

# TWO NEW SETS FOR CONSTRUCTORS

# Popular Wireless

Every Wednesday  
PRICE  
3d.

No. 568. Vol. XXIII.

April 22nd, 1933.

**NEW!**  
*The* **Q.P.-B.**  
THE FIRST "CLASS B" SET  
TO USE ORDINARY VALVES!

**NEW!**  
A **DOUBLE DIODE  
TRIODE SET**  
ALSO USING THE NEW  
**H.F. PENTODE**



Also Inside:  
**THE 'P.W.' AUTOGRAM**  
—CONSTRUCTING THE CABINET  
**MORE NEW VALVES**  
**SHORT-WAVE NOTES**  
**ECKERSLEY EXPLAINS**  
etc., etc., etc.

## ONCE AGAIN "P.W." LEADS THE WAY



OHMITE RESISTANCE

BETTER THAN WIREWOUND  
All values from 50 ohms  
to 5 megohms. Accurate  
and Constant.  
1/6 each. Holder 6d.

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**GRAHAM  
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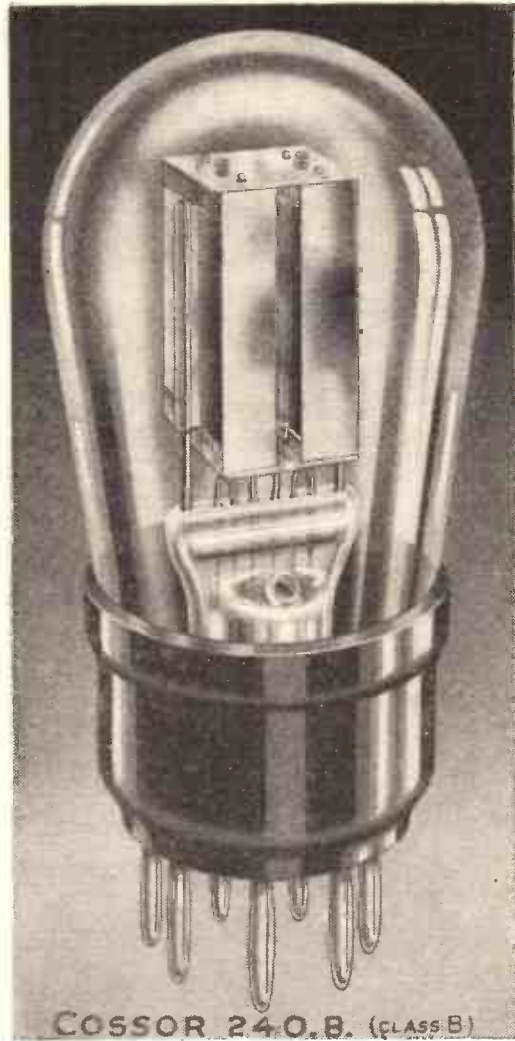
# COSSOR 240 B

—the new valve  
for

## CLASS "B" AMPLIFICATION

Filament volts 2.0. Filament amps 0.4;  
Anode volts 150 max.; Max Anode  
Current Swing 50 mA.; Max. Peak  
Applied Signal (Grid to Grid) 40 volts;  
Static Anode Current at  
 $V_a=100, V_g=0$  (each half) **14/=  
1.5 mA., Price**

Full instructions for the use of this remarkable  
new valve, including circuit diagrams will  
be supplied on application to our Technical  
Service Department.



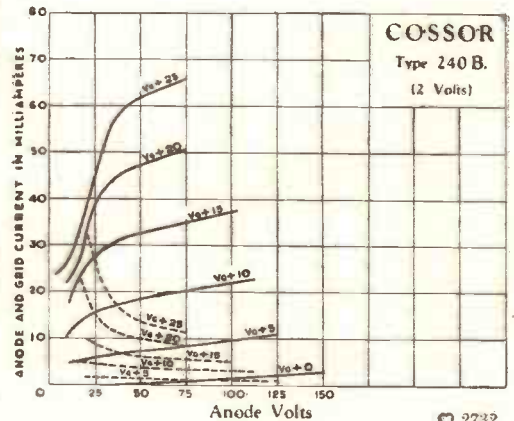
COSSOR 240 B. (CLASS B)



KINGS  
OF THE  
AIR

Volume equal to that of the average Mains Receiver is now obtainable from Battery Sets with this new Cossor Valve, and with this remarkable output, the H.T. Current demand of the Cossor 240 B. is lower than that of a small power valve. Thus, a really large output is obtainable without in any way over-stressing the average H.T. Dry Battery.

Anode and Grid Current/  
Anode volts curves of  
Cossor Class "B" Valve  
Type 240 B.



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**THE FIRST AND FOREMOST RADIO WEEKLY**  
 Scientific Adviser: SIR OLIVER LODGE, F.R.S. Chief Radio Consultant: P. P. ECKERSLEY, M.I.E.E.  
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 Chief of Research Department: K. D. ROGERS.

*The Paper that Made Wireless Popular*

**CONTINENTAL QUALITY  
 ANONYMOUS ARIEL  
 U.S.A. BROADCASTS  
 THE 1933 SHOW**

## RADIO NOTES & NEWS

**FISHY STORY  
 THE SAFE AERIAL  
 CHANGE THE NEEDLE  
 FAMOUS ROOMS**

### Listening "Foreign."

**I**N spite of the ecstasies of the many people who are able to receive from places abroad, there has for some time been in progress an undercurrent of discussion amongst working amateurs, as distinct from "listeners," about the merits of the foreign transmissions and their reception here. Some of us, who were driven abroad, so to speak, by the B.B.C.'s programmes, have been driven back by the Continental transmission and reception quality. "P.W." has done much for the amelioration of the long-distance rover, but still, it's a good receiver that will make Rome, for instance, sound like a Regional station to a Regional listener.

### Questions of Quality.

**W**S. (E. Grinstead), in reference to a paragraph of mine eulogising the A.T.B. in "Airsprite," says, "What I want to know is why all you professional wireless people deride foreign station reception?" A fine thing to say of the paper which created "Sydney" Two, "Magic" Four, and "Airsprite."

Deride it! Great Grid Bias! We helped to make it possible. No, W.S., the fact is that it is our very dissatisfaction with the results which inspires us to be everlastingly trying to improve them, and which renders it possible for you to say that you can get about thirty "worth while" stations.

### A Personal Note.

**M**Y own experience may be of interest. Having been a "wireless man" for some twenty-three years the glamour of mere distance has become dimmed for me. But I wanted to sample Continental culture generally, and so I spent much time in hunting foreign stations. I got a lot of "mush," jamming, variation of frequency, "fading," "blasting," and in some instances, plain bad transmission. So I had my set re-designed to receive specially the London Reg. and Daventry Nat. Now that "P.W." has introduced some improvements I am turning to a superhet of last-minute design and shall soon be abroad again for a "try-out." But I fear my discriminating ear.

### I Avoid the Limelight.

**A**KIND invitation to accompany a certain Mr. Thomas of Thornton Heath when he lectures before the Thornton Heath Radio Society on the subject of

Short Waves, and thus to be the guest of that Society, finds me glowing warmly beneath my veil of anonymity, but none the less determined to retain that veil. And if the mysterious Mr. Thomas should in his wisdom have pierced the aforesaid veil, I conjure him to maintain silence—as a pal and in the interests of "P.W."

### The New National.

**O**N a site three miles north-east of Droitwich the B.B.C. will build a 100 kw. station to replace the present Daventry (5 X X) transmitter. This station will contain, in addition, a high-power,

## SERVICE.

### How "P.W." Leads the Way.

Full constructional details of the First "Class B" Receiver appeared in "Popular Wireless" dated March 25th—details which were greatly in advance of those published in any other wireless paper.

"P.W.'s" second "Class B" Receiver appeared in the issue dated April 1st—the FIRST receiver to employ Ferrocart Coils and "Class B" in combination, and the FIRST set making use of either principle in portable receiver design.

"Popular Wireless" has thus given its readers full details of TWO "Class B" sets before any other wireless paper.

"Popular Wireless" was also FIRST in the field with a description of a "cold valve" receiver; and was also the FIRST wireless paper to describe an automatic radiogram for home constructors.

medium-wave Regional transmitter, replacing the existing Midland Regional transmitter (5 G B). I doubt whether Droitwich will be in service before the summer of 1934, but I am told that it will be well worth waiting for. Lessopeso!

### Take Your Choice.

**M**R. OLIVER D. YOUNG (of the "Young Plan"), Chairman of the Advisory Council of the National Broadcasting Company, comparing our methods with the U.S.A. "free for all," says: ". . . European governmental

broadcasting generally exceeds American private broadcasting in the potential cultivation of good taste—by a graceful margin." I will contend that: "American private broadcasting exceeds European governmental broadcasting . . . in the potential cultivation of free citizenship—by a vital margin." Judging from the revelations of American free citizenship vouchsafed to the world during the past four years, Mr. Young speaketh sooth, indeed.

### A Remarkable Record.

**W**HATEVER may be its function as a cultivator of free citizenship, the N.B.C. of America can justly pride itself on its 1932 record of broadcasts from foreign countries, which amounted to 147, taking up 52 hours of broadcast time. There was one from Manchuria, even. Altogether the programmes came from 23 different countries, the largest number being from Switzerland (43), Germany being next with 37, England third with 25, and France next, with 16. Japan, the Philippines, Hawaii, Poland and Cuba contributed to the list.

### We Can't Complain.

**B**UT when I consider the list of world personalities who have been introduced to American listeners during 1932, I cannot feel that the B.B.C. lags far behind its American cousin. Consider! Pope Pius XI, King Albert of Belgium, the Prince of Wales, Hindenburg, ex-President Doumer, President Lebrun, Crown Prince of Sweden, Earl of Bessborough, Macdonald, Baldwin, Churchill, Tardieu, Brüning, Von Papan, Von Schleicher, Grandi, Mr. Bennett, Jusserand, Schacht, Citroën, Edstrom, Maurois, Sir J. Stamp, Wellington Koo, Aga Khan, and others. There are not many of these we haven't heard in Britain.

### This Year's Show.

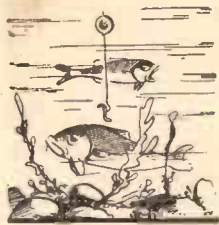
**T**HE R.M.A. Show this year is to be held at Olympia from August 15th to August 24th, inclusive. The colour scheme will be, as in 1932, blue and silver. That is all I have to say about it this week, except that the middle of the summer holidays seems to be a queer time to choose, and that the colour scheme is slightly less important than the complexion of the door-keeper. In America, by the way, there is to be no official R.M.A. trade or public show this year.

*(Continued on next page.)*

# ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

## An "Eye" for Fish.

THE Marconi Echometer, which is primarily intended to measure the depth of the sea, has at least two other accomplishments. Firstly, it can



give an indication of the nature of the sea bed, whether there is rock or mud or sand, and so forth; secondly, it is credited with the ability to determine whether the ship is passing

over a shoal of fish or not.

It cannot name the fish, count them or catch them. Perhaps it can inure them to the idea of being caught. However, Marconi is very busy—and is not the man to let a few herring discourage him

## Radio Up and Down.

WHAT about listening-in a mile or so below ground at a place some 9,000 feet above sea-level? A queer combination, you may think, and especially queer for a woman to experience. Yet all this is what that intrepid explorer Rosita Forbes tells about in the April "Modern Wireless"—a "scoop," if ever there was one, in radio journalism—and there was! In the same issue there is a constructional article about the "Q.P.P. Radiogram," and another about the "Three-Range" Two, utilising a new three-band circuit efficient on all the important wavelengths between 20 and 2,000 metres.

## The Wilful Wind.

DURING the last spell of cold weather, I was careful to tune in all the "hot" music I could find, thus preventing the snow from collecting on the aerial and



bringing it down. I had to chance the gales in mid-March, and was surprised to find that they managed to blow down one of my best lilac trees, a mere 20-foot bush, but failed to move my

aerial jury-mast in the copper beech, which, like the B.B.C., has not even bowed to the storm. Navy lashing, my boy!

## Tuning in to Ham.

NOW for bathos. Still shorter waves! The "Evening Standard" gives an account of an interview with a doctor who diagnoses with a divining rod and a small plumb-line, on the theory that all living things are wireless sets, sending and receiving rays on definite wavelengths. The evidence for the theory is not stated, but is, I suppose, the "divining rod" and its antics. Says the doctor, "All living beings have in their nervous systems cells which correspond to the movable condensers in wireless sets.

## Vinegar Not Advised.

SORRY! The ham got crowded out of the last paragraph. Well, our divining doctor made the interviewer hold a

piece of ham. The divining-rod then indicated that ham "agreed with the holder because the wireless emissions from your body have synchronised with those from the ham." Personally, I don't care for ham which is alive; it doesn't agree with me. Vinegar, through the medium of the rod, said that it was bad for the interviewer. Bless us! Is vinegar a living thing, too? I know whether ham agrees with me or not. It does. And no divining rod can frighten me off it. I like mustard with it, too!

## "Rooms of the Scientists."

THE Ideal Home Exhibition contains a section in which are displayed the studies and laboratories of some outstanding figures in science, and one of the most interesting exhibits is a reproduction of a part of the wireless room on Marconi's yacht "Elettra." Besides a collection of the modern apparatus with which this inventor does "impossible" things there is, in a special museum, a selection of early coherers as used by Marconi in his pioneer experiments in 1895.

## SHORT WAVES.

Teacher: Now then, Tommy, if your father bought a twenty-guinea radio set on the instalment plan, and paid off two guineas a month, how long would it take him to pay off the whole amount?

Tommy: Ten years, miss.

Teacher: Sit down. You don't know the lesson.

Tommy: You don't know my father!

As an instance of the attempt to create "atmosphere" in B.B.C. studios, it is mentioned that a portrait of George Washington indicates the room used for talks to America.

We have been unable to ascertain whether the room used for talks to Canada is indicated by a portrait of Lord Beaverbrook.—"Punch."

"Giant speaker fills theatre," runs a headline in an American magazine. There can't be much room for the audience.

## IN THE SOUP.

"9.15—'Soup from the Shows.'"—Wireless Programme.

Well, the B.B.C. have been in it before.

## Two Requests.

D.A.D. (Cambuslang) asks us, firstly, whether we have considered the designing of a short-wave, portable superhet with a wave-range of 13-60 metres, single-knob tuning, A.V.C., using the "new cold valve, for operation from batteries." This set is to work on the broadcast band also. Why not ask for television and a radiogram to be combined with it, too? We might work in a self-changing record device, alarm clock and miniature Blattnerphone! Passed to the Technical mob for deep thought.

Next, he asks us to use our influence to induce people to sell television parts at a reasonable price.

## Ridgeway's Record.

THE Ridgeway Parade of April 24th and 25th is notable in that it is the first of P.R.'s shows to be broadcast to the Empire, though Africa is the favoured territory in this instance. I am informed

that a record has been set up by Mr. Ridgeway in sales of gramophone discs for a period of 13 months, five consecutive records which he made reaching a total of 773,813. I hope that Phil and Eric, the new light entertainment chief, will agree like little birds in a nest.

## Oddments and Whatnots.

A WELL-KNOWN English firm (four and twenty blackbirds, baked in, for the use of) was awarded a first prize at the Cairo International Radio Exhibition.

The superhet is coming to the fore again. Why? Because "Ariel" is having one made up for his domestic use. Five valves. Quiescent everything. Down with Mühlacker!

What is to be done about the lady who leaves her accumulator at the charging station and says, "I'll call for it in about half an hour?"



## What About an "Annual General"?

I READ the Viscountess Snowden's article in "P.W.," March 25th, with care, with enjoyment, with admiration. She missed every snag, yet contrived to conceal a "punch" in every paragraph. So far as I know she is the first prominent public person to describe the "listener" as a shareholder of the B.B.C., which he certainly is, always provided that he, has paid his fee. But shareholders are entitled to meet yearly to receive and approve (or otherwise) the report and accounts of their directors. Do we?

## New Wireless Club.

MR. G. F. HOWARD, of 43, Cumberland Avenue, Blackpool, informs me that he proposes to form a wireless club in Blackpool and district, and asks me to broadcast the fact, a request to which I am happy to accede. A fine, populous town like Blackpool, inhabited by those Lancashire folk—"electricity from the neck upwards"—ought to have a club whose deeds will resound throughout the world of amateur radio.

## What Can I Say?

A SORT of a Portuguese writes to me from Angola as follows (or as nearly as I can translate his letter). "Hoo! My mister, thousands of happiness about England's without wires. It are of the cultural the superior. Swelp me! Nevertheless (and I abase myself at the mere thought) there was, if not were, plenty of apartments (or rooms)



of betterization in the zones of *le art*. I indicate *le art* off (*he means "of"*) the drama. For example, in the *eclaircissement* off ze . . ."—oh, shut up!

ARIEL.

# 'P.W.' OFFERS YOU FIRST DETAILS OF — A DOUBLE-D.I. RECEIVER

THE FIRST SET TO MAKE USE OF THE NEW DOUBLE DIODE TRIODE VALVE AND THE NEW MULTI-MU H.F. PENTODES.

Designed and Described by K. D. ROGERS.

too, was still in an early stage of development, though it has been slowly developing for many years.

The S.G. valve you have read about and used, because it was an important step forward, and in a way complete in itself. But even this has been improved upon, as you will see.

Now the time has come when we can put before you the culmination of many months of radio design—an automatic volume control set using multi-mu H.F. pentodes and a double diode triode valve.

It is the first design of its kind to be placed in the hands of the home constructor, and it will be the forerunner of a host of

deliver power to a diode rectifier, for which an S.G. valve is unsuitable.

Being of the multi-mu type they are also available for automatic volume controlling, and this is a feature incorporated in the "Double Diode Triode" Set.

The Set Cannot Overload.

The advantage of A.V.C., of course, is that the set can never overload, even when the local is tuned in, for the strength of reception tends to decrease the gain of the H.F. side, thus maintaining a definite level of H.F. input to the detector.

By an ingenious scheme the automatic control is "delayed," so that it does not come into operation until a certain detector input is reached, thus allowing distant stations to read the strength of the nearby broadcasters before their volume is checked.

But the beauty of the D.D.T. receiver does not end here. We have mentioned the double diode triode, from which the name of the set is taken.

This is a valve of dual role. Primarily it is a diode valve with two anodes, which can be used separately in a variety of ways. We employ one for straight-line rectification and the other to obtain the special delayed volume control that is such a feature of the set.

Combined Triode and Diode.

But apart from these two anodes, the valve has a complete triode assembly in the same bulb. The result is that we can, in addition to obtaining pure rectification, use the valve as an L.F. amplifier, and thus do away with the insensitivity normally associated with diode detection.

(Continued on next page.)

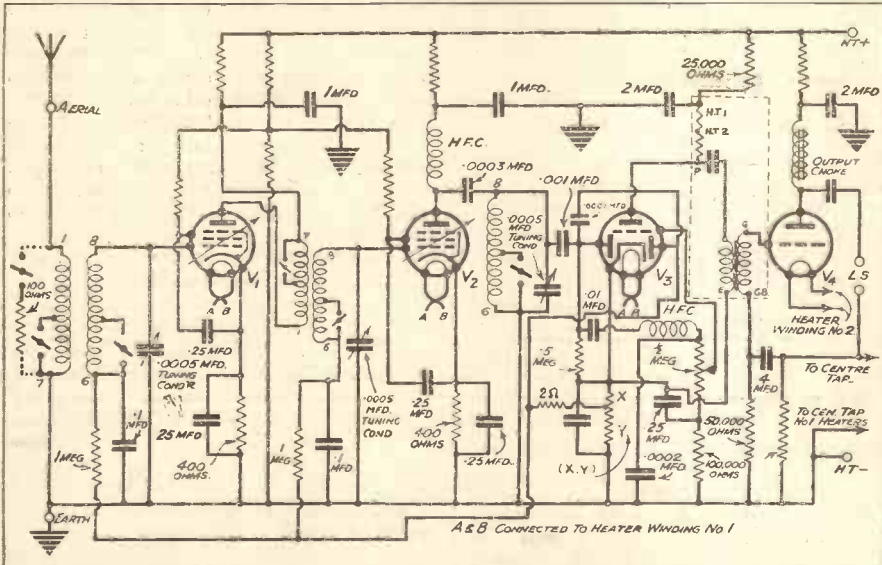


SOME years ago the radio world was excited about the advent of a special tetrode valve that would do away with the need for neutralising H.F. circuits—the screened-grid valve. It came, we saw, and it conquered. It has been with us ever since.

Something Better.

Later, the variable- or multi-mu S.G. arrived, and with it came automatic volume control. That was a short time ago. The diode rectifier was also revived, and used in many sets where distortionless rectification was required.

## IT HAS DELAYED AUTOMATIC GAIN CONTROL



This is probably one of the most unusual circuits you have ever seen, since it incorporates a number of the very latest radio developments, including multi-mu H.F. Pentode and the Double Diode Triode which performs three separate functions. On the right you see this new "P.W." triumph in the course of construction.

We have said little about the use of variable-mu valves for automatic volume control, or of diode rectification, though the variable-mu valve has been used many times in our circuits. We knew that something better, something bigger was imminent, and that, while keeping right in the forefront of set developments and valve design, it would be better largely to ignore some of the minor steps that led to the "big thing."

So you have seen little in "P.W." of diode rectification—because it is insensitive, in that a diode valve does not amplify, requiring a stage more of L.F. than is normal with triode detectors.

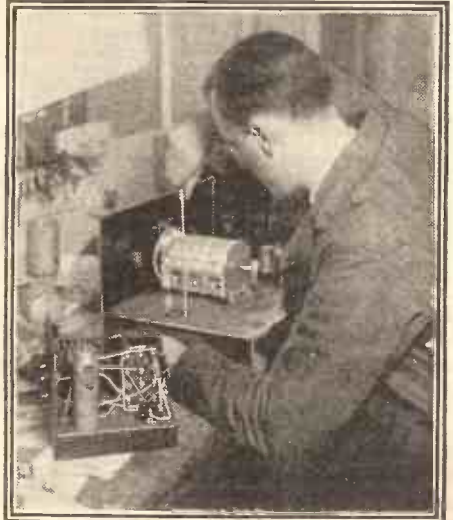
You have heard little of A.V.C. (Automatic Volume—or gain—control) because that,

others, both home constructed and commercial. There will be many similar designs on show at the next radio exhibition, no doubt.

Its advantages are numerous, while at the same time the number of valves is kept down to four, and the cost is not by any means high.

First of all, we have ensured the highest possible H.F. amplification by using the new multi-mu H.F. pentode, an advance on the screened-grid valve that has to be experienced in practice before it can be truly realised. These pentodes are more efficient than the S.G. valve, and thus greatly enhance the distance-getting properties of a set. Also, a pentode will

## CLEAN BASEBOARD DESIGN



## A "DOUBLE D.T." RECEIVER

(Continued from previous page.)

This advantage immediately obviates the need for any intermediate L.F. valve, and allows the double diode triode to be fed through ordinary resistance coupling into the grid of the output valve. Also, it allows a plain form of L.F. volume control to be used, to set the maximum volume of the set at any desired degree.

### Pure Reproduction.

The net result, of course, is a sensitive, highly practical receiver which will provide within wide limits a constant level of "signal" strength—controllable at will by the normal L.F. volume control—with straight-line rectification and pure reproduction.

It is an all mains design, with separate power pack, and employs the very latest Ferranti valves. This source of valve supply may come as a surprise to many, but Ferranti, who have long been recognised as leaders in L.F. amplification and transformer design, have for some time been producing valves for their own sets.

Now they have decided to place the results of their labours on the open market, and these new valves are typical products of the usual high-class Ferranti design. The output valve is of the directly-heated variety, the other three being indirectly heated.

### How the Circuit Operates.

As there is a great deal to discuss in a design of this nature, containing, as it does, so many new developments, we shall have to continue the constructional details next week. But in the meantime, let us have a look at the circuit employed and see how it operates.

First of all, the aerial input is provided

if desired, with a local-distance switch (connections shown dotted in diagram), which is useful for those who wish to use the set nearer than, say 20 miles to a powerful broadcaster.

The aerial impulses are fed from a primary to a secondary winding of an H.F. transformer, the secondary being tuned. The output of the first multi-mu valve, one of the new pentodes, is fed, via another transformer to the grid of the second multi-mu pentode, and this latter is shunt fed through a one-to-one "auto-transformer" (in other words, tuned anode) to the double diode triode.

So far everything is straightforward, apart from the automatic volume control

## VALVES AND ACCESSORIES

**VALVES.**—2 V.P.T.4, 1 H.4D., 1 L.P.4 (Ferranti).  
**POWER PACK.**—To be described in "Popular Wireless."  
**AERIAL AND EARTH EQUIPMENT.**—Electron "Superial," Goltone "Akrite," Graham-Farish "Fit" earthing device.  
**LOUDSPEAKER.**—B.T.H., Celestion, H.M.V., Epoch, Atlas, R. & A., Magnavox, Amplion, Marconiphone, Ormond, Blue Spot, Rola.

following—heater, cathode, two small diode anodes (these are screened from the rest of the valve, by the way), a control grid and an ordinary large anode. The

cathode—being merely an electron supplier is common to both sections of the valve—the diode and the triode parts.

The D.D.T. can be looked upon as two distinct valves, and save that only one heater and cathode are used, and the valve is in one "bottle," it is connected as such.

Let us take the diode first. From the output of the third coil unit the two diode anodes are fed through fixed condensers, and they are used for two different purposes. The left-hand one in the theoretical

diagram is employed solely as a half-wave rectifier, and its energy is joined on to the grid of the triode section over the .5 megohm and .01-mfd. resistance coupling scheme, just as if it were an ordinary diode.

(Continued on page 224.)

## VALVES CANNOT BE OVERLOADED



This further view of the "Double D.T." receiver shows the H.F. end with the three matched coils in the process of being wired.

connections, which come into the grid circuits via 1 megohm decouplers to "6" on the coils.

At the double diode triode the circuit gets a bit involved, but you will find that included in the glass envelope of the valve are the

## THESE PARTS ARE RECOMMENDED FOR THIS OUTSTANDING "P.W." DESIGN

Component.	Make used.	Suitable Alternatives.	Component.	Make used.	Suitable Alternatives.
1 Panel, 16 in. x 7 in.	Goltone	Peto-Scott, Lissen, Becol	2 2,500-ohm ditto	Graham Farish "Ohmite"	—
1 Baseboard, 16 in. x 12 in.	—	—	2 400-ohm ditto	Graham Farish "Ohmite"	—
Two side pieces, 12 in. x 3½ in. x ½ in.	—	—	1 700-ohm ditto	Graham Farish "Ohmite"	—
1 three-gang variable condenser, .0005 mfd.	Polar "Star"	—	1 L.F. Coupler	Benjamin "Transieeda"	—
1 Disc drive for above	Polar	—	1 Output choke	Lissen	—
1 Three-gang assembly canned coils	Telsen W.288	—	2 4-mfd. fixed condensers	T.C.C. type 61	Dubilier, Igranic
1 .5-meg. potentiometer	Lissen LN.571	Igranic, Lewcos, Tune-well	2 2-mfd. ditto	T.C.C. type 50	Dubilier, Igranic, Telsen
1 Screened H.F. choke	Wearite HFPa	—	2 1-mfd. ditto	Telsen W227	T.C.C., Dubilier
1 Screened H.F. choke	Bulgin "Supernet" type	—	2 .1-mfd. ditto	Telsen W231	Dubilier, T.C.C.
3 5-pin chassis mounting valve holders	Clix	—	5 .25-mfd. ditto	T.C.C. type OF	—
1 7-pin do.	Clix	—	1 .01-mfd ditto	Dubilier 620	T.C.C.
1 2-meg. leak with wire ends	Goltone	—	1 .0003-mfd. ditto	Lissen LN.11	Dubilier 610, T.C.
2 1-meg. resistances with horizontal holders	Graham Farish "Ohmite"	—	1 .001-mfd. ditto	Dubilier 610	Telsen, T.C.C.
1 .5 do.	Graham Farish "Ohmite"	—	1 .0002-mfd. ditto	Dubilier 610	ditto
1 100,000-ohm do.	Graham Farish "Ohmite"	—	1 .0001-mfd. ditto	Dubilier 610	ditto
1 50,000-ohm ditto	Graham Farish "Ohmite"	—	1 on-off switch	Bulgin S.80	—
1 25,000-ohm ditto	Graham Farish "Ohmite"	—	Sheet foil to cover baseboard	—	—
2 10,000-ohm ditto	Graham Farish "Ohmite"	—	4 Indicating terminals	Belling Lee type R	Goltone, Igranic, Ealex, Bulgin
2 3,000-ohm ditto	Graham Farish "Ohmite"	—	1 Push-pull on-off switch	Lissen	Bulgin, Ready Radio
1 Tapped resistance (X, Y) see text next week	—	—	1 100-ohm resistance with wire ends	Dubilier 1-watt	—
			2 Terminal strips, 3" x 1½"	—	—
			2 yds. insulating sleeving	Goltone	Wearite
			4 yds. single screened sleeving	Goltone	Lewcos
			8 yds. 18-gauge tinned copper wire	Goltone	Wearite
			1 yd. iron-covered sleeving (single)	Goltone	Lewcos
			Flex, screws, etc.	—	—

# ECKERSLEY EXPLAINS-



If you are good at construction, then Eckersley envies you! In this week's contribution to his recently introduced new feature, our Chief Radio Consultant makes this confession. He also has some tips for you concerning the saturation of transformers, including details of the arrangements he personally prefers.

**D**O you like making things? I was wondering, because if you do I envy you so. I love making things, but I make them so terribly badly. Mark you, I do not mean that I make bad writings, bad designs, or ever think badly, no! I mean I cannot use a soldering iron, a screwdriver, a saw, or a drill so as to produce a good-looking job. It isn't usual for people to do things badly and yet like doing them. But I do adore having to make a set or repair a set or set up a circuit coherently, or experiment so that someone besides myself could understand the connections.

### Making Things that Work.

Perhaps it is that those who think they can make things better than I can go to such trouble to tell me how bad I am. Now I am bad, no doubt, if "workmanship" is in question. If I were to make a box I know that the nails would be inclined to put their silly little faces in the way of fingers groping for a lost nut.

The amount of solder in the general vicinity of a joint made by me is perhaps

So be not deterred. Carry on. Make the things yourself, never mind what they look like, lots of 'em won't look worse than they sound. But if you are good with your hands—there's no denying it after all this—I do envy you.

Now there's R. W. of Barking, who writes:

"I have a super-power output valve in my receiver, and as the anode current is large I have decided to use some form of coupling to the speaker (which is of the cone type), as I have been told that it is better to remove the direct current from the winding of such a speaker.

"Which is the best means of obtaining the coupling—by a transformer or a choke—and is a condenser necessary for either?"

It's a particularly important point this question of iron saturation. Personally, unless pennies are very important, I always like to design so that no D.C. current ever flows in any winding embracing

turns by the current flowing in these turns. Ten thousand turns carrying twenty milliamperes gives you two hundred ampere turns (remember milli means thousandths).

The iron core of a transformer is usually continuous. The iron core of a choke frequently has an air gap. So (say) two hundred ampere turns acting in the closed iron core magnetises that core like anything. Two hundred ampere turns acting in a core with an air gap does not magnetise the iron anything so much.

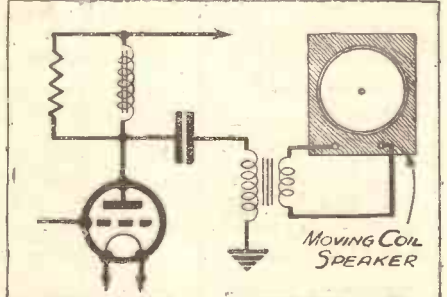
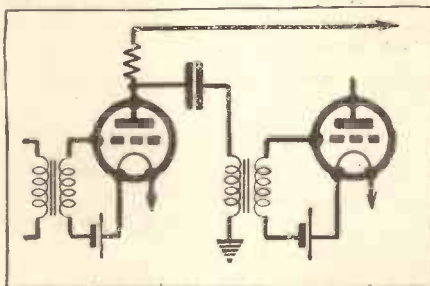
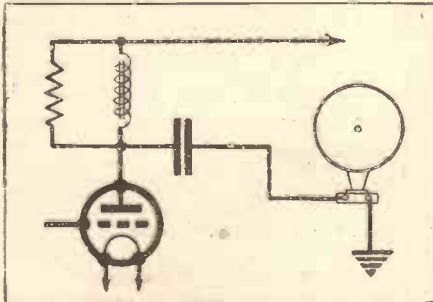
### Impracticable Perfection.

When you magnetise iron you saturate it, and it won't respond to current variations linearly—you get distortion.

The "perfect" technique is to use resistances in the anodes of all valves and so do away with iron. But power-valves want lots of volts on their anodes. Resistances stop volts getting on anodes.

You might apply 500 volts or even 1,000 volts through a proper resistance and get

## INTER-STAGE AND LOUDSPEAKER COUPLING



These three schemes of connections are recommended by our Chief Radio Consultant because they keep D.C. current out of those iron-cored windings which are often liable to saturation.

disproportionate to that actually at work holding the wires together. Maybe the condensers are not quite in line, that certain holes are rather more than clearance holes (because they had to be not being straight in the first place), but—I say to all you critics *BUT*—the things I make may not be pretty but they do work. Perhaps if you had made them your meticulously minded friends with their straight-line eyes would be better pleased, perhaps the thing would have been made in just half the time I took to make it, and the screwdriver and two drills might still be intact but, I keep telling you, I've had a good time.

iron or, if it must, then let's be generous about the iron.

### Magnetising the Iron.

If you have a many-turned winding over an iron core any direct current flowing in that winding magnetises the iron. The amount of magnetisation increases with the ampere turns and whether the iron is a completely closed circuit or not.

Ampere turns is only a number obtained by multiplying the number of

the right conditions for a power valve—but well! 1,000 volts H.T. is a bit impractical.

So a choke in the anode circuit is advisable to get the proper impedance and a reasonable anode voltage. But don't saturate the choke—get a good one with an air gap.

A choke will increase its impedance with increasing frequency. So I like to put a resistance across the choke. Thus my diagrams show the best way to use either transformer, inter-stage connection, or how to use choke-feed to a loudspeaker.

It is particularly important to use choke feed, I think, when using pentodes.

THE MIRROR OF THE B.B.C.

By O. H. M.

## MORE STAFF CHANGES?

Empire Programme Scoops— L.G.'s Banner—Dame Madge Kendal at the Microphone—Higher Salaries.

**A**LTHOUGH the B.B.C. emphasise the fact that Mr. E. Liveing, the North Regional Director, is only temporarily engaged on duties at Broadcasting House, I should not be in the least surprised if he remained in London. He is due to return North early in the summer but, if he goes back, it may be only for a short while, and I anticipate seeing Mr. Liveing down south again before long, probably working under Major Gladstone Murray.

### Programme Scoops Stopped.

Steps have had to be taken to cancel arrangements whereby the B. B. C.'s Empire programme paper might be bought in this country. For a time it was on sale at the B.B.C. bookshop and elsewhere at a price of 5d., but it may now only be obtained abroad, and a rule forbidding the staff to take copies of the paper out of the building, is strictly enforced.

It appears that this tightening up is due to several enterprising journalists who bought the paper regularly and were therefore enabled to give surprisingly accurate forecasts of the next three weeks' broadcast programmes! One reporter, at least, obtained two minor "scoops" for his paper in this way. Broadcasting House takes such things good-humouredly, but I wonder whether the newspapers would keep smiling if the B.B.C. snatched the early editions of the "Daily Blank" and shortly before midnight treated listeners to all the next day's exclusive news?

### The Children's Eisteddfod.

Twelve thousand people from all over Wales will travel in many special trains to

Caerphilly to take part in the Urdd National Eisteddfod, from which a broadcast will be taken as part of the West Regional programmes on Saturday, May 27th. Although the event has become to all intents and purposes the Children's Eisteddfod, it differs from all others inasmuch as no prizes are awarded, although the competitors receive certificates, and marks are given to branches rather than individuals.

## A RADIO LESSON IN GEOGRAPHY



Taken at the Cookridge Street Baths, Leeds, this scene shows a broadcast lesson in geography during a demonstration for school teachers and university students. Following the speaker with the aid of maps is an important feature of such lessons.

The most coveted distinction is the banner which Mr. Lloyd George presented last year for award to the area securing most marks, and which is at present held by the Swansea Valley. Keen competition is certain, and already Llanelli has decided that the Swansea Valley will have to fight exceedingly hard to justify their claim to the banner this year. Other districts are also hopeful

of securing it, so that the proceedings on May 27th should make an admirable broadcast. We hope to give further details of the programme in due course.

### Great Actress to Broadcast.

The B.B.C. are more than delighted at having persuaded Dame Madge Kendal to take part in the "Stars In Their Courses" series. About a year ago Dame Madge was due to take part in a radio play at Broadcasting House, but there was disagreement, and the B.B.C. feared that the great actress was offended and would never again agree to broadcast.

Her willingness to take part in the present series is, therefore, hailed as a sign of her goodwill towards the Corporation, and I need hardly add that steps are being taken to ensure that she shall not again have grounds for complaint.

### Belfast Musical Competitions.

The annual Belfast Musical Competitions, which last for a fortnight and attract competitors from all over Northern Ireland have become much more important since the B.B.C. has arranged to broadcast a concert by selected prize winners. The concert will take place this year on Thursday, April 27th, and while very little can be said at the moment owing to the uncertainty of the actual performers, the broadcast will undoubtedly make a wide appeal among listeners of the six counties.

### G.M.T. for Empire Service.

Listeners should note that, although Summer Time was officially adopted in this country on April 9, the B.B.C. has adhered to Greenwich Mean Time for their Empire services. It would obviously have been absurd to serve up Summer Time to the world when the southern hemisphere is enjoying winter!

### B.B.C. Salary Increases.

Great satisfaction is being expressed among the staff of the B.B.C. that the Board

(Continued on page 220.)

**I** WONDER how many of us adhere rigidly to the advice that is so often given by the gramophone record manufacturing concerns to be sure and change the needle after every record?

Perhaps, in some respects, it is unfortunate that the record makers are also responsible for the production of needles, for the advice is so apt to be misconstrued as just diplomatic sales talk. But very definitely it isn't. It is sound advice, as is obvious from some interesting figures which have just reached me from H.M.V.

I, for one, had no idea that the length of recorded track on a standard ten-inch record was rarely less than *one eighth of a mile*, and when, added to that, is the fact that the weight of the needle point upon the record is equivalent to 20 tons per square inch, there is not much doubt concerning the soundness of the advice.

### Remarkably Good Reproduction.

This is not strictly radio, I know, but so many of us derive entertainment these days from the electrical reproduction of



Weekly Jottings of Interest to Buyers.

records that I feel justified in referring to the matter. After all, the standard of reproduction is so remarkably good that it does seem a pity to spoil the records for a ha'p'orth of needles!

Some little while ago I referred in my notes to a booklet that had been produced by Ediswan upon the all-important subject of getting the most out of your H.T. battery. So great was the demand for the booklet,

coupled with the fact that a reprint edition was then going through to announce reductions in prices, that there was in some cases slight delay in dealing with applications.

The reprint edition, of which supplies are now available, is every bit up to the standard of the original one, and if there are any readers who have not yet obtained a copy, I strongly advise them to let me have a postcard right away.

In addition to giving very sound advice upon the choice and use of batteries, the Ediswan booklet contains a useful station chart upon which readers can fill in the readings that apply to their own sets.

Send your postcards right away, and I will endeavour to make arrangements for copies to be sent off with as little delay as possible. (No. 22R)

### Artificial Big Ben.

Necessity, so 'tis said, is the mother of invention, and to Marconiphone goes the credit for having produced an artificial

(Continued on page 221.)



# The P.W. AUTOGRAM

## CONSTRUCTING THE CABINET

Full details of How to Build the Cabinet for the Magnificent All-Electric Automatic Radiogram described in last week's issue.

By the "P.W." RESEARCH DEPT.



THE cabinet framework for the "Autogram" consists essentially of four main corner supports which take the form of corner mouldings.

These particular mouldings are obtainable in various designs, but it is essential if a really sound cabinet is to be constructed that the grooves provided should take wood at least  $\frac{1}{2}$  in. thick. Unless wood of this thickness is employed for the loud-speaker compartment the finished cabinet

### WORK TO THESE DIMENSIONS

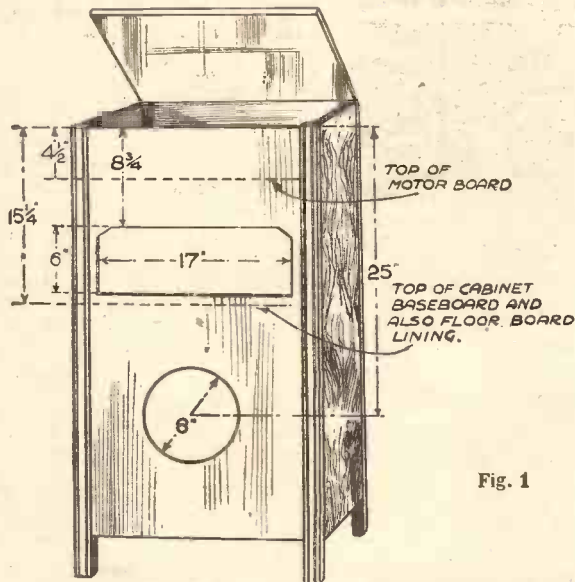


Fig. 1

The correct dimensions and positioning of the loudspeaker aperture are shown in this diagram, together with the size of the vignette for the panel.

will rattle and poor reproduction may result.

The four corner supports are each 40 ins. long, and in the case of the moulding shown (Handicrafts K146) this is approximately  $1\frac{1}{8}$  square.

First it is necessary to glue pieces of wood into the grooves in the portion of the four supports which are in effect the legs of the cabinet. These pieces of wood are  $\frac{1}{2}$  in.  $\times$   $\frac{3}{4}$  in., and approximately 6 in. long.

Whilst the glue is setting a start should be made on the sides of the cabinet, and for these either  $\frac{1}{2}$  in. floor boarding should be employed, or, better still, tongued and grooved boards.

The boards must be cut into equal lengths of  $20\frac{1}{4}$  in. for the front, and  $15\frac{1}{4}$  in. for the sides; the exact number of pieces will, of course, depend on the width of the

boards employed, and the above measurements are actual lengths and must not be confused with the inner distances between the legs given in Fig. 3.

In the case of the front, a sufficient number must be cut so that the space nearly up to the line marked "top of cabinet" in Fig. 1 is filled in. A space between the top edge of the last board and this line must be left so as to fix the cabinet baseboard in place—note this line does not refer to the baseboard of the set.

In the case of sides it is suggested that the "boards" are taken nearly up to this line, and then a gap left along each side approximately 3 in. wide, so as to facilitate the mounting of the various controls. The boarding may then be continued to the top.

### Starting Construction.

At this stage it is advisable to start the construction of the actual cabinet. The two front corner pieces should be taken and the planks, already cut to size, fitted into the grooves provided, making quite sure that the first one, i.e. at the bottom, is at right angles with the two side pieces.

These planks must now either be glued or nailed into position—both, if possible.

The two back legs must now be treated in a similar manner, but here only two are required—one is fitted so as to be flush with the top edge, and the other rests on top of the small fillets of wood which have previously been glued in

the lower ends of the two grooves.

It will be seen from the diagrams that both the top planks in the case of the sides, front and back are only  $4\frac{1}{2}$  in. wide. Actually this measurement need only be adhered to for the back and front, since in the case of the sides the planks may be taken to the top—with the exception of the gap already referred to.

### Fixing the Bottom.

The two sides must now be taken and the planks already cut fitted into the remaining grooves in the front and back corner supports, not

forgetting to leave the spaces above the cabinet baseboard line for the controls. This really completes the rough framework around which the finished cabinet is built.

The next stage is to turn the framework

### THE CORNER PIECES

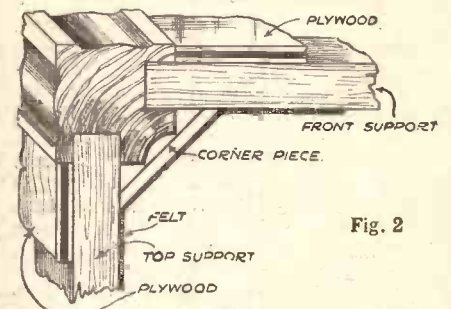


Fig. 2

The body of the cabinet is built up of short lengths of board slipped into grooved uprights. Here you see the manner in which the boards are held, and also how they are finally covered with plywood.

upside down and fit either a three-ply bottom into place, or better still, some more tongued and grooved boards. The bottom is easily fixed, since it may be nailed to the boards forming the front, back and sides.

### Supporting the Baseboard.

Having reversed the framework, cut the cabinet baseboard, for this  $\frac{3}{8}$ -in. plywood is suggested, and to aid fitting, it should be made in two pieces.

To support the baseboard, two strips of wood 1 in.  $\times$  1 in. should be nailed to the sides of the cabinet, holding a heavy piece of flat iron or a hammer on the outside to prevent the hammer blows from breaking the side panelling.

(Continued on next page.)

The loudspeaker is secured to a separate baffle which is placed inside the lower portion of the cabinet immediately behind the circular opening at the front.



## THE "P.W." AUTOGRAM : CONSTRUCTING THE CABINET

(Continued from previous page.)

The motor-board is not really a board, but consists of four pieces of wood forming a frame and screwed on the underside of the front and back top pieces, i.e.  $15\frac{1}{2} \times 4\frac{1}{2}$  in. and  $20\frac{1}{2} \times 4\frac{1}{2}$  in. In the case of the side supports they should be screwed through the side panels.

In Fig. 2 details are shown for the fitting of corner pieces in the top of the motor compartment, so as to cover the inside edge of the corner moulding, these pieces may either be glued or nailed into position. Do not, however, make the triangle formed by this crosspiece too large, otherwise it will not be possible to place the motor into position.

### Preparing the Panels.

A door must be made for the back of the cabinet, and this is really the next step, and it is advisable to construct to this point before purchasing the wood for the door, since slight divergences from the measurements given would result in the wood being wasted.

When measuring for the door do not forget to allow for the addition of a thin strip of flat moulding round the outer edge of the door, for this moulding will prevent the door from warping;  $\frac{3}{8}$  in. plywood is a suitable material for the door.

After the door has been temporarily fitted and two hinges screwed on the side, the door should be removed and a large hole, 12 in. or so in diameter, cut so that its centre is approximately opposite to the centre of the circular hole shown in Fig. 1. This is at the front of the cabinet, although actually this latter hole should not yet be cut.

The outside of the framework must now be examined to make quite certain that no screw heads are above the level of the wood and all the nails have been driven in below the surface of the wood.

### IN SKELETON FORM

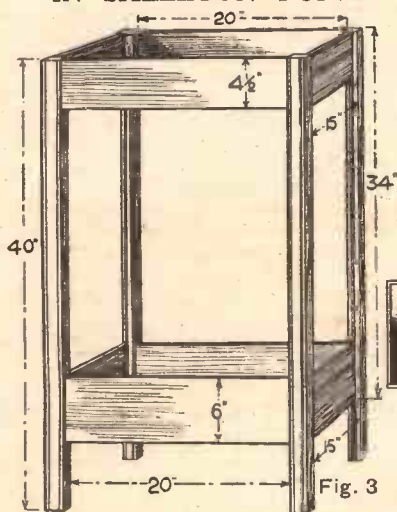


Fig. 3

So far, the question of the actual wood for the outside of the cabinet has not been mentioned. Actually this is  $\frac{1}{8}$  in. faced plywood, this particular wood being ordinary plywood covered with a veneer of mahogany, walnut, plain oak or figured oak.

The wood chosen will, of course, depend on individual taste and requirements.

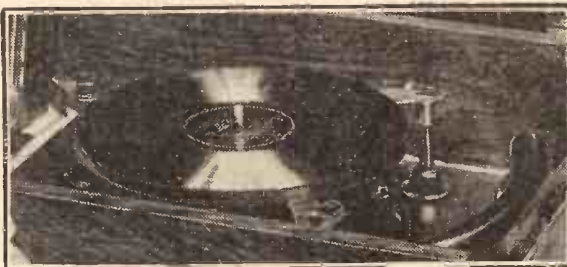
It is advisable to bear in mind, when purchasing the faced plywood, that the side panels of the front should each have a similar grain, i.e. they should be matched for colour and grain.

It is not advisable to purchase the panels until you have reached this stage in the construction of the cabinet, and if you do not possess a really first-class saw they should be cut to size by the suppliers of the wood. They must also be cut "dead" to size, to fit to the corner mouldings as shown in Fig. 2.

The front panel is in two pieces, and the dividing line, or the line at which this panel is to be cut, is 18 in. from the top edge of the cabinet. This allows the vignette to be cut for the panel with a normal fretsaw frame.

To fix the plywood for the front and sides into place,  $\frac{5}{8}$  in. veneer pins should be used, and to cover the saw cut across the front where the two front panels meet a piece of half-round beading must be fitted.

### AUTOMATIC IN ACTION



Above : The special Garrard Universal self-changing unit upon which the Autogram is based. Below : The cabinet in skeleton form and a section of the corner moulding. Reference should be made to the text for the actual overall dimensions of the boards forming the front, back, and sides of the cabinet assembly.

Moulding must now be fitted round the bottom edge of the sides and front so as to give a finishing touch to the bottom of the cabinet. Quarter-round moulding or flat strip is really the most satisfactory.

### Lid Details.

It is strongly advised that the circular 8 in. hole at the front of the cabinet should not be cut until the front panel is fitted, otherwise there is the difficulty of making the paneling and plywood coincide.

The position of the hole should be marked, and veneer pins driven in 1 in. apart on a slightly larger diameter circle than that already marked out for the loudspeaker. These pins will not only stop the front from bulging, but will also prevent it from "rattling." A keyhole saw will enable the aperture to be cut to the required size after drilling the necessary hole so as to be able to start the saw.

The cabinet, minus the lid and fret,

is now complete, with the exception of staining and polishing. A start must now be made on the lid, and details of the construction are shown in Fig. 4.

The main frame really consists of picture moulding of a suitable section;

### HOW THE LID IS MADE

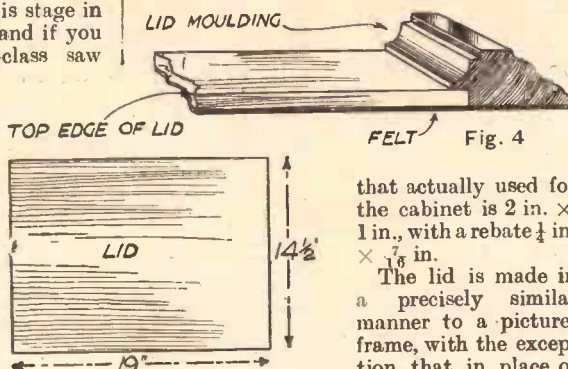


Fig. 4

that actually used for the cabinet is 2 in.  $\times$  1 in., with a rebate  $\frac{1}{8}$  in.  $\times$   $\frac{7}{8}$  in.

The lid is made in a precisely similar manner to a picture-frame, with the exception that in place of the picture and glass a piece of  $\frac{7}{8}$  in. plywood,  $19 \times 14\frac{1}{2}$  in., is fitted. Unless you have a mitre block, it is advisable to get the corners cut when purchasing the moulding, because a badly cut mitre, particularly on the lid, will spoil the appearance of the whole cabinet.

### To Prevent Strain.

A 12 in. gramophone lid hinge should next be fitted to the lid, and this should not be recessed on either the lid or the cabinet. The reason for this is explained later. To prevent strain on the lid before the felt is fixed, nail a piece of thin wood on the top front edge

of the cabinet for the lid to close down on.

The cabinet is now ready for marking out the position of the holes and drilling same for the various controls, and the reason for leaving the gap between the side panels is now evident; for few of the components are designed for mounting on a panel thicker than  $\frac{1}{2}$  in. thick.

Both the radiogram switch and the on-off switch are provided with escutcheons, and it will be necessary to drill slightly larger holes than usual; actually they should be  $1\frac{1}{8}$  in. in diameter.

### Staining and Polishing.

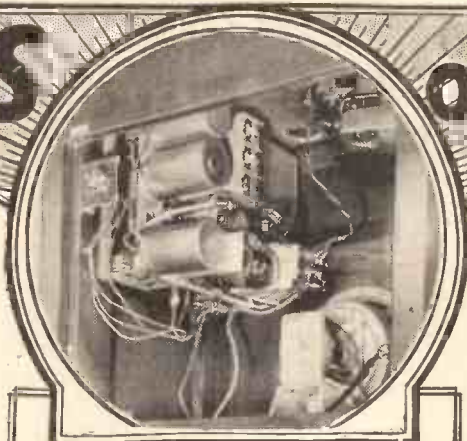
The set should now be placed into position, and the controls and automatic record-changer fitted. Having made quite certain that all the necessary holes have been drilled, remove the various component parts, and the cabinet, after sandpapering, is ready for staining. The colour of the stain will again depend on individual taste, and also the plywood with which the cabinet has been completed.

There are really so many excellent stains and polishes available that the home constructor should have little trouble in finding those most suited to his particular needs.

From the photograph on last week's cover, it will be seen that the fret is of rather unusual design, and is, in fact, a pressing made from spruce pulp, seeming at first sight to be hand-carved.

(Continued on page 218.)

# RECEIVERS of RENOWN



**The Columbia "Radiograph" Four**  
A magnificent all-electric four-valve radiogram for A.C. mains.

**I**T'S an old saying that wisdom is the art of being a good listener.

Whoever it was that was responsible for those words unknowingly missed his vocation. He should have been on the Publicity Staff of Columbia!

Why? Well, ask yourself a simple question. When all is said and done, what is a good listener? Frankly, as we see it, a good listener is simply and solely the product of a good set. And the 1933 interpretation of a good set is one that will give absolute fidelity of reproduction above all else.

As most of you will know, Columbia, perhaps to a greater extent than any other firm in the industry, has always hammered home the importance of tone purity as the paramount consideration. And it is only now, after years of what we might refer to as "quality mediocrity," that the wisdom of their policy stands out in brilliant relief. Wisdom, in the manufacturing sense, is the art of providing for good listeners.

After all, a listener only tires of his own reproduction when he hears something that is better. And if in the first instance he hears one of the Columbia "original tone" instruments, then automatically he will become a good listener, and as such he will most certainly exercise wisdom! That is only one of the many reasons for the amazing popularity of Columbia instruments.

Yes, the Columbia policy is a sound one. And that is what makes it so very easy for us to approach a review of what is perhaps one of the most famous of all their instruments. We refer to the "Radiograph" Four.

### Secret of Success.

It is easy to say nice things about anything that is good, but perhaps the most graceful compliment that we can pay to this modern monument to scientific research is to say that the radio link between is entirely missing! Or at least, that is the impression that is created when first you hear the "Radiograph" Four.

Atmosphere! That's it. That is the whole secret of its success! None of that over-accentuation of high notes with its catastrophic effect upon sopranos, and none of that thumping bass which reminds one so irresistibly of the one man who succeeds in running a "band," but whose pent-up physical energies can only find an

outlet via the big drum-stick! No doubt it is clever, but it's *not* music.

For the recreation of music in all its tone colours, the whole secret is correct balance, and the Columbia engineers have got that down to a fine art. The "Radiograph" Four is a magnificent instrument, and it does them credit.

### In the Front Rank.

It is one of those sets which makes you reluctant to tune to other stations simply because the real enjoyment is not in searching but in listening. All the same, we must do justice to the instrument by adding that its sensitivity for the type of set is so much above the average that one must necessarily

### AN INSTRUMENT OF QUALITY



The radiogram is a fine piece of work, no matter from what point of view it is considered.

regard it as in the front rank of modern receiver design.

If you want distant stations—dozens of them—well, you can get them. You can get them at real alternative programme value, and with about as much energy and technical ability as it takes to turn a door-handle! Just one simple knob, and all you have to do is to turn it.

The principal stations in Europe are all named on the dial, and having picked out the programme that happens to suit your fancy, well, the rest is child's play.

Perhaps our observations up to now appear to be a trifle abstract. That is because when once you start to talk about the virtues of the "Radiograph" Four, convention becomes a quite secondary consideration. You just want to go on talking until you have said all that there is to be said, and even then the tendency is to rhapsodise about the superb cabinet work!

But the need for conventionalities is offset by the fact that our impressions are based upon practical experiences.

Remember that we have actually heard the set, not just on the local stations, but on transmissions from all over Europe, and then perhaps the reason for our enthusiasm will be obvious. The gramophone side, too, provides a thrill that tends to make one marvel at the wonders of modern science.

Unhesitatingly, we say that the Columbia "Radiograph" Four is definitely unsurpassable in so far as existing standards go, and that means, well, just realism as near as we shall know it for many years to come.

### Splendid Value.

But our review, we feel, would not be complete without at least a brief reference to design details, even though the vital information is adequately covered in the accompanying technical specification.

The provision of an aerial selector switch, the inclusion of a mains aerial device, the attention to mains hum elimination, the automatic brake for the gramophone motor—all are points which the intending purchaser cannot afford to overlook.

To sum up, the Columbia "Radiograph" Four represents all that is desirable in modern radio and gramophone practice. At the price, and consistent with the number of valves employed, you could not possibly better it however hard you tried. What more need we say?

### TECHNICAL SPECIFICATION—

**GENERAL DESCRIPTION.**—Self-contained all-electric radio-gramophone for A.C. mains.

**CIRCUIT DETAILS.**—Four valves (including rectifier) arranged in circuit sequence of variable- $\mu$  S.G., detector and pentode output. Aerial selector switch for regulating selectivity is provided and tuning is ganged.

**CONTROL ARRANGEMENTS.**—For convenience all controls are mounted on gramophone turntable motor board. The three knobs on tuning scale escutcheon control (rear), four-position switch giving "medium waves," "long

### —FOR PROSPECTIVE BUYERS

waves," "gramophone" and "off" positions (centre), main tuning condenser, and (front) volume. Gramophone motor is actuated by automatic "stop" and "start" device.

**SPECIAL FEATURES.**—(1) Tone purity; (2) easy station selection; (3) "station names" calibration; (4) superb cabinet work; (5) provision for use of mains aerial.

**PRICE.**—32 gns. A.C. model; 34 gns. D.C. version.

**MAKERS.**—The Columbia Graphophone Co., Ltd., 98-108, Clerkenwell Road, London, E.C.1.

## MORE NEW VALVES

The set designer, valve maker, component manufacturer and home-constructor are continually striving after greater efficiency. Thus, we all welcome the new types of valves which are described below, since they open up an interesting era of still better radio.

**D**URING the past year the Valve Design Laboratories of all valve manufacturers have been extremely busily engaged. Work has proceeded apace on the design of valves which would help British set designers in their continual striving towards perfection. Certain outstanding wants have been obvious for some time, and there are now on the market, or soon will be, valves which, it is felt, will fill these wants.

A typical example of such a long-felt want existed in the lack of a really efficient and satisfactory output stage for battery-set users. The extraordinary difference in the volume obtained from mains sets and that from battery sets must have been obvious to all, since the ratio of output wattages in the two cases was, on the average, of the order of 10 to 1.

### The First "Class B" Valve.

Valves of the pentode type have, indeed, been available to battery set users for some time, but even here to attain an output wattage comparable with that of a mains set has involved an anode current consumption so high as to be quite impossible if battery life is to be considered.

This problem has been catered for, to a large extent, by the introduction of the system known as Q.P.P. In the Cossor laboratories, however, another method has been fully developed for British set users. This is, of course, the system known as "Class B" amplification, the first British valve for which was the Cossor 240 B.

The method of using this valve is now fairly well known and need not be described here. The result of the introduction of the valve is that battery set users may now have an output stage which will, for the expenditure of an anode current well within the limits of an ordinary H.T. battery, provide an undistorted A.C. output of 2 watts, a figure equal to that obtained from a powerful mains set.

### Automatic Volume Control.

Subsidiary to large output combined with economy of anode current, other advantages which led to the adoption and recommendation of the scheme, are the low value of load impedance into which the valve works together with cheapness and easiness of design of the output stage as a whole, and the ease of adoption to existing set designs.

Next on the list in the continual endeavour towards perfection comes the consideration of mains sets. Here the problem is rather different. At the moment the output stage may be considered as moderately satisfactory.

Existing conditions have made it imperative that selectivity should be improved, and hence a general trend towards superheterodyne sets has become apparent. The ease of manipulation and general satisfactory performance of these is greatly improved by the provision of automatic

volume control. This problem will in England be solved by the use of valves embodying one or more small diodes and either a triode, tetrode or pentode type valve, in the same bulb.

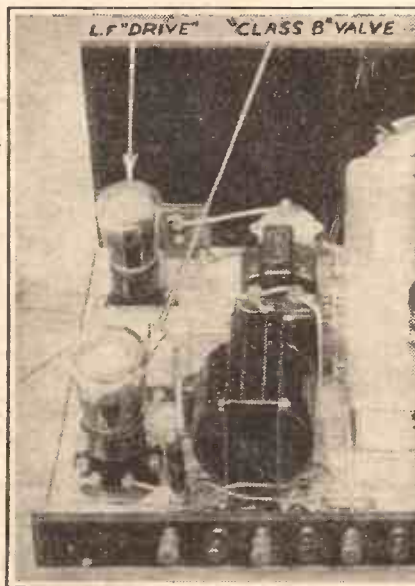
In the case of the double-diode type valve, one of the diodes will detect in the normal manner whilst the other will provide the voltage to be used for automatically altering grid bias for preceding valves. The triode, tetrode or pentode portion will act in general as a low-frequency amplifier after the diode detector.

### Improving H.F. Amplification.

The Cossor contribution towards the provision of this essential refinement will consist of a double-diode pentode valve. The high amplification which may be obtained from this type of valve will make it suitable for use with even the largest output stages, and in addition will provide means for further refinements of the automatic volume control system as a whole.

In close association with the automatic

### FIRST IN ITS CLASS



The first receiver for home constructors using "Class B" amplification, which was described in "Popular Wireless" for March 25th. The new output valve and its "Drive" are indicated in this view of the L.F. end of the set.

volume control system comes the design of valves to provide improvements in H.F. (or I.F.) amplification, and detection. High efficiency screened pentode valves have been designed in which great improvements over the existing screened grid valves are embodied.

The first and most important advantage in the use of these valves lies in the much larger voltages which can be delivered by them without distortion as compared with that delivered by existing screened grid

valves. Two types will be available, one of the variable- $\mu$  type (which will be particularly suitable for the later amplifying stages of superheterodyne sets) and one of the non-variable- $\mu$  type. This latter valve will be undoubtedly the most efficient valve yet known. The Cossor valves of this type, together with the double-diode pentode valves previously mentioned, will be on the market during the next few weeks.

### Looking Into the Future.

With regard to the future, it appears extremely probable that the next few years will see the disappearance of many existing valves and the appearance of many new and better valves to replace them. Developments are in hand for still greater efficiency both in mains and battery valves.

Battery sets will undoubtedly enjoy a new lease of life by virtue of the provision of a really adequate output stage. It may be that work which is at present in hand and which it is premature to consider, may radically affect set design both in this battery field and in the mains field.

## ANOTHER BOOK ABOUT TELEVISION

**M**R. SYDNEY A. MOSELEY'S introduction to the third edition of "Television: To-day and To-morrow,"\* if it does nothing else, provides the reason why so much criticism has been levelled at television in recent years.

"Our personalities," says Mr. Moseley, "are only cognisable to our fellows by the senses, so that if we can transmit the sensations of sound, vision, and smell, we have to all intents and purposes solved the problem of transmitting our bodies corporeally over space."

This being typical of the extravagant remarks made about television by its most ardent supporters, there is little wonder that sane critics are reluctant to take television à la Moseley too seriously.

"Television: To-day and To-morrow" claims to be the most up-to-date and authoritative work on the subject.

Undoubtedly it provides an entertaining, thorough and well-illustrated history of Baird Television systems over the last seven years. But surely no work can claim to be up-to-date which dismisses cathode ray and other systems in eight pages, nor authoritative which contains not even a passing reference to the POPULAR WIRELESS £1,000 challenge, which gave to television the greatest chance it will ever have to justify the claims made for it.

The technical side of the work has been conscientiously prepared by Mr. Barton Chapple, whose statement that "it is of great importance to note that the apparatus used by Mr. Baird in these (early) experiments is almost identical with that now in common use" explains why results in 1933 are so nearly identical with those obtained in the experiments of 1928.

"Television: To-day and To-morrow" is obviously intended to be the justification of Baird television, and as such it will be read and enjoyed by all the owners of television receivers in this country.

P. C.

\*Television: To-day and To-morrow—third edition—by Sydney A. Moseley and H. J. Barton Chapple. Published by Sir Isaac Pitman and Sons, Limited, 7s. 6d.

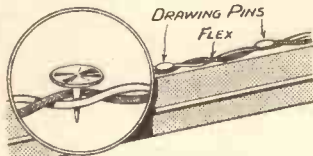
# RECOMMENDED WRINKLES



## SECURING TWIN FLEX.

It is very often inconvenient and unsightly when running flex wire round the room, to fasten with staples. The following method enables flex to be laid very quickly and satisfactorily whether temporary or permanent.

All that is required is a quantity of drawing-pins. The pins are inserted between the twists of the flex at



A dab of secotine on the points of the pins increases their holding powers.

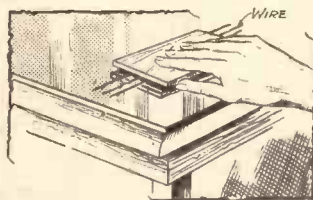
suitable intervals and then pressed into position. If a dab of secotine is placed on the points of the pins before pressing down the work will be much more secure.

No disfigurement is made to the woodwork even if the wire is removed at a later date.

## OVERCOMING WIRE WORRIES.

ALTHOUGH many very good notions for straightening lengths of wire have been suggested, not one of them, from a practical point of view, could be successfully used to straighten ends of, say, from one to six inches in length.

Tugging between pliers and other grips is a waste of time, for although that idea may to some extent straighten things out, it will not smooth out the sharp kinks.



Pliers are not much good for small lengths of connecting wire. Try this alternative method.

A successful and exceedingly quick method of doing this is to roll the pieces between two small boards or the table (polish protected) and one piece of wood.

## THREE-PLY PANELS.

IF your eye has become so accustomed to the appearance of ebonite, malozanite and similar coloured insulating materials for panels that you resent the somewhat unfinished appearance of three-ply, why not give the wood an imitation hard-gloss composite finish? This can be almost any colour you wish.

All that is necessary to do this is to obtain a stick of suitably coloured sealing wax and make it into a solution by breaking it up into small pieces and dissolving them in methylated spirit. The dissolving process must be done in an airtight bottle, and will take 24 hours.

At the end of that time the solution can be applied with a camel-hair brush.

Two coats are necessary for good results, but before applying the second coat any brush marks left on the first coat must be smoothed down with a knife, scraper, or very fine sandpaper.

Should brush marks show on the final coat—they shouldn't if the solution is fairly thin and the panel is stood upon its side to drain—they can be roughed off as before and then polished with pumice powder (Yim or an equivalent) and water. There should follow a final polish with furniture polish.

Some beautiful results can be brought about by spraying a different coloured solution on a panel which is still wet. A scent spray can be used for this idea.

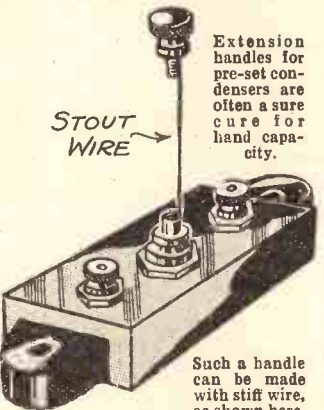
## CONE CONSTRUCTION.

THE two chief requirements in a cone for a loudspeaker are lightness and stiffness. To a certain extent these two requirements are contradictory but, if a paper is chosen for lightness it is possible to obtain the desired stiffness in two ways.

The simplest is to dope the fashioned cone. This will toughen the material and let it work with the desired piston-like movement, it will render it non-

small screw to make it longer and above the coil.

I have a Comet 3, which has two pre-set condensers and I did this to them both and I found a big difference when



Extension handles for pre-set condensers are often a sure cure for hand capacity.

STOUT WIRE

Such a handle can be made with stiff wire, as shown here.

## ONE GUINEA FOR THE BEST WRINKLE!

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

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

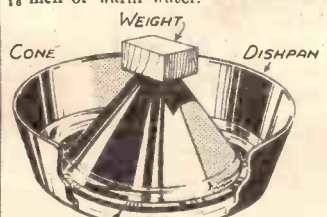
Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

The best Wrinkle last week was sent by Mr. E. KUHR, of 14, Brunswick Terrace, Brunswick Avenue, Hull, to whom a guinea is being awarded.

hygroscopic, a common fault with untreated paper, and it will improve the bass notes.

It will also eliminate the tendency of the material to "flap" which is often noticed with large cones in damp weather.

Another plan to stiffen the cone is to equip the edge with a flange. This can be done roughly by bending over the edge with the fingers, but a more mechanical method is to stand the cone, rim down, in a dish containing about 1/2 inch or warm water.



EDGE OF CONE IN WATER

This composite diagram shows both operations in one. Actually the weight is not put on until the cone has been taken out of water and stood on glass.

When the rim is softened, it should be removed and stood on a sheet of glass with a slight weight placed on the apex until it has dried, when a workmanlike flange will result.

## ADJUSTING PRE-SETS.

MY idea to stop hand capacity when handling pre-set condensers was to solder a length of stout wire on to a

I had to alter the settings on the condensers.

The knob can be either waxed on or else another screw soldered on the top to allow the knob to be screwed on as I did.

This brings the control knob above the coil and makes tuning more selective.

## SILVERING BRASS SCREWS

POLISH all screws up as bright as you can. Burnish, if possible, with a steel burnisher.

Obtain a small quantity of pure tin (when burnished pure tin has the closest appearance to silver) and granulate it by melting in a large spoon or ladle, and drop from about a height of four feet into a pail of cold water.

Place the granulated tin in a coffee tin with enough cream of tartar to cover it; completely fill with water. Place the parts to be tinned in the tin and boil for about half an hour. The articles will then be covered with a film of pure tin. Polish with a soft rag, and lacquer with transparent lacquer.

If done carefully the result is difficult to distinguish from silvering, and your set will look splendid.

## MAINS HUM.

A. C. hum is often the bugbear of an otherwise efficient mains set, and is often caused by flex from the plug point to the set passing behind the latter and thereby introducing hum into it.

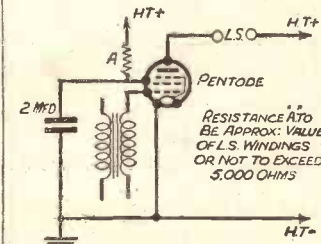
I have found that by passing the flex through a piece of narrow-bore, flexible metal gas tubing and, of course, earthing the latter, a complete cure is effected.

The earthing wire should be taken from a terminal on the set, or on the eliminator if one is used, and either soldered or bound tightly to the tubing, the end of which must be clean.

Care should be taken to prevent the tubing from coming into contact with the bare ends of the mains' wires where they are attached to the set.

## CHANGING TO PENTODE.

WHEN a pentode is fitted to a set, in which the loudspeaker is working direct off the anode of the last valve, and the auxiliary grid lead is taken direct from the battery to the auxiliary grid, a hum is sometimes heard, varying in intensity with the frequency of the note in the loudspeaker, or it might be found that the output is distorted.

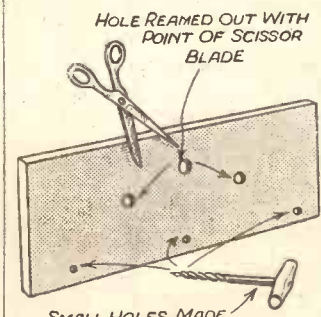


A resistance (A) in the auxiliary grid lead will cure hum in the output arrangement shown here.

This can be cured by fitting a resistance in the auxiliary grid lead of approximately the same value as the loudspeaker windings in ohms, and by passing it to earth by a 2-mfd. condenser.

## MAKESHIFT DRILLING

IT is not necessary when drilling a panel to go to the expense of buying a drill, etc. All you want for this job is a small gimlet and an old pair of scissors, or an old scissor blade with a point.



SMALL HOLES MADE WITH GIMLET

Wooden and ebonite panels can be dealt with in this way when a drill is not available.

First make a hole with the gimlet, then ream this small hole with the point of the scissor blade with a half-round motion, backwards and forwards, putting pressure on all the time.

This reaming idea applies to wooden panels as well as ebonite. If using a wooden panel, rub round the hole with sandpaper after reaming to remove rough edges.

**F**OLLOWING up my note of last week concerning re-radiation by neighbouring receivers—and the conclusion that it was very unlikely to be responsible for "freak" reception—here is another one. "J. W." (Newtownards) writes: "I think it is rather amusing to imagine that, if you hear someone oscillating on your selected wavelength, your oscillation is coming from Australia."

Very unlikely, "J. W." I won't say impossible, as nothing seems to be impossible on short waves. But it would have to be some receiver at the other end.

#### Chassis Construction is Ideal.

"J. W." also raises the question of the advantages gained by building a short-wave set in an aluminium box. Candidly, I don't think it is worth while for the average man to do this. A metal panel and a metal-lined baseboard are the two important points. I use an aluminium box myself for various reasons—one of which is that the receiver sits within a foot or so of a 500-watt transmitter, but I should probably get on just as well without it.

I think "chassis" construction is ideal for a short-wave set, and have been asked to make a chassis two-valver.

"R. G. C." (Tunbridge Wells) is another who finds no difficulty in receiving Fécamp on 70 metres odd. He also wants to know who is the American station between G S B and G S C? It looks like W 2 X A F, but the times are wrong.

## THE LISTENER'S NOTEBOOK

A critical review of recent broadcasting topics.

**A**NOTHER winter of broadcasting is over. Apart from the fresh series of talks to herald in the spring, there is little else in the radio programmes to mark the new season. Broadcasting does not regard the four seasons of spring, summer, autumn and winter as markedly as it does the festive seasons of the Church. And, of course, it couldn't. We have always associated certain music with certain Church festivals, and broadcasting has merely carried on the tradition. This is a comparatively easy job.

#### Outside Broadcasts.

Running commentaries are as indicative as anything that winter has gone, and I hope they are going to be more indicative still. London stages a number of events during the season at which the public would like to be present through the medium of their loud-speakers.

The lives of many people would lose much drabness if only they were occasionally transported from the narrow confines of their four walls. Normal radio fare has already done a good deal in this direction, and I wouldn't belittle the achievement for a moment, but everyone loves variety. Hence my repeated demand for more commentaries.

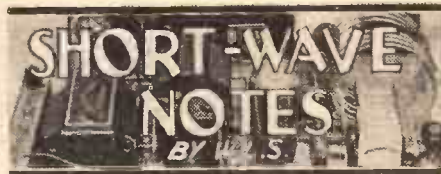
#### Well-Tackled Talks.

Many listeners will regret the end of some of the winter talks, and as sincerely as Mr. S. P. B. Mais regretted the full stop he had to put to his S O S talks. Mr. Mais was fairly worked up on the occasion of his last. But no one doubts his sincerity. It has been apparent throughout the season how seriously he has tackled his job. Some people may have preferred his "Unknown Island" manner, but we have got to realise that he was on a different errand this time.

The beauty of nature and the misery of unemployment obviously demand different treatments. But whenever (and this was quite often) he came across something beautiful among much that was sordid, we did get glimpses of the "Unknown Island" manner.

The Saturday night debates, too, have had many admirers—and rightly so. Without exception, every debate was a good one, and the selection made of the questions of the hour was equally good.

The only fault I could find, at least with some of the debates, was that the twenty minutes allotted to each debate was absurdly inadequate for dealing with the question at issue. "Vivisection" for instance, was only considered from one or two angles



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

"R. G. C.'s" particular problem is a short-wave set that doesn't work nicely unless he has the earth lead connected to another nearby set. When that is removed, his short-waver goes all googly!

Long earth-leads always do funny things, and the best recommendation that I can make to "R. G. C." is that he should persevere with the short-waver until it works properly with no earth connection whatever to either set. The old dodge of standing the batteries on the floor with a metal plate underneath them may help. Don't earth the metal plate, but connect it to L.T. negative.

#### The Best Stations.

This sudden spasm of more or less technical queries in the post-bag indicates a loss of interest in the actual station-getting part of short-wave work. This is probably due to (a) fine weather; (b) absence of said stations. As a matter of fact we have had a rather poor period since the phenomenally good conditions that prevailed early in March.

at most. I know that people are seriously concerned with this question, but admirable as the debate was, neither of the debaters could claim to have cleared much up.

#### Microphone Technique.

Talks have definitely progressed during the winter. Apart from their subject matter all "talkers" seemed to have mastered the technique of the microphone. I cannot recall a dud. Or else it is that we have mastered the art of listening. Perhaps a bit of both.

#### Music's High Level.

Music, old and new, big and small, has maintained its high level. Adrian Boulton has made every Wednesday a red-letter day for music lovers. Henry Hall and other big directors have served their followers just as faithfully. The occasional visits to the studio of the two Jacks were always events, but both seem to have gone outside the sphere of dance hands pure and simple. Some of their numbers were elaborately staged affairs, while their novelty numbers were unique.

#### Those Variety Stunts.

On the other hand variety has stood still. Several stunts were tried to help get it over. But they all failed, and we note now with satisfaction that they have been dropped—we hope for good. I understand that the management of this form of entertainment is to pass into fresh hands. Well! There is plenty of scope for fresh ideas, and no one will welcome an improvement more than I. But I take a pessimistic view of variety's future, so long as it remains a studio presentation. However, we shall see!

#### Radio Drama Wants Improving.

And what of radio drama? No fundamental change has come over it, either. The fact that there have been several revivals suggests that the powers that be are satisfied to leave radio-drama as it is. Personally, I cannot share that view.

There have been too many plays accompanied with warnings to the nervous, infirm and aged to switch off, and an almost total absence of good comedy.

Plays of the "Chopin" order are in a different class, of course. They may be beautiful with their musical background (well to the fore sometimes, by the way), but a funeral march must tend to depress if played *ad nauseum*, as it was in "Chopin."

It seems to me that only plays of a certain type have as yet been tried out. I would like to see more experiments. I like the recent innovation of two small plays; I liked the one act of "The Middle Watch," just because it was different from the bigger plays usually broadcast. I am definitely fond of plays—particularly comedies. In fact I would place radio drama at the head of radio fare, if it weren't so restricted. As it is, talks get my vote.

(Continued on page 220.)

At the time of writing, however, they are quite good again, and the best stations on the map seem to be W 2 X A D, W 1 X A Z, W 3 X A L and (strangely) Jo'burg on 49 metres. I generally find the latter station only about half the strength of Nairobi, but of late he has been coming over very well indeed.

#### Entertainment is Coming.

I am longing for a few more Australian and New Zealand stations to start up on short waves. Personally, I shall never get tired of "knob-twiddling" for its own sake, but when I do want to settle down and listen to a programme I must confess that I am getting fed up with the Americans.

This isn't because their programmes are bad, in the least. But the most hardened talkie-fan sometimes confesses to an ardent desire for a change from the accents of New York.

"A distinguished contemporary," as the better newspapers would say, has been analysing his views on short waves in no uncertain fashion, saying thuswise: "The world-wide range of a set having a short waveband is a spectacular thing. It is magnificent, but it is not entertainment."

With this I agree completely. We short-wavers have a queer little kink that may be a love of the spectacular, or a preference for magnificence over entertainment! But the entertainment part of it is coming—just you wait and see.

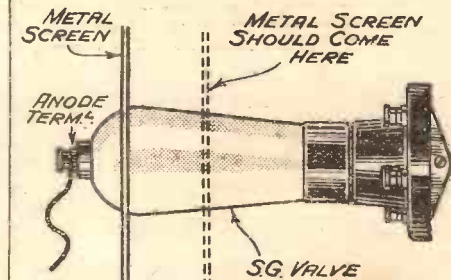
## BAD SCREENING

There is a correct position for the screen of an S.G. valve. Do you know what it is?

**T**HERE are still some constructors to whom the word "screening" means a vertical metal plate with a hole cut through it for the S.G. valve. How the S.G. valve is arranged in this hole does not enter into their calculations.

Consequently we often see in home-built receivers the state of affairs shown in the diagram, where the S.G. valve is just pushing its nose and nothing more through the hole.

To secure correct screening it is necessary to arrange the valve so that the metal



The screen should be so placed that it forms an external continuation of the valve's screening grid.

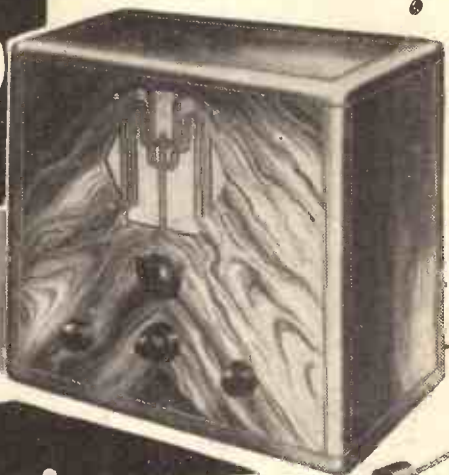
screen and the valve's screening grid form a straight line.

Hence the dotted line on the valve in the diagram shows just how much of the valve should be through the screen for successful screening.

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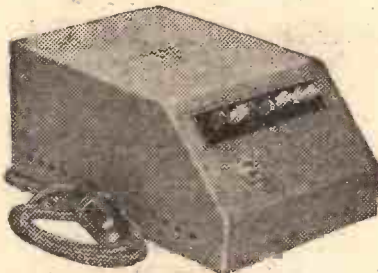
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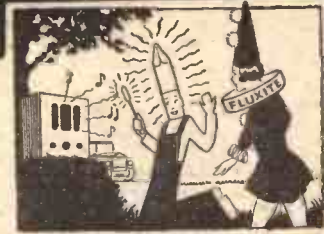
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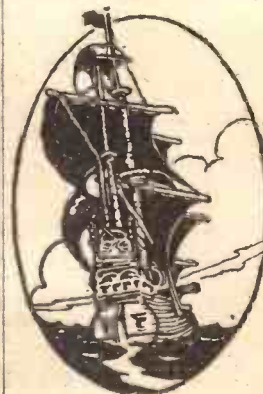
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# RADIO SIMPLIFIED

# A PRACTICAL OUTLINE FOR BEGINNERS

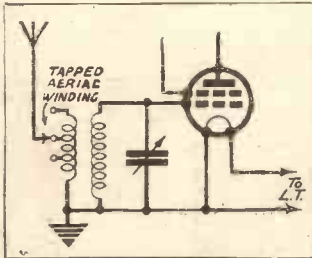
**S**ELLECTIVITY is the ability to separate one broadcasting station from another, so that the desired programme is received free from interference from other programmes on nearby wavelengths. The degree of selectivity given by different receivers varies according to the design and number of tuning circuits.



however, practical difficulties which have to be overcome. For example, volume and selectivity are inter-related; that is to say, if the selectivity of a given circuit is increased, the volume is decreased. In the case of a highly sensitive design this doesn't matter very much, because the power margin is sufficiently large to render any loss of volume due to selective filters negligible. Moreover, it is useless for a receiver to have great range if the selectivity is poor. It is true that numerous stations will be received, but of what use are they if several can be heard together?

without background from the London Regional. Hence the ability to receive the wanted transmissions free from interference depends not only on their distance apart in wavelength or frequency, but also upon the relative strengths of the wanted and unwanted stations. The simplest form of tuning circuit is one in which the aerial is joined direct to the grid end of a coil tuned by a variable condenser.

degree of selectivity graphically in the form of a response curve. The height of the curve at any point represents volume. Along the horizontal scale are kilocycles. A simple tuning circuit of the type mentioned above would



The tapings on the aerial coil enable different degrees of selectivity to be obtained.

For instance, one three-valve set may be far more selective than another, although both are perfectly sound designs from the standpoints of amplification or fidelity.

### Overcoming Difficulties.

Since the normal spacing of broadcasting stations working in the medium waveband is 9 kilocycles, it is desirable that a receiver design should be capable of separating any two transmissions having this degree of spacing. There are,

### THE SIMPLEST FORM



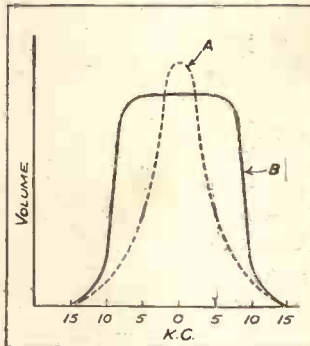
In sets of the det. and L.F. type it is usual to employ a tapped coil or separate aerial winding in conjunction with a series aerial condenser, to give the necessary sharp tuning.

Readers residing near the Brookmans twins will know how difficult it is to receive Stuttgart clear of the London Regional, yet these two stations are spaced 11 kilocycles apart. Although Stuttgart may be heard, the Regional is usually audible in the background to a greater or less degree, depending upon the type of set and its nearness to the Regional transmitter.

### Improving Simple Circuits.

On the other hand, if the same receiver is taken to some spot where these two stations are at approximately the same volume when tuned separately, there will be little difficulty in separating one from the other so that Stuttgart is receivable

### PEAKED AND FLAT



The difference in the shapes of the response curves given by single circuit tuning (A) and a good band-pass filter (B) is depicted above.

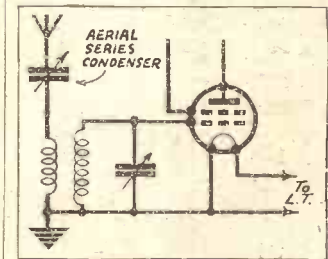
only a portion of the tuning coil in the aerial-earth circuit, (3) by loosely coupling the aerial to the tuned winding by a separate coil which may be tuned or untuned. These methods all increase the selectivity, which can be further enhanced by the use of reaction.

### Undesirable Resistance.

Every tuning coil offers some resistance to the flow of high-frequency currents, the best designs being those that possess low H.F. resistance.

This resistance decreases selectivity, because it adds "damping" to the circuit. Reaction, however, greatly reduces the "damping," and so aids selectivity.

It is usual to indicate the



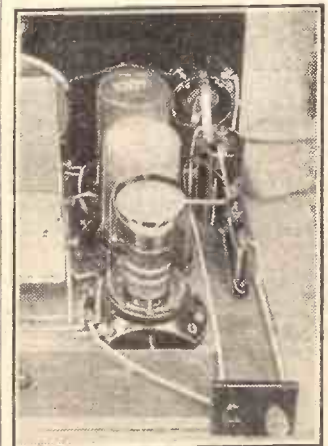
In this case the selectivity is varied by adjusting the series aerial condenser.

have a shape similar to "A," and although with the help of reaction quite good selectivity could be achieved, this will always be at the expense of the higher musical frequencies.

### The "Flat Top" Curve.

Curves like "A" are not ideal, because they tend to give distorted reproduction, and a much better one is shown at "B." Here the curve has a flat top and steeply sloping sides, so that, although the response is substantially uniform for about 9 kc. on either side of the zero point, the sensitivity falls off very rapidly indeed outside this frequency.

### BAND-PASS TUNING



Two of the three coils here are provided for band-pass tuning, a scheme which enables a very high degree of selectivity to be achieved.

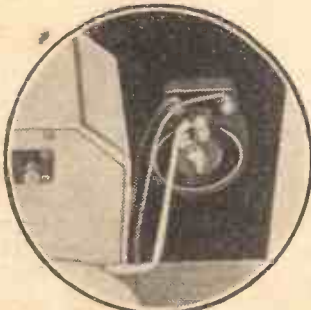
Special Beginners' Supplement—Page 2

**T**HE continuous alteration and improvement in radio technique which is always going on is nowhere better exemplified than in controlling volume.

There is a great diversity not only in the methods of control, but also in the position in the circuit of the point at which it is exercised. In some cases it is external to the set altogether—at the loudspeaker, for instance; whilst in other cases we find that an integral merit of a particular receiver design is the excellent control of volume which it affords.

**Essential Features.**

Variable- $\mu$  receivers, the popularity of which is fast rendering obsolete the ordinary S.G. types, have swept to



The grid bias potentiometer used in conjunction with a variable- $\mu$  valve is joined across the grid bias battery which normally has a value of 9 to 15 or more volts.

success because of the better volume regulation they afford. And all the technical prophets agree that A.V.C.—Automatic Volume Control—will be one of the most popular features of next season's sets.

One of the first essentials of successful control is a wide range, enabling either a talk to be reproduced in the quiet conversational tones of a fireside discussion, or a military band to flood the room with music that sounds really martial. And the control must be smooth, without any sharp transitions between piano and forte.

Another very important factor is that the volume control should not appreciably affect the characteristics of the set. In other words, it should be quite independent of factors like tuning and tone, involving not the slightest change in these no matter how the volume adjustment is varied.

**Satisfactory Method.**

Generally the most satisfactory way of ensuring these and the various other technical requirements being fulfilled is to employ a high resistance poten-



tiometer arrangement. One of the diagrams shows the principle upon which it works.

The full voltage to be controlled (or to be applied, in the case of grid-bias and H.T. schemes) is impressed across the ends of the volume-controlling resistance, and any desired fraction of it is then available between the slider and one of these ends.

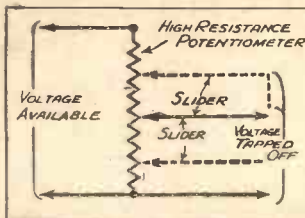
One advantage is that the main load on the voltage supply remains virtually constant for intermediate positions of the slider. A further important recommendation is that the potentiometer's action is simple and mechanically robust, and also readily lends itself to grading if proportional or "straight-line" variations are not desired.

A typical method of the practical application of such a system is shown in the other diagram. Here the voltages developed across the secondary of

the succeeding valve, or only some desired fraction of the full voltage.

The total value of the resistance in such a case is half a megohm or so, and such a value is usually equally suitable for

**HOW IT WORKS**



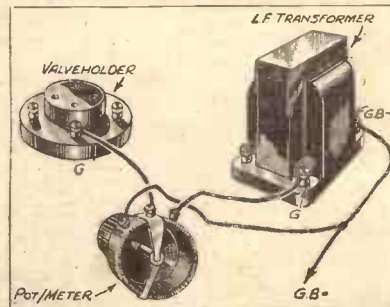
A volume control potentiometer enables any desired proportion of the total voltage to be applied across the grid and filament of the valve or other control points.

**VARYING THE BIAS**



With the variable- $\mu$  valve the volume is controlled by varying the bias on the grid. This provides a means of adjusting the input to the detector and prevents overloading.

**ACROSS THE TRANSFORMER**



This sketch shows how a volume control potentiometer is used in a transformer-coupled L.F. stage.

meter may completely replace the grid resistance. One end of it goes to the coupling condenser, the other end to grid bias, and the grid of the succeeding valve is joined to the slider, which can thus tap off any proportion of the voltage between the zero and maximum.

**An Easy Favourite.**

Similarly, for control of screened-grid potential, a "voltage-dropping" resistance is often saved when potentiometer control is employed.

The variety of uses and adaptability of which it is capable make the potentiometer an easy favourite, but other forms of volume control are still widely used, though most of them have marked disadvantages. One of the simplest is the variable condenser in series with the aerial lead, where it



One other method of varying the volume to suit one's requirements and which also prevents overloading the detector is to connect a potentiometer across the aerial and earth circuit.

regulates to some extent the degree of aerial coupling.

The drawbacks in this instance are that tuning is often appreciably affected, as well as selectivity. Moreover, range of variation is comparatively restricted.

Another method, which is now fast disappearing, is the control of filament current by a variable resistance, usually on an S.G. valve. It frequently introduces marked distortion, and in any case its alleged advantage of economising in L.T. current is largely illusory nowadays, whereas the distortion introduced is all too real!

**The Superior System.**

If the set-owner has any doubts about the merits of various methods he will probably be completely converted to the potentiometer system when he studies the makers' literature, and realises the wide applications of this type of control. No matter what kind of set or circuit is in use, there always seems to be an easy way of fitting it.

employment across the ends of a gramophone pick-up. The makers of both transformers and gramophone pick-ups often recommend some definite value of volume control resistance as being best for use with their products; and set-

designers also may specify the number of ohms for some particular circuit arrangement, so the wise purchaser will not regard any "volume control" as good enough if he can obtain one exactly to specification.

In the carton in which the volume control is purchased are given as well, showing how easily and usefully it may be employed in the set.

For resistance-capacity coupled volume-control potentiometer

★ **NEXT WEEK:** REACTION AND ITS USES AND FUNDAMENTAL FORMULÆ. ★

# The "Q.P.-B"



**B**EFORE you begin to read my remarks about this astonishing set, I want you to scan the diagrams and photos carefully.

They hide nothing. Every illustration was prepared with the object of showing you as much of the set as possible.

Now what are your first impressions? I believe you will have come to the conclusion that the "Q.P.-B" appears to be an exceptionally simple and easy-to-build set, but that there must be a snag somewhere!

### Magnificent Output.

But there isn't. It is one of the easiest sets to build "P.W." has ever produced—and that is saying something.

And yet it has a really magnificent output, one that equals that of many mains sets. It gives up to one watt, and its full-bodied bass must be heard to be believed.

It puts an ordinary battery set right in the shade, although its H.T. consumption is almost absurdly low.

While it is "quiescent," i.e. during pro-

## THE FIRST "CLASS B" SET WITH ORDINARY VALVES

Once again "P.W." leads—this time with the first "Class B" set to use ordinary valves. It gives "mains volume," although it is miraculously economical on H.T.

By G. V. DOWDING,  
Associate I.E.E.

into the grid current area; this is to right of the vertical line.

And because considerable grid current flows in these conditions it is necessary to use a special coupling transformer. This is preceded by a small power valve such as figures in the output stage of the average battery set.

Seems a rather topsy-turvy arrangement, doesn't it? Nevertheless, it is all quite sound theoretically, and in practice it gives extraordinarily good results.

If you build the "Q.P.-B," and to do so will cost you comparatively little in time or money, you'll certainly marvel at its performance.

I am not going to

no hard task to make it do quite useful "Continental travelling."

Pick-up terminals are fitted, and, of course, the "Class B" amplification enables a magnificent record rendition to be achieved.

All the components, with the exception of the drive transformer and the output choke, are perfectly standard.

### Simple to Build.

The baseboard is covered with copper foil and it is worth noting that, in addition to this assisting in giving the set an unusual degree of stability, it very greatly facilitates the wiring as you will see when we arrive at a description of that operation.

The panel drilling is quite elementary, although it will pay you to adopt care when drilling the holes for the wavechange switch.

The foil is held to the baseboard by three small tacks along each side.

When the panel drilling has been done the panel components can be mounted and the panel and terminal strip screwed to the baseboard.

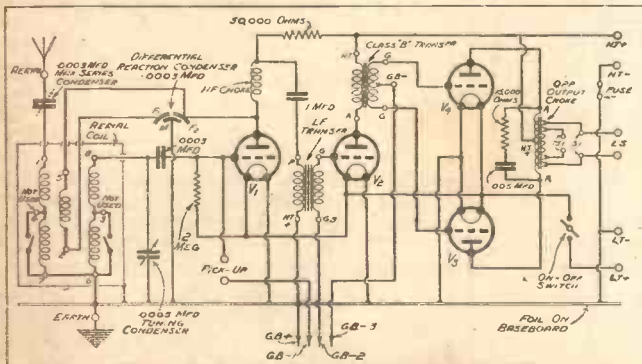
The screws for fixing the baseboard components are driven right through the foil, small holes being pierced in it for that purpose.

Because the metal shielding of the coil comes into contact with the foil, an automatic earthing effect is provided. But there are other items which must not make an earthing contact of that nature.

I refer to components whose terminal screws project through their bases. You

(Continued on next page.)

### PARALLEL-FEED AND TRIODE OUTPUT



The first L.F. stage of the "Q.P.-B." is shunt-fed, and this is followed by a special "Class B" "drive" transformer coupled to two "H.L." type valves in the output stage.

gramme pauses it takes a mere  $5\frac{1}{2}$  milliamperes and, I suppose, its average over a whole evening does not exceed 9 milliamperes, which is less than the H.T. taken by many two-valvers!

Although the "Class B" system is employed (the latest of all the new developments), no special valves are needed; many of you will already possess suitable ones, for they are ordinary three-electrode types, not even pentodes.

### Theoretically Sound.

No doubt many of you are wondering how on earth two ordinary valves, such as are usually employed as detectors, can possibly deliver a hefty full-bass output.

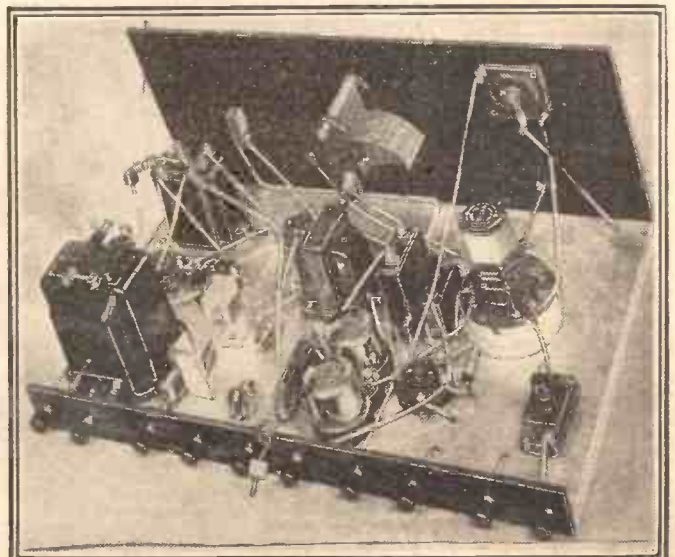
It is done by taking advantage of that part of each valve's curve which extends

claim that it will bring in a hundred stations, because it isn't the purpose of this receiver to provide D X enthusiasts with lengthy logs.

Its job is to give you a useful number of programmes at real power with an exceptionally economical expenditure of H.T.

There is a highly efficient detector circuit incorporating differential reaction and, handled with care, you'll find it

### INCORPORATING THE LATEST METHOD



An ideal set for the battery user, the "Q.P.-B." combines exceptional economy in running costs with full loudspeaker volume, excellent range, and good selectivity.

## THE "Q.P.-B."

(Continued from previous page.)

won't often encounter them these days, but it is advisable carefully to examine all the parts in order to ascertain that this doesn't happen.

If there should seem to be any possibility of one or more terminals of any of them touching the foil, cut pieces of stiff paper and interpose these between the components and the foil.

### No Need to Solder.

As only a 4½-volt grid-bias battery will be needed, this can be accommodated on the baseboard, as shown. The clips for this cost only a matter of a few pence.

Don't try to do without them or you will have the little battery floating about loose inside the set.

Many of you will no doubt make your own clips, acting on the principle that even a few pence are worth saving these days.

Anyway, it is easy enough and any sheet metal can be used for the job.

As I have already said, the wiring has been greatly simplified by the baseboard foil.

About a dozen leads are joined to it, as you will see by referring to the wiring diagram.

There is no need to solder. All you have to do is to make loops in the ends of the leads and screw these down on to the foil with small wood screws (¾-in. round-headed).

In the case of the positive grid-bias lead, a washer will be required, for this wire will, of course, be of the flexible variety. A soldering tag from one of the components will serve excellently as a washer for the purpose.

### Operating Voltages.

Don't forget to join terminals 6 and 7 of the coil together, and make sure that the leads coming away from the coil pass easily through the apertures and do not get pinched by the cover.

There is only the one H.T.+, and this must be given the full 120 volts. Don't attempt to use less or the set will be unable to deliver the first-class output of which it is capable.

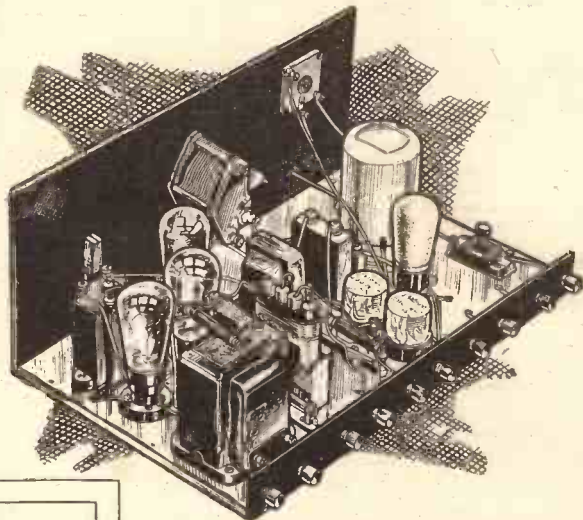
Grid-bias minus Three will need one and a half or three volts. Try both and decide by ear which you consider gives the best results. It is not an extremely critical matter and you will have no difficulty at all in fixing the better value.

Give Grid-bias Two the whole 4½ volts. Grid-bias One will need one and a half or three; insert its plug in whatever socket of the two is left free by the G.B.3 plug. I'll wager you will find it perfectly satisfactory! Of course, G.B.1 comes into action only when a pick-up is used.

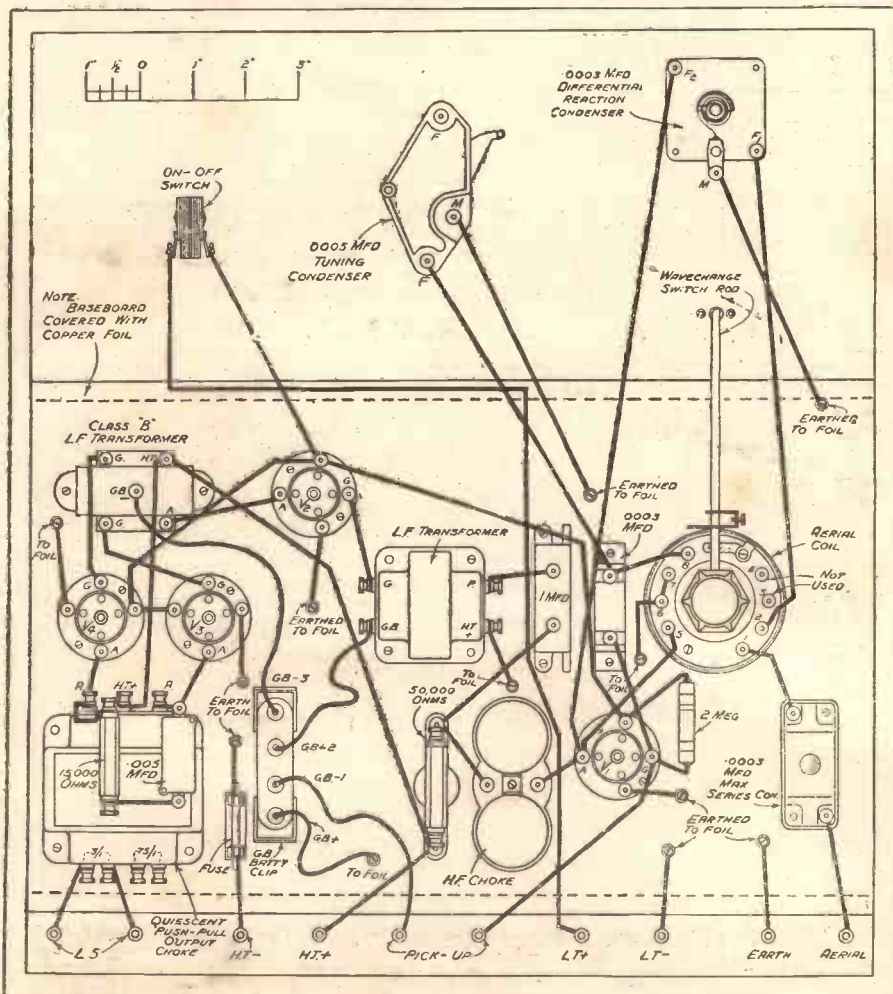
Don't regard the wiring diagram as a guide in respect to the grid bias adjustments. The wander plugs are shown in the grid bias battery merely for illustrative purposes.

I didn't happen to spot it until rather late in the day, but I notice that our

## IDEAL FOR THE BATTERY USER



## GIVES AMAZING OUTPUT POWER



At first sight the low grid-bias value for the output valves may seem rather unusual until it is remembered that "Class B," unlike Q.P.P., operates on the grid current portion of the valves' characteristics. It will be noted that pick-up terminals are provided on the terminal strip, and that the baseboard is covered completely with foil.

draughtsman decided that G.B.3 should have 4½ volts and G.B.2 3 volts.

Well, some of you might find that O.K., but I fancy the majority would get better results with the two reversed, i.e. 4½ volts for G.B.2 and 3 or 1½ for G.B.3.

I'm not quite sure what set our draughtsman is using at the moment, but this I do know: he hasn't even got a normal "Class B" outfit, let alone one using ordinary valves!

### Concerning the Transformer.

And now for some real "stop press" news, actually collected on the day of going to press with this issue.

Messrs. R.I. have changed their "Class B" Drive transformer slightly, so that the

(Continued on page 212.)

## ACCESSORIES FOR THE Q.P.-B.

- LOUDSPEAKER.—Clarke's Atlas, Celestion R. & A., H.M.V., B.T.-H., Ormond Igranic, Epoch, Magnavox, Amplion Marconiphone.
- H.T. BATTERY.—1 120-volt Ediswan, Drydex, Ever Ready, Magnet, Marconiphone, Petrix, Silver Knight, Siemens, Lissen.
- L.T. BATTERY.—2 volt Ediswan, Exide, Ever Ready, Petrix, Lissen, G.E.C., Block, etc.
- G.B. BATTERY.—1 4½ volt. Siemens, Ever Ready, Lissen, Petrix, etc.
- AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Graham Farish "Filt" earthing device.

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# Q. P. - B.

Described this week.

## KIT-BITS

Selected C.O.D. Items. You pay the postman. We pay post charges on orders over 10/-.

- |   |       |
|---|-------|
| 1 Peto-Scott Panel, ready drilled, 16 x 7 in. | 4 8   |
| 1 Lissen Hypernik L.F. Transformer            | 12 6  |
| 1 R.I. "Class B" Driver Transformer D.V.39    | 12 6  |
| 1 Varley Q.P.P. Output Choke D.P.39           | 16 6  |
| 1 Set of Valves as specified                  | 1 9 9 |
| 1 Cabinet                                     | 15 0  |

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**KIT "A"** Delivered Carriage Paid, on first payment of

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- |   |        |
|---|--------|
| 1 Baseboard, assembled to Specification, and Panel, 16 x 7 in., ready-drilled | 8 0    |
| 1 Polar Star 3-gang Variable Condenser, with disc-drive                       | 1 10 6 |
| 1 Telsen 3-ganged Coil Assembly, W.288  | 1 5 6  |
| 1 Lissen Output Choke, C.N.5301   | 12 0   |
| 15 Graham Farish Ohmite Resistances to Valves as specified with holders       | 1 10 0 |

NOTE.—At the time of going to press, valve prices are not available.

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Author's Kit of first specified parts, including ready-drilled panel, but less valves and cabinet. Cash or C.O.D., Carriage Paid, **£4 16 0**

Delivered, Carriage Paid, on first payment of

**8/9**

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- |  |  |
|--|--|
| <b>KIT "B"</b> As Kit "A" but with Valves less cabinet. CASH or C.O.D. Carriage Paid, <b>£6/18/0</b> . Delivered, Carriage Paid, on First Payment of <b>12/6</b> . Balance in 11 monthly payments of 12/6. | <b>KIT "C"</b> As Kit "A" but with Valves and Table Cabinet. CASH or C.O.D. Carriage Paid, <b>£7/13/0</b> . Delivered, Carriage Paid on First Payment of <b>14/-</b> . Balance in 11 monthly payments of 14/7. |
|--|--|

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## THE "Q.P.-B."

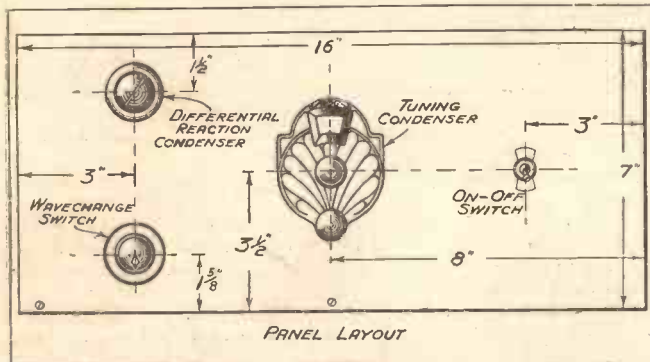
(Continued from page 210.)

one you buy may differ in appearance and its terminal positions slightly.

But its terminal markings remain the same, so that the wiring of the set will be unaffected. Also, there will be no difference in the functioning of the set.

It should be further noted that numerous manufacturers are going into production with "Class B" drive transformers. At the moment of writing I have details of about six.

### STRAIGHTFORWARD CONSTRUCTION— SIMPLE OPERATION.



Simple construction is one of the features of the "Q.P.-B." and the actual building of the set is a task that can be successfully undertaken, even by the absolute beginner.

Now this is the point, and a very important one, too. The valve manufacturers appear to be anything but standard with their "Class B" valves, so different makes of valves will necessitate different drive transformers.

The difficulty may be partially met by the provision of tapped models.

But the "Q.P.-B." does not use a "Class B" valve. So far so good. We now arrive at the crux of the matter.

In due course you will have a number of different "Class B" transformers offered to you, but I cannot say how many will be

absolutely interchangeable with the one we have chosen for the "Q.P.-B."

Therefore, you will be well advised to use no other than either the R.I. type D.Y.39, or the Varley type D.P.40. The latter offers you a choice between two ratios and we advise the 1 to 1.

Both of these "Class B" transformers are perfectly suitable for the "Q.P.-B." and the set has been designed so as to operate at full efficiency with either.

There has been no extemporisation; the "Q.P.-B." is a completely tried and tested design, all its circuit values and its components having been carefully chosen after a strict routine of test had been observed.

After which lengthy diversion I must return to the operating details of the set.

Almost any loud-speaker can be employed quite successfully with the "Q.P.-B." When there is a transformer on the speaker it will be found that the "tap" recommended for super-power valve outputs will be the best one for the "Q.P.-B."

You won't want one of those excellent instruments which embody special "Class B" transformers, for the very simple reason that the set already possesses its own special output choke. This is, of course, the equivalent of a transformer for the purpose.

It is quite safe to regard the output of the "Q.P.-B." as being normal so long as the low ratio tags of the output choke is used as shown in the diagram.

## THE VALVES YOU WILL NEED

Make	Detector	L.F.	2 Outputs
Mullard	P.M.H.L.	P.M.2a	P.M.H.L.
Cossor	210 H.L.	220 P.A.	210 H.L.
Osram	H.L.2	L.P.2	H.L.2
Marconi	H.L.2	L.P.2	H.L.2
Eta	B.Y.1815	B.W.604	B.Y.1815
Tungsram	H.210	P.220	H.210
Lissen	H.L.2	P.220	H.L.2
Hivac	H.210	P.220	D.210

The selectivity of the receiver is adjustable within pretty wide limits by means of the .0003-mfd. preset condenser on the baseboard.

This enables you to adjust the set to suit your own particular local conditions.

Most of you will discover "half-way" position quite satisfactory. To obtain this, first screw down the knob of the component as far as it will go, and then turn it back about one and a half turns.

For greater selectivity the knob is screwed farther out still.

When you have decided upon the most satisfactory setting that little preset can be forgotten, for it is no more an operating control than is the grid bias or H.T.

### For "Swamp" Areas.

However, it is always there should you ever move to a new neighbourhood. In that event a new setting might be advisable.

If you are in one of the swamp areas, right under the shadow of one of the big regionals, don't use a larger outdoor aerial.

To do so is simply to throw the door wide open to interference from that station. Even a multi-H.F. set might feel the effects of such close proximity.

And, in any case, you will find 40 or 50 feet, and a single wire at that, quite good enough, providing it is at least a few feet above the ground.

As to the actual manipulation of the "Q.P.-B." there is little to be said, for there are only the one tuning control and reaction to be handled.

And there can be few people these days who have not had at least some experience of similar elementary radio set controls.

But there is nothing "elementary" about the output of the "Q.P.-B."!

## USE THESE COMPONENTS FOR THE BEST RESULTS

Component	Make used by designer	Suitable Alternatives	Component	Make used by designer	Suitable Alternatives
1 Panel, 16 in. x 7 in.	Peto-Scott	Lissen, Goltone, Permcot	4 4-pin valve holders	W.B.	Lotus, Telsen, Lissen, Benjamin
1 Baseboard, 16 in. x 10 in.	Peto-Scott	Camco, Osborn, Lock	1 Screened coil	Telsen 216	R.I., Telsen, Varley, Igranic
1 Cabinet for above			1 L.F. transformer	Lissen Hypernik	Varley D.P.49
1 Sheet .004 in. foil, 16 in. x 10 in.			1 Class B driver transformer	R.I. D.Y.39	
1 .0005-mfd. variable condenser	Telsen W.132	J.B., Polar	1 Q.P.P. output choke	Varley D.P.39	Ferranti choke, R.I., etc.
1 Slow-motion drive for same	Telsen W.141	Igranic Indigraph	1 On-off switch	Bulgin S.80	
1 .0003-mfd. differential reaction condenser	Graham Farish	Polar, Lotus, Telsen	1 Fuse holder	Belling-Lee 1034	Goltone, Bulgin, Telsen
1 .0003-mfd. max. preset condenser	Telsen W.151	Goltone, Sovereign	1 Fuse	Belling-Lee 1056	Goltone, Bulgin, Telsen
1 .0003-mfd. fixed condenser	Dubilier 50	Dubilier, Telsen, Lissen	1 Pair bias battery clips	Bulgin No. 1	
1 .0003-mfd. ditto	Dubilier 820	T.C.C., Lissen, Telsen	3 Yards insulating sleeving	Goltone	Wearite
1 .005-mfd. ditto	Dubilier 670		4 Yards 18-gauge tinned copper wire	Goltone	Wearite
1 2-meg. grid leak with wire ends	Goltone	Tunewell, Igranic, Dubilier 1 watt	1 Terminal strip, 16 in. x 1 1/2 in.		
1 50,000-ohm with horizontal holder	Graham Farish "Ohmite"	Ferranti	10 Indicating terminals	Belling-Lee type R.	Bulgin, Goltone, Ealex, Clix, Igranic
1 15,000-ohm with terminals	Graham Farish "Ohmite"		Flex wires, screws, etc.	Goltone	Belling-Lee, Bulgin, Igranic, Clix
1 H.F. choke	Graham Farish L.M.S.	Telsen, Lewcos, Lissen, Goltone	6 Battery plugs		
			2 Accumulator spades	Ealex	

Mr. PETER SIMPLE reviews—

# THE LISSEN A.C. "SKYSCRAPER."

An outstanding all-electric receiver for  
the home-constructor.



**B**BATTERY "Skyscraper" enthusiasts—and their name is legion—who have been waiting six months or so for a mains version of this home-constructor's receiver, may have felt inclined to blame Lissen's engineers for keeping them waiting so long.

As a matter of actual fact, this delayed appearance of the A.C. "Skyscraper" provides one of the best examples of patience and thoroughness that I have yet come across in the radio industry.

### Important Safety Features.

So great was the popularity of the original battery "Skyscraper" that it would manifestly have been impossible to give this respected name to an all-electric receiver until the one real problem of home-constructed A.C. sets—the problem of absolute mains safety—had been successfully solved.

For months, therefore, the Lissen designers worked on this problem until they were able to produce a mains receiver which was "as safe as houses" in the most inexperienced hands.

Two important safety features mark this new kit. The first is apparent as soon as the parts are unpacked; the Lissen power unit, with its rectifier, resistances, and so forth, is built as a self-contained unit, entirely enclosed in sheet metal. The tyro need have no knowledge whatever of mains outfits; he simply treats the unit as he would an H.T. battery.

The second and less obvious safety feature is the provision of two fuses, one in each mains lead, enclosed in the mains plug itself. This makes the receiver completely foolproof, as well as guarding expensive components in the unlikely event of an accidental short.

What of the actual construction? Last week I had an S O S from a neighbour to look at a commercial three-valve mains receiver. A keen, though inexperienced home-constructor was staying with me at the time, and I took him along with me since he had expressed a wish to build a mains set for himself. One look at this commercial receiver was enough.

### Anyone Can Build It.

"No mains set for me," he said. "I should never have believed that any receiver could have so many wires and gadgets."

Fortunately, I had just received the A.C. "Skyscraper" for test, and was, therefore, able to reassure this discouraged enthusiast. For the "Skyscraper" is one of the easiest sets to build that I have ever met. Coils, gang condenser, and power pack are each supplied as separate units all ready for fitting to the base, and the chassis form of construction provides for under-base wiring and mounting of small components.

It seems almost unnecessary that such an easily built receiver should be accompanied by the best construction chart I have ever seen, but "safety first" seems to have been the motto of the designers with regard to those who have to build the set as well as those who will use it! Actually this construction chart is a work of art which is as thorough as the receiver itself.

It is not until you have completed the A.C. "Skyscraper" that the real enjoyment begins. Quite frankly, even if you have admired mains sets in the past, you will be pleasantly surprised at the performance of the "Skyscraper."

The control of volume from a whisper to a roar which the variable- $\mu$  S.G. valve provides; the brilliant reproduction of glittering treble or majestic bass which can be found only with a mains pentode and moving-coil loudspeaker; the thrill of twisting one knob and finding the stations one after the other as clear cut as you want 'em which the ganged tuning and selective coils give you—this, in brief, marks the performance of the A.C. "Skyscraper."

### Ingenious Dual Control.

I was especially interested in the combined volume-reaction control which is incorporated in this receiver. With the knob turned to the left, volume is at minimum. Turn it to the right and the efficiency of the variable- $\mu$  valve steadily increases until the knob is in the centre. Turn it still further and reaction is applied for those distant stations which will sound so much better on the A.C. "Skyscraper."

Apart from this volume-reaction control,

there are only two other knobs on the panel: the tuning control with concentric trimmer, and the wavechange switch. Pick-up terminals are provided at the back, as are also the three aerial tappings which provide variable degrees of selectivity either for outdoor or mains aeriels.

I gave myself the interesting task of trying out the "Skyscraper" between 10 and 1 o'clock on a Saturday morning. Five stations on the long waves and as many as I had time to listen to on the medium band gave me some idea of the remarkable range which this receiver must enjoy under favourable conditions.

But I have a feeling that those who build the A.C. "Skyscraper" will not spend a great deal of their time station searching. The entertainment value of the super reproduction is too tempting!



The self-contained power unit is clearly shown to the right of the photograph, which also shows the compact and clear-cut layout.

### TECHNICAL SPECIFICATION OF THE A.C. "SKYSCRAPER."

**CIRCUIT.**—Variable- $\mu$  Screened-grid H.F., Detector and Pentode, Valve Rectifier. For A.C. Mains 100/125 and 200/250 volts (6 tappings).

**SPECIAL FEATURES.**—Combined variable- $\mu$  volume control and reaction; self-contained power unit; one-knob tuning; special safety fuses incorporated in mains plug; 3 aerial selectivity tappings and mains

aerial; provision for gramophone pick-up.

**REMARKS.**—A remarkably fine receiver giving adequate selectivity on long and medium wavelengths, and excellent volume and tone from a moving-coil loudspeaker.

**MAKERS.**—Lissen Ltd., Isleworth, Middlesex. Price (including console cabinet, moving-coil loudspeaker and valves) £10 12s. 6d.



### A SHORT-WAVE CONDENSER

ONE of the readers who visited our laboratories a short while ago (during the period when we extended an open invitation—which we have since had to withdraw owing to pressure of work) was in possession of a short-wave set.

But he said that although he could hear plenty of stations on it, he was never so fortunate as to be listening while they were broadcasting speech or music!

In view of the fact that there is some short-wave speech or music to be heard at all hours of the day, I suspected, and told him so, that he was not able to "resolve" the carriers.

To hear a short-wave carrier, all you have to do is to put the reaction "hard over" and turn the tuning condenser until a whistle comes through.

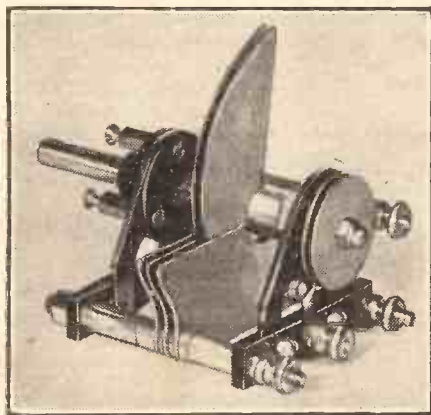
Fairly close adjustments are then necessary until you have juggled just off reaction, without going off the tuning point, in order to resolve the carrier into speech or music.

Clearly, it is overwhelmingly advantageous to have smooth, easy-to-handle controls of high electrical efficiency if the operation is to be one that is within the powers of the constructor of average skill.

And in this connection I would draw your attention to a condenser, especially designed for short-wave sets, which is as good as anything of its kind I have ever encountered. It is the J.B. Short-Wave "Special."

It has an exceptionally precise and velvety action, and the frame structure and insulating are designed and placed for extremely low H.F. losses.

There is a special screened pigtail.



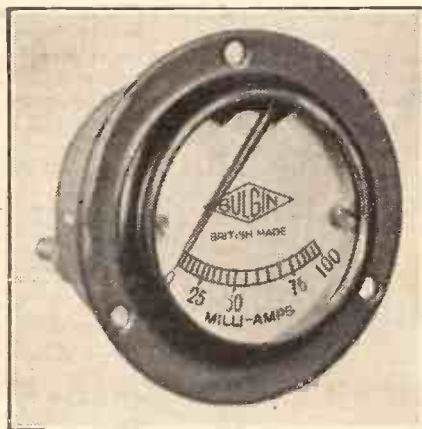
This is the J. B. Short Wave "Special" variable condenser

This J.B. Short-Wave "Special" is available in various capacities from .00005 mfd. to .00025-mfd at 5s. 9d.

### USEFUL METERS

Several times lately I have required meters for various tasks for which laboratory accuracy was not necessary. For example, there was a mains unit needed for a transportable testing outfit and a fairly close check on its output was essential, although a high-priced precision milliammeter would have been unnecessary.

As has often happened before, I found exactly what I wanted in the Bulgin catalogue. Bulgin have British-made equivalents of those little Continental panel-mounting meters. (Equivalent in price, that is, but rather better in quality.)



One of the several types of panel-mounting meters made by Bulgin.

As you will see, the one illustrated on this page is a milliammeter reading up to 100 milliamps. ; just the thing for the "gauge" of a big mains unit.

I have almost a passion for meters, I like to see what is happening at every point in my outfit. And I think constructors would get more out of their sets in performance and interest if the meter habit were more widespread.

And these inexpensive Bulgin meters are perfectly suitable for the majority of ordinary radio set purposes.

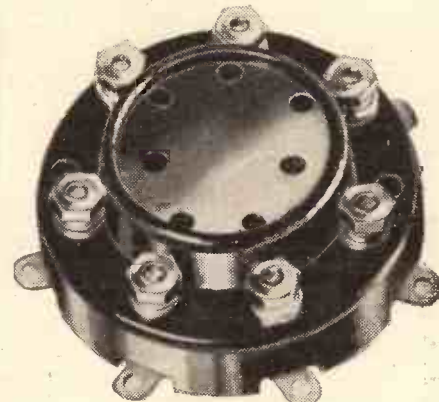
### "CLASS B" VALVE HOLDERS.

The "Class B" valve for battery sets has six pins, and when the mains types come along they will each have seven.

Therefore, a holder having seven sockets has been standardised. I have been told that there was considerable discussion among valve and component makers before the design was finally decided upon.

I can well believe it. I remember the problems which confronted me some years ago while I was engaged on the design of what was to be the first five-socket valve holder.

It might at first sight seem an easy enough task, but when it is remembered that the following factors have to be considered, it will be seen that there are



The W.B. valve holder for "Class B" valves.

difficulties. (1) The holder must be small in dimensions. (2) The sockets have to be well separated from each other. (3) They must conform to a symmetrical pattern and yet make it impossible for the valve to be inserted incorrectly.

Seven sockets are obviously much harder to deal with than five, and I consider that, on the whole, those responsible for the "Class B" valve holder have accomplished their difficult task very well. The greatest separation in the smallest area has been achieved.

The first production model to reach me is one due to Whiteley Radio, who have evidently not let the grass grow under their feet.

It is a refined and polished component, and bears no indication of the enterprising speed with which it must have gone into production.

Despite the multiplicity of sockets, contact is good throughout. Both terminals and soldering tags are fitted, and these, too, are well spaced and accessibly placed.

### FOR MAINS SETS.

Lectrolinx are now making their Clix Chassis Mounting Mains Aerial Strips available to constructors.

They each comprise two sockets and a "dummy" hole, and the two pin shorting plug is transferred from the two sockets to the one socket and dummy hole when it is desired to disconnect the mains aerial.

The Strip, which is made of tough bakelised material, is very plainly marked and it is fitted with terminal screws on the ends of the sockets for screw connection.

The price is sixpence and the shorting plug for use with the Strip costs three-pence.



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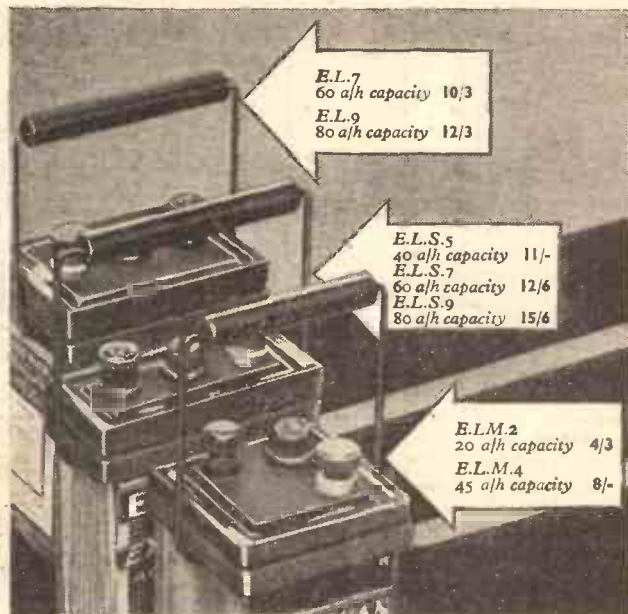
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# RADIOTORIAL

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

## QUESTIONS AND ANSWERS

### WAS IT THE G.B. ?

A. G. (Stowmarket).—"I am not exactly in trouble, having now got the set going to my full expectations. There is, however, one thing I do not understand, and that is this:

"As I was finishing it too late one Saturday night to get a separate H.F. bias battery, I ran flex leads to the L.F. grid bias, which being joined plus to L.T. neg. seemed to be exactly equivalent to an H.F. battery from the electrical aspect. However, it wouldn't do.

"I put in the week-end and two evenings afterwards before I got to the root of a sort of weak distortion that was holding the set back all the time. And the thing that shifted

rect, bearing in mind that its numbers may be different from those on the blue print.

Writing from Gt. Malvern, Worcestershire, Mr. B. Woodward, of Barnard's Green Lodge, says:

"Allow me to thank you most sincerely for your reply to my request for information concerning the 'Airsprite' Three, and for your offer of assistance.

"I am pleased to say that *all that was wrong with the set was just the connections on the coils were connected the wrong way*, but I was going by the blue print, and for the Colvern coils it didn't just suit.

"I have connected up as you advised, and the set is working absolutely splendid. I couldn't wish for a better one. The selectivity of it is amazing. The tone is all that could be desired, and the volume is as much as anyone could wish for.

"I could go on writing its praises for hours. I

### "P.W." PANELS.—No. 120.—KATOWICE.

This popular Polish station works on 408 metres (just above the Midland Regional wavelength) on a power of 16 k.w.

Both men and women announcers are employed. The name Katowice sounds like "Katto-vecha," and is often preceded by the words "Polskie Raadjo"—pronounced as "Polsky Rahdjo."

Some of the announcements are in French, and the station is famed for its "Radio Circle," members of which are entitled to personal replies to their letters, via the microphone. Katowice is 835 miles from London.

the trouble completely was to put in a new H.F. grid bias.

"Why should it make all that difference, when the other connections amounted to the same thing?"

It seems evident that you were getting interaction in the longer leads that became necessary when the L.F. bias was extended to cover the H.F. requirements as well.

One of the great advantages of a separate H.F. battery is that it can be placed "on the spot" exactly where needed; and, of course, there are sometimes objections to linking the H.F. and the L.F. stages of a set through a common battery if it can be avoided. Unless adequate decoupling is installed stray H.F. may affect both the volume and quality very adversely.

As you have proved, the more complete the separation between the H.F. and the L.F. stages, the better the results with your set.

### WHERE TO WRITE FOR IT.

S. F. B. (Walsall).—"I want to get hold of the February 18th POPULAR WIRELESS, giving the article on the 'Airsprite' in action. How much will it be?"

Back numbers of "P. W." which are still in print can be obtained from The Amalgamated Press, Ltd., Back Number Department, Bear Alley, Farringdon Street, London, E.C.4. The price is 4d. per copy post free.

### THE "AIRSPRITE"—MORE PRAISE.

The following letter is typical of many we have received in praise of the "Airsprite." It affords a useful reminder of the importance of using a specified coil unit if the circuit is to be exactly the same as the blue print; or, alternatively, if a different make of recommended coil is being employed, of seeing that the coil connections for this particular make are cor-

rect, bearing in mind that its numbers may be different from those on the blue print.

### DECOUPLING THE SCREENING GRID.

J. C. C. (Lams Conduit Street, W.C.1).—

"When I bring my H.F. tuning exactly in step with the detector tuning the set spills over into oscillation. There is a high screen between the two coils, so I do not think it is because there is any feeding back there.

"I have my doubts about it being anything else but the H.T. battery, as it seems to get worse as soon as the battery gets down a bit.



### MARKING THE DIMENSIONS

Panels should always be marked out on the back with a scriber or sharp-pointed nail. It should also be remembered that when panel drilling dimensions are given for the front of panel, these dimensions are reversed when the panel is turned over for marking out.

"Another thing I do not understand is this:

The flex lead from the A terminal on my S.G. valveholder goes straight to the plug in the H.T. battery, whereas most S.G.'s I have seen have a condenser here, and also a resistance sometimes, as well.

"There is certainly something wrong with the set. Plenty of stations are to be heard, but as soon as I try and settle on one the oscillation begins when the final tuning is done.

"This completely ruins it as a distance getter, so I hope you can say how I can put it right."

The fact that the trouble is worse when the battery is a little run-down is a clear hint that more decoupling is needed. And this is borne out by your

## DO YOU KNOW—

the Answers to the following Questions ?

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

- (1) Why does the reversal of the leads to the secondary of an L.F. transformer often result in removing L.F. instability ?
- (2) What is the effect of placing an aluminium screen too close to a tuning coil ?
- (3) Can a two-point switch be used to disconnect the H.T. battery as well as to switch off L.T. ?

observations on the connections to the A terminal of the S.G. valveholder.

As you have noticed, there is generally some form of decoupling fitted to the screening grid (which is the electrode to which the plate pin of the valve is joined internally), and as this is absent from your set the oscillation when the two circuits are adjusted to be dead in tune is hardly to be wondered at.

What you should do is to join a resistance, of about 1,000 ohms or a little more, between the A terminal on the valve holder and the flex lead which is at present connected to it.

To the valveholder side of this resistance connect one side of a 1-mfd. non-inductive condenser.

To complete the decoupling all you have to do is to join the remaining terminal on this non-inductive condenser to "earth"—i.e. to filament, L.T. negative, or to any point connected to earth.

We think you will find that this will cure the trouble.

### CONVERTING A BATTERY SET FOR USE WITH MAINS VALVES.

F. R. L. (Gidea Park).—"We are going to move into a new house at Ilford in May, and as it is fitted with electric light mains (A.C.), I naturally thought I would prefer to make my set into a mains-driven, by fitting A.C. valves.

"But a friend to whom I mentioned it, the other day, tells me that he has heard that this is unworkable, and the set will have to be rebuilt.

"This seems quite fantastic to me, because I took no end of trouble in the first building of it. I used a foil-covered baseboard, with ebonite-bushed holes for the under-baseboard wiring (filaments, etc.), every joint soldered properly, and really ample spacing everywhere, as the cabinet was quite big enough for a four-valver, let alone a detector and 1 L.F.

"It has served me so well that I do not want to alter it except to get rid of necessity for charging and replacing batteries. Surely there is no need to pull a perfectly good set down and re-build, just because the new valves are to be A.C. type, and an H.T. eliminator will be used with them?"

Your friend was right in one respect—it does not do to assume that a set converted for the use of mains valves will behave with them in the same way as it did with battery-run valves. In fact, with the great majority of sets such a valve conversion entails re-building.

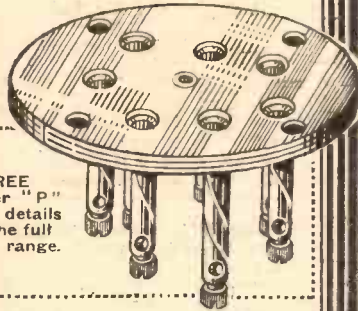
The trouble is, of course, that the A.C. valves are liable to be so much more efficient, that the set becomes too "lively," and little feed-backs which before did not matter much, now tend to create

(Continued on page 218.)

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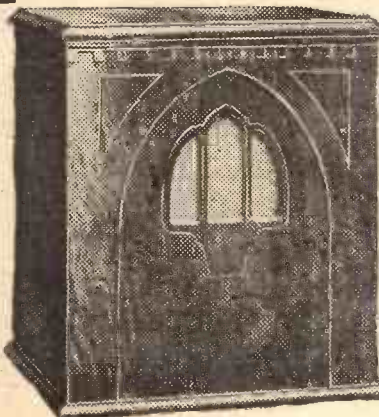
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## RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 216.)

instability due to insufficient screening, or decoupling.

Fortunately, you built your set so well and with such an adequate factor of safety, that the great probability is that when you have re-wired it for A.C. valves the only difference they will make to the set will be that it is better than ever.

That is the advantage of getting really good spacing and screening to begin with, and you have the additional advantage that yours is not a complicated set. Had it been a four-, or even a three-valver, we might have hesitated to advise a straight change-over without further re-building; but as it is we feel sure that in view of its present excellence you will be quite safe in fitting A.C. detector and output valves in place of those now in the set.

### THE CHOICE OF CHOKES.

F. M. (Sussex).—"I am a bit uncertain about the right or rather the best positions for H.F. chokes. The S.G., det. and L.F. I have in mind would employ parallel feeding for L.F., and for H.F. the S.G. would have an H.F. choke in the anode circuit, with a condenser-coupled tap down to the grid coil of the detector.

"The detector also would use an H.F. choke, with differential reaction, the idea being a really good long-distance circuit to use up the parts I have on hand.

"Included in these are two H.F. chokes, one of good quality and the other—well, not so good.

"I don't know whether to put the good one first, in the S.G., or second, where it will have to look after reaction. Which is more important?"

Put the good one first, its high impedance and low capacity being of greater importance in the S.G. stage than they would be looking after reaction results in the detector's plate circuit.

### ALTERING TO PENTODE.

"**QUERIST**" (Winchester).—"With S.G., det. and 2 L.F. I now get really large volume, and the quality is almost perfect. I say 'almost' because I am not quite sure whether

### HOW IS YOUR SET GOING NOW?

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

Whatever your radio problem may be, remember that the Technical Queries Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Queries Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you post free immediately. This application will place you under no obligation whatever, but, having the form, you will know exactly what information we require to have before us in order to solve your problems.

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

my specially good bass register is not emphasised by just a little lack of high stuff.

"If so, would using a pentode as output valve be the easiest way out of the difficulty?"

No, you would not find the fitting of a pentode to such a set at all satisfactory.

It would certainly not be easy either, for the whole output stage would have to be re-designed. And, in any case, the improved high-note response obtainable with pentode output is not the only effect to be considered.

The magnification of the pentode is much higher than that of an ordinary triode output valve, so if you fitted a pentode you would be up against severe overloading problems, especially as you are already getting big volume.

### BRINGING AN OLD SET UP TO DATE.

H. H. (Charlton).—"Back in 1930 I built the "Three-Coil" Three from instructions in your paper, and a very good set it proved to be.

"A neighbour of mine also built it, on my recommendation. He moved out of the district some months later, but when I met him the other day he told me he had brought his

## THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 216  
ARE GIVEN BELOW.

- (1) Because such a reversal alters the phase relationship of any feed-back in this stage, and so may tend to cancel instead of promote instability.
- (2) The effective inductance of the coil is reduced, and the tuning of the circuit is flattened.
- (3) Not unless it is converted into a 3-point switch (with one contact going to negative of filaments, one to L.T.— and the other to H.T.—). A flex lead to the plunger can be used for such a conversion.

DID YOU KNOW THEM ALL?

set up to date from the instructions you published just after Christmas, 'Modernising a Set.' Can you tell me in which copy these instructions appeared?"

The article on modernising an old set appeared in "P.W." No. 553, January 7th issue.

### "TAKES SOME BEATING"

To the Editor, POPULAR WIRELESS.

Dear Sir,—I built the "1933" Four about two months ago, and I must say it is a very fine set indeed. As a reader of your paper for years, I have built many of your sets, but for quality, volume, and selectivity this set takes some beating.

When I connected up for the first time I found I had no reaction, but as the stations were coming in at great volume there was no need to bother about it for the time being. Later I traced the fault to a broken reaction winding on one of the coils, so I changed the coils round and reaction was perfect.

Yours faithfully,

W. F. HARVEY.

Sunnyborough,  
Monkstown Farm, Monkstown Avenue,  
Co. Dublin, Ireland.

## THE "P.W." AUTOGRAM

Constructing the Cabinet.

(Continued from page 200.)

After the fret has been stained and polished, a suitable piece of material must be stuck to the back and the fret nailed into position, using the special holes provided.

All that now remains to be carried out is the lining of the inside of the automatic section of the cabinet, the lid and the top edge of the cabinet with felt. This double thickness of felt obviates the need for recessing the hinge for the lid.

The felt prevents extraneous noises from the pick-up, although in practice there is little, if any, noise from this source, since the pick-up is remarkably quiet.

A lid stay should also be fitted, and these may be obtained in various designs and finishes. The opening in the hinged back of the cabinet should be covered with a muslin material to keep the set reasonably dust-proof.

Although the front of the cabinet is fairly thick, it is advisable to cut a separate baffle, which can then be screwed on to the front panel from the inside.

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WRITE FOR CATALOGUE P.W.66 S.

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## MIRROR OF THE B.B.C.

(Continued from page 198.)

have once again found it possible to give a limited number of salary increases. It was at first feared that the £250,000 grant to the Treasury would cripple the B.B.C.'s finances this year, and the staff were even prepared for cuts in their pay. The decision to give rises, after none last year, is therefore all the more welcome for being a surprise.

### Blattnerphone Programmes

An important question of policy has yet to be settled at Broadcasting House regarding the extent to which the Blattnerphone may be used in programmes.

It is an open secret that quite a number of talks have been broadcast by its aid when listeners fondly imagined that the learned professor lecturing to them was at that moment seated before the microphone. If the practice of not revealing whether or no an item is recorded is allowed to continue, much of the intimacy of the microphone will be lost and a feeling of resentment, or—as one broadcasting authority put it to me—"a feeling of having been played a rotten trick" will certainly tend to develop among listeners.

## THE LISTENER'S NOTEBOOK

(Continued from page 204.)

### Too Rigid Time.

Of course, I don't listen to all talks. Certain subjects don't interest me at all, so I leave them alone. But others do. National lectures don't interest me just because they are National Lectures. Anyhow, why should these be called National Lectures when they are identically the same as many others?

There are also some talks I never listen to, only because I can't. That is why I would welcome a little less rigid time-table from the Talks Department. Many people have certain nights set apart for certain activities—they have had for years, even before broadcasting appeared. The result is that anything broadcast between 6.30 and 8 p.m. on a certain day of the week I never hear. And I never will hear it as long as this rigidity of programme is the mode.

That very interesting series of talks on careers I have been obliged to miss only because they were given at the same time on the same evening of each week. I did hear the talk on "Printing," but that was quite accidental.

## ALL IN ONE WEEK!

An Indian Reader's experiences with the "W.L.S. Short-Wave Two."

The Editor, POPULAR WIRELESS.

Sir,—I am taking the liberty of writing and congratulating Mr. W. L. S., your short-wave expert, on the success of the "W.L.S. Short-Wave Two," published in one of the free gift books of your journal. I have in a week's time logged the following stations at good headphone strength:

Moscow, R W 59, 50.0 metres.

Vatican State, Rome, H V J, 50.26 metres.

Rome, 2 R O, 48.2 metres.

Pontoise, F V A, 25.63 metres.

Pontoise, F V A, 19.68 metres.

Empire Broadcasting Station, Daventry, G S E, 25.28 metres.

Cairo, testing, 21.7 metres.

Rome, 2 R O, 25.4 metres.

Amsterdam, testing on about 28 metres.

S.S. Conte Rosso, of the Lloyd Triestino line, talks on about 30 metres.

There are, however, many more stations which I have not as yet identified.

G S E comes in very well; talks being very distinct. I think that this station will increase enormously the licence numbers in India. Let us hope so!

I am a keen short-wave experimenter and listener, and as I am only a beginner, I wish Mr. W. L. S. would send me a design of a short-wave three using det. and 2 L.F., and using possibly the same parts.

Wishing you and your staff all prosperity.

I remain, yours faithfully,

BRUNO F. DE FIGUEIREDO.

Poona, India.

## HIGH VACUUM VALVES

A New Range of British-made  
Two-Volters

BEFORE me, as I write, are half a dozen slips of paper. On each is the picture of a radio receiving valve, its price, name, list of ratings and characteristic curves. A few words on operation follow and then: "The High Vacuum Valve Co., Ltd., 113-117, Farringdon Road, London, E.C.1."

These slips have been taken from six valve cartons, containing the two-volt range of a new British-made valve—the "Hivac." On the anode of each valve is stamped the letter "H," in the same way as a well-known valve firm stamps its products, while assembly of the electrodes is excellent.

### Types Available.

What is more, the slips referred to are perfectly truthful, and give accurate average data concerning the characteristics of the "Hivac" valves, which, on test, have proved themselves perfectly satisfactory.

Here are the various types available: S.G.210, V.S.210 (variable-mu), H.210, D.210 (special detector), L.210, and P.220. The main characteristics are: Slopes, 1.0, 1.0-0.075, 1.15, 1.25, 1.2, 2.0 respectively; while the impedances are 250,000, 110,000, 22,000, 12,000, 8,600, and 3,000 ohms.

As can be seen, these are good, and in practice the valves behave just as one would expect from the figures.

The prices form the most astonishing part of the whole range, however, for the S.G. valve costs but 10/6, variable-mu 10/6, while H, D, L, and P types are only 4/6, 5/6, 4/6, 5/6 respectively.

At such prices I imagine that there will be a ready sale for "Hivac" valves, inasmuch as they are really well made, and are not just low-priced.

### The Matter of Evacuation.

It takes some enterprise nowadays to enter the lists of the valve manufacturers, for though it may appear that the turning out of vacuum "tubes" is a comparatively simple matter, it is by no means easy to ensure that every sample (less an inevitable low percentage of "chuck-outs") shall be up to standard in characteristics, and also "contain" a high vacuum.

The matter of evacuation of valves is a most important one, interwrapped with the choice of electrode metal and the process of gettering and electrode heating, for the final success of the valves depends upon all those things being done properly, and done consistently well.

"Hivac" valves live up to their name as far as the samples I have received, and I think that in all fairness to the makers I ought to say that if all their specimens are as good as those I have had, it will mean another make of valves for "P.W." to use in the research and test departments, and another addition to our published lists of recommended valves.

Primarily, I am not concerned with matters of price; for either a valve works well or it fails in its purpose. The "Hivac" valve (made in London, by the way) is primarily a good valve; that it is remarkably cheap is so much extra ballast. K.D.R.

## THE LINK BETWEEN

(Continued from page 198.)

Big Ben that is practically indistinguishable from the genuine article.

Some time ago, arrangements were made by this enterprising company to relay the chimes of Big Ben from the roof of their building in Tottenham Court Road. The idea became so much of a utility service in the district, that permission was sought for the permanent establishment of the Westminster microphone and the connecting land line.

Unfortunately, the Office of Works had different ideas about the matter, and the necessary permission could not be obtained.

As a result of the cunningly contrived artificial Big Ben that the Marconiphone engineers have produced, it is doubtful whether many people in this part of the west-end of London have yet discovered the innocent deception. Where there's a will, there's a way—Marconiphone!

### Radio Psychology!

Whenever anything new in radio makes its appearance (not infrequently!) I am always inclined cursorily to judge its potentialities from the prestige of the people behind it.

### OUR POSTCARD SERVICE

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

It is a fairly safe omen, and that is one of the reasons why I am confident in predicting that the new "Class B" output scheme has come to stay.

It is, I think, significant that most of the leading component manufacturers in the country have interested themselves in the new scheme, and from my own experiences I am certain that their confidence in "Class B" is not unjustified.

Varley, for instance, are doing both an input transformer and an output choke, and they ought to know! Incidentally, I have just received a copy of the leaflet in which these two new Varley components are described, and in view of the interest that is being shown in the scheme generally, I propose to make it available through "P.W.'s" postcard literature service. (No.30).

### Other "Class B" Speakers.

Last week I gave a list of the firms from whom I had heard officially concerning the introduction of special "Class B" speakers. I have since been advised that the PM4 and the PM5 in the famous W.B. range of speakers are now being produced suitable for "Class B."

An extra charge of 2/6d. is made in each case, bringing the list prices to 30/- and 44/6d. respectively.

By the way, before I leave the subject of "Class B" (even if only for another week!) readers may be interested to learn that a "Class B" converter suitable for adding on to any existing battery-operated set has recently been produced by Ferranti.

It can be added to any set without making any alterations to the design, and the price is 3 gms., which includes the necessary valve. Further details can be obtained through our postcard literature service. (No.31).

### THE "AIRSPRITE" THREE

"TRULY A WONDERFUL SET!"

The Editor, POPULAR WIRELESS.

Dear Sir,—Having decided to enter the Wireless World, I resolved to build my own set—and, being a novice, I asked a friend for advice as to the best set to build.

My friend, a regular reader of "P.W." having studied your "Airsprite" Three, and your claims for A.T.B., advised me to build same.

I have done so, and after about fourteen days with the set working I am satisfied that I have received the best possible advice. It is truly a wonderful set and the results justify all your claims.

I have logged all the stations you give on the long waves and, in addition, the experimental station from Luxembourg, whilst on the medium waves I have received a considerable number of stations at loudspeaker strength.

I have no hesitation in recommending the "Airsprite" to the beginner as reasonable in cost and extremely simple to construct. I write solely as a novice, having had no previous experience in radio set construction, and my knowledge of wireless was practically nil.

Yours truly,  
C. H. OSBOURN.

St. Austell, Cornwall.



The Dubilier Type B.B. Paper Condenser is tested to 500 Volts D.C. and is suitable for 200 Volts D.C. working. Capacities from .09 to 4'0 mF. Prices from 1/9.

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MONARCH OF THE MAINS.

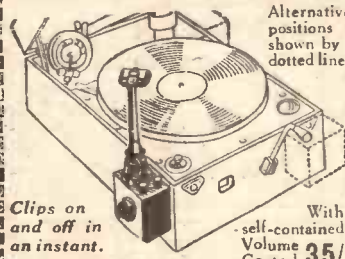
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Alternative positions shown by dotted lines

With self-contained Volume Control 35/-

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Cambridge Arterial Road, Enfield, Mdx.

# TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio technique.

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

### Automatic Brakes.

A READER has asked me why it is that the automatic brake on his electric gramophone motor will work on some types of records and not on others, and why, if it is an automatic brake, it should not work upon all records.

There are various kinds of automatic brakes. Some of them operate on the principle that the brake is switched on as soon as the tone-arm ceases to progress across the record—which, of course, it does when it comes to the end of the selection. Some depend on a sudden movement of the tone-arm towards the centre of the record.

### Delicately Balanced.

The first type is truly automatic, but it has the drawback that it is apt to be very delicately balanced in operation, and therefore liable to "go on" unexpectedly or not to "go on" when it should do so at the end of a record. It is obvious that if it depends upon the very gradual creeping movement of the tone-arm during the playing of a record it must be pretty finely adjusted, especially as some records "swing" to a greater or less degree; by that I mean that the tone-arm or sound-box, whilst making a gradually progressive movement, does so in an oscillatory fashion, "two steps forward and one step backwards" all the time.

### Depends Upon the Record.

The other type of brake, which depends upon a sudden movement of the tone-arm towards the centre, is not so finely adjusted, and is designed to "go on" when the record ends up with a scroll, that is, a sort of run-in towards the centre. Many records are made in this way nowadays, for one thing to conform with this type of automatic brake, and for another thing to give a central safety track in which the needle will run harmlessly at the end of the record even if there is no automatic brake fitted.

When the record comes to an end the tone-arm ceases to move gradually towards the centre and moves more or less suddenly, as the needle runs into this scroll, and it is this sudden movement which trips the brake and puts it on. You will find that with a brake of this kind the same thing will happen if you bring the tone-arm towards the edge of the record and then move it suddenly inwards. This sudden inward movement will put the brake on no matter what the position of the tone-arm may be.

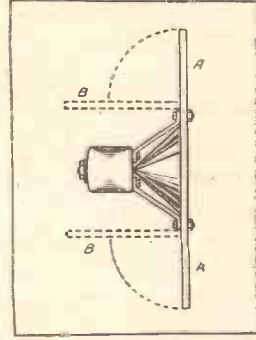
### Powerful Speakers.

When using a loudspeaker, especially a powerful one, such as moving-coil, often enough poor results and a muffled effect are obtained owing to the use of too small a baffle plate or no baffle plate at all. The object of the baffle plate, as most readers know, is to prevent to some extent, at any rate, mutual interference between the sound which is emitted from the back surface of the loudspeaker diaphragm and that which comes from the front surface. By the way

the atmospheric waves produced by the diaphragm know no "front" or "back," and so far as they are concerned the front is the back or the back is the front.

In the case of a plane diaphragm struck and vibrating freely, precisely the same vibrations come from the one side as from the other, only in opposite phase. When you get a diaphragm shaped like a cone, this does not act in precisely the same way, but

### TYPES OF BAFFLES



(A) Shows the usual arrangement of baffle-board employed to make a longer path for the sound-waves from the back. (B) indicates diagrammatically the effect of turning back portions of the baffle-board and extending these so as to enclose the loudspeaker on all sides except the back.

the difference is not great. Therefore, you have to recognise that the atmospheric waves coming from what you call the "back" of the diaphragm may seriously interfere with those coming from the "front" and you may get more or less "dead" regions where, by reason of their opposite phase, they tend to neutralise one another.

### Phase Interference.

The shorter the sound-waves—that is, the higher the pitch of the sound—the easier it is to keep them separate in the immediate vicinity of the speaker. The longer waves, however, will curve around larger obstacles, and so, to preserve these, we have to use a fairly large baffle plate. If it is convenient, this may be a single large sheet of ply-wood, but if you want to make it more compact you can (in effect) turn the edges over, which in practice amount to using a box or cabinet with the back open. The essential point is to use a non-resonant material for the baffle plate, and to arrange matters so that the sound-waves from one surface of the diaphragm have a fairly long path to traverse before they can mix up with the sound-waves from the other surface of the diaphragm which were produced at the same instant, and which, therefore, are of opposite phase.

### A Question of Amplitude.

It is interesting in this connection to note that in an ordinary telephone receiver a somewhat similar plan is adopted, the hole in the front plate being much smaller than the total area of the diaphragm and being placed opposite to the centre. I assume that in the telephone receiver this was done for some specific purpose, and the tests I mentioned last week which we made with the baffle seemed to bear it out.

(Continued on next page.)



## TECHNICAL NOTES

(Continued from previous page.)

Well, I have already used up more space on baffles than I can afford to give to it in these Notes, but if any of you want to ask me any further questions I shall be very pleased to answer them.

### A Sudden Movement.

Reverting to the query I mentioned previously, you will see that the type of brake which depends upon a sudden movement will not operate at the end of a record if the needle just stays in the final groove of the record without moving quickly inwards.

There are, of course, other types of brake which you have to "set" before you start to play the record, by shifting the tone-arm over until the needle lies in the final groove of the record and then adjusting the brake accordingly, but this type of brake is going out of fashion in favour of the other types, which are more automatic.

### Cold Valves.

In view of the interest which has been aroused lately by the introduction of the Westector, which is a detector device embodying a modification of the well-known Westinghouse rectifier, I may mention a new type of valve which will soon be put on the market in the United States.

I mentioned this very briefly in these Notes some little time back, but now more details are to hand. This valve—for it is actually enclosed in a glass bulb which is like an ordinary valve—is in one sense a gas-discharge tube.

To outward appearances it looks very like an ordinary valve, and the glass bulb is fitted into a standard type of valve base. One form of the device is a small fuse-like tube containing two internal electrodes and having a third element in the form of a narrow clip or band that is placed around the middle of the glass container.

### Ionization Stream.

The main difference between these new valves and the ordinary type is in the method of obtaining the necessary electron stream. Instead of using a heated cathode the valve gets the electrons simply by the ionisation of the residual gas. The bulb may contain residual neon, argon, or air.

In the centre is a straight rod element which is surrounded by a hollow metal cylinder having lines of holes perforated through it, the lines of holes being parallel to the axis. Surrounding this perforated cylinder is a spiral of wire which acts somewhat after the same fashion as the grid in an ordinary valve, whilst around this spiral again is another element which acts more or less as a plate or anode.

When a suitable potential is applied between the outer electrode and the perforated cylinder electrons pass out through the holes in the cylinder and through the spiral grid to the surrounding anode.

### On Test.

In actual tests these filamentless valves have been used as detectors, oscillators and amplifiers and are claimed to be able to perform all the functions of the ordinary modern valve.

(Continued on next page.)

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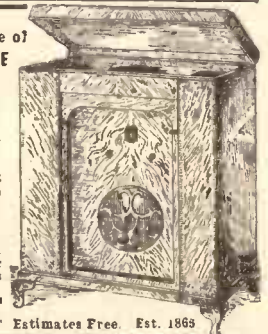
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## A "DOUBLE D.T." RECEIVER

(Continued from page 196.)

The triode section is also automatically biased by the resistance in series with the cathode.

Hence the triode anode is coupled to the grid of the output valve in the usual way, being supplied, like any other triode, with H.T. "on" the anode.

But to return to the other diode anode. This is used solely to supply automatic bias control to the two H.F. valves. These valves are already statically biased, by cathode resistances, so that a pre-determined degree of maximum sensitivity may be obtained, but they require a variable bias in addition to allow the multi-mu control to be operated.

This variable bias is applied by the second diode anode of the D.D.T. in this way. When "signal" rectification takes place intermittent D.C. current flows through the diode-cathode circuit of the D.D.T. valve. In the case of the left-hand anode this flows through the .5 meg. resistance giving rise to A.C. variations across it.

### Bias-Control Diode.

These vary in frequency with the programme modulation, and are passed on to the triode grid for amplification.

Meanwhile, the other diode anode is also rectifying, and the rectified current is flowing through the 2-megohm resistance to the cathode (neglect the cathode resistance tap for a moment).

This gives rise to a voltage across the 2-megohm resistance and "earth," which voltage is obviously also applied across the grids of the pentodes and earth, thus adding to the static bias voltage an amount which varies according to the strength of the received carrier.

The stronger the carrier the more the rectified current, and the greater the bias applied to the multi-mu valves. As increase of bias means decrease in amplification, it is easy to see how a steady level of amplification is reached.

But, if the diode were allowed to commence applying bias to the H.F. valves immediately reception occurred the sensitivity of the H.F. side would be decreased *proportionately* whether weak or strong "signals" were being received.

### Pre-Determined Volume Level.

This we do not desire, for it limits the distance-getting properties of the set. So we arrange for the automatic bias from the diode not to be applied till the input to the diode reaches a pre-determined amount. This amount is just below that required to overload the triode section.

Over and above this amount the bias begins and keeps the input to a value that will just not overload the valve. Of course, on occasions when this will be too loud the volume of *sound* (distinct from degree of H.F. amplification) can be controlled by the .5 meg. triode potentiometer.

To bring about this "delayed" control we merely tap the diode-anode circuit into the bias resistance of the diode triode cathode, thereby applying a certain amount of negative bias to the anode.

(To be continued next week.)

## TECHNICAL NOTES

(Continued from previous page.)

I understand that these valves are still more or less in the laboratory stage, but that the tests with them have proved so promising that the inventors hope to have them on the market very shortly.

### Accumulators for H.T.

If you are thinking of going in for an accumulator battery for high-tension supply you may be interested to know that there are other types of cell for this purpose besides the lead-and-sulphuric-acid type. For one thing there is the nickel-iron or so-called Edison cell, in which the plates are respectively nickel and iron, with a caustic alkali electrolyte, and there is the nickel-cadmium cell which also employs an alkaline electrolyte.

The particular feature of the nickel-iron type of cell is that it will stand all kinds of neglect and abuse which would very soon put paid to an ordinary grid plate lead cell. These features naturally render it valuable for all purposes where accumulators are used.

Of course in large installations, and wherever lead accumulators are given proper attention, they give excellent service. When it comes, however, to wireless batteries, and especially a set of high-tension accumulator cells where, I am sorry to say, neglect and ill-treatment are only too common, it seems to me that this type of cell should fill a very useful purpose.

### Use and Abuse.

The plates are practically free from damage by over-charging and little or no harm is done by accidental short-circuiting, whilst the cells will stand any amount of neglect. They also will stand up to very hard work, rapid charging and discharging, and altogether have always seemed to me to be a very good proposition for wireless users.

They require periodically testing, topping up with distilled water every few months and the replacement of the electrolyte perhaps every year or two; in other words, very similar attention to ordinary lead cells.

At any rate, if, as I say, you are thinking of going in for a high-tension accumulator battery, it is well worth while to have the literature of the various firms who manufacture these nickel cells and consider the advantages for yourself. I forgot to say that they can be recharged in exactly the same way as lead cells, either from a high-tension source or, by means of a special switching arrangement, from a low-tension source such as a low-tension battery.

### Stabilising H.F. Amplifiers.

I have before me a very interesting Paper published by the Institution of Electrical Engineers and entitled "The Balancing and Stabilising of High-Frequency Amplifiers" which will be useful to those of my readers who take a serious interest in the commercial side of radio, and particularly in transmitters.

The Paper deals with the stabilised high-frequency amplifier with special reference to power amplifiers for wireless transmission purposes.

The first part covers the development of the high-frequency amplifier and the work of Hazeltine, Rice and others, whilst the second part includes a discussion of the balanced bridge in relation to the valve circuits, in which the effects of stray coupling circuit unbalance and asymmetry of driving potentials upon the stability of bridge-circuit amplifiers are considered. Methods of obtaining a neutralising balance and devices for reducing the effective anode-grid couplings are described.

The third part of the Paper gives an account of the development of a two-stage power amplifier used for naval purposes as a wireless transmitter; whilst the latter part contains a description of the transmitter and some details of design.

### Atmospherics.

Another interesting Paper which came to hand a day or two ago is a Report (Number 5) of the Radio Research Board of Australia; this particular Report deals with atmospherics, which, although of the Australian variety, bear a very close resemblance to those which we experience in this country.

The Paper describes a very thorough investigation into the interference caused

## NEXT WEEK

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with radio reception in Australia by atmospherics of various kinds. So far the work has been carried out mainly by means of cathode-ray direction finders, and it includes descriptions of the principle and the characteristic features of these instruments, together with the procedure adopted in their installation, calibration and use.

Observations on transmitting stations and atmospherics were carried out with one cathode-ray direction finder on board ship during a voyage from England to Australia.

### Long-Wave Tests.

These observations of atmospherics, on a wavelength of 30 kms., supplied very definite evidence in favour of the thunder-storm origin of atmospherics. The directions of the main source, as observed from day to day during most of the voyage, seemed to converge on an area in Central Africa, which is known as the most active thunder-storm area in the world, whilst the directions of most of the other sources of atmospherics observed passed through other active thunder-storm areas in the East Indies and Northern Australia.

From the whole of the observations it is concluded that all the atmospherics observed have had their origin in lightning strokes occurring generally in thunder-storms or possibly, in a few instances, in dust storms.

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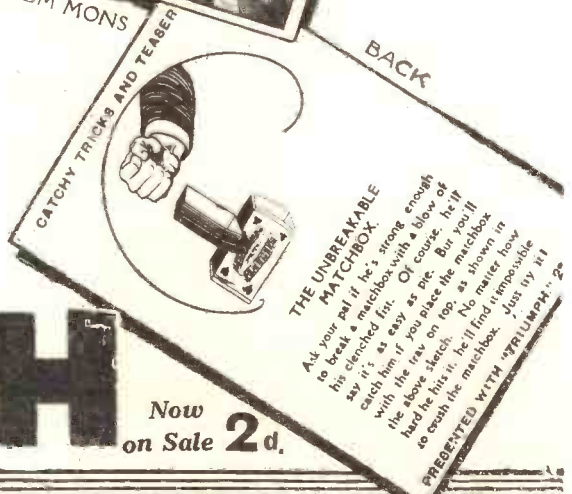
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