to the unit.

If the receiver valves do not take current the output from the rectifier flows entirely into the smoothing reservoir condenser, and actually raises the voltage across this to the peak voltage supplied through the rectifier. This voltage is nearly half as much again as the normal voltage, and will be applied to all condensers and components across the H.T. supply.

Making Sure.

Thus an unnecessary strain will be thrown on these components and may cause a breakdown.

A very effective method for testing a large fixed condenser of, say, 1 mfd. or

CONCERNING CONDENSERS

A useful tip which will safeguard your fixed condensers, and a method of testing them when you are uneasy about their condition.

over is by means of a small flash-lamp battery and a pair of phones.

The battery connectors are touched momentarily across the terminals of the condenser under test, the positive connector

touching one terminal and the negative connector the other. Then, after a period of ten minutes or a quarter of an hour, the 'phone tags should be brushed across the condenser terminals.

The Indicating Click.

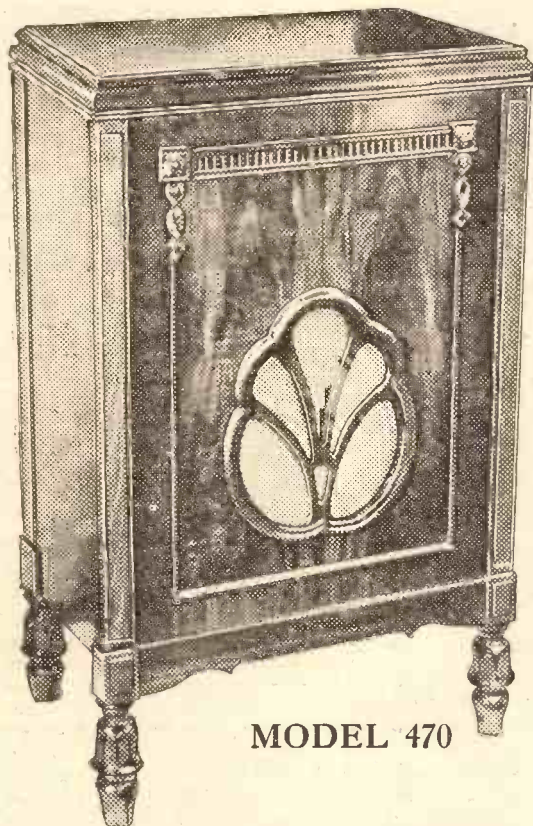
An appreciable "click" should be heard, indicating that the charge has been held by the condenser and that the component is thus in order. If no click results, of course, the insulation of the condenser must be at fault.

This method is much simpler than the usual high-voltage test which often gives unpleasant shocks.

H. C.

Listen!

THE LITTLE DOG IN "His Master's Voice" trademark carries a graphic message to all intending purchasers of radio. He listens — and cannot believe that what he hears is not reality. Apply the same test to any "His Master's Voice" radio instrument . . . LISTEN, just listen—for it is by that test that every "His Master's Voice" instrument has been made for a quarter of a century.



MODEL 470

The Aristocrat of Radio Receivers—for 25 GNS.

An outstanding example of "His Master's Voice" range of 'true-to-life' radio instruments is the Superhet Lowboy Seven, Model 470. This instrument, employing a seven-valve superhet circuit and band-pass tuning, picks out every worth-while home and European station with satisfying ease. There is no 'overlap,' and the background, thanks to the use of variable mu valves, is practically silent. This razor-edged selectivity and remarkable station-getting power are allied to a tone perfectly balanced from top to bottom of the register. The 'true-to-life' tone is further enhanced by a walnut cabinet acoustically matched with a mains-excited moving coil speaker. Provision is made for the attachment of a pick-up which makes possible the electrical reproduction of gramophone records, and the instrument has sufficient power to operate two or more additional loudspeakers. Take the first opportunity of calling at your nearest "His Master's Voice" dealer for a demonstration. The price of this instrument is 25 gns. —or by hire purchase.

COUPON

To the Gramophone Co., Ltd.
(Dept. P.W.), 98 Clerkenwell Road, London, E.C. 1.
Send me full details of Model 470 and complete list of "His Master's Voice" Radio.

Name

Address

"His Master's Voice"

"TRUE-TO-LIFE"

RADIO

The Gramophone Co., Ltd. (Dept. P.W.), 98 Clerkenwell Rd, London, E.C. 1 (Prices do not apply in I.P.S.)

SCOTT-TAGGART FOR "POPULAR WIRELESS"

BRITAIN'S LEADING DESIGNER CREATES THE

"S.T.500" EXCLUSIVELY FOR "P.W." READERS

"POPULAR WIRELESS" TRIUMPHANT!

By THE EDITOR

JOHN SCOTT-TAGGART has designed a set for POPULAR WIRELESS and will give full constructional details of it in our next issue.

To tens of thousands of constructors and to the whole of the great radio industry this is the most momentous news of the year.

An "S.T." set is indeed an event, and the fact that POPULAR WIRELESS has been so fortunate as to secure the publication rights of the first Scott-Taggart star design since the mighty "400" of 1932 is a scoop of the greatest magnitude.

And we feel sure all our readers will agree that this is service in *excellis*.

No designer of home-constructed sets has a greater following than John Scott-Taggart, and no designer more readily deserves the immense popularity that has been accorded to this distinguished personality.

Colossal Success of "S.T." Designs.

It is particularly appropriate that his great new set should reach the public through the pages of POPULAR WIRELESS, for eleven years ago he became the first Technical Adviser to this journal, later founding "The Wireless Constructor" and "Modern Wireless."

The colossal successes which "S.T." achieves with his receivers for home construction occasion little surprise in the minds of those who know something of his

past experiences and present accomplishments.

His great abilities as a physicist and engineer are such that his services as a consultant have been sought by practically all the leading radio concerns of the world. His inventiveness is to be gauged by the fact that many of his patents have been acquired by the principal corporations in Europe and America. His possession of a keenly analytical as well as constructive brain is evidenced by his legal standing (he is a barrister-at-law).

Incredible Versatility.

This, then, is the foundation upon which his genius is firmly based, and it is surely extraordinary that such incredible versatility of experience should have been obtained by a man who is still in his thirties. And it is to the inestimable advantage of home construction that he is bending his present energies largely to its development.

He has tackled this new POPULAR WIRELESS set with great enthusiasm. Indeed, he has said that nothing is giving him greater pleasure than the anticipation of making a whole host of new friends through it. And there is nothing more certain than that he will do this, for with every successive set his circle of followers grows wider and wider.

At least one hundred thousand "S.T.300's" were built; no one can gauge

exactly the immensity of the success achieved by the "S.T.400" (letters of appreciation were received by "S.T." from all quarters of the globe). To what new heights will the "S.T.500" rise? That question is fraught with the most exciting possibilities.

At this juncture we cannot even tell you what the "S.T.500" is, but must leave it to the master craftsman himself to introduce his latest design to you next week. No doubt between now and the day when that "S.T." number of POPULAR WIRELESS will be flowing out from bookstalls and newsagents in all parts of the country a host of constructors will be speculating on the details of design of the "500." But at best it can be nothing but idle speculation. John Scott-Taggart does not stick to grooves, and his past successes seldom give clues to his present lines of thought.

Order Your Copy in Advance.

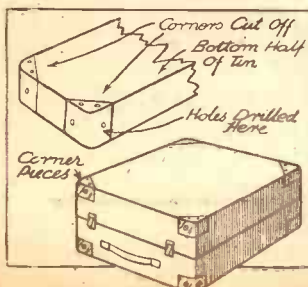
If you must try to guess what his "S.T.500" is, clear your brain of all preconceived notions and read nothing out of the symbol itself except that it is, in fact, a Scott-Taggart set. That will at least bring you into tune with the "P.W." triumph of next week.

Over 218,000 copies of "S.T.'s" last set description were sold. A greater success than ever is assured this time.

So don't forget to order your copy of POPULAR WIRELESS in advance!

CABINET CORNERS.

It often happens that the corners of portables and transportables receive damage when being moved from place to place. This can be remedied in the following manner: Take a two-ounce tobacco or other flat tin (Digger Flake in my case), cut off corners as shown in sketch, trim up and polish with fine emery cloth. Pieces may be blued by heating over an ordinary gas jet. Fix by means of



Protecting the portable's case.

THREE MONEY-SAVING TIPS

Practical tips which the constructor will find easy to carry out and really effective in practice.

small steel screws to corners of cabinet. The screws may also be blued if desired:

REPAIRING A SPAGHETTI RESISTANCE.

OWING to their flexible nature, the very fine wire with which spaghetti's are wound is easily fractured.

Repair as follows: Carefully prise off the end eyelets and remove the sleeving. It will now be noted that the fine wire is merely wound round the core, and at the two ends short lengths of thicker wire is tightly wound over the finer, making electrical contact with it. The eyelets are in turn pinched over the thicker wire. Usually the fine wire fractures near the end. However, wherever it is, remove the thicker wire from the end nearest the fracture and rewind it on just the other side of the fracture. Measure the length of the

resistance, cut it right through at the fracture and remeasure the new length. Shorten the sleeving to suit, slip it on and pinch the eyelet over the thick wire—which has been wound over what is now the new end. The reduction of resistance (in ohms) will be in proportion to the reduction in length. When the cut out piece is of appreciable length it can obviously be used to make a second resistance, two extra eyelets only being required, short lengths of fuse wire serving to bind the two ends.

CLIPS FROM CLOTHES PEGS.

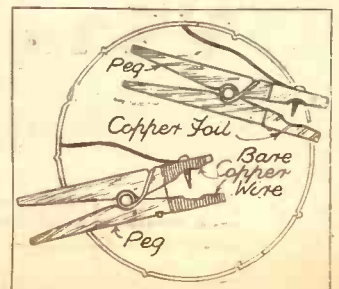
IMPROVISED crocodile grips may be made quite easily from clothes pegs.

The type of peg with a metallic spring is utilised. Copper foil is wrapped round each jaw and a tiny

brad used to retain it in place. Through the one jaw drive a screw which will hold the connecting wire and act as a terminal. The end projecting through the jaw will act as a positive contact.

These grips are very useful when using a car battery, as they will open wide enough to take the terminal pillars.

If more convenient the jaws may be wound with bare copper wire in place of foil.



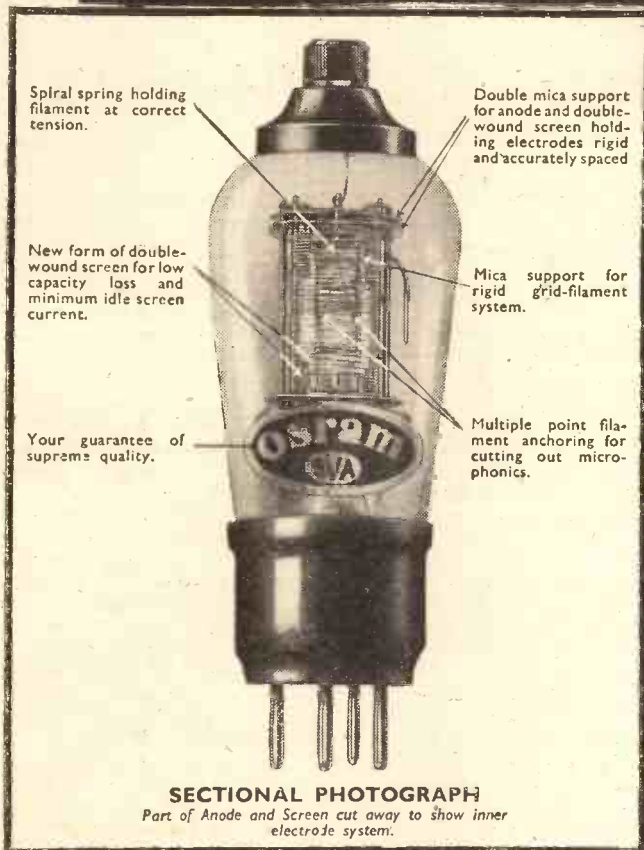
A wooden clothes peg adapted for use as a crocodile clip.

Revitalise your set

3 NEW 2-volt

Screen-Grid Valves mean —

- 1** GREATER SENSITIVITY WITH COMPLETE STABILITY—owing to low capacity and higher impedance.
- 2** ENTIRE ABSENCE OF MICROPHONICS— due to latest multiple anchored filament.
- 3** H.T. CURRENT CONSUMPTION FROM 1.5 M.A. ONLY.



S23

A NEW low H.T. non-microphonic screen grid to improve all Osram Music Magnet 3-valve, 4-valve and similar built sets. Mutual conductance 1.1 ma/volt ... **Price 15/6**

S24

A NEW high slope, non-microphonic screen grid for all single stage H.F. sets using screened coils. Mutual conductance 1.4 ma/volt ... **Price 15/6**

VS24

A NEW "variable mu" screen grid to give full and distortionless control of volume with only a 9 volt bias battery. Mutual conductance 1.5 to 0.01 ma/volt ... **Price 15/6**

Osram

2 VOLT BATTERY

Valves

MADE IN ENGLAND

SOLD BY ALL RADIO DEALERS

WRITE for the OSRAM VALVE GUIDE (1933 Edition) sent post free.

These Valves can be supplied metallised or plain.

Adv. of the General Electric Co. Ltd., Magnet House, London, W.C.2.



"ALL-IN" and "BUILT-IN"

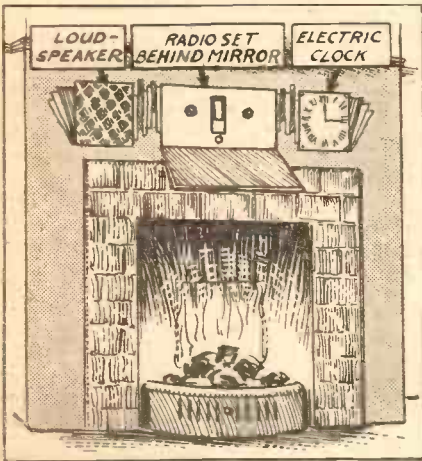
HOW much truth lies behind the opinion of some people that the commercial receiver is the all-in-all of radio and that set construction by the amateur is a back number?

Mechanically and technically, the commercial receiver is a very sound job, especially if a good price is paid for the instrument.

But I still consider that the bought set lacks artistic design in many cases.

The purchaser is tied by the limit of two or three designs by each maker, and the external appearance of each does not differ to the extent of making the choice of receiver easy. There often seems to be a

AN IDEAL SPOT



"Builders and architects will have to be consulted in the near future, and sets will have to be planned and built as integral parts of the actual houses," suggests the author of this article.

The home constructor scores greatly over those who buy ready-made sets when the question of housing comes along. There are many ways in which designs can be adapted to special circumstances, and some ingenious suggestions are made in this article.

By EDWARD A. BASSETT.

lack of imagination, and if the ordinary house furniture were built with the same want of variety most homes would be truly dull.

This is where I believe the home constructor scores over the owner of the bought set. Admittedly, the commercial set is a boon to the elderly, and ladies living by themselves, who could not be expected to build their own receivers. The man, however, who wishes for a first-class receiver would be better advised to build one of the sets described in "P.W.", for even should he have no knowledge of radio, the diagrams of these sets are easy enough to follow.

Striking an Original Note.

And what a choice of "housing" and cabinets the amateur has!

If you look through the advertisements of POPULAR WIRELESS you will find numerous cabinet makers who will send you catalogues on request, containing many attractive designs, and many of them will alter these for your convenience.

A little conference with your family will elicit ideas that will bring satisfaction to all, and if you are not great at woodwork there are joinery and woodworking establishments that will carry out your designs at a reasonable price.

I think builders and architects will have

to be consulted in the near future, and sets will have to be planned and built as integral parts of the actual houses. A receiver fitted into the chimney-piece of a house could be made both artistic and efficient.

Its bulk would be hidden in the thickness of the wall, or in built-in bookcases with leaded windows, where unsightly plugs and wires would be eliminated.

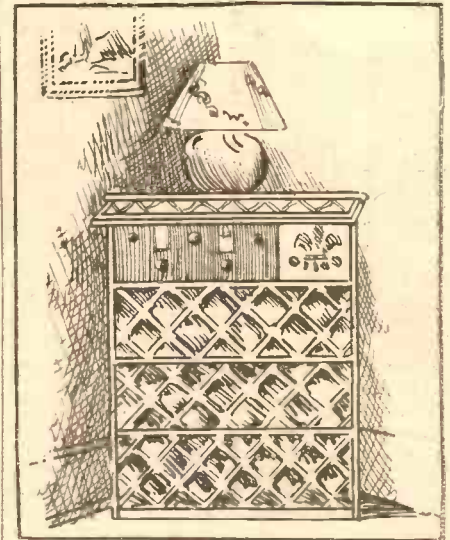
And no doubt asbestos linings in chimney corners would overcome any overheating difficulty.

Concerning the Radiogram.

Two suggestions are illustrated on this page, and I see no reason why the loudspeakers about the house should not receive the same treatment, and become part of the design of a room as much as the necessity of having a linen cupboard.

With regard to the radiogram this is a different proposition from the ordinary transportable set, and is generally planned on more pleasing lines. At the same time the home constructor can use his ingenuity here, for one side of the sideboard can be utilised for this purpose and bureaux can be converted into excellent cabinets for the radiogram outfit.

HOUSED IN A BOOKCASE



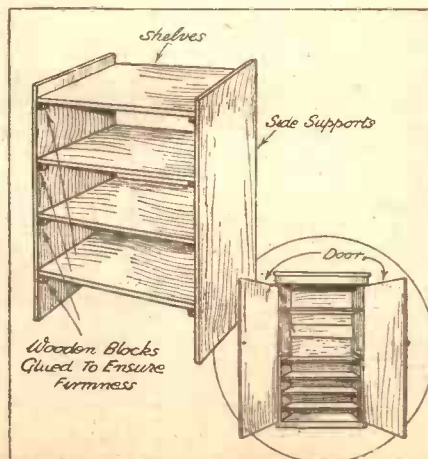
One of the shelves of a bookcase is admirable as a spot where the radio receiver will be handy, and yet quite unobtrusive.

STORING COMPONENTS

A simple scheme which is easily adapted to all circumstances.

IT is not generally realised that the lower portion of a disused cupboard can offer a very convenient method of storing spare components until such time when replacements or experimental work necessitate their use. If the cupboard available is one of the wardrobe type where no shelves are provided in the bottom, it can easily be adapted without any considerable expense or trouble.

In the above instance, of course, shelves must be fitted, and it should first of all be ascertained how many are required to accommodate the number of components on hand. Having decided upon this, the side pieces, or supports, must be



The block of shelves is self-supporting and in no way damages the cabinet into which it is fitted.

included in the overall measurements when obtaining the necessary timber.

After cutting the wood to the desired dimensions the shelves must be fitted between, and at right angles to the side pieces, and firmly screwed into position. If preferred, small wooden blocks can be glued between the inner parts of the sides and under parts of the shelves, as shown in the diagram, to ensure firmness. Another method of preventing the shelves from becoming unstable is by arranging the supporting sides to fit flush against the sides of the cupboard. In this way no side movement is possible.

The back of the cupboard will serve the useful purpose of providing a back for the shelves, thus simplifying the actual construction. Apart from smoothing the woodwork and applying a coat of stain, the components can now be safely stowed away.

A. W. Y.

PUSH-PULL CIRCUITS

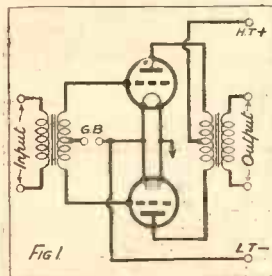


OF THE FUTURE

By J. ENGLISH.

Before the innovation of Q.P.P. and Class B practically the whole field of radio was concentrated on the single-valve-per-stage system of amplification and the use of the various methods of push-pull amplification restricted to a comparative few, notably the more serious experimenter. In consequence, the "balanced-valve" system has been somewhat neglected.

PRIOR to the introduction of the Class B valve, with its revolutionary effect on the outlook for battery-driven receivers, I doubt whether push-pull amplification had been tried by any but a few experimenters. For years the whole of our interest has been concentrated on the single-valve-per-stage system of amplification, with the object of getting higher magnification, greater stability and more realistic reproduction



BALANCED OUTPUT

A push-pull output circuit of this type has definite advantages from the hum point of view and simplifies H.T. smoothing.

from a string of what I will call single-phase valve stages.

There are now signs that this line of development, which we have followed so slavishly for many years, has reached if not passed its zenith. I should not be at all surprised to see in the near future the development of new variations of the original push-pull system as serious rivals to the conventional single-phase amplifier.

Disappearing Complications.

I find it particularly fascinating to visualise receivers of the future wherein all stages, whether in a straight or superhet circuit, will be balanced-valve stages, almost certainly using valves with a double-electrode assembly like the Class B valve. These valves will have remarkable characteristics, making possible phenomenal results as regards range and fidelity with only a few valve stages; most of the smoothing and decoupling complications of our present designs will have disappeared.

In order to appreciate to the full the real and practical advantages of the balanced-valve system you must first realise some of the major disadvantages of the single-phase system.

The most prominent of these, as regards the H.F. and detector stages, is the feedback through the grid-anode capacity to the input circuit. In the detector this produces loss of selectivity and of efficiency, and in the H.F. stage uncontrolled oscillation, now cured by the S.G. valve with its almost negligible grid-anode capacity.

A particularly exasperating defect of the unbalanced single-phase system is the

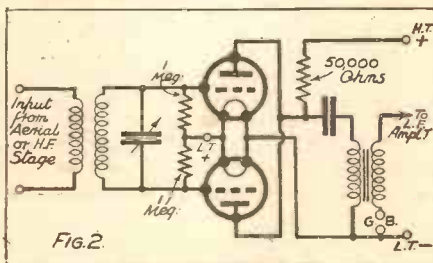
leakage of H.F. or L.F. energy into the H.T. supply system and into the following stages, causing motor-boating and general instability. Consequently we have to employ complicated decoupling to bottle up this unwanted energy in the stage to which it belongs. Leakage of H.F. past the detector is even then difficult to cure.

Eliminating Decoupling.

Now let us take the ideal case of a simple balanced-valve L.F. stage like that of Fig. 1, in which both valves and their associated halves of input and output circuits are perfectly matched. Since the two grid voltages are exactly out of step, the anode currents are also 180° out of phase, cancelling out where they meet in the common H.T. lead. Consequently there is no A.C. energy to pass into the H.T. supply and decoupling is quite unnecessary. This also applies to the grid circuits, so that automatic bias could be used without the usual decoupling.

What is even more remarkable is that, with this perfectly balanced system, we

PREVENTS H.F. LEAKAGE



The use of a push-pull detector results in the virtual elimination of the Miller effect.

could feed both filaments and anodes with raw A.C. without a trace of mains hum in the output! Although such a perfect balance is not possible in practice, we can, nevertheless, considerably reduce the normal amount of H.T. smoothing, with consequent simplification and economy of design.

Overwhelming Advantages.

This ability of the balanced-valve system to confine all the amplified energy to the stage in which it arises and cancel out all products of distortion arising therein is of major importance. When we add its ability to deliver nearly two and a half times the undistorted power we can get from one valve, I think we have sufficient advantages to more than compensate for the use of two valves. Further, when we can obtain special double valves already matched internally at little more than the

Our contributor visualises receivers of the future in which all the stages will be of the "balanced-valve" type, probably using valves with a double-electrode assembly similar to those for Class B. This, he considers, will overcome most of the smoothing and decoupling difficulties that designers now have to contend with and result in phenomenal range and fidelity.

price of one, even this objection must disappear.

Another important advantage of the system is that there can be no saturation of the iron cores of L.F. chokes and transformers as in the single-phase circuit. As in Fig. 1, the D.C. component of each anode current, flowing in opposite directions to the centre tapping of the output transformer's primary, produces magnetic fields which cancel out, so that the net result is the same as if there were no D.C. at all through the primary. Consequently very excellent reproduction can be obtained with cheaper and smaller components.

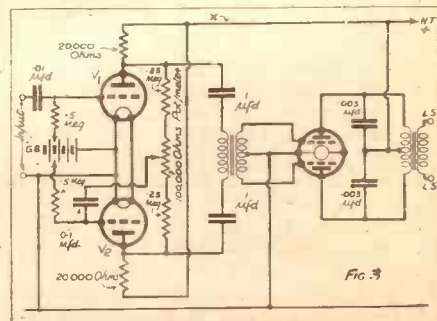
For and Against.

We are now in a position, I think, to sun up for and against the balanced-valve system. In its favour we have, compared with the single-phase system, more power and amplification and better stability and quality. All this is due to the symmetrical arrangement of the two valves of each stage, resulting in the virtual elimination of such causes of distortion as second harmonics, mains hum, iron-saturation and of back-coupling.

There is really very little to be said against the system. The objection to using two valves instead of one is easily outweighed by the better results obtained. Moreover, you can use cheaper valves in push-pull until the new ones come along, and in these days of mains operation the extra running costs hardly count at all. The further objection to the use of special centre-tapped components also carries little weight, as we shall develop circuits wherein only one or two such components will be required, thus making possible the

(Continued on next page.)

STABILITY A FEATURE



This paraphase amplifier circuit has among its features excellent quality and rock-like stability. The scheme shown obviates the use of a centre-tapped primary on the coupling transformer.

REDUCING CHARGING CHARGES

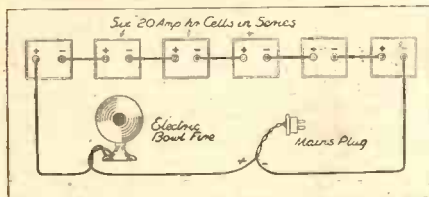
An economical method of obtaining a heavy current output from low-capacity cells.

By T. B. SANDERS.

ALTHOUGH valves are now available which render the design of all-mains D.C. receivers a practical and satisfactory proposition, it is probably safe to say that the majority of home constructors "on D.C." take their high-tension power from the mains, but rely on accumulators for L.T.

This is quite satisfactory, providing the ambitions of the D.C. man are not too

CONNECTED IN SERIES



The cells and the bowl fire are joined in series for charging, as shown above.

great. If, however, there is any inclination towards a "ten-watts output" state of affairs, the provision of L.T. from accumulators is apt to prove expensive.

For instance, the present writer, like Caesar, is an ambitious man and, at the moment, he operates an outfit which, with two PX 4's in the output stage, takes an amount of L.T. which is far nearer to four amperes than is pleasant.

The provision of four amperes of L.T. has, all the same, been found well within the capabilities of a 60-ampere-hour capacity accumulator providing re-charging at frequent intervals is carried out. This, however, has proved expensive.

A small electric bowl-fire passing roughly two amperes has been used for charging and, on a 230-volt D.C. supply, a 12-hour charge costs, at 3d. per unit, nearly six-

pence. Since, of course, re-charging must be carried out after roughly ten hours' listening, such a consumption of L.T. would soon prove too much for even the "output-watts-at-any-cost" type of experimenter. Where electricity is charged for at sixpence per unit the cost would be prohibitive.

Achieving Lower Running Costs.

It occurred to the writer that the problem deserved a little investigation and, after some deep thinking, a method of supplying the L.T. needs of his valves' voracious filaments at lower charging costs was evolved.

Briefly, the idea was to use small cells in parallel for running the set and to connect them in series for charging. Each 60-ampere-hour cell was, therefore, replaced by three 20-ampere-hour cells and the six connected up to the set as shown.

For charging the six cells were connected in series with each other and with the bowl-fire.

Working It Out.

With this arrangement the charging is complete in one-third of the time that would be required for the 60-ampere-hour cells and, consequently, at one-third of the cost. Actually, of course, it takes a little longer than one-third of the original time since charging is only at 218 volts because the mains voltage is "backed off" to that figure by the 12 volts of the series connected cells.

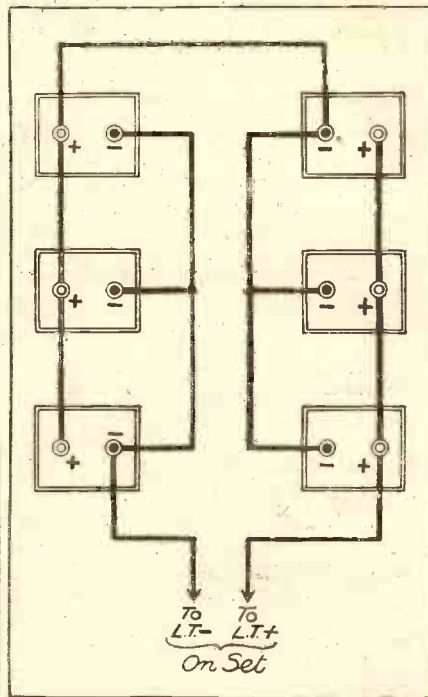
The resistance of the bowl-fire (since it passes 2 amps. when charging two 2-volt cells) is 113 ohms, so when charging six cells the current passing at the reduced mains voltage drops to 1.8 amps. This is so nearly 2 amps. that for all practical purposes the charging time for the six

20-ampere-hour cells can be regarded as exactly one-third of that taken for the two 60-ampere-hour.

Initial cost is, of course, the chief snag in this arrangement. The purchase-price of the two 60-ampere-hour cells was thirty shillings, whereas the price of six 20-ampere-hour cells was fifty shillings.

The difference of twenty shillings is, however, very soon recovered, especially if electricity is paid for at more than a

PARALLEL WIRING



The cells are connected in series - parallel grouping for running the set. This provides a terminal voltage of four and a capacity of 60 ampere-hours from the six 20-ampere-hour cells.

penny per unit, and the serious experimenter who charges from D.C. mains would do well to consider purchasing a number of small cells in preference to an accumulator of high ampere-hour capacity.

PUSH-PULL CIRCUITS OF THE FUTURE

(Continued from previous page.)

full use of normal components. The possibility of trouble due to parasitic oscillation can be successfully overcome.

Let me now give you in brief a few examples of the practical application of the balanced-valve system, commencing with the push-pull detector of Fig. 2. This is arranged so that neither a centre-tapped coil nor grid condensers are required. Due to the process of grid rectification, the resultant L.F. signal is in phase in each anode circuit, so that a parallel connection of anodes is required, unlike the push-pull amplifier where the amplified signals are 180° out of phase and would cancel out with such a connection. The H.F. components of each detector, on the other hand, are 180° out of phase, and so cancel out at the common output connection.

This results in the virtual elimination

of the Miller effect with a consequent improvement in results. At the same time, that pernicious cause of instability—leakage of H.F. past the detector—is almost completely removed. You will see that a Class B valve can easily be used in this circuit.

The push-pull detector is particularly valuable for short-wave reception, as you will find an absence of threshold-howling tendencies, together with better selectivity and smooth reaction control. At present a centre-tapped reaction coil is necessary, but I hope to show before long how to set up a short-wave circuit with normal tuning coils.

R.C. Coupled Push-pull.

Next we come to the paraphase amplifier, which is composed of one or more balanced-valve stages forming two separate amplified chains, the signal through one being always 180° out of phase with that in the other, recombining in the output transformer. A very high order of purity, with large power and rock-like stability, is thus obtainable.

A simple example of the method is the single stage of Fig. 3, shown driving a Class B output valve, which I can recommend as a really worth-while proposition for anyone who wants a first-class amplifier. This circuit also shows how to dispense with a centre-tapped input transformer. The input is fed by an R.C. coupling to V_1 , and since the anode current is 180° out of phase with the input grid volts, we can get the necessary out-of-step grid volts for V_2 by tapping off some of the voltage drop across the potentiometer connected between the anodes. The slider is adjusted so that a minimum sound, or none at all, is heard in 'phones connected at X. Grid bias of V_1 and V_2 is also adjusted, separately for each valve if necessary, until both anode currents are equal.

Notice that no centre-tapped primary is required on the coupling transformer, as this circuit uses a special scheme of connections which I have developed to enable an ordinary driver transformer to be used in front of the Class B valve.

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1 BRITISH RADIOPHONE three-gang -0005-mfd. tuning condenser, type 604	1 0 0
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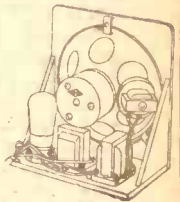
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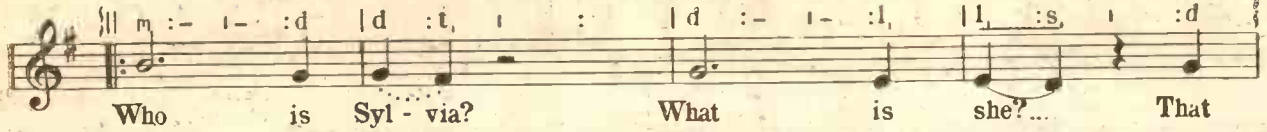
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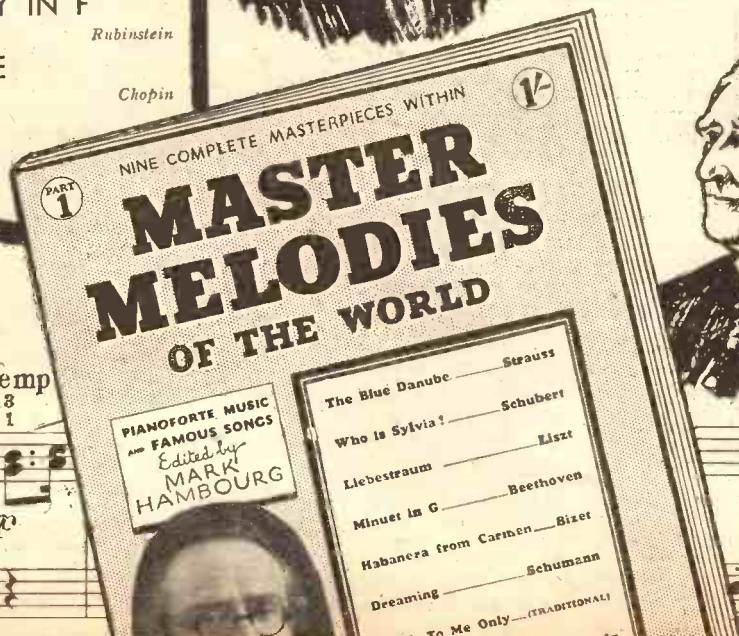


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RADIO STEP-BY- STEP

OUR SPECIAL
SUPPLEMENT FOR
BEGINNERS

WE have planned this new Beginners' Supplement on the most ambitious lines, and when, in due course, it gets into its stride I think readers will agree that it is definitely wider in its scope and more interesting than anything previously attempted.

This week we are confining ourselves to a "clearing of the decks," as it were, and the next Supplement will be larger and a definite start will be made in it along various parallel paths.

Complete Articles.

As far as is possible, each article will be made complete in itself and "serialising" avoided. At the same time, we shall work towards the goal of equipping our readers with a thorough all-round understanding of the whys and wherefores of wireless.

But don't imagine for a moment that you are to be confronted with an academic course of dry-as-dust theory, or that we shall adopt the attitude of the pedagogue.

We have a very definite attitude of mind towards this "beginners' stuff," as some lordly technicians are pleased to call it, but it isn't one that underrates either the importance of the subject or the intelligence of the average reader of a radio journal.

As a matter of fact, I consider such articles are decidedly harder to write *properly* than the most advanced thesis. And inasmuch as they are ostensibly directed at a vastly wider public they obviously deserve the greatest care in preparation.

Fact Selection.

Anyone with a smattering of knowledge can write elementary articles of a sort. Many attempt it; the majority fail to achieve success. The bookstalls are always littered with foredoomed failures of this kind.

You see, it is not so much a matter of simple fact collection and presentation as fact *selection* that really matters. One must know what to leave out as irrelevancy as well as what to include.

And then, even more important, one must avoid pedantry, condescension and undue familiarity.

Incidentally, many more people write for themselves than for others! At this point you might well ask what we are writing these articles for.

Well, you can take it from

this word deliberately) his time painfully stuffing himself with facts while there exists (and doubtless always will exist) numerous bulbous-browed enthusiasts who devote all their

In this, the introductory article to our new step-by-step beginners' series, Mr. G. V. Dowding, "P.W.'s" Technical Editor, describes how the reader will be guided by easy stages along the road to radio knowledge. Every article will be, as far as possible, complete in itself, free from unnecessary technicalities and written in straightforward language. Every radio enthusiast should read this splendid series.

me that if we don't make tens of thousands of you "P.W." readers come to the conclusion that we are writing for you, then we shall regard our efforts as quite fruitless.

EASY-TO-FOLLOW EXPLANATIONS

PRACTICAL HELP



Our step-by-step articles will enable the beginner to obtain a thorough understanding of the principles of radio and will be of the utmost practical value to all set constructors.

And that brings me to the next point. Why should you want to know the "whys and wherefores" of wireless?

Now, you needn't think I'm going to dissertate upon the value of learning for the mere sake of learning. I am not, because I don't believe in it.

Not Academic.

There are depths of academic knowledge that it is not worth while plumbing if you are an ordinary sort of human desirous of getting the most out of life.

And, in any case, why should any normal human waste (I use

living hours to the compilation of encyclopedias and other types of works of reference?

To know where to look for your facts, and to be able to interpret them when found, is

such, but, believe me, the cogs of life gain just as much of their driving force from "practicians." "Theoreticians" make laws and inscribe them in great tomes; "practicians" mould these laws into shape and apply them to practical ends.

No, we are not going to place indigestible wads of theory in front of you. If we did you'd probably turn over the pages without reading them; and I wouldn't blame you

Fascinating.

But we shall, among other things, try to make you see that there is fascination and value in accounts of the processes underlying the working of your radio sets.

You know, it is a very different thing from studying, say, some narrow, scientific subject, however interesting that might be to some folk.

A fairly thorough knowledge of how a radio set works at once places one in a position to criticise constructively whether a set is working as well as it should work and, if necessary, to effect adjustments and repairs.

And, on top of that, all such electrical affairs as bells, lighting, vacuum cleaners, fans, car ignition and so on are swept within your comprehension.

That, you will have to admit, is rather useful, to say the very least of it.

Short Cuts.

Note, I have said little or nothing about the pleasure that is to be obtained from knowing "what makes the wheels go round." But that is an abstract quality. And I have shown that there are enough and to spare of concrete advantages in this "little learning" which, far from being "dangerous," is in fact of extreme practical value.

That the theory of electricity and radio can be shown as a beautiful thing, its individual components fitting together with the perfection of a wonderful mosaic, is only one of the things which will enable us to render our articles supremely readable.

I am convinced you'll not only want to read our articles but will like doing so! You'll have to proceed "Step-by-Step" if you want to go all the way with us, but we've got some cunning short cuts to show you.

all that one really needs to be able to do. That, to the educationalist, may sound rank heresy, but it is plain common sense.

A Good Recipe.

Nevertheless, although "an ounce of practice may be worth a ton of theory," you simply must have some theory. I like the sound of "an ounce of theory and a ton of practice." That seems to me to be an excellent recipe.

There always will be great "theoreticians"; some men are constitutionally made to be

Special Beginners' Supplement—Page 2.

WHAT a wonderful thing broadcasting is! To think that a voice speaking in, say, New York or Sydney can be heard in England with the aid of nothing more than the simplest of apparatus, such as any "handyman" can construct for himself!

The Pioneers.

Haven't you ever thought about it? marvelled at the idea of this medley of ether-borne voices, music, drama spreading outwards in all directions to be picked up hundreds and even thousands of miles away, and providing entertainment in the homes of millions of listeners?

I wonder if great pioneers like Hertz, Lodge and Marconi realised that the whole world would be linked by wireless within thirty years or so of their early experiments.

For it was Hertz who first discovered that energy could be transmitted from one place to another without the aid of wires.

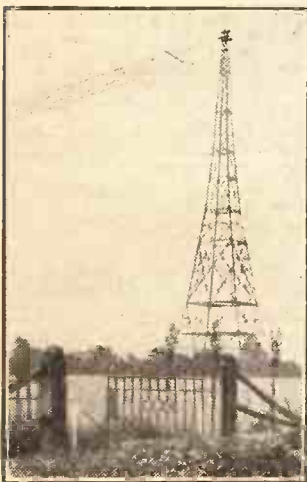
His apparatus was crude—his "broadcasting" consisted of transmitting and receiving an electric spark. His transmitter and receiver were separated by only a matter of a few feet.

Early Experiments.

But his experiments proved beyond all doubt that wires were not essential for transmitting electrical energy from one point to another, and laid the foundation of a science that was to revolutionise communication and ultimately to create a world chain of broadcasting stations.

It was left to Marconi to commercialise the results of Hertz's experiments, and it was Marconi who demonstrated the fact that actual messages could be sent

LONDON'S AERIAL



The London Regional transmitter is situated at Brookmans Park and radiates programmes on two wavelengths. One of the giant aerial masts can be seen above.



By A. JOHNSON-RANDALL.

over long distances with nothing to link the transmitter and receiver except space.

Commercial Communication.

At that time Marconi was concerned only with commercial communication between ships and places. A code of dots and dashes was used to represent letters of the alphabet, and it wasn't until after the war that broadcasting, as we know it to-day, became a practical possibility.

Those who first heard the cheery voice of "P.W.'s" Chief Radio-Consultant during those never-to-be-forgotten impromptu concerts

to Writtle would have been sceptical had they been told that in a little over ten years there would be nearly six million licensed listeners in this country alone.

Broadcasting owes a debt of gratitude to P. P. Eckersley, for it was he who gave us our appetite for radio; he who controlled the technical side of the old British Broadcasting Company; and he who planned the Regional scheme.

And since those early days of Writtle radio has improved out of all recognition. Vast strides have been made both in transmission and reception. Receivers have increased in sensitivity; the reproduction of speech and music has become indistinguishable from the real thing; and there is now a choice of, not one programme, but dozens.

Hundreds of Stations.

In Europe there are some two hundred and fifty stations sending out programmes for those who care to listen. In Great Britain the B.B.C.'s Regional scheme provides a wealth of entertainment throughout the day for a mere ten shillings a year. And with the recent opening of the Western Regional station every town and village has a regular and reliable service.

The Western Regional completes the broadcasting chain in so far as Great Britain is concerned. There are five Regional transmitters which operate on the medium waves. These are the London, Midland, Northern, Scottish and Western transmitters.

A Long-Wave Alternative.

Each of them has a service area embracing the densely populated portions of England and Scotland. Those listeners who are situated on the fringe of any of these areas are catered for by the Daventry long-wave station or by local relays.

In Ireland the equivalent to our Regionals is the powerful Athlone transmitter whose studios are in Dublin.

Incidentally, it is as well to remember that Broadcasting House has no actual transmitting apparatus apart from experimental equipment.

When broadcasting first started under the regime of the old British Broadcasting Company the transmitter and studios were both situated in Marconi House, although the latter were later moved to Savoy Hill in the Strand. So the station could truly be called the London station.

Suitable Sites.

But the Regional scheme altered all this. It was obvious that the great aerial masts and station buildings could not be accommodated in the middle of a city, so the B.B.C. looked round for a suitable open spot as near London as possible.

Finally Brookmans Park, near Hatfield, was decided upon, and this became the site of the transmitter for the London Regional.

The programmes are controlled from, and the studios are situated in, Broadcasting House, which is the B.B.C. headquarters.

In the same way the other

Regionals have their transmitters in some convenient open space, while the studios themselves are accommodated in one of the big towns in the area.

Some of their programmes are also supplied from the studios at Broadcasting House, being sent over the Post Office telephone system to the area headquarters and then distributed via the Regional transmitter for that area.

"Land-Line" Links.

The Post Office telephone wires are used quite often in broadcasting. Apart from carrying programmes from the various studios to different Regional areas, they are employed for outside broadcasts.

If, for example, the B.B.C. wished to relay a concert from, say, Liverpool via London Regional, it would utilise the 'phone system for carrying the programme from Liverpool to Broadcasting House, which would then be passed on to Brookmans Park for transmission to the London area.

In addition to the transmitters which supply programmes to listeners in this country there is also one which sends them to the far-flung outposts of the British Empire.

On Short Waves.

This transmitter is at Daventry, and its aerials are arranged so as to be directional towards the countries they serve. In this way the B.B.C. is able to transmit news and musical items to Canada, South Africa, India and our other Colonies and Dominions, thus keeping them in touch with home and so helping to bind our great Empire together.

It is fascinating to know exactly how the programmes travel from place to place, and how it is possible for them to be picked up and reproduced in a loudspeaker using quite simple apparatus. But we must leave this for future articles.

IN THE STUDIO

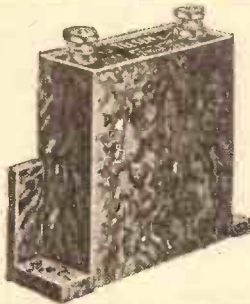


The actual studios from which the broadcasting originates are usually in a building remote from the transmitter itself. The various items from the studios are sent by "land-line" to the transmitting station in that particular area.

TELSEN

PAPER MICA and ELECTROLYTIC

CONDENSERS



TELSEN PAPER CONDENSERS

Subjected to rigorous tests up to Post Office and Admiralty standards, the exclusive method of construction making them genuinely non-inductive. They give the highest insulation with complete freedom from breakdown—built for lasting efficiency under all conditions. Specially designed for 2-way fixing.

Cap. mfd.	500 Volt Test	1,000 Volt Test	Cap. mfd.	500 Volt Test	1,000 Volt Test
.01	1/3	1/9	.5	1/6	2/-
.04	1/3	1/9	1	1/9	2/6
.1	1/6	2/-	2	2/6	3/6
.25	1/6	2/-			



TELSEN MICA CONDENSERS

Adaptable to flat and vertical mounting. H.F. losses, even in the larger sizes, have been virtually eliminated. Grid leak clips supplied free with the smaller capacities. In capacities of from .0001 mfd. to .001 mfd. **6D.**

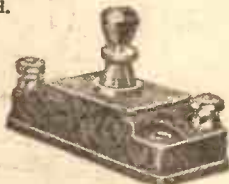
.002 = 1/- .006 = 1/3



TELSEN TAG CONDENSERS

Of compact and sturdy construction. May be mounted on either insulated or metal panels. Tags enable the condensers to be connected to any other components, either directly or by soldering. H.F. losses are negligible. In capacities of .0001 mfd. to .001 mfd. **41D.**

.002 mfd. 6d.



TELSEN PRE-SET CONDENSERS

Give widest variation between maximum and minimum capacities, and exceptional range of selectivity adjustment when used in the aerial circuit. High insulation with low loss. In mfd. capacities of from .0001 to .002. **1/3**



TELSEN High Voltage Dry ELECTROLYTIC CONDENSERS

An outstanding achievement in condenser design.

Excellent for use in smoothing circuits and other positions in which high voltage high capacity condensers are required. The special bracket and terminal supplied with the condenser enables it to be mounted on any type of base-board or chassis.

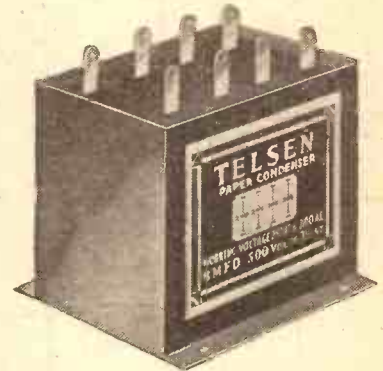
Cap.	275 working peak voltage
4 mfd.	3/6
6 "	3/9
8 "	4/-
Cap.	500 working peak voltage
4 mfd.	4/6
6 "	5/-
8 "	5/6



TELSEN Low Voltage ELECTROLYTIC CONDENSERS

Ideal where a very high capacity with a fairly low voltage is required, as in automatic bias circuits for L.F. valves. Very compact, with wired ends for easy suspension in the wiring.

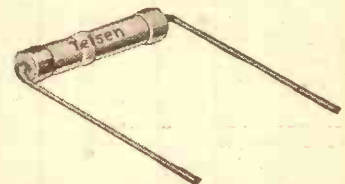
25 mfd. at 25 volts	2/6
25 " at 25 "	3/-
25 " at 50 "	3/-



TELSEN PAPER BLOCK CONDENSERS

Represent a definite advance in current condenser practice. In metal cases with soldering tags.

Cap. mfd.	500 Volt Test	1,000 Volt Test
4	4/9	6/6
6	7/-	9/6
8	9/6	



TELSEN RESISTORS WITH WIRED ENDS

Very small and light, and easily suspended in the wiring of a receiver. Supplied in the following values: Power rating of 1/2 and 1 watt: 250, 500, 1,000, 1,250, 5,000, 10,000, 20,000, 25,000, 50,000, 100,000, 250,000, 500,000 ohms resistance. Price **1/-**

Power rating of two watts: 250, 500, 1,000, 1,250, 5,000, 10,000, 20,000, 25,000, 50,000, 100,000 ohms resistance. Price 2/-



TELSEN SMALL TUBULAR CONDENSERS

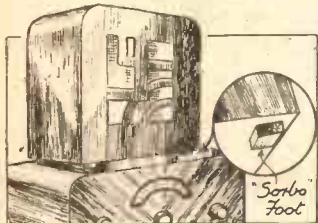
Very small yet highly efficient, with wired ends for easy suspension in the wiring.

Cap.	Price	Cap.	Price
.0001 mfd.	1/-	.002 mfd.	1/-
.0002 "	1/-	.005 "	1/-
.0003 "	1/-	.006 "	1/-
.0005 "	1/-	.01 "	1/3
.001 "	1/-	.1 "	1/6

TELSEN FOR EVERYTHING IN RADIO
ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM



PREVENTING VIBRATION.
 IF a loudspeaker be placed on top of the receiver, detrimental vibration may be transmitted to the set.

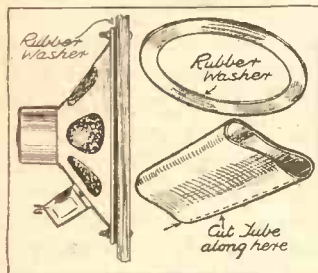


Insulated by rubber.

All this can be avoided by cutting pieces of "Sorbo" sponge and gluing these as feet to the speaker cabinet.

TO IMPROVE QUALITY.

A NOTICEABLE improvement in quality can be made if, instead of mounting the chassis of a M.C. direct on to the baffle, a large rubber "washer" be placed between baffle and chassis. The "washer" is made from an old motor-car inner tube (any garage will give you one).

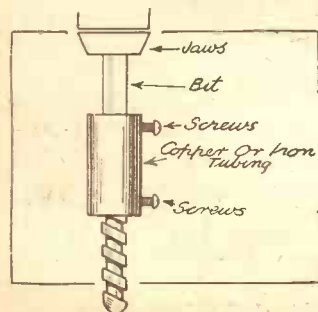


A scheme to prevent rattles.

Cut a "slice" off the tube about 1 ft long; cut this again, as shown in sketch, so as to form a flat sheet. On this sheet describe two circles, having the same centre, the size of the inside circle being the same diameter as the inside diameter of the chassis-mounting ring, the outer circle being, of course, the size of the outer diameter of the loudspeaker chassis. Mount as shown in sketch.

A DRILLING HINT.

SOMETIMES when fixing a cabinet together by pieces of dowelling you drill the hole too far, consequently producing a bad joint. A piece of

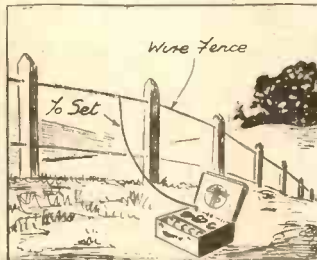


An aid to drilling.

copper tubing helps greatly. Fix two screws into the tubing, and then it can be fitted on the bit at the desired position to act as a stop.

WHEN YOU'RE HIKING.

WHEN wireless fans go hiking they often take a portable set with them. For reasons of weight this is necessarily a somewhat "skimpy" affair, with a rather limited range. Naturally, the aim is to get the most out of it.



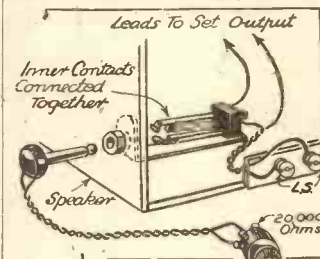
It's well worth trying.

The set may be attached to a wire fence in order to increase the pick-up;

set is installed it is a great advantage to be able to control the volume in the same room, and, better still, an arm-chair volume control will be found a real boon.

The control recommended is a variable high resistance of, say, 20,000 ohms, in series with the speaker. The resistance should be mounted at the end of two or three yards of flex, the other end terminating in a plug. A double-circuit jack is mounted on the speaker cabinet at the back or side and wired as shown in the diagram.

When the plug is inserted the resistance is wired automatically in series



Just plug it in.

ONE GUINEA FOR THE BEST WRINKLE!

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 is. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles." Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

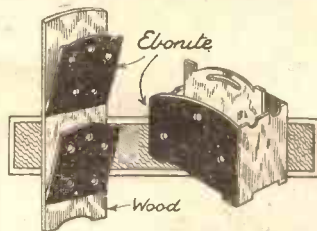
The best Wrinkle last week was sent by Mr. S. Holmes, 96, Carbrook Street, Sheffield, 9, to whom a guinea is being awarded.

but if the fence is a long one the chances are that oscillation will be stopped completely.

To get over this difficulty it is only necessary to wrap about 10 or 20 turns of insulated wire around the wire of the fence, continuing it to the set. The wire should not be in actual contact with the wire of the fence, as the connection is purely a capacitive one. The effect of this simple expedient is often surprising.

THAT OLD EBONITE.

HAVE you ever thought of making things out of your old ebonite? I have cut up a couple of old panels and made letter-racks out of them.



Suggested rack designs.

Wherever the holes come put another the other side the same size to balance the pattern. I found it quite easy with the aid of a hacksaw and a couple of drills.

FOR REMOTE CONTROL.

WHEN listening to a speaker in a room other than that in which the radio

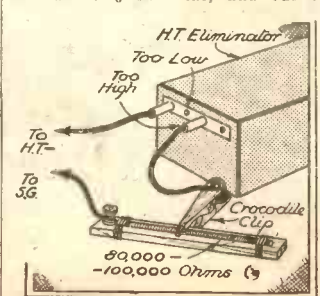
with the speaker, and when withdrawn the jack short-circuits itself.

Another jack can be fitted to the wireless set and similarly wired, in order that the remote control can be plugged into it when the self-contained speaker is being used. It is assumed that choke-filter output is being used.

VOLTAGE VARIATION.

THOSE who run their sets from an eliminator with fixed tapplings and have difficulty with the taps to the screening grid of the S.G. valve, one being too high and the other too low, and who have a spare 100,000-ohm fixed spag. resistance by them, might try the following:

Cut off with the scissors one end of the spag. and withdraw carefully the wound wire. Find a thin piece of wood, say not more than 1/4 in. thick and about 1/2 in. wide, and cut to



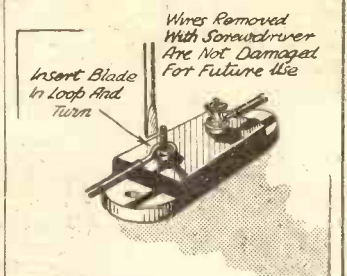
Adjustable to suit your valves.

length of wound wire. Cut off two portions of the stiff covering originally on the resistance about 1/4 in. long, and slip one to the end of the wire and the other piece at the other end. Lay the wire carefully on the wood and bind the ends with a waxed thread or strong linen thread.

Cut the lead from H.T.+S.G. tapping, and solder the end going to the set to the end with the terminal on, and leave the other free; solder on to the lead coming from the H.T. eliminator a crocodile clip. Plug into the tapping which is too high and try the clip on different portions of the wire until the best position is reached. Then it may be left alone.

REMOVING WIRES.

IN removing a wire from a condenser terminal with pliers, the terminal pillar may easily be damaged and the

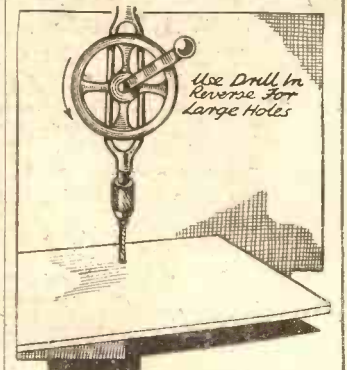


Ease it with a screwdriver.

loop spoiled for future use. A better and easier way is to insert a screwdriver in the loop, and by turning this outwards the loop is made large enough to allow the wire to be raised from underneath. When using wire again it is only necessary to place it around terminal and close the loop with pliers.

REVERSE DRILLING.

PANEL chipping and drill jamming when drilling large holes in panels can be got over as follows: First drill a small guide hole and then select



Saves those nasty chips.

drill to size of hole required and drill in reverse from both sides of panel. By this method the pull of cutting edges is away from the material. If the large drill is fixed tightly in chuck it will not become loose unless great pressure is applied.

(Continued on page 210.)

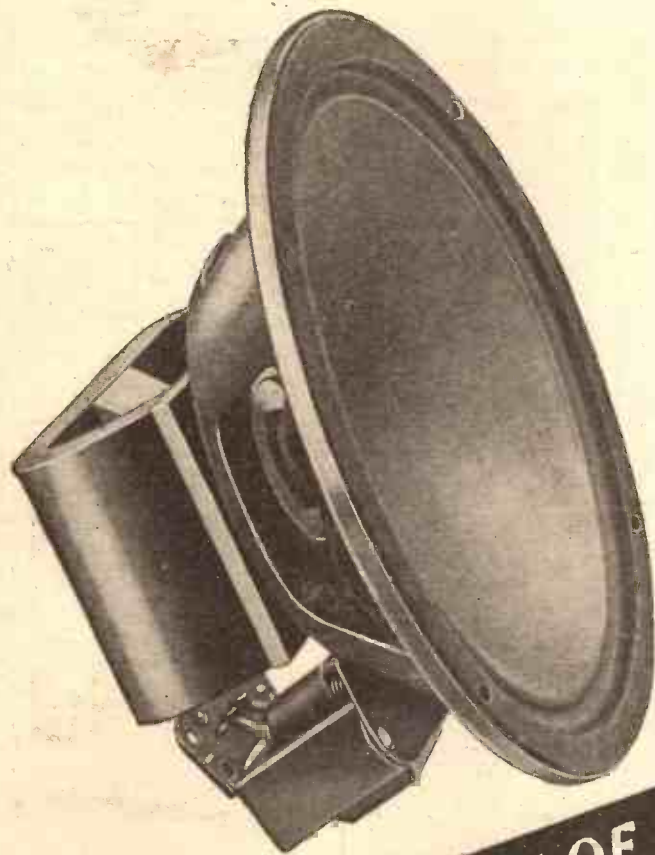


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MOVING COIL CHASSIS**

To get the utmost in enjoyment from your Class B circuit, you need a 'speaker that's specially designed to handle this particular type of output. Such is this Ormond 'speaker. Choose it for this reason, and also because its name guarantees you the utmost in Quality and Value. In performance it compares with many much higher-priced products, giving a delightfully faithful response throughout the entire frequency range, with neither booming in the bass nor shrillness in the treble. It is supplied with an output transformer specially designed for Class B circuits. Overall size: diameter 8", depth 4 1/4". Cat. No. R/475 C.T. Price



Also supplied with output transformer for use with high-efficiency Pentodes. Cat. No. R/475Z, and for normal outputs Cat. No. R/475.

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A MASTERPIECE OF QUALITY PRODUCTION!

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FOR PUNCH · POWER & PURITY !!

RECOMMENDED WRINKLES

(Continued from page 208.)

"SKINNING" WIRE.

HERE is a wrinkle for skinning wire such as "Glazite" or systoflex sleeving:

Into the ordinary side-cutting pliers drill two or three holes of consecutive sizes, as illustrated. The pliers should

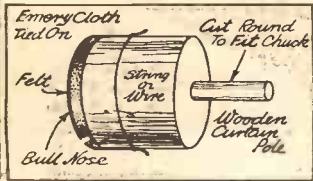


Ideal for set construction.

be clamped in a vice for this purpose. If the wire to be skinned is first pinched in the appropriate hole and, without loosening the grip too much, the pliers are given a drawing motion, the sleeving will be found to be cut cleanly at the required point, leaving the wire ready to be bent round the terminal.

A USEFUL POLISHER.

THE home constructor often requires to polish up panels, screens or home-made components, etc



For finishing off.

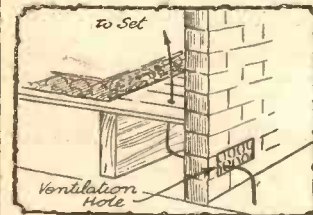
A handy polisher can be made from a piece of curtain pole, cut down so as to fit into the chuck of a hand-drill. The "business end" of the polisher can be pared to various shapes to suit the particular job on hand. "Bull-nosed" and "pointed" are the most suitable.

When prepared, the wooden shaft is first covered with felt (ghed on if you like), and then emery cloth is tied around the whole.

Medium emery cloth and then fine give a frosted effect to any flat surface, and the finish can be buffed by replacing the emery cloth by felt.

YOUR EARTH LEAD.

WHERE a buried earth is used outside a window there is often a ventilating brick to be found



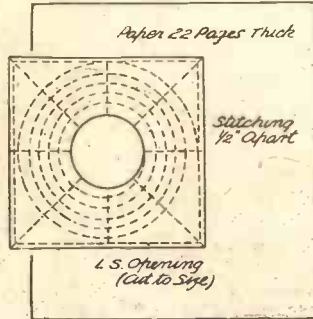
Saves those trailing wires.

under the latter which is a convenient exit for the earth wire. All that is necessary is to bore a hole in the floor sufficiently large to take the earth wire, which is then pushed into the hole, having previously made a small loop at its end.

With another stout wire this loop can then be caught and pulled through the ventilating brick to be joined to the earth. There will be no damaged earth wire on account of window slamming and no necessity to bore an unsightly hole in the window frame. The hole should be as near the skirting as possible for neatness.

TO STOP BOOM.

THE following scheme will be found quite successful for lining thin loudspeaker cabinets. Take a newspaper (about 22 pages thick), mark out a circle for the loudspeaker, and cut the



This idea reduces box resonance.

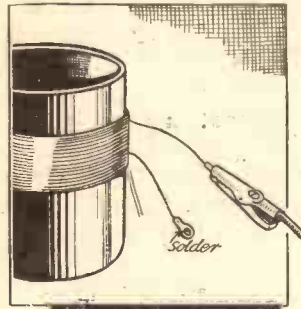
paper to the inside size of the front of the cabinet. Place the paper in a sewing machine and stitch round the loudspeaker opening, running rows of stitching about half-inch apart to the full size of the paper.

A row is then run round the outside, and several rows radiating from the centre to the outside. The opening for the loudspeaker is then cut out. Two of these are made, glued together and into the front part of the cabinet.

In some cases it may be as well to line the sides of the cabinet in the same way.

FOR GOOD GRIP.

OH those crocodile clips that bite and yet don't "bite"! Numerous sets are in use which utilize coils wound with a fine-gauge wire, and various tappings are formed on the aerial and grid windings by means of a loop in the wire. The bite of the clip on these fine loops is anything but certain, so when using one of these coils attach a little blob of solder on the end of each loop. Better still,

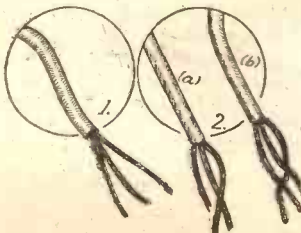


Something to hold on to.

solder one of those small tags one finds on the terminals of most wireless components to each tapping. The result is always a good, firm connection.

CONDENSER REPAIRS.

VARIABLE condensers using a pigtail connection to the moving vanes sometimes cause very undesirable crackles, particularly on short-wave sets, when used for tuning purposes. This is often due to broken strands in the pigtail.

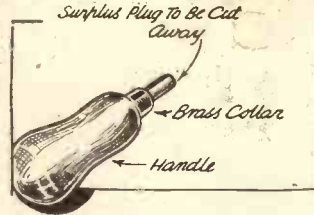


Plaited pigtails from flex.

Instead of replacing the pigtail with ordinary flex, it is a good plan to make a new one. Take some ordinary flex and bare about four inches of it. Untwist the strands. Remove any broken ones and divide the wires into three sections (1). Then plait the three sections together as in (2), when a serviceable pigtail will result which can be cut to the length required.

RENEWING TOOLS.

ONE often sees in tool chests old handles of bradawls and their blades lying about. Here is an idea that I think will make use of these once again. When the blade turns round in the handle, it should be

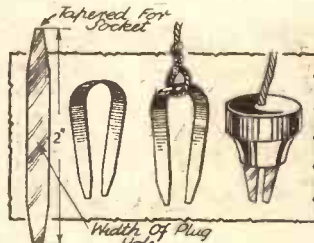


A "Rawplug" does the trick.

removed, and one of those "Raw-plugs" tapped into the hole. Then cut away any surplus and once more insert blade till it is right home. This will secure blade again and put it once more into service.

NEW PLUGS FOR OLD.

SOMETIMES it happens that one breaks a wander-plug in the H.T. battery and has no spare one. A new one can be made as follows: Take a piece of springy brass, say from the side of a flash-lamp battery.



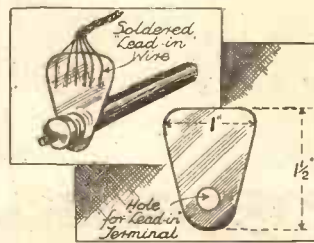
An easy repair.

Cut so that it will fit the insulated part of the old plug, and then bend double, but do not flatten down at the bend. Taper the two loose ends to fit the socket in the battery.

Bare the flex and twist round the bend of the metal, having first passed it through the insulated part. Force the brass into this and it will hold firmly. Spring the two free ends apart by slipping a nail between, and bend slightly inwards with the pliers, when a good temporary fit will result.

A BETTER LEAD-IN.

INSTEAD of wrapping the lead-in wire round the lead-in tube terminal—where it soon gets dirty—a more permanent connection can be made as follows:

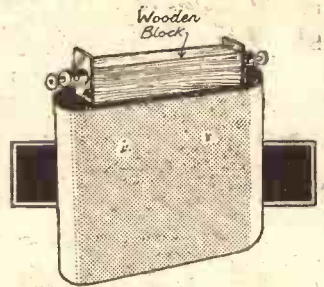


Ensuring a good connection.

Get a piece of brass or copper from the junk box, cut and drill similar to sketch and solder lead-in wire to it. Fix the "plate" to lead-in terminal and cover with a little grease. This type of connection will still be quite clean even after months of service.

BATTERY COUPLING.

WHEN joining up flash-lamp batteries to form a G.B. or H.T. battery difficulty may be experienced in making a satisfactory connection between the contact tabs and in providing tappings for intermediate voltages.



Well worth the trouble.

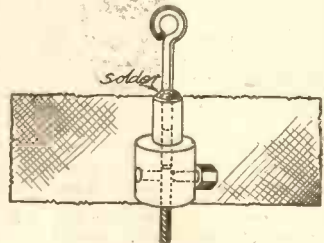
Holes may be drilled through the contact tabs and small terminals fixed, but with this method the tabs may easily touch and cause a short circuit.

A better method is to fix the tabs to a wooden block. Obtain some strips of dry hardwood, half-inch square, and cut them into strips that will just fit between the two tabs when they are vertical. One will be required for each battery and they may be shelaced if desired.

Next cut off the tabs so that they stand up a half-inch and drill a hole through each. Place the block between the two tabs and fix them with small terminals fitted with wood-screw shanks. The terminals may then be connected up as required with short pieces of wire.

NIPPLE ADAPTORS.

A SOLDERLESS nipple can be bought from any cycle shop for one penny, and can be used in quite a



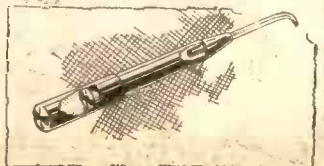
Useful in many ways.

number of ways in a wireless set. First of all make a loop on a piece of connecting wire, and then solder the straight end into the nipple, as sketch. This can be used in a short-wave set where coils have to be changed.

Instead of unscrewing a terminal each time just undo the set screw. It is very handy also for connecting 'phone leads or pick-up, or extra loud-speaker where provision for such is not already made.

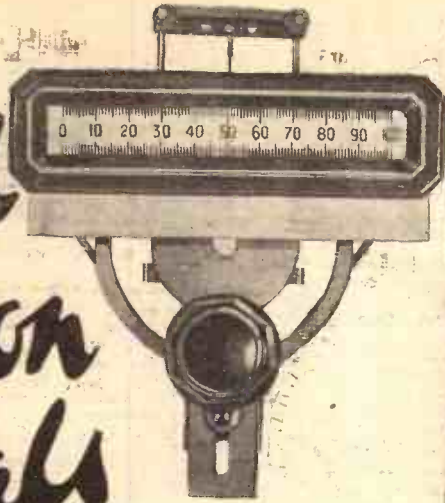
A SIMPLE BLOW-PIPE.

THE blowpipe shown is made from a fountain pen and about six inches of tubing. The tubing is pushed into the end of the pen body, and, if a good fit, need not be stuck in position. The other end of the body is drilled, and cap is retained to keep the mouth-piece clean and free from dust. The arrangement makes a neat and useful tool for the wireless man or mechanic.



Uses an old fountain-pen!

Full
vision
dials



W 330 and 333 are the latest form of the straight-line dial. With these dials the scale is always in view and is traversed by a moving pointer.



6/6
EACH

UTILITY were the first straight-line dials offered to the constructor. Naturally there are others: the idea was so good it was bound to be copied.

But here is a new Utility full-vision dial, the finest dial now available. The friction drive gives perfect control of any type or size of condenser and is guaranteed free from backlash. The bold scale is always in full view and the hair-line pointer enables very accurate readings to be made. The new dial is supplied in two types, straight line and oval, and with each the pointer remains upright at all positions. This important refinement adds to our assembling difficulties but ensures accurate readings for you by avoiding parallax errors.

The dials can be supplied marked in degrees 0-100 or in wavelengths.

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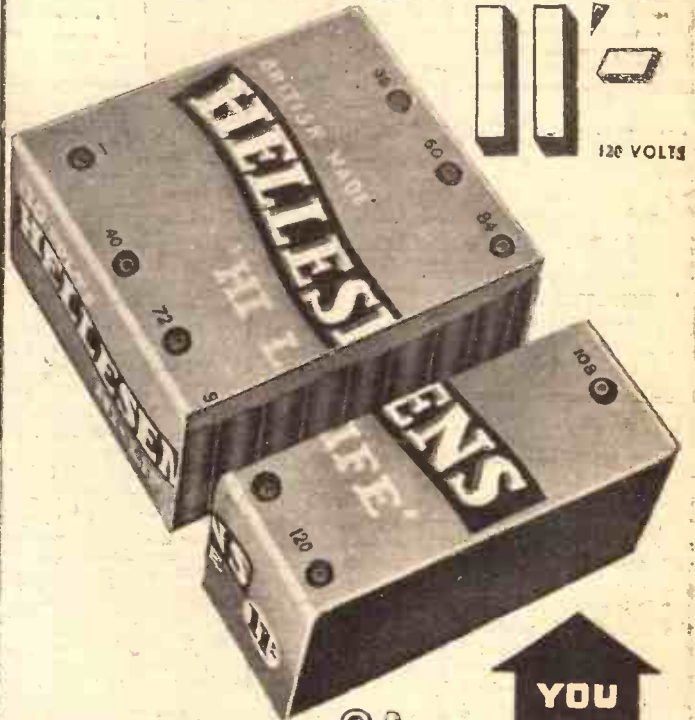
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RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.



Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

For instruction in this, and as a general guide to short-wave success, you should watch the Short-Wave Notes, by W.L.S. (every week in "P.W."), for conditions are always changing, new stations crop up, and programme times alter in a way quite different from medium-wave working.

You will soon get accustomed to the operation of the controls, for it is chiefly a matter of knack. Modern short-wave operation tends to become easier and easier, but you must remember to turn the tuning dial *slowly*. As slowly as possible, in fact.

Another big difference is that you should search with the set gently oscillating. (As you know, this is not advisable upon medium or long waves.)

Note the word *gently*. The idea is to bring reaction up very gradually until the soft breathing sound

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

HANDLING A SHORT-WAVER.

F. B. (Felixstowe).—"Last night I brought home a short-wave adaptor, and got one very interesting station and any amount of 'possibles.' But I fear I am not handling it as it should be, so I should be grateful if you will tell me how it is different from the ordinary tuning.."

"It is certainly very lively in some parts of the dial. And what surprised me was the strength of the station I picked up. It was first class.

"Even so, I nearly missed it because at first I thought I had got a whistle and not a programme. As I was adjusting it, it quite

suddenly came clear, and a man with a 'talkie' voice said something about Buenos Aires. 'Hullo, Buenos Aires,' I think it was.

"He also repeated something about station 'W 2 X A F,' and said the wavelength was 31.48 metres. But then I lost it, which makes me think I am not working it properly, as it was very strong.

"Do you think this was a South American station first time? And what other stations are there near the same wavelength?"

The station that you heard was almost certainly the famous American short-waver, W 2 X A F. It is situated at a place called Schenectady (pronounced Shen-ek-ta-dee, with the emphasis on the eck, as indicated by the italics). Its wavelength is 31.48 metres, and it frequently transmits programmes for the special benefit of South American listeners, so that would explain the reference to Buenos Aires.

The distance from your aerial would be about 3,000 miles, at which range short-wave stations are often received powerfully. And very much greater distances will be quite commonplace when you are accustomed to handling the controls properly.

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them: they are just interesting points that crop up in discussions of radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

- (1) Which European country has the largest number of licensed listeners?
- (2) Is an indoor aerial just as good as one of similar shape and size placed out of doors?
- (3) Brussels has two main stations—"No. 1" on 569 metres and "No. 2" on 338.2 metres. Why does the former announce in French, instead of in Flemish, like the latter (No. 2) station?

that denotes oscillation commences, and then to keep the set in this just-oscillating condition as the tuning is slowly varied.

When you tune in a chirp (carrier-wave) slowly slack off the reaction and, if necessary, slightly re-adjust the tuning as you do so. This is called "resolving" the carrier-wave, and if it is a broadcasting station you will find that the chirp becomes a steady whistle, and then resolves itself into the programme of speech or music as the reaction is slackened, when the tuning has been adjusted correctly.

(Continued on page 214.)



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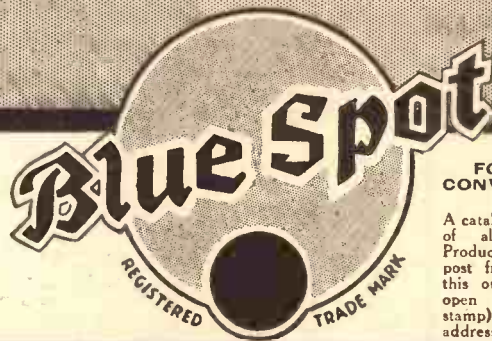
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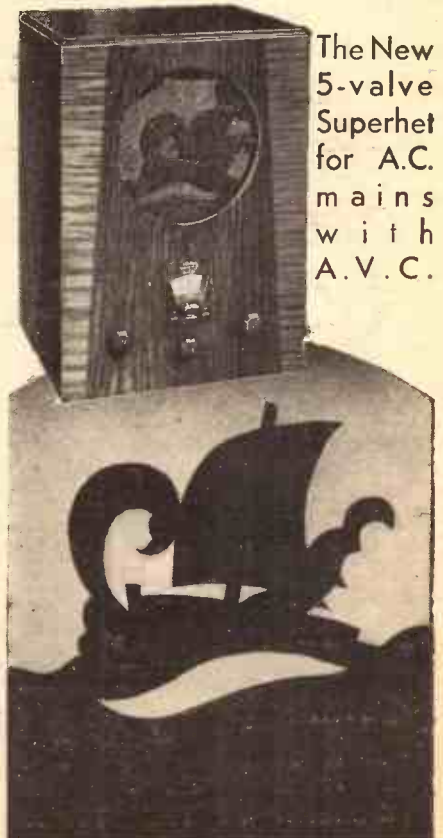
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 212.)

You will find that the short-wave stations are very close together on the dial. They tend to be concentrated in narrow wavebands.

Remember the time that you listen is very important, for not only are the programme times comparatively brief in many cases, but the strength and reliability of reception often varies enormously according to the time of day or night.

Re other stations on the short waves, see the reply to "League of Nations," who asks this week for details of the 30-40-metre stations.

BETWEEN 30 AND 40 METRES.

"LEAGUE OF NATIONS" (Dagenham, Essex).—"I am told that the League of Nations station at Geneva broadcasts on various waves between 30 and 40 metres, and should appreciate details of these.

"As my set is not marked out in wavelengths, please give also names and wavelengths of other regular short-wave programmes in this part of the waveband."

Radio Nations, H B L, has been transmitting on Saturdays, at 11 p.m., for three-quarters of an hour during summer time, but it is not certain whether he will operate at 10 p.m. or 11 p.m. when Greenwich time is being kept. His wavelength is 31.32 metres.

Another Radio Nations programme which has been transmitted at the same time as H B L's, has been given from station H B P, which works on 38.47 metres. There is also another Radio Nations transmitter, H B Q, on 40.3 metres, which wavelength it shares with Bogota, Colombia, the hours of working being irregular.

Regarding the other stations, Madrid has been on daily from 11 p.m. to 1 a.m. on 30 metres. And on 31.25 metres is Lisbon, the famous C T I A A, who generally operates on Tuesdays and Fridays between 10.30 p.m. and midnight, or thereabouts.

31.23 metres is shared by Sydney, Australia (V K 2 M E), and Philadelphia (W 3 X A U). And one of the Empire programmes from Daventry goes out on 31.3 metres.

On 31.35 and 31.38 metres respectively we have Springfield (W 1 X A Z) and Zeesen, Germany (D J A). The former works afternoons and evenings,

and Zeesen generally from 10 or 11 p.m. until the small hours.

Schenectady (W 2 X A F), is on 31.48 metres, and Skamlebaek (Denmark) relays Copenhagen upon 31.51 metres. 31.55 metres is shared by Melbourne (V K 3 M E) and one of the Empire relays from Daventry. Immediately above, on 31.56 metres, is Caracas, Venezuela (Y V 3 B C).

Poznan, Poland (S R 1), is on 31.6 metres, and Heredia, Costa Rica (T 14 N R H), is on 32 metres. Then in ascending wavelength order we have Guatemala City (T G X), London-Ont. (V E 9 B Y) and Radio Maroc (C N R). The respective wavelengths of these latter are 33.5, 34.68 and 37.33 metres.

Another Bogota (Colombia) station is on 39.7 metres.

WHEN THE ACCUMULATOR'S POSITIVE BECOMES THE NEGATIVE TERMINAL.

"ACCUMULATOR" (Birmingham).—"By a bit of luck I had a six-volt car battery given me. Not in bad condition, though it had been

not quite up to what I expected they were not bad.

"The snag was that the battery did not last as it should. And in trying it over it was noticed that, according to the voltmeter (a borrowed one), positive had turned into negative and negative into positive.

"At first I thought that the case might have been reversed and made the terminal marking wrong. But it is one of the kind built in one piece, so it cannot be that.

"What is the cause, and would this explain the results not being up to what I expected?"

We are afraid that the charging has been carelessly carried out "backwards," resulting in the reversal of the battery's polarity.

This is a serious matter for the accumulator, and we should point that fact out to the charging people and ask them what they are going to do about it.

The cause of the trouble is that the battery has been joined up to the charging supply the wrong way round, and so it has first been discharged completely and then, as "charging" continued, its polarity was reversed.

Shortened life and failure to hold its charge result from such treatment; but no doubt your poor results were also partly due to the fact that owing to the unsuspected reversal you had, in effect, joined the accumulator the wrong way round on the set.

A FAULT THAT IS DIFFICULT TO FIND.

R. P. (Cottentham).—"What is the cause of the set going very quiet and weak until the table or cabinet is thumped? This is a sure cure for it, but something is wrong to make it go like that.

"I have looked it over and cannot see anything amiss. Please advise."

This is a very troublesome fault to trace. It is due to a bad contact somewhere, and as it may be inside one of the components it is possible that even the most careful and skilled overhaul of the connections of the set will not remove it.

The best thing to do is to go over all the joints and terminal connections very carefully. Give a sharp tug at the soldered joints to see whether they are mechanically sound. A good mechanical connection is usually a good electrical one. If an inspection of the wiring fails to reveal the cause of the trouble the only alternative is to get the components tested.

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 212 ARE GIVEN BELOW.

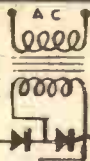
- (1) Great Britain leads the way by a considerable margin, the next competitor being Germany.
- (2) No. There is bound to be some screening indoors, and the fact that the roof is sometimes wet and conductive is a drawback, causing variations in strength.
- (3) About half the population of Belgium do not speak Flemish, but habitually use French instead. The two stations are thus intended to serve both sections of the community.

DID YOU KNOW THEM ALL?

allowed to stand aside without recharge for some weeks.

"As I had a complete set of six-volters for the old set I took the battery round to the garage and got them to recharge it. On return I connected up, and although results were

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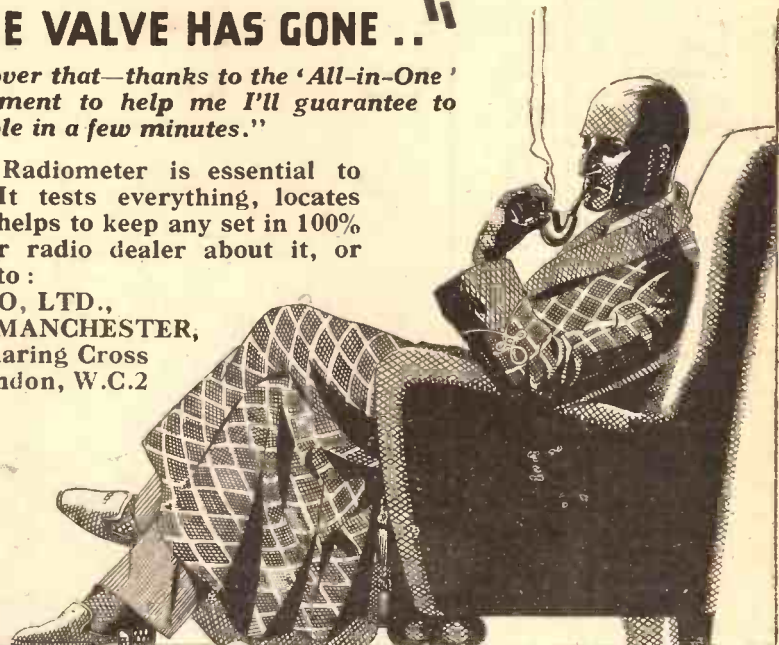
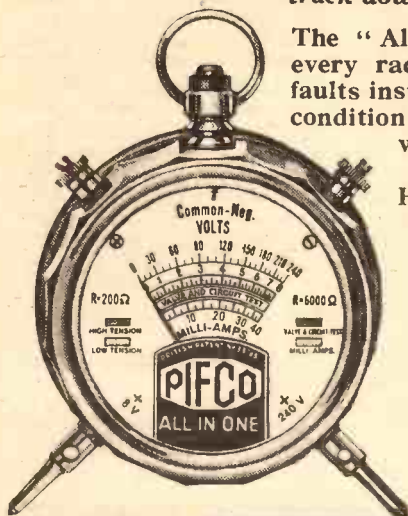
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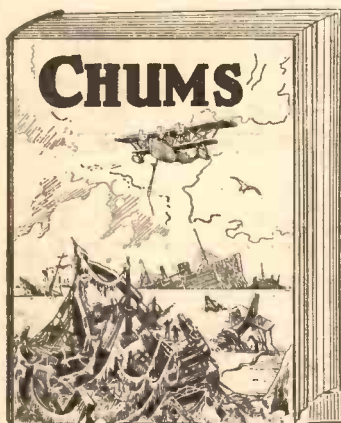
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PLUGGING IN CLASS B

A review of a new Class B loudspeaker unit produced by the New Times Sales Company. It is connected to the existing receiver by a plug-in valve adaptor and no alterations to the set's wiring are entailed.

THERE must be very few constructors who have not been carried away by the enthusiastic reception given this year to the system of amplification known as Class B. At the same time there are many who are loath to make alterations to existing sets, while desiring at the same time to enjoy the benefits which Class B undoubtedly confers.

It is these people who will be most attracted by the new loudspeaker amplifier recently put on the market by the New Times Sales Company.

Gives Maximum Efficiency.

The plug-in unit has always enjoyed great popularity since it was used for short-wave work, and the comparative ease with which such a unit can be constructed for Class B amplification has encouraged New Times Sales to produce a model which, while giving maximum efficiency both in power and quality of reproduction, will at the same time be cheap enough in price to appeal to every constructor.

In actual fact they have succeeded probably beyond their own expectations. This loudspeaker amplifier is a very fine

job, both in its commonsense construction and in actual performance.

COMPACT AND POWERFUL



The adaptor which connects the speaker unit to the set is seen to the left of this photograph. The output valve is placed in it, as shown, when the unit is in use.

While undergoing its tests in our laboratories it was plugged-in to a not very efficient three-valve receiver of a more or less obsolete pattern. Not a very fair test, perhaps, but one calculated to show up very vividly any defects in the unit. It passed with flying colours, and it did not need the second test we gave it with a new receiver to prove that the quality, even with the small baffle provided, is first class and the output sufficient for almost every need.

The layout of the unit is straightforward, a wooden panel and baseboard assembly taking the speaker and the few Class B components required. It is interesting to note that the layout is such that the windings of the transformers are in opposed planes to obviate any kind of interaction. Moreover, the adaptor plug, which fits the output valve holder of the set and acts at the same time as a holder for the valve itself, is of a new and sensible design, specially made for the job.

Suits All Valves.

The Class B valve holder is installed on the baseboard, and the two leads—one marked H.T. and the other L.T.—allow of every make of Class B valve being used.

Quite irrespective of price considerations, this loudspeaker amplifier is a fine proposition. But the list price of 59s. 6d., complete with valve, puts it at once into the realms of bargains which it would be folly for those interested in Class B to miss. And, incidentally, it is made a still more attractive proposition by an offered allowance of 10s. for the purchaser's present loudspeaker.

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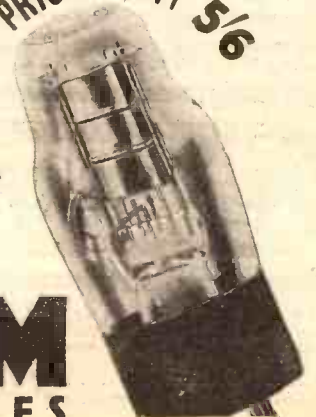


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THE MIRROR OF THE B.B.C.

(Continued from page 188.)

Margaret Balfour to Sing.

It will include the symphonic study "Falstaff," which dates from 1913; the Prelude and Angel's Farewell, from "The Dream of Gerontius," sung by Margaret Balfour, who will also be heard in a group of songs; and the Concerto in E minor, with Harry Stanier as the 'cellist.

Sir Edward is an Honorary Freeman of Worcester, and his latest composition, a part-song, "The Woodland Stream," which he wrote for performance at the Worcester Schools Festival this year, is still fresh in the minds of listeners.

A Pianoforte Recital.

The other Midland composer, Dorothy Howell, whose work comes into the programmes on Friday, October 20th, will herself give the performance in the form of a pianoforte recital.

Miss Howell, who now lives in London, was born in Handsworth, Birmingham. She studied pianoforte under Percy Waller and composition under Sir John McEwen at the Royal Academy of Music, where she is now a member of the teaching staff.

Some of her compositions have been played in concerts at the Queen's Hall, including one of Sir Henry Wood's "Proms."

An Old Favourite.

An old favourite with listeners, Miss Alma Vane, returns to the microphone on Saturday October 21st, when she will take part with Jack Wilson and Jack Venables in a programme of light tunes grouped under the title of "Knocked 'em in the Old Kent Road," from the Midland Regional studios.

Some years ago never a week passed without Miss Vane took part in the programmes from Savoy Hill, and her association with Miss Florence Oldham provided countless bright interludes of syncopated songs, sung at the pianoforte, long before somebody decided upon the word "crooner."

THE LINK BETWEEN

(Continued from page 188.)

For D.C. Mains Users.

For the benefit of "P.W." readers who are on D.C. mains I am glad to be able to pass on the news of two new Marconiphone releases. As from October 16th the Marconiphone models "272" and "276" will be available for D.C. mains operation.

In the case of the "276" the designation for the D.C. version will remain the same, but the D.C. model of the "272" will be known as the "278."

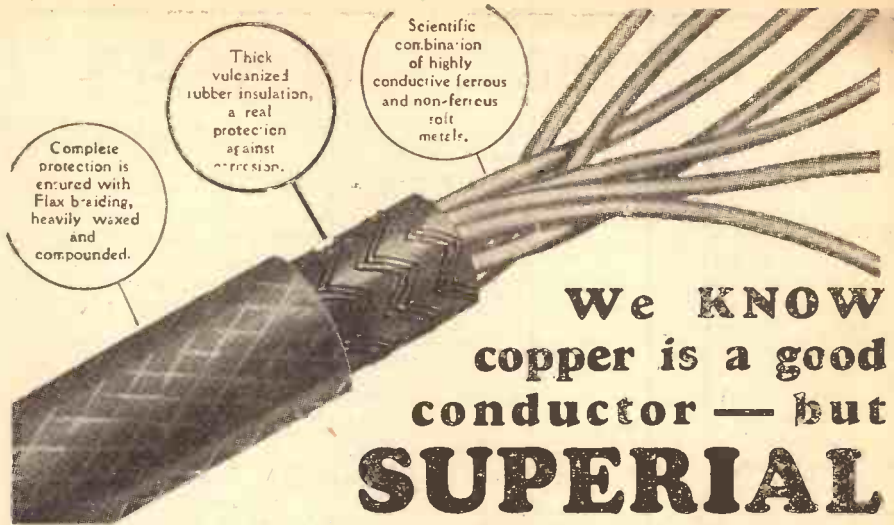
A Fine Kit Set.

What is perhaps one of the most famous of all commercial kit sets, the Lissen "Sky-scraper Three," is now sharing honours with still another addition to the Lissen family.

This time it is a seven-valve superhet, the "Sky-scraper Seven," and (on considerations of price alone it is a safe conjecture that it will be tremendously successful. At the price of £8 17s. 6d. for the kit, complete with seven valves, the new "Sky-scraper Seven" definitely brings superhet reception within the reach of all.

As a matter of fact, this new Lissen production is a very fine job, and I can well imagine that it will be in great demand. It is a single-dial controlled super which, with the aid of the Lissen Constructional Chart, is particularly easy to build; and, moreover, it is a battery set.

I extend my hearty congratulations to Messrs. Lissen, not only for having created such a first-class design at such a remarkably low cost, but also for the way in which they have prepared the constructional chart in which it is described. I am confident that it is one of the most ambitious efforts I have yet seen.



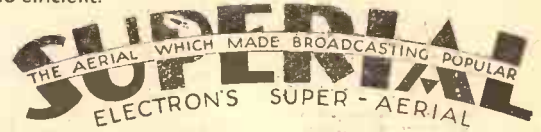
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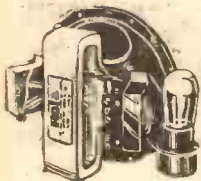
ELECTROSETS, Solihull, BIRMINGHAM.



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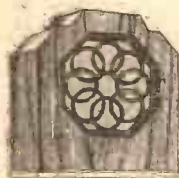
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SHORT-WAVE NOTES

(Continued from page 190.)

if co-operation from the French coast can be expected.

Personally, I have a complete transmitter and receiver all ready for 2 1/2 metres. Five metres is so dreadfully out of date nowadays! We have plenty of waste ground to fill up before we begin to encroach on Marchese Marconi's "micro-waves."

A man who ought to know tells me that the behaviour of 2 1/2 metres may be described as "like 5 metres, only more so." Personally, I think it of vital importance that some really original receiving circuits should be devised for these ultra-short waves. Our present receivers are nothing more than makeshifts.

What Would Have Happened

After all, if we had started radio down on these wavelengths, instead of working downwards from 5,000 metres or so, we should be in a very different state nowadays as regards receivers and transmitters. The development would have taken place along completely different lines.

We are faced with the anomaly, at present, of using gear that is in nearly every possible way a "cut-down" version of long-wave apparatus. Inventors, please note.

THE LISTENER'S NOTEBOOK

(Continued from page 192.)

If we are to get the best out of these talks we've to make a selection. It is impossible to listen to them all. Fortunately, as there is such a good assortment the task shouldn't be difficult.

The talks introduced by Mr. Baldwin attract me no end. Mr. Baldwin's excellent effort was first-rate publicity for the series. It is a cause for regret, however, that he isn't to speak again. I wish more speakers would cultivate his style of address or, at any rate, emulate his naturalness. One could listen to him, I think, indefinitely without tiring.

I wonder whether other listeners sensed a hint of impending danger in his concluding remarks—a danger that would challenge the Englishman's pertinacity, his love of freedom, his respect for law and the individual, his strength and his weakness about which Mr. Baldwin waxed so eloquent. Anyhow, I hope the ex-Premier wasn't playing the prophet.

The series of talks, entitled "The British Empire," introduced by the Rt. Hon. S. M. Bruce, ought to be taken as complementary to the above. They promise well, too.

The old gang—G. K. C., Sir Walford, Vernon Bartlett, S. P. B. Maas—will always command my attention and respect. I listen to these almost as a matter of duty, but I think I should be tempted to give even these a miss if, perchance, they should clash with Walter Widdop. I wouldn't miss his singing for worlds.

"No, No, Nanette" atoned for all the disappointments of the week. Binnie Hale can never hope for a bigger success. Her singing was wonderful—so clear and confident. The same thing may be said of all the females taking part in this broadcast. Every number should have been encored. But broadcasting doesn't allow this treat.

I wouldn't like to suggest that Arthur Riscoe and Reginald Purdell were eclipsed by the ladies in this performance. They weren't. And if the chorus had been able to get their words over better I would have said that every department, including the orchestra, gave an equally faultless display. The mike doesn't always do justice to chorus work. I find, "What a marvellous musical comedy "No, No, Nanette" is! No wonder it ran for 665 performances.

THE WORLD'S SHORT-WAVERS.

We regret that owing to the pressure on our space we have been compelled to hold over the list of short-wave stations mentioned in last week's issue. This list, which is to be a monthly feature, will appear in an early issue of "P.W."

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

High-Frequency Input.

ALTHOUGH we are continually making improvements in the circuit arrangements and components of a receiver, we do not, I think, give anything like the corresponding attention to what I may call the "intake" and the "exhaust," by which I mean the aerial and earth.

Whatever the arrangement of the set itself may be, it depends ultimately on what comes in on the aerial, and after this has passed through the high-frequency part of the set, or at any rate through the aerial circuit within the receiver, it has to pass out via the earth.

Piling on Amplification.

Amplification is now so great, and modern sets in consequence so sensitive, that we are in danger of treating the aerial as almost superfluous; we know that however small or inefficient the aerial may be, we can as a rule make up for all its deficiencies by lumping on so much more amplification.

This is all very well, but quite apart from the fact that it is uneconomical, there is another side to the question, and that is the accurate and faithful reception of the incoming signals. Most of us just sling up an aerial of some sort—in these days almost invariably an indoor aerial, such as a piece of wire around the room—and then proceed to adjust the electrical constants of this by means of a tuning circuit in the set.

But with modern conditions an aerial consisting of just a fixed length of wire is not really sufficient when you consider the various wavelengths which have to be received. It is true that you can adjust it over a very wide range, but that is not the same thing as using an aerial which is naturally somewhere near to the required characteristics.

Watch For Aerial Developments.

Those of you who were at the Radio Show at Olympia will have noticed the many improvements in aerials; you can have, in effect, an aerial to suit each individual band of broadcast wavelengths. This is really a great improvement on merely forcing the tuning with one fixed aerial to suit these very widely different conditions.

I recommend you to keep your eyes open for developments in aerials such as this, as it seems to me that this is one of the rather neglected sections of radio reception and one which, therefore, offers scope for development in the near future.

Short-Wave Condensers.

It is of great importance to keep condenser vanes clear of dust and dirt, even with a broadcast receiver, but when it comes to short waves the importance of this becomes still greater. The same thing, of course, applies to a triple-wave set. If you have any dust or dirt in the vanes you

(Continued on next page.)

TECHNICAL NOTES

(Continued from previous page.)

will certainly get scratchy noises and will never be out of trouble.

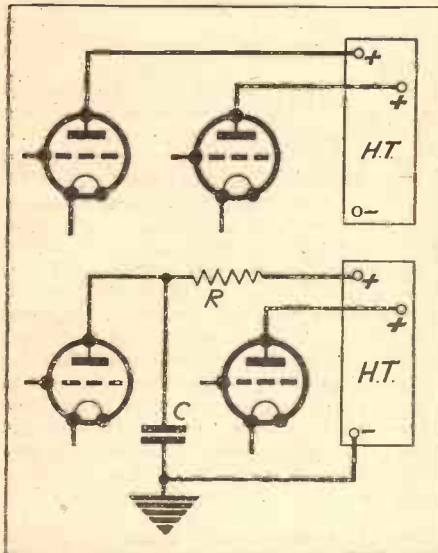
A pipe cleaner may be used for cleaning between the vanes, but the cleaner should be a "thin" one and quite straight. It is really better to use a very fine feather to get in between the vanes. The job is one which is worth doing at regular intervals because it is surprising how dust collects in a condenser even though you may imagine that with the lid closed the set is reasonably dustproof.

A Question of Decoupling.

I said something a week or two ago about the use of decoupling resistances for preventing low-frequency oscillation and motor-boating. In the first of the two diagrams herewith is shown the ordinary arrangement of H.T. supply to two-valve sets, and it will be seen that, owing to the two positive connections to the H.T. battery, there will be coupling between the two valves if the H.T. battery has any considerable resistance.

In the second diagram is shown a decoupling resistance R and capacity C. The decoupling resistance prevents the

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Showing how the insertion of a resistance and condenser will prevent instability due to a high resistance battery.

pulsating currents from getting into the H.T. battery, whilst the condenser to earth provides an easy alternative path. For both of these reasons the L.F. is kept in its right place and low-frequency oscillation is avoided.

Synchronous Motors.

I mentioned in these Notes some time ago the question of synchronous electric gramophone motors, and pointed out that these are designed to run at just one fixed speed which, of course, bears a definite relationship to the frequency of the alternating-current supply. For example, the standard type of such motors is designed to rotate the turntable at 78 revolutions per minute when the alternating current has a periodicity of 50 cycles per second.

(Continued on next page.)



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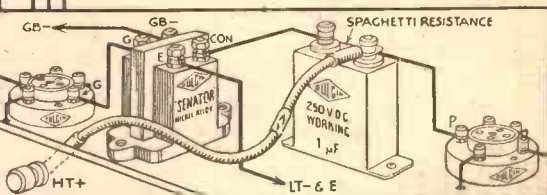
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TECHNICAL NOTES

(Continued from previous page.)

There is, in my opinion, a distinct advantage in having a gramophone which runs at one fixed speed, because I think the speed regulator with the ordinary type is apt to lead most people into trouble.

Speed Variations.

I should say that, owing to the fact that the speed of an ordinary gramophone motor, whether spring or electrical, is liable to vary slightly due to various factors, it is more or less necessary to provide a regulator by which small adjustments of speed can be made. But many people use the speed regulator not to keep the speed of the turntable always at 78 r.p.m., but rather to suit their own taste and fancy by departing from this standard speed, in some cases quite considerably.

So far as my experience goes, the great temptation is for people to speed up the gramophone so that it plays the record too fast, with the result that the sound becomes high pitched and also louder. In fact, I think it is this "livening-up," and also the fact that the apparent intensity of the sound is increased, that tempts so many people to err on the side of excessive speed.

"Livening-Up."

The next time you are listening to records played in friends' houses, just you notice how many of them play the records too fast; if you try to get them to slow down the records to the right speed they will be obviously quite disappointed.

Playing records too fast is a bad habit that grows on people, and it should be avoided at the outset. You may not be able to get a hundred-per-cent perfection in reproduction so far as quality is concerned, but you can at least get a hundred-per-cent perfect conditions so far as the pitch is concerned by the very simple process of playing the record at the right speed, in which case the pitch of the sound will be the same in the reproduction as it was when the selection was recorded.

Synchronous for D.C.

Returning to the question of synchronous electric motors, these have hitherto been designed solely for alternating-current electric supply. At the Radio Show a type of such motor was shown which could be run from direct current mains, the principle being that a "converter" is introduced between the D.C. supply and the input to the motor.

The converter may be either a fixed-frequency vibrating-reed interruptor or similar device, or it may be an out-and-out motor generator, working on D.C. and supplying A.C. Of course, there is a little extra cost involved in the D.C. model, owing to the need for this converter, but once you have the outfit complete you have gained the great advantage not only of steady running but of running at the correct speed.

Self-Starting.

There is one point against the ordinary type of synchronous gramophone motor, and that is that it is not self-starting. In order to start it, it has to be given a swing round with the hand and the current switched on whilst it is moving, when it almost immediately picks up and gets into step.

On the other hand, it has the advantage, which it shares with the induction type of non-synchronous self-starting motor, that there are no brushes or commutator, therefore no sparking, and no consequent danger of interference with electrical pick-up conditions.

New Earths.

One of the new "earths" which was on view at the show was a sort of combined metal-tube earth, of the type which we have known for some years past, together with the relatively new "chemical" principle. This comprises a pointed copper tube, pierced with holes throughout its length, with a slight flare at the top, this being "charged" with special metallic salts.

These salts are of a deliquescent character—that is, they tend to gather moisture from their surroundings—and so, when the tube is driven into the ground, the salts act to keep the surrounding soil moist. In this way a better electrical contact with the earth is obtained.

Built-in Clock.

Some months ago I said something in "Technical Notes" about synchronous electric clocks, and since that time a number of readers have told me that they have incorporated one of these clocks in with their home-built radio receiver. This is quite a neat idea and is really very simply carried out, since, if it is a mains set, you already

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have the mains supply available. Having found a suitable place for mounting or incorporating the clock, all you have to do, so far as the operation is concerned, is to connect the leads to the mains input.

Shielding.

There is one other point I should mention, and that is that if the set is frequently switched off the clock will, of course, stop every time and will have to be restarted when the current is switched on again and reset to the exact time by the radio signal. There are some clocks which run synchronously on the mains and which will also keep going for a few hours on an ordinary clockwork spring arrangement even whilst the mains are disconnected, the clock picking up again on the mains when the current comes on. I know these are sold in America, but I do not remember having come across them in this country.

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Special Contributions by

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

entitled

"From My Armchair" & "Questions I Am Asked"

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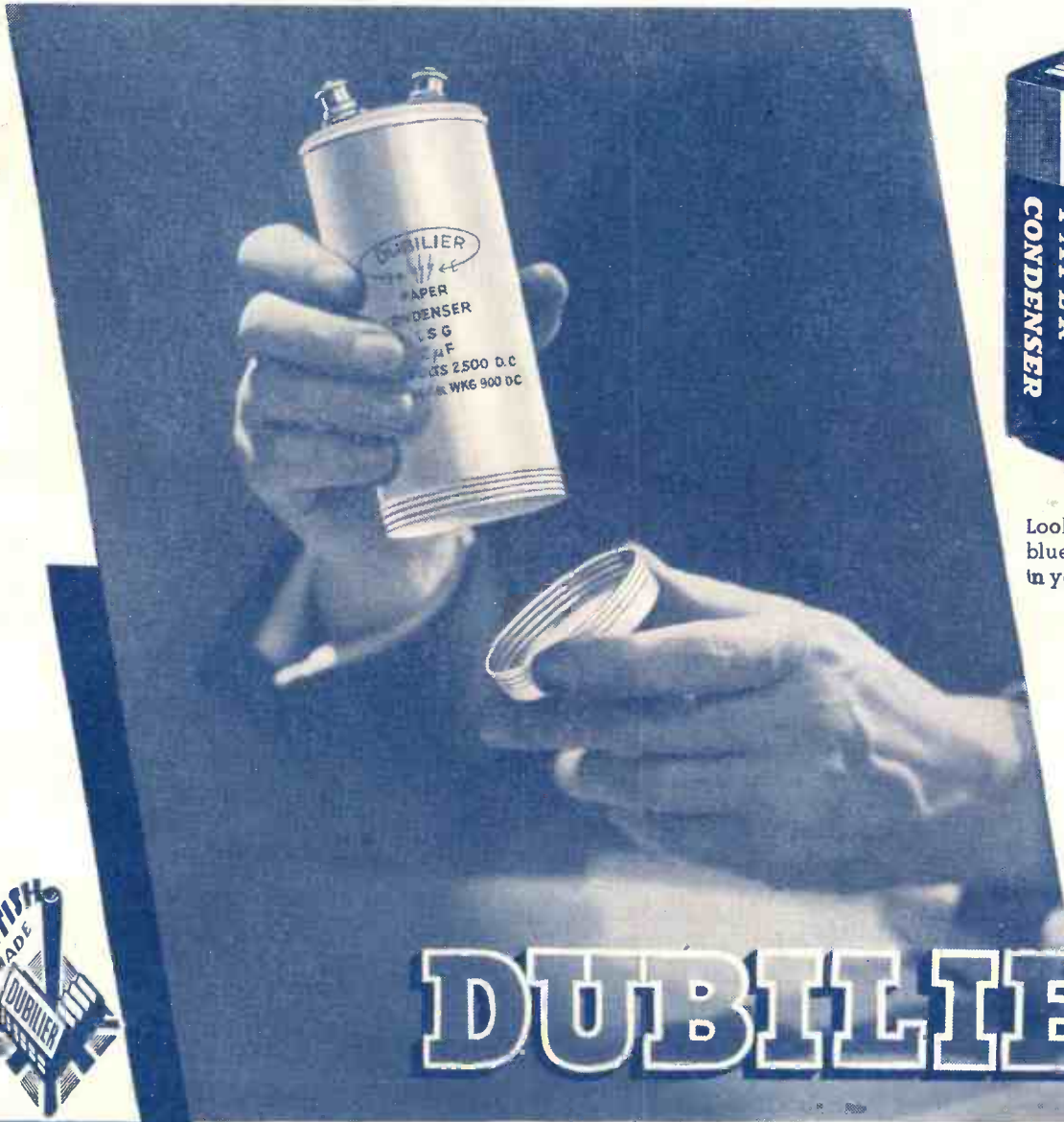
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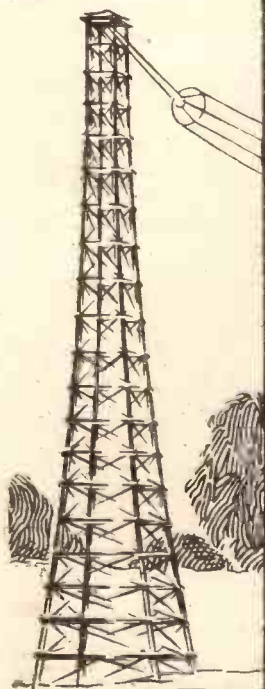
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It guarantees the strict technical accuracy of a volume which covers the whole field of modern radio technique. But, in addition to the great authority which is lent to this new book of reference, the readers benefit by Mr. Scott-Taggart's genius for writing so that "he who runs may read."

Since he was only eighteen John Scott-Taggart has been an instructor. At that age—before he was officially old enough to be in the Army at all—he was Chief Sergeant-Instructor in Signalling to a Highland Brigade. During a spell from the trenches in 1917, and now as an officer in the Royal Engineers, he became Instructor in Wireless to the First Army; he was nineteen years of age!

In that year began his famous articles on valves, which were virtually the first revelations to the public of the revolution in technique effected by the valve. A brilliant writer himself, he was—as far back as 1919—appointed Radio Book Critic to both the leading electrical journals in this country. viz. *The Elec-*

trician and *The Electrical Review*. This double distinction was a great tribute to a reputation already established fourteen years ago. His predecessor as regards *The Electrician* was Dr. W. H. Eccles, D.Sc., F.R.S. (who has been President of the Institution of Electrical Engineers, of the Physical Society, and of the Institute of Physics, and Adviser to the British Government). It was on Dr. Eccles' advice that *The Electrician* offered Mr. Scott-Taggart the post mentioned.

"The Manual of Modern Radio," therefore, is by one who, above all others, knows how to write a book on wireless. His ability to impart knowledge to the veriest beginner in a clear, simple, accurate manner is proved by one simple but overwhelming fact:

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It is seven years since Mr. John Scott-Taggart has found time to write a wireless book. His "Manual of Modern Radio" is a monumental work—a landmark in the literature of wireless technique. Within its pages he has brought the whole art of radio reception and the use of valves.

The Manual is "red hot" as regards recent developments. If you are interested in such things as H.F. Pentodes, Iron-Core Coils, the Double-Diode Pentode, Cathode-Injector systems, Metal Detectors, Class B Amplification, the Capenhart Circuit, Metal Valves, Quiet Automatic Volume Control, the Pentagrid—here in this book will you find all you want to know.

But if, on the other hand, you are a novice who would like to know a little about "how the wheels go

round," here again is the book for you. Scores of circuit diagrams are duplicated in pictorial form to help the beginner, and it has been assumed that the reader knows nothing whatever about electricity or science. All one needs is the ability to read.

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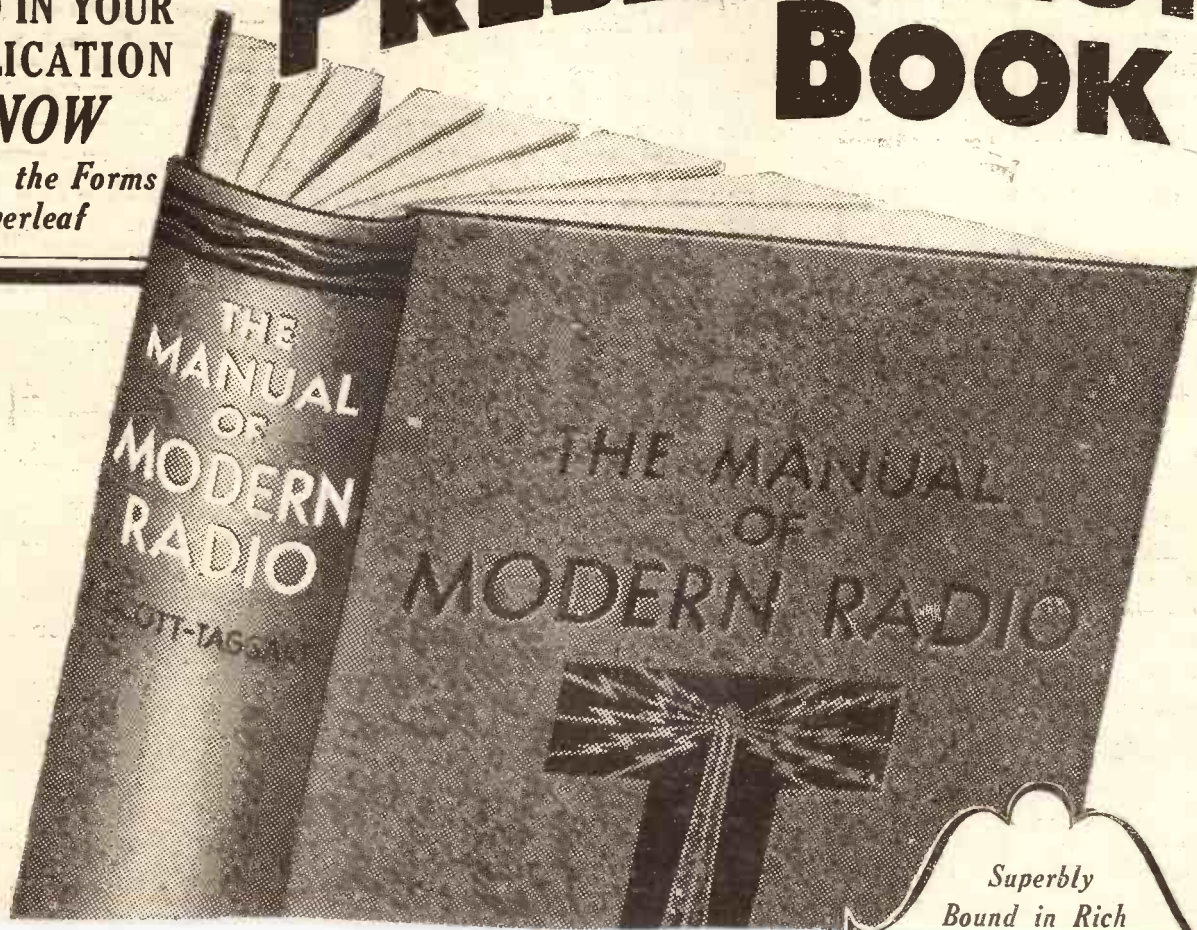
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Metal Rectifiers.
Metal Rectifiers for Detection.
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Tone Control Systems.
Pick-Up Circuits for Radio - Gramophones.
Automatic Volume Control.
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Operation of D.C. Mains Valves.
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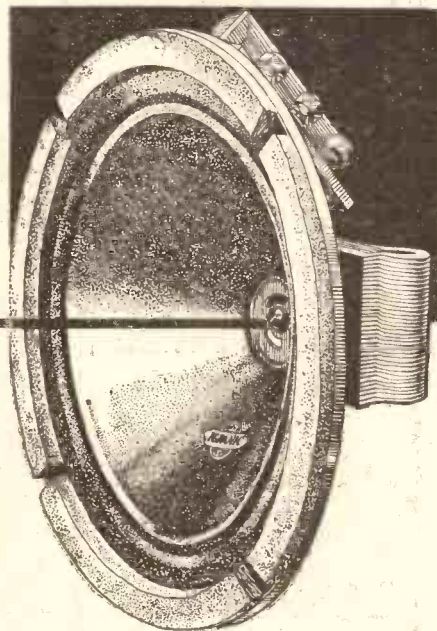
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AND CONTAINS

Special Contributions by

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

entitled

"From My Armchair" & "Questions I Am Asked"

The November issue is one which everyone interested in radio should not miss, for as well as the special constructional articles there is much to interest the ordinary listener, and every set user will find the various hints, tips and suggestions of help in getting the best from his set.

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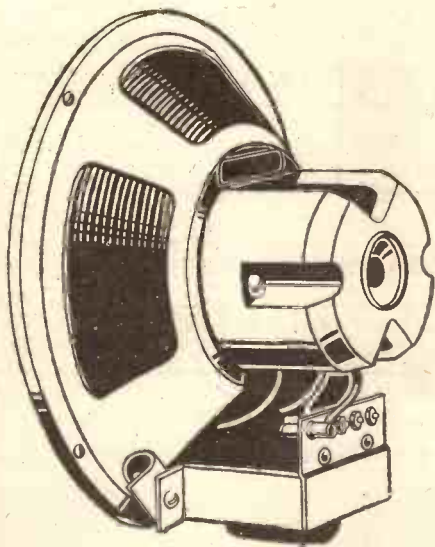
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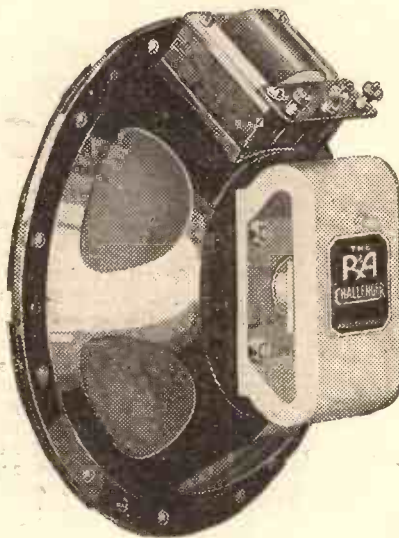


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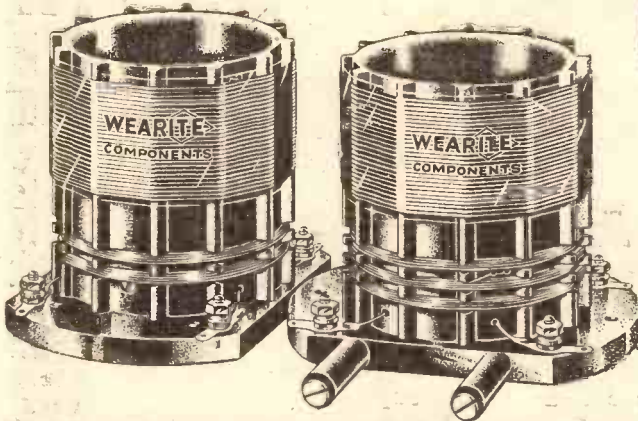
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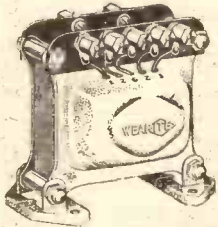
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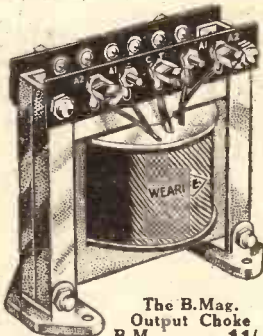
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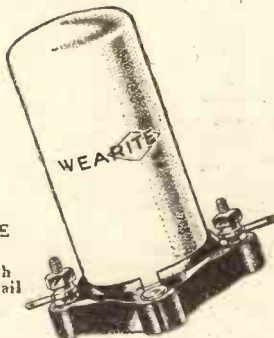
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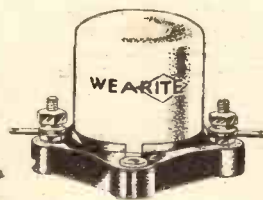
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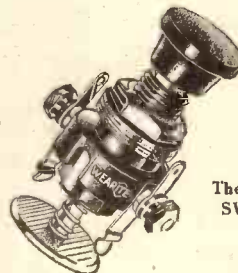
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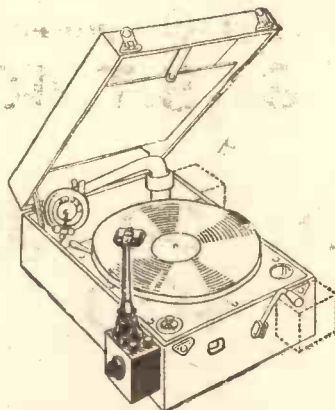
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Twin Tap Plug

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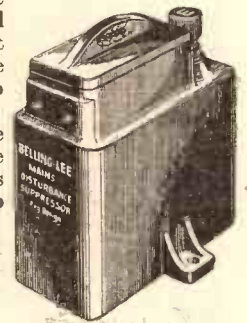
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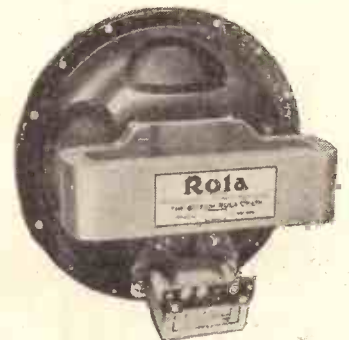
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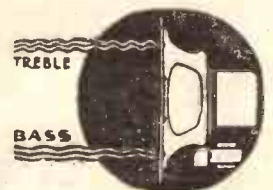
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Friction Control
COND**



For the best Results you
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**ORMOND 'CLASS-B'
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One of the few speakers *especially designed for Class B output*, and made with the same care and precision which distinguishes the Ormond Condenser specified by Mr. Scott-Taggart, this speaker is a worthy ally for a magnificent receiver.

Its name guarantees you the utmost in Quality and Value. In performance it compares with many much higher-priced products, giving a delightfully faithful response throughout the entire frequency range, with neither booming in the bass nor shrillness in the treble. It is supplied with an output transformer specially designed for Class B circuits. Overall size: Diameter, 8 in.; depth, 4 1/4 in.

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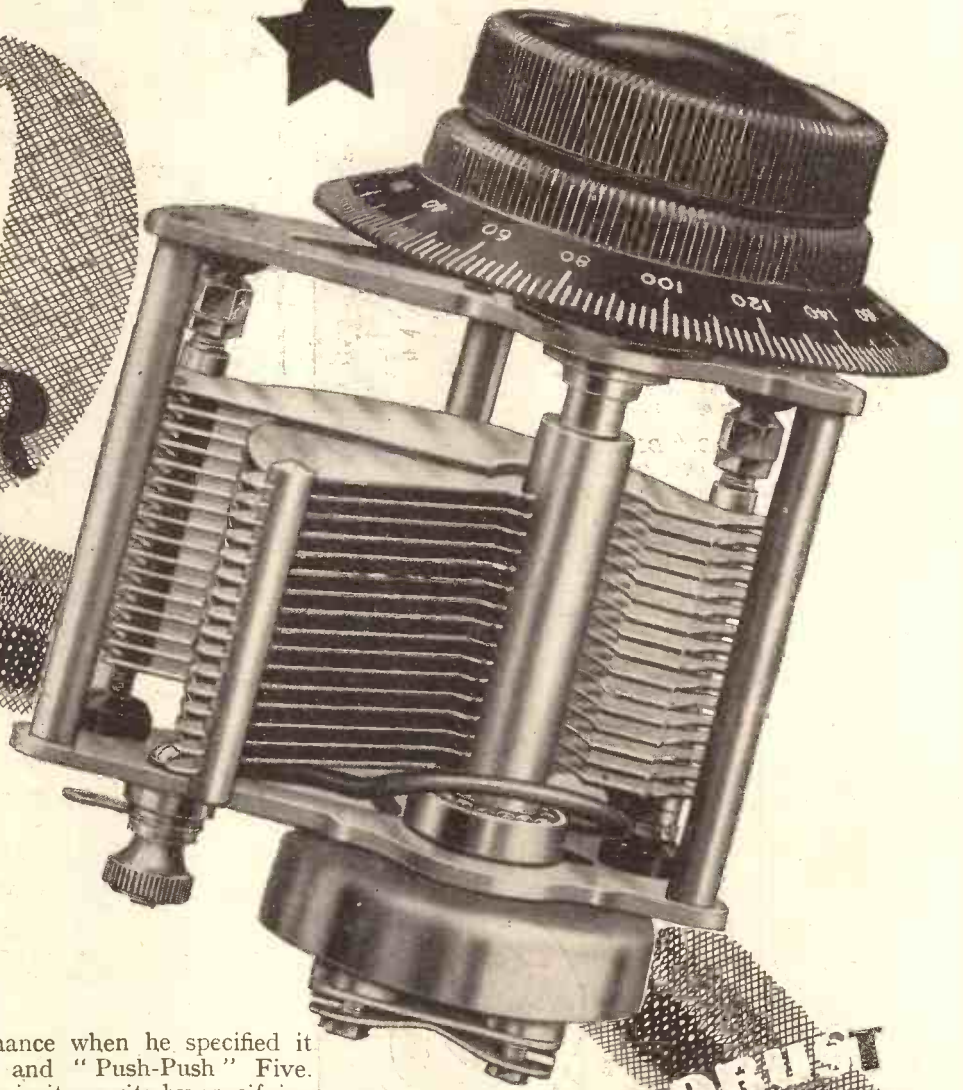
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CONDENSER



FOR a remarkable set—
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 Naturally, and quite justifiably, Mr. Scott-Taggart regards his "S.T.500" as his masterpiece. Therefore he chooses for it a condenser which he knows is a triumph of engineering and unrivalled in its efficiency and reliability—the Ormond No. 6 Friction Control. He acknowledged its superb construction and performance when he specified it for his "S.T.300," "S.T.400" and "Push-Push" Five. Now once more he shows his faith in its merits by specifying it yet again. Make sure *your* set is as fine as *he* would make it. Incorporate the Ormond No. 6 Friction Control Condenser. A friction device is incorporated at the rear end of this condenser, giving a superb slow-motion movement with ratio of 50 to 1. Direct drive is obtained by means of Bakelite dial, engraved 0 to 180 degrees. Slow motion is controlled by the upper small knob. Fast enough for easy searching, it is yet slow enough for finest tuning. Easy to mount. One-hole fixing. Terminals and Soldering Tags for connections. Complete with 2½-in. dial and slow-motion knob. Cat. No. R/493. Capacity .0005. Price

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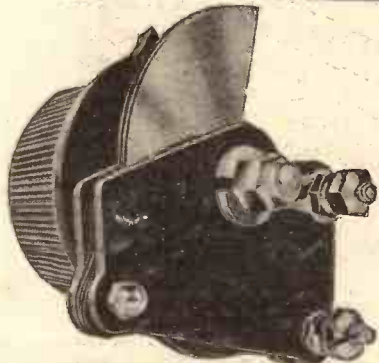


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Whatever the circuit, the experienced constructor will always choose "J.B." For tuning iron-cored coils, in particular, the accurate matching found in J.B. Gangs becomes imperative; and the mechanical rigidity of "J.B." ensures the permanence of this matching.

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Tappings 60/80v. (Min. and Max.), 50/90v. (Min., Med. and Max.) 120v. and 150v. Output 25 mA at 120 or 150v. Trickle Charger 2v. at 0.5 amps. Westinghouse Rectifiers. 80/- Cash or 10/- down.

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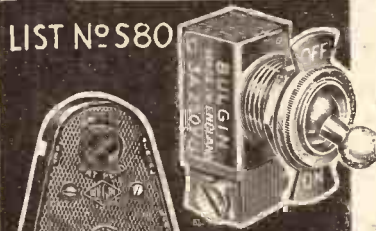
NAME.....

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Quality Components FOR THE S.T.500

LIST NO S80



LIST NO S 99



LIST NO SC



LIST NO VH 8



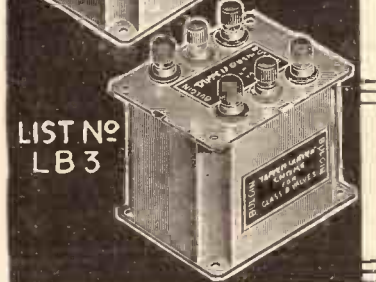
LIST NO TL

LIST NO S38



LIST NO LF 5

LIST NO LB 3



MAKE SURE OF THE BEST RESULTS BY BUILDING THIS WONDERFUL NEW RECEIVER WITH BULGIN QUALITY PRODUCTS. EACH AND EVERY ITEM IS GUARANTEED TO GIVE YOU EVERY SATISFACTION AND IS BACKED BY THE FULL RESOURCES OF OUR TECHNICAL LABORATORY.

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L.B.3.	Class B Output Choke	12/6
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H.F.4.	S.G., H.F. Choke	4/6
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V.H.8.	5-pin Horizontal Valveholder	9d.
V.H.15.	7-pin Class B Valveholder	1/6
H.F.12.	H.F. Choke	2/-
M.C.	Metallic Grid Leak	1/-
G.6.	Grid Leak Holder	6d.
W.E.	(2) 5,000 ohms. Metallic Resistors	1/-
W.E.	(2) 10,000 ohms Metallic Resistors	1/-
A.R.	250 ohms Resistor	1/-
S.C.20	2-mfd. Condenser	3/4
S.C.10	1-mfd. Condenser	2/4
C.C.	(2) .005 Tubular Condensers	1/9
C.C.	.0005 Tubular Condenser	1/-
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Our latest 80-page Catalogue No. 153 "P." is a veritable mine of information to all Constructors and will be sent free of charge to readers of "P.W." enclosing 2d. postage.



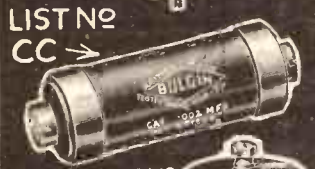
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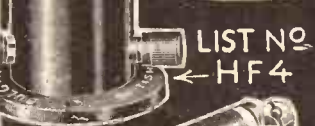
LIST NO N



LIST NO CC



LIST NO HF12



LIST NO HF 4



LIST NO AR



LIST NO LF12



LIST NO VH15



WHEN you try one of these handsome Cossor Receivers in your own home (your Dealer will gladly arrange it) you will realise that you can have up-to-date Radio for a surprisingly modest outlay. In performance, appearance and ease of operation these Cossor Console Models are equal to much more expensive Receivers. Send the coupon for full particulars.

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Complete Receiver, as illustrated, with Cossor 220VS Variable-Mu Screened Grid, Cossor 210 H.L. Detector, Cossor 215 P Driver and Cossor 220 Class "B" Output Valves. Single-dial tuning, selectivity control and combined volume control and "on-off" switch. Wavechange switch for 200-530 and 900-2000 metres. Handsome walnut finished Console Cabinet, 2 ft. 11 in. high, 1 ft. 2 in. wide, 11 in. deep, giving ample accommodation for batteries. Permanent Magnet Moving Coil Loud Speaker of the latest type. **PRICE £9.19.0**

Price does not include Batteries or Accumulator. Hire Purchase Terms: 20/- deposit and 10 monthly payments of 20/-.

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Specification similar to Battery Model 3456, but operating from Electric Light Supply. Complete with four Cossor A.C. Mains Valves viz: M.V.S.G. (Met.) Variable-Mu S.G., 41 M.H. (Met.) Detector, 41 M.P. Output and 442 B.U. Rectifier. Mains Energised Moving Coil Speaker. Illuminated tuning-dial (Model 3468 only) For A.C. Mains only, 200/250 volts adjustable. **PRICE £10.15.0**

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As Model 3468, but for operation on D.C. Mains. Supplied complete with three Cossor D.C. Mains Valves viz: D.V.S.G. (Met.) Variable-Mu S.G., D.H.L. (Met.) Detector and D.P. Power Output. For D.C. Mains only, 200/250 volts (adjustable). **PRICE £10.15.0**

Hire Purchase Terms: 25/- deposit and 10 monthly payments of 21/-.

Legs are detachable on all Console Models and the receivers can be used as table models with legs detached.

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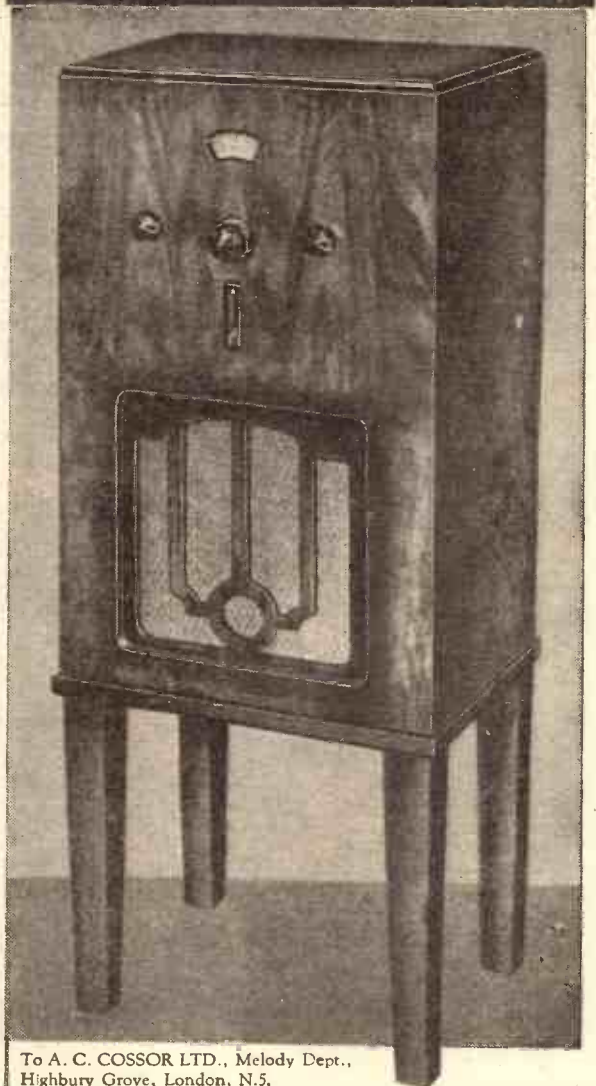
BATTERY & ALL-ELECTRIC RADIO

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Console Receivers



To A. C. COSSOR LTD., Melody Dept., Highbury Grove, London, N.5.

Please send me free of charge, Folder No. L99 which gives full particulars of Cossor Console Receivers.

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POPULAR WIRELESS

THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

Scientific Adviser: SIR OLIVER LODGE, F.R.S.
 Technical Editor: G. V. DOWDING, Associate I.E.E.
 Assistant Editor: P. ROBERT BIRD.

Managing Editor:
 N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
 Assistant Editor: A. JOHNSON-RANDALL.
 Chief of Research Dept.: K. D. ROGERS.

**HENRY HALL'S TRIP
 THE "P.W." COMPETITION
 THAT "BOGEY" VAN!
 SOME INTERESTING
 FIGURES**

RADIO NOTES & NEWS

**OUR BRITISH "BOBBIES"
 RADIO IN INDIA
 THOSE BAGPIPES
 AGAIN
 A RARE "BIRD"**

America Tells Henry.

HENRY HALL'S account of his American researches was a bracing ordeal which proved, at least to me, that our best bands and their conductors are the best for this country. The "split-second" method of presentation, whilst necessary where ether-time is sold, is foreign to our notions of fireside enjoyment. It would leave us time to say only, "That's a band, that was"!

I am glad that Henry went, though. Maybe he will now know what to guard us against. He can be sure that his reception at Radiolympia was not a token of our love for dance music gone mad, crooners and the like.

What Henry Did Not Tell Us.

NOTHING can be more certain than that Henry was overwhelmed with hospitality and that it was rounded off by many a good yarn. One story, which has come to me from an American source, is that one of the big band leaders told him that his income was \$15,000 a week.

Henry came away feeling dizzy, because that means £156,000 per annum at par—which is real money. Later they debunked him and reduced the aforementioned income to \$5,000 per week, which, for America, is just fairish. "Brother, can you spare a mansion (with swimming pool) in the Adirondacks?"

This Means More Work.

RADIOLYMPIA and Glasgolympia were worth while—a thousand times, because they resulted in work for many men and women and were a nasty kick in the neck for Ole Man Depression. Why, I hear that the H.M.V. people alone have had to engage more than a thousand extra "hands" to cope with their Exhibition orders!

By the way, I wonder whether the general public realises that the Hayes factories are producing over a thousand complete sets and nearly a million components every twenty-four hours.

Our Radio Play Competition.

FIRST, as usual, practical, helpful and topical, "P.W." goes many lengths ahead in instituting, in collaboration with the B.B.C., its Radio Play Competition,

the prize being not only £50 but the assured production of the winning play.

Here, for some clever reader, is perhaps the beginning of fame and fortune as a radio playwright. Were I not debarred from so doing I would enter the lists at a gallop and put every ounce of me into the contest. I am looking forward to the result with keen interest.

Hints to Competitors.

DON'T take these hints as authoritative; just think them over, however. First of all, I suggest that a radio play cannot stand up on the strength of "sound effects" alone; it must have a plot, a

★.....★

This is an exceptional issue of "Popular Wireless." A unique issue.

For the first time in the history of the paper John Scott-Taggart, the world-famous radio engineer and designer of the finest sets ever offered to the home constructor, gives exclusive details of his latest masterpiece—the "S.T.500."

I have placed at Mr. Scott-Taggart's disposal more than thirty-three pages of this issue. He has used them magnificently. Each page breathes the spirit of his intense enthusiasm for his latest and greatest set.

I have little more to write. Build the "S.T.500." Now is your chance. "Popular Wireless" offers you the greatest radio event of the year.

THE EDITOR.

★.....★

good plot and preferably an "ending" which is not a mere tapering-off.

The "effects" are to be used in order to supply, as far as possible, what is lacking because the play cannot be seen. Remember that many successful short-story writers banked on the surprise ending, *the zip in the tail*; O. Henry, for a good example.

A Few More Hints.

DO not offer dialogue which is mere "slapstick and custard-pie," or which is so brilliant that eighty per cent of listeners will not follow your scintillating sallies. Get down to real life—which is *not* the *salon* of South Kensington or the Chelsea studio.

If I were competing I should eschew

crime, drunkenness, gambling and drugs. People nowadays are not very much different from their fathers, who loved Dickens. So go for the *heart*, nevertheless missing Dickens's super-sentimentality.

I'll swear that most folk like stories of the middle class much more than those which feature the *terra incognita* of Mayfair, Park Lane and "the Ritz."

Radio Relay Systems.

ACCORDING to a writer in the "Electrical Review" there are now about three hundred radio relay systems operating in this country. The Post Office licence under which they work has more restrictions than permissions.

The relay company may not initiate a programme, play a gramophone record or even make an announcement. It must keep a log-book of its receptions and transmissions, and the licence gives the P.M.G. the right to prohibit reception from certain Continental stations. Proprietors may, however, wear their "old school" ties!

Our P.O. Van.

THE Americans simply cannot swallow the Post Office detector van story—except as a radio joke. The whole business is so like a bit of their own native bluff that they applaud it as such, but say "Apple sass" when asked to take it seriously.

You see, there are no pistols or impudent reporters or fat and brutal policemen connected with these little round-ups, and so the American is unable to regard them as bits of real life. Now, I ask them—do they think that mere Englishmen could bluff Scots into paying licence fees?

An Illuminating Census.

A CENSUS taken by a contemporary amongst 30,000 families in the United Kingdom reveals that 25,000 of them have radio sets. Of 14,000 sets 34.5 per cent were a year old and 1.6 per cent nine years old. Sixty-five decimal three per cent of the sets were three-valvers and 17.6 per cent had four or more valves. Forty-seven decimal six per cent were either amateur-made or made by local dealers.

(Continued on next page.)

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

Amongst the trade-built sets there was no make of particular prominence, the leading make being only 9.3 per cent. On the other hand, the most popular make of valve accounted for 42 per cent of the total number used in these 14,000 sets.

The New Police Force.

THERE is such a lot in the newspapers nowadays about the police, their new college, their pocket wireless sets and so on, that I am sure many people believe that one of the foundations of England's liberty is being tampered with. What we want, say the old-fashioned folk, is a good, solid "bobby," with no frills but a mule's kick in his truncheon.

No less than four promising youths have asked me whether they are likely to qualify for a place in the police "officers' college on the strength of their familiarity with radio. I assured them that the police have more interest in "crooks" than in "anode bends."



Society Paragraph

OH YEZ! The Bec Radio Society began a new session on September 28th, and extends a hearty welcome to new technical and non-technical members. The syllabus looks good to me, and I notice that it includes experiments in television and the formation of a short-wave transmitting and receiving section.

Fee for the term of 26 weeks is five shillings. Please apply to the Hon. Sec., Mr. A. L. Odell, Bec Literary Institute, Bec School, Beechcroft Road, London, S.W.

Glorious Beer.

JUST plain beer, and pretty poor stuff, too, has revolutionised America for a second time. The first time was when the Americans chucked tea into Boston Harbour. Los Angeles County is now prospering by beer.

The miniature golf courses and the theatres are combining amusement with free beer—of a sort (they ought to try Kent's strong brown ale!)—and although all this has nothing to do with wireless, the radio pages of their newspapers are full of beer.

Presently they will announce that an American discovered beer, ignoring the fact that King Harold was defeated and the Spanish Armada was beaten on Beer.

Liquor and Lambda.

LAMBDA stands for "wavelength" in radio. Now see how the repeal of Prohibition in America affects radio there. From "Variety," a U.S.A. paper:



"Lord & Thomas has closed for a \$5,000,000 account with the Schenley Distilleries, which markets Golden Whisky, has the Martell cognac and Heidsieck champagne agency for the U.S."

The certainty of repeal is so generally accepted that the L. & T. agency is going ahead planning its campaign, which may also include a radio show.

Indian Radio on the Mend?

IT is refreshing to learn that radio in India is sitting up and taking a little nourishment. The Director of the Calcutta station states that broadcasting shows a small profit this year.

Whether this happy turn of the tide is due to lessened piracy or only to increased listeners as a result of the B.B.C.'s Empire broadcasts, I do not know. But it is a sign that law and order are being more observed, and that is welcome.

A greater use of broadcasting would undoubtedly bring a greater measure of peace and contentment to that demagogue-ridden country.

SHORT WAVES

"I say, old man, do you know enough about wireless to come and help me discover what's wrong with my new set?"
"Yes, I know enough about it not to!"

A WORD TO THE B.B.C.

Is it not time we heard a first-class wedding performance broadcast? I am confident Mr. —, as an Old Bridegroom, would make a brilliant commentator.—"Punch."

It is claimed by a scientist that if the nervous system is sufficiently nourished a man can live to be 180.

In fact, he might even succeed in paying off that last instalment for his wireless set.

"Visitors to the Manchester Exhibition should not fail to inspect these beautiful models. The stand decorations include a magnificent LANDSCAPE BY GAINSBOROUGH," runs an advertisement. But we understood this was a Wireless Exhibition.

MUSIC IN THE AIR!

Now the wireless is playing
In the maisonette above,
Where a baritone is braying
Of his everlasting love;
And the awful oscillation
In a set across the street
Trying some new foreign station
Makes the medley more complete . . .

Yes, there's music in the ether.
You can hear it everywhere,
And I long to get a breather
Of less musical fresh air.
So I'm off to be a diver—
In the depths I may be drowned,
But I shall not care a stiver
If I cannot hear a sound!

—"Answers."

Do Such Things Happen?

WHEN I read that a clergyman had determined to leave his flock in order to lead a bagpipe band I rubbed my eyes, for that sort of thing, I thought, happens only in the topsy-turvy land of dreams. But it appeared to be a real newspaper, complete with photograph of the would-be bagpipe king.

Then I was shot by a sudden fear. Suppose this meets the eye of a Dawnay or a Maschwitz! Or suppose—being bagpipes—Sir John Reith should issue a Napoleonic edict and create a two-years series entitled "Foundations of (Scotch) Music," illustrated with yon band! Yes, it is a nightmare, after all.

A White Man's Toy.

A MAN who has just returned from the wilds of Bolivia tells me that his demonstrations of wireless on a powerful receiver failed completely to impress the Indians of that country. They listened dutifully enough, but plainly regarded the set merely as a toy of that childish creature the white man. Much more interest was shown in his "boot-trees," and his safety-razor almost caused a riot. But his greatest triumph was the extraction of a cork with a corkscrew! They just loved the "plop."



Rapid Rejoinders.

J. T. F. (Yeovil).—The reply is in the negative. My negative of "P.W." on Ben Nevis was a wash-out because, as I said, my fingers were numbed. But "P.W." was well and truly affixed to the old observatory. L. S. (Cape Town).—Much obliged, but I get only three months holiday (I don't think!) per annum—hardly enough for an investigation of South African radio. Be a good South African and call diamonds every time.

As for you, T. C. (Wigan), I can say only this—tell the missus from me that Radio Paris is just as good as Blackpool, except for the "rock." N. S. P. (Bath).—Noo! I have no financial interest in "P.W." All my money seems to be in income-tax bonds minus nought per cent. But I have no money, anyway.

American Radio Humour.

THE Ogpu and a pack of bloodhounds are searching for a Russian violinist who does not claim to have played before the late Tsar. If found he will be presented to the American radio public as a novelty.



It is estimated that if every radio violinist who claims to have been Court fiddler has each played a two-minute selection for the Tsar, the last of

the Romanoffs would have spent 119 years 10 months and 24 days listening to "Dark Eyes." Thus speaks an American "columnist," who adds the epigram: "He who laughs last will not be invited to the studio again."

THE MAN BEHIND THE S.T.500

THERE are four wireless personalities whose careers are recorded in "Who's Who." One of these is John Scott-Taggart, M.C., F.Inst.P., A.M.I.E.E.

You see him—or rather part of him—on this page. We want you to know him. There is a double reason. He has designed the autumn boom set for us—the "S.T.500" described in this number. He is also the author of the "Manual of Modern Radio," the great presentation volume available to every reader of POPULAR WIRELESS.

We want you to know something about him because we believe the public has a right to know the credentials of their advisers and the solid record of achievement which has marked the career of one who now offers both a great design and a great look.

We have, in this issue, broken a tradition of eleven years. Hitherto all our star sets have been designed by our own research laboratories, and readers will know of their great success. This year, however, we have the privilege to present to you the design of Britain's acknowledged leader in this field. Needless to say, we can wholeheartedly recommend this set to you.

Although the name Scott-Taggart—and his initials S. T.—are known to probably everyone with a wireless set, there will be many thousands who, with this issue, will be taking up radio for the first time. To these, particularly, some biographical details of our eminent contributor will be of interest.

John Scott-Taggart, although only thirty-six years of age, is a pioneer of the valve era in which he has played an unusually constructive rôle. His first valve patent was filed sixteen years ago.

A Great Inventor.

Few modern inventors will fail to have one or other of Mr. Scott-Taggart's numerous patents cited by the Patent Office against their broader claims.

Amongst his inventions which are in common use to-day are the use of a series-aerial condenser in the aerial (1921). He



was the first British patentee of the use of multiple-grid valves for radio reception by applying different frequencies to the grids (1919). He is the inventor of most of the more recently used systems for heterodyne reception, e.g. the mixer valve, the anode-injector system, the various multi-grid valve systems. He was, as Professor Hazeltine declared in 1926, the inventor

of the neutrodyne in this country. Reflex circuits of various types were developed by him. He was the inventor of the use of a negatively biased rectifier or diode for delayed automatic volume control, a system now almost universally used when A.V.C. is employed. His Negatron negative-resistance method of generating oscillations has been used by the Post Office for long-distance communication, and was fitted to several hundred ships.

The importance of his inventions may be estimated by the fact that the following companies, amongst others, have purchased them from the concerns with which Mr. Scott-Taggart has been associated.

Marconi's, Radio Communication Company, Ltd., Mullard Radio Valve Company, Hazeltine Corporation (U.S.A.), La Radiotechnique (France), Telefunken (Germany), Commercial Cable Company (U.S.A.) and Edison Swan Electric Co., Ltd.

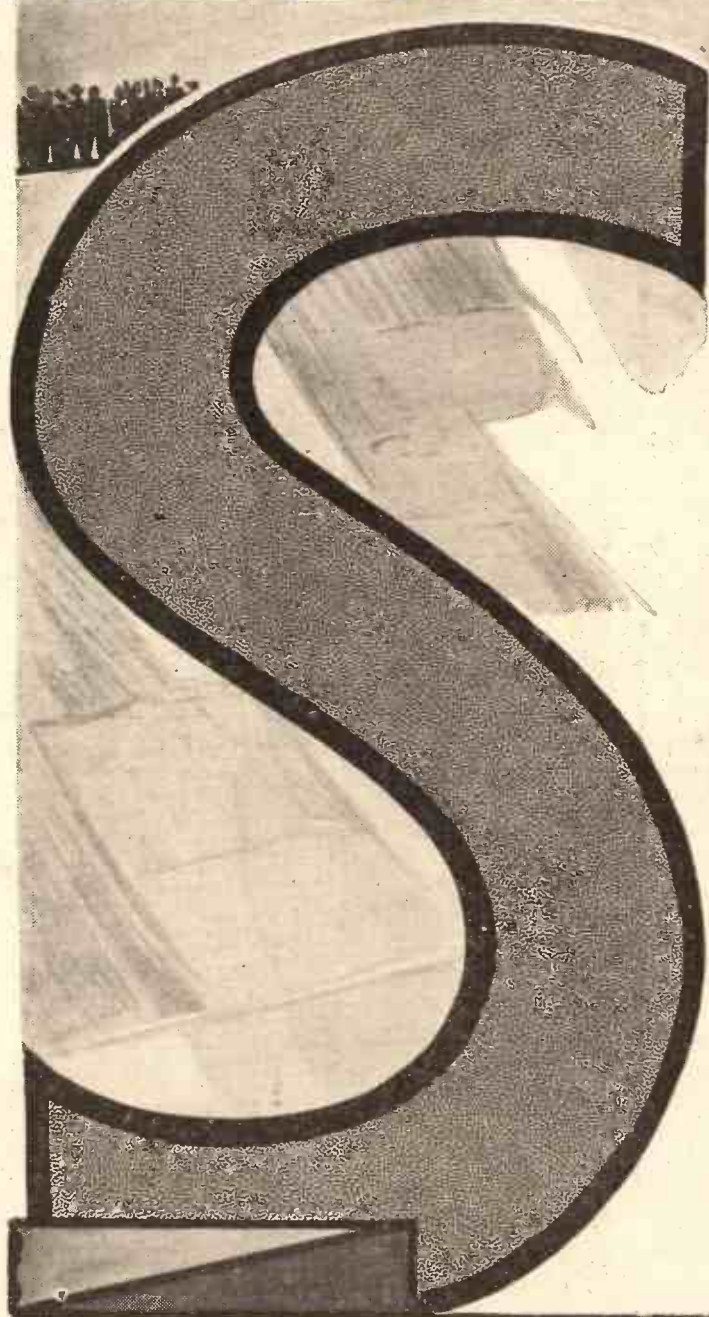
As a consulting engineer Mr. Scott-Taggart enjoys an international reputation. He has been adviser on patents to the Radio Communication Company, C. F. Elwell Ltd., and Mullard Radio Valve Company. He has acted as technical adviser to the Radio Manufacturers' Association of America, which represents the American radio industry, and to the Independent Radio Manufacturers (U.S.A.).

International Reputation.

This concern represents the greater portion of American radio concerns. He has also been British patent adviser to the De Forest interests in the U.S.A. and the Huth Gesellschaft of Germany. He was consulting engineer to His Master's Voice

(Continued on page 316.)

HERE IT IS!



JOHN SCOTT-TAGGART describes

I AM new to POPULAR WIRELESS.

A stranger, almost.

But not quite. Because in 1922, when this weekly journal was first established, I was honoured by being invited to become Chief Technical Adviser.

I resigned to establish what became a highly successful technical publishing organisation. The "Wireless Constructor" and "Modern Wireless" were two journals which I founded.

I was in competition with POPULAR WIRELESS—an enemy! The Editor of this journal is to-day presenting me to you in flattering terms.

You will agree with me that the situation is a rather curious one.

And yet to me it is a serious one. When the Editor said to me, "We want to give 'P.W.' readers the set of their lives. That's why we want you to do it for them," I could not restrain a smile.

But as a matter of fact I was tremendously keen on the suggestion. Here was a chance of appealing to a great new public. I resolved to put the very best I was capable of into this POPULAR WIRELESS set I was to design.

And here it is—the "S.T.500."

Of course, I had moments of doubt.

Here was a new public. I wondered whether you would be sympathetic towards an outsider. You have become accustomed to your regular designers, their methods of presenting their "boom" sets. You have had conveyed to you technical ideas with which I may, in some cases, have disagreed—perhaps violently.

I am afraid I have a reputation for being "awkward": for thinking all wrong what other designers think is all right.

I am not popular.

Except—and please do not think I am boasting—amongst those who have to spend their money and listen

RADIOS



his S.T.500 RECEIVER

to the results my sets give them. In other words—constructors. But, in a sense, I am starting afresh when I design a set for POPULAR WIRELESS readers who may never have built a set of mine before.

I therefore appeal for a fair hearing. I am convinced I shall get it. I warned the Editor that my style of writing might displease you, that my technical views might be unattractive and that my photograph might "put you off"!

He said you would study what I had to say with a mind open to receive ideas, whether opposed or not to any opinions published in "P.W."

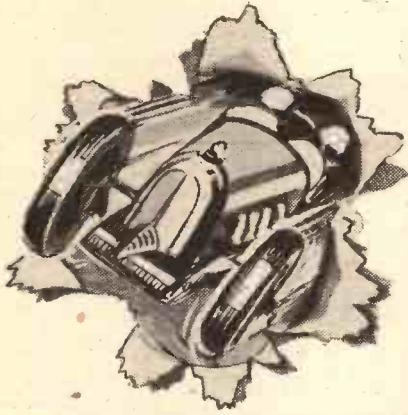
The publishers of POPULAR WIRELESS tell me that they expect a quarter of a million constructors to buy this special issue. It would be hypocritical of me if I did not admit that some of those reading these words are regular followers of my writings elsewhere.

I ask those of you who already know some of my views to be patient if I repeat myself a little in dealing with the "S.T.500."

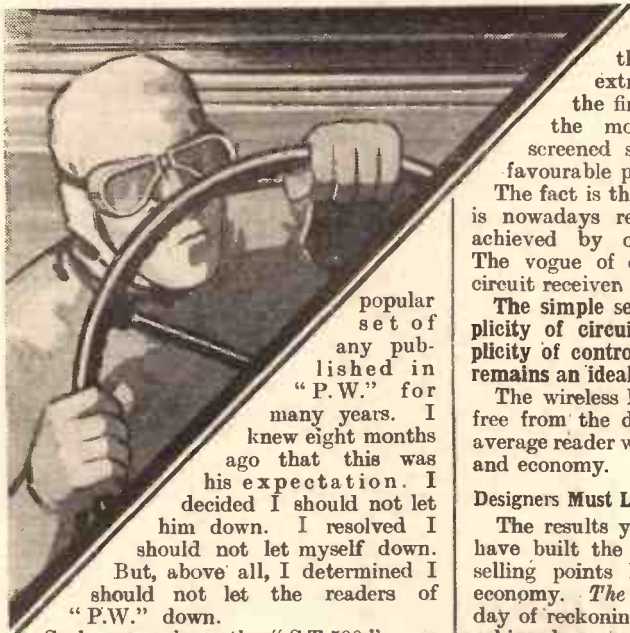
I am conscious that a large section of the POPULAR WIRELESS public has never built one of my sets. I am intensely anxious that you should do so. Into no set I have designed have I put as much thought, keenness and hard work.

Frankly, I have felt on my mettle. Why shouldn't I be honest about it? I know everyone has his eyes on this experiment—to see whether I shall make as great a success in POPULAR WIRELESS as I am told I have done elsewhere.

The Editor hopes and expects this "S.T.500" to be the most



RACING MODEL



popular set of any published in "P.W." for many years. I knew eight months ago that this was his expectation. I decided I should not let him down. I resolved I should not let myself down. But, above all, I determined I should not let the readers of "P.W." down.

So here you have the "S.T.500."

It may be the only set I shall design for you. The Editor says he offers you the "S.T.500" as a possibly unrepeatable bargain which should be snapped up.

This is complimentary to me. I can only say that throughout the months I have been designing the "S.T.500" (and rejecting a score of other circuits I have tried) I determined to do all I could to keep my reputation safe.

You may not have another set of mine in "Popular Wireless," but I have determined that this one shall make us understand each other. And make us friends.

Let us now get down to the actual receiver. You will find a concise description of the circuit on page 287. The results the set has given are on page 278. A Rapid-Construction Guide starts on page 289, while operating notes are to be found on page 284.

Must Appeal on Merit.

But before you read these pages I should like to enjoy your hospitality for half an hour: to sit in a comfortable chair opposite to you and talk of this "S.T.500."

I want you to ignore the fact that I have designed it; I do not wish to trade on a long, successful experience of set designing for the home constructor. Nor should you have regard to the fact that this is the autumn set for "Popular Wireless," and therefore the one they think you should build.

The set must appeal solely on its own merits. I want you to let me argue its case. I expect a hundred thousand "S.T.500's" to be built as an absolute minimum! Your friend across the road will build it; that fellow at the works or the office will talk to you about it. People will ask you—and perhaps you will ask them—"What do you think of this 'S.T.500'?"

All opinions will not agree. Violent controversy has greeted every set I have designed. I relish it. I want people to think about my designs; I would rather they thought the wrong way than not at all. And I know that within a month controversy will be dead; the successful experiences of tens of thousands will have killed it. I speak simply from what has occurred before.

The first thing you will have noticed about the "S.T.500" is that it has extra control knobs. I was the first in this country to offer the modern style of one-knob screened set. So I am in a very favourable position to criticise it!

The fact is that much greater selectivity is nowadays required, as it cannot be achieved by ordinary simple methods. The vogue of ordinary single or double-circuit receiver is definitely over.

The simple set has gone for ever. Simplicity of circuit is discredited, and simplicity of control for the home constructor remains an ideal.

The wireless Press has not been wholly free from the desire to accommodate the average reader who wants results, simplicity and economy.

Designers Must Look Ahead.

The results you do not know until you have built the set, so that the tempting selling points have been simplicity and economy. *The two easiest to achieve!* The day of reckoning is now here. Sets which achieved a very considerable popularity a year or two ago are declaring their weaknesses. They are breaking down under the heavy load of interference. If there is any lesson at all to be learned from this, it is that a receiver should be designed not to achieve a temporary success under existing conditions, but a lasting success under conditions which will become worse.

Let us see what the history of broadcasting tells us:

BALANCED PHASE DOUBLE REACTION!

In 1926 there were 119 stations in Europe, and their total power was 150 kilowatts. Within three years 81 stations were added, and the total output was now 600 kilowatts. The Prague Plan, which arranged the European stations so as to result in a minimum of interference, was obsolete by the spring of 1931, when 261 broadcasting transmitters were radiating a total power of 2,860 kilowatts.

To-day, excluding a lot of minor little stations which, however, can produce a considerable amount of background noise, whistle and distortion, the number of stations is 240, and the total energy output is about 5,000 kilowatts.

The Prague Plan, believed to be heaven sent, is now proving to be the very devil. But the new arrangement of stations under the Lucerne Plan of 1933 is not likely to please anyone but local-station listeners.

Mighty Voices Growing Mightier.

What of the future? Insignificant stations are to blossom forth as monsters; stations already working on considerable power, are to increase their power.

Frankfurt is going up from 17 kw. to 6 kw.; a station, Nice-Corsica, at 60 kw., is available. Naples, now 1.5 kw., will be able to go to 60 kw. Falun, now .5 kw., can go up to 100 kw. Seville has 1.5 kw. at present, but it is entitled to go up to 100 kw. Graz, now 7 kw. (and next door to

London Regional!), will, after January, still be next to London Regional, but will be able to increase to 100 kw. Stations like Trondheim (now 1.2 kw.), Viipuri (13 kw.), Lisbon (2 kw.), Sundsvall (10 kw.) and others will be able to go up to 100 kw.!

Listeners in the Shadows.

The position would not be so bad if all the stations acted together, but this, of course, will not happen. Some stations will introduce plans for new stations immediately, while others will wait one, two or three years. Meanwhile, the selectivity demands upon a wireless receiver will be extreme. Huge steam-roller stations will spring up overnight, and the programme, 9 kc. off, which you have been enjoying will suddenly cease to be. It will be so seriously interfered with that all enjoyment will be lost. The powerful station of to-day is the swamped and mutilated station of tomorrow.

We may take it, then, that the B.B.C. will intend, and rightly so, to be masters in their own home. The increase in the power of the new Daventry will be the first step, but will it be the last?

The present Regional stations are permitted under the Lucerne Plan to increase their power from 50 kw. to 100 kw. There seems no shadow of doubt that ultimately they will do this.

Where the shadow will occur will be over the millions of aeriels within the zones of the B.B.C. Regional stations.

Those who live near the B.B.C. have been lashed with whips, but they are to be chastised with scorpions.

You may consider that I am trying to make your flesh creep. I am. I tried to do so a year ago, and a year before that, and I was justified. By all means, if you wish to do so, follow the design of one who thinks that the worst has been reached; he probably thought that the worst had been reached years ago.

The average receiver, built or bought, begins to be obsolete from the moment you have connected it to your aerial. It is not at all surprising that the appeal of the ordinary home-constructor's set design lasts about three weeks. Big Ben, when first heard on such a set, tolls its death-knell and the cabinet becomes its coffin.

Anticipating the Future.

So far my own system has worked successfully. By producing only one, or at the most two, big sets per year the wireless public knows where it stands—at least, as far as I am concerned. Each individual reader can make up his mind whether he likes or dislikes my sets; but if he decides not to build it he can put me completely out of his mind and consider other designers' products. If, on the other hand, he decides, as I hope he will, to build this set, for example, he will know that I shall stand by the receiver and not pull down the building I have only just erected.

Security of tenure is as important in a wireless set as in any other branch of life.

It is an incontrovertible fact that a receiver without full facilities for enhancing selectivity as conditions demand is only designed to cope with conditions as they are to-day. If a set can do this it accomplishes a great achievement. But it is inevitable that every week that brings greater interference will throw a greater burden on the receiver. Since the receiver cannot be

altered, the results from the loudspeaker will be. Imagine a car which may give very good results on the level roads of Holland being taken to Switzerland. Devoid of proper gearing and reserve power, the car starts up the foothills on the approach to the Alps; as the gradient increases the car labours, and finally the struggle is abandoned.

The owner of the car did not foresee that he might want to use it outside of Holland. This, of course, is a hypothetical case, but the need for reserve adjustments is very plain.

Full control of selectivity, with a possibility of increasing it, has been a feature of each of my three national sets. The subsequent history of these sets has startlingly justified the policy I adopted. Vast numbers of the "S.T.300" and "S.T.400" were built.

The first receiver was a cheap, simple three-valve set, but with far more controls than any other receiver making the same appeal to the public. It was, in fact, a turning point—and a hairpin bend at that—in designs for the home constructor. Hitherto the simplicity fetish had held sway, and a complete reversal of public opinion took place. The "S.T.400" is a four-valve development, also generously provided with controls.

Designs that Endure

How have these two sets served in the hands of the public? The reply can best be summed up by stating that the "S.T.400" and "S.T.300" sets are current designs to-day. Both receivers were actually at the last Radiolympia, and no one thought it at all odd that these sets should be on show nearly a year and nearly two years respectively after they were published. As far as I am aware, no builder of the "S.T.400" has changed over to another designer's set, and I know of no one possessing an "S.T.300" who has changed his set unless it be to convert it into an "S.T.400."

This is a truly remarkable tribute to both sets when one considers that it was the custom for thousands of constructors to build new sets every few months. Chopping and changing had so far become fashionable that to keep a given design in commission for even six months was something unusual. The reason for the continual changing was not interest in the hobby, but sheer dissatisfaction, and a praiseworthy, if despairing, search for something better.

Let us now get down to the technical aspect of the "S.T.500" and see how and why it is different from other sets, and whether the difference is one of detail or principle.

Too many circuits of to-day are the mummified relics of an obsolete technique,

while most new-born circuits go straight from their swaddling clothes into their winding sheets.

The circuit of the "S.T.500," in my opinion, is not only novel, but necessary.

The Panel Controls

The most casual glance at the receiver will indicate that its panel boasts several knobs. Three of these are switches, and as such are in no sense of the word controls. Two switches are for waveband changing, and one is for switching the set on and off. This leaves four panel controls and two tuning condenser dials. There are two tuned circuits, called respectively the aerial and the anode circuit. Such circuits are sometimes tuned by a single-control knob, but there are several reasons why such a simplified arrangement is unsatisfactory.

The upper left-hand knob on the panel is a series-aerial condenser which controls the high-frequency input and selectivity of the

by a detector, a driver valve and a Class B output arrangement.

Those readers of POPULAR WIRELESS who have built sets of the detector and 2 L.F. type have no conception of the increased selectivity which they can obtain from quite an ordinary H.F. amplifying stage. Sensitivity to weak signals will also be greatly increased.

My detector is of the sensitive, leaky-grid condenser type, but uses a much smaller value of condenser than usual in order to obtain better results; the explanation of this will be given later.

The Class B output ensures much better quality and much greater volume than have hitherto been obtainable on the ordinary battery-valve arrangement. In fact, the results obtainable with the "S.T.500" will astonish those who have not yet tried a properly designed Class B outfit. This development puts the battery set in a position to compete with the mains receiver

on its own ground, which has always been that of volume and quality. There is the added merit of economy of H.T. When the set is "on," but signals are not being received, the H.T. current for the output valve is only about 1 or 2 milliamperes, whereas it would be nearer 12 or 14 for a power valve. On the Class B valve you only use as much H.T. as the loudness of the signals needs. On quiet passages of music the current from your battery is negligible.

A Sound Investment

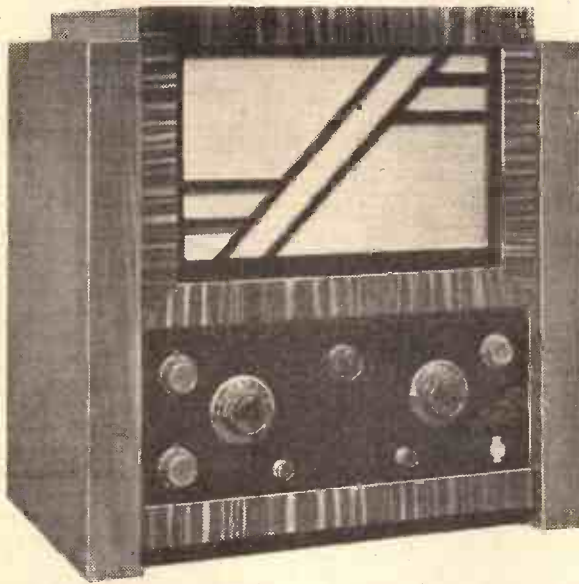
If an ordinary power valve is used you are spending perhaps pounds a year on H.T. current which is never made use of. This is because the average anode current of an ordinary power valve is the same whether you are receiving a whisper or the crash of cymbals. You have to have a large current so that the crash of cymbals can be "handled." But it is like buying and maintaining an hotel so that you can spend your summer holiday there. In Class B you pay for what you use, and the scheme will pay for itself in a month or two.

The high-frequency amplifying system of the "S.T.500" is highly effective for reasons which will be given in a detailed description, and the effect of applying reaction to both the aerial and the anode circuits simultaneously is to enhance signal strength and selectivity beyond anything which has been hitherto obtainable with two circuits.

This is not a general claim, but simply a technical fact, since the reduction of losses on two circuits *must* result in a degree of selectivity which it is impossible to obtain by taking advantage of the ordinary resonance effect of two tuned circuits, to one of which reaction is applied.

The first and almost the most vital decision you have to make is whether the

A CONSOLETTA VERSION



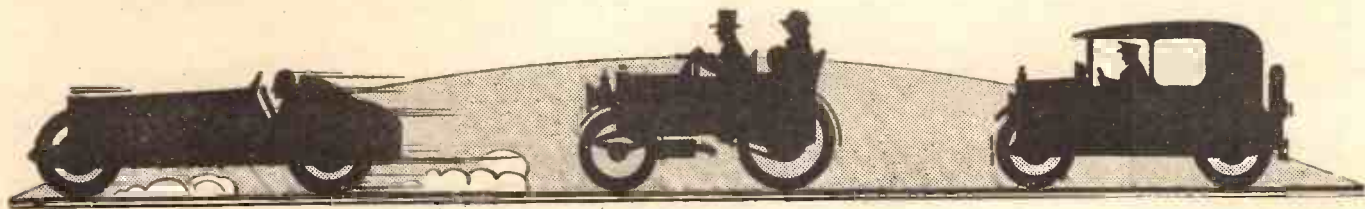
The "S.T.500" is here shown in a very handsome console cabinet complete with speaker. This artistic design was prepared specially for the set.

aerial circuit; at the bottom left-hand corner is an aerial-reaction knob, which provides reaction for the aerial circuit and still further increases its selectivity.

A Revelation in Sensitivity

Between and above the two tuning dials is a differential anode-coupling condenser which has proved so extraordinarily effective in the "S.T.300" and "S.T.400" sets. On the extreme right, in the top corner of the panel, is the ordinary reaction knob, which provides reaction on to the anode circuit.

The whole receiver consists of a stage of S.G. high-frequency amplification, followed



Glorious Volume and Depth Made Possible With

various knobs frighten you or not. In spite of the great success of the "S.T.300" and "S.T.400" sets, there is still a great deal of prejudice against multiple controls. This can easily be understood, and no one is more alive to the need for simplicity in the operating of a wireless receiver than myself.

It is generally recognised that, while single control is sought, it is impossible to obtain the same degree of selectivity or sensitivity unless all tuned circuits are individually tuned to the station to be received. The ganged set nearly always involves some discrepancy of tuning at some point or other on the wavebands.

For You or Your Grandmother?

The question of control generally raises the point: "Who is to operate the receiver?" If you are building a receiver for your grandmother I would advise something less effective but more simple than the "S.T.500"; or else tell her to leave some of the controls alone. My own idea of the average amateur, however, is that he is not a grandmother. We must come to an understanding on this point at once.

Commercial receivers are so cheap that something more than price prompts a man to build a set himself. The wireless constructor obviously has a greater technical interest in the subject than the

lay person, who twiddles a knob without the slightest idea of how the set works. If you build a pseudo-factory-built receiver you are simply placing yourself in the same position as the completely non-technical old lady.

You may turn the knob a little more slowly than she does, and perhaps get a little more accuracy of tuning, although the modern visual tuning arrangement will deprive you even of that consolation. Unless you can employ your skill to obtain better results you might just as well give up wireless as a hobby altogether.

If you gave Steve Donoghue a cart horse in the Derby in which all the other horses are of a similar type I would not be at all surprised if he were beaten by every driver of a dray. Put Stainforth in the cockpit of an old Avro and he would probably get left behind by every joy-ride pilot in the country. Do you imagine that Sir Malcolm Campbell would be able to get more out of a 1925 Austin Seven than anyone else? I very much doubt it.

The moral is that the machine should match the man. A tricycle may be the safest and best form of transport for an invalid old gentleman, but I cannot imagine Woods, who makes a habit of winning the T.T. races, proving his mettle in such a saddle.

Simplicity versus Results.

The presentation of a complete set of golf clubs to me would be a sinful waste. I could do better with a single iron than with the whole bag. Completely devoid of any golfing skill, I not only do not desire a bagful of clubs, but even think that golf would be a better game if only one club were allowed!

The frank realisation of one's inability to handle more than one knob on a wireless set may stamp one as a non-technical enthusiast, but it is no disgrace. I dare say

there are people who could drive a locomotive if it only had one control, but I cannot imagine the driver of the Flying Scotsman being satisfied with such an engine. One-knob control in every phase of life brings everyone to a single level, and it is a lower level than that which could otherwise be obtained.

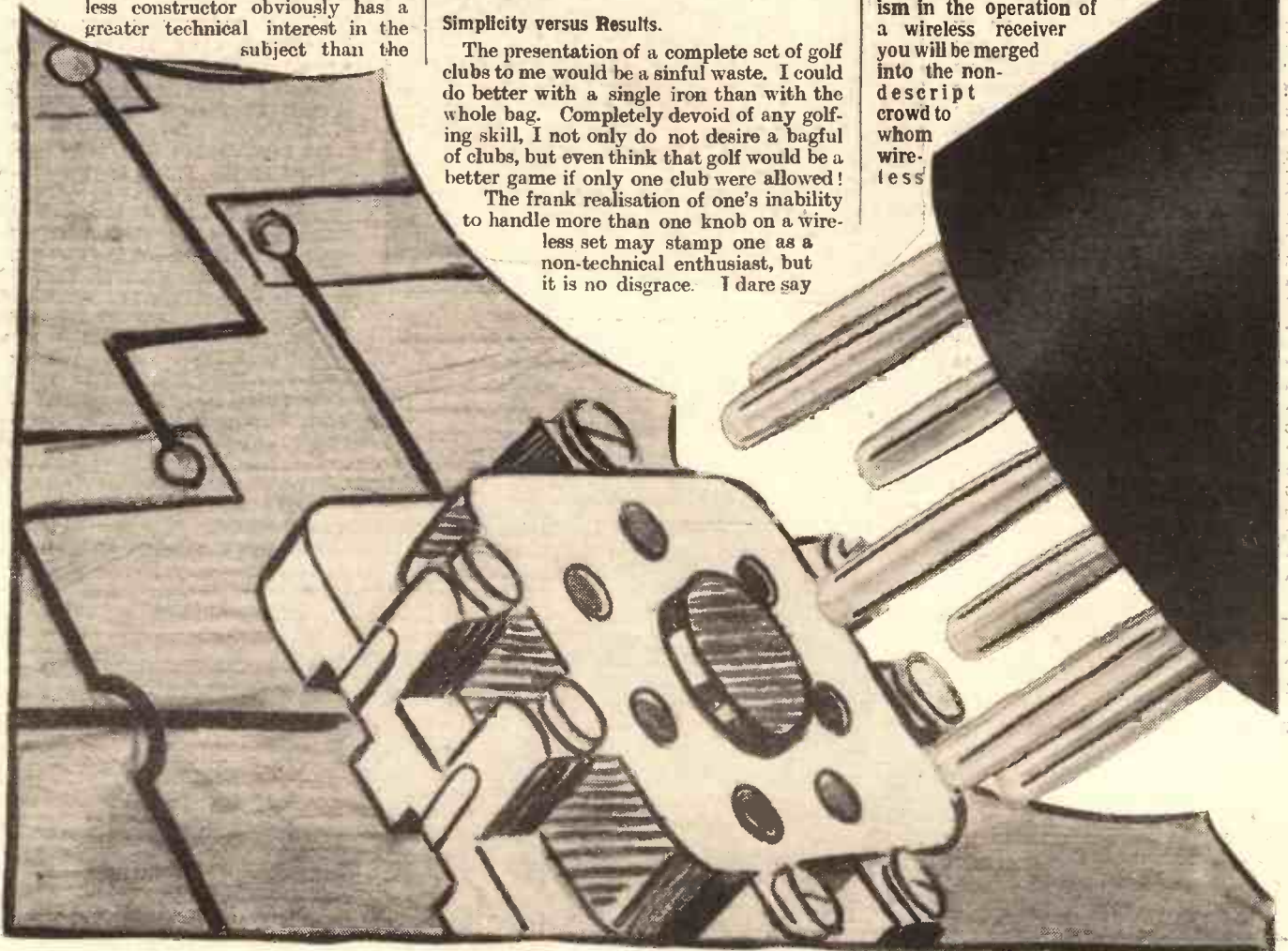
There are some people devoid of "road sense." To put into their hands the steering wheel of the slowest family car would be as felonious as administering cyanide.

Similarly, there are wireless people who have no "panel sense"; they are at sea with two knobs and at the bottom of the sea with three.

If you are one of these you are wasting your time by reading this. Panel sense is easily acquired, but those who fear controls must simply put up with poorer results.

Maintain Your Pioneer Supremacy.

Many of you were pioneers who popularised broadcasting in its early days and placed it on the sound foundations on which it now stands. You built and listened and encouraged others who have helped to develop the radio industry into what it is to-day. Unless you show yourselves alive to the possibilities of Individualism in the operation of a wireless receiver you will be merged into the nondescript crowd to whom wireless



Class B Output

means nothing more than a dial inscribed with the names of stations.

Such experience and skill as you have acquired through the years will count for nothing. You will be unable to use it. You will be forced to operate receivers which you know are less effective than they should be.

Wireless will lose its interest as a hobby. The zest of home construction, of a fine receiver built with your own hands, will



have vanished. You will have joined the lost legion of wireless enthusiasts.

As a means of introducing wireless to a new public, there may have been some justification for the "simplicity era." I am glad, however, that I had no hand in it. Let me disclose what occurred, as far as I was concerned, in 1926. The sale of wireless books and constructional envelopes, blue prints, etc., by Radio Press, Ltd. (of which I was the head), was on a huge scale.

Taking Drastic Action.

These publications continued to sell long after I was convinced that technical progress in my laboratories had made many of the press designs obsolete, or at least obsolescent.

In 1926 I determined to take drastic action to prevent the building of sets which I felt would be sooner or later—and prob-

ably sooner—incapable of coping with new conditions and a greater interference. In view of the big business done in instructional books and envelopes large stocks had to be carried.

I stopped all advertising of obsolescent designs. In spite of this, sales continued.

A Magnificent Gesture.

I then decided on the drastic step of refusing to sell any publications of my own, or of the many other authors who wrote for me, which contained designs no longer representative of the new methods which were being developed, all of which involved high-frequency amplification. Large stocks of publications were, at my order, destroyed. Compensation was paid, and paid willingly, to printers and authors. This clean sweep involved a personal loss to myself of several thousand pounds. No one suffered but myself, and there could be no greater testimony to the technical sincerity of a designer than this gesture.

If there are any knobs on the "S.T.500" other than the tuning controls and reaction, about which you have the slightest doubt whatsoever, you can leave them strictly alone and, if it will make you any happier, you can actually take the knobs off! The set will then become a very good average receiver, every bit as good as the kind of

"simpler" set which you might otherwise choose to build.

The reason why the extra controls can be left at "normal" (usually either in a vertical position or to the left) is that the controls are not interdependent. None of them is a vital link in a chain. Set controls are essentially part and parcel of the circuit of a set. Without them the whole set will fail. An example of such a control is a tuning dial. If it is not tuned correctly, the desired station will not be received.

Only Two Essential Controls.

On the other hand, a control such as reaction will greatly improve signal strength and selectivity on any well-designed receiver, but it is not an essential control in the sense that the set will not work without it. Fewer stations may be obtained and more interference experienced if the reaction is faulty or not used, but it is not a direct link. The only essential controls on the "S.T.500" are the tuning dials, and in this respect the set is no different from any other. Every other single control on the "S.T.500" could be ignored and yet leave the set operating quite effectively.

(Continued on page 254.)



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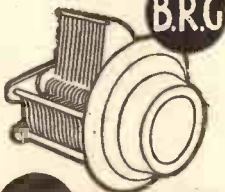
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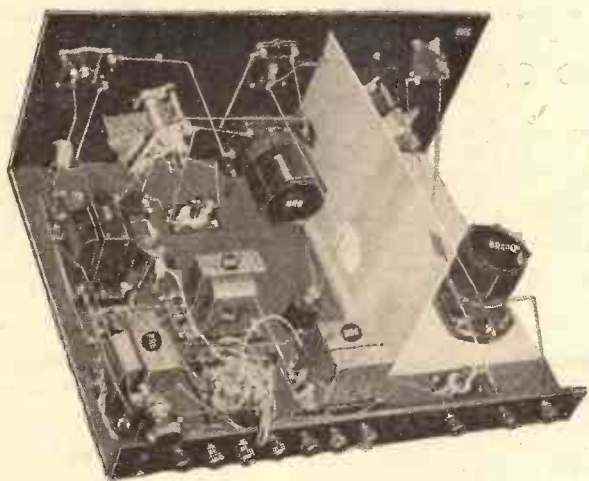
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Every Sealed **B.R.G. S.T.500 Kit** contains a coupon which entitles you upon request to a **B.R.G. Guaranteed Long Life 2-volt Accumulator.**

To **BRITISH RADIO GRAMOPHONE CO. LTD.**,
Pilot House, Church St., Stoke Newington, London, N.16.
Dear Sirs,—I wish to obtain immediately a
B.R.G. S.T.500 KIT.
My Dealer is (NAME).....
(ADDRESS).....
MY NAME.....
MY ADDRESS.....

SCOTT-

Contrast this type of control with, say, five separate tuned circuits each separately controlled by a knob. Every single circuit has to be correctly tuned, otherwise the desired station will not be properly received. To all but the experienced man the tuning of such a receiver would be about as easy as finding the combination for a safe. Hundreds of different combinations of values of the condensers could be tried without getting the desired stations.

Exactly the opposite is the case in the control of the "S.T.500." You are bound to tune in stations even if all the extra controls are set at random. Admittedly, selectivity, sensitivity, volume and quality may be impaired. But the extra controls are what I call the parallel type and not the series type.

A good example of the series type of control is the trimmer of a gang condenser. It is an actual link in the chain, and if wrongly adjusted the set will simply not work. The average factory-built set is all links, and it takes a factory to see that the links all fit together. It is a cardinal policy, adhered to in the case of every set I have so far designed for building on a national scale, that the extra controls shall be refinements.

In my opinion, no "variable" should be capable of throwing the set out of working order if incorrectly adjusted. Secondly, each control should produce a very definite and easily observed effect when it is separately operated.

The "S.T.500" is a racing model, and the effect of its controls may be compared to the additional refinements on a car or on any other racing models. Take a racing yacht, for example. It has one or two main sails which are always in use, but the skipper can raise and lower other sails to obtain a faster performance. He can let out that rope or pull in this one in order to take

ences in valves and in the components of a receiver which may vary to some extent amongst the same type and manufacture, but which vary even more between different types. Such things as an S.G. choke or a reaction choke may cause a very wide variation in performance due to differences in inductance, resonance peaks, resistance and self-capacity.

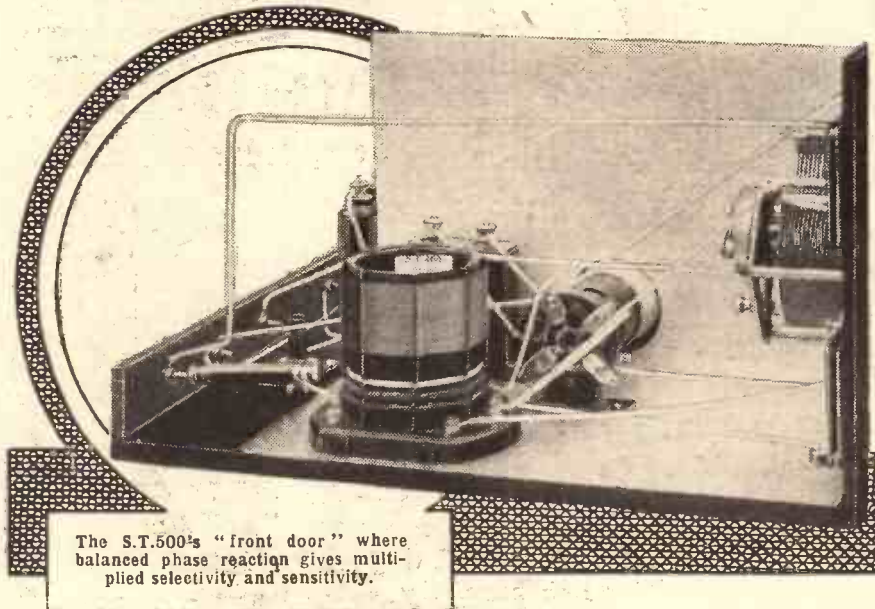
The reader is advised to adhere to the components used by the designer, but there is no guarantee that he will always do so, and it is clearly desirable to provide controls which will bring the set up to the very high level desired in spite of difference in individual sets.

I say very definitely that, unless you are prepared to add some controls, consistent results are not obtainable. The designer who gets excellent results in his own laboratory will find that conditions in different homes vary enormously. I have been in scores of constructors' homes from Land's End to John o' Groats, and I believe I know your own local problems as probably no other designer does.

I can design, and have designed, receivers for dithery hands and shaky intellects. It is, however, a relief to design a receiver for a public which can appreciate flexibility and real racing-car performance.

The mania for simplicity in home-constructed sets has led to a welter of unsatisfactory receivers which are now making their owners discontented and reproachful.

VIEW OF THE AERIAL END OF THE "S.T.500"



The S.T.500's "front door" where balanced phase reaction gives multiplied selectivity and sensitivity.

Here you see the aerial end of the receiver. The aerial coil is of the "S.T.400" type. An "S.T.300" aerial coil may be modified by the constructor by adding a very simple aerial-reaction coil.

advantage of every breeze or every change of tide. His extra sails are refinements, but they make all the difference between winning or losing a race. By stripping and simplifying their craft the captains of the "Britannia" or "Shamrock" can turn these racing yachts into sailing barges.

Apart from all other benefits, extra controls are needed to compensate for differ-

DESIGNED

TAGGART

The fault, however, is chiefly the public's. Those who have been beguiled by the clean look of a panel are now finding out that what one gains on the swings one loses on the roundabouts, and the roundabouts are proving very big and noisy.

The swings themselves have lost all their attraction. There are certainly a million sets hopelessly out of date, and I should be inclined to put the figure at nearly four million. Most of the other sets are obsolescent. This applies to commercial and a amateur-built receivers. Probably the greatest trouble of all is being caused by the cheap three-valve sets.

One-knob control definitely limits the technical development of a receiver. The necessity for absolutely accurate ganging of the different tuned circuits makes it impossible to apply any device for improving signal strength or selectivity owing to the risk of upsetting the ganging. A curious situation has already arisen with regard to the new iron-core coils. These coils have a greater efficiency than air-core coils of the same size. Owing to their lower resistance, any error in tuning of one circuit will cause a much greater change in overall response. Since the resonance curve is sharper it is much more important to tune accurately. This means that with iron-core coils

ganging is increasingly difficult. The inventor of one brand of iron-core coil tells me that the efficiency of the coil has deliberately to be made less than it could be in order to make it commercially possible for set manufacturers to gang their circuits. In other words, separate condensers be-

applied reaction to both the aerial circuit and the anode circuit, so that the efficiency of both circuits is extremely high. It would be quite impossible to use ganging with such a circuit; the very slightest variation of capacity or inductance or stray capacity would prevent the double-reaction system from being used.

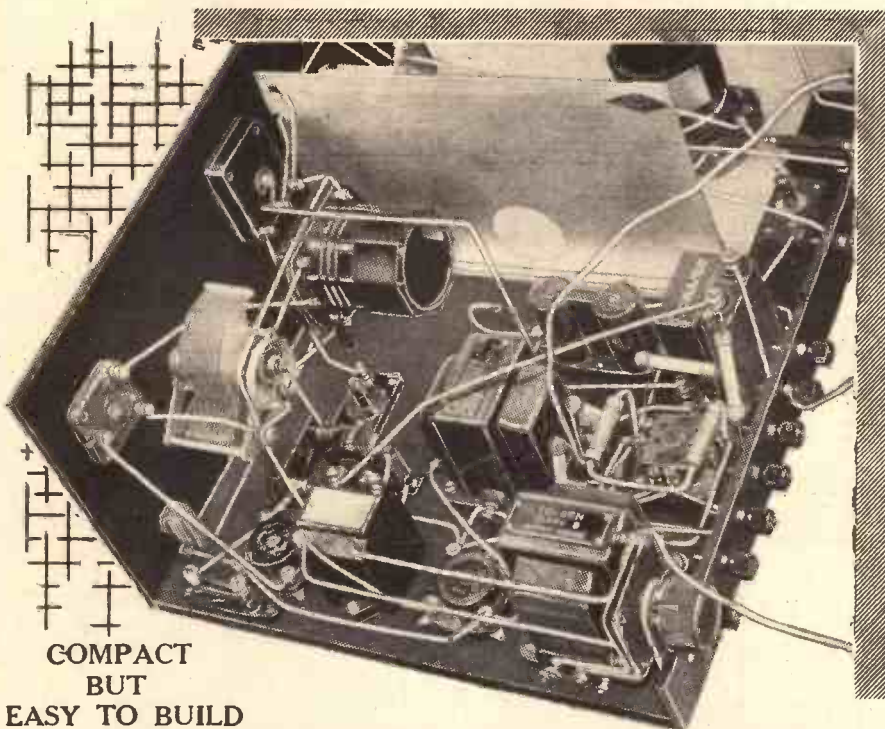
There is thus no chance of the scheme being used by set manufacturers. It is a technical development of the utmost importance which cannot be used for the simple reason that a ganged condenser could not be employed. What a wonderful opportunity for those with just that little extra tuning ability!

It is a justification of my opinion that the technique of a home-constructed set should be utterly different from that of a factory set. What is a stumbling block to the factory can be the golden opportunity of the constructor.

Even apart from the double-reaction scheme there are important features in the "S.T.500." The selectivity of nearly every set is fixed, or partly fixed. How much different is it on the "S.T.500,"

where the selectivity and sensitivity are completely adjustable over its whole range on every wavelength and on each waveband! If interference gets worse in the future you can simply make a small alteration to the control on the panel and your set progressively

THE DETECTOR, DRIVER AND CLASS B



COMPACT BUT EASY TO BUILD

This view shows how simple even the more compressed part of the set is. Class B is used, and the component in the bottom corner is the output choke, which is not bought if you buy a moving-coil speaker with Class B terminals.

come even more advantageous as the efficiency of the coil increases, while if the tuning of each circuit is kept fairly flat—i.e. unselective—ganging is greatly simplified.

In the case of the "S.T.500" I have

THIS SET

The S.T.500 gives Enormous Magnification with

becomes more selective. Even if you are not prepared to use the controls in the way intended you can, by rotating the aerial and anode couplers to the left, increase the general selectivity of the set every few months if you find interference increases, as you undoubtedly will do.

You who are reading this must choose now whether you propose to wear the strait-jacket of simplicity or whether you prefer the flexibility of the "S.T.500."

Avoiding Counterfeit Simplicity.

I could easily have simplified the panel by inserting at least two of the controls inside the set. This, however, would only be a half-measure. It would certainly popularise the set amongst those who were not prepared to stop and think. Conditions of reception, however, vary at every degree on the dial, and for that matter at every hour of the day.

If you can get a big increase in volume or a striking improvement in selectivity by the slight turn of a knob it is better that the control should be on the panel, where it is easily to hand. No one wants to climb under a motor-car every time

a gear is to be changed; nor does a golfer want to go back to the club house every time he wants a mashie niblick, even though he may look simpler on the golf course without his bag of clubs.

The idea of full-range, panel-controlled selectivity of each circuit in a receiver was introduced by me on the "S.T.300." Before that time it was customary at the most to provide a certain degree of variable selectivity on the aerial circuit of a receiver; the tuned circuit between the valve was completely ignored, although a tapping was sometimes provided to increase the stability of the set. The introduction of differential anode coupling, as well as an aerial coupler, enabled the selectivity of both circuits to be varied over the whole range.

The aerial and anode couplers are the two main selectivity-volume controls; the rotation of either in an anticlockwise

water-tight, so to speak, compartments; these are the aerial circuit and the anode circuit, and the aerial circuit is tuned by means of the left-hand dial, while its selectivity and strength of signals are governed by the aerial coupler and the aerial-reaction knob.

The anode circuit is tuned by means of the right-hand dial, while its selectivity is governed by the anode coupler and the ordinary reaction knob. The two circuits are therefore identically treated, and you can either have high selectivity on the aerial circuit and flattish selectivity on the anode circuit, or vice versa. In extreme cases you would have the maximum selectivity on each circuit.

When first handling the receiver you would experiment on each circuit purposely and learn the effect of an alteration on the control of that circuit. You would then proceed to try the effect of the controls on the other circuit. With the aid of the



direction will improve selectivity, while a rotation to the right will improve volume. In practice the anode coupler will very rarely go beyond the half-way position, and sometimes, with some valves, no advantage will be gained by rotating the anode coupler further to the right.

The two reaction controls are independent of each other, as, in fact, are all the tuning arrangements. The set is divided into two

very full instructions which will be given the complete art of working the set will be mastered on the first evening, and this mastery of the set will give an extraordinary sense of power and control over the apparatus.

Members of the household who do not wish to learn how to operate this set to the best advantage can simply use the two tuning dials and the anode reaction (if desired). The other controls can be left at normal. Wives and relatives of readers will, in any case, probably not wish to tune in anything but the main stations. Provided the additional controls are left alone, the set may be used as a very tame and easily-operated receiver.

When, however, the constructor himself comes home the "S.T.500" will develop

Every instrument is brought out clearly without losing by the amplification.

Absolute Realism of Tone

new life and will respond submissively to intelligent handling. Sound common sense is the only qualification necessary for working the set, and speed of tuning is a feature of the working of the receiver, since everything is under complete control. There are no fluky results.

The "S.T.500" can, therefore, be operated as a "family bus," whilst in the hands of its master it becomes a true racing model.

This, surely, is the ideal to aim at in the design of a wireless receiver. The thrill of receiving station after station, cutting down interference as if you were sand-papering the roughness off a piece of wood, makes the controls a delight to use. You can hear them chopping off the excrescences of interference which may be clinging to the

any of them had heard the set at work. It was purely a question of faith. Faith in my reputation as a designer. It would be hypocrisy on my part not to feel pleased about a matter of this kind. But it also makes it tremendously important not to let the public down.

Quite half a million pounds will be spent in the next week or two by builders of the "S.T.500." It is a very large sum of money, and I feel intensely the responsibility. But I have no qualms. No set I have yet designed has been more deliberately conceived



desired station. You can hear them bring a signal up from a whisper to a glorious outpouring of melodious sound. You can hear them reducing an overpowering signal to one of pleasant strength. In fact, the controls not only give you authority over the set, but mastery of the ether.

Those who feel their interest in radio is flagging, who want to recapture the thrill and enthusiasm with which they listened to their first set, will find in the "S.T.500" something to rekindle their joy in radio.

The Responsibilities of Success.

I want every reader of this issue of POPULAR WIRELESS to appreciate that, with a string of successes behind, I feel the very great responsibility in offering a new design. It is a very simple matter to see how the public is building a new receiver by consulting the component manufacturers, especially the coil-makers.

Within the first five days of my last set—the "S.T.400"—being published, 40,000 home constructors ordered the coils. This, of course, must have been before

or based on such a wide experience in all parts of the country of the novel principles involved.

A fully complete and fully technical service, conducted by an efficient staff working in the closest co-operation with myself, is ready to help you if you have any kind of trouble whatsoever. You can proceed to build the set with the full confidence that it will be backed up by the proprietors of POPULAR WIRELESS and by myself. I urge you to start building the receiver at once. If you lack faith

(Continued on page 261.)



The following Dubilier Condensers and Resistances are chosen by Mr. John Scott-Taggart for the S.T. 500

Three Type B.B. non-inductive type fitted into moulded bakelite cases. 250 volts D.C. peak.
Two 1mfd. 2/6 each.
One 2mfd. 3/6.

Three Type 4401 Tubular Paper Condensers.
Two .005 mfd. 1/3 each.
One .0005 1/-.

One Type 670 Moulded Mica Condenser.
.00005 1/-.

Five Dubilier Metallized Resistances, one watt type. Two 5,000 ohms. Two 10,000 ohms.
One 250 ohms, 1/- each.

One Dubilier Grid Leak.
1 megohm, 1/-.

PROOF POSITIVE of DUBILIER SUPREMACY

Scott-Taggart's
personal
choice for his
S.T. 500



100% British
and dependable
as the Flag

DUBILIER CONDENSERS & RESISTANCES



EXTRACT FROM A TESTIMONIAL.

Crouch End, N.B.
24th April, 1933.

Dear Sirs,
You will be interested to learn that I shall shortly be discarding one of your H.T. batteries. The H.T. Battery in question is a "Siemens Power" 100 volt and was purchased by me in November 1931, and has been in use in conjunction with a 3 valve set since that date—a matter of 17 months.

I am,
Yours faithfully,
(Signed) C.H.

With the new developments now available Battery Sets can be made as sensitive and as powerful as their equivalent types in "all mains" and with a purity of reproduction which cannot be surpassed.

*YOU CAN BE ABSOLUTELY SURE OF THE BEST RESULTS
IF YOU USE*

SIEMENS
FULL O'POWER
RADIO BATTERIES

THEY COST NO MORE THAN ORDINARY BATTERIES

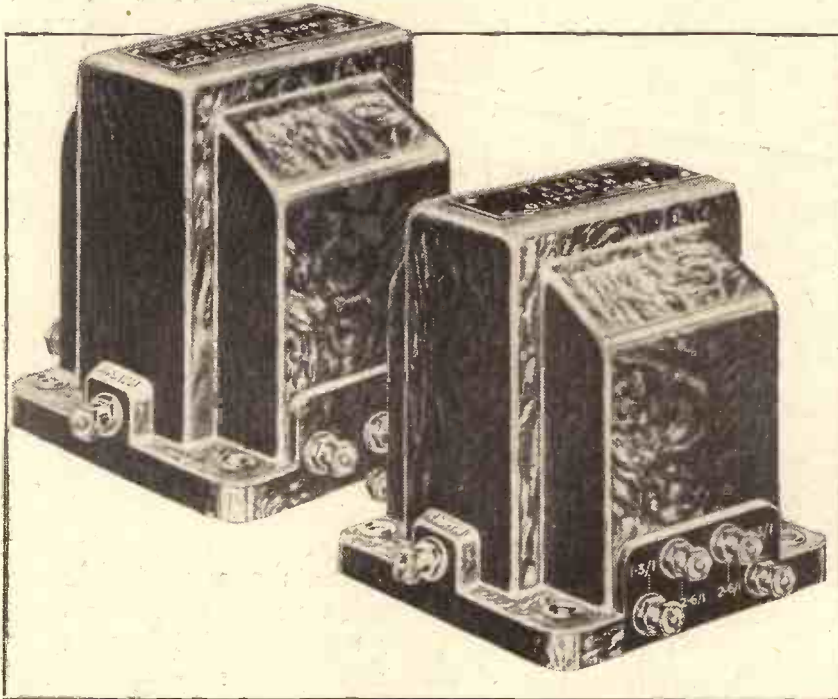
WRITE FOR FREE BOOKLET 667 OF UP-TO-DATE BATTERY INFORMATION

Advt. of SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38/9, UPPER THAMES ST., LONDON, E.C.4.

TELSEN

Class B COMPONENTS

SPECIFIED BY MR. JOHN SCOTT-TAGGART



For the P.W.
 "S.T. 500"

THE Telsens 'Class B' Driver Transformer and the Telsens 'Class B' Output Choke each represent the finest components of their respective types it is possible to produce, providing, at reasonable prices, a performance which is literally unsurpassed. Mr. John Scott-Taggart, like many other famous set designers, has shown his appreciation of this fact by specifying and using them in preference to all others. What better evidence of their superiority can you wish for than this?

**TELSEN
 'CLASS B' DRIVER
 TRANSFORMER**

Made in two ratios, covering the requirements of all the 'Class B' Valves available at present.

RATIOS
 Overall 1-1; Primary to half-secondary 2-1. Overall 1.5-1; Primary to half-secondary 3-1 **8/6**

**TELSEN
 'CLASS B' OUTPUT
 TRANSFORMER**

For matching to M.C. speakers having low resistance speech coils. Primary resistance 200 ohms per half-winding **8/6**

**TELSEN
 'CLASS B' OUTPUT
 CHOKES**

For matching to M.C. speakers having either a high resistance speech coil or a low resistance coil and input transformer. D.C. resistance 220 ohms per half-winding. Total inductance 18 henries **8/6**

**TELSEN
 7 PIN VALVE HOLDERS**

Specially designed for 'Class B' valves. Contact sockets extended in one piece to form soldering tags. Terminals numbered according to standard R.M.A. system.

Rigid Type **1/6**
 Anti-Micro Type **1/9**



The illustration above shows the position occupied by the Telsens 'Class B' Driver Transformer and Output Choke in the built-up P.W. 'S.T.500.'

TELSEN FOR EVERYTHING IN RADIO
 ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

or are ultra-cautious, by all means wait and hear someone else's set. But if you delay you may have to wait for your components.

My advice is: Start your "S.T.500" to-day. I am sure you will never regret the decision.

Let us now go into more detail regarding the reaction system of the "S.T.500." My last set—the "S.T.400"—involved a reaction chain in which the anode circuit of the detector provided reaction both to the grid circuit of the detector and also to the aerial circuit.

The reaction applied to the aerial circuit completed its circuit back to the detector valve via the differential anode coupler. Changes in anode coupler, therefore, changed greatly the reaction on both circuits.

Moreover, reaction on the aerial could only take place when both aerial and anode circuits were in tune, and alterations in tuning consequently affected the reaction.

In spite of these objections, which at that time were regarded as insuperable, tuning the "S.T.400" presented no great difficulty, since the aerial reaction could be cut out and only brought into use when the other selectivity adjustments fell just short of complete success and when the desired station had already been tuned in.

In the "S.T.500" all these objections have been removed and aerial reaction is used, not as a last resort but as a perfectly docile and advantageous aid even to finding a station and bringing it up to full strength. The complexities of the former scheme—which were freely admitted in my "S.T.400" description—no longer exist.

Independent Double Reaction.

The reaction for the second tuned circuit (i.e. associated with the grid of the detector valve) is obtained from the detector valve. The reaction for the aerial circuit is independently obtained and is derived from the S.G. valve.

This arrangement makes double reaction extremely straightforward. The two tuned circuits are kept wholly stable and either may be made more selective quite independently of the other. Sensitivity is simultaneously increased, and whereas in the "S.T.400" aerial reaction was used essentially to improve the selectivity, on this set—the "S.T.500"—aerial reaction will be often used to provide a delightful

increase in volume apart from any merits of improved selectivity.

For the daylight reception of weak signals I regularly use it, and even at other times often use the aerial reaction only.

Unparalleled Long Wave Performance.

The results on the long waves are even more startling, since reaction on this wave-band is notoriously bad on many sets. In fact, the long-wave band, which in my opinion provides some of the finest and most consistent radio entertainment to be had, is treated with contempt by most designers—chiefly, I think, because their

of the correct tuning point. Could a more ideal result be obtained? No parched and withering plant could sprout more quickly and eagerly after an unexpected fall of rain.

The aerial circuit of practically every set in Britain is robbed of the help which is always given to the anode circuit. Yet it needs the help more than its sister tuned circuit.

We designers recognise its need. We know what a terrible load the aerial-earth system is on the first tuned circuit in the set. I believe I was the first to appreciate to the full the need to lift some of this burden. At any rate, I invented the series-aerial condenser as used not for tuning but for improving aerial selectivity.

A heavily laden man moves sluggishly. A tuned circuit connected to the heavy load of an aerial-earth system is sluggish. One can make the first tuned circuit less so by inserting a series-aerial condenser which separates the aerial losses from what, by itself, may be quite an efficient tuned circuit.

This arrangement increases selectivity, but will very greatly decrease signal strength if the full selectivity benefits are to be obtained. It is a mixed blessing. You can evade the pressing claims of creditors by placing a big distance between you and them; but you will then find it just as difficult to collect any money that others may owe you.

The first tuned circuit shirks the burden of the aerial circuit by placing a small capacity as a separator. But the aerial retaliates and says: "Very well, I shall feed weaker signals to you."

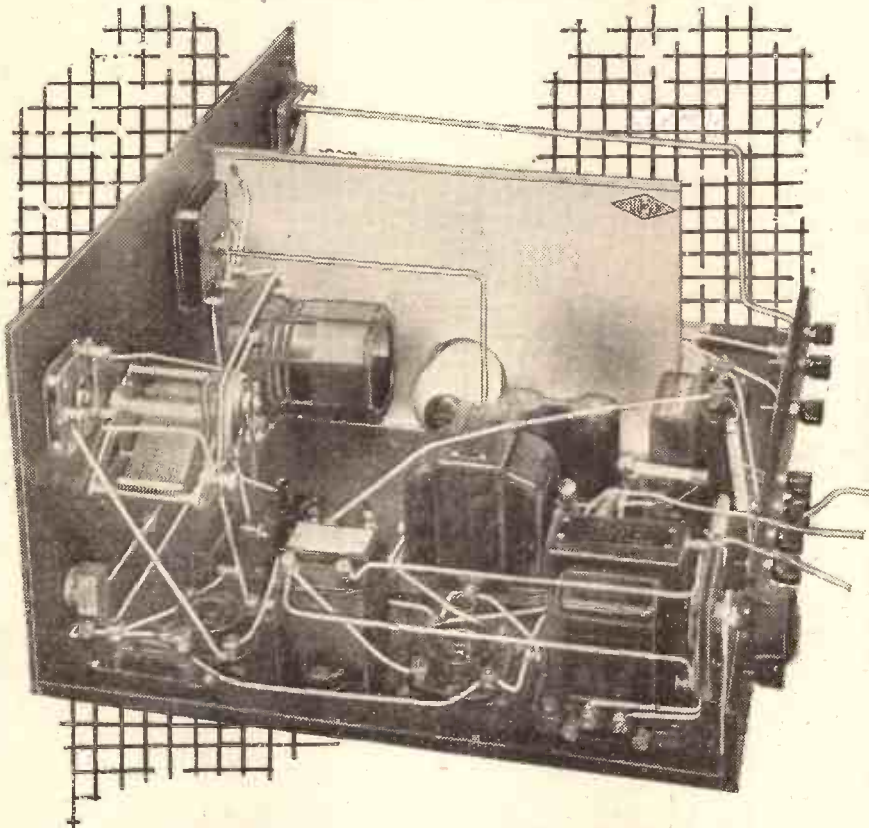
The aerial is like a tyrannous father who supports a son who wants to live a free life. The father says: "You can cut yourself adrift if you like, but I shall cut off your allowance." The son may therefore make a bargain to have a little more freedom but a smaller allowance.

Fallacy of Shortened Aerials.

This is what happens on the average set. The designer compromises between signal strength and selectivity. The aerial may be an Old Man of the Sea, but, after all, he does deliver the goods. We cannot do without the collector of our signals.

A favourite nostrum for selectivity is: "Shorten your aerial." This quack remedy lessens the aerial load but also reduces signal strength. A series-aerial condenser

SO SIMPLE THAT ANYONE CAN BUILD IT



A great feature of this set is that its astonishingly good performance is obtained while keeping the general constructional design extremely simple. Those who may have built the "S.T.300" or "S.T.400" will be able to use their panels, screen, condensers, terminal strip, L.F. transformer, S.G. choke, and other components.

circuits are stripped of the extra controls which would give equal efficiency on both wavebands. Since the god of simplicity must be worshipped at all costs, the long-wave band is offered up as a sacrifice!

Another reason why I favour aerial reaction even over anode reaction is that the damping of the aerial and earth is very much greater than that of the anode circuit of the S.G. valve on the tuned anode circuit.

The aerial circuit—the first in the whole set—is in the greatest need of help, yet it is always the anode circuit which receives the sympathy. Is it any wonder that the aerial circuit responds with almost pathetic enthusiasm as reaction is applied to it?

As one turns the aerial-reaction knob "up," one can hear the big aerial resistance being wiped out and signals previously a whisper rise in strength until majestic volume is reached. And yet the same signals will collapse to nothing if the aerial tuning dial is moved a degree to either side

Aerial Losses are Wiped Out

is also to some extent a questionable tonic, but if variable and on the panel, you only take it when really ill, i.e. when interference on a particular station is bad.

If you have lopped off some of your aerial you have to take your medicine whether you are ill or well. When, on a certain station, or at a certain time of day, you know you could let things rip, you cannot very well go out and extend your aerial; but on my sets you can get the same effect by increasing the capacity of the aerial coupler.

Gains Without Losses.

But cutting off your signal strength to spite your interference is regarded as inevitable. This is the eternal and infernal see-saw: Signals up—selectivity down. Selectivity up—signals down.

Now, at last, the "S.T.500" knocks the see-saw off its hinges. By applying reaction to the first tuned circuit we can wipe out the aerial losses. The aerial can now be brought closer to the tuned circuit; if a series-aerial condenser is used this is done by increasing the capacity of the condenser. Without reaction the aerial resistance and other causes of losses would immediately impair the selectivity and flatten tuning. But the reaction not only restores the original selectivity but provides a far higher degree of it. Moreover, not only does the close connection with the aerial result in very much stronger signals, but the reaction is now applied to these stronger signals and makes them stronger still!

The see-saw law under which we have grovelled for so long is not only repealed but actually reversed. Not only does double reaction unshackle every bond-servant of the harsh tyrant, but increased selectivity is now accompanied by greater signal strength.

It is, however, still possible, when desired, to obtain weaker strength while retaining equal selectivity, since the aerial coupler can still be reduced, and then will feed less H.F. into the set. Wide variations in volume are thus possible while maintaining full selectivity.

When a person was wasting away the doctors of past centuries would apply leeches to suck the life-blood of their patients. The designer who wants greater selectivity on his aerial circuit proceeds to starve it of signals! From now on each prescription will be as technically sound as the other.

To double the amplification of the S.G. valve is an extremely difficult proposition. But to multiply the strength of signals fifty times in the aerial circuit by means of aerial reaction is a simple matter. The new reinforced signals will be amplified by the S.G. valve in the ordinary way, and signals of fifty times the strength obtained on an ordinary set will be applied to the detector.

Benefits of Double Reaction.

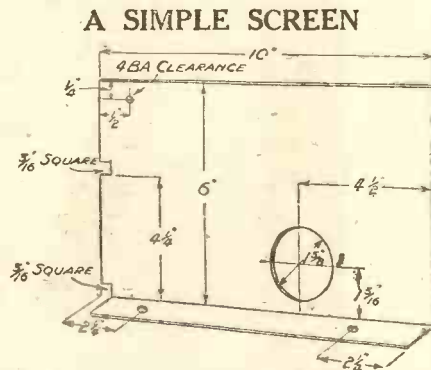
Well begun is half done. This is superlatively true of a wireless set where all the complications, difficulties, technical subtleties and miscellaneous losses occur after the first tuned circuit. A tainted spring will pollute a mighty river. I want you to start well in your set. Build up your signals at

the very beginning and filter out the biggest portion of the interference before it is amplified. You can do all this if you apply double reaction to your set.

If you prefer to mumble the shibboleths of the high priests of simplicity you must not blame me if you find difficulty in getting adequate volume and selectivity. If you leave till too late in the set the task of sifting out the interference and increasing the signal strength do not shift the responsibility on to me.

No parent would dream of underfeeding a child and allowing it to grow up wild and uncivilised, with the idea that when it was ten years old the process of nourishment and education could begin. Yet in every single design you pick up the aerial circuit is underfed and under-disciplined. Charity on such sets not only begins in the anode circuit: it ends there.

The principle of starving the aerial circuit to make it more selective is comparable to



The screen between the input and output of the S.G. valve. An "S.T.300" or "S.T.400" screen will serve, but note the upper notch.

a gardener lopping off most of the stems of a plant so that it will require less water to live. And, all the time, the little extra trouble of carrying a watering-can would turn the weakling into a flourishing plant with a profusion of flowers.

My advice to you is to encourage the weak signal when it first appears in the set. Give it reaction, which will build it up in the critical stage of its progress. This reaction will only build up signals in the immediate vicinity of the desired wavelength, so it is possible to make the desired station tower over its former bullying neighbours. The desired signal may then be sent out into the world, i.e. passed into the set. It will experience further growth and a final sprucing, but it has been launched with every advantage.

The comparative merits of different receivers is illustrated pictorially in accompanying diagrams.

Fig. 1 shows three aerial circuits. (1) is a plain tuned circuit directly between aerial and earth. Signal strength is good, but selectivity is really terrible. You can try it for yourself; improving the coil and condenser will not make very much difference when the aerial load is a big factor.

(2) shows an aerial-coupling condenser in use. This will at once improve selectivity, but as the capacity of the condenser is decreased the improved selectivity is ac-

companied by a rapid falling off in signal strength.

This is the see-saw effect. Even if the condenser capacity is made exceptionally low you still have all the losses in the coil and condenser; therefore under the most favourable conditions you cannot get more than a fair degree of selectivity and, of course, you will get comparatively very little signal strength (especially as the wavelength received increases), because the aerial is almost disconnected. If the aerial coupler had a minimum of zero the aerial would actually be disconnected.

Reaction Reigns Supreme.

The absolute theoretical limit of selectivity is reached when the inductance and condenser are free of the aerial load. But this theoretical maximum selectivity is not—and cannot be—anything but hopelessly inadequate, because there remains—and always will remain on any coil—the heavy losses in the coil and condenser.

The trouble in many a set is that by the time you have made it selective there is no station there to select. Most sets do not even have a variable-series-aerial condenser, or else you have to fumble with a pre-set buried somewhere in the set and neither intended for nor capable of use to suit the conditions of interference which vary at every degree on the dial on both wavebands and at every hour of the day.

But even if my policy of having the control boldly to hand on the panel is adopted the results are mean compared to those obtainable with the aerial-reaction scheme of (3). The reaction coil R is fed from the S.G. choke L_1 , the reaction condenser C_1 enabling the reaction to be adjusted to the best value. The S.G. valve, of course, also acts as an H.F. amplifier and feeds the subsequent circuit, which is omitted for the sake of simplicity.

Fig. 2 shows the resonance curve of different aerial circuits using (a) an air-core coil, (b) an iron-core coil of efficient design, and (c) an air-core coil with reaction. The height of each curve represents the signal strength obtainable, while the average width of the "mountain" is an indication of selectivity.

In practice, the selectivity of the reaction arrangement is very much higher, because one can afford to cut down the original signal strength and then bring it up with reaction. By this method the amount of interference at the base of the "mountain" in Fig. 2 becomes very small, and for a given signal output from the speaker the selectivity with aerial reaction is enormously greater than with any other method.

Fig. 3 gives some idea of the comparison.

Better Than Iron-core Coils.

The general efficiency of aerial reaction depends upon how effectively the reaction can be applied. Theoretically one might expect a circuit with full reaction to be literally millions of times better than a plain circuit, since the circuit resistance can be reduced to zero. There are, however, certain practical and theoretical limitations to the extent to which one can use reaction.

While seeking an efficient coil I had an ultra-efficient iron-cored coil specially made

(Continued on page 264.)

Because results have proved them the most reliable valves in the world; because performance has proved them the finest design in the world; because public choice has proved them the most popular valve in the radio industry, three million aerials today lead down to Mullard Master Valves. **And three million aerials can't be wrong.**

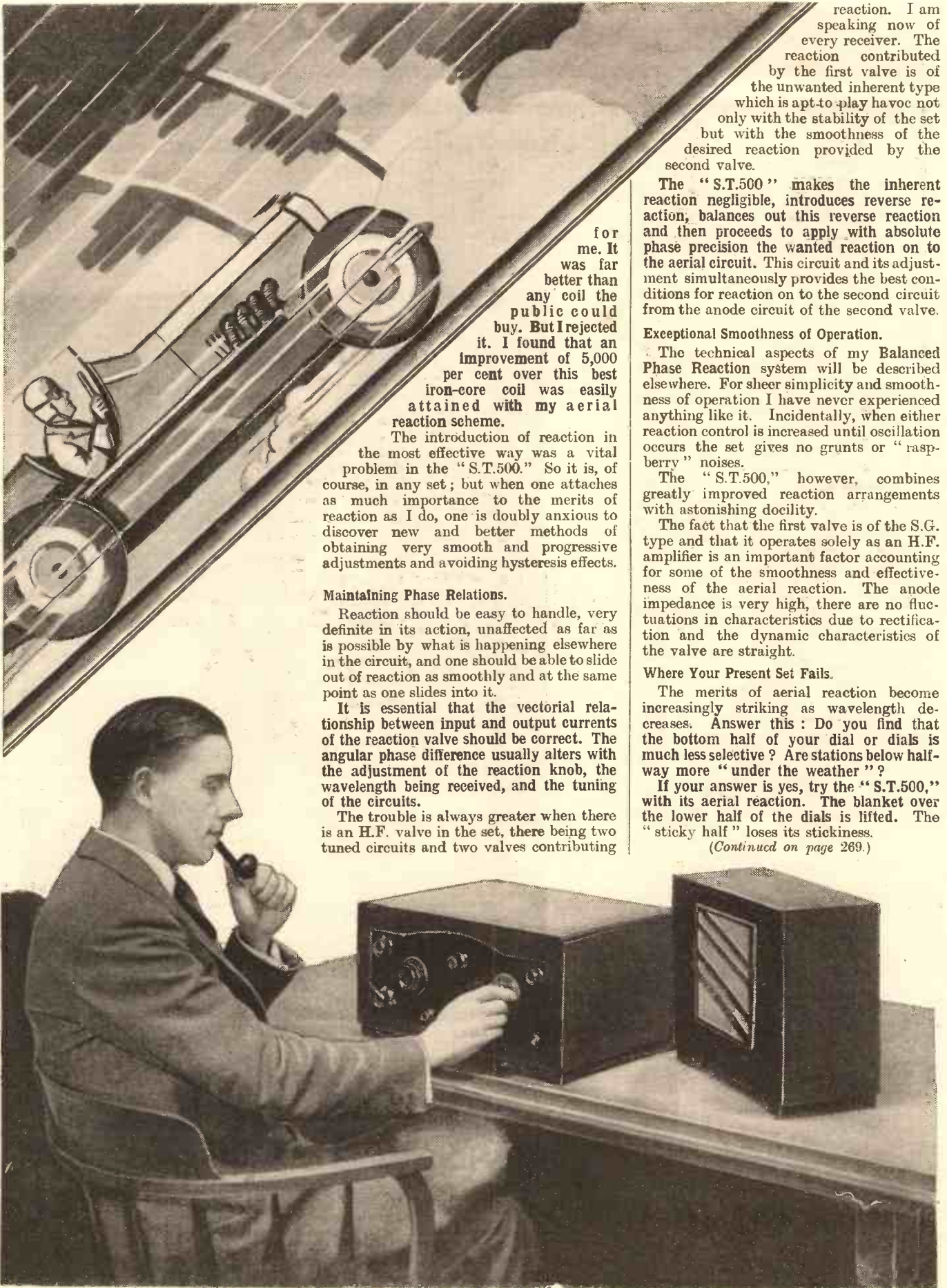
ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You're under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. C.V.R.



Mullard

THE · MASTER · VALVE

The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.



for me. It was far better than any coil the public could buy. But I rejected it. I found that an improvement of 5,000 per cent over this best iron-core coil was easily attained with my aerial reaction scheme.

The introduction of reaction in the most effective way was a vital problem in the "S.T.500." So it is, of course, in any set; but when one attaches as much importance to the merits of reaction as I do, one is doubly anxious to discover new and better methods of obtaining very smooth and progressive adjustments and avoiding hysteresis effects.

Maintaining Phase Relations.

Reaction should be easy to handle, very definite in its action, unaffected as far as is possible by what is happening elsewhere in the circuit, and one should be able to slide out of reaction as smoothly and at the same point as one slides into it.

It is essential that the vectorial relationship between input and output currents of the reaction valve should be correct. The angular phase difference usually alters with the adjustment of the reaction knob, the wavelength being received, and the tuning of the circuits.

The trouble is always greater when there is an H.F. valve in the set, there being two tuned circuits and two valves contributing

reaction. I am speaking now of every receiver. The reaction contributed by the first valve is of the unwanted inherent type which is apt to play havoc not only with the stability of the set but with the smoothness of the desired reaction provided by the second valve.

The "S.T.500" makes the inherent reaction negligible, introduces reverse reaction, balances out this reverse reaction and then proceeds to apply with absolute phase precision the wanted reaction on to the aerial circuit. This circuit and its adjustment simultaneously provides the best conditions for reaction on to the second circuit from the anode circuit of the second valve.

Exceptional Smoothness of Operation.

The technical aspects of my Balanced Phase Reaction system will be described elsewhere. For sheer simplicity and smoothness of operation I have never experienced anything like it. Incidentally, when either reaction control is increased until oscillation occurs the set gives no grunts or "raspberry" noises.

The "S.T.500," however, combines greatly improved reaction arrangements with astonishing docility.

The fact that the first valve is of the S.G. type and that it operates solely as an H.F. amplifier is an important factor accounting for some of the smoothness and effectiveness of the aerial reaction. The anode impedance is very high, there are no fluctuations in characteristics due to rectification and the dynamic characteristics of the valve are straight.

Where Your Present Set Fails.

The merits of aerial reaction become increasingly striking as wavelength decreases. Answer this: Do you find that the bottom half of your dial or dials is much less selective? Are stations below halfway more "under the weather"?

If your answer is yes, try the "S.T.500," with its aerial reaction. The blanket over the lower half of the dials is lifted. The "sticky half" loses its stickiness.

(Continued on page 269.)

"S.T.500"

Makes used by designer

Component	Colvern
2 "S.T.500" coils	Ormond, type R.493
2 0005-mfd. tuning condensers	Graham Farish "Littos" log. mid line
3 .0005 solid dielectric (log. or log. mid line) variable condenser	Telsen, type W.353
1 .0001-mfd. differential reaction condenser	Polar
1 .0002-mfd. differential reaction condenser	J.B., type
1 baseboard preset .0001-mfd. J.	
1 baseboard preset .0005-mfd.	
1 Class B driver transform (See article for ratios)	
1 Class B output choke (Not required if Class used.)	
1 transformer	
1 S.G. choke	
2 4-pin valve holders	
1 5-pin valve holder	

Altern. speech
Telsen
Graham
Ultra
Polar, J.B.
Radiogram
Radio-
phone
Radio

J.B., Telsen
S.S.
Lissen

Gr.
Liss

COLVERN

COLVERN COILS WERE USED IN THE ORIGINAL "S.T.500"

That means to say that when you use Colvern coils in your set you are assured of results identical with those obtained by Mr. Scott-Taggart because

EVERY COLVERN COIL IS THOROUGHLY TESTED AND GUARANTEED TO BE IDENTICAL WITH THOSE EMPLOYED IN THE ORIGINAL RECEIVER.

Type "S.T.500" ... Price 8/- pair

COLVERN SPECIALISE IN COILS

COLVERN LIMITED, MAWNEYS ROAD, ROMFORD, ESSEX.

MOST SENSATIONAL



E.M. PLUS 4

(Design based on the famous EVERYMAN FOUR.)

A new straight-four employing the most efficient coils that can possibly be made. These coils cannot be obtained in any other set—they are exclusive to the E.M. Plus 4, and are made specially for it. Gives superhet selectivity without any of the usual disadvantages. Amazing range and sensitivity with beautiful quality. Very easy to build and operate—single-knob tuning with the efficiency of multi-control operation. Circuit consists of variable- μ , screened grid, detector and 2 L.F. stages for battery operation. Beautiful cabinet of modern design with space for M.C. Speaker and batteries.

Build the E.M. Plus 4 and try it for 10 days—if you are not convinced that it is the finest four-valver obtainable, return it and we will refund your money in full.

KIT A
Complete Kit of parts, less valves and cabinet.
£4-5-0

KIT B
Complete Kit of parts with valves, less cabinet.
£6-6-6

KIT C
Complete Kit of parts with valves and cabinet.
£7.14.0

USE COUPON ON NEXT PAGE AND OBTAIN YOUR COPY OF "EVERYMAN RADIO"

AMAZING OFFER TO CASH CUSTOMERS

10-Days' Free Trial in your home

S.T.500 KITS

LIST OF PARTS

	£	s.	d.
1 Telsen Driver Transformer 1-1	8	6	
1 Telsen Class B Output Choke	8	6	
1 Ready Radio -0001 Differential Condenser	1	6	
1 Wearite Radiogram Switch	4	0	
1 Ready Radio S.G. Binocular Choke	3	0	
2 Ormond -0005-mfd. Variable Condensers	15	0	
3 -0005 Log Law Condensers	5	3	
1 T.C.C. -0005 Tubular Condenser	1	0	
1 Pr. Ready Radio S.T.400 Coils	8	6	
1 Varley Nictet Transformer	7	6	
1 W.B. Universal Valve Holder	1	0	
1 T.C.C. -0005 Mica Condenser	1	8	
2 Push-pull Switches	1	3	
1 250-ohm Thermium Resistance	1	6	
1 Ready Radio Reaction Choke	1	6	
1 Bulgin 7-pin Valve Holder	1	6	
1 Ready Radio 1-meg. Grid Leak	1	6	
1 Grid-Leak Holder	1	6	
1 Ready Radio -0003-mfd. Differential Condenser	2	6	
2 T.C.C. 1-mfd. Fixed Condensers, type 50	5	0	
2 T.C.C. -005 Tubular Condensers	2	6	
1 T.C.C. 2-mfd. Condenser	3	6	
1 Toggle Switch	1	6	
1 J.B. -00005 Baseboard Preset Cond.	1	0	
1 J.B. -0001 Baseboard Preset Cond.	1	0	
2 10,000-ohm Thermium Resistances	1	0	
2 5,000-ohm " " Valve Holders	1	8	
10 Belling-Lee type "R" Terminals	2	6	
1 S.T.500 Screen	2	0	
1 Pr. Panel Brackets	6		
1 Piece Aluminium Foil	1	0	
1 Baseboard 16 x 12 in.	1	6	
1 Panel 16 x 7 in.	5	6	
1 Terminal Strip, 16 x 1½ in.	1	3	
7 Wander Plugs	1	0	
1 Packet Jiffilix	1	6	
Flex, Screws, etc.	1	5	
4 Valves, as specified	2	5	3
1 Direct Radio Cabinet, Walnut	2	0	0
	£9	14	3

Any component can be supplied separately if desired.

KIT A

(less Valves and Cabinet)
£5-9-0

KIT B

(with Valves, less Cabinet)
£7-14-3

KIT C

(with Valves and Cabinet)
£9-14-3

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DIRECT RADIO LTD.
159 BOROUGH HIGH STREET,
LONDON BRIDGE, S.E.1.

RECOMMENDED ACCESSORIES

	£	s.	d.
Pertrix 120 volts	11	0	
Pertrix 120-volt Super Capacity	15	6	
Ever Ready 120-volt Winner	11	0	
Ever Ready 120-volt Popular	15	6	
Pertrix 9-volt Grid-Bias Battery	1	3	
Ever Ready 9-volt Grid-Bias Battery	1	0	
Block 120-volt Plateless Accumulator 5,000ma/hrs.	3	15	0
Block Plateless Accumulators 2-volt 80amp/hrs.	11	6	
Exide 2-volt Accumulator D.F.G.	8	6	
Atlas Eliminator Type C.A.25	2	19	6
Regentone Eliminator Type W.I.F.	2	15	0
Blue Spot 29P.M. Permanent Magnet Moving-Coil Loudspeaker with input transformer	1	12	6
Blue Spot 99P.M. Permanent Magnet Moving-Coil Loudspeaker	2	19	6
Epoch Permanent Magnet Moving-Coil Speaker, type 20C	1	15	0
Baker's Selhurst Permanent Magnet Speaker	2	5	0

Meteor S.G. All-Wave Kit, with-out valves	£2	10	0
Meteor S.G. Kit, with Valves	£4	1	3
303 Kit. Simple to build; only five wires to connect. Without valves	£1	15	0
303 Kit with valves	£2	17	9
Lissen 7-Valve Superhet Chassis Model, with valves	£8	17	6
Lissen Skyscraper 3, with valves	£4	9	6
Station Master Four, with valves	£4	6	6
Telsen Super Six, complete with valves	£9	15	6
S.T.400, complete Kit	£4	17	6

Cossor Model 341 3-Valve Kit, with Valves and Cabinet, Balanced Armature Speaker	£6	7	6
Telsen Class B4 Chassis Kit only	£3	17	6
Ferranti Class B Super-Power Converter, with valves	£3	3	0
Epoch Moving-Coil Speaker and Class B Unit, with valve	£3	3	0
Celestion P.P.M.19 Permanent-Magnet Loudspeaker, with tapped output Transformer	£2	7	6
Gorrard Automatic Record-Changer, Universal Model	£10	17	6

RADIO OFFER EVER MADE

Kits and Sets direct from Designers to purchasers

BUY DIRECT and SAVE POUNDS

Here is the greatest offer ever made to the Radio Public. New Kits and Sets of outstanding design and possessing all the latest improvements and many exclusive features at amazingly low prices. Why? Because we offer you the opportunity of buying direct, so that you are saved all the usual middle-man's profits. Never has such wonderful value been offered; never have such remarkable Sets and Kits been available at such astonishingly low prices.

And you can prove it for yourself with complete safety and confidence. If you are unable to call at our Showrooms at London Bridge to see, hear and test these wonderful Sets for yourself, we offer them to you for 10 days' free trial in your own home.

This unique offer is proof of our supreme confidence that you will be delighted with the Set you choose, and want to keep it. If for any reason you wish to, return it to us within 10 days, your money will be refunded in full without question.

DEMONSTRATIONS DAILY.

If in London, call at our showrooms at 159, Borough High Street (2 minutes from London Bridge Station) for a demonstration of any of these models, or any other Set in which you are interested. If unable to call, post coupon at once.

PROMPT DISPATCH.

There will be a big demand for these Sets. First come—first served. Order at once for prompt delivery.

DIRECT RADIO ALL-ELECTRIC (A.C.) SUPER-HET (5 valves including rectifier). Employs a new circuit possessing many special features. Screened-grid detector-oscillator, variable-mu I.F. amplifier, screened-grid 2nd detector and pentode output combine to give maximum efficiency obtainable and superior to many sets employing more valves. Special I.F. circuit eliminates second-channel interference. Amazing range and selectivity with 2-watts speech power in moving-coil speaker. Single knob tuning; combined wave-range and on-off switch; volume control. In beautiful cabinet of superb finish and modern design, fitted with high quality M.C. Speaker.

Only 10½ guineas in oak cabinet. In walnut, mahogany or limed oak cabinet, 10/- extra.

Also available as a battery model at same prices. **DIRECT RADIO ALL-ELECTRIC (A.C.) SUPER-HET RADIOGRAM (5 valves including rectifier).** A super-het radiogram possessing all the special features described above and fitted with electric gramophone equipment and high-grade pick-up giving most realistic tone. No photograph can do justice to the beauty of the cabinet design and workmanship. You must see it for yourself. All controls concealed when cabinet is closed. When opened the radio and gramophone equipment are at just the best height for easy operation.

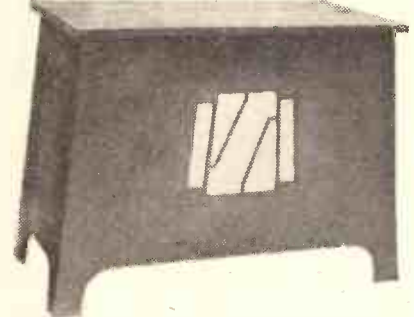
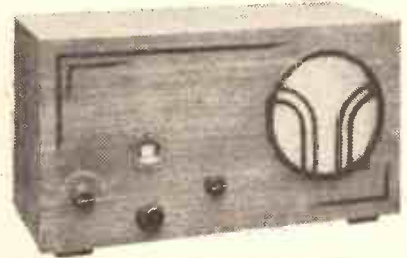
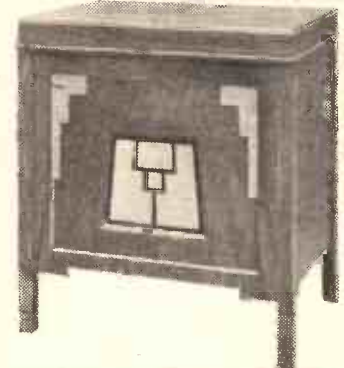
Only 15 guineas in oak cabinet. In walnut, mahogany or limed oak cabinet, 1 guinea extra.

DIRECT RADIO 3-VALVE MAINS SET (2 valves plus rectifier). For superb tone from local stations and a choice of the more powerful foreigners you cannot do better than choose this wonderful set. All-electric—no trouble: just switch on. Easy to operate, very selective. Beautiful cabinet. High quality speaker, giving exceptional tone. Only three controls—combined wavechange—on-off and selectivity control (a most useful feature), tuning and reaction volume. An ideal domestic receiver, yet responds amazingly to those who want distant stations.

Only £5 19 6 in oak cabinet. In walnut, mahogany, or limed oak cabinet, £6 7 6.

DIRECT RADIO ALL-ELECTRIC RADIOGRAM (3) valves plus rectifier. For real life-like quality and volume, this is the set you want. Will fill a house or a hall with music as loud as the original. Ideal for dance-halls, restaurants and hotels, yet equally suitable for the house because volume is under complete control. Principally intended for local reception and gramophone reproduction it is, nevertheless, capable of giving a good selection of foreign programmes at exceptional strength. All-electric, with electrically operated gramophone. All controls concealed when lid is closed. Radio and gramophone are placed at the most convenient height for easy control and record changing. Very solidly constructed throughout, the cabinet is specially designed to give a large and rigid baffle area, so that tone is delightfully rich and full, with beautiful bass reproduction.

Only 11½ guineas in oak cabinet. In mahogany, limed oak or walnut cabinet, 1 guinea extra.



Direct Radio

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To DIRECT RADIO LTD., 159, Borough High Street, S.E.1.
As I am unable to call at your Showrooms please send me full details of the
(Please fill in name of Kit or Set in which you are interested.)
Please state if you require particulars of our Easy Payment Terms

Name
Address

ORDER FORM.

To DIRECT RADIO LTD., 159, Borough High Street, S.E.1.
Please dispatch to me at once
(Please state voltage required.)
I enclose full cash payment of £
This order is sent on the strict understanding that if I return the goods supplied within ten days in good condition you will refund my money in full.

Name
Address

Better 'Class B' *with..*

MARCONI



Marconi B21 brings better 'Class B' performance to all battery sets because of these important features :

- It operates with grid bias. Hence quality is better because the anode current cut-off is less sharp and the currents in the two halves overlap. This reduces spurious oscillation and gives less distortion at low output levels.
- For the same reason and also because two grids are used in each half, the sensitivity is higher, because the input impedance is higher and less power is needed from the driver valve.
- Greater overall magnification, because it is possible to use driver transformers having a higher ratio than those allowable with the zero bias type of valve.
- Shaped bulb and rigidly interlocked electrode system with top support means greater accuracy of matching —important in push-pull.

MARCONI VALVES FOR USE WITH B 21

- Marconi VP21** — The first Variable-Mu battery H.F. pentode, for all up-to-date circuits **15/6**
- Marconi S24** — High Efficiency straight screen grid **15/6**
- Marconi VS24** — High slope Variable-Mu screen grid **15/6**
- Marconi HL2** — Non-microphonic triode detector ... **7/-**
- Marconi L21** — High Efficiency Class B driver for normal use **7/-**
- Marconi LP2** — Power valve and Class B driver for sets where full output is needed ... **8/9**



PRICE

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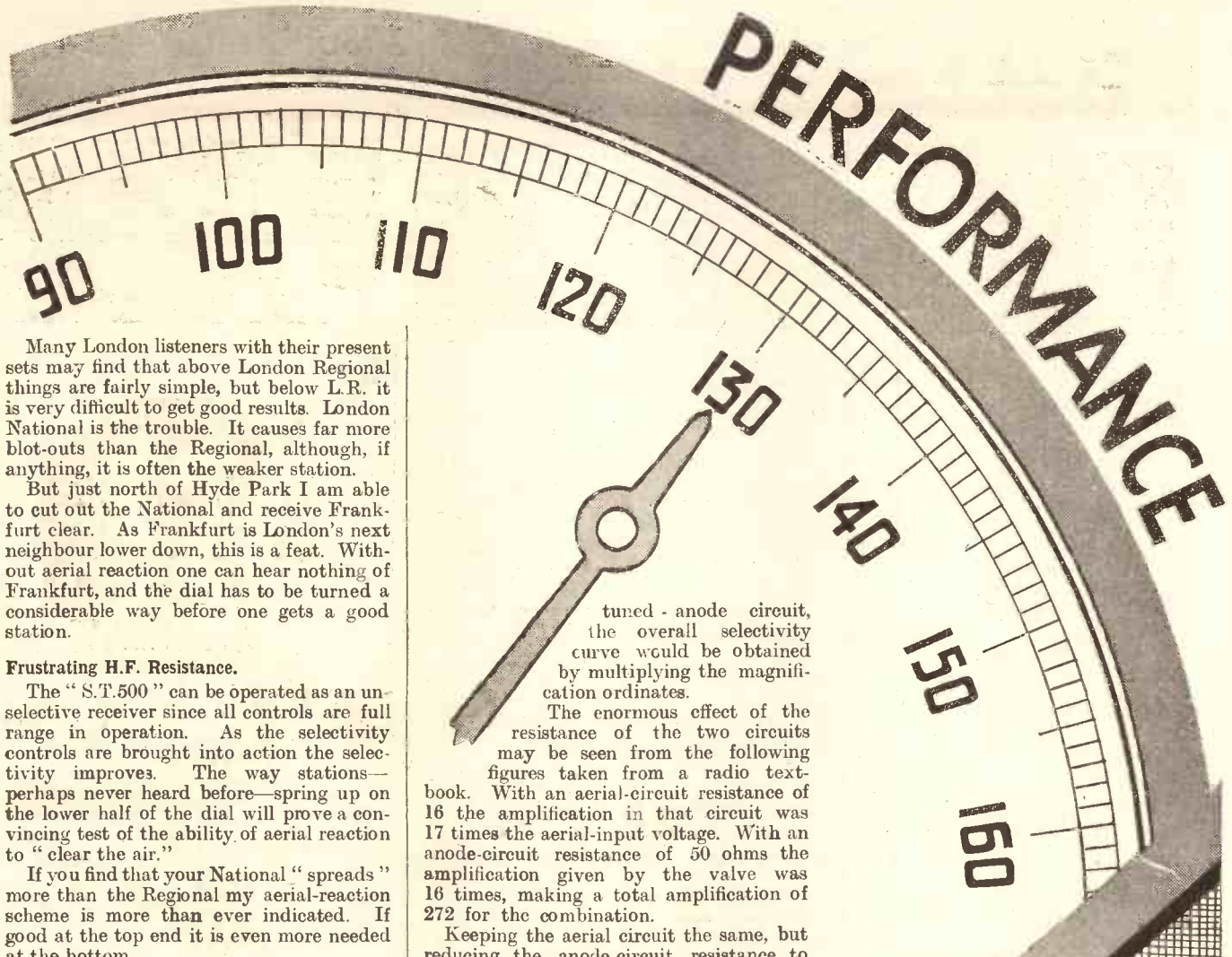
For full details and lists send this coupon to The Valve Department, The Marconiphone Company, Ltd., 210-212 Tottenham Court Road, London. W.1.

Name

Address

P.W. 21/10/33

MARCONI VALVES
the choice of the experts



Many London listeners with their present sets may find that above London Regional things are fairly simple, but below L.R. it is very difficult to get good results. London National is the trouble. It causes far more blot-outs than the Regional, although, if anything, it is often the weaker station.

But just north of Hyde Park I am able to cut out the National and receive Frankfurt clear. As Frankfurt is London's next neighbour lower down, this is a feat. Without aerial reaction one can hear nothing of Frankfurt, and the dial has to be turned a considerable way before one gets a good station.

Frustrating H.F. Resistance.

The "S.T.500" can be operated as an un-selective receiver since all controls are full range in operation. As the selectivity controls are brought into action the selectivity improves. The way stations—perhaps never heard before—spring up on the lower half of the dial will prove a convincing test of the ability of aerial reaction to "clear the air."

If you find that your National "spreads" more than the Regional my aerial-reaction scheme is more than ever indicated. If good at the top end it is even more needed at the bottom.

The percentage that a separation of 9 kilocycles is to the received signal becomes less and less as wavelength decreases and the high-frequency resistance of the coil and tuning condenser losses rapidly increase with frequency, i.e. as one tunes "lower."

Think of the great thick wire or even tubing that is used for every short-wave receiver. It is all in the effort to reduce "resistance."

In a broadcast receiver the rapid rise in the selectivity-destroying resistance as wavelength falls can be frustrated by aerial reaction and by aerial reaction only.

Multiplied Selectivity.

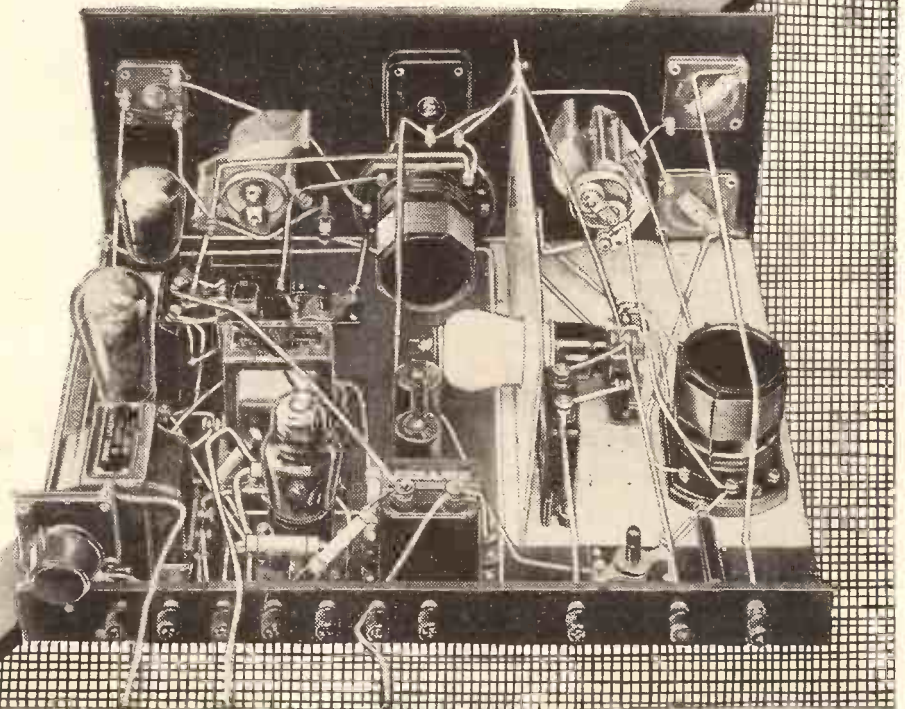
The maximum effect of the "S.T.500's" selectivity is obtained when both circuits are brought to their most selective condition, i.e. when reaction is applied to each. The full selectivity will only be necessary in extreme cases, but as other conditions become worse the average degree of selectivity you will use will increase.

In any receiver the overall selectivity is due to the multiplied selectivity of its separate tuned circuits. If you drew the curve showing aerial circuit magnification for different signal frequencies and then drew a similar curve showing magnification of the S.G. valve and its

tuned - anode circuit, the overall selectivity curve would be obtained by multiplying the magnification ordinates.

The enormous effect of the resistance of the two circuits may be seen from the following figures taken from a radio textbook. With an aerial-circuit resistance of 16 the amplification in that circuit was 17 times the aerial-input voltage. With an anode-circuit resistance of 50 ohms the amplification given by the valve was 16 times, making a total amplification of 272 for the combination.

Keeping the aerial circuit the same, but reducing the anode-circuit resistance to



The speed a car can maintain is an indication of its performance capabilities, and similarly with the "S.T.500" its ability to cope with all conditions all the time is the measure of its performance.

Make This Your 1934 Set and Get 1936 Performance

1.5 ohms by means of reaction, the total amplification was increased from 272 to about 7,000 times!

This startling result is a practical proof of the merits of anode reaction, but my whole point is that aerial reaction will give an equally startling result. The amplification of the aerial circuit depends on the resistance. If we halve the resistance we double the amplification.

Proved in Half a Minute.

If we reduce the aerial-circuit resistance to half an ohm by reaction we should get signals 32 times as strong—i.e. an amplification of 544. And this is before the signals are amplified by the S.G. valve! If we apply more reaction—as is easily done on the "S.T.500"—the figures become even more remarkable.

Since the overall selectivity of two tuned circuits is due to the multiplication of the amplification ordinates, any improvement of aerial-circuit selectivity will pay handsomely.

On an aerial circuit of 16 ohms resistance the amplification of a desired station was 17. An undesired station of equal strength but 9 kilocycles off was amplified 9 times. In other words, it was more than half as strong as the wanted station! But the designer of this receiver applied reaction to the anode circuit, and relied on this process for selectivity. The valve and anode circuit now amplified the desired signal 400 times and the interfering signal only 30 times.

Selectivity means cutting the interfering signal down in respect to the desired one. In the above example the aerial circuit cuts the interference down by less than a half; the anode circuit, with the aid of reaction, cuts it down to a thirteenth of its value.

What is regularly done on the anode circuit can be equally effective on the aerial circuit. But no one does it! The constructor—untrammelled by "simplicity"—can do it, and I show you the way.

Multiple reaction means multiplied selectivity. Half a day could be spent in mathematical explanation, but half a minute on the set will bring you proof.

Triumphs of Aerial Reaction.

Listen for some obscure station—perhaps a feeble Russian—on the "S.T.500." The dials are correctly set, but everything is silent. Anode reaction fails to help, but is left at a medium value. Look at that knob at the left bottom of the panel. It is the aerial reaction. Turn "up" the knob a little and slightly tune the aerial dial. The station emerges. Increase the aerial reaction. Signals swell up. Note that the set throughout is as stable as a rock. The music now fills the room.

Turn back the aerial reaction. Other stations may still be excellent, but the obscure station has sunk again into obscurity. Yet it can be conjured back by

the simplest operation in the world: aerial reaction.

Try for some other station. It may be not only obscure but buried in a morass of interference. It may have a precious programme covered by the undergrowth of sprawling stations.

Here is a clear case for aerial reaction. The interfering stations on either side cling stubbornly at first to the desired station. As the latter's volume increases with reaction, the jamming stations begin to lose their grip and slip away as the desired programme emerges triumphant. Aerial reaction!

Whether you are seeking stronger signals or a purer programme, aerial reaction is so effective that you may tend to forget anode reaction. Many readers will probably prefer to use aerial reaction first and leave anode reaction at zero or a small value. The set is then almost as simple to operate as a detector and L.F. receiver. The anode

amplification. They are then efficiently amplified by the S.G. valve and afterwards undergo further amplification by the aid of anode reaction. After this triple magnification they will do more than justice to the Class B output arrangements. Can the same be said for other Class B "fours"?

What Class B Must Have.

There is a more subtle reason for requiring adequate H.F. magnification. It is this: If the H.F. amplification is insufficient, good quality is impossible. If you choose your Class B "four" without regard to the vital question of sensitivity you will find that not only are your foreign signals unexpectedly weak but unhappily distorted.

The sensitivity of the "S.T.500" is high, to begin with. It is increased by the use of aerial reaction and by the additional advantage that a bigger aerial input can be arranged since the extra aerial-load effect can be wiped out by the aid of reaction: a double advantage already explained.

It is because I can afford a bigger input that I now use an input-aerial condenser more than ten times the size of those in my previous sets. It is now .0005 mfd. as against .00004 mfd. The normal disadvantages of large capacity disappear with aerial reaction, and the advantages (including improved signal strength) are multiplied.

The relative merits of four types of circuits can be seen at a glance in Fig. 4. There are two tuned circuits (aerial and anode) in each diagram, and the amount of interference in each circuit is illustrated by circles. One circle means that one station only is heard, i.e. the desired signal. A second

circle indicates that there is some interference, while several circles indicate more interference—perhaps by several stations.

The more circles, the more interference. The circles in the anode circuit represent the currents there, and therefore the overall effect of the two circuits. The top circuit shows a simple H.F. arrangement with no reaction at all. Some attempt at selectivity is made, and the anode circuit helps, but results are poor. The second circuit (b) shows the same circuit with reaction on the anode circuit; aerial-circuit interference is the same as before, but improved selectivity of the anode circuit is illustrated by fewer circles.

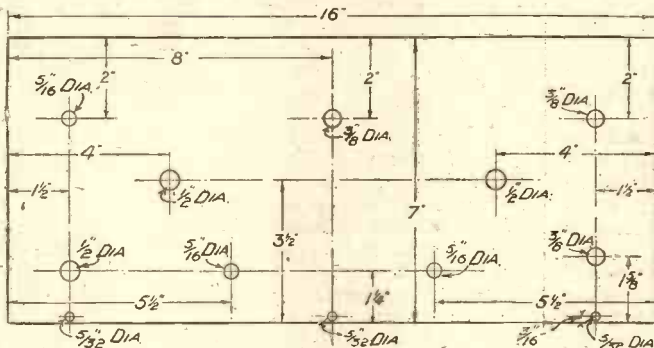
Approaching the Ideal.

This type of circuit is representative of most designs offered to the home constructor, although a series-aerial condenser is often added.

The third circuit (c) is similar to my "S.T.300," a simple and effective three-valver. Aerial selectivity is improved (but only up to a point and only with loss of signal strength) by the variable aerial-series condenser. The arrangement, in my opinion, still represents the best that can be done without aerial reaction. The

(Continued on page 272.)

IF YOU DRILL YOUR PANEL



BACK OF PANEL DRILLING DIAGRAM.
This drilling diagram shows the back of the panel. Note particularly that it is of the back of the panel, not the front. Pilot holes are first drilled from the back, and the main holes from the front.

circuit is then flatly tuned and searching is extremely easy. But, of course, anode reaction will often be needed.

The high performance of the "S.T.500" is due chiefly to multiple reaction producing multiplied selectivity simultaneously with multiplied signal strength. Add perfected Class B to what you have got so far, and you can imagine the performance of the set!

This, perhaps, is a good point at which to remind readers that Class B is not a sensitive arrangement. It will give a big output, but it requires a fully adequate input. A steam roller is a "powerful" piece of apparatus, but you could not drive it with a 1 h.p. motor-cycle engine.

The ordinary four-valve Class B set—and its number is and will be legion—will work loudly on a strong signal, but disappointment will be experienced on weaker stations. Let every reader be warned.

Four valves are the fewest you can use if you are to enjoy the merits of Class B, a three-valve set being worse than a det. and 2 L.F., except as a local-station receiver.

The weak link even in all four-valve Class B sets will be in the lack of sensitivity. In the "S.T.500," however, we amplify our signals many times by reaction before ever they are applied to the S.G. valve for normal

TELSEN

'S.T. 400' COILS

for Mr. John Scott-Taggart's

P.W.

'S.T. 500'

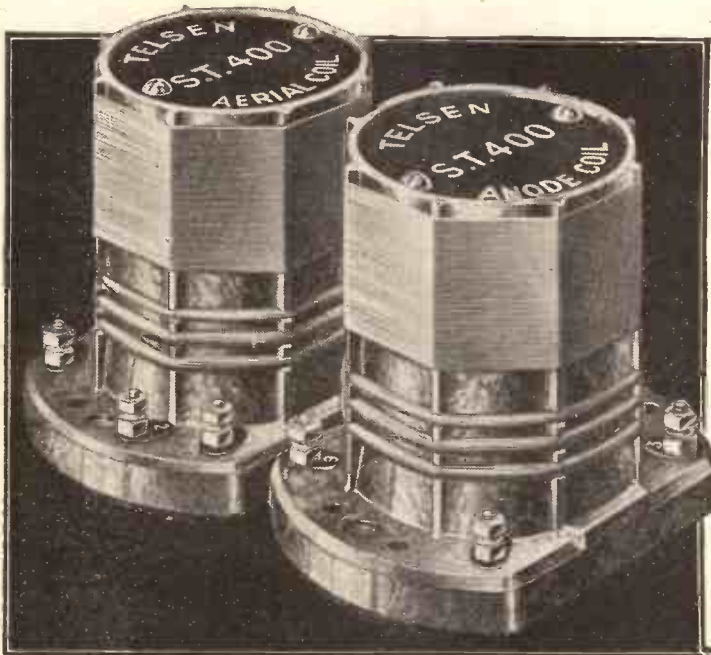


Illustration below shows the position occupied by the Telsen 'S.T. 400' Coils in a built-up 'S.T. 500' Receiver.

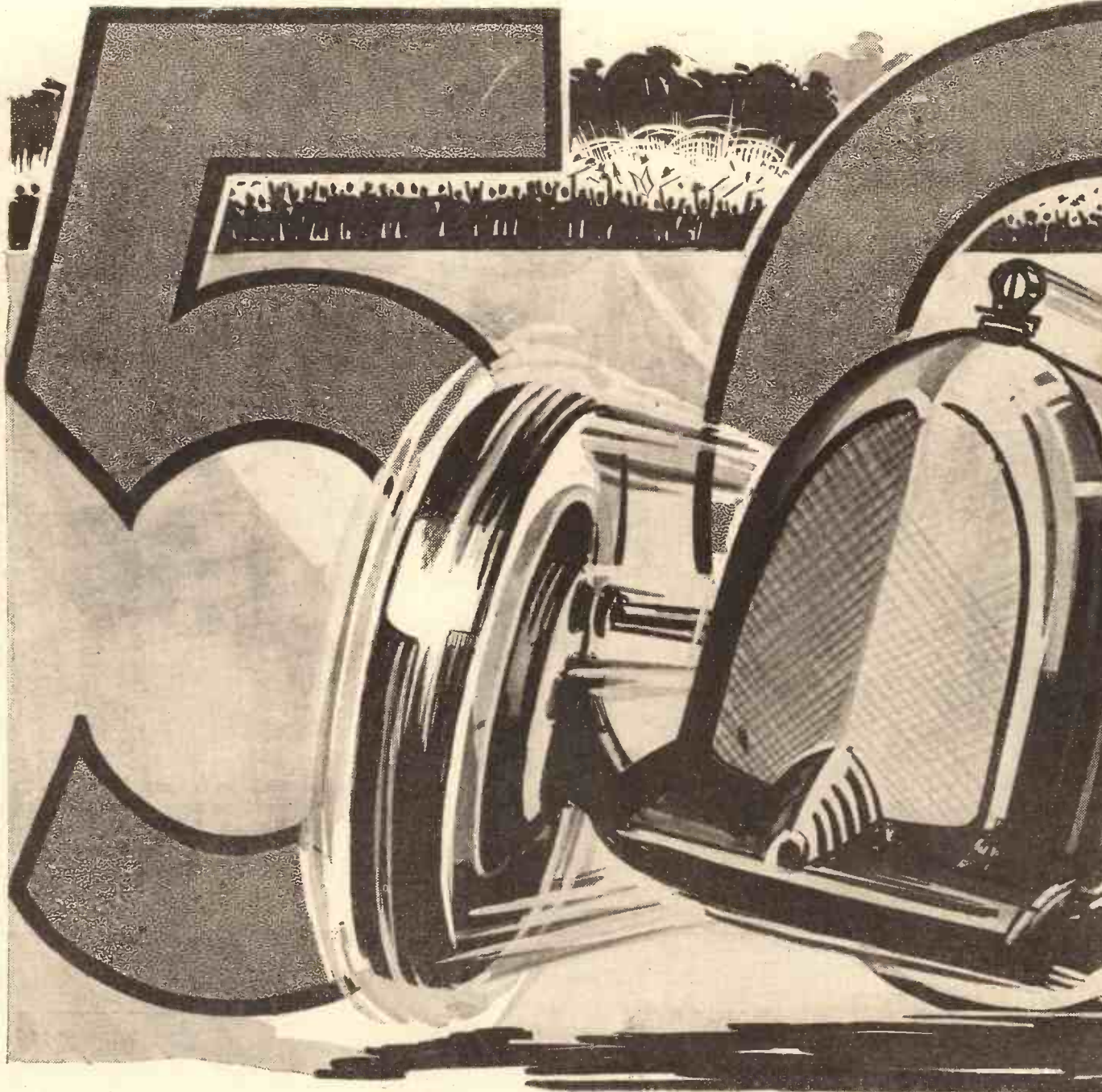
RECOMMENDED for use in the S.T. 500 by Mr. John Scott-Taggart, the Telsen S.T. 400 Coils have been specially designed for their purpose, to ensure immaculate performance with enduring efficiency. The Aerial Coil consists of plain long and medium wave windings connected in series, with a separate reaction winding, the Anode Coil having a larger reaction winding connected to the earth end of the main winding. The Anode Coil is supplied complete with two brackets and the necessary screws for mounting.

Price per pair **8/-**



TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM



anode circuit employs my differential-anode-coupling system with reaction, and is therefore highly selective. The aerial circuit—as in all sets—is the weak point and tends to let through some interference.

Making it Hard for Gate-crashers.

The bottom circuit (d) is the elementary form of my present set—the “S.T.500.” Aerial reaction is employed and “front-door” selectivity is enforced. The single circuit will not alone keep out all interference, but when the anode circuit has had a second “whack” at interference the result is only one circle—representing the currents of the desired station without interference.

I have spoken of multiplied selectivity, and explained how any improvement in signal strength or selectivity, if carried out on the hitherto neglected aerial circuit, will

be multiplied by the S.G. valve and its anode circuit.

Let me give a simple illustration to explain multiplied selectivity. We can regard each of the two tuned circuits as gates to a mansion. The aerial circuit is the outer gate, while the anode circuit is the inner gate.

First consider a receiver with a single-tuned circuit without reaction (as in a simple crystal set). We can compare this circuit to a wide gate to a mansion. An invited guest (the desired station) finds himself surrounded by a crowd of gate-crashers (interfering stations). The gate-keeper may turn a few back, but the man with a ticket will find that a crowd of rowdies enter the mansion with him.

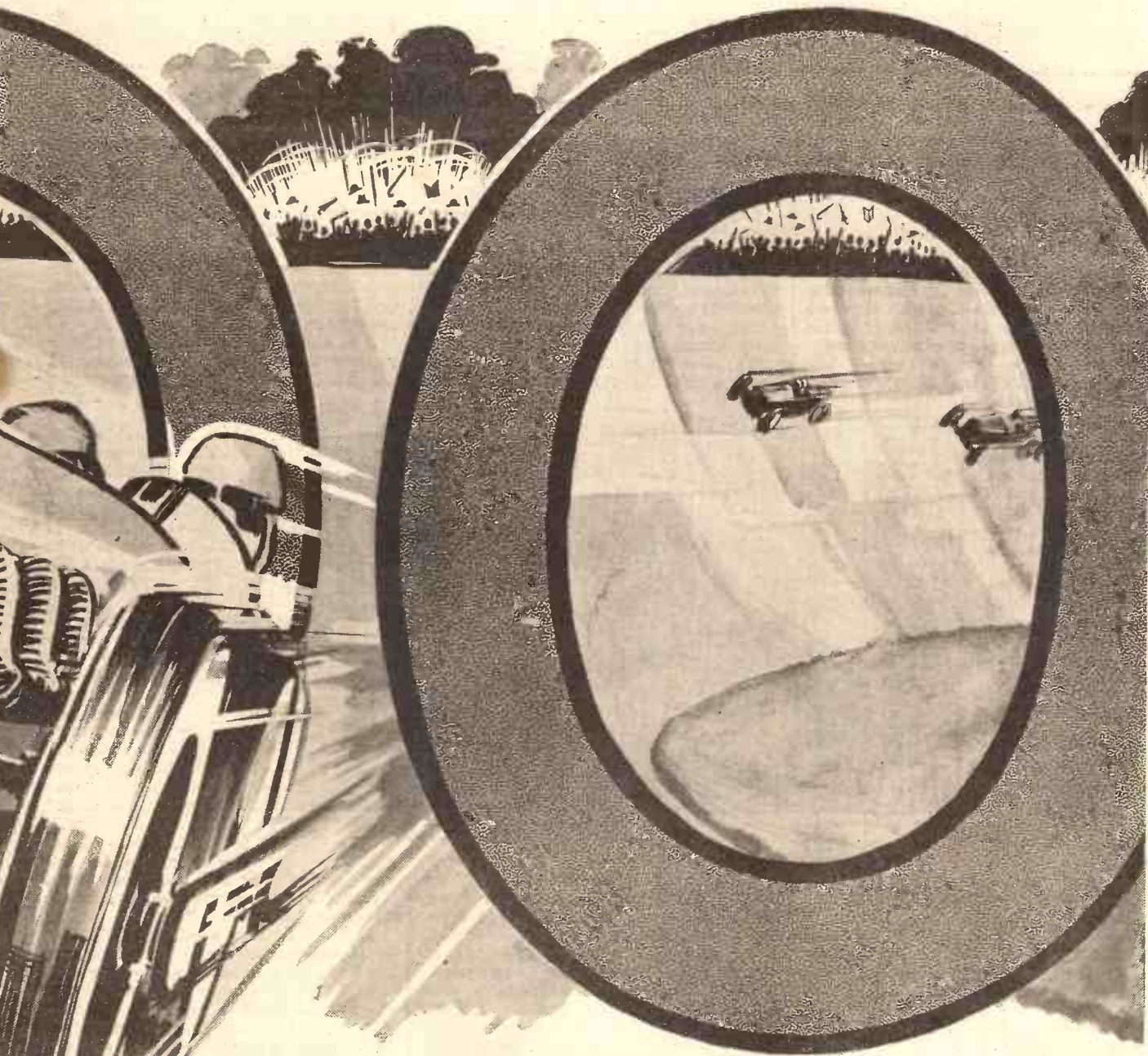
What steps can we take to ensure admission by ticket only? We can narrow the gateway so that a big crowd cannot

get through. In technical terms, we improve the selectivity of the aerial circuit. We can only do this up to a point by lessening the aerial load or by using iron-core or other efficient coils, or by both methods. An immensely more effective method is to use reaction, but the gate even then is not one-station wide.

Improving on Normal Practice.

The gatekeeper is liable to be overpowered by muscular interfering gate-crashers. So we establish a second gate through which visitors must pass and show their credentials. The second gate is, of course, the second tuned circuit. The first gatekeeper may let a few rowdies through, but the second gatekeeper can tackle them.

The guard at each gate may, if the crowd is large and turbulent, require strengthening. This is equivalent to increasing the



selectivity of each circuit.

The normal practice is to have a wide, poorly guarded outer gate (ordinary aerial circuit) and a strongly guarded narrow gate (anode circuit with reaction). My own proposal is to narrow the first gate and put a

very strong guard there, i.e. to keep out the jostling crowd before they get into the grounds. I retain the narrow second gate and its guard, and thereby permit only the desired guest to enter the house.

Narrowing the Gaps.

In other words, I apply reaction to both circuits separately, and thus keep the bulk of interference out at the very start. The bit that may get through is cut out by the second circuit.

The merits of the double-gate arrangement can be fully appreciated by a study of

Fig. 5. These illustrations represent (1) an ordinary single circuit with reaction, (2) an aerial circuit without reaction followed by an anode circuit *with* reaction, and (3) the "S.T.500" with reaction on both circuits.

In the top figure there is a wall with a gap in it, and to the right is a net. A group of men in a semicircle each have a football which they have to kick through the gap in the wall into the net. The footballs represent signals from different stations, the gap in the wall represents the degree of selectivity of the circuit, and the net represents the output signals from the set.

A man at D can shoot through the gap straight into the net. This is equivalent to the desired station. But men at E, F, H and J can all shoot into the net.

A very wide gap makes it easy for anyone to "score"; it is as if goalposts were very wide apart. A tuned circuit with little or no reaction admits many undesired stations. If we apply reaction effectively, however,

we narrow the gap, and this makes it more difficult for footballers at F and J to get the ball through.

Those further round will be unable to get the ball through.

As the gap is narrowed only the footballers near D will score. The semi-circle, in fact, represents the tuning dial. Only stations near the tuning point will affect the speaker.

The Stone Wall Circuit.

Interference on a single circuit, even with reaction, will be great, so we introduce a stage of H.F. amplification, thus providing a fairly flatly tuned aerial circuit and a sharply tuned anode circuit. This corresponds to having to kick the football through two gaps. This is shown in the second diagram (2) of Fig. 5. A large gap in a wall is followed by a small gap in a second wall. The man at D has only to kick straight ahead and his ball will pass through both gaps and so into the net.

Everyone Will Envy You Your "S.T.500"

A man at E or H will also be able to score a goal. But a man at F or J will be able to get the ball through the first gap with ease, but not through the second gap; the second wall will act as a barrier.

In a wireless set of the ordinary two-circuit type the tuning on the aerial circuit is flat, and on the anode circuit is sharp. Selectivity is better, but stations on either side are liable to get through.

In the "S.T.500," however, I narrow both gaps as in the bottom diagram. The first gap permits some interference, but far less than in the preceding arrangement; such interference as gets through the first gap (i.e. circuit) is, however, stopped by the stone wall of the second circuit. Just as only a man standing at D can shoot a ball into the net, so only a single station at any point on the dial can produce an effect on the speaker.

Multiplied selectivity may be illustrated in several other ways. Try this experiment. Place a table-napkin ring on the table about a foot from the eyes. Close your left eye, and with the right look through the ring at some object. Move your head to either side. Note that there are several positions from which you can see the object through the ring.

Now place a second ring about two feet beyond the first ring.

Place your head (keeping it the same distance away) so that you can see the object through both rings. Now move your head to each side. You will find that you can only see the object with your head in one position. This is equivalent to greater selectivity in a wireless set. The smaller the rings the more striking the experiment.

Some Simple Analogies.

If football is too strenuous let us play croquet. A group of players can knock a ball through a single hoop from quite wide angles, as shown in the top diagram of Fig. 6. The wider the hoop (the more unselective the circuit) the more people could knock their balls through.

But suppose the problem is to hit the ball through two hoops in a line. Only one person can get through both hoops, and his ball must be in line with the two hoops, as shown in the bottom figure. If another player (E or F) to one side (interfering station) tries he may get through the first hoop (first circuit), but will fail at the second hoop (second circuit).

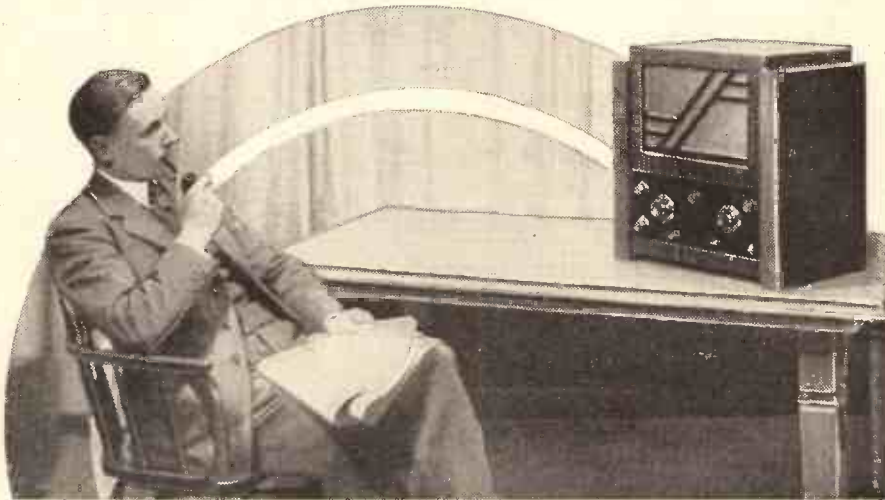
If we made the first hoop much wider than the second, several players, instead of only one, could shoot through both hoops; this is shown being done in the second picture of Fig. 6. This is exactly

what other designers are doing: they provide a big, wide, easy first hoop for their signals, and so interference finds its way into the speaker.

Alternative Operating Methods.

The amount of interference shown by shadows on aerial and anode dials is shown in Fig. 7. In each case there are two tuned circuits, and the second dial indicates the overall selectivity. The top pair shows two circuits without reaction—an arrangement rarely if ever used by the home constructor.

The second pair shows reaction on the anode circuit only; results are much better.



AND NOW TO ENJOY YOUR "S.T.500"!

The bottom pair are the dials of the "S.T.500." Aerial reaction is now being applied, thus greatly increasing aerial selectivity and therefore the overall selectivity.

The amount of "spread" on each dial of the "S.T.500" is completely under control, which incidentally makes the set so easy to use when finding a station. One can operate the "S.T.500" in two ways: Either it can be set for maximum selectivity; hair-breadth tuning is then necessary, and the inexperienced man may experience difficulty in finding a desired station which will emerge from silence into full power and back to silence in a single degree of the dial.

Or he can use the receiver so that tuning is flattish. The station is then very easily found, but will need a little cleaning up.

Advantages of Panel Control.

By a movement of the selectivity controls the interference is "sandpapered" off and the station is then french-polished! The cleaning-up process may take ten seconds or in a very bad case fifteen seconds. You hear the wanted station all the time.

The process is like polishing a silver vase. If ultra-selectivity is used, to begin with, it is like having to hunt all over the house for the vase.

The advantages of having a full panel control of the selectivity of each circuit are fully appreciated within ten minutes of

handling the set for the first time. It may take you half an hour to learn to get the best out of the controls, but I am going to tell you all the simple rules. It is quite unnecessary to know the technicalities of the operations but obviously I would prefer constructors to know what is happening.

Life is certainly simpler living in a tent in the Sahara or in an ice-house in the Arctic, but for real comfort and future happiness it is probably better to live in a cosy, well-furnished house even if it is necessary to open and close a few doors.

It is simpler to have a cold bath (with single-knob control), but personally I am glad I learnt at an early age to adjust to a nicety the h. and c.!

A considerable degree of selectivity can be obtained by the proper use of three or more tuned circuits. But this involves more H.F. valves, or else a loss of signal strength which can, in any case, not be afforded on a four-valve Class B receiver. Screening and ganging become necessary, and the chance of success is greatly reduced and a loss of signal strength is certain through "mis-ganging wastage."

Band-pass circuits, if used, present further opportunities for complication loss and distorted peaks. Fewer and better circuits was my motto in designing the "S.T.500."

Although I frankly admit the "S.T.500" lends itself to hotting-up in the hands of the user, yet this has been my very aim. The hotting-up process is, however, very simple and there is nothing chancy or tricky about it. The set starts where the conventional type ends, so that you can always convert the "S.T.500" into a "family bus" by setting all the controls to normal.

The Cost of Caution.

The more conventional a set the trickier it usually is, since there is no provision for different aeriels and earths, different battery voltages, different components, different valves, etc. The designer has either to allow for the very worst combination of troubles (in which case the set will be hopelessly inefficient) or else take a chance on average conditions. Even this last step means that good conditions, good components, good batteries and good valves cannot be taken advantage of; the owner is hobbled, tethered by the designer's cautiousness. But the set builder who is handicapped by bad conditions cannot make the most of his apparatus. He is not merely tethered, but has a halter round his neck.

The "fixed" or "simple" receiver is either under-efficient or over-risky.

On This Page: The Advised Components.

There is no such thing as average conditions, except in theory.

Have you an average earth? Do you live an average distance from the B.B.C.? Has your H.T. an average voltage and your valve an average emission? Are you of average height, average complexion, average girth? Do you wear average-sized collars with an average-coloured tie? If so, by all means build a set designed for the average man in average conditions.

Most of us live in a row of houses, but that is no reason why we should live in a row of minds.

Allowing for Individual Conditions

A wireless receiver for the home-constructor should be a highly individual instrument. It should be adaptable to circumstances, but easily adaptable.

I anticipate that between 100,000 and 200,000 "S.T.500's" will be built. I prophesy now that, for a given result, no two of these sets will be adjusted exactly alike. You cannot have it both ways; you must either get the same high standard of performance by adapting the controls to suit individual conditions, or you must do without the controls and get different standards of performance.

Suitable controls do not add to the trickiness of a design; they remove it. A "fixed" design must vary in its performance under different conditions—perhaps two neighbouring houses in the

same street. The aim in my sets, and especially in the "S.T.500," is to cut out the risk by compensating controls.

The value of this policy has been proved up to the hilt on my other sets, and the only objection is an unwarranted fear of

5,000% BETTER!

In the hopes of obtaining simplicity combined with maximum efficiency, the designer of the "S.T.500" had a special iron-core coil made for use in the aeric circuit.

A specially efficient iron core was employed, resulting in a very considerable improvement over all existing iron-core coils as available to the public. Iron-cored coils have a very great and useful function in many sets, but this super-efficient coil for the aeric circuit was totally inadequate when compared with the simpler and cheaper coil with the "S.T.500" inventor's Balanced Phase Double Reaction System.

An improvement of five thousand per cent was obtained—a colossal gain which any constructor of the "S.T.500" can easily reproduce.

complexity. It is for you to decide what results you want; then, and then only, consider the question of "simplicity."

My advocacy of controls in my own sets has naturally led to some imitation. If other designers follow my policy effectually, I shall be only too glad. We are all

aiming at providing better radio sets, and I have respect for others who are conscientiously making for the same destination, even if it is by a different and perhaps sometimes mistaken route.

But mere knobs for knobs' sake is ridiculous. A reader who inquired at a wireless dealer's about one of my sets was shown another type. The reader showed his impatience, and the young assistant retorted: "What's wrong with it? It's got nine knobs."

If I can ever get the same results with fewer knobs as I can on the "S.T.500," I assure you I shall be the first to rejoice and you shall be the first to hear of it.

The basic reason for the "S.T.500's" success is multiple reaction, bringing in its train multiplied selectivity and multiplied signal strength.

Exhaustive Experiments

But the introduction of aerial reaction was a whole problem in itself. A score of different arrangements were tried exhaustively before the "S.T.500" arrangement was invented.

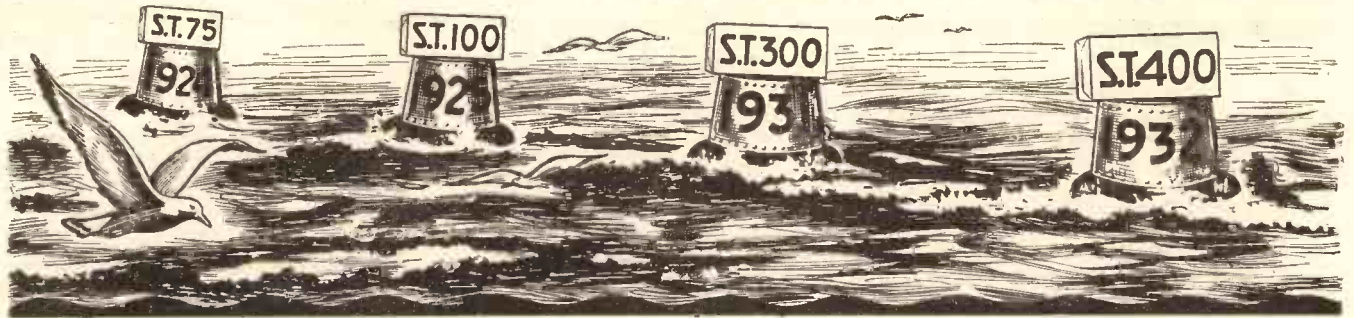
Let me tell you the difficulties which had to be solved. A year ago I introduced aerial reaction in the "S.T.400." In this case the reaction came from the detector valve and was distributed between aerial and anode circuits. The scheme is highly successful, but it requires that both

(Continued on page 280.)

COMPONENTS AND ALTERNATIVES AS OFFICIALLY APPROVED BY MR. JOHN SCOTT-TAGGART

Component	Makes used by Designer	Alternative makes of suitable specification recommended by Designer	Component	Makes used by Designer	Alternative makes of suitable specification recommended by Designer
2 S.T.500 coils (same as S.T. 400 coils)	Colvern	Telsen, Wearite, Ready Radio, Lewcos, Sovereign, Goltone	2 5,000-ohms resistances	Dubilier 1-watt metallised	Graham Farish, Erie
2 .0005-mfd. tuning condensers	Ormond, type R.493	Graham Farish, Polar, J.B., Utility, British Radiogram, Telsen, British Radiophone	2 10,000-ohms resistances	Dubilier 1-watt metallised	Graham Farish, Erie
3 .0005 solid dielectric (preferably log mid line) variable condensers	Graham Farish "Littos" log mid line	Polar, Telsen, Ready Radio,	1 250-ohms resistance	Graham Farish "Ohmite"	Dubilier, Erie
1 .0001-mfd. differential reaction condenser	Telsen, type W.353	Graham Farish, British Radiogram, J.B., Polar, Igranic, Ready Radio	1 2-mfd. fixed condenser	Igranic	Graham Farish, T.C.C., Dubilier, Telsen, British Radiogram
1 .0003-mfd. differential reaction condenser	Polar	Graham Farish, British Radiogram, Telsen, J.B., Ready Radio	1 1-mfd. fixed condenser	T.C.C., type 50	Graham Farish, Dubilier, Telsen, Igranic, British Radiogram, Ferranti
1 baseboard pre-set, .0001 mfd.	J.B., type 1088	Graham Farish	1 1-mfd. fixed condenser	Dubilier, type BB	Graham Farish, T.C.C., Telsen, Igranic, Ferranti
1 baseboard pre-set, .0005 mfd.	J.B., type 1087	Graham Farish	2 .005-mfd. tubular condensers	T.C.C., type 300	Graham Farish, Telsen, Dubilier
1 Class B driver transformer	Telsen, ratio 1 : 1	R.I., Lissen, Ferranti, Varley, Benjamin, Wearite, Ferranti, R.I., Lissen, Varley, Wearite, Multitone	1 .0005-mfd. tubular condenser	Graham Farish	Telsen, T.C.C., Dubilier, Igranic
1 Class B output choke	Telsen	Lissen "Hypernik," Ferranti, Telsen, Lewcos, L.F.T.8A, R.I. "Hypermite," Tunewell, Igranic, Multitone	1 .00005 mica condenser	Lissen	Graham Farish, Dubilier, T.C.C.
1 L.F. transformer	Varley "Niclef" Type D.P.21	Graham Farish, Wearite, Lewcos, R.I. "Dual Astatic," Ready Radio, Bulgin S.5, Sovereign SuperAmplion binocular	2 push-pull on-off switches	Lissen, type L.N.5070	Telsen, British Radiogram, Benjamin, Wearite, Tunewell, Bulgin, W.B., Ormond, Sovereign, Ready Radio
1 S.G. choke	Telsen, type W.74	Graham Farish, W.B., Telsen, Lissen	1 toggle on-off switch	Bulgín S.80	—
2 4-pin valve holders	Benjamin "Vibrolder"	Graham Farish, Lissen, Ferranti, Wearite, W.B., Benjamin	1-ply baseboard (16 in. x 12 in.) with Metaplex section	Peto-Scott	Permool, Goltone
1 5-pin valve holder	W.B. "Universal"	Graham Farish, Lissen, Ferranti, Wearite, W.B., Benjamin	1 panel, 16 in. x 7 in. x 1/2 in.	Peto-Scott	—
1 7-pin valve holder	Graham Farish	Graham Farish, Lewcos, Igranic, Telsen, Wearite Amplion	1 S.T.500 screen	Peto-Scott	Magnum
1 H.F. choke	Lissen, disc type L.N.5092	Graham Farish, Dubilier, Erie, Ready Radio, "Thermion"	1 terminal strip	Peto-Scott	—
1 1-megohm grid leak	Ferranti, synthetic type S.	—	1 bracket for .0005-mfd. variable condenser (tone control)	British Radiogram	—
1 holder for same	Ferranti	—	10 terminals	Belling-Lee, type R	Igranic, Clix, Bulgín
			3 wander-plugs (G.B.)	Clix	Igranic, Belling-Lee, Ealex
			4 wander-plugs (H.T.)	Belling-Lee	Clix, Ealex, Igranic
			2 spade terminals	Clix	Belling-Lee, Ealex, Igranic
			Connecting wire (glazite 20 S.W.G.)	Lewcos	—
			Flex, screws, etc.	Peto-Scott	—
			1 anode connector	Belling-Lee	—
			Special cabinet	Peto-Scott	—

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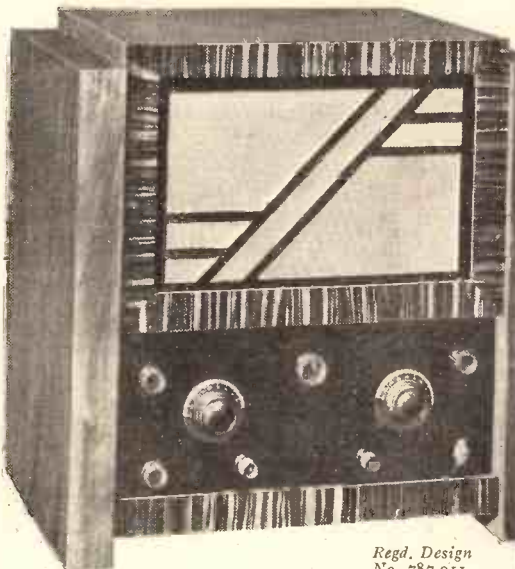
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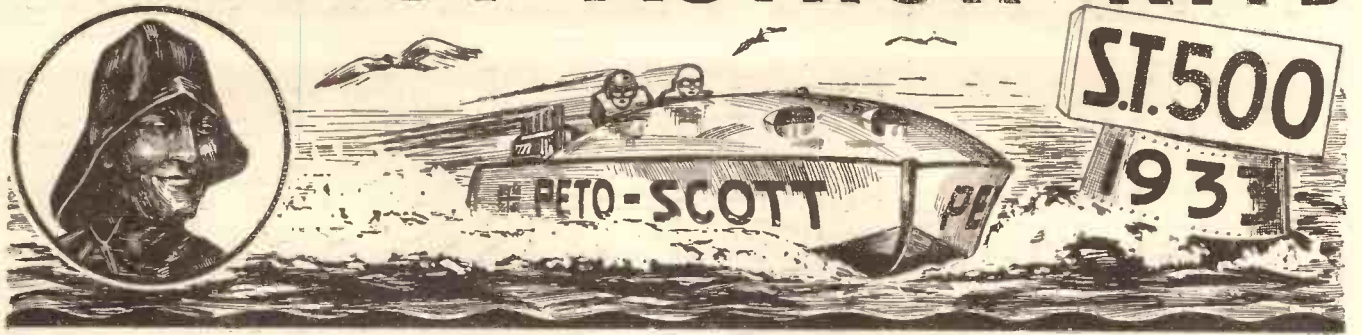
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1	PETO-SCOTT	S.T.500 screen	1 9
1	PETO-SCOTT	ebonite terminal strip (ready drilled)	9
	PETO-SCOTT	flex, screws, connecting wire	2 6
2	OLVERN	S.T.500 coils	8 0
3	ORMOND	type R.495 .0005-mfd. tuning condensers	15 0
3	GRAHAM FARISH	"Littlos" .0005-mfd. variable condensers	6 0
1	TELSEN	type W.353 .0001-mfd. diff. reaction condenser	2 0
1	POLAR	.0003-mfd. diff. reaction condenser	3 0
1	J.B.	type 1088 B/B pre-set .0001-mfd. condenser	1 0
1	J.B.	type 1087 B/B pre-set .00005-mfd. condenser	1 0
1	TELSEN	Class B driver transformer, ratio 1-1	8 6
1	TELSEN	Class B output choke	8 6
1	VARLEY	"Nictet" L.F. transformer, 3-5 to 1	7 6
1	TELSEN	type W.74 S.G. choke	3 6
2	BENJAMIN	"Vibrolder" 4-pin valve holders	1 8
1	W.B.	"Universal" 5-pin valve holder	1 0
1	GRAHAM FARISH	7-pin valve holder	1 3
1	LISSEN	disc type LN.5092 H.P. choke	2 0
1	FERRANTI	1-meg. synthetic grid leak and holder	1 6
2	DUBILIER	1-watt metallised 5,000-ohms resistances	2 0
2	DUBILIER	1-watt metallised 10,000-ohms resistances	2 0
1	GRAHAM FARISH	250-ohms "Ohmite" resistance	1 6
1	IGRANIC	2-mfd. fixed condenser	3 0
1	T.C.C.	1-mfd. fixed condenser, type 50	2 6
1	DUBILIER	type B.B. 1-mfd. fixed condenser	2 6
2	T.C.C.	.005-mfd type 300 tubular condensers	2 6
1	GRAHAM FARISH	.0005-mfd. tubular condenser	1 0
1	LISSEN	.0005-mfd. mica condenser	1 6
2	LISSEN	type LN.5070 push-pull on-off switches	1 8
1	BULGIN	S.80 toggle on-off switch	1 6
10	BELLING-LLEE	type B terminals	2 6
3	GLX	wander plugs	4 1/2
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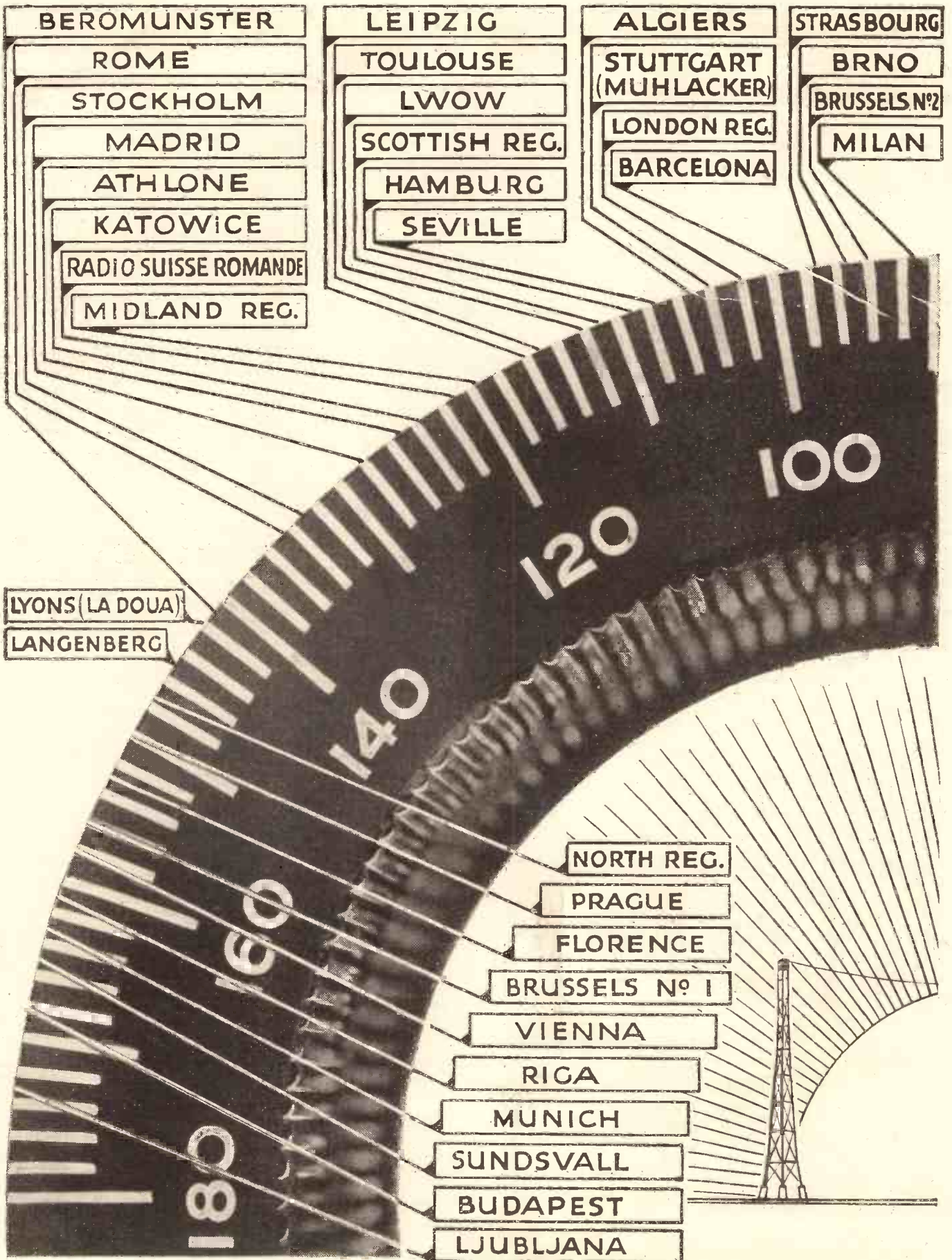
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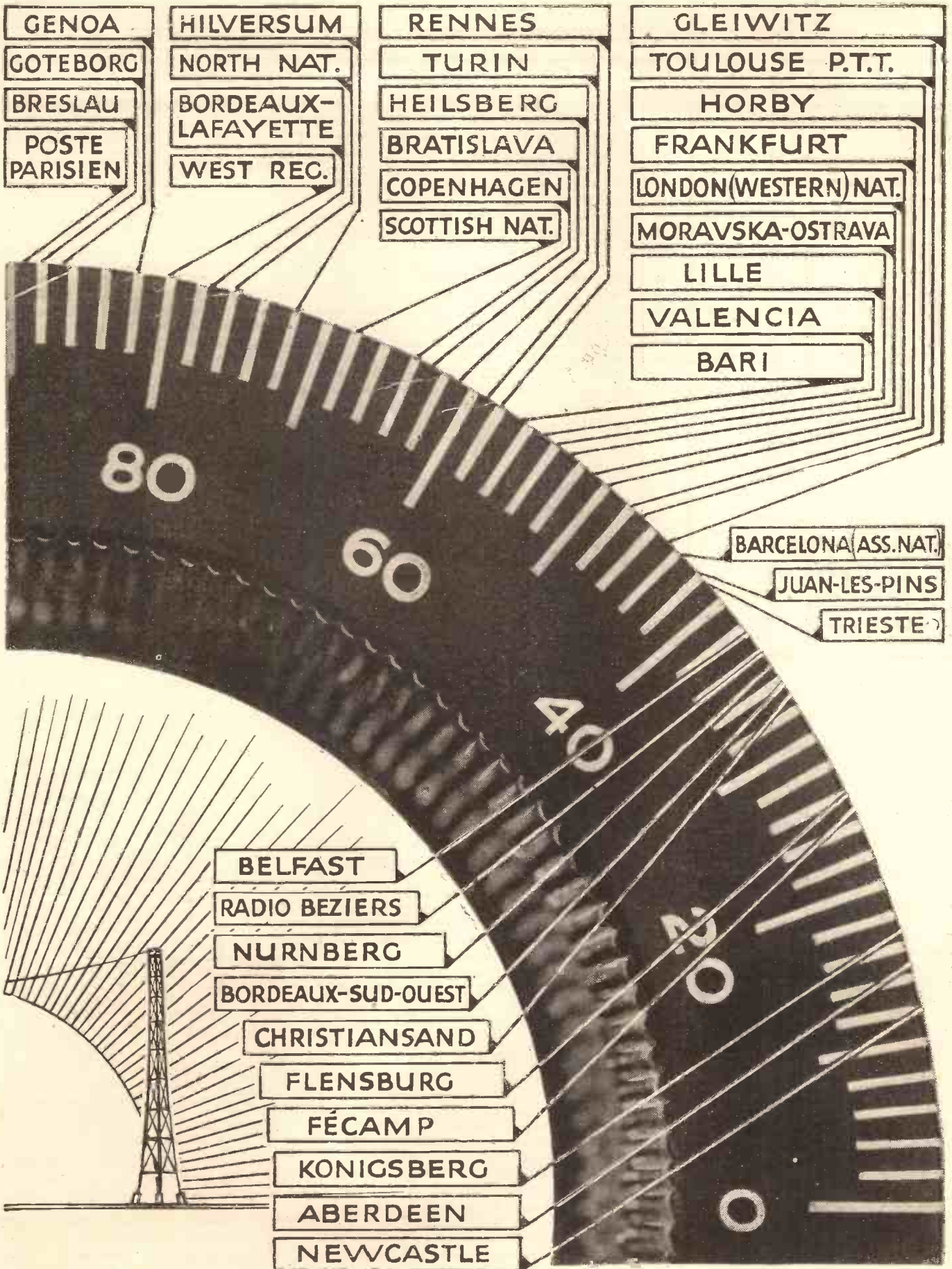
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Secrets of Balanced Phase Double Reaction

circuits be in tune. Large changes in reaction can be caused by one of the circuits being out of tune or if the anode coupler is reduced to a low value. The smoothness of the reaction is also impaired somewhat by the detector valve being in the reaction chain.

COMPARE—

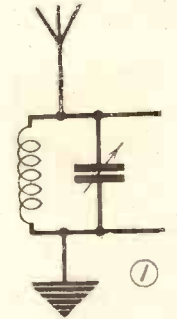


Fig. 1(a). A simple aerial circuit. Very insensitive.

From a luxury adjustment in the "S.T.400" aerial reaction has become "standard equipment" on the "S.T.500." Separate independent reaction for each circuit has been introduced for the following reasons:

(1) It is far simpler to operate.
 (2) Each circuit requires a different amount of reaction, and a separate independent supply enables the right amount to be given without affecting the other.

(3) Reaction can be applied to either circuit and all its benefits obtained, even though the other circuit is not in tune. It can, in effect, be completely off tune.

(4) Searching for a weak station becomes simply finding it.

(5) The differential anode coupler is not in the reaction chain, and the general H.F. amplifying functions are thus kept separate from reaction.

(6) Each circuit can be separately adjusted to the desired selectivity and sensitivity, as if in separate compartments.

(7) Aerial reaction is obtained from an S.G. valve, providing ideal conditions for supplying reaction; the S.G. is only amplifying H.F., and its characteristics are not modified by having to detect.

Currents That Must Keep Time.

Other factors, however, contribute to the remarkable smoothness of the aerial reaction. The greatest difficulty in all reaction circuits is the application of feed-back currents in the right phase.

This means that the strengthening currents must be fed at exactly the right time so as to assist most effectively the currents in the grid circuit. To keep a child's swing on the move one can give it a push at the end of every swing, but the push must occur at the right moment for effective results. There is no difficulty about frequency in reaction; the nigger in the woodpile is the timing of the reaction currents.

If the timing is 180 deg. out of phase the reaction currents act in an opposite way and oppose the original currents. This reduces signals. The reaction currents may, however, be induced in the grid circuit at an intermediate number of degrees. Instead of hitting the nail on the head, so to speak, it is given a slanting blow.

And floppy reaction is one result. The angular displacement will vary, no doubt, with the adjustment of the reaction condenser. Instead of the reaction increas-

ing right up to the point of oscillation it works well at first, but as reaction is increased the valve suddenly oscillates. This means that reaction has been arrested long before its full effects have been enjoyed; sometimes, signal strength may even fall off, after a point, due to an improper phase relationship between reaction and original currents.

Effects of Inherent Feed-back.

Where an H.F. valve is in use, reaction requires an extra-special amount of study. There is always some inherent reaction in all sets using H.F. amplification, due to stray couplings, and this will always form a percentage of the total reaction—and a percentage which can actually ruin proper reaction. The inherent reaction can cause the wrong valve to oscillate, render the whole set unstable (or stable under special conditions only) and produce reaction hysteresis in the set and hysteria in the operator.

Everything in the set modifies the inherent reaction—and I am still speaking of all sets. There are no two sets alike. The slightest difference in a valve, the minutest difference between two coils, the shifting of a component a thousandth part of an inch will alter the amount of inherent reaction. There is inherent reaction in the most stable set on earth, and the amount of it varies enormously from one home-constructed set to another.

Yet in nine out of ten sets there is no effective control of it or means for keeping it within the desirable limits. It is one of the greatest causes of erratic results in home-built sets.

Sometimes, you get accidentally good results, perhaps only on one or two stations, or when your batteries are at certain voltages, or when you change a valve (possibly for a worse one). This is when reaction is getting on the aerial circuit by virtue of inherent coupling in the set. The vice has become a virtue, but it is a tricky, accidental advantage and we are better without it.

Turning Accident into Certainty

The "S.T.500" applies trained, disciplined reaction under perfect control to the aerial circuit, and so what was a rare accidental advantage is obtained with certainty and in greater measure on every station and under every possible set of conditions.

A technical study of the "S.T.500" circuit will recall that its solidity has been assured. Solid foundations are required before reaction can be applied with certainty and success. A set must not be "up in the air," i.e. on the point of oscillation, before reaction is applied. With the "S.T.500" you can, if you wish, apply the most critical

reaction with the confidence that the basic circuit itself is rock-like in its stability and a perfect foundation from which to work up to any degree of sensitivity and selectivity desired.

The application of reaction from a detector to its grid circuit is a much simpler problem than applying reaction from the output of an H.F. valve to its own input. This is because in the latter case there is a tuned anode circuit and phase-shifting is very troublesome.

The whole problem is completely solved in the "S.T.500," although it took months to provide the right solution. The actual reaction currents are taken from the S.G. choke and fed through a variable reaction condenser to the aerial reaction winding. The phase is correct, the choke (instead of the tuned anode circuit) being made the controlling source of reaction.

Applying Reverse Reaction.

Reverse reaction is also applied from the S.G. choke by means of a pre-set condenser of .00005 mfd. and a resistance of 250 ohms. This constitutes a phase-reversal circuit of a frequency discriminating type, and positive reaction is applied to balance this out and then to reduce the effect of the aerial-circuit resistance by currents injected in exactly the correct phase.

The whole aerial reaction arrangements, including the balance-phase system, provide exceedingly smooth and helpful reaction at all tuning points on both wavebands. It is certainly more effective than any other reaction scheme I have ever tried, including simple single circuit sets.

The pre-set condenser of the phase-reversing circuit is not critical in adjustment; about a fifth of the way will usually prove perfectly suitable.

—THESE—

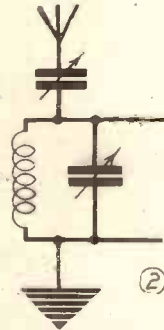


Fig. 1(b). The series-aerial condenser greatly improves selectivity, but signals are weakened, and a limit to selectivity is soon reached.

—THREE METHODS

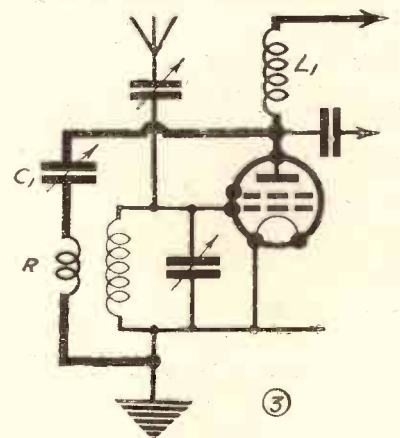


Fig. 1(c). The double-reaction circuit of the "S.T.500" wipes out aerial losses. Multiplied selectivity is accompanied by multiplied sensitivity.

I hope to give a full technical explanation of the whole aerial reaction system in a future issue.

The Grid Condenser.

You have probably noticed that the value of the grid condenser is .00005 mfd. This is half the value I have previously used and a sixth of the value used by many readers.

Grid-condenser values are apt to be ignored. People are inclined to say: "Well, if designers haven't made up their minds about grid condensers after all these years, it is time they did!"

Well, the values of many condensers have been treated as sacred—almost taboo. To alter them is sacrilege. A .0003-mfd. and 2 megohms resistance

SENSITIVITY!

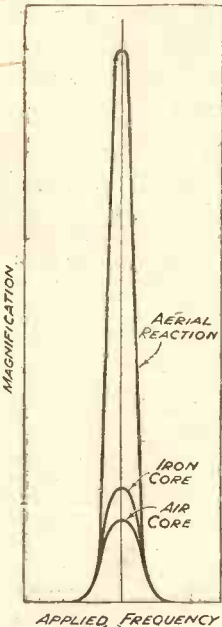


Fig. 2. Resonance curves show improvement of iron-core coils over the air-core type, and the vastly greater superiority of aerial reaction. The height indicates sensitivity.

was a holy combination at one time; it is still venerated by many. I have done a great deal, however, to popularise .0001 mfd. and 1 megohm. Now I offer .00005 and 1 megohm!

The general design of a set may govern the most desirable combination. The size of the grid condenser will influence, amongst other things:

- (1) The selectivity of the anode circuit.
- (2) The high-note response of the set (improving it).
- (3) The time-constant of the rectifying system.
- (4) The sensitivity of the set.
- (5) The amount of the reaction current.
- (6) The relative degrees of reaction at different wavelengths.

(7) The smoothness of reaction.

A reduction in the size of the grid condenser will improve selectivity by reducing the damping due to grid current during the rectification process. This fact is, perhaps, insufficiently appreciated.

An improvement in signal strength is also obtained up to a certain point. If the grid condenser is reduced beyond this point signal strength falls off.

I have found that a reduction in grid condenser value also improves reaction control, and there are several other reasons to be found in the list given above for the choice of .00005 mfd. in the "S.T.500."

Exposing the Band-pass Fallacy.

A criticism which was levelled at the "S.T.400" was that the high selectivity produced by two lots of reaction would cut down the high-note response of the set. The same thing will be said of the "S.T.500." Let me say that this criticism was ill-founded in theory and confounded in practice.

The parrot cry of "Mustn't cut off top. Oh, no, we mustn't cut off top," was arrogantly piped by hundreds of pseudo-technicians, and a few weeks later lisped by many smaller fry, who wanted to appear "in the know."

The band-pass craze, of course, fostered the idea; after all, it was its chief justification. Lovely square peaks—which probably not one in a hundred ever got—were

worshipped as the Japanese reverence the snow-capped Fujiyama.

Band-pass enthusiasm nourished the top-note craze. Commonsense—and the report of a Government Department (not necessarily the same thing)—killed it.

A certain amount of top-note cut-off is believed by many practical listeners to be desirable as a means of eliminating heterodyne whistles, needle scratch, and miscellaneous mush.

Where Tone is Controlled.

But even if the full-note response is kept in the speaker, there is no need to keep it in the H.F. circuits. In other words, one can "cut off top" by selectivity and restore the reduced notes in the L.F. part of the set. The ultimate result is the same as if one used the most perfect band-pass.

It is, however, getting unfashionable to talk of "cutting off top." The band-pass enthusiasts are feverishly hunting about for a new catch-phrase, but some of their land-lubber followers may not have noticed the change in the tide. If you come up against some of these stragglers as regards the "S.T.500" tell them this:

The tonal output of a set is not the result of cutting off or preserving the top-note side-bands, but of the effect of per-

CLASS "B"

is a revolutionary development in battery valve technique, placing the battery set in a position comparable to that of the main-valve receiver.

Truly amazing volume with superb tone is possible, but the choice of the rest of the circuit is vital.

VOLUME

The "S.T.500" will put Class B on the map because it is the ideal circuit for this unique system. If you are interested in Class B—and who is not?—this is emphatically the set for you.

The designer rightly points out that Class B cannot just be hitched on to any kind of circuit. The whole arrangement of components must be harmonised.

ECONOMY

haps a score of component values and adjustments, some, perhaps, increasing top and others reducing it. It is the designer's job—my job—to give you good quality, and there are a dozen places where compensation can be provided, even though it is not at once obvious from the circuit diagram.

As for side-band cutting, I should do a great deal more if I could—compensating for it, of course, elsewhere in the receiver.

In a Class B set, owing to the pentode-like characteristics of the valve, there is a tendency to exaggerate the high notes: so much so that, even if the side-bands have been cut on the H.F. side, we need to do some more "cutting-off of top" in the L.F. side to keep the tonal response correct.

Various resistances and condensers provide for this, and in the "S.T.500" I have added a separate variable tone control which enables the listener to have his music or speech as he likes it, and also to provide a means of singeing off high-note interferences (such as whistles) if experienced on some stations.

The tone-control is effected at the earliest L.F. part in the set, and this will result

in further H.T. economy, since undesired frequencies will not be amplified.

To many constructors the use of Class B will be a revolution in technique and in results attained. Let us consider the matter in more detail.

In considering "quality of reproduction" you must consider the risk of (1) frequency distortion; (2) amplitude distortion.

I say definitely, and with the experience of listening to hundreds of home constructors' sets and speakers, that seven out of ten sets twist the incoming music note, of course, out of recognition, but out of realism.

The output from the speaker is an imitation, a false reflection of the original. Yet weeks of habit, perhaps years of custom, have dulled the ears and worn down the critical sensitiveness of the listener.

Giving the Constructor Quality.

The set is lovely! The selectivity may be poor, but the quality is grand!

Listening, as I often do, for hours to my own experiments on quality reproduction, I find my ears becoming deadened to imperfections. Measuring instruments, however elaborate, cannot replace the human ear as the final arbiter of "good quality."

After hours of work my intellect may be alive and critical, my brain may assure me that this or that technical alteration should produce a difference in tone, but my hearing tiredly declares: "The quality is good; leave it at that."

There is only one cure: A brisk walk in the fresh air and then a return to the set. As a standard I have a receiver working with two larger-power output valves working off 400 volts. It is designed to give as near perfect quality as is electrically possible. This quality is then compared with that given by the new receiver undergoing test. With a refreshed hearing imperfections loom up and cry aloud to be put right.

The average constructor has not these facilities. I have them because I am not an amateur; it is part of my profession to recognise poor-quality reproduction and advise on how realism may be obtained. But most listeners are blissfully unaware of what they are missing. Many have become acclimatised to indifferent quality.

Import the "S.T.500" into your home, hear it handle with ease the loud booming

SELECTIVITY!

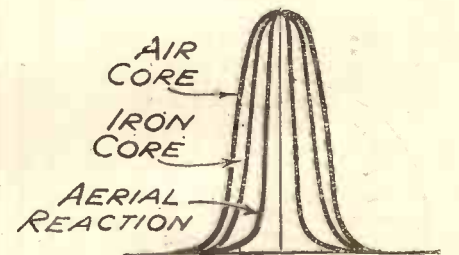


Fig. 3. Here is another set of curves showing how interference is much less with "S.T.500" reaction. The H.F. outputs have been made equal. Selectivity is indicated by the narrow width of the reaction curve.

reverberations of Big Ben, the passionate crescendo of an opera, and I think you will say: "This is the real thing that I used to think mine was."

The Receiver Which Ensures Amazing Results Everywhere

You may say it regretfully as one who jettisons a prejudice long nourished and beloved.

And let me say frankly that there is no greater difficulty than that of persuading a man that his reproduction is not up to scratch (or too full of scratch!).

Only by direct comparison will the most prejudiced constructor realise the difference between a tolerated reproduction which has grown into "pleasing reproduction" and that which can be simply called "the real thing."

My experience has been that when he has heard the "S.T.500" his appreciation of the contrast has been instantaneous and generous. There has been no niggardly acknowledgment or a "Well, perhaps, on the whole the '500' has it."

And when, as frequently has happened, I have noticed that the constructor himself owns a really good-quality speaker (not necessarily of moving-coil type), we have hitched it on to the "S.T.500" and obtained just the same results.

"Vital With Truth."

There is something to be said for not knowing anything better. If I saw the Taj Mahal I shouldn't care very much for Bush House. Having looked down from a peak in the Canadian Rockies into the gorgeous valley of Banff, I find it difficult to appreciate a trip to Snowdon.

As an inventor I instinctively hate the placid, contented frame of mind, but I know it makes for happiness. But ought we to be happy with something less than the best, when the best is within reach?

THE S.T.500 WINS!

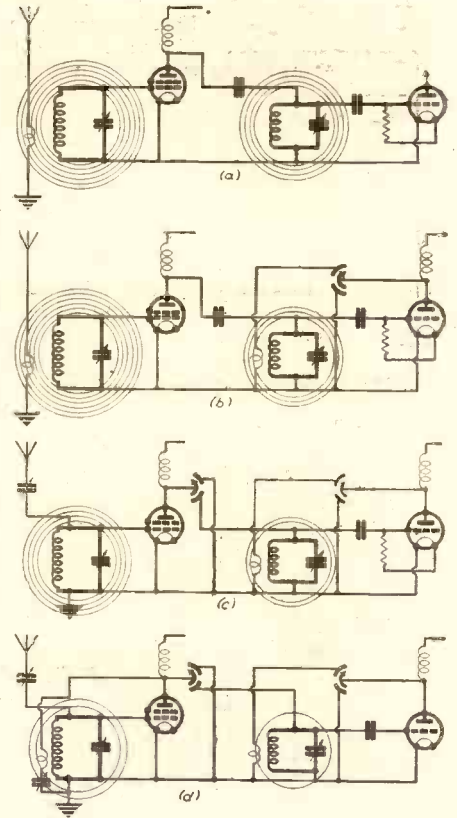
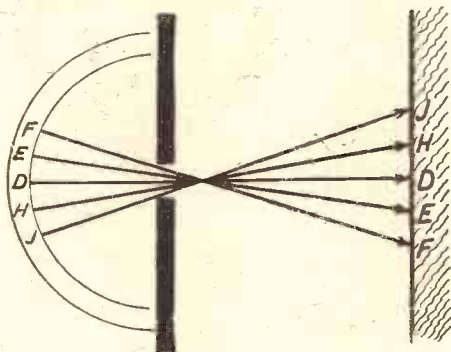
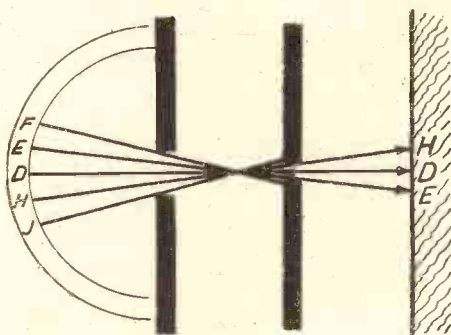


Fig. 4. The top figure shows the simplest two-circuit receiver. The circles indicate the number of stations producing currents in the circuit concerned. The second circuit shows the improvement when reaction on the anode circuit is employed. The third figure shows the "S.T.300" and the benefits of a small aerial condenser and differential anode-coupling. The bottom figure shows the "S.T.500" in elementary form. Only the desired station (one circle) appears in the final circuit.



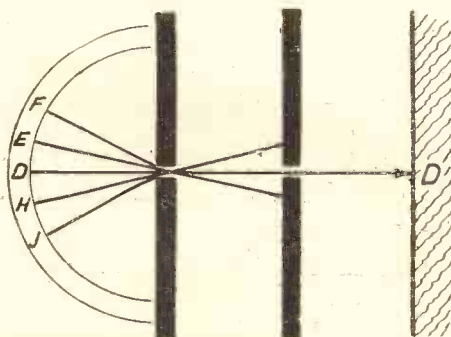
1

SINGLE CIRCUIT WITH REACTION (e.g. DET. & 2LF)



2

TWO TUNED CIRCUITS WITH ANODE REACTION (e.g. SG., DET & LF)



3

S.T.500

Fig. 5. An ingenious method of describing the merits of multiple circuits with reaction. Footballers (corresponding to the various stations affecting the receiver) try to kick their balls into the net—i.e. the loudspeaker. It is easy to do so in the simple single circuit, even when reaction is employed. Fig. 2. shows that by arranging an extra wall with a gap, it becomes increasingly difficult to "score." With the "S.T.500" it is possible for only one station to get through—the desired station.

Is it fair to one's judgment—not to mention one's family—to deprive it of the full enjoyment which comes from real "quality" reproduction sparkling with life and vital with truth?

A Low Barrier.

Lack of money and shortage of leisure form a barrier between us and many of the beauties of life.

But the barrier between second-rate and first-rate radio is so low that even the financially harassed and most busy listener can leap it. I hope that this article will provide the springboard. J. S.-T.

S.T.500—82 STATIONS!

82 stations have been received on the S.T.500. The 70 stations of the medium waves are marked around the large aerial dial on pages 273-279. The anode tuning dial readings will be approximately the same. The readings given are actual ones on the designer's original set. The long wave stations received are Huizen, Radio Paris, Deutschlandsender, Daventry, Moscow (Kominfern), Eiffel Tower, Warsaw Motala, Luxembourg, Kalundborg, Oslo, Moscow (Trades Union).

S.T. 500

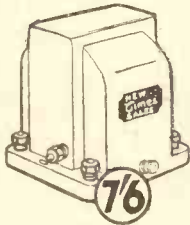
EASIBILT CONSTRUCTOR KIT

GUARANTEED MATCHED AND TESTED PARTS

Having just acquired a large, modern component Factory, we are able to assist S.T.500 constructors considerably by supplying them direct, eliminating, therefore, the usual middle-man's profits. This saves you up to 33% on the cost of building your S.T.500. Build with complete confidence an N.T.S. Easibilt Constructor Kit. In addition to these advantageous features, every component part is matched, tested and fully guaranteed. Complete down to the last screw with FREE FULL-SIZE BLUE PRINT AND COPY OF "POPULAR WIRELESS," OCTOBER 21, 1933.

N.T.S. S.T.500 COMPONENTS SAVE YOU MONEY

N.T.S. Differential
Condenser.



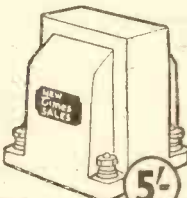
N.T.S. Class B
Driver Transformer.



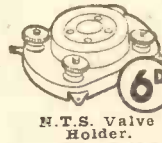
N.T.S. Baseboard
Trimmer.



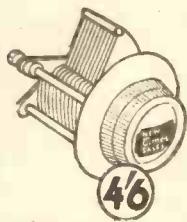
N.T.S. S.T.500
Coils.



N.T.S. Super L.F.
Transformer.



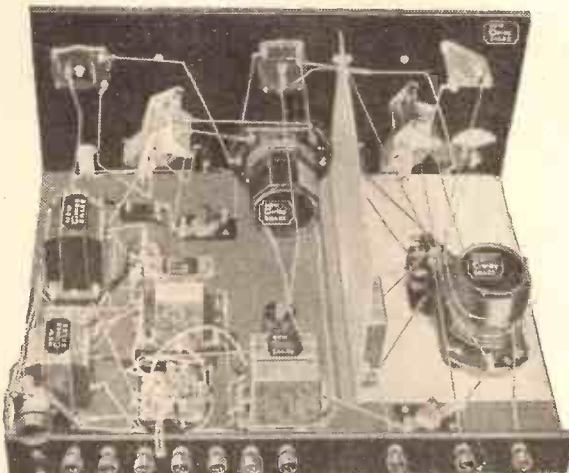
N.T.S. Valve
Holder.



N.T.S. Slow-Motion
Condenser.



N.T.S. Fixed
Condenser.



Balance in 11 monthly
payments of 6/9

KIT 1

Comprising Kit of matched parts as listed, including ready-drilled Panel and terminal strip, S.T.500 Screen, Peto-Scott Metaplexed Baseboard and "Class B" Output Choke. With Free Full-Size Blue Print and Copy of "Popular Wireless" Oct. 21st. Less Valves and Cabinet. Cash or C.O.D., Carriage Paid.

£3 : 15 : 0 or 12 monthly payments of - 6/9

KIT 2 As Kit 1, but including 4 specified valves Cash or C.O.D., Carriage Paid,
£6 : 0 : 0
or 12 monthly payments of - 11/-

KIT 3 As Kit 2, but with Specified Console Cabinet, Cash or C.O.D., Carriage Paid,
£6 : 19 : 6
or 12 monthly payments of - 12/9

KIT 4 As Kit 2, but with Peto-Scott Specified Console Cabinet, Cash or C.O.D., Carriage Paid,
£7 : 8 : 6 or 12 monthly payments of - 13/6

If Permanent-Magnet Moving-Coil Speaker required, add 15/- to Cash Price or 1/3 to first and each monthly payment.

FINISHED INSTRUMENT

Assembled from N.T.S. components and broadcast tested, complete with valves and in specified Peto-Scott Table Cabinet. Cash or C.O.D., Carriage Paid,
£8 : 9 : 6 or 12 monthly payments of - 15/6
As above, but Ready to Play in Peto-Scott Specified Walnut Console Cabinet with Peto-Scott Permanent Magnet Speaker. Cash or C.O.D., Carriage Paid, £9.15.0, or 12 monthly payments of 18/-.

THESE PARTS are MATCHED, TESTED AND GUARANTEED

	s. d.
1 PETO-SCOTT plywood baseboard with Metaplex section, 16" x 12"	1 9
1 N.T.S. panel, 16" x 7" x 3/8", ready drilled	3 0
1 N.T.S. S.T.500 screen	1 6
1 N.T.S. terminal strip, ready drilled	9
1 N.T.S. bracket for tone control condenser	3
2 N.T.S. S.T.500 coils	6 0
2 N.T.S. slow-motion .0005-mfd. tuning condensers with dials	9 0
3 N.T.S. .0005-mfd. solid dielectric reaction condensers	4 6
1 N.T.S. .0001-mfd. differential reaction condenser	1 3
1 N.T.S. .0003-mfd. differential reaction condenser	1 6
1 N.T.S. baseboard pre-set .0001-mfd. condenser	9
1 N.T.S. .0005-mfd. pre-set .0005-mfd. condenser	9
1 N.T.S. Class B driver transformer, ratio 1-1	7 6
1 N.T.S. Class B output choke	9 0
1 N.T.S. super transformer	5 0
1 N.T.S. S.G. choke	2 6
2 N.T.S. 4-pin valve holders	1 0
1 W.B. "Universal" 5-pin valve holder	1 0
1 GRAHAM FARISH 7-pin valve holder	1 3
1 N.T.S. disc type H.F. choke	1 6
1 N.T.S. 1-meg. leak with wire ends	1 0
2 N.T.S. 1-watt metallised 5,000-ohm resistances	1 8
2 N.T.S. 1-watt metallised 10,000-ohm resistances	1 6
1 N.T.S. 250-ohm resistance	9
1 N.T.S. 2-mfd fixed condenser	2 0
2 N.T.S. 1-mfd. fixed condensers	3 0
2 N.T.S. .005-mfd. tubular condensers	1 6
1 N.T.S. .0005-mfd. tubular condenser	9
1 N.T.S. .00005-mfd. mica condenser	6
2 N.T.S. push-pull on-off switches	1 4
1 N.T.S. toggle off-off switch	1 3
10 N.T.S. terminals	1 8
Flex, screws, 3 wander plugs, connecting wire, etc	2 0

KIT "A," CASH OR C.O.D. £3 15 0

Separate items in this Kit sent Cash or C.O.D. Part Kits, value over 40/-, on Easy Terms. Orders over 10/- sent Carriage and C.O.D. Charges Paid. Send for latest lists. MAIL ORDER ONLY. NO CALLERS.

To **New Times Sales Co**

56, Ludgate Hill,
London, E.C.4.

Please send me N.T.S. Easibilt S.T.500 Kit..... for which I enclose £.....s.....d.
Cash/Deposit.

NAME.....

ADDRESS.....

P.W., 21/10/33.

**FREE FULL SIZE
BLUE PRINT
WITH
EVERY KIT**

and copy "Popular Wireless" S.T.500 issue.

EST. 1924.

OPERATING *your* S.T. 500

HERE are the brief instructions necessary to operate your "S.T.500." Fuller information will be given in a later issue. Incidentally, may I say that everyone who builds this receiver should read everything I have to say about it during the next month. I want you to get

real service on this set, and there may be some point not fully appreciated which I can clear up or emphasise.

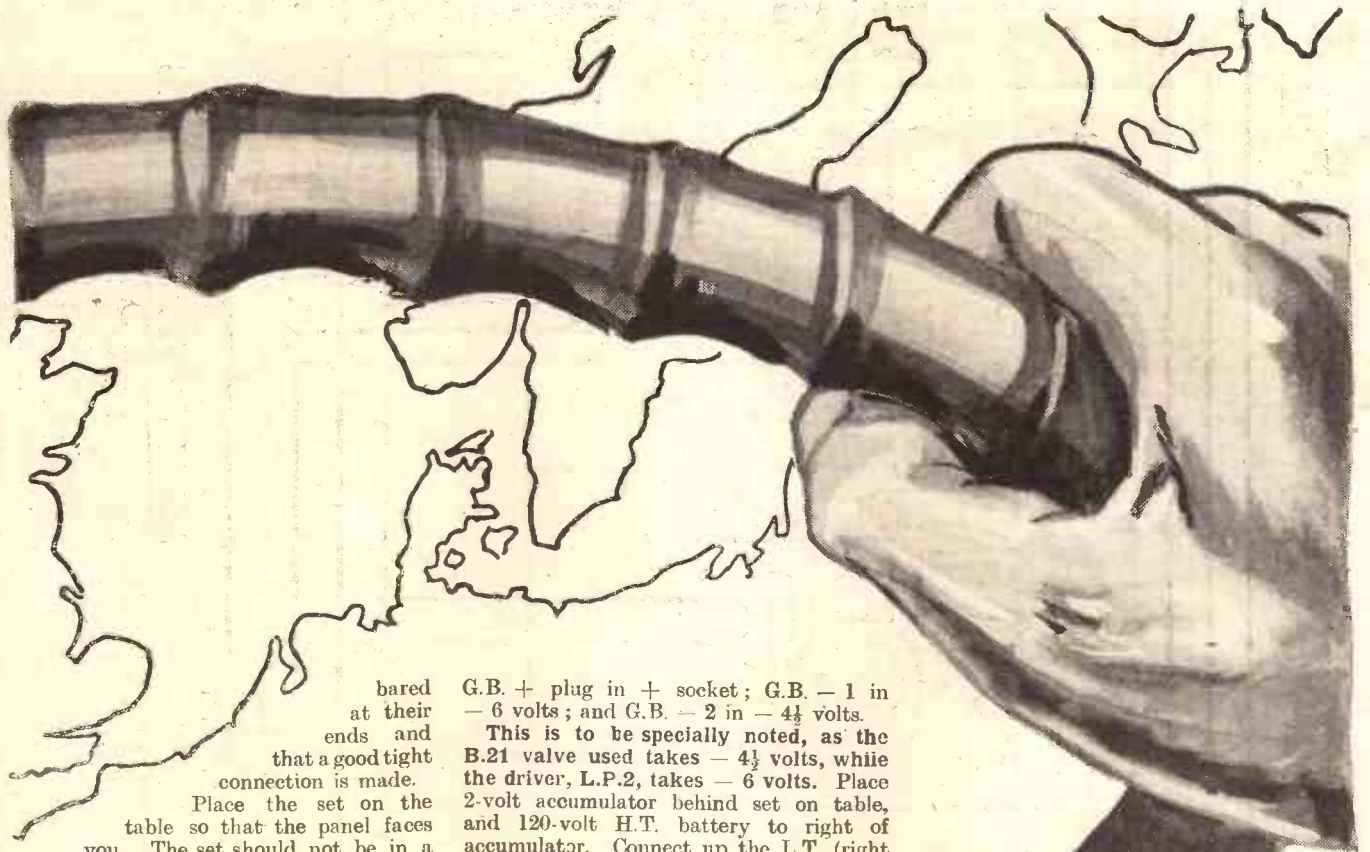
I will now assume you have completed the set by means of the guide. Check wiring extremely carefully to see the wires are properly connected and that there are no short-circuits to the screen, earth sheet or components.

Check—and Be Sure !

If you have other coils than those I use, it is vital to see that the terminals from windings correspond to the Colvern's. If differently numbered and you do not allow for this the set will obviously not work.

To check wiring, I advise a constructor, as a perfect check, to ask a friend to read out to him the numbers on the Rapid Guide. You then follow the wires on the set from this description. It is vital to see that the wires are properly





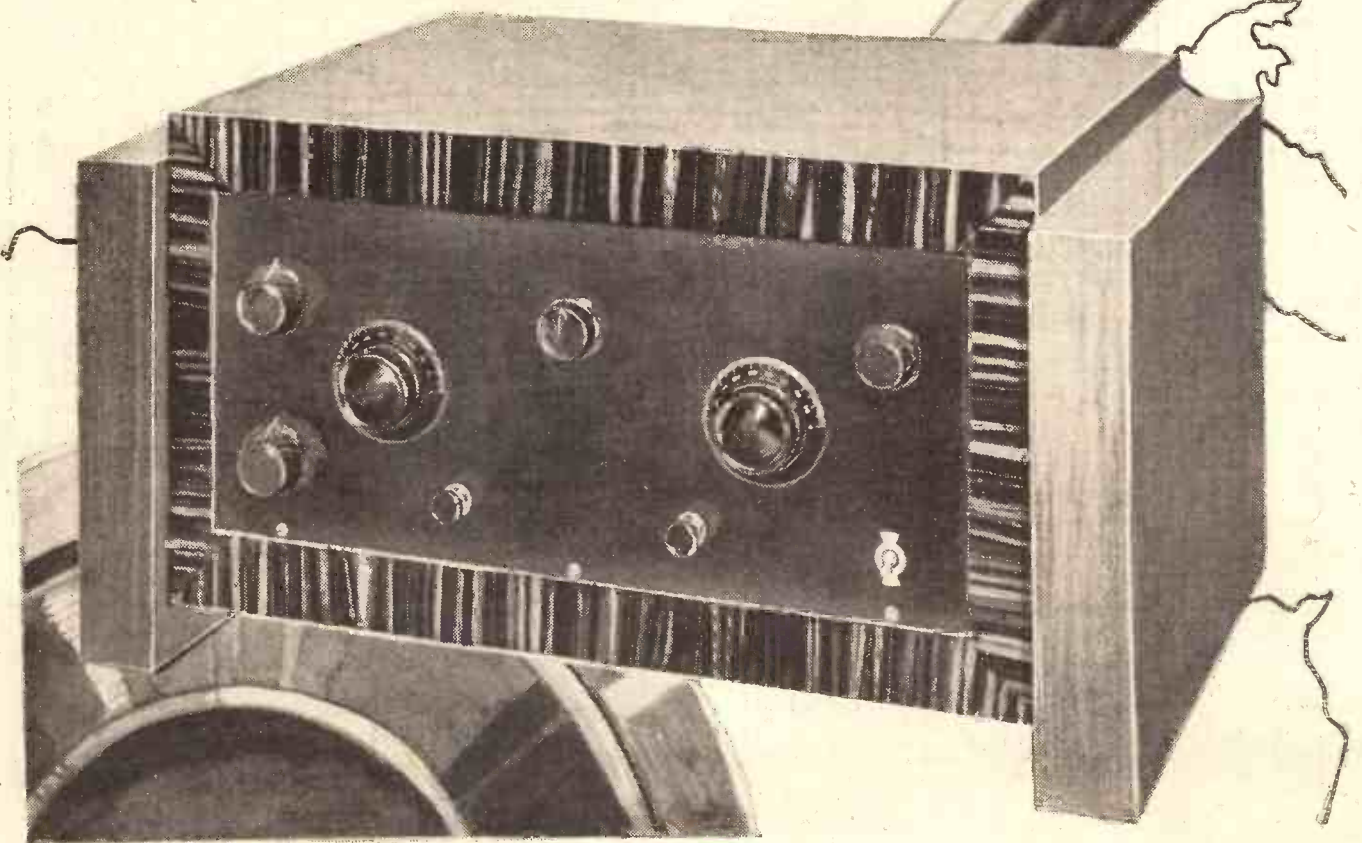
bared at their ends and that a good tight connection is made.

Place the set on the table so that the panel faces you. The set should not be in a cabinet. Switch on toggle on-off (i.e. press down). Place a good 9-volt grid-bias battery (thousands of dud ones are used by constructors) behind terminal strip. Insert

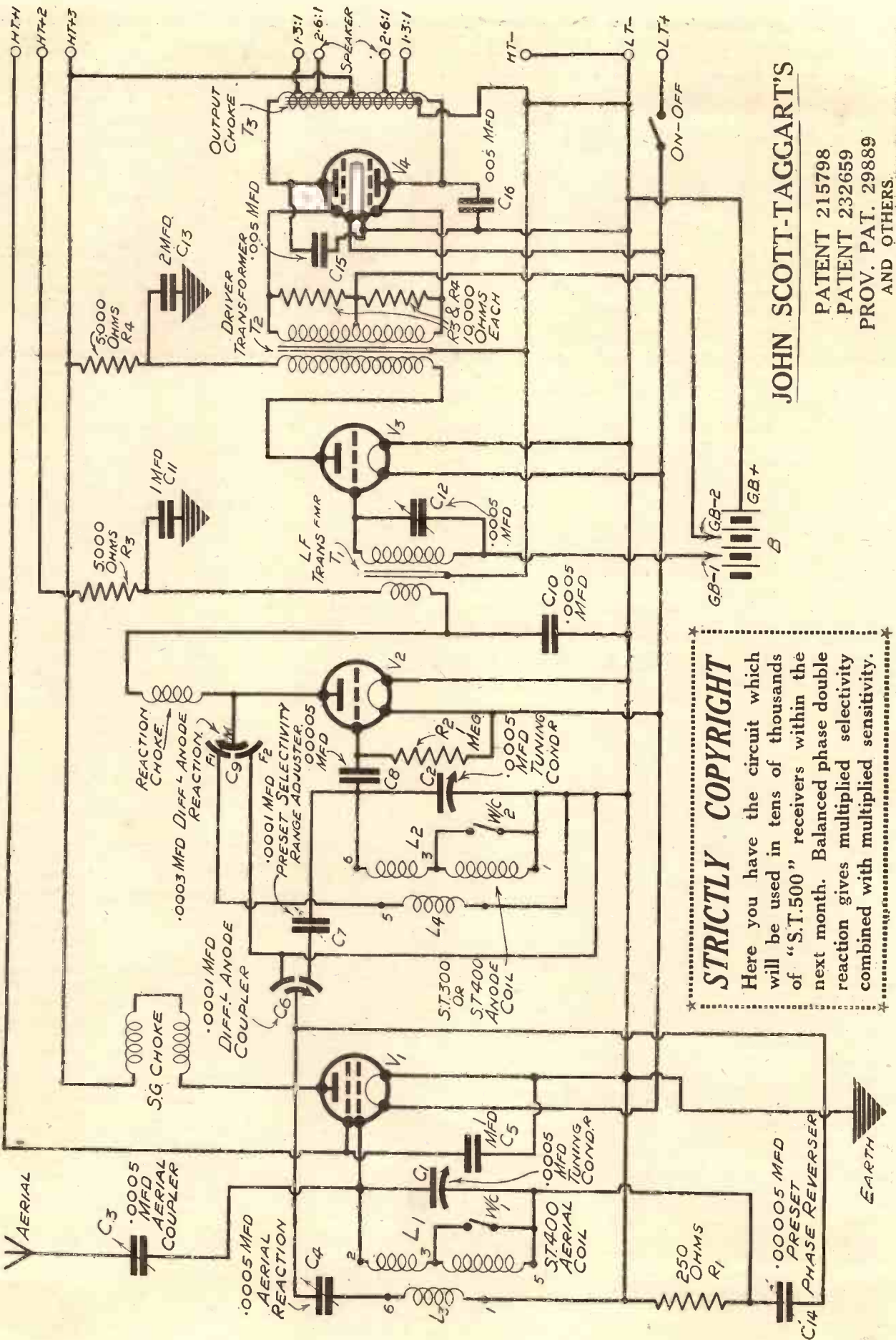
G.B. + plug in + socket; G.B. - 1 in - 6 volts; and G.B. - 2 in - $4\frac{1}{2}$ volts.

This is to be specially noted, as the B.21 valve used takes - $4\frac{1}{2}$ volts, while the driver, L.P.2, takes - 6 volts. Place 2-volt accumulator behind set on table, and 120-volt H.T. battery to right of accumulator. Connect up the L.T. (right way round!). See that free end of wire, 71, the S.G. anode flex in the set, does not touch anything. Connect aerial and earth

(Continued on page 318.)



THE S.T.500 CIRCUIT SPECIALLY DEVELOPED FOR "POPULAR WIRELESS"



STRICTLY COPYRIGHT

Here you have the circuit which will be used in tens of thousands of "S.T.500" receivers within the next month. Balanced phase double reaction gives multiplied selectivity combined with multiplied sensitivity.

JOHN SCOTT-TAGGART'S
 PATENT 215798
 PATENT 232659
 PROV. PAT. 29889
 AND OTHERS

THE 500 CIRCUIT

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

SOME people are façadists. The front, or façade, is the chief thing that matters to them. Go to any wireless exhibition and you will hear façadism rampant. The "look of the thing" is as important to many people as the technical results—until they get the set home. Then harmony with the furniture will not make up for discord in the reception.

In Italy, in country districts, you will find many magnificent-ly fronted churches. As you stand before them you gain an impression of beauty and dignity. Behind the inspiring stone front (a foot thick) is a tin shack.

Many a well-informed visitor to a radio exhibition returns home with the impression that he has been to a furniture show.

The home constructor looks for something more than beauty of cabinet work. He suffers none of the agonies which rack the layman in his choice of cabinet—whether to buy the tombstone or the coffin.

Circuit that Matters.

And yet even the constructor, if he is inexperienced, may prefer his panel rather than his music to be "clean." But, when all is said and done, a wireless set is a scientific instrument. It is performance that counts and the circuit that matters.

The "S.T.500" circuit (whose principal feature is an unique and highly successful method of applying reaction to both tuned circuits) may be considered in four stages:

- (1) The aerial circuit.
- (2) The H.F. amplifying valve and anode circuit.
- (3) The detector.
- (4) The Class B output.

The aerial circuit has provision for:

- (a) Varying the H.F. input.
- (b) Application of reaction.

The variation of input of H.F. to the first valve is of great importance. A wireless receiver must have a volume control, and there is no better place for it than at the very beginning of the set. A reduction of volume by reducing the series-aerial condenser (called the aerial coupler) simultaneously improves selectivity.

The need for an H.F. type of volume control is increased by the fact that the "S.T.500" employs reaction which increases signal strength at the same time as selectivity. To start with an excessive amount of H.F. input is undesirable, because the amplification after reaction would result in cumbersome magnification.

If selectivity is sought, the input currents (as controlled by the aerial coupler) should be reduced to such a value that when double reaction has been applied the output volume from the speaker is brought up to the right loudness. The aerial coupler is thus an essential control.

Use of Aerial Coupler.

When aerial reaction is not used the aerial coupler controls the selectivity of the aerial circuit as well as the H.F. input. Reducing the aerial coupler improves selectivity; turning the aerial-coupler knob to the right increases the aerial coupling and flattens tuning.

When aerial reaction is used the aerial coupler's function is primarily to reduce H.F. input. If signals are weak, however, one uses as much "coupler" as is necessary. This is also usual during daylight reception.

Aerial reaction is obtained from the S.G. choke via a variable .0005 "solid dielectric" condenser which preferably should be of the log-law or similar "tuning" type, since this will make for convenience in reaction handling.

The aerial reaction is really a combination of both positive and negative reaction. A phase-reversal circuit consisting of a 250-ohm non-inductive resistance and a pre-set condenser having a maximum of .00005 mfd. are common to both grid and anode circuits; the amount of reverse voltage is controlled by the pre-set, but the adjustment is not at all critical. The reverse-phase voltages are developed across the

resistance and are applied to the grid of the S.G. valve.

I have called the arrangement **Balanced Phase Reaction**: it makes for uniformity of results and much smoother and more effective reaction. The proportion of negative to positive reaction falls as aerial reaction is increased.

The H.F. Stage.

The H.F. amplifying valve is of the maximum-efficiency S.G. type,—e.g. a Cossor 220 S.G. Valves of lower efficiency, such as were first introduced (e.g. Cossor 215 S.G., Mullard P.M. 12, etc.), are workable but not recommended; variable-mu S.G. valves (if of high maximum mutual conductance) and high-frequency battery pentodes can be used.

The second tuned circuit, which I call the tuned anode circuit or simply "the anode circuit," is of the choke-fed type, and is, of course, connected across grid and filament of the detector valve. The amplified currents are fed to the tuned anode circuit through a

differential anode coupling condenser called the anode coupler.

This, when it is at zero (i.e. full left), will pass on a minimum of H.F., and volume

will fall, but not to zero.

At low values of anode coupling signal strength will fall off, but anode reaction will bring it back to some extent. With no reaction, volume will increase (but selectivity will decrease) if the anode coupler is turned to the right.

The Anode Coupler.

Without use of anode reaction, or with only a little, the anode coupler will be used for increasing selectivity by turning the knob to the left. In this position the anode load is reduced and selectivity rises.

With anode reaction the anode coupler will always be used as far to the left as possible (consistent with output volume), especially when aerial reaction is also being used. Otherwise the amplification on nearly all signals would be excessive and the whole set overloaded. Excessive anode coupling would in these circumstances result in no louder signals; selectivity

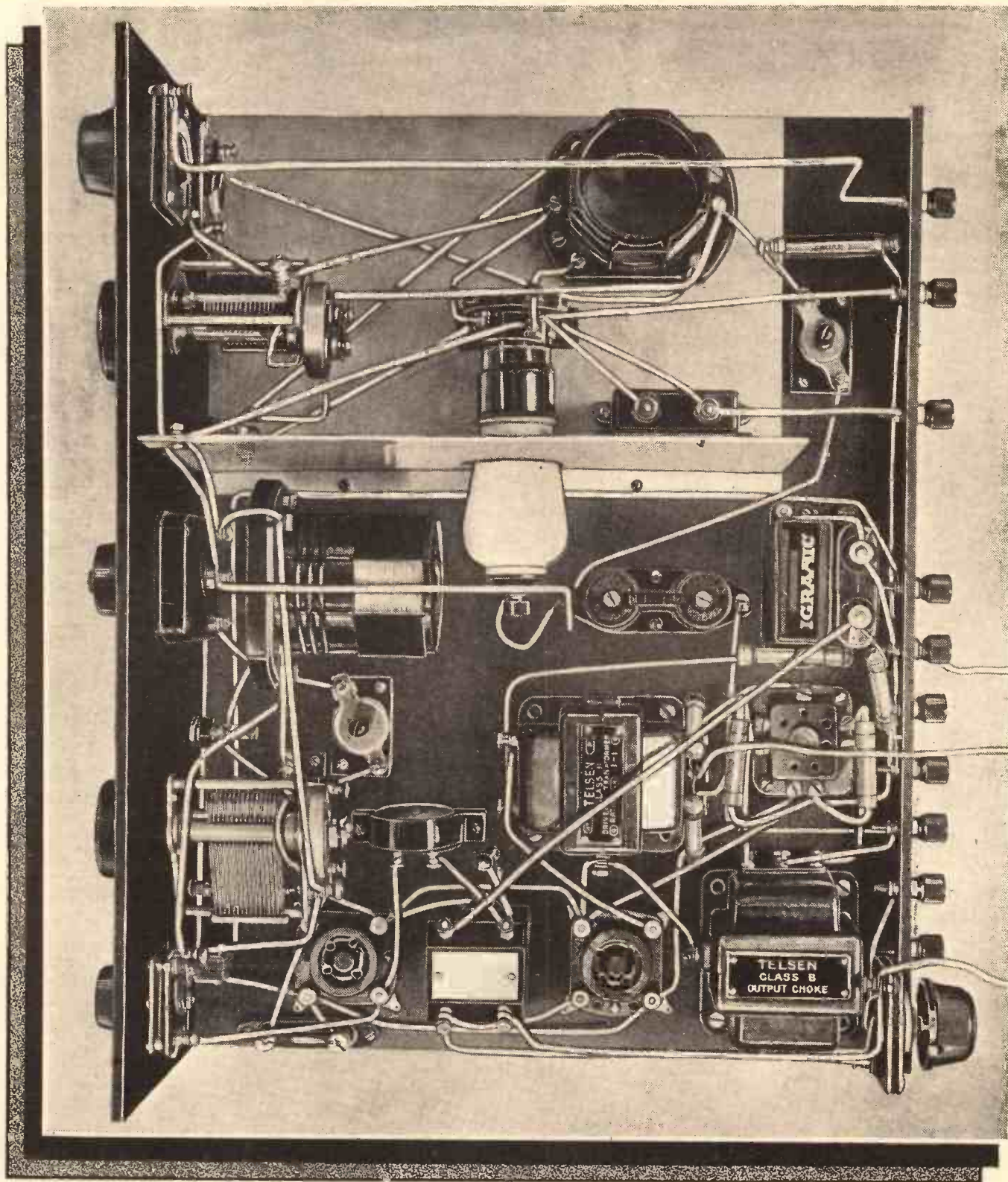
(Continued on page 314.)

BALANCED PHASE DOUBLE REACTION

MULTIPLIED SELECTIVITY

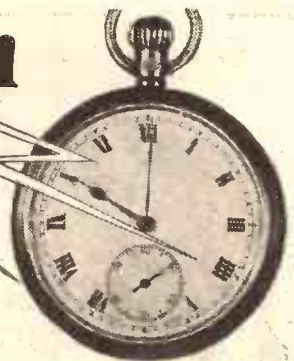
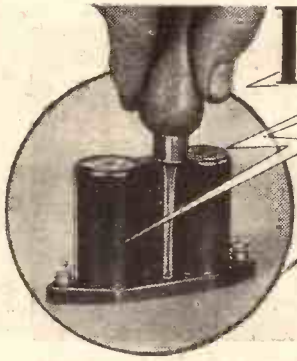
PERFECTED CLASS B

Scores of Foreigners : Amazing Quality : Economy



An almost vertical view of the "S.T.500." Every single component in the set may be seen. Note the Balanced Phase Reaction components on the right above the screen. The selectivity range-adjuster below the anode coil is also clearly visible. The tone control is in the bottom right-hand corner.

Rapid Construction Guide for the S.T. 500



MY rapid guides used in previous sets have proved enormously popular and various improvements have now been added; for example, you are told when finally to tighten the terminals.

The following guide gives you every single step to take to build the S.T.500. Great trouble has been taken to ensure minute detail and extreme accuracy and the various steps are in the best and most time-saving order. The detail is great because it is assumed that the reader has never built a set before in his life. Explanations of the order of construction are not given, but the reasons will be appreciated by constructors who ignore the guide.

Details make for speed.

The wiring in the finished set may be checked by getting a friend to read out the numbered list while you check the wires on the set; it is unnecessary to consult the blueprint for this purpose.

If you use different components slight variations must be made. If you intend to fit a radiogram switch (Wearite type 123) any two contacts may be used in place of toggle switch which need not in this case be bought. Full details for using S.T.500 for gramophone work will be given very shortly.

(A) Study component list, see which items you already have (and which you can guarantee are O.K.) and order the rest without delay. Avoid using a component again which may have been the cause of undiagnosed failure in a previous set. If buying new components or valves I very strongly advise you to use the same components as I did, but in no case to wander from the list of alternatives; no responsibility whatever can be taken for results if this warning is not heeded. If you are thinking of buying a new speaker the cost of the choke is saved. Decide whether to use a Class B moving-coil speaker or an output choke for your existing speaker.

(B) Examine components. Try valves in valve holders to see that pins make good contact. (If old valve holders are used see that they are in good condition and that no metal part will touch baseboard.) See that vanes of variable condensers are free from dust and do not touch at any point; pigtails on them should be examined. The upper plates of the .0001-mfd. and .00005-mfd. open-type pre-sets must (after temporary removing adjusting knob) be bent up so that a low minimum capacity is obtainable. Make sure that all terminal screws are secure in all the components and tighten the nuts underneath if necessary.

(C) Check size of baseboard (16 in. x 12 in.) and of panel (16 in. x 7 in.). The sizes are important if you have a cabinet into which they must fit, and you should make any small alterations before the set is built.

(D) Examine screen to see that it conforms approximately to sketch, modifying it if necessary. Note that a small hole is in screen for later insertion of a terminal.

Follow the order carefully.

(E) If Metaplex baseboard is used check size of metallised surface. Under no circumstances should the metallised surface extend beyond the screen.

(F) Take G₁ in. x 10 in. earth sheet (metal foil) and fix it down flat over one corner of baseboard (as shown in blueprint), securing by means of four tacks or drawing pins in corners; make sure that tacks are clear of screen or any component.

(G) Lay blueprint face upwards on baseboard; the aerial end of blueprint, of course, goes over the earth sheet. Keep blueprint steady with a weight. Using Bradawl, prick through into baseboard the fixing holes of all baseboard components, including holes for anode-coil pillars and holes for vertical screen-fixing screws, making sure that the holes for screen correspond with your own screen (screen-fixing holes vary slightly).

(H) Remove blueprint and prepare holes in baseboard for anode-coil supporting pillars and countersink these holes from underneath. (See that holes go through baseboard as shown in sketch illustrating method of mounting anode coil.)

(J) Prepare with Bradawl the two already-pricked holes for fixing vertical screen. (The holes are merely in preparation for receiving small wood screws; the vertical screen is not fixed at this stage).

(K) Clean earth sheet (with emery paper) where it will later be held down by ledge of vertical screen.

(L) Remove superfluous terminal C from the W.B. universal valve holder. Discard the bent metal socket. Put terminal aside for later use.

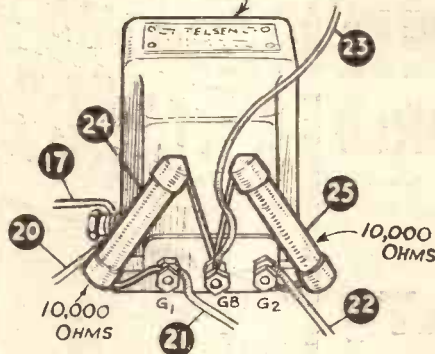
(M) Using blueprint as check for their positions, screw down the following in the order given: W.B. universal valve holder (marked V1 on blueprint), S.T.400 aerial coil, 1-mfd. (T.C.C.) on metal foil, phase-reverser .00005-mfd. pre-set, S.G. choke, 1-mfd. (Dubilier) on uncovered part of baseboard, 2-mfd. condenser, 7-pin valve holder, output choke (if used), driver transformer, valve holder V3, L.F. transformer, valve holder V2, 1-megohm resistance in holder, reaction choke, grid condenser, selectivity range adjuster.

(N) Mark out and drill terminal strip (or buy same). Countersink three fixing holes. Fit ten terminals loosely into terminal strip, which is then fixed to edge of baseboard by means of three countersunk-head screws (unless fixing holes are countersunk do not use countersunk-head screws as splitting of the ebonite may occur).

(O) Fit tone-control .0005-mfd. variable condenser to tone-control mounting plate: fix mounting plate to terminal strip by means of nut and bolt.

THEY STABILIZE IT!

1/1 DRIVER TRANS'R.



This sketch shows the two 10,000-ohm resistors which go across the two secondaries of the driver transformer.

(P) **WIRE BASEBOARD COMPONENTS** with stiffish insulated wire, e.g. bell wire or one of the advertised varieties, such as Glazite. To save the reader time and trouble I have numbered the wires in the most convenient order for connection.

Use the following list to find the wires quickly on the blueprint and note their shape on the perspective drawings and photographs. The numbers of wires are the same in all drawings. You need not read the wording after the wire if you can find the wire without.

It is very important to tick off the numbers on this list after completing each connection. No terminals should be finally tightened until the word "tighten" appears in brackets after the terminal concerned. When the word "tighten" appears it means all wires to that terminal are in place; then tighten firmly, as it may be more difficult to do so later.

N.B.—Valve holder filament terminals are marked F+ and F— in blueprint for purpose of identification, although not so marked on the valve holders themselves; likewise I have labelled certain terminals G1, G2 and P1, P2 to assist in their identification.

- (1) Screening-grid terminal (tighten), marked A on W.B. valve holder to neighbouring 1-mfd. condenser.
- (2) Same terminal (tighten) of the 1-mfd. to H.T.+3 terminal (tighten) on terminal strip.
- (3) Earth terminal on strip to L.T.— terminal on strip; this wire runs on baseboard and next to terminal strip.
- (4) L.T.— terminal on strip to H.T.— terminal on strip.

(5) .00005-mfd. phase-reverser terminal nearest aerial coil to aerial-coil terminal No. 5. [All coil-terminal numbers apply to Colvern S.T.400 coils].

(6) Earth terminal on strip to one terminal (tighten) of 250-ohm Ohmite resistor. This wire supports one end of the resistor.

(7) The other terminal (tighten) of 250-ohm Ohmite to .00005-mfd. phase-reverser terminal (tighten) nearest aerial coil.

(8) Earth terminal (tighten) on strip to upper filament terminal F— of W.B. universal valve holder V1.

Tick off completed connections.

(9) Same upper filament terminal F— of W.B. valve holder V1 to nearest terminal (tighten) on neighbouring 1-mfd.

(10) Aerial-coil terminal (tighten) (1) to upper filament terminal F— on W.B. valve holder.

(11) Aerial-coil terminal (2) to control grid terminal (tighten) on W.B. valve holder V1.

(12) S.G. choke terminal nearest terminal strip to H.T.+3 terminal on strip.

(13) 7-pin valve holder terminal (tighten) F+ to valve holder V3 terminal F+ nearest baseboard edge.

(14) Same terminal (tighten) F+ of valve holder V3 to valve holder V2 filament terminal F+ nearest baseboard edge.

(15) L.F. transformer earth terminal (if any) [in case of Niclet used it is one of fixing screws] to valve holder V2 filament terminal F— furthest from baseboard edge.

(16) Same V2 terminal F— furthest from baseboard edge to valve holder V3 filament terminal F— furthest from baseboard edge.

(17) Same V3 terminal F— furthest from baseboard edge to driver transformer earth terminal.

(18) Valve holder V3 filament terminal (tighten) F— furthest from baseboard edge to 7-pin valve holder V4 filament terminal F— nearest terminal strip.

(19) Same V4 F— terminal nearest terminal strip to H.T.— terminal (tighten) on terminal strip.

(20) Driver-transformer earth terminal (tighten) to output-choke earth terminal (tighten).

(21) Driver-transformer terminal G1 to 7-pin valve holder V4 grid terminal (tighten) G1.

(22) Driver-transformer terminal G2 to 7-pin valve holder V4 grid terminal (tighten) G2.

(23) Driver-transformer terminal GB via 12 in. length of flex to G.B.—2 plug (tighten).

(24) Driver-transformer G.B. via 10,000-ohm resistor to driver-transformer terminal (tighten) G1.

(25) Driver-transformer terminal (tighten) GB via 10,000-ohm resistor to driver-transformer terminal (tighten) G2.

(26) Output-choke terminal (tighten) P1 to 7-pin valve holder V4 anode terminal A1.

Tighten terminals when told.

(27) Output-choke terminal (tighten) P2 to 7-pin valve holder V4 anode terminal A2.

(28) H.T.+3 terminal (tighten) on terminal strip to output-choke terminal (tighten) H.T.+.

(29) L.S.+ terminal (tighten) on strip to output-choke terminal (tighten) 2:6 : 1 furthest from strip (there is another terminal further still from strip, but it is not a 2:6 : 1).

(30) L.S.— terminal (tighten) on strip to output-choke terminal (tighten) 2:6 : 1 nearest strip.

(31) 7-pin valve holder V4 anode terminal (tighten) A1 via .005-mfd. tubular condenser to 7-pin valve holder V4 filament terminal F—.

(32) 7-pin valve holder V4 anode terminal (tighten) A2 via .005-mfd. tubular to 7-pin valve holder V4 filament terminal (tighten) F—.

(33) Valve holder V3 anode terminal (tighten) A to driver-transformer terminal (tighten) P.

(34) Driver-transformer H.T.+ terminal (tighten) to 2-mfd. condenser terminal nearest 7-pin valve holder V4.

(35) Same terminal (tighten) of 2-mfd. (i.e. nearest 7-pin valve holder) via 5,000-ohm resistor to S.G. choke terminal (tighten) nearest 2 mfd.

(Continued on page 292.)



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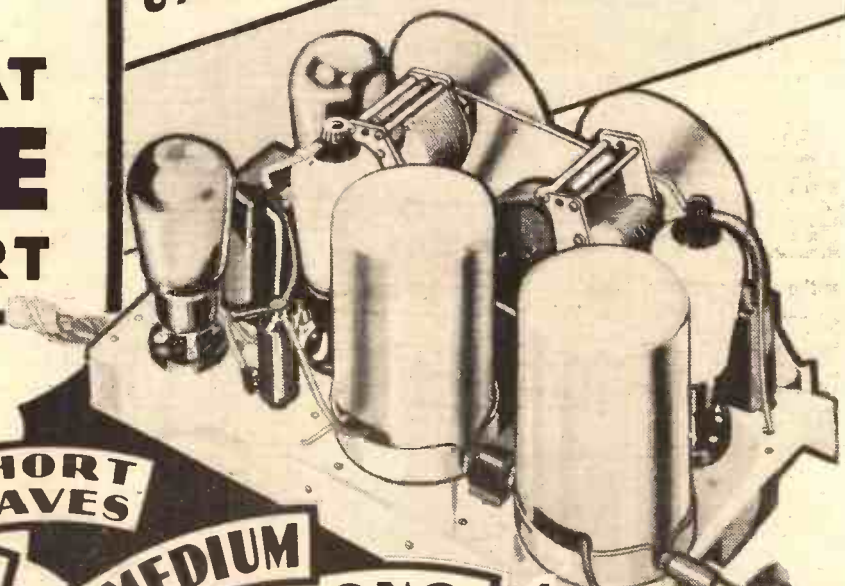
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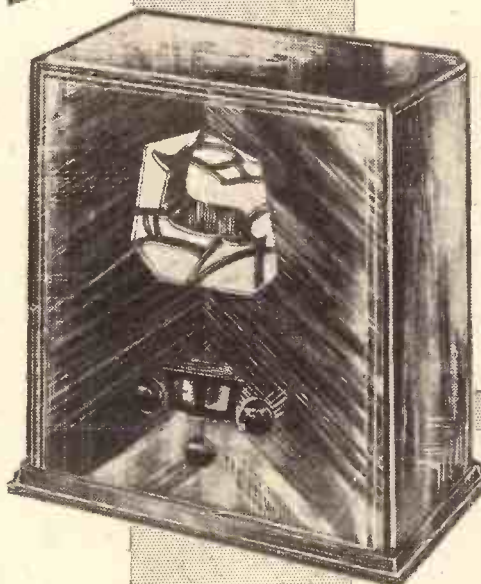


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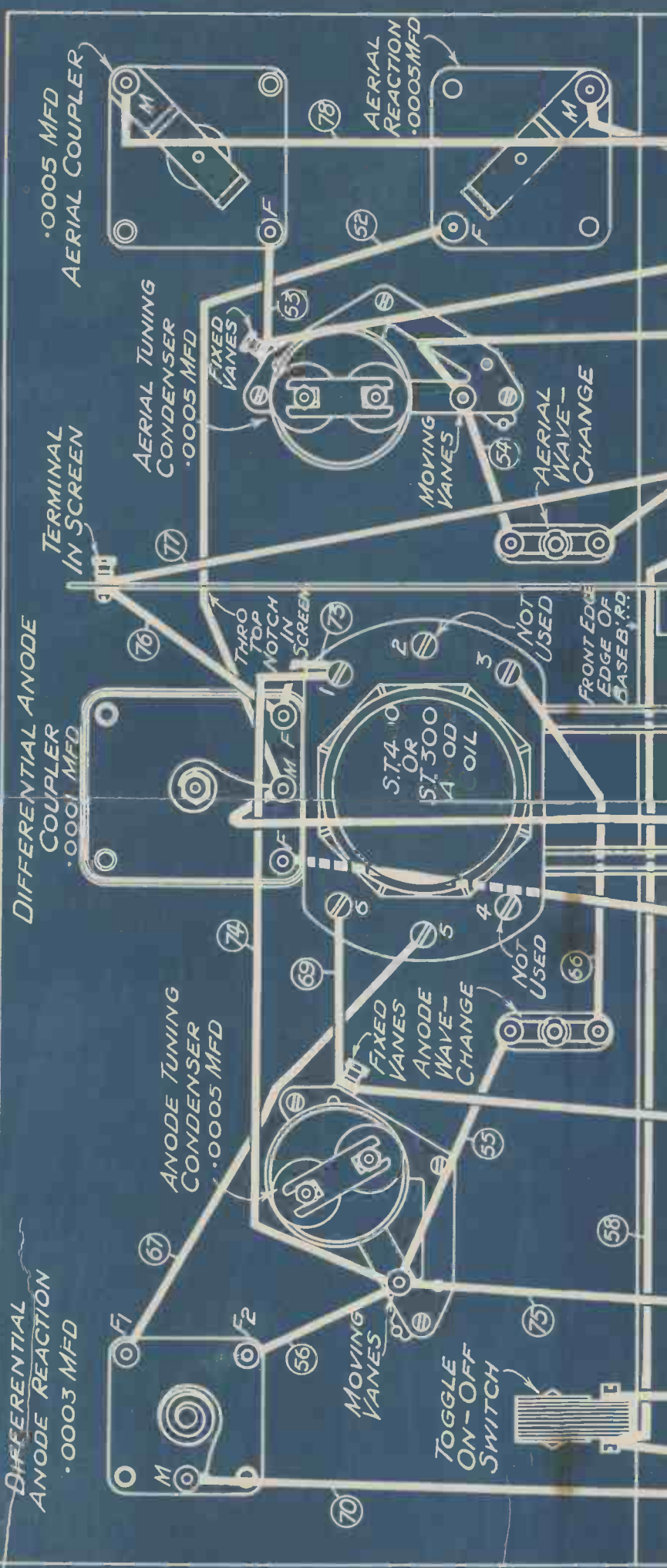
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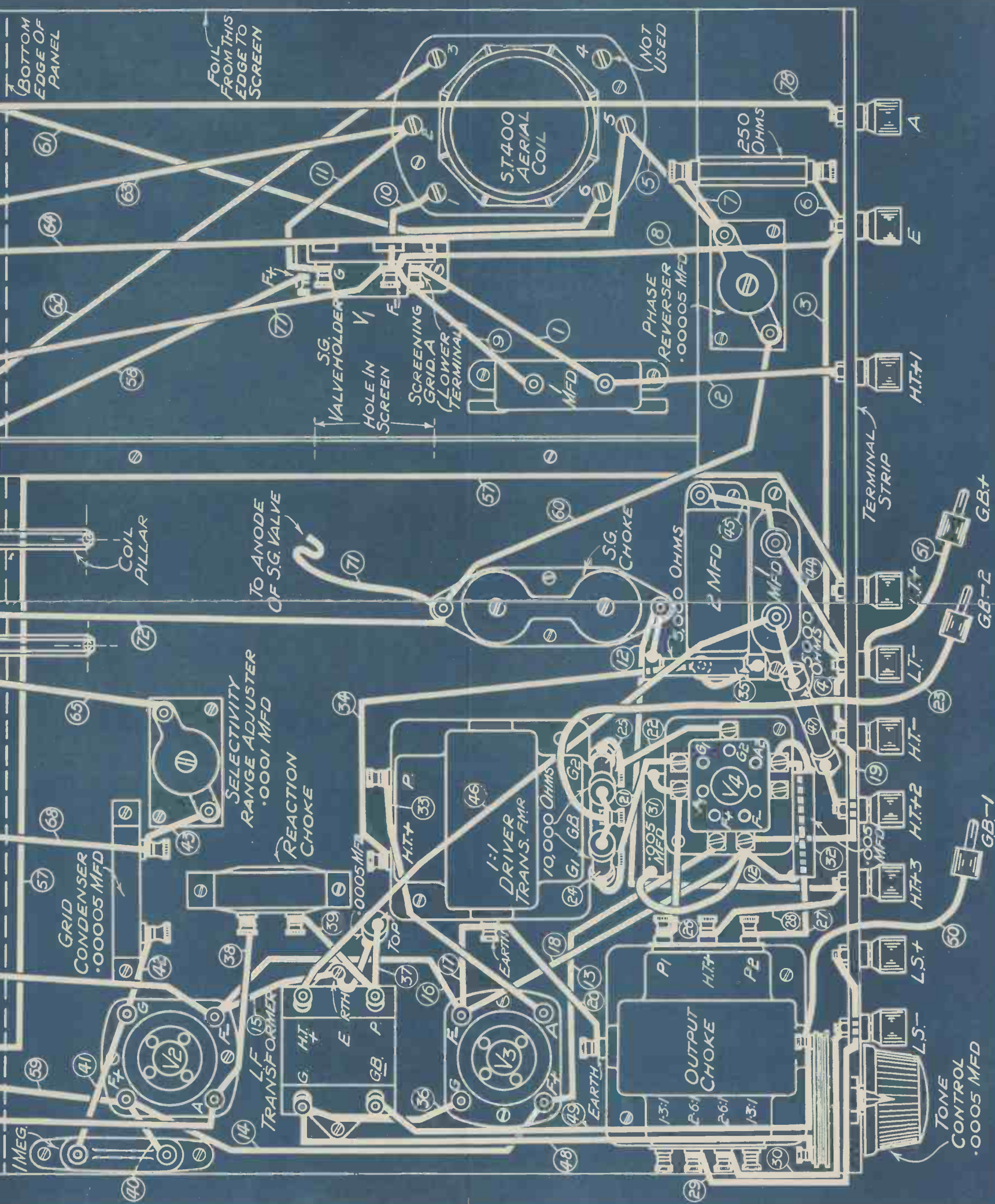
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BOTTOM
EDGE OF
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FOIL
FROM THIS
EDGE TO
SCREEN

NOT
USED

S.T.400
AERIAL
COIL

250
OHMS

PHASE
REVERSER
.00005 MFD

VALVEHOLDER
HOLE IN
SCREEN

SCREENING
GRID.A
(LOWER
TERMINAL

COIL
PILLAR

TO ANODE
OF S.G. VALVE

S.G.
CHOKE

SELECTIVITY
RANGE ADJUSTER
.0001 MFD

REACTION
CHOKE

GRID
CONDENSER
.00005 MFD

1:1
DRIVER
TRANS. F.M.R.

OUTPUT
CHOKE

L.F. TRANSFORMER

TONE
CONTROL
.0005 MFD

TERMINAL
STRIP

HT+1

LT-

GB+2

GB+

HT+2

HT+3

LS+

LS-

HT+

GB-1

GB-2

GB+

1 MEG.

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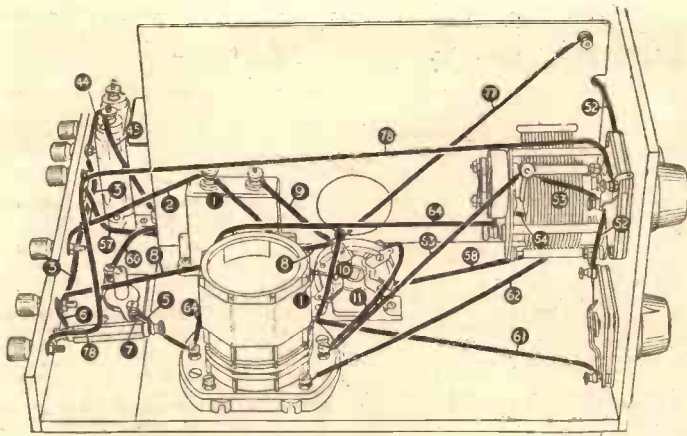
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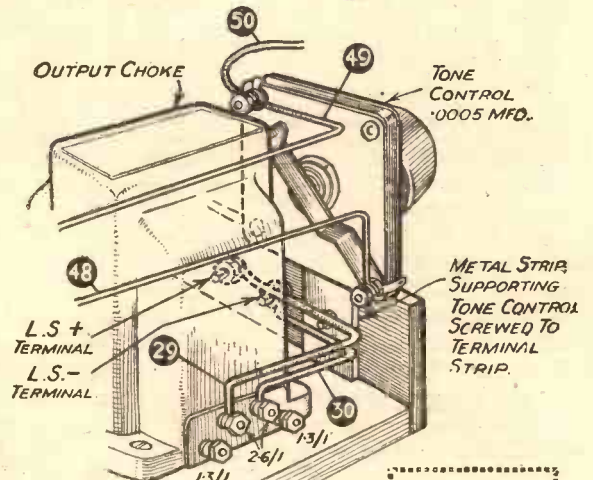
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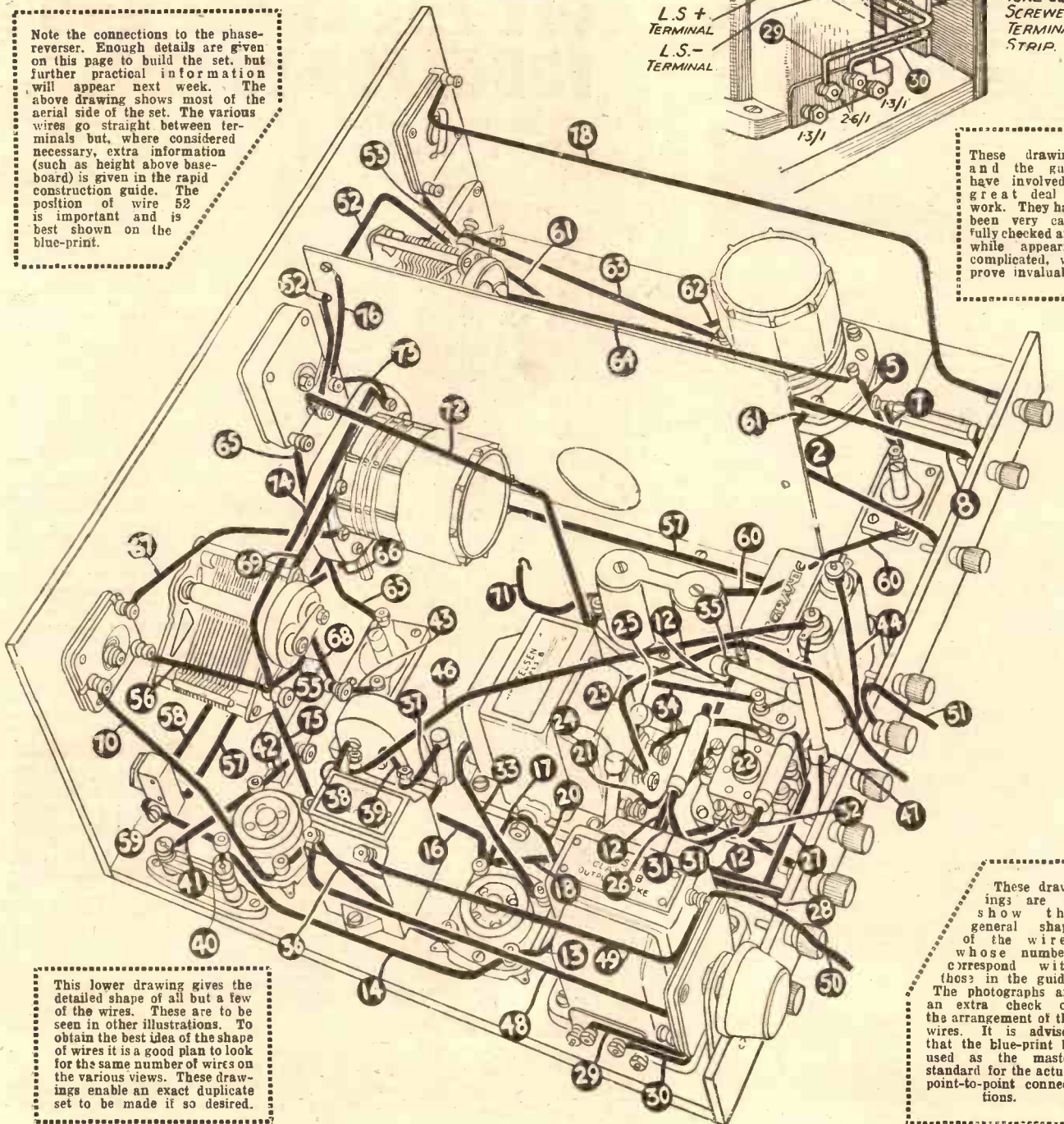


Immediately below you will see how the connections are made to the tone control. The output transformer is not used if a Class B speaker is employed.



Note the connections to the phase-reverser. Enough details are given on this page to build the set, but further practical information will appear next week. The above drawing shows most of the aerial side of the set. The various wires go straight between terminals but, where considered necessary, extra information (such as height above base-board) is given in the rapid construction guide. The position of wire 52 is important and is best shown on the blue-print.

These drawings and the guide have involved a great deal of work. They have been very carefully checked and, while appearing complicated, will prove invaluable.



This lower drawing gives the detailed shape of all but a few of the wires. These are to be seen in other illustrations. To obtain the best idea of the shape of wires it is a good plan to look for the same number of wires on the various views. These drawings enable an exact duplicate set to be made if so desired.

These drawings are to show the general shape of the wires whose numbers correspond with those in the guide. The photographs are an extra check on the arrangement of the wires. It is advised that the blue-print be used as the master standard for the actual point-to-point connections.

Every Conceivable Detail is Given Here

- (36) Valve holder V3 grid terminal (tighten) G to L.F. transformer (Nictel) terminal G.
- (37) L.F. transformer terminal P via .0005-mfd. tubular to L.F. transformer earth connection (tighten).
- (38) Valve holder V2 anode terminal A to reaction choke terminal (tighten) nearest grid condenser.
- (39) Reaction choke terminal (tighten) nearest driver transformer to L.F. transformer terminal (tighten) P.
- (40) Valve holder V2 filament terminal F+ nearest baseboard edge to 1 megohm resistance terminal (tighten) nearest strip.
- (41) 1-megohm resistance terminal (tighten) furthest from strip to valve holder grid terminal G.
- (42) Same grid terminal (tighten) G of valve holder V2 to nearest terminal (tighten) on grid condenser.
- (43) Grid-condenser terminal nearest selectivity range adjuster to selectivity range-adjuster terminal (tighten) nearest grid condenser.
- (44) L.T. terminal (tighten) on strip to adjacent 1-mfd. terminal furthest from 7-pin holder V4.
- (45) Same terminal (tighten) on 1-mfd. to 2-mfd. terminal (tighten) furthest from 7-pin valve holder.
- (46) L.F. transformer H.T.+ terminal (tighten) to nearest terminal on 1-mfd. nearest 7-pin valve holder V4.
- (47) Same terminal (tighten) on 1-mfd. nearest 7-pin valve holder V4 via 5,000-ohm resistor to H.T.+2 terminal (tighten) on strip.
- (48) L.F. transformer terminal (tighten) G to tone-control .0005-mfd. condenser lower terminal (tighten).
- (49) L.F. transformer G.B.- terminal (tighten) to tone-control .0005-mfd. upper terminal.
- (50) Same upper terminal (tighten) on the control condenser via 8-in. flex to G.B.-1 plug (tighten). Make sure connection to plug is good.
- (51) Connect a 7-in. flexible lead (having a G.B.+ plug at one end) under the terminal head of L.T.- terminal on strip (see blueprint).

THIS CONCLUDES THE BASEBOARD WIRING.

(Q) Mark out and drill panel (or buy same). My panel-drilling diagram is a back view and is for marking back of panel. (On no account use it to mark the front of panel.) Small pilot holes are first drilled from the back (the final holes being drilled from the front). Any marks on panel front (to assist the reading of dial and coupler positions while working set) are best scratched immediately after drilling pilot holes. Their position is vertically above pilot holes and the scratches should show about one quarter of an inch when knobs are fitted. The three holes for the panel-fixing screws should be countersunk, otherwise panel will probably fracture when countersunk screws are used.

(R) FIT PANEL COMPONENTS in following order: toggle on-off switch, two push-pull wave-change switches, one .0005-mfd. differential reaction condenser, one .0001-mfd. differential anode coupler, one .0005-mfd. aerial coupler, one .0005-mfd. aerial reaction condenser, two .0005-mfd. slow-motion tuning condensers. If aerial wave-change switch is of different type turn it around if necessary to clear vertical screen.

Do not fit any knobs or dials at this stage, except those on wavechange switches.

- (S) WIRE PANEL COMPONENTS as follows:
 - (52) Differential anode coupler moving vanes middle terminal to .0005-mfd. aerial reaction upper terminal (tighten). This wire passes close to panel where it will later pass through top notch in vertical screen. It is important that this wire should follow the route on the blueprint, especially where it passes midway between aerial coupler and aerial tuning condenser.
 - (53) Aerial coupler fixed vanes lower terminal (tighten) to aerial tuning condenser fixed vanes terminal (this terminal is on the side of the Ormond condenser).
 - (54) Aerial tuning condenser moving vanes terminal (i.e. at end in case of Ormond type) to upper terminal (tighten) of aerial wave-change switch.
 - (55) Anode tuning condenser moving vanes terminal (i.e. at end on Ormond type) to anode wave-change switch upper terminal (tighten).
 - (56) Anode reaction condenser fixed vanes lower terminal F2 (tighten) to anode tuning condenser moving vanes terminal (i.e. terminal at end on Ormond).
 - (T) Hold panel temporarily in position against

baseboard and mark on baseboard the points above which the on-off switch terminals will come. Remove panel. Prepare wires for later connection to toggle switch, viz. (58) from W.B. valve holder V1 lower filament terminal. This wire will leave toggle, goes round behind toggle and then runs along baseboard close to panel until the screen is passed.

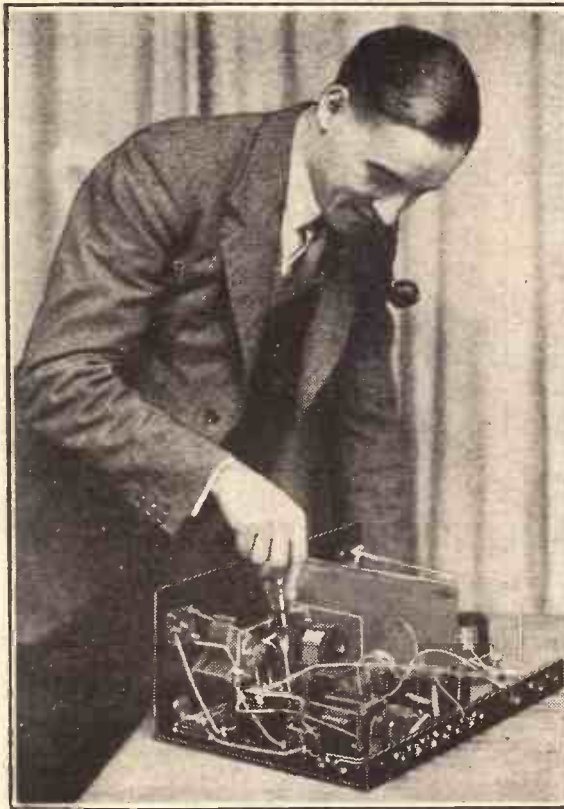
Prepare wire (57) from toggle to L.T.+ terminal on strip; this wire will leave toggle, run along baseboard and half an inch away from front edge of baseboard until it turns off near vertical screen. The general shape of these two wires is obtainable from blueprint, drawings and photos.

(U) Connect end of prepared wire (58) to W.B. valve holder V1 lower filament terminal (tighten) F+.

Leave toggle end of (58) free.

(V) Connect one end of prepared wire (57) to toggle

TWO EVENINGS OR LESS!



The "S.T.500," if built by this ingenious rapid guide, can be made and built in a few hours. By 10 p.m. the second night you will have Europe to entertain you.

terminal (tighten) nearest push-pull switches, leaving other end of wire free.

- (W) FIX PANEL TO BASEBOARD by three screws, having tucked end of (58) behind toggle.
- (57) Connect free end of (57) to L.T.+ terminal (tighten) on strip.
- (58) Connect free end of (58) to toggle terminal furthest from push-pull switches.
- (59) Same toggle terminal (tighten) furthest from push-pull switches to valve holder V2 filament terminal (tighten) F+ nearest baseboard edge. This wire goes under (41).
- (60) Phase-reverser .0005-mfd. condenser terminal (tighten) nearest 2-mfd. condenser to S.G. choke terminal nearest panel. This wire is kept about three-eighths of an inch above baseboard.
- (61) Aerial reaction condenser lower terminal (tighten) to No. 6 terminal (tighten) on aerial coil.
- (62) Aerial wavechange lower terminal (tighten) to No. 3 terminal (tighten) on aerial coil.
- (63) Aerial tuning condenser fixed vanes terminal (tighten) [i.e. terminal on side in Ormond type] to No. 2 terminal (tighten) on aerial coil.
- (64) Aerial tuning condenser moving vanes terminal (tighten) terminal at end in case of

Ormond type] to No. 5 terminal (tighten) on aerial coil.

- (65) Anode differential .0001-mfd. coupler fixed vanes terminal (tighten) nearest anode tuning condenser to selectivity range-adjuster terminal (tighten) nearest earth sheet.
- (X) Fix the two mounting pillars on the S.T.400 anode coil and fix pillars from underneath baseboard with the two countersunk-head screws (see sketch for method of fixing anode coil). The coil is now in position on its pillars.
- (66) Terminal No. 3 (tighten) on anode coil to anode wave-change switch lower terminal (tighten).
- (67) No. 5 terminal (tighten) on anode coil to anode reaction condenser fixed vanes upper terminal (tighten) F2.
- (68) Grid condenser terminal (tighten) nearest selectivity range adjuster to anode tuning condenser fixed vanes terminal (on side, in case of Ormond).

Same fixed vanes terminal (tighten) on anode tuning condenser to No. 6 terminal (tighten) on anode coil.

Valve holder V2 anode terminal (tighten) to anode reaction condenser moving vanes terminal (tighten) nearest side edge of panel.

Fix the previously bared end of a 3-in. length of flex to S.G. choke terminal furthest from strip. The other end is bared and is for later connection to anode terminal on S.G. valve.

S.G. choke terminal (tighten) furthest from terminal strip to middle moving vanes terminal (tighten) of .0001-mfd. differential anode coupler. This wire leaves S.G. choke terminal and rises vertically for 4 in. and then travels horizontally towards the .0001-mfd. differential and then drops to make connection with middle terminal.

.0001-mfd. differential anode coupler terminal nearest aerial tuning condenser to No. 1 terminal on anode coil.

Same No. 1 terminal (tighten) on anode coil to anode tuning condenser moving vanes terminal at end in case of Ormond.

Same moving vanes terminal (tighten) to valve holder V2 filament terminal (tighten) F+ furthest from baseboard edge.

FIX VERTICAL SCREEN with two screws having given screen and earth sheet a final rub with emery paper where they will come in contact, seeing that wire (52) passes through top notch and that (38) passes through bottom notch.

Fit terminal (previously taken from W.B. valve holder as suggested) to screen after cleaning with emery the screen near the hole.

.0001-mfd. differential anode coupler terminal (tighten) nearest screen to terminal on vertical screen.

W.B. universal valve holder V1 upper filament terminal (tighten) F+ to terminal (tighten) on vertical screen.

Aerial terminal (tighten) on strip to upper moving vanes terminal (tighten) on .0005-mfd. aerial coupler. The wire proceeds horizontally for 1 in. towards panel, then rises 4 in. vertically and then proceeds horizontally to the aerial coupler.

THIS COMPLETES THE WIRING.

Fit knobs and dials to panel components, turn spindles of the four solid dielectric condensers (this excludes the two main tuning condensers) as far anti-clockwise as possible locking from front of set. Fit knobs with their pointers pointing horizontally to left.

Turn the two main tuning condenser spindles as far anti-clockwise as possible (i.e. moving vanes fully "out") and fit dials with their zeros opposite prepared scratch marks (if any) on panel. Fit slow-motion knobs to tuning condensers.

YOUR S.T.500 IS NOW COMPLETE.

Please turn to operating instructions and enjoy it. J. S. T.

START TO-DAY!

If the article on the "S.T.500" has inspired interest, start building it at once, and enjoy its remarkable performance as early as possible. This set is our big Autumn star receiver.

THE MIRROR OF THE B.B.C.

By O. H. M.

THE JANUARY SCRAMBLE

The Lucerne Plan—On Christmas Day—The Truth about the B.B.C. and Television—Some Dates to Remember.

THE Amsterdam meeting of broadcasters does not seem to have helped very much towards ironing out the prospective difficulties of the great change-over to the Lucerne Plan in January. Fortunately, however, the B.B.C. is taking steps to minimise the dislocation.

I hear that extra power will be used while stations settle down to their new channels. Even so, however, listeners should allow for a period of uncertainty, especially as the B.B.C. programme builders are not putting on anything like their best talent in the second half of January and in February.

Bells of Bethlehem.

It is still very "hush-hush," so I just whisper that all the broadcasters of the Western Hemisphere are likely to relay the bells of Bethlehem at the appropriate time on Christmas Day. I wonder who will do the running commentary.

Reorganisation Misfires.

The great scheme of reorganisation of the B.B.C. seems to have miscarried in at least one direction. There was a plan to transform the News Section into a Department of Topicality, with staff qualified to "produce" news and dramatise events of the day. Mr. Lionel Fielden was to have been in charge.

But all this has fallen through. Mr. Fielden will stay where he is in the Talks Department and Mr. Holt, as a practical Pressman, will continue to direct the news in a professional way, for which small mercies many thanks!

The Television Muddle.

With all the contradictory statements that are floating about concerning the future of television it is perhaps just as well that I am able to tell the truth. The present thirty-line transmissions which go

out four half-hours a week on 261 metres are under notice to stop on March 31st, and the B.B.C. engineers and administration certainly mean them to stop then.

Between now and Christmas the B.B.C. ultra-short-wave transmitter will experiment with apparatus provided by the Baird Company. This will have to be cleared out before the end of the year, then the B.B.C. will begin active co-operation with

A TRUNK CALL FROM CANADA



An operator at the London Exchange plugging in a call from Montreal. This Radio Exchange, as it might be called, is used for linking up transatlantic calls with telephone subscribers on this side of the Atlantic. The operator on the left is seated in front of the New York switchboard.

the apparatus provided by Electrical and Musical Industries Limited. This is the apparatus next to be tried out. So that is the position.

A Relay From Woolwich.

This year November 5th falls on a Sunday, but no doubt we shall explode our few fire-

works on the night before. However, on Sunday morning, November 5th, which, by the way, is also Armistice Sunday, the B.B.C. is relaying the parade service at the Royal Garrison Church of St. George, Woolwich, as part of the National programme for that day.

The service will be conducted by the Senior Chaplain to the Forces, the Rev. B. K. Bond, and the musical part will be performed by the Royal Artillery Band, conducted by Major E. C. Stretton.

Special Anniversary Programme.

Here is a lot in a little space:

Saturday, October 21st.—Special anniversary of the Battle of Trafalgar programme. This has been arranged by Alan Wade and is a first episode from "The Dynasts," by Thomas Hardy, comprising nine scenes from that epic drama of the war with Napoleon, and dealing with the Battle of Trafalgar and the death of Nelson.

"The Blue Boar."

Monday and Tuesday, October 23rd and 24th.—National and Regional stations respectively. Roger Quilter's light opera, "The Blue Boar," with Amy Augarde in her first appearance before the microphone.

Ina Souez, Raymond Newell, Appleton Moore, Mark Raphael, Norah Gruln and Samuel Dyson are also in the cast. Instead of dialogue to carry along the story, the musical items will be linked together by a narrator.

The "Circus Princess."

Thursday and Friday, October 26th and 27th.—Kallman's operetta, "The Circus Princess," with John Hendrik in the leading part. Harriet Bennet, never yet heard in England, but holding a big reputation in America and Australia, where she has sung in "Rose Marie" for two years, to play the Princess.

(Continued on page 317.)



The LINK BETWEEN

BY G. T. KELSEY

Weekly jottings of interest to buyers.

THE advertising columns of "P.W." are always interesting. That much may be deduced from the large number of letters I receive each week from readers concerning products that have been advertised.

But this week very special interest attaches to the advertisers' announcements on account of the publication in this issue of Mr. Scott-Taggart's great new set, the "S.T.500." Judging by the phenomenal success of Mr. Scott-Taggart's previous

designs, I haven't the slightest doubt that the "S.T.500" will be built by literally hundreds of thousands of readers.

In the ordinary course of events it is one of my pleasurable tasks to provide weekly notes of interest to buyers. This week the only advice I can give is that you study with more than usual interest the numerous advertisements that are appearing. I am confident that you will find something to interest you on every single page.

G.F. Catalogue Now Available.

A week or two ago I mentioned in my notes that Graham Farish were about to produce a new catalogue, and I am glad to be able to pass on the news that adequate supplies of this new catalogue are now available.

The range of products that is now being produced by this enterprising firm is bigger and better than ever, and includes such components as ganged condensers, Class B driver transformers, Mansbridge-type condensers, etc.

May I remind all those who are interested

that it is available under our (No. 51.) postcard literature service.

A New Watmel Leaflet.

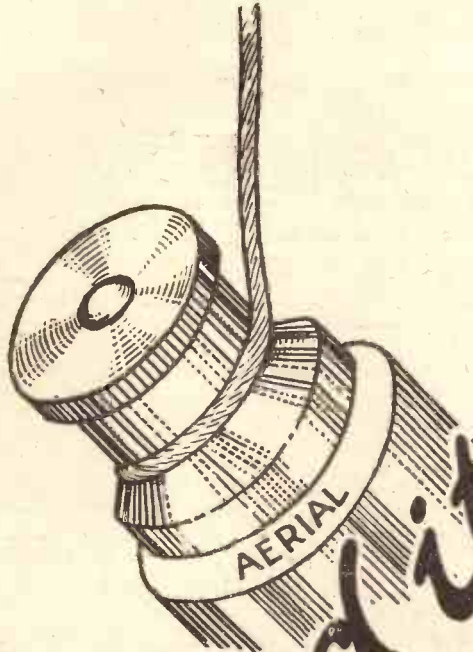
An informative leaflet on the important subject of volume controlling has just come to hand from Watmel.

In addition to giving details and prices of the various resistances and potentiometers included in their range, this new Watmel brochure gives some useful information on the question of volume controlling in general.

Since it is a leaflet that is likely to be of interest to home constructors, "P.W." readers can obtain a copy through the medium of our postcard service. (No. 58.)

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.



*Lead it down
to Colvern coils;
the designer did!*

S.T. 500
COLVERN

**COLVERN COILS FOR THE
"S.T. 500"**

Type "S.T. 500" ... Price 8/- pair

To ensure outstanding performance
and reliability use Colvern Coils as
incorporated in S.T.'s original design.

COLVERN SPECIALISE IN COILS

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FROM THE TECHNICAL EDITOR'S NOTE BOOK

TESTED AND FOUND?

USEFUL BENJAMIN UNIT

THERE are supposed to be two classes of constructors. In the one are those who like to experiment and do not object to a considerable amount of tinkering with bits and pieces in order to achieve their ends; and in the other those who look for the shortest and easiest cuts.

Personally, I do not think any such arbitrary classification is possible. Indeed, I would go so far as to say that the above types of constructor represent two extremes.

And in any case I fancy that there are very few indeed who will deliberately choose an unnecessary complication in face of a simple alternative.

That is why I believe the Benjamin Economiser Unit will prove very popular. There does not seem to be any reasonable excuse for purchasing the individual items needed to apply the Westector Economising scheme when they are available in the one compact unit at approximately the same price.

The saving is more than a mere saving of space. Circuit connections are greatly reduced, and the constructor has the assurance that the elements employed are completely suitable for the purpose.

Gone is the need to prepare a shopping list (admittedly not large) and, perhaps, wander from shop to shop to make the various purchases.

And in this particular case the old and sometimes valid objection that unified apparatus prohibits experiment and close adjustment does not apply.

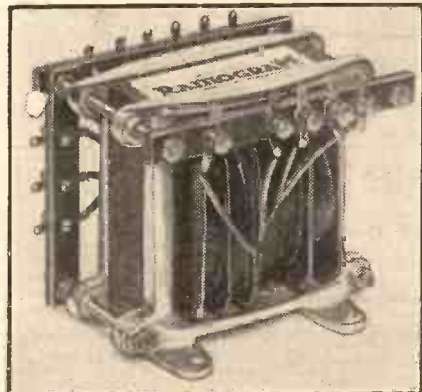
The Benjamin Economiser Unit provides for all normal requirements perfectly satisfactorily.

As you have no doubt gathered, it incorporates a Westector wired to condensers and resistances for H.T. economising in a power or pentode stage (alternative terminals are fitted).

You probably know the scheme. If you've been reading your "P.W." regularly you will; but perhaps I'd better insert a brief description of it for the benefit of new readers.

Well, as all battery-set owners will realise only too keenly, the output valve of a set, whether it be an ordinary power or pentode type, takes a fair amount of H.T. current. Perhaps ten milliamperes. This current is steadily draining away from the H.T. battery, whatever the volume from the loudspeaker.

There is just as much when a single fiddle is quietly playing or a very weak station is coming over, or even during programme pauses, as there is when the speaker is delivering a really loud passage.



The B.R.G. Mains Transformer.

The Economiser alters all that and proportions the H.T. current in accordance with the volume, and thus effects a considerable saving.

And this Benjamin Economiser Unit forms a most convenient method of adding this money-saving system to any ordinary set.

It works perfectly. A meter convincingly proves it. There isn't the slightest effect on the quality or volume. The saving is made without sacrifice. I think it is a fine scheme, and I hope Benjamin's enterprise in making it so readily available to all meets with the full success it deserves.

A BRITISH RADIOGRAM TRANSFORMER

My recent remarks regarding the progress made by British Radiogram are further endorsed by the fact that they have now extended their activities to the making of a new mains transformer, which is a specialised type of component not easily manufactured without real technical ability and production skill behind it.

This B.R.G. Type 56 Mains Transformer in question is designed specifically for the Westinghouse H.T. 12 unit to get 250 volts H.T. at 80 ma. There is an L.T. output of 4 volts at 3 amperes.

Input tappings to suit any voltage between 200 and 250 volts are provided, so that it will suit most mains.



In this photo you see the Benjamin Economiser Unit actually in a set.

IT was extraordinary how

Billy Merson's show, "Taking You Over," improved in quality and vigour as it progressed. Billy Merson himself wasn't as prominent in the programme as he might have been. But in his one big turn as a Roman Caesar he was something that suited his pompous style. He is without a rival in this sort of thing.

The other snippets of parts he played weren't Billy Merson parts at all, so were unimpressive. There was very little new ground broken in any of the departments, but the surprise endings of the sketches were much appreciated.

There's nothing like a good beginning to everything. Vernon Bartlett attaches great importance to opening sentences, and will spend a long time in their preparation. There's wisdom in this. Writers of burlesque do the same, apparently though they don't usually show the same wisdom. It seems the rule for them to open their show with a regular babel of noise, everyone, including principals, going it hammer and tongs.

This may create atmosphere, but it also creates a difficult situation for the listener. He has to spend a good deal of time sorting everyone out, and this interferes with his enjoyment. Whereas, if the principal characters were introduced in turn, the listener would be spared endless trouble. Atmosphere may be lacking for a time, but I prefer above everything else to know where I am at the earliest possible moment. "Daylight Robbery" was the latest offender.

Here are two Poste-Parisien items. Try to find time to listen to the Sonora Radio Dance Orchestra broadcasting modern dance music for a couple of hours every Saturday. Their leader is Fred Hoffman. They are good! I came across them quite accidentally, but I shall take them now as regularly as I do a hint.

I understand they are very popular across the Channel, and owe their success to their having studied the requirements of the mike and adapting their interpretation thereto. An obvious expedient, I would have thought.

The other concerns the new announcer operating

I was at once favourably impressed by this B.R.G. transformer, for it is robustly constructed on obviously sound lines.

The frame is heavily built and the windings carefully sectioned. On test there was negligible temperature rise and good voltage regulation on both L.T. and H.T.

It is a transformer we can recommend, and the price is the very reasonable one of 22s. 6d.

A GRAHAM FARISH CONDENSER

Have you ever noticed how often it seems to happen that the most wires join to the component with the smallest terminals?

It's an exasperating shortcoming. Even as I write my mind flies to innumerable sets of the past in which I have been confronted with large fixed condensers bearing tiny terminals and whole handfuls of fat wires to join to them!

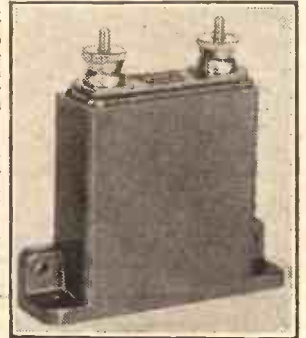
And it is remembering this which makes me view the substantial terminals on the Graham Farish 1-mfd. fixed condenser (and other similar values) with intense pleasure. There is an unusually generous length of shank on each. You can't bare no less than 1/4 inch of it and the milled nut still has ample threads left to it.

A small point? No, I consider it a vitally important one. The whole working of a set can go by the board through an odd lead wandering off a illusory, overtaxed terminal.

Another sound, practical feature of this Graham Farish condenser is that it can be mounted either vertically or horizontally equally well.

It is built into a strong bakelite casing, attractively coloured red, it holds its charge well, and its actual capacity closely follows its rating.

A good component, thoughtfully designed, is this Graham Farish condenser.



The Graham Farish Fixed Condenser.

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

I like the idea of broadcasting excerpts from forthcoming plays. Of course, it is a borrowing from the cinema, but, unlike the cinema, it is only possible in the case of revised plays, unless records of new plays are made during rehearsals. I am inclined to think that even this would be worth while, as these excerpts, like those of the film, do arouse interest.

The dozen plays included in the present Drama Festival are interesting not only in themselves, but also for the light they throw on the development of radio drama. To my mind, "Danger" and "The Wrong Bus" might have been two of the most recent plays written, instead of being six or seven years old. I couldn't recall either of them; but in "Danger" I thought the effects were excellent and more realistic than those of "The Wrong Bus," in spite of the first-class crash at the end of the latter. I must say, too, how I like the small cast. It makes listening so much easier.

Mr. C. W. Lyle's general introduction to the autumn series of sports talks was a remarkable survey of the world's sports. He had to travel the whole world in 15 minutes; he omitted no sport of any standing; he gave considerable detail. Obviously, he had to race against time, and he couldn't conceal the fact that this was the only fly in the ointment.

Mr. Lyle's remarks on the enthusiasm of all Americans for their national game, and the way American radio fosters this enthusiasm, emphasised the B.B.C.'s tendency to treat our national game as if it were a thing of no special importance. True, Saturday evening's First News Bulletin contains the football results. But they are always given last, often yielding pride of place to results of only local interest.

(Continued on page 312.)



Columbia's amazing radiogram offer!

A FOUR-VALVE ALL-ELECTRIC RADIO-GRAMPHONE WITH MOVING COIL SPEAKER AT

23 GNS.

SPECIFICATION

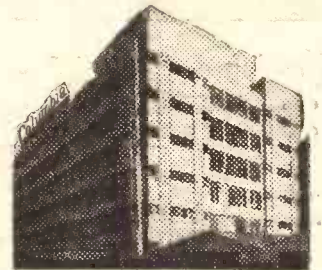
Circuit—Bandpass aerial circuit, screen-grid high-frequency amplifier, followed by tuned-grid power-grid detector. Parallel-fed low-frequency transformer coupling to pentode output. **Speaker**—Energised moving coil. Provision for additional speaker of high or low resistance. **Controls**—Gramophone LW, MW, 'O9'. Switch, single knob tuning for three-gang condensers. Volume control which also operates on pick-up. **Motor**—Induction type (A.C. model). **Cabinet**—Walnut. **Valves**—AC model: MS4B, MH4, MPT4, U12. **Output**—14 watts. **Current Consumption**—65 watts on radio, 95 watts on gramophone. **Wave-lengths Range**—200-550 medium-wave metres; 1,000-2,000 long-wave metres. **Voltage Range**—200/250 volts, 50/60 cycles. **Size**—34 ins. high, 23½ ins. wide, 16½ ins. deep. **Price**—23 guineas. **Hire-Purchase Terms**—Deposit £2.8.6 and 12 monthly payments of £1.19.0.

SPECIAL FEATURES: 1. Band-pass circuit. 2. Flood-lit scale calibrated in wave-lengths with station-finder. 3. Energised moving-coil speaker. 4. Provision for additional speaker. 5. Universal automatic brake. 6. Volume control common to both radio and gramophone. 7. Induction motor (A.C. model). 8. One knob tuning with reduction gear. 9. Three aerial tappings. 10. Mains aerial device. 11. Low running costs.

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Here is the chance of a lifetime to buy a luxury radio-gramophone at an amazingly low figure. For 23 GNS. you are offered an instrument that embraces every material advancement of radio and gramophone science—combined in an instrument which needs but plugging into your electric light supply to bring you the finest programmes that modern broadcasting has to offer, and superb rendering of gramophone music—both with an amazing fidelity of tone.

Columbia have never had more confidence in an instrument than they have in this—representing as it does the greatest value for money to-day—an instrument that might reasonably be priced at many pounds more. This radio-gramophone is a standard product of the great Columbia factory—the largest in Europe—and like all Columbia instruments has undergone nearly eleven hundred tests as part of the routine of manufacture—which explains Columbia's confidence in this product. Read the brief specification given—then take the first opportunity of seeing and hearing it at any Columbia dealer's. Remember, this is a chance not to be missed!



Columbia

RADIO AND RADIO-GRAMPHONES

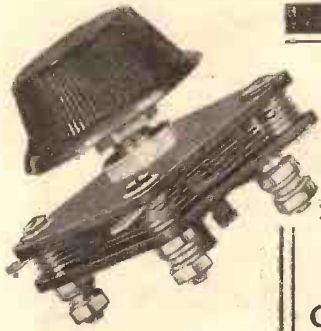
COUPON: To the Columbia Graphophone Co., Ltd., 98 Clerkenwell Road, E.C.1.

Please send me particulars of the new Columbia all-electric Radiograph-Four, Model 620, without obligation.

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POLAR DIFFERENTIAL

ONE .0003 e/s SPECIFIED
ONE .0001 e/s Recommended

3/- each

The condenser with an insulated spindle. Constructed with highest quality materials. Smooth action. Complete with knob.

Also made in .00015 e/s.

S.T.500 specifies

POLAR

POLAR CONDENSERS for the S.T.500

SPECIFIED

1 Polar Differential .0003 e/s - **3/-**

RECOMMENDED

2 Polar No. 2 S.M. .0005 **6/6 each**

3 Polar Compax .0005 - **2/6 each**

1 Polar Differential .0001 e/s - **3/-**

POLAR No. 2 S.M.
TWO .0005 Required

6/6 each

The well-known fast and slow motion condenser. Ball-bearing spindle. Rigid construction.

Also made in .0003.

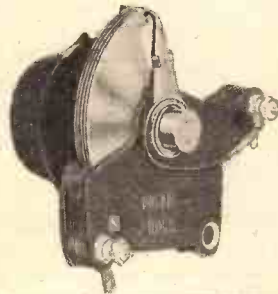


POLARCOMPAX
THREE .0005 Required

2/6 each

Suitable for tuning or reaction where air dielectric is not essential. Made with best materials. Is of the highest quality of its type.

Also made in .0003, .00015, .0001 and .00005.



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KIT A. Com. ponents, blue print and sundries ...	KIT B. As Kit A with matched set British valves ...	KIT C. Kit 'B' with high-grade cabinet and P.M.M.C. Spkr. ...	KIT D. Kit 'C' with batteries comprising complete outfit, ...	POST FREE 57/6d. Cash or C.O.D.
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REMEMBER—YOU CAN'T GO WRONG WITH A "GOLD-MINE" KIT.

Whether it be one of our own bargain Kits (as below) for a published circuit (as above), or for a Kit made up to your own particular requirements. In every case a direct cash saving of 8/- to 10/- in the £.

1933-4 BARGAIN KITS. St. III, 12/6; S.G. III, 18/6; S.G. Triple Wave III, 22/6; S.W. III, 18/6; Adaptor, 8/6. **CLASS B.** H.L.V., 22/6; S.G. IV, 35/-; conv. Kit, 12/6. Each with full instructions. Cash or C.O.D.

COMPONENT BARGAINS at the lowest liquidation prices ever. Listed by the hundred in the "RADIO GOLD-MINE," packed from cover to cover. Enclose 3d stamps now for late Oct. issue. Many 50-75% reductions.



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Specification: Soundly constructed of well-seasoned timber and beautifully polished rich walnut shade with ebonised mouldings.

SIZE OVERALL
Height, 3 ft. 3 in. Width, 1 ft. 8 in. Depth, 1 ft. 4 in.
Allowing ample room for all pick-up, turntables and sets with baseboards up to 18 in. by 14 in. and 7-in. panel, also speaker and all accessories. Hinged motor board for easy use. **SEND FOR LEAFLET.**

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Wireless Set needs these

Double capacity H.T. Units			
W.1231	120 volts	8 1/2 x 7 x 3 1/2	14/6
W.1217	126 volts	9 1/2 x 5 1/2 x 3 1/2	17/6
W.1210	135 volts	10 x 6 x 3 1/2	18/6
(and 18 volts G.B.)			
Triple capacity H.T. Unit			
Pop. Power	120 volts	13 1/2 x 10 1/2 x 3	24/-


The Grid Bias Battery required for use with the above H.T.'s (except W.1210) 's Winner 9 5 x 1 1/2 x 2 1/2 1/-

READY


made particularly to power your set

WIRELESS BATTERIES

The Ever Ready Co. (Gt. Britain) Ltd., Hercules Place, Holloway, N.7.




Patrons of Electric Lamps By Appointment



Manufacturers and Purveyors of Electric Lamps By Appointment

EDISWAN




Hear
PAUL ROBESON'S
records as they
were meant
to be heard

The greatest coloured singer the world has known, and artist to his finger-tips—Robeson has moved the hearts of millions. Hear the exquisitely unmistakable timbre of his voice when you play his records. Play them with a B.T.H. Pick-up. It's easy to fix in place of your old sound-box and tone arm. Then all you have to do is connect it to the "P.U." terminals on your set.


The "Senior" model for the connoisseur—the "Minor" model at 21/- for the man wanting good reproduction at a reasonable cost.

with a
SENIOR



PICK-UP

37/6
COMPLETE WITH
VOLUME CONTROL



The Edison Swan Electric Co. Ltd.
155 Charing Cross Rd., London, W.C.2

GOOD RADIO DEALERS RECOMMEND EDISWAN

W.220

ECKERSLEY EXPLAINS-



"THE ordinary man—we have to face it—is an anarchist. He wants to do as he likes. This anarchism has been at work since the beginnings of civilisation."

So, says Mr. Bernard Shaw, and it is none the less true for that.

I do not intend to discuss anarchy, its value as a stimulant or its nuisance to the community. I open in this way to show you that you can indulge your desire to do what you like, to be free within certain limits, without hurting anyone else, if you will take up experimental work. Whatever the limitations of its scope, experimental work is the greatest of all employments, because it leaves one and one's imagination free to do what it likes, but nevertheless disciplines in it terms of the results achieved.

Good Work with Make-Shifts.

People keep coming to me with ideas. They are frequently more imaginative than sound, more ingenious than factual. I say my piece—I hope not discouragingly—but I have to tell the truth as I see it; and then, if the recipient of my opinions is still sceptical, I say: "Go and try it."

He replies: "How can I?" Well! There are limits, but a tremendous amount of good work has been done with plasticine, string, cardboard, sealing wax, wire and a few "good-enough" instruments adapted ingeniously to the accuracy required.

The joy of experimental work can be severally classified, as: (1) it employs the hands in making things; (2) it employs the mind in devising things; (3) if ever it yields results you may be sure that you have succeeded. Your opponents' inviolable laws never let you get away with an untruth.

Big Expenditure Unnecessary.

You may reply: "Oh, yes, I know it's all very well for you; your laboratory is stacked with every kind of instrument you ever need; but think of me—I cannot go out and just order Moulin voltmeters and test sets and resistances and—oh, everything."

I am not so silly as to suggest that one can, at once, set up a laboratory without the expenditure of any money; but I do suggest that you need not spend a great amount for a given receipt of pleasure if you set about things properly.

I am in the midst of a research at the present moment. I have used only four instruments, as: two types of valve voltmeter, a thermo milliammeter and a test

set. I could have used one valve voltmeter and the thermo milliammeter was very, very useful, but nevertheless a bit of luxury which saved a lot of time.

Experimenting for a hobby is our Chief Radio Consultant's subject this week. He comments on the fact that quite useful work can be done with comparatively simple apparatus. In his own words, "while you may never discover anything which will make your fortune, you will in any case have a grand time."

If I were setting up a laboratory on my own, and I had,

as indeed is true, very little money to spend, I would first and foremostly buy a test set, one which told me D.C. amps. and volts over a wide range. I should try to get it second hand, but if I couldn't, and if it was too expensive, I should realise that all I really wanted was a sensitive milliammeter for nearly all my work.

Making a Voltmeter.

If you will remember that voltage equals current times resistance you have made a voltmeter. Suppose you want a voltmeter 0-8 volts for L.T. and 0-200 volts for H.T. You have a milliammeter reading,

2 volts. Then apply your laws. So build up. Don't want everything at once. Make up valve voltmeters by putting negative on the grid of a valve like an A.C./H.L.2. But it's the spirit I want to get over; if anyone wants it I should be delighted to give further advice on how to measure quantities.

"Science is Measurement."

It is so difficult answering questions without data given. "Oh, doctor, I feel so ill; what is the matter with me?" Suppose one had to write a reply to that and explain what was wrong! At least the indication of a pain somewhere would help the poor doctor. He might even give a correct diagnosis if the sufferer had observed things

such as temperature, pulse and so on: if he had, in fact, presented the results of simple measurements.

But there's no question about your being ill. Nor anarchistic against the community. Nor vastly out of pocket. Nor an offence to your neighbours. On the contrary, if you take up this hobby, while you may never discover anything which will make your fortune, you will in any case have a grand time.

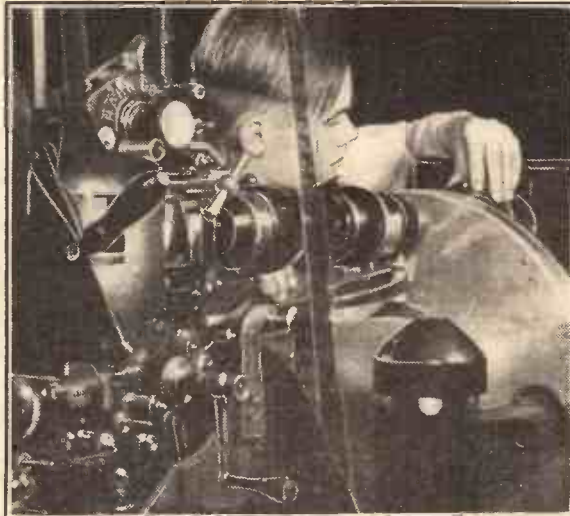
* * *

All the time new ideas are pouring out of people's brains. These ideas come because people are experimenting. On its lowest terms, if you set up a little laboratory, you will appreciate better what is going on; on its highest you will become one of those who will be allowed to work (or, I feel, play is a much better word) in a well-equipped laboratory and give to the world something of

worth and consequence.

POPULAR WIRELESS and "Modern Wireless" and the rest are all the time working for you, turning out new sets for you to make. You will be helping them to help you if you will take up a study of the technique. But no study is complete or even worth while unless you have means to do practical experiments.

GERMAN TELEVISION EXPERIMENTS



In Germany television is going ahead by leaps and bounds, and this photograph shows an experimental film transmitter. It is possible, for the principles involved in an advanced system of this nature, to originate in the home laboratory of an amateur.

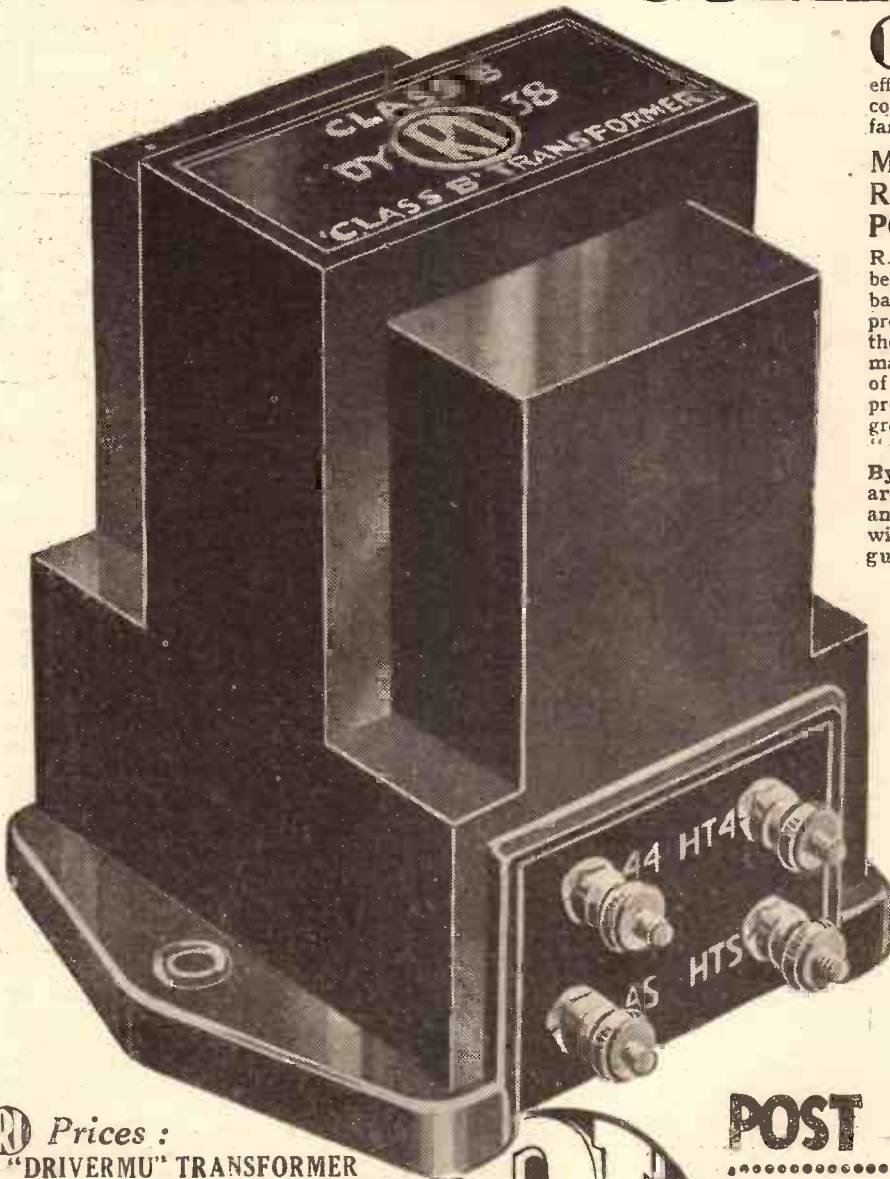
say, 0.5 milliamperes. Thus, with 8 volts through a resistance of 1,600 ohms, you get 5 milliamps. So your milliammeter, connected through a resistance of 1,600 ohms, is a voltmeter. Connected through 10,000 ohms it is a voltmeter to 200 volts.

How to measure ohms? Well, you might start by assuming that a low-tension accumulator half discharged gives exactly

SPECIFIED FOR ALL GOOD 'CLASS B' CIRCUITS INCLUDING THE S.T. 500.....

DRIVERMU

'CLASS B' COMPONENTS



(R) as the foremost designers and producers of transformers and chokes in this country, have set the standard of efficiency in "Class B" with their "Drivermu" components, which are universally acknowledged far and away the

MOST EFFICIENT AND MOST RELIABLE "CLASS B" COMPONENTS—AT ANY PRICE

R.I. have done most to make the remarkable benefits of "Class B" attainable by every battery set user. They have introduced the most progressive developments in the system, and by their collaboration with the "Class B" valve makers in the first instance, and the vast amount of research work that resulted, have succeeded in producing the components that give, to the greatest extent, the performance for which "Class B" was evolved.

By installing "Drivermu" components you are sure of greatest power, superior quality and absolute freedom from distortion, together with utmost economy in H.T. They are guaranteed to give—

THE FULLEST ADVANTAGES OF AN ALL-MAINS SET USING AN ORDINARY H.T. BATTERY ONLY

CONVERT YOUR EXISTING SET INTO "CLASS B"

The R.I. 'Class B' Booklet Will Show You How

This brochure tells you all about "Class B" in the simplest possible language, and enables even the most inexperienced constructor to understand exactly what he is doing with "Class B." It shows you at a glance what combinations of valves, transformers and chokes are needed for every desired output. The diagrams are easily understood and apply to the conversion of old and to construction of new sets. Ask your dealer for a copy or

(R) Prices:
"DRIVERMU" TRANSFORMER

List No.	RATIOS		PRICE Royalty 1/6 extra
	Primary	Secundary	
DY37	1:1 and 1.5:1	2:1 and 3:1	15/-
DY38	2:1 and 2.5:1	4:1 and 5:1	15/-
DY39	1:1	2:1	11/-
DY41	2:1	4:1	11/-
DY42	1.5:1	3:1	11/-
DY43	2:1 and 1.6:1	4:1 and 3.2:1	15/-

R.I. "CLASS B" CHOKE No. DY 40
Ratios 1:1, 1.2:1, 1.5:1, and 1.8:1. **12/6**
Over 90% efficiency



POST COUPON TODAY

To Radio Instruments Ltd. Croydon, Surrey

Please send me your "Drivermu" Brochure Free and Post Free. Also your Broadsheet of Components.

Name

Address

(Enclose in 3d. stamped unsealed envelope). P.W.

SHORT-WAVE NOTES

BY W. S. STEVENS

All the interesting news and views of current short-wave practice.

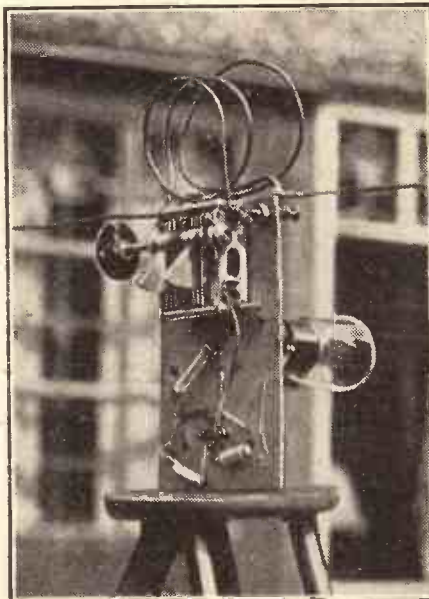
WHO says that activity in the 5-metre sphere is not causing interest? A few days ago I was parading the streets with my car in the vicinity of my native town, complete with 5-metre transmitter and receiver, with aerial à la "fish-pole." Four hours later an enterprising (and unknown) gentleman removed the car to some spot so remote that neither I nor the police have seen it since. But the 5-metre gear wasn't there!

The result is that, just at present, I am burdened with a very nice lot of gear suitable for use in a car, but have no car to use it in! And if I ever find that man!

I am asked, by the way, to announce that G 6 K A and G 5 N C are carrying out telephony transmissions nightly on 5 metres. G 6 K A transmits from 23.00 to 23.30 G.M.T., and G 5 N C from 23.30 to midnight. Reports are particularly wanted. Please forward them, in the case of G 6 K A, to R. S. G. B., 53, Victoria Street, S.W.1, and in the case of G 5 N C to his own address H. Osborne, 77, Barrett Road, Walthamstow, E.17.

Has any other reader heard the

FOR FIVE METRES



The aerial of this neat transmitter consists of rods about four feet long projecting from either side of the coils. The apparatus is mounted on a tripod to facilitate tests on directional effects.

station reported by C. F. W. (Hove)? This is New Brunswick, Canada, transmitting experimentally on about 46 metres. I find all the 45-50-metre stations coming in extremely well lately. Incidentally, I am old-fashioned (and observant) enough to believe that local fog *does* affect short-wave reception. I don't think any other purely local weather condition has any effect, but I invariably find short-wave stations above the average level on a foggy night.

Agreements, contradictions or brickbats on the above statement will be cordially welcomed.

Single-Valve Work.

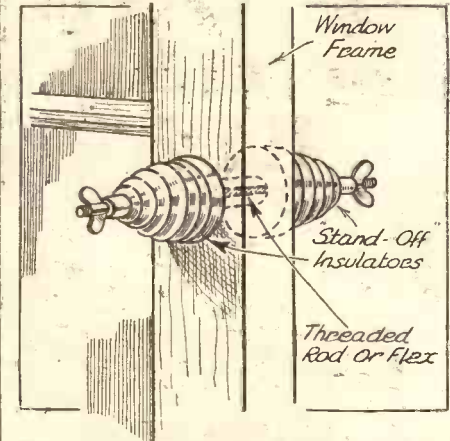
My one and only single-valver has left my bench for the present. I have not deposited it by a brighter and better set, but have simply sent it to a friend who has never before tasted the joys of single-valve short-wave work. Perhaps I shall be able to get him to write his experiences with it for the benefit of my readers.

For three whole days I have been without a short-wave receiver of any kind. I have been re-building the whole of my station, and the transmitter, being the biggest job, had to come first. The result is that, pro tem., I am equipped with quite a nice transmitter but no receiver whatever.

The new receiver is going to contain two valves, but I shrewdly suspect that only one will be in use most of the time. It is being built in an iron box, as I want to do rather more in the

AN EFFICIENT LEAD-IN

WHERE something more efficient than the ordinary small lead-in tube is wanted it is a good plan to drill a hole of about $\frac{1}{2}$ -inch diameter in the window frame and to mount on either side of it a small



Not only is a lead-in arranged in this manner electrically good, but it is very pleasing in appearance.

"stand-off" insulator. The screws in the tops of the two insulators are connected by a stout piece of insulated flex, or they may be removed and a single length of 2 B.A. threaded rod used.

way of screening than I have attempted before.

The circuit will consist of a screen-grid detector, resistance or choke-coupled to an output triode. Provision will be made for coupling the detector to the headphones through a specially wound transformer. I have great hopes of this scheme, because an S.G. detector certainly does gain over a triode in the matter of efficiency.

I have just built a single-valve broadcast receiver, which feeds into my "standard" L.F. amplifier-cum-radiogram-cum-modulator. Nothing like making these L.F. stages work overtime!

BLOCK BATTERIES SUCCESS

IF any firm deserves success it is Block Batteries, Limited. At the 1933 radio exhibitions wireless enthusiasts were delighted to see that the problem of H.T. accumulator design had been tackled in a big way by the provision of the new Block plate-less accumulator. The response which constructors made to this bold challenge, a response which has necessitated a complete revision of the Block Company's plans, is due entirely to the hard work and complete confidence of this new firm.

Twelve months ago Block accumulators were an unknown quantity as far as the public was concerned. Last month the Mayor of Barking pressed a switch which set in motion the machinery and summoned the employees of a fine new factory devoted entirely to the manufacture of Block accumulators. This is triumph indeed for a new firm entering upon life at a time

when so many firms are feeling the effects of trade depression.

Block Batteries undoubtedly fill a pressing need. The new factory is thoroughly equipped in every way to cope with the volume of business which has been created over the last few months.

The Mayor of Barking suggested, in his speech opening the new factory, that his successors would probably be called upon regularly each year to open the latest extension to Block Batteries works. If this is so, then to Mr. Sudlow, managing director of the firm, will be due most of the credit.

THE "CHRONICLE WIRELESS ANNUAL"

THE excellent work done for radio by the "Manchester Evening Chronicle" was most clearly demonstrated during the Northern Radio Exhibition which finished last week.

And not the least excellent part of this work is the issue every year of the "Chronicle Wireless Annual," the eleventh issue of which is now on sale at the price of 1s. Almost 200 pages, packed with information of all kinds, comprise this new edition, which contains, in addition to technical articles written by leading research engineers in the radio trade, full details and diagrams for building more than a dozen complete receivers and units. These range from a home-made trickle charger and a Class B adaptor to a six-valve superhet and a Class B radiogram.

The general articles include discussions on aeriels, interference, quality, television, batteries and short-wave work, while one of the most useful features is a complete list of the principal European broadcasters, with the new wavelengths which come into force next year.

The "Chronicle Wireless Annual" is, without any doubt, the best manual of its kind, and constructors who expend a shilling on its purchase will get their money's worth over and over again.

ACE S.T. 500 DE LUXE KIT

£5.12.6

"ACE" De Luxe Specification

	s.	d.
2 Colvern S.T.500 matched coils	8	0
2 J.B. NEW TYPE STRAIGHT-LIKE SLOW-MOTION, DIALS WITH ILLUMINATED SHADOW TUNING DEVICE	15	0
2 POLAR No. 4 LOG AIR-SPACED TUNING CONDENSERS, .0005-mfd.	8	0
3 Graham Farish "Litlos" bakelite log-midline condensers, .0005-mfd.	6	0
1 Graham Farish "Litlos" differential condenser, .0001-mfd.	2	0
1 Polar differential condenser, .0003-mfd.	3	0
2 J.B. baseboard condensers, .0001 and .00005-mfd.	2	0
1 Wearite "BJ" Class B transformer for B21 valve	8	6
1 E.I. SPECIAL "NEW HYPERMU" TRANSFORMER	15	6
1 Graham Farish binocular screened H.F. choke	4	6
2 W.B. 4-pin valve holders	1	0
1 W.B. universal S.G. valve holder	1	0
1 Graham Farish 7-pin Class B valve holder	1	3
1 Wearite HFPF screened midgot reaction H.F. choke	2	0
1 Erie 1-meg. grid leak	1	0
2 Erie 5,000-ohms resistances	2	0
2 Erie 10,000-ohms resistances	2	0
1 Erie 250-ohms resistance	1	0
1 Dubilier fixed condenser, type BS, 2-mfd.	2	6
2 Dubilier fixed condensers, type BS, 1-mfd.	4	0
2 Dubilier fixed condensers, tubular type, .005-mfd.	2	6
1 Dubilier fixed condenser, tubular type, .0005-mfd.	1	0
1 Dubilier fixed condenser, type 665 mica, .00005-mfd.	6	6
2 BULGIN TOGGLE TYPE WAVE-CHANGE SWITCHES	2	6
1 Bulgin toggle type on/off switch	1	3
1 "ACE" S.T.500 baseboard with foil	1	0
1 "ACE" S.T.500 aluminium screen	1	6
1 "ACE" S.T.500 WALNUT PANEL, DRILLED TO SPECIFICATION	5	6
1 "ACE" S.T.500 terminal strip, drilled to specification	1	0
1 S.T.500 set of Belling-Lee terminals, battery plugs and anode connector	3	6
2 SPARE J.B. CONDENSER KNOBS FOR MATCHING UP PANEL	1	0
Wire, flex, screws, etc.	11	3
S.T.500 blueprint and constructional details	Gratis	3
1 Bracket for .0005 condenser	3	0
"ACE" S.T.500 DE LUXE KIT "A"	£5	12 6
4 B.V.A. valves to specification	£2	5 3
"ACE" S.T.500 DE LUXE KIT "B"	£7	17 9

NOTE.—A Class B output choke is NOT REQUIRED with the "ACE" S.T.500 DE LUXE kit if used with a Class B moving-coil speaker. A Wearite "B Mag" Class B output matching choke, price 11/-, should be ordered in addition if any other type of speaker is used.

KIT "A" £5.12.6
KIT "B" £7.17.9

NOTE THESE SPECIAL FEATURES UNIQUE TO THE "ACE" DE LUXE S.T.500 KIT.

1. Modern type straight line illuminated tuning dials as used in all the latest models of manufactured receivers, giving simplified tuning combined with tasteful appearance.
2. All panel knobs match the walnut panel.
3. Super efficient type L.F. transformer for punch and real quality of reproduction.
4. Latest type low-loss bakelite log condensers.
5. Toggle switches used throughout to give perfect symmetry of panel layout.
6. No extra wiring required; simply follow the blue print.

Trade Supplied—Usual Discounts.

A FREE GIFT AND A STRAIGHT GUARANTEE ON A STRAIGHT SET



Donald P. Marcus, Managing Director of Messrs. Marcus, Overton Radio, Ltd., and originator of the popular S.T.500 and S.T.500 DE LUXE Kits, says—

PERSONALLY GUARANTEE

"ACE" DESPATCH. All orders despatched by return post from stock. No annoying delays.

"ACE" QUALITY. Every "ACE" kit is exact to specification given. No substitutions. Study carefully the "ACE" Standard and De Luxe Kits. Every component made by world-famous British manufacturers, and especially chosen for performance and efficiency regardless of price.

"ACE" PERFORMANCE. Every S.T.500 constructed from an "ACE" kit will give results equal to those obtained by Mr. John Scott-Taggart himself. The De Luxe S.T.500 is absolutely unbeatable for wonderful tone, punch and selectivity.

"ACE" SERVICE. I shall not consider your purchase completed unless your "ACE" S.T.500 gives these results. If you have the slightest cause for complaint when you have built and tried out your "ACE" S.T.500, my SERVICE DEPARTMENT will put it right free of charge.

"ACE" FREE GIFT. Every cash purchaser of a complete "ACE" S.T.500 Kit is presented with a "RIGI" S.T.500 constructor's combination tool, value 3/9, free of charge.

"ACE" S.T.500 CONVERSION KIT

containing all necessary components for converting S.T.400 to S.T.500 **35/-**
 OR including "Class B" Valve **49/-**

DEMONSTRATIONS The S.T.500 will be demonstrated at the offices of Messrs. Marcus, Overton Radio Limited, 62, Borough High Street, London Bridge, S.E.1.

ONE MINUTE FROM LONDON BRIDGE STATION

MARCUS OVERTON

62 Borough High St., London Bridge, S.E.1

TO MARCUS, OVERTON RADIO LTD., 62, Borough High St., London Bridge, S.E.1.

Please supply immediately:

"ACE" S.T.500 Standard Kit.....

"ACE" S.T.500 DE LUXE Kit.....

"ACE" S.T.500 CONVERSION KIT.....

for which I enclose £.....

NAME.....

ADDRESS.....

Block letters, please. Cross out Kit not required. P.W., 21/10/33.

"ACE" Standard Specification

	s.	d.
2 Colvern S.T.500 coils	8	0
2 Polar No. 2 slow-motion condensers	13	0
3 Graham Farish "Litlos" .0005 log midline condensers	6	0
1 Graham Farish "Litlos" .0001 differential condenser	2	0
1 Graham Farish "Litlos" .0003 differential condenser	2	0
2 J.B. baseboard pre-set condensers, .0001 and .00005-mfd.	2	0
1 Wearite BJ Class B driver transformer for B.21 valve	8	6
1 R.I. L.F. transformer, type DY.33	7	0
1 Graham Farish binocular screened H.F. choke	4	6
2 W.B. 4-pin valve holders	1	0
1 W.B. S.G. valve holder	1	0
1 Graham Farish 7-pin valve holder	1	3
1 Wearite HFPF screened midgot reaction H.F. choke	2	0
1 Erie 1-meg. grid leak	1	0
2 Erie 5,000-ohms resistances	2	0
2 Erie 10,000-ohms resistances	2	0
1 Erie 250-ohms resistance	1	0
1 Dubilier fixed condenser, 2-mfd., type BS	2	6
2 Dubilier fixed condensers, 1-mfd., type BS	4	0
2 Dubilier fixed condensers, .005-mfd., tubular type	2	6
1 Dubilier fixed condenser, .0005-mfd., tubular type	1	0
1 Dubilier fixed condenser, .00005-mfd., type 665 mica	6	6
2 W.B. 2-point push-pull switches	1	8
1 Bulgin toggle type on-off switch	1	3
1 S.T.500 baseboard with foil	1	0
1 S.T.500 aluminium screen	1	6
1 S.T.500 ebonite panel, drilled to specification	3	0
1 S.T.500 ebonite terminal strip, drilled to specification	1	0
1 Set of Belling-Lee terminals, battery plugs and anode connector	3	6
Wire, flex, screws, etc.	9	9
S.T.500 blueprint and constructional details	Gratis	3
1 Bracket for .0005 condenser	3	0
KIT "A"	£4	7 6
4 B.V.A. valves to specification	£2	5 3
KIT "B"	£6	12 9

NOTE.—A Class B output choke is NOT REQUIRED with the "ACE" S.T.500 kit if used with a Class B moving-coil speaker. A Wearite "B Mag" matching choke, price 11/-, should be ordered in addition if any other type of speaker is used.

KIT "A" £4.7.6
KIT "B" £6.12.9

S.T.500 ACCESSORIES

	s.	d.
Ever Ready 120-volt Winner H.T. Battery	11	0
Ever Ready 120-volt Popular type H.T. battery	15	6
Ever Ready 9-volt grid bias battery	1	0
Block plateless L.T. accumulator, 80 amp./hrs.	11	6
Block plateless 120-volt wet H.T. accumulator	3	15 0
M.P.R. H.T. eliminator for A.C. mains	2	10 0
M.P.R. H.T. eliminator for D.C. mains	1	10 0
W.B. Microloide moving-coil speaker, type FM4A	2	2 0
Bluespot 99PM moving-coil speaker	2	19 6
Bluespot new model 33 pick-up with self-contained volume control	1	15 0
Belling-Lee unit pick-up with self-contained volume control, model G	1	15 0
Garrard No. 30 double spring gramophone turntable	1	5 0
"ACE" standard table model cabinet	17	6
"ACE" De Luxe model table cabinet in solid oak	1	15 0
"ACE" standard console table cabinet, upright or horizontal type	1	10 0
"ACE" De Luxe console table cabinet in solid oak with beautiful antique finish	2	2 0

ACE S.T. 500 STANDARD KIT

£4.7.6

Trade Supplied—Usual Discounts.

RADIOTORIAL

The Editor will be pleased to consider articles and photographs dealing with all radio subjects, but cannot accept responsibility for manuscripts or photos.



Every care will be taken to return 3. SS. not accepted for publication. A stamped and addressed envelope must be sent with every article.

All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All enquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

ADDING A HIGH-FREQUENCY AMPLIFIER UNIT.

J. J. (Whitby, Yorks.).—"My old detector-and-L.F. is very good indeed on quality, and ropes in the Continental stations wonderfully for two valves. I suppose I ought to be satisfied, but I have an idea that I should like to hot it up with one more valve as high-frequency amplifier.

"So far I have looked in vain for a high-frequency amplifier unit that is specially recommended for such a set. Have you recently given details of a suitable design, in small cabinet, to stand between set and aerial, using same H.T. and L.T.?"

"I think H.F. instead of extra L.F. amplification is required, because there is plenty of volume at present for a smallish house. In fact, I suppose I should only need the extra stage in when receiving from distant stations, which at present are of insufficient strength to be enjoyable.

"I should like your frank opinion as to whether it is worth incurring the extra expense

just for an amplifier or whether it would be better to build a new set altogether."

In our opinion, your best plan would be to build a new three-valve—S.G., detector and L.F.—incorporating as many of your components as possible. (This should be a large proportion of them.)

Although you might, instead, fit an H.F. amplifier as suggested, we have not described such a unit recently, and we feel that whilst you are about it there are more advantages in complete rebuilding.

An up-to-date three-valve set will revolutionise your ideas of good reception and give you a variety of entertainment incomparably better than your present outfit is capable of providing.

To modernise just the H.F. end, in unit form, would doubtless effect a big improvement on the present results, but it would cost very little more to "go the whole hog" and completely rebuild. This would be much neater and more efficient, and we are sure that the improved appearance and reception would make you feel you had done the right thing.

H.T. FROM D.C. MAINS FOR A SHORT-WAVE SET.

P. D. (Liverpool).—"Having found H.T. from the direct-current mains much more to my liking than batteries for ordinary wavelengths, I am surprised that it is regarded with suspicion for short-wave reception with phones.

"Is there any danger from the tingling ears one may get when the 'phone hand touches them? And could it not be overcome by a filter-choke arrangement?"

(Continued on page 306.)

"P.W." PANELS, No. 140.—OSLO.

Norway's famous long-waver works on 1083 metres, with a power of 60 kilowatts. It is generally well received in this country, though subject to weak periods.

Oslo opens with the call "Hallo! Hallo! Oslo her" and closes down with "Godnat" (Good-night), themes from the Norwegian National Anthem being used as opening and closing airs.

Distance from London, 715 miles. Man announcer.

A P O L O G Y



You may be disappointed by a little delay in obtaining your AvoMinor, but we ask your indulgence. It is entirely due to the overwhelming rush of orders for the first accurate combination testing instrument that has ever been put on the market at a reasonable price.

We anticipated, and made provision for, an exceptional demand, but the success of the AvoMinor has surpassed our highest expectations. Orders are being filled in strict rotation, whilst energetic measures are being adopted to increase production.

We would like to point out that, as the whole world has waited so long for an instrument capable of accurately carrying out so many tests as the AvoMinor, it is surely better to wait a little longer for the perfect, than to purchase a less reliable product.

THE AVOMINOR

Trade Mark.

gives you the testing facilities of the most expert technical engineer. It is an ACCURATE moving-coil combination testing instrument giving ten different ranges of readings in milliamps, volts and ohms. It tests everything. It means quick, accurate, easy detection of every possible fault. No other similar instrument makes so many tests with such accuracy. Ask your dealer about the AvoMinor, or write direct for descriptive literature.

Complete in handsome case with pair of leads and interchangeable crocodile clips and testing prods.

40/-

Deferred Terms if desired.

Any Intelligent Man or Woman CAN Make These and Make Money!

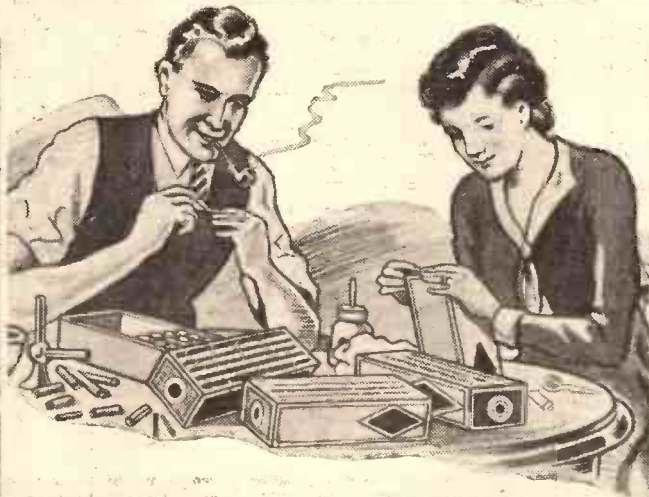
Made at Home for 2/3--Sold at 6/--PROFIT 3/9

**£5 per Week—
5 Hours a Day!**



Dear Sirs,
I am writing to let you know how well I am progressing. I started 15 months ago with 30s. worth of chemicals. I made £4. 11s. 11d. profit in the first five weeks and now have stock and plant valued at £40. All my chemicals I buy in bulk, so that I can make as much as 200 per cent. profit. The last five weeks' business has brought me in £25. 7s. 6d., working 5 Hours a day.

These excellent results are due to your kind assistance at all times.
(Sgd.) E. W. Edwards.
(Original can be seen.)



**SELL AS FAST
AS CAN MAKE**

Gentlemen,
I am very pleased with the excellent service you give and also the quality of the goods. My spare time has been very limited, but I am satisfied that I am getting full value for my money. The product sells as fast as I can make it.

(Sgd.) Norman Stockwell.
(Original can be seen.)

**STRAIGHTFORWARD
—EASY**

Dear Sir,
I thank you for your straightforward and easy process. I think it is one of the best hobbies that anyone could take up.



(Signed) F. J. Herbert.
(Original can be seen.)

**MASS PRODUCTION
EXPECTED**

Dear Sir,
I have managed to get into the Trade, although I did not look for it, as I started too late in the Season. However, I have had trial orders from all the Ironmongers here, and all are very pleased and there are no complaints. I am looking forward to contracts from the same sources this next Season, and I hope to be able to go in for mass production gear. I am very pleased I took up your proposition, and in my humble opinion there isn't a better product on the market. I have had all the other kinds through my hands and have dissected them all, and I know they are all inferior.



Yours faithfully,
(Sgd.) Allan L. Litt-Wilson.
(Original can be seen.)

**Many People LIKE YOU Have
Doubled Their Incomes!**

Let us introduce you to genuine, honest, spare-time work in the comfort of your home at which men and women to-day are making handsome Profits regularly—week in and week out.

By simply posting the Coupon below you can learn at once how you can BUILD UP PRESENT AND FUTURE PROSPERITY. You can commence on your Kitchen Table, in a spare room or outhouse. The work is clean, safe, pleasant and quite simple. It is the making of our Patented Radio Appliances. The demand for these Appliances is so enormous that it runs into MILLIONS.

Help us to supply this demand and help yourself to the profits. You can make anything up to £300 a year this self-same way! Think what you could do with all those extra £s. Why, it means freedom, independence, and a definite "knock-out blow" to Financial Worry and Trade Depression.

The wonderful part of it is that you need not have the slightest previous experience or technical knowledge. There is no expensive "plant" to buy. Only a few small hand tools and presses, most of which you can make yourself at trifling cost. And you are not "tied" in any way whatever. Your profits are only limited by the amount of time you choose to devote to the work.

**One Man Earned
£960 in Spare
Time**

**We GUARANTEE
you profit**

and, if necessary, we will take sufficient of your output off your hands to ensure it, provided only that your work comes up to the easily attained standard of efficiency—we undertake to continue your training FREE as long as required. Start now. The Market is unlimited and cannot possibly become overcrowded. It is A GOOD, CLEAN, HONEST, STRAIGHT-FORWARD BUSINESS which will help you to become your own "Master."

£6
A WEEK in a
**Business
of Your Own**

N.B.—The originals of these and other testimonials may be inspected at our offices at any reasonable time.

Send this Form for
FREE Instructions
How to Start →

COUPON

To Mr. V. ENGLAND-RICHARDS,
THE ENGLAND-RICHARDS CO., LTD.,
1143, King's Lynn, Norfolk.

Sir,—Please send me at once, and FREE, full details as to how I can Make a Patented Radio Speciality for 2s. 3d. to retail from 6s. to 7s. 6d. and Make Money at Home in my spare time: also Big Broadsheet of Fully Illustrated Original Testimony from those already making Big Money. I enclose 2d. stamps for postage.

Print your name and address boldly in capital letters on a plain sheet of paper and pin this coupon to it.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 304.)

All cases of "live" loudspeakers or 'phones due to D.C. mains H.T. can easily be overcome by proper circuit arrangements. Such tingling should not be tolerated either from 'phones tuning controls, metal panel or loudspeaker, because, though not actually dangerous in itself, it shows that the set does not comply with the I.E.E. regulations regarding safe installation.

It is therefore not because the mains H.T. is unsafe that one often sees the batteries preferred. The objection is generally on the grounds that battery H.T. can be perfectly silent, whilst there is often some difficulty in getting the very last trace of hum removed from an H.T. mains supply.

Even the smallest residual murmur, which would not be noticeable on ordinary wavelengths, is a nuisance when very long-range reception is attempted upon short waves, so batteries and a perfectly silent background are often preferable to the provision of extra smoothing for a mains unit H.T. supply.

ADAPTING H.T. MAINS UNIT FOR POTENTIOMETER-FED S.G. TAPPING.

A. C. (Leeds).—"On the new set is an H.T.+1 terminal which needs 75 volts for the S.G. tapping. There is no 75-volt plug on the mains unit.

"As the unit will supply up to 25 milliamps and the set will take less than 20, I could get the H.T. from it if it had the tapping arranged for. H.T.+4 on the mains unit gives 150 volts, and it was suggested that I could cut this down with resistances to give 75 volts.

"Please say, if this is O.K., what value the resistances must be and exactly how to connect to set. There is no room for extra wiring, etc., inside the set, but there is ample space outside the terminal board, where the wires from the unit below (in small compartment) come through.

"A final point. I suppose I should have said 'potentiometer' instead of 'resistance,' because it says 'it is essential that H.T.+1

should be fed from a separate S.G. tapping (potentiometer type) on the eliminator."

You can arrange two ordinary fixed resistances to give a potentiometer-fed effect as follows:

Connect one end of one resistance to the H.T.+4 terminal on the set. Join the other end of this resistance to the H.T.+1 terminal.

Also connect one end of the second resistance to the set's H.T.+1 terminal. Its remaining terminal goes to the set's H.T. negative terminal.

When these resistances have been added there is no need for any other H.T. lead to the H.T.+1

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by 'phone or in person at Fleetway House or Tallis House.

terminal, as the connection is made through the resistances.

You will require two resistances of equal value, and this can be either 25,000 or 30,000 ohms. The resistances should be of the type rated to carry 3 or 4 milliamps safely, so don't use cheap spaghetts.

ADDING DECOUPLING.

H. T. F. (Swindon, Wilts.).—"At present, H.T.+2 terminal goes to the H.T.+ on

L.F. transformer, and H.T.+3 goes to the L.S.+." "How can I put in decoupling?"

A resistance of about 25,000 ohms should be joined between the H.T.+ terminal of the transformer and the H.T.+2 terminal, the wire which formerly joined these points being removed, of course. A 2-mfd. condenser must also be joined up, one terminal to H.T.+ of the transformer and the other terminal to H.T.—.

THE EFFECT OF A GRID RESISTANCE UPON THE BIAS VOLTAGE.

F. K. (Bournemouth).—"To get rid of the distortion it is suggested that I need a resistance wired between the grid terminal and the grid wiring, which has proved successful in a similar case I know of. But I am afraid of doing that, because in my case there is a 600-ohm resistance between cathode and transformer to provide grid bias.

"Surely if I put in another resistance I shall get more grid bias than I want, and that in turn will ruin quality quite as much or more than at present.

"I am itching to try it, but will not do so unless you say it is O.K."

Try it, by all means, as the effect you fear is an imaginary one.

Your 600-ohm resistance has a grid-biasing voltage developed across it because it is in the *anode current circuit*, where a comparatively large current is flowing all the time the set is in action.

The added resistance would be in the *grid circuit*, and under ordinary (Class A) amplifying conditions there is virtually no current whatever in this circuit.

Voltage is proportional to the product of resistance and current, so you will see that there will be no voltage developed if there is no current flowing.

"MODERNISING 'THE COMET'"

"Comet" owners who read the "Modernising" article in our October 7th issue may have noticed that the aerial coil shown in the diagram on page 160 appears to have its "E." and "R.E." terminals reversed. As they are connected together via the earth terminal, this does not matter in the least, but on the actual coil unit "E." will be the upper terminal, and vice versa.

ETHER SWEEP

PATENT APPLIED FOR.

INDOOR-AERIAL.

Supersedes the ugly old-fashioned Aerial

Pushes up the chimney out of sight

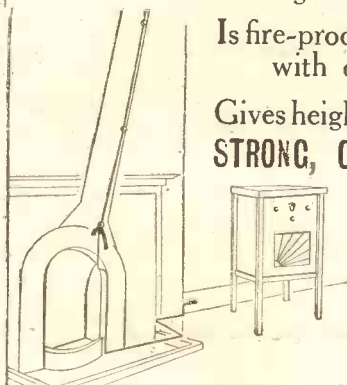
Is fire-proof and does not interfere with chimney sweeping

Gives height which is necessary for STRONG, CLEAR-CUT RECEPTION

Price **12/6** Complete

Of your Dealer or Post Free from.

REVEX LTD.,
Shenfield Common,
BRENTWOOD, ESSEX.

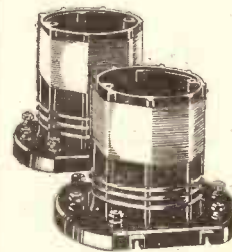


S.T.300—S.T.400—NOW

S.T. 500

Mr. JOHN SCOTT-TAGGART
AGAIN RECOMMENDS

SOVEREIGN COILS



Carefully made to Sovereign Standards exactly to Mr. John Scott-Taggart's own design, and approved by him.

7/-

PER PAIR

IT'S THE COILS THAT COUNT

In cases of difficulty send direct together with name and address of your usual dealer. Also for free Components Catalogue. Use Sovereign whenever you can.

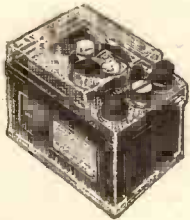
SOVEREIGN PRODUCTS, LTD.

Sovereign House, 57, James St.
Camden Town, London, N.W.1.



The Navy's Wireless Battery!

The Battery chosen by the Senior Service, and relied on in 9 out of 10 British ships, is the Battery that you, too, should have, to bring to your own fireside the pleasures of perfect radio.



Exide

BATTERIES

EXIDE UNSPILLABLE BATTERIES

There is an Exide Unspillable L.T. Battery, in both free acid and jelly acid types, to suit every portable set. Prices from 5/-

For Wireless H.T. get Drydex—the dry battery by Exide

Obtainable from Exide Service Stations and all reputable dealers.

Exide Batteries, Exide Works, Clifton Junction,
Branches: London, Manchester, Birmingham, Bristol, Glasgow, Dublin and Belfast

S.T.500 BEFORE YOU BUILD

READ THIS FIRST

I WANT to warn you! Some constructors refuse to leave the burden of responsibility on the shoulders of the designer. They want to redesign the set to suit their purse, their ideas, their cabinet, their existing components, and the opinion of the "man at the shop." I implore you not to do so.

There is nothing specially critical in the set, but unless you are prepared to accept full responsibility I advise you to keep to my component list; I prefer you to build a duplicate of my own set, but realise that this is an ideal.

Use the Specified Parts.

Alternative components are given and are often as good as the original, but avoid doubtful apparatus which has not been personally tested by myself. On every big set I have designed, scores of unscrupulous dealers have fobbed off totally unsuitable components, valves or accessories on to their innocent dupes.

The usual reason given is that the parts are "difficult to get," unobtainable, out of stock, etc. If you swallow this yarn I cannot be responsible for the results. If you are tempted by price considerations, the fault is wholly yours.

I ask you to check your proposed choice against my own list of components in this article and to trust to my judgment. Remember that every "S.T.500" kit does not necessarily include even the alternative components in my list; there is a real danger here, and the responsibility for substitution becomes the manufacturer's and not mine.

The components which are most important are the transformers, the S.G. choke, the coils (if you only knew what trouble unapproved coils have given!), the resistors and condensers. I honestly think you will regret false economy in these cases.

Note not to buy an output choke if you propose—an extremely excellent plan—to invest in a Class B moving-coil speaker. Models are made by most firms; but I strongly advise you to choose by hearing. There are some shocking cheap moving-coil speakers. Buy the best model you can afford from my list of manufacturers.

You save at least 8s. 6d. on the set if you buy a speaker which has additional terminals for Class B.

Class B and Driver Valves.

The "S.T.500" uses B21 and LP2 valves for Class B and driver. The B21 differs from other Class B valves, but if you

use a different ratio transformer and no bias on the grids and use the right driver other Class B valves could be used. The set is, however, designed primarily for the B21.

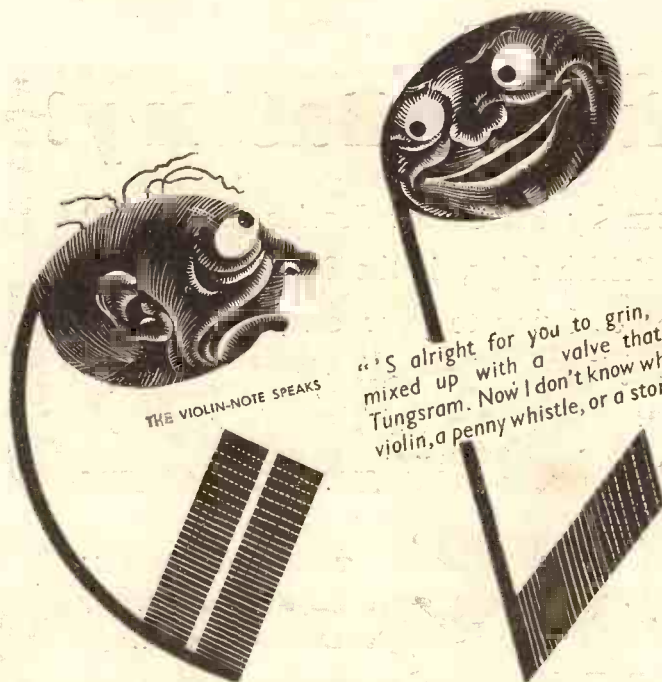
The "S.T.500" anode coil is identical to the "S.T.300" and "S.T.400" anode coils. The "S.T.500" aerial coil is the same as the "S.T.400" aerial coil. It consists of the "S.T.300" aerial coil with a reaction winding added. You can wind it yourself (I will tell you how, next week) or you can buy the "S.T.400" aerial coil only.

I have no objection to you trying your existing components in the set. But, unless you are careful, you may use the wrong values, etc. Of existing components I am most suspicious of grid leaks, presets, spaghetts and the L.F. transformer. All these are liable to be faulty, except for the transformer, which I list as doubtful because it may be of inferior make. I now use open presets exclusively and firmly discourage others.

Look to Your Earth.

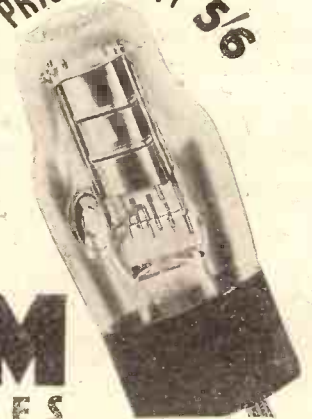
See that your earth is as good as possible. Don't take it on trust. Go and look at it. If you intend to use the "S.T.500" for radiogram purposes (it is ideal for records) buy a Wearite 123 switch, instead of the toggle. More details later. On general grounds buy a double- or triple-capacity H.T. battery. The "S.T.500" will use the current extremely economically. The S.G. and detector valves may be metallised, but this is not essential.

(Continued on page 310.)



- THERE'S A TUNGGRAM VALVE FOR EVERY RADIO NEED
- TUNGGRAM'S VIVID TONE PUTS NEW LIFE INTO OLD SETS
- FULL RANGE OF UNIVERSAL A.C./D.C. VALVES
- IF YOU'VE A RADIO PROBLEM, WRITE OUR TECHNICAL DEPARTMENT AND THEY WILL HELP YOU GLADLY

BUT AT PRICES FROM 5/6
THE WORLD'S FINEST



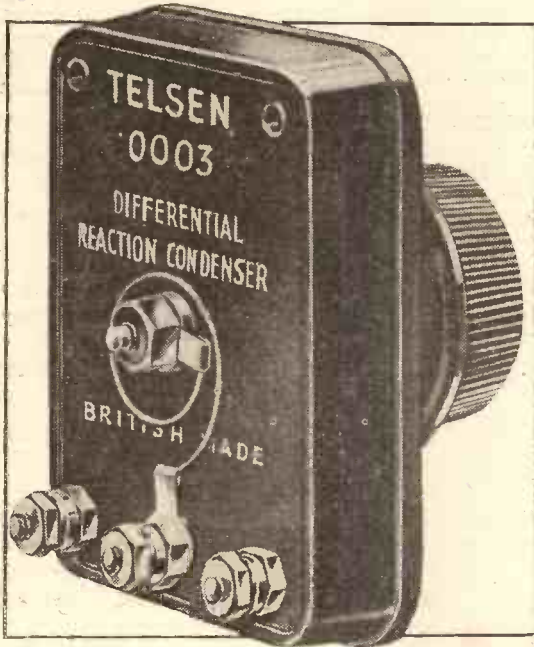
TUNGGRAM

BARIUM VALVES

Advt. of Tungram Electric Lamp Works (Gt. Britain) Ltd., 72 Oxford St., W.1

TELSEN DIFFERENTIAL CONDENSER

Specified by Mr. JOHN SCOTT-TAGGART
for the P.W.



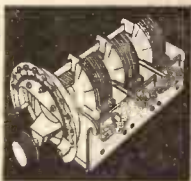
"S.T. 500"

Illustration below shows the position occupied by the new Telsen Differential Condenser in the built-up S.T.500.

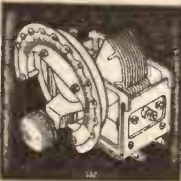


MR. JOHN SCOTT-TAGGART'S choice of the new Telsen Differential Condenser is an eloquent tribute to its lasting efficiency. Any possibility of deviation from the stated capacity is prevented by the entire elimination of end-play (positive contact being made by a flexible pig-tail) the effective life of the component being enormously increased, and the occurrence of 'rustling' noises due to grit being prevented, by the dust-proof bakelite case which now encloses the entire unit. Yet, in spite of these valuable improvements, there has been no increase in price **2/-** (Capacities .0003, .00015, .0001)

TELSEN COVER EVERY CONDENSER REQUIREMENT



TELSEN TRIPLE GANG CONDENSER 17/6



TELSEN CONDENSER UNIT 7/6



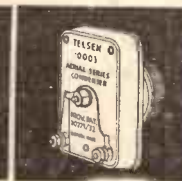
TELSEN TWIN GANG CONDENSER 12/6



TELSEN VARIABLE CONDENSER 2/6 & 3/6



TELSEN TUNING CONDENSER 2/-



TELSEN AERIAL SERIES CONDENSER 2/-



TELSEN REACTION CONDENSER 1/9 & 2/-

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

S.T.500 : BEFORE YOU BUILD

(Continued from page 308.)

A last word : please do not use in the "S.T.500" a suspected component which may have caused your last set to fail. It is almost unnecessary to add that L.T. and H.T. should be O.K. and your valves in first-rate order. Nearly all the notes here given apply to every design for the constructor. Forgive me if I have been rather dogmatic.

J. S. T.

SOME TIPS FOR CONSTRUCTORS

Efficient Control—Good Joints—
Using a Fuse—Making Speaker Frets.

REACTION ON THE SHORT WAVES.

A SHORT-WAVE set depends entirely on the smoothness of its reaction control for its efficiency. If the reaction is at all "ploppy" it is impossible to receive any but the strongest of stations. Consequently it is essential to find some cure for this trouble if the set is to give of its best.

It is generally advised to adjust the high tension voltage on the detector valve to obtain the best results, but this does not always put matters right. There is a very simple thing to try, and that is to increase

the value of the grid leak to about 5 megohms. This usually makes a vast difference to the smoothness of the reaction. A. S.

A WOODWORK HINT.

To ensure stability in woodwork the craftsman usually fixes the joints and corners with glue, in addition to screws, but to make a firm joint it must be remembered that the wood requires a certain amount of attention before applying the glue.

Actually, if the fixing is carried out in a cold workshop the glue is liable to become hard and lose its adhesive property before the joints are firmly in position. With this in mind it is advisable slightly to warm the pieces of wood before the glue is applied, although if this is done by means of a fire great care should be taken not to overheat, otherwise splitting is possible. A. W. Y.

COMPLETE FUSE PROTECTION.

A FUSE in the H.T. negative lead provides a fair degree of safety for the valves in the set if a wrong connection is made, and also for the H.T. battery if a short circuit occurs. The best position for this fuse is as close to the negative socket of the H.T. battery as possible, and consequently one of the wander-plugs with incorporated fuse is ideal.

But where two or more H.T. positive taps are employed it is not impossible for trouble to arise from the section of the H.T. battery between two of these, particularly if experiments in varying the circuit are tried.

Complete protection is provided by using

one of the wander-fuses for each positive tap as well as for the negative. But as these wander-fuses are usually marked negative, care should be taken to remark them. A. S. C.

A NEW USE FOR OLD RECORDS.

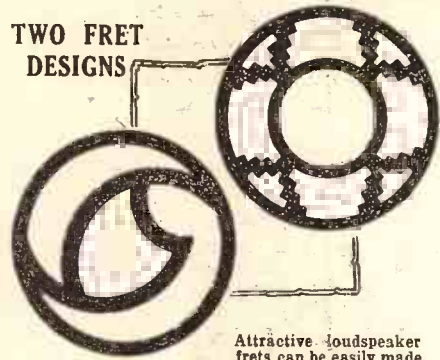
THERE are many uses for old gramophone records in the constructor's workshop, as you have probably found out. One will come in useful, for instance, as a loudspeaker fret. Two simple designs are shown.

Almost needless to say, a black fret will tone in contrast with any cabinet colour. And it is surprising how effective the groove markings make a fret look.

On one of the most beautiful frets of this kind I have seen the grooves were filled up with various blending shades of brown sealing wax to match a walnut cabinet.

W. W.

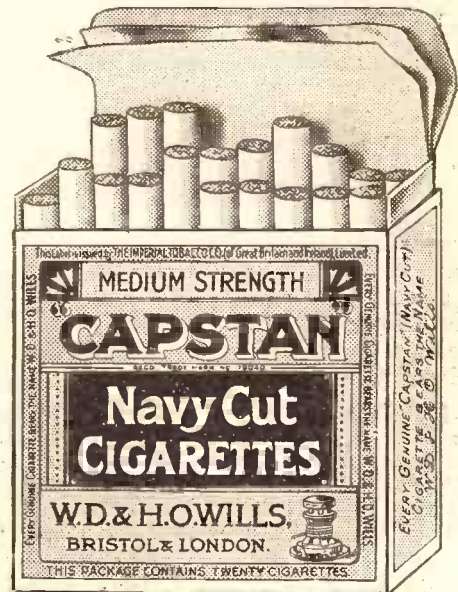
TWO FRET DESIGNS



Attractive loudspeaker frets can be easily made from old gramophone records.



10 FOR 6^D
20 FOR 11¹/₂^D



There's no better value.



Here's how...

... to make a real success of your S.T.500

Make your S.T.500 the success it was meant to be. A set that will be a credit both to yourself and the designer.

Amplion components are reliable and low in cost. Choose your parts from the range given here and you won't be disappointed.

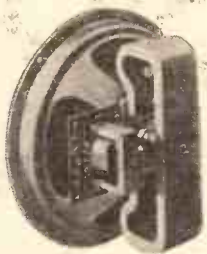
Compare prices and you'll find that in addition to quality, Amplion also means Economy.

The Amplion S.T.500 matched coils, illustrated have been specially designed for this circuit and are fully tested.

Illustrated is a choice of 3 speakers each provided with a universal transformer for correct matching to your valve.

AMPLION

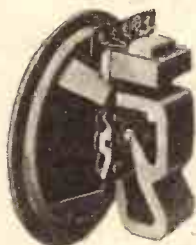
AMPLION (1932) LTD., 82/84, Rosoman Street, E.C.1.



Amplion
"Audiola"
9" Cone.
Price 49/6



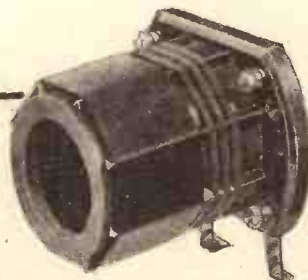
Amplion
"M.C.22"
7" Cone.
Price 39/6



Amplion
"Sonette"
5 1/4" Cone.
Price 27/6



Amplion "B" driver transformer in a choice of 3 ratios—1:1, 1:5:1 and 2:1. Price 9/6. The Output Choke is available in a choice of ratios—1:1.1:5:1, and 3:1—suitable for matching all valves to existing loudspeakers. Price 9/6. Amplion Screened Choke with special earthing terminal to prevent interaction. Price 3/6.



Amplion S.T.500 Matched Coils Price 8/- the pair



THE LISTENER'S NOTEBOOK

(Continued from page 296.)

I would like to have every Saturday evening a special bulletin for football results given at the earliest possible moment after they are available. After all, football is our national winter game, claiming thousands of devotees.

I haven't lost interest in the "Anywhere for a News Story" yarns yet. On the contrary, I find it increasing with every new story. Col. Lionel James had a good story to tell—as his predecessors had—and he told it just as well.

Last week it was Binnie Hale from the stage broadcasting for the first time. This week it is Margaret Bannerman, and I hope we shall hear them both again very soon. How beautifully Margaret Bannerman's words came through, and all with the greatest ease! Of the four songs, I liked "I wasn't quite sure" best.

Ronald Frankau is better than ever. He is certainly the best entertainer the B.B.C. has.

Elizabeth Pollock does a very clever act. Unfortunately, she reminded me of Florence Desmond, whom I hate to think of delighting American audiences when she might be here.

This variety, which included Danny Malone and The Moderniques, was one of the most distinguished varieties ever put on the Regional.

H.T. BATTERY ECONOMY

IT is quite probable that you find the lower tappings on your high-tension battery deteriorate first. The voltages between, say, negative and sixty tend to drop off more quickly than the voltages between sixty and maximum.

This is more often than not due to the fact that the lower half of the battery is called upon to supply slightly more current than the other half. The actual difference depends upon the type of circuit, the tappings made on the battery, and the valves, etc.

NEXT WEEK :

JOHN SCOTT-TAGGART

will contribute another long and fascinating article on the

S.T. 500



Tell your friends about our Special Supplement for Beginners—

"RADIO STEP-BY-STEP."

Next week's "P.W." will contain a long instalment of this lucid and valuable guide for the newcomer to radio.

It is as well, therefore, where two batteries are used in series, to change them round occasionally so that the load is more evenly distributed.

This may mean quite a few weeks' extra service. H. C.

WHEN YOU BROADCAST

By JOAN INGLESANT

I FEEL that I am not wrong in saying that you who play the pianoforte often dream of the great day when you will be playing before a microphone, knowing that beyond it the great world is listening to your rendition.

I know that in my climb upwards my thoughts turned towards that ambition, and the nearer I came to it the more I realised that the purchase of expensive music took deep inroads into my meagre resources.

The modern pianist need not have the worry that then I had, for to-day he has at his command a new work entitled "Master Melodies of the World." It is edited by Mark Hambourg, and each week it will contain nine masterpiece melodies, full-music size.

Here you will find Chopin, Mendelssohn, Wagner, Schumann, Schubert, Liszt, Rubinstein, indeed all the great ones of the world of music they adorned.

For one shilling expended each week for nine pieces, at the close of the publication the pianist will have one of the most complete collections of musical gems ever offered to the public.

What is more, a master pianist has selected them for you—a pianist who has studied his audiences and who knows what they want.

YOU GET MORE OUT OF THIS BATTERY



BECAUSE THERE IS MORE PUT INTO IT

Every Grosvenor Battery contains an *extra* amount of power—*extra* chemicals crammed into each one of its cells by the force of hydraulic pressure. The Grosvenor MERCURY process is the secret. It guards these vital cells against corrosion—makes them last so long that they are *supercharged* with power to use them up.

Next time, insist on a Grosvenor super-life Battery, and get real value for your money!

Grosvenor Mercury Batteries are made in three grades for every Radio need, from 5/6 to 20/-.
 * Mercury enormously increases the life!

MISCANLITE ELECTRIC TORCHES
 Ask your Retailer to show you these strong, attractively-coloured torches, in the new everlasting material, Miscanlite. From 1/6.

GROSVENOR ELECTRIC BATTERIES, LTD., 2-3, White Street, E.C.2
 Works: Watford, Herts. Telephones: METropolitan 6866 (3 lines).

CONVERT YOUR SET INTO AN ALL WAVE SET

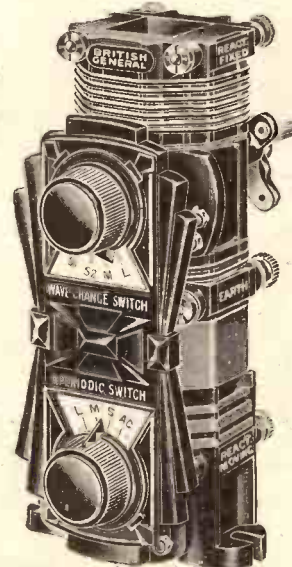
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9'6

only

9'6

All wavelengths from 145 to 2,000 metres covered by this British General All-Wave Tuner.



Free wiring diagrams showing how you can build or convert your set supplied Free. State circuit when ordering.

From all dealers or direct from the manufacturers:

BRITISH GENERAL

MANUFACTURING CO., LTD., Brockley Works, London, S.E.4

TELSEN BINOCULAR H.F. CHOKE

Specified by **Mr. JOHN SCOTT-TAGGART**

for the P.W.

"S.T. 500"

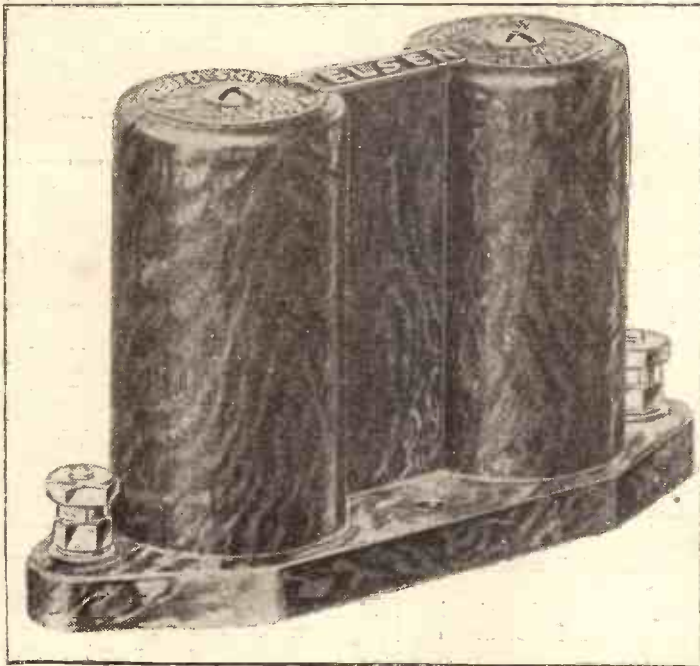


Illustration below shows the position occupied by the Telsen Binocular H.F. Choke in the built-up 'S.T. 500.'

EXPERT designer and home constructor alike concur in their choice of the Telsen Binocular Choke where lasting efficiency at low cost is the first requirement. Its external field is negligible, with a very low self-capacity, while its inductance is as high as 180,000 micro-henries

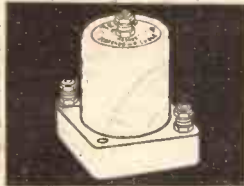
3'6



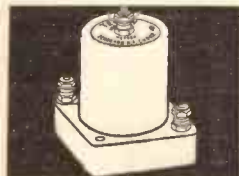
TELSEN COVER EVERY H.F. CHOKE REQUIREMENT



TELSEN ALL-WAVE SCREENED H.F. CHOKE - - - - 4/6



TELSEN STANDARD SCREENED H.F. CHOKE - - - - 2/6



TELSEN SHORT WAVE SCREENED H.F. CHOKE - - - - 3/-



TELSEN STANDARD H.F. CHOKE - - - 1/6



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TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD. ASTON, BIRMINGHAM

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CLASS B SPEAKERS ARE SPECIALLY MADE TO SUIT CLASS B ONLY

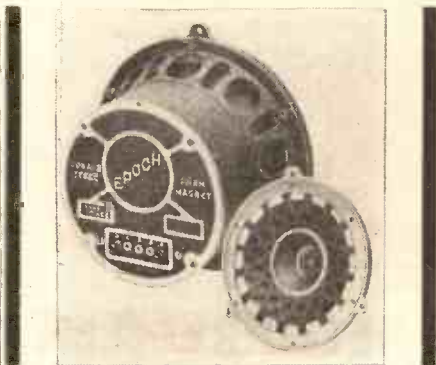
No transformer complications. No extra windings. No extra mechanism. No added cost for useless fittings. Epoch realises that Class B Amplification has come to stay and that a battery-set user when he purchases a speaker for Class B, does not want any complications to enable him to use it also on the ordinary set which he has made obsolete. Epoch has therefore developed its range of Class B speakers regardless of ordinary battery sets, thus saving many shillings on each speaker which would have to be added for useless equipment, and at the same time avoiding many weak points where a speaker could get out of order.

FINEST VALUE AND QUALITY ON THE MARKET

Two striking examples from the large Epoch range are shown below:

THIS UNIT IS ONLY **30/-**

but is vastly superior to speakers costing 10/- to £1 more. It includes a large 9% cobalt steel magnet, a full-size 8½-in. diaphragm, and a Class B transformer with alternative terminals for various Class B valves. In handsome Oak cabinet it is 42/6. Ask for Epoch Super Junior Model (new edition, Type M.B.).



FOR THOSE WHO SEEK REAL QUALITY at an extremely reasonable price, we recommend this unit which has no equal anywhere for quality of reproduction even at £2 or £3 higher price. Hand made and balanced. Totally enclosed in a massive aluminium case. Price **63/-**

Ask for Epoch Type A 2½ B.

Price **63/-**

INSIST UPON EPOCH AND DON'T BE PUT OFF WITH INFERIOR MAKES.

Send for catalogue and new season's programme including many other models.

EPOCH RADIO MANUFACTURING CO., LTD.,

Exmouth House, Exmouth Street, E.C.1.

Phone: Clerkenwell 6666 (4 lines).

THE S.T.500 CIRCUIT

(Continued from page 287.)

would be impaired; distortion would be likely, and the handling of the reaction controls would be less smooth. Greediness at the anode coupler will produce H.F. indigestion. But it represents a very useful reserve when the incoming signal is weak, due to an indoor aerial, daylight reception or the weak power of the station itself.

Associated with the anode coupler is a preset .0001-mfd. condenser, called the selectivity range adjuster. This is not critical of adjustment, but serves chiefly to bring up signal strength on S.G. valves which are below par; this is done by increasing the capacity by screwing the top plate down.

A Luxury Adjustment.

By decreasing this capacity the maximum selectivity of the anode circuit is increased somewhat, but at the expense of signal strength.

The most practical use of this condenser is to widen the scale of the anode coupler. With both reaction condensers at zero the set, with some valves, may oscillate when the anode coupler is near its full right (maximum) position. By reducing the range-adjuster preset any instability can be immediately stopped.

Some inherent reaction in a set is inevitable, but in operating the "S.T.500" it must be kept to a low value so that full play can be given to the properly controlled aerial reaction and anode reaction. The range adjuster, if reduced, will reduce the inherent reaction to as low a value as you like.

An immediate relief of self-oscillation (if it occurs with reaction knobs at zero)

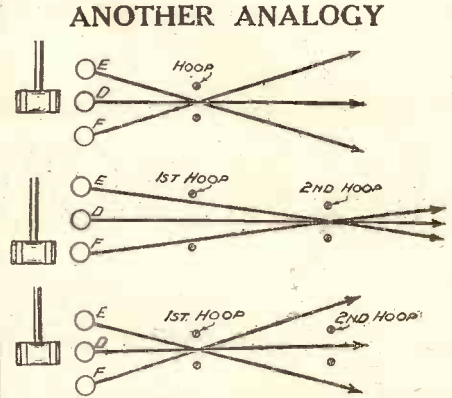


Fig. 6. This diagram which is referred to in the main article, is for the purpose of explaining the merits of the "two narrow hoops," i.e., two highly-sensitive circuits both with reaction applied. Just as only one player can knock a ball through both hoops if these are narrow, as shown in the bottom diagram, so only the desired station can operate the loudspeaker on the "S.T.500."

is always to turn the anode coupler a little to the left; but the range adjuster can be used and has special advantages where poor and old-type S.G. valves are used.

RECOMMENDED VALVES.

It is extremely important that readers should match valves and transformers if the author's Class B specifications are varied. The Class B valve actually used in the set is of the B.21 type, the driver being an L.P.2.

Make	S.G.	Detector	Driver	Class B
Mullard	P.M.12A.	P.M.2D.X.	P.M.2A.	P.M.2B.
Cossor	229 S.G.	210 Det.	215P.	229B.
Osram	S.22	H.L.2	L.P.2	B.21
Mazda	S.215B.	H.L.2	P.229	P.D.220
Marconi	S.22	H.L.2	L.P.2	B.21

The range adjuster is best screwed up tight when first using the "S.T.500." It is really an ultra-luxury whose uses can be explained at leisure; even so it resembles the phase-

reverser preset in that, once adjusted, it is never touched again. It is not a control.

The anode reaction is obtained by a differential condenser from the detector valve. Selectivity and reaction are improved by using a smaller grid condenser (.00005 mfd.) than is usually employed.

The "Driver."

An intervalve transformer feeds into what readers will recognise is the "driver" valve, which is really a further stage of L.F. The anode circuit of this valve contains the primary of a "driver transformer" which has a double secondary.

The fourth valve of the set is a Class B valve which is really two special three-electrode valves combined in one bulb. Each secondary is connected to a grid, and the connections are such that, when one grid is being made positive by the L.F. signals, the other is being given a negative impulse, and vice versa.

A STARTLING DIFFERENCE

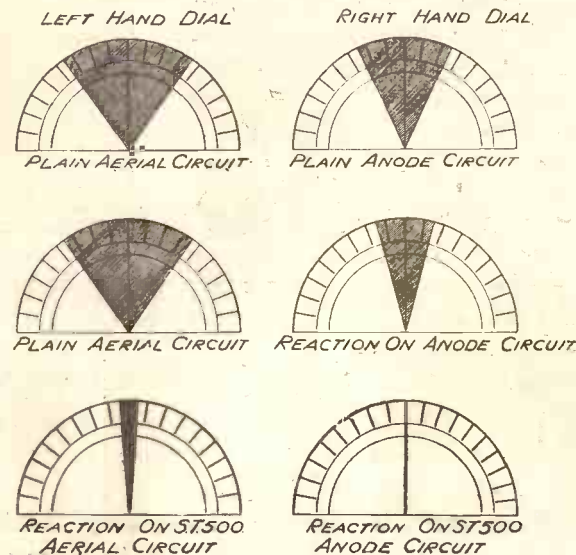
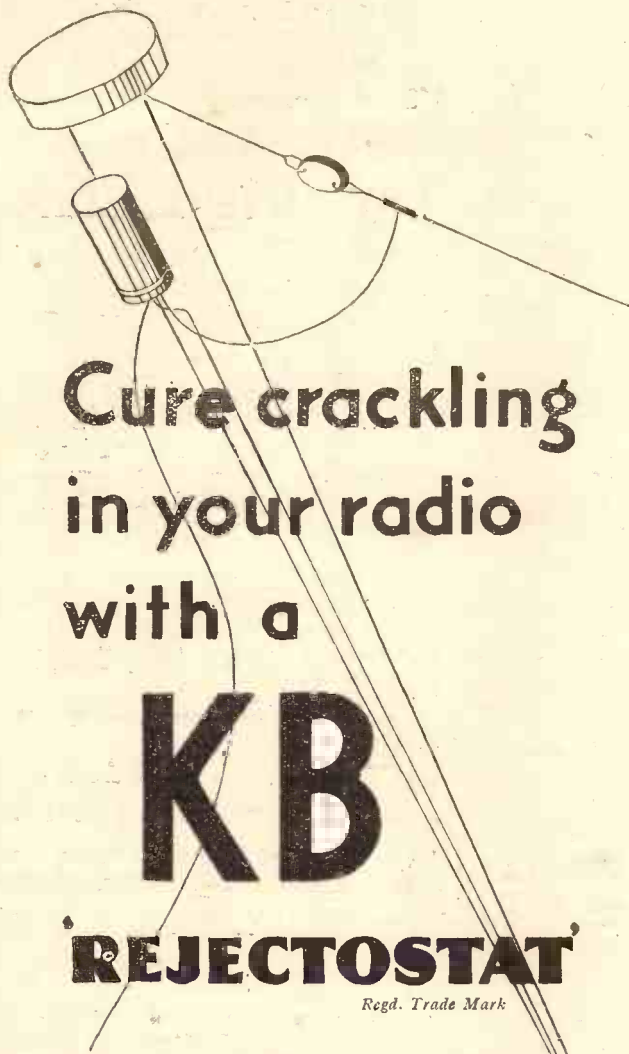


Fig. 7. Here you see the interference or "spread" of a local station on three different sets, as explained in the main article. The first line shows a two-dial circuit with no reaction. The second line shows how reaction improves matters. The last line shows the dials on the "S.T.500." The local becomes restricted to an absolute minimum as regards "spread." How do your dials compare?

(Continued on page 316.)



Cure crackling
in your radio

with a

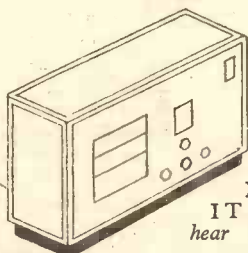
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You can clear your radio reception of most of the interfering noises caused by trams, signs, sweepers and other electrical machinery, *without any alteration to your set*. Ask your local KB Authorised Dealer about the KB "Rejectostat." He will explain how to fix it to your aerial.

KB "REJECTOSTAT" UNITS—£1 5s. 0d.
Special shielded lead-in cable—4½d. a yard



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ITS BEST—you must
hear KB—the new Radio

CUT OUT AND POST THIS COUPON

to Kolster-Brandes Ltd., Cray Works, Sidcup, Kent.

Please send me full particulars of KB "Rejectostat" K 9
21.10.33

Name

Address

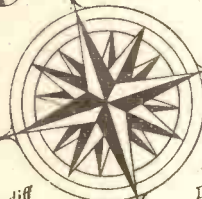
Post in an unsealed envelope using 4d. stamp

**They
all say
the same**

14th Sept. 1933.
Newcastle-on-Tyne

Dear Sirs,
I had a Pertrix 120-volt battery which gave me eight months continuous and uncomplaining service. Not content with that, I chose for its successor another make. It has been in use for only 3½ months, and despite the fact that my set has not been used to the same extent owing to the summer season, it is practically petered out.

I suppose one pays for experience, and it would appear that it is to be "Pertrix" next time and always.
Yours faithfully,
F.G.B.U.



20th March 1933.
Dear Sir,

As a matter of interest I should like to record my experience with one of your Super-Capacity Batteries which I purchased in May 20, 1932. My set is a home-made one and employs three valves. Up to the present time, therefore, I have had the Battery exactly ten months and there is still sufficient power to "rope" in stations at good Loud-Speaker strength.
Yours faithfully,
W.C.

Cardiff

September 1933.

Dear Sirs,

May I be allowed to submit a little item which may of interest to you. On April 1st 1931, I made a purchase of one of your well-known Pertrix H.T. Batteries (99 volt price 13/-) from a local dealer which has been in constant use more or less every day ever since and it was only this week that it gave out.
Yours truly,
H.M.

Birmingham

**... longer life
from these batteries!**

Letters beyond number, from all parts of the country, tell how Pertrix Batteries have lasted until they became sources of wonder. If you could read all these letters, you would be convinced that Pertrix Batteries really have put up records for long life. Yet you still wouldn't be any wiser as to *why*.

The reason is that Pertrix Batteries are non-sal-ammoniac. They are the only batteries using a patent *neutral* electrolyte which cannot rot the zinc cells. There is no 'shorting' between the cells—and no resistance crystals to clog the current. Instead of wasting away when the set is idle, a Pertrix actually recovers power.

Now you know how and why, make your next battery a Pertrix!

FIT PERTRIX
TRADE MARK
FOR GOOD

BRITISH MADE BY BRITANNIA BATTERIES LTD., 233 SHAFTESBURY AVENUE, LONDON, W.C.2.

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MONARCH OF THE MAINS.

The Sign of first-class mains TRANSFORMERS

Look for the Heyberd name-plate when buying Mains Transformers . . . and be sure that you are getting the products of Mains Specialists. Heyberd Transformers are absolutely foolproof and safe in operation. Windings are completely screened by stout metal end-plates, whilst the terminals are of the insulated plug-in type—colour coded to prevent wrong connections. Moreover . . . all materials are thoroughly British; the transformers are severely tested at every operation; and they are **GUARANTEED 12 MONTHS.**

Here are three typical models from the wide Heyberd range:

MODEL W.35.
For use with Westinghouse H.T.II Rectifier.
Rified Output: 500v 120 ma. L.T. 4v. 5 amps.
and 4v. 2 amps. C.T. Price 65/-

MODEL 803.
Suitable for class A valves, Tappings: 250+250
75 ma. L.T. 4v. 1 amp. and 4v. 5 amps. C.T.
Price 32/6

MODEL 723.
Filament Transformer, 4v. 3 amps. C.T.
Price 12/6

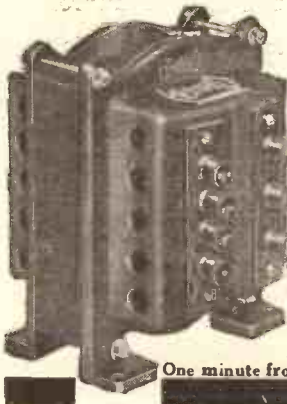
And— as for Mains Units

Heyberd, of course, are well-known for their Mains Units and Mains Unit Kits, especially for high-power models and Class B Units. Mr. Scott-Taggart has often specified Heyberd for his famous receivers and, for the S.T.300-A.C. version, a special Mains Unit (Model MW1) was produced for him and was exclusively specified by him for that receiver. Now, if you want to run the S.T.500 from the mains you cannot do better than select a Heyberd Class B Mains Unit which incorporates the Cossor Neon Stabiliser. Here are brief details of three popular Units:

HEYBERD CLASS B MAINS UNITS
Special filter circuits for Q.P.P. and Class B, incorporating Cossor Neon Tube to give perfect voltage regulation. Two models—for D.C. or A.C. OUTPUT: 130v. at from 5-50 ma. TAPPINGS: 40/110v. Var. S.G., 100v. Fixed and 130v. Fixed.
PRICES (excluding Neon Tube)
D.C. Class B Mains Unit . . . 55/-
A.C. Class B Mains Unit . . . 97/6

HEYBERD D.150 MAINS UNIT.
OUTPUT: 250 ma. at 150v. or 120v. (alternative). TAPPINGS: 40/110v. Var., 60/130v. Var. and 150v. Incorporating Heyberd Transformer, Double Chokes, 16 mf. Condensers and Westinghouse Rectifier. Complete in neat steel case ready to switch on. **GUARANTEED.**

PRICE **86/-** INCLUSIVE



Cut out this ad. and send NOW with 3d. stamps, for 36p. Handbook and Catalogue—packed with hints, tips and circuit diagrams. Sent by return.

HEYBERD
10, FINSBURY STREET,
LONDON, E.C.2
One minute from Moorgate Stn.

THE S.T.500 CIRCUIT

(Continued from page 314.)

Each anode circuit has a transformer primary in circuit, the two primaries energising a common secondary which feeds the loudspeaker.

The valves comprising the Class B "valve" really work in turn, operating when their grids are made positive. When this happens grid current will flow, but the driver transformer is so designed that this does not matter.

The fact, however, is important when we have to choose the transformer to go with certain Class B and driver valves. The transformer in the set is to match an L.P.2 driver and B 21 Class B valve which are the valves suggested for these positions.

Selecting the Tappings.

The output transformer is usually of the auto-coupled type and is sometimes called an output choke. Various tappings on it are usually provided to enable the constructor to match his speaker. This simply means trying one or two pairs of terminals to see which connections give best results on your own speaker.

If you buy a Class B moving-coil speaker—which is an excellent plan, but not necessary if you have a good speaker already—you will not need the output choke in this circuit; a suitable transformer will already be in the speaker.

J. S. T.

S.T.500 ACCESSORIES

LOUDSPEAKERS. (See article also.)—Blue Spot, W.B., Rola, R. & A., Epoch, Celebration, G.E.C., Atlas, Marconiphone, H.M.V., Ferranti, Ormond, Magnavox, Amplion. All above should be models suitable for Class B output valve used. In this case no output choke is needed in the set. Speakers only suitable for triode output necessitate the output choke in the set.

BATTERIES.—H.T.: Lissen, Ediswan, G.E.C., Ever Ready, Siemens, Pertrix, Marconiphone, Drydex, Hellesens, or Block H.T. accumulators.
G.B.: Ediswan, Siemens, Ever Ready, Lissen, Pertrix, Marconiphone, Drydex.
L.T.: Block, Lissen, Ediswan, Pertrix, Exide, Oldham.

OPTIONAL AERIAL AND EARTH EQUIPMENT.—Electron Superial, Goltone Akrite, Radiophone "Receptru" downlead, Bulgin lightning switch, Graham Farish Filtr earthing device.

THE MAN BEHIND THE S.T.500

(Continued from page 243.)

for two years. Recently his services have been sought in various important patent cases; for example, he was invited, last March, to act as technical adviser and expert witness to Philips (perhaps the greatest valve and radio manufacturers in Europe) in their great patent action with Marconi's. Although he declined, the offer is an indication of his standing in professional radio circles.

As regards his writing activities, more is said elsewhere. He founded "Modern Wireless" and "The Wireless Constructor," and played a vital part in popularising home construction. His first wireless article appeared in the first volume of the

(Continued on next page.)

Give your Set SELECTIVITY

Fit the RADIO INDUCTOR

The Latest and Greatest Aid to Better Reception.

GIVES:

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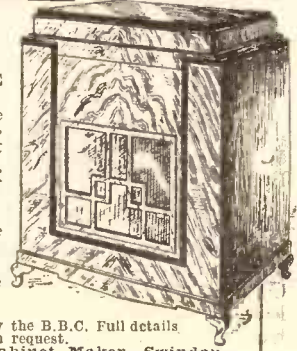
Remarkable Values

Cabinets for the S.T.500 a speciality.

Maker under licence of the HOWE BOX BAFFLE.

Recommended by the B.B.C. Full details on request.

GILBERT, Cabinet Maker, Swindon. Estimates Free. Est. 1866.



PLEASE be sure to mention "Popular Wireless" when communicating with Advertisers. Thanks!

THE MAN BEHIND THE S.T.500

(Continued from previous page.)

first wireless journal in 1914, when he was seventeen years of age. During the war he was engaged in wireless work on the Western Front, received a commission in the field, was the first to use continuous wave sets in action, was mentioned in despatches, and in the final advance in 1918 was awarded the Military Cross for gallantry in maintaining wireless communications under fire. He invented a wireless valve circuit which at the very close of the war was ordered by Colonel Trew to be fitted to every trench set in France.

Shortly after demobilisation he took charge of Government valve manufacture at the works of the Edison Swan Company.

A Splendid Record.

He was elected a Fellow of the Institute of Physics in 1922, and is the only member to have achieved that distinction at his age. He is an A.M.I.E.E., and holds the technical diplomas of various other learned societies. In 1921 and in 1923 he lectured before the British Association for the Advancement of Science. He is one of the two honorary members of the German Radio Society.

His interest in the legal side of inventions culminated in his achievement of high success in the Bar Final examinations. He was called to the Bar in 1928. Although he is qualified as a barrister, he has, so far, preferred to practise as a consulting engineer.

As a set designer his work is too well known to need a reference to it. Many famous sets, from the "S.T.100" onwards, have won him supporters by the hundred thousand. Two of the designs emanating from his laboratories won first prizes in the face of world competition at international exhibitions at New York and Rotterdam.

Here, then, is the background of the man behind the "S.T.500." We believe that there is no one else of his particular experience and international prestige designing for the home constructor to-day.

THE MIRROR OF THE B.B.C.

(Continued from page 294.)

The operetta will be produced in the Concert Hall at Broadcasting House, as was done in the broadcast of the musical play, "Waltz Time." The new variety director seems to know what he wants. We hope he gets it.

Friday, October 27th.—Another "European Dances" programme by the Wireless Military Band. If anything like its predecessors we shall enjoy it.

Saturday, October 28th.—Music-Hall programme by Jack Hylton and his Boys Marie Burke, Charles Heslop, Rupert Hazell and Elsie Day.

"America Calling Again."

Of course, it just had to come after the gigantic success of the first "America Calling" programme, that delightful burlesque on American broadcasting which has undoubtedly been one of the outstanding radio events of this year.

"America Calling Again" is the title and Thursday and Friday, November 16th

(Continued on next page.)

The VALUE of T.C.C. RESEARCH to YOU....



EVERY T.C.C. announcement has been a plain statement of fact—of achievement. No extravagant claims have been needed. Year by year T.C.C. research has been going on, large sums of money have been expended on pioneer work, the best brains employed. The T.C.C. efforts have been rewarded. Every development of note in condenser practice has emanated from the T.C.C. laboratories.

The following facts provide the reason for the wonderful confidence held by set designers, serious experimenters and amateurs in T.C.C. Condensers

★
REMEMBER THIS RECORD

when you order your condensers

for the

S.T. 500

MILESTONES IN RADIO HISTORY

- 1906 T.C.C. founded with factory operating solely on Condensers and artificial line for submarine cable work.
- 1914 T.C.C. introduce Mansbridge Condensers, and manufacture under original licenses.
- 1915 T.C.C. working on Condensers for War Office, Admiralty—Air Service—etc.
- 1918
- 1920 T.C.C. manufacture heavy duty Transmitting Condensers.
- 1922 T.C.C. manufacture Power Condensers.
- 1926 T.C.C. contract with B.B.C. to supply Condensers for 2LO.
- 1927 T.C.C. discard Mansbridge type, and introduce Rolled Condensers using Aluminium Foil of higher conductivity—and greater reliability.
- 1928 T.C.C. introduce Dry Electrolytic Condensers of very high capacity for low tension smoothing.
- 1929 T.C.C. introduce Dry Electrolytics for 100 volt working.
- 1930 T.C.C. introduce Moulded-in Mica Condensers—the now famous "M" Type.
T.C.C. introduce Non-inductive condensers.
- 1931 T.C.C. introduce Wet Electrolytic Condensers.
- 1932 T.C.C. manufacture Dry Electrolytic High Voltage Condensers—(550v. peak).
T.C.C. first to publish Surge Voltage ratings of paper condensers.
- 1933 T.C.C. research still building up data, still adding to its specialised knowledge so that Radio Technicians may have available not only a "pedigree" range of condensers, but a range ahead of time.

T.C.C.
ALL-BRITISH
CONDENSERS



The Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton, W.3

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Big Pay for Trained men!

Thousands of men are earning regular incomes for interesting spare time work such as Set Designing, Writing for the Press, Servicing, Inventing, Demonstrating, etc., etc. You can do the same. You can turn your evenings into guineas and, if you wish, qualify for highly-paid full-time employment. Trained men are urgently wanted and we can give you the sort of training that employers demand. T.C.R.C. Radio Correspondence Courses are prepared and conducted by men who have themselves made good in the Radio Industry and earned four-figure incomes.

Read what a Leading Radio Manufacturer says:

"There can be no doubt as to the urgent necessity for such a College, and I heartily commend your enterprise in spreading wireless wisdom in this manner. There is a great future in radio and the men who take the trouble to study and specialise will find their progress assured. I know that those who complete the thorough course will be well equipped with the valuable knowledge so essential to the modern radio craftsman."—Signed: **W. S. VERRELLS, Managing Director of E. K. COLE, Ltd.** (Manufacturers of the famous EKCO RADIO).

Fathers! Prepare your sons for jobs like these:

Radio offers immediate rich rewards to trained men. It is a field of tremendous and unlimited opportunities. Air traffic, broadcasting, television, talkie pictures and the whole of the electrical field, quite apart from the actual radio industry, are vitally linked up with radio science. In less than 10 years more than 150,000 jobs have been created, some men earning over £2,000 a year and many thousands over £500 a year for work that you would call a hobby.

Read what "Practical Wireless" says:

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MIRROR OF THE B.B.C.

(Continued from previous page.)

and 17th respectively, the days on which it will be broadcast.

Eddie Pola, who has devised it, will again appear before the microphone as announcer, and Al Bowley will impersonate Bing Crosby, the only part of "America Calling" which is to be included in the next programme.

For the rest, Dave Burns will impersonate Jack Pearl as "Baron Munchausen," America's Dutch dialect comedian who created the expression "Vase you dare, Charlie?" while the Mills Brothers will be impersonated by the Moderniques.

Burns and Allen will take part in the programme as themselves, and other artistes who will be burlesqued are Al Jolson, Ruth Etting and Sophie Tucker.

For West Regional Listeners.

The first of a number of talks by Welsh Members of Parliament on current events in the House of Commons will be given by Sir William Jenkins, M.P., on Tuesday, October 31st, at 8.15 p.m. The talks are intended primarily for West Regional listeners, and Sir William Jenkins will speak in Welsh.

NEXT WEEK

JOHN SCOTT-TAGGART

will contribute a further long article on the S.T. 500

Order Your Copy Now

A B.B.C. Book.

I stated in a recent issue that a book about the B.B.C., written by Mr. Cleghorn Thomson, Miss Hilda Matheson, and Mr. P. P. Eekersley, might shortly be published. A few days ago, however, Mr. Cleghorn Thomson informed me that, although such a book had "been discussed," it was now certain that no book on the B.B.C. would be done.

I stated that such a book, if written, might offer a frank exposition of all that the authors think is wrong with the B.B.C. and how they would repair it; but Mr. Thomson asks me to make it clear to readers that, even if a volume on the B.B.C. had been written, it would not have been "a book of grievances against the B.B.C."

I never suggested the authors had any "grievances," but I did suggest they had ideas about improving the B.B.C. If they have not, is a very great pity.


OPERATING YOUR "S.T.500"

(Continued from page 285.)

to appropriate terminals. Tighten up the selectivity range adjuster preset (0001-mfd.) to its maximum position. Unscrew the phase reverser preset 00005-mfd. until the far end of the top plate is about 1/8 in. up (i.e. the condenser is about a quarter "in"). This value is not at all critical. Connect loudspeaker to set, preferably seeing that speaker is not near the aerial lead-in. The speaker is probably best on

(Continued on page 321.)

HIGH IN QUALITY



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IMPORTANT TO ALL BUILDING THE "S.T.500"

"Popular Wireless" said:— Before me as I write, are half a dozen slips of paper . . . These slips have been taken from six valve cartons . . . What is more, the slips referred to are **perfectly truthful**, and give accurate average data concerning the characteristics of the "HIVAC" valves, which, on test, **have proved themselves perfectly "satisfactory."**

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ALL needed for the "S.T. 500." You also need the HIVAC B220 at 10/6 equally as efficient.

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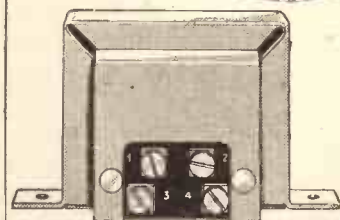
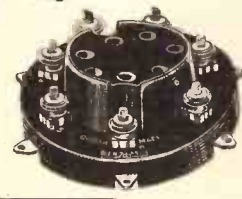
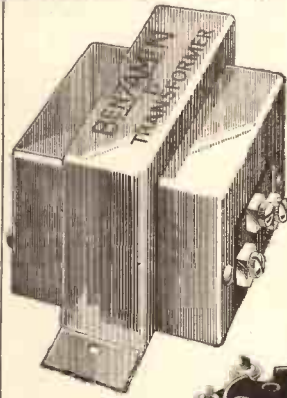
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 - One Benjamin Output Choke Price 11/-
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- Standard Model (7" cone) Price £1 17 6
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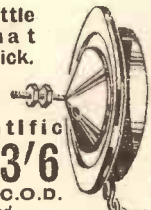
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"S.T.500"

COMPONENTS

<p>Component</p> <p>2 "S.T.400" coils</p> <p>2 .0005-mfd. tuning condensers</p> <p>3 .0005 solid dielectric variable condensers</p> <p>1 .0001-mfd. differential reaction condenser</p> <p>1 .0003-mfd. differential reactable condenser</p> <p>1 baseboard preset .0001-mfd. J.</p> <p>1 baseboard preset .00005-mfd.</p> <p>1 Class B driver transformer</p> <p>1 Class B output choke</p> <p>1 L.F. transformer</p> <p>1 S.G. choke</p> <p>2 4-pin valve holders</p> <p>1 5-pin valve holder</p> <p>1 7-pin valve holder</p> <p>1 H.F. choke</p> <p>1 1-megohm grid leak</p> <p>1 holder for same</p> <p>2 5,000-ohms resistances</p> <p>2 10,000-ohms resistances</p> <p>1 250-ohms resistance</p> <p>1 2-mfd. fixed condenser</p> <p>1 1-mfd. fixed condenser</p> <p>1 1-mfd. fixed condenser</p> <p>2 .005-mfd. tubular condensers</p> <p>1 .0005-mfd. tubular condenser</p> <p>1 .00005 mica condenser</p> <p>2 push-pull on-off switches</p> <p>1 toggle on-off switch</p> <p>1 ply baseboard (16" X 12")</p> <p>1 panel 16" X 7" X 3/16ths</p> <p>1 "S.T.500" screen</p> <p>1 terminal strip</p> <p>1 bracket for .0005-mfd. mid log. line condenser</p> <p>10 Terminals</p> <p>3 Wander plugs</p> <p>4 Wander plugs</p> <p>2 Spade terminals</p> <p>Connecting wire (Glazite 20 SWG)</p> <p>OPTIONAL 1 anode connector Flex, screws, etc.</p> <p>All the above components supplied immediately from stock.</p>	<p>Makes used by designer</p> <p>Colvern</p> <p>Ormond, type R.493</p> <p>Graham Farish "Litlos" log. mid line</p> <p>Telsen, type W.353</p> <p>Polar</p> <p>J.B., type 1088</p> <p>J.B., type 1087</p> <p>Telsen, ratio 1:1</p> <p>Telsen</p> <p>Vaxley "Nictet" standard</p> <p>Telsen binocular (type W.74)</p> <p>Benjamin "Vibrolder"</p> <p>W.E. "Universal"</p> <p>Graham Farish</p> <p>Lissen, disc type LN5092</p> <p>Ferranti, synthetic type S</p> <p>Ferranti</p> <p>Dubilier 1-watt metallised.</p> <p>Dubilier 1-watt metallised</p> <p>Graham Farish "Ohmite"</p> <p>Igranic</p> <p>T.C.C., type 50</p> <p>Dubilier, type B.E.</p> <p>T.C.C., type 300</p> <p>Graham Farish</p> <p>Lissen</p> <p>Lissen, type LN5070</p> <p>Bulgin S.80</p> <p>Peto-Scott</p> <p>Peto-Scott</p> <p>Peto-Scott</p> <p>Peto-Scott</p> <p>British Radiogram</p> <p>Belling-Lee, type R</p> <p>Clix</p> <p>Belling-Lee</p> <p>Clix</p> <p>Lewcos</p> <p>Belling-Lee</p> <p>Peto-Scott</p>
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On Sale at Booksellers, Newsagents and Music Dealers.

OPERATING YOUR "S.T.500"

(Continued from page 318.)

the right of the set, and should not face the valves, as a microphony howl could result in a bad case. This, together with other precautionary notes, applies to all sets, and not merely this.

Insert H.T.— plug into negative socket of H.T., which should have a value of 120 volts to get best results. A run-down H.T. is no use for Class B work.

Precautionary Measures.

Insert H.T.+1 (screen of S.G. valve) into 72 volts; H.T.+2 (detector) into 90 volts (this can be adjusted); H.T.+3 into the maximum 120 volts. Ensure that you get no filament burn-outs through a wrongly wired set by a flash-lamp bulb, which is connected in turn across filament terminals of each valve holder, including the S.G. valve holder. If the bulb burns out or does not light at all, there is a fault in the wiring. A voltmeter (reading up to 120 volts) may be used instead.

Switch off toggle. Take out H.T.— plug. Insert S.G. valve (Cosor 220S.G. or equivalent type), connecting flex wire to anode. If S.G. valve is metallised, take great care that its metal covering does not touch S.G. choke terminal (which should be some distance away); the covering may, however, touch vertical screen, as it is connected to earth. Take care that no frayed, bare ends of the flex come into contact with metal covering. See that the S.G. valve is pushed home into its socket.

Insert other three valves. Many sets do not work simply because the valve pins make bad contact. I have used very good valve holders, and this trouble is not likely to arise. The detector valve (Mullard P.M.2DX or similar type) goes in the holder V2 (see blueprint); the driver valve (Marconi or Osram type L.P.2 or other suitable small-power valve) goes in V3; while the B.21 (Osram or Marconi) Class B valve goes in V4.

Replace H.T.— plug in H.T. battery.

Pull out both wavechange switches (you are going to listen to the medium waves first). Set aerial coupler half-way round (pointer vertical).

Getting Your First Programme.

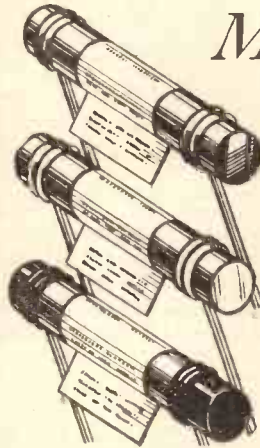
Set anode coupler so that pointer is about vertical; turn aerial-reaction knob full left (anti-clockwise); turn anode-reaction knob full left. Set aerial and anode-tuning condensers half-way. Switch on toggle. Signals will be received and the set may be used for station getting.

Familiarise yourself with your "locals" first. Unless you are a considerable distance away, they will spread considerably. Volume will be immense, but quality excellent. The first thrill may delay further tests; you will want to stop and listen to the rich outpouring of music; probably,

(Continued on next page.)

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S.T. 500



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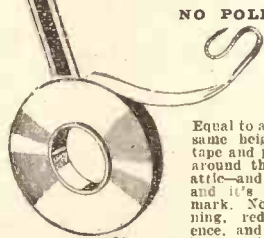
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OPERATING YOUR S.T.500

(Continued from previous page.)

however, it will be the fat-stock prices. Even these will sound attractive! Try the effect of the tone control. Rotate the right to produce a general lowering of tone. Leave full left, looking from the back, during following tests.

Now let us get the hang of the controls. Tune both aerial and anode-tuning condensers until a chosen station is loudest. Move the aerial-coupler knob to the left, retuning slightly on the aerial-tuning condenser. Selectivity is improved and signals are weakened. If you move the aerial-coupler knob over to the right signals will become stronger but selectivity poorer.

You can use the aerial coupler as a volume control, but remember that slight retuning on the aerial-tuning condenser will always be necessary.

The Anode Coupler.

Having learnt the use of the aerial coupler set it once more to vertical. Tune to a station on the two dials. Now turn the anode-coupler knob to the left (anti-clockwise). Retune on the anode-tuning condenser. Signals will be weaker but selectivity has been improved. If you turn the anode coupler more to the right the signals will get louder still, but "spread" will increase.

The anode coupler thus works exactly in the same way as the aerial coupler, but there is an additional effect to be noted. Turning the anode coupler to the right increases the inherent reaction effects in the set, and it may oscillate. This is only likely in the far right position of the knob.

The user need not be at all concerned (unless he has altered my design of the set). Turning the anode coupler to the left a little will immediately stop oscillation. Another method, if the set oscillates, is to set the anode coupler full right and reduce the capacity of the range-adjuster preset until oscillation stops.

Now try the following reaction experiments. Set the aerial and anode couplers to a low value (to the left of vertical), so that your signal is weak, but properly tuned on the two dials. Now apply anode reaction, moving the anode-reaction knob clockwise (to the right) a little at a time, retuning slightly on the anode tuning condenser as is always done on reaction circuits. All this is perfectly normal, and within the experience of nearly every wireless user.

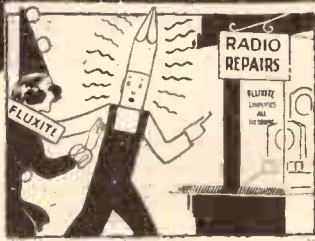
Testing Double Reaction

Now for the aerial reaction control. Leaving all the other knobs where they were, turn the anode-reaction knob to zero (full left). Bring up the aerial reaction a very little, by turning the aerial-reaction knob slightly to the right. Retune the aerial-tuning condenser slightly.

Signals will be louder and selectivity on the aerial-tuning condenser will be much greater. Increase reaction right up to the point where oscillation begins and note how delightfully smooth and effective it is. This reaction control is just as easy to adjust as ordinary reaction.

Now to test the double reaction—the second great thrill the "S.T.500" offers—

(Continued on next page.)



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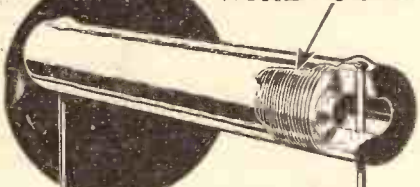
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OPERATING YOUR S.T.500

(Continued from previous page.)

the first being the colossal volume and superb quality of music and speech.

Great selectivity is our aim. Set both reaction controls to zero. Set the anode coupler to about 10 o'clock as it were, i.e. a little way off the zero position. Set the aerial coupler to about 9.30 o'clock, i.e. nearly full over to the left and therefore at a small value.

Now tune in to a station on the two main dials. It is useless to use double reaction if the signals are loud. You must weaken them by turning the aerial and anode couplers until signals are tuned in on the dials but weak. There may be interference at this stage, but that is what we are going to remove. Apply some anode reaction, re-tuning slightly on the anode circuit. Apply aerial reaction, re-tuning slightly, as usual, on the aerial tuning condenser. Signals will now be full loudspeaker strength and all interference will have disappeared.

Tests on Long Waves.

For daylight reception and when double reaction is principally for increasing signal strength, much greater values of aerial and anode coupling may be used.

During any of the tests, the tone control may be tried, and it will singe off heterodyne whistles which may be experienced on some stations.

Now try the tests on the long waves by pushing in both wave-change switches. All the merits of the controls will be repeated. Those readers who have built the "S.T.300" or "S.T.400" will find that owing to its greater capacity the normal position of the aerial coupler will be more to the left than in the other sets.

In succeeding issues of POPULAR WIRELESS I will deal fully with both simple and de-luxe methods of operating the set. The actual handling is delightfully and perhaps surprisingly simple. And the results will justify the methods up to the hilt.

J. S. T.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

Automatic Volume Control.

THOSE of you who were able to visit this year's exhibitions must have been struck with the number and variety of improvements which have been made to date, and not the least of these must be counted automatic volume control, quiescent push-pull and Class B amplification. We have heard a lot about these during recent months, but at these shows you saw them really in full swing for the first time.

There is no doubt that automatic volume control is an immense advantage, because not only does it get over one of the principal difficulties in tuning in distant or weak stations and the disconcerting effects of fading, but also it removes that sudden

(Continued on next page.)

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TECHNICAL NOTES

(Continued from previous page.)

jump in volume which you so often get on tuning in.

As most of my readers know, automatic volume control depends in principle on making the high-frequency amplifying part of the set vary in its amplifying power according to the strength of the incoming signals; if the signal is strong the amplification is correspondingly reduced, whilst, vice versa, if the signal is weak the amplification is increased. You will see from this why it is called *automatic* volume control, because it automatically varies according to the strength of the signal.

Applicable To Superhets.

There is just one point which I should like to mention, however, as I think that on this particular point there is a certain amount of misapprehension. Some people think that automatic volume control is applicable to—or, at any rate, useful with—any type of set; but you will see from what I have just said that it is really more particularly intended for use with a very sensitive and powerful set where there is plenty of volume available. In actual

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I want to urge you, one and all, to waste no time in carrying out the simple instructions, clearly set out on another page, for acquiring the "Manual of Modern Radio." Fill in the coupon now. And tell your friends about this great offer. . . . an offer which, without exaggeration, may be said to be unique in the history of radio journalism.

THE EDITOR.

practice it is most useful with a superhet receiver or with a receiver of the ordinary type which has at least two stages of high-frequency amplification.

As regards the actual principle of the automatic volume control, I think I mentioned this in these Notes some time ago; but as I have had a number of queries on this point it may be as well to refer to it now.

How It Works.

The essence of the whole thing is the multi-mu valve, the amplification of this valve being reduced if the grid-bias voltage is increased, and, of course, vice versa. By the same token the amplification of the valve reaches its maximum value when the grid bias is reduced to zero. If a strong signal comes in, this increases the current in the detector circuit, and this current is then used to produce a grid-bias voltage for the multi-mu valve. You may wonder how the current can be made to produce a voltage, but if you just cast your

mind back to Ohm's Law you will realise that the way to make a current produce a voltage is to pass the current through a resistance, when you will get a voltage at the ends of the resistance.

Noises Between Stations.

Before leaving the subject of automatic volume control I should say something about what is sometimes called quiet A.V.C. because the automatic volume control operated on the simple principle mentioned above has one particular disadvantage in that it is not quiet between the stations. If you think about it for a moment you will see, (if you have not, in fact, actually experienced it with A.V.C.) that if the set is not tuned to any particular station you will get the full amplification, and so all kinds of background noises will be greatly amplified. This shows itself in practice by a considerable volume of "noises between stations." The same sort of thing occurs on fading signals because the automatic volume control operates in a way to keep the signal at a fairly constant volume level, but in doing so it throws up the background noises sometimes into much greater prominence.

Quiet A.V.C.

For instance, if the background noise is reasonably constant in actual volume and the wanted signal falls to a low value, then the amplification automatically jumps up, bringing the signal back to the required level, but at the same time pushing up the background noise to a much greater volume. If the signal becomes strong and the amplification goes down, the background noise goes down, too. The result of all this is that you get a kind of "surging" of background noise which sometimes becomes extremely unpleasant.

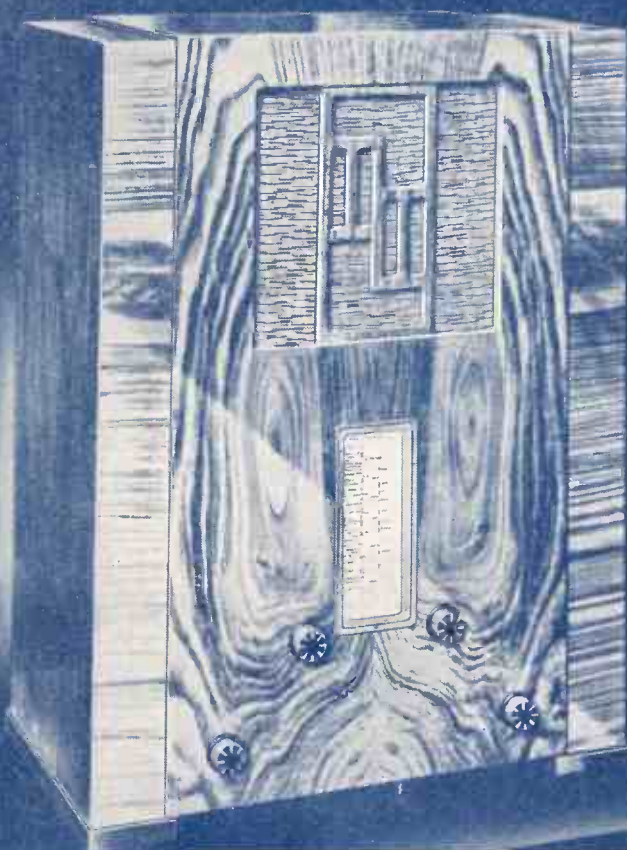
In order to get over all this, quiet automatic volume control was brought in, whereby the circuit does not respond to very weak signals at all. This means that if we choose a minimum signal volume which is greater than the average background noise we can largely eliminate the latter.

Two Effective Methods.

One method of obtaining quiet automatic volume control is to use a pair of biasing resistances connected in the cathode lead of the multi-mu valve. One of these resistances is of variable and is used as a volume control the ordinary type; the other resistance is a fixed one and serves the function of what is sometimes called a "noise suppressor." This fixed resistance is short-circuited by means of a switch, and if the switch is opened so that the noise suppressor is in circuit the grid bias applied to the valve will be fairly large. In these conditions the circuit will not respond to very weak signals, and this is the condition of the circuit when tuning for a station. When, however, the station has been tuned in, the switch can be closed, thereby short-circuiting the noise suppressor resistance and so increasing the volume.

Another quiet A.V.C. system employs an arrangement operating on the low-frequency amplifier and a double-diode detector.

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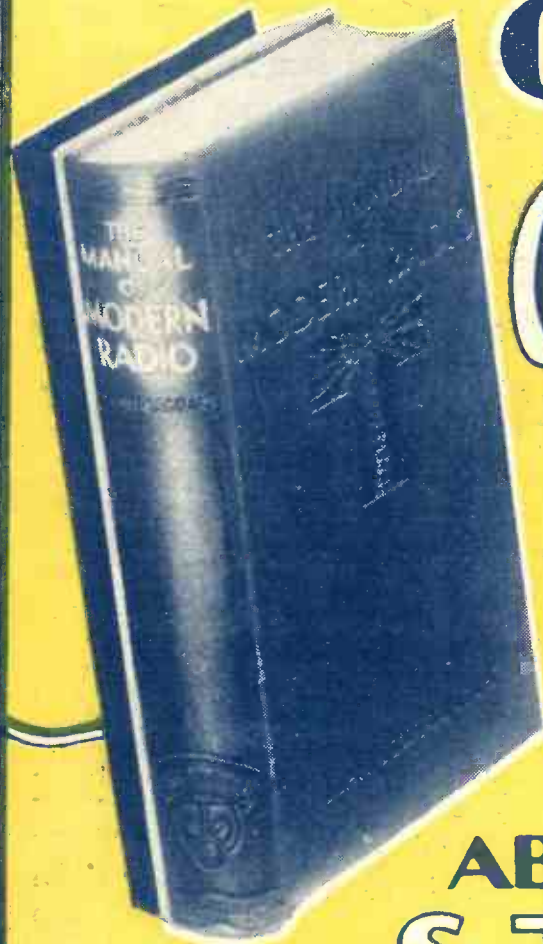
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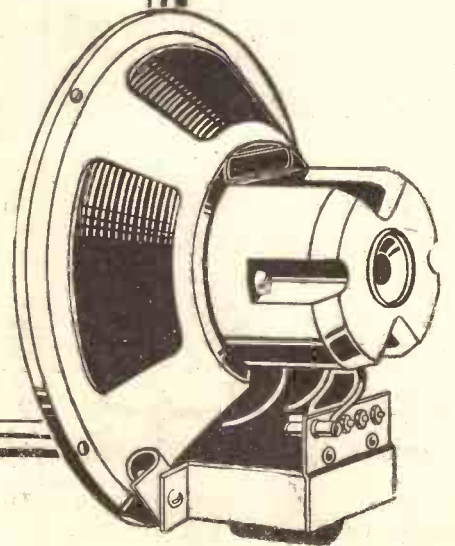
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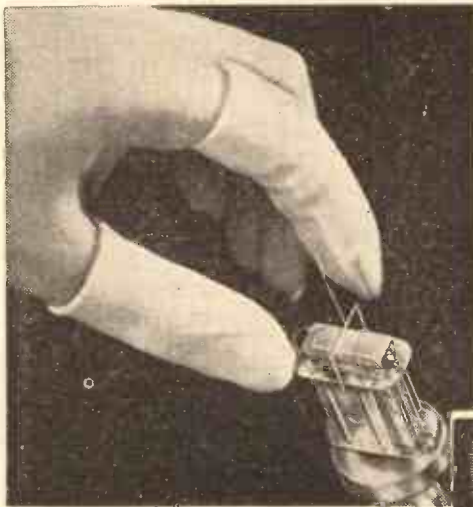
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If you could watch Cossor Valves being made you would be surprised to see every one of the hundreds of girls engaged in assembly wearing thumb- and finger-stalls.

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POPULAR WIRELESS

THE FIRST AND FOREMOST RADIO WEEKLY FOR THE CONSTRUCTOR & AMATEUR EXPERIMENTER

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 Technical Editor: C. V. DOWDING, Associate I.E.E.
 Assistant Editor: P. ROBERT BIRD.

Managing Editor:
 N. F. EDWARDS.

Chief Radio Consultant: P. P. ECKERSLEY.
 Assistant Editor: A. JOHNSON-RANDALL.
 Chief of Research Dept.: K. D. ROGERS.

FACTS AND FIGURES

"TOO BAD"
 THE RADIO TRAIN
 TWO-VALVE "SUPERS"

RADIO NOTES & NEWS

BATTERIES WANTED
 FOR THE MAIDS
 THE CRYSTAL AGAIN
 IN THE NORTH

Paderewski Likely to "Go Radio."

ONE of the few giants of art who have hitherto given the microphone a wide berth, Paderewski, the beloved pianist, has apparently realised that he has a duty to that part of humanity who cannot attend his concerts in person.

I understand that he may consent to broadcast in America this year, though he stipulates that he shall be "put on the air" only for the last half-hour of one-hour concerts given in public."

And We Let 'Em Do It!

DURING 1932 America sold to our very own Empire radio goods as per schedule which follows. In the words of Socrates, "How come?"

Transmitting sets and parts: To Canada, \$85,000. Receiving valves: To the United Kingdom, \$93,000; to Australia and New Zealand, \$551,000. Receivers: U.K., \$370,000; Canada, \$110,000; New Zealand, \$290,000; S. Africa, \$450,000. Receiver components: To Canada, \$770,000.

Every cent of that trade should have been booked by manufacturers in the British Commonwealth! What's wrong? After all, Americans don't produce goods at sweated wages or for nothing and a half per hour, like the Japs.

Short Waves.

IT is my colleague, W. L. S., who really merits the gratitude which Mr. Arthur E. Bear heaps upon us for our efforts to popularise work on the short waves.

I do a little now and then by dropping a word or two about the International Short-Wave Club (European representative, Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16), but W. L. S. does the real spade work. So to W. L. S. be the honour and glory.

Beyond doubt the short wave is the wave of the future; even now it is the wave of the radio explorer and adventurer. So build a "P.W." short-waver, and then write to Mr. Bear for small handbills of further particulars.

Light Interlude.

THERE is a news director of one of the American broadcasting chains who chafes under the restrictions of the Federal Radio Commission. They stand

OUR £1-1-0 BOOK YOUR LAST CHANCE TO SECURE S.-T.'s "MANUAL OF MODERN RADIO"

Spare a moment to read these words before you become absorbed in the further details given in this issue of the "S.T.500."

If Shakespeare had been Editor of "Popular Wireless" (fantastic thought!) he would doubtless have started this editorial with: "Friends, Romans, Countrymen, lend me your ears"; but I prefer to put it this way: "P.W. Readers, Pay Attention, lest you live to weep in vain regret."

THIS ISSUE OFFERS YOU YOUR LAST CHANCE TO SECURE "THE MANUAL OF MODERN RADIO."

I need not repeat here the very simple rules you have to comply with in order to become the owner of the most important book on radio reception ever published. The veriest tyro—I mean the newcomer to the hobby of radio who does not know the right end of a valve from the back of a bus—will be able to read this book with enjoyment and profit; and he will find, when he reaches the last chapter, that "The Manual of Modern Radio" has taught him more about radio than he would have believed it possible to acquire after reading a dozen other books on the subject.

Turn to page 327 and fill in your reservation form NOW.

Our offer of John Scott-Taggart's latest and greatest work is a bargain of a lifetime. Seize your opportunity, and before Christmas the book will be yours. But remember, THIS IS YOUR LAST CHANCE.

So don't write to me next week and grumble at having lost your chance. You have been warned!

THE EDITOR.

between him and the snappiest broadcast ever "put over" to the thrill-thirsty American public. They are cramping his style. What is this all about? Well, when questioned he said: "I got a guy who wants to commit suicide in front of a microphone. Would that be a broadcast? It would be sensational. But they won't let him do it." It's scandalous that a mere Commission should thus paralyse Art.

A Radio Ruse.

A RECENT news item from China states that the Japanese army is experimenting with a radio-controlled train. The idea is that this train will be sent on ahead of another, which will be bursting with soldiers, guns, etc., so that while the Chinese bandits are trying to loot an empty train a very full one will arrive without notice and will knock seven bells out of them.

Clever, but is it done? Should an honourable Jap radio man stoop to such a trick, wearing his old school tie and all?

A Spot of Prophecy.

MR. CARLETON DYER, in a speech last month, gave his opinion that the key to the future development of receivers is the valve. He expects to see a two-valve superhet with A.V.C. in about two years, and receivers no bigger than cigar-boxes with separate L.S. units.

As to television, he said that the receiver is now in a commercial, practical stage, but that the real difficulty will be the high cost of the transmitters and the clearing of television channels on the medium wave-band.

S.-W. Transmission.

DO you realise what a world of communications is tucked away in the amateur band? There are hundreds and hundreds of amateur transmitters all over the world in daily communication. America probably has most, and more freedom for them! But I'll admit that the U.S.A. amateurs deserve well of their Government because, on occasions of national importance, they really do come into snappy action and do vitally useful work.

(Continued on page 368.)



S.T. 500-

JOIN THE THOUSANDS

Although the "S.T. 500" has been out only a day or two at the time of writing, we of "Popular Wireless" have received such amazing testimony of the public's practical interest in the set that we take this opportunity of congratulating Mr. John Scott-Taggart on a great personal triumph.

Thousands are flocking to their dealers or buying direct. We are inundated with keen, interested enquiries about the set. Last week's issue of "Popular Wireless" was snapped up the moment it appeared.

Never have we at Tallis House known such—

BEFORE saying anything further about the "S.T. 500" I wish to thank all readers who have decided to build the receiver. Even at this early stage it is overwhelmingly obvious that my third National set for International reception has proved acceptable.

I cannot conceal the very deep appreciation which I feel towards those who have acted immediately, and thereby shown their trust in the receiver and their faith in me.

Let me urge those who are on the threshold of building this set to make the decision early. Christmas will soon be here, and before then there will be weeks of wireless enjoyment before you, of a kind which I believe many have no inkling.

Here is Your Set.

As far as I am concerned, this is the only set of its kind which I shall design for twelve months, and if you desire enormous volume and perfect quality, selectivity of a very high order and certainty of results, then I believe that here is your set.

I think that any attempt to hustle a reader into building a receiver is the greatest mistake that can be made. I want you to build it purely and simply on its own technical merit and without regard to any other consideration whatsoever.

I have outlined the major technical points in connection with the "S.T. 500," but I desire this week to deal with the set once more and in greater detail as regards certain aspects of policy and technique.

The fact that my receivers are frequently built as long as twelve months after they are first published is evidence of their

ability to withstand the competition of more recent receivers and the ravages of interference. Curiously enough, a fact which, on the one hand, is a compliment, but, on the other, an unpleasant aspect is that older sets of my design are persistently built, even though a new and better circuit is placed before the public by myself.

Eleven Exclusive Features none of which is found in any other designer's sets.

- ★ DOUBLE REACTION
- ★ FULL-RANGE SELECTIVITY ON BOTH CIRCUITS
- ★ BALANCED-PHASE AERIAL REACTION
- ★ LOW-CAPACITY GRID CONDENSER
- ★ EXCLUSIVE COIL DESIGN
- ★ SPECIAL TONE CONTROLS
- ★ PERFECTED CLASS B
- ★ SELECTIVITY RANGE ADJUSTER
- ★ PROGRESSIVELY ADJUSTABLE SELECTIVITY
- ★ DIFFERENTIAL ANODE COUPLING
- ★ LARGE-CAPACITY AERIAL COUPLER

Obviously these sets are being built as a result of personal recommendations by those who already have one of my receivers, and there is thus the desire to have exactly the same results as those obtained on a neighbour's set.

If you do not build this set to-day, or next week, or next month, it will still, I

believe, be the set you will turn to in the end.

I am addressing now a public of about a quarter of a million, and it is fair to assume that this includes the keenest enthusiasts and the most cautious sceptics. Many of the former will act at once and take steps to have the receiver working in the shortest possible time. But others prefer to "wait and see."

Enterprise versus Caution.

What they are waiting for it is rather difficult to say. Probably the verdict of their friends who have acted with greater enterprise. I have no fault to find with caution in the choice of a set to build. I expect you to exercise caution before building my own and only to act after mature consideration.

The great trouble about home construction in the past has been that sets have been built in the heat of misplaced enthusiasm, and the results have been a cold douche. Indiscriminate set-building has been the curse of home construction. The manufacturers of parts have benefited from it, but I very much doubt whether, in the long run, such an attitude of the public pays the industry.

A month before the "S.T. 500" was completed I was chatting with a manufacturer who said: "Things are not what they used

"We of Tallis House Congratulate Mr. John

A GIGANTIC SUCCESS!

WHO ARE BUILDING IT

—general excitement and keenness about a new design. The "S.T.500" is obviously destined to break all the designer's own records—and these have never been even approached in recent years.

In obtaining the exclusive right of the "S.T.500" we interrupted a very long tradition of producing all our star sets in our own excellent laboratories.

But the "S.T.500" is an immensely successful exception. It offers a unique opportunity to readers and a bargain which may never be repeated. We urge you to build it. And now its inventor has something more to say to you about it.—The Editor.

to be. It is not so long ago that the public would build thousands of sets from any design that was published. Now they are getting fussy and particular. Instead of building sets without regard to the name of the designer, they now follow a group rapidly dwindling in numbers but increasing in influence."

He spoke regretfully as of palmy days that were no more and of golden harvests which would never be reaped again.

This particular manufacturer made components of indifferent quality. He was feeling the pinch of a more educated wireless public. He regretted that it should be in the power of a well-known designer to ensure that the quality of the apparatus the public received was of a standard which would do credit to the designer's circuit.

In the Public's Interest.

Fortunately he was an exception. The economic troubles of the last two or three years have eliminated most of the second-rate firms, and the successful ones welcome a designer who places the public first and foremost.

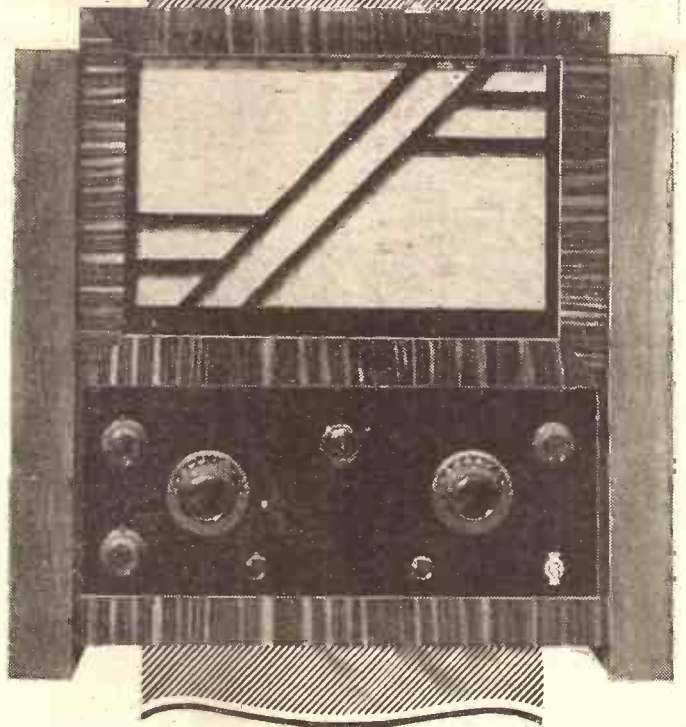
I myself am not in this industry as a representative of manufacturing interests, but of the public, and of the public alone. Every one of my sets is so plainly a set designed with both eyes on the public. There are very many who have built former

sets of mine who will want to build the "S.T.500." These will notice the unobtrusive way in which I have saved them a large sum of money and a considerable amount of trouble.

In the first place, I have not changed the coils which I specially designed for the "S.T.400." These, in turn, were—as regards the anode coil—the same as in the "S.T.300," and, as regards the aerial coil, only a simple modification consisting of the addition of an aerial-reaction coil is necessary.

In these days of multitudinous coils it would please the manufacturers much better if each of my sets had special coils. But I decline to encourage the public who do me the honour of following my designs to expend money unnecessarily when apparatus previously used in one of my sets will serve as well.

Although, when ordering the coils for the "S.T.500," you will call them "S.T.500" or "S.T.400" coils, the two types are identical. In the case of the Colvern coils



the numbering is now altered to "S.T.500," but other manufacturers, I notice, are calling them "S.T.400," which is perfectly in order. The fact is that I designed these coils myself not so much for an individual set, but for fulfilling certain technical requirements which might be found necessary in any set.

Saving Constructors' Money.

For a constructor to be able to use the same coils in several of my sets is some indication of my attitude towards the public and of my sincere desire to save them money. Perhaps that is why I resent so bitterly the purchase of inferior apparatus.

If you go through my list of components

.....
Scott-Taggart on a Great Personal Triumph"—The Editor
.....

" S.T. 500 "

(Continued from previous page.)

actually used in the set I doubt whether you will be able to save anything by substituting any other approved apparatus. I know perfectly well that immediately one of my sets is announced and details of com-

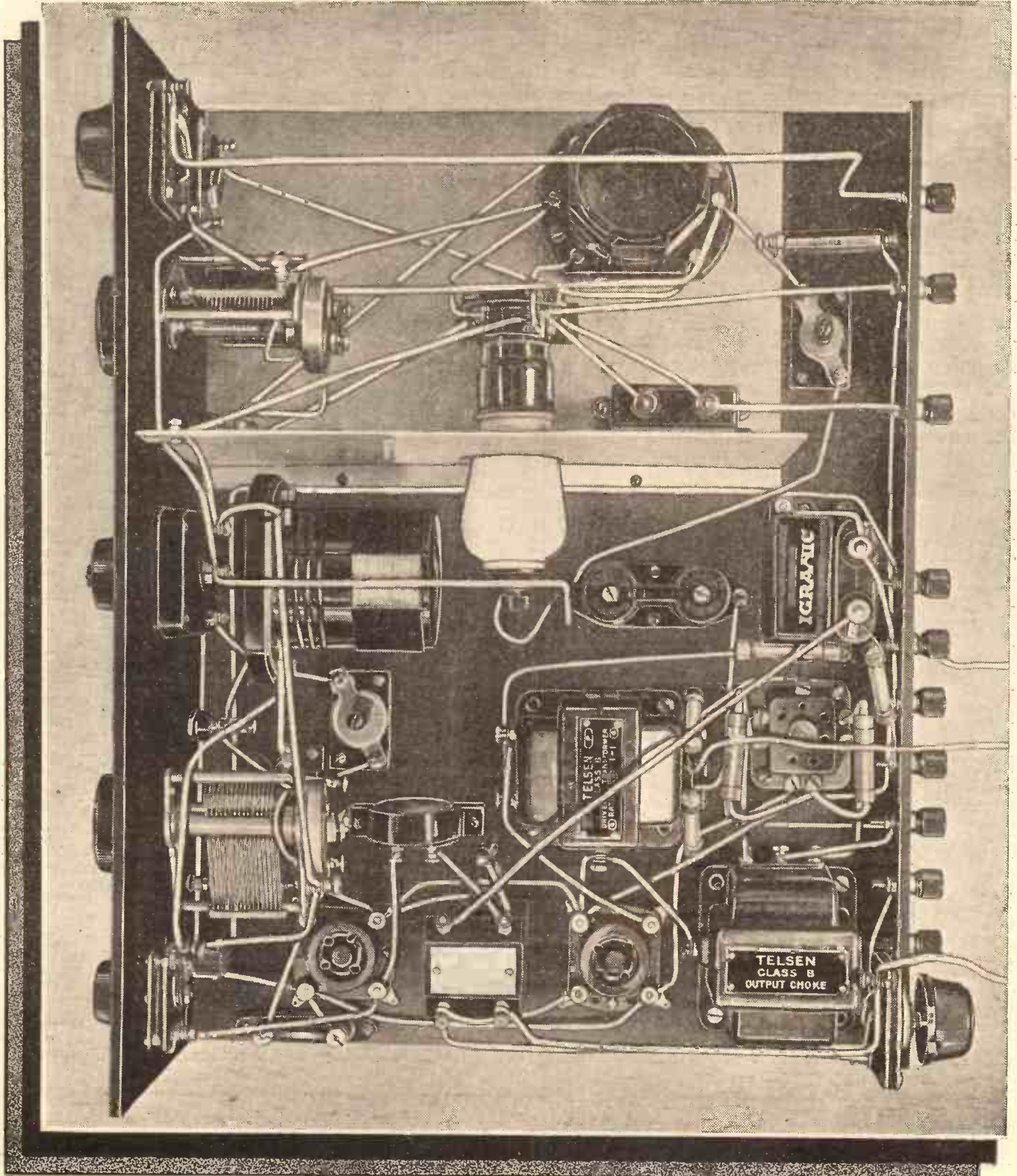
ponents are published there is a rush on the part of obscure and unreliable firms to "cash-in" on my reputation as a designer.

They believe that by associating themselves with a highly popular set, and a designer in whom the public have confidence they are adding prestige to apparatus which would never stand on its own legs or sell on its own merits.

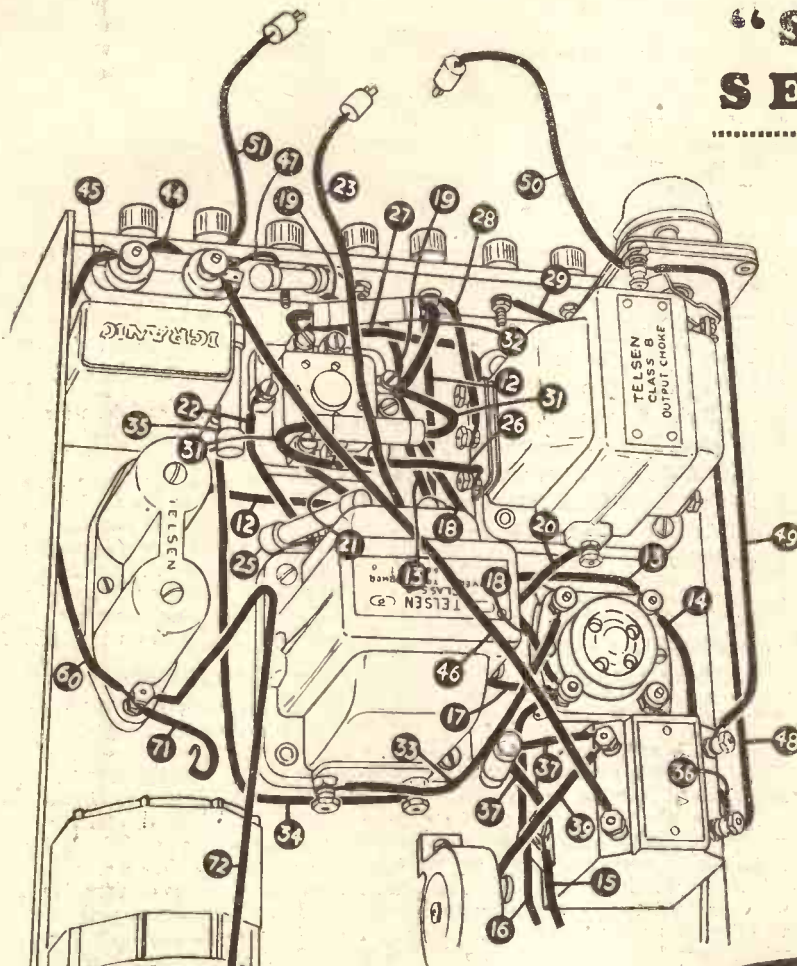
They "advise" this or that for the "S.T.500," and even go to unscrupulous

lengths at times to imply or suggest that I have approved apparatus the very existence of which I deplore.

To-day—yes, this very day—you will find some shop in your district displaying parts, or perhaps even a complete set, which I know (and who should know better?) will exasperate and disappoint some poor fellow who, in perfect good faith, believes that he is obtaining apparatus for the "S.T.500." But is he such a poor



"S.T.500"—YOUR SET FOR 1934



All these numbers correspond with those on the blueprint which was presented you last week.

which I had deliberately excluded from my list of alternatives, and the preset condensers were also of a certain manufacture which prevented a sufficiently low minimum capacity being obtained and which had therefore been rejected by me on that score.

I went back to my hotel and nearly cried myself to sleep. I knew some member of the public would buy that set, which I admit was a little cheaper than my own original one, and that the results obtained would be greatly inferior.

Manufacturers' Magnificent response.

One manufacturer's coils which I rejected were obviously wrong without a test, and when I spoke to the makers they replied: "Oh, we thought the reaction coils on both were the same." As a matter of fact, although the "S.T.500" aerial and anode coils have each three windings, no two are similar.

Incidentally, the sale of spurious coils for the "S.T.500" is not likely to be very profitable. Knowing the danger of bad results through unapproved coils, I urged the various manufacturers to keep their prices as low as possible. They have certainly responded magnificently in this direction, and the margin of profit must be extremely small.

To be able to buy a pair of tested

fellow, after all? If I have warned him with all the vigour and sincerity that I possess, must he not accept the full responsibility himself?

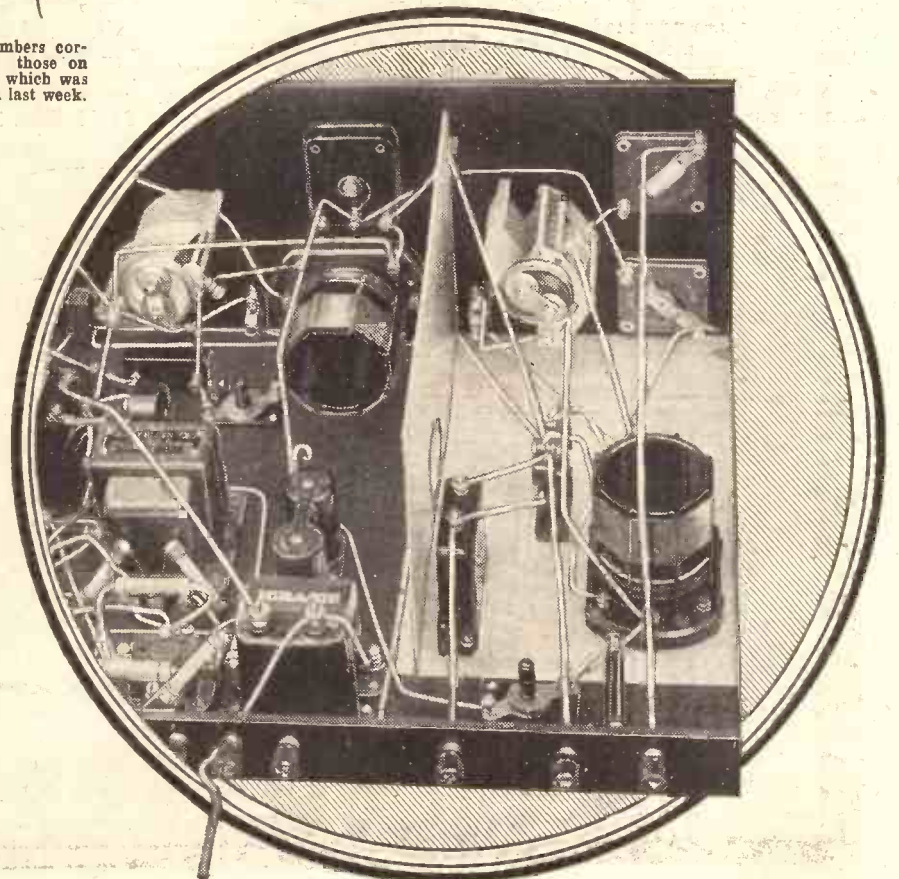
If he reads these words, and then accepts unapproved substitutes, surely the fault is wholly his own, and he must bear the consequences. The most astonishing thing, however, is that frequently these substituted parts will give quite good results.

I remember calling (during my wireless tour of Great Britain last year) at the house of a man who had built the "S.T.300" and was delighted with it. I knew at once, on switching on the set, that, although the results were good, they were nothing like those which my original set would have given. Here, then, was a man who was ignorant of the full performance of the receiver.

An Observed Case.

There are, however, many worse cases. I was in Nottingham some time ago, and saw a receiver of the "S.T.400" type in the window of a wireless shop there. The coils were of some wholly unknown type, the aerial coil was quite obviously an anode coil, while the anode coil in the set was clearly an aerial coil wrongly labelled.

The L.F. transformer was of a type



DISTANCE *with*

"S.T.500" coils by the leading manufacturers in the industry for 8s. per pair is something unheard of. The reason for the public's ability to obtain such components at so low a price is partly because the coils are already standard, having been developed by me for a previous set, and partly because of the huge number which will be manufactured and sold, and which, in fact, are to-day being sold in huge quantities. The manufacturers tell me that on no other set can they possibly afford to produce coils at so low a price.

There is a point in connection with coils which I can easily deal with here. Some designers feel that a new coil should be used in a set in order to give it an appearance of modernity and freshness. This is pulling wool over the eyes of the public.

Five Thousand Per Cent Better!

The coil that is different is not necessarily a coil that is better. In fact, the chances are that a new coil, while gaining in certain directions, may lose in others. I think this process is exemplified by some makes of iron-core coils.

Owing to the improved performance obtainable by the use of an iron core, the old fetish of compact size is once more rampant. The result is that the coils, while more efficient size for size than the air-core coils, are now made so small that all the technical merits of a large coil are lost. We have thus a very small coil which is no more efficient, or little more efficient, than a much larger air-core coil. The

"S.T.500" as RADIOGRAM

The glorious tone and full, rich volume which Perfected Class B gives to the "S.T.500" is equally obtainable from gramophone records. Mr. Scott-Taggart will shortly give full, simple details of how to add a radiogram switch. Meanwhile, build the set as it is and enjoy "distance with enchantment."

"S.T.500" coils are generously dimensioned, and there was no reason why they should be of the air-core type.

I have already indicated that for a moment I was tempted by the novelty and technical interest attaching to iron-core coils. I wondered whether the public would regard a set not using such coils as being just a little behind the times. I might have fallen in with this public view if the results obtainable with iron-core coils had been at least equal to those obtained with the "S.T.500" coils.

There was, however, no comparison at all. The use of Balanced-Phase Double Reaction

is so vastly superior to any results obtainable with iron-core coils that there was no moment of hesitation as to what arrangement I should employ.

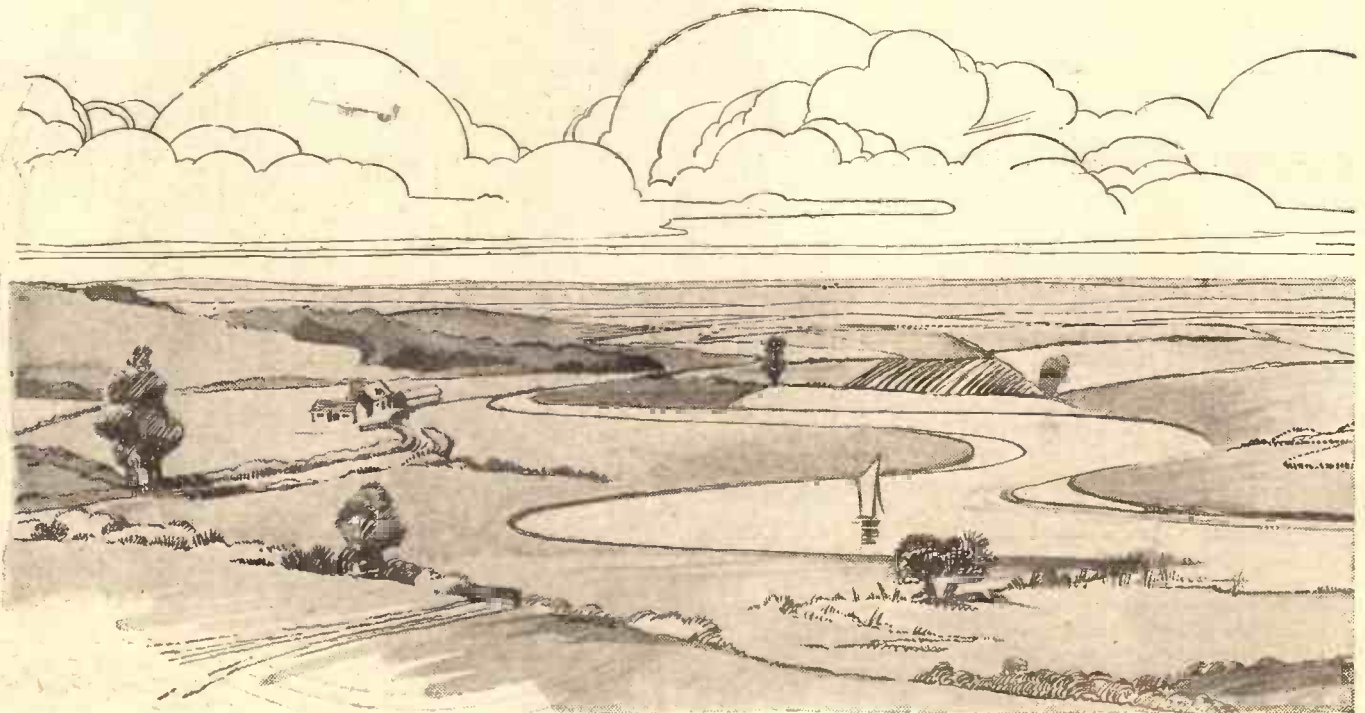
The aerial coils with the special reaction employed in the set gave results which unquestionably were at least 5,000 per cent better than the best iron-core coil available to-day.

This is a tremendous increase, and the five thousand should be spelt out by the printer so that no reader should imagine that an additional nought has been added. Actually, the figure is very much higher, but it is difficult to measure the enormous amplification of an extremely weak signal. The obvious way to convince one's self is to try the system on the "S.T.500" itself.

Size of Aerial Coupler.

I have been asked already why I have used a .0005-mfd. aerial coupler, whereas I used a .00004-mfd. coupler in the case of my two previous National sets. Possibly I did not explain myself sufficiently clearly in the last issue, or else my correspondents had been so overwhelmed by the number of words published last week that they had failed to find the explanation in the article!

Let me make the position clear, because it is an extremely important one. On the "S.T.300" the aerial circuit selectivity was dependent solely upon the size of the aerial coupler. The aerial and earth system of the wireless receiver places a heavy load upon the first circuit of the set, and this results in very poor selectivity unless some



ENCHANTMENT

means is adopted of preventing the full effect of the load being placed on the aerial circuit.

My British patent 232659 of November 1st, 1923, covered the use of a small condenser in series with the aerial for the purpose of separating it electrically to some extent from a tuned aerial circuit. This arrangement has been adopted by the B.B.C. for many years as their recommendation for obtaining greater selectivity. I more recently developed improvements on the simple arrangement of ten years ago so as to enable variable selectivity to be obtained by the user of the set.

Benefiting Both Ways.

This was done by placing the control of the aerial coupler actually on the panel of the set so that different degrees of selectivity could be obtained at will at different times of the day and on different portions of the dial, according to the amount of interference experienced. This itself was an important innovation, but the size of the condenser as regards its maximum value was limited by the amount of interference to be expected.

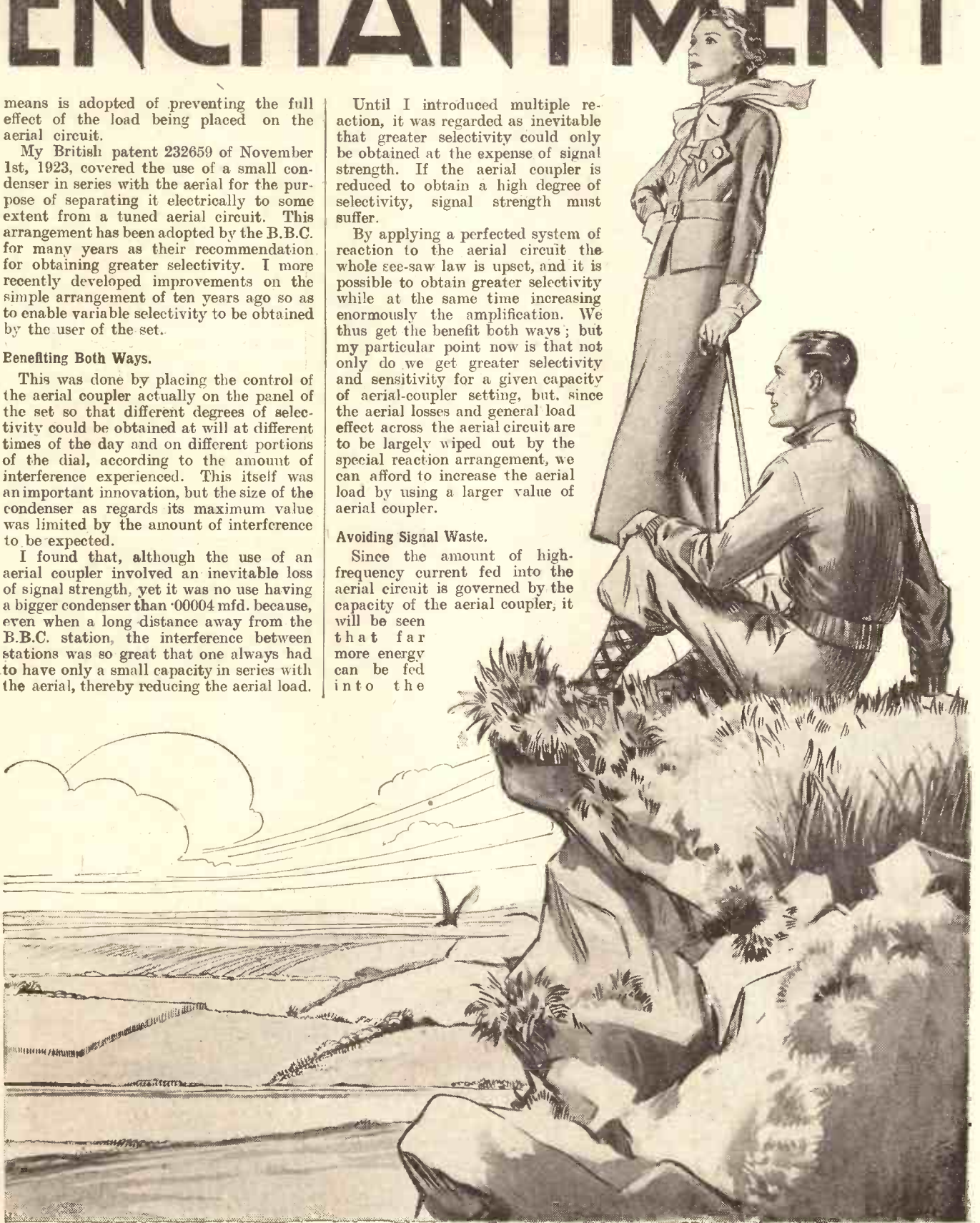
I found that, although the use of an aerial coupler involved an inevitable loss of signal strength, yet it was no use having a bigger condenser than .00004 mfd. because, even when a long distance away from the B.B.C. station, the interference between stations was so great that one always had to have only a small capacity in series with the aerial, thereby reducing the aerial load.

Until I introduced multiple reaction, it was regarded as inevitable that greater selectivity could only be obtained at the expense of signal strength. If the aerial coupler is reduced to obtain a high degree of selectivity, signal strength must suffer.

By applying a perfected system of reaction to the aerial circuit the whole see-saw law is upset, and it is possible to obtain greater selectivity while at the same time increasing enormously the amplification. We thus get the benefit both ways; but my particular point now is that not only do we get greater selectivity and sensitivity for a given capacity of aerial-coupler setting, but, since the aerial losses and general load effect across the aerial circuit are to be largely wiped out by the special reaction arrangement, we can afford to increase the aerial load by using a larger value of aerial coupler.

Avoiding Signal Waste.

Since the amount of high-frequency current fed into the aerial circuit is governed by the capacity of the aerial coupler, it will be seen that far more energy can be fed into the



ALLEUROPE—

tuned aerial circuit than on any previous known arrangement. This is a matter of vital importance, because on all other sets, except my own "S.T.400," which uses a less perfected system of aerial reaction, a great proportion of the incoming signals is completely wasted. I am not putting the fact too strongly when I say that to obtain selective results on the aerial circuit as much as 80 per cent of the aerial current is wantonly wasted and prevented from energising the aerial circuit.

Startling Improvement.

I am not blaming designers. I have done exactly the same thing myself, although I have provided means for reducing the wastage when a full degree of selectivity was not desired, or was not necessary. The inexorable law as regards loss of signal strength when selectivity was to be obtained governs us all. But at last the "S.T.500" provides a means of feeding almost the whole of the aerial energy into the aerial circuit.

When the aerial coupler has a fixed value, the merits of this increase as wavelength increases. This is because the reactance of the aerial coupler increases with wavelength. The result is that the longer waves suffer most by having a smaller aerial coupler, and the increase to nearly ten times the size (which is accomplished in the "S.T.500") provides a startling improvement on the longer-wave stations.

To hear the aerial reactance overcoming the heavy aerial load is a delight to anyone who has been suffering for years the burden of aerial losses.

* * *

Amongst my early correspondence there

LA FRANCE



have been some letters from readers who ask whether aerial reaction is not likely to cause interference with neighbours. My retort is that there are certainly a couple of million receivers of the det. and 2 L.F. type which employ aerial reaction, and the "S.T.500" is no more likely to cause interference than these. In fact, it is less likely to do so, because the reaction is extraordinarily smooth and the chance of radiation is very much less. Moreover, the great reserves of selectivity and sensitivity on the "S.T.500" make it unlikely that the set will be worked "full-out" except on rare occasions. I have no fears at all on the score of radiation, and the set is actually far more stable than nine-tenths of the screen-grid sets built by constructors.

Keeping Input Within Bounds.

Although the aerial coupler has a maximum capacity of .0005 mfd., it will only be rarely that this maximum capacity will be used. If you are listening to, say, Radio-Paris or a medium-wave station during the daytime you may easily use a large value of the aerial coupler and perhaps no reaction at all; but under normal conditions the aerial coupler will probably be adjusted to a value corresponding to a position the knob nearly full left.

The aerial coupler serves as an input volume control on the high-frequency current and owing to the high magnification of the set as a whole it is important not to overload the circuit, because this will not result in any louder signals, but merely in distortion and very poor selectivity. It is, therefore, better to use too little rather than too much aerial coupler, especially where aerial reaction is employed.

You cannot, and obviously need not, obtain a greater output than 1,500 milliwatts (2,300 with 150 volts H.T.). The full output from the set is obtainable with a certain definite value of high-frequency input. If you increase this high-frequency input you exceed this value, and will not get any louder results, but you will have the disadvantages already described.

If you are unable to reduce the input sufficiently by reducing the aerial coupler to zero you will have to reduce the anode coupler also. Neither of these couplers will give absolute zero, and consequently a very strong local signal will come over even with these couplers at zero, although selectivity will be high.

I am now going to say a few words about



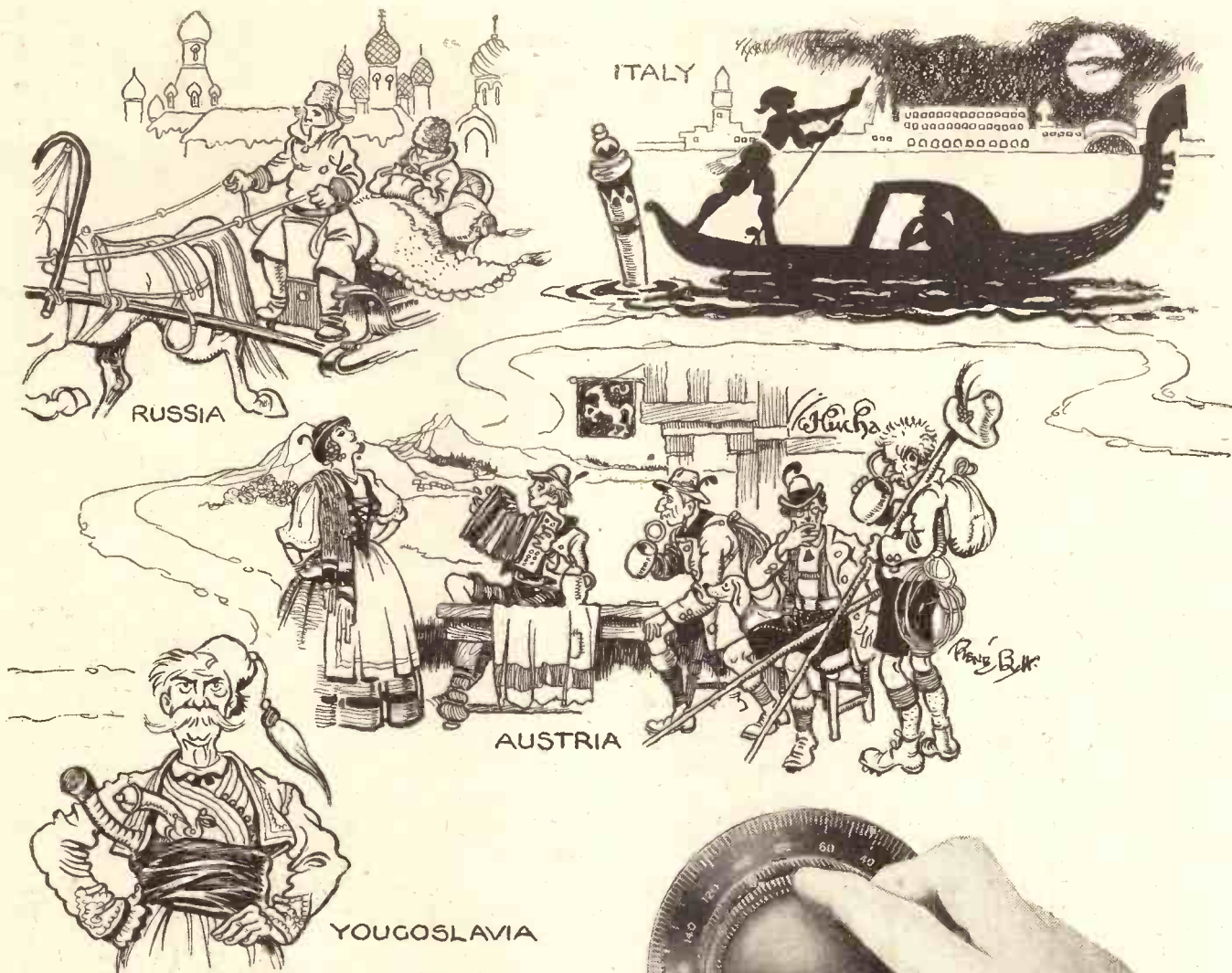
DENMARK



GERMANY



HOLLAND



- IS YOURS



the anode-coupler differential condenser. All differentials have a moving vanes terminal, and also two terminals connected respectively to the two sets of fixed vanes between which the moving vanes travel.

Different manufacturers arrange their terminals in different ways. The moving vanes terminal is always easy to identify because there is usually a pigtail connection to it, although one manufacturer has turned out a model in which the contact is of the rubbing type. As soon as I saw that the pattern had been altered, I stopped using this manufacturer's condensers, but I notice that this season he has reverted to the much more reliable pigtail connection.

Nevertheless, there will be many tens of thousands of various older patterns of differentials in use or in the shops. It is therefore not possible to guarantee that if you use a different differential for the anode coupler the knob will produce the same effect. The reason is that on the original "S.T.500" set, when the reaction knob is turned full left, the high-frequency current from the anode of the S.G. valve will to a large extent pass to the fixed plate

of the differential connected to the vertical screen.

You will find this wire marked 76 on page 292 of last week's POPULAR WIRELESS (dated October 21st). You will also notice that the other fixed terminal is connected by a wire 65 to the selectivity-range adjuster .0001-mfd. preset condenser. If you arrange your connections to the fixed vanes terminals so that, when the knob (looking from the front) is over to the left, the moving vanes are opposite the fixed vanes connected to the vertical screen, then you will obtain the same results as on the original set.

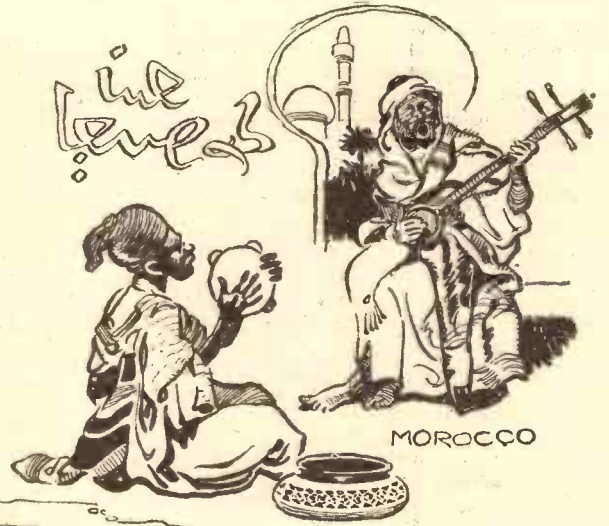
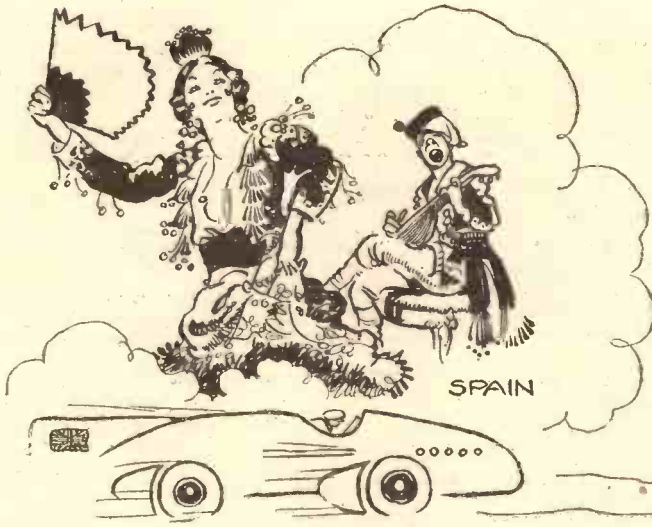
Connecting Differentials Correctly.

You might be able to do this by looking at the differential condenser, but it is often rather difficult to see in what position the moving vanes are in or even where the fixed vanes are placed. It is therefore desirable to try altering the connections of wires 74, 76, and also, be it noted, wire 73 from the coil.

It is very simple to find out whether you have connected the differentials the right

way round or not, because, when the anode coupler is full left, signals should be weakened; this test, of course, should be carried out with all reaction knobs at zero, i.e. full left. The anode-tuning condenser should be slightly retuned after turning the coupler to the left, so that you retain the stations you are receiving. If signals grow weaker when the differential anode coupler is turned to the left, then whatever differential you may be using is correctly connected.

If, however, signals became weaker when you turned the anode-coupler knob to the right (looking from the front), and after the



usual slight retuning of the anode-tuning condenser, then you have the connections to the fixed terminals the wrong way round and you should take off the wire 74 where it joins the terminal and connect it to the other fixed vanes terminal of the differential.

Needless to say, changes of connection of this kind should only be made with the H.T. battery disconnected. The wire 76 and the wire 73 should both be disconnected from the fixed vanes terminal, and both connected to the other fixed vanes terminal.

In making any alterations of this kind, see that no wire goes close to wire 52. This wire is perhaps the most important in the whole set, and when reversing connections keep any other wires at least $\frac{1}{4}$ in. away from it.

A still simpler alternative method, and one which I would prefer in most cases where possible, is to turn the differential anode coupler upside down, and then connect the wires mentioned to the fixed vanes terminals.

Direction of Reaction Control.

It is important to notice that these suggested alterations will not make the set work any better. The set will work just as well whichever way the fixed vanes terminals are connected, but the anode-coupler knob will have to be rotated in the opposite direction to that given in my various instructions. It is much simpler to have the anode and aerial couplers producing the same effect for a given direction of rotation.

If the reaction differential is of a different type than the one I use, its knob may, or may not, also have to be rotated to the left instead of the right to obtain more reaction.

Here, again, the operation of the set is not influenced in any way, but I think that reaction should be increased by turning the reaction knob clockwise, i.e. to the right. Probably a great many readers have experienced the reverse effect on other sets using differential reaction.

Some Simple Tests.

All you have to do is to take the connections 67 and 56 and reverse them to the two fixed terminals. Any alteration of the connections of wire should be so made that the wire clears the anode-tuning condenser by at least half an inch; the fact that the wire has to be bent will not matter.

Here are some simple tests to see whether you have your differential condensers the right way round:

(1) If you have used the exact models and makes of differential condensers in my set, and you have made the connections as illustrated in the various drawings, then the result will be correct.

(2) If you have used a different model of Telsen differential or a different make of differential for the anode coupler, you may have the connections reversed.

(3) If you have used the anode-reaction condenser specified, your anode reaction will be correct, and you can then proceed to put your anode differential coupler right. The way to do this is to set your anode-reaction condenser to zero, your aerial-reaction condenser to zero, and the anode coupler half-way.

Now tune in a station on the two dials. Turn the anode-coupler knob to the left and retune slowly on the anode-tuning condenser so as to keep the station. If

signals are now weaker your connections are correct. If they are stronger or the set oscillates, then your connections to the fixed vanes terminals on the anode coupler should be reversed.

(4) If both your differential condensers are different from those actually used in the set (as regards the Telsen, check whether the latest model is used), then carry out the following test: Turn the aerial-reaction knob full left; keep the aerial coupler about half-way; set the anode coupler half-way; set the selectivity-range adjuster at nearly minimum, i.e. undo the adjusting knob.

Tune in a station on the two main dials and then apply reaction by turning the reaction knob to the right, looking from the front. This reaction should improve signal strength if the anode-tuning condenser be suitably retuned. By increasing the reaction to the right you should be able to make the set oscillate. If, however, the set oscillates with the reaction knob fully to the left the reaction is working the

wrong way and you will have to reverse the connections of the fixed vanes terminals.
 (5) Having put the reaction right, set it to zero fully left. Tighten up the selectivity range adjuster to maximum capacity. Now

test the anode differential by moving it to the left. Retune the station slightly on the anode-tuning condenser. If the station is weaker the anode-differential condenser is correctly connected. If stronger or if the set oscillates, then your connections require reversing on the anode differential.

Preventing Confusion.

All this sounds rather complicated, but it actually is not so if you will follow out the instructions. Remember always that the set will work just as well whichever way round the connections may be, and that it is only to prevent confusion that the correct connections should be made.

* * *

A great feature of the "S.T. 500" is the perfected Class B which enables mains-set volume and richness of tone to be achieved.

"But," will cry a thousand listeners, "I don't want volume." Another thousand will say quietly: "My home is a modest one. There is no point in excessive noise; it would only irritate me."

Wireless designers, when they wish to "write down" to the wireless public, talk of "room strength."

I say there is no such thing as "room strength." I acknowledge no standard other than realism. A weak signal—one consistently weak—would not

be real to me. One may wish to "turn down" the power for a variety of excellent reasons, but a generous reserve of output is essential for realism.

It is a fact—and also a serious reflection on receiver design—that "turning down the wireless" results in most cases in better quality. Speech becomes more natural and music more "real."

Ask yourself this question: "Is the quality given by my set better when the volume is reduced?" If the answer is "Yes," you are admitting the failure of your set.

Nine-tenths of those who prefer their wireless sets on the quiet side do so, not because they like quietness, but because greater volume will expose and exaggerate every latent vice in the receiver and speaker.

Distortion Called Volume.

This is the unpalatable truth. Only hundreds will admit it and thousands do not even know it. All they know is that "loudness" is unpleasant. They hear Distortion and they call it Volume!

Is it surprising that loudness has become from the earliest days associated with "noise"? My dictionary defines "noise" as: (1) Loud outcry, clamour; din or disturbance; (2) evil report, scandal; (3) a loud or harsh sound of any kind; (4) a sound of any kind; (5) an agreeable or melodious sound. *How rare!*

It may be rare to hear a melodious noise, but it is the crucial test of a modern set. Look at a photograph through a magnifying glass and every imperfection will be thrown into relief. Is that any reason why one should go through life wearing not merely rose-tinted spectacles but smoked glasses?

Increasing the volume in the average set makes results worse to all but insensitive ears. Why? Simply because distortion is revealed or—more likely—is created. Overloading of the detector, L.F. or output valve occurs with resultant blurr, dither or definite blasting. The speaker, perhaps, reveals its defects, box resonances develop, spurious vibrations occur. "Turn it down! Please!"

A Revelation to the Listener.

It is "turned down," and all is well—or appears so. And one more listener is convinced that he or she likes signals at "reasonable room strength"!

The same listener will, later, turn on his gramophone and listen to perhaps the same music at a volume five times as loud as he like it on the wireless!



SWITZERLAND



SWEDEN



ALGIERS



POLAND

Balanced-Phase Double Reaction—

Why is a gramophone loud? Would a gramophone which played records at "room strength" sell? No. And in three years a wireless set giving "reasonable room strength" will, if anywhere, do so on the dust-heap.

Explanation: A modern gramophone gives much better quality reproduction at the higher sound levels than does the average constructor's set. Loud signals, if of perfect quality, can prove a revelation to the listener.

Really excessive volume—even if sufficient to vibrate the whole body—can be tolerated if the quality is flawless. One-fiftieth of that power can make one shriek even if there is only a small amount of distortion.

I ask you to follow my lead as regards the "S.T.500." The use of improved Class B, the design of the circuit, in fact the "S.T.500" as a whole, will bring to your fireside the thrill of realism.

Class B in the "S.T.500."

The reader will have to choose which of several courses he follows as regards Class B. There are various combinations of driver valve and transformer ratios. This information is obtainable from the Class B transformer manufacturers.

As regards the driver, the choice is between a small-power valve or an L.F. type of valve. The small-power valve (L.P.2) takes more current and costs 1s. 9d. more than

the L.21. The power output of the small-power valve is about twice that of the L.21. Quality is also considerably better.

As regards the overall results, you will get half as much again out of your Class B valve if you use the small-power valve L.P.2. The maximum you can get with H.T. up to 150 volts is 1,500 milliwatts with the L.21 as against 2,300 milliwatts with the L.P.2 which I advise.

On the score of sensitivity, power output and quality I very definitely prefer the L.P.2 and B.21 combination. Nevertheless, I feel that many of the public will lean towards the L.21. And they will be wrong.

There will be lots of temptations to use apparatus different from what I advise. But if you fall for it you must accept the responsibility.

I give you alternative choices, but reluctantly. You are probably not in a position to experiment with all sorts of combinations as I have done. I have no intention of throwing the responsibility on your shoulders and leaving you stranded at a cross-road, uncertain which of several apparently attractive roads to follow. I definitely tell you what I think is best. In this case I prefer the L.P.2. The H.T. current (since considerable negative bias is employed) is 2.5 milliamp as against 1.7 milliamp—a saving of only three-quarters of a milli-ampere; the extra 1s. 9d. in price is well worth while, and most readers will have a small-power output valve already.

The Need for Selectivity.

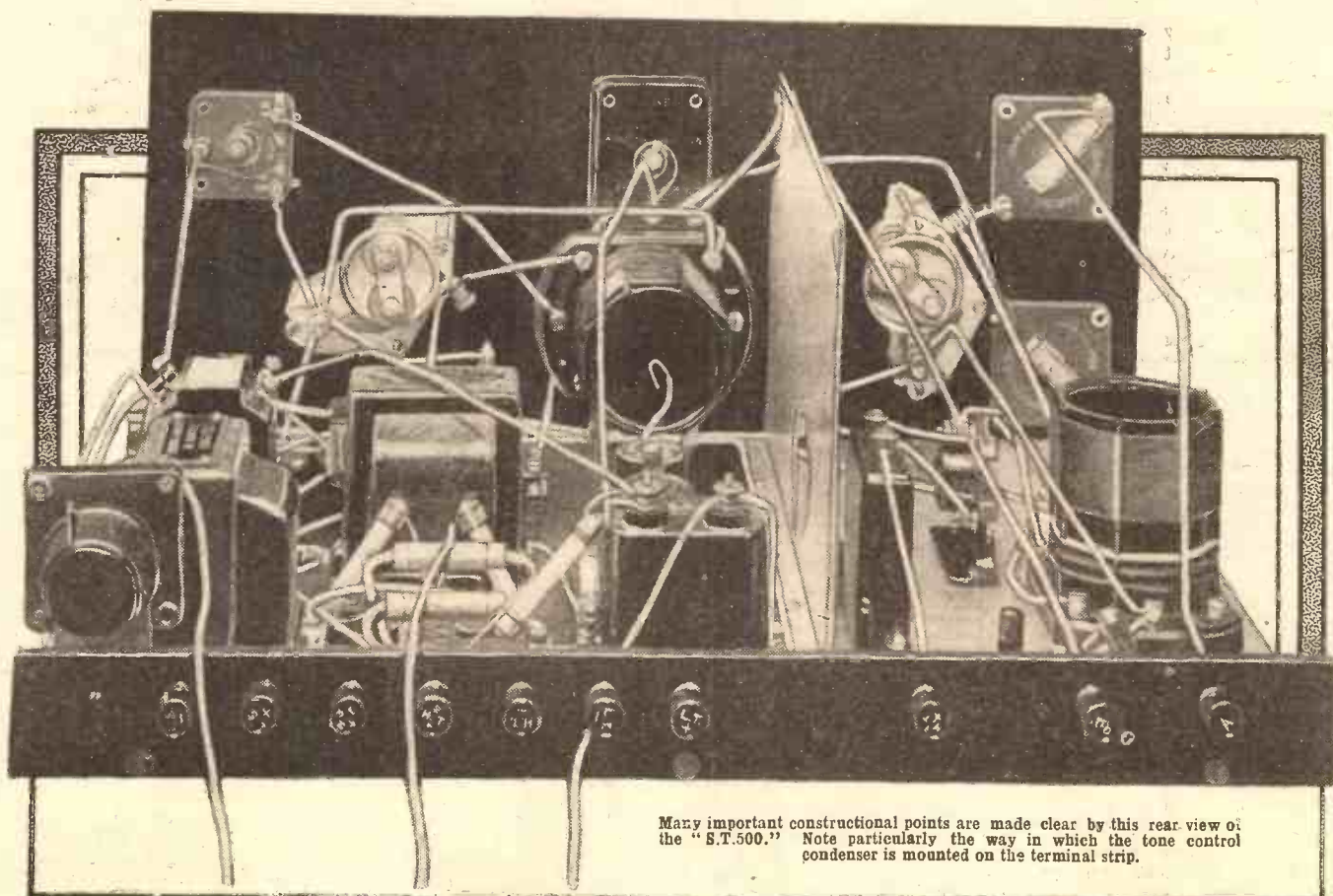
Apart from quality there is need for greater selectivity. The position has been getting worse every year. Country is fighting country in the ether, and the battle, while a bloodless one, has taken toll of listeners' pleasure and entertainment.

So acute has the problem become that many thousands of listeners are crying out: "We should be satisfied if we could only receive half a dozen foreign stations if they could be received perfectly."

This is a cry of despair. It is a cry which I have consistently refused to listen to.

I have never yet designed a receiver intended to give very good results on a very few stations. The reason is simple. Firstly, I consider that the reception of a few stations perfectly is a despairing aim, and that something far more ambitious should be sought for the constructor and found by the designer. Secondly, the designing of a receiver which will get a few stations very well is practically no different from designing a set which will get many stations very well.

Of course, one can produce a very simple set, such as a detector and 2 L.F. stages, and claim that it will receive a few stations very well. It will do nothing of the kind. The claim that it will involve, on the part of the designer, a wholly uncritical frame of mind and limited experience—or downright humbug.



Many important constructional points are made clear by this rear view of the "S.T.500." Note particularly the way in which the tone control condenser is mounted on the terminal strip.

—For Unprecedented Selectivity and Power

Stations are so close together, their powers vary so enormously, that ordinary selectivity methods are inadequate even for "local" reception except within the immediate neighbourhood of the B.B.C. stations. If trouble can occur when ten miles from the B.B.C. (remember Muh-lacker's jabber), how much more necessary is it to provide for the future!

There are several reasons why the "S.T.500's" adjustable controls are necessary. In the first place, the conditions of reception of no two persons are alike. Aerials differ widely, and even next-door

fact, I can remind you of half a dozen proverbs such as "Well begun is half done," "The first blow is worth two," "Muddy springs will have muddy streams."

The types of aerial and earth, however, is less important than the situation of the house. Everyone knows that the nearer one is to a B.B.C. station the greater is the interference. In fact, the interference from, say, the Scottish Regional station may be five hundred times greater for one reader of this article than for another.

Efficiency Demands Controls.

The signal strength from foreign stations as well as from the B.B.C. varies very greatly from place to place, and there must be some means in the set of either cutting down the signals to proportions which can be handled or increasing them from an unduly low level. This cannot be done without controls.

Then, again, the amount of interference varies at different points on the dial. For example, greater selectivity is required in London, or, in fact, anywhere else, on the lower half of the dial. This is partly because, although the stations may be 9 kilocycles apart, the percentage change in frequency becomes less. A wireless

receiver therefore behaves entirely differently at different points on the tuning dial. When a change is made over to the long waveband, conditions are entirely different once more, and here again efficiency and selectivity vary at every degree on the dial.

Saving a Bad Situation.

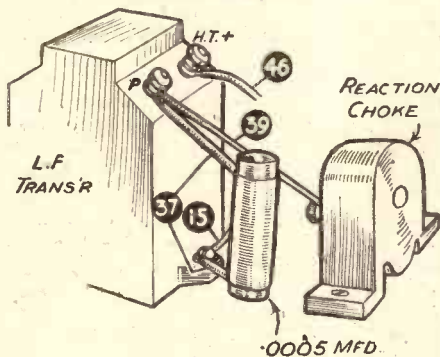
If efficiency falls off, what are you going to do if you have only a one-knob control? If selectivity decreases at the bottom end of the dial you will be powerless to improve matters. You will be conscious that you are getting poorer results, but you will be unable to do anything about it. It is here that the extra controls on the "S.T.500" will save you from such a situation.

Another extremely important factor in a receiver is the H.F. amplifying valve and to a lesser extent the other valves. The H.F. valve governs the amount of amplification obtained, the selectivity, and the inherent reaction of the set. The inherent reaction is due to stray couplings and the capacity coupling inside the valve. It tends to make the whole receiver oscillate, and this instability will ruin performance.

All sets, whatever steps are taken to avoid these couplings, are prone to self-

(Continued on page 384.)

SELF-SUPPORTED CONDENSER



Showing how the .0005 mfd. condenser (C₁₂) is connected by its own wiring tags to the L.F. transformer.

neighbours will have a different aerial system and a different sort of earth. In fact the different kinds of earth vary probably more than the aerials.

The character of aerial and earth govern the load on the first tuned circuit of the receiver. A small aerial and a poor earth will often result in greater selectivity, greater instability and weaker signals. A small aerial and a very good earth may give greater selectivity, poorer signals and greater stability than if a poor earth were employed (the latter helping inherent reaction). How in the name of reason can the same set perform in exactly the same way on all these aerials and earths?

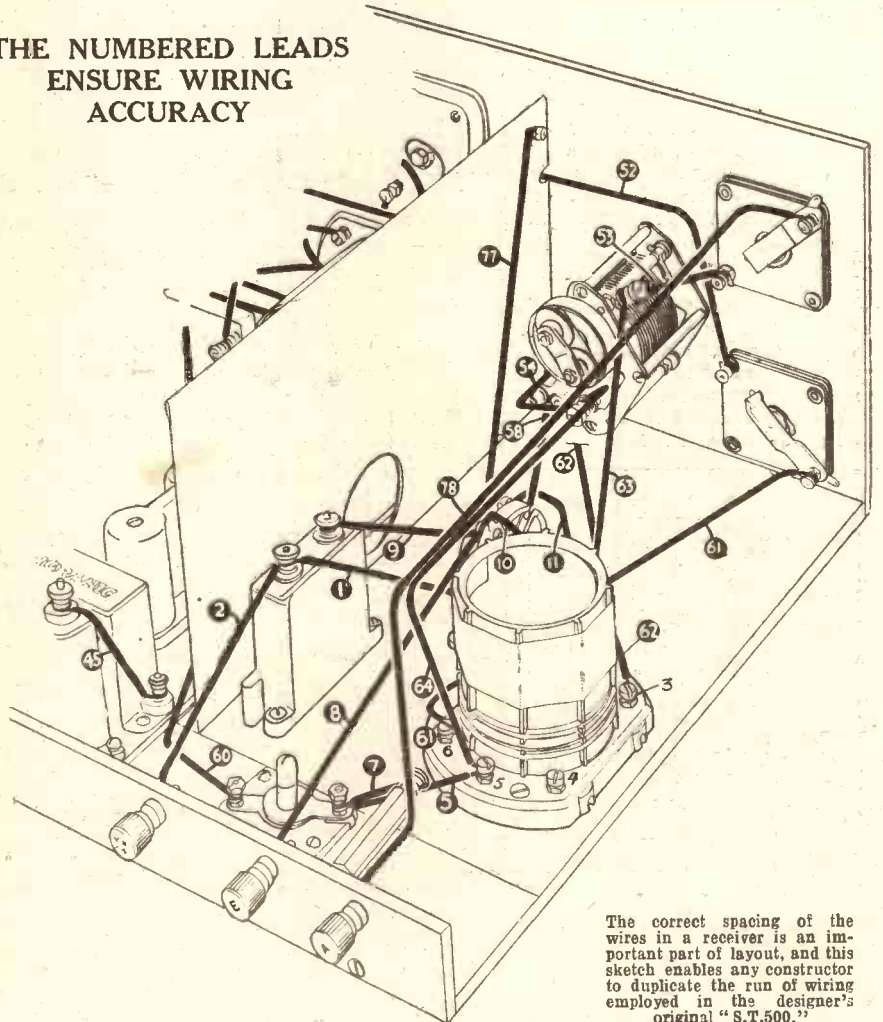
Compensation for Aerial Differences.

There must be some form of compensation for the difference, sunless, of course, one is prepared to forgo the advantages obtainable from a good aerial, and a good earth and to dispense with the means for getting better results on a poor aerial and earth.

The aerial coupler on the "S.T.500" enables you, so to speak, to alter the length of your aerial, while the aerial-reaction control will enormously strengthen the incoming oscillations in the first circuit, which hitherto has been the most neglected of all. A good beginning is half the battle, and this is superlatively true in radio. The present practice of sacrificing volume by a wasteful system of aerial selectivity is a confession of technical failure, and the way that the "S.T.500" overcomes this trouble has been fully explained.

Meanwhile, remember the proverb that good beginnings make good endings. In

THE NUMBERED LEADS ENSURE WIRING ACCURACY



The correct spacing of the wires in a receiver is an important part of layout, and this sketch enables any constructor to duplicate the run of wiring employed in the designer's original "S.T.500."

★ THE MIRROR OF THE B.B.C. ★

By O. H. M. ★

EUROPEAN BROADCASTING—A SERIOUS SITUATION

North Regional Gets Its Director Back—How the Empire Transmissions are Received—A World-Wide Broadcast—After the Lord Mayor's Show.

THE dispersal of the delegates to the European Broadcasting Conference in Holland without final agreement creates a serious situation. There are rumours of reference to the Permanent Court of International Justice, but these can be discounted. The big countries will hardly take the risk of losing some of their channels, which would be quite a possibility if the smaller countries were able to state their case before an independent judicial tribunal.

I believe that one final effort will be made through foreign offices. January is getting near, and unless agreement is reached there will be general chaos.

Mr. Liveing Returns to Manchester.

Mr. E. G. D. Liveing, the North Regional Director of the B.B.C., is returning from London to Manchester after seven months at Headquarters. His return will be widely welcomed in the North, where he is extremely popular. The idea of switching round Provincial and London officials is having good results in creating a more comprehensive understanding of the numerous problems of broadcasting.

Christopher Stone's Popularity.

Christopher Stone's appearances on the music-hall stage both in and out of London seem to be a great success. I hear he is planning a special tour with Jack Hylton. This is another sign of Mr. Stone's great popularity.

Malcolm Frost's Return.

Mr. Malcolm Frost, the B.B.C. Empire Service "Ambassador," just back from his world tour, has some definite ideas about the short-wave service. He found this was not nearly as well received as Broadcasting House was inclined to believe from his correspondence. In Australia, for instance,

there was hardly any reception. On the other hand, I gather that Mr. Frost did well with B.B.C. recorded programmes for which there was a brisk demand both in the Orient and in Australasia.

New Transmitting Stations.

It is now definite that if any kind of agreement can be reached about wavelengths in January, the B.B.C. will start at once a new transmitter for the Highlands of Scotland and another one for the Newcastle area. There is, however, no promise as yet of a transmitter for North Wales. The

AN ELECTRIC VIOLONCELLO



Readers of "Popular Wireless" who have built the "Valonium," recently described in these pages, will be interested in this photo of an electric violoncello. Note the loudspeaker mounted on the top of the instrument.

new transmitter for Northern Ireland will be built as already planned.

Armistice Day Plans.

Listeners throughout the whole of the British Empire, as well as in all parts of Great Britain, will have an opportunity of

hearing the Armistice Day broadcast from the Cenotaph in Whitehall on Saturday morning, November 11th.

All B.B.C. transmitters, including those which radiate the Empire services on short waves from Daventry, will be working, and this relay from the Nation's and Empire's memorial to the Glorious Dead, in London, will be radiated by wireless for the first time to the most distant parts of the earth.

The broadcast is due to begin at 10.30 a.m., G.M.T., with music by the bands of the Grenadier, Coldstream, Irish and Welsh Guards, and will continue until the close of the service which follows the Silence at 11 a.m. and the sounding of the Last Post.

It is interesting to mention the approximate times at which the broadcast will be heard in different parts of the Empire. At Vancouver it will be 3 a.m.; in Nigeria mid-day; the Sudan and South Africa 1 p.m.; in India and Ceylon 4.30 p.m.; Western Australia 7 p.m., and South Australia 8.30; in the cities of Melbourne, Sydney and Adelaide it will be 9 p.m., and in New Zealand and the Pacific Islands about 10.30 p.m.

In Memory of Percy Pitt.

Dr. Adrian Boulton is to conduct the B.B.C. Orchestra on November 23rd, in a concert to be broadcast to London Regional listeners in memory of Percy Pitt, the anniversary of whose death last year falls on that day.

The programme will consist of the music of the B.B.C.'s first Musical Director, and Arthur Catterall will be the violin soloist.

Carnival Again.

Five novels have lent themselves so readily for adaptation as radio plays as Compton Mackenzie's "Carnival," which the author and Holt Marvell prepared for presentation before the microphone nearly

five years ago.

This story of London before the War will be revived on October 31st and November 2nd, and produced by Val Gielgud, the Productions Director of the B.B.C. Lilian Harrison will play the part of Jenny, Charles H.

(Continued on page 378.)

"OTHELLO" was a great success, and as perfectly played as one could wish for. But for one fault I would have said that Malcolm Keen as Iago was every bit as good as Godfrey Tearle, who played Othello. Iago didn't move along as rhythmically as Othello did—i.e. he tended to convert his poetry into prose, and all too frequently there was a reshuffling of words in his lines.

Godfrey Tearle gave a masterly interpretation of the part of the Moor. There was a refreshing restraint about his acting; the modulations of his voice were exquisite; and, unlike other Othellos I have listened to, he didn't rant.

He never once began a speech on a fortissimo only to find himself unable to work up the required crescendo. He always started quietly, and could increase to a mighty fortissimo with telling effect.

The noise problem was once again apparent. I cannot suggest a solution, however. The crowds are essential if the right atmosphere is to be got, but they do interfere with the dialogue. Even Othello lost some dignity through his inability to silence the mob. At

THE LISTENER'S NOTEBOOK

Frank comments on recent programmes and on microphone personalities of the moment.

least, that was the impression it left on my mind.

Rural Britain by a Professor sounds as if it might be dull. Rural Britain by Professor J. A. Scott Watson, however, was anything but dull. For instance, his descriptions of the sturdy Ayrshire folk, of the stock they breed, of the homesteads they inhabit, of the stock-markets they conduct, compare very favourably with anything of the same nature I have ever come across.

Listeners who are also book-lovers will certainly find in Professor Watson's talks something to remind them of the best descriptive passages of rural Britain to be found in the pages of literature.

This is yet another of a new series of talks to emphasise the tremendous progress made in broadcast talks. A radio-talks revival, if it were possible, and on the same lines as the present drama revival, would be an astounding revelation. Both in manner and matter there is no comparison between the talks first broadcast and those that now fill the air.

A curious thing about the drama revival is the absence of any disparity in character and substance between the early plays now being revived and the very latest ones. I formed this opinion after hearing the first pair of plays, and "The White Chateau" has only confirmed this opinion.

"The White Chateau" contained all the elements and problems of the most modern radio-play. There was a large cast, noises of every description had to be transmitted, including a symbolic voice. I can't say the symbolic voice was very convincing, but the voices of every character and all the noises were clearly audible. I wish I could recall those earlier productions better. If I could, I would probably sense a feeling of greater certainty in the revived productions than was apparent in the original.

One cannot read the same book over and over again, no matter how interesting it is. But one can read the same author indefinitely, providing he is good and his output prolific enough. The same applies to listening, especially to radio sketches. Whereas I am growing tired of Haver and Lee, I am still interested in Mabel Constanduros and Michael Hogan.

Both these pairs are first-rate artistes in their own particular way, but with Haver and Lee it's like reading the same story for the nth time. It's appeal

(Continued on page 378.)

TELSEN

'S.T. 400' COILS

for Mr. John Scott-Taggart's

P.W.

'S.T. 500'

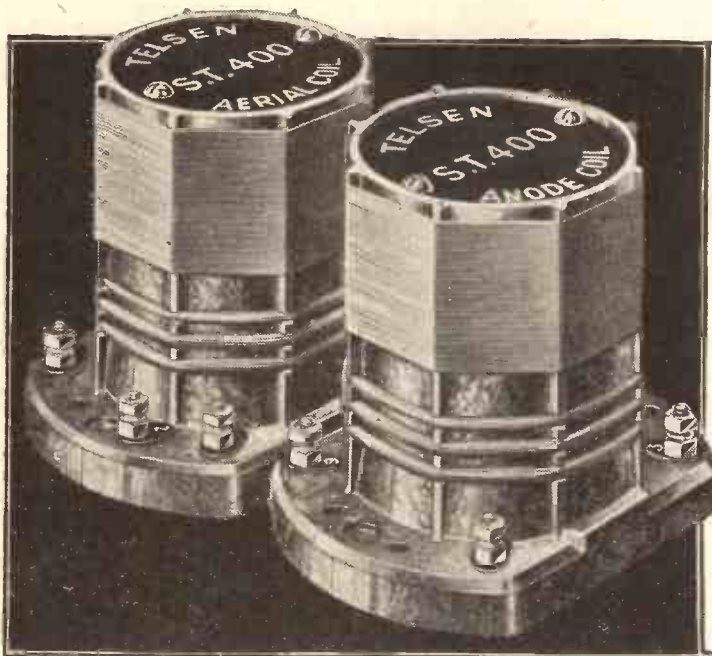
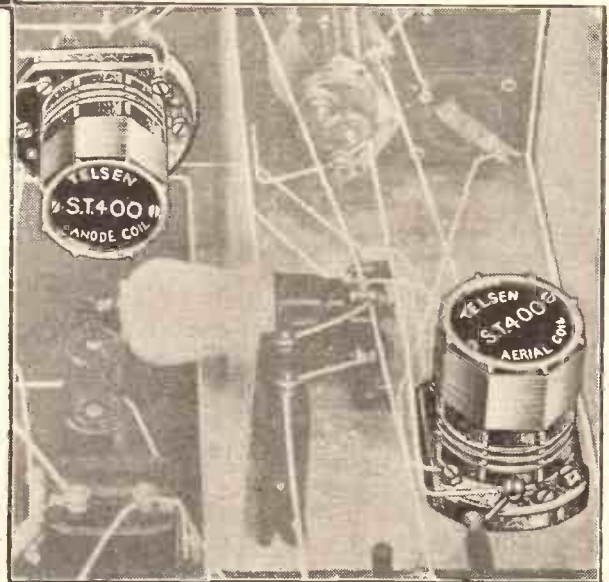


Illustration below shows the position occupied by the Telsen 'S.T. 400' Coils in a built-up 'S.T. 500' Receiver.

RECOMMENDED for use in the S.T. 500 by Mr. John Scott-Taggart, the Telsen S.T. 400 Coils have been specially designed for their purpose, to ensure immaculate performance with enduring efficiency. The Aerial Coil consists of plain long and medium wave windings connected in series, with a separate reaction winding, the Anode Coil having a larger reaction winding connected to the earth end of the main winding. The Anode Coil is supplied complete with two brackets and the necessary screws for mounting.

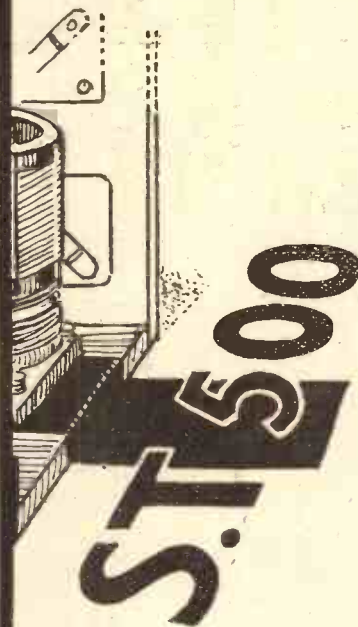
Price per pair **8/-**



TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

Not a
shadow
of doubt



—TO BUILD YOUR "S.T.500" EXACTLY IN ACCORDANCE WITH THE DESIGNER'S SPECIFICATION AND THEREBY TO MAKE CERTAIN OF EQUALLY SATISFACTORY RESULTS, YOU MUST USE

COLVERN

The whole success of your receiver depends upon the components that you use in it. For the "S.T.300," the "S.T.400," and now again for the "S.T.500," Mr. Scott-Taggart has selected Colvern Coils because every pair of coils that is despatched from our works is thoroughly tested and guaranteed to be identical with those used in the original receiver.

REMEMBER, COLVERN SPECIALISE IN COILS

COLVERN LIMITED, MAWNEYS ROAD, ROMFORD, ESSEX

ECKERSLEY EXPLAINS-



This week our Radio Consultant-in-Chief describes the vexed theory of side-bands in a new way. At the same time he explains that in spite of numerous suggestions made to the contrary, "side-bands are not mathematical fictions."

I HAVE just been looking at a table concerned with the constants of coils. I read, in a corner I had so far neglected: "For lower B.B.C. wavelengths coil-price—For Daventry and Radiola coil-price—" I wondered why, and then I saw the heading "Coils for Trap Circuits"—and many pieces of my technical past came back to me.

Looking Back.

The Navy Rejector, an experiment in which a fixed-wave receiver had twenty circuits and ten valves (R. valves) in cascade; a circuit so "sharp" that Morse signals "rang" because of persistence of oscillation.

And all the old stuff of selectivity—of a publication in about 1926 by the Westinghouse people of America saying that "by a new principle" they could work stations 1,500 cycles apart. Then Dr. Robinson and his stenode.

All sorts and conditions of people defying, with magnificent courage, the fundamental laws of physics. The people who invent television circuits to work "on a single frequency," the people who make "knife-edge" selectivity, the people— It's tiring, as one gets older, to see the same old stuff trotted out again and again and again.

Producing New Frequencies.

Everyone must know by now, surely, that if you modulate the intensity of one frequency so many times a second you produce new frequencies. I mean, if you have a carrier-wave which is caused by

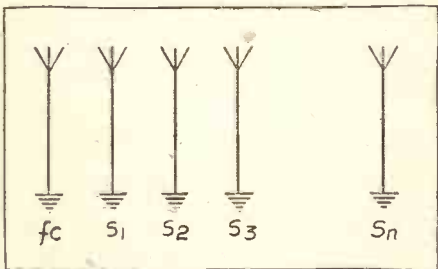
setting up, alternating currents in an aerial of frequency (say) one million, and you increase and decrease the intensity of those currents one thousand times a second, you produce two new frequencies in addition to the old.

Two Side-Bands.

You have, in fact, additional to the original carrier-wave of one million, a million plus one thousand and a million minus one thousand. The two new frequencies (a million plus and a million minus) are called side-bands. This you all know.

Perhaps what may astonish you is to know that side-bands are not mathematical fictions.

FOR SECRET TELEPHONY



This diagram is used by P. P. Eckersley to explain the principles of secret telephony transmissions.

I would like to explain this side-band theory in a new way. I have said that modulation produces new frequencies. If I am right, then you could not tell the difference between a system in which, as to-day, a carrier-wave was modulated 1,000 times a second, say, and a system in which the transmitter consisted of two transmitters, one making a carrier-wave and the other making the side-band!

Carrying this a step further, suppose we had a broadcasting station which had not one transmitter but several hundred transmitters, one for creating the carrier-wave and all the others for creating the side-bands.

For instance, choose a carrier wavelength of 300 metres or a frequency of 1,000 kilocycles. Now add the side-band transmitters. Add them like the notes of an organ or a piano. Take the octaves first. Start with middle C, a note of 256 cycles per second.

Well, the frequency of the carrier was 1,000,000, so middle C would be "created" as a note (after rectification in a receiver) by another wireless transmitter, quite separate from the carrier-wave transmitter, working on a frequency of either 1,000,256 cycles per second or 999,744 cycles per second.

A "Radio Organ."

By adding twice as many wireless stations to the original carrier-wave station as there are notes on the piano or organ, you start with a rather amusing wireless piano or organ. True, it is very costly, and no one would ever be so silly as to use such an arrangement.

I drag up the whole subject to show you that, in theory, and (provided you were clever in various subtle ways) in practice, too, it would be impossible to tell the difference between a station which radiated side-bands from separate transmitters and one which had its side-bands created by the ordinary processes of modulation. Side-bands are exactly the same as new station's radiations heterodyning with a carrier-wave.

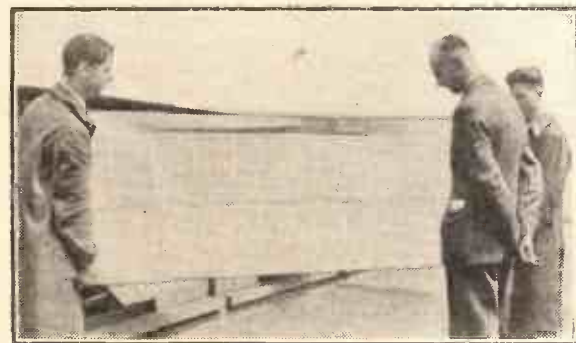
There is another interesting thing. If you set up all those hundreds of different radiators or transmitters, each differing a little audible amount in frequency, you could try the experiment of changing the carrier-wave frequency from one end of the spectrum to the other.

Easily Explained.

Look at the diagram; f_c represents the carrier-wave, S_1 , S_2 and S_3 the side-bands (we are only using one set). S_n is the highest frequency audible, say 10,000, added to f_c , the carrier-wave frequency.

You could take f_c and shove it round outside S_n , when all the noises become inverted, always provided the man (who switches on the transmitters according to what were the right notes when f_c was next to S_1) goes on with this technique.

This is the principle of "secret" telephony, but "what one fool can do another can." I have tried to make the side-band theory clear. I hope I have succeeded.



EIGHT FEET OF BLUEPRINT

This tremendous blueprint, which is over eight feet long, is completely taken up with one circuit diagram. It is a small part only of a new Automatic Telephone Exchange, the complete circuit occupying a space many times larger. How would you like the job of wiring it up?

Short-Wave Notes *By* W.L.S.



MY recent remark that I have discarded "super-regens" for five-metre work (or for anything else) has prompted "K. H. S." (Ross-on-Wye) to write to me. He points out that the circuit using a separate regenerator (like my own 5-metre receiver) can be "switched" with the greatest of ease to cut out the super-stage. He uses a detector-and-L.F. receiver with a separate super-valve which can be switched in and out at will.

He also says that to get the best out of a super-regenerator one must make provision for varying the quenching voltage applied to the detector, which rules out at once the hybrid circuits in which "supering" and detection are done by the one valve. Quite true, "K. H. S." I have always had a mortal hatred for those circuits—probably on account of prejudice—and always use a separate stage to provide the mush myself.

Where the "Super" Fails

Incidentally, in one casual sentence "K. H. S." sums up the entire failure of the super-regenerator. I will quote him verbatim: "I have found it chiefly of value when a weak, clear, interference-free carrier-wave is tuned in. If there is interference the 'super' only tends to make it worse."

It always strikes me that if one wants to increase the strength of a weak, clear signal, the cleanest way to do it is to add an L.F. stage. The super will work wonders with it, but, as "K. H. S." says, it's no good when there is interference about. (Query: Does anyone remember a time when there wasn't?)

"T. C." (Wakefield) recently reported a transmission on 42.8 metres which he could not identify. In the same post to-day arrived letters from my old correspondent "N. H." (Malmo, Sweden) and from "T. C." himself identifying the station as Oslo. It is a "short-wave link" used for relaying the Oslo medium-wave programme to the far north of Norway. Short-wave transmission has been found to be less expensive than land-lines.

A One Man Show

"N. H." (Malmo) reports that he is experimenting with H.F. pentodes, both for H.F. and detection. Unfortunately, in Malmo, to quote friend "N. H.," "there is only one wireless dealer, and he only sells parts with very high prices and very low quality, so I have to buy all I need from England direct."

"T. C." and others report that W2 X A D is quite the star turn nowadays. On most days he is a good R9 throughout his whole programme. W8 X K, strangely enough,

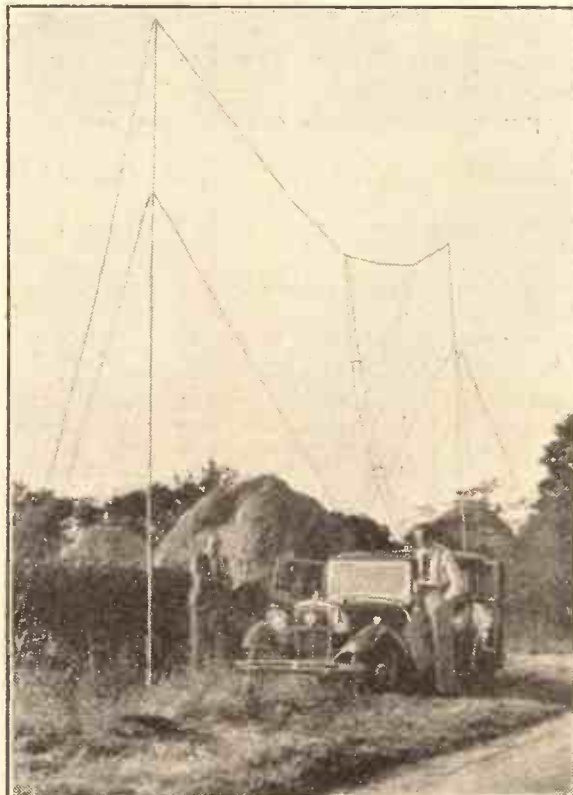
although his 19.72 wave is so close to the 19.56 wave of W2 X A D, is nearly always disappointing. His 25-metre transmission, however, makes up for the poorness of the other one.

Can anyone identify the amateur stations

Our popular short-wave expert keeps you up to date with all the latest news about this fascinating band. Station information, answers to correspondents and five-metre notes form the principal items from his pen this week.

ES X 5 C and Y T 7 X Z? V P U 1 and V P U 2 are both in Sierra Leone, and U X 6 K R is presumably a Russian portable station. Finally, "T. C." quotes the "D J B mystery." He says that on a good night, when the D J B programme is coming over really well, a "little D J B" can be tuned in at about 250 kes. on either side of the main wave, fading rapidly and very distorted and tuning quite sharply. It isn't "spreading" of D J B himself, for

A PORTABLE FIVE-METRE STATION



This is Portable Experimental Station G5FK. The impressive-looking masts and aerial weigh only a few pounds, and when dismantled form a bundle but five feet in length. Note the twin feeder line leading down to the car.

you can find a silent space between the three different dial settings.

I listened to D J B when I had read this letter, and happened to find the very thing, exactly as "T. C." describes it. I have heard funny transmissions, but this is unique. The queerest part of it is that the main carrier is perfectly constant, while the two subsidiary ones are doing a kind of St. Vitus' dance. Explanations, guesses, hazards, etc., eagerly awaited.

Getting Ready for Winter

During a general rebuild of my station in readiness for winter activities I decided that it would be a good plan to make myself a really permanent receiver. I have such a habit of tinkering with receivers until they are mere ghosts of their original ideas that something of the sort had to be done.

Accordingly I took the trouble to accumulate just the parts that I wanted, and proceeded to make a real "commercial job" that will be so difficult to alter that it will simply have to be left alone. And now I have the consolation that whatever circuit I am playing with my receiver will still be ready for action at a moment's notice. (Or will it? Where *did* I put that accumulator? And, there's no grid bias! And so on.)

Two Valves Only

This particular set is a two-valver, with provision for switching the L.F. stage out of circuit. It is built in a fairly large iron box, with a black crystalline finish. Although I built it myself, I have no hesitation whatever in saying that it looks very nice. Incidentally, it works quite well.

I wonder, by the way, how many readers have gone to the luxury of equipping their short-wavers with illuminated dials. I find it a great comfort late at nights to be able to sit in the dark, save for the soothing glow of two neat dial-windows.

Very Useful!

One can see to make entries in the log-book by them; and the scheme has the additional advantage that the neighbours (and even the family) don't know that one is burning the midnight oil. I'm so tired of being asked by my neighbours whether I ever go to bed, that I find it a distinct relief to be able to switch my lights off at a reasonable hour.

I wonder how many readers realise the troubles that beset the amateur transmitter when he has to get his gear into a fairly small space, and, incidentally, to keep it tidy. All keen receiving men with a fair amount of gear find themselves perplexed at

(Continued on page 383.)

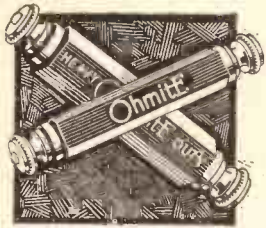


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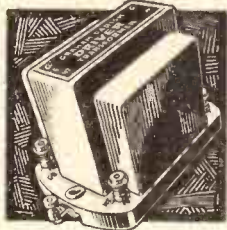
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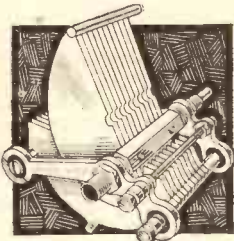
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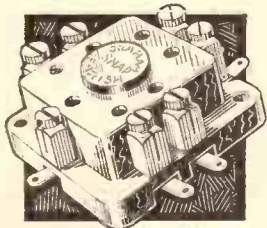
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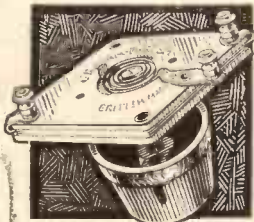
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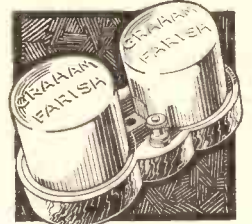
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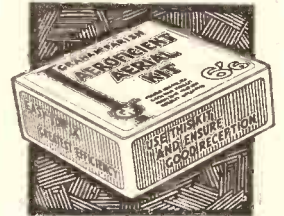
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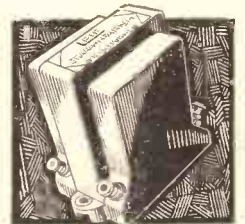
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STATIONS WORTH HEARING

A review of recent conditions on the "broadcast" bands, including details of stations that are coming in well, and other information that will enable you to get the best results when searching for foreigners.

By R. W. HALLOWS, M.A.

frontier. The station is to have an output power of 10 kw. and is to relay the Oslo programmes.

Since it is more than 1,200 miles from Oslo, the telephone lines cannot be used for the purpose, and the link between the relay and the parent station will be made by a directional short-wave wireless transmitter. This is, I believe, the first time that short-wave transmissions have been used for the regular relaying of programmes by a medium-wave station.

Those Atmospherics.

Reception conditions during the latter part of September were rather spoilt by the prevalence of atmospherics, but there has since been a considerable improvement in this respect. Atmospherics are not at all unusual just at the "turn" of the year, and they were to be expected this autumn when unsettled weather conditions followed the long, dry summer.

When the Roumanian station already mentioned is not at work Huizen's transmissions are excellently received on the long waves. Radio-Paris is, as ever, a fine provider of programmes, but Zeesen has "off" nights every now and then. These will probably cease to exist when the new transmitter, with its special aerial, is built. Warsaw is coming in very strongly, but occasionally a heterodyne is noticeable. Even the giant Luxembourg suffered on one recent evening from this kind of interference. Oslo is now good both in daylight and after dark.

The stations at the top of the medium waveband have now come back to splendid form. Budapest can be relied upon for good loud-speaker reception, and Munich is almost as good. Vienna is well heard, and reception will be still better when the second aerial mast is completed.

A Good Selection.

Brussels No. 1, Florence, Prague and Langenberg are a fine quartet which never disappoint the listener. There has been a good deal of jamming on the waveband immediately below Langenberg, but Lyons Doua and Beromünster are well heard when not interfered with.

Rome is always good, but Stockholm is showing curious variations, being very strong

on some days and barely audible on others. Belgrade is equally fickle, but always worth trying for, since, if it is coming in well, excellent entertainment is assured.

Little or nothing is now heard of the Spanish stations, but these should improve considerably within the next few weeks. In Portugal the new Lisbon station—a 20-kilowatt working on 282.2 metres—will probably come into action very soon now.

Katowice, Toulouse Midi and Leipzig should never be missed, and Strasbourg is generally as good a transmission as one could wish for.

THE improvement in all-round field strength that is now observable helps to show how necessary it is for the Lucerne Plan, however it may be modified in the meantime, to come into operation at the earliest possible moment.

During the summer naturally little is heard of the smaller and more distant stations. Hence, even if they are working off their wavelength, as is so often the case, they are responsible for little, if any, heterodyne interference.

As the days draw in these small, far-away stations are more and more strongly heard, and unpleasant whistles begin to make their appearance in portions of both the long and the medium wavebands that were previously clear of them.

Spoil by Heterodynes.

Though the number of stations that can be received without interference is large, there are now far too many whose transmissions are spoilt by heterodynes. The trouble is largely due to stations which have no conscience in the matter of altering their wavelength from night to night as they may think fit and to broadcasting pirates. The latter are unauthorised stations which have no right whatever to be in operation. The average number at work on the broadcast band is from a dozen to a score.

Under the Lucerne Plan each country is pledged to allow only authorised stations to operate and to see that they keep very closely to their authorised wavelengths. Whether such an ideal state of affairs can ever be realised time alone can show; but there is no question that if the countries of Europe will abide loyally by the provisions of the Plan a very great improvement must result.

The Swiss station, Monte Ceneri, is at work again on almost exactly the same wavelength as Kalundborg. This causes a good deal of interference with the Danish station, and there seems to be no excuse, since Switzerland will have no long wavelength under the Lucerne Plan and Monte Ceneri will actually be working on 257.1 metres.

A Change Round.

The interference with Huizen that readers must have noticed is caused by a Roumanian station, Brasov, which is trying out a new plant that will come into use shortly. The Lucerne allotment gives the wavelength of 1,875 metres to Brasov, Huizen being down to share 1,345 metres with a Russian station.

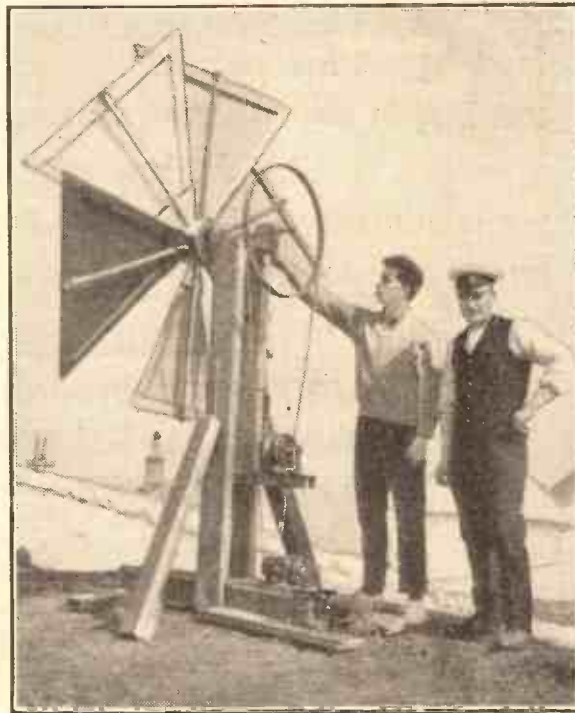
The French Regional scheme is making good headway, and already four super-power stations are nearing completion. These are Nice, Lyons, Toulouse P T T and Paris P T T. Nice will be a 60-kw. station, but the other three will have ratings running into three figures. Work will shortly begin on three other Regional stations, Rennes, Marseilles and Lille.

Remembering how well we now hear Toulouse Midi with an output of but 8 kw., you will realise that we may expect something rather extraordinary from the 120-kw. Toulouse P T T with a power fifteen times as great. And if a 10-kw. Fécamp already gives the loudspeaker full scope, what about the 100-kw. Rennes or the 60-kw. Lille, whose distance will be still shorter?

We shall hear little of Stuttgart (Mühlacker) between now and the middle of January, for the big station is being closed down during the rebuilding of the aerial masts, and the bulk of the work is being undertaken by the old 1.5-kw. Stuttgart transmitter.

The new Mühlacker aerial will take the

CHARGING WITH A WINDMILL



Two lighthouse keepers at St. Abb's Head, Berwickshire, have rigged up this accumulator charger with the aid of a bicycle wheel and car dynamo. Power is, of course, obtained from the wind by the triangular vanes.

form of a single lattice tower over 600 ft. in height. This will not be the world's tallest wireless aerial, for the tower of W L W, at Cincinnati, Ohio, which is now nearing completion, will be nearly 800 ft. in height when it is finished and the masts of the new longwave station at Droitwich will be over 700 ft. high.

Short-Wave Radio Link.

Europe's most northerly broadcasting station will be in operation before very long. This is Vadsoe. If you look at the map you will find Vadsoe in the very north of Norway, quite close to the Russian

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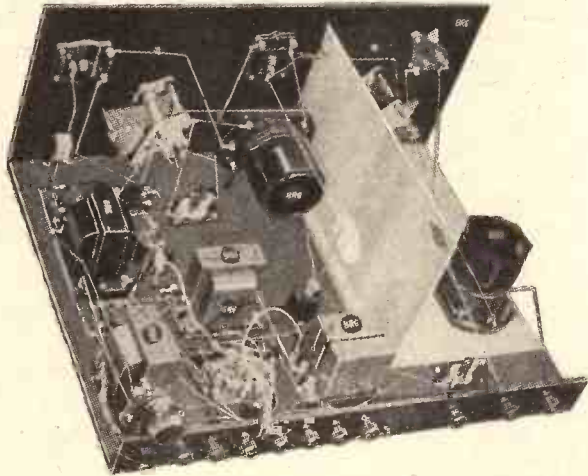
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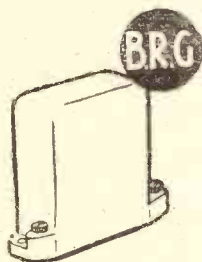
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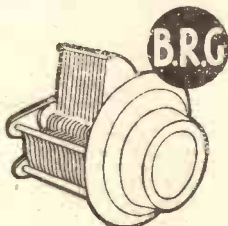


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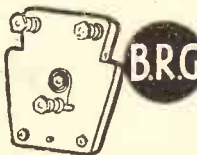
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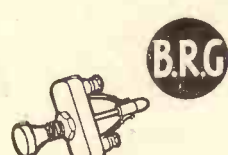
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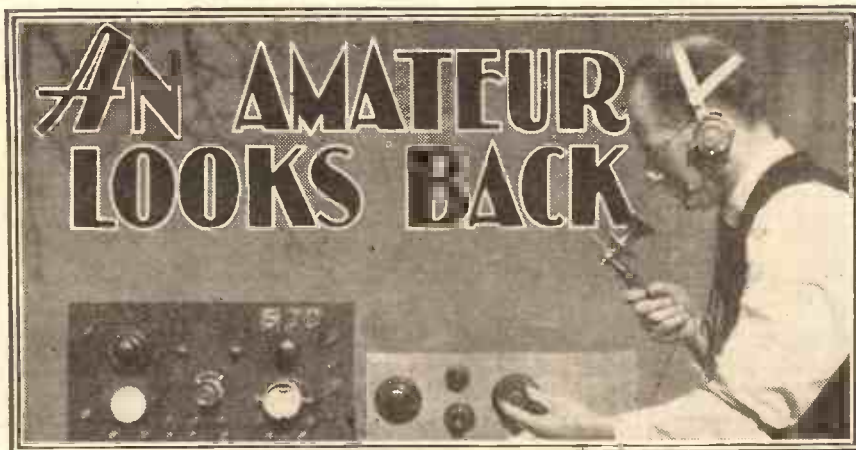
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P.W. 23.10.33



THE following is in the form of notes taken from my log book, and may prove of interest to some readers.

On referring to my log I find that it was in November, 1920, when I first took up wireless as a hobby. It very soon took a grip of me, and with the aid of a friend I erected an aerial 30 feet high, one end fastened to a poplar tree (which, years later, when I took up short-wave work, I found very troublesome during stormy weather). The antenna was 60 feet long, and the lead-in was passed through a window of a boxroom. This room was known as my wireless den, and was so precious to me that I kept it locked up.

It soon became arrayed with maps showing all the wireless stations then operating. These were practically all coast stations using Morse code for working with ships at sea. At this time there was neither voice nor music on the air, so I settled down to master the Morse code.

Crystal and 'Phones.

I built a crystal receiver which comprised a long cardboard tube wound with enamelled wire, and a sliding contact running up and down the tube varied the wavelength. A home-made crystal detector and a pair of headphones, and I was all ready for testing out the apparatus.

It was a really exciting time, as I had never heard a wireless signal. The headphones were put on and slowly moving the slider on the big coil up and down, I listened very carefully for any signal.

I had only been listening about half an hour when I heard my first signal. The call sign was G C C, and proved to be the Admiralty land station, Cullercoats, working on a wavelength of 600 metres.

It was nearly an hour before I heard another signal; this also was an Admiralty station, B Y B, at Cleethorpes, using a wavelength of 3,000 metres.

One of the next stations to be picked up was F L, Paris, on 2,500 metres; as the aerial was slung from the top of the Eiffel Tower, this was an appropriate call sign.

Early D.X. Reception.

I had begun to pick up fragments of messages and was anxious to do some long-distance work, and on consulting the schedule of regular transmissions I found that a spark station, B Y Z, Rinella, in the Mediterranean, was on the air every evening at 9 o'clock on 2,700 metres.

I commenced listening just before the appointed time, and was fortunate enough

at the first attempt to intercept the transmission. In those days this was considered quite good as signals were only just audible in the 'phones. All this happened in 1920 and early 1921, and may not sound very exciting, but to me and two or three other enthusiasts in Lincoln it was exciting to hear a signal at all, as one might listen

Great though the thrills of distant reception can be under modern conditions, they hardly compare with the excitement that a few letters in the Morse code held for enthusiasts of ten or twelve years ago. The experiences of listeners in early days are well illustrated in these notes, written around entries from an amateur's log.

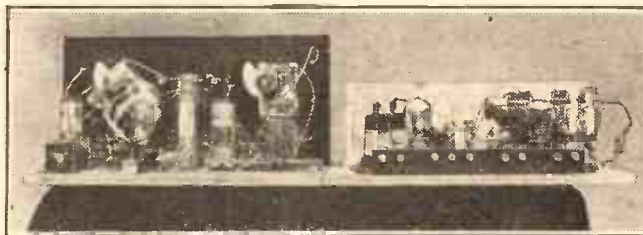
By RALPH BATES

on a crystal set for an hour and not hear a transmission.

In May, 1921, my first one-valve receiver was completed, and I soon made good progress with the Morse code as I was able to pick up ten times as many stations.

A station operating at Vossegat in Holland with the call sign B E, on 1,000 metres,

THE PRINCIPLE APPARATUS OF 50 D



A behind-the-panel view of short-wave transmitting and receiving apparatus, that proved very successful in the hands of the author of the article on this page. A front view of the same gear is seen in the heading photograph.

used to transmit a weather report in Dutch at 7.40 every evening very slowly, and repeat the report much faster. I was able to copy the slow transmission, and to this station I owe my thanks for teaching me the Morse code.

I heard the first voice on the radio in November, 1921, from the aircraft station at Croydon on 900 metres.

Then came P C G G, the Hague in Holland, that pioneer of broadcasting music,

etc., on 1,000 metres. He was just nicely audible on the 'phones on one valve, and I have sat for hours listening in my den in the winter months with very cold feet.

A Pioneer Transmitter.

One of the first amateur transmitters I heard was our old friend Burbury of Yorkshire using the call sign 2 A W. The wavelength used at that time was 1,000 metres, and one favourite item sent out by this station was a gramophone record "I'm for ever Blowing Bubbles."

Then 2 M T, Writtle, commenced to give weekly broadcasts for half an hour every Tuesday evening on 700 metres. The programmes were unique and I do not think I missed one. Captain Eckersley, late of the B.B.C., was in charge of this station, and his cheery voice would announce "two emma took calling." He was engineer, programme director, etc., as well as an artiste on many occasions.

British Broadcasting Commences.

In November of 1922, British Broadcasting commenced from the transmitters 2 L O London and 5 I T Birmingham. Christmas Eve of the same year I was sitting up rather late and was searching for anything I could find and was fortunate enough to pick up the American station W G Y about 1.15 a.m. on 326 metres, using a three-valve set. The reception was quite good on the headphones.

January, 1923, wireless became more interesting, as I was fortunate enough to obtain a transmitting licence.

I should mention that I was allotted the call sign 5 O D, and was allowed to work on 440 metres and also a choice of the waveband 190 to 200 metres. Scores of other amateur transmitters were picked up from all parts of the country, and many times I tried to make contact but failed. However, I had my first thrill with the transmitter on Sunday morning, June 17th, 1923, about noon.

Establishing Two-Way Contact.

I picked up an amateur in Grimsby, 2 Q H, on 440 metres, and as usual, replied in Morse. Then I listened, and was more than surprised to hear him answering my call. We kept up communication for about half an hour, his last message being "my batteries are running down."

The 600-metre waveband always afforded good practice in the Morse code and was full of interest.

S.O.S.!

On July 30th, 1923, it was close upon midnight when I

went to bed, and I had a sudden fancy to hear if anything was going on in the shipping world, so went to my den, as I thought, for a few minutes, just before turning in. I slipped on the headphones and tuned in to 600 metres. I looked at the clock and noticed that it was five minutes past midnight. I had only been listening for five minutes when I had one of the biggest thrills of my experience,

(Continued on page 374.)



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COMPLETE

PRECISION INSTRUMENTS



Describing how a "cut-out" for a loudspeaker diaphragm may be made with a minimum of calculation.

By T. B. SANDERS.

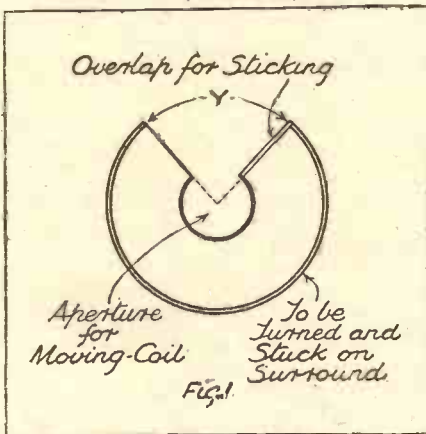
THE many experimenters who have had the misfortune to damage the diaphragm of a moving-coil loudspeaker will readily agree that, at first sight, it seems a very simple matter to effect a repair.

All that needs to be done is to make a new cone, stick the moving coil on and mount a new surround. Of course, all this requires care in manipulation, but not more than the average constructor customarily bestows on the assembly of apparatus.

Deciding the Size.

The "snag" arises when deciding what the size of the new cone has to be. It is not generally possible to use the old cone as a pattern, as it invariably becomes too damaged when removing it from the surround and taking from it the moving-coil.

ACCURACY WITHOUT—



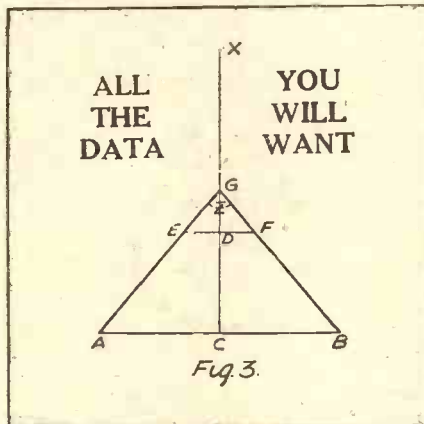
Everyone knows that to make a cone you have first of all to cut a shape like that shown in Fig. 1. It is, however, not such an easy matter to determine what dimensions this shape should have so that it forms a cone which will exactly replace the original one.

Fig. 2 is a diagrammatic representation of the invariable arrangement of a moving-coil and its associated cone diaphragm. Some of the leading dimensions of this can very easily be made with an ordinary ruler. The distance A B, for instance.

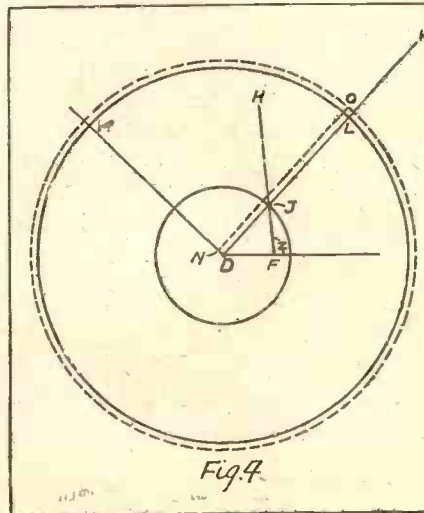
Start, then, by drawing a line on a piece

of paper the same length as A B, as in Fig. 3. Then bisect it and draw a line at right angles (C X.)

Another simple measurement to make is from the face of the moving-coil to straight out to the "face" of the cone. This may



In conjunction with the few simple rules in the accompanying article, these four diagrams provide all the data required to make an accurately fitting diaphragm for a moving-coil loudspeaker.



be done by clamping a sheet of paper in the surround-clamping ring and poking a piece of straight wire through. The measurement is CD (Fig. 2 and Fig. 3).

Even more easy is the measurement EF, since this is merely the outside diameter of the moving-coil former. On your guide drawing set it off as shown in Fig. 3.

Now join A to E, continuing to cut CX, and join B to F, continuing to cut CX, which gives the point G and the angle Z, which may be measured with a celluloid protractor.

This is the "angle" of your cone, and a most important quantity. You have also got the measurement AE or BF of the cone side, which is also useful to know. With these discoveries you can proceed with the cutting of the shape of Fig. 1 with every confidence.

How It is Done.

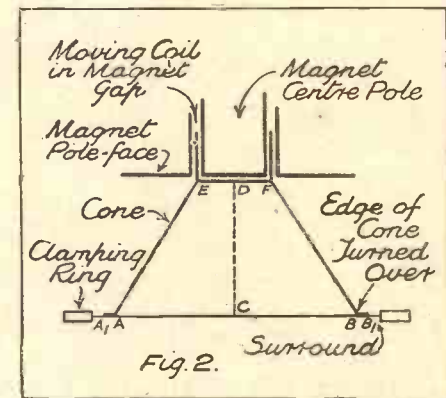
On the material of which the cone is to be made draw a line and set off on it the distance DF of Fig. 3 (the radius of the coil former) as in Fig. 4. At F draw the line FH so that the angle Z is the angle of your cone (Z in Fig. 3). At J a point is marked so that FJ equals DF, then extend D through J to K, and with D as centre draw a circle whose circumference goes through J.

Now from J set off along the line DJK the distance AE or BF of Fig. 3 at L. With D as centre again draw another circle whose circumference this time goes through L.

You will now have two concentric circles, the smaller of which is the aperture for the moving coil and the larger the circumference of the cone. It remains to find what angle of paper has to be removed (Y of Fig. 1) to form the cone.

First of all, multiply the distance DF (Fig. 4) by 360, and divide the result by the measurement DJ (also Fig. 4). Then subtract the answer from 360, and you have

—DIFFICULT CALCULATION



the angle Y of Fig. 1, which may now be set off on Fig. 4 to make the angle MDL.

Before, however, you cut out this angle draw parallel to DL the line NO (Fig. 4) to form the overlap for sticking the cone. You will also want a piece on the edge of the cone to turn over (AA₁ and BB₁ on Fig. 2) to stick on the surround. The dotted circle on Fig. 4 shows this.

All that remains to complete the repair is to stick the cone, mount the moving coil and centring device and assemble on the surround—all of which is well within the scope of most experimenters' ability.



RADIO STEP-BY-STEP

OUR SPECIAL
SUPPLEMENT for
BEGINNERS

THE first thing that must be realised is that wireless waves have nothing to do with air. It is true that radio artistes are often said to be "on the air," but this is a misleading Americanism.

If wireless communication depended upon the existence of air it would frequently fail. How, for example, could a radio set, shut in an air-tight room, tune in the London stations if air were essential? And that has been done.

Not Always Convincing.

We mention this because the old argument that you can still receive a programme on a portable set, even though the windows of the room are shut, does not seem always to prove convincing with some beginners earnestly attempting to ferret out the whys and wherefores of wireless.

And, after all, it is sound criticism to say that air seeps through to everywhere a radio set is commonly used!

Nevertheless, as we have said, it has been scientifically proved that the total absence of air constitutes no deterrent to the wireless wave.

How, then, does it manage to exist?

A Simple Theory.

Well, there is a fairly simple theory, and this presupposes that the whole of space, including even the space between the particles of atoms, is pervaded by a substance known as ether. (Not the medical variety!)

This ether is supposed to be thinner than the thinnest gas. Water can soak through many substances. But air is thinner than water and can soak through numerous substances that are "water tight."



When an announcer speaks into a microphone he causes waves to be sent out in all directions—

The ether is said to be so "thin" that it can soak through anything, even such things as glass, steel, rock and so on,

universe floating deep down in a sea of this wonderful stuff. As you walk along the street or flash along the roads in a fast-



as though they were mere sponges.

But it must also be so stiff that it can be vibrated.

The ether theory is—by no means universally accepted. Another theory is that wireless waves (and also light and heat waves) consist of series of particles shot off from the transmitter like bursts of machine-gun bullets.

Yet another theory maintains that the whole of space is filled with fields of electrical energy, and that light and wireless waves are superimposed on this.

But this is really only another and perhaps more logical conception of the ether.

Undoubtedly, for purposes of explanation, the ether theory is the best. Providing you can overlook its somewhat fantastic properties—i.e. that it soaks through everything, all gases, fluids and solids, and yet has sufficient "body" to maintain waves—it is a perfect foundation on which to build your ideas.

Therefore we plump for the ether. Think, then, of the whole

moving vehicle you disturb the air.

But the ether remains unmoved by such activities. You are so porous to this thin stuff,

and your movements are so relatively slow, that there is no more effect than there would be if you very, very slowly moved a very wide-meshed sieve through water. (You are the sieve; the ether is the water!)

However, if a sudden shock is inflicted on the ether it causes a vibration to ripple through it.

The broadcasting station creates a continuous series of shocks in the ether while it is working.

The vibrations adopt a wave motion. That is to say, they can be compared with water waves in some ways, although it must be remembered that, while waves on a sea or lake occur on the surface, waves in the ether start from a central point and extend in every direction.

If you can visualise Fig. 1 as the cross section of the ether you should be able to get the idea easily enough.

The central point is the disturbance which creates the vibration.

But to understand what a wave is we must revert to the water simile.

A wave in the sea is not a rolling forward of the whole surface of the sea. Although it may look to the observer as though a wave is a piled-up mass of water tearing along over the ocean, actually what happens is similar to the shake of a stretched rope which causes a loop of rope to ripple along.

An Explanation.

But the loop arriving at the far end is composed of different rope from the loop that starts the motion, isn't it?

Let us examine a wave in detail.

Supposing a stone is dropped into a pool of water (Fig. 2). The stone depresses the water at the point where it hits it, and that makes the water all round lump up.

When this lumping up subsides (in a fraction of a second) an effect known as inertia causes it to act like the stone itself did and depress the surface.

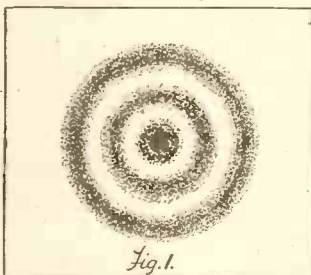
Gradually Reduced.

That creates a new lumping up a bit farther out, and the operation is repeated. But each successive lumping up and depression is smaller than the last, because the effect is spread out over an increasingly larger area.

That, to leap ahead a bit, is the reason why a broadcasting station's waves get weaker the farther you are away from it!

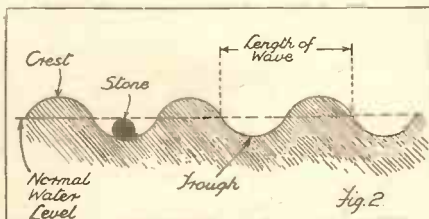
There are other reasons why in certain circumstances a station is heard better (or worse) than one's distance from it might at first presuppose and we shall deal with them in due course.

ETHER VIBRATIONS



For purposes of explanation this diagram may be assumed to represent a cross section of the ether.

A WATER ANALOGY



When a stone is dropped into the water it depresses the water at the point where it hits it, and that makes the water lump up.



—These waves, develop electrical energy in the listeners' aerial which is passed through the set and is reproduced as sound waves by the loudspeaker.

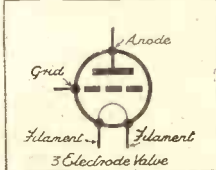
Your Valves

THERE is no need to be confused by the wide variety of valve types if you bear in mind that, with a few exceptions, all valves are either amplifiers or rectifiers.

The best method of recognising the various types is to consider the work they are called upon to perform rather than to endeavour to remember the letters and numerals by which the different valves are identified in a maker's list.

Every set needs a detector to rectify or detect the received impulses.

DET. OR L.F.



This symbol is the theoretical representation of an ordinary three-electrode battery valve.

speech or music from the broadcast carrier-wave nothing at all will be heard in the loudspeaker.

Generally, the type of valve chosen for this important duty is one of the ordinary three-electrode variety.

These three-electrodes consist of a filament, grid and anode in the battery type and a cathode (with its heater), grid and anode in the indirectly-heated mains version. The battery valve has four pins and the mains type five pins.

Practically any three-electrode valve will work satisfactorily as a detector, but some are better than others and for this reason the valve makers usually list special types for this particular work. Much depends upon the design of the circuit, but it is safe to say that any valve of the "H.L." variety will make an efficient detector.

General-Purpose Duties.

The letters "H.L." indicate the suitability of the particular type for general-purpose duties, and it happens that the characteristics of this class of valve are just right for effective detection. In addition to its work of detecting, the three-electrode valve also amplifies, thus combining two functions simultaneously.

There is a special kind of valve detector known as the diode (two-electrode valve) which does not amplify, but since the diode is



The Class B valve is unlike the other battery types in that it has seven pins. This is because it is really two valves in one bulb.

not in common use we shall not deal with it at this stage.

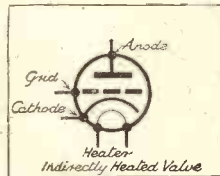
Certain types of valves are intended for use purely as amplifiers. For instance, the range of a receiver is dependent upon its ability to magnify the very weak impulses picked up by the aerial. The transmissions from broadcasting stations hundreds of miles away require considerable amplification before they become worth while from the entertainment standpoint.

Distant Reception.

A set designed for long-distance reception is provided with high-frequency amplification; that is to say, it has a valve (or valves) whose sole purpose it is to magnify the received broadcasting in its raw state, prior to detection.

The valve generally used for high-frequency amplification is the screened-grid (S.G.) valve, and it has four electrodes, viz., a filament, grid, screening grid, and anode. In the indirectly-heated mains type the filament is replaced by a cathode and heater.

A.C. OR D.C.



Mains valves of the indirectly heated type can be recognised by the extra electrode, called the cathode.

The S.G. valve is a very efficient device, and when used in a properly designed circuit it is capable of magnifying the minute currents picked up by the aerial to many times their original strength.

The screening grid and anode are both joined to the positive side of the high-tension supply, the anode terminal being located at the top of the glass bulb surrounding the valve elements.

A Great Advance.

The screening grid is joined to the pin at the base of the valve, which in the three-electrode type goes to the anode.

The S.G. valve was brought out in 1926, and it may be truly said to have revolutionised H.F. amplification, for prior to the advent of the S.G. valve, any attempt to obtain really appreciable amplification before detection



The screen-grid valve has a terminal on the bulb as well as four pins in the battery type, or five pins in the mains version.

was invariably accompanied by instability; thus the H.F. amplifier as we know it to-day was then quite impracticable.

But the S.G. valve overcame this, and the secret of its success is the second grid, which we have previously referred to as the screening grid.

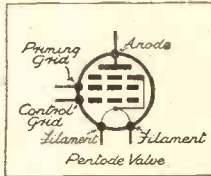
There are other types of valves which can also be used for H.F. amplification. For instance, there is the special H.F. pentode, but generally speaking, the S.G. valve is the type employed in the vast majority of present-day receivers.

There are two kinds of S.G. valves—namely, the standard S.G. and the Multi-mu.

Volume Control.

The multi-mu (or variable-mu) is externally identical with the standard S.G., but it is designed to be used in conjunction with a potentiometer arranged so that the negative bias applied to its grid can be varied within certain limits. The effect of this is to provide a very convenient and effective method of volume control, and the multi-mu S.G. amplifier has now attained a greater degree of popularity than the non-multi-mu version.

PENTODE



In a pentode there are three grids, one of these being connected internally to the filament.

Although primarily intended for H.F. amplification, the S.G. valve is sometimes employed as a detector, but its use in this sphere is chiefly confined to special circuits, such as those of the short-wave type.

The L.F. Side.

When the impulses picked up by the aerial have been amplified at high frequency and rectified, it is necessary to magnify them still further before they are sufficiently strong to work a loud-speaker.

This final process is called low-frequency amplification.

The number of low-frequency stages rarely exceeds two, and one is often adequate.

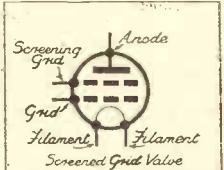
If there are two stages, the first valve in the low-frequency

chain will be of the three-electrode type, while the one which follows it, and which is known as the output valve, can be a power, super-power, pentode or Class B valve (depending upon the circuit).

In fact, there are a wide variety of valves designed for use in the output stage and space does not permit us to deal with them all at this juncture.

Power and super-power valves have three electrodes and derive their name from the fact that they have to supply power to the loudspeaker. They do not greatly increase the overall magnification of the set.

S.G. TYPE



The screen-grid valve has two grids, an anode and filament.

On the other hand the pentode is an excellent amplifier and is frequently used in single stage low-frequency amplifiers where the maximum volume is desired in return for a comparatively small input. A pentode has five electrodes (hence the name), three of which are grids. Three-electrode power valves and pentodes are obtainable in both battery and mains types.

A recent development is the Class B valve, an output valve specially designed for the battery user. The Class B valve is in reality two valves in one glass bulb. It requires a seven-pin valve holder, and has the advantage of extraordinary economy in H.T. current consumption combined with large output power.

Theoretical Symbols.

On this page there are four small sketches which represent four commonly used types of valves. When you next see a theoretical circuit in POPULAR WIRELESS you will have no difficulty in recognising the valves.

The bulb containing the electrodes (grid, filament, anode, etc.) is shown as a black circle. Inside this circle are the electrodes, the grid being represented by a row of dashes, the anode by a thick black line, the filament or heater by a thin semicircular line and the cathode by a thicker line just above the heater. With the help of black lines representing the external wiring in the set it is possible to show, not only the type of valve, but also the way it is joined in the circuit.



This is an ordinary battery three-electrode valve suitable for use with a 2-volt accumulator. Valves of this type are employed as detectors and low-frequency amplifiers.

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1	PETO-SCOTT ebonite terminal strip (ready drilled)	9	
	PETO-SCOTT flex, screws, connecting wire	2	6
2	COLVERN S.T.500 coils	8	0
2	ORMOND type R.493 '0005-mfd. tuning condensers	15	0
3	GRAHAM FARISH "Litios" '0005-mfd. variable condensers	6	0
1	TELSEN type W.353 '0001-mfd. diff. reaction condenser	2	0
1	POLAR '0003-mfd. diff. reaction condenser	3	0
1	J.B. type 1088 B/B pre-set '0001-mfd. condenser	1	0
1	J.B. type 1087 B/B pre-set '0005-mfd. condenser	1	0
1	TELSEN Class B driver transformer, ratio 1-1	8	6
1	TELSEN Class B output choke	8	6
1	VARLEY "Nielit" L.F. transformer, 3.5 to 1	7	6
1	TELSEN type W.74 S.G. choke	3	6
2	BENJAMIN "Vibroldier" 4-pin valve holders	1	8
1	J.W.B. "Universal" 5-pin valve holder	1	0
1	GRAHAM FARISH 7-pin valve holder	1	3
1	LISSEN disc type LN.5092 H.F. choke	2	0
1	FERRANTI 1-mcg. synthetic grid leak and holder	1	6
2	DUBILIER 1-watt metallised 5,000-ohms resistances	2	0
2	DUBILIER 1-watt metallised 10,000-ohms resistances	2	0
1	GRAHAM FARISH 250-ohms "Ohmite" resistance	3	0
1	IGRANIC 2-mfd. fixed condenser	1	6
1	T.C.C. 1-mfd. fixed condenser, type 50	2	6
1	DUBILIER type B.B. 1-mfd. fixed condenser	2	6
2	T.C.C. '005-mfd type 300 tubular condensers	2	6
1	GRAHAM FARISH '0005-mfd. tubular condenser	1	0
1	LISSEN '00005-mfd. mica condenser	6	
2	LISSEN type LN.5070 push-pull on-off switches	1	8
1	BULGIN S.80 toggle on-off switch	1	6
10	BELLING-LEE type R terminals	2	6
3	CLIX wander plugs	4	3
1	BRITISH RADIOGRAM bracket	3	

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BBROADCAST receivers can be divided into two classes, viz. those which obtain their current from batteries and those designed for plugging into the mains and known as all-electric sets.

In some cases the high-tension current is derived from the mains, while the low-tension supply and grid bias are obtained from batteries. Receivers in this category are basically of the battery-operated type, and the mains high-tension supply could, if necessary, be replaced by a suitable battery.

Battery Sets.

In the case of the normal battery-operated set three different batteries are needed for supplying current to the valves and to maintain them in their proper operating conditions.

The filaments have to be heated up to a certain temperature before any electron emission can take place. Similarly, the anodes have to be maintained at a positive potential, otherwise the valves will not work at all.

Low-frequency amplifiers (not Class B valves) and screen-grid H.F. valves of the multi-mu type are among those valves requiring negative grid bias on their grids in order that efficient operation shall be achieved.

The Filament Current.

The filament current in a battery receiver is obtained from an accumulator, usually consisting of a single 2-volt cell. This is because the valves used in the vast majority of sets are of the 2-volt type. The accumu-

H.T. SUPPLY



H.T. batteries are composed of a large number of dry cells joined in series, the total voltage being that of one cell multiplied by the number of cells.

lator used for filament heating is called the low-tension or L.T. battery.

An accumulator requires regular charging, and given proper attention will provide trouble-free service for a very long time. When you go to buy an L.T. battery you will probably be asked what capacity you require.

This is because all accumulators have a definite rating of so many volts and so many ampere hours. All single accumulator cells give a voltage of two, irrespective of their ampere-hour capacity.



If a battery of, say, 6 volts is needed for any particular purpose three cells are connected so that their respective voltages are added together.

But although each cell gives 2 volts, the amount of current it can supply is solely dependent upon its ampere-hour capacity.

Suppose, for example, the ampere-hour capacity is thirty. This means that it will, when fully charged, supply 1 ampere for thirty hours, 2 amperes for fifteen hours, and so on.

Similarly, a 60-ampere-hour cell would supply 1 ampere of current for sixty hours and 2 amperes for thirty hours.

Now a valve filament consumes current, hence the L.T. battery must have a sufficient ampere-hour capacity to supply the current for ALL the valves without having to be recharged too often.

That is why the dealer asks you what capacity you require.

You can figure this out for yourself or, alternatively, put yourself in the hands of the dealer, telling him the number and types of valves you are using in your set.

Suppose you have a three-valve receiver with, say, one screen-grid, a detector and a super-power valve. Suppose, also, you look up the valve maker's list and find that the S.G. valve takes .15 amp., the detector .1 amp., and the super-power valve .25 amp. The total filament consumption is .5 amp., and if you used the set for four hours a day your valves would consume 2 ampere hours (half an ampere multiplied by four).

Therefore a 30-ampere-hour accumulator would last for about fifteen days before it needed charging.

The liquid used in an L.T. battery is dilute sulphuric acid, and you must take care not to spill any of this acid upon the carpet or your clothes, because it will eat the material away unless you quickly neutralise its effects with ammonia or a strong soda solution.

If you are wise you will find a reliable charging station and ask them to keep your battery regularly charged and topped up with water. At the end of this series you will no doubt be well equipped to carry out many of these maintenance jobs yourself.

Next we come to the high-tension battery. In most cases this is a dry-cell unit giving a maximum voltage of 108 or 120, and provided with tapings for intermediate voltages. Those who use high-tension accumulators are usually in a position to do their own charging or are fortunate in having available a regular charging and collection service.

The dry battery is by far the most common source of H.T. for the average battery-operated receiver. A dry-cell unit consists of a number of individual cells joined together in series (so that their respective voltages are added).

A dry cell is not really dry, because the active material in its construction is a paste of sal-ammoniac solution. The sketch shows one form of this type of cell. The case is of zinc, and inside this is a lining of sal-ammoniac paste. In the centre of the cell is a rod of carbon, and this is separated from the active material (the paste) by a layer of manganese dioxide. The top of the cell is filled in with pitch.

The cells used in high-tension batteries are quite small, and consequently the current that can be taken from them is also

small. But this is all that is required of them, because they are only called upon to supply a few milliamperes (a milliampere is one-thousandth of an ampere) to the anodes of the valves.

Nevertheless, H.T. batteries are made in different capacities, the super-capacity types having larger cells than the "standard" types.

It therefore behoves the beginner to see that his particular H.T. battery is the correct capacity for his set, otherwise he may overload the cells and so considerably shorten the life of the battery.

The Size to Use.

Three-valve sets with super-power or pentode valves need one of the larger batteries, and it is uneconomical to use the "standard" types. On the other hand, the smaller sizes will give excellent service with one- or two-valve sets.

It is all a matter of current consumption, and in the absence of experienced advice it is a good plan to ask the battery makers, telling them what valves you have.

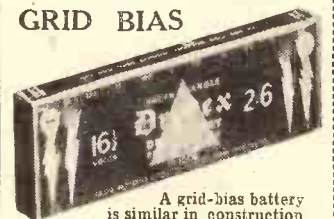
The third battery in the set is the one used for grid bias. This is a small dry-cell unit similar to the H.T. battery, but having only a few cells.

Varying Demands.

With some battery sets a 4½-volt grid-bias unit is ample. With others 15 or 18 volts may be needed. This depends upon the valves used, the super-power types requiring more grid bias than the small-power variety.

A grid-bias battery will last for a long time without replacement, but if there are no means

GRID BIAS



A grid-bias battery is similar in construction to that used for high-tension supply, but has fewer cells.

of testing its voltage it is a sound scheme to renew it every six or eight months.

Too little grid bias, e.g. a run-down grid-bias unit, causes the valve to consume more high-tension current and so throws a heavy strain upon the H.T. battery. Moreover, it may ruin the valve, in addition to having a detrimental effect upon the reproduction.

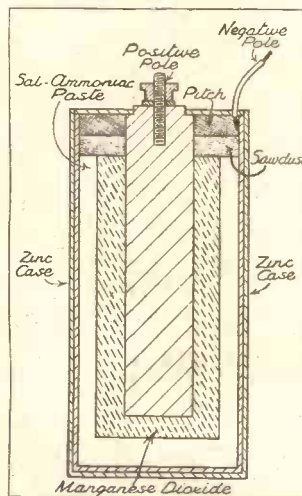
Also grid-bias voltage should never be adjusted while the set is working. That is to say, the low-tension supply to the valve filaments should be switched off before any of the grid-bias plugs are removed. This applies particularly to a power or pentode valve and should be made a rigid rule.

FOR L.T.



A Block accumulator of the type used for L.T.

INSIDE A CELL



This sketch shows the internal construction of a dry cell. The positive terminal makes direct connection to the carbon rod seen in the centre.



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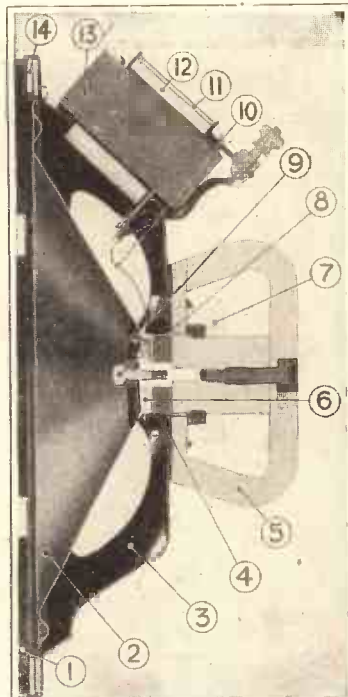
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Sectional view of the famous "CHALLENGER." Write for Explanatory Leaflet.

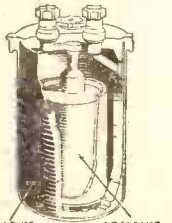
THE ACCUMULATORS OF A NEW DAY

● Why re-charge your L.T. accumulator so often?

● You can now have one that is the same size yet lasts twice as long per charge!



1. The secret is a new process that enables active material to be formed solid round the inside of a lead cylinder (which is both the negative and the cell's container!) without the aid of space- and-weight-wasting grids. The positive is a central column.



2. Get a Block plate-less accumulator to-day — 100,000 happy listeners are already enjoying this new freedom from old-time battery restrictions.

BLOCK
PLATE-LESS ACCUMULATORS

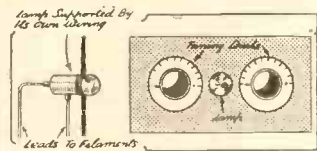
BLOCK BATTERIES LTD., BY-PASS ROAD, BARKING, ESSEX



TWO IN ONE.

THE following is yet another version of a panel light; this time it serves as indicator also. By placing a cross on the bulb, one line serves as indicator with lamp on, and a quarter turn brings the other line across, and this serves as indicator with lamp off. It can, of course, be used with one or two dials.

To make the cross on the bulb, proceed as follows: obtain a piece of transparent adhesive tape, cut to about the size of a shilling and make six small cuts round the edge. Now wet two pieces of black thread (each an inch long) and place these on the



tape so as to form a cross. Now light bulb, wet the glass, press tape into position, and snip off surplus thread. A very neat and efficient job will result.

SAFETY SWITCHING.

THE following is a description of a switch attachment designed to prevent tampering with the inside of an all-mains set with the "juice" on:

If the lid of the cabinet lifts completely off it should be hinged. A tumbler switch (of the wall-mounting, not panel-mounting type) is fixed on the inside of the side of the cabinet, 3 in. from the top and 2 in. from the back. It is connected in the live mains lead before the present switch. It should, of course, be fixed so that the knob moves up and down.

A piece of card, about 6 in. by 4 in., with a flange along the short side, is pinned to the back of the cabinet, with its surface parallel to the side of the cabinet and lightly pressing on the switch knob. The switch knob is liberally coated with ink and the



The metal is simple to cut and bend.

cabinet back is closed. The path traced by the switch knob on the card is therefore marked on the card (see dotted line in sketch). A template is then drawn as sketch.

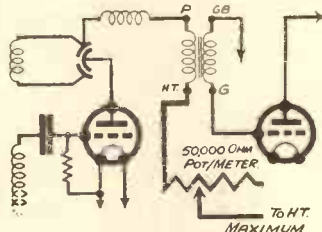
Distance marked "a" is the distance switch knob moves from "off" to "on" positions. This assumes that the switch knob was up when the tracing was taken. This is then cut out in stout brass or aluminium. The slot is best cut with a fine fret-saw. The end is bent back at right angles, as indicated, and the arm is screwed in the position formerly occupied by the card, and so that the switch knob passes through the slot.

The switch knob should be up when the back is open. Then, as the door is closed, the knob, passing along the length of slot, will be pressed down and

the set switched on. Thus it is impossible for the "juice" to be on when the set is open.

ECONOMISING H.T. CURRENT.

HAVING built a det. 2 L.F. set recently, and finding the voltage on the anode of the detector valve rather



It reduces the anode volts.

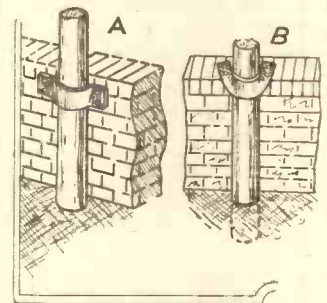
critical, I sought to "kill two birds with one stone."

I disconnected the H.T. cable from the transformer connected to the anode of the detector valve, and connected the transformer H.T. terminal instead to one terminal of a 50,000-

If this home-made condenser is connected between the aerial and the aerial terminal of the set, selectivity can easily be varied by sliding one of the metal plates in or out and thus varying the aerial coupling.

FIXING AERIAL MASTS.

THIS hint will probably be useful to those who intend to make use of a handy wall for supporting the aerial mast, instead of going to the trouble

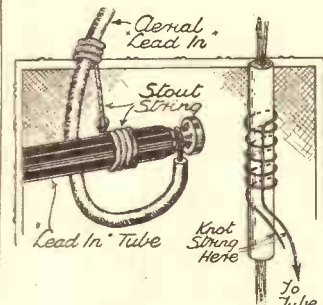


A. The wrong way. B. The correct method.

AN IMPROVED LEAD-IN

USERS of insulated lead-in wire are frequently annoyed by breaks, disconnecting the aerial. The constant swaying of the down lead chafes and frays the wire until it snaps.

The writer has found that by using



Try this for fixing your lead-in.

a piece of stout string, tied as shown in the sketch, this trouble is almost entirely eliminated. The string takes practically the whole strain which would otherwise fall on the strands of the lead-in wire.

ONE GUINEA FOR THE BEST WRINKLE !

Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1. is will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles." Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

The best Wrinkle in the October 14th issue was sent by Alan J. F. Green, Penylan Pentyle, Port Talbot, Glam., to whom a guinea is being awarded.

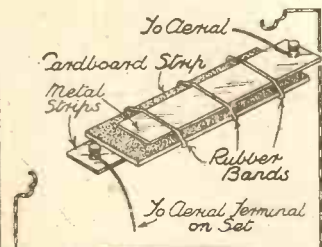
ohm potentiometer which I mounted on the panel. I then connected the sliding arm of the potentiometer to the nearest terminal at a potential of 120 volts (or more), i.e. the L.S. + terminal of the set. The other terminal of the potentiometer was left free. Thus I did away with one plug, at the same time having a control of H.T. detector volts.

A HOME-MADE PRE-SET.

A USEFUL pre-set condenser can easily be made as follows.

A strip of stiff cardboard should be cut to a suitable size (say 4 in. x 1 in.) and two strips of copper or other thin metal should be cut to a slightly smaller size.

Terminals should be affixed to one end of each of the metal strips, which should then be fastened to opposite sides of the cardboard by means of rubber bands.



A simple gadget for improving selectivity.

of digging a deep hole and then fixing stay wires from the top of the pole to the ground.

When I first erected my pole in this manner, I fastened it to the wall in the way shown at A, which is the obvious way of doing it; but after the first gale I found that the force of wind on the aerial wire had dragged the 4-in. nails from the wall. After this experience, I erected the mast differently, by first of all digging a small hole about a foot deep and firmly planting the lower end of the pole in this.

I then fastened it to top of the wall as shown at B. By fixing it in this way, the pull on nails, being indirect, is comparatively slight, and my aerial system will now withstand the severest gale. The pole is a heavy 23-ft. seafoam pole.

LINEN-DIAPHRAGM LOUDSPEAKERS.

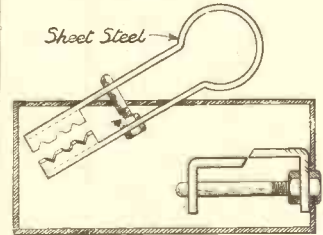
MANY readers who have constructed double-linen-diaphragm speakers may have found difficulty in preventing slight chatter on loud passages occurring at the point where the two diaphragms are joined. The following method will be found thoroughly effective.

Insert a paper washer between the metal cone-shaped washer and the linen on each side of the speaker. Then, when the two diaphragm centres are drawn together, apply some Secotone to each.

This will soak through the linen to the paper washers, and the two diaphragms will be securely fixed together, and any chatter due to slight looseness will be eliminated.

STRIPPING INSULATION.

A USEFUL insulation stripper can be made up from sheet steel, as shown. The usual stripper has an end-on application, but in some instances the one shown will be found useful.



As the jaws of the tool must be kept in alignment a guide-peg is found necessary. The tool will be found very useful in difficult corners and positions where it would be difficult to apply an end-on stripper.

SHORT-WAVE CALIBRATION.

COMMENCING at the right-hand side with 0, I measured off on a large graph sheet up to 600 millimetres in tens. This is as much as one sheet will hold, but extensions can be made on other sheets at either end of the scale or range. Up the right-hand side of sheet I marked off in tens 0 to 180 (the condenser markings).

I multiplied the millimetres by 10 and then used the figures as kilocycles, a range from 6,000 kc. to 12,000 kc. now being available. I used Moscow 50 m. 6,000 kc. as 0 station, and marked on sheet the point where it came in on condenser, and then Rome, 25.4 m., 11,810 kc. Drawing a line through both points gave me an approximate point for any intermediate station.

(The line must be very carefully and minutely drawn.)

(Continued on next page.)

RECOMMENDED WRINKLES

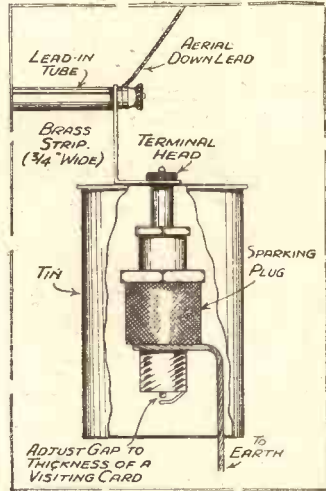
(Continued from previous page.)

A SAFETY DEVICE.

HERE is a radio idea of my own in the form of a lightning arrester which I find quite practical in use and quite inexpensive.

All that is needed is an old sparking plug a strip of brass and a tin of suitable dimensions—a cocoa tin about 2 1/2 in. diameter is quite suitable.

The brass strip is bent in L formation, length of base being 1 in., vertical portion 3 in. (see sketch), a hole being drilled at the top and bottom for fastening on "plug" and lead-in tube, as shown.



Well worth making.

A hole is then drilled in the bottom of the tin, through which the terminal part of the "plug" is inserted.

The brass strip is then clamped in between the tin and terminal head.

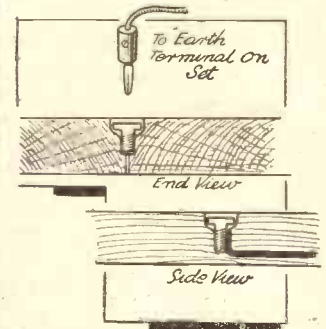
A length of wire should be fastened round the base of the "plug" before insertion into the tin; this runs to earth.

The device fastens on the lead-in tube, as shown, and a coat of paint given to the tin ensures a permanent and water-proof job.

HIDING THE EARTH.

IT is sometimes impossible to take advantage of a good "earth" without trailing unsightly wire round the room. The following method may overcome the difficulty.

First consider where your best "earth" is, and then decide how it can be reached by running a lead between the floorboards. Next secure a small plug and socket, costing about 1d. or 1 1/2d. To the socket solder a length of 10-gauge copper wire. Then make a hole between the boards sufficiently large enough to wedge the socket firmly, sinking it just below the surface. Its position should be directly underneath the set and as near the wall as possible. The boards should now be gently levered apart at intervals with a screwdriver, and the wire



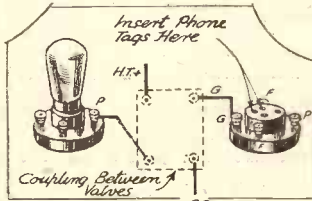
No more trailing wires.

pressed in, and finally connected to your "earth."

A short piece of flex from the earth terminal of the set should be connected to the plug, which can, of course, be disconnected at any time from its hardly perceptible "earth point" in the floor.

SIMPLE TESTING.

IN various articles dealing with trouble-tracing in stages, utilising 'phones, it is stated that they should be placed in the anode leads of the valves whose stages are being tested. Now, this obviously requires breaking a lead, or leads.



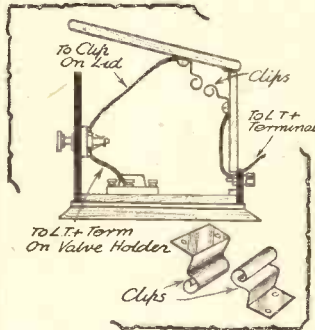
Try it yourself.

It will be known that the signals from one stage are applied between grid and filament of the succeeding valve, therefore if 'phones are placed in the grid and filament sockets of a stage, then (except where the preceding stages are H.F.) the signals from the preceding valve will (or won't) be heard. This saves breaking any wires, merely necessitating the removal of a valve.

LONGER VALVE LIFE.

FOR the guilty, as well as the innocent here is a tip which makes it impossible to pull out the grid-bias plugs while the set is switched on. Two springy brass clips (as per sketch) and a slight alteration to the L.T. switch wiring are all that is required.

For the reader who is unable to make the clips shown, two pieces of metal which make contact when the lid of the wireless cabinet is closed will do quite well, provided the contact is reliable. The idea is to make a break in the L.T. wiring whenever the lid is opened for the purpose of adjusting the G.B. wander-plugs.



An excellent safety tip.

The G.B. battery should, of course, be clipped inside the set (it generally is). Irrespective of the position of the on-and-off switch, this method will prevent the swing of excessive current caused by removing G.B. plugs, and thereby prolong the life of your valves.

REMOVING BROKEN DRILLS.

WHEN drilling a very small hole—for instance, 3/16 in. (for 6 B.A. tapping) in iron panel brackets, etc.—the drill often breaks off, and, unfortunately, flush with the surface of the iron. To remove it, without injuring the metal and spoiling the position of the hole, a good idea will be found in the following:

First heat the metal slightly round the hole and then drop a few spots of acid (from wireless accumulator) into the hole where possible. In cooling, the acid is drawn in and slowly attacks the metal and the drill.

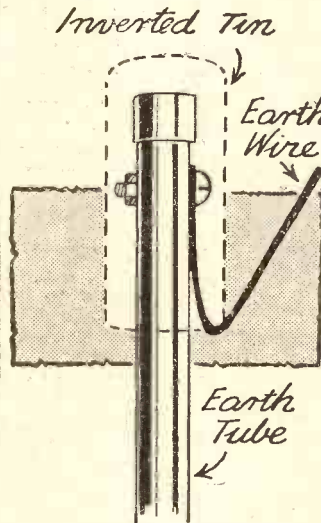
Then, after five minutes or so, with the aid of a pair of watchmaker's forceps inserted into the flutes of the drill, work the drill about, when it will be found to eject itself quite easily. Afterwards wash forceps and hole in a solution of washing soda to "kill" the acid.

When the hole is now tapped it will be found to give a full thread: thus the amount of metal removed is infinitesimally small.

For brass, use the same plan, but dilute nitric acid instead of sulphuric acid, because it will act more quickly. To handle the acid use an ordinary fountain-pen filler and also for forcing the washing soda solution down the hole.

CONNECTION PROTECTION.

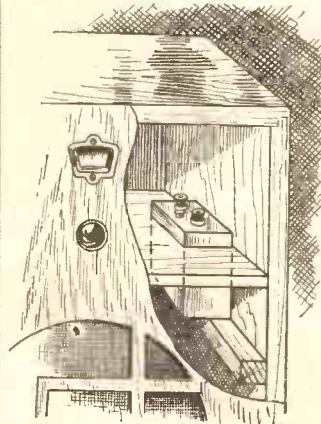
IN order to maintain the efficiency of an "earth" it is desirable that where the earth wire joins the conventional earth tube, usually under a nut and bolt, it should be protected



from the elements to avoid corrosion and the ingress of dirt. A simple way to effect this is to place a discarded shaving-stick or other round tin over the end of the earth tube and wire, the latter being bent down so that water cannot reach the actual junction of wire and metal.

ACCOMMODATING THE ACCUMULATOR.

A HOLE is cut out of the end of the baseboard the same size as the base of the accumulator. Inside the set, if the loudspeaker is beneath the



Spilled acid is avoided.

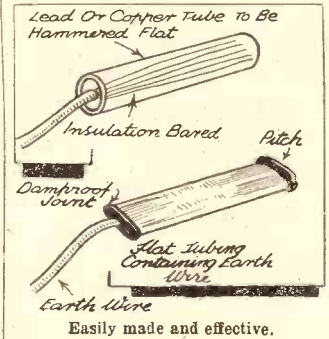
set itself, a wooden batten can be fixed as a rest for the accumulator.

The batten, which runs from the front to the back of the cabinet, should be fixed about a distance of 1 in. less than the length of the side of the accumulator from the baseboard. For instance, if the side of the accumulator is 8 in., the distance from the baseboard should be 7 in.

The accumulator is then in a sunken position through the baseboard, leaving room for an output choke or a transformer to be fixed against the side or back of the cabinet.

EFFICIENT "GROUNDING."

A NOVEL and efficient earth is easily constructed in the following manner.

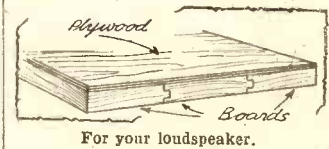


A length of common lead tubing is obtained and is joined to the earth wire by stripping an equal length of the wire of its insulation and threading the bare wire down the length of the tube. This is then hammered flat, and the two ends of the tubes sealed with battery pitch.

One of these earths that was in use for several years, when examined, was in very good condition, due, no doubt, to the careful sealing of the ends of the tube.

A HOME-MADE BAFFLE.

ONE often finds while trying to make a baffle that the timber merchant cannot supply a board wide enough.

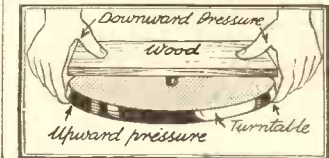


Here is a simple and cheap way of overcoming the difficulty.

Buy the widest boards possible; tongue and groove them, filling grooves with glue when fixing; cover the front with plywood. This can now be polished and will look and work like a one-piece baffle.

REMOVING A TURNTABLE.

DIFFICULTY is often experienced in removing the turntable from the spindle of a gramophone motor, especially if it has got "bedded down" through long usage. I find that this is greatly simplified if a piece of wood is



An even pull does the trick.

put on to the top of the spindle and the turntable and wood pressed together, as shown in sketch. This method also stops unnecessary strain being put on the spindle shaft.

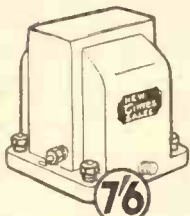
S.T. 500

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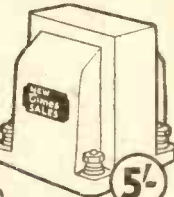
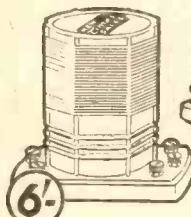


N.T.S. Class B
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N.T.S. Class B
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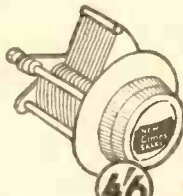
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N.T.S. Valve
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N.T.S. Fixed
Condenser.

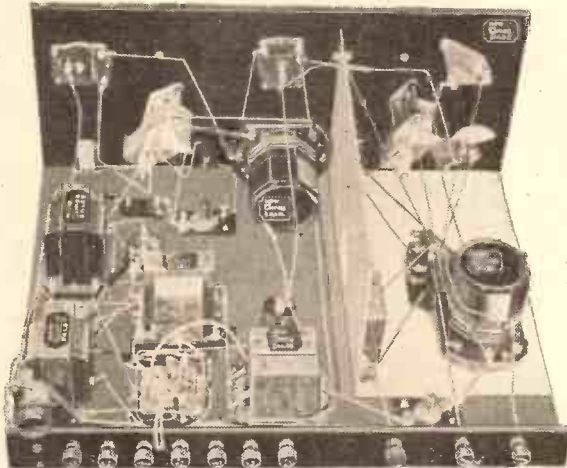


N.T.S. Slow-Motion
Condenser.

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KIT 1

Comprising Kit of matched parts as listed, including ready-drilled Panel and terminal strip, S.T.500 Screen, Peto-Scott Metaplex Baseboard and "Class B" Output Choke. With Free Full-Size Blue Print and Copy of "Popular Wireless" Oct. 21st. Less Valves and Cabinet. Cash or C.O.D., Carriage Paid.

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If Permanent-Magnet Moving-Coil Speaker required, add 15/- to Cash Price or 1/3 to first and each monthly payment.

FINISHED INSTRUMENT

Assembled from N.T.S. components and broadcast tested, complete with valves and in specified Peto-Scott Table Cabinet. Cash or C.O.D., Carriage Paid.

£8:9:6 or 12 monthly payments of 15/6

As above, but Ready to Play in Peto-Scott Specified Walnut Console Cabinet with Peto-Scott Permanent Magnet Speaker. Cash or C.O.D., Carriage Paid, £9.15.0. or 12 monthly payments of 18/-.

THESE PARTS are MATCHED, TESTED AND GUARANTEED

1	PETO-SCOTT plywood baseboard with Metaplex section, 16" x 12"	1	9
1	N.T.S. panel, 16" x 7" x 1/4", ready drilled	3	0
1	N.T.S. S.T.500 screen	1	6
1	N.T.S. terminal strip, ready drilled	1	9
1	N.T.S. bracket for tone control condenser	3	0
2	N.T.S. S.T.500 coils	6	0
2	N.T.S. slow-motion .0005-mfd. tuning condensers with dials	9	0
3	N.T.S. .0005-mfd. solid dielectric reaction condensers	4	6
1	N.T.S. .0001-mfd differential reaction condenser	1	3
1	N.T.S. .0005-mfd. differential reaction condenser	1	6
1	N.T.S. baseboard pre-set .0001-mfd. condenser	9	
1	N.T.S. baseboard pre-set .00005-mfd. condenser	9	
1	N.T.S. Class B driver transformer, ratio 1:1	7	6
1	N.T.S. Class B output choke	6	0
1	N.T.S. super transformer	5	0
1	N.T.S. S.O. choke	2	6
2	N.T.S. 4-pin valve holders	1	0
1	W.B. "Universal" 5-pin valve holder	1	0
1	GRAHAM FARISH 7-pin valve holder	1	3
1	N.T.S. disc type H.F. choke	1	6
1	N.T.S. 1-mer. link with wire ends	1	6
2	N.T.S. 1-watt metallised 5,000-ohm resistances	1	6
2	N.T.S. 1-watt metallised 10,000-ohm resistances	1	6
1	N.T.S. 250-ohm resistance	9	
1	N.T.S. 2-mfd. fixed condenser	2	0
2	N.T.S. 1-mfd. fixed condensers	3	0
2	N.T.S. .005-mfd. tubular condensers	1	6
1	N.T.S. .0005-mfd. tubular condenser	9	
1	N.T.S. .00005-mfd. mica condenser	6	
2	N.T.S. push-pull on-off switches	1	4
1	N.T.S. toggle on-off switch	1	3
10	N.T.S. terminals	1	8
	Flox, screws, 3 wander plugs, connecting wire, etc	2	0

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P.W. 28/10/33.

GUARANTEED MATCHED AND TESTED PARTS



TWO NEW SWITCHES

I THINK that of all types of switches the "toggle" is the neatest and most generally satisfactory and the push-pull (or the majority of them) the crudest.

There is an attractive phrase, "a touch of the switch," which is often employed in eulogising electrical apparatus. It envisages a light tap with one finger which at once makes the gear spring into action or causes a complete change of conditions.

But it certainly does not apply to some of those stiff push-pull switches which need to be yanked out like a dentist drawing a horse's tooth, and driven in with such force that the panel sways back with creaks and groans.

They are as much the relics of the stone age of electricity as the toggle is representative of modern technique. Bulgin makes some beautiful little toggles. You know what they are, of course; outwardly, at least, they resemble miniature light switches. And in that they work with crisp up-and-down motions they are familiar to handle to anyone whose house is wired for electricity.

This, to my mind, is a great advantage; the kind of standardisation that is sensible. I always use toggles for on-off purposes. Hitherto they haven't been available for much else.

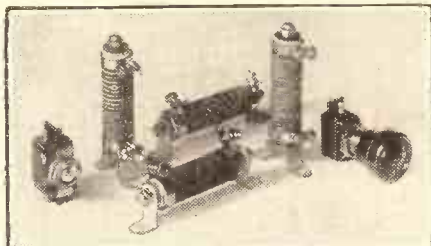
But now Bulgin has produced one of the double-action, double-pole, double-throw type which has many uses. And it retains the simple, easy, crisp action that is the hall-mark of the good toggle.

No half-way positions are possible; it snaps over to one side or the other, and that is that.

It is rated at 1 ampere, 250 volts, which, in itself, is rather wonderful for so small and neat a device.

The price is 2s. 3d., and that includes a metal indication plate bearing the words "Radio/Gram," "On Off," and any other of several alternative markings.

The same mechanical principles which make these Bulgin toggles so successful, and a similar high degree of electrical reliance, are to be found in yet another new Bulgin switch.



Heavy duty anode resistances, and double-pole double-throw toggle and rotary switches of Bulgin manufacture.

This is a rotary-action mains-miniature switch. It has a handsome walnut knob arranged for rotary operation. Its action is perfect.

Rated at 250 volts 3 amperes, this switch costs 1s. 9d., and it can be supplied with a longer bush for panels up to 1-in. thick, if desired, at 2s., but there are no indicating plates in either case.

I have tested both these new Bulgin switches for flash-over and insulation resistances, and find them completely O.K. And I would like to take this opportunity of saying that of a number of Bulgin switches which I have had in constant use for some long time none has developed the slightest fault.

Yet another recent addition to the now widely comprehensive Bulgin range is a Heavy-Duty Anode Resistance.

This can be obtained in numerous values from 300 ohms (this can carry 270 milliamperes) to 40,000 ohms (with a current-carrying capacity of 25 milliamperes).

The component is equipped with terminals, unlike the above-mentioned switches, for these have only soldering tags, and is designed on particularly robust lines.

The winding is accommodated on a grooved porcelain former. We have already used numbers of these Bulgin resistances with entire success.

A NOVEL VALVE HOLDER

In an age of radio, when the valve, as never before, dominates almost every sphere of progress, the Ostar-Ganz Universals stand out as worthy of very special consideration.

Anyway, that is my personal opinion, based on very recent experiences with sets and amplifiers using them.

Their versatility, the fact that they enable one to design a set equally suitable for either D.C. or A.C., is a quality of great importance. But it must not be allowed to over-shadow the fact that Ostar-Ganz valves are good purely as valves.

The rather special treatment they demand in respect of smoothing is eliminated when an ingenious valve holder that has been designed for them by Ostar-Ganz is used.

It is a quite inexpensive, simple component, but embodies special shielding.

A portion of this comprises a small vertical shield which divides the sockets. You can clearly see it in the accompanying view of the pieces comprising a complete holder.



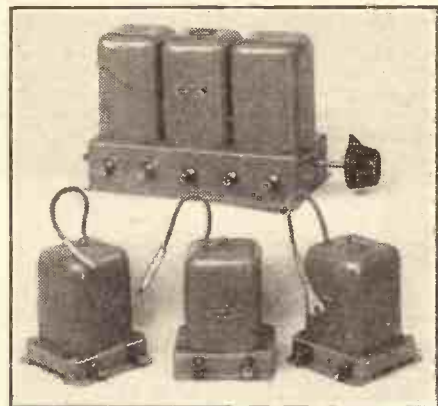
Made specially for Ostar-Ganz "universal" mains valves, this holder has a special shield between some of the sockets.

This shield continues and completes the good work done by a shield which runs up the base of the valve itself.

Practical experiments reveal that the scheme functions admirably. Freedom from hum, even with high magnification, is given.

WEARITE COILS

The great revival of the superhet is now a matter of history, though there are probably some readers who do not realise that there was a superhet renaissance. They may even think the "super" is a modern thing that was steadily developed in the way, for example, that the all-mains set progressed.



Wearite (triple-coil unit) and intermediate coils employing iron-core coils.

But we had our supers in the earliest days of broadcasting. Then the system fell from favour and for years languished in an obscurity bordering on extinction.

Giving credit where credit is due, I believe that we owe quite a deal to Messrs. Wright and Wearite for the great revival. Anyway, they very actively assisted by introducing apparatus and ideas that put the super firmly on its feet again.

It is, therefore, appropriate that Messrs. Wright and Wearite should be among the first to apply the new iron-core technique to a triple-coil assembly particularly suitable for this and other up-to-the-minute designs and to intermediate transformers for superhets. These latter are skilfully designed components, and on test we have found them perfectly satisfactory in every way.

They are admirably constructed and are unusually compact; that is for coils as such. Advantage has been taken of the fact that efficient screening can be employed with small physical dimensions.

The switch action of the triple coil assembly is definitely good. It is curious how many components of this nature have fallen below standard on account of what is after all little but a mere mechanical detail. But the Wearite assembly does not.

HOME construction is now in fullswing. The various R.M.A. exhibitions are over; all the carefully guarded secrets are out, and "P.W.," by the publication of Mr. Scott-Taggart's latest and greatest set—the "S.T. 500"—



Weekly jottings of interest to buyers

has given the greatest boost to home construction that the industry has ever known.

Now is the time to buy and to build. While it is true that home-construction is no longer a seasonal pastime, there is inevitably a certain amount of hesitancy (and very wisely so) immediately before the dawn of radio's "New Year." But now, very definitely, the slogan everywhere should be "full steam ahead."

It may perhaps be wondered why I should be so keen to press the matter. As a matter of fact, to whatever extent I may be inclined to press the matter, you can take it from me that it is in your own interests. That is the idea of "The Link Between," and from information which has come to hand, as a result of my various trade liaison activities, there

is a possibility that prices may rise.

I don't say that it is definite, in fact, anything that can be done by "P.W." to maintain on an economically sound basis the present low levels—even, if possible, to bring them still lower—will most certainly be done. That is a

matter that depends very largely upon the prices of raw materials. All the same, there is just the possibility, and since nearly all the new season's secrets are now out, there is absolutely no reason for waiting any longer.

Increase of Set Prices?

This timely hint applies particularly to readers who may be contemplating the purchase of a commercial receiver. I have heard from several reliable sources that there is a distinct possibility of set prices going up within the next month or so.

Frankly, and to express my own point of view, I should be very surprised if any advances are actually made, either in the

(Continued on page 376.)

EVERYTHING **The G.E.C.** ELECTRICAL
your guarantee

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BATTERY RECEIVERS**

A trio of 2 volt Valves which lifts the standard of Battery Set performance to an entirely new level of UN-DISTORTED POWER.

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HL2 NON-MICROPHONIC DETECTOR. Filament current 0.1 amp. Amplification Factor 27. Impedance 18000 ohms. Mutual conductance 1.5 m.a./volt.

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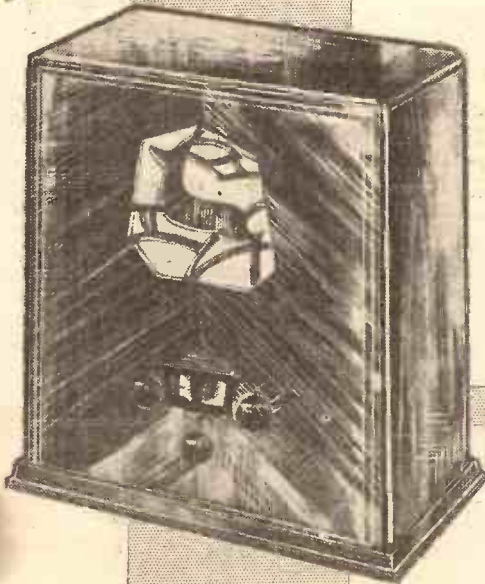
At last the day of All-World Radio has arrived, and you can build with your own hands the first receiver to give you not only England and Europe, but America and Australia direct. The Lissen All-Wave All-World Skyscraper 4 tunes from 12 to 2,100 metres. It brings two complete new wavelength ranges within reach of the ordinary listener—stations and programmes which before he was never able to receive—Ultra-Short and Short-Wave transmissions from the ends of the earth.

SUCCESS IS CERTAIN— GET THE CHART AND JUDGE FOR YOURSELF

And remember you get these stations through Double Balanced Pentode Output giving brilliant reproduction on a Moving-Coil Speaker—as much power as a Mains Set from ordinary high-tension batteries. Lissen have made this All-Wave All-World radio available to Home Constructors first, because it brings back the thrill of conquest to hear America and Australia *direct* on a set you have built yourself, it makes you an enthusiast to realise what a wonderful thing you have created! And when you see the Great Free Chart of the All-Wave All-World "Skyscraper 4," which tells you how to build it and how to work it and why it gives such marvellous results, you will agree at once that it will be wise of you to build for yourself rather than buy a factory assembled receiver which cannot give you these new and intriguing short-wave stations. The **FREE CHART** simplifies everything; there are pictures of every part, with every wire numbered, every hole lettered, every terminal identified. **YOU CAN'T GO WRONG!** But get the Chart and see for yourself—then build the Lissen All-Wave All-World "Skyscraper 4," the SET THAT SPANS THE WORLD!

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ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

(Continued from page 331.)

They are well organised and seem to have plenty of time and money for their hobby. I should like to see something organised in this country which would ensure emergency communication.

Bouquet from Back of Beyond.

HERE, so far as we can decipher it, is a note from an esteemed citizen of (illegible), in (we think) Portuguese East Africa: "Dears Masters Poplarys,— Making oportunes of to inscribe primary cartel to excellenz wireless jornal. If you pleas. Thanks so much. Yes. Was desire to makking muzic-receval, thus to harks to musiques allover ter-triatriel glob, but fearfully sadness finding non batriss attainable for here.



"Why not do poplars wireless indicate merchantes display batriss to thees toun? We have monnay for pay." Poor bloke! I advise him to sit back and thank his stars that he has "monnay," even if he lacks "muzic" from the "glob."

"Ariel" as Knight-Errent.

THE "Morning Post" thinks it a little ungracious of Lady Snowden to attack women announcers, she having left the B.B.C. It certainly would have been improper for her to have done so in public while she was on the Board, but why should she not now if she thinks that their voices are not, as a rule, suited to the microphone? She has many supporters of her views amongst listeners.

Genuine Diehard Story.

CAN you believe it! I met a man to-day who was "thinking about getting a radio set." He said that neither he nor his wife is very anxious to have one, but the maids might like it—and could he have one which could be switched on to the kitchen and switched off the drawing-room. I allayed his doubt, but did not attempt to make him a convert.



This kind of chap must be left to work out his own salvation. As he is an LL.B. and a chartered accountant, with no ear for music, I presume that you forgive my diffidence. I suppose he is the sort of man that spends a hectic evening in analysing the balance sheet of the Gas Light and Coke Company!

A Missing Word.

MASTER J. C. W. (Colwyn Bay) invites my attention to a reference by a coroner on an electrocution case to "a current of over 200 volts." Have I ever heard of a current of 200 v.? Add the word "pressure," old son, and the matter will not be so very bad. Experts like you, me, and Marconi must not be too severe with coroners.

Why, I once heard a mere common banker refer to the air-waves which ran down his aerial, and all I did was to ask him whether he had ever caught the little beggars running up!

Fibre Needles.

I AM indebted to J. L. C. (Forest Hill, S.E.) for the information that there is a fibre gramophone needle, suitable for use in a pick-up, which will play up to six of the heaviest recordings without requiring to be sharpened.

I shall try these, provided that they fit my pick-up, and report the result. I hope, however, that I shall not lose in crispness or

Brazil No Home for Crooks.

ABOUT that Brazilian police wireless! I had the luck to get some accurate data from the Marconi people, who did the job. The idea was to provide inter-



communication between the central police-station in Rio de Janeiro and provincial police-stations and motor-cycle patrols; also communication between the Rio marine police-station and ships

in the harbour or at sea.

All this has been worked out and executed. The Rio central station has two telegraph-telephone transmitters (medium and short-wave) and two receivers. The medium-wave set can be used for broadcasting a "police hour" when news about lost-and-found persons and goods, traffic orders and new regulations is radiated.

SHORT WAVES

Jones: When friends come in and listen to my radio they are simply glued to their seats.
Brown: What a quaint way of keeping them there!

It is stated that having the ears pierced is a cure for defective eyesight. A correspondent who has a wireless and gramophone enthusiast living next door to him says he has unwillingly persevered with the treatment for years.

Optimist: G-g-g-good—m-m-m-m-morning, M-Mister S-Studio M-M-Manager. D-d-did you adver-tise for a g-g-good r-r-r-radio an-n-nouncer?

A farmer, writing to the Press, says he thoroughly enjoys the Children's Hour on the wireless. It would be a graceful response if some toddler were to write expressing the interest he (or she) takes in the Fat Stock Prices.—"Punch."

A radio set has been invented which can be attached to the back axle of a bicycle. The next thing we shall hear is that someone has designed a set to broadcast the Children's Hour to perambulators.

"Here is, in process of development, an education of the best kind; by not abusing its privilege of supplying the public with unprejudiced facts from which to gauge the truth for itself, broadcasting cannot help but build a better-informed society," we read in the "Radio Times."
But does it?

There issues from the B.B.C. A standing rule that those who chatter into its microphones shall be Debarred from controversial matter. (Although it doesn't seem to tether The gentleman who talks about the weather).

A golden rule, and one that I'd Extend to after-dinner speeches, And also like to see applied. In places where a parson preaches; Because the helpless hearers lack The opportunity to answer back.

brightness or detail what I hope to gain by way of surface quietness. No one has commented on my suggestion for an agate needle. What does J. L. C. think?

Another Crystal Diehard.

W. H. T. (Cleveland Square, W.2) asks why I have "such a down on" the crystal. He still uses one, in combination with an ancient pair of French phones! I have no more objection to crystal-phone reception than I have to the flint-steel tinder box, the stage coach, and the hour glass and other obsolete devices. I could, however, write a page about why I prefer valves and an M.C. loud-speaker.

Moreover, during the war I had so much companionship from phones that my poor cars shrink at the very mention of them! I congratulate W. H. T. on his luck in getting all the radio he needs without any upkeep costs. His luck, however, prevents him from entertaining a roomful of friends!

The Complete Crime Disturber.

THE short-wave station can communicate with all the Brazilian states and many foreign countries. Moreover, there have been installed seven other short-wave stations: one at the H.Q. of the Marine Police of Rio, four at strategic points for police operation in the Federal District and two in police launches.

The road-patrol service comprises six motor-bikes and sidecars, with sending and receiving sets which are in constant touch with police-stations.

All this anxiety for poor, honest crooks—just because Marconi would mess about with electric sparks at Bologna! Is it fair? Well, we've got to remember that crooks as a whole have already used radio to aid them in their nefarious schemes!

Northward Ho!

AT Vadsø, Norway, they are building a broadcasting station which is said to be the most northerly of all, with icicles twelve feet long on the aerial and a chorus of seals.



Intensive research has revealed to me that Vadsø stands on Varanger Fjord; further research on a map indicates that it is in or about latitude 74 N. It is a 10 kw. station, and will relay Oslo, frost and polar bears permitting. "Excuse me, but your reindeer is eating my lead-in." Ouf! I prefer our right little, tight little heat-wave, even if it does mean a few more crackles.

TELSEN BINOCULAR H.F. CHOKE

Specified by **Mr. JOHN SCOTT-TAGGART**

for the P.W.

"S.T. 500"

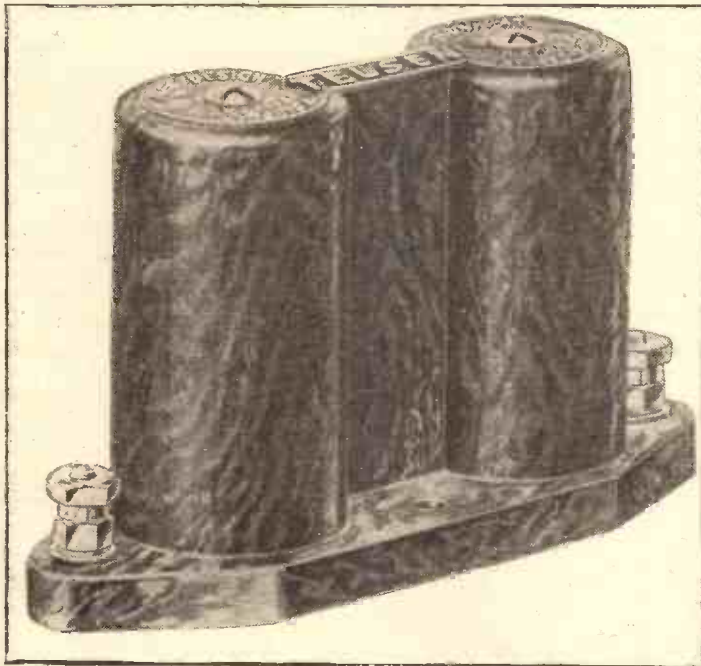


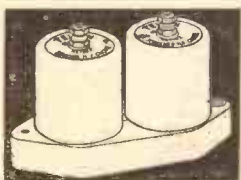
Illustration below shows the position occupied by the Telsen Binocular H.F. Choke in the built-up 'S.T. 500.'

EXPERT designer and home constructor alike concur in their choice of the Telsen Binocular Choke where lasting efficiency at low cost is the first requirement. Its external field is negligible, with a very low self-capacity, while its inductance is as high as 180,000 micro-henries

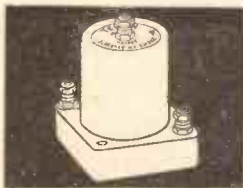
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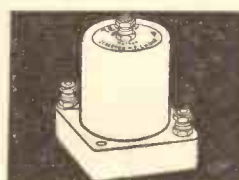
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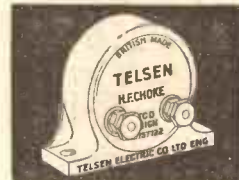
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TELSEN SHORT WAVE SCREENED H.F. CHOKE - - - - 3/-



TELSEN STANDARD H.F. CHOKE - - 1/6



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RADIOTORIAL

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All Editorial communications should be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless reception. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialties described may be the subjects of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS

"THE SET IS TOO LIVELY."

G. M. (Birmingham).—"The set is too lively. It is an A.C.3—S.G., detector and power—and as soon as I connect aerial and earth it goes into oscillation; but it is very sensitive, and without any aerial I can hear a lot of stations.

"Another thing which I do not understand is that if I put aerial lead to a .0001 fixed condenser and the other side of this to the terminal on the top of the screened-grid valve it works fine as a two-valver.

"What can I do to make the S.G. stage work as it should?"

It would appear that there is undesirable interaction between the S.G. and the detector stages, and the usual cure for this is to increase or improve the screening. Are you using the correct screening (and screened components, if these were recommended) as prescribed for the original model?

If coil cans are used see that they make good electrical contact with the metal bases. If a simple metal screen of the vertical type is employed make sure that it is properly earthed and that any foil on the baseboard, etc., which is used for screening is soundly connected, as it should be.

Sometimes the frame of a condenser is left "in the air" instead of being earthed, as the designer intended, so this is another point to watch for.

In general, all the "earthed" wiring is important, clean contacts and sound joints being essential.

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

- (1) What foreign stations are now the London Regional's neighbours (i.e. occupying the adjacent wavelengths)?
- (2) What is the voltage of one of the cells of an H.T. or grid-bias battery?
- (3) If a .0003-mfd. condenser were connected in series with a 2-mfd. condenser, would the effective capacity of these two be high or low?

because with a high-amplification receiver it is necessary that all the screening should be effectively at earth potential.

In general, also, it is vital that the general layout and run of the wires should follow those of the original design, any considerable departure being likely to introduce feed-back trouble of the kind you are experiencing.

Similarly it is imperative that the aerial lead-in wiring should be well spaced from the detector and low-frequency end of the set and from the loudspeaker and its leads.

The observance of these precautions prevents instability unless the valve-operating conditions (especially of the S.G. valve) are incorrect. But if the specified valve and power supply are used there should be no difficulty on that score.

WIDE DIFFERENCES IN THE CONDENSER-DIAL READINGS.

V. A. B. (Stockport).—"Where I was staying on holiday they had a three-valver which was so good that I took a copy of the diagram (circuit, with values) to get built up on return home.

"It is a great success, but the two tuning condensers are fifteen degrees different on most stations. Is there anything I can do

"P.W." PANELS, No. 141.—PALERMO, ITALY.

Palermo's wavelength is 537.6 metres—immediately above Munich's, and about two degrees below the dial-reading for Budapest.

The programme usually begins at about 11.45 a.m. As the power employed is low—only three kilowatts—the station is not well received in this country except under freak conditions.

The call is "Radio Palermo," and is given by a woman announcer. The distance (from London) is about 1,130 miles.

to make them come close together? Otherwise the set is a winner."

Owing to different stray capacities it is very difficult to get two condenser dials to remain closely in step over the whole of a tuning range, even when the coil units are chosen with that end in view. And if different makes or types of tuning condenser are employed the capacity-change is sure to get more or less out of step at different dial readings.

You could ensure that the readings would be close and remain very nearly in step by using two identical condensers in conjunction with coils designed to work together, but this might prove a too-expensive alteration. In your place we should try something simpler, and be satisfied to get the dial difference reduced to a reasonably small degree.

Why not, for instance, change over the present two tuning condensers? By coincidence they may match up quite well when reversed in position, i.e. aerial condenser changed over to the anode circuit, and vice versa.

Failing that, procure another condenser that resembles one of the original ones, and try matching those two. It should be possible to reduce the present wide difference quite easily, for it is unusual to find such a big discrepancy where the recommended capacities have been fitted.

POWER-GRID DETECTION FOR EXTRA VOLUME?

D. L. (Gillingham, Kent).—"As I cannot afford new valves or greater high tension I wondered if I could get the extra volume by changing over grid-leak detector of usual type to power-grid detector.

"If this can be done without much difficulty, please give the connections."

You are under a misapprehension about power-grid detection if you expect it will result in greater volume. It does not produce any such effect.

As a matter of fact, the term "power-grid detection" is not a suitable one, like so many others that we have grown accustomed to. The distinguishing feature of this class of rectification, as compared with that of the ordinary grid-leak-and-condenser arrangement, is that it is capable of satisfactorily handling a large input, and so of providing a comparatively large low-frequency (detected) output for operating the last stage without intermediate low-frequency amplification.

Incidentally, the connections are the same as for the ordinary grid-leak-and-condenser arrangement,

the difference between the two systems lying in the values of the leak and condenser and of the high tension applied.

USING UP THE OLD HIGH-TENSION BATTERY.

W. W. C. (Sheringham).—"Now that we are listening again more regularly and for long hours at a time again, I want to ask a question that I meant to raise last time I wrote. It is about using up the old H.T. battery when a new one is bought.

"Having proved what a big difference a new battery makes to the quality, I should like to be able to throw the old one away as soon as the new one is fitted. But owing to salary reductions that is out of the question if I can save a bit by using the remaining volts.

"I know I have read that there is a right and a wrong way of doing this. And I feel sure it is wrong to connect the negative of one battery to the positive of the other, as is sometimes done.

"But what is the right way? My set has one screened-grid valve, detector and pentode, the battery terminals being as marked on the sketch."*

* [NOTE.—Sketch not reproduced.—Ed.]

You are right in assuming that it is wrong to connect one battery in series with the other. This results in the old fault reappearing in the new high-tension supply.

The fault in question is high internal resistance. As an old battery's voltage drops its resistance goes up, and usually this results in back-coupling troubles

between the output and preceding stages which are supplied from that battery.

If one battery is joined in series with the other their resistances are placed in series, and the tendency to trouble is inevitable. The alternative is to use the old (high-internal-resistance) battery as a separate H.T. supply to one of the stages that requires but little current, where its high resistance will be little detriment.

In your case you have a separate H.T. tapping to the detector. And as this valve will only take about a couple of milliamperes at the most, the old battery will probably be able to supply this small current for a long time without any apparent distortion arising.

All you have to do is to connect the new battery in place of the old one, with all the H.T. plugs in their respective positions except the one for the detector (H.T. +2 in your case).

Stand the old battery beside the new one and join its negative socket to the set's H.T. negative terminal also. Then take the detector's H.T. (plus plug) to the extra battery, instead of to the main (new) battery, and work the set like that.

(Continued on page 372.)

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

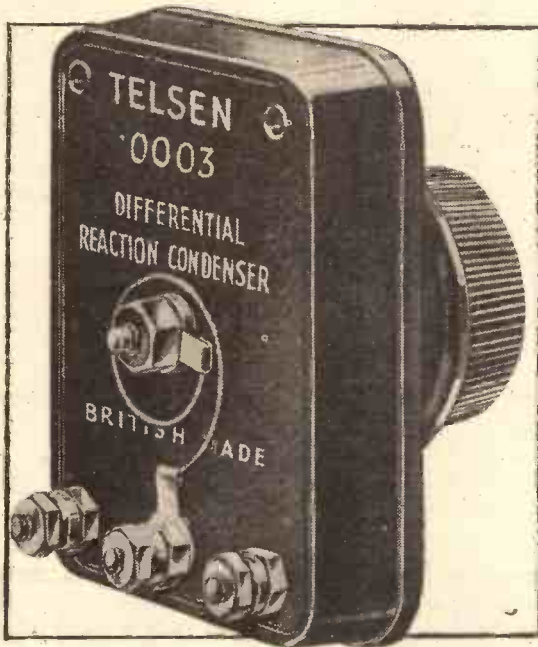
Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by phone or in person at Fleetway House or Tallis House.

TELSEN DIFFERENTIAL CONDENSER

Specified by **MR. JOHN SCOTT-TAGGART**
for the P.W.



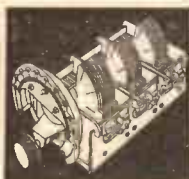
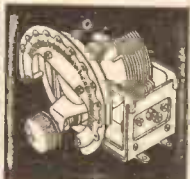
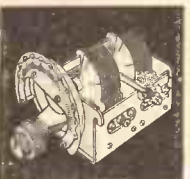


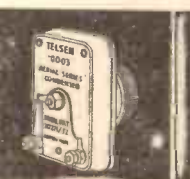

"S.T. 500"

Illustration below shows the position occupied by the new Telsen Differential Condenser in the built-up S.T.500.



MR. JOHN SCOTT-TAGGART'S choice of the new Telsen Differential Condenser is an eloquent tribute to its lasting efficiency. Any possibility of deviation from the stated capacity is prevented by the entire elimination of end-play (positive contact being made by a flexible pig-tail) the effective life of the component being enormously increased, and the occurrence of 'rustling' noises due to grit being prevented, by the dust-proof bakelite case which now encloses the entire unit. Yet, in spite of these valuable improvements, there has been no increase in price **2/-** (Capacities .0003, .00015, .0001)

TELSEN COVER EVERY CONDENSER REQUIREMENT

						
TELSEN TRIPLE GANG CONDENSER 17/6	TELSEN CONDENSER UNIT 7/6	TELSEN TWIN GANG CONDENSER 12/6	TELSEN VARIABLE CONDENSER 2/6 & 3/6	TELSEN TUNING CONDENSER 2/-	TELSEN AERIAL SERIES CONDENSER 2/-	TELSEN REACTION CONDENSER 1/9 & 2/-

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 370.)

Probably it will carry on satisfactorily in this way for months until another main battery is required. When this occurs the same procedure can be adopted, and the "detector" battery can be thrown away after giving its extra service.

WHEN LONG H.F. LEADS ARE UNAVOIDABLE.

G. V. R. (Brechtin).—"The point I want to raise is an unusual one, concerning the wiring of a high-frequency stage. I am fully aware that with tuned circuit leads, etc., it is most important to keep all the wiring short and direct. But this is a case where some of the leads *must* be longer than is usual or desirable. And the question is which ?

"The trouble arises because the cabinet in which this set is being built is an expensive one, and there is *too much* room in it. The result is that the high-frequency valve holder will be about 16 inches or more away from the panel on which the tuning condenser for that stage is mounted.

"What I want to know is whether the H.F. coil unit (for this condenser to tune) is better placed close to the valve or to the tuning condenser.

"In the former case, there will have to be long leads from condenser to coil, but the coil can be very close to the valve holder with short grid lead.

"If, instead, I put the coil unit near to the panel on which its condenser is fixed there will have to be a long lead to grid and a fairly long one to filament.

"Which is likely to prove the better arrangement ?"

We favour the coil being placed close to its condenser. You will then have a compact oscillatory

circuit, and the only disadvantage will be the long leads connecting this to the rest of the set.

If you arrange the coil and condenser far apart you will have a cumbersome oscillatory circuit which is probably much more liable to unwanted interactions than the alternative arrangement.

EASY METHODS OF CONTROLLING THE VOLUME.

R. T. B. (Strood, Kent).—"Now the dark nights are falling early, the volume is too big from many of the stations, and I want an *easy* method of controlling it.

"Could I use a small preset condenser instead of the one marked .0001, which is

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 370 ARE GIVEN BELOW.

- (1) Immediately below London Regional is Graz, Austria, on 352.1 metres. The wavelength above London Regional's is now occupied by Tiraspol, Russia (358 metres), whilst Stuttgart (Muhlacker), Germany, is a little higher up on 360.5 metres.
- (2) The ordinary small dry-cell unit has a voltage of 1.5.
- (3) The effective capacity of condensers in series is always less than the smallest of the individual capacities. The combination in question would therefore have a capacity of less than .0003-mfd.

DID YOU KNOW THEM ALL ?

between the aerial terminal and the coil tapping lead ?

"Or would a potentiometer be any good ? I have one left over which is in good condition, and I think it is 50,000 ohms. But I don't want any big alterations to the inside of the set."

You could employ a variable condenser in place of the .0001, and, although the alterations for that are very simple indeed, it would probably prove quite satisfactory. Special types of series-aerial condensers are available, with very low-minimum capacity, and these are the types from which you should make your selection.

(The method has the additional advantage of increasing selectivity when the volume is decreased, which is generally desirable when a simple set is concerned.)

Alternatively the potentiometer can be used in the following manner: Connect the flex lead, which normally goes to the coil tapping, to the centre (slider) terminal of the potentiometer instead of to the .0001-mfd. condenser.

The remaining potentiometer terminals are now joined to the respective ends of the tuning coil—i.e. one terminal to that end of the coil which goes to the fixed vanes of the tuning condenser, and the other terminal to that end of the coil which goes to the condensers, moving vanes, earth, etc.

Volume can then be controlled by the rotation of the potentiometer knob.

FITTING AUTOMATIC TONE BALANCE TO THE "APEX."

A. C. N. (Northampton).—"Before I get busy on the new set I want to put A.T.B. into the good old 'Apex.' What are the connections for using the 'Airsprite' reaction condenser, audioformer, and .01-mfd. fixed condenser ?"

The transformer will replace your present transformer, and can be connected up in exactly the same manner since the terminals are marked the same in both cases.

The special "Airsprite" type reaction condenser will replace the present reaction condenser. The wire from the terminal of the H.F. choke, which formerly went to the F. terminal of the reaction condenser, will now be connected to the moving-vanes terminal instead.

The lead from No. 9 of the anode coil should be joined to F1 of the reaction condenser—that is, to that set of the fixed plates to which no shorting strip is attached.

F2 will then be joined to one terminal of the .01-mfd. fixed condenser. The other side of this condenser will be joined to the negative filament of V3, and the .0002-mfd. fixed condenser will be removed to complete the modification.



SPECIFIED

S.T.500.

In signifying his approval of the W.B. "Micro-lode" speaker for the "S.T.500," Mr. John Scott-Taggart endorses the opinion of all other leading technicians this year.

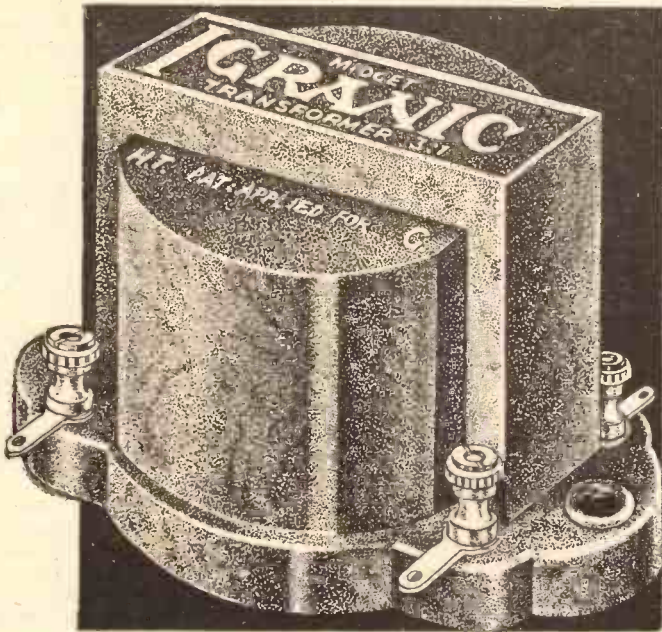
Outstanding sensitivity and wonderfully crisp "attack," due to the unique "Mansfield" magnetic system; even balance of reproduction, due to the patent "Micro-lode" feature and the accurate matching it provides; until you hear one you cannot appreciate the difference this speaker makes. "Micro-lode Model" P.M.6 - 39/6

Write now for the new
W.B. Folder.

P.M.4A WITH THE SENSATIONAL MICROLODE 42!



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IGRANIC
DEVICES



A Transformer I purchased in February, 1925, is still in constant use and as good as ever . . . My slogan after all these years is "Once a user of Igranic, always a user of Igranic."
"Igranic Enthusiast," Leyland, Lancs.

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Igranic have specialised in Transformer manufacture since the inception of Broadcasting, and many years of experience and costly research have led to the production of the "Midget" Transformer—unsurpassed for quality and performance. This wonderful Transformer renders the highest standard of tonal purity without a trace of "drumming." Its production reaches a standard never previously attained by a Transformer of such reasonable price. Supplied in ratios 3-1 and 5-1. Price 8/6

Write for fully illustrated Catalogue No. R.214 of Igranic Quality Components.

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IGRANIC COMPONENTS WILL BE THE MAKING OF YOUR SET

CVS—55



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Ediswan "Extra-life" accumulators are designed so that the positive and negative plates are in perfect electrical balance. This means quicker charging, longer discharging and extra life. And they have other special features, too—metal carriers, non-corrodible terminals, a host of minor refinements. Better, from every point of view, than ordinary cells, and no more expensive. Get your Ediswan to-day.

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E.L.M.4. 45 a/h - 8/-	E.L.S.7. 60 a/h - 12/6	E.L.9. 80 a/h - 12/3
	E.L.S.9. 80 a/h - 15/6	

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THE EDISON SWAN ELECTRIC CO. LTD.
PONDERS END, MIDDLESEX

TUNGAR—the Better Service Chargers

B.275

S.T.500 NOTES

Converting S.T.300 Aerial Coils
—Using Class B Speakers—Grid-
Bias Adjustments.

THE Colvern type of S.T.300 aerial coil may be converted by yourself into an "S.T.500" aerial coil as follows: 14½ turns of 36 S.W.G. single-silk-covered wire form a new winding between the medium-wave and long-wave windings. This single hank is wound in the same position on the former of this aerial coil as is the reaction winding on the anode-coil former—i.e. in a slot exactly the same distance above the long-wave winding slots.

The new winding starts from No. 1 terminal, and is wound in a clockwise direction looking from the top of the coil, and ends at No. 6 terminal. The direction of the winding is vitally important, of course, as it is a reaction coil.

The above instructions for adding the aerial-reaction winding apply only to the Colvern S.T.300 aerial coil.

I strongly advise the purchase of a Class B moving-coil speaker unless you already have an excellent speaker. The reason is that the output currents should not have to go through two transformers unnecessarily. The Class B speaker will probably, as in the Blue Spot type, be provided with terminals for ordinary power-valve output as well.

If you buy such a speaker you do not

buy the output choke, and elsewhere in this issue the new connections to L.S. + and L.S. — are given.

Next week I am giving a small reproduction of the blue print as altered and also a modification of the Rapid Guide to provide for this.

82 STATIONS

Next week Mr. Scott-Taggart will give the dial readings of 70 medium-wave and 12 long-wave stations received on the S.T.500.

Once you have the "S.T.500" working try altering various voltages. The bias of the L.P.2 driver valve G.B.—1 can be tried at -4½ volts, while the G.B.—2 of the B.21 can be given -3 volts.

AN AMATEUR LOOKS BACK

(Continued from page 352.)

SOS was the signal I heard, and I was so excited that I had difficulty in copying the Morse message. The message ran: "SOS URGENT CID ON ROCKS OFF TARIFA."

Many other messages were picked up, and the last I heard on this occasion was one from the Fishguard station G R L, at

12.56 a.m.—"SOS NOW CLEAR, SOS NOW CLEAR." So I went to bed, and in the local press next day was a piece of news stating that the British steamer "Cid" was on the rocks off Tarifa.

I was anxious to get down to the short waves, and so a special coil was made and connected up. At 11.25 p.m. I picked up that famous American station K D K A on 100 metres and "Morning, Noon and Night" by Suppé was played by the Westinghouse Band, and came through very well, using only one valve and headphones.

The reception was so good I listened until 2 a.m.

All-Night Sittings.

A new two-valve receiver was designed and built early in 1925, and amateurs in all parts of the world were heard, especially during the night of August 15th-16th, 1925, when I sat up all night listening. Amateurs in Holland, Denmark, Italy and America were picked up on a wavelength of 40 metres.

I was trying out a new microphone on Sunday, March 28th, 1926, and made contact with an amateur, G G F, of Leicester, on 180 metres. We had quite a long talk with each other, and this was my record distance so far, as regards transmitting speech.

In order to give the new short-wave receiver a good test I sat up all night again on the 29th May, 1926. I put on the headphones at midnight and did not take them off again until eight o'clock in the morning. Several pages in my log book were filled, and amateurs from many parts of the globe

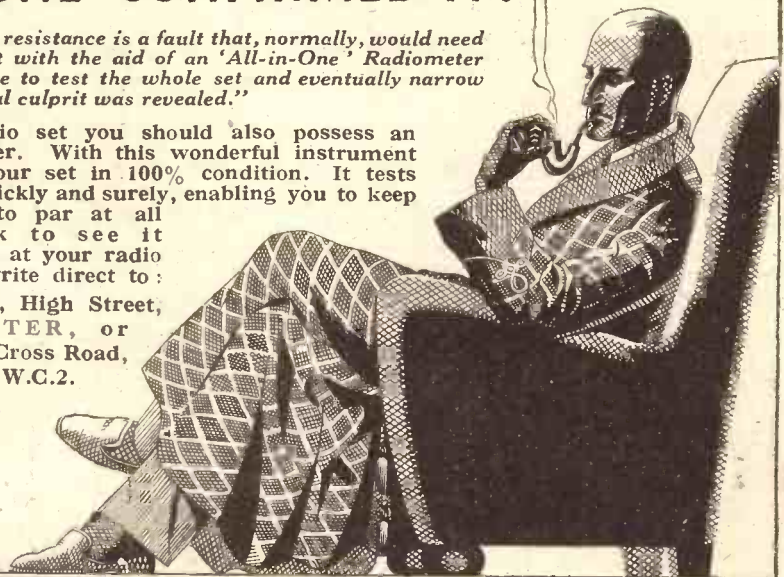
(Continued on page 376.)

"Intricate deduction, Watson, BUT THE 'ALL-IN-ONE' CONFIRMED IT."

"A broken-down grid bias resistance is a fault that, normally, would need some locating, Doctor, but with the aid of an 'All-in-One' Radiometer it took me very little time to test the whole set and eventually narrow down the field until the real culprit was revealed."

If YOU possess a radio set you should also possess an "All-in-One" Radiometer. With this wonderful instrument you can always keep your set in 100% condition. It tests everything quickly and surely, enabling you to keep the set up to par at all times. Ask to see it demonstrated at your radio dealer's, or write direct to:

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150, Charing Cross Road,
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ALL IN ONE
RADIOMETER

Standard Model "All-in-One"
Radiometer, for Battery Sets
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Sets, Electric Receivers and
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CLASS 'B' constructors can save an extra 30% H.T.

Multitone TRUE TONE CONTROL, in the first L.F. stage, not only ensures good reproduction under all conditions, but also saves an extra 30% H.T. in addition to the saving already made by using Class "B" amplification.

Write to Dept. B for the new Multitone Guide to Class "B" telling you all about the theory of Class "B" together with details of components and circuits.

TOCO TONE CONTROL TRANSFORMER
Ratio 1/4
(saves an extra 30% H.T.) Price **17/6**
Graded Potentiometer Price **3/6**

BEPU DRIVER TRANSFORMER
Ratios 1/1, 1 1/2, 2/1
High Power Efficiency over 85%. Very low overall secondary resistance 100 ohms. Price **9/6**

PUCHOKE CENTRE-TAPPED CHOKE
For matching any speaker to Class "B" output. Price **9/6**

CLASS "B" CONVERTER UNIT
Those who do not wish to interfere with the wiring of their present set can buy this simple unit. Just plug in adaptor, to last valve stage, and enjoy Class "B" advantages. Price **37/6**
(less valve) **27/6**

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If you do not know who is your nearest Multitone Dealer, please let us know.



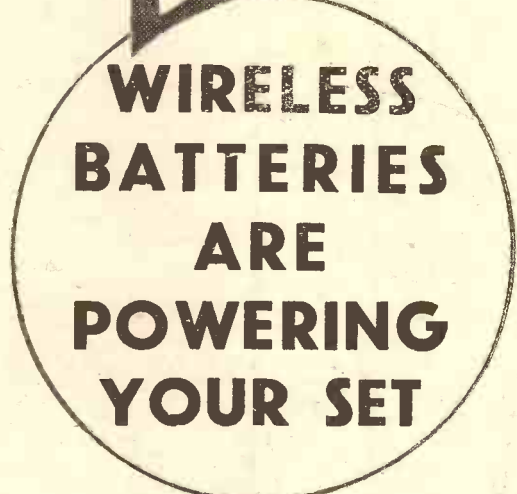
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Then you need Ever Ready Batteries: H.T. Port. 17; G.B. 4; L.T. 2169—all made specially for it. Or simply ask your dealer for the Ever Ready List, showing all popular makes with their special Ever Ready Batteries. Your set will be powered perfectly by its appropriate Ever Ready Batteries.

The Ever Ready Co. (Gt. Britain) Ltd., Hercules Place, Holloway, London, N.7.

NOTICE to the TRADE

We beg to solicit your enquiries for all your

S.T.500

requirements, having purchased large stocks of all Specified Components and B.R.G. S.T.500 Kits.

Prompt Delivery. (Cash with order or C.O.D.) All well-known accessories and components available.

Personal attention to all orders.

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Prices: BATTERY TYPES, H.F. and G.P., 3/- Power, 3/6. Super Power, 4/- S.G., 7/- Var. Mu., 7/- Pentode Type, 9/6. Class B, 1 watt, 8/6. 2 watts, 9/-.

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TEED

3/-
POST FREE

AN AMATEUR LOOKS BACK

(Continued from page 374.)

were intercepted. Just after 2 a.m. scores of Americans were heard, and at 2.27 a.m. B Z I A D was logged, from Rio de Janiero, Brazil. A good programme was heard from K D K A at 2.35 a.m.

Soon after 7 a.m. an Australian, 2 C M, was heard, this being my greatest long-distance reception.

A new transmitter was built early in 1927 for work on 45 metres.

International Communications.

About 10.30 p.m. on April 5th, only two nights later, I heard E C 2 Y D, an amateur in Moravia, Czecho-Slovakia, calling in Morse for anyone to reply. I immediately started up the transmitter and replied to him, finishing up with my call sign 5 O D. Then I listened-in, little expecting any luck, and was much surprised to hear him calling 5 O D. I was nearly too excited to work the key, and I guess my Morse must have been rather bad, as I did not think my signals would be heard so far. We carried on communication by the aid of the international code of signals, and though my power was only 2½ watts, I was heard 770 miles away.

Nothing very exciting happened after this, and although many transmissions were carried out by this station (5 O D), interest began to lag, due, largely, to the very decreased activities of the amateur transmitting fraternity as a whole. One could listen on Sunday on the 40-m. band and hear dozens of amateurs, and now it is seldom if one is heard.

SIR OLIVER LODGE'S MESSAGE



Sir Oliver Lodge, to whom "The Manual of Modern Radio" was mentioned, writes to the Editor:

"I KNOW SCOTT-TAGGART. I FEEL SURE THAT ANYTHING HE WRITES WILL BE OF INTEREST TO WIRELESS EXPERIMENTERS."—OLIVER LODGE.

THE LINK BETWEEN

(Continued from page 364.)

prices of components or sets. But still, forewarned is forearmed, and one can never tell!

Loudspeaker Revolution.

There have of late been so many developments in the matter of receiver output schemes that inevitably in the early stages there has been a certain lack of standardisation in components. The change from Class A to Class B outputs, for example, has generally meant a change in transformer ratios and so forth. So that many constructors have been hesitant about taking full advantage of new developments.

All this has been changed, completely and finally, by the advent this season of the W.B. "Microloids" speakers manufactured by the Whiteley Electrical Company. The new patent system which has been introduced in these loudspeakers enables them to be used with every known variety of output *without the need for new transformers*. The simple switching arrangement allows seventeen different ratios to be obtained, and this is, so far as I am aware, the very first loudspeaker to qualify for the description "completely universal."

It is definitely a revolution in loudspeaker practice, and I strongly advise you to apply under the "P.W." postcard scheme, for a leaflet giving (No. 59) particulars.

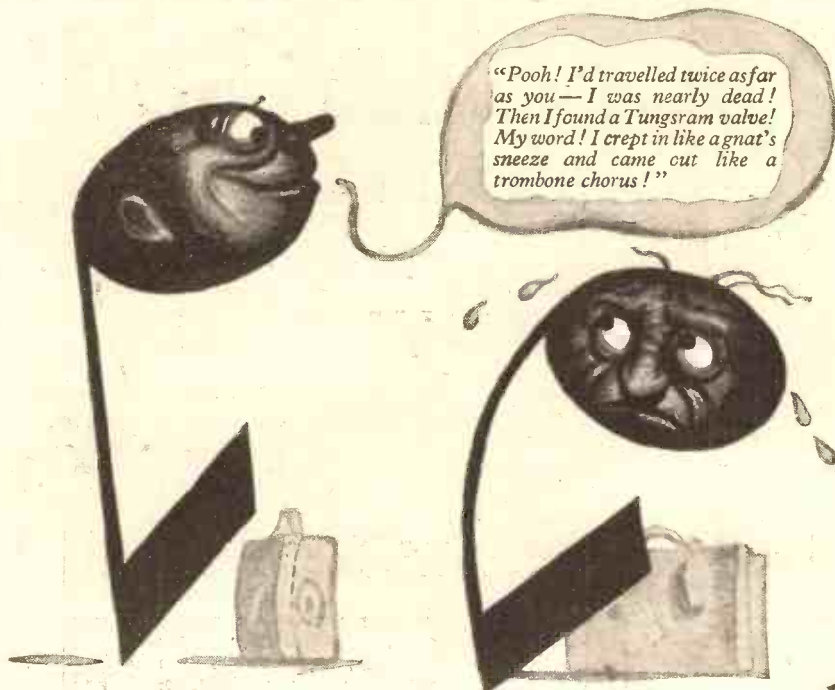
In Contrast.

As a welcome diversion from the more serious aspect of my first paragraph, I am glad to be able to pass on the news of several price reductions in the components manufactured by Ready Radio.

All "P.W." readers will be familiar with the productions of this old-established concern, and so that you may be equally familiar with the new and attractively low prices that have recently been introduced, I propose to make their latest catalogue available under "P.W.'s" postcard (No. 60) literature scheme.

OUR POSTCARD SERVICE

Applications for trade literature mentioned in these columns can be made through "P.W." by quoting the reference number given at the end of the paragraph. Just send a postcard to G. T. Kelsey, at Tallis House, Tallis Street, E.C.4. Any literature described during the past four weeks may be applied for in this way—just quote the number or numbers.



There's a Tungram for every radio need. Their vivid tone turns old sets into new. Ask our Technical Dept. about your radio problems.

BUT AT PRICES FROM 5/6
THE WORLD'S FINEST



TUNGSRAM

BARIUM VALVES

Adv. of Tungram Electric Lamp Works (Gt. Britain) Ltd., 72 Oxford St., W. 1

MAKE 2^D WORTH 3^D



Not the result of our own test, but the result of a test by a famous British set-maker. A bad battery in his sets might ruin his reputation, so before placing his order, he put Hi-Life batteries on test. The result showed their life was no less than 50.2% longer than their nearest competitor.

This test, made with the identical batteries that you buy, means that you get 50.2% more life, 50.2% greater power, 50.2% higher capacity, free. And you get the same high standard of quality and constant performance for which Hellesens have been famed for over 40 years.

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Arks

THE TRUTH ABOUT MAINS DISTURBANCE SUPPRESSION

The Position of Belling & Lee Ltd.

A great deal of nonsense has been published about this subject, both in the form of advertisers' announcements and in articles. With their Mains Disturbance Suppressor, Belling & Lee Ltd. are in the position of a dispenser making up a doctor's prescription, the doctor in this instance being the Engineers of the Post Office. After an investigation of 16,000 cases they state that 80-90% of the unwanted Mains noises coming through a Radio Set are due to H.F. disturbance carried by the Mains, re-radiated by the house wiring, and picked up by the aerial system of the receiver.

They state that a condenser unit such as that produced by Belling & Lee Ltd. will considerably reduce or entirely eliminate the disturbance. In about 10%



Mains Disturbance Suppressor No. 1118, each 10/6.

cases additional aids may be required. Such a Mains Suppressor Unit should be fitted at the source of the trouble or next best should be fitted at the listener's Mains switch. No relief can be expected if the Suppressor is fitted to the set.

You should certainly fill in the coupon and get a copy of a booklet on this subject.

Its Application to the S.T.500 Circuit.

Many people cannot see how a Mains Disturbance Suppressor can help the Battery Set user. We have already pointed out that the Post Office Engineers are emphatic that the H.F. is mains carried and re-radiated by the house lighting wires and picked up by the aerial system of the receiver. Whether Mains Driven or Battery does not matter.

Be sure and fill in the coupon opposite. It will bring you full details and latest authentic information on Mains Disturbance Suppression.

S.T.500 SPECIFICATION



10 R type terminals at 3d. lettered A, F, LT - LT + HT -, HT +1, HT +2, HT +3, LS -, LS + :
7 Wanderplugs at 1½d. lettered HT -, HT +1, HT +2, HT +3, GB +, GB -1, GB -2; 1 Screen Grid Anode Connector at 4d.



Not specified but a useful refinement are 2 Spring Spade terminals at 2d. and twin tap plugs at 1d. each.

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To **BELLING & LEE LTD**
CAMBRIDGE ARTERIAL ROAD, ENFIELD, MIDD.

NAME

ADDRESS

THE LISTENER'S NOTEBOOK

(Continued from page 344.)

has largely gone. Mabel Constanduros, on the other hand, is always introducing fresh situations—it's always a new book with her. Have you ever analysed any of her lines? Not only are they amusing, but they are also very cleverly written, with the listener always in mind.

This is why she is so easily followed, and her situations so quickly visualised. She always uses the right word; her descriptions are apt; she avoids irrelevancies which only go to confuse the listener. I know no broadcaster who has a better mastery of the technique of broadcasting than she has.

"The Canterbury"—the first of "The Old Music Halls"—was disappointing. It did scant justice to that famous old hall. The heyday of the Canterbury was too much before my time for me to have a personal experience with which to compare this broadcast version.

But I am quite certain that a performance at the Canterbury wasn't as refined an affair as this broadcast would lead us to suppose it was. These performances must have an audience. If the old-time atmosphere is to be recaptured. And a none too well behaved audience at that.

There was a rich variety of songs, ranging from the comic to the sentimental—all tuneful enough to haunt one for days afterwards; but there was little suggestion of the gusto that old-time stars used to put into their efforts. The men were too genteel by half.

THE MIRROR OF THE B.B.C.

(Continued from page 344.)

Meson will be Maurice Avery, Baliol Holloway is to be Hechary Trehella, and Betty Bolton will fill the rôle of Mrs. Raeburn. The play will occupy nearly two hours.

A Budapest Concert.

Another of the series of "European Concerts" arranged by the different

members of the Union Internationale will be relayed to London Regional listeners on November 4th from Budapest. It begins at 8.40 p.m. and will consist of a serious concert of Hungarian music from Liszt to Bartok.

Those who may prefer to miss it (and there will be some, because serious music, come from where it may, is not everybody's choice) will have an opportunity at 9.15 p.m. the same day of hearing a concert of light Hungarian music played by a Tzigane Orchestra. As this will also come from Budapest it will be the real stuff.

The Lord Mayor's Banquet.

Those who want to hear the Prime Minister's speech at the Lord Mayor's Banquet at the Guildhall on November 9th will be able to listen at home. The B.B.C., the Post Office engineers and their own receiving sets will provide the necessary means.

ARTHUR MEE'S 1000 HEROES

ARTHUR MEE has been looking round the world again, looking back and looking forward, a little impatient of hearing it said that Youth has no chances in these days.

He has looked back to the dark days that have been before and has seen how men

got out of them. He has looked about in every age and every land and has chosen a thousand heroes equal to their situation and told their story in a new 6d. part work called "ARTHUR MEE'S 1000 HEROES."

Some of them were heroic all their lives, facing hard times and overcoming them. Some have made themselves immortal by great deeds which all the world remembers. Some of them are heroes all unknown, some of yesterday, some of our day, some men and women like ourselves.

It is not true that Youth has no chances in these days. What Youth needs is Courage. Here are a thousand heroes who have known dark days and overcome them. They have done incredible things. They have made the world we live in.

Here are a thousand great adventures of Humanity, told in that fine way in which Arthur Mee's stories are always told, glowing with life and feeling and hope and courage. Here is nothing for the pessimist, but here is something for all who are thrilled by the past and believe in the future.

Here are the Greathearts of the world. Here is inspiration for these dark days. Here is the very book the world is waiting for, the very thing Youth needs.

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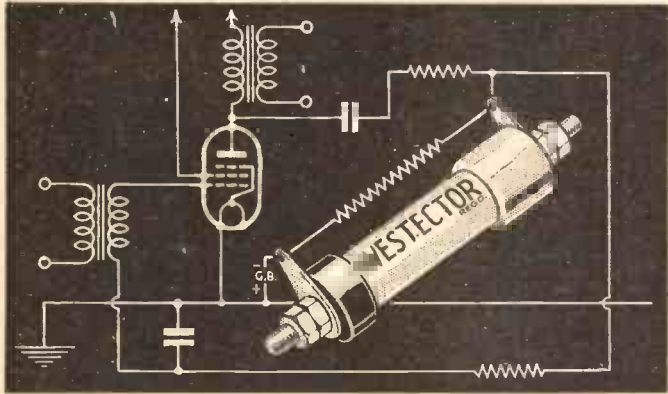
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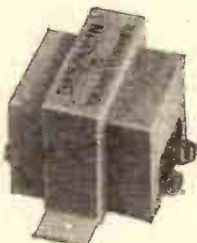


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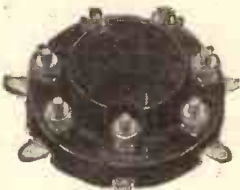


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TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio.

By Dr. J. H. T. ROBERTS, F.Inst.P.

A Class B Peculiarity.

THE introduction of Class B amplification, and quiescent push-pull also, for the matter of that, have, like the majority of inventions, brought with them their own peculiar problems. As you know, Class B has particular advantages where a battery-driven set is concerned, owing to its economy in H.T. current consumption. The fact that it gives such excellent output volume on such modest H.T. current supply is, of course, one of its outstanding advantages.

There must be very large numbers of people, however, who use Q.P.P. or Class B with H.T. supply units, and here there is a peculiarity which sometimes develops into a serious difficulty. In fact, I have had quite a number of cases where readers have been disappointed with Class B, owing to the fact that it gives bad distortion.

Voltage and Current.

If you think about it for a moment you will see why this may happen with an H.T. mains unit, particularly if it is one of somewhat limited output. The H.T. unit differs

THE MANUAL OF MODERN RADIO.

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"The Manual of Modern Radio" is unique in its own field, and I can confidently urge readers to grasp this opportunity of obtaining it."

P. P. ECKERSLEY.

essentially from an H.T. battery, even a dry battery, in that it has a considerable internal resistance; the consequence of this internal resistance is that the output voltage depends very largely upon the current which is drawn from it. If the current is seriously increased the output voltage may drop quite a large amount, and vice versa.

Now, with a push-pull arrangement, whether it be Q.P.P. or Class B, the anode current drawn from the H.T. source will go up enormously when you get a large grid swing. In fact, this is the essence of the efficiency of the system. But with a mains unit in which the voltage varies largely with the current it obviously means that, just at the moment when a large current is drawn, the voltage will go down, so that what is gained on the swings is lost on the roundabouts. It is worse than that really, because it may introduce bad distortion, and this is the reason why, as

(Continued on next page.)

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TECHNICAL NOTES

(Continued from previous page.)

mentioned above, many people using Class B have been disappointed in that way.

Neon Regulator.

There are more ways than one of dealing with this difficulty, but one very simple method is to use a neon regulator which is now made by one of the leading valve manufacturers. The principle is that when the valves draw a large current the neon tube takes a small one, and vice versa, with the result that the total current—that is, the current which is taken by the neon tube, together with that taken by the valves—keeps fairly well to a uniform average and so prevents the output voltage from the unit from varying very seriously.

In fact, in actual practice it is found that, under proper conditions, the variation in output voltage is a very small percentage. If you are using Class B or Q.P.P. with a mains unit and are having trouble with distortion it is worth while to consider the question of one of these neon regulators.

Tapped Chokes.

In a choke-capacity output filter it is a good plan to use a tapped choke, because this enables you better to match up impedances. The impedance of the output valve and the impedance external to the valve—that is, the load—should bear a certain relationship to one another for best

NEXT WEEK

JOHN SCOTT-TAGGART

will contribute further details of the

S.T.500

THERE WILL ALSO BE ANOTHER STEP-BY-STEP SUPPLEMENT

For Beginners.

results. If these two impedances are not within measurable distance, so to speak, it is necessary to put in either an output transformer giving the proper ratio or a suitable choke, and, as I say, a tapped choke is best in this case because you can so easily adjust it to the best working conditions.

In fact, adjusting the impedance of the choke has very much the same effect as adjusting the ratio of the transformer. You should have no difficulty in getting a suitable choke for your purpose, as there are plenty of tapped chokes available on the market giving all the required "ratios."

That Core Hum.

By the way, it is surprising what a lot of chokes (and transformers too, for that matter) are so badly assembled that the iron laminations of the core give an audible hum. This is very aggravating, and whilst you can sometimes stop it by tightening up the assembly bolts, there are other cases when it seems quite impossible to do anything with it. I saw one experimenter use a very neat little trick in such a case; he melted some paraffin wax and allowed this to soak in between the laminations, and

when it was "set" it stopped the audible hum completely. Of course, you cannot always use even a little dodge like this because the core is not always easy to "get at."

How Things Change!

Isn't it extraordinary the way things move in wireless, first this way and then that, and then back again to where they started? Firstly we had the two-electrode detector, the Adam of all valves, then came the three-electrode valve which would amplify, then the four-electrode valve, and more recently valves with all kinds of electrodes for all kinds of purposes. Who would have thought that we would suddenly go back again to the two-electrode detector? But this is what we have done for many purposes, one of the most recent being the double-diode triode.

Unit Sets.

When broadcasting first started we had sets which consisted of units which could be added together very much like building-bricks in a child's toy. On the face of it this looked like an excellent system, but it was soon found to be troublesome in practice as well as to have important technical drawbacks. Needless to say, with modern highly efficient sets the drawbacks referred to would have been infinitely more pronounced. There was no such thing as incorporating the loudspeaker with the set. For one thing, loudspeakers of those days were not at all adapted to be conveniently housed with the set, whilst for another thing sets had not then taken unto themselves cabinets suitable for housing anything very particular.

The Craze for Compactness.

As set design developed it became all the fashion to incorporate everything possible within the cabinet, and this soon led to the popularity of the radiogram, with the radio set, gramophone and loudspeaker all in one cabinet. This again brought with it its own problems, not the least of which was the microphonic effect of the loudspeaker on the valves.

A Compromise.

I suppose it would be heresy to-day to suggest that this passion for compactness may go too far. The difficulties met with in putting the loudspeaker in the cabinet have not, in my opinion, been completely overcome, and I think many of you will agree with me that the present-day outfit is really something in the nature of a compromise. A powerful mains-excited moving-coil speaker—none of your permanent-magnet speakers, however efficient they may be, within their limitations, but the real thing, with plenty of juice in the field winding—wants a bit of housing, and for practical purposes is a bit of a "bull in a china shop" inside a radiogram.

I know that mains-excited speakers are so used and with quite a good deal of success, but the point I am making is that there are definite limitations imposed by this condition of compactness. I am thinking of a favourite moving-coil speaker of my own—one of the big fellows that you don't often see nowadays—which I have housed in a special cabinet, built for the purpose, and which it would be pretty well impossible to fit into any likely-looking radiogram cabinet.

(Continued on next page.)

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TECHNICAL NOTES

(Continued from previous page.)

Why Not Separate Cabinets ?

The only real solution in a case of this sort is to do as I have done, and that is to have the set and the speaker entirely separate. But it would be funny if there came a swing of the pendulum in this opposite direction, and if we found manufacturers proclaiming the advantages of their separated sets and speakers, and the disadvantages of the all-in-one system! At any rate, if it does come it will, in my view, be quite a good move, at least in a considerable number of cases, and it will be just one more of the many paradoxes which we have met with in the last few years of radio development.

Shock Excitation.

Often enough readers ask me why it is that they get a station—a high-power station—at all parts of the tuning dial, whatever type of circuit they use. This is generally due to shock excitation, which means that the impulses are so powerful that they are actually operating on the coil itself as an aerial, and are practically incapable of being tuned.

You may do something towards getting over the trouble by putting screens over your coils (if the coils are adapted for the

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the finest wireless book ever written. Apart from the dictionary, tables, and invaluable reference matter, there are approximately

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John Scott-Taggart.

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purpose); but if this does not give you what you want, the best thing is to scrap the coils and replace them with properly screened ones.

Heterodyning.

Owing to the large number of stations now operating within the medium broadcasting band, you often get a couple of stations causing a heterodyne whistle; this happens sometimes even if the stations do not actually interfere with one another in the ordinary way.

You can get over this, as a rule, by means of one or other of the types of tone control which I have dealt with in these Notes previously.

If this is not convenient, however, you can use a little intermediate circuit sometimes called a heterodyne stopper.

A Stopper Circuit.

The heterodyne stopper circuit consists essentially of a couple of condensers and a high-frequency choke, the condensers of a

(Continued on next page.)

THE

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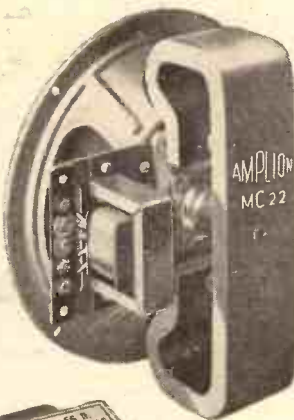
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TECHNICAL NOTES

(Continued from previous page.)

value of, say, .005, whilst the choke should be of fairly high impedance. A choke which is ordinarily used with a screened-grid valve will be suitable for the purpose, and incidentally the impedance of the choke determines to some extent the capacity of the condensers. Anyway, it is quite a simple matter to try different values around that which I have indicated.

The high-frequency choke I referred to is nothing to do with the H.F. choke used with the anode of the detector valve. The choke of this heterodyne stopper circuit is included between the H.F. choke of the detector anode and the primary of the L. F. transformer, whilst the two condensers are connected together in series and shunted across the heterodyne choke. The point between the two condensers should be connected to H.T. negative.

Screened-Grid Detector.

We have heard a good deal lately about using a screened-grid valve as a detector, and several readers have asked me what are the advantages of this system and whether it is worth trying. I should explain briefly that the advantage generally claimed for the screened-grid valve as a detector is that the input damping is low but, on the other hand, there is a tendency for the reaction to become rather "ploppy."

Ploppy Reaction.

This disadvantage of "ploppy" reaction can be got over, as a rule, by means of a fine control of the grid bias, using a potentiometer for the purpose. If this doesn't work you can try taking the reaction from the screening grid instead of from the anode. In fact, this latter method is practically certain to succeed if the potentiometer arrangement does not give satisfaction. It is necessary, however, to use exactly the right voltage on the screen grid, and you will then find that you get a very nice, smooth control of the reaction.

SHORT-WAVE NOTES

(Continued from page 348.)

some time or another by the necessity for keeping it clean and for nipping in the bud that distressing habit that it has of "sprouting" loose and straggly leads all over the place.

The poor old transmitting man has to look after his receiver (possibly two), his transmitter, which, if it is of the crystal-controlled variety, will probably need two power supplies, and a monitor or heterodyne wavemeter. In my case you can add to that a broadcast receiver. When I am "off duty" I do like to listen, whether it be to Henry Hall or to a symphony concert (provided, of course, that it is not one of the B.B.C.'s ultra-modern nights)!

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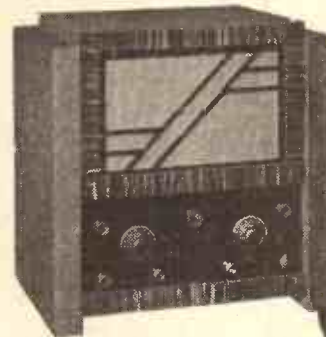
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S.T.500

(Continued from page 343.)

oscillation to a greater or lesser extent, and absolute stability, when obtained, is accompanied by a loss of signal strength. Valves differ very widely in their characteristics—*far too widely in my opinion.*

We have, however, to budget for things as they are, and a 25 per cent variation either way is commonly experienced. This means that one valve may easily be 50 per cent more efficient than another, and therefore more liable to produce self-oscillation and instability.

Providing for Variables.

Many readers will know that when battery valves were greatly improved in their performance many of the older sets could not be used owing to instability. If valves of a same type by a given manufacturer vary so greatly how much more do different makes of S.G. valve vary?

The set manufacturer issues his receiver adjusted for a given type of valve and even for the actual sample which he sells with the set. No set manufacturer would dream of supplying a receiver without the actual valves carried. We who design for the home constructor, however, must provide for various contingencies. A reader who already has a screened-grid valve is not likely to buy another in order to conform to a designer's recommendation.

In my opinion, a set for the home constructor should have some means of enabling the best results to be obtained from almost any type of S.G. valve. It is absolutely impossible to do this unless some variable control is provided.

Still another variable element in a wireless receiver is the filament voltage and the H.T. A set which will work well with both these at minimum values may be very difficult to operate and liable to instability when the batteries are at full voltage. A set which is designed to work with full voltages will be insensitive when the batteries are below par. But extra controls can accommodate different voltages.

After Years of Experience.

With different valves, different voltages, different aerials, different districts, different components, the results are bound to be different and bound to be worse on the average. It is little wonder that widely varying reports are often received on what,

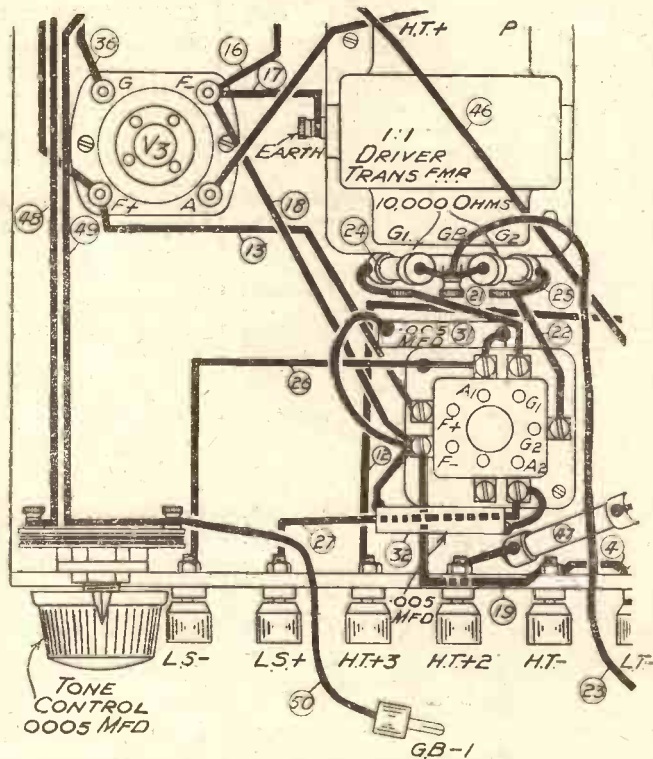
in the original model, was a really good set. Years of experience for designing for the home constructor have taught me that some latitude is essential and that some provision must be made for different conditions of operation.

The Best and Worst of Imitation.

The slavish imitation of the factory-built set is a fatal mistake on the part of designers and would only be justifiable if the designer could service and adjust every set before it was sent out, and ensure that the right valves were in the set. Virtually the receiver would then be a factory-built one.

At the best, the results would equal the factory-built product; at the worst, the result of issuing designs similar to those of a factory set can be disastrous; the widest variations in results are obtained. That poor

FOR A CLASS B SPEAKER



The above is the modification necessary when a Class B speaker is used. Many speakers of the moving-coil type now have extra terminals to enable Class B to be used. There are three such terminals, and the manufacturer tells you which they are: One is connected to the H.T. + 3 on the terminal strip of the "S.T.500." Another of the three terminals is connected to L.S. —, and the third to L.S. +. These latter two terminals on the strip are shown above connected to the anode terminals of the Class B 7-pin valve holder. It will be noticed that the output choke has been removed since it is not needed. The rest of the blue print remains the same, but as a special check I shall reproduce a small edition of the whole blue print as adapted for those buying Class B speakers; a modification of the rapid construction guide will also be given to cover the slight alteration. Practically all constructors, however, will find the above explanation adequate.

results are often obtained is due to the absence of highly technical knowledge, measuring instruments, etc.

Freedom of Home-Construction.

The first requirement of a factory-built set is that it shall be simple in operation, so simple in fact that simple people can work it. No such restrictions apply to the home constructor. The designer, instead of designing down to the lowest common multiple of intelligence, can appeal to the highest common factor of general common sense.

(Next week Mr. Scott-Taggart will contribute a further article on the "S.T.500.")



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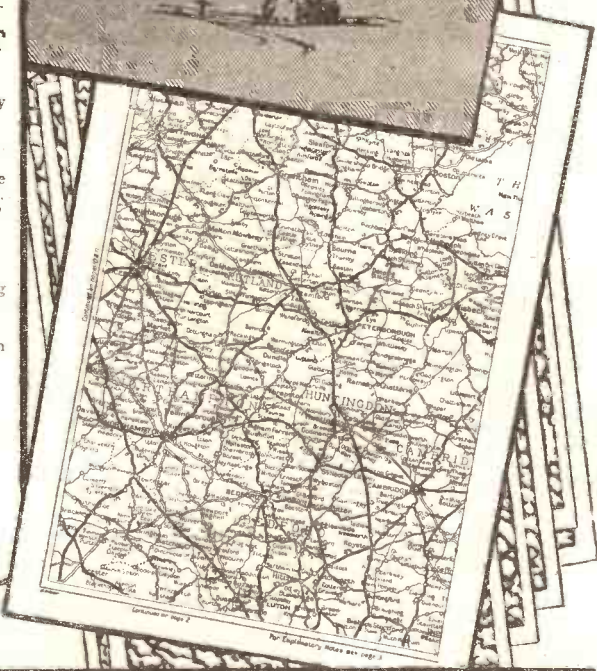
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