The Wireless Constructor

6d

Vol. XV. MARCH 1933. No. 77.

FREE FULL-SIZE BLUE PRINT OF JOHN SCOTT-TAGGART'S

A.C.S.T.400

ALL-ELECTRIC !

SELF-CONTAINED !!

AMAZING POWER AND TONE!!!

A PERFECT COMBINATION

RADIO COMPONENTS

Lewcos REGD.

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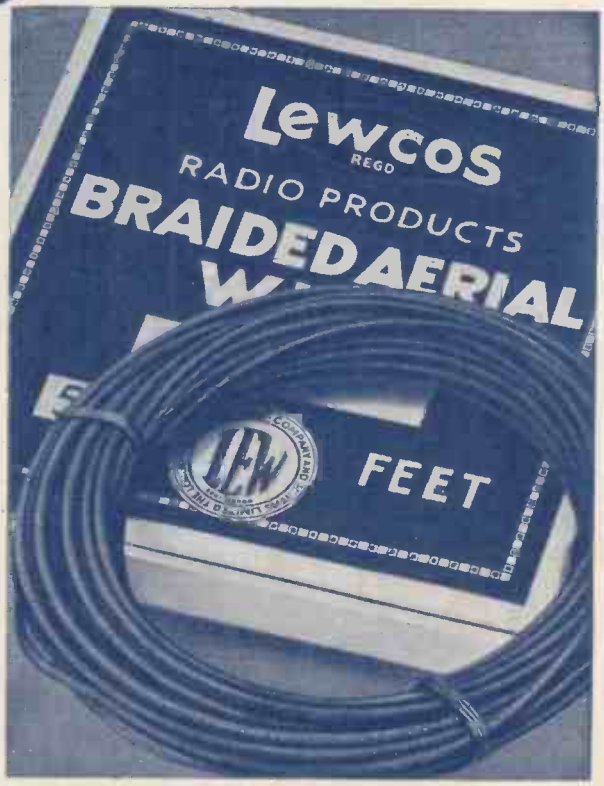

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS, LIMITED, CHURCH ROAD, LEYTON, LONDON, E.10.

CONTENTS

As some of the arrangements and specialties described in this Journal may be the subject of Letters Patent the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

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The Fleetway House, Farringdon Street,
London, E.C.4.

S.T.400

IMMEDIATE DELIVERY FROM STOCK

S.T.400 ALL-ELECTRIC CONSOLETTE

KIT "A"
Author's First Specified Components, including ready-drilled panel and terminal strips with Peto-Scott combined shelf and baffle board, but less valves, cabinet and speaker.

CASH or C.O.D. Carriage Paid.
£9.7.6
Or 12 monthly payments of 17/3

THESE ARE THE PARTS USED BY MR. JOHN SCOTT-TAGGART.

	£ s. d.
1 Slektun super 1-5 L.F. transformer	8 6
1 R.I. Audirad L.F. choke	8 9
1 Wearite new dial type T.21A. mains transformer	1 5 0
3 T.C.C. type 80 4-mfd. condensers	1 5 6
1 Dubilier type B.B. 1-mfd. condenser	2 6
3 Telsen standard type 1-mfd. condensers	6 9
1 T.C.C. type 50 2-mfd. condenser	3 10
1 Dubilier type B.B. 2-mfd. condenser	3 6
1 T.C.C. type 80 2-mfd. fixed condenser	5 0
5 Dubilier type 670 condensers: (1) ·01, (2) ·002, (1) ·0003, (1) ·0005	6 6
2 Erie 300-ohm 1-watt resistors	2 0
9 Dubilier resistors, 1-watt type: (1) 30,000, (1) 40,000, (1) 7,000, (1) 750, (1) 5,000, (1) 20,000, (1) 50,000, (1) 12,000, (1) 10,000 ohms	9 0
1 Ready Radio 400-ohm potentiometer	2 9
1 Pair Lewcos A.C. S.T.400 coils	10 0
2 J.B. Popular Log slow-motion ·0005-mfd. variable condensers	17 0
2 Telsen ·0003-mfd. preset condensers	3 0
1 Graham Farish ·0003-mfd. differential condenser	2 0
1 Lotus M.D.35 ·00035-mfd. differential condenser	3 0
1 Igranic 1,500-ohms spaghetti	6
1 W.B. universal S.G. valve holder	1 0
3 Benjamin Vibrolders 5-pin	3 9
1 Telsen binocular S.G. choke	5 0
1 Lewcos type M.C. reaction choke	2 6
2 Bulgin S.80 2-point on-off switches	3 0
1 Ready Radio ·00004-mfd. variable, special low minimum	1 6
2 Telsen 2-point switches	2 0
1 Bulgin radiogram switch, S.86	1 6
1 Bulgin F.15 combined mains plug and fuse holder	3 6
5 Clix marked terminals	1 0½
1 Belling-Lee S.G. Anode Connector	4
1 Ready Radio ·0001-mfd. differential condenser	2 6
1 Peto-Scott Red Triangle black ebonite panel, 16" × 7" × 3/16", ready drilled	3 3
1 Peto-Scott baseboard, 16" × 10", ready fitted with foil, 10" × 7"	2 0
2 Peto-Scott Red Triangle terminal strips, 16" × 1½" and 2" × 2", ready drilled	1 0
1 S.T.400 Screen	1 9
1 Peto-Scott combined shelf and baffle Insulated connecting wire, screws, flex, etc.	3 6
KIT "A," CASH OR C.O.D.	£9.7.6

KIT "B"
As for Kit "A," but with valves only. Cash or C.O.D. Carriage Paid £12.14.0, or 12 monthly payments of 23/2.

KIT "C"
As for Kit "A," but including valves and Peto-Scott oak consolette cabinet as specified, but excluding speaker. Cash or C.O.D. Carriage Paid, £13.19.0, or 12 monthly payments of 25/7.

ROLA SPECIAL MODEL S.T.400 MOVING-COIL SPEAKER.
Cash or C.O.D. **£1.15.0**
or add 3/3 to each of 12 monthly payments.

PILOT AUTHOR KIT

Exact to Mr. John Scott-Taggart's **ZONE TESTED FIRST SPECIFICATION**

DELIVERED Carriage Paid CASH or C.O.D. KIT "A"
95/-
with FREE Full size Blueprint & Copy Wireless Constructor

THIS IS THE KIT MR. JOHN SCOTT-TAGGART USED
—BATTERY MODEL—

	s. d.
1 PETO-SCOTT low minimum Aerial Coupler, ·00004	3 6
1 LISSEN Hypernik L.F. transformer	12 6
2 COLVERN coils, "S.T.400" type	9 10
2 ORMOND ·0005 variable condensers, type R.493	15 0
1 POLAR ·0003 differential condenser	3 0
1 LOTUS ·00035 differential condenser, type MD.35	3 0
2 TELSEN ·0003 preset condensers	3 0
1 READY RADIO ·0001 differential condenser	2 6
3 BENJAMIN Vibrolder valve holders	2 6
1 W.B. Universal valve holder	1 0
2 TUNEWELL 2-point switches	1 8
1 TELSEN binocular S.G. choke	5 0
1 LEWCOS reaction choke	2 6
1 GOLTONE ·0003 fixed condenser	5
1 GRAHAM FARISH ·006 fixed condenser	1 0
1 DUBILIER ·006 fixed condenser, type 670	1 6
2 IGRANIC 2-mfd. fixed condensers, Nondu	5 6
1 DUBILIER 1-mfd. fixed condenser, type 9200	2 9
1 FERRANTI synthetic grid resistance, 1 megohm, with holder	1 6
1 IGRANIC 1,500 spaghetti resistance	6
1 IGRANIC 50,000 spaghetti resistance	1 0
1 IGRANIC 20,000 spaghetti resistance	9
1 LEWCOS 60,000 spaghetti resistance	1 6
1 BULGIN toggle switch, type S.80	1 6
11 BELLING & LEE terminals, marked	2 3½
1 10" × 6" screen, drilled to specification	1 9
1 PETO-SCOTT baseboard, 16" × 10" with 10" × 7" aluminium foil ready mounted	2 0
1 RED TRIANGLE black ebonite panel, 16" × 7" × 3/16ths, ready drilled	3 3
1 RED TRIANGLE black ebonite terminal strip, 16" × 1½" × 3/16ths, ready drilled	9
1 Each BELLING & LEE anode connector and twin tap plug, together with wire, screws, flex	2 1
1 FULL-SIZE BLUEPRINT, with copy "Wireless Constructor," S.T.400 issue	GRATIS
CASH OR C.O.D. KIT "A" ..	£4 15 0

- All panels and terminal strips accurately drilled to specification.
- Matched knobs for all panel components.

KIT "A" DELIVERED *CARRIAGE PAID* ON FIRST PAYMENT OF **8/9**
Author's Kit of specified parts, including FREE BLUEPRINT, Ready drilled Panel and Foil-covered Baseboard, but less Valves and Cabinet.
Balance in 11 monthly payments of 8/9
OR *CASH or C.O.D.* £4-15-0 *Carriage Paid*

KIT "B"
As Kit "A" but with valves less cabinet
12 monthly payments of **12/3**
Cash or C.O.D. £6.14.3
Carriage Paid.

KIT "C"
As Kit "A" but with valves and cabinet
12 monthly payments of **14/-**
Cash or C.O.D. £7.11.3
Carriage Paid.

S.T.400 PILOT STRUCTAKITS

BATTERY MODEL. 'Red Triangle' ready-drilled black panel 16" × 7" × 3/16", terminal strip 16" × 1½" × 3/16", Peto-Scott baseboard 16" × 10", with foil, drilled aluminium screen 10" × 6", and all screws, wires and nuts. Complete with Free Full-size Blueprint and copy of *Wireless Constructor* S.T.400 issue. **10/6**

A.C. MODEL. Contents as for Battery Model Structakit but with the addition of Peto-Scott Combined Shelf and Baffle; Peto-Scott 2" × 2" Terminal Strip and extra supply of Connecting Wire, Screws and Flex. **15/6**

S.T.400 PILOT CONVERSION KIT

CONTAINS Colvern aerial coil, Polar and Lotus differentials, 2 Telsen preset condensers, Benjamin valve-holder, Goltone ·0003 mfd. fixed condenser, Graham-Farish and Dubilier ·006 mfd. fixed condensers, Igranic 2 mfd., Igranic 1,500 and 50,000 ohm and Lewcos 60,000 resistances, Bulgin S.80 switch, Belling & Lee terminal, anode connector and twin-tap plug, wire, screws and flex. Full-size blue-print and copy Dec. issue *Wireless Constructor.*
Cash or C.O.D. Carriage Paid **31/-**
Or send 29/- only with old Colvern S.T.300 Aerial Coil.

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PILOT AUTHOR KIT, S.T.400 { KIT "A" Battery Model or A.C. Model. / KIT "B" Battery Model or A.C. Model. / KIT "C" Battery Model or A.C. Model.

for which I enclose £ .....s.....d. CASH/H.P. Deposit.

NAME .....

ADDRESS W.C.3/33

SEND DIRECT to AVOID DELAY — CASH, C.O.D. or EASIWAY

The WIRELESS CONSTRUCTOR

The EDITOR'S CHAT

Our Free-Blueprint Set—Double-Channel Reaction—A Great New Series Begins

DETAILS of the "A.C. S.T.400" have been eagerly awaited by thousands of readers of THE WIRELESS CONSTRUCTOR. They are now available in this issue.

Mr. Scott-Taggart describes the construction of an all-electric consolette receiver—self-contained, and with moving-coil loudspeaker. This mains version of the famous "S.T.400" is a remarkable example of first-class set design. With the aid of the full-size blueprint presented free with this issue, readers should find the minimum of constructional difficulty.

Comprehensive Account

"S.T." also writes in this issue the first comprehensive account of Double-Channel Reaction. This subject is of absorbing interest to all radio enthusiasts, and especially to those who have built the "S.T.400." "S.T." candidly admits that, ever since he was a child, he has firmly believed that if a teaspoonful of medicine does you good, then two teaspoonfuls will do you still more good! And he considers that this unscientific, but very human, belief may possibly have had something to do with the fact that nine years ago he decided that, since reaction was good when applied to one circuit, it would be even better when applied to two—or even more circuits!

And to quote "S.T.": "Lo, it was so!"

As our distinguished contributor points out, the merits of multiple reaction were "before their time," for the war in the ether was then undeclared, and stations had not begun to fight for a place on the dial. But these days it has undoubtedly become necessary to exploit to the fullest limit every known selectivity device.

Many readers have written to us in the past asking for a simple and yet comprehensive explanation of the controversy which raged, and still rages, around Dr. James Robinson's Stenode invention, and in "S.T.'s" article on "Double-Channel Reaction" you will get—probably for the first time—a really clear idea of what the argument is all about.

The "A.C. S.T.400" All-Electric Consolette

This month's great Free-Blueprint Set in action under the critical eye of its designer—Mr. John Scott-Taggart.

A Great New Feature

An interesting and entirely new feature contributed by Mr. Scott-Taggart begins in this issue, under the title "Questions I Am Asked." Here you will find representative queries received from readers given personal attention by the inventor of the "S.T.400"; while in his popular feature "From My Armchair," "S.T." raises the interesting but rather provocative query: "Who are the keenest radio constructors?"

B.B.C. and Poland

The new year has not started very auspiciously for the B.B.C. Poland got very restive to begin with—and now our own M.P.'s are likely to start kicking in their traces. And all because of broadcasting!

Since the incident on New Year's Eve which led the Polish Ambassador to protest against certain comments on Poland contained in a broadcast, the number of critics of the B.B.C. has increased in Parliament.

An unofficial committee of M.P.'s has been formed, and it intends to request the Government to exercise greater control over the B.B.C.

The truth is that our M.P.'s are rather jealous of the B.B.C.'s growing influence. Let's hope they won't tether the B.B.C. too tightly.

"ON THE GRID"

Earthing via mains—Divide your log—Watch that switch.

RECENTLY I installed a combined mains unit and charger in the five-valve portable of a relation. The other day when I saw him I was gratified to hear that the set was doing fine and bringing in many more foreigners than before.

As a matter of fact, the owner was getting quite a DX fan, and asked my advice on a turntable for the set. When I informed him that there was no point in having one, he was almost rude, pointing out that he remembered testing out the directional properties of the set in the past and finding them most marked.

Earthed Frame

What he had overlooked was the fact that the addition of an earth connection to a frame aerial usually completely removes any sign of directional qualities. One side of the mains was earthed and the capacity of the unit was sufficient to earth the set to all intents and purposes.

Directional Searching

Talking about frame aerials and directional effects brings up the question of searching with a frame. The best way to avoid missing any stations, and to get a really comprehensive log, is to have four lists of four different directions of the frame. Final adjustments for best direction can be made once the station is found.

The four directions would be in the same relation to one another as the following. Frame pointing North and South, North-East and South-West, East and West, and South-East and North-West.

The average frame and receiver is not so critical that any stations are likely to be missed by all four of these positions.

A Point to Watch

Before I quite forget the subject of my first item, there is a little warning for those who use mains combined H.T. and charger units in similar circumstances. The accumulator is permanently connected up with the set and the trickle charger, so that it is receiving power from the mains all the time the set is on—so long as the switch is over to charge.

If, then, the mains are turned off at the plug point or wall switch the set will stop working, but the accumulator will still be feeding the filaments. So it is necessary to switch the set off in the ordinary way as well.

If you forget to do this the accumulator will soon be run right down. There is no harm in switching the set off without the mains, for that is the usual procedure when it is desired to charge the accumulator by itself.

A. S. C.

THE MONTH ON SHORT WAVES

All the interesting news about this fascinating waveband.

PAST short-wave experiences extending over a considerable number of years have taught me that whenever the static level is particularly low, it is precious little use searching for really distant stations.

The relationship between no static and no signals is almost uncanny, yet it isn't by any means an infallible conclusion. I have known occasions (mostly after midnight!) when it would have been almost impossible to distinguish American stations from our own local transmitters.

Good Times Coming

Unfortunately, such occasions are rare, and the no-static conditions of the past month have certainly not been bristling with them! Generally speaking, if the evening is quiet from the point of view of noise level, it can usually be taken as an omen of bad DX conditions, and that pretty well sums up the past month as far as my own experiences are concerned.

There were one or two mediocre exceptions, to use an expressive if clumsy term, and on those occasions I heard several of the American "punch-merchants," but never at more than R6/7. The "star-turn" was W 8 X K on 25·27 metres during the early evening, and although his mean strength was never at real "wake-the-baby" strength, intelligibility was good.

As I write these notes, there is every indication of a return to better conditions. W 3 X A L is coming over remarkably well as I write. At times his signals reach R9, although the whole of that part of the transmission to which I am listening is punctuated with fairly deep fading.

Another Nairobi Broadcast?

I also came across a transmission which stirred up treasured memories of that first inter-Imperial broadcast of little more than a year ago. I wonder how many readers remember that special WIRELESS CONSTRUCTOR broadcast from Nairobi?

I wonder, also, how many would smack their lips and resin their finger-tips at the prospects of another one? I'm quite prepared to see what can be done about another one if all those who are interested would let me have their feelings on the matter. Just a few words on a postcard will do.

One of the latest recruits to the CONSTRUCTOR short-wave circle has written to tell me that he is having some difficulty in "assessing" the signal strengths of stations in terms of the "R" code.

Interpreting the Code

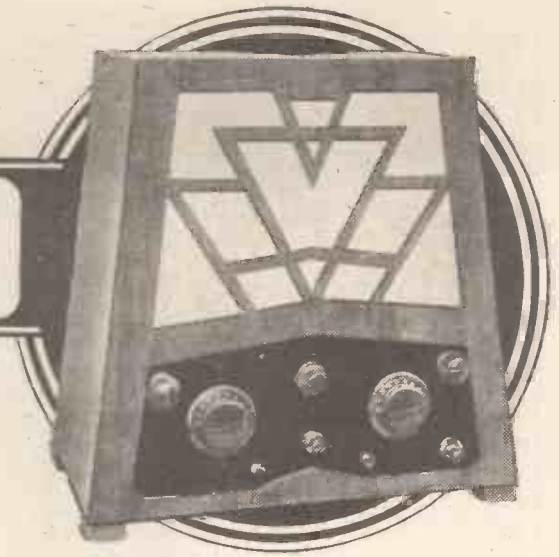
His query raises rather an interesting point, and so that we can all work and report on some sort of definite basis, I propose to give my interpretation of the "R" code which I believe is more or less the accepted one.

Strength R1 is applied to faint signals that are barely readable; R2 denotes weak signals just readable; R3 weak signals but fairly consistent; R4 fairly good signals easily understood; R5 moderately strong signals; R6 comfortable 'phone strength; R7 loud 'phone strength; R8 moderate speaker strength, and R9 full loudspeaker strength.

Henceforth I am hoping that you will all work on this basis, and then we shall know where we are.

G. T. K.

THE A.C. S.T.400 ALL-ELECTRIC CONSOLETTE



BY JOHN SCOTT-TAGGART A.M.I.E.E., F.INST P

ANY designer who is worth his salt has one ambition which he rejoices to see fulfilled. It is the building by the public of a receiver which he has designed *from beginning to end.*

Many sets are built to a designer's specification and spoilt by unsuitable valves and speaker. The temptation to "use up" existing apparatus is tremendous, and usually there is no serious harm done. But what is the designer's position when his constructor insists on using, say, a speaker which the designer *knows* is a poor one?

Designer's Responsibility

What also are the feelings of the designer when the builder of his set feels compelled to use a low voltage H.T. battery or an inadequate mains unit? (Incidentally, I regard nearly all mains units as unsuitable; they have been designed to operate at voltages unsuitable for many sets, especially as regards their intermediate tappings, which are too low for many circuits.)

It was a great delight to me to design the "S.T.400" all-electric receiver described in the following pages. And the delight was the result of being able to design it completely from end to end of the circuit, and from top to bottom of the cabinet.

All I ask you, as a constructor, to provide is the A.C. mains. From the moment the current enters the set the responsibility is mine, *provided you have followed the instructions.*

Output "Matching"

I should like all readers to follow my advice about apparatus. I give you a wide choice, but many depart from the component list for reasons which I cannot fathom. Perhaps they are persuaded in their local shops that A's condenser, for example, is as good as B's. Or a false economy lures them into a morass.

It may be that I am perfectly satisfied with all of A's manufactures except, say, an aerial coupler. I may heartily disapprove of it and exclude it from my list. Nevertheless, A sells thousands of his unsuitable aerial couplers, and I weep in secret because of it; because I know that these wilful readers are going to get results which are inferior.

In this article "S.T." describes a magnificent three-valve mains receiver for those who have A.C. in their homes.

Half the receiver will remain unaltered, even if the reader should build another type of set in the future, and so this forms an ideal set for those who are launching out for the first time on an A.C. model.

All the features of the battery "S.T.400" are embodied and are equally successful. The components, speaker, power pack, etc., are perfectly blended to give a really fine receiver for the home.

As regards loudspeakers, opportunity occurs to match loudspeaker and output valve when a complete consolette or radiogram receiver is designed. The "quality," output "handling" power, etc., may be made to suit the other parts of the circuit.

This applies to the present receiver in which I am able to choose the output valve, the mains transformer, the smoothing system and the speaker. They "work together," but I do not suggest the makes used are the only ones which would prove satisfactory.

Mains-Energised 'Speaker

The latter is of the mains-excited type, it has a transformer to match the pentode output valve, and it belongs to a type which is cheap.

When I say cheap, I mean that a mains-energised speaker compares very favourably with, say, the permanent magnet type of moving-coil speaker. The important point to bear in mind about "mains-energised" speakers is that since a strong magnetic field is readily obtained, the gap between speaker coil and the magnet system can be made wider (lessening the chance of rubbing), and the whole cost of the speaker is reduced by about fifteen shillings. Incidentally greater sensitivity is usually obtained.

The present receiver follows closely on the "S.T.400" set designed for operation off batteries. Owing to the greater efficiency of mains valves, one L.F. stage was eliminated, so that the "A.C. S.T.400" Consolette is virtually a 3-valve all-electric receiver working off a full-wave valve rectifier.

Increased Advantages

The "S.T.400" features are all retained in the A.C. circuit, so that the advantages given by double-channel reaction, the aerial and anode couplers, the selectivity range adjuster, anode-bend detection, and reaction equalisation have added to them the merits

MARCH 1933

THE WIRELESS CONSTRUCTOR

S.T. 400

A.C. CONSOLETTE

DESIGNED BY

JOHN SCOTT-TAGGART

1/- FULL SIZE BLUEPRINT

MOVING COIL SPEAKER

SPEAKER FIELD WINDING

PENTODE OUTPUT TRANS'R..

RECT. VALVE.

NOT USED

C

F

G

A

F

1A

TOP TERMINAL

TOP 60M/M TERM.

2

2

250

250

4 MFD..

·01 MFD..

SPEAKER BAFFLE SUPPORT

10,000 OHMS

L.F. CHOKE

MAINS TRANSF'R..

TOP TERMINAL

CENTRE TERMINAL

4A

2 MFD..

12,000 OHMS

300 OHMS

2 MFD..

4 MFD..

4 MFD..

MAINS PLUG & FUSES

TERMINALS AT BOTTOM

V_3

PENTODE OUTPUT VALVE

A

C

F

F

G

TO PRIMING GRID OF PENTODE

50,000 OHMS.

A

B

C

D

E

F

G

H

MAINS SOCKET FITS HERE

ON-OFF MAINS SWITCH

MASTER REACTION ·0003 MFD..

ANODE COUPLER ·0001 MFD..

BENDS INWARDS

ANODE TUNING COND'R.. ·0005 MFD..

S.T.400 OR S.T.300 ANODE COIL

TERMINAL ON SCREEN

AERIAL COUPLER ·00004 MFD.

AERIAL TUNING COND'R. ·0005 MFD..

REACTION DISTRIBUTOR ·0003 MFD..

·002 MFD..

RADIO-GRAM SWITCH

ANODE WAVE-CHANGE

NOT USED

THROUGH NOTCH IN SCREEN

AERIAL WAVE-CHANGE.

RISES VERTICALLY

1.500 OHMS

SELECTIVITY RANGE ADJUSTER ·0003 MFD. PRESET.

V_2 DETECT. VALVE

COIL PILLARS

AUTOMATIC REACTION EQUALISER. ·0003 MFD..

RISES VERTICALLY

·002 MFD..

TO ANODE OF S.G. VALVE.

S.G. VALVE-HOLDER. V_1

HOLE IN SCREEN.

30,000 OHMS

S.T.400 AERIAL COIL.

·0003 MFD..

·0005 MFD..

REACTION CHOKE

750 OHMS

20,000 OHMS

S.G. CHOKE

40,000 OHMS.

400 OHMS

NOT USED.

·5000 OHMS

1 MFD

P. H.T.

L.F. TRANS'R..

G. G.B.

2 MFD..

300 OHMS

NOT USED

TERMINALS UPPERMOST

7000 OHMS

B PICK-UP A

C

D

H.T.+1

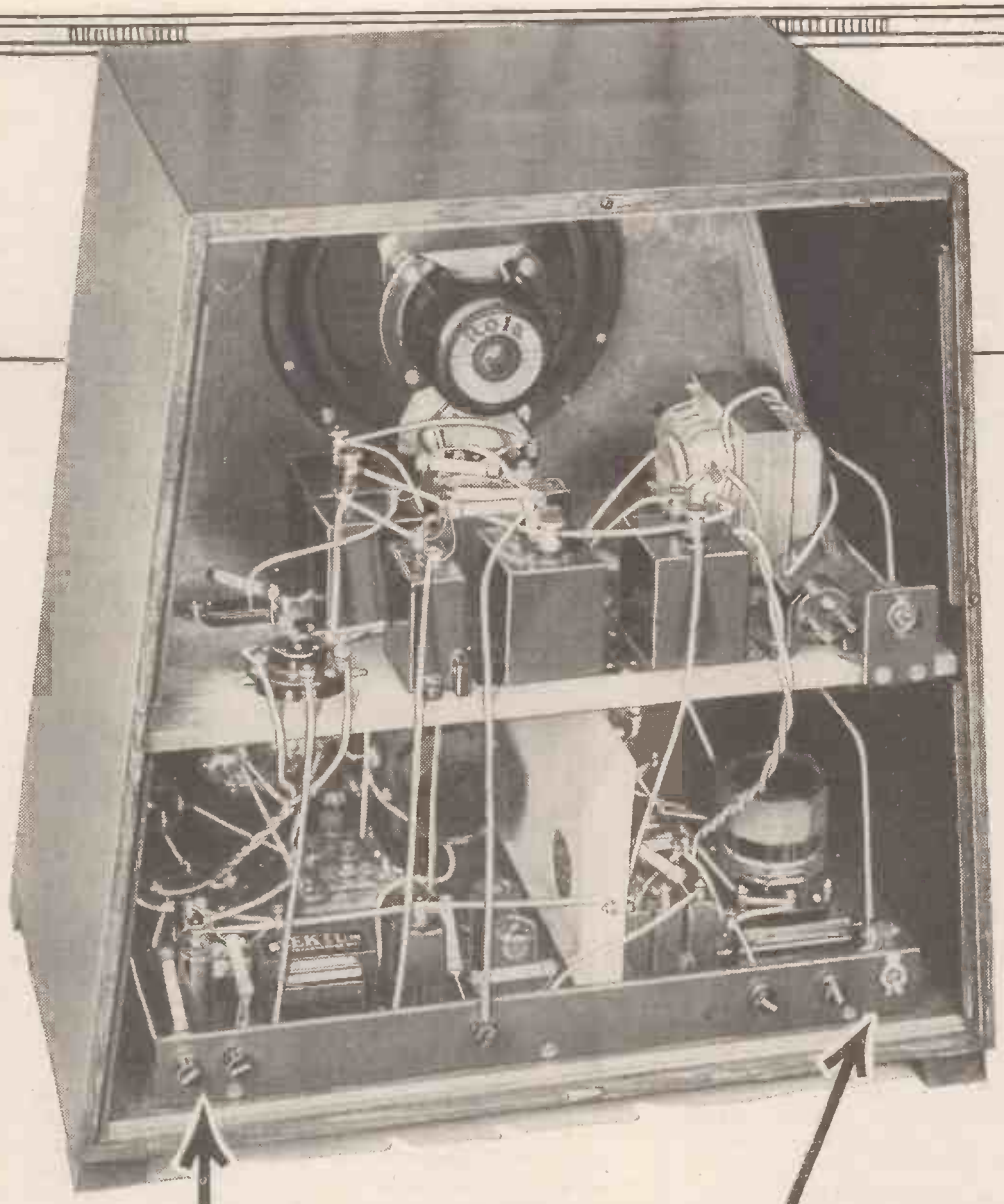
E

F

EARTH H

AERIAL G

LOCAL-DISTANCE-SW..



Here we have a back view of the self-contained set which embodies all the advantages of the battery "S.T.400," together with several merits obtainable only by the use of A.C. valves.

The set is built in two layers. The top "floor" is a shelf to which is fixed the baffle board on which the moving-coil speaker is screwed. The whole top half of the set is therefore easily built and simply slid into the grooves on each side of the cabinet.

The main portion of the set, which closely resembles the original "S.T.400," is built as usual on a plywood baseboard and ebonite panel. The receiver proper is therefore little different from the battery model and slips into the cabinet.

From the above remarks it will be seen that the receiver is complete without the cabinet, which merely serves as a "shell" for containing the two "halves" which are wired together by a few simple connections which pass the shelf edge nearest the reader.

The valve holder to the left of the top shelf is for the output pentode valve. A tone corrector circuit is used, but the reader is advised, in nearly all cases, to use the ·01-mfd. condenser without the 10,000-ohm resistance. The value of this latter resistance controls the "tone" and, in my experience, a better result is obtained without it. The result is a great reduction in heterodyne interference. As tastes vary as regards tone, the resistance is left included to show where such a resistance should be connected.

J. S.T.

possessed by a perfectly matched output and speaker arrangement.

The volume obtainable from this set is terrific without any loss of quality. Only by actually hearing the really fine tonal output can one realise how it is possible to listen to great power without distress to the ears. It is loudness *without* fidelity which makes one shudder.

model. Anode-bend detection once again proves a valuable ally.

As regards operation, it is identical with the battery model. To get maximum selectivity, you will use the reaction distribution, thus improving aerial circuit selectivity. If you have not built the battery set, I urge you to read all I have written on the subject of the "S.T.400". Unfortunately,

disappears. There will still remain far more volume than one would listen to in the ordinary way.

The adjustment of the selectivity range adjuster must obviously be done with the set switched off, and preferably with the mains socket pulled out. One does not want to receive a shock. The adjustment instructions have previously been given.

RECOMMENDED PARTS FOR THE "A.C. S.T.400" ALL-ELECTRIC CONSOLETTE

1 L.F. transformer. Slektun 8/6 type (1 to 5), or R.I. Hypermite, Lissen Hypernik, Lewcos L.F.T.6A., Varley Niclet (1 : 3·5), Tunewell, Igranic Midget, Lotus 10/6 type, Ferranti A.F.3, Multitone (1 : 4).

1 L.F. choke. R.I. Audirad, or Varley, Igranic, Wearite.

1 Mains transformer to give 250 v.—0—250 v. (60 milliamps.), 2 v.—0—2 v. (1 amp.), 2 v.—0—2 v. (4 amps.). Wearite (new dial type T.21A; standard type T.21A is also satisfactory).

3 4-mfd. fixed condensers (suitable for working up to 400 volts peak). T.C.C. type 80, or Dubilier type L.S.B.

1 1-mfd. (used as detector self-bias by-pass). Dubilier type B.B., or Telsen, T.C.C. type 50, Igranic, Formo, Lissen, Sovereign.

3 1-mfd. (used for S.G. self-bias by-pass, S.G. anode decoupling, and across 30,000-ohm resistance). Telsen standard type, or Dubilier 9200, T.C.C. type 50, Igranic, Formo, Lissen, Sovereign.

1 2-mfd. (for pentode grid-bias decoupling). T.C.C. type 50, or Dubilier type B.B., Telsen, Igranic, Formo, Lissen, Sovereign.

1 2-mfd. (for decoupling detector anode). Dubilier type B.B., or Telsen, T.C.C. type 50, Igranic, Formo, Lissen, Sovereign.

1 2-mfd. (for decoupling auxiliary grid of pentode). T.C.C. type 80, or Dubilier type L.S.B.

1 ·01-mfd. Dubilier type 670, or T.C.C., Lissen, Telsen, Graham Farish, Bulgin.

2 ·002-mfd. Dubilier type 670, or Graham Farish, Telsen, Lissen, T.C.C., Bulgin.

1 ·0003-mfd. Dubilier type 670, or Lissen, Graham Farish, T.C.C., Bulgin

1 ·0005-mfd. Dubilier type 670, or Lissen, Graham Farish, T.C.C., Bulgin.

Resistors—1 watt type.
- 2 300-ohm. Erie or Dubilier (metallised type).
- 1 30,000-ohm. Dubilier or Erie.
- 1 40,000-ohm. Dubilier or Erie.
- 1 7,000-ohm. Dubilier or Erie.
- 1 750-ohm. Dubilier or Erie.
- 1 5,000-ohm. Dubilier or Erie.
- 1 20,000-ohm. Dubilier or Erie.
- 1 50,000-ohm. Dubilier or Erie.
- 1 12,000-ohm. Dubilier or Erie.
- 1 10,000-ohm. Dubilier or Erie.

[Not usually necessary. See note on Tone Control.]

1 Potentiometer (400 ohms). Ready Radio.

1 Pair "S.T.400" coils. Lewcos, or Colvern, Wearite, Telsen, Tunewell, Goltone, Sovereign, Ready Radio.

2 ·0005-mfd. variable condensers. J.B. Popular Log (slow motion), or Ormond R.493, Polar No. 2 SM., Lotus.

2 ·0003-mfd. preset condensers. Telsen or Goltone.

1 ·0003-mfd. differential (for master reaction). Graham Farish, or Polar, Telsen, Magnum, Lotus ·00035-mfd., J.B., Bulgin.

1 ·00035-mfd. differential (for reaction distributor). Lotus ·00035-mfd. M.D.35, or ·0003-mfd. of following: Graham Farish, Polar, Magnum, Telsen, J.B., Bulgin. (There is no technical merit in ·00035-mfd. over ·0003-mfd.)

1 Spaghetti (1,500 ohms). Igranic (or other types, but Igranic fits conveniently).

1 S.G. valve holder (horizontal). W.B. Universal type.

3 Valve holders (5-pin).—Benjamin Vibrolders, or Lotus, Graham Farish, Telsen, Bulgin, Tunewell, Ferranti, Ready Radio.

1 S.G. choke. Telsen Binocular, or R.I. Dual Astatic, Lewcos, Ready Radio, Wearite H.F.O., Magnum, Bulgin, Sovereign Super, Slektun.

1 Reaction choke. Lewcos type M.C., or R.I. Quad Astatic, Telsen, Lissen, Graham Farish, Wearite, British General, Ready Radio, Tunewell, Watmel.

2 Toggle switches (2-pt. on-off). Bulgin S.80, or Claude Lyons B.A.T., Igranic, Wearite, etc.

1 Aerial coupler (·00004-mfd. variable with very low minimum). Ready Radio ·00004-mfd., or Peto-Scott, J.B. Midget.

[Readers are advised to fit a Graham Farish knob as fitted to the Graham Farish master reaction differential.]

2 2-pt. switches. Telsen, or Tunewell, Lissen, Ready Radio, Wearite, Sovereign, W.B., Igranic, Goltone, Ormond, Lotus, Bulgin.

1 Radiogram switch. Bulgin rotary change-over radiogram switch S.86.

1 Combined mains-plug and fuse-holder. Bulgin F.15.

5 Terminals: Aerial, Earth, H.T.+, Gramo, Gramo. (Clix or Belling-Lee, Bulgin, Igranic.)

1 S.G. Anode connector (if desired). Belling-Lee.

1 ·0001-mfd. differential. Ready Radio, or Polar, Graham Farish, Magnum, Bulgin, J.B., Utility, Lissen, Wavemaster.

1 Rola F.6 moving-coil speaker, 2,000 ohms field, complete with pentode output transformer. (Specify for "S.T.400" when ordering, to ensure obtaining type specially fitted with terminals, otherwise the speaker is standard.)

1 Oak Consolette cabinet. Peto-Scott, type for A.C. "S.T.400," complete with panel, baseboard and copper foil (has special combined shelf and baffle which slides out and greatly facilitates set construction.)

1 "S.T.400" Screen. Magnum, or Wearite, Peto-Scott, Direct Radio.

VALVES

1st (S.G.). Marconi or Osram M.S.4B. (if metallised see that coating does not touch screen, although a short would produce no dangerous or damaging effect).
2nd (Detector). Cossor 41M.R.C.
3rd (Output). Mazda A.C./PEN.
Rectifier. Mullard D.W.2.

With battery sets one has to take care to avoid overloading. With the "A.C. S.T.400" built as described you cannot overload. You simply get such great volume of perfectly pure sound that you will have neighbours coming round to complain. The remedy is to ask them to come in!

Selectivity Adjustments

As regards selectivity, you get all the benefits of the "S.T.400" battery

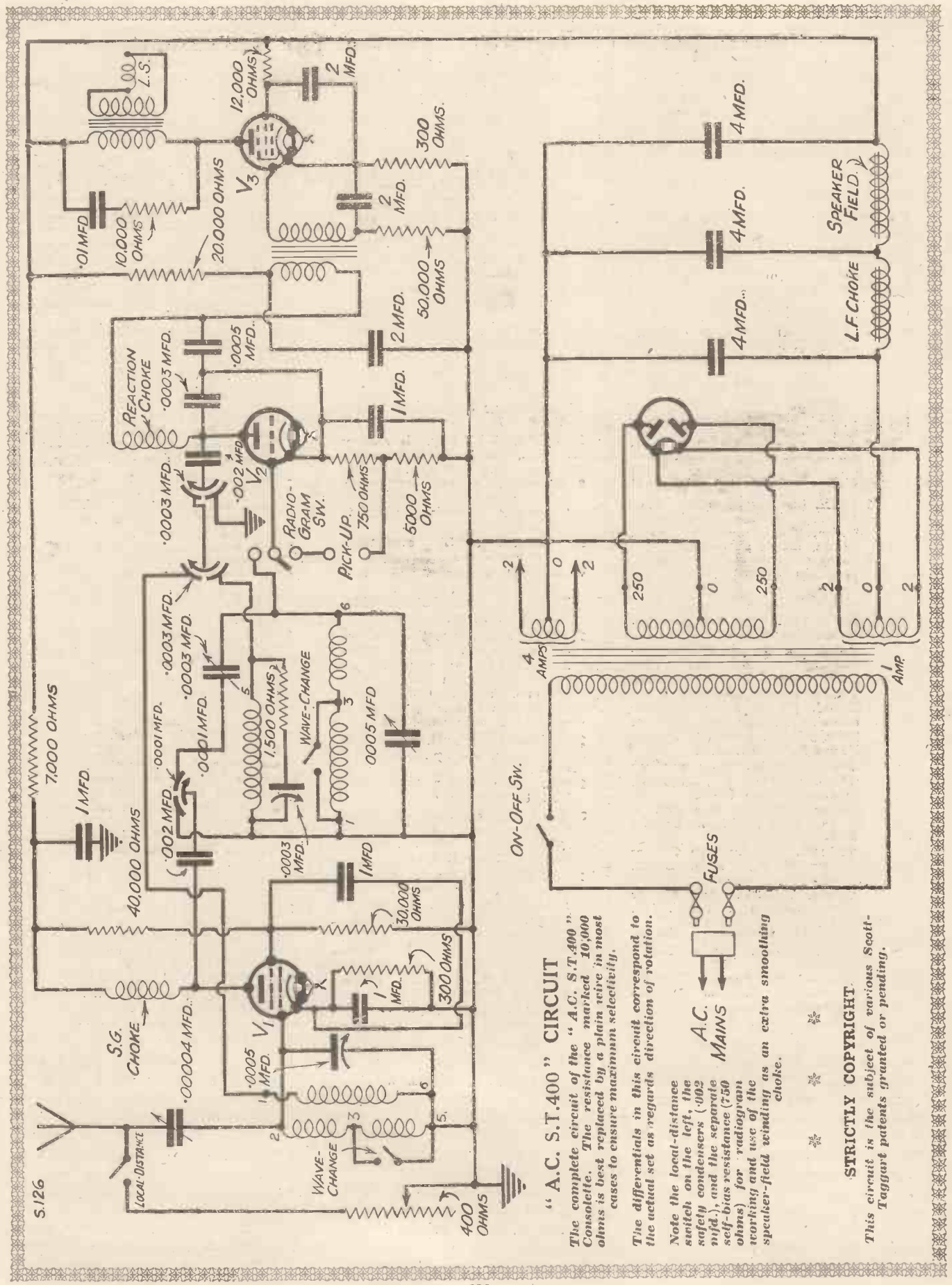
many readers do not read the instructions carefully.

It is important, for example, to cut down the H.F. input to the set (by turning the aerial coupler knob towards the left) before applying reaction to the aerial circuit with the distributor. If you work your set so that it can be heard three streets away, you may get some interference loud enough to hear in your room.

Obviously, you should cut things down until the "interference level" You simply reduce the capacity of the preset by turning the knob anti-clockwise a turn or two at a time if there is a tendency for the set to oscillate with reaction at zero and distributor at normal. One should only unscrew sufficiently to ensure stability.

A Point to Watch

After each alteration, the set is switched on and tested. When correctly adjusted, see that the knob of



"A.C. S.T.400" CIRCUIT

The complete circuit of the "A.C. S.T.400" Consolette. The resistance marked 10,000 ohms is best replaced by a plain wire in most cases to ensure maximum selectivity.

The differentials in this circuit correspond to the actual set as regards direction of rotation.

Note the local-distance switch on the left, the safety condensers (·002 mfd.), and the separate self-bias resistance (750 ohms) for radiogram working and use of the speaker-field winding as an extra smoothing choke.

* * *

Remember by Saying, "Down for Distance"

the preset does not turn when the lock-nut is tightened up.

Testing the Preset

The procedure for adjusting the reaction equaliser is much the same. Start with the knob nearly full-out and screw up a few turns at a time until the equalisation effect is obtained. If you cannot get proper reaction at the lower end of the tuning condenser scale, reduce the equaliser preset capacity (turn knob anti-clockwise). If results are still not satisfactory, a one of the few unlucky ones you will get poor results until it is either taken out of circuit or replaced by a satisfactory preset.

As regards tuning, I advise you to read my general notes which have appeared in this magazine. Do not turn the master reaction up until you need it. The tuning-in of a set without making it oscillate is simply a knack.

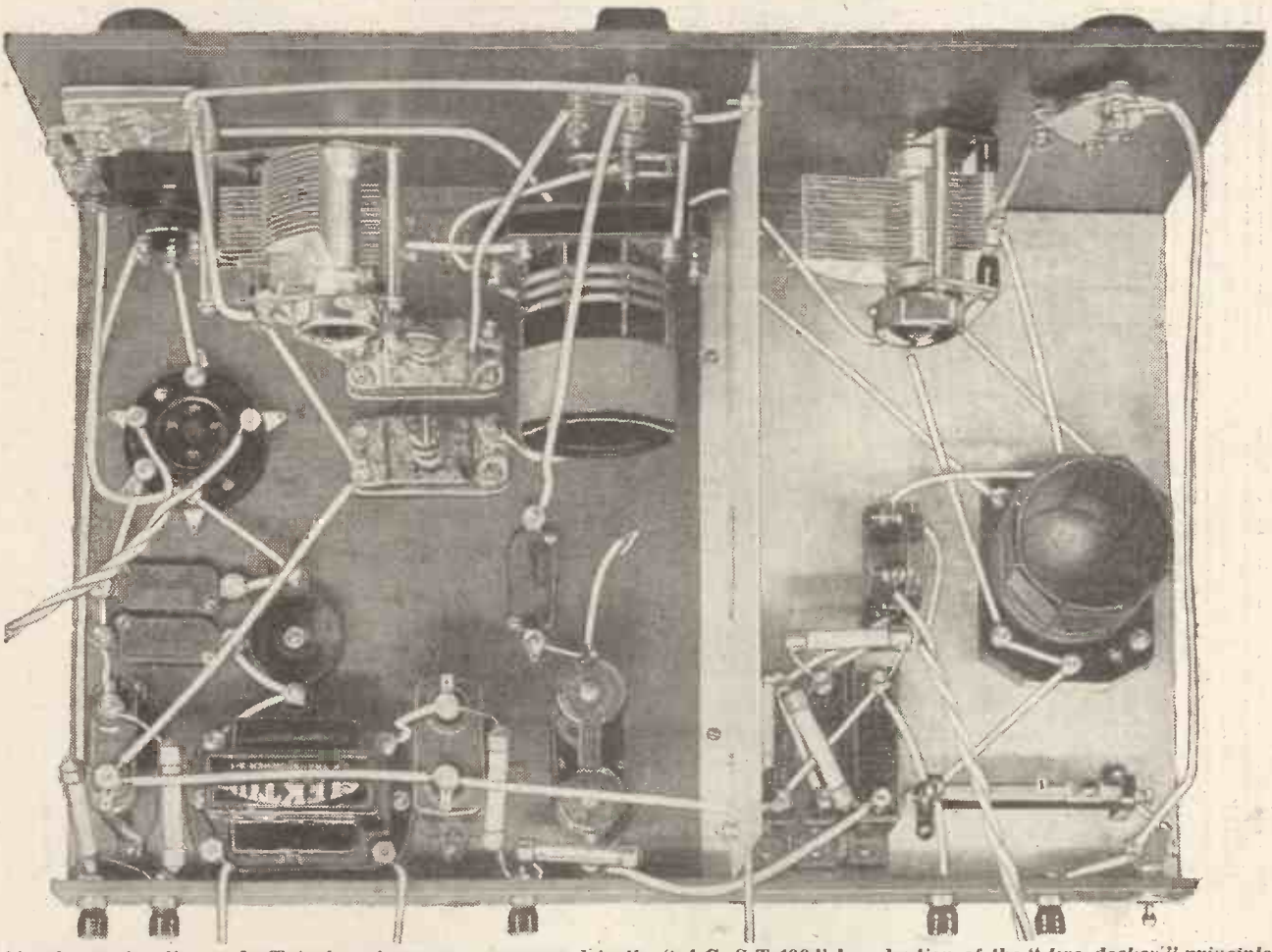
Remember to keep the reaction below the normal level when altering the tuning dials; and remember that beginners to use the make specified first in the list of components.

A feature of the "A.C. S.T.400" which was not in the battery set is the local-distance switch. I have incorporated a 400-ohm variable resistance which can be switched across the aerial and earth of the set.

Dealing with the Local

The object of this is to cut down the H.F. input in the case of those near to a B.B.C. station. With the switch knob "down" you cut out the resist-

ALL GEAR WELL STOWED ON THE LOWER "DECK"



Simple construction and efficient performance are ensured in the "A.C. S.T.400" by adoption of the "two-decker" principle of assembly. The receiver section (lower "deck") comprises H.F. and detector circuits only, and you could almost build your duplicate of it from this illustration.

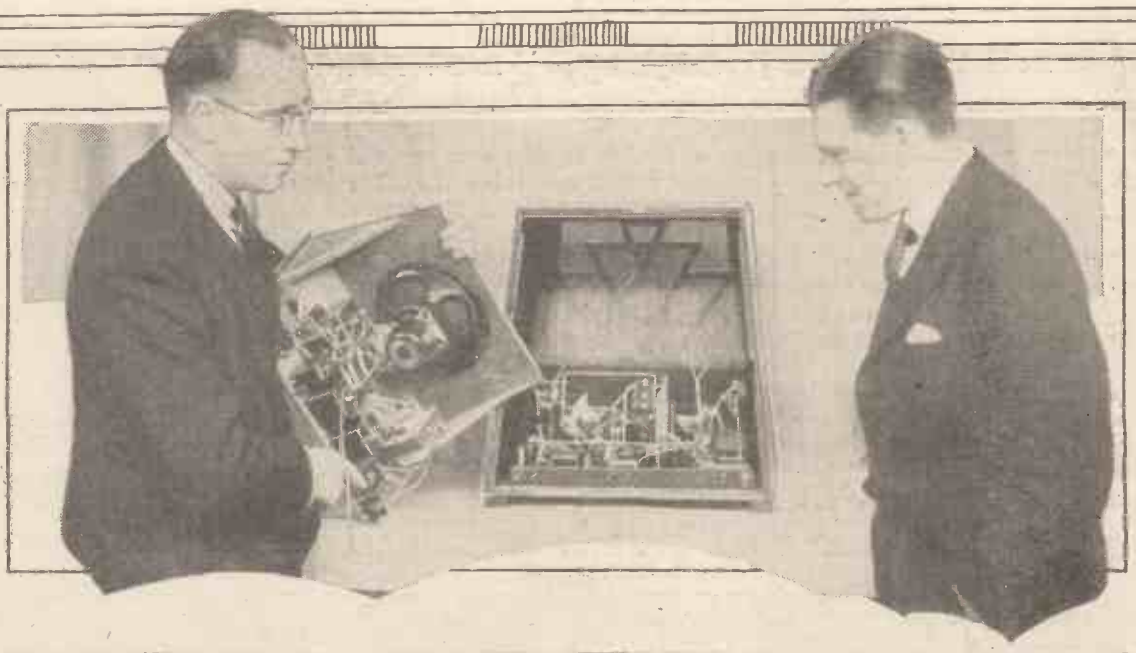
faulty "stuck-down" preset is the probable cause.

Disconnect it entirely and remove the 1,500-ohm spaghetti. Satisfactory reaction, if now obtained, is a sure indication that the preset was faulty.

I mention this because presets sometimes "stick," and if you are when the two tuned circuits are in tune with each other (as they should be), the inherent reaction of the set will increase slightly.

I ought to mention that differentials different from those used in the set may require turning the other way round. Details of this were given last month. I strongly advise ance and are ready for distant reception. You can remember this by saying "Down for distance."

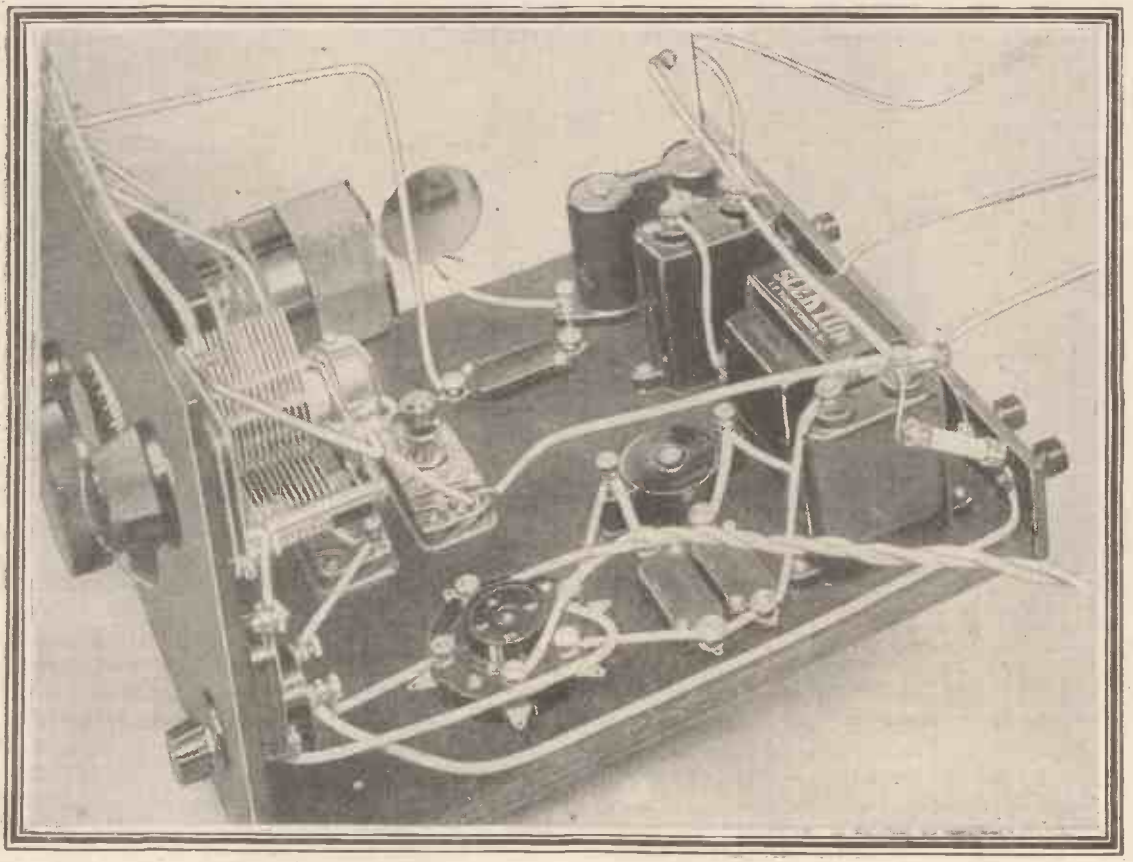
The value of the resistance may be adjusted to suit your local conditions. It is a useful adjunct to the set, but, of course, signals may be reduced a great deal when the aerial and anode couplers are near the zero positions (full left).

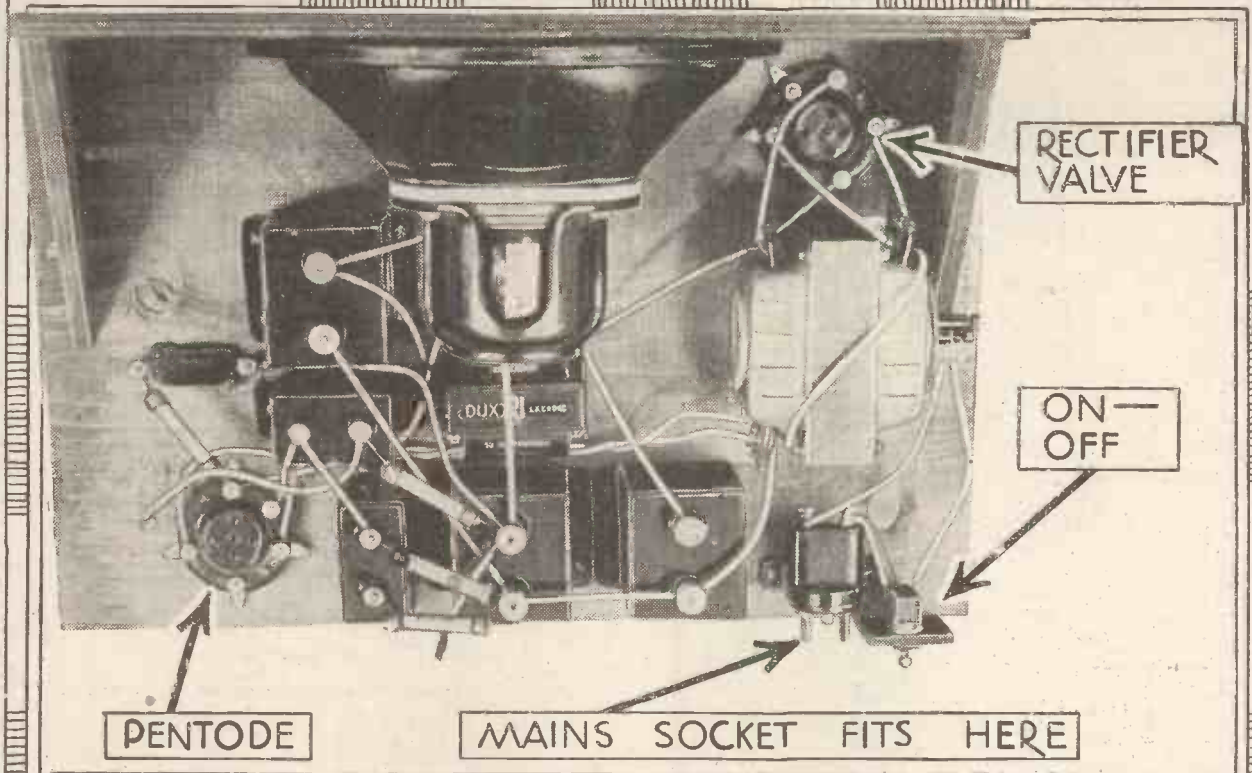


The excellence of a home-construction receiver cannot be assessed only from the point of view of performance. Simplicity of construction and assembly must be paramount features of the design. In the "A.C. S.T.400" unusually high performance has been achieved but without introducing difficulty in building the set.

This has been made possible by adoption of a "two-unit" method of assembly. In themselves, the units are "constructional simplicity" exemplified as may be readily appreciated by examination of the lower illustration which shows the H.F. end of the receiver unit.

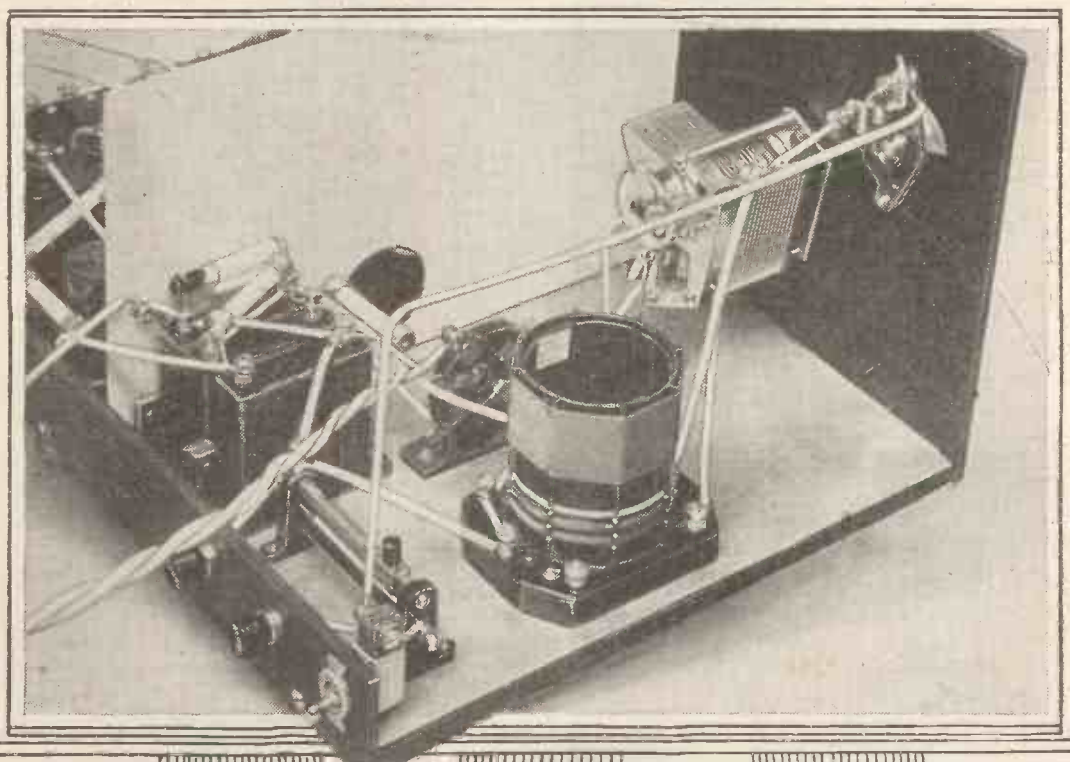
The picture above demonstrates how the "power-pack" unit can be slid into and out of the cabinet.

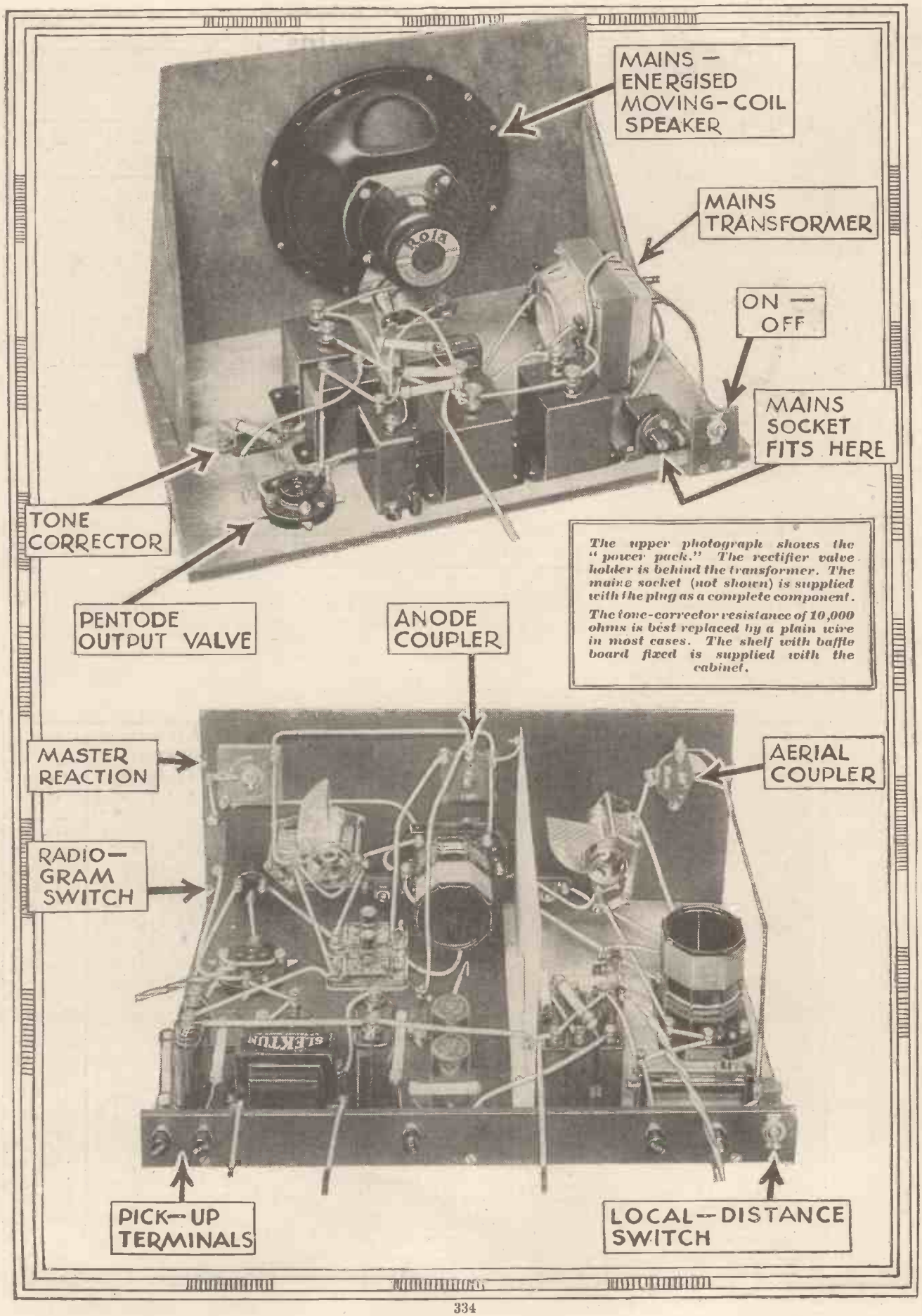




"As regards the construction of the set, no difficulties whatever will present themselves. The receiver is built on a baseboard and the output pentode and rectifier system are very simply mounted on a special sliding shelf."

The top photograph clearly shows the above-mentioned pentode and rectifier section of the A.C. "S.T.400." A close-up of the "aerial end" of the receiver is depicted below. This should be compared with the blueprint during construction to ascertain the actual "run" of the wires.





The upper photograph shows the "power pack." The rectifier valve holder is behind the transformer. The mains socket (not shown) is supplied with the plug as a complete component.

The tone-corrector resistance of 10,000 ohms is best replaced by a plain wire in most cases. The shelf with baffle board fixed is supplied with the cabinet.

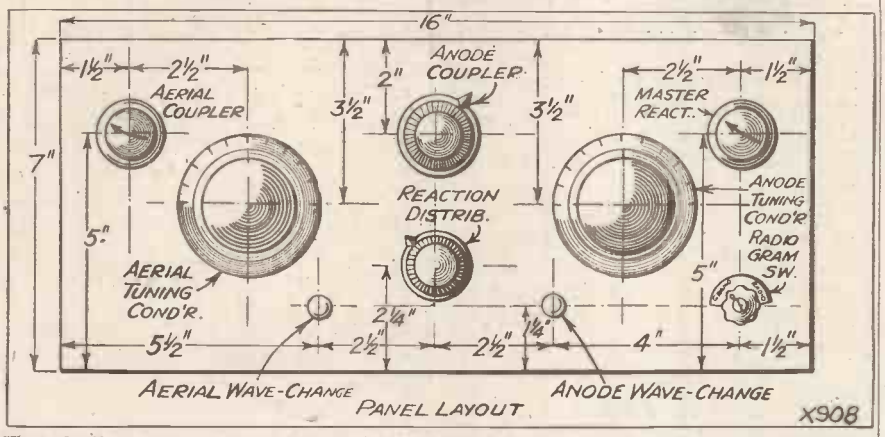
The "Danger" in Using Mains is a Bogy

This "S.T.400" model is provided with a radiogram switch and two pick-up terminals. The results on records are excellent.

There is always present in the minds of would-be mains users three objections: (a) danger, (b) difficulty of construction, (c) cost. The first is a bogy, pure and simple. You could, of course, get a shock by thrusting your hand into the "works" with the set "on," but the voltages are not very high. It would teach you a valuable lesson. If you always pull out the socket first, before touching the inside of the set, you will merely be taking an ordinary precaution.

Before switching the set on, however, it is desirable to check your wiring extremely carefully. A faulty connection may cost you money.

A PANEL LAYOUT FAMILIAR TO THOUSANDS



Exactly the same controls, similarly arranged, are employed in the "A.C. S.T.400" as were used in the battery model. There can be few wireless enthusiasts who are not familiar with the purpose of the various knobs.

As regards the construction of the set, no difficulties whatever will present themselves. The receiver is built on a baseboard and the output pentode speaker and rectifier system are very simply mounted on a special sliding shelf.

I have arranged to have the baffle fixed to the shelf so that the whole can slide in and out of the cabinet. It is therefore advisable to keep to the recommended cabinet which, incidentally, is very good value and looks attractive.

No Fear of Shocks

A few wires connect the baseboard to the shelf, but these all pass at the back and not through holes. The construction will be found a very straightforward job. Although there are two "layers," each is simpler, really, than the "S.T.400" battery set.

Wiring is not done with bell-wire or glazite, but with No. 18 S.W.G. bare tinned copper wire over which is slipped oiled cotton sleeving. This is made necessary because rather higher voltages are used than in a battery set.

This brings me to two points I wish to raise. One is that there need be no fear of shocks. There is an on-off mains switch at the back of the set, and also a plug-in socket (with combined fuse) which is best pulled out before doing anything to the inside of the receiver.

Question of Cost

The S.G. valve, if metallised, should not touch the screen. If desired, a strip of insulating tape may be wrapped round the valve coating. No damage would be done by a "short," but the S.G. grid bias would be shorted.

I have dealt with the alleged difficulty of constructing an all-electric set. I solemnly assure you that the job of building this receiver is easy.

The third objection, namely, cost, is the only serious one. I have fought hard to persuade the component manufacturers to throw open an enormous market which awaits them. Set manufacturers obtain components such as condensers and mains transformers at prices so far below the cost to the amateur that the latter is at a disadvantage which some firm—some day—will remove.

Standard Output Unit

Meanwhile, there is a very great deal to be said for buying even at present prices. In this set, you have a speaker, an output valve, a mains transformer, a cabinet—in fact, a whole power and output equipment which will do for other receivers.

As in all my sets, the apparatus is of first-rate quality and will last. You will be able to use it time and again, if you should so desire. In fact the power equipment, speaker and output valve will probably never be altered, and any changes will only occur on the baseboard.

You will have the supreme satisfaction of having very excellent "quality," with perfectly matched output apparatus, always at your service to tack on to the end of any receiver you may build.

There is a double-smoothing circuit, by the way, because the field winding of the speaker both drops the H.T. voltage to the necessary value and also acts as a secondary smoothing choke. The total effect (combined with proper design work) is a total absence of mains hum.

(*Please turn to page* 388)

TONE CONTROL OF THE "A.C. S.T.400"

"Tone control on this receiver is obtainable by varying the value of the resistance which (together with the ·01-mfd. condenser) is shunted across the primary of the speaker transformer. My own preference is to omit the Resistance altogether, leaving the condenser alone connected across the primary. This reduces the top response slightly, but reduces heterodyne whistles and interference. I strongly advise it. If the 10,000-ohm resistance is used, try short-circuiting it as a test. A value of 2,000 ohms instead of 10,000 ohms will produce better results for all-round work, but I personally prefer no resistance at all.

PICK-UP HINTS AND TIPS

Some interesting notes on various practical aspects of radiogram reproduction.

By A. BOSWELL

THE tendency in radiogram work at the present time is all towards easier and easier operation. At one time it was necessary between every record to jump up, stop the motor, re-wind the motor, change a needle, put another record on, start the motor, place the pick-up on the record again, and then sit down.

This process had to be gone through every four or five minutes. No wonder some thought radiograms were not worth while. But a number of these items have either been done away with or considerably simplified.

Automatic Stopping

Let's take them one by one, and see what has been done to eliminate them. First of all, there was the question of stopping the motor.

So far as that goes, there is now hardly a self-respecting gramophone motor, electric or clockwork, that does not stop itself automatically when the record is played. So we can go on to the next item, that of re-winding the motor.

The overcoming of this is dependent upon mains being available so that an electrically driven turntable can be used, in which case there is never any winding to be done. Even with clockwork motors the periods for winding have been greatly reduced by increasing the time efficiency of the spring motors, making re-winding necessary only after every three or four records, or rather sides of records.

A Matter of Taste

Next we have the changing of the needle, that finger-pricking job so hated by those whose fingers are all thumbs. Here the use of the solution is a matter of taste.

Not everyone is in agreement with permanent type needles which can be used many times before changing. But even for those who prefer one needle per playing, the changing of these needles has been greatly simplified in many cases by pick-ups which rotate on their arms.

In connection with the next item we have the most outstanding improvement of the time where radiogram work is concerned, the automatic record-changer. With these you just put on eight or so discs and then sit down to enjoy them one after the other without any bother at all. But alas! these are expensive items not available to all pockets.

Like the automatic stop of a motor, in many cases an automatic start is made by the very fact of moving the pick-up arm and putting the needle on to the record. But except in the case of the automatic record-changer, this last act of replacing the needle on to the disc is still with us.

Perhaps the least thought about, but most annoying of all the items mentioned, is the getting up and sitting down again after each record. An expensive way out is the automatic record-changer, although undoubtedly the best way out.

But all other improvements are comparatively cheap, so one is inclined to look for some cheaper way of mitigating this nuisance. There is just one way, and it enables one to recline in the most easy chair and play record after record without getting up, no matter where the radiogram itself is situated.

FOR YOUR RADIOGRAM

Yes, Mr. Brown and Dreaming. Blue Mountaineers	Broadcast
Accordeon Nights (DX 425). Geraldo and His Accordeon Band.	Columbia
I Love the Moon. Howard Jacobs (Saxophone)	Columbia
Ballet Egyptien. Grenadier Guards	Columbia
Let's Put Out the Lights. Sydney Torch (Cinema Organ)	Columbia
Love is the Sweetest Thing. Henry Hall and the B.B.C. Dance Band	Columbia
Hungarian Dances. Hallé Orchestra	Columbia
Her Name is Mary. Charles Kullman (Tenor)	Columbia
Laughing Through. Charles Penrose	Columbia
Die Meistersinger. Clemens Schmelstech's Symphony Orchestra	H.M.V.
Hungarian Rhapsody No. 2. Mark Hambourg (Piano)	H.M.V.
The Legion of the Lost. Peter Dawson	H.M.V.
How Deep is the Ocean? Gracie Fields	H.M.V.

Must Be Sound-Tight

The idea is to have a little portable playing desk. It consists of turntable, pick-up and volume control, and leads run from its output to the input of the set. If desired, the records can be given a compartment in the desk itself.

Do you get the idea? About two feet off the ground is a good height for the turntable. The lid must be really sound-tight because as it is to be used near one, any audible pick-up dither would be very undesirable.

Lining the lid with felt will ensure the noise being kept in, particularly if the edges of the lid are also trimmed with felt. Of course, the idea is applicable to mains-driven motors as it is to clockwork ones, or vice versa if you prefer.

Connect to Earth

There is just one point to watch with care, and it concerns the leads from the player to the radiogram itself. These should be of the braided-metal-covered type, and the covering should be connected to earth. This prevents noises being picked up by these leads and passed on to the amplifier.

Those who are particularly keen on neat appearance, may like to try the following idea instead of having the pick-up leads trailing across the room. I say try, because there is just a possibility that it will not work in every case in spite of the use of armoured cable.

Round the Wall

Where it is successful it is a very effective idea, and consists of running the pick-up leads round the wall to a plug-socket near the fireplace, or wherever the "player" is intended to be used. A short piece of flex is then used on the player with a plug attached.

The drawback to the scheme is, of course, the extra length of the leads, and one is usually advised to keep these short. But very often, assuming they are screened, there seems little harm in extending them.

A PRACTICAL MAN'S CORNER

By R. W. HALLOWS, M.A.

Into these pages, month by month, our contributor packs a wealth of practical information and advice on constructional work. The regular reader of this "Corner" cannot help picking up a more or less complete training in radio workshop practice, while every month there are wrinkles to read, gadgets to make or hints to help you.

Just The Thing

WHILST I was looking the other day round a shop which deals in both tools and cutlery, I came across the little appliance illustrated in Fig. 1. I had not the slightest idea for what purpose it was intended, but I could see at once that there was a place waiting for it in my tool drawer.

On inquiry I found that it was called a knife-cleaner, but, like myself, the wireless man who buys one will use it for very different work. It consists of a small block of abrasive material measuring about 1½ in. in length by 1 in. in width, and rounded off at the front to something of the shape of the bows of a barge. It cost only a few pence and has already proved worth the money and more.

Some Uses

It is the handiest possible tool for cleaning up both tags and the ends of wires before soldering operations are undertaken. One of the reasons why many people can make nothing but dry joints when they try to solder is that they will not clean the work before they begin. A touch up with the business end of this little gadget removes all dirt and grease from wires and tags and soldering is easy. The rough rim left on the "out" side when a hole is drilled in copper or aluminium is smoothed down in a trice.

You can trim up the edges of pieces of ebonite or of metal after cutting them with the hacksaw or with the shears. It is the very thing for dealing with burred threads at the end of a screw. It makes dirty old terminals like new ones in a few moments and it is the best thing I have discovered yet for cleaning up steel tools which have been allowed to become rusty.

Any reader who cares to invest in one will find that he is always discovering new ways in which it can make itself useful.

A HANDY TOOL

Fig. 1. The business end of this little gadget is intended to clean the household cutlery, but it also has a number of diverse uses in the practical man's hands.

More About Battery Connectors

Recently I described a method of making endpieces of lead wire for the flex leads running to accumulator batteries. The purpose of these is, of course, to prevent corrosion of the copper strands of the flex by acid fumes from the battery. Fig. 2 illustrates another tip which readers will, I am sure, find useful.

Instead of connecting the flex direct to the terminals of the accumulator, make some extension strips like those illustrated. All that is required is a small amount of sheet lead and as many terminals as there are going to be connectors.

Cut the lead into strips about six inches long by half an inch to three-quarters of an inch in width. In one end of each cut a slot that will fit the terminals of the accumulator; at the other mount an ordinary brass terminal, greasing it thoroughly after you have fixed it in place. If desired, these soft lead connectors can be bent down the sides of the accumulator or the wooden crate which contains it.

EXTENDED TERMINALS

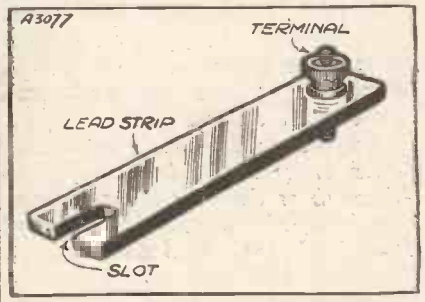


Fig. 2. It won't take you long to make up a couple of lead accumulator extension strips like these. Once made, they will put an end to corrosion troubles.

The brass terminals and the flex connected to them are then quite safe from the evil effects of fumes from the battery. The only possible drawback to this scheme is that bare lead strips might offer opportunities for short-circuits—and from personal experience I can testify that it does not pay to provide such opportunities.

You can make everything perfectly safe by giving your connectors two coats of ordinary Brunswick black or stove enamel. This dries quickly and it is an excellent insulator. Or if you prefer it, you can bind each connector with insulating tape or with sticking plaster.

A Practical Man's Corner—*continued*

Ganged Condensers

Most constructors know nowadays that unless the cans of screened coils are properly connected to earth all kinds of queer and highly undesirable results may occur in modern sensitive circuits. I have called attention to this point in these notes. But there is another culprit which often goes quite unsuspected. This is the two or three-gang screened condenser with a detachable cover.

FOR QUALITY AND SENSITIVITY

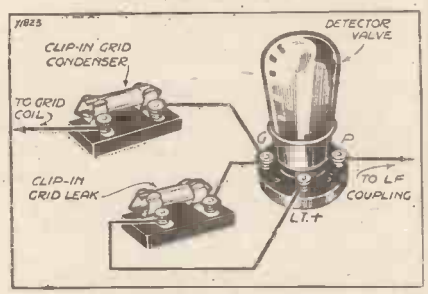


Fig. 3. By employing grid leaks and condensers of the "clip-in" type you can adjust your detector to suit the needs of the moment. "Power-grid" for quality on the "local," and "leaky-grid" for sensitivity on those distant foreigners.

It might be thought that since the cover appears to fit pretty tightly on to the fixed part of the condenser screen a good earth connection would be secured automatically. Appearances, however, are proverbially deceptive and a simple test will sometimes show that the cover is by no means effectively earthed, even though the fixed portion of the screen is solidly connected to low-tension negative or to the earthed metal chassis.

Putting Matters Right

Here is the test. With the set in its most sensitive condition (that is, with reaction just short of the oscillating point in a straight set, or with the volume control full "on" in a superheterodyne), touch the cover of the ganged condenser with a wet finger. If the cover is properly earthed there should be no response; but supposing that it is not, there will be a marked difference in the volume or the set may howl.

A "plock" as the finger touches the cover is another indication of ineffective earthing. The best way of setting matters right is similar to that suggested some time ago in these notes for coil cans. Drill a hole in the cover and provide it with a terminal. Connect this terminal to earth by means of a piece of flex. The cover can then be removed when required without disturbing the lead.

Detector Problems

In mains sets containing high-frequency amplification the power-grid detector is generally used now when quality is a primary consideration, as invariably it should be. But the battery man who wants the finest quality is placed in a quandary.

Ordinary leaky-grid condenser detection is good enough so long as the detector valve is not called upon to deal with large impulses. Anode-bend detection, though once acclaimed as the only possible means of obtaining good quality, is now becoming completely rare for a very good reason. If the "straight" portion of valve characteristics really was straight, no distortion would be introduced, provided that the coupling resistance, the coupling condenser and the grid leak of the following valve were of the correct values.

Unhappily, this portion of the curve is not straight but shows a pronounced bend. The bending leads to a peculiar and most unpleasant effect known as harmonic distortion.

Power-Grid System

The battery user, therefore, who values quality and uses sufficient high-frequency (or, in a superheterodyne, intermediate frequency) amplification to provide the detector valve with fairly large grid voltage swings, would be well advised to get as near as he can to power-grid detection.

Not a little of the unsatisfactory quality of which some battery users complain can be traced to faulty detection. Power-grid detection differs from ordinary leaky-grid condenser detection in three important ways.

In the first place, a high voltage is applied to the plate of the detector valve, and the plate current in battery valves is not less than 3 to 5 milliamperes, or about three times the amount usual with ordinary leaky-grid condenser detection. Secondly, the grid condenser has a small value—usually about ·0001 mfd. Thirdly, the grid leak has a comparatively low resistance—about ·25 megohm as against the usual 2 megohms.

A Useful Method

Unfortunately, the true power-grid detector is distinctly less sensitive than the ordinary leaky-grid type, and if we discard the latter in favour of the former in a battery set, the loss in volume from distant stations may be sufficient to do more than offset the gain in quality from the local.

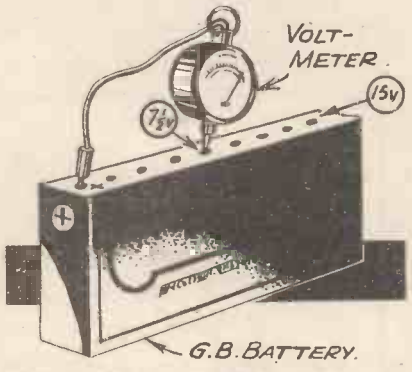
It is possible, though, to arrive at a compromise by the method indicated in Fig. 3. For both the grid condenser and the grid leak use clip-in components. Arrange your H.T. so that the plate voltage of the detector is not less than 100; if you can make it 120 or 150, so much the better.

Component Values

Begin with a ·0001-mfd. grid condenser and a ·25-megohm grid leak in the case of the second detector in a superheterodyne set. In straight sets the grid-leak value will probably have to be higher. You may find that there is enough available amplification to compensate for the decreased efficiency in the detector. If so, well and good. If not, you will find that increasing the value of the grid leak to 500,000 ohms, or 1 megohm, brings about a very distinct improvement in the volume.

The capacity of the grid condenser should be kept as near ·0001 or ·00015 mfd. as possible, and you will be able to discover a value for the grid leak which gives you reasonable sensitiveness combined with a big improvement in the quality.

BIAS BATTERY HINT



When testing a 15-volt bias battery with a voltmeter, neither the 0-8v. scale nor the 0-150v. reading are suitable. The simplest method is to use the 0-8v. reading and test the battery by halves, i.e. 0-7½v. and 7½-15v.

AS WE FIND THEM

NEW APPARATUS TESTED

Under this heading we publish reviews of apparatus submitted by radio manufacturers and traders for examination and test in "The Wireless Constructor" laboratories.

The Atlas "Lambda"

THE Atlas "Lambda" receiver, manufactured by H. Clarke & Co. (Manchester), Ltd., of George Street, Patricroft, Manchester, is a three-valve broadcast receiver, utilising the popular S.G., detector and power valve combination.

DISTINCTIVE CABINET WORK

The Atlas "Lambda" receiver incorporates a variable-mu S.G. valve and a parallel-fed transformer-coupled L.F. stage. It is an efficient three-valve set, economical in upkeep.

The set is chassis built and entirely self-contained in a distinctive two-tone walnut cabinet.

The loudspeaker is an Atlas permanent-magnet moving coil, and the layout is arranged so that the batteries can be placed on a shelf behind the valves.

On the back of the metal chassis are the aerial and earth terminals: two for connecting a pick-up for record reproduction, and two for the loudspeaker; an additional speaker can, of course, be joined to these terminals if desired.

The on-off switch is between the loudspeaker and gramophone pick-up terminal plugs; while on the extreme right of the chassis, underneath the aerial and earth terminals, is a variable selectivity control. On the front of the set there are three controls. The one in the centre operates the gang condensers, the scale above this knob giving a direct reading in wavelengths.

There is also a small concentric knob, which actuates a trimmer, so that the set can be balanced up to suit any aerial.

The other two controls are the wave-change switch on the left, and the reaction control on the right.

Very Good Results

The three valves supplied with the sample submitted were the Marconi V.S.2 for the S.G. stage, H.L.2 for the detector, and the L.P.2 for the output stage. Using 120 volts H.T. and the grid-bias voltage of $4\frac{1}{2}$ on the L.P.2, the total measured anode current consumption was 8 milliamps.

We tested the set in Tallis House, using the larger of our two outdoor aerials. On the medium waves the Northern and Midland Regionals both came in at good strength, and the two London stations were separable with ease, even with the selectivity control screwed down to its least selective position.

It goes without saying that a goodly number of Continentals are receivable on this combination of valves, the sensitivity of the receiver being fully up to the standard for this class of circuit.

So far as reproduction was concerned, this was characterised by a general brightness and clarity, speech in particular was very good, this tending to show that the upper frequencies have been well maintained. On measurement we found this to be the case, while at the bass end of the frequency range we were able to obtain an audible response down to as low as 50 cycles.

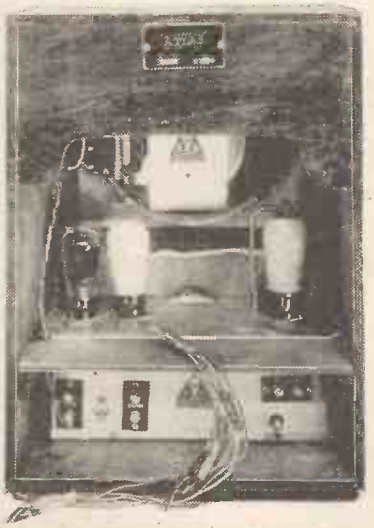
The "Lambda" retails at £9 15s., complete with H.T., G.B. and L.T. batteries, and is an attractive proposition.

"Clix" Chassis Strips

Messrs. Lectro Linx, Ltd., of 79a, Rochester Row, London, S.W.1, have added two new chassis mounting strips to their range.

Each strip is about $2\frac{3}{4}$ in. long, one being provided with four sockets, marked L.S. + and —, and pick-up. The other has two aerial sockets—A_1, A_2—and also an earth socket E.

COMPLETE WITH MOVING COIL



The "Lambda" is chassis built and includes an adjustable selectivity control and gramophone pick-up terminals. The "on-off" switch is on the back of the chassis and can be seen between the loudspeaker and pick-up terminals.

As We Find Them—*continued*

The sockets are designed to take either solid or resilient plugs, and the resulting contact is up to the usual "Clix" high standard.

OF MASSIVE CONSTRUCTION

This "Massicore" mains transformer is intended for use in conjunction with the H.T.7 Westinghouse metal rectifier.

The price of the three-socket strip is 7d., and the four-socket strip 8d.

"Massicore" Transformers

Messrs. W. B. Savage, of 56–58, Clerkenwell Road, London, E.C.1, who are well known as the makers of power transformers and chokes, have submitted one of the W121 power transformers, designed for use in conjunction with Westinghouse metal rectifiers.

The transformer is a substantially made and workmanlike component, having an L.T. output, when connected to 200/250 volts A.C. mains, of 4 volts, 3–4 amperes. The H.T. A.C. output is 135 volts, 90 milliamps., and it is intended that the instrument should be used in a voltage doubler circuit, as recommended by the makers of the H.T.7 metal rectifier. The rectified output after smoothing, using this circuit, would be approximately 28 milliamps. at 200 volts.

The transformer can be supplied in two models; one called the "standard" model, and the other suitable for manufacturers to build into sets.

"Massicore" transformers are wound on bakelite bobbins, ferro silicon cores being employed. Other features are the positive clamping of the laminations and the fact that a twelve-months' guarantee is given with each instrument.

Lotus Ganged Condensers

Messrs. Lotus Radio, Ltd., of Mill Lane, Old Swan, Liverpool, have sent us one of their latest three-gang condensers for test.

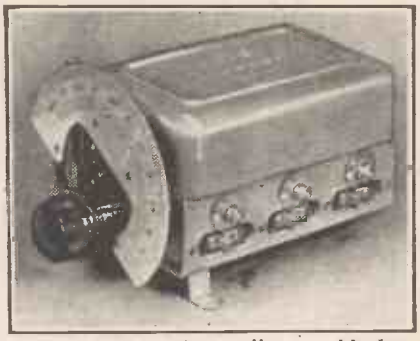
The unit consists of three sections, each having a capacity of ·0005-mfd. and is solidly constructed on a substantial metal chassis, a dust cover being provided to complete the assembly.

The slow-motion drive, which can be fixed to either end of the condenser spindle, has an ivorine scale illuminated from the rear.

One of the features of this ganged condenser is the fact that both the fixed and moving-vanes sections are cast into position, thus it is impossible for any alterations in the capacity to occur after assembly, due to movements of the vanes in their mountings.

On the side of the chassis there are three trimmers, each having small hexagonal nut adjusters and mica-dielectrics.

BUILT TO LAST



The Lotus three-"gang" assembly has mica trimmers and the vanes are die cast into position. The slow motion control can be fitted to either end of the moving-vanes spindle.

The condenser is a very well-made job, and is capable of giving good service over a long period. The matching is accurate, and the individual sections of the condenser are well up to their rated capacity values.

The price complete is 19s. 6d. A template for mounting is supplied with every model sent out.

Lewcos Transformers

We have received from Messrs. Lewcos a small L.F. transformer of the alloy core type.

This transformer retails at the very moderate figure of 6s. 9d., and when used in a parallel-feed circuit is capable of giving a substantially level response curve over a wide range of musical frequencies. The turns ratio is 4 : 1.

Good quality reproduction is a feature of the parallel-feed scheme and, in addition to the transformer, the only parts needed are a resistance and condenser of suitable values to deflect the steady anode current from the transformer primary winding. Messrs. Lewcos are assured of a ready market for a transformer of this type, backed up, as it is, by a well-deserved reputation for high-grade radio components.

Castle Contacts

The Castle Fuse and Engineering Co., Ltd., of Chester Street, Liverpool, have sent us a selection of their terminal tags and other sundries for examination and test in our laboratories. The items in question include plugs and sockets of various types and sizes, terminal connectors, wander plugs and terminals.

The plugs and sockets are well made, having small set screws for holding the flexible wire in position.

A feature of the plugs is their snug fit. We tried the wander plugs in a number of batteries and the contact was all that could be desired.

The insulated portions of the different components are obtainable in the usual range of colours and indicating labels for the banana sockets, and 4B.A. W.O. type terminals are also available.

(*Please turn to page* 383)

FOR SHUNT-FEED L.F.

One of the Lewcos transformers designed for parallel-feed L.F. circuits. The core is of the high permeability alloy type, and when used with a resistance condenser shunt-feed arrangement, the response is eminently satisfactory.

All About DOUBLE-CHANNEL REACTION

by JOHN SCOTT-TAGGART F.INST.P. A.M.I.E.E.

The thousands of satisfied builders of the "S.T.400" will welcome an explanation of the principles which govern the set's unique performance. And even those who have not yet built the "400" will find the author's opinions on the selectivity problem of absorbing interest.

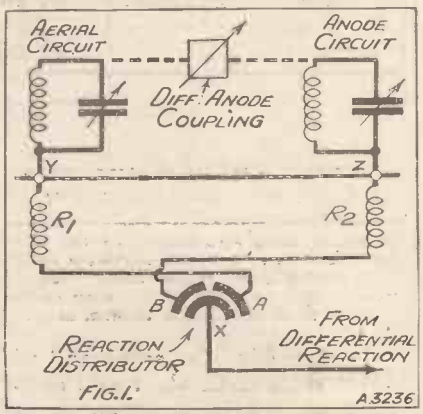
EVER since I was a child I have firmly believed that if a teaspoonful of medicine does you good, then two teaspoonfuls will do you still more good.

This unscientific but human belief may perhaps have been to blame when some nine years ago I decided that since reaction was good when applied to one circuit, it would be even better when applied to two—or even more—circuits.

Circuit Development

And lo, it was so! But in those days I spent a great deal of my time on circuit development rather than on producing a finished receiver. Consequently there was no "big"

DIVIDED REACTION



The H.F. currents from the detector can be made to reach "earth" via the aerial or anode reaction coils to an extent which may be differentially adjusted by the reaction distributor.

set published embodying the principle.

But even so, the merits of multiple reaction were before their time. The war of the ether was as yet undeclared and stations had not yet begun to fight for a place on the dial.

But now it has become necessary to exploit to the fullest limit every known selectivity device and—if possible—invent new ones.

Two Main "Schools"

There are at present two main "schools" of thought who favour either (a) the straight circuit or (b) the superheterodyne. The latter is an American invention and is, perhaps, the most ingenious one in general use. I was at the New York radio show four years ago when the "superhet" was taken from the dustbin, given a good dry-cleaning, and reintroduced by the Radio Corporation of America. It set the States on fire and, since the prevailing winds of radio progress blow from West to East, the flames have reached this country.

But opposing the superhet we have the "straight set" school, which is divided into two subclasses: (a) those who believe in a multitude of tuned circuits and (b) those who pin their faith to ultra-selective arrangements no matter how few circuits be employed.

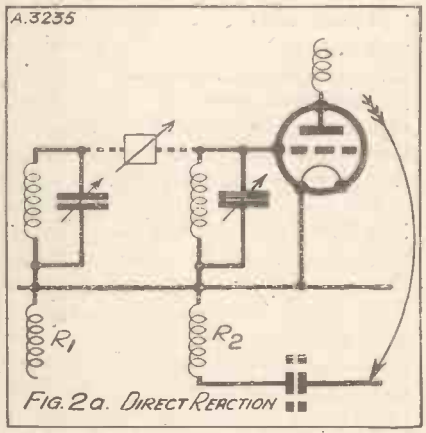
A Technical "Pit"

This last school, which can look to Dr. James Robinson, of Stenode fame, as its spiritual head, has won laurels at the expense of nearly every radio scientist in Great Britain. The ultra-selective circuit followed by tone-correction has proved a pit into which have tripped the best "theoreticians" in the country. Mathematicians with high brows and narrow prejudices are still sucking burnt fingers which were too eager to tear to pieces a red-hot invention.

Dr. Robinson has, in short, come largely into his own, although he cannot escape criticism as to the technical presentation of his work, the form of which was bound to produce antagonism in mathematical circles. Nevertheless, the results are really all that count. It was mathematically proved that the selective results were impossible, but Robinson was no more perturbed than was the zoo-keeper when the old lady on seeing a giraffe for the first time, said: "There's no sich animal."

Dr. Robinson will encourage *extreme* reaction provided tone-correction is subsequently used. Other designers, however, have favoured the "square-peak" band-pass tuning system, which is intended to preserve the high-frequency sidebands representing the high notes.

DIRECT REACTION



When the reaction distributor is set "normal" on the "S.T.400" it is equivalent to having ordinary reaction from detector to the H.F. coupling coil. No reaction is applied to the aerial coil.

The band-pass epidemic has, as usual, been accompanied by much over-emphasis by hangers-on who, in some cases, have wrecked the whole technical effect aimed at by the improper introduction of reaction. The genuine purists would do well to disown those who, while loudly claiming to be initiates of the square-peak mystery, have tended to bring it into disrepute.

Cheery cynics, with much greater technical honesty, have, however,

All About Double-Channel Reaction—*continued*

used "band-pass" circuits simply as a convenient form of loosely coupling tuned circuits, thereby obtaining greater selectivity. They have not claimed that their peaks are not as other men's, but have quietly and genially and justifiably compensated for "loss of top," where necessary, by suitably designing the L.F. end of their sets.

FORGING A LINK

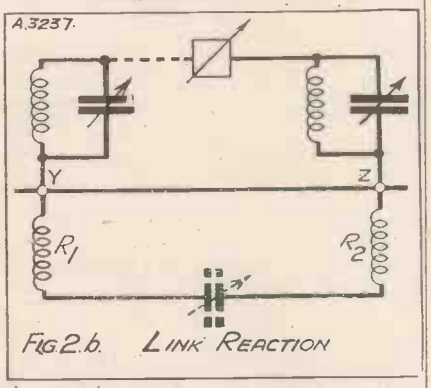


FIG 2.b. LINK REACTION

By setting the master reaction at zero, control of reaction may be effected by adjustment of the distributor alone due to the formation of a "link circuit."

The fashionable critical squawk, "It must cut off top," while showing a praiseworthy concern for the whole musical spectrum, generally uncovers the speaker's ignorance that "top" can always be stuck back again in the L.F. circuits and speaker—even though quite unobtrusively.

We thus have square-peakers, bluntly-pointed-peakers and sharp-peakers all offering their solutions. Of these, the square-peakers (half the time with crater-like resonance curves) take themselves very seriously; the blunt-peakers don't care a damn what anyone thinks; and the pointed-peakers find themselves (perhaps a little to their own surprise) laughing heartily at their enemies' discomfiture.

A Dark Horse?

As for the superhets. school, they are repeating such old lessons that they have no excuse for posturing. They are just doing their job and, for the most part, doing it well. With the blunt-peakers, they are sharing the radio markets of Europe.

The needle-sharp Stenode, however, may still prove a dark horse; but if it does not win the race it may be because designers are surreptitiously pilfering from its nose-bag.

The home constructor is faced with a different problem. The choice lies between (a) multiple-tuned circuits with inevitable ganging, (b) fewer circuits but ones possessing greater selectivity, (c) the superhet.

"Hotting-Up"

My own proffered solution, the "S.T.400," comes in category (b). Nevertheless, if designing a set for "universal" use I should have chosen (a) and sacrificed something for simplicity of operation. The superhet. I should have ruled out for the moment, primarily on the score of the number of valves required.

The "S.T.400," of course, is deliberately a set which lends itself to "hotting-up," and the double-channel reaction scheme is a "super-charger" which can be brought into action at will.

The system has already been explained in general terms, but the technical functioning can be as complicated as the practical handling is easy.

In the "S.T.400" the total reaction is varied by means of the master reaction differential connected to the detector valve in the usual way. This reaction is *distributed* to either the aerial or anode tuned circuit *or to both* by means of the differential reaction distribution.

The Simplest Case

A skeleton circuit is shown in Fig. 1. Valves, etc., are omitted for the sake of clearness. The screen-grid valve and the differential anode coupler are represented by a square with an arrow through it. This square, it must be remembered, acts as a device for varying the degree of H.F. amplification. (For example, with the anode coupler at zero, the anode circuit would be almost isolated from the aerial circuit.)

The coils R_1 and R_2 are the aerial and anode reaction coils respectively. The ends are connected to fixed plates A and B of the distributor. By moving the rotating plates X, it is possible to pass the H.F. reaction currents (which come via the master reaction from the anode of the second valve) either through R_1 or R_2 or through both in desired proportions. This looks a charmingly simple system of shunting reaction wherever it is wanted most, but actually there are complicated processes at work.

The simplest case is when distribution is at "normal," i.e. full left on "S.T.400" (remember that all differentials are assumed to be of make actually used in set). In these circumstances we have straightforward direct reaction on the anode circuit alone as shown in Fig. 2a. The aerial reaction coil is isolated and unused, and no deliberate reaction is applied to the aerial circuit.

Inherent Reaction

[Since there is always some accidental inherent reaction transference from the tuned-anode circuit to the grid circuit in any S.G. set due principally to valve and other capacities, there will be *some* vague reaction applied to both circuits when these are brought into tune, even when the master reaction is at zero. This inherent reaction effect can be reduced by decreasing the anode coupling. It comes from the first valve (the S.G.), and the set should definitely be stable with master reaction at zero and distribution at normal. If not stable, reduce the anode coupler or selectivity range adjuster.]

CHAIN REACTION

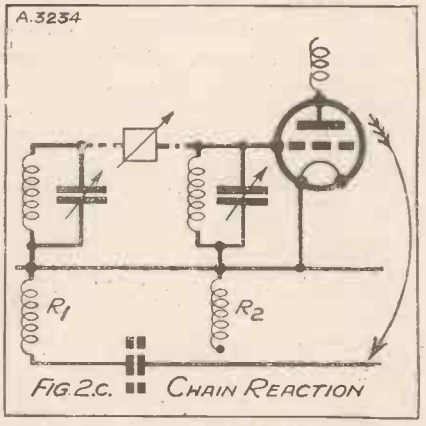


FIG 2.c. CHAIN REACTION

Reaction may be applied to the aerial circuit alone. This is done by setting the distributor "full right" in the "S.T.400," adjustments being carried out with the master control only.

In the Fig. 2a condition, with direct reaction on the anode circuit, the reaction adjustments are all done on the master reaction control. Beginners should always go back to this simple normal condition (i.e. distributor at normal) if they feel in the slightest doubt about their competency to handle the set. The aerial reaction coil R_1 is not now in use.

The second case is that of "link reaction," as I call it. This is illustrated by Fig. 2b. The master reaction

(*Please turn to page* 384)

B.B.C. NEWS

Topical notes regarding British Broadcasting Stations and their Programmes.

By Our Special Correspondent

Announcing in the Empire Programmes

My correspondence from abroad contains an under-current of criticism about the announcers in the Empire Service Programmes. Especially is this so in the case of Australia and Canada, where the "refaned" words and polished manners of the B.B.C. appear to cause a good deal of irritation.

I am sure I don't know how this problem should be solved unless perhaps by the retention by the B.B.C. of two or three announcers with overseas dialect; alternatively, announcers might be used with distinctive United Kingdom dialects—for example, Welsh, Northern Scottish, Yorkshire, and Somerset. It seems to me that if the ruggedness and picturesqueness of some of these local dialects could be conveyed over the microphone, much of the present irritation would evaporate.

Those New Governors

The three new Governors have been at work for two months. The staff has not seen much of them except for Mrs. Hamilton, who is setting about her work with the same sort of energy and devotion which characterised Lady Snowden.

Lord Bridgeman and Mr. Norman have kept very much their own council and are not insisting on reorganisation to mark their acceptance of office.

Summer Proms

Having disposed successfully of the short season of Christmas Promenades, the B.B.C. music department is now hard at work on the Summer Promenades. Despite rumours to the contrary, Sir Henry Wood will again be in charge, continuing the wonderful record which has now lasted for forty years.

An effort will be made this year to produce some new and striking artistic talent on the singing side. Perhaps also Dr. Adrian Boult will share part of the burden, especially if it is a very hot summer.

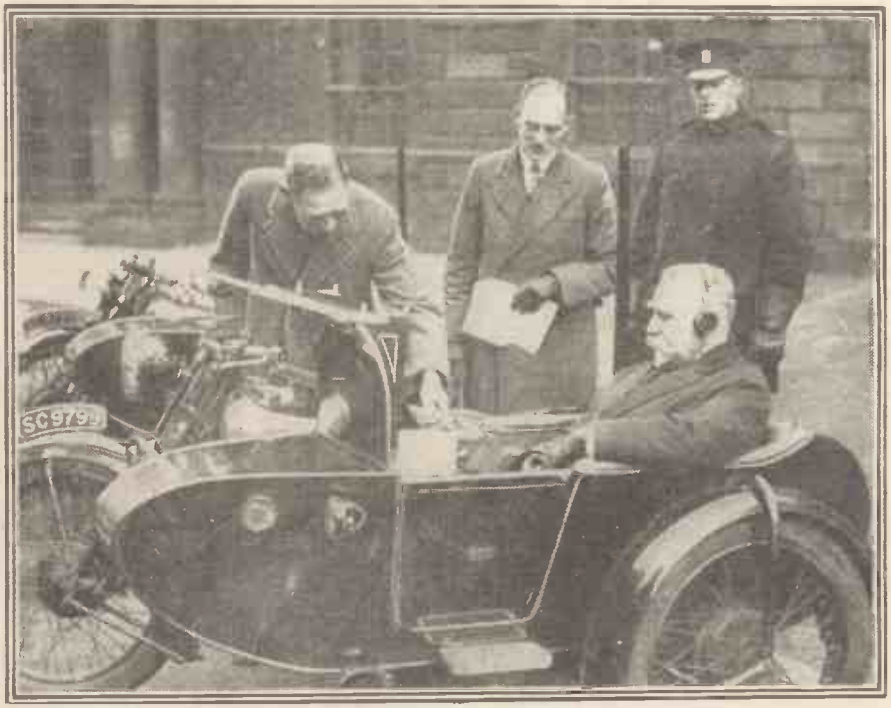
Music lovers generally and the Broadcasting public as a whole would take great pleasure in acclaiming the announcement that he was one of the chosen for Royal recognition in the next birthday honours.

Television

Mr. Robb is gaining a great reputation for himself, and deservedly, for the enterprising and successful programmes which he is devising for the Baird transmissions through the B.B.C. This side of the problem of Television is undoubtedly better cared for in England than anywhere else in the world at present.

My own impression, however, gained from conversations with responsible B.B.C. officials, is that developments are imminent on the transmitting side. It is felt, for instance,

MAKING IT CLEAR TO "THE CHIEF"



Edinburgh police are experimenting with a new radio telephone service between headquarters and patrolling "speed cops." This practical demonstration is being given to the Chief Constable.

B.B.C. News—*continued*

that better permanent results will be obtained by the use of ultra short-waves than any other ether channels not excepting the medium band.

The objection, of course, to the ultra short-wave is that its range is very limited. In order to cover the country adequately, it would require almost as many transmitters as there are centres of population.

The cost of such an enterprise would be almost prohibitive. But, whatever happens, important developments are certain. The B.B.C. is naturally anxious to induce the various interests concerned with television to combine at least for the purpose of broadcasting.

While such a combination will probably come about in due course, immediate prospects of union are not bright.

Future of the Regions

Although there is still, from time to time, a breaking-out of the old feud between the "centralisers" and the "regionalisers" of the B.B.C., the latter are no longer in any real danger of being eliminated, as they were as recently as two years ago.

The "drive" now is for "new blood in the Provinces," by which is meant a measure of replacement. I doubt if this move will succeed. What is more likely is that the staffs at the various Regional Centres will be strengthened both in number and in quality.

People like Mr. Liveing and Mr. Edgar, the Directors at Manchester and Birmingham respectively, have always been much too hard-worked. Also their staffs have been milked of the most promising talent in the interests of London.

Two outstanding examples of this attitude are Mr. Joseph Lewis, who was taken from Birmingham, and Mr. Clarke, Mr. Liveing's second-in-command, who was allotted to be chief assistant to Mr. Graves, the Empire Service Director. Reparation for these and others should be undertaken without delay.

Mr. Malcolm Frost's Adventures

Mr. Malcolm Frost, the B.B.C. "travelling salesman" for Empire programme gramophone records, and general "booster" of the Empire service, is now about half-way round the world on the tour which began three months ago and which will finish in May. He has been doing a great deal of flying with various adventures, including crashes, although nothing serious.

Parliament and the B.B.C.

There have been the seasonal alarms and excursions about Parliament demanding more direct control of the B.B.C. and so on. I do not attach much importance to the scheme for a "Vigilance Committee." It has been tried so often before without result that it is hardly likely to succeed when there is probably less cause for it.

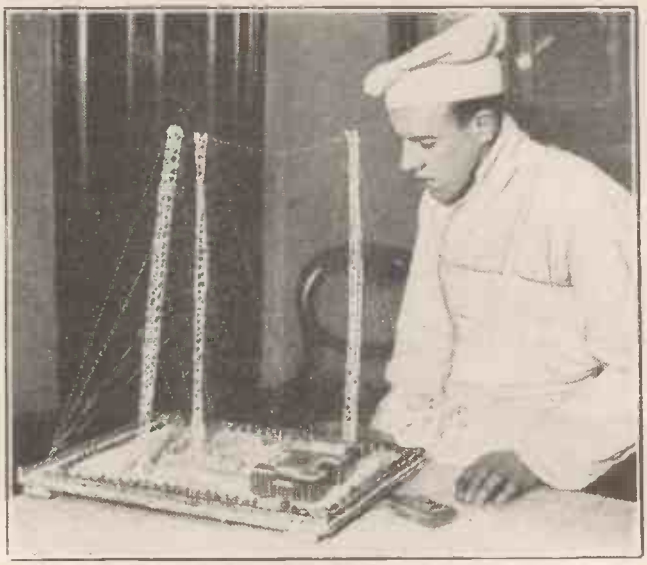
On the other hand, I believe that the form of B.B.C. Report which the Postmaster-General is required under the Royal Charter and Licence to present annually to Parliament may be changed. At present it is a succinct, bald, statistical document, which hardly satisfies those who are critical and suspicious of the B.B.C. I think we shall find the Report developed a good deal; also I think the P.M.G. will find it desirable to arrange for an annual opportunity of debate on the B.B.C.

At present, the B.B.C. can be discussed on the Post Office Estimates, or, of course, on any adjournment if the Speaker can be persuaded to let the issue stand, and if enough Members stay in the House to enable a debate to go on. The last two years there was no debate on the Post Office Estimates, and those members who have tried to raise the B.B.C. on adjournments have had no luck.

Personally, I think it would be a wise plan to have it recognised that Parliament could talk about the B.B.C. once a year for an hour or two. Until this is granted there is bound to be a back-current of hostility and jealousy fostered by those who profess to believe that the B.B.C. is irresponsible and badly run.

Much better this solution than any fantastic scheme of limitation by a "Vigilance Committee" of Members of Parliament.

BUILT FROM ONE "COMPONENT"



Frank Oldham, a Huddersfield baker, occupied his leisure for six months in the home construction of an unusual "set." It is a model of Moorside Edge made entirely of sugar.

TRANSMISSION TECHNIQUE

Transmitter and receiver technique run parallel in at least one direction. The search for new and better valves is prosecuted with equal vigour by both transmitter and receiver designers. A 100-kw. "tube" of special design is one of America's recent contributions to valve progress on the transmission side.

CAN TELEVISION EVER BE REAL?

BY JOHN SCOTT-TAGGART, A.M.I.E.E., F. INST. P.

I WANT to talk about an unusual topic. Is life *real?* And if it isn't, does it matter?

Wait a minute. Don't throw your hands up, or this magazine down. The topic is not a morbid analysis of things that don't matter a hoot to those who, like myself, are workers.

It is a question which is not only not divorced from wireless, but bound up inextricably with the whole of our lives.

One of Three Things

One of Dostoievski's Russian characters might stand on Westminster Bridge, decide that life wasn't real, and proceed to the logical conclusion under the black surface of London's river, leaving nothing, perhaps, but a circular, widening, but transitory ripple as a memorial to his disillusionment.

We ourselves, seeing this act of self-destruction, would probably mutter, "The darned fool!" and proceed to do one of three things—jump in, go and annoy the traffic policeman at the foot of Whitehall, or proceed on our way to the pictures.

More and More Unreal

In short, we don't give a cuss for reality, but are patronisingly sorry for any poor lunatic who does.

Although life is becoming more and more unreal with every year, I have not the slightest intention of standing on Westminster Bridge with the intention of ending a life which has become too artificial. (In any case, I should much prefer the Tower Bridge.)

Methods of Escape

I go, as a matter of fact, to the other extreme and brood at home on new methods of making life for humanity even more mechanical and electrical and artificial.

I get handsomely paid for doing this, and I spend the money in part on highly mechanical methods of escape from the world of everyday things.

And yet a full moon above and a never-ending panorama of blue-white cloud-mountains beneath is, perhaps, the realest thing I have experienced, a reality which would have remained unknown but for the whirring of a slim propeller and the rhythmic throb of nine steel cylinders.

To nearly all of this generation comes escape through science. How far is this mechanised life we live justified? And if it is, to what end may we ultimately be forced?

Already our newspapers think for us, our movies feel for us. Love, children, poverty, sickness—these are stark realities. But even here science or psychology probes its way, sometimes to disillusion, sometimes to help.

We of this generation have been handed a tremendous responsibility. Except for a few warning prophets, we are unanimously resolved to exploit to the full the gifts—be they altogether benign or not is another matter—of a science which makes life faster, more vivid; I was going to say, curiously enough, more *real.*

"We Invent Machines"

It will, perhaps, never be decided whether we are any happier for our wireless, our aeroplanes, our trains, our terrific armaments. A million of our finest lives, ten million of Europe's finest lives, must be set in the balance as one weight alone—and what a weight that is—against the benefits of the march of science.

We save that we may later kill; we invent machines that will enhance the happiness of some but filch the livelihood, and even the life, from others.

Cynically Inclined

As a scientist, however, I see some of the illogicalities of the arguments against the progress of science. I am even inclined to be cynical about the question of "reality."

All this has cropped up through a discussion with a friend about television.

He said: "We want *real* television, of artistes in the studio, of the Derby, of the——"

"I expect many readers will disagree with me," writes "S.T." in forwarding this unusual kind of article.

It contains a provocative and thought-stimulating idea. Is there a fallacy in it—and, if so, where? Let us publish *your* views.

Can Television Ever Be Real?—*continued*

"Yes, I know," I groaned; "the Boat Race, Test matches and——"

"Well, what's wrong with them?"

"Everything," I replied, with all the contemptuous prejudice I could compress into the word. "I have seen all these on the talkies, and been bitterly disappointed. What we need is a normal talkie programme—drama, humour, action——"

SEEING LIVING PEOPLE

A certain time, small, but nevertheless definite, is taken by the processes of television from the picking up of light rays to the reproduction of the scene on the television-receiver screen. "What delay," asks Mr. Scott-Taggart, "would you, as a 'viewer' in your sitting-room, permit?"

"Greta Garbo in your own sitting-room!"

"Absolutely," I replied, "and Mickey Mouse to bring one back to reality."

"Canned humour and celluloid sentiment! You call that reality?"

Well, I am convinced that television will make its premier appeal to our emotions and our sense of humour. To do so it requires elaborate direction and staging. The broadcasting of talkie films is the initial solution.

"But," says my antagonist, "that isn't real television at all. Television is the actual *seeing* of live people."

What is Reality?

That is the crux of the matter. What constitutes reality?

The television transmitter consists of a conglomeration of apparatus which carries out a multitude of operations. A spot of light traverses the object to be transmitted—say Greta Garbo. This takes time. A photo-electric cell picks up the bits of reflected light and turns them into electrical variations. Reality has already disappeared.

The electrical variations now modulate high-frequency currents which cause ether waves to be radiated. These waves take time to reach the receiver, although the delay is slight. At the receiver the H.F. currents are converted back to L.F. impulses which control a neon lamp that by the aid of, say, a revolving mirror drum or a disc builds up bit by bit a picture of the original person.

This, my dear friends, is called Reality, real *seeing!* Chopping Greta Garbo up into little bits of light and shade, picking the bits up on an artificial electric eye, turning her into bits of L.F. and then into ether waves, and finally piecing her together again into an integral human being!

Since the whole process is a scientific fake, does it matter how many extra artificial processes we insert? Why not just make a talkie film of the "star" and then run the film through the television transmitter?

I admit one instinctively hesitates to say it would be "the same." But that is because we have been told what is happening! If Professor X took us to a cinema and told us that we were going to see a great demonstration of a new system of television, *and we had implicit faith in Professor X*, we might be shown an ordinary talkie and believe it was television.

"Reality" is largely a matter of faith, or ignorance. That's why dogs are supposed to bark at their reflections in a mirror.

If we have faith, or are ignorant, does it matter how an effect is obtained? (Remember Father Christmas!)

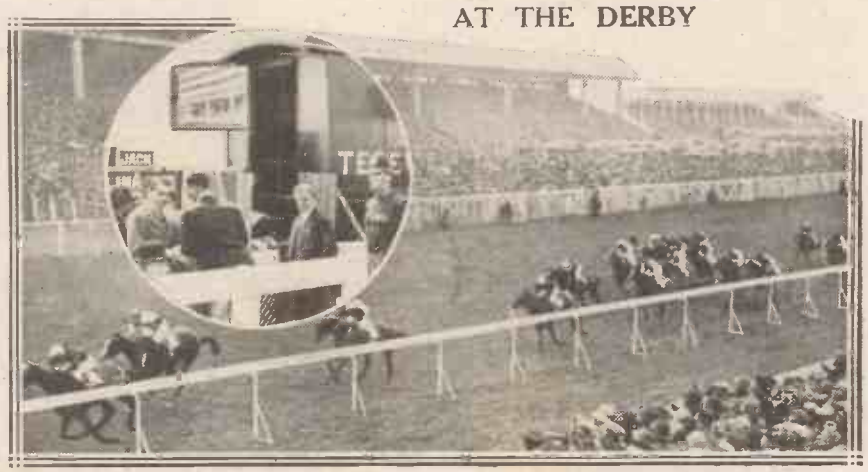
A Matter of Time

My friend said: "I think you've missed the whole point. In *real* television the process is simultaneous. If you took a film of the Boat Race and then broadcast it, the 'viewer' would not be seeing it as it happened, with all the attendant element of surprise."

But this is only a matter of time taken by the processes, and even "direct television" takes time. I can imagine a strip of celluloid taking photographs, running through a developing machine and straight through the television transmitter mechanism. The delay might be a half-hour, a half-minute or a half-second. What delay would you, as a "viewer" in your sitting-room, permit? Two hours—*if you knew it*—would not be "reality." But if they speeded up the photography so that you saw on your screen the finish of the Boat Race within a fraction of second of its actual happening, would *that* be reality, real *seeing?*

What do *you* think about it?

AT THE DERBY



A view of the world's most famous race, and (inset) a television van carrying out tests with a view to broadcasting the great Epsom spectacle. Note the large reflector in the form of a swinging door at the back of the van.

WITH PICK-UP AND SPEAKER

Conducted by A. JOHNSON-RANDALL

ON some modern pick-ups and tone-arms the head or actual pick-up is arranged to swivel for easy removal of used needles. But on many, particularly inexpensive ones, no such movement is permitted, and if, as is frequently experienced, the movement of the arm is restricted, removal of needles is not, to say the least, quite as straightforward as it might be.

But there is hardly ever any restriction in the sideways movement of an arm, which makes possible the following scheme which is a slight help.

About Stroboscopes

Sink a used needle cup in the motorboard, where the pick-up can be swung immediately over it.

Needle movement then resolves itself into a matter of swinging out the arm and releasing the pressure on the fixing screw that holds the needle. It will then drop down into the cup.

And now, to change the subject a bit, here is a point about stroboscopes. The type in question is the cardboard disc, with black and white sections around the edge, which is placed on a record turntable to be viewed in the light of a bulb run on A.C. mains in order to ascertain when the speed of the turntable is correct.

Completely Interrupted

The point concerns how they work. Why, it is asked, if the eye cannot distinguish the variation in the light of the bulb, is it able to note the effect of this variation when watching the stroboscope card?

The best way to explain is to consider an ordinary light as used for stroboscope work. Here the light is completely interrupted by a shutter, and does not merely change in brilliancy.

But stroboscopic effects can be noted even if we have a steady light shining on the stroboscope disc the whole time. The only effect it will have will be to reduce the brilliancy of the effect and turn the whites greyish to a degree dependent upon its power in relation to the stroboscope light.

Prove It Yourself

A similar effect takes place with the bulb. Although the light varies in brilliancy, there is a certain point of power below which it never falls. If, therefore, we consider this as the steady light referred to in the case just considered, the variation of light beyond this point becomes more or less the same as the completely interrupted stroboscopic light.

VOLTAGE REGULATION

Users of mains radiograms know the importance of keeping voltage constant in spite of current variation. This is the automatic voltage regulator at WJZ.

You can prove this for yourself by trying different wattage bulbs. The more powerful the light the longer the filament takes to cool, so that the less definite is the effect. The steady component is increased in power at the expense of the varying component.

Use Plenty of Oil

There is a tendency with some people not to bother to oil their gramophone motor. This is much to be deprecated, because, although it will go on working without oiling and apparently just as well, it is not doing so actually.

Power will be taken up to overcome unnecessary friction, and with small spring motors particularly this is liable to result in a slight slowing up on really loud music.

It may not be audible as such, but the effect may be to spoil reproduction without the real cause being apparent.

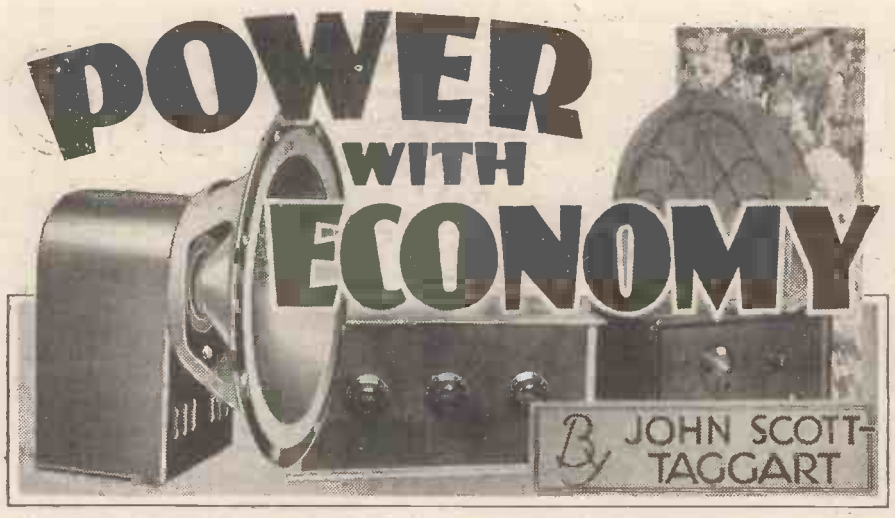
Another item which will cause a big loss of power, apart from the trouble it can produce by unnecessary record wear, is a pick-up that is badly tracked. If it is much out, it will be sufficient to slow even a three-spring motor on certain loud "stuff."

Tone Control

The tendency for pick-up makers to compensate frequency characteristics by a lift at either end of the curve, coupled with the improvements in bass and treble amplification, sometimes causes one or even both of these to become over-exaggerated.

In view of this some form of variable tone control is highly desirable nowadays, and those whose sets are suitably arranged should lose no time in fitting one.

POWER WITH ECONOMY



By JOHN SCOTT-TAGGART

Quiescent push-pull is a development in L.F. amplification of which much should be heard in the future. Our eminent contributor describes in his usual easy-to-follow and explicit style just what it is, how it works, and the advantages it offers to battery users.

THOSE battery-valve users who desire a large output volume but grumble about the H.T. current (and don't we all ?) are about to be catered for.

The new magic phrase is to be "quiescent push-pull amplification." You are likely to hear a great deal about it in the future. It is extraordinary, really, that more has not been heard about it before.

The idea is this: when receiving signals we operate the last valve with a negative bias of, say, —12 volts on the grid. This bias is sufficient to cut the anode current down to, say, 10 milliamperes.

When speech or music is received, the grid voltage varies above and below the fixed negative bias of —12 volts. The result is that the anode current rises momentarily to 18 milliamps. during the positive half-cycle of L.F., and drops to 2 milliamps. during the negative half-cycle.

A Steady Current

The average current will remain 10 milliamps. and will flow all the time the set is switched on, even though no signals are being received. There is thus a big wastage.

If you carefully think of all the intervals in a programme and also all the small silent periods between words and notes, you will see what a lot of "H.T." is flowing to waste without doing any "work."

How much more economical it would be if we only used up the H.T. battery during actual signals ! Well, this is just what the "quiescent push-pull" amplifier does.

Most readers will have some idea of what a push-pull amplifier is: it consists of two valves whose grids are given opposite potentials at any given moment by a "split-secondary" on the input transformer. The anode circuits of the valves are then made to actuate a loudspeaker, the rising anode current of one valve being made to produce the same effect as the falling current in the other valve. The valves thus help each other.

The "quiescent" system is very similar to the ordinary push-pull circuit, except that both valves have their grids biassed so that very little current normally flows. When signals are received, alternating currents due to the signals are impressed on both grids.

One Valve at a Time

If one grid is made positive the anode current of that valve rises—and through an output choke or transformer affects the loudspeaker. The other grid is meanwhile made negative, but the anode current of that valve cannot fall much more because it is already very small; the second valve therefore does not contribute much to the output.

When the alternating input current changes direction, the process is reversed. The grid of the first valve is made negative and that of the second valve is given a positive impulse. The second valve, therefore, is now the useful one.

Thus each valve acts in turn to amplify the input currents, one valve amplifying the positive half-cycles, and the other the negative.

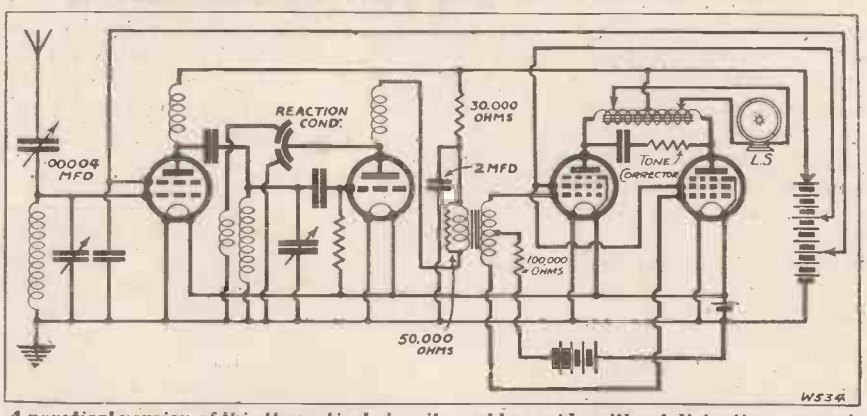
Saving of H.T.

An ordinary single valve, of course, is not suitable for "quiescent" amplification because if highly biassed the positive half-cycles only would produce an anode current. You need a second valve to amplify the other half-cycle, a common output circuit being then used to "join up" the two half-cycles which proceed to feed the speaker. A single valve with two grids, two anodes and one common filament would give the same general result.

The output valves may be either ordinary three-electrode or pentode.

The disadvantage of the "quiescent" system is the higher initial expense. An extra valve is required, and there is the cost of push-pull input and output transformers.

IS THIS THE BATTERY SET OF THE FUTURE?



A practical version of this theoretical circuit would provide without distortion approximately twice the volume of an ordinary S.G., det. and L.F. three-valver, but would provide an economy of H.T. battery power.

But a saving of fifty per cent of "H.T." will soon pay for these. Economy of H.T. current, however, is not the only angle from which to view the system. It also opens up the possibility of battery-valve performance which may rival mains-valve results.

I have drawn a double pentode circuit which embodies the principle outlined above, and I hope shortly to describe a special set incorporating the features of the scheme.

The B.B.C.'s OWN SETS

Our Special Correspondent describes how the B.B.C. uses its own check receivers to test transmissions from all its main stations, and takes you on a special visit to the control-room to hear what the engineers have to say about the circuits.

LAST week one of the control-room men at Broadcasting House, London, took me on an unofficial visit to parts of the building which *hoi polloi* are forbidden to see—the engineering sanctums, and so forth.

"Now tell me," I said, "what kind of sets do you *really* use for the loudspeakers in the building. The quality sounds fine. Can you describe the circuit?"

He pondered, and then explained.

No Criterion

"Of course, the type of gear which we use for the reception of only the local stations must not be used as a criterion of what the B.B.C. officially thinks suitable for general reception, or even for local-station reception, by ordinary listeners."

"Taken for granted!" I replied dutifully.

"These sets do much more than provide a check on the transmissions for Brookmans Park. The whole of Broadcasting House is wired for amplifiers and repeater speakers.

"At the touch of a switch the National or Regional programme can be turned on to any one of these speakers or amplifiers. This input could be taken direct from one of the microphone amplifiers in the control-room, but we don't want to do this for a number of reasons."

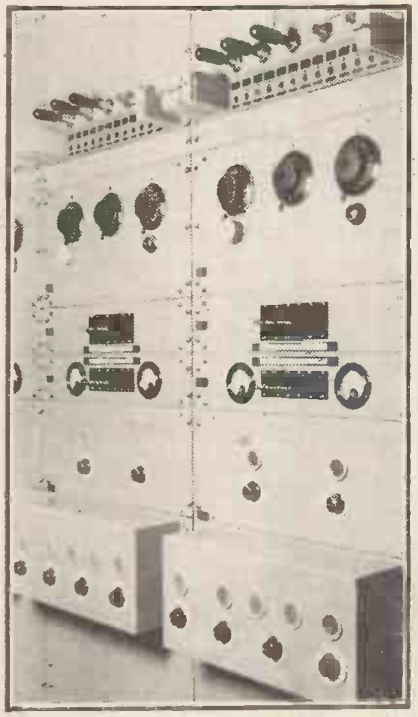
"Why not?" I asked.

Specially Designed

"Direct wireless reception is much better. Especially when radio plays are broadcast it is an advantage for the producers listening to the speakers on the sixth and seventh floors (radio-play section) to know what the programme sounds like when broadcast, and not as it is handled by the microphone amplifiers."

"So they aren't ordinary sets?"

"The result is that our check receivers are designed with special ideas in mind. They must be selective enough to separate the National and Regional, of course. They must give enough output through the standard "A" amplifiers to fill Broadcasting House with the received programmes. They must be absolutely reliable."



CHECK RECEIVERS

Two of the B.B.C. check receivers are seen in this photograph which shows the arrangement of the units. Fuses are at the top, then the controls for the three tuned circuits, and finally, in a screened box at the bottom are the output connections with their "trap" valves.

"But the circuit——" I pressed impatiently.

"Well, the circuit arrangement is easy. There is one screened-grid stage and a push-pull detector. The H.F. valve is transformer-coupled to the twin detectors, and the degree of coupling between the primary and secondary windings is variable. There is a 100,000-ohm potentiometer across the first tuning circuit, and a little aid to selectivity is a ·0002-mfd. condenser in the aerial lead."

"And the valves?"

Cutting Down Selectivity!

The screened-grid valve is coupled through a ·001-mfd. fixed condenser to the H.F. transformer. The push-pull detection arrangement is rather ingenious, as there are no grid condensers, but ·5-megohm leaks are shunted from grid to filament of one valve and from filament to grid of the next. The screen-grid valve is decoupled with a 20,000-ohm resistance and a 1-mfd. fixed condenser. The shunting of a resistance across the tuned circuit damps the tuning and cuts down the selectivity."

"What's the idea of that?"

"The point of this variable resistance is to act as a useful volume control and to cut down the rectified current from the detector. All our B.B.C. check receivers are adjusted to give the same output.

Resistance Coupling

"Any standard 'A' amplifier can be switched on to a check receiver for loudspeaker working throughout the building without fear of overloading, or of getting greater volume on, say, Regional than National.

"The push-pull detectors are not transformer coupled to the output, but are fed through a resistance and

T

Single Output Stage Sufficient

condenser arrangement, the coupling condensers having a value of 2-mfd. The valves take 300 volts high tension, and there is a milliammeter in series with the push-pull detectors to show that there is no overloading. Automatic bias is obtained by 35-ohm resistances."

Unnecessary Masts

Well, that's the explanation. We went along to see the sets. In the Broadcasting House control-room the sets are mounted side by side, one for National and one for Regional. Fuses are at the top, the three tuned circuits next, and the output connections neatly boxed at the bottom.

The same kind of sets are used at all the main stations for checking, but as 'phone reception is generally needed (loudspeakers being switched on only for the quality tests made during the morning transmissions), a single output stage is all that is needed.

Before the 7-metre transmitter was installed in Broadcasting House, the 35-ft. high masts of the roof were all used for the check receivers, but now these are not necessary. There are a large number of low-frequency amplifiers mounted in steel racks in the control-room, and any one of these can be switched on to the check receivers.

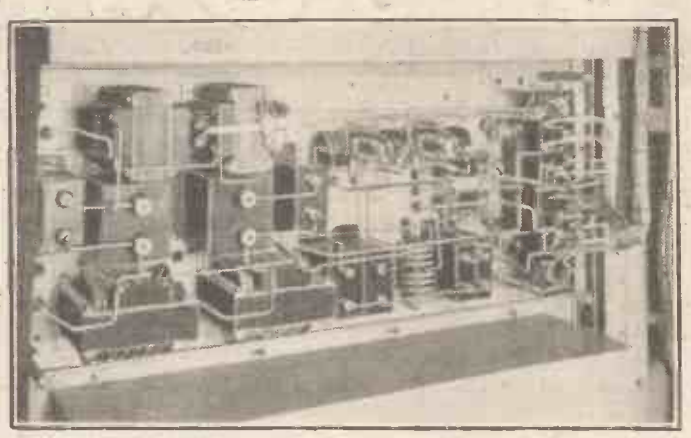
Ordinary Dials

Every morning both the check receivers are switched on and the tuning adjusted. Slow-motion dials are not used. They are really not necessary for local reception on sets having tuning and loose-coupling of the type embodied in these outfits.

Must Be Right

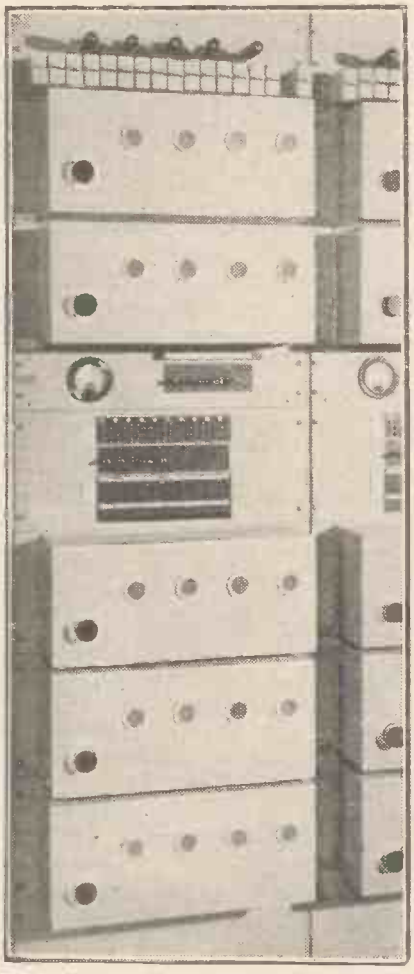
The loudspeakers throughout the building which can be connected up to the check receivers are wired to a switchboard and individually controlled from the eighth floor. If, say, a play producer wants to hear the National programme in any one studio, he gets through the house 'phone to the people in the control-room, and the appropriate speaker is then supplied.

Don't, please, blame me if you make up a set with push-pull detectors and all it does is to put up the H.T. consumption! All I can say is that the B.B.C. does it, so it *must* be right!



A CLOSER VIEW

The "A" amplifier seen in column one is here viewed from the back to give a better view of the connections and the current supply. 4-volt valves are used in these amplifiers.



AN AMPLIFIER BAY

showing the telephone switchboard arrangement in the centre, by which the "A" amplifiers can be switched to any loudspeaker in the building.

CONVERTING A TWO-POINT SWITCH

Two simple methods for the home constructor.

WHEN a three-point push-pull switch is required, and only a two-point switch is available, it is quite simple, in the majority of cases, to convert the latter into the former.

The third point is obtained by taking a connection from the spindle or bush.

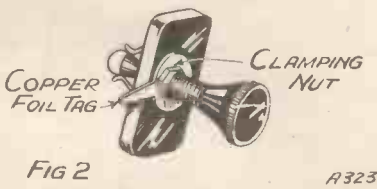


FIG 2 A3238

A copper foil tag clamped to the bush makes a good permanent connection.

Two methods of doing this are shown in the sketches. Fig. 1 shows a flex lead soldered to the end of the plunger. This is quite satisfactory for a temporary job, but the method shown in Fig. 2 is a more satisfactory way, if it is to be permanent.

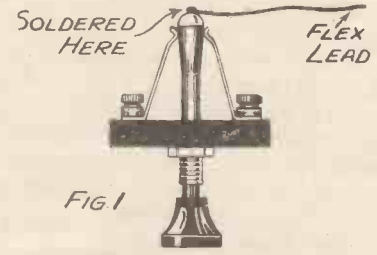


FIG 1

For a temporary job, a flex lead soldered to the end of the plunger is perfectly satisfactory.

Here, a copper foil tag is fitted to the bush, and clamped down with a nut. Connection is made on the tag.

A. SMITH.

From My Armchair

by "S.T."

Here is another pot-pourri of monthly miscellaneous musings from Mr. John Scott-Taggart's fireside.

Gasometers, clergymen, a Chinese ship's surgeon, operations, wireless advertising, face creams, aeroplane mishaps, and a character reading of "S.T." are some of the topics toyed with this month.

IT is curious that out of the thousands of readers who read this paper not a single one wrote in reply to my question some months ago about the effect of gasometers on screening.

Are we so snobbish that we decline to admit we live anywhere near a gasworks? Surely not. If there's one thing that binds every man and boy together, it is our common hobby.

Unfortunately, my own pet gasometer is too small to be of any use. I must say I did get one letter from Southall where the father of all gasometers is situated. This reader gives no data *re* screening, but says that there is a staircase up to the top and that a charge is made for going up.

The funds thus collected are not, as one might expect, given to local wireless listeners to enable them to buy extra valves, but are given to charity.

Another reader, who is a gas engineer, tells me that I am betraying gross ignorance, and that the big thing that sticks up is a *gas-holder*. "Besides this gas-holder will be a small building housing a gasometer which is a very modest affair simply for measuring gas."

Surprising Variety

I am surprised at the variety of people who write to me. Here are some of the professions and trades: milkman, inspector of police, scores of bus-drivers, ship's surgeon on a Chinese vessel, director of a huge publishing concern, doctor, clergyman, dentist, cotton weaver, income-tax collector (wasn't I glad his "S.T.300" didn't work), farmer, fitter, grocer, schoolboy, tailor, button manufacturer, hairdresser, solicitor, coffee grower, photographer, hotel "boots" . . . The list is endless.

Busman's Holiday

If I were asked what section of the public were the keenest radio constructors, I should say at once—London busmen. It has always been so. Why is it?

Of course, the drivers are the cream of the motor transport service and, no doubt, are mechanically-minded. But the conductors are equally keen. Why? I feel it has something to do with their peculiar hours of work.

By the way, if you live in London you may have noticed that most of the buses have an S.T. number painted on the front, e.g. "S.T.450." Look to see if you can find an "S.T.400." I have seen an "S.T.100" also an "S.T.299" and "S.T.301," but "S.T.300" has eluded me. I shall probably get run over by it some day.

After busmen, I should say clergymen are the keenest amateurs. I correspond with a number. I cannot help wondering sometimes whether they ever experiment on a Sunday like we sinners do.

Curiously enough, most of my ideas seem to arrive on what should be a day of rest. Double-channel reaction, for example. Yes, a Sunday invention. Pity.

The keenest amateur I ever knew, however, was not a clergyman, but a sausage manufacturer from Bermondsey.

But what about T. K. Chan, ship's surgeon of the SS. An Tung, of Hong-Kong? He writes:

Owing to the use of two differential condensers in "S.T.300" circuit of your valuable magazine, I have tried many a circuits according to Mr. S.T.'s 300 design. I found the accompanying circuit having given me the most marvelous result. I can get 90% stations out here every night and nearly all the stations in China, Japan, Siam, Philipine Islands and Hong-Kong in good loudspeaker strength. I am to say we have most of the stations out here having weak powers except a few. No obligations is expected.

Yours faithfully,
T. K. CHAN.

Taking it Easy

Here am I lolling back in my armchair while the SS. An Tung glides out of the harbour of Hong-Kong at midnight, past yellow-sailed junks tossing on waves which reflect the lights from the portholes of Dr. Chan's ship.

Write again, doctor; your letter brings to us something of the fragrance of unknown lands. To me it

The Sugar Coating Is Too Thin

brings, in a way, regret. I was so near China, and never went.

* * *

There are times when I am more than glad I am a designer. Take, for example, the letter from a Romford reader, who built the "S.T.300," and after months of use wrote on September 30th: "I am eagerly awaiting November 15th, when you are to announce your new set and, although I will be unable to construct it (having fallen on evil times—even being forced to part with my cherished 'S.T.300'), I will hoard up THE WIRELESS CONSTRUCTOR in the hope that perhaps in the near future I may be in the position to rejoin the ranks of the happy brigade of home constructors."

If a letter like this does not make one give of one's best, nothing will do so.

Under the Knife

Then one gets letters of gratitude from temporary invalids to whom wireless is the greatest godsend in the world. I have been under the surgeon's knife seven times. I know.

The last time, three years ago, was in New York. Throat. I chose a local rather than a general anæsthetic. But I stipulated that a radio set should be allowed in the operating theatre.

So seven valves and W G Y kept me distracted.

"Say, you must be fond of the radio," said the surgeon laughingly.

I guess I have never been so fond of it as during that half-hour. I remember the whole business very vividly. The reproduction, however—as with all American sets at that time—was too boomy. . .

Now here's a letter from St. Austell, Cornwall. It relates to the "S.T.300," not the "S.T.400," but is of interest (a) because the "S.T.300" is still extremely popular, (b) because it should cheer those readers who may have experienced initial failure with one of my sets.

Of Postcard Fame

Mr. F. J. Powles bought the set from H. Whetter, the radio dealer who sent me the famous postcard announcing, "The 'S.T.300' is a washout." This hasty verdict was given before he discovered a fault due to the suppliers.

Well, on this very same set (after it had been put right) Mr. Powles has received ninety-four stations! This includes eight Americans. This is far better than I can do on the "300." He is now going in for the "S.T.400." He won't get more stations, but he'll get them better.

The Gift Horse

I want to give voice to a loud squeal against some of the radio advertising that goes on. Radio Normandie (Fécamp) is an example of a station that has been giving us too high a proportion of talky-talky.

The sugar-coating on the pill is, in fact, too thin. One tastes the pill before one has swallowed it.

Yes, I know it is ungracious to criticise the free gift. After all,

IN HONG-KONG HARBOUR

". . . yellow-sailed junks tossing on waves which reflect the lights. . . ."

Radio Normandie is a great blessing to those who desire entertainment after midnight or, as in my case, often experiment after that hour.

Tasteful Advertising

But the continual talk about the I.B.C. club, the badges from Spinks, the members' letters (as boringly alike as a bagful of peanuts), detract greatly from the value of the station's work.

Fécamp has a wonderful opportunity to show how radio advertising can be done tastefully. At present it stands out as a warning of what might happen in this country if the B.B.C. lost their job.

There is another aspect of wireless advertising which I do not like, and that is the recommendation of radio products over the ether.

An official announcement such as, "You who are listening to this programme will find you will obtain much better results if you fit Blank's valves in your receiver" comes as a considerable shock. There is an official ring about such a statement which we shall have to learn to ignore.

The statement *may* be quite untrue, but coming from an actual broadcasting station it will carry much greater weight than "advice" on, say, face creams.

Not for Men

Perhaps I have a face-cream complex, but I must confess to a certain degree of repugnance towards these mixed-audience radio advertisements.

How would *you* react if you had to listen to the following:

A mask treatment does exhilarating things to your face in anticipation of a party. If your skin is dull, sallow, coarse-pored or thick-looking, a mask treatment the day before will give your complexion clarity and colour. If your skin is the dry, fine, apt-to-flake kind, an oily or eggy type of mask will leave it smooth and velvety.

Personally, I should prefer my skin to remain dull, sallow, coarse-pored, thick-looking and apt-to-flake than submit to eggy masks.

And it is all very disillusioning for us menfolk. "Smooth and velvety" may be all very well, but I, for one, would rather not know it was due to an eggy type of mask.

* * *

A reader writes: "Your flying tour of Great Britain must have been good fun."

As a matter of fact, I got very little fun out of the flying side. I had three bits of excitement, though. One was when I was leaving Plymouth for Helston.

Decidedly Lonely

Sea fog on the left and high cliffs on the right, I flew in and out of every cove and round each headland a few feet above the water, expecting to be hemmed in at any moment. I could not rise higher because of very low clouds.

I felt decidedly lonely, with just the "S.T.400" in the front cockpit and the knowledge that if I came down

Looking On The Dry Side of Things

on the sea the chance of rescue was pretty remote. Having lost my third 'plane, S.T.3, in the English Channel—and nearly my life—I was glad to turn inland up the valley that leads to Helston.

The next day I left the field at Helston (next to the cricket club's ground) and made two trips to Land's End. The first was with the Helston reader, who was keen on experiencing his first flight. The second trip was with the "S.T.400" and equipment.

Missing the Pole

It was dark when I set off, and black when I arrived over Sennen (the village at Land's End). There was only one field suitable for landing in; it contained a large outcrop of rock in the centre, and there was a life-saving rocket-pole in the line of approach.

AN ARTIST'S TRIBUTE

This carved portrait of Mr. John Scott-Taggart was executed in 400 years old English oak from the frontispiece to the December 1932 issue of "The Wireless Constructor." The artist, whom you see above, and who makes a hobby of portraying celebrities in wood, sent the carving to "S.T."

Dodging these by daylight was bad enough, but now I couldn't even find the field! I hunted and hunted in circles, skimming repeatedly over the church, over the garage, peering over the edge through the darkness to find the field and miss the pole.

Some intelligent person commandeered five motor-cars and lined them up in a field so that all their headlamps formed a roadway of light along the grass. But, though I appreciated their action, I knew this field was too small to land in.

There was only one that would do, and I could not see the stone walls of its boundaries. The two WIRELESS CONSTRUCTOR readers who expected me (the passenger and Mr. Thomas) finally saved the situation.

Forced Landings

Each stood with a pocket flash-lamp at each end of the field, and this gave me the direction in which to land.

I had two forced landings near Bathgate (between Glasgow and Edinburgh). The second field I had to get into with a mighty hurry as the engine failed when I was only a hundred feet up. It was as level as a camel's back, with a railway cutting on the far side of the hump and a herd of highly intelligent sheep on the near side. (They exhibited their intelligence by a very rapid decision not to be turned prematurely into mutton).

I was greatly inconvenienced by a huge crowd. An hour or two later, when the engine was once more O.K., they had the sad spectacle of gallon after gallon of petrol being allowed to run to waste into the ground. It was necessary, because I had to lighten the machine to the extreme limit, but it was enough to make stern Scotsmen go to the edge of the crowd and weep.

The more practical ran home for cans and jugs which were filled at the thin stream of petrol, which ran for over an hour.

* * *

I think the coldest place I visited on the tour was North Shields. But they are hardy folk on the Northumbrian coast.

Leaning over the railing on the sea-front I ventured the sociable opinion: "Pretty cold, isn't it?" to a native. His reply came slowly—and reluctantly: "Aye, but it's dry."

I walked along the sea-road to Whitley Bay where, rubbing my hands vigorously, I prefaced an order for lunch by the friendly suggestion, "Pretty cold." The waiter seemed as if insulted and muttered defensively: "Aye, but it's dry."

The people up there apparently believe in looking on the dry side of things.

Restoring Self-Respect

I began to feel not only cold but effeminate. On the bus to Newcastle, however, I was able to restore my self-esteem.

"Cold day," said the conductor.

"Aye, but it's dry," was my retort.

The air trip from Edinburgh to Newcastle was very rough going over the bleak and desolate Cheviots. Feeling particularly air-sick over one peak, I noted from the map that it was called "Oh Me." Other peaks of the same range have names not

(*Please turn to page* 382)

TIDIER TOOL-BOXES

Too often the tool-box becomes a receptacle for all those odds and ends of screws, etc., as well as its legitimate contents. What you should do is to make up a neat tray like one of those described here.

By J. R. WHEATLEY

HAVE you ever purchased a dozen small washers, used perhaps two or three, and then been at a loss to find a safe place for the others until required?

More often than not the "spares," whether they are washers, bolts or nuts, are either placed in too safe a place and cannot be found, or else they are just thrown into the junk box.

All home constructors have surely suffered that feeling which results from misplacing small parts—you know that you have them somewhere, but——! For this reason it is suggested that boxes are constructed, with or without trays, into which these oddments can be placed.

Built at Home

The cost of such boxes already constructed makes it more than worth while for them to be made at home—and it is surprising how simple this is, providing that the correct material is obtained and they are constructed in accordance with the following instructions:

It is suggested that a start is made with a simple flat type of box without a tray. Such a box is suitable for holding screws or small nails.

A convenient size is 7 in. by 4 in. by 1 in., and for this will be required two pieces of wood 7 in. by 4 in. by $\frac{1}{4}$ in. The last dimension really depends on the wood on hand, for there is no need to purchase special material for the bottom and the lid—three-ply is quite satisfactory.

Sandpaper Finish

Since you will probably not have a plane, the wood must be cut fairly accurately, and be sure to get the sides at right angles. If you haven't a "square," use a copy of THE WIRELESS CONSTRUCTOR. You will find that this gives you a right angle sufficiently near for your purpose. Then finish off with sandpaper.

For the side pieces and dividing bars for the various sections "strip-wood" is used; this is a name given by timber merchants to flat strips of wood of various widths and thickness, and it is usually sold at so much a foot. The actual side pieces are 1 in. by $\frac{3}{8}$ in.; this costs approximately 3d. for 2 ft., which will be sufficient for the box in question.

For the "bars," however, slightly thinner wood should be used, 1 in. by $\frac{3}{16}$ in., otherwise in a box of this size with three or four bars the box tends to look clumsy.

Nails—Not Brads

A start is made by making the side pieces, which should be cut to length—that is, 7 in. Special nails known as fretwork nails are used for fixing the sides to the bottom, and these nails can be obtained in various lengths from $\frac{3}{16}$ in. to 1 in., and they are to be preferred to brads.

If care is taken there is no reason why you should split either the bottom of the box or the side pieces. When cutting the remaining two sides do not forget that they will be 4 in. minus $\frac{3}{4}$ in. These sides are attached as before by nails, and three or four in each side are ample.

Fitting the Hinges

One nail should now be placed at each corner so as to prevent the sides from falling away at the corners. Then place the remaining piece of wood, 7 in. by 4 in., on top of the box to ensure that it will fit when used as a lid.

If you are an inexperienced woodworker you may have to make another lid, but do not make any further additions until this has been done.

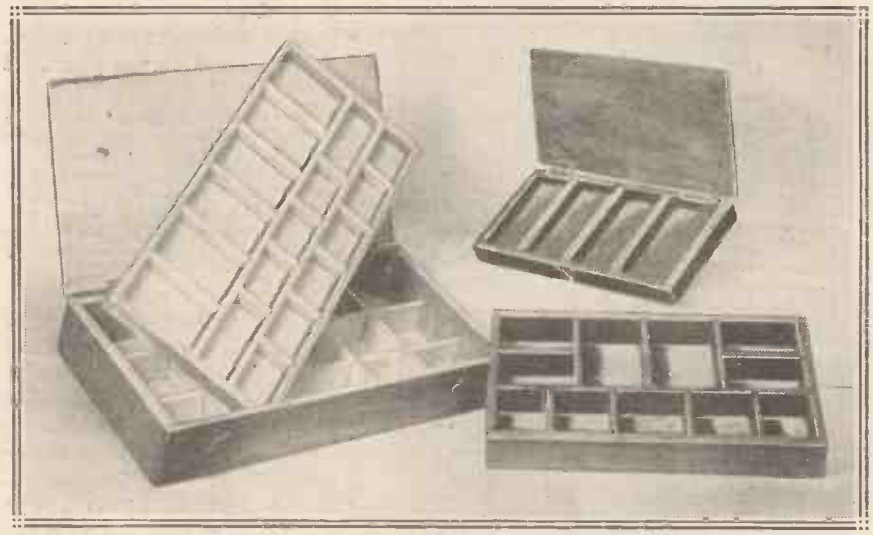
It is now advisable to fit the hinges, and here again some care is necessary. For a box of this size a pair of brass hinges 1 in. by $\frac{1}{4}$ in. are quite suitable.

Use a Penknife

Each hinge must be mounted on the back strip of the box in such a manner that the top of the hinge when closed is level with the top edge of this strip. The actual slots for the hinges are made by cutting two saw-cuts in the top face a fraction deeper than the over-all thickness of the hinge when closed, and 1 in. apart. Then with a penknife remove the piece of wood between each of the two saw-cuts.

This method is suggested since it obviates the need for cutting both the back of the box and also the lid. The hinges should now be attached to the back of the box by size No. 1 or No. 2 wood screws.

YOU'LL KNOW EXACTLY WHERE TO LOOK



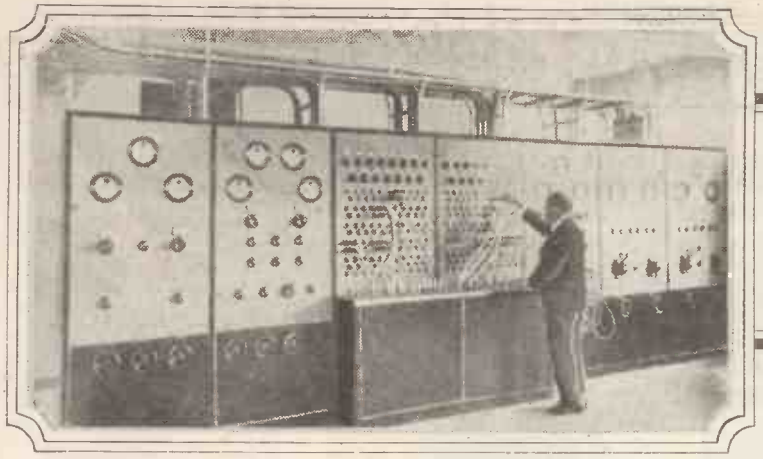
"Time is money," they say. If it is, then these simple screw boxes are destined to repay constructors a hundredfold for the trouble of building.

Then attach the lid to the hinges with a similar gauge screw—the actual size of the screw will, of course, depend on the thickness of the lid and the size of the holes in the hinges.

All that now remains is to fit the cross-bars, and the number may be left to individual requirements. These are cut dead to size and held in place with a little "Croid" or similar glue smeared along the bottom of the 1 in. by $\frac{3}{16}$ in. strips.

To complete the box a small hook,

(*Please turn to page* 385.)



"R.R.G.'s" RADIO RESEARCH

Although all programme material in German broadcast stations is the responsibility of the regional officials concerned, much saving of expense ensues from centralising the technical investigations. In this article some idea of the research work of the Berlin laboratories of the Reichs-Rundfunk-Gesellschaft is given by

Our Special Correspondent.

THE central German broadcasting organisation, the Reichs-Rundfunk-Gesellschaft (R.R.G.), in Berlin, is responsible for the technical side of broadcast studio work throughout Germany. This is a great advantage, as all technical questions are settled in Berlin, whereas the actual programmes originate at the headquarters of the regional companies.

Much saving of expense ensues from this centralisation of broadcast technique. The regional companies look after everything that happens in front of the microphone, the R.R.G. takes charge at the microphone and sees the broadcast safely out to the land-line connecting with the transmitter, where the Post Office steps in and sees it safely out over the aerial to the listener.

Picking the Best

In Germany's giant "Portland Place," where the R.R.G. and the Funkstunde (the Berlin regional company) have their offices and studios, the R.R.G. occupies a series of laboratories. There are some ten rooms, the whole tract being over 500 ft. in length.

Actually there are three different laboratories and the room for measurements. There is a laboratory for the development of new amplifier gear, one for reception, and one devoted to electro-acoustics.

Actually, each of these requires a separate article to describe it and tell readers of the useful work done there. But I think if I boil it all down a little we will get through; naturally, only picking the very best.

As I walked through the laboratories, I found that very often a bell would ring and a signal lamp would flash above the door of the room we were in. I discovered that this was a very ingenious device for finding people quickly.

Supposing Mr. So-and-So has left his office and has gone for something in a neighbouring room, or has gone to one of the laboratories and somebody wants to speak to him on the 'phone; well, then, automatically his colour signal flashes up in all the offices and laboratories till he goes to the nearest telephone.

Signal Lamps

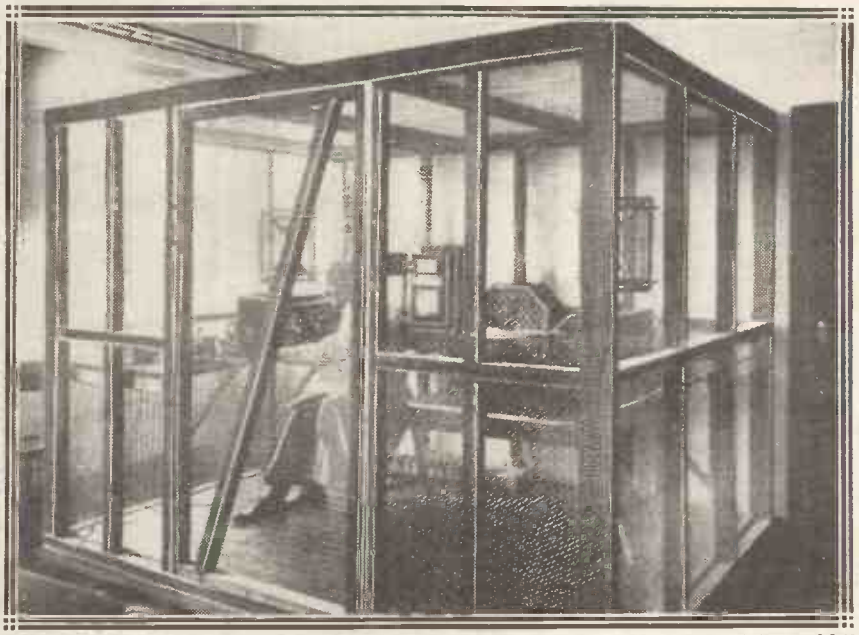
With four different coloured lights fifteen combinations are used so that fifteen people have their special light signals. This is very necessary as the engineers are seldom in their own offices.

Adequately Tested

Of the many ingenious devices which I saw at the laboratories I will describe just one or two. One of the fundamental instruments for all broadcast measurements is one that is capable of producing any frequency between 50 and 10,000 kilocycles with exactly the same amplitude.

By means of this instrument any amplifier, any receiver, and any transmitter, also any loudspeaker or any pair of headphones, can be adequately tested. The R.R.G. developed what they call a light sirene. This consists of an electrical motor which drives a disc with holes in it. The motor speed is regulated by means

RADIO IN A RABBIT HUTCH!



This fiercesome-looking wire cage—which so closely resembles an outsize rabbit hutch—is a Faraday testing-room used for trying out receivers and apparatus in conditions which are free from all outside interference.

"R.R.G.'s" Radio Research—*continued*

of a resistance, and thus, indirectly, the speed with which the holes in the disc pass in front of an electric lamp. The rays of this lamp fall on to a photo cell, but always through the holes in the disc.

If one changes the speed of the motor ever so slightly, then the frequency automatically changes, too. A stroboscope disc on the motor shows the exact frequency at which it is rotating, and one can then pass the electrical impulses coming from the photo-cell through an amplifier and into the circuit to be tested.

Rather Bulky

This apparatus is still rather bulky, as it requires a motor, a light, a photo-cell and an amplifier. So the R.R.G. engineers also have a new instrument which will probably supersede the present one. This consists of a motor which drives the rotor of a kind of variable condenser.

Here the change in frequency arises from the alteration of the capacity. Every German station goes through all its amplifiers once and sometimes twice a day with an instrument like this to test its response curve, and beware if it does not work as it ought to!

Another thing which caught my eye was an automatic amplifier for placing in restaurants and cafés. Instead of having a man in charge there this amplifier is placed in a safe position and lights up automatically when the control-room engineer connects up the lines to that café. It is fitted with three valves.

Passing through one vast room after the other, where I saw intricate measuring instruments and white-clad engineers bending over charts or work benches, we came to a very curious room. On both sides of the entrance I saw a door.

One opened into a common-or-garden photographic dark-room of a rather superior type, and exactly opposite a door opened into a silence cell. Once you are in this silence cell and the door closed, restful silence surrounds you.

Like Dead Butterflies

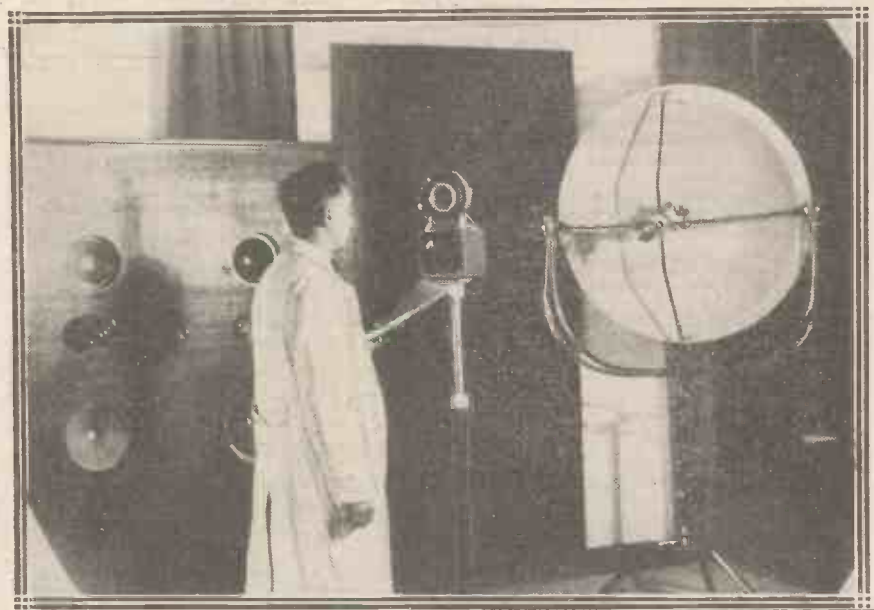
I understand that even if one were to let off a good, heavy colt revolver the sound would hardly impress one. Intendant Hardt, of the Cologne station, once said that sounds were like dead butterflies in that room.

Actually the cell has a very useful purpose. All kinds of loudspeakers are put in there, and opposite them a microphone. Then they are put through their paces by means of one of the light sirenes already mentioned. I wonder how many loudspeakers have been found wanting!

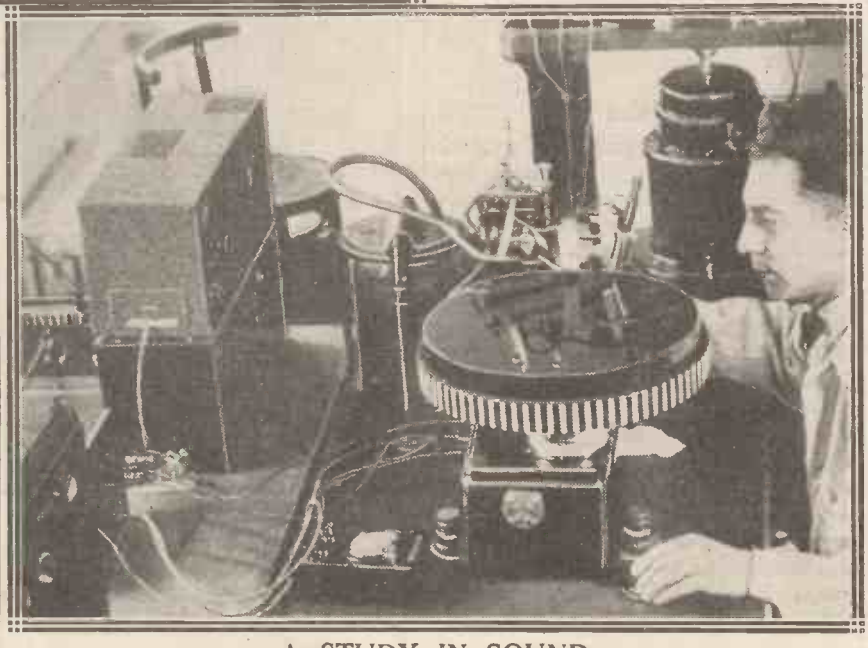
In another laboratory I found a man testing sets locked up in a wire cage. I asked if they used cheap labour from one of the prisons and kept him locked up nice and safely. But it turned out to be a harmless

(*Please turn to page* 385.)

HE CAN TEST HIS OWN VOICE



This room is used for testing various types of microphone and loudspeaker. The announcer provides tests on speech frequencies, and two grand pianos are employed for musical tones. The results on the microphone are heard by means of the loudspeakers on the left.



A STUDY IN SOUND

No, this is not Buster Keaton in a technical film, but an engineer of the R.R.G. testing one of the typical sound-recording apparatus used in the Berlin laboratories.

QUESTIONS I AM ASKED

by JOHN SCOTT-TAGGART

EDITOR'S NOTE.

In this new regular feature our contributor places at your disposal the experience and ability which have made him famous as a radio consultant on both sides of the Atlantic.

Q. 1.—How does a reaction differential work? Why in some sets is a ·00015-mfd. differential used, and in others a ·0003-mfd.?

A.—A differential condenser consists of a moving set of plates (usually connected to the middle terminal *via* a pigtail) and two sets of fixed plates. The moving plates can be turned to come opposite either set of fixed plates or to any intermediate position.

The reaction choke, as its name implies, chokes back the H.F. currents and forces them to go through the differential. The current takes two paths, one through the (a) reaction coil and the other through (b) one portion of the differential and so straight to earth.

In the sketch, the curved arrow represents the moving plates. When these are opposite the upper fixed plates in sketch, the whole of the reaction current goes through the reaction coil, the path of the current being shown by the arrows (a). In this position, the reaction knob will cause the set to oscillate violently.

If the knob is turned so that the moving plates are opposite the lower plates in sketch, the whole of the reaction current runs to waste as shown by arrows (b), and therefore no reaction is applied to the tuned circuit.

At intermediate positions of the moving vanes, varying degrees of reaction are obtained. As the moving vanes engage more with the upper fixed vanes, the capacity between them increases, thus affording an easier path for useful reaction current; simultaneously the amount of reaction current running to waste decreases as the moving vanes are disengaging from the lower set of fixed vanes. The two effects (more useful reaction and less "wastepipe" current) go together.

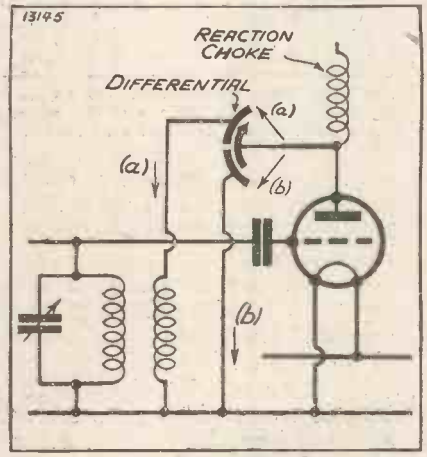
But although the *distribution* of the reaction current is governed by the position of the reaction knob, the *amount* of total reaction is governed partly by the size of the differential. The amount increases as the capacity rating of the differential increases.

N.B.—If no "waste-pipe" for unwanted reaction were provided, and a plain variable condenser used, instead of a differential, the high-frequency E.M.F.'s across the choke would be communicated to the grid through the anode-to-grid capacity inside the valve.

This "Miller effect," as it is termed, produces a form of reverse reaction, introducing "damping" into the tuned grid circuit, with resultant deterioration in signal strength and selectivity.

To minimise this, a fixed condenser is sometimes joined across anode and filament. It is unnecessary when a differential is employed.

DISTRIBUTING REACTION



The curved arrow of the differential symbol represents the moving plates, and it will be seen that they can be arranged to feed the reaction coil via "top" fixed plates (a), or to pass reaction to the "wastepipe" circuit (b).

Q. 2.—Why do you persistently call the second circuit of the "S.T.300" or "S.T.400" the tuned-anode circuit when every other designer calls the parallel-fed arrangement a "tuned-grid" circuit?

A.—Because (a) I am obstinate upon occasion; (b) I was the first to publish the tuned-anode-with-reaction circuit ("Electrical Review," Feb., 1919), and described the parallel-fed circuit in 1924, so I have some right to please myself; (c) because there is already a tuned-grid circuit belonging to the first valve, and confusion might arise; (d) because it *is* a tuned-anode circuit [see (a)!].

"He only does it to annoy, because he knows it teases." Not a bit of it. The so-called "tuned-grid" circuit is a pure unadulterated form of tuned-anode circuit, the choke being merely a convenient means for feeding the circuit.

Q. 3.—When I bring up reaction on my S.G.3 receiver, I have usually to re-tune slightly. Is this usual?

A.—The ideal reaction arrangement should make no difference whatever to tuning. But usually there is some slight alteration due to the capacity link between reaction and main coil windings, and also to subtler reasons.

In any case, re-tuning will usually be necessary for quite a different reason. When there is little reaction, tuning will be flattish, and you will be unable to find the exact tuning point. When you increase reaction, you are making the set more selective on a wavelength perhaps just a trifle above or below that of the incoming signal. You may thus even experience a drop in signal strength. All reaction adjustments should therefore be accompanied by a slight re-tuning of the tuning condenser concerned.

Stabilising—Grid Bias—Parallel-Feed—Overloading

Q. 4.—My set works perfectly every day of the week except Sunday. It seems to go to pieces then, but picks up again on Monday. What do you advise me to do?

A.—Sell it to a clergyman.

Q. 5.—On my "S.T.400," with anode coupler at zero, I still can get signals through. How is this? I did not notice the effect so much on the "S.T.300."

A.—Even with the moving vanes opposite the earthed fixed vanes, there is still a small capacity coupling to the other fixed vanes, and *some* H.F. currents are thereby smuggled over. The effect is more noticeable on the "S.T.400" because it is a more sensitive set, but no harm is done.

Q. 6.—I live 6 miles from Brookmans Park. Would you advise me to build the "S.T.400"?

A.—No. I tried the set at that distance and it was comparatively a flop. As one penetrates Zone A the "local" strength increases enormously. Except in the case of London, the Zone A population is small, especially as one approaches the station.

Q. 7.—Please advise me how to control the volume on the "S.T.400" without altering tuning.

A.—Probably the simplest way is to fix a variable resistance of 400 ohms, say, across the aerial and earth terminals. This is not free from objections, but I have used it on more than one occasion where the aerial employed was too effective. The "S.T.400" is so sensitive that a good aerial may readily overload it, thus preventing any attempt even at bringing double-channel reaction into play. If the aerial is good and you are close to a B.B.C. station, even the aerial and anode couplers at zero may be insufficient to cut down the input sufficiently to get, say, Mühlacker clear of London Regional.

I am against a reduction of aerial size, so a variable resistance may be used. Many commercial sets use a "local-distance" switch, which puts a resistance across aerial and earth. A fixed resistance of, say, 75 ohms could be tried on the "S.T.400" if the input is too great, even with aerial and anode couplers at zero.

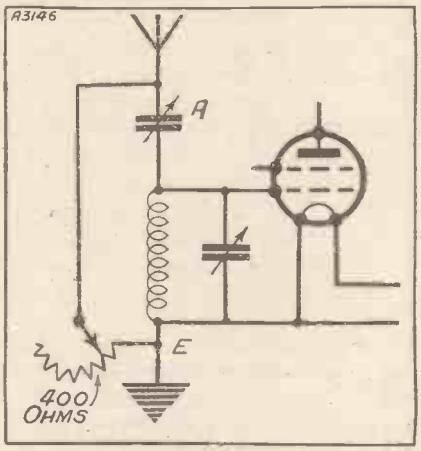
The above circumstances will be only rarely met with. The proper volume control is the aerial coupler, re-tuning on the aerial tuning condenser. If the volume is not reduced enough, try reducing the anode coupler as well.

Of course, you can also reduce the sensitivity of the set still further by using less H.T. on the screen of the S.G. valve.

Q. 8.—My set is perfectly stable on a friend's aerial and earth, but on my own I cannot stabilise it without great sacrifice of signal strength. What is the reason?

A.—Probably you have a dud earth. Nothing makes a set more unpleasantly lively than a poor ground connection. On the other hand, your friend's aerial may be leaky, and this would help to stabilise a faulty set.

THE SIMPLEST WAY



An easy method of controlling volume by means of a variable resistance connected between aerial and earth.

Q. 9.—Is a grid-bias cell an advantage on an S.G. valve? Can it be used on the "S.T.400"?

A.—Different manufacturers have their own recommendations. Some say "yes" and some say "on no account." It is safer, on the whole, to do without.

If you use one, I advise a Siemens' Cadmium cell, which gives 0·9 volt, and is designed for the job. Arrange matters so that it is not shorted by a wavechange switch.

Q. 10.—What do you think of parallel-fed L.F. transformers? Are they better than direct-fed types?

A.—The inductance of the primary of an L.F. transformer is usually greatly reduced by the flow of anode current. This renders the transformer less capable of reproducing the lower notes. By passing the direct current through an anode resistance, the transformer can do its job better as regards reproduction.

On the other hand, there is a loss in sensitivity, and you have the bother and expense of a feed resistance and condenser which probably make the combination dearer than a good direct-feed transformer.

But do we want "good" transformers? When there was little interference we did, but inferior transformers are commonly used so as to obtain a "rising characteristic"—i.e. greater reproduction of high notes which have been pruned by ultra-selective H.F. circuits.

Q. 11.—I bought a popular cheap kit set and find quality is very poor on the local stations, but much better on distant ones. Why is this?

A.—Probably it has a poor transformer giving tinny results (poor bass reproduction). On distant stations you use considerable reaction, and this weakens the higher notes *and greatly strenghtens the side-bands near the carrier wave*—(i.e. the waves corresponding to the bass notes.) Result; great improvement in quality.

To get the same quality on your local stations, cut down H.F. signal input (e.g. by series aerial condenser, if there is one) until signals are weak, and then bring them up by the liberal use of reaction. The effect may, from my experience, be startlingly good.

Q. 12.—May I use leaky-grid condenser rectification on the "S.T.400"? There seems some criticism of the "S.T.400" because anode-bend rectification is employed.

A.—Yes, by all means try grid condenser rectification. All you need do is to insert a ·0001-mfd. condenser in the grid lead of the detector, and connect a 1-megohm resistance across the grid and the positive filament terminal. The G.B.—1 wander-plug should be removed from G.B. battery and connected to L.T. — terminal.

The arguments which are advanced against anode-bend detection are also applicable to the grid condenser arrangement *as ordinarily used*, although this is not realised by many.

As the "S.T.400" will work well with either system, it affords an ideal opportunity for a comparative test, and I should like to hear readers' results. Those who pin their faith to the grid condenser system can still derive most of the "S.T.400" benefits.

The approved READY RADIO S.T.400

READY RADIO S.T.400 (A.C. Model)

£9-5-0

or 12 monthly payments of 18/6

Complete Kit without speaker

Complete Kit, with valves less speaker **£12-11-6** or 12 monthly payments of 25/3

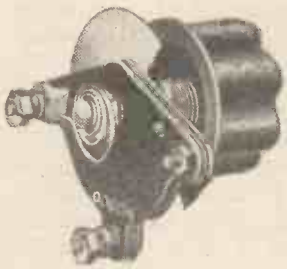
Complete Kit with valves, speaker and walnut cabinet **£16-10-9** or 12 monthly payments of 33/-

Insist on a Ready Radio S.T.400 Kit and you will be sure of getting *everything* necessary with panel ready cut and drilled, baseboard and Jiffilinx for wiring. Complete with full instructions.

INSIST UPON READY RADIO COMPONENTS FOR THE S.T.400

READY RADIO POTENTIOMETER

400-ohm baseboard-mounting Potentiometer (the only type suitable) - 2/9



READY RADIO AERIAL COUPLER

·00004-mfd.capacity 1/6

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Sturdily constructed, highly efficient - 5/-

Ready Radio Kits and Components are obtainable from all leading radio dealers. In case of difficulty order direct.

Ready Radio are the largest distributors and manufacturers of Kits in the World and are recognised as official distributors for all press Kits.

READY RADIO LTD., Eastnor House, Blackheath, S.E.3.
Telephone: Lee Green 5678. Telegrams: Readirad, Blackvil, London.

"With reference to my S.T.400 Receiver, described in the current issue of 'Wireless Constructor,' I have received for test from Messrs. Ready Radio Ltd. a Kit of parts in accordance with the circuit. This Kit has been tested, and has proved entirely satisfactory."

JOHN SCOTT-TAGGART.

Testimonial on the original Ready Radio S.T.400.

S.T.400 Battery Model

Complete Kit of parts, absolutely complete down to the last screw, and contains panel (ready cut and drilled), baseboard and Jiffilinx for wiring.

£4-17-6

Or deposit of 9/6 and 11 monthly payments of 9/9.

MODEL A

Complete Kit as above, with four specified valves, and handsome walnut cabinet fitted with Permanent Magnet Moving-Coil Speaker.

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MODEL B

Complete Kit with four specified valves.

£6-16-9

Or deposit of 12/6 and 11 monthly payments of 13/9.

FREE WITH EVERY KIT—

Full-size blue print and photoplan with Easy-build wiring chart and copy of "Wireless Constructor" containing full instructions.

MORE REPORTS FROM READERS

EDINBURGH.—"I am the proud possessor of one of your 'S.T.400' sets. I am able to receive upwards of 100 stations, the quality, volume and range leaving nothing to be desired."—Gordon Wood, 5, Braidburn Terrace, Edinburgh.

BELFAST.—"I must write to let you know how much I am delighted with your latest set—the 'S.T.400.' Nine months ago I built the 'S.T.300' and I was amazed at the range, power and quality. In fact, it was the best set I ever handled, so when the 'S.T.400' came I was very reluctant to convert it. Anyhow, last week I did, and was astonished at its performance. **The rapidity with which it brings in station after station, one after the other, is astounding. In most cases, the foreign stations are as strong as the local, and as for the selectivity problem—well, it is solved now!**

"Fécamp I get quite clear of Belfast. It takes a good one to do that. I have logged all the main stations in Europe (medium and long) and **on Sunday, December 4th, at 1 a.m., I received four American stations at full loudspeaker strength. During my nine years of wireless experience this is the finest set I have ever handled. You certainly never let us down."**—David Finlay, 416, Springfield Road, Belfast.

CHESTERFIELD.—"It surpassed my imagination. I think a schoolboy could build it, and a child could work it."—W. Skelton, Foljambe Road, Brimington, near Chesterfield.

NEWCASTLE.—"I have converted my 'S.T.300' to your latest 'S.T.400.' I cannot express myself in words how delightful I am with it, for it is beyond words.

"The set is so easy to work, and the stations are all clear and innumerable. I started on Wednesday to log some of them, and I got to 58 on three-quarters of the dials.

"I am three-quarters of a mile from Newcastle (5 N O) station, but I have no difficulty in cutting it out to receive Fécamp perfectly.

"I am ready to challenge you to see who can get most stations on my aerial and earth!"—A. S. Davison, 31, Auburn Gardens, Newcastle.

SHEFFIELD.—"I feel that in view of the performance of your set I must write to you. I built your 'S.T.300' but it is utterly bettered by the '400.' The tone, volume and selectivity are nothing short of remarkable. I find absolutely no difficulty in separating North Regional, Prague and Langenberg, and on the long waves Königs Wusterhausen is clear of Daventry. The reaction equaliser is a great help, as is the selectivity range adjuster. **In all I have received an average of 75 good programmes each night.** Thanking you for a great set."—F. E. Weedham, 24, Montgomery Road, Sheffield.

Here are extracts from the flood of letters appreciative of the "S.T.400." Remember them when it comes to considering the building of an "S.T." set.

PRESTON.—"I feel I must write and thank you for a most excellent set—the 'S.T.400.' The set does what you say as regards selectivity with ample volume. I had been waiting from your first announcement, and am more than glad I did wait, as at last I feel I have a set which fully endorses all your readers' views who had a personal test before publishing. I built the set in four hours. I have been building sets and dabbling with wireless during the war and ever since, and at last I feel I have a set to be justly proud of. Once more thanking you for a most excellent set."—J. E. Davenport, Brindle Road, Bamber Bridge, near Preston.

HAMMERSMITH (London).—"I took the set to a friend at Hammersmith and left it there! I don't think I could have rescued it if I wanted to! I actually had to search for London, and, I might add, his aerial was badly screened by very tall buildings within a few feet each side."—A. R. Barnard.

DURHAM.—"I have recently built and tested your 'S.T.400' receiver and have received 104 stations, 92 medium wave and 12 long wave. May I take this opportunity of congratulating you on the very great success of your latest circuit."—W. Ward, Queen's Road, Blackhill, Co. Durham.

PRESTON.—**"The strength and clarity of W A B C (New York) held me spellbound. I was so excited, I tried for more, and I got thirteen Americans on the loudspeaker, including W C A U, W P G, W T I C, K D K A, W A B C and W G Y.** I will be only too glad to demonstrate my 'S.T.400' to any would-be constructor. Thanking you again for such a great set."—C. M. Birket, 1, Nelson Street, Preston.

MUSWELL HILL (London, N.10).—"May I congratulate you on your wonderful achievement, namely, the 'S.T.400.' **It is certainly as good as any superhet that I have seen."**—E. C. Kearly, Colney Hatch Lane, Muswell Hill, London, N.10.

FOREST GATE (London, E.7).—"After wiring your 'S.T.400' and hearing its performance I feel I must let you know how satisfied I am. It is truly a wonderful set. I must add I have been wiring your circuits up since 1923."—W. Wiskin, 65, Studley Road, Forest Gate, E.7.

BATTERSEA (London, S.W.8).—"Your claims for the 'S.T.400' are too modest. It is by far the most superior set of its type I have had the pleasure of building. I have logged many stations, some of which were impossible to get on my previous set—a four-valve S.G. The strength, volume, and purity are great."—W. T. Clarke, 286, Queen's Road, Battersea, London, S.W.8.

SWINDON.—"Congratulations and many thanks for this fine set—the 'S.T.400.' It is truly a most astounding receiver."

"What a glorious thrill I had when I operated it for the first time. The quality, volume and selectivity are all that can be desired, and the ease of tuning-in any desired station clear of interference is simply great. **All the stations worth listening to were all obtained with the greatest ease, and every one clear of interference."**—A. W. Smith, 25, Whitehead Street, Swindon, Wilts.

HAYWARDS HEATH.—"I have built the '400' in radiogram form, and must say that it is the finest set that I have ever used."—C. Allen, Ardingly, Haywards Heath, Sussex.

PLYMOUTH.—"Having built your 'S.T. 400' we must congratulate you

"S.T.400" In Action—Remarkable Reports

on the remarkable results attainable on this receiver. Upon testing the 'S.T.400s' built by some of our clients, who had complained of poor results, we found in every case the trouble lay in either faulty components or in the constructor having considerably altered the layout, giving rise to instability. We have an 'S.T.400' built to your specification to convince anyone who may be dubious as to the results obtainable on this remarkable receiver."—Athenæum Radio Stores, 15, Athenæum Arcade, Plymouth.

* * *

SCARBOROUGH.—"Just a few words of thanks for giving to us fed-up wireless fans such a set as the 'S.T.400.'"—W. M. Bayes, Castle Road, Scarborough.

UCKFIELD.—"I have just completed your new and very successful set, 'S.T.400,' and am astounded at the remarkable set it is. I only lost one station out of your list, but got eight more in its place. I changed your 'S.T.300' to my present set and made it into an 'S.T.400' radiogram, and the above results are on a 40-ft. aerial."—M. Hards, Ringles Cross Garage, Uckfield, Sussex.

LIVERPOOL.—"I have never before written to anyone in the wireless world, although I have dabbled in its mysteries for about eight years. I converted my 'S.T.300' and, adapting your tone-control suggestions, used a ·001 mfd. in place of the ·006 mfd. What I am most impressed with is the tone, selectivity, power (with reserves always in hand), and ease with which it is handled, once one has become accustomed to it, despite all the knobs. I am grateful to have, at last, a set which **gives me all the stations I want, clear of mush and background,** all the volume I want, and despite the increase in power all over the globe, to know that one can cut them apart so easily."—P. Wood, 35, Ellerslie Road, Tuebrook, Liverpool.

* * *

ISLE OF MAN.—"I have to thank you for giving me unlimited pleasure, which is, after all, the principal object of your research. I can truthfully say for the first time I have the 'complete wireless.' You have built a set which has surprised me—and I have built a few. It is selective, everything one can desire in the way of simplicity, and it is fool-proof. One need not be scared of all the 'knobs.' I sincerely congratulate you."—Wm. Curphy, Victoria Road, Douglas, Isle of Man.

MANCHESTER.—"I will challenge any commercial receiver with my 'S.T.400.'"—F. Berisford, Sunny Brew Park, Gorton, Manchester.

CHADWELL HEATH.—"Heartiest congratulations! **Undoubtedly the star of receivers. 'S.T.100' was great, 'S.T.300' magnificent—but the 'S.T.400' is wonderful!** Like all your sets it does all you say. I have tuned-in practically all the stations you published, at more than full L.S. strength. Some of my friends who have 'S.T.300's' have been round and heard my 'S.T.400.' And the cry is: 'Kindly convert.' Once again, sincerest congratulations, and awaiting 'S.T.500'!"—E. C. Richardson, 14, Baron Road, Chadwell Heath, Essex.

WHERE DO YOU LIVE?

No matter where your home is, it cannot be far from a satisfied "S.T.400" Constructor. An excerpt from his letter is probably on these pages. Look for it and learn what unanimous satisfaction a good set can give.

ACTON. (London, W.3).—"Just a few lines to express my appreciation of your marvellous circuit, the 'S.T.400.' This set answers everything asked from it—tone, volume and above all, selectivity. **The local stations are put in their proper position and the distant stations brought up to the front line without a sound from 'Nat.' and 'Reg.'** My aerial is badly screened and yet it is capable of pulling in stations (well over 50) from all corners of Europe. I have read THE WIRELESS CONSTRUCTOR since the first number, but I do not remember a 'four' or 'five' that could equal the 'S.T.400.'"—Wm. J. Searle, Jnr., 81, Church Road, Acton, W.3.

* * *

LIVERPOOL.—"I have recently converted my 'S.T.300' to the 'S.T.400,' and **there is no doubt it is a set in a hundred. My list for one night was 69, including 14 American stations,** all at good loud-speaker strength."—T. A. Riley, Everton, Liverpool.

MUSWELL HILL (London, N.10).—"You will guess from my address that I have had a hard fight to get selectivity and range here—about six sets a year I have made up. Now, at last, I have a permanent set in the 'S.T.400.' All that is said of it is true, and **the most surprising thing about it is the uncanny silence of the set in the intervals between programmes.**"—H. Jeffries, Greenham Road, Muswell Hill, N.10.

* * *

ORPINGTON.—"**Built 'S.T.400.' Phew! 'Smarvellous.**"—G. C. B., Charterhouse Road, Orpington, Kent.

CHARTHAM HATCH.—"I am satisfied the 'S.T.400' is absolutely the finest circuit both for selectivity, volume and general efficiency that has ever been placed before the public. I shall have no hesitation in recommending the 'S.T.400' to every person that I have conversation with about wireless."—A. J. Watts, Romden, Chartham Hatch.

PECKHAM (London, S.E.5).—"When I look at my log I feel I must write you expressing my thanks and my amazement at such a wonderful performance. **Tuesday 63 stations, Wednesday 55, and Thursday 61—all on an indoor aerial.**"—A. F. Larkman, Peckham, S.E.5.

READING.—"I have just completed it and think it a marvellous set. I am quite a novice at wireless, having built one set before, but I managed to get it going straight away, and have already picked up quite a lot of stations very selectively. I find it a very powerful set.

A friend of mine here who has built a number of sets has now built the 'S.T.400' for a friend of his. He finds it so good that he is loth to part with it. I know of others who have also built it and they all speak very highly of it. Thank you for the splendid way it is detailed out. It is impossible to go wrong."—S. Stroud, Earley Hill Road, Reading.

* * *

ISLEWORTH.—"You must be receiving shoals of congratulations on the remarkable performance of your 'S.T.400.' Allow me to offer mine. I was astounded and, to say the least, overjoyed at the results I received.

Quality is fine, and the gramophone side is perfect. I am chattering away to everybody about this set and despite the fact that I have built many radio sets during the last seven years, I feel like a schoolboy when he becomes the proud possessor of his first pocket knife!"—E. J. Hall, Woodland Gdns., Isleworth, Mddsx.

(*Please turn to page* 374.)

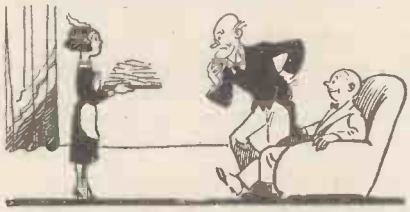
IN LIGHTER VEIN

By Wireless Wayfarer

"THE post, sir," announced Emily Jane, the Professor's maid, handing him a tray piled up with envelopes. The Professor groaned. "Look at the infernal things," he said. "All the wrong shape."

It has often been a puzzle to me why people should always send their disgusting bills in those narrow, mean-looking envelopes. You know at once what these contain without even opening them. I must admit that this saves a great deal of trouble so far as I am concerned, but all the same I do feel that bills would be much less unwelcome somehow if they came in nice, fat-looking, square envelopes.

THE PROFESSOR'S POST



"Those narrow, mean-looking envelopes—you know at once what they contain."

"Look at them," murmured the Professor.

"Why?" I asked. "Why bother? Shove the lot in the fire, or mark them 'Gone, no address' and send them back."

Financial Troubles

Some years ago the Professor left unopened for months one of these nasty looking envelopes and when he did look inside found that it contained a cheque for a tenner. He is so afraid of doing anything of the kind again that he cannot now treat bills as they should be treated. Instead, he began to examine the wretched things one by one.

"In the hands of our solicitors," he muttered, glancing at the first, and then rapidly went through the pile. "Very much overdue—proceedings forthwith—electric light will be disconnected—Dr. Miggles must insist upon settlement—Mr. Blinks, the butcher, won't supply any further meat until——"

You have heard of free grid bias. This month "Wayfarer" describes something that was much better—his system of free-current charging for accumulators!

"My friend," I said, "I think I have diagnosed your trouble. Unless I am greatly in error, the jolly old finances are not exactly what they might be. Correct me if I am wrong."

Ways and Means

The Professor smiled a sickly smile of agreement. Then I confessed that my own case was very much the same only much more so, and we formed ourselves into a committee of ways and means.

Rather sadly we decided that raising the wind was by no means as easy as it had been in previous crises, since all of our friends and acquaintances having been more than once bitten were by now more than twice shy. Many suggestions were made and rejected before I hit upon a clear and obvious winner.

"Let's start a charging station," I cried, and the Professor fell upon my neck, weeping tears of joy.

Until I described to him the Wayfarer system of free-current charging (you have heard of free grid bias: this is one better), the Professor was afraid that lack of capital might prevent us from getting the charging station into action. But once he understood the scheme he agreed that there were no obstacles in the way.

Transport Problems

Mrs. Goop happening fortunately to be out, we were able to commandeer the micro-Goops' perambulator, and with this we set forth to make our first collection. Primpleson, Tootle, Captain Buckett, Miss Worple and all the rest were overjoyed to learn that charging was about to be done properly (it was, but not the kind of charging they meant), and handed us simply stacks of batteries for attention. Of course, we told all of them that the acid required changing and that there would be a slight extra fee for this.

It was obviously our lucky day, for the axles of the perambulator did not break until we were almost back at the door of the "Microfarads." Then both went simultaneously and the thing sat down. It didn't matter in the least, for we had only a yard or two to carry the batteries.

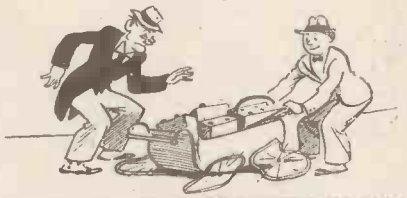
The first process was to change the acid, for which our fee was half-a-crown a time. This was easily done by pouring that from Sir K. N. Pepper's into Tootle's, Tootle's into Miss Worple's, and so on, round the ring.

Delightfully Simple

Then we started on our free-current charge. As we had collected twenty-four batteries, none of which was anything like flat, we had quite a lot of volts to play with. Selecting Tootle, Primpleson and Winklesworth as the probable best payers, we decided to deal with theirs first.

The process is delightfully simple and it is really amazing that no one should have thought of it before. For

OUR LUCKY DAY



"The perambulator did not break down until we were almost at the back door."

Tootle's accumulator we just wired Sir K. N. Pepper's and Captain Buckett's in series and then connected the combination positive to positive and negative to negative to the single cell. It bubbled a bit, but I always think that there is nothing like a good boosting charge for an accumulator that is looking a little tired.

In Lighter Vein—*continued*

As soon as the first free-current batteries were flat out we just used two more—there were plenty available. The three selected batteries were charged in almost record time, and we were able to deliver them and to collect the money next morning. Our original collecting and delivery van having broken down the previous day, we pressed Captain Buckett's baby car into service, the owner being happily away from home when we visited his garage.

Sudden Inspiration

Our fee of five shillings a time for special charge and special attention was readily paid, and with fifteen shillings in hand we felt things were looking up. We were now able to collect a further supply of batteries with which to continue our free-current charging.

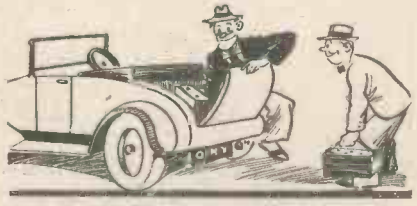
One of those sudden inspirations which come to geniuses like myself enabled us to get some really good work out of Captain Buckett's car battery, and when this flopped we were able to use the dynamo with the car lever in neutral.

I cannot think why people won't take the trouble to see that the sumps of their engines are properly filled with oil. We naturally assumed that the captain would have taken this precaution, and kept the engine revving like anything. It was really quite a shock to us when the big end went, but you will see that we were in no way to blame.

Business Expansion

However, all's well that ends well. We were able to push the car back to his garage under the cover of darkness and before the captain returned. A fresh collecting and delivery van was

THE BORROWED "BABY"



"The owner being happily away when we visited the garage."

then improvised from a soap-box and spare wheels, kindly, if unwittingly, lent by various friends.

By this time our business had grown to such proportions that I was seldom able to snatch more than three or four hours for my after-lunch nap. The only trouble was that, unless we could go on expanding indefinitely, the supply of booster batteries must obviously dry up before so very long.

HIS "GRAND" IDEA

"A little offering of primroses or violets."

However, we now had a certain amount of capital in hand, and we felt quite justified in investing some of this in plant. Owing to the oddities of our local current supply a rotary converter seemed the best thing, and we were able to pick up one of these for something like the proverbial old song.

Working Out Well

The Professor's electricity supplies having been by this time cut off because he preferred to spend his profits upon the juice of the grape rather than that of the dynamo, we were faced with the problem of supplying the motor part of our converter with the necessary wherewithal. Most people would have been completely floored, but we Wayfarers never know when we are beaten. On the whole it all worked out very well indeed.

Miss Worple's is one of those twin-wired aerials, and she never uses her wireless set until about eight o'clock in the evening. Her house is next door to the Professor's, and it was an easy business really to connect two unobtrusive leads to the far ends of her aerial wire. These were taken to our converter.

The Hidden Power

Two other wires and a small but effective switch were installed at the other end of the aerial. These led to a power plug hidden behind Miss Worple's grand piano. We had of course to snip one arm of the down-lead "Y," but this did the good lady no harm at all; in fact, she was surprised to find how much improved her set had suddenly become as regards selectivity.

Each morning at about ten o'clock one or other of us called upon the dear lady with a little offering of primroses, or violets, and whilst we were waiting for her the plug was slipped into the electric power socket on the skirting board.

The one who had not called in the morning did so in the evening, removing the plug and switching on her aerial in good time for her to enjoy reception of the programmes.

On Velvet

For the time being, at any rate, the Professor and I are on velvet. We have, I feel, demonstrated first of all that good service pays, and secondly that there is real money in an intelligently run accumulator-charging station. All, I think, will be well unless some criminal suggests to Miss Worple that daylight reception is marvellous nowadays. I can only hope that he will assist her during her first attempt and that he will receive, not metaphorically, the shock of his life.

A NOISY WARMING

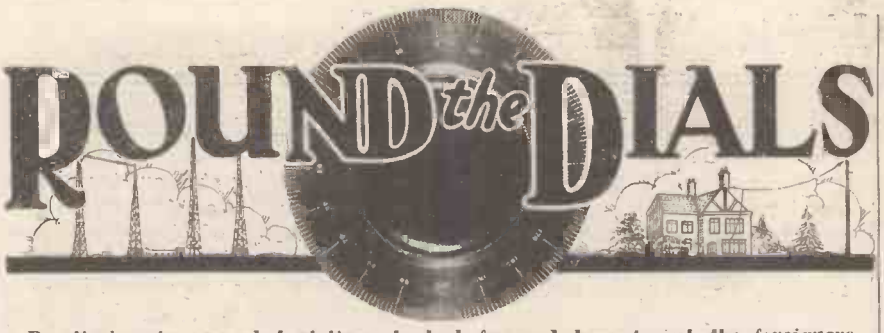
Have you ever experienced it?

IT does happen occasionally—and if you are one of those to whom it has occurred, you may have been puzzled to know what it was. The effect is noticed when the set is switched on, and is most likely to be heard on a set using a pentode output valve.

The noise is metallic in nature, comes from the loudspeaker, of course, and is very reminiscent of the sound of a steel-wire being stretched. It is due to the expansion which takes place when the electrodes warm up, due to the heat of the filament.

The slight movement causes a support, perhaps not quite as tight as it should be, to move; and rubbing together, the support and what it is supporting vibrate. This causing a fluctuation of anode current in unison, thus making the sound mentioned to be heard from the loudspeaker.

A. S. C.



Practical notes on what stations to look for and how to get the foreigners that are coming over well.

MOST keen long-distance listeners have found the past few weeks particularly interesting, because of the rather freakish results which have been noticeable.

On the whole, reception has been distinctly excellent, and yet on several occasions there has been a certain "ether sluggishness" in evidence, and we have had what the DX man calls a "puddeny" effect, when the usually lively foreigners seemed reluctant to travel far.

* * *

To off-set an occasional disappointing evening, we have experienced some really "starry" nights, when low-powered Scandinavians blossomed out like young Regionals, and Russian, Hungarian relays, and other far-off programme providers, came over with unwonted punch and clarity.

Americans, too, sometimes arrived before midnight, on medium waves, but judging by general experience there have been fewer transatlantic scoops in 1933 than at the end of last year.

* * *

Another queer effect noticed, especially in the North, is that very low-powered stations—like Stavanger on 240 metres—can occasionally be heard quite well before dark. Despite the fact that the power is only a quarter of a kilowatt, this station, and certain of his colleagues, relay Stockholm at the bottom of the medium waveband with such vigour that that usually rather uninteresting end of the dial has deserved constant attention.

* * *

Incidentally, there is a new Hungarian on 210 metres, named Magyarovar, whose relays of the Budapest programme have occasionally been receivable. This is particularly interesting because Budapest is to have several other similar relays in action during the next few months.

* * *

Just above the middle of the medium-wave dial Dublin has been going strong, and Katowice and Radio Suisse Romande (Sottens) have also excelled themselves, with the result that we have had another good group to test our set's selective powers. The respective wavelengths (413 m., 408 m., and 403 m.) are so close together, and to Midland Regional's, that any set-owner who can separate those programmes has something to boast about.

Dublin, by the way, does not seem to be getting much stronger now, although it was stated some weeks ago that he was due to open out on the full new power rendered possible by the move to Athlone.

* * *

The B.B.C., though saying but little about the new Droitwich site for 5 X X, has hinted that it will probably be in use in a little over twelve months from now.

It seems a long time to wait, but there is a rumour that the new Daventry's prowess is going to cause quite as much sensation as the original 5 X X station did when it commenced its career.

IF you listen regularly to Radio Normandie and Radio Paris, the popular French stations, you may have noted that H. Clarke & Co. (Manchester), Ltd., are now advertising their far-famed "Atlas" products over the air.

The Radio Paris "Atlas" programme is timed from 3 to 3.30 p.m. on Sundays, while Radio Normandie has two sessions on the same day—5.30 to 6 p.m., and also 10 to 10.30 p.m.

From Ferranti's

Gramophone and quality enthusiasts will be particularly interested in the 46-page Ferranti publication on "Constructional Power Amplifiers and Receivers," now issued at sixpence per copy.

Three different band-pass receivers, a battery or mains amplifier, and three mains amplifiers are dealt with, and the pamphlet can be obtained by any reader who sends the above-named sum to Ferranti, Ltd., Hollinwood, Lancs.

POINTS FOR PURCHASERS

Interesting details from manufacturers about recent trade activities.

"Trix" New Lines

Talking about mains, you might note that Eric J. Lever (Trix), Ltd., have just issued a new list of mains transformers and chokes. Several new types are now available, and a postcard to 8 and 9, Clerkenwell Green, E.C.1, will bring you details.

Change of Address

If you are writing to Lectro Linx, Ltd., in praise of their "S.T.400" Terminal Kit, or on any other "Clix" subject, please address your letters to 79a, Rochester Row, Westminster, London, S.W.1—the firm's new address.

Dubilier Service

Arrangements were recently completed whereby the National Radio Service Co., of 15, Alfred Place, London, W.1, take over the servicing of all Dubilier receivers. Needless to say, Dubilier clients can rely on the efficiency of the organisation to which their inquiries should now be forwarded.

Cossor Publications

Admirers of the 40-page Cossor Valve and Wireless Book—still obtainable by any WIRELESS CONSTRUCTOR reader who applies to A. C. Cossor, Ltd., Melody Dept., Highbury Grove, London, N.5—will be glad to know of another handsome publication by this firm. It is in the form of a constructional folder for the builders of their famous "Melody Maker."

Illustrated by photogravure and detailing step by step the various stages of assembly, it worthily upholds the enviable reputation that the Highbury firm has achieved for this class of service to the public. When applying state whether you are interested in the battery-operated or the mains-driven model.

JOHN SCOTT TAGGART'S ST.400

STILL THE BEST SET FOR THE HOME CONSTRUCTOR

A.C. MAINS MODEL

DE LUXE BATTERY MODEL

		£	s.	d.
1	R.I. "Hypermite" L.F. transformer		12	6
1	R.I. Audirad L.F. choke		8	9
1	Wearite mains transformer to give 250v.-0-250v. (60 m.a.), 2v.-0-2v. (1 amp.) 2v.-0-2v. (4 amps.), new dial type T.21A	1	5	0
3	T.C.C. 4-mfd. fixed condensers, 400 volts peak, type 80	1	5	6
4	T.C.C. 1-mfd. fixed condensers, type 50		11	4
2	T.C.C. 2-mfd. fixed condensers, type 50		7	8
1	T.C.C. 2-mfd. fixed condenser, type 80		5	0
1	Dubilier ·01-mfd. fixed condenser, type 670		2	0
2	Dubilier ·002-mfd. fixed condensers, type 670		2	6
1	Dubilier ·0003-mfd. fixed condenser, type 670		1	0
1	Dubilier ·0005-mfd. fixed condenser type 670		1	3
2	Erie 300-ohm resistors, 1-watt type		2	0
1	Erie 30,000-ohm resistor, 1-watt type		1	0
1	Erie 40,000-ohm resistor, 1-watt type		1	0
1	Erie 7,000-ohm resistor, 1-watt type		1	0
1	Erie 750-ohm resistor, 1-watt type		1	0
1	Erie 5,000-ohm resistor 1-watt type		1	0
1	Erie 20,000-ohm resistor, 1-watt type		1	0
1	Erie 50,000-ohm resistor, 1-watt type		1	0
1	Erie 12,000-ohm resistor, 1-watt type		1	0
1	Erie 10,000-ohm resistor, 1-watt type		1	0
1	Ready Radio potentiometer, 400 ohms		2	9
1	Pair Colvern's S.T.400 coils		9	10
2	Polar No. 2.S.M. ·0005-mfd. variable condensers		13	0
2	Telsen ·0003-mfd. pre-set condensers		2	6
1	Ready Radio ·0003-mfd. differential condenser		3	0
1	Lotus ·00035-mfd. differential condenser, type MD35		3	0
1	Igranic 1,500-ohms spaghetti resistance			6
1	Universal type S.G. valve holder		1	0
3	5-pin valve holders		2	3
1	Ready Radio Binocular S.G. choke		5	0
1	Ready Radio reaction choke		1	6
2	Bulgin 2-pt. on-off toggle switches, type S.80		3	0
1	Ready Radio "Micadi" ·00004-mfd. aerial coupler		1	6
1	Graham Farish knob			6
2	Ready Radio 2-pt. switches		1	8
1	R.G. switch		2	9
1	Bulgin F.15 combined mains plug and fuseholder		3	6
5	Terminals (Belling-Lee) type R		1	1
1	Belling-Lee S.G. anode connector			4
1	Ready Radio ·0001-mfd. differential condenser		2	6
1	Rola "S.T.400" F.6 moving coil speaker	1	15	0
1	Direct Radio "159" type consolette cabinet for A.C. "S.T.400" (with special combined shelf and baffle which slides out and greatly facilitates set construction)	2	5	0
1	Direct Radio "S.T.400" screen		2	0
4	Valves: Marconi or Osram M.S.4B, Cossor 41M.R.C., Mazda A.C./PEN, Mullard D.W.2	3	5	0
	Screws, wire, flex, etc.		3	4
		£16	5	0

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We specialise in Radio for Export. Goods to your exact specification are very carefully packed and insured, all charges forward. Terms: Cash with order, or deposit one-third with order. Balance C.O.D.

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S.T.400 ACCESSORIES

		£	s.	d.
1	Siemens 120-volt H.T. battery		13	6
1	Siemens 9-volt G.B. battery		1	0
1	Oldham 0-50 accumulator		9	0
1	Epoch Twentieth Century permanent magnet moving-coil speaker with input transformer	1	15	0
1	Blue Spot 44R magnetic type speaker in oak cabinet	2	12	6
1	Atlas A.C.244 mains unit	2	19	6
1	Atlas A.K.260 mains unit, with trickle charger	4	10	0
1	Atlas D.C. 15/25 for D.C. mains	1	19	6
1	Cop aerial lead-in and lightning arrester		2	6
1	Selectanet indoor aerial		2	6
1	Selectanet earth		1	6

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Exact to T.C.C. booklet specification with all necessary components, screws, wire, baseboard, terminals, mains plug, etc.

Power Unit No. 1, £3.7.6, or 10 monthly payments of 7/6,

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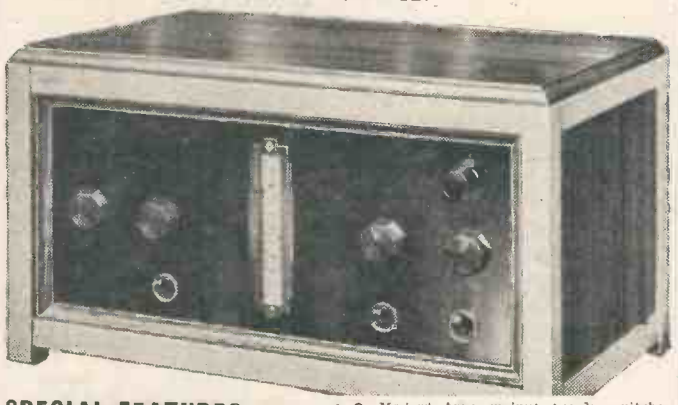
Power Unit No. 4, £5.5.0, or 12 monthly payments of 10/-.

Full constructional details of these units are contained in a book entitled "The Design and Construction of Radio Power Units," obtainable, price 6d., from The Telegraph Condenser Co., Wales Farm Road, North Acton, W.3.

"S.T.400" DE LUXE MODEL

Obtainable only from the official Distributors—DIRECT RADIO, LONDON BRIDGE.



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WISE SPENDING—DISCRIMINATING SET BUILDERS INSIST ON DIRECT RADIO SPECIFICATION

UNWANTED COUPLINGS

A PRACTICAL ARTICLE

by Victor King.

THE relinquishment of elaborate shielding has left us somewhat at the mercy of peculiar coupling effects.

Those sets which employed bulky screening boxes for whole stages, plus metal panels, metallised baseboards, and goodness knows what else besides, were at least stable.

Though one is bound to add that they were also often rather insensitive!

Unwanted Coupling

And now we are building and using sets which are not always effectively shielded, but are generally highly efficient because of their better components and better valves.

It is true, as I have said on previous occasions, that components are very well screened these days; or, at least, many are. But, unfortunately, however excellent may be the screening of the individual parts, there are several ways in which unwanted coupling can occur and cause instability and howling.

Of course, designers are well aware of this, and no good receiver design will be inherently unstable. The danger lies in making what may seem to be quite minor variations from the design.

Hopelessly Unstable

I can give you a very good example to show you what I mean. A week or two ago I built up a quite straightforward S.G. "Three" outfit. Not one devised by myself; for once I had placed myself in the position of an ordinary constructor and was copying, as a matter of interest, the design of another.

But I must admit that I hurried over the wiring and worked from the theoretical circuit instead of following the wiring diagram.

The set was wired up correctly so far as the circuit was concerned, but it proved hopelessly unstable, and my opinion of the designer fell considerably!

However, it was my own fault, because I hadn't wired the receiver in the manner directed.

Rather Critical

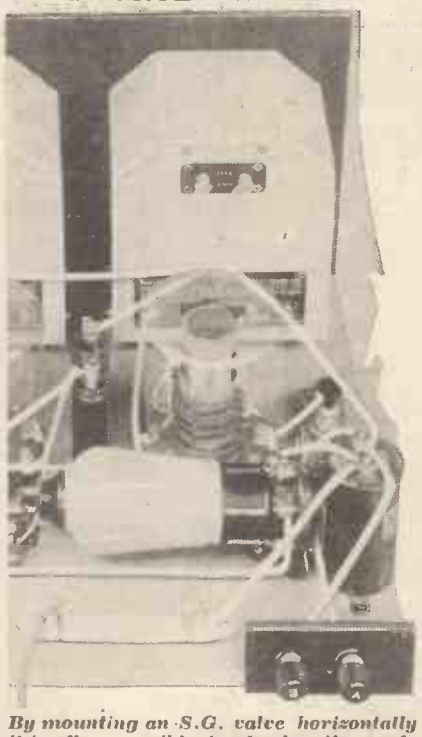
There was a filament lead which also ran to the moving vanes of the two tuning condensers.

I took this lead up to the condensers first, and, although it was an "earthed" lead, it provided a coupling link between the anode and grid circuits of the S.G. valve, with the result that there was serious instability.

When the lead was altered, everything was perfectly O.K. I must say I thought the set was rather more critical than it ought to have been, although when wired as directed it gave excellent results.

One of the most critical of all the leads in a set using an S.G. valve is the lead which joins to the anode terminal of the S.G. valve. In order to shorten this lead as much as possible it is often arranged that the valve is mounted in a horizontal position.

SHORTER WIRING



By mounting an S.G. valve horizontally it is often possible to shorten its anode lead a great deal.

Metal-Covered Lead

Even then it may still be the cause of too much unwanted coupling, in which case it should be enclosed in metal sleeving or consist of metal-covered wire. The metal covering or sleeving should, of course, be earthed.

Hum in mains sets is frequently extremely difficult to eliminate, especially the last residue.

I met an instance not so long ago when the mains rectifying valve was injecting hum direct into the H.F. and detector part of a set.

No Help from Screening

Obviously, no ordinary smoothing would have been of the slightest use. And it was only by a fortunate mischance that the fault was discovered quite early on in the trouble-tracking proceedings.

By the way, if you meet with serious hum troubles in a mains set, don't waste your time tinkering with shielding and screening. No normal screening is likely to help you a scrap.

People often argue that the couplings between H.F. valves cannot transfer low-frequency mains hum.

Of course this is so, and you can always detect hum brought in at the H.F. end because it can only be heard *when a station is being received.* The hum *modulates* the received station's carrier, is detected by the detector, and then passed through the L.F. stages to the speaker!

MATCHING THE OUTPUT

An ingenious explanation of why it usually happens that the output circuit should have an impedance of about twice that of the power valve itself.

By GEO. LENNIE

IT is a well known and easily proved contention that the maximum power from a power or output valve is obtained when the resistance connected in the anode circuit is equal to the internal resistance of the valve. It is also stated that this combination does not give distortionless reproduction. Let us go farther into this and see what value of anode resistance will give us good reproduction. Of course, it is assumed that the previous valve is passing to the output valve distortionless signals. Now, we know

Fig 3.

R in ohms	Anode current in m.a.	Voltage drop across R. Volts	Battery voltage
1,000	20	20	220
2,000	20	40	240
4,000	20	80	280
8,000	20	160	360

that the signals we wish to amplify are alternating currents—that is, they vary about a mean value of steady current. That steady current is that which the valve is passing when no signals are impressed on the grid.

When a signal is impressed on the grid, this mean value of current rises and falls, and—here is an important point—if a frequency of, say, 200 cycles per second is applied to the grid, then the anode current will vary at this frequency and the rise in current should equal the fall in current. This is, if one part of the applied constant frequency causes the anode current to rise by, say, 15 m.a., then another part should cause it to fall by 15 m.a.

Distortionless Output

In Fig. 1 the line AB represents the steady anode current when no signals are passing. The wavy line shows what happens when we apply a frequency of about 200 cycles per second, or, approximately, when we hear middle C of the piano. The steady current of the valve, 20 m.a., rises to 35 m.a., then back to 20, then down to 5, and so on just as long as the frequency is applied to the grid.

This is true reproduction, or distortionless output. And now let us try an experiment by connecting up the apparatus as shown in Fig. 2. We shall take a valve with the following characteristics:

Anode volts, 200.
Grid bias, — 20.
Anode impedance, 2,000 ohms.

Maintaining Plate Voltage

At this anode voltage and grid bias the anode current is 20 m.a. All the "twos" look impressive, but actually we could substitute the corresponding figures for any valve in which we were interested. At R we insert first a resistance of 1,000 ohms, then 2,000 ohms, then 4,000 ohms, and, lastly, 8,000 ohms. Now, when no signal is on the grid we must have 200 volts on the anode with each of these resistances in place, and to maintain this voltage the battery voltage must be altered as shown in the table Fig 3. Each of the values in this table are taken at a grid bias of — 20 volts. With each resistance in place we shall vary the grid volts from 0 to — 40, and at each value of grid voltage we shall obtain a different reading on the milliammeter.

In the table, Fig. 4, are some results obtained in our experiment. The first column shows the value of grid-bias volts applied, the second the anode current with 1,000 ohms in circuit, the third with 2,000 ohms, and so on.

Current Rise and Fall

Looking at this table, what do we find? Remember, our normal grid bias is —20 volts. We note this, that with the resistance of 1,000 ohms in the anode circuit, between 20 and 40 grid-bias volts, the anode current has dropped from 20 m.a. to 1 m.a., a difference of 19 m.a., while between 20 and 0 volts the current has increased from 20 m.a. to 54 m.a., a difference of 34 m.a. This obviously will not give us true reproduction, because, as previously stated, true reproduction will only be obtained when the fall in current is equal, or nearly equal, to the rise in current. This condition is satisfied when the anode external resistance is 4,000 or 8,000 ohms. But we know that the maximum power is obtained from the valve when the external resistance equals the internal resistance. Unfortunately, when the external resistance is 2,000 ohms, we see that when the grid bias is changed from 20 to 40 volts, the fall in current is 18 m.a.;

Fig 4.

Grid-bias volts	Anode current with external resistance of			
	1,000 ohms	2,000 ohms	4,000 ohms	8,000 ohms
40	1	2	5	10
30	7·5	10	13	15
20	20	20	20	20
10	37	33	29	25
0	54	45	36	31

(*Please turn to page* 378)

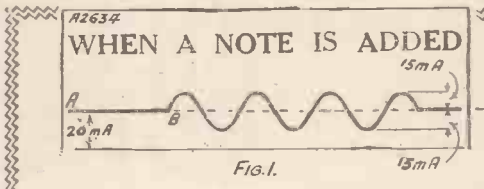


FIG. 1.

AN EXPERIMENTAL CIRCUIT

The tables of Figs. 3 and 4 were prepared with a circuit arrangement similar to that of Fig. 2. The milliammeter is to ensure that the anode voltage remains constant.

Fig. 1 explains just what happens to the anode current of a valve when a steady note is applied to the grid.

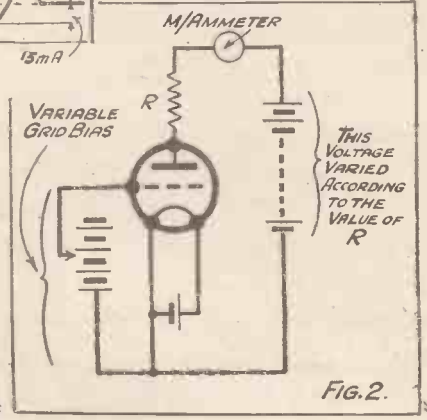
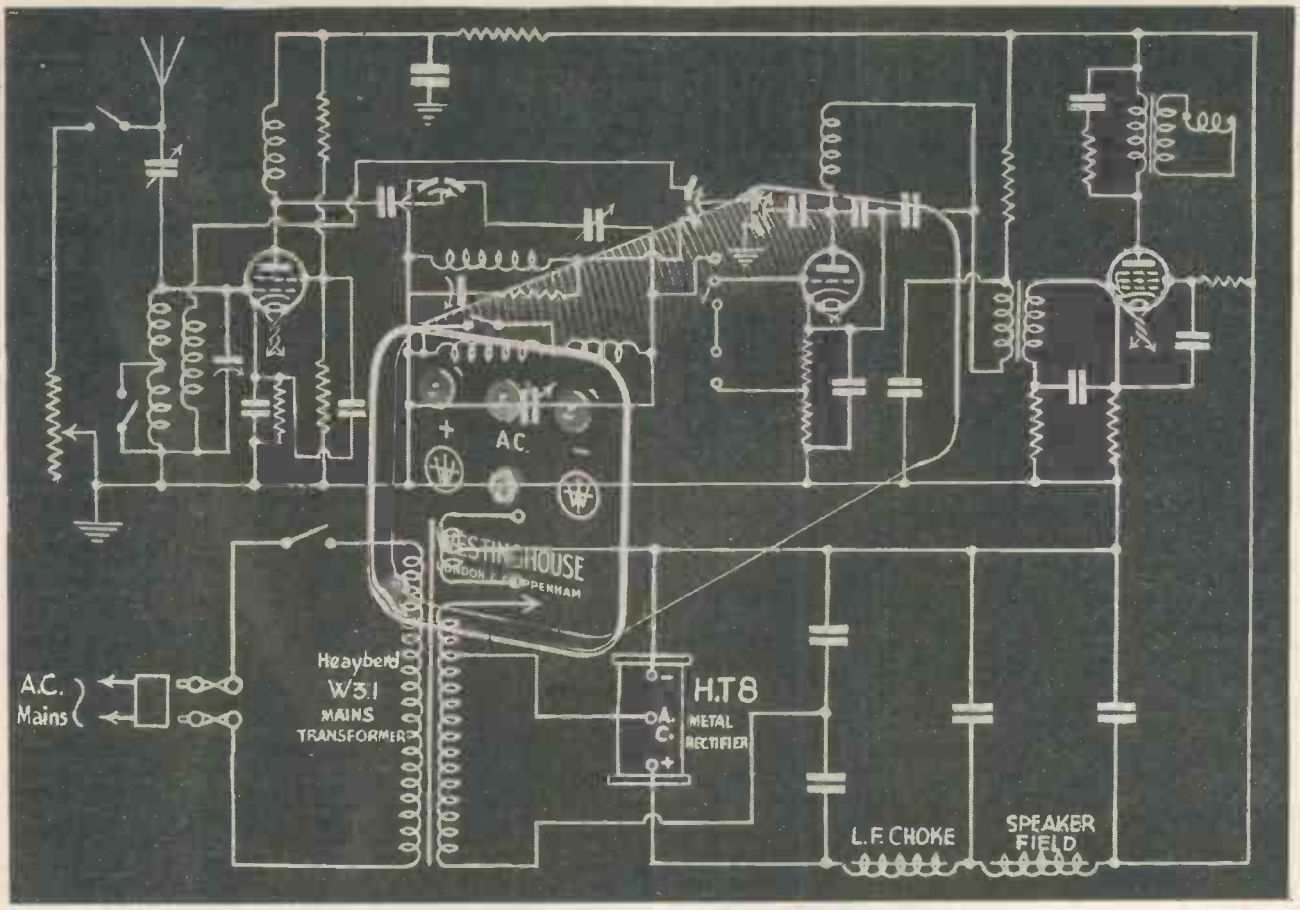


FIG. 2.



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The modifications are but slight—substitute a Westinghouse H.T.8 Metal Rectifier and Heayberd W. 31 Mains Transformer for the rectifying valve and its appropriate transformer, and use one extra 4 mfd. condenser to obtain the advantages of the 'voltage-doubler' system. You will then be assured of a constant and lasting high-tension supply, with no replacements and consequent better reception.

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MORE REPORTS FROM READERS

—continued from page 362

WALSALL.—"I have had marvellous results."—Wm. Taylor, South Street, Walsall, Staffs.

DORCHESTER.—"Just a line to tell you that my 'S.T.400' is a great success. I had trouble with spaghettis, but have fitted Dubilier metallised resistances instead, and they work perfectly. With a Rola moving-coil speaker the set is superb.

"I have built many sets, but take my hat off to 'S.T.' for the best set I have ever attempted. It beats my all-mains set to a cocked hat, and my wife says she prefers the tone any time, as it is so much better quality. My next-door neighbour said he thought I had a seven-valve superhet!"—D. C. Harding, South Street, Dorchester.

BROTTON-IN-CLEVELAND.—"I have given it a good test on both bands and have logged 72 stations, 59 on the medium band and 13 on the long waves. My aerial is about 45 feet long and all the stations logged were free from interference.

"I think it is the most selective set I have handled. Selectivity and volume are great. A set like the 'S.T.400' is worthy of all the praise it gets. I am using a 99 P.M. moving-coil Blue Spot, and it is simply great."—A. G. Roberts, Ings Lane, Brotton-in-Cleveland, Yorks.

BRISTOL.—"Thank you for a really wonderful receiver, which I converted from the 'S.T.300.'"—T. Callear, Duckmoor Road, Ashton Gate, Bristol.

SLOUGH.—"I am entirely satisfied with my 'S.T.400,' and would not exchange it for the most expensive radiogram on the market. I logged 25 American stations from midnight to 5 a.m. last Thursday morning."

MILE END (London, E.1).—"I have built many sets, but your 'S.T.400' is the best. Results are amazing."—A. Turner, Devonshire Street, London, E.1.

ILFORD.—"May I, as a successful builder of the 'S.T.400,' advise all readers to see that their components are sound. Presets may be tested by screwing knob right out and then, in its place, press down a stout wire; if it is pushed up on releasing, the preset is O.K. Be sure your valves are O.K. I am perfectly willing to help any 'S.T.400' or 'S.T.300' builders in this district."—Chas. H. Grover, 297, Eton Road, Ilford.

MANCHESTER.—"A month ago I converted my 4-valve set (2 S.G., det., and L.F.) to the 'S.T.400,' and the improvement is astonishing. The old set gave very good volume and quality, but was not very selective. The 'S.T.400,' however, is extremely selective, and the surprising thing is that it gives louder and clearer results than ever before. On a 100-foot outside aerial I receive 80 stations on a good night.

"One morning at 2 a.m. I tuned-in and identified three or four U.S.A. stations. In addition, I heard a station just above Genoa's wavelength announcing 'Radio Nacional de Buenos Aires.' Thanking Mr. Scott-Taggart for such a wonderfully efficient receiver."—K. Whitnall, Western Road, Flixton, Nr. Manchester.

POPLAR.—"My set is now working wonderfully well. I took your advice about changing the transformer and installing the specified one, discovered a dud valve-holder, and found the two reaction differentials needed changing round. A dismal failure has been changed to a wonderful success."—R. Adams, Stainsby Road, Poplar, London, E.14.

ABERTILLERY, MON.—"After giving it a month's trial, I am one of the many thousands who wish to congratulate you on producing such a wonderful set as the 'S.T.400.' When you wrote 'Old circuits should not be raked up but ripped up,' I did not appreciate your remark until I made up my 'S.T.400'; for like most enthusiasts, I thought my former set one of the best.

"My friend, whom I persuaded to purchase a kit of parts, did not know the first thing regarding wireless construction, but he built the 'S.T.400' without assistance, which speaks much for your wonderful rapid construction guides. All the members of our staff will soon be owners of this wonder set, for I am voicing their opinions as well as my own when I say, 'It is the best set yet designed.'"—H. Telway, 33, Newall Street, Abertillery, Mon., Wales.

STAINES.—"I must say it is a marvellous set. I have logged 61 stations on an aerial 32 ft. long and 15 ft. high, all at loudspeaker strength."—H. Ellis, Goring Road, Staines.

SUDBURY.—"May I add my voice of approval of your new set? I had some doubts as to the wisdom of starting to convert my old one (an 'S.T.300' with extra L.F. added), especially as I rather doubted the wisdom of anode-bend detection, but I comforted myself by saying that I could easily go back to leaky grid, if necessary, and went ahead.

"I am very pleased with the result; volume and tone excellent and really wonderful selectivity, London Regional coming in clear of Stuttgart without the slightest difficulty, and Stuttgart clear of London with quite the minimum of knob-twiddling."—Capt. R. N., Newton Green, Sudbury.

RYE.—"Let me give out a few medals with regard to the set itself. The selectivity is extraordinarily good without loss of volume and without loss of frequency range to any appreciable extent. I tested the latter one evening with the aid of Mr. Watson Watt, of the B.B.C., and covered from 50 cycles per second to 6,000 cycles without much loss at any frequency on a P.M. moving-coil speaker."—R. P. Coleman, Cadboro' Road, Rye, Sussex.

PRESTON.—"I did not waste any time in converting my 'S.T.300' to an 'S.T.400' when it made its appearance. And what a set it is! I am afraid you will have to retire on your laurels, as it does not seem possible to design any better circuit. Let me thank you for a most marvellous set."—J. Darlington, Nelson Terrace, Preston, Lancs.

EALING (London, W.5).—"I am writing to tell you how delighted I am with the 'S.T.400.'"—F. W. Leaver, Ealing, W.5.

S. BENFLEET.—"Once again I have the great pleasure of writing to you about your wonderful sets and this time to offer you my heartiest congratulations on your 'S.T.400.' My '300' was the goods, but the '400' is 500 per cent better.

"Your double-channel reaction is really good; it puts the ginger where it is needed. I have picked up every station worth while."—A. Landgraf, South View Road, S. Benfleet, Essex.

BOLTON.—"Having converted my 'S.T.300' to the 'S.T.400' I must say how satisfied I am with the results. In half-an-hour's test I was able to receive 43 stations all at good volume. Thanking you for a fine set."—J. Sumner, Chapman Street, Bolton.

HARRINGAY (London, N.15).—"I have never had a better set, and I have had radio since it first started. I should like to thank Mr. Scott-Taggart for such a fine set."

BOURNEMOUTH.—"Now I have converted the '300' into the S.T.400,' it is the best of all for tone, distance and everything."—E. R. Petyfer, Moordown, Bournemouth.

RIPON.—"It is, without any doubt, wonderful. I have built nearly every one of your 'S.T.' sets,

(*Continued on page 376*)

MORE REPORTS FROM READERS

—*continued from page 374*

but as to this one—there's nothing can beat it. I think I was almost the first one in Ripon to own one. It took me two nights to build it.

"I had no trouble to work the set at all; a child could do it. The stations came rolling in one after the other without any background. Seventy-three stations, 63 on the medium waves and 10 on the long, within two hours."—M. Cockerton, Bondgate, Ripon.

BOURNEMOUTH.—"Having made the 'S.T.300,' may I add my belated congratulations on the 'S.T.400'—surely an instrument that gives real entertainment value from very many stations, even living under the shadow of Bournemouth's aerial, as I do."—R. C. Stowe, Wimborne Road, Bournemouth.

DERBYSHIRE.—"There are claimed to be seven wonders of the world, but now there are eight, and 'S.T.400' one of them. If I may give 'washout' readers some advice, it is this: 'Build the set exactly as described and the 'S.T.400' will do the rest.'"—A. Boardman, Church Road, New Mills, Derbyshire.

ST. HELEN'S.—"I have built your much renowned 'S.T.400' and confidently say it is one of the best sets of the year. The number of stations is really remarkable. The selectivity is great.

"Hilversum and North National can be received clear and at full volume. With the Blue Spot 66R unit and chassis the tone is as good as a moving coil. As you will see from the address, the set is getting plenty of advertising, for the customers say it is one of the best they have heard. Hardly a day goes by without someone wanting to have a look at it and express their appreciation of the tone and clarity."—W. N. Glassey, Hawk and Buck Hotel, St. Helen's.

SCOTLAND.—"I have completed the 'S.T.400,' and find it all that is claimed for it as regards power, selectivity and tone. I am about twelve miles from Falkirk."—S. R. Howe, Hopetown Road.

WORTHING.—"Working at odd moments, it took me three days to assemble and work the set. The very first evening, stations rolled in to the point of embarrassment, and have still continued to do so even on 'bad' nights.

"Allow me to thank you for a set which, at a reasonable outlay, enables me to enjoy international broadcast reception at a volume and quality which cannot be beaten by any four-valver I have heard nor by many multi-valve superhets."—(Miss) Gwendoline Logan-Bell, Brighton Road, Worthing.

BOLTON.—"Gee!"—J. E. Crompton, Oliver Row, Bolton.

BIRMINGHAM.—"Words are useless to convey one's first impressions of the set, and I can only say that it does all your readers say and makes one feel that it has no limits as regards range and selectivity. I must specially mention the quality which is quite equal to the push-pull I was using before and which I was reluctant to abandon, but decided to try your circuit first.

"The radiogram is just as good, but has to be cut down for the size of room. Valves are: S.G.220, P.M.1H.L., P.M.2D.X. and P.M.252. Coils home-made as described for 'S.T.300,' with aerial reaction added. Speaker is Amplion U66.

"I can confidently recommend anyone to build this set. If they should fail to do so they are missing owning a set which I honestly believe to be equal to a 7- or 8-valve superhet, and I would like to add my thanks and admiration for designing such a fine receiver. I shall not change from my 'S.T.400' for a very long time. I am willing to demonstrate to anyone interested in this district."—H. W. Forrest, 16, Primrose Croft, Hall Green, Birmingham.

MAPLEDURHAM (Oxon.).—"I should like to congratulate you on the 'S.T.400.' The feature which strikes me is the volume and purity of the amplifying end. I have struggled with multiple valve amplifiers for purity, but have always gone back to one valve. But in the 'S.T.400' the results equal the one-valve amplifier with, of course, the extra output. The selectivity is wonderful. Considering only one stage of H.F. I hardly expected such good results. I cannot beat 77 years of age, but I am not one of your youngest readers!"—B. C. Cox, Mapledurham, Oxon.

GLASGOW.—"The 'S.T.400' is the best set, yet built."—H. Bailey, Nith Street, Riddrie, Glasgow.

WESTBURY (Wilts).—"The set is a long way ahead of any other that I have come across."—R. T. Cranshaw, Warminster Road, Westbury, Wilts.

MANCHESTER.—"I have built your 'S.T.400' for myself and three personal friends also have the same set, and all are thoroughly delighted with the station-getting possibilities of this wonderful set."—A. Ashworth, Hollingsworth, Manchester.

DURHAM.—"I am highly delighted with the results I am getting."—N. M. Bolsover, Eagles-cliffe, co. Durham.

WEST KENSINGTON (London, W.14).—"I converted my 'S.T.300' to the 'S.T.400' as soon as your new circuit came out. The 'S.T.300' was the best set I had ever built before, and I have constructed a large number of sets since I started wireless in the early days of broadcasting, including your 'S.T.100,' which was a good set in its day. I must say that the 'S.T.400' is the finest set I have ever built and is all that you claim for it. Thanking you for providing all wireless constructors with such a fine set. I get all the stations I want, and am 77 years of age."—J. F. Thompson, North End Road, West Kensington, London, W.14.

BASLE (Switzerland).—"I beg to congratulate Mr. John Scott-Taggart for designing such a wonderful set as the 'S.T.400.' Though my set is handicapped, I am receiving over 80 stations in ample loudspeaker strength and wonderful quality.

"I even receive Trieste clear of our local transmitter only 18 kc. apart, the latter being at a distance of only 400 yards from my home."—Edmund Ermertz, 70, Hammerstrasse, Basle, Switzerland.

GUISBOROUGH.—"We are in a valley surrounded by ironstone-charged hills, except to the NE. Stations simply roll in, some at terrific volume. Selectivity is of an order that compares well with a seven-valve superhet that I have, but is better than the superhet, as whistles are eliminated. Thanking you for both the 'S.T.300' and the 'S.T.400,' which, in my opinion, are outstanding in every respect."—T. H. Horsley, Guisborough, Yorks.

SATISFACTION.

No other receiver for the home-constructor has earned its designer such praise as has the "S.T.400."

AND REMEMBER——

of the many thousands of appreciative letters received only a small proportion can be printed.

WHICH WAY ROUND?

Correct connections for a milliammeter.

THE majority of milliammeters and ammeters are marked "positive" and "negative," which indicates that there is a right and wrong way of connecting them in a circuit. Since to connect one the wrong way might upset the correctness of its reading, it is important to put the wires on first.

As the meter is connected "in series" with the components that make up the circuit in which the current is to be measured, avoid confusion with the "in series" connection for batteries—namely, positive to negative.

This is not quite such an unnecessary warning as might at first appear. Take the case of joining a milliammeter between the plate of a valve and H.T. positive.

It is unusual to think of a plate of a valve as anything but positive, yet the negative of the meter must be joined to it. Always consider the two points to which contact is to be made only, and decide which is positive to the other.

When there is a valve in the circuit there is little need to be puzzled which *is* positive, if you remember that the electron current always flows towards the negative one and that electrons can pass through the valve only from filament to plate. So you can find out immediately which way round the circuit the current is passing.

Incidentally, while on the subject, when two H.T. batteries such as two 60-volters are joined in series, the most convenient position for a meter to read the current is often between them. In this case, plus on the meter of course, goes to the positive tapping. But make sure there are no tappings at a voltage less than 60 if you want to read the *total* current.

When measuring total current with the meter in the usual place, the negative H.T. lead, you have a good example of the difficulties that arise in connecting.

In this case you have two negatives —H.T. negative on the battery and the H.T. — terminal on the set. The question arises to which does negative on the meter go? By working out in the method described, you will decide that it must go to negative on the battery.

A. S. C.

MATCHING THE OUTPUT

—continued from page 372

when the bias is changed from 20 to 0 volts the rise in current is 25 m.a.

At 4,000 ohms' external resistance the rise in current is 16 m.a., while the fall is 15 m.a. These values are nearly equal, and so 4,000 ohms would be used in the anode circuit. With 8,000 ohms the rise and fall are equal, but we are not obtaining nearly the best power output of the valve.

We have thus an *approximate* rule, that for distortionless amplification, together with high power, the external resistance should be twice the internal A.C. resistance of the valve.

THE FEBRUARY NUMBER OF

MODERN WIRELESS

IS NOW ON SALE

There is a

SPECIAL SECTION

entitled

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It includes

SITTING UP FOR AMERICA.
FRAMES FOR FOREIGNERS.
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Among the practical and detailed features for the constructor are:

The "MU-GRAM" A four-valve instrument for the Radiogram enthusiast.

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BETTER RADIO

A simple-to-understand section with universal appeal and intensely practical presentation.

THE BEST VALUE FOR 1/-

GET IT TO-DAY THE FEBRUARY NUMBER OF

MODERN WIRELESS

OBTAINABLE AT ALL BOOKSTALLS

"THE TRUTH ABOUT TONE CONTROL"

The Editor,
THE WIRELESS CONSTRUCTOR,

Sir,—We have read the article under the heading "The Truth About Tone Control" which appeared in your January issue, on which we desire to offer certain comments.

The article is written round a series of curves which bear a very strong resemblance to the published curves of our Tone Control Transformer. As we know of no other components to which these curves could apply, we presume that it is to the Multitone Tone Control Transformers that your contributor's remarks are intended to refer. If that is the case, some of the statements made in his article call for correction.

Although we have never used the expressions "bass lift" or "top lift," the fact remains that, on turning the potentiometer to the high-frequency end the amplification given to the high frequencies is nearly double that of the straight-line level. Similarly, in the other extreme, not only is there suppression of top, but also very definite increase of bass amplification. Further, curves (b) and (c) of your contributor's Fig. 1 correspond to extreme settings of the potentiometer which, in practice, would be very rarely used. In fact, it is possible for our 1/4 and other models to obtain a practically straight curve from 40 to 1,000 cycles, with a big rise between that frequency and 5,000 cycles, the straight line corresponding to the 1/4 step-up.

In all our publicity and literature we try to emphasise the advantage of selecting a particular part of the frequency scale for proportionate amplification before the output stage of the set or amplifier, as compared with suppression of undesirable frequencies after full amplification. The latter method must lead to overloading of the output valves with unwanted frequencies, if a generous output is desired from the set.

It appears to us that it is misleading in the extreme to call our system of tone control a "loss system." It would be equally misleading to label as a loss system any transformer of less than the highest permissible ratio, which we will take as being 1/9. The 1/3·5 transformer, for example, would not enable the maximum stage amplification to be realised, and would consequently, we presume, be regarded as a loss system by your contributor. The effect on volume of using the Multitone Tone Control Transformer can be summed up as follows:

If bass notes or high notes alone were being broadcast at any given moment, the turning of the potentiometer to one or other end would make the notes sound louder than in the intermediate position. If, however, a wide range of frequencies is transmitted, as in the case of an orchestral item, turning the knob to one end or the other may produce some loss of general volume, although the drums or piccolos, as the case may be, would actually sound louder.

We trust that you will give to these comments such publicity as will enable the erroneous impression made by the article in question to be corrected.

Yours faithfully,
For and on behalf of
MULTITONE ELECTRIC CO. LTD.,
S. M. GREEN
(Manager).

95–98, White Lion Street,
Islington, London, N.1.

A UNIVERSITY IN THE HOME

The New Popular Educator.

THE B.B.C. does much to assist education, but its efforts are of necessity somewhat fragmentary, and any series of talks on a special subject, however admirably arranged, must miss its mark to some extent, because of the inability of people to be sure of hearing every talk in the series. There are generally missing links in education by wireless.

The old idea of imparting knowledge by means of a book arranged as a popular educator was an excellent one. The wireless talk once given has gone for ever, but a book remains, and can be picked up at any time.

It is therefore good news for those who feel the need and desire to

(*Continued on page* 381)

A UNIVERSITY IN THE HOME

—*continued from page* 380

increase their knowledge, that a new Popular Educator has been prepared embodying all the latest knowledge on a vast variety of subjects, and is to be issued in such a way that it is within the reach of all.

Fifty Sections

It is edited by Sir John Hammerton, the well-known encyclopedist, and a really delightful work it is, for it embodies not only all the advantages of a systematic text-book—or rather of a library of text-books, for it is divided into fifty sections dealing with as many distinct subjects—but it is also a fascinating book to read for its own sake.

Under each heading there is a series of graded lessons leading from the elements up to more advanced stages, and the whole book is well illustrated with photographs and drawings that really help and elucidate the text. It is a stupendous work, and at the same time a masterpiece of compression.

Bind It Yourself

The book is indeed, as its sub-title suggests, a university in the home. It is a really comprehensive work on all the subjects that make for the broadening of the mind and give a grasp of modern conditions in the social, political, economic and scientific worlds.

There will be 52 weekly parts, and the price of each part is sixpence. In connection with the work there is a binding scheme by which you can bind the work yourself as it comes out, at very little cost, and further, there is an offer of a splendid presentation guinea volume open to all regular subscribers.

The first part of The New Popular Educator is now on sale, and in order that you may not be disappointed or meet with delay you should go right away and secure a copy from your newsagent. You will certainly not regret it!

FROM MY ARMCHAIR

—continued from page 353.

exactly seductive to an airman, e.g. Hungry Law, 1,643 ft., Hedgehope, 2,348 ft., and Windygate Hill, 2,034 ft.

At Mr. Young's house at North Shields, three newspaper reporters turned up because they had heard Marconi was coming to test a set. (I know I shall arouse my enemies if I add that when they heard it was myself they still wanted to come!)

Impartial Opinion

It was in Newcastle while doing some shopping in Woolworth's that I came across a machine known as the Green Ray Television Wonder. It reads your character, and as mine has been attacked from Watford, Chorlton-cum-Hardy, St. Helens, Penge, and a place called Pennymoor, I feel readers ought to have an impartial opinion given after much flashing of lights and clanking of machinery (all set in motion by the insertion of one penny).

Often misunderstood . . you bear no malice . . . fluent and accurate . . . highly strung and temperamental . . . emotional . . . instincts are good and genuine . . . well balanced . . . vain . . . hopeful.

You see, quite a harmless sort of fellow, really, more deserving of pity than anger.

Being interested in what would happen if I put the machine to further trials, I inserted another penny. This was what was on the second card:

Full of beans and popular . . . have few enemies . . . perhaps too truthful . . . never lend money . . . truthful and reticent regarding the great gifts you have . . . too independent . . . fond of the other sex . . . sensible.

The last two delineations are rather quaint, but I want you to note specially the bit about being truthful and reticent regarding the great gifts, etc.

The Third Penny

A third penny resulted in the following:

Not easily roused, but can be bitter . . . never really defeated . . . will stand no bunkum . . . artistic temperament . . . strong will-power . . . sincere . . . personal vanity.

That's twice there's been something about vanity. I felt another penny could be profitably invested. A crowd of about twenty had now gathered round. Flash, clank, flash, clank, chunk. Here it is:

You trust others when they have proved their worth . . . you hate deceit . . . artistic temperament . . . temper volcanic when really roused . . . a loyal person . . . blood is thicker than water . . . try to be calm.

In London, I found a similar machine in Oxford Street and decided a final trial was called for. This was what I got for a penny:

Kindly and charitable in mind . . . hate cruelty . . . have psychic powers and foresight . . . sex appeal magnetic . . . very intellectual ideas . . . often misunderstood through keeping in background.

Well, you can take the average! Sunday letter writers and grousers in general should note that I am often misunderstood, that my instincts are good and genuine, that I am full of beans and popular, kindly and charitable, but temper volcanic when roused.

An Eye for Opportunity

A technical assistant of mine to whom I foolishly mentioned the Green Ray Television Wonder had himself delineated and afterwards showed me his card:

Have unusual ideas . . . good ones . . . more scope needed . . . should "break away" . . . should move in some new direction . . . keep your eyes open for an opportunity.

I have had to raise his salary.

DON'T COOK YOUR BATTERY

Keeping the H.T. dry doesn't mean putting it near the fire.

ACTING on the maxim that an H.T. battery should be kept in a warm, dry place, some set owners may carry the idea to extremes by putting the battery as near as possible to the fire during a cold, frosty spell.

If you have even put a flashlamp battery in the oven to secure an extra hour or so of service from a "dead" cell, you will know that heat can cause a voltage rise in a battery which seems practically extinct.

But excessive heat is definitely injurious to a battery, and although by putting it "in the hearth" you may get a temporary voltage rise, prolonged warmth will dry up the paste inside the cells and do more harm than good.

AS WE FIND THEM

—continued from page 340

Double-Throw Switch

Every listener should be provided with some protective device so that in the event of a storm there will be a direct path to earth for any charge which may accumulate on the aerial.

There are two popular methods. In one case a change-over switch is employed to connect the aerial and earth leads together. In the other the aerial and earth are separated by a very small gap, the aerial charge sparking across this gap when it attains a certain value.

The most satisfactory method is that which combines both schemes, and the W.B. Double-Throw Knife Switch comes within this category. The W.B. switch is solidly made, the double handle being noteworthy for its rigidity and ease of manipulation.

It is undoubtedly an efficient protective device against lightning discharges. The makers are The Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts.

New Wearite Transformer

Messrs. Wright & Weaire, Ltd., 740, High Road, Tottenham, N., have modified their popular Type T.21A mains transformer.

The new instrument has a "dial" by which it may be conveniently "set" to the voltage of the mains supply. The dimensions of the core have been increased and every precaution has been taken to render the user free from accidental shock. Specially fully insulated terminals have been employed, and the whole assembly encased in a neat metal cover.

Our tests show that it is a well-designed and highly efficient transformer, and we shall give a full description of this interesting component in our next issue.

"Eta" Valves

The latest addition to the "Eta" range is a 2-volt H.F. valve, Type No. B.Y.1815.

This valve has an impedance of 14,000 ohms and an amplification factor of 18, so that it is suitable for use either as a detector or in the first L.F. stage.

The filament current is rated at 0·12 ampere, and the makers state that the construction is such as to render the valve non-microphonic, an essential feature of a good detector.

"Eta" valves are handled by the Electrical Trading Association, Ltd., of Aldwych House, London, W.C.2.

ALL ABOUT DOUBLE CHANNEL REACTION

—continued from page 342

is set at zero and the distributor is slowly turned to the right, aerial and anode circuits being slightly retuned whenever the distributor is altered.

It will be found that reaction is obtained and reaches a maximum when the distributor knob is half-way round. (The set can usually be made to oscillate.)

"Stepping-Stone" Capacity

Link reaction is due to the fact that the anode and aerial circuits are coupled together by a link circuit consisting of R_1, R_2 and the "stepping-stone" capacity between the fixed plates (via the moving vanes). The greater the stepping-stone capacity, the greater the reaction; the capacity is at a maximum with the distributor knob half-way.

Note that the whole of this link reaction comes from the *first* valve, but often the results are excellent. An important factor is the position of the anode coupler. Any reduction in anode coupling will reduce the link reaction effect, since the tuned, anode circuit currents have been amplified less. Pure "link reaction" will not be obtainable with very low anode coupling.

The third form of reaction is "chain reaction," and in its purest form is illustrated in Fig. 2c. The distributor is now full right so that all the reaction current goes through the aerial reaction coil, leaving the anode reaction coil unused. Reaction is adjusted by means of the master reaction knob.

Double Amplification

In this case, the H.F. currents are amplified by the S.G. valve, reappear in the tuned-anode circuit, are amplified by the detector valve and are fed (via the master reaction differential) through the distributor to the aerial reaction coil R_1. There is thus a feed-back into the grid circuit of the S.G. valve.

The anode reaction coil R_2 is isolated, but the tuned-anode circuit—as well as the aerial circuit—derives reaction benefits because it is in a chain. One cannot say which valve is providing the reaction since—unlike the previous case—this is an example of the double amplification of the H.F. currents used for reaction.

In this third method the adjustment of the anode coupler will have a decisive control in the amount of reaction. For example, if there were no coupling at all, there would be no reaction possible, as there would be a complete break in the chain.

Obtaining High Selectivity

In practice, even with the anode coupler at zero (full left), there is still some slight coupling, and even this will often be enough to enable reaction effects to be obtained by increasing the master reaction.

This "chain reaction," since it involves two stages of H.F. amplification, is in fact specially suitable for obtaining high selectivity, since the low anode coupling can be used while still preserving reaction effects on both aerial and anode circuits.

The fourth condition of the set is when the distributor is in an intermediate position (usually between full left and half-way). Reaction will be adjusted usually by means of the master reaction knob. You can, however, *try* a little master reaction and turn distributor clockwise to adjust reaction.

What exactly is happening now is a combination of "direct," "link" and "chain" reaction, but it matters little how these effects combine. My explanation, however, will provide all the reasons for any effect you obtain by altering the various controls.

Fascination of Experiment

Sometimes one or other of the three forms of reaction takes the biggest share of the work, depending often on the position of the anode coupler.

The commonest experience will be a reduction in signals and selectivity when the distributor is rotated a little to the right. This robs the anode circuit, and the chain and link reaction effects are perhaps insufficient to make up the loss. But there will be a much happier story to tell if you now follow up by increasing the master reaction.

This article is chiefly one of technical explanations. The special methods of getting reaction are worth trying, but do not just alter one knob and leave it at that. Slight retuning of the two circuits and some adjustment of the master reaction knob will usually be desirable.

I have given you explanations. They will add to the fascination of experiment; but in the "S.T.400" the results are more important than their explanation.

TIDIER TOOL BOXES

—continued from page 354

catch and screw-eye or box catch should be attached to the front, and the whole—when the glue is quite dry—given a coat of wood stain.

A more complicated type of box, with a tray, can then be started, and the actual procedure is very similar to that of the simpler box.

First the top and bottom should be cut, and for this box a convenient size is 12 in. by 6 in. of any suitable wood up to $\frac{3}{8}$ in. thick. The side pieces are constructed from stripwood 2 in. by $\frac{3}{8}$ in. and attached as before to the bottom.

Assuming that the bottom of the box is to be split up into sections 1 in. deep, obtain sufficient 1 in. by $\frac{3}{16}$ in. stripwood. (The amount will, of course, depend on the number of sections.) First of all cut the bars running lengthwise, say two in number, and then three cross-bars, so as to equally space the two longbars.

Cutting the Crossbars

Having wedged these into the centre of the box, the other small cross-bars are cut. Do not make these oversize—slightly under is preferable—and always work from the outside to the centre of the box, otherwise the front and back strips of the box will be forced out.

Then remove all the pieces, numbering them so as to be sure that they are replaced in exactly the same positions for which they have been cut, and glue each piece into position, starting with the two long bars. When the glue is quite dry, cut a piece of three-ply which just drops into the box and rests on top of the cross-bars.

This is for the bottom of the tray. (In the photograph the tray is shown removed from the box.)

Now treat this piece of plywood as though it were the bottom of a new box, fixing side pieces as before—of approximately $\frac{1}{4}$ in. thick and of sufficient height to allow some clearance when the lid is closed.

The tray having been completed, the slots should now be cut for the hinges, and these fixed in a similar manner to that already described, and the box finished by the addition of suitable fasteners.

The third type of box shown in the photograph is really a tray made on similar lines to the first box, but is minus a lid; this will be found very useful for holding small oddments.

"R.R.G.'S" RADIO RESEARCH

continued from page 356

device to prevent any electrical parasites from penetrating to the set under test.

I was rather exhausted by this time and asked my guide if we weren't nearly finished, but he smiled and led me into what at the first glance seemed to be a studio. Here I was introduced to Dr. von Braunmühl.

This gentleman very kindly explained the reason for the presence of no less than two grand pianos, some six or seven loudspeakers, and as many microphones in that room. Here all sorts and kinds of microphones are tested, and at the same time different types of loudspeakers can be used to listen-in to the results once recorded.

The German broadcasters make any amount of use of gramophone recording for rehearsals, for "photographing" programmes and for research work. At rehearsals parts or even the whole of a rehearsal are recorded, so that the players themselves can hear how very bad they were five minutes ago; then they start all over again!

OUR NEWS BULLETIN

New German Television

At a recent meeting of the Television Society (at University College), Mr. E. H. Traub gave an interesting account of a new German television system devised by von Ardenne, in which the reproduced picture is formed by the impact of an electron beam on a sensitive screen in a vacuum tube.

Illumination Improvements

It was claimed that one of the most striking features of the new system was the brightness of the image. The picture was five to ten times as bright as pictures obtained by other cathode-ray methods.

The method in its present form is applicable only in the transmission of film pictures, but it has also been shown that even in reproduction by home sets, such reproduction has great entertainment value.

Cost to Produce

The lecturer pointed out that it has been estimated that a complete home-receiving outfit consisting of an ultra short-wave receiver, two-way tune filter, and cathode-ray tuning, etc., could be produced for about £20, and such a set would reproduce images of a quality, size and intensity to satisfy the most critical onlooker.

Brighton's Police Radio

Some of the policemen in Brighton are now equipped with pocket wireless sets and, while walking on their beats, they can listen to messages broadcast from a powerful transmitter at the Town Hall.

Two-Year Tests

The Chief Constable stated that only a few of the men in the Brighton Police Force are equipped with these wireless sets at the moment, but others will be equipped as fast as the makers can supply the sets.

It is said that the set now in use is the result of over two years of experiment. In appearance it is a slim, black box, 6 in. long, weighing less than 2 lb. It fits into the constable's breast pocket. A bell warns him to listen in through an earphone attached to a length of flex.

Five-Mile Radius

It appears that the chief obstacle to wireless in crowded cities has been the difficulty of picking up clear speech, but it is claimed that the Brighton policemen's receivers can clearly pick up messages in crowded streets within a radius of five miles.

Wireless Exchanges

There are now nearly 200 wireless exchanges in the country, with a membership of 70,000. It is pretty clear that the system is spreading, for there are few large towns without a wireless exchange. They vary in membership from 8,000 in Hull to 20 in Andover. It is claimed that the relay system offers great conveniences to listeners, for reception is really free from all outside interference and is consistently good.

A Licence is Required

There is, of course, nothing to worry about as regards batteries, etc. All the listener has to do is to provide himself with a loudspeaker (if this is not supplied by the exchange) and, of course, to pay the annual licence fee of 10s. to the Post Office.

Take It or Leave It!

The greatest obstacle to the popularity of wireless exchanges is the fact that you have to put up with what you are given; you cannot tune in a number of stations, and take your choice from a variety of programmes.

Regional Developments

Work is proceeding fast at the Western Regional Station at Watchet, Somerset; while the present National and Midland Regional transmitters at Daventry are shortly to be replaced by stations of higher power at Wychbold, near Droitwich.

Northern Ireland is also to be provided with an up-to-date transmitter of high power.

(*Continued on page* 387)

OUR NEWS BULLETIN

—continued from page 386

Belfast Tests

B.B.C. engineers are now busily carrying out tests with the portable transmitter, in order to determine the best site on which to erect a station to take over the service of the old-fashioned low-power transmitter at Belfast.

The new Northern Ireland station will be almost the last link in the Regional chain for service in the British Isles.

High Power for Ulster

The new North Ireland station will differ from existing twin-wave regionals as it will be a single-wave transmitter, and consequently only one programme will be radiated. The power will probably be something like 50 kw.

The "B.H." Organ

The B.B.C.'s new organ in Broadcasting House is rapidly taking shape, but it will probably be well into the Spring before listeners can hear it.

Messrs. John Compton, who are building the organ, state that it will contain over 2,300 pipes divided into 31 tones. The organ will be electrically driven and the organist will be able to play it from a distance.

Those Notices

It is reported in the Press that hundreds of B.B.C. artistes have received notice that their services will no longer be required for broadcasting. It is pointed out, however, that the Corporation is not really dismissing anybody, but that, in the course of the last few years, a great list has accumulated of people who have had one audition for broadcasting, but have never had an engagement.

There is also another list of artistes who have had one engagement, or perhaps two or three, over a lengthy period; but it is now realised that the days when border-line amateurs could be broadcast have passed.

Possibles and Probables

The B.B.C. believes that it has its own way of finding out whether an artiste is successful from the broadcasting point of view, and it has consequently gone through the lists of artistes who are recorded as possible broadcasters, with the idea of removing all those who do not come up to this B.B.C. standard. And, rather than keep people in all parts of

(Continued on page 383)

THE "A.C. S.T.400" ALL-ELECTRIC CONSOLETTE

—*continued from page 335*

The mains transformer may be "set" for any A.C. mains voltage from 200 volts to 250 volts. You will find your mains voltage engraved on the electric light meter.

The new Wearite "dial" transformer is "set" to the required voltage before the transformer is fitted. You will find two black insulated terminals on the dial, one in the centre and one at the edge. Screw the one at the edge right out by turning it anti-clockwise. Then turn the "dial" until the voltage nearest your mains supply appears (e.g. 200, 220, 240). Then insert the screw terminal again and tighten up.

The ordinary Wearite transformer type T.21A is also satisfactory, but the dial type is a slightly modified version.

Strongly Advised

Tone control on this receiver is obtainable by varying the value of the resistance which (together with the .01-mfd. condenser) is shunted across the primary of the speaker transformer. My own preference is to omit the resistance altogether, leaving the condenser alone connected across the primary. This reduces the top response slightly, but reduces heterodyne whistles and interference. I strongly advise it. If the 10,000-ohm resistance is used, try short-circuiting it as a test. A value of 2,000 ohms instead of 10,000 ohms will produce better results for all-round work, but I personally prefer no resistance at all.

My concluding advice is definitely to start your all-mains career with this receiver. Its simplicity, safety and efficiency should produce thousands of converts to A.C. If you have a battery "S.T.400" you will, of course, be able to use practically all your parts.

As regards volume and purity of quality, I believe you will be amazed and delighted if you keep to my design.

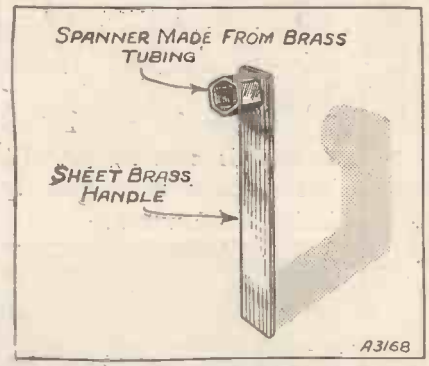
HANDY SPANNERS

"Special-Purpose" tools which you can make at home.

RECENTLY I had reason to bless a pair of special box spanners that I made up in an odd hour in the workshop. These are of 4B.A. and 6B.A. sizes, and they are of the special "round-the-corner" pattern illustrated in the sketch.

The spanner part is made from a short piece of brass tubing whose internal diameter is such that a nut of the required size will just, and only just, fit into it. It is reduced to hexagonal shape by placing a thick nut inside it and hammering with a light ball-pane hammer. The spanner portion is about ⅜-in. in length, and it is brazed or soldered to a handle of sheet brass. R.W.H.

FOR AWKWARD CORNERS



This home-made box-spanner will deal with nuts which are hard to get at.

OUR NEWS BULLETIN

—*continued from page 387*

the country on tenterhooks in hopes that they may one day receive an engagement, the B.B.C. is now making it quite clear when their services will not be called upon.

Wholesale Summonses

It is stated that more than 10,000 summonses against people in various parts of the country who, it is alleged, have bought wireless sets on the hire purchase system and have not completed payment for them, are listed at the Bromley (Kent) County Court. All the summonses have been issued by one firm of manufacturers.

Luxembourg's Latest

One of the most powerful radio stations in the world will shortly start broadcasting in one of the smallest countries in Europe.

Luxembourg's new radio station at Junglinster, about nine miles from the capital, will shortly transmit programmes daily on a wavelength of about 1,200 metres.

Modulation tests have recently been made between 6 to 8 p.m. on this wavelength, and it is understood that they have been satisfactory.

French Finance

The new station has an aerial power of 150–200 kilowatts. The aerial is of the triangular type supported at 585 feet above the main building, which is 1,190 feet above sea level in very mountainous country.

French financiers have supplied the bulk of the capital.

The Government of the Grand Duchy have stipulated that the new broadcasts must not disturb the reception of foreign stations in Luxembourg!

INDEX TO ADVERTISERS

All communications concerning advertising in "Wireless Constructor" must be made to John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Telephone: City 7261.

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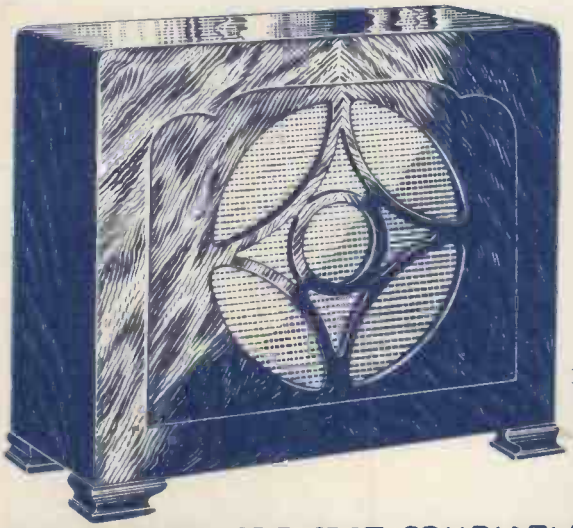
A GOOD SET deserves a GOOD SPEAKER

give yours the best

Your set may bring you all the stations of Europe, but what use are they if you can't *hear* the programmes. The loudspeaker is always the trump card—it makes or mars your enjoyment.

Therefore, however much care and money you may expend on improving and modernising your existing set, or in building a new one, be ABSOLUTELY SURE that your speaker is the best there is—in other words be sure it is a Blue Spot Speaker.

Blue Spot Loudspeakers, one and all, represent the very highest attainment in the science of musical reproduction for wireless programmes. Ask your dealer to let you hear a Blue Spot Speaker and advise you which model will best suit your requirements. A full, descriptive brochure No.W.C.26.S will be sent post free on request.



BLUE SPOT 100D 52/6

BLUE SPOT 100D

as illustrated opposite, is remarkable for its wonderful flexibility and purity of tone. It has excellent bass reproduction without boominess. It reproduces the entire musical scale with ease. It requires but a small input for efficient work and no matching transformer is necessary.

CHASSIS ONLY (100U) 32/6
CABINET (OAK 100D) 52/6

BLUE SPOT 99 P.M.

This is without question the most wonderful Moving-Coil Speaker in the industry. Its richness and depth of tone, its almost miraculous range and purity, its perfect quality of reproduction for speech and music have aroused intense enthusiasm. 99 P.M. is an event, a masterpiece—you must hear it to understand its worth.

CHASSIS 59/6
CABINET (Walnut 32 P.M.) 87/6

BLUE SPOT 31K

This speaker has the world famous 66K movement. Its tone is clear and pure. It never muffles or distorts. In its handsome cabinet of fine quality oak 31K represents the most wonderful value for money you could possibly obtain.

UNIT ONLY (66K) 15/-
UNIT on chassis (66Kc) 19/9
CABINET in oak (31K) 31/6

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FACTS YOU SHOULD KNOW..
ABOUT THE MAZDA PENTODES

The output stage in portable battery-driven receivers has always presented a problem to the designer on account of the limited H.T. supply available.

THE MAZDA PEN 220 *has solved this problem as, owing to its extreme sensitivity, ample volume can be obtained with only 4 m/A anode consumption. The Pen 220 has, in addition, rapidly gained favour in the case of standard battery-operated receivers where economical H.T. consumption is an important consideration.*

THE PEN 220A *is a high-power output pentode suitable for driving a large moving-coil speaker. It should be used in conjunction with an eliminator.*

THE PEN 425 *for receivers operating on anode voltages above 150.*

THE AC/PEN, *the finest all-mains power pentode, sensitive enough to operate a loud speaker direct from aerial input.*

Full details of these and other useful Mazda types will be found in the Mazda catalogue, sent FREE on request.

Mazda valves are fitted by all the leading receiver manufacturers.

The amazing

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