POPULAR WIRELESS, December 1st, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

GREATEST VALUE AND HIGHEST CIRCULATION

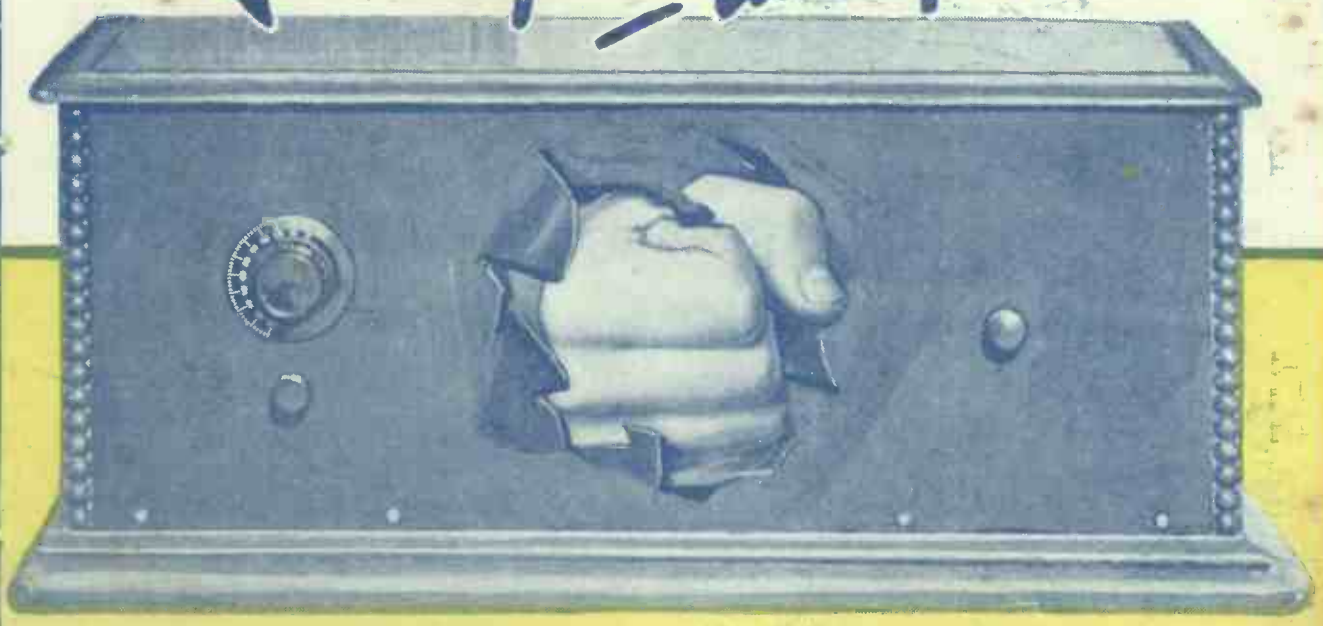
Popular Wireless

Every Thursday PRICE 3d.

No. 339. Vol. XIV. INCORPORATING "WIRELESS" December 1st, 1928.

"EVERYBODY'S" THREE

Punch, Power, and Plenty!



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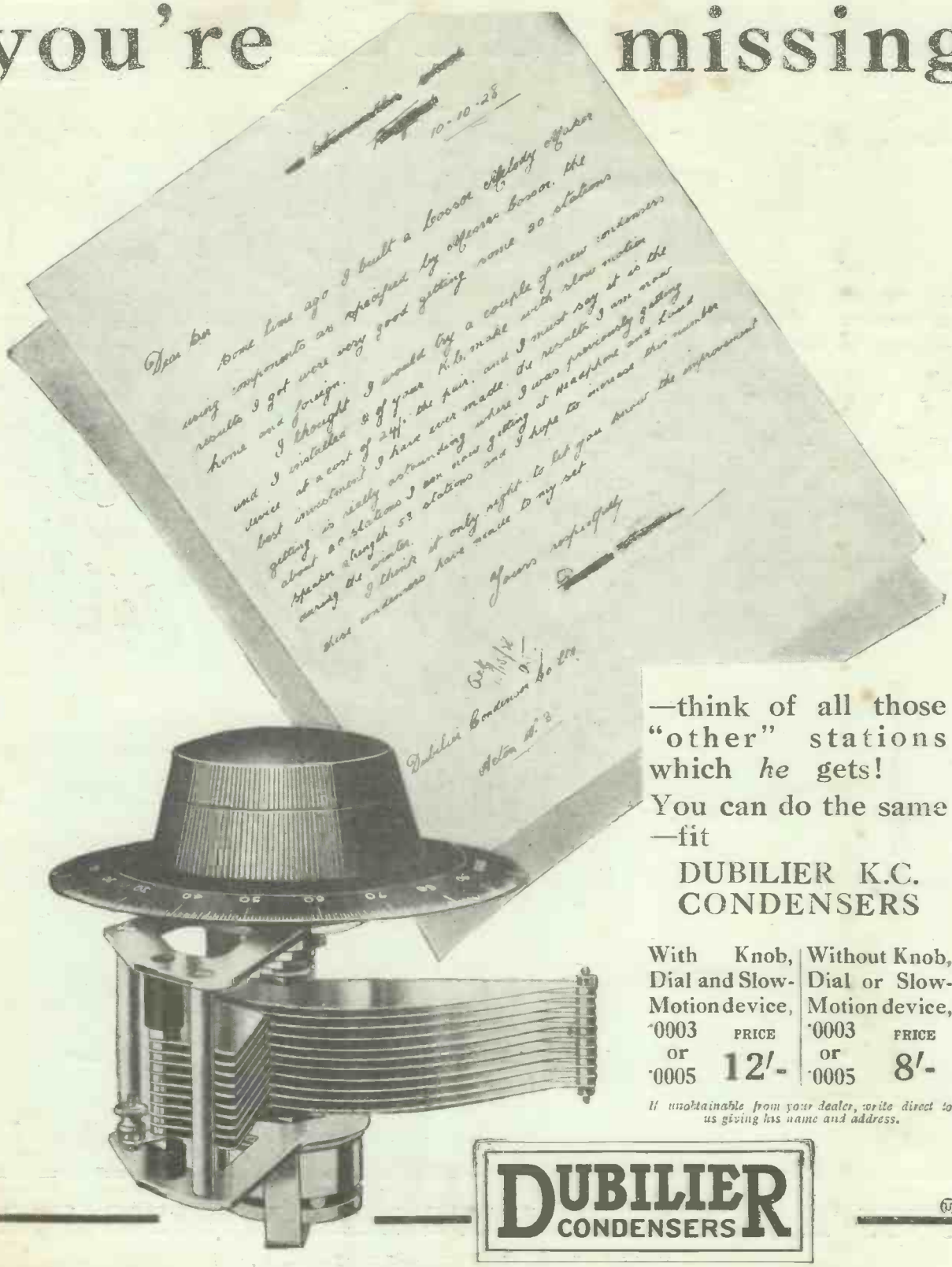

—think of all those "other" stations which *he* gets!

You can do the same —fit

DUBILIER K.C. CONDENSERS

With Knob, Dial and Slow-Motion device,	PRICE	Without Knob, Dial or Slow-Motion device,	PRICE
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NEXT WEEK!—*Our Wonderful Christmas Number*

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On Sale NEXT THURSDAY PRICE 3d. as usual.

LOOK OUT FOR THE "P.W. WHITE PRINTS."

A new service for amateurs.

Commencing in the special Christmas Number of "Popular Wireless," on sale Thursday, December 6th, readers will find a new innovation in radio journalism which should make a very strong appeal.

The "Popular Wireless" White Print Service will begin with a one-valve set specially designed for amateurs who which to change from short to long waves.

This White Print may easily be torn out and kept as a reference sheet and, in due course, the amateur will be able to have by him a thoroughly comprehensive and invaluable collection of all the important and practical circuits used in radio reception.

The last page of "Popular Wireless" has been specially reserved for the reproduction of the new White Print theoretical diagram and layout of all the best known circuits.

On no account miss this new service which "P.W." is providing for its readers, commencing with next week's special Christmas Number.

AMONG the many features which will be included in the special Christmas Number of "Popular Wireless," the amateur will be interested in the magnificent receiver: The "Empire" Two—a specially designed set for short and long waves which can be easily and cheaply built, and which will embody all the latest developments in radio reception.

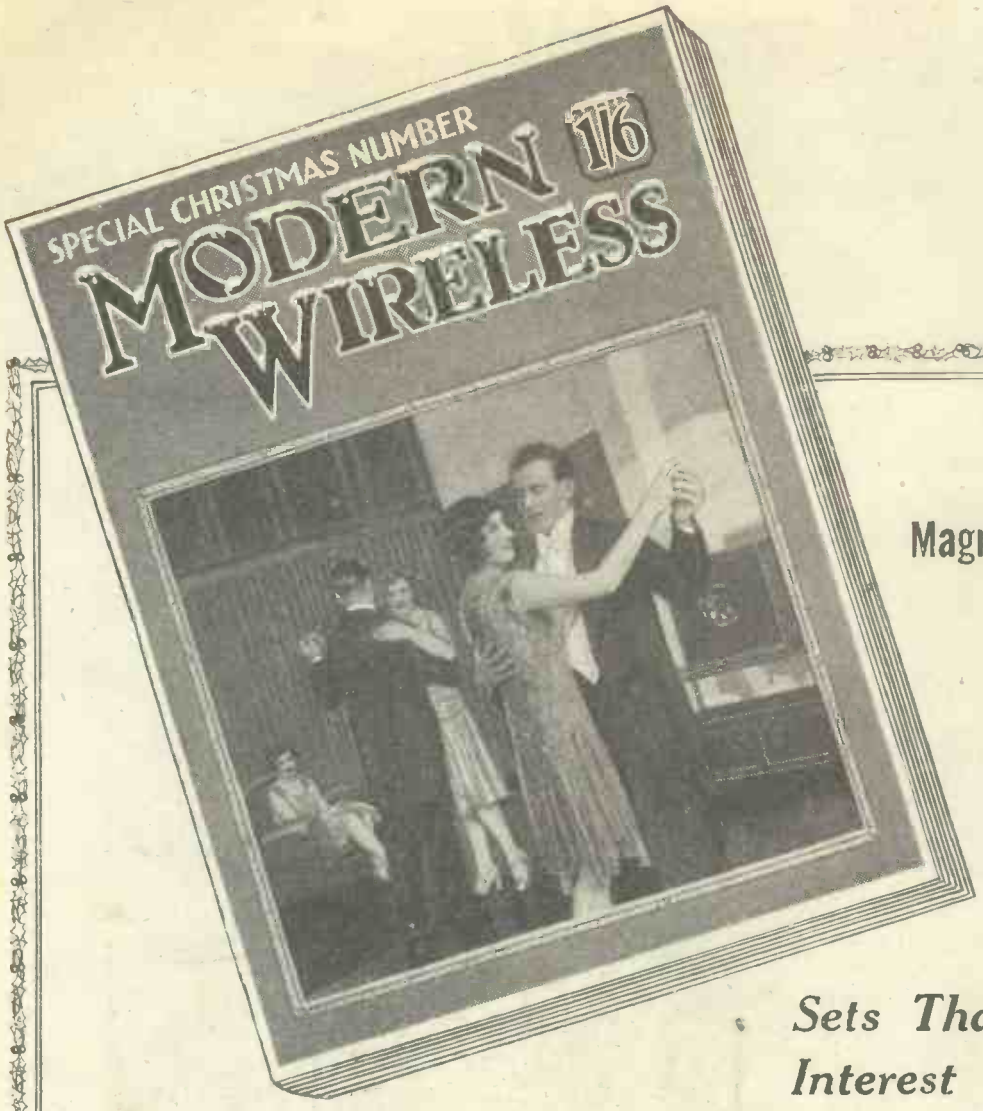
Special contributions to the Christmas Number include: A fine article by Captain Eckersley on "Invention and Service"; a fascinating article on Christmas Radio Experiments, and a valuable guide to Choosing Your Christmas Presents.

Commander Kenworthy also contributes a provocative and deeply interesting article entitled, "If I Were P.M.G."; and Sir Oliver Lodge, Senatore Marconi, Dr. J. A. Fleming, and many other famous men contribute messages to this special issue.

ORDER YOUR COPY NOW and be sure of not missing this *greatly enlarged* Christmas number of "P.W." The new "White Print" Service alone is worth the modest 3d. charged for

"POPULAR WIRELESS"

The Leading Radio Journal with the Highest Circulation.



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Consists of an H.F.-Det., using a screened-grid valve and a pentode valve amplifier; either unit can be used independently.

THE "R.G." CRYSTAL SET

Something quite new in crystal-set design.

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A Det.-L.F. set embodying wave-change switching, which can also be used on the short waves.

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A special short-wave receiver designed and described by "W. L. S.," the well-known short-wave expert.

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RADIO NOTES AND NEWS.

B.B.C. and That Crane—Lauder Teaches Them—Bits and Pieces—One in a Million—Ariel is Bowled Out—Watch Your Step.

The B.B.C. and That Crane.

THE B.B.C. has let me in for a dressing-down. The electrified crane of Portman Square and its attendant sprites spitting blue sparks inspired a jocular Note in our issue of November 10th. This Note has, to my regret, imbued a Poplar reader with the idea that I was having a tilt at the "worker." Only in a Pickwickian sense, friends! Has my correspondent read "P.W." for twelve months without realising that my little arrows have no sting? Bless me! Why should I, who have cooked my dinner on a shovel over the boiler fire in my time, go out of my way to be rude to manual workers?

The Saving Grace.

BLESSED be humour. It is the Briton's greatest asset. Let us look for it in our hottest corners. I remember the father and mother of a row once, when we were erecting a big wireless mast. A time-limit was fixed by the contract—and the men (not British) wouldn't go up any higher than 100 feet. I appealed to their honour, their manhood, their sportiness, and I know not what else. A lemon! I had a little fire on three bricks, ready for to cook my dinner, and a striker in his excitement stood over it and caught his bags alight. "*Up there*," I said, "is wind enough to put it out." They roared—and went *up there*.

Will Someone Explain.

THE Herefordshire Rural Community Council is interesting itself in adult education, and early this month St. Albans began the experiment of having debates after the hearing of broadcast "talks." What puzzles me is that according to the "Observer," Mr. Stobart, the B.B.C.'s director of education, said that "adult education" suggested to him "addled education." My dictionary tells me that this means "Education made rotten." Is that what Mr. Stobart means? And if so, will he lease the joke to Clapham and Dwyer, and explain why he continues to addle our children's heads with his loud-speaker lessons in school hours?

Lauder Teaches Them.

SIR HARRY LAUDER is not content with collaring untold riches for something under an hour of work before the microphone, but he must do a little research into the bargain. He has found out that the interposition of a wet towel between his "bonny lassies" voice and Mister Mike renders the result—to the listener—less metallic. Well, in my time

THE BISHOP'S BIRTHDAY.

To celebrate his 80th birthday, the Bishop of Willesden, Dr. Perrin, was recently presented with a portable wireless set. He is here shown listening to an afternoon programme.

I have had various uses for wet towels—chiefly in application to one's head—but I never suspected that they would form part of a wireless circuit. "Lauder's Wet Towel" sounds OK—but somewhat too near "wet blanket." A bad ad.!

The Letter of the Law.

QUOTING the Postmaster-General as their authority, the P.O. officials summoned Major W. O. Prichard for using a crystal set without a licence. It sounds a dreadful crime, but considering that the major's house joined with the post office and that his aerial was in full view, it does seem that they might have said, "Look here, major, what about ten bob," instead of prosecuting him. Obviously there was no intention (or hope) of defrauding the P.O., and the major was fined one shilling. My Aunt! Is it impossible to hope for common sense?

Unique Broadcasting System.

THIS title is surely deserved by the system in vogue in Holland, where there is no equivalent of the B.B.C., no licence fee, and no advertising revenue. I do not know whether the old saying still holds good. "In matters of commerce, the fault of the Dutch is offering too little and asking too much." But be that as it may, the system of voluntary subscriptions seems to keep the stations going. My knowledge and experience of the Dutch is that they are a high-minded and just people, and I think this is supported by the success of the free-will contributory system.

Bits and Pieces.

WIRELESS telephony is developing. The British Post Office service to America is an accepted fact. A service between Buenos Aires and Berlin will be opened soon, and tests between Buenos Aires and Paris are in progress. Picture-radio-telegraphy tests between Buenos Aires and Berlin are also being made. It will be possible before long for the public in England to sit at home and put through a telephone call to most important capitals of the world.

More Pieces and Bits.

SWEDEN is reported to have issued 371,000 receiving licences, or 6·1 per cent of the population. In the U.S.A. it is estimated that 9,640,348 families have radio sets, which makes an audience of some 41½ million. (I should like to see the B.B.C. tackle that lot!) Mr. W. W. Burnham is not General Manager of the Edison Swan Electric Co.'s Radio Dept. but Manager. (The General Manager of the

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

Company announces this.) The king of Jugo-Slavia has a seven-valver. Long may he curse it! Makers of "kits" may like to know that "kit" is Dutch for "a large bottle." Contents not defined.

Australia Speaks.

AN energetic man (an exile from the finest county, to wit, Kent), initials A. J. W., now of Pinjama, West Australia, writes six interesting pages, and bids me take a holiday to read 'em. In spite of the fact that London journalism is "one grand sweet song," I assure him that to read his letter is as good as a trip to Boulogne—and much cheaper. Naturally, he begins with 5 S W, whose clarity he alleges is second to none and has been heard on a two-valver, "L.S. in the next room." Which is very good hunting indeed.

Red Ink From a "Digger."

MY friend from the gold-digging place has written his nuttiest bits in red ink, to draw attention to his heterodox practices. F'rinstance, his aerial is 175 ft. long, but 75 ft. of it is coiled up on a nail in the wall. His set is devoid of soldered joints. He does not mention the "earth," but I suspect that he goes to ground through a Wallaby, dingo-dog or bush-ranger. But I forgive him because he comes from Kent. He has done 1,468 miles on his detector valve, with no earth or aerial. Now I am waiting to hear from a man in Kentucky who gets Mars without using a receiver or the ether.

Overheard in a Tram.

FIRST Lady: "Jew have the wireless atome?"

Second Lady: "Neow. We've got a set but my 'usban's alwis *himprovin'* of it."

First Lady: "Har! No more do we. We've got a set. too, but me 'usban's alwis looking fer sunnick in Hermericker and ain't fahnd it yert."

Guaranteed absolutely genuine. My sympathy!

One In a Million.

THERE'S a man down in Somerset who was born under a lucky star. *His wife helps him to tinker with radio.* Moreover, that lady is distinguished by being the first person of her sex who has ever written to me about constructional work. Old and cunning in judging readers by their letters, I detect genuine enthusiasm in her words. Congratulations to Mr. N., of Chard. It was all about a loud speaker made of matchboarding and copper strips, but that is a mere side issue. I have found my first working lady "fan," and I'm not going to stop gloating just to tell you the mundane details.

Trains and Other Noises.

IF you are occasionally annoyed, like the oyster, by a noisy noise, don't growl but consider this: Commander C. P. Edwards, the man who is a sort of fairy godfather to Canadian "fans," writes to me from Ottawa to say that "the Interference Division stopped 89 per cent of the cases reported last year and report 1·7 per cent of the same beyond hope. In England of course, you have no idea what real griefs is."

What the Canucks Suffer.

COM. EDWARDS adds, "I suppose that 95 per cent of your distribution wires are underground, which cuts out 95 per cent of your trouble. Out here practically 100 per cent of the wires are overhead, with anything from 10,000 volts down on them. Wires run along every street in every city and act as excellent antennae." So, all things considered, I venture to remark that we in England are, as a whole, to be congratulated that we live in a two-by-four allotment and can have 95 per cent of our lines underground.

News from Nowhere.

IN case some of you are interested in that League of Those Nations, here are some items about the proposed radio station for the League. The League wants a radio station. The Swiss Government proposes to build a Swiss station, to be at the disposal of the League in times of crisis. The British delegate to the Third (Reduction of Armaments) Committee considers the cost of a purely League station to be out of proportion to its possible utility and disagrees with the Swiss Government's proposal. Helpful! What?

SHORT WAVES.

For six years, we are told, broadcasting experts have been striving after a new art-form for the ear. And we all thought it was atmospherics!—"Punch."

* * *

There was an announcer named James,
A favourite, indeed, with the dames;
But they all had to smile,
Every once in a while,
When they heard him pronounce foreign names.

* * *

Loud speakers as Christmas gifts are not always what they "scream" to be.

If you have a future mother-in-law to study, give her a crystal set. It will keep her quiet for hours.—"Popular Radio Weekly."

* * *

When the latest television invention is attached to our telephones, we shall be able to see the person we are speaking to; but no invention has yet been discovered that entirely eliminates the possibility of being suddenly switched on to a wrong number.—"London Opinion."

* * *

We understand that wireless sets have been installed in the gaol at Rheinbach.

Some countries are certainly going to extremes to suppress the crime wave.

* * *

WHAT THE CENSOR MISSED.

Low cartoon wirelessed to New York. (Manchester Paper).—"Punch."

* * *

There's just one thing I'd like to know
That's queer to me in radio.
I wonder why each tuneful strain,
Like anæsthetic, drugs the brain!

Then o'er you drowsy feelings creep,
And lull you to profoundest sleep.
No doubt the scientists will claim
Those ETHER WAVES must be to blame.
"Radio News."

"Ariel" is "Bowled Out."

I THOUGHT you might like to have the latest from my 13-year-old "fan" who told us that he had got 20 stations, 14 known and 5 unknown. Just remarking *en passant* that the missing one is obviously Mars, I would say that my juvenile reader has with fiendish perspicacity "rumbled" me, for he writes, "Sometimes I think you are laughing at me, but if so all I have said is true, except 14 plus 15 equals 20, though Madrid fades terrible." Is there anything to laugh at in that? If so, all I have said is true. And I fade terrible, forthwith.

Watch Your Step.

KNOWING a bit about the Law, and more than a bit about bye-laws, I was rather amused—shame on me!—to note the adventures of one, C. T. Rhodes. This citizen, rather than put his doubloons into War Loan, embarked on the manufacture of accumulators. Forthwith he dropped no less than five bricks, for, apparently, he watted not the Accumulator Regulations of 1925. He was fined a quid, a cheap let off. Heaven alone knows what he did or didn't, but he has had a cheap lesson. Oh, what a happy land is England! Beware, lest ye sneeze!

Greece and the "Ordinary Listener."

THE rulers of Greece seem to be either very optimistic or very ignorant of human nature, for in asking for tenders for the establishment and working of a broadcasting monopoly they stipulate that a central station must be built in Athens, capable of supplying the whole of Greece with "a satisfactory service." As though *the whole* of a country could be satisfied! I foresee Chamber Music, Talks on the Elgin Marbles, and Byron evenings. Not to mention Homer *ad nauseam*. I feel rather sorry for the Grecian listener, because Greece has created so much high-brow bilge.

News from Memphis.

NOT the town of the very first King of Egypt, but of Tennessee, one of those United States. An accommodating reader of Memphis, Tenn., favours me with a note in which he says that our Big Ben was picked up by a short-wave receiver there, re-broadcast, and heard by him on a crystal set. Big Ben and "P.W.," the cream of British time and opinion, both making their mark on Memphis, eh? I said, "an accommodating reader." On his note-paper are words which bring joy to struggling hack-writers like me. "Cash *or Credit*." The italics are mine. Credit for me, every time, please.

The Brandes Radio Orchestra.

THIS orchestra, composed of the cream of Continental artistes, and conducted by Hugo de Groot, will give another concert on Sunday (December 2nd) at 5.40 p.m., which will be broadcast from Hilversum on 1,071 metres. There are ten items on the programme, and they all look good. If you appreciate Brandes' effort to fill up one of those big blank spaces left by the B.B.C. on Sundays, write to their Cray Works, Sidcup, Kent, and say so.

For Smokers and Others.

I JUDGE from the letters I get from "fans" in Rhodesia and Kenya that they out there are determined to make Britishers burn British weed, and I am glad to notice that Empire-grown tobacco is becoming popular. Which reminds me that somewhere I have seen an announcement about "Rhodian" cigarettes, which are of Rhodesian stuff. If you get a Blue tin of 100 you will find therein a 5½-in. amber-coloured fag-holder for a Christmas present.

ARIEL.

"EVERYBODY'S" THREE

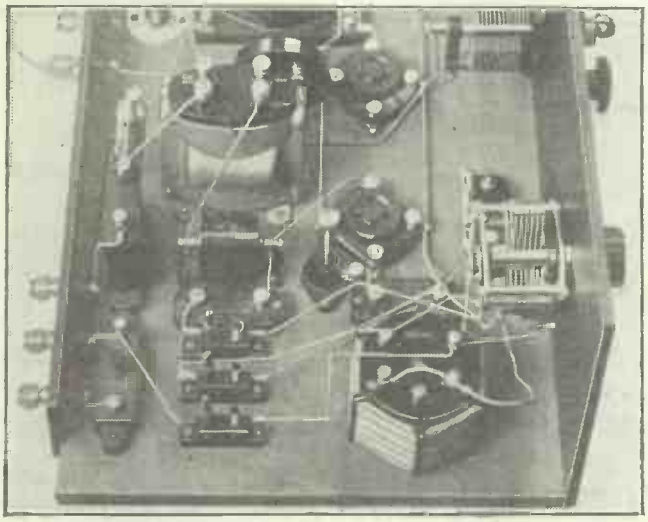
Power! Punch! and Plenty!

A magnificent and economical loud-speaker set.
Designed and described by the "P.W." RESEARCH DEPT.

"SOME set!"—that is the universal comment on "Everybody's Three" so far. All those who have heard it at work (being somewhat conceited about it we have taken every chance to demonstrate it to visitors) have reacted in the same way; on hearing a programme coming in at tremendous strength, and discovering for themselves that the reaction had to be well slacked back to keep it down to bearable volume at all, they have immediately alleged that it was 2 L O, which is only about a mile away.

Surprise!

Then when an announcement from the loud-speaker proved that it was 5 G B there would come the aforesaid ejaculation of "some set!" for it is to be noted that the test would be a daylight one on a perfectly rotten aerial in the heart of the City with high buildings all round. Having got used to the extraordinary "punch and power" part of the set's performance, some of its other virtues would next be noticed, such as the really very fine quality of reproduction which it gives.



The standard loading coil, which fits the receiver for long waves, is shown in the foreground. It is put in or out of action by a switch on the panel.

Incredulity!

Some visitors have been so struck by this feature that they have at once asked for details of the L.F. amplifying circuits, and on being told that both stages were transformer-coupled were so incredulous that they had to be shown the inside of the set before they would believe it!

As a matter of fact, the quality with transformers of practically any good makes in

(Continued on next page.)

LIST OF COMPONENTS REQUIRED.

1 Panel, 18 in. × 7 in. × ¼ in. (Resiston, Trelleborg, "Kay Ray," Ebonart, Becol, Red Seal, etc.).
1 Cabinet to fit, with baseboard 10 in. deep (Raymond, Lock, Cameo, Bond, Makerimport, Caxton, Pickett, Artcraft, Gilbert, etc.).
1 ·0005-mfd. variable condenser, slow motion, or plain type with vernier dial (Formo, Lissen, Cyldon, Igranic, Ripault, J.B., Ormond, Gecophone, Colvern, Dubilier, Marconiphone, Utility, Raymond, Bowyer-Lowe, Peto-Scott, etc.).
1 ·0001 or ·00015-mfd. reaction condenser (Cyldon, Bowyer-Lowe, Peto-Scott, Dubilier, J.B., Ormond, Igranic, etc.).
1 L.T. on-off switch (Benjamin, Lotus, Lissen, Peto-Scott, Igranic, Burne-Jones, etc.).
1 Push-pull type on-off switch of the type commonly used for wave-change switching (This is simply an L.T. switch of the type with two side contacts and a central plunger to which a third connection can be made with a piece of flexible wire. Examples are the Lotus, Lissen, and Burne-Jones).
1 Standard loading coil, "P.W." type (Wright & Weaire, Paroussi, Burne-Jones).
3 Baseboard-mounting single-coil sockets (Lotus, Peto-Scott, etc.).
1 Baseboard-mounting compression-type semi-variable condenser, maximum capacity about ·0003 mfd. (Formodenser, Igranic "Pre-set" Condenser, etc. See text).
1 Fixed condenser of ·001 mfd., 1 of ·0003 mfd., and 1 of ·0005 mfd., the last to have grid-leak clips (Dubilier, Lissen, T.C.C., Clarke, Mullard, Igranic, Burne-Jones, etc.).
1 2-meg. grid leak and holder (Dubilier, Ediswan, Lissen, Igranic, Mullard, Pye, Marconiphone, Carborundum, etc.).
2 H.F. chokes (Igranic and Bowyer-Lowe in set). (Any other good makes also suitable, such as Lewcos, R.I.-Varley, Lissen, Colvern, Climax, Cosmos, Dubilier, Burne-Jones, Wearite, etc.)
1 2-mfd., and 1 1-mfd. Mansbridge-type condensers (Lissen, Ferranti, Dubilier, T.C.C., Mullard, Hydra, Polymet, etc.).
3 Sprung valve holders (Igranic, Lotus, B.T.H., Pye, W.B., Wearite, Burndept, Benjamin, Marconiphone, Burne-Jones, Ashley, Redfern, Formo, Bowyer-Lowe, etc.).
1 H.T. fuse (Burne-Jones, Hunt, etc.).
1 Output filter choke, about 20 henries (Pye, R.I.-Varley, etc.).
2 L.F. transformers (Any good make. Lissen, Brown, Ferranti, Igranic, Philips, R.I.-Varley, Marconiphone, Mullard, etc. Those actually used were a Mullard and R.I.-Varley "G.P." type. Fairly low ratios are desirable for both).
1 Anode resistance, normal value 50,000 ohms (see text as to value and method of mounting). (Lissen, Igranic, R.I.-Varley, Ferranti, Mullard, Dubilier, etc.)
1 Terminal strip, and 9 terminals (Belling & Lee, Igranic, Eelex, etc.).
Wire, screws, Clix plugs for G.B., etc.

"EVERYBODY'S" THREE.

(Continued from previous page.)

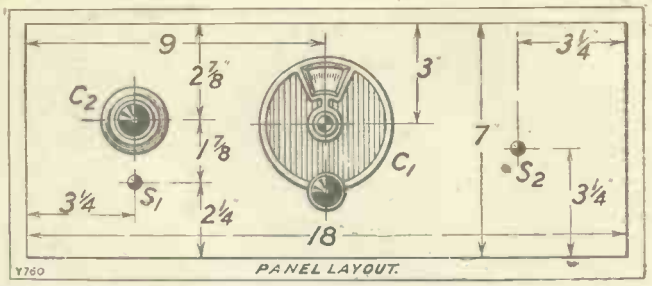
this set is definitely better than many people get with some of the special "purity" circuits often used which incorporate one or more stages of resistance-coupling.

The reason is a very simple one, being a matter of the removal of a much neglected but very important source of possible distortion, as you will see shortly when we go into details a little.

Perhaps the most striking virtue of all to the more experienced listener is the happy way the set just ignores a bad H.T. battery and goes on giving its best almost regardless, provided it is given a fair number of volts.

Of course, if the battery is bad to the point of being crackly and noisy you will hear it, but so long as it is merely a matter of a high resistance it will have little effect until the actual voltage drops so low that the valves can no longer do their work properly.

We have demonstrated this remarkable feature in a very striking way by imitating the effect of a bad H.T. battery. To reproduce this condition artificially all that is needed is to connect in series with the lead to the negative socket of the H.T. battery a variable resistance, such as the winding of a potentiometer.



Remarkable Stability.

When this is done with "Everybody's" Three it is found that as much as *three hundred ohms* can be added to the resistance of the battery without having the slightest effect so far as one could judge.

What this means, of course, is that the set is extraordinarily stable, which is all the more remarkable when we remember how extremely powerful are the L.F. amplifying circuits. As a rule, when very high magnification is obtained from the L.F. stages (by using two transformers, for example) the set is pretty sure to be a little

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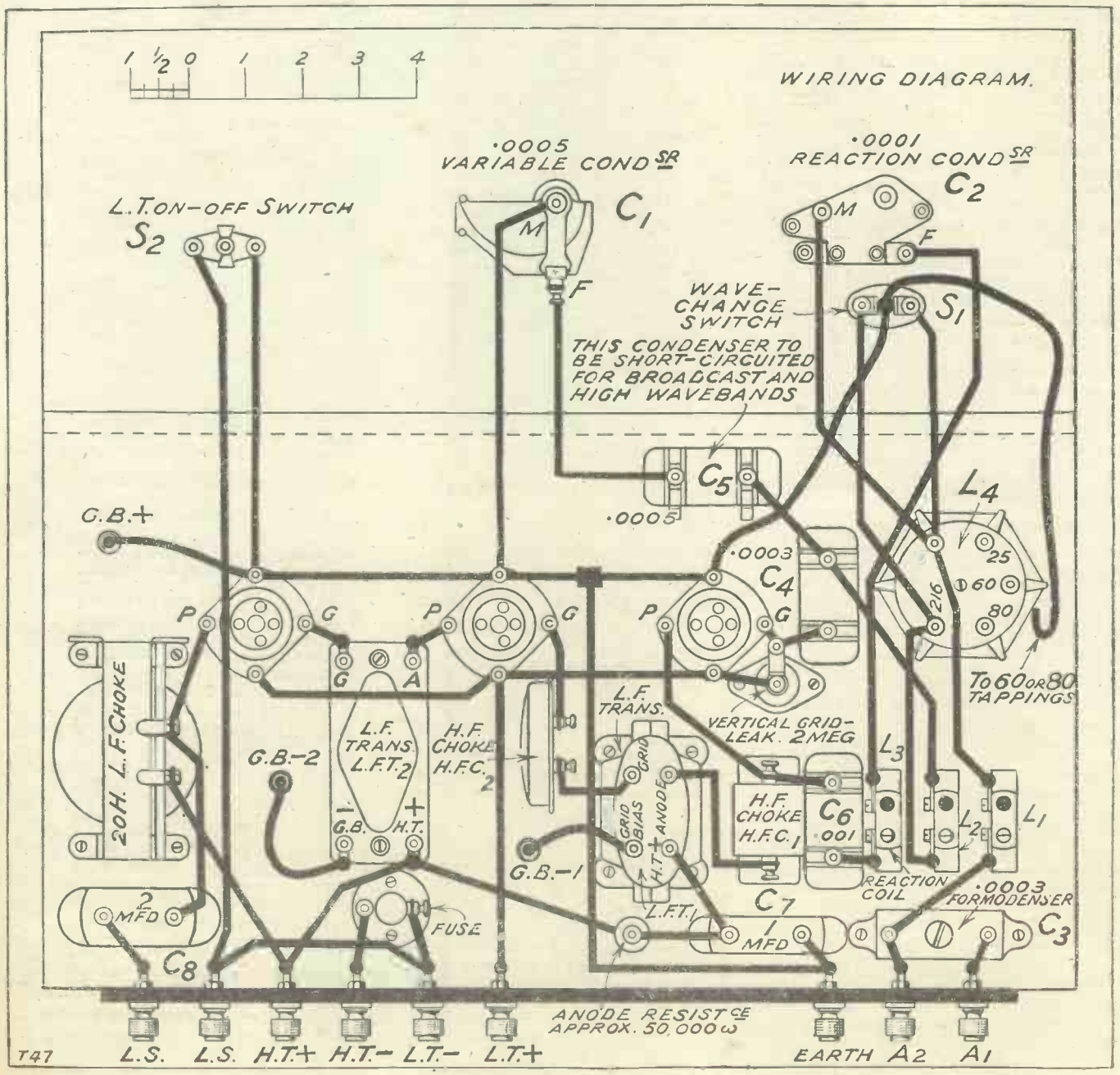


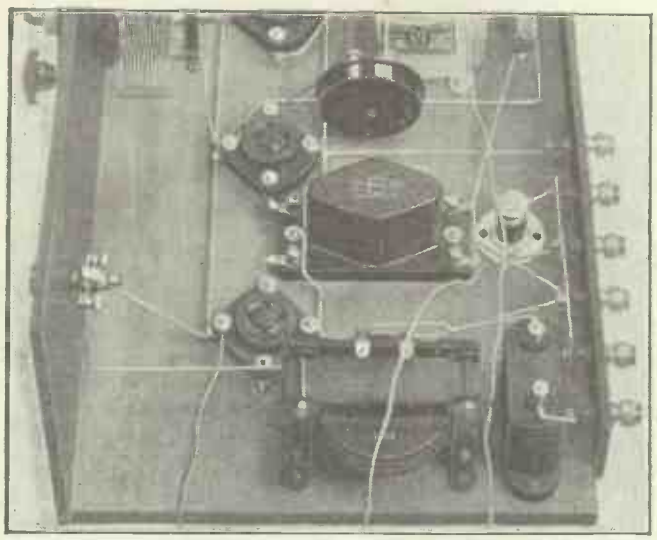
"EVERYBODY'S" THREE.

(Continued from previous page.)

unstable and prone to go into a howl if the H.T. battery is getting a bit old and developing a high internal resistance.

We have found, for example, that with an ordinary set containing two transformer-coupled L.F. stages and no special devices, as little as 30 ohms in series with a new H.T. battery would be enough to start a continuous L.F. howl. Compare this with the 300 ohms (and still no howl) which "Everybody's" Three will put up with, and you will begin to get an idea of its phenomenal "safety factor."

You will begin to see now, probably, why the set gives such remarkably fine quality of reproduction. It is simply because we have taken very special precautions to cut out all chances of trouble due to what is called "battery coupling."



Here is a view of the low-frequency end of the set. Note the wide spacing and the flash-lamp bulb which acts as a protective fuse.

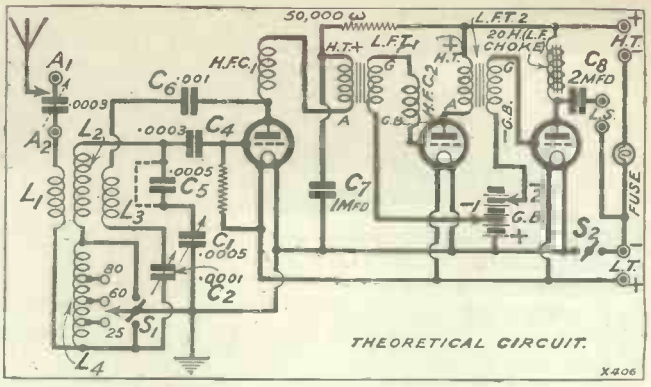
Now, that is a rather fearsome-sounding name, but the matter is simple enough really. The point is this: When the L.F. stages are giving very high magnification only a very little coupling between them will be sufficient to set up feed-back effects (highbrow name for reaction!) which may either start a howl or merely spoil quality by making it muffled, jarring, or indistinct.

Excellent Quality.

The resistance of the H.T. battery, being common to the anode circuits of all the valves, may easily supply just the little bit of back-coupling needed. Hence, if we arrange to circumvent this we not merely make it impossible for the set to start a howl just because the battery is running down a little, but we also insure against poor quality. Having done so, we then discover that two good modern transformers can give remarkably good quality, better even than many people get from arrangements using resistance-coupling and so, theoretically, superior to our pair of transformers.

The reason is, of course, that the resistance-coupled set may not be properly protected against the effects of battery resistance and so may suffer from battery coupling.

You will now begin to see that our enthusiasm for this set is based upon some very sound and solid facts. Not merely has it a very powerful and stable L.F. side with an abundant safety factor, but preceding this it has a very sensitive and efficient detector circuit capable of excellent long-range results. Added to all this is the fact that the set is equipped with one of the latest and best types of wave-change switching, so that there is no coil changing to be done when going over to the long waves, so that it is surely fair to claim that it is something like the ideal three-valver; hence its name!



Again, just in case some constructors should feel that all the good features we have enumerated are not enough, we have added a further attraction by making the set suitable for use on the short waves also!

By changing the coils, i.e. taking out the ordinary plug-in broadcast coils and replacing them with special short-wave ones, such as the Atlas, Igranic, DX, etc., and making a simple little adjustment, the set becomes an efficient short-waver on which you can hear America almost any night during the winter.

Now let us take a look at the circuit diagram and see in a general way how all this is done. (No, we are not going to bore you with a lot of technicalities, just a general look-over, to give us an opportunity of explaining one or two little details which you need to understand in order to work the set properly.)

First of all, the detector and tuning circuits. These are very similar to those used so successfully in the "Sceptic's" Three ("P.W." No. 315), the differences being that plug-in coils are used instead of a specially wound affair, and that a slight modification is made in the connections of the standard loading coil which improves the selectivity on long waves a trifle.

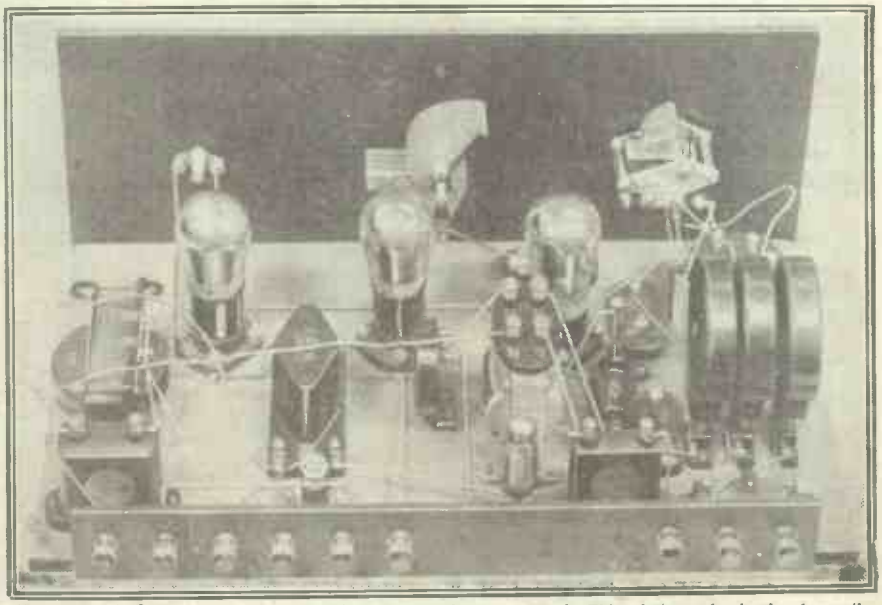
Special Selectivity and Volume Control.

A special feature is the provision of a small semi-variable condenser (C_3), which can be used in the aerial circuit when it is desired to get higher selectivity than normal. This is done by connecting the aerial lead to terminal A_1, instead of its usual position on A_2, and setting C_3 to a small value, then tuning in as usual.

If selectivity is then found to be good enough, but volume is reduced too much, increase C_3 a little and retune on the main tuning dial. This condenser (C_3), by the way, is one of the small compression type, and its capacity can be anywhere round about ·0003 mfd.

In some makes, for example, only a ·00025 is available, in others a ·00028, but any of these will serve (so will a ·00035).

(Continued on page 676.)



"Everybody's" Three is the sort of set that anybody can make! This photograph clearly shows the simplicity of the back-of-panel layout and wiring.

LATEST BROADCASTING NEWS.

THE VIENNA PHILHARMONIC.

CHANGES AT SAVOY HILL—LABOUR PARTY AND THE B.B.C.—KING GEORGE'S KEYS—AN ENTHRONEMENT BROADCAST—CAPTAIN P. P. ECKERSLEY'S MISTAKE—SINGLE WAVE-LENGTH HITCH—A RHOSLLANERCHRUGUG BROADCAST—SIR IVOR ATKINS AT BELFAST.

The Vienna Philharmonic.

PROPOSED co-operation between the B.B.C., the Germans and the Dutch seems likely to bear fruit in a rare treat for British listeners early in the New Year. The idea is to bring the Vienna Philharmonic Orchestra to Brussels for a week, and relay their performances from there throughout Great Britain, Germany, and Holland. In view of the fact that the B.B.C. engineers can now guarantee good quality from Brussels, these relays should be the cause of general interest and much enjoyment.

Changes at Savoy Hill.

There are persistent rumours of impending staff changes at Savoy Hill. It has been suggested that the broom of the Governors, held so long in suspense, has at last started to sweep. The two departments which appear to be in process of reorganisation or reconstruction are those concerned with the Children's Hour and Dramatic Production.

Labour Party and the B.B.C.

The Parliamentary Labour Party were badly upset by the decision of the B.B.C. to take as an "O.B." Major Walter Elliot's speech at the annual meeting of a Highland Association. The subject was "West Highland Transport," and Major Elliot set himself to give an explanation of a transport bill whose provisions are designed to make transport conditions in that area very much better. The Labour Party regard the measure as definitely controversial. Their protest on the day before the broadcast was not successful, and now they are pursuing the matter further.

King George's Keys.

The ceremony of the Keys, which for centuries has been enacted every night at the Tower of London—it is really the "locking up" of the ancient building—has twice been broadcast during the last two years. There is something in it which thrills, the tramp of the feet as they resound through the dimly-lit passages, the stern challenge of the sentries "Who goes there?" and the reply "The Keys—King George's Keys."

The microphone, or rather the six microphones which are required for this broadcast, take us back through the ages as nothing else can do, for which reason doubtless there have been many requests that it shall be repeated again. The B.B.C. has acceded, and the date will be Monday, December 10th, at the usual time, 9.40 p.m.

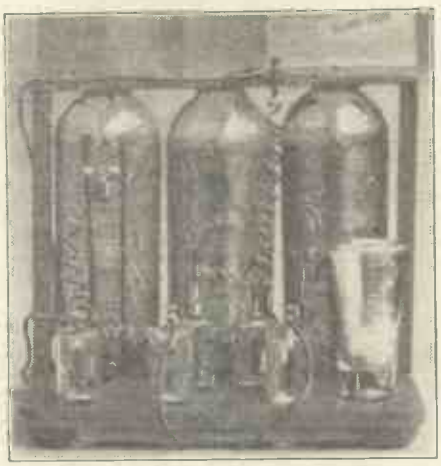
An Enthronement Broadcast.

The most important ceremony of the Church of England, the Enthronement of a new Archbishop, takes place in the Canterbury Cathedral on Tuesday, December 4th, when the Most Rev. Cosmo Gordon Lang officially takes over succession to Dr. Davidson. Listeners throughout the country will be pleased to learn that arrangements have been made to broadcast the ceremony from London and 5 X X between 11.30 a.m. and 1 p.m.

Captain Eckersley's Mistake.

Although there was much general appreciation of Captain Eckersley's "Birthday Programme" this year, there was a good deal of discontent with his message to listeners at the end: "Good-night, Listeners all; may your rabbits die." This was not the Chief Engineer at his best.

WIRELESS BOTTLES.



This ingenious crystal set was made by Mr. H. Huggen, a Leicester reader, and has taken several prizes. Whisky bottles (empty, of course!) make good coil-formers, and several sweet-bottles in front serve to hold the crystal detector, leads, etc. Tuning is carried out by means of a pair of glasses (right) covered with silver paper and placed one inside the other.

Single Wave-length Hitch.

The placing of the relay stations on ons national exclusive wave-length, which was planned to take effect in November, has been postponed to the middle of January because of difficulties with the apparatus required.

A Rhosllanerchrugug Broadcast.

Many listeners who spend the early part of Sunday evenings fiddling with the knobs of their receivers endeavouring to "pull-in" foreign stations will get equal exhilaration if they tune in to 5 X X between 6.30 and 7.55 p.m. on December 9th, when Daventry Senior will be broadcasting a service in Welsh.

It is to come from Capel Mawr, Rhosllanerchrugug, the largest Nonconformist place of worship in North Wales, where, it is said, people often travel long distances to hear and to join in the music. The acoustics of the chapel are claimed to be practically perfect, so that all who understand the Welsh language (and those who do not) should be able to enjoy the singing (which will be under Mr. Joseph Davies), and listen to an address which will be given by the Rev. Wynn Davies, the Pastor.

Some members of the congregation of this church have private telephone lines between the pulpit and their homes, and this broadcast will provide an opportunity for comparing telephonic and wireless reception.

Sir Ivor Atkins at Belfast.

Sir Ivor Atkins, the organist and master of the choristers at Worcester Cathedral, is to conduct an orchestral concert in the Belfast Studio on Friday, December 14th. The principal item in the programme will be a performance of Zoltan Kodaly's "Psalmus Hungaricus," a Hungarian paraphrase on the fifty-fifth Psalm for tenor, chorus and orchestra.

TECHNICAL NOTES. By Dr. J. H. T. ROBERTS. F.Inst.P.

ELECTRICAL PICK-UPS

Gramophone Interest—A Blessing in Disguise, Etc., Etc.

Electrical Pick-Ups.

I RECEIVE all sorts of inquiries, from readers of these Notes, about gramophone electrical pick-ups and similar matters, and lately I have been getting many questions concerned with the gramophone motor. This is not directly related to radio in any way, but the inquiries obviously indicate the increasing interest which is being taken in gramophone matters by radio experimenters. In fact, it almost appears as though the gramophone art and the radio art are merging one into the other.

Gramophone Interest.

Digressing for a moment from the subject of gramophone motors, it is interesting to consider the causes of the present unprecedented boom in the prosperity of the gramophone industry. I suppose it is not more than eight or nine years ago that the gramophone industry was something of a Cinderella and the great rise in its fortunes undoubtedly dates from a point somewhere after the establishment of radio broadcasting.

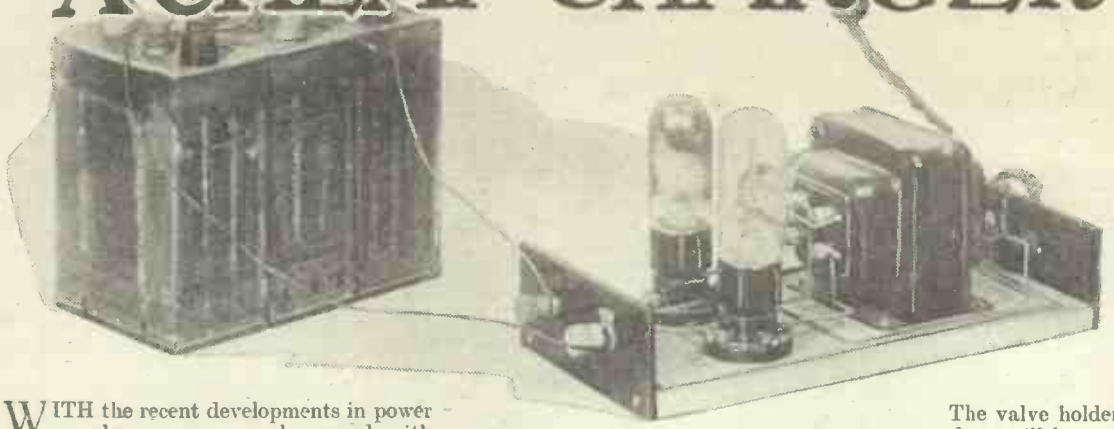
No doubt everyone has his own view as to the explanation of this great development; but my own opinion is that the introduction of radio has resulted in an enormous number of people taking an interest in reproduced music, to whom the gramophone had never previously appealed. It was really natural and inevitable that, having become interested in the reproduction of speech and music over the radio, they should be much more open to the appeal of recorded music.

A Blessing in Disguise.

It is very interesting indeed to observe that whilst the prophets foretold that the

(*Continued on page* 670.)

A CHEAP CHARGER



Details of an easy-to-make, economical charger, for home charging from A.C. mains.

By FREDERICK LEWIS.

WITH the recent developments in power and super-power valves, and with the introduction of the new pentodes, or five-electrode valve, the question of supplying suitable H.T. is becoming increasingly acute.

Large numbers of listeners are beginning to realise that in order to get really good volume and quality something more than the ordinary H.T. dry battery must be supplied. The pentode valve takes anything from 14 to about 18 milliamps, while super-power valves take varying but heavy currents from the H.T. supply. So increasing numbers are turning their attention to battery eliminators and mains units of

PARTS REQUIRED.

2 Terminal strips, 5 in. × 2 in.
Baseboard, 10 in. × 5 in.
2 Valve holders.
1 Power transformer, "Radcroix" TR2 or TR1 (according to mains voltage). (Wholesale Wireless Ltd.)
1 each Philips' 328 and 329 valves.
2 Terminals (plus and minus).
Wire and Systoflex or Glazite.
Flex and lamp plug adaptor.

all descriptions are being made and supplied from small D.C.-H.T. units to the large A.C. mains units capable of giving anything up to 500 volts and 120 milliamps.

It is the listener who has the fortune to be on A.C. that I want to interest in these remarks. He is enabled to build a mains eliminator which will give him practically any voltage he likes and practically any milliamps he likes. The man with D.C. is rather handicapped in that respect.

Also, if one has A.C. it is extremely simple to rig up a little charger which can be put on two or three times a week, or whenever one wishes after the set has been used, keeping the L.T. battery up to scratch at a minimum of cost. The current taken from the mains is not so much as that of an ordinary electric bulb, while the charging rate of the accumulator is 2 amp.

Simple and Cheap.

The little charger which is being described here supplies perhaps a little more current than most trickle chargers, but is thoroughly reliable and well worth possessing. The whole thing merely consists of a mains transformer which can be obtained very cheaply, and a rectifying valve and a barreter to prevent the current rising above a certain maximum.

As will be seen from the photograph, the charger is mounted on a piece of wood, very few components being required, while absolutely no skill is needed to make it up.

The transformer is of the usual Radcroix type (TR1 or TR2), suitable for the voltage of the mains and suitable for the rectifying valve in use—the Philips 328. Well-insulated wire should be used when building this little unit, but when in use it should not be boxed up closely or it may get unduly warm.

As a matter of fact, when it has been placed under the table on which the set is I have never found it to heat up at all, the whole thing remaining remarkably cool with the exception, of course, of the rectifying valve.

Quickly Charged.

This is of the usual mercury vapour type, and when the unit is switched on there is a bright flash in the valve, followed by a little blue flicker, and then the whole thing settles down to charge steadily at the rate of about 2 amps., and will carry on like this for days on end if required.

Usually three or four hours' charging is quite sufficient, though occasionally I would advise that the accumulator be allowed to run down a little, then given a really good charge overnight for about eight hours. This will keep it in far better condition than by just keeping it up to its top point without ever allowing it to gas properly.

The valve holders are of the usual type, and, as will be seen, only three sockets are used in one holder, the grid socket being left unconnected in this case. This holder is for the barreter valve—the Philips 329. In the case of the rectifier holder all the four sockets are used and are connected as shown in the wiring diagram.

Connecting Up.

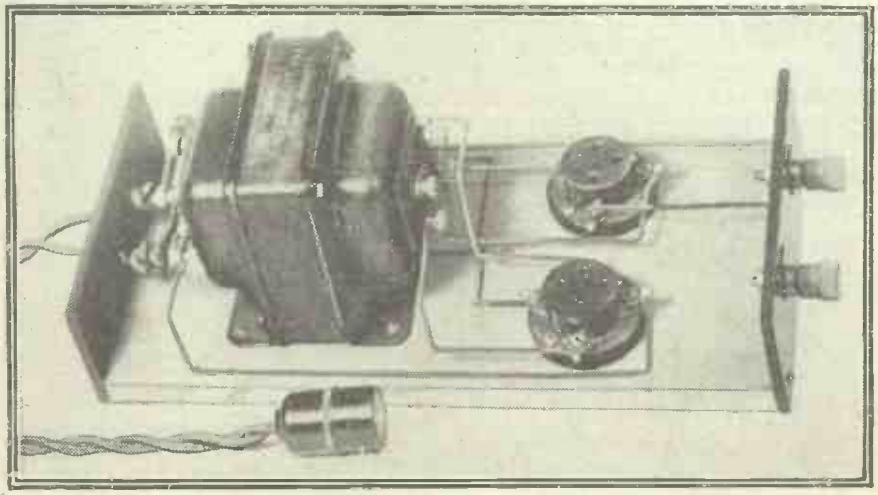
The transformer is connected direct to the mains by the two top terminals at the back, the three under terminals being taken elsewhere, as shown in the diagram. It is advisable to place a knot in the mains lead to prevent it being dragged off the terminals, the knot being on the inside of the ebonite strip at the back of the unit.

The accumulator positive terminal is connected to + on the charger and the negative on the battery to — on charger. It can be left connected if desired when the charger is switched off from the mains.

The whole outfit should not cost more than about 35s., and can be tucked away in any convenient spot, although care must be taken that dust should not fall upon the unit.

The only thing which has to be watched when using a charger is the level of the acid in the battery. This must be topped up from time to time, and it is advisable to use a hydrometer to tell the true condition of your battery and whether it is fully charged or not. A voltmeter will not give a really reliable test.

(Continued on next page.)



The charger in its final form, showing how simple is the construction. The whole thing measures only 10 in. by 5 in.

THAT OUTPUT FILTER.

When should it be used, and is it really an advantage?

By A CORRESPONDENT.

AN output filter is a useful device and is a great aid towards stability in a low-frequency amplifier. In certain types of receivers it is practically essential, for reasons that will be given later.

Most readers know that it is the usual practice to choose a power valve of some kind for the last socket—the output stage—of a set designed for loud-speaker work.

Now in many of the designs published in the periodicals a choke-filter output is included as part of the set. In others there is no filter device. Whether or not such an arrangement should be included depends largely upon the purpose for which the set is intended.

It really boils down to a question of D.C. resistance. The average power valve takes a fairly heavy current. Readers may not be quite clear as to why a power valve is necessary.

Power Valves.

We know that if we wish to work a loud speaker we must amplify the signals so that the volume is adequate for our particular requirements.

If the signals will only work a pair of 'phones at decent strength, it is no good expecting the speaker to give you anything more than 'phone volume. The actual signals which the speaker receives must be many times greater than this. When so much energy is being handled, the last valve must have a characteristic which will permit sufficient grid bias to be applied, in order to avoid distortion.

This necessitates a valve having what is termed a low impedance, or in other words a power valve.

These valves take a fairly high anode current because of their comparatively low impedance or resistance. I have explained this, because it is all connected with output filters.

Large Volume.

With small sets, such as two- or three-valvers, it is scarcely possible for the volume to be large enough to overload a small power valve with, say, 120 volts H.T. and 9 volts grid bias.

This applies in particular to the former class of receiver. The exception might be if the set were employed within the "shadow" of the local station; but even so, one would expect the detector valve to be overloaded first in the case of a two-valve set.

A small power valve can be used fairly safely directly in circuit with a loud speaker winding, because the current is not so great as to cause damage to the windings (assuming the instrument to be of high quality) and because the drop in volts across the windings is not large.

When, however, we come to the question of four- and five-valve sets, the use of an output filter becomes very necessary. Such sets are quite capable of delivering sufficient signal volume to overload a small power valve on the local station. A super-power valve, that is, one designed to handle a greater volume, then becomes essential.

Now a super-power valve may easily take twice the anode current required by a small power valve, and in consequence it is not wise to connect the delicate windings of a loud speaker in series with it. It is not solely a question of current, since one has also to consider the mechanical stresses on the windings produced by the greater power which is being handled.

Preventing L.F. Oscillation.

Then again the heavier current increases the volts dropped, or in other words the volts lost across the loud-speaker windings. This drop is equivalent to so many volts less H.T. at the anode of the valve, and it may be serious with one of the super-power type—in extreme cases producing distortion.

Thus it is an advantage to pass these heavy anode currents through the robust low-resistance windings of a suitable filter choke, feeding the speech or music impulses to the speaker via a condenser, in this way isolating the loud speaker from everything except the fluctuating currents. In a large set, which is capable of handling a considerable intensity, there is always a danger of low-frequency oscillation commencing. By separating the steady anode current from the music impulses with a choke-filter circuit it is frequently possible to stabilise an otherwise troublesome set.

A CHEAP CHARGER.

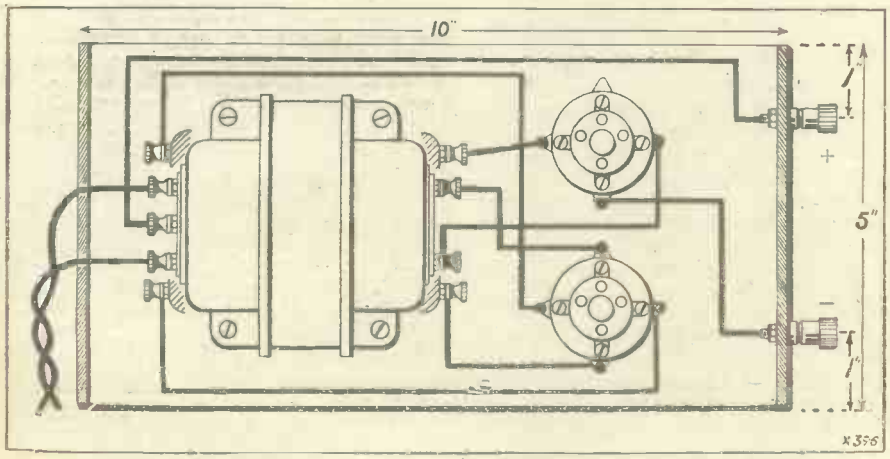
(Continued from previous page.)

Either a 2-, 4-, or 6-volt battery can be charged with the little charger just described, the barreter controlling the output so that it is not more than the two amp. maximum.

I find this class of charger far more satisfactory than the liquid types; but whatever charger you use, whether you use the one described here, a dry rectifier, or even the wet type, it really does pay to get a charger going at home to charge one's batteries. It saves an enormous amount of trouble and time, and from a sheer £ s. d. point of view it works out very much cheaper than taking the batteries round to the local garage to have them charged say once a week or once a fortnight.

TECHNICAL TIPS.

Cutting a crystal in two and using the new bright surface instead of the old dirty one will often result in a great improvement in crystal set reception?



Six months is a good time to allow for the normal life of a grid-bias battery.

* * *

A connection to earth is not always necessary or beneficial for short-wave work.

* * *

Galvanised iron as sold for clothes-lines makes an excellent stay for masts. Rope should never be used.

* * *

To avoid fouling at the masthead, a large shell insulator will often give better results than a metal pulley.

* * *

When a counterpoise earth is used, it must be insulated just as carefully as an aerial.

* * *

A good counterpoise earth may be made by running a rubber-covered wire along a fence, especially if this runs directly underneath the aerial.

* * *

Amplification at high frequency means that the currents magnified are those which are flowing in the aerial or the tuned circuits, before the detector.

* * *

Amplification at low frequency means the magnification of those currents which represent speech or music, i.e., the magnification of the output from the detector (whether crystal or valve), gramophone records, etc.

RADIO ENERGY

Some facts concerning the amount of radio energy which your aerial collects.

By J. F. CORRIGAN, M.Sc., A.I.C.

FAMILIARITY breeds contempt, they say. Certainly, it is productive of a large amount of indifference; and that is why, I think, that the majority of us hardly ever pause nowadays to consider the approximate magnitude of the radio currents which our aerials bring down into their respective receivers.

Assume, for instance, that the transmitting aerial of a B.B.C. main station flings out into space a quantity of electrical energy which, for the sake of discussion, we will represent as equalling one hundred horse-power. A man situated, say, at about ten miles distance from the station may be working a two-valver in a manner which is exceedingly satisfactory to him. Yet, is his aerial receiving anything like a reasonable proportion of the energy of the broadcasting station? Not a bit of it. It can be shown mathematically that the average amateur receiving aerial collects an amount of radio energy equalling about a million-millionth of a horse-power.

Extraordinary Efficiency.

Such is the magnitude of the electrical energy which the receiving amateur has invariably to deal with. A remarkable fact, but, nevertheless, a true one; and, considered from this point of view, one is able to obtain at once a true appreciation of the extraordinary degree of efficiency with which modern valves and receivers generally work.

You might express the energy received by an outdoor aerial as a fraction of a fly-power. And here, again, mathematical calculations are apt to come as a surprise. Dr. Whitney, an American scientist, of the General Electric Company, for instance, worked out a little time ago the fact that an ordinary house fly would expend as much energy in walking a distance of one inch as an ordinary receiving aerial would collect in a space of 35 years.

An ordinary spider, therefore, in weaving its web around a frame aerial (as, indeed, such a creature has been known to do)

Close-up view of headphone magnet assembly (case removed), showing the diaphragm.

would expend more energy than you could possibly receive on your aerial during the course of your whole life-time, and that of your sons—and that, also, of your grandchildren, and their children as well.

These above calculations are based solely upon the radio energy collected on the aerial of a receiving station. But, in considering the magnitude of the energy which flows into the grid of the valve, or across the crystal contact, we have still to realise that a large percentage of it is lost before it reaches these portions of the circuit. Consequently, in a crystal set, the amount of energy which is ultimately available for operating the headphones is almost indescribably small.

Indescribably Minute.

You will often have noticed, no doubt, the tiny midge which flits about the window panes of your den during the summer and autumn evenings. It is a creature measuring barely an eighth of an inch all over. Now, this insect, in flying, vibrates its wings about a thousand times per second, which is something like the number of times per second at which the metal diaphragm of a headphone earpiece vibrates. However, in performing one complete vibration of its wings, this tiny window-fly uses up not less than five million times the amount of energy which is required to set up one complete oscillation of a telephone diaphragm.

There is yet another point of interest connected with the subject of energy magnitudes in a radio receiver. It is the question of the actual distance moved by a headphone diaphragm in performing a single vibration. Stated in bald figures, this distance is approximately one hundred-millionth of an inch—a statement which conveys really very little, so difficult is it to form an adequate appreciation of that magnitude.

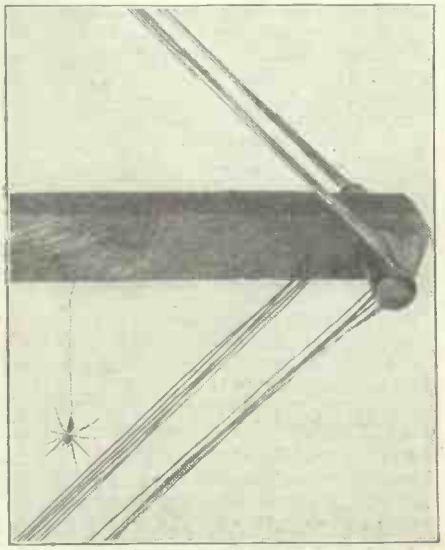
Real "DX" Work.

But this is not all concerning the magnitude of the energy which is effectively dealt with by modern receivers. Suppose you withdraw your present receiver from its situation a few miles from your local broadcasting station and place it somewhere on the other side of the Atlantic.

In such an instance, the amount of energy becomes incredibly smaller, so much so that, expressed in decimals, thus: ·000000000, a row of printed noughts several yards long would have to be written before the first numeral was reached.

Almost impossible to appreciate, you say, no doubt. And, indeed, such is the case. The fact that radio receivers are capable of dealing with such indescribably small amounts of energy is, after all, *the* tribute to their wonderfully efficient nature, for surely when you come to think about it, it is a matter for amazement that any mechanical or electrical device can deal at all with quantities of energy so infinitely minute.

A highly-magnified photo of a Window-Midge, a single beat of whose wings requires millions of times more energy than does a single vibration of a headphone diaphragm.



A spider, in weaving its web around a frame aerial, would expend more energy than would be picked up on an ordinary aerial during the course of several life-times.

RADIO AND THE "VESTRIS" TRAGEDY.

Once again the name of a wireless operator is added to the ocean's roll of fame.

By THE EDITOR.

THE tragic disaster of the steamship "Vestris" has again drawn public attention to the extraordinary value of wireless communication at sea, and to the extraordinary heroism of wireless operators. Every reader knows now that the Chief Operator of the "Vestris," Mr. Michael Joseph O'Loughlin, lost his life in standing-by sending out the S.O.S. while the "Vestris" gradually listed over, and finally sank.

Had it not been for the devotion of O'Loughlin and his two subordinates, Mr. James Taylor Forbes MacDonald and Charles Tulloch Verchere, it is inevitable that the loss of life on the "Vestris" would have been much greater. In fact, it is conceivable that the mystery of the "Vestris" would have been listed with that of the "Marie Celeste," and perhaps if no survivors had been picked up we should not know to-day what had become of the ship and why it failed to reach its destination.

8,000 Lives Saved.

It is not out of place to refer to the "Vestris" here because the saving of so many lives from that ill-fated ship is another tribute to the life-saving value of wireless at sea and, in fact, brings the total number of lives saved through the agency of wireless up to a total of over 8,000 in major disasters at sea in times of peace.

It has been officially stated at the enquiry in New York that the wireless on board the "Vestris" was handled with the utmost skill from the time the first S.O.S. signal was sent out on November 12th until the ship was abandoned when, according to reports, the late Mr. O'Loughlin was reduced to transmitting his messages while standing on the wall of the wireless room which, owing to the listing of the ship, had practically become the floor of his cabin.

The "Vestris" was equipped with a very fine wireless outfit. By the courtesy of the Marconi Company, I am able to say that the "Vestris" apparatus consisted of a Marconi main 1½-kw. installation, with emergency apparatus; also a continuous long-wave transmitter for special service and a standard valve receiver. The transmitting apparatus would enable the ship to carry out communication at distances up to 1,500 miles from its C.W. set, and up to 500 miles on its main spark set. It was with this latter set that the S.O.S. signal was sent out.

Emergency Apparatus.

As the "Vestris" was on the New York-Buenos Aires route, which is a busy shipping route, the ranges of her wireless set gave every opportunity for the calling of attention of other vessels, and the number of ships which answered her and came to her aid shows that the apparatus more than fulfilled its function as regards getting into communication with rapidity and despatch. It has been shown at the enquiry that the operator of the "Vestris" was able to carry on for three hours with his main wireless transmitter and after that to continue communication with the emergency transmitter until the ship was abandoned. The main installation was obviously kept in operation so long as the ship's dynamos were working, but after the ship heeled over and the engine-room was flooded with water, it is probable that the donkey engine, which supplied power to operate the dynamos, was swamped, the dynamos stopped and the main power supply to the wireless room cut off. It was then that the operator would have had to switch over to his emergency set operated by battery power.

A RADIO HERO.

Mr. Michael Joseph O'Loughlin who died at his post in the wireless room of the ill-fated "Vestris." The gallant operator continued to send out S.O.S. messages on his emergency apparatus until the ship listed right over.

Space would not be sufficient in this issue to pay full tribute to the wireless operators of the "Vestris" who, as might be expected, acted in accordance with the best traditions of the wireless service. Mr. O'Loughlin and Mr. MacDonald were both experienced operators, with eleven and thirteen years' service respectively, while the junior operator, Mr. Verchere, with only three months' service in the Marconi Company, proved himself a worthy recruit to the wireless calling.

Mr. O'Loughlin was thirty years of age and joined the staff of the Marconi International Marine Communication Company as an operator during the war, on September 11th, 1917, and served during the remainder of the war and subsequently on merchant ships. He left England for New York on the White Star Liner "Adriatic" on June 23rd, and after one trip to Valparaiso joined the "Vestris" on September 1st, this voyage being his second between New York and Buenos Aires on this ship and, tragically enough, his last.

Mr. MacDonald, the second operator, was luckily saved. He is thirty-four years of age, and has been in the service of the Marconi Company for thirteen years. He was appointed in February, 1915, and, like O'Loughlin, served on merchant ships during the war. On one occasion he was shipwrecked.

Charles Verchere, the third operator, who was also saved, is eighteen years of age, and is a native of Fifeshire. He joined the Marconi Co. in July this year, and left London on his first voyage on August 4th on the Red Star liner "Minnesota." He transferred to the "Vestris" at New York on August 24th, this being his second voyage on that ship.

15,000 Vessels Fitted.

It is interesting to note, in view of the tragedy of the "Vestris," that wireless was first introduced to the British Merchant Service in 1901, when the Marconi Company fitted the Beaver Line Steamship "Lake Champlain." To-day there are few ships of any importance that are not fitted with wireless gear. From 1901 until the present day, no fewer than 6,000 British merchant ships have been fitted with Marconi apparatus, and at the present moment there are over 15,000 ships throughout the world which are equipped with wireless gear of the Marconi type.

The life-saving potentialities of wireless were first demonstrated to the public in 1899 when the East Goodwin Lightship, which had just been fitted with apparatus, called for assistance when it was struck in a fog by another steamship. From that date onwards wireless has steadily been accumulating records of lives saved at sea.

The tragedy of the "Vestris" should again remind us of the heroism of those who stick to their posts and, like the old Roman soldier when Pompeii was gradually being inundated with burning lava, subordinate self to the service to which they are dedicated.

The name O'Loughlin is but another to add to the long roll of those men of the wireless calling who have laid down their lives and so nobly kept fresh the traditions of wireless at sea.

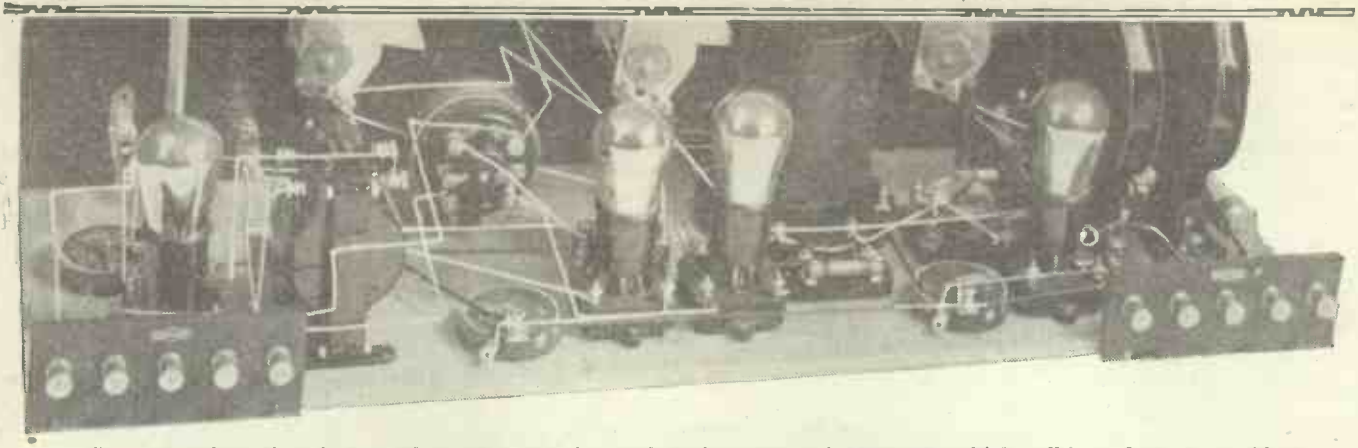
IMPORTANT POINTS.

A calibrated receiver is one for which a chart has been prepared of the dial-readings showing the stations obtainable, or the wave-length covered for the various dial settings.

Sulphation is the greatest enemy of the high-tension battery, and the best way of keeping it at bay is to have the battery regularly and fully charged.

Amplification at high frequency means that the currents magnified are those which are flowing in the aerial or the tuned circuits, before the detector.

THOSE VALVE STAGES



Some practical hints in regard to the operation and maintenance of your set, which tell you how to avoid "weak signals," erratic reaction, instability and other such troubles.

By J. ENGLISH.

IN the course of a periodical "polish-up" of your set, do not forget that attention to the valve stages and accessories will improve both sensitivity and quality of reproduction. Before taking each valve stage separately it is a good plan to run over all the valves and valve holders and clean them up generally.

Where valves have remained in their holders for any length of time you will probably find the valve pins and the interior of the holder sockets tarnished. In order to restore good contact, which is really essential, the pins should be cleaned up with fine emery paper and the sockets cleaned out in the same way, and a light smear of vaseline applied. Where the leads to the valve holders are not soldered to the socket connections, but held under a terminal, it is often wise to clean up the wires and terminal nuts with emery paper.

The Detector Valve.

The most important points are the grid and anode pins and sockets. If these are dirty and making faulty contact, the result will be poor signals, weak or erratic reaction effects, and possible unstable L.F. stages. For this reason it is advisable to take each valve in turn and gently ease the pins slightly or prise them open a little with a penknife where they are split, until all four pins fit firmly in the valve holder sockets.

Now the detector valve is, in many cases, the first valve of the receiver, and upon it depends the sensitivity of the set and, to some extent, the quality of reproduction. In order to get the maximum efficiency out of the receiver there must be no faults in the detector stage. If the well-known grid condenser and leak method of rectification is used, the grid leak, if an old pattern, should be replaced by one of the more modern resistances.

Grid resistances of the older patterns have the unfortunate habit of changing considerably their resistance value, and possibly the grid resistance in your set is several times its original value, so that the detector valve cannot possibly rectify efficiently. Also, defective and old grid leaks are responsible for a background of noise, a faint hissing, which is all against successful DX reception. See to it, therefore, that your grid leak is a reliable one and that the grid condenser has high insulation resistance. This can be tested in the well-known manner with a battery and a pair of 'phones.

Faulty Reaction Control.

Grid-condenser rectification is usually employed where reaction is obtained from the detector and the value of the grid leak and its connections have a decided influence on the degree and smoothness of the reaction control. If you find that this is at all "plonky," the set going into oscillation with a thud and coming out of oscillation at a different setting of the reaction condenser, then try the effect of using a grid leak of higher value.

Usually the filament end of the grid leak is so connected to L.T. that the potential on the grid is too positive. For the smoothest control of reaction the filament end of the grid leak, or the grid return lead where the leak is in parallel with the grid condenser, should be connected to the slider of a 400-ohm potentiometer. This is then connected across the L.T. battery and a more suitable positive potential can then be quickly obtained. This will take all the "backlash" out of the reaction control, provided the reaction coil is not too big, making it much easier to tune in weak signals. For short-wave work this potentiometer adjustment is really well worth while.

Where anode-bend rectification is used and the working negative potential is furnished by one or more dry cells, these should be tested and renewed if at all run down. After standing for six months or so the useful life of grid-bias batteries generally comes to an end, and it is false economy to use them for a longer period. Where the negative potential is controlled by a potentiometer, see that the moving contact is quite clean and runs smoothly over the resistance coil.

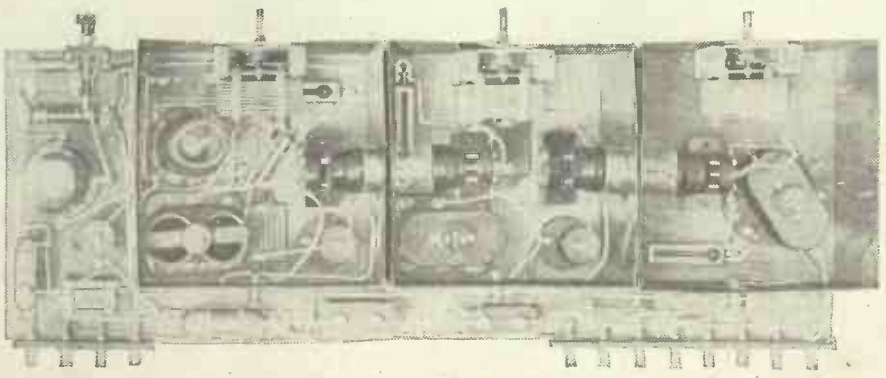
A great deal depends, of course, on the detector valve itself as to what degree of efficiency you can obtain from it. If it is an old one, it is well worth while investing in one of the modern detector valves, as this will probably improve your results more than you would expect.

On the L.F. Side.

The remaining sections of the receiver calling for attention are the amplifier stages and of the two H.F. and L.F. little need be said about the former, as the treatment of the coils and condensers has been dealt with elsewhere, and these practically constitute the H.F. stages. To be on the safe side, however, it is advisable to see that the insulation of leads passing through screens and screening boxes has not deteriorated. It may not be worn through, but the rubber insulation of flex, for instance, is apt to perish in time.

You should now turn your attention to the L.F. stages of

(Continued on next page.)



The horizontally-mounting type of screened-grid valve requires more than usual attention in regard to its pin contacts.

BATTERY LEADS.

By A. S. CLARK.

STRANGE though it may seem, even small things like battery leads need to be properly understood if trouble is to be avoided in a receiver. There is a correct way of connecting battery leads, and also a correct way of handling them.

First of all, there is the type of wire to use. For all batteries, that is to say, H.T., L.T., and grid bias, rubber-covered flex should invariably be employed. If other wire, such as double-cotton-covered or similar is employed, trouble may be caused by the insulation becoming rubbed off and two wires shorting.

Apart from the damage which might be done to the batteries, such a short could easily be the means of burning out all the valves in the receiver.

Tag Tips.

Now, as regards the ends of the leads. It is always advisable to finish these off with proper plugs or spade terminals. Remember, however, when you connect the leads to the receiver to make sure that two of the tags do not touch. Such is quite possible when large tags and terminals fairly close together are employed.

This brings us to another point, namely the order in which to connect up leads. All wires should first be joined to the set before any are attached to the batteries, unless, of course, the grid bias is inside the receiver when it may be ignored so far as these notes go.

Connecting to the set first makes it impossible for the batteries to be shorted by the ends of the battery leads touching. Join up the L.T. before the H.T., since this will help to avoid the possibility of connecting the H.T. across the filaments.

When disconnecting the set, remove the wires from the batteries first. This is for the same reason as the joining of the leads to the set first when connecting up, namely to avoid shorting the batteries.

Heavy leads for the low-tension must be used if resistors are employed in the receiver, otherwise a considerable voltage drop will occur in the connecting wires, which, together with voltage drop in the resistor will result in the valves not getting sufficient current.

Adjusting Grid Bias.

As a matter of fact with multi-valve sets, a drop in the L.T. between the battery and the filaments is almost unavoidable, and for this reason many designers omit the filament resistances altogether.

Never adjust the grid bias of power valves when the set is switched on and the H.T. connected. Always switch the set off between each adjustment. If the above is not observed you may injure your valve or H.T. battery or perhaps both.

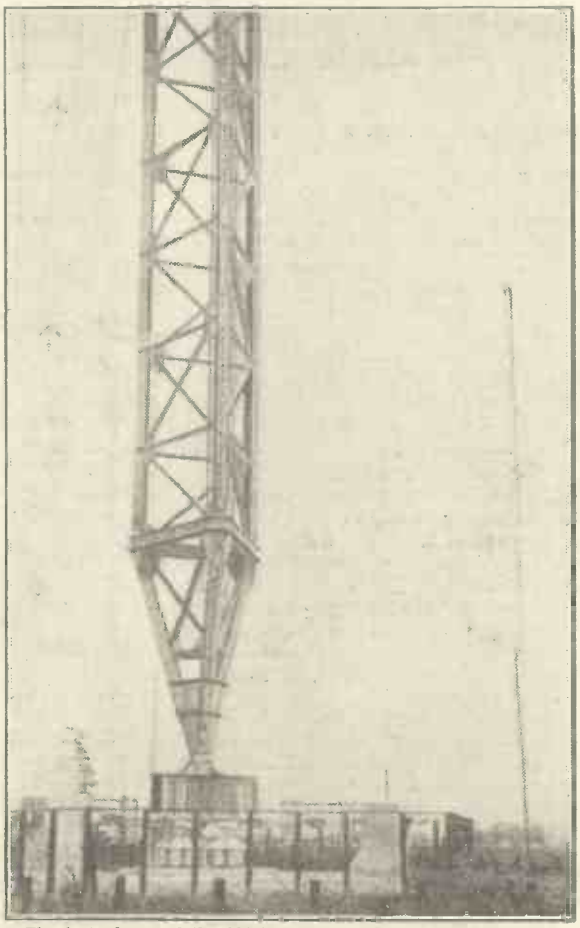
When the grid-bias plug is removed there is a sudden heavy rush of H.T. current of such a value that it may be more than the H.T. battery can stand. The consequent sudden rush of electrons from the filament may also weaken it and thus shorten the life of the valve.

Burnt Out!

Finally, an incident which came before the writer's notice will help to make clear the need for treating your battery leads carefully. One of the multi-battery leads which are so popular was in use on a two-valve set. On moving one of the H.T. plugs to make an adjustment, both the valves expired. All connections, both internally and externally were checked, and as no fault could be found another valve was tried. Everything went well until the leads were slightly moved when yet another valve went "west!" (Enter the expert.)

A careful inspection of the multi-battery lead revealed the fact that it had had a bath of accumulator acid at some time. The insulation had been impaired, and consequently a short occcured between one H.T. + and L.T. +.

A NEW JAPANESE STATION.



The foot of one of the 820-ft. towers at the new Isami (Central Japan) station, which is to be opened next January. It is stated to be the most powerful transmitter of the Far East.

THOSE VALVE STAGES.

(Continued from previous page.)

the receiver, because the degree of amplification and the quality of reproduction is decided largely by the efficiency of these stages.

Several faults may develop while the set is inactive during the summer months, and in any case it is as well to overhaul this part of the receiver, thus making sure that all is in order.

In many receivers a transformer coupling follows the detector valve and it is here that trouble very often develops due to faulty insulation or a partial breakdown in the windings. The transformer can very easily be tested for continuity of windings in primary and secondary by means of a pair of 'phones and a small dry cell, in series, one 'phone tag being connected to one primary terminal and the other side of the battery to the other terminal. A distinct click on making and breaking the circuit denotes that all is well, the click with the secondary being fainter than with the primary. The insulation between primary and secondary and between windings and the core can be tested in the same way.

Testing L.F. Transformers.

When overhauling the transformer it is a good idea to earth the frame by a lead connected to L.T. negative or the earth terminal. Where the transformer has no special earthing terminal the wire can be secured under one of the holder screws or under one of the bolts holding the frame together, first scraping away the enamel insulation where the wire makes contact.

In order to obtain good quality reproduction the primary of the transformer should have a large number of turns and some of the older patterns are very deficient in this respect, so that the low notes are hardly amplified at all. Such transformers should be replaced by a modern type of proved efficiency.

In resistance-capacity-coupled amplifiers, the anode and grid resistances must be perfectly constant in value and the insulation of the grid condenser above suspicion. Any faults in these components may occasion serious distortion and poor amplification. It therefore pays to renew any doubtful components, especially the grid coupling condensers, which should be of the mica dielectric type.

Cleaning Switches.

This almost completes the overhaul of the receiver itself and the only other components calling for attention are switching devices, which are particularly liable to develop faults.

Most switches depend upon constant use to keep the contacts clean by the rubbing action of operating the switch, so that a period of disuse is bound to result in dirty contacts due to atmospheric corrosion. You should therefore get busy with a piece of fine emery paper cleaning up the contacts of L.T. and H.T. switches, especially the contacts of jack switches, following up with a smear of vaseline.

Sometimes a contact blade will lose its springiness and make poor contact, in spite of the fact that the contact points are quite clean.

THOSE "ZEP" BROADCASTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to "H.W.'s" letter recently re Zeppelin broadcasts, I may mention that on the following evening to the one referred to about 6 p.m. 2 X A D was running again, and the announcer said that, "for the benefit of Germany, they were relaying speeches from the New York Advertising Club." But when I changed over I could not find any of the Germans were relaying him again. Then followed a complete host of speeches, leading off with one by Sir Thomas Lipton. I heard Dr. Eckener speak in English. Lady Drummond-Hay said she was more afraid at being the only lady present at that function than at any time on board the Graf Zeppelin! A nephew of Count Zeppelin spoke. The commander of the Los Angeles spoke, and an officer of the Zeppelin spoke in German. I did not find reception so good on the night as I have found many nights or afternoons before or since. 2 X A D runs Mondays and Thursdays from 5 to 6 p.m., and 2 X A F 10 to 12 Tuesdays and Thursdays, as well as at other times advertised.

I heard the operator at 2 X A D announce the arrival of the first snow at Schenectady recently at twenty minutes to 6 p.m. our time. Yes, short-wave work is interesting. Java (A N E), 15·74 metres, is now acknowledging receipt of reports. On another day I heard reports acknowledged from all parts of the world; including Norfolk (England), Brisbane (Australia), Colombo (Ceylon), Sydney (Australia) Pittsburg (U.S.A.), Delhi (India), and Lahore (India). These official Dutch East Indies stations come in very strong, and with amazing good quality for the distance.

Why do not Melbourne and Sydney try the 17 to 15-metre band? One feels they would get "home" to England better than the 28 to 33-metre band at present used.

Yours faithfully,
G. W. BROWN.

Darlington.

7 L O OF NAIROBI.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have not yet seen any reports of the reception of 7 L O (Nairobi), so perhaps the following may be of interest.

I first heard this station on Sunday, November 4th, at 5.30 p.m. The wave was 32·5 metres (according to my wave-meter), and not 35 metres as published. The quality was very good, but the strength only reached R2½. The best of the items heard was the "Blue Danube" waltz at 6.28, both in quality and strength.

On weekdays 7 L O is very badly jammed by a powerful C.W. Morse station on exactly the same wave-length, which completely spoils the signals. On Sunday, the 11th, from 6 p.m. onwards, it was not interfered with, but the quality was not so good as at the first time I heard it.

Has this transmission been received by any other amateur, or am I the first to receive it—I cannot remember seeing any reports.

For short-wave work I use a 0-v-1 modified Reinartz, with aerial connected direct to grid coil, and buried earth—this gives louder signals than no earth, but interference and mush are increased.

Hoping this is of interest.

Yours truly,
D. S. COE.

Plymouth.

CORRESPONDENCE.

TRANSATLANTIC TELEPHONY.

7 L O OF NAIROBI—USING TWO TRANSFORMERS—SHORT WAVE EXPERIENCES.

Letters from readers discussing interesting and topical wireless events or recording unusual experiences, are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents and we cannot accept any responsibility for information given.—EDITOR.

TRANSATLANTIC TELEPHONY.

The Editor, POPULAR WIRELESS.

Dear Sir,—Your recent article on the transatlantic telephone states that it is not possible to listen to the English transmissions with an ordinary receiver. This does not appear to be the case with the American transmitter.

About six weeks ago I was listening on a one-valve short-wave receiver when I picked up what sounded like one side of a telephone conversation. The audible part of the conversation was being carried on by an American lady and was of a very domestic character.

I should have mentioned before that this took place on a Sunday evening, and the wave-length was about 22 metres.

A few weeks later I again picked up the same station but this time a male voice was plaintively calling the "London technical operator" after which it appears that communication was established with England.

If this is not transatlantic telephony, then why did the American lady broadcast her domestic troubles to the hams who are hardy enough to be on 22 metres on a Sunday evening and why did the male American seek council with the "London technical operator"?

Perhaps some of your readers can throw a light on the matter.

By the way, how are the short-wavers getting 3 L O (Melbourne)? Last winter I could always raise them with a one-valve set, but so far I have only heard an occasional whisper from them, this winter.

Yours faithfully,
WILFRED B. COLLINS.

Bath.

USING TWO TRANSFORMERS.

The Editor, POPULAR WIRELESS.

Sir,—Having read the recent article issue regarding transformers, I am prompted to let you know that I have constructed and am working the "Progressive" Four, but am using instead of choke on last valve, a B.T.H.2-1 transformer, with very fine results. Detuning is necessary on 2 L O, but otherwise no distortion at all. On last three valves I get full loud speaker on all main Continental stations, having had on occasions to quieten down Langenberg and Toulouse. I am now fitting switch to cut out last valve.

I have found, however, that the H.F. does not pull its weight, and rubs in still once again "Is H.F. worth while?" I find its only virtue a slight aid to selectivity, and a slight help to very weak signals. On most stations it only seems to complicate tuning.

Whilst at it, I must state that the "Sydney" Two is the very peer of two-valvers. On the lower broadcast band I can guarantee 18 stations on loud speaker, as conditions are suitable. Melbourne is good when obtainable. Yanks on loud speaker. It's great!

By the way, is there any explanation of the fading by Langenberg? It is well known that this fading does take place—but why? On one Sunday this was very bad—going from full loud speaker to nothing.

I am, sir,
Yours faithfully,
S.W.20. ERNEST C. FREEMAN.

SHORT-WAVE EXPERIENCES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am a short-wave "fan" who is lucky enough to have a deep well just outside a corner of the house. As it is about 60 ft. deep to the surface of the water I am able to suspend an aerial of nearly that length in it.

Using this aerial, I heard Java (Bandoeng, 15.93 metres) announce that their wave-length had been altered to 15.74 metres. This was Wednesday, November 7th, at about 1.30 p.m. (afternoon). The following Wednesday, having altered the aerial from one of a single strand tinned 18 gauge to a twin aerial of 7/22's, I received this station much louder and was able to hear all announcements, names of musical items, etc., on this wave-length of 15.74 metres.

A three-valve straight circuit is used and all tuning done on loud speaker. The music could be heard all over the house, but static was rather prominent in the background.

Fading was only slight, and I have written for confirmation.

Living where I am now, I can put up (and have tried) many types of aerial up to 400 ft. long and 50 ft. high, also many kinds of "earth," such as water main, gas pipe, electric main, various counterpoise and, of course, the well, which has 18 ft. of water at the bottom. In fact, I think that I have better facilities for testing aerials and earths than most radio experimenters. Incidentally, my "Popular Wireless" is waiting for me every Thursday morning!

K D K A, 2 X A D, 2 X A F, P C J J, and Sydney (28.5 m.) are regular visitors to my various aerials.

I might conclude by saying that from long experience (and expense) in broadcast reception, the best aerial of all is one about 60 ft. of wire (stranded) suspended as nearly vertical as possible. The one I use for all normal reception is suspended from the branch of a high tree that leans slightly over the house and is just far enough away to let the wire come in the window frame without touching any other object.

By the way, re the strength of P C J J, I advise the people who complain of his loss of power to look to their sets as I am a regular listener to him and he comes in here easily as loud as the local (Liverpool, four miles), but of course with a little fading that is not inconvenient.

With best wishes to "Popular Wireless."

Yours faithfully,
R. BELLIAN.

Liverpool.

SHORT-WAVE NOTES.

By W. L. S.

READERS will probably have gathered from my remarks in these notes during the past year that my opinion of the best short-wave receiver has always leaned strongly in the direction of the "straight detector and note-mag." They will not have been mistaken, for I have most emphatically told anyone asking my advice that he or she could not possibly better a conventional arrangement of this kind.

Screened-Grid Success.

Much as it goes against the grain, however, I must confess to having been completely converted. Luckily I have no one else to thank for the conversion; the bitterness is relieved by the fact that it is simply a set I have made myself that has turned the tables on me! To put it shortly, I am now a "screened-grid fan."

I have made three screened-grid short-wavers, and one screened-grid unit for putting in front of any ordinary and respectable set, and it is chiefly the performance of the latter that has made me sit up and take notice.

With the "partially-tuned" aerial circuit arrangement I have mentioned before (arranged this time with a four-turn coil and a "Formodenser" of low capacity) no extra tuning control is introduced into the set, yet the amplification is practically equal on distant stations to that given by one note-mag., and the interference from the locals is not amplified up to the appalling degree usually associated with a second note-mag.

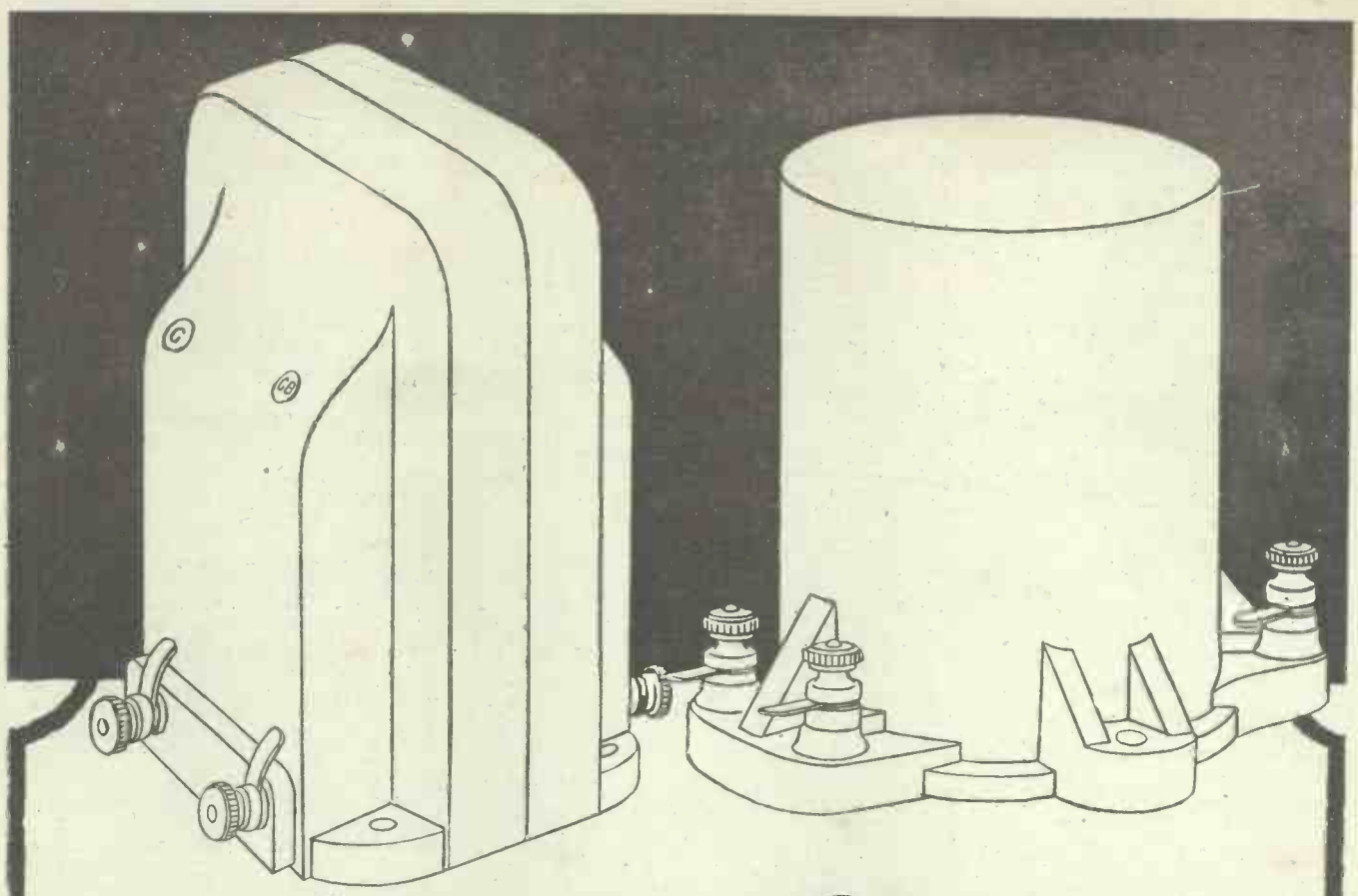
Well Worth While.

Even if no amplification whatever were obtained, the screened-grid stage would be well worth while, on account of the fact that the interpolation of a stage of this kind between the aerial and the detector removes all the "flat spots" from the latter and makes practically constant reaction possible. Another point is that I have as yet had no trouble with threshold howl on one of these screened-grid sets; whether this is a mere coincidence or not I cannot yet say, but it looks hopeful for the future!

The 10-Metres Band.

Doubtless you have noticed the way 2 X A D and 8 X K (and in fact all the broadcasters below about 30 metres) are fading out early in the evening now. They come in "great guns" about 6.30 p.m., and then disappear rather abruptly. By 10 o'clock on the average night they are not worth listening to, although on some freak evenings the fade-out does not seem so severe, and they are still at quite good strength almost till midnight.

No one can yet say what the "working hours" of the new 10-metre band will be; I have heard the Americans coming over on a Sunday afternoon and fading out by 3.30, whereas on the following Sunday they keep in at good strength until after 6 o'clock. Very few of them seem to have spare time enough for "brass-pounding" on week-days, so that Sunday afternoons are now the time for the "10-metre party."



not a sound upon the background

A dead silent background is the first thing you notice about the reproduction a Lissen Transformer gives you. You get volume and you get purity, because the notes of music stand out with startling definition.

It is well worth while to replace any specified transformer in any circuit you are building with a Lissen Transformer; and if you want to bring your old set up to date, the first step is to get a new Lissen Transformer for it. Because by doing this you get rid of the rustling background which less carefully-designed transformers always will produce, the notes of music, words of song or speech are amplified in a background upon which no other sound is heard.

THE LISSEN SUPER TRANSFORMER

—with which you get almost perfect amplification.. **19/-**

The laboratory curves taken of the Lissen Super Transformer prove that there is *exceptionally* even amplification over the whole band of audible frequencies, and it *should be noted that these curves have been taken with ordinary standard valves.*

Two ratios. 3½ to 1 and 2½ to 1. **19/-** each.

THE FAMOUS 8/6 LISSEN TRANSFORMER

For all ordinary purposes this Lissen Transformer at 8/6 has proved itself the equivalent of many at double the price, and its popularity has been reflected in huge sales. In the two years since it was introduced it has earned the title of "The transformer that never breaks down."

Ratio 3 to 1.
Obtainable of all Radio Dealers **8/6**

LISSEN

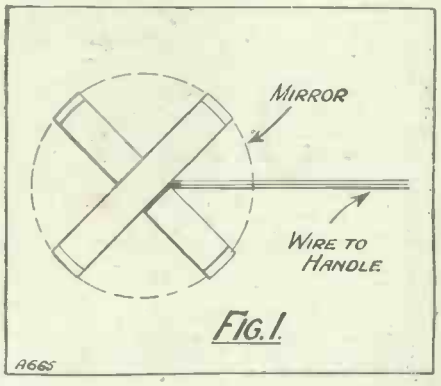
TRANSFORMERS

LISSEN LIMITED, 8—16, Friars Lane, Richmond, Surrey (Managing Director: THOS. N. COLE).

A selection of short articles covering many subjects of especial interest to the home-constructor of radio receivers, contributed by various of "P.W.'s" well-known technicians.

IT is sometimes hard to locate a screw for condensers and other instruments to be mounted on a panel without the aid of a drilling template. Here is a simple way to locate the position of these holes.

Locate and drill the hole for the centre shaft of the condenser; then place the instrument on the panel with the shaft protruding through the hole and rest it in exactly the position you wish it to occupy. Sprinkle a little white powder or flour around the screw bushings, and then carefully pick up the condenser without disturbing the panel. The powder will form little circles, the centres of which may be marked with a sharp centre-punch.



Sulphating.

Sulphating may be caused by:

(1) Charging or discharging accumulators at excessive rates.

(2) Discharging beyond the point at which the voltage begins to fall rapidly, i.e. at about 1·8 volts per individual cell.

(3) Short-circuiting.

(4) Allowing cells to remain uncharged for any length of time after having been in use.

(5) Allowing the acid solution to become either too weak or too strong.

An Exploring Glass.

At some time or another I expect you have all paid a visit to the dentist and, seated "comfortably" in the chair with your mouth wide open, observed him examining the teeth with the aid of a small mirror attached to a steel handle. The reflections in the mirror held at the most convenient angles enable him to ascertain exactly what is wrong with the teeth, and without such an instrument his task would be rather awkward, as you can well imagine.

Perhaps it has never occurred to many readers how an adaptation of the same idea can prove of great service when it is necessary to examine wireless components mounted in awkward positions inside receiving sets. You have found the plates of a variable condenser touching but a view from the top fails to reveal the buckled plates.

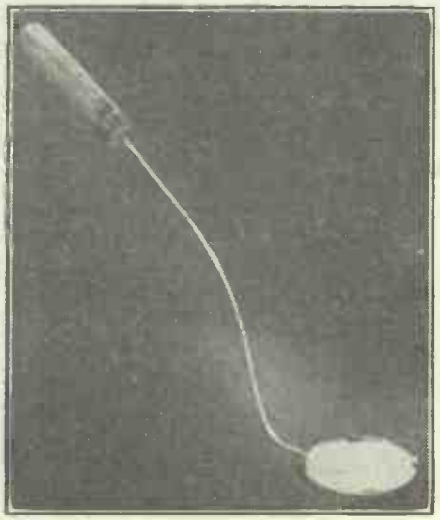
Short of taking the condenser out of the set, or disconnecting the leads, loosening the holding nut and twisting the condenser round, how can you examine the under-side and locate the trouble? You feel sure that a switch mounted on the panel but close to the baseboard is causing those crackling noises in your set, but how are you to examine the underneath portion and make sure that therein lies the fault?

Easily Made.

The remedy is to use a small looking-glass which can "get round corners," so to speak. The accompanying photograph shows how easily one can be made up and, if desired, two or three mirrors of varying sizes can be used. Procure a small piece of looking-glass of any shape, and two thin strips of brass.

Make a crosspiece of the brass strips by soldering them together at the centre and then solder this to, say, a six-inch length of 16 or 18 gauge copper wire. See Fig. 1. Point the free end of the wire and fit it into a small wooden handle and then grip the mirror in the crosspieces by bending over carefully the ends of the strips.

Constructional work is now complete, and the copper wire can be bent in such a manner that it enables you to view out-of-the-way parts of components when holding this device in your hand. You will be surprised how useful this little gadget proves on divers occasions.

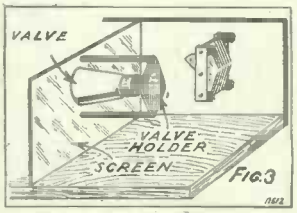


Here is the simply made "exploring glass."

New Screens for S.G. Valves.

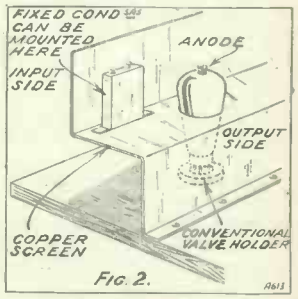
The introduction of the new type of screened-grid valve has been followed by the production of a valve holder which enables it to be used with the conventional inter-stage screens we have been using hitherto. Unfortunately, this method of construction, illustrated in Fig. 3, takes up rather a lot of room on one side of the screen, thus wasting space on the baseboard which might otherwise be occupied in a more useful manner.

It is true we can mount the valve vertically on one side of the screen, but this leads to instability if highly efficient coils and condensers are used; and it certainly becomes necessary to have the output circuit mounted well away from the input circuit.



An Improved Method.

A simple method of overcoming this difficulty which enables us to employ inter-stage screening is shown in the sketch in Fig. 2. It will be seen that the copper screen is bent into the shape of a step, a hole being cut through the horizontal part through which the valve may be inserted into a conventional baseboard mounting valve holder. Input and output circuits are completely isolated provided that the step is at the right height from the baseboard, while the use of a sprung valve holder insulates the valve from vibration and shock. This method of construction enables compactness to be achieved in such cases as it is necessary, and is from practically all points of view an improvement on the more vertical type of screen.



The top part of the step need not prove to be waste space either, since fixed condensers or H.F. chokes can be accommodated on either side of the valve, thus clearing the baseboard for other apparatus.

OPERATING THE "FANFARE" FIVE.

Important points regarding the handling of the five-valver described last week.

By THE "P.W." RESEARCH DEPARTMENT.

OPERATING the "Fanfare" Five is a little more difficult than a set with only one H.F. stage, because there are three dials to be kept in step and most people have only two hands to do it with, but it is not nearly so awkward as you might think before actually trying it. You cannot move them all continuously, keeping them in step, as you do on a set with only two dials, but there is quite a simple and workable alternative.

This is how you should search with a set like this: Get the dials roughly in step by putting them all to the same reading near the middle of the scale, then move each up a degree, listen, move them a degree farther, and so on, until you come across a station. (You will ultimately reach 5 G B if the circuits are so far out of step that you don't find a foreigner on the way.)

Once you have got a station you can tune each dial separately and so get the circuits accurately in step, and when that is done you can continue searching by moving each one degree and pausing to listen. Each time you find a station, of course, the mere act of tuning it in accurately checks up the "in step" adjustment for the next bit of searching.

It may sound a tedious process, but you are not likely to be bored when you come to try it, for the simple reason that the stations roll in so profusely as to keep your interest pretty closely.

Simple Rules for Neutralising.

Neutralising is little more difficult than with a single H.F. stage, but not very much so, since both can be "neuted" at the same time. Here is the procedure: When the set is finished and first put on test (or when valves are changed at any later time) you should set all the neut. condensers to minimum, and likewise the reaction condenser.

Then set the tuning dials to a mid-scale reading, and move the right- and left-hand ones a trifle either way, noting whether the set is oscillating. It probably will be, but if not increase the setting of the reaction condenser very carefully until it just does when the three dials are in step.

Now increase each neut. condenser by an equal very small amount, and see whether oscillation stops. It almost certainly won't, so increase the neuts. a little more and try again, swinging the tuning dials while you test for oscillation so as to make sure the circuits are in tune with each other.

If oscillation stops here, note carefully the setting of the neuts., then go on increasing them and re-tuning until you find oscillation beginning again. When this happens turn the neuts. back half-way towards the setting you had previously noted and the job is done.

This method gives quite a good result, but it is as well to check up on a distant station when you have found one. Tune it in carefully and bring up the reaction as far as you can without making the set oscillate. Now see whether a slight re-adjustment of the neuts. will make it more stable, that is, will enable more reaction to be applied before oscillation starts.

If so, make the new setting permanent, for it will enable you to make better use of the reaction on very weak stations. Of course, when you alter the neut. condenser settings you must remember to re-tune a little, to keep the station fully tuned in.

Next we come to the question of the local station, and what to do about it with so powerful a set as this. It is *not* satisfactory to tune it in fully and then cut down on the volume control until the strength comes down to manageable proportions, because overloading of the earlier valves will take place and probably spoil quality.

Controlling Volume.

The best expedient seems to be this: Detune the first dial *above* the loudest reading, the next one *below* it and the third above again. In this way the volume is cut down, quality improved and there is no risk of running into some other station. Final adjustments, of course, can be made on the volume control proper, to suit different items, and so on.

There is just one more adjustment to consider, and that is the control of selectivity. This is effected at two points in the aerial circuit, namely, on the terminal strip and on the aerial coil socket. The first consists in placing the aerial lead on either of the two terminals provided, which has the effect of bringing into circuit or cutting out a fixed series condenser. When the condenser is in, of course, selectivity is greater.

As regards the aerial coil adjustment, you will see that one of the connections is a flexible one, and this is to be placed under either terminal No. 3 or No. 4. The greatest selectivity is given by No. 3, but No. 4 usually produces slightly stronger signals, especially if the aerial is rather a small one or the station being received comes in near the upper end of the tuning range.

Finally, as to valves and voltages. Both 2- and 6-volt valves can be used, provided that the 2-volters are of the improved types now available, and there is not very much to choose between them.

The "sixes," of course, are undoubtedly a little better, but where economy is a very vital factor the "twos" can be used without fear of spoiling the set's performance, subject to the warning that they must be good modern ones.

For the H.F. and detector sockets you want valves of the H.F. type, with impedances of from 20,000 to about 30,000 ohms. It pays to use two of the same make and type in the H.F. stages so that they shall neutralise similarly, but the detector can be of a different make if desired.

Some Suitable Valves.

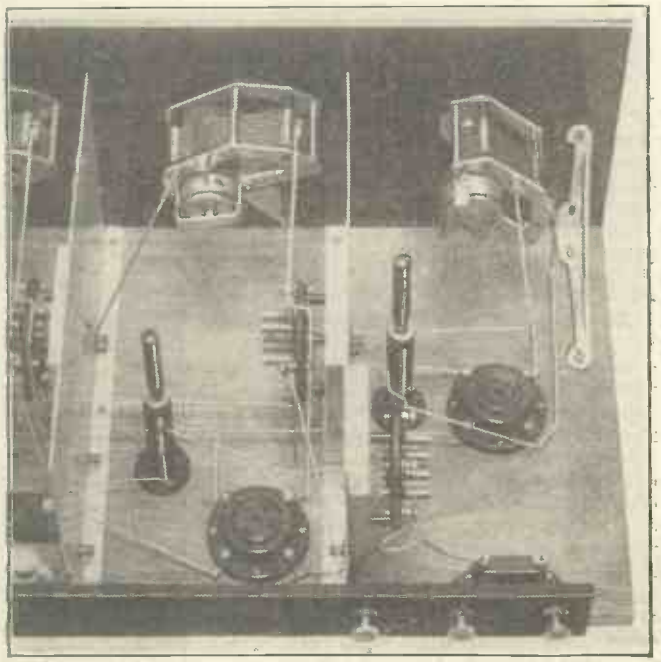
Examples in the 2-volt range are these: Ediswan H.F.210, Cossor 210 H.F., Marconi and Osram H.L.210, Mullard P.M.1 H.F., etc. For the first L.F. stage a valve of the same type can be used, but slightly better quality can be got by choosing one of the L.F. or general-purpose variety, such as the Mullard P.M.1 L.F., Marconi and Osram D.E.L.210, Cossor 210 L.F., Ediswan L.F.210, Mazda G.P.210, etc. (all 2-volt).

For the last stage a really good-sized power, or preferably super-power, valve is most desirable, for you must remember that the set gives extremely powerful signals, and will overload a small valve hopelessly.

If you are compelled to use such a valve in order to keep down your H.T. consumption, the only thing to do is to cut down the volume carefully until the valve is just fully loaded and no more, or you will never get proper quality. Suitable super-power valves are available in both 2- and 6-volt ratings, and in all the well-known makes.

The H.T. voltages are just the normal ones for each part of the set, namely, 100 volts on the H.F. valves (H.T. + 1), about 60 to 70 volts for the detector (H.T. + 2), and the maximum available on the L.F. stage (H.T. + 3).

Naturally, where the set is capable of producing really loud signals it becomes more than ever important to provide plenty of H.T. on the last stage.



The H.F. end of the "Fanfare" Five, showing the neutralising condensers, the setting of which is described in this article.

HOW TO MAKE LOUD SPEAKERS

No. 2. THE "P.W." CABINET CONE

Here is another inexpensive, easy-to-make but extremely efficient cone speaker, which any handyman can build. It is specially designed to appeal to the constructor who wants a good appearance right from the start. Built in a handsome cabinet, it dispenses with all the work of making a special framework. Results? Well, you try it!

THIS, the second of our series of home-made loud speakers, is intended to meet the needs of the man who desires to build an instrument of pleasing appearance right away, instead of proceeding in stages.

In other articles in the series, of course, we are describing how to make up various types of speakers which take the form of a complete self-supporting assembly which can be built and tested and then later fitted to a baffle, in a cabinet, or otherwise beautified as desired.

In the case of the one described this week, however, we are assuming that the constructor has decided before he begins that he is going to put the speaker in a cabinet right away, so that there is little point in building up a separate assembly. Accordingly, we have worked out a very simple scheme for building the speaker direct into the cabinet, using the latter instead of a special frame, and so cutting down the constructional work to a minimum.

Choice of a Cabinet.

Actually, this is probably the easiest of the whole series to build, and is not, furthermore, at all costly, for the total outlay is only a few shillings over two pounds, varying a little above or below this figure according to the particular cabinet chosen.

The particular cabinet we used for the original speaker is one of the standard lines of Messrs. W. T. Lock, but, of course, similar types can be obtained from most of the well-known cabinet makers (suitable ones are certainly obtainable from Messrs. Carrington, Goodman, and others). Prices vary according to the finish, but mostly fall round about the twenty-shilling mark. There is only one point to look out for in buying a cabinet for this speaker (or in making one, if you are fond of woodwork), and that is to see that the diameter of the hole in the front is about nine inches.

How It Is Done.

First of all, it may help to give you a clear idea of the construction of the speaker if we give a general description of the way it is assembled. Well, the cabinet itself forms the basis of the whole job, and replaces the usual frame, so that the actual woodwork involved is very slight indeed.

The paper cone is mounted upon a "suspension" of soft leather or a special material known as Suedlin, and this in turn is stuck to a cardboard ring round its rim, leaving a space of free leather all round to permit the cone to move back and forth fairly freely. The cardboard ring is then fixed to the inside of the cabinet, either with drawing pins or adhesive, and so the cone is held securely in place.

Easily Mounted.

The unit is fixed to a single strip of wood, which in turn is attached cross-wise inside the cabinet in a fashion which is very clearly shown in the photo on the second page of this article. By taking just a little care over this part of the work it is not difficult to get the point of attachment for the cone on the unit exactly opposite to the point of the cone. All that you have to do then is to fit the necessary washers and clamping device (provided by the maker of the unit) to the cone, and the speaker is finished!

The actual work is very little more difficult than you would imagine from this general description, especially if you adopt certain labour-saving dodges which we will explain as we go. First of all, about the paper cone. This is of exactly the same size and construction as the one used for the speaker described last week, and you can cut it from the grade of "Kraft" paper which runs about 120 lb. to the quire. (This is the kind commonly used for the cones of moving-coil speakers), using last week's diagram.

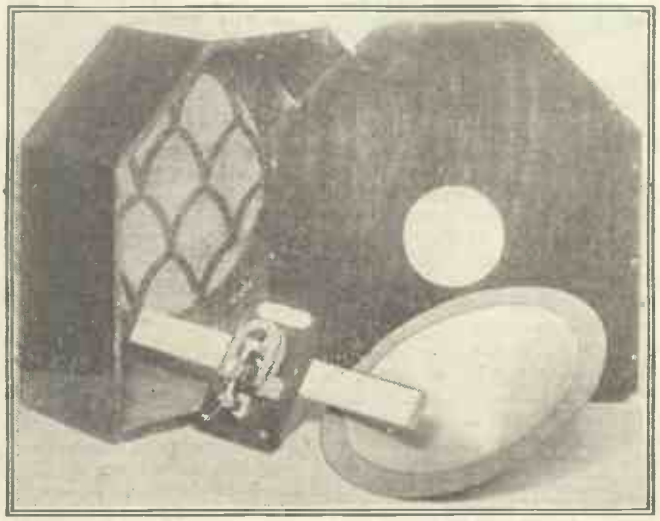
Alternatively, you can get the diaphragm cut out and ready for sticking together from certain of the firms advertising in "P.W.," together with the necessary cardboard ring and suspension material. The latter, in this case, will be found to consist of a number of segments of Suedlin all ready for sticking together round the edge of the cone.

Simplifying The Work.

In making the original speaker we used one of these sets of parts, so that the work of construction was cut down very considerably, and the extra cost is only a few shillings. If you use one of these sets of parts this is how you should proceed. First, stick together the overlapping edges of the cone, noting the "dove-tailing" scheme, and let it set for a while. Then take the Suedlin segments and stick them on all round the edge of the cone on the *outside* surface of the latter.

Note in doing this that you should put the segments on with the correct overlap where they join so that they will form a complete ring round the edge of the cone

(*Continued on next page.*)



Here are all the "bits" fitted and ready for assembly in the cabinet. Note how the unit is carried on a wooden strip.

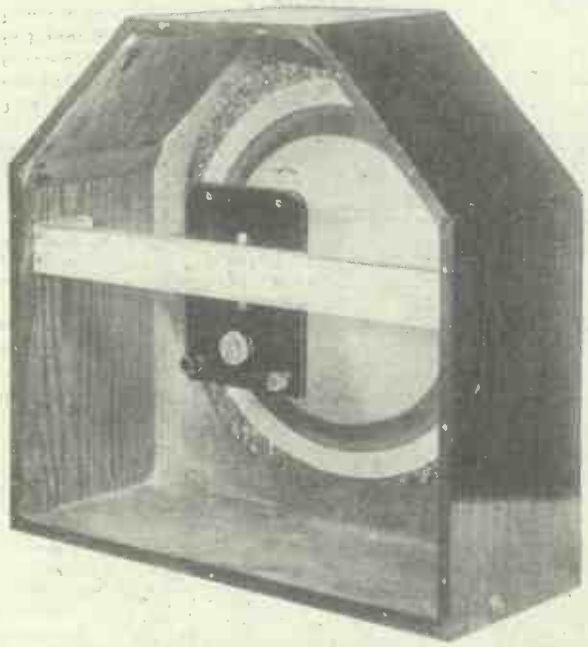
HOW TO MAKE LOUD SPEAKERS.

(Continued from previous page.)

when they are all in place. You will soon see how much overlap to allow once you have got two or three segments in place, if you just lay the others round without sticking them on. You can then make any slight variation necessary in the overlap of the last one or two to be fitted. By the way, the Suedlin should be stuck on with the rough, leather-like side next to the paper.

Completing the Cone.

Now for the cardboard ring. This has an inner and outer diameter of 9¾ in. and 11¼ in. respectively (figures given in case you want to cut it yourself), and it need not be very thick. To attach the ring to the suspension material, proceed as follows: place the cone on the table with the point upwards, and spread the Suedlin fringe out smoothly on the table all round. Now smear one side of the cardboard ring evenly all over with seccotine and drop it down



This view shows all the constructional details so clearly that you can check up each point as you read the description of the work.

over the cone on to the Suedlin fringe, taking care to get it placed so that there is an equal space of suspension material all round, and press it down firmly and carefully with the fingers.

Now put this assembly aside to set, going back to it in a few minutes and pressing all joints together to make sure they are well stuck. After the cone and suspension assembly has had an hour or so to dry, you can mount it in place in the cabinet, by driving nine or ten drawing-pins through the cardboard ring into the wooden front, or by using seccotine (drawing pins advised).

While the cone part is setting you can get the rest of the work finished, and still have some time to spare, for it is a very simple matter indeed. First, you require a strip of wood cut rather carefully to a length which just allows it to slip rather tightly into the cabinet cross-wise (see photo on this page). If you expect to have any difficulty in cutting it accurately to length, by the way, try cutting it a shade too long, and then reduce it to a nice fit with a wood rasp or a coarse file.

Fixing the Unit.

Now take the loud-speaker unit, and secure it to the centre of the strip, taking care to get the position fairly exactly. The mounting of the unit will naturally vary according to the type chosen. Last week's method will serve again if you intend to use a "Lissenola" unit, and the photos show quite clearly how we mounted the Whiteley, Boneham unit employed in the speaker illustrated in this week's design.

This unit is supplied ready mounted on a small oblong piece of wood, and it is therefore extremely easy to attach it to our wooden strip: all you need is a couple of wood screws. Schemes can fairly easily be devised for other types of units, of course, still keeping to the same general construction. Here are a few other types of various prices which can be depended on for good results: Goodman, Triotron, Blue Spot (the estimate of a few shillings over two pounds for this speaker was based on the use of a unit costing not more than 18s. 6d., which is the price of the Whiteley, Boneham one).

Next, we have to arrange for fixing the wooden supporting strip (which, by the way, can be about 2 in. wide and ½ in. thick) in the cabinet, and for this we require two little blocks of wood which can be screwed inside the cabinet. These form two ledges to which the main strip can be screwed, as you see in the photo of the inside of the finished speaker.

Before you fix these blocks in place, however, you must get the cone mounted up inside the cabinet, so that you can determine the position for the strip carrying the unit before you screw it in. Fix the cardboard ring to the cabinet, therefore, remove the clamping washer and screw from the reed of the cone unit and proceed to move the wooden strip about inside the cabinet until the attachment point on the unit comes exactly over and just touching the point of the cone. Mark the point where the ends of the wooden strip touch the sides of the cabinet, then attach your two little wooden blocks to the cabinet, so that the strip will come just to the pencilled positions when screwed down finally.

The Verdict.

There, that completes the fitting work, and all that remains is to screw everything in place, cut a little hole in the point of the cone and fix it to the reed, connect up the outfit to your set, adjust the speaker unit, and sit down to decide whether the results justify your trouble. We don't think there will be much doubt about your verdict!

Quite a professional appearance! The cabinet used was quite a handsome one, but the total cost is still only a few shillings over the two-pound mark.

FOR YOUR NOTEBOOK.

A dirty lead-in is a graveyard for distant signals.

* * *

An old curtain rod, hammered to a point at one end and drilled at the other end to take terminals, will make an extremely good earth.

* * *

Before commencing to build a new set, it is an excellent plan to run over your screw-drivers and make sure the edges are not blunt, as a little treatment with a file may prevent a slip and a consequent bad scratch.

* * *

Valves of the high magnification type generally make extremely good detectors in short-wave sets.

* * *

Anti-sulphuric paste, which is obtainable quite cheaply, is an excellent preservative of a wooden accumulator-carrying case and is very useful for floors and cabinets, etc., where the accumulator is standing.

* * *

If your accumulator carrying case has a leather handle, be absolutely certain not to get any acid upon this or the result will be to eat it away, possibly with disastrous results to the carpet.

* * *

Although, theoretically, the anode bend method of detection is capable of giving better quality than the grid leak method of detection, the latter is very much more sensitive.

* * *

If threaded brass rod has to be gripped in a vice remember that it would be placed between two pieces of soft wood or otherwise the thread may be damaged.

* * *

Be sure to give your valves the correct grid bias, as failure to do this results in imperfect reception, and an unnecessary strain upon the H.T. battery.

* * *

L.F. Transformers, L.F. Chokes, and similar highly inductive windings should not be placed close together, and their cores should be arranged at right angles to one another.

FROM THE TECHNICAL EDITOR'S NOTE BOOK

GAMBRELL VOLUVERNIER.

WITH the rapidly increasing popularity of the gramophone pick-up, the demand for high-resistance potentiometers must have risen considerably. Hitherto, there have been very few of a reliable design available, but now we have, among others, the Voluvernier, due to Messrs. Gambrell Bros., Ltd.

It provides a variation of resistance from zero to 1 megohm, and it does this positively and with a smooth action, and I certainly agree with Messrs. Gambrell when they say that zero in the majority of such controls is usually so high as to cut off signals at fair volume, for I have had actual experience of many that do this.

With the Voluvernier you have certainly a good control of volume. It is a high-class production, and appears to be

An earlier "Voluvernier." The model now marketed is completely enclosed in a neat metal casing and is an improvement on the above.

worth every penny of its 6s. 9d., but I have one small suggestion to make, and that is that Messrs Gambrell should supply models fitted with substantial terminals. At present it has only nuts and soldering tags, so that its use will be debarred to many constructors—an ever-increasing number these days—who assemble their sets without soldering.

GRAHAM-FARISH PRODUCTIONS.

Graham-Farish Ltd., of Bromley, Kent, recently sent me several of their new productions. Their new coupler is practically a complete three-valve set or amplifier, according to how it is used. Of remarkably compact form, it incorporates three complete sets of valve sockets, two sets of anode resistance clips and two of grid-leak clips, and the necessary condensers. It eliminates practically all wiring and, apart from the battery connections, there remain only the input or coil connections to be made.

This new Graham-Farish coupler has separate grid-bias terminals for the second and third valves. I believe in the early model there was one common grid-bias terminal, a weak point in the design. No such criticism can be made against the new model.

The new Graham-Farish resistance-capacity-coupling unit is fitted with an Ohmite anode resistance. This is a new-process product capable of standing up to considerable currents. The R.C.C. unit is a neat affair, well made and brightly finished. The grid leak and anode resistance are provided with terminals and these fit into clips and can be screwed securely into position.

THE RUNBAKEN TRICKLE CHARGER.

In our July 21st issue I had occasion to criticise, somewhat adversely, an Automatic Trickle Charger due to the Runbaken Magneto Co. It will no doubt be remembered that two of these articles were very carefully tested, and that "in both, the relay was found to be unsatisfactory."

The Runbaken Magneto Co. advance the explanation that both samples were damaged in the post and have forwarded a further charger for our examination.

It so happened that I, personally, unpacked the original samples and, as far as my recollection goes, there was every evidence that the packages had travelled well. Further, it should be noted that one charger functioned satisfactorily for fourteen hours.

However, it is only fair to say that the third sample has operated without any trouble at all, for a very considerable number of hours.

The Runbaken Magneto Co. should endeavour to send all their chargers out so that they arrive in a similar happy condition, for it is undoubtedly a device having many attractive features.

ZAMPA MOVING-COIL SPEAKER.

We understand that the type of moving-coil loud speaker sent us for test by Zampa Components two or three months ago has given way to an improved model. This last, however, we have not yet seen. The model tested by us is one taking a ·5 amp. field winding current at 6 volts. The moving coil is of the high resistance variety (1,500 ohms), so that the unit does not require a transformer.

To test the unit we mounted it in a moving-coil speaker cabinet. The moment the outfit was switched on to a standard set it was apparent that it held very interesting possibilities. Unfortunately, however, we found that the unit was rather insensitive, but the reproduction was decidedly there. All the "piston" effects following the percussion in orchestras and the realistic timbre of the wind instruments, were clearly to the fore. The low notes were realistic and free from boominess.

Undoubtedly the Zampa moving-coil loud speaker has the elements of an outstanding production. If the models now to be marketed have equally good responses and are satisfactory in regard to sensitivity then I, for one, will reckon the "Zampa" to line up with the best.

MARCONIPHONE UNIVERSAL L.F. TRANSFORMER.

The new Marconiphone Universal Transformer is enclosed in a handsome metal case green in colour, It is rather more compact than is usual with such a component, the actual dimensions being 3 in. × 2¼ in. × 1¾ in. Nevertheless, it can do moderately heavy work, as it has a core of special material and of large cross section. The price is 16s., and it is decidedly well worth that.

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality, under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

We gave it a series of careful comparative tests and found it well up to standard. We do not know of any other transformer round about the same price which could seriously rival it. It is available in two ratios, viz., 2·7 to 1, which is recommended for following low-impedance detector valves or after medium-impedance types such as the H.L.610, D.E.L.410, H.L.210, when in an amplifying stage; and 4 to 1, which is recommended after medium or loud-speaker valves, such as the D.E.L.610, 410, and 210 in amplifying stages.

The Marconiphone L.F. Transformer described in the accompanying paragraphs. The component is green in colour.

Its mounting in any convenient position is facilitated by the fitting of reversible feet. Another special feature is that "the windings are thoroughly insulated and impregnated with an impervious compound rendering them immune from moisture and climatic conditions."

RADIOTORIAL

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject 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.

FITTING A VOLUME CONTROL.

A. W. G. (Rugby).—"It is a Det.-2 L.F. set with a resistance in the first stage and a transformer in the second. Where can I fit a ½-megohm potentiometer so as to act as a volume control?"

This is very easily fitted in the following manner. Fit the volume control in some handy place upon the panel, where you can keep the wiring short. The necessary wiring is as follows, and you can easily consider how it will appear and thus mount the volume control in such a position that these wires are as short as possible.

At present one of your secondary L.F. transformer terminals goes to the grid of the last valve, and the other secondary terminal from this transformer is taken by means of a flexible lead to a plug on the grid-bias battery. This lead which goes to the plug on the grid-bias battery is not altered, except that one end of the potentiometer is joined to it where it joins the secondary.

The other secondary terminal is then disconnected. Now join the remaining end of the potentiometer to this secondary terminal which has been disconnected. Finally, take a lead from the grid of the valve to the slider on the potentiometer, this completing the wiring.

You will find that the volume is completely and smoothly controlled according to the position of the control knob on the instrument.

WHAT TOOLS ARE REQUIRED?

E. D. G. (Huntingdon).—"As I have never tried my hand at it, I should like to know what tools are required for building a simple set and any details which you can give me about the right kind to choose."

Very few tools are required, and the chief of these will be found in the ordinary household tool-box. The following summary brings out some important points which should be borne in mind if purchasing them.

A. Soldering iron (get one with a good, heavy end, not one of the light ones which will not keep hot long enough to use).

B. A tin of fluxite or similar soldering paste.

C. A pair of cutting pliers. (Those known as side cutting are very convenient, but the flat-nosed variety are invaluable for tightening up nuts, etc.)

D. A pair of round-nosed pliers, for bending the wire when it is required to put round terminal shanks, etc.

E. A flat file.

F. A hand drill for drilling panels, etc., and a set of drills for same.

G. A couple of screw drivers, one fairly large, one small.

There are many other tools which will come in handy later, such as a vice, etc., but much depends upon the set you decide upon building. With the above you will be able to make a very good start upon ordinary constructional work.

A NEUTRALISING HINT.

W. P. J. (Coventry).—"I cannot quite neutralise the set properly, because although I screw the condenser right out, it does not seem to come out far enough, and the set would be better if I could reduce the capacity a little further. I am told that I could overcome the difficulty by buying another neutralising condenser, but this seems rather an expensive way of getting over it. Is there any other method?"

You can easily and cheaply overcome the difficulty by adding a little capacity to the grid and filament of the valve which is being neutralised. A good method of doing this is to take two pieces of Glazite or similar well-covered insulated wire, carefully bare a little of it and make a loop which will fit over the valve-holder terminal. Then fit one piece of the insulated wire on the grid and the other on the plate terminal of the valve. If now this insulated wire is twisted together (like flexible wires) a certain small capacity will be introduced between the grid and plate of the valve, and this can

(*Continued on page* 664.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 662.)

then be balanced out on your neutralising condenser at a convenient point of its travel, and not right at its minimum as at present.

SHORT-WAVE ABBREVIATIONS.

Referring to a question about Morse abbreviations which was raised in these columns some months ago, and to the answers, a "P.W." reader who is apparently a wireless officer in the Mercantile Marine sends us an interesting letter from Sierra Leone. He says :

"It should prove very interesting to all 'hams' if a collection of all abbreviations could be compiled. So far this has never happened and probably it could never be up to date (unless through the columns of 'P.W.') because new abbreviations crop up, and sometimes old ones which have been further abbreviated die out.

"My fellow correspondent, 'Q.R.SOS,' who says he is very keen on amateur transmission, should buy the P.M.G. Handbook for Wireless Telegraphists (which costs only 9d. net and 3d. postage) from H.M. Stationery Office, Adastral House, London. W.C.2. He will find the above book explains everything he requires, including the methods of working, abbreviations, and regulations under the Radiotelegraphic Convention of 1912, etc.

"Besides the official ones. there are numbers of other abbreviations and some of these I give here : A.A. = All after ; A.B. = All before ; W.A. = Word after ; W.B. = Word before ; E.E. = End of work ; N. = No ; Y. = Yes ; E.T. = and ; S.A. = say ; O.M. = old man ; O.C. = Old chap ; U. = you ; U.R. = you are, or your ; R. = received ; H.R. (or H.W.) = listen here ; M.O. = wait ; N.A. = no answer ; N.R. = no reply ; N.D. = nothing doing.

"In addition to all these, of course, there are the abbreviated words such as WD for word ; ADD for address ; ABT for about ; PSE for please ; TKS for thanks ; SRI for sorry ; FR for for ; IM for him ; E for he ; SES for says ; and WX weather.

(About eighteen months ago the signal for 'end of work' that was all the rage was E.S.E. E.E. Yet this is out of fashion now. I heard a nigger use it the other day from Nigeria and it was the first time I had heard it this year !)"

A 'PHONE CORD PROBLEM.

W. S. (Peckham).—"In connection with the peculiar troubles of short-wave sets, could you suggest anything for the peculiar fault taking the form of a severe wave-length change when the 'phone cords are handled ? In the ordinary way the set is not troubled with hand capacity on the tuning dials, but the handling of the 'phone leads tunes a wave-length right out. How can I cure this ?"

Such a fault is very difficult to diagnose in a short-wave set unless one has the set in front of him in order to see the exact spacing of it. In many cases large bypass condensers across the telephones will effect a cure, but in really bad instances nothing short of a general rebuild of the set will eradicate the fault. One thing that is worth trying, however, is to insert a small choke in each of the 'phone leads. All that is necessary for this is about 60 turns of No. 30 wire wound on a test tube, which makes a very good short-wave choke for this or similar purposes.

A VERY SIMPLE REMOTE CONTROL.

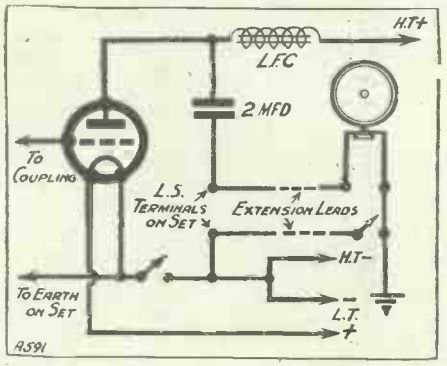
We have great pleasure in publishing the following hint from a reader who gave the details in a letter to the Editor. (As the reason why the mere connecting up of the loud speaker should act as a remote control may not be apparent to other readers, the letter is reproduced below instead of in the "Correspondence" columns.) "Dear Sir," he says. "I am much encouraged and assisted by reading of the difficulties surmounted by your correspondents and I find the articles given in your bright and up-to-date paper most absorbing. Now, having discovered something myself, I send it on to you, 'A new method of remote control.' Two wires run from set to speaker and I find extra battery power in my case, 30 ft. from set (in kitchen) to bedroom table, unnecessary. My distant on-off switch consists of two telephone terminals in line so that as I push the L.S. lead through, the set is automatically on. Earth is on water pipe in kitchen and gas bracket in bedroom, and volume reduction is not noticeable. Try it.

"W. G. E. P. APPERLEY.

"P.S.—My valves are 4-v. Mullard."

Accompanying sketch shows that the arrangement is of a more or less standard type, but the wiring of H.T. and L.T. negatives and the switch, filament leads, etc., results in the following state of affairs.

L.T. positive is connected to one filament of a valve holder. The other filament socket of this is connected to one side of the on-off switch and to the earth terminal *of the set*. Earth is connected also to one of the extension terminals and to the loud speaker, so that by means of the common earth connection L.T. positive is in fact connected to the one loud-speaker terminal through the filament.



The L.T. negative, on the other hand, is connected by means of its extension lead to the other terminal, and consequently when the terminals are shorted by pushing the lead through, the L.T. current can flow from L.T. negative, along the extension lead, across the terminals, to earth, through this, and via the earth terminal on the set to one filament holder of the valve. The other filament terminal is joined direct to L.T. positive, so that joining the break in the extension lead (the lower one in the sketch) will have the effect of completing the filament circuit, lighting the valve, and thus effecting remote control.

WHICH WAY DOES THE CURRENT FLOW ?

A. H. (Holloway, London, E.7).—"I have followed each week the articles for the newcomer to radio and I have made up the set described. When tested it works fine and the finished three-valve set is a grand receiver. Whilst this series was running I think it was the most interesting part of your paper.

(*Continued on page* 666.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 664.*)

"Not knowing very much about wireless, I learned a lot by following closely the use of each part used and how it functioned. There was one thing, however, I did not know when making up the three-valve set, and that is—how does the current flow? From the negative to the positive terminal, or vice versa?"

This is an easy question to ask but a very difficult one to answer. For one thing, the working of a three-valve set, even a simple one like that described, is an extremely complicated and involved affair in which not one but a great many currents are flowing. Moreover, these currents are of different types, in fact they are so different that some of them will flow with ease through insulators which offer a complete barrier to the other kind.

The story of the working of a three-valve set, even simply expressed, would take a long article to explain, but even if one considers one of the simplest types of currents flowing in the set we shall find that it is not so easy to explain as one might expect. For instance, the low-tension current in a three-valve set

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and 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.

is that current which flows from the low-tension battery along the wires to the three filament sockets, through the filaments of the valves, out at the opposite sockets, and finally back to the low tension battery's other terminal, either direct or through a resistance and a switch.

Any text book on electricity which is more than a few years old will explain that the electric current leaves the positive pole of the battery and will flow through the outside circuit (in this case the valve, etc.) back to the negative pole of the battery.

This explanation was generally believed, and appeared to be quite satisfactory until comparatively recently, when it was shown that an electric current is really an electron flow. The true nature of an electric current was not known at all previously, but now it is believed to be really nothing more or less than a drift of electrons. Scientific investigation shows that these "electrons" are what was previously called negative electricity, and thus it comes about that the true direction of an electric current is not, as was always supposed, from the positive of the battery round to the negative, but is actually a flow of NEGATIVE electricity, starting from the negative end of the battery and flowing to the positive end!

The Guess that was Wrong.

As the current is an invisible one and as its electrical effect is not in question, it does not matter which way round the electrons actually travel. The truth is that the EFFECTS OF electricity were known before the NATURE of it was understood in any degree, and the investigators who did the original work were perfectly certain in their own minds that a current was flowing, although they had no idea that this was composed of electrons.

In order to explain what was happening in a circuit they had to suppose that the current was a mysterious drift of something, and they had to guess the direction of its flow—whether from negative to positive or vice versa. Unfortunately, they guessed wrong and it is because of this that the confusion now existing arose.

B.B.C. CHRISTMAS PLANS.

THE programme staff at Savoy Hill is always several weeks ahead of the calendar. Just now it is in the throes of Christmas, or rather "up to its eyes" in planning what form the programme shall take during the festive season.

In accordance with established custom special programmes will be given not only during the actual Christmas week, but also during the week preceding, because the B.B.C. has to its credit a strong desire not only to celebrate Christmas as this should be done, but also to create the right feeling and spirit among listeners for several days before Santa Claus is due. Here is a brief glimpse of some of the items which the officials are hoping to fix up.

A School Breaking-up Party on Monday, December 17th, will give parents all the enthusiasm they may require to get ready for the homecoming of their offsprings. It is something new and should certainly go well.

Plenty of Carols.

On the following evening there is to be a broadcast of the Nativity Play performed every year at St. Hilary's Church, Marazion, the little village in Cornwall "discovered" two years ago by Mr. Filson Young. This play, as most listeners are aware, is performed by villagers who speak in the broad dialect of their county, and although interesting it is not intended to be in the nature so much of an entertainment as to show the simple religious sincerity of those who take part in it.

On Friday, December 21st, there is to be a performance of "Alice in Wonderland," adapted and produced by Mr. C. A. Lewis, who still retains close connection with the dramatic side of the B.B.C.'s work.

Carols by the Civil Service Choir are down for Saturday afternoon, December 22nd—the first of other similar programmes which will be broadcast—viz. at 3.30 on Christmas Eve from King's College Chapel, Cambridge, and by the Wireless Choir from Whitechapel Church at 8.30 the same evening.

Christmas Day Programmes.

The main part of the programme on Sunday afternoon, December 23rd, will be devoted to a performance of "The Messiah," relayed from York Minster. This transmission will begin at 2.30 instead of the usual time.

For Christmas morning the usual religious service has been arranged, and this year it will most likely be that from St. George's Chapel, Windsor, where Sir Walford Davies is the organist. After the usual lunch time music, the Wireless Military Band, under Mr. B. Walton O'Donnell, will give a concert, and this will be followed at 4.45 p.m. with a performance of the Nativity Play, "Bethlehem," by Laurence Housman. There will be plenty of light, cheery music throughout the evening, winding up with dance music until midnight. For those who prefer all dance music, a special programme

(*Continued on page 668.*)

B.B.C. CHRISTMAS PLANS.

(*Continued from page 666.*)

by Jack Payne and the B.B.C. Dance Orchestra will be available from 5 G B.

The inevitable pantomime—this year it will be "Dick Whittington"— has been arranged for the evening of Boxing Day, after which will come a "spot" of chamber music; switch over to 5 G B for variety if you don't like this.

A. J. Alan has promised to compère a programme on the Thursday evening, and there is a Symphony Concert conducted by Sir Landon Ronald for Friday.

The period ends with an all-star variety bill and a musical comedy programme from London on the Saturday, and a rollicking Pantomime Revue from 5 G B.

Educational Radio.

Part of the equipment of a new central school, now nearing completion at Ince-in-Makerfield, Lancashire, will be a wireless receiver of the most up-to-date type, by means of which scholars in every class-room will hear broadcast lessons, the local Education Committee having decided that these shall become a regular part of the curriculum.

This development marks another phase of the growing interest shown recently by certain education authorities in Lancashire to give official encouragement to the new medium of teaching. Some time ago the Liverpool Education Committee authorised the expenditure of £150 for experiments in wireless lessons in both elementary and secondary schools in their area, while the Warrington authority also sanctioned a grant of £2 10s. towards the cost of apparatus in schools which decide to instal receiving sets.

There is no doubt that the successful experiments, conducted some time ago by the Kent Education Committee, have had a good effect in assisting other counties to recognise broadcast education as a worthwhile adjunct to the work of teachers.

A NEW FAIRY TALE "FOR MEN."

ONCE upon a time there was a handsome young prince, and his parents wished that he should grow great in the land and endeavoured to make provision for him, therefore seeking the advice of the wise men of the East, who trained him in various crafts and gave unto him much wisdom.

After many years the Prince grew to manhood's state, and his father sent him forth, saying, "Go, my son. I have provided for thee richly. Thou hast knowledge in thy head which should bring unto thee many shekels."

"But," quoth the Prince, "Father, thou sayest unto me 'Go,' but thou sayest not whither. Truly thou hast given me of talents, but how shall I employ them? Unto whom shall I offer them?"

Then his father, the King, was sad at heart, for he knew not how to make answer. "Come, my son," quoth he (weeping the while), "we will call a council of our wise men."

At the council of the wise men which the King called, there rose to speak one light of years but heavy of wisdom, named "Ino."

"O mighty King," quoth he, "I can solve thee this riddle; thy son, the Prince, shall tread the road that thy heart desires, but he must get him another father."

"How so?" quoth the King. "How may a man have two fathers? Solve me this."

To which "Ino" made reply, "O mighty King, know thou that there is one wise man who has devoted many years to the guidance of the young, who shouteth from the house tops, 'Let me be your Father. Let me be your Father.' Him thou shouldest consult. He is known as the Gov-Ernor, and dwelleth at The Bennett College, Sheffield. He is helped by many wise men and knoweth well the markets of all the world, and is able to guide the footsteps of the young and the old, so that they waste not good effort, but shall prosper even up to thy high desires.

"Therefore, O King, send unto him a message, but, O King, send not of gold or other presents for the advice of the wise one is free. Thus shall thy son, the Prince, have a new guiding hand, a new father."

TECHNICAL NOTES.

(Continued from page 644.)

introduction of broadcasting would kill the gramophone industry, the result has been precisely the opposite, and I can think of no more conspicuous commercial example of an apparent menace turning out, in the long run, a blessing in disguise.

Electric Drive.

Well, to come back to the question of gramophone motors, I am often asked whether there is any great advantage in using an electrically-driven gramophone motor rather than one of the spring type with the hand "wind."

The electric-motor-driven gramophone or, if you prefer it, the electric-gramophone-motor, is considerably more expensive than the spring-driven type and can, of course, only be used where electric mains are available. Apart from this, however, the electric gramophone motor has the great advantage that it runs on continuously, and the necessity for re-winding is entirely done away with.

Speed Variation.

It used to be urged against electric gramophone motors that they were liable to variation in running speed, owing to variations in the voltage of the mains, and also "pulling up" when a loud passage was encountered on the record. In the earlier types of electric gramophone motor these troubles, more especially the second one, undoubtedly existed, but you may take it that in the present-day types, with fairly high-speed motors of sufficient power and with well-designed smooth-running reduction gear, the performance of the driving unit is well-nigh perfect.

Spring Drive.

The much more usual spring-driven motor has also been very greatly improved during recent years, and provided the spring is of sufficient effective "length," there is really little cause for criticism. In the larger gramophone models it is usual to instal a double spring or even a triple-spring motor. The springs are mechanically connected "in series," to borrow an electrical phrase, and the effect is the same as that which would be obtained with a spring three times as long as each of the individual units. Many people imagine that the advantage of a long spring (a double or a treble spring) is simply that the gramophone runs over a longer time without re-winding.

Uniform Pull.

This, however, is by no means the only advantage; a further very important point is that, apart from the question of the length of the run, a long spring will give a more uniform torque during the period of playing a record than will a short spring. With a short spring it quite often happens that the actual torque is appreciably less at the end of the run than at the beginning, and this difference is not entirely compensated by the friction governor.

Portables.

Therefore, from every point of view, it is very desirable to have a fairly long spring, but considerations of size, weight, and cost

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TECHNICAL NOTES.

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often prevent the fitting of anything more than a single-spring motor in the smaller types of gramophone, especially the smaller portables.

"Straight Track."

Whilst I am on the subject of gramophones I should like to say something about another point which has often arisen in correspondence, and that is the travel of the soundbox across the record as the record is played. The point is that when the record commences the soundbox makes a certain angle with the sound grooves on the record (or, to be more accurate, a certain angle with the *tangent* to the sound groove at the point where the needle enters it).

Now, as the soundbox progresses gradually across the record from the edge towards the centre, this angle gradually changes. If we assume that the conditions are correct when the soundbox lies in the tangential plane, it is obvious that if the angle changes the soundbox must be at an incorrect angle for the majority of its travel across the record.

Maintaining Constant Angle.

Attempts have several times been made in the past to devise an arrangement which would keep the soundbox at a constant angle to the track throughout the whole of the record, but so far as I know these attempts have been unsuccessful, either because the mechanical arrangements were too cumbersome, or because the object in question was not fully achieved.

Ingenious Parallel Linkage.

I notice that the Varley people, however, have this year brought out a very simple

(*Continued on page 674.*)

TECHNICAL NOTES.

(*Continued from page 672.*)

and ingenious linkage arrangement which ensures that as the soundbox moves across the record it is maintained parallel to its original direction. Assuming, therefore, that it has once been adjusted to the correct angle, it is clear that it will remain so throughout the whole of its passage from the edge towards the centre. I am leaving out of account very slight discrepancies in this argument due to the fact that the actual path of the needle point across the record is a curved one.

The linkage system employed is a very simple one indeed, and one which is used in a great variety of other applications, but I do not recollect ever having seen it adapted to this particular purpose.

Adjustable Pressure.

In addition, the Varley automatic pick-up arm includes several other refinements. The angle of the needle may be varied, and the pressure of the needle point upon the surface of the record may be adjusted between quite wide limits by means of a special spring-tension device incorporated internally. The arm is mounted upon ball-bearings so that friction and "play" are reduced to a minimum. Finally, the gramophone motor stops automatically when the tone-arm reaches the end of the record.

Reaction.

A reader sends me a note of one of the advantages of using a low-tension mains-supply unit or a trickle-charged accumulator which is not often put forward, although as soon as I mention it I am sure a great many of my readers will agree at once that within their own experience it *is* an advantage.

The point is this: with receivers employing reaction, especially where the reaction is fairly critical and more especially where the adjustment of the filament rheostats has a critical effect upon the reaction, you will often find that as the battery runs down you are continually having to re-adjust the rheostats in order to keep up a fairly uniform volume, whilst as soon as a freshly-charged battery is put in, the set howls and a readjustment is again necessary.

This is all very well for the *experimenter*, but in the large number of cases where the set is intended to be used by members of the family, with the minimum amount of adjustment—in the cases where the receiver is intended to be simply an "on-and-off" arrangement—all this continual adjustment is very annoying.

On-and-Off Receivers.

Now when you use a low-tension mains-supply unit you get a constant voltage (or at any rate a very reasonably constant voltage) and once the receiver is adjusted there is practically no need for it to be touched, so long as it is intended to receive only the one station.

The same thing applies to practically the same extent where a low-tension accumulator with trickle-charger is used, provided, of course, that the trickle-charging is done on a regular basis and that the battery is not allowed to run down appreciably below its fully-charged voltage.

"EVERYBODY'S" THREE.

(*Continued from page 643.*)

Selectivity can also be varied by alterations of the size of the aerial coil L_1. For most purposes this will be a No. 30, 35, or 40, but for higher selectivity, especially on a larger aerial, a No. 25 will be needed. While we are dealing with coil sizes and adjustments it may be as well to give some notes on the other coils in the set. The secondary, L_2, should be a No. 60, and for most valves the reaction coil, L_3, can be a No. 50. In some cases (when the detector is not a very freely oscillating valve, for example) a No. 60 or 75 may be needed, but this is not likely.

Long Wave Adjustments.

The long-wave coil, of course, is one of our standard loading coils, and there is an adjustment for selectivity on the long waves here. You will see on the wiring diagram that one of the connections to the loading coil is a flexible one, and this can be attached to the "60" or "80" terminals. The highest selectivity is obtained on the 60, but signals are usually slightly louder on 80. It only takes a moment to try each in turn, and see which suits your aerial best.

You will already have gained a general idea of the arrangement of the L.F. circuits which follow the detector, but there are just one or two points to be explained in detail before we go on to constructional matters.

In the anode circuit of the detector you will see the first of the safety devices, which consists of what is commonly called an anti-motor-boating filter, and forms a valuable preventive of battery coupling. It consists simply of the anode resistance marked 50,000 ohms and the large condenser C_4.

This device not merely helps to cut out battery coupling, but also serves to adjust the H.T. voltage on the detector valve, so that only one H.T. positive terminal is needed for the whole set.

The value (50,000 ohms) marked will suit most detector valves, but if you find reaction ploppy, remember that you can vary the H.T. on the detector very simply by exchanging this resistance for one of 80,000 or 100,000 ohms.

Killing Reaction Squawks.

In the first L.F. circuit you will see another special feature, an H.F. choke this time. This is the one marked H.F.C.$_2$, which was added because we found that with some pairs of transformers there was a little trouble due to H.F. currents getting through and causing reaction to be fierce and "squawky."

The extra choke stopped this completely, and proves specially helpful on the short waves.

In the last stage we find the final scheme for stopping battery coupling, which is simply an output filter circuit *properly arranged*.

This is so connected that the alternating currents which represent the speech and music pass from the anode of the valve, through a large fixed condenser, C_8, then through the loud speaker, and so direct to the filament circuit without passing through the H.T. battery at all. This little

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"EVERYBODY'S" THREE.

(*Continued from page 676.*)

point is worth noting, Just one other point before we leave circuit details. You will see a fixed condenser of ·0005 mfd. marked C_5 in series with the tuning condenser, with a dotted line intended to indicate that it can be short-circuited when desired.

Helpful on Short Waves.

This is one of the devices provided to make the set easier to work on the short waves, and its effect when not shorted is to make tuning much less critical. It actually reduces the *effective* maximum capacity of the tuning condenser to ·00025 mfd., and hence tuning becomes easier. It is only used on the short waves, and is shorted out for ordinary broadcast work.

The actual shorting is done in a very simple way, without switches or other complications. It is provided with clips as though for a grid leak, and in these a piece of stick (a short pencil will do) wrapped round with tinfoil is slipped when it is desired to short it out.

General instructions for building the set you will not require, for everything is quite clear in the photos and diagrams, and there are no special parts to make (one of the special attractions of the set is that it uses perfectly standard parts throughout, even to ordinary plug-in coils

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"EVERYBODY'S" THREE.

(*Continued from page 678.*)

of sizes which most people will have. However, there is one point calling for a word of explanation, and that is the resistance in the anode circuit of the detector valve, and its method of mounting. In the original set we used a Lissen resistance, which is fitted with small terminals.

Taking advantage of this feature, we dispensed with the usual holder and "hung" the resistance directly in the wiring. Of course, you can use any make of resistance you like, so long as it is a good one, but you must provide a holder for other types.

Working the finished set is particularly easy, for it is very pleasingly free from vices. Questions of coil sizes, adjustment of selectivity on long and medium wavelengths, and the H.T. adjustment on the detector valve we have already dealt with.

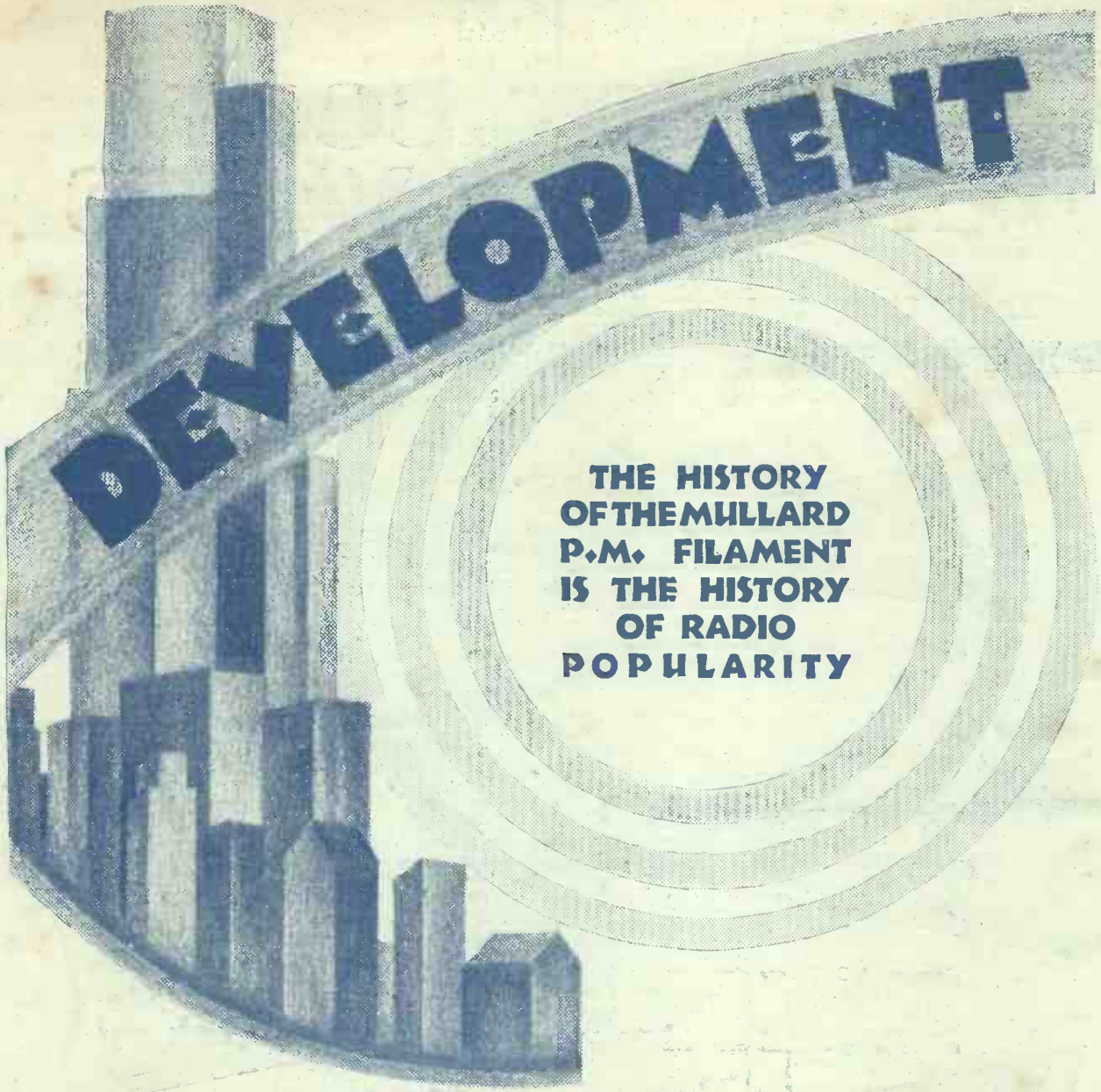
In addition, it should be pointed out that to give the set a fair chance you really must provide it with a reasonable amount of H.T. (not less than 100 volts).

Now as to valves. For the detector you want one of the H.F. type, such as the Mullard P.M.1 H.F., Cossor 210 H.F., Marconi and Osram H.L. 210, Mazda H.F.210, Ediswan H.F. 210, Dario Bi-volt.

In the second socket you should use one of the L.F. or "G.P." type, such as these: Marconi and Osram D.E.L.210, Mazda G.P.210, Ediswan L.F.210, Mullard P.M.1 L.F., Cossor 210 L.F., etc. In the third socket a good power or super-power valve is very desirable indeed, because the set will give extremely powerful signals and overload a small valve hopelessly.

Here are a few suitable valves, again all 2-volters: Cossor Stentor Two, Ediswan P.V.215., Marconi and Osram D.E.P. 215, Mullard P.M.2. Mazda L.F.215, Cosmos Red Spot, etc. These are mostly ordinary power valves, but if your H.T. supply is a fair-sized one a super power type should certainly be chosen. Examples are: Cosmos double Red Spot, Mullard P.M.254, Marconi and Osram D.E.P.240, etc.

Grid bias on the fourth and fifth valves should, of course, be in accordance with the maker's instructions.



WITH a four years' lead in construction and performance; with the finest research and laboratory organisation in the World, working and maintaining this lead; with the wholehearted support of a huge majority of the radio public behind them—Mullard P.M. radio valves must be the choice of every radio set owner.

They make an old set modern,
they make a modern set perfect.

Mullard

THE·MASTER·VALVE

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SPECIAL CHRISTMAS NUMBER

Popular Wireless

3d

CONTENTS

No. 340 Vol. XIV. December 8th, 1923.

Registered at the G.P.O. as a Newspaper.

The new B.T.H. GRAMOPHONE PICK-UP AND TONE-ARM

THE new B.T.H. Gramophone Pick-up and Tone-arm is an exceptionally sensitive instrument, which when used in conjunction with a suitable amplifier and loud speaker gives results unapproached by any other instrument.

The wonderful reproduction obtained is due to the faithful response over a wide range of frequencies.

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The tone-arm is telescopic, and can be extended from 8 to 10 inches, greatly simplifying adjustment when fixing to gramophone.

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BUILD THIS PORTABLE

THE Mullard Master Five can be carried from house to house — from room to room—from fireside to bedside. It will give you music wherever you go—at your house—your friends' houses, in your car. It is entirely self-contained — receiver, batteries, aerial and loud-speaker all enclosed in one attractive cabinet. It gives an amazing choice of programmes with one dial tuning. It is highly efficient on long waves as well as on the broadcast band, an achievement rare with portable sets. Its tone is rich and realistic. Its operation is of the simplest. Its simplicity of construction eliminates error and assures success.

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RADIO NOTES AND NEWS.

A Happy Christmas to You All!—So Near and Yet So Far—The Way Out—The B.B.C. Orchestra—Light Interlude—Wireless Exchange—Popular Wireless Pictures.

A Happy Christmas To You All!

THE time has come, said the walrus
To talk of many things—
Of puddings and pies of *e-naw-mus* size—
And the fun that radio brings.

For this is the time of year, my friends,
When the dancing chestnuts fizz,
When you make a bet
That your radio set
Is the finest set there is.

CHORUS:
The finest set there is, my boys,
For it's a "Filadyne,"
A "Handyman," a "Sceptic's Three,"
Or one of that goodly company—
"P.W.'s" design!

The Amateur Wells.

I HAVE no thirst to come a cropper in trying to rival a dreamer like Wells, but as it was only a dream it will not be taken in evidence against me. I dreamed quite clearly that radio had developed to such a pitch that a man could talk into his office telephone in London and his words be reproduced in Roman characters on paper tape in any far country. We all know that in modern telegraphy Morse signals are turned into ordinary printed letters, but what about speech? Is it wilder to imagine my dream come true than to believe that men could fly?

So Near—And Yet so Far.

MEANWHILE, radio has a great deal more room for expansion, and it must expand over the seven seas. I do not know whether the report is correct, but I saw in one paper a note to the effect that the steamer "Montoso" was only 25 miles from the "Vestris" at the time of the disaster, but did not hear the S.O.S. because she was not fitted with wireless apparatus. In other words, she could have reached the "Vestris" in, say, three hours, if she had known of the need.

The Way Out.

CAPT. P. P. ECKERSLEY is reported as saying, "If interference is not to take place in reception there is only room for 100 stations (broadcasting) in Europe." Now, a reader of the "Bradford Telegraph and Argus" writes to that paper (November 5th) suggesting that all relay stations should be scrapped and all original British stations raised to 10–30 kw., put on a common wave-length and a common source of programme, namely, London. Good, but it would not please the Scots, I am afraid!

The B.B.C. Orchestra.

SOME weeks ago I ventured, in my timid way, to suggest that the B.B.C. Orchestra might be capable of improvement, much as I enjoy it. Hence I was suffused with a glow of pride when I read in the "Saturday Review," from the pen of a man who must know a lot about music, "At present their orchestra is by no means the best in London." Why do I say that this critic must know a lot about music? That's easy! He praises the B.B.C. for producing dins like Honegger's "King David" and Schönberg's "Gurrelieder" instead of "known favourites."

> Once again we present to you our Radio Xmas Number of "P.W."—and take this opportunity of wishing you a happy Christmas and a Prosperous New Year. Long may we continue to provide you with a Christmas "P.W.," and long may you live to enjoy it. On another page the Radio leaders of this country wish you seasonal greetings, and with them we on the staff of "P.W." join most heartily.—The Editor.

A News Note.

TOWARDS the end of this year it is hoped that the new Prague station will be in operation. With its 50–60 kw. it will be one of the most powerful in Europe.

The British East African Broadcasting Company operates on two transmitters; one a 1-kw. set, on 33·5 metres; the other a 4-kw. set, on 400 metres. The Marconiphone Company provided no less than sixty Public Address Equipments for relaying the Armistice broadcasts.

Wireless Exchange.

THIS idea grows apace, as well it might, though I doubt whether "P.W." readers are likely to lay awake thinking about it. Portsmouth has it. Reading is going to have it, though the local wireless traders are fulminating at the idea. And Darlington has been attacked and has repulsed the proposal on the grounds that the wires necessary for the service would be dangerous. I seem to remember a story about *railways* being considered dangerous. And George Stephenson gave the answer, "Awkward for the cow"! Come, Darlington, move with the times—and blow the consequences.

Light Interlude.

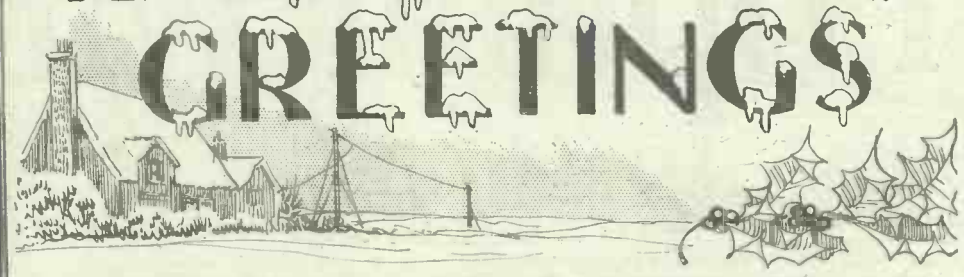
GLANCING at an American magazine devoted to the interests of telegraphs and telephones, two things caught my delighted eye. First, let John D. Rockefeller speak: "Have I not God to thank that I can still hold this glass without trembling?" He holds his liquor like a gentleman—or a telegraphist. Second: "I never won games as a boy, but that, to my mind, is the gorgeous part of sport." That was Theodore Roosevelt, a "*Britisher*" who once ruled America, and had the right idea. *What* a "fan" he would have made if he hadn't gone shooting lions in British Africa!

Popular Wireless Pictures.

THE results of a competition held in connection with the Manchester Radio Exhibition showed that the three most popular exhibits were Wireless Pictures, Daily Concerts, and the Ferranti Amplifier and Stand. The next three in order of popularity were Mullard Valves and Master Three, Cossor New Melody Maker, and Amplion "Lion" Speaker. By the way, it was with the aid of the Ferranti Amplifier that the picture of the King, broadcast by the B.B.C. for the demonstration of the "Fultograph" system, was picked up at the exhibition, 100 miles from Daventry.

(*Continued on page* 734.)

RADIO XMAS GREETINGS



From SIR JOHN REITH.

I am glad to send good wishes for Christmas and the New Year to readers of "Popular Wireless."

* * *

From the GOVERNORS OF THE B.B.C.

The past year has been one of steady progress, both in the service itself and in the number of licences. An adjustment of wave-length arrangements has effected an improvement in listening conditions of relay station centres. The new era of distribution through fewer stations of higher power is brought appreciably nearer by the beginning of work on the London Station at Brookman's Park. Preparations for the other new stations are also in hand. In sending cordial greetings to your readers we also are glad to be able to anticipate far-reaching developments.

Sir John Reith, Director-General of the B.B.C.

From SENATORE G. MARCONI, G.C.V.O.

Once again I have much pleasure in accepting your invitation to wish the numerous readers of "Popular Wireless" a Happy Christmas and a Prosperous New Year.

Much progress has been made in all branches of wireless during the past year, and many important developments for the year upon which we are now entering are foreshadowed.

The future is full of promise and also, it may be, of surprises, and I am still of the opinion that we are a long way from finality in the utilisation of electric waves.

Wireless experimenters will, I feel sure, continue to contribute their share to our increasing knowledge, and I wish them every success in their endeavours.

* * *

From SIR OLIVER LODGE, F.R.S.

All good wishes to radio workers for Christmas and the New Year. This old year has been a time of promise in many directions. More progress has been made towards world peace than could have been anticipated; let us back it up in every way we can. The English summer has been an exceptionally fine one, the harvest has been plentiful, friendliness is continuing to spread among all classes, no great upheaval has occurred, nor any misfortunes that could have been avoided. We should feel grateful for the old year as it passes, and not abuse it. Let our message be one of thankfulness and hope.

* * *

From Dr. J. A. FLEMING, F.R.S.

I have pleasure in sending all your readers of "Popular Wireless" a Christmas greeting and wishes for a prosperous New Year. The attendance at the Exhibition at Olympia this year showed that there is no falling off in the public interest in wireless and that it continues to enlist the keen interest of amateur electricians. We are not yet by any means at the end of its wonders.

* * *

From GERALD MARCUSE, Esq.

A year has quickly passed since my last Christmas greetings to readers of "Popular Wireless," and in the meantime certain developments have taken place in radio.

My small efforts in connection with Empire broadcasting have made me many new friends throughout the length and breadth of the British Empire, and I cannot let this festive season pass—when naturally every member of this great Empire of ours turns his thoughts towards the Homeland—without wishing them a Happy Christmas with Good Luck and Prosperity in the New Year.

Dr. J. A. Fleming, F.R.S.

I must confess to being somewhat disappointed in so far that developments have not been so fast in connection with Empire broadcasting as I had hoped, but perhaps in 1929 greater strides will be made in this direction and so bring activities in Old England to every home in the distant parts of the Empire. My small efforts to this end have proved that it is a practical proposition, and every effort should be made by those interested to inaugurate an Empire service.

* * *

From CAPTAIN P. P. ECKERSLEY, M.I.E.E.

It seems a long while ago when, at the Writtle Station, on or about Christmas, 1922, I asked one of the Writtle staff if he could possibly buy me a popgun. Owing to the blind and unquestioning obedience which is the attribute of everyone who has worked under me for long, a popgun arrived. It was designed to make a noise like an erupting champagne bottle. The actual champagne could not be purchased by us as the Writtle transmission designed for the amateurs of England was not paid for at highly remunerative rates.

Nevertheless, the amateurs were, on that occasion, with me in spirit if not in champagne. I hope to-day, with the more difficult task and the less intimate relations, they are none the less still with me in the cause of wireless broadcasting; and as far as I am concerned I may reassure them that, where they help in that cause, I am with them still.

From left to right, the lower photographs show the Earl of Clarendon, Chairman of the B.B.C., and Mr. Montague Kendall, Mrs. Philip Snowdon and Sir Gordon Nairne, Bart., Governors of the B.B.C.

INVENTION and SERVICE

by

CAPTAIN P.P. ECKERSLEY

M.I.E.E.

In this article the Chief Engineer of the B.B.C. discourses about inventions from a practical point of view, and makes special reference to television.

IF someone managed to be clever enough to secure the services of a good publicity agent, and succeeded in convincing a non-technical journalist that he had invented an apparatus for smelling at any distance, I have no doubt he would form a company and that the public would rush in to buy shares. "The smell of Southern vineyards in your home," would run the headlines. "Inventor's long nose," "the sewer and the wrong wave-length," so we should read, while the less sensational headlines would invent a new name like "Telesmelography," which a rapturous technician would translate to "Telesmelly."

"So Wonderful."

Would you inquire how much you could smell, what you would smell, and whether you wanted to smell at all? And, secondly, assuming everyone liked the idea and went on liking it, and really and truly wanted it, would anyone inquire whether it was practicable to do it? By observation of other similar things, I am inclined to think people would say, "Oh, yes, isn't it *wonderful?* We must have it; it's so *wonderful.*"

The faculty for wonder is admirable, but if engineering is to be judged as to its service value by the degree of wonder it excites, one may as well give up being an engineer and start being a modern inventor. I believe if I set about it, and had enough money, I could excite all sorts of wonder in people's minds. Death rays, now; given the thing that is specially unprotected, a death ray can easily be demonstrated.

A Hysterical Age.

You *can* stop a motor-car running at full bat if you're allowed a few hours to talk to the motor-car before you start the experiment. Isn't it wonderful? Death ray, and all that! I suppose if you worked hard enough and long enough, you could produce an apparatus which would start cooking your dinner by wireless (wireless must come into it; it always makes the shares go to higher values).

The prospectus might be got out for the British Foodcasting Company. A common menu cooked simultaneously in every home. No more restaurants (and quite possibly no more good food), but still, wouldn't it be *wonderful?* Wonder—what is wonder? It is usually interpreted by people as their sensations when confronted by the unusual. When a baby is born, people usually don't say, "How wonderful!" (except the mother and father, if it's the first), when, in fact, to my mind, the birth of any living thing is far more wonderful than, say, "wireless."

So really many inventors obtain great prestige because they associate themselves with some apparatus that associates itself with the unusual and makes the layman astonished and the technician frequently disgusted. This is a hysterical age. Reasoning is at a low ebb; sensationalism and romance are to the fore. Jaded, nervous, bored workers cry more and more for sensation. "I'm tired of livin' but 'feart of dyin'"; their mind grasps eagerly at some new promised marvel to free them from the horror of thinking.

A past generation covered up the legs of their tables as indecent; reality was indecent, and so they lived shielded from all that might hurt them. The present generation sees barer and barer legs, but still shrinks from unromantic reality. As always, human beings crave some shield from actualities, some romance, some way of turning their heads aside from the ugly but interesting nakedness of truth.

Wrong Judgment Standards.

So invention is judged in terms of romance, not in terms of either service or practicability, and we who have to live with actualities must ever be disliked for our apparently superior and discouraging attitude to inventors. But what, in the end, counts in an invention? What is the truth in this matter? To my mind, all judgment must be based on the following:

(a) Although crude at present, can the apparatus be improved so that it will work under service conditions?

(b) If improved to give a worth-while result, will this have permanent public service value?

(c) If, in spite of favourable answers to (a) and (b), is the invention profit-making? Are its economics sound?

(*Continued on next page.*)

Capt. P. P. Eckersley, M.I.E.E., at home with his wife and their favourite Alsatian.

INSULATING SCREWDRIVER BLADES.

An idea that will be of value to all constructors.

By H. J. B.

WE know that "to err is human," but when the result of the error of our ways is calculated in terms of hard cash we resolve once more to adopt those precautions which will prevent a recurrence of such happenings. How often has the wireless enthusiast burnt out valves, short-circuited accumulators or batteries, etc., through his neglect to render the set "dead" by switching off before he attempts to make any adjustments or alterations inside the cabinet.

In making these small adjustments it happens invariably that a screwdriver is called into play, and its metal blade has been the means of inadvertently metallically bridging contact points which should be left open.

Easily Insulated.

In my own case I find it an excellent plan to render screwdriver blades non-conducting, as then accidents will not occur even if the receiver on-off switch is not operated when making internal adjustments. There are several ways of carrying this into effect, one of the easiest being to wrap black adhesive tape round the blade as shown in one driver illustrated in the accompanying photograph.

If this covering exhibits a tendency to be tacky outside, dust it with powdered chalk, or wrap a strip of oiled silk over the tape. Only the tip of the blade is uncovered, and this is hardly likely to be large enough to cause any accidents.

When the driver blades are narrow enough, Systoflex sleeving may be slipped on and held in place by Chatterton compound; or rubber tubing will serve the same purpose in an admirable manner, as is clearly demonstrated in the second small screwdriver shown in the illustration.

The little trouble necessary to carry these suggestions into effect will be well repaid by the reduction in the possibility of accidents from short circuits, and merits the attention of all readers.

The two screwdrivers insulated as described on this page.

INVENTION AND SERVICE.

(*Continued from previous page.*)

It will perhaps be interesting to examine some later inventions on this purely factorial basis, a basis which to all reasoning people must appear undeniably sound.

Take something well-known, like the petrol engine. Under (a), when the first engine was made it was crude enough—carburetter a wick dipped in petrol, ignition by coil and a funny sort of sparking-plug, automatic inlet valve and probably quite wrong valve timing. But there was nothing fundamentally wrong. Aluminium pistons for higher revs, higher compression, mechanically operated valves, super-chargers, better and better plugs, the magneto, proper "timing," lubrication by pumps, special oils for high temperature, more scientific design of exhaust chambers, and so on, built up, from the old, crude engine, something which has revolutionised land transport, made flying possible as an actuality and not a stunt, and changed the whole aspect of warfare.

Under (b) the compactness of the petrol engine was its chief usefulness, weight per horse-power in fact, combined with its extraordinary simplicity in operation. It scored over steam because of the more direct link between fuel and fly-wheel. It therefore renders public service.

Under (c) its economics are obviously in its favour.

Take, however, the invention of low-temperature combustion. Under (a) this has long been known possible as a laboratory experiment, but in the past most attempts to make it possible on a large scale have failed because of the unwieldiness of the larger mass.

Transmission of Photographs.

It has obvious potentialities of success; it is on the border-line, and those who coax it from laboratory to factory will reap a rich reward. Under (b), obviously, *if* it can be got to work, it will render great public service. Under (c), obviously, *if* it can be got to work, it will have to be economically sound before it can be exploited.

And, lastly, take telephotography and television. Let us examine them both according to our simple acid tests.

Telephotography? It is not crude now. Can it be developed up to a pitch of technical excellence worthy of public service? It is, in my opinion, even now technically good enough to be considered in the public experimental stage. Is it useful to the public? Well, that remains for the public to see. Some will support pictures because of their novelty.

Use of Television.

The people who believe in wireless pictures must establish a lasting public service benefit before the public will give them a lasting support. Is it economically sound? Perfectly.

And television: is it crude now? No one can deny that it is very crude compared with the cinema—crude in reproduction, crude in the amount that it will show. But will it be improved? My own view is that along the lines of mechanical scanning as used by Baird it cannot improve; quantities beat it. Even if that problem is surmountable, it requires such a large number of (effectively) wave-lengths that by wireless it is hopelessly unwieldy. Any *technician* will say the same. Television is in the state of an interesting laboratory experiment. Has it ultimate service value? Of course, if it can show us events in our own homes as they happen. Are its economics sound? At present they are not, and never will be until the whole problem is attacked from some as yet undisclosed but quite different angle.

Watch Your Step.

I counsel the interested reader, when assessing invention claims, to consider the permanent service value of the invention, and to ask himself (or, rather better, an unbiased and knowledgeable technician) whether in fact the thing is practicable, does it work without too skilled care, do the public want it?

Examine Empire broadcasting on this basis, and see how sceptical you must become except as to very limited applications. Examine all inventions this way, and stop yourself and everyone else saying "How wonderful." The only time I exclaim "How wonderful!" is when I examine the trend of some contemporary investment!

ODDS AND ENDS.

It is an excellent plan to use a low-capacity tuning coil for the H.F. choke on a short-wave set. (Different coils will be found better for different tuning ranges.)

* * *

When high-tension positive leads are taken through holes in a screening box it is advisable not to trust to the insulating covering on the wire, as the sharp edges of the box may easily cut through this.

* * *

One common cause of "threshold howl" and unsatisfactory reaction control in a short-wave set is the use of an unsuitable L.F. transformer following the detector valve. (It is a good plan to try another transformer.

* * *

The old-fashioned plan of shunting a grid leak or other high resistance across the secondary of a low-frequency transformer is sometimes of assistance in extreme cases of reaction trouble in a short-wave set employing this form of coupling between the detector and the L.F. valve.

CHOOSING YOUR XMAS PRESENTS

An article to assist you in the annual problem of present-giving. By P. R. BIRD.

RADIO gifts make perfect presents, but the choosing of them often offers some difficulty.

Thinking over my own and other people's Christmas presents, I determined that one practical way to attack the problem was to visit the big stores and to watch how the crowds there hunted for bargains. It proved to be a good move!

The first chap I noticed was a peppery old colonel who wanted to get high-tension from the electric light, don't-you-know! In true army style he had got all the details, "Type A.C., cycles 50, voltage 240," etc., written on a "chit," and despite his martial appearance he was a devotee of Safety First!

"It must be safe to use," he said. "I want 80 milliamps and perfect safety. No electrocution, you know." Eventually he went off with one of the Ferranti H.T. supply units on order, quite happy in the promise of the required voltage, 80 milliamps, and *perfect safety*.

Economy First.

Looking over some H.F. chokes was a short-wave fiend, who paid 3s. 6d. for a Burndept because the salesman told him impressively that its capacity was only ·000007—a fact which fairly floored the hunter of the high frequencies! Next I heard an interesting argument about using dry cells for H.T., an economical gentleman contending that it was a sin and a shame to throw away good cells because one was a dud in a battery.

Eventually he was persuaded that for real power work you must have a super-capacity type of battery. But he got his way in the end, for he took one of the Gecophone interchangeable dry batteries, which is made up in sections, so that when one section runs down it is simply replaced by a new one.

"And do you mean to say," said one lady, looking at the leaflet her friend had given her, "that the box will contain a real wireless cabinet, and all the parts to make a wireless set, and the valves, as well as the screwdriver, or whatever it is to connect it with?"

Being assured that she could indeed get all this for £7 15s. if she purchased a Cossor Melody Maker, the lady turned to her friend and said, "My dear, isn't it too beautiful? He can spend the first part of his holiday making the thing, and the rest of it listening in with it!" Some schoolboy in for a good time!

The Schoolboy's Ten Bob.

Talking of schoolboys, there was one who obviously had about ten shillings to spend, and he was determined to leave no stone unturned until he had laid it out to the utmost advantage.

Amongst his purchases were a Benjamin battery switch for 1s. 3d., two W.B. valve holders for half a crown, a Brownie dial for 3s. 6d. (purchased on account of its non-backlash slow-motion drive), some Belling-Lee terminals (3d. each), and a number of those handy little Clix and Eelex accessories at 4d. and 3d.

The cabinets, I noticed, are in a particularly good profusion this year, some really excellent examples being available. Numbers of wise men brought their wives with them to choose the cabinet, on the principle of "what's yours is mine, and we've both got to live with it." The question of suitable size, etc., need never trouble the purchaser nowadays, for people like the Carrington Mfg. Co. (Camco) not only make cabinets specially for most of the famous sets, but are also willing to oblige as to any other style of cabinet required.

Another cabinet difficulty, that of paying down for an expensive piece of furniture, is overcome by the Pickett cabinet people by granting facilities for easy payments.

Adding a Valve.

The difficulty of having a loud speaker available in two or three different rooms, and controlled quite apart from the set, has appeared insuperable to some purchasers until they made acquaintance with the "Lotus" remote control. This simple little component is easily installed in several rooms if required, each room containing a wall plug which is pushed in to hear the programme, and pulled out when you want to switch off.

Constructors who want to add a stage of R.C. coupling but have not much room to do it in will understand the triumph of the old gentleman (he was sixty at least, and an ardent constructor) who found that the new Dubilier R.C.C. unit incorporates a valve holder with it, the whole thing being very little bigger than an ordinary valve holder. Complete with two interchangeable Dumetohms, and costing only 8s. 6d.,

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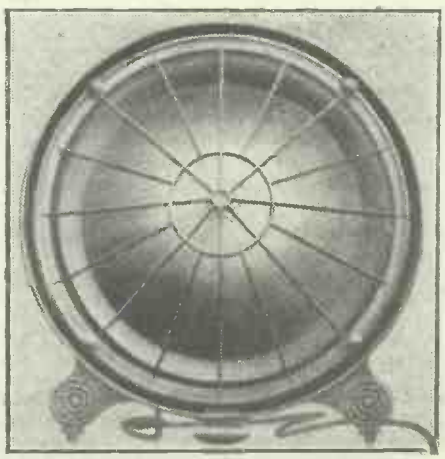


The new Mullard Loud Speaker would make a very handsome present to the person who studies both appearance and performance.

A new L.F. Transformer will often "transform" reception.

CHOOSING YOUR XMAS PRESENTS.

(*Continued from previous page.*)

one could understand his elation at procuring it.

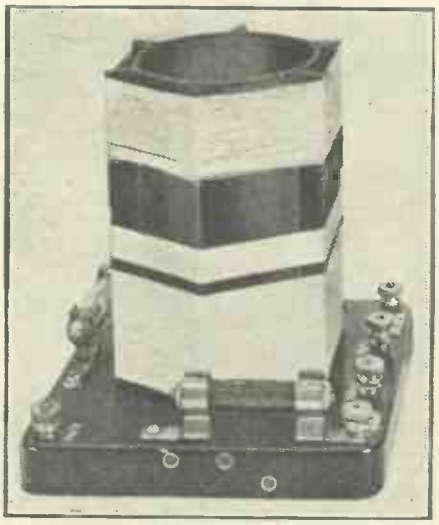
Talking about compactness, it is rather interesting to notice that a great many people are still unaware that it is not necessary continually to keep coil changing, nor to have a wide range of coils to cover both long and short waves. Instead, it is possible to use one of the new types of tuners. One customer being shown the new R.I.-Varley tuner, which retails at 25s., could hardly credit that when tuned with a ·0005 variable condenser it would cover the wave-band from 265 to 600 metres, and then, by merely throwing over the switch at the bottom of the dial, start again at 1,200 and go to 2,000 metres.

Loud Speakers and Valves.

Amongst the general favourites in loud speakers, such as the Brown, the Celestion, the new Marconiphone moving-coil, the Orphean, the Brandes Elipticon, etc., is now to be found the new Amplion Lion loud speaker, and a host of newcomers, some of really outstanding merit. Amongst these can be mentioned the new Blue Spot unit, the M.P.A. loud speaker, and the new types specially designed to operate with those receivers which utilise the latest valve developments, such as the Pentode.

Such a loud speaker is the new Philips five-guinea model, which, with its large balanced-armature movement and special cone construction, has three different impedance values available to suit any output valve.

The moving-coil loud speakers continue their triumph, and in this field there is not only the original Rice-Kellogg B.T.H.



This is the Inductance Unit for the famous Ediswan "R.C. Threesome."

loud speaker, but a host of others including such well-known names as Goodman, Lang & Squire, "Sylphone," etc.

Treating yourself to a valve is a very exciting business, for there are some wonderful things from which you can choose.

For long-distance work several makers are already making excellent 2-, 4-, and 6-volters in the screened-grid type which are capable of giving great signal strength on long-distance stations. But undoubtedly the valve of the moment is the new Pentode, introduced in this country by the Mullard "Pentone." This valve is a kind of screened-grid valve for *low*-frequency work, and it is fitted with a third grid which enables one single valve of this type to produce an enormous volume of sound such as previously could only be obtained with two valves.

One advantage of the Lissen Resistance is that it can be mounted either vertically or horizontally.

Used in a set like the "P.W." "Pentode" Three, which was described in this journal recently, a pentode handles the whole of the output from the detector valve, and works the loud speaker "on its own." But intensely interesting as the Pentode is, the Mullard people are not the only ones alive to new developments in valve design.

Ediswans, for instance, have not only a wonderful range of all ordinary types of valves, but they are also specialists in valves for use from the house lighting mains, valves for H.T. eliminators, and other recent developments in this field of radio research. Another great valve firm, the "B.T.H.," has recently put upon the market a whole new series of Mazda valves in 2-, 4-, and 6-volt types, the whole range comprising valves fitted with *nickel* filaments.

Coil and Condenser Bargains.

Prominent amongst the firms catering for the man with mains are the Metro-Vick Supplies Ltd., and for a few pounds this firm can supply Cosmos H.T. valves for your set, and an eliminator which enables you to dispense with batteries altogether, and to operate straight off the electric-light mains.

Another firm very famous for this class of work is E. K. Cole & Co., makers of the "Ekco" Units, and talking of H.T. eliminators, etc., recalls the possibility of building your own, a task that any home constructor can do very satisfactorily with the aid of the handsome booklet issued by the Telegraph Condenser Co.

The Colvern people will supply not only the sets of coils for long waves, short waves, or medium waves, but also all the necessary coil-holders, formers, etc., and considering the efficiency of the modern coil the price is really remarkably low. This applies also to H.F. chokes, even such as the "Lewcos" which is suitable for use on all wave-lengths from 20 to 2,000 metres.

So many and varied are the wireless products of to-day that not a few people will be purchasing on the "good firm" principle. The idea behind this is that suppose a purchaser gets, say, a Lissen H.T. battery. The fact that Lissens gave him a good battery for his money encourages him to believe that if he buys, for instance, one of their transformers, they will not let him down, and thus it is that a single firm such as Lissens can score success after success in different directions in radio.

One of the finest features about a crowd of shoppers is that you *do* get enthusiasts there. The loving way in which some clever-fingered long-distance fiend will turn a J.B. condenser dial, or will gloat over one of those little Wright and Weaire baby condensers, proves that the fine work put into the making of radio goods is not wasted.

Talking of precision instruments, what a grand gift a "Sifam" voltmeter or milliammeter will be or one of those little One-meters (Electradix Radio Ltd.). It is not necessary to pay a lot of money to get a precision instrument either, for some of these slow-motion dials such as Ormond's, can fairly be called that.

Radio is an Investment.

If it is not so much precision as robustness and dependability that appeals to one, there are long-lasting components like Exide batteries or those Atlas battery eliminators which will give one all the reliability that could possibly be required.

Radio is really reliable nowadays, consequently a firm like Ripaults selling an H.T. battery with a whole life history attached to it, find themselves in a very strong position when they are up against competition from anonymous firms. Remember, too, that those "P.W." standard loading coils supplied by Paroussi, Burne-Jones, and other well-known firms

In the excitement of the Christmas Pudding, don't forget the Pye-Transformer.

may give pleasure out of all proportion to their cost, and even the best-known firms put out a number of low-priced components nowadays. Igranics, for instance, will sell you an Indigraph dial for 1s. 6d., rheostats, jacks, neutralising condensers, etc., any of which will leave you quite a nice bit of change out of a couple of half-crowns.

Such a firm as Siemens, too, or the Ever-Ready Battery Company, the Columbia Battery Company, etc., do not rely upon the popularity of their excellent super-type batteries only, but upon every single component they make, including even the smallest grid-bias battery, or the little 1½-volters for anode-bend bias.

Remember, finally, that a well-chosen radio present offers all the advantages of a gilt-edged investment, returning a rich measure of full flavoured enjoyment for every little bit of time, care, and money spent upon it.

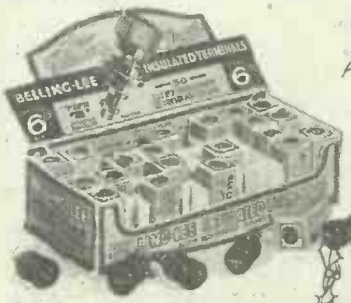
XMAS RADIO GIFTS

The R.I. Adjustable L.F. Choke is a heavy-duty component, for effective choking even under heavy loads.

Above (to the right) is shown the recently introdnced and modernised "Star" version of the famous Mullard Det. and 2 L.F. receiver—"The Master Three."

In the centre of the page is depicted the "Lion," the new Amplion loud speaker which created so much attention when introduced to the public a month or so ago.

A selection of high-quality sixpenny terminals is always sure to please a set constructor.

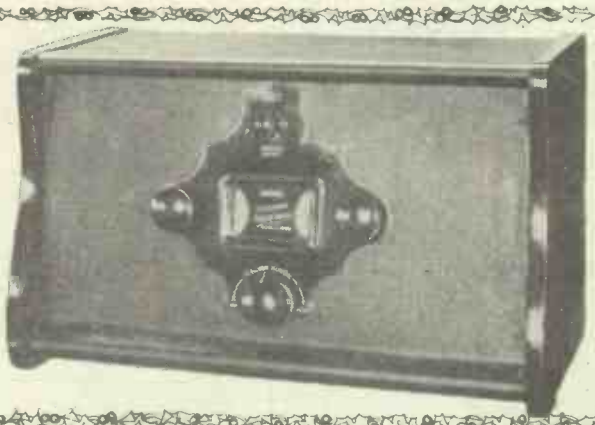


A centre-tapped coil of the type shown here is a great aid to selectivity.

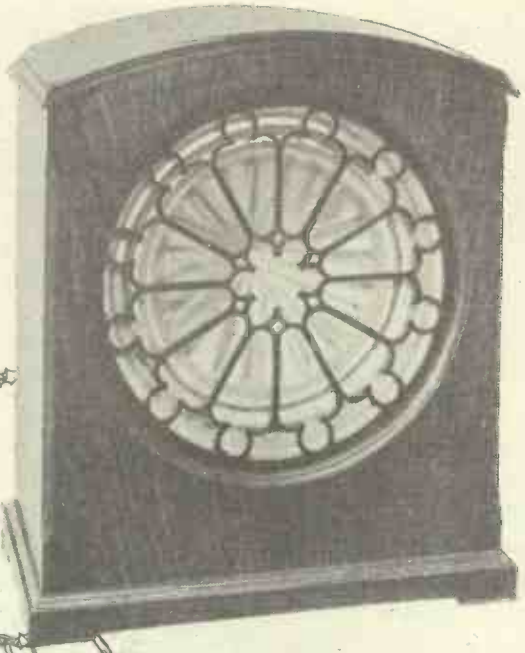
An excellent example of compact workmanship and sound design is the Lissen portable receiver shown here. The loud speaker is contained in the lid.

Cossors, living up to their great reputation, have produced this remarkably efficient screened-grid valve.

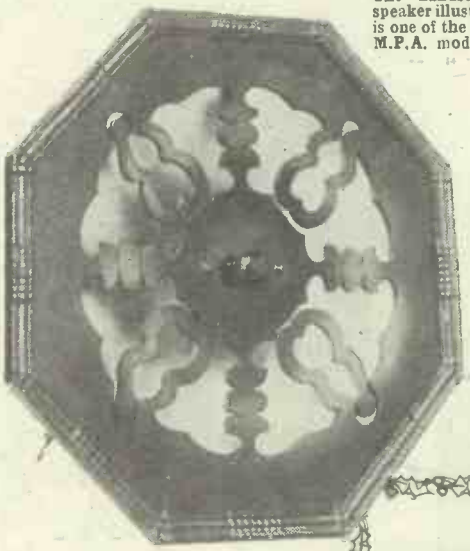
The set to the right is a Marconiphone production with wonderful distance-getting properties.



A "Screened Ethophone" is shown to the left. This is a Burndept product, which tunes between 210-550 metres and 650-2,100 metres. To the right is illustrated the Orphean "Super" Cabinet Cone Loud Speaker.



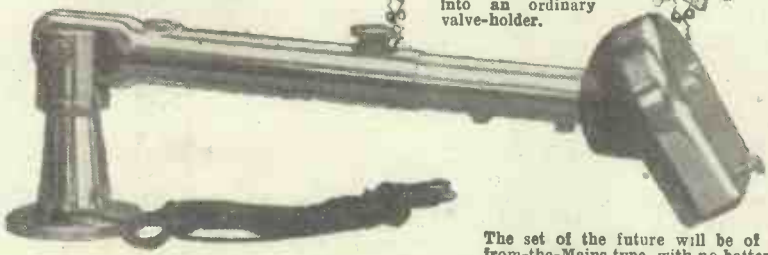
The handsome loud speaker illustrated below is one of the well-known M.P.A. models.



Even the best set will benefit from proper battery conditions, which can be checked with ease by means of a Three-Range Meter. The model shown to the right is one of the famous Ferranti range of components.

A terminal on the top of the Six-Sixty screened-grid valve takes the plate connection, and the other four pins fit into an ordinary valve-holder.

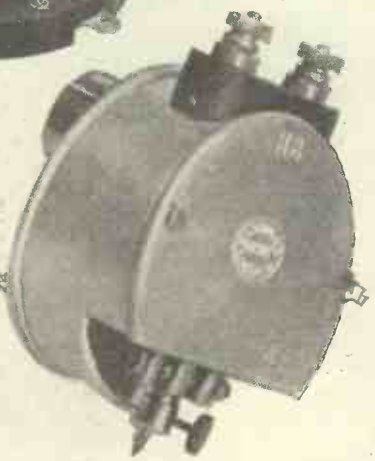
The B.T.-H. pick-up with tone-arm, illustrated below, is ingeniously adapted for use with different gramophones.



The gramophone pick-up illustrated in the right-hand bottom corner of the page is made by the well-known "sound" specialists, S. G. Brown, Ltd., of Acton.

The set of the future will be of the All-from-the-Mains type, with no battery bother at all. That shown below is an "Ekco" production, with just a plug for connection to the house wiring.

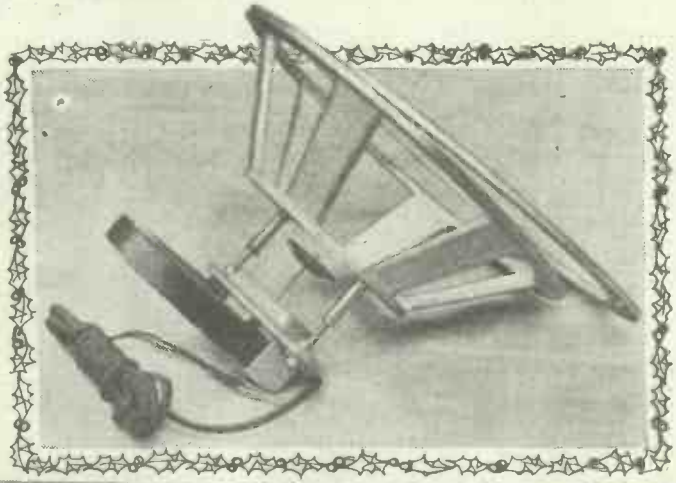
Above is illustrated a very useful present for the set-builder, in the form of a non-microphonic valve holder (Whiteley, Boneham, Ltd.).

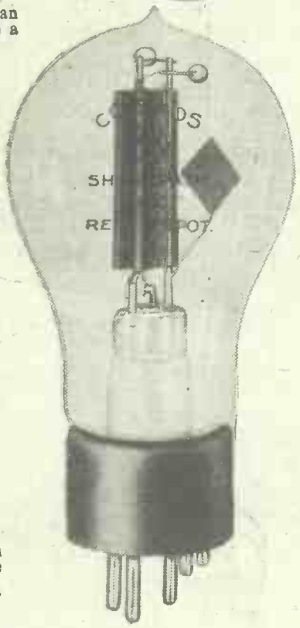


The Lotus Distant Control is illustrated above, and to the left is shown one of Goodman's Cone Loud-Speaker Units.

The Gecophone electrical pick-up shown below enables gramophone music to be reproduced upon the loud speaker.

Well-designed grip and easy movement are welcome features of the Ediswan variable condenser (left). Below is a "Blue Spot" Loud-Speaker Unit, fixed to a suitable frame.

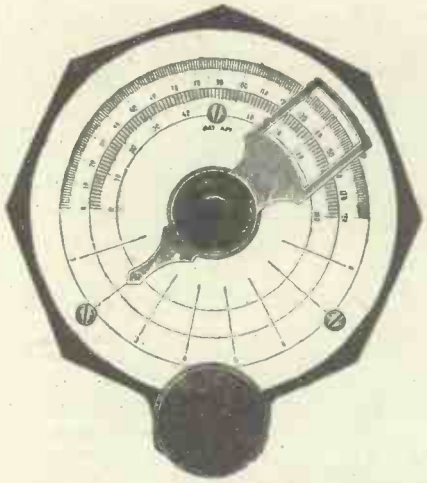




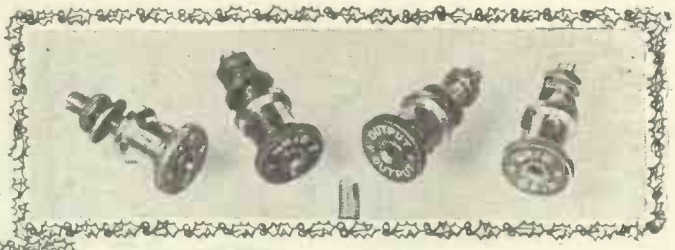
One of the famous Cosmos A.C. valves is shown to the right, and below it is the seven-valve "Neutro Sonic," an Igranic product.

To the left is a reminder that a dry battery makes a most acceptable gift.

An Osram valve is a gift that goes on giving good service indefinitely. Below is shown a handsome Brandes receiver, for ordinary and long-wave programmes.

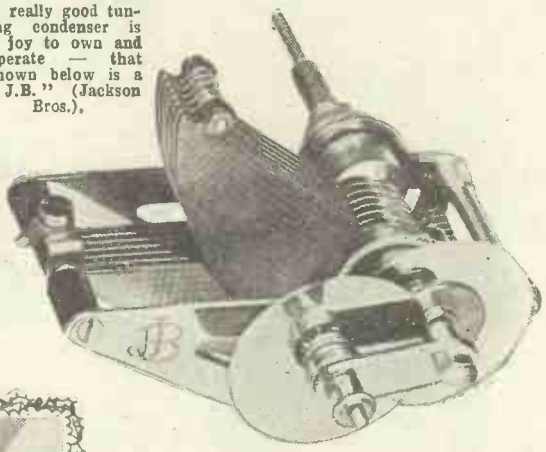


Fitted with a slow-motion drive, the popular Ormond Dual-Indicator Dial is a great aid to fine tuning. To the right is illustrated a selection of Eastick's terminals—always acceptable.

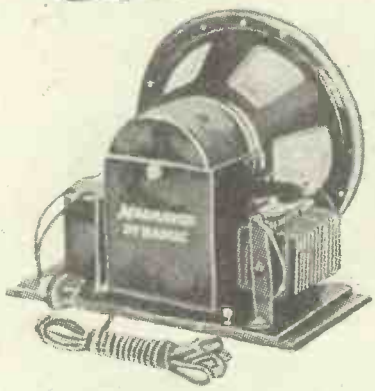


Bother with frayed ends of wire will vanish and good contact will be assured if the "Clix" specialities (right) are fitted to the flexible leads.

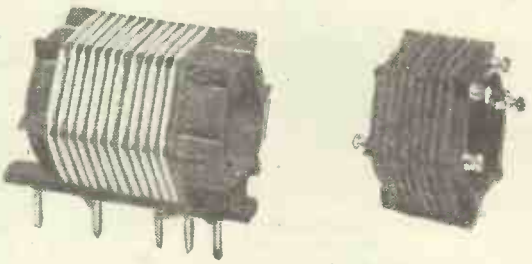
A really good tuning condenser is a joy to own and operate — that shown below is a "J.B." (Jackson Bros.).



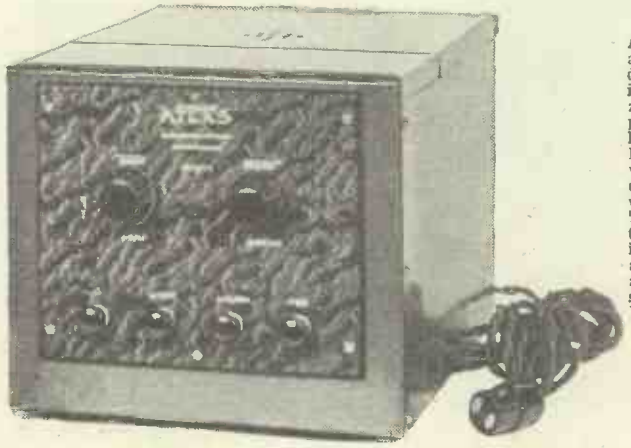
A Siemens' battery is a very sound present.



The Magnavox "Dynamic" (left) is a quality moving-coil loud speaker. Above it is shown a familiar favourite—the Dubilier mica condenser, and (centre) a "Formo" semi-variable condenser.

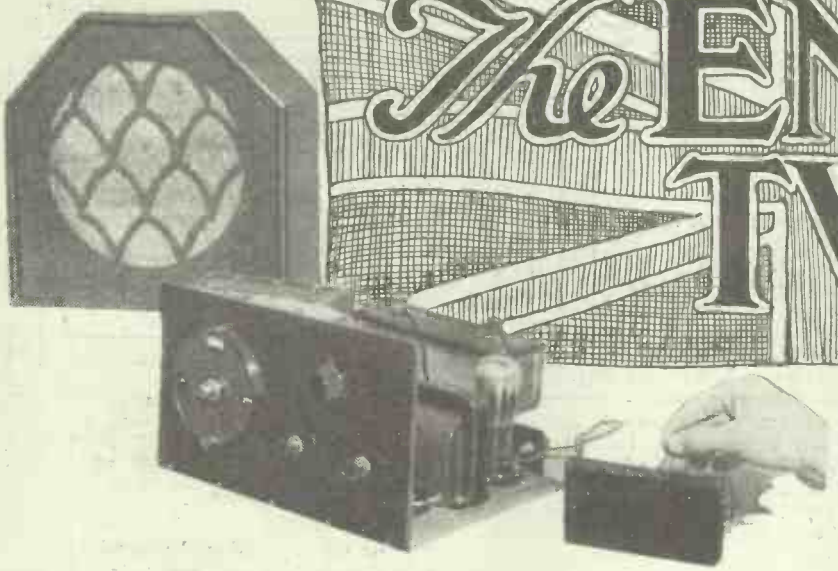


Solodyne and "P.W." Standard Loading Coils (E. Faroussi).



Above is illustrated a T.C.C. fixed condenser, easily fixed in either a horizontal or vertical position. To the left is an "Atlas" Mains Unit, with variable voltage controls, for use with A.C. mains. The Philips L.F. transformer (right) is an excellent example of compact and efficient design, small in size but big in performance.

The "EMPIRE" TWO



Here is a set that sets a standard! With it you can turn from your local station and reach right out to 3 L O Melbourne, and the other famous short-wave stations. It is a revelation of what two valves can do!

Designed and Described by THE "P. W." RESEARCH AND CONSTRUCTION DEPT.

THE "Empire" Two is one of the most attractive two-valvers designed by the "P.W." Research and Construction Dept.

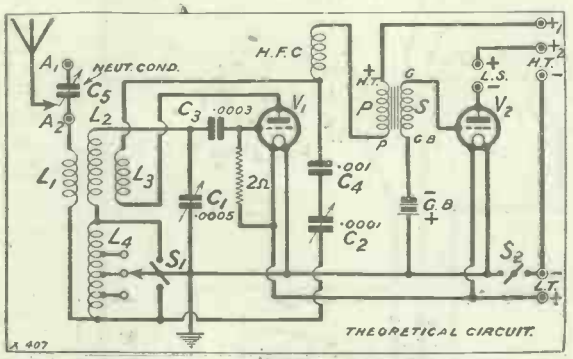
In what way does it differ from other two-valve sets?

Well, it is really two receivers combined in one. That is to say, the design has been carefully worked out so that the set will give excellent results on three different wave-bands. With one set of plug-in coils the broadcast programmes from the British and Continental stations operating on the 250–500-metre wave-band can be received. At a touch of the switch the set can be instantaneously changed over to Daventry on 1,600 metres without any alteration in the coils.

An Efficient Circuit.

But the "P.W." Research Staff realised that there were many listeners who, although desirous of hearing such stations as Melbourne and New York, etc., were deterred by the fact that a special set was usually necessary for work of this nature on the very short waves in the neighbourhood of 20–30 metres. Therefore, an endeavour was made, with complete success, to provide a set capable of going down to 20 metres and yet retaining its utility as a purely domestic receiver.

It is unnecessary to go into the theoretical considerations which governed the design, but there is no harm in giving a few brief details of how the set works.



It looks simple, doesn't it? But it can reach round the habitable globe and thinks nothing of ordinary European stations!

The circuit is a straightforward detector, followed by a transformer-coupled L.F. valve. Now, such a circuit arrangement is very suitable both for long-range reception on the 'phones and loud speaking at moderate distances from the local main station, and either of the high-power stations (5 G B and 5 X X). One would put the range, as far as loud speaking is concerned, at 80 miles from Daventry and 10 or 12 miles from a station such as 2 L O, or Manchester, or Cardiff, etc.

Now, plug-in coils are used throughout, the reason for their choice being twofold. In the first place it is quite likely that a number of enthusiasts will already have a stock of the usual sizes which they have employed in another set. Secondly, such coils are cheap and obtainable anywhere. For instance, the loading coil is a standard No. 200 X or other tapped coil, and the remaining coils are perfectly standard sizes.

Reaction Control.

The set is selective and, what is more, the degree of selectivity can be varied by changing the size of the aerial coil.

The method of controlling reaction is, perhaps, one of the most attractive features in the design.

The reaction coil itself is magnetically coupled to the grid coil. The scheme is

(*Continued on next page.*)

COMPONENTS REQUIRED.

- 1 Panel, size 12 in. × 7 in. × ¼ in or ³⁄₁₆ in. (Red Seal, "Kay Ray," Resiston, Becol, Trelleborg, Ebonart, etc.).
- 1 Cabinet to fit, and baseboard 9 in. deep (Camco, Pickett, Makerimport, Raymond, Bond, Lock, Caxton, Gilbert, Artcraft, Peto-Scott, etc.).
- 4 Baseboard coil sockets (Lotus, Peto-Scott, etc.).
- 1 Neutralising condenser for use as series aerial condenser on short waves (any standard make).
- 1 ·0005 variable condenser, slow-motion type or with slow-motion dial (Igranic, Lissen, Cyldon, Formo, J.B., Dubilier, Ormond, Bowyer-Lowe, Lotus, Ripault, Raymond, Colvern, Peto-Scott, etc.).
- 1 ·0003 fixed condenser and one ·001 ditto (Dubilier, T.C.C., Mullard, Lissen, Clarke, Burne-Jones, etc.).
- 1 ·0001 reaction condenser (Bowyer-Lowe, Cyldon, Peto-Scott, Dubilier, J.B., Ormond, Igranic, etc.).
- 1 H.F. choke (Lewcos, R.I.-Varley, Cosmos, Lissen, Bowyer-Lowe, Climax, Colvern, Dubilier, Wearite, Burne-Jones, Peto-Scott, Igranic, etc.).
- 1 2-megohm grid leak and holder (Mullard, Ediswan, Lissen, Dubilier, Igranic, Marconiphone, Pye, etc.).
- 1 L.F. transformer, low-ratio type (Lissen, Brown, R.I.-Varley, Pye, Igranic, Mullard, Marconiphone, Philips, etc.).
- 1 On-off switch (Lissen, Benjamin, Lotus, Burne-Jones, Igranic, Peto-Scott, etc.).
- 1 Wave-change switch of usual type (Lissen, Lotus, Burne-Jones, etc.).
- 2 Sprung valve holders (Lotus, Pye, W.B., Benjamin, B.T.H., Marconiphone, Wearite, Burndept, Formo, Igranic, Ashley, Burne-Jones, Bowyer-Lowe, etc.).
- 1 Terminal strip, size 10 in. × 2 in., and 10 terminals (Eelex, Igranic, Belling-Lee, etc.).

Quantity of wire, flexible, screws, etc.

THE "EMPIRE" TWO.

(Continued from previous page.)

not unlike the older method of obtaining reaction by means of a swinging coil. But in this case the coil is not variable; it is closely coupled to the secondary winding.

The actual reaction control is carried out with the aid of a small ·0001 variable condenser. This scheme is known as "throttle" control, and is one of the finest methods in existence of getting smooth reaction.

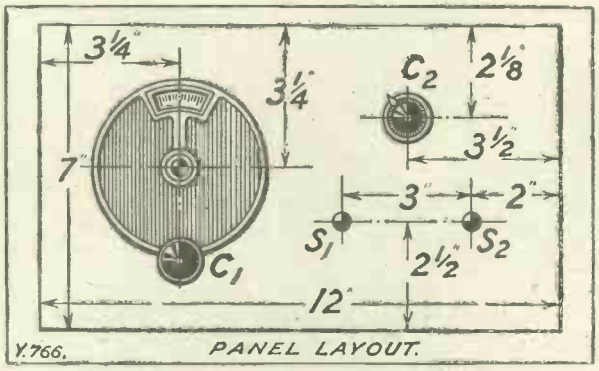
On the long waves when the loading coil is switched in, a portion of this coil is utilised to obtain reaction, together with the existing reaction winding used on the 250-500-metre band.

The Series Aerial Condenser.

A "neutralising" condenser is placed in series with the aerial for short-wave work. The reason for this very small condenser is that some aerials have a large capacity, possibly due to such causes as their proximity to buildings or trees, and because of this it is frequently difficult to get the set to oscillate on wavelengths of about 30 metres, and should be very valuable in such cases. The small condenser should always be tried when it is found that the receiver does not function as it should with the aerial lead joined to A_2.

The L.F. stage is of normal type, and any transformer of medium ratio is suitable. As a matter of fact, on the very short waves a fairly high ratio instrument or, alternatively, a moderately-priced one with not too large a primary winding is frequently an advantage.

Now for the constructional details. Since there is no high-frequency stage, the layout is not super-critical, and small variations are not likely to have a detrimental effect upon the working of the set. Even so, it is highly desirable to follow the lay-out as shown in the photographs and on the wiring diagram. After all, one cannot do better than to copy the original.



Making a Start.

Start off by drilling the panel. Take a scriber or a sharp nail and a straight-edge, and mark off the drilling centres in accordance with the dimensions given in the diagram. Then drill the four holes for the components, which comprise the tuning condenser, reaction control, and the two switches. All these are of the one-hole-fixing type.

Mount these on the panel and do not forget to choose a good slow-motion dial for the tuning condenser, otherwise you will never be able to tune in the short-wave transmissions.

Drill four holes along the bottom edge of the panel about $\frac{3}{16}$-in. up, to secure it to the baseboard, and use ordinary wood screws, preferably countersinking them for neatness.

Then having screwed the panel *firmly* to the baseboard commence the layout by placing the various components in position as in the wiring diagram.

Note how these have been arranged so as to be able to obtain short leads where possible.

Screw down the parts and mount the terminal strip against the back of the baseboard.

Place the three coil sockets in position with the coils in place if you can, because you will then be able to see how far apart to put the sockets.

The coils should be just touching, or very nearly so.

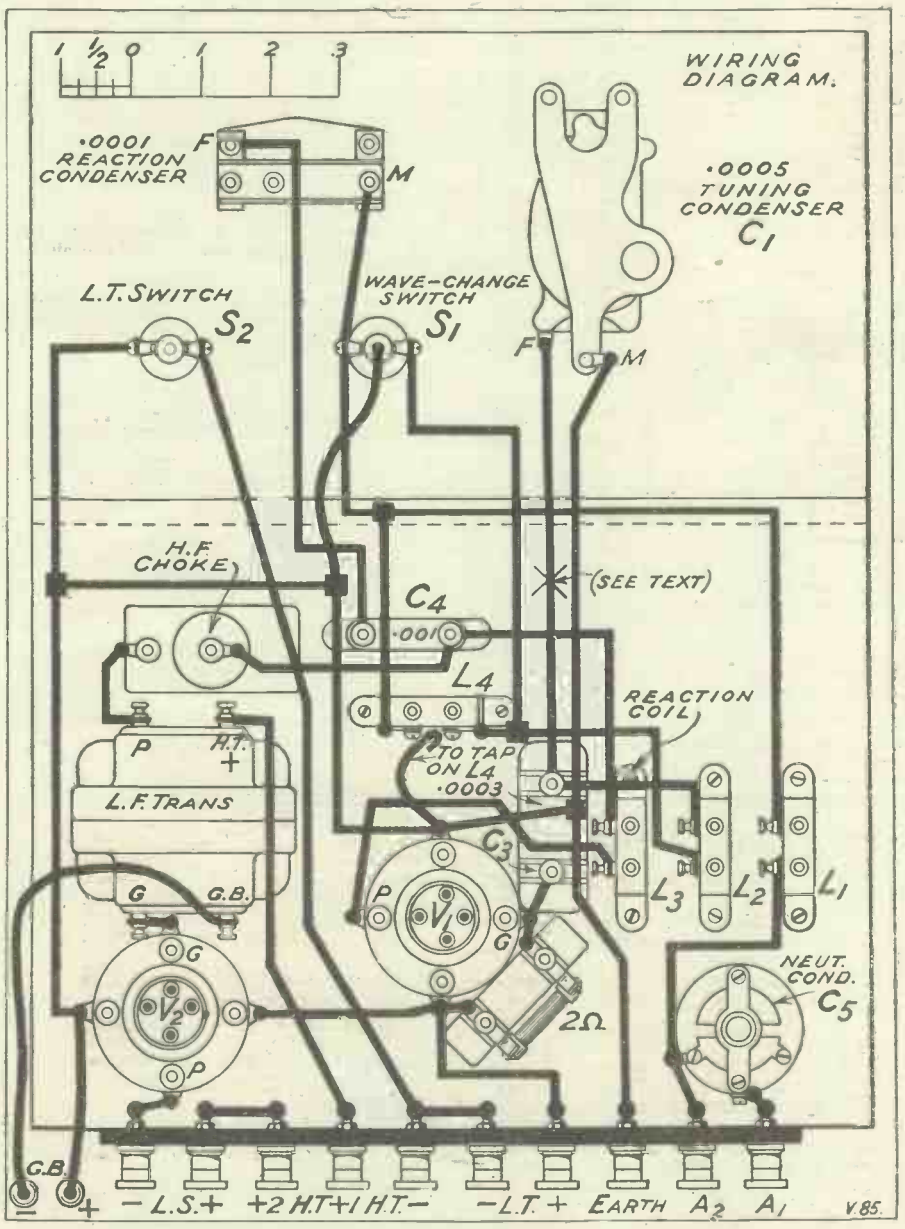
Wiring up.

Now you can make a start with the wiring. Use insulation covering on all the leads, either Systoflex tubing or Glazite, and bend the wires carefully in order to keep the spacing as per wiring diagram and as shown in the photographs.

You will note that there are two flexible leads, apart from those for G.B.+ and —. One goes from the L.T.— terminal of the valve holder V_1 to the tap on the loading coil and the other from the centre-point on the wave-change switch to earth and L.T.—.

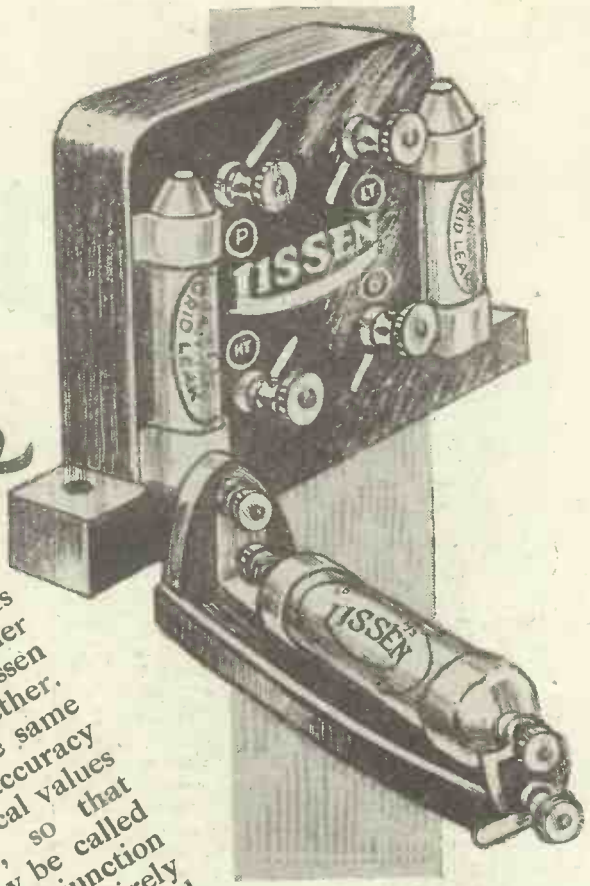
Wherever possible it is advisable to solder the various wires because a good mechanical joint is very necessary on the short waves. These are the main points to note in wiring up.

(Continued on page 711.)



LISSEN

THE PARTS THAT PULL TOGETHER



BUILD *any* published circuit entirely of Lissen parts and you will get better results than ever the original designer dreamed of. Because Lissen parts are made to pull together. They are made to the same high standard of accuracy throughout, the critical values adjusted carefully, so that any parts that may be called upon to work in conjunction with one another are entirely suitable. The result is a balanced circuit that retains its original selectivity and quality of reproduction throughout its life.

LISSEN FIXED CONDENSER.

Holds its charge and delivers it without leak or loss. In any R.C.C. circuit, the condensers you use should be absolutely leak-proof, otherwise 50% of volume will be lost. Lissen condensers never leak, never vary, and they are accurate to within 5% of their marked capacity.

·0001 to ·001. Price, each **1/-**

·002 to ·006. Price 1/6 each.

LISSEN GRID LEAKS.

These resistances are absolutely unvarying, no matter what the conditions or the current load. All values, each **1/-**

LISSEN R.C.C. UNIT

Embodies a ·01 condenser which delivers all its stored-up energy and resistances that will never vary, no matter what the current load, interchangeability of resistance values. Price **4/-**

LISSEN WIRE-WOUND RESISTANCES.

Ohms.		Price.
10,000	..	3/6
20,000	..	3/6
25,000	..	3/6
50,000	..	3/6
80,000	..	4/6
100,000	..	4/6
150,000	..	5/6
200,000	..	6/-
250,000	..	6/6

Use all Lissen parts in every circuit no matter what is specified and get results you could never get with mixed parts. Practically every radio dealer will help you in your use of Lissen parts.

LISSEN LIMITED,

8-16, Friars Lane, Richmond, Surrey

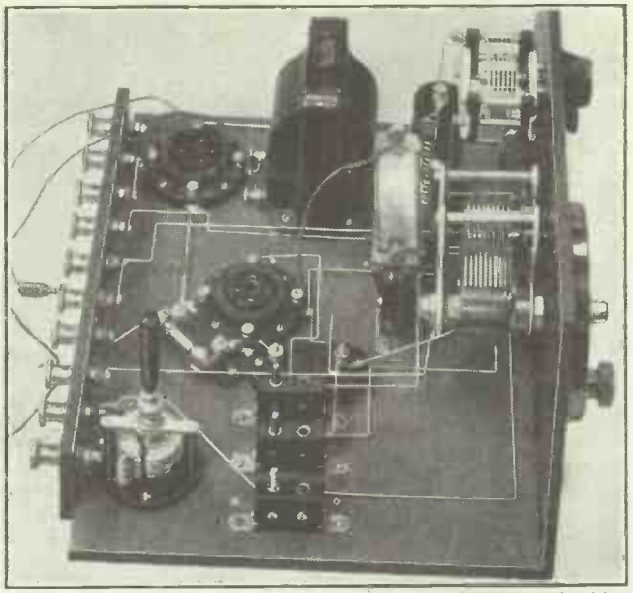
(*Managing Director: THOS. N. COLE*).

THE "EMPIRE" TWO.

(*Continued from page 708.*)

When you have completed the constructional work you will naturally be eager to try out the set.

Well, the connections are as follows: Join the highest voltage tapping on your H.T. battery to H.T.+2 and take a tapping at about 40 volts to H.T.+1.



This view shows the tuning end, where good spacing and sound wiring are essential.

Connect H.T.– on the H.T. battery to the H.T.– terminal on the set. Join up L.T.+ and– on your accumulator to their respective terminals on the strip. Connect up the aerial and earth, taking the aerial to A_2, and join your 'phones or speaker to L.S.+ and–.

Testing Out.

In coil socket L_1 place a No. 25 coil and in L_2 a No. 60. L_3 is the reaction-coil socket and it is probable that a No. 35 or 50 coil will suffice. Try a No. 35 first. In L_4 place a No. 200 coil of the X or tapped variety and join the flexible lead to one of the tappings. Pull the wave-change switch out.

In valve holder V_1 insert a general-purpose valve similar to the Marconi H.L.210 in the 2-volt series, and in V_2 any small power valve.

Now switch on, using the switch S_2. Rotate the tuning condenser and keep the reaction control in a position so that the set does not oscillate. You should have no difficulty in hearing your local station or 5 G B at good strength. If you find that you cannot obtain reaction use a larger coil in the L_3 socket and if this does not remedy matters try reversing the two leads to the coil socket (L_3).

Now try for the long-wave station 5 X X by pushing in the wave-change switch. Rotate the tuning condenser and note whether you obtain any reaction when you turn the reaction knob.

If not, try another tapping on the tapped coil L_4.

For the very short-wave stations you will need a set of short-wave coils, such as the Igranic or Atlas.

Place a 2-turn coil in L_1, a 4- or 6-turn coil in L_2 and one of six turns in L_3. Place the set in an oscillating condition and see whether you can tune in the carrier-waves of a station. 5 S W is a good one to try for. Let me warn you that tuning in these very short-wave transmissions requires a certain amount of practice, and you must not think that you will be able to obtain wonderful results without some experiment. Even experts cannot tune in these stations just when they wish. Atmospheric conditions are an important factor and a delicate touch of the reaction and tuning controls is very necessary.

Smooth Reaction.

Decrease the H.T. voltage on the detector until you obtain perfectly smooth reaction. Try the aerial on both A_1 and A_2 and see whether removing the earth lead helps matters at all. Wear 'phones for the preliminary tests on the short waves.

You may find the reaction control very critical on 20–30 metres. It is frequently the case that the removal of one's hand causes signals to vanish. This being so, the use of an extension handle on the reaction knob will often reduce this trouble.

When on the short waves try various H.T. values on the detector until you get the best results. You may find that 20 volts is ample and just right for smoothest reaction.

LOUD-SPEAKER "BOOM."

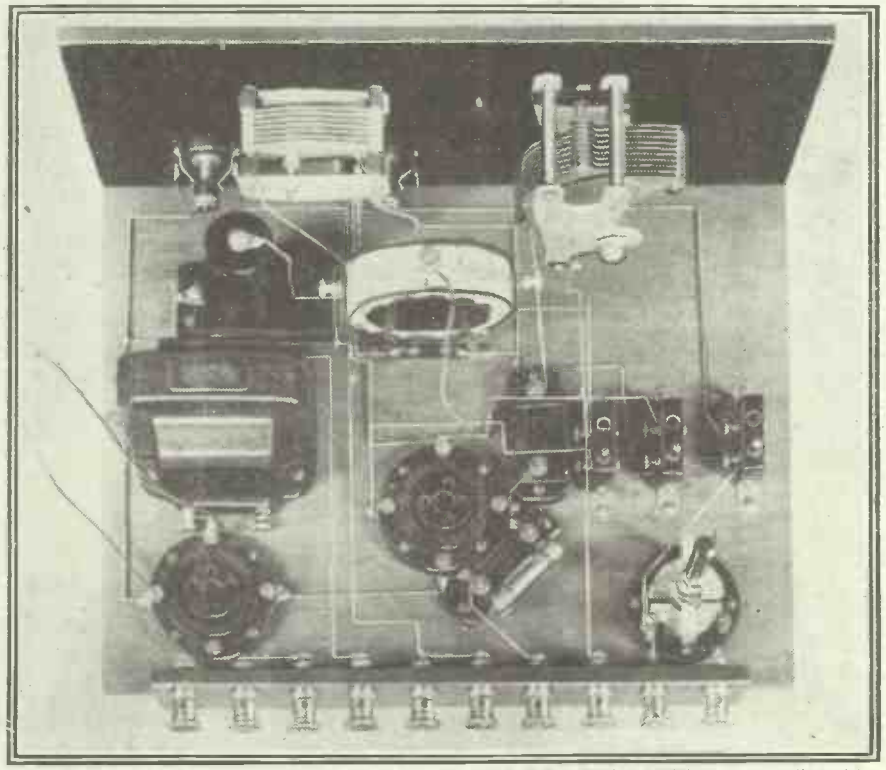
HORN-TYPE loud speakers, more especially the older models, are often observed to give rise to a "booming" effect in their reproduction of speech and music, an effect which is rather apt to give the hearer the impression that the music or speech is issuing forth from out of a long tunnel or deep shaft.

Added to this loud-speaker "boom," there is often a certain amount of rattle and reverberance which makes the reproduction most unpleasant to listen to.

Faults of this nature are often very difficult to cure. Their cause, in many instances, lies in the defective design of the horn of the instrument, and, this being the case, it cannot be eliminated entirely.

Despite this, however, it is generally possible to make a very big improvement in the reproduction by the simple process of connecting the two magnet coils under the diaphragm *in parallel*, instead of in series, as they will be found to be wired. This re-arrangement tends to lessen the diaphragm vibration on the low and middle-low notes, and, as these are the very notes on which the speaker gives the unpleasant boom and rattle, a much greater clearness of reproduction will be effected.

For slight booming and rattling effects, a plug of gauze or of cotton-wool stuffed *very lightly* into the neck of the speaker will effect a great improvement without, at the same time, muffling the tone.



The "Empire Two" seen from behind the panel. Compare this view of the original set with the wiring diagram on the previous page, and you won't find the slightest difficulty in wiring-up.

LATEST BROADCASTING NEWS.

THE PASSING OF UNCLE PETER

LORD MELCHETT AND THE B.B.C. — BROADCASTING HOUSE—TELEVISION DEVELOPMENTS—BRIGHTENING 5 G B — MR. PITT VISITS WALES — "THE THIRD DEGREE" AT MANCHESTER—RADIO REVEL AT NEWCASTLE.

LAST week POPULAR WIRELESS gave the first hint of important impending changes in the organisation arrangements of the B.B.C. Children's Hour. It is now possible to add that Mr. C. E. Hodges, chief of the Children's Hour for the past three years, has resigned, to be replaced by Mr. Alan Howland.

The passing of Uncle Peter will be regretted by many children, and other members of Radio Circles up and down the country. Except that Mr. Hodges is stated to be returning to the film world, which engaged his attention before, no reason is given for this move. Fortunately, however, Uncle Peter is to continue to contribute to the Children's Hour from the outside, particularly in his well-known barnyard scenes.

Lord Melchett and the B.B.C.

Lord Melchett was "down" to give the most important talk of the series on industrial tendencies arranged by the B.B.C. According to gossip at Savoy Hill, Lord Melchett departed for Paris on the day arranged for the talk, and made no explanation whatever to the B.B.C. In the end the talk was read by an announcer. There were other circumstances which annoyed people at B.B.C. headquarters. The result is that Lord Melchett and the B.B.C. are no longer on "speaking terms." It will be interesting to see whether any "remarks" will be made by either side.

Broadcasting House.

Now that the contracts for Broadcasting House have been signed, sealed, and delivered, public interest is reawakened to what the B.B.C. have in mind. From the imaginative illustration issued by Savoy Hill, it is apparent that the architectural style is the rugged American, after the model of Bush House. It is by no means certain, however, that the building will be as symmetrical as is represented.

The reason for this is that the B.B.C. has had a lot of trouble with various authorities in the course of an endeavour to adjust the building line. It may well turn out that the building will be lopsided.

Television Developments.

A curious calm has fallen upon the relations between the B.B.C. and Baird Television. Mr. Sydney Moseley, the versatile publicist, who is chivalrously sponsoring the Television cause, and is usually decisive in his views of B.B.C. policy towards Television, shows a surprising reserve lately.

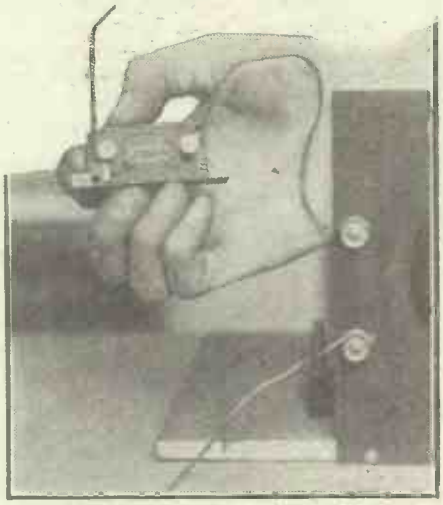
It is rumoured that some big technical development is about to be announced at Baird Headquarters. Meanwhile, the B.B.C. seems to have dismissed the subject except for a murmur the other day when the check-receiver at Savoy Hill discovered the Long Acre transmitter wandering from its allotted wave-length of 200 metres.

Brightening 5 G B.

The extension of the lighter side of 5 G B's programmes, as it affects the major part which comes from the Birmingham studios, has been decided upon, particularly in the provision of more musical shows on revue and concert party lines.

A start will be made during the afternoon programme on Saturday, December 22nd, when what is described as a New Radio Show with the title of "Moonshine," written and arranged by Charles Brewer, with sketches by Edwin Lewis, will be broadcast. The cast includes Edith James,

IF YOU GET A FIXED CONDENSER IN YOUR STOCKING! . . .



Remember that you can often improve selectivity, and prevent programmes from trespassing on one another's ether by connecting a ·0001 (or thereabouts) between the aerial terminal and aerial lead-in.

Phyllis Lones, Harry Sennett, Alfred Butler, Harry Saxton, and Brian Victor. 5 G B remains by far the most popular of B.B.C. stations.

Mr. Pitt Visits Wales.

Christmas music, including compositions by Percy Pitt, Musical Director of the B.B.C., and Victor Hely-Hutchinson, a member of the staff at Savoy Hill, will form the programme to be given by the National Orchestra of Wales in the City Hall, Cardiff, on Saturday evening, December 22nd. Part of the concert is to be relayed to 5 G B listeners, the artist being Topliss Green (baritone). Later, the Station Repertory Choir will contribute some well-known carols in which, it is hoped, the Orchestra will join.

The National Orchestra will also be heard on Thursday, December 20th, when the concert in the City Hall will include the last scene of the "Mastersingers," May Blyth, Tom Dickens Alexander, Arthur Fear, Parry Jones and William Michael being the principals. The choir of seventy will be drawn from the Cardiff Musical Society.

Incidentally, it is good news that Mr. Pitt has been persuaded not to take advantage of the privilege of retirement next year.

"The Third Degree" at Manchester.

A typical example of the requests for repeat performances of various items in the programmes at more or less regular intervals is provided by Charles Klein's four-act play, "The Third Degree," which is to receive its third broadcast from Manchester on Saturday, December 22nd.

After its first performance, 500 congratulatory letters were received, the writers of most of which asked for an opportunity to hear it again. The second performance resulted in well over 1,500 letters from listeners, and though more than two years have since passed, requests are continually being received that the play shall be broadcast again. Such are the difficulties and compensations of the programme builders.

Radio Revel at Newcastle.

The Newcastle Station has decided again to organise a Radio Revel for young listeners, the date fixed being Saturday, December 22nd. The event will take place in the Grand Assembly Rooms, Barras Bridge, where the Lady Mayoress, Mrs. Arthur W. Lambert, will present awards for the best fancy dress. By the way, why doesn't London have another Radio Revel on the lines of that which was so successful in 1925. Wake up, Savoy Hill!

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

FILTER CIRCUITS

GRAMOPHONE INTEREST—A BLESSING IN DISGUISE, Etc., Etc.

Filter Circuits.

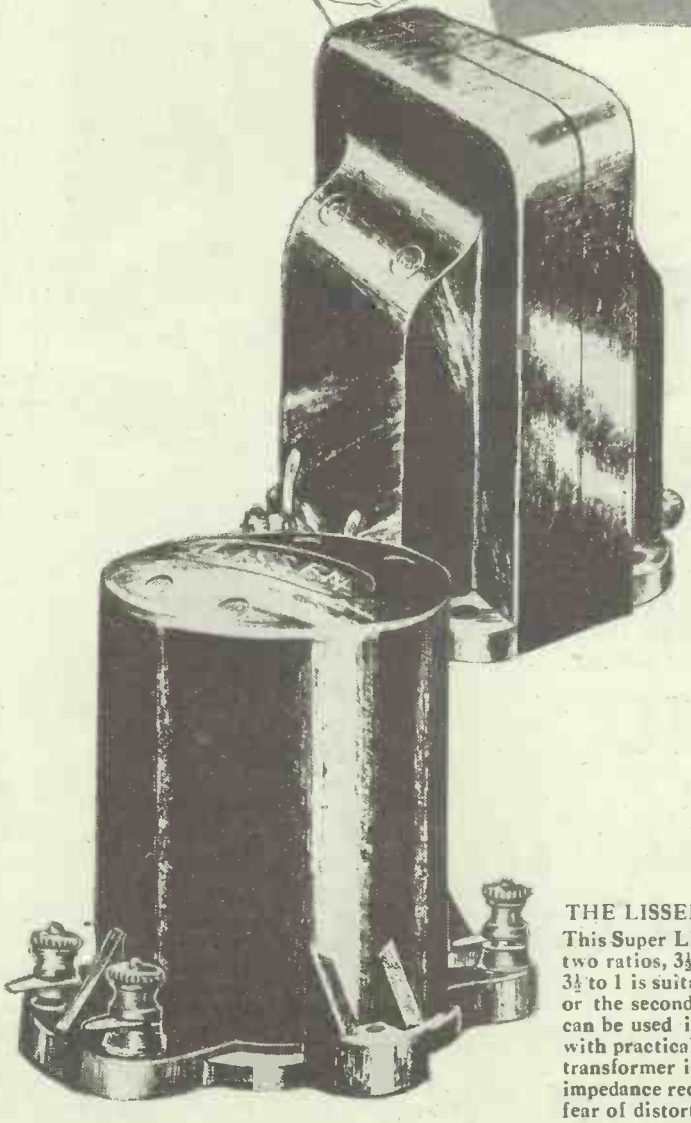
FILTER circuits are now used for such a great variety of purposes that it is almost impossible to define in what cases filter circuits may be useful or in what particular way they may be employed. They have, of course, been used for a very considerable time past in telephone circuits of all types and, as you know, they have served many very useful purposes in radio receiving circuits during the past few years.

In these days of loud-speaker improvements, especially where very large volume of reproduction is required, filter circuits are finding a still further field for useful application.

Various Types.

As I am often asked questions relating directly or indirectly to the use of filter circuits for various purposes, I should perhaps say first of all that a filter circuit may be roughly described as a circuit arrangement which will separate direct-current from alternating current (or vice versa) where the two are already mixed,

(*Continued on page* 760.)



There's a hush of expectancy—the sharp tap of the conductor's baton—and then through the silence comes the melody of familiar instruments.

Judge a Lissen Transformer by the intensity of this preliminary hush; you will not hear a sound to break the stillness. By this alone you may know that the Lissen Transformer brings a new standard of purity to transformer amplification. Test the Lissen Transformer by any other standard—listen for the low bass notes of some sonorous chord, or be critical of the purity of some passage in the upper register. In every case you will find the Lissen Transformer is supreme and ***this is scientifically proved*** by the laboratory curves taken with a Lissen Transformer using ordinary standard valves; these curves show that a Lissen Transformer gives *exceptionally* even amplification over the whole band of audible frequencies.

LISSEN
TRANSFORMERS

THE LISSEN SUPER TRANSFORMER

This Super LISSEN Transformer is made in two ratios, 3½ to 1 and also 2·1/3 to 1. The 3½ to 1 is suitable for use in either the first or the second stage of an L.F. amplifier, or can be used in cascade for both stages, and with practically any valve. The 2·1/3 to 1 transformer is suitable for use after a high impedance rectifier valve without fear of distortion or loss of high notes and overtones. The price is the same for both ratios.

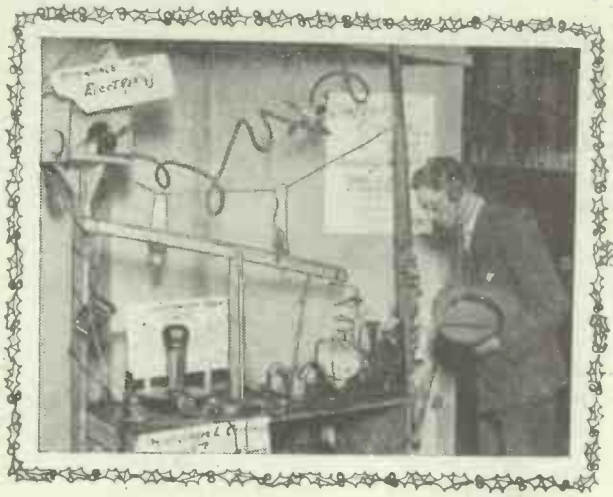
19/-

For GENERAL USE the 8/6 TRANSFORMER IS STILL SUPREME AND WILL NEVER BREAK DOWN

The famous 8/6 Lissen Transformer is suitable for all ordinary purposes, and its huge sale proves it still supreme value. It continues to earn high praise as "the transformer that never breaks down." Turns ratio 3 to 1. Resistance ratio 4 to 1.

8/6

LISSEN LIMITED, 8-16, Friars Lane, Richmond, Surrey (Managing Director: THOS. N. COLE.)



XMAS RADIO EXPERIMENTS

Wireless, coupled with a little imagination, can be employed as a most mysterious and effective Christmas Entertainer. Here some perfectly wonderful party stunts are described in detail.

By H. BRAMFORD.

AT Christmas old jokes are raked up, old games are played once more, some in new guise and some with new names, but all based on ideas which are as old as the hills.

Even wireless as a source of entertainment has been exploited, but there are a number of ways of introducing this new visitor to our party. So we will assume that we are going to have a party with the assistance of Mr. Radio, the great entertainer.

Announcing Arrivals.

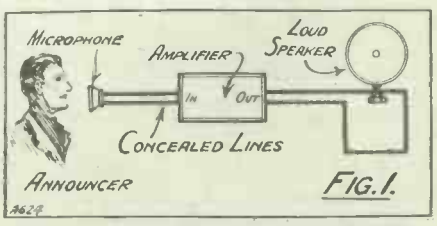
Everything is in readiness, suppressed excitement reigns all over the house, and it is time for the guests to arrive at our long anticipated party. A knock at the door, a rush, the first guest has "turned up." Effusive greetings and he or she or both are escorted into the reception room.

As soon as they enter, the loud speaker loudly announces to the host and hostess, "Master Percy Boyd," or whatever the name or designation of our guest may be. Think of his surprise, and the first question will be how is it done.

At this point I should like to warn all entertainers: Never explain how such a thing as this is done! A good conjuror would not be considered good for long if he explained how he performed his tricks. In this case you can tell your friend that you have made arrangements with 2 L O to announce all your visitors as they arrive, which is done by a special new telepathic process combined with televisual transmigration. This will give the learned atmosphere so necessary to the entertainer. The guest then will take great interest in the advent of the next arrival, which is what you want him to do.

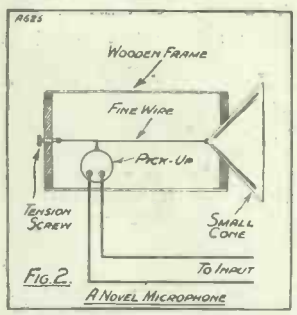
How It Is Done.

This performance, which is really the basis of some of the other suggestions made in this article, is quite easily carried out and, in this particular instance, is not absolutely new, but is presented with new adaptations. A two-valve amplifier is best for the purpose, or if you do not possess this separately, you may use an ordinary receiver by coupling to the input of the first transformer, or making the same connections as would be used between a gramophone pick-up and the set.



This is the "Give-your-Guests-a-surprise]" apparatus—and you will see it is quite easy to rig up.

From the input secret lines, which are connected to an earpiece, are laid to an adjoining room, a small microphone or the pick-up itself may be used for the purpose. The diagram, Fig. 1, shows how the arrangement is set out, and Fig. 2 shows how a "pick-up" is used as a microphone. The announcer in the adjoining room must be in a position to see the guests arrive, but not so that they can see him. As each one enters he just calls out their names with due ceremony, and this is reproduced through the speaker in the reception room with greatly increased volume. The set is "on" for the purpose, but the aerial and earth are temporarily disconnected.



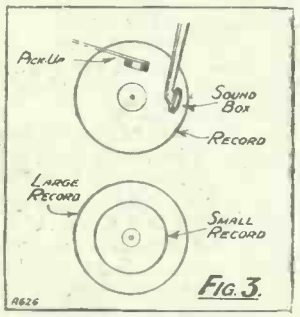
If a microphone or ear-piece is not available, the ingenious constructor can rig up a novel microphone upon the lines shown here.

While the guests are amusing themselves in some other part of the house, your family engineer prepares for the next experiment. In the meantime, over the tea-table you announce that you intend to carry out an entirely new experiment of great interest and of a very wonderful nature. You then make the startling announcement that you have invented a receiver which can read thoughts and which is almost human.

Thought Reading by Wireless.

For this entertainment the receiver is exactly the same as before, but has been inspected during the interval to see that all is in perfect order, as failure in such a case is fatal to the reputation of the performer. The announcer once more quietly takes his place in the adjoining room, slipping out unseen by the others. This time he is in "co" with the performer and has a previously prepared list of announcements to make in their correct order.

The performer memorises the various questions he is to make, which may not be more than six in number, as a prolonged performance dulls the interest of the audience. Start off by asking a question, which you declare your receiver will answer for you, such as "How many persons are there in this room?" The concealed announcer immediately speaks into the "mike" saying in a clear but disguised voice "Twenty," or the number that there actually are.



The Mad-Jazz Band will give a surprising and indescribable turn if arranged in the manner dealt with on this page.

As each question is asked, the performer "switches on" the set, which will be the signal to the announcer to answer, as if he listens at the "mike" he will hear the switch, then he announces and waits to hear the switch put "off" in readiness for the next question. In the second instance you may, by way of variety, hide something and demand an answer as to where it is and so on. If properly carried out the whole performance should be a great success, and there is no possible means of the audience arriving at a solution to the mystery.

Real Jazzy Jazz.

Now leave the receiver for a while, disconnect the concealed input lines, and link it up to the gramophone by means of the pick-up. Induce your recent audience to forget all about radio mystery, and tell them that you are going to treat them to the last word in real jazzy jazz, with all sorts

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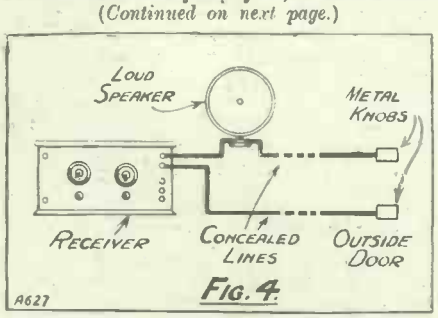


Have you ever heard of kiss-control? Arranged like this, the loud speaker will loudly give the game away, and tell the audience just how much kissing is going on!

XMAS RADIO EXPERIMENTS.

(Continued from previous page.)

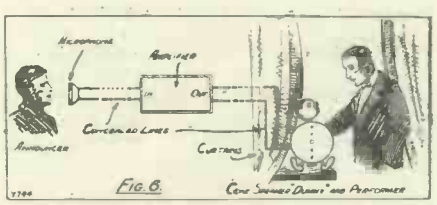
of variations. No one minds a little noise at Christmas-time, and if they do, invite them to come and share it. This is the opportunity for dancing, and such games as musical chairs, and so forth, or a general romp. You can first switch on the set if music is being broadcast or play the gramophone records via the pick-up, and then demonstrate your jazz band gone mad.

Really Modern Music !

The mad jazz is simple to conduct, and the general idea is shown in the diagram, Fig. 3. Place the soundbox, which is attached to the tone-arm of the gramophone, on the record at the point where the grooves begin. Then place the pick-up on the same record, but a few grooves further in.

Start the motor and the result is indescribable and can be varied in all sorts of ways by altering the distance between the starting points of the two instruments. The volume from the receiver via the pick-up should be toned down to equality with that of the gramophone itself from the tone-arm soundbox, as with the two running together one should not drown the other for real effect. This adjustment might be made before demonstration.

The same idea can be carried out by using two records, one small, of the 6 or 8 in. diameter type, which is placed on the turntable over one of the 10 or 12 in. type. Thus, with the sound-box on one and the pick-up on the other, the medley of two distinct tunes is obtainable, often with interesting effect.



The ventriloquial performance is the star turn of the evening—if the "dummy" has a real live person's voice.

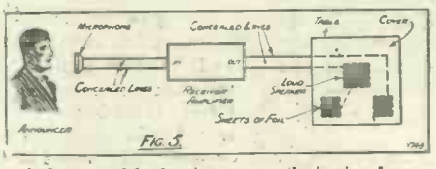
"Giving the game away" is a new version of that time-old game, Postman's Knock. You propose that this should be the next game to play, and no doubt many of the party, both grown-ups and children, will heartily agree. The essential thing is that the party must now be in one room, the host in the room where the receiver is, and the postman outside the door of this room.

The game causes all the usual fun, with a lot of extra fun in the nature of harmless chaff and uproarous laughter. For what actually happens is that the receiver is made to give a definite indication of the actual amount of kissing that goes on; or, in other words, it simply "gives the game away."

How It Is Done.

Remove one of the connections made by one of the loud-speaker leads to the set, and from it extend a secret line, together with a further concealed line to the outside of the door where the postman knocks. At the end of each line attach a metal knob, and conceal the wired part. The players are instructed that in this particular kind of postman's knock it is essential for each player outside the door to touch one of the knobs and to keep their hands on it.

You tell them that if they fail to do this a forfeit must be paid, or that something will happen. The postman knocks, and whoever is called for comes from the room beyond and out to the postman. Now, as soon as they kiss, or continue kissing, the music will start up from the speaker. Adjust the volume so that it is just audible to those in the room. If they stop kissing, or



A deep sepulchral voice, apparently issuing from your victim, announces to all and sundry "I am silly" !

do not kiss at all (?), there will be no response from the loud speaker.

The reason is that as soon as the kissing commences the circuit is completed by human contact, and this sets the receiver in operation. The receiver is on all the time, of course, but only operates when contact is thus made. What an opportunity for endless chaff and merriment, whatever the result may be !

When the first players have been caught they are let into the secret, so that they may enjoy the joke at the expense of the players who follow them. The illustration, Fig. 4, should make the preparation of this trick quite clear.

Magnetic Power.

All these things need not be tried at one party, but a suitable selection may be made and practised beforehand. In this instance the same lines are used as for the previous example. To commence with, the performer boasts of his wonderful power of magnetism, which is always an attractive subject to the uninitiated. Then he proceeds to prove that by simply exercising this remarkable gift under great stress of will power he can cause music or speech to emanate from any person present simply by touching them.

Force of Will !

The lines which were used for the previous game are used once more, but this time they are concealed beneath the table-cover. At the end of each line a piece of tin-foil is attached, and the loud speaker is hidden below the table. The announcer once more fades away into the next room and attends to the "mike" lines.

You take two pins and give one to your victim; then stick your pin into the table over one of the tin-foil pieces and tell the other player to stick his pin into the table, also, just where the foil is concealed. You can signal the announcer at appropriate intervals by sharply rapping the table, apparently for general attention, which he should hear.

You have, of course, prepared your questions beforehand with him. Supposing you start off by telling your victim that you will make him say, by sheer force of will, "I am silly." He will not believe you, so you rap the table and immediately take hold of his hand or touch his face and look him sternly in the eyes, and immediately a deep, sepulchral voice, apparently from him, will announce the startling fact, "I am silly," which, of course, is really spoken by the announcer into the mike in the next room. Your remarkable powers will be recognised by all, and although the victim will swear he did not say it, no one will believe him. (Fig. 5.)

A Ventriloquial Performance.

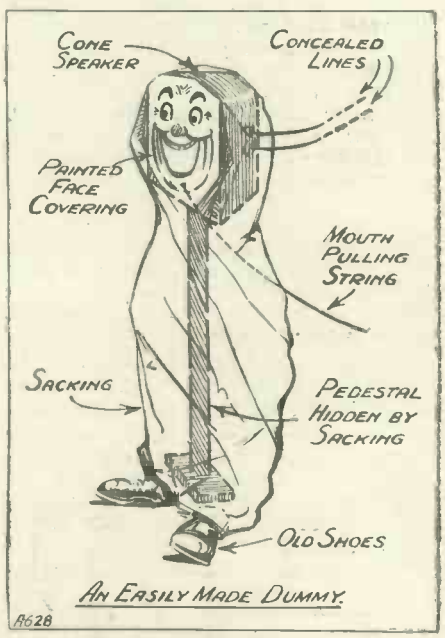
This is the event of the evening. All the other tricks have been temporarily forgotten in the midst of laughter and merriment. Refreshments have gone round many times, and the hour is getting late. Thoughts turn to Scrooge, and Tiny Tim, and ghosts, and bed. It has been a jolly time, so let us wind up well. The great ventriloquial act is about to be performed.

Preparations.

Prior to this turn everyone except those sharing the secret should be accommodated in another room. The performance room is then lit with subdued lights. A small stage, appropriately curtained, is temporarily erected. The receiver is as before, and the concealed input lines are still used, and the announcer is also concealed. The output lines are used and concealed, and terminate at the figure of a dummy such as is usually used by a ventriloquist.

This dummy should be a really good one, and should by itself, without speaking, make the spectators laugh. The dummy is, however, really made up from a cone speaker which offers good scope for disguise. The output lines are connected from behind, and all is ready for the ventriloquial act of the evening.

A movable mouth may be operated on the dummy by means of a piece of string. Fig. 6 shows how the general scheme is laid out, and, providing everything is in order, the turn should be a great success and a good wind-up for the night.



Old clothes, an easily-made stand, and a cone loud speaker are all that is necessary for the production of a perfect dummy.

The *New Amplion* can roar. Hear it on a Saturday afternoon when a football match is being broadcast. The *New Amplion* can whisper. Listen to Auntie whispering half-secrets to Uncle in the Children's Hour. The *New Amplion* can be Sir Henry Wood and all his Orchestra—or A. J. Alan. For this is no ordinary speaker ▣ It is the first speaker (not excepting the expensive-to-operate moving coil type) to tell the truth about broadcasting. It lets you know that the B.B.C. 'cellos are bass instruments and that the B.B.C. drums give a deep boom. It tells you when Albert Sandler is fingering the E string tremulously near the bridge. All things that are clear at the microphone are clear at the mouth of the *New Amplion*. It gives measure for measure. No more. *No less.* ▣ This "no less" is its triumph. The subtleties, the depths of tone which the ordinary loud speaker cannot reproduce, are revealed by the *New Amplion*. It represents a new era in the science of sound reproduction. Hear it to-day.

AMPLION®

The *New Amplion* Speakers in Handsome Cabinets of Oak or Mahogany range in price from £9 10 0 to £42 0 0. Chassis only, £6 and £8.

The Amplion Radio Gramophone in Oak £58 12 6 . . . . in Mahogany £63 12 6, including Royalties.

Amplion Standard Speakers, Cone and Horn Types, 52/6 to £5. Junior Models, 35/- to £3 3.0.

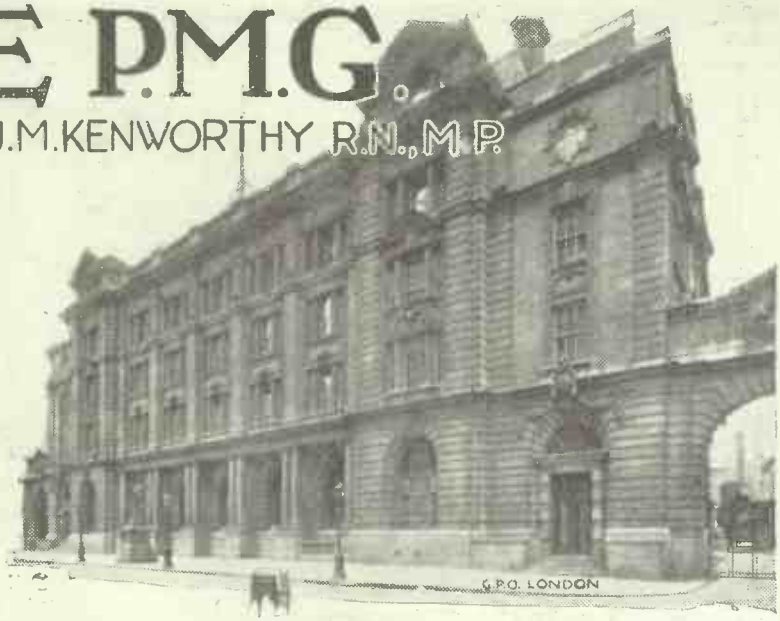
Catalogue from all Radio Dealers or from Graham Amplion Limited.

London: 25/26, Savile Row, W.1.
Manchester: 10, Whitworth St. West.
Glasgow: 6/8, West George St.
Works, Slough.

IF I WERE P.M.G.

BY COMMANDER THE HON J.M.KENWORTHY R.N., M.P.

Some interesting things would happen to radio if the writer of this pungent article had the G.P.O. under his control.



IF I were the Postmaster-General, which Heaven forfend, there are many things about which I should energise; such as extending and improving the telephone service and providing country postmen with motor-bicycles. These are, however, outside the scope of this article.

Particularly would I do something drastic about wireless generally. I fear the present Postmaster-General, his political assistant and his department as a whole, have not yet "tumbled to" the immense importance of wireless telegraphy and telephony generally, and broadcasting in particular.

This great invention will eventually have an effect on humanity similar to that of the printing press. A particular responsibility rests on the Postmaster-General as the representative of the Government in the matter, in that we have allowed a monopoly under complete Government control to be set up. And the only apology for a monopoly in such an institution as broadcasting is that it must be thoroughly efficient, up to date, and give the best possible service.

The P.O. "Rake-off."

Now this is partly, but only partly, a question of money. The British Broadcasting Corporation needs all the money it can get, firstly, for the benefit of the public; and secondly for national prestige; for our wireless programmes and concerts are listened to by the public in most European countries and presently, as the technique of the science improves, will be available for the whole civilised world.

To begin with, what justification does the Post Office itself have for taking a rake-off of 2s. 6d. in every 10s. wireless licence? In the last five or six years they have probably been making a profit on this every year of between £100,000 and £150,000; and there should be a surplus of, at least, half a million pounds in hand. Who has this money, what is being done with it, and why shouldn't it be devoted to the development of our wireless system?

I speak of profit, because the cost of issuing the licence is nothing like 2s. 6d. each. The Post Office does a huge business in pensions, postal orders, money orders, telegrams, etc., and the same staff issues the wireless licences.

Graduated Licence Fees.

This licence isn't a tax like the game licence, the dog licence, and the gun licence, for the benefit of the Treasury; and yet, such is the force of habit and precedent, when the B.B.C. was in its infancy and licences were issued by the hundred this rake-off was started; and continues now that licences are issued by the million.

Apart from the improvement in equipment and broadcasting stations which could be made with extra money, better fees could be paid to the artists who entertain the public. Indeed, one of the many functions of wireless should be to encourage and develop all forms of British art, musical, dramatic, poetic, etc. Still, on the question of finance, I would be in favour, unless there are insuperable difficulties in the way, of graduating the licence fee.

It is not democratic to charge the same licence fee to the owner of a cheap crystal set as to the owner of a fifty-guinea multiple-valve apparatus. The tax should be graduated, as it is with motor-cars; but should not be so high as to hamper the industry as, I am afraid, the horse-power tax has hampered the development of all but the lightest type of motor-cars.

Commdr. The Hon. J. M. Kenworthy, R.N., M.P.

And, in any case, I would give a rebate on sets that are incapable of interference and oscillation. The neutrodyne receivers, for example, should get an allowance off. And this brings me to the question of interference generally.

Far more drastic steps should be taken to detect and prevent this nuisance. Careless oscillators, with their "howling," should not be allowed to interfere with the enjoyment of innocent people, and we should wage a really strenuous campaign against this minor trouble of the wireless world.

The Imperial Aspect.

And before I finally leave the all-important question of finance, an extraordinary intention was expressed by the Government, when the present departmentally-controlled organisation was established, that the surplus or profits from the B.B.C. should go to the Treasury! This, as Postmaster-General, I would fight to the utmost. Any surplus should go to the improvement of the service; and, after that, to the reduction of licences on the cheaper instruments.

Now as to the Imperial aspect of wireless. I think we have been slack in the Imperial, both political and business, aspect of wireless. I refer now to wireless telephony as a means of communicating with distant countries. Far more could be done to develop this, especially with our own Dominions, to the advantage of inter-Imperial relations and of trade and commerce alike. The charge for telephoning to Canada to-day is almost prohibitive. By lowering the rates and advertising the service, we should get a bigger turnover, and should not lose money, but would, indeed, gain in the long run.

Future Possibilities.

The other Governments, also, I would encourage to make more use of the wireless telephone. The great departments of State should be invited to make use of wireless telephony for communicating with their agents and departments abroad whenever possible. This is more a matter, I think, of the future; but the science is developing fast, and it won't be long before the Admiralty will be able to speak to our great naval stations abroad, the India Office to Government House in Simla, the Prime Minister in Downing Street to the Prime Ministers in the Dominion capitals. Indeed, this great subject of the development of inter-Imperial wireless would need an article to itself; and here I can only indicate its importance and possibilities for the future.

(*Continued on page 750.*)

RADIO and CO-OPERATION

A CHRISTMAS MESSAGE OF GOODWILL

By
SIR OLIVER LODGE, F.R.S.

NOW that the ends of the earth are being drawn together by radio communication, and now that the nations are seriously considering a method of settling disputes in a more rational manner than by attempts at mutual extermination and irrational wholesale destruction, it behoves us to try and cultivate an international sentiment—that is to say, to extend friendly co-operation and mutual assistance beyond the limits of family, tribe, and nation, as heretofore, and begin to treat the whole earth as a unit in which humanity is striving to develop its better qualities, and to rise to a higher state.

The welfare of every nation should be regarded as a contribution to the progress and free development of the whole. Nor should there be any jealousy at the achievements of any one branch of the family in special directions.

Even in games the Old Country has been too apt to feel chagrin and disappointment when beaten by its offspring in the Dominions; but it is a constant family experience that the old are sooner or later eclipsed by the young. And surely we should rejoice at their prowess, and feel encouraged by the signs of exuberant vitality.

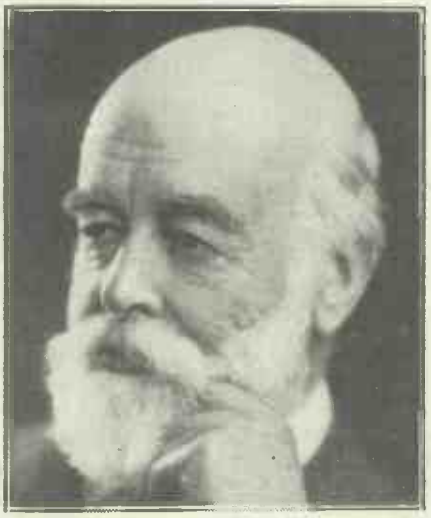
Why Not Share Success?

So also every nation is likely to have special aptitudes and achieve exceptionally good results in various directions. This, too, should be welcomed by the others. Every nation should cultivate its own powers, and by free interchange make the results available for all.

If America is better than we are at big telescopes, ingenious mechanical devices, and the production of films, we need not be constantly on the strain to do what we are evidently not so fit for. We can proceed to cultivate our powers in other directions, and do things which they are not able to do so well.

Again, if the Germans have a natural aptitude for encyclopaedic knowledge, for indexing and cataloguing and collecting and putting on record the progress in knowledge all over the world, then, though it may be well for us to translate their efforts into our own language, we need not try to duplicate the labour, and waste our time and energy in trying to do what they can do better.

Our scientific powers lie in other directions. We have on the whole been stronger than they in individual genius. Of course, there have been exceptions, such as Helmholtz and Hertz, and, indeed, many others; but we have had Newton and Maxwell and Kelvin and Faraday, and can hold up our heads with pride in our individual achievements. In chemistry they have had a multitude of workers, supported by the great industries and by the State; and



The Doyen of British Scientists—Sir Oliver Lodge.

on the whole their results have eclipsed ours. But in biology all nations have contributed; and in that subject it is we that had Darwin, the French that had Pasteur. In music, again, they beat us hollow. But in literature we have been supreme. Why should we not divide up among us the limited supply of human genius and rejoice at each other's successes, which, after all, contribute to the enjoyment and well-being of the whole.

Better Understanding.

The whole tendency of the present year has been in the direction of good will among the nations. A better understanding is growing up; ill-feeling and hostility are dying down. Difficulties and controversies must arise; but if only we can agree to settle them by legal and rational methods, without flying into a temper and smiting at each other, then the present is an era of hope for the world. The message of Christmas is good will among men. There is no patriotism of a local and an exclusive kind about Christianity. Its real message, apart from ecclesiastical considerations, is world-wide peace and good-will. And the progress of science and its applications are rendering this more and more of a possibility, and are tending to make it actual instead of only a pious ambition

Scientific men are teaching us, moreover, that humanity is naturally much better than ecclesiastics have thought. The depressing doctrine of Original Sin is dying. We are told by anthropologists that savage men are not always fighting and destroying each other any more than civilised men are. Mutual aid and friendly co-operation are prevalent among primitive tribes. The tiger instinct is not natural to man. It is aroused in defence of the young and the weak, or in defence of property against aggression; but it requires a good deal of stimulus to arouse it; it is not the natural condition of mankind.

Radio's Great Chance.

Sir Berkeley Moynihan has recently said that in his experience as a surgeon—experience of humanity under difficult circumstances—he finds a nugget of gold in the heart of every human being; it is that which comes to the surface in times of stress, however much it be hidden ordinarily.

Moreover, he is struck with the innate goodness of children, until they are warped by the mean conditions of present life and the perverting circumstances around them. It is these circumstances that need amending; it is these that many societies are trying to ameliorate. Our state is not desperate; but it is so far from perfect that too many human beings are deteriorated by their passage through the world, and leave it worse than they entered. If that is true, it is a serious indictment against society.

Let us radio workers be thankful for the means that have now been put into our hands—far in advance of anything previously possible in the whole long history of the earth—and let each do his best and contribute his or her quota to the divinely inspired and guided international effort in which statesmen of all countries are no co-operating.

Our Seventh Radio Christmas

WELL, herewith the seventh special Christmas Number of POPULAR WIRELESS.

Writing those words is a bit of a shock, for it certainly does not seem seven years ago since the first public excitement about broadcasting was aroused in this country by reports of the success of a new innovation in entertainment in America, and which subsequently grew so quickly in this country that POPULAR WIRELESS was planned and produced some months before the British Broadcasting Company had its first transmitting station ready.

B.B.C.'s Seventh Year.

And this year we should also remember that the B.B.C. is entering into its seventh year of activity. In fact, it was on November 14th, 1922, that the first B.B.C. programme was transmitted. If I remember rightly, Mr. Arthur Burrows was the first announcer to open the new broadcasting service. That evening he said that broadcast messages would be sent twice each night, at six and nine p.m. The Call Sign would be 2 L O and the wave-length 360 metres. And I shall never forget how, after the official announcement, he began a little talk by saying: "You know, this broadcasting is going to be jolly good fun!"

Well, up to a point it has. And, being Christmas time, we all ought to bear in mind that the chief spirit of Christmas is that of good will and perhaps, we should refrain from criticism of the B.B.C., at any rate in this particular number. But, in all friendliness, we suggest those words spoken by Mr. Burrows when 2 L O first began broadcasting—"You know, this broadcasting is going to be jolly good fun"—are well worth bearing in mind.

Broadcasting has been jolly good fun; but perhaps it would be hardly right to use the word "jolly" these days. There is rather a lack of jollity about broadcasting, a lack of spontaneity, and a lack of that intimate comradely feeling which was so great a feature of the atmosphere of broadcasting when the old B.B.C. first began its duties.

It would be a great pity if that spirit of jollity were to be lost, and we sincerely hope that this Christmas time any little misgivings we may have had on this point will be quashed, and that the B.B.C. will begin the New Year by a strenuous endeavour to recapture that spirit of jollity and friendliness which was so greatly appreciated in the past. Not for one instant do we suggest that the B.B.C. do not feel friendly. They exude good will and friendliness. But in such a way that it is rather difficult to appreciate in these days. We suggest perhaps it may be due to the fact that

In this article the Editor looks back over previous Christmases, and recalls the "good old days" of radio following the birth of the B.B.C.

In wishing readers "A Happy Christmas," he makes a plea for a renewal of the old spirit of jollity, and spontaneity in the programmes.

super-organisation has left little room for sentiment and, however much we may decry sentiment, it is no good denying that, without sentiment, life would be a very dull business.

Too Much Aloofness?

Broadcasting has certain definite drawbacks which even Captain Eckersley will admit. For example, the most perfect production from the finest loud speaker, in conjunction with the finest transmitting gear, will never dispel that little feeling of "mechanism." But a good deal of the atmosphere of mechanism can be dispelled if the voices we hear via the microphone from 2 L O and other stations are vibrant with comradely feeling and intimate good-fellowship, plus a little harmless jollity and freedom from aloofness. Perhaps aloofness is the keynote of the present atmosphere of broadcasting.

On certain nights, especially when the B.B.C. gives its own concert party, that air vanishes, and we listen in with a keener enjoyment and a keener appreciation of the benefits of broadcasting. We suggest that even when reading the news bulletins, the announcer should be given a much freer hand, and be allowed to intersperse a little aside now and then and a little joke and, above all, a little warmth.

However, that is really an aside. The fact remains that the B.B.C. has now entered upon its seventh year of activity and, that one little criticism having been said, let us admit that the progress of the B.B.C. since 1922 has been extraordinarily rapid.

Rapid Progress.

Six years ago I remember meeting Captain Eckersley for the first time in a little cubby hole of an office in Kingsway, while in another cubby hole sat Sir John Reith and, fluttering in and out of the room, up to their eyes in work, were Mr. Cecil Lewis and Mr. Arthur Burrows. To-day one has to pass by several stalwart guardians at Savoy Hill and, after a long journey in a lift, and the exploration of several corridors, one may perhaps succeed in reaching Captain Eckersley, now installed in a very different sort of office; and, instead of being whirled to the top floor of Marconi House into a little studio decorated with soap boxes and suspended microphones, one can now visit Savoy Hill and wander into several studios, the size and magnificence of which makes one realise what real progress has been made in the last six years.

And, before very long, the Regional Scheme will have its first station ready at Brookman's Park and, in fact, one wonders what will be the state of broadcasting in, another six years time. But again, in all friendliness, we revert to that question of atmosphere and to the words spoken by Mr. Arthur Burrows when 2 L O began its first transmissions: "You know, broadcasting is going to be jolly good fun."

Well, let us hope so. And let us close by wishing the B.B.C., our readers, our advertisers and everybody connected with radio a very happy Christmas and a bright and prosperous New Year.

To The Editor, POPULAR WIRELESS,
Dear Mr. Editor,

You wrote me early in October, inviting me to contribute an article to your Christmas number, but whether from consideration for me, or from lack of inspiration on your part, you made no suggestion as to subject.

Now, as you can, perhaps, imagine, I receive a good many similar requests. Most of them are immediately declined, courteously, I hope, but certainly firmly. A small number are referred to Mr. Murray at Savoy Hill. You know him; in fact, I think you know him very well. Of that small number so referred the majority are also in due course declined; quite definitely, but still, I think, politely. A few, however, he bids me accept.

Enormous Expansion.

In your case I was informed that I should comply with the request, but no offer of "assistance" was vouchsafed. I accordingly replied to you, in indeterminate fashion, and about three weeks after the receipt of your letter. By that time I had imagined that it would be too late. You speedily reminded me that I had written for you each Christmas, and implied that it would be unfortunate now to break that excellent record. And, moreover, you added that there was still plenty of time.

You are always rather a difficult person to deal with, and you usually manage to get your own way. Also you occasionally put your own interpretations on things and draw your own deductions. In fact, you require watching.

I am very busy. I dislike writing articles almost as much as I dislike speaking. There is nothing at the moment about which I am moved to write. It would, in fact, have been much better if I had, once again, courteously but firmly declined your invitation immediately it arrived. Not, however, that I delude myself by imagining that that would have ended the matter.

Apart from anything else, it is much more difficult to-day to write articles on broadcasting than it was a few years ago. There are various reasons for this. One is that practically everything that one might wish to say has been said already either by oneself or by somebody else; and repetition is wearisome and pointless.

Moreover, the volume of work and the sphere of activity has expanded so enormously that naturally and rightly we are tending more and more towards specialisation. Comments on recent developments, speculations as to the future, and so on, can therefore more properly and adequately come from those more immediately concerned. Another difficulty is that the public and individual outlook on broadcasting has changed. Its functions and significance are now much more generally appreciated and understood. In the early days there were so many oppositions and obstructions, so many misunderstandings and misinterpretations, some of them deliberate, that there was real need for explanation and defence of the position and attitude of the B.B.C.

Sir John Reith was born in 1889 in Stonehaven. He is the fifth son of the Rev. Dr. Reith, a former Moderator of the Church of Scotland. Sir John was educated at Greshams School, Holt, and was afterwards apprenticed to an engineering firm. He is a Master of Science, and served in the Royal Engineers in the War. He was Knighted in 1927.

Many Difficulties.

Very interesting those days were, Mr. Editor. We never knew what combination, or combination of combinations, we should find in array against us. These combinations were considerate to this extent, that they did not often overlap. Usually one lot had been dealt with before the next lot appeared. There was little breathing space in between, however. Very interesting and very satisfactory. I have always said that antagonism is preferable to apathy. Antagonism is easier to handle. Apathy is one of the curses of this age.

You will remember that there were different ways of dealing with these oppositions. Some of them were met squarely and brought to definite issues; others were evaded; and perhaps the majority were ignored altogether.

Course of the B.B.C.

Do you not agree that much the best way to deal with stupid or self-interested oppositions is to ignore them? It saps morale. Sometimes, of course, their irritation is so increased that they become fiercer and more determined than ever—but almost always more futile or ridiculous. To reduce one's enemies to a state of uncontrolled rage is to win bloodless victory. On the whole, therefore, I think it is sound policy to proceed upon one's settled course—provided always that the course was wisely chosen and every energy employed in its pursuit—and decline in general to be perturbed by the malcontents and the axe-grinders, and so forth, and be satisfied that their tactics will be abortive in the long run.

That was a lesson early learnt—not to worry. There were plenty of things to cause worry in those early days; so many, in fact, that had we been the worrying kind, all our time would have been spent in worrying, with none left for constructive effort. Some

(*Continued on page* 758.)

WHY I WELCOME BROADCASTING

A symposium of opinions from famous men and women upon the subject of broadcasting.

THE PRIME MINISTER (Rt. Hon. Stanley Baldwin, M.P.).

I CAME down one Sunday morning at Chequers a few minutes before breakfast was ready, and I went to the wireless set and tried all round Europe to see if anything was coming through at 9 o'clock in the morning. By chance I struck some exquisite music in Berlin, and heard shortly the singing of a hymn. I thought immediately that when the day comes when nearly every cottage in this country can switch on to any station in Europe and hear the peoples of Europe at their music, their dancing, hymn-singing, and prayers, what a bond that will be throughout the world!

The Prime Minister, the Rt. Hon. Stanley Baldwin, M.P.

Look back on your own childhood. Look back at the people in the country you used to talk to. We in England regarded everyone who lived across the seas as savages, pagans. We knew nothing about them; we were not interested in them; they were "those foreigners," and when the mass of the people realise that, in whatever country in Europe a man lives, he is a human being like himself, with a family and family life, a wireless set, with his services on Sunday, his dancing in the evening, and with his lectures, war presents a very different aspect, and I believe that wireless—ordinary, common or garden wireless—is going to be one of the greatest bonds between the common people of the whole world, and it is the common people who, in the long run, will decide whether there will be war or not. (In a recent speech.)

* * *

MR. RAMSAY MACDONALD, M.P. (ex-Prime Minister).

You ask me why I welcome the growth of broadcasting. I welcome it because it is one of the greatest educational opportunities that has ever been given to the young people living in the scattered districts from Land's End to John o' Groats.

I welcome it also because it makes us more independent of a syndicated press, and because it brings us all into more direct touch with one another.

* * *

Mr. LLOYD GEORGE, M.P. (ex-Prime Minister).

I welcome the growth of broadcasting because it is bringing happiness into millions of homes and because it has great potentialities as an educative medium. I have watched its growth during the last few years—both in public popularity and in the realm of scientific achievement; and when I think of the mighty strides that it has made, and the still mightier strides that it is destined to make, I feel thankful for this scientific development which is bringing happiness and knowledge daily within closer reach of an ever growing number of our people.

* * *

Mr. PHILIP SNOWDEN, M.P. (whose wife is one of the Directors of the B.B.C.).

Wireless promises to be one of the most revolutionary of social influences. Its possibilities are only yet in the first stage of development. As an educational factor its influence cannot be exaggerated. As a means of bringing music into the lives of people hitherto excluded from enjoying its highest expression it is an inestimable blessing. As an adjunct to the means of teaching in schools it is already being successfully used, and highly appreciated.

* * *

Mrs. HILTON PHILIPSON, M.P. (formerly Miss Mabel Russell, the variety star).

Broadcasting is a veritable blessing to multitudes of people. I have an invalid sister, for instance, into whose life it brings a ray of sunshine every time the programme opens. Her case must be typical of thousands of others.

It is an absolute boon to the hundreds of war wounded and disabled men who are still lingering, in their hospital blue, in hospitals and homes in various parts of the country. People do not realise how many of these men there are. They cannot get out to theatres and other places of amusement at night, and the wireless enables them to have an entertainment every evening. It brightens what would otherwise be a very dull life, and it enables them to keep in touch with the outside world in a way that would not otherwise be possible.

Then think of all the blind people—the civilians as well as the soldiers—and the aged people who are forced to stay in their homes for the greater part of the day. Broadcasting relieves the monotony of their existence.

And the housewife. Wireless takes her mind off the worries of the home, it livens up her daily round, and it even provides the children with a programme of their own to listen to before going off to bed.

It is impossible to welcome too heartily the advances that wireless has made during the last few years.

* * *

CAPTAIN IAN FRASER (the blind M.P.).

Why do I welcome the growth of broadcasting?

Because broadcasting is probably the cheapest method of bringing daily news, views and music into humble homes.

Mr. Lloyd George.

Because the culture and education that must arise from broadcasting will be a potent factor in providing more equal opportunities for individual development and enjoyment of life.

Because broadcasting may subconsciously teach Englishmen and women to speak better English, and ultimately may make English

(*Continued on page* 729.)

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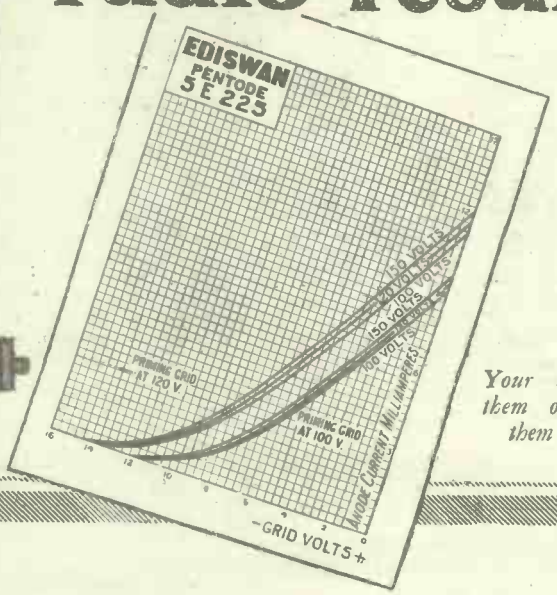

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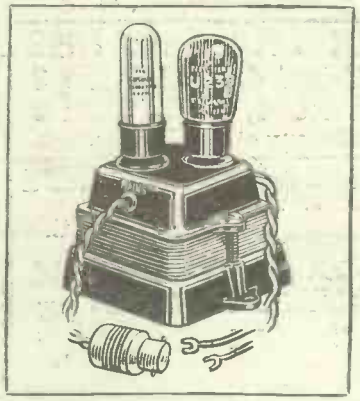

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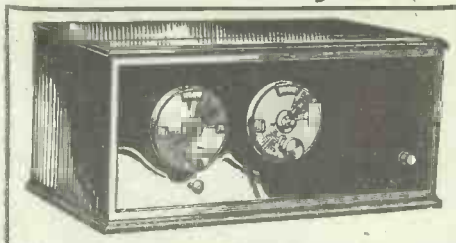

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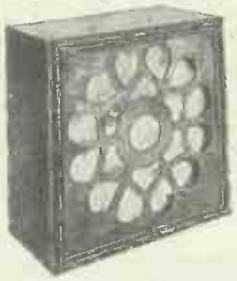

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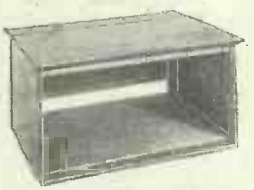
21 × 7	21/6
24 × 7	24/-

all 9" deep. *Carr. Paid.*



LISSEN

Valve-holders, 1/-; Fixed Con., 1/-, 1/3; Leaks, 1/-; Switches, 1/6, 2/6; Latest 2-way Cam. Vernier, 4/6; Rheostats, 2/6; B.B., 1/6; Lissenola, 13/6; L.F. Transformers, 8/6; Coils, 60X, 6/4; 250X, 9/9; 60-v. H.T., 7/11; 100-v., 12/11; Super 60-v., 13/6; Grid Bias, 1/6; 4.5, 5d. Super L.F., 19/-; Variable .0003, 6/-; .0005, 6/6.

A.W., P.W., M.W. STANDARD LOADING COILS, 7/6

Post 2d.

Wearite, Magnum, Lewcos.

COPPER SCREENS ALUMINIUM SCREENS

10x12, 10x6, 8½x6, In stock. M.W. Screening Boxes, 12/6

COSSOR NEW MELODY SPECIAL OFFER

PLUG-IN COILS ACCURATELY WOUND HIGHEST QUALITY D.S.C. WIRE TESTED

250/600 B.B.C., 8/6 per pair; Long Wave, 9/6 per pair. POST 1/-, pair.

TUNEWELL DUAL COIL FOR MASTER 3 STAR 7/9 (switch 1/-)

EBONITE PANELS best Grade "A" 3/16" Stocked in usual sizes or cut to special size at ½d. square inch.

COUPON No. 22

ONLY ONE COUPON ON ANY ONE ORDER

If you spend 25/- or more you can buy for 3d. extra any one (only) of the following:

S.M. Dial, 100 ft. 7/22 Copper Aerial, 12 yds. Lead-in, Fuse and Holder, 12 Nickel Terminals, 60X Coil, H.F. Choke, Permanent Detector, Battery Switch, .0003 and 2-meg. Leak, 9-volt Grid Bias, Panel Brackets, 6-pin Coil Base, 100 ft. Insulated Aerial, Loud Speaker Silk Cord, 30 ft. Covered Connecting Wire, Ebonite panel, 9x6. 12 yds. Twin Flex. 100 ft. Indoor Aerial.

ONLY AVAILABLE AT K. RAYMOND'S

CORRESPONDENCE

SOME SHORT-WAVE EXPERIENCES.

THE FILADYNE CIRCUIT—THE "ANTIPODES ADAPTOR."

Letters from readers discussing interesting and topical wireless events or recording unusual experiences, are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents and we cannot accept any responsibility for information given.—EDITOR.

SOME SHORT-WAVE EXPERIENCES.

The Editor, POPULAR WIRELESS.

Dear Sir,—It will no doubt be of interest to you to hear of my experiences with a two-valve short-wave receiver, which I assembled a week ago from details given in two articles published in your paper, namely: The "Handyman" Two, described in the issue of "P.W." dated February 25th, 1928, and the "P.W." "Short-Wave" Two, described later.

I have only made one coil, that for the 20- to 40-metre wave-band, and that was built on the principle of the one given in the "Handyman" Two, only that it was wound on a built-up skeleton former. The 24 wire was bared of its cotton covering, and, as I had no 34 wire, the reaction winding was wound with 32 D.C.C.

In wiring the set I added to it refinements given in the "P.W." "Short-Wave" Two, namely, a ·0005 fixed condenser in series with the ·0005 variable. Also a ·001 F.C. wired across the anode of the last valve and L.T. negative. Lastly, instead of using the fixed choke, as given in the "Handyman" Two, I put in its place a single coil holder, and, for short waves plugged into it a home-constructed choke of 150 turns of 36 D.C.C., wound on an inch former, and tapped at 50, 75, and 100 turns.

Wonderful Results.

Results obtained were as follows: P C J J on 9,554 kc. was received during broad daylight, at good speaker strength. 2 F C (Sydney, N.S.W.) was received clearly on 'phones, on Wednesday, November 7th, at about 7.30 p.m. (I cannot state definitely the length of time I was receiving him, as I didn't note it down.) However, here are some items from his programme: Two gramophone records, one "The Rollicking King's Highway," and the other a popular dance number, "She's Tall and Dark and Handsome." The announcer also called 5 S W, and asked him to try and pick up 2 F C's transmission on Sunday morning, when they would hear the M.C.C. team before the microphone. I may mention incidentally that I intended listening for this broadcast, but made rather a silly mistake and forgot that Sydney time is in advance of ours, and I realised too late that though they would be working on Sunday, it would be Saturday night over here. On November 8th I picked up 8 X K, though I believe that this is no extraordinary feat, and listened to him from 11 to 12 p.m. At times he could be heard twelve inches away from the 'phones, and was relaying a concert from the Astoria (?) Hotel. A few items from his programme were: "Tell Me Your Dreams," also a selection from the operetta "Irene," and Rachmaninov's "Prelude in D Minor." Part of the programme was relayed from K D K A.

The following night I received him again, only this time much louder than before. To give you an idea of his punch, another person was wearing the 'phones while I seated myself about six or seven feet away, where speech could be heard but not distinguished. This was while he was giving a talk on Mohammedanism. I also received another Yank the same night, but did not get his call-sign.

The New K D K A.

I have also received a German station on this wave-band, who comes in very loud and very clearly during daylight, but as I don't understand his lingo, I therefore cannot identify him. During his intervals he transmits a loud metronome signal, and a peculiarity about his transmission is that he always seems to be giving a kind of dictation, reading very slowly and very distinctly, with pauses at frequent intervals. Can any reader give me information as to the identity, frequency, and power of this station?

There is just one other transmission I can mention, and that is K D K A, who is now working on a new frequency of 9,800 kc. This station I received one Sunday evening from 7 to 8 p.m. He comes in very well and is worth trying for. The announcer stated that K D K A had just recently started transmitting on this frequency, and that reports on the reception of his transmission would be welcomed. I don't know whether any reader has picked this station up yet, but as I have remarked, he is worth trying for.

Reverting to the receiver, there is just one thing I am troubled with at present, and that is hand-capacity effects. I have yet to cure this fault. However, I think that the results are pretty decent for the first "kick-off."

Well, I will close now, thanking you for the valuable assistance and knowledge I have gained from your excellent paper.

I am, yours sincerely,
E. BIRCHENALL.

Manchester.

THE FILADYNE CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—When are you going to have another "Filadyne" set? It is about two years ago that I made my first Filadyne, and have since built two others. Each new Filadyne seems to be better than the last, and if it goes on, I for one cannot see how this sytem can fail to displace most others.

With a two-valve Filadyne made up to the latest circuit I have seen, I can get anything on the Continent I want, heterodyning and static permitting.

Yours faithfully,
L. COOKE.

Birmingham.

[ED. NOTE.—The "P.W." Research Department is busy at work on several new Filadyne developments, and full details of them will be published in due course. Articles and sets by Mr. English on the Filadyne are also in hand.]

THE "ANTIPODES ADAPTOR."

The Editor, POPULAR WIRELESS.

Dear Sir,—Having had no previous experience of short-wave sets, I decided that the "Antipodes Adaptor" would suit my requirements admirably, so I hooked it up out of some old junk parts and settled down to try it out.

The results are exceedingly above my expectations, for up to now I have logged the following stations:

2 X A D—good loud-speaker strength.

A TRIBUTE TO "P.W." SET DESIGN

MR. EDGAR WALLACE
(the famous author and playwright).

Dear Sir,—The set you lent me is working wonderfully. I get perfect reception from Germany, and, the other morning, at 4 o'clock, I managed to get quite a number of American atmospherics punctuated by jazz bands. It is great fun, and remains an essential part of my domestic equipment.

Yours sincerely,
EDGAR WALLACE.

2 X A F—slightly less volume than 2 X A D.
P C J J—roaring strength on loud speaker.
P C L L—good loud-speaker strength, but badly distorted.
5 S W.
3 L O (Melbourne).
K D K A—on 27 metres.
A F K (Doberitz).

Also what I believe is transatlantic telephony from 2 X A A—Houlton (Maine).

All the above on 0-v-2.

I think you will agree that this is a fair bag for a newcomer to short waves. I might add that my set for broadcast reception is the "Spanspace" Four, which gives me every satisfaction.

Wishing POPULAR WIRELESS continued success,
I remain, yours faithfully,
J. BUTCHER.

Barnstaple.

WHY I WELCOME BROADCASTING.

(Continued from page 724.)

an even more universal language than is now the case.

Because it offers an unrivalled opportunity—which has up to the present been wasted—to statesmen and politicians to communicate their views to the people from whom they derive their strength, without the intervention of newspapers, which seldom transmit their views faithfully, but almost invariably amplify or distort them.

Because when politicians wake up to the fact that this new power is at their service they will be better able to work a democratic system dependent upon an almost unmanageably large electorate.

Because it should provide—when the B.B.C. reads public opinion aright in its love of the British Empire—a means whereby many areas inhabited by British subjects may be linked together for the purpose of simultaneous broadcasting, as is the United Kingdom at present.

Because it provides amusement and interest to large numbers of blind, disabled and bedridden persons, who are deprived, by their physical condition, of access to the older methods whereby these amenities were distributed.

* * *

Miss ELLEN WILKINSON, M.A., M.P.

It is very good for a working woman, who is within four walls for so much of her day, to be able to relieve the tedium of housekeeping, sweeping and cooking, by turning on the wireless to hear a pleasant voice giving her not only hints on modern cookery, but pleasant popular music to keep her spirits up.

I think there might be some improvements in the Children's Hour. Most of the children, I know, dislike the Children's Hour intensely. They seem to think that the B.B.C. do not hit the right note. There is a tendency to talk down to the children too much—and to be too superficially hearty.

* * *

Miss SUSAN LAWRENCE, M.P. (for many years a workhouse visitor and Guardian of the Poor).

I do not think that anybody living in London ever has been in want of daily entertainment, but when I think of the extraordinary dullness of the life of a middle-aged woman in the villages, prior to the introduction of the 'buses and wireless, I realise the extraordinary benefits that wireless has brought.

In many places, too, subscriptions have been raised for the purpose of installing wireless sets in the workhouse wards. It is impossible to over-estimate the immense amount of pleasure that has been given to the old people as a result of this kindly and thoughtful act.

Although there is a Children's Hour in the broadcasting programme it is true that children are usually able to provide their own amusement. It is the elderly, and particularly the women, who have gained such enormous pleasure from this new form of entertainment.

* * *

SIR WILLIAM JOYNSON-HICKS, M.P. (the Home Secretary).

In the first place, because all knowledge is good, and broadcasting increases the knowledge of mankind in almost every direction. Secondly, because it affords facilities for public men of all shades of political and religious opinion to express their views to the million.

I have myself recently had some experience of broadcasting; as a speaker, as well, of course, as a listener.

It is a wonderful thing to sit before the microphone at the B.B.C. Headquarters, and realise that you are speaking to—it may be a third of the population of Great Britain. I have often addressed large meetings in a hall, but that is nothing to the power which broadcasting gives to a speaker.

I am certain that it will increase in power and utility as the years go on.

GEARY ROUSES THE EMPIRE

I HOPE you recollect my friend Geary—Aloysius Geary. He is the fellow who put the "oh!" in Radio down our way. He is Tooting's Own Ass. He knows no more about radio than the secret of absconding from my house with small parts, generally the choicest measuring instruments or a pet condenser. When bowled out, he says that they must have hooked themselves to his garments as he brushed past them.

Geary's ambition to shine as a golden radio bug is in inverse proportion to his skill in, and knowledge of, the subject.

Every now and then Geary's evil angel prompts him to concoct some unusually evil plot, at which I generally am forced to connive.

He Turns Up Again.

Now, a week or two back Geary came to my house, ostensibly to borrow a ten-shilling note, a lemon-squeezer, and a No. 75 coil; all quite normal and above suspicion. But as soon as he got into my radio den and had lit a pipe of my tobacco, he began:

"Look here, Higham; I've an idea."

"If that's so, if you haven't mistaken a pain in the head for an idea, I'm going to Davos for the winter sports, and I'm going to-morrow. Try and get Snarper to help you."

"There, there; it's all right! Listen! You know this 5 S W racket?"

"Go on."

"Well, it's no earthly! Small beer, as we say in the trade. Heeltaps! Swipes!"

"Possibly the ardent pioneer in his lonely shack in Bongaruba, and such places, considers it—er—inadequate. But what would you?"

"Well, Higham, I *would* give 'em a show for Christmas."

"Ha! Likewise, ho! I thought so. My richest aunt is puffing out and needs me at Barnsley to witness her Will. So you see, my esteemed Aloysius, I cannot possibly come in on this."

I Fall for It.

"Forget it, Higham," he purred. "But, as I was saying, you know this Marcuse racket? Good man, Marcuse; pioneer! Drove the jolly old plough and swung the axe to blaze the trail, and all that. Showed them the way, eh? Brought tears to the eyes of hard cases in every corner of the world, in the great open spaces and closed prisons where men are Scots, and so forth. *But*, Higham—*and* Higham—you mark my words. What the Empire is yowling for is a slap-up, homey, Christmas programme. And A. Geary's the bloke to supply same, f.o.b., empties returnable. None genuine without our label."

Again I fell for it. Built his transmitter, arranged the tests, wangled the licence, and supplied most of the refreshments. He held his great Empire reception on December 1st, to anticipate possible competitors. My aunt, I sweat to think of it!

After due advertisement, the Empire was all one large ear at seven p.m., and I switched on, carefully backing away from the mike.

Geary hoarsely whispered, as softly as a prompter at the Old Vic:

"Son, where did you put Aunt Annie's hot-water bottle?"

Things Go Amiss.

Like a flash, I switched off, and cursed him in a friendly way. After that we got down to business and gave "God Save the King." But I forgot to switch on until the end, and as the gramophone had not been fully wound up, I fear that all the Empire heard was a note like those Holborn "dying pigs" emit. Said Geary nonchalantly:

"That's that, old bean. Let's stick on Bransby Williams in 'Scrooge,' and go and have a coupla spots while the Empire sobs."

That bit got over perfectly, as I later learned from Nyasaland, Kenya, Borneo, British Guiana, and St. Helena.

I am sorry to say that Bert Geary messed up the gramophone, so that the Empire got "Scrooge" perfectly, but backwards. I learned afterwards that a whole tribe of Booloozagis recognised it as a "talk" on ants, in the vernacular, and became entomologists on the spot, much to the annoyance of the governor, who was devoting his leisure to stamping ants into blazes.

When Geary and I got back to the "mike" the time o' day indicated that the management was due to provide that charming lyric known as "Love's Old Sweet Song." For this we had engaged Miss Swattlebloom, who started up in the approved manner. But Geary thought she needed a little male assistance, so he supplied what I believe is known as "seconds." A melancholy duet, i' faith! Just as they got to "Love's old *sweeeet* song" there was an unexpected "third" in the form of the "maiden helper." This wench, who had not the foggiest notion of what was on, thrust her head through the door and bawled:

"Sir, the cat's-meat man ses shall he leave liver and lights or just lights and no liver?"

A Prize Nuisance.

I switched off. Hurried explanations. I switched on. Geary said:

"Cuss the gal! Where's her tact?"

The Empire said afterwards: "That's the sort of girl we want out here."

Then we gave 'em "Oranges and Lemons," and a lot of squalling kids supplied the chorus. And after that a recipe for plum-pudding. But, by some oversight, young Bert Geary mixed that up with a gramophone record of "Once in Royal David's City," so that what the Empire heard was, more or less, "Once a pound in Royal Candied Peel stood a lowly pound of David's suet." And the musical chairs were complicated by Mrs. Geary's urgent request for Geary's key of the tantalus, "because Cousin Jane has got her usual attack of whatsisnames, and brandy is the only thing."

Anybody shooting Geary, well and truly, can apply to me for a reward. Not more than five shillings! But I will supply a monument of purest Aberdeen granite and glad of the chance.

For he is the world's—and Tooting's—Own Prize (£20,000) Nuisance.

HIGHAM BURLAC.

". . . the cat's-meat man ses shall he leave liver and lights . . .?"

FROM THE TECHNICAL EDITOR'S NOTE BOOK

SWITCHES FOR WAVE CHANGING.

OF particular interest to readers of "P.W." will be a new switch produced by A. F. Bulgin & Co., Ltd. This is styled the Triple-Short-Circuit switch, and it is suitable for use in the majority of "P.W." wave-change sets. The switch, which is of the single-hole panel-mounting variety, has three terminals, each of which carries a spring contact.

All three terminals are isolated when the plunger is in, and when it is pulled out they are all connected together. Thus a connection at three points is possible without the necessity for such improvisations as connecting a piece of flexible wire to the centre plunger of a normal switch. This Bulgin switch, which retails at 2s., is distinctly well made and has a smooth and positive action.

Some idea of the heat generated by the short-circuiting of a good H.T. battery is given by this photo of two Hellesens inadvertently so treated.

A MOVING-COIL BOOKLET.

Messrs. Baker's Selhurst Radio recently sent us one of their catalogue booklets, which is entitled "A New Hobby for Wireless Constructors and Experimenters." Full details of the various moving-coil component parts obtainable from this firm are given together with several circuit diagrams.

"CHRONICLE WIRELESS GUIDE."

Allied Newspapers, Ltd., have now published the sixth edition of the "Chronicle Wireless Guide." The price of this publication is 6d., and it can be obtained at any bookstall or newsagent. It appears to be a remarkably good sixpennyworth. Some dozen sets and amplifiers are concisely described and there are interesting articles on such modern things as moving-coil loud speakers, "Wireless and the Gramophone," and so on.

ETON VALVES.

The Eton Glass Battery Co., of Eton Works, Grange Road, Leyton, E.10, have produced a range of low-voltage valves specially designed for use in conjunction with their large-capacity Leclanché cells. The actual voltage and amperages of the valves are stated to be from 1·2 to 1·4 volts at ·15 to ·18 amperes. It will be noticed that the voltage is brought down to below that of one primary cell of the Leclanché type.

In fact, the makers state that their valves will run satisfactorily from one large dry cell for a long period. Four large-capacity Leclanché sac cells, such as those which they supply, will run a one-valve set from six to twelve months for four hours daily. R.C, H.F., L.F., and power valves are available at 8s. 6d. and 9s. 6d. each. Country listeners should find them of considerable interest. On test we found the Eton valves quite good and their consumptions well within those specified.

A POCKET SOLDERING OUTFIT.

An interesting novelty recently placed on the market is the Soldometa Pocket Soldering Outfit, due to Elmesan London, Ltd. It is sold at 2s. 6d. complete, and comprises everything necessary for doing small soldering jobs. In a strong metal box with a hinged lid are a tiny soldering iron, some Meta Fuel, a burning tray, a tin of Soldo, a stick of solder, and a tin of Fluxite. "Meta" is, of course, a solid fuel which burns hotly like methylated spirits. It is quite a safe material to handle. A brochure entitled. "Hints and Tips on Soldering" is supplied with each outfit.

HAY'S RADIO WAX.

A week or two ago Hay's Marine Waterproof Glue Co., Ltd., sent me a tin of their "Radio Wax," This is a black compound which is unaffected by moisture or acids, and which is very easily melted. The tin in which it is sold (at 6d.) has a handle so that it can be held over a flame.

It is a most useful substance, and all kinds of repairs can be carried out with it. Holes in ebonite panels can be filled up, temporary insulation affected, fixed condensers, etc., mended, and so on. Additionally, terminals of batteries and battery tops can be protected with this excellent wax.

Its electrical properties are similar to those of ebonite, and altogether it is the sort of stuff a practical radio man can find many uses for.

AN AERIAL PULLEY.

S. H. Collett Mfg. Co. recently sent us one of their No. 2 rotary Eze-Way aerial pulleys. The price of this, with halyard, is 2s. 6d. It is said to be the only pulley on the market specially designed for the wireless mast. The special features of the device are that it is fitted with a pivoted back plate so that it is self-centring to the pull of the aerial wire.

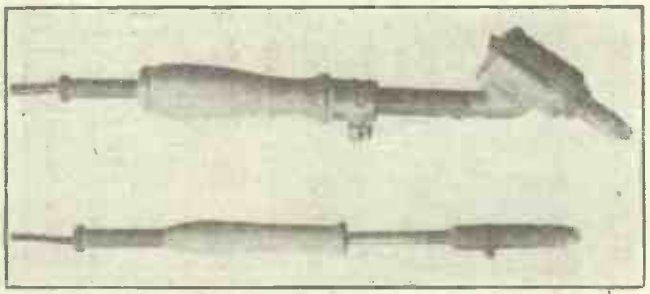
This means that however the line of the aerial is changed, the pulley follows it and no damaging halyard friction results. The pulley wheel, which is made of duralumin, such as is used in aeroplane work, has two grooves, one for the halyard and the other for the aerial line. The body of the pulley is made of stout brass heavily tinned and will not rust. Taking everything into consideration it certainly appears to be a considerable advance on the ordinary simple pulley wheel.

Traders and manufacturers are invited to submit radio sets, components and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

ELECTRIC SOLDERING IRON.

Some time ago S. Woolfe & Co., Ltd., of 115, Southwark Street, London, S.E.1, sent us two of their electric soldering irons for test. These were immediately placed in commission in the construction department and, up to the time of writing, have given excellent service. It has been noticed that they maintain even temperature throughout long periods of usage.

The F.L. type, which has a current consumption of 120 watts, retails at the reasonable price of 13s. 6d. It weighs 14 oz. and is well-balanced and easy to handle. The bit is interchangeable. The F.Z.O.O. is a somewhat lighter iron having a current consumption of 80 watts, and selling at 13s. Its design is in every way satisfactory.



The two electric soldering irons after having been in use for some weeks.

THE "INDISPENSO" CHARGER.

In our recent report concerning this interesting and useful product of Ward & Goldstone, Ltd., we gave the price of the De-Luxe pattern as 24s. 6d. This was, however, incorrect; it should have been 22s. 6d.

NOTES AND NEWS.

(*Continued from page 697.*)

The Essential Sag.

I SUPPOSE that no "P.W." reader needs warning about the erection of an aerial wire without a certain sag as a safety factor. If that is correct I may infer that my neighbour, on the starboard side as you face the gasometer, does *not* read "P.W." I'll stuff a copy through his bill-slit (letter-box) one dark night. Not long ago I was an interested spectator of the ceremony of installing his new mast and aerial. Aerial nice and taut; mast with a bias towards the house. I was very sad—but I never give advice to neighbours unless they seek it.

The winds of a week or two later crashed the mast, which brought his rose-pergola down!

Wireless in the Wilds.

INTERESTING details of the Chevrolet Car and One Ton Truck expedition from Cape Town to London are to hand. Mr. W. Watson, of Port Elizabeth, was "called in" to help arrange the radio gear. This had to be such as would transmit 10,000 miles and stand all the exigencies of travel over the length of Africa. Mullard's Jo'burg agent built the set in two days, the transmitter being fitted with Mullard valves, and run off the One Ton Truck Engine.

Cast-Iron Valves.

THE aerial was slung between two 15-ft. poles on the truck. Over desert, mountains, and forests they struggled, crossing many rivers which in some instances submerged them, but all the time after reaching Rhodesia they got their messages away and received the Savoy Hotel music and Big Ben. It took them five months to reach Cairo and seven to reach London, but those all-fired, cast-iron valves stuck it out and not one had to be replaced, being as healthy at the finish as at the start.

Radio from the Mains.

IN startling relief from the haughty attitude of the Westminster electricity authorities and others, are the attitude and action of the Middlesbrough Corporation. They do not say "You have not been authorised to work your wireless from our mains," but have approved a unit which, plugged into the lighting socket, will supply both H.T. and L.T. for any type of valve set at a cost of about 30s. per annum. The unit may be purchased by instalments. Middlesbrough is to be congratulated on its luck—and its Electrical Engineer.

"Purple Patches."

WHAT broadcast item has most impressed you? This question has aroused more interest than I expected. Here are some of the "purple patches" notified so far. New Year's Greetings, 1924–5; last Cenotaph ceremony on November 11th; Mr. Baldwin's strike speech; "R.U.R."; "first item picked up from 3 L O (Melbourne)"; Menin Gate ceremony; "my daughter's first song before the microphone"; debate between Sir E. Benn and Mr. Maxton; "when my battery conked out during a talk on Toadstools"; relay of Zepp landing in America; Sir O. Lodge on Atoms, etc.; Mary Pickford; Melba.

Wireless Society Note.

THE Kentish Town and District Radio Society still has room for new members, who will be initiated heartily by the Hon. Sec., Mr. A. H. Sartan. Meetings at 8 p.m. every Friday at the Carlton Road Schools, Kentish Town. Fee, one shilling per quarter, and no "extras." Why not join a club this winter? A session in the company of a few experienced fans may bring you near to a Valve Bartship. I have still a few left.

A Warning.

AS I have seen numerous references in the Press to the so-called "broadcasting" by Major Court Treatt, who is with his expedition in Southern Soudan, I think it well to remind readers a second time that his transmissions are *not radio-telephonic*, but in Morse. His call is F X C T, and the wavelength about 30 metres. The note of his signals will probably vary because he is using a hand-power generator.

More League Broadcasts.

THE Secretariat of the League of Nations is to resume its experimental short-wave broadcasts, using Kootwijk (Holland), probably on 18.4 metres. The station will be connected with a studio in the Palais des Nations at Geneva. The experiments are intended to reach certain specified areas, especially the Americas, Japan, Australia and New Zealand.

(*Continued on page 736.*)

NOTES AND NEWS.

(*Continued from page 734.*)

Angel Voices.

A PROVINCIAL newspaper asks why the B.B.C. has no full-time women announcers. The answer is easy; women's voices, except in instances of trained elocutionists—the late Ellen Terry for one—and certain exceptions, do not reproduce well. Some of the "talks" and debates in which women have faced the "mike" have been most disappointing. I am *rather* afraid that too many ladies cultivate mannerisms in their speaking—the "well-off" society drawl, you know—and these are mostly fatal to clear reproduction.

SHORT WAVES.

We sincerely hope that all short-wave fans will have a very happy D X-mas.

* * *

SCIENTIFIC AGE.

Freddie: "There's no sign of a new sled where ma hides the Christmas presents, so I'm going to send a letter to Santa Claus."
Jimmie: "You're too late, kid. Your only chance to get him in time is with a radio."
"Radio News."

* * *

Radio Expert: "What on earth are you grinding that wire for?"
Novice: "I'm building a radio set, and they tell me a good ground wire is essential."
"New Zealand Radio."

* * *

"A loud speaker for 10/-. Sounds an impossibility," runs an ad. in a provincial paper.
We have no doubt!

* * *

AN EYE FOR BUSINESS.

Crabshaw: "I can't afford to buy you a radio set, Willie."
Willie: "It will pay for itself over and over again, dad. Just buy me one and I'll radio Santa Claus for the finest bunch of Christmas presents you ever set eyes on."
"Radio News."

* * *

ROCKCAKE AND RADIO.

'Twas Christmas Eve in the workhouse,
Because the day after was Christmas Day,
And the gloomiest man in the institution
Was one named Jock McKay.

A wireless set and loud speaker,
Donated by Sir John de Smithe,
Was the one redeeming feature
Of this dread workhouse life.

And from it there issued music—
Sweet carols—and now and then
Messages of Christmas greeting
Of peace and goodwill to all men.

They were seated at the big deal table,
Eating their frugal repast,
When his hand reached out for a rockcake—
Though he still had half of his last.

He rose to his feet, took deliberate aim—
A crash, and the music ceases!
The deadly missile found its mark,
And the set lay there in pieces.
"Popular Radio Weekly."

Barkisland and the B.B.C.'s Water.

UNLESS Barkisland can supply the B.B.C. with 10,000 gallons of water a day, the B.B.C. cannot put its regional station there. Now Barkis is short on water, and has asked Soyland to help it out, but Soyland, possibly with an eye to its own eligibility, has refused the request. What a chance for an out-of-work dowser (or "water-diviner")! Let him step, like the Pied Piper, into the Council Chamber and say, "Me and my little twig will solve your problem." Or why should not Barkis sink a few wells? They might strike oil!

(*Continued on page 738.*)

NOTES AND NEWS.

(*Continued from page* 736.)

One Jay—Less.

PHILIPS' advise me that in accordance with the Washington agreement their famous short-wave station known as P C J J, will from January 1st, 1929, be known as P C J. So when you hear the new call don't mistake it for Jix's initials or think that your grid has dropped a stitch. As you know, j's are fluid. One has run right away. (Copyright joke.)

"P.W.'s" Puzzle.

THE tribulations of a man with a daughter in the Girl Guides might fill a book. Besides being supposedly an authority on birds' nests, astronomy and sailors' knots, I am expected to give help on all questions arising out of signalling. The latest question is this:

"Daddy, if a dash is T and a dot is E, how can a dash and a dot be N. It ought to be T E."

Now, I ask you! What is the correct answer?

Amazing Radio Conversation.

IT is reported by the G. E. C. of America that W G Y (Schenectady), 2 M E (Sydney), and a station at Bandoeng (Java) held a three-way radio talk. The 2 M E man "introduced" W G Y to Bandoeng, and then all three settled down to a nice cosy little chat. Kindly note the distances. Schenectady to Sydney, 10,000 miles; Schenectady to Bandoeng, 9,500 miles; Sydney to Bandoeng, 4,000 miles. It certainly is a mad world, my masters.

Plato on the Farm.

THE Radio Correspondent of the "Daily News" says that Miss Matheson, the Director of Talks, told him she found "that even Sussex farm workers read and enjoyed Plato's 'Republic' after a broadcast talk on philosophy." Nothing wonderful in that. Anything would be enjoyable after such a talk. But why that word "even"? Does the lady mean that the Sussex man is superlatively cloddish? If so, she is in error. And, finally, *how many* of them read and enjoy Plato? I'll wager she wouldn't find a round dozen. Do let's be reasonable, even if we are enthusiastic about adult education.

Baldwin the Spartan.

ACCORDING to Mr. Baldwin, in his speech on Lord Mayor's Day, he is the sort of man who comes down before nine o'clock on a Sunday, and has the hardihood to go dialling all round Europe *before breakfast*. That's the stuff "men of good will" are made of, my sons, and don't forget it. Stout as nails. But, joking aside, Mr. Baldwin surely hit the mark in saying that radio is going to be one of the greatest bonds between the common people of the world.

Radio and Esperanto.

IF radio is destined, as Mr. Baldwin thinks, to produce a sort of international comradeship, Esperanto must surely play its part. The movement for the marriage of Esperanto and radio is growing healthily, and it is said by the German Esperanto Union that the following stations are in the conspiracy and announce certain items in the international lingo: Berne, Breslau, Brussels, Danzig, Dresden, Freiburg, Gleiwitz, Huizen, Königsberg, Kiev, Laibach, Leipzic, Langenberg, Moscow, Madrid, Minsk, Paris, Stuttgart, Vienna and Zurich.

ARIEL.

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

BATTERIES INSIDE THE CABINET.

A. H. G. (E.C.4.).—"Recently I have heard and read on several occasions that accumulators put too near, or in a cabinet under a set will damage the components, etc.

"I am about to make a cabinet to combine set, batteries and probably loud speaker, and wondered whether by making several holes about ½-in. diameter at the back of the battery compartment, near the partition, this would overcome the difficulty.

"Also, I have just put up an aerial composed of seven strands of 22 D.C.C. wire. Will it be better if it is bared, or left covered ?"

The use of a separate battery compartment (as shown by your sketch) is quite a sound idea, and no harm will result to set or components. The holes for ventilation are recommended, but telephones or other sensitive apparatus should not be stored in the battery compartment.

There is not much noticeable difference between bare and covered wire for the aerial. One advantage of covered wire is that exposure to weather has less effect upon it than upon bare wire. But the insulating covering should be thin—such as enamel—or the increase in bulk will more than counterbalance any gain.

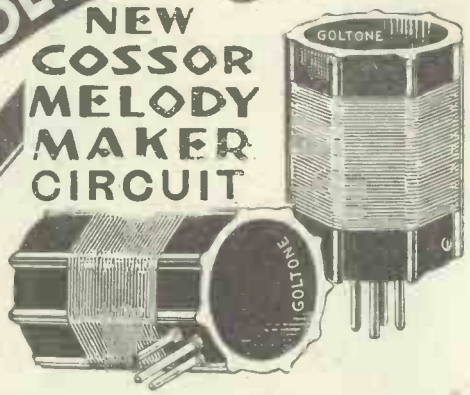
A "CHOKE OUTPUT."

"POPULAR WIRELESS" (Walworth, London, S.E.).—"I have read with interest the article in a recent 'P.W.' about the 'P.W.' Flexible Filter, but there is one thing that I would like you to answer me through your columns. That is, you say that most loud speakers have a high-resistance winding, and very often the voltage is dropped by 20 volts by the time it reaches the plate. Does it mean that if one adds an L.F. choke to a set that the H.T. battery will last longer, or is it that one will get better volume out of the set ? I can quite understand that it will be better for the set, but could you tell me if the H.T. battery has a longer life by adding a choke ?"

The adding of an L.F. choke means that the H.T. battery will last longer *if long loud-speaker leads are used*, because with these there is nearly always a certain amount of leakage going on. When a choke

(*Continued on page* 742.)

GOLTONE COILS *for the* NEW COSSOR MELODY MAKER CIRCUIT



These plug-in coils are accurately wound with best silk-covered wire, each coil separately tested on actual set. Boxed in pairs.

SHORT WAVE COILS (250-600 metres) CM/6 **5/-** each **10/-** per pair
LONG WAVE COILS (600-2000 metres) CM/2 **6/-** each **12/-** per pair

Full particulars on request.

Experts select the "GOLTONE" POWER TRANSFORMER!

FOR H.T. BATTERY ELIMINATORS WORKING FROM A.C. MAINS. Made in Two Types.

TYPE D.W., for Full Wave Rectification. Maximum Current Output, 80-100 milliamperes. No. R 14a/10. PRICE £1-12-6

TYPE S.W., for Half-Wave Rectification. Maximum Current Output, 30 milliamperes. No. R 14a/5. PRICE 18/6. *Full particulars on request.*

"Goltone" SUPER-CHOKE

This Choke is specially designed to work in conjunction with the "GOLTONE" MODEL "D.W." POWER TRANSFORMER. Inductance approximately 50 henries. Limiting current 80 milliamperes. Approximate D.C. Resistance 1,000 ohms. Size 3¼ x 2¾ x 5 ins. high. List No. R14a/50. PRICE 25/-.

"GOLTONE" (REGISTERED) DUAL RANGE COIL

SUITABLE FOR THE MULLARD MASTER THREE AND OTHER CIRCUITS.

Range 200-600 metres and 1,000-2,000 metres. A movement of the controlling knob provides *high* or *low* wavelength ranges. List No. MM/10. PRICE 15/6.

Full particulars on request.

"GOLTONE" GRAND L.F. TRANSFORMER

FOR PURITY, VOLUME AND FAITHFUL REPRODUCTION.

Maximum possible efficiency with remarkable amplification and freedom from noise and distortion.
List No. R15/88 (Ratio 5-1) **12/6**
List No. R15/98 (Ratio 3-1) **12/6**

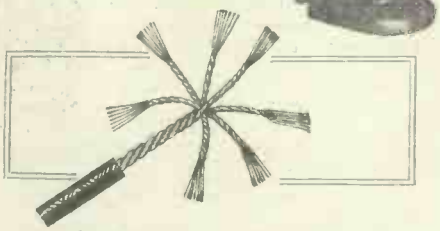
Use the **Goltone "JUNIOR" L.F. Transformer Price 8/6** For Portable Sets and where small space only is available.

Full particulars on request.

"INDISPENSO" BATTERY CHARGER

(For D.C. Mains only.)

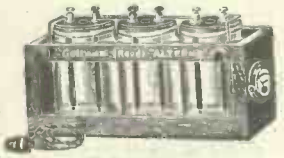
A high-grade Instrument fitted with Polarity Indicator and Ammeter, showing current passing to Accumulator. No. R.42/40 (as illustrated). Price 22/6. STANDARD MODEL with Polarity Indicator, but without Ammeter. No. R.44/4. Price 6/-.



"GOLTONE" (Regd.) NEGROLAC AERIAL

The Aerial that adds 25 per cent. volume and brings in far distant stations hitherto unobtainable.

Sample and full particulars with extracts from numerous testimonials received, sent on request.



"ALTERNO" BATTERY CHARGER

(For A.C. Mains only).

This Rectifier is recommended for charging H.T. Radio Accumulators. Will charge at negligible cost. Complete with adaptor, connecting cords, and full instructions.

No. R.44/6. Price **21/-** each.

No. R.44/7. With ammeter (as illustrated.) Price 12/6 extra.

From all best Radio Stores. Refuse substitutes. Illustrated Radio List P.W. R/119 free on request.

Ward & Goldstone PENDLETON MANCHESTER LTD

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 740.*)

output is used the fixed condenser employed for this type of output circuit restricts the H.T. to a much shorter path (through the choke) than would be the path via the loud-speaker leads.

Another advantage of the L.F. choke is that it has a low resistance compared with the loud speakers referred to, and consequently there is not such a big voltage drop across it.

Yet another advantage is the removal from the loud speaker of the steady current from the H.T. battery. But from the point of view of your question the most important effect of a good choke output is the removal of leakage from the loud-speaker leads, and the comparatively slight loss of H.T. voltage owing to the lower D.C. resistance of the L.F. choke as compared with the loud speaker.

A HOME-MADE PICK-UP.

C. A. A. (Woolwich).—"Can you tell me where I can get details of how to make a pick-up for gramophone work?"

The only how-to-make particulars for an instrument of this kind that we know of are contained in the Radiogram supplement of the November issue of "Modern Wireless," where you will find a full description of a little instrument which, though not intended to compete with the products of pick-up manufacturers, is yet capable of giving good results. The article was entitled "A Pick-up for 7s. 6d."

"VERY WORRYING."

"WORRIED" (Llandudno).—"It is very worrying, because although it is all right sometimes, it is very worrying at other times. If we are listening to a talk it may stop suddenly, and no more is heard unless I tap the set gently with my finger, when it comes on again in bursts. This is very worrying, and I cannot make out what is wrong, so I should like you to tell me if I shall have to get another valve. At present I would rather be without the set, it is so very worrying."

From your description we expect that all that is wrong is that one of the small nuts inside the receiver has come undone, or a joint partially unsoldered, and as this is the kind of thing that an experienced amateur could put right in a couple of moments we think that if you can show the set to any friend that has had experience of wireless construction he will be able to solve your difficulty at once.

DOUBLE OUTPUT CONNECTIONS.

H. K. D. (Glasgow).—"The problem is this: I am using a moving-coil loud speaker with a D.E.5A. in the last stage. For an output choke I employ one side of a large 1-to-1 transformer, the moving coil between connected between the 'plate' end of this and the large fixed condenser, which is earthed. Would it be possible to take off leads from the other (secondary) terminals on the L.F. transformer to a separate loud speaker line, using an ordinary loud speaker and not a moving-coil type? And how would this affect results?"

You will find that if you connect the loud-speaker lines as suggested the signals will come through all right on the other loud speaker, and probably there will be no very marked effect upon the output to the moving coil. But the exact effect of such an arrangement is very complicated, and if you have a critical ear for music it is possible that an alteration in results may be detected when the second loud speaker is switched in.

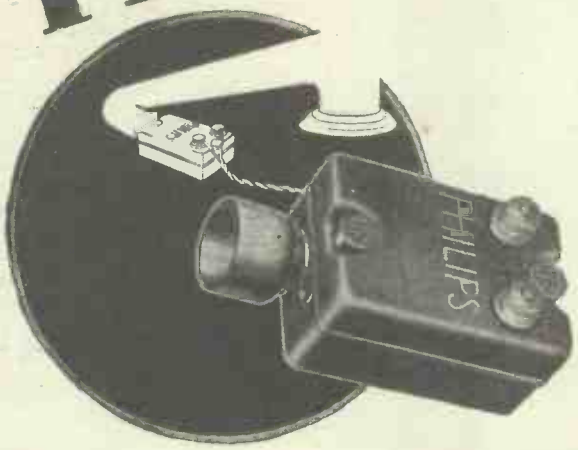
A PRESENT PROBLEM.

F. W. T. (Leominster).—"My friends have got a tin loud speaker but it's very nasal, and I should like to give them a cone cabinet one for Christmas. But could they work both speakers from the same set without losing strength—one in one room and the other in another? If so, the maid could listen-in as well, which would please everybody. How could the two speakers be joined to one set?"

The two loud speakers will work perfectly well together. All you have to do is to break the line going to or from the old speaker and put the new one "in series." If you examine the speakers you will notice that each has a positive (marked +, or red) terminal, and a negative (−, or black, or blue) terminal.

(*Continued on page 744.*)

NEW! PHILIPS GRAMOPHONE PICK-UP



The new Philips Gramophone Pick-up fulfils the long-felt want for a real light-weight pick-up which would not put any more strain on records than an ordinary sound box and give faithful reproduction without surface noises. This neat, scientifically made instrument has standard fitting for any tone arm. An ingenious switch greatly simplifies the fixing of needles.

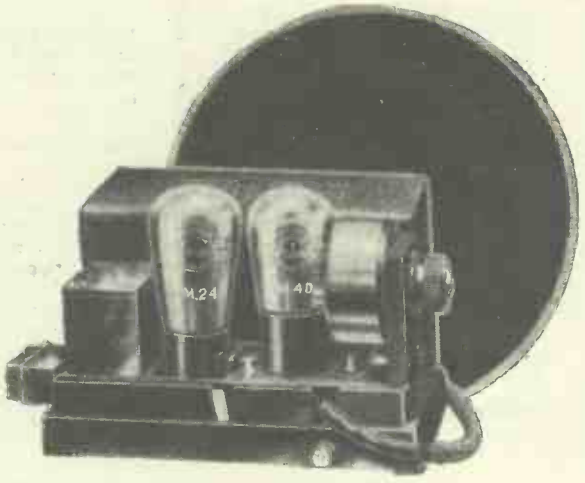
TYPE 4005. **50/-**

PHILIPS AMPLIFIER

Built on the same advanced principles as the well-known PHILIPS Receiving sets, this new Amplifier, incorporating the famous Philips L.F. transformer type 4003, a steep-slope detector and Pentode valve, gives reproduction of gramophone records with a purity and volume hitherto unobtainable.

Volume control permits the reducing or increasing of volume without altering the sound proportion between high and low notes.

TYPE 2781.
Price, including valves and leads, **£6. 10.**



PHILIPS

for Radio

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 742.)

One side of the loud-speaker terminals on the set also is marked positive (+) and the other side negative (−). The correct connections for two loud speakers are: From positive L.S. terminal on set to first L.S. + terminal. From negative terminal of this loud speaker to the positive (+) terminal of L.S. No. 2. Finally, negative (−) terminal of No. 2 L.S. is joined to the negative (−) loud speaker terminal on the set. There will be no marked falling off in strength after the second loud speaker is connected in circuit.

THE WEIGHT OF WIRE.

W. E. L. (Leytonstone).—"I am going to use No. 24 D.C.C. wire, and I have carefully worked it out from the diameter of the former, etc., and I find I shall need in all 150 feet of wire. As the wire is not sold by length but by weight, can you tell me how much in weight I shall require of this kind of wire?"

No. 24 D.C.C. wire weighs approximately one pound for 199 yards. A little calculation will show you that the length you require will represent almost exactly a quarter of a pound of wire.

SWITCH FOR AN INVALID'S SET.

T. R. (Norwich).—"He will have to spend his Christmas in bed, so I wonder if you can suggest a cheap and easy way of switching out the bedroom loud speaker, without disturbing the other loud speaker downstairs. Something simple enough for an invalid to work even when half asleep, and preferably something on a flexible lead like the bedside bell which I fixed up"

All you need is a short extra flexible lead and a push-pull, or any other kind of make-and-break switch. Connect up as follows:

At one end of the flexible lead the two wires go to the two terminals of the invalid's loud-speaker. At the other end of the flexible lead one end of the wire goes to one side of the switch, and the other end to the remaining side of the switch.

When he wants to listen-in he puts the switch "off," or open, and the current has to flow through the loud speaker, which therefore works.

When he wants silence he closes the switch, and this then "shorts" the loud speaker and cuts off the music.

Other loud speakers joined in series will not be affected.

TROUBLE WITH TUNING.

J. A. (Whitley Bay).—"You will see from the sketch that it is a simple set, but all the same it works good except for one thing. I get the crystal right, and I can't hear anything at 0 on the dial, but it starts to come in at about 100. Then it gets stronger as I go further, and is best of all at 180. If I could turn a bit further it would be a bit better still, I think, but the condenser is all in then and won't go any more. Is there any way of getting farther round the dial, as I should like it as good as it can be during the Xmas holiday?"

(Continued on page 746.)

WHEN WRITING IN—

to the TECHNICAL QUERIES DEPARTMENT, remember that the thousands of letters received cannot possibly be dealt with unless the rules are obeyed.

On no account can a reply be sent to you unless you—

ENCLOSE A STAMPED SELF-ADDRESSED ENVELOPE

IN PERIL AND IN PLEASURE

Now if the Exide Battery is used—as it is used—where the behaviour of the battery is a matter of life and death. If the Exide Battery is found—as it is found—in the Marconi Station on the coast and in the wireless cabin at sea. And if the Exide Battery soars with the aeroplane and submerges—as it does—with the submarine—does it not follow that you, installing the Exide Battery in your own wireless set, are following the highest scientific example and making sure of the finest musical results?

Exide

THE LONG LIFE BATTERY FOR WIRELESS

FOR LOW TENSION
THE DTG SERIES
These cells give more effective burning hours per charge in relation to first cost than any others. They are particularly suitable for the Mullard Master 3* and the Cossor Melody Maker Receivers.

SIZES AND PRICES

TYPE DTG
2 volt. 20 amp. hrs.
Price—4/6

TYPE DFG
2 volt. 45 amp. hrs.
Price—8/6

TYPE DMG
2 volt. 70 amp. hrs.
Price—11/-

TYPE DHG
2 volt. 100 amp. hrs.
Price—14/6

Obtainable from Exide Service Agents and all reputable dealers.

EXIDE BATTERIES, CLIFTON JUNCTION, NR., MANCHESTER E54a

QUESTIONS AND ANSWERS

(Continued from page 744.)

You need a larger coil than the one you are using, so get either a new coil which is larger, or add a few turns to this one, (say 15 or 20). You will then find you can "tune through" by turning the condenser dial right round—that is, you can start at 0, bring it up to full strength, and then by turning still further, make it start "falling off" again. This proves your tuning is O.K., so adjust it back to the setting where the programme is strongest, and then listen in with confidence that your set is properly tuned.

RADIO AND RACING PIGEONS.

J. E. L. (near Brighton).—"I am writing to ask you whether an indoor aerial which runs round the room several times would be strong enough for a 100 Per Cent Crystal Set? The trouble is, my father has got racing pigeons, and he does not like an outside aerial in case his birds hit it. If the indoor aerial is not strong enough, what is the best thing for me to do?"

We are afraid that you won't get good results with an indoor aerial, even with the 100 Per Cent Crystal Set, because you are such a long way from a broadcasting station. An indoor aerial gives very poor results compared with an outdoor aerial when used with a crystal set, but there is one thing which might overcome the difficulty.

Ask your father if he thinks the birds would hit the aerial wire if you put corks all along it, every 2 or 3 feet. This is what they do up North, where lots of racing pigeons are kept, and it seems to be a perfect protection, for the birds can see the line of corks very easily, and they avoid it without any trouble.

If your father says no, you will find that the corks have little or no bad effect upon reception, and you will therefore get good outdoor aerial results.

"EVERYBODY'S" THREE ON SHORT WAVES.

To use "Everybody's" Three (which was described in "P.W." last week) upon the short waves, is quite an easy matter.

The first thing to do is to remove the plug-in coils and in their places insert the special short-wave type of coil, as sold by "Igranics," "Atlas," etc.

The most interesting short-wave programmes are those between 20 and 40 metres, in which wave-band are included the programmes of 2 X A D, 2 X A F, 8 X K, (America); 3 L O (Australia); P C J J (Holland), etc. For this band of wave-lengths the necessary coils will be aerial coil, No. 2; secondary or grid coil, No. 4; reaction coil, No. 6 or 9.

When changing over to short-wave work, remove the shorting bar from the ·0005 mfd.

(Continued on page 748.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 746.)

fixed condenser clips, and if any "dead spots" (i.e. places where reaction is unobtainable, or very difficult to obtain) are found when searching, connect the aerial to A1, and set the semi-variable condenser C_3 to a very small value.

If reaction should prove to be fierce or "floppy," try the effect of placing a 100,000-ohms resistance in the H.T. + (detector) lead.

NOTE.—It has been found that the volume obtained is generally far too great for any ordinary power-valve to handle unless volume of the local station is cut down. The easiest way to do this is to reduce C_3 to a small value, connect the aerial to A_1, and then de-tune a little.

A FLEXIBLE ONE-VALVE SET.

"WOULD-BE EXPERIMENTER" (Stockton-on-Tees).—"Can you tell me of a one-valve set that I can carry out experiments with? I should prefer it to be a pretty good-looking set so that it will not be objected to on account of appearance in the home, but I would like to be able to try different kinds of circuits, and I am very keen on getting the last ounce out of the valve.

"I do not want to have to pay too much for it, but I do not mind getting good components providing the set is not one of the kind which, once put together, you can never touch."

One of the best circuits we know for your purpose is that described in the free booklet given away with the November issue of "Modern Wireless." As probably you are aware the performance of a one-valve set will depend to a very great extent upon the efficiency of the reaction adjustment and there are several things which will affect this quality in a circuit.

With any given circuit, Reinartz, Schnell, etc., it is obvious that the best results are obtainable when a particular kind of valve having a certain H.T. voltage and an aerial having certain characteristics are employed. By juggling about with these factors a one-valve receiver can be "hotted up" to an exceptional degree.

The set referred to incorporates a switch on the bottom of the panel by which it can change from one form of reaction to another while you are actually receiving distant stations. In addition, the receiver is provided with alternative methods of coupling the aerial to the set.

This seems to be just the set you require.

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and 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.

See page 736

IF I WERE P.M.G.

(Continued from page 749.)

But to return to our equally important domestic broadcasting. The ban on controversial subjects has, thank goodness, been removed; at any rate, in theory. But in practice it still exists up to a point. In this respect the ether should be as free as the printed page.

There should be no more interference with what goes over the wireless in the way of discussion and debate than with what is printed in the newspapers or what people discuss in public. The only limits should be those of morals and decency.

"Censored" Talks.

One hears a lot these days of broadcast programmes being "submitted" to the political office of the Party in power. This is an intolerable state of affairs, and no such interference should be permitted. Once one political office is allowed to interfere, the political offices of the other Parties when they are in power will claim the same right and privilege. Free broadcasting in an age of free speech and a free press will then be non-existent.

I would certainly make a serious attempt to get part of the Parliamentary proceedings broadcast. We could at least try the experiment. And if listeners didn't like it we could drop it again. But I think the most important debates in Parliament, on, for example, the Budget, or great questions affecting the lives of the people, should be broadcast.

Again, as Postmaster-General, I would insist on every sympathy being shown to genuine experimenters and amateurs. Some of the most wonderful of recent discoveries have been made by amateurs working with enthusiasm and genius under difficulties at this great science. Every reasonable facility should be given to bona-fide experimenters, and the only safeguard should be that they should not interfere with the ordinary enjoyment of licence-holders.

Sorting the Amateurs.

It should not be difficult to separate the genuine experimenters and keen and knowledgeable amateurs from the cranks. Before granting experimental facilities we could invite applicants to appear before a small expert panel and satisfy these experts as to their suitability and claims for facilities.

I think I have said enough to show that I should realise, and should make my subordinates realise, that wireless is not a side-line or a passing craze. Just as the Press is spoken of as the Fourth Estate, so it is quite proper to speak of wireless to-day as the Fifth Estate; and no limits can be set to its importance, usefulness and the profound influence it will have in the future.

SHORT-WAVE NOTES.

By W. L. S.

MY notes recently about the unknown German or Dutch station working in the region of 37-38 metres have awakened considerable interest, and I have to thank various correspondents who have forwarded either their own observations or some further information about the station. It was not, however, as one writer suggests, PCLL in Holland, as I have often heard him since, and his wave-length is generally exactly 38·5 metres, whereas this other station was considerably lower.

The most likely suggestion is that the station is AFK, at Doberitz, Germany. This station used to operate on interrupted C.W. for long periods, much to the annoyance of my ear-drums when I was listening for ".DX" on schedule! At any rate, I cannot see the idea of transmitting for days on end without ever giving a mention of the call-sign. It is not as if the transmission is one of which they need be ashamed, since it is really excellent in every way.

With reference to 10-metre work, London amateurs in particular have lately been dispelling the bogey that "10" is only a long-distance daylight wave. All the London amateurs active on this wave-length seem to be in regular communication with each other, and although, from the entire absence of signals from the other active British stations, it seems as if, after 20 miles or so, signals fade out completely up to 3,000 miles or more, there is much more to be found out yet regarding results with different types of radiating systems, etc.

Successful Londoners.

The active stations in and round London at present appear to be G2FN, G2KF, G2NH, G2OD, G6HP, G6LL, G2CX, G6QB, and a few others. G6HP has been in communication with G2OD, a distance of about 25 miles, which appears to be one of the "longest short distances" yet covered on 10 metres.

The R.S.G.B has practically resolved to drop "metres" altogether now, and pin its faith to "kilocycles." The fact is, of course, that wave-lengths should never have been allowed to intrude into radio. Frequency is the fundamental, and it should always have been frequency in which we thought and spoke. It has clearly got to be frequency in future, and it seems to me that there is nothing to do but to try our hardest to forget wave-lengths altogether from now onwards.

It is a bit laborious to speak of the 40, 20, and 10-metre bands as the "7,500, 15,000, and 30,000 kc." bands, but the megacycle (one million cycles) is convenient, and it is almost as easy to speak and think of "30 megacycles" as "10 metres." The great advantage of thinking in frequency is that a change of 10 kilocycles represents the same amount of variation wherever we take it, as I explained before.

Also, as a rough guide to calibration, we know that if we are receiving a signal or carrier-wave "in the silent point" with our receiver oscillating, and we detune until the signal has *just* gone out of audibility, we have made a change of, roughly, 10 kilocycles.

LATEST TELEVISION NOTES.

Mihaly's System.

MORE doings in the von Mihaly camp! The young Hungarian is back in his Berlin laboratory after a series of demonstrations with a simple television set. He is pushing on his experiments while he negotiates with the German Post Office for the sale of the German rights of his system.

Steps Forward.

Now he tells me: "Yesterday we made a *very big* step forward. We succeeded in making a light-valve 70 times surpassing the modern cell. A further step forward is our Snow-white Light; and another is that we have devised a constant synchronisation device which automatically corrects itself."

Full details of all these improvements are coming to me, and as soon as they are available you shall have them.

High-See-All.

Aero-television is a popular pastime in America. Apparatus in a giant tri-motor Ford plane has just picked up a television broadcast 3,000 feet above Chicago.

A Science?

Academicians will not yet look upon television as a serious branch of science. When I was approached not long ago to write a monograph on the subject for graduates and science teachers I thought that they did. But a friend of mine has offered the history of television as the thesis for his M.Sc., and the authorities of London University find it "unsuitable."

On One Wave-Band.

Carter Radio Company, Chicago, have broadcast voices and television on one wave-band. They claim to be the first in the world to do it.

Confusion.

When will the public—and many more scientific than the general public—stop confusing "television" and "photo-telegraphy"? Even a deep-brow paper like "Nature" cannot avoid the error. I have had to write to tell them so. Meaning television, they said that "radio pictures" were disappointing. Whatever the views on Baird television, photo-telegraphy results, as you know, are by no means disappointing.

Experts Go Wrong.

Captain W. G. Jarrard represented the Baird system at a meeting of the Radio Manufacturers' Association, in America, which attempted to standardise television terms. The "experts" went wrong immediately by defining television as "vision by radio." Most television demonstrations

(*Continued on page 756.*)

LATEST TELEVISION NOTES

(*Continued from page 754.*)

have been given by line. Following the cinema industry they named each complete image built up at the receiver a "frame."

Standard Television.

A standard for television broadcasting was fixed: 48 lines to an image, and 15 "frames" a second.

This Year, Next Year?

Five men who should know have been asked when television will be available to the average radio fan. These are the replies: Dr. Lee de Forest: "May be a matter of ten years or more"; Dr. C. Francis Jenkins: "Radiovisers for Christmas presents this year, baseball by television next summer"; David Sarnoff, vice-president of the Radio Corporation of America: "Four or five years are yet needed for perfection"; a television-set manufacturer: "It's here now!"

B.B.C. v. Continent.

I have heard the threat of Continental broadcasts for English listeners—and seers—before. Captain Fulton told me, in Vienna, a year and a half ago, that if the B.B.C. would not take up his radio picture apparatus he would broadcast photographs and cartoons for English receivers from Paris.

Tuning-In.

A New York man has fitted a sliding visor before his television disc so that he can bring 24, 36, or 46 holes into use. He is now able to "tune-in" to stations broadcasting images made up of different numbers of lines.

H.J.B.

"DEAR MR. EDITOR."

(*Continued from page 723.*)

oppositions have, of course, to be reckoned with and valuable time occupied thereby. This is bad enough, being negative instead of positive, but it is part of the game, and can be done without worrying.

What Worry Does.

Perhaps I might have written an article: "On Not Worrying." Have you ever reflected how enormous and tragic an influence worry has on the world's affairs? I suppose most mental and physical collapses are due to it. I believe mighty few people collapse owing to overwork. Incidentally, do you know what is at the back of a great deal of worry, a very great deal of it, in fact? Fear of losing one's job or means of livelihood. Just that. There are all sorts of contributory circumstances, of course, but it usually comes to that simple statement in the long run.

However, I am sorry I cannot write an article for you this year. You have quoted the precedent of previous years. There is another possible article: "On Precedents." It is quite good to have precedents to follow, or make other people follow. Sometimes, not always, they are embarrassing. One must be strong enough to refuse to be bound by them. This is sometimes difficult. Perhaps it is still more difficult to create precedent, but what a fine and satisfactory thing to do. You remember the classic story where the objections of the bureaucratic and timid were brushed aside by the magnificent "I am here to create precedent."

Still Need for Imagination.

That was one of the delightful things about broadcasting. There were no precedents, certainly not in this country, and such as existed elsewhere were of the sort to be avoided. Precedents were being created all the time and in everything that was done. One likes to feel to-day that most of them were sound and good. I hope, however, that we are strong enough and wise enough to depart from precedent when occasion demands. I, certainly, am not going to be bound this year by the precedent of Christmas Articles to you in previous years, as you will by this time have gathered.

If I had been writing an article for you, Mr. Editor, you would have expected me to say that the B.B.C. is not inclined to rest on its oars or its laurels, or whatever it is that complacent people do rest on. I could have assured you and your readers of this. I could have said that, whatever measure of success has been achieved—and, mark you, we are not so silly as to pretend that nothing has been achieved—we all feel that there is still need for the same outgoings of imagination and enterprise and devotion.

All to the Good.

I think, however, that many erstwhile captious critics have a more adequate conception of what broadcasting means and what is involved in its conduct, more tolerance of the things they personally dislike (or did dislike), more appreciation of the necessity for catering for other people's tastes. And that is all to the good.

(*Continued on page 760.*)

DEAR MR. EDITOR.

(*Continued from page 758.*)

By the way, Mr. Murray now says I am right to decline to write an article this year. He says your suggested fee was preposterous (*). I agree with him.

Yours sincerely,
J. C. W. Reith.

* If you take a thousand pounds and subtract £X from it, you will see that the fee offered to Sir John was a very generous one.—The Editor.

TECHNICAL NOTES.

(*Continued from page 712.*)

or a circuit which will separate alternating currents of one frequency or one group of frequencies from alternating currents of another frequency or another group of frequencies.

Filter circuits may be broadly divided into three classes—low-pass filters, high-pass filters and band-pass filters.

Low-Pass Filters.

A filter of the low-frequency or low-pass variety is one which is designed to pass all the low-frequency currents below a certain more or less definite value, and to resist the passage of frequencies which are appreciably above the critical value.

The critical value, by the way, is generally referred to as the "cut-off" frequency and, although the impression is sometimes given that the cut-off frequency is very sharply defined, as a rule this is not so, and the cut-off frequency is more of a *region* than a particular frequency.

Zero Resistances.

Of course, an ideal low-frequency or low-pass filter would be one which offered zero resistance to frequencies below the cut-off value and an infinite resistance to frequencies above that value but, as I have just mentioned, the curve showing the relation between the frequency and the resistance is never in practice quite like that which would be given by the foregoing theory.

The high-frequency choke in the plate circuit of a detector valve functions to some extent as a low-pass filter, since it permits audio frequencies to pass into the L.F. amplifier but excludes the H.F. from the amplifier.

High-Pass Filter.

An H.F. or high-pass filter as its name implies has precisely the opposite effect to a low-pass filter and permits the passage of high-frequency currents whilst obstructing the passage of low-frequency currents.

The H.F. chokes and condensers used in the plate circuits of an H.F. amplifier constitute an example of a high-pass filter, passing the high-frequencies directly to the filaments thereby keeping them out of the plate supply but obstructing the passage to the filaments of the D.C. plate current; the D.C. may be considered as an alternating current of zero frequency.

Band-Pass Filter.

An example of a band-pass filter as used in radio receiving circuits is a series tuned circuit.

(*Continued on page 762.*)

TECHNICAL NOTES.

(Continued from page 760.)

Dynamic Speaker.

The so-called dynamic type of loud-speaker depends, as most of my readers know, upon the production of a strong magnetic field between the poles of a magnet, the moving coil being situated in this strong field.

The magnetic field exists across an air-gap and may be produced either by means of a permanent magnet or by means of a magnet which is energised by the passage of an exciting or "field" current.

Value of Flux.

The maximum value of the flux which can be produced depends, amongst other things, upon the magnetic properties of the iron used for the field magnet.

The strength of the magnetic field, however, is influenced to quite a large extent by the shape of the pole-pieces of the magnet and also by their distance apart, that is, by the effective length of the air-gap which the magnetic flux has to bridge.

Small Air-Gap.

It is a very great advantage to have the air-gap made as small as possible as this greatly concentrates the flux into the region in which the moving coil is placed. Naturally this means also that the moving coil has to be reduced as much as possible in dimensions and in practice the coil is so arranged that it only just clears the pole-pieces.

As a matter of fact, the attempt to reduce the clearance between the pole-pieces and the moving coil to the smallest possible dimensions sometimes results in trouble being experienced due to some slight imperfection or to the coil having got out of adjustment.

Buzzing.

Thus it will sometimes be found that a buzzing sound is produced when the moving-coil speaker is used, whilst if some other type of speaker be substituted for the moving-coil speaker the results may seem to be quite satisfactory.

On the other hand, if this occurs it is not always safe to assume that the receiving set itself is not to blame, for cases will sometimes arise where a moving-coil speaker, even if in perfect adjustment, will give imperfect results, whereas a speaker of a less sensitive type will seem to give quite satisfactory results.

In such cases the real explanation is that the imperfection in the receiving circuit is not sufficient to be brought into evidence by a loud speaker of ordinary sensitivity, whereas when a speaker of extra sensitivity, such as a carefully adjusted moving-coil speaker, is used the defect is immediately made apparent. Therefore, if you have trouble with your moving-coil speaker you should try the speaker on another set before assuming that it is the speaker that is to blame and not the set itself.

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Saturday, December 8th, 1923. T/R R/R N/R D/R

THE "P.W." "WHITE PRINTS."

A NEW SERVICE FOR OUR READERS.

White Print No. 1. :: :: A Wave-Change One Valve Set.

This week we publish the first of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the White Print filed. In due course you will thus have available an encyclopædic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

THE single-valve wave-change set, of which the theoretical circuit diagram is given below, employs a very well-tried although simple scheme. By means of a single push-pull switch the set can be adjusted for reception on either the lower broadcasting band or the 5XX band. By this means it is unnecessary to change any coils, an arrangement of which the advantages are obvious.

The coil for the lower broadcast band is home-made, all three windings—that is to say, aerial, tuned, and reaction—being on the same former. As far as reception on this band is concerned, the set is of the usual Reinartz reaction type, a variable condenser being used to control the reaction. The leaky grid-condenser method of rectification is employed. When reception on the long waves is desired, a loading coil is switched in series with the tuned circuit of the lower band, the whole then being tuned by the ·0005 variable condenser. A portion of the loading coil is included in series with the aerial winding, so as to increase the coupling.

Home-made Coils.

Reaction is still capacity controlled; but is now partly Reinartz and partly Hartley. The latter is automatically provided by the fact that the earth is tapped on to the loading coil at a point a number of turns from the end at which the L_3 coil is joined.

It will be seen that when the wave-change switch is pulled out, the loading coil is shorted in two sections, thus only leaving the home-wound coil in circuit, which tunes to the lower broadcast band.

Very little needs to be said re the construction of the set, the diagram overleaf being more or less self-explanatory. Details of the coil for the ordinary broadcast wavelengths will, however, be required.

Of the three windings, L_1 and L_3 may be of 24-gauge D.C.C. wire, and L_2 of No. 30, and they must all be wound in the same direction. The coil former is 3 in. in diameter, and the spacers between L_1 and L_2 may conveniently be small pieces of wood, and six of them should be arranged equi-distant around the coil.

First wind on L_2, which should have 55 turns. L_3 can be put on next, with a small gap between it and L_2. This is the reaction winding and should have about 30 turns, sometimes, however, it will be found in practice that a few more or perhaps less turns than this will give best results, when an adjustment should be made.

L_1 is wound on top of L_2 but spaced as already described. It should begin at the No. 3 end of L_2 and have 30 turns in all with taps at 15 and 25 turns. The numbers on the coil correspond to those on the circuit, the thick wire running next to the No. 3 wire being the beginning of L_1. If desired, L_3 may be wound with a slightly smaller gauge wire than specified.

Having completed the coil, the constructional work may be continued. First drill the panel. The positions of the components may be gathered from the wiring diagram by means of the scale, which will be found in the bottom right-hand corner.

The dimensions for the terminal strip are actually given. Mount the components on the baseboard as nearly to the positions shown as possible. The method of mounting the short-wave coil is left to the ingenuity of the constructor, and a number of ways will immediately suggest themselves. When the set has been wired strictly in accordance with the wiring diagram it is ready for use.

A valve of the H.F. type is used, although one of the usual general-purpose or detector valves could be employed. H.T. up to about 90 volts will be required, but the actual value employed must be the highest which gives smooth reaction.

No filament rheostat or fixed resistor is employed, since with modern valves of the 2-, 4,- or 6-volt type these may be dispensed with.

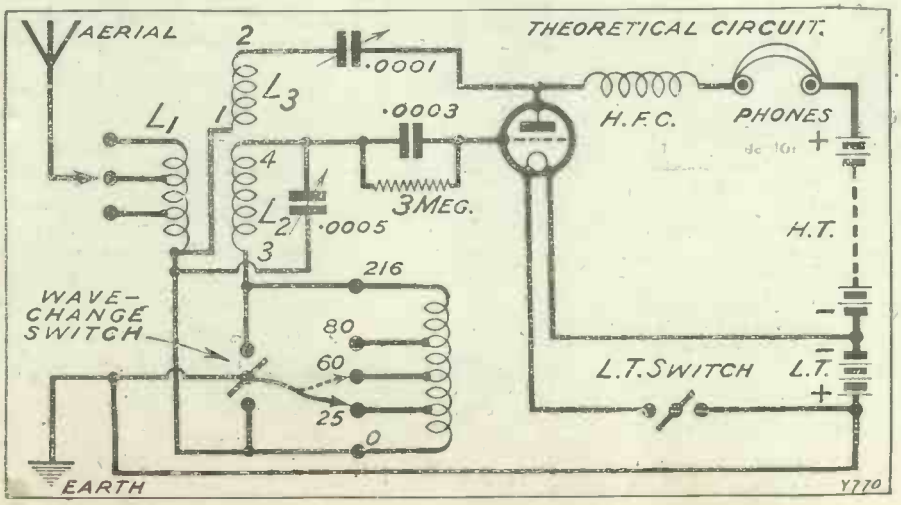
Increasing Selectivity.

For reception on the lower band, pull the wave-change switch out and switch the set on with the other switch. The clip to the aerial should be placed on the end of the 30th turn of the coil L_1. The set is now tuned in a similar manner to any ordinary one-valver. The reaction condenser capacity must be increased as the tuning condenser capacity is increased. This will enable you to keep the set at its most sensitive point, namely just before it oscillates.

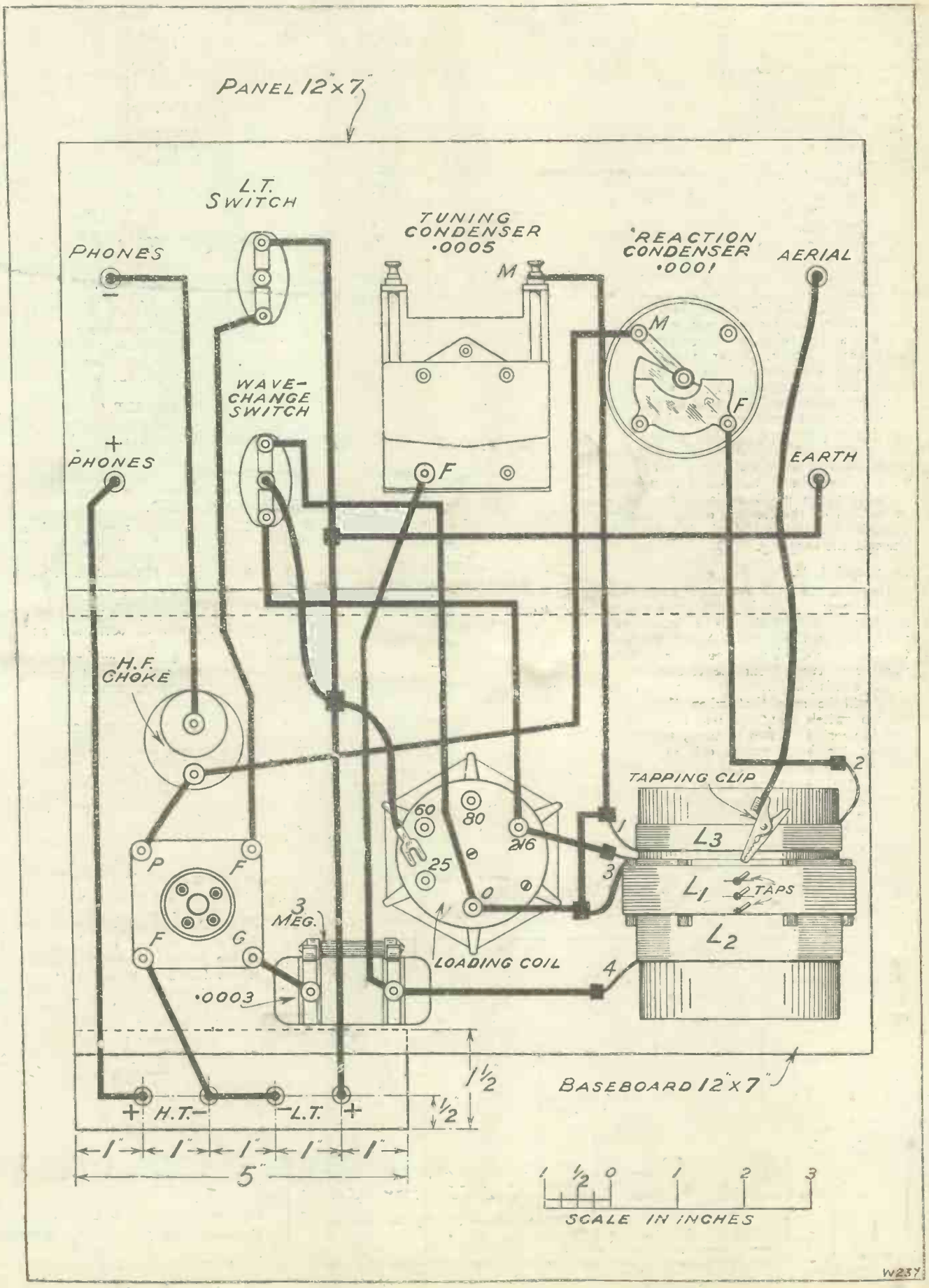
If selectivity is not high enough, try the aerial clip on the two tappings of the aerial coil L_1. For long waves leave the aerial clip where it is and push in the wave-change switch. The set is tuned in just the same way as for the lower band. The flex lead to the standard loading coil should go to 25, 60 or 80, according to the degree of selectivity found necessary.

COMPONENTS REQUIRED.

- Ebonite panel, 12 in. × 7 in. × ¼ in. or ⅜ in. Cabinet for above with baseboard 7 in. deep.
- 1 ·0005 variable condenser with plain or slow-motion dial according to choice.
- 1 ·0001 reaction condenser (a ·00015 could be employed).
- 2 Ordinary type push-pull on-and-off switches. (One suitable for wave-change.)
- 8 terminals, with ebonite strip for 4 of them, 5 in. × 1½ in.
- 1 Standard loading coil. This coil is made up by a number of firms to specification given in "P.W."
- ·0003 Fixed condenser with grid-leak clips.
- 3-megohm grid leak.
- 1 Anti-vibration valve holder.
- 1 H.F. choke to cover low and high broadcast bands.
- 3½ in. length 3 in. diameter coil former.
- Quantity 24 and 30 D.C.C. wire, wire for connecting up, screws, spring clip, spade tag, flex, etc.



NEXT WEEK:
A WAVE-CHANGE TWO-VALVE SET.


PANEL 12"x7"
L.T. SWITCH
PHONES
TUNING CONDENSER ·0005
REACTION CONDENSER ·0001
AERIAL
WAVE-CHANGE SWITCH
+ PHONES
EARTH
H.F. CHOKE
TAPPING CLIP
60
80
25
2/6
0
P
F
G
3 MEG.
·0003
LOADING COIL
L3
L1
L2
TAPS
1
2
3
4
+ H.T. −
−L.T. +
1"
5"
1½
½
BASEBOARD 12"x7"
1 ½ 0 1 2 3
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"P.W." WHITE PRINTS

No. 2

In this Issue

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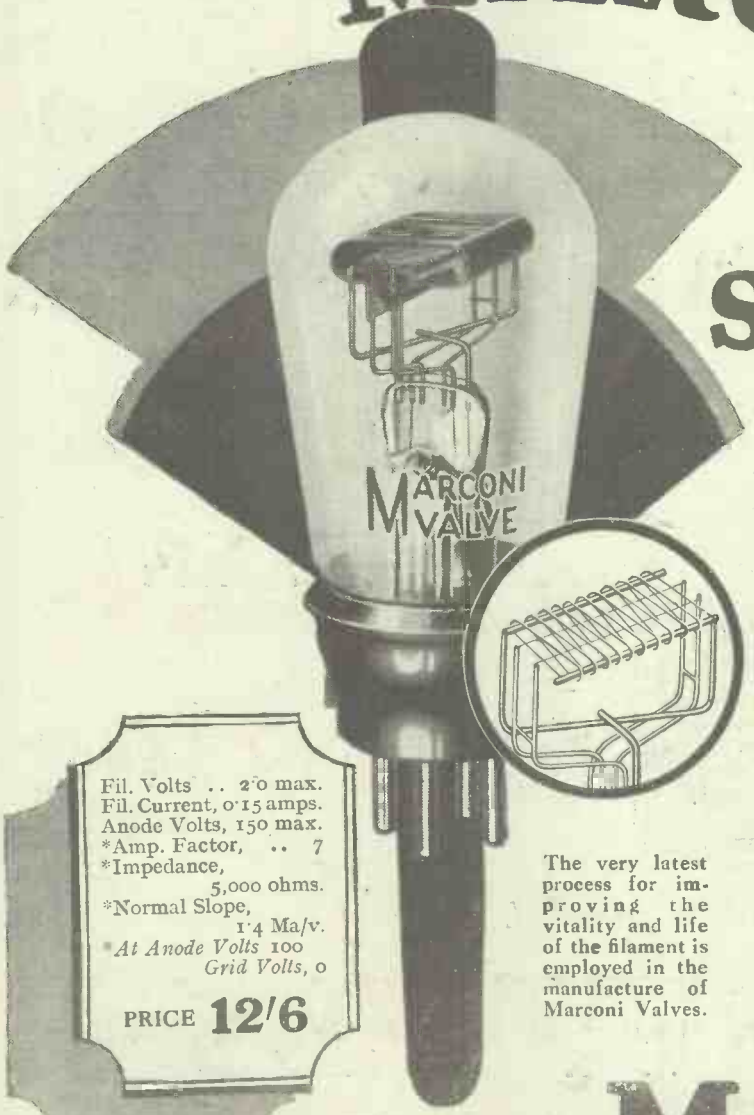

Fil. Volts .. 2·0 max.
Fil. Current, 0·15 amps.
Anode Volts, 150 max.
*Amp. Factor, .. 7
*Impedance, 5,000 ohms.
*Normal Slope, 1·4 Ma/v.
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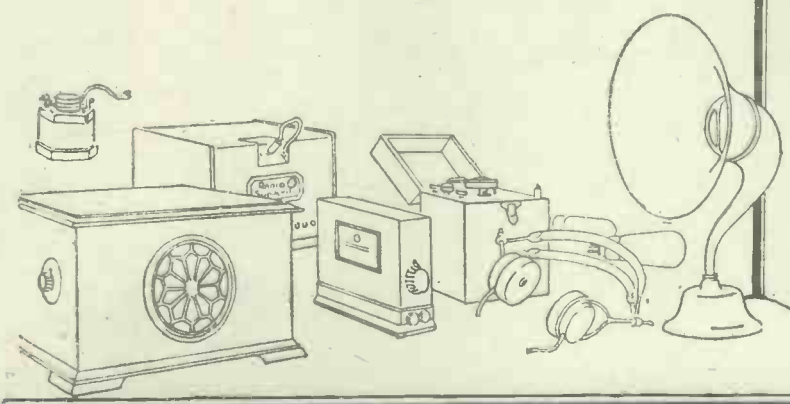

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RADIO NOTES AND NEWS.

Wales Wants Welsh—One Wave-length Relay Stations—More About the Aurora—Speaking Spools—The First Broadcaster—New DX Feat—The Father of the Valve.

In the Air.

THE family wash, Dr. Mansfield Robinson (the man who paid to send our love to Mars!). Lindbergh, television—all these are "in the air." But what else? Ask little Johnny, who is beginning to show signs of studied and quite unnatural virtue. Ask any turkey. Ask Pa. Ask yourself. The 1928th Christmas! And *still* there is a thrill in the sound of the word.

A Few Suggestions.

I SHOULD like to see a special effort, through 5SW, for the benefit of Britons overseas. And what about the men of the Navy? Are they allowed to listen-in? Why not send them a kindly word or so and a few special items? Not forgetting the exiles in lighthouses and lightships. And a special message of cheer and hope to the blind, the sick, the inmates of workhouses (terrible word!) and the kids in the orphanages! And—the prisoners? Why not?

Wales Wants Welsh.

ABERYSTWYTH has sent to the B.B.C. a petition asking for a large increase in the Welsh programmes pending the provision of a Welsh station. It is said that there are 150,000 Welsh people who speak Welsh only—by which, I suppose, the petitioners mean to imply that those people cannot understand spoken English. Well, be it far from me to deplore the ignorance of English prevalent in Wales. But I fancy that the B.B.C. will be hard to convert to the "whole hog" in this matter. They will probably suggest English lessons for the 150,000.

"Sport."

BY way of a Special News Bulletin let me announce that the results of the championship of the Wireless and Allied Trades Tennis League were: 1st. Baker Perkins Tennis Club; 2nd. Messrs. S. G. Brown, Ltd.; and 3rd. Messrs. C. A. Vandervell & Co. Applications for membership of the League should be addressed to Mr. M. Hailes, c/o Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, W.3.

The One Wave-length Relay Stations.

IN order to avoid interference from foreign sources the B.B.C. plans to operate all its relay stations on one wave-length, but owing to the time required to instal the necessary apparatus the scheme will not come into effect until the spring; thereafter it will remain in force for about three years until the "regional" scheme gets going. In return for non-interference listeners will have to put up with one programme for all relays, which will generally be that sent from Daventry (5XX). One programme is better than none, eh?

DON'T DENT DIAPHRAGM.

If you wish to test whether the 'phone diaphragm is free or touching the magnet pole-pieces, DON'T tap it with a pencil, as shown. But see page 778.

Golly! What Gales!

AT the time of writing the December gales are still doing their darndest to boost the aerial and insulator trade. Next door's aerial has so closely twined itself round the poles of my pergola that it will have to stay there. They say that the Eiffel Tower (1,000 ft.) swayed so much that visitors were kept off its top stage. What high steel structures can stand from the wind is simply incredible to the lay mind. I have stood at the foot of a 200-ft. wireless mast made of steel and seen the top moving like a pendulum; there were about 20 sections and yet nothing went wrong.

More About the Aurora.

MY remarks about the effect of the Aurora on wireless have drawn a welcome letter from Mr. F. Dearlove, who has spent the past eighteen months in Labrador and has carefully studied the matter. He states that according to his observations the Aurora is of two types, affecting transmission and reception differently according to their direction compared with the path of the wave. He agrees with me that the polar regions are "top-hole" for reception, but adds that the Aurora does not often make itself very evident far into the Arctic Circle. I live and learn. By the way, Mr. Dearlove contributes an absorbing account of his Arctic adventures to the current number of "Modern Wireless."

Speaking Spools.

A GERMAN inventor, Dr. Stille, has demonstrated a wonderful steel (or Stille) wire which will, it is said, store up records of the human voice as long as necessary and deliver up the sounds when required. A speech which takes an hour to deliver can be repeated to this wire as fast as tongue can utter it, and the darned thing will transmit it again in as little as ten minutes. We shall live to hear the B.B.C. announce "Julius Cæsar." "In three reels."

"A Lordly Pleasure-house."

THE B.B.C.'s new headquarters bids fair to set the pace to the rest of the world, U.S.A. included. The site is at the corner of Langham Street and Portland Place, and the building is estimated to cost between £400,000 and half a million. Space is insufficient for me to detail all the wonders of the projected palace of chamber music, but I may say that there will be nine studios, one of which will be big

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

enough to hold a large orchestra and an audience of 1,000 people. Ready in 1931, barring strikes.

The Terrible Infant.

MY kid son has reached the stage of his intellectual history where he daily conceives, and propounds to me, strings of questions. Cunningly devised, they appear to be intended to catch me napping or to make me contradict something that his schoolmaster has said. Some of them are snorters and the following is a typical instance: "Daddy, if sounds get weaker farther away from where you make them, why can't you hear the wireless louder down the garden than in this room? Isn't it nearer London down there?" How is that for a small trial order?

Mullards' Make Merry.

THE first dance at the New Royal Horticultural Hall was given by the Mullard Wireless Service Co., over 1,500 of the guests being members of the staff. Carefree, in spite of their tremendous output, and with no thoughts of valves, they wore out the floor with their "light, fantastic" toes and then gave Mr. S. R. a wrist-watch to show there was no ill-feeling. Several nobby nobs were amongst the guests, including the Mayor of Battersea (the place where they fly the "red flag" of liberty). A fine firm! Long may they give dances.

The Point of View.

WHAT do *you* think about it? A "Daily News" reader wrote deploring that the B.B.C. had interposed the time-signal upon a beautiful song by Schubert which was being sung by a lady with a lovely voice. In reply another person alleged that the B.B.C. time signal "is of more importance in a vital sense than all the solo singers, however illustrious." My own feeling is that the B.B.C. committed a sin against art, good taste, and commercial sense. Confound the blessed time! Let's forget it when the day's work is done!

The First Broadcaster.

IT'S news to me, but a New York paper alleges that the great Caruso broadcast as early as 1909. The paper says that Dr. Lee de Forest installed the radio transmitter in the attic of the Metropolitan Opera House, and put microphones on the stage. The piece sung by Caruso was the Siciliana aria from "Cavalleria Rusticana." It is added that the broadcast was not very successful and that only a few people heard it, mostly ship operators. Would any ship's radio operator who heard this favour me with a few lines, please?

Chamber "Music" and Education.

I AM not sure that the B.B.C. is going to "get away with" this Chamber Music and Radio Education business. Sometimes, I have feared that I was just a lone voice "crying in the wilderness" about those abuses of power, but now I am gladdened to note that the Manchester Radio Society has carried a resolution viewing with alarm the increasing amount of time allotted to purely educational talks. The discussion also revealed considerable horror of Bartok and Co. and their works, i.e. Chamber-Highbrow Music. One speaker expressed a preference for the noise which accompanies the tuning-up by the orchestra. Hear, hear!

A Radio Tragedy.

EXCEPTIONALLY sad is the true story of the death of Mr. G. Jones, radio operator of the "Princess May." On his announcing his forthcoming marriage to a Carnarvon lady, Engineer Leon Fiesta slapped him on the back, overbalanced himself and fell overboard, grabbing at Mr. Jones and carrying him over also. The engineer was rescued, but the ill-fated wireless man's body did not come to the surface again. "P.W.'s" deepest sympathy is extended to his parents and fiancée.

SHORT WAVES.

"The latest device for amusing baby is the installation of a wireless set in the pram," we read in the "Sphere."

Well, if it's a boy, he's got to get used to loud speakers some day, anyway.

* * *

English Visitor: "Nice outfit, eh, what, old bean?"

Yankee Ham: "A watt? The dickens! Fifty watts, O.M."—"Radio News."

* * *

"Loud speakers in large varieties from 12s. Bone or Horn."—"Acton Gazette."

We'll have one of the former; we can always say the dog chewed it.

* * *

It has been suggested that loud speakers should be installed in dentists' operating rooms, with programmes as follows:

Topical Talks on Gumboils. By A. Swell.
Jack Mumbles' Toothless Syncopaters.
One-act drama: "The Yeller Room."
Revue: "Sore this is Tornmouth."

* * *

Answer to Correspondent: The best way to eliminate the crackle of static from your loud speaker is to CUT THE LOUD SPEAKER CORD!

* * *

THANKS, B.B.C.

Morning talks for housewives are the latest wireless development. Perhaps they will let us read our papers over breakfast now.—"Birmingham Daily Mail."

* * *

Smith: "If prizes were given for the laziest man, Biggs would get the furlined bathtub."

Jones: "Is he so lazy?"

Smith: "Is he? He's so lazy he'd rather listen to a bedtime story than turn the dial!"—"Radio News."

* * *

Even now critics are asserting that wireless is responsible for bad weather.

Is it "talks," I wonder (drat 'em!),
On the "Nature of the Atom,"
Or "Some Fossils Found at Chatham,"
Which invite this endless mud?

Or perhaps we ought to banish
Little chats in French or Spanish?
Or, should all jazz music vanish,
Lest the land be one large flood?

"Manchester Guardian."

Something for Nothing.

THIS is, apparently, the principle discovered by the Lancashire man who has been widely reported as having invented a means of amplifying electricity. So far as I know, electricity can only be amplified by first subtracting energy from something else, and this can already be done satisfactorily. My view is that the inventor is a clerk in the local power firm, who has found a means of amplifying electricity bills—and the reporter missed out the last word.

Oh, Worthing!

FROM a local paper I learn that a company asked the Worthing Corporation for permission to instal a radio exchange. The conditions under which the application was made appear to me to be quite reasonable, every security and precaution being offered.

But no, the dignitaries of the Council refused consent, though offering consideration to individual applications in certain streets. Apparently it is the overhead wires which scare them. Why? Has Worthing no overhead wires carrying more than 20 volts?

New DX Feat.

A BROTHER Scot of Mr. Baird's, T. W. M. M., of Edinburgh, who agrees with our editor on the subject of television, writes to say that on Armistice Day, 7.30 p.m. (G.M.T.), he received 6 A G Perth, W. Australia. I haven't heard much from the short-wave DX fellows lately, and presume that they are busily occupied in making sets for the winter's work. But I should like to know whether 6 A G has been properly heard here by anybody else. Wavelength about 32 metres.

News from Afar.

AN amazing epistle from a Jap with a signature like a cobweb. His postage stamp was received by my young son with a murmur of joy; his letter gave me a few moments of sunshine. Here is some of it:

"Adverting to your long-distant remarks of the short wave, I speculate if they thereover intercept the Joak. Here we have Teishinsho. That is not the better thing, but it is ours."

Always glad to intercept jokes. Sorry about Mr.—or Mrs.—Teishinsho. A poor thing, but your own, as Shakespeare might have said.

The Father of the Valve.

DR. J. A. FLEMING, F.R.S., inventor of the first type of valve, has accepted the presidency of the Television Society. He is only 79 years old. Do not think that your struggle with the income-tax form necessarily shortens your life. Dr. Fleming, after a life of strenuous brain-work, will cheerfully "take you on"—on any subject connected with electricity—and wipe the floor with you in higher mathematics.

He is a living example of the truth of the saying, "Man is immortal till his work is done." He, like Sir O. Lodge, is a source of shame and inspiration to young men who dream of retirement at sixty.

Gee! Likewise—Whizz!

JUST to show you the desirability of keeping as far away from litigation as possible allow me to mention a case which has lasted eleven years and put more than £200,000 into the pockets of the lawyers. Dr. Lee de Forest v. Major Edwin H. Armstrong—a name not quite unknown to our readers. The U.S.A. Supreme Court has terminated a perfectly good case, which might have been continued for many years and kept the lawyers in clover, by deciding that De Forest and not Armstrong was the original inventor of the regenerative or "feed-back" circuit. So now we know.

ARIEL

A NEW FILADYNE CIRCUIT

GOOD NEWS FOR THE AMATEUR EXPERIMENTER.
By J. ENGLISH.

DOUBTLESS you are well acquainted with the details of that very novel and efficient detector scheme, the Filadyne circuit, originated some two years ago by Mr. G. V. Dowding. In my opinion, this is quite one of the most interesting circuits of recent years and, although widely used, the scheme deserves an even more

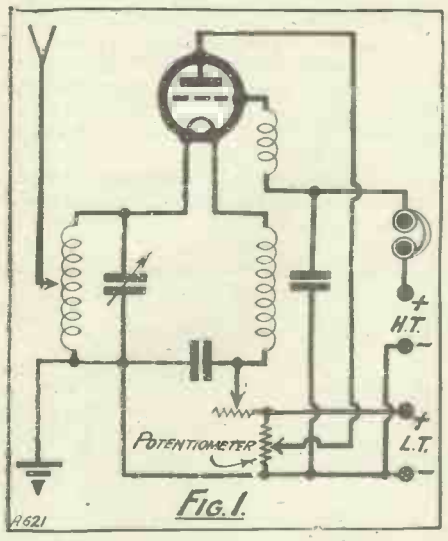

FIG. 1.

prominent position in receiver design than it enjoys at present.

Although the Filadyne circuit is so unorthodox it is yet capable of remarkedly fine results and the possibilities of the scheme have not yet been fully developed. Filadyne enthusiasts will welcome details of new modifications of the circuit, and in this article I shall deal with the more interesting results of some of my recent experiments.

Work for the Anode.

In Fig. 1 you will recognise the standard Filadyne scheme wherein the two filament coils form the tuned input, the grid being the output electrode corresponding to the anode of the ordinary valve detector, while the actual anode is given a suitable positive bias by means of the potentiometer, reaction being controlled by variation of this anode bias.

Now, although the anode performs important work in this circuit it seemed to me that it might be possible to give it still more to do by removing the reaction coil from the grid circuit to the anode circuit. If the circuit worked properly after making this change we should obtain reaction from the anode circuit, while the grid circuit would be free to deal with the audio-frequency output.

As you know from previous experience, a valve whose L.F. output circuit carries considerable H.F. current, as in the grid circuit of Fig. 1, is liable to cause serious trouble through H.F. energy getting into the L.F. amplifiers. In our new scheme, however, it would be easier to suppress this

> **"In my opinion, the Filadyne is quite one of the most interesting circuits of recent years, and, although widely used, the scheme deserves an even more prominent position in receiver design than it enjoys at present."**

stray H.F. component because all the H.F. current we require would be that in the anode circuit, which is quite distinct from the L.F. output circuit.

In order to get a clear idea of the proposed new arrangement let us concentrate on Fig. 2, where you will see the reaction coil transposed to the anode circuit. The latter is completed through the potentiometer as before and this component is shunted by a small fixed condenser in order to bypass freely the H.F. component. Referring for a moment to Fig. 3, which gives the anode and grid current curves of a valve under Filadyne conditions, you will see that a change of anode potential produces a variation of anode current almost exactly opposite to the corresponding variation of grid current.

This fact tells us that if there is an H.F. current in the grid circuit there must also be an H.F. current of almost equal magnitude but opposite in phase in the anode circuit. This anode H.F. current we turn to advantage in the circuit of Fig. 2 in the shape of reaction effects, shunting to

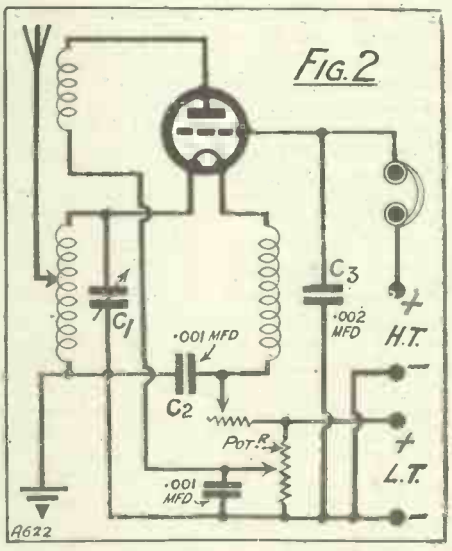

FIG. 2.

earth the H.F. component in the grid circuit. Since the anode H.F. current is opposite in phase to the grid H.F. current the connections to the reaction coil must be reversed when it is removed from the grid.

Smoother Reaction.

Now, on trying out an experimental receiver built to the circuit of Fig. 2, I found that oscillation was readily obtainable, and that the degree of reaction could be controlled very easily by varying the potentiometer setting as before. The advantages of changing the position of the reaction coil quickly made themselves evident in a smoother control of reaction without howling at the critical state and a better elimination of H.F. current from the

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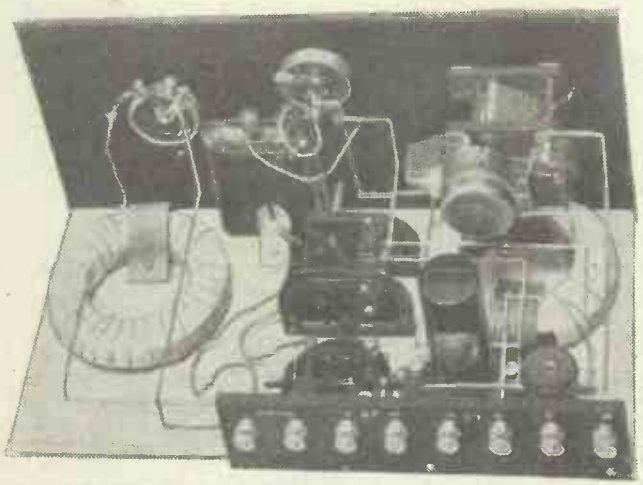


One of Mr. Dowding's very earliest Filadyne sets. Large H.F. chokes were used to "isolate" the filament.

A NEW FILADYNE CIRCUIT.

(Continued from previous page.)

grid output circuit. These advantages are of some importance, chiefly the latter, which makes for much better stability when one or more L.F. stages are added. Incidentally the layout of the circuit is somewhat simplified and wiring made easier.

For the circuit of Fig. 2 the size of the reaction coil is not critical, and a coil having one-third of the number of turns of the filament coils is of sufficient size. It is rather instructive to note that an H.F. coil inserted in the grid circuit, having removed the bypass condenser, C_3, produces a complete cessation of regeneration, so that for this reason alone the bypass condenser is a necessity. The correct capacity is shown in Fig. 2.

Reaction control by means of a potentiometer as in the standard Filadyne, although extraordinarily effective and simple, is somewhat of a "brute force" method. For the best results we should first set the anode potential for maximum rectification efficiency and then adjust the degree of reaction by some other means. This, of course, is quite easy to arrange and in Fig. 4 we have the standard Reinartz method of control incorporated in the circuit of Fig. 2. The anode bias is applied through an H.F. choke, and from the anode we have the usual series circuit of reaction coil and condenser back to the filament.

An H.F. Choke Point.

When first trying out this circuit I found that the usual reaction condenser was much too big and at minimum setting oscillation persisted with the potentiometer adjusted for maximum rectification efficiency. A three-plate variable condenser proved to be quite ample for full control of reaction over the whole tuning range of the set.

Although reaction control was all that could be desired I was somewhat surprised to find that signal strength was noticeably less than normal when using this method of control. At first I was at a loss to account for this falling off in volume until I recalled to mind some previous experiments with the circuit of Fig. 1, which showed that a resistance introduced into the anode circuit flattened the grid-current curves and rounded off the bends, thus reducing the efficiency of the valve as a rectifier.

This was presumably the reason for the behaviour of the circuit of Fig. 4, because the H.F. choke in the anode lead has quite an appreciable resistance. The keen amateur will find plenty of scope here for experimenting with different H.F. chokes, as it would seem that a special choke of low D.C. resistance and high inductance would bring the efficiency of the circuit up to standard once more.

The Valve to Use.

There are certain amateurs who have a preference for the swinging-coil method of reaction control. The circuit of Fig. 2 is readily adaptable to their needs by making the anode coil the moving one. With this arrangement we obtain the advantage of separating the reaction and anode bias adjustments which we attempted with Fig. 4 circuit. With the swinging-coil method, however, there is no loss of rectification efficiency as in the Reinartz method.

If you have had any previous experience with the Filadyne circuit you will know that the type of valve used makes all the difference to your results. Some valves

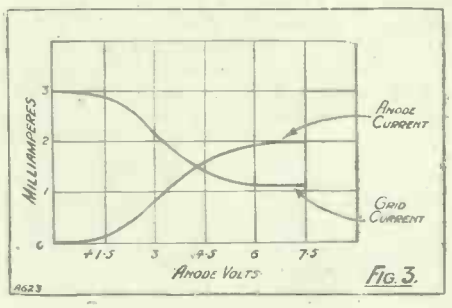


FIG. 3.

work excellently while others give but poor results.

Valves of the type D.E.2 L.F., D.E.3, D.E.R., etc., are known to be particularly good for the Filadyne scheme, while certain foreign valves of the ·06 type are excellent for this circuit. In any case, it is a matter of a few moments testing out the valves you have in stock until you find the one that gives the best results.

You will not find it necessary to use more than 30 to 45 volts H.T. with the Filadyne valve. These low voltages will give ample signal strength and although an H.T. voltage up to 60 produces an increase in signal strength the higher voltage incurs the risk of shortening the life of the valve. I rarely find it necessary to use even as much as 45 volts H.T.

Adding L.F.

The coupling between the Filadyne valve and the succeeding L.F. amplifier is of some importance when you begin to think of adding another valve. If you intend using a transformer there is no necessity for a very high primary inductance because the output impedance of a valve used on Filadyne lines is considerably less than its normal value.

If we use a transformer having a primary smaller than the more expensive models we shall not be troubled with the distortion which is bound to occur when such a

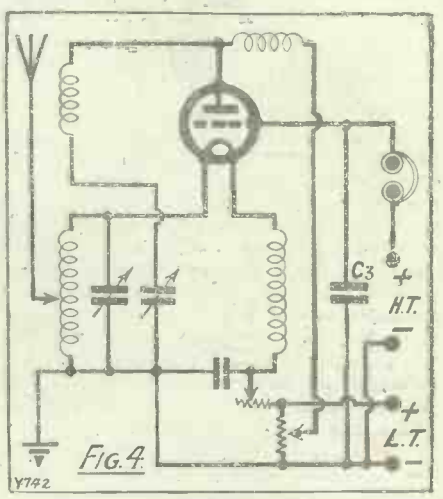
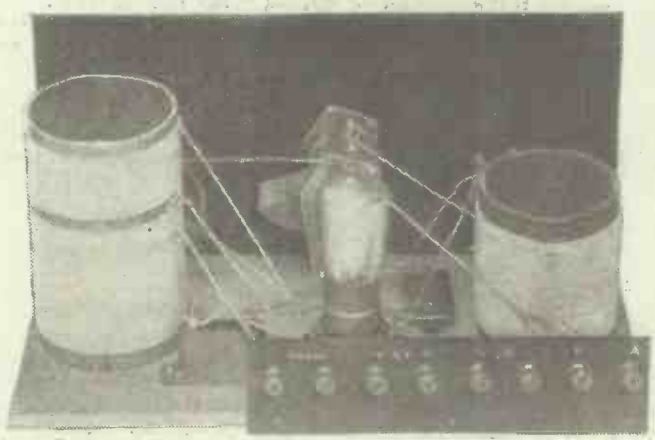


FIG. 4.

transformer is used with a detector of higher impedance. A similar state of affairs governs the choice of the coupling following a first stage L.F. amplifier where the valve impedance is considerably less than that of the preceding detector valve.

With some valves in the Filadyne stage I prefer to use choke coupling. Some of the voltage step-up of the transformer is lost, but the lower D.C. resistance of the L.F. choke gives a better rectification efficiency by producing less flattening of the grid-current curve. As for R.C. coupling I have not yet been able to squeeze from the elastic and adaptable Filadyne scheme the amount of reaction necessary for a useful detector arrangement.



One of the later Filadynes. In this is incorporated the "filament-tuning" scheme originated by Mr. English, which proved such a valuable asset in the practical development of the circuit.

FOR YOUR NOTEBOOK

AMPLIFICATION at high frequency means that the currents magnified are those which are flowing in the aerial or the tuned circuits, before the detector.

* * *

The ampere is the unit for measuring the flow of electric current. One ampere is equal to the flow which takes place if one volt of pressure is applied to one ohm of resistance.

* * *

An acceptor circuit consists of a coil and condenser in series with one another; it gets its name from the fact that its opposition to a flow of current is at a minimum at the frequency to which it is tuned, i.e. it accepts that frequency more readily than any other.

* * *

Alternating current is that sort of current which is continually changing its direction, rising from zero to a full positive maximum, returning to zero and then falling to a negative maximum before returning to zero again. The complete rise and fall, fall and rise, is called a "cycle," and ordinary A.C. (alternating current) usually performs about fifty of these cycles per second, i.e. the "frequency" is fifty per second.

A BEGINNER'S ONE-VALVER

Here is a first-class set reduced constructionally to the simplest possible form. It employs swinging coil reaction and is of outstanding sensitivity and selectivity. You can roam the whole Continent with this receiver. Designed and described by the "P.W." Research and Construction Department.

IF you are a crystal-set user growing tired of the limitations of your receiver and thinking longingly of valves here is just the set you want. It is just the ideal outfit for making a start with valves and provides an excellent introduction to the loud-speaker set you will one day build.

COMPONENTS REQUIRED.

- 1 Panel, 7 in. × 8 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in. (Any good branded material, such as Becol, "Kay Ray," Resiston, Ebonart, Red Seal, Trelleborg, etc.).
- 1 Cabinet to fit, with baseboard 7 in. deep, and slot 2 in. high cut out right across the back for the terminal strip (Bond, Caxton, Raymond, Cameo, Peto-Scott, Arteraft, Lock, Maker-Import, Gilbert, Pickett, etc.).
- 1 ·0005-mfd. variable condenser, preferably with slow motion mechanism or vernier dial (Dubilier, Igranic, Lissen, Cyldon, J.B., Bowyer-Lowe, Formo, Raymond, Ripault, Colvern, Ormond, Lotus, Gecophone, Marconiphone, etc.).
- 1 L.T. switch (Lotus, Lissen, Benjamin, Peto-Scott, Burne-Jones, etc.).
- 1 two-way coil holder, baseboard mounting (Raymond or similar type).
- 1 ·0003-mfd. fixed condenser with grid-leak clips (or separate holder). (Lissen, T.C.C., Dubilier, Mullard, Clarke, Igranic, Goltone, Marconiphone, Burne-Jones, etc.).
- 1 2-meg. grid leak (Lissen, Igranic, Mullard, Dubilier, Ediswan, Pye, etc.).
- 1 ·0005-mfd. fixed condenser (Dubilier, T.C.C., Lissen, Igranic, Mullard, Marconiphone, Clarke, Burne-Jones, Goltone, etc.).
- 1 Sprung valve holder (Lotus, Bowyer-Lowe, W.B., Benjamin, B.T.H., Igranic, Pye, Burndept, Ashley, Marconiphone, Formo, Wearite, Redfern, etc.).
- 1 Terminal strip, 8 in. × 2 in. × $\frac{1}{4}$ in. and 8 terminals (the engraved or indicating type is convenient, such as the Igranic, Eelex, Belling & Lee, etc.).
- Wire, screws, and a little flex.

It is not at all difficult to make, requires nothing but standard parts such as you can buy anywhere, and is extremely simple, both in theory and practice. All the same, you will be able to pick up quite a lot of foreign stations with it when you have had a little practice in handling it, and have got the hang of the controls.

With it you will be able to learn all the ins and outs of the use of reaction, how to search for distant stations without oscillating, how to bring them up to their maximum strength without causing any squeaks and howls, and a host of other things which will be a great help to you some day when you tackle a bigger set.

Again, a little receiver like this is always a valuable start, because it is so easy and comparatively inexpensive to add a one- or two-valve L.F. amplifier later, whereupon you have a loud-speaker outfit without actually building a complete new set.

Another use which we should like to suggest for this set is this: most of us have felt at some time or other that we should like to make a set for some friend or relative who is missing the pleasures of broadcast entertainment, but have shirked the considerable amount of work and expense involved in a loud-speaker outfit, so that in the end nothing has got done. Well, what about a little set for headphone reception?

Attractive Points.

It may not be so pleasant as listening to a really good loud speaker, but it will still give a great deal of very real enjoyment, it is very cheap for you to build and for the recipient to maintain.

If you choose the present design you will have something like the ideal receiver for the purpose, for it is particularly easy to work, it looks neat and attractive, and it is very compact. Furthermore, it has no critical adjustments so long as it is used only for the local station and 5 G.B. (as it would be in the circumstances we are supposing), and so can quite safely be put in non-technical hands.

Simple but Efficient.

Just in case the beginner should get the perhaps natural idea that so small and simple a set cannot give much of a performance, we had perhaps better give some account of what it will do before we go any farther. Let us point out right away that it is actually quite a sensitive little receiver which will give a decidedly good account of itself when the operator has mastered the simple art of handling it.

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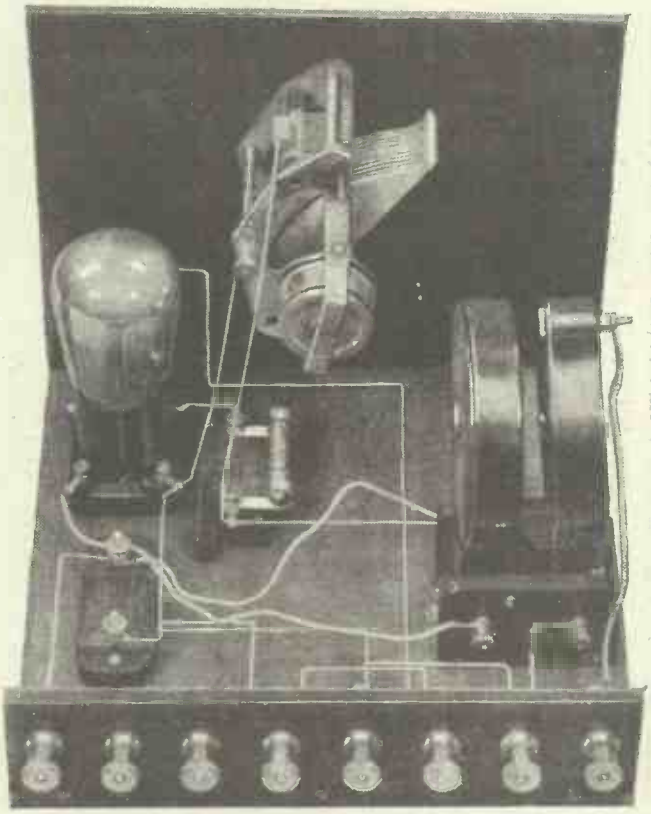


As will be seen in this photo, the parts required are few in number and are very easily assembled on the panel and baseboard.

A BEGINNER'S ONE-VALVER.

(*Continued from previous page*)

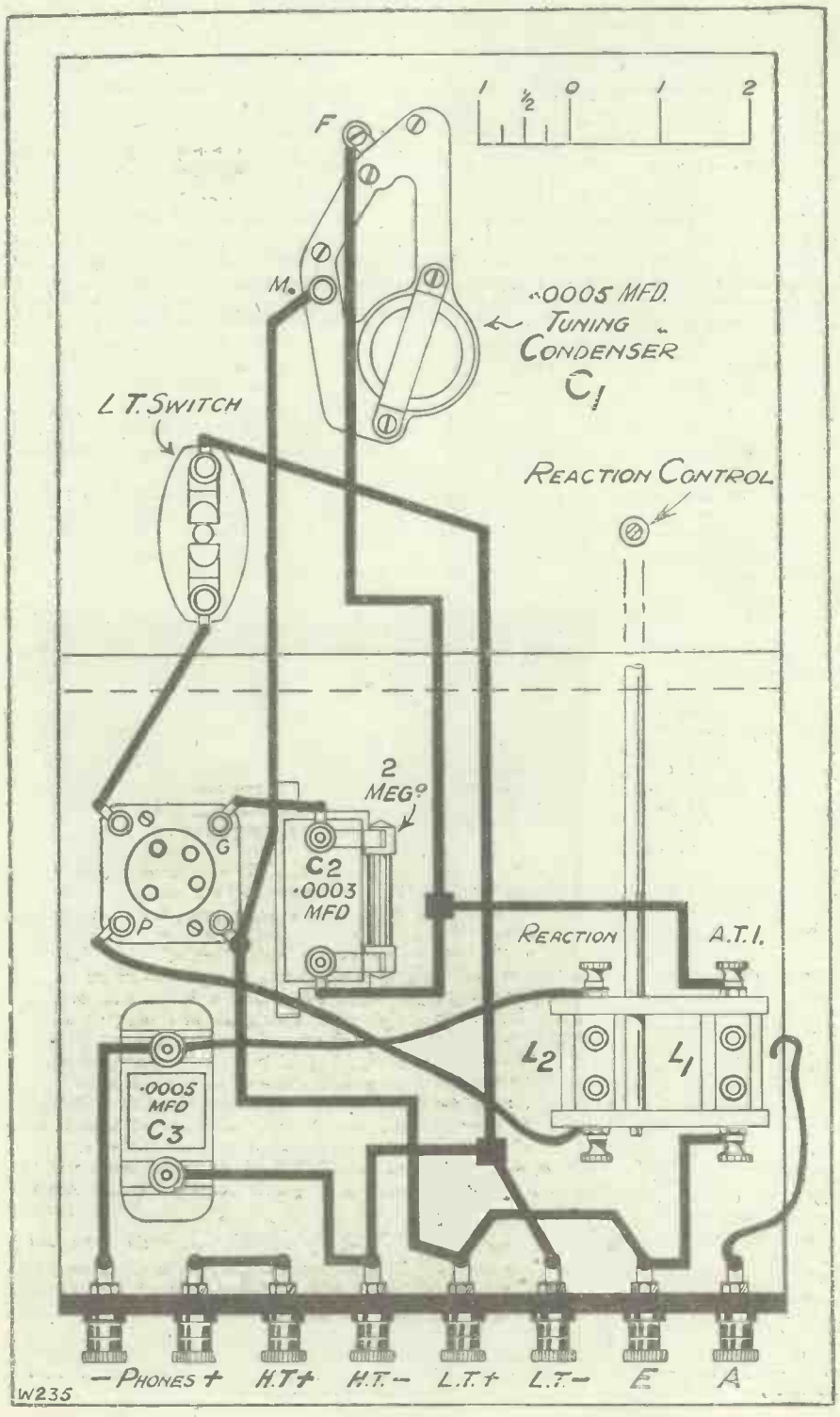
When used on an average outdoor aerial it will give really good "signals" from 5 G B and 5 X X practically anywhere in the kingdom, also from any main station up to at least 50 miles (much farther after dark).

This is without any real delicacy in handling. When it is handled with just a little skill it will bring in quite a lot of foreign stations as well.

Selectivity, too, is quite good, bearing in mind how simple the circuit is. You must not expect to cut out the local station easily if you live within a few miles of it, of course, because that calls for a super-selective set, but it is an easy matter to add a simple little wave-trap and get rid of it that way when desired.

How It All Works.

Now let us take a look at the circuit, and get a general idea of how it all works, since this is our first valve set. First note that there is one main tuned circuit made up of the coil L_1 and the variable condenser C_1 of ·0005 mfd.



The grid and filament of the valve are connected across this circuit so as to detect any signals flowing therein, the usual grid condenser (C_2) and leak being provided to make the valve rectify and produce sounds in the telephone receivers.

In the anode circuit of the valve is a reaction coil L_2, which is arranged to "couple" magnetically with the tuning coil L_1, and so feed back a little of the amplified energy flowing in the plate circuit. In this way the incoming signals are boosted up and made louder, but, of course, the exact degree of coupling between the coils must be properly adjusted.

If too much energy is fed back the set will actually oscillate, and then everything we hear will be more or less distorted, and there will be squeals as we tune through the carrier-waves of the stations we are trying to hear, squeals, moreover, which our neighbours will hear and be annoyed by.

Be Careful About This.

If ever you accidentally set the circuit into oscillation, therefore, always slack off the coupling a trifle until it just ceases before you continue searching. Above all, *never* run the slightest risk of oscillating when tuning in the local station or 5 G B, for if you do you are certain to spoil the reception of scores, possibly hundreds, of other people. Just how these adjustments are made we shall see later.

The aerial is coupled to the main tuned circuit by using what is called an "X" coil, as L_1, which has a couple of tapping points provided for the purpose. The aerial is wired to one or other of these, and we then have what is called auto-coupling; in other words, the aerial and earth are connected across just a portion of the tuned circuit, giving quite a respectable amount of selectivity.

The arrow on the end of the aerial lead in the circuit diagram, by the way, is intended to indicate that this is a variable connection which can be made to either of the tapping points on the "X" coil. The other arrow drawn through the two coils is the usual sign to denote variable coupling.

So much for the general principles of the set (it is just as well to understand them, so as to be able to get the best out of it). Now let us turn to the practical arrangements. First of all, notice that the set is built on the American plan with a vertical front panel and a horizontal baseboard. The panel carries only the actual operating controls, namely, the knob of the coil holder, the variable condenser, and the on-off switch.

Simplifying The Work.

On the baseboard are the rest of the components (coil holder, valve socket, grid condenser and leak, and telephone by-pass condenser), and a terminal strip for the aerial and earth, batteries, and 'phones. This system of construction gives you the extra job of fixing the panel and baseboard together, but it makes all the rest of the set very simple to put together and wire up.

Just one other point before we go on to constructional matters. You will see by now how the desired adjustment of coupling between the tuning and reaction coils (L_1

(*Continued on next page.*)

A BEGINNER'S ONE-VALVER.

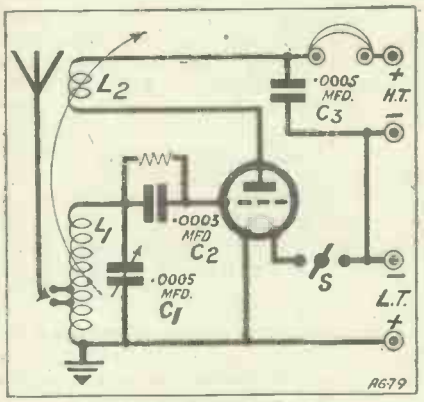
(Continued from previous page)

and L_2) is obtained. The first is placed in the fixed socket of the coil holder and the other in the moving one, and so by turning the knob you can move them closer together, or further apart, and so strengthen or weaken the reaction.

Building the set is really very little more difficult than making a crystal outfit, because it is so extremely simple. First, take your panel and mark the positions of all the holes, taking them from the diagram herewith, and not forgetting the necessary three or four holes along the bottom edge (about $\frac{1}{16}$ in. up) for the screws which will later hold it to the baseboard.

Some Drilling Hints.

Now take your smallest drill (preferably an $\frac{1}{8}$ in.) and run it through at each point, not forgetting to put a piece of wood underneath. Next proceed to enlarge each hole



This is the circuit in theoretical form.

with a suitable drill up to the size required by your particular components, and countersink slightly the ones for the screws along the bottom.

Now fix all the components in place which go on the panel and screw the latter to the edge of the baseboard, after which you can go on and screw down all the other parts on the baseboard, copying the original lay-out as well as you can. Next, cut the terminal strip, drill it and fit the terminals, and fix the strip to the rear edge of the baseboard.

Now you are ready to start the wiring, and this will not take you long. There are only one or two points to explain here, for the wiring diagram and photos make everything pretty clear. First of all, there is the obvious point of spacing out the leads nicely, and the photos will help here. Next, observe that the leads to the moving socket of the coil holder should be of flex, in case you get no reaction at first and have to reverse the connections. The only other point is that the lead from the aerial terminal which goes to the tapping on the "X" coil (L_1) should also be of flex.

The First Test.

Now for testing the finished set. Connect up aerial and earth and 'phones, also an L.T. battery to suit your valve and an H.T. battery of, say, 60 volts (even a little lower voltage will do). Next insert the valve and the coils: for L_1 you want a No. 60 "X" coil for the ordinary waves and a No. 250 "X" for long waves, with a No. 50 or 150 (long waves) for reaction. Join the flex lead from the aerial terminal to one of the tapping points on L_1, set the reaction coil well away from the tuning coil and proceed to tune in the local station. Now bring up the reaction coil gradually and see whether signals get a little louder. If they do not, reverse the leads to the reaction coil.

Next test the reaction control for smoothness, by tuning to a point well clear of the local station and tightening the coupling until the set oscillates. As it starts to do so you should hear a very slight click, followed by a faint, continuous sound of rushing and general liveliness. Adjust the H.T. to get the smoothest possible passage into oscillation, and you are then ready to begin searching for distant stations. Searching is simple: just turn the condenser very slowly, adjusting the reaction all the while to keep the set *just* below the oscillation point, and you will soon pick up some of the foreigners.

One final point: the set is not critical as to valves, and 2-volters work excellently in it. In general, the best kind to use is the H.F. or general-purpose type, which is available in all the well-known makes.

DID YOU KNOW THAT . . .?

If a battery is regularly overcharged or undercharged the plates are liable to buckle, and this trouble may arise also from short-circuiting the battery.

* * *

Amplification at low frequency means the magnification of those currents which represent speech or music, i.e. the magnification of the output from the detector (whether crystal or valve), gramophone records, etc.

* * *

The "aerial circuit" is generally understood to mean not only of the aerial itself, and the down-lead, but also the lead-in wire, the aerial coil (whether tuned or untuned), the earth lead, and the earth itself, together with any condensers which may be in series.

* * *

The best way to measure the high-tension voltage actually on the plate is by means of a high resistance voltmeter connected between the valve filament and the plate terminal.

* * *

A good deal of leakage due to a wet lead-in tube can be overcome by arranging that the down lead either bends below the level of the lead-in connection or else is fitted with a little draining pipe down which the rain, etc., will run in preference to running across the lead-in insulation.

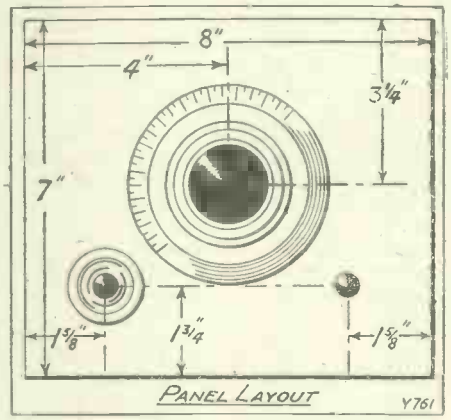
When "Systoflex" or similar covering is not obtainable for protecting H.T. leads that pass through screening boxes, a little insulating tape will afford sufficient temporary protection.

* * *

When a set employs a potentiometer across the L.T. leads it is important that this should be disconnected when the filament switch is in the "off" position, or otherwise there will be a constant and unnecessary drain upon the battery.

* * *

When a loud-speaker filter circuit is connected between the plate of the last valve and H.T. negative, it is a good plan to include a



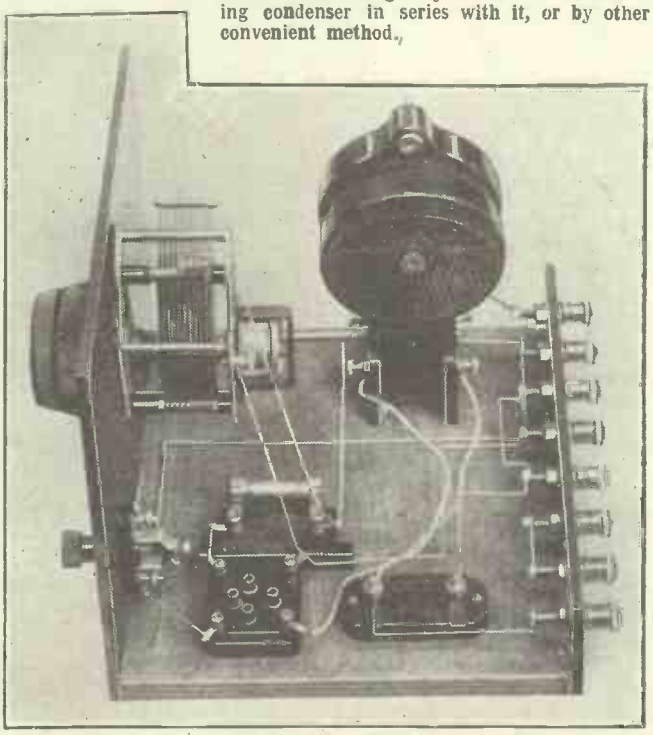
flash-lamp bulb in series with the condenser and loud speaker so that in the event of a condenser breakdown the bulb will act as a fuse.

* * *

The coupling between adjacent coils is far greater when their axes are in line than when these are at right-angles.

* * *

Short-wave "dead spots" or places on the tuning condenser where reaction is unobtainable are generally due to aerial radiation and may be overcome by adjusting the aerial to a different wave-length by means of a neutralising condenser in series with it, or by other convenient method.



The Beginner's set with coils in position. The wiring is almost elementary in its simplicity. But you must not judge the power of this little set by its very simple make-up!

LATEST BROADCASTING NOTES.

QUIESCENCE ON TELEVISION FRONT.

TRADE WAR ON THE B.B.C.?—DANCE BAND CHANGES—A "VIRGINIA BROADCAST—SPECIAL BAGPIPES FOR STUDIO—A K.C. SONG-WRITER BROADCASTS.

Quiescence on Television Front.

THE abrupt termination of arguments between the B.B.C. and Baird Television early in November has been followed by a prolonged truce. Meanwhile, there are growing rumours of at least two new systems of television to be exploited by established wireless firms. It is stated authoritatively that one of these, coming from America, is a good way ahead of the Baird system, and will emerge from the laboratory stage early in the New Year.

Trade War on the B.B.C.?

Members of the Radio Trade Committee on Broadcasting declare that that means of liaison with the B.B.C. is about to be dissolved. Following a period of amicable relations, there have been several acute disagreements lately, and the chances of the continuance of the committee are regarded as slight.

There has been acute difficulty about the attitude of the B.B.C. towards "wireless exchanges," and also towards reception in general. Savoy Hill is disposed to encourage "re-diffusion" through wireless exchanges such as exist at Southsea and Hythe. The result of the trouble on the Trade Committee may well be a new war on the B.B.C. with the radio trade ranging itself alongside of other malcontents and the theatre industry.

A Puplic Campaign?

It is already stated with some show of authenticity that important interests have decided that the B.B.C. monopoly will be brought to an end next year by legislative action.

The public campaign is being delayed until it is ascertained whether or not Lord Melchett can be induced to take the leadership.

Lesser lights, in particular Members of Parliament, have a curious dread of coming out into the open against the B.B.C., because they believe that that body has ways and means of taking effective reprisals against all except the most high. But if Lord Melchett's recent contretemps with Savoy Hill can be exploited to the end that he will lead the charge, there is promise of a worthy struggle. But those who believe that the constitution of the B.B.C. will be changed before 1936 are living in a false heaven.

Dance Band Changes.

It is understood that the transmissions of dance music from the Savoy Hotel will shortly be replaced by transmissions from another hotel in the same group. The Berkeley is mentioned in this connection. So far, I have heard no reason for this proposed change.

A "Virginia" Broadcast.

Part of the second act of "Virginia," the successful musical show, will be broadcast from the Palace Theatre, London, to London and 5 X X listeners at between 10 and 10.45 p.m. on Saturday, December 29th. The broadcast will begin with the overture to the second act, and continue until the end of the item "Roll Away Clouds."

Another broadcast which will be pleasurably anticipated is a carillon recital by Le Chevalier Jef Denyn, from Messrs. J. & E. Atkinson's, Old Bond Street, on December 21st between 4 and 4.30 p.m. The programme will include "O Canada," "Juanita," "Marching thro Georgia," "Stille Nicht," and "La Parisienne."

TESTING A DIAPHRAGM...

. . . Is best carried out by dropping a match as shown, when the sound will indicate whether or no the diaphragm is free.

Special Studio Bagpipes.

A unique set of small bagpipes, the invention of Pipe-Major A. Ross, late of the Scots Guards, designed for playing indoors—an attribute not possessed by the large variety—has solved the problem of broadcasting pipe music from the studio.

The instrument, which is known as the chamber-pipes, is effective when played with pianoforte accompaniment, and Scottish listeners will no doubt look forward to hearing this combination during the Glasgow programme on Monday evening, December 17th, when the pipes will be played by Pipe-Major William Ross, Instructor to the Army School of Piping at Edinburgh Castle, the piano accompaniment being provided by his daughter Cicely.

A K.C. Song-writer Broadcasts.

By the end of the year Mr. Fred E. Weatherly, K.C., the well-known and prolific song-writer, will have spoken on twenty occasions before the microphone. Mr. Weatherly gave his first broadcast in February, 1927, after which he had to confess that, accustomed as he was to speaking in public, he was just a little distrustful of himself before the "magic box." His next broadcast is arranged for Tuesday, December 18th, when, with the assistance of Dennis Nobel and Ethel Dakin, he will take listeners to many places associated with the familiar songs which bear his name.

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

EXPONENTIAL LOUD SPEAKERS.

PUBLIC ADDRESS WORK—VOICE DISTORTION—THE CRITICAL EAR, Etc., Etc.

Exponential Speakers.

I WROTE in these notes some little time ago about the exponential type of loud-speaker horn which has been developed in America and largely used there.

The characteristics of the exponential horn have been fully described, and you will remember how the cross-sectional area depends upon the axial distance from the small end of the horn.

It has been claimed that owing to the particular relationship between the cross-sectional area and axial distance from the small end, the exponential horn gives very special amplification to the sound-waves introduced into it and that there is very little loss of faithfulness in the reproduction.

Public Address Work.

A few days ago I was given a demonstration of some very large models of exponential horn in connection with combined radio-gramophone sets. The reproduction in both cases was very powerful—as a matter of fact the particular models in question were intended for public demonstration work—but I thought that the quality of the reproduction was particularly good, having regard to the enormous volume.

Everybody knows that when the volume of reproduction is very greatly increased there is invariably a certain amount of "tubbiness," and distortion is often painfully apparent.

Voice Distortion.

This is particularly the case where the item happens to be a vocal one, because we are not accustomed to hear the human voice at more than a certain maximum loudness in the ordinary way, and when we hear the voice very greatly magnified we are bound to feel that there is something unnatural about it, even though an actual analysis of the wave-form might show this to be reasonably near the original.

The Critical Ear.

Where instrumental music is being reproduced the ear does not seem to be so critical. Whether this is due to the fact that, owing to the comparatively simple character of the waves from musical instruments (as compared with the very complicated

(*Continued on page* 814.)

LOUD-SPEAKER EXTENSIONS.

How to wire up loud-speakers in different rooms safely and efficiently.

By W. L. S.

THE whole business of wiring a house so that one radio receiver may be used to provide programmes in any room in the house, using one or more loud-speakers, is in itself quite simple. The entire difference between success and failure is, however, usually due to the type of arrangement which has been decided upon in the first place, and on whether it is really suitable for the user's particular requirements. There are many different ways of tackling the job, and there is, in all probability, one of them which is far more suitable to one's own conditions than any other.

Generally speaking, it is always advisable to wire all the speakers in parallel, if a number are to be used. We are more concerned, however, with the form the wiring shall take with only one speaker (or two at the most) in use, these being moved more or less frequently from room to room.

The average reader will not feel qualified to make a really good job of the wiring, using lead-covered cable and taking it through the walls and ceilings, so that the article will be confined to arrangements within the reach of those who believe in ordinary twin flex.

In the first place, it is best to erect your aerial with due regard to the lead-in, and to arrange this so that the set can be placed and operated in a position not too far away. For one class of listener, who wants to listen only to the local station, and perhaps 5 G B, it will often be best to keep the set in a bedroom or at any rate a first-floor room, and to run leads downstairs. The writer's "home" receiver lives in such a room, and the extension is taken outside the window and down the wall, two lengths of heavy single flex being used.

Two Types of Output.

If the reader is badly bitten with "DX fever," it will naturally be inconvenient to have the set so placed, in which case a downstairs room with a window conveniently placed for taking the lead-in should be utilised. Incidentally, always, if possible, avoid bringing the lead-in for a long-distance between two houses. Rather than use such an arrangement, with the aerial going for half its length down a long "passage-way," sacrifice a little length and end the aerial at a point from which a good, short, straight lead-in can be arranged.

Returning to our leads, however, a further sub-division may be made—those sets that use an output filter and those that do not. The latter are, in general, sets of the smaller type, and, provided that not too much wiring about the house is necessary it will not matter very much whether this system is used or not. With an excessive amount of wiring, however, the total capacity of it may be high enough to have quite an appreciable effect upon the tone of the loud speaker, in which case it will be necessary to modify the output.

Fig. 1 shows what is probably the most popular and most effective method. A 20 or 30-henry choke is suitable, and the condenser may have a value of 1 or 2 mfd. It will be noticed that one side of the loud speaker is connected directly to H.T.—, which, in most sets, will be earthed. Thus, if we have an earth connection available anywhere near the room in which the loud speaker is to be used, one lead may be dispensed with.

Various snags arise, however, and the scheme is occasionally disappointing in results. In such cases the trouble is nearly always due to faulty design of the set, and is caused by presence of H.F. energy in the plate circuit of the last note-magnifier. Fortunately, not many sets are prone to such troubles nowadays.

It is, generally speaking, always best to arrange a twin lead to the loud speaker, and with this scheme in use there is no objection to the presence of such a lead.

Better to use Filter.

In the case of a large set without a filter output circuit, the writer would strongly advise that one be put into use before the use of a landline of any length is contemplated. Failing this, it is as well to use two separate wires two inches apart or so, rather than resorting to twin flex, and I am of the opinion that most will prefer the filter-output scheme to the business of

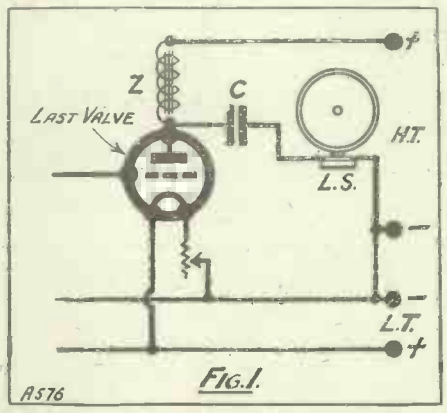


FIG. 1.

erecting young telephone wires all round the house.

With small sets (such as the ubiquitous detector and note-mag.), the design of which is fairly simple and the operation straightforward, it will very often be found possible to carry out quite a fair amount of wiring without having to resort to the output filter.

Making it Tidy.

Now as regards the actual placing of the wires. Generally the phenomenon known as "domestic interference" will make tidiness an essential feature. If the house is equipped with the modern type of picture-rail, it will be found easy to dispose of ordinary five-ampere twin flex by tucking it down behind the rail, making quite an invisible job of it.

The wire should, of course, be carried round until it reaches the corner nearest the point at which the loud speaker is to stand, and it may then be taken down the wall in the corner and held in one or two places with small insulated staples of the type that can be bought anywhere for one shilling per hundred. A very neat and permanent job may be made of the whole thing if one takes a little trouble in this way.

The loud speaker itself may either be affixed to a two-pin plug, sockets being attached to the ends of the wiring in the various rooms, or the two tags may be left, and little "two-terminal" strips may be made up for the occasion and screwed to the top of the skirting. In the case of the terminals it is, of course, easy to make sure that the loud speaker is correctly connected as regards polarity. With a two-pin plug, unless one of the eccentric variety be used, this is not so easy. Here is another advantage of the output filter, for with one in use it is not important that the loud-speaker should be connected with the windings in the right direction.

A small two-pin porcelain plug which is very suitable for the purpose may be obtained from most electrical shops, and may be rendered distinctive by making a thick line in red ink down one side of the plug, the socket being similarly treated.

Question of Polarity.

Common-sense with regard to the placing of the wiring where many rooms are to be wired up will probably result in much saving of wire. Probably if the set is upstairs one single wire to a convenient point down below will suffice, the other various wires radiating from that point. Joints in the flex should be carefully made and afterwards bound with insulating tape.

It is, incidentally, preferable to use red and black coloured flex on account of the ease with which the polarity may be found. I have met cases of loud speakers which sounded well in one room and perfectly hideous in another, the reason being simply that one of the points had "slipped" and was incorrectly wired up.

Nothing more than these few generalities need be said to keep the reader on the right track, and if the more experienced find the remarks appear somewhat obvious, perhaps they will be forbearing and remember some of the "obvious" mistakes that they have all made at some time or other. It has been my experience all along that the "obvious" points are those of which we need to be reminded most!

TRANSFORMERS IN TEAM.

The Editor, POPULAR WIRELESS.

Dear Sir,—Your article re above in your issue November 10th, will attract widespread attention, as it is so well known that two stages of transformer L.F. magnification will far exceed in volume one resistance and one transformer, particularly with modern valves and transformers. I for one was anxiously looking forward to your first circuit (modern), using two transformers. Amateur constructors have a lot to thank you for, and this is another instance of "P.W." being first in the field.

Whilst on this subject of volume, I have often wondered why a volume control is not incorporated in any of your circuits? In view of the fact that volume on the local station with two transformers is bound to be enormous, why did not you incorporate a volume control in your first circuit?

Yours faithfully,
GEORGE LEACH.

N.W. 3.

[ED. NOTE.—The "P.W." Research Department reports that: Regarding the use of volume controls, we would explain that they are not often incorporated in "P.W." sets for the main reason that we endeavour to keep the cost down as much as possible. We find that in practice on all the smaller sets it is perfectly satisfactory to limit volume on the local station by the simple expedient of de-tuning. Where there is no H.F. amplification there is little risk of running into another station on de-tuning if reaction is kept at minimum. Where the L.F. side is so powerful that there is some risk of picking up another station on de-tuning with reaction at minimum, as in our new set ("Everybody's" Three), we provided a semi-variable series condenser which can be placed in the aerial circuit when desired. This serves to increase selectivity for normal working, or, if set to a very small volume, will reduce sensitivity so much that the local can be detuned without any chance of picking up another station.

Where one stage of H.F. is employed, de-tuning can still be used. By de-tuning one dial above the wave-length and the other below, the desired reduction is again obtained, and without running into other stations. Where more than one H.F. stage is provided this method becomes inadequate in some cases, and we then do provide a volume control as a rule. (See the "Fanfare" Five, in "P.W." for November 24th.)]

ELIMINATOR PRECAUTIONS.

The Editor, POPULAR WIRELESS.

Dear Sir,—The article on page 550 of your issue of November 17th is timely, as many people fail to realise that there are considerable dangers involved in the use of the direct-current mains for obtaining supplies for radio receivers, and in view of the uncertainty involved as to whether the negative or positive main is earthed, it is advisable in all cases to connect a 2-mfd. high-voltage condenser in the earth lead so that there is no direct connection between one's H.T. supply unit or the set and earth.

To comply with all the regulations of the Institute of Electrical Engineers, all these connections, including the terminal of the condenser, should be placed in such a position that contact with them is not possible.

There is a further difficulty which is a very serious one, namely, in the case of three wire direct-current supplies the middle wire is earthed by the supply authorities through a limiting resistance, and in certain cases the out-of-balance current through the middle wire is such as to produce a voltage drop as high as 160 across this resistance, which means that when working on one side of the system the H.T. negative of the receiver, including the L.T. battery and all the L.T. wiring of the set, can be, say, 160 volts above earth, and in consequence the maximum H.T. applied to the set on a 220-volt supply can be as high as 380 volts, which is obviously very dangerous.

This will indicate clearly the danger involved in the use of D.C. supplies for radio purposes, and it would seem advisable before installing any D.C. apparatus to get a competent electrician to make sure of these points, and to arrange one's receiver and all the wiring connected in it so that accidental contact is not possible.

Further, it will be seen that the use of metal panels, dial, or dials having metal parts on the front of the panel, should be carefully avoided in all mains-driven apparatus.

Yours faithfully,
F. BAGGS.

Manchester.

UNKNOWN GERMAN STATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to W. L. S. in the "Short-Wave Notes" regarding the unknown German station, I have heard the German station at various times during the evenings of the last fortnight. Using Det., 1 L.F., signals have been R.8; at times transmission has been a little coarse.

I have always been very interested in short-wave reception, and can receive Morse at eight words per minute.

Yours sincerely,
W. P. HUTCHINSON.

Derbyshire.

THE "SCEPTIC'S" THREE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having waited for some time to see what reports were available in respect of your late set, the "Sceptic's" Three, I feel as if I must write and ask you to tender my log to many of those "P.W." readers who, like myself, undertook the task of building this wonderful little set. It seems probably unbelievable that on one single evening, taking some pains, I managed to rope in no fewer than 61 stations, ranging from 2,000 metres to 236. Of the stations recorded, I can assuredly state that each and all have been definitely identified by either call-sign or relative programme. I believe one or two more would have come under my log, were it not for heterodyning, chiefly on the broadcast band. I shall be pleased, sir, if you could find room in our weekly ("P.W.") for this little log; I might then hear of others who have also had such satisfactory reports.

My thanks and appreciation naturally goes to the "P.W." Technical Staff, for the designing of such an efficient little circuit.

Thanking you in anticipation, I am, Yours,
"A FERVENT READER."
(Leading Aircraftsman Preston, T., Royal Air Force).

P.S.—I have built the "Antipodes Adaptor" to go with the "Sceptic's" Three, and expect wonders.

Winchester, Hants.

FAITHFUL TRANSMISSION.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I request that you refrain from instructing your readers in the gentle art of obtaining faithful reproduction of the B.B.C. transmissions from their receiving sets! To attain anything approaching such an achievement is a mixed blessing.

For months I have been striving to accomplish the high ideals as set out so frequently in your admirable journal but have dismally failed to eliminate a form of distortion which I can best describe or liken to a tin tray being dropped on a table. Many weary hours have I spent in trying to overcome this irritating jangle, which is most pronounced when a piano is being played.

Being an honest fellow, I took for granted that the B.B.C. could be relied upon to live up to their statement that their transmissions were beyond reproach, and in consequence always looked for the seat of the trouble in my set. You can imagine how shocked I was to hear this very same form of distortion the other evening via crystal and 'phones!

This form of distortion has been consistent, especially via the local station, for a matter of months. Have you had any complaints of this nature from other quarters?

On the strength of this, may I beg of you not to encourage your readers to aim at faithful reproduction as it only emphasises the poor transmission.

Yours faithfully,
C. E. LEWIS.

P.S.—No. It's not overloading nor a faulty loud speaker. I'm too old a hand to be tripped by these snags.

Swansea.

[Ed. Note.—We have had a few reports concerning alleged faulty transmission from B.B.C. stations, more particularly in regard to piano and gramophone transmissions from London. And undoubtedly there are cases where such complaints are warranted. But on the whole, more especially in respect of important stations such as London and 5 G B, the transmissions are relatively far ahead of the best it would be possible to do in the way of reception. We have seen the carefully checked curve of 5 G B's apparatus taken by a 10 to 10,000 cycle oscillator and it is one to make a purity fan's mouth water, being practically straight and free from peaks! Much of a station like Swansea's input is handed over from secondary land lines and the B.B.C. is obviously, in such circumstances, somewhat handicapped.]

CORRESPONDENCE

TRANSFORMERS IN TEAM.

ELIMINATOR PRECAUTIONS — UNKNOWN GERMAN STATION, Etc.

Letters from readers discussing interesting and topical wireless events or recording unusual experiences, are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents and we cannot accept any responsibility for information given.—EDITOR.

SHORT-WAVE NOTES.

By W. L. S.

AS I write this a most decided change in conditions is taking place, and distant stations are coming through incredibly well once more on all the wave-bands allotted for amateur work. It is 9.30 a.m., and the American stations are still coming through at great strength on the 40-metre wave. Last night 2 X A F on 33 metres was twice as strong as I have heard him for months, while during the early evening 2 X A D, on 22 metres, was fairly shaking the walls of the room on a big set finishing up with a pentode and moving-coil loud speaker.

Strong Signals from 2 X A D.

It is rather remarkable to note—as I have now done for the first time—that a change for the better in "DX" conditions apparently coincides with a distinct drop in the strength of 5 S W (in London, at all events). The latter station was so weak that he caused me several anxious moments until I found 2 X A D several times stronger than usual!

Having been optimistic ever since I failed to receive W G Y on a crystal, I predict that the spell of good conditions will remain with us until the end of January at least.

I am much indebted to a correspondent who sends me the following authoritative information re PCLL: Wave-length 38·8 metres. Location, Kootwijk, Holland. Power 30 kw. Transmits regularly on Wednesdays, 4.0 to 7.0 p.m. Irregularly at other times. This information was received by my correspondent from the director of the station, and may therefore be taken as absolutely accurate.

I also wish to thank others for the nice "bouquets" sent me re these notes. It is a hard business to keep them interesting when the sole topic is my own observations. A few notes from other sources, criticisms, etc., such as I have been receiving lately, are a valuable help and guide.

And now, to return to the topic of screened-grid amplification on short waves. One point I have found most definitely during my work on two or three sets of this type—if parallel feed is used, the size of the coupling condenser must *not* in any circumstances exceed ·0001 mfd. This is slightly on the large size, and I am going to use a neutralising condenser of the larger baseboard-mounting type in the next receiver.

Screened-grids on Short-Waves.

If too large a coupling condenser is used, we introduce more damping into the grid circuit of the detector than would normally be introduced by an aerial coupled straight on, and we lose at once one of the most valuable properties of this form of amplification. I am also experimenting with a "grid tap" on the detector valve, and hope to place results on record shortly.

I am convinced that for the short-wave broadcast listener, as apart from the searcher, this form of short-waver cannot be beaten.

LIGHT and SHADE

YOU can only get the lights and shades of fine music if you have a transformer which leaves the background entirely silent. Again a single low note missing from a sonorous chord or a single high note distorted in amplification will rob a beautiful composition of much of its effect. That is why musical people who build radio sets almost invariably use LISSEN Transformers; first they want the dead silent background which LISSEN Transformers give, the entire absence of that rustling sound which is almost always present in less carefully designed transformers. Then the critical ear discovers how very even is the amplification, so that every note keeps its true value; a fact which is proved by laboratory curves taken with LISSEN Transformers.

The LISSEN SUPER TRANSFORMER

This Super LISSEN Transformer is made in two ratios, 3½ to 1 and also 2½ to 1. The 3½ to 1 is suitable for use in either the first or the second stage of an L.F. amplifier, or can be used in cascade for both stages, and with practically any valve. The 2½ to 1 transformer is suitable for use after a high impedance rectifier valve without fear of distortion or loss of high notes and overtones. The price is the same for both ratios **19/-**

The famous 8/6 LISSEN Transformer is still supreme in price and will never break down——

The famous 8/6 LISSEN Transformer is suitable for all ordinary purposes, and its huge sale proves it still supreme value. It continues to earn high praise as the transformer that never breaks down. Turns ratio 3 to 1. Resistance ratio, 4 to 1 .. .. **8/6**

LISSEN TRANSFORMERS

LISSEN LIMITED, 8-16, Friars Lane, Richmond, Surrey

(Managing Director: Thos. N. Cole)

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality, under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

THE "MICRO LOG" DIAL.

A VERY great number of home-constructed receivers have to be used by two totally different kinds of operators. The "fan" of the house takes over the outfit at irregular periods, and with more or less skilled and razor-edge adjustments he DX hunts the world. Then there are the "hams" of the home, viz., those who are reckoned to be able only to make simple tuning alterations, and to switch the set on and off.

A set subject to such various treatment can well do with dials of the kind of the Micro Log, a product of C. F. & H. Burton. Two types are sold, one at 5s. 6d. with the slow-motion movement only, and another at 6s. having a direct and a slow-motion movement. The special feature of the dial is that it has the ordinary aperture revealing a black and silver scale and hair line, as well as a central knob having a pointer which runs around an inset white logging strip.

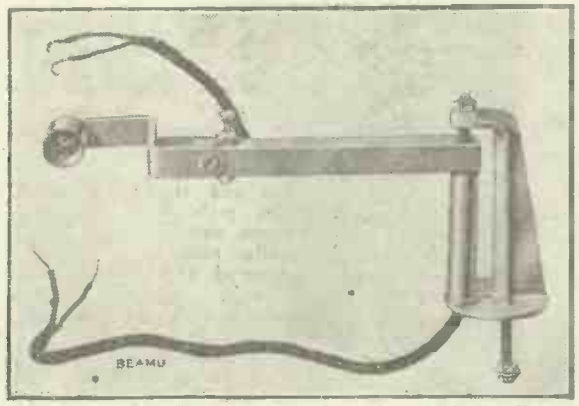
On this strip the tuning positions of the alternative stations available for ordinary programmes can be noted. The dial appears

This is the "Micro Log" Dial.

to be quite well made and the slow-motion movement is smooth and free from backlash. As to the appearance of the component, that can be gauged by the accompanying photograph.

A "PICK-UP" CARRIER.

Readers will no doubt remember a report published recently concerning a gramophone arrangement especially designed for use in conjunction with radio sets. The makers of this novel instrument, Messrs. Beagley and Musto, of 47, Cranbourn Street, W.C.2, have now sent me one of their



This is the Pick-up Carrier Arm as sold complete with leads. Note the earthing terminal.

"Beamu" Counter-balanced Pick-up Carriers. It is exactly as fitted to their "Drive," and is a bright, cleanly-made article. It can easily be fitted to an ordinary gramophone without interfering with its normal duties. It has leads running through it which can be taken to terminals mounted on the back of the gramophone.

The carrier has an exceptionally easy swing and the counter-balancing adjustment is excellent. It is supplied complete with a junction arm suitable for any specified pick-up at 10s. 6d., post free. It seems to me cheap at the price.

IPSO H.T. BATTERY.

A Mr. D. Grabow recently sent us an H.T. battery for test. An outstanding feature is that the week and year of manufacture are stamped on the back of each Ipso. Thus the purchaser can see when the battery was made and is safeguarded against old stock.

The sample left with us is a 60-volter, and is tapped at every 1½ volts up to 7½ volts, enabling grid bias to be taken at that end. On a flash test the battery showed four amperes, and this is quite good. A subsequent slow discharge indicated possibilities of a useful life. We are informed that these batteries are to be sold at lower prices than normal. The batteries are made by a Berlin firm.

A FINE GANG CONDENSER.

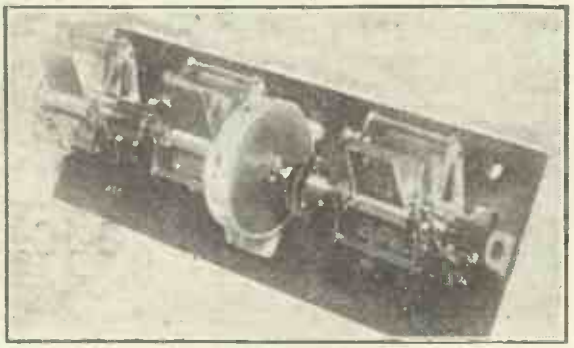
Now that the technical snags of Screened-Grid valves and Pentodes are being overcome, it would appear that the day of the five- and six-valver is passing. We only want a detector having a proportionately greater efficiency to make three valves all that could be wanted. And, by the way, it is curious that L.F. and H.F. stages should have jumped so far ahead while the detector stage has remained more or less stationary.

A one-valve super-regenerator will give an enormous volume, but it is not easy to handle, and quality of reproduction tends to go by the board, but it would be foolish to consider it impossible that one day we shall have an easily-handled detector stage capable of great amplification without impairing quality. What caused me to reflect in this way was the arrival a week or two ago of a triple gang variable condenser due to Ormond Ltd. Actually we want another revolution or two before the multi-stage H.F. amplifying set vanishes. True one control with selectivity and purity is, in the immediate present, only possible with a string of tuned circuits, ganged.

This particular Ormond gang has a drum control. Its special feature is that it has additionally two knobs which are fitted one on each end of the panel. These "trimmers" provide adequate compensation to cope with not too well-matched transformers. The gang is not fitted with screens, but the design is such that simple screens can easily be arranged. It is a well-made piece of apparatus, and the movement is delightfully smooth.

"SWORN TESTIMONY."

C. S. Dunham, the well-known radio manufacturer, recently sent us a book of extracts from letters written by appreciative customers which have been declared genuine on oath.



The Ormond Triple Gang Condenser assembly.

DANCE MUSIC ON SUNDAYS

The Lissen S-G 3

has brought a new interest to radio opened up new and fascinating fields abroad

IT "SPANS THE EASTERN HEMISPHERE"

YOU BUILD IT IN SIX SIMPLE STEPS

The Lissen S.G.3 is the latest development of radio science, brought within the reach of every listener. As you turn the dials of this receiver, station after station comes in at full loud-speaker strength. There is dance music for you to a late hour on Sundays when the home programmes are of a serious turn. Nothing like it has ever been available before, and Lissen have arranged that you can either build it yourself or buy it completely assembled in a fine mahogany cabinet.

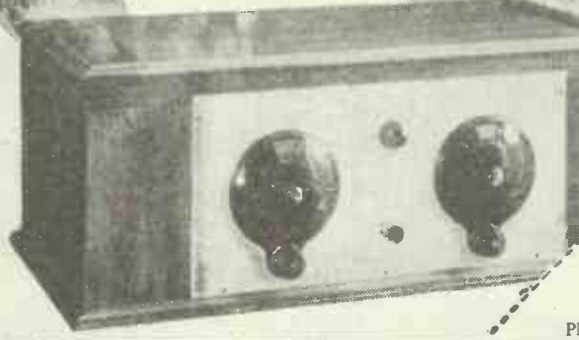
You will find a new interest in radio when you own the Lissen S.G.3, because it will enable you to keep in touch with all the important stations of the Continent night after night. At first it will seem that the stations are never-ending, and as you get accustomed to the dials you will find that you never really knew what selectivity was until you owned it.

Lissen have published a FREE STEP-BY-STEP CHART which makes failure impossible. Go to your Radio Dealer and ask for a copy of this Lissen S.G.3 Chart; on the back of it you will find a complete list of the parts required. Your dealer will help you to choose them from his stock. There is an envelope sold separately which contains panel, baseboard, screens and all the sundries you require, price 10/-. But Lissen have not tied you down to any particular make of valve, nor to a cabinet of tin. You can even use it without a cabinet at all if you wish. The selection and arrangement of the parts is such that you are bound to get results which make you proud to say, "I built it myself."

If you prefer it, you can buy the Lissen S.G.3 receiver already assembled. Complete in handsome wood cabinet big enough to take batteries, accumulators and valves, as illustrated Price **£8**
(This price includes everything except valves, batteries, accumulator and loud speaker.)

LISSEN LIMITED,
8-16, Friars Lane,
Richmond, Surrey
(Managing Director: Thos. N. Cole)

FREE Step-by-Step Chart and Wiring Diagram



To:
Lissen Limited,
8/16, Friars Lane,
Richmond, Surrey.

Please send me the FREE STEP-BY-STEP Chart of the S.G.3. Receiver.

NAME.....

ADDRESS.....

.....

Please Mark Envelope S.G.3 in top left corner

Delivers all its stored up ENERGY

Serious experimenters as well as amateur constructors who realise the importance of the fixed condenser are turning to Lissen, because Lissen Fixed Condensers deliver all their stored up-energy, are leak-proof and are accurate within 5% of their specified values.

YOU CANNOT AFFORD TO IGNORE CRITICAL AND ACCURATE VALUES

In almost every circuit volume and purity depends upon the precise making of a fixed condenser and a fixed grid leak. Select these from the Lissen range and you will get the utmost from your receiver. Any radio dealer will supply you with the correct values of Lissen Condensers and Lissen Grid Leaks.

LISSEN FIXED CONDENSER

Holds its charge and delivers it without leak or loss. In any R.C.C. circuit, the condensers you use should be absolutely leak-proof, otherwise 50 per cent of volume will be lost. Lissen condensers never leak, never vary, and they are accurate to within 5 per cent of their marked capacity. ·0001 to ·001, price, each **1/-**
·002 to ·006 price, each, 1/6.

LISSEN FIXED GRID LEAKS

These resistances are absolutely unvarying, no matter what the conditions or the current load. All values, each **1/-**

LISSEN R.C.C. UNIT

Embodies a ·0r condenser, which delivers all its stored-up energy and resistances that will never vary, no matter what the current load, interchangeability of resistance values. Price **4/-**

LISSEN

LISSEN LIMITED
8-16, Friars Lane, Richmond, Surrey
(Managing Director: Thos. N. Cole).

AMATEUR "BROADCASTING"

Ready for the amateur broadcasting tour.

The adventures of two amateurs who fixed up a simple "public address" outfit and toured the country giving open-air concerts.

By LAURENCE E. COUSSELL.

INSPIRED by the efforts of various mobile amplifiers on publicity work (equipments costing about four thousand pounds we are told), the writer and a colleague set out to see what could be done with comparatively simple apparatus. In the first place, we had at our disposal an Austin 12 saloon car, which seemed as reliable and easy running as one could desire, and also two papier-mâché five-foot straight horns which were more "ex-anything" than exponential.

The first task was to fix these to the roof; a stipulation was that no holes or fixtures of any kind were to be made in or on the car. Fortunately, each of the four doors had a slightly projecting hinge; accordingly we constructed a wooden cradle and this was mounted on a felt pad on the roof.

Only 130 volts H.T.

A stay rope from each corner of the cradle was then anchored to the corresponding door hinge. The horns were fixed into felt beds on the cradle, one facing fore and the other one aft.

The back section of the car had now to become the control-room, and, as everything for the trip had to be in the back, there was little room to play about with. The high-tension problem was overcome by employing four-electrode valves. Though it sounds almost impossible, the total H.T. voltage used was 130, and the loud speakers had a range of nearly a mile in the open country. The current consumption was rather less than 100 milliamps, so a small bank of accumulators in duplicate went on board.

The total filament current required was 2 amps. at 6 volts. This was taken from the 12-volt car battery, via a plug on the dash-board and a 3-ohm resistance. As a stand-by an ordinary 6-volt 60 accumulator was carried and this also supplied the micro-phone current. These batteries were all packed on the floor and leads then taken to a switchboard fixed over them. This board enabled the alternative supplies to be fed to the amplifier, while meters showed us that all was correct during working.

The Amplifier Circuit.

There now remained just sufficient floor space for the case holding gramophone motor, turntable and dummy tone-arm supporting the pick-up. The winding handle was accessible through one of the doors, and most operations could be carried out from the same point. The leather pockets behind the two front seats were packed with records, whilst the microphone was mounted behind the driver's seat.

Now we were ready for the amplifier itself. This had been constructed previously and fully tested at a garden fête where dance music and announcements were "broadcast." One photo shows the apparatus installed in a conservatory on that occasion. This photograph will give a good idea of the amplifier, but a few details may be of interest.

Altogether four stages of amplification are employed, the last stage consisting of four super-power valves in parallel push-pull. The valves are arranged on a shelf in front of the panel, the latter accommodating an ampmeter and milliampmeter, a heavy-duty master rheostat, volume control and two insulated terminal strips—that on the left for the leads from the pick-up and the microphone and that on the right for H.T., L.T., and output.

The back of the panel is open so that everything is accessible in case of trouble. The output from the pick-up or microphone and associated transformer is fed to the grid and grid-negative connections of the first valve, resistance-coupled to the second, transformer-coupled to the third, and finally comes the push-pull stage.

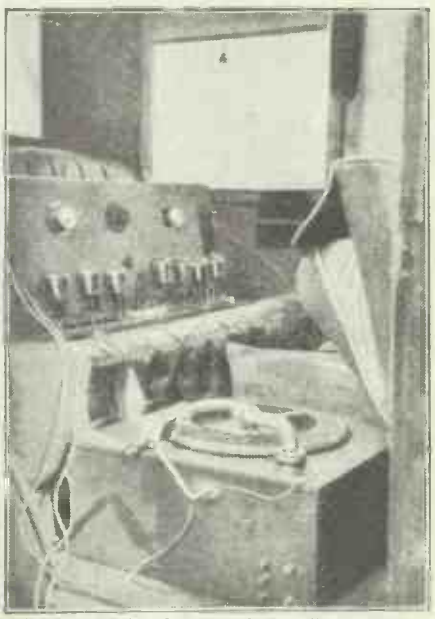


Fig. 1. Interior of the car showing the amplifier, turntable and the gramophone pick-up.

At the output, a heavy-duty tapped choke is employed, each loud-speaker lead being taken through a 2-mfd. condenser.

The transformer and choke cores, together with the pick-up frame, are taken to the common negative connection, and on the car this was automatically earthed to the framework through the car battery. No self-oscillation was then encountered.

Having mounted the amplifier on the back seat, the remaining space was occupied by a special resilient valve container for a dozen valves—five of them spares. Although the four-electrode valve is constructed with very close spacing of its electrodes, no single breakage occurred in the whole run. A partial view of the interior of the car is shown in the photograph below.

Did They Start at Barking?

At last all was ready for the journey, and, when finishing touches had been completed outside the suburban house, a trial "Hallo!" was directed at the microphone. "Mike," a little excited about the pending holiday, put up a good show, and most of the dogs in our corner of London commenced public-address work on their own account! We were a little dubious about the strain on the roof structure when in motion, but after driving for some miles with occasional halts for examination, we hoped for the best and drove on at full speed.

On arrival at a South-coast resort, we found a big hospital campaign in progress, so offered our services, and thereafter had an excuse for creating an uproar in different parts of the town. The inhabitants had recently had similar demonstrations, firstly from a newspaper publicity outfit and then an effort by a company just commencing open-air work.

The latter gave indifferent results for one hour in three—during the other two hours their engine was running hard to charge their batteries. From various conversations we gathered that the publicity outfit gave good results in most people's opinion, but our own set seemed to give satisfaction, because its tone was altogether more mellow, though, of course, we had not the same power.

Lady Loses Her Voice!

It was rather interesting to note that the first short demonstration without appeal for funds attracted a very large crowd, but when we summoned up all our powers of oratory to make appeals for the hospitals, our activities created a more distant interest. Nevertheless, the financial result once more proved the wonderful advertising value of such equipments.

Of course, we had many visitors willing to discuss at great length the whole of their wireless career—but many were really interesting and welcome. There were others who did not quite grasp what was happening; if it wasn't wireless, and it wasn't a

(*Continued on next page.*)

BELOW 50 METRES

Some practical hints of value to the short-wave enthusiast.

By G. P. KENDALL, B.Sc.

WHEN you get down on the really short waves, such as the 20 to 35-metre band, usually a number of things strike you as being perplexingly different from the conditions you are familiar with on longer waves, and although you may get used to them, there is always a feeling that the set would be pleasanter to work if it would behave in a more rational fashion.

Sometimes it is possible to remove or reduce these little peculiarities by various dodges, such as one learns by experience, and the disconnected notes which follow are intended to help in getting rid of two of the most tiresome ones. They are based on experiences with sets of the general type likely to be in use among readers of "P.W.," and it may be taken that the remedies suggested are of a pretty universal nature and will suit practically any case.

Moving "Flat Spots."

First of all we have the rather curious phenomenon of "flat spots" on the tuning range of the set. These are patches—sometimes only a few degrees wide, at which a great deal more reaction has to be used to make the set oscillate (in extreme cases it may refuse to oscillate at all), and on either side of which reaction is quite normal again.

You may find two or three of these patches on the tuning range of a given coil, and they can be a great nuisance, in ways which I need not describe since they will be painfully familiar to most readers who have tried the short waves. The usual remedy recommended is to place a small fixed condenser in the aerial lead, and although this works (at any rate, it shifts the flat spot somewhere else!), it is rather a nuisance to be obliged to transfer the aerial lead to a fresh terminal on the set, and then shift it back when the flat spot is encountered once more in its new position. Besides, the condenser, if small enough to do its job, usually reduces signal strength a little.

A better cure in most cases is to weaken the coupling of the aerial to the tuned circuit. Where a separate aerial coil is used this is fairly simple, and it generally pays to provide some scheme for swinging this coil away from the secondary. For example, where plug-in coils are employed, you can use only a single screw for fixing the aerial coil socket, so that you can afterwards adjust it to various angles. Flat spots are generally quite easy to move in this way.

Cures for "Threshold Howl."

When the aerial is connected straight to the tapping on the tuned grid coil matters are a bit more difficult, and probably the best solution is a tapping clip which can be quickly moved from turn to turn to give various degrees of coupling. The only serious drawback to this method is that it causes considerable changes of wavelength, so that you must be prepared to re-tune fairly frequently to find your station again.

Then again there is that annoying squawk or howl heard with some sets as they go into oscillation, commonly called "threshold howl," since it stops once oscillation has started properly. It is a rather mysterious complaint, but the main causes appear to be these (the remedies being fairly obvious where they are not given): (1) Aerial coupling too tight. (2) Reaction winding too big, or possessing too much capacitative rather than magnetic coupling to the grid coil. (3) Detector valve of too high an impedance, or unsuitably supplied with H.T. and L.T., or unsuitably biased as to grid (try connecting lower end of grid leak to slider of a potentiometer). (4) L.F. side unstable (reverse I S and O S leads to transformer) or being upset by intruding stray H.F. currents (use better H.F. choke, by-pass transformer primary with ·0005-mfd. condenser, and space out the parts a little more widely).

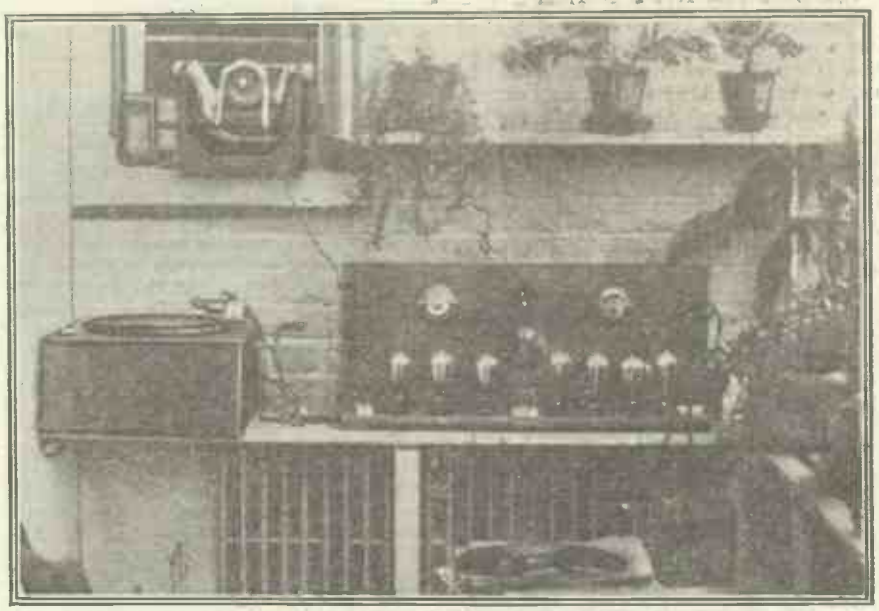


Fig. 2. The experimental public address amplifier installed in a conservatory. Note the microphone on felt and cotton wool. (The loud speakers were fixed on the roof.)

AMATEUR "BROADCASTING."

(*Continued from previous page.*)

gramophone—then what was it? They would look through a window and see us chatting to "Mike," but really could not associate that with the great voice above, any more than the revolving record with the "band strength" outside.

Microphone nerves were encountered even with our set. The writer, who trotted out most of the brilliant (sic!) speeches, managed one afternoon to persuade an interested lady to make a short appeal herself. The record ended, the fade switch brought "Mike" into action, and a little introduction was made.

Thoroughly surprised that such a quiet voice was required at some distance from the instrument, she found herself unable to say a word! The announcer came to the rescue and carried on with the next item!

"Spectacular" S.O.S.

Another little adventure occurred when we visited a popular "landslide" haunt near the town. We dropped anchor at the top of a cliff and could send out our efforts to everyone scattered about the country below. Shortly after we commenced action a gentleman came up to us and explained that he had lost one lens of his spectacles; would we kindly send out an S.O.S.? We accordingly delivered a little speech on the subject, and a short while later we had the pleasure of announcing that the lens had been restored to the owner.

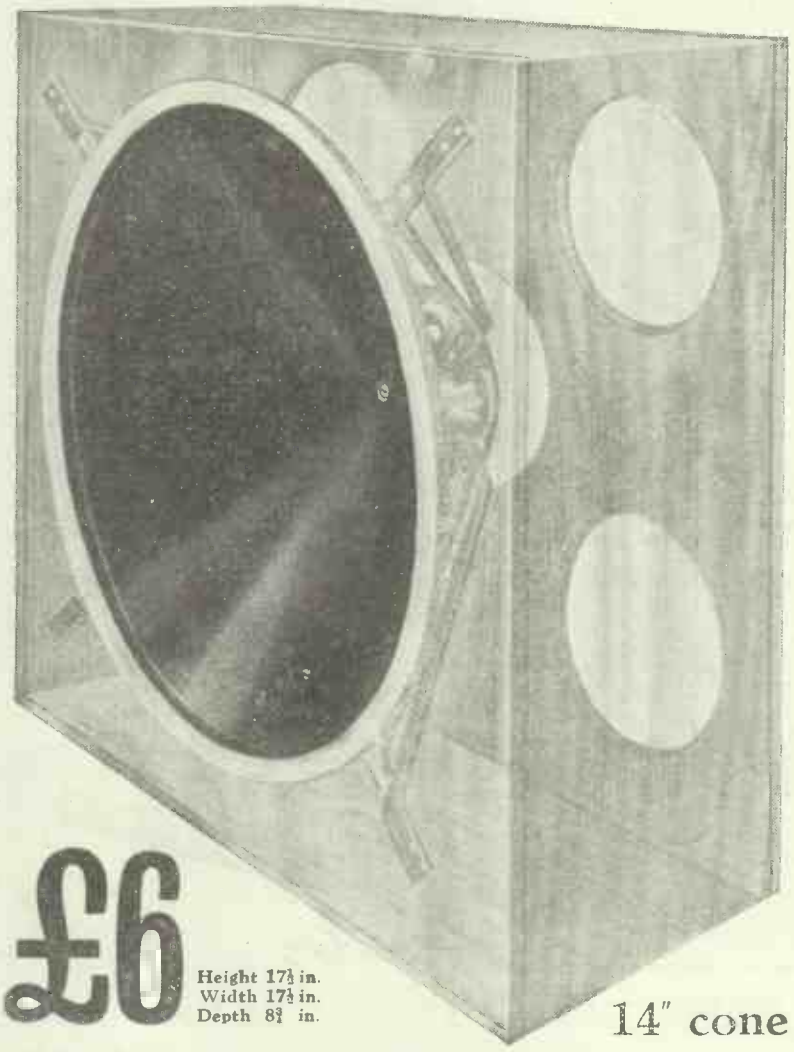
On another occasion we visited, quite accidentally, a delightfully sleepy village far from the beaten tracks. We were giving a performance on the village green, when a splendid old gentleman came up and told us that during the eighty years he had lived there he had never seen anything of the kind in the village before.

Feeling very satisfied with the experiment, we at length set out on the homeward run. By this time we were quite accustomed to the staring crowds who lined our route, though at first the attention we attracted was almost embarrassing. This would rather point to the fact that a private car with two dummy speakers on the roof and an advertisement for the latest cure for 'flu would gain great publicity.

The Only Accident.

On arrival in London we had our first accident. On the homeward run we had not even withdrawn the valves from their holders, yet in removing the amplifier from the car one of them had the misfortune to fall out on to the pavement. The glass "bent" very badly, and that was the only accident during the whole trip.

A-P-P-L-A-U-S-E



★ You've read that Dr. N. W. McLachlan, D.Sc., M.I.E.E., the well-known authority on loud speakers, claims that "it (the *New Amplion*) reproduces sound better than any loud speaker now on the market."

★ And perhaps you noted that the *New Amplion* headed the recent "Wireless World" Ballot, being voted not only the best loud speaker on view at the recent Olympia Radio Exhibition, but also the most outstanding exhibit of the show.

★ What says the North? On November 28th the Manchester Radio Society devoted their meeting to loud speakers, half-a-dozen being tried. They were switched on in turn both on speech and music, and the members voted by numbers, the make of the speaker not being known. To quote the "Manchester Evening Chronicle" . . . . . "The *New Amplion* was easily the first in the voting."

★ And now to hear the views of Mr. Ernest Newman, the famous music critic. Writing in the "Sunday Times," of December 2nd, he says: "My wireless set having been supplemented by one of the *New Amplion* loud speakers, I have done a good deal of intensive listening-in this week. Some of the results have been quite astounding; what I have heard has been nearer the real thing than anything that has come my way before."

£6

Height 17½ in.
Width 17½ in.
Depth 8¾ in.

14" cone

For £6 you can buy the *New Amplion* in chassis form. The unit is a complete full-size speaker, ready for connecting to your set. It is supplied in a plain wooden box from which it may easily be detached to fit any cabinet of your choice. The power chassis (size 21½" × 21½" × 10⅛") is also available in this form, with 18" cone, price £8/0/0.

Catalogues from Graham Amplion, Ltd., 25/26, Savile Row, London, W.1.
Manchester: 10, Whitworth Street West. Glasgow: 6/8, West George Street.
Works: SLOUGH.

AMPLION ®

The scene aboard the "Berengaria" during the well-known mid-Atlantic television experiment.

A TELEVISION DEMONSTRATION

AND AN INTERVIEW WITH MR. BAIRD.

By LAURENCE CORBETT.

Mr. Corbett was for some time on the staff of "Radio Broadcast," the well-known American radio journal, and while in New York acted as the "P.W." official correspondent. Mr. Corbett has lately returned to this country, and one of his first duties was to interview Mr. J. L. Baird. The following article gives a faithful account of what took place.

Upon my return from New York a little while ago, I was somewhat surprised to find that the Press was giving so much publicity to television. Frankly, I at first little heeded those over-optimistic literary approbations, supposing the reports to be as highly exaggerated as those which appeared legionfold in the New York papers. Indeed, I have subsequently learned that this was precisely the case, although the reports at the time became so persistent and colourful that I was finally moved to investigate.

Reports "Too Optimistic."

My interview with Captain Eckersley on the subject has already been recorded in POPULAR WIRELESS, his remarks to me, in essence, refuting the current rumour to the effect that the B.B.C. was preparing to engage itself actively in the transmission of television programmes.

He pointed out to me that the existing systems of television were as yet in their early stages, and that a development somewhat radical in nature would be necessary before the general public could be interested.

Although the B.B.C. chief engineer's remarks were non-discriminatory, I gathered from his carefully-worded replies that his opinion of known television systems was not high. Perhaps that is putting it a little strongly, but its emphasis will tend to offset to a degree some of the ridiculously optimistic statements which so carelessly seem to creep into the editorials of certain journals.

Purchasers are "Pioneers."

A little while ago, Mr. Baird very courteously showed me over his laboratories at Long Acre, for at that time I had been commissioned by an American wireless journal, "Radio Broadcast," to report on television developments in this country. Whereas the frequent Press reports on the progress of television are invariably highly coloured and optimistic, I formed my opinion during the interview that the inventor's personal views were definitely more conservatively balanced. He seemed prepared to admit that the art was still in a vastly experimental stage.

"Will you, in future years," I asked Mr. Baird, "consider the amateurs who purchase the television sets you are now designing, as pioneers?"

"Yes," was the immediate reply.

Surely this must be construed as a definite admission that the art is yet in its cradle days, for a pioneer is hardly one who steps in and takes the reins after accomplishment has materialised. Yet reports have it that television is ready for the masses, and the B.B.C. is being criticised in some quarters as a result of its stand in the matter.

I Witness Colour Television.

While I was in his offices Mr. Baird promised to give me a special laboratory demonstration. "The monochrome apparatus is not set up," he informed me, "but I will give you a demonstration of colour television."

Within a few moments we were in the laboratory, Mr. Baird issuing orders to an operator in a distant part of the building. "Transmit your head," he called.

Mr. Baird (right) describing one of his television instruments. The photo was taken in his laboratory in Long Acre, London, where the interview detailed in the accompanying article was given to our correspondent.

The resultant image was, to say the most, crude. It was indeed possible to see the lips moving, and even the eyes opening and closing, but the features were not recognisable, and lacked contour. I was somewhat relieved, therefore, when, during the course of the demonstration, Mr. Baird informed me that monochrome television is six times more effective than colour television.

Subsequently, the operator was ordered to "put on a green hat and wear a red scarf," etc., etc. Whereupon the change in colour became reasonably evident on the miniature screen. Whether the features lent for the experiment on this occasion were of a chimpanzee, a Hyde Park policeman, or of Greta Garbo (with due apologies to the latter two), I have never learned.

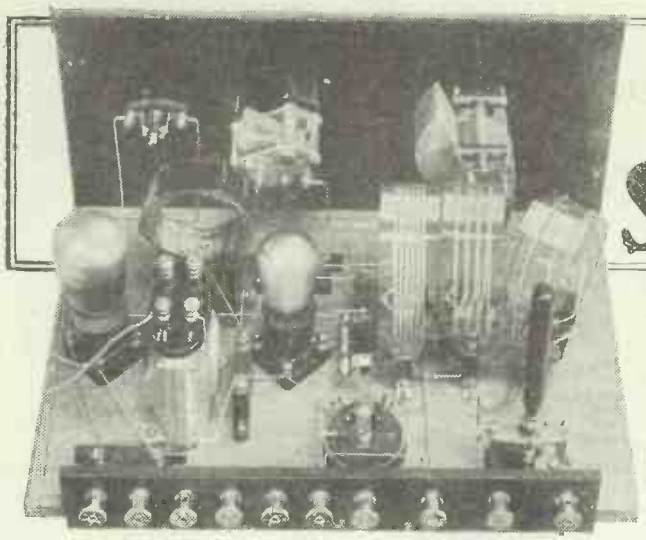
Doubtful "Detail."

The occasion of my visit was previous to the recent B.B.C. demonstration, when the system was finally turned down, and before leaving I questioned Mr. Baird on his future plans. His attitude was one of determination, and, according to his remarks, I gathered that he proposed to start transmissions despite the fact that he held no licence to do so. (I understand that he has now obtained an experimental licence.) The B.B.C.'s stand he described as acutely hostile, an opinion that cannot be endorsed by this writer.

Since my visit to Long Acre I have again been privileged to witness a Baird television demonstration, this time of the "highly developed" monochrome system, and I was disappointed.

Flickering was quite apparent, and although it was a simple matter to recognise and describe broadly the object being "sent over," it was no simple matter to recognise features.

An engineer friend of mine who witnessed a demonstration, supports this in the following sentence: "I spent the whole half-hour endeavouring to determine whether the televised object had a moustache or not, and came away still in doubt."



H.F. SHORT WAVERS

A considerable amount of experimenting has recently been carried out by the "P.W." Research Department in connection with the various problems concerned in short-wave reception. As a result, some interesting circuits have been originated, and much data of really practical value collected.

By G. P. KENDALL, B.Sc.

A FEW years ago we used to hear fierce discussions upon the question "Is H.F. amplification worth while?" and many and varied were the arguments put up by the opposing camps, one party claiming that they could do as much with a set of the "det. and L.F." type as anyone else with a multi-H.F. receiver, while their opponents swore they could get loud-speaker results from stations that the "det. and L.F." merchants couldn't even get a smell of.

Well, that particular feud seems to have died out at last, chiefly because modern properly stabilised H.F. stages give so much real amplification that it is scarcely possible to argue the point any further. It is true that one still occasionally meets a real die-hard who hasn't tried a neutralised H.F. stage, doesn't want to, and claims that his "det. and two L.F." combination is a world-beater, but they are rare, and most of us now realise that for long-distance work a stage or two of H.F. is a great advantage.

Chiefly, of course, it enables us to get our stations without forcing reaction so much, and so quality is better, fading effects are not exaggerated, and there is far less risk of annoying one's neighbours by oscillating in an attempt to squeeze in a weak signal. It is much easier, too, to get good selectivity with the aid of a stage of H.F. properly designed than with the ordinary detector and L.F. receiver.

All Over Again.

It seems, however, that the whole business is likely to start all over again with greater bitterness than ever in connection with short-wave receivers in the near future. so perhaps it would be as well to try and clarify our ideas a little before the subject is confused by partisan argument.

Now, the position on short waves is rather different, for the carrier waves of even very distant stations are often quite strong when they come in at all, so that a set of the "det. and L.F." variety will give surprisingly good results. For example, on a good aerial and a good night it is quite frequently possible to get one of the Americans (2 X A D, 2 X A F, 8 X K, and Co.) just up to moderate loud-speaker strength by tuning in very carefully and getting just the right reaction setting.

Evidently, then, the opponents of H.F. are going to be in a pretty strong position, especially when we remember that to get H.F. amplification on the really short waves is not very easy. They are likely to make the best of it, too, because the aforesaid die-hards are now mostly short-wave enthusiasts, and you may be sure they haven't forgotten the old arguments in favour of the simple, cheap, and easily built "det. and L.F." receiver.

What they are rather apt to forget, however, is that although this type of set is undoubtedly capable of an excellent performance, and is very simple and inexpensive, yet the fact that it possesses only one tuning dial does *not* mean that it is very easy to operate. On the contrary, tuning is very critical, and so is the reaction adjustment.

The Real Difficulties.

As a matter of fact, this last is the crux of the whole matter, for on the short waves success depends very largely on this factor. With the set in its most sensitive state, on the verge of self-oscillation, signals may be quite strong, but if the reaction is slacked back the merest trifle they may vanish altogether. To make things more difficult there is usually a certain amount of hand capacity on the reaction control, and reaction adjustments usually upset the tuning a little more than on the longer waves.

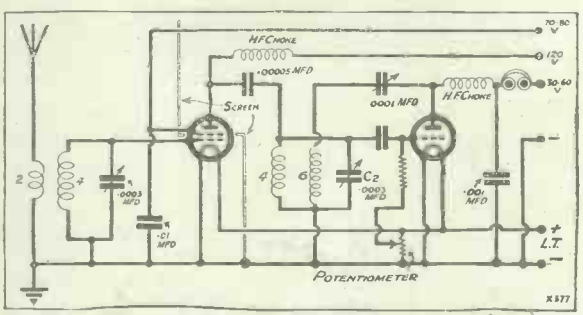
All this means, of course, that to operate a short-waver one must cultivate a more delicate touch, pick up some special tricks to counteract hand-capacity effects, and so on. It is really something of a special art, and although it is not too difficult for anyone to learn it is rather an irksome business.

I don't want to give the impression that operating a short-waver of the det. and L.F. type is an impossibly difficult business, for it is nothing of the sort, and anyone can learn to do it. All that I wish to do is to emphasise the fact that there *is* a certain amount of difficulty in working a short-wave set of a type which depends entirely upon the use of critical reaction, because this is a point which the short-wave enthusiast is apt to forget.

He has learned the art, and is scarcely conscious of the difficulties with which he is contending every time he tunes in 3 L O. Hence, when he tells you that there is no need for H.F. on short waves you should bear this point in mind.

If we could only manage to get a little real H.F. amplification working in front of our detectors on short waves these difficulties would be very greatly reduced, because we should no longer have to use so critical a reaction setting, and so tuning would become less razor-edged, while signals would no longer disappear altogether when the reaction is slacked off a trifle.

Now, we have been investigating this problem closely in the "P.W." Research Department, and have reached some very interesting preliminary conclusions. We have found that it certainly is possible to get quite a useful amount of H.F. amplification even on waves down to 20 metres, and the expected benefits do undoubtedly follow.



A short-wave circuit using a screened-grid valve, developed by the "P.W." Research Dept.

Success.

To get such H.F. amplification on the short waves is certainly a difficult matter with the ordinary three-electrode valves, but the arrival of the screened-grid valve, particularly in its latest 2-volt types, opens a new and most promising field. With these valves and some quite simple circuits we have obtained very good results indeed, and we hope soon to give practical details.

Our general conclusion is that for a short-waver of the "De Luxe" type, a stage of screened-grid H.F. amplification is worthy of serious consideration. For the simpler type, where first cost is a very serious consideration, the "det. and L.F." set seems likely to remain the standard.

BROADCASTING HOUSE.

Some details of the great building to stand near Oxford Circus.

By THE EDITOR.

SO at last the B.B.C. have definitely announced details concerning their new home. The new Broadcasting House, when it is built, will undoubtedly be one of the most palatial and impressive buildings in London, as our readers will judge for themselves by looking at the photograph which we publish this week.

To Cost Over £400,000.

Broadcasting House will stand at the corner of Portland Place and Langham Street, near Oxford Circus, and probably the shift will be made to the new home in 1931. The building is expected to cost at least £400,000, probably £500,000. It will include nine studios, four of which will be more than twice the size of the largest studio at present in use at 2 L O, and that, I believe, is at present 44 ft. by 25 ft. There will also be a super-studio, three storeys high, and very nearly 4,000 sq. ft. This will have a gallery and will be able to accommodate an audience of over 1,000 people, as well as a large orchestra.

Work has already begun on the new building, and the site is being rapidly cleared. There is still the formality of having the plans passed, but it is anticipated that no difficulty will be encountered with the L.C.C. in this direction.

Huge Premises.

The ground on which the new home will be built measures about 20,000 sq. ft., and is in the form of a peninsula facing south, and visible from Oxford Circus. The western front of the building will look out on Portland Place and the eastern will face on Langham Street. The outside of the building will not be decorated with much carving, etc., for which mercy, many thanks! London has far too many over-decorated buildings and the simplicity and austere dignity of the new Broadcasting House will help to enhance the beauty of some of London's new buildings. Probably all the building will not be occupied by the B.B.C., for there will be some office space available to let out and probably some ground floor shop space will be available.

The studios and the necessary offices for the B.B.C. will be insulated from all external noise, so that in the studio not a sound from the outside world will penetrate to interfere with that sensitive gentleman, Mr. Microphone. The studios will all be grouped one above the other in a big central tower of heavy brickwork, and they will be ventilated artificially, so that open windows will not be necessary.

Wide corridors with thick brick walls will be the order of the day. To each of the four large studios will be attached a suite, which will consist of a waiting room, band room, engineers, announcers, listening and echo room. There will also be eight rehearsal rooms, six waiting-rooms, a special suite and a dramatic effect studio. This new building is being financed by a Syndicate on terms favourable to the B.B.C. which retains an option to purchase it if and when this appears necessary or desirable.

Lieut.-Colonel G. Val Myer is the architect, and already he has to his credit Portsoken House in the Minories and Asia House in Lime Street.

Broadcasting House, as it will appear when completed.

Increasing Licence Figures.

Wireless licence figures for October indicate that a very large increase in the number of listeners has been recorded this year. The total, in fact, was just over 21,000, while in the same month of 1927 the figure was only about 4,000. The B.B.C. seems to think that this increase is due to the fact that many people of to-day have grown so familiar with wireless that when marrying and making a home for themselves, they instal a wireless set as a matter of course.

Not the Programmes!

It has been suggested, also, by some critics that the great improvement in programmes is responsible for this increase in licences. But that theory is a little difficult to appreciate when we consider the case of Mr. George Hicks, of Sidcup, who was fined £10 at Bromley Police Court the other day for assaulting a policeman, and there also followed a fine of 40s. and costs for using bad language. Mr. Hicks stated that he arrived home and put on the wireless; that it was so dull he went to the pictures afterwards and had two glasses of port. The rest of the story you know!

A LETTER FROM SIR JOHN REITH.

DEAR MR. EDITOR,—This is very confusing. It seems only yesterday that I had to decline a request from you for an article in the Christmas number of POPULAR WIRELESS. And now I have to deal with a request for a criticism of a "Special Christmas Number" of "Modern Wireless." You may not have realised the risk you run in inviting an opinion of this kind!

In order to stop such requests I should like to have told you that the special Christmas number of "Modern Wireless" is the worst production of its kind that I have had the misfortune to encounter. I should like to have said that there was altogether too much "talk" in it, that its wiring diagrams were wrong, that it was hopelessly edited, and was bound to fail. I might have said all these things, and more besides, if I had been wise enough not to look at your Christmas number.

Unfortunately I have looked at it and I cannot say all these things or anything like them; in fact, I cannot avoid praising it. But then, if I praise it, I might be guilty of making an unfair distinction between your excellent "Special Christmas Number" and perhaps equally excellent "Special Christmas Numbers" edited by your competitors. So there it is. I must ask you to note the growing strength of precedent.

Yours sincerely,

(Signed) J. C. W. REITH.

TECHNICAL TIPS.

THERE are several forms of local action which can ruin an accumulator, but the chief cause of this in a good class cell can usually be traced to impurities in the electrolyte.

* * *

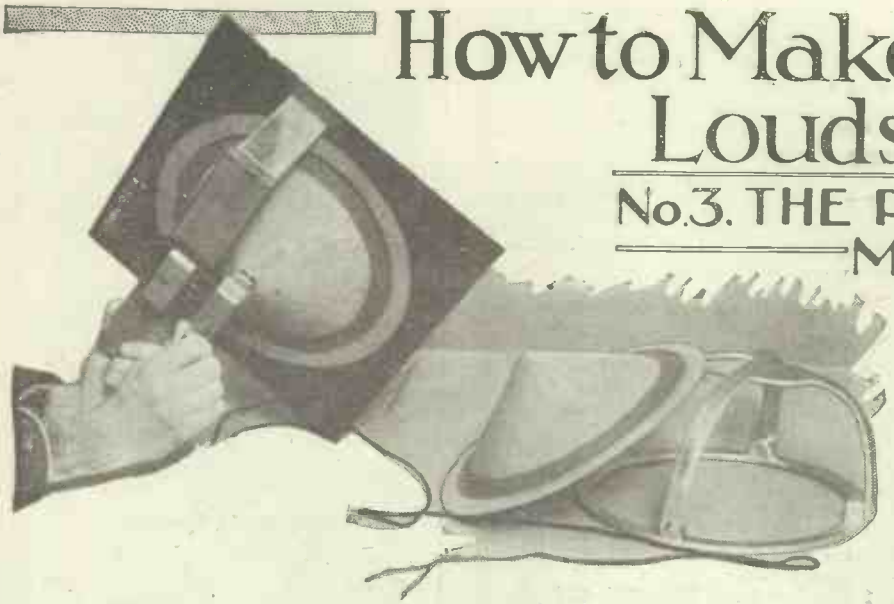
Owing to minute irregularities and imperfections in a low-tension battery, even a fully-charged battery will in time run down when not used to supply current externally.

* * *

If a cell has been accidentally charged in the wrong direction so that its polarity has become reversed this may sometimes be corrected by a long charge in the normal direction or by several long charges and discharges in turn.

How to Make Loudspeakers

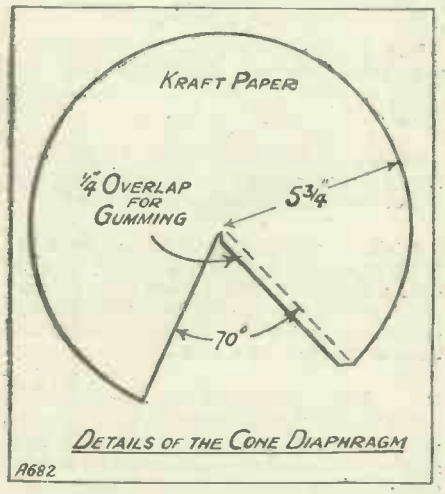
No. 3. THE P.W. "CHASSIS" MODEL



A speaker of considerable sensitivity capable of results not far short of first class moving-coil quality. This is just the instrument for the medium or small set man.

By G. V. COLLE.

WE are offered a range of units working on the reed or balanced armature principle which are, on the whole, more sensitive than the most expensive moving-coil loud speakers, and, therefore, more suited to the man who owns a small receiver. There are, roughly, a dozen reeds being offered for sale in England at the present time, and the performances of these, when incorporated, are every bit as good as many loud speakers costing two or three times the price.



Naturally, when one purchases one of the rather expensive reed units, the results should be proportionately better, assuming the correct type and weight of paper is chosen for the cone diaphragm, and other suitable arrangements made. Therefore, in introducing the "P.W." "Chassis" Cone to the readers of this paper, the writer has no hesitation in stating that, while being the most expensive of those yet described, it is by no means an extravagance.

Cheap but Efficient.

Costing under £2 for parts, without cabinet, it can very easily be assembled in an hour or so. Compared with the usual home-made loud speaker, the volume obtainable, using an ordinary detector and L.F. receiver, is about half as much again on this loud speaker (while the quality is first-class).

The bass register is, frankly, not so good as obtained from a moving-coil loud speaker, but bass is there, and in good proportion. Further, the higher register appears more brilliant than that on the average specimen of the moving-coil type of instrument.

Referring now to constructional details, the wood framework for mounting the unit costs less than one shilling.

Dimensions for the diaphragm are given in diagram form, the cone being made of "Kraft" paper of a grade having a weight of approximately 120 lb. per ream.

Commencing Construction.

A good gum or liquid glue should be used to stick the overlapping portions of the paper, and the same adhesive employed to attach the Suedlin segments (special fabric which supports the periphery of the cone diaphragm) to the cardboard ring on which the whole suspension ring is mounted

The writer has found the particular suspension material used in the construction of this cone very suitable for moving-coil loud speakers, and it was the latter which gave him the idea of employing it to advantage on this type of cone. Once the paper cone is formed it is simplicity itself to attach it to the Suedlin segments and cardboard supporting ring; as the following notes will prove.

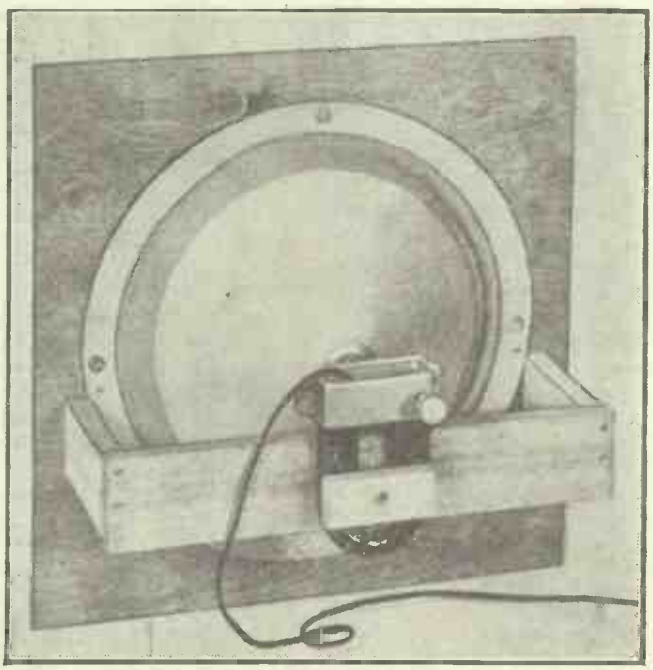
Make the cardboard ring to the required dimensions and coat one surface of it with the gum and allow the adhesive to get "tacky." Now pick up the Suedlin segments one by one and press them into contact with the gummed surface, the surplus of Suedlin being towards the inside of the ring and the outside edges flush with the outside edge of the cardboard ring. The segments should overlap each other for about a quarter of an inch or less, and they should be so arranged that they form a continuous and even Suedlin ring inside the cardboard ring to which they are attached.

Mounting the Unit.

When the gum has set, the paper cone can be introduced so that one can gauge the amount of cone which has to be gummed on the *outside* surface of the diaphragm. It can then be removed, the paper surface near the periphery of the diaphragm treated and again introduced into the Suedlin ring, the latter being pressed firmly into contact with the paper.

While the assembly is put by to allow the gum to become hard, the reed unit can be fitted to its supporting frame-

(Continued on next page.)



The unit is held in position by a simple wooden framework, all the details of which can be seen in the above photo.

HOW TO MAKE LOUDSPEAKERS.

(Continued from previous page.)

work. It will be necessary to clamp the permanent magnet on the reed unit between the long wood strip and a smaller piece of wood fitted to the opposite side of the magnet, the whole being held together by a long wood screw, or a piece of 4 or 6 B.A. screwed spindle, with clamping nuts each end. (See photo.)

The Last Step.

The next and last process, other than attaching the completed unit to the "baffle" board, is to attach the cone diaphragm to the fine screwed rod projecting from the reed unit. This involves no special ingenuity on the part of the constructor, provided he observes a few small points. In the first place a small hole should be made at the apex of the cone, and then the surrounding paper must be pressed into a shape corresponding to the coned washers supplied with the unit.

The latter can be done by removing the top coned washer, inserting the screwed rod through the hole in the diaphragm, and replacing the washer and nut and then screwing the nut up tight against the back nut and washer. The final position of the washer is at the extreme end of the screwed rod, and this must be strictly observed if rattle and buzzes are to be avoided.

Care should also be taken in fitting the red felt washers under the coned washers, as the metal should not be in actual contact with the surface of the diaphragm. Lastly, see that no undue stress is thrown on the screwed rod, as the correct position for this is a free control one assuming the nuts and washers are removed, and not taking into account the stress caused by the nuts when in position.

The cardboard ring supporting the periphery of the diaphragm can be attached to the wood "baffle" board by drawing-pins or round-head wood screws and small washers.

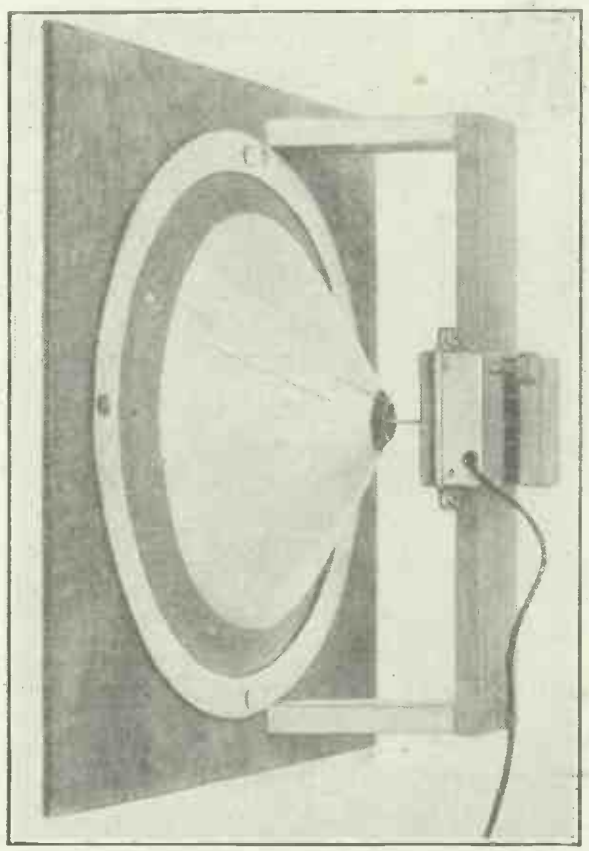
PARTS REQUIRED.

- 1 Reed unit (Blue Spot adjustable type, price 25s., used in the original. Quite a number of others will work into this design perfectly).
- 3 Pieces of wood, two 4⅛ in. × 1¾ in. × ½ in. thick, and one 12½ in. × 2 in. × ½ in. thick, and one plywood board approximately ¾ in. thick, or less, measuring 13½ in. × 13½ in. with hole cut in its centre 9¾ in. diameter. Alternatively,
- 1 Complete metal framework and plywood front. (F. Squire.)
- 1 Sheet of Kraft paper cut as per sketch, alternatively 1 stamped sheet ready for forming into a cone.
- 4 Pieces of Suedlin of suitable size (obtainable at any drapers).
- 1 Cardboard ring (see text regarding these three items), 11¼ in. outside dia. and 9¾ in. inside dia.

Suitable cabinets are obtainable from a number of wireless cabinet makers and other firms, including Lock, Carrington, Bond, Goodman, Squire, etc. With any of these cabinet type "baffles," it is essential that the fretted hole should be of a diameter equal to the inside diameter of the cardboard ring.

Do not use a "baffle" or cabinet which has a hole smaller than that specified, as this will probably cause the reproduction to be muffled. Again, one can omit a "baffle" altogether, but with a loss of the lower frequencies. It is also possible to employ the cheaper model Blue Spot unit, having no adjustment, the results being the same except that greater care has to be exercised in erecting the unit, to avoid decentralising the reed. Quite a number of other units can also be used, of course.

A metal framework which can be used for mounting the unit instead of the wooden frame can be obtained from various specialists in such devices.



The cone is fastened to a ring of Suedlin (a kind of leather material—kid or wash-leather is sometimes used), and this is held to the front board by means of a cardboard ring.

INTERESTING ITEMS.

One of the best methods of obtaining very smooth reaction and avoiding "threshold howl" in a short-wave set's detector is to connect the L.T. end of the grid-leak to the slider of a potentiometer fitted across the L.T. leads.

* * *

Dirt is a great enemy to good reception, and many apparently untraceable cases of fading, or poor signals, may eventually be traced to this cause.

* * *

Never allow the acid from an accumulator to spill on any carpets, clothes, or fabrics, as it is one of the most destructive agents known.

* * *

When an accumulator is allowed to stand inside a wireless cabinet it is a good plan to have a little baseboard to stand it on so that any small leakage or accidental excess of acid on the case is absorbed by the baseboard instead of reaching the cabinet.

* * *

BAD REACTION CONTROL.

If the plate or grid leads to your detector valve are unduly long, or run parallel to one another, it is quite likely that smooth reaction control will be out of the question owing to the unwanted capacity coupling introduced.

* * *

Cheap foreign batteries often have a high internal resistance, even when new, and they may thus give rise to "motor-boating" or to unsatisfactory reaction control.

* * *

When using a potentiometer to control a detector valve, remember that it is quite likely that the best position for the slider for rectifying purposes is not always the best position for reaction control.

* * *

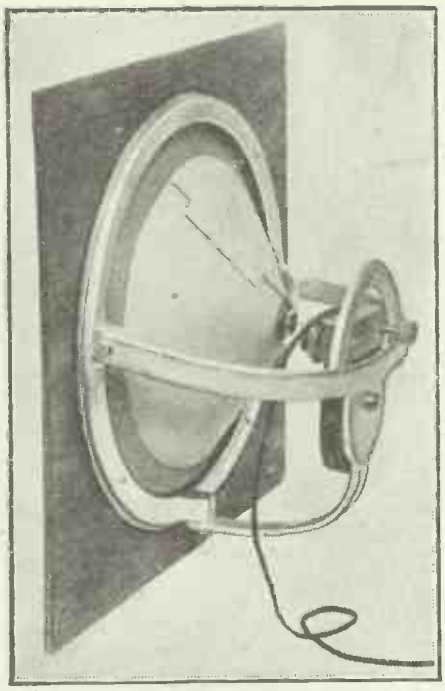
The value of the resistance of the grid leak often has an important bearing upon the smoothness of reaction obtainable.

* * *

When reaction control is fierce, or "overlap" is present, the substitution of a grid leak of a rather lower value than the one at present in use will often overcome the trouble.

* * *

One of the most important components in a short-wave set is the choke, and unless it is suitable to the circuit it will be impossible to get proper reaction control or long-distance results.



Instead of the simple wooden framework, a metal arrangement can be used.

RADIOTORIAL

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lite, Ltd., 4, Ludgate Circus, London E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject 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.

WHAT IS A C.A.T.?

C. S. T. (Hamilton, N.B.).—"I am told that I ought to put a 'C. A. T.' condenser in the aerial, but as I have not the faintest idea what a C. A. T. condenser is I should be glad if you would tell me what kind of a thing it is and why it is so called."

A C.A.T. condenser is merely a small condenser of approximately ·0001 mfd. capacity which is placed in series with the aerial in order to give a constant tuning effect. It has been found that the effect of connecting such a condenser in series with an aerial primary coil is largely to overcome the difficulties which arise owing to the discrepancies in aerial tuning with different aerials. With a "constant aerial tuning" (C.A.T.) condenser connected to the aerial, the tuning-condenser readings will tend to resemble strongly those of other receivers fitted with a "C.A.T." condenser, even although the set is connected to aerials the lengths of which differ.

USING SEPARATE H.T. TAPPINGS.

R. R. E. (Old Trafford).—"What is the advantage of having a lot of different H.T. plus terminals? In my last set I only had two and it was perfectly satisfactory, but in the new one which I am thinking of building there are no less than four. Are they really necessary?"

The idea of having a large number of H.T. plus tappings on any set enables each particular valve to have exactly that high-tension voltage which it requires. For very selective, and high-quality reception it is frequently necessary to adjust the high-tension positive and the grid-bias potentials very accurately in order to obtain the maximum results, and it is impossible to do this for separate valves unless each has a separate high-tension supply.

It is for this reason that the H.T. positive terminal is duplicated or triplicated on many sets, and we think that in general you will find that it is a refinement that is well worth while in practice.

Care of L.T. Battery.

W. H. E. F. (Longeaton, Notts).—"When I first took up wireless we used to be told that it was absolutely fatal to short a low-tension battery, and great care was taken to prevent this. But recently I have noticed a tendency among my friends to think that accidental shorting of a battery will not do it any harm at all, and I have, indeed, heard this stated as a fact. What really happens when this occurs, and what is the damage done to the battery, if any?"

Sudden over-discharging is likely to lead to a good many accumulator troubles, though certain modern accumulators are far more "hardy" than their predecessors. Amongst other things, shorting often gives rise to the buckling of a plate and to the loosening or shedding of the active material in the plates. (This latter is due to excessive sulphation, which is accompanied by a certain amount of expansion of the active material in the plates, and if this expansion is greater than the containing grid can cope with, when the sulphate is reduced by the next charge on the accumulator a certain unavoidable loosening and shedding takes place.)

The over-discharge due to a dead short-circuit or to a short through quite a low resistance is likely to give rise to buckling of the plates and frequent over-discharge may quite easily cause a reversal of the polarity of the plates in one or more of the cells, especially if they are partially discharged to begin with.

A SIGN OF SULPHATION.

"DEALER" (London, N.W.).—"What is likely to be the trouble in a L.T. battery which when placed on charge shows a very quick and unusual rise of voltage?"

(*Continued on page* 798.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 796.)

Frequently this is due to over-sulphation which, by its retarding action, has the effect of concentrating the acid strength over the active area, and so giving a misleading indication of the condition of the whole electrolyte.

A SHORT-WAVE SNAG.

W. W. V. (Bradford, Yorks).—"The only snag is this howl which at times nearly drives me balmy. I am told that the best way of curing it is to fit a potentiometer, and as I have one on hand from my first set, where it was used for the H.F., I should like to know whether I can use this for the short-wave set, and if so what are the connections?"

Such a potentiometer as you have is quite suitable for the purpose, and it is very easily fitted in the following method. One of the terminals on the potentiometer which is connected to the *end* of its winding should be joined to one of the leads on the set which goes to L.T. negative. The other terminal which is joined to the opposite end of the winding of the potentiometer is connected to one of the wires which goes direct to L.T. positive terminal.

This leaves you with one other terminal on the potentiometer, which is internally connected to the slider. Before connecting this you must examine well the winding of your grid leak.

You will notice that one end of it is connected to the grid socket on the valve holder and also to the grid condenser. This end of the grid leak is not interfered with and remains connected to the two points named above. The other end of the grid leak, however, is disconnected from its present wiring and a lead is taken from this other end to the terminal on the potentiometer which has been left vacant (i.e. the terminal which is connected to the slider of the potentiometer).

This completes the new wiring, and it should be noticed that in all short-wave sets the spacing and length of wiring is important so that considerable care should be taken before the actual position of this component is decided upon. Place it as near as possible to its former position so that the leads are short and direct ones, and do not interfere or run too close to any existing high-frequency leads.

In order to cure the threshold howl do not forget that not only is the exact position of the potentiometer setting important, but if any difficulty is experienced in controlling the howl, or if there appears to be a tendency for the signal strength to drop, owing to the potentiometer setting, the whole of the other adjustments of L.T. resistance, H.T. voltage, etc., should be varied in conjunction with the potentiometer. A little careful adjustment and readjustment will soon determine the best position for the setting of the potentiometer, but do not forget that threshold howl is caused by a great many different causes, and it is quite possible that in your case the potentiometer alone will not effect a cure.

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and 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.

Probably it *will* do so, but if not, try the alteration of grid-leak value, or if this fails try substituting one L.F. transformer for another if you have a second one on hand. Small output chokes in the telephone leads are also very useful for preventing this, as is also a bypass condenser across the 'phones, or from H.T. negative to the telephone terminal farthest from H.T.

Threshold howl is a very difficult fault to get rid of, but if you watch "P.W." closely you will find that cures for this are constantly being found by readers, or are recommended in the articles dealing with short-wave sets.

CURE FOR MOTOR-BOATING.

N. P. S. (Walthamstow).—"To cure the motor-boating I am told that I should use a 3,000 ohms resistance and a large fixed condenser connected in series together. As I have these parts on hand I should like to try it, but I am not sure how they should be connected in the 1st L.F. valve's lead. Can you give me the connections?"

One end of the resistance is joined to the lead from H.T. positive. The junction between the resistance and the large fixed condenser then goes to the point to which the H.T. positive was formerly connected. The final connection is from the remaining side of the fixed condenser, which is taken to H.T. negative, or to any one of the leads connected thereto.

TROUBLE WITH OSCILLATION ON SHORT WAVES.

D. R. W. (Reading).—"The set will not oscillate on the very low waves, unless I take the aerial coil out or remove the aerial lead from it. What is the cause of this and how can it be overcome?"

Your aerial is coupled too tightly to the grid coil and, consequently, too much of the energy in the grid circuit is being drawn off by the aerial and radiated, thus preventing the set from reaching oscillation point. You can either use a smaller coil in the aerial circuit, or else tap the present coil by means of a "crocodile" clip.

This is very easily arranged, for all that is necessary is for you to take the permanent lead from the aerial

(*Continued on page* 800.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 798.)

terminal to the aerial coil holder away, and in its place fit to the aerial terminal a flexible lead with a crocodile clip at the end of it. This clip can then either be affixed to the soldering tag on the coil holder (thus restoring the previous connection, for long-wave work) or, when used on the short waves, this clip can be put on any portion of the bare wire of the aerial coil.

In this way you can, in effect, make the aerial coil of one turn, two turns, or whatever you may desire, thus giving very loose coupling and overcoming your trouble. If you find any difficulty in fitting the clip, or find for any reason that this is not easy to do, try moving the aerial coil further away from the grid coil holder, which, in conjunction with an aerial coil of fewer turns, should do the trick.

WHICH VALVE SHALL I USE?

T. F. R. (Gillingham, Kent).—"I am going to buy a detector valve for use in a short-wave set—Det., 2 L.F.—transformer coupled with Reinartz reaction. Would it be an advantage to use a very high impedance valve for detector, or should I get a general purpose type?"

For your purpose we recommend a valve having an amplification factor of about 20 and an impedance of 20,000 or so. Very high impedance valves often give good results, but generally speaking the valve in such a set is not unduly critical. The general purpose type will do, but we recommend one of the types known as "H.F. valves," with impedance and amplification factor of approximately the figures given above.

THE POSITION OF THE FILAMENT SWITCH.

A. W. C. (Crewkerne, Som.).—"If it is possible I should like to disconnect the H.T. battery as well as the L.T. when the filament switch is in the "off" position. If this can be done will you please tell me what the connections are?"

With the ordinary on-off switch you can only break one lead, though if desired the switch can be placed in such a position that L.T. and H.T. negative leads are only joined together when the filament switch is "on." This, however, is no protection to the valve because it means that H.T. negative, instead of being joined to L.T. negative direct, is joined to the valves themselves, and thus it is always in the potential "danger position." If, however, H.T. and L.T. negative terminals are joined together and led to the switch, with the object of cutting off both from the filaments when the set is switched off, the danger remains so long as the L.T. battery is connected up, for through this the H.T. negative will be connected to the other side of the filament, which is the very thing it is desired to avoid.

The best way to break both the leads when using only one switch is to use a double-pole double-throw switch or its equivalent, one section carrying the lead from H.T. negative terminal and the other arm or section taking the lead from L.T. negative. The two corresponding contacts can then be joined together so that when "on" the H.T. and L.T. negatives are joined together and to the filament. But when in the "off" position the connections will be: arms on the switch joined together and to filament and thus to L.T. positive, L.T. negative to the stud making contact with one arm of the switch, H.T. negative to the stud making contact with the other arm of the switch. This arrangement will afford complete protection.

H.F.C. AND R.F.C.

"H. F. C. and R. F. C." (Gloucester).—"What is the difference between an H.F. choke (H.F.C.) and an R.F. choke (R.F.C.)?"

There is no difference, "radio-frequency" being the American name for high-frequency.

WHEN THE EARTH WIRE MAKES NO DIFFERENCE.

V. B. (Hampshire).—"Ever since I have had the H.T. eliminator in use I have been puzzled about one thing, and that is the earth. Formerly the earth wire used to make a great deal of difference to the set, and removing it would cause half the stations to fall off.

"Now I find that even on distant stations the earth appears to make no difference at all, and as the aerial-earth system has not been altered I am very puzzled to account for this. Has it anything to do with the fact that whereas I used to have the earth lead coming in to the earth terminal of the set I now have it coming in to one earth terminal of the eliminator?"

Probably it is the change-over to the use of a mains unit that accounts for your different results with the earth lead. Previously, if you removed the earth lead there was no way for the aerial current to pass to earth except through the batteries, and any stray capacities connected to the filament. As this stray capacity would be slight, the effect of removing the earth lead would be very noticeable.

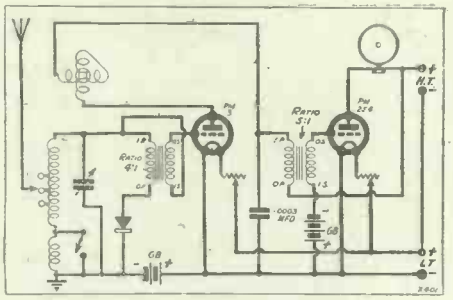
Now that you have a mains unit connected to the set the filaments are joined to the negative lead of the mains, and this is probably earthed, so that you have a very good earth at this point. Consequently, the effect of connecting or disconnecting the extra earth lead, which is connected to the eliminator, would be negligible (although in many instances the mains might be differently connected, and that is why the mains unit is fitted with the earthing terminal).

THE "VARIACTOR HALE."

A. C. (Letchworth, Herts.).—"I have just seen in your letters from readers that one from Mr. Woodhall of Wolverhampton, in which he says he combined the Variactor and the Hale, getting 32 stations on the speaker.

"I am especially interested in the volume obtained from 2 valves and crystal, and should like to know what are the actual circuit connections."

The circuit sent to the Editor in the letter from Mr. Woodhall, which was published in "P.W." No. 337 (Nov. 17th issue), is reproduced herewith:



It will be seen that the second stage is a conventional L.F. amplifier, but the first valve has a variometer in the plate circuit on the lines of the "Variactor," whilst its grid circuit incorporates the "Hale" method of L.F. transformer connections.

A LEAD-IN QUESTION.

"NEWCOMER" (Stanstead Essex).—"Is it really an advantage to have the set placed close to the lead-in?"

Yes, it is decidedly advantageous in nearly all cases to have the shortest possible lead-in, so the answer to your question is in the affirmative.

THE REQUIRED RESISTANCE.

S. M. (Bath).—"Can you tell me if No. 40 Eureka resistance wire will carry ·1 of an ampere, and if so, about how many ohms resistance will a yard of this wire have?"

No. 40 S.W.G. Eureka resistance wire will easily carry ·1 ampere, and the resistance of this wire per yard is about 37·184 ohms.

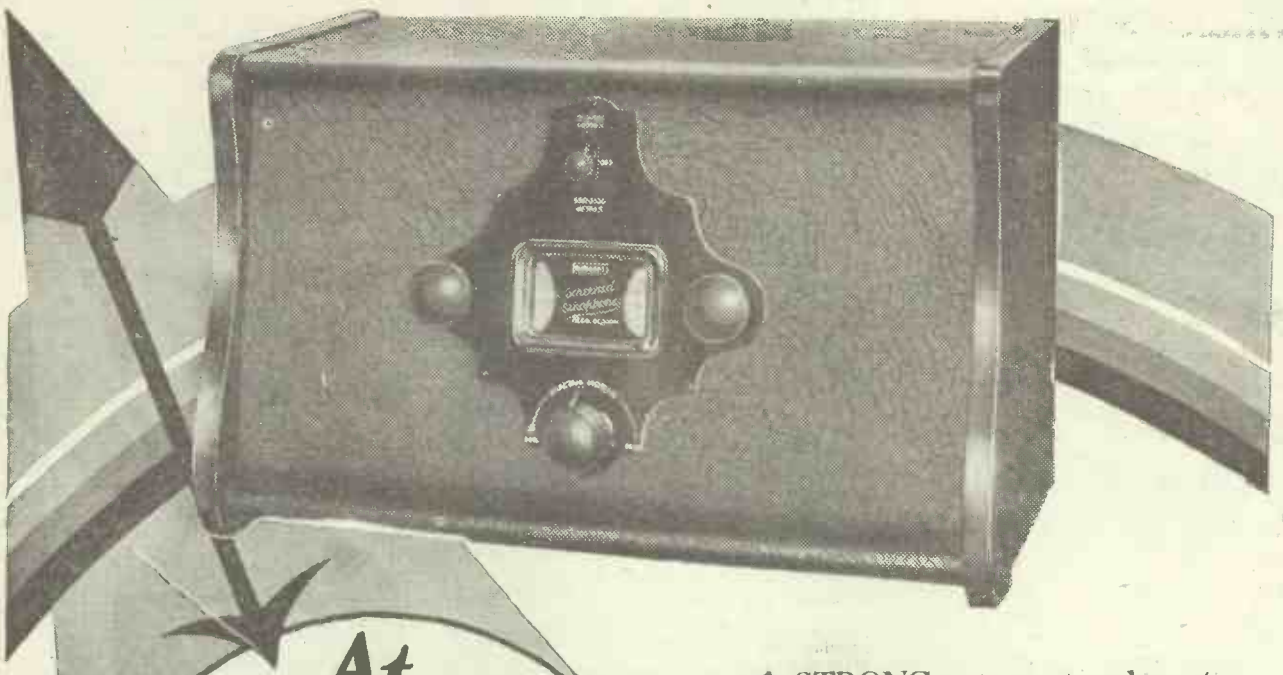
THE USE OF A COUPLING CONDENSER.

A. S. A. (Hatton Garden, London, E.C.).—"I have become very interested in the use of resistance-capacity coupling instead of transformer coupling, but I am very puzzled as to the use of the coupling condenser. Does this act like a transformer and transfer the energy from the first valve to the succeeding valve?"

The coupling condenser can hardly be said to act in the same way as a transformer, for the latter often gives a very useful step-up in voltage, whilst the coupling condenser would invariably be better out of the way if we could do without it. The reason that it cannot be dispensed with is that resistance-capacity coupling, unlike transformer coupling requires a direct connection between the plate of the preceding valve and the grid of the succeeding valve.

Actually a direct connection cannot be used, because if it were made the full H.T. positive would be on the grid of the valve as well as on the plate of the preceding valve. The fixed condenser, however, possesses the property of insulating the grid

(*Continued on page* 802.)



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A.J.W.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 800.)

from direct current, and at the same time acting as a conductor for the L.F. impulses which it is desired to hand to the second valve.

THE "EMPIRE" TWO.

In the wiring diagram of the "Empire" Two (page 708, "P.W." December 8th issue), one of the wires was marked "See Text." The object of marking this wire (it is the one that joins the fixed plates of the tuning condenser to the grid condenser and grid coil-holder) was to indicate where the tuning condenser's capacity can be reduced for short-wave work.

On ordinary wave-lengths there are several degrees upon the dial "covered" by any particular station, but if you use a set of short-wave coils and try for short-wave stations you will find all this is altered. On the short-waves the tiniest touch of the condenser is all that is necessary and the programmes of half a dozen different stations might be concealed behind a ten degree space on the dial!

Consequently very slow motion of the condenser is necessary, and it is for this reason that an (extra) ·0005 fixed condenser can be connected to the lead at the point marked X on the diagram. Its effect is to make the tuning condenser much smaller, so that the movement of the dial will not give such a disconcertingly sharp alteration in the tuning as would be the case if the tuning condenser's capacity were ·0005 mfd. By adding a ·0005 fixed condenser in this way, the one tuning condenser is perfectly efficient for both the long and medium wave-lengths, and also for the short waves.

Changing Capacity As Required.

Any good make ·0005 mfd. fixed condenser can be affixed to the baseboard (at the point marked X in the diagram), if the set is to be used for short-wave reception. Some means of cutting it out of circuit quickly is desirable, so that when ordinary wave-lengths are being received the tuning condenser's capacity is restored to ·0005 mfd.

One good method of doing this is to fit a 3-in. length of flex with two crocodile clips, the joining of these to opposite terminals of the fixed condenser being all that is necessary to restore the effective tuning capacity from ·00025 to the original ·0005 mfd.

THE CHALLENGE TO THE B.B.C.

By A. A. CAMPBELL SWINTON, F.R.S.

I AM asked by the Editor of "Modern Wireless" to write a few words of criticism on his remarkably instructive special Christmas number, and I think I cannot do better than give some of my views upon what is mentioned therein as the Challenge to the B.B.C. Those who know me will understand that I should be the last upholder of what I understand the "Sunday Dispatch," in one part of its columns, calls a calculated experiment in state socialism, for personally I am individualistic to the core, and all forms of so-called socialism are to me anathema and proper things to be fought to the last gasp. At the same time, my opinion is that what the "Sunday Dispatch" says in this respect is pure nonsense, while I entirely agree with the further excerpt given from the same paper that we have, in the B.B.C., a system which has proved itself under men of high ability.

It is, of course, an entirely impossible task to satisfy all tastes.

No doubt, too, we shall have eventually a real choice of two programmes which can be easily and simply separated, which is not the case when you live, as I do, within a very short distance of the London B.B.C. sending station.

Anyway, I am sure that the present system of all broadcasting in this country being under a single control is much the best, and that the suggestions of inducing competition from neighbouring foreign states is most unwise. Furthermore, I do not believe that in practice it will ever be allowed, as the law, if not sufficiently wide to catch all offenders, can easily be effectively strengthened without going to the absurdities of the last Post Office Wireless Telegraph Bill, which was simply laughed out of existence by the absurdity of its diction; while again, those who infringe the law of this country, even from foreign territories, will find that the arm of the British law is very long and eventually very sure.

Meanwhile, I am clear that the B.B.C. are right to concentrate on work that the present state of wireless telegraphy renders certain of successful results such as are worth reception, and to leave alone others which for the present are only interesting to speculators on the Stock Exchange, and I trust that in this view they will continue to have the support of the Post Office and of the Government.

Another "M.W." Appreciation.

Senatore Marconi writes:—

"Thank you for the Christmas Number of 'Modern Wireless.'

"I have had no time to do more than just glance at it, but it appears to be both an attractive and informative issue."

USEFUL RULES OF THUMB.

QUITE apart from formulæ, which are rather forbidding to the non-mathematical, there are certain rules of thumb of the simplest kind, which are often exceedingly useful in wireless work. Take coil making, for example. If you wish to construct a coil to tune to a maximum of, say, 500 metres with a ·0005-mfd. condenser in parallel, you could work out either by using a complicated formula or by employing a special slide rule, just the amount of turns required.

That, however, is a comparatively long business, and there is a rule of thumb which provides a convenient short cut. If coils are wound solenoid fashion, as they usually are to-day, you will find that with a 3-in. former every turn corresponds to roughly 10 metres on the medium waves. Thus fifty turns would be approximately right.

The wave-length of the coil will, of course, depend upon the thickness of the wire used, the closeness together of the turns, and the actual maximum capacity of the variable condenser, for not all ·0005-mfd. condensers actually reach this figure when the moving plates are fully meshed with the fixed. Still, it will be found that the rule is close enough to be a very useful guide.

It is helpful, too, when you have made a coil and find that it is not quite of the right size. It tunes, we will say, only to 450 metres and you want it to go up to 600. How many extra turns do you need? At 10 metres per turn fifteen will be required. Put on sixteen or seventeen, you can then strip off one or two if necessary.

Another useful rule to remember is that if a coil of a certain number of turns tunes to a particular wave-length in a circuit, then one made on a similar former with twice the number of turns will tune to approximately double the wave-length, and one with half the number of turns to half the wave-length.

Do you make your own fixed condensers occasionally? If you do, there is really no need to make use of complicated formulæ to calculate the number and size of the plates required to give a certain capacity. Provided that you use the best ruby mica, ·002 in. thick, and make the overlap of your plates exactly one square centimetre,

(*Continued on page 808.*)

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GRIP, SELECTIVITY & TONAL QUALITY

We say P.R. valves are as good as the best. If you don't think so, the trader you buy them off will refund your money without question. If not we will! Bear in mind P.R.'s are the only valves with a written guarantee as to life and performance. You are the sole judge. Just try one—refund by return of post if not satisfied.

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A standard 10/6 valve for 3/6! A perfectly coated "tenacious" filament, strong enough to stand postal despatch—you know what that means—with an astounding emission that makes users of P.R. valves order again and again for their friends. As one man wrote, "I can't 'keep' your valves, my friends are always 'borrowing' them!"

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We have profited by others' mistakes. The chief reason for failure has been want of careful and repeated testing before sale. The policy of allowing rush work during the season.

If you are in any doubt, send a diagram of the set and we will send you the best combination.

OUR AIM

We want our name, P.R., to represent Perfect Reliability in your mind. Our only aim, the aim of our staff, is to give satisfaction if it is humanly possible. Don't hesitate to ask us for a refund if you are not entirely satisfied. Our tests are as thorough as possible. P.R. valves are tested twice at the factory and once in our London offices—yet with all the care a "bad-un" will get through. Don't nurse a grievance, let us know, let us settle it. We are building up a business—we want to be proud of it—we want to make friends all over the country—friends who will trust us to give them a square deal. We want this because we know it is the only way to build up a sound solid business.

A year's experience, during which we have made many friends, has proved our treble test policy to be right. At our works in Birmingham each valve has to pass through two exacting tests before despatch to us. Each valve is again tested on broadcast conditions in London before being sent out. These tests weed out the undesirables and ensure you getting the best humanly possible.

SPECIAL CIRCUITS

Since some circuits are very ticklish as regards valves—Super-hets, for instance—the intermediates of such sets require to be matched so that they come into oscillation together—we do this for you at a charge of 1/- a set.

Choke coupled H.F. stages are very touchy to suit because only by trial on a set can the best valves for the purpose be found. In such cases half a dozen assorted valves should be ordered and the ones required picked out—the others can be returned for refund.

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Our valve list has a full page of valve notes. We are told that this page contains more honest information than many expensive books on the subject. Please send addressed envelope for full lists.

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Each valve has attached to it a written guarantee covering 7 months. In the event of the valve losing emission or becoming inefficient in any way during this term a new valve will be supplied under the terms of the guarantee. If not fully satisfied that the valves received are equal to any they should be returned within a week, full refund will be made by return of post.

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7/6 Each Post 4d.

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PR 2	2	·095	28,000	13	Det.
PR 3	2	·095	15,000	8	L.F.
PR 4	2	·095	120,000	32	R.C.
PR 8	3.5.4	·063	23,000	15	H.F.
PR 9	3.5.4	·063	18,000	14	Det.
PR10	3.5.4	·063	10,000	8·7	L.F.
PR11	3.5.4	·063	88,000	40	R.C.
PR16	5.6	·1	19,000	13	H.F.
PR17	5.6	·1	18,000	17	Det.
PR18	5.6	·1	9,500	9	L.F.
PR19	5.6	·1	80,000	40	R.C.
PR20	2	·15	7,000	6	Power
PR40	4	·15	7,000	6	"
PR60	6	·1	5,000	6	"

P. R. VALVES, 17-33, PATERNOSTER SQUARE (Opposite G.P.O. Tube Station), LONDON, E.C.4.

USEFUL RULES OF THUMB

(*Continued from page* 806.)

then the capacity of the condenser will be ·0001 mfd. for every dielectric.

A ·0005-mfd. condenser can be made by using five dielectrics (which means six plates) with the same overlap. Or a single dielectric will suffice, if the area of overlap is 5 square centimetres.

You want to couple the rectifier or the first note-magnifier in your set by means of a transformer to the following valve. What should be the inductance of the transformer primary for good results? Here is a rule which works out in almost uncanny accord with abstruse calculations. Instead of covering reams of paper with figures, or spending an unconscionable amount of time in discovering by experiment the most suitable value, proceed in the following simple way.

Cross off the last three noughts in the maker's figure for the valve impedance, and multiply what remains by five. Thus, if your rectifier is a 20,000-ohm valve, a suitable inductance value for the primary of the coupling transformer is 5 × 20 or 100 henries.

H.T. Current Consumption.

Should the transformer be between a first note-magnifier which has an impedance of 10,000 ohms and the output valve, then a good value is 5 × 10, or 50 henries. The same rule holds good for low-frequency chokes, whether used in choke-capacity coupling or in output filter circuits.

What is the proper capacity of dry-cell high-tension battery to use with a given receiving set? High-tension batteries, though the fact is not always known, are made in four different capacities. The "Standard" capacity has cells measuring ¾ in. × 2⅛ in., the "Double" cells 1 in. × 2¼ in., the "Treble" cells 1½ in. × 2¼ in., and the "Quadruple" cells 1½ in. × 3½ in.

The maximum economical outputs are:

Standard, 6 milliamperes.
Double, 10 milliamperes.
Treble, 15 milliamperes.
Quadruple, 20–25 milliamperes.

All that you have to do to answer the question is to ascertain the high-tension current drain of the set. This is very easily done by inserting a milliammeter, which you can probably borrow if you do not possess one, into the common high-tension negative lead when the set is working.

Should you be unable to obtain a milliammeter, a reasonably good idea of the H.T. consumption can be obtained by taking the figures from the valve curves.

NEWS FROM FRANCE.

M. GASTON DOUMERGUE, President of the French Republic, is a wireless enthusiast. In the presidential palace of the Elysée he has one receiving set in his dining-room, another in the billiard-room, and a third in his study. When the President occasionally removes to his country seat at Rambouillet he is not without his wireless, for there also are a number of receiving sets for his use.

An Ancient City

Toulouse, an important city of Gaul in the days when Cæsar's legions invaded the country, has paid a pretty compliment to its former masters. On a recent occasion a message was broadcast from the radio station of this city in Latin. In transmitting one of the world's oldest languages by the newest scientific means the speaker invited listeners to transmit their appreciation or criticism "a directorem gallicæe stationis Toulouse-Pyrenées in urbe Tolosa ædificatæ."

The wireless station at Toulouse, France, is broadcasting by the Bélin system autographed photographs of the artistes responsible for each evening's musical entertainment.

A number of agricultural societies in the neighbourhood of Toulouse have requested that statistical and weather charts should also be transmitted.

This station promises to broadcast reproductions of pictures, statues, and other works of art by artists of the south-west of France.

A Radio Ramp

Much remains to be done to educate the public in France in matters relating to wireless. At a recent trial in Paris a share-pusher was condemned to a term of imprisonment for selling shares of a bogus company which the prospectus intimated was formed "to plant steel posts all over France for the conveyance of wireless waves which shall bring the world's concerts to the humblest crystal set."

TEN DX COMMANDMENTS.

NOW that DX, or long-distance, reception is again possible, due to the winter months, the following Ten Commandments for the DX fan may be useful.

1. Good reception begins with the interception of ample signal strength. Therefore, make sure of a good aerial and earth connection. Joints should be soldered.
2. Reception can be no better than the valves employed. Valves, contrary to general opinion, do not last for ever. Even if they light, that is no indication of their goodness. When they have been in use more than a year, they should be replaced with fresh ones. Only valves of a reliable brand should be used. Cheap ones are most expensive in the end.
3. Proper H.T., L.T. and Bias voltages should be applied. In the case of batteries, this may be done by voltage taps. In the case of mains units, this may be done by employing efficient variable resistors, in obtaining precise voltages for all purposes.

FROM SIR OLIVER LODGE

Dear Mr. Editor,
I congratulate you on the good appearance of the Christmas Number of "Modern Wireless," on its broad scope, and interesting illustrations, as well as some provocative articles. You have certainly provided plenty of material for radio enthusiasts this Christmas.
Yours sincerely,
(Signed) OLIVER LODGE.
Salisbury.

4. The grid leak in the detector circuit should be adjusted for best results. While the 2 megohm value may be satisfactory for powerful local signals, this resistance value is too low for weak DX signals. Either a collection of grid leaks of various values should be on hand, or a suitable variable grid leak should be employed if you would enjoy DX results.
5. Reaction is practically essential to real DX results.
6. A sensitive loud speaker should be employed, or, better still, a pair of headphones. Many loud speakers to-day are relatively insensitive, because they are designed to operate on powerful local signals without rattling.
7. It is well to change valves around, so as to obtain the best valve for each function in the radio set, increasing the magnification where possible.
8. If troubled by excessive background noises or microphone interference, the cause is generally traced to the detector valve, which should be changed.
9. By-pass condensers of 1 or 2 mfd., connected between minus H.T. and the various plus terminals of the radio set, may improve sensitivity and tone quality of weak signals.
10. And in the final analysis, DX is largely a matter of patience and skill, for some fellows can cover long distances on a crystal detector while others cannot cover 500 miles with an eight-valve super-heterodyne.

AMAZING TRIBUTE TO THE WONDERFUL WEILO TRANSFORMER

Again and again we receive positive proof of the immense superiority of Weilo Transformers. When tested alongside the highest priced instruments on the market they have given a cast-iron efficiency of performance worthy of the highest standards of transformer value. In many cases the experts have been amazed that such unusual efficiency and high quality could be marketed at such a low price.

A. J. B. writes:
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Oct. 7th, 1928.

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6 TYPES 1 PRICE 6/6

207G	2v .07 Gen. Pur.
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407RH	4v .07 " " "

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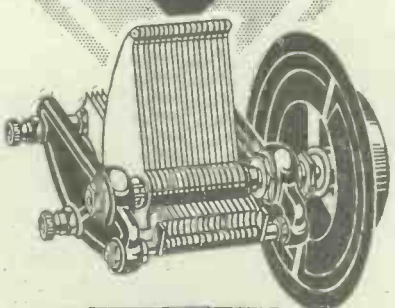

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DUNHAM LONG-RANGE 3 VALVE SET, in handsome cabinet with compartments for all batteries. LEGAL PROOF given that actually

20 STATIONS ON LOUD SPEAKER

are average results obtained. With Screened Grid, and Pentode Valves, Batteries, Loudspeaker, etc., **Cash £21, or 47/6 now and 28/- monthly.** Constructor's Envelope this set, 2/9 only.
DUNHAM DE LUXE ALL-WAVE MULTI-RANGE TWO-VALVE CABINET SET, for all wavelengths, Hilversum, etc. NO COILS REQUIRED. Complete, £9/10/0, or 16/- monthly. Your own set taken in part payment.

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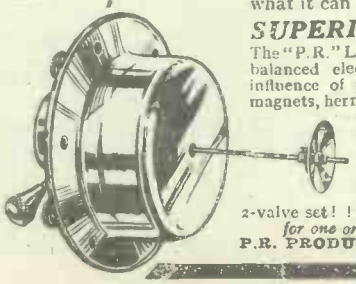
THE NEW LOUDSPEAKER

ALL THE REFINEMENTS OF THE MOVING COIL

ONLY 12/6

The "P.R." Unit will reproduce every note as clear as a bell—the full depth of the big drum to the harmonics of the violin—the reality of the performance will surprise you. Try one—give your set a chance to show what it can do.



SUPERIOR in TONE VOLUME

The "P.R." Loudspeaker Unit is driven by a fully-balanced electro-magnetic armature under the influence of powerful cobalt steel, permanent magnets, hermetically sealed and absolutely foolproof. It swings to the weakest impulse, bringing out the treble notes and the rich double bass of the organ. Fitted with a simple tonal adjustment that "stays put." Most powerful Unit giving full strength from a 2-valve set! ! No extra H.T. *Ask your dealer for one or send your remittance direct to—*

P.R. PRODUCTS, 17B, Paternoster Square, London, E.C.4.

TECHNICAL NOTES.

(*Continued from page 778.*)

wave-form of the human voice) the ear can "put up with" a much greater amount of distortion, or whether it is due to the fact that we are accustomed to hear musical instruments sometimes played very loudly, so that there is nothing particularly unnatural in hearing very loud reproduction of a musical instrument—is a matter which scientists have not yet been able to decide.

Psychological Effect.

It seems very probable, in fact almost certain, that the psychological effect plays a very important part in the impression received on listening to reproduced sound. For one thing, the mere fact that you *know* that the sound you are listening to is not the original is in itself quite sufficient to set your ear and mind into a critical attitude.

Loud-speaker Progress.

It is rather curious how one type of device will come into favour and then be superseded by something else and finally come into favour again. I am thinking in this instance of the horn type of loud speaker. This was practically the only type worth considering a very few years ago, but in the forms then available it was afflicted with many serious disabilities.

Then came the advent of the cone type, which has certainly had a very good run for its money, and was undoubtedly a great improvement in many respects upon the older type of horn.

The cone type of speaker has been made in various sizes for public-address work and, with the introduction of the moving-coil speaker with the small cone and the baffle-board, this type of instrument has made a very definite and permanent place for itself as a loud-speaker achievement.

A Throw-back.

Now we come to the exponential horn, which in a sense is a throwback to the horn type, but with a very great difference. Certainly the reproduction which I heard in the demonstration referred to above was quite equal in quality to that which I have ever heard from any cone type of speaker, and was enormously greater in volume.

In this connection, there is another point which I think is rather interesting, and which I have never heard discussed in any serious way: I refer to the question as to whether for really loud reproduction to, say, several thousand people in a large hall, it is better to use a single loud speaker (or a collection of loud speakers bunched together) or to distribute loud speakers at different points throughout the hall.

A Single Source.

Now you will remember that the latter method was the one which was originally adopted for public-address purposes, but personally I have always felt that it was unnatural to hear a reproduction of a voice coming from two or three different directions, with different degrees of loudness. This method meant that the sound from one source reaches the ear at a different instant from the sound from another source, and this must be confusing to the ear.

(*Continued on page 816.*)

TECHNICAL NOTES.

(Continued from page 814.)

Modern Practice.

More recently it has become the practice to use either a single powerful reproducing instrument, or a collection of such instruments located in as close proximity to one another as possible, so that the whole of the sound comes practically from a single place. The effect is much more natural, and I think the reproduction, especially if it be speech, is much more intelligible when the loud speakers are used in this way than when the same loud speakers are distributed about the hall in different places.

A Special Pick-up.

Talking about gramophones and loud speakers, I saw recently a special type of electrical pick-up to be used with gramophone records which I can best describe briefly as being a reversed moving-coil loud speaker. It is unnecessary for me to dilate on the particular features of the moving-coil loud speaker as distinct from the ordinary electro-magnetic type, as I suppose all my readers are fully conversant with the details of moving-coil speakers. The essential principle is to use an extremely light moving coil operating in an intense magnetic field produced by a large electro-magnet.

The ordinary type of loud-speaker unit depends upon the movement of a magnetic armature in the magnetic field of a permanent magnet, the speech currents being fed into a coil wound upon the latter. This system, although simple and convenient, is comparatively insensitive.

A Reversed Movement.

Now, so far as I know, most of the electrical pick-ups at present in use may be described as reversed electro-magnetic loud-speaker movements. The moving armature, which is attached to the gramophone needle-holder and therefore vibrates in correspondence with the needle, acts in a way to vary the magnetic flux in the permanent magnet and the corresponding induced speech currents are drawn off from windings placed upon the permanent field magnet.

In the pick-up which I am describing, however, the vibrating element is a moving coil, and is consequently very small in mass. This vibrates in the intense magnetic field produced by an *electro*-magnetic and the speech currents are drawn off from the moving coil.

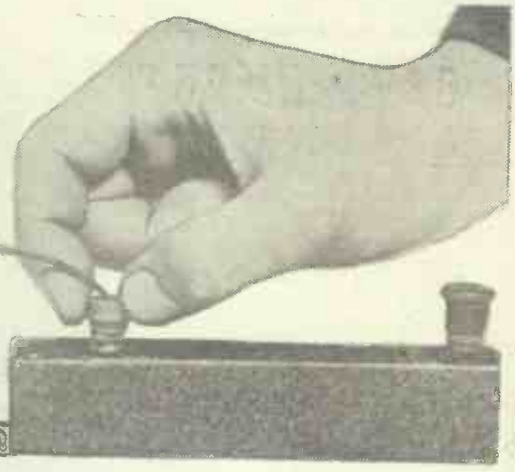
Extra Amplification.

The speech or signal currents induced in the moving coil are comparatively small and consequently a somewhat greater degree of amplification is necessary, but according to the results which I heard, the reproduction was extremely good in quality, and well worth the difference.

Of course, the use of a mere moving-coil form of pick-up is not in itself anything new, but there are certain features about the one which I am describing, which I was asked not to divulge at this stage, which struck me as being extremely clever and which I was assured—and was prepared to agree—were largely accountable for the excellent quality obtained.

(Continued on page 818.)

FREE GRID-BIAS



Why not take your grid bias as well as H.T. from the mains? Our correspondent tells you how to do it.

By C. P. ALLINSON, A.M.I.R.E., F.Inst.P.Inc.

HAVE you made or are you just going to make an H.T. eliminator? If so then here is an extra refinement that you can add to it, if it does not already incorporate such an arrangement, that will greatly increase its utility and enable you to dispense with the last battery so far remaining—the grid-bias battery.

In cases where the actual value of H.T. available is limited and a fairly high value of bias is required it should be borne in mind that the method of obtaining grid bias that I am going to describe will reduce the H.T. voltage available by an amount equal to the maximum G.B. which has been allowed for. If this drop is going to be at all serious, then it is advisable to retain the battery for biasing L.F. valves.

How It Is Arranged.

The actual arrangement will be seen in the theoretical circuit in Fig. 1. The resistance which enables the required grid bias to be obtained is shown at R. In order to avoid any instability resulting from its presence in the common H.T. return, it is advisable that it be shunted by a high value fixed condenser C, 2 or 4 mfd., the latter for preference if two stages of L.F. are being used.

The actual value of the resistance required will, of course, depend on the total current consumption under normal conditions and the maximum voltage required, and this is the first point to decide. Suppose you want an optimum bias available of

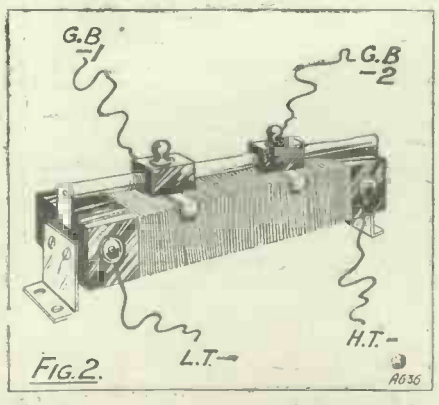


FIG. 2.

20 volts and the H.T. current taken is 20 milliamps, then the value of R should be 1,000 ohms.

You will also need one, two or three sliders, according to the number of tappings you need. Since the average set with different valves in the different stages will not require two values of bias to be the same, there is no need to arrange the sliders to pass over each other. The chief thing is, of course, that they should be insulated from each other.

There are two ways of making up a suitable potentiometer. One is to make

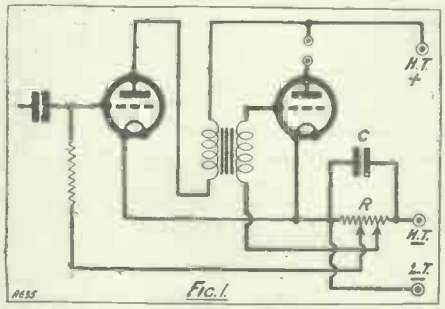


FIG. 1.

it on the lines of those big instruments used on switch boards. A rectangular insulating former carries a straight solenoid winding of resistance wire. As is shown in Fig. 2, a rod is mounted parallel to the former which carries two sliders to which connection may be made by means of a pig-tail or piece of flex. I have not attempted to give any dimensions, since these will depend on the value of the resistance, and the gauge of the wire, this latter depending again on the current the wire has to carry. These details can be obtained from the usual wire tables.

An Easier Method.

This method of construction is not, however, too easy, since it is desirable that the former be threaded to take the wire, which must be put on very tightly to prevent shifting. The making and mounting of the sliders, too, is not a job all will be able to undertake.

The alternative form of construction, shown in Fig. 3 is, I think, a little simpler. The resistance wire is wound on to a flat strip of fibre, or some similar flexible insulating material of a suitable width and length to take the length of wire needed. This is mounted, as shown, on a circular core. Two insulating discs either end of this core carry the sliders, the completed component being mounted as suggested.

This method of construction also has the advantage that the two sliders do not interfere with each other in any way.

An excellent method which can be employed is to use two potentiometers in series. The sliders on each gives you a different voltage, and the use of this arrangement simplifies the question of controlling the bias from the outside of the eliminator.

Automatic Adjustment.

If the total resistance of the two potentiometers is not sufficient, the extra resistance needed can be connected in series either between them or between the first one and L.T. — according to which side of the first tapping you need the extra voltage.

An interesting point to consider with regard to this method of obtaining G.B. is that it is, so to speak, self-compensating. For instance, turning to Fig. 1, it will be seen that as you increase the H.T., owing to the rise in H.T. current, the voltage across R will rise and the grid bias rise, for the grid bias voltage is directly proportional to the H.T. current. On the other hand, if you decrease the H.T., then the H.T. current will drop and the grid bias will also drop.

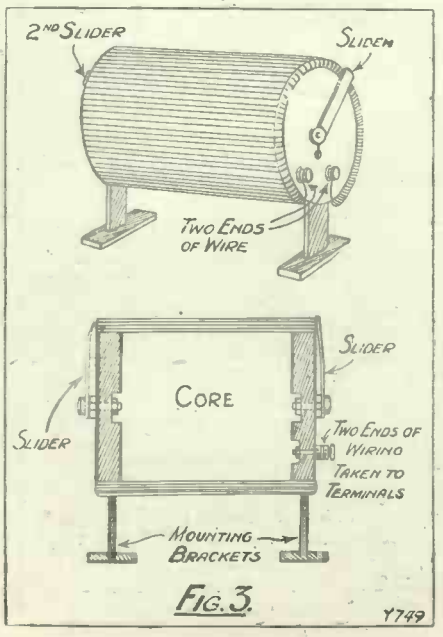


FIG. 3.

TECHNICAL NOTES.

(Continued from page 816.)

Reinartz Modifications.

Experimenters using the Reinartz type of circuit with detector and, say, two low-frequency amplifiers, often find themselves desirous of increasing the sensitivity and range of the circuit. The suggestion which naturally occurs is to add a stage of high-frequency amplification before the detector, but this is not so easy with the Reinartz circuit as might at first be imagined.

Critical Reaction.

In the first place it should be noted that the accurate control of reaction is one of the characteristics of the Reinartz circuit, and this is a circumstance to which it already owes most of its sensitivity.

If high-frequency amplification be used in addition, it is necessary to introduce the H.F. amplifier between the aerial tuning circuit and the detector, and this involves such an amount of interference with the circuit that it amounts practically to re-designing the whole thing.

In actual practice, therefore, it is generally inadvisable to attempt introducing high-frequency amplifying stages with the simple Reinartz circuit, the latter being eminently suitable for a simple and easily operated receiver.

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THE "P.W." "WHITE PRINTS."

A NEW SERVICE FOR OUR READERS.

White Print No. 2. :: :: A Wave-Change Two-Valve Set.

This week we publish the second of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the White Print filed. In due course you will thus have available an encyclopædic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

THE set chosen for this week's "White Print" is again a very straightforward and well-tested one. It employs two valves, a detector with reaction and a low-frequency amplifier with transformer coupling, and forms a very neat little outfit for loud-speaker work on the local station (and 5 G B at moderate distances), and head-phone reception from the Continent. When conditions are at all favourable and the aerial is a good one, moreover, it will often put some of the foreigners on the speaker as well.

The circuit of the detector valve with its tuning and reaction arrangements is one of the standard wave-change schemes, with some special detail features which make it a decidedly individual design. These are mainly devices for getting very high efficiency from the detector valve, and so getting the utmost sensitivity.

For example, this valve is fitted with a variable filament resistance, so that the current can be adjusted to the least value which gives the best reaction effects, which is sometimes helpful. Also, it is provided with a potentiometer for adjusting the exact potential on the grid, and this is a very valuable feature, for it makes it much easier to get really smooth and progressive reaction.

Real Trouble-Saving.

Since the circuit is a wave-change one, of course, there is no coil-changing to be done, and you can go from the ordinary broadcast waves to the long waves, and vice versa by operating a single switch, a feature you will find a great convenience in use. With the knob pushed in you are on long waves, and by pulling it out you come back to the lower band.

The general details of the switching scheme are very much like those of White Print No. 1, the only serious difference being on long waves, where the aerial coupling and reaction scheme is altered somewhat. This alteration is intended to provide a slightly better degree of selectivity, desirable in a larger set.

The main tuning coil, i.e. the one for the ordinary waves, can be one of the same type as was used in the "Sceptic's" Three and various other sets, and this can be bought ready wound if desired. (Purchased ones may be arranged for mounting vertically, and this can be done without risk of ill-effects if it seems easier.) Otherwise, a special coil can be wound from the data given on one of the diagrams herewith.

COMPONENTS AND MATERIALS REQUIRED.

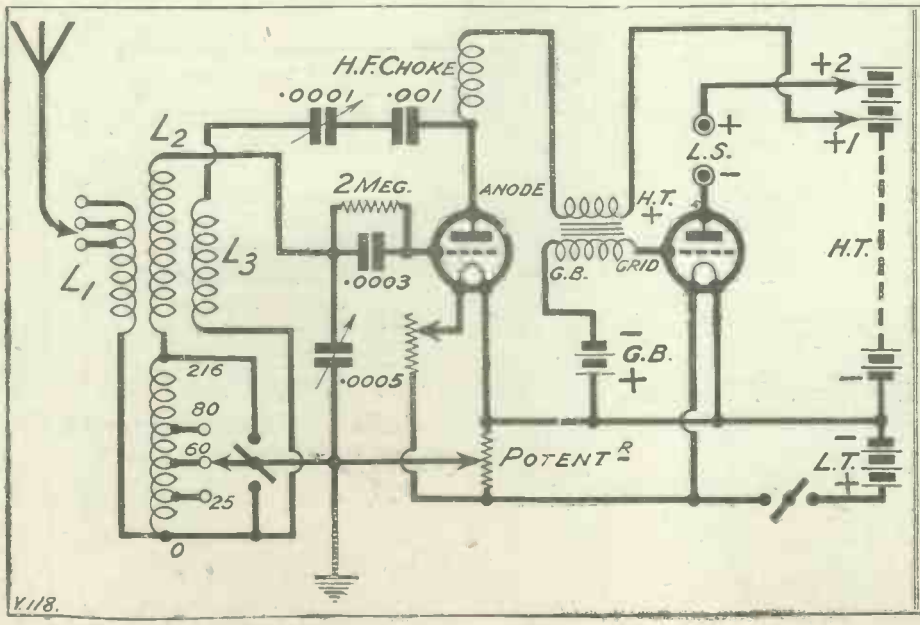
1 Panel, 14 in. × 7 in. × ¼ in.
1 Cabinet to fit, with baseboard 9 in. deep.
1 ·0005-mfd. variable condenser.
1 ·0001 or ·00015-mfd. reaction condenser.
NOTE.—The one shown has an earthing terminal for a screening plate. With types not so fitted simply omit the lead shown to E.)
1 L.T. switch.
1 Wave-change switch of usual type.
2 Sprung valve holders.
1 Baseboard-mounting potentiometer.
1 Baseboard rheostat.
1 H.F. choke.
1 L.F. transformer.
1 ·0003 fixed condenser with clips, and 2-megohm grid leak.
1 ·001-mfd. fixed condenser.
1 "P.W." standard loading coil.
1 "Sceptic's Three" type aerial coil, or materials for home construction of the very similar one shown in the drawing (see text).
1 Terminal strip, 12 in. × 2 in. × ¼ in., and 9 terminals, or two separate strips, as shown.
Wire, screws, flex, G.B. plugs, tapping clip, etc.

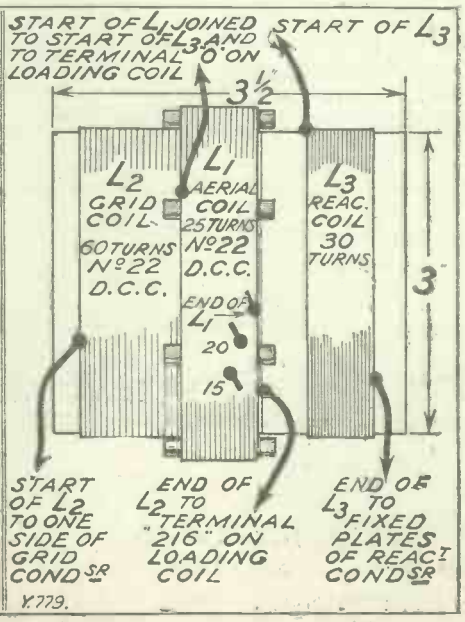
Winding the Coil.

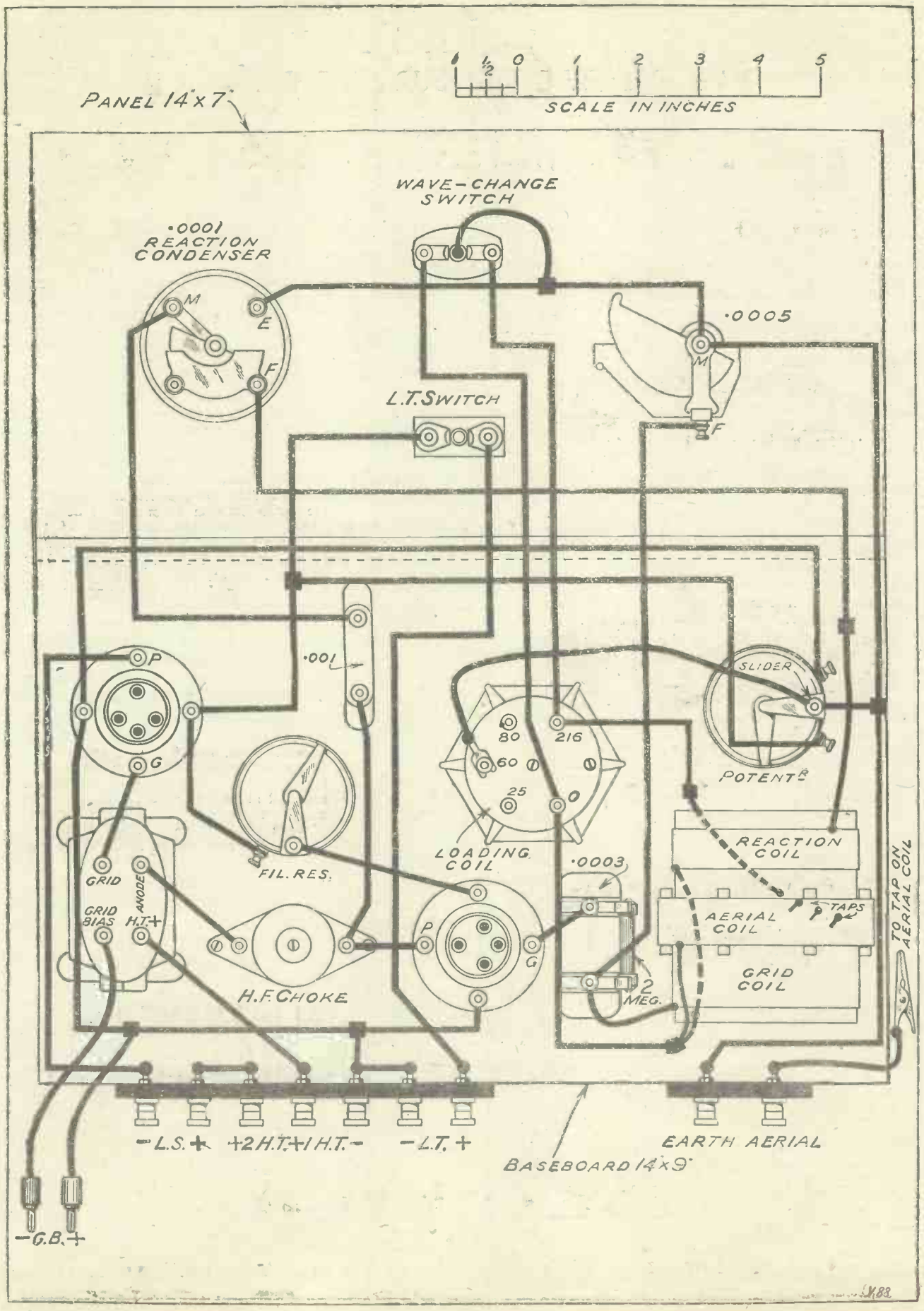
This diagram is almost self-explanatory, giving turn-numbers, size of tube, etc., and showing how to use small wooden spacers to support the primary (L_1) and so on. It should just be added that L_3 must be wound in the same direction as L_2, and that the space between them should be only ⅛-in. (the draughtsman exaggerated the space for the sake of clearness). The wire for the reaction coil should be No. 30 or 32 D.S.C.

Finally, some brief operating notes. The first valve should be one of the H.F. or general-purpose type, with a small power or L.F. valve in the second socket, with suitable grid bias. H.T. on the detector will be about 60 volts, and 100 or 120 on H.T. +2. The potentiometer should be set to give the loudest signals and smoothest reaction, and will generally be best fairly near the positive end. (Reaction may be smoothest of all at the negative end, but signals are then usually not at their loudest.)

NEXT WEEK:
A HIGH-EFFICIENCY THREE-VALVER.






PANEL 14"x7"
SCALE IN INCHES
WAVE-CHANGE SWITCH
·0001 REACTION CONDENSER
·0005
L.T. SWITCH
·001
SLIDER
POTENTIO
LOADING COIL
·0003
REACTION COIL
AERIAL COIL
TAPS
GRID COIL
TO TAP ON AERIAL COIL
CUT ALONG THIS DOTTED LINE.
FIL. RES.
H.F. CHOKE
GRID
GRID BIAS
ANODE
H.T.+
2 MEG.
-L.S.+ +2H.T.+ +1H.T.- -L.T.+
EARTH AERIAL
BASEBOARD 14"x9"
-G.B.+

POPULAR WIRELESS, December 22nd, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER

"P.W.'s" SPECIAL XMAS WEEK NUMBER

Popular Wireless

Every Thursday PRICE 3d.

No. 342. Vol. XIV. INCORPORATING "WIRELESS" December 22nd, 1928.

VALVES WITHOUT CURVES

THE "SHORT-WAVE" TWO

SEE LAST PAGE FOR "P.W." WHITE PRINT No. 3

CONTINENTAL CAROLLING

RADIO AND CHRISTMAS

GIVE HIM A VALVE

HIGH TENSION

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WINNER 99 volts, 11/6
WINNER 120 volts, 14/-

GRID BIAS

WINNER 9 volts, 1/3

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RADIO NOTES AND NEWS.

"Ariel's" Christmas Mottoes—Radio Out of the Wall—A Warm Corner for Listening—Miss "Sparks"—Radio in the Kitchen—Well, Well!—The Hidden Hand.

A Good Christmas Programme.

WHEN Station X M A S starts,
Tune it in, my lads, tune it in!
When it broadcasts peace to all hearts,
Tune it in, tune it in!
When it bids you bear in mind
What you did that was not kind;
And recounts to you the burdens
Of the old, the sick, the blind;
When it tells of wives and kiddies
"Unknown Warriors" left behind;
Tune it in—and "do the needful"—tune it in.

Packing Up.

WELL, boys, work this side of Christmas is practically over, bar the shouting. I won't touch a pen till Black Thursday next. (If I have to score in games, or draw pigs with curly tails with my eyes shut, I'll do it with an HB.) *I'll have nothing to do with radio* except to put up the aerial, charge the battery, tune the set, supply spare valves, and generally wet-nurse the outfit. And the same to you. Here's hoping! A Happy Christmas! A good time! Smiling kids and pretty girls! And the old folk clucking by the fireside!

"Ariel's" Christmas Mottoes.

"A SWITCH in time saves a burn-out." "Love me; love my set." "It's never too late to—make sure the battery's charged." "Empty accumulators make you make the most sound." "It's a long lead that has no kink." "Stolen circuits are the neatest." "When the 'fan's' away the wife can play—with the set." "Kind hearts are more than Valve Bartships." "Hitch your aerial to a star." "All's fair in radio—so long as you get 3 L O (Melbourne)." "Still trams are good trams." "Set an Eck to catch an —oscillator." In conclusion I offer a prize of one volt for the best verse beginning, "Trickle, trickle, little charger."

Radio Out of the Wall.

REPORTS from the U.S.A. state that if matters continue to develop in the way they are at present tending, in twenty year's time all broadcasting will be done by "wired wireless" over the household light and power cables, thus leaving the ether much freer for commercial and service radio-cummunications.

There is a lot of sense in this notion, for at the present rate of increase in wireless stations of all kinds the other will be stiff with electricity in much less than twenty years. Already responsible wireless people are considering frequencies of over 300,000,000.

Canada Prefers Size.

A FRIEND whose normal domicile is in Canada, but who is over here for Christmas without zero, tells me that the radio set trade over there runs violently in the direction of the "console" type of goods. In other words, they want "a piece of furniture," and so the poor wretched sets have to be camouflaged as linen presses, cottage pianos, settees, whatnots—and what not. I am past the age which presumes to dictate other peoples' tastes, but for the life of me I fail to grasp the point of view of a person who must have a modern convenience dolled up to look like a domestic object.

A Foolish Consistency.

SINCE this is a sort of off week, let us for a moment debate this matter further. People often say something like "Yes, I should like a set but it must be suitable for my drawing-room." Heaven knows what is suitable for the rooms of such folk, but I'll trouble you to tell me whether (1) a Pom., (2) a husband with a bald head and walrus moustache, (3) a picture of a sunset looking like a fried egg, (4) several electric-light bulbs, (5) a hassock, and (6) a bunch of yellow chrysanthemums in a tartan vase, are in keeping with the esoteric taste which shrinks from a mahogany-covered radio set of moderate size.

A Couple of Jokes.

J'EVER hear about the American radio enthusiast who during the Great War joined the artillery on condition that he was drafted to "B. Battery"? And that one about the dumb Scotchman whose

(*Continued on next page.*)

WAS IT FATHER CHRISTMAS?

In Hungary passengers waiting for their trains are provided with 'phones to listen-in. The gentleman to the right of the picture looks rather "sheepish," doesn't he?

NOTES AND NEWS.

(Continued from previous page.)

wife thought a radio set might brighten his existence. "And how much shall I pay ye for the instr-r-ument?" she asked the agent who had called. The Scotchman turned his head sharply and said—*nothing.*

A Warm Corner for Listening.

I HAVE been reading a short account of the observatory on Mount Etna, which is situated within the very crater zone. A wireless station has recently been set up there, of what kind was not stated, but I presume it is not for "broadcasting." The story goes on to say that when the evening wind sweeps the acid fumes from the active craters across the station it is observed that reception is specially clear. *Nasal* reception, I suppose they mean. The most violent eruptions are said not to interfere with reception. Try a boil on the ear.

The Professor Disowns the Brick.

SEE "P.W." November 24th, paragraph 1, page 587. Professor A. M. Low writes to say that he thinks that all he said was "that electrical disturbances affected radio." If his memory has served him aright then the whole incident is a "wash-out," because that statement is unassailable and as safe as houses. The Professor adds that anyone who realises that in this century we waste about 90 per cent of our fuel, and have virtually no idea as to the meaning of the word "electricity," should be humble. No, sir! Not humble, but thoughtful—especially a scientist. No need to be Heepy because we are not omniscient, surely!

Evidence from the R.C.M.P.

C. R. P. (Edinburgh) kindly tells me of a Royal Canadian Mounted police officer who, having spent the last three years in Baffin Island, alleges that during auroral displays "his set was dumb." That is an extreme case, anyway. But I would point out that I did not query the effect of the Aurora upon reception in polar regions, but upon transatlantic telephony. In fact, hardly that. I asked only how it was known that the Aurora upset the telephony service. The Professor washes his hands of the matter and talks about fuel and etymology. So where are we?

A Cry in Passing.

I SEE in the "Irish Radio News" that at 7.30 p.m. on December 4th, Dublin broadcast an item entitled Leigheacht Ghaedhilge. Padraig O Domhnallain. "An Tuatha—Cead bliadhain o shoin." Heaven send that Mr. Stobart (Education) of the B.B.C. does not hear of it, for if he does we shall have six months of "The foundations of Ghaedhilge," every Monday, Wednesday, and Friday.

Miss "Sparks."

IT is announced that Miss A. J. Burns, of Lanarkshire, is the first woman to secure the P.M.G.'s certificate authorising her to act as wireless operator aboard ship. More, they say that she headed the list, beating twenty-five men. Congratters, and all that! And then? Well, I hope she will shortly marry and live "happy ever afterwards," for she must not go to sea as an operator. It's simply not done, dear lady.

The Old Stagers Dine.

ON November 27th, Senatore Marconi entertained to dinner forty Marconi employes who had served that organisation for twenty-five years or more. There were the Kite-flyers of Newfoundland, including Mr. G. S. Kemp, still hale, hearty and fluent. There was Dr. J. A. Fleming, who had a great deal to do with the Poldhu station, and there was Mr. R. D. Bangay, whose book on wireless you probably all know. Quite an historic gathering! Little they thought in 1903 that radio was destined to play such a noble part.

Wireless Beacons.

THE Trinity House wireless beacon at Start Point, the seventh of its kind to be erected round our coasts, has recently been completed. Its call-letters are G S M and it works on 1,000 metres, using "interrupted continuous waves." The power is 500 watts. The installation of this station permits cross-bearings to be taken by ships carrying D.F. apparatus, using the three Channel beacons. So if you hesitated in the summer over a trip to Dieppe or Boulogne you need no longer do so. 'Squite safe!

SHORT WAVES.

It is suggested that wireless should be used in the campaign against germs. The idea is a good one, but how can the little beggars be compelled to listen-in?—"Humorist."

* * *

Jack: "I think I'll have to get a new radio set."
Jim: "Why, what's the matter with the one you have?"
Jack: "I can't meet the payments on it."

* * *

AT HOME.

Wireless ought to be a great success in China, as it is almost impossible to distinguish atmospherics from the Chinese language.—"Birmingham Daily Mail."

* * *

A Croydon correspondent writes to tell us that he has built up a very good set from details published recently in "P.W." In fact, he says, it's so good it frequently refuses to work on Sundays.

* * *

Wireless experts are considering how to make Britain laugh louder than it has ever laughed before . . . but nobody seems to have suggested funnier jokes.—"Time and Tide."

* * *

Anti-Wireless Vicar.
2 L O calling the British Aisles.—"Daily Mirror."

* * *

A preacher says that he doesn't think women listen-in to sermons over the wireless. Naturally; they can't criticise the dresses of the rest of the congregation.

* * *

"Young man, I would desire to get
Your very best selective set.
I crave to hear *one* single song,
And not a motley scrambled throng."

"Well, sir, permit me here to show
A real selective Radio.
You tune one voice from a Duet
And hear a Solo on this set!—"Radio News."

What Is An Amateur?

THE Editor of "Radio in Australia and New Zealand," after splashing a whole page in order to explain that radio is not wireless, and vice versa, has turned his etymological mind to the meaning of the word "amateur." His conclusion is that the private radio experimenter is not an amateur. Sorry, I can't agree. "Amateur" is a French word applied to one who has a fondness or love for an art. That was why it was applied to radio "fans." A man may be a professional during business hours and an amateur afterwards. "Amateur" by no means is synonymous with "dabbler" or "non-expert." The amateur does for pleasure what the "pro" does for pay.

"M.W." Christmas Number.

I SAY! *Did* you forget the December issue of "Modern Wireless"? Hard luck! Well, perhaps they can rake up another copy. Mention "Ariel's" name—it has a heavy "pull"—with the boy who fetches the night-watchman's supper. The Christmas "M.W." is the finest all-round wireless magazine that ever refused my article on "Chaucer's Views on Radio." Just the ticket! Get a copy by some means and reserve it for perusal during the sacred calm which follows "The Dinner of Dinners."

Radio in the Kitchen.

HAD rather a hectic time of late in the matter of domestic assistance, and in an attempt to woo our latest acquisition from the attractions of the R.A.F. men, who have an establishment in the district, I have put a one-valver in the kitchen and get 2 L O and 5 G B, 'phone strength, on a bit of "flex" stretched across the room. I explained the adjustments to the lady, warned her to turn off the valve, and gave her the "Radio Times." *It was "The Foundations of Music," just then! "And 'ow do I get the Sevoy Bend?"* she asked.

Well, Well!

DID you spot Mr. R. Bellian's letter in our issue of December 1st? I have heard of men flying kites for aerials and using bedsteads, dustbins and fenders; burying their aerials in the ground; doing without aerials, and using several aerials at once, but I never before came across one who put it "in the well," along with Truth and Pussy. It's a great, new idea, capable of all sorts of development. Mr. R. B. might, for example, put his set down the well, or he might put the local tax-collector there, or go down himself, the set and all, and put his "earth" in the top of a tree. Nothing like variety!

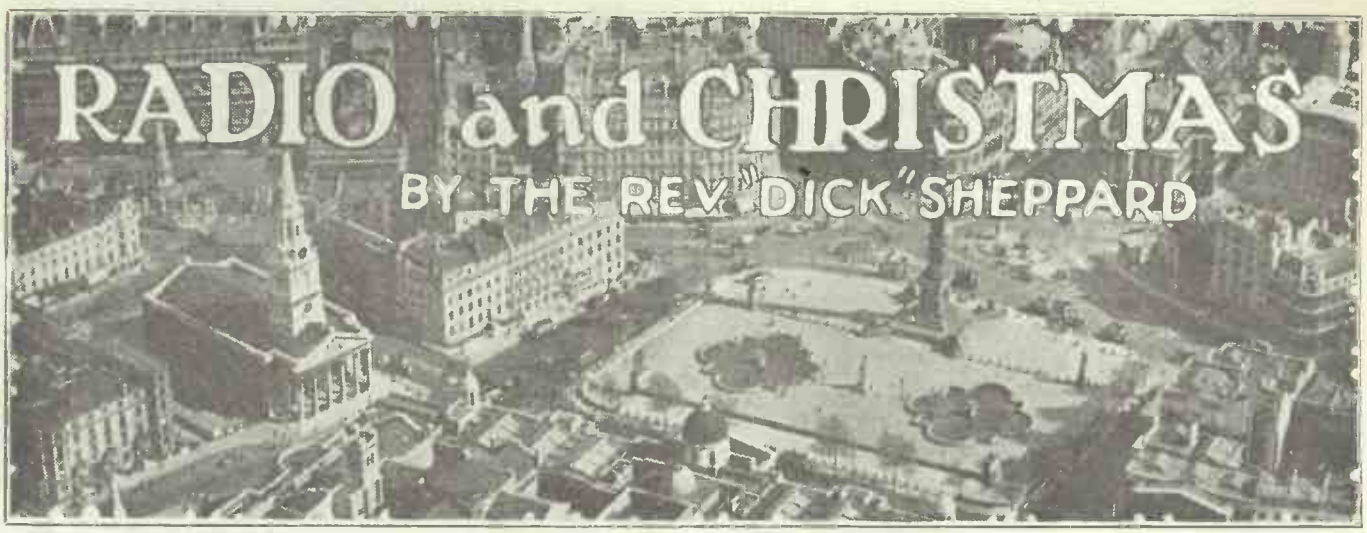
The Hidden Hand in Erin.

IRELAND, that land of freedom, has apparently been a bit too free, for according to a letter in the "Irish Independent" the hand of the wily advertisement-monger is at work, corrupting Irish broadcasting with a boost of —ye gods!—baking-powder. Worse, the baking-powder manufacturer is a "foreigner," which, I suppose, means "Englishman." It is unthinkable that the bread of a M'Ginty should be "raised" by bi-carbonate of soda sold by a Britisher (whose Income-Tax inspector is probably an Irishman). When *will* the "curse of Cromwell" be lifted from a suffering nation?

Great Scotch Discovery.

GREAT Scot! The "Edinburgh Evening News" prints a letter from a canny fellow who found that he could receive broadcasting for nothing by placing his ear against a telegraph pole. All the telegraph poles in Aberdeen are now beautifully polished to a height of twelve feet; ladders are growing longer and longer, and I predict that the next generation of Aberdonians will have telescopic ears.

ARIEL



IT is a curious combination, this association of wireless with Christmas, a combination of modern and ancient wisdoms which at first seems a little incongruous. I must confess that when the Editor asked me to write on this subject, I found that my ideas tended to run away and hide themselves behind some formidable piece of wireless apparatus.

However, I have coaxed them—and they did not need much coaxing—into telling me that the Christmas message comes as well by radio as by reindeer. Indeed, I think that in wireless Father Christmas has the sort of ally he would choose to spread most effectively his tidings of goodwill.

Wireless Christmas Presents.

Times change and science advances, but it is good to remind ourselves that the spirit of Christmas is the same as it ever was. It is a simple thing, this Christmas spirit, and because it is simple it is one of the most beautiful of our possessions. That parcel on the breakfast table on Christmas morning may contain a super-heterodyne receiving set instead of clockwork train, but it will be a Christmas parcel just the same. There will be all the thrill of opening it, there will be the delight on the children's faces, there will be the incredulous surprise in father's voice as he wonders how Santa Claus knew so perfectly the present which would give most joy.

There is no morning in the year like Christmas morning; it has a spirit of its own which has persisted through the centuries. To me the fact of that persistence is very wonderful. I am afraid it cannot be said that we encourage things spiritual in these days; indeed, we are apt to put them aside as unworthy of our practical consideration.

Goodwill Everywhere.

I hope you won't think me solemn if I talk of the spiritual side of Christmas, for in the spiritual lies its true reality. As I have said, it is a simple thing, and I do not think that even the most enthusiastic scientist could call it forbidding. Perhaps I had better try to explain what I am getting at.

First there is the phenomenon of that spirit of goodwill which seems to be released in the world at Christmas-time. It may be that it should not be a phenomenon, but it is certainly a fact. We have all felt it, that strange lightening of the heart which makes us so much more kindly disposed to our fellow-men than we ever are at other times. You may tell me that it is caused by the traditional pageantry of the day, but you will forgive me if I do not believe you. I believe rather that there is actually a spirit of love abroad, just as there are wireless waves passing through the air.

A "Marvellous Season."

Unconsciously we all tune in to that spirit; I say unconsciously because any deliberate assumption of goodwill, any forced jollity to meet the occasion would make our enjoyment of Christmas impossible. It just happens that something enters our lives at Christmas-time, and, to my mind, there is implicit in that "something" a great part of the truths of religion.

Every listener has heard the "Bishop of Broadcasting"—and although ill-health has kept the Rev. "Dick" Sheppard from being heard more often of late, this fine article from his pen will again remind listeners of his vivid and human personality.—The Editor.

The Rev. H. R. L. Sheppard.

You have only to look round you to see what I mean, to see serious-minded people forgetting their solemnities in lovely childish games, to see families who, perhaps for the rest of the year are apt to bicker among themselves, to see them happy together, forgetful of the petty irritations which disturb the daily round.

I love to go through the crowded shopping streets just before Christmas and see men coming home from business carrying their parcels, and loiter before the brightly-lit shops, and the fat turkeys in the poulterers. It is true that those turkeys remind us that there are some for whom Christmas cannot be a happy time, some who, through want or loss, can only be lonely or miserable on this day of days, and I think in our happiness we ought to remember them, and try not to intrude our own joy, if we meet them, on their sorrows. But for all that Christmas is a marvellously happy season, and it is this very happiness which expresses all I am trying to say.

Christmas All the Year.

We imagine so often that religion is rather a straight-laced affair, a series of prohibitions and exhortations which cannot touch our ordinary lives.

We think of it, perhaps, as something outside ourselves to which we may turn in the hour of need, but which we may forget when all goes well with us. That is where the quiet and unobserved entry of the spirit of Christmas into our hearts proves us to be wrong. Religion is not an extraneous philosophy, but a better way of ordinary life. It should be as much a part of us as breathing and eating and sleeping, and possibly Christmas was given to us to remind us of the fact.

We say and hear so often that God is Love, but unless we happen at the moment to need His love rather specially, we regard the statement with polite but mild interest. It takes Christmas to prove that this conception is a very simple reality, and one which we should do well to try to remember for the rest of the year. It is, to my mind, wrong that we should feel the influence of the Babe of Bethlehem only for one day out of three hundred and sixty-five.

(*Continued on page* 864.)

LATEST BROADCASTING NEWS.

THE FUTURE OF THE FULTOGRAPH

THE FINANCE OF BROADCASTING HOUSE—THE YORK ENTHRONEMENT—THE BIRTH-CONTROL DEBATE—CARDIFF LOOKS BACKWARDS—NEW YEAR ARRANGEMENTS AT SAVOY HILL—FORTHCOMING TALKS.

The Future of the Fultograph.

GERMANY, France and Austria have now included Fultograph transmissions in regular broadcasting hours as part of the general service of broadcasting. The B.B.C., however, has not yet made up its mind, with the result that Wireless Pictures 1928, Ltd., is in a state of great perplexity.

The issue is coming to a head shortly, when it is believed that Savoy Hill will announce their intention to extend the experimental transmissions over a definite period long enough to encourage the public to buy sets. This step will represent the admission that Fultograph has come to stay in British Broadcasting.

The Finance of Broadcasting House.

The silence of the B.B.C. with regard to the financial arrangements for the new building is ill-judged. Critics have naturally concluded that the terms would not bear too strict an examination. Members of the "Syndicate" have let the cat out. It appears that Sir John Reith struck a very astute bargain.

The result is that Broadcasting House will be built to B.B.C. specifications without initial capital outlay. It is believed that the syndicate will have great difficulty in showing any profit at all. The whole cost is spread over a period of years, at any time during which the B.B.C has freedom to buy out the syndicate and acquire the freehold.

The York Enthronement.

The ceremony of the Enthronement of Dr. Temple, the new Archbishop of York, will be broadcast from all Northern Stations on Thursday afternoon, January 10th. As Bishop of Manchester Dr. Temple has been closely associated with broadcasting, and thousands of listeners will look forward to hearing his address to the Clergy as well as other details of the solemn ceremony.

The Birth-Control Debate.

Our old friend, the oft-postponed birth-control debate, is now planned for early in the New Year. Apparently the latest suggestion in favour at Savoy Hill is that the debaters shall be women, but no names are known as yet. Of course, this will be disguised by some such title as the Population Question.

Cardiff Looks Backwards.

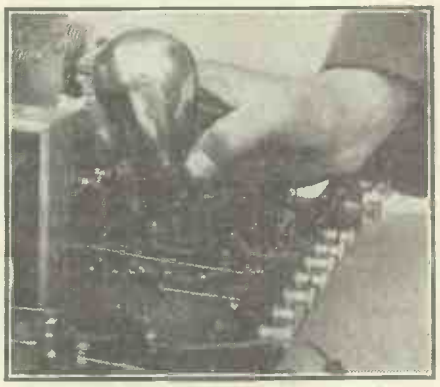
Sunday, December 30th, has been chosen by the Cardiff Station for a programme of memories entitled "Looking Backwards." The whole of the past year will be reviewed in a manner calculated to create a deep and lasting impression upon listeners, and in a way appropriate to Sunday, for which perhaps Cardiff Station, more than any other, has indelibly stamped the Sabbath Day transmissions through the Silent Fellowship.

New Year Arrangements at Savoy Hill.

The final details of marking the passing of the Old Year and the birth of the New in the broadcast programmes have not yet been decided, but the tentative arrangements show that this year will witness a departure from what has hitherto been done.

There will most likely be a Suprise Item at 10.35 p.m. following a popular concert,

KNOW THE KNACK?



When putting a valve into its holder, it is a good plan to keep one finger on the plate pin, which can then be guided into its socket by the feel of the terminal on the holder.

after which there will be dance music until 11.50, when a short religious service will be held, to be followed by muffled bells relayed from St. Michael's, Cornhill, until midnight.

The actual hour will be signalled by the chimes and strokes of Big Ben, and this will be immediately followed by a peel of unmuffled bells relayed from Southwark Cathedral. In both instances the bells will be rung by members of the Ancient Society of College Youths.

Forthcoming Talks.

The New Year will see the introduction of a series of morning talks to be broadcast at 10.45 a.m.—Daventry (5 X X only)—by Mrs. M. I. Crofts on "Law and the Home." The early part will show how the Law affects our everyday lives, and later the subject will be developed on more advanced lines.

Other interesting forthcoming talks are: "My Day's Work," by a Factory Girl—Monday evening, January 7th; a further talk on Rabbit Keeping, by Capt. Walter Brumwell, Tuesday, January 8th; the first talk on current events, entitled, "A Woman's Commentary," by Mrs. Ray Strachey, 10.45 a.m. (5 X X only)—Wednesday, January 9th; a new series on our boys and girls, covering the child at home, at school and at work, introduced by Mrs. Wintringham, Thursday, January 10th; the first of a series of "Letters from Overseas," tracing the progress of a typical family in the Dominions and Colonies, arranged in collaboration with the Overseas Settlement Department, Thursday, January 10th; "The Origin of New Plants," by Mr. Charles W. Unwin, Friday, January 11th; "Coming Fashions," by Mrs. Allison Settle (5 X X only), Saturday morning, January 12th; and the first of a series of episodes entitled "Six Strange Saturdays," by Holt Marvell, the novelist, 9.15 p.m. the same day.

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

DX RECEPTION

CARE OF RECEIVER—A GOOD EARTH, Etc., Etc.

DX Reception.

MANY receivers, which have been operating well for distant reception, after a time seem to become less efficient; in other words, distant stations do not seem to come in properly. This may be due to quite a number of different causes, and with distant reception one is, of course, always very much dependent upon atmospheric and transmission conditions generally.

At the same time, unless your receiver and all accessories are very carefully attended to, there is bound to be a gradual deterioration, even if other conditions remain normal.

Care of Receiver.

Perhaps the easiest way in which to improve the sensitivity of the average receiver is to commence with the aerial-and-earth system.

Whilst almost any type of aerial will serve for powerful local stations, it takes an efficient aerial to bring in DX signals properly. Furthermore, even the best of outdoor aerials may become poor in time, especially if the aerial consists of a bare wire with any exposed joints, for these accumulate a high-resistance coating of dirt and oxide, from exposure to the elements.

Enamelled aerial wire has the advantage that it is protected from corrosion; any joints which it is necessary to make should be carefully soldered and then taped.

A Good Earth.

The earth connection is often considered by amateurs to be of minor importance compared with the aerial. So far from this being the case, the earth is, if anything, more important than the aerial, and whilst good results may sometimes be obtained with a good earth and an indifferent aerial, it is rarely that a good aerial will give satisfactory results without a good earth (or its equivalent).

(*Continued on page* 863).

THE "SHORT-WAVE" TWO

In response to many requests W. L. S., our well-known and popular short-wave expert, has designed this special short-wave set. Its special feature is that it can be adapted to give results above the average on the ordinary wave-lengths.

Designed and described by W. L. S.

IN accordance with the doctrine I have always preached—to the effect that an efficient short-waver, with the necessary alterations, will make a broadcast receiver of *more* than average efficiency—I have made such a set, with the object of showing that it is *not* necessary for every short-wave enthusiast to possess two separate sets if he wishes occasionally to listen to broadcast.

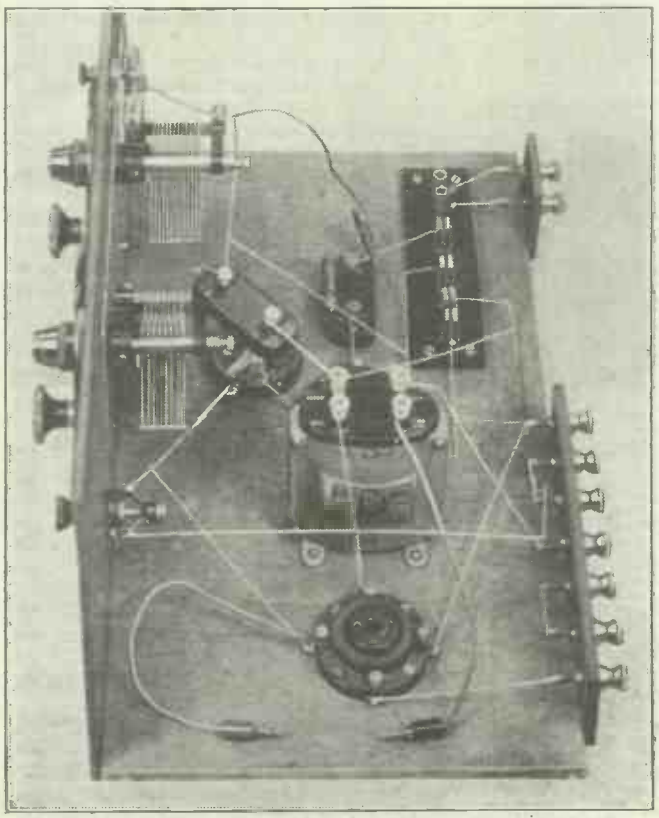
Primarily for Short Waves.

The little two-valver described herewith is first and foremost a short-wave receiver. It was designed as such without any thought of any other work that it might have to do when completed. It was tested out, first, as a short-waver only, and as such we will consider it.

The circuit employed is the usual detector and one note-mag., with capacity-controlled reaction on the well-tried "throttle-control" principle. There are, however, one or two deviations from standard in the general layout and arrangement of the set, which will be discussed as they come up. The theoretical diagram shows the full arrangement.

It is, of course, always realised that the great essential of a short-wave set is that the variable condenser and coil used should be chosen in such a way that they just cover the band of wave-lengths on which it is desired to listen without an undue amount of overlapping at either end.

In this way it is ensured that the tuning is not too critical, and that we do not have a 180-degree swing of dial with all the interesting stations crowded in between, say, 30 and 40 degrees. To arrive at this state of affairs it is necessary to use a very small tuning condenser, quite a convenient size being ·0001 mfd. This is, however, such a small capacity that if we wish to use the set for any other purpose we are always changing coils and the whole thing becomes rather inconvenient.



The short-wave enthusiast will find this set as good as any he has ever handled, and he can use it for ordinary broadcast reception as well. Further, this set can be definitely described as having no tendencies whatever in the direction of that annoying complaint "threshold howl."

"Distortion."

One method that has often been adopted is the use of a larger condenser—·0003 or ·0005—with a small fixed condenser that can be placed in series with it, thus giving an effective maximum capacity of a value rather smaller than that of the fixed condenser used. A ·0005 variable with a fixed condenser of ·0001 in series gives an effective capacity of about ·00008.

The disadvantage of this, however, is that we distort the curve of the variable condenser, since the fixed condenser in series with it does not have an equal effect throughout the full capacity variation of the components.

A scheme which has, in practice, proved much better, is incorporated in this set, and consists of tuning only part of the coil of the variable, which has a capacity of ·0005. Thus if we have a 10-turn coil and connect the variable condenser across only five turns of it, we have the effect of a smaller condenser across the whole coil, and we can, if we desire, simply by moving a clip, tune anything down to one turn of the coil.

COMPONENTS REQUIRED.

- 1 Ebonite panel, 16 in. × 8 in. × ¼ in. or ⅛ in. (Ebonart, Radion, Kay-Ray, Red Seal, Becol, etc.).
- 1 Baseboard, 16 in. × 9 in. deep (Cabinet if desired).
- 1 ·0005 and 1 ·00025-variable condenser (Formo De Luxe in set). (Any good make giving a really good and silent connection for moving vanes.)
- 1 Set short-wave coils, with base and broadcast adaptor (Marconiphone Co.).
- 2 non-microphonic valve holders (Lotus, B.T.H., Benjamin, W.B., Igranic, Pye, Redfern, Burndept, Marconiphone, Bowyer-Lowe, Burne-Jones, Wearite, Ashley, etc.).
- 1 L.F. transformer (R.I.-Varley General Purpose in set). (Any good make of a type which does not incorporate or require a condenser across the primary.)
- 1 baseboard-mounting rheostat (Lissen, Igranic, etc.).
- 1 Fixed condenser ·0001, and 1 ·002 (Dubilier, Lissen, Mullard, T.C.C., Clarke, Igranic, Goltone, etc.).
- 1 Push-pull switch (Lissen, Benjamin, Lotus, Igranic, Peto-Scott, Burne-Jones, etc.).
- 2 Slow-motion dials and 1 panel lamp (Igranic on original). (Other good makes can, of course, be used.)
- 1 Seven-terminal and 1 two-terminal strip (Or one strip 14 in. × 2 in., to suit a cabinet with the slotted back now standardised).

Wood screws, tinned copper wire, etc.

Changing Over.

This does not upset in any way the curve of the condenser, and stations remain evenly spread out over the dial. All that is necessary then to receive broadcast is to insert a suitable coil, and, at the same time, shift

(Continued on next page.)

THE "SHORT-WAVE" TWO.

(Continued from previous page.)

the variable condenser clip so that the condenser is across the whole coil.

No switch for this purpose was incorporated, as it was felt that it was essential to keep the whole thing as simple as possible, and it is no hardship, while one is "inside the set" changing coils, to shift the position of one clip.

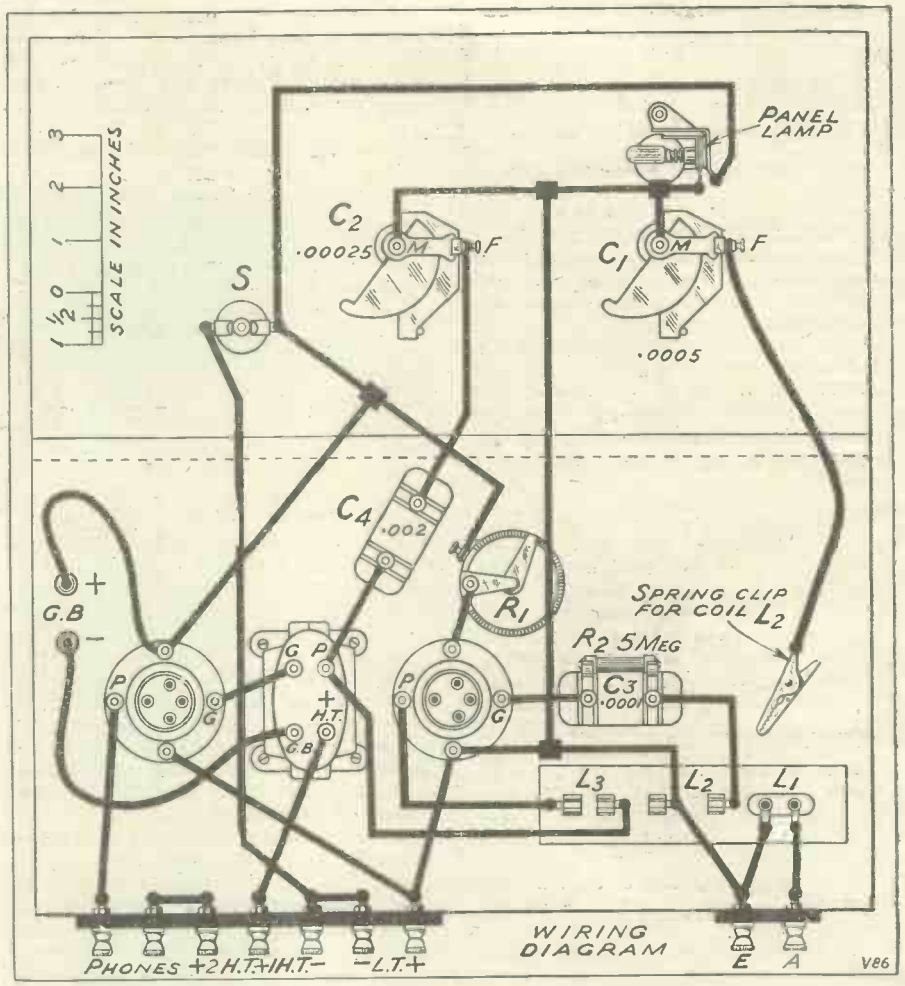
Another object that I had in view when constructing the set was to arrive at a set which could be described definitely as one which had no tendencies towards "threshold howl," which seems to be upsetting so many short-wave enthusiasts at the present time.

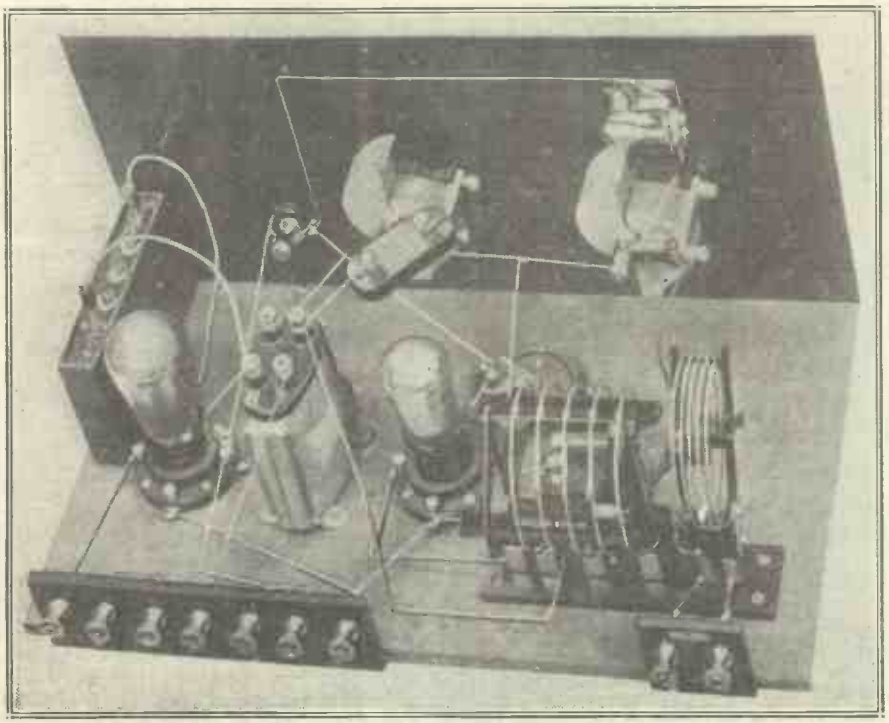
No "Interlocking Control"

It can certainly be said of this original set that at no time during its career has it shown the least desire to start this or any other ungentlemanly action! Naturally, it is impossible to guarantee that a replica of the set will behave in exactly the same way, but it is perfectly true that the original set has always behaved as if it did not know what "threshold howl" was.

Yet another point is that the reaction control has barely any effect upon the wavelength. Far too many sets have what is known as an "interlocking control," meaning that the process of tuning in a weak signal is one long juggle with two controls, the slightest movement of each upsetting the other.

We have our station nicely tuned in but think the set sounds as if it is oscillating too hard, so reduce the reaction slightly, whereat the signal disappears. We then increase the reading of the tuning control, bring the signal back, chase it away again with the reaction control, catch it again, and so on, by which time the station has probably closed down.





Keep this page before you whilst wiring up. You can trace practically every lead shown in the wiring diagram from its beginning to the point where it terminates if you carefully look at the photograph. Also you will be able easily to identify the various terminals.

Why one should ever put up with this sort of thing I cannot understand, but I have seen very few home-made short-wavers which are not victims to it. As a sport it is quite exciting, but rather out of place if one intends to do any serious reception!

On this set the reaction condenser affects the frequency just sufficiently to enable it to be used as a vernier control, and as such it is rather useful. A fifty-degree swing of the reaction condenser (its size being ·00025) just raises the pitch of a 20-metre C.W. signal from the silent point to the normal pitch of 800 or 1,000 cycles at which one usually listens to C.W.

The "Safety" Condenser

Incidentally, although there is a fixed condenser connected in series with the reaction condenser, this does not appreciably reduce the effective capacity of the latter, since its value is ·002. Its purpose is, of course, to protect the transformer primary and H.T. battery, should the variable accidentally develop a short circuit; but it also quietens the movement of the latter considerably if there happens to be any dust on the plates, since it is impossible for any leakage of the H.T. to occur.

No filament rheostat has been provided for the note-magnifier, but a baseboard-mounting control was provided for the detector filament voltage, as this has proved useful in previous sets. So far, on this particular set it has not been used at all, but

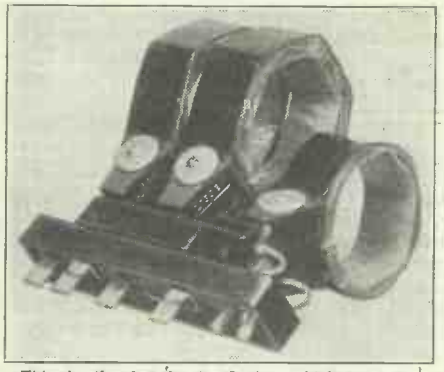
(Continued on next page.)

THE "SHORT-WAVE" TWO.

(*Continued from previous page.*)

in several cases of threshold howl in other sets a slight reduction of detector filament voltage has cured the trouble, so that, owing to lack of faith, it was included in this case. Readers who wish to dispense with it may do so.

It will be noticed from the back-of-panel photographs that a panel lamp has been incorporated, behind the main tuning dial. This has proved well worth while, particularly as—I believe—most short-wave "fans" burn considerable quantities of midnight oil.



This is the broadcast adaptor which can be plugged in to make the set suitable for ordinary wave-lengths.

One can now listen in perfect comfort with no other illumination than that provided by the set. In my own case there was yet another reason for its inclusion, since I have recently been troubled by a loud A.C. hum when I have switched on the light above my work-bench late at night. It is a real relief when listening to weak distant signals to be able to switch this light off and have a really quiet background.

"Light" on the Reaction!

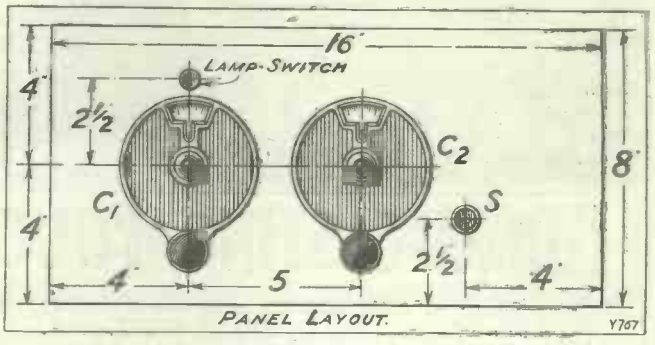
This lamp, by the way, helped to show the constancy of the reaction control, since on one occasion when my accumulator was running low the switching on of the lamp perceptibly dimmed the filaments of the valves and stopped the set oscillating. To re-start it it was necessary to advance the reaction condenser by 40 degrees or so, and yet the signal I had been listening to was still there!

It is useful, by the way, to use a vernier dial on the reaction condenser, as has been done in this case, for the purpose of very fine tuning.

Regarding the constructional details, there is really very little to be said. The somewhat ragged appearance of the wiring is due to the fact that each wire has been taken via the shortest path instead of being made to walk round right-angled bends. This is a point of real importance with a short-waver unless one has arranged the layout extremely carefully.

The grid lead is about 2 in. long, and the anode lead not more than 3 in. The only leads in the set that are at all long are those in the filament circuit, which do not matter.

The coils that have been used are the new products of the Marconiphone Co., and there is a "broadcast adaptor" which fits in the entire holder and enables three standard plug-in coils to be used. Provision in both cases is made for a swinging aerial coil to obviate any possible trouble from "dead spots."



Assembling the Set.

The diameter of these coils is not unduly large, so that it is not necessary to make a very big affair of the set in order to keep them away from the transformer, variable condensers, etc. It will be seen that they are separated from all the metal components by quite a reasonable distance without the necessity for long leads to the coil-holder.

Nothing has been mounted on the front panel but the two variable condensers and the L.T. switch, but in addition to the necessary holes for these and the slow-motion dials a 1-in. hole has to be cut for the panel lamp. Templates and full instructions are provided with both the dials and the lamp, so that no difficulty should be experienced over this.

When the set is completed and everything "on board" two valves should be inserted—one of the general-purpose or H.F. type as detector and a small power valve for note-magnifier—and the batteries connected up. With a valve of the D.E5b class as detector I used 60 volts H.T., giving the note-mag. the full 100 volts available, with about 6-volts negative bias.

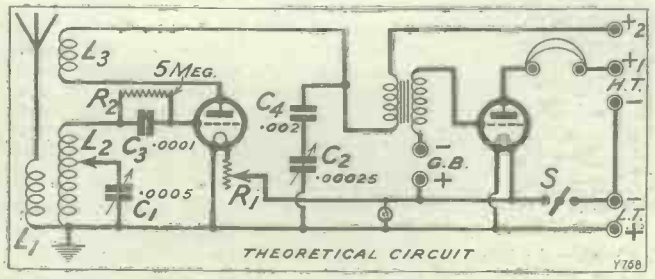
Operating Details.

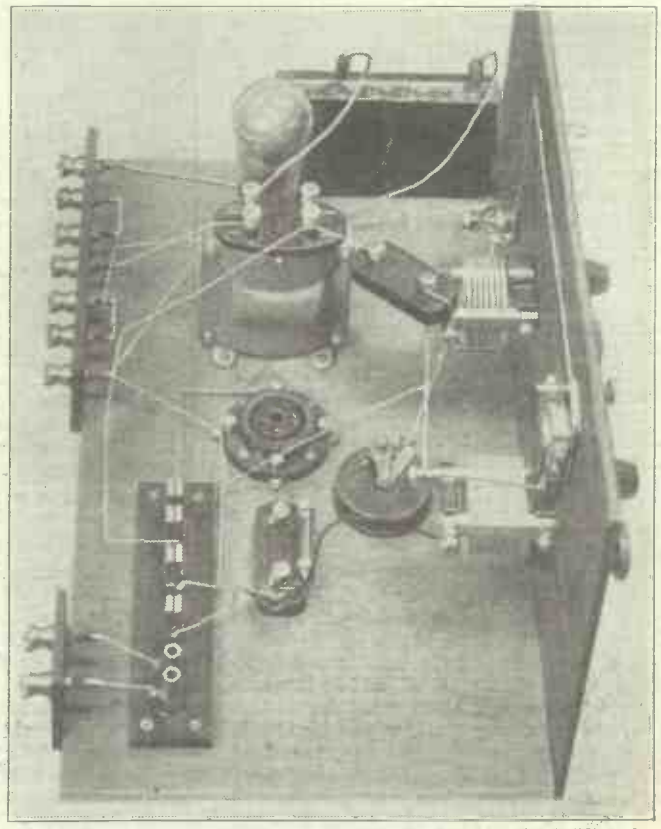
The grid condenser and leak in use proved quite suitable for this class of valve, the values being ·0001 mfd. and 5 megohms. Insert the larger of the two short-wave coils (labelled 29–52 metres) and place the variable condenser clip on the bare wire of the coil, three turns up from the filament end, which is the right hand end, looking from the front of the set.

Now operate the controls in quite the normal manner, and it should be found that the set slides smoothly into oscillation when the reaction condenser is somewhat less than half-way in. If there is a pronounced spot over which it will not oscillate, slacken off the coupling of the aerial coil until it disappears.

With the condenser clipped across the number of turns mentioned, the range is not quite 29–52 metres, the top of the scale corresponding to a wave of about 47 metres. This is, however, high enough, and numerous

(*Continued on page* 869.)





One of the points you should pay particular attention to in the building of this simple, inexpensive, but powerful set is direct, well-spaced wiring.

BROADCASTING & EDUCATION

By HELEN ALVEY.

Theoretically we agree with our contributor, but the practical methods of the B.B.C. in co-operation with the educational authorities are very far from ideal. However, here is a new plea for a spirit of eagerness to which we are glad to give publicity.—THE EDITOR.

THE tragedy about school education is the lack of the spirit of eagerness that alone can make the dry bones of fact live.

The schoolmaster must go on year after year cramming the same dull lessons into the more or less reluctant child, who often learns in parrot-fashion, not realising any connection between the different subjects. And now broadcasting has swept through the world, with Aladdin-like possibilities of illuminating the misty dullness of routine work, a searchlight to cut across the boredom of both teacher and child.

True Education.

I see new hope for both town and country schools. How can we call a child educated who has never listened to the songs of birds, nor ever seen a real expanse of sky! The birds can now penetrate his town-deafened ears. And who can say what beauties of nature may not be shown to him if and when television becomes a practical possibility.

Reciprocally the towns can now bring their benefits to the country child, broadening his views, and kindling in him new ambitions. For the schoolmaster can draw upon the inspiration of those who move in great cities: he can turn on the radio when beautiful and famous buildings are being described. I can imagine some country child who has just listened to a description of some vast cathedral, looking upon some beautiful avenue of trees, and wondering if such a sight inspired the early vision of the first cathedral builder.

International Influence.

But neither town nor country child need stay now in his own country: he can travel via waves in the ether to other lands. It means just the turning of a radio knob, at the right moment, and he becomes a traveller amongst strange people.

If the lecturer in the broadcasting studio is a wise and sympathetic one, the child may realise something of the ideals and point of view of other nations, and thereby will be deposited the germ of an international amity that surely must be the next step upwards to enlighten the distracted bickering nations of the world. And in time when we have come to realise the ideal of international brotherhood on this planet, let us hope that we shall be led to a truer conception of our place in the Universe; not imagining that we on this planet are the only beings of importance, but that there are higher beings, ready to help us in our upward striving.

Wide Outlook Required.

For let us not be narrow and stereotyped in our broadcasting programmes. There is no need to keep to stodgy material when we are thinking along educational lines. True education should be a learning to look for, and appreciate, reality. And for many reality is glimpsed through the arts, through music or poetry, or through the higher art of religion.

Educational broadcasting, for the schools or otherwise, should take the broadest view of their scope. Glimpses of reality, perhaps, may be attained in a child's day-dreams; and broadcasting might stimulate dreams on a high level. It should enter the child's consciousness as a voice from another and better world. So that broadcasting could become a strong weapon against the modern tendency to turn out children to pattern instead of individual creatures. At the lowest, if it has only taught children how to listen, it has not been entirely unavailing.

But, perhaps, the most hopeful thing about broadcasting is that it enables everybody, of whatever age, to pursue education when school days are left behind.

To those who are eager to learn, and who realise that school learning is but the fringe of education, broadcasting is an untold boon. There were many who, in pre-broadcasting days, were cut off from education in later life, because they could not get into touch with means of learning.

A Powerful Agent.

There is no need for them to despair now; for at a minimum of expense they can come into contact with a wider world. They can learn new languages by means of regular broadcast lessons, and later can listen to a foreign station with comprehension. The nations of the earth are drawing together in family reunion.

Perhaps broadcasting may undo the curse of Babel, so that the whole earth may become again "of one language, and of one speech."

Broadcasting is indeed a powerful agent, whether we use it for good or for evil purposes. Let us not repeat the mistake that sometimes we are liable to make about locomotion—the mistake of travelling too quickly, and of having no ennobling destination.

If we entrust waves to the ether, let us see that when they are translated into sound they are words worth saying. The messages we send must be worthy of their vehicle.

A Radio lesson in the Infants' class of the new church school at Stow St. Mary, Essex.

ODDMENTS.

Generally speaking, it is folly to share an earth, however good it is, with a neighbour, as this has been found to be one of the greatest contributory causes to mutual interference.

* * *

Two of the commonest causes of poor quality in reception are the use of inefficient high tension and improper valves.

* * *

An old high-tension battery should never be connected in series with a new one.

* * *

Correct grid bias in not only essential to good quality, it also effects an enormous saving in the current taken from the high-tension supply.

* * *

Although grid-bias batteries do not supply current to a set they deteriorate in time, and should not be expected to last longer than six months or so.

* * *

When choosing a soldering iron remember that a long, thick iron holder for the bit will make the latter more difficult to heat.

CONTINENTAL CAROLLING

Stories of Foreign Favourites to be heard by Radio.

By LEONARD TRAVERS.

THIS Christmas, as in the past, we shall no doubt be hearing the usual carolling broadcast from wireless stations in Great Britain. But because we have all heard these carols time after time since we were children (and though they lose none of their appeal), it is refreshing to seek pastures new in listening to the carols broadcast from continental stations which perpetuate the good old custom year after year even as we do.

At Christmastime, therefore, more than at any other time in the year, the listener whose set is powerful enough should reach out for foreign stations.

700 Years Old.

Carols, of course, originally came to us from Europe. For 1,200 years men had kept Christmas without carols (for the term should not be confused with Yule-tide drinking songs), but when carols as welcome aids to cheerful piety were introduced, they were taken up with alacrity by the devout of every country in Europe.

It was only to be expected, however (and that is why I want to warn listeners against expecting to hear any particular language from any stations), that many of the early carols were composed by the clergy, who wrote in pure Latin.

Most of these carols are widely known, and are always to be heard on the wireless at Christmastime from continental cities. They include "In hoc Anni Circulo" ("In the ending of the year"), "Dies est Lætitiæ" ("Royal Day that chasest Gloom"), and "Resonet in Laudibus" ("Faithful souls your praises bring").

In the Vernacular.

But to be really popular, of course, in any one nation the carols had to be in the vernacular. No writer, however, appears to have made great efforts to write any specially appealing carol for any nation at that period.

Thus we arrived at the Macaronics which are widely known and which will still further confuse the listener who attempts to identify a station by the language.

In several European countries, for instance, one can hear examples of the macaronic sung in Italian, Spanish, French and German—all mixed with Latin. The original of our own favourite "Good Christian Men Rejoice," is in Latin and German, "In dulci Jubilo, Nun singet und sey froh, etc."

Italy was the birthplace of the carol as we know it to-day, and from there it spread rapidly through Spain, France, Great Britain and Belgium in a stride, and through Germany, Russia, Denmark and Sweden in another.

In spite of its travels, however (and in successive Christmases now I have heard the carol all over the Continent from Copenhagen to Vienna), it retains its essential simplicity and fervour. Many of the carols are quaint and introduce not only legendary matter, but also much pious fiction.

They are usually of great length and curiously dramatic, though the groups of characters remain unchanged in the various countries.

In an Italian carol a gipsy woman offers hospitality to the Holy Family on their retreat to Egypt. In a Spanish carol, usually to be heard from Barcelona or Madrid, gipsies at the town gate welcome three Kings (the Wise Men from the East).

In a Provençal carol, gipsies read the lines on the hands of the Child, Mary and Joseph, and predict their destinies, and in an Andalusian carol the "rascally gipsies" have stolen all the swaddling clothes and left the Child naked.

Rome and Milan stations will probably mention the fact that St. Francis of Assisi, whose seven hundredth anniversary was recently celebrated, was accounted the originator of the carol, though no carol can be directly attributed to his efforts.

His followers, however, composed bright, homely songs about Gospel facts in the common tongue of the people, and later, a Franciscan poet, Jacopo de Todi, wrote many carols of outstanding beauty.

From Radio-Paris.

The almost universally familiar theme upon which Handel afterwards built up his "Pastoral Symphony" is taken from an Italian carol of this period:

"In Bethlehem is born the Holy Child,
On hay and straw in the winter wild.
Oh, my heart is full of mirth
At Jesu's birth."

We have records of Spanish, Austrian and Russian carols, but I cannot say I have heard many of them over the wireless.

French carols that we may expect to hear from Eiffel Tower or Radio-Paris, can nearly all be found to have been translated into English—"The holly and the ivy," "Now sing we all full sweetly," and "The Carol of the Flowers."

Berlin, Frankfurt-on-Main, Hamburg, Koenigsburg, Leipzig, Muenster, Munich, and Stuttgart, as a selection of the best heard German stations, will probably give us a selection of old-time German carols, of which there are a number written in the old High German.

Luther's Carol.

Perhaps the best known and loved is Luther's carol, said to have been written in 1540 for Hans, his son, the English version being:

"From Heaven above I came to you,
To bring you tidings good and true."

If this is heard the listener should remember the tradition that in Luther's household the first five verses were sung as a solo by a singer to impersonate the Angel Gabriel, and the remainder of the carol in chorus.

LISTEN FOR THESE.

Radio-Paris	1765 m.	Madrid (E A J 7)	405 m.
Zeesen	1649 m.	Hamburg	396·8 m.
Hilversum	1071 m.	Toulouse	388·6 m.
Vienna	517·2 m.	Stuttgart	379·7 m.
Langenberg	468 m.	Paris (Radio L L)	370 m.
Oslo	461 m.	Leipzig	366 m.

CORRESPONDENCE.

TRANSATLANTIC TELEPHONY.

OUTSTANDING VALVE IMPROVEMENTS.—THE "P.W." RESEARCH DEPT.—RADIO IS SO FRIENDLY, etc.

Letters from readers discussing interesting and topical wireless events, or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

TRANSATLANTIC TELEPHONY.

The Editor, POPULAR WIRELESS.

Dear Sir,—One of your correspondents in a recent number of POPULAR WIRELESS was asking if any listeners had picked up transatlantic telephony. A few weeks ago I had a similar experience to your correspondent. At 11.10 I picked up a telephonic conversation, but I did not get the two speakers, which was somewhat extraordinary. I should think that the wave-length was approximately 24 metres. It must have been American because the lady speaking said: "The time is now five minutes after six." At 12.10 I again picked up a lady speaking on the telephone. The conversation was of a purely domestic character; the second lady was speaking to her mother. If this letter is of any value to your readers, I should be pleased if you would use it. Personally I should like to hear more on the matter.

Yours, etc.,
"SHORT-WAVER."

Glamorgan.

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to Mr. W. B. Collins' letter re "Transatlantic Telephony," in POPULAR WIRELESS, December 1st. The American station he hears is 2 X G, Rocky Point (Long Island).

I receive this station almost every evening at good strength, calling "Hallo, London!" Wave-length used varies according to conditions, 16, 22, and about 30 metres. I have noticed that reception below 25 metres is impossible after 9 p.m. at present, every evening, and 2 X G seems to alter his wave-length accordingly. I received a station between 25 and 30 metres on Friday morning, November 16th, at 9 a.m. A male voice announced that the evening programme was about to commence, after which a musical item followed. A talk then followed in a foreign tongue, which I could not follow, then another announcement in English. Perhaps some of your readers can help me to identify this station.

Yours faithfully,
H. D. PRITCHARD.

Anglesey,
North Wales.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to Mr. Wilfred B. Collins' query in December 1st issue of "P.W." regarding the Transatlantic telephone, I am sending the following details in the hope that they will be of interest to him and to other readers.

It certainly was the transatlantic telephone transmission that Mr. Collins heard. As a matter of fact it is the long-wave transmissions (5,000 metres), which cannot be picked up as intelligible speech on an ordinary receiver. The short-wave transmissions are as easy to receive as 2 X A F or 2 X A D.

The male voice that he heard calling the "London technical operator" was actually the New York technical operator. There is a technical operator at either end of the transatlantic telephone (i.e. in London and in New York). His duty is to listen-in on the transmissions and keep them up to a constant volume by means of special volume indicators.

These operators occasionally call one another to make certain adjustments or to exchange data relating to the telephone calls. Hence the call that Mr. Collins heard. If the London technical operator wished to speak to the New York operator, he would call "Hallo, New York technical operator."

The lady who was carrying on the "domestic" conversation, would be an ordinary telephone subscriber in America making a call to a friend in England.

The actual short-wave transmitting station in America is situated at Deal Beach, and is connected by land-line to New York.

Hoping that the above will be of interest,
Yours faithfully,
K. H. R.

Croydon.

OUTPUT VALVE IMPROVEMENTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—The listening public have lately had presented to them some "vastly improved" output valves. An examination of the technical data shows that the improvement lies mainly in an increased amplification factor for a given impedance. May I suggest to manufacturers, with all due humility and at the risk of being called various kinds of idiot, that this particular feature is of relative unimportance. The output valve performs a rather different function from the other valves in a set. It is not required to pass on amplified signals to a further stage, but to handle the power necessary to drive our rather inefficient methods of producing sound.

As it happens, the existing type of valve is quite capable of producing sufficient din for the average living-room fairly easily, but is quite incapable of handling the voltage variations impressed on its grid. I suggest that it is rather childish—if I may say so—to go on piling up the amplification factor and totally neglecting the question of permissible grid swing. When a very ordinary set, used close to a powerful transmitter, will produce peak voltages on the last grid in excess of the anode voltage, it is rather silly to find our "super-power" valves limited to 20 volts.

Will somebody please produce an output valve (for 150-200 volts anode) with the power capacity of the modern super-power valve, but capable of handling 100 volts on its grid.

Yours faithfully,
G. M. PART.

Surrey.

THE "P.W." RESEARCH DEPARTMENT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have not seen any published tributes regarding your Research and Construction Department, and am wondering whether it is your own modesty or lack of appreciation on the part of your readers that is the cause of this. If it be the latter, then let me for one hasten to repair matters. I have followed the work of Mr. G. P. Kendall, B.Sc., and his department with the keenest interest, and my admiration of the results achieved is almost overshadowed by my surprise at the modest way in which they are chronicled. The research on transformer coupling, on the Pentode, on Screened-Grid valves, and on many other most important things, seems to have brought to light much new data of great value. Further, I admire the way in which this laboratory work is devoted to problems concerning the production of cheap sets capable of good quality reproduction. That I believe I knew Mr. Kendall when he was at Leeds University must not be allowed to prevent me signing myself

"IMPARTIAL ADMIRER."

Leeds.

RADIO IS SO FRIENDLY.

The Editor, POPULAR WIRELESS.

Dear Sir,—At one time I collected postage-stamps, but other collectors used to envy all my unused specimens. Then I tried photography—and lost all my friends when they saw my "studies" of them! Finally, I took up radio—and found every other "fan" a friend in need, ready to help and advise and assist, just as happy over my triumphs as over his own! Why is radio so friendly?

Yours faithfully,
R. BRIDE.

Ilford.

TEXT BOOK WANTED.

The Editor, POPULAR WIRELESS.

Dear Sir,—The text books on wireless are innumerable, but I have never found one that gives any lucid exposition of the subject.

In the much despised Victorian times men like Faraday, Tyndall, Huxley, and Brewster were able to explain the science of their day in the clearest manner. One series of Tyndall's lectures (on Sound) was actually translated into Chinese, and is said to have been quite intelligible to the Oriental mind.

Why is it that in the present age we have so few scientific text books comparable with those of a past generation—as regards lucidity—particularly in the matter of wireless science?

A tyro is at once bewildered by the jargon employed without proper definition, or when definition is attempted it is merely a re-expression in equally unintelligible language. He is further perplexed by the fact that the obvious questions which must occur to any novice are neither elucidated nor even referred to.

There are so many who are well versed in every detail of the science and practice of wireless. Is there not one among these who can express what he knows in clear terms and good English, clearing up the difficulties of the every-day student as Tyndall did in the province of Sound, Lights and Heat, as Faraday did in his discourses on the Candle Flame, as Brewster did in his Optics, and as Huxley in his lectures and essays on Physiology?

"LAUDATOR TEMPORIS ACTI."

SHORT-WAVE NOTES.

By W. L. S.

I HAVE been asked by a number of readers to express my views on wave-meters, particularly as to which is the most suitable and useful type for the average "short-wavist." I have replied in nearly all cases to this effect: "If you have the time and the spare parts to make a heterodyne wave-meter, you will be amply repaid for your trouble.

"If you have not, then a simple absorption wave-meter, carefully made, will fill the bill."

My "Most Useful Gadget."

After making and calibrating my very first heterodyne wave-meter I vowed that it was the most useful radio gadget I had ever made in my life, and I am still inclined to think that my present wave-meter is indispensable.

I honestly should feel quite lost without it, since it serves at least five different purposes, including its use as a "monitor" for producing a beat note with a harmonic of the transmitter to make certain that it is turning out a pure and steady note at all times.

A heterodyne wave-meter for short waves is quite a simple affair, and I think, personally, that the most useful range for it to cover is about 70–105 metres. The second harmonic will then give you a range of 35 to 52·5 metres, and the third, 23·3 to 35 metres. When on the very short waves, you simply swing the wave-meter dial until you hear two harmonics and the difference between the wave-length of these two will give the wave you are listening on.

Listening on the 10-metre wave-band this week-end I heard the first crystal-controlled American station that I have found so far on this wave. He was W 2 B R B, a well-known "Yank," and was turning out a note that would have been a credit to him on 200 metres!

And it stood out well among the vile noises that seem to be the common rule on 10 metres! Apparently conditions on 10 metres vary very rapidly, since a fortnight ago the Yanks were coming across beautifully, while the last two Sunday afternoons there has hardly been a sound except from our own locals.

Some of the German amateurs turning out telephony in the region of 40 metres are now putting over some remarkably fine transmissions. I heard one a few days back giving a gramophone programme that would have been a credit to 2 L O's lunch hour.

Real Research Carried Out.

They are, it is true, a nuisance when they occupy our narrow wave-bands with their powerful transmissions, and I think all telephony should be confined to crystal-controlled transmitters, but probably these people are doing far more experimental work than the "DX hounds" who ponder lovingly over their keys and send CQ all day.

It is a great pity that the 80-metre wave-length is more or less closed to amateurs in this country. This was, to my mind, one of the most useful waves that amateurs ever discovered, and yet it is closed by the G.P.O. except for "organised tests of a special nature."

Surely it is time for an organised protest against the official tactics which seem to have but one end—to cramp the amateur as much as possible.

Valves Without Curves

Do you know exactly which types of valves you should use in your set? Further, would you be able to classify a whole group of these devices? You need not study mathematics and grapple with "curves" in order to be able to do so. The author shows you how to "read" valve characteristics without the necessity of either. This article will give you a new appreciation of the subject.

By C. E. FIELD, B.Sc.

IN order that we may determine the suitability for our purpose of a particular type of valve, we are usually presented with "characteristic curves," or graphs, which tell all that we wish to know about the valve, provided that we know how to use the curves. Many of us, however, still look askance at characteristic curves, and prefer to try the same type of valve that we have heard operating well on a friend's set, with results which are too often disappointing.

Although it is proposed here to discuss valves without the aid of curves, it should not be thought that a study of a valve's characteristics is not worth while. On the contrary, wireless enthusiasts should make every endeavour to become familiar with what is undoubtedly the simplest and most scientific way of studying valve performances.

Readers are doubtless familiar with the operation of the three-electrode valve, which may be summarised as follows:

The filament of the valve, being heated, gives off a shower of electric particles, known as electrons, a flow of which constitutes what we call an electric current. The valve plate, which is connected to the positive of the high-tension supply, attracts the electrons (which would otherwise fall

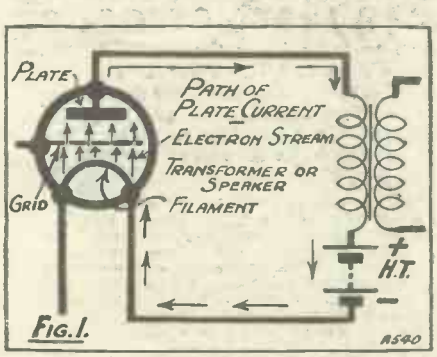


FIG. 1. A540

on to the side of the glass bulb or back on to the filament), and causes an orderly flow, or current, to pass from the plate to the high-tension positive (through a transformer or speaker winding) through the battery to the negative terminal, from there to the valve filament, and through the valve to the plate, the complete circuit being as shown in Fig. 1.

Action of the Grid.

The valve grid is placed in the path of the electron stream from filament to plate for the purpose of controlling the flow of electrons. If the voltage on the grid is positive, it assists the plate in its work of attracting electrons, while a negative voltage on the grid causes the latter to decrease the flow by repelling the electron back towards the filament. The conditions inside the valve will then be as shown in Fig. 2 (a) and (b).

When signals are received by a valve, the voltage on the grid is alternated from positive to negative, and so the current in the plate circuit is correspondingly changed, giving rise to output signals which are a replica of those received, but of greater strength.

A valve may thus be regarded simply as a tap, the handle of which, operated by means of the incoming signals, is the grid, which serves to turn on and off the flow of current from the high-tension battery.

Since the effect of a valve is to amplify, or magnify signals, evidently one of its most desirable features is an ability to magnify to a great extent, and consequently the degree of magnification obtainable is a point upon which information is most needed when a new valve is being purchased.

A valve's capability for magnifying signals is invariably supplied by the manufacturers, under the name of Amplification Factor, or Voltage Amplification.

Amplification Factor.

It is impossible to state how many times louder a valve will render signals until we can agree as to the meaning of the word "loudness," so the amplification factor is obtained in another way.

When the voltage on the valve grid is changed by incoming signals, the current in the plate circuit is correspondingly changed, just as if the high-tension battery voltage had been altered. For instance, an increase of one volt on the grid might produce the same increase of plate current as would be the case if the grid voltage had been left unaltered and the high-tension battery voltage increased by, say, 10 volts. In short, a change of 10 volts would have been produced in the output circuit by a change of 1-volt in the input, so that the valve would have had the effect of magnifying or amplifying the voltage 10 times, 10 in this case being the amplification factor of the valve.

We will let it suffice for the moment, then, that the amplification of a valve is the number of times by which it magnifies the voltage changes on its grid, and that this value should be as high as possible, providing that the valve also performs its other duties correctly.

Now, it is of no use for a valve to possess a high amplification factor if it is unable to make use of this property with the particular signals with which it is required to deal.

Unfortunately, unless the filament current and plate voltages are very much increased, as the amplification factor becomes higher the valve will become more easily overrun by strong signals, and distorted results will be produced.

For example, suppose we had two valves, with amplification factors of 30 and 10 respectively, the first might be capable of dealing with an input voltage of only 1 volt, whereas the second might handle signals producing voltage changes on its grid of 4 volts.

The voltage change obtained in the plate circuit in the first case would be $30 \times 1 = 30$ volts, whereas in the second case the value would be $10 \times 4 = 40$ volts, so that if strong signals were being received it might pay to use the lower amplification valve rather than to reduce the signals to such an extent that they could be handled by the other.

"Power" Output.

Evidently then, a feature of a valve which is just as important as a high amplification factor is a capability for dealing with strong signals without introducing distortion.

This feature is indicated on a valve specification by the grid-bias voltage which is recommended by the manufacturers.

Thus, if it is recommended that a valve be given a grid bias of 9 volts, the indication is that that valve will deal with signals which produce a change of 9 volts on the grid, and that it will handle twice the voltage input that could be handled by a valve biased with 4½ volts only.

In addition to the two features just considered, we require some means of expressing a valve's capability for giving a large *power output*, or volume of sound.

The output from a valve depends upon the changes which take place in the *current* in the plate circuit, and for given changes

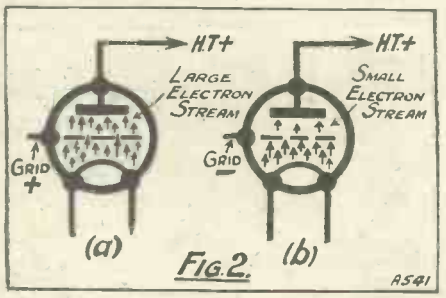
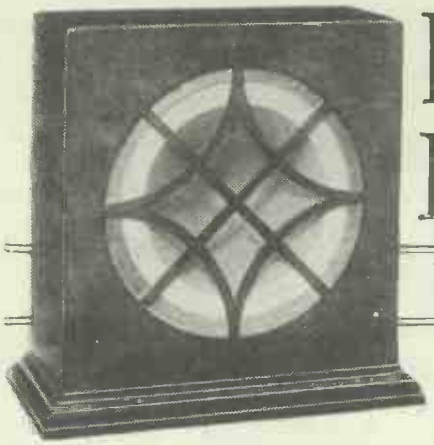


FIG. 2. A541

of plate circuit voltage these must depend upon the resistance effect offered by the valve. This resistance is known as the *impedance* of the valve, and is one of the quantities which is always supplied by manufacturers. The lower the impedance of a valve, the greater is the power output, or volume of sound that it should supply.

We might consider the case of two valves, having impedances of 6,000 ohms and 60,000 ohms respectively. Although the latter might be capable of producing larger changes of voltage in its plate circuit than

(*Continued on page 866.*)



HOW TO MAKE LOUDSPEAKERS

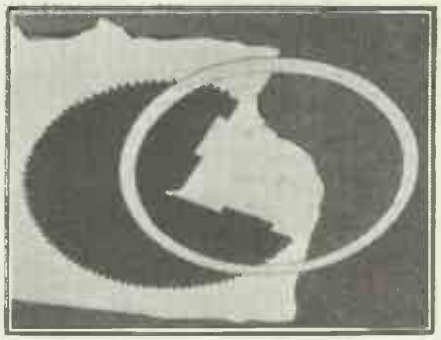
No. 4. THE P.W. "PURITY" CONE

This special design uses a framework and mounting which can be purchased ready for assembly, and will take practically any of the well-known cone units. The constructional work is therefore exceptionally easy. The cone and suspension arrangement is the same as that originally developed for use in the "P.W." moving-coil loud speaker, and the completed instrument will give you realistic reproduction of a wonderfully high standard.

By THE "P.W." RESEARCH DEPARTMENT.

THIS cone speaker is specially interesting to "P.W." readers, because it shows very clearly the influence of the moving-coil type of speaker. Actually, the cone and method of suspension are exactly the same as those developed for use in the moving-coil type of speaker which we described some time ago in "P.W." and we have found them well-nigh ideal for use in conjunction with an ordinary reed or balanced-armature-drive type of speaker unit.

There can be little doubt that a quite considerable part of the special efficiency of the moving-coil speaker depends on the use of a very light but rigid conical paper diaphragm very freely suspended, and it is very interesting to find how greatly the



The set of parts for the cone ready for assembly (you will find the paper is already cut to shape when supplied). The suspension materia. is a sheet of very soft thin leather resembling kid.

ordinary type of cone speaker can be improved by constructing it in the same way.

As a matter of fact, we have used a cone and suspension system of this general type in every one of the speakers in this series, modifying it in various ways to suit the particular class of unit, method of construction, etc., of each design, and the results have been in every case strikingly better than we have ever obtained with any of the older methods of cone mounting.

A Very Flexible Design.

Naturally, the actual standard of reproduction obtainable will depend in the end upon the quality of the particular unit chosen, and the more expensive ones may reasonably be expected to show up favourably in a comparative test, but even with the cheapest ones the results are not to be despised, and indeed they have been amazingly good when the low total cost is remembered.

The present design is again of a type which enables any one of a great variety of types of unit to be incorporated without any alteration, since it is provided with a form of clamp which will hold almost any of them. Consequently, we do not wish the intending constructor to feel at all tied down in his choice of a unit, or to be unduly influenced by our suggestions, for we feel that it is so largely a matter of personal preferences that it is best for him to make a free choice.

The fact is that different units give a different tone and general style of reproduction, and it is only natural that different people will prefer different makes of unit. Here is a trio of units which will fit straight in place, all of which we are confident will give excellent results in this particular design: Goodman, Blue Spot, Triotron. No doubt there are many others as well.

Special Points.

The special features of this design, then, are the cone, suspension, frame, and method of mounting, rather than the particular unit, and it is to these points that we shall be confining ourselves in the description which follows.

The whole thing makes a compact, self-supporting assembly which can be fixed into one of the standard cone cabinets supplied by most of the wireless cabinet-making firms, attached to a plain baffle board like a moving-coil speaker, mounted behind a hole in a fire-screen or a cupboard door, or mounted in any other fashion which appeals to you.

It is perhaps as well to point out that some sort of mounting such as the ones mentioned is really desirable for all these semi-floating cone speakers, for exactly the same reason as in the case of a moving-coil type, i.e. to bring out the bass properly. If no baffle effect is provided the bass will not be heard at its full volume, and the proper depth of tone will be lacking.

The cabinet actually used for the original speaker was a standard "Camco" line, of very reasonable price, and quite pleasing appearance, but of course this is decidedly a matter for your own choice.

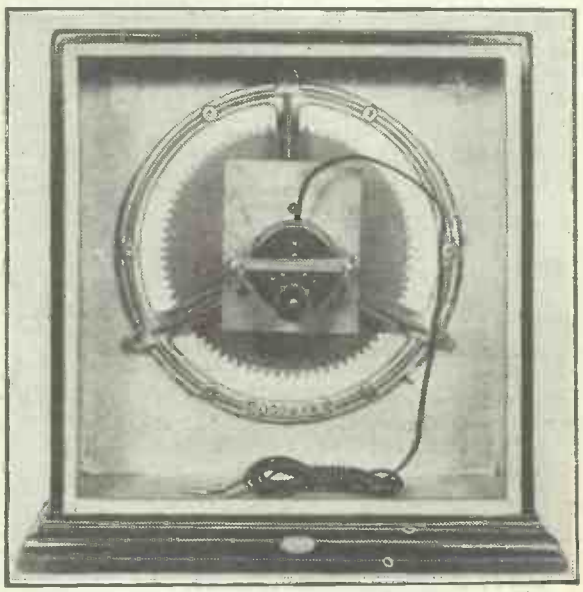
Whatever type of mounting you decide upon, be on your guard against what is called "box resonance," which usually takes the form of a booming sound on some musical items and most speech. It sometimes happens with the cabinet type of mounting if the back is completely closed, so always try the effect of removing the detachable back. If the objectionable quality disappears the remedy is obvious.

A Ready Made Frame.

Now let us take a closer look at the special frame and cone with the aid of the photos reproduced on these pages. The frame and mounting which we have incorporated in this week's design is a standard line produced by one of the advertisers in "P.W." (Messrs. Goodman).

The paper cone is of the same general type as the one used last week, and is roughly the same size. The suspension is a little different, consisting of a very soft and pliable leather, but it functions very similarly. The framework consists of a skeleton aluminium casting, on the back of which is

(*Continued on next page.*)



The finished speaker seen from behind with the back of the cabinet removed. It is fixed in place with three screws through lugs cast on the rim of the metal frame.

HOW TO MAKE LOUD SPEAKERS.

(Continued from previous page.)

a wooden block carrying a clamp which will hold almost any of the well-known units in the correct position.

A separate aluminium ring is provided which is attached with screws to the body of the frame, clamping in position the edge of the suspension arrangement. The whole assembly when completed can be screwed to the inside of a cabinet by means of holes provided in the casting, so you will see that the whole work of assembly is really very easy, being little more than a "pliers and screwdriver" job.

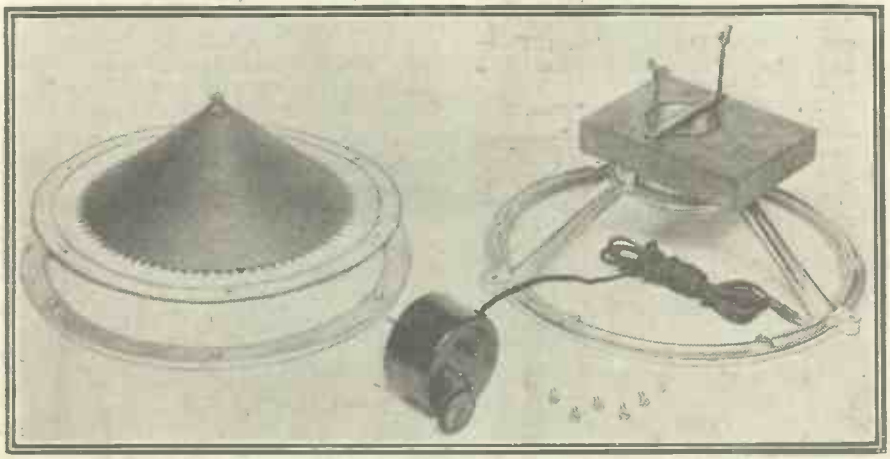
Making the Cone.

Now for the details of construction. The paper cone, cut to shape and ready for sticking together, and the necessary materials for the suspension are obtainable with the framework, and the procedure in assembling is quite simple.

The first step is to take the paper intended for the cone and form it to shape by sticking together the straight edges with their simple dove-tailing arrangement (this will be quite clear when you have the paper before you).

When you do this use a sufficiency of a good adhesive, such as Seccotine, Durofix, etc., and be careful to make a really sound job, for any imperfect joints anywhere are apt to set up a chatter or buzz in the finished speaker. Give the cone a little while to dry, and then prepare it for attachment to the suspension. You will see that the outer edge of the cone is cut into little serrations all round.

These are for convenience in sticking the cone to the leather, and the next step is to bend them all outwards so that they project all round and will rest flat upon the table if the cone is stood upon its base with joint upwards.



All the parts ready for assembly. Note how the cardboard ring is used to support the edge of the soft suspension material. In assembling, this ring is clamped between the edge of the main frame and the detachable aluminium ring.

Don't Hurry Over This.

Now take the sheet of soft kid leather and spread it out quite smoothly without wrinkles, smear all the projecting points round the cone thickly with adhesive, and then place it in the middle of the leather. Press all the serrations down firmly and leave everything to set.

While this is going on you do one more job, which is to stick down upon the leather a cardboard ring which is provided for the purpose of forming a support.

Smear one side of the ring pretty thickly with the adhesive, and drop it down on the leather round the base of the cone, placing it carefully so as to leave an equal space of leather all round between the ring and the outer edge of the cone. Press the ring down firmly and leave the whole assembly to set.

When it has dried thoroughly cut off all the superfluous leather projecting beyond the outer edge of the ring, then proceed to cut out all the leather *inside* the cone. When you have done this the result should be that the cone is mounted on a flexible ring of leather all round, the outer edge of this leather ring being stuck to the cardboard ring.

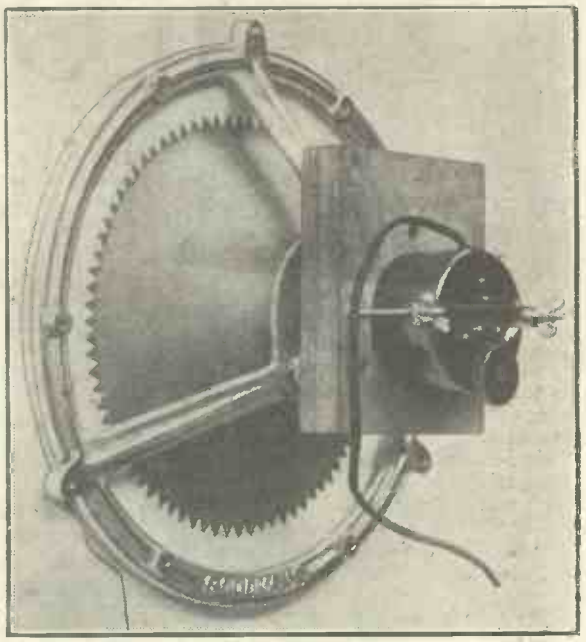
Now you can fix the finished cone and suspension into the metal framework, to do which it is merely necessary to clamp the cardboard ring between the main frame and the detachable aluminium ring. To do this screws must be passed right through all three parts (screws are provided) and so you will have to cut some holes round the cardboard ring, but this is quickly done.

All that remains now is to fix the unit in place, and the special clamp provided on the Goodman frame which we used makes this a very simple business. Place the unit carefully so that the point of attachment for the cone comes exactly opposite to the tip of the cone itself, and then tighten up the two butterfly nuts so that the crossbar grips the unit very firmly indeed.

Just how the cone is to be fixed to the driving mechanism will obviously depend on the particular unit, but it is usually a very simple matter, because the necessary coned washers and nuts, or other clamping device, is provided with the unit.

With all of them you will need to cut off the extreme tip of the cone to make a small hole, and then proceed in a manner which will be obvious when you have examined your unit.

By the way, most of the units are provided with some sort of locking nut which clamps the paper firmly between coned washers, but it is usually as well to take precautions against any possibility of looseness and chattering here.



The finished assembly ready for screwing to a baffle or into a cabinet.

One good scheme is to cut a couple of washers from flannel, the waste leather of the suspension, or similar soft material, and put one on each side of the paper. Another good method is to run some of the adhesive in between the paper and the metal clamping washers so that everything is stuck firmly into one solid mass, and this is perhaps the safest way of all.

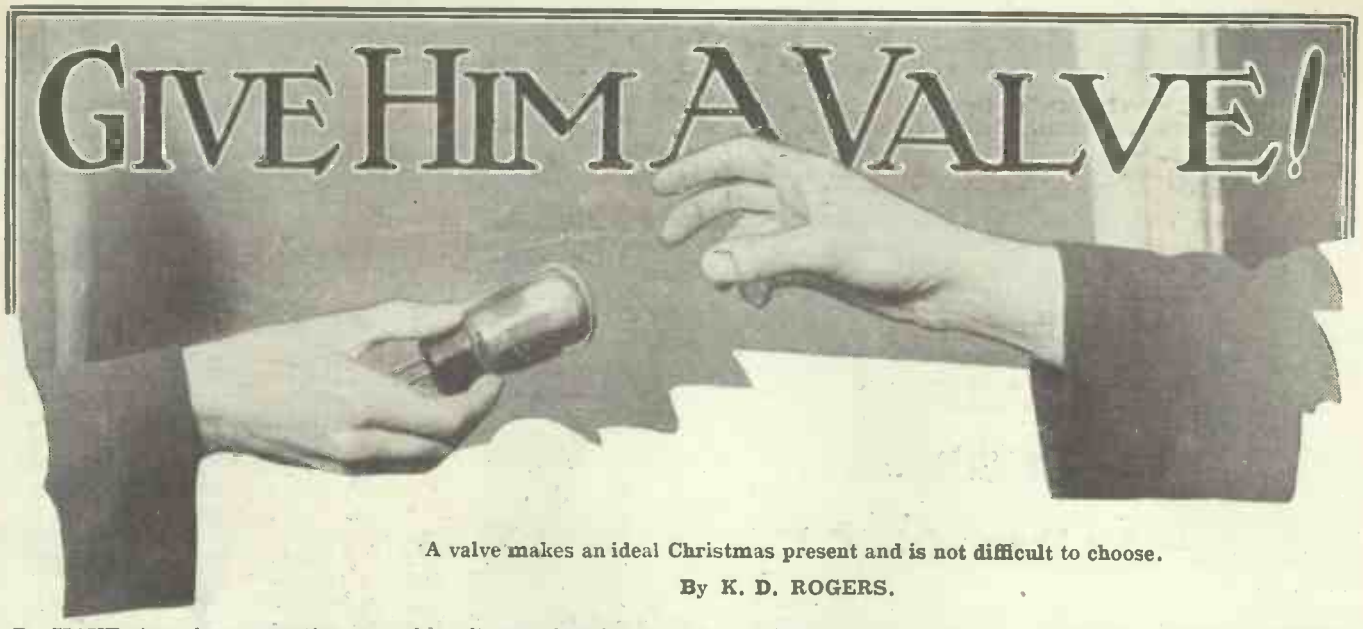
What It Will Do.

Finally, as to results. Well, with any really good unit this cone and suspension will enable you to get reproduction which we can say quite soberly and without any exaggeration is very near indeed to the standard of a good moving-coil instrument. Sensitivity, again, will be considerably above that of any ordinary moving coil, so that good results can be obtained on relatively small sets.

Just one warning. Do not build one of these special cones and expect it to give you high quality reproduction on a set giving a distorted output. It is still necessary, obviously, to use a power valve in your last stage, with plenty of H.T. and proper grid bias, and to take the normal precautions in the way of avoiding too much reaction, trying to handle a greater volume than your last valve can take without over-loading, and so on.

Always be on the alert, therefore, when you are adjusting volume, for signs of "blasting," breaking up of some of the notes, and so on. If you get anything of the sort, reduce the volume a trifle, and see whether it disappears. If it does, it was almost certainly due to overloading, probably of the last valve.

GIVE HIM A VALVE!



A valve makes an ideal Christmas present and is not difficult to choose.

By K. D. ROGERS.

I HAVE just been counting up the number of friends and relations I have, and to whom I have to give Christmas presents, and I find that at least eight are keen wireless fans. Furthermore, I am certain that seven, at least, out of the eight would far rather have something wireless than anything else.

A Difficult Problem.

Consequently, I am in rather a quandary as to what to give them, and I expect a good many of you have also got the same problems to solve; and in cases where you know of no particular preference for any special component or accessory, I expect you will solve yours in the same manner as I intend to solve mine. In other words, I expect you will give your friends valves in preference to anything else appertaining to radio.

After all, a valve is a very easy thing to choose and to give. It is easily sent by post, can be purchased at a price to suit every pocket, and is sure of a good reception at the other end, facts which cannot be said for every other piece of wireless apparatus.

Somehow one thinks of loud speakers when Christmas comes along, but from the point of view of wireless presents they are expensive, though in some cases undoubted pleasure givers.

But if you choose a loud speaker for any particular friend, and do not know the type of set he is putting it on, and what his views are concerning musical reproduction, you are just as likely as not to make a mistake, and it is quite possible that the loud speaker you have chosen will not suit his particular taste, though it be ever so efficient.

Other Components.

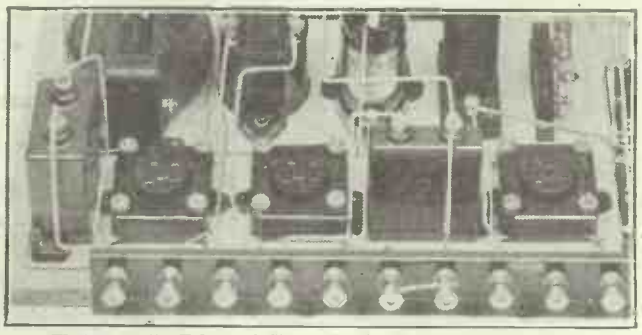
The same, of course, applies to mains units, batteries, and similar accessories, for quite a considerable knowledge of the receiver used is required to enable a suitable choice to be made.

In the case of smaller components, such as L.F. transformers, etc., these are handy for the enthusiastic set-builder, but your listener friend is rather more likely to let them lie on the shelf for a considerable time before being wanted, possibly getting out of date before he really requires them.

This is quite different in the case of the valve. Nobody is averse to "trying" another valve, and in cases where you know a set is being built specially for Christmas, and you know the type and feel a little more generous, perhaps, you can give a complete set of valves. Or you and one or two friends can combine to give a complete set of valves.

If you can find out all about your friend's set before you choose your valves, it will make it very much easier; but should you want the thing to come completely as a surprise, you can get along quite nicely by just knowing the filament voltage that he uses.

Here's Your Chance!



Waiting for the Valves—A Chance for the Christmas Present Giver.

Such a point can be found out by paying a visit on some pretext or other, and talking about the set, keeping your eyes open to see what he uses and, incidentally, what H.T. he employs and, more or less, what valves he has in stock. Then you can go away and choose a valve which will really suit his apparatus. This is not difficult if you bear one or two little points in mind.

There are one or two things to avoid, the main being that of giving him special valves, unless he has real need of them. For instance, a screened-grid valve, a pentode, or a mains valve might be quite useless to the average man; for these valves cannot be plugged into an ordinary set, but require a special outfit, with special wiring and layout, to accommodate them.

You cannot pull out your last valve or super-power valve, insert a pentode, and right away expect the best, because it is ten to one you will not get it. The pentode is an excellent valve when used properly, but it must be used properly in order to do itself justice.

The Best Choice.

Resistance-coupled valves and super-power valves also are only suitable for more or less special conditions, the former for resistance coupling or tuned anode H.F. or other circuits needing very high magnification valves, while for the super-power valves special H.T. batteries have to be considered. Do not forget this last point if you think of giving your friend an output valve. Remember that to use an output valve of anything large in calibre, you have to give it plenty of H.T. voltage and plenty of H.T. current.

As a general rule, you will find that a valve having an impedance of between 10,000 and 30,000 ohms is a good present, for this can be used as H.F., detector, first L.F., either transformer or resistance-coupled, with success.

The ordinary H.F. valve is perhaps the most generally useful of the lot, one having an impedance of something about 15,000 to 30,000 ohms. This can be used perfectly for H.F., perfectly as a detector and a really good first L.F. in a great many cases.

Bound to be Suitable.

So, in your Christmas presents this year, if you decide to give valves, bear these few points in mind, and if it is at all possible find out full details of what are required, then you can go ahead on more definite lines. But if you cannot find out, then do not make a blunder by giving a really unsuitable valve. Choose something which is bound to be suitable, and your present will be bound to be acceptable.

REGIONAL RUMOURS.

The position of relay-station listeners under the new Regional Scheme has caused a certain amount of anxiety, but the B.B.C.'s attitude is clearly outlined below.

By THE EDITOR.

THOSE of our readers living in the Sheffield district will be glad to know of the B.B.C.'s assurance that when the Regional station is erected on the Pennines, listeners in Sheffield and in the neighbourhood using reasonably efficient receiving sets, including crystal receivers, will be adequately served.

As is well known, it is the policy of the B.B.C. to continue the use of the Sheffield Relay station until the Regional station in the Pennines is in operation, about 1930. Even then, if it is discovered that the strength of signal reception in Sheffield from the new Regional station is not sufficiently adequate, the Relay station at Sheffield will be kept in operation.

Crystal Reception Guaranteed.

It was recently explained to the B.B.C. by a deputation that it was absolutely necessary to adequately serve the Sheffield area by continuing the use of the Sheffield Relay station, should the Regional transmitter prove insufficient. A good deal of alarm has been occasioned by the idea that crystal-set reception would be rendered useless under the B.B.C.'s proposed plans; but as a matter of fact the B.B.C. is well aware how popular crystal reception is in Sheffield, especially among the people who cannot afford to instal valve sets, and its attitude is one of sympathy and consideration.

The B.B.C. believes that efficient crystal sets will be quite adequate when the new Sheffield Regional station is in operation; and it must be remembered, of course, that when the Nottingham Station closed down thorough tests were made on crystal sets, and it was found that equally good results could be obtained from the Daventry experimental station as from the local station when it was working.

The Welsh Station.

The question of a wireless broadcasting station specially for North Wales has again been brought up by a meeting of the Flintshire Education Committee, and once again the B.B.C. has given its definite answer. The B.B.C. points out that in the last year or so it has had a great many communications from Wales on this question of a special broadcasting station. Although the B.B.C. would be pleased to erect a high-power station in North Wales, it is impossible for the Corporation to do so, for the fact remains that 300 or 400 broadcasting stations are now trying to operate on a wave-band which is really only adequate for about 100.

It is the British allocation of wavelengths that is the determining factor in the number of stations to be erected in this country; and because of this factor, the B.B.C.'s Regional high-power station scheme has had to be modified, for the simple reason that there are fewer wavelengths available now than was anticipated three years ago.

But the B.B.C. realises that North Wales cannot be served as adequately as had been hoped, though the high-power station in the south to replace the Cardiff Station will do a good deal, and the extension of service from Daventry 5 X X, and sometimes the new high-power station in North England, will also help.

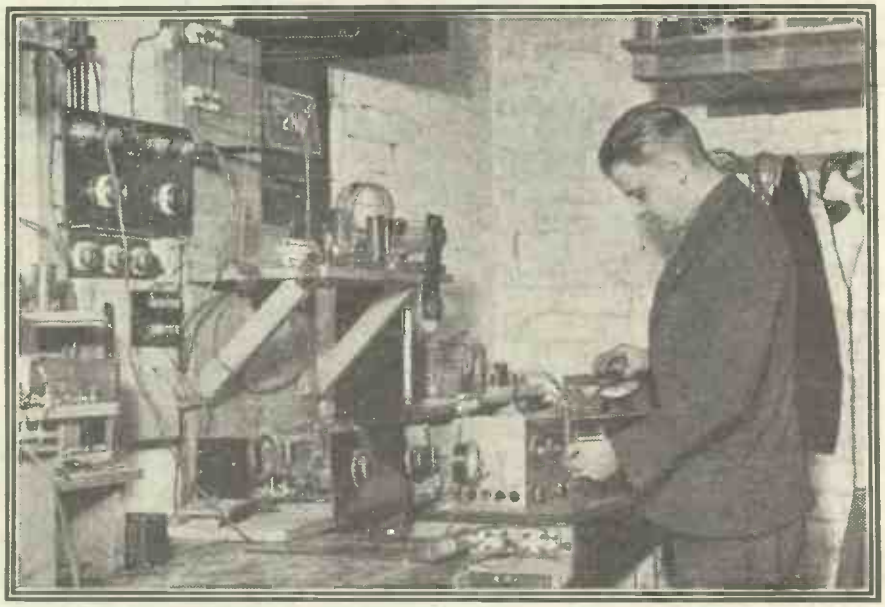
Nevertheless, however much sympathy may be with the Welsh Nationalists who want their own station, there is no getting away from the hard fact of the wave-length problem, and it is not quite fair adversely to judge the B.B.C. because it cannot do anything in the way of giving Wales its own station.

At the annual dinner of the Radio Manufacturers' Association, when Sir William Bull, M.P., was present, Captain Ian Fraser, M.P., during the course of his speech referred to the progress which had taken place in the wireless industry. He pointed out that in 1925 the imports of wireless apparatus and valves in this country was £790,000, while in 1927 the imports totalled £450,000, a drop of 40 per cent. In 1925 there were 1,500,000 licensees, while last year the figure reached was 2,525,000.

The export figures were not quite so happy, and he referred to the fact that the United States exported about £2,000,000 worth of wireless apparatus in each of the last few years; while Germany had increased her exports from £1,125,000 three years ago to over £2,000,000 at the present day. The British exports had remained more or less constant during those years at £1,250,000.

Sir William Bull, in proposing the toast of the B.B.C., said that during October last 21,561 new licences were taken out, as against 5,071 in October the previous year. The total number of wireless licences in force on October 31st last was 2,542,958, which represented an increase of 194,100 in twelve months, and he was also given to understand that the figures for November would reveal an even more substantial and satisfactory increase.

FAMOUS AUSTRALIAN AMATEUR STATION.



Some of the transmitting and receiving apparatus at 2NO, a well-known 23 and 42-metre station situated in Australia.

RADIO TECHNICALITIES.

As the value of the grid leak has an important effect upon reaction in a short-wave set, it is always advisable to try the effect of different values of grid leak if these are available.

* * *

If a green deposit is found to form upon the terminals of your accumulator, this can be removed with a solution of ordinary washing soda.

* * *

When refilling an accumulator, remember that no liquid should be spilled on the case.

If accumulator terminals are covered with a thin coating of petroleum jelly they will be completely protected from attack by the acid of the cell.

* * *

If empty cotton reels and camera spools are thrown into the tool box when they are available, it will be found that odd lengths of wire which would otherwise be thrown away can be wound upon these.

* * *

In the insulation of H.T. accumulators particular care is necessary, as the slightest leakage between adjacent rows will represent a continuous drain upon the battery.

* * *

An ordinary neutrodyne condenser connected in series with the aerial lead makes an excellent means of "loose coupling" the aerial for short-wave work.

RADIO—WORLD PEACEMAKER?

BY A. CORBETT SMITH

An arresting article that is particularly timely at this season of Peace and Goodwill to Men.

THEY have a saying in the Royal Navy that directly an officer gets transferred from service afloat to a job at the Admiralty he immediately becomes "a blithering idiot."

Well, we all know the Royal Navy, and we can take its picturesque language with a generous pinch of sea salt. But still, when you come to think of it, men who join up with the bureaucracy of Whitehall or Westminster do, in some odd fashion, seem to get dehumanised.

They become robots; they talk a queer jargon like "the answer is in the negative," instead of just saying "no"; they seem to lose all touch with human nature—as when they insist upon retaining "Dora"—and they come, like Lemuel Gulliver of the famous story, to view us poor, ordinary mortals as a race of invertebrate and brainless Houyhnhnms.

Here is the Prime Minister, for example, talking vaguely about "ordinary or common wireless." He actually goes so far as to venture the "belief" that, some day or other, it will become one of the greatest bonds between the peoples and so, by inference, the preventative of war upon the earth.

Now Mr. Baldwin, being at heart a real old English country squire, will take my meaning when I call this casual talk of his "hedging and ditching." The world lies under the dread shadow of another ghastly war liable to break out anywhere at any moment.

B.B.C. Leads The World.

It is a potential fact which, like a stone thrown into a pond, sends its waves lapping over every activity of our everyday life, business, and recreation. It accounts, in large measure, for the inactivity of Youth in these days. For they feel that creative work is not worth the effort. It is by far the biggest factor in the modern world.

Very well. It is, then, obviously an occasion for action and not talk. If the Prime Minister sees in radio even the germ of a possible preventative it is the simple duty of the Government to secure a "try out." We lesser mortals visualised it all six good years ago.

Our radio service leads the world in technical efficiency and æsthetic appeal. We could not desire a better instrument for the experiment. In charge, we have men of vision and ideals, even if they lack the practical knowledge for translating those ideals into effective action. With the whole country to choose from and with expense no object, there should be no difficulty in co-opting the right men of experience and action and the best brains in the country.

Let me emphasise this. I make no definite assertion that the B.B.C., co-operating with other countries, has it in its power to put an end to war by influencing public opinion. I say, only, that it is worth the trial to the limit of our capacity. For the "next war" can mean little else than the crash of European civilisation.

A recent portrait of the author—Mr. A. Corbett Smith.

As always we begin with two clean-cut lines of thought for our strategy, what is our objective, and how do we reach it? And here, at the start, is an obstacle. Clear thinking and clean planning are outside our national temperament. Instead, we improvise—superbly, I grant you—and muddle through. We must get over that in this specific case.

Assuming, for the moment, that Mr. Baldwin is right in his "belief," our objective is two-fold, our own people and the peoples of Europe. Each calls for a different line of approach. With the former we can almost apply "direct action"; with the latter it must be "indirect." With our own people we can go straight ahead just as we have done in effecting the music revolution, and just as we could easily win any other project of national importance—our national aviation, the public health, the unemployment problem, emigration, and so forth.

Get Busy!

But with other peoples the B.B.C. must first establish itself and win confidence. And mark this! It is already upon the way to doing so. Listeners all over Europe are aiming to take B.B.C. programmes in preference to their own, because they are of far better quality. Here, then, is the obvious line of development before we begin upon the Peace motive. The soil must be carefully prepared before the seed is sown.

I do not suggest that all this is as easy as falling off a log. I can see plenty of difficulties. But difficulties are the salt of life.

But there is this to be said. The B.B.C. cannot and will not create that "bond between the peoples" of the Prime Minister's vision by any methods of academic education. The professional educationalist is the greatest bar to progress. We are concerned with artistic creation. And, as Lady Oxford and Asquith lately observed, "On a matter of artistic taste don't put anyone associated with education on the committee; he is always smothered with ivy and virginia creeper."

For the rest, I am with Mr. Baldwin. Or I would be if only he would quit his "hedging" and come out into the open. I should like to hear that he had sent a New Year's greeting to Savoy Hill: "I believe that we can pull this matter through. Please get busy!"

And since this is a matter for action I shall invoke the spirit of our greatest man of action.

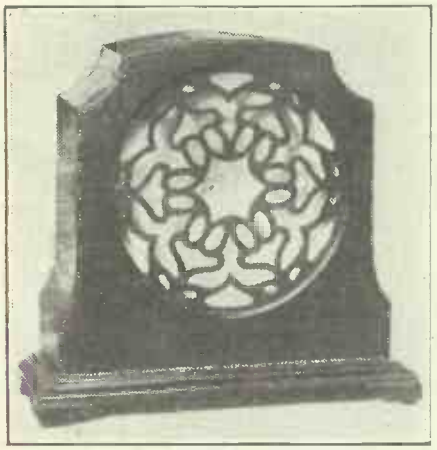
"The measure may be thought bold," said Nelson before one of his greatest victories, "but I am of opinion the boldest measures are the safest; and our country demands a most vigorous exertion of her force, directed with judgment."

FROM THE TECHNICAL EDITOR'S NOTE BOOK

"AMPLION" LOUD SPEAKER.

Messrs. Graham Amplion, Ltd., recently sent us one of their 1928–9 standard cone speakers, type A.C. 29. This instrument replaces a last-year's model, the A.C. 9, which retailed at £7. The new A.C. 29 sells at £5. And in their covering letter the Graham Amplion people suggest that "we think you will find, on test, at least (it is) as good, if not definitely superior to, our last year's model, the A.C. 9." The old A.C. 9 certainly was a very good speaker, and one thinks none the less of it when one finds the A.C. 29, as the makers anticipated, "as good, if not definitely superior."

When I first placed it on test, and I am now speaking of the new speaker, the A.C. 29, the first thing that struck me was its almost abnormal sensitivity. We have, in our test room, among many others, a loud speaker which is super-sensitive, although here, I personally think its virtues end. But the A.C. 29 was found to be equal in that sole quality. Another speaker switched in sounded almost "dead" against it and, for an ordinary cone speaker (by ordinary I am specifically excepting the moving-coil class), the reproduction of the A.C. 29 is exceptionally good.



The Amplion A.C.29 Loud Speaker.

It has little or no coloration, a fault which I might say with all friendliness was somewhat prominent with the earliest Amplions. Speech on the higher register is crisply clean and bass, and not false bass, is present in goodly proportion. It is the sort of speaker that 99 out of 100 radio enthusiasts could fit on to a set and be perfectly satisfied.

The hundredth would be a moving-coil fan looking for the deepest of bass notes, the sort of fan who, when he finds his bass, does so only to discover he has lost the higher register, starts off again to search for this among other moving-coil speakers, paralleled output valves, 500 volts H.T. etc., finally to give up in disgust and settle down to ordinary conditions such as are so well exemplified by the A.C. 29!

LINKS AND LEADS.

In our issue dated November 17th we published an article entitled as above. Inspired by this interesting contribution Messrs. Ward and Goldstone, Ltd., sent us a range of their own flexible cords designed for making rapid connections and, of course, for sale to amateurs. The leads seem to be every bit as good as those described in the article and have the advantage that they are fitted with the well-known Goltone clips and terminals.

Some have Quickgrip connectors at each end, others Quickgrip connectors at the one end and fork terminals at the other. And they are insulated and distinctively coloured. Having carefully examined the whole set one begins to wonder how we have been able to do without such useful things for so long! Messrs. Ward and Goldstone also sent us a sample five-way radio assembly of leads, made up especially by them for the new Cossor "Melody Maker" set. The assembly can be used equally well for other receivers.

RECENT CATALOGUES RECEIVED.

Two interesting publications were recently received from the General Electric Co., Ltd. The "Osram Wireless Guide" contains full details of the whole range of Osram valves, as well as much other useful data, such as mains unit operating notes, broadcasting station details, and so on. The Gecophone List of Radio Receivers and Gramophone Reproducers is a brightly-produced brochure as interesting as a big shop window.

From Claude Lyons, of Liverpool, two new publications are to hand. The one is a twenty-page gratis brochure which deals with ClarOstats. These are variable resistances having many applications and these are dealt with. The other Claude Lyons publication is a gratis four-page pamphlet entitled "Power," and this is descriptive of their new range of A.C. H.T. eliminators and "kits" for the home constructor.

FERRANTI MAINS UNITS.

Ferranti Ltd. recently sent us five of their new charts which fully describe the building of first-class H.T. Mains Units. The five types are all A.C. models of high-class design.

"BLUE SPOT" LOUD-SPEAKER UNIT.

Our Research and Construction Department seems to have had a lot of "Blue Spot" loud-speaker units in use lately, and I have watched the assembly of these and the various designs of semi-free edged cones with great interest. Also I have heard these assemblies in use in various cabinets and on various baffle boards, and I must say that the performances are, generally speaking, very impressive.

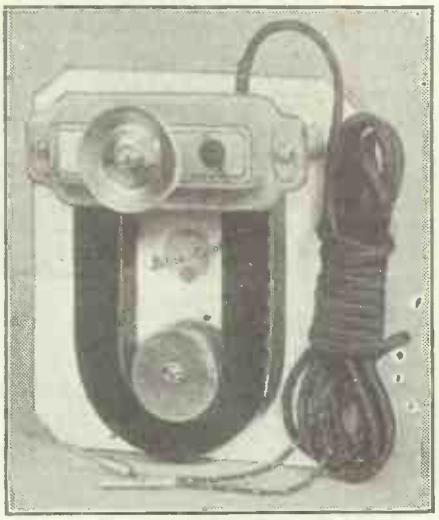
The 66 K four-pole balanced-armature unit, the one which retails at 25s., is one of the most sensitive I have come across, and its response can only be described as brilliant. The unit is, I believe, of continental origin, and it is handled by F. A. Hughes and Co., Ltd. (regular advertisers in "P.W."). It is not every amateur who can be so fortunate as to possess a moving-coil type of reproducer, but the many who cannot may gain comfort from the thought that a home-made speaker using the "Blue Spot" need fall very little short in results of those possible with a moving-coil instrument.

Traders and manufacturers are invited to submit radio sets, components and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality, under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

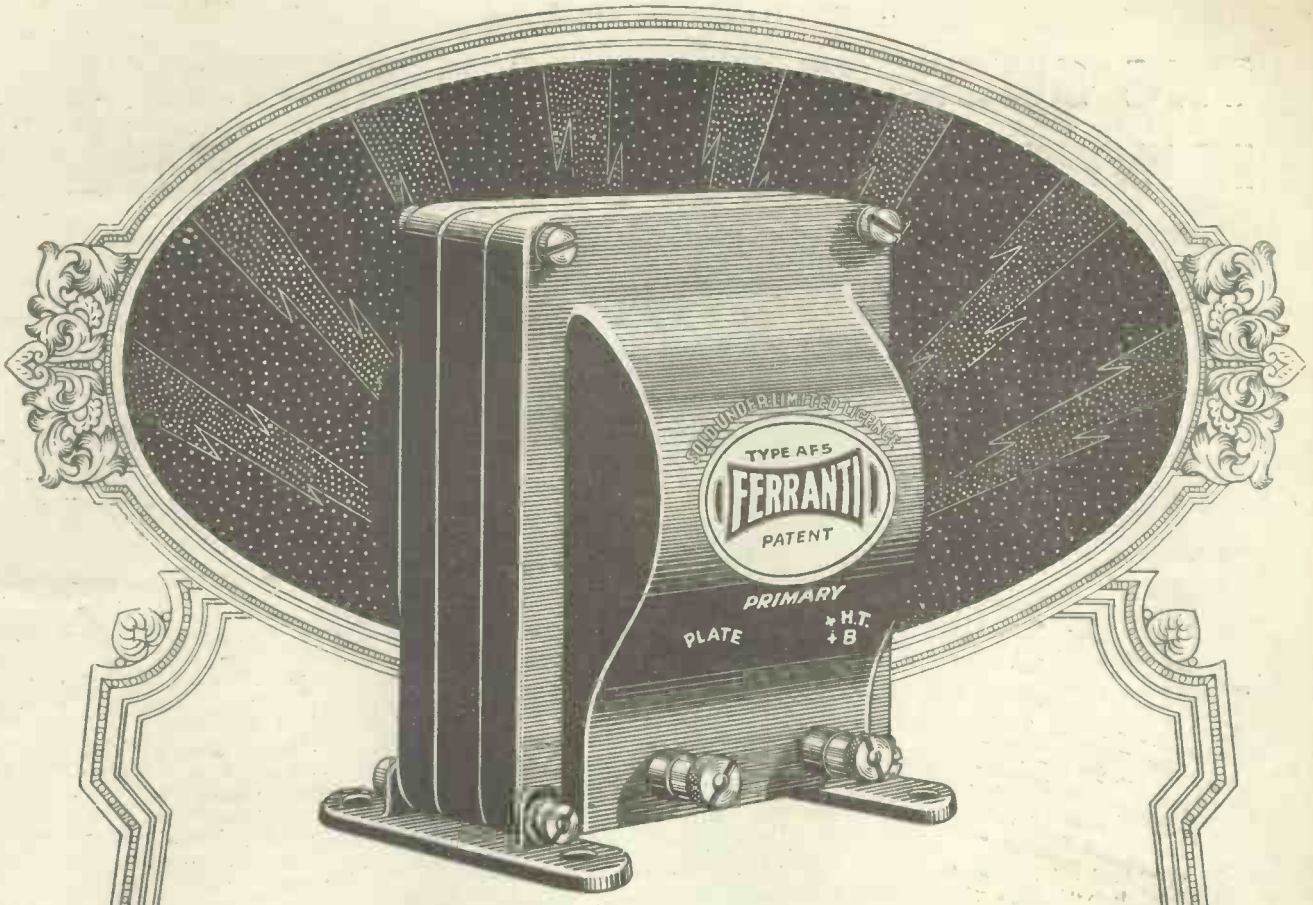
EXCELLENT CHRISTMAS GIFT.

There are still quite a few days left before Christmas is really upon us, so that there is yet time to purchase presents. I was reminded of this by the arrival of a "Sunray" Spotlight, Focusing Torch from A. H. Hunt, Ltd., of Croydon. It is not exactly radio, but it is an object most radio fans could find a real use for.

The torch is built on massive lines and the "Senior" model (price 10s 6d. complete) is a 3-cell model which carries a spare bulb. It gives a very brilliant light, and you can focus it, by means of an ingenious screw movement, until a parallel beam some hundreds of yards in length is emitted. The Hunt people have a whole range of torches and hand lamps.



A "Blue Spot" Loud Speaker Unit.



Radio is steadily improving. Transmission embodies greater skill and more efficient apparatus. Better components, better sets and more responsive speakers, with fuller knowledge of their proper use, ensure reception considerably in advance of that which satisfied not very long ago.

The Transformer plays a vital part in this advance. A good set must have a good Transformer.

The Ferranti AF5 is supreme and is the final choice of the experts.

PRICE 30/-

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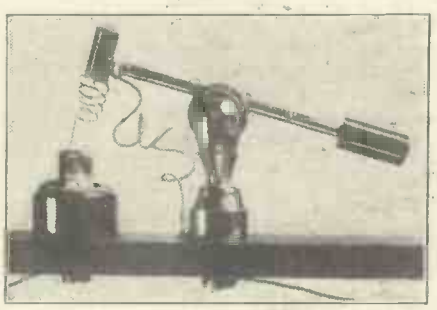
FERRANTI

A selection of short articles covering many subjects of especial interest to the home-constructor of radio receivers, contributed by various of "P.W.'s" well-known technicians.

A Crystal Detector Improvement.

CRYSTAL detectors which have been in use for one or two years often develop loose-contact troubles at the ball-and-socket joint of the cat's-whisker arm. It is, more often than not, very difficult to remedy effectively such troubles merely by compressing the area of the joint by means of a pair of pliers, because such compression can seldom be exerted evenly all round the joint, and, therefore, the result may be a joint which makes efficient contact at one part, and very bad contact at another.

The illustration, shown below, however, serves a purpose in depicting a ready means of recovering the pristine electrical efficiency



A crystal detector after "doctoring."

of a detector ball-and-socket joint which has been lost owing to wear and tear.

The photograph is really self-explanatory. A small piece of thin wire is neatly soldered at one end on to the end of the cat's-whisker arm, the wire being coiled loosely in order to allow for the extended movement of the detector arm, and then taken, by means of a tiny hole drilled in the panel, down to the screw which secures the upright arm of the detector. The wire is soldered, also, at this point.

Electrically Efficient.

By these means a rubbing contact of the detector arm will be avoided completely, thus giving to the detector a perfect degree of electrical efficiency. Moreover, this degree of efficiency will be absolutely permanent.

Another advantage of the scheme lies in the fact that if a little attention is paid to the precise manner of coiling the connecting piece of wire, the latter can be made to act as a sort of compensating spring which will serve to prevent the detector arm from being knocked or jerked off the sensitive spot on the face of the crystal. Thus, by the use of a few inches of wire, any of the more usual forms of cat's-whisker detectors can be given a perfect electrical efficiency, together with an extra amount of stability.

Aerial Soldering.

The soldering of aerial wires and out-of-door connections is bad enough even in the best of weathers, but on cold, damp, or windy days it becomes almost a physical impossibility to keep the soldering iron sufficiently hot, no matter how large this implement may be.

A better method of soldering under these adverse conditions is by the use of an alcohol torch, an illustration of the employment of which is given below.

Using the Torch.

Such an article is very simply made. All that it consists of is a piece of stout wire provided with some type of heat-insulating handle. The wire is pushed through a hole made centrally in a tin lid, and the upper end of the wire is curved so as to form a sort of hook on which a tuft of cotton-wool or of tow can be placed.

The hole in the lid is then carefully soldered up, after which the alcohol torch will be ready to use.

To employ the torch, pour a little ordinary methylated spirits into the lid, and pour a little, also, over the cotton-wool or tow on the end of the wire.

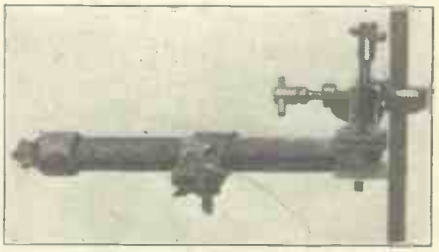
Having with flux prepared the wires to be connected, ignite the torch, and hold it under them. The torch will burn steadily with an exceedingly hot flame, and the operations of tinning and finally soldering can rapidly be performed.

This is how the home-made soldering torch is made.

A Ready-made Resistance.

Busy amateurs and experimenters who find themselves in need of a rheostat or resistance at a moment's notice, and who have no such article available, need not despair. As the photograph reproduced below shows, quite an excellent form of resistance can be made from a carbon rod obtained from an old dry battery of the larger type.

This carbon rod should be clamped securely in a horizontal or vertical position, either by placing it in a vice, or by any other readily-available means. Be sure, however, that the jaws of whatever type of clamp



Here is a variable resistance fixed up in accordance with the accompanying details.

is used are provided with a rubber covering in order to prevent any leakage of current.

An ordinary earth-clip is now attached to the carbon rod, its pressure being adjusted so that it provides a smoothly-working sliding contact along the rod.

Another lead is taken from the terminal at the upper end of the carbon rod, thus completing the circuit of the resistance.

Resistances of this nature are very readily made. They are reasonably constant, and they are not affected by atmospheric changes.

The total resistance of an ordinary bell-battery carbon rod of approximately 6 ins. in length is between 50 and 60 ohms, which value is amply sufficient for many purposes.

Increased by Heat.

Of course, any number of such resistances can be connected up in series for any special requirements, but for the average test-usage, it will be found that a single carbon resistance of this nature will suffice.

Finally, it may be of some interest to note that the resistance of the carbon rod can be increased considerably by heating a portion of it, a small gas or spirit lamp flame placed under one portion of the rod being sufficient in many instances to more than double its total resistance to direct current. Generally, of course, such a procedure will not be necessary.

(*Continued on next page.*)

FOR THE SET BUILDER.

(Continued from previous page.)

Celluloid Varnish.

It is a pity that the manifold advantages inherent in the use of celluloid varnish are not more known and appreciated by the general run of radio amateurs. When you come across an amateur using a varnish for the purpose of protecting metal work or insulating wires, you will nearly always find that the material used is that nasty, messy, sticky, mud-coloured substance which goes under the name of shellac varnish.

Now, celluloid varnish is a prefectly colourless liquid, and, on account of this fact, it can be used on the most delicate metal surfaces without any fear of discolouring the latter. Moreover, whereas ordinary shellac varnish takes generally hours to dry, celluloid varnish dries in a few minutes.

Celluloid varnish is not difficult to make. Procure from your local druggist a quantity of acetone and amyl acetate, or, if you prefer it, get him to make you a mixture of the two liquids in the proportion of 2 parts of acetone to 1 part of amyl acetate. For a shilling you ought to get sufficient of this mixed liquid solvent to fill a fair-sized bottle.

"Let every shred drop, as you cut it, into a bottle of the mixed solvents."

Next, take some *clean* celluloid—old photographic roll films, with the emulsion and gelatine cleaned off, make excellent material for this purpose—and cut it up into small shreds, letting each shred drop as you cut it into a bottle of the mixed solvents mentioned above.

Cheaply Prepared.

Put the cork in the bottle, and allow it to stand overnight. In the morning, most of the celluloid will have dissolved. If not, add a little more of the solvent, and shake vigorously. The actual thickness of the varnish can, of course, be varied at will according to the quantity of solvent or celluloid used. Aim, however, at preparing a varnish which will flow easily.

A single coat of celluloid varnish laid on the bright surface of a radio component or terminal will preserve the brightness of the article almost indefinitely. Note carefully, however, that celluloid varnish is a good insulator, and, therefore, do not allow it to get on the portions of the metalwork, such as the under-sides of terminals, at which actual electrical contact is accomplished.

For insulating and damp-proofing connecting wires, the varnish serves a very efficient purpose. Moreover, its presence does not increase the capacity of the wires to any appreciable extent.

And, finally, if you have a small screw which fits rather loosely in its hole, dip the screw in a little thick celluloid varnish, and then screw it home immediately. After five or ten minutes the varnish around the screw-thread will have set, and you will find that an excellent "grip" will have been obtained.

POTENTIOMETERS.

MOST amateurs are more or less acquainted with that instrument known as the potentiometer, and it is therefore interesting and instructive, to those who have not done any physics, to look at the laboratory version of this very useful little piece of apparatus, which most people seem to regard as a glorified rheostat, before discussing its use in radio.

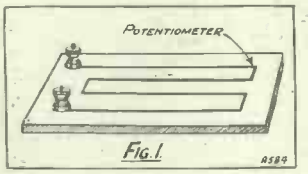


FIG. 1.

In the first place, in the laboratory the potentiometer is not the compact little circular resistance of the radio receiver, but is often 3 ft. long, it consisting of a length of wire screwed firmly to a board; the wire may be anything from 50 centimetres to 10 metres long, although when it is so long it is usually doubled back and forth on the board, as in Fig. 1, the ends being secured to terminals. This instrument has a variety of uses, for comparing the E.M.F.'s of cells, comparing resistances, measuring currents, the internal resistance of batteries, and very small potentials of the order of microvolts. The method is simple and all depends on the fact that there is a uniform fall of potential along a wire of constant cross-sectional area.

From the potentiometer we get the potential divider, which in its simplest form is a length of resistance wire (AB in Fig. 2a) across any source of potential. Various voltages may then be tapped off AB as shown. Obviously such an arrangement has a limited application, because in order to get a sufficiently great resistance the wire would necessarily have to be very long, and therefore a clumsy instrument would result. So the usual potential divider is a modification consisting of a number of fairly high resistance coils connected in series, or one large tapped coil (see Fig. 2b), the tappings being connected to a switch or other selector. Such a divider may be constructed for any E.M.F. by making the coils of sufficiently high resistance, and this form is very common in battery eliminators and other similar apparatus.

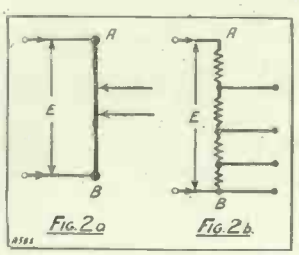


FIG. 2a FIG. 2b.

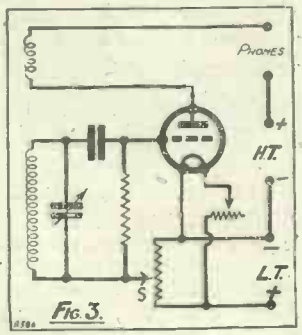


FIG. 3.

The so-called potentiometer used in radio is usually really a potential divider and is seldom employed as a true potentiometer, but whatever the correct designation it is an extremely useful instrument, which is not used as much as it might be. One of the oldest uses is as a provider of positive bias on the grid of a radio-frequency amplifying valve to prevent oscillation by damping: this was done by connecting the winding of the potentiometer, which is usually a circular affair of 200 to 400 ohms resistance, across the filament supply leads, the bottom of the grid circuit being connected to the sliding contact of the potentiometer.

Reaction Control.

This practice is now superseded by suitable neutralising arrangements, but a similar circuit can be advantageously employed in single-valve regenerative sets. A circuit diagram is given in Fig. 3. By varying the position of the contact S on the potentiometer it is often possible to eliminate "bumps" in oscillation control so that the valve glides smoothly into and out of oscillation, greatly facilitating the reception of telephony transmissions.

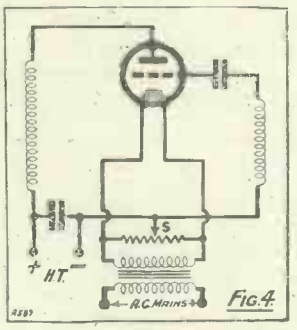


FIG. 4.

A modification of this use is shown in Fig. 4, where the potentiometer is employed as a means of finding the electrical centre of a valve filament operated off an A.C. transformer. Such an arrangement is often of use in a small transmitter, as in the example illustrated, or in H.T. eliminators when the transformer secondary lighting the filaments is not centre-tapped.

There are many similar uses for the potentiometer, chiefly for biasing purposes, but it is interesting to note that in none of these is the potentiometer used in its true sense, and when the radio experimenter handles the neat circle of ebonite and resistance wire that is his potentiometer he should remember the laboratory investigator with his cumbersome boards.

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

A TWO-VALVE SET FOR H.T. MAINS.

R. B. M. (Newbury Park, Essex).—"What I want is a two-valve set, capable of giving 2 L O and 5 G B at good strength, and if possible other stations as well. I have an accumulator, but as I have electric mains in the house I should be very glad to get rid of H.T. batteries and to take my H.T. from the mains. Can you tell me where I can get details of a good two-valve set of this kind which is driven from the mains?"

The best set for your purpose is the "Any-Mains Two," which was fully described in detail in the "P.W." Blue Print No. 50. The set comprises a compact detector and one L.F. stage for loud-speaker reception of the local station, and 'phone work over greater distances.

As 5 G B comes over well in your locality you will be able to receive this station also at good strength and the set is quite capable of putting even foreign stations on the loud speaker if conditions are extremely good. A complete H.T. battery eliminator is used and is built into the set, so the only external battery you need is the low-tension accumulator. Ordinary valves are used and are furnished with a constant supply of high tension, which never runs out and costs extremely little when once it is installed.

MICROPHONIC NOISES.

H. P. T. (Nuneaton, Warwickshire).—"Not having too much money to spend on the set, which is to be a Christmas present, I am making it from a number of old parts. Amongst my spares I have found two variable condensers and the three valve holders necessary, but one of the variable condensers is a little bit doubtful as regards its silkiness of movement, for it was in use for over two years.

"Should I use this for the reaction condenser or for the aerial-tuning condenser? (Both condensers are of the same capacity—·0005 mfd.) Similarly, two of the valve holders are of the old fixed type, and one is an "anti-microphonic" valve holder. The set is to be an H.F., Det., and L.F., and shall I be right if I put the anti-microphonic valve holder in

(*Continued on page* 856.)

METROVICATION

FOR ALL-ELECTRIC WIRELESS OPERATION

THE ALL ELECTRIC VALVE

If only valves would work without accumulators and without H.T. batteries!

Yet this is now actually possible with the Met-Vick All-Electric Valve which in combination with a suitable eliminator (like the Model 'B') enables everyone living in an electrically lit house to operate a wireless set straight off the mains like a lamp or other domestic appliance.

These amazing Met-Vick All-Electric Valves have solved the problem of mains operation. They are standardized by the leading set makers. They are so designed that they can be plugged into an existing battery set without altering the wiring, thus making conversion into an All-Electric set easy.

Met-Vick All-Electric Valves will improve a set out of all recognition. With these wonderful valves and All-Electric operation the H.T. never fades away, the L.T. is always just right.

Met-Vick All-Electric Valves are without doubt the most supremely successful valves obtainable.

Convenient hire purchase terms arranged if desired.

MET-VICK All-Electric Valves AC/G for all but last stage 15/-—AC/R last stage(power)—17/6.

Disc Adaptors, price 6d. enable MET-VICK All-Electric Valves to be fitted into existing Valve Holders.

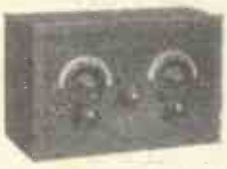
Fully descriptive illustrated literature and name of nearest dealer on request.

MET-VICK

VALVES-SETS-COMPONENTS

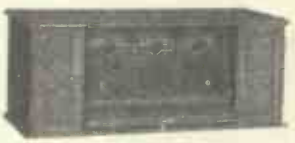
Metro-Vick Supplies Ltd., 155, Charing Cross Road, London, W.C.2.

The model "B" Eliminator connected to a wall plug or lamp socket provides heater current for the All-Electric Valves, five tappings for the H.T. supply, up to 180 volts 20 milliamps, and automatically regulated grid bias taps for the last stage. Price complete with Met-Vick Rectifying Valve for A.C. £8. For D.C. £7 2 6.



The Met-Vick 3 Valve All-Electric Mains Operated Set for Local, Daventry & many Continental Stations. The extremely high quality reproduction is a special feature. It is very suitable for new Regional Scheme. Price complete with Valves, coils and Royalties, A.C. £12 17 0. D.C. £13 8 0.

The Met-Vick 4 Valve All-Electric is called the "All Necessary Performance" set, one H.F. stage, low loss coils and condensers, loose coupled Tuned aerial, it gets anywhere and everywhere at Loud Speaker strength. Price, complete with Valves, coils and Royalties A.C. £17 14 6. D.C. £18 7 6.



Met-Vick 5 Valve All-Electric. More powerful, of course, than the Met-Vick 4. In beautiful cabinet with cupboards for L.T. and large size H.T. Eliminators, 220 volts 35 milliamps. For A.C. or D.C. supply price complete with all accessories, except Loud Speaker, and including Royalties. In Oak £47 9 0. In Mahogany £50 19 0.

For Constructors: This Met-Vick combined Transformer furnishes current for the Met-Vick indirectly heated Valves and for the Rectifying Valve in Eliminator. Price, any voltage £1 17 6.

R.V. 136.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 854.*)

the H.F. stage, as I assume any small vibrations of the filament here would be magnified in the rest of the set? (Please say which is the best way as I do not want to get it all done and then have to alter them.)"

The more important condenser is the *tuning* one, so we should use the good condenser for this, and the other one for reaction. If possible we should join a ·001 or similar capacity fixed condenser in series with the reaction condenser, so that should the latter accidentally short through being old you will not damage the battery or valves.

Regarding the best position to use the one anti-microphonic valve holder, the facts are not as you suppose. Theoretically, it is quite natural to suppose that the most important valve in the set from an anti-microphonic point of view is the H.F. valve, the signals from which, as you say, are magnified by both the other valves. But in practice it has been found that microphonic disturbances mostly arise in the *detector* valve and not in the H.F. stages. We advise you, therefore, to use the anti-microphonic valve holder for the middle valve in the set.

AN EASILY-MADE ERROR.

"CONSTRUCTOR" (Bucks).—"Measuring up without thinking, I accidentally drilled a 2 B.A. hole in the wrong end of the panel. I hoped that it would not show much, but now I have finished the set it is an eyesore to see this round big hole, which is constantly reminding me of my mistake. Is there any way of filling it up without showing?"

There are half a dozen different things which will give the necessary black filling for the hole, amongst those commonly used being black sealing wax, shoemakers' "heel-ball," and "Glitterwax," which is a modelling wax obtainable from any toyshop for a few pence.

ADDING BIAS TO CRYSTAL SET.

A. F. R. (Hunstanton).—"I like experimenting with different crystals, and up to the present I have not been very successful with carborundum, because I understand it needs 'an initial potential on the crystal before it reaches its most sensitive condition.'

"I have tried several ways of applying this initial bias with a battery, but so far it has made no difference to the signal strength, and apparently has run the battery down after a time. Can you tell me what the correct connections should be? I have a 500-ohm potentiometer on hand, and plenty of time to 'mess about' and make a good job of it, so if you could give me the point-to-point connections of a set incorporating this I should be very grateful."

A whole point-to-point description will not be necessary. Any crystal set will do, and the only re-wiring occurs in the crystal-telephone circuit. This circuit at present consists of the crystal and the telephone in series, one side of the crystal going to one end of the tuned circuit and the remaining side of the telephones going to the remaining side.

The two last-named circuit contacts should be left alone, the wiring alterations being carried out on the connection which joins the crystal to the telephones. The first thing to do is to disconnect this.

Then mount your potentiometer near to the crystal and arrange a lead from each end of it to the respective ends of the battery. This can be a small dry cell (4½ volts). It is a good plan to include a switch in this part of the circuit so that when the switch is "on" the potentiometer is connected to the battery, and when it is "off" this connection is broken.

This little extra circuit will, therefore, consist of—one end of the potentiometer to the switch, the other side of the switch to one of the battery terminals, the other battery terminal to the other end of the potentiometer winding. Now connect the arrangement to your crystal set as follows. Take the slider of the potentiometer to the vacant terminal of the crystal detector. Join one end of the potentiometer (it does not matter which) to the vacant telephone terminal. The wiring is now practically complete, but there are two things to remember.

If the telephones have a by-pass condenser, this can be left in circuit, and a similar by-pass condenser will be needed for the potentiometer. (This should be connected on one side to the slider of the potentiometer and on its other side to that end of the potentiometer which is connected to the telephones.)

You can use one single by-passing condenser for the whole arrangement by connecting it as follows: One side of the by-pass condenser to the slider of the potentiometer and the other side of the condenser to that side of the telephones which is *not* connected to the potentiometer. This completes the wiring.

If connected correctly it should be found that a fine adjustment is obtainable on the potentiometer, in which position the sensitivity of the crystal is increased. Below and above this position signals will fall away rapidly, so it is worth a little care to get it exactly right. Do not forget, however, that it may be necessary to reverse the battery, i.e. connect its positive to where the negative was formerly connected, and vice versa, before the correct bias is applied to the crystal.

(*Continued on page 858.*)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and 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.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 856.)

INTERFERENCE FROM OUTSIDE.

D. W. C. (Manchester).—"I get a lot of crackling and humming which I think must come from the power station or the electricity works, as, being a caretaker, I live right in the heart of a manufacturing district all the time. Is there any means of getting rid of this kind of interference?"

We are afraid that cases of interference from outside sources such as electric railways, tramway systems, power mains, electric motors, X-ray apparatus, etc., are extremely difficult to deal with, and in many cases it is impossible to effect a complete cure.

Sometimes, however, a certain measure of relief may be gained by one or more of the following expedients:

1. Use a counterpoise instead of a direct earth. (This should be as nearly as possible a replica of the aerial, erected at a height of ten or twelve feet, just as much care being taken over its insulation as over that of the aerial.)
2. Try a *different* earth, e.g. if you are using the water main, transfer to a buried plate, etc.
3. Connect a small fixed condenser of about ·0002 capacity between the earth terminal and the earth lead.
4. Use an indoor frame aerial and no earth.
5. Try aperiodic coupling.

CALIBRATING A WAVE-METER.

J. B. J. (Evesham, Worcs.).—"I have just purchased a wave-meter which I am told was built from a description which appeared in 'Modern Wireless' some time ago. It is of the heterodyne type, using a valve, and I should be very glad if you would tell me how to calibrate a wave-meter of this type."

The best method of calibration is to send the wave-meter to some firm which specialises in this class of work, and get it calibrated by comparison with a standard instrument used for that purpose. Failing this, it will be necessary to borrow a wave-meter and calibrate the new one against that.

To do this you will need an ordinary receiving set of the kind which can be made to oscillate if necessary, so as to transfer the readings from the borrowed instrument to the new one. (It is an advantage to transfer as many of the readings as possible, and then these can be worked out into graphs so that the dial settings for any wave-length can be determined at a glance.)

The method of taking the readings is as follows: Fix a short indoor aerial to the receiving set and get it into a state of liveliness. Then set the borrowed meter for, say, 400 metres, and tune to the receiver until you can pick up the radiations from the borrowed meter. If the borrowed one is of the buzzer type keep it well away from the little receiving aerial, so that you can only hear the buzz when the set is accurately adjusted to the wave-length in question.

Then switch the wave-meter off and turn the dial of the new heterodyne wave-meter until you are able to hear a chirp in the receiving set, indicating that the heterodyne wave-meter is now tuned to the same wave-length as the buzzer wave-meter previously heard. (If the borrowed wave-meter is of the heterodyne type, too, you will receive not a buzz but a sort of carrier-wave, and this must be "resolved" in just the same way as a carrier-wave from a broadcasting station would be.)

In this way you can pick up on the receiving set the exact wave-length emitted by the borrowed wave-meter, and transfer corresponding dial readings to the new instrument. By the way, if the wave-meter used for comparison is of the buzzer type, it will be necessary to keep the receiving set oscillating just a little when picking up the readings, or otherwise it will not be possible to hear the chirp which is given by the heterodyne wave-meter when this instrument comes into tune with the receiver.

FITTING GRID BIAS TO A BLUE-PRINT CIRCUIT.

"SELLY OAKITE" (Selly Oak, Birmingham).—"I have been using the 'P.W.' Blue-Print circuit No. 11—det., L.F.—for the past two years, and I want you, please, to let me know how to fit grid bias to the low-frequency valve."

If you examine the connections to the low-frequency transformer you will find that one of the leads goes from the secondary to the grid socket of the second valve holder, and the other lead from the secondary goes to the L.T. negative wiring. This latter lead should be removed, and a grid-bias battery is inserted in its place.

You will need a tapped grid-bias battery (4½ volts maximum for small power valve or 9 volts if specified by valve-makers), and into this must be fitted two plugs, one red and one black, attached to flexible leads. The red is attached to a lead which is fitted at its other end to the low-tension negative terminal, or to any wiring directly connected to this.

The black grid-bias plug is fitted on a flexible lead, the other end of which is attached to the now unoccupied secondary of the low-frequency transformer. (Not the one that goes to grid, but the one from which the wire was removed.) The grid-bias battery can be stood at any convenient point inside the set, and the length of the leads are determined by the position of the battery, as they should be of just sufficient length to permit of adjustment.

The red plug should be put into the positive end of the grid-bias battery, and the black plug should then be fitted into the 1½-volt tapping, 3, 4½, etc., sockets to determine in which position it will give the best results. You will find that a change in the high-tension voltage will generally mean a corresponding change in the grid-bias negative voltage, and conversely the addition of grid bias will enable you to use more high-tension and to get better results than you have been able to do previously.

MAKING A POTENTIOMETER.

I. E. E. W. (Harringay, London, N.).—"I am especially fond of trying to make my own components, and I should like to have a go at a potentiometer. It is of the ordinary kind for controlling the potential on the grid of the detector valve for short-wave work, and I suppose it will be best to have a resistance of 400 ohms.

"I have a suitable former and slider arrangement, which I can adapt, I think. I am in a little difficulty, however, as regards the wire. I should like to use the proper Eureka resistance wire, but I do not know how much to purchase nor what size. The former I have has previously been used for fine wire, which looks like No. 40 or thereabouts, but I do not want to get No. 40 Eureka unless this is O.K.

"What size do you think I ought to use, and how much of it will be required to give a resistance of 400 or 500 ohms? Also, is it possible to get an idea of the thickness of the wire, or, rather, the length on the former which it will occupy?"

As the potentiometer is not fundamentally required to carry current, but merely passes a small amount (due to the fact that it is connected as a resistance across the low-tension battery), you will be able to use quite a fine wire. We do not recommend, however, quite such a fine wire as No. 40, and this is always difficult to work, and we think you will find No. 36 more satisfactory.

Reference to a wire table shows that the resistance of No. 36 S.W.G. Eureka is 14·84 ohms per yard. The length of the wire required for the given resistance therefore equals the total number of ohms divided by 14·8, the answer being in yards. For instance, if you decide on 450 ohms, and divide this by 14·8, you will get the answer 30·4, which is the number of yards of this particular kind of Eureka required to give a resistance of 450 ohms.

From the wire table also can be worked out the exact length of the former which will be occupied by a winding of any given circumference, as the diameter of the wire is always obtainable from the wire table, and the total number of turns of this wire will be equal to the total length of the wire divided by the circumference of the former. It is therefore an easy matter to find out how much room the wire will take when its diameter is known, and as a guide it may be mentioned that usually about 90 turns of No. 36 Eureka are spaced to the inch.

THAT "PENTODE" THREE.

E. F. E. (London, N.).—"I built that 'Pentode' Three, and, my goodness, what a set! You'll laugh when I say there is only one thing I want to know—how to cut down volume! If I detune in comes another station, also loud and strong, so what am I to do?"

You could, if desired, fit a volume control, as often described (particulars of various ways are obtainable from the Query Department). If, however, you would prefer not to go to this expense, try "double detuning." That is to say, if you want to hear 5 G.B, but he is too loud, adjust the aerial condenser a little *above* 5 G B's setting, and the H.F. tuning a little *below* it. If both were tuned *above* you would probably bring in, say, Vienna, but by keeping one "up" and the other "down" you should be able to get the required volume from any given station without interference.

RADIO PICTURES FROM BERLIN.

"PICTURES" (Lincoln).—"Are any of the continental stations following 5 X X's example and sending out radio pictures on long waves? If so, what are the times of transmitting?"

(*Continued on page* 860.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 858.)

The Königswusterhausen, Berlin, station has recently inaugurated a series of picture transmissions at the following times (G.M.T.). Sunday, 12.45 to 1.30 p.m. Monday, Wednesday, Thursday and Saturday, 12.45 to 1.15 p.m. Tuesday, 9.45 to 10.15 p.m. Friday, 9.45 to 10.15 p.m.

MILLIAMMETER MEASUREMENTS.

G. C. L. (Newcastle-on-Tyne).—"How is it that a milliammeter which can only measure from 0 to 5 milliamps will, when provided with a 'shunt,' measure from 0 to 50 milliamps? What is inside the shunt?"

The shunt is merely a resistance made of high quality material, which is connected in parallel with a milliammeter or similar instrument. The windings of the milliammeter have themselves a certain amount of resistance, so that when another resistance is placed in parallel with this it provides an alternative path for any current flowing in the circuit. That is to say, as much of the current flowing as is desired can be shunted through an alternative path, and this fact gives the additional "shunt" its name.

The resistance of a good measuring instrument, such as a milliammeter, is necessarily high, so that when a comparatively low resistance shunt is placed across it, most of the current flowing in the circuit will go through the shunt, and only a small proportion will find its way to the measuring instrument. By providing carefully matched shunts with different resistance values, the proportion of the total current carried by the milliammeter can be varied, and thus it is that such an instrument provided with a shunt of known value can measure either amperes or milliamperes, according to the shunt with which it is provided and to the other circuit conditions.

L.T. AND A CHRISTMAS TREE.

H. R. W. (Longton).—"Will it hurt the L.T. battery if I use it to light up the Christmas tree? I have a number of ordinary flashlamp bulbs on hand which I intend to fit up with neat green-coloured wire, one wire being soldered to the lamp's end contact, and the other to its base. I thought that if I then joined two wires to the accumulator and connect up one of the wires from each flashlamp to respective leads from the accumulator, the latter would then light up the Christmas tree. (It is a 4-volt accumulator.)

"Would it work all right while the set was on at the same time, and would it be perfectly safe?"

The scheme is a perfectly sound one as outlined by you, and if you put a switch in one of the leads connected to the accumulator, you can switch off the illuminations when necessary.

MODERN WIRELESS XMAS NUMBER.

Dear Sir,

May I take this opportunity of congratulating you on the uniform excellence of "Modern Wireless," and the very varied interest of the matter therein.

Yours faithfully,
THE MARCONIPHONE COMPANY LIMITED,
C. S. Agate, Chief Engineer.

It is perfectly safe, if you take care to keep the wires from each side of the accumulator well separated from one another, and remember that the insulation covering the wires must not under any circumstances be scraped off so that two different wires come accidentally in contact with each other. It is well worth going to a little trouble to make the job a good sound one, as if this is done you will have no fears when the youngsters get a bit lively, as they are bound to do. We hope the whole affair will be a "brilliant" success!

THE "BANDMASTER'S" SPEECH.

O. C. (Everton, Liverpool).—"I built the 'Bandmaster' from the blue print you gave away on October 20th in 'P.W.' It is a

(*Continued on page* 862.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 860.)

beautiful set, and in fact I am so pleased with it that I am in a bit of a difficulty.

"My son, who is home for the holidays, wants to undo two of the transformer leads and connect a flexible wire to it, the idea being to place a loud speaker at the other end of this wire and, by talking into it, to get the main loud speaker to reproduce his voice! He is very keen to try, but I do not like undoing the set unless it is absolutely successful, so I promised to write and ask you if there was any objection to it."

There is no reason why you should not use the extra loud speaker as a microphone in this way and have a good deal of fun with it. You must, of course, be careful not to cross or touch any of the wiring, in such a way as to short the battery or burn out valves, but with ordinary care there is no fear of this.

There is no need to undo *both* of the primary terminals of the transformer, simply undo the one which goes to the plate of the valve, and then place one of the leads from the "microphone" speaker on this terminal, and the other lead on the other terminal. (If the permanent lead is bent back gently out of place, it can easily be put back in place when the stunt is finished, and the set will carry on as before no worse for its Christmas frivolities.)

From One Set to Another.

A. M. D. (Macclesfield, Cheshire).—"I should like your opinion upon a rather remarkable peculiarity which I have experienced. To start with, I have a three-valve set using 6-pin coils, and this set is situated in the dining-room. Just recently I have built a one-valve edition of this set, i.e. the first stage, detector, and I am using this in my bedroom. A second aerial and earth is used, but the two aerials are very close to each other. The funny part about it is this. When the one-valve set is completely switched off and I rotate the condensers on it, terrible whistles and oscillations come through the speaker on the three-valve set (which is, of course, switched on). I might also mention that when I have tuned in a foreign station on the one-valve set, and leaving it tuned but switching the set off, I cannot get the three-valve set to react about ten degrees either side of the same station. Why is that?"

The phenomenon that you have noticed is an interesting one. It depends upon the fact that when current is flowing in a tuned circuit and another circuit is placed near (i.e. coupled to it), there will be a maximum transference of energy from one circuit to the other, when the two circuits are in tune with each other. When you tune in a foreign station on the one-valver, even although the set is switched off, the tuned circuit is still there, and it is coupled to the three-valve set by means of the adjacent aerial. When you go to work the three-valve set, you will find it behaves normally on all other wavelengths, because very little energy is being drawn into the one-valve set from the three-valve set. But as soon as you adjust the three-valve set to the same or nearly the same wave-length, energy begins to pass easily across from one set to the other, and consequently even with full reaction the three-valve set cannot be made to oscillate, because so much energy is drawn from it into the one-valve set.

The howls and whistles are due to the same cause (i.e. interaction between the two tuned circuits), and your experiences will be of interest to other readers, because they show how easily tuned circuits act and interact across space when the aerials connected to them are close together.

SPECIAL CHRISTMAS NUMBER—

"MODERN WIRELESS"?

7th December, 1928.

My Dear Editor,

This is an excellent number—I wrote in it!

Yours sincerely,

Savoy Hill, P. P. Eckersley.
London, W.C.2.

RADIO AND CHRISTMAS.

(Continued from page 829.)

I have just been told of a saying which epitomises my feelings, for a friend remarked that "the bells ring all the year round, but we only hear them at Christmas." That may or may not be a quotation, but that does not matter. It remains a striking truth. I know it is a hard thing to expect, and I have said it elsewhere, but it seems to me that the fundamental message of Christmas is that there *is* goodwill among men, and that we should extend that goodwill in all our dealings and in all our ways of life. It strikes me as so churlish to rejoice for twenty-four hours, and to grumble and question and backbite our neighbour for the rest of the year.

I think I can say that I am as fond of musical chairs as you are, and for heaven's sake don't take it that I am suggesting that you should spend your Christmas in solemn meditation. I am sure, in fact, that you will do nothing of the sort.

Real Enthusiasm.

You will come down to breakfast and be in raptures over the penwiper which your little daughter has made for you, just as I shall; you will welcome the turkey and the flaming pudding with a shout nearly as loud as mine.

You will forget the intricacies of the Stock Exchange as you collapse on the floor with the whole chain of oranges and lemons on top of you.

And you will go to bed with as warm a glow of happiness in your heart after another wonderful Christmas day as any man in the world.

That is as it should be. I only know that personally I am going to try—no doubt I shall fail—but I am going to try to prolong the spirit of this Christmas into the coming year. I am going to imagine that the feeling of goodwill which comes to me on Christmas morning is composed of waves just as real as those which circle the world from 2 L O, and that from now on, as far as I am concerned, I shall attempt to maintain a continuous broadcast. And if we could make it a simultaneous broadcast, relayed to all stations, then Christmas will indeed have been worth while.

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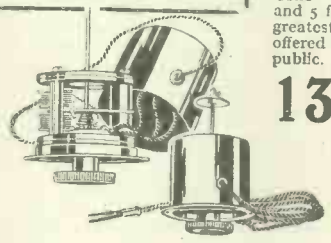

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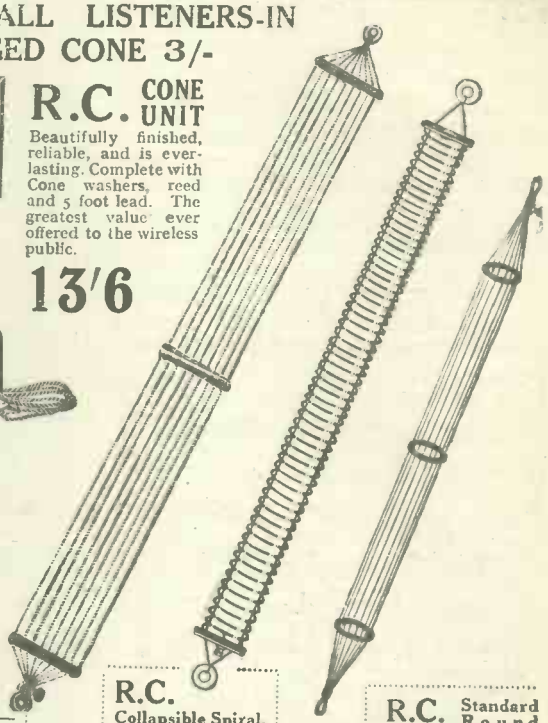

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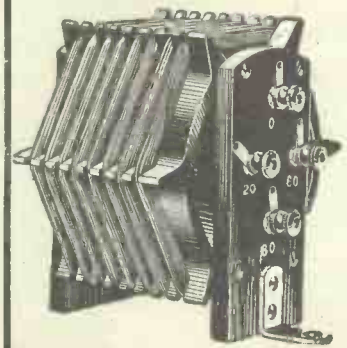

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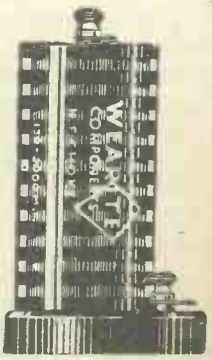

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VALVES WITHOUT CURVES.

(*Continued from page 838.*)

the former, and thus might furnish louder signals when these were handed on to another valve, its plate *current* changes would be relatively very small, and the valve would be unable to supply sufficient power directly to a loud speaker to give good results.

It is thus desirable that the impedance of a valve should be as low as possible, but unfortunately a low impedance is inseparable from a low amplification factor. What is required, therefore, is a valve with as high an amplification factor as possible, consistent with a low impedance and the capacity to deal with a large input.

The "Slope of a Valve."

Consequently, a figure which gives a very good idea of the merits of a valve is the ratio of amplification factor to impedance. This ratio, multiplied by 1,000, is usually given by valve makers under the name of "mutual conductance," or "slope." As an example, a valve with an impedance of 6,000 and an amplification factor of 6 would have a mutual conductance of

$$\frac{6}{6{,}000} \times 1{,}000 = 1.$$

This value, 1, is a useful figure for a good power valve, but in the case of higher amplification valves, 0·5 is a common value.

From the foregoing we may say that the following considerations should be borne in mind when selecting a valve:

If the valve is required for use in the last stage to operate a loud speaker, a power valve is required, and the choice of this should be governed largely by what experience shows to be the grid bias necessary for the volume likely to be required.

As a rough guide, 9 volts may be taken to be the bias necessary for medium loud-speaker results, at least twice this voltage being advisable for really good results on a hornless speaker.

Having decided upon a valve capable of taking the grid bias required, there

(*Continued on page 868.*)

VALVES WITHOUT CURVES.

(Continued from page 866.)

will not be many types available, but preference should be given to the valve with the highest ratio of amplification factor to impedance.

For other low-frequency valves, followed by transformer coupling, the sames rules apply, but in this case a smaller grid bias can be employed, allowing the use of a valve with higher impedance and higher amplification factor.

Unless the receiver is within five or six miles of a B.B.C. main station or several H.F. amplifying stages are employed, a valve biased with 3-6 volts is usually suitable for the first L.F. stage, the following stage being occupied by a power valve.

If very strong signals are dealt with by the detector valve, a small power valve may be required in the first stage, the following valve being biased with about 25 volts.

In the case of resistance-capacity coupling, however, for either a first stage L.F. amplifier or anode-bend detector, high amplification and relatively low impedance are essential features.

A high amplification factor is desirable because no voltage step-up is obtained in the intervalve coupling as is the case when a transformer is employed.

Most valve manufacturers now make valves specially designed for resistance-capacity coupling, but it should be remembered that if the valve is used for low-frequency amplification after one or two H.F. stages, a grid bias of 1½ volts or more might be required, and a valve of the "H.F." type, with a voltage magnification of about 20, would be more suitable than a "resistance-capacity" valve giving an amplification of, say 35, and only capable of dealing with a signal strength of 1 volt or less.

It is hoped that the foregoing will have made it clear that when a new valve is required, it is of much more importance to select the right *type* of valve than it is to select a particular *make*.

Watch the valve characteristic figures, and do not worry too much about the name on the Box.

THE "SHORT-WAVE" TWO

(Continued from page 833.)

amateur signals in the 40- and 45-metre wave-bands should be heard. There is also a very strong German telephony station which should be found at about 70 degrees on the main dial. When the set was on test in Tallis House, under extremely adverse conditions, this station was received at good loud-speaker strength during the morning.

Eindhoven, 2 X A F, and the other stations operating in the neighbourhood of 30–32 metres, will be found near the bottom of the dial.

Inserting the other coil (the 5-turn coil marked "16–29 metres") and placing the clip at the centre turn (i.e. three turns up from the right-hand end) the 20-metre band of stations will be heard if a suitable time is chosen, and 2 X A D (21·96 metres) should be found at about 45 degrees on the condenser at any time after 9 p.m. or so.

Numerous other short-wave broadcasting stations will also be heard towards the bottom of the dial when this coil is in use. I have derived considerable amusement from listening to the transatlantic telephone on about 16 metres on occasions!

Usually 2 X A D is received by 10.30 p.m. at just such a strength in the 'phones that one automatically detunes the set slightly for comfort. 2 X A F and 5 S W are about equal in strength and both slightly weaker than 2 X A D. 3 L O (Melbourne) has been heard often at ample 'phone strength, and has twice been put on the speaker.

With regard to "DX" reception of amateur C.W., some sixty Australian and New Zealand stations have been logged within a few weeks, as have also stations in Argentine, Indo-China, Straits Settlements, Hawaii and others.

On Broadcast Wavelengths.

Broadcast reception is simply a matter of inserting the "broadcast adaptor" in the coil-holder, plugging suitable coils into the top of the adaptor, and listening round! With a No. 30 aerial coil, 60 secondary and 35 reaction, and, of course, the condenser clip now directly on the wire joining the grid condenser to the coil, the normal broadcast band of wave-lengths is covered.

5 G B is, in London, received at ample loud-speaker strength, and Langenberg, Stuttgart and the usual foreigners can always be understood perfectly on the speaker. Selectivity seems distinctly good, particularly if the coupling of the aerial coil is slackened off a little. Even with tight coupling, however, London, at seven miles, occupies but twelve degrees or so of the dial.

With larger coils Hilversum was, on one night, received at strength almost equal to that of 2 L O, while 5 X X and Radio-Paris have also been heard frequently. There is, of course, practically no limit to the wave-length range of the set, and a smaller coil is being made for 8 and 10-metre work. If a range of 8 to 18,000 metres can be covered I shall begin to think that the "all-wave" sets previously published have been somewhat inadequate.

The somewhat unusual values for grid condenser and leak do not seem at all unsuitable for the long-wave side of the set, although it was anticipated that trouble would arise in this connection. They certainly give best reaction control and a quieter background on the short-wave side.

TECHNICAL NOTES.

(Continued from page 830.)

Multiple Earths.

Some experimenters who go in for refinements actually use a series of different earth systems, with a selector switch arranged so that any particular earth or combination of earths may be used for distant reception. Of course, there is practically nothing to beat a good low-resistance connection, with a clean, properly-soldered joint, to the cold-water supply pipe.

Automatic Switching.

The Americans have been for some time past using automatic switching units for operating the receiver, and switching the H.T. eliminators and L.T. battery on and off the set, and on and off charge. There are now several of these units on the American market, some of them being most ingenious and adapted to do almost anything (except *think !*).

A British Model.

I was interested to hear some little time ago from the B.T.H. Co. details of their power-control switch (this is now advertised) which strikes me as an excellent unit and very reasonable in price, considering all it does.

When the unit is switched on for receiver operation it connects the H.T. eliminator to the lighting circuit, disconnects the trickle-charger from the lighting circuit, connects the L.T. battery to the set, and disconnects the L.T. battery from the trickle-charger. When the unit is switched off—that is, when the receiver is out of operation, the unit disconnects the H.T. eliminator from the lighting circuit, connects the trickle-charger to the lighting circuit, disconnects the L.T. battery from the set and connects the L.T. battery to the trickle-charger.

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THE "P.W." "WHITE PRINTS."

White Print No. 3. :: :: A High-Efficiency Three-Valver.

This week we publish the third of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the White Print filed. In due course you will thus have available an encyclopædic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

IF you want a really adequate loud-speaker set which will give you good volume on the local, even if you are well out in the suburbs, a reserve of power on 5 G B, and plenty of foreigners on the speaker, an "H.F., Det., and L.F." combination is hard to beat. It may be a little less simple to make and operate than the "Det. and 2 L.F." type, but is usually a good deal more sensitive, and is therefore generally preferred for long-distance work. It is particularly desirable, of course, where the aerial is not very efficient or local conditions are bad for any other reason.

Efficient Screening.

This week's White Print design is a particularly efficient receiver of this type, using ordinary valves and components, with a specially good system of screening which ensures very high sensitivity and selectivity and perfect stability, provided that good components are used. The H.F. valve is neutralised, the coupling device being a standard 6-pin type split-primary transformer.

The aerial tuning inductance is another 6-pin coil of the type called a "split-primary aerial coil," and you will require two of each of these units, one pair for the lower wave-band and another pair for the long waves. The detector valve is the usual grid condenser and leak type, with condenser-controlled reaction, and this is coupled to the last valve with an ordinary L.F. transformer.

The special feature of the set is the method of screening and mounting the coils, which is exactly the same as that used in the "Fanfare" Five and various other successful designs. A plain, vertical screen similar to our standard ready-cut type is used, and to each side of this wooden face-pieces are screwed, a suitable thickness being ⅜ in. for the wood. These pieces are fitted to provide a surface to which the coil bases can be screwed, and you should note the position for these latter rather carefully.

Coil Mountings.

Just one or two other points about the constructional work; first, observe that it was not possible to show every connection to the coil sockets, so some of the leads are numbered to indicate the points on the bases to which they go. Also, mount each holder so that the No. 1 socket of each coil base should come at the top.

Be careful to note, also, the various points at which actual connection is made to the screen itself. These connections are easily made by means of the nuts and screws provided for the purpose with the screen. These are to be inserted at suitable points in the perforations across the lower edge of the screen. (NOTE: These would actually be hidden in a true plan view by the wooden face-pieces above, but in the wiring diagram the draughtsman has shown them as though the wood were transparent for the sake of clearness.) One other point: the 2-mfd. H.T. reservoir condenser is screwed direct to the wooden face-pieces of the screen, and so lies horizontally out of the way of the coil.

COMPONENTS AND MATERIALS.

- **1 Panel 14 in. × 7 in. × ¼ in. or 3/16 in.**
- **1 Cabinet to fit with baseboard 12 in. deep.**
- **2 ·0005 mfd. variable condensers, slow motion or with vernier dials.**
- **1 ·0001 or ·00015 mfd. reaction condenser.**
- **1 L.T. switch.**
- **3 Sprung valve holders.**
- **2 6-pin coil bases.**
- **3 Filament rheostats or resistors to suit valves.**
- **1 Neutralising condenser.**
- **1 L.F. transformer.**
- **1 H.F. choke.**
- **1 ·0003 and one ·002 mfd. fixed condenser.**
- **1 2 mfd. condenser.**
- **1 2-meg. grid leak and holder.**
- **1 Copper or aluminium screen, 12 in. × 6 in., and two pieces of wood about 12 in. × 5 in.**
- **1 Terminal strip, 12 in. × 2 in. or 14 in. × 2 in., according to slot in cabinet.**
- **9 Terminals.**
- **Tapping clip, wire, flex, screws, etc.**

The necessary operating data for the finished set follow, and you should find it a very simple one to get going properly. The first two valves should be of the H.F. type (impedance 20,000 to 30,000 or thereabouts), either 2- or 6-volters, and in the last socket a power-valve should be used if proper loud-speaker quality is desired.

The H.T. voltages are just the standard ones of about 60 volts on H.T. +1 (for the detector) and all you have, say 100 or 120, on H.T. + 2, which feeds the H.F. and L.F. valves. Grid bias on the last valve will usually be about 6 volts, but this, of course, depends on the particular valve and H.T.

Neutralising is particularly easy with this set, and you can either switch off the H.F. valve filaments at the rheostat and use the silent point method or (and this is generally better) carry out the "reaction demands" scheme.

This is the procedure: Set the reaction control at minimum and likewise the neutralising condenser. Now, on setting the tuning condensers so that the two tuned circuits are in step with each other it will probably be found that the set is oscillating. To test for oscillation touch the fixed plates of the tuning condensers.

A Useful Indication.

You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other, and this can be used as an indication. It is convenient to perform the operation at some point near the middle of the tuning range. Now, increase the capacity of the neutralising condenser.

Test at intervals for oscillation, as this is done, and you will presently find that the set has ceased to oscillate and will not recommence even when the tuning dials are slightly readjusted. Now increase the reaction a little, until the set once more oscillates, and again increase the neutralising condenser setting until oscillation ceases. Slightly readjust the tuning condensers again to make sure that the set is completely stable once more.

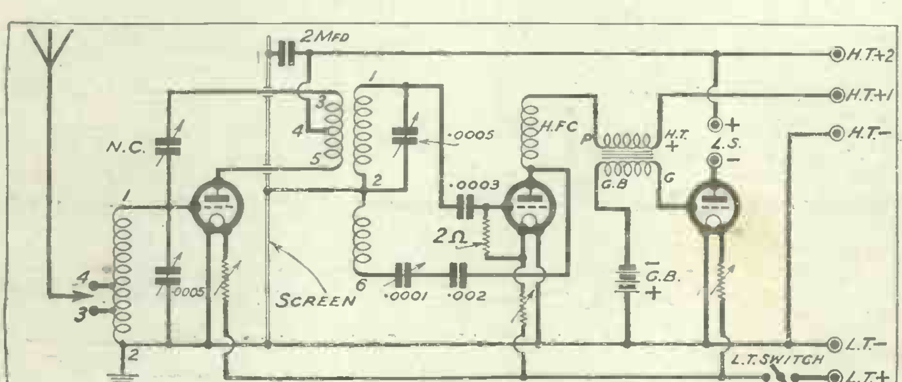
The Correct Setting.

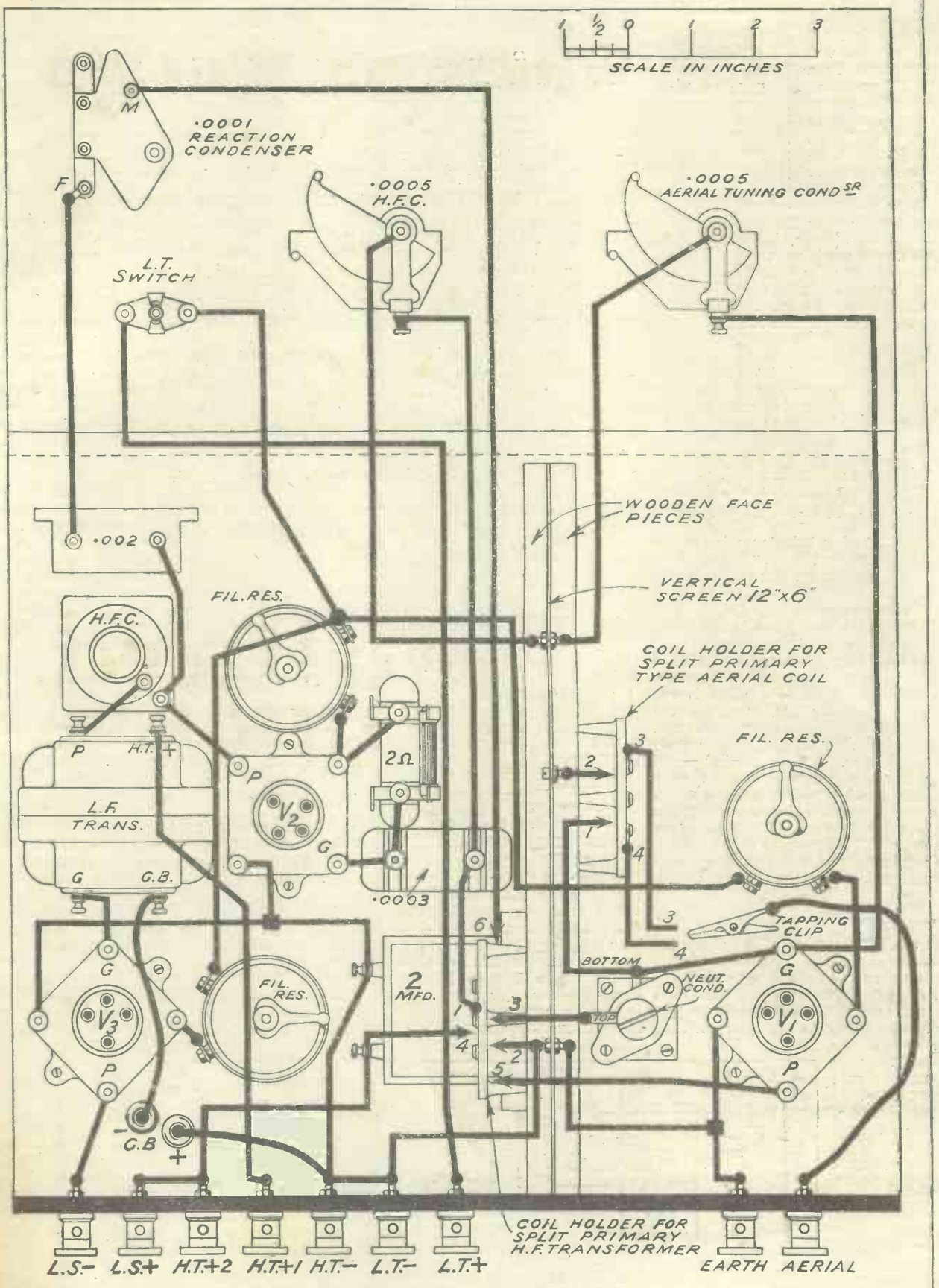
Proceed in this way until it is found that the correct adjustment of the neutrodyne condenser has been over-shot. Once this point has been passed it will be observed that further increases of the neutrodyne condenser setting no longer stop oscillation, but cause it to become stronger.

The object is to find such an adjustment of the neutralising condenser as will permit the greatest setting of the reaction condenser to be used without producing oscillation.

When the tuned circuits are in step and the set is on the verge of oscillation, a slight movement in either direction of the neutrodyne condenser will cause the receiver to oscillate.

One final point: Selectivity is adjustable by connecting the flex lead from the aerial terminal to either 3 or 4 on the coil base. Note the two short leads with bare end and the tapping clip.





WIRING DIAGRAM.

T.50.

CUT ALONG THIS LINE.

A Rheostat – Potentiometer – Volume Control

by

R I and Varley

Some weeks ago we had no less than 533 letters in one week congratulating us on the finish and the efficiency of our Rheostats, Potentiometer, and Volume Control. Wireless enthusiasts in all parts of the country are impressed with the fact that they can at last get a fitting which is wire-wound and at the same time dust and damp proof.

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The Volume Control is of entirely new design, which has a uniform increment, thus giving the best possible control of volume.

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75 ohms		

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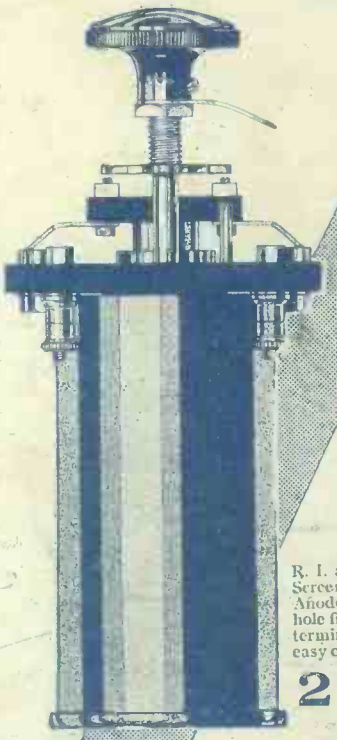

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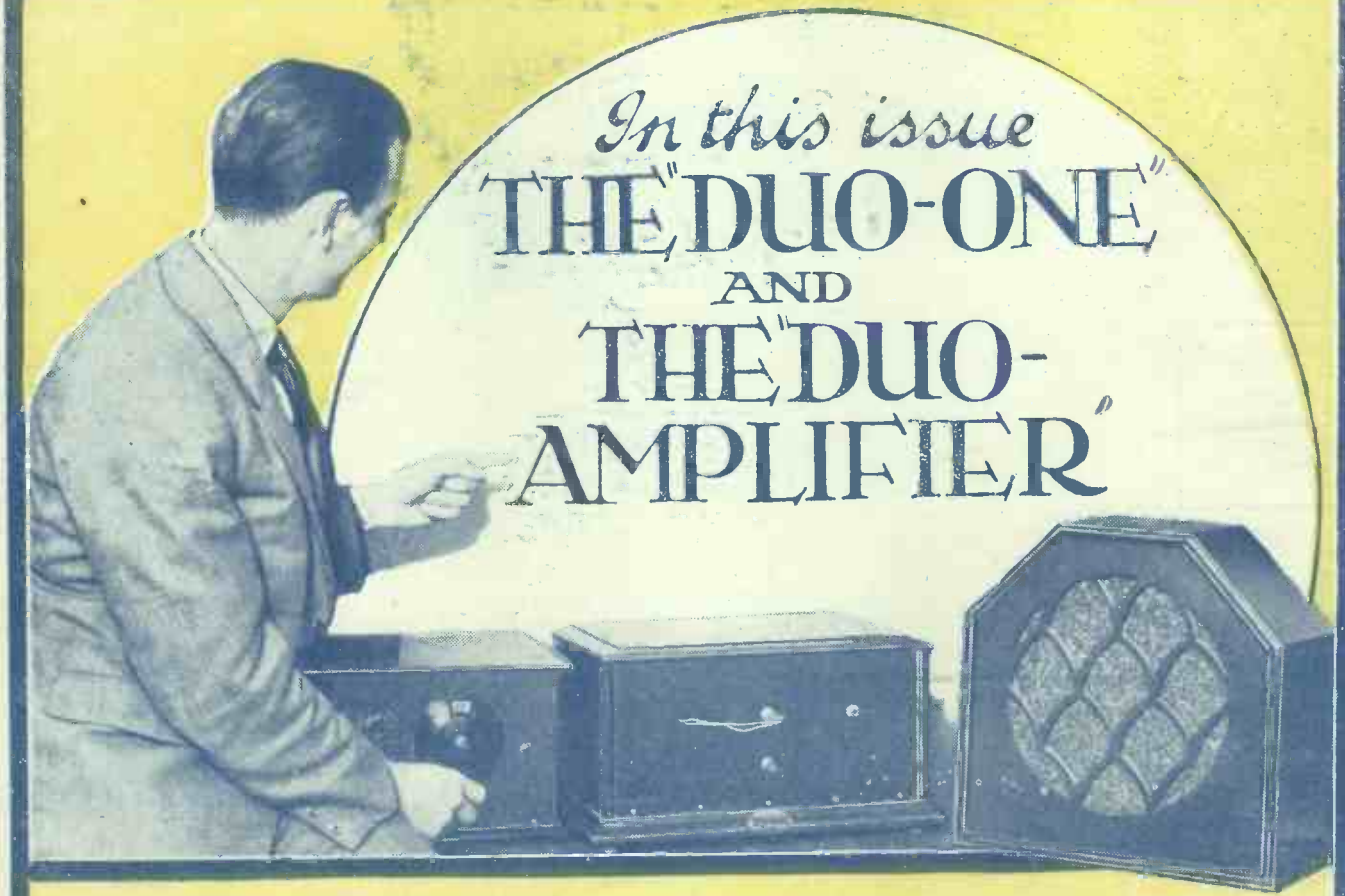


In this issue

THE "DUO-ONE" AND THE "DUO-AMPLIFIER"

Special Features in This Issue

The New B.B.C. H.Q.

Notes on the Fultograph

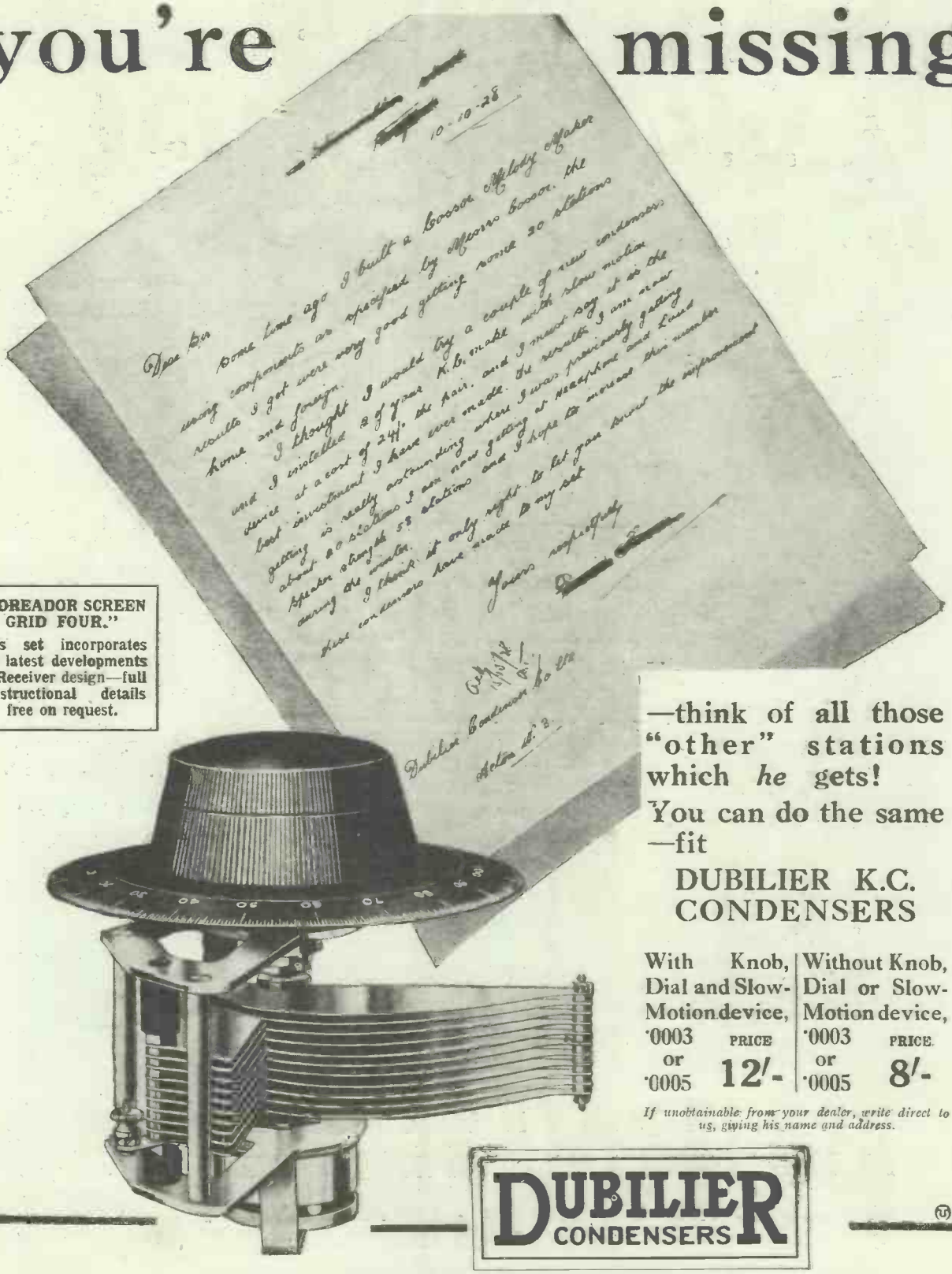
HOW TO MAKE THE "P.W." "BETTER-BALANCE" CONE

Stabilising Resistances

The Electric Eye

"P.W." WHITE PRINT No. 4

You don't know what you're missing



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RADIO NOTES AND NEWS.

Transatlantic Telephony—The "Vestris" Hero—Romance of the Cheerio Man—Society S O S—Pot Pourri—Radio in 1722—The First Etherversity.

Hail and Farewell.

HAIL to the New Year, farewell to 1928. The old year, one of the best for weather I can remember, was otherwise like most of its predecessors—"the mixture as before." This is the season of hope, when whatever the past has held we lift up our chins and march on to our destinies, wishing ourselves better luck. So a happy New Year to you all, with good health and leisure to enjoy it; money for components, and the freedom to employ it.

You Never Can Tell.

HOW did your Christmas radio arrangements "pan out"? Any casualties? Ours went as merry as a marriage bell, but of course I got no credit for that. Had it broken down I should have come right into the picture. We had an S O S on the knocker one evening; a friend's guests had overflowed into a second room for dancing, but, sad to say, his set had not quite enough "punch" for the music to be heard well in both rooms. Had I an L.F. amplifier? I had, and all was well. I thought the old brute would never be needed again!

Best of the Bunch.

THIS is the pick of the basket. Heard at a Christmas party:—

There was a young "fan" of Whitstable
Whose receiver was not a bit stable.
If he switched on the "juice"
It would kick up the deuce
And "motor-boat" all round its table.

Transatlantic Telephony.

"DX" (Manchester) confirms our correspondent's, Mr. Collins', statement that it is possible to receive the U.S.A. end of the transatlantic telephone service, for he himself can do so any night on about 22 metres. It appears, he adds, that the "carrier-wave" is suppressed; hence it is necessary for the receiver to—oh, 'orrors!—*to oscillate*. The critical point seems to be just across the "threshold" which marks the line between oscillation and non-oscillation. He uses a "straight" detector and one L.F.

Radio-Telephony Spreads.

ON December 10th the wireless telephone service between Buenos Aires on the one side and Berlin, Hamburg and Frankfurt on the other was opened to the public. The charge is £9 for the first three minutes *plus* £3 per additional minute. This is a bold experiment, for the distance involved is much greater than between London and New York; I understand, however, that excellent speech is possible and that the expectation of big business runs high.

Transmitting Note.

MR. A. C. EDWARDS, Wellhead Lane, Perry Barr, Birmingham, asks me to announce that his station, E G 6 X J, will be carrying out regular tests on the new amateur wave-bands, both C.W. and telephony, and that reports will be welcomed and acknowledged. His 'phone number is Northern 218.

The "Vestris" Hero.

THE heroism of Michael J. O'Loughlin, radio operator of the "Vestris," was commemorated by a service in Trinity Church, Broadway and Wall Street, New York City, on November 18th. Some 2,000 people, headed by the British Consul General, attended. Some of the crew of the "Vestris" were present. I do not know whether O'Loughlin was Irish or British, and I don't care, for he died like a brave man, and I am proud to think that the Americans held that service in memory of him.

Ex Cathedra.

THAT is to say, from the seat of authority. David Sarnoff, Vice-President of the biggest thing in radio in America (the Radio Corporation of America) writing on December 1st in the "Telegraph and Telephone Age," said "Television is still in the experimental stage," and that, "many refinements, improvements and even new engineering solutions are required in the transmission and reception of light images by radio." That is a recent pronouncement by a man who has worked his way to an international reputation in radio, through every grade from radio operator upwards. 'Nuff said.

Romance of "Cheerio" Man.

THERE is an unknown in America, who daily broadcasts seeds of sunshine from W E A F, W E E I, W R C, and W G Y. He gives his services free and his campaign in the interests of downcast listeners is said to have been inspired by his attentions to his dying mother, for whom he used to collect bright bits of verse and philosophy. After her death he turned to radio, desiring to do good to others in her memory. It's a lovely story, with

(*Continued on next page.*)

STYMIED?

Miss Enid Wilson, winner of the English Women's Golf Championship, is a keen wireless enthusiast, and thinks nothing of wiring up a multi-valver after a strenuous day on the links.

NOTES AND NEWS.

(*Continued from previous page.*)

a heartache behind it, and one which demonstrates that the human soul has definitely gained ascendency over the "ape and tiger" of our remote ancestry.

Triumph for British Loud Speakers.

A LITTLE bit of jam, still. The trade papers announce that the Swedish educational authorities, who are embarking on an extensive scheme for the provision of school radio receivers, held an open competition to choose the best loud speaker for the classrooms. After careful tests a well-known British moving-coil was chosen against Continental and American types. And that's that!

Society S.O.S.

THE Queen's Park Radio Society, after a good programme run, has unfortunately been "let down" by several people who had promised to lecture and demonstrate. Unforeseen circumstances are the very dickens for club schedules. However, there are plenty of firms and persons capable of providing an interesting radio evening and I can assure any of them that an offer to fill the breach on some Wednesday evening between eight and ten will be doing a real good turn. Please write to Mr. J. W. Hedges, 22, Bravington Road, Harrow Road, W.9.

Pot-Pourri.

UP to October 1st 2,334,253 receiving licences had been issued in Germany, an increase of 50,005 since July 1st. The Rugby station is said to cost on an average £383 daily and to receive daily £397. (Oi, oi! Vot a pishness!) The record in radio-telephony seems to be the communication which was established on October 4th between Bandoeng (Java) and Buenos Aires, via Kootwyk (Holland) and Nauen (Germany). Sweden has 371,000 licensed listeners. New short-wave stations are to be built in the Pamirs (Atlas, forward!) and at Khorog and Hassan-Kuli, by the Soviet blokes.

The Big Wireless and Cable Merger.

THE debates on the Imperial Telegraphs in connection with the merger between the cables and Marconi's have revealed the awful ignorance which exists about the Beam. Apparently the Beam is thought to have been invented and developed by the Post Office. Far, far from that! It was so difficult to get the authorities to adopt it that the commercial enterprise which really developed it was forced to supply the Beam stations under contracts which were unparalleled in the stringency of their conditions and which committed the government to no iota of risk. So much for the vision and scientific nous of P.O. engineers.

Radio in the Year 1722.

EITHER radio or the telephone! A writer to the "Jewish Chronicle" says the "Telegraph and Telephone Journal," points out that Rabbi Jacob Reischer of Prague, in his "Responsa," printed in 1722, asks; ". . . . and particularly with regard to the special instruments whereby one is able to speak and listen to his friend at a distance of many miles; should such a thing be forbidden on the Sabbath Day"? I should be delighted if any erudite Jewish reader could throw some light on what the Rabbi referred to.

A For Apple.

TALKING of telephony recalls the latest story from the States. They say that a lady of Texas, having brewed a goodly portion of the prohibited stuff, called up her ironmonger's 'phone number and ordered a pound of bottle caps. Unfortunately she got the wrong number and connected with the police-station, with the result that 450 pounds of cop were delivered instead of one pound of caps. The beer was sent down the sewer and the lady was fined twenty-five dollars. In a thirsty world, too!

SHORT WAVES.

TELEVISION.

This is a scheme to make your face
Appear in some far distant place,
Enabling you to send it there
Without the cost of railway fare.
I see this novelty endearing
Itself to folk electioneering,
Since it will be of little use
To hurl our eggs and loud abuse
At speakers who are only seen
Upon an aggravating screen.—
"London Calling."

* * *

Listeners were very surprised recently when, after announcing: "There will be a wait of one and a half minutes before 'The Ceremony of the Keys,'" the B.B.C. broadcast a short piano solo.

Surely there must be some sort of Trade Union to prevent this kind of thing.

* * *

1st Radio Fan: "What sort of a set has Joe got?"

2nd Radio Fan: "Well, you don't need a radio log with his receiver. All you need is a splinter."—"Radio News."

* * *

Wireless and the telephone are now linked. The operators, having used up all the wrong numbers in this country, are jubilant at the chance of tapping-in to America.

* * *

A FISH STORY.

"Last night I landed Madrid," said the angler, who had newly turned radio fan. "But you should have heard the stations that got away."—"Radio Digest."

* * *

Adams, living at Bognor (to late neighbour): "How did you get on in the gale, old man?"

Evans: "Oh, my bungalow's at Bexhill now. I've only got to move my aerial!"

* * *

AN UNSOLVED MYSTERY OF RADIO.

Set Owner (more in sorrow than in anger): "What I can't understand about this radio business, anyway, is how Static always knows what nights I ask company in to listen to the programmes."—"Radio News."

* * *

The Queen of Hearts
She made some tarts
From a radio recipe;

The Knave of Hearts
He stole those tarts,
And now he's R.I.P.

The First Etherversity.

PERMISSION has been granted for the erection of a 50-kilowatt station in Orange County, forty miles from Los Angeles, California, which is to constitute an ethereal university. A sum of two million dollars (£400,000) is to be sunk in the enterprise. Wave-length, 201·6 metres. Everything that the dry-as-dust, highbrow mind of America can conceive is to be "featured," but no information as to how the show is to derive revenue is published. I expect they will pay their way by broadcasting advertisements of stations which radiate low-brow "dope."

Latest P C J Schedule.

THURSDAY from 18.00 to 20.00; and 23.00 to 0 (in Spanish). Friday, 0 to 01.00 (in Portuguese); and 01.00 to 03.00 (in Spanish); and 18.00 to 20.00. Saturday, 0 to 01.00; 01.00 to 04.00 (in English, Spanish and French); and 04.00 to 06.00, in English. It will be noticed that these transmissions are linguistically arranged to be suitable for the greater part of the globe.

Radio in History.

RADIO is about the only invention which the Chinese are not said to have had 4,000 years ago. Radio would have saved a lot of trouble here in 55 B.C., both for the Romans and the British; the British would have been in Wales before the Romans arrived in Kent. Radio would have enabled Harold to give Bill the Conk a nastier reception and probably kept Norman blood out of the House of Lords. Radio would have told John the time of high tide in the Wash. Lizzie, the Spinster Queen, would have put the kybosh on a lot of Drake's affairs—if she had had radio. And if Nelson had had it——!

History Repeated.

THOSE of you who recollect Cuthbert the Rabbit, of the War period, will know that he represented—correct me if I am wrong—the type of person who sought shelter from shells in Government civil service. "Caution and safety first" was his motto. Now! When locomotives were invented there were the gravest fears for stray cows. Early motor-cars, and even steam-rollers, had to be preceded by a pedestrian with a red flag. In 1921–2, the Civil Servant believed that broadcasting would destroy the world's radio communications, and he would not let the Marconi Company broadcast for more than *fifteen minutes a week*. And now——

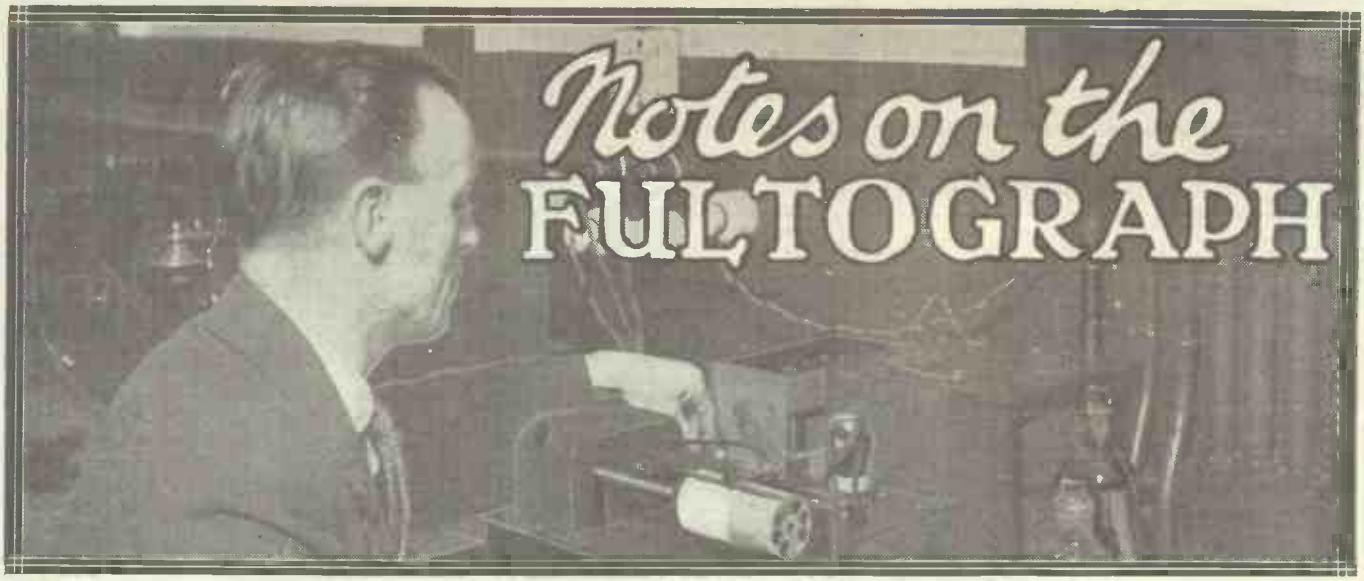
The Primitive Human Boy.

IT is only natural that my family should take to Morse as a duck to water! Inspired by his big sister the Girl Guide, who is deep in the mysteries of "flag-wagging," my small son actually kept quiet for at least half an hour recently, without asking me one single question. He was "inventing a new code," he said. The *éclaircissement* occurred at 7.45 a.m. this morning, at which time I was awakened by a series of hollow bangs. It was the boy, beating with a cricket stump on an empty box. His "code" was "Loud, loud, soft, loud," etc. I reduced it from "soft" to "inaudible," and sent him to wash his knees.

Big Ben at the Falklands.

IS it new romance or the death-knell of the old, that in the Falkland Islands, where, by the way, the winds are so strong that they can blow the fleas off a dog, Big Ben is received nightly by radio? When one considers the tremendous struggles of Anson's little fleet in its passage round Cape Horn, and the epic fights of innumerable windjammers on the same tack since his time, the idea of London's Clock actually being *heard* in the zone of the Falklands makes one wish that some of the old mariners could revisit the scenes of their exploits just for a day, to hear Big Ben—and some jazz music!

ARIEL.



Notes on the FULTOGRAPH

Some practical notes for amateurs interested in this latest method of picture transmission by means of radio.

FROM A SPECIAL CORRESPONDENT.

IN many respects there has hardl y been a more fascinating application of radio science than that inherent in the working of the recently-marketed Fultograph. I know that in one or two quarters it is inclined to be considered merely a sort of radio plaything. Nevertheless, the Fultograph possesses very many inherent possibilities, and, if it still continues to be favoured, there is no doubt of the fact that ultimately it will come to be used as an inevitable accompaniment to the regular broadcasting of radio news.

The forthcoming of the Fultograph, however, in some aspects gives one to reflect upon the oft-repeated observation that "there is nothing new under the Sun." Without a doubt, of course, the Fultograph forms a new feature in the annals of radio's applications, but the basic idea rests upon principles which have been known for nearly a century.

An Early Attempt.

A forerunner of the Fultograph will be seen at Fig. 1. This is a reproduction from an old print depicting a writing telegraph invented in the forties of the last century by a Scotsman, Alexander Bain. It is interesting to note, in passing, therefore, that Bain's electro-chemical telegraph utilised the basic principle of the present-day Fultograph—to wit, the decomposition of certain chemical solutions by means of the electric current.

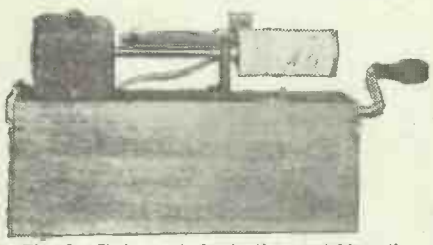


Fig. 3.—It is most fascinating watching the picture slowly build up on the cylinder of the instrument.

I think the electrical operating principles of the Fultograph are well known enough to most of my readers at the present time, no matter whether they actually possess such an instrument or not. At any rate, very briefly, the Fultograph system comprises, in effect, two cylinders which rotate synchronously, one cylinder being situated at the transmitting end of the system, the other being at the receiving end.

How it is Done.

The synchronous rotating of the cylinders is accomplished by providing each cylinder with a sort of magnetically-controlled clutch, by means of which each cylinder is stopped for the fraction of an instant at the beginning of each revolution, and then re-started. Thus, the receiving cylinder is kept in step with the cylinder at the transmitting end of the system.

Around the transmitting cylinder is wrapped a sort of copper negative of the image to be transmitted. A stylus is made to traverse this image in the same fashion in which the reproducer of the old-fashioned type of phonograph used to traverse its cylindrical records. The copper image and the stylus are in an electrical circuit, and, therefore, owing to the inequalities in the make-up of the image, a series of currents are led to the transmitter connected to the apparatus.

These current pulsations are then broadcast in the usual manner, and so reach the receiving part of the Fultograph. Here, again, a stylus traverses a sheet of prepared paper which has been wrapped around a cylinder revolving synchronously with the transmitting cylinder. Each impulse of current effects a chemical decomposition of the solution with which the paper is impregnated, and in this manner the image forming the picture is built up in about four minutes.

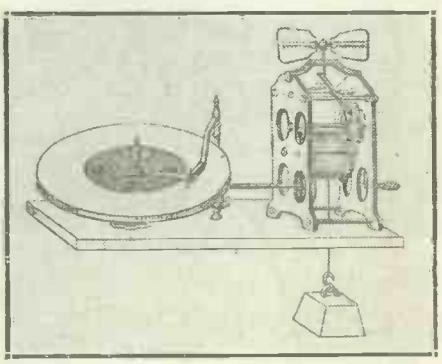


Fig. 1.—A forerunner of the Fultograph; a writing telegraph invented in the "forties" of last century.

Thus, when the transmitting stylus traverses a dark area of the picture, it sends a relatively heavy flow of current to the receiving stylus. Consequently a greater decomposition of the chemical material in the paper is accomplished, and therefore the dark shades of the original are reproduced.

Many amateurs find especially interesting the fact that the picture on the receiving cylinder can be built up seemingly out of nothing, merely by the passage of a platinum stylus over the paper. The secret, however, lies in the solution with which the prepared paper is impregnated.

Fig. 2.—A simple experiment which illustrates the principle of the Fultograph.

Simple Solution Employed.

If the amateur cares to take the trouble, he can easily prepare for himself a quantity of paper which will give rise to visible writing merely by the passage of a battery electrode over it. Take a small amount of *potassium iodide*, and make it into a moderately strong solution. Next, with the aid of a small sponge, impregnate a piece of very fine-grained white blotting paper (chemical "filter-paper" is better to use) with the iodide solution. Whilst the paper is still damp, flatten it out on a metal surface, the latter being connected to one pole of a single dry cell. Now take a piece of wire

(*Continued on page* 902.)

THE NEW B.B.C. H.Q.

Is the building of the new home for the B.B.C. extravagance, or is it really needed?

By THE EDITOR.

QUITE a storm of criticism has been levelled at the B.B.C. in connection with the new building it proposes erecting as a future home for British broadcasting. The B.B.C. has announced that the building will cost anything between £400,000 and £500,000, and more than one correspondent to the newspapers has suggested that this is sheer extravagance. Questions have also been raised as to whether it is necessary for the new studios to have such a great capacity.

The B.B.C. has briskly replied to these criticisms, and declares a belief that the erection of the new building, which is being financed by a syndicate from which the B.B.C. will lease or rent the premises, is necessary.

It is pointed out that no capital expenditure is being undertaken by the Corporation; the B.B.C. merely becomes a tenant with an option to purchase.

Many critics seem to think that the B.B.C. is going to lay down something like half a million pounds in hard cash, but this is quite wrong. It will merely have an option on the building, and the cost of its erection will be borne by a special syndicate. The B.B.C. points out that the accommodation at Savoy Hill is inadequate for the present broadcasting service. When the alternative programme service from Daventry began, it meant an expansion of studio room at London, for the programmes, in part, originate in the London studios; and when contrasting programmes are relayed, it means a duplication, not merely of transmitters, but also of studio accommodation.

Cramped Quarters.

Critics of the B.B.C.'s new venture should also bear in mind that all productions have to be rehearsed in the B.B.C. studios, and in the new building provision has been specially made for eight rehearsal rooms, in order to relieve the congestion at present experienced at Savoy Hill, where, as can easily be believed, at least six or more studios are often required for one production, and sometimes no fewer than three broadcasts may be originated at Savoy Hill under the present methods of working.

The B.B.C.'s largest studio at present is only 44 ft. by 25 ft., and few operas can be presented in such a small space; for an opera calls for a big orchestra and sometimes a large chorus. And that is why very often the B.B.C. in the past has had to hire outside halls for some of its big productions.

It is difficulties like these which will be overcome when the new building is ready, and it is difficulties like these which have made it imperative that the B.B.C. look ahead and prepare for itself more satisfactory, up-to-date, and commodious quarters.

The B.B.C.'s Expenditure.

A critic in the "Daily News" has worked out an ingenious analysis of how the B.B.C. spends its money, but this critic, unfortunately, has based his criticism on the idea that the £500,000 which the B.B.C. building will cost will actually be spent by the B.B.C.

However, the "Daily News" critic, having sat up late one evening to work out some mathematical details, has certainly produced some aspects of the B.B.C.'s balance-sheet which are interesting. Here is one discovery he made: that the B.B.C. transmitted programmes for 65,000 hours during last year and, on its programmes, spent £487,728 8s. 6d. We have the "Daily News" critic's word for it that this works out at just £7 10s. 0¾d. per hour. As he rightly points out, it seems absurd to suggest that two and a half million licence-holders, or something like twelve million listeners could be entertained at the rate of £7 10s. 0¾d. an hour.

He further calculated from facts given in the B.B.C.'s own handbook that, inclusive of fees, staff salary, power, taxes, depreciation on property, land-line charges, and everything else, the B.B.C. programmes cost only £13 17s. 5d. an hour to produce.

However, the point of this mathematical analysis of the B.B.C.'s expenditure has nothing to do really with the cost of the new Broadcasting House, but it does suggest that either more money should be spent on the programmes, or alternatively the B.B.C. should reduce the number of hours of transmission.

Curtail the Programmes?

We agree with the "Daily News" critic when he suggests that the latter should appeal most to common-sense, for a reduction of programme hours would mean a reduction of running expenses, and consequently there would be more money to spend on programmes; and, furthermore, the public would not have so much broadcasting that they wouldn't know what to do with it.

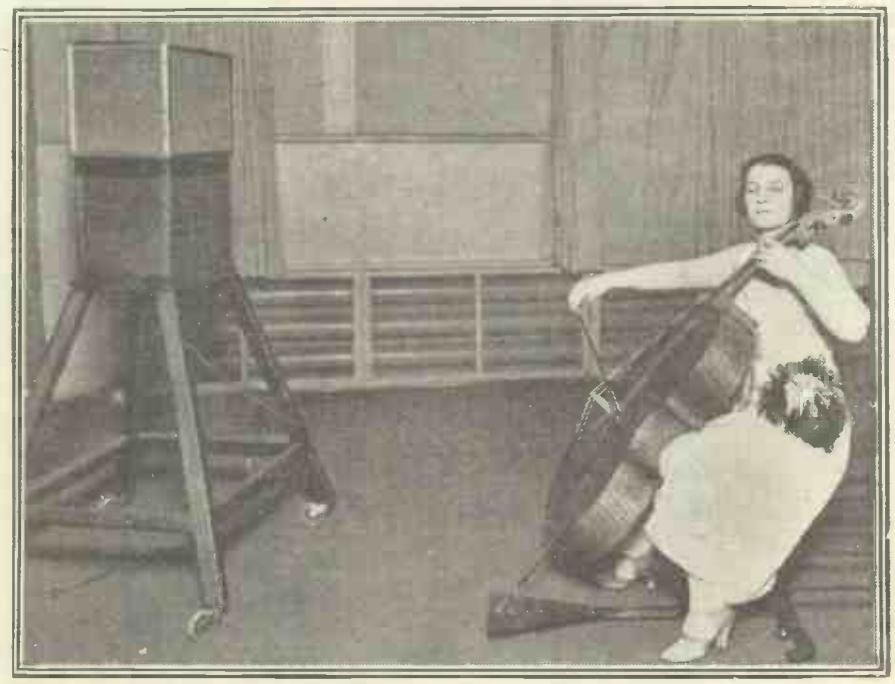
After all, theatres and picture palaces do not start entertaining at all sorts of hours of the day; and, apart from news bulletins, weather reports, etc., we suggest that the B.B.C.'s main programme should start about half-past seven.

Not Financed by Listeners.

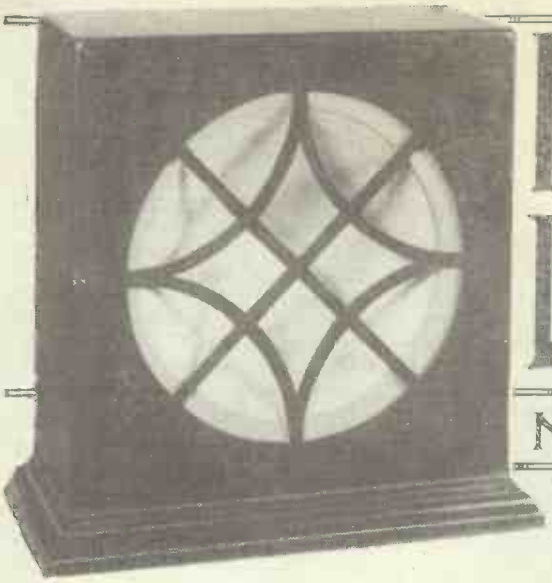
However, that will always be a bone of contention, but the main thing is that, when criticising the B.B.C., let us be certain of our facts, and we hope further correspondents to the newspapers who adversely criticise the B.B.C. because of its future home will bear in mind that the cost is not being borne by the B.B.C., and consequently not by licence-holders.

That argument may crop up later on, when the B.B.C. has to decide whether to exercise its option and so purchase the building outright.

BEFORE THE MIKE.



Madame Suggia, the famous 'cellist, broadcasting from one of the studios at 2 L O.



HOW TO MAKE LOUDSPEAKERS

No. 5. THE P.W. BETTER-BALANCE CONE

An article of great interest to anyone who aims at truly realistic reproduction. It shows how far we can be led astray by following fashions too blindly, and gives valuable practical instructions for improving the response of a speaker to those much-neglected higher notes.

By THE "P.W." RESEARCH AND CONSTRUCTION DEPARTMENT.

IS it really only one of the sexes which tends to follow the fashion blindly, I wonder? It seems very doubtful to anyone who has watched the development of the loud speaker in recent years!

Not so very long ago we all used horn-type speakers of one type or another, and we were fairly happy with them so long as we got what we called "pure" reproduction, that is, so long as there were no noticeably jarring or broken notes and no "blasting." Every now and again, however, we got a rude shock: some really musical person would come along and start off quite pleasantly, agreeing that wireless was certainly very wonderful, and then proceed to give us what our American friends call an ear-full.

We would be told that it wasn't even a colorable imitation of what the band was really playing, that quite a number of the instruments couldn't be heard at all, that others sounded all wrong in various ways, and in fact that the reproduction wasn't worth listening to as music. It might not be put quite as tactlessly as that, and it was generally watered down with assurances that it was very much better than most wireless, but that was the gist of it.

It was all rather upsetting to anyone who was proud of his set, but at first I don't think many of us worried very much. For one thing the wonder of it all was too fresh and the novelty of receiving a living entertainment programme in our own homes was too great, and for another we could always fall back on the thrill of picking up distant stations abroad. That always silenced the musical critic and made him agree that it really *was* a very fine set after all!

Disillusioned.

As time went on, all the same, we began to realise that perhaps there *was* something wrong after all. The deeper notes seemed to be lacking, we couldn't hear drums properly, and orchestral stuff seemed to lack robustness. It was difficult to notice these things, of course, because the ear has an extraordinary power of getting used to even very imperfect reproduction and becoming deaf to its defects.

We did get a lurking suspicion, however, and it was confirmed when the various early cone speakers began to make their appearance. Their makers told us that here at last were speakers which *would* reproduce the low notes, and so it came to be admitted that the previous types did *not* do so.

Chasing Bass!

That began it, and pretty soon the new fashion was well started and more and more of us began to chase the elusive bass notes, getting very worried over the rival merits of R.C. and transformer coupling, and so on, all with a view to making sure we got plenty of bass. Nowadays it seems that the one thing we all ask first about a new speaker is, "does it reproduce the bass fully?" and it has really become quite a

A rear view of the complete speaker, showing how the supplementary "high note strengthener" is fitted to the back. The small round hole seen immediately above it was for the purpose of getting at the adjusting knob of the main unit.

craze. If a speaker booms out strongly on bass notes many people seem apt to take the rest of its performance for granted, often with rather deplorable results.

Matters have gone so far that it seems really time to call a halt for consideration. Of course, if we were simply getting good bass reproduction added to our previous adequate response on the higher notes, there would be no possible cause for complaint, but are we? Frankly, we are not: many modern commercial cones give us bass absolutely at the expense of the higher notes, and to an ear which has not grown deadened and accustomed to this sort of imperfection their performance is almost as untrue as that of the discarded horn types.

Moreover, if you listen critically to a very great number of these cones (there are exceptions, of course) you will find that they are not even reproducing the low notes properly. True, there is some sort of response on bass notes, but it sounds booming and unnatural, all bass instruments sounding rather alike. This is what is known technically as false bass, and is the perhaps natural result of the manufacturer's endeavour to supply a public demand.

Now, false bass is generally due to some sort of resonance effect, and may have been introduced deliberately or accidentally. However it may have arisen, the effect is not at all pleasant once you have discovered it, and many of us are now looking for ways of getting true bass reproduction which shall be free from the objectionable boominess which is so pronounced a feature of the false variety, with its deplorable effects on speech in particular. A really good moving-coil speaker is one solution, of course, but that is hardly a practical way out for the user of the average medium-sized set with limited H.T. for whom we are mainly concerned in this series of articles.

A Temptation Resisted.

Much can be done with the cone type of speaker, as those readers who have built one of the instruments described in "P.W." recently will have discovered for themselves. In none of these designs have we introduced false bass, although we knew how fond of it some people have grown. Each will give a good measure of real honest low note reproduction, and at the same time is free from the booming over-emphasis of certain particular low tones which is so common among the instruments which get their effects by means of bass resonance.

Further, they all give a pretty good account of themselves on the upper register, and so give a brightness and brilliance to

(*Continued on next page.*)

HOW TO MAKE LOUD SPEAKERS.

(*Continued from previous page.*)

the reproduction of orchestral music and a naturalness to speech and vocal music hardly ever heard from instruments suffering from false bass. This, in my experience, is of great importance in securing reproduction which is really pleasing and natural, and matters far more than getting a tremendous boom on the drums which drowns all the other instruments.

Improving the High Notes.

It is largely a matter of compromise, and still we have not reached perfection, even within the limits of the normal type of cone using one of the standard units. What we have aimed at in this series is a good balance between the upper and lower register, and provided you mount each speaker on a baffle or in a cabinet you will find we have gone a long way towards success. The bass is full and convincing, even if not quite up to moving-coil standard, and by avoiding the over-emphasised false variety of bass we have been able to get a good deal of the brilliance which comes from high note response.

Even so, in the design of every speaker and driving unit, it is largely a matter of compromise between upper and lower register, and a trifle more brilliance would improve all these speakers to a really critical ear. They may be, and we believe are, extremely good as they stand, but if you are aiming at the very best possible results within the limits of your resources, this point is worthy of consideration.

Alternative Scheme.

It is really rather a matter of "gilding the lily," and it is only expected to interest the truly critical user, but it deserves consideration. A good deal of work has been done on the problem in the "P.W." Research Department, and the general conclusion reached is that within the limited constructional resources of most readers a good compromise between upper and lower registers is all that can be achieved with a single reproducing unit.

A very successful alternative scheme has been developed, however, which involves the addition of a second unit, specially faked to add the desired emphasis to the higher notes, and it is this which we are describing and illustrating this week. Now, it is a relatively simple matter to make a small supplementary cone speaker which shall be weak in the bass register and strong on the high. We have found that if one of these is worked into one of the standard designs in a suitable way there is an improvement in brilliancy which is distinctly perceptible to a critical ear.

The constructional part of the business is very simple, and the photos give you almost all the details you need. A unit which we have found very suitable for use in this little supplementary "high note strengthener" is the cheaper model Blue Spot (the non-adjustable one), and this is mounted upon a wooden support in the manner you see illustrated.

The Supplementary Cone.

It carries a small-sized cone made of the usual grade of Kraft paper (about 120 lbs. to the ream) or light drawing paper, the actual dimensions of the cone not being at all critical. A suitable size is a diameter across the mouth of 5 in. and a radius of about 3 in. This cone is so small and light that it needs no suspension round the edge, and the desired end is best achieved by leaving it quite free, the only support being at the point of attachment to the cone unit. Since this point carries the whole weight it is as well to use a little Seccotine or Durofix here.

The placing of this supplementary unit calls for a little care, and we have found that a very good position is in the back of the main cabinet (see photos). A hole of a diameter half an inch greater than the finished diameter of the cone should be cut here, and the unit mounted upon the inner side of the detachable back-piece, so that the cone comes nicely in the centre of the new opening. It will then be able to move freely without fouling the edge or the hole in the cabinet back, and the air gap all round will help to produce the desired effect.

The back of the cabinet removed from the main portion, showing how the supplementary unit is fitted up. The exact position for this unit needs to be determined with a little care to see that it does not foul any of the parts of the main reproducer.

Connecting the Unit.

It now remains merely to connect the extra unit into circuit, and here a little testing is necessary. If your set has an output filter the units will probably go best in series, but they should also be tried in parallel.

G. P. K.

PICTURE TELEGRAMS BY RADIO?

IT has been suggested that the advent of picture transmission, as used regularly by the Daily Press, may revolutionise our postal telegraph system by enabling telegrams to be transmitted *en masse*, instead of word by word, a facsimile of the sender's handwriting being, of course, received.

That the transmission of a written or printed page is a practical proposition is, of course, proved beyond doubt, for it is simply the transmission of a picture. Whether the scheme presents commercial possibilities, however, is quite another matter.

The constant aim of telegraph engineers is to provide facilities for transmitting a maximum number of words per minute along one pair of wires. The time occupied in the preparation of the matter to be transmitted, whether it be photograph, telegram, or printed page, is of minor importance; but it is vital to avoid a quantity of matter "queuing up."

Highly Inefficient.

Consequently, if any new system is to be of commercial importance, it must be able to compete with existing systems in the matter of words per minute transmitted.

It would appear at first sight as if the transmission of a single picture must be a shorter process than the transmission of a string of, say, thirty words. This is not the case, however.

The transmission of a telegram of normal size would occupy about five minutes by the most rapid picture transmission system. If the size of the sheet were reduced, the time of transmission would be correspondingly shortened; but even when the sheet and the handwriting are reduced to the smallest dimensions possible, there is such a very large ratio of blank paper to written matter, *all of which must be transmitted*, that the process is highly inefficient.

There is also a limit to the advantage that can be gained by reducing the size of the characters, even if these were printed, because a certain minimum number of impulses must be sent out for the clear transmission of any letter; and if the letter is reduced below the size required to produce that number, distortion results.

Very Different Proposition.

Turning to the telegraph system, it is possible to send as many as twelve messages simultaneously in one direction along a pair of wires by means of a "wired wireless" system. Combining this system with special transmitting apparatus, it is possible to transmit more than 700 words per minute, which is a very different proposition from, say, a 50-word telegram in five minutes.

Add to this the difficulties of distribution to small local offices which could not be equipped with costly apparatus, and it appears very doubtful whether the relatively small advantages gained will ever make facsimile telegram transmission a commercial proposition.

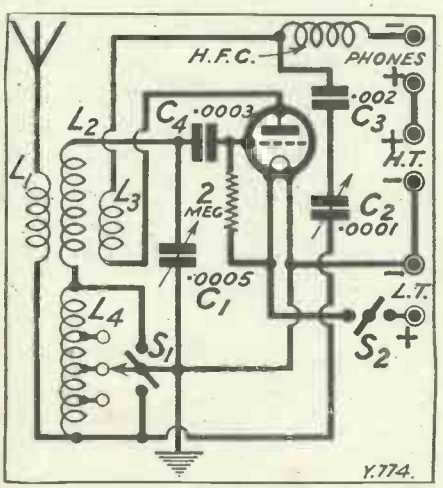
THE P.W. "DUO" ONE

A remarkable wave-change one-valver which is suitable for all wavelengths. It can also be used in conjunction with the "Duo" Amplifier (described in another page) to make a really efficient and up-to-date loud-speaker outfit.

By THE "P.W." RESEARCH AND CONSTRUCTION DEPT.

HAVE you ever considered what a very handy thing it is to have your receiving outfit in two distinct parts—i.e. the receiver proper and the L.F. amplifier? It is not a scheme likely to appeal to the man who simply wants a compact outfit which is to be used for reception pure and simple, and not for experimental work, but it has many good points from the point of view of the man who spends a good deal of time trying out new circuits and so on.

If you have a good standard amplifier always at hand it means that whenever you want to try out a new receiver you need only complete it up to the detector stage. Having got so far you simply hitch on the standard amplifier and proceed to your tests right away, with a considerable saving in time, work, and expense.



Power and Sensitivity.

Again, if you are interested in L.F. circuits it is a very handy thing to have a small receiving set always available which contains no L.F. stages. Then when you want to try some particular type of L.F. amplifier all that you need do is to build it up as a separate unit and test it by feeding in a small signal from the standard receiver just mentioned.

Altogether, you will see, a two-unit outfit is a great help in general experimental work, and so we have produced a design for one with the necessary features to make it as useful as possible. At the same time, it will be found to make a very good and flexible outfit for general work in addition, with remarkable power and sensitivity (it is much above the ordinary "Det. and 2 L.F." standard, for reasons which we shall see). It would be a mistake, then, to regard the "Duo" design as one solely for the experimenter.

The circuit of the complete outfit is very similar to that of "Everybody's" Three, and it has similar features of tremendous power and excellent sensitivity which made the latter such an outstanding design. The L.F. side has a similar powerful arrangement of two transformer stages, properly arranged with a stabilising device on the detector stage to prevent howling due to battery coupling.

It is, however, somewhat simpler than the L.F. side of "Everybody's" Three, since it was desired to keep the cost down as much as possible in view of the fact that the amplifier will be simply an additional piece of apparatus to many people. The main difference is that no output filter is provided, the reason being that it was felt that users of this outfit are likely to possess one as a separate unit, and it is obviously unnecessary to duplicate it.

A Good Factor of Safety.

As it stands, the outfit is pretty "safe," and will work with almost any pair of transformers and H.T. battery. If, of course, you find that with your particular transformers there is a tendency to become unstable when the H.T. battery grows old—it is simply necessary to add a filter output circuit of the type in which the loud speaker is wired between the plate of the last valve and the L.T. circuit, with a 2 mfd. condenser on either side, and all will be well. This, by the way, is rarely necessary, since the "de-coupling" device on the detector stage is almost always enough.

So much for the general idea of the "Duo" outfit. Now let us go into the

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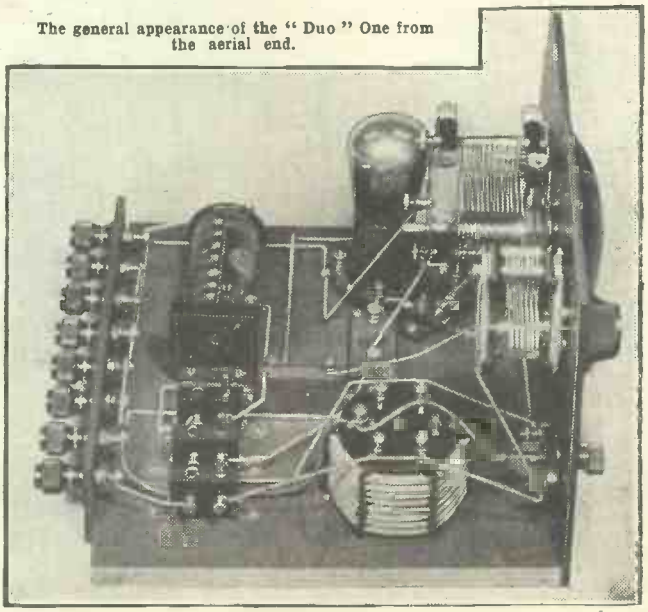
The general appearance of the "Duo" One from the aerial end.



THE P.W. "DUO" ONE.

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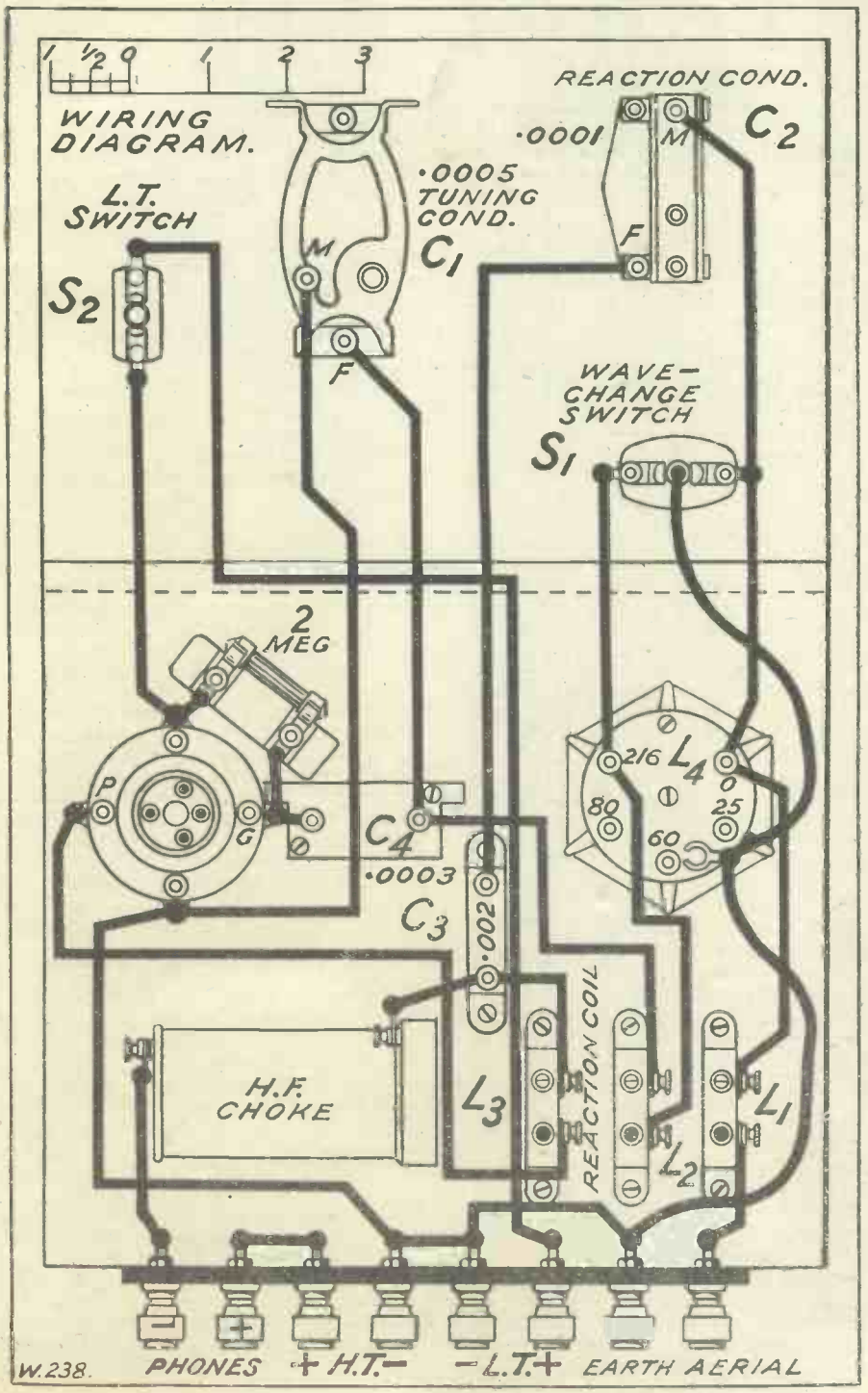
details of the receiver proper. It is actually a neat little single-valver of a sensitive and selective type, with an efficient scheme of switching to enable you to cover both medium and long waves without coil changing. A particularly good method of reaction control is used which accounts in no small measure for the unusual sensitivity which we found the little set to possess on test. (It will bring in quite a string of foreign stations after dark.)

As a matter of fact, a slightly different method of reaction control is used on the two wave-bands, each being the one found most suitable for the purpose in this particular set. On the lower waves "throttle control" is used, and on the long waves this is supplemented by additional Reinartz reaction. If you are familiar with the art of reading diagrams you will soon see how this is done if you examine the circuit carefully.

A Flexible Circuit.

On the lower waves the circuit is made up with three plug-in coils. L_1 is the aerial coil, which will be a No. 25 or 35 as a rule, the smaller size giving greater selectivity, but if the aerial is a very small one a No. 40 or even 50 may be needed for this coil. L_2 is the tuned secondary, and this should be a No. 60 (75 will do at a pinch). The reaction coil is L_3, and a No. 50 is usually correct here, but a No. 60 or 75 can also be tried if the valve is not a very freely oscillating one.



COMPONENTS

- 1 Panel, 10 in. × 7 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in (Radion, "Kay Ray," Red Seal, Trelleborg, Becol, Ebonart, Ripault, etc.).
- 1 Cabinet to fit, with baseboard 9 in. deep (Camco, Raymond, Bond, Peto-Scott, Arteraft, Lock, Makerimport, Gilbert, Pickett, Caxton, etc.).
- 1 ·0005 mfd. variable condenser, slow-motion type, or with Vernier dial (Lissen, Lotus, Cyldon, Igranic, Burton, J.B., Dubilier, Ripault, Gecophone, Formo, Colvern, Bowyer-Lowe, Ormond, Utility, etc.).
- 1 ·0001 or ·00015 mfd. reaction condenser (Bowyer-Lowe, Dubilier, Cyldon, J.B., Igranic, Ormond, Peto-Scott, Burton, etc.).
- 1 L.T. switch (Benjamin, Lissen, Igranic, Lotus, Burne-Jones, Peto-Scott, etc.).
- 1 On-off switch of the pattern usually employed for wave-change purposes (Lotus, Lissen, Burne-Jones, etc.).
- 1 Sprung valve holder (Lotus, Igranic, W.B., Wearite, Formo, Burton, Pye, Burndept, Ashley, Marconiphone, B.T.H., Redfern, Benjamin, Bowyer-Lowe, Burne-Jones, etc.).
- 1 Standard loading coil (Quest Radio, Paroussi, Lewcos, Burne-Jones, etc.).
- 3 Single coil mounts (Lotus, Peto-Scott, etc.).
- 1 H.F. choke (R.I.-Varley, Lewcos, Lissen, Bowyer-Lowe, Colvern, Dubilier, Burne-Jones, Cosmos, Climax, Igranic, Marconiphone, etc.).
- 1 Fixed condenser of ·0003 mfd. (Lissen, Burne-Jones, Dubilier, Igranic, Mullard, T.C.C., Clarke, Goltone, etc.).
- 1 Fixed condenser of ·002 mfd (See above).
- 1 2-meg. grid leak with holder (Mullard, Lissen, Igranic, Dubilier, Pye, Ediswan, Carborundum, etc.).
- 1 Terminal strip, 8 in. × 2 in. × $\frac{1}{4}$ in. and 8 terminals (Belling & Lee, Igranic, Eelex, etc.).

Wire, screws, flex, etc.

The long-wave coil is marked L_4, and this is a "P.W." standard loading coil. A tapping lead of flex is provided for attachment to the 60 or 80 terminal on this coil, and the portion between "O" and whichever tap is used then becomes a coupling winding for the aerial and also for Reinartz reaction on the long waves. On the lower waves, of course, the whole of this coil, coupling winding included, is cut right out by the wave-change switch S_1. (This is when the switch knob is pulled out.)

A Selectivity Point.

Selectivity is adjusted on the long waves by placing the tapping lead on either the 60 or 80 terminal on the loading coil. Selectivity is greatest on 60, but signal strength is usually a little better on 80. In any case, it is as well to try both and see which suits your aerial best.

By the way, while we are on the subject of selectivity, there is just one point which

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THE P.W. "DUO" ONE.

(Continued from previous page.)

ought perhaps to be mentioned: the selectivity of this set is well up to the best standard for a receiver with no H.F. stage, but if you live in the real "agony area" within a few miles of the local you must not expect to cut it out without the aid of a wave-trap.

No ordinary set of this type can be expected to do it, but it is a very simple matter to add the standard "P.W." trap and shut it out that way. (This trap has been described in "Radiotorial" at various times and is easy to make, or it can be bought ready made at a very moderate figure from various advertisers.) If you find the local forcing its way in over a considerable part of the lower wave-band and at the bottom of the long-wave range, therefore, do not be perturbed, but just hitch on a trap and you will find that it goes out and stays out in a very satisfactory fashion.

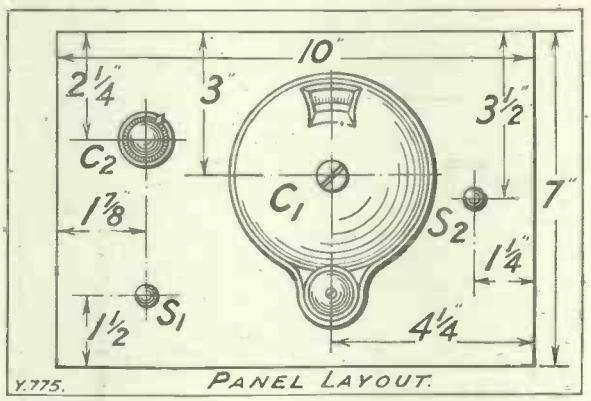
Good on Short Waves.

Before we leave the tuning details it should just be added that it is quite easy to use the set on short waves also with very good results, since the reaction scheme adopted is a particularly efficient one for this purpose. All that is needed is to take out the broadcast size plug-in coils and replace them with the correct sizes in one of the standard short-wave series, such as the Igranic and Atlas. For example, for reception on the interesting band of waves between 20 and 35 metres, a coil of two turns for L_1, four turns for L_2, and six for L_3, will be correct.

So far as the constructional work is concerned, you will almost certainly find the diagrams and photos a sufficient guide. Just one or two points should perhaps be mentioned in passing, however. First of all, if you intend to use the set on short waves, it is as well to space the coil sockets about $\frac{1}{8}$ in. further apart than usual, since most of the special short-wave coils are rather broad.

As to the mounting of the H.F. choke, this may look a little puzzling at first; but that is simply because it is one of the R.I.-Varley type, which can be mounted on its side if desired. Any make can, of course, be used, and mounted in the usual upright position without affecting the set in any way. The horizontal position shown was only adopted because it made the wiring a little simpler.

The loading coil used was of a make which calls for mounting flat on the baseboard,



but you can equally well use one of the type which is mounted edgewise. Take care to place it at right angles to the other coils if this type is used, and all will be well.

Operating the set is very simple, of course, since it is merely a matter of tuning on one dial and adjusting reaction to the most sensitive point (just short of the oscillation point) to get the greatest volume. This applies to distant stations; on the local you should use no reaction at all if you want the best possible quality.

To get smooth reaction you should try different sizes of reaction coil if necessary (a No. 50 will suit most valves, however) and adjust the H.T. voltage on the detector. When the amplifier is in use, by the way, the H.T. voltage is automatically dropped to a suitable value by being passed through the resistance of the anti-motor-boating device, and will be found correct for almost any valve if the total battery voltage is about 100 or 120. (See notes in amplifier article re this point, also connections.)

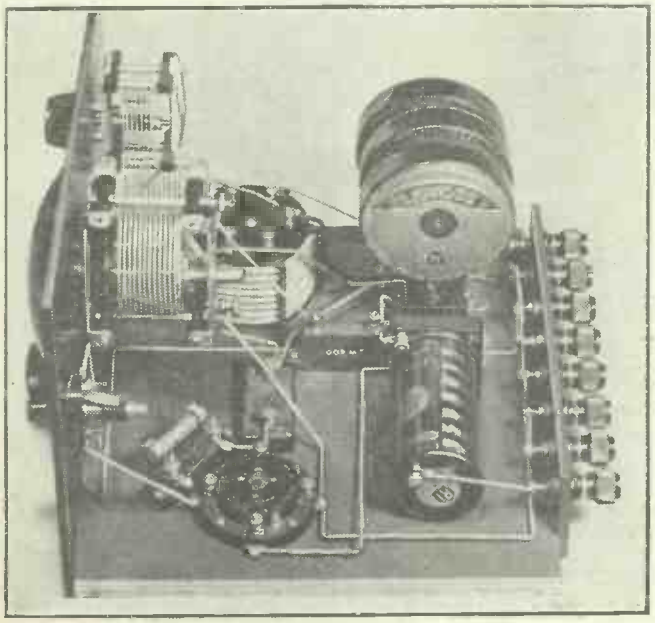
Some Suitable Valves.

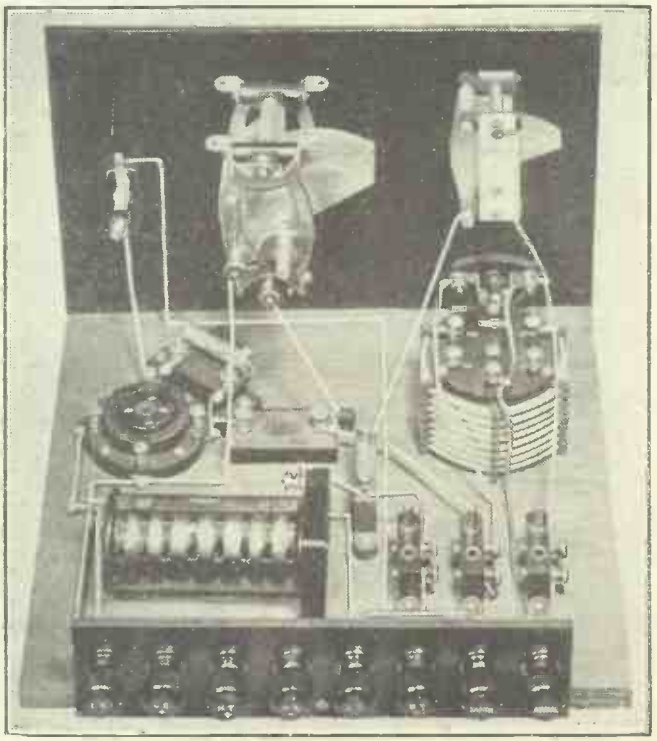
Next, as to valves. We have found that one of the usual H.F. type is the most suitable in this set as a rule, and 2-volters go very well. Here are a few examples: Mullard P.M.1 H.F., Mazda H.F.210, Ediswan H.F.210, Cosmos Short-Path Green Spot, Cossor H.F.210, Marconi and Osram H.L.210, Dario Bi-volt H.F., etc.

Finally, some hints on short-wave work intended for the newcomer to the waves below 100 metres. So far as regular broadcast transmissions are concerned, the most interesting wave-band is that already mentioned, i.e. 20 to 35 metres. This includes such stations as 2 X A D (America), 5 S W (short-wave B.B.C. station), 8 X K (America), 2 X A F (America), P C J J (Holland) and 3 L O (Melbourne), all of which transmit regular programmes.

All these stations can be picked up with a "det. and L.F." set (one L.F. stage is usually the best for 'phone reception) at times, but, of course, short-wave conditions are very variable. However, if you look up their times in "World Radio" you should find one or two of them can be heard most nights during the winter, often so strongly that they are quite audible on the detector valve alone.

Below: The "Duo" One with plug-in coils in position, while the photo on the right shows the simple nature of the wiring in this interesting receiver.





LATEST BROADCASTING NEWS.

"DRAMA" AT SAVOY HILL

THE PROFESSOR AND THE COLONEL — COMMUNITY SINGING REVIVES — SOCCER RELAYS FOR SCOTLAND —WHAT ABOUT ENGLAND?

THE changes in the organisation of the dramatic Department at Savoy Hill, exclusively foreshadowed in POPULAR WIRELESS, are now complete. Mr. R. E. Jeffrey, formerly head of the department, is handing over to Mr. Gielgud on January 1st. Mr. Jeffrey will be in charge of a new department which will bear the interesting name, "Programme Research."

Under Mr. Jeffrey will be Mr. Sieveking, Mr. King-Bull, Mr. McConnell, and Mr. Harding. It is believed that Mr. J. Watt, the brilliant young producer at Belfast, will be "absorbed" by Mr. Gielgud. It has taken the B.B.C. nearly seven years to decide to encourage Programme Research and experiments. Let us hope that there will be results within the next seven years.

There is certainly room for them! Mr. Gielgud, the new "Producer," is a promising young journalist who did good work as Assistant Editor of the "Radio Times." He distinguished himself as producer of "Tilly of Bloomsbury," which was staged as an amateur theatrical by the B.B.C. Staff, with Sir John Reith and Admiral Carpendale as "leads."

The Professor and the Colonel.

The B.B.C. wisely refrained from being "drawn" by the Press stunt over the row between Professor Andrade and Colonel Brand. The latter used to be "host" at Ranelagh, where his urbanity was so generally recognised that he came under the notice of the B.B.C. when Savoy Hill was searching for an official soother.

Colonel Brand is a tennis player of Wimbledon standard and frequently does running commentaries on big tennis matches. It is understood that the difficulties between Colonel Brand and Professor Andrade were more acute than represented. Sir John Reith is standing by Colonel Brand.

Community Singing Revives.

Two months ago Mr. Joseph Lewis, Musical Director at the Birmingham Studios, inaugurated a series of radio community singing concerts for 5 G B listeners. Now nobody knows more about community singing than Mr. Lewis. Before he joined the B.B.C. he was identified with the "Get Britain Singing" movement, and very ably he carried it through.

He understands his subject absolutely, because he has made people sing in hospitals, workhouses, and even gaols, and these things take some doing. Community singing produces a wonderful psychological effect. Mr. Lewis has used it with wonderful results to raise money for charitable purposes; he employs it on Monday mornings in a big Birmingham store to get the staff in good fettle, thus improving the day's takings, which otherwise so early in the week might not be so satisfactory.

And now he is serving it up to listeners in a novel way by an intimate treatment which gives an impression that the trained and rehearsed studio chorus and orchestra are as new to their task as an audience in an outside hall. The enthusiasm he creates is so spontaneous and infectious that listeners vote these concerts to be among 5 G B's most popular items.

The last broadcast brought 600 congratulatory letters, and more than a hundred copies of "The Old Arm Chair," a song for which many people had asked but of which Mr. Lewis had no copy. 5 G B is having another radio community singing evening on Tuesday, January 1st, consisting entirely of plantation songs. Listen and see how much you will enjoy it.

Soccer Relays for Scotland Only.

The desire—to put it mildly—of all Scotsmen to get hold of the "bawbees," or alternatively to get something for nothing, is agitating the minds of the "outside broadcast" officials at Savoy Hill. How is it, they ask, logically argued that running commentaries on football matches adversely affect attendances on English grounds, while in Scotland they produce just the opposite result?

Certainly something is wrong somewhere. Take the case of Scotland first. Running commentaries on several important games have already been given this season, and more are promised on New Year's Day—Scotland's National holiday—when the Rangers meet Celtic in the biggest match of the Season, at Ibrox, and on the following day of the game between the Heart of Midlothian and Aberdeen.

There is also to be an eye-witness account of the match between St. Mirren and Dundee on January 5th, altogether a nice little bunch of sporting events to which listeners will look forward. But what is happening on the South Side of the Border? Just nothing.

Only one club in the English League, the Arsenal, will allow a description of their games to be broadcast, and there is not enough variety in having to depend on one venue to make running commentaries more than occasionally worth the trouble and expense.

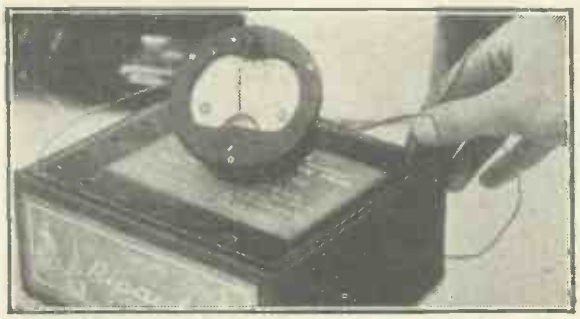
What About England?

Even in the forthcoming games of the F.A. Cup competition it is by no means certain that permission will be granted to instal the microphone, though the B.B.C are hopeful that this will be given. The officials controlling the Rugby game are not so short-sighted, and enthusiasts of the oval ball who cannot get to Twickenham will be pleased to learn that they can hear descriptions of the play between England and the Rest, and England v. Wales, on January 5th and 19th respectively.

It is very evident that there is more than meets the eye behind this refusal to allow running commentaries on important Soccer games in England. If broadcasting stimulates attendances in Scotand it must equally improve the gates in England.

No keen supporter of football is content with "listening" to a game if he can possibly see it, but on the other hand there are thousands of luke-warm footballers who only need to hear a game before determining to be spectators.

Perhaps it would be better for the B.B.C. to forget "bawbees" and keep an eye on the powerful influences outside the game, and then adopt a little of those "reciprocal tactics" that have successfully overcome other awkward snags raised by the diehard element against broadcasting.



When measuring the voltage of the H.T. Battery do not place the voltmeter across the battery, as shown, but measure the voltage whilst the set is in action, so as to find the voltage "under load."

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

USING MAINS FOR AERIAL.

CORRECT VOLTAGES—OVERLOADING, Etc., Etc.

Using Mains for Aerial.

IN some circumstances a good deal of trouble can be saved by using the electric-light wire as an aerial, especially where the locality is known to be a poor one for radio reception.

It is difficult, in fact, impossible, to say definitely in what particular cases the use of the electric-light wiring systems will be most satisfactory for reception, and in what cases it will be unsatisfactory. I can only say that for those who are situated in places where the use of an outdoor antenna is impossible, or, at any rate, inconvenient (for example, in flats), the use of the electric-light wiring as the wave interceptor, if it proves to be satisfactory so far as reception is concerned, has the great advantage of convenience and cheapness.

Correct Voltages.

Assuming that the maximum signal pick-up has been obtained the next step is to look over the receiver itself, and one

(*Continued on page* 898.)

METROVICATION

FOR ALL-ELECTRIC WIRELESS OPERATION

THE ALL ELECTRIC VALVE

If only valves would work without accumulators and without H.T. batteries!

Yet this is now actually possible with the Met-Vick All-Electric Valve which in combination with a suitable eliminator (like the Model 'B') enables everyone living in an electrically lit house to operate a wireless set straight off the mains like a lamp or other domestic appliance.

These amazing Met-Vick All-Electric Valves have solved the problem of mains operation. They are standardized by the leading set makers. They are so designed that they can be plugged into an existing battery set without altering the wiring, thus making conversion into an All-Electric set easy.

Met-Vick All-Electric Valves will improve a set out of all recognition. With these wonderful valves and All-Electric operation the H.T. never fades away, the L.T. is always just right.

Met-Vick All-Electric Valves are without doubt the most supremely successful valves obtainable.

Convenient hire purchase terms arranged if desired.

MET-VICK All-Electric Valves AC/G for all but last stage 15/-—AC/R last stage(power)—17/6.

Disc Adaptors, price 6d. enable MET-VICK All-Electric Valves to be fitted into existing Valve Holders.

Fully descriptive illustrated literature and name of nearest dealer on request.

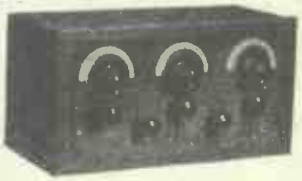
MET-VICK

VALVES-SETS-COMPONENTS

Metro-Vick Supplies Ltd., 155, Charing Cross Road, London, W.C.2.

The model "B" Eliminator connected to a wall plug or lamp socket provides heater current for the All-Electric Valves, five tappings for the H.T. supply, up to 180 volts 20 milliamps, and automatically regulated grid bias taps for the last stage. Price complete with Met-Vick Rectifying Valve for A.C. £8. For D.C. £7 2 6.

The Met-Vick 3 Valve All-Electric Mains Operated Set for Local, Daventry & many Continental Stations. The extremely high quality reproduction is a special feature. It is very suitable for new Regional Scheme. Price complete with Valves, coils and Royalties, A.C. £12 17 0. D.C. £13 8 0.



The Met-Vick 4 Valve All-Electric is called the "All Necessary Performance" set, one H.F. stage, low loss coils and condensers, loose coupled Tuned aerial, it gets anywhere and everywhere at Loud Speaker strength. Price, complete with Valves, coils and Royalties A.C. £17 14 6. D.C. £18 7 6.

Met-Vick 5 Valve All-Electric. More powerful, of course, than the Met-Vick 4. In beautiful cabinet with cupboards for L.T. and large size H.T. Eliminators, 220 volts 35 milliamps. For A.C. or D.C. supply price complete with all accessories, except Loud Speaker, and including Royalties. In Oak £47 9 0. In Mahogany £50 19 0.

For Constructors: This Met-Vick combined Transformer furnishes current for the Met-Vick indirectly heated Valves and for the Rectifying Valve in Eliminator. Price, any voltage £1 17 6.

R.V. 136.

A GERMAN SHORT-WAVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—In the Christmas Number of "P.W." Mr. E. Birchenall, of Manchester, asks for information with regard to a short-wave station which broadcasts very slow speech in German and uses a metronome signal during intervals. On December 7th, at 17.50, I picked up a station sending very slow speech in German and which used a metronome signal during intervals which at times were very long. The name of the station and call-sign were frequently mentioned. The name was Döberitz, call-sign A F K, wave-length 67·65 metres (4,434 kc.). According to "World Radio," this station has a power of 5 kw. and broadcasts on two different frequencies, 4,434 kc. (67·65 m.) and 7,968 kc. (37·65 m.), every Monday, Wednesday and Friday, from 10.00–11.00 G.M.T. and again from 18.00–19.00 G.M.T.

I have also heard P C L L on 38·8 m. (7,732 kc.), P B 6, the Dutch experimental station; another Dutch station on the same wave-length as P C L L, which frequently announced "Hier Amsterdam, 2 A O A G J, 6 W T," and one or two French stations. This is not much of a bag, I know, but I have only been experimenting on the short waves for a little over a week. The set is a hooked-up one-valver using a circuit similar to the detector portion of the Empire Two.

On the broadcast wave-band, using a one-valve set I constructed early in 1924 from a "P.W." circuit, I have logged between 50 and 60 stations, including a number of amateurs and two American, W B Z and W G Y. The first time I heard these American stations was in the late autumn of 1924, and it was some thrill. I hope to hear a few more of these distant stations when I get my short-wave set going properly.

With best wishes to POPULAR WIRELESS and its staff.

Yours faithfully,
T. A. GORDON GODDARD.

Gloucester,

The Editor, POPULAR WIRELESS.

Dear Editor,—With reference to Mr. Birchenall's inquiry about identity, frequency, and power of the unknown German station, I hold the following letter, which may interest other short-wave enthusiasts:

"Berlin,
December 1st, 1928.

"Dear Sir,—Best thanks for your letter communicating us, that you receive our A F K short-wave sender good, without great fadings. We make here, with that sender, experiments with waves from 15–100 metres, and change most every week the wave. We have not yet tried a fixed program: when we give, we send 15 minutes talk, and 15 minutes metronome, or music by means of gramophone! We principally study the fadings to the diffint hour, and the quality of the modulation.

"Yours truly,
WALTER PODEHL,
"Wilhelmshavenerstr 68."

Without a doubt this is Mr. Birchenall's "ghost"! He used to worry me a lot on occasions, but his letter explains it all away. And now for a friendly "tilt" at W. L. S. (whose articles have always been of a very helpful nature), A F K does give his call-sign (ar-eff-Kar) more frequently now, but I agree with W. L. S. that his transmission is just about as perfect as I have heard on short waves. I should also like to mention that P C L L does not work on 18 metres (as advertised), but his Q R A card gives 38·8, and his times of transmission are 16.00 till 19.00 G.M.T. (and not 14.00 till 16.00) as advertised (not by POPULAR WIRELESS). Tell Mr. Kendall to get busy with some more circuits, please.

I wish yourself and all the staff a prosperous New Year.

Yours faithfully,
PERCY TAYLOR.

Stoke Newington, N.16.

The Editor, POPULAR WIRELESS.

Dear Sir,—I note that your correspondent, E. Birchenall, of Manchester, asks for the identity of a powerful German short-wave station, and although he gives no wave-length, I have little hesitation in declaring it to be A F K Doberitz (5 kw.).

The strength of this transmitter is wonderful, and I can receive him under almost any conditions, with or without aerial. Trusting that this information will be of use and wishing "P.W." the best of luck.

Faithfully yours,
WALTER C. HOWARD.

Thirsk.

SHORT-WAVE HINTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I wonder if the following hints may be of use to short-wave enthusiasts.

(1) If hand capacity is found to be bad, cut a "nick" across the vernier knob with a fine fret saw, then after tuning-in with the hand in the ordinary way, re-tune by the aid of a screwdriver and the above-mentioned "nick."

(2) If results with ordinary earth and aerial are not quite "up to the mark," try a small double indoor aerial slung across the room, as directional as possible (nearly due west for Schenectady). Then use your outdoor aerial as an earth—presumably it acts as a sort of counterpoise.

My set is the "Sydney Two"—results very satisfactory using the above methods.

Yours truly,
"FOLLOWER."

British Army of the Rhine,
A P Post Office.

THE "ANTIPODES" ADAPTOR.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am writing to thank you for your wonderful circuit (the "Antipodes" Adaptor). On this circuit last Saturday, December 1st, I received the following, P C J J, and at 6.30, 2 X A F broadcasting a football match. I had this until 9.20. Have you heard of anyone else receiving same? I also received 2 X A F at 11.30 on Saturday, 3 L O on Sunday.

Again thanking you for your most wonderful circuit, and good luck to "P.W."

I remain yours sincerely,
RALPH B. HALL.

Staffs.

A NEW DUTCH STATION?

The Editor, POPULAR WIRELESS.

Dear Sir,—I see in to-day's issue of "P.W." that one of your readers receives P C J J on his set at good loud-speaker strength.

For the last four weeks or so, I have not been able to get P C J J at all, but am able to get a new Dutch station (about 38 metres) at full loud-speaker strength.

I wonder if any other of your readers are unable to get P C J J now?

Yours faithfully,
H. W. BROWNSWORD.

Carnarvonshire.

THE "EMPIRE" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having just completed the "Empire Two," circuit, let me offer my congratulations.

My previous circuit was a pretty good one, giving excellent results, but the "Empire" Two "puts it in the shade."

I may add I have added a stage of R.C., the results being far better than I expected.

The circuit you publish has been a long-felt want to myself and many others, I should think, and the use of plug-in coils a decided advantage to the average constructor desirous of not going to the expense of special coils.

I have not tried the short waves yet, but the set gives really excellent results on both Daventry and broadcast wave-lengths. A point noted, and an important one, is the easy reaction control.

In conclusion, let me thank those responsible for so splendid a circuit and that it is a Christmas gift worthy of merit.

Keep on with the good work, and wishing your paper every success.

Yours, etc.
L. WATSON.

Sunderland.

THE NAIROBI STATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Referring to Mr. Coe's report on being the first to receive 7 L O Nairobi Station.

We received this station on the 29th of July, 1928; it came in at good 'phone strength, with slight mush, receiver used screened-grid four, modification of "Austral" Three.

American stations can be had any night, while Australian stations vary. We received a confirmation report from 7 L O giving particulars of their transmissions. Their wave-length is 35 metres and power 1 kilo, time between 4 and 7 G.M.T. Are we the first to receive this station?

Wishing "P.W." the success it deserves.

We remain,

Yours truly,
W. CHAPMAN and E. KINGSCOTT.

London, S.E.7.

CORRESPONDENCE.

A GERMAN SHORT-WAVER.

SHORT WAVE HINTS.—A NEW DUTCH STATION.—THE NAIROBI STATION, etc.

Letters from readers discussing interesting and topical wireless events, or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

SHORT-WAVE NOTES.

By W. L. S.

I HAVE recently received full details of a new schedule of transmissions from P C J J, which shows that he is now giving special programmes for different countries at different times of day and night. This schedule is very interesting, if only on account of the choice of times for reaching various countries with the greatest degree of certainty. It is rather surprising to note that in no way does it correspond with the times at which stations in these countries come in well in Europe; the P C J J engineers have apparently obtained reliable reports as to when their station is heard best at various parts of the globe, and drawn up the schedule from them.

One Way Traffic!

I have always held that when a signal from, say, Great Britain is getting to Brazil at its best, the Brazilian reply is *not* at its best. Further, as amateur transmitters know only too well, when one calls a "test" or "C Q" call, and several stations reply to it, those that are getting your call best are often those that are entirely inaudible on your receiver, and the ones that you can hear are probably not getting you nearly as well as the others! It is a sort of "short-wave one-way traffic" business.

The times of P C J J's transmissions most likely to interest readers are: Thursday and Friday, 1,800–2,000 G.M.T., and Thursday, 2,300 till midnight. The wave-length is about 33 metres, and if you can't find P C J J you would be well advised to build a new receiver!

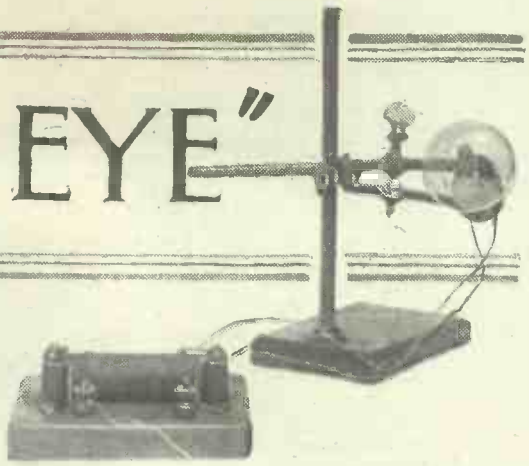
I have recently spent many late nights on the calibration of a short-wave heterodyne wave-meter from two or three quartz crystals. The wave-meter has got to be a super-accurate job, and it is altogether a very ticklish piece of work to get everything to fit in. The actual range of the wave-meter is from about 60 metres to 110 metres, so that its harmonics will cover all bands down to 10 metres with ease. The wave-lengths of the only two really accurately calibrated crystals available are 179·5 metres and 201·7 metres.

Beaten By Beats!

So far, from the two crystals I have produced fifteen different beat notes with the various harmonics of the crystals and "overtones" of the wave-meter, but I am still at sea as to exactly *what* harmonics some of them are! When you get a beat note that can, from the rough curve, only be produced by the 3rd harmonic of the wave-meter beating with the seventeenth harmonic of one of the crystals it becomes a little difficult to sort things out.

A wave-meter calibrated from standard crystals is, however, well worth the trouble, and need not itself be made in too much of the form of a precision instrument, since if any small shift does take place the crystals are always reliable and may be depended upon to give the original readings. In many cases a minute alteration of the wave-meter dial sets things right again.

THE "ELECTRIC EYE"



Fundamental, but simply-told, facts concerning Photo-electric cells for the Radio-picture and Television Enthusiast.

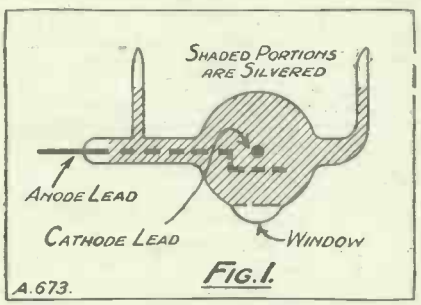
By J. F. CORRIGAN, M.Sc., A.I.C.

UNTIL some radically different contrivance is discovered, the photo-electric cell, or the "electric eye," as it is often picturesquely described, must of necessity constitute the heart of any apparatus purporting to transmit pictures by television methods.

Of course, selenium cells can and have been used for such a purpose, but owing to the enormous strides which have recently been made in the construction and development of photo-electric cells, there is no doubt that they are more than ever likely to hold the field for television purposes until the at present unknown and much-wanted "valve" of that new science is discovered.

Advantages of Selenium.

Photo-electric cells, as is well known, differ fundamentally from selenium cells in that they actually generate current under the influence of light. Cells of the selenium



type merely change in resistance under the light impulse, there being with these devices no actual generation of current. As would be expected, both these light-sensitive devices, have their own champions and opponents.

Certainly, selenium cells have their own advantages. They are rather more robust in construction, and the current which they allow to flow is greater than that generated by a cell of the photo-electric type. But, on the other hand, a photo-electric cell proper is generally a much more sensitive means of converting light impulses into electrical currents, and, primarily on this account, it is being developed to its fullest extent.

Generating a Current.

The principle on which the modern photo-electric cell works has been known for some years. When light rays fall on certain substances, notably thin layers of the alkali metals, such as potassium, sodium, rubidium and cæsium, the light impulse causes a negatively-charged electron to be released from each atom of the metal. These knocked-off electrons are free, and, therefore, if an external circuit is made to the cell, they will flow through it, thus giving rise to an electric current.

Fig. 3. — An American photo-electric cell of the vacuum type.

A diagram showing the constructional principle of a modern photo-electric cell is given at Fig. 1. The shaded parts of the diagram represent portions of the inner walls of the cell, which are silvered. On these silvered portions is deposited a very thin layer of either potassium, rubidium, or sodium, these portions of the cell forming the cathode. An anode plate is placed more or less centrally within the cell, and, by means of an external battery, a difference of potential is provided between the cathode and the anode.

The cell, of course, is highly exhausted, and placed in a light-tight box, merely the "window" of the cell being exposed to light rays.

A cell of this type will give a current of 10-8 amperes when it is exposed to the light of a 60-watt gas-filled lamp situated six inches away from it. These vacuum photo-electric cells are very constant, and they are perfectly reliable in action, not being influenced by temperature and many other external conditions. Although these cells will work without an external "driving potential," the application of the latter greatly increases their efficiency.

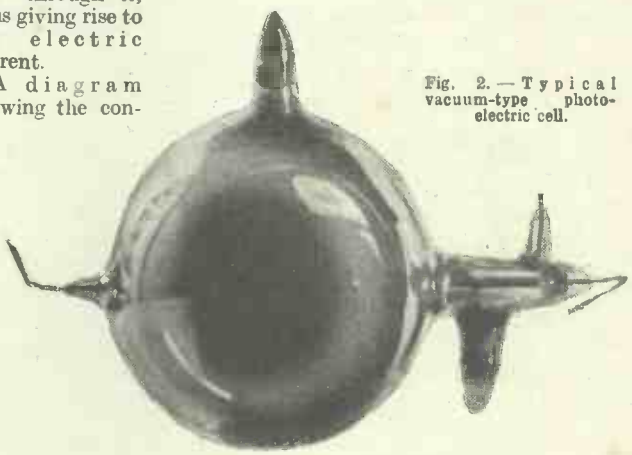


Fig. 2. — Typical vacuum-type photo-electric cell.

Fig. 2 shows an English-made photo-electric cell, constructed on the principle of the diagram, Fig. 1; whilst at Fig. 3 is illustrated a similar type of cell, although rather less sensitive, constructed after an American design.

The Latest Type.

One of the most recent developments of the "electric eye" is the gas-filled photo-electric cell, the latest type of which is illustrated at Fig. 4. In this cell, the light-sensitive surface of finely-deposited potassium is formed on a silvered cup which is to be seen within the upper part of the cell. This cup acts as the cathode of the cell, the anode comprising a disc of wire gauze placed centrally within the cell.

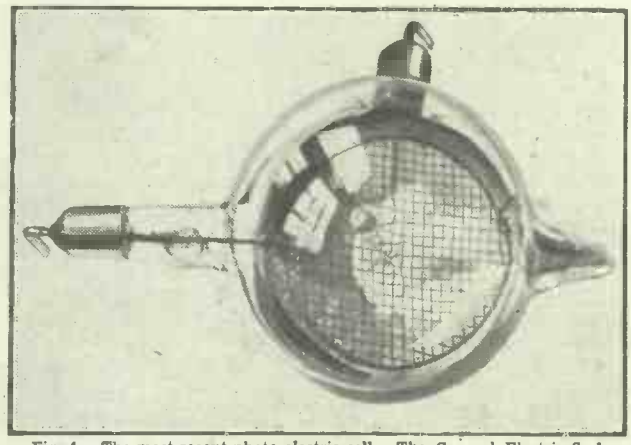


Fig. 4.—The most recent photo-electric cell. The General Electric Co.'s gas-filled type.

(Continued on next page.)

THE "ELECTRIC EYE."

(Continued from previous page.)

Gas-filled cells of this type are much more sensitive than those of the vacuum type, for in the former the liberated current is magnified by its passage through the rarefied gas existing within the cell, the electrons of the primary current colliding with the particles of rarefied gas and thus liberating more electrons which augment the total current obtained from the cell.

Despite the fact that gas-filled photo-electric cells provide several hundred times as much current as do the vacuum cells, the current derived is too small to be of any practical use. On this account it is necessary for any photo-electric cells to be connected up to a valve amplifier, a diagram of the typical connections made being given at Fig. 6.

An Ingenious Development.

In a special type of cell constructed by Dr. V. Zworykin, of the American Westinghouse Company, an ingenious attempt has been made to overcome the necessity of having a separate amplifying valve for use with the sensitive cell, the Zworykin "Thermionic photo-electric" cell, illustrated at Fig. 5, containing within it the elements of the light-sensitive cell and those of a valve amplifier. This cell, however, is of the vacuum type, and is therefore not as sensitive to light impulses as the gas-filled cell.

Fig 5.—The Zworykin thermionic photo-electric cell, which combines both the light-sensitive elements and the necessary valve amplifier.

A cell of the latter type, correctly adjusted and working at a distance of about five or six inches from a 60-watt electric lamp, will deliver up a current of about 30-40 micro-amperes, which is just about the order of current which operates the headphones of a crystal set working at reasonable efficiency.

Gas-filled photo-electric cells, of course, possess none of the "lag" which characterises many of the older types of selenium cells. They will, in fact, respond instantly and accurately to rays of light vibrating as many as 5,000 times per second.

SHORT-WAVETTES

One of the most important factors relative to smooth oscillation on a short-wave set is the degree of coupling of the aerial coil.

* * *

If a short-wave set is inclined to give "fierce" or "floppy" reaction, do not forget that a readjustment of the high-tension voltage will often make a great deal of difference to this.

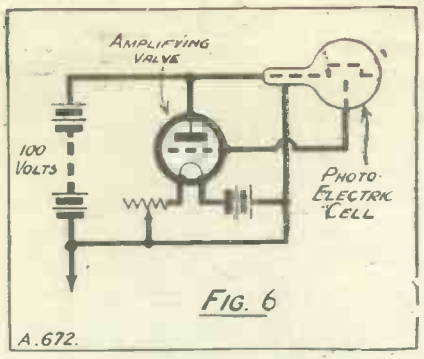


FIG. 6

A.672.

TIME PROBLEMS IN RADIO.

By W. GORDON CAMPBELL.

IF someone were to ask you "When does the New Year begin?" you would probably pity his ignorance and explain that it begins immediately after midnight on December 31st, according to the local time at any place on the earth's surface. In other words, according to our mode of reckoning time, that interesting event would be celebrated throughout a period of 24 hours—that is, during a complete revolution of the earth on its axis—in order to cover the whole circumference of the globe.

But if the inquirer, thirsting for further knowledge, should continue: "Yes, I understand all that, but *where* does it begin?" probably nine persons out of ten would be "stumped" and find it difficult to give a ready answer. New Year's day, or any other day, must begin somewhere on the earth's surface as the zero line from which the day is reckoned. The explanation of this problem is as follows: Many years ago it was agreed between the principal Powers that the day should be assumed to begin on the earth at the 180th degree of longitude east (and west) of Greenwich, that is, half-way round the globe. Some people imagine that as the zero meridian of longitude passes through Greenwich the day must begin there, but that is, of course, a mistake.

Walking Into Yesterday.

The imaginary line forming the 180th meridian of longitude passes from the South Pole northwards through the Pacific Ocean, a little to the east of New Zealand, as shown in the accompanying diagram. It lies between the Fiji Islands on the west and Samoa on the east but, in order to avoid the inconvenience of dividing solid land, the line threads its way entirely over water, otherwise one might find, for example, that his dining-room was in Friday while his bedroom was still in Thursday!

Again, after enjoying the New Year on the west of the line, he could paddle his canoe about twenty-four hours later to a friend's house to the east of the line and celebrate that event a second time. In consequence of this convention the captains of ships passing westwards over the line have to omit a day from the week in writing up their logs.

Now, it may be asked, "What has all this to do with radio?" The answer is, that although wireless signals pass almost instantaneously between any two points on the earth's surface, our lives are regulated in accordance with our conventional conception of time and, therefore, some curious and interesting problems arise in listening to broadcasting or other signals from a distance. While it is true that in England the programmes and times of transmission of the principal broadcasting stations are given by the B.B.C. in its publication, "World Radio," according to Greenwich Mean Time or Summer Time, persons in other parts of the world have to make their own calculations. Here, at Constantinople, our local time is about two hours ahead of Greenwich, so that midday in England is 2 p.m. with us, and if we wish to hear Big Ben striking midnight (as we sometimes do to remind us of home), we have to sit up until 2 a.m. But it is well worth the trouble to hear his cheerful voice.

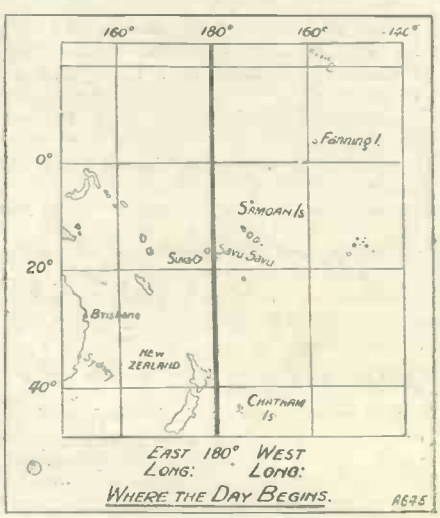
Chasing the New Year.

On ships at sea proceeding eastward or westward the local time is continually changing, and is usually checked by an observation of the sun when he is visible. The chronometers only show G.M.T., and these are often checked by the time signals from the Eiffel Tower and Nauen, both of which give Greenwich time. Indeed, Nauen announces the fact every time by the letters M.G.Z. (Mittag Greenwich Zeit) which follow its call-letters P O Z.

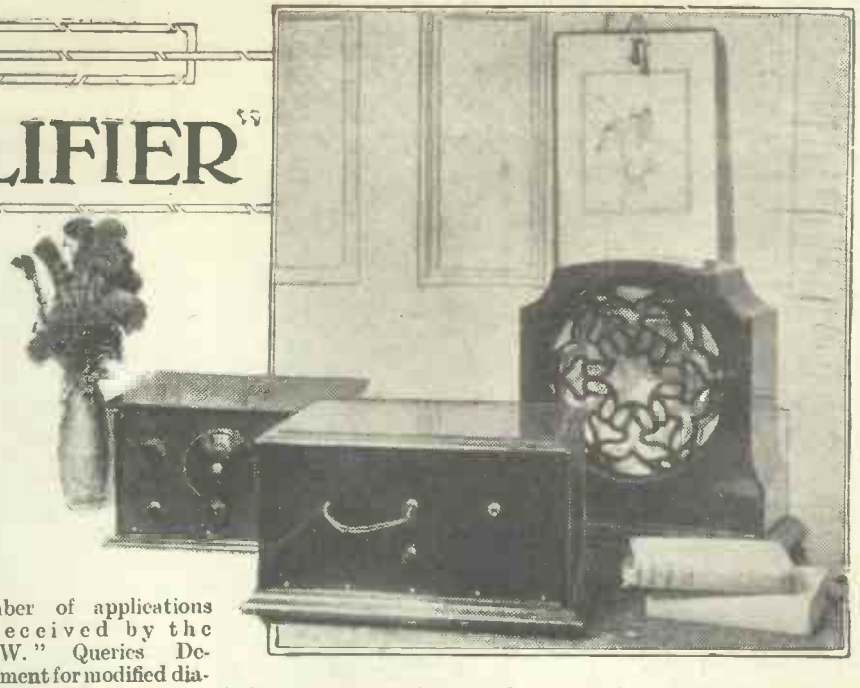
But in Germany and other countries farther east the people generally observe the "zone" time system according to which German time is 1 hour fast on G.M.T. (called Mid European Time), and Greece, Turkey, etc., are 2 hours fast (East European Time). However, listeners will have observed that Berlin and other German stations usually broadcast according to G.M.T., while the transmissions from Vienna and other Austrian stations are 1 hour fast on G.M.T.

On last New Year's Eve I followed the New Year by wireless as it slowly crawled westward from this place to England, during a period of two hours, and it was interesting to follow the rejoicings at the various stations en route until I finally heard the strident tones of Big Ben ringing in the New Year.

It will thus be seen that the time problems in connection with the reception of wireless signals or broadcasting are not so simple as one might at first imagine.



The P.W. "DUO-AMPLIFIER"



A very powerful amplifier which you can couple to practically any set, although it was specifically designed to operate with the "P.W." "Duo" One Set described in other pages in this issue.

By the "P.W." RESEARCH & CONSTRUCTION DEPT.

THIS two-valve amplifier is something out of the ordinary, because it possesses certain attractive features not usually found in the average low-frequency amplifying unit.

It is well known that a good quality medium ratio transformer enables one to obtain the highest possible magnification combined with really decent reproduction. In most cases, however, directly an endeavour is made to couple up two stages of transformer-coupling, quality suffers, owing to the tendency towards L.F. oscillation.

It is true that an expert can successfully work more than one transformer-coupled L.F. stage, but the average listener is always faced with the possibility of "battery coupling" occurring. This effect, which is common to dry batteries, H.T. accumulators, and eliminators, is a frequent cause of trouble, and it is obviously unfair to the constructor if he is supplied with a design which becomes unstable immediately his batteries begin to run down, or get old.

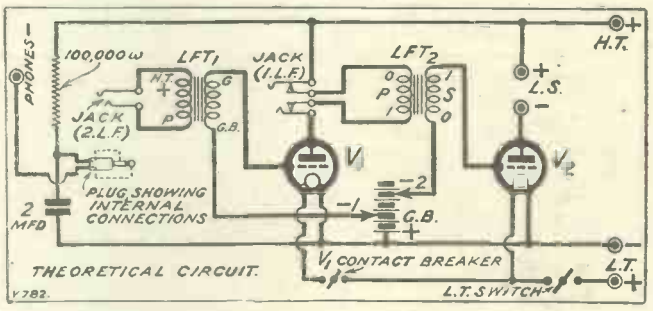
Switching.

The "P.W." Research Department had this fact in mind in designing the "Duo-Amplifier."

A series of experiments proved that a perfectly stable arrangement for all practical conditions resulted if an anode-feed resistance and by-pass condenser were inserted in the "input" side of the amplifier. This device is included in the unit in question and is one of the special features in the design.

Most constructors, at some time or other, wish to use either one or both L.F. valves. This is proved by the fact that directly a "non-switching" set is published a large number of applications is received by the "P.W." Queries Department for modified diagrams showing how one of the stages may be cut out. Now, it is not always possible to arrange for this, sometimes because of some critical feature in the design.

In the "Duo-Amplifier" it is interesting to note that by the simple insertion of a plug either one or both valves may be employed. This is an advantage inasmuch as, while both stages may be needed for long-range reception on the 'speaker, very often one stage is ample for local station work. These jacks do not act as filament control switches and it was considered that to carry out such a scheme would involve needless complication.



A neat little device is incorporated for the benefit of those who might like to economise when using only one stage for some appreciable period. This is a "contact breaker" which is placed in a convenient position on the baseboard, and with its aid it is but a matter of a second or so to switch out the V_1 filament and thereby save the additional load on the L.T. battery.

Thus we have a really high magnification, quality amplifier which is perfectly stable, and in which such a desirable feature as switching from one to two stages has been incorporated in the simplest possible way.

Suppose we take a look at the circuit. First we have a lead from the terminal in the unit marked "Phones —" which goes to the end contact of the plug. Then there is a second flexible which is joined to the 100,000 ohms resistance and to one terminal of the 2-mfd. condenser. These two flexible leads must be connected correctly, otherwise the unit will not function properly. If you inspect the wiring diagram you will see a note explaining the proper method of connecting-up, and these instructions should be followed with care.

You will observe that both jacks have an arrow pointing to "long contact arm." Thus the 100,000 ohms resistance should make contact, via the inner contact or sleeve of the plug and the long contact arm of the jack, to H.T.+ on the first transformer and H.T.+ on the terminal strip, respectively, according to which jack is in use.

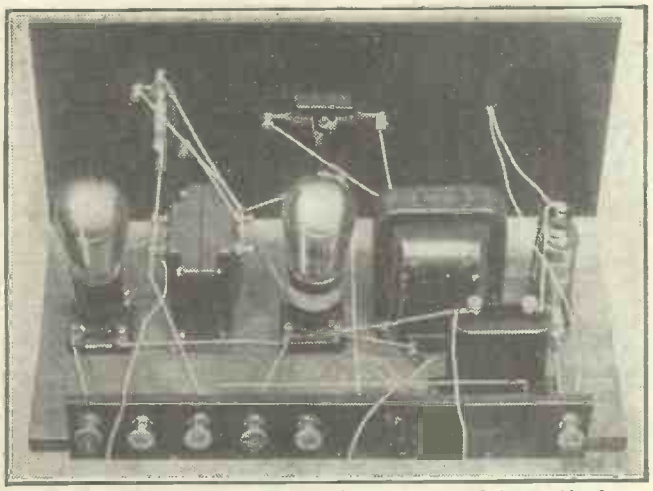
Both of the transformers used in this unit should be of the low or medium ratio type. By this is meant a ratio between 2·5 and 4–1; certainly not higher than 4-1.

Transformer Ratios.

It is a good plan to use two different ratio instruments, say, one of 2·5–1, and one of 3·5–1 or 4–1, otherwise stability may suffer, in spite of the special device incorporated in the amplifier.

Now for the construction of the unit. This is very simple. When you look at the panel you will at once think that it is somewhat large, in view of the fact that so few components are mounted on it. The reason is that a 14-in. baseboard is necessary to

(*Continued on next page.*)



The amplifier employs two L.F. transformers, and is capable of amazing punch and purity.

THE P.W. "DUO-AMPLIFIER."

(Continued from previous page.)

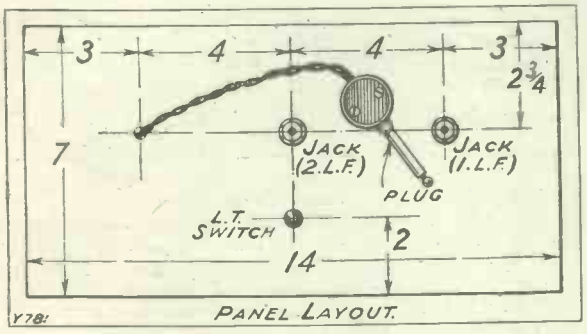
accommodate the transformers and other parts and to ensure adequate spacing.

Actually, the only components on the panel itself are the two jacks and the L.T. switch.

Mark off the panel to the dimensions given in the panel layout diagram, and centre-punch the drilling centres.

Building the Unit.

You will need four holes, two for the jacks, one for the L.T. switch, and one to take the two flexibles which go to the plug. In addition, you will also require four or five holes spaced at intervals along the bottom edge of the panel to secure it firmly to the baseboard.

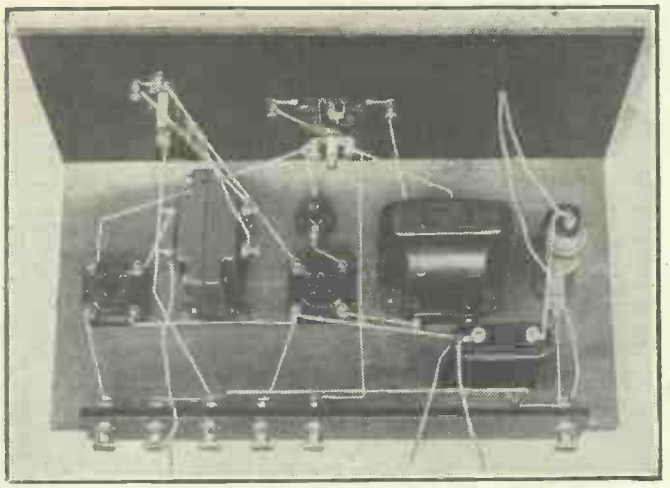


PANEL LAYOUT.

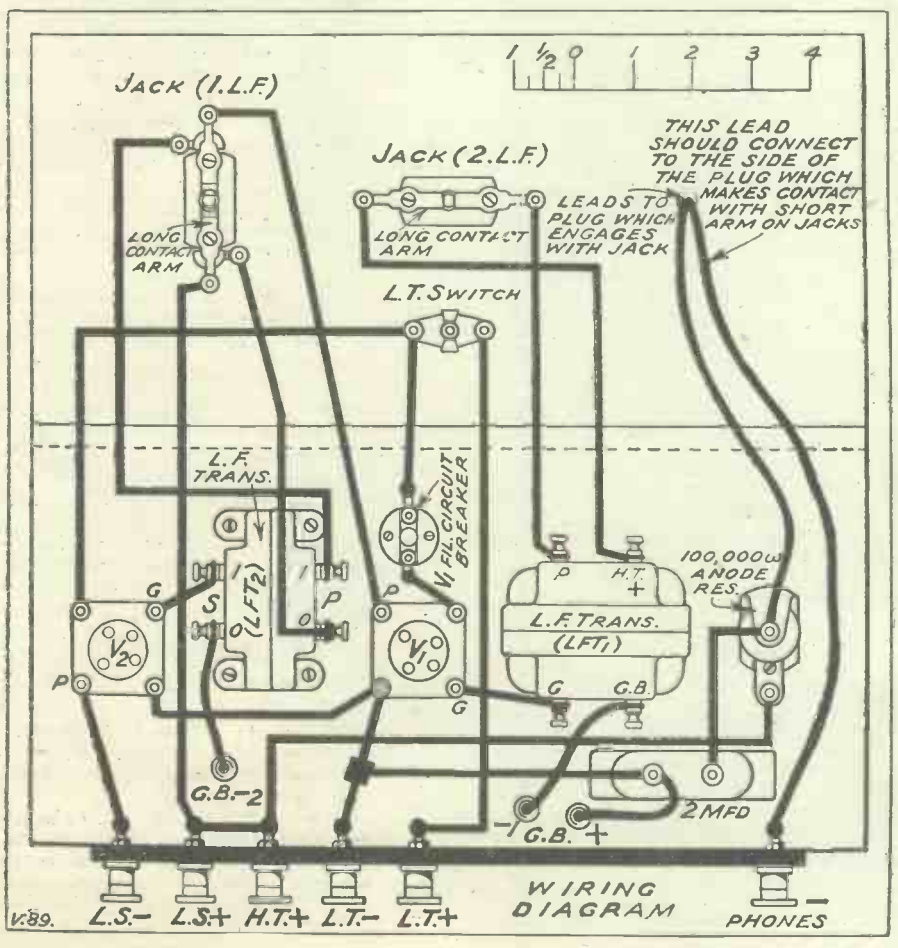
Having completed the drilling, mount the components, and attach the panel to the baseboard. You can then commence to lay out the various parts in their positions on the board. Follow the wiring diagram carefully and note that the two transformers are placed at right angles. Arrange matters so as to keep the vital leads as short as possible.

Now commence the wiring. Use tinned copper wire of 16 gauge and thread over it some Systoflex tubing, or alternatively you can employ a wire such as Glazite, which is already covered with a special insulating material. Do not forget to connect up the plug and jacks as explained on the diagram. As has been pointed out earlier in the article, this point is very important.

When you have finished the wiring you will be anxious to test the unit. Place a valve of the H.F. or General Purpose type in the V_1 socket and a small power or super-power valve in the V_2 socket. An "H.F." valve is one with an impedance of not more than 20,000 ohms (in this particular case) and a high magnification factor of 15–20. Connect up the 'speaker, L.T. battery and H.T. battery to the terminals marked. You will not need an H.T.– connection because you have this already on the set to which the unit is attached. You will naturally be using a common battery for both set and unit. Insert the H.T.+ wander plug into the highest voltage tapping on the H.T. battery. If you are using 120 volts you will need about 3 volts grid bias on G.B.–1 and 7½–9 on G.B.–2 provided V_2 is a small power valve. If V_2 is a super-power valve, about 16–18 volts will be required. Join "'Phones–" to the 'phone terminal in the set which is not connected to the H.T.+ terminal.



This photo shows you how simple in construction is the "Duo-Amplifier"; how few the parts used and their low cost relatively to the power of the instrument.



WIRING DIAGRAM

COMPONENTS REQUIRED

- 1 Panel, size 14 in. × 7 in. × 3/16 in., or ¼ in. ("Kay Ray," Ripault, Ebonart, Becol, Trelleborg, Red Seal, Radion, etc.).
- 1 Cabinet to suit, and baseboard 7 in. deep (Raymond, Caxton, Pickett, Gilbert, Makerimport, Lock, Artcraft, Peto-Scott, Bond, Camco, etc.).
- 1 100,000 ohms wire-wound anode resistance and holder (R.I.-Varley, Lissen, Mullard, Dubilier. Igranic, etc.).
- 1 2 mfd. condenser (Ferranti, Dubilier, Lissen, Mullard, T.C.C., Hydra, etc.).
- 2 L.F. transformers low-ratio type (Any of the good standard makes, such as Lissen, Philips, Ferranti, R.I.-Varley, Mullard, Igranic, Brown, Marconiphone etc. See text).
- 2 Valve holders (Sprung type for baseboard mounting). (W.B., Igranic, Lotus, Benjamin, Pye, B.T.H., Burne-Jones, Bowyer-Lowe, Redfern, Burton, Formo, Burndept, Ashley, Wearite, etc.)
- 1 Contact breaker (Burne-Jones & Co.).
- 1 On-off switch (Lotus, Lissen, Benjamin, Igranic, Burne-Jones, Peto-Scott, etc.).
- 1 Single open jack (Lotus No. 1, or similar type, such as Igranic, Bowyer-Lowe, Ashley, etc.).
- 1 Double closed jack (Lotus No. 3, or similar type).
- 1 Telephone plug (See above).
- 6 Terminals (Igranic, Eelex, Belling & Lee, etc.).
- 1 Terminal strip, 12 in. × 2 in. × ¼ in.
- Quantity of flexible wire, Systoflex tubing, tinned copper busbar, wander plugs, screws, etc.

STABILISING RESISTANCES

A new circuit of great sensitivity, but easy to assemble and control is described in this article.

On the 200-500 metre band the circuit is particularly "lively."

By C. P. ALLINSON, A.M.I.E.E., A.M.I.R.E., F.Inst. P.Inc.

IT is unfortunate from certain points of view that practically all neutralised circuits call for a tapped or a special form of winding in one respect or another.

In the case of the split secondary, the tapped grid, and the split-primary circuits special windings are needed. The home constructor who likes to "roll his own" finds this rather a drawback. This is especially the case with the split-secondary type of neutralising where a tapping has to be taken in the course of winding a fairly heavy wire inductance of 50 or 60 turns.

Overcoming the Difficulty.

Some time ago I found a way of overcoming the difficulty, which not only simplified the construction of an H.F. transformer but also made it easy to use one's old plug-in coils for a modern circuit.

This was done as shown in Fig. 1. At "1A" we have the split-secondary circuit modified so as to allow of a straightforward inductance being used. The grid coil L_1 is connected between grid and one end of high-resistance, R (100,000 ohms), the other end of which is connected to L.T. negative direct, or else through a small battery which enables grid bias to be used. The neutralising condenser is connected from the bottom end of the tuned circuit to the anode of the valve, and this circuit not only gave complete stability but also made the generation of parasitic oscillations an impossibility. Unfortunately, the over-all efficiency of the circuit was not so high as it might be.

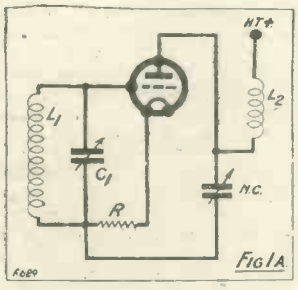


FIG 1A

The variation of the split-primary neutralised circuit is shown at "1B." Here an extra component is required in the form of an H.F. choke, which is rather a drawback to the average experimenter.

I therefore saw that if anything was to be done in this line it would be necessary to develop the Fig. 1a circuit, and accordingly I carried out some experiments with a view to increasing the efficiency of the circuit.

First of all it was desirable to apply as large a proportion of the signal voltage as possible across grid and filament, and this end would be reached by reducing the value of R to the lowest possible figure.

I was able to reduce quite considerably, but not to as low a figure as I had been able to do in the case of the tapped-grid circuit; which I have used with very excellent results in various receivers.

While trying out various arrangements I happened to connect the experimental set on which I was working up to an H.T. eliminator which I use rather a lot. The H.F. valve H.T. tapping was taken from a variable resistance that I had incorporated in the eliminator so as to give me a continuously variable voltage for screened-grid valve work, and other cases where it was desirable to be able accurately to adjust the H.T. voltage to a certain value.

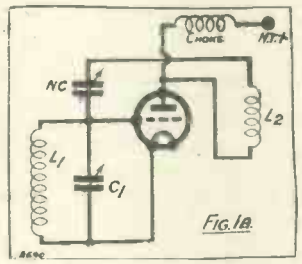


FIG 1B

When using this eliminator I found that the H.F. valve would now stabilise with a resistance of only 200 to 400 ohms for R, the neutralising condenser being set at its maximum value.

A Novel Scheme.

This occurred even with a high voltage H.T. on the H.F. valve in the neighbourhood of 100 to 120 volts, and was, therefore, not due, as I first thought, to the voltage drop across the regulating resistance in the eliminator. On examining this latter further, however, I found that no shunting condenser was provided, so that the resistance was in the H.F. circuit of the output side, namely, the primary of the output transformer.

I then tried the effect of different resistances for this, using the circuit reproduced in Fig. 2. The original resistance was retained, as shown at R_1, while R_2 was connected in the plate lead as shown. A large condenser having a capacity of 4 mfd. was connected across the other end of R_2 and H.T.— so as to make sure that extraneous resistances were not affecting my results.

I found that with this arrangement it was a simple matter to get complete stability with only 300 to 400 ohms, even when using a high plate voltage. Since the value of R_2 was low compared with the impedance of the valve, it would have an absolutely negligible effect as regards the voltage drop across it, and a high effective plate voltage was actually being used.

The circuit was highly efficient, and distant stations were brought in at excellent strength. Selectivity was good, while the circuit showed one very pleasing characteristic in that it became a little more lively on the higher wave-lengths, and so compensated for the extra reaction required in the detector circuit.

Almost Constant Reaction.

I found, in fact, that reaction could be left set over a very wide wave-band, and the set would yet be just on the edge, in its most sensitive and selective condition.

There was, however, one drawback to the circuit, as I feared there would be, and that was that with these low resistances it was found absolutely impossible to stabilise on the high wave-lengths between 1,000 and 2,000 metres.

For the experimenter, however, who concentrates on the 200 to 500-metre wave-band, this is a very lively, efficient and simple circuit to use, it is easy to adjust, easy to handle and is capable of giving good amplification for long-distance work. I have not yet tried to use two stages of this arrangement—so that leaves something for you to experiment on for yourself!

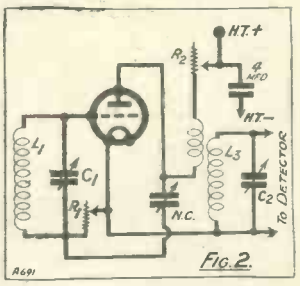


FIG 2.

TWO TIPS.

When a set is troubled with microphonic noises remember that these generally arise in the detector valve, so that the valve holder in this position should be suitably cushioned.

* * *

Remember that the H.T. positive actually on the plate of the valve is always less than the figure at which the corresponding H.T. plug is tapped in on the battery, because there is a drop of voltage through resistances, primary windings, etc.

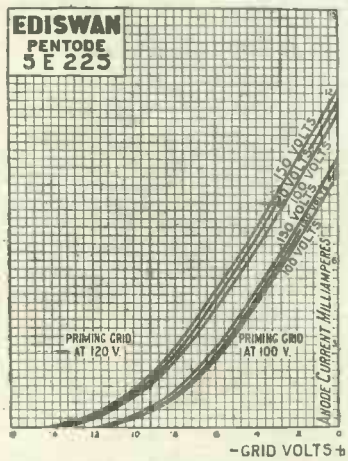
FROM THE TECHNICAL EDITOR'S NOTE BOOK

AN EDISWAN PENTODE VALVE.

The Ediswan type 5E. 225 has the honour, if honour it be, of being the first Pentode valve I have *officially tested*. It is a 2-volter and its characteristics are as follows:

Filament volts, 2; filament current, ·25 amp.; maximum anode volts, 150; priming grid volts, 100 to 150; amplification factor, 80; impedance, 66,000 ohms.

A Pentode valve is really a screened-grid valve, adapted for low-frequency work. Instead of the one grid, as in the case of the ordinary three-electrode valve, it has three. The first grid, the one nearest the



This is the Static Characteristic Curve of the Ediswan Pentode Valve.

filament, is the control grid, and its external connections are exactly the same as is the case of an ordinary valve.

Around this grid is another which is taken to a small terminal on the side of the base of the valve. This is the screening or priming grid, which is joined direct to an H.T. battery tapping via the small terminal referred to above. If, then, the valve had only a plate or anode its characteristics would be that of the screened-grid type, as used for high-frequency amplification, but to a central point in the filament is connected the third grid which lies between the priming grid and the plate.

I do not think this grid has, as yet, a recognised name, but by its insertion the impedance of the valve is brought down and the valve generally made suitable for low-frequency work. The impedance is, of course, still high, and that is the reason that, as you will have noticed, the "P.W." Research and Construction Department insists upon the use of a special output transformer when a Pentode valve is being used.

You can, of course, have a Pentode valve in the last holder of any set and merely connect its additional terminal to a point on the high-tension battery. But this is, as I have said, not the correct way to use the valve. These Pentodes, or at least, I should say the Ediswan Pentode, for it is with that I am dealing, do fulfil the promise of their wonderful characteristics.

The Ediswan type 5E. 225 is stated to have an amplification factor of 80, whereas 8 was considered good for a power valve not so long ago. Used properly one undoubtedly gets two-valve amplification with only the one stage. And when the application of the Pentode is studied it will be seen that the gain is much more than that of saving one valve and its coupling devices.

It must not be forgotten that, incidentally, there are profits in the decrease of circuit connections, an elimination of components and their potentialities for giving trouble, and last, but by no means least, there are the fewer corresponding factors requiring careful treatment to avoid distortion.

The price of the Ediswan Pentode is 25s. It is a lot of money, but I am inclined to think that it is worth it.

ANOTHER NEW LECTRO LINX LINE.

The latest Clix production is a lead-coated spade terminal. The object of the lead coating is to prevent acid corrosion. If you use an ordinary brass terminal or clip at the end of your accumulator leads it does not take long before corrosion sets in. Within a few weeks the terminal is eaten away. This new Clix spade terminal ensures a clean contact, and should be popular.

DETEX R.C.C. UNIT.

Messrs. Detex Distributors, Ltd., recently sent us one of their new R.C.C. units. It is rather out of the ordinary in design, for, instead of the usual square or round solid moulding, its moulding is cut away at the side so that the resistance and clips drop into semi-protected compartments. The price of the unit is 4s., and the standard values employed are ·01-mfd. coupling condenser, ·25-meg. anode resistance, and 1-meg. grid resistance. Other resistances can be supplied if required.

I carefully tested the unit and found it quite satisfactory in operation. These resistances are, as has been indicated, of an interchangeable variety, and are held in the ordinary kind of clips, but in trying to remove these resistances from the sample model, one end of each fell off! Not that this mattered very much, for I simply fitted the pieces on again. The fixed condenser in the base is, too, a rather flimsy assembly, and if you include this component there are, in the whole unit, round about fourteen pressure contacts. The majority of these are such that no insidious oxidation is likely to creep in and upset matters, but I should like to have seen some good hard soldering done. However, one must not forget the price, and, as it stands, the article passes its test.

BRITISH GENERAL COMPONENTS.

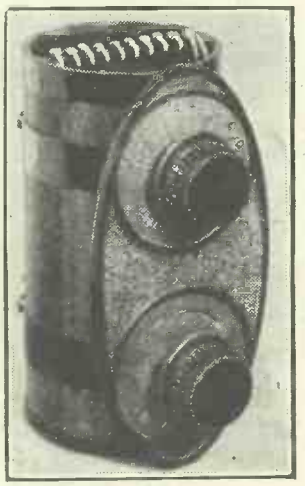
An alternative to ordinary wave-change schemes is to use an aerial tuning unit such as the one due to the British General Manufacturing Co., Ltd. This can be mounted on the panel by means of two holes, the front appearance being that of a nicely moulded plate having on it two knobs and pointers. The top one operates a switch which enables you to cover from 250 to 2,000 metres. The bottom knob controls reaction.

The connections to the unit are via four terminals, two for reaction and one each

Traders and manufacturers are invited to submit radio sets, components and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

aerial and earth. One has of course, to use a tuning variable condenser in addition. The unit, a sample of which was recently sent us for test, is nicely made, and it certainly works well. Considering the coils it replaces and their necessary connections, 18s. 6d. seems a reasonable price for it.

Another British General component which costs exactly the same, i.e. 18s. 6d., is the Super Shrouded Transformer. This is a large, robustly-made component, having a brightly nickelled casing. The terminals, large substantial items in keeping with the rest of the product, have plain markings on the nicely moulded top in which they are set.



The British General Aerial Tuning Unit.

The transformer is guaranteed for twelve months against breakage. On a careful comparative test I found the British General transformer very good. I could not honestly say it was the best I have tested, or even as good as some, although no doubt many would long ponder over the extra few shillings required for one to beat it.

RADIOTORIAL

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

THE "D.C." THREE.

F. P. N. (Kingston-on-Thames).—"I am building the 'D.C.' Three, as described in 'P.W.,' November 10th issue. Are there special precautions to take with a mains set like this when searching for distant stations, or in the way of safety?"

When searching for distant stations you will find that the resistance R4 is a considerable help. It is not at all critical, and in fact it can be put at about a sixth of the way round and left there if desired, but to get full signal strength and really efficient rectification, slight readjustment of R4 might be desirable, particularly if reaction is not smooth and sweet.

As regard safety, there are no particular precautions to be taken, except those which are always advised with a set of the kind that is operated from the electric-light mains, namely, always switch off the mains before any adjustments inside the set are made. Always keep earthed objects such as telephones, house wiring, flexible leads from vacuum cleaner, etc., away from everything connected to the set. (Normally there is no danger from any of these things, but as it is possible for insulation in them to become faulty, it is best to take no chances.)

By the way, you should be careful to see that the filaments are getting their correct current and not under-run or over run them, as it is important that both L.T. and H.T. should be adjusted according to the valve makers' specifications. Finally, remember that if when receiving distant programmes a little hum is audible, this may often be overcome by the correct adjustment of the grid bias on either the first L.F. valve, the second L.F. valve, or both.

A PENTODE FOR H.F.?

B. M. J. (Ampthill, Bucks).—"Can any of these pentode valves be used for high-frequency amplification?"

No. The pentode has been expressly designed for low-frequency amplification, and is unsuitable for use in H.F. circuits.

BROADCASTING TO THE NEIGHBOURS.

E. P. M. (London, N.).—"Since we moved the aerials close together I found out quite by accident that we can hear our neighbours talking in our set. Sometimes every word is quite distinct, and this has given me an idea for a New Year party surprise.

"I notice that it is when they get near to their loud speaker that we can hear the voices most clearly (for I can see in their windows from our back garden), and I feel sure that if I make my set oscillate just a little, and then shout in the loud speaker they could hear every word very distinctly.

"There is no other aerial quite near, and it would be great fun if I could give them a shock in this way by calling out their names, etc. Do you think it would be picked up in other receivers?"

Probably it would be picked up in other sets, and it is quite possible that the post-office authorities would get to hear about it. In this case, not only would your neighbour receive a shock, but you would also, for you would be liable to punishment for interfering with other people's programmes! Deliberately communicating across space in this way is an infringement of the rights of the Postmaster-General, and the authorities might take a serious view of any wilful case of this kind of thing.

A QUESTION OF CURRENT.

"ECONOMY FIRST" (Keswick).—"As I have a spare potentiometer on hand I should like to use this for regulating the voltage on the grid of the detector valve. I understand that all that is necessary is to connect the potentiometer across L.T. positive and L.T. negative leads, and then to connect the "filament" end of the grid leak to the slider. Does this arrangment use up any L.T. current, and, if so, how much? It is a 400-ohm potentiometer."

You omit to mention the voltage of the L.T. accumulator, which will have an important bearing upon the current the potentiometer will take. You can, however, easily work out the current consumption for yourself, as this is simply a question of applying Ohms law.

Ohms law states that the current flowing will depend upon the voltage of supply (in your case the accumulator), divided by the resistance in ohms. So if you have a 4-volt accumulator you will simply divide this figure by 400 (the resistance of the

(*Continued on page* 896.)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

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RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 894.)

potentiometer) and the answer will indicate the current taken. In this instance the answer is ·01 (10 milliamps); but if the battery is a 2-volt one the current will be correspondingly less, while if it is a 6-volt it will be correspondingly higher.

An important point to remember when connecting a potentiometer in this way is that one lead should be on the *filament* side of the on-off switch. If this point is not watched it is quite possible for you to connect the potentiometer across the L.T. battery in a position where it will take current even when the set is not in operation!

This, of course, would mean that more current than was necessary would be withdrawn from the accumulator, so be sure that the wiring is so arranged that when the on-off switch is out the connection from L.T. to one side of the potentiometer is broken.

MOVING-COIL LOUD SPEAKERS.

D. P. H. (Canterbury).—"I have recently become interested in the moving-coil type of loud speaker, and have discovered that there are several different kinds of this instrument available. What are the differences between the various types?"

The principle of operation is the same in all cases, but different types arise from the different methods employed for providing the necessary magnetism There are three different classes, the first being the type similar to the original "R.K.," namely that which makes use of a *permanent magnet*.

Secondly, there are the "*mains-operated*" type, which have a magnet winding designed to suit the voltage of the electricity supply, and to be plugged in direct to the existing power supply.

Thirdly, there is the type which has a field winding that is suitable for use with an ordinary *accumulator* (6-volt).

The permanent-magnet coil-driven cone is fairly sensitive, but not quite so sensitive as those which have a separately excited field. Obviously, the permanent magnet moving coil is most suitable for those listeners who have difficulty in getting their accumulators charged, or who have no electric lighting in the house.

The current taken by the mains type is quite small, a usual value being about 90 milliamps. The battery-operated types that work from 6-volt accumulators, take far heavier currents than this, and generally the current value is in the neighbourhood of half an amp or a little more.

In all types the object is to design a satisfactory strong magnetic field in which the moving-coil is suspended, and to which it reacts at the bidding of the current flowing through it (according to whether these currents assist or oppose the permanent magnetism).

CONDENSER CONSTRUCTION.

"MECHANIC" (Darwen, Lancs).—"Why is it that a year or so ago condensers used to be sound and thoroughly built jobs, but nowadays a sort of skeleton formation is used, and all the metal that can be cut away is removed?"

At one time the condenser end plates and other metal parts incidental to construction were solidly and strongly constructed with the idea of providing robust and mechanical action, to withstand the effects of constant movement. Since that time experience in short-wave reception has proved that unnecessary metal in the vicinity of the active area of the plates of a condenser gives rise to very much the same kind of losses as those due to shielding placed too close to a tuning coil.

It is for this reason that the light skeleton method without unnecessary substance is now being employed in condenser construction.

DISTORTION WHEN USING GRAMOPHONE PICK-UP.

A. G. M. (Oxford).—"Can you tell me whether it is possible for a pick-up to distort? I ask the question because all the components in the set have been carefully chosen, and I have never heard this distortion except on pick-up work.

"The set is chiefly used for radio, and its performance has been so uniformly good that I thought I would invest in a pick-up so as to take advantage of the excellent reproduction which is given by the amplifier. I have had this pick-up in use (in the detector socket) for about three weeks, and there is no doubt whatever that the distortion is only troublesome when the pick-up is in use, and if I switch over to radio there is no trace of it, the set giving just as good results as ever it did. With the pick-up, and especially on certain of the dance pieces, there is a harshness and unnaturalness which I am unable to account for, and I should be glad to know whether you think this is due to the pick-up, or to hear what suggestions you can give to remove it."

From your description we are pretty sure that the whole trouble is due to the overloading of the valves. Situated as you are at some distance from the nearest broadcasting station, your set was never called upon to handle very large signal voltages until you introduced the pick-up.

The output from this is evidently greater than that you can obtain from any radio station, and consequently your last valve or valves are being overloaded. To test this try using the pick-up not in the detector stage, but in the first L.F. amplifier position. This will have the effect of reducing volume and will probably do away with the distortion which you find so objectionable.

WON'T OSCILLATE ON SHORT WAVES.

"DISAPPOINTED" (St. Helens).—"The only trouble is that I cannot always get the set to oscillate on the short waves. Why is that?"

Failure to oscillate may be due to an unsuitable H.F. choke, but if yours is a good choke, the probability is that the failure is due to the fact that at certain adjustments the set is tuned to the natural wave-length of the aerial, or to a harmonic.

To overcome this trouble it is a good idea to try removing the aerial coil farther away from the grid coil, or if a tapped grid circuit is used, to take this tap "lower down" towards the earth end of the coil. If this is insufficient to overcome the trouble, alter the aerial tuning by means of a small condenser in series. Or arrange a small *fixed* condenser in series with the aerial and then when one of these dead spots is found, either insert or remove the series condenser, thus altering the natural wave-length of the aerial and allowing the receiver to be tuned over the desired point without cessation of oscillation.

TECHNICAL NOTES.

(*Continued from page 884.*)

of the first points which needs attention is the H.F. amplifier.

Great care should be taken to use the proper anode voltage.

It is surprising how much more sensitive the receiver becomes when the correct anode voltage is used in H.F. valves. An improvement may sometimes be made in this direction by introducing a suitable variable high-resistance in the positive lead to the H.F. anodes, this resistance being, of course, shunted by a condenser of, say, 1 mfd.

Overloading.

Care should also be taken with the detector in order to avoid overloading. For this purpose some set manufacturers use rather a low value of grid leak so as to drain off the charge on the grid and prevent if from distorting the quality of the reproduction.

Whilst this heavy drain is quite satisfactory and even necessary for powerful signals, it militates against sensitivity when endeavouring to work with very weak signals. A variable grid leak is the obvious solution, but unfortunately some new types of variable grid leak do not give satisfaction.

A variable grid leak may conveniently give a range of from $\frac{1}{10}$-megohm to 10 megohms, but it is very important that the variable leak should be noiseless in operation and otherwise satisfactory. In particular, having once been adjusted to a particular valve, it should remain reasonably constant.

Detector Adjustment.

A device of this kind in place of the usual fixed grid leak permits of the adjustment of the detector for the best possible results, whether it be on powerful local signals, which tend to overload the detector valve and introduce distortion, or on weak signals, the field-strength of which must be applied to the grid of the detector valve.

Reaction.

Reaction also comes to our aid in getting extreme sensitivity, and a very simple method is to wind, say, 30 turns of cotton-covered wire upon a cardboard tube 2 in. in diameter, and to introduce this coil in series with the H.T. supply to the anode of the detector valve.

The coil is laid upon the top of the H.F. transformer immediately preceding the detector. If a suitable variable resistance is shunted across this coil to act as a throttle control, very considerable reaction may be obtained, and often the range of a receiver may be enormously increased in this way.

Suitable Valves.

Finally, it is, of course, always worth while to look over the valves and, if necessary, to shift these about until you make

(*Continued on page 900.*)

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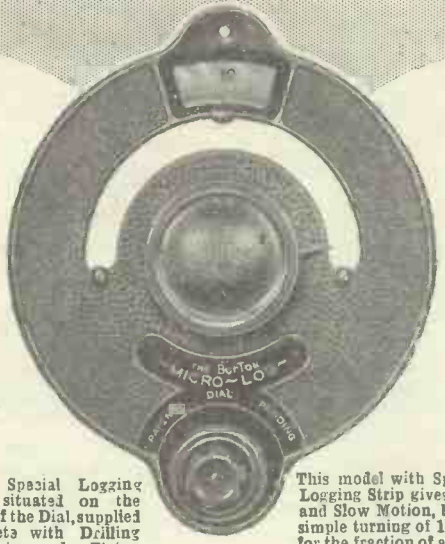

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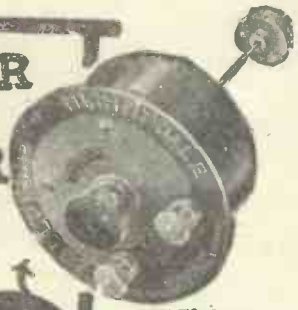

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NIGHTINGALE SPEAKERS

TECHNICAL NOTES.

(Continued from page 898.)

certain that each valve is doing the job for which it is best suited.

When all the above precautions and hints have been observed, there is still plenty of room left for what I may call the "human element," and the skilful handling of the set and its various adjustments will still play a great part in the success which is obtained.

Power Consumption.

In these days of large power valves the question of filament current consumption is apt to become a serious one, but happily there are various methods of avoiding the necessity either for very heavy duty accumulators or for continual journeys to the charging station.

I will not refer at any length to the ordinary small accumulator with trickle-charger, as this is now well-known and very widely used. I may, however, remark that in quite a number of cases it is possible to leave the trickle-charger in action, thus charging the accumulator whilst the latter is supplying the set. In other words, the trickle-charger, accumulator, and set may all be in operation at the same time.

In some cases you will find that this will *not* work, owing to the A.C. hum produced from the charger; but in quite a large number of cases, as I have already said, it *does* work, and therefore, in such cases, the accumulator need not be of particularly large capacity, since it is taking in at the same time that it is giving out. The accumulator, in fact, in these circumstances functions largely as a "buffer" to smooth out irregularities in the current.

A Simple Solution.

I have a letter from a reader who describes another method, which he uses for his last valve, which consists in employing a suitable step-down transformer with centre-tapped secondary, the two ends of the secondary going to the terminals of the filament, whilst the centre-tap is connected to H.T. negative.

If the secondary of the transformer is not centre-tapped, a resistance may be connected across the filament terminals, this resistance being centre-tapped, the tapping being connected to H.T. negative.

Inductive Hum.

When using a transformer this way—or, for that matter, when using a trickle-charger as mentioned above—it is desirable to keep the transformer fairly well away from the set, so as to avoid any inductive hum. It is also desirable to use double flex (preferably twisted flex) for carrying the alternating current, especially in the immediate vicinity of the set, so as to avoid stray alternating magnetic field, which will be picked up by the set and cause A.C. hum.

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NOTES ON THE FULTOGRAPH.

(Continued from page 877.)

and connect this to the remaining pole of the battery.

On writing with the end of the wire upon the iodide-impregnated paper, visible characters will be made, as illustrated at Fig. 2.

This is an interesting experiment to perform because it illustrates how the receiving part of the present-day Fultograph exerts its effect. The prepared paper is merely soaked in an iodide solution, roughly dried, and then attached to the cylinder. The incoming pulsations of current thereupon decompose the iodide present in the paper, liberating free iodine which is brown in colour, and whose presence, therefore, effects the building-up of the picture.

Why it Fades.

Fultograph pictures, as they stand to-day, are unfortunately not permanent. Which, of course, is only to be expected in the case of a picture composed of an iodine deposit. Iodine is a very volatile substance, and it quickly dissipates itself into the air.

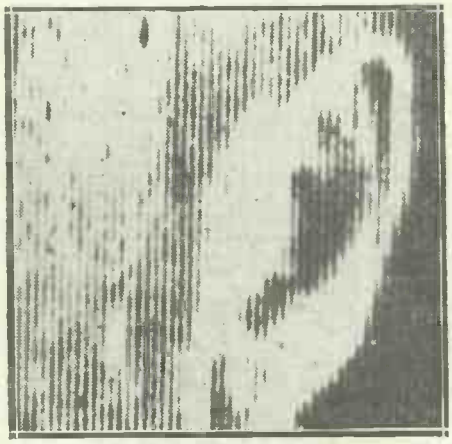


Fig. 4. A magnified section of a picture received via a Fultograph.

It is for this reason that a Fultograph picture after a few hours' exposure to the warm sun will show signs of fading. Again, a hot fire will spoil a Fultograph picture.

It is interesting to examine the composition of a Fultograph picture under a strong lens. Now glance for a few moments at Fig. 4. Here we have a very considerably enlarged view of a portion of the face and background around the ear of a picture recently broadcast. The light and shade of the picture consists of parallel lines, some broken and interrupted by white spaces, others almost continuous.

But in every case note that the individual lines are not "sharp." You could make lines similar to them by drawing a fine pen down a sheet of blotting paper. This lack of sharpness is, of course, due to the fact that the iodine liberated by the platinum stylus of the receiving cylinder spreads slightly from its area of liberation, and it is this microscopic spreading of the iodine which is one of the causes of the Fultograph picture not being as well defined as a true photograph.

For all that, however, the Fultograph is capable of reproducing accurate designs and images, and there is no doubt that the degree of definition of its pictures will be improved as time goes on.

THE "P.W." "WHITE PRINTS."

A NEW SERVICE FOR OUR READERS.

White Print No. 4. :: :: A Plug-in Coil Three-Valve Set.

This week we publish the fourth of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the White Print filed. In due course you will thus have available an encyclopædic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

PLUG-IN coils are things most of us have about, and very handy they are for all sorts of purposes where we require flexibility and close adjustment to conditions. This week's White Print design shows one of the best and most straightforward ways of using plug-in coils to form a very efficient and flexible detector circuit with reaction, followed by two more or less standard L.F. amplifying stages.

The special advantages which follow upon the fact that different-sized coils can be used in each of the sockets to suit the requirements of the moment are these: Selectivity can be varied within quite wide limits by altering L_1, any desired wave range can be covered by using the right size for L_2, and by altering the size of L_3 you can suit the reaction requirements of practically any valve.

Easy Selectivity Adjustments.

The circuit is of the Reinartz type, with separate coils for aerial coupling, tuning and reaction. L_1 is the aperiodic aerial coil, and for the ordinary wave-band will be a No. 25, 35 or 40, the smaller sizes giving the greatest selectivity. Just which size to use depends upon the size of your aerial, how near you are to the local station, i.e. how much selectivity you need, and so on, so it is always a matter of trying it out for yourself.

The tuning coil, L_2, should be a No. 60 for the ordinary wave-band, and the reaction coil will usually be a No 50. If the detector valve is a rather "flabby" one, however, you may need a No. 60 or even a No. 75. For the long waves L_1 will be a No. 75 or 100, L_2 a No. 250, and L_3 a No. 150. By the way, the circuit is quite a useful one for short-wave work, and all you need to adapt it is a set of the special short-wave plug-in coils now produced by a number of firms.

The L.F. Circuits.

The L.F. side is quite normal, and uses one resistance-coupled and one transformer stage. The first, by the way, is arranged for the use of a self-contained R.C. unit, but a separate anode resistance, grid condenser and grid leak could quite well be used if you happen to have the parts handy. Suitable values are 250,000 ohms (i.e. ¼ meg.), 2 meg. and ·005 mfd., while if you use an R.C. unit the same figures for the anode resistance and leak should be used.

The transformer can be of any good make (resist the temptation to use something cheap and unknown if you want real quality), and a low ratio is desirable. A higher ratio of, say, 4 or 5 to 1 will give slightly greater volume, but the reproduction of the lower notes cannot be expected to be quite so good.

COMPONENTS.

- 1 Panel, 14 in. × 7 in. × ¼ in. or ³⁄₁₆ in.
- 1 Cabinet, with baseboard 9 in. or 10 in. deep.
- 1 ·0005 mfd. variable condenser.
- 1 ·0001 or ·00015 mfd. reaction condenser.
- 1 L.T. switch.
- 3 Single coil mounts.
- 3 Sprung valve holders.
- 1 L.F. transformer.
- 1 R.C. unit. (Complete.)
- 1 ·25 meg. grid leak and holder (to act as "H.F. stopper").
- 1 ·001 mfd. fixed condenser.
- 1 ·0003 fixed condenser with one plain and one insulated grid-leak clip (or separate leak holder).
- 1 2-meg. grid leak.
- 1 H.F. choke.
- 1 Strip, 12 in. × 2 in. × ¼ in. and 8 terminals.
- Wire, screws, flex, G.B. plugs, etc.

There is only one constructional point which seems to call for explanation, and that concerns one of the connections to the reaction condenser. You will notice on the wiring diagram that this condenser has three terminals, and from the one marked E a dotted connection goes to the earth side of the tuning condenser. This is shown because some makes of reaction condensers have a screening plate and special earthing terminal, the object being to reduce hand-capacity effects. If the one you use does not possess such a plate and terminal, of course, simply omit the dotted lead.

Just the standard arrangement of valves will suit this set, that is, two of the H.F. or general-purpose type for the detector and first L.F. positions, and a power or super-power for the third socket. Two-volters work well in a circuit like this, and are obviously the correct choice where economy is a very important consideration.

Simple Battery Connections.

Only one H.T. positive terminal is provided, and to this you should apply 100 or 120 volts for the best results. No separate tapping is provided for the detector, since the use of R.C. coupling automatically drops the voltage on this valve to a suitable figure.

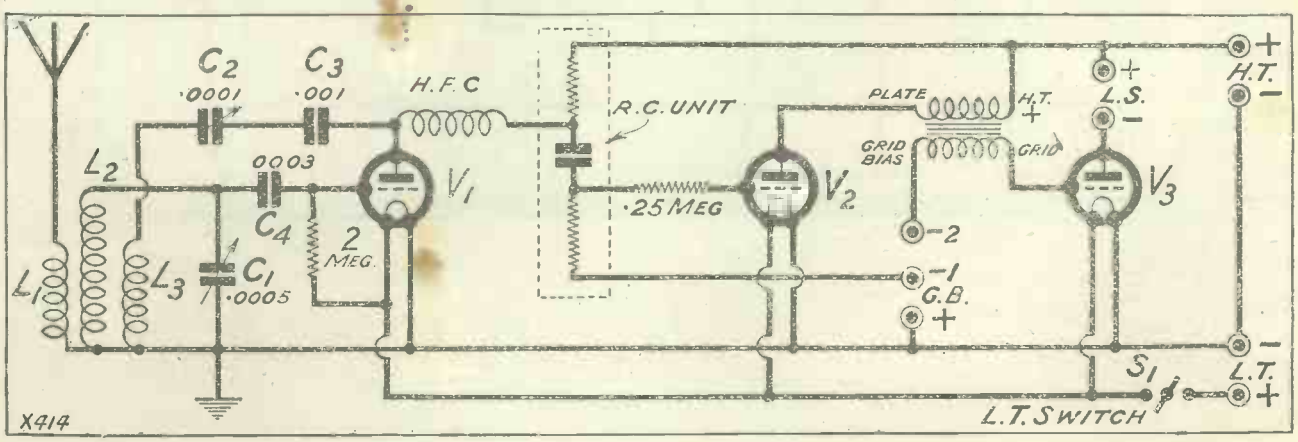
This scheme is a perfectly satisfactory one for sets of the simpler type in practically all cases, but it should just be noted that it is not always desirable where the H.T. supply is from a mains unit. It is a little apt to produce "motor-boating," and so a separate tapping for the detector should be used in this case.

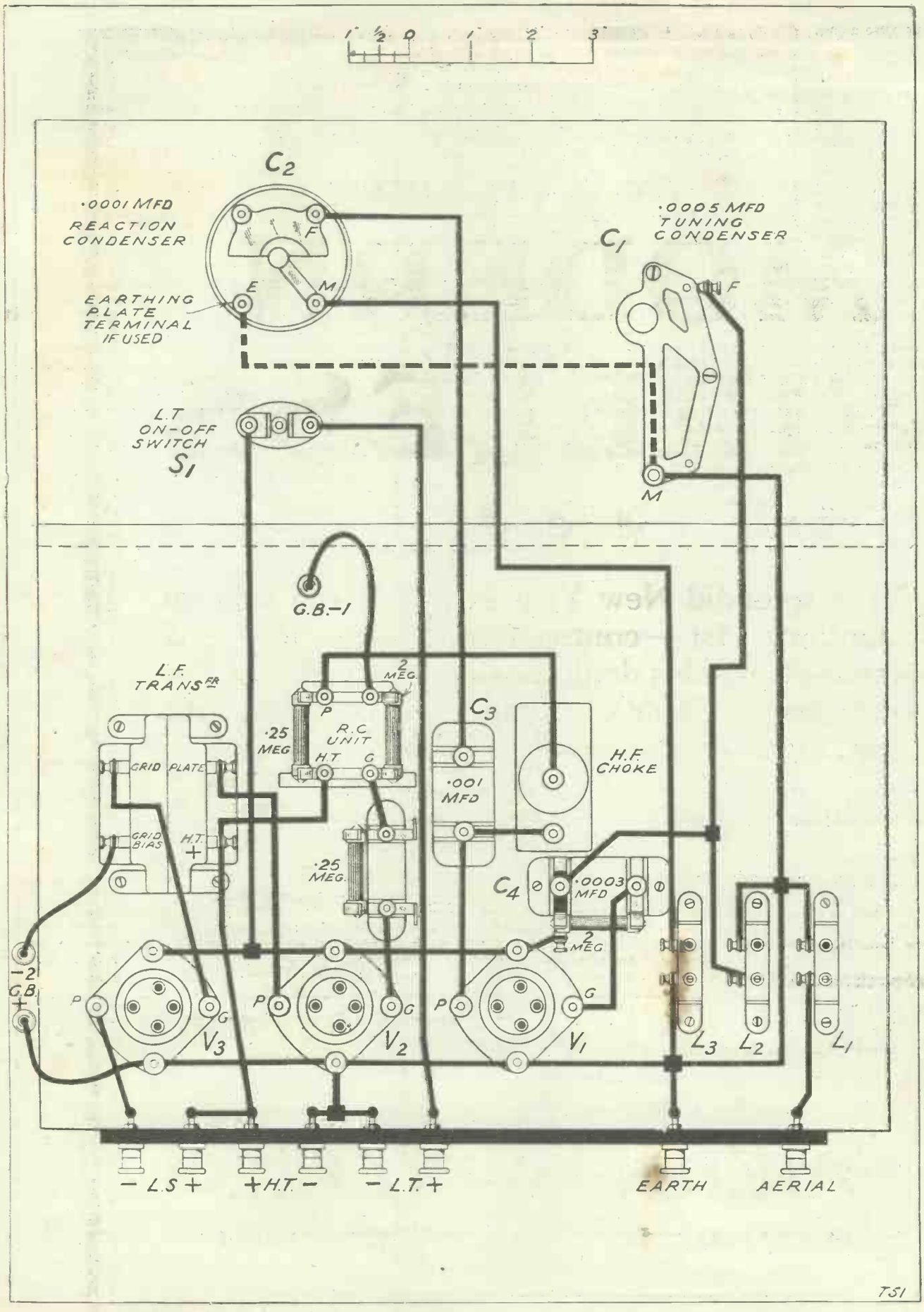
This is a standard remedy which is very easy to apply. Just disconnect the lead to the "H.T." terminal of the R.C. unit, and instead take a lead from this terminal out to a separate positive tapping on the mains unit. This, by the way, should be one of the higher voltage points.

On the Short Waves.

A few notes on short-wave working with the set may be helpful. First of all, you must be prepared for the fact that tuning is extraordinarily sharp and critical on the really short wave-lengths, hence a really good vernier dial is necessary, especially as a full-sized tuning condenser is used.

Perfectly smooth reaction is the key to success. A small aerial coil (2-turn size) helps here, and so does a careful choice (by test from amongst your stock) of the detector valve.





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