

THE ECONOMY SET OF THE YEAR

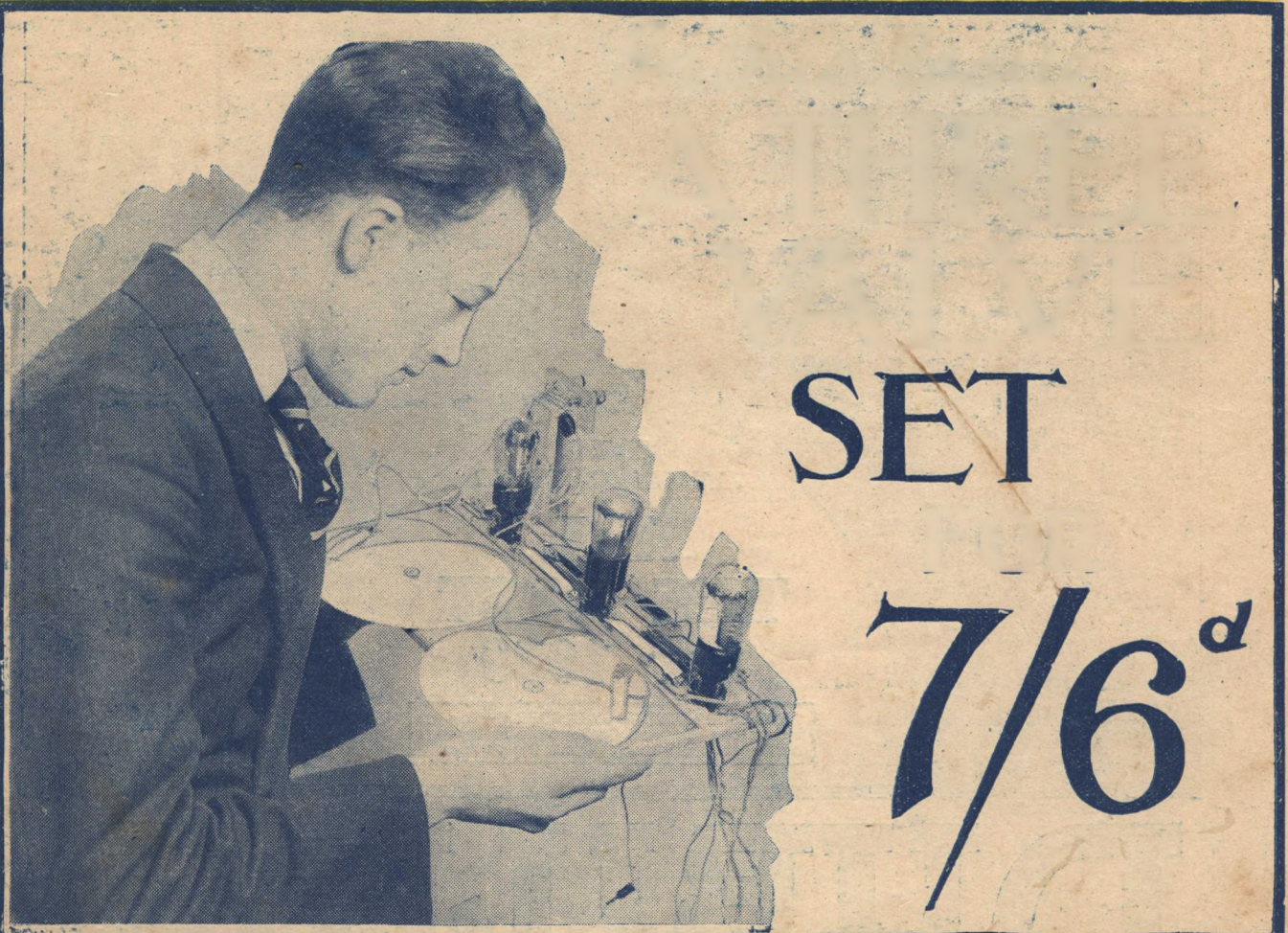
Popular Wireless

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3d.

No. 344. Vol. XIV.

INCORPORATING "WIRELESS"

January 5th, 1929.



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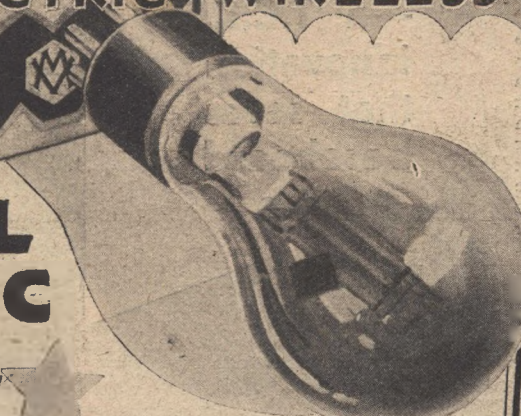
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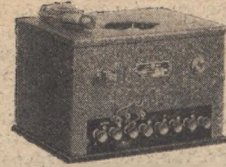
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2. OUT OF PRINT.
3. 1-VALVE L.F. AMPLIFIER.
4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
5. H.F. (Tuned Anode) AND CRYSTAL WITH REACTION.
6. H.F. & CRYSTAL (Transformer Coupled, without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F. & DETECTOR (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
12. OUT OF PRINT.
13. 2-VALVE REFLEX (Employing Valve Detector).
14. OUT OF PRINT.
15. OUT OF PRINT.
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (With Switch for Last Valve).
17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (With Switching).
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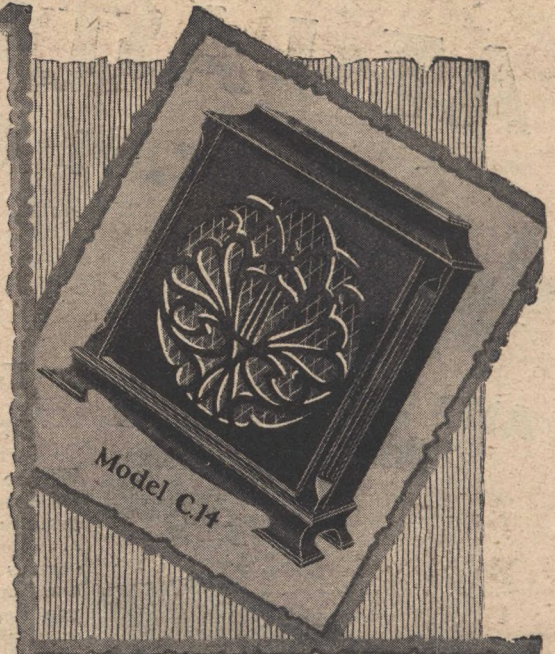
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33. A “KNIFE EDGE” CRYSTAL SET.
34. AN H.F. AND DETECTOR TWO-VALVER.
35. THE “UNIVERSAL THREE” (Det. and 2 L.F. stages resistance-coupled).
36. THE “SPANSACE FOUR” (H.F., Det. and 2 L.F.).
37. THE “LONG SHORT” CRYSTAL SET.
38. A TWO-VALVE L.F. AMPLIFIER.
39. THE “SYDNEY” TWO.
40. THE “SUPER SCREEN” THREE.
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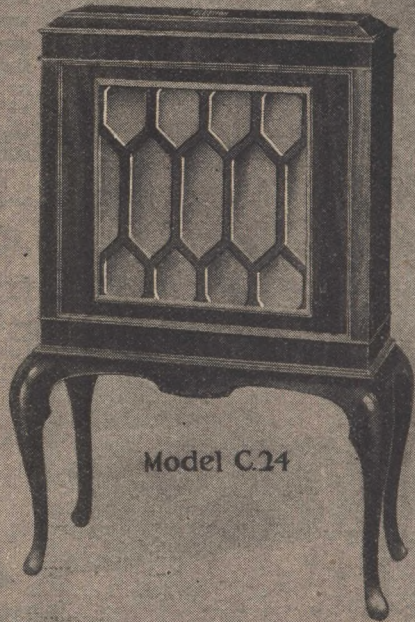
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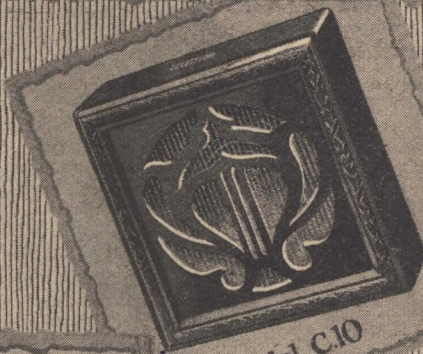
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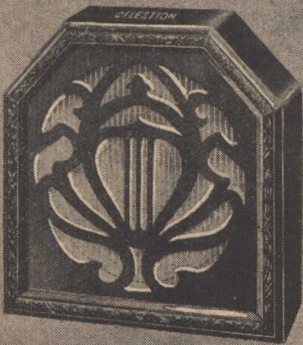
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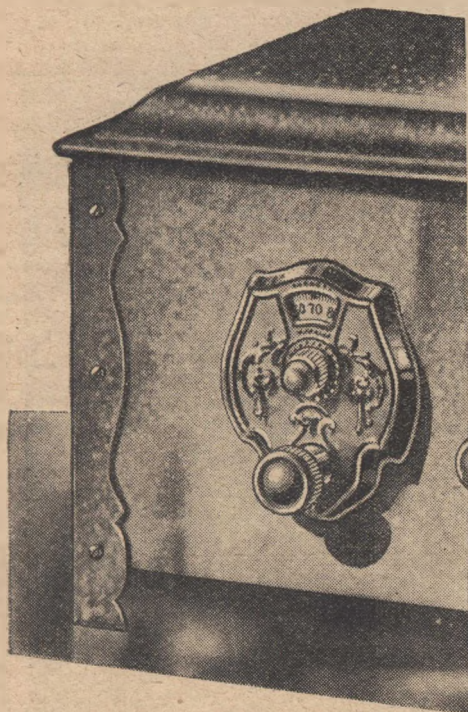
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Price includes the three Cossor Valves, the handsome cabinet, all the parts, and even the simple tools—everything necessary to assemble this wonderful Receiver. Long Wave Coils 8/6 each extra if required



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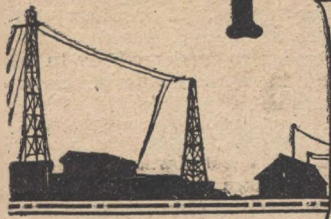
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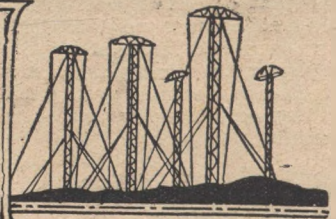
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RADIO NOTES AND NEWS.

Tele-Television—Pictures at Sea—Hark, Hark, the Asparagus!—Thirty-Million Cycles—
 The Ether-Robbers—Our Bartest Bart.—The B.B.C.'s Latest.

"Ariel's" Promotion.

GREAT news! Effective January 1st: I am to be allowed real ink, provided I roll my shirt-cuffs back; and something better than the backs of used envelopes to write on. I can have the reversion of the tea-leaves in the office pot, and the technical chaps say that I can have any burnt-out valves I see lying around. If all this happens in January, perhaps by June I'll be a director.

The Wireless Diary.

I KNOW that it is not a scrap of good talking about diaries, for although they are bought in thousands they are "kept" only in dozens—and that by folk who haven't much else to do. But I know one good use to which the hideous thing can be put; it can be used as a register of your accumulator charges. But I suppose no one uses accumulators nowadays except on cars. You can't run a car from the mains. I asked a man if he was interested in keeping a diary, and he replied: "No, a brewery!"

Tele-Television.

A REPORT from Johannesburg states that an engineer of that city picked up some television transmission from 2 X A F (New York), a distance of nearly 7,000 miles, on a home-made set. Amongst the things he said he saw was a toy monkey. Yes! This television is going to keep us sober, for I can conceive occasions when a televised monkey would make some men ask their companions if they, too, saw it. It reminds me of the story of the man who said he saw rats with top hats on, but whose "steady" friend said: "Hold up, Jock—they've no hats on at all!"

Red Letter Days.

JANUARY 5TH, 2 L O and 5 X X. Running commentary on Rucker match, England v. The Rest, at Twickenham. January 8th, 2 L O and 5 X X. Wish Wynne. January 11th, 13th and 14th. 2 L O and 5 X X. The Wireless Singers. Also from 5 G B on January 18th. By the way, in 1929 the Greenwich Time Signal will be given from 5 X X in place of Big Ben at 1 p.m. The present 4 p.m. time signal will be dropped and a new one introduced at 4.45 p.m. On Sundays, the

time signal at 4 p.m. will be dropped and one will be broadcast at 3.20 p.m. instead of Big Ben.

Pictures at Sea.

FIRST the ocean newspaper and now the ocean *illustrated* newspaper. Pictures have been successfully transmitted by the Fulton process through Rugby to the "Olympic" in mid-Atlantic and printed in the ship's paper. This is undoubtedly a great stride forward, but soon there will be no place on earth where a man can escape from the busy world except the inside of a monastery. I wonder whether radio is permitted in such places.

Hark, Hark, the Asparagus!

THERE is a man in Austria called Professor Richtera, who is said to be able to measure the one ten-millionth of a metre's growth of a plant, and to make the sound of the plant's effort audible. This gentleman aims at broadcasting that sound. As for the measurement, well, if

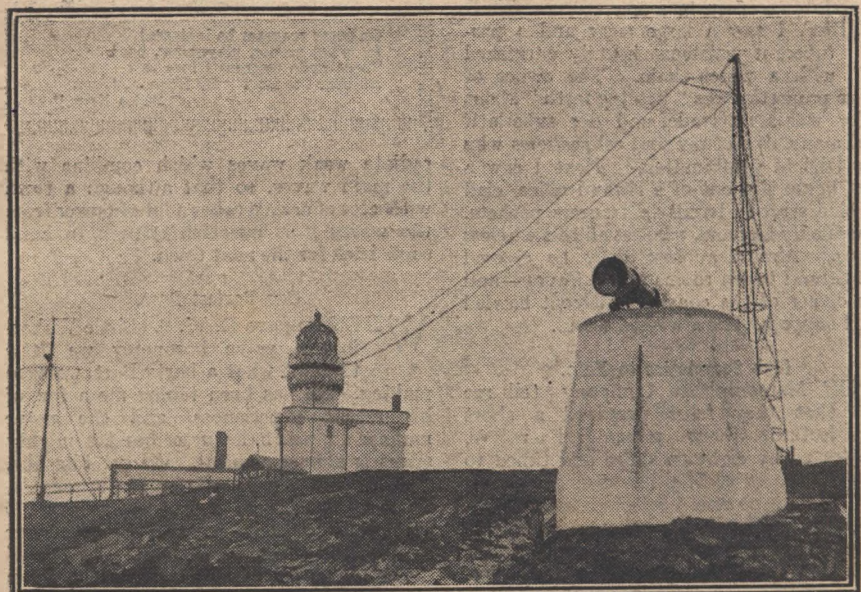
that is scientific gardening, I'd sooner collect stamps. And as for the sound, I don't think a plant has any right to make a noise about a ten-millionth of a mm., unless it can "say it with flowers." I think the professor should start with the song of the mushroom, which cometh up like a rocket.

"And the Next, Please?"

ON reading over my notes so far, I have the feeling that I have been straining your credulity. Here's another. New York says that the radio operator of the "New York Times" failed to get through on the 'phone to a friend in a suburb of that city. Knowing that the friend was listening to the Byrd Antarctic Expedition, 10,000 miles distant, he sent a radio to the operator of the Expedition, who relayed the message back to New York, and so the friend received it. Nothing incredible about this, and I envy "friend" the thrill he undoubtedly got.

(Continued on next page).

"FOR THOSE IN PERIL . . ."



Lighthouses are now being equipped with radio as a safeguard for mariners, and this illustration shows the new aerial installed at Fraserburgh, Scotland. Note also the foghorn on the tower in the foreground.

NOTES AND NEWS.

(Continued from previous page.)

Talking Back.

NEWS from America! The Bell Telephone laboratory has evolved a means of inverting speech, with the object of ensuring secrecy in telephony. The speaker pours out a stream of gibberish which at the other end of the line is, somehow, converted into real words. I don't know how it is actually done, but on thinking it over I should say it would not be difficult and that the method will have much to recommend it.

Brain Wave.

A HINT to the Post Office. Why not issue an "All In" Licence, covering dog, radio set and chauffeur and/or gardener, and (by arrangement with the L.C.C.) the car? All the best insurance companies have omnibus policies, so why not omnibus licences? Think of the work it would save! That's the snag, I fear.

Thirty Million Cycles.

GOODNESS! What a frequency! Ten metres. What a wave-length! We are getting on and no mistake! Our famous amateur, who must be quite a clever engineer, Mr. E. J. Simmonds, has been working from G 20 D a regular two-way communication with IA Q D (Maine, U.S.A.) on 10 metres. He uses an Osram T-250 valve, with quartz crystal control, and for doubling the control frequency he uses Osram L.S. 5 B. valves. His receiving valves are the D.E.Q. and the S.625 screen-grid type, also Osram's.

Television Tests.

COLONEL MALONE recently asked a question of the Postmaster-General, in the House of Commons, about the Baird Television, whether his department carried out any examination and with what results. This question was answered by Lord Wolmer, Assistant P.M.G., who said: "Demonstrations of a limited character have taken place before Post Office officials; the results were inconclusive but sufficient to warrant further experiment."

Seen in a Day.

FIRST, I saw a large cigar and a tuberculant waistcoat heavily garnished with a watch-chain. The owner of those properties was "holding forth" about "der wahless terrade, und der suberlatif vorkmanschipp of my lout shepkeerss wiss our falls in gombination." Next I saw a slim figure slip out of a Strand office, clad in blue serge; hands in trousers pockets. It was only Marconi, who set all this wireless going. Almost apologetically he crossed the Strand to his rooms at the Savoy—and the owner of the convex waistcoat bawled on, I suppose. It's a wicked world.

Club Secretaries to Note.

THE Marconiphone Company tell me that they have prepared a short lecture about screen-grid valves, illustrated by eighteen slides and timed to last from forty to fifty minutes. They will lend the lecture and a set of slides to secretaries of radio clubs. Shortly they will have also a lecture on "Drawing Power from A.C. Mains," with about twenty slides. (These lectures ought to help the Queen's Park Society out of their fix.)

The Ether-Robbers.

MESSRS. R. H. BARFIELD and G. H. Munro, in a paper read before the Wireless Section of the Institution of Electrical Engineers, described their investigation of the effects of buildings, tuned aeriels and transmitting aeriels masts in robbing the waves emitted by 2 L O. A complete survey of S.E. England was made with a receiver on a motor-van, and two distinct minima were observed in W.S.W. and E.N.E. directions, due to the "shadows" of the transmitting masts.

Take and Give.

THE absorption of the wave energy was found to be strongly marked over the denser parts of a town on the short waves. A large number of aeriels in tune with the transmitter have a critical effect on the attenuation of the waves, due to their acting as absorbers of energy. When these aeriels oscillate, however, they actually

SHORT WAVES.

A military expert predicts that the next war will be fought by wireless. From what we heard the other night we had the impression that it had started.—"Punch."

First Comedian: "Didn't it make you nervous, to be telling your jokes the first time to a radio audience!"

Second Comedian: "Nervous? Man, I never felt safer in my life!"—"Radio News."

A correspondent writes to ask us whether he is correct in assuming that the filament terminal of an audio-frequency transformer should be connected to L.T. positive. The answer is, of course, in the negative.

UP-TO-DATE.

It was the schooner Hesperus
That sailed the wintry sea;
But the Skipper had a wireless set
To keep him company.
So what cared he for the wintry sea?

A member of the radio trade expressed his opinion that far more valve receiving sets would have been bought as Christmas presents if the public would get the idea out of their heads that a set employing valves was too complicated for the uninitiated to operate. Everyone round our way is making a howling success of them, anyway.

BY REQUEST.

A thousand talents has this chap
To whom I humbly doff my cap.
A world-renowned composer, he
Whose name is flung 'cross land and sea.

On every program he is starred
As gifted author, playwright, bard.
Those radio features I love best
All bear the label "By Request."
"Radio News."

radiate weak waves which combine with the main waves, so that although a town with a lot of aeriels takes a lot of power from the waves it is unselfish enough to hand some back for the next town.

Our Bartest Bart.

WHEN we gave R. W. S. (Little Wakering) a valve baronetcy we little thought what a barty Bart. we were making. He has been telling me a few of his recent experiences, and the naive manner in which he describes his mighty spans is almost comical. We get bits like, "At present the Americans are unreliable, in fact, Bandoeng, Java, has the whole lot beat." "I have been having some splendid evenings with 7 L O (Nairobi)." "One slight move of the condenser (from 7 L O.—Ed.) and 3 L O (Melbourne) was on." Isn't he rich?

Nairobi Relays.

R. W. S. likes Nairobi so much that he stayed there, so to speak, for eleven consecutive nights, on two of which 7 L O relayed 5 S W and the voice of Big Ben was heard in Essex, rebroadcast from Africa. What would Gladstone have said in '29? Our Bart. vouches for the variability of P.C.J., and states his opinion that K D K A has "gone off" since last year, though he has ascertained that the output has not altered. He dares anybody to tell him to look to his set for the answer, nevertheless. Guess he's right, too.

Sabbath Humour.

WHENEVER I feel downcast I turn to my clippings from the wireless columns of the Sunday newspapers; generally they rival "Punch." I have just read in one of them the astounding news that a wireless operator can tell that a friend is on duty aboard another ship by the "rhythm of the Morse he taps out on the wireless key." Well, I ask you to recall or look at the Morse code and then to consider how much *rhythm* can be "tapped out." Might as well talk about a Yeoman of Signals doing his flag-wagging as gracefully as Maud Allen!

A Minute Off.

"PUNCH" says: "Discussing work for the B.B.C., a novelist says it is time authors looked round. This advice has been anticipated by Mr. G. K. Chesterton." Jolly good! But authors ought also to "sit up," advice which has been anticipated by the Sitwell family. (Sit down and dry up!—Ed. "P.W.")

Jugo-Slavia Gets the "Bird."

BERLIN reports the completion of the new Jugo-Slavian broadcasting station at Laibach, 35 miles from Trieste. The station will radiate on a wave-length of 566 metres. But the great joke is that during intervals it will broadcast the call of the cuckoo. This is an indication that the B.B.C.'s advertisement of the nightingale had not universal appeal. It is to be hoped that the idea will not be generally adopted, lest the ether be filled with the cries of animals and birds. Such competition with chamber music would be deplorable.

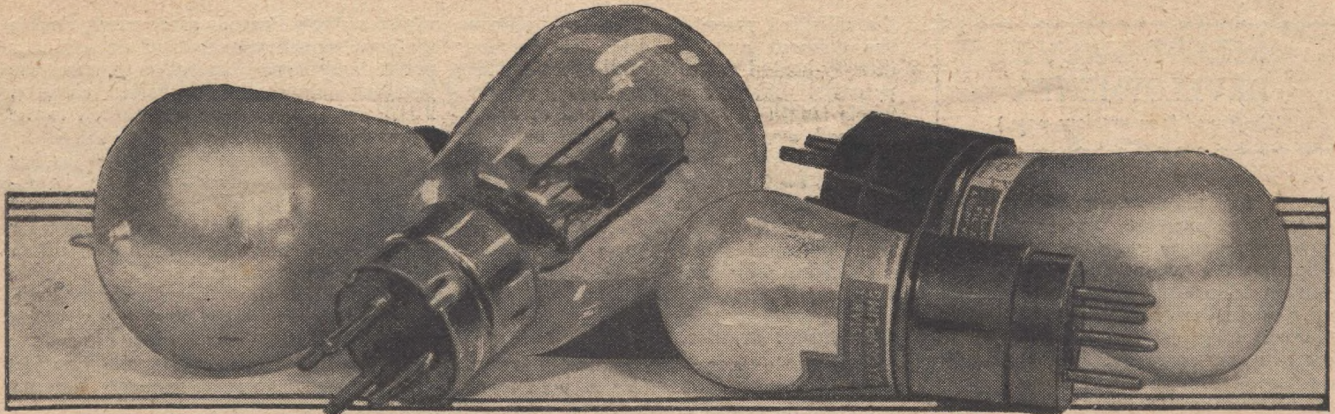
The B.B.C.'s Latest.

SO not content with brochures, libretti, syllabuses, "annuals," and the "Radio Times," the B.B.C. plans to found a twopenny "literary" weekly—an unwarranted invasion of the rights of "T.P.," "G. K. C.," and John o' London, etc. Won't the minor poets grow fat? Well, if this is a true report, all I can say is that the B.B.C. is running wild with the bit in its teeth. Much more cheering is Sir J. Reith's alleged statement that an orchestra a hundred strong is to be formed for London.

The Busy B's.

THIS is to give a friendly shove to the fortunes of the Bec Radio Society, Bec School, Beechcroft Road, Balham, S.W.17. (Hon. Sec., Mr. A. L. Odell, 171, Tramere Road, S.W.18.) They sent me a notice of a very fresh-looking little "do" called a Radio-Gramophone Dance, organised by themselves, but unfortunately far too late for me to use. However, they are evidently one of Balham's hot spots, and I hope that some of you may be tempted to join them.

ARIEL.



RECENT VALVE DEVELOPMENTS

THE Tetrode, or four-electrode valve, is now safely past what may be called the experimental stage. In the form commonly known as the screened-grid valve, it has set a new standard in radio-frequency amplification. On the low-frequency side of reception we have another remarkable new-comer—the Pentode—which is, in effect, a Tetrode with an additional grid.

Looking ahead and venturing to make an intelligent anticipation as to where these innovations are leading, one might be tempted to say that they foreshadow the "passing of the three-electrode valve."

The Screened Grid.

It is, perhaps, the natural line of evolution. The two-electrode tube had its brief day and gave place to De Forest's valve with a grid. The introduction of a second grid has taken longer to develop, but it is now standardised, and has quickly been followed by a third grid, making five electrodes in all.

Originally the second grid was introduced as a means of dissipating the so-called "space" charge, or accumulation of stagnant electrons trapped between the control-grid and the filament. The insertion of a space-charge grid permitted a

The advent of the Pentode valve has already marked a tendency towards a departure from the ordinary design in the manufacture of valves. The valve of the future is discussed in this article.

By SEXTON O'CONNOR.

more efficient control of the electron stream passing from the filament to plate. To some extent the same idea still holds good, but it has been specialised.

In the screened-grid valve as used for high-frequency amplification, the additional grid serves to screen the control grid from the electrostatic charge located on the plate. By breaking-up the field of force which normally links the plate with the grid, it prevents "back-coupling," or the transfer of energy in the wrong direction through the valve.

Previously the same result had been secured by neutrodyning or using a special balancing coil and condenser in the external circuits. The screened-grid valve provides a more convenient method of preventing capacity coupling, and one which is equally efficient for all wave-lengths.

Another consequence of the insertion of an extra grid is that it gives the valve an exceedingly high internal resistance, of the order of 200,000 ohms, together with a very favourable amplification factor, in the neighbourhood of 200. Both these features are extremely desirable in a high-frequency amplifier, because they tend to increase selectivity as well as range.

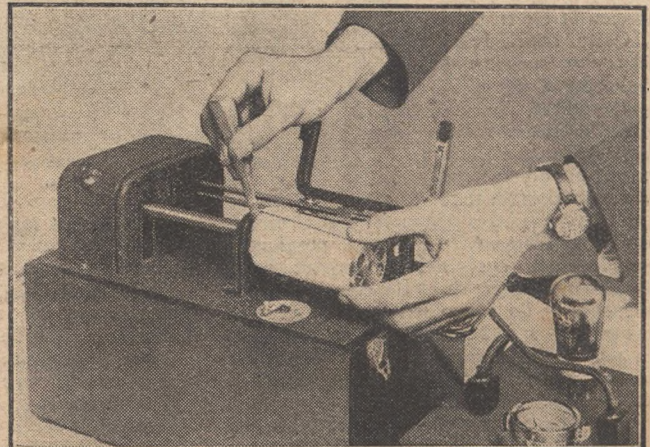
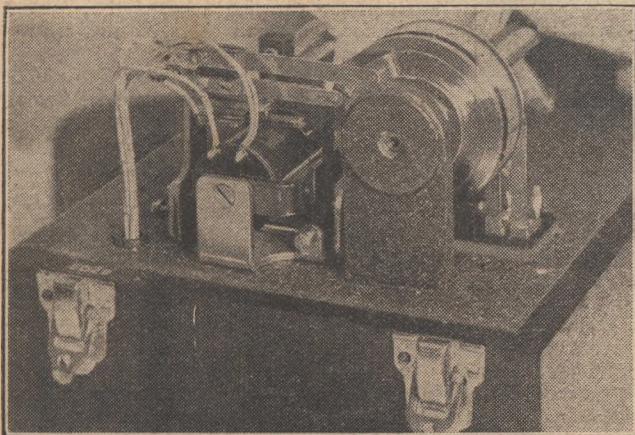
On the other hand, so high a resistance is a fatal defect where low-frequency amplification is concerned. Ample current flow is necessary when it is a question of operating a loud speaker, and this is not possible with a valve having a resistance of nearly a quarter of a million ohms.

Still Another Electrode.

Accordingly, in the Pentode, still another grid is employed, which is "earthed" by being connected (inside the valve) to the filament. It is located between the "screening grid" and the plate, and increases the total flow of current through the valve by preventing the formation of the reverse electron current, which tends to occur under certain circumstances in the ordinary screened-grid valve.

As is well known the screening grid carries a high potential, nearly as high, in

(Continued on next page.)



Two views of the Fultograph. (Left) The driving and synchronising mechanism and (right) placing the "doped" paper in position.

RECENT VALVE DEVELOPMENTS.

(Continued from previous page.)

fact, as the plate. One effect of this voltage is to increase the speed of the electron stream to such an extent that "secondary" electrons are liberated when it strikes against the plate. These secondary electrons are then attracted back on to the screening grid, so that sometimes the plate may lose more electrons in this way than it receives from the filament.

The third or "carthed" grid of the Pentode blocks the backward passage of the secondary electrons, and in effect reduces the internal resistance of the valve to something in the neighbourhood of 30,000 or 40,000 ohms.

The "False" Filament.

At the same time the amplification factor is kept high, and, what is of more importance, the change in plate current for a given change of input voltage is maintained at an extremely favourable figure. The latter characteristic is usually called the "conductance" factor and, other things being equal, reaches a higher value in a Pentode than in any other type of valve.

Curiously enough there is another tendency in valve design which also affects the three-electrode standard. For instance, the indirectly-heated valve is an attempt to eliminate the battery problem by using alternating current drawn direct from the electric-supply mains. The method employed necessitates the use of a fourth electrode in the shape of a "false" filament or heating-element mounted inside the valve.

The current-supply from the electric-light mains flows through the false filament, the heat from which is then radiated on to a sensitive filament, causing the latter to liberate a stream of electrons.

Quite apart from its convenience in not requiring a filament accumulator, the indirectly-heated valve possesses another peculiar advantage. Owing to the fact that

no current passes through the electron-emitting filament, which, as previously explained, is energised by radiant heat, this filament remains at the same potential throughout its entire length. By way of contrast, it is to be noted that a steady fall in potential takes place from the positive to the negative end of a filament heated in the ordinary manner.

Now the control of the electron stream passing through the valve depends upon

the effective potential difference between the filament and the grid. In the indirectly-heated valve the full effect of this potential difference is exercised over the whole length of filament, instead of being confined merely to the positive half, as in the three-electrode type. This in turn leads to an increased efficiency or over-all performance. For instance, the new Cosmos AC/S valve of this type has a magnification factor of no less than 1,200, an internal impedance of 800,000, and a high conductance value.

The Housing Question.

In consequence, the indirectly-heated valve is likely to exercise a permanent influence on the future design of valves in general. Already, in fact, the principle of the uni-potential filament has been combined with screened-grid amplifiers for radio-frequency working and to Pentodes for low-frequency amplification.

The Loewe multiple-stage valve is still another instance of valve elaboration. Here two or three separate sets of electrodes, together with the necessary coupling resistances and condensers, are all housed together inside the same glass bulb. In certain cases a unitary stage of four electrodes is used, including a space-charge grid.

Taking the case where a four-electrode high-frequency amplifier, a three-electrode rectifier, and a three-electrode low-frequency amplifier, are housed inside the same bulb, we get one valve containing no less than ten electrodes, to say nothing of the intervalve coupling elements. In fact

whilst a single Pentode gives nearly double the low-frequency output of an ordinary power amplifier. In other words the previous standard five-valve receiver, 2 H.F., Det., 2 L.F., has now shrunk to the dimensions of a three-valver.

To push the comparison a stage further the original five-valver will soon be replaceable by two of Dr. Loewe's valves, and in all probability the day is not far distant when these two multi-unit valves will be combined in one.

Glancing backwards one recalls the time, not so long ago, when from eight to ten valves were built into a super-heterodyne circuit to form the most powerful receiving set then known to radio science. Now we depend upon Tetrodes and Pentodes to do the same work, with less than half the number of valves in circuit, whilst Dr. Loewe appears dimly upon the horizon with the whole bag of tricks housed inside a single bulb.

The Set of the Future.

Simultaneously with the tendency to complicate further the inside of the valve, the number of outside accessories of a wireless set is steadily diminishing. The loud speaker is now commonly incorporated in the receiver "cabinet." The high- and low-tension batteries were first transformed into separate "eliminator units" drawing the necessary "juice" direct from the electric-lighting mains. Now, in the latest models, eliminators and smoothing circuits are both neatly housed inside the common cabinet.

Finally, with the increased range and power of the modern valve, and its emancipation from heavy batteries, the outside garden aerial is beginning to lose its former importance. Compact portable sets are now available which are quite capable of touring Europe on a 15-in. loop aerial.

Fitted with an "eliminator" unit supplied from the mains, and mounted on a turntable so as to take full advantage of the directional properties of its frame aerial, the compact self-contained set of the so-called portable type appears to foreshadow the lines along which the ideal home receiver of the future will be modelled.



Sir Harry Lauder (above) is one of the many thousand portable-set enthusiasts.

one can almost say that the complete wireless receiver, apart from the batteries and loud speaker, is centred in the valve.

This emphasises another striking tendency in modern receiver design. As the complexity of the valve increases, the number of separate valves necessary for a given "reach" in reception is decreasing.

The screened-grid high-frequency valve is roughly worth two stages of "unbalanced" high-frequency amplification,

HINTS AND REMINDERS.

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 stands.

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 should be placed between two pieces of soft, rounded wood or the thread may be damaged.



How to Make Loudspeakers

No. 6. ASSEMBLING AND USING MOVING COIL TYPES

You can save pounds by assembling a moving-coil loud speaker yourself instead of buying a complete instrument. But a certain amount of care must be exercised in the constructional work as well as in choosing the necessary parts. Here are some valuable hints on the subject.

By A MEMBER OF THE P.W. TECHNICAL STAFF.

ONE of the most fascinating sights in radio is to watch a keen wireless enthusiast listening for the first time to a good moving-coil loud-speaker demonstration. Up to this time probably he has been quite content with his existing instrument—possibly he has modified the circuit slightly to get the best from it, and quite likely he is running two different loud speakers, say a cone and a horn, together, to get the effect he desires. But once he has heard a good moving-coil instrument outfit, he realises the shortcomings of his present outfit, and how much he has deceived himself in imagining that the reproduction was really true to life.

How Can I Get One ?

Naturally, the first question that jumps to his lips is "How can I get one of those?" There are, of course, two ways—by buying a ready-made outfit, or by home construction, either throughout, or from a kit of parts. The B.T.H. Rice-Kellogg, the Magnavox, the Marconiphone, the S. G. Brown—these are a few of the completely finished moving-coil loud speakers available at prices to suit different purses.

Alternatively a large number of excellent kits of parts are available which not only add considerably to the pleasure of the reader in enabling him to do a good deal of the work himself, but also bring the first cost down to a low figure. It is quite possible by choosing a suitable kit of parts to build for oneself a good moving-coil loud speaker at a cost much lower than is generally realised.

Before we go any further it should be pointed out once more that a moving-coil loud speaker, wonderful as is its reproduction, cannot improve on the quality fed into it, and thus, in order to get the best from these remarkable instruments, we must make sure that the receiver itself gives not only first-class quality, but that such quality is at adequate strength for operating a moving-coil speaker.

Real M-C. Quality.

With one or two exceptions, the sensitivity of the average moving-coil loud speaker is considerably below that of the average cone or horn, and for really high-quality reproduction either a large modern super-power valve, of a high voltage type, with 200 or 300 volts on the plate; two in parallel at a somewhat lower voltage; or two in push-pull at, say, 120 to 150 volts, are really necessary.

When the maker of a kit or a finished moving-coil loud speaker tells you that it will work perfectly satisfactorily from an ordinary three-valve set, you must not take this to mean that it will give what the more expert user calls "real moving-coil quality"!

A moving-coil speaker working off an ordinary three-valve set will give results of a pleasing order, providing the speaker is reasonably sensitive, but you will not get that fine, rich, undistorted tone which is so characteristic of the properly driven moving-coil instrument.

The choice of a kit is governed by several considerations. Moving-coil loud speakers are of different types, one requiring a supply of direct current to energise the field magnet and the other providing the necessary strong magnetic field by a permanent magnet. The advantage of the former type is that they are more sensitive, while the

As we are concerned in the field magnet with ampere turns we can obtain our magnetic effect with a small number of turns and a large current, as in the accumulator-driven model, or with a small current and a much larger number of turns, as in the "mains" models.

Self-Smoothing.

When alternating-current mains are available one plan is to fix up a simple voltage reducing and rectifying unit so as to provide adequate current for the low-voltage type. Personally, to drive my low-voltage moving-coil loud speaker, I use a step-down transformer from 220 down to 9 volts, and a Westinghouse R4-2-2 metal rectifier, with its output terminals connected directly to the field magnet terminals of the loud speaker.

The very large inductance of the field winding provides adequate smoothing, and there is no hum heard when we come to an interval between items. This form of drive is perfectly satisfactory, takes very little current from the mains, and does away with the trouble of constantly recharging the rather large accumulator necessary to drive the accumulator-driven model of the moving-coil loud speaker. Another method which can often be used is to run the field winding from an ordinary trickle-charger, provided that the current required is not too large.

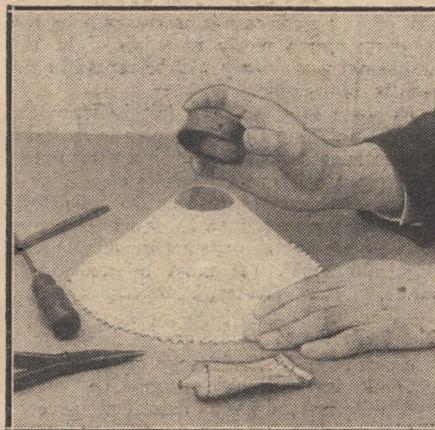
Correct Number of Turns.

Another point you must consider before purchasing your kit, or before beginning the construction of the instrument, is whether you will use a high or low resistance winding for the moving coil itself. Opinions are divided on this point, which means in practice there is not a great deal to choose between the two methods, but there is no question that the low-resistance winding, by using a thicker wire, is the easier to wind.

The correct number of turns is very important, and the makers' instructions should be followed very carefully. Alternatively, you can buy the moving coil ready wound—not a bad plan, as the task is by no means so simple as many people think.

An output transformer is essential with the low-resistance winding (generally a 25 to 1 ratio is used), and a suitable transformer or choke output is highly advisable with the high-resistance winding.

(Continued on next page.)



The fixing of the moving coil to the cone and the latter to the suspending material are tasks that must be carried out very carefully.

advantage of the latter type is that one can dispense with rather a heavy drain on one's current supply.

The former type can be sub-divided once more into high and low voltage instruments, the low voltage generally working at six to twelve volts with a current up to one ampere (thus making the accumulator a practical form of "drive") while the high voltage can be run direct from D.C. mains or from high-tension mains units (A.C. or D.C.), provided they will supply adequate current.

HOW TO MAKE LOUD SPEAKERS.

(Continued from previous page.)

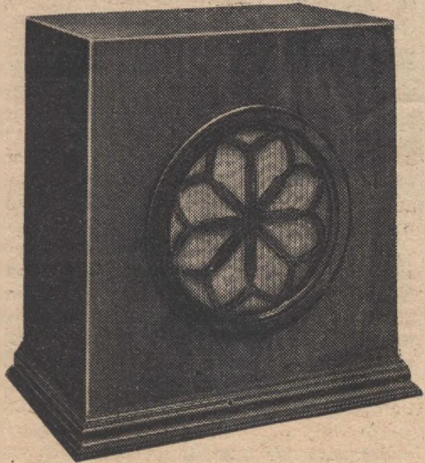
The parts of a moving-coil speaker consist of the field magnet, the moving coil, the cone, the flexible material for supporting the front edge of the cone, and the supporting frame, which enables the cone with the moving coil attached to it to be accurately centred so that the moving coil itself is free to move back and forth in the annular space between the inner and outer poles of the field magnet without at any time touching the poles. A number of highly ingenious fittings have been devised for this purpose, one in particular by Mr. G. P. Kendall, B.Sc., of the "P.W." Research Department, as regular readers will no doubt remember.

The field magnet consists of a casting called a "pot"—a kind of iron jar—a central pole firmly secured in the middle of the bottom of the pot, and an iron plate—a kind of lid for the pot—with a round hole in the centre of such a size that the central pole comes neatly in the middle with a ring aperture of just sufficient size to enable the moving coil to swing freely back and forth.

The Current Consumption.

Before the "lid" is secured in place a bobbin of wire with a very large number of turns is connected to external terminals, and when a current flows through this winding the whole pot and pole pieces are magnetised. The pot and the central rod or pole piece forms one part of the magnet and the lid the other, the magnetic field being concentrated with great intensity in the annular space between the central pole and the lid.

It is as well to find out the exact current consumption of the field magnet in the moving-coil loud speaker kit as the current drain on an accumulator may be very considerable, and I have known some field



A moderately large cabinet can be used instead of a baffle board, but remember that the back of the cabinet must be left open.

magnets which take nearly two amperes. From half to one ampere, however, is the usual figure, and one should reckon on an ampere when choosing an accumulator.

If you are using an accumulator you will naturally not desire to have it charged more frequently than once a week, and if

you run for three hours a day during weekdays and longer on Saturdays and Sundays you will find that a thirty ampere-hour (actual) accumulator is the very smallest that will give satisfactory service, and a sixty ampere is much more suitable. If you are running off the mains you will not have to worry on this score.

The task which the purchaser usually has to perform for himself in building a moving-coil loud speaker from a kit is the cutting out of the cone, its formation, attaching the moving coil, and fixing the cone to the soft material such as leather, which is used for the suspension. *Do not attempt to rush any of these tasks.*

Some Practical Points.

So far as cutting and making the cone is concerned, I strongly advise you to make one first of all from ordinary fairly stiff paper, using the design furnished by the manufacturers before you cut the special material used for the actual cone itself. By making up a "dummy" first of all you will become accustomed to handling the paper and you will find several little tricks about it which you would not discover perhaps if you started straight off on the final cone.

In particular be very careful in the use of the adhesive material such as seccotine. Too little will make an unsatisfactory joint and too much will make the drying period prolonged, while causing at the same time an infernal mess. I find it a good plan, when handling sticky material such as seccotine, to keep handy on the table a well-soaked cloth and a dry cloth, then if one should get any seccotine on the fingers it can be quickly washed off with the wet cloth and the fingers dried on the other cloth. Remember that your cone will show prominently in the finished instrument and you will want to keep it neat and tidy.

Spend all the time you can afford on making a nice job of the moving coil itself, if you wind your own. You may not at first realise why great care is necessary here, but if you make a really nice job of it, the additional work really will be repaid in the results obtainable.

In some kits the gaps left between the central pole and the outer pole is so small that satisfactory results are impossible unless the moving coil is very carefully placed, while others allow a great space. Do not delude yourself, however, into thinking that your moving coil will be satisfactory so long as it does not touch. It must be really well made.

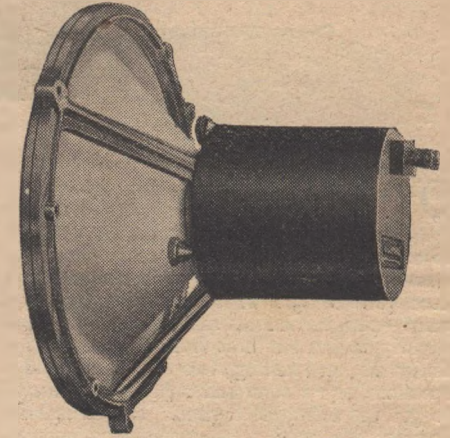
The Baffle Board.

Suspension methods vary so much that general instructions cannot be given. "P.W." has already described several. Whichever is chosen, remember that accuracy in final adjustment must always be possible or failure will inevitably result.

Once you have completed the task of assembling your moving-coil speaker you can of course try it, but if you do this before it is suitably mounted the tone will be poor, thin and unsatisfying. The use of either a large, flat and fairly thick baffle board, or a suitable cabinet so designed that the shortest air path from the front of the cone to the back is at least 30 inches, is essential if proper note reproduction is to be obtained. Fortunately, the moving-coil user is now very well catered for in this direction, and baffles and cabinets may be obtained

in what may be truly termed a baffling variety, either as plain or polished boards, fire screens, decorative cabinets, or tables and pedestals. One or two enthusiasts have even mounted their speakers in the middle of a door!

If you do not get thoroughly satisfactory results at first, do not be in too much of a hurry to blame your kit. Remember the better the speaker the more it will show up defects and distortion in your set! Blasting noises will almost invariably be due to set distortion or valve overloading, as a moving-coil loud speaker can handle enormous volume without any sign of distress.



A complete unit all ready for fitting to a baffle board or into a cabinet.

DON'T FORGET THAT—

The earth connection is quite as important as the aerial, if not more so.

For a sensitive long-distance set it is often an advantage to use a variable condenser as a grid condenser, provided that this does not necessitate long wiring.

Good containers for 2, 4, or 6 B.A. nuts, small screws, etc., can be made from the lids of old valve-boxes.

Before stowing drills away give them a rub over with petroleum jelly or a little oil on a rag, as a rusty drill loses its cutting edge quickly.

Ordinary lighting flex, obtainable from any electrician's, makes quite a good indoor aerial.

The fact that a valve filament is intact does not necessarily mean that it is in good order, for it may have lost its emission.

The necessary current to energise the mains-driven type of moving-coil loud speaker can practically always be taken direct from D.C. mains, as it does not have to be filtered or smoothed like that of H.T. mains units.

When flash-lamp bulbs are recommended for use as fuses in radio sets, the kind meant are the low consumption type of bulb.

January 1st, 1929, was the date selected for the introduction of the new Q sign abbreviations for wireless.

By dividing the total filament consumption into the actual ampere-hour capacity of your accumulator, you can tell about how many hours the latter should last without recharging.

MAKING YOUR OWN COILS



LOOKING at the title of this page you may fear that you are in for an exhaustive (and exhausting!) talk on coils of every possible type, so let me start by assuring you that I have no intention of inflicting any such thing upon you. On the contrary, we shall be dealing with just one simple type of coil, and that from an entirely practical point of view.

I am rather an enthusiast about winding coils myself, for the simple reason that so far as most ordinary types are concerned you can wind at home ones which are quite as efficient as the average commercial equivalent at a considerable saving in cost. Consequently, it seems to me that if only people would get over their idea that the job is a difficult one (quite a mistake, really) they would get a good deal more pleasure out of constructional work. Also, they would be able to try out all sorts of special schemes calling for coils which they do not feel justified in buying just for an experiment.

Really Quite Simple.

In this article I am only going to try and show you how easy it is to wind for yourself a set of plug-in coils of standard sizes. This is really the easiest job of all, and strongly to be urged upon all who have not already got such a set.

The only reasons why more people do not do it seem to be (a) a suspicion that it is difficult and tedious, and (b) lack of information as to the correct turn numbers.

By adopting some simple schemes the first reason vanishes, while as for the second, I will give you the necessary data later on to wind a set of useful coils which will match those of a standard series. You will thus be able to use them wherever standard sizes are recommended.

For The First Attempt.

Here is the job I am suggesting to you as a first venture in coil winding; get a set of those simple black fibre basket-coil formers, some basket-coil mounts and a little wire, and proceed to wind the first four coils of a standard series. It won't take you long, you will need no tools beyond a screw-driver and a pair of pliers, and it is the simplest little job you ever tried. The resulting coils are quite good from the efficiency point of view, and will cover practically all normal purposes on the ordinary broadcast wave-lengths (we will discuss long waves later).

How to make a simple but efficient set of plug-in coils of the basket type. Correct turn numbers are given to make them match up with the usual standard commercial types. By THE "P.W." TECHNICAL STAFF.

If I can once persuade you to take this first step I believe I shall have achieved my object, for you will discover what a lot of benefits follow from a very little work, and will be pretty sure to go on and tackle bigger jobs of coil winding.

Well, I have probably said enough to convince you that a set of home-made plug-in coils of standard sizes would be a useful thing to have, but so far as the difficulty or otherwise of the job is concerned I expect all that you will have gathered is that I personally think it a very easy one. To satisfy yourself on the

going alternately over and under the spokes all the way round, a basket formation coil grows under your hands with surprising ease and quickness.

All that you need do to ensure a good coil is to keep a fair amount of tension on the wire as you go, so that it shall fit down snugly turn by turn.

A few moments of trying will show you how easy it is to wind a coil like this, and then you can see about winding the whole series. A suitable gauge of wire for the job is No. 24 D.C.C., and I suggest you get a 1/2-lb. reel.

The usual set of fibre formers will be found to have an inner diameter of about an inch and a quarter, by which I mean that the first turn put on will be of that diameter, and the turn numbers which I shall give presently are based on that size.

The Right Turn Numbers.

Start with your largest former and put on 66 turns, and label this No. 60, for that is the standard coil to which it will be equivalent. At the beginning and end leave three or four inches of wire projecting, then take one of your coil mounts, attach the coil former thereto by means of a small brass screw and nut through the holes provided (see photo again).

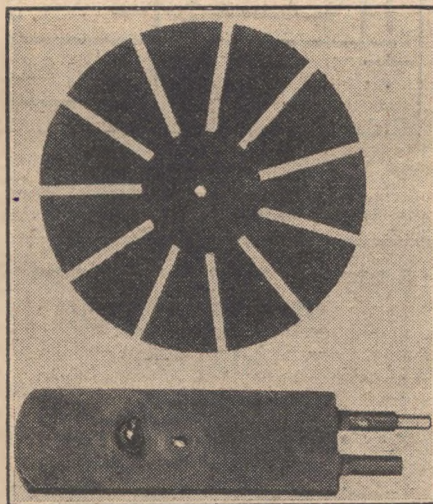
Next scrape a bare place on each end of the wire and secure to the plug and pin respectively of the mount by means of the nuts or screws provided, and the coil is finished. Just one point here: be careful to connect all your coils up the same way, and attach them to their mounts the same way round.

Turn numbers for the others in the series are these: 56 (equivalent to a standard No. 50), 44 (equal to a No. 35), and 32 (No. 25), and these smaller sizes will be quickly wound and mounted up. There, that wasn't a very difficult business, was it?

Don't Forget This.

The only points to watch are these: to make sure you get the right equivalent sizes use the gauge and kind of wire I have specified, and also the size of former. To ensure correct reaction don't forget the question of uniform connections.

Finally, as to long-wave coils: these, I admit, are a little tedious to wind, and the basket system is no longer very suitable, because one has to use very fine wire to get all the turns into so small a space. Perhaps I shall be able to make some suggestions about these coils in the future.



The foundation for each coil is a black fibre former and a simple type of plug mounting which can be purchased very cheaply.

point I think all you will have to do is to read the practical instructions which follow.

First of all, just how is a basket coil wound? Well, if you take one of the fibre formers I have mentioned (one is shown in a photo on this page) you will find that if you pass the wire round it,

SHORT-WAVE EXPERIENCES.

The Editor, POPULAR WIRELESS.

Dear Sir.—It will, no doubt, be of interest to you to know of my experiences with a two-valve short-wave receiver designed by a friend of mine. The best station I have so far received is P C L L, Kootwijk, which is good loud-speaker strength in daylight. I have a card from the Dutch State Telegraphs stating that their wave-length is 38.8m, and their power 32 kw. (I do not know if this is kilowatts in the aerial.)

P C J J, Hilversum, used to be very good strength, but lately it is only possible to receive him weakly on the 'phones.

2 X G, Rocky Point, comes over at excellent 'phone strength, and without any fading when he is operating on 35 m. But when he works on about 20 m. he is much weaker, and fades badly.

2 X A F on 31.4 m. is always a good 'phone signal and does not fade very often.

2 X A D on 21.96 m. is slightly weaker and more subject to fading.

8 X K, Pittsburg, is about equal to 2 X A F in strength and quality.

K D K A on 62.5 m. is very weak and difficult to time. His quality is poor.

During last August 2 X A G and 2 X E, New York, were received after midnight on 26.92 m. and 22.1 m. respectively. Their strength was only weak 'phone strength and both faded badly.

A F K, Döberitz, near Berlin, is a good 'phone signal here. The wave-length used varies considerably. He comes in best, however, on 37.65 m. (7.968 kc.). I am sure W. L. S. is in error when he says this station transmits for days on end without ever giving a call sign. At the beginning of every speech test he calls "A F K, Anna Franca Kaspar." With reference to Mr. Birchenall's query, the power used is 5 kw.

3 L O, Melbourne, was heard for the first time on Sunday, December 2nd, from 7.8 p.m. at fair 'phone strength. "The 'Lost Chord" and a Scottish song came over very clearly. The rest of the items were weaker and fading was troublesome.

7 L O, Nairobi, on 33.5 m. has been coming in regularly at fair 'phone strength during the last fortnight. He is badly jammed at intervals by a C.W. station.

From 3.30 p.m. onwards an unknown station has been transmitting a musical programme on about 32 m., during the last week. The language is guttural and similar in sound to German. I should be interested to hear if any other reader has received this transmission.

Also, did anyone hear the tests from a Swedish station on 51 m. at the end of September. I believe these came from Motala, but I am not certain.

I will close now, thanking you for your valuable assistance in wireless matters, and wishing "P.W." every success.

I am,
Yours faithfully,
R. C. WHEARE.

Nr. Bristol.

AN AUSTRALIAN SHORT-WAVER.

The Editor, POPULAR WIRELESS.

Dear Sir.—I was interested to read in a recent issue of "Popular Wireless," of an Edinburgh reader hearing the S. W. station at Perth (Western Australia), 6 A G.

I also received the station on Armistice Day at about 7.30 p.m.

Although this station is advertised at 32.9 metres it came in slightly below 3 L O, Melbourne.

The items I heard were some popular dance tunes of about two years ago, one, I think, was called "Whispering," and also a woman singing opera.

Signals were rather weak, however, being overshadowed by 3 L O, which is a very strong signal here.

Best wishes to "P.W."

Yours truly
ALBERT S. COCKS.

Surry.

I HAVE been asked to pass on the word to readers that a new Egyptian station is now operating with the call-sign I C A G in Suez. The operator is a three-years' subscriber to "P.W.," and his address is Box 2, Suez. He will be delighted to receive reports from other readers on his 32.5 metre transmissions.

For the first time for over a year I heard a signal from the Philippines on 40 metres or so a few days before Christmas. The honour falls to I A F, at first P I A F, then O P I A F, and now K I A F. His C Q calls at 6 p.m. G.M.T. are always received now at a good R6, although he never seems to receive any of the numerous Europeans who reply to them.

Speaking of the new call-signs, in such a case as this it is essential that the call be written as K I A F, since the "K" is an

CORRESPONDENCE.

SHORT-WAVE EXPERIENCES.

AN AUSTRALIAN SHORT-WAVER.—5 S W IN ARGENTINE.

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.

5 S W IN ARGENTINE.

The Editor, POPULAR WIRELESS.

Dear Sir.—I thought a few notes from someone in the Argentine would prove interesting to your readers.

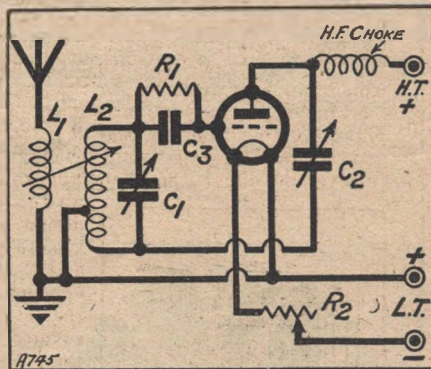
I listen regularly to 5 S W and the American short-wave stations. I have tried many and varied circuits for the detection of short-wave signals, and the best one I have yet used is as shown.

The values are: $R_1 = 6$ meg.; $C_3 = .000175$ mfd.; $R_2 = 20$ ohms.

This circuit consists of leaky-grid detection with 22½ volts on the plate using a Radiotron 201A general-purpose valve. With a DEL 610 I find 45 volts at least are necessary. For waves up to 30 metres these low-plate voltages are ample, but for higher wave-lengths an increase in voltage is necessary, so as to avoid excessive use of reaction.

Coil L_1 consists of five turns, ¼ in. diameter, of bare No. 18 wire, variably coupled with L_2 , which has nine turns of 2-in. diameter, also of No. 18 bare wire, and tapped for 3 turns of reaction. The condensers are neutralising condensers, C_2 having a maximum capacity nearly double that of C_1 . The actual condensers used were 7 and 13 plate neutralising condensers as made by the Pilot company.

The condenser C_1 is connected across the whole of L_2 , thus reducing the total number of turns for a given wave-length to a minimum. The set is com-



pletely free from hand-capacity effects. In fact, unless the coil is actually touched the only effect putting the hand over the coil is damping. To avoid this damping the condensers are mounted on 20 cms

extension rods with the coil well away from the panel.

The set is very easy to tune, and with a two-stage L.F. transformer-coupled amplifier, gives enough strength to work 5 S W on a loud speaker, loud enough to hear well at 12 yards on average days.

On some days the volume obtainable is almost incredible. It has been heard in a shop on the other side of the road. The roads in this particular place are 40 metres wide, but of course, all is more or less quiet, in camp town like M. Caseros.

The strength of 5 S W varies considerably, and for that matter so do the American stations. 2 X A D is on the whole stronger than 5 S W, but K D K A is weaker than either.

The time difference of 4 hours is all in our favour for listening-in, the gramophone concerts ending at 10 p.m. The value of 5 S W to Englishmen out in the Camp in this country can only be appreciated by those who have experienced it.

For example, one Englishman had an American six-valve Mono-control Atwaterkit for waves from 200-600 metres. This was a 3 H.F., detector, and 2 L.F. transformer-coupled set, on which, with favourable conditions at about 11.30 p.m. he could hear 500 metre-wave American stations. Apart from this he could listen only to Buenos Aires stations.

I built for him a detector unit on the principal outlined above for short-wave listening. This unit was plugged into the broadcast receiver by taking out the detector valve, which was used in the short-waver, thus giving a three-valve short-wave set, using the foot of an old valve for plugging in purposes.

A filament switch for cutting off L.T. current to the H.F. valves was provided, so accomplishing the change from one set to the other with the minimum of movement of valves, connections, etc. This set works Chelmsford, Pittsburg, and the General Electric stations at comfortable loud-speaker strength.

In conclusion, I would like to say how much the Chelmsford station is appreciated out here, and I am quite willing to pay a voluntary licence-fee in support of the station if the Postmaster-General should wish to collect same, the fee being the same as for listeners at home.

Yours very sincerely,
A. S. WORBOYS.

Argentine.

TELEPHONE TIPS.

It is easy to damage telephones by dropping them from—apart from the effect upon the magnetism—their sensitivity depends upon the exact shape and position of the diaphragm.

If a telephone diaphragm is discovered to be rusty, it can after careful removal be cleaned and slightly smeared with petroleum jelly before being replaced, in order to keep it in good condition.

If, for any reason, the telephone diaphragm is taken from off the earpiece be very careful not to bend or damage it in any way.

When replacing a diaphragm over a telephone earpiece, do not place the diaphragm straight down over the earpiece, so that the magnet exerts a pull upon it, but slide the diaphragm sideways over the rim of the earpiece so that it will not be bent or pulled.

SHORT-WAVE NOTES.

By W. L. S.

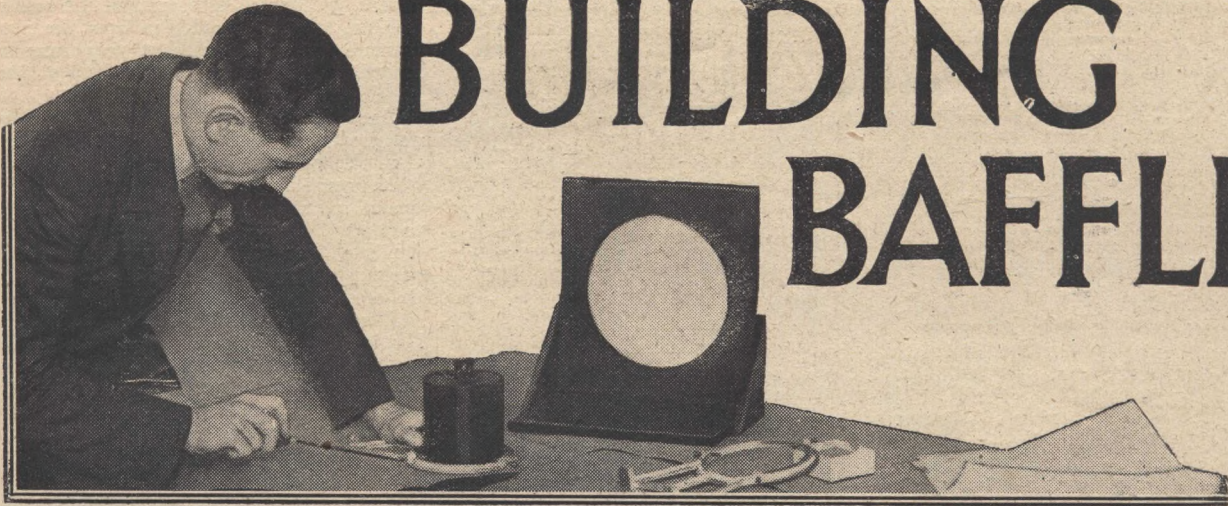
integral part of the call-sign. "K-1 A F" or "k 1 A F" will now be incorrect, since the "K" is in no sense a prefix or "intermediate." As various countries will apparently be retaining their old prefixes well into the new year I propose to use a hyphen when referring to them, and to drop it when speaking of the new call-signs. Incidentally, British amateurs, even when using telephony, should now include the "G" on every occasion.

Whether the United States broadcasting stations will include the "W" (or our own, for that matter!) is a moot point. It seems rather unlikely that we shall ever hear "Hullo, folks, this is W 2 X A D!"

P C J J is dropping one of his J's in the new year, and I believe all the Dutch stations with similar call-signs are being treated in the same way. At all events, we are certain of hearing P C J and P C L on 31 and 38.8 metres respectively.

A F K, about which a correspondent had a "friendly tilt" with me recently, is certainly announcing his call-sign much more frequently. A G K and A G L, both at Nauen, are also frequently heard nowadays, and A G J, at present working with a vile L.C.W. note which wipes out half the amateur wave-band on 42 metres, is, I understand, shortly changing over to telephony.

BUILDING BAFFLES



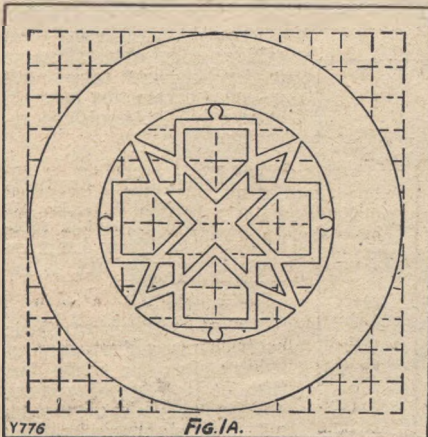
Simple, inexpensive, but artistic, baffles for cone and moving-coil speakers are described.
From A CORRESPONDENT.

A BAFFLE-BOARD at first sight presents a little difficulty to the constructor, but there is really no reason why he should not be the proud possessor of one he has made for himself. There is little work which any home

speaker, he can add a fretted front as an overlay to the board, making it to his own design and style. If he purchases a plain plywood board—and five-ply is certainly preferable, he can cut out the central hole with a keyhole saw, holding the wood upright in a bench vice whilst cutting. As, too, the circle edge will be covered by the fretted portion he need not be particular if he runs a little off the cutting line, or makes a jagged edge.

be held by a strengthening block glued inside, and to the back of the board. One is clearly seen in the picture.

Small moulding should be used for the edges and glued flush with the outer edge of the board (Fig. 3).

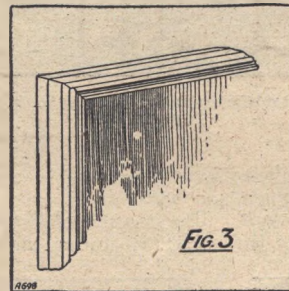
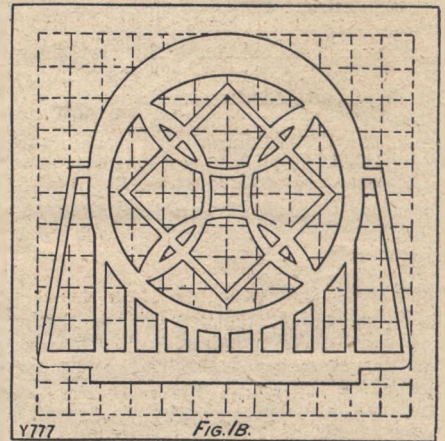


Suitable Front Designs.

The fretted panel can be designed according to one's ingenuity, and can even be made to incorporate the owner's monogram. We illustrate herewith two simple designs which can be transferred to the wood by marking off the inch squares shown.

Both are cut from a board 12 in. square, and the rim of the design at 1A is wide enough to cover any circular hole from 8 in. to 10 in

wide. The design at B is more open, and the 8-in. aperture of the board is covered by the circular rim seen. Of course, if a greater circle is required, the squares can



amateur cannot undertake for baffles are usually quite plain, straightforward affairs of plywood.

Very Small Cost.

To this plain board he can add his own handiwork, to his own style, and in his own time until he has completed a board equal to any he can purchase. Moreover, the cost is quite small, and entirely in inverse ratio to the result obtained.

Instead of the ordinary open circle of the

be marked off proportionately larger.

These fretted panels are cut from faced plywood, or ordinary fretwood $\frac{1}{4}$ in. or $\frac{3}{8}$ in. thick. Any young friend will cut out the work if the worker cannot himself handle a fretsaw. The outer edges can be left square, but will look better if rounded down with sandpaper. The completed panel is glued to the larger board, or screwed on from behind.

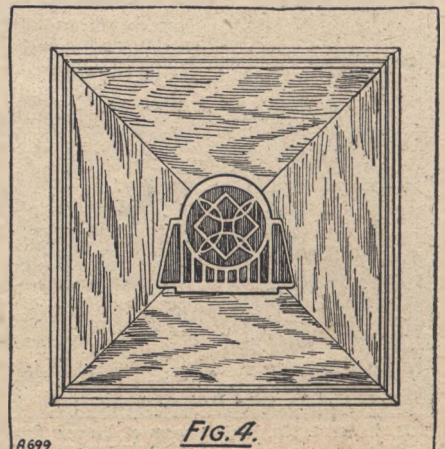
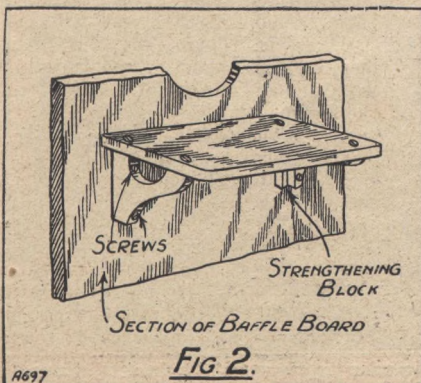
Supporting the Speaker Unit.

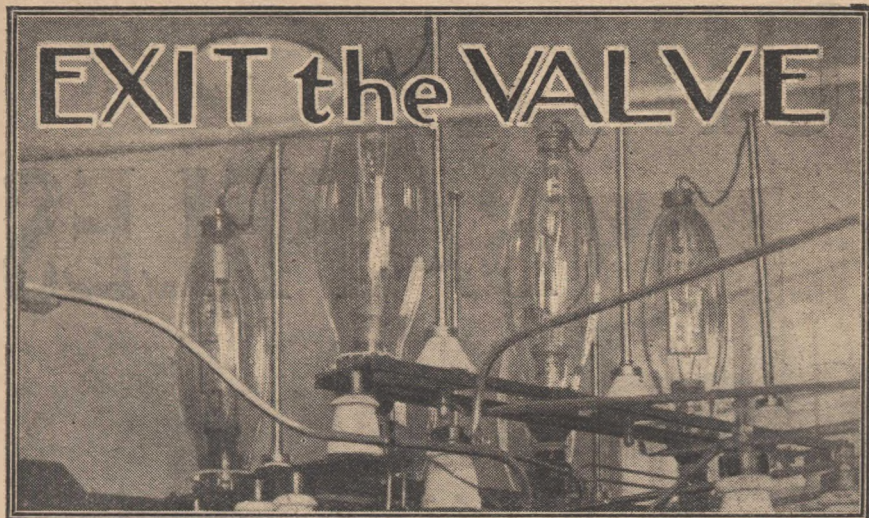
The use of a fretsaw handframe is also necessary if we are to build on behind the baffle-board a support bracket for the moving-coil unit. The illustration at Fig. 2 shows one simply constructed from three pieces of board.

To give greater strength $\frac{1}{2}$ in. or $\frac{3}{4}$ in. wood should be used and, in addition to the two screws shown, each bracket should

The whole board can be polished or varnished, but if polishing is done it should be undertaken before the fretted panel is glued on.

Another method is to purchase four large sheets of veneer paper, and glue these to the board with a decorative scheme, such as shown at Fig. 4.





New H.F. generators have been developed in Germany capable of producing outputs suitable for even short-wave transmissions. These wonderful machines enable broadcasting to be carried out without using valves.
From A SPECIAL CORRESPONDENT.

VALVES are expensive, difficult to manage and sometimes fragile. I do not think that I go far wrong in stating that nearly all of the very few transmitter breakdowns are due to the burning out of a valve.

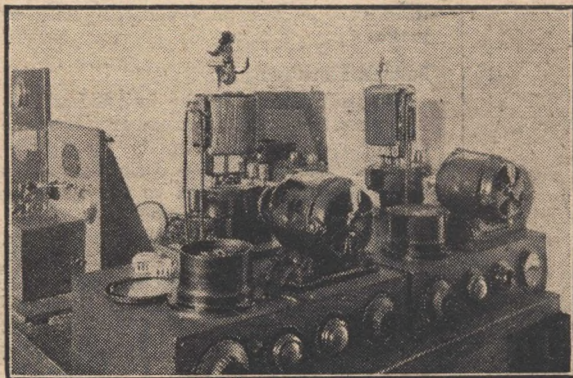
It is quite an old story, of course, that I am dishing up, but it has quite a new ending. Long-wave transmitters with waves from one mile and a half long to ten and more miles long, at present use machines for generating their high-frequency power. But with these machines one would require anything from 10,000 to 100,000 revolutions per minute to generate waves under 1,000 metres.

New System at Munich.

So valves hold their own for generating what is really nothing but alternating current of rather a high frequency. At home, on the mains, you have anything from 15 to 100 alternations per second. A wave-length of 300 metres requires one million alternations per second.

A German firm (Lorenz & Co.), with their technical manager, Hahnemann, and their engineers, Herzog and Seidlbach, and using fundamental patents of numbers of eminent research workers, have now developed a transmitter solely employing generators

instead of the expensive valves for broadcast wave-lengths right down to 250 metres; and work is going ahead, I am told, to adapt the new type of transmitter for the short-wave band down to 15 metres.



The voltage and revolution regulator belonging to the high-frequency generator.

The first of these transmitters has been installed in Munich and will shortly take over full time work. The transmitter has had rather a bad time of it, and during one

period the Munich listeners had the rather dubious honour of suffering from the new transmitter in its crudest experimental stages. This was as early as 1925 at the All German Traffic Exhibition.

Since then it has been completely redesigned and rebuilt and is now even better than the existing type of valve transmitter quite apart from being much cheaper in operation, as there are no expensive valves to renew.

I hear that a further transmitter of the same type will be erected in Leipzig during the coming year.

When I viewed the new transmitter in Munich, the original inventors of all the more important improvements and alterations were there and I got first-hand technical details, which I could not attempt to put down on paper—they were far too formidable.

* * * * *
WORKSHOP WRINKLES.
* * * * *

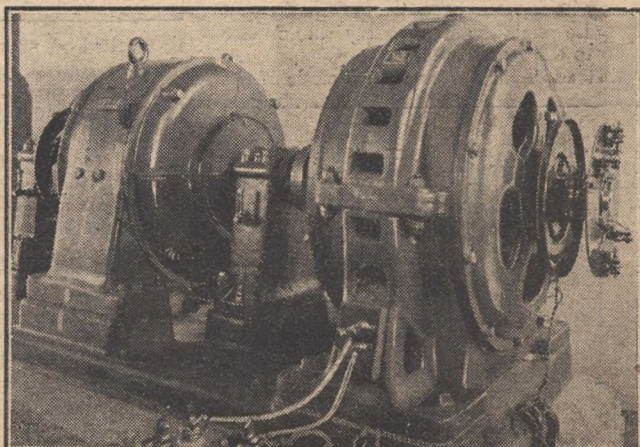
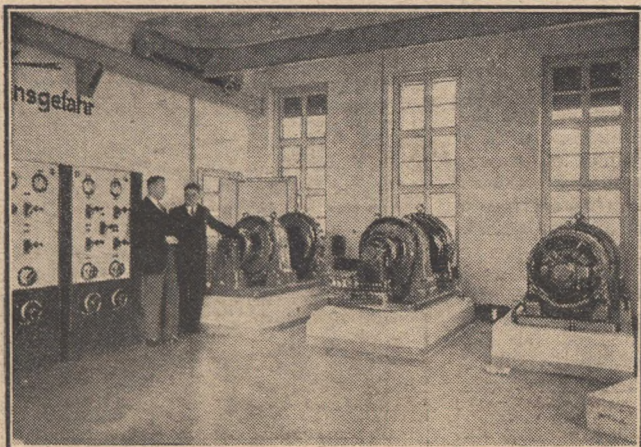
The presence of lumps of sediment in the bottom of the electrolyte of an accumulator is an indication that the cell has been misused and that it needs careful handling or overhauling.

The objection to using killed spirit as a flux when wiring up is that the heat causes this to splutter, and the acid will eventually give trouble in reception.

It should be an invariable practice directly a joint has been soldered to wipe it carefully with a clean duster so that all surplus flux is removed.

Violent and uncontrollable oscillation on a short-wave set is very often due to the fact that the high-frequency choke and the reaction condenser are setting up an unwanted tuning effect (the easiest cure is another H.F. choke).

When wooden separators are grooved only on one side, the grooves should be placed against the positive plates, so as to provide free access of the electrolyte to the active material of the plates.



On the left is the machine-room of the new Munich transmitter; Engineer Herzog and Dr. Pohousch are seen inspecting the generators. On the right is one of the high-frequency generators that are now being used instead of valves. (Photos, copyright by L. J. Kleintjes, 1928.)



silence

stant

The hush that comes before the downward sweep of the conductor's baton is all-important; it gives time to gather the instruments together for the burst of melody and it adds contrast to the intensity of the succeeding sound. These pauses are used to fine effect by great musicians and the silent background which you get when you use Lissen Transformers gives you amplification which is inimitably fine. Notice how the notes of music and the words of song and speech stand out in sharp stereoscopic relief when you use Lissen Transformers. In every circuit you can employ them—no matter what else is specified. They have brought a vast improvement to radio reproduction.

LISSEN
TRANSFORMERS

The LISSEN SUPER TRANSFORMER

This Super LISSEN Transformer is made in two ratios, $3\frac{1}{2}$ to 1 and also $2\frac{1}{2}$ to 1. The $3\frac{1}{2}$ 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 $2\frac{1}{2}$ 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 **19/.** is the same for both ratios

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." **8/6** Turns ratio 3 to 1. Resistance ratio 4 to 1

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(Managing Director: Thos. N. Cole.)

FROM THE TECHNICAL EDITORS NOTE BOOK

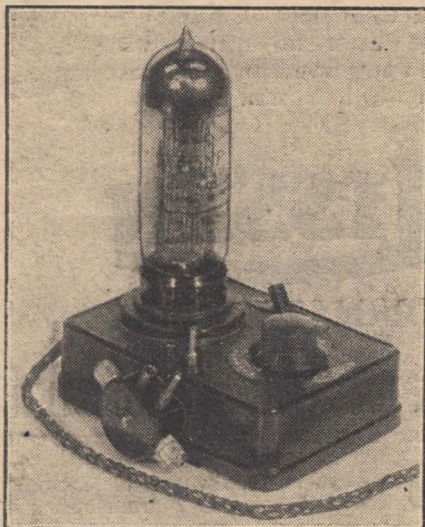


A LOEWE RECEIVER.

Undoubtedly the Loewe valve forms one of the most striking developments of radio. Here you can have a valve not much larger than any ordinary type and not quite so large as some of the power varieties, which contains in itself all the necessary items for a three-valve amplifier. And the interesting feature is that the Loewe Radio Company Ltd. have gone into production with these remarkable valves, and the sets with which to use them, in this country. No doubt their recent patent action will still be fresh in the minds of readers.

Quite recently we were sent a Loewe radio receiver type O.E.333. Actually, of course, the receiver part is mostly within the valve itself, for this is three separate valves and their coupling elements all in one.

The other part of the set consists of a neat base into which the valve plugs and on



The Loewe receiver described in this column. On the left will be seen the coil holder which accommodates the aerial tuning and reaction coils. The knob in front of the valve operates the tuning condenser.

which is a tuning dial and the coil holders. A "multi-flex" cord is provided for battery connections. The triple valve takes .34 amps. at 4-volts L.T., and the set as a whole operates satisfactorily with an H.T. voltage of 90.

The valve itself, as can be imagined, is a remarkable assembly. Readers will remember an article in "P.W." some weeks ago in which the valve was fully described, and looking at all its intricate internal assembly one trembles at the thought of dropping it. The valve has six pins at the base, but this and its corresponding socket

on the set are so arranged that it cannot be inserted the wrong way round.

When one has connected up this Loewe set one gets something of a shock, for the set itself is rather smaller than some of its accessories, such as the H.T. battery and an ordinary size of accumulator, and much smaller than a small loud speaker. The price of the set without coils is £4, the royalty in addition being 10s. (not 37s. 6d. you will notice!), and it is quite a good little set. On the local station, 5 G B, and 5 X X the reproduction is very good, and some of the powerful Continentals can be tuned in.

SCREENED WIRE.

Messrs. Ward & Goldstone recently sent us a length of their new back-of-panel brass-screened wire. This, they state, they have found particularly useful where either low- or high-tension mains units are

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.

installed, also for receiving sets where there is an alternating-current supply or where K.L.I. type valves are in use.

They also state that they have supplied for some time a similar screened wire with aluminium armouring, but, owing to the difficulty of soldering it, it has been found preferable to use the brass screened conductors.

The insulation can easily be stripped off and the brass armouring unwound. It certainly seems to be a useful material, and constructors should bear it in mind for they might find it very useful for certain jobs.

OLDHAM H.T. ACCUMULATOR.

There is a further development in design in connection with the Oldham H.T. accumulator of a very interesting character. In future, all Oldham H.T. accumulators are being fitted in 10-volt units utilising the method of "Isola" cell construction. The purpose of this system is to provide a minimum leakage path between cells. The cells are filled with bitumen providing an unbroken surface from end to end. The only contact between cells is by a connecting bridge at the top of the cell and the small

amount of bitumen which binds each cell together. In actual practice the result is tantamount to almost complete air spacing of cells.

A BOOK RECEIVED.

Messrs. Partridge & Co. recently sent me a copy of "Wireless—The Modern Magic Carpet," by Ralph Stranger (3s. 6d. net). The book is brightly written and endeavours to cover a lot of ground.

FERRANTI SAFETY BOX.

Messrs. Ferranti Ltd. have produced a fireproof box made of steel for the containing of mains units. A double-pole switch and a fuse are arranged so that when the lid of the box is lifted the whole of the apparatus secured inside is completely disconnected from the mains. A three-cord flexible cable is fitted, the one cord being provided for earthing purposes in order to comply with regulations. (This is where an earthing pin is fitted to the power plug.) If this plug is not available, then you do not use this lead.



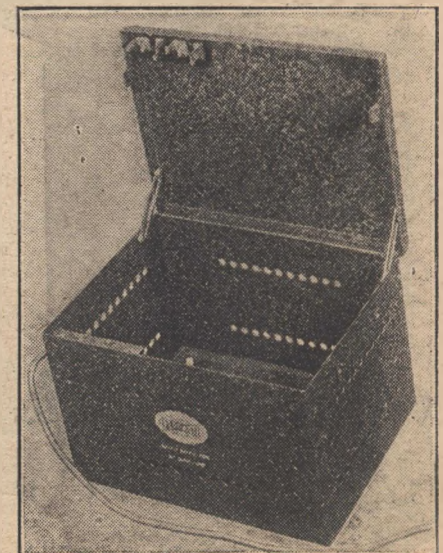
Dr. Loewe, inventor of the Loewe valve.

As readers will probably remember it was mentioned recently in this page that the Ferranti people had prepared charts of a number of mains units, and any one of these units can

be fitted into their safety box. The price of this very useful arrangement is 13s. 6d., although it has the appearance of something of a much higher price. It certainly enables complete safety to be achieved.

FORTHCOMING REPORTS.

Among the various components and accessories recently received for test are: Gecophone Mains Units, H.T. Batteries, Plaque Loud Speaker, Amplifier Unit and Condenser Bank, R.I. and Varley A.C., H.T. Eliminator, Philips' Pick-up, Lewcos Fixed Potentiometer and Loading Coil.



This is the Ferranti Safety Box. The fuses and switch can be seen in the left-hand corner.

HEAR REVELRY ON SUNDAYS!



from CONTINENTAL CABARETS

YOU will enjoy the kind of programme they broadcast on the Continent on Sundays—gay hours from the famous cabaret shows, music from the dance halls, and all the happy freedom of the Continental Sunday are brought to your home by the Lissen S.G.3 Receiver. Because, with this latest development of radio, distant stations come in all around the dials at full loudspeaker strength; the Lissen S.G.3 Receiver gives you a degree of selectivity, volume and purity of reproduction of Continental programmes such as you can get from no other receiver you have ever tried. The cost is moderate; you can easily build the S.G.3 Receiver yourself, or you can buy it completely assembled. If you build it yourself you save pounds.

HOW TO START BUILDING IT!

There are only 6 steps in the building of the Lissen S.G.3 Receiver. Lissen have published a free STEP-BY-STEP Chart and Wiring Diagrams, which make every step absolutely simple. Lissen also provide a ready-drilled panel, baseboard with component layout marked, aluminium screens all ready to erect, and all the wires, terminals and sundries you require in an envelope, price 10s.

Go to your wireless dealer and ask for the Lissen S.G.3 Chart; on the back of it is a list of all the parts you require. Your wireless dealer will help you to choose these parts from his stock. Lissen do not tie you down to any particular make of valve, nor to any special cabinet; you choose these yourself, although Lissen advise a cabinet of polished wood so as to make the finished set a handsome piece of furniture.

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sell the parts for the Lissen S.G.3 Receiver, and any one of them will help and advise you. Get the free chart to-day, or send coupon below direct to factory for it.

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If you prefer it, you can buy the S.G.3 Receiver completely assembled in finely finished wood cabinet large enough to hold batteries and accumulator, price **£8**

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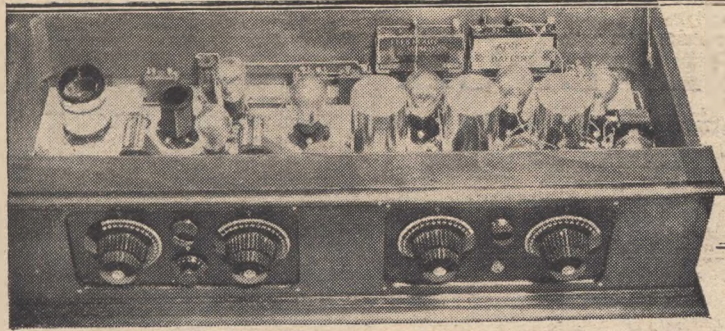
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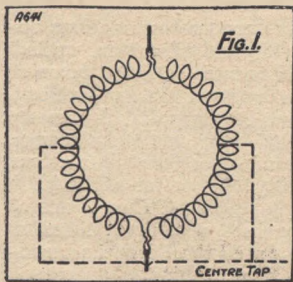
**Osram
Valves**
with the
"TENACIOUS"



TORUSOLENOID TRANSFORMERS

By B. H. J. KYNASTON.

RECEIVING sets employing several stages of transformer-coupled high-frequency amplification are often troublesome things to construct to one's own design, especially if the set is intended for use on the very short wave-lengths. The amateur often finds, unless he works to a good modern design, that although great care has been taken and all leads have been kept



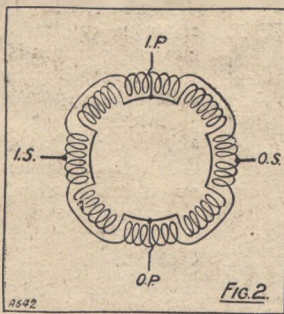
well apart, and as short as possible, the results are not what they should be.

The usual trouble is that the set has a nasty habit of bursting in to oscillation for no apparent reason.

Often a receiver using several stages of transformer-coupled H.F. will be found to work more or less satisfactorily even when one of the high-frequency valves has been removed from its socket.

Such troubles as those mentioned above will in almost every case be found to be due to small energy exchanges taking place between tuning coils, H.F. transformers, etc.

Some time ago a type of coil was described in this paper which has certain special advantages over the ordinary types of coils in



general use, and is very interesting to the man who designs his own sets. The coil referred to is the Torusolenoid, which was invented by Ross Gunn, of Yale University Laboratory. The chief advantage of the coil was that it had no external field, and a very low distributed capacity.

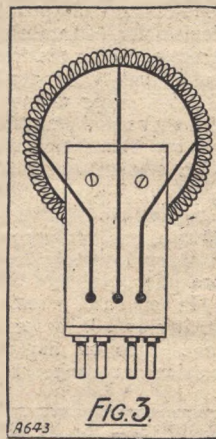
Fig. 1 shows the arrangement used for the fieldless coil. It will be observed that the coil is wound in two sections, and that the sections are wound in opposite directions.

A very similar arrangement can be used for constructing fieldless H.F. transformers. The transformer consists of two Torusolenoid coils wound in sections. The diagram, Fig. 2, shows the method of winding much better than it is possible to describe it in words.

It will be seen that each section of these transformers and coils is in parallel with a similar winding. This secures a uniform magnetic field inside the coil, which does not have any tendency to stray outside the coil and interfere with any other component in the set. The two windings also being in parallel decrease the high-frequency resistance of the winding.

Number of Turns.

Figs. 3 and 4 show an easy method of constructing and mounting these transformers. It will be seen from these diagrams that the coils have a fairly small diameter and will therefore need a large number of turns. The high value of inductance of each half of the coil will allow a



large number of turns of fairly small wire to be used.

For a 200-500-metre band a coil can be wound with a total of 480 turns (240 in each section). No. 30 D.S.C. wire being used.

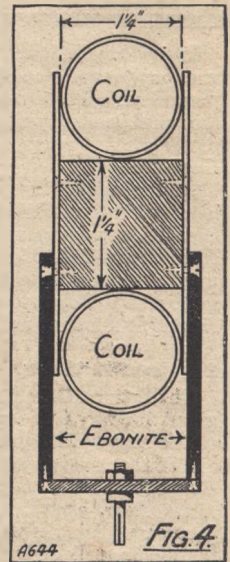
For a transformer for the same band the primary can have 120 turns and the secondary 140 turns.

On the Short Waves.

The number of turns for a tuned transformer for long waves of 1,600 metres should be 440 turns in the primary and 500 in the secondary.

A Torusolenoid for short waves can either be made as shown in Fig. 1, but if the Hartley or similar circuit is to be employed

a centre tapping can be used. The centre tapping must, of course, be taken from the centre of each section, as shown by the dotted lines in the diagram. Using the same size formers, as shown in Figs. 3 and 4 twenty turns in each section (a total of 80 turns) will tune from about 35 to 60 metres with a .0003-mfd. condenser. If a similar coil is used with a centre tapping and the same size tuning condenser is connected between the grid and filament ends of the coil, it will be found to cover about 20 to 40 metres. Such coils are likely to be helpful when an attempt is made to use H.F. amplification on these waves.



If your reception is interrupted intermittently according to the position of your head or the position of the telephones, it is a sign that one of the leads is faulty and needs replacing.

An excellent test for sensitivity is to place the telephones over the ears in the ordinary way, put one of the tags between the lips and rub the other tag with a key, nail, or other piece of metal; if a rubbing noise is heard corresponding with the movement of the key you can be sure that the 'phones in question are sensitive.

To calculate the total amount of low-tension current required by a set add together the figures given by the makers for each valve under the heading "Filament Amps."

TELEPHONE TIPS.

As telephones are among the most sensitive instruments known to science that are in common use, we should always treat them carefully.

When telephones are not left connected permanently to the set, but are stowed away in a cupboard, make sure that they are kept in a dry place, as dampness will in time affect them.

If you are using a crystal set it does not matter which way round the telephone leads are connected to the terminals.

If you are using a valve set be very careful that the 'phone leads are connected in circuit the right way round. Practically all telephone leads are marked with a red cord or a positive sign to denote which side of the telephones should be connected to that telephone terminal which goes to H.T. positive.

If the telephones are incorrectly connected to the 'phone terminals in a valve set, it is only a question of time before they become demagnetised, owing to the plate current flowing through them in the wrong direction.

INTERFERENCE.

The problem of jamming and heterodyning between two or more transmitting stations is not an easy one to solve.

By THE EDITOR.

AS we go to press with this issue, there is still no definite clue to the origin of the unknown broadcaster who has been interfering with 2 L.O. A few days ago, many listeners complained of an amateur station working on 2 L.O.'s wave-length, and which was not only causing interference with the programmes but which was broadcasting matter which has been described as blasphemous and obscene.

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MODERN WIRELESS

Full of articles of exceptional interest including full descriptions of

Four Fine Receivers

Now On Sale

Price 1/-

It is thought that these vulgar transmissions have emanated from a station somewhere in the centre of London, although it is also a theory that it is a high-power station operating in the North of England.

According to the "Daily Express," a listener in North London said that one evening he was listening-in to the Children's Hour from 2 L.O when he thought he would switch over to a German station and, as he was switching over, he heard someone singing, "Linden Lee."

Objectionable "Items."

The listener thought there was something about the way this song was being rendered which suggested it was not being done by one of the usual broadcasting stations. The singer soon broke off, then there was a talk about Beer, and then some laughter, and then some remarks which the listener hopes no children listening in will again hear. According to the listener, this sort of thing went on from about 5 o'clock to 5.30, when he turned off his set and communicated with the authorities.

The B.B.C. has investigated the matter, and so has the Post Office, and it is anticipated that should this had-mannered radio pirate start interfering again he will soon be located by the direction-finding sets and brought to book.

There have also been cases reported in the papers lately of rather mysterious broadcasts from an unknown foreign broadcasting station, and the B.B.C. have received many letters of complaint during the last few weeks from listeners who say they cannot pick up 2 L.O because of interference caused by this mysterious station transmitting during programme hours.

If by the time this issue of POPULAR WIRELESS is in the hands of our readers there is no news of the culprit being caught,

we hope any readers who pick up this station will take every care to note full details, and that they will forward them to us and to the B.B.C.

Shifting Wave-lengths.

In the case of the foreign broadcasting station, it may be that, like Langenberg the other day, the station is off its wave-length and is not deliberately interfering with the B.B.C. It is most important that every station should keep to its allotted frequency. There is no excuse these days for foreign stations not keeping to their right wave-lengths, for the practice of keeping transmitters at a constant frequency is now widely known, and ignorance cannot be put forward as an excuse.

Furthermore, the increasing use and development of quartz crystals and other devices for maintaining the correct carrier frequency of a station is well known, but unfortunately a good many Continental stations either do not use these devices or else they use them casually or wrongly.

Very often these days we have to complain of a station transmitting a frequency as much as 5,000 cycles from its normal one. Luckily, the International Radiophone Bureau and various watching stations keep a sharp look-out for these offenders, who are quickly brought to book.

In one case, a station may operate at a frequency a little removed from its normal one, while on the other hand a foreign station may sometimes be heard having a

varying frequency; sometimes being above and sometimes below its normal one. British stations seldom, if ever, err in this matter, for the B.B.C. maintains a very strict supervision on the frequency of its various broadcasting stations.

Of course, any broadcasting station usually has to have a frequency range of 10,000 cycles, whereas a C.W. Morse transmitting station usually requires only about 400 cycles. Consequently, a telephony broadcasting station usually takes up more frequency channels than an ordinary Morse transmitting station.

Minimising Interference.

If we consider broadcasting stations operating between 200 and 600 metres, we find the wave-lengths covered include a range of a million cycles between the two extreme frequencies, and consequently it can be worked out that there are only enough broadcasting channels for about 100 stations broadcasting telephony, or for about 2,500 high-speed Morse stations. That is one of the reasons why there is so much difficulty in finding room for all the European broadcasting stations now working.

On the very long wave-length range there is available for broadcasting a wave-length band of 1,000 to 2,000 metres, or in cycles 150,000. But even then, only fifteen or sixteen stations having a frequency range of 10,000 cycles each can be accommodated. This country only has one wave-length in that range, and that is 5 X X Daventry.

However, when the change-over of the relay stations to one common wave-length is accomplished, and, better still, when the Regional Scheme is in operation, this trouble of interference will be considerably minimised.

In the meantime, it behoves every amateur to keep a very close watch as far as he is able, and to report at once in full detail any stations he hears interfering either deliberately or unintentionally with the legitimate broadcast transmissions.



Members of one of the leading radio societies carrying out D.F. tests during a search for a "pirate" transmitting station.

Registered



Trade Mark.

Purity
Range

Melody
Volume

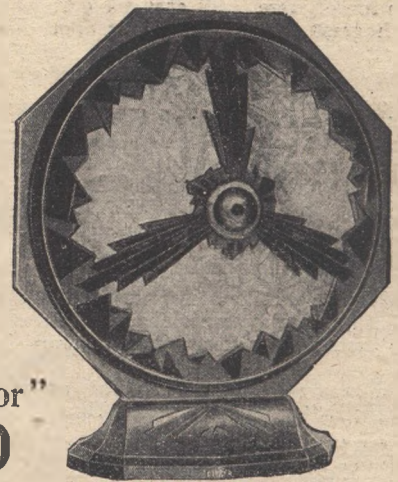
Fidelity
Sensitivity

These are all distinctive features of

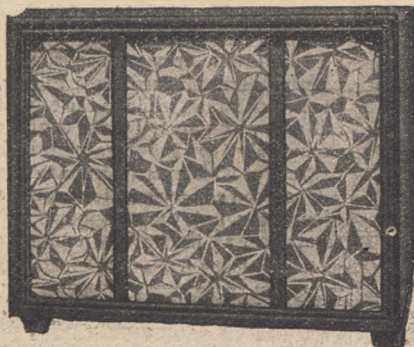
The Loud Speaker de Luxe

The "E L O D É N"

The very latest and most perfect achievement in acoustic reproduction.



The "Compressor"
£6.5.0



Model E.M.6
£3.15.0

Elodén Loud Speakers are sold under licence from Standard Telephone & Cables Limited. Hopkins and Lektophone Corporation, under whose numerous patents the trade and users are fully protected.

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ask your dealer for an
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Telephone : VICTORIA 2919.

"It can't be done!" said the Editor of "P.W.," laying down his pen with great deliberation and swivelling round in my direction.

"Why not?" I replied, settling back very comfortably into the visitor's easy chair and preparing for an argument.

"Do you mean to tell me," went on *He Who Guides "P.W."*, "that you can show our readers how to make a three-valve set with variable condenser tuning, condenser-controlled Reinartz reaction, antiphonic valve holders—in fact, everything but the batteries, valves and speaker, for under half-a-guinea?"

"Yes," I replied, with what the novelists called "studied nonchalance." (After all, I had spent many weeks thinking it out, and I was feeling that this was rather *my* day.) "Let's call it 7s. 6d., and I will see that you get aerial and earth terminals, and nice red and black insulated spade terminals for the accumulator and loud speaker leads."

YOU CAN MAKE IT!

"Far be it from me," remarked the Guiding Spirit of "P.W.," picking up his pen once more and examining its nib with great care, "far be it from me to suggest that the eminent editor of the 'Wireless Constructor' is capable of adding three stages of amplification to the truth, but I should very much like to see and hear this set you are talking about."

And so, a few weeks later, the Editor and I stood by the testing bench in the "P.W." Research Department. In front of us stood the weird but efficient receiver depicted on the cover of this issue. Out of the loud speaker near by poured music—loud, clear, and free from distortion. A touch of the dial and it faded away to nothing, and in a moment another programme poured in from 5 G B.

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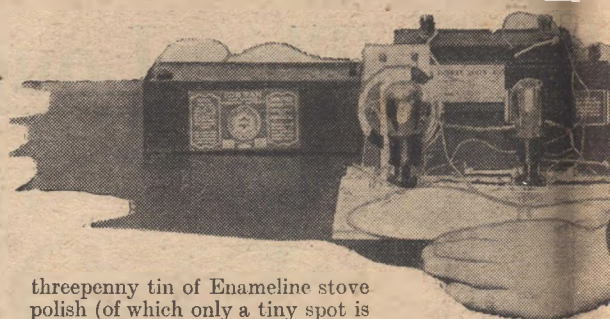
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A THREE VALVE SET FOR 7/6^d

PERCY W. HARRIS



All the parts needed for the 7s. 6d. three-valver!	
Note the very low total cost!	
	s. d.
Baseboard, 15 in. x 8 in.	- -
Double flex, 4 yds.	0 8
3 antiphonic valve holders (Cason)	3 0
5 Clix wander plugs	0 10
4 Clix Spades	0 8
1 tin Enameline, 3d.	0 3
2 terminals for aerial and earth	0 2
Bare tinned wire, stiff, 1 yd.	0 2
3 doz. roundheaded brass wood screws, 3/8-in.	0 6
1 1/2 doz. tin soldering lugs	0 3
Tinfoil, wax paper from 7 packets 20 Players' cigarettes	- -
Stick of sealing wax	0 3
Twenty yards No. 24 D.C.C. wire (2 oz.)	0 9
Piece of "P.W." paper, and odd pieces of firewood	- -
	7 6

threepenny tin of Enameline stove polish (of which only a tiny spot is used, the rest being available for the household), a few yards of electric lighting flex, some cardboard, wood screws, soldering tags, stiff wire, sealing wax, tinfoil, wax paper, and three antiphonic valve holders.

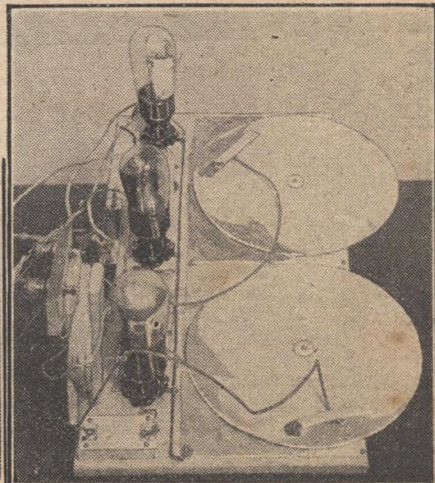
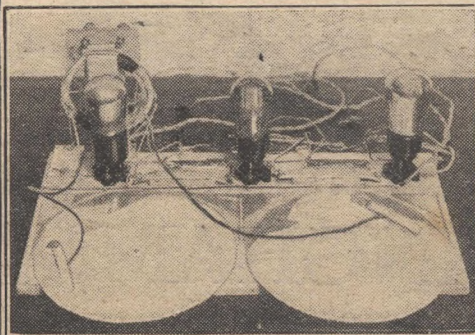
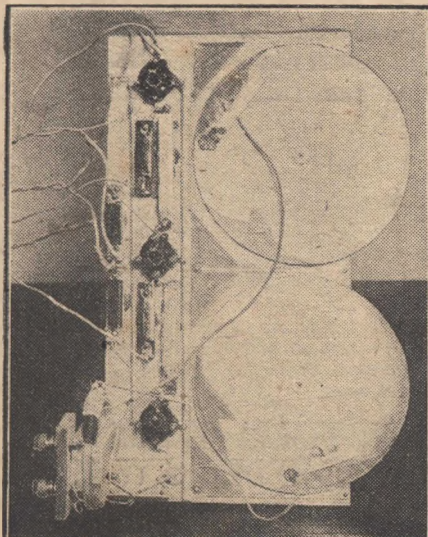
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The fixed condensers, for example, consist of nothing but the wrappings of Players' cigarettes, at the rate of one set of wrap-

receiver, and as the agreed figure of 7s. 6d. allowed the holders to be bought, the manufactured articles were included. They are quite efficient but inexpensive, costing only a shilling each.

"Players', Please"!

The materials required are—any old piece of board for the base, a few tiny pieces of firewood for supporting the anode resistances, grid leaks, and condensers, a couple of ounces of No. 24 D.C.C. wire, a



Three views of Mr. Harris's unique set clearly showing its construction. You will notice that the home-made coupling resistances and condensers are mounted between the valves, while the large circular objects are the home-made variable condensers. The assembly is an extraordinarily compact one notwithstanding its simple all-home-made nature.



IRIS M.I.R.E.

worked out in my laboratory), and if built as described you will be able to receive on the average outdoor aerial, not only the local station and 5 G B but, after dark, several of the continentals on the loud speaker, with a little practice.

Probably the most interesting part of the receiver is the special type of variable condenser used. If you examine the circuit diagram you will see that one set of plates of each variable condenser is at earth potential. For this reason two strips of tinfoil measuring, when placed end to end, some 14½ in. long by 3 in. wide are placed along the baseboard, being gummed to a strip of card fastened down to the wood. The card is used here to obtain smoothness.

Next, two discs of card are cut, 7 in. diameter, from as thick cardboard as you have available, and over half of one side of each of these discs a sheet of tinfoil is attached with gum. The ends of the tinfoil are folded over to the other side of the disc, where they are out of sight, and gummed

packets, and you will find that the baseboard mounted foil can be made from exactly two sheets of foil, while one sheet of foil will serve for each card disc.

How Coils are Made.

Wax paper from outside the packets is gummed to the foil on the baseboard, thus serving as the necessary dielectric. In the photograph the wax paper is shown cut away somewhat to reveal the foil, but so long as the wax paper is so arranged that the foil on the underside of each disc cannot touch the foil on the baseboard, all will be well. In order that electrical connection may be made to the foil on the discs, two strips of cardboard are fastened with sealing wax as shown, and the bared ends of flexible wires tucked underneath the cardboard so as to make contact with the foil. Each disc is held in position by means of a wood screw passing through it into the baseboard.

The valve holders are simply screwed into the wooden baseboard in the positions shown, with the plate terminals on the right and the grid on the left. The coil, which really consists of three separate windings, is hank wound, and to make this all you have to do is to take some round object 3 in. in diameter (a tumbler or cocoa tin will do if it is this diameter) and then wind on to it the three coils as follows.

Coil No. 1. This consists of 10 turns of the No. 24 D.C.C. wire. Allow 2 or 3 in. at each end of this coil, carefully pull it off the former, and tie it in two or three places with cotton so as to make a tight hank. Lay this aside, and then make another coil with 40 turns of the same wire, leaving 2 or 3 in. at each end as before, and binding it again; and then wind a third coil of 20 turns of the same wire and put this aside also.

Watch the Winding.

You will now have three coils. Place these on top of one another, being careful to keep them so that the direction of winding is the same in each case, and tie them all together lightly but firmly with cotton; or, if you like, bind them round in one or two places with electricians' tape. Bare the ends of all three coils and, for convenience at the moment, stick paper labels on at the ends, numbering them 1 and 2 for the beginning and end of the first or aerial coil, 3 and 4 for the beginning and end of the second or grid coil, and 5 and 6 for the beginning and end of the third or reaction

(Continued on next page.)

pings per condenser. Tinfoil from cakes of chocolate will be equally satisfactory, as will the wax paper used for wrapping many food products, such as breakfast foods. There is more than enough wax paper round one packet of "Force," for example, to provide all that is necessary for this receiver. May I take this opportunity of offering, in advance, apologies to many readers who smoke and who have found they are unable to obtain their cigarettes with the usual facility? No doubt the makers will immediately erect a large number of new factories to meet the demand!

Continental on the L.S.!

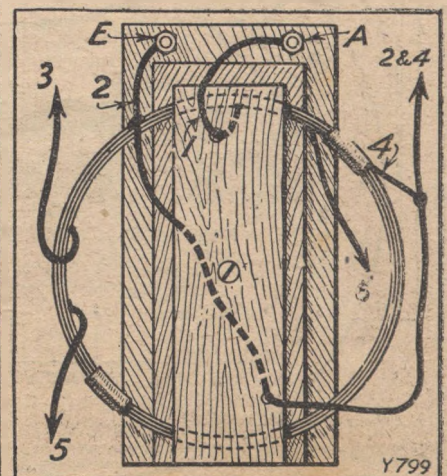
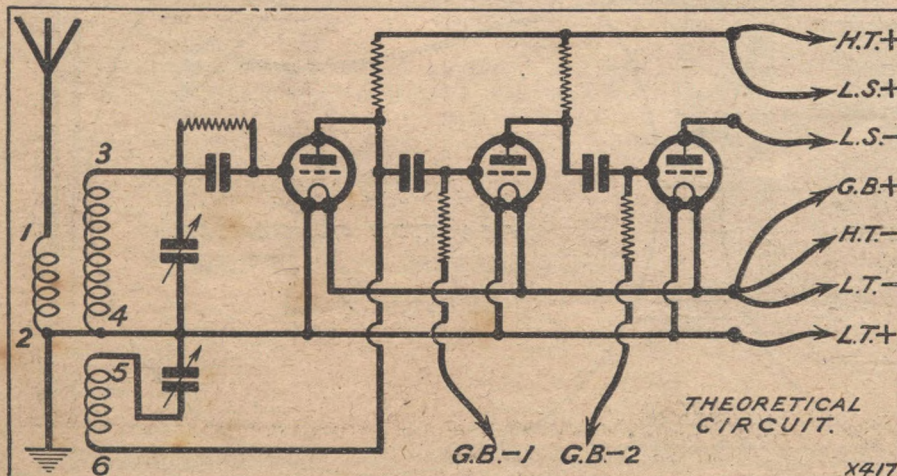
Seriously, this receiver has taken many weeks to work out, particularly with the view to making it as easy as possible to duplicate. The work has been made particularly simple, but it is necessary to follow out all instructions carefully, even when some of the instructions may appear to you a little unnecessary or trivial. No skilled work of any kind is required, there are no electrical measurements to be done (this has all been

This is undoubtedly one of the most striking receiver designs ever published. For "three half-crowns" one can build a Detector 2 L.F. three-valve set capable of surprising punch and purity. The L.F. stages are resistance-capacity coupled, and capacity reaction control figures in the efficient and up-to-date circuit. You can work a loud speaker with this set, and the results will compare with those given by an expensive commercial production.

Home-made variable condensers, home-made resistances and fixed condensers, and home-made coils, are features of this real home-constructor design. Literally this is a set you MAKE, as opposed to the usual assembly of manufactured components. And the parts are easily made out of ready-to-hand materials.

The 7s. 6d. Three-Valver is a triumph of ingenious improvisation, and the description of its construction makes fascinating reading.

firmly in position. Tell all your friends who smoke Players' cigarettes to let you have the wax paper and the foil from their



Y799

A THREE VALVE SET FOR 7/6.

(Continued from previous page.)

coil. Now cut a piece of wood measuring approximately $\frac{3}{8}$ in. or $\frac{1}{2}$ in. by $5\frac{1}{2}$ in. high and $1\frac{1}{2}$ in. wide, and screw this against the back edge of the baseboard in a vertical position.

Next cut a similar piece of wood measuring 1 in. wide by 4 in. long, and screw this on to the back piece in such a way that it clamps the composite coil between it and the back upright, as shown. This will hold the coil firmly in place. An additional small strip of wood of any convenient size should be screwed as shown to the top of the upright at the back to carry the aerial and earth terminals. None of these sizes are critical, and if you follow the general connections shown in the drawings for these pieces of wood the results will be quite satisfactory.

Certain other portions must be cut accurately, and these will be explained later.

What the Coil Covers.

This coil, by the way, will be found to cover a very wide range of wave-lengths running well above 5 G B—indeed, up to 600 metres or so—and well down below the lowest British broadcast wave-length, so that you will be able to get a number of the Germans in favourable conditions

on the lower band. This week we will confine ourselves to details, to the manufacture of the coil and the variable condensers; and next week I will give you full details for the manufacture of the grid leak and condenser, the coupling condensers, the anode resistances, and the grid leaks. For this I have had a series of special, very clear explanatory photographs prepared, and these will accompany the next article.

“Foiled at Last!”

The following points should be borne in mind when making the variable condensers: You may wonder how it is that a single moving plate condenser can give you the necessary capacity for tuning in this receiver, as the variable condensers usually incorporated have a number of fixed and moving plates. The reason is that the separation between the fixed and moving plates in this receiver is extremely small, being only that due to the thickness of the waxed paper.

For this reason, it is necessary that the foil should be applied to very smooth surfaces (provided, in this case, by the sheet of cardboard on the baseboard and the cardboard disc), that the foil itself shall be very smooth, and that the wax paper shall be smoothly applied. Remember that it is the smoothness of the cardboard which is important, and it does not matter a jot whether anything is printed on it or not. This is how I proceeded in my own work.

First of all, I took a sheet of smooth millboard measuring 5 in. by $14\frac{1}{2}$ in.

(you can obtain quite a large sheet of new Bristol board from a stationers for 4d.) and fastened it to the baseboard (which was made of a piece of an old packing-case) by means of four small round-headed wood screws, one at each corner. I then took a lead pencil and ruled a line along this cardboard at a distance of 3 in. from the back.

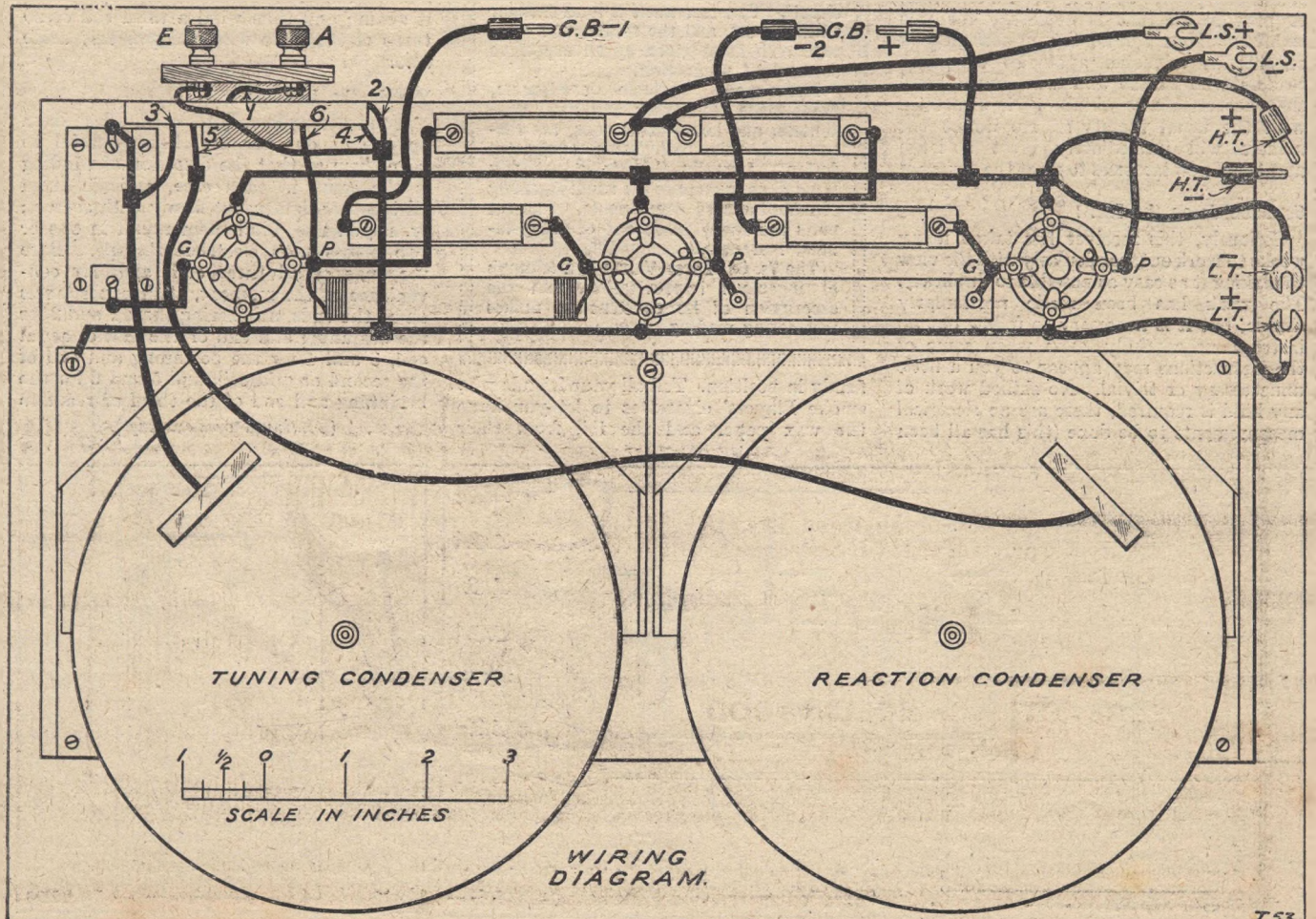
The next step was to take some gum and spread it thinly and smoothly all over the cardboard behind this central line; that is to say, between this pencil line and the edge of the cardboard nearest the valve holders. This was then allowed to get nearly dry, and two sheets of tinfoil out of packets of 20 cigarettes were carefully laid on and rubbed smoothly in place with a handkerchief rolled up into a pad. In rubbing down this foil, you should work from the centre outwards, so as to drive out air bubbles.

Do not rub too hard, otherwise you will tear the foil. The task is quite easy, and a few fine creases here and there will not matter much.

The Condenser Connection.

The two foils are not in contact in the middle of the board, but sound electrical contact is assured by passing a wood screw through the centre space with a piece of any thin metal, such as a brass or tin washer interposed between the screw-head and the tinfoil. When the screw is driven home this will make good contact between the two foils, and assure continuity from one end of the tinfoil to the other.

(Continued on page 938.)



THE FERRANTI TRANSFORMER

*worth looking
into —*

The Ferranti AF 3 Transformer has changed the opinion of the whole radio world as to the amazing efficiency and tonal fidelity of transformer amplification.

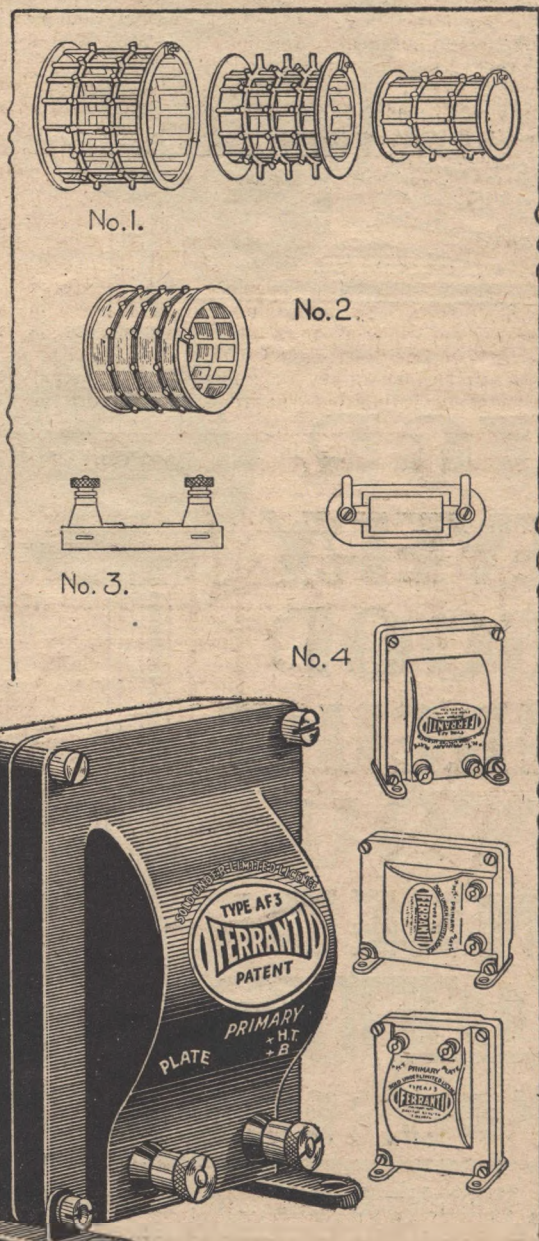
The AF 3 is the almost perfect transformer; made up to a standard that only the house of Ferranti could set.

As some evidence of skilled design and craftsmanship, glance at the accompanying sketches. No. 1 shows the special skeleton coil formers which ensure robust strength along with low self-capacity. Fig. 2 shows the secondary coil, and gives an idea of the unique sub-division of the windings. No. 3 shows the '0003 condenser which is built into every AF 3 across the primary winding. No. 4 gives an indication of the general adaptability of the transformer, which can be mounted in either of the three positions depicted — thanks to the movable feet.

For a component of anything like its quality the price of the AF 3 is remarkably low at

25/-

**FERRANTI LTD. HOLLINWOOD
LANCASHIRE**



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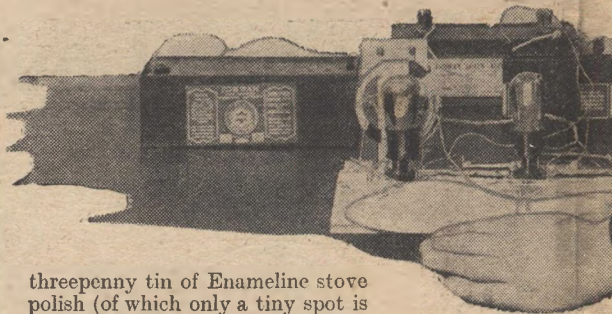
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by PERCY W. HAR



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Double flex, 4 yds.	0	8
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5 Clix wander plugs	0	10
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1 tin Enameline, 3d.	0	3
2 terminals for aerial and earth	0	2
Bare tinned wire, stiff, 1 yd.	0	2
3 doz. roundheaded brass wood screws, 3/8-in.	0	6
1 1/2 doz. tin soldering lugs	0	3
Tinfoil, wax paper from 7 packets	—	—
20 Players' cigarettes	—	—
Stick of sealing wax	0	3
Twenty yards No. 24 D.C.C. wire (2 oz.)	0	9
Piece of "P.W." paper, and odd pieces of firewood	—	—
	7	6

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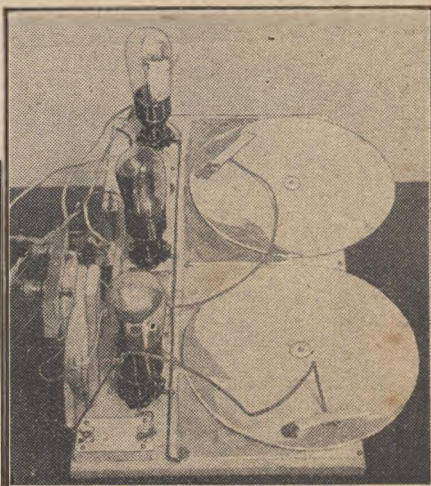
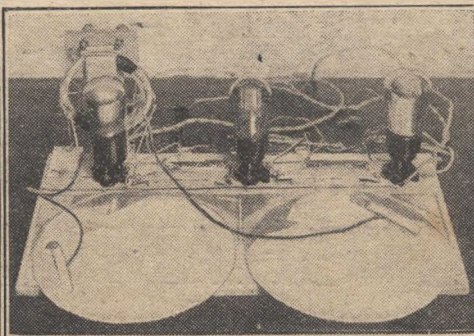
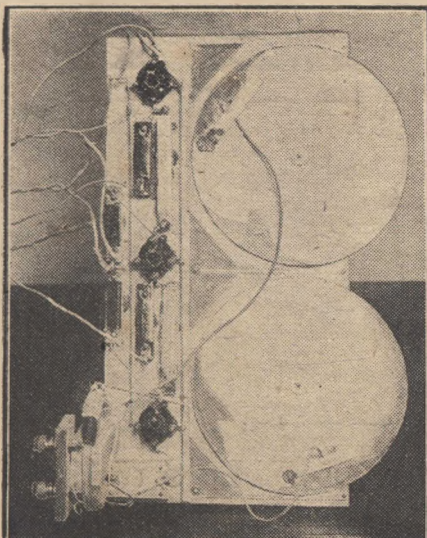
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RRIS WIRE.

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Seriously, this receiver has taken many weeks to work out, particularly with the view to making it as easy as possible to duplicate. The work has been made particularly simple, but it is necessary to follow out all instructions carefully, even when some of the instructions may appear to you a little unnecessary or trivial. No skilled work of any kind is required, there are no electrical measurements to be done (this has all been

This is undoubtedly one of the most striking receiver designs ever published. For "three half-crowns" one can build a Detector 2 L.F. three-valve set capable of surprising punch and purity. The L.F. stages are resistance-capacity coupled, and capacity reaction control figures in the efficient and up-to-date circuit. You can work a loud speaker with this set, and the results will compare with those given by an expensive commercial production.

Home-made variable condensers, home-made resistances and fixed condensers, and home-made coils, are features of this real home-constructor design. Literally this is a set you MAKE, as opposed to the usual assembly of manufactured components. And the parts are easily made out of ready-to-hand materials.

The 7s. 6d. Three-Valver is a triumph of ingenious improvisation, and the description of its construction makes fascinating reading.

firmly in position. Tell all your friends who smoke Players' cigarettes to let you have the wax paper and the foil from their

packets, and you will find that the baseboard mounted foil can be made from exactly two sheets of foil, while one sheet of foil will serve for each card disc.

How Coils are Made.

Wax paper from outside the packets is gummed to the foil on the baseboard, thus serving as the necessary dielectric. In the photograph the wax paper is shown cut away somewhat to reveal the foil, but so long as the wax paper is so arranged that the foil on the underside of each disc cannot touch the foil on the baseboard, all will be well. In order that electrical connection may be made to the foil on the discs, two strips of cardboard are fastened with sealing wax as shown, and the bared ends of flexible wires tucked underneath the cardboard so as to make contact with the foil. Each disc is held in position by means of a wood screw passing through it into the baseboard.

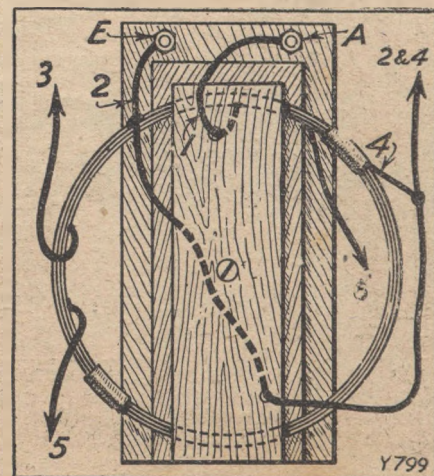
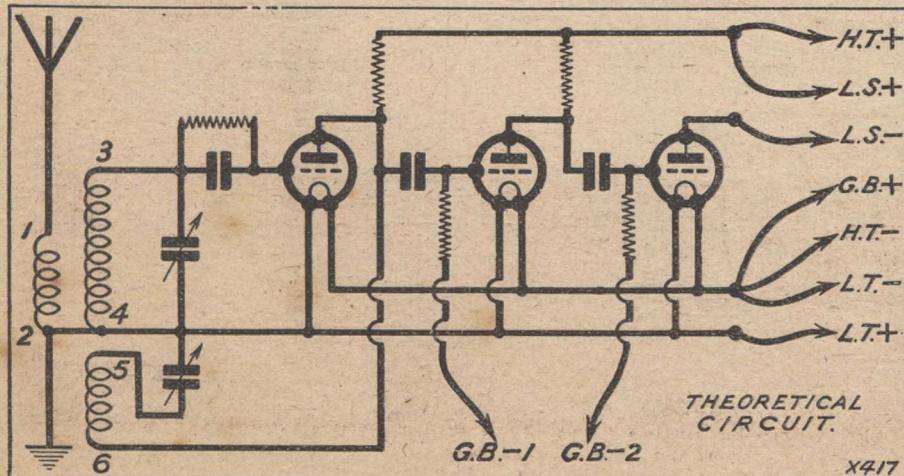
The valve holders are simply screwed into the wooden baseboard in the positions shown, with the plate terminals on the right and the grid on the left. The coil, which really consists of three separate windings, is hank wound, and to make this all you have to do is to take some round object 3 in. in diameter (a tumbler or cocoa tin will do if it is this diameter) and then wind on to it the three coils as follows.

Coil No. 1. This consists of 10 turns of the No. 24 D.C.C. wire. Allow 2 or 3 in. at each end of this coil, carefully pull it off the former, and tie it in two or three places with cotton so as to make a tight hank. Lay this aside, and then make another coil with 40 turns of the same wire, leaving 2 or 3 in. at each end as before, and binding it again; and then wind a third coil of 20 turns of the same wire and put this aside also.

Watch the Winding.

You will now have three coils. Place these on top of one another, being careful to keep them so that the direction of winding is the same in each case, and tie them all together lightly but firmly with cotton; or, if you like, bind them round in one or two places with electricians' tape. Bare the ends of all three coils and, for convenience at the moment, stick paper labels on at the ends, numbering them 1 and 2 for the beginning and end of the first or aerial coil, 3 and 4 for the beginning and end of the second or grid coil, and 5 and 6 for the beginning and end of the third or reaction

(Continued on next page).



A THREE VALVE SET FOR 7/6.

(Continued from previous page.)

coil. Now cut a piece of wood measuring approximately $\frac{3}{8}$ in. or $\frac{1}{2}$ in. by $5\frac{1}{2}$ in. high and $1\frac{1}{2}$ in. wide, and screw this against the back edge of the baseboard in a vertical position.

Next cut a similar piece of wood measuring 1 in. wide by 4 in. long, and screw this on to the back piece in such a way that it clamps the composite coil between it and the back upright, as shown. This will hold the coil firmly in place. An additional small strip of wood of any convenient size should be screwed as shown to the top of the upright at the back to carry the aerial and earth terminals. None of these sizes are critical, and if you follow the general connections shown in the drawings for these pieces of wood the results will be quite satisfactory.

Certain other portions must be cut accurately, and these will be explained later.

What the Coil Covers.

This coil, by the way, will be found to cover a very wide range of wave-lengths running well above 5 G B—indeed, up to 600 metres or so—and well down below the lowest British broadcast wave-length, so that you will be able to get a number of the Germans in favourable conditions

on the lower band. This week we will confine ourselves to details, to the manufacture of the coil and the variable condensers; and next week I will give you full details for the manufacture of the grid leak and condenser, the coupling condensers, the anode resistances, and the grid leaks. For this I have had a series of special, very clear explanatory photographs prepared, and these will accompany the next article.

“Foiled at Last!”

The following points should be borne in mind when making the variable condensers: You may wonder how it is that a single moving plate condenser can give you the necessary capacity for tuning in this receiver, as the variable condensers usually incorporated have a number of fixed and moving plates. The reason is that the separation between the fixed and moving plates in this receiver is extremely small, being only that due to the thickness of the waxed paper.

For this reason, it is necessary that the foil should be applied to very smooth surfaces (provided, in this case, by the sheet of cardboard on the baseboard and the cardboard disc), that the foil itself shall be very smooth, and that the wax paper shall be smoothly applied. Remember that it is the smoothness of the cardboard which is important, and it does not matter a jot whether anything is printed on it or not. This is how I proceeded in my own work.

First of all, I took a sheet of smooth millboard measuring 5 in. by $14\frac{1}{2}$ in.

(you can obtain quite a large sheet of new Bristol board from a stationers for 4d.) and fastened it to the baseboard (which was made of a piece of an old packing-case) by means of four small round-headed wood screws, one at each corner. I then took a lead pencil and ruled a line along this cardboard at a distance of 3 in. from the back.

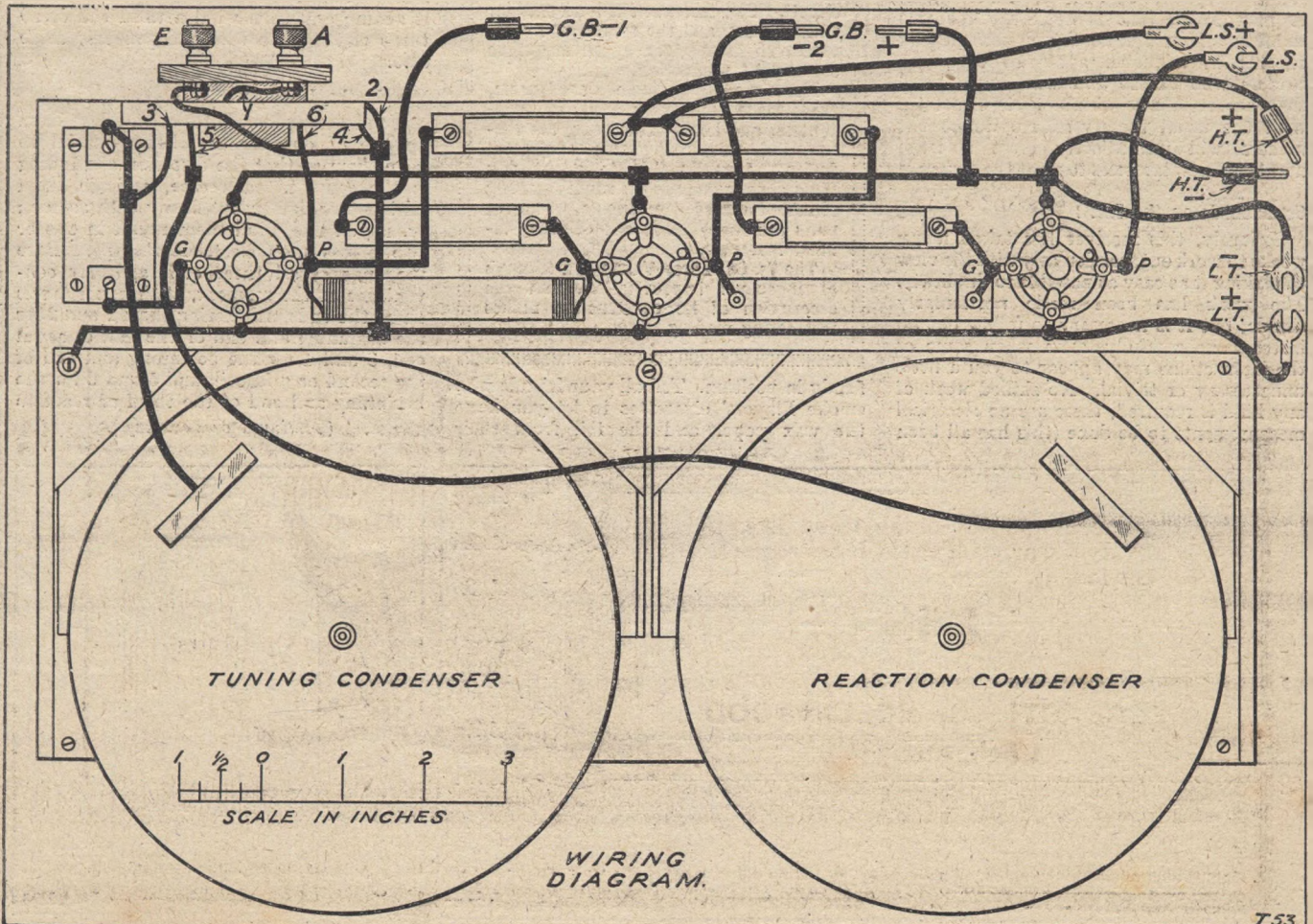
The next step was to take some gum and spread it thinly and smoothly all over the cardboard behind this central line; that is to say, between this pencil line and the edge of the cardboard nearest the valve holders. This was then allowed to get nearly dry, and two sheets of tinfoil out of packets of 20 cigarettes were carefully laid on and rubbed smoothly in place with a handkerchief rolled up into a pad. In rubbing down this foil, you should work from the centre outwards, so as to drive out air bubbles.

Do not rub too hard, otherwise you will tear the foil. The task is quite easy, and a few fine creases here and there will not matter much.

The Condenser Connection.

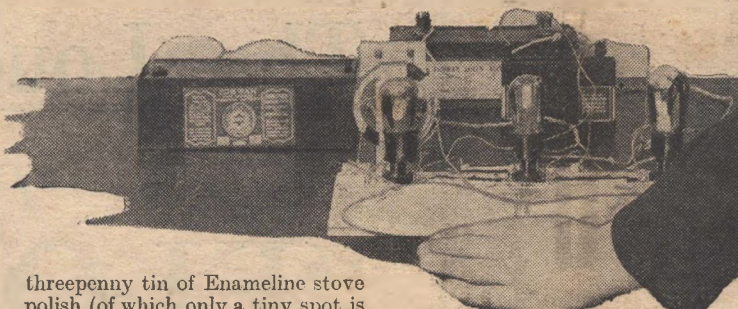
The two foils are not in contact in the middle of the board, but sound electrical contact is assured by passing a wood screw through the centre space with a piece of any thin metal, such as a brass or tin washer interposed between the screw-head and the tinfoil. When the screw is driven home this will make good contact between the two foils, and assure continuity from one end of the tinfoil to the other.

(Continued on page 938.)



A THREE VALVE SET FOR 7/6^d

PERCY W. HARRIS MIRE.



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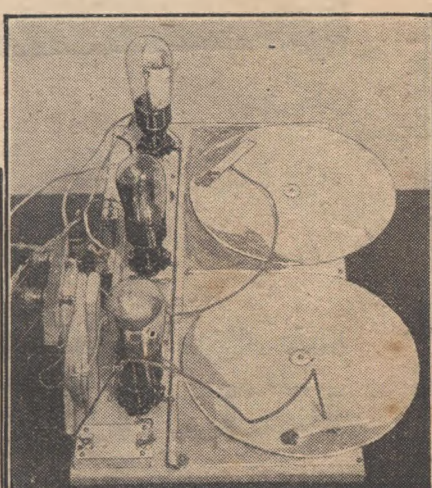
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rettes	0 3
x	0 9
24 D.C.C. wire	0 9
paper, and odd	0 0
d	0 0
	7 6

threepenny tin of Enameline stove polish (of which only a tiny spot is used, the rest being available for the household), a few yards of electric lighting flex, some cardboard, wood screws, soldering tags, stiff wire, sealing wax, tinfoil, wax paper, and three antiphonic valve holders. As a touch of luxury I have added two terminals for aerial and earth, five Clix wander plugs, and four Clix spades. These can, if desired, be dispensed with, reducing the cost by 1s. 6d. or so, but they add to the comfort and still enable the set to be made for 7s. 6d. In the list of components I have not included any charge for the cardboard, tinfoil, or wax paper, as any old pieces of flat stiff cardboard will do, such as the lids of boxes, while in the case of the tinfoil and wax paper, I have confined myself exclusively to the wrappings found in packets of 20 Players' cigarettes!

The fixed condensers, for example, consist of nothing but the wrappings of Players' cigarettes, at the rate of one set of wrap-

agreed figure of 7s. 6d.
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required are—any old
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porting the anode res-
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No. 24 D.C.C. wire, a



notice that the home-made coupling resistances and condensers are mounted between
ers. The assembly is an extraordinarily compact one notwithstanding its simple
made nature.

ings per condenser. Tinfoil from cakes of chocolate will be equally satisfactory, as will the wax paper used for wrapping many food products, such as breakfast foods. There is more than enough wax paper round one packet of "Force," for example, to provide all that is necessary for this receiver. May I take this opportunity of offering, in advance, apologies to many readers who smoke and who have found they are unable to obtain their cigarettes with the usual facility? No doubt the makers will immediately erect a large number of new factories to meet the demand!

Continental on the L.S.!

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worked out and if built will be an average out the local station after dark, tinental on with a little Probably ing part special typ denser use the circuit that one s variable co potential.

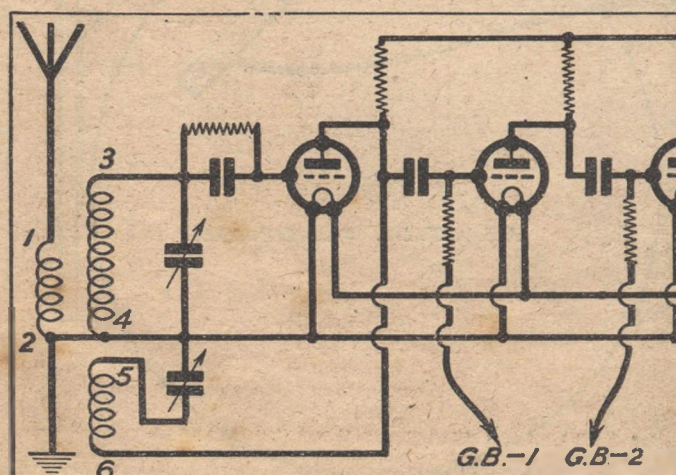
strips of tinfoil m end to end, some wide are placed being gummed fastened down to is used here to o Next, two dis 7 in. diameter, board as you ha half of one side a sheet of tinfoil The ends of the to the other sid they are out of

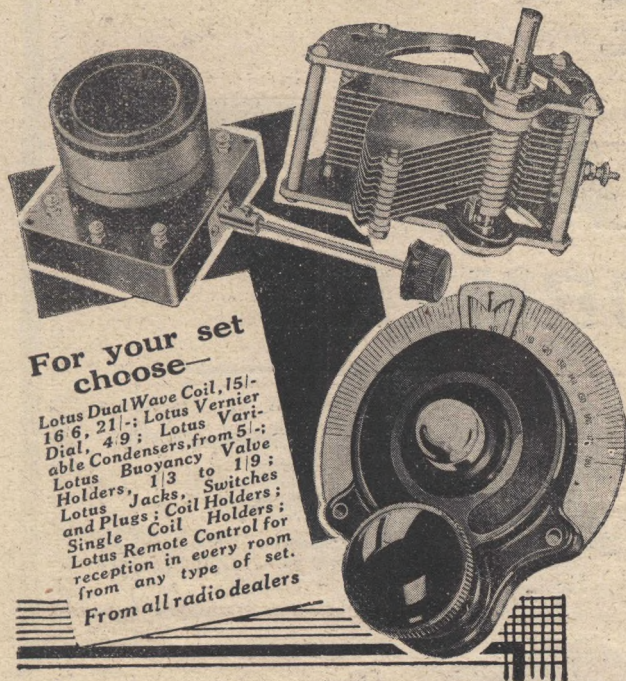
This is undoubtedly striking receiver des For "three half-cro a Detector 2 L.F. thr of surprising punch L.F. stages are coupled, and capaci figures in the effici circuit. You can w with this set, and th pare with those giv commercial product

Home-made va home-made resistan densers, and home- tures of this rea design. Literally MAKE, as opposed t of manufactured co parts are easily ma hand materials.

The 7s. 6d. Three of ingenious impr description of its fascinating reading.

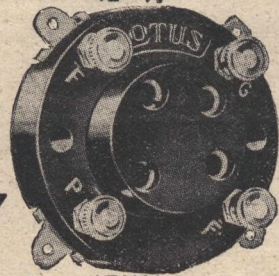
firmly in position. Te smoke Players' cigar the wax paper and





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 able Condensers, from 5/-;
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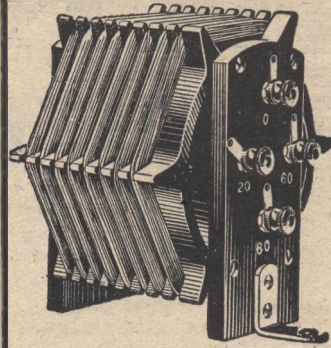


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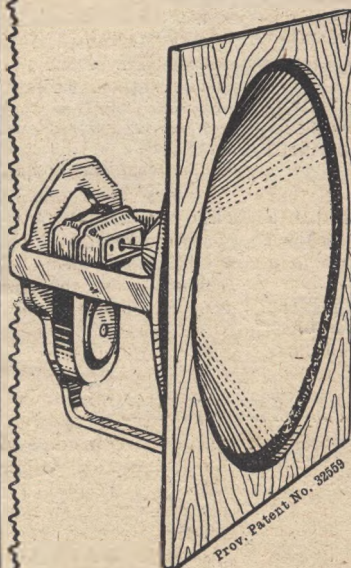
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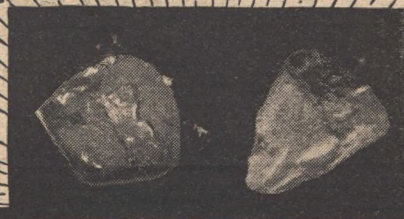
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Framework is as used in Loud Speaker
 described in this issue.

Prov. Patent No. 32359

GLOWING CRYSTALS



AS most of our readers know, a quartz crystal, in common with certain other piezo-electric substances, will vibrate with enormous rapidity under the influence of a high-frequency current. Each crystal has a certain fundamental frequency at which the "mechanical" action is most pronounced. This frequency is determined by the particular dimensions of the crystal and the manner in which it has been cut out from the mother quartz.

For instance, by cutting along certain directions related to the optical and electrical axes of the original quartz, a size can be selected such that the finished crystal can be depended upon to vibrate, say, at the

The valve, marvellous as it is, cannot claim to be any more mysterious than the crystal. For certain crystals will not only "vibrate" and glow when connected to a suitable circuit, but they can thus act as a relay, as told below.

By **SEXTON O'CONNOR.**

in the wave-length allotted to a given broadcasting station. Such an indicator forms a valuable means of avoiding the heterodyne trouble that occurs when a station "wavers" above or below its allotted wave-length, and so overlaps the carrier of another station.

Quite recently the glowing crystal has found another ingenious application in the hands of the Metropolitan Vickers Company, in connection with the distant control of apparatus by wireless, or by high-frequency currents fed through wires.

The idea of controlling the flight of an aeroplane or the course of a submarine from a distance by means of wireless waves has been known in principle for several years. The method broadly consists in installing several relays, each sensitive to one particular frequency, and each controlling a definite part of the steering apparatus.

In practice, however, it has been found difficult to design a relay sufficiently selective, as regards frequency, to give a reliable response. Obviously, if the "star-board" relay is tuned to a certain frequency, it must respond promptly to this frequency, but must remain inactive when "port" signals are received, and vice-versa.

The Fundamental Frequency.

It has been previously stated that a piezo crystal only glows when it is energized at its fundamental frequency.

It has also been pointed out that the "glow" is due to ionization of the rarefied gas surrounding the crystal oscillator. Now when a gas is ionized it becomes a conductor, whereas before it is ionized it is an insulator. This fact is utilised in the selective relay illustrated in the diagram.

A quartz crystal (Q) is mounted on one electrode (A) inside a glass bulb containing Neon, Argon, or Helium gas under reduced pressure. A second electrode (B) is brought to a point very close to the crystal, but not actually touching it.

A third electrode (C) is bent around the electrode B, as shown, so as partly to encircle but not to make contact with it.

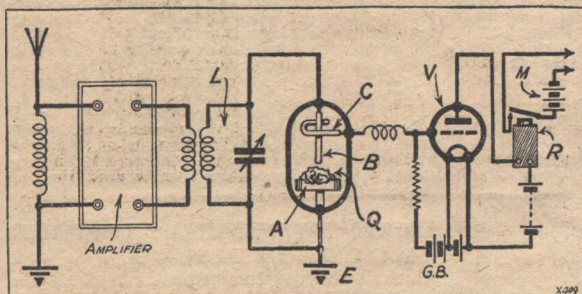
Released by the Glow.

Under normal circumstances the electrode B is insulated by the Neon gas from the electrode C. If, however, the circuit L is energised, say, from a valve receiver at the particular or fundamental frequency of the crystal Q, then the peculiar "glow" sets in, the gas in the bulb is ionized, and the electrode B becomes in effect electrically connected to the electrode C. In other words, the insulation previously existing between the electrodes B and C is broken down by the "glow" of the crystal.

On the right-hand side of the figure it will be seen that the electrode C is connected to the grid of an amplifying valve, V. Normally, a heavy negative bias is imposed upon the grid from a battery GB, so much so that the valve is "paralysed," i.e. practically no current flows in the output circuit.

As soon as the crystal "glow" breaks down the gas insulation between the two electrodes C and B, the voltage from the bias battery GB promptly finds a path of escape from C across the ionized gas to the electrode B and then to earth at E.

This, of course, immediately reduces the paralysing voltage on the grid of the amplifier, so that a considerable plate current begins to flow through the electro-magnetic relay R. The armature of the latter is thereupon closed and a local circuit containing a battery, M, comes into operation either to swing the rudder to one side or other, or to do whatever other work it may have been designed for.



Here is the circuit which enables the glowing crystal to be used as a sensitive relay.

rate of one million per second. Such crystal oscillators may be used to control or stabilise the output of a valve oscillator, so that the carrier-wave, say, of a broadcasting station can be maintained absolutely steady.

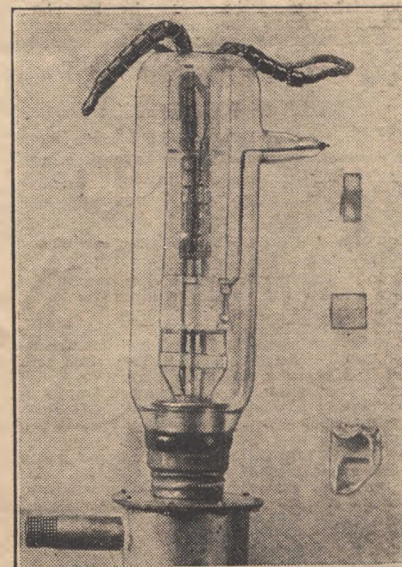
Control at a Distance.

Some time ago two German scientists, Messrs. Giebe and Scheibe, made a further curious discovery. They found that when a piezo crystal is mounted in a bulb containing rarefied Argon or Neon gas, and then energized at its fundamental frequency, it gives out a distinct glow or luminous effect.

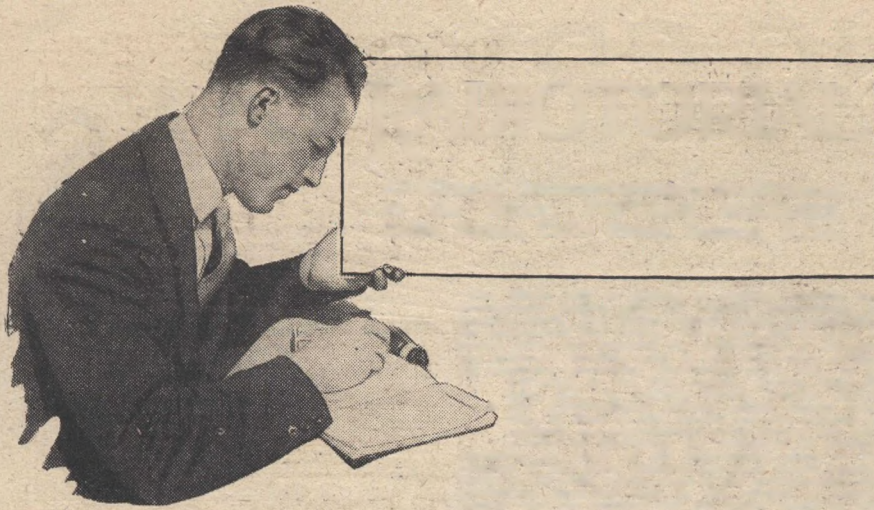
The glow is something similar to that observed when a Neon tube is placed in a high-frequency field, as in the well-known method of testing for aerial current in a wireless transmitter.

In the case of the quartz crystal the luminous effect is due to the piezo voltages which accompany the bodily or molecular movements of the crystal. These actually ionize the adjacent molecules of Neon or Argon gas, and so render the gas conductive, whereupon a glow discharge occurs similar in principle to that seen either in a Neon tube or in an ordinary Osclim lamp, but naturally of less intensity.

Messrs. Giebe and Scheibe have utilised this piezo glow, both to give a visible indication of the frequency of a particular carrier-wave and also to indicate any fluctuation



This picture shows a powerful transmitting valve contrasted with the piezo-electric crystal used to hold a transmitting station upon its assigned wave-length.



QUESTIONS AND ANSWERS.

THE VALVE TO USE.

W. B. M. (Birmingham).—"I am a little puzzled about the valve to use for my set. I have a power valve which is O.K. for the output, but the first valve is a neutralised H.F. employing the split-primary method. After this comes a grid leak detector valve with a high resistance in its plate circuit. What type of valve would you suggest for each of these sockets?"

For both the H.F. and detector valves you will need one having an impedance of about 20,000 ohms and an amplification factor of 20 or so. If desired, they can both be fed from the same H.T. positive terminal.

A POINT TO WATCH.

E. B. W. (Leigh-on-Sea).—"I was going to try and repair the accumulator myself, but a friend of mine who works at an electrical engineer's in London strongly advised me not to, on the ground that there is a good deal of poison in an accumulator, and I might damage my hands which are frequently cut, or knocked a little owing to my work. Is it a fact that accumulators might be poisonous in this way?"

Accumulators, as you know, consist of lead plates immersed in sulphuric acid. Both the lead and the acid are poisonous, and neither of them should be allowed to come into contact with broken skin. We certainly recommend you to take your friend's advice.

SKILL IN SOLDERING.

G. S. W. (Leamington).—"Soldering is to me the greatest difficulty. I have not been taking 'P.W.' for long, so probably I have missed articles dealing with this subject, and I shall be glad if you can tell me the proper method of setting about this soldering business."

Soldering is really quite simple, the main idea being merely to heat the surfaces which have to be joined together sufficiently for solder to adhere to them. When they are thus warmed, solder can be "run" across from one surface to another, and on this cooling it will set as one mass, thereby joining the two surfaces together. The great art is to keep clean both the iron itself and the working surfaces.

First of all, the iron must be "tinned," which is done by heating it in a clear flame (a gas jet is ideal), till it commences to burn with a green flame. When this occurs it can be removed and filed till it is bright, and whilst still very hot it should be dipped into a little flux and a blob of solder, in a tin lid. The melted solder will then run over the clean surface of the iron and coat it with a bright covering of solder, and then the iron is warmed up again ready for business.

Whilst it is reheating the two surfaces can be thoroughly cleaned with a file or emery cloth, till the bright metal shows, touched with a little flux, and then brought into contact of the hot iron until a thin coating of solder appears on them also. (In other words, until they are "tinned" also.) When

both the surfaces have been tinned, they are held together, the iron is heated again, and then it is placed over the two surfaces so that it can *simultaneously and equally heat them.*

When hot enough the blob of solder adhering to the iron will readily run over the two surfaces, and these should be held perfectly steady until it solidifies, which it does a moment after the iron has been removed. At this stage, and before the joint has had time to get cool, wipe it over with a clean cloth so as to remove any traces of superfluous flux.

The heat will have liquified this, and it can be removed easily and quickly, but if it is left for a little while it will get cool and become greasy, and then be exceedingly difficult to remove. If, however, the above hints are borne in mind soldering will become a very easy and pleasurable occupation.

COILS "FOR THE CHITOS."

T. S. C. (Stafford).—"What are the proper coils for the 'Chitos' Two-Valver, which was described last spring in 'P.W.,' and can this

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receiver be used for 5 X X band as well as for the ordinary broadcasting?"

You should provide a No. 52, 60, 75, and 100 for work on the shorter band for the "Chitos." In the aerial socket you usually require either the 75 or 100 coil according to the range you are working on (that is to say, whether on the band of waves below 400 metres, or the band above 400 metres). For reaction the No. 50, 60, or 75 coil should be tried, and you will soon find the one to give the best control over the whole tuning scale.

A little experimenting here will soon show you the best size to obtain really good reaction, not forgetting, of course, that different values of high tension should at the same time be tried on the detector valve.

For the long waves you will require a fairly large size in the aerial socket, and you may meet with a little difficulty in getting the best values. As in all series-tuned circuits one coil does not give a very wide tuning range, and therefore you must try more than one size to get the best results. Usually a No. 200 coil will be correct, but you may have to try even a higher value than this.

A No. 150 will usually be correct for the reaction, although you may find it advisable to increase the value of high tension on the detector valve a little when experimenting on the long waves. In the earlier models of the Chitos receiver there were certain difficulties about getting the long-wave stations, but the set you refer to employed a special supplementary reaction control which practically eliminated this difficulty.

CALCULATING THE FILAMENT RESISTANCE REQUIRED.

B. N. F. (No address).—"I have a 6-volt accumulator and a 6-volt power valve, but would like to use 2-volt valves for the H.F. and detector positions. What is the correct value of filament resistance to use with these?"

When 2-volt valves are being run from a 4-volt or 6-volt accumulator the value of the resistance required can easily be calculated by a slight modification of the ordinary Ohms' law.

Ohms' law says that if the volts are divided by the current in amps, the answer will be resistance in ohms. In other words $R = \frac{V}{C}$. For our purpose we can modify the meaning of these letters a little.

If we call the correct consumption of the 2-volt valve V, and if we subtract the voltage at which the 2-volt valve should operate from the voltage of the accumulator, and call this figure V', then the required resistance in ohms will be equivalent to V divided by C'. For instance, suppose that we are going to use a 6-volt accumulator with a valve which is rated to take .25 ampere filament current at 1.8 volts. we can use the above formula as follows.

To determine the value of V we take 1.8 volts from 6 volts, and the answer is 4.2 volts. This gives us V, and C is the rated consumption of the valve, i.e. .25 amps. To find R we must divide C into V, and in this case the answer is 16.8.

In other words, if a 6-volt accumulator is to be employed for a valve needing 1.8 volts, an additional resistance of 16.8 ohms will be necessary in the circuit. Any other resistance can be worked out in the same manner.

FINDING THE POLARITY OF THE MAINS.

D. V. C. (Preston, Lancs).—"How can I tell which is the negative mains and which the positive?"

An easy method of finding the polarity of direct-current mains is to bring flexible leads from a lamp holder to a glass of water to which has been added a pinch of salt. One lead should be immersed at one edge of the glass and one at the opposite edge, the two being arranged so as to be well separated and secure.

When the current is switched on, bubbles will rise to the surface from the wires, and the wire from which most of the bubbles rise is the negative.

[NOTE.—Do not forget that in all cases where the house wiring is interfered with in this way, the utmost care is necessary in order to avoid the danger of shocks, etc.]

THE CHOICE OF VALVES.

"HORATIO" (No address).—"Which are the best valves for the 'All-Programme' Two, the 2-volt or the 6-volt type?"

The valves for the All-Programme Two may be either 2-volt or 6-volt, the former for extreme economy and the latter if super results are the main object.

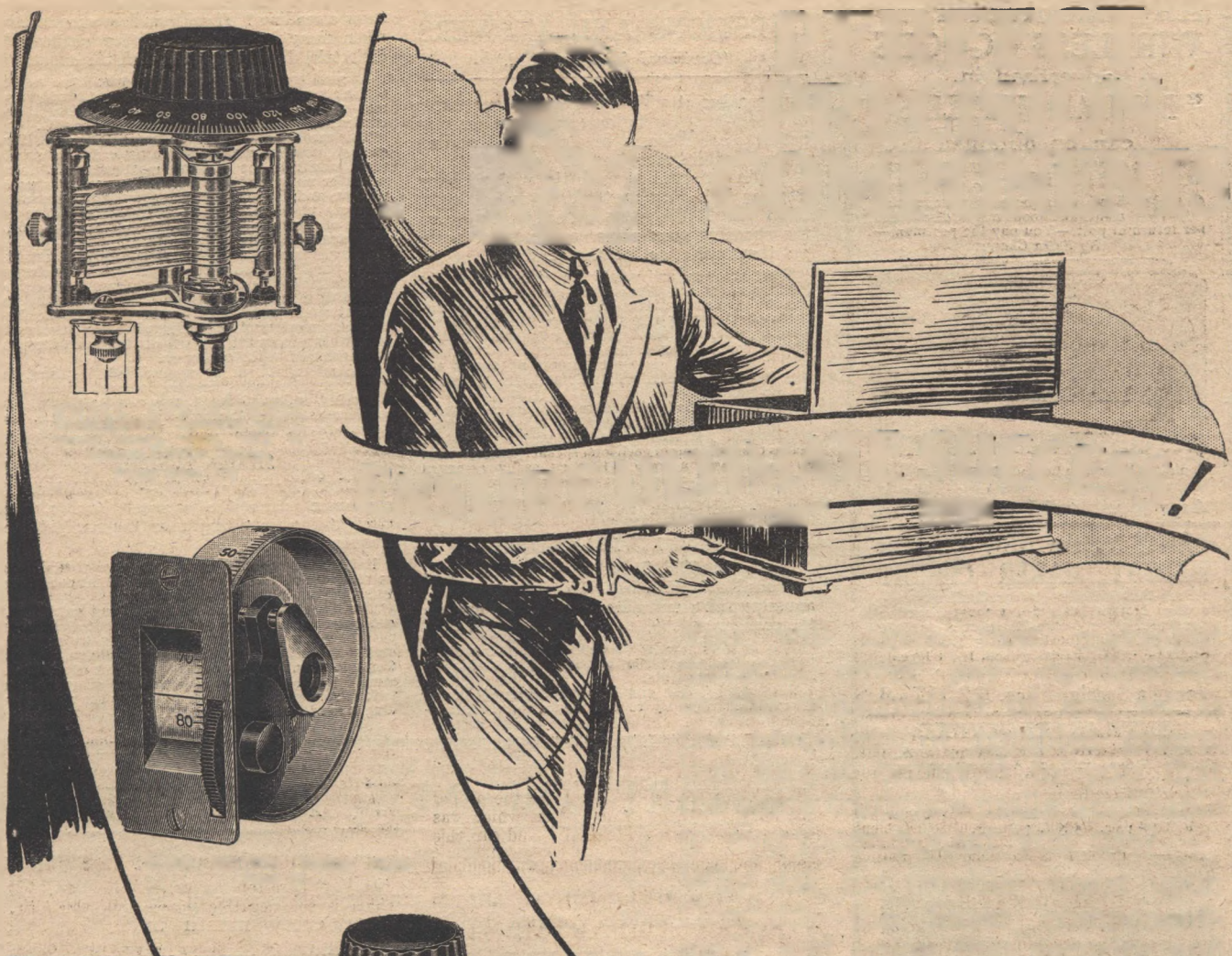
The first valve should be of the H.F. type with some 45 to 60 volts H.T., while in the second valve socket you should use a power valve with all the H.T. you can muster up to 120 volts, if you want real quality on the loud speaker. Certainly you should not use less than 100 volts if the signals are fairly strong, but if you are so situated that you have a small aerial and can only get medium strength, a somewhat lower high tension—say, 72 volts—will serve quite well.

Whatever you use, of course, be careful to use the correct grid bias specified by the valve makers. This is an important point if you wish to secure the best results and have a long life from your H.T. battery.

LOUD-SPEAKER EXTENSIONS.

P. F. (Norwich).—"When the workmen were in the house I got them to lay wires so that we had three different loud speakers in use, one in the dining-room, one in the drawing-room, and another in the kitchen. These all work excellently, but I should like some stunt whereby I could switch out any

(Continued on page 934.)



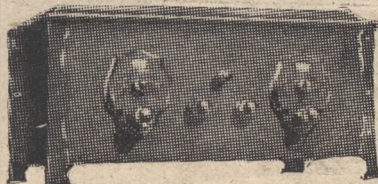
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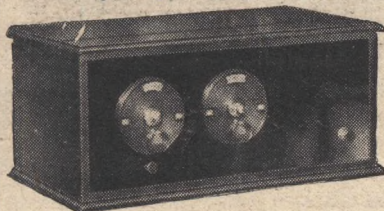
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 932.)

loud speaker at will, as very often one wants to listen-in only in one room and not in both the other rooms, or perhaps in two and not in the third room.

"I do not want to undo the wiring in any way, as it is very neatly done out of sight, but I should like some means, preferably on the speakers themselves, by which I could put them out of action when desired."

Your speakers are wired "in series," so if the loud speakers are fitted with plugs that can be removed from the wiring, all you need do is to purchase another plug like the one on the end of the loud speaker, and short its two terminals together. Then when any loud speaker is removed because it is not required, simply replace it by one of the shorting plugs, which will automatically reconnect up the circuit.

If, however, the loud-speaker plugs are not removable in the wiring system, but are permanently attached, all you need do is to arrange a wire to short across the terminals of each loud speaker or telephones. In most cases a switch is very easily arranged (ordinary on-off type), or alternatively, you should not have any difficulty in arranging an inexpensive cut-out from pieces of stiff wire.

ADDING NEUTRALISATION.

B. N. T. (Old Trafford).—"Can an old-fashioned set (H.F.-Det.-L.F.) of the tuned-anode type be neutralised, and if so what are the connections?"

This type of set can be neutralised satisfactorily providing there is plenty of room upon it for the additional components.

The holder for the plug-in neutralising coil should be mounted close up to the holder for the tuned-

impressed across the circuit would the meter show a reading? If so, how does current flow when there is an insulator (the condenser's dielectric) directly in series with the circuit?"

A sensitive meter of the hot-wire type would register a current flowing in such a case, but the current registered would not be flowing through the condenser, it would merely flow in and out of it.

This can be explained as follows: When no difference of potential was applied to the ends of a circuit there would be no electron movement (i.e. there would be no current). But when one end was made positive and the other negative, a rearrangement of electrons would take place, and there would be an excess of electrons on the negative plate and a deficit of electrons on the positive plate.

This electron movement would constitute a current, which would be shown by the meter, and every change of potential on the condenser plates would be accompanied by a rearrangement of electrons so that "a current would be flowing" continually. But the electron movement would be taking place via the external circuit connecting the two sets of plates, not through the insulation of the condenser.

The meter, it will be remembered, is placed in that external circuit connecting one set of plates to the other, so, providing it was a suitable type, it would register the electron movement there, i.e. the current-flow in that circuit.

SHARP TUNING.

T. S. I. (Hamilton, N.B.).—"Which kind of condenser gives the sharpest tuning, the straight-line wave-length or the straight-line frequency?"

Neither type can do this. Sharpness of tuning is an attribute of the set itself, and not of the condenser which is used in the tuning position.

The difference between an S.L.F. and an S.L.W. condenser is one of the distribution of stations over the condenser scale, but sharp tuning depends on certain other things about the circuit design, such as the coil sizes, type of coupling, amount of reaction, size of aerial, etc. And although this sharpness, or lack of sharpness, will be shown up by the condenser dial, it is not due to the condenser.

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anode coil, so that when the coils are plugged in they are coupled closely together. A neutralising condenser should then be mounted near to the neutralising coil, and then a terminal on each of these two should be joined together by a short wire.

The only remaining connections are a lead from the free side of the neutralising condenser to the earth side of the filament lead, and another lead from the remaining coil-holder terminal to the grid of the tuned-anode H.F. valve. Neutralising is carried out in the ordinary way, but it may be necessary to reverse the leads to the neutralising coil (or if more convenient the anode coil), as these two must be arranged in correct relation to each other.

BACK NUMBERS.

D. C. W. (Grantham).—"I have only had the set about a couple of months and since then I have become extremely keen on wireless and anxious to do a bit of experimenting myself. For this purpose I frequently want one of the back numbers which I see referred to and which I am unable to get locally. Is there any way of getting it from the publishers?"

Back numbers of "P.W." (or of "Modern Wireless" or "The Wireless Constructor") can be obtained direct from the publishers, The Amalgamated Press, Ltd., Back Number Dept., Bear Alley, Farringdon Street, London, E.C.4.

CAN CONDENSERS PASS CURRENT?

B. M. (Lechlade, Gloucestershire).—"If a sensitive meter is placed in series with a large condenser and an alternating potential is

If you take, for example, two stations very close to one another in wave-length, but sufficiently far apart to enable a very sharp tuning receiver, such as a super-heterodyne, to separate them; when using a straight line wave-length condenser at some portion of the scale these two stations will be separated by, say, two degrees. If a straight-line frequency condenser is used, they would be separated by perhaps three degrees. The set would do the separating, and the condenser dials would show it (in one case by three degrees, in the other by two degrees).

If, on the other hand, the receiver is such that it cannot separate these stations, it will make no difference to its sharpness of tuning whether they use a straight-line frequency or a straight-line wave-length condenser. For, if when tuned to one station you hear signals from the other, you will get precisely the same amount of interference with a straight-line-frequency condenser as with a straight-line wave-length condenser.

WHAT IS A CONDENSER?

I. A. T. (Richmond, Surrey).—"Are fixed condensers the same in essentials as the other type, and if so, what is it that decides the capacity?"

A fixed condenser, like the ordinary variable condenser, consists of two sets of metal plates placed close together but not touching one another. These plates, or sets of plates, are separated by means of air or some substance such as mica, which will not conduct electricity.

The size of the plates, the distance separating them, and the substance separating them, decides the capacity of the condenser. The larger the plates and the closer they are together the greater its capacity—its capacity to hold electricity like a tank holds water.

(Continued on page 936.)

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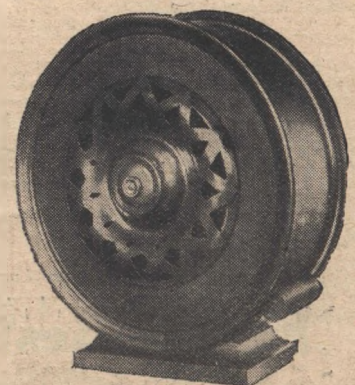
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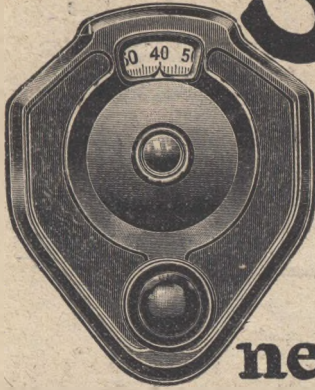
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**RADIOTORIAL
QUESTIONS AND ANSWERS**

(Continued from page 934.)

The capacity of an ordinary variable condenser is varied by altering the overlap of the two sets of plates, and this is the same as varying the size of the plates or the distance between them, which ever way you like to look at it. A fixed condenser is simply one which is not provided with any means of adjustment, so its capacity will always be that value marked upon it, i.e. '0005 mfd., '0001 mfd., etc., etc.

A GOOD LONG-DISTANCE SET.

M. F. W. (Edgware).—"I want a good DX set, preferably of the H.F.-Det.-L.F. type, as I have two H.F. valves on hand and one of the small power kind. Could you recommend me to a good set, preferably one using a couple of '0005-mfd. variable condensers, slow-motion type, and if possible transformer coupling for the last stage, as I have on hand a good low-frequency transformer of fairly low ratio."

For your purpose we recommend the "Long Range" Three, described in the "P.W." Blue Print circuit, No. 51. This is a sensitive and selective set for long-distance work, and it incorporates one high-frequency valve, a detector, and one low-frequency, as desired, with switching for changing over from ordinary broadcast waves to the long waves. The components you mention can all be employed, and as we have had very enthusiastic reports from readers about this set we feel sure you will be completely satisfied with it. It is not a difficult set to build.

HOW TO OPERATE THE "SYDNEY" TWO.

K. R. G. (Burton-on-Trent).—"I have built the original 'Sydney' Two (like the 'P.W.' Blue print No. 39), and although it is going extremely well, I fancy I could get more out of it if I knew how to operate it properly. Can you give me some particulars?"

The first point to consider is the type of detector valve to use (the second valve can be any L.F. or small power type). What is wanted is a valve of a

freely oscillating type which is also a good detector, and the modern special H.F. valves will be found to satisfy these requirements very well for the most part. Here are a few examples: P.M.5X., G.P.607, H.L.610, Cossor 610H.F., S.S.6075H.F., etc.

H.T. Adjustment.

The H.T. voltage on the detector must be adjusted by trial, and will be found in most cases to be rather higher than one is used to on the broadcast band. This is because there are usually several patches on the tuning range of a short-waver where it is a little difficult to get enough reaction, and a fair amount of H.T. is needed to overcome the trouble.

Further, of course, the H.T. and L.T. must be adjusted to give smooth reaction effects, and in this you will find the potentiometer on the baseboard very useful. This is a special feature of the "Sydney" Two, and is a great help in getting rid of the annoying trouble called "threshold howl" which afflicts so many short-wave sets. "Threshold howl" usually takes the form of a nasty little squawk just as the set goes into oscillation, and makes it a very difficult and ear-aching business to get the receiver adjusted to the proper point on the verge of oscillation (for telephony reception, of course).

Searching.

Once the detector valve is functioning properly there is little to do except to revolve the tuning dial very carefully and slowly, keeping the set just oscillating with the reaction condenser, until you pick up a carrier-wave. Then bring back the reaction until oscillation just dies out, very carefully and delicately readjusting the tuning all the while.

A little practice will be needed in handling these controls, and in learning to allow for the slight hand-capacity effects which are almost inevitable on the shorter waves. By the way, if you find body-capacity really very troublesome (this may occur with some pairs of 'phones) connect up a fixed condenser of '001 mfd. across the 'phone terminals.

The only other operating point concerns the aerial tap, and this again must be adjusted by trial on each station picked up. As a general guide it may be stated that for stations coming on the upper half of the condenser dial the tap will be somewhere near the middle of the coil, while for those near the lower end of the scale it should be only about two or three turns from the right-hand end.

With these adjustments and the particular type of tuning condenser and vernier dial mentioned in the list of components, K D K A should then be found between 60 and 70 degrees on the dial, and Sydney between 10 and 20 degrees, assuming an aerial of medium size. For K D K A the "grid" clip will be on the left-hand end of the coil, and for Sydney on the fifth turn from the right.

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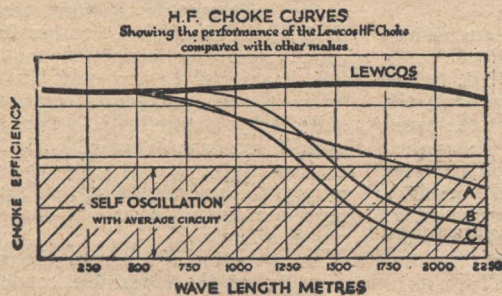
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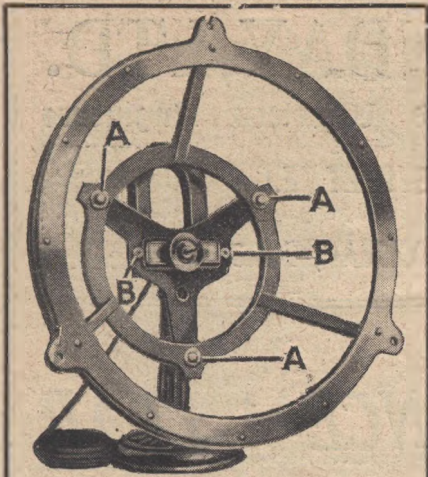
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A THREE-VALVER FOR 7/6.

(Continued from page 928.)



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On the extreme left-hand end the wood screw used for securing the cardboard in position was removed, and a soldering lug placed underneath it, whereupon it was driven in again. Later a wire soldered to this made connection to the tinfoil sheet, which is all at earth potential.

The procedure in fixing the foil to the half of each disc is the same, but in this case a little gum is placed on the upper surface of the disc, so that the foil can be folded over and pressed in contact with it. Obviously, the foil will be somewhat creased and crinkled where it is brought over at the top, but this does not matter so long as you do not tear the foil.

Fixing the Flex.

The two pieces of card, which are sealing-waxed in position as shown, are only attached at each end, so that, when necessary, they may be sprung up in the middle with a penknife to enable the bared end of the flexible wire to be pushed underneath, so as to make contact with the foil. You will understand that it is not possible to pierce the cardboard in any way here, as it would make a bump on the other side and prevent the two foils coming as close as we need.

The wax paper can be similarly attached to the tinfoil, by means of gum, avoiding air bubbles as much as possible. Actually the paper used to wrap the cigarettes is not strictly speaking "waxed," although it is impervious to moisture; but if you are using waxed paper as used for wrapping

some of the breakfast foods, you will find that on holding it in front of the fire the wax will soften.

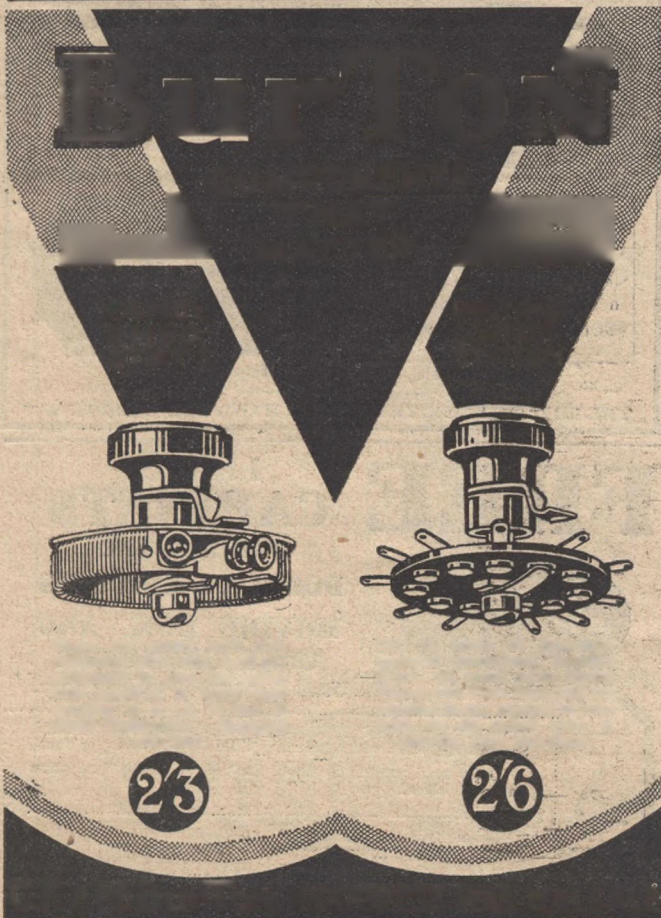
If this kind of paper is being used, it should be cut to the necessary size to cover all the foil, and can then be secured in position by using a hot iron, a piece of cloth being interposed between the iron and the wax paper, and the hot iron passed quickly but firmly over the whole.

By Gum!

Some readers may care to take a strip of ordinary thin paper and soak it in melted paraffin wax, draining off the surplus wax and, after it is set, applying it with a hot iron as just explained. There are many variations of the method of applying the wax paper to the foil, and so long as the paper is reasonably thin, and is smoothly applied without air bubbles, that is all that is needed. When you are fixing the paper from the cigarettes to the tinfoil, be careful to use only the thinnest layer of gum, and let it stand till it is quite tacky. Seccotine is better than gum here, if you have it available; but be sure that, whatever form of adhesive is used, it is very thin and easy to dry, as it is difficult for the moisture to get out once the wax paper is in place.

As a matter of interest, the measured capacity of these variable condensers at the maximum is about .0003 mfd., the figure being raised when a weight, such as a paste-pot, is placed on top of each disc.

Making the grid leaks, anode resistances, and fixed condensers is a most fascinating task, and a description of this I will reserve until next week.



CLARKE'S "ATLAS" BATTERY ELIMINATOR

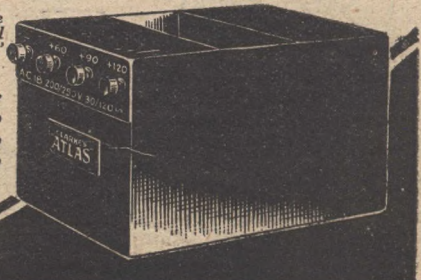
makes noisy, expensive H.T. Batteries a thing of the past. The model illustrated (A.C.18, for Alternating Current) is especially suitable for "Cossor Melody Maker" and "Mullard Master Three" Sets, and is priced at £4 17s. 6d. with half-wave rectifying valve and Royalty. Full-wave rectifying valve 7s. 6d. extra. There are also Direct Current models at prices ranging from £1 17s. 6d.

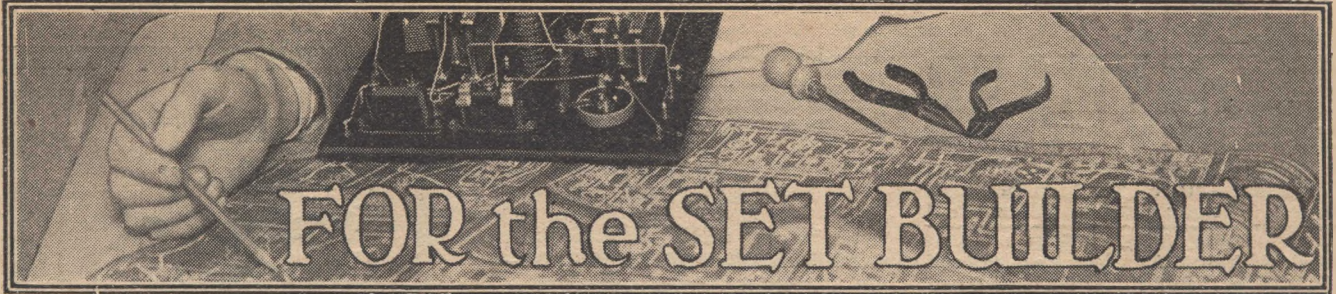
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SAFEGUARDING YOUR VALVES.

NO, this is *not* a political note: it is nothing to do with protecting British valves from foreign competition, but deals with a question of more direct practical importance to every user, namely, how to prevent one's valves from contracting that deadly disease, "blueflashitis," in the event of a short in the H.T. circuit.

Now, it is all very well to say that such things should not happen, that one should always pull out the plugs from the H.T. battery before doing anything inside the set, and so on, but if anyone imagines that such preachings will stop a man in a hurry from taking risks, well, he has still something to learn about human nature!

Practise What You Preach!

As a matter of fact, it is often the people who talk most virtuously about precautions who are the first to plunge their hands into the interior of the set while it is working. Who has never been shown a new set by its proud owner, with a discourse on his beautiful safety-switching schemes to cut off the H.T. altogether, immediately after which he dives inside to find out why a crackling noise has started?

The sudden transition from a lecture on safety switching to muffled curses as he gets his fingers across the H.T., having forgotten to operate the aforesaid switches, is certainly amusing, but it also points a moral which we should all do well to take to heart. We may as well be honest and confess that we all do these things at times, and then see whether anything can be done about it. The fact is that although switches and what-not are all very well as a protection, unless we have some sort of absolutely automatic safety device on the job we are prone to forget, and then we are no better off than when we started.

The mere risk of shocks to intruding fingers is, after all, rather a minor matter, and merely acts as a reminder to switch off or disconnect next time.

One Fuse Not Enough.

The serious affair is the risk to expensive valves, for if one goes fishing about inside a set with a screwdriver or other tool, there is always a chance of something really disastrous happening, as a result of the shorting together of two points with the H.T. across them. Although we only do things like this in our more reckless moments, still it does sometimes happen, and there are various other ways for the same thing to occur, which need not be enumerated.

What can be done about it? Well, for a sum of round about a shilling you can get an H.T. fuse of the flashlamp bulb variety, and until you have experienced it you can have no idea what a comforting feeling it gives you to see one of these

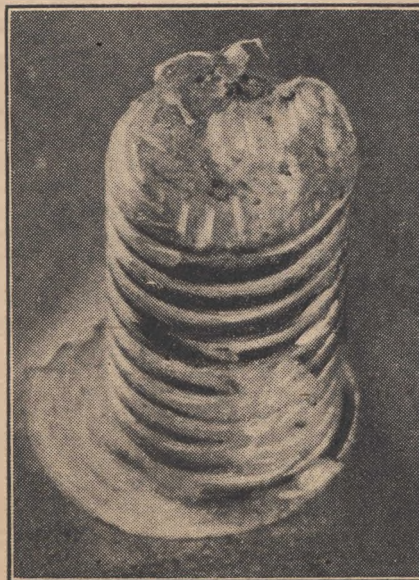
A selection of short articles covering many subjects of especial interest to the home-constructor of radio receivers, contributed by various of "P.W.'s" well-known technicians.

flash up and go out again instantaneously when a short occurs which might otherwise have cost the lives of a set of valves.

Now, most of us understand the normal placing of such a fuse in the lead between H.T. negative and L.T. negative, and just a single fuse here will certainly do a great deal to insure safety in the event of a short. There is still, however, the possibility of another type of short-circuit in a set with more than one H.T. positive terminal, namely, between a high and a low voltage tapping, which is not covered by a "single fuse" insurance policy.

One for Each Lead.

To protect properly a set like this a fuse is needed in the intermediate H.T. positive leads where they leave the terminals inside the set, and the small expenditure required to put them there is surely a good investment. Although a single fuse in the negative lead is usually the only provision shown on publication designs, it is to be understood that if the fullest degree of protection is desired one or two others might be added as has been explained. The main risk is covered by the negative fuse, but the others are probably worth while in all large sets.



A greatly enlarged photo of a terminal shank, showing the packing in the hole.

TIGHTENING TERMINALS.

Occasionally, owing to an error of judgment, or to some other cause, a hole is bored in a panel which provides too loose a fit for the terminal; and the result is that, no matter how tightly the under-nut of the terminal may be fastened, the terminal itself sooner or later comes loose, and develops a most annoying degree of play.

Fortunately, however, such cases can be remedied by the exercise of a little trouble. If the hole in the panel is only very slightly larger than the outer diameter of the terminal shaft, make up a paste of fine ebonite powder and thick gum. Roll the terminal shaft in this, and then insert it immediately into its hole, allowing it to stand for several hours before it is again touched. By this method, the ebonite powder will effectively bind the terminal.

If the panel hole is considerably larger than the diameter of the terminal shaft, another means will have to be employed in order to provide an effective fit for the terminal.

This is the method of terminal "packing"—the terminal being packed in its hole by means of some substance which can be poured in the hole in a molten stage, and then allowed to solidify.

The Best Substances.

The two best substances available for this purpose are sulphur and Wood's metal. Either of these may be melted, and then carefully poured from a small spoon around the terminal in its hole. They will quickly solidify, and will provide a very fast binding for the terminal.

On the whole, Wood's metal is the better material to use for this purpose, it being rather more indifferent to mechanical shocks than sulphur.

If the hole in the panel is not excessively greater than the diameter of the terminal shaft, the presence of the packing will not show on the upper side of the panel, for it will be hidden away from sight by the base of the terminal pillar.

As for the underside of the panel, if the packing material overflows the hole when it is poured in, and flows over the ebonite surface, it can readily be removed after it has solidified by the aid of a knife and a little sand-paper.

SOLDERING.

To many constructors, soldering is the most unsatisfactory part of their work.

All too often one sees a poorly-soldered joint surrounded with a mass of flux. The main stumbling-block is the absence of a well-tinned "bit."

So many "solderers" never tin their bits at all, but simply run a blob of solder on and wonder why the thing won't work! To tin a "bit," heat the soldering iron to

(Continued on page 941.)

K. RAYMOND

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1 " 50,000 anode	4 0	2 G.B. Clips, 9 En-
1 " 20,000 "	4 0	graved Terminals,
(with holders)		Ebonite Panel 21x7,
3 Lotus V. Holders	3 9	Baseboard 21x9,
1 Igranic L.T. Switch	2 6	2 Dial Indicators,
Dubilier '0003 (610)	2 6	1 Terminal Strip,
2 Meg. & Clip . . .	3 0	Sufficient screws,
Wearite Tuner . . .	15 0	cable, wire, wander
'0005 Variable & Dial	6 0	plugs, for set.

Total £5. 7. 3. Above Lot 3/6 extra.
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OR 1 New Gramophone 10" Record (Broadcast, Dominion, or Edison Bell) FREE. (State title required. (Must be recent issue.)

TECHNICAL NOTES.

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

SELECTIVITY

"P.W." LEADS THE WAY.
ELIMINATING THE DIAPHRAGM—
A GOOD EARTH—ETC., ETC.

THE advantages of a counterpoise instead of an earth are well known, especially in cases where there is much interference from artificial causes, such as electrical machinery. A well-known radio engineer has recently described his experiences in this direction, in which he found that a suitable counterpoise gave him practically a perfect solution of his problem. His account runs as follows:

"A counterpoise was decided upon as being the best of a bad bargain. There was simply nothing else we could do. A piece of No. 14 rubber enamelled wire was run out of the window and strung horizontally around two sides of the building.

"It was attached to several window ledges on the same floor. We hooked up the set to the aerial, which was located on the roof, and to our new counterpoise as an earth instead of using a common earth connection of the building; the counterpoise was not connected in any way with the earth, in fact, the set was not earthed at all in the ordinary sense.

Good Results.

"The result was little short of a miracle. All traces of the artificial static and motor noises absolutely disappeared. Furthermore, the strength of reception was increased about 50 per cent, and there was a marked increase in selectivity.

"The motor noise was coming through the set in the original arrangement through the common earth connection and not by direct radiation and pick-up from the aerial. By disconnecting the set from the earth this source of interference was entirely eliminated. As soon as the counterpoise was employed the signals increased and the tuning became sharper because the aerial and counterpoise were much lower in resistance than the aerial and the long earth connection previously used."

I give his account in case it may help other readers.

"P.W." Leads the Way.

An excellent short-wave adaptor (similar to the "P.W." Antipodes Adaptor), has been introduced on the U.S. market for use with broadcast receivers. It was designed by E. T. Flewelling, the well-known radio engineer.

The adaptor is designed to be plugged into the detector socket of a standard broadcast receiver, whereupon the L.F. amplifier and the loud speaker of the regular receiver may be employed for reproducing the short-wave signals. An adaptor of this type may be used with any broadcast receiver which employs L.F. amplification.

Eliminating the Diaphragm.

A recent German invention relates to the production of atmospheric vibrations
(Continued on page 942.)

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DARIO Super H.F. means Super Radio

See page 935.

PLEASE MENTION "POPULAR WIRELESS" WHEN MENTIONING TO ADVERTISEMENTS

FOR THE SET BUILDER.

(Continued from page 939.)

nearly red heat, then rub it vigorously with an old file and plunge into a tin lid in which there is a smear of flux and blob of solder.

Each "face" of the "bit" should be so treated.

But all this will be useless if (a) the joint, (b) the flux, and (c) the "bit" are not all kept scrupulously clean.

HOME-MADE DX COILS.

Without a certain amount of geometrical knowledge a simple spiral is very difficult to put down in black and white. The construction of spiral short-wave coils, however, is a real pleasure, and it would be difficult to imagine anything more simple. This fact will be revealed by a glance at the accompanying photographs, which are almost self-explanatory.

The former (Fig. 3) is made from a piece of board $4\frac{1}{2}$ in. square by $\frac{1}{2}$ in. in thickness, and four slotted spacing ribs as detailed in Fig. 2, the latter being arranged as shown in Fig. 1 and attached firmly by means of small screws or nails which are driven in from the under side of the square base.

The distance between the slots in the upper edges of the ribs (i.e. the marking-off distance) is $\frac{1}{8}$ in., the width of same depending upon the size of the (bare) wire used for the winding. They should all be of an accurately equal depth—about $\frac{1}{4}$ in.

The wire should be an easy push-in fit into the slots, so that any "jump-out" tendency is avoided. Such a former will serve for the winding of coils up to eleven turns, and it will be obvious that for larger coils the ribs should be extended.

The wire is wound on in the manner shown in Fig. 3, the beginning and the end being sharply bent so that the spiral is

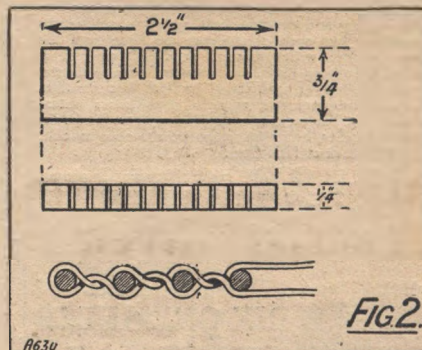
For an 8-turn coil each piece of twine should be about 15 in. long; this leaves a sufficient amount for tying the knots on the outer (last) turn of the spiral. The four "twistings" should then be given two or three coats of shellac varnish, and when this is thoroughly dry (it should be left over night) the complete coil may be carefully eased out of the slots.

The problem of mounting the coil presents no greater difficulty than its construction. A very convenient method is shown in Fig. 1, where the coil, being sufficiently rigid, is self-supporting, the two ends being formed into loops and clamped under the nuts of an ordinary coil-plug. Other methods should suggest themselves.

The great advantage with such coils is that they occupy very little space, in fact rather less space than ordinary plug-in coils, and considering that they are as efficient as other types, and that their cost is practically negligible, any DX enthusiast will do well to give them a trial.

but give rise to the possibility of leakage and scraping noises.

If a loud speaker is connected to the input terminals of an amplifier, speech from this can be reproduced by the main loud speaker.



If the flux from a newly-soldered joint is wiped whilst it is hot it comes away cleanly, but if left until cool it becomes sticky, and it is impossible to remove it from the underside of wires, etc.

One of the greatest disadvantages of soldering flux left behind on a joint is that dust will settle upon this in time, and so make a conductive path which may destroy the advantages of correct insulation.

Galvanised wire as sold for clothes lines makes good stays for high masts.

When a water-pipe earth is used, and a clip is placed round this to carry the contact, it will often be found that a few sharp blows on a nail so as to form projecting points, will cut through any small film that may have formed, and so ensure better contact.

GETTING SMOOTH REACTION.

Although with modern valves rheostats are not generally necessary, it is as well to remember that a filament adjustment of the detector valve on a short-wave set is often an invaluable aid to smooth reaction.

A neglected soldering iron which has become "scaly" can easily be cleaned by heating the iron until it is red hot and then plunging it into cold water.

When soldering at a gas stove, do not forget that the best way of holding the iron in the gas flame is to arrange a duster on the stove, upon which the handle of the iron can be rested in any position.

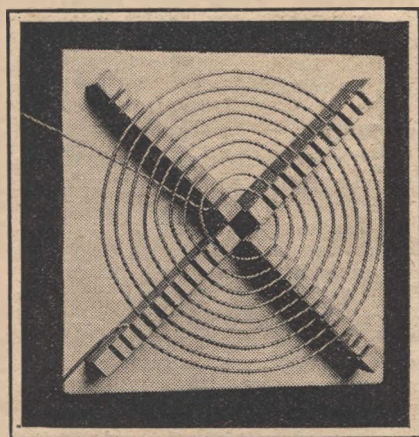


Fig. 3. On a cross former it is easy to wind a low-loss coil.

OSCILLATION ON SHORT WAVES.

If your set employs a standard H.F. choke and you are experiencing difficulty in the matter of oscillation, a cure can often be effected by replacing it with a number 60 or 75 coil of the ordinary plug-in type.

In a short-waver the use of a fairly high impedance detector such as an H.F. valve, is strongly to be recommended. As a general rule, however, a valve of this type will not oscillate so readily as one with a lower impedance.

The use of a higher H.T. voltage will often help in this respect, and only if the H.F. valve cannot be made to oscillate should a lower impedance valve be tried.

Finally, do not ignore the possibility of a reversed reaction coil. This error may seem somewhat obvious, but we are all liable to mistakes and it is of little use to expect satisfactory results if the reaction coil is connected round the wrong way.

FOR YOUR NOTE-BOOK.

Accidental shorting of an H.T. accumulator is more serious than a similar mishap in the case of a low-tension accumulator, owing to the smaller capacity.

Frayed flexible leads in which a single wire stands out from the others are not only a source of irritation when screwing down terminals,

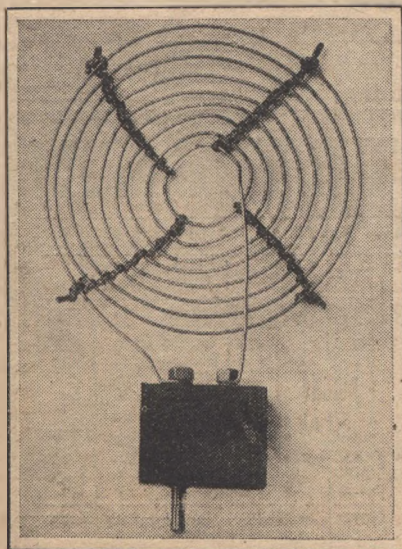


Fig. 1. A self-supporting coil of bare wire.

firmly held in position. While still on the former the spiral is permanently locked by means of twine bindings, or perhaps it would be more correct to say "twistings," as shown in Fig. 4 and also in the lower part of Fig. 2.

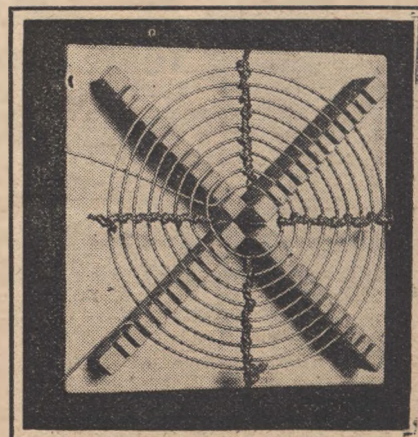


Fig. 4. Shows the method of fixing the turns.

In a properly-charged accumulator the negative plates should be light grey in colour, and the positive plates chocolate colour.


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2 in. wide by 5 in. high, just a convenient size for carrying in the pocket. Switch cannot be accidentally left on and thus run down the battery. Specially manufactured to Government specification for use in the Army and the very best materials and workmanship. The ends of the case are brass and the body is zinc which cannot rust. Fitted with a powerful Bullseye Lens, white un tarnishable reflector and bulb. New "Ever-Ready" two-cell batteries (No. 1626) of full strength, capable of 6 hours' intermittent light for months with ordinary care and use. These Torches being Surplus, we are able to offer a limited stock at Half Cost.

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DARIO

This week's best bargain

See page 935.

PLEASE MENTION "POPULAR WIRELESS" WHEN REPLYING TO ADVERTISEMENTS

TECHNICAL NOTES.

(Continued from page 940.)

(sound-waves) without the intermediary of a material diaphragm. Whenever a diaphragm is employed for the purpose of transforming electrical vibrations into sound-waves it is clear that the diaphragm must exert its own influence upon the nature of the sound-waves produced and consequently the material diaphragm is bound to introduce a certain amount of distortion. In some cases this may be quite considerable, and usually takes the form of extra amplification of one frequency—sometimes several frequencies—these frequencies which are abnormally amplified being called the "resonance points" of the diaphragm system.

Small Mass.

It is obvious that if a method can be found whereby the sound-waves are produced by a non-material agency, or at any rate by something which is of exceedingly small mass, the disadvantages just referred to may be avoided.

Brush Discharge.

According to this German invention, an electrical brush discharge is obtained from a pointed electrode, whilst the output from a low-frequency transformer is superimposed upon the high voltage which produces and maintains the brush discharge.

The effect is that the brush discharge takes on the character of the superimposed electrical variations from the low-frequency transformer, and it sets the air into corresponding vibration. As might be expected, this arrangement gives remarkable purity of tone, but I have no information as to the volume obtainable; I should imagine that this would be rather limited.

A Good Earth.

In making an earth connection by means of an earth plate or earth tube it is very important to ensure that the plate or tube maintains good electrical contact with the surrounding soil or earth throughout all periods of the year.

In the winter-time, when rain is abundant, there will be little or no difficulty arising in this direction, but in the summer-time, if the plate is not too deeply buried and in intimate contact with the soil, there is a danger of the "earth" becoming very inefficient and giving rise to a good deal of trouble, the exact nature of which may not at first be suspected.

Low Conductivity.

In the first place the earth plate should always be in contact with soil or clay and not with gravel or sand, as the latter allows the moisture to drain away and has little or no conductivity of itself in the absence of moisture. Soil or clay, on the other hand, tends to retain a certain amount of moisture much longer, and so to be more reliable from this point of view.

Zero Potential.

It is a good plan, especially if any trouble is experienced owing to the soil around the earth plate becoming dry, to pour two or three buckets of water into the surrounding soil, say, every week or two.

The simple theory underlying the efficient operation of an earth plate is that it should maintain good electrical connection with the surrounding earth, so as to maintain itself reliably at zero potential to dissipate instantly any electrical charges which may be fed into it.

Ingenious.

A curious example of ingenuity is sent to me by a reader who describes an arrangement by which the radio receiver is automatically switched off when the house telephone is in operation. You will have already thought of the arrangement before I go any further.

It consists in a little "gadget," attached to the vertical pillar of the telephone instrument, whereby the filament circuit of the radio set is interrupted when the telephone receiver is removed from its hook.

Easily Made.

To make the little device, all you have to do is to carry a pair of twin leads from the

(Continued on page 944.)



P.R. VALVES. TRY ONE!

YOUR JUDGMENT IS FINAL
If it doesn't beat your "Favourite" WE'LL GLADLY TAKE IT BACK

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 - 241. EAST INDIA DOCK RD., POPLAR, E.14—Bottoms & Co.
 - 103. HOLLOWAY RD., N.7—John Burns & Sons.
 - 249. HIGH RD., KILBURN, N.W.6—Deskphone Co.
 - 24. KNIGHTS HILL, W. NORWOOD, S.E.27—Frederic Chidsey.
 - 100/101. HOUNDSDITCH, E.1—E. Simons.
 - ROMAN RD., BOW, E.3—Bishops Stores, 309; Harrison, 119; Louis Saverna, 19.
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	Type	Fil. Volts	Amp.	Imp. Ohms.	Amp. Fac.	
3/6 Post 4d.	PR 1	2	.095	30,000	14	H.F.
	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.	
POWER 7/6 Each Post 4d.	PR20	2	.15	7,000	6	Power
	PR40	4	.15	7,000	6	"
	PR60	6	.1	5,000	6	"

365. SEVEN SISTERS RD., HOLLOWAY, N.4—D. Wensall.

14a. CLAPHAM PK. RD., S.W.4—The Electric Shop.

680. HIGH RD., TOTTENHAM, N.17—Ruskin's Accumulator Service.

18. BLACKHEATH RD., S.E.10—Radio Box.

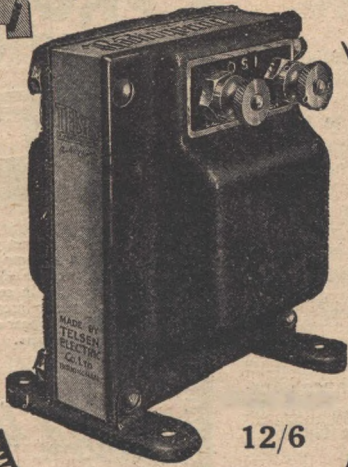
80. HIGH ST., COLLIER'S WOOD—Kinetic Wireless Supply.

14. HARROW MANORWAY, ABBEY WOOD, S.E.2—Abbey Wood Radio Depot.

P.R. VALVES, 17-38, Paternoster Sq., London, E.C.4
(Opposite G.P.O. Tube.)

TELSEN

TRANSFORMERS



12/6

TO HOME CONSTRUCTORS!

Build the Peerless "Resonic 2"

Anyone can build this set in 60 minutes. No drilling. No soldering. All Wires cut and bent, **JUST ASSEMBLE** and then immediately enjoy the radio entertainment which is of splendid tone and comes in at good loudspeaker volume. Circuit allows use of standard valves (1 H.F. & 1 Power). Blue Print and easily followed Diagram of Connections included with every set. Cabinet and full Kit supplied in Carton.



Regd. No. 456002

£3.15.0

Obtainable from all dealers or

THE BEDFORD ELECTRICAL & RADIO CO., LTD., 22, Campbell Rd., BEDFORD.

DX Short-wave COILS

For short wave work specify the famous DX Coils. Experts use them wherever Radio is known.

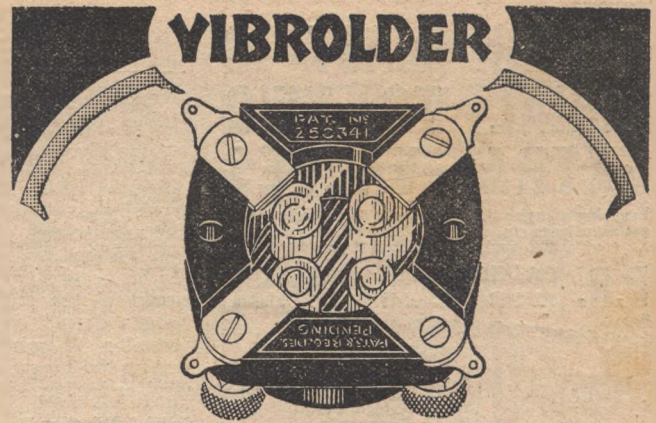
Wound 3 in. diameter; fit standard coil holders. Tinned copper, 16 gauge; open core; can be tapped any where by alligator clips.
3, 5, 7 and 9 turns.

DX COILS, LTD., LONDON, E.8.



7/6

The Set of four



EXCELLENCE of DESIGN

Look at the base of the Vibrolder; study its design from behind the scenes. Note the one-piece springs whose coils form the sockets for the valve legs—the self-aligning contacts; the transparent "window" which excludes all dirt and dust; the ready tinned soldering tags.

PRICE

Next time say "Vibrolder" **1/6** and be sure of the best.

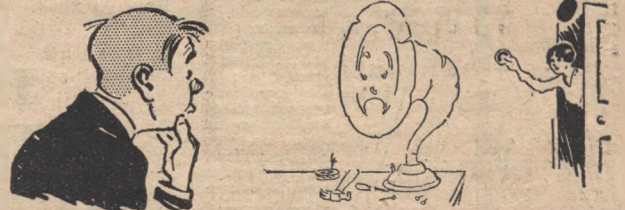
1,500,000 Benjamin valve holders are already in use

BENJAMIN

ELECTRIC LIMITED

Brantwood Works, Tottenham, London, N.17.

NEVER SAY DIE!



UP MAN AND TRY



FLUXITE

IT SIMPLIFIES ALL SOLDERING

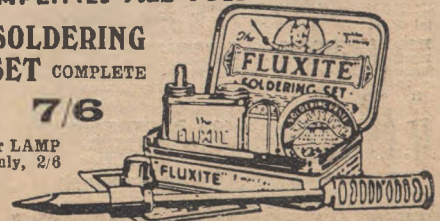
FLUXITE is sold in tins, price 8d., 1/4 and 2/8.

Another use for Fluxite: Hardening Tools and Case Hardening. Ask for leaflet on improved methods. **FLUXITE LTD.** (Dept. 324), Rotherhithe, S.E.16.

SOLDERING SET COMPLETE

7/6

or LAMP only, 2/8

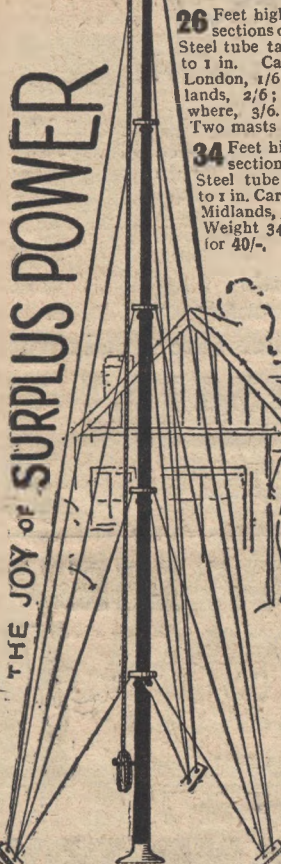


A HIGH MAST IS EQUAL TO TWO EXTRA VALVES

Everybody knows that to have a high aerial is to get extra powerful signals. The difficulty of fixing up a high aerial is banished if you fit a

P.R. PATENT STEEL MAST

**DAMP PROOF!
ROT PROOF!!
CALE PROOF!!!**



26 Feet high. In 3 sections of 1 1/2 in. Steel tube tapering to 1 in. Carriage, London, 1/6; Midlands, 2/6; elsewhere, 3/6. Weight 24 lbs. Two masts for 28/6.

34 Feet high. In 4 sections of 1 1/8 in. Steel tube tapering to 1 in. Carriage, London, 2/-; Midlands, 3/-; elsewhere, 4/-.

The "Super" Mast.

42 Feet high. In 5 sections of heavy 1 1/2 in. Steel tube tapering to 1 in. A real bargain. Carriage, London, 2/6; Midlands, 3/6; elsewhere, 4/6. Weight 46 lbs. Two masts for 55/-.

P.R. MASTS are made of British Steel in 9 ft. lengths, from 1 1/2 in., tapering to 1 in. and are supplied with cast-iron bed plate, steel ground pegs, stay rings, galvanised steel flexible wire stays cut to lengths, pulleys, bolts and fullest erecting instructions. No further outlay necessary.

NO HOLES TO DIG. ONE MAN'S JOB.

Any intelligent man can assemble and erect a P.R. Mast in a couple of hours. Our patent Mast being tapered, it is easy for anyone to raise it from the ground into position. Ordinary tubular Masts require several hands and difficult rigging to do this. To help you the wire rope is sent out to size—a saving of endless worry. Imagine sorting out 500 ft. of rope in your back garden!

Minimum Radius 3 ft. 6 in. **GUARANTEE** Money refunded without question if not satisfied. **The easiest Mast to erect.**

PAINTING. Any protective coating applied before dispatch gets damaged by the Carriers that it is essential to paint the Mast before erection. All P.R. Masts are sent out oxide-finished ready for painting. One coat of P.R. Colloid covering applied—a 10 minutes' job—to all parts of the Mast when ready to erect sets dead hard in an hour and protects it against all weathers.

PRICE OF ACCESSORIES. P.R. Colloid Covering sufficient for a Mast—with brush, 2/6. Halyard Log Line—Ryland's patent rot-proof; For 26-ft. Mast, 1/6; 34-ft., 2/-; 42-ft., 2/6. For 100 ft., 3/-. Note.—Double length supplied to make lowering of Aerial easy.

A HIGHLY EFFICIENT AERIAL. P.R. Aerial is made of 14-26 High Conductivity Pure Copper Enamelled Wire—each strand insulated from its neighbour to give the highest signal strength obtainable. 100 ft., 4/3; 50 ft., 2/3.

P.R. MASTS 17-40, PATERNOSTER SQUARE, LONDON, E.C.4. Opposite G.P.O. Tube.

IF YOU USE VALVES it will pay you to write to us for particulars of the famous 3/6 range of P.R. valves. Each valve has a written guarantee of life and performance.

TECHNICAL NOTES.

(Continued from page 942.)

filament circuit and pass these through a pair of contacts arranged one upon the telephone hook and the other upon the main pillar of the telephone instrument: of course, both these attachments must be carefully insulated from the telephone instrument itself.

When the telephone receiver is picked up, the hook rises and breaks the filament circuit of the radio set, which therefore "shuts down," while the telephone conversation is going on, immediately re-summing the programme when the telephone receiver is replaced upon its hook.

Official Objection!

I am not sure that I can recommend this device, since for one thing it would certainly be objected to by the Post Office engineer the next time he called round to inspect the telephone, but as an example of simple ingenuity, not without a certain amount of convenience, it is interesting.

G.B. from Mains.

In many cases where a resistance is employed for the purpose of obtaining grid bias from the H.T. mains-supply unit, no by-pass condenser is employed. This is an item which ought not to be overlooked, since L.F. currents must pass through this part of the circuit with the resistance offering serious opposition to their flow: in the case of a wire-wound resistance there is, in addition, a certain amount of "choke-coil effect" as well. In fact, in many cases there is an appreciable loss of volume and tone-quality in the absence of a by-pass condenser.

The "TITAN" THREE ?

Better Tone.

You will generally find that there will be an improvement both in volume and tone when a by-pass condenser is shunted across any grid-bias resistance. This condenser may conveniently have a capacity of 1 or 2 mfd. and may be of the comparatively low-voltage type, with an operating rating of say 200 volts.

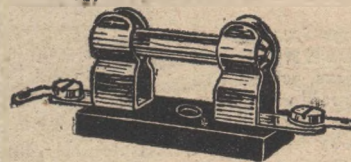
Gradual Decay.

Talking about grid-bias there is an important reason why the grid-bias battery should be occasionally inspected and tested, and that is because no dry battery will last indefinitely, even if it is disconnected from the set altogether.

A dry battery gradually loses its efficiency even whilst in stock on the dealer's shelf, owing to the deterioration of the chemical ingredients, the drying up of the small amount of moisture which is contained in the cells, and which is essential for their operation, and also to various forms of "local action" and electrical leakage

The New SIFAM

RADIO FUSE completely PROTECTS RADIO CIRCUITS



Now you can protect your radio circuit just as an ordinary electrical house circuit, with the ingenious SIFAM Radio Fuse which, when connected in series, ensures complete valve and meter protection from overload. Banishes the bugbear of burnt-out valves and costly meter repairs. A boon to all. Don't be without it.

Avoid burnt out valves and costly meter repairs
Fit this ingenious invention **2/6**

Price: 50-500 M.A. 2/6; 1-5 to 4-6 Amp. 2/- Complete with clip. THE SIFAM ELECTRICAL INSTRUMENT CO., LTD. (Dept. P.W.), Bush House, Aldwych, W.C.2

Obtain from your dealer or direct

SIFAM Radio Meters have been specified for the



Sir Isaac Pitman "All Distances Three."

NOW CONTROLS AND PROTECTS RADIO METER RADIO FUSE



Protect Your Set with the

AERMONIC

Safety Earthing Switch

Scientifically designed to adequately protect your set in all conditions. Has a fuse between the aerial and the set, thus giving security from lightning even if the set is left connected. Soudly made with Bakelite cover to keep it waterproof. Price 4/6.

AERMONIC List Free. post free on money-back guarantee. JAMES CHRISTIE & SONS, Ltd., 246, West St., SHEFFIELD. or London Agents: A.F. Balgoin & Co., 10, Curator St., E.C.4

The Picture Paper with the MOST News —SUNDAY GRAPHIC—

TECHNICAL NOTES.

(Continued from previous page).

Economy.

Therefore it is a good plan to test your grid-bias battery at least every three or six months, and if you find that it is not up to standard, it will pay you to replace it with a fresh G.B. battery, since the actual cost is quite small, whilst, on the other hand, the influence of the correct grid-bias voltage upon the operation of the receiver as a whole can scarcely be exaggerated.

LATEST BROADCASTING NEWS.

TELEVISION DEVELOPMENTS

FULTOGRAPH EXPERIMENTS EXTENDED—NEW WAVELENGTHS—UNDERGRADUATE ELOQUENCE.

ALL the various moves between the B.B.C., Wireless Pictures, and Television have been accurately and exclusively forecast in POPULAR WIRELESS, "Modern Wireless," or the "Wireless Constructor." The curious calm which fell upon the television front recently was duly noted. Then there was a short, sharp period of activity, but a minimum of investive.

And now the calm has fallen again. Round at Long Acre, there are rumoured improvements, and it is a fact that a lot of eminent people have been very much impressed with recent demonstrations there. Leading M.P.'s, including Mr. Lloyd George, are reported as having witnessed demonstrations, arranged by Lord Angus Kennedy, and Sir Edward Manville.

THE FERRANTI CHART

Every copy of this week's issue of P.W. should contain a chart fully describing the construction of the Ferranti "Simple Three-Valve Set." If your copy does not do so, please advise the Publishers at Fleetway House, Farringdon Street, E.C.4. and matters will be put right immediately.

What is all this leading to? Intelligent deduction is not difficult. There are to be trials from B.B.C. stations, presumably conducted with guarantees of secrecy. It is believed that these will take place in February. One wonders what Captain Eekersley will have to say about what can only be interpreted as a political move against him personally. Whatever happens, there will be some terrific rows, and a lot of fur flying!

Fultograph Experimenting Extended.

The decision of the B.B.C. to continue the Fultograph experiments until October 30th next year is of very great importance. It can only mean that the B.B.C. are favourably impressed with result to date. It is now a practical certainty that still picture transmissions will find their way into the programmes next year. This has already happened in Germany.

(Continued on next page).

**OUR NEW YEARS GIFT —
REDUCED PRICES
OF THE
STANDARD
SAC LECLANCHE
Permanent H.T. Batteries —
The battery that lasts for years
and the introduction of a new model**

CELL	ZINC		SAC		Complete Cell		Capacity	Milliamp-Hours.
	Old Price	New Price	Old Price	New Price	Old Price	New Price		
No. 1.	11d.	10d.	1/2	1/2	4 1/2d.	4 1/2d.	2,500	milliamp-hours.
No. 2.	1/-	11d.	2/2	1/9	6d.	5 1/2d.	5,000	" "
No. 3.	1/7	1/3	4/-	3/-	9d.	7 1/2d.	10,000	" "
No. 4.	..	1/6	..	4/6	..	10d.	20,000	" "

THE BENEFIT OF AN AMAZING GROWTH IN POPULARITY. The tremendous and steadily maintained growth in the popularity of this wonderful permanent battery has led to what will be greeted as a splendid New Year gift to listeners throughout the Radio World. The prices of the standard Battery are **Now Reduced**—this includes all models of the battery, and all spare parts. This wonderful benefit to listeners means that although the battery has already

sold to the extent of **Hundreds of Thousands**, even greater numbers will use this super efficient and money saving source of permanent H.T. supply. The Standard Battery lasts for years because it is positively self-regenerative and **Recharges Itself Overnight**. All that is necessary to maintain the voltage is replenishment of the elements at long intervals, beyond which little or no attention is needed. This wonderful battery greatly improves the quality of reception.

NOTE:— ANY VOLTAGE SUPPLIED. Listeners are asked particularly to note that any size of the battery is supplied from 1 1/2 volts upwards. The larger cells and especially the new model No. 4 are proving the most economical in the long run.

Write for Booklet now, sent free on receipt of card. The new booklet is entirely revised and contains valuable data that assists in the selection of a suitable battery, cost of upkeep, spare parts, lists and new prices.

NOW 7/6 DOWN on exactly the same terms.

The benefit is passed on to you—order NOW!

M.B.

CLAROSTAT
VARIABLE RESISTANCES FOR VOLUME, TONE, DISTANT CONTROL, ELIMINATORS ETC.,

As frequently specified by "The Experts."
• HIGH QUALITY • LOW PRICE •
New 20 Page Brochure free on request.
Many unique circuits.

CLAUDE LYONS LTD.
76, OLDHALL ST., LIVERPOOL.

Write for the New
DARIO
Folder
See page 935

WET H.T. BATTERIES
Solve all H.T. Troubles.
SELF-CHARGING, SILENT, ECONOMICAL.
JARS (waxed) 2 1/2" x 1 1/2" sq. 1/3 doz.
ZINCS, new type 1 1/2 doz. SACS 1/2 doz.
Sample doz. (18 volts), complete with bands and electrolyte, 4/3, post 9d.
Sample unit, 6d. Illus. booklet free.
Bargain list free.

AMPLIFIERS 30/-.
P. TAYLOR, 57, Studley Road, STOCKWELL, LONDON

Make
The DAILY SKETCH
YOUR Picture Paper

ALL APPLICATIONS FOR ADVERTISING SPACE in "POPULAR WIRELESS" must be made to the Sole Advertising Agents, **JOHN H. LILE, LTD.**, 4, LUDGATE CIRCUS, LONDON, E.C.4.

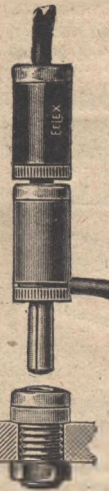


SPADES, PINS AND EYES

are a few of the accessories that comprise the Eelex Standardisation System. Every one is a standardised fitting and all parts are interchangeable. By adopting this system the possibility of a wrong or accidental connection is minimised.



They are specially designed to suit every requirement of the wireless enthusiast. They have coloured sleeves, red, black, green, blue, yellow and white, and cost 2d. each.



E E L E X T14 PLUGS AND SOCKETS

are also components of the Eelex Standardisation System, and are so designed that numerous connections can be made to a terminal or socket. 6 different coloured sleeves are available. T 14 Plugs, 3d. each; Sockets, 1d. each; Name tabs (40 varieties) 1d. each.



T 14 CONNECTOR

TYPE C.



This is a very useful accessory to possess, as it connects easily T 14 Plugs or wander plugs. Ideal for joining extension leads to loud speakers and earphones, saving wall fittings. Price 3d. each.

Write for the new EEX Booklet T. 70, which gives full details.

J. J. EASTICK & SONS
Eelex House, 118, Bunhill Row, Chiswell Street, London, E.C.1.
Phone: Clerkenwell 9282-3-4.

LATEST BROADCASTING NEWS.

(Continued from previous page.)

New Wave-lengths.

The application on Sunday, January 13th, of the Plan de Bruxelles, will affect B.B.C. wave-lengths as follows:

PRESENT.		
Kilohertz.	Metres.	Station.
192	1,562.5	Daventry 5 X X
610	491.8	" 5 G B
740	405.4	Glasgow.
780	384.6	Manchester.
830	361.4	London.
850	353	Cardiff.
920	326.1	Bournemouth.
960	312.5	Newcastle.
980	306.1	Belfast.
1,040	288.5	Edinburgh.

NEW.

Kilohertz.	Metres.	Station.
192	1,562.5	Daventry 5 X X
622	482.3	" 5 G B
748	401.1	Glasgow.
793	378.3	Manchester.
838	358	London.
928	323.2	Cardiff.
964	311.2	Aberdeen.
991	302.7	Belfast.
1,040	288.5	Relays and Bournemouth.
1,230	243.9	Newcastle.

N.B.—These changes come into operation on Sunday, January 13th.

Undergraduate Eloquence.

It cannot be helped, though it is none the less regrettable; that only those who can listen in the afternoon will be able to hear the Inter-University debate of the Manchester University Union on Friday, January 18th, which is to be broadcast from all stations of the Northern grouping. The subject promises to be one of the most amusing ever discussed before the microphone, namely, that this House regrets the past, deprecates the present and has no hope for the future. No doubt the various participants will themselves go all out on such an intriguing topic, but the broadcast will be limited to the first four speeches representing, it is hoped, Leeds, Liverpool, Aberystwyth, and Sheffield. The debate begins at 4.30 p.m.

Free!
ENGINEERS
A.M.I.A.E.
A.M.I.C.E.
A.M.I.E.E.
A.M.I.Mech.E.

A BOOK YOU MUST NOT MISS!
"ENGINEERING OPPORTUNITIES" is the most complete hand-book on Engineering Exams, and Courses ever produced. It describes over 60 Exam. and home study courses in all branches of Mechanical, Electrical, Motor and Civil Engineering, including WIRELESS. **We ALONE Guarantee—"NO PASS—NO FEE"** This book should be in your hands—it is a mine of valuable information and advice. We offer it FREE. Write for your copy now stating branch or Exam. which is of interest.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY,
101, Shakespeare House, Leicester Sq., London, W.C.2.

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ECLIPSES EVERY METER VALUE WATES "three in one" VOLT-AMP RADIO TEST METER

THREE READINGS ON ONE DIAL

This wonderful feature incorporated in the Wates Meter has caused a stir throughout the Radio World. Every preconceived notion of meter value has been swept away. This amazing Meter tells you all you want to know—NOW a variety of single-purpose testing instruments are a totally unnecessary waste and expense. The Wates Meter gives three dead-beat readings from one clearly engraved dial. It is in every sense a precision job. Exceptionally handsome appearance. Fully guaranteed. Dead-beat readings. From your dealer or direct with explanatory free leaflet.

Stocked by Halfords' Stores, Currys' Stores and All Radio Dealers.

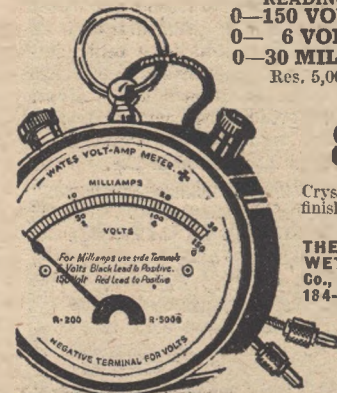
READINGS
0—150 VOLTS.
0—6 VOLTS.
0—30 MILLIAMPS.
Res. 5,000 ohms.

PRICE

8/6

Crystallised black finish. Fully guaranteed.

THE STANDARD WET BATTERY Co., Dept. P.W., 184-188, Shaftesbury Avenue, LONDON, W.C.2.



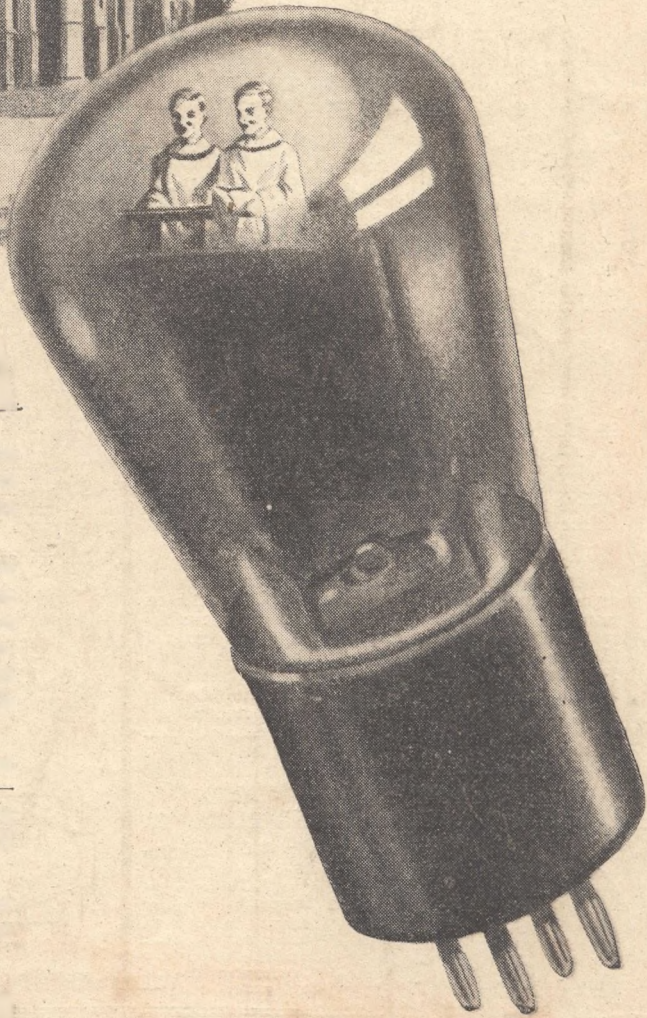
Three in One
M.B.

"BROADCAST" PLUG-IN COILS
We have been making Plug-in Coils for five years. So know your requirements.
NOTE THE LOW PRICES.

25	1/-	50	1/2	125	1/6	250	2/3
30	1/-	60	1/3	150	1/6	300	2/6
35	1/-	75	1/3	175	1/9	400	3/-
40	1/2	100	1/6	200	2/-	500	3/6

CENTRE TAPPED, 6d. EXTRA.
"X" COILS 1/- EXTRA.
Post paid on two or more coils.
CARLTON MANUFACTURING CO.,
1a, Gospel Oak Grove, London, N.W.5.
TRADE SUPPLIED. Phone Hampstead 4290.

**Keep on Saying
DARIO for Radio**
See page 935



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THE · MASTER · VALVE

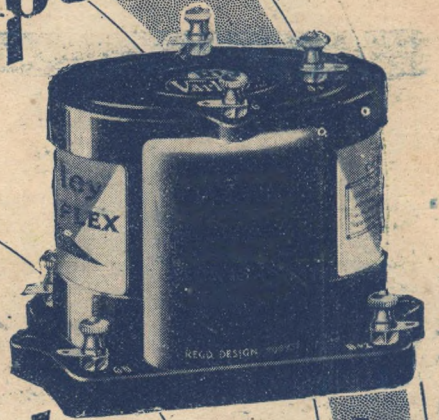
ADVT. THE MULLARD WIRELESS SERVICE CO., LTD., MULLARD HOUSE, DENMARK STREET, LONDON. W.C.2

Arks

No Aerial
No Earth
No Batteries



This up
component



fills
a
great
need in Radio today

Europe. Its clever design in-

earth can be used, if desired.

have used it in their Sets.

Z
Y
X



OF



Kingsway House, 103, Kingsway, London, W.C.2.