

MORE ABOUT THE HARRIS CIRCUIT (See Page 947.)

Popular Wireless

Every Thursday
PRICE
3d.

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INCORPORATING "WIRELESS"

January 7th, 1928.



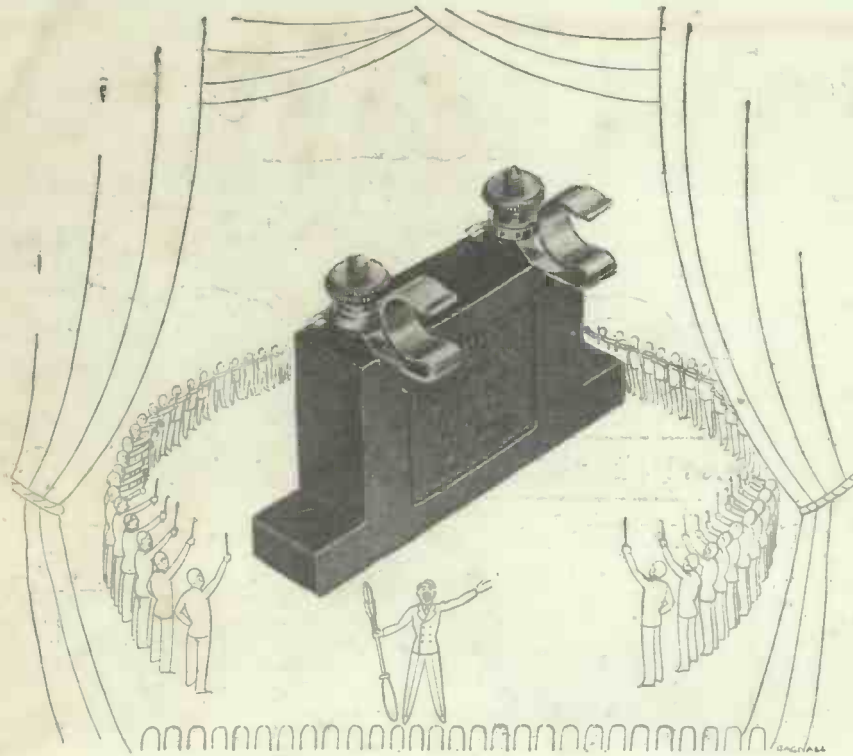
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DUBILIER DICTA



No. 5.

Many years ago there dwelt on the outskirts of a far-off city an honest merchant. Daily would he sit by the wayside offering for sale unto those entering the city small singing birds.

"Take this bird," he would say, "treat it with kindness, and it will make melody to gladden your city home."

Now it so happened that the fame of this honest merchant spread abroad throughout that land, for the exquisite melody of his singing birds was it not a joy unto all that heard? Moreover, as he charged a fair and reasonable price for his birds he waxed prosperous.

Then there arose (as there usually does in such cases) a cunning merchant whose name was Haak. He made much study of the honest merchant's ways, and, being envious of his prosperity, he sought means whereby he might divert into his own coffers the shekels that fell to the lot of the honest one.

And he caught many sparrows of the city and did colour them to resemble the song birds. And he said that the Alchemists would give much to discover the secret of his dye. And he did take up his stand with his coloured birds farther down the highway, so those entering the city came to him first.

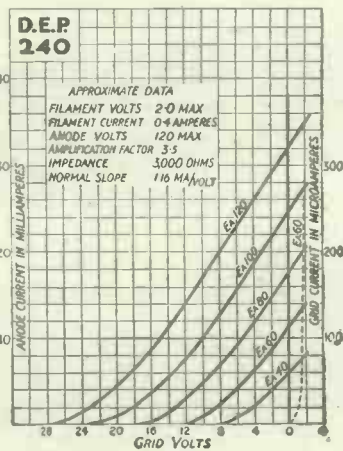
"Who'll buy? Who'll buy?" he piped from the wayside, "Are not my birds cheaper by far?" And many bought who, being deceived by the outward appearance, and attracted by the small cost, believed they were receiving true makers of melody at knock down prices.

And, as they passed on down the dusty road that led to the city, a wry smile played about the lips of the cunning merchant who was named Haak.

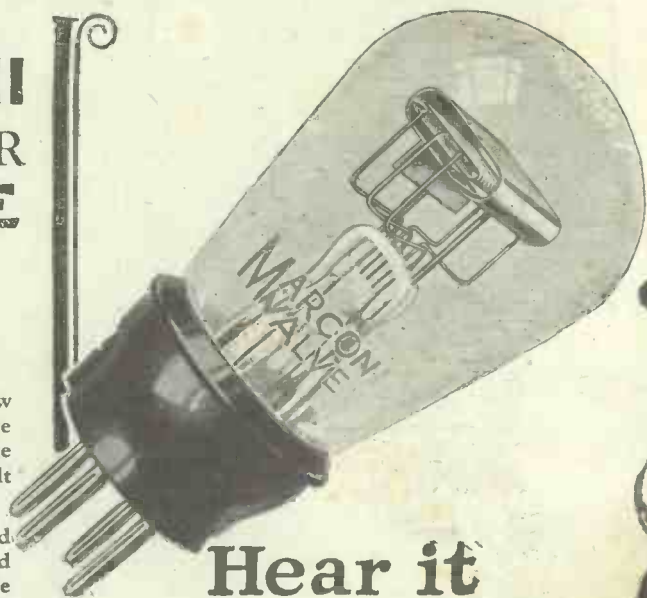
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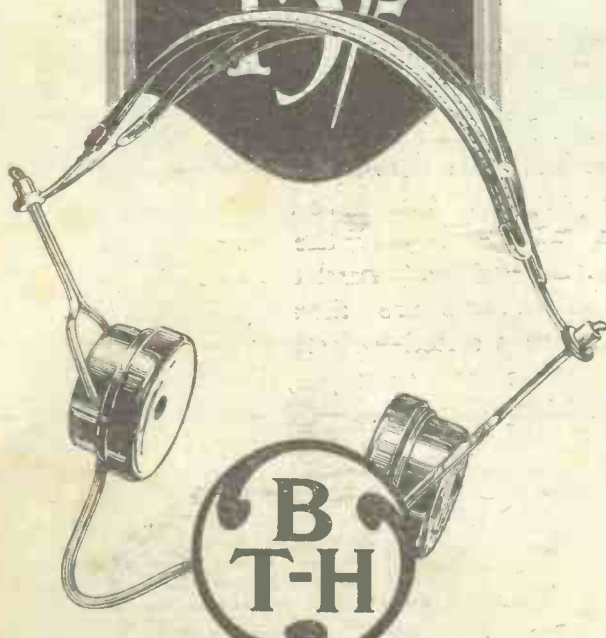
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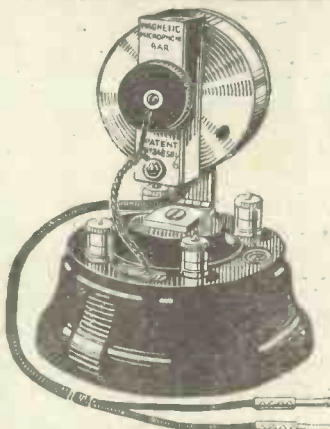
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Compiled by

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For working off the Electric Light Mains

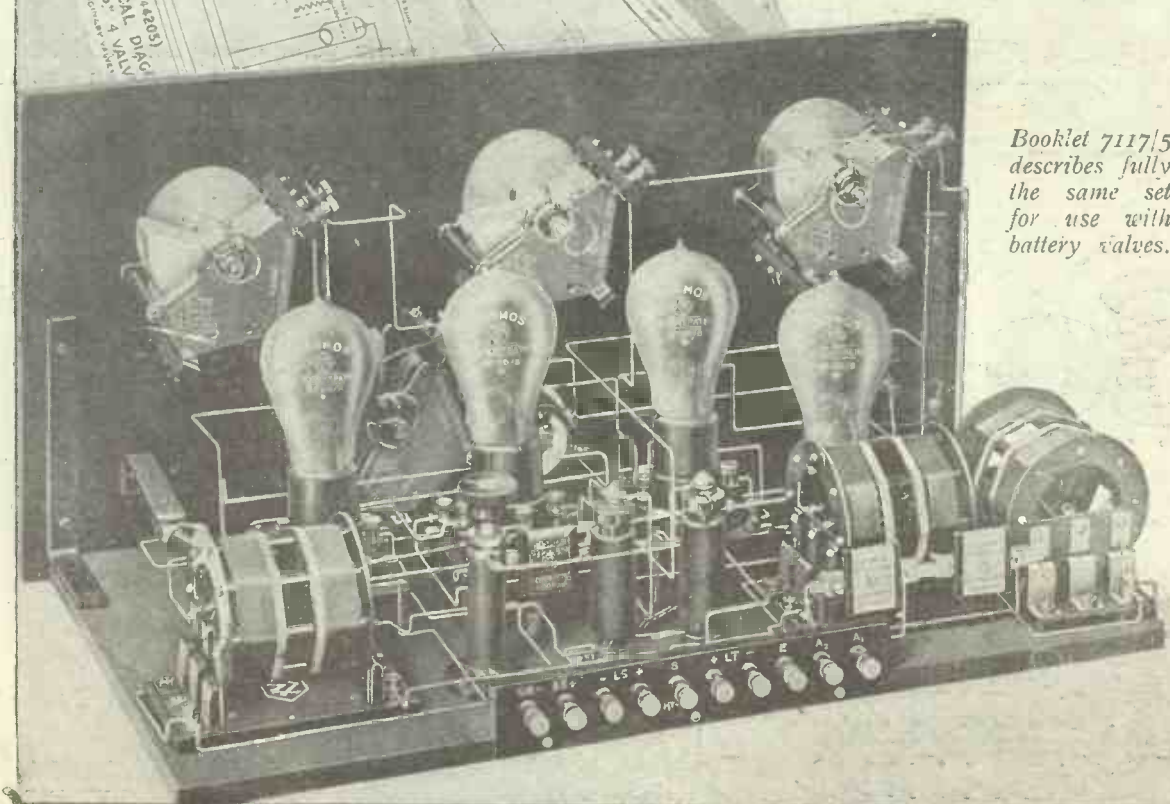
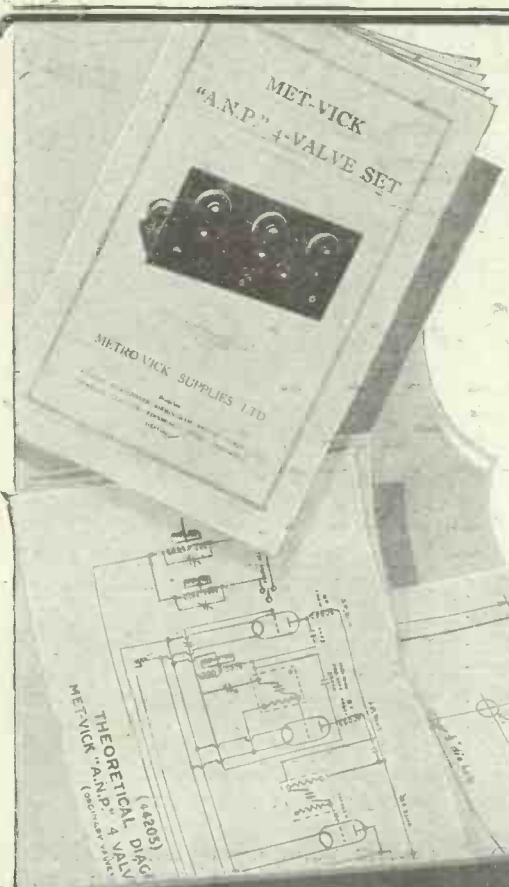
The "Met-Vick" 4-Valve A.N.P. Set shown on this page can also be constructed for working direct from the electric light mains. This involves the use of "Cosmos" A.C. Valves and Battery Eliminators, and is fully described in the booklet 7117/4 obtainable from your wireless dealer complete with drilling template and wiring diagram. The performance of the set is astonishingly good, giving great selectivity with a wide range, high quality of reproduction and simplicity of operation.

The cost of the necessary parts is low. Ask your dealer for the booklet or write to the makers.

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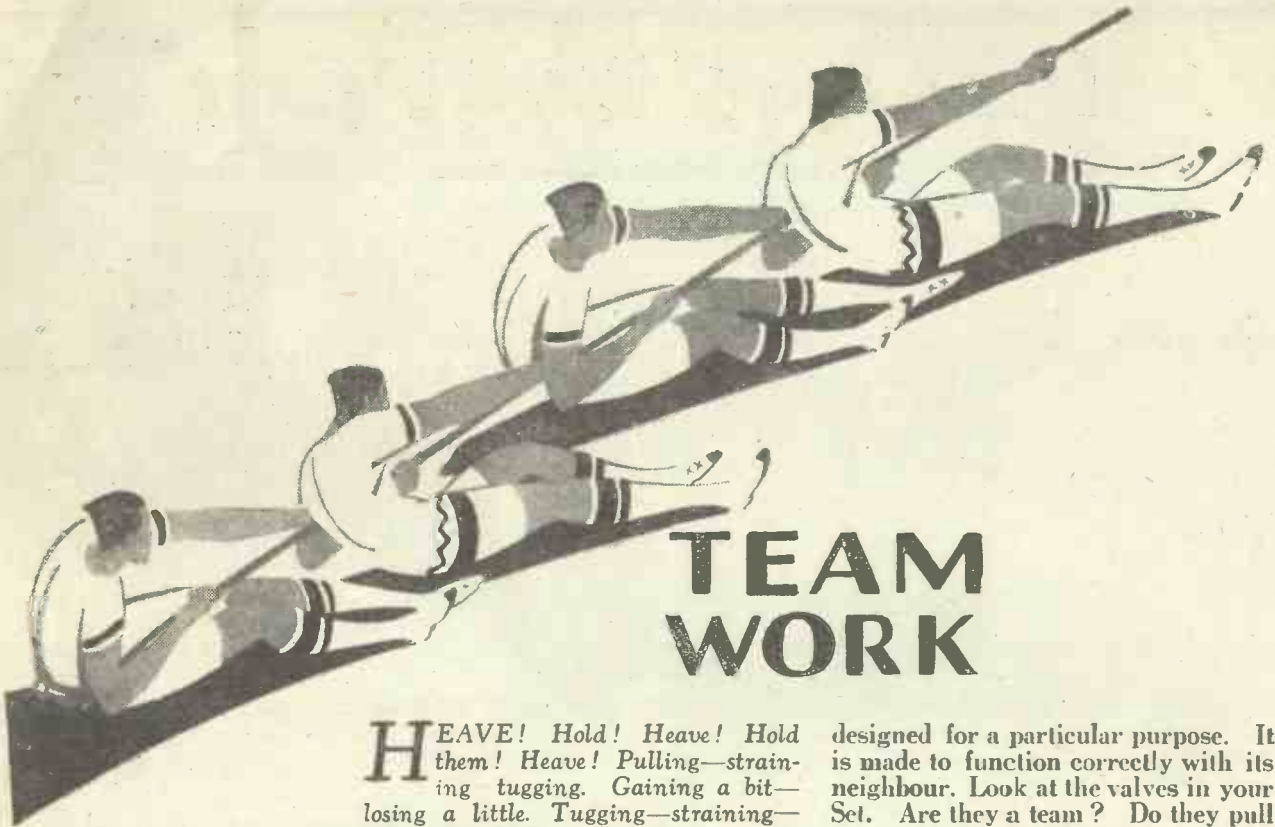
(Proprietors: Metropolitan-Vickers Elec. Co. Ltd.)

155, Charing Cross Road,
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Booklet 7117/5 describes fully the same set for use with battery valves.

R
P102



TEAM WORK

HEAVE! Hold! Heave! Hold them! Heave! Pulling—straining—tugging. Gaining a bit—losing a little. Tugging—straining—pulling. Each man in perfect unison with the next—working together. Team work.

Team work is as essential to success in Radio as in tug-of-war. You have no idea of the capabilities of your Wireless Set unless your valves are “pulling together”—as a team. Using valves of different makes in your Set is like choosing men of different weights and physique for a tug-of-war team. They are not designed to “pull together.” Every Cossor Valve* is

designed for a particular purpose. It is made to function correctly with its neighbour. Look at the valves in your Set. Are they a team? Do they pull together? If not, replace them with the correct Cossor Valves. Immediately your Set will give you results of which you never before believed it capable. It will give you purer tone. And far more life-like reproduction. And greater volume—without distortion. And it will give you more economical performance, too.

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RADIO NOTES AND NEWS.

Results of 5 S W—Everlasting Waves—Birthmarks for Batteries—English Time Signals—Now—and Then.

Last Year of the "War?"

NOW that Wish Wynne has had her wish and broadcast for the B.B.C., but did not win the round with Sir O. Stoll, one wonders how much longer this unfortunate tug-of-war, with the artistes as the rope, is to continue. Is the (so-called) war to be settled this year, or is the listening public to be continually denied the services of the cream of the variety stage because one or both of the parties will not compromise?

A Poor Look Out.

IF the Variety Lords intend to remain adamant and to demand the right to run broadcasting stations, then I fear that the public will lose, for I cannot see the slightest reason to hope that the authorities who control broadcasting will loosen their grip on it. Let the Post Office protest as it may, broadcasting is now in Government tentacles, and is likely to remain there. But I still think that the B.B.C. might make an arrangement with Variety, whereby the light entertainment side is "let" to the controlling parties, in return for a share of the licence fees.

Results of 5 S W.

I UNDERSTAND that an expert analysis of the reception in various parts of the world of 5 S W's transmissions on November 5th, 6th, and Armistice Day, has recently been completed. Reports from Canada, Australia, U.S.A., Buenos Aires, Rio de Janeiro, Lima (Peru), West Indies, South Africa, India, China, Japan and Egypt have been received. A general survey of the results shows that in all cases, excepting that of Sydney, N.S.W., the maximum strength of reception was noticed when it was dark at Chelmsford and just after dark at the receiving station.

Business is Business.

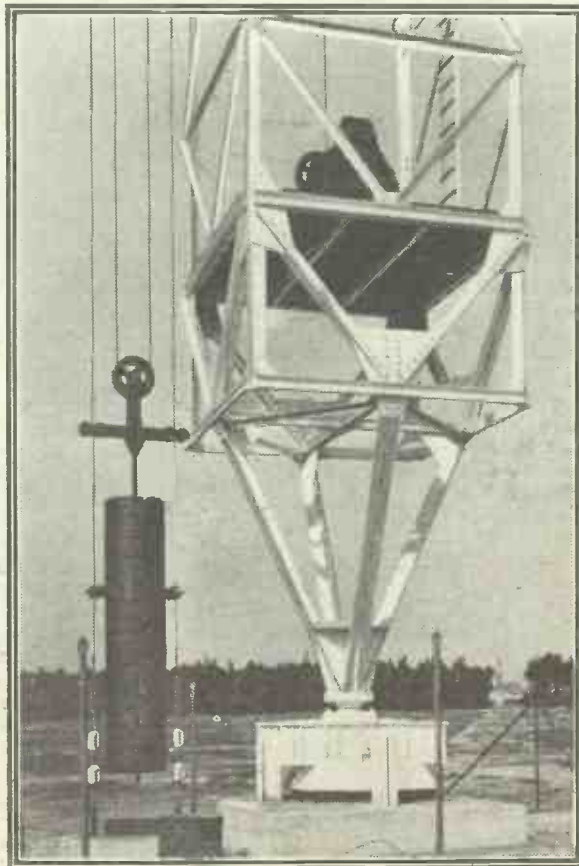
SIR HARRY LAUDER says that he does not like the American system of broadcasting, and thinks that he will not broadcast during his coming tour "over there." With all the respect which is due to a great artiste and likeable man, I venture to say, "Softly does it." Biz is biz, and even Sir Harry does not work solely for

his health. I have no doubt he will hear big figures talk when he gets to the U.S.A., and if he is the man I take him for, he will reconsider his thoughts. Why not?

Everlasting Waves.

FOLLOWING a visit of Press-men to the Marconi Beam station at Dorchester, I noticed several lyrical accounts in the papers of the eternal life of radio waves. It was hinted, for example, that,

given instruments of the required sensitivity, our great-great-grandchildren should be able to hear 1928 broadcasts, and so on. But be ye not misled. Mathematically considered, and excluding all factors other than its logarithmic decrement, an ether wave never wholly disappears; but when the wave leaves the professor's squared paper for this cold and crowded world, it is subjected to all manner of interferences and absorptions. Hence after a few minutes of propagation it is probably a complete wash out.



The base of one of the huge masts at the new German super-power broadcasting station, Zeesen. The whole weight of the mast is taken by the kind of huge ball-socket base, enabling the massive structure to sway bodily in high winds. Great steel stays and guy-wires keep it in a vertical position.

B.B.C., Printer and Publisher.

SO successful has the B.B.C. been as a publisher—its business is broadcasting, you may probably remember!—that it now proposes to institute subscriptions for its libretti, pamphlets on talks, etc. Libretti, 2s. for a series of 12; school syllabuses and pamphlets, about 24 for 4s.; adult education programmes and adult aids to study, about 24 for 4s. The libretti business is useful, no doubt; for the rest, I am sorry to see listeners' money used to maintain a staff to prepare them. I consider that the entire educational side of the B.B.C.'s activities should be paid for by Government grants—or, preferably, abolished. We pay enough for education.

"Flappers of 1927."

DID you hear the broadcast on this subject by Ray Strachey on Dec. 20th? If you did, perhaps you would like to know that the speaker, who is Mrs. Oliver Strachey, is rather an accomplished and versatile lady. She studied at the universities, including Oxford and Cambridge; became a practical building
(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

contractor, and is also an electrical engineer. She has three times been an Independent candidate for Parliament, wrote one of the most talked-of novels of the autumn season, "Shaken by the Wind," has built her own week-end cottage, and is writing the history of the Women's Movement. Did women have a movement? Or did they have voteness thrust upon them?

Joke (Scotch).

I AM informed by the Canadian National Railways that for broadcasting purposes there is nothing to equal the bagpipes. Yes! I had noticed it before. They say that on the occasion of the Empire broadcast from the Albert Hall, Ottawa lost the Prince of Wales' speech, and the trumpets and fifes, but that the pipes went across with a wallop. Och aye! there's naething like a good hefty Hiellanman playing on a well-tuned haggis. Like the men of Caledonia—they get everywhere, those squeals. They are the pattern on which Chamber Music is modelled, I verily believe.

Birthmarks for Batteries.

F. V. P. (Brighton) writes to suggest that "all good makers" of H.T. batteries should stamp the date of manufacture on the pitch filling. His object is to protect himself and the public from having "so many stale ones" sold to them. First, why should not a *bad* manufacturer stamp the (wrong) date on his batteries? Second, why does F. V. P. buy "so many stale ones"? Can it be that he accepts a dry battery from a dealer or a manufacturer without seeing it tested, or, if he buys in bulk, without testing them on delivery? No "good" maker of batteries sells anything but new laid ones or refuses to replace "low voltagers" which may creep out unseen.

Indian Note.

INDIA produces many wonders and the latest is that in Bombay the Colombo broadcasting station is received very well on five-valve sets. Such is the statement of Mr. Abdullah Fazalbhoy, of the All India Radio Merchants' Association. Now, my investigations show that Colombo Radio, some 800 miles from Bombay, is a 1½ kw. transmitter, working on 800 metres, and has a "crystal range" of ten miles; in the intervals between programmes it conducts an ordinary telegraph service with ships. Either the crystals in Ceylon are rotten bad or the valves in Bombay are marvels.

Stop Press News.

BERGEN broadcasting station is to duplicate the transmissions it makes normally on 370.4 metres, on a wavelength of 30 metres. Thirsting to be received in the Falklands, I suppose.

A "P.W." Enthusiast.

C. M. (E. Finchley) is the sort of amateur our technical hounds dream about on their mats. Nothing but a biscuit or a new method of valve coupling can stop them snoring about him. He has made up the "Sydney Two" and lost much sleep thereby because it has led him the wide

world over. He likes it and says so. He gets oodles of stations on it and his Simmonds' 20 metres panel is oozing varnish out of sheer jealousy. Moreover, his "P.W." Wave-trap is sobbing its heart out with weariness because of the overtime it has to put in. The worst we wish C. M. is that Sydney (N.S.W.) will wake the baby!

English Time Signals.

THESE began to be emitted from Rugby on December 19th, on 18,740 metres.

Details of the signals were given in these "Notes" some time ago. I see that by the instrumentality of some time-signals, surveyors in the Arctic were recently able to prove that some wretched cold place is

SHORT WAVES.

At the ante-Christmas Meeting of Carol Singers, it was unanimously agreed that wireless has completely spoilt their business. A kind word for the B.B.C. at last.

A preacher says that he doesn't think women listen-in to sermons over the wireless. Naturally; they can't criticise the dresses of the rest of the congregation.—"Everybody's Weekly."

He: "Now there's quite a difference between a neutrodyne and a super-heterodyne. Do you want me to explain?"

She: "Oh, don't bother. It's the when-we-dine and the where-we-dine that interest me."

Ask your wife if she knows the difference between a sigh, a motor car, and a loud speaker, and tell her that a sigh is "Oh, dear," a motor car is "too dear," and a loud speaker is "you, dear"—then run!

ONE MAN'S MEAT—

Smith: "I got Greece on the radio last night!"

Brown: "Huh! I'd like to know how to get rid of it when I tune up my car!"—"News of the World."

"There are two proverbs which signify that 'Patience is a virtue' and 'Nothing is impossible.' But if there is a believer of these proverbs, let him spend an evening trying to get America on a crystal set."—Australian Paper.

Stranger: "Say, where can I get radio supplies in this town?"

Bright Boy: "See that church, mister?"

Stranger: "Sure, but you don't mean to tell me they sell them there?"

Bright Boy: "No, sir; but that's the only place where they don't."

not where the map shows it. Heavens! Suppose Rugby proves that our office is really in Downing Street! What about my season ticket?

Insulation!

A WIRELESS man looked in on me to-day. He is home on leave after four years in the South American Republic of—er—San Matador will do. Amongst other atrocities, he related that he, having had trouble with the telegraph lines between his wireless station and the telegraph office in the capital, made an inspection of the said line and found that a pole had fallen and some kindly hand had twisted the wire round a bronze crucifix by the wayside.

Transmitting Note.

MR. J. L. JEFFREE asks me to announce that his station, 5 F R, has been removed to 2, Fernhurst Road, Croydon, Surrey, to which all communications should in future be sent. Done, sir!

Obituary Note.

I HAVE often referred to the U.S.A. Federal Radio Commission which is clearing up some of the chaos in American broadcasting, and so I am bound to record with regret the death of its well-known chairman, Rear-Admiral W. H. G. Bullard, which occurred on November 24th, 1927. Admiral Bullard was the man chiefly responsible for the birth of the Radio Corporation of America, which concentrated in American hands the chief radio patents owned by the then American Marconi Company. Salute to a radio patriot!

An Omission.

THE U.S. Circuit Court of Appeals, in some legal mix-up about patents, has declared that Dr. Lee de Forest is the inventor of "reaction" and the oscillating valve. That may be O.K. (oil krect) in America, and I do not propose to dispute it, but I note that the "Telegraph and Telephone Age," in elaborating the victory, jumps from Branly's coherer to the three-electrode valve of De Forest, quite forgetting our Dr. Fleming's two-electrode valve and Marconi's fine "magnetic detector," the last having been used generally for several years before the valve appeared. Radio history ought to be universal.

Now—and Then.

THE new motor-liner "Bermuda" has been fitted with a ½ kw. spark transmitter, with emergency set; a 1½ kw. valve set (600 m.—850 m. and 2000 m.—2,750 m.), for C.W. and I.C.W.; a new type of receiver with a note filter; a direction-finder and two life-boat installations. When I first struck wireless a ship equipment consisted mainly of a Rhumkoef coil and a few Leyden jars for a transmitter, a coherer detector, variable condenser, and plug-in inductance.

Hard Luck!

IT looks like real hard luck that the place which Californian radio men consider to be the DX fiend's paradise should be called "Death Valley." One suspects that it is not so named without good reason; in fact, I understand that it is one of the hottest places on earth, and is considerably below sea-level. Anyway, it is there that they can get Havana and many other very distant stations with amazing clarity and strength. Most good things have their drawbacks in this world, I suppose.

"P.W." Blue Print No. 31.

THIS is a two-valver and has been made by B. J. (Rushden), though he used a .00035 condenser instead of the specified .0005. He can get six or more continentals any night, and once got seventeen, all at L.S. strength. Gets K D K A and 2 F C direct, and considers this set the best two-valver he has ever used. A Valve Bart, I think, with knobs on. New season's entrants to the DX field might do worse than try No. 31.

Reception of Java.

THOSE Javanese short wave stations seem to come over unusually well and furnish excellent subjects for tests of manipulative skill and receiver design. M. B. (Southport) has had A N H at good telephone strength, and S. B. (Shoreham-by-Sea) got A N E on a "P.W." set quite comfortably.

ARIEL.

More About The HARRIS CIRCUIT



Further details concerning the
"constant-sensitivity" scheme
recently disclosed in "Popular
Wireless."
By PERCY W. HARRIS, M.I.R.E.

BY the time these lines appear in print very many readers will have tried my new circuit, either in experimental form or as a finished set, such as that described recently. Already I have been asked a number of questions about the circuit and the following notes may perhaps be of assistance, not only to those who are

efficiency, so that by suitably proportioning the couplings we can obtain a practically constant-reaction effect over a very wide band. Furthermore, the new high-magnification R.C. type of valve enables an appreciable H.F. amplification to be obtained, with the particular convenience that such forms of amplification do not require a

frequency amplification but without the many troubles connected with neutralisation, balancing circuits or ganged control;

(3) No special new parts are required, existing components being used throughout. There are, of course, a number of other advantages which will occur to the keen student.

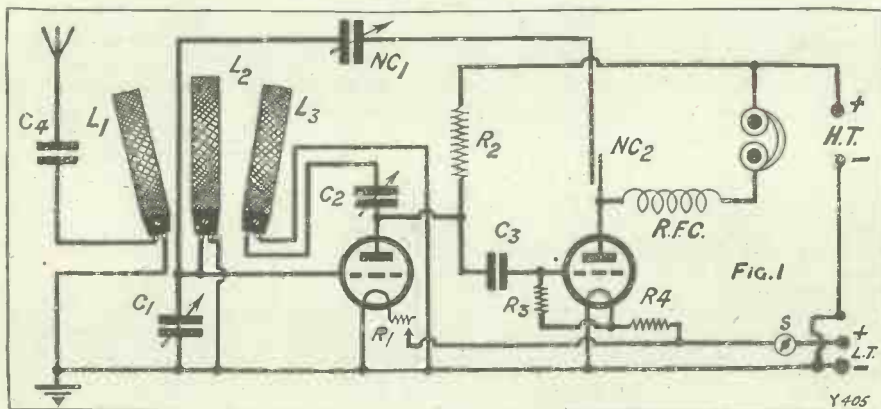
It should be noted that the full theory of the circuit is somewhat complex.

Reverting now to the point regarding the use of a circuit with the ordinary type of plug-in coils, we see that as we are dependent upon accurate feed-back how important it is to suitably proportion the windings, or in other words to choose the right size of coil and coupling. For those readers who wish to try the circuit with plug-in coils, I would suggest they utilise a three-coil holder first of all, so as to get the best results from the particular make of plug-in coil they happen to be using at the time

H.F. Resistance.

At this point I should explain that plug-in coils vary very considerably in size, shape of field, high-frequency resistance, self capacity and other factors. Only those experimenters who maintain a properly equipped laboratory with accurate measuring instruments can fully appreciate the differences which exist between some makes. Take, for example, the subject of high-frequency resistance. I have compared two different makes of No. 60 plug-in coil, both having approximately the same inductance. The high-frequency resistance

(Continued on next page.)



interested in the theoretical side, but to the many who like to experiment for themselves.

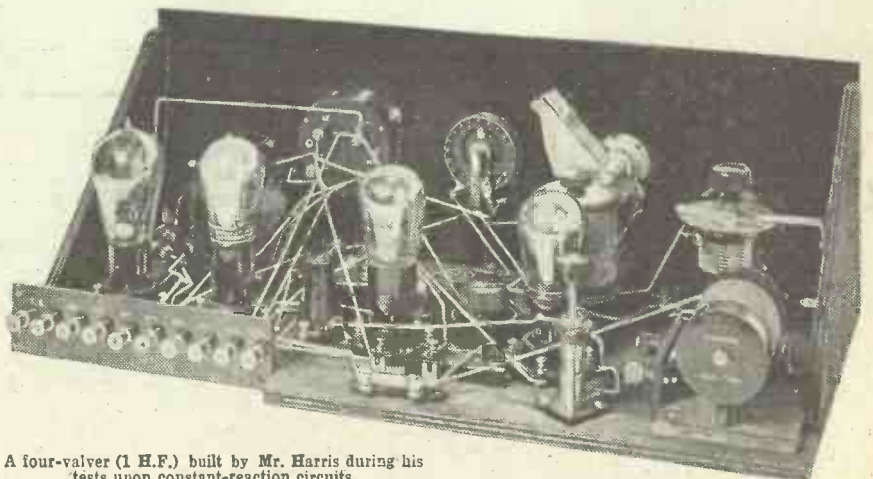
The first question is: "Can the new circuit be used with plug-in coils of the older type?" The answer is "Yes," provided care be taken to use the right size of coil and to proportion the various couplings correctly. In order that one may follow why this is essential, some consideration must be given to the manner in which the circuit works. As explained in previous articles, the circuit in the form already described consists of a high-frequency valve with "Reinartz" reaction resistance-capacity-coupled to a detector valve. It is, of course, possible to use the swinging coil reaction, though the control is not generally so convenient.

Important Reaction Effect.

A further and important reaction effect is provided by a condenser joined between the plate of the detector valve and the grid of the high-frequency valve, and while the first reaction coupling decreases in efficiency as we go from the shorter to the longer waves, the feed-back between the detector plate and the H.F. grid increases in

special tuned circuit. We thus obtain a circuit with the following very appreciable advantages:

- (1) Constant reaction amplification over the whole tuning scale;
- (2) A one-control receiver using high-



A four-valve (1 H.F.) built by Mr. Harris during his tests upon constant-reaction circuits.

MORE ABOUT THE HARRIS CIRCUIT.

(Continued from previous page.)

of one has been just ten times that of the other!

Then consider the shape of the field set up by a particular coil with a current flowing through its winding. We will take three well-known makes of coils (all of which, I can assure readers, have a low high-frequency resistance)—the Gambrell C, the Lewcos centre-tapped No. 60, and the Lissen No. 60. (naming them in alphabetical order). A pair of each of these makes of coils, arranged in a two-coil holder so that the coils are at an angle of forty-five degrees to one another, will give different coupling between coils in each case.

Effect of "Circuit-Damping."

Unfortunately, too, the numbers given by makers do not necessarily correspond. The tuning range of a No. 60 of one make is not necessarily the tuning range of a No. 60 of another make, although fortunately there is, generally, not a great deal of difference between makes.

These points regarding coils are mentioned in regard to the Harris circuit, as I wish to make it clear that I cannot state in an article such as this that you must use a certain number coil at a certain setting. I can only give you approximate ideas of the size of the coil and coupling, and you must experiment for yourself. Fortunately, it is very easy to make the experiments.

In any circuit where an endeavour is made to obtain a constant-reaction coupling one must consider the damping of the

Here, then, we have to take into account the effect of aeriols, for these differ notoriously from one another; and if the aerial is coupled too tightly, it may completely upset the constancy of the reaction setting. For this reason I advise, when plug-in coils are used, that a three-coil holder, as mentioned above, should be tried. The coupling between the aerial coil marked in the diagram L_1 and the grid coil L_2 should be adjusted until the best coupling is found. L_2 can always be a No. 60 or a Gambrell C for the ordinary broadcasting band. L_1 will have to be chosen according to your aerial and the make of coil, but usually a 25, 35, or 50 should be tried to see which gives the best results, with varying couplings between L_1 and L_2 . In most cases the 25 will probably be the most suitable, and it is generally advisable to insert a fixed condenser at C_1 of a value round about .0002 mfd.

Various values can be tried for L_3 , the reaction coil. In this arrangement it is not intended that reaction should be varied by moving the angular relation of L_3 and L_2 , for reaction control is best made on C_2 . Variation of coupling between L_3 and L_2 is useful to find the best combination of capacitative and inductive coupling, the final adjustment always being made on the condenser.

Component Values.

A 35 or a 50 coil (or Gambrell A or B) should be tried, first of all, in the socket L_3 .

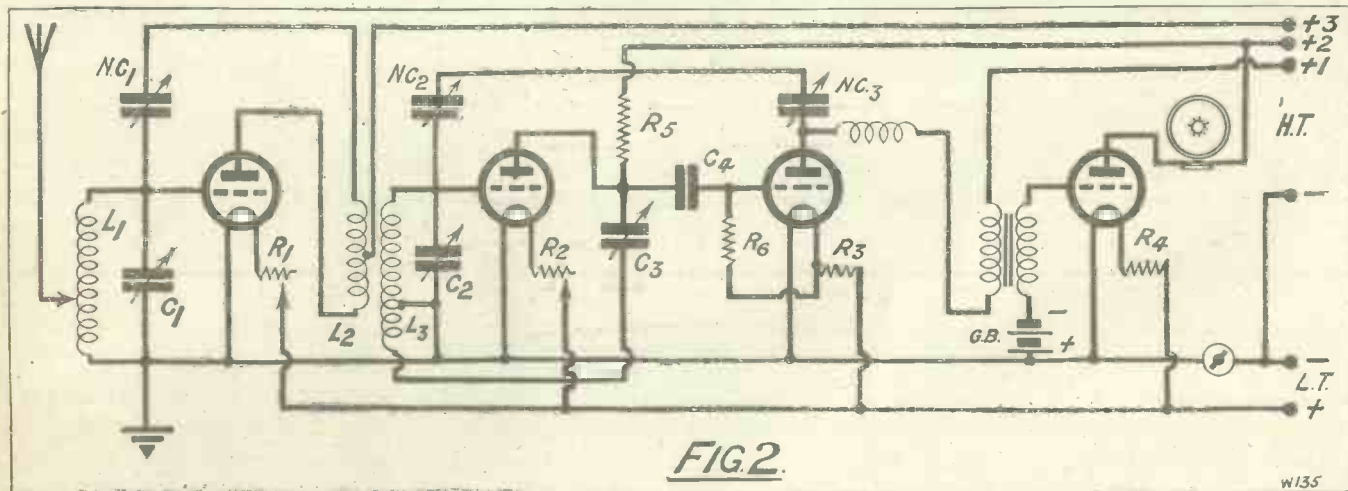
NC, should be an ordinary neutralising condenser, preferably of the screw-down variety, as this makes for easiest adjustment; while NC₂, shown as two parallel lines, is the scheme already suggested in a recent issue of POPULAR WIRELESS, where two wires are kept apart by their insulation. A greater refinement is to substitute

Resistance R_1 , which is the filament resistance of the high-frequency valve, can with advantage be made variable, but very little difference will be found unless a larger value than usual is employed.

An Efficient Circuit.

A particularly efficient receiver, having a much greater simplicity of control than normally, can be made by adding a stage of neutralised high-frequency to the Harris circuit already explained. We then get a particularly sensitive and sharp tuning receiver with only two tuning controls which can be ganged, if necessary, although very careful matching of coils and condensers is required if this is done. The circuit is shown in Fig. 2, which depicts a four-valve receiver with one stage of neutralised high-frequency transformer-coupled, one stage of resistance-coupled high-frequency, a detector, and one stage of transformer-coupled note-magnification. The tuned high-frequency stage is of the split primary type, and the resistance-coupled H.F. valve and the detector are as already described in the Harris circuit, while the transformer-coupled note-magnifier is quite conventional.

Although, on examining the diagram, there seems to be a large number of adjustable condensers, actually the only tuning condensers are C_1 and C_2 , which will read approximately equally over the whole tuning range, using a standard six-pin coil, the coil L_1 being the well-known split-primary aerial coil, and L_2 and L_3 standard split-primary transformers. NC₁, NC₂ and NC₃ are all standard neutralising condensers, NC₃ being of a type which can be dispensed with if parallel wires are used as described in last week's issue. The values of C_1 and C_2 are each of .0005 mfd., and the other values are as before described.



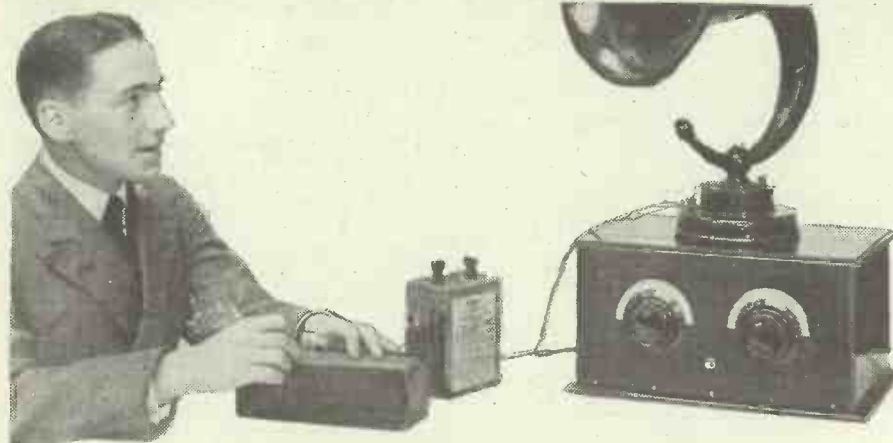
A 2 H.F., Det. and 1 L.F. receiver embodying the Harris constant-sensitivity scheme.

circuit which is being "reacted into." If this circuit is of a certain high-frequency resistance and the reaction is set to bring the circuit to just under the oscillation point, then a reduction of the resistance of the circuit will make the reaction coupling too great. If we introduce into the circuit further resistance, then more reaction will be required to bring it up to the oscillation point or, put in another way, the same degree of reaction will not bring the circuit so close to oscillation as before.

for NC₂ a second neutralising condenser, which can be of the interleaving plate type or the screw type, as preferred; but it is not absolutely necessary. With some valves NC₂ can be dispensed with entirely, or shorted. C_1 should be a .0005 mfd. condenser, and C_2 a .0001 reaction condenser; C_3 a .0003 mfd. grid condenser, R_1 a 1-megohm grid leak, R_3 a 2-megohm grid leak (these values can be varied experimentally), RFC being a radio-frequency choke

The adjustment is much simpler than would appear, and is best effected as follows. First of all, remove aerial and earth and the first valve, and adjust the constancy of reaction exactly as described in the article in last week's POPULAR WIRELESS. You will, of course, hear no signals, but the object is to see that there is constant reaction from the bottom to the top of the scale. When this is done, place the first valve in its socket and neutralise in the usual way.

CAUSES OF DISTORTION



THIS is indeed a well-worn subject. But it is a subject which will never be threadbare. The popular controversy of resistance-capacity versus transformer coupling rages stronger than ever and, as a judge might put it, "The evidence on both sides of the dispute is entirely contradictory."

I have always "plumped" for resistance capacity coupling, but now I must confess that in certain circumstances transformer coupling is superior. But only in certain circumstances, mark you, Mr. Counsel for Transformers!

You need not have read many issues of POPULAR WIRELESS to be well aware of the fact that low-frequency transformers have certain limitations. Even the most expensive and so-called distortionless transformers, when used in a single stage of amplification, give an uneven response to various parts of the audible frequency range. Some are better than others, of course, but a very large number are almost unbelievably bad. There are several reasons for this uneven response, the chief of which are: (1). Insufficient primary impedance (not enough turns of wire on the primary). (2). High self capacity (no sub-division of primary or secondary windings). (3). Saturation of iron core (poor iron or small core). All these faults concern the manufacturer; now let us see what part the listener plays in this "unintentional conspiracy" against natural reproduction.

Use Good Components.

Nowadays, by buying one of the better quality transformers, the listener usually wins the "first trick."

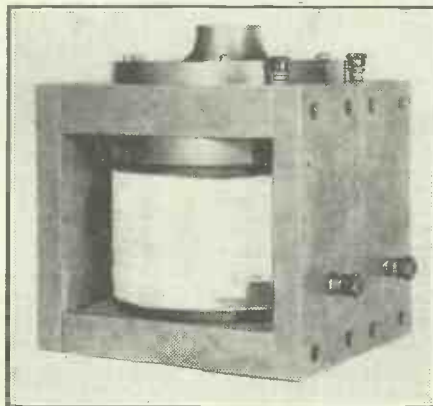
He reads the advertisements, notes the excellent "curve" (probably a straight line), pays his pound note or so, and takes home a rather weighty box of "tricks." So much to the good.

And here is where the trouble probably starts. It is put into a receiver which is not properly operated. Owing to insufficient H.T. and its corresponding grid bias, the valve following the excellent transformer will run into grid current on loud signals; (i.e., on big amplitudes the grid will become more positive than the filament and attract electrons destined for the plate of the valve). This "swallowing of electrons down the wrong throat," so to speak, has a sad effect

on the quality. The output of this valve on the loud passages becomes "clipped" and harsh. Not only that; the passage of grid current through the secondary of the transformer puts an unexpected load on it and completely changes the response curve of the transformer—for the bad. This distortion usually shows up as a rattle on good loud speakers, but on bad ones may not be noticed. This is not, however, a recommendation for you to use a bad loud speaker!

Resistance Coupling.

When the correct *relative* values of components are used, the response curve of a stage of resistance-capacity coupling over the entire audible-frequency range will be reasonably straight. The requirements for a stage of good resistance-capacity coupling



A portion of the newly perfected "exponential" loud speaker developed in U.S.A. Absolutely distortionless reproduction is claimed.

are: A good high magnification valve (with as low impedance as possible); an anode resistance with a value four or five times that of the impedance of the valve: a coupling condenser of high insulation with a capacity not less than .01 mfd.; a grid leak of about twice the resistance of the anode resistance preceding it. It is an advantage to insert an additional resistance—about 50,000 ohms—in the actual grid lead. This prevents the passage of H.F. through the amplifier, and also acts as a stabiliser.

So far so good. We have all the elements of an excellent amplifier. But assemble two

In this article our contributor deals with some of the troubles that are to be found in the L.F. side of the set.

By BAYNHAM HONRI.

or three stages, with switching and a volume control, and taking the H.T. from the house electric light mains! Then our troubles commence.

It is an unfortunate fact that a very great deal of distortion is caused by badly designed "H.T. eliminators," especially when used in conjunction with resistance-capacity coupling. With very few exceptions, the commercial article does not deliver enough power for the adequate operation of modern low-frequency amplifiers. One frequently comes across H.T. eliminators which give an output of 100 volts at 10 milliamps. or less—quite inadequate.

The H.T. Supply.

A modern power valve requires at least 200 volts on the anode, and may consume from twenty to thirty milliamps. What chance has this valve when used with a badly designed "H.T. eliminator"? In order that there should be no "limiting" of current, the unit should be capable of delivering at least twice the amount of H.T. current actually required, and should have well-designed smoothing chokes of low D.C. resistance.

It is asking for trouble, for instance, to use smoothing chokes which have a D.C. resistance greater than 1,000 ohms. The effect of high-resistance chokes is to drop the actual voltage which reaches the set and to form a coupling between the L.F. stages, tending to set up low-frequency reaction and a probable audible oscillation.

The note of the oscillation may vary from a motor-bike-like "plup-plup-plup" to a fairly high pitched whistle. More dangerous still (because it does not actively show its symptoms) is the reaction effect which is just below audibility. This reaction effect may upset the performance of the amplifier by bringing in a boom tone or a certain mushiness.

Where Transformers Score.

Unless you are absolutely sure of your H.T. eliminator it would be wise to run the anode current for the last power valve through a separate smoothing system, thus minimising the possibility of coupling effects and low-frequency reaction.

Returning to the question of "Transformer v. Resistance-Capacity," it must be admitted that used in conjunction with H.T. eliminators, transformers are likely to give far less trouble. Moreover, it must also be admitted that there are few loud speakers which really do justice to resistance-capacity coupling. In many cases the bad characteristic of a transformer amplifier is balanced out by a bad loud speaker resonance. It is a positive fact that the worst loud speakers are at their best on the worst sets!

OPERATING THE "SUPER-SCREEN" THREE.

Some further notes on the modern and efficient set described last week.

By G. P. KENDALL, B.Sc.

CONSIDERING the operating details of the "Super-Screen" Three, the first point requiring attention is that of the various H.T. voltages required. It is here that we find one of the possible slight drawbacks of the shielded valve, since it is definitely somewhat critical as to high tension and it is very desirable to use a fairly high voltage on the plate. (The standard value is 120 volts.) It is quite useless to expect good results with one of these valves unless a little care is taken in obtaining a proper adjustment. The particular voltage which is a little critical is that upon the shielding electrode, the standard value of 120 volts being quite safe to apply to the plate without further experiment.

H.T. Voltages.

That upon the shielding electrode, however, will be in the neighbourhood of eighty volts, and it is well worth while to spend a little time experimenting here, choosing for the purpose the signals of a fairly weak distant station. The H.T. on the detector valve will be adjusted in the usual way to give smooth reaction control, and with many of the modern types of H.F. valves (these make particularly good detectors as a rule) this will be somewhere about 70 volts. On the remaining valve, that is to say the L.F. valve, all available H.T. should be used and a valve of the power type should of course be chosen if possible.

While dealing with the question of H.T., it may perhaps be as well to explain that there is only one connection on the terminal strip for the battery connections to carry the leads from H.T. negative and L.T. negative, this scheme having been adopted in order that the same number of terminals might serve as was used in the "Cube-Screen" Three, thus owners of this latter set who at some future date may decide to modify it into the "Super-Screen" will not have to scrap their terminal strip. The filament current for the shielded valve will not be found at all critical, indeed it works perfectly well with the full 6 volts. The life of the valve will, however, be somewhat lengthened if the current is cut down a little, 2 or 3 ohms being included from the rheostat.

Handling the Set.

This amount is quite easily estimated if you are using one of the 6- or 7-ohm type of rheostat. This, then, automatically applies



An early type of multi-valver made by one of our Wembley readers.

a suitable small grid bias on the grid of the H.F. valve.

So far as the actual operation of the "Super-Screen" Three is concerned this will be found a very simple matter, since there are only two tuned circuits and neither of these is really critical as regards tuning unless the reaction is brought up until the set is on the very verge of oscillation. There is normally so much amplification to be obtained in this set, however, that there is no need to use the full amount of reaction, except on the very weakest of signals, so that it becomes quite a simple matter to rotate the two tuning dials in step with each other and tune in station after station without having to touch the reaction control. This absence of critical adjustment makes the set a particularly easy one to operate, but the reader should be warned that it handles rather differently from previous types, and that his first impression is likely to be a disappointing one as regards selectivity, since it is certainly surprising to find over how many degrees of one dial or the other you can hear the same station.

This is a somewhat misleading impression because the selectivity is quite as high as many of the more familiar H.F. types. Actually, if you were to try turning both dials simultaneously and in the same direction, you would find that the station goes in and out quite sharply on either side of its tune position, indicating that the real over-all selectivity of the set is quite good. The only occasion on which you are likely to have real trouble with lack of selectivity in a set of this kind is within the usual "agony" area of a radius of about six miles from a broadcasting station, and here a good wave-trap must be used with practically any receiver. (You will find details of a very neat and efficient unit wave-trap in "P.W." No. 261, or of course, you can use the new standard wave-trap placed at some convenient position inside the cabinet of your set.

TELEVISION.

Some Questions for Mr. Baird.

MR. BAIRD stands alone amongst inventors in having definitely promised to bring television within the reach of the man in the street by the end of 1927.

To be a commercial success, such a television service should be capable of bringing into the home not only the features of some distant person, but also a representation of far-off events actually in progress, such as a prize fight or a football match, or a tennis tournament, on at least the same scale and with equal clarity to that given by the small kinema projectors now on the market.

The Baird Company presumably aims to provide a service on these lines. Otherwise the general public are hardly likely to be interested in the project.

Up to the present no public demonstration of successful long-distance radio television has been made by the Baird Company. It is true that moving effects representing a person's features have been secured, but it is by no means clear that these effects were transmitted by wireless.

Similar results have previously been

claimed by other inventors both in America and on the Continent, but they have not been so rash as to promise a comprehensive scheme of television reception on a standard set priced at £30.

Extremely Expensive.

The most successful television experiment on record cost the American companies concerned several thousand pounds and the services of over a thousand men, to reproduce clearly a single person's face, on a scale of two inches by three.

So far as can be ascertained, Mr. Baird claims to stand head and shoulders above all other workers in television, partly because he has discovered a new light-sensitive cell, which was first announced two years ago, but the composition of which still remains a secret, and partly because he uses a special method of illuminating the object to be transmitted.

Otherwise he appears to work on the same general lines as Jenkins, Belin, Alexanderson, Karolus, and many others.

So far as the sensitive light-cell is concerned, the merit of this discovery can only be judged by results. As regards the use of infra-red rays in place of more highly actinic light, it would appear on first principles that this must inevitably reduce the effective light-intensity and prejudice

clarity of reproduction, particularly for long distance working.

Without making any unfair criticism of the work done by Mr. Baird, we would point out that the time is ripe for some clear and convincing demonstration of the value of his promises. Can he, for instance, televise the Boat Race, or even a theatrical show?

Leading Questions.

In short, we ask Mr. Baird to answer these questions:

1. Does he propose to start a Television service from 2 T.V., and if so, when?
2. Does he propose selling Television Receivers at £30?
3. Assuming that the price of his home receiver is £30, what size of picture can be reproduced by this apparatus? Will the price of the receiving set cover a reasonable service of topical events, or will this be subject to a special subscription fee, and, if so, how much?

It is up to Mr. Baird to answer these questions.

The above is an extract from an important and illuminating article appearing in the January issue of "Modern Wireless," now on sale, price 1s. Order your copy to-day, and learn the real facts about Television.

The "VARIATOR" TWO

"The most sensitive Detector and L.F. set that we have handled"—the verdict of the "P.W." Research and Experimental Department, after testing the "Variator," Two.

Designed and Described by
G. P. KENDALL, B.Sc.
(Chief of the P.W. Research and Experimental Department.)



THE science of radio is as yet too young to possess any proverbs, but if I were asked to coin the first one I should suggest this: "There's more in the detector valve than has ever been got out of it." In so many sets—in all those of a straightforward type, particularly multi-

valvers, in fact—the detector simply does a plain job of rectification with more or less uniform efficiency, with the addition of a certain fairly definite amount of amplification from the use of reaction, and there is little or no difference between one set and another in this respect.

fuller use of the extraordinary amplifying powers of that most useful but rather dangerous device, reaction, although in some cases there is a real difference in rectification efficiency.

Provided always that the user realises that reaction is a dangerous device, and more particularly so in simple sets, there is no reason why these special circuits should not prove a fascinating field, especially to the man who wants real long-distance results on one or two valves. They cannot, obviously, compete with modern multi-valvers in simplicity of adjustment and quality of reproduction on far-distant stations, but there is something very fascinating about being able to achieve something even nearly as good on a simple little "det. and L.F.," and, of course, they are far cheaper to build and to run.

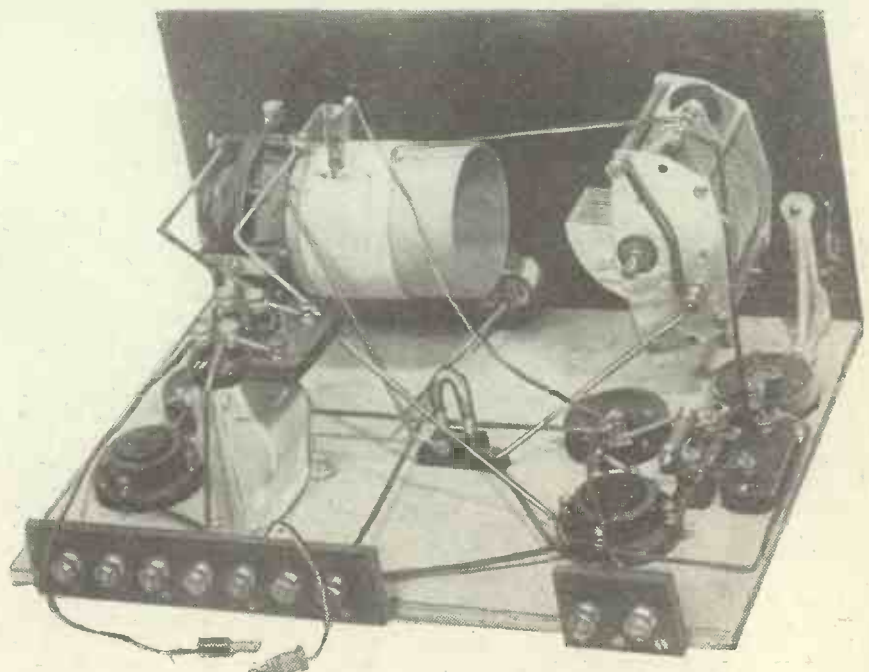
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LIST OF COMPONENTS.

- 1 Ebonite panel, 14 in. × 7 in. × $\frac{1}{4}$ in. (Any good branded material. Becol, Ebonart, Radion, Trolite, etc.).
- 1 Cabinet, 14 in. × 7 in. × 10 in. deep, complete with baseboard, 14 in. × 10 in. × $\frac{3}{8}$ in., and panel brackets (Artercraft). (Cameo, Caxton, Peto-Scott, Pickett, Raymond, etc.)
- 2 Valve holders.
- 2 Baseboard rheostats, resistances to suit valves (Lissen in set). (Any good make can be used, Igranic, McMichael, etc., etc.)
- 1 400-ohm baseboard-mounting potentiometer (Lissen, or similar type).
- 1 Single-coil holder—baseboard type (L. & P., Lotus, Peto-Scott, etc.).
- 1 L.F. transformer (R.I. & Varley "General Purpose" in set). (Any good make.)
- 1 Variometer covering broadcasting wave-lengths (Igranic type F.).
- 1 .0005 mfd. variable condenser, complete with slow motion dial (Peto-Scott in set). (Any good make.)
- 1 Grid-leak holder (Dubilier, Lissen, etc.).
- 2 .0003 mfd. fixed condensers (Clarke, Dubilier, Igranic, "Goltone," Lissen, Mullard, T.C.C., etc.).
- 1 Composite tube, 3 in. diameter by $3\frac{1}{2}$ in. long (Pirtoid).
- 1 Terminal strip, complete with 7 terminals.
- 1 Terminal strip, complete with 2 terminals.
- Quantity of wire for wiring, screws for fixing and $\frac{1}{2}$ lb. reel (or less) of No. 24 D.C.C. wire.
- 1 On-off switch.
- 1 2-meg. grid leak (Dubilier, Igranic, Lissen, Mullard, etc.).
- 1 Tapping clip for the solenoid aerial coil.
- 1 Short-circuiting link for loading coil holder. G.B. plugs, wire, etc.

Special Circuits.

The fact of the matter is, of course, that detector arrangements have become more or less stereotyped, and it often comes as something of a surprise to discover that some scheme which one might be tempted to call freakish at first glance is capable of much better things. Examples which will be familiar to "P.W." readers are the "Chitos" circuit, and, of course, the various forms of the Filadyne, and it will be realised that in most cases what these special circuits do is to enable us to make



Note the flex lead from aerial to the tapping on the coil.

THE "VARIATOR" TWO.

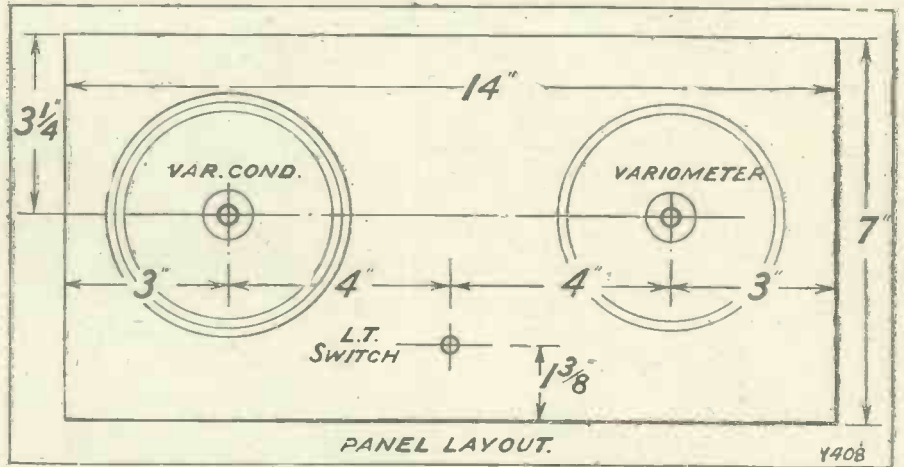
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Just why reaction is labelled "dangerous" should, perhaps, be explained, because this is a very vital point if long-distance reception is to be worth while in the future and is not to be spoiled for all of us by the misbehaviour of a minority of persistent oscillators. The point is this: in these small sets there is no H.F. amplification, and we must, therefore, rely entirely on reaction to bring in distant stations, hence there is a great temptation to use as much of it as ever one can, in order to hear the station as loudly as possible.

This means that on a weak station the set is kept on the very edge of oscillation, and may even be allowed to oscillate and be simply tuned to the silent point in the middle of the carrier wave (quality becomes very bad then, but some operators do not seem to mind!); this inevitably means interference with other people, even though no actual squeal is produced. What happens is that it causes that particular station to be heard in a horribly bubbling and distorted fashion by everyone else in the neighbourhood. Here is an obvious danger of the misuse of reaction which every right-minded user of the ether wishes to avoid, but there is another, of which I want to warn the reader before we go any further, and that is the risk of spoiling one's own quality of reproduction. This is a less

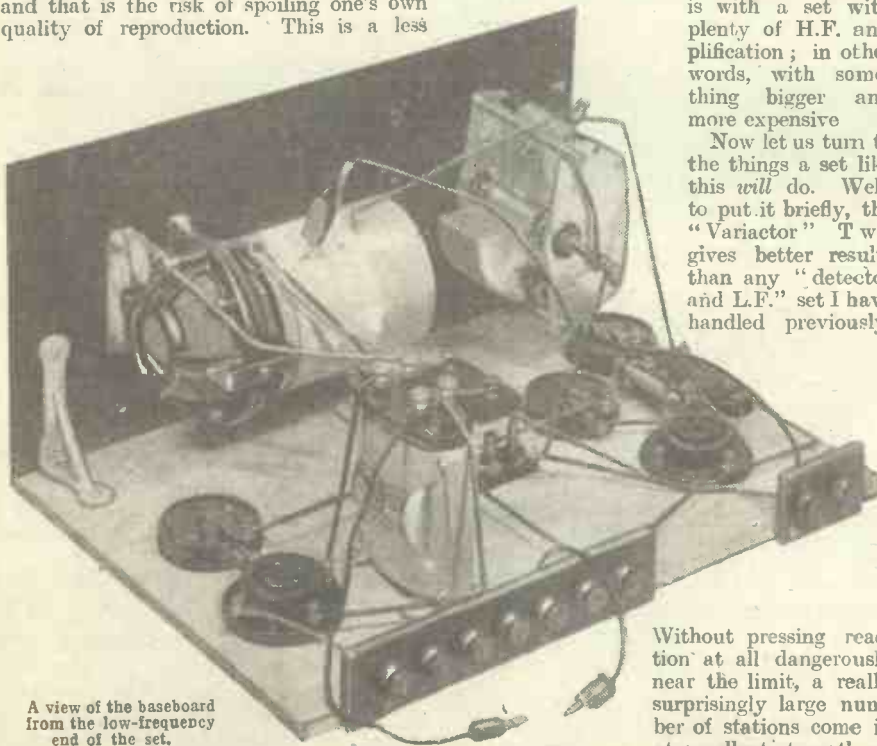
of this article to a solemn warning against the dangers of reaction, but it seems only fair to prospective builders and their neighbours to point out these things at the start. I do not wish to put anyone off this set, or others like it, but the fact remains that with any receiver of this sort you will always find that there are a lot of weak

in the anode of the detector valve to obtain reaction. When this was manipulated with a little skill a wonderful build-up of signals was obtained, and when things were just right the reaction control was very smooth and gradual. However, it was rather critical as to valves, and distinctly tricky
(Continued on next page.)



stations which can only be brought up to adequate strength by the intensive use of reaction, and that means that their quality will not be good, and, moreover, you will be running the risk of annoying other people if you keep trying to bring them up. The only way to hear them properly, of course, is with a set with plenty of H.F. amplification; in other words, with something bigger and more expensive.

Now let us turn to the things a set like this will do. Well, to put it briefly, the "Variator" Two gives better results than any "detector and L.F." set I have handled previously.



A view of the baseboard from the low-frequency end of the set.

obvious one, but it is a fact that if one works just a little too near the oscillation point everything becomes muffled and "woofy."

The "Variator" Two is a set which depends for its rather extraordinary sensitivity upon a special method of getting much more reaction amplification than the ordinary set will give. It may seem somewhat strange, therefore, to devote so much

the poor test aerial used for all new "P.W." sets, and on an aerial of even average size and efficiency it is quite possible to put several of the stronger Germans on the loud speaker quite loudly enough for a small room. The whole secret, of course, is contained in the special reaction device, and it will be as well at this point to turn to the circuit diagram and see just how this is arranged.

Now, a very popular scheme at one time in America was to put a large variometer

POINT-TO-POINT CONNECTIONS.

One filament socket of each valve holder to one side of each respective rheostat.

Remaining sides of the rheostats joined together and to one side of the L.T. switch.

Other side of switch to the L.T. + terminal.

Remaining filament socket of the V. valve holder to the H.T. - and L.T. - terminals, to G.B. +, to the remaining filament socket of V₁, to the earth terminal, to one end of the potentiometer winding, to the plug of the single-coil holder and to the frame and moving vanes terminals on the .0005 mfd. variable condenser.

Other end of the potentiometer winding to the side of the first rheostat joined to the L.T. switch.

Arm on potentiometer to one end of the 2 meg. grid-leak holder.

Remaining side of grid-leak holder to the grid of V₁ and to one side of the .0003 mfd. fixed grid condenser.

Other side of grid condenser to the fixed vanes of the .0005 mfd. variable condenser and to the end of the solenoid coil winding farthest away from the variometer.

Socket of single-coil holder to the remaining end of the solenoid coil winding.

Plate of V₁ to the terminal on the variometer nearest the solenoid coil.

Remaining variometer terminal to the "anode" terminal on the L.F. transformer and to one side of the .0003 fixed condenser.

"H.T. + " terminal on transformer to the remaining side of the .0003 fixed condenser and to the H.T. + 1 terminal.

"Grid" terminal on transformer to the grid of V₂.

"Grid Bias" terminal to the G.B. - plug via a flexible lead.

Plate of V₂ to the L.S. - terminal.

L.S. + terminal to the H.T. + 2 terminal.

Aerial terminal to one of the tappings on the solenoid coil, via a flexible lead with a tapping clip fixed to it.

This completes the wiring.

THE "VARIATOR" TWO.

(Continued from previous page.)

to work, so that it never made much headway in this country. A very simple modification can nevertheless be made in it which removes all these objections and makes it quite easy to work. This modification is merely to use a rather smaller variometer, and instead of depending upon it to produce

tuning coil, but this last is merely mounted behind it. On the baseboard you will see the two valve sockets with their attendant rheostats, the potentiometer, grid condenser, and grid leak for the detector valve, the loading-coil socket for long waves, and the L.F. transformer. Along the back of the baseboard the terminals are arranged on two ebonite strips, one carrying the aerial and earth terminals, and the other those for the batteries and 'phone or loud speaker. Mounted up in the air, so to speak, is a by-pass condenser of .0003 mfd. across the primary of the L.F. transformer, and this

tional work calling for detailed explanation is the winding and mounting of the coil. This is a plain single-layer winding of 55 turns of No. 24 D.C.C. wire on a tube 3 in. in diameter and 3½ in. long, which can be of any good insulating material.

The Coil.

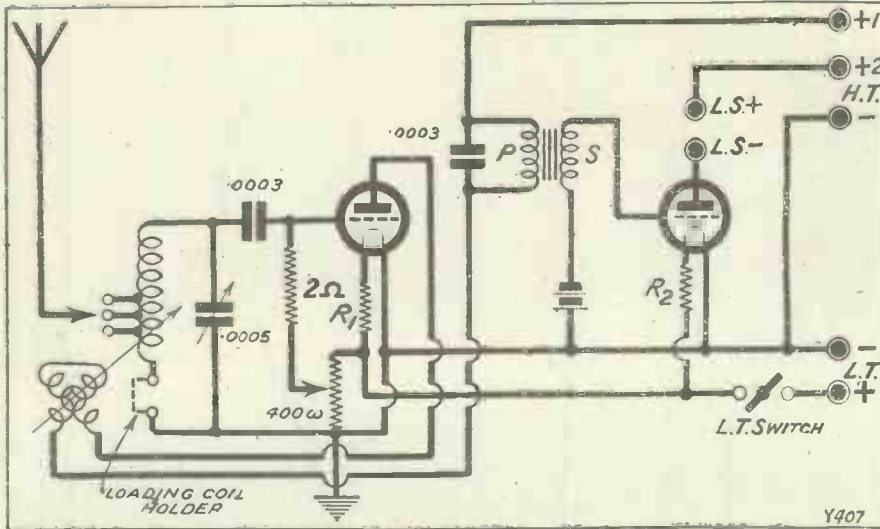
The tappings indicated on the diagram are located at 15, 20 and 25 turns from the beginning of the winding, and can be made by twisting up small loops in the wire at these points as they are reached in winding. The tapping clip is, of course, attached to one or other of these points, according to the size of your aerial, degree of selectivity required, and so on. In general, the lower point gives greater selectivity, particularly with large aerials, while the higher taps give louder signals.

The coil is held in place in the original receiver by means of a short piece of threaded brass rod passing through the panel and secured by means of two nuts. Two other nuts hold the tube itself, the rod passing through a hole therein. Any convenient device can be used here, of course, such as a small bracket made by bending a bit of strip brass.

The wiring of the original set, by the way, was done with No. 18 tinned copper wire covered with Systoflex tubing, but any of the standard materials, such as Glazite, Junit, etc., may be used.

Finally, one or two practical points concerning the operation of the finished set. First of all, as regards the tuning range, it will be found that the single-layer coil alone will cover a band of waves from about 200 to 550 metres, and for this range a shorting link should be inserted in the loading-coil socket. Then, to receive 5 X X and stations on similar wave-lengths, a centre-tapped coil of size No 150 or 200 should be inserted, and the tapping clip attached to the centre-

(Continued on next page.)



reaction by a sort of tuned-anode effect, to place it against the side of the tuning coil so as to produce actual direct magnetic reaction.

Smooth Control.

If you look at the photos of the inside of the set you will see that the coil is of the ordinary single-layer type, and the tube is mounted up against the side of the variometer so that there is considerable coupling between them, the actual strength of coupling being adjustable by the setting of the variometer. A really extraordinarily smooth and effective control of reaction results, so that a very little practice in handling the dials will enable you to search for distant stations successfully, keeping the set all the while just a little way below the oscillation point.

The rest of the circuit is quite plain sailing, consisting of a straightforward detector arrangement, with one transformer-coupled L.F. stage. There is just one other special detail which calls for a word of explanation, however, and that is the provision of a potentiometer for the detector valve.

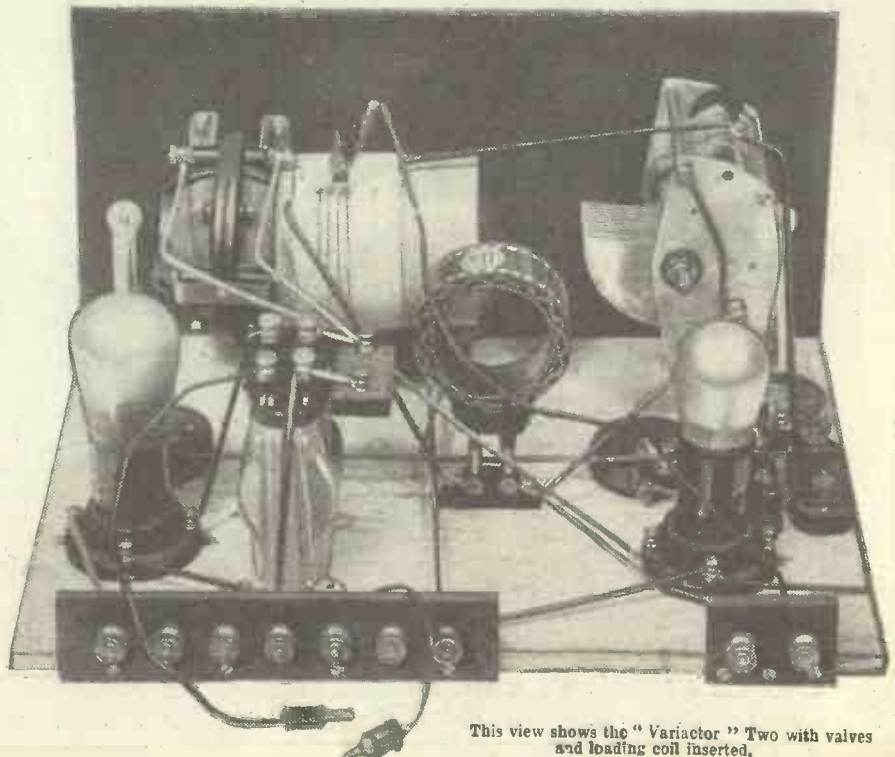
Detector Adjustment.

This is a very simple matter in practice, since all that one does is to try different settings of the slider until one is found which gives the loudest signals on a distant station and also the smoothest control of reaction. You will probably find that this will be with the arm somewhere near the middle, and you should not forget to try variations of H.T. on the detector valve.

Building the "Variator" Two is a very easy matter, as you will see if we run over the main constructional features. The panel only carries the tuning condenser, the variometer and the on-and-off switch, also the

is held in position only by the stiffness of the wires. (Note: If you use a Ferranti transformer this should be omitted, while if you choose the R.L. Varley "Straight Line" type it should be of .0005 mfd. With practically all other makes it should be exactly as shown.)

Probably the only part of the construc-



This view shows the "Variator" Two with valves and loading coil inserted.

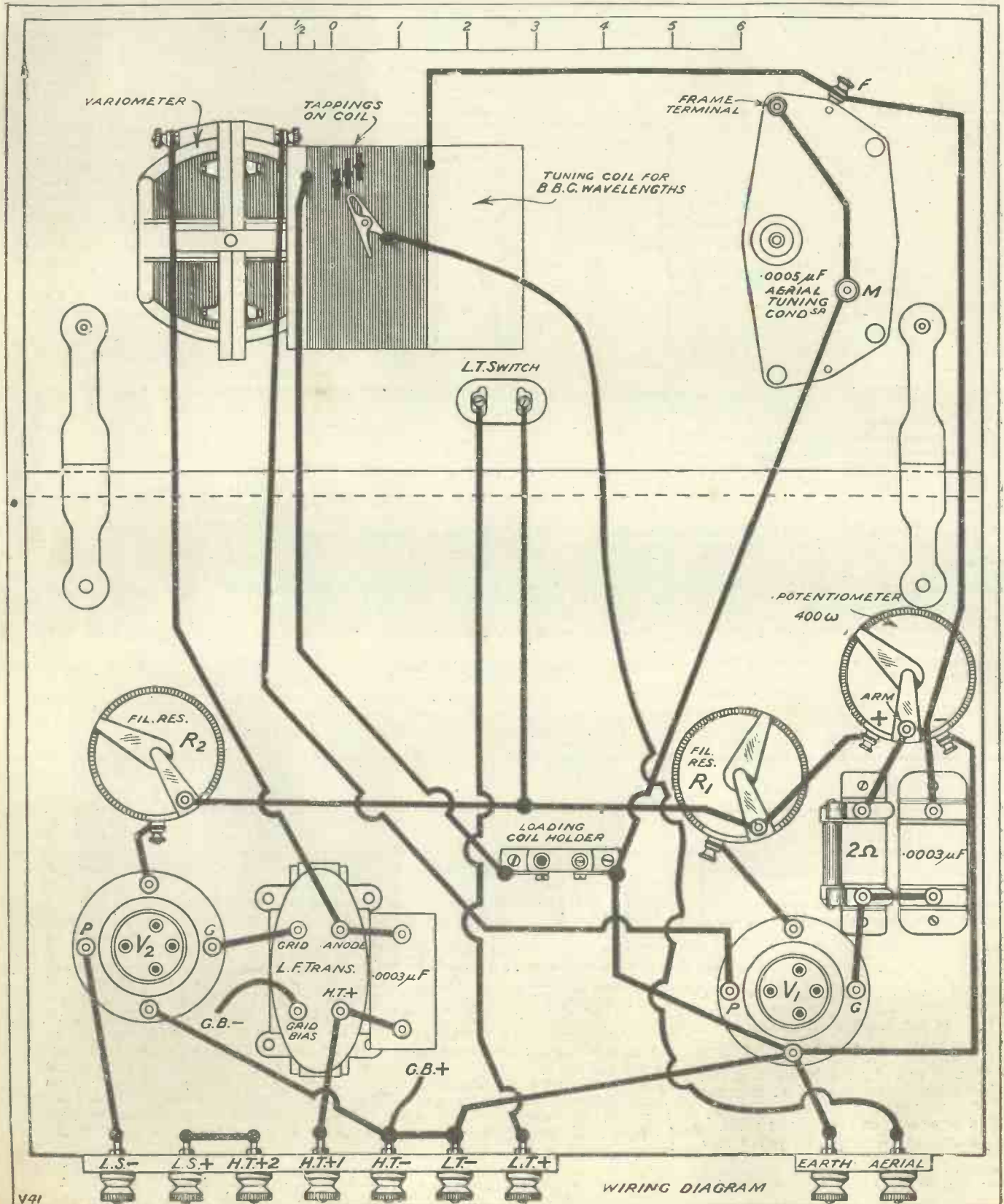
THE "VARIATOR" TWO
(Continued from previous page.)

tap terminal on this coil, instead of its normal place on the single-layer coil.

The question of the potentiometer adjustment has already been covered, but it should be added that terminal H.T.+1 will probably require about 60 volts, while H.T.+2 should be given the maximum available, say 100 or 120 volts, if you want good quality on the loud speaker from your local station, with grid bias according to

the valve maker's specification. For the detector valve one of the H.F. type is desirable, and a power or L.F. type in the second socket. Either 2-, 4-, or 6-volters work well in this set.

One final tip: If at first you do not obtain correct reaction effects, just reverse the leads to the variometer.



WIRING DIAGRAM

THE fact that the B.B.C. short-wave broadcasting station 5 S W recently started a regular broadcast service for the benefit of the Empire has stimulated very considerably the interest in short-wave reception. Just in case any of my readers have missed the official announcement concerning 5 S W, it may be pointed out that the new short-wave station at Chelmsford is transmitting programmes between 12.30 p.m. and 1.30 p.m., and between 7 p.m. and midnight (except Sat. and Sun.).

Stalwart Short-Wavers.

This article is being written before the transmission of the special Empire Christmas programme, but there is no doubt that whether that programme is successfully received over a wide area or not, the progress of 5 S W and short-wave broadcasting in general is as certain and as inevitable as the rising of the sun. The writer ventures to predict that this time next year short-wave broadcasting will have been responsible for the revolution in the present system of B.B.C. programmes, and that we shall be enjoying a system of interchanging programmes by wireless with many other parts of the world.

Listeners with short-wave sets should make a point of trying to tune in some of the American short-wave broadcast transmissions, for instance, 2 X A D, 2 X A F, and K D K A. Some of the ordinary American broadcasting stations are also not very difficult to receive. For example, W G Y, at Schenectady, and W J Z, at Boundbrook, can be heard under normal atmospheric conditions with considerable success. W G Y, by the way, has now a power of 100 kilowatts, and W J Z is working on 30 kilowatts.

A Consistent Station.

The well-known New York station, W E A F, uses a power of 50 kilowatts; and K D K A, Pittsburg, 30 kilowatts. W G N, Chicago, uses 15 kilowatts. There are, of course, many other American stations working on power round about 5 kilowatts. W G Y, on 375.9 metres, should be received without any difficulty on an ordinary four-valve neutralised set, at loud-speaker strength.

The writer has received this station fairly consistently during the last two or three

U.S.A. STATIONS TO RECEIVE.

A Secret Transmitter?—Rugby's Time Signals.
FROM A CORRESPONDENT.

months, and it is surprising how clear and with what excellent quality the signals are received. Fading, too, has not been particularly noticeable, although some interference, especially from ships, is noticed.

W J Z works on 454.5 metres, while W E A F, on 491.8 metres, can be received quite well. Probably the station most readers have heard and with the greatest of ease is W B Z, on 333.1 metres.

Note These Wavelengths.

This station is announced as "W B Zee," and many of our readers will remember the controversy which arose in these columns some time ago by readers mistaking the Z for a C. K D K A, on 62.5 metres, is not very subject to fading, but signals are not of particularly high quality, while W G N, on 300 metres, is so interfered with by spark signal transmissions that it is hardly worth tuning for.

By the way, W E A F, on 491.8 metres, has exactly the same wave-length as 5 G B, so if you sit up fairly late one evening to tune in this station, the adjustments correspond almost exactly on your set with the adjustment for 5 G B, and again, the adjustment for W J Z is the same as that for Stockholm. Adjustments for the reception of W G Y will be found to be just a little below those required for Stuttgart, and slightly above those needed for 2 L O, while adjustments for W B Z correspond very nearly with those for Bournemouth, and Newcastle corresponds in settings to those of K D K A, which has a wave-length just between that of Newcastle and Milan.

Secret "Red" Station.

By the way, if any "P.W." readers have heard the so-called Secret Red Radio Station, the Editor would like them to communicate with him, giving any details.

There appeared a story in the newspapers last week stating that a mysterious wireless station, supposed to be somewhere on, or in the vicinity of, the Baltic Coast, and probably near Denmark, had been noticed by the Danish authorities, as it was sending out Bolshevist propaganda in the Danish language. There is a theory that this station is operated secretly by the Bolsheviks, as the B.B.C. recently informed a Press Representative that it had heard rumours that the Soviet Government proposed to establish a propaganda station in another country.

New Time Signals.

Existence of this so-called secret red station, it seems, was first discovered by Professor William Rung, who, when trying to tune in the Copenhagen Broadcasting Station, heard this Bolshevist propaganda being sent out by an unknown station. No details are available as to wave-length, except that it must be very near that of the Copenhagen station.

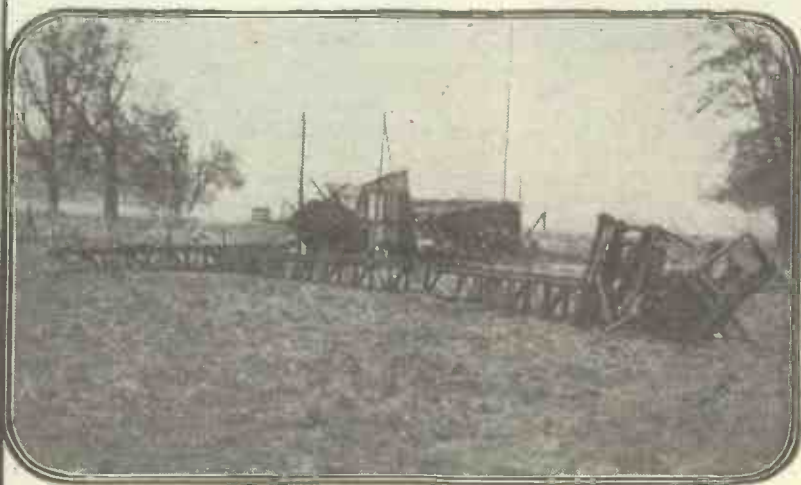
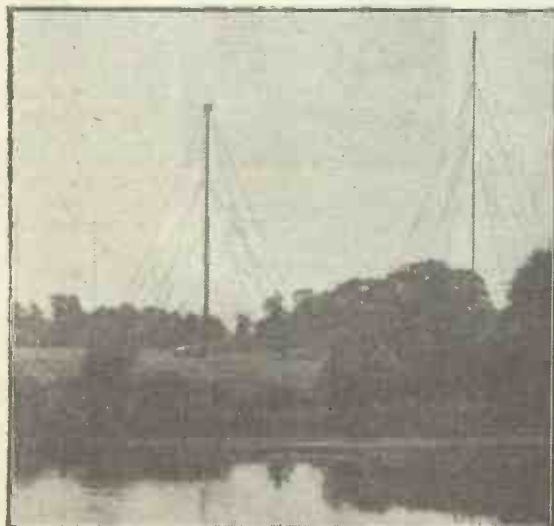
Details are announced of a series of new time signals to be sent out from Rugby. They will be sent twice daily during the five minutes terminating at 10 a.m. and 6 p.m. G.M.T. Each transmission will be controlled from the standard clock at Greenwich Observatory, and will be of the type proposed by the International Time Commission, 1925, and known as the International System of Rhythmic Wireless Time Signals.

Accurate Time Check.

The time signal will consist of a series of 306 signals transmitted in 300 seconds of mean time. Each minute will be clearly marked by a dash of 2/3rds of a second duration, beginning on the exact minute. The dashes at the 55th, 56th, 57th, 58th and 59th minutes will be followed by a succession of sixty dots spaced at equal intervals following the commencement of the dashes at these minutes. The hour will be indicated by a dash of similar duration to the others, commencing on the exact hour.

It is stated that this arrangement helps to provide an accurate time check, and is extremely useful for the ships at sea.

Transmission will be on continuous waves on a wave-length of 18,740 metres.



The radio station at Ditton Park, employed for scientific research by the Radio Research Board, was recently burnt down, and instruments of almost incalculable value were destroyed. On the left is a photo of the station taken before this catastrophe, while on the right clearly can be seen the ruins of the hut and the 220 ft. mast which crashed down in flames.

TECHNICAL NOTES.

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

CONE LOUD SPEAKER PATENTS.

A CURIOUS TRANSFORMER—FLYING BY WIRELESS—A TIME MACHINE.

Cone Loud Speaker Patents.

A GOOD deal of controversy is going on at the present time with regard to what is known as the "cone patent question," to which reference has been made before in these "Notes."

The position appears to be rather complicated and, according to an official of one of the well-known Companies, it may be that it is possible to make a cone "of sorts," so to speak, which does not infringe existing patents, but that worth-while advantages are obtained by adopting the construction and other features which are the subjects of patents.

This would, of course, not be the place to express my opinion on the cone patent question, but it seems to me a great pity that some general working arrangement cannot be arrived at so as to avoid litigation and to give the wireless user, as well as the trade, a feeling of security. Whenever it becomes known that there is a clash of interests, this always produces a timidity amongst a section of the buying public and has a directly adverse effect on trade.

A Comparison.

Talking about loud speakers, and cone loud speakers in particular, you



The Marconiphone Amplifier panel, which, using 19 valves, is embodied in the wonderful Lambeth Hospital radio installation, and

know that the main advantage claimed—probably rightly—for the cone type over the horn type is that the former, in addition to being much more compact and slightly, gives a more uniform reproduction throughout the usual audio range.

There are certain essential characteristics to be kept in mind in designing a loud speaker of the so-called "cone" or "diaphragm" type. What is required in the diaphragm is to obtain a large surface of great stiffness or rigidity and, at the same time, of extreme lightness. If we could have, for example, a plain disc of a material which, whilst being extremely light in weight (or small in mass, to speak more scientifically) was at the same time very rigid, this would act in the same way as the cone. The rigidity of the cone is imparted to it by reason of its geometrical shape.

The difficulty is to make a plain disc

with a rigidity equal to that of the cone. But in this connection I hear of a new patent diaphragm built up in a special way, somewhat on the principle of three-ply wood which, although made of paper or aluminium foil or other very light material, has also the extreme rigidity of the cone. This diaphragm is obviously entirely outside the cone patent dispute and, therefore, has important advantages quite apart from its technical ones.

Resonance.

Before leaving the subject of loud speakers I should like to make a reference to the Donotone loud speaker which I heard some considerable time ago and which, I understand, is now even better than when I heard it. This incorporates a very novel feature in that it makes use of a multiplicity of resonant members which pick up and reinforce the various tones in the reproduced sound and certainly give a remarkable purity of tone.

Loud-speaker reproducer units are now, as you know, available to be secured to some part of a pianoforte and so to take advantage of the ready-made set of resonators represented by the strings of that instrument. In a sense, the underlying idea here is similar to that of the Donotone, but in the latter instrument the resonant members are tuned gongs and appear to me to be much more directly available to the reproduced acoustical vibrations than in the case of the piano instrument.

H.T. Performance.

I have had, during some time past, the opportunity of testing the new Lissen H.T. dry battery, and it is only fair to remark on the extremely good performance which it has put up. Not only has it maintained its voltage in a remarkable way, in spite of being frequently subjected to heavy overload, but it has entirely failed to develop the crackling noises and "artificial static" which are so frequently a sign of premature decay with H.T. dry batteries.

I understand that Messrs. Lissen, Limited, have some trade secrets in regard to the manufacture of this battery. With this I am not concerned, but on the theory that the "proof of the pudding is in the eating," it would certainly seem that the secrets, whatever they may be, are very useful ones.

A Curious Transformer.

A curious transformer, involving a novel principle, has lately been patented by the Etablissements Brunet of Paris, the well-known manufacturers of headphones. This transformer is provided with a control knob at the top which connects with the core of straight iron wires. The windings surround this core in the usual way. The novel feature of the transformer is that the system of iron wires forming the core may be twisted by means of the control knob and the angle of

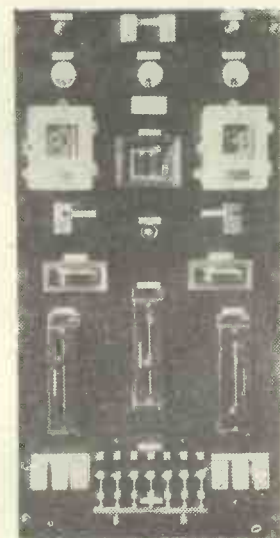
twist is indicated by means of a pointer attached to the control knob, the pointer moving over a graduated dial on the top end of the transformer. It is claimed that the characteristics of the windings may be usefully varied by twisting the core in this way.

Oiling Aerial Pulley.

Amongst my recent correspondence is a letter from a reader describing an ingenious way of doing an awkward little job, that is, oiling the aerial pulley at the top of a mast. This is done simply by tying a length of three or four inches of cotton wool or felt to the rope and soaking this cotton wool thoroughly with oil, then letting the aerial down until the felt lies over the pulley and applying tension so as to squeeze the oil out of the felt against the pulley and leaving it to run into the bearing. As a matter of fact, this little dodge is quite an old one, but I thought it might be worth passing on to readers in case it should prove useful.

Flying by Wireless.

Some little time ago a pilot flying a machine belonging to Imperial Airways had the remarkable experience of travelling from Paris to London almost entirely by means of wireless directions. The pilot was Captain A. Willcockson, flying a Handley-Page Rolls-Royce machine, and he completed the journey in less than two and a half hours, which was a good average time for the trip. Leaving Le Bourget at eight o'clock in the morning in a dense fog, he rose to a height of about 2,000 feet and got



here is the control panel. Towards the top, left and right, are the automatic switches. These wind up like clocks and switch the installation on and off at prearranged times.

clear above the fog and into bright sunshine. He flew practically the whole journey above the fog by compass bearing and asked several times for bearings and positions from Croydon.

"I had no difficulty at all in keeping in communication with Croydon at any time, whether I was in the fog, above it, or coming down to the aerodrome, but it would have been impossible to have

made the journey without wireless," said Captain Willcockson. "The apparatus I was using was the ordinary A.D.6 apparatus and not any new or special apparatus."

There were five passengers in the machine, and they had a comfortable journey and were quite thrilled with their novel experience.

A Time Machine.

When searching for foreign stations, of course you have to make the necessary

(Continued on page 984.)



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HOWEVER long the programme, with a Lissen Battery in your set you will find your loud speaker from first to last reproducing with a clarity of tone and a truth of utterance which will make your Radio thoroughly enjoyable.

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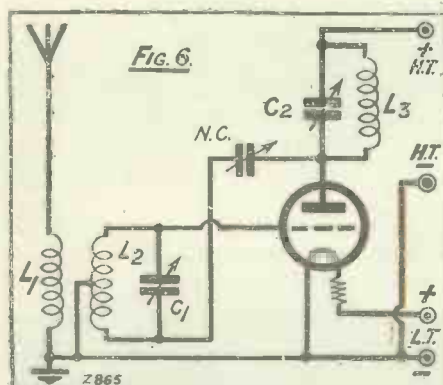
THE A B C OF H.F. AMPLIFICATION.

The final article of the second series for the new amateur. Next week the L.F. amplification series will commence.

By G. P. KENDALL, B.Sc.

LAST week we considered the general principles of the split-tuned anode and the split-primary circuits. Another well-known method of neutralising with which we must deal very briefly is illustrated in Fig. 6, and this is what is called the split-secondary type. In this circuit the neutralising feed-back is taken from the anode end of the anode circuit, but is led back to such a point on the preceding grid circuit that it produces an opposite effect to the feed-back which takes place inside the valve.

Actually, it will be seen that the centre point of the secondary coil L_2 is connected to earth and filament, one end going to grid and the other end being left more or less free. If we arrange our neutralising feed-back on the free end of the circuit, it



will be seen that the currents fed back through the neutralising condenser will pass to earth through the lower half of the coil. Those currents which are fed back through the plate-to-grid capacity of the valve, however, will pass through the other half of the coil from the grid end to earth by way of the centre tap, and since these two currents, therefore, pass through the coil in opposite directions, their effect will naturally be to cancel each other out.

A Tricky Circuit.

In this way a neutralising adjustment can be obtained which, under favourable conditions, is usually rather more perfect than that given by a split-primary circuit, in the sense that once the correct adjustment has been obtained it holds good over the whole tuning range more perfectly. In practice it has been found that this advantage is to some extent offset by the fact that the circuit is, on the whole, rather more tricky than the split primary, and, further, that a somewhat reduced degree of amplification is obtainable. These are points which can be to some extent overcome, but, nevertheless, they have been rather against the circuit, and it has not

gained nearly so wide a degree of popularity as the split primary.

Fig. 7 shows a practical version of the split-secondary circuit, and it will be seen that here the intervalve-coupling circuit is not a tuned anode, but is the more usual H.F. transformer scheme, with reaction upon the secondary winding L_4 , from the winding L_5 . L_3 is the primary, and so far as the neutralising is concerned can be looked upon exactly as was the anode coil in Fig. 6. Neutralising potentials are taken from the anode through a small neutralising condenser to the free end of the grid circuit exactly as before.

The circuit shown in Fig. 7 is quite a practical one, and has been incorporated in many sets. One interesting feature which should be noticed is the resistance R , mention of which point brings us to one of the special details which must be considered in connection with split-secondary circuits. This is a tendency to what is called "parasitic oscillation," to which space will only permit me to give rather a passing mention. The fact is that circuits of this kind are very apt to break into oscillation at some extremely high frequency, that is to say, short wave-length, being actually the natural wave-length of each half of the split-grid coil.

Eliminating Parasitics.

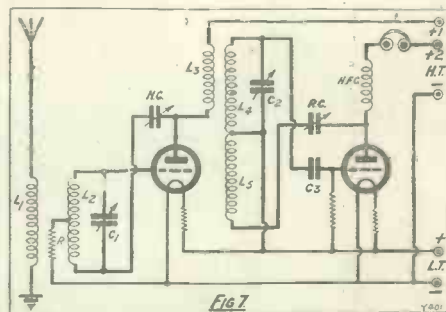
This oscillation is not controllable by means of the neutralising adjustment, and was at first a great drawback to this circuit. Various methods of eliminating it have, however, been devised, and the resistance R is one of the simplest of these. This is simply any standard high resistance of some such value as 100,000 ohms in the conventional circuit, and has the effect of

principal drawbacks, and it would appear that a certain amount of success is meeting these efforts.

A New Method.

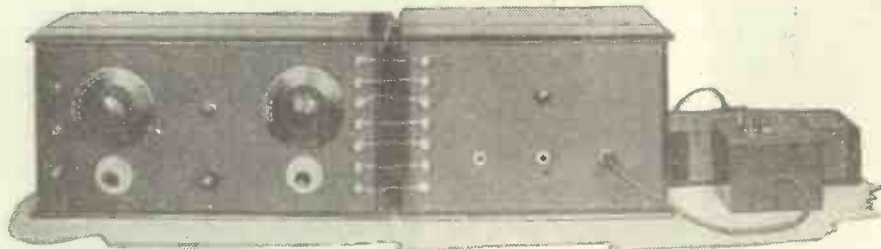
Although it is not possible to go into the matter more fully, I cannot conclude this series of articles without a brief mention of a comparatively new but important method of H.F. amplification, namely, that which uses the new shielded valve. Articles have appeared comparatively recently in various journals describing the functioning of the valve, but it may be as well to remind the reader that it attacks the problem of instability from an entirely different angle, aiming at cutting out the cause of the instability in the valve rather than neutralising it or otherwise getting rid of it by external means.

In these valves, a special screening electrode is inserted between the grid and



the plate, which is connected to earth through a part of the H.T. battery, this latter being simply included so as to apply a suitable positive bias to the shield, and this has the effect of screening the plate from the grid so thoroughly as almost to eliminate the internal feed-back which has been the bugbear of H.F. amplification.

If due care is taken to eliminate practically all possibility of feed-back from stray coupling effects in other parts of the circuit, for example, between coils and leads and so on, it is possible to produce a perfectly stable H.F. amplifier, and in practice a very high degree of amplification can be obtained with these valves without the slightest tendency to self oscillation. As a matter of fact, the degree of amplification



Here is (right) a low-frequency amplifier connected to a two-valve set. Note the neat and simple method of coupling. The terminals on the set are the battery and 'phone terminals. Next week Mr. A. Johnson Randall contributes the first of a short series of articles for the beginner on L.F. amplification.

damping out these parasitic oscillations very thoroughly. In some cases a high-frequency choke is used instead of the resistance R , a similar effect being obtained.

Although the split-secondary circuit has not been looked upon with great favour in the past, there are signs that in the future it may achieve somewhat greater popularity, since a good deal of work is being done with a view to removing some of its

which they give in suitable circuits is so great that very special pains must be taken to reduce the chances of stray feed-back taking place at odd points in the circuit, and to use such valves demands rather a special set. For a full explanation of the action and use of the screened-grid valve, I am afraid, however, that I can only refer the reader to previous issues of "P.W.," containing special articles upon the subject.

THE WASHINGTON CONFERENCE.

A story of what happened and how it took place.

By OUR SPECIAL CORRESPONDENT.

AFTER eight weeks of talk, countertalk, and many runours, we are able to sit down and describe the results of the International Radiotelegraph Conference which closed at Washington on November 25th, 1927.

Many readers have not realised what a huge concourse of people were engaged in these discussions, which are likely to have a profound effect on amateur radio the world over and this country in particular.

Multitude of Committees.

In all about 500 people attended this, the greatest conference on International communication the world has ever seen. Something like 78 countries were represented in the scramble for a place in the ether, and so vast was the ground covered during the deliberations that it was necessary to split the meetings into a number of committees, sub-committees and sub-sub-committees.

The committees sat morning, noon, and night right through the session and every day people came and went to the various rooms, people of all tongues and colours and creeds engaged in the seemingly impossible task of parcelling out the ether to the various services. Paper was used by the ton, agenda, minutes, and notes. Pencils were used by the yard and ink by the pint.

Gradually the programme was worked through until that fatal day when quite definitely the fate of the amateur was in the balance and his future hung by a thread. At one time there was the possibility of his speedy extermination, and all amateurs have but to thank the untiring energy of K. B. Warner, Secretary-Editor of the Radio Relay League, Vice-President C. H. Stewart and, last but not least, the American Government delegation, that this catastrophe was averted. From time to time delegates from Italy, Australia and New Zealand and Canada backed them, but always the British delegation harried and hunted the amateur in every way possible and attempted his undoing.

It should be clear that the British delegates did not advocate the extermination of him at any time. Our Wireless Telegraphy Bill, with its hard-won privileges, prevented them from doing that, but if it had not been for this Bill there is no doubt but what amateur radio would have been a thing of the past, so great was the influence of the British delegation at the conference.

A Disastrous Proposal.

Japan was responsible for the first suggestion that the amateur should be confined to "dummy aerials." This is somewhat interesting, seeing that Japanese amateurs are very poorly organised, and shows that it is for every nation to see that its amateurs get a fair show in its legislation.

This effort on the part of Japan was neatly stopped by W. D. Terrell, Chief of

the American Radio Division of the Department of Commerce. This gentleman made a telling speech in which he made it quite clear that America required that its amateurs should have a fair show. After this the subject became referred to a sub-sub-committee on the amateur consisting of eleven members, with Professor Mesny of France as its chairman. Owing to the kind efforts of the American delegation, Mr. Warner was made a member of this committee.

For days the battle waged, and it was noted that liberally-minded delegates were Captain Montefinale, of Italy, Commander Edwards of Canada, Mr. Brown of Australia, and Mr. Gibbs of New Zealand. The odds were uneven, however, and had it not been for the American delegation the amateur would have lost more than he eventually did. From the very first, this delegation made it quite clear that the amateur simply must have his place in the ether, and so the discussions went on.

Further Restrictions.

Mr. F. W. Phillips, of the British Post Office, was a member of this sub-committee, and his one anxiety was to restrict the amateur to very narrow wave-bands. The whole of the following deliberations were based on an interpretation of the word narrow. By a very small majority the word narrow was eventually retained. The question of allocation did not enter into the discussions at this stage, and the report

amateur should share a small portion of the already shared bands. Such a condition of affairs can easily be imagined, both from the point of view of the amateur and the point of the view of the other sharers of the band. It could have led to but one conclusion, a long-drawn-out story of trouble, jamming and mutual interference, with its consequent administration difficulties. Happily the idea was squashed by the aid of the Italian delegate who advocated 20-40 and 80 metres.

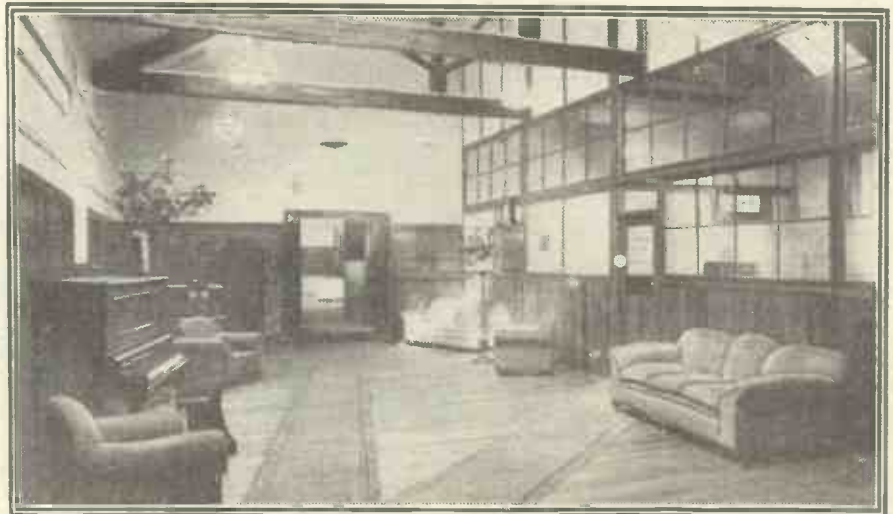
The End of the Battle.

Mr. Shaughnessy stuck out for narrow bands as defined by the sub-sub-committee before referred to. The matter was again referred to the committee, and this was composed of seven members: Colonel Mauborgne, Commander Craven of the U.S.A. Navy, Major W. A. Steel of Canada, Dr. Van der Pol of the Netherlands, representing the Broadcasting stations, Mr. C. E. Rickard representing the Marconi Beam stations, Capt. H. Abraham of Germany representing Telefunken, and Mr. Warner.

This was the last stage of the duel, and upon these people the fate of the amateur depended. They were a strange group, and only one represented a Government, the others representing the various concerns referred to. Major Steele was the Canadian Government representative.

After a deal of argument, the wave-bands eventually decided upon were 160, 80, 40, 20, 10, and 5 metres, and even at the end Mr. Shaughnessy of the British Post Office objected to the last two bands as being earmarked "amateur," as if the amateur succeeded in developing the band into a useful communicating band it would have to be used for some purpose apart from amateur experiments! Nobody can say that this delegate was not at least living up to the reputation of Government servants in so far as cautiousness is concerned.

The final position cannot be decided



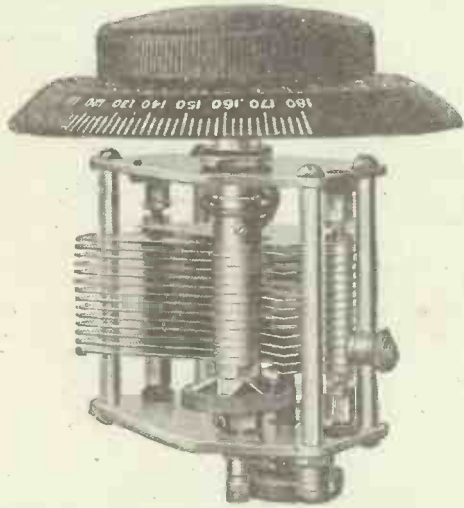
The "No. 2" studio at 3 L O, Melbourne. Hung from the second rafter is a cone loud speaker, so that artistes in the studio may hear outside broadcasts while awaiting their turn.

eventually reached the main committee under Mr. Shaughnessy, and was adopted. From here it went to General Ferrie's committee with the same result, and then to Professor Kennelly's committee for the question of allocation to be settled.

To cut a long story short, Mr. Shaughnessy led off with a proposal that the

until the various administrative promulgate their decisions as to how much they will allow their amateurs, but in no cases are the concessions likely to exceed those outlined below:

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BROADCAST NOTES

FROM OUR BROADCASTING CORRESPONDENTS.

Scottish Broadcasting—Hallé Orchestra for London—A Lionel Tertis Recital—German Conductor at Liverpool—"The Black Cat Cabaret"—A Syngé Programme—A Glasgow Speciality—Arthur Catterall at Manchester—Cardiff's Radiologues—Schulhoff at 2 L O.

Scottish Broadcasting.

FOR some time past Mr. Cleghorn Thomson, the young and brilliant director of the Northern Area, has been introducing with conspicuous success an ever increasing element of Scottish characteristics into the programmes of those stations which come immediately under his control. All phases of broadcasting activities have been dealt with, including religion, in connection with which a special series of talks has been arranged for Sunday afternoons during the first half of the New Year.

The talks, to which both ministers and laymen will contribute, have been divided into two sections—historical and topical, and the first in the historical section, under the general title of "The Church in History," will be given at 4.15 p.m. on Sunday, January 8th, when the Rev. Dr. Archibald Main, Professor of Ecclesiastical History in the University of Glasgow, takes as his subject "The Dawn of Christianity in Scotland—St. Columba." The second part of the series will describe what the Church is doing, and will be given by people responsible for the social side of Scottish religious activities.

Hallé Orchestra for London.

The visit of the famous Hallé Orchestra to London for the National Concert, which Sir Hamilton Harty is to conduct at the Queen's Hall on Friday, January 13th, recalls the sensation created in Metropolitan musical circles two years ago by their fine playing during a series of three concerts in the same hall. The programme on January 13th consists entirely of Wagner, and should make a very wide appeal as it includes such varied items as "The Mastersingers Overture," "Siegfried's March," excerpts from "Tannhäuser" and "Tristan," and "Siegfried's Journey to the Rhine."

A Lionel Tertis Recital.

Lionel Tertis is a famous viola player who has inspired many composers—Dale, Bax, McEwen, Carse and Bowen all having written concertos for him. He began his studies with the violin, but quartet music drew his attention to the possibilities of the viola, which in his hands is a solo instrument of great beauty and perfection. Mr. Tertis is to give a recital of pieces for the viola and piano between 8.40 and 9 p.m. in the London studio on Thursday, January 12th.

German Conductor at Liverpool.

The sixth concert of the Liverpool Philharmonic Society on Tuesday, January 10th, to be broadcast from the Liverpool and Daventry Experimental stations, will be under the direction of Oskar Fried, the conductor of the Berlin State Opera, an important post to which he was appointed last year.

He is also a composer, being a pupil of Humperdinck and Scharwenka, and has a

number of interesting works to his credit, though in this rôle he is not so familiar in England as he is for his appearances with the baton in both studio and public concerts. The programme on January 10th will include Brahms' "First Symphony" and the same composer's "Alto Rhapsody," in which the solo part will be sung by Astra Desmond. Other works are Delius' Rhapsody on the English tune "Brigg Fair," and excerpts from Berlioz' "Damnation of Faust."

"The Black Cat Cabaret."

The experiences of a suburban dweller in the night life of London is the basis of a new revue called "The Black Cat Cabaret," the book, lyrics and music of which have been specially written by Ernest Longstaffe, the author of many similar radio productions. It will be broadcast from Manchester



His Excellency the Governor of Victoria, broadcasting from 3 L O, the Melbourne station (Photo: C. J. Frazer, Melbourne.)

and Aberdeen on Saturday, January 7th; from Newcastle and Glasgow on Saturday, January 14th, and from London and the Relay Stations on Saturday January 21st.

A Syngé Programme.

A programme arranged round the works of J. M. Syngé, the well-known Irish playwright, is to be broadcast from London on Thursday, January 19th. The exact form which this transmission will take has not yet been decided, but the idea is to make it thoroughly representative of Mr. Syngé's literary activities, which include, as most people know, "The Playboy of the Western World," "The Tinker's Wedding" and "Riders of the Sea," together with other notable pieces. Mr. Syngé was associated with Lady Gregory and W. B. Yeats in the production of many famous plays at the Abbey Theatre, Dublin.

A Glasgow Speciality.

The All-Scottish concerts, contributed by one or other of the stations north of the

Tweed and broadcast as S.B. items for Scottish listeners, have proved so popular that it was inevitable that arrangements should be made to continue the series during 1928. Glasgow Station is due to give one on Tuesday, January 10th, when the programme will be sustained by the Scottish Co-operative Wholesale Society's Prize Brass Band, which was heard by the Prince of Wales during his visit to Shawfield; Nell Ballantyne, whose singing at a concert in St. Andrew's Hall a short time ago attracted so much attention; Pipe-Major Gavin Robertson, of the Corporation Tramways Band; and Matthew Nisbet (bass) who carried off a prize at the Glasgow Musical Festival.

Arthur Catterall at Manchester.

Arthur Catterall is one of the most distinguished musicians that Manchester has ever produced. For some years he was leader of the Hallé Orchestra, and frequently appeared at Hallé concerts, playing concertos. His work in Chamber Music has been no less important, and his string quartet, known by his own name, is one of the leading organisations in this country. It deserves to be known better abroad, where it would hold its own with any of the leading contemporary quartets of the day.

Mr. Catterall and his quartet are giving a series of Chamber Music concerts at Manchester which are to be relayed to the London or Daventry Experimental stations. The first concert takes place on Wednesday, January 11th, and the programme will include an unfamiliar quartet by Turina, the Spanish composer who visited the London studio to play and conduct some months ago.

Cardiff's Radiologues.

For some time past Cardiff station has been conducting experiments in the presentation of new dramatic forms, particularly as these can be applied to artistic settings for running commentaries and in the development of music drama. The experiments have resulted in the evolution of a new venture in broadcasting, to which the title of "Radiologues" has been given.

A "radiologue" is story-telling in a new form, the narrator taking the place analogous to the chorus in Greek drama, the dialogue being supplied by the actors. The idea is undoubtedly an improvement upon the reading of a short story by one person, for not only will it preserve the story in its original form, but it will eliminate the necessity for the usual stage settings of acts and scenes.

A series of "radiologues" will be broadcast in 1928. The first has been prepared by Mr. E. R. Appleton, the Station Director, and has a place in the programmes on Thursday, January 12th.

Schulhoff at 2 L O.

The Chamber Music concert from the London Studio on Sunday, January 8th, will include piano music by Schulhoff, the composer and pianist who made his first appearance in British broadcasting at the Grotian Hall Chamber Series given by the B.B.C. last year. His music is interesting, witty, of clever workmanship and considerable novelty of style and material. He has done a good deal of propaganda for modern music by his recitals all over Europe.

Modernising an Old Set



How an old receiver was brought up-to-date and how the various "snags" encountered were overcome. An article of interest to all who wish to modernise their receivers.
By E. A. ANSON.

IT was an old set, but I had not had the heart to dismember it, for it had given me years of faithful service. The components were good and I could look back down the years and say truthfully that never once had they let me down. Always when I wanted it to work well it had worked well—for a 1922 receiver. It had never even allowed a valve to burn out in its service. As you know, the bright

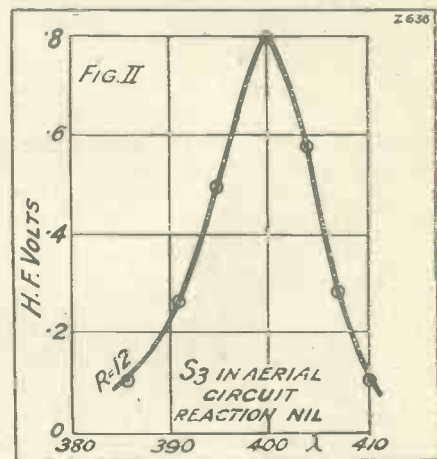
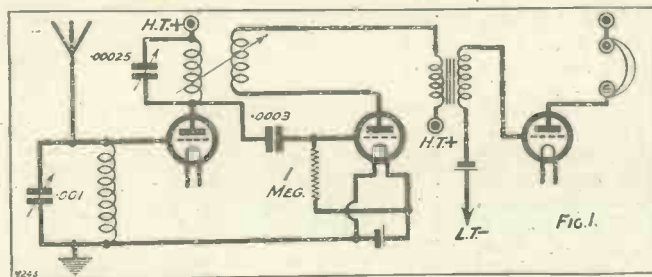
principle. Grid leak, detector and Sullivan L.F. transformer. As a matter of fact, a complicated switching system put the aerial condenser in series or parallel with the aerial coil and the L.F. valve could be turned on by a similar switch. But I have spared you this circuit complication in the diagram. Anyhow, the H.F. switching was eliminated in the conversion.

The aerial condenser is .001 maximum, and the anode condenser .00025. Both have vernier plates. These condensers were made by Sterling and proved to be excellent condensers.

Now let us see what this set could do. With bright-emitter 4-volt valves the H.F. amplification on 400 metres, using no reaction, was barely 2. This amplification was measured with a valve voltmeter, and is the ratio of

controllable and far from the oscillation point. The L.F. results were quite good on a loud speaker when using 5-7 volts grid bias.

No resonance curve was made with the bright-emitter valve, but Figs. 2 and 3



emitters of 1922 were fickle creatures, whose filaments were prone to rest their sagging lengths on grid or plate before their day's work was done.

So I decided to modernise my faithful set; to give it unstintingly all that was best to-day. The conversion was not so simple as I thought. In fact, had I known the rocks ahead this set might have gone the way of many others—a little pile of grid condensers, leaks, and ebonite upon my working bench.

However, the snags and tribulations, the teething troubles that beset the conversion make good reading. For step by step I stopped, I reasoned, and I tested to see how things progressed. Now my troubles might be your troubles if you tried to modernise your set. So perhaps if you read through this the pitfalls into which I fell and from which I slowly floundered may not come your way.

A Simple Circuit.

The diagram is the circuit of my faithful set as it saw the light of day late in '21. The photo shows the set almost as it was then, except that condenser reaction had been added when the photo was taken. Moving coil reaction was employed in the original circuit but more about that comes later on.

It is a simple 1 H.F., Det., 1 L.F. The H.F. being on the normal tuned-anode

H.F. volts across the anode coil divided by the H.F. volts across the aerial coil when connected to a .00028 mfd. capacity single-wire aerial. On the L.F. side results were all right on headphones. That is weak signals were certainly made stronger, but for loud-speaker work results were quite ghastly—naturally!

An Improvement.

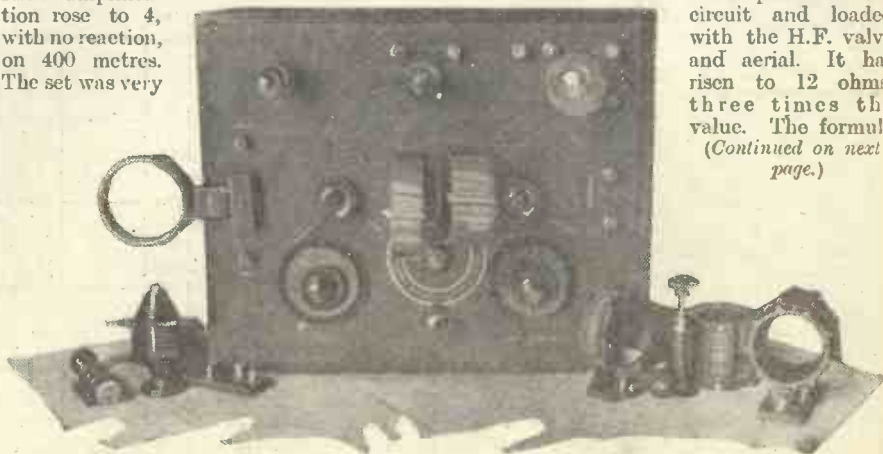
More modern valves, D.E.2H.F., D.E.2L.F., D.E.P.215, gave much better results. The D.E.2H.F. has a mu of 12. The actual H.F. amplification rose to 4, with no reaction, on 400 metres. The set was very

give resonance curves for the old receiver on 400 metres, using no reaction and D.E.2H.F., D.E.2L.F. valves.

H.F. Resistance.

The coil used in the aerial circuit was a Burndept S3. Its true H.F. resistance as tested with a valve voltmeter, making due allowance for the load of the valve voltmeter, was 4 ohms at 400 metres. From the resonance curve it is possible to calculate the apparent H.F. resistance of this coil

when placed in the circuit and loaded with the H.F. valve and aerial. It has risen to 12 ohms, three times the value. The formula
(Continued on next page.)



The receiver under discussion—before it was modernised.

MODERNISING AN OLD SET.

(Continued from previous page.)

for calculating H.F. resistance from resonance curves is as follows:

$$R = 153 \frac{\lambda \times \Delta C}{C_0 \times C_0}$$

Where R = required resistance,
 λ = wave-length in metres,
 ΔC = width of resonance curve in metres at $\frac{1}{2}$ resonances,
 C_0 = capacity at resonance in mmfd.

This and the other resonance curves were made with the help of a wave-meter and a

metres is 16 ohms. When inserted in the anode circuit using no reaction the H.F. resistance rose to 18 ohms. Thus, the load on this coil in the plate circuit of a tuned anode H.F. valve feeding the detector grid through a .0003 condenser increases the H.F. resistance to 2 ohms. In this circuit there is no aerial load, only valve load. A station at 386 metres and 424 metres would come in at a quarter strength. Not very good. But when reaction is pushed to its utmost we have the inner resonance curve. The apparent H.F. resistance is now 2.6 ohms. That is reaction has reduced the H.F. resistance of the circuit nearly 7 times. Of this 2.6 ohms probably .6 ohm belongs to the coil and 2 ohms belong to the valve loading, for the reaction would reduce the losses in the coil more than the losses due to loading. A station as close to 400 metres

in a third condenser, I have put in a choke. The third condenser situated between the two other tuning condensers may be interacting with the others, or the H.F. choke may be coupling with either the aerial tuning coil or the anode

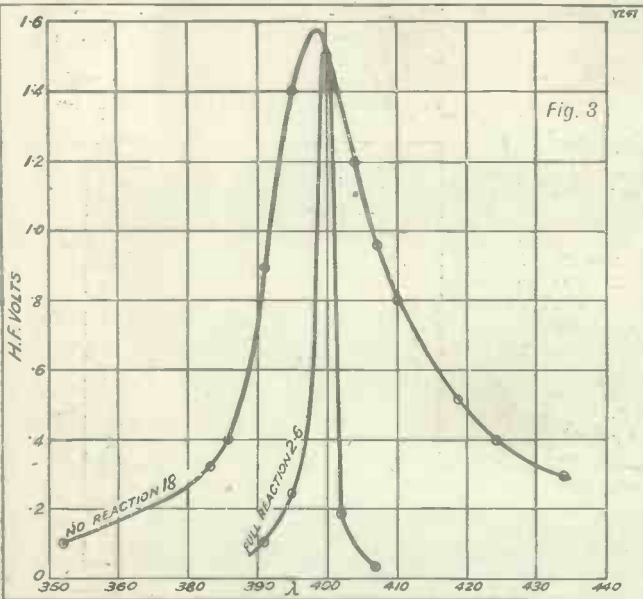


Fig. 3

valve voltmeter. The valve voltmeter was connected in this case across the aerial coil. All circuits were tuned to 400 metres and the wave-meter condenser varied on both sides of resonance, the H.F. volts and wave-lengths being noted. In this case another station on 390 metres or 409 metres would

as 397 and 402 metres now comes in at a quarter strength—not bad. But remember reaction had been pushed to its utmost, in fact, that peculiar hollow rushing noise could just be heard.

Instability.

So much for the old set. These tests show pretty well what it was doing.

The first improvement was to add condenser reaction. Fig. 4 shows this.

As there was a 2 mfd. condenser across the H.T. the reaction was not connected to L.T.— but to H.T.+ via this 2 mfd. condenser to L.T.—. This method avoids shorting the H.T. if the

reaction condenser vanes touch one another. As a matter of fact, with the condenser used, a .0005 Miniloss, this was very remote, but anyhow my motto always is "Safety First."

The result was dreadful! At low settings of the reaction condenser under about 20 one heard all the howls and chirrups ever born in a wireless circuit. The choke was home made—800 turns of 30 D.C.C. between two 1½-in. discs of ebonite spaced ¼ in.

For a week I was stumped. The old faithful did not like being modernised, and shrieked disapproval.

I thought like this: It is obvious that H.F. inter-action is occurring between two points—one point is feeding H.F. energy to the other—hence the squeal. What have I altered? I have put

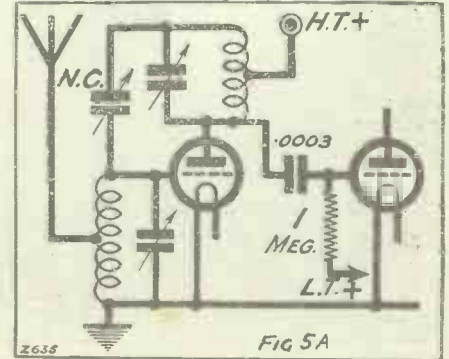


FIG 5A

coil. Taking the reaction condensers, it is obvious that the vanes connected to the plates of the detector valve will be at H.F. potential.

It is obvious that the other tuning condensers fixed plates are also at H.F. potential to earth. If this is the case and the condensers are feeding back one to another there is nothing for it but to enclose all these condensers in metal shields.

So I did. It took me four hours to construct suitable earthed zinc shields for each condenser.

But it was worth while. The shriek disappeared. Reaction was beautifully smooth, and the set went out of oscillation at exactly the same point that it commenced to oscillate.

Improved Results.

Don't you feel proud when you have solved that wireless trouble of yours? I did in this case, but there was nobody to tell about my solution!

This condenser reaction improved the

(Continued on page 967.)

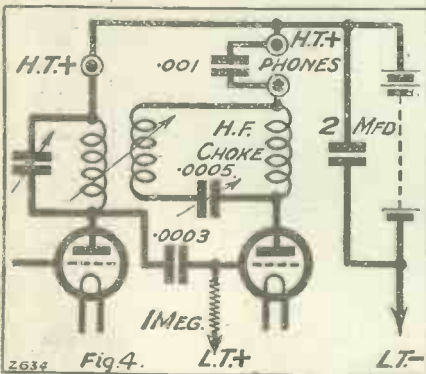


Fig. 4.

have come in at a quarter the strength of the station to which the receiver was tuned. All right when separating a nearby station from a distant station but hopeless in trying to do the reverse. The aerial and valve-loading is significant and not good.

Resonance curves for the anode circuit are shown in Fig. 3. A Bærdept S4 coil was used. Its true H.F. resistance at 400

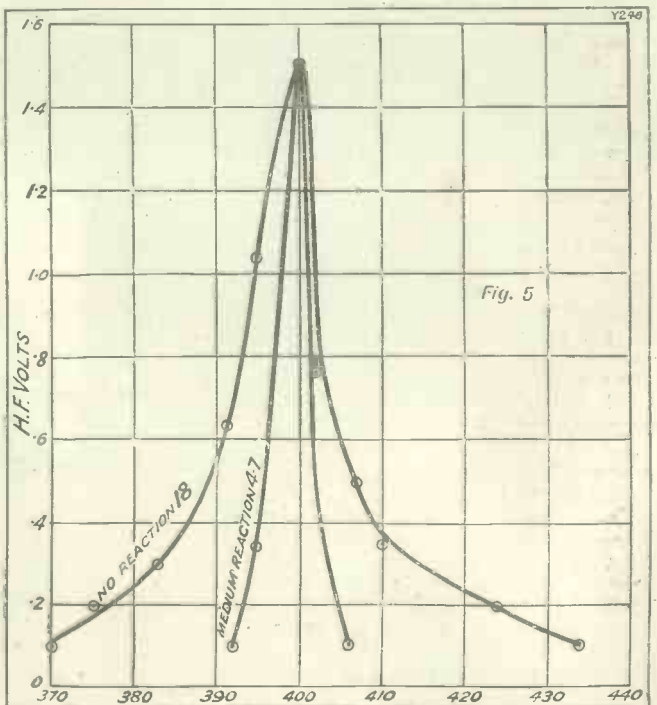
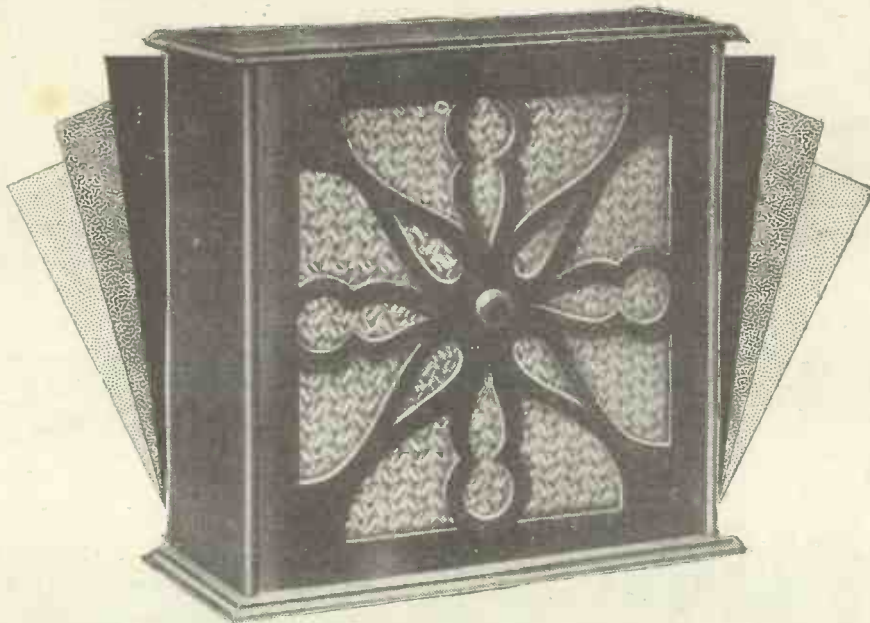


Fig. 5

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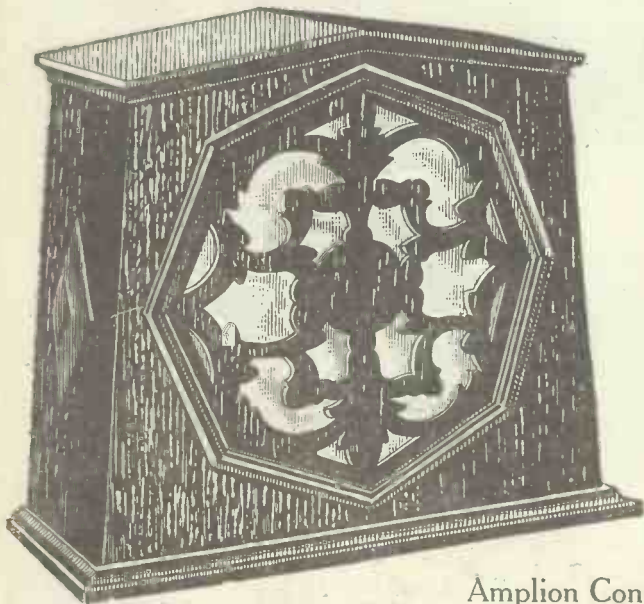
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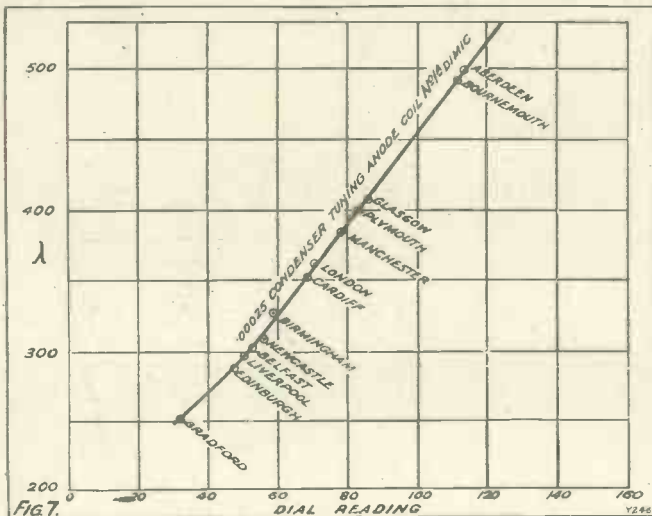
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MODERNISING AN OLD SET.

(Continued from page 964.)

sensitiveness of the set enormously, for it was possible to work much closer to oscillation point without oscillating.

But high mu H.F. valves came on the market. I tried one, a D.E.H.210. It oscillated furiously and uncontrollably—rather naturally—wanted neutralising!



thought. Well, I might as well do the job thoroughly, fit the latest low-loss centre-tapped coils, neutralising condensers and modern valves.

So I obtained a set of Dmic coils for the aerial and anode circuit, some Unimics for reaction and a McMichael neutralising condenser. Fig. 5A shows the circuit I proposed to use. It looks simple—but—well, I fell in and out of pitfalls—but wait! They were conquered one by one.

The aerial circuit had a Dmic No. 1 and the anode circuit a Dmic No. 1a. You will, of course, realise that this circuit is designed to lessen aerial and valve damping on the coils used. The neutralising condenser takes the whistle out of high mu valves, and this permits of greater H.F. amplification.

Well, it did. When the set was got to work properly with no reaction and using a D.E.H.210 (mu 35) the H.F. amplification had risen to 16. But let the snags come first. Photo No. 2 shows what the set looked like when the conversion had been made. You wouldn't think there could be inter-action anywhere. The aerial coil was tucked away in quite a different place from the anode coil.

But the set oscillated violently and squeaked and squealed, and otherwise said clearly that it wasn't feeling ready for work.

Neutralisation Troubles.

The first thing I discovered was that the otherwise excellent neutralising condenser was too low even at maximum value. So I got two inches of ribbon aerial and overlapped 1/4 inch between a piece of mica. Fixed them in a saw cut in a piece of ebonite clamped by a small bolt. This was fixed across the neutralising condenser and adjusted till oscillation was almost con-

trollable at maximum setting of the tuning condenser.

But still the squeals continued at other settings. The coils used were very efficient, and so low was their H.F. resistance that the smallest coupling was enough to cause oscillation. I mounted a baffle of zinc between the anode coil and the aerial coil. This made things a bit better. But still at some settings the set squealed, whilst at others oscillation was unneutralisable. So I mounted the aerial coil on a plate of zinc. Incidentally, the anode coil shield fits right under the McMichael Dmic mount. This shielding not only cuts off the coupling from coil to coil, but from coil to H.F. choke.

On 300-600 metres everything was now lovely. Reaction was smooth, neutralising behaved splendidly, and tuning was quite selective.

However, on 5 X X reaction effects were still peculiar. I suspected the H.F. choke, which was home-made. So a good commercially-made H.F. choke was fitted with eminently satisfactory results.

My old faithful receiver was tame once more. But how did it compare with the old set?

In the first place, using D.E.H.210, D.E.L.210 and D.E.P.215, the H.F. amplification had risen to 16, L.F. amplification was vastly improved and was, in fact, almost as good as can be expected with L.F. transformers.

Fig. 4 shows a resonance curve for the aerial circuit. The No. 1 coil had an H.F. resistance of 5.3 ohms at 400 metres. When inserted in the aerial circuit this increased to 8. An increase of only 2.5 as compared with 4 in the old set. Aerial loading had been minimised. So had selectivity. An interfering station on 393 metres and 408 metres was now reduced to 1/4 strength.

Less H.F. Resistance.

In the anode circuit the No. 1a had a true resistance of 22 ohms. (See Fig. 5.) However, due to incomplete neutralisation, this had fallen to 12 ohms when no reaction was used intentionally. It was difficult to neutralise by the approved method because there was no nearby station, and when the H.F. valve was not used nothing was heard anyhow! Reaction wasn't pushed nearly to the utmost, hence the wider curve. The H.F. resistance has fallen to 4.7 ohms, nearly five times, and an interfering station is reduced to 1/4 strength at 395 metres and 404 metres. But remem-

ber reaction has not been pressed. It was, in fact, possible to make this circuit so selective that I couldn't make out a resonance curve. For resonance rose and fell from maximum to minimum in under one metre, and my wave-meter could not be read as closely as this.

Interesting Comparisons.

The conversion, in fact, proved to be worth while. Fig. 6 gives a comparison table between all the coils used. Remember that a coil of large inductance will tend to have a larger H.F. resistance than one of low inductance. The true measure of a coil is to take its H.F. resistance and inductance into account and obtain a figure

Fig. 6—COMPARISON TABLE.

	Ohms at 400 metres.	Inductance Microhenries.	Power Factor
Dmic No. 1	5.3	200	.0042
Dmic No. 1a	22	525	.009
Dmic No. 0a	2.4	126	.004
S 3	4	110	.008
S 4	16	210	.0162

of merit. This has been done. The lower this figure of merit the better the coil. Fig. 7 gives a calibrated chart and curve for the receiver, and shows how the stations are spaced out on the condenser.

I should have liked to have fitted vernier control to the condensers, but could not find suitable controls. These condensers had not got one-hole fixing. The vernier vane is quite satisfactory once a station has been picked up, but the more modern geared control would make it easier to tune in a station.

Daventry Experimental.

The final tests and the graphs of this receiver were made just before 5 G B came on the air with regular programmes, so that it will be noticed in Fig. 7 that Bournemouth occupies the position that 5 G B should have and that Birmingham is mentioned between Newcastle and Cardiff. Birmingham now transmits via 5 G B. and is heard just below Aberdeen, while Bournemouth has gone back to its old wave-length of 326 metres or thereabouts.

The foreign stations have been omitted because of space considerations, but they come in equally as well as, if not better than, the British stations.

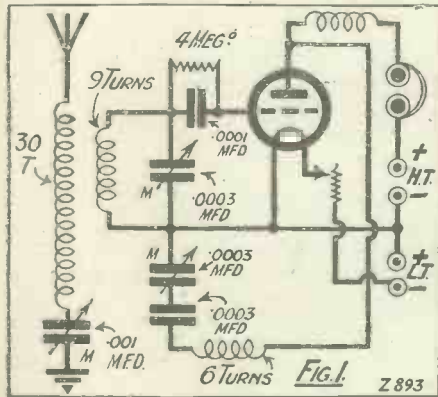


The reconstructed receiver, complete with low-loss coils, etc.

THE "PROGRESSIVE" SETS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am writing to say how interested and pleased I am with your new "Progressive One" and "Two." Your method of building a set one stage at a time, as also your method of wiring, are the best I have yet seen or tried. To prove how good the first is I have proved by experience. When I had made the "Progressive One" I could get nothing from it. I felt sure the wiring was correct, since you made it so easy and simple. Well, after a lot of brain-racking, etc., I found out my H.T. eliminator had broken down either just as I had switched on to the P.O., or just as I had switched off my other three-valve set; this I discovered after borrowing my neighbour's H.T. battery. I had, previous to this, partly pulled to bits and put fresh components in the P.O. Now, had you put this four-valver all together at once, I as an amateur would not have known where to begin or what to do. I should just about have sat down and cried, but to just pull the one part to bits was not too big a task. I had some friends come, and knowing my three-valve was O.K., I thought I would give them a bit of music, and that was how I discovered that the eliminator had broken down. Then after borrowing H.T. I tried out the P.O., and although I live under the Nottingham station I had no difficulty in shutting it out and finding Stuttgart, also a French station, etc., on 'phones and one valve. I was too amazed and pleased to listen further, but set about adding the next part, and this on Sunday night, and by 12 p.m. I had finished the second part, and even at that late hour I must try it out, and was listening until a matter of 12.30 a.m. to Madrid (on 'phones) from some "Teatro," probably the Liceo.



After the music, came the announcer saying about closing down until such a time Manaña and buenos noches 2 todo, but to me it was night—and delight. I have a premonition that this set is going to be my "ideal" one. I wanted one that would reach out, and secondly I wanted one to cut out Nottingham without wave-trap, and it is doing that even whilst writing this, for on the L.S. it is giving me 5 GB without the slightest trace of the Nottingham station. Finally, will you either in, or to the set, add a "soother," or should I say "filter." With this request I close with thanks and congratulations for your "Progressive One" and "Two."

Yours faithfully, H. H.

Nottingham.

The Editor, POPULAR WIRELESS.

Dear Sir,—Many thanks for "Progressive One" and "Two." Have got excellent results, and have found the set very selective. With best wishes to you and "P.W."

Yours truly, P. F. W.

Ealing, W.5.

The Editor, POPULAR WIRELESS.

Dear Sir,—We have followed the instructions in the first two articles, and the set so far is a perfect success, and does everything claimed for it.

We have also used it with a two-valve amplifier. We tried it on four large loud speakers at the same time. It gave tremendous volume and very good tone, but if we do this often I am afraid we shall have complaints from the neighbours.

Yours faithfully, "PROGRESSIVE."

Northampton.

100 DIFFERENT STATIONS PER MONTH.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having seen the increasing amount of correspondence in your columns re short-wave reception I thought that the short-wave results obtained here would be of interest to your readers.

The set is a modified "Simmonds," and is used in conjunction with a three-valve amplifier, only two stages of which are used, generally for amplifying signals from stations such as KDKA, 2XAD, 2XAF, 2FC, PCJJ, ANH, etc. All these stations have been received on the loud speaker at some time or other.

CORRESPONDENCE.
THE "PROGRESSIVE" SETS
SHORT-WAVE NOTES—THE "FILADYNE."

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.

I have logged over 1,100 stations during the last ten months and have heard signals from all over the world, i.e. all Europe—25 countries (21*), Algeria*, Argentina*, Australia, Belgian Congo, Brazil*, Canada*, Canal Zone*, Chile*, Costa Rica, Cuba, Colombia, Egypt*, French-Indo-China, India*, Jamaica, Java (Dutch East Indies), Labrador*, Libya*, Morocco*, Newfoundland, New Zealand, Oman (Arabia), Porto Rico, Syria, Union of South Africa*, U.S.A.*, Iraq.

* Confirmation received.
I should be pleased to send further details of my station to anyone interested in same, on receipt of a stamped addressed envelope, or to make an appointment with any short-wave enthusiast who would care to pay me a visit. Wishing "P.W." every success,
Yours faithfully, A. G. BURGESS.
T. & R., R.S.G.B., A.R.R.L.
Castelnau,
26, Gunnersbury Park Gardens,
Acton, London, W.3.

SHORT-WAVE NOTES.

The Editor, POPULAR WIRELESS,
Dear Sir,—Your unflagging zeal in dishing up the latest and best news for the S.W. merchant, prompts me to hurl my first "letter to the papers." If it is of interest, I will feel I have made some return for the assistance "P.W." gives the amateur.

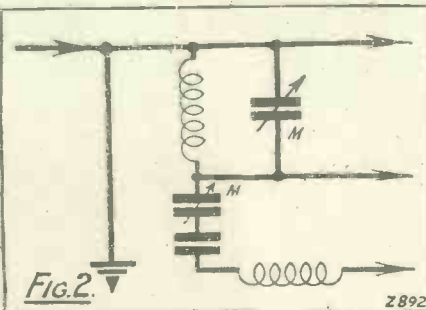
The best thing I have to record is the return to-night of KDKA on 62 metres to something approaching the strength of the winter before last. In fact, at 11.40 p.m., that hackneyed one and only Overture of Leoncavallo's came in at the average at which I receive 2XAD. As my tuned circuit for KDKA is rather wild and wonderful, I give it in Fig. 1.

Tuning is roughly adjusted on A.T. condenser and then completed by means of a nentrolyne condenser, which is across the A.T.C., and also by the .001 variable condenser in earth lead.

These values have been decided on only after trials of dozens of others, none of which have proved so satisfactory. My log of the big S.W. stations isn't a bad one for an 0-v-0.

Every Saturday evening I have one or two friends in (three 'phones in circuit) for the football match from 2XAF (6.30 p.m. to 9.30 p.m.), which averages about R.5 to R.6, then 2XAD is received nineteen out of twenty evenings at, say, R.5. In common, apparently, with every other one-lung worker in England, I got the 2FC S.W. programme direct the first Sunday—picked it up ten minutes before 2LO started relaying. Then, last week, 2XG came in at 11.40 p.m. with word tests at R.6 to R.7, though on quite a high wave-length for them, since it was about 40 metres. Test consisted of "Left-hand Melbourne," "Left-hand Toronto," "Left-hand amputated," "Left-hand cyclone," etc.

For all stations below about 50 metres, circuit is modified, as per Fig. 2 until 30 metres is reached, when the earth is dispensed with.



Set oscillates with 2 grid coil and 3 anode, and I am wondering what wave-length minimum this represents?
Good luck to "P.W."
Yours faithfully, W. K.
Kew Gardens, Surrey.

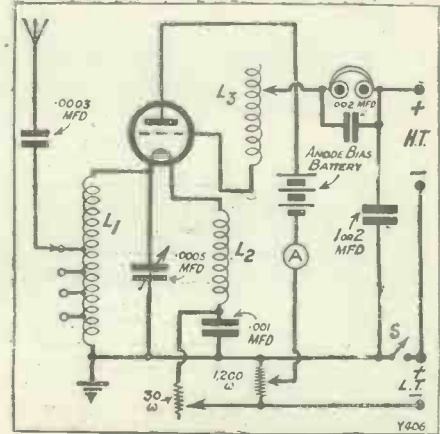
"THE FILADYNE."

The Editor, POPULAR WIRELESS.

Dear Sir,—In "P.W." No. 286 your correspondent "R.G." asks how he can make the "Filadyne" oscillate. I suggest that he, and others interested in the Filadyne, should try the accompanying circuit, which is a slight modification of that given in "P.W." No. 265, and which provides for adjustment of reaction and anode bias to suit individual conditions. I have found this circuit to give excellent results with valves which would not work at all in the original circuit, for example, high impedance valves ("R.C." type), such as Cosmos SP 18/B, may be used.

For experimental work the anode-bias battery should be of the ordinary "grid-bias" type; when the best voltage has been found, this can be replaced with a flashlamp battery of appropriate E.M.F. clamped inside the set. Connections to aerial and reaction coil tappings may conveniently be made with "crocodile" clips, and these will not require moving once the best positions have been found.

Using a 2-volt L.T. battery, the potentiometer takes less than .002 amp., therefore the current consumption here is quite negligible. If desired, a .002 condenser may be connected between anode and earth so that the H.F. current will not have to pass through anode battery and potentiometer; this con-



denser will make the set oscillate more easily, but I find the circuit to be quite lively enough without it.

It should be noted, when dealing with the Filadyne, that a condenser of adequate size—.001 or .002 microfarad—must be connected across the 'phone terminals. If L.F. amplification is used, such a condenser must be connected across the primary of the transformer. If this condenser is omitted, the set cannot be made to oscillate. Also, the choice of aerial tapping has a considerable effect on reaction, and it is difficult to bring the set up to oscillation if the aerial is connected to the top of the coil.

As stated in "P.W.," the circuit works well with a stage of transformer-coupled L.F. amplification. I have also had excellent results by adding a stage of neutralised high-frequency amplification.

In the modified arrangement, an interesting point is that there is quite an appreciable L.F. current in the anode circuit, but an attempt to utilise this by connecting an L.F. choke at "A" (see diagram) and by-passing the L.F. component to the 'phones by means of a Mansbridge condenser, was unsuccessful, signal strength being much reduced. It appears that, for efficient working, this L.F. current must have a free path to "earth."

In conclusion, I should like to compliment "P.W." on a most interesting circuit.

Yours truly, J. HALLER.
Northern Ireland.

"CHITOS" AND 5X X.

The Editor, POPULAR WIRELESS.

Dear Sir,—In your issue of December 3rd, you mention the "Chitos" one-valver and draw attention to the fact that it is not so good on the longer waves as on the shorter ones.

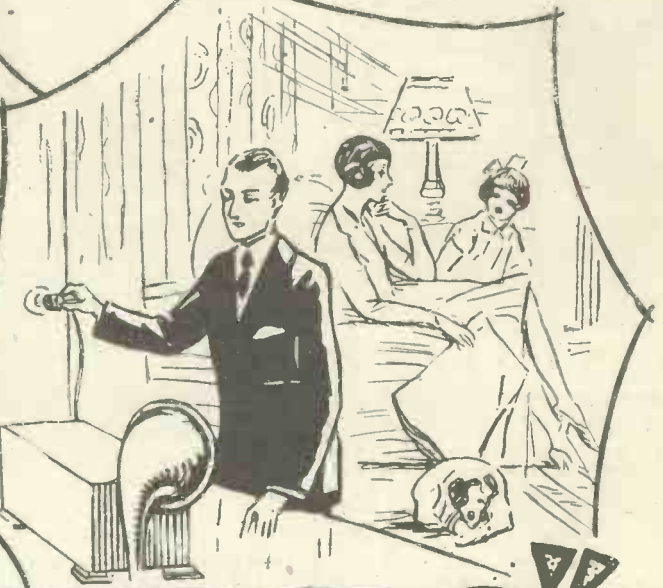
It may interest other "Chitos" owners to hear that I get 5XX very much louder by connecting an ordinary (honeycomb) coil of about 100 to 130 turns across the aerial and earth terminals on set. The aerial coil in moving-coil holder can still be 250 or 300, but the reaction coil only 60. With this hook-up I can get Radio-Paris and a couple of other long-wave stations unidentified. Incidentally, with the 100 aerial coil, as used for shorter waves, 5XX can be tuned in just above 5 GB which is useful for time signals from 6X X.

YESTERDAY

*Messy batteries.
Ugly wires.
Burdensome
accumulators
that seemingly
always needed re-
charging during
the vilest weather.*

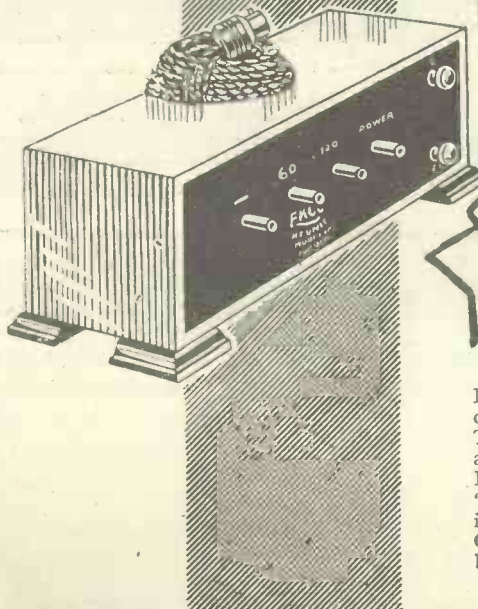
TO-DAY

Batteries and accumulators scrapped. Radio now simplicity itself, thanks to Mains Power Wireless Units, and therefore "EKCO," first and foremost amongst radio units.



EKCO

Safe-Silent-Sound!



**"EKCO" pays for itself
over and over again.**

Do you realise that an "EKCO" D.C. model selling at 17/6 complete consumes only 6d. worth of electric current for every 1,000 hours of use? That an "EKCO" A.C. model selling at £4 12s. 6d. complete with Royalty and valve consumes only 2/6 worth of electric current during 1,000 hours of use? In other words, if you use your set as much as six hours a day a 17/6 D.C. "EKCO" will only cost you 6d. in six months. And the life of an "EKCO" is many years. Compare these figures with your battery costs and you will never buy a battery again!

A QUESTION OF DETERIORATION.

CONTRARY to the belief expressed by quite a number of listeners, radio receivers cannot be said to "wear out." If the signals from your receiver appear to be getting weaker, it is more than possible that this is due either to the batteries or valves. You should always take a voltmeter reading of your accumulator while it is actually joined up to the set and operating the valves. An accumulator may register its full voltage while disconnected, but immediately it is placed "on load" it may give all the symptoms of a worn-out battery.

However, if your set is losing strength and you are satisfied that the batteries are quite O.K. then you must suspect the valves. In the course of time, and as they grow old, dull-emitter valves tend to lose their electron emission. The only way you can satisfactorily test for such troubles is to place a milliammeter in the anode circuit of the valve or valves and note whether the anode current that passes has fallen or not.

Valve "Ageing."

If the valve on test is rated by the makers to pass a certain anode current at a certain H.T. voltage and the observation shows that it is only passing a third or a quarter of this, then, providing everything else, such as the grid-bias adjustments, is O.K. you have proof that the valve has "aged." There are other faults in a set which will cause weakening signals, such as bad connections, and so on, but components, such as low-frequency transformers, variable condensers, coils and so on do not wear out in an electrical manner, and but few of them can in a mechanical sense.

COIL-DRIVEN LOUD SPEAKERS.

Sir Oliver Lodge's Patent.

FOR very many years loud speakers in general were recognised as being inefficient instruments, but this did not cause a great deal of concern because of the shortcomings of receivers. Only a year or two ago it was mooted that the average set did not do the average loud speaker justice, but with the high-grade components and efficient valves which are now available it is possible to design and construct a receiver which will have an output closely approaching perfection, and this is the reason for the comparatively recent emergence of the loud speaker from its quondam obscurity.

No New Thing.

It is becoming a very important item indeed in the eyes of the radio public, and is no longer taken for granted. Where once upon a time you would find listeners discussing the distance-getting qualities of their receivers, you now find them more loquacious in respect of the characteristics

of their speakers. The merits and demerits of logarithmic horn types and cone models are now becoming subjects for common discussion, but it is worthy of note that this coil-driven type of loud speaker of which we have heard so much lately is by no means a new thing.

To Sir Oliver Lodge, who is the Scientific Advisor to POPULAR WIRELESS must be given the credit for inventing the coil-driven loud speaker. As a matter of fact, this famous scientist took out a patent for such an article as far ago as 1898, but, as in many other things, Sir Oliver was years before his time, and it was not until nearly a quarter of a century after that that the universal need for such a device was beginning to be felt.

How They Work.

The principle of the coil-driven loud speaker is simplicity itself. A small coil of wire is placed in the field of a strong magnet, a magnet which may be either of the permanent variety or electro-magnetic. The low-frequency currents from the receiver are passed through the coil, and this is made to move accordingly and actuate the diaphragm, but coil-driven loud speakers are as yet expensive articles, and are more spoken about than used.

Also, it cannot be said that on the present-day average type of receiver that they are able to claim many points of advantage over a good ordinary cone type of speaker. There are many very excellent cones on the market which are capable of really excellent performances.

RADIO WRINKLES.

A THIN layer of lubricating oil will overcome gassing and popping in an accumulator.

When "dithering" occurs on a cone type loud speaker the trouble may often be traced to a nut or screw becoming loose.

The coupling condensers for resistance-capacity or choke amplifiers should be of the mica type.

A spare fixed condenser of .001 mfd. capacity or so can be used as a safeguard in sets of the Reinartz type where the voltage of the H.T. battery is across the reaction condenser? Simply connect the .001 mfd. in series with the smaller variable condenser, and then if the latter should become accidentally shorted the larger condenser will prevent the short circuit.

As soon as a joint has been soldered, it should be wiped over with a clean duster in order to remove the liquefied flux which otherwise is liable to cause leakage.

Very short waves—i.e. those below about 50 metres, do not travel along the surface of the earth, but are projected into space and reflected by the Heaviside layer. For this reason the signals from short-wave stations may not be so strong near to the point of origin as they are at a distance of several hundreds, or even thousands, of miles away.

TWO VALVE NOTES.

DO not forget that the special type of resistance valve employed with R.C.C. units is always inserted in the position preceding the coupling. As a matter of fact, the same sort of thing applies all through the receiver. It is easy for the less technical constructor to fall into the error of supposing that the special valve is employed subsequent to the coupling. The confusion may arise over the use of the term "adding another valve." Let us take a concrete case. Supposing you have a two-valve set, H.F. and detector, and you wish to add a stage of resistance-coupled low-frequency amplification. The special resistance-coupling valve will take its place in the detector position and will not be the third valve. This must be of the low-frequency type having last stage characteristics—i.e. a capacity to handle a fairly heavy input without distortion.

If you inadvertently insert the valves in a multi-valve receiver in their wrong order, it is quite possible to cause a complete wipe out of results. Even the lusty roar of the local station can be blotted completely out of existence, and that this is indeed a fact has been discovered by not a few nonplussed listeners.

The "wipe out" comes about when one of the H.F. or detector valves is inserted in either the second or, as the case may be, the final low-frequency amplifying position and the reason is that in these last positions generally is employed something between 9 and 15 or even 22 volts of grid bias. This will, of course, completely paralyse a detector or H.F. valve. If you reduce or eliminate the grid bias, signals will be obtained but will be considerably distorted.

SAVING THE LOW NOTES.

THE sound waves from a loud speaker are not projected evenly. The higher notes go straight forward, while the lower notes tend to go off sideways and even round towards the back of the instrument. The latter phenomenon is generally referred to as "spilling" and, in the case of a powerful receiver of the coil-driven type, this can cause trouble by an interaction effect between the front surface and the back of the diaphragm.

It is to prevent this occurring that what is known as the "baffle board" is used with coil-driven speakers. Unfortunately, with the average type of set and, indeed, with the average type of speaker, there are not very many low notes to lose, so that it is well worth while making the most of those which are present.

It is, therefore, a good plan to place the instrument close to and facing away from a wall, so that some of those elusive low notes can be reflected back again to the front.

AFTER 2 YEARS 4 MONTHS



STILL WORKING SPLENDIDLY"

Oakbank,
Morley Road,
Little Eaton,
Derby.

November 19th. 1927.

Messrs. Siemens Brothers & Co. Ltd.

Gentlemen.

I am writing thinking perhaps you would be interested to hear of the longevity of your High-Tension Batteries. I am a regular user of my wireless set, sometimes using one or two valves (D.E.2 volts) as the case may be. I use your 60 volt H.T. Batteries and have only found it necessary to purchase two since July 1925. No. 1. was in use from July 9th 1925 until April 6th 1926.

From April 7th 1926 to Sept. 30th 1926, I was not using my wireless set owing to change of residence. I commenced using Set again on October 1st 1926 and, thinking my H.T. Battery would be useless, I purchased No. 2 which was in use regularly from October 1st 1926 until about middle of May 1927, when one day I thought I would just see if there was any life left in No. 1; the date would be about May 20th. 1927, when I found it worked splendidly. I am still using same and can get many Foreign Stations with it, although it has been in my possession no less than 2 years and 4 months. No. 2 is also working well yet.

I remain,
Yours truly,
(Sgd.) H. Spence.

SIEMENS

WIRELESS BATTERIES

OBTAINABLE AT YOUR DEALERS.

SIEMENS BROTHERS & CO. LTD., WOOLWICH, S.E.18.



Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." test-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

OVERSEAS TRADE ITEM.

THE A.J.S. people inform us that they have now completed arrangements for the distribution of their products throughout India with Messrs. Bombay Radio Company, 73-75, Marine Lines, Queen's Road, Bombay, and that their Symphony receivers, loud speakers and cone reproducers can now be obtained anywhere in India.

AN ACCUMULATOR CAPACITY INDICATOR.

Those amateurs who charge their own accumulators should find the Accumulator Capacity Indicator manufactured by the Fanshaw Mfg. Co., of Walsall, of considerable interest. The instrument is similar in appearance to a small panel-mounting voltmeter and has a moving needle. But, instead of figures the scale consists of colours. There is first a stretch of red, then of yellow and finally of blue. The

words, "low," "medium" and "full" accompany these colours. Towards one end of the scale is a red line, past which the needle must not fall, and at the other end of the scale is another red line, beside which are the words "stop charging."

The instrument can be left in circuit across the cells all the time these are being charged, for it consumes but the small current of six milliamperes. Actually, of course, it is a sort of voltmeter, but it has the advantages over this instrument in that the part of the scale that matters to the accumulator while it is being charged is spread over practically the whole movement of the needle, and it enables one to see at a glance the exact condition of the battery.

It can also be used to test the condition of a battery when it is used with a receiver. The sample submitted to us for test is for use with a 6-volt battery, and we found the indications it gave close enough to

make it quite trustworthy. This particular type costs 12s., but there is a more expensive model retailing at 30s., calibrated for definite makes of batteries which actually gives ampere-hour ratings. But the average radio amateur will find the cheaper model a reliable guide and a fascinatingly easy instrument to use.

A USEFUL BOOK.

The 1928 issue of Colvert's Mechanic's Almanack seems to be even more comprehensive than usual. It embodies nearly 200 pages of information concerning practical mechanics. There are dozens of tables giving screw-cutting details and so on, while conversions and other such calculations are skilfully tabulated. The book is published by Messrs. John Hayward, Ltd., of Deansgate, Manchester, and the price is the low one of 6d., or post free, 8d.

LISSENAGON TAPPED COIL.

Messrs. Lissen. Ltd., recently sent us one of their 300-turn Lissenagon tapped coils. There is a single tapping taken to the centre of the coil, making it suitable for aerial auto-coupling, neutralising and other such purposes. The tap terminal is placed on the side of the base and a winding is carried out on the familiar Lissen hexagonal fashion.

It is a well constructed and rigidly assembled coil, and the pins are accurately spaced in the cut-away base. On test it gave satisfactory results. Used as a tapped aerial coil on the Daventry 5 X X and Radio-Paris long-wave band, a definite increase in selectivity was noticeable without reduction in sensitivity.

(Continued on page 974.)

Protect your valves!

If your reception is unsatisfactory see that your valve holders are guaranteed to absorb shock and eliminate microphonic noises. Valves must be protected by good valve holders if they are to function perfectly.

When the valve pins enter the valve sockets of the Lotus Valve Holder the leg sockets immediately expand and automatically lock, and the floating platform in which they are fixed is suspended by four phosphor bronze springs. Although these springs have great mechanical strength they are sufficiently resilient to absorb any external shock liable to damage the valve.

Lotus Valve Holders are used and recommended in the Mullard circuits in Radio for the Milton, and are ideal for use in the Master Three and the Cossor Melody Maker.



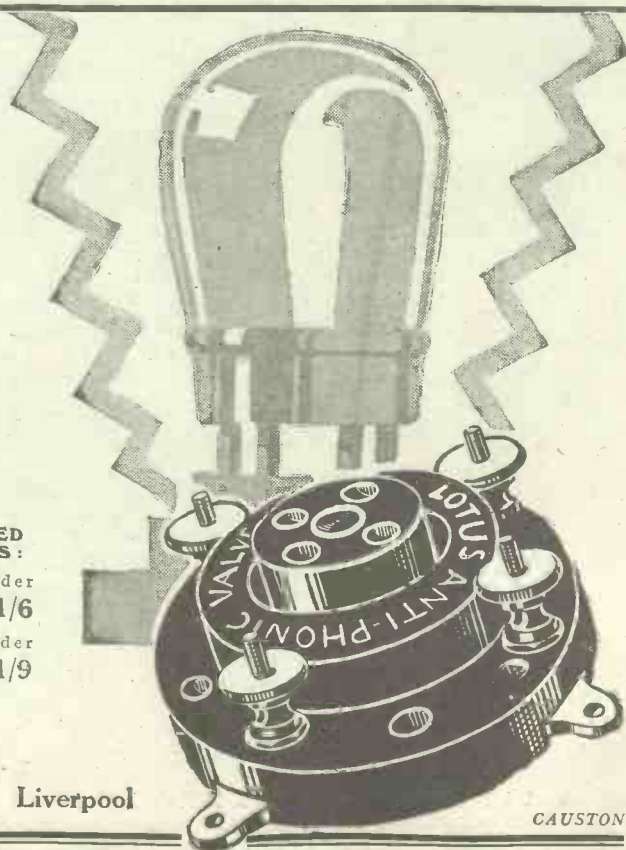
REDUCED PRICES:

Valve Holder without terminals 1/6

Valve Holder with terminals 1/9

Made by the makers of the famous Lotus Remote Control, Lotus Vernier Coil Holder, and Lotus Jacks, Switches and Plugs.

Garnett, Whiteley & Co., Ltd., Broadgreen Road, Liverpool



CAUSTON

ABSORBS SHOCK—ELIMINATES MICROPHONIC NOISES



CAN BE BUILT WITH LISSEN PARTS

Congratulations to Messrs. Cossor on an excellent set.

It has been definitely proved that LISSEN parts can be used for this Set with eminently satisfactory results, as well as for every other type of Circuit which may be popular at a given time, and which requires Standard parts of recognised quality.

LISSEN parts are guaranteed to give satisfaction every time they are used. Test the LISSEN TRANSFORMER against any other, and if you are then willing to part with your LISSEN, and return it within seven days of purchase, your money will be willingly refunded.

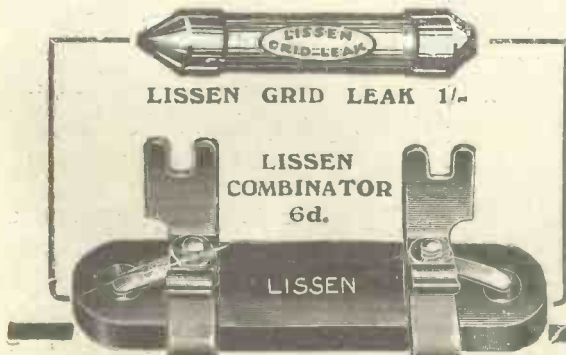
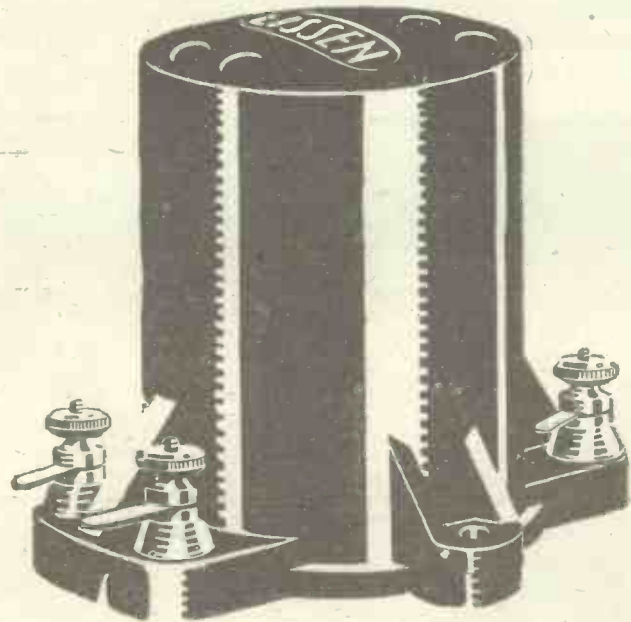
Use the other LISSEN parts as well, resistances, condensers, rheostats, valveholders, batteries, etc.

Lissen Parts for the Cossor Melody Maker

- 1 Lissen L.F. Transformer (Price 8/6).
- 1 Lissen .001 Fixed Condenser (to be put across the primary of the L.F. Transformer) (Price 1/-).
- 1 Lissen Baseboard Rheostat, 7 ohms (Price 1/6).
- 2 Lissen Key Switches or Lissen 2-way Switches (Price 1/6 each).
- 2 .0003 Lissen Mica Fixed Condensers (grid-leak clips are included) (Price 1/- each).
- 1 .0001 Lissen Mica Fixed Condenser (Price 1/-).
- 1 .001 Lissen Mica Fixed Condenser (Price 1/-).
- 1 .002 Lissen Mica Fixed Condenser (Price 1/6).
- 1 Lissen Mansbridge-type Condenser, 2 mfd. (Price 3/6).
- 1 Lissen Grid Leak, 3 meg. (Price 1/-) and 1 Lissen Combinator (Price 6d.).
- 1 Lissen Grid Leak, .25 meg. (Price 1/-).
- 1 Lissen Grid Leak, 4 megs. (Price 1/-) and 1 Lissen Combinator (Price 6d.).
- 3 Lissen Valve Holders (Price 1/- each).
- 1 Lissen 9-volt Grid Bias Battery (Price 1/6 each).

Also use the Lissen H.T. Battery

All these Lissen parts for the Cossor "Melody Maker" are obtainable from 10,000 radio dealers throughout the country. Ask for Lissen parts in a way that shows you will take no other, and be sure of perfect results.



LISSEN

LISSEN LIMITED,
8-16, Friars Lane, Richmond, Surrey.

Managing Director: Thomas N. Cole.

APPARATUS TESTED.

(Continued from page 972.)

At one time the Lissenagon was one of the very few coils whose losses were sufficiently low to enable them to be used in certain circuits. Since then we have passed through the low-loss era when manufacturers, large and small, concentrated on the production of so-called low-loss components. But the Lissenagon still holds its own as a coil which will provide good coupling and give good results in modern receivers.

A RADIO YEAR BOOK.

The Wireless Trader Year Book and Diary for 1928, published by the Trader Publishing Co., Ltd., of Fleet Street, London, should certainly be in every trader's, if not amateur's, hands. A special feature of this is the directory section which gives very complete alphabetical lists of manufacturers' sole agents, and factors, together with addresses, telephone numbers and telegraphic addresses. There are also some twelve pages of general information, eighteen on broadcasting and trade matters, and twenty of technical data. The large diary pages are spaced with blotting-paper.

AMPLION JUNIOR CONE SPEAKER.

Messrs. Graham Amplion, Ltd., have broken quite fresh ground with their new junior hanging type cone speaker. This is the model AC2 which retails at 37s. 6d. It has an overall diameter of 13½ in., the cone itself being 9 in. in diameter. This latter has an "old-gold" finish, which is

graduated artistically to harmonise with the rim which is of a chocolate-brown moulded material. A cord of heavy silk material is supplied for hanging the instrument from a picture hook or other support.

It has a very pleasing appearance hanging on the wall, and resembles much more an artistic plaque or other such decorative article, than a loud speaker. The terminals and adjusting device are at the back. It is a very sensitive instrument and operates well with a small set, and on test we found



The Amplion cone speaker which is reviewed on this page.

the sample sent us capable of handling quite a hefty input. The tone is excellent, and the quality both on the high and the low notes and on speech is almost up to the Amplion senior cones.

There is rather a high degree of coloration, but this is more of an advantage than a disadvantage, as it serves with an average set to smooth out discrepancies in the input. This Amplion junior cone speaker could not fail but to please the average listener, both in point of appearance and performance, and at the very low price it is a distinctly attractive proposition. Readers who are thinking of purchasing loud speakers, should certainly take the earliest opportunity of hearing this latest Amplion product in operation.

AN EFFICIENT L.F. TRANSFORMER.

We have recently had the opportunity of testing one of the new general purpose R.I.-Varley L.F. Transformers. This has a ratio of 4-1 and retails at 15s. It is of the shielded type and has a distinctive salmon-pink coloured casing, with the familiar black and gold label. The four clearly marked terminals are well spaced on an oval insulating moulding on the top of the component.

It must have been very skilfully designed for it gave results far superior to those its lightness and price would lead one to anticipate. In fact, we must admit that we consider its performance falls very little short of those transformers in the above-one-pound class. With a transformer such as this R.I.-Varley available at the low price of 15s., constructors have no excuse for going to foreign makes.

The New 1928 Burndept Variable Condensers

NOTE: The following purely personal note was written by Mr. Frank Phillips, M.I.E.E. (Burndept's Chief Engineer) to the Sales Manager, who considers it will be of general interest.

My dear Barraclough,

Just a line about our new variable condensers, and why they so definitely fill a want in present-day radio practice. Up to recently most circuits showed one pole of each condenser connected to earth (or to plus H.T.), and therefore it was logical to make the condenser frame of metal with the moving plates connected thereto, because that portion of the condenser could be earthed and hand-capacity obviated. Now, circuits have changed—we have the Screened Grid Valve, Capacity Reaction, and so on, where nearly always both poles of the condenser are at a potential above or below earth, one usually going to Grid and the other to Anode; it follows, therefore, that metal end plates are wrong, that both poles of the condenser must be insulated, that the spindle

driving the moving plates must be of insulating material, and that an earth shield must be placed between the condenser and the operating dial or knob. Accordingly, I have designed our new condensers on these lines, and the result is extremely low losses, extremely low minimum and a complete absence of hand-capacity.

In the new condensers the tensioning is all done on the bottom end cheek by means of a coned seating on one side of the cheek pulled up against a steel bearing on the other side of the same cheek; the top bearing is simply a "steady" and plays no part in the adjustment. The result is a condenser that will "stay put" indefinitely, but can easily be adjusted. It really is "the goods," the best we have done so far—and the construction is so rugged that it can't go wrong.

As regards types, we are making a very neat Square Law Condenser in two capacities, '00007 and '0001 mfd. (price 13/6 each), designed respectively for Capacity Reaction and Short Wave Receivers (we are using these in the Admiralty Receivers); the minimum is

just under 4 mfd. The two larger condensers ('0003 and '0005 mfd., 15/- and 15/6 each respectively) are Log-Law, and are being used in our new Screened Four Receiver. Log-Law Condensers are quite the best thing for modern H.F. Amplifiers, as they are so very easily ganged; the coils used in the several stages need not be identical, as variations in inductance can be compensated by adjusting the respective condensers; for this reason I have prepared a set of printed Wave-Length Scales (150 to 3,000 metres, price 1/6), as if set for any one station all the other stations will follow the printed scale.

Please don't forget that these new condensers are built like a watch, and we can't turn them out like shelling peas, and the prices you have fixed are so low that demand will exceed supply, so first come first served. We are not supplying dials with these condensers, because most people use our Ethovernier Dial (price 9/- each); we use it in all our sets and the Admiralty Sets, too, and, if it's good enough for the Navy—well, 'nough said.

Yours ever,

(Sgn.) FRANK PHILLIPS

BURNDIPT

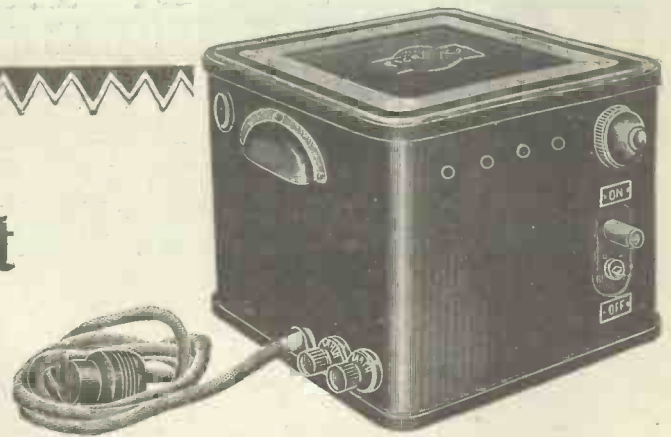
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Why pay a big price for a cabinet for the Cossor "Melody Maker"? We can supply you with a parcel of mahogany planed and cut the right size and ready for you to put together. All the necessary parts supplied, complete with baseboard and panel supports. A genuine bargain for the home constructor. Illustrated instructions enclosed. Only glue and screws required; you cannot go wrong. The baseboard is supplied 21 by 9, but by cutting 1 in. off the length it is the size required by the "Melody Maker." The lid supplied in two parts for hinging.

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RADIOTORIAL.

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

QUESTIONS AND ANSWERS.

WINDING A LONG-WAVE COIL.

S. J. (Ponders End, Middlesex).—"There was not sufficient room on the holder to get all the turns on, so when I came to the end I started winding back towards the beginning again. And although I have put on the correct number of turns, the wave-length does not seem to be right. Instead of getting Daventry I can only hear Morse going on, which makes me think I am round about 600 metres. How can I overcome this?"

You should not have continued the windings from the end backwards, but you should have started again at the beginning. It is necessary for the wire to go round the former, and the winding to go along it, in the same direction, taking the wire, if necessary, right along the coil in order to begin the second layer at the same point. If you imagine a current flowing in the wire you will notice that it changes its direction when it comes to the end of your coil, which means that the coil is non-inductive there. You will have to undo the coil and arrange the overlapping turns so that they run on in the same direction as the layer underneath.

BATTERIES FOR THE "PROGRESSIVE."

"PROGRESSIVE" (Chester-le-Street, Durham).—"I have decided to build the 'Progressive' One, and shall work up eventually to the four valves. Although only one valve will be in use at first I shall need to get batteries to suit the whole four. What H.T. and L.T. batteries do you recommend?"

The question of which is the best battery is decided by the choice of valves. To find what L.T. battery you need, find first of all the total filament current consumption of the set. If you are using 2-volt valves you will probably find that the first valve takes about 1, the second 1, and the third 1, while the power valve may take 15 amp. Adding these together it will be seen that the total consumption of the set will be a filament current of just under half an amp. A low-tension battery rated at thirty actual ampere hours will supply one amp. for 30 hours, or half an ampere for approximately sixty hours. Assuming that you use the set for about five hours per day on an average, this battery would last you nearly a fortnight without recharging, which is a convenient time. The length of time that a smaller or a larger battery would last can be found in the same way. With regard to the high-tension battery, you will find that in its 4-valve form the set requires too much current to run from ordinary dry cells. These would be quite O.K. for the one, two, or perhaps even for the three valves for a short while, but when the fourth valve is added you will need a battery of the triple-capacity type.

RESISTANCE-TRANSFORMER COUPLING.

"EXCELSIOR" (Chesham, Bucks).—"I am building a three-valve anode-bend rectifier with two L.F.'s, and I was going to use a transformer to couple the detector to the

(Continued on page 978.)

A NEW VALVE for the NEW YEAR

In addition to the renowned K Type Valve we have pleasure in announcing the introduction of the new

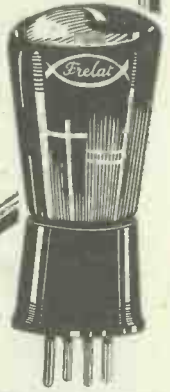
FRELAT Dark Emitter POWER VALVES

which are destined to be the New Valves for the New Year. It is the Valve you've long been waiting for. It is the really long life Valve. It guarantees perfect reception at minimum cost and consumption. Filament Volts 1.6-1.7 Filament Amps 1 Price 6/8. Also made to take 4 volts at same price.

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P1	6 1/2d	3/3	5/9	14/-
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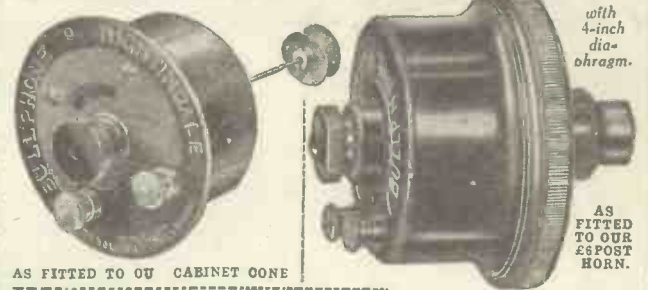
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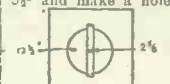


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with 4-inch dia. diaphragm.

AS FITTED TO OUR £8 POST HORN.

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2 1/2" dia. in centre. This will carry the unit. Fix strip to board as shown.

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Astonishing Results, equal to the most expensive Loud Speakers yet made, are guaranteed with either of these Units.

BUY ON 10/- EASY TERMS 5/- DEPOSIT
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Size 17 ins. high by 15 ins., in Mahogany, Walnut or Rosewood finish



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21 ins. high, with 14-inch Bell! Mahogany finished, with plated arm and stand.

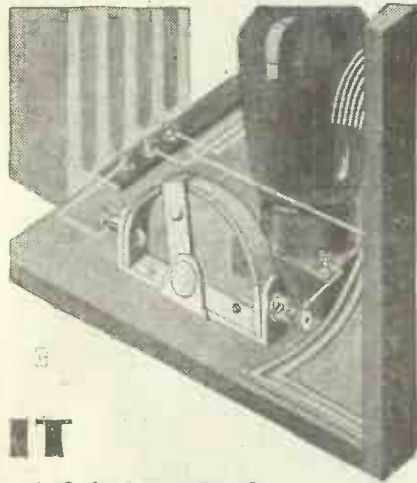
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The reliability of its performance is assured by the high class quality of the materials used. Our many years specialised experience in resistance winding, guarantees efficient and lasting service.

Stocked in 3, 6, 10, 15, and 20 ohms.

SPECIALLY SUITABLE FOR THE COSSOR MELODY MAKER 1/3 each.

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 113 St. Vincent Street, C.2

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 976.)

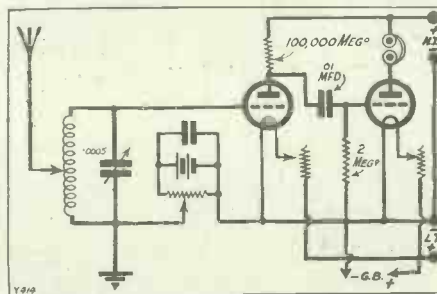
first amplifier, but I have been told that this is never done, and certainly I am unable to trace any recent diagrams in which such a circuit appears. What is the objection to it?"

For the purpose of bottom-bend rectification it is usual to use a valve with a high-magnification factor (and incidentally with a high "impedance") in order to take advantage of the comparatively sharp bottom bend of its characteristic. Such a valve has a tremendously high "impedance" when used as an anode-bend rectifier, and in order that the quality of reproduction should not suffer it is essential to use a high impedance in the valve's external circuit. The transformer represents a comparatively low impedance, so for this reason it has been found to be better to employ resistance-capacity coupling between these two valves.

CAPACITY OF COUPLING CONDENSER.

S. L. (London, S.W.11).—"To improve the purity of my reception I have done away with the grid-leak detector and transformer

WHAT IS WRONG ?



The above diagram is supposed to represent the connections of a resistance-coupled Det. and L.F. set, with bottom-bend rectification. But it is wrong and would not work properly.

Next week the correct diagram will be given, and to test your skill we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems week by week the reader cannot fail to learn a lot about radio circuits.

(L.F.), and am going to substitute for it an anode-bend detector with a resistance-coupled L.F. amplifier. Can I use the old grid condenser as a coupling condenser between the detector and the first L.F.?"

We certainly do not recommend this, as the impedance of such a condenser is high at low frequencies, and will destroy the quality of your reproduction. In order to bring out the low notes you should use a mica coupling condenser of not less than .1 mfd. If this is too expensive you can go as low as .015 or .01 mfd. without a serious falling off, but with it specially designed coupling it is not safe to use lower capacities.

REACTION OVERLAP.

"GEORGE". (Stansted, Essex).—"When I turn the reaction condenser the set promptly starts oscillating with a 'pop,' and then when I turn the condenser back it does not cease oscillating at the point where it began but continues about four degrees further. I am told that this is called 'overlap.' What is the cure for it?"

There are a number of factors which will cause trouble of this kind, the commonest being incorrect voltage for L.T. and H.T. Another frequent cause is a reaction coil which is too big, and very often it will be found that the trouble can be cured by an alteration in the value of the grid leak, or in the grid condenser, or both. You should first of all

(Continued on page 980.)

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 are 100 per cent. efficient
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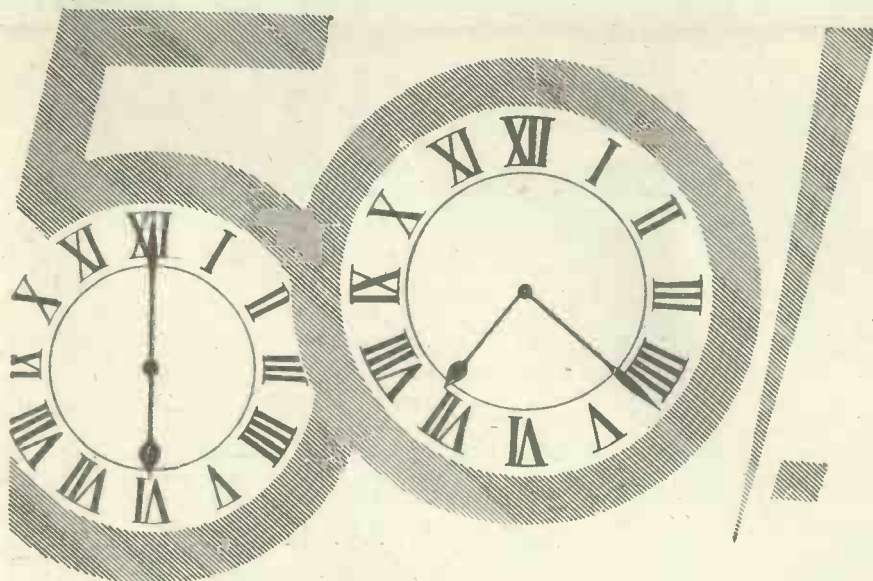
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 Money back guarantee that each and all Panels are free from surface leakage. Megger test infinity. **CROXSONIA CO., 10, South St., Moorgate, E.C.2**
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SELF-CHARGING, SILENT, ECONOMICAL
JARS (waxed) 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.
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 As far as possible, all advertisements appearing in "P.W." are subjected to careful scrutiny before publication, but should any reader experience delay or difficulty in getting orders fulfilled or should the goods supplied not be as advertised, information should be sent to the Advertisement-Manager, "Popular Wireless," 4, Ludgate Circus, London, E.C.4.



**YOU MAKE THE
NEW R.C.
THREESOME
IN 1½ HOURS**
*- the parts cost
only fifty
shillings*

ONLY 5 CONNECTIONS

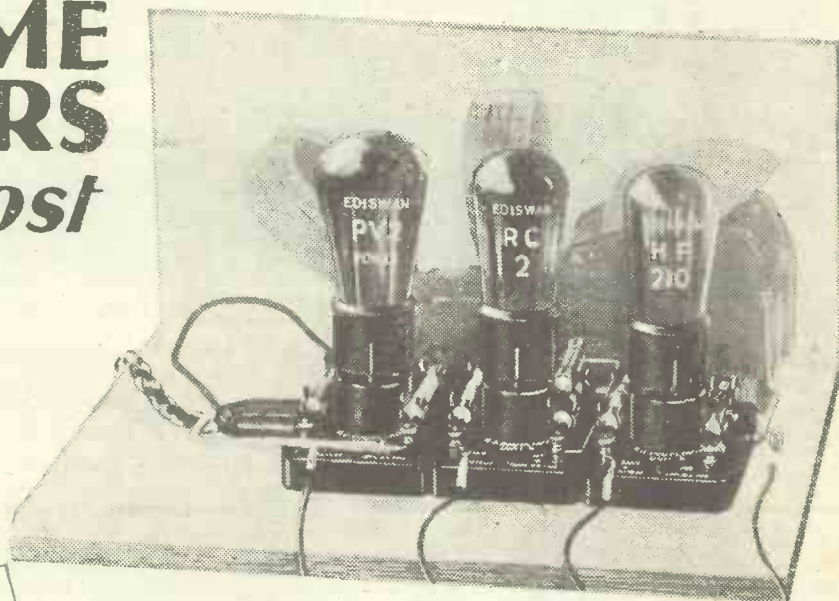
No soldering—nothing you cannot understand—nothing to go wrong. You need know nothing about radio mechanics to make up this set. Just an hour with nimble fingers and a screwdriver—and you can be sure of wireless reception of amazing purity.

The new R.C. Threesome brings in many additional stations with all the quality of the original receiver.

The valves essential for the very best results are H.F.210, R.C.2 and P.V.2—three valves from the Ediswan range.

Send coupon at once for Free Instruction Book and easy-to-follow full size Blue Print.

Bring in those other stations by using the new Ediswan Local Station Eliminator. Ask your dealer for particulars. Price - 25/-.



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**CLEAREST-STRONGEST
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A type for every purpose

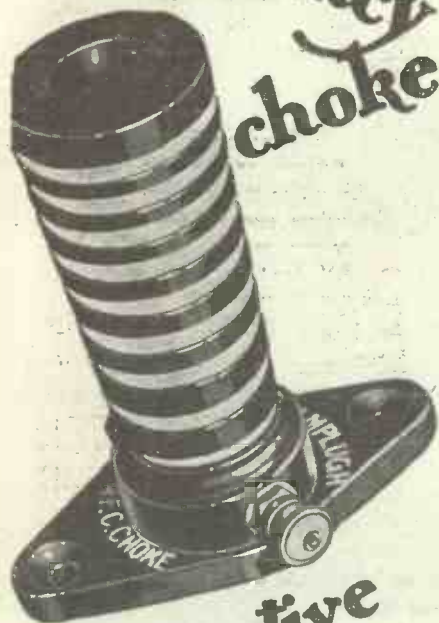
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Please send, post free, presentation
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Radio Frequency Choke



distinctive in design and efficiency

Windings of double silk-covered wire wound in special manner, preventing Choke acting as by-pass condenser at certain frequencies. Suitable for wavelengths from 200 - 2,000 metres. No pronounced self-resonant points.

6/6 EACH

LAMPLUGH BRITAIN'S BEST RADIO

"LAMP-LOO"

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SEND FOR LISTS OF OUR HIGH - GRADE COMPONENTS

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 978.)

make sure that the correct voltages are being applied to the valve, and then if the trouble persists, a little experimenting on the lines indicated should cure it.

PROTECTING THE H.T. BATTERY.

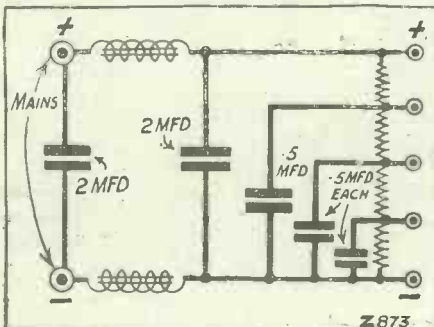
"SAFETY" (Basingstoke, Hants).—"My reaction condenser has one wonky plate, and the consequence is that when this touches the fixed vanes I get a very loud 'plonk' in the 'phones, and a small spark passes, due to the shorting of the H.T. battery. I have managed to straighten the plate now, but for safety's sake I should like to put another condenser in series with it to protect it against an accidental short circuit. Would a .002 mfd. condenser be O.K. for this purpose?"

Yes, the value named, i.e. .002 mfd., will be quite suitable for the purpose you have in mind, and will not result in an appreciable alteration of the capacity of the reaction condenser.

OVERCOMING HUMMING.

R. A. (Leicester).—"I get just a trace of hum from the eliminator on my three-valver (H.F., Det. and L.F.), and I am told that an

H.T. BATTERY ELIMINATOR (D.C.).



The correct connections for an H.T. battery eliminator are shown above. (In the "What is Wrong?" diagram, last week, the .5 mfd. fixed condensers were connected between the H.T.appings and the positive lead, instead of to the negative main.)

L.F. choke such as an old transformer primary can be used in such cases to reduce the trouble. In which part of the eliminator should it be inserted?"

In such cases it is generally the detector valve that gives the trouble. Try putting the choke in the H.T. positive leads to the detector. As it will not have a very heavy current to carry, the choke suggested will probably be O.K.

THE KNIFE-EDGE CRYSTAL SET.

C. H. (Ashby-de-la-Zouch).—"What wavelength does the Knife-Edge crystal set cover without a loading coil? I want to try for 5 G B, but I see that it says for Daventry I must use a 150-turn loading coil. Is this right?"

The wave-length covered by the set without a loading coil is approximately 220 to 550 metres. It is thus suitable for "Daventry Experimental" (5 G B) as it stands; but if it is required for Daventry 5 X X on 1600 metres, a loading coil must be used as stated.

PLUS AND MINUS.

T. G. (Walthamstow, E.17).—"Although I have only constructed a simple crystal set previously, I feel confident of making a success of the 'Progressive,' thanks to your lucid explanations. One thing I should like to know. Should the red flex on the earphones be connected with the 'phone terminal lead to the plus on the H.T. battery to prevent demagnetisation of the telephones?"

Yes, the plus flex on the earphones should be connected to the terminal which is joined to the plus of the H.T. battery.



The Modern Trend of receiver design invariably calls for Super Capacity Batteries.

Ripaults Self-Regenerative H.T. Dry Batteries, through the elimination of internal resistance, have a greatly increased capacity output, and tests have proved that they possess at least 50% longer life than the normal type.

RIPAULTS SELF-REGENERATIVE H.T. DRY BATTERIES

are supplied in STANDARD, DOUBLE, TREBLE and QUADRUPLE CAPACITIES.

Write for full particulars of our range and also ask for copies of Leaflet P/60, giving "Life Chart" and "Right Choice" Table, so that you can select the correct battery to suit your receiver.

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A RADIO EXPERT

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"RED DIAMOND"

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THE RECOGNISED DETECTOR FOR ALL CIRCUITS USING CRYSTAL RECTIFICATION. By Insured Post 2/3 or 2/9 with shield. Can be mounted on brackets or through-panel. Once set always ready. Not affected by vibration. Each one is tested on broadcast before despatch, and is perfect. Of all high-class Radio Dealers or Sole Makers—

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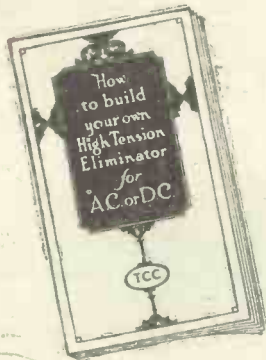
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H.T. FROM YOUR MAINS

FOR YOUR **COSSOR**
"MELODY MAKER"

If you have electric light you are wasting money every time you buy H.T. batteries. Start saving money—build an H.T. Eliminator and get current from your mains. Send the coupon for a book which shows you how to do it. "How to build your own H.T. Eliminator for A.C. or D.C." is written by an authority for the makers of T.C.C. Condensers. If you follow its concise instructions, clear photographs and simple diagrams you will have no difficulty in building an Eliminator which will give you constant H.T. from your electric light mains—for negligible cost. And, if you use T.C.C. 600 volt Condensers, you will build an Eliminator that is *utterly safe and reliable*. Send the coupon to-day. It will cost you nothing.



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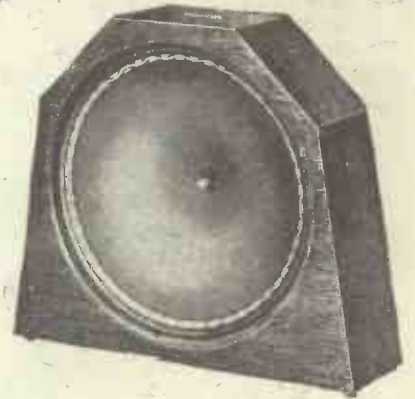
Telegraph Condenser Co., Ltd.,
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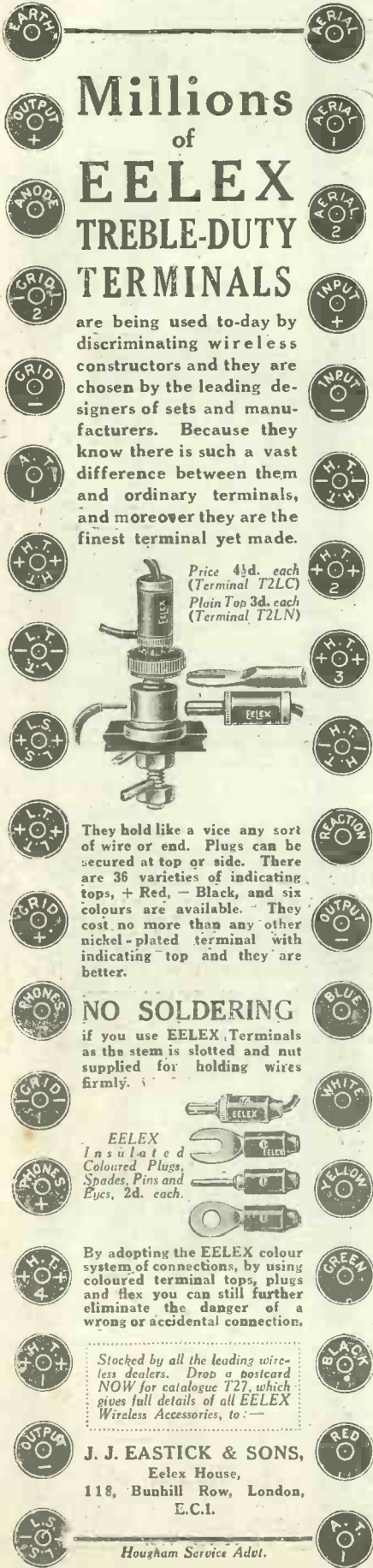


If, to-night, at a friend's house, you were to hear the Brown Mascot Loud Speaker without knowing you were listening to a loud speaker, you would be almost sure to ask who was his singing friend. Then when he replied that it was a loud speaker you heard, you would laugh and offer him the other leg. At that his eyes would sparkle, as he disillusioned you, and you would be quite astonished that a mere instrument could be so human. After that you would want a Brown Mascot Loud Speaker for yourself, and when you had bought one you would say that in all the world there was no better place than your own fireside, in your old chair, with this almost-living loud speaker to thrill the evening hours.

The Wireless shop round the corner has the Brown Mascot Loud Speaker Only 90/- is its price.

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are being used to-day by discriminating wireless constructors and they are chosen by the leading designers of sets and manufacturers. Because they know there is such a vast difference between them and ordinary terminals, and moreover they are the finest terminal yet made.



Price 4½d. each (Terminal T2LC)
Plain Top 3d. each (Terminal T2LN)

They hold like a vice any sort of wire or end. Plugs can be secured at top or side. There are 36 varieties of indicating tops, + Red, - Black, and six colours are available. They cost no more than any other nickel-plated terminal with indicating top and they are better.

NO SOLDERING

if you use EELEX Terminals as the stem is slotted and nut supplied for holding wires firmly.



By adopting the EELEX colour system of connections, by using coloured terminal tops, plugs and flex you can still further eliminate the danger of a wrong or accidental connection.

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Hougham Service Advt.

SHORT-WAVE NOTES.

By W. L. S.

IT is surprising to the newcomer to short-wave work to find how many sources of inefficiency and mysterious noises crop up. These are, of course, really present on the higher waves as well, but the extra difficulty in tuning when one gets down lower brings them up to an alarming extent. One suddenly realises that one's pet condenser is noisy, that one's super-efficient earth connection hardly works at all, and all sorts of alarming discoveries are made.

This is really one of the beauties of short-wave work (although the writer knows quite a number who do *not* think so!). Probably nothing better could be done to find the weak spots in an ordinary broadcast receiver than to take it down to, say, 40 metres or so by the substitution of suitable coils and condensers for those in use normally, and to spend a week or so down there improving it as much as possible. Then, when returning to broadcast reception the difference made by all these alterations would be very conspicuous.

Home-made X's.

The writer found recently that some annoying "rustling" noises in both the transmitter and receiver were due to an old earth connection which had become dirty, although it was connected to neither transmitter nor receiver. The mere presence of the end of the earth lead in the room was enough to cause all the trouble.

Incidentally, it often pays to substitute a counterpoise for the earth, especially if one happens to be near a tramway or power station. A marked reduction in noises and "artificial atmospherics" will often result, although this is not a general rule.

Yet another week has gone by without more than the merest trace of the American amateurs of the 40-metre band. 2 X AF, 2 X AD and 2 X G have been correspondingly poor, although WIZ and other American commercial stations seem to have been quite as strong as usual. Probably

(Continued on page 984.)



ENGINEERS & APPRENTICES

skilled and unskilled—is this your intention? Are you during 1928 going to shuffle off the overalls and, fortified with knowledge and Diplomas, assume a position of authority and trust?

IF THIS IS YOUR INTENTION, then we can open the door for you; make possible your desires for advancement in your career, and place you nearer to the pinnacle it is your ambition to reach. The story of how this can be accomplished, in the privacy of your home, is told in a vitally interesting Book, entitled "THE ENGINEER'S GUIDE TO SUCCESS," which is offered post FREE to all genuinely interested in the manifold branches of engineering. It tells how you can prepare speedily and effectually for the:-

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HEADPHONES REPAIRED.
Rewound and re-magnetised 4/- per pair. Loud Speakers repaired 4/-. Transformers rewound 5/- each. All work guaranteed and tested before delivery. Write for Trade Prices. Phone: Clerk. 1735. MASON & CO., 34, East Rd., City Rd., N.1.

COMPLETE SETS, LOUD SPEAKERS, COMPONENTS, Etc.
Supplied for all circuits, including the Mullard Master 3, Cossor Model Maker, also the new circuit featured in this issue.

EVERYTHING WIRELESS ON EASY PAYMENT TERMS

Send list of requirements, and best monthly terms will be quoted by return.
THE P.D.P. COMPANY,
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STARTLING REDUCTION IN WIRELESS VALVES

BEST BRITISH MADE VALVES FOR 3/6 OLD PRICE 8/6

L.F., H.F., R.C., AND DETECTOR IN 2 and 4 VOLTS. P.R. SUPER DULL EMITTER VALVES are the latest product of one of the finest equipped Wireless Research Factories in Great Britain. They must not be confused with Bankrupt or Foreign stocks of old and rubbishy valves. The P.R. SUPER VALVE FILLS EVERY WIRELESS NEED, and has enormous TONAL STRENGTH, PURITY, and SELECTIVITY.

Type	Fil. Vts.	Fil. Amp.	Imp. Ohms.	Amp. Fac.	M/C	
206h	2	-06	35,000	15	-4	H.F. Det.
206d	2	-06	25,000	12	-43	Det.
206l	2	-06	18,000	-8	-44	L.F.
206rc	2	-06	120,000	40	-33	R.C.
215h	2	-15	40,000	20	-5	H.F.
215d	2	-15	30,000	15	-5	Det.
215l	2	-15	12,000	6	-5	L.F.
406h	4	-06	23,000	15	-65	H.F.
406d	4	-06	19,000	9.5	-5	Det.
406l	4	-06	11,000	6	-55	L.F.
406rc	4	-06	120,000	40	-33	R.C.
Power Valves	2V	-20	6,000	5	-82	P
	4V	-15	4,000	4	1-0	P

NO BETTER CAN BE BOUGHT ANYWHERE. THEY WILL SAVE YOU POUNDS.



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In the hours you now spend just "passing the time away" you could be making money, producing a patented article, for which there is a constant demand. No cumbersome "plant" is necessary. Your own Kitchen Table can be your factory. Only a few simple tools which you can make are required. The work is simple and easy—even the children can help. The possibilities of making money are only limited by the time you spend on it.

Up to £300 a YEAR Earned!

Think of the luxuries and comfort you could enjoy with £300 a year extra! Then send the Coupon below to-day for full particulars. For your own sake! For your family's sake! Only one person in 50,000 of the population is allowed to manufacture under my Royal Letters Patent. This protection allows of unrestricted marketing. Arrangements will be made to take surplus output off your hands, thus guaranteeing your profits.

YOU can do it!

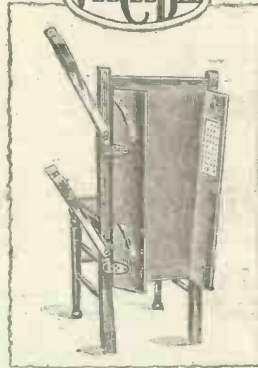
Seize your opportunity NOW. Don't say "I'll do it to-morrow"—for to-morrow never comes. The man who "wins" is a man of action—so "act" now. The posting of this Coupon is the first swing of the pendulum—the starting of the clock, ticking away, not WASTED HOURS, but GOLDEN HOURS—for YOU! It is so easy to take the first step THIS MINUTE, by simply sending this Coupon. Will you do it?

"MAKE-MONEY-AT-HOME" COUPON.

To THE ENGLAND-RICHARDS CO., 114, King's Lynn, Norfolk.

Sirs,—Please send me at once, and FREE, full details as to how I can Make Money at Home in my spare time. I enclose 2d. stamp for postage.

Print your name and address boldly in capital letters on a plain sheet of paper and pin this Coupon to it. Popular Wireless, 7/1/28.



"The picture on the box"

may not be the sign of a good cigar, but a good wireless cabinet is a sure sign of a good set.

Your set deserves a V. C. Bond Cabinet. It will not only add distinction to your room as a piece of furniture, but will add to the efficiency of your apparatus.

Our cabinets are made like that—experts in radio and cabinet-making contribute to the beauty of design and sound construction which has made them so popular.

We have many designs from which you may choose, but we can make one to your special requirements too.

This combined bedroom chair and trouser-press is not only a piece of distinctive furniture, but a personal servant any man would appreciate.

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REFUSE IMITATIONS!



Standard Size panels supplied in three finishes, Black polished, Black Mat, and Grain polished, carefully packed in attractive cartons. Every panel and piece of ebonite guaranteed and made by British hands.

Apply for particulars of our new foot-proof 4 and 6 contact Former with bases ready for winding, directions and fully illustrated booklet, Price 6d.

ORIGINAL PRIZE-WINNING "BECOL" LOW LOSS FORMER, No. 5. 3 inch diam. overall.

Insist on a Becol Low Loss Former, the Former "with a reputation," incorporated in sets that have taken four first prizes and gold medal, a proof of their superiority. Supplied in cut lengths, 3 in., 4 in., 6 in., packed in cartons, and standard lengths of 3 ft.

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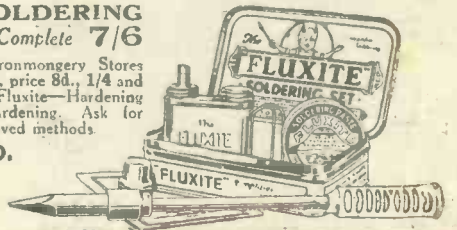
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MELODY MAKER Inductance Wire E. and C.C. Copper, Sale 1/6 lb. Paxolin Tubes, 3 by 2 1/2, 4d. each, quarter usual price.

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VARIABLE. Panel mounting Square Law, with Vernier new in cases .001 mfd. Reduced to 2/3. Polar 3-gang panel triple. Controls aerial and 2 H.F. circuits, dust proof, only 8/-.

NO. 1A SPARK TRANSMITTER SETS. Complete in case, with platinum tip control key. Ideal for distant ether control of models, spark experiments, etc. Only 14/6.

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ELECTRIC HEATERS. Hot plates and immersion Heaters for liquids, 5/- each. 110 and 220 volts.

VIBRO-MASSAGE SETS. cost £4. New, in case. Sale 25/6. X-Ray Tubes, 35/-.

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WATERPROOF LOUD-SPEAKER, H.T. OR L.T. BATTERY CORDS. Twin conductor with eyes at end, 4 ft. long, 6d. each. 4 Pinplug and Socket, 2/6.

MICROPHONE BUTTONS, as used in the Service, solid back inset type, 10d. each. Genuine Skinderviken in original boxes, 2/- each. The wonderful little units are used in the "A.W." system for amplifying without valves, speech magnification, sound detection and Micro-Stethoscope fitting, 5/- Reed Micro Receiver, 3/-.

BARGAIN RECEIVERS. These are all by first-class makers. 2-Valve, No. 33 Marconi Lid Case, all waves, 50/- 2-Valve Mark 32, 250 to 1,800 metres, £4. Western Electric, 3-Valve, £6 5s. 3-Valve Aircraft, £4. Polar 4, Pol. Cab., £6 10s. 5-Valve R.A.F., with Valves, £5. 6-Valve Marconi De Luxe, £8. Sterling Surplus Anodian, £5 10s. Marconi R.B. 10 Crystal and 1-Valve closed Cabinet, complete with Valve, 22/6. Marconi Screened 6-Valve, £12, cost £50. 25 per cent discount on all purchases over £5.

TABLE ELECTRIC PROJECTORS for Photo Slide or Home Television experiments. 4 Magnif. and focus lenses, swivel stand. Socket cord and plug for supply mains or battery. Sale 25/- Cost £4.

ELECTRIC FESTOONS 16 Fairy Lamps on Flex, with clips and battery adaptor. 220 Volts, 25/-.

EX-ARMY OSRAM VALVES. Unused, in original cartons. Not the type without valve legs offered by junk shops. Fully guaranteed, 2/-.

H.T. ACCUMULATORS, 10 amps., 14 volt units. 7/- each in wood case. 8 volt 10 amp. units, 4/- each.

NERT FULLER NAVY BATTERIES, in Ebonite case, 1 1/2 volt. Will light a 3-valve, .05 amp. receiver for 2 months on a charge. Can be replenished over and over again. Only 1/- each.

VARLEY DOUBLE WOUND CHOKE COILS. Carry 60 m/a and fitted ebonite panel with terminals, ready for use in H.T. Eliminator Filter circuit from the mains. Bargain, 4/6. L.F. Ironclad chokes, 1/- each.

THE DIX-ONEMETER. The 55 Range "Rolls Royce" of Radio. An instrument of exact precision reading 40 micro-amp. to 20 amps., 2 milli-volts to 2,000 volts. Measures Crystal Signals or Resistances from 50 ohms to 50 megohms. Instrument De Luxe, 55/- Multipliers, each 6/8.

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Moving Coil Milliammeters from 15/-.

FIVE GUINEA CABINET LOUD SPEAKERS for 25/- whilst they last. The famous VIOLINA can be heard all day at Electradix Showrooms.

WESTERN ELECTRIC 2000 ohms TABLE TALKER, 15/- cost 35/-.

GRAM PICKUPS, Magnetic Earpiece Units for making your own 40/- reproducer. Adapted with a little work. Only 1/2 each.

PRECISION CONDENSER, POLAR. Full dial sq.-law, .0003 mfd., 3/6; .0005 mfd., 4/6; list 12/6. Panel 3-gang Triple, 8/-, list 15/- Penton .001 Panel, 1-hole fixing Varia. Condensers, 2/6, list 8/- Polar Rheos., 1/3, list 4/6. Polar Panel 2-way Coil Holders, 2/9, list 7/6. Polar Varia. H.F. Transformers, 300/500, 3/6, list 8/6. L.F. Gambrell, Inter-valve, 7/6, list 15/- Polar Variometer panel and dial, list 21/- Sale 8/6. Polar Detectors, Everset, 1/9.

ELECTRADIX RADIOS, 218, Upper Thames St., E.C.4

SHORT-WAVE NOTES.

(Continued from page 982.)

when the N U stations do appear again they will be exceptionally good, and remain so for some time. At all events, we have good reason to hope for a spell of good transatlantic conditions, for such a prolonged bad spell as the last month or so has seldom been noticed before.

The strange part of it is that conditions on 32 metres are quite different from those on 40 metres. When no NU stations can be logged at all the Australians and New Zealanders are coming in merrily in the early hours of the morning.

Probably some readers who live in crowded areas have noticed that the local station (particularly 2 LO in London) seems to spread itself well over the dial of their short-wave set when it is oscillating. This seems to be due chiefly to the proximity of crystal sets, and is apparently caused by rectified current from the latter finding its way into the short-wave receiver. It can generally be stopped by connecting a small fixed condenser in series with the earth.

TECHNICAL NOTES.

(Continued from page 953.)

allowance for the difference in time and to calculate whether they are likely to be "on the air." It is quite a simple matter, knowing the difference between British time and that of the place in which the station is located, but nevertheless it is convenient to have a small rotary chart by which the time at any distant place can be instantly shown.

Such simple cardboard devices can be readily made and by their convenience will repay the little trouble involved. I see there is one now put on the market by the Atlas Press Pty., Ltd., and advertised in "Popular Radio Weekly" (Melbourne), at 1s. 1 1/2d. "By giving universal time it allows you to search for a distant station when that station is operating, and it saves you wasting your time trying for stations which are not on the air," says the Journal.

Frame Settings.

We are generally told that a frame aerial, for best results, must bear on the station which is being received. But this is a very general statement and probably in nine cases out of ten is not strictly true. It is more correct to say that the frame aerial must bear upon the apparent position

of the received station, that is, the position corresponding to the direction of the arrival of the waves.

A very simple illustration of this may be given by comparing the incoming waves to the light from the sun when the sun is setting. Everyone knows that when the sun appears to be very low above the horizon it has actually sunk beneath the horizon, but it is still seen owing to the fact that the light is deviated (or "refracted," as it is called) in its passage through the atmosphere. The eye receives the light and presumes the sun to be in a position which would correspond to the light having travelled in straight lines. In the same way the frame aerial when adjusted for best results bears on the position of the broadcast station which would be given, so to speak, by tracing back the waves in a straight direction.

Deviated Waves.

Deviation of the arriving waves may be brought about by various causes. Usually the deviation takes place in the close vicinity of the receiving set itself and is due to iron girders in the building or to electrical conductors, such as pipes, electric cables, and so on.

In the ordinary way these deviating causes are not troublesome, since we are usually not concerned with the bearing of the station so long as we get efficient reception. Moreover, deviating causes such as those just mentioned above are at least constant in their effect.

A Curious Effect.

Sometimes, however, in working, say, with a super-heterodyne receiver, you will find that the bearing of a given station (that is, the best setting of the frame aerial) will vary very considerably from one occasion to another. This has been found in particular cases to be due to the varying effect of an outside aerial in the neighbourhood, which has been perhaps tuned to the wavelength of the same station which is being received on the frame aerial.

As a rule, the signal strength received on the super-heterodyne will be considerably increased when the neighbouring outdoor aerial is tuned to the same wave-length.

A good deal depends upon whether reaction is being used in connection with the outdoor aerial and, of course, if this is the case it probably means that the aerial is acting as a local radiator. If this is so, it is only to be expected that the resultant direction of arrival of waves will be upset.

ALL communications concerning advertising in

POPULAR WIRELESS MODERN WIRELESS CONSTRUCTOR must be made to

JOHN H. LILE, LIMITED, 4, Ludgate Circus, LONDON, E.C.4. (Phone: City 7261.)



FORMO-DENSER

Price from 2/6



FORMO-DENSER

A sound variable condenser which fills a long-felt want. Specially designed to take the place of the hitherto generally used Fixed Condenser. For use as:

- Neutralising Condenser
- Aerial Condenser
- Grid Condenser
- Reaction Condenser
- Phasing Condenser
- Tone Control Condenser

5 Capacity ranges, and each in Baseboard and Panel models.

22, CRICKLEWOOD LANE N.W.2
Phone: Hampstead 4787.

These numbers save you money—



Valves with the wonderful MULLARD P.M. FILAMENT

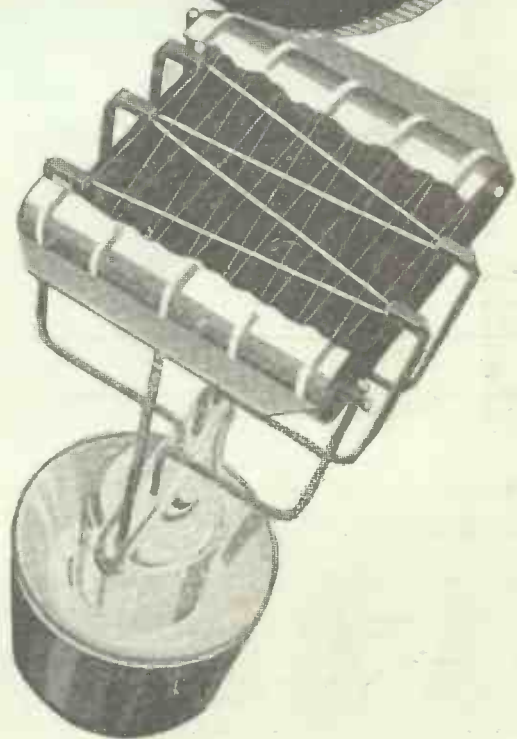
Pay less for great power, long length of life and beautiful purity from your valves—use the new Valves with the wonderful Mullard P.M. Filament consuming only .075 ampere filament current.

These are the valves that have revolutionised maintenance costs and performance, making 1/10th ampere consumption extravagant.

There are many unique advantages in Mullard Valves with the wonderful Mullard P.M. Filament. Use them and enjoy the improved performance and economy they bring to any radio receiver.

Mullard

THE · MASTER · VALVE



The Transformer for every set

When building a transformer-coupled Receiver, get hold of the efficient transformer—The R.I. and Varley. You must have seen time and time again in the leading Wireless Publications the name R.I. and Varley in the list of specified components. Consider the importance of the fact that R.I. and Varley Transformers have been specified for :

The 1928 SOLODYNE

and the principal circuits published
in "Radio for the Million."

The shortage of the specified transformer for the famous "Cossor Melody Maker" has lead thousands of constructors to apply to us for the Straight Line Super Transformer. In order to avoid confusion we are publishing below the connections of the Super Transformer in this famous Receiver.

Connect terminals 1 and 2 together with link provided, then terminal 3 to plate or "A" with lead No. 23. Terminal 6 should then be connected to H.T. positive with lead No. 20. Then connect terminal 5 to grid bias with lead No. 34, and terminal 4 to grid with lead No. 22. A .0005 fixed condenser may be connected across terminals 3 and 6.



25/-



THE MARK OF BETTER RADIO

Varley LTD.

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

Tel. Holborn 5303

EASILY BUILT AND WORKS WELL (See Page 993.)

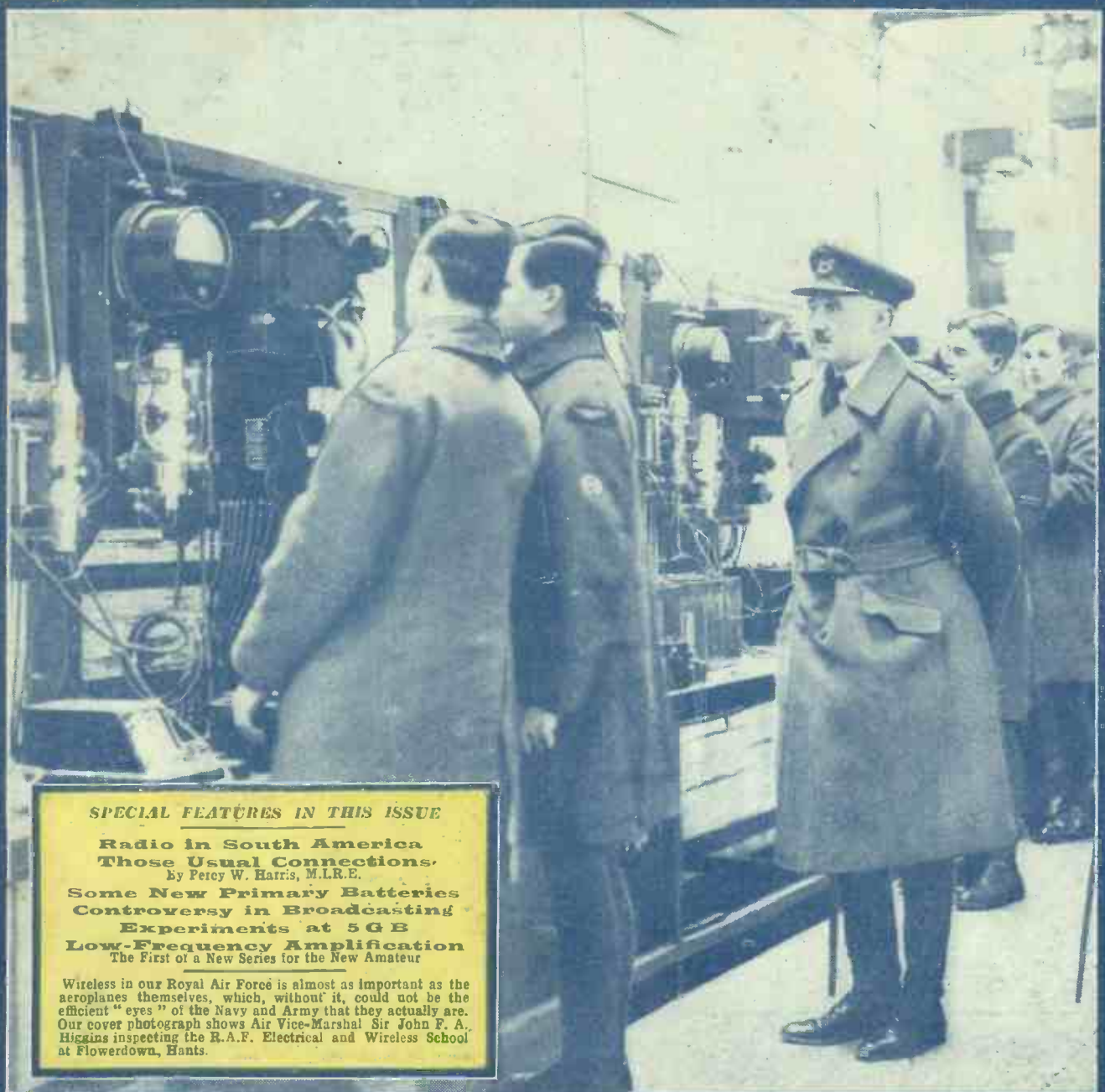
Popular Wireless

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No. 293. Vol. XII.

INCORPORATING "WIRELESS"

January 14th, 1923.



SPECIAL FEATURES IN THIS ISSUE

**Radio in South America
Those Usual Connections.**
by Percy W. Harris, M.I.R.E.

**Some New Primary Batteries
Controversy in Broadcasting
Experiments at 5 GB**

Low-Frequency Amplification
The First of a New Series for the New Amateur

Wireless in our Royal Air Force is almost as important as the aeroplanes themselves, which, without it, could not be the efficient "eyes" of the Navy and Army that they actually are. Our cover photograph shows Air Vice-Marshall Sir John F. A. Higgins inspecting the R.A.F. Electrical and Wireless School at Flowerdown, Hants.



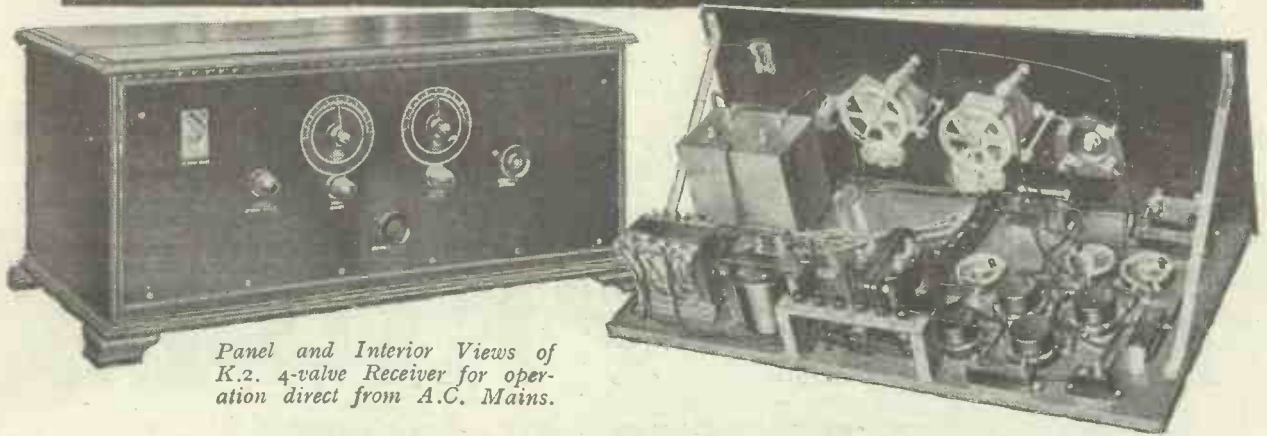
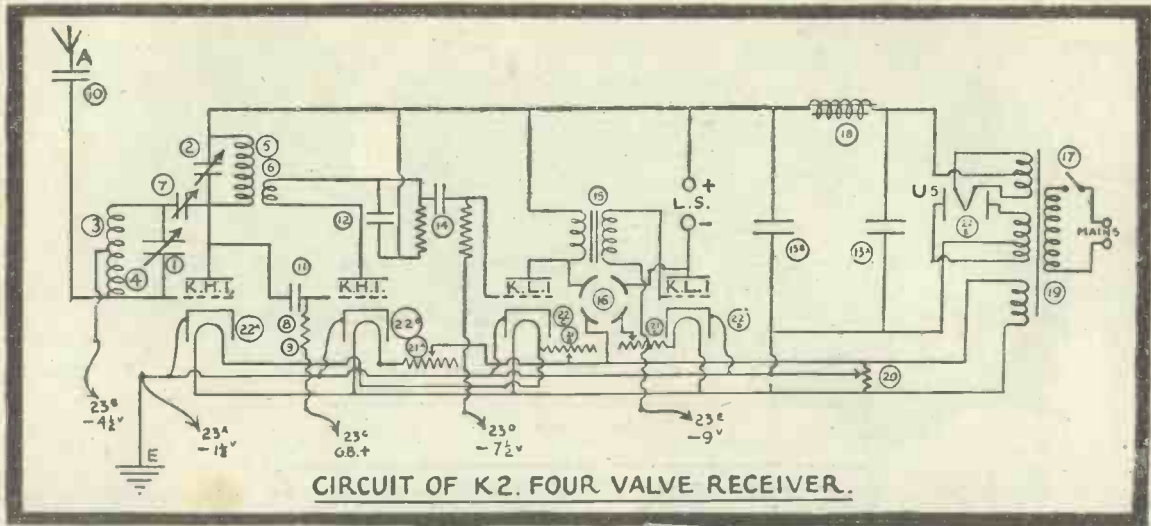
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Panel and Interior Views of K.2. 4-valve Receiver for operation direct from A.C. Mains.

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A four-valve receiver, operating from batteries, and possessing extraordinary qualities of sensitivity and selectivity, is the T.I. Receiver incorporating 1 Marconi S625 valve. Under favourable conditions the range of the T.I. is very considerable and full loud-speaker volume is obtainable from a number of stations, *with* complete stability. The circuit incorporates 1 Marconi S265 Valve in the H.F. stage, Det. and 2 L.F. (Resistance and Transformer coupled.)

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Please send me free constructional booklet, including blue-print for circuit.....

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P.W. BLUE PRINT
Number

1. DETECTOR VALVE WITH REACTION.
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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. AND 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. AND DETECTOR (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer Coupled, with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled, with Switch for Cutting Out Last Valve).

P.W. BLUE PRINT
Number

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).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
19. H.F. DETECTOR AND L.F. (With Switch to Cut Out the Last Valve).
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**makes an astounding
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B 210 H	B 210 L	B 215 P
<i>R.C. and H.F.</i>	<i>General Purpose.</i>	<i>Power Amplifying.</i>
Fil. Volts 2	Fil. Volts 2	Fil. Volts 2
Fil. Amps. . . . 0.10	Fil. Amps. . . . 0.10	Fil. Amps. . . . 0.15
Max H.T. Volts 150	Max H.T. Volts 120	Max H.T. Volts 120
10s. 6d.	10s. 6d.	12s. 6d.

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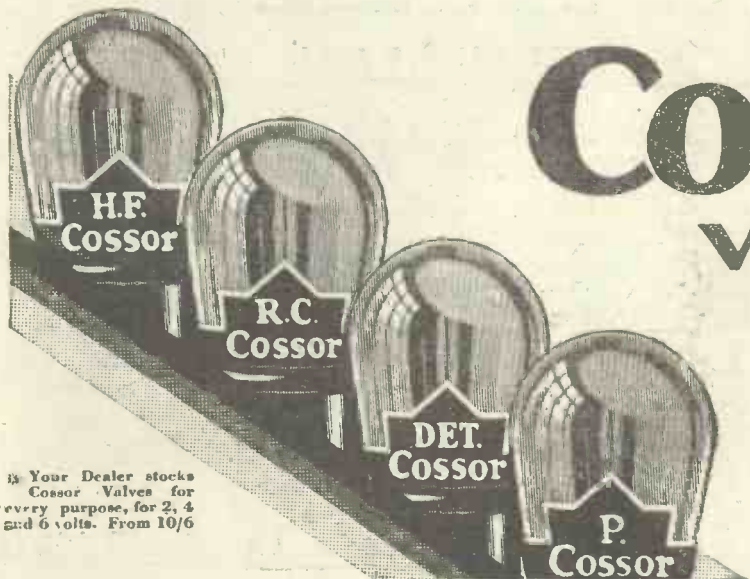


TEAM WORK

THEY'RE off! Away they shoot like hounds loosed from the leash. One! Two! Three! Four! With perfect rhythm the oars rise and fall. The men who propel them are no longer men . . . they row like a machine. Team work.

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The Valve which made possible the wonderful Cossor "Melody Maker"

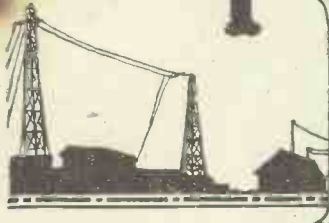


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RADIO NOTES AND NEWS.

The Super Enthusiast—Empire Broadcasting—Future of 5 G B—Ultra-Violet Interference—
 The Merry-Go-Round—Have You Tried Java?

The Super-Enthusiast.

ALL the (visible) world is white as I write these notes, and winter sports are in full swing in this locality. Old and young are out on the hills with their sledges, which is proof that radio has not yet turned us into a nation of chimney-corner fixtures. I ask you to imagine my feelings when I was solemnly consulted by a sixteen-year-old as to the feasibility of equipping his racing sleigh with a frame aerial and portable set.

Boxing-Day Disaster.

WHEN one comes to think of it, the fact that mine was the only aerial in the road to collapse during the Christmas holidays looks like a little bit of leg-pulling on the part of Nature. The top section of my steel pole plunged into a Weeping Ash tree, and there is a fine old raffle of stay-wires, aerial and insulators. The raffle will remain there till about July, if the weather does not improve. Meanwhile, I have had to shorten the aerial—a thing I have been going to do ever since 1923!

Outstanding Items.

MR. ANDRE CHARLOT will produce revues on January 12th, 19th, and 21st. On January 15th, 5 G B is to transmit Mendelssohn's oratorio "Athalie"—a fine work. On January 21st, description of England v. Wales Rugby, from 2 L O and 5 X X. Concert from Kingsway Hall on January 14th.

Empire Broadcasting.

THE failure of the Sydney broadcast on Christmas Day was disappointing, but I suppose we must consider it to be compensated for by the success of 5 S W in getting through to the Antipodes the day before. Let us hope that these bitter lessons are being zealously studied so that the proper combination of wave-length and time of transmission will be speedily discovered. Even in Beam transmission the tendency is towards the use of a longer wave for night work.

Broadcast Exchange.

THE wireless people in the U.S.A. have not bated a whit of their enthusiasm for the development of a system of

exchange programmes between America and Europe. After experiment, the American receiving point has been fixed at River Head, Long Island. According to the American experts 5 S W's 24-metre wave is not satisfactory; but the present tests on that wave-length, which are being reported on from all quarters of the globe, ought to say the last word on that point.

Daventry Junior.

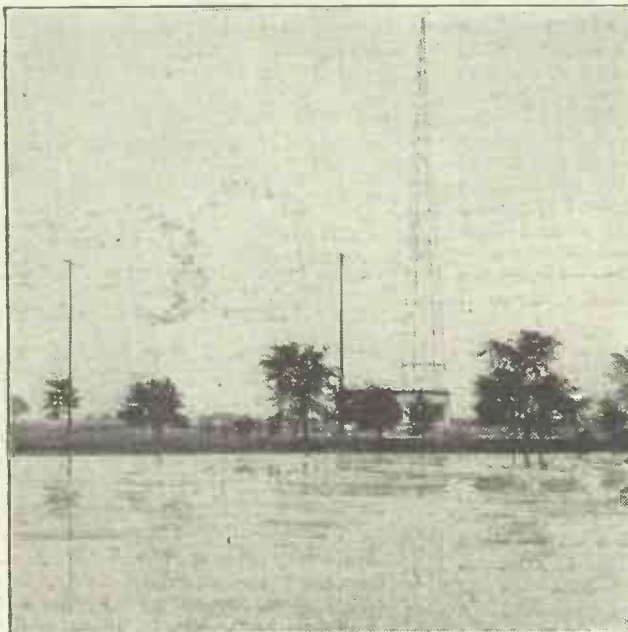
REMARKS of considerable importance to many readers have recently been made by the B.B.C. about the 5 G B aerial. It will be remembered that in August last year it was found that the high aerial of 5 X X shielded Birmingham from the emissions of 5 G B's low aerial. The B.B.C. then put up another low aerial in parallel with the first, but designed to

radiate in the direction of Birmingham. (That is the first case of directional broadcasting—what a contradiction of terms!—of which I have ever heard.)

The Future of 5 G B.

NEXT, they erected the aerial on 300-ft. high masts, only to find that the shielding effect was increased. The B.B.C. is now going to rearrange the masts in an attempt to maintain the signals in Birmingham at their present strength, whilst giving a greater field strength elsewhere. The B.B.C.'s exploits at Daventry are not of the highest order of technical efficiency, and as the B.B.C. is a public utility concern, with lots of "pull," these experiments ought not to be allowed to upset the listeners of a great city like Brun. We are sorry for Captain Eckersley's troubles—but they are "his pigeon."

A BILLIONAIRE'S RADIO STATION.



Mr. Henry Ford, the richest man in the world, whose interests embrace practically every industry and country, naturally included radio among his activities. He owns one of the largest radio stations in the United States, and this photograph shows the main aerial mast and transmitting house of the "Ford" station, which is situated among most picturesque surroundings in Michigan.

Chelmsford and Overseas.

IT is almost pathetic to read the letters one receives about 5 S W from Britons overseas. I know only too well how this little island, with its unmentionable climate, wickedly high taxes and degenerate population, pulls at the heartstrings of the exiled Britisher. If 5 S W is only a gesture born of public pressure, as I believe it to be, it is being taken with great seriousness by the Empire, and I hope the B.B.C. is aware of the deep-seated interest its "experiment" has aroused.

Interest in 5 S W.

J. C. S. (Travancore) —does not "P.W." travel? —sat up in order to get (Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

5 SW, and got the precious home signals quite well, though he has something to say about their quality as compared with those of 2 FC and 2 X A F. F. A. M. (Ottawa) also obliges with notes on his reception of the Prince's Armistice Day speech. Seriously, I think the Government should build and subsidise a special Empire station; better than strolling Cabinet Ministers, or "showing the flag."

Greetings from 3 L O.

THE Australian Broadcasting Company issued a Christmas Greetings card, which has come just a little late to my notice. It is very nice indeed, and is doubly valued because it contains a versified description of radio waves, which are said to swing through the trackless spaces of the world, "All toil forgot, all care, all strife." Well, whatever else we may accuse the B.B.C. of, its waves are not toilers nor are they careworn or bellicose, but rather weak, gentlemanly fellows, with regular hours and habits.

Ultra-Violet Interference.

PLACES where ultra-violet light rays treatment is given are increasing in number and nuisance. I am cursed with a "clinic" next door but two, and when the practitioner is at work his "signals" sound on our loud speaker like a buzz-saw in full blast. R. V. P. (Finchley) tells me that he can receive 2 L O in style, while Mrs. R. V. P. basks in the artificial sunlight. My practitioner must broadcast his sunlight on a very wide band, for he knocks my 2 L O silly. There is no doubt that U.V. is an obstacle to reception, generally speaking, and the nuisance will have to be tackled sooner or later.

Christmas Cards, £8.

THAT radio Christmas and New Year card racket was an interesting application of the transatlantic photoradiogram service, but a good deal beyond the resources of the general public. For a card of 4 in. by 5 in., £8 4s. 6d is a charge which only much capital or much love could stand. I saw some of these radio cards, sent from New York, and they were very well reproduced. One multi-millionaire—I think he must have been that—sent no less than 240 of them—though the odd 239 cost him only a dollar apiece as copies.

The Merry-go-Round.

ENGINEERS at the Marconi Beam station at Dorchester have actually recorded their own signals three times on the receiving tapes at Somerton, proving that the said signals have thrice traversed the globe. The third record is said to have been somewhat off colour—proving that even a wireless wave cannot play fast and loose with its constitution without showing signs of dizziness.

Short-Wave Stations.

NOTE: Not necessarily telephony stations. Berne, H B C, 34-2; Catania, I H F, 5-35; Erythra Amara, 32-5, 64; Vienna, O H K, 40-6; Koepong Radio, P K D, 22; Amboina Radio, P K E, 24; Medan, P K P, 21-5,

31-5; Tiflis, R T R L, 22 to 42; Tashkent, R A U, 23, 35; Irkutsk, R P O (?); S.S. Canadian Commander, V G J L, 43; Elgin Islands, W N B T, 33-5; Portland (Oregon), 7 X A O, 53-54; Ministry of Agriculture, Mexico, C Z A, 0 to 14, 43 to 45.

"Ariel" in Hot Water.

HUZZA, boys! Only January 14th and a row on already, with yours truly as the storm centre. On December 17th, I reprinted for your delectation the plain statement of a writer in "Reynolds' News," as follows: "If the acid of an accumulator has a specific gravity of less than 1.250 there will be a fallacious reading on the

SHORT WAVES.

8 A S Q wants to find out: "Does the relay relay relay?"

A PERMANENT JOB.

Fan: "Something's wrong with this; can you fix it for me?"
Repair Man: "Sorry, but that's a fixed condenser."—"Radio News."

"Many of the items broadcast," writes a critic of the B.B.C., "are a positive insult to the public intelligence."

Another point of view, of course, is that the public intelligence is a positive insult to many of the items broadcast.—"Birmingham Gazette."

"The quality of static is not strained, it falleth like the gentle coal in a cellar."—With apologies to Shakespeare.

A FAIRY STORY.

Once upon a time a man bought a five-valve set and a loud speaker, and his neighbours lived unhappily ever after.

Mister: "Now I'll tune the radio set for you."

Missus: "What—a brand new radio and it needs tuning already?—"Science and Invention."

Much development is reported in the design of indoor aeriols.

"No wonder," says the cynic. "The whole population of Aberdeen has been engaged on the problem for several years."

It is understood that one of the B.B.C.'s surprises this year will be an attempt to broadcast a ripe Stilton.—"Help Yourself."

Friend (to Scot who has his aerial attached to a small sapling): "You want to buy a pole, Sandy, and put the aerial up higher. You'll get better reception."

Sandy: "I ken, mon; but the tree will grow."—"London Opinion."

We read that a certain clergyman states he has not acquired the vocabulary to play golf.

Will any reader volunteer to lend the gentleman a radio set for a few weeks?

THIS FREEDOM.

Tommy: "How do you like having lessons from the loud speaker?"

Jimmy: "Fine! You can put your tongue out at it."—"Yorkshire Evening Post."

hydrometer." Now, I thought that was humorous, because a proper hydrometer ought to give a reasonably correct idea of the S.G. of any liquid, provided it covers a suitable range, and ought not to mislead anybody, even if the S.G. is less than 1.250 (or 1.2,500,000, ad lib.).

Treatise on Hydrometers.

I AM not only severely corrected by A. C. (Worksop) for unseemly levity, but am, in effect, rebuked by "Reynolds'," which returns to the attack, re-states the "bloomer," prefaced by "As before stated," and terminated by "This should be clear to anybody." Sorry, my dear fellows, but there is a misunderstanding—on your side. It seems that "Reynolds'" and A. C. use as an hydrometer an instrument

devoted solely to the needs of amateur radio people; in addition to the usual scale it bears legends such as "Empty" (another bloomer), "Half-charged," "Completely blotto," "Half-seas over," and so forth.

"Partly Discharged."

IN fact, "Reynolds'" says that hydrometers are usually marked in that way. That is not correct, and I guarantee that any boy of fifteen who has studied physics will agree with me. However, the root of the trouble is that A. C. has his accumulator charged; the S.G. of the electrolyte should then be 1.2; he "tops up" with water, thereby reducing the S.G.; the comic hydrometer thereupon records "Partly discharged." Good heavens! Then let him test the S.G. before he "tops up"—and try the voltage as well. It is not the reading which is fallacious, but the test of the battery is incomplete. It's a catch.

Reception of Australia.

USING the "P.W." "Sydney" Two, C. W. U. (Burton-on-Trent) got 3 L O on Christmas Day at good 'phone strength. So the B.B.C.'s hard luck did not worry him. He got also 2 FC, and K D K A and the 2 X A family are as easy to tune in as falling off a log. C. G. N. (Langport) has succeeded with 3 L O; set not mentioned. P. W. (Heybridge)—lucky initials, those!—is quite happy with his "P.W." "Every Purpose" Two, and reports 3 L O. With two P.W.'s on the job, I am not surprised at the result.

Licences in Germany.

THE total number of licence-holders in Germany in December, 1927, was two millions, an increase of about a quarter of a million since September, 1927. We are still a little ahead, with 2,355,600, as at the end of November. The difference, however, is that with such a showing it is considered that there may be a reduction of the German licence fee of 24s. per annum. I think our licence ought to be reduced, for I calculate that the B.B.C.'s present net annual income is £924,400, or thereabout. Less tommyrot with schools and booklets, and a reduced fee, please!

Sensible Resolution.

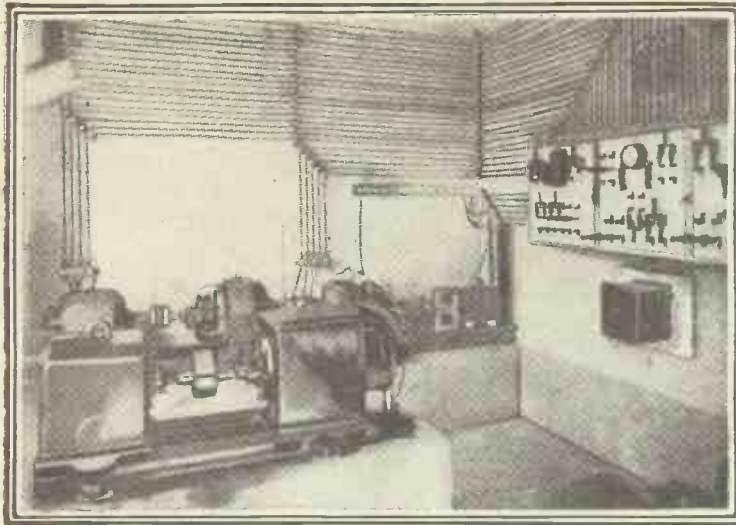
AS you have all made your "good" resolutions, permit me to suggest that you find room for a sensible one, namely, to begin at once to subscribe to "Modern Wireless," or the "Wireless Constructor," or both. The cost of both is only 0.8 penny per day, or less than the price of the lunch edition of a newspaper, which you glance at and throw away. But what a difference in the contents! These two mags. keep you in touch with every important phase of radio.

Mayday.

ON December 17th I said that the Washington Conference had formally adopted the word "Mayday" as a telephony distress call. J. S. K. (Lanark) tells me he thinks I have misled my readers, because this call has been in use for at least two years. J. S. K.'s microscope must have missed the words I have italicised above. However, my friend is right, in that aviators certainly have used the word for some time. This scrupulous reading is quite a tonic and keeps me up to the mark.

ARIEL.

RADIO IN SOUTH AMERICA



The dynamos and main supply switchboard at L O Y.

I HAVE just returned from a visit to South America, and while there made a study of broadcasting in all its branches. All the countries in the Continent are well equipped with stations, but nearly



The entrance to the Flores broadcasting station.

all are used for the purpose of propaganda and advertising.

There are several stations in Brazil, the chief ones being Rio de Janeiro, Pernambuco, Bahia, and Santos, who broadcast daily.

In Uruguay there are only three; and the Argentine possesses ten, eight in Buenos Aires and one each at Santa Fé and Rosario. Chile also has several stations.

The Flores Station.

When in Buenos Aires I was shown over the Flores Station, which is the largest and most powerful in the Argentine, by Signor Gunche, the chief engineer.

The transmitter was made by an American firm, except for the microphone, which is of the Western Electric pattern, and was designed by the station's own engineers. For its comparatively low power of 2½

kilowatts the station has a remarkable range, I myself having heard it at a distance of over 3,000 miles when 6° north of the Equator. This, I am sure, is due to the fact that the station is always over-modulated, but it does not overcome the fact that a station of such power can penetrate the tropics. The aerial system is exceptionally fine, and is of the cage type with a central lead-in, swung between two steel latticed masts 115 ft. high.

The counterpoise is swung beneath the aerial at a height of about 12 ft.

The studio is small, though well equipped and artistically furnished, and only moderately draped. The microphone described above stands on a pedestal about 4 ft. off the ground, and is connected to the transmitter in the next room through a plug in the wall. This method of breaking the microphone contact causes an unpleasant jar in the receiving phones.

The station commences broadcasting at 10 a.m. and closes down at 12 midnight, two announcers working in relays; hard work, you will understand, when a great percentage of their work is reading out lengthy advertisements.

The programmes are built up in sections of half an hour, each advertising firm paying highly for a section.

Very little classical music is broadcast, and the programmes chiefly are comprised of tangoes, sentimental songs, and American fox trots, the advertiser pouring out as much propaganda as he can between each musical item.

Some interesting information mainly concerning the broadcasting activities of Brazil, Argentine, Chile and Uruguay.
From A SPECIAL CORRESPONDENT.

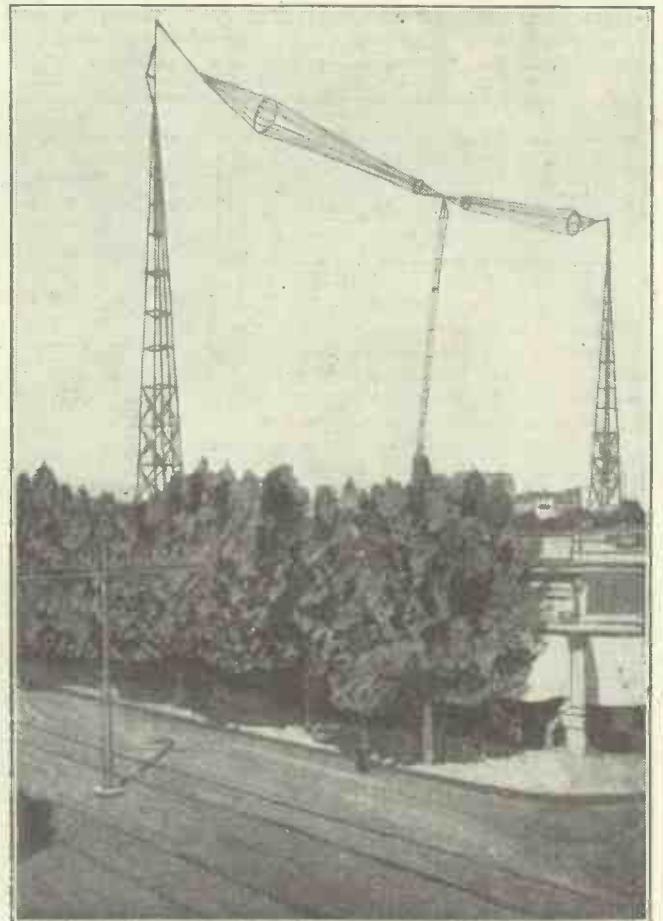
The whole cost of running the station is borne by the advertisers, and the owner, I gather, obtains quite a substantial profit.

Opera Broadcasts.

All the other stations in the Argentine are run on these lines, except for that owned by the newspaper "La Nacion," which, though of low power, gives remarkably pure transmissions from the Theatre Colon of the opera, besides other outside broadcasts.

"El Dia," the station which I visited in Monte Video, is run on exactly the same lines as the Argentine stations. Its transmitter is only of 500 watts, and consequently its range is small.

(Continued on next page.)



The Flores station, L O Y, of Buenos Aires, is stated to be the largest and most powerful broadcaster in the Argentine.

RADIO ODDS AND ENDS.

Concerning Harmonics.

ONE frequently hears statements concerning the reception of "harmonics from a certain station" and an amateur gets Daventry, 5 XX, in on an 800 metre or so adjustment, and says: "Ah, I am getting the second harmonic of Daventry." Again, he may find 5 XX on a 500 or so metres adjustment if he is close enough to that station, and asseverates that here is the third harmonic of Daventry. But broadcasting stations transmit only on one wave-length and not on a series, and such harmonics should be referred to as receiver harmonics. The fundamental wave-length or frequency of the transmitting station is causing the set to oscillate at a harmonic resonance. It is, therefore, a harmonic of the receiver.

An Aerial Tip.

Now that we are in the middle of the more-than-usually rainy season, not to mention snow and frost, radio amateurs would be well advised to examine their aerial equipment now and then. This is a duty that can more pleasantly be carried out in the summer but, unfortunately, the necessity arises more strongly during the winter.

It should also be remembered that ropes shrink when they get wet, and the shrinkage is sufficient to cause breakage if sufficient slackness is not allowed. The very low

temperature experienced at this time of the year will not cause much trouble, but damp and wet generally will tend to rot unprotected poles and guy ropes. The copious use of creosote and tar will prove a good investment.

L.T. Economy.

If you would get the most out of your accumulator for every charge, switch off your set every time you come to an item to which you do not desire to listen. An accumulator which is used in ten-minute spasms will last almost twice as long per charge as one of the same capacity that is used for solid periods of two or three hours. Accumulators must, however, be charged at regular and fairly frequent intervals. To make one last a month or two for every charge is false economy, for it will tend considerably to shorten its life.

A Rheostat Hint.

Many amateurs take advantage of the definite "off" position on the rheostat to use that component as an on-and-off switch. In such a case, however, care should be taken that the leads to the rheostat are kept well clear of the contact arm at whatever position this might be. It would not matter, of course, if the contact arm touched the lead going to the terminal connected to the contact arm itself, but should it touch the other, then the rheostat will in effect be entirely out of circuit and the L.T. joined direct to the filament of the valve. Therefore, unless the simple precautions indicated are taken, it is quite possible that the "off" position of a rheostat might be a very definite "on" position!

TECHNICAL TIPS.

The valves used by the B.B.C. for transmitting cost about £90 each.

If hand-capacity effects are noticeable when tuning, these may disappear if the leads to the condenser in question are reversed.

Disconnecting the earth lead sometimes improves reception from short-wave stations.

The ordinary biscuit tin is quite unsuitable for use as a screening-box owing to its magnetic properties.

When using a hydrometer, care should be taken to return the electrolyte to its proper cell.

Crackling noises are frequently caused by faulty anode resistances, or by bad contact at the clip or terminal of the resistance.

The proper way to remove a plug-in coil from its socket is to hold the base of the coil, and not the winding.

If a resistance-capacity unit is used in the plate circuit of a detector valve, it may be necessary to shunt a .0001 mfd. fixed condenser across the anode resistance in order to obtain reaction effects.

RADIO IN SOUTH AMERICA.

(Continued from previous page.)

The studio is exceptionally small and heavily draped, and, as far as I could gather, the only ventilation it obtained was when the door was opened between the items.

The receiving apparatus, which I saw was nearly all of American design, and the British trade seemed to be very badly represented both in complete sets and all classes of components. This cannot be put down to the high cost of British production, as the components of American and Continental firms are sold at exorbitant prices. I am quite sure that there would be a large demand for British apparatus in South America if it was sold at competitive prices. The sets that struck me particularly were the very fine portables on the market. I cannot say that I have seen anything so compact on the British market. There seems to be a very large demand for these, for they give very loud and pure reproduction on a loud speaker of the cone pattern situated in the lid, are selective, and comparatively light.

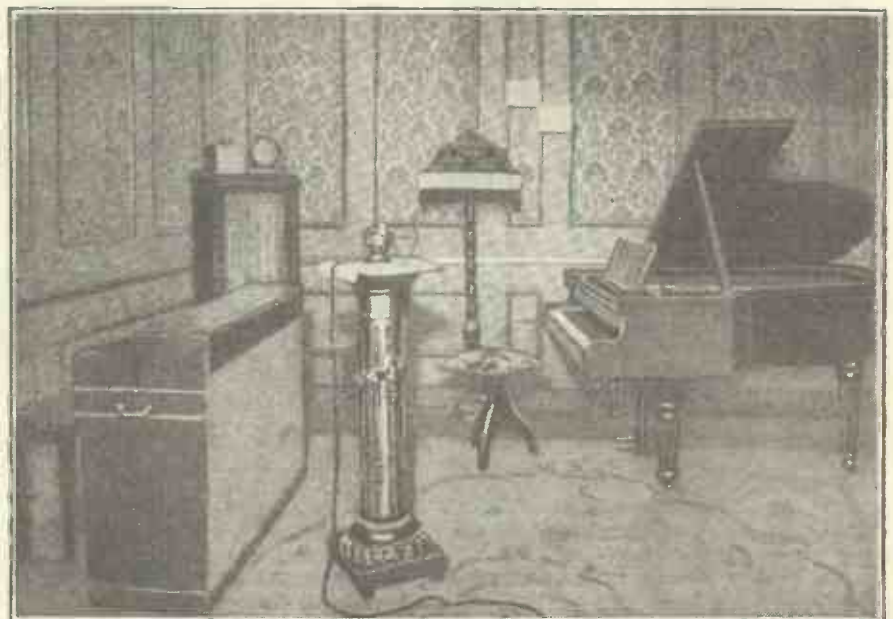
Argentine Army Radio.

I had the good fortune to be able to examine some wireless gear in the Argentine army. Both transmitting and receiving

apparatus is carried in double-roomed motor-vans. One room contains the apparatus and adjacent gear and the other comprises the commander's headquarters.

In this way the commander is always in wireless telephonic communication with his base. The aerial is swung between telescopic masts on the roof.

In Buenos Aires I heard W G Y and the new Dutch station at Eindhoven at good strength on a two-valve short-wave receiver, and this made me realise what a boon the new British short-wave transmitter will be to British communities marooned all over the world. Let us hope the B.B.C. will soon have it in operation.



One of the studios at F O Y the Flores station of Buenos Aires.

The "WORK-WELL" ONE



Despite its extreme simplicity and cheapness of construction this one-valver has proved to be one of the most sensitive of single-valve sets ever tested in the "P.W." Laboratories.

By G. P. KENDALL, B.Sc.

A FEW weeks ago the Research Department received instructions to turn out "a really simple, cheap, and easily-made single-valve set" for the benefit of newcomers to radio, especially those new readers who are being catered for in the special series of articles for the beginner now running in this journal. A good deal

of interest was taken in the task of producing such a set without at the same time involving the builder in difficulties with the actual construction of the components used in the receiver, but as far as results were concerned it was not expected that anything very special would be obtained, and all that was hoped for was something at any rate comparable with those given by the more elaborate and expensive "one-valvers." A very pleasurable surprise was, however, in store for us, for by adopting one of the best and most straightforward single-valve reaction circuits, using efficient coils and one of the best methods of varying magnetic reaction, paying careful attention to details, and so on, a set has resulted which is the equal of any single-valver ever tested by this department and very definitely above the average.

can his neighbours with much more elaborate and imposing single-valve sets. Naturally, something must be sacrificed, and this is purely a matter of appearance and probably just a little inconvenience in manipulation. Let us now turn to the details of the set and see wherein its special features lie, what it is that gives it its high efficiency, and what devices have been adopted to make it so cheap and easy to make.

COMPONENTS REQUIRED.

- 1 .0005 mfd. variable condenser (Formo).
 - 1 Valve holder (any reasonably priced socket; need not be of the sprung type).
 - 1 Filament rheostat for baseboard mounting. (Lissen used in original set. Any similar type is suitable, of about 7 ohms.)
 - 1 .0003 mfd. grid condenser with clips for grid leak (Clarke, Dubilier, Lissen, Igranic, Mullard, T.C.C., etc.).
 - 1 2-meg. grid leak (Dubilier, Lissen, Igranic, Mullard, etc.).
 - 1 Terminal strip, 7 in. \times 1 in. \times $\frac{1}{4}$ in., complete with 7 terminals.
 - 1 Terminal strip, 3 $\frac{1}{2}$ in. \times 1 in. \times $\frac{1}{4}$ in., complete with 1 terminal and 3 sockets (Clix, Eelex, or similar type).
 - 1 Aerial plug to fit aerial sockets (ditto).
 - 1 Wooden baseboard, 11 $\frac{1}{4}$ in. \times 7 $\frac{1}{4}$ in. \times $\frac{3}{8}$ in. approx.
 - 1 Strip of wood, 8 $\frac{1}{2}$ in. \times $\frac{5}{8}$ in. \times $\frac{3}{8}$ in. thick approx. for reaction extension handle.
 - 2 Blocks of wood for supporting terminal strips, 1 piece 7 in. \times $\frac{1}{2}$ in. \times $\frac{3}{8}$ in. thick, 1 piece 3 $\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times $\frac{3}{8}$ in. thick.
 - 1 Small block of wood, 1 $\frac{1}{2}$ in. \times $\frac{3}{4}$ in. \times $\frac{5}{8}$ in., for supporting reaction extension handle.
 - Various small wood screws and a few lengths of wire.
 - 2 Fibre or cardboard coil formers having an internal diameter of 1 $\frac{1}{2}$ in. and 4 $\frac{1}{2}$ in. externally, with 11 slots in each.
- Quantity of No. 28 D.C.C. wire (an amount under $\frac{1}{4}$ lb. will be sufficient).

High Efficiency.

No one need therefore hesitate to make a start with this little set, fearing that he is going to lose efficiency by following so simple a design, since as a matter of fact he will quite likely find that he will be able to put

The Circuit.

First, there is the question of the circuit employed, and it will be interesting to the man who likes to understand his hobby as he goes along to go through this in some detail and see how it bears out what the reader has learned from the Technical Editor's special series of articles. The first essential, of course, is a tuned circuit, and this is composed of the usual coil and variable condenser in parallel; next, in order to be able to receive signals, this must of course be connected to aerial and earth. The earth is connected to the usual place—that is to say, at the lower end of the tuned circuit. The aerial, instead of being connected to

(Continued on next page.)



Three tappings are arranged for the aerial coil and are connected to the three sockets shown on the right of the small terminal strip.

THE "WORK-WELL" ONE.

(Continued from previous page.)

the opposite end of the circuit, as is done in the simplest case, is led in by the special scheme known as auto-coupling. In this arrangement, the aerial is connected to a tapping point on the coil a little way from the lower end, so that only a fraction of the whole coil is included in the aerial and earth circuit.

Coupling Details.

Just how this circuit works is not a matter for the beginner, since it is rather a tricky point, and we will therefore confine ourselves to some of its more practical aspects. First of all, the aerial and earth circuit is not fully tuned at all, quite a rough adjustment of the tapping point on the tuning coil being quite sufficient, the really accurate tuning taking place in the secondary circuit. Nevertheless, a certain degree of rough adjustment is necessary in the aerial, and it is useless to expect to cover the whole broadcast band by means of a single tapping when this scheme is employed.

Two, or, better still, three, tappings are desirable, and if these are used properly very good results will be obtained over the whole of the broadcast band from 250 to 550 metres. In general, it can be said that on any given station louder signals are obtained by using more turns in the aerial

circuit; but it must not be forgotten that the larger the number of turns included in the aerial circuit the poorer will be the selectivity—that is to say, the power to separate one station from another, and more particularly to tune out the local station when it is desired to pick up more distant ones.

It must not be assumed, however, that it would be an advantage to put the tapping point higher and higher up the coil, since on any given station it would be found that after the best position had been reached the signal strength begins to fall off again, and tuning to become exceptionally flat, for reasons with which I will not trouble the reader.

Reaction of the simple magnetic type is provided, the method of varying the coupling being to slide one disc-shaped coil edgewise across the face of the other, since it has been found that this scheme gives a particularly easily-handled variation of coupling, and makes it a simple matter to obtain a very good build-up of signal strength. The detector valve is connected straight across the tuned circuit with a grid condenser and leak in series in the lead to its grid, the filament, of course, being connected to the earth side of the tuned circuit.

One point which perhaps calls for a little explanation while dealing with the circuit is that, contrary to usual practice, no by-pass condenser is provided across the telephones, the reason being that it is found that with the majority of 'phones this is not necessary, and quite good effects can be obtained without it. If, however, by any

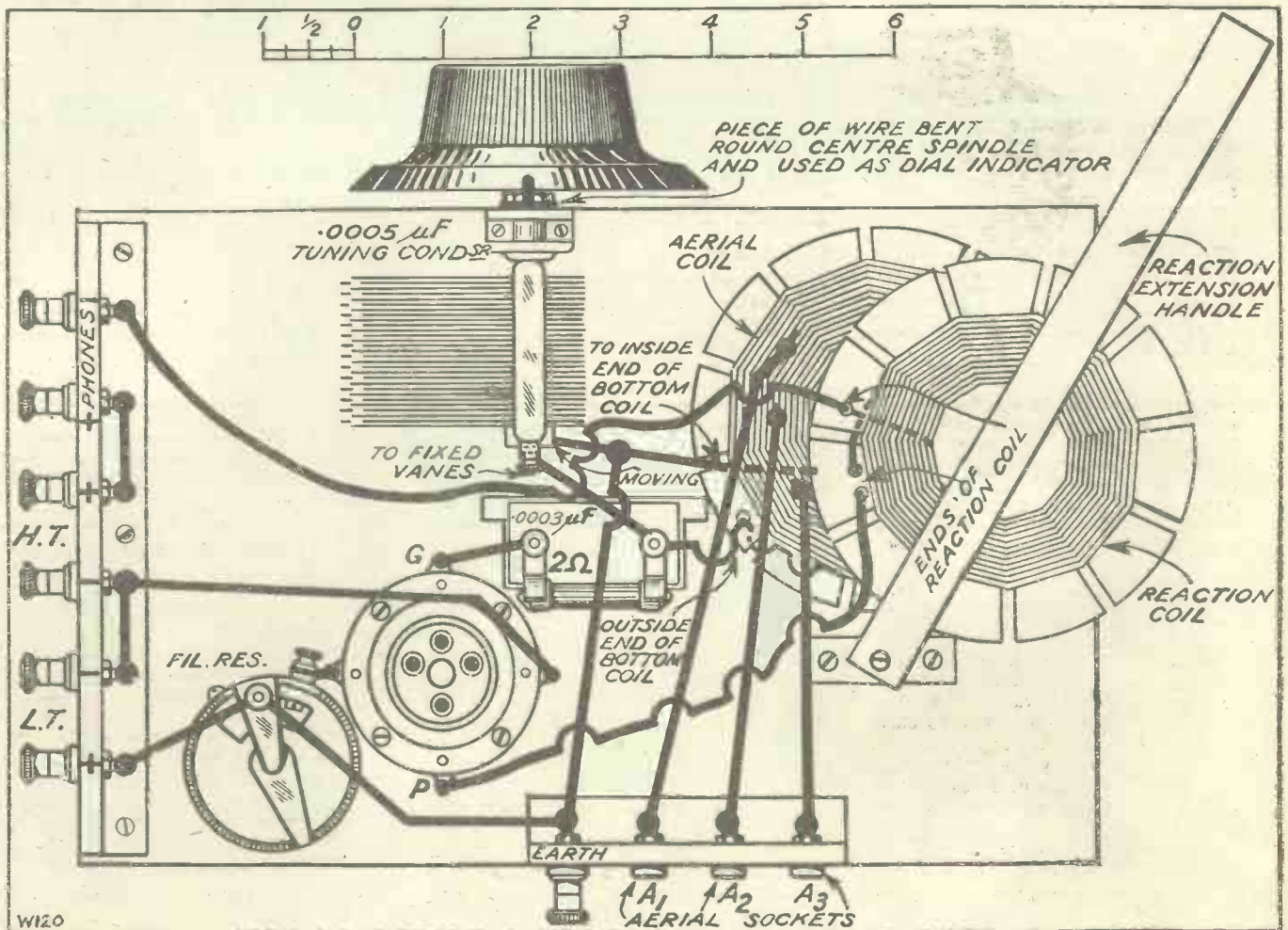
chance you should find that you possess a pair of 'phones which will not enable you to obtain proper reaction effects with this set, place a fixed condenser of .001 mfd. straight across the telephone terminals, and all will be well.

Filament Control.

It was omitted from the original set simply in the interests of economy. Another point is that we have committed the builder to the expense of providing a filament rheostat, after some consideration, since it was felt that to be able to control filament temperament properly is a desirable thing in any set which depends for its efficiency upon a really pleasant and smooth control of reaction. It was a considerable temptation to leave this out and simply advise the reader to use a 6-volt valve with a 6-volt accumulator, a 2-volt valve with a 2-volt battery, and so on; but, after all, the cost of the rheostat is very small, quite a good one being obtainable for eighteen-pence, and in view of this it was not considered advisable either to omit it or to show how one could be made.

As regards the reasons for the efficiency of the set, the main one appears to be found in the use of coils of reasonably high efficiency, and a method of arranging the variable reaction coupling in such a way that it is easy to obtain just the right adjustment with a consequent maximum strengthening of signal. In addition to this is the fact that the particular construction employed in the set is one which makes it

(Continued on next page.)



THE "WORK-WELL" ONE.

(Continued from previous page.)

very easy to obtain an efficient lay-out of parts, with short direct wiring, freedom from undesirable interaction between one part and another, and so on.

A good deal of consideration was given to the question of cost in a set like this, and it will be realised that there was a great temptation to employ almost entirely home-constructed parts, since it is easy in this way to get the cost down to a remarkably low figure, but at the same time this would be defeating our other object of making the set very specially easy to build. It was thought that the majority of the readers who will undertake the construction of a set like this will wish to do it by obtaining a small number of relatively cheap parts, and assembling them upon some very easy plan, so as to have the set working at the end of an hour or so, instead of spending several evenings constructing variable condensers out of biscuit tins and performing similar stunts.

Easy Construction.

Accordingly, it was thought worth while to specify the use of a standard variable condenser of a reasonably priced type, the particular one used having a special advantage from the present point of view of being capable of being mounted direct upon a wooden baseboard, by means of special feet

up oneself, since good plug-in coils and coil holders are necessarily rather expensive, and something which will serve our present purpose quite well can be made up for an outlay which can almost be reckoned in pence.

As a result of this very modest outlay for a few ready-made components the actual construction of the set is really extremely easy, and no one need fear to undertake it who can use a screwdriver and a drill. As a matter of fact, even the drill can be dispensed with if the terminal strips are bought ready made, and further, there is no need even to do any soldering if the constructor has not yet learned that useful art, although naturally a better job will result if the soldering iron is properly employed, due pains being taken to ensure really good sound joints.

Making a Start.

Turning now to the practical construction side, the first point to note is that the set is assembled upon a wooden baseboard, of the dimensions given in the wiring diagram. Upon the edges of this two strips of ebonite are mounted, one carrying a row of small brass terminals for the battery and 'phone connections, strips of this kind being obtainable ready for attachment if the constructor cares to buy them. Alternatively, of course, a strip of ebonite can be obtained, the necessary holes drilled in it and the terminals fitted for oneself.

The other strip of ebonite carries one terminal which is for the earth, and three sockets, such as the Clix or Ealex type, for the insertion of a plug upon the end of the

transferred from one terminal to another as required—quite a feasible scheme, although a little less convenient.

The various components, such as the valve socket, grid condenser, grid-leak holder and tuning condenser are mounted directly upon the wooden baseboard by means of wood screws, and a few minutes will see this part of the work accomplished. Just one point about the variable condenser. Since this is not mounted in the usual way upon the panel, some provision must be made for a dial indicator so that you can note the readings of the various stations you tune in, so that you will be able to pick them up again on future occasions.

Winding the Coils.

This can be done very easily by taking a piece of stiff wire about 3 in. long and bending one end round to form a hook which can be gripped securely under the one-hole fixing nut on the spindle of the particular condenser which has been used in the set. If this wire is secured in this way in a vertical position, the upper end can be bent over so as to form a pointer against the graduated edge of the dial, in a manner which is indicated in the wiring diagram.

The coils must, of course, be wound for oneself, and this is the only part of the construction of this set over which you need sit down and spend a little time. They are wound on a pair of the black fibre slotted disc formers or spiders which you can obtain from most general wireless dealers, the necessary details appearing in the list of components. The tuning coil consists of fifty-five turns of No. 28 D.C.C. wire, and starting from the inside, you should wind on fifteen turns, and then make a tapping point, wind on another five turns, make a second tapping, then put on another five turns; again making a tapping, and then continue without further tappings until the whole fifty-five turns have been put on,

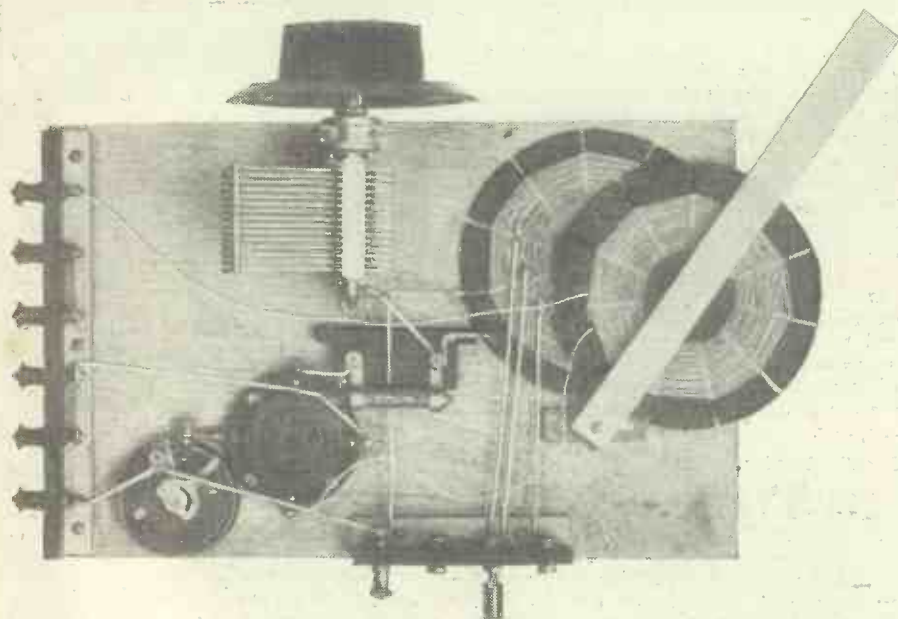
The Tappings.

By the way, it should be mentioned for the benefit of those who have not previously wound basket coils that there is no need to count the turns as they go on one by one, since it is quite an easy matter to count them at any given moment, if you remember that the procedure is to count up the number of turns visible on one side of the coil, and multiply this by two to allow for the fact that the coil is wound in basket fashion by weaving over and under the spokes as you go round the spider.

The method of making tappings will depend upon the particular aptitudes of the constructor, since the man who has learnt to solder will probably prefer to make a really sound job of it by soldering on a short piece of wire at the correct point, subsequently taking this over to the appropriate socket on the strip of ebonite at the back of the set. In this case, there will be no need actually to make the tappings as the coil is wound, and it can be wound from start to finish without stopping. Then the correct turns for the tapping points can be lifted up with the blade of a knife, the wire scraped bare, and the tapping lead soldered on.

Those who do not intend to solder, however, should twist up a loop in the wire about 6 in. long as they arrive at each

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Reaction is controlled by means of the swinging coil method, a form of regeneration that has never been superseded in efficiency.

incorporated in its construction. Similarly, bought components were used for the grid condenser, grid leak, valve socket and rheostat, but if care is exercised to choose these parts with a due regard to price there is no reason why the whole cost of the set should exceed about fifteen shillings, not, of course, including valve, batteries, 'phones, etc.

When we come to the question of tuning coils, and coil mounts, etc., it is at once seen that it is well worth while to make these

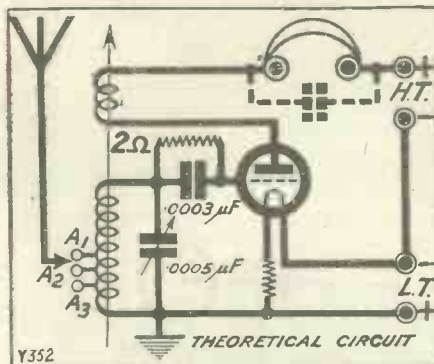
aerial lead. Each of these sockets is wired to a tapping point on the tuning coil, and transferring the aerial plug from one socket to another has the effect of varying the number of turns used for coupling to the aerial circuit, a point which has already been referred to. If the constructor wishes to save himself the trouble of drilling the ebonite strip and fitting the sockets, he can, of course, obtain a terminal strip with the necessary terminals upon it, and use these instead of sockets, the aerial wire being

THE "WORK-WELL" ONE.

(Continued from previous page.)

tapping point, and these can be taken across and screwed down under the nut of the correct socket when the coil has been fastened down in position, the part of the wire which goes under the nut, of course, being scraped bare before tightening up.

The reaction coil consists of fifty turns of the same wire on a similar former, but there is no need to bother about the particular direction of winding or mounting the coil at first. The tuning coil is fastened down to the baseboard by means of a single brass screw through its centre, but the reaction coil must be mounted, so that it can be swung across the face of the tuning coil, and this can be done very simply in the fashion illustrated in the photos and the



wiring diagram. The coil is simply screwed to the side of a strip of wood which serves also as an extension handle, and one end of this is secured by a wood screw passing down into a small block of wood, which in turn is fastened to the baseboard.

The thickness of this latter block of wood can be about $\frac{3}{8}$ inch, which will just serve to hold the reaction coil high enough to swing clear over the tuning coil with its various tapping leads. The connections to the reaction coil will, of course, require to be moderately flexible to allow for movement of the coil, and the best scheme is to solder two pieces of flex to the end of the coil for the purpose, but if it is desired to avoid all soldering pieces of wire can be left over in winding the coil, so that the coil itself can be continued to form these connections, which will be sufficiently flexible for ordinary purposes.

Safety Tests.

This completes the actual constructional details of the set and we can now assume that the reader has finished it and is ready to try it out. First of all, connect up the accumulator to the L.T. terminals, insert the valve in its socket and see whether it lights when the filament rheostat is turned on. Assuming that it does so, turn the rheostat nearly to the full on position, supposing that you are using a 6-volt valve and a 6-volt accumulator, or a 2-volt valve and a 2-volt accumulator, and then disconnect the accumulator and connect it to the H.T. terminals.

The valve should *not* now light up, this being merely in the nature of a precautionary test to make quite sure that you

have not made a mistake in wiring-up. All being well, return the accumulator to its proper position on the L.T. terminals of the set, and connect up the H.T. battery, which may be of about 60 volts. Next connect up the 'phones and set the tuning condenser to about the middle of its scale. Now listen in the 'phones, and gradually bring the reaction coil nearer and nearer to the central position over the tuning coil. Start this test, of course, with the coils well separated, and you should presently hear a slight click followed by a very faint rushing sound, which is an indication that the valve has started to oscillate. During this test, the aerial and earth should not be connected, the object being to discover, firstly, whether the reaction coil is connected round the right way (if the set will not oscillate, reverse its two leads), and secondly, for the operator to learn how to test for self-oscillation. This is a most important point for anyone who intends to use a reaction set, since if he is not quite clear on this point he may make himself a nuisance to all his neighbours and spoil their distant reception completely by the interference which he will cause.

Testing for Oscillation.

The safest indication is this: the set is oscillating as soon as you have heard the slight click which occurs when the reaction coil has passed the critical point, although you may not hear any actual howls or squeals yourself. A certain test in the case of a set like this is to touch with your finger one of the terminals of the grid condenser, the correct one being the one which is wired to one side of the tuned circuit, that is to say, not the terminal which is wired to the grid of the valve. This will cause a faint click at all times, but if the set is actually oscillating quite a loud "plonk" will be heard, and whenever this occurs the reaction should be slacked a little until oscillation just ceases.

Let me repeat, a set can be oscillating long before the actual howling condition is reached, one of the oldest fallacies in wireless being that a set can only be radiating when you hear an actual howl. As a matter of fact, the oscillation which occurs when in the silent condition is usually much worse and more capable of causing annoyance over great distances than that which occurs when an actual howl is heard as a result of the use of really excessively tight reaction coupling.

Smooth Reaction.

Having got the reaction working properly, and satisfied yourself that you know when the set is oscillating, proceed to adjust the receiver to give a smooth control of reaction, so that the oscillating condition arrives very smoothly and without any strong click. This is a matter of adjusting the high-tension voltage and filament current, and a few trials will produce the desired state of affairs. When this has been done, you are in a position to search for distant stations, which you can do by turning the condenser dial very carefully and slowly with the set in its most sensitive condition, that is to say, on the very edge of self-oscillation, but not actually oscillating.

Very little practice will enable you to keep it in this state while you turn the variable condenser, and you will be surprised at the number of stations you can pick up in this way without actually oscillating at all. The local station, of

course, you should hear at very great strength in the 'phones without any critical reaction adjustment at all, and, indeed, you will probably hear it quite strongly with the reaction coil set right away from the tuning coil.

Working a little set of this type is really so simple that very little more need be said. You will soon obtain very excellent results from it, since it is really only a matter of just a little practice in handling the reaction and tuning controls to obtain the necessary delicacy of touch which will enable you to tune in even weak signals and bring them up to audible strength.

Just one final point, however. The type of valve used naturally has a great bearing on the quality of the results which will be obtained, and although practically any valve will give results of some sort, to get really good long-distance reception you will require some type of valve which will give you the smoothest and best reaction effects as well as good rectification. In general, the modern types of special H.F. valve are most suitable in a set like this, a few types from the 6-volt range being these: B.4H., P.M.5X., D.E.L.610, S.S.6075 H.F., E.S.5 H.F., etc. Similar types, of course, can be chosen from the 2-volt class.

A GRID-BIAS DANGER.

EVERY now and then one hears of mysterious valve burn-outs, and victims have been heard vehemently to assert that they were certain that (1) the H.T. was entirely disconnected, or (2) they had an H.T. fuse, or (3) they were certain, anyhow, that it couldn't possibly have been the H.T.

Well, there is no valve yet made that will fuse its own filament, or yet a strong enough local station yet erected which will do such damage by ejecting sufficient energy. But what about the grid-bias battery?

Be Careful.

Grid-bias batteries are generally asked to deliver such infinitesimal currents that they have come to be regarded merely as harmless, long-lived characteristic curve shifters. But a fairly new grid-bias battery of 15 or 22½ volts will produce quite enough electrons to melt a valve filament if this latter be inadvertently connected directly across it. One side of a grid-bias battery is always taken to one side of the filament, and should the remaining terminals of these things be "short-circuited," then it is for one brilliant moment that a dull-emitter becomes a bright-emitter!

Where large grid-bias batteries are used (anything above 7½ volts) it is worth while employing a fuse, and this fuse should be connected between the plus terminal of the battery and the filament lead to which usually it is joined. All the valves are then protected.

And if you do not incorporate a grid-bias fuse in your set, do not forget that you have not only the H.T. to be careful of, but also that the grid-bias battery can be as great a danger. If you have an H.T. fuse already connected between the H.T. minus and L.T. minus terminal, you can join the plus of the grid-bias battery to the H.T. minus terminal, and thus make the one fuse give you protection against the two potential sources of danger.

THOSE "USUAL" CONNECTIONS

There are certain almost "standard" connections in radio receivers which we are apt to make without a thought as to their value. In this article Mr. Harris shows how very important they are and how slight variations may improve the operation of our sets.

By PERCY W. HARRIS, M.I.R.E

THERE are a number of small connections made in almost every wireless set to which the average home constructor gives very little attention. True, there are certain conventional ways of making them, and as the conventional ways "work" they are generally followed without much special thought. Wireless, however, is a progressive art, so that some of these conventional methods of joining up components, while excellent in the past, are no longer quite satisfactory, and, indeed, will sometimes cause quite a little trouble.

By-passing H.F.

Take, for instance, the good old ".001 mfd. across the transformer primary." Look at Fig. 1, and you will see what I mean. Apart from the fact that .001 mfd. is almost invariably too large a condenser to use with a well-designed modern transformer, without destroying the excellent quality now obtainable, the position of this condenser is really illogical. Its use is to by-pass the radio-frequency component in the plate

component in the leads I have referred to may actually cause trouble by inducing other radio-frequency currents in undesirable paths. The logical position for this condenser is between the plate of the valve V_1 and the negative filament as shown dotted in Fig. 1. In this position it by-passes the radio-frequency currents just as effectively, while giving them the shortest possible path to where they should go.

If, by any chance, radio-frequency currents should get through the audio-frequency side, a condenser across the loud speaker will often get rid of the trouble. Here, again, the position shown for C_1 is illogical, and the connections are better made as shown dotted.

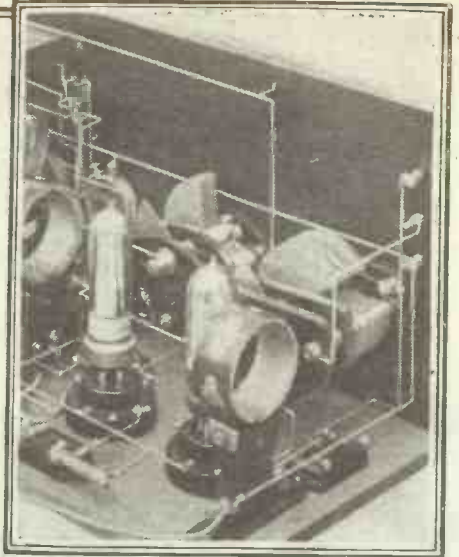
Another connection of interest is that of the negative of the high-tension battery. In some sets the negative of the high-tension battery is joined to the positive of the low tension, and in others to the negative of the low tension. Either connections work well, and there are advantages and disadvantages in both ways. In view of the general trend of development, particularly in regard to screening, it is the policy of POPULAR WIRELESS to join the connection from negative to negative.

I do not propose discussing the pros and cons of these connections here, as it would take too long, but I raise the matter to illustrate a point regarding the Mansbridge condenser which is generally used for shunting the high-

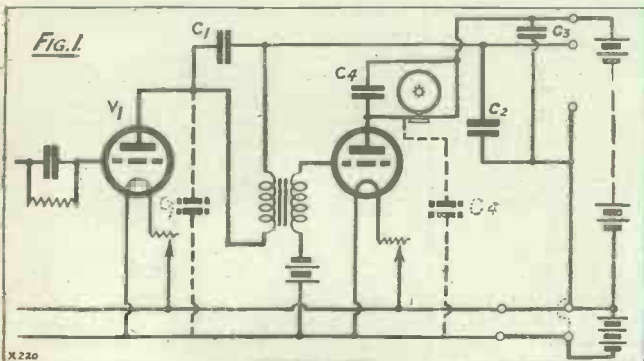
tension battery. In all cases where the high-tension negative is connected to low-tension positive, the voltage of the low-tension battery is added to that of the high tension and, therefore, both batteries, high and low tension, are really supplying the high-tension current to the valve. In such circumstances, the Mansbridge condenser should be shunted right across both batteries and not merely across the high-tension battery terminals. The better connection is shown dotted in Fig. 1.

Grid-Leak Connections.

Some very interesting variations of connections are possible in the detector circuit (Fig. 2). Here we have a grid condenser and a leak R , which, for the purpose of illustr-



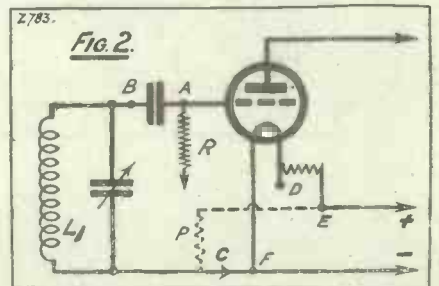
tion, I have terminated in an arrow head. The grid condenser is generally of a value of .0003 mfd., and in a very large number of circuits the leak R is connected between A and B ; that is to say, in parallel with the grid condenser. This enables the charge on



current of the detector valve, V_1 , while offering a high impedance to the passage of the low-frequency component which we desire to pass through the primary of the transformer.

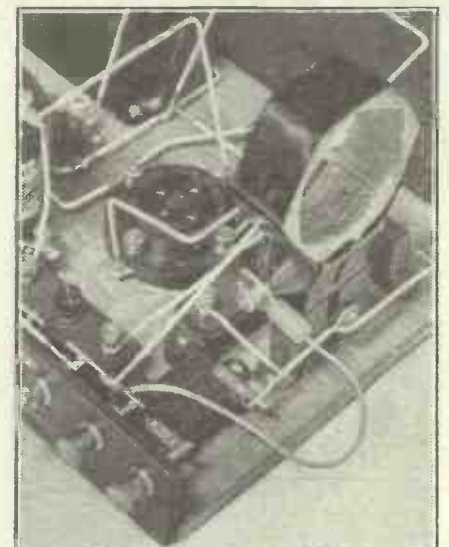
Where do we want to lead the radio-frequency current? Back to the filament! Why, then, should we take it through leads to the high-tension battery, and through the high-tension battery back to the filament; or, at best, if not through the battery itself, through a Mansbridge condenser, if one is provided, as shown in the diagram at C_3 .

Indeed, in a highly sensitive modern receiver where we are endeavouring to keep any radio-frequency currents from straying along wrong paths, the radio-frequency



the grid to return to the filament through the inductance L . In such cases the filament return C is generally joined to either E or D , although sometimes it is joined to F .

The next question we may ask ourselves is: What is the difference between the three connections? Which is the best of the three? So far as the leakage of the charge (Continued on next page.)



The use of an auto-coupled aerial circuit will greatly increase the selectivity of a receiver which hitherto has been directly coupled.

THOSE "USUAL" CONNECTIONS.

(Continued from previous page.)

accumulated on the grid is concerned, it does not matter to which point the return connection is made, but with regard to the normal potential at which the grid is maintained, the differences are important.

For example, if the grid return is made to F, then the grid is normally kept at zero volts. If the return is taken to D, the grid is kept positive by the amount of the voltage

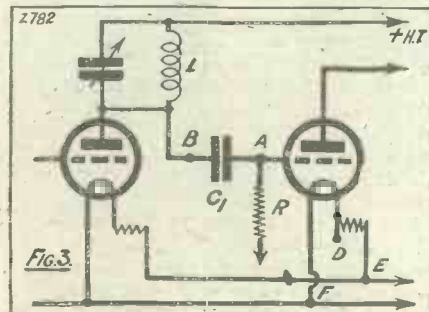


Where screened-grid valves are used extra care in by-passing and screening has to be taken.

applied to the filament. If it is taken to E the grid is normally maintained at a positive potential equal to the voltage of the accumulator supplying the set. Quite big differences may occur in some circumstances. Let us, for example, take the case of a valve with a 4-volt filament running from a 6-volt accumulator. With the grid return at F the normal voltage on the grid is zero, connected to D it is 4 volts positive, and connected to E it is 6 volts positive.

Positive Bias Preferable.

Now the constant changes that have taken place in the last few years have quite altered the conditions under which we work our sets, for we use quite different valves than those available when the conventional



connections were first decided upon. When broadcasting first started practically everyone used valves which required about 3-8 volts on the filament with an accumulator which was generally of the 4-volt variety.

Nowadays, more 2-volt valves are used than any other class, and in many cases these valves are used without a filament resistance.

When the filament resistance is adopted it is only needed to give a very small drop in voltage—say, from 2 volts to 1.8 volts—so that the highest positive voltage in such circumstances that can be given to the grid is 2. The values of the three points, then, are zero, 1.8 and 2 respectively. Similarly, so-called 4-volt valves are generally worked at 3.8 volts, and 6-volt valves generally average about 5.5.

In such circumstances it does not matter much whether we connect the return to D or to E, but, in practically all cases, the grid return to D or E is preferable to that to F.

Preventing Choking.

There are exceptions, however. I have done a good deal of experimenting recently with sets in which a very high degree of high-frequency amplification precedes the detector. In such circumstances I find that the grid return to D or E is almost invariably inferior to the return to F. The disadvantage of the connection to D and E being a "packing-up," or overloading of the detector, and consequent distortion which certainly does not occur when the connection is made to F. With a good deal of high-frequency amplification, such as is obtained with two screened grid valves, the return to F is definitely superior to the return to D or E.

If we like, the lead from the inductance to the condenser can be permanently joined to F, that is, the arrow head C can be joined to F and the grid leak taken, instead of to B, to F, D or E, as required. The effect will, in most cases, be precisely the same as before when we took the leak to B and altered our connections by taking C to F, D or E.

In certain circumstances, one must avoid taking the leak to B. A typical case is the tuned-anode circuit, shown in Fig. 3. Before leaving Fig. 2, however, I would like to point out that connecting a potentiometer P (shown dotted in Fig. 2) across the accumulator leads and taking the lower end of the grid leak R to a slider on this potentiometer, one can try any positive voltage between the maximum of the accumulator and zero by varying the slider.

Tuned Anode Circuits.

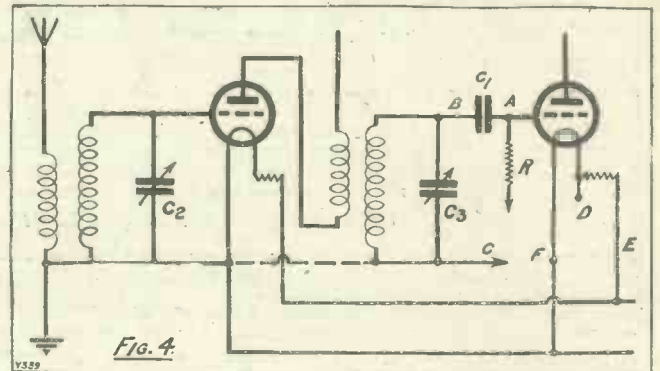
And now for Fig 3, or the tuned anode circuit. Here I have used the same letters, R, D and E, to indicate the various points at which the grid leak can be connected. If now we connect the grid leak R to B it will be seen that there is a direct path for the high-tension current from the battery through the inductance L and through the leak to the grid.

The grid condenser C₁ in this diagram is necessary, not only for detection by the condenser-and-leak method, but also for isolating the grid of the detector from the high-tension voltage.

In this case we have a choice of the three

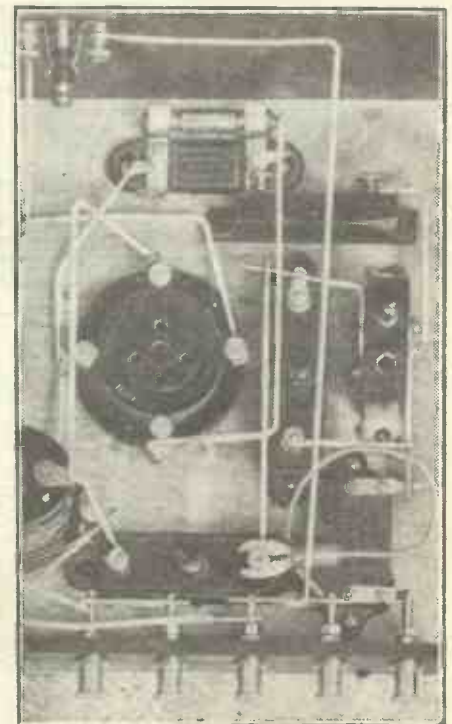
positions D, F and E, and the same remarks apply as before.

In transformer-coupled circuits, one can either use the method of joining a leak across the condenser or direct to filament. Here, again, there are one or two points that can be taken in consideration very profit-



ably, particularly in regard to modern sets with gang control and shielding. Take Fig. 4 as an example. Here we have a high-frequency valve, followed by a transformer-coupled detector valve. If the grid return of C is taken to, say, D or E, good detection is generally obtained, the leak in such circumstances being connected to B. Except when very considerable high-frequency amplification precedes the detector connection of C to F and the grid leak R to B will result in weak signals, but in most cases the connection to D is thoroughly satisfactory.

In this case, however, the moving plates of condenser C₃ are at a positive potential while the moving plates of condenser C₂ are earthed and at a zero potential. If, however, C is joined to F, then the moving plates of the two variable condensers can be joined together, as shown by the dotted line, and earthed. The leak can then be taken to D, thus obtaining the necessary positive bias on the grid.



An example of grid leak and condenser rectification.

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TECHNICAL NOTES

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

THE H.T. SUPPLY

SLACK AERIALS—FITTING PANELS—SLOW-MOTION DIALS—
STORING VALVES.

The H.T. Supply.

IN these days of inexpensive high-tension supply devices there is a great temptation to abandon high-tension accumulators, which always require a certain amount of care and attention if they are not to be allowed to depreciate rapidly. Personally, as I have said before in these "Notes," I prefer the high-tension accumulator from the point of view of quality of reproduction, and I think most of my readers who have had any considerable experience with all varieties of H.T. supply will agree with me. But there is no getting away from the fact that a high-tension accumulator, quite apart from being usually rather high in first cost, requires looking after pretty carefully. No doubt a large percentage of H.T. accumulators are habitually ill-treated by neglect.

Slotted Cases.

With this position in view, it behoves the manufacturers of H.T. accumulators to turn out a type of battery specially designed to stand the effects of ill-treatment and particularly of neglect. Efforts are now being made in this direction, and one of the most useful features, to my mind, is the employment of specially moulded glass containers provided with slots in the glass into which the battery plates are fitted.

This form of construction has, of course, long been employed in connection with low-tension accumulators, and has permitted the use of thick plates for slow rates of charge and discharge, which are also peculiarly fitted to withstand the usually disastrous effects of long periods of idleness.

The application of the same principle to high-tension accumulators seems to me a very practical step forward. In fact, anything which will reduce the sense of responsibility which always rather oppresses the owner of an expensive high-tension accumulator battery will be of great value.

Slack Aerials.

A slack aerial is liable to swing about in the wind, and as you know only too well this produces periodic "fading" in the reception. Usually the beginner is rather averse to tightening the aerial, owing to the fact that it imposes an extra strain on the mast. But in view of the effect just mentioned, and also of the very untidy appearance of a slack and drooping aerial, it is very desirable to strengthen the mast sufficiently to permit of the antenna being well tightened. If the mast itself is not sufficiently rigid, the side tension due to the antenna can be quite simply counter-balanced by means of a guy.

Fitting Panels.

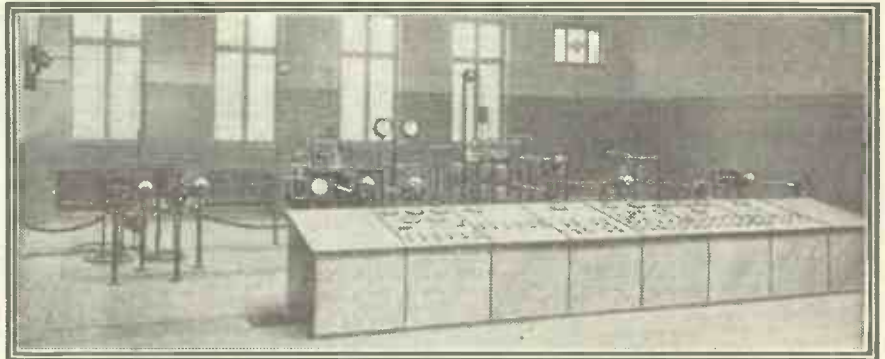
When you come to fit an ebonite panel into a cabinet you often find that there is a

discrepancy—either the panel is too large to fit the cabinet or else it leaves a wide margin all round.

I think in such cases the fault is generally in the cabinet, for commercial panels are usually fairly accurate to size.

If the panel proves to be a shade too large for the cabinet it will, of course, be necessary to trim it down, and as it will generally be nice and square, it is important to true it in such a way as not to upset its rectangular shape. This is best done, not by the use of a saw, or even of a file, but by means of some form of scraper. If the panel is held in a vice (well padded with thick paper to prevent the jaws of the vice from marking the ebonite), with the operating edge upwards, it is quite a simple matter to remove $\frac{1}{8}$ th in. or even as much as $\frac{1}{4}$ in. by means of a knife in a comparatively short time.

The knife should be held by both hands and at right angles to the edge of the



The control switchboard at Zeesen, Germany's latest and greatest broadcaster.

ebonite, or even tilted slightly forward, so that it cannot "cut" into the ebonite, but only scrape. In this way, with a very little patience you will be able to trim down the panel and yet keep the straight edge and also the square corners.

Slow-Motion Dials.

Slow-motion dials are now so much the order of the day that I suppose you will be hardly likely to find any high-class set fitted with the ordinary direct variety. With increase in selectivity of sets, experimenters and even broadcast listeners have come to appreciate the great value of the slow-motion or vernier dial.

If this is important on the broadcast band, it is much more so when working with short waves of, say, 45 metres or less, and in fact I should say that for practical purposes the operation of a really short-wave set would be quite impossible without either a slow-motion dial or some equivalent such as a long extension handle.

In addition to vernier movement, it is also highly important to avoid even the smallest amount of back-lash in the vernier

drive, so the control must not only be of the slow-motion variety but must also be of good design and workmanship.

In many slow-motion dials, where the mechanism consists simply of a small wheel engaging with a larger one, the direction of rotation of the dial or pointer is opposite to that of the control knob. Personally, as I have long been accustomed to mechanism of this kind in all sorts of laboratory instruments entirely outside wireless, it does not bother me, but I know that many people find it rather "left-handed," as it were, and very much prefer a dial in which the control knob and the dial or pointer rotate in the same sense.

Gear Ratios.

As to the actual gear-ratio, this may be between say 5 to 1 and 20 to 1, although some slow-motion dials have reduction ratios even greater. A large reduction ratio is very good for extremely selective work, but for general purposes it is not an unmixed blessing, since the process of "searching" is apt to be tedious.

Sometimes a coarse adjustment is provided as well, but even this, again, is not a complete solution of the difficulty, as it may not be possible to find the station you want by the coarse adjustment at all, and you have to search carefully over the whole range with the aid of the fine adjustment. If you happen to know the approximate dial-setting for the station in question then the coarse adjustment may be used. But

generally it is better to be patient and to go slowly and systematically through the necessary range.

Storing Valves.

Now that so many different types of valves are on the market, the experimenter who, in course of time, has acquired (as most experimenters do) a motley collection of valves of all shapes and sizes, finds it rather a problem to store his spare valves safely and conveniently. One way it is to keep them lying in a drawer on a large pad of cotton-wool, with a piece of cotton-wool covering them; but if the drawer is opened or closed suddenly the valves are apt to jostle one another, with considerable danger of a breakage.

In the old days, when there were fewer types, it was a fairly simple matter to arrange a box with "nests," and ex-Government boxes could be obtained which were excellent for the purpose.

Probably the most satisfactory way is to make a wooden shelf (from a board of about $\frac{3}{4}$ in. thickness and 6 in. in width,
(Continued on page 1027.)

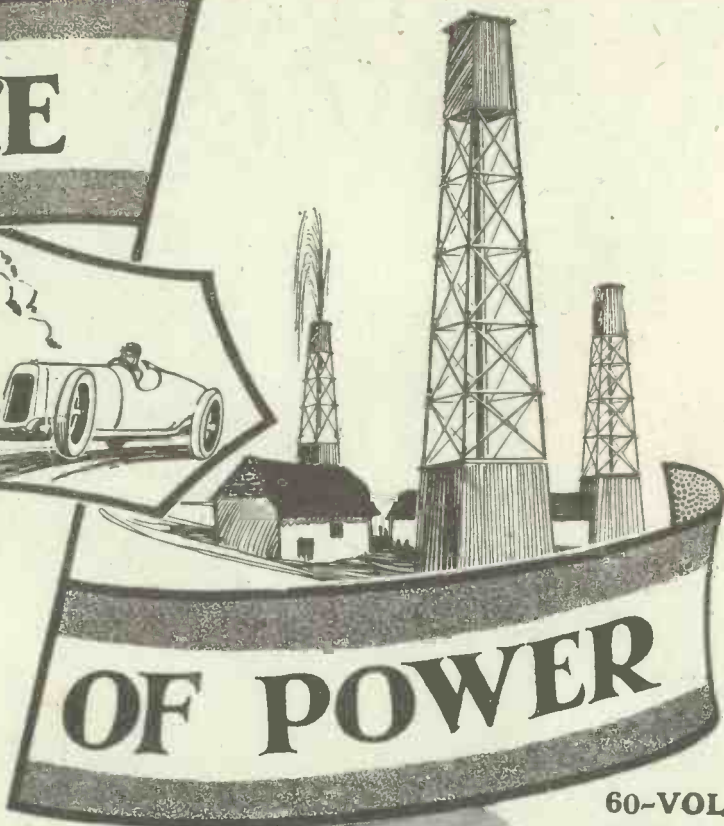
THE SOURCE

More modern than the petrol-driven engine—more convenient than mechanical contrivances working off the mains—lower in first cost, and more economical in every way—that's the Lissen New Process Battery. When converted energy from the mains is used new valves may come out with different characteristics

from the old, or you may wish to change your valves, and your mechanical contrivances then may become useless. The Lissen Battery provides pure D.C. current all the time of the correct voltage for any and every type of valve you may want to use now or in the future. No expensive moving parts to wear out and be replaced—no hum to eliminate because the energy is chemical instead of mechanically generated. The Lissen Battery yields safe power, safe for children, safe for your valves, safe for everybody and everything. It brings a new power smoothness, and a new tone clarity to your loud speaker which were never there before. It stands up to the longest programme, it lasts for months and months. You will find it, as tens of thousands of other users have already found it, the most economical source of power for your radio set, and all the time you use it you will get the finest reproduction you have ever had.

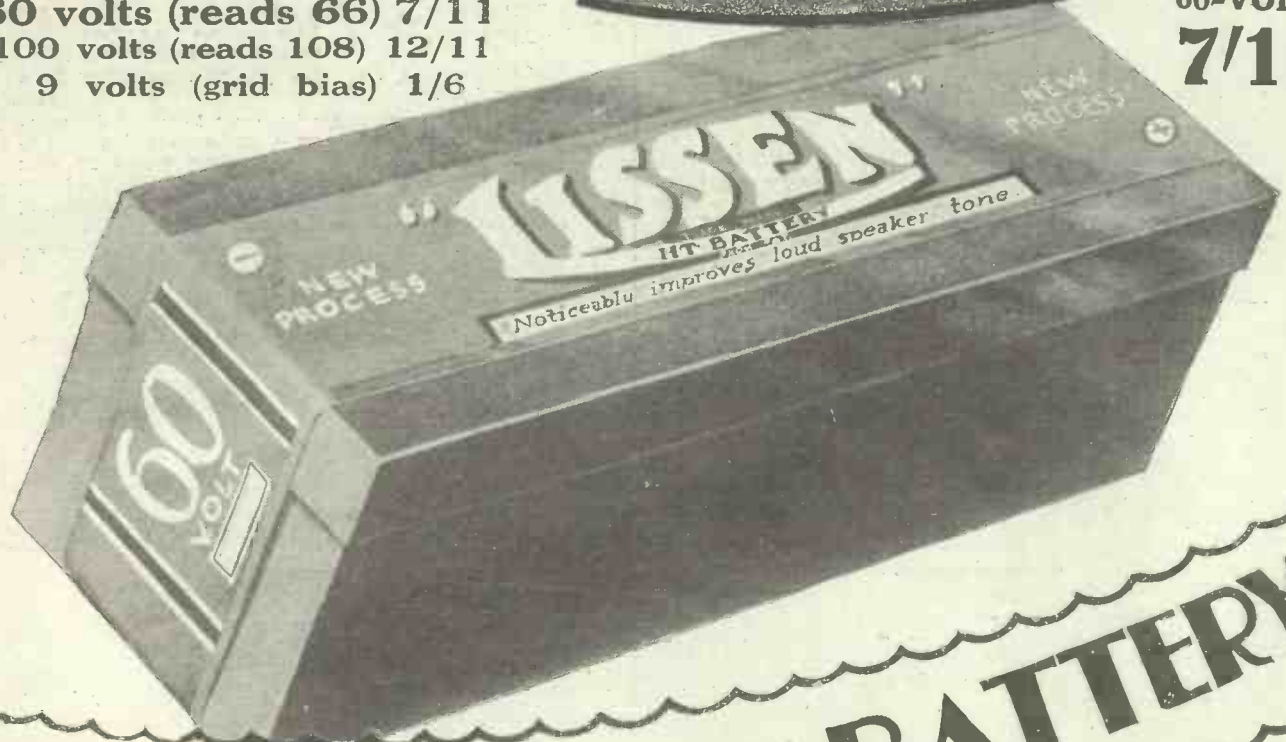
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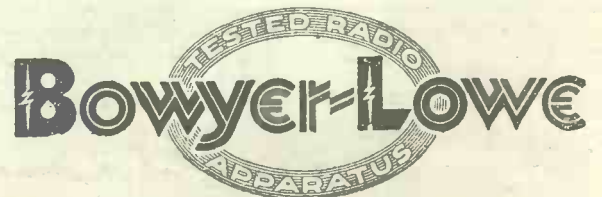
Now this value is to be even greater. Our new factory, equipped for a far greater output, is able to produce these "Popular" Condensers still more inexpensively. We pass these economies in full to public.

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THE POSITION AFTER WASHINGTON.

"... a solid international movement is the only one which can help the amateur experimenter to attain his desires."

From A SPECIAL CORRESPONDENT.

WE have become accustomed to cast-iron limitations as regards licence facilities for transmission, and also in the past we have had great difficulty in persuading the Post Office that amateurs insisted on a receiving licence for experimental purposes.

The final result of the Washington Conference will show us that in these days of international conferences and massed conversations a solid international movement is the only one which can help the amateur experimenter to attain his desires. Our own section of the movement is only a unit of the whole, and is none too strong. Warner, of the A.R.R.L., is clearly of the opinion that, had all amateurs of various nationalities been sufficiently strong to impress their wishes upon their various governments, a different story would have been told concerning this conference.

Strangled by Red Tape.

As it is, America has lost much owing to the fact that the various governments had no mandate from their respective amateurs as to what was required, and the result is that we have also lost certain concessions in Great Britain. If the British amateur had been strong enough, our delegates could not have harassed the amateur in the way they did.

Amateur radio has come to stay, and it is impossible for it to be confined for ever to the narrow limits which have been agreed. By amateur radio we mean receiver and transmitter alike, for one is as necessary as the other. To attempt such limitations is akin to endeavouring to prevent the tides from functioning or the public from eating and drinking. In this country we are all well-disciplined and law-abiding citizens, but elsewhere a different story is told. In many cases where transmission is absolutely forbidden the transmitter exists, and in those countries where undue restrictions have been imposed it has been impossible to administer the regulations.

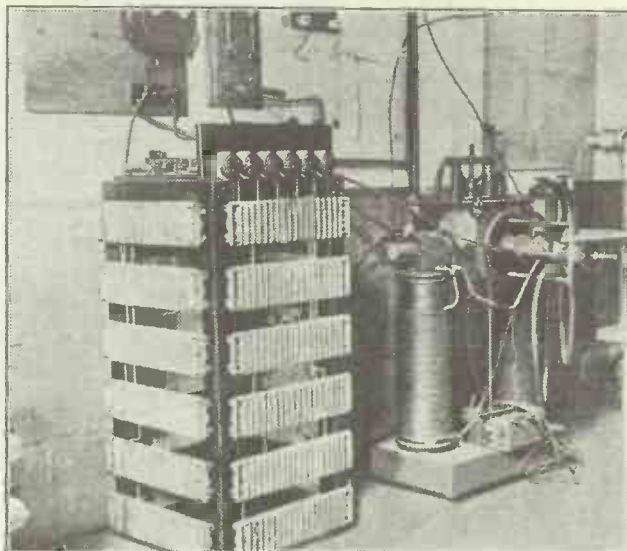
We have only to look back to the early days of the motor-car to see a parallel case. Here we find respectable ladies and gentlemen being badgered by police and public for driving a motor-car. Imaginary offences are trumped up and a ridiculous speed limit imposed. Thus progress is retarded by red tape and by self-imposed nurses. The industry is crippled and civilisation held up while red tape officials earn a fat income by endeavouring to strangle it.

International Co-operation Necessary.

It is to be hoped that amateur radio will not allow such a condition of affairs to pertain indefinitely in radio. Similarly it is to be hoped that both the amateur receiver and transmitter will get together, so that by mutual co-operation it will be possible to use the ether so that all will get a fair share of its benefits. It is only by these means that our end can be accomplished, for not all the conferences held in London or Washington can do so much for amateur radio as the participants themselves.

We have at last received recognition of the amateur, but it has been hard going: Warner has fought hard at Washington to get further than this but has failed, owing, to be quite frank, to lack of support by other nations, including our own.

International amateur radio is not yet, but the seeds have been sown from which will spring a strong, determined body of enthusiasts who will brook no interference with their rightful and reasonable require-



The experimental Poulsen Arc transmitter, used in connection with special investigation work in the Radio Laboratory at Harvard University, U.S.

ments. The first step is to get together and to create a virulent organisation affiliated to the I.A.R.U. No time should be lost in impressing the various administrations and governments with the fact that amateur experimenters exist and have their rights in the ether. Every experimenter should belong to a society of his own nationality so as to bring pressure to bear in the right quarters. Amateurs of all nations and tongues must get together and agree on their future plans and operations, so that there can be no mistake next time.

Abolish Absurd Restrictions.

Any attempt to impose absurd restrictions must be swept away, and both receiver and transmitter must enjoy reasonable licence facilities for their experiments. We cannot be cramped by narrow wave-bands, so narrow that mutual interference will render our work impossible, and any attempt to impose impossible charges for meagre licence facilities must be rendered abortive.

With the lesson of Washington fresh in our minds we should get to it and commence to consolidate our position. The recognition of the amateur by the International Conference is but one step forward; we have still a long way to go before we are granted the right to international communication. Help to forge a link in the chain of strong amateurs by letting us know your feelings concerning the cut in wave-lengths which we have received.

EXPERIMENTS AT 5 G B.

The B.B.C.'s Report—British Radio Apparatus in New Zealand.

By THE EDITOR.

THE report issued by the B.B.C. on a four months' test of 5 G B makes interesting reading. Upon the ultimate efficiency and success of 5 G B depends, of course, the future of the Regional Scheme, for Daventry Junior is an experimental station only; that fact must not be lost sight of when studying the policy of the B.B.C. with regard to their future plans and theories in connection with a more up-to-date and comprehensive system.

The report just issued, although short and by no means comprehensive, is at least welcome, for beyond an assurance given by Captain Eckersley about two months ago, that 5 G B would remain in operation, whatever happened, for at least another year, a good deal of doubt has existed with regard to the station—especially among listeners in the Midlands, who do not wish to be "left in the dark" as to the broadcasting future for that area.

It appears from the report that when the Daventry experimental station replaced

the local Birmingham transmitter in August last, a single low aerial was installed; but after a short trial it was found that the fulfilment of one of the main objects of the new station—namely, the provision of an adequate signal for Birmingham—could not be guaranteed.

A Double Aerial.

The reason was that a certain amount of shielding occurred from the masts of the long-range Daventry station, 5 X X. The engineers were thus confronted with an unexpected problem which nothing but practical tests could have revealed.

It was, therefore, decided to erect a second low aerial in parallel to the first, designed to radiate in the Birmingham direction. This object was accomplished, considerable improvement being effected in the signal strength over the Birmingham area.

Having in mind another important aspect of the 5 G B experiments—namely, the

(Continued on page 1025)



A description of two novel cells which should prove of considerable interest to the radio experimenter.

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

ADDITIONS to the number of primary cells which are available for radio and electrical experimental purposes are not common these days, and, in view of this fact, the wireless enthusiast will view with a good deal of interest a description of two primary cells which have been discovered within recent months.

Both varieties of cells are of the "wet" type, and therefore they cannot be used

The porous pot is placed in a glass vessel which contains a solution of potassium bichromate in dilute sulphuric acid. This solution is made up by dissolving one ounce of potassium bichromate in twelve ounces of water, and adding to the liquid two ounces of strong sulphuric acid. A zinc rod is placed in the porous pot, whilst a carbon rod stands in the outer vessel containing the potassium bichromate-sulphuric acid solution.

The cell gives an E.M.F. of 2 volts, and its internal resistance is approximately half an ohm. Carefully made, it is capable of giving a continuous current for a period of twelve hours, the voltage remaining practically unchanged, and the rate of dissolution of the zinc rod being very slow.

Simple Construction.

Potassium bichromate and sulphuric acid are, however, objectionable materials to have about owing to their corrosive nature, and therefore the amateur will probably find a greater interest in the construction and utilisation of the second type of cell.

This cell, discovered a few months ago by Mr. D. R. Barber, of the University College, Exeter, is very inexpensive to construct, and it employs no objectionable materials. The elements of the Barber cell are illustrated in the photograph, Fig. 1, whilst the complete cell is shown at Fig. 2.

The cell consists of a porous pot containing a saturated solution of potassium permanganate standing in an outer vessel containing a saturated solution of ammonium sulphate. A zinc rod is placed in the outer vessel, whilst a carbon rod stands in the porous pot. The cell gives a pressure of a little over 2 volts. Its internal resistance is half an ohm, and it is capable of providing a continuous current for twenty hours.

There is extremely little action on the zinc element of the cell, and very little polarisation occurs.

A few experiments with this type of permanganate cell will soon convince the amateur of its practical utility. It should be observed, however, that care must be taken to see that both the permanganate and the ammonium sulphate are saturated. The best

way of obtaining a saturated solution is to dissolve as much of the salt as possible in hot water, and to pour the solution hot into the cell. On cooling, crystals will be deposited at the bottom of the vessel, thus proving that the solution is entirely saturated.

For purely experimental purposes, a cell of this nature can readily be constructed in an ordinary jam jar. For the porous pot an old Leclanché porous pot may be used, after its contents have been removed. A scrap piece of zinc may very conveniently take the place of the conventional zinc rod, whilst the carbon element from an old dry battery can be placed in the permanganate solution.

The cell should be allowed to stand overnight after it has been made up, in order that the solutions may permeate the porous pot thoroughly.

Efficient H.T. Battery.

The cell works better if the permanganate solution in the porous pot is slightly acidified. This may be brought about by adding a few drops of hydrochloric acid ("spirits of salts") to the permanganate solution, or a like quantity of sulphuric acid.

Of course, a complete H.T. battery made of these cells would be rather cumbersome, but nevertheless it would be efficient. Quite apart from this question, however, one or two cells of this type are very useful to have available for the purpose of providing the supply of current for galvanometer tests, for lighting small electric bulbs, for supplying current for local relay circuits, and for numerous other uses. They might also be adapted to filament heating purposes, although they do not appear to have been utilised for such purposes up to the present.

For lighting the filaments of valves several of these cells would be needed in parallel, and it is doubtful if it would be a really practical proposition. However it is well worth testing them on a one or two-valve set. They might also be used for slow charging of an accumulator in the same way as the Daniell cell.

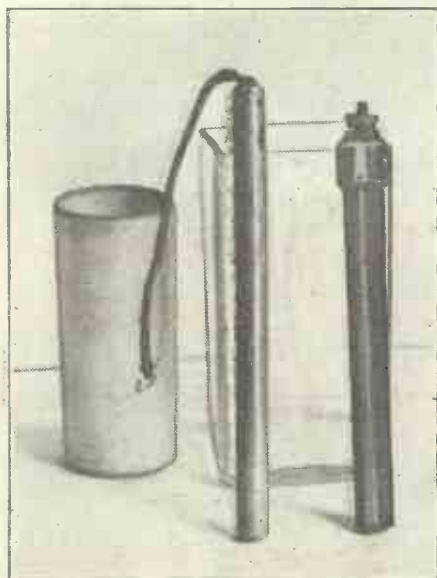


Fig. 1.—The elements of the cell developed by Mr. Barber.

for portable purposes. For the experimental workshop or laboratory, however, and for the purpose of constructing in the form of H.T. units, the cells offer considerable possibilities, for they are both efficient and inexpensive to construct, their upkeep expenses being low.

The first of these cells, due to an Indian scientist, S. L. Jindal, working at Cawnpore, consists of a porous pot containing a solution of ammonium chloride ("sal-ammoniac"), this solution being made up by dissolving half an ounce of the ammonium chloride in eight ounces of water.



Fig. 2.—This is the complete Barber cell, which is stated to have considerable possibilities.

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CONTROVERSY IN BROADCASTING.

"There are few problems so obscured by loose thinking as this one of controversy in broadcasting."

By THE EDITOR.

BY far the most sensible thing that has been said through the B.B.C. for months past was Mr. Bernard Shaw's remark that in order to make sure of being objectionably controversial he must not omit challenging references to the "gorilla" squabble in the Church of England.

I am sure that this Shavianism was received with relief and gratitude by millions of listeners. For the truth is that Savoy Hill has allowed itself to get into a rut in this matter of controversy. At the beginning of the year, the Postmaster-General told Members of Parliament that he was going to let the new Broadcasting Corporation take a six months' trial run experimenting with a measure of controversy properly controlled. At the end of the six months, the P.M.G. had nothing to say. What has the B.B.C. been doing about it?

Weak Excuses.

Savoy Hill made a great splash about extending its frontiers to include debates. These debates were good on the whole, but they are not enough. Meanwhile, the indications are that censorship for the ordinary run of talks is a good deal tighter than it was twelve months ago. The recent Air League incident calls attention to the subject. The B.B.C. may have been right in declining to accept talks from the Air League. But they were not right in declining these talks on the ground that they were controversial. This is no longer an excuse which will hold water. Unfortunately, however, in this way, the Air League incident reveals a timidity of spirit which we do not look for at Savoy Hill. Because a subject is controversial should commend it for broadcasting. It may be unsuitable, but on quite other grounds.

There are few problems so obscured by loose thinking as this one of controversy in broadcasting. If the alleged existing rule were really applied practically no talk of any interest could be given. Every religious address or sermon is more than acutely controversial. It is necessarily objectionable to large sections of listeners.

More Debate Required.

Any talk on Economics or History is controversial. Therefore, it is absurd for the B.B.C. to say that they ban controversy. The truth is that they are in a kind of muddle, trusting to luck not to take anything for the microphone which will create enough alarm and despondency to find an echo in Parliament. This policy of expediency may be excused for a short time but it offers no foundation for the satisfactory evolution of the serious side of broadcasting.

The B.B.C. should realise that their listening public is out of its swaddling clothes. People are not nearly as susceptible to contrary views as they are given credit to be.

The right line for the B.B.C. to take is to expound a new, bold practical policy, take listeners into their confidence and then proceed to develop the policy. The medium of debate for acute controversy need not be restricted to its present conventional form. One side of a problem can be discussed one day and the other side a few days or a week later. An occasional row, even occasional protest, is an excellent thing for broadcasting.

Why Not Parliament?

At present things run too smoothly; Savoy Hill exercises too much control over outside comment on its work. With the genuine addition of controversy to the programmes, would come much needed vitality. Let the debates continue, but brighten their subjects and widen their range.

Then as to Parliament, it is a disgrace that in five years of broadcasting the microphone is still excluded from Westminster. Two years ago the B.B.C. made a great stir to get the Budget speech. Nothing came of it. But it is noteworthy that Mr. Philip Snowden, writing in the B.B.C. official organ, strongly advocated the broadcasting of his opponent's speech on the occasion of his introducing the Budget.

A UNIVERSITY RADIO STATION.



The Harvard University of America, the status of which in the U.S. is something of that of Oxford or Cambridge in this country, has a very well-equipped radio laboratory. The buildings and the main aerial of this are shown in the above photograph. An excellent idea of the size is given by the rear of the large motor-car which can be seen close to the main entrance.

Last spring students of broadcasting expected the B.B.C. to make a much more effective effort to get the Budget speech. But for some quite unexplained reason there was hardly a murmur from Savoy Hill. The indefatigable Captain Ian Fraser got no change from the P.M.G. and so the matter was dropped again.

Wake Up Westminster.

The attitude of this Government or of any Government will remain obstructive until two conditions are fulfilled. First of all, persistent keenness at Savoy Hill, and secondly a public demand. The first of these conditions does not appear to be fulfilled and without it the latter is hopeless. Therefore, in connection with the urgently needed solution of the general problem of controversy there is the subsidiary problem of the broadcasting of Parliament.

Now that the B.B.C. is in transition to a new kind of distribution which should enable it to provide contrast programmes, the broadcasting of Parliament should not be neglected. I do not advance this as a novel or exciting form of entertainment. On the other hand, I disagree entirely with those who suggest that the proceedings of Parliament, at least on important occasions, are not of interest to more than fifty per cent of the listening public.

The interest in politics is rapidly increasing. To broadcast Parliament would have far-reaching and, in my opinion, a desirable influence not only upon the style and the character of political oratory but also upon the conduct of the public affairs of the country and the Empire.

The knowledge that their remarks would be received by thousands of their interested constituents would make Members of Parliament a great deal more careful about what they were saying in the House. More-

over, this would provide a much needed antidote to the slovenliness and carelessness which too often characterise even Front Bench utterances.

But there is a much more important side to this problem than the one I have just mentioned. It has become a commonplace to deplore the alleged decline of the Parliamentary system of government as evolved by the British tradition. Political Jeremiahs pour ridicule upon the ignorance of the elector and his indifference to affairs of state. I do not share this pessimism. I think that most of the electorate is ready and anxious to learn about affairs of state.

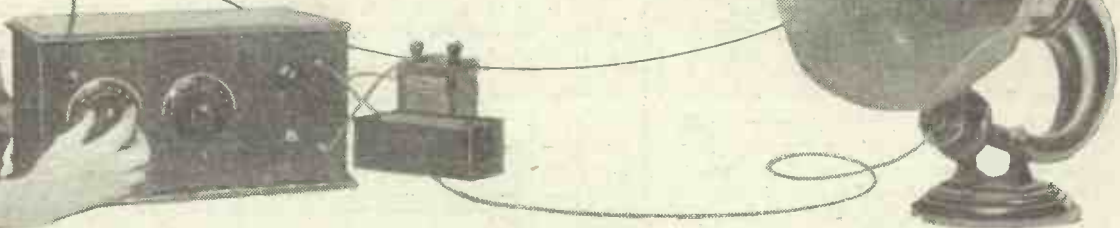
The trouble is that Parliamentary news is not comprehensively covered by the newspapers. The use of wireless would be of enormous value in educating the electorate.



A NEW SERIES FOR THE AMATEUR.

LOW-FREQUENCY AMPLIFICATION.

In this first article of a further short series for the new amateur the main principles of L.F. amplification are discussed.
By A. JOHNSON RANDALL.



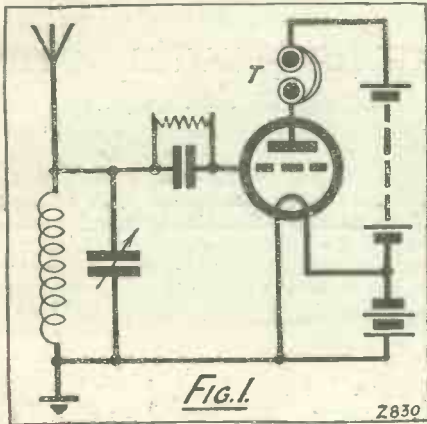
THE uses of a three-electrode valve in a wireless receiver may be divided into three parts. These three are: high-frequency amplification, rectification, and low-frequency amplification. The former, namely, that of amplifying the received signals before they are rectified, has already been dealt with by Mr. G. P. Kendall in his articles entitled "The A B C of H.F.

pulses (speech, music, Morse, etc.) in the anode circuit of the detector valve.

I mention detector valve because the majority of modern sets employ a rectifier of this type, but, of course, there are other types of detectors, such as our old friend, the crystal. A low-frequency amplifier can be employed in conjunction with a crystal in exactly the same way.

out its duties with the minimum amount of distortion.

Let us see how best we can couple together our valves if we are to make full use of their properties as magnifiers. The most popular scheme, and, moreover, that which gives the highest magnification per stage, is to use an L.F. transformer. Fig. 1 shows a simple detector circuit, and a pair of telephones marked T, which are joined between H.T. positive and the anode of the valve. If the receiver is tuned to the wave-length of a local broadcast transmitter, the rectified signals will be audible in the telephones.



Faithful Reproduction.

The function of an L.F. amplifier is not merely to magnify the rectified pulses, its duty is to deal with them in such a way that the amplified signals at the output, or loud-speaker terminals, will be an exact counterpart of the weaker signals at the input, or detector end, of the amplifier.

There is little point in going to the trouble of magnifying the strength of the broadcast signals if at the finish they are to be so hopelessly distorted as to be practically unrecognisable. It will therefore be seen that if a valve is to be employed as an efficient low-frequency amplifier it must be used in a way which enables it to carry

Step-up Ratio.

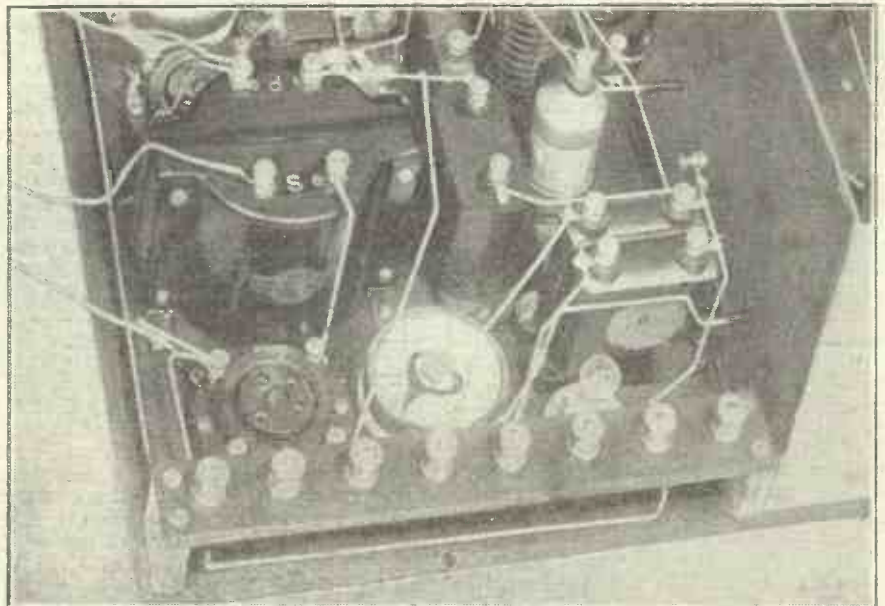
If now, instead of the telephones, we connect in the plate circuit of the valve the primary winding P of an L.F. transformer, the rectified pulses will set up voltages across the winding. These voltage pulsations in turn will induce similar voltages across the secondary winding S, and these voltage pulsations across S will be magnified
(Continued on next page.)

Amplification." In this article and subsequent ones I propose to describe the more common methods of employing a valve as a low-frequency amplifier.

Magnifying the Signals.

Low-frequency—or, as it is called in America, audio-frequency amplification—is simply the method employed to magnify the signals after they have been rectified. If one places a pair of ordinary headphones in the plate circuit of a detector valve it is possible to hear the signals which are coming in on the wave-length to which the receiver is tuned, because these signals have been rendered audible by the process of rectification.

It may be, however, that the signals are not sufficiently loud for the purposes to which they are to be put. For instance, these audible sounds may be broadcast speech or music, and perhaps it is desired to magnify this speech or music to a strength sufficient to operate a loud speaker. This, briefly, is the function of a low-frequency amplifier, and it may be looked upon simply as a magnifier of the signal



Here are the L.F. amplifying stages of a large multi-valve receiver designed for long-distance loud-speaker reception. Low-frequency amplification magnifies the rectified impulses (speech and music variations of current) and makes them very much louder. It does not to any great extent increase the range of reception of a set.

A NEW SERIES FOR THE AMATEUR.

LOW-FREQUENCY AMPLIFICATION.

(Continued from previous page.)

in proportion to the ratio of the turns on S to the turns on P. It will therefore be seen that, theoretically, the signal variations across the grid and filament of the L.F. valve, V_2 , will be proportional to the voltages across P multiplied by the step-up ratio of the transformer.

Essential Requirements.

The L.F. valve itself, however, will further magnify these voltages, the amplified signals across the terminals L.S. being proportional to the voltages across S multiplied by the amplification factor M of the valve. Theoretically the voltages across L.S. will be:

$$\frac{S}{P} \times M \text{ times those across P.}$$

This, briefly, is the action of a transformer, and it now remains to be seen how we can ensure faithful reproduction. In building a transformer-coupled amplifier, the secret of success lies in the choice of a well-designed transformer and a suitable valve. Dealing first with the transformer, the essential requirements are—a primary winding with a great number of turns and, consequently, a high inductance value, and an iron core of adequate cross section. A high-inductance primary winding is of vital importance from the point of view of the reproduction of the low tones.

Fifty henries may be taken as a good average figure, but the actual value, of course, depends upon the valve with which the transformer is to be used. Now this necessity for a large number of turns on the primary winding greatly complicates the

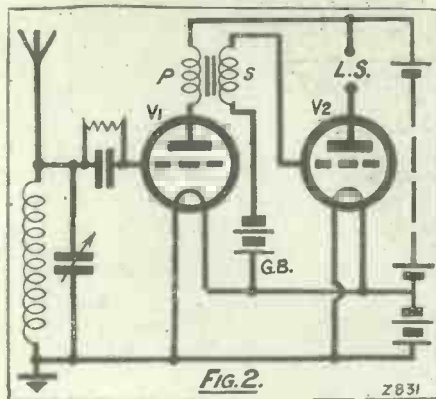


FIG. 2.

Z 831

design of transformers generally, and, in addition, it tends to make the price of a really good instrument somewhat high.

If the transformer is to give any voltage step-up at all, then the number of turns on the secondary winding must be greater than that on the primary winding, for we have already seen that our effective magnification depends largely upon this ratio of turns between the two windings. In practice, to design a high-quality transformer having a moderate step-up requires the utmost skill and ingenuity. Obviously, as the number of turns is increased the

capacity effect between the turns will be increased also.

This distributed capacity or self-capacity of the windings, may be regarded as equivalent to a small condenser connected in parallel with the secondary, and the result of this small capacity value tends to cause a decrease in the amplification of the higher musical frequencies. With a modern transformer of first-class design, the secondary winding and, for that matter, the primary also, is wound in sections, one of the effects of this method of winding being to keep down the capacity effect to a minimum. Even so, however, it is not

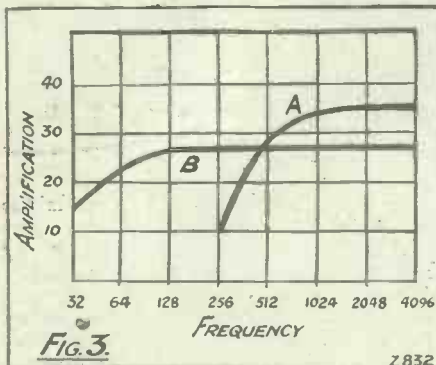


FIG. 3.

Z 832

desirable for the secondary to primary turns ratio to be more than three and a half to one if the primary winding is to have a high inductance value.

Primary Current.

It follows, therefore, that in order to obtain high quality with an ordinary valve, a low-ratio transformer is necessary. The remaining important factor concerns the saturation of the iron core. If we pass a current through a winding, lines of force will be produced, the number of lines depending upon the magnetising current, the number of turns, and the permeability of the iron. An increase in the magnetising force should increase the number of lines, and this holds good up to a point.

Saturation is reached when an increase in the magnetising force no longer produces a difference in the number of lines, and there is a limit to the magnetising force for any given core. Apart from this question of saturation the inductance of a given primary decreases as the current increases. Two well-known manufacturers go to the trouble of stating in their catalogues the maximum current values which should be passed through the primaries of their various transformers, and if these values are exceeded there is a danger of distortion occurring. In addition, certain other effects occur which cannot be dealt with in an article of this nature.

Simple Curves.

It has been stated previously that the quality of reproduction obtained depends upon the valve and the number of turns upon the primary. In Fig. 3 I have shown two curves. These have been drawn simply for explanatory purposes, and do not depict the performance of any transformers in particular. Plotted along the base of the graphs are frequencies taken along the piano scale and vertically certain arbitrary figures to represent amplification. Curve A is what might be obtained with a thoroughly bad transformer, or with a

moderately good transformer and an unsuitable valve. It will be noticed that none of the lower frequencies is reproduced at all; and such a curve might be the result of an inadequate number of turns on the primary winding. Curve B is that which might be expected from a good transformer with a primary winding of high inductance value and a suitable valve. In general, provided the transformer is of suitable design, a decrease in the impedance of the valve in series with the primary winding, that is, V_1 in Fig. 2, improves the amplification of the lower frequencies.

Obtaining Purity.

Hence it is conceivable that the curve shown as A, assuming the design of the transformer to be sound, could be considerably improved by the use of a more suitable valve, such as one having a lower impedance. The reader will now see that if he wishes to obtain high quality with a transformer, he must first purchase a first-class component; secondly, he must use a suitable valve, preferably of the type suggested by the makers in their instruction pamphlet or catalogue; thirdly, he must keep down the primary current to within the limits specified by the manufacturers, by the use of a suitable H.T. valve.

Lastly, there is the question of grid bias. Referring to Fig. 2 it will be seen that a small battery marked G.B. is connected between L.T. — and one end of the secondary winding of the transformer, so as to apply a certain voltage value to the grid of the valve V_1 .

If you refer to the curve of a small power-valve such as the one shown in Fig. 4 you will notice that it is merely a graph showing values of grid volts plotted against anode current taken at a certain H.T. voltage! This is called the static characteristic of a valve. For distortionless amplification it is necessary to work on the straight portion of the curve to the left of the vertical line

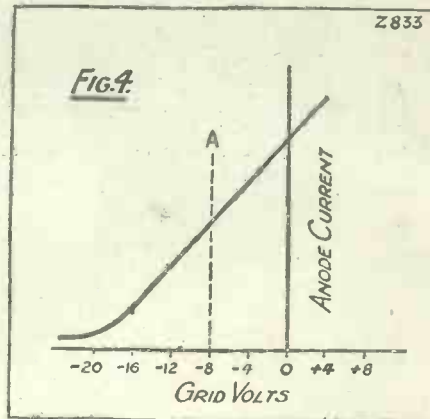


FIG. 4.

Z 833

denoting values of anode current. In practice one takes a point along this curve at A, halfway between the vertical line at zero grid volts and the portion where the graph commences to bend.

Dropping a perpendicular from this point to the negative grid volt line will give the value of grid bias to be employed for the particular H.T. voltage selected. The portion of the characteristic to the right of zero grid volts is frequently called the grid current area, and the curved portion of the characteristic on the left is termed the bottom bend.

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ELECTRICAL

The First combined H.T. Accumulator for A.C. Mains & Charger

The "GEEKO" Combined H.T. Accumulator and Charger for A.C. electric light mains—200/250 volts, 40/60 cycles—solves the problem of keeping the H.T. Accumulator constantly charged without removal from its position and without disconnecting it from the receiver.

The Charger consists of an entirely new electrolytic rectifier employing an electrolyte which has these unique advantages:—

- Gives off no fumes.
- Remains perfectly cool.
- No sediment forms.
- Requires no attention.

Running costs vary from 2/2 a year for a 2-valve set to 6/- a year for a 7-valve set.



MADE IN ENGLAND

PRICES:

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O.663 100 volts £7- 0-0

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(D.C. MODEL)

O.660 100 volts £6-6-0

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H.T. ACCUMULATOR & CHARGER

Models now available for A.C. and D.C. Mains

A Home-made Met-Vick Four

For working off the Electric Light Mains

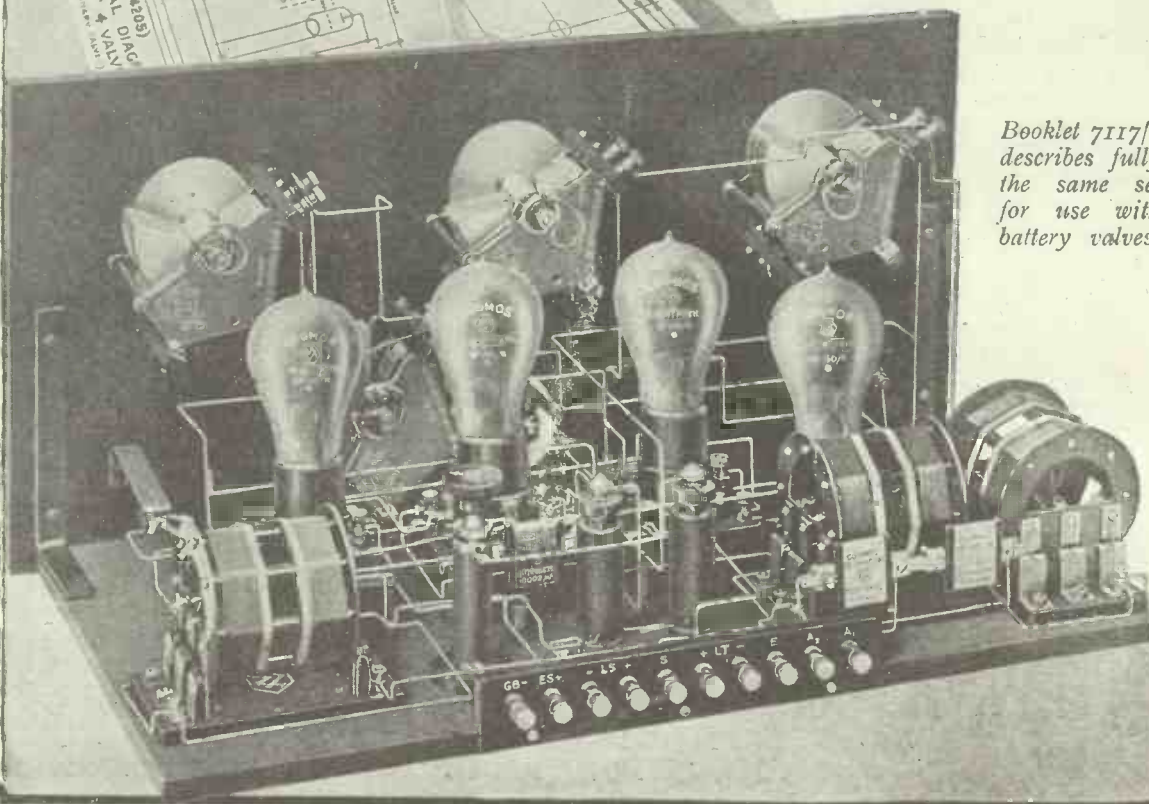
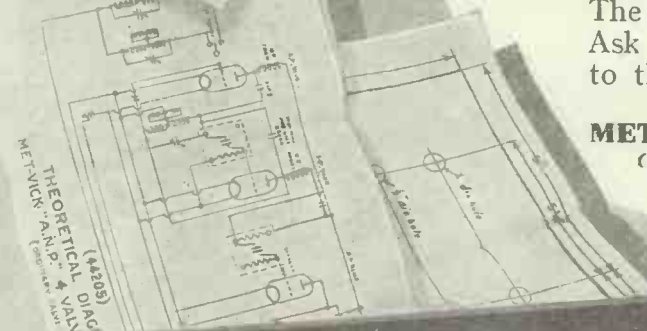
The "Met-Vick" 4-Valve A.N.P. Set shown on this page can also be constructed for working direct from the electric light mains. This involves the use of "Cosmos" A.C. Valves and Battery Eliminators, and is fully described in the booklet 7117/4 obtainable from your wireless dealer complete with drilling template and wiring diagrams. The performance of the set is astonishingly good, giving great selectivity with a wide range, high quality of reproduction and simplicity of operation.

The cost of the necessary parts is low. Ask your dealer for the booklet or write to the makers.

METRO - VICK SUPPLIES LIMITED

(Proprietors: Metropolitan-Vickers Elec. Co. Ltd.)

**155, Charing Cross Road,
LONDON, W.C.2**



Booklet 7117/5 describes fully the same set for use with battery valves.

AN OUTPOST OF EMPIRE.

The Editor, POPULAR WIRELESS.

Dear Sir,—The following is a letter I have received from Ascension Island, which no doubt will be of interest to you:

"E. T. C. Staff Mess,
Ascension Island.
December 3rd, 1927.

"Dear Mr. Marcuse,—I am writing to let you know that when listening in last night at 11 p.m. local time (that's an hour slow of G.M.T.) I heard Big Ben striking midnight. At first I thought I might have picked up 5 S W, if this station is working yet? However, I feel pretty certain that during the course of the next half-hour I heard you say this is British 2 N M calling, but exactly what the programme consisted of I can't tell you, except that it was chiefly dance music and orchestral items; at half-past eleven o'clock you apparently closed down. The signals were not very strong, and were suffering very badly from severe fading. I should not be writing now really until I had heard you again and were able to give you a more useful report—however, as the mail leaves to-morrow, and there is not another for a month, I thought I would drop you a line now.

"I am a regular reader of POPULAR WIRELESS, and wish to congratulate you on your fine achievements in regard to the reception of 2 N M in Australia. I might add whilst in Port Sudan during 1925 and '26, I constructed the Short-Wave Set described by you in POPULAR WIRELESS, and got very satisfactory reception from K D K A on 62 metres. At present I have no particulars of the times or dates of your transmissions, but hope to see something in POPULAR WIRELESS.

"Wishing you every success,
I remain,
Yours truly,
(Signed) "LESLIE FORD SMITH."

Yours sincerely,
GERALD MARCUSE.

Caterham, Surrey.

[EDITORIAL NOTE.—Ascension is a lonely island in the Atlantic, many hundreds of miles from the western shores of Africa—the nearest mainland. Practically the only white inhabitants are the engineers and telegraphists employed in the Eastern Telegraph Co.'s cable station. Also, during the Great War, a naval wireless station on Ascension was an important link in the chain of radio stations operated by the Admiralty in the interests of the British Mercantile Marine.]

BRITISH BROADCASTING.

The Editor, POPULAR WIRELESS.

Dear Sir,—The series of critically constructive articles on British Broadcasting are the most accurate and best I have ever read. If the B.B.C. only studied the "Daily Mail" Ballot, which is the most conclusive proof of what the majority of listeners require, and not pander to their own tastes and a small section of listeners, there would be less dissatisfaction.

Re the plight of Birmingham crystal listeners: Do the B.B.C. intend to cater for crystal listeners in the regional scheme? If not, why the use of it? As, with a decent valve set one can get alternate stations now. Everyone cannot afford a valve set with its attendant expenses, and the B.B.C. will lose a large amount in revenue.

S.W.11.

"JUSTICE."

2 F C ON A FILADYNE.

The Editor, POPULAR WIRELESS.

Dear Sir,—It may interest you to know that I have made the Filadyne described in your April issue. The results on the broadcast range were so good that I made up some short-wave coils for it at once. The results were amazing, K D K A, W G Y, 2 X A F, W R N Y, W L W, 3 X L and 2 X G, all of which were tested with the wave-meter described in this month's "Wireless Constructor." Last Sunday I had 2 F C (Sydney) at quite good strength, without much fading. This is, in my opinion, the very best short-wave set that I have ever tested.

Yours faithfully,
J. M.

Cheltenham.

THE FILADYNE ONE-VALVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—This remarkable circuit merits much more attention than it has hitherto received, not only for results already achieved, but also for its hidden mysteries. I was attracted to it in the first instance because of the easy conversion of my existing crystal set into the Filadyne. The set in question was known as the seven circuit crystal (designed by Mr. Harris) and as built constituted one-half of the Filadyne. On completing the wiring I found that the Filadyne gave much greater volume with almost equal purity as with the crystal set and with one-valve amplifier combined. Stations come in at almost every degree of the condenser, but with remarkable isolation when tuned out, among which are the following in order of volume: Leeds, 10; Manchester, 9; Langenberg, 9; Stuttgart, 8; Newcastle, 8; 5 G B, 8; Glasgow, 4; 2 L O, 4 (direct); and many other foreign stations at good strength but not identified up to the present. I have placed numbers against the foregoing as an indication of signal strength.

CORRESPONDENCE.

AN OUTPOST OF EMPIRE

2 F C ON A FILADYNE—DOUBLE-END HIGH-FREQUENCY VALVES.

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.

I am situated about 10 miles north of local relay and 70 miles to nearest main station (Manchester). The local station can be heard from the 'phones while lying on the table. Among the "freaks" of the circuit are the following: A cheap 3/- British valve is simply marvellous, while one of the high-priced British valves is sadly deficient in this circuit. By inserting the original Daventry coil in the loading socket, instead of getting the long-wave station as with the crystal set, I get the short-wave "local" at increased strength! Again, while the "local" is tuned and set, by simply withdrawing the aerial plug I can hear a foreigner talking with almost equal volume as with the local. Such are the "freaks." Now for ascertained results by "chopping and changing." While "L 3" (reaction) coil requires 30 turns for the local station, 5 G B requires 40 for best results—this being achieved by "tapping." While the condenser tuning is fairly sharp, the reaction is entirely controlled by the rheostat and not by the potentiometer as stated in the text. In my set—the one described as "Another Filadyne One-Valver" by Mr. Dowding—when the potentiometer is removed the volume seems greater, but slightly coarse, otherwise I would discard this component. I find that 36 volts H.T. gives as good results as 66 I also find that the addition of a one-valve amplifier worked the "local" on an Amplion loud speaker. Summing up, the advantage of this circuit over other "one-valvers" is first, its simplicity; second, its "reaching out" properties; third, wide and smooth reaction margin; fourth, selectivity; fifth, purity of signals. Thanking Mr. Dowding and Mr. English and hoping that these lines will be helpful to others.

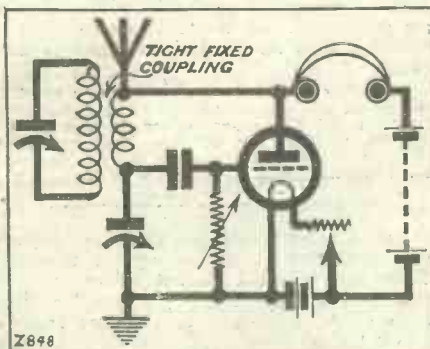
Yours faithfully,
HOOKER-UP."

Pool, nr. Leeds.

THE "NOVEL" ONE-VALVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I see in your "Correspondence" page in the issue of November 19th, 1927, a letter from Australia giving us the "Novel" one-valve circuit.



This circuit has long been in use (it is the simplest ultra-audion circuit), and I was introduced to it through the medium of your columns.

As it may interest your readers to know a little about the working, I am referring to my notebook, with notes dated January, 1925.

Filament control.—Very important, as we can use this to control reaction. Rheostat with smooth movement necessary.

Variable Condenser.—Must have vernier movement, and, of course, be perfect insulator, as the H.T. is shorted (through the 'phones and coil) if any plates touch.

Grid Leak.—Variable leak a great help; different values alter the sharpness of filament control and the broadness of tuning.

I usually worked the circuit in the form shown in the figure.

Hoping that this is of interest to your readers:

Yours faithfully,
R. M. KAY, B.Sc. Tech.

Manchester;

DOUBLE-ENDED HIGH-FREQUENCY VALVES.

The Editor, POPULAR WIRELESS.

Dear Sir,—Since the introduction of the Osram "Screen-Grid" Valve the minds of many amateurs have been busy contemplating the re-design and construction of the H.F. portion of the receivers, and it has perhaps occurred to them during the process of planning the "lay-out" that the double-ended type of screen-grid valve is the only solution to the problem of entirely screening the plate from the grid—a precaution which is very necessary when the utmost amplification is desired.

Were all the connections to the electrodes of the S.625 valve brought down to a single insulating cap mounted at one end of the valve, it would be impossible to eliminate the small but nevertheless serious capacity existing between the pins and the connections to the latter. On the other hand, by bringing the grid and filament connections to one end of the valve and taking the plate and screen-grid to the other end, it is an easy matter to eliminate entirely any capacity effect.

The beauty of this system lies in the fact that all the grid circuit, with its attendant connections, may be housed in one screening box; while the plate circuit and all its connections may be placed in a separate adjacent screening box. The valve itself projects half way through each box.

With this system only is it possible to obtain the very utmost amplification from the valve, for the slightest capacity existing between grid and plate may be regarded as a partial short circuit of the valve, and a considerable loss in amplification occurs.

These points should be borne in mind, for there are several single-ended screened-grid valves appearing on the market in which, although the grid and plate is shielded internally, externally no efficient shielding can be made.

Yours faithfully,
THE GENERAL ELECTRIC CO., LTD.
London, W.C.2.

THE "CUBE-SCREEN" FOUR.

The Editor, POPULAR WIRELESS.

Dear Sir,—I trust you will convey my heartiest congratulations to Mr. G. P. Kendall on that wonderful set, the "Cube-Screen" Four. By "Gee" it is some set. I have yet to see the four-valve set that will equal it, and I don't say this because it is the only set I have tried, for, being a reader of "P.W." since No. 1, you can guess my sets have been more than a few, and I must say they have all been winners, but this one tops the bill for four valves. I have been using it now for three weeks, and there seems to be no limit to the number of stations I can receive. There are a round dozen of them that come in at extraordinary strength on the loud speaker, so loud that I am always obliged to use the volume control, and then there are several more that come in at lesser strength on the L.S. I have built the set exactly as described, wire for wire, the only alteration being I have used Jackson's slow-motion condensers instead of those specified, and the set went straight away first time without any trouble. Of course, this is only natural with a "P.W." set when instructions are closely followed, and this is a part of set building I am a great believer in, so the splendid photos of this set that were printed made the building of the set comparatively easy. I will switch off now, as I want to finish the construction for a friend of the "Standard Two," another "P.W." winner. Again sending you my congratulations on so fine a set.

Yours faithfully,
E. A. S.

Plastow, E.13.

IS H.F. A LUXURY?

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been following very closely the letters of your two correspondents regarding high-frequency being a luxury, and as I am at present in possession of a three-valve Reinartz "P.W." blue print, I am, of course, very interested.

Could I be allowed through the medium of your paper to ask your correspondent who signs himself "Is H.F. a Luxury," why he has a flexible connection on the fixed vanes of the aerial tuning condenser? Thanking you.

R. C.

P.S.—Needless to say, I am a regular reader of "P.W." Middlesbrough.

H.T. BATTERIES.

The Editor, POPULAR WIRELESS.

Dear Sir,—In the issue of POPULAR WIRELESS dated July 30th, you appealed for reports on six months use of H.T.B. My set is at present a Det., L.F. 2-valver, and I am using 4½-volt batteries in series for 60 v. H.T.

Following is an extract from my log-book:

	£	s.	d.
July 1st.—15 4½-volt batteries (60 v.) at Cd.	0	7	6
Nov. 1st.—3 4½-volt batteries (13½ v.) at Cd.	0	1	6
Nov. 9th.—1 4½-volt battery (4½ v.) at Cd.	0	0	6
Nov. 21st.—8 4½-volt batteries (36 v.) at Cd.	0	4	0

Total for six months 0 13 6

The battery is well up, viz. 55 volt at the date of writing.

Hoping this will be of some assistance to you,
Yours truly,
Winchester, Hants; I. A. D.

RADIO TUTORIAL

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

QUESTIONS AND ANSWERS.

THE GUARANTEED REFLEX.

"I have built the Guaranteed Reflex as described on the 'P.W.' Blue Print Circuit No. 22, and I must say it goes like a son-of-a-gun. There are plenty of stations, and they are rendered with plenty of volume, but I do

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good" ?

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

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

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

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

not think I am getting the full results of the circuit. The thing that puzzles me is that I cannot give the valves the voltages which the makers recommend for them. Apparently, in order to get full results from the second valve (which by the way is a power valve), I should give it another 25 or 30 volts H.T., as compared with the first valve

In order to take this properly, and perhaps a little more than that, I should be able to increase its grid bias to more than the grid

bias on the first valve. As far as I can see from the connections, however, it is impossible to give the second valve extra H.T. or extra grid bias. Could not this be arranged without much alteration to the wiring? If so, I should be very glad for I feel sure that with these additions the set would give even better results than it is giving at the present."

For simplicity's sake the circuit was worked out in its most elementary form, as it often happens that a multiplicity of leads gives rise to all sorts of howling troubles which would not occur had the circuit been simpler. If, however, you have built the set and you find it has no tendency to self oscillation, it is quite a simple matter to fit extra grid bias and extra H.T. to the last valve. In order to do this proceed as follows.

First of all remove the lead which goes from IS of the second transformer to the earth terminal. In its place put a flexible lead on the IS terminal, and at the end of this lead fix a black grid-bias plug which can be plugged into the grid-bias battery. This will give you a separate grid-bias to the second valve.

In order to provide separate H.T. for this valve you will first of all remove the lead which goes from the .002 mfd. fixed condenser across the loud-speaker terminals to the .3 mfd. fixed condenser which is joined across H.T. positive and L.T. negative. When you have disconnected the two condensers from each other join a long flexible lead to the loud-speaker terminal which is marked positive, or else to the side of the .002 mfd. fixed condenser, which is connected to the loud-speaker plus terminal.

At the other end of this flexible lead a red plug should be put, and this can be plugged into the H.T. battery at the appropriate voltage, thus applying the correct anode potential to the plate of the second valve.

R.F. CHOKES, OR H.F. ?

L. A. (Buxton).—"What is the difference between an H.F. choke and an R.F. choke? I have never understood this point, and as I am going to build the 'Progressive' Four I should like to know which is better in that circuit?"

An H.F. choke is exactly the same as an R.F. choke. In this country the full name of the component is High-Frequency Choke (H.F.C.), but in America it is always called a Radio-Frequency Choke, and is thus often abbreviated to "R.F.C."—But it means exactly the same in both cases.

SPEAKING INTO AN AMPLIFIER.

NEW READER (Hockley, Essex).—"I have been told that some time ago in POPULAR WIRELESS, before I started taking it, you published an account of how an amplifier can be used to reproduce programmes spoken into it by its owner. I want to do a stunt of this kind at a kiddies' party, and I should be very glad of particulars if you could give me same, provided that it involves no very great alterations to the amplifier."

It is quite easy to operate the amplifier in the way suggested. An examination of this instrument will show that at present the amplifier is operated by the output from the detector valve. Probably the amplifier's input is the primary winding of a low-frequency transformer, the secondary of which goes to the grid of the amplifier's first valve.

In such a case, all that is necessary is to disconnect the amplifier's input from the set and connect a loud speaker across its primary terminals, OP and IP (or "H.T. positive" and "A"). If now the loud speaker is spoken into, amplified reproduction will be given by the main loud speaker, which is connected to the output of the amplifier.

It is not essential that the loud speaker which acts as the microphone should be connected directly to the primary winding of the input transformer. As a matter of fact, long leads can be used so that the

loud speaker can be spoken into in another room, thus adding greatly to the effect of what seems to be a very mystifying trick.

THE "ARMSTRONG" SUPER.

"Some two or three years ago I built an 'Armstrong' super circuit, and although I had a good deal of experimenting with it I found it a bit too tricky to handle, and it was thus put aside. The parts in it seem pretty good, so I should like to use it as an ordinary one-valve set if possible. How can I convert it into a one-valver set?"

If you examine the connections you will find that there are two large quenching coils, across which fixed condensers are connected (generally of .0005 mfd.). Pull out both of these coils and short each of them with a piece of wire between the plug and socket of the coil holder.

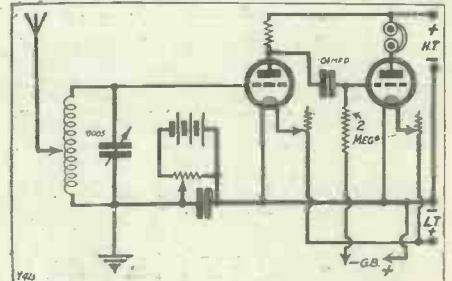
In its main features, the set is now an ordinary one valver, the only difference being that instead of having an aerial coil connected across the aerial tuning condenser, it is usual in the "Armstrong" super circuit to employ a small coil of thirty turns or so in series with a frame aerial across it. Such an arrangement can easily be converted into an ordinary set by shorting the terminals provided for the frame aerial connection, leaving the small coil (to which the reaction coil is coupled) connected across the tuning condenser in the usual way. One end of this coil and condenser goes to the grid leak and condenser, and the other end of the coil and tuning condenser is joined to L.T. negative and to earth, so when the aerial lead has been connected to the grid side of the valve, the circuit should function as an ordinary one valver.

COIL CONNECTIONS.

W. B. (Hockley, Essex).—"Your correspondent who enquired "What is Electricity?" in a recent issue may be glad to have the following "simple" explanation, attributed to Herbert Spencer:

"Electricity is the preconceivable incorporation of an abstruse science, elucidating conglomerated locomotion, and

DETECTOR AND L.F. AMPLIFIER.



The correct connections for a resistance-capacity-coupled Det. and L.F. two-valver are shown above. In the "What is Wrong?" diagram last week, the anode-bias battery's connections were shown reversed, and its bypass condenser was not connected across the filament and slider leads. The anode resistance was of too large a value, and the G.B. battery plus was connected to L.T. + instead of to L.T. neg., whilst the grid leak to grid-bias lead should have crossed over the L.T.-lead, instead of making connection.

the immutability of an immutable matter, in a concrete mass which can be illustrated by the perimodical podological apparatus.

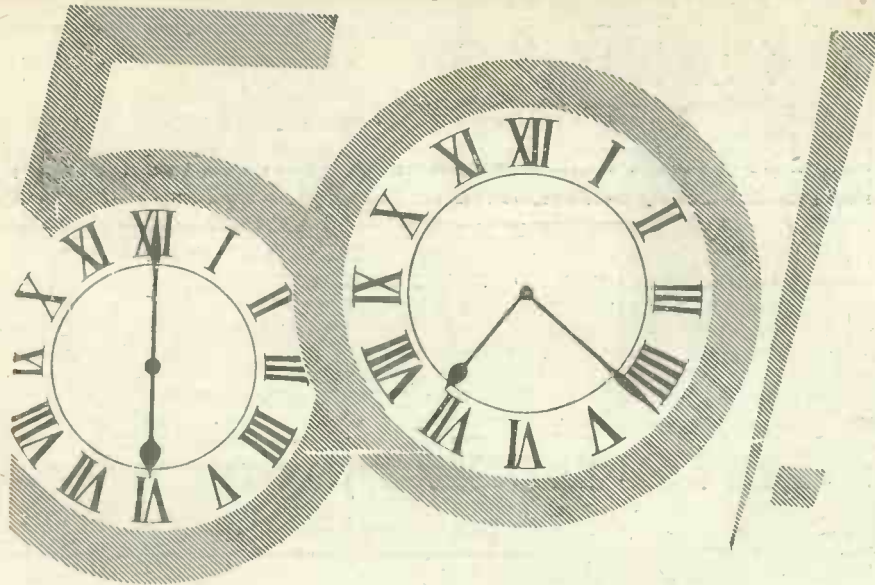
When you have got over that!! I should be glad to know the proper, or usual, way plug-in coils are connected. Beginning of coil to (pin) or (socket)?"

The usual method is to connect plug of the coil to its beginning, and the socket to its end, i.e. plug to inner connection, socket to outer.

COMPONENTS FOR THE "PROGRESSIVE."

CAPSTAN (Nelson).—"Will the following components (which I have on hand) be suitable for the 'Progressive' set?"

(Continued on page 1014.)



ONLY 5 CONNECTIONS

No soldering—nothing you cannot understand—nothing to go wrong. You need know nothing about radio mechanics to make up this set. Just an hour with nimble fingers and a screw-driver—and you can be sure of wireless reception of amazing purity.

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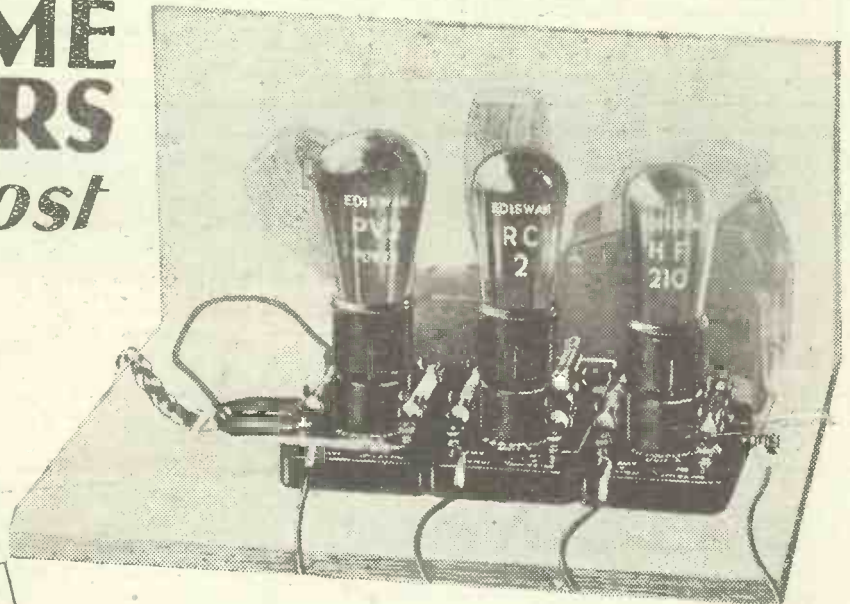
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V.78

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1012.)

- "1.0005 variable condenser (slow motion).
- "0003 variable condenser (slow motion):
- "Ferranti L.F. transformer (old type, unshrouded)."

All the above are quite suitable, though the more modern type of L.F. transformer naturally would give better results than its predecessor.

THE EARTH CONNECTION.

"I have often read a good deal about how to make the aerial connections, and all that sort of thing, but I have not seen much about the earth wire. Does this mean that the earth is comparatively unimportant? If not, what are the main points to watch when making the earth connection?"

The essential features of the earth connection are a large metal surface making good contact with a good big area of damp soil. The earth connection is quite as important as the aerial, and there is no doubt that in a very large number of cases a little extra care with the earth would result in a great increase of signal strength. This, by the way, is especially true in the case of crystal sets. From the foregoing it should be noted that a main water pipe should make a pretty good earth connection, as this generally represents a very large area buried well below the surface of the ground. Where such a pipe is used it is important to make really good contact with it or otherwise there will be a considerable resistance to the flow of current between the earth terminal of the set and the actual soil. Good stout wire should be used for the earth lead. There is no need to use an insulated lead, but it should be short and direct.

HOW TO NEUTRALISE.

R. M. S. (Singlewell, Kent).—"For economy in long distance I am convinced you cannot beat a three-valve straight set, (H.F., Det., and L.F.). My old three-valver was a good one and now I have completely modernised

it, using a neutralised H.F. valve with condenser controlled reaction to its secondary. Results already seem extremely promising, but it howls easily, and I cannot neutralise the set properly. What is the correct method?"

Neutralisation is easily carried out as follows. First of all, set the vanes of the reaction condenser "all out," and also those of the neutralising condenser. Choose a time when there is no broadcasting on so that you can easily hear in the phones whether the set is oscillating or not. Set the aerial tuning condenser to about 50 degrees, and then slowly rotate the high-frequency condenser, and note whether the set starts oscillating or not. Probably it will do so, over just one or two degrees on the dial, where the two circuits are in resonance. Make a note of the dial reading, and then slightly readjust the neutralising condenser. A position for this will soon be found in which the set has no tendency to oscillate, even though the two tuned circuits are in resonance. When this has been done introduce a little reaction in the circuit by turning that condenser, say, three or four degrees, and then listen carefully as the two tuned circuits are readjusted. When the set oscillates again, carefully readjust the neutrodyne condenser, and the oscillation should cease when the setting is increased slightly. A little more reaction may now be introduced, further small increases of the neutrodyne condenser adjustment enabling you to balance the feed-back and make the set stable again. Continuing in this way you will soon come to a point where the adjustment of the neutralising condenser appears to be over-shot, and further increase of its capacity makes the set oscillate instead

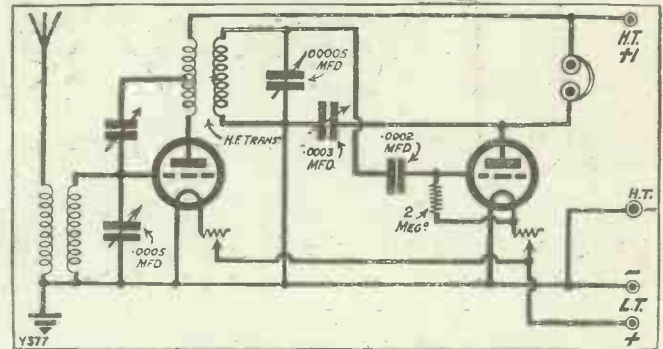
of stabilising it. When this happens slacken off the adjustment a little, trying to find the exact spot where, when the maximum permissible reaction is used, the slightest variation of the neutralising condenser either way results in a tendency to oscillate. This is the adjustment for correct neutralisation.

EXCESSIVE GRID BIAS.

"GRID BIAS BOTHER" (Pershore, Worcs).—"For some reason the last valve in my R.C. amplifier requires two or three times as much

(Continued on page 1020.)

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a neutralised tapped-primary H.F. and Detector set, with condenser-controlled reaction to the secondary. But it is wrong and would not work properly.

Next week the correct diagram will be given, and to test your skill we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems week by week the reader cannot fail to learn a lot about radio circuits.

Protect your valves!

If your reception is unsatisfactory see that your valve holders are guaranteed to absorb shock and eliminate microphonic noises. Valves must be protected by good valve holders if they are to function perfectly.

When the valve pins enter the valve sockets of the Lotus Valve Holder the leg sockets immediately expand and automatically lock, and the floating platform in which they are fixed is suspended by four phosphor bronze springs. Although these springs have great mechanical strength they are sufficiently resilient to absorb any external shock liable to damage the valve.

Lotus Valve Holders are used and recommended in the Mullard circuits in Radio for the Million, and are ideal for use in the Blaster Three and the Cossor Melody Maker.



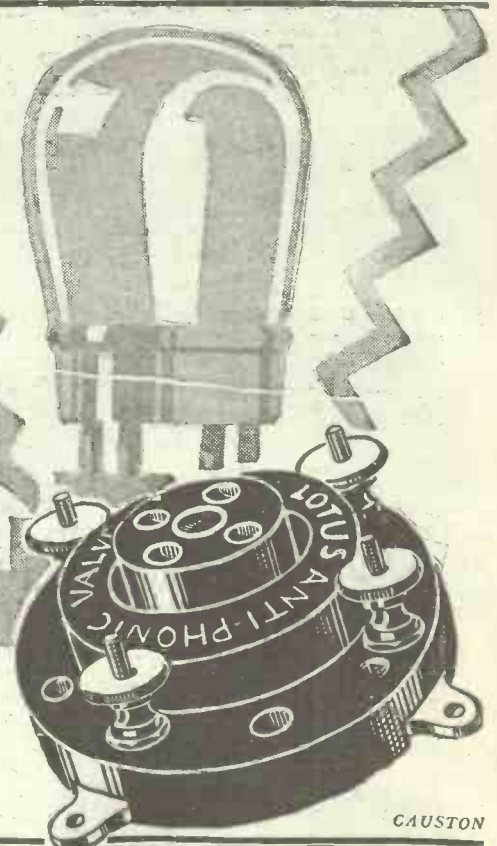
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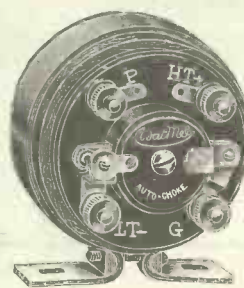


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Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

RADIO TENDENCIES.

WE have behind us a year full of progress from a radio point of view. The highlights of this have been dealt with in a general manner in other articles, but it still remains to gather them together in order that we can summarise their accumulated importance. First of all we must reiterate that there have been no revolutionary inventions or discoveries. The screened-grid valve is a very notable development and so is the A.C. valve; both may be new to commercial radio but neither is to radio science.

Expensive Items.

Nevertheless, they are important steps in the march of radio progress and not technical "nine days wonders." When the work of the Electrical Commission bears full fruit and the electrical supplies of the country are standardised "All from the

A.C. mains receivers" are going to be very popular indeed, and traders would be well advised to keep this fact in mind for we are not, we believe, referring to a very distant future.

There appears to be nothing against the use of these indirectly-heated cathode valves whatever. They are highly efficient and have long working lives. But both the screened-grid valve and the A.C. valve are, as yet, expensive items. However, the listener can take comfort in the thought that the now obsolete bright-emitter valve which these days hardly sells at a matter of five or so shillings readily retailed at over a pound a mere three or four years ago.

And so with ganged variable condensers, those necessary adjuncts to that desirable "one-knob" tuning. As their popularity increases and manufacturers have to meet greater demands, so will their prices fall as a natural consequence. Reputable radio

manufacturers are not so shortsighted as not to pass on the benefits derived from mass production to "consumers."

Regarding components in general, we see a commendable tendency towards scientific production and an almost complete weaning away from the haphazard design which marred the first few years of broadcasting. There was once a fable circulated that British-made components were superior to those emanating from the U.S. It is no longer a fable. But it is only the ultra-patriot who deludes himself into the belief that we are now comfortably leading the way. We were ahead with a commercially sound screened-grid valve, we crept ahead in the matter of quality L.F., but the Yanks have still "much on us." There is a reason for this, and it is to be found in the large number of radio laboratories staffed by energetic scientists they are able to maintain.

Live American Institution.

There is, first of all, the radio department of the National Bureau of Standards. We have nothing like it in this country. Our own Radio Research Board does magnificent work in regard to the greater issues, and neglects the practical applications so near the domain as broadcasting and reception of broadcasting in the home. If you want to know the effect of a total eclipse of the sun on Radio Direction Finders ask our Radio Research Board, but if you crave information regarding the standardisation of radio-receiver set component characteristics write to the U.S. But as a panacea to the patriot, let it be

(Continued on page 1018.)



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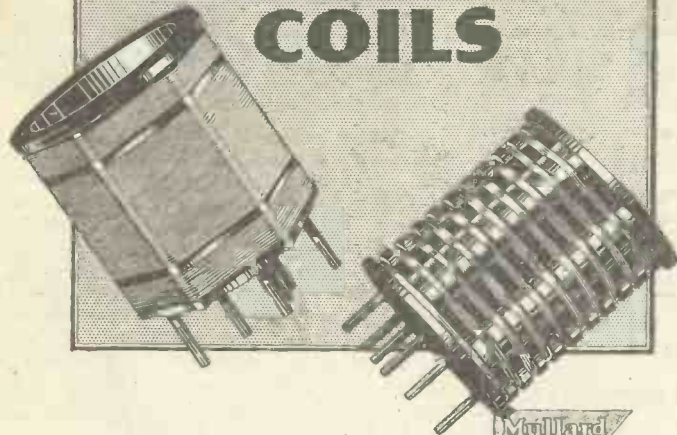
Polished Black		Mahogany		Walnut		Wavy		Cube	
3/16 in.	..	3/16 in.	..	3/16 in.	..	3/16 in.	..	3/16 in.	..
1/4 in.	..	1/4 in.	..	1/4 in.	..	1/4 in.	..	1/4 in.	..

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If you intend to build one of these receivers you should be very insistent with your dealer that it is your wish to adhere strictly to the published specifications.

Apart from the fact that by so doing you will be able to duplicate the published results, within a degree or two either way you will be able to locate stations with the assistance of the published dial readings.

Remember to use Colvern Accurate Space-wound Coils—these give the best results on both wave bands.

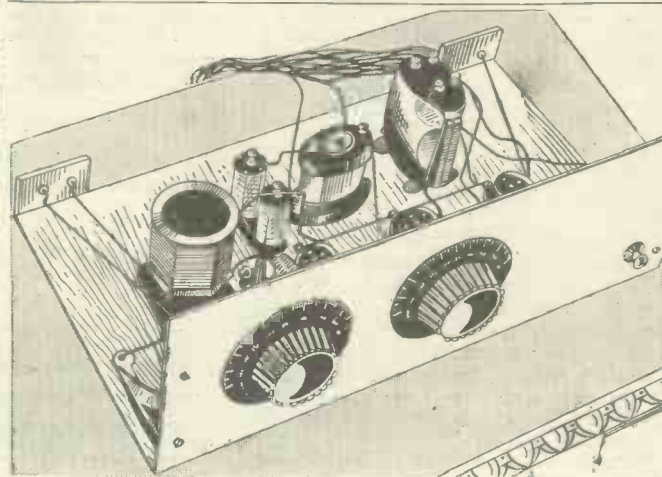
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APPARATUS TESTED.

(Continued from page 1016.)

whispered that at least one leading American radio paper has decided that "vacuum tube" is a misleading term and is now using the British misdescription "valve"!

But to return to the subject under discussion, how much will the events of the past year affect the average home constructor and the average trader? Our answer is "not greatly." The most popular type of valve set is either a straightforward detector and L.F. (transformer-coupled) two-valver or a three-valver employing two stages of L.F. amplification. Nothing of moment has happened for some time in the crystal world, so that a crystal set made two or three years ago need not be considered obsolete or even obsolescent.

The Stability of Radio.

Cheaper and better valves and cheaper and much better loud speakers are the really Big News in radio. If you are still using valves or a loud speaker purchased twelve months ago, it will be worth your while to go into purchasing session with your local trader. And don't forget that L.F. transformers have been considerably improved and that changes in this direction may be worth while.

In conclusion, we hope that we have made the point that the radio industry is just as stable as any other. Constructors should not be led to hold their purchasing hands for fear that the whole of radio is apt to be entirely revolutionised at any moment. There have been many reports in the daily

Press concerning "revolutionary" radio inventions and developments, but it is significant that a Det. L.F. of 1925, or even 1920 for that matter, is essentially the same as a 1927 Det. L.F.! As in everything else, there is a continual and steady march forward in radio, but is it now any more rapid than that evinced in the motor-car industry? We venture the opinion that it is not, and that the constructor can build any of the current "P. W." sets with the confident assurance that it will not be hopelessly out of date for many years.

THIS YEAR'S SOLODYNE

is fully described in the January issue of MODERN WIRELESS, which is now on sale, price 1/-. With every copy is given

A FREE BLUEPRINT

of this magnificent receiver. With one-dial tuning dozens of stations come in on the loud speaker—it is in every sense of the term an easy-to-build and easy-to-handle last-word set. You MUST read about

THIS YEAR'S SOLODYNE

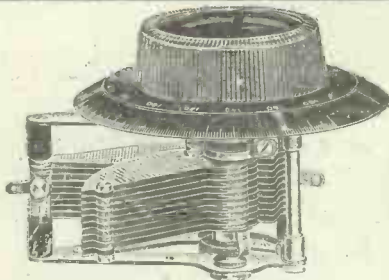
EDISWAN "ONE-DER" LOUD SPEAKER

The Ediswan people recently sent us one of their "One-Der" loud speakers for test. This is a large horn-type model, having a height of 22 in. It has a deep brown matt finish, and a special feature is the large flare, this having a diameter of 16 in. The price is £2 10s. In an accompanying letter, Messrs Ediswan state "many people consider that the day of the horn type loud speaker has passed. Let them hear the Ediswan 'One-Der.' At 50s. this is the best loud speaker available to the public."

A rather sweeping statement, and one which at first sight one would be liable to pass over quickly as a piece of more or less justifiable optimism on the part of the makers, but actually this new Ediswan product is one of the best horn-type loud speakers we have heard. It is a habit of many amateurs to speak disparagingly of the horn-type loud speaker as an obsolescent article. But there are many cones on the market which are by no means up to even the medium-quality horn models, and, in any case, it is an indisputed fact, that these latter sometimes give better results with many of the simpler types of receivers.

The new Ediswan "One-Der" will handle as much bass as the average small set will supply, while on the higher register it has a definite advantage over many cones. It is sensitive, has a good projection, and is notably free from resonance. Those about to embark on loud-speaker reception should make a point of hearing this new Ediswan instrument, for it is quite possible that they will find it just the article which does the most justice to the output of their particular sets.

WHY?



J.B., S.L.F.

- WHY** when you open any Wireless journal to-day do you always find J.B. condensers used by the designers of the premier Receivers?
- WHY** is the 1928 Solodyne Receiver equipped with a specially-designed J.B. condenser?
- WHY** is "The Master Three" the simplest and most wonderful Receiver ever known to Radio, fitted with two J.B., S.L.F. Condensers?
- BECAUSE** the designers of these well-known Receivers know that when they specify J.B. they are specifying condensers which are unsurpassed in Efficiency, Workmanship and Finish. They know they are safe in using J.B.—that any Receiver equipped with J.B. Condensers will yield only first-class results.

Prices, J.B., S.L.F. complete with 4" Bakelite Dial. 0005 mfd. 11/6; 00035 mfd. 10/6; 00025 mfd. 10/-.
 For Short Wave Receivers 00015 mfd. 10/-.
 J.B., S.L.F. Slow Motion (J.B. True Tuning S.L.F.). Complete with 2" Bakelite knob for Slow Motion Device and 4" Bakelite Dial for coarse tuning. Double Reduction Friction Drive Ratio 60-1. 0005 mfd. 16/6; 00035 mfd. 15/6; 00025 mfd. 15/-.
 For Short Wave Receivers 00015 mfd. 15/-.
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A Perfect Combination!

—the Ericsson Family Two Loud Speaker Set and the Ericsson Super Tone. They combine to give the finest possible rendering of the "local" and 5 X X or 5 G B.

The set is beautifully made in a sturdy Oak cabinet. All parts enclosed. Price £6 - 15 - 0. Royalties 25/-. The Ericsson Super Tone costs 45/-.

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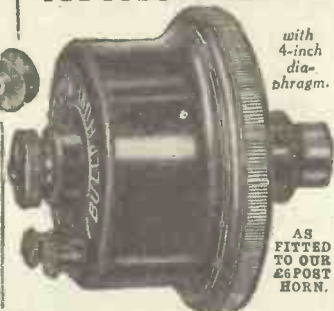
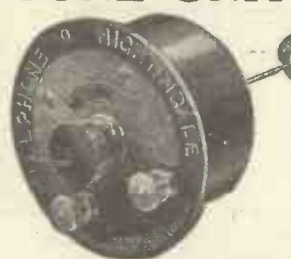
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GRAMOPHONE ATTACHMENT



with 4-inch diaphragm.

AS FITTED TO OUR 26 POST HORN.

AS FITTED TO OUR CABINET CONE

From a 3-ply board, 5 ft. square, cut out a 12 $\frac{1}{2}$ " circle, then cut a strip of wood 16" x 3 $\frac{1}{2}$ " and make a hole



2 $\frac{1}{2}$ " dia. in centre. This will carry the unit. Fix strip to board as shown.

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10/- SECURES THIS SPEAKER. 5/- SECURES THIS SPEAKER. SEND DEPOSIT NOW.



CABINET CONE

Size 17 ins. high by 15 ins., in Mahogany, Walnut or Rosewood finish.

77/6 cash, or **EASY TERMS** 10/- deposit and 12 monthly payments of 6/-



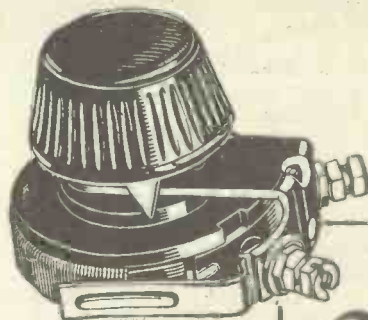
21 ins. high, with 14-inch Bell, Mahogany finished, with plated arm and stand.

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A really high-grade rheostat possessing every known refinement necessary for perfect filament control at the exceptionally low price of two shillings.

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embodies every feature which experience has shown desirable for perfect filament control. The body is of Bakelite, providing perfect insulation. The contact finger is of a well-tried type which provides a smooth running contact free from chattering and noises. Terminals are conveniently placed and easily accessible from the top of the set.

A particularly attractive feature is its compactness. It is only 1 $\frac{1}{2}$ " in diameter and projects only $\frac{1}{8}$ " behind the panel. One-hole fixing, for panels $\frac{1}{8}$ " to $\frac{1}{4}$ " thick, makes it easy to mount. Supplied in three resistance values, viz., 6, 15 and 30 ohms. Price 2/-.

Your dealer has them or can get them for you immediately.

Write to Dept. R.73.

Igranic components are always stocked by reputable dealers. All reports received by us of difficulty in obtaining them receive immediate attention.

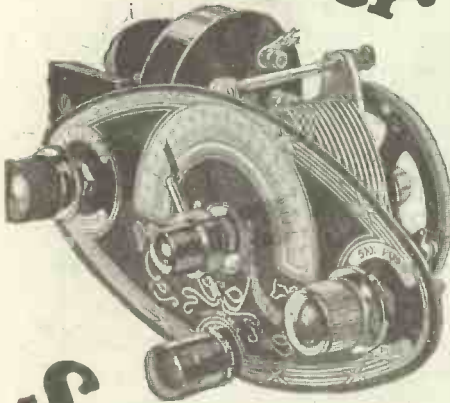


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Solves your difficulties

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Regd. Design.

The introduction of this Unit has rendered the home construction of a powerful and efficient set a matter of the greatest simplicity and certainty. No longer need the amateur be troubled as regards panel layout and the cutting and drilling of ebonite. This Unit is half a set in itself and requires no ebonite panel, it can be fitted to any form of cabinet and a 2 or 3-valve receiver can be constructed with the final appearance of the highest-grade factory production.

Unit includes S.L.T. Condenser, Slow Motion control, specially calibrated inductance covering B.B.C. wavelengths, push-pull switch for local, 5 GB or 5 X X, the whole mounted on a richly-engraved metal panel in black and gold or silver finish. No loose coils. Diagrams supplied for wiring 2 or 3-valvers.

35/-

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LAMPLUGH BRITAIN'S BEST RADIO

"LAMP-LOO"

S. A. LAMPLUGH LTD.
King's Road, Tyseley, Birmingham.

Representative for London and Southern Counties:
G. C. Shore & Co., 28, Newman St., Oxford St., W.1.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1014.)

grid bias as the makers say it should. Unless I use a lot I find a peculiar form of distortion, and the whole set seems to work badly. What is the cause of this?"

Probably the coupling condenser which is in circuit between the grid of the last valve and the preceding valve is faulty. In such a case a certain amount of high-tension positive would creep across the condenser and find its way to the grid of the last valve, thus necessitating a great deal of negative grid bias to compensate. Try the effect of removing the coupling condenser and replacing it with a good one, preferably of mica, and you will probably find that the trouble will disappear.

AN INAUDIBLE "HOWL."

E. B. (Newbury, Berks).—"Just to use up the components I had on hand I tried the effect of a detector and two (high-ratio) transformer-coupled L.F. stages. As the leads were long and rather paralleled, I expected it to howl, but this did not happen. What did happen was a most curious and phenomenal sort of distortion that absolutely choked up and spoilt the broadcasting. Speech was almost unrecognisable as such! For curiosity I should like to know how this distortion came about, considering that the set was not howling?"

As a matter of fact, the set probably was "howling," although it was doing so at a frequency beyond the limits of audibility. That is to say that the "howl" was there, but the human ear could not pick it up because its "note" was at a frequency outside the range of audibility.

RADIO ABROAD.

F. L. (Wymondham, Norfolk).—"I wish to take a small portable wireless set abroad with me. What duty is chargeable?"

The duty chargeable varies with different countries and with different types of sets, number of valves, transformers, etc. Some countries charge according to components and accessories, and as the laws are continually being modified, you should address your inquiry to the Secretary, Custom House, London, E.C.1., from whom full particulars can be obtained.

THE "PROGRESSIVE" ON LONG WAVES.

W. M. F. (Hastings), E. G. (Gt. Yarmouth), etc.—"Is the 'Progressive' Set as satisfactory on long waves, Daventry '5 X X', as on the ordinary broadcasting wave-lengths?"

The "Progressive" Set is just as efficient upon the long waves, and the change-over of coils can be made in a moment.

A SUDDEN FALLING OFF.

S. M. A. (Dorchester, Dorset).—"My set is a two-valve, and up to last week it was perfect, but when I brought the newly-charged accumulator home on Wednesday and connected it up I could hardly hear the local station. No matter how I turn the dials it makes no difference, and now I want to know what I can do, and what is the cause of the trouble?"

There are numbers of minor faults which will cause a sudden weakness of signals, so that we advise you to look to the following:

Is the accumulator connected properly to the set?
Is the aerial or the lead-in touching a gutter-pipe or other obstruction?

Is there a break in the earth lead, either above or below the ground?

Have the phones or loud speaker become demagnetised through being connected the wrong way round?

Are all your battery connections in good order?
Are the leads to the plugs all sound with no breaks internally?

If the set has not been tampered with, and all the above points appear to be in order, the probability is that the accumulator has not been charged properly, and you should try the voltage with a voltmeter, or return the battery to the charging station for examination.

(Continued on page 1022.)

A NEW VALVE for the NEW YEAR

In addition to the renowned K Type Valve we have pleasure in announcing the introduction of the new

FRELAT

Dark Emitter POWER VALVES

which are destined to be the New Valves for the New Year. It is the Valve you've long been waiting for. It is the really long life Valve. It guarantees perfect reception at minimum cost and consumption. Filament Volts 1'6-1'7 Filament Amps '1 Price 6/6. Also made to take 4 volts at same price.

Other types available:
New K. Type made with ebonite sockets 2 volts. Now use only '2 instead of '3. Price reduced from 4/11-4/6. All valves sent Post Free or C.O.D. Plus 6d.
Full particulars on request.

PRICE OF POWER VALVE
6/6



Sole Agents:
Continental Radio Import Co. Ltd.
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Phone: London W'all 6318.
Grams: Radimenta, Ald. London.


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THE LITTLE CELLS THAT SATISFY.
Eton Primary H.T. Battery. P.I. Porous Pot Cells, S1 and S2 Sac Cells. All complete

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P1	6d .. 3/3	.. 5/9	.. 14/-	
S1	6d .. 3/-	.. 5/3	.. 12/-	
S2	4d .. 2/6	.. 3/10	.. 9/6	

Send 1d. stamp for booklet giving full particulars to—
THE ETON GLASS BATTERY CO.,
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RADIO REGISTERED PANELS



TRADE MARK

7x 6, 1/3	9x 6, 1/7
8x 6, 1/4	11x 8, 2/3
10x 8, 2/1	12x 8, 2/6
10x 9, 2/4	12x 9, 2/10
12x 10, 3/-	14x 10, 3/5
14x 12, 4/-	16x 9, 3/6
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16x 8, 3/2	24x 7, 4/-
8x 5, 1/2	min. thick. Post Free.

Money back guarantee that each and all Panels are free from surface leakage. Megger test Infinity.
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Phone: Clerkenwell 7853

Agents: John Henry Smith, 139, Anlaby Rd., Hull.
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HE'S BUILDING HIS OWN ELIMINATOR



THE LITTLE T.C.C. BOOK IS SHOWING HIM HOW TO DO IT

DON'T waste money. Build your own H.T. Eliminator and get current from your electric light mains. Here's a book that shows you how to do it. Its concise instructions and clear diagrams can easily be followed by anyone. It is written by Mr. W. James for, appropriately enough, the makers of T.C.C. Condensers. Send the coupon and stamped addressed envelope for it to-day, and build an eliminator which, because it uses T.C.C. 600 volt Condensers is utterly safe and reliable.

BE SURE TO USE

T.C.C. CONDENSERS

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I enclose 1d. stamp to cover postage of your book "How to build your own H.T. Eliminator for A.C. or D.C."

Name
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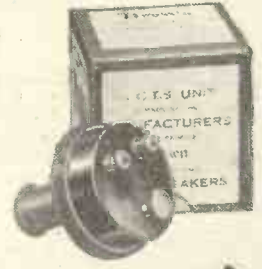
A Loud Speaker for 16/-

-built by yourself



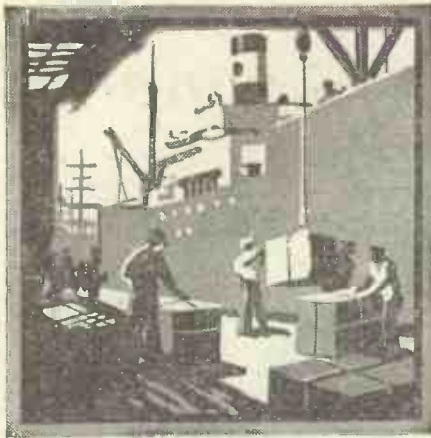
WHEN we were very young didn't we just love 'making things'? And who is to say that, now we are older, we are not still proud to say "I made it myself"? At least, we are sure *you* would be of the loud speaker you can make with the **BROWN Constructor's Unit**. Can't you imagine the joy of building a real horn loud speaker? Or, if you would rather, with the addition of the **BROWN C.T.S. Accessory Set**, a handsome hornless type? The joy of making it would only be surpassed by the joy of hearing it when you had finished. You would agree that its tone was quite as pure and its volume quite as loud as many factory-made loud speakers. And yet it would only cost you 16/-. You would expect to pay far more for such a good loud speaker, wouldn't you?

With the **BROWN C.T.S. Constructor's Unit**, price 13/6, anyone can build a horn type loud speaker. By adding the **BROWN C.T.S. Accessory Set**, price 2/6, a hornless loud speaker can be made. At all Wireless Dealers.



S. G. BROWN, LTD.,
North Acton, London, W.3.

BROWN CONSTRUCTOR'S UNIT



Plantations and Panels.

5. The last lap in the long journey.

NOW comes the last lap in the journey of the rubber which is to become a Resiston Panel. The long, thin sheets of pure rubber are now ready for ever to leave the land of their birth. The native tree tapper would see little resemblance in one of these sheets to the milky fluid he knew, but he would be more amazed to see what strength and what beauty is given to this self-same latex when, finally, it becomes a Resiston Panel.

Only the pick of the rubber ever finds its way to the Resiston factory. That is why Resiston has such sheer strength. Such lustrous beauty. Such perfect insulation. Why its colour is permanent. Why its dielectric constant is so low. If you want your Set to have the finest panel that ever was made, you will fit a Resiston Panel.

Resiston Panels come in 13 stock sizes in black and Mahogany-grained. From 6 in. x 9 in. in black. 3/5, to 8 in. x 30 in. Mahogany-grained 19/-.



"24 hours Cut Panel Service"

Advt. American Hard Rubber Co., Ltd., 13a, Fore St., E.C.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1020.)

TERMINALS LOOSE AFTER SOLDERING.

"DIFFICULTY" (Bournemouth).—"Although I screwed them up with all my might, after I had finished soldering I found that all the terminals on the panel were loose. How can this be prevented?"

However tightly you screw the terminals into the ebonite they will tend to loosen when being soldered, because the heat of the soldering iron softens the ebonite in which they are embedded. To reduce the trouble to a minimum the terminals should be tightened up after they have been well tinned. Then if the actual soldering is done expeditiously there is no need for the terminal to remain heated for long, and there will be less tendency for the ebonite to melt owing to heat.

But even if you are able to solder really well you may find it necessary to tighten up the terminals after each connection.

CONDENSERS IN SERIES.

R. S. E. (Dundee).—"Out of an ex-Army set I picked up cheap I got a .001 variable condenser, which is in first-class going order. The only trouble is that the capacity is too big for ordinary tuning purposes, but I understand I can 'bring it down' by connecting another fixed condenser to it. Is that so?"

"It would be a great convenience if I could make it into a .0005, because I have several fixed condensers on hand, and should not have to buy a variable .0005 for the new Reinartz set I am making. What capacity fixed condenser would it need, how do I connect it, and will it give me 0 to .0005 just like a proper tuning condenser?"

You will need a .001 fixed condenser, connected in series with the .001 variable condenser. This will give you a maximum of .0005 mfd., and variation of the variable .001 will smoothly reduce the capacity from the maximum (.0005) to the minimum capacity of which the arrangement is capable. (This minimum will be very low, like that of the ordinary .0005 tuning condenser when "all out").

To connect up, you simply join one side of the fixed .001 condenser to the fixed vanes of the variable .001 condenser. This will leave you with two vacant terminals, one on the variable and one on the fixed condenser, and these two terminals should be treated exactly like the two terminals of an ordinary tuning condenser—i.e., connected across a coil or in any other position in which the condenser should be connected.

POWER VALVES IN PARALLEL.

S. E. (Chepstow, Mon.).—"When fitting two power-valves in parallel, grid-to-grid, and plate-to-plate, is it necessary to use separate filament resistances for each valve, or will one resistance do?"

As the valves should be of the same type, their filament requirements will be identical, so it is better to control them both from one rheostat.

FLAT TUNING.

J. S. (near Watford).—"Both 2 L O and 5 G B come in on the crystal set at good strength, but the trouble is that the programmes overlap. If London is talking and 5 G B is playing a musical item there is an irritating accompaniment all the time that makes one too much aware of what the other station is doing."

"A neighbour of mine tells me he knew of a similar case near here, which was cured by plugging-in a centre-tapped coil, instead of using an ordinary one like mine. Do you think it would help in my case, and if so, how is the set altered for it?"

Probably the use of a centre-tapped coil is all that is necessary to give you the extra selectivity required. Use a coil of the same number of turns (or a few more) as your present aerial coil, plugging it in just as at present. Then disconnect the aerial lead from the set's aerial terminal, and join it instead to the centre-tapping on the coil itself. Upon returning you should find that the programmes are now quite clear of one another.

Mullard
The Master Three

Patent.

The designers of the famous Mullard Receiver, The "Master Three," in their choice of the best possible components, specified Belling-Lee terminals. Your own choice must be Belling-Lee.

Prices:

Type "B." Standard large insulated model. Polished black bakelite - 9d. each

Type "M." As type "B" but smaller, and with only the engraved top insulated. Rest nickel-plated brass - 6d. each

BOTH TYPES GUARANTEED.
Made with 30 different engravings.

BELLING-LEE TERMINALS

Belling & Lee, Ltd., Queensway Works, Ponders End, Middlesex.

A VACANCY OCCURS in an up-to-date wireless circuit for several first-class condensers of proved ability, reliability, and trustworthiness. Applicants must have many years experience behind them, the highest references and not be afraid of hard work. Permanent posts offered to right condensers.

HYDRA CONDENSERS

(if you go by qualification you'll choose)

When you've got a condenser job in your set—give it Hydra. Hydra will never let you down. Their technical qualifications are not excelled by any other condenser. And they have given faithful service to many of the most important electrical concerns for 28 years.

HYDRA

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Telephone: Holborn 6209.

RETAIL PRICES—TESTED ON 500 VOLTS D.C. 1 MFD., 2/6; 2 MFD., 3/6; 4 MFD., 5/3. (TESTED ON 750 VOLTS D.C. EQUAL TO 500 VOLTS A.C.) 1 MFD., 3/-; 2 MFD., 4/-; 4 MFD., 6/9.

Transformer troubles banished by **BROWNIE** WIRELESS

Brownie Transformers are guaranteed 100% British. Made from the very finest materials, the characteristics and performance are equal to those of transformers costing twice the price. Ensure perfect tone and quality by building a Brownie Popular Transformer into your set. Write to Department 26 for our new free booklet "Wireless without Worry."



THE BROWNIE POPULAR TRANSFORMER.—The magnetic field is composed of special laminations of the softest iron procurable, and the accuracy of the windings on their moulded bobbin guarantee distortionless reproduction, free from resonance. Totally enclosed in a moulded case

9/6

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The famous

LOEWE High Vacuum Resistances and LOEWE High Vacuum Block Condensers



are now available in Great Britain. They have been a full success on the Continent, and will, no doubt, be equally favoured by the British public.

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Telephone:—Tottenham 2076

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Please send me your literature concerning LOEWE High Vacuum Resistances and LOEWE High Vacuum Block Condensers.

Name

Address

TWO WONDERFUL LOUD SPEAKER SETS

These wonderful instruments incorporate all 1928 improvements, and are the finest sets money can buy.

22 STATIONS on the two-valve and 48 STATIONS on the three-valve have actually been received, and most of these at good volume on the loud speaker.


The latest all-wave tuner is used, thus eliminating coils entirely, and any amateur can build these sets in two hours.


NO SOLDERING—NO DRILLING—NO COILS TO CHANGE.

Booklet describing the "Saxon" Two-Valve Loud Speaker Set, with diagram and full instructions. 3d. post free.

Booklet describing the "Saxon" Three-Valve Loud Speaker Set with diagram and full instructions. 3d. post free.

SAXON RADIO CO. (Dept. P.W.) HENRY ST. WORKS, BLACKPOOL.





A MONUMENT IN THE MARCH OF PROGRESS.
The Formo Shrouded Transformer is the universal favourite.

10/6 Made in Ratios 1-1, 1-2, 1-3, 1-4 and 1-5. 1-3 and 1-5 for First and Second Stages.

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MAKE your radio set as attractive as any sold in the shops by installing it in a Camco cabinet. Illustrated list of complete range sent FREE. Fill up and post coupon below.

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Name

Address





**"Utility"
MICRO-DIAL**

This New Micro-Dial incorporates the same excellent mechanism as our previous model, but is improved by an aluminium dial surveyed by a hair-line and cursor which obviously make readings of the adjustments much easier. Clock-wise or anti-clockwise readings can be made. Price **7/6**

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EXPERIMENT
WHEN YOU BUY**

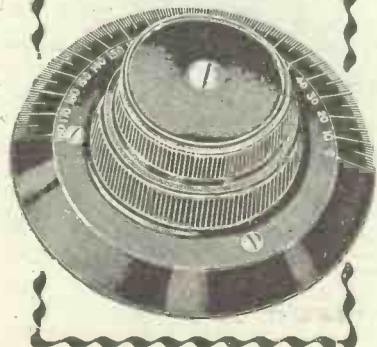
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GUARANTEED
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They have been satisfying Wireless enthusiasts for years and are the best you can buy irrespective of price. Write us for Free Lists to-day of these and other Components including Variable Condensers, Neutrodyne Condensers and Anti-Capacity Switches, etc.

WILKINS & WRIGHT, Ltd.
Kenyon St., Birmingham.

**"Utility"
MICRO-DIAL**

This is the original famous "Utility" Micro-Dial which facilitates accurate adjustment of the condenser and permits the finest possible tuning. The centre knob controls Vernier adjustment, and backlash is impossible. For use with all makes of Condensers. Price **7/6**



**SHORT-WAVE
NOTES.**

By W. L. S.

THE commencement of a new radio year has, appropriately enough, seen a sudden improvement in conditions. As a matter of fact, the snowy Christmas seemed to coincide with better short-wave conditions, and snow always seems to agree very well with short-wave signals. 5 S W seemed to be extremely strong on 24 metres during the four or five nights round about Christmas Day, and all other broadcast stations that were heard on the lower bands were rather stronger than usual. Any theories as to why snowy conditions should improve short-wave working, while apparently having no effect upon the longer wave-lengths, will be gratefully accepted.

Reception Experiments.

New Year's Eve was also very good, and the following night was even better. At the time of writing conditions are still good.

Those who are not interested in transmission, or cannot obtain a permit, might very well spend a little time in experimenting on high-frequency amplification on the short-wave bands (meaning anywhere below about 100 metres). There is at least one commercial receiver incorporating one H.F. stage on the market at the present time, but there is still much work to be done in this direction. Super-hets. have decided advantages on short waves, and the writer is wondering whether a set could not be constructed using H.F. amplification which would give the advantages of a super-het. without the disadvantage of receiving every station at two different readings on the dial!

How many short-wave enthusiasts possess a respectable wave-meter? It is astonishing, in view of the extreme ease of making and calibrating an absorption wave-meter, to find numbers of amateurs absolutely fogged as to "where they are" in the spectrum! The writer has calibrated an absorption wave-meter quite accurately from the harmonics of 2 L.O. His wave-length being 361.5 metres, there are fairly strong harmonics audible at six miles or so at 91.4 metres, 60.25 metres, and 45.2 metres, and a reasonably good condenser should give quite a respectable curve when calibrated from three or more harmonics such as these. On short waves it is easy, however, for there are such "landmarks" as SUC (Cairo) on 47.25 metres, WIZ (New Brunswick) on 43.15 metres, and many others.

A Common Fault.

Heterodyne wave-meters are, of course, more accurate instruments in use, but rather greater care is required in their construction and calibration. There are several circuits, however (mostly of American origin), which have characteristics such that the wave-length remains quite constant in spite of changes in H.T. or L.T. supply.

The most common fault found in short-wave receivers inspected by the writer for faults is that far too large a tuning condenser is used. Anything larger than .00025 is practically useless on wave-lengths below 50 metres or so, if careful searching is desired.



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EXPERIMENTS AT 5 G B.

(Continued from page 1003.)

provision of data in connection with the scheme of Regional stations—the B.B.C. proceeded to erect masts, 300 ft. high, which it was thought might ultimately replace the low double masts.

Experiments to Continue.

Experiments have recently been carried out with the new masts; but it appears that the shielding effect in the Birmingham direction is likely to be accentuated by their use. The next step, therefore, will be to rearrange these 300-ft. masts in such a way as to maintain the present signal strength in Birmingham while giving a greater all-round strength to that portion of the rest of the country which is within range of 5 G B. Until it is possible to guarantee that the field strength in Birmingham from the higher aerial is, on its lowest terms, as great as it is to-day, the 300-ft. masts will not be brought into regular service.

The B.B.C. announce that it may be stated that the general efficiency of the new aerial has been definitely proved to be greater than that of the twin aerial at present functioning, and the experiments for which it is adapted will be of ultimate value in connection with the Regional Scheme. Experiments may necessarily be protracted, but the time so spent will not be wasted if the engineering investigations help to solve the many problems which surround the erection of regional stations. The last paragraph will be heartily agreed with; the problems of the Regional Scheme, although numerous and difficult, will have to be solved before practical steps can be taken to put into effect the B.B.C.'s new plan for a re-organised transmitting system—and the experiments at 5 G B will have to be continued—perhaps for some time, and continued until successful and conclusive results have been obtained—before the Regional Scheme can be said to have come into the sphere of practical broadcasting politics.

British Sets Banned.

The following quotation, from the "Otago Daily Times," New Zealand, is worthy of the close attention of British Radio Manufacturers:

"Although inquiries were made throughout the Dominion it was quite impossible to get a British set that would give satisfaction and in the end we had to get an American one," said Mr. J. J. Dougall, at Thursday night's meeting of the Canterbury branch of the Navy League, in reporting on the purchase of a six-valve wireless receiving set for the league. He said that the sub-committee was anxious to get a British set, but there was not one to be obtained in New Zealand suitable for their purpose. They had obtained a number of opinions regarding British-made sets, and all were unanimous that for long-distance reception the British sets were not suitable. They were told that a British set might pick up Australia, but could not be depended on to do so. The American set which they had bought would pick up any station. If there were favourable conditions it would pick up England, and Australia and America could always be picked up."

(Continued on next page.)



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The Benjamin Standard is known throughout the Radio trade. It stands for a greater efficiency, a far higher degree of excellence and an unequalled value. Every component that is stamped with the name of "Benjamin" is the very best of its class.

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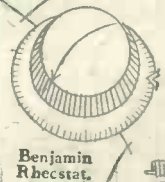
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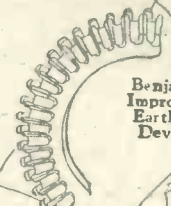
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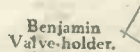
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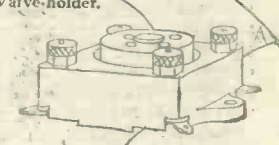
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EXPERIMENTS AT 5 G B.

(Continued from previous page.)

Our correspondent in New Zealand, who forwarded the newspaper cutting, adds that there is a definite campaign in New Zealand for running down British goods and boosting American radio products, and especially in connection with component parts for the construction of sets described in this journal and in "Modern Wireless" and "The Wireless Constructor."

A Serious Matter.

We regard this matter as extremely serious, and we are addressing a letter of enquiry to the High Commissioner for New Zealand, with a view to ascertaining the exact position of the British radio manufacturer in New Zealand.

We feel sure that amateurs in New Zealand would prefer to build British sets with British goods. As our New Zealand correspondent points out, something should be done to counter all the "Yankee radio dope" which is swamping the market and injuring British radio manufacturers in New Zealand.

We hope to publish further details in due course.

**AN IMPROVED
WIRELESS CABINET.**

AT some time or other every wireless enthusiast feels the need of something which will hold all the necessities of his wireless existence. The ideal cabinet, he decides, would be one which would keep all his "junk" ready to hand, but which, at the same time, would not look untidy in a room. To combine these two desirable qualities at a small outlay of money is generally difficult, but I solved the problem for three shillings!

I bought an ordinary orange-box from the greengrocers for a shilling, and the only "tools" which I used were some sand-paper and a paint-brush. First of all, I gave the box a thorough sanding, both inside and out, with a coarse sand-paper, and then, when all the rough edges were gone, finished off with a finer paper.

A Useful Article.

All that was left to do then was the staining. I stained mine dark oak and then gave it a coat of varnish. When dry, it was ready for use.

I found that it suited me far better than an adapted bureau. Standing on its end, it provided me with three roomy shelves besides the flat top on which to stand the set. I put the accumulator, high-tension batteries and 'phones on the top shelf. Coils, valves and condensers, things that I might want at any minute, I kept on the middle shelf; and on the bottom shelf I kept the "junk" such as every wireless man likes to keep handy.

A little screen, to put round it when not in use, quite completed my orange-box wireless cabinet, transforming it into a desirable article of furniture.

A. B. C.

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TECHNICAL NOTES.

(Continued from page 1000.)

the length depending upon the number of valves to be stored) into a simple "valve rack" by drilling a number of holes of such a size that the four valve pins just slide fairly tightly in, the valve thus resting upon its cap with the bulb upwards.

A Valve Rack.

This is quite a satisfactory method if there is no likelihood of serious vibration, or if the valve rack and its contents are not likely to be interfered with. It is somewhat safer to drill four small holes for each valve in the appropriate positions for the individual valve pins, instead of pushing the four valve pins into one large hole. The four holes for the pins may, of course, be readily marked out by means of an ordinary valve template, and when the valves are pushed into position they are held fairly securely.

This method, again, does not protect the valves from vibration. In the event of serious vibration being produced in the course of "experimental operations" at the work-table (of course, hammering

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is This Year's SOLODYNE Five Valve Receiver which is fully described in the January issue of MODERN WIRELESS

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and knocking should not be indulged in in the immediate vicinity of a set of valves, or even of a wireless receiver; but frequently it is, the valve filaments, especially if of the dull-emitter kind, are apt to suffer.

The really perfect way, from this point of view at any rate, is to install a set of anti-microphonic valve holders on the valve rack, and to insert the valves into these holders. They are then perfectly secure, and are also protected from quite large mechanical disturbances. It costs more, but the set of valve holders should last indefinitely, and the ratio of the cost of a valve holder to that of the valve of which it takes care is negligible.

Shunting Condensers.

We discussed in these Notes some little time ago the use of a shunting condenser across the loud-speaker terminals in order to improve the quality of reproduction, particularly to cut out certain high-pitched tones which produce what is sometimes called a "tinny" effect.

The necessity for a shunting condenser used in this way does not arise nearly so much with the present-day loud speakers as it did with those of, say, a couple of years back. In those days it was almost invariably an advantage to connect a

(Continued on next page.)



LOG-MID-LINE

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It is a Precision Instrument of universal use, with an ingenious system of multipliers which enable full-scale readings of any value to be made over a wide range. One millivolt to 2,000 v., or 50 ohms to 50 meg-ohms. Mirror scale, jewelled knife edge. A £10 de luxe model for 55/-.



THE VIOLINA LOUD SPEAKER is constructed on cabinet lines, and gives wonderful reproduction over the complete tonal range. This loud speaker de luxe is of beautifully polished mahogany. Price, complete with Reed producer and cord, 25/-.

DISTANT CONTROL SWITCH RELAY.—This is the most efficient method of distant control for all who use valve receivers. Simple to connect up and easy to operate, only two connections to L.T. battery and two to control circuit. Can be used in all L.T. circuits of 2 to 8 volts up to 5 amps. Indoor type, which is enclosed in a fine polished oak case, 15/-; Outdoor type, in watertight brass case, 17/6. Our new 72-PAGE CATALOGUE is now ready. Over a thousand bargains are listed and handsomely illustrated. Send 4d. in stamps to

ELECTRADIX RADIOS,
218 UPPER THAMES STREET, LONDON, E.C.4

"TROMBA" THE WET H.T.
90 v. for 2-valve sets, 18 4
108 v. for 4-valve sets, 34/-
NO EXTRAS. CARR. PAID.
No. 1 sacs 1/1, Zincs 7d. per doz.
No. 2 sacs 2/1, Zincs 10d. per doz.
JARS (for either size) 1/2 per doz.
11d. stamp brings booklet; 6d. a cell, or 1/- comp. range of samples.
TROMBA ELECTRICAL CO.,
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PLEASE MENTION "POPULAR WIRELESS" WHEN REPLYING TO ADVERTISEMENTS

TECHNICAL NOTES.

(Continued from previous page.)

condenser across the speaker terminals; in fact, you rather assumed that you could not expect the best performance from your loud speaker until you had set to work to make a series of tests with condensers of different values up to, perhaps, .01, finally employing the largest condenser you could without giving a "woolly" or muffled effect.

In the present-day loud speaker either a suitable condenser is embodied in the instrument by the manufacturers, or the design of the unit is such that a condenser is practically unnecessary.

Telephone Transformers

In discussing this matter previously I omitted to mention one point which will be of more interest to those of you who happen to be using loud speakers of a rather older type; I mean the low-resistance



TO all who love London—and who among those who have come under its spell does not?—there comes now the opportunity of seeing the life and sights of London's highways and by-ways through the eyes of gifted camera artists and brilliant descriptive writers. The three volumes of "Wonderful London," edited by St. John Adecock, have almost captured London itself within their covers. They contain more than twelve hundred illustrations, all in photogravure, and 114 chapters by widely-known writers. The publishers of this beautiful work offer to all readers of POPULAR WIRELESS, free of all cost, a delightful booklet that tells all about this fascinating three-volume picture gallery of London and its life. Just send a post-card asking for the "Wonderful London" booklet, to the Educational Book Co., Ltd., 17, New Bridge Street, London, E.C.4.

type with which a step-down transformer is used. I happen to have a loud speaker of this kind myself which was sent to me by the manufacturers quite a long time ago, and I find that whereas a very large condenser has to be used across the loud-speaker terminals to give a good quality of reproduction, quite a small capacity condenser is sufficient to achieve the same object if placed across the primary winding of the telephone transformer.

The condenser used in the former case was .2 microfarad, whereas if I used a condenser across the primary of the transformer instead, I found that this needed only about one-hundredth of that capacity; that is, .002. Of course, there is nothing very critical about this capacity, and an ordinary .005 will serve the purpose quite well in place of the .002, which was a special condenser taken from another piece of apparatus altogether.

"Experimenting."

It is surprising how much trouble some experimenters will take in fitting up new circuits and new lay-outs, and yet how impatient they seem to be with regard to little details, such as high-tension battery connections, which make a great difference

to results. I was watching an experimenter a few days ago who was so busy trying out a new hook-up that he scarcely had time to take his meals.

Although he was prepared to chase troubles "to the last ditch," he was so intent that he had practically no patience to make decent connections to his high-tension battery. It would only have required a very few minutes to fit a number of proper wander-plugs, but those few minutes apparently could not be spared.

Instead, he had a number of bared and twisted wires which he fumblingly inserted into the high-tension battery sockets, pushing them home with broken match-stalks, and showing considerable irritation when (as is their wont) they promptly came out again! I made a mental calculation of the ratio of the amount of time and trouble which were necessary for this "method" of H.T. connection and for the more conventional method of employing properly-fitted wander-plugs. I think it worked out at about ten to one, but it may have been more.

More Haste

The moral, of course, is "the more haste the less speed"; and whilst impatience born of enthusiasm is perhaps pardonable, it is always quicker—and infinitely more satisfactory in the long run—to restrain your ardour and do the job properly at every stage.

In a long experience of scientific investigation and investigations in various branches of science, I have always found that the men who accomplish most are the ones who, even though under considerable self-restraint, go carefully and methodically, step by step.

NEW SOLDERING CANDLE
This water-cooled, automatic feed, plated META pocket Burner No. 20 is ideal for soldering wireless parts. Gives a clear flame—no smoke. Complete as shown, 4/6. **FREE.**—If you cannot obtain META Products locally, send for generous trial of META Solid Fuel, and descriptive booklet, stating dealer's name.
ELMESAN (LONDON) LTD.,
(Dept. A), 66, Victoria Street, London, S.W.1

EASY PAYMENTS
LOUD-SPEAKERS, HEADPHONES, H.T. ACCUMULATORS. Anything Wireless
Send a list of the parts you are requiring, and we will send you a quotation on monthly payments.
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Phone: Museum 1414. Qt. Portland St., W.1.

REPAIRS—THREE MONTHS' GUARANTEE
accompanied all our repairs. Any make of L.F. Transformer, Headphone, or Loud-Speaker, repaired to maximum efficiency, 4/- Post Free. Terms to Trade.
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CABINETS OF QUALITY.
Have a Cabinet worthy of your set. Made from selected timber—Hand polished. We guarantee satisfaction.
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Any Cabinet supplied. Let us quote you for your own design.
A GOOD SET IS WORTHY OF A GOOD CABINET.
QUALITY CABINET COMPANY (P.W.),
46, Grove Green Ed., Leytonstone, E.11.

UNIDYNE 4-ELECTRODE VALVES
6/11
We are now the sole suppliers of the genuine U.G. and Thorpe valves, as specially tested and recommended by the "Unidyne" inventors and "Popular Wireless" U.G. and Thorpe K.4. (Both 4-electrode 5-pln valves). Post free. Only direct from—
UNIDYNE VALVE CO.,
1, CHARING CROSS, LONDON, S.W.1

Another Big Advantage!



Standard Model.
39/6

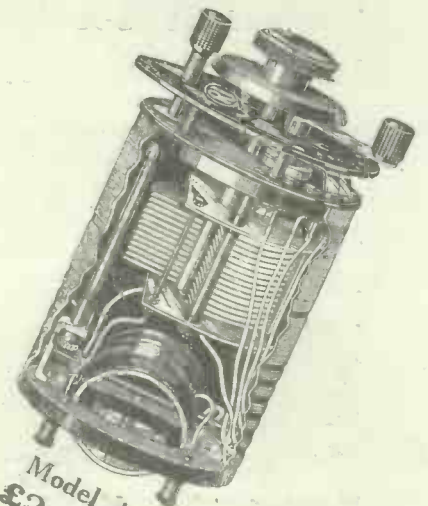
ALTHOUGH the famous Retroactive Tuner has been on the market for two years, its full possibilities are only now being realised. Not only are alternative programmes an absolute certainty in any district, but the same station can be tuned in on two, or in some cases three different tuning studs. This is one of the many advantages it has over plug-in coils, as with the latter, to obtain the same effect, it is necessary to change the coil.

Everyone has at some time or other wished to cut out that troublesome Morse, or another station near the same wave-length. These wonderful tuners enable this trouble to be entirely overcome, as one can change from stop "C" to "B" or "D," or from stop "F" to stop "G" or "H," thereby enabling the station one requires to be tuned in without interference by selecting the combination which gives the best results. These advantages will be found even more apparent when the new regional system of broadcasting comes into operation.

The R.I. and Varley Retroactive Tuners are wound on the single layer solenoidal system which ensures remarkably low self-capacity with internal losses reduced to an absolute minimum.

The three models now available give a choice of ANY circuit; being practically complete receiving sets in themselves they effect a great saving of space, and for simplicity of control and efficiency of tuning they have no equal.

Illustrated leaflet G13—free on application—gives full particulars and interesting circuits.



Model A.
£2-7-6



Model B.
37/6



THE MARK OF

Kingsway House, 103, Kingsway.

BETTER RADIO.

London W.C.2. Telephone: Holborn 5303

No need to wait for darkness

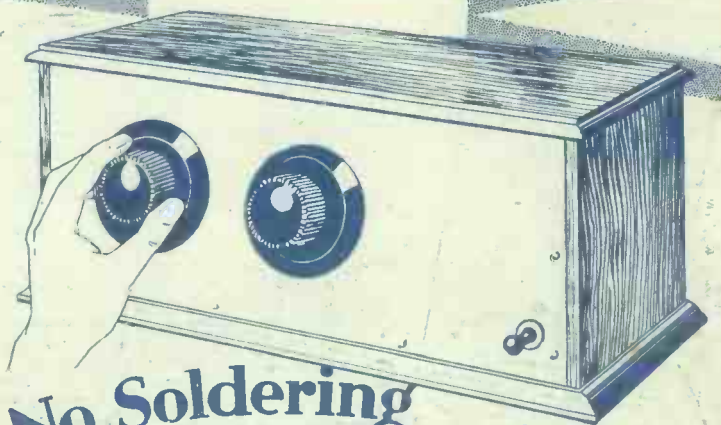
The master set that brings in station after station in daylight

In One Hour without soldering, you can build the Mullard Master Three—the receiver that makes the most efficient use of three valves.

Only 20 Wires to connect to terminals once you have mounted the few components by using the Simplified Plan of Assembly supplied FREE.

Easy to Handle. Only one dial for tuning, another for volume. As simple to operate as setting the hands of a clock.

Wonderful Results are certain. You have a choice of six or more programmes at loud speaker strength. Build the Mullard Master Three now! The cheapest and simplest 3-valve receiver ever designed.



**No Soldering
Only 20 Wires
Built in One Hour**

Mullard

The Master Three

The Editor; "Radio for the Million,"

63, Lincoln's Inn Fields, London, W.C.2

Please send me FREE complete instructions and Simplified Plan of Assembly for the MULLARD MASTER THREE & No. 5 "RADIO FOR THE MILLION"

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MASTER · RADIO

NAME (Block Letters)

Address

P.W.3

THE "LO-COST" CRYSTAL SET (See Page 1053.)

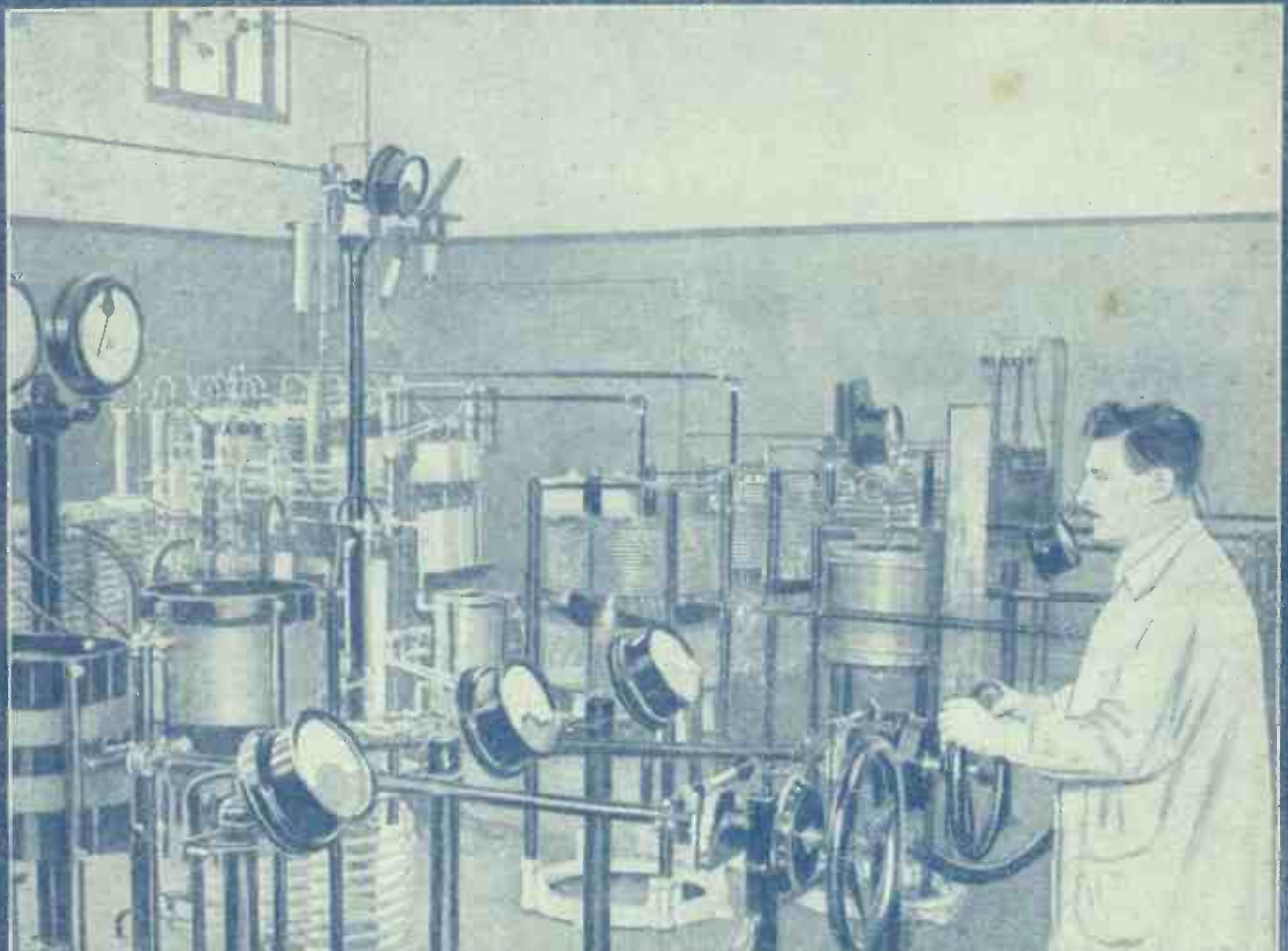
Popular Wireless

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PRICE
3d.

No. 294. Vol. XII.

INCORPORATING "WIRELESS"

January 21st, 1928.



Some Outstanding Features

- Australia's Star Station**
- The Future of the Four-Electrode Valve**
- Tell-Tale Noises**
- Nobody Loves The Amateur!**
- Increasing Accumulator Life**

Our cover photograph shows a section of the huge transmitting gear at the new German super-power broadcasting station, Zeesen.



2 Microfarad, Type B.B.
working voltage 150 v D.C.

Price 3/6

Sheer Superiority

has put and kept Dubilier Condensers at the top of the tree since radio sets were first constructed.

THE PROPER SELECTION OF VALVES

To discover for yourself, by trial, the most suitable valves for a receiver or amplifier of any type may be a costly business. On the other hand, just to guess at it is frequently to miss getting the efficient results the design of the instrument and its circuit would appear to warrant.

Of the numerous types of valve in use to-day it is difficult to say, without numerous laboratory tests and inside knowledge of the valve's design, what results ought to be expected. For the convenience of experimenters and listeners, the Marconiphone Company have tabulated the results of such tests and design factors in their book "500 Marconi Valve Combinations." It is possible, with this book, to ascertain the correct combination of valves for maximum results in any circuit.

For instance, a single glance shows you that the correct 2-volt valves to use in a 5-valve circuit hooked up as 2 H.F., Anode Bend Detector, 2 L.F. (one Resistance-Capacity, one Transformer) are—
First, Marconi D.E.L.210, Second, D.E.L.210, Third, D.E.H.210, Fourth, D.E.L.210, Fifth, D.E.P.240.



This book is FREE

If you will fill in the coupon below, we will send you, free and post free, a copy of "500 Marconi Valve Combinations." This shows you, at a glance, the correct valves for 1, 2, 3, 4, and 5 valve circuits using 2, 4 or 6 volts of L.T. supply. Additionally, it gives full details of impedance value, amplification factor and anode voltage of the valves themselves as well as their characteristic curves. The book is of the utmost value, both as a time and money saver, to the serious experimenter or to the beginner.

Send for your copy now.

We shall be pleased to send you, too, a copy of that amusing little book "Back Chat." It contains many interesting facts about Marconiphone Wireless. If you want a copy as well as the above book, just write B.C. on the coupon.

MARCONI VALVES

do everything that a valve should do

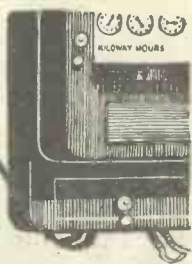
The Marconiphone Company, Ltd.,
210-212, Tottenham Court Rd.,
London, W.1.
Please send me a copy of
"500 Marconi Valve
Combinations."

Name.....

Address.....

P.W.12

H.T. FROM YOUR MAINS

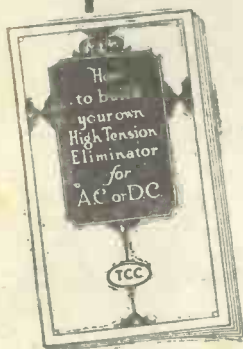


STOP wasting money on H.T. batteries. If you have electric light, every switch in your house is a power switch for your Set.

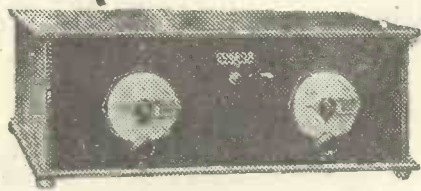
This free book "How to Build Your Own High Tension Eliminator" tells you in clear simple language, aided by diagrams and photographs, how to get current from your mains—how you can build your own H.T. Eliminator.

Send for the book to-day. You will see at a glance how simple it is, and, specially written by an authority for the makers of T.C.C. condensers, absolutely reliable.

With an H.T. Eliminator using T.C.C. 600 volt Condensers, you have a power source that is constant, economical and safe.



**FOR YOUR COSSOR
"MELODY MAKER"**



**POST THIS COUPON
TO-DAY**

Telegraph Condenser Co. Ltd. Wales Farm Rd., N. Acton, London, W.3
I enclose 1d. stamp. Please send me your book "How to build your H.T. Eliminator for A.C. or D.C."

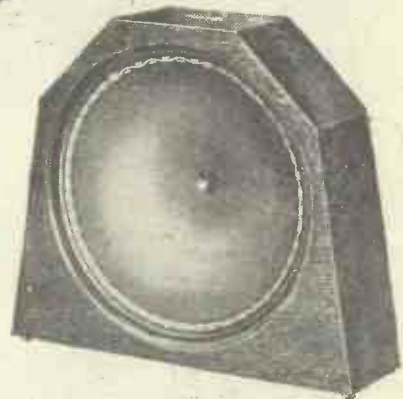
Name.....
Address.....

P.W. Jan 21

T.C.C. Condensers

1551

almost alive!



IF, to-night, at a friend's house, you were to hear the BROWN Mascot Loud Speaker without knowing you were listening to a loud speaker, you would be almost sure to ask who was his singing friend. Then when he replied that it was a loud speaker you heard, you would laugh and offer him the other leg. At that his eyes would sparkle, as he disillusioned you, and you would be quite astonished that a mere instrument could be so human. After that you would want a BROWN Mascot Loud Speaker for yourself, and when you had bought one you would say that in all the world there was no better place than your own fireside, in your old chair, with this almost-living loud speaker to thrill the evening hours.

The Wireless shop round the corner has the Brown Mascot Loud Speaker Only 90/- is its price.

BROWN LOUD SPEAKERS

S. G. BROWN, LTD.,
Western Avenue, North Acton,
London, W. 3.

1529

REACH THE ACME OF PERFORMANCE

with

EDISWAN wireless equipment



EDISWAN "LOTEN" 2-VOLT ACCUMULATORS.

Dry charged type.
 10 amps.— 6/- each.
 20 amps.— 8/6 each.
 30 amps.— 10/6 each.
 45 amps.— 13/6 each.
 Prices of 4 and 6 volt Accumulators pro rata.

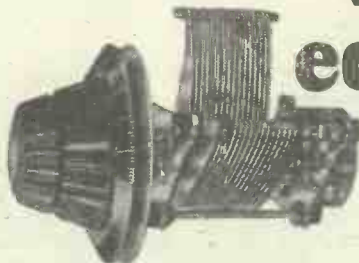


EDISWAN VACUUM GRID LEAK.
 (Glass enclosed.) (Patent applied for.)

Steady resistance under working conditions. Low Capacity—Noiseless—Accurate. In values of .5, 1, 2, 3, 4 and 5 megohms. Price 2/6 each.



EDISWAN VACUUM ANODE RESISTANCE.
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 Made in values of 40,000, 60,000, 80,000, 100,000, 150,000, 200,000 and 250,000 ohms, with safe current carrying capacity of 1 milliamp at a pressure not exceeding 180 volts. Constant resistance—no heating—noiseless.
 Price 2/6 each.



GEARED CONDENSER.

Machine-cut gears of special configuration ensure positive motion without backlash. Ratio of 100:1 permits of very critical tuning. Easy to fix—one hole only required in panel.

Prices: '0005 - 27/6. '0003 - 26/6.



Cartridge Condenser



Clip CONDENSER AND CLIP.

The Ediswan Cartridge Condenser, available in values of .0001/2/3/4/5 and .001, fits into the Standard Clip for grid leaks, offering a simple method of changing values.
 Condenser: Price 1/6 each. Clip: Price 1/- each.

EDISWAN NEW SHROUDED TYPE L.F. TRANSFORMER.

The inductance of the primary winding is 50 henries and the impedance 31,500 ohms at a frequency of 100 cycles per second.
 W.L. 600 3.5-1 Ratio Low Frequency Transformers 25/- each.

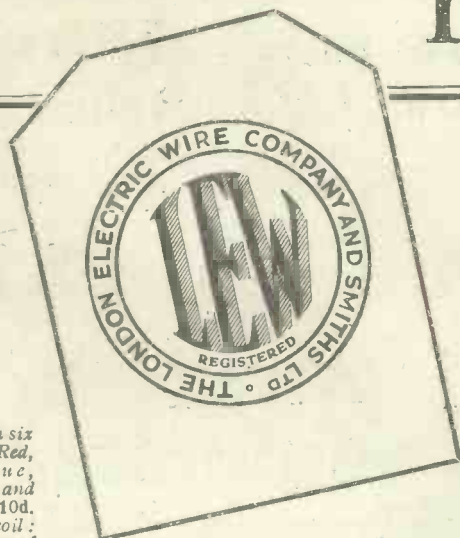


EDISWAN VALVES

CLEAREST · STRONGEST · LAST THE LONGEST

A type for every purpose

What *this* mark means



Obtainable in six colours: Red, Yellow, Blue, Green, Black and White. Price 10d. per 10 ft. coil; 9d. per packet of four 2 ft. lengths (assorted colours)

This LEW trade mark guarantees coloured connecting wire to be the original GLAZITE.

When you buy wire bearing this label you take no risks. Hundreds of thousands of constructors have proved GLAZITE the way to quicker, simpler, more efficient and cheaper wiring. Glazite is flameproof, damp-proof and does not deteriorate in use.

Always be sure to see the LEW mark on the label. From all radio dealers.

THE LONDON ELECTRIC WIRE CO. & SMITHS LTD.
Playhouse Yard, Golden Lane, London, E.C.1.

GLAZITE

BRITISH MADE REGD

THE ORIGINAL COLOURED CONNECTING WIRE

WIRELESS CONSTRUCTOR ENVELOPES

No. 1. "The Radiano Three" Now on Sale Price 1/6 net.

Here is the first of a new series of Constructor Envelopes which thousands of amateurs have been in need of for many a long day. No. 1. is now on Sale—an envelope containing full instructions for building the famous P. W. Harris receiver

"THE RADIANO THREE"

In this envelope you will find every detail of the set simply explained; photographic reproductions and diagrams are included, as well as a

FULL-SIZE BLUE PRINT

"The Radiano Three" is a set you can build in an hour or two—no soldering necessary, and a wide choice of components and valves open to you.

Stop at the bookstall or newsagents and buy the first of the Wireless Constructor Envelopes, and remember—it is a Percy W. Harris Set.

Details of future Envelopes will be announced later

A Home-made Met-Vick Four

For working off the Electric Light Mains

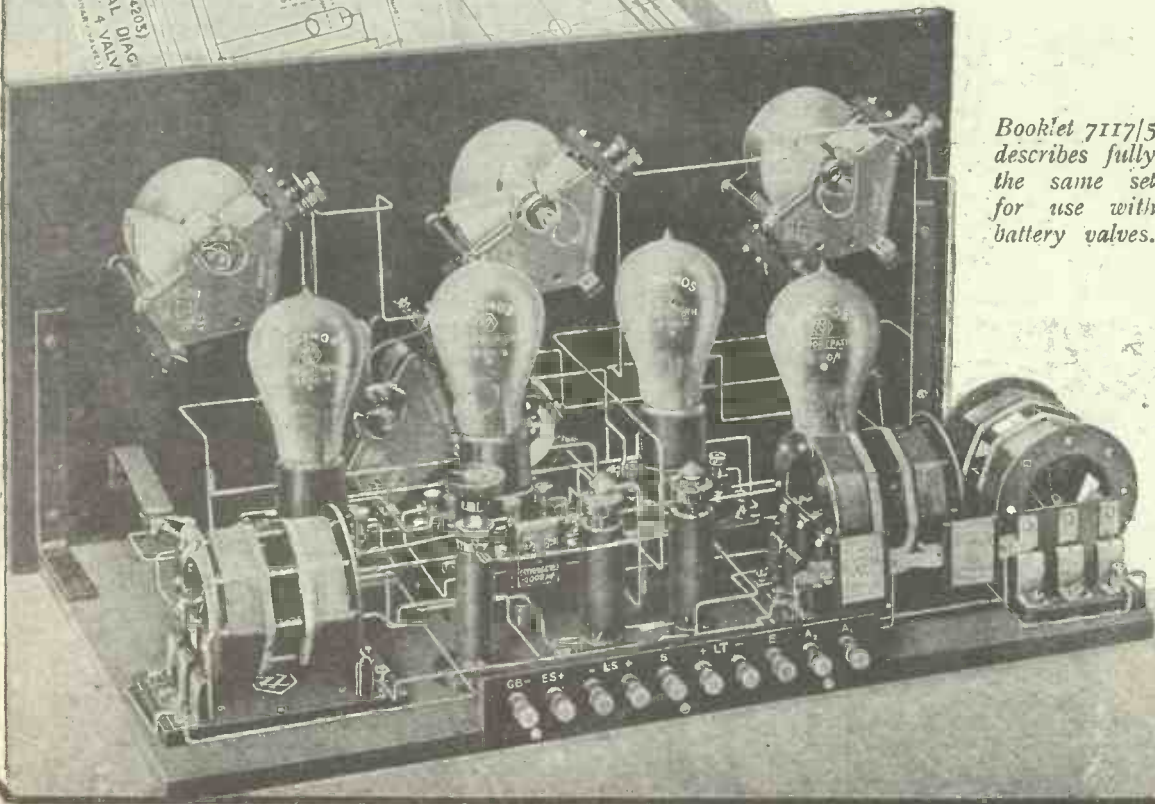
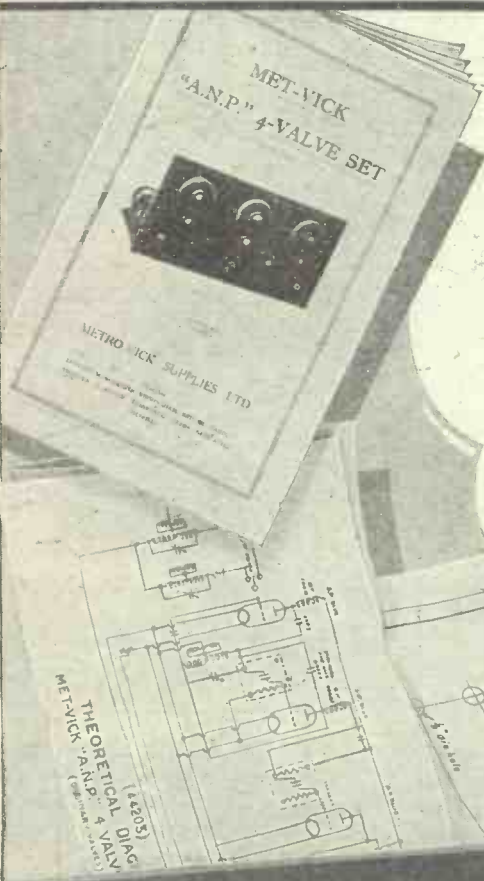
The "Met-Vick" 4-Valve A.N.P. Set shown on this page can also be constructed for working direct from the electric light mains. This involves the use of "Cosmos" A.C. Valves and Battery Eliminators, and is fully described in the booklet 7117/4 obtainable from your wireless dealer complete with drilling template and wiring diagrams. The performance of the set is astonishingly good, giving great selectivity with a wide range, high quality of reproduction and simplicity of operation.

The cost of the necessary parts is low. Ask your dealer for the booklet or write to the makers.

METRO - VICK SUPPLIES LIMITED

(Proprietors: Metropolitan-Vickers Elec. Co. Ltd.)

**155, Charing Cross Road,
LONDON, W.C.2**



Booklet 7117/5 describes fully the same set for use with battery valves.

RP
102



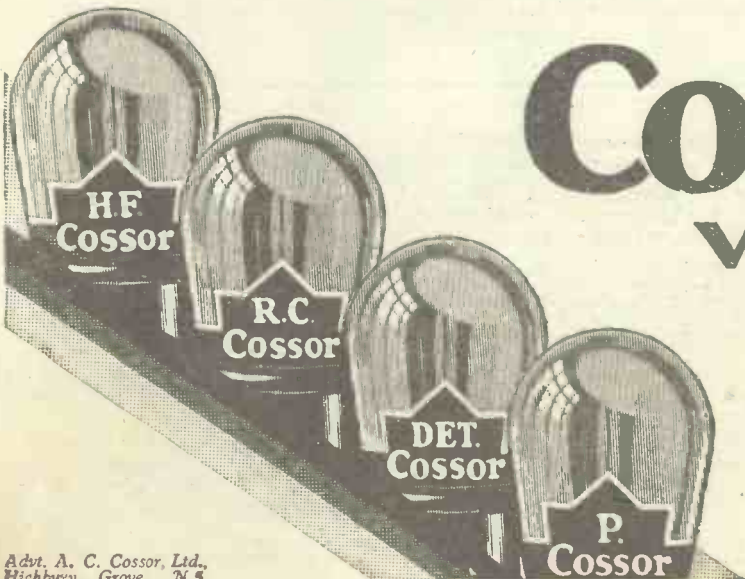
TEAM WORK

LOOK at them! See them swinging across the field. See the ball pass from one to the other—with lightning's speed. How they seem to know when it is coming—and where it is going! Fifteen men acting together—as one. Team work.

As in "rigger" so in Wireless. Unless your valves are working together—as a team—you cannot know the full capabilities of your Set. Using valves of different makes in your Set is like choosing strangers for a football team. They are not designed to work together. Every Cossor Valve* is designed for a special purpose. It is made to function correctly with its fellows. Study the valves in your Set. Are they a team? Or are they strangers? If so, replace them with the correct Cossor Valves. A remarkable improvement will be your instant reward: In tone. In fidelity of reproduction. In volume. In cost of operation. Get a team of Cossor Valves to-day.

The Valve that made possible the famous Cossor "Melody Maker"

* Your nearest Wireless Dealer stocks Cossor Valves for every purpose, for 2, 4 and 6 volts, From 10/6

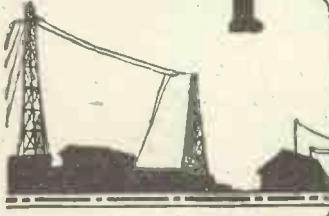


Cossor VALVES

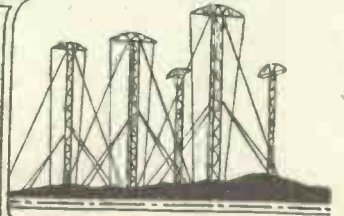
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RADIO NOTES AND NEWS.

More Free Blue Prints Coming—A Sound Tip—Gas Attacks—Is America Moving?—
 The Curse of Progress—Why Men Go Wrong—Value in Valves.

Shut Your Eyes . . .

JUST before you shut them, please to observe that we are featuring this week the "Lo-Cost" Crystal Set, an efficient little hook-up, whose performances will surprise its makers. Its cost in materials is trifling, but it is a fine answer to the complaint that "P.W." has forgotten the stalwart Knights of the Cat's-whisker.

And Open Your Mouth . . .

THIS "Lo-Cost" is just the thing for giving young hopefuls a start in radio or as a gift to someone who would not thank you if you gave a valve set—on account of the cost of upkeep. However, if our Valve Barts. and Barons think they have lost their threepences this week let it be known that they will recover their money, with several hundred per cent interest, next week. Yes, our issue on January 28th will be something to write home about—a lallapalooza; in fact, I might go so far as to say it will be a sannakatowser.

And See What "P.W." Sends You!

WITH our issue of January 28th we shall present readers with four more sixpenny "P.W." Blue Prints. It is not for us to praise our blue prints, for our friends do that loudly and long. Four new sets to choose from, and each one a guaranteed winner. Don't forget that "P.W." Blue Prints are unique because of their novel and comprehensive lay-out; "as plain as plain can be." Each gives all essential diagrams and data, and all you have to do is to join up the bits.

A Sound Tip.

JUST a word of caution. The demand for the last four prints, issued free a few months ago, was tremendous, and I fear that many people were disappointed; certainly many were too late for a copy of "P.W.", and had to pay sixpence each for the blue prints. So don't miss the 'bus. Place your order early; better still, place a year's subscription and get all the good things as a matter of course. Radio is now the world's pulse. "P.W." has its finger on it.

Gas Attacks.

WELL, well, well! if Sir Thomas Beecham isn't on the anti-wireless rampage again. Radio is making us comatose. You know, my idea is that Sir

Thomas once lived in a flat underneath a "signals-heard-all-over-the-house" fiend, and has cussed radio ever since. However, the answer is, "No, sir! All in the pink and dead off grand opera." Then, Mr. Shaw Desmond, a journalist who writes lots and lots on the strength of a sojourn in America, asks if wireless is making us lazy. What an idiotic question! Radio stimulates the mind, broadens the mind, improves the mind—but it evidently muddles the minds of many writers, who don't understand what they are writing about.

Modesty.

DID you hear the B.B.C.'s New Year's Greetings, re-transmitted by 5 SW? It did not excel in modesty, I thought. It began, "Here's the London station of the B.B.C. sending a New Year's message to the Universe, Hullo all stars and nebulae." I am afraid that 5 SW is not quite so good—on 24 metres—as Mr. Stobart, the author of the message, seems to think. But it was a most comprehensive blessing; nobody was missed except the tax-collector, and the wonderful, all-embracing curse in the "Jackdaw of Rheims" is a fool to it.

AIRCRAFT RADIO.



It is claimed that the new aerodrome at Croydon will be the best-equipped terminal air station in the world. In the mystery tower three people will be on duty day and night, and will have control over air expresses flying hundreds of miles distant. Above the control tower is the mast of a perfected wireless installation which will enable those in it to tell pilots who are in flight where they are, and guide them to Croydon in any weather.

We Hold Our Own.

PLOUGHING through trade returns—such is my miserable lot—I came upon the following little oasis. The value of the valve exports from this country last year was £170,000; from the U.S.A., £179,000, and from France, £31,953. What about it? Are we going to the dogs yet?

Is America Moving?

PROFESSOR A. WEGENER has advanced the theory that the American continent is drifting westward. That is startling, but not so startling as it would be if the drift were eastward. However, in order to test this hypothesis, thirty countries have combined in a world-wide radio investigation of longitude. Does it really matter? If America is drifting Europe must suffer it in silence.

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

Are Your Ears O.K.?

A WRITER to the "Observer" is puzzled about the effect of "listening" upon the ears. He cannot be sure whether the effect is beneficial or whether it is a strain on the power of hearing. It is beneficial when we hear what we like, but Chamber music, and, generally, music "performed in England for the first time," is a terrific strain. Speaking seriously, I may say that my experience is that constant listening to weak signals sharpens the hearing till it becomes almost uncanny, and has no ill-effects.

Marvellous Invention.

THE poor old Soviet! It does its best to make a show in radio matters, even to the extent of shoving forward Popoff—on a postage-stamp—as the true inventor of wireless. There is now an attempt by Moscow to dazzle the world with a newly-invented crystal. Russia, they say, has had to import all its crystals, and so the Institute of Applied Mineralogy, after many experiments, has produced a crystal almost as good as the foreign ones. But what is all the fuss about? Anybody can make galena and carborundum—and what more do they want?

Interest in 5 S W.

ACCORDING to "Radio" (South Africa) the transmissions of 5 S W and of Mr. Marcuse are not satisfactory for South Africa, and the periodical goes on to say that there are several Marconi revolving beams lying idle in this country which might be revolved and used to fire at each of the Dominions in turn. Splendid idea, but for the fact that the revolving beams are radio "lighthouses," have nothing to do with telephony, and have an effective range of about ten miles!

Getting On.

MY word! We are getting on. Here is Mr. Stenson Cooke, the genial Secretary of the Automobile Association, referring to wireless sets as popular parts of motor-car equipments. He even dallies with the idea of attacking the restrictions imposed on motor-car sets on the Continent. Quite right! But what I like is the steady assimilation of the radio receiver into the body politic. It has almost arrived.

The Curse of Progress.

(Lifted from "The Wireless Trader.")
Little Jack Horner sat in a corner,
Eating his Christmas Pie.
He put in his thumb
And pulled out two Synthetic Crystals
And a Patent Terminal
And said, "This is what comes of having a
Publicity Agent for a cook."

History's Repetitions.

HERE is a case of history repeating itself—with a slight difference due to progress. H. M. Stanley searched for Dr. Livingstone equipped with beads, quinine and a gun. Now, Commander G. H. Dymott is going to find Colonel P. H. Fawcett (who disappeared into the Amazon jungles) equipped with two short-wave transmitters; 36 metres; one 15 watts and

the other one a hefty fellow with a punch like a B.B.C. relay station. Perhaps some of my readers will get into touch with Dymott and hear the modern equivalent of "Dr. Livingstone, I presume."

Spain to the Fore.

I UNDERSTAND that a strong combination of British, French and German interests has obtained a radio concession in Spain and will go right ahead with a short-wave station (telegraphy). That is, however, only a beginning, and radio-telephony is also covered by the concession. It must not be thought that because Spanish broadcasting has been a wash-out, the country is backward in radio generally. Its Canary Islands and Balearic Islands have regular services

SHORT WAVES.

There have been several cases recently of houses robbed while the occupants slept. The strong soporific effects of wireless Talks constitute a new menace.

"London Opinion."

A. What station do you listen to most?
B.: The local power station.

Definition of a portable radio receiver. Apparatus which requires a porter to carry it—ask the man who has run for his train with one. "News of the World."

"Why the dickens doesn't the Postmaster-General buy a wireless set?" said the motorist, whose car had hit a telegraph-pole and pitched him into the ditch.—"Sunday Pictorial."

AN UP-TO-DATE HOWLER.

King Alfred burnt the cakes because he was busy listening-in to a matron talking on Infantry Welfare.

The question has been asked: Who are the best wireless announcers?
"Broadly" speaking, we should vote for the Americans!

SAFETY FIRST.

Sonny: Daddy, mother wants you to look at a cobweb before she brushes it away.
Daddy: What's so wonderful about it?
Sonny: She's afraid it's part of the wireless set.

A Yorkshire miner claims to be able to play ten musical instruments at once. Strenuous efforts are being made to keep the B.B.C. in the dark about this.—"Humorist."

"What kind of radio is this?"
"Scotch, of course. You can't get anything out of it."

with the mainland; there are numerous coast stations; the Army, Navy and Air Force are equipped with the very latest gear, and the Dons know how to use it, too.

Why Men Go Wrong.

I HAVE heard of a martyr whose wife wanted him to leave the loud speaker on during the summer holidays, as it would be "such company" for the goldfish! And of another, whose wife asked him whether he tuned-in with metres or kilowatts! And yet another, who, having with super-human efforts got 2 FC, was asked by his mother-in-law to change the record because she preferred a nice song to that silly "whistling solo!" Truly, no man knows what the next one suffers.

Battery Bad Luck.

PROMPTED by laudable patriotism, H. F. (W. Hampstead) gave cheap and foreign H.T. batteries the go-by and bought one by a well-known British maker. It conked out in less than a month and the maker would not replace it unless half the price of a new one was paid. H. F. is,

naturally, overcome with indignation and tempts me to publish a note which would be libellous. Sorry! Too old a bird to walk in, H. F.! You had sheer bad luck, but did you test the voltage directly you bought the battery? The maker you mention is world-wide known and makes dry-cells second to none. How was he to know what had happened since he sold it?

Value in Valves.

ON the other hand, A. W. (Bradford) made a set. It only sat and smiled! He traced the trouble to a valve; but was our reader riled? No. He returned the valve and the maker gave him another, adding thereto a coil and two condensers, all accompanied by a letter which was a model of courtesy. A. W. sings anthems whenever he thinks of this. Yes, there is no doubt that a square deal and a polite tongue are master keys to successful trading.

Crystal Marvels.

A TOTTENHAM reader tells me that on his crystal set he gets "audible" loud-speaker signals from 2 L.O. (That sort of signal is always the best in the long run.) He gets 5 G B and 5 X X on the telephones—even more audible. I am afraid I cannot divulge the name of the firm that made this wonderful receiver—not being the Advt. Manager (worse luck!)—but I will express my satisfaction that there is still a Knight of the Cats'-whisker left at the Round Table.

Transmitting Notes.

STATION G W 15 C (owner, Mr. W. Bryan Bates) has been removed to "Glebelands," Ratoath, co. Meath, Irish Free State. Also, will readers kindly note that Mr. D. Gwyn Johns has set up a transmitter at Caerithin, Mumbles, Swansea; call-letters 6 G J; metres 8, 23 and 45; he would be pleased to have reports about his signals.

London's Air Port.

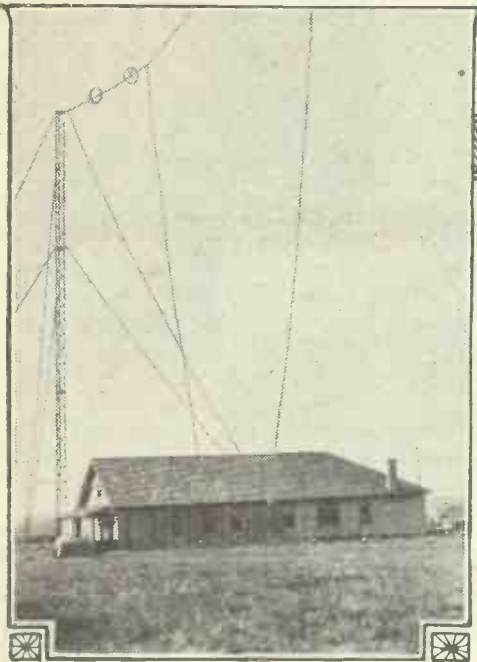
THE great new air port at Croydon is probably the best-equipped in the world, with its wonderful control tower and complete radio arrangements, the aerials for which are situated several miles from the port and operated from the 'drome by "remote control." There are four 3 kw. transmitters working in conjunction with a direction-finder. The wave range of the transmitters is 800-2,000 metres and they can work on telephony, C.W. and I.C.W. The D.F. can be operated on different wave-lengths for the reception of telephony and telegraphy on the same aerials.

Amateur Telephony from Australia.

THE first instance of the reception by an amateur in this country of telephony from an amateur in Australia reported to me this year is between H. T. (Warrington), with a three-valve, and Mr. W. E. Coxon, 6 A G, of Perth, W. Australia, who transmits on about 200 watts, crystal-controlled with frequency doubler; 32.9 metres; programme nearly every night at 6.30 p.m., for half an hour. H.T. may congratulate himself—and take a Valve Barony with my compliments!

ARIEL.

AUSTRALIA'S STAR STATION



An interesting description of the Melbourne transmitter, whose short-wave broadcasts have penetrated to the Homeland.
By OUR SPECIAL CORRESPONDENT.

is proud of these studios. The largest, 90 ft. by 30 ft. by 17 ft., is thought to be the largest studio in the world. Most certainly it is impressive, complete with two pianos and everything else that a perfect studio should have.

In all there are three studios at 3 L O. The control room is in visual connection with them all. Specially-designed doors and windows make the control room absolutely soundproof. Although the engineer in the control room can see the artistes as he anxiously watches the flicker of his delicate meters, yet he cannot hear a sound. Not direct, that is, but a specially-designed resistance-capacity receiver picks up the actual radio broadcast and supplies the deficiency.

Ahead of British Broadcasters.

In this way he can tell at a moment's notice if anything goes wrong with the transmission.

In several respects 3 L O is ahead of our English stations. Particularly is this noticeable as regards the broadcast of plays. The Williamson Associated Theatre Company, who practically control everything in the theatre world of Australia, are in close touch with 3 L O and other Australian broadcast stations. Sometimes whole plays, some-

times alluring excerpts, but always something, is broadcast from Theatreland.

In fact, the Theatre Company, far from despising broadcasting, consider that they



Mr. W. R. Baird, one of the engineers, adjusting the tuning controls.

derive very material benefit from a close co-operation with the broadcasting stations.

Thanks to all this it is probable that

(Continued on next page.)

EFFICIENCY—it was not long before I realised this was 3 L O's slogan. It was evident from the moment I arrived to the moment I left.

This vastly complicated business of broadcasting to a district very much larger than the whole of the British Isles seemed a very simple matter.

Such is efficiency. Difficult things look easy.

There was no delay at the inquiry bureau and in a few minutes 3 L O's General Manager, Major W. T. Conder, greeted me. Ever since October 13th, 1924, he has been toiling and striving to make 3 L O the best station in the Antipodes.



Major W. T. Conder, General Manager of 3 L O.

Now 3 L O reigns supreme as the star station in the Southern Hemisphere.

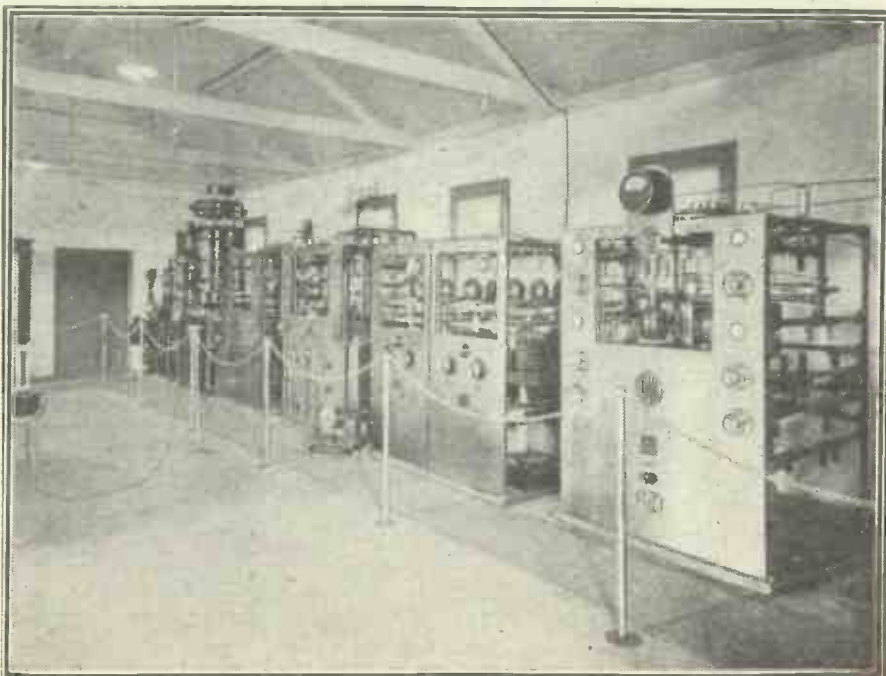
Laughingly, he told me that a bare three years ago he and his then small staff occupied one tiny room near the present building. With the aid of a rather doubtful typewriter and a few bits of equally doubtful radio junk they were expected to satisfy Victoria's desire for radio.

Throbbing with Life.

To-day, I saw a large modern building throbbing with life. Typewriters rattled in their multitudes—faint echoes of pianos, violins, flutes, and other instruments could be heard rehearsing out of sight. In fact, there was a bustle and activity about the place not outdone by our 2 L O itself.

The ground floor houses all the administrative offices. Here programmes are carefully worked, artistes interviewed, and the thousand and one details attended to that go to make a perfect programme.

On the second floor are the studios. 3 L O



The short-wave transmitting plant at 3 L O, which is capable of working on 15 kw. down to 15 metres.

AUSTRALIA'S STAR STATION.

(Continued from previous page.)

3 L O's listeners get the very best from Theatreland that it is possible to get. Better, indeed, than we can hope to get in England at present.

In this respect Australia has blazed a trail that the Mother Country would well follow.

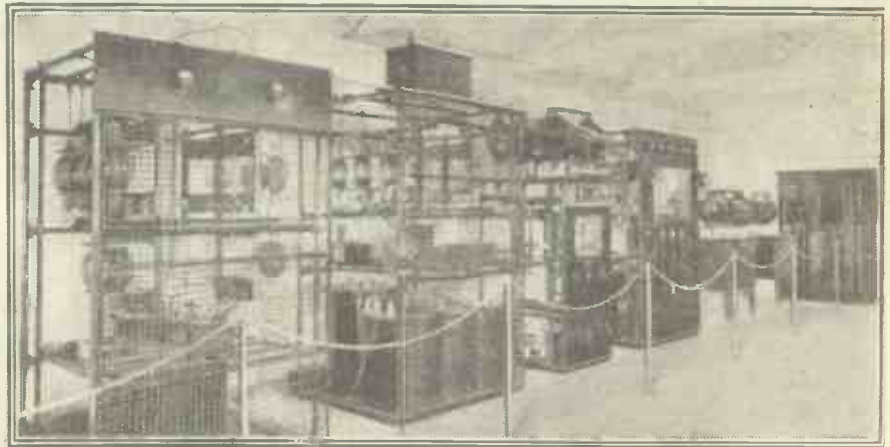
The total number of licensed listeners in 3 L O's official district of Victoria amount to no less than 126,000. To us in England these figures may seem small when compared with London's teeming millions, but on the other hand 3 L O covers distances far greater than any of our own stations. In fact, 3 L O has a greater listening public than any of the other stations in all Australia put together. Her total number of listeners must amount to something like a million or more, for even in New Zealand 3 L O is a favourite station, whilst in the uttermost wilds of Australia super-hets. and neutrodynes tune to 3 L O nightly.

The Licence Problem.

The licence problem in Australia is under revision at the time of writing. At the moment a licence costs 27s. 6d., obtainable at any Post Office. In the case of 3 L O 70 per cent of the licence receipts are used for actual broadcast purposes, whilst the remainder is retained by the Postal authorities. Thus the actual receipts that come to 3 L O work out at something like £98,000 yearly.

However, the deliberations of the Royal Wireless Commission have been just made public. As far as 3 L O is concerned the nett result of these deliberations would appear to be somewhat Gilbertian.

This commission praises this station highly and considers the organisation excellent—in fact, it goes so far as to hint



The main transmitting plant at 3 L O, Melbourne, which can operate at a power of 15 kw., five times the maximum power of 2 L O, London.

that 3 L O is the star station of Australia. Then it goes on to say that having done so well now I am going to take some of your takings away and give them to other stations who have not done so well. This means a loss of £10,000 a year to 3 L O, and may be considered, I suppose, as a humorous pat on the back for a go-ahead policy that has boomed wireless in the State of Victoria.

Whilst I was talking with the Station Director a taxi-driver came in. In Australia people come and go more casually than in the British Isles—everyone seems to be more accessible. Could he have an invitation ticket for the Audience Hall?

He got it; the Station Director explained matters to me.

A Successful Innovation.

"Some time ago we realised certain difficulties that prevented artistes from giving of their best—heavily-draped rooms that swallowed up all echo, the lack of a visible audience making everything seem different from the way they do things in the theatres. Now all that is altered. For

we have an Audience Hall attached to our new studio. We issue tickets free every night. The hall seats 120 comfortably, and



Mr. F. Stevens, in the Control Room.

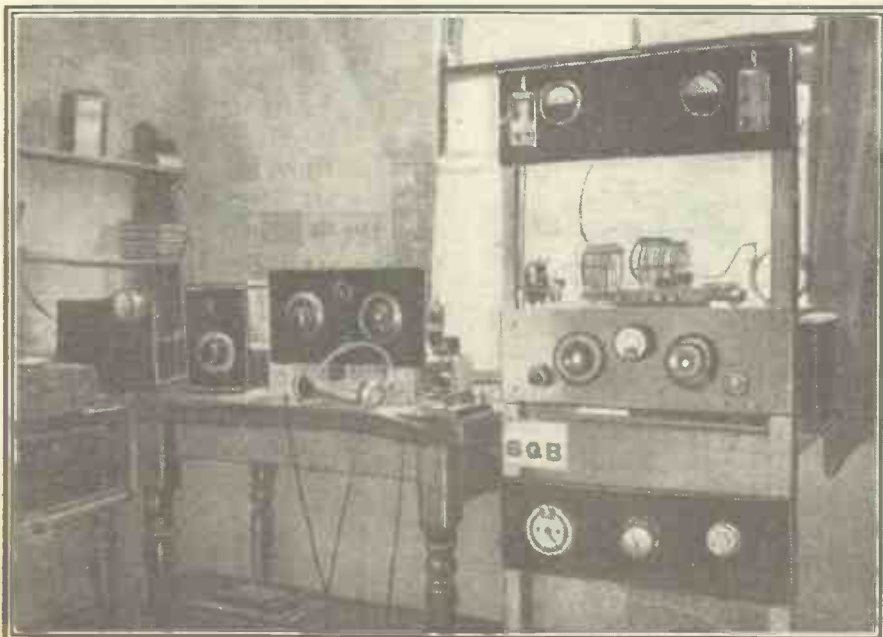
has been a great success. There is always a long waiting list for tickets. The artistes have got their audience and, somehow, I think things go with more of a swing."

Two permanent orchestras are employed, one for dance music and the other for more serious music. Each contains some twenty instruments.

So much for the studios, an entire two-storied building situated in the very heart of Melbourne's busiest street.

The actual transmission takes place eight miles outside Melbourne, near a small village called Braybrooke. As a matter of fact, the studio departments and the transmitting department are quite separate. The studios belong to 3 L O, whilst the transmitting is done by contract with Amalgamated Wireless of Australasia. For so much a year this firm guarantee to put on the "air" the programmes supplied by the studios in Melbourne.

In Melbourne itself I saw a fair proportion of British components. On the other hand nearly all completed sets hailed from America. In Australia wireless sets must give superlative DX results. A set in Australia is not even looked at unless it can pull in station after station thousands of miles away. Why don't our B.B.C. come to Australia and study broadcast development in the Antipodes. They would find many interesting points worth adopting.



The amateur short-wave station, shown above, 8QB, belongs to Mr. L. H. Thomas, a well-known contributor to "Popular Wireless." Here signals from all over the world have been received, and some very interesting long-distance low-power records have been set up. The transmitting key for Morse working is shown on the right of the table.

TELL-TALE NOISES



IN most forms of man-made machinery or apparatus a kindly nature has so provided that dull-witted man shall receive forcible indication when all is not well. So the bearing that needs oil squeaks, the worn one rattles, and the engineer or mechanic who loves his machinery can recognise at once any noisy protests—sometimes when they are so slight as to be inaudible to the untrained ear—and, more important still, trace them by their peculiarities to one particular unit of a complex assembly.

Wireless apparatus is no exception, and indeed the indications that something is wrong are usually proclaimed aloud by the smallest faults in no unmistakable manner.

The strange rattle or thump that starts in the engine of your car or motor-cycle can (inadvisedly) be ignored, but the warnings emitted by a receiver generally prevent enjoyable reception at once.

Six Typical Symptoms.

Noises produced by certain defined faults differ as widely as the proverbial calcium carbonate does from the Cheddar cheese, and, with a little study and the exercise of sound reasoning, it is easy to differentiate and to gauge the possible causes.

The noises heralding a fault in wireless receivers of the usual pattern employed for broadcast reception may be classified under six main headings as follow:

1. Intermittent sizzling or "frying" noises.
2. Intermittent crackling noises.
3. Howling, continuous or periodic.
4. Buzzing noises.
5. "Ticking" noises.
6. Distortion.

* * * * *

Is your set working silently and efficiently? If it is not, you should read this article—it may help you. But in any case read it, because the advice given will extend your store of information, and prove useful against future contingencies.

By R. W. BLOXAM.

* * * * *

In this article the indications and faults arising are those which may develop in sets which have previously worked satisfactorily, as distinct from similar troubles which may be met with in a newly constructed receiver being tried out for the first time, and which latter may be due to incorrect design.

Intermittent Sizzling Noises.

(a) The first thing to be suspected when noises of type 1 develop is the H.T. battery

The noises produced in such a case are due to high internal resistance in the battery, and the fact that the resistance offered to the path of the H.T. current is variable.

It does not necessarily mean that the H.T. battery is at the end of its life, but generally the fault will be found to lie with one or more individual cells.

If the battery is of the tapped variety it is usually easy to discover and short-circuit the faulty cells out of use. If, however, the battery has given a fair service, this is generally the first indication of its expiration of life, and other cells will rapidly follow suit.

(b) Noises due to poor contact creating a variable high resistance. Very frequently this may be traced to the point where the L.T. leads are attached to the accumulator. The accumulator terminals become coated with sulphate due to the creeping of the acid, or the splashing which takes place when charging, and it is as well to examine and clean the ends of the leads periodically, also making sure that the terminals screw down firmly and grip the wire. A faulty soldered joint may cause the same trouble.

(c) Faulty primary of first stage L.F. transformer. This is often the first stage of the decease of the primary winding, the noise developing later to loud intermittent crackling.

Difficult to Trace.

At this first stage it is very difficult definitely to show the fault to be with the transformer, as the ordinary click test with a small battery in series with a pair of headphones will not reveal the trouble.

As a "trouble hunter" of some years experience, I have no hesitation in saying that this is one of the most obscure faults to prove definitely, but fortunately it usually develops rapidly to the "crackling" stage, when one can be more certain of "laying" it, but unless one tries changing the transformer it is not generally possible to locate it in a single evening.

(d) Faulty valve or high resistance connection.

In the case of valves, if the noises are only slight they are probably emanating from the

(Continued on next page.)



Even the best of H.T. batteries will run down after a long and useful life, and need replacing if good results are desired. But the contacts between the wander plugs and their sockets should be checked up and cleaned periodically in order to avoid wrongfully suspecting the battery of "making noises," when actually it is in good condition.

TELL-TALE NOISES.

(Continued from previous page.)

last L.F. stage, otherwise they would be amplified considerably. The fault is easily located by substitution with the aid of a spare valve.

High resistance connections are most likely to occur at places where no soldering is employed and two wires are joined by the pressure of a screw or washer only. Such joints should not exist in any well constructed set—all joints should be soldered.

(e) Faulty grid leak. This is a prolific cause of "frying" noises which, in the case of a multi-valve set, become a positive roar, due to the amplification.

(f) Faulty insulation of grid condenser "Frying" noises are the result of a very slight fault in the insulation, but if the fault is serious the noises will be of the crackling variety.

(g) Faulty contact of valve pin with socket. It should hardly be necessary to mention this, as it is of such common occurrence, especially where cheap and poorly designed valve holders have been fitted. Fortunately, the trouble is generally cured at once by carefully opening out the valve pins to make a good fit.

Intermittent Crackling.

(a) Provided the H.T. battery is in order, the most likely offender is the L.F. transformer—usually of course the primary winding. The autumn is generally a time when transformer troubles arise. The windings are subjected to strain due to expansion and contraction caused by temperature variations, particularly during hot summer weather, and the result is that the wire fractures. In about 80 per cent of cases this is the cause of failure, and not actual burning out through excessive current. Transformer design has made rapid strides in recent years, however, and the better-class apparatus will allow wide temperature changes without trouble.

(b) Broken connection or loose contact.

The former can usually be quickly located, either at sight, or by feeling each connecting wire with the fingers. To produce noises it must be making contact intermittently. Loose contacts can generally be confirmed by the fact that the trouble is aggravated by striking the table on which the set rests.

(c) Faulty loud speakers or telephones. This includes the leads thereto, and in the case of telephones, owing to the severe call for flexibility, the wire often fractures close to the earpiece terminals. Stretching and contracting the wire with the hands will generally show up this fault.

(d) A serious breakdown in insulation. This, of course, may be either in transformer, condenser, coils, or headphones.

It may also be in the aerial circuit, switch, etc. A case once came to the writer's notice where crackling noises on a sensitive multi-valve set were traced to a bad contact in the lead-in of an aerial next door used on a crystal set. Tactful persuasion induced the owner to allow it to be examined and soldered, with the result that his signals went up 50 per cent in strength, and the noise ceased!

This form of trouble will ruin reception on a super-heterodyne or any highly sensitive instrument.

Howling.

(a) Apart, of course, from the injudicious use of too much reaction, the H.T. battery may be put down as the most common cause of this fault. This is particularly the case where more than one low-frequency stage is used—the high resistance of the battery producing a coupling effect between the stages of the amplifier, which in turn creates a beating note at an audible frequency.

(b) A microphonic valve probably takes second place as the cause of howling, although it is not often that a valve becomes microphonic after being in use, as the cause of the trouble is generally due to faulty construction or supporting of the electrodes.

Valve howl often becomes troublesome if the reaction is unduly forced, or rendered highly sensitive, par-

ticularly with low-consumption filaments, and in such cases it is nearly always the detector valve which gives bother. Anti-microphonic valve holders will not always stop the howl, and the cure must generally be sought by changing the valve for a better specimen of the same type.

Buzzing Noises.

Buzzing or humming noises are of rare



You should keep the terminals of your accumulators bright and clean, and don't forget to note that the injunction inscribed above is carried into effect.

occurrence, and unless due to some source external to the receiver, they are generally caused by a disconnection in the grid circuit, usually in the first valve.

In some cases this fault will arise due to a defective transformer secondary winding, or a disconnection of the grid-bias battery.

"Ticking" Noises.

This fault is produced by the charging and discharging of a condenser and generally a grid condenser. It is the logical outcome of the disconnection of the grid leak, the condenser charging up and then discharging suddenly when the insulation resistance is overcome, the whole process being repeated continuously.

Weak or Distorted Reception.

(a) A faulty transformer winding will often produce weak or distorted signals. It occasionally happens that a few turns of the winding become shorted together owing to insulation breakdown, and the eddy currents set up in the "loops" thus formed will produce severe distortion which is hard to locate.

The only cure of course in this case is a new transformer.

(b) Battery trouble is almost certain to account for 99 per cent of the cases where signals weaken or distort, following perfect reception.

(c) If the accumulator has just been charged it has probably been re-connected with the polarity reversed.

Complete Silence.

Although this hardly comes under the heading of noises, it is a symptom not infrequently met with, and usually indicates a disconnection.

If no click is heard when 'phones or loud speaker are attached to their terminals the break is in the H.T. circuit somewhere.

An occasional cause is a faulty valve or valve holder. Test with pocket lamp battery and pair of 'phones.



This constructor is using an electric soldering iron, but few amateurs possess such a luxury. With one of these useful articles clean and efficient joints are easily made, but an ordinary soldering iron carefully handled can do just as good work even if it takes a little longer to do so. Faulty joints cause a great deal of trouble in radio receivers.

THERE is little danger of any receiving set ever catching fire, especially owing to a lightning-struck aerial, for this possibility is so remote that

we may, for all practical purposes, consider the risk entirely negligible.

When dealing with electrical instruments such as fuse boxes, resistance coils carrying heavy currents, and so on, there is perhaps a more definite risk of fire occurring owing to the fusing of one or more wires.

Not that such a fire would generally prove dangerous, but it might take the form of a smouldering which would entirely ruin any cabinet or woodwork in the immediate vicinity of the fused wire.

The following simply-made preparation, however, will render any type of woodwork entirely fireproof, and thus it may be useful for many readers to have the formula at hand in case they wish to employ it for the above purpose.

EASILY PREPARED "DOPE."

A strong solution made by dissolving as much alum in water as will dissolve, will be found to be very efficacious as an anti-fire treatment. This solution, when cool, should be poured into a bottle, in which container it retains its fireproof properties indefinitely.

If now we have a fuse box the interior of which we wish to render fireproof, it is merely necessary to paint a little of the above solution on to the woodwork with a soft brush and to let it dry on. Two applications of this process will render the woodwork almost entirely fireproof, and if an electrical fire did take place in the box, the woodwork might not even smoulder.

All sorts of fabrics may be fireproofed by soaking them for an hour or two in the above solution. Thus cloths which are used for covering up radio sets may be subjected to this process if there is any risk of lighted or smouldering objects being carelessly thrown in the vicinity of the receiver.

BY-PASS CONDENSERS.

At least one well-known transformer incorporates a fixed condenser which comes permanently across its primary winding. This is of a small value but has an effect of some importance on the frequency characteristics of the component. In the case of a transformer used for coupling, a first L.F. stage to a detector using reaction, a small condenser across the primary is necessary in order to by-pass the high frequency, but from the point of view of quality of reproduction it is in almost every case an essential component and it should be used wherever the transformer figures.

Even the best of low-frequency transformers have what is known as falling characteristics on the lower range. This means to say, that they do not pass the lower frequencies as well as the higher. Now, a fixed condenser will pass high frequencies better than the lower ones.

"Straightening" the Curve.

Therefore, one of the effects of a fixed condenser connected across the primary of a transformer is that it tends to offer

SOME USEFUL HINTS.

A page of practical and informative items of particular interest to the home constructor.

a higher resistance to the L.F. current the lower you go down the frequency range of audio notes. The condenser across the primary of an L.F. transformer will tend to by-pass some of the higher frequencies and therefore tend to level up the frequency characteristic of the transformer, but the capacity of such a condenser should not exceed .0005 mfd. or so.

A SOLDERING HINT.

It is extremely annoying, when soldering, to find you have stuck your elbow in the open tin of Flux, or that, through constantly working with the tin open, the flux has become so dirty as to be almost useless.

To obviate such circumstances, the follow-

ing "gadget" will be found very useful as, with its help, the lid can be permanently kept "on."

Procure a short length of square section wire, four inches will be ample and bend one end roughly to the shape of a button-hook handle. Now hammer out the other end as flat as possible, to form a spade. In the lid of the flux tin, punch a hole large enough to admit the "spade." It will be found that when the wire is inserted in the tin of flux, sufficient for several joints will adhere to the wire, and will be easy to apply to the required spot.

SERIES AERIAL CONDENSERS.

Listeners who use receivers employing series aerial condensers of about .0001 to .0005 mfd. capacity will do well, as a rule, to short circuit these condensers when tuning to wave-lengths above 600 metres.

For high wave-lengths a condenser of at least .001 is required, but as a rule better results will be obtained without it.



Miss Elisabeth Pechy, the Hungarian Actress, tuning in with her seven-valve set.

DO YOU KNOW THAT.....

A valve of the high-impedance type should be used for the tuned-anode H.F. coupling ?

If your cabinet is one of the french polished type you should not use a renovator which contains spirits to clean it ? (A very soft rag with a trace of medicinal paraffin oil makes a far better polisher.)

The Empire beam stations work on wave-lengths roundabout twenty-five metres ?

If the loud speaker is connected to the input of an amplifier it may be used as a microphone ?

The green deposit upon neglected accumulator terminals may be removed quite easily with a strong solution of ordinary washing soda ?

There is no need to use unsightly rubber-covered wire for indoor aerials as the cotton or silk-covered electric lighting flex obtainable from an electrician's shop is quite suitable ?

You must not run your aerial across other people's property without the owner's permission ?

Quite a good little coil-winder can be improvised from a hand-drill gripped in a vice ?

The most northerly wireless station in the world is one used by the Canadian Mounted Police to maintain order in the Arctic Circle ?

TECHNICAL NOTES.

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

INCREASING ACCUMULATOR LIFE

COIL COUPLINGS—A CURIOUS PHENOMENON—BALANCE EFFECT.

Increasing Accumulator Life.

HOW to prevent the active material from falling out of the plates of an accumulator—especially the positive plates in high-tension accumulators—has always been one of the standing problems of battery manufacturers. Separators of wood, ebonite, or other material are largely used, but they have important drawbacks.

The difficulty is to find a mechanical support which will not interfere with the proper functioning of the active material when the cell is in operation.

In some modern types of battery separators are done away with, and the plates are formed in such a shape, or of such a thickness, that they are, so to speak, self-supporting.

The Kathanode people have adopted glass-wool separators, in addition to the ordinary wood or ebonite separators, and claim that this has great advantages in preventing disintegration without interference with normal working. The use of glass-wool in electrical accumulators, of course, is not new. Glass-wool was used many years ago in portable accumulators which had to be filled up with acid before being charged and subsequently emptied out, leaving only the acid which was held by the wool.

Hitherto the use of glass-wool in accumulators has generally been regarded as not entirely an advantage, but the Kathanode batteries made with this material between the plates certainly give excellent service, as I can testify from a considerable experience of them.

Coil Couplings.

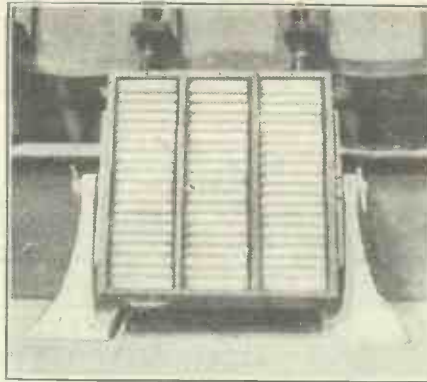
When two coils are placed in such relative positions that the electro-magnetic field from the one coil is able to enter the second, there is said to be magnetic, or electro-magnetic, coupling between the coils, and if an alternating current is passing in the first one a similar alternating current will be induced in the second.

The amount of the electro-magnetic coupling between the two coils depends (amongst other things) upon their position with relation to one another, because this relative position determines whether or not the electro-magnetic field from one coil can enter the other. If the two coils are placed side by side it is obvious that a large part of the field from the one coil will enter the second coil, but if the second coil is shifted laterally, or if it is rotated so as to be at right angles to the first coil, then the amount of the electro-magnetic field from the first one which is able to enter the second one is very much reduced, or, as it is usually stated, the coupling of the two coils is lessened or is made "looser."

Coils which are placed close together and side-by-side, so as to get a maximum electro-magnetic effect between them, are said to be "closely coupled," or the

coupling is said to be "tight" coupling, whilst coils which are so placed that only a small percentage of the maximum electro-magnetic effect is obtained in the second coil from the first, are said to be "loosely coupled."

Perhaps the simplest example of coupled coils, in which the variation of the relative position is made use of for varying the coupling, is the *variometer* in which one coil is mounted so that it may be rotated with respect to the other coil. When the moving coil is at right-angles to the fixed coil the coupling between the two is a minimum, whilst when the two coils are parallel the coupling is a maximum.



This is the loud speaker which is used in connection with the well-known Dresden Opera Co.'s transmissions. The instrument weighs 500 lb., and it is claimed by its German designer that it achieves a naturalness of reproduction hitherto unapproached.

The foregoing is, of course, familiar to all of my readers except those who are just beginning the study of wireless, but there is rather an interesting point which I should like to mention, which is not generally known.

A Curious Phenomenon.

It is usually assumed that when the one coil has its axis at right-angles to that of the other, the coupling is actually zero. Now this is often far from being true, and you can very easily prove it for yourself by connecting the second coil (assuming that high-frequency currents are passing in the first coil), to a detector and one or two low-frequency amplifiers and then to a pair of headphones.

If you place the second coil in the theoretically zero position with regard to the first coil, you will find that the energy received is by no means zero. If, however, you shift the coil sidewise (that is, parallel to itself but away from the axis of the first coil), you will probably be able to find a position where the signals received are practically zero.

This effect is partly due to irregularities in the shape and other properties of the coils, which renders them unsymmetrical, and partly to the fact that, in addition to *electro-magnetic* coupling there is also *capacity coupling* between them. The capacity coupling, of course, does not become zero when the second coil is placed at right-angles to the first.

Balance Effect.

The reason that a zero position can be found by shifting the second coil a little distance away from the axis of the first is because actually the electro-magnetic coupling is *increased* and counterbalances the capacity coupling. This can easily be proved by shifting the second coil a little to the right of the axis of the first coil and then a corresponding distance to the left.

You will find that if the shifting to the right has the effect of reducing the signals gradually to zero, shifting to the left will

(Continued on page 1076.)

NEWS FROM SAVOY HILL.

FROM OUR OWN CORRESPONDENTS.

COMING BROADCAST THRILLERS

A TEMPLE THURSTON PREMIERE—CONTROVERSY ABOUT DIARIES—
TRIBUTE TO SIR EDWARD GERMAN—A THEATRE CHARITY APPEAL.

A Temple Thurston Premiere.

WHEN an author of so outstanding ability and prominence as Temple Thurston consents to his new play having its first performance in a broadcasting studio, we may be reasonably sure he has sufficient faith in radio to give it adequate and faithful presentation. His decision is certainly an encouraging sign of the times to Mr. R. E. Jeffrey, head of the Productions Department of the B.B.C., who, as the first Station Director at Aberdeen, and, therefore, one of the oldest broadcasters in this country, has probably done more to develop radio drama than anybody in the world.

Temple Thurston has already had considerable experience with broadcasting as a medium for play producing, since his most famous stage work, "The Wandering Jew,"

has been given on two occasions in the London studio. His new play, to which he has given the title "The Burden of Women," is a story of the trials and troubles of those who watch and wait for the return of their men-folk who earn their livelihood from the sea.

The action depends very largely for success on sound effects and the tense atmosphere which wireless has shown itself so capable of interpreting into realism. This play has been included in the programmes from London and other stations at 9.40 p.m. on Tuesday, February 7th.

Coming Thrillers.

With some people a little Grand Guignol goes a long way, but that is no reason why we should not have a bit of it now and

(Continued on page 1074)

FAMILIARITY breeds contempt. There is a modified version: "Familiarity breeds content," and in this form the proverb certainly applies to scientific as well as to personal matters.

The ordinary house telephone system would have seemed a very wonderful thing a hundred years ago, but to-day it is so familiar that we fail to see anything very wonderful about it.

Wireless, is sufficiently new for us to regard the transmission of messages through space, apparently "full of emptiness," as something very wonderful and difficult to understand.

An Invisible Link.

As a matter of fact, the space between a broadcast station and your home receiver, so far from being full of emptiness, is very full indeed of an intervening medium, and it is by virtue of this medium that the wireless waves are enabled to travel. The main difference between the wire which connects one telephone instrument to another and the medium which connects a broadcast station and a wireless receiver is that, in the former case the link is visible and familiar, whilst in the latter the link is invisible and quite unfamiliar.

Probably you know that this intervening medium through which wireless waves are conveyed is known as the "ether."

It is this medium in which all kinds of electric or electro-magnetic waves are set up, such as wireless waves, light waves, heat waves, X-rays, and the various radiations from radio-active substances. Two of these types of ether waves, namely light and heat, affect our bodily senses, but the others are only perceptible to us indirectly as they manifest themselves through the aid of special appliances.

When an electric current passes along a wire, such as a telephone wire, we now know (in the light of recent scientific discovery) that electrons flow along the wire, just as water drops flow along a brook and constitute a stream of water.

Some of the electrons, starting at one end of the wire, actually reach the other end and there, in the form of what we call the "electric current," they are able to produce desired effects, such as, for instance, to cause a diaphragm to vibrate and the sound of speech to be reproduced.

Enables Reproduction of Conditions.

Now, in wireless transmission and reception we have streams of electrons moving through electrical conductors, but instead of connecting the two parts of the system together (that is, the transmitter and the receiver) so that the electrons from the one actually pass into the other, what we do is to make the electrons of the first system move about in such a way as to cause vibrations or waves in the ether medium:



There is air between you and your local broadcasting station, but if this air were completely removed you would, if you could live without air, still be able to receive the programmes on your set. Why is this? The answer is given in the following interesting article.

these waves travelling out and, so to speak, "taking hold" of the electrons in the second system cause them to move in a similar way to the electrons in the first system. Consequently, the state of affairs in the transmitter is virtually reproduced in the receiver.

Between the Two Points.

A very simple illustration which is sometimes used to make this point clear is as follows: Imagine a small rowing-boat floating on the surface of a pond near one edge, and another similar boat at the opposite edge. If a man in the first boat rocks the boat about so as to produce surface waves on the water, these waves will travel across and eventually will begin to set the second boat into rocking or oscillation in exactly the same way as the first boat. The first boat in this case corresponds to the transmitter, the second boat to the wireless receiver, whilst the water corresponds to the "ether" medium, and the surface waves on the water to the wireless waves sent out from the wireless transmitter.

In the transmitter we arrange matters in such a way that streams of electrons move first in one direction in the transmitting aerial, then come to rest, and then surge back in the opposite direction, then to rest and back in the first direction, and so on, these reversals or "oscillations" taking place with great rapidity. In the case of wireless waves of a wave-length of 300 metres the reversals take place at the rate of about one million per second.

In consequence of the peculiar and intimate relation between the electrons and the other medium (which we will touch upon a little later), the to-and-fro motion of the electrons in the transmitting aerial "shakes" the ether in exactly the same way that the man in the first boat "shakes"

the water. These ether motions, or "wireless waves," as they are now called, travel outwards in all directions and strike (amongst various other objects) the aerial of a receiving set. Again, owing to the intimate connection between ether and electrons, the ether "takes hold" of the free electrons in the copper wire of the receiving aerial and begins to "shake" them to and fro, exactly as the water waves from the first boat took hold and shook or oscillated the second boat.

We now have a state of affairs in the receiving aerial—due to the arrival of the wireless waves—exactly similar to the state of affairs in the transmitting aerial. It is easy, by means of a wireless circuit with various other devices, to make this oscillating current produce acoustical or other effects which will be a reproduction of those at the broadcast station.

By Activity of Electrons.

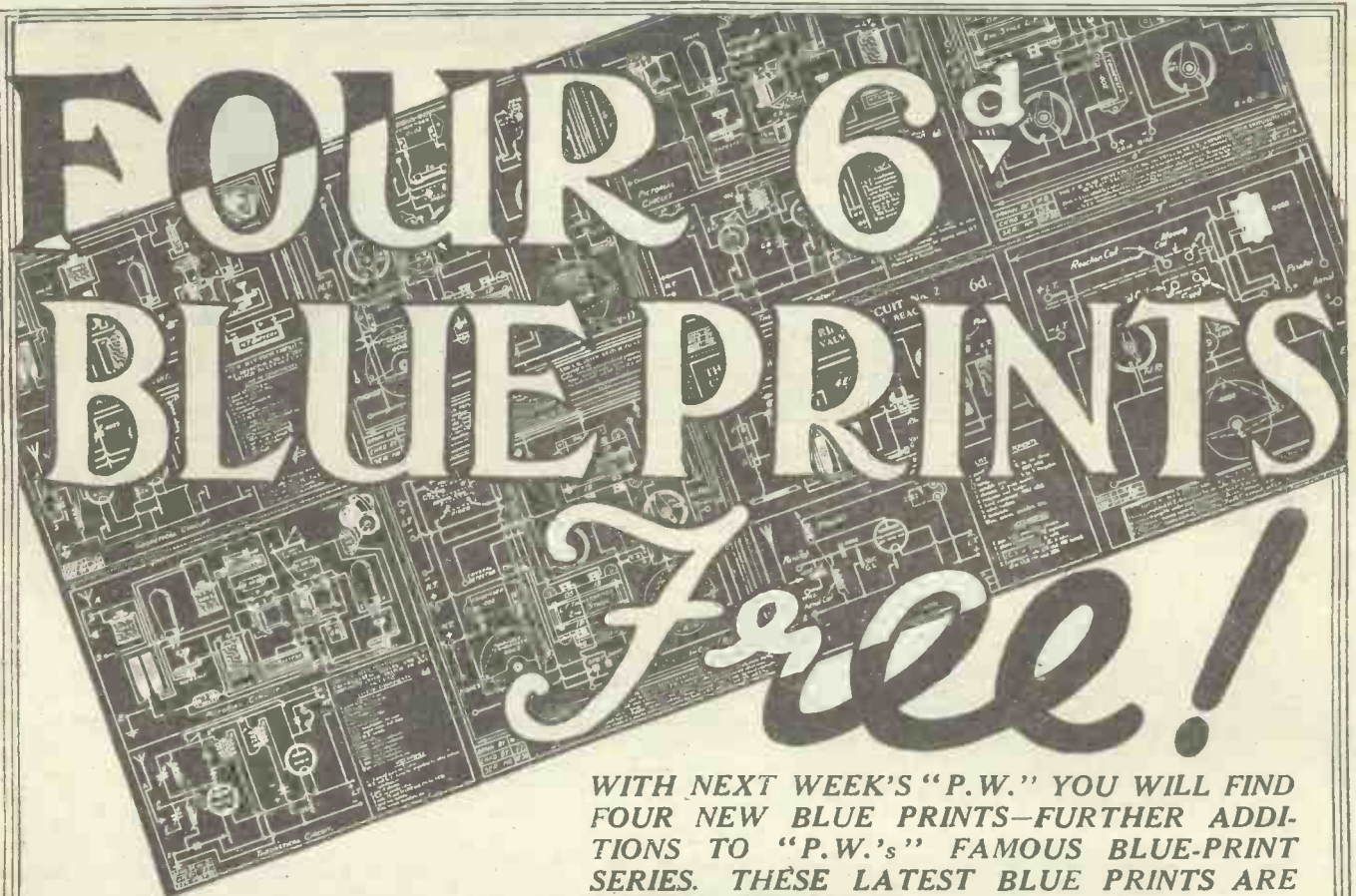
Now a word as to the nature of the relation between the electrons and the ether. You know that ordinary matter, such as a piece of wood or a piece of metal, although it appears solid and impenetrable, is, in fact, a vast collection of molecules or atoms. These are tiny "units" which are much too small to be visible, even under the most powerful microscope, and we are only aware of their general characteristics.

Until a very few years ago it was thought that the atom was the smallest particle of matter which could exist, but recently it has been found that the atom itself is really a kind of small "solar system," consisting of positive and negative "particles" of electricity. The positive electricity is thought to be compressed into a small "nucleus," together with some portion of the negative electricity, whilst the remainder of the negative electricity is represented by a number of flying or "planetary" electrons which are moving around in various orbits. The dimensions of the electron are exceedingly small in comparison to the distance between electrons of the same atomic system, just as the dimensions of a planet may be very small compared to its distance from the sun.

In "Solid" Matter.

The point I want to make clear from all this is that the atom must be regarded not as a solid thing, but as a system which, although it "occupies" a certain space, does not fill that space. A very neat idea to illustrate this is to compare the atom to a swarm of gnats such as you often see dancing about in the air on a summer evening. The swarm "occupies" a space perhaps two or three feet in diameter but if you caught all the gnats and compressed them they would probably occupy a space not more than a fraction of an inch in diameter!

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WITH NEXT WEEK'S "P.W." YOU WILL FIND FOUR NEW BLUE PRINTS—FURTHER ADDITIONS TO "P.W.'s" FAMOUS BLUE-PRINT SERIES. THESE LATEST BLUE PRINTS ARE AS FOLLOWS:—

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No. 38. TWO VALVE L.F. AMPLIFIER—will bring your crystal set up to full loud-speaker strength.

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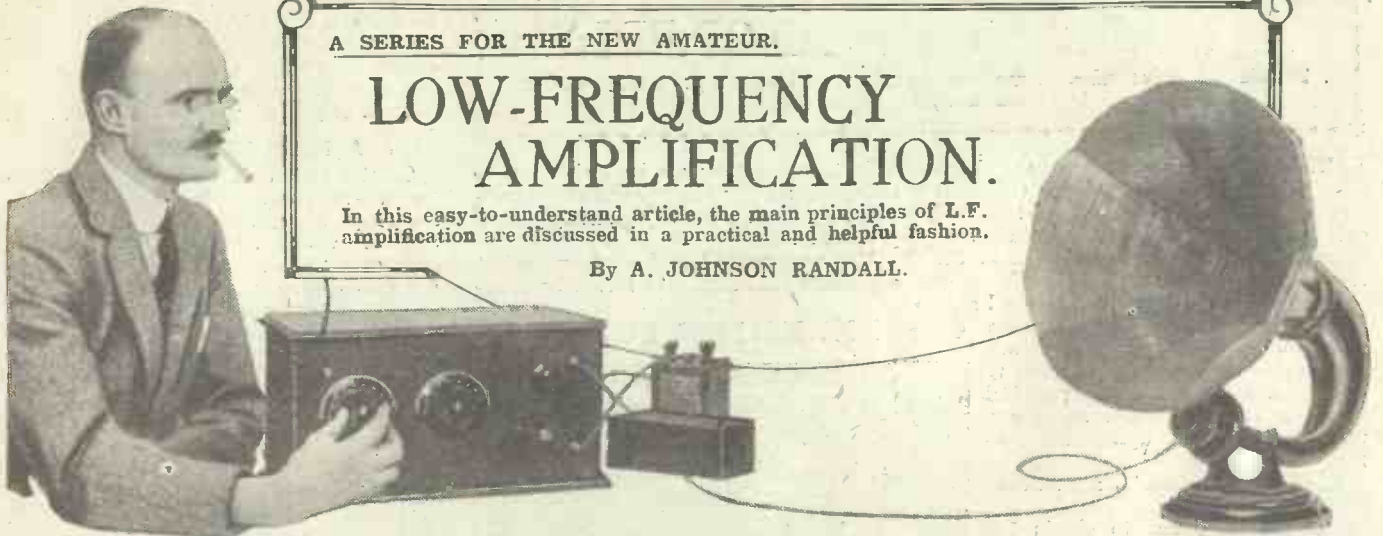
No. 40. The "SUPER-SCREEN" THREE—a last-word three-valver employing many ultra-modern refinements, and capable of long-distance loud-speaker reception. Inexpensive and simple to build—equal to a four-valver of a year ago.

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THE RADIO
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A SERIES FOR THE NEW AMATEUR.

LOW-FREQUENCY AMPLIFICATION.

In this easy-to-understand article, the main principles of L.F. amplification are discussed in a practical and helpful fashion.

By A. JOHNSON RANDALL.

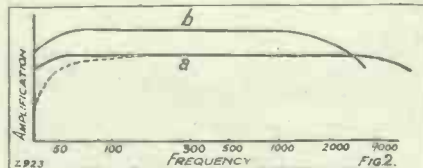
IN my last article I explained how a valve may be used in conjunction with a transformer as a magnifier of wireless signals. In addition to the popular transformer method of amplification there are two other well-tried arrangements. These are resistance-capacity and choke-capacity coupling. Both schemes are very similar but in this article I shall deal only with the former, because once the idea of resistance coupling is grasped the action of an iron-core choke can be explained in a few sentences. As we saw in the last article, with transformer coupling it is possible to obtain with ease a very high degree of amplification.

Resistance Coupling.

You will remember that the signal voltages (this is only another way of indicating the strength of the music or speech) in the plate circuit of the valve were always magnified by the step-up ratio of the transformer.

This characteristic gives the transformer a very distinct advantage from the point of

same high amplification per valve as can be obtained with the transformer method, and it is as well to point out that if an attempt is made to get an equivalent degree of step-up per stage with the aid of a resistance, reproduction will probably suffer.



Curves look awfully uninteresting, don't they? But really there is nothing mysterious about them, as Mr. Johnson Randall explains, and they can be uncommonly helpful in getting good reproduction.

Hence, those who are striving for ideal quality must be content with a moderately small amplification per valve.

The reason for this will become clearer when the principles of resistance coupling have been explained.

In Fig. 1, I have shown a simple circuit consisting of a detector valve having an anode resistance R_1 connected in its plate circuit between H.T. + and the anode of the valve.

Principles.

From the previous explanation of the working of a transformer, you will remember that if we insert a pair of telephones in the place of the resistance signals will be heard. This is due to the small rectified voltages which are set up across the 'phone windings by the process of detection. Now, if we replace the telephones by the resistance R_1 we still get voltages set up across this resistance, in exactly the same way as in the case of the 'phone windings. If these voltages, or if you prefer we will say signals, are applied between the grid and filament of a second valve suitably connected, they will be magnified by the action of the valve, and if a pair of telephones are connected at the point T in

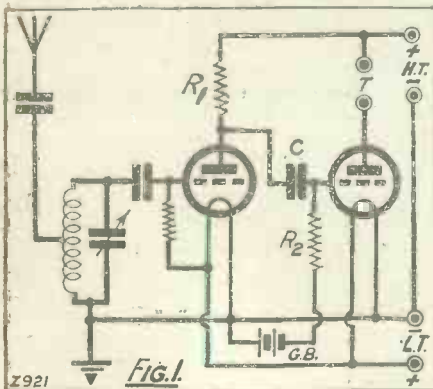
Fig. 1 considerably amplified signals will be heard.

At first glance one might think that all that is necessary is to join the anode of the first valve to the grid of the second, because from the point of view of the wireless signals the H.T. end of the resistance R_1 may be considered as being joined to the filament of the second valve, if one neglects the H.T. battery. Unfortunately, the matter isn't quite so simple as this.

The Coupling Condenser.

A definite H.T. voltage is applied to the anode of the first valve and if we joined this to the grid of the second valve, the steady H.T. voltage would also be applied to the grid. This would prevent the valve from operating, and to stop this it is necessary

(Continued on next page.)

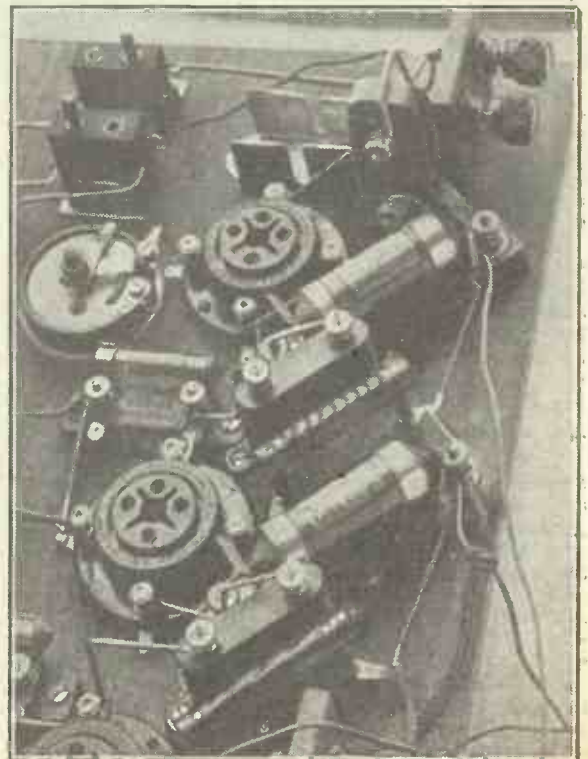


The first valve is the detector, and it is coupled to the second by the resistance-capacity method.

view of magnifying pure and simple. Unfortunately, however, this valuable feature tends to be swamped by its disadvantages from the standpoint of reproduction when more than one stage is employed.

I do not mean to imply that good reproduction cannot be obtained if two transformers are used. This would obviously be untrue.

Resistance coupling does not give the



Simplicity is one advantage of R.C. coupling.

A WIRELESS ENCYCLOPÆDIA.

Details of a sound scheme for keeping radio cuttings handy—and a good hint, to begin with!

RECENTLY, I resolved to spend an evening going through my collection of wireless periodicals, and to retain only those with any particular hint, or information, likely to be required in the future.

But there the trouble started, for I soon found that hardly a single issue did not contain something that I was loath to destroy, and thus I came to the conclusion that the only practical plan was to cut out and retain just the articles, or paragraphs, which were likely to be of use.

In this way was started my Wireless Encyclopædia.

The first step was to obtain five fairly large albums—they cost me one shilling each—and these were labelled respectively, "Coils and Condensers," "Aerials and Earths," "Valves and Batteries," "Constructional Information," and "Miscellaneous."

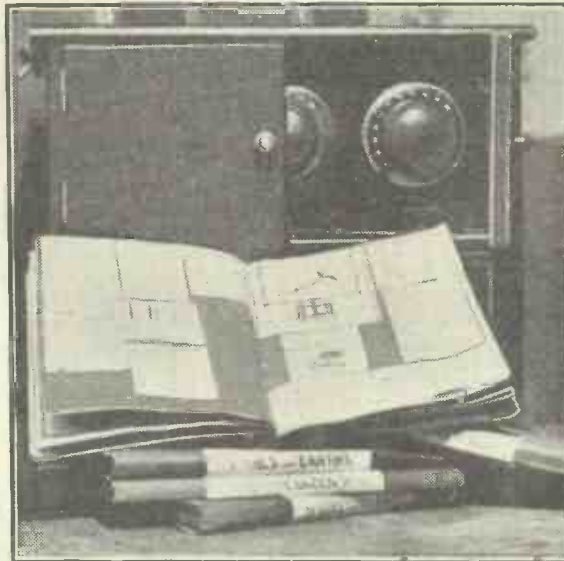
My collection of cuttings was very large, and pasting each into its own appropriate section was a rather laborious proceeding, but it was finished eventually, and I am quite sure that the time taken over it was well spent.

Since then I have always made it a rule to cut out any useful information from my usual periodicals, and paste it into my albums right away.

In this way they are kept right up to date, and already the amount of information they contain is really amazingly comprehensive.

It is very rarely that I come up against a problem that cannot be solved by refer-

FOR KEEPING CUTTINGS.



LOW-FREQUENCY AMPLIFICATION.

(Continued from previous page.)

to insert a fixed condenser, marked C in Fig. 1, between the anode of the first valve and the grid of the second.

The condenser will permit the signals to be applied to the grid, but will stop the steady H.T. current. In overcoming one difficulty we have introduced another. When signals are received the condenser will become charged, and since the accumulation of electrons on the grid cannot leak away, the music or speech will cease after a few moments. It is therefore necessary to insert a grid leak between the grid and filament (or G.B. —), and this is shown as R_2 in Fig. 1.

A Special Advantage.

This is the principle of a resistance amplifier, and the only points of importance are which values of R_1 , C, and R_2 will give the best results in a particular circuit.

Resistance coupling has one special advantage, and that is, it is easy to obtain good quality cheaply and with little risk of failure. On the other hand, the amplification will never be quite equal to that of the valve itself, but if the values are correctly chosen it will be in the neighbourhood of two-thirds of the total magnification obtainable with a given valve. With transformer coupling there is the step-up ratio of the windings to assist in the amplifying, and so,

on the question of signal strength purely, the resistance must give way to the transformer.

Simple Curves.

In a resistance amplifier the amplification of the musical frequencies over most of the available range is constant because the value of the resistance R_1 does not vary with the frequency. The impedance of a transformer primary winding does vary with the frequency, and in consequence it is far more difficult to obtain constant magnification, and therefore faithful reproduction of all musical notes.

Although, ideally, resistance coupling should give us constant amplification of every musical note, in practice perfection is not obtained.

In Fig. 2, I have shown two simple graphs marked *a* and *b*. There is nothing mysterious in these curves. Along the base are marked the common musical frequencies from 50-4,000. The vertical line represents amplification. Now the frequencies above, say, 3,000 give the brilliance to music, and those below about 200 the warmth. The perfect graph would be a straight line parallel to the scale of frequencies, and the dip downwards at either end of the scale merely indicates a falling off in amplification. The greater this falling off the less will be the amplification over that part of the range of musical notes.

Going back again to Fig. 1, let us try to understand in what way the values of R_1 , C, and R_2 can bring about a departure from a perfect straight line graph. Take the anode resistance R_1 . If this could be con-

sidered a pure resistance it would not alter the graph, but in practice there are certain very small capacities, such as valve capacities, capacities between wires, and so on, which are virtually in parallel with R_1 . The effect of these capacities is very small unless in an effort to obtain high amplification R_1 is made large, say, .5 meg. and above. In these circumstances the graph begins to fall off on the higher musical frequencies owing to the by-passing effect of the unwanted capacities, as in curve *b*. The result is that music tends to lose its brilliance, and in bad cases to be muffled or woolly.

Choice of Values.

The values of the coupling condenser C and the grid leak R_2 decide the shape of the lower end of the graph. If C is too small the bass notes will be reduced in strength, or cut out entirely, and the resulting reproduction may sound high pitched. The effect of a fairly small coupling condenser is shown by the dotted line in graph *a*, but this is by no means an extreme case, and in practice this falling off on the bass notes would not be audible on many loud speakers. The value of R_2 will also have an effect upon reproduction, but since it must be considered in relation to C, it would be out of place in an article of this nature to endeavour to explain the exact relations between the coupling condenser and leak. R_2 can be chosen so as to have a value four or five times as great as R_1 , and the value of C can then be determined accordingly.

Graph *a* incidentally is quite a good curve, and would give excellent results with the best of loud speakers.

A PANEL-DRILLING HINT.

Constructors who prefer to see a clean panel, unadorned by bolt-heads and unnecessary holes, will find that, providing one is working on fairly substantial ebonite, a "blind" hole at the back of the panel, tapped to take the required screw or terminal, fills the bill.

The main difficulty is to know how deep to drill, and the following little device will be found to make a very useful stop:

Secure about three-quarters of an inch of stout ebonite tubing, having a bore of roughly quarter of an inch (an old lead-in tube is just the thing) at equal distances round the tube drill, and tap three holes to take 6 B.A. screws. Slip the stop over the drill to be used, and adjust for distance; thus, if quarter-inch ebonite is being used the point of the drill should protrude from the stop slightly over three-sixteenths of an inch. The three screws are then tightened.

The hole can now be drilled in the usual way, until the stop touches the panel. A refinement is to fix a further two screws at the opposite end of the stop, thus making the whole thing practically solid.

This is very easily done, and the time spent in preliminary adjustments is more than regained by the increased speed of drilling.



BE A RADIO MISER

THE IMPULSES your aerial receives from foreign stations are doubly precious because of their weakness. You must arrange your receiver so that none of the energy is lost. You must guard against leakage. You must be miserly in the way you save each minute portion. This means more than using good radio parts—it means using the one make of parts that have been conspicuously notable for their low loss qualities for many years—LISSEN.

ECONOMISES H.T.

By putting a Lissen 2 mfd. Mansbridge Condenser across your H.T. Battery (1 mfd. will do, but larger size is better) you will lengthen its life by 10 per cent.



LISSEN Mansbridge Type Condensers

2 mfd. 3/6 1 mfd. 2/6
Other capacities:
.01 1/9 .25 2/-
.05 1/9 .1 1/9
.025 1/9 .5 2/3
A specially moulded solid insulating case totally encloses each Lissen Mansbridge Type Condenser.

NEVER LEAK OR VARY

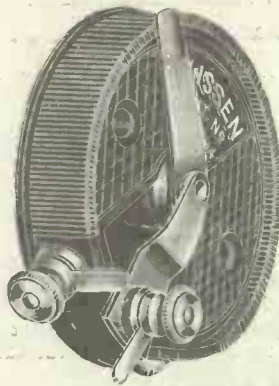
Lissen fixed condensers are accurate to within 5 per cent. of their marked capacities. They never leak, they never vary. Less than a year ago they were being sold at twice the price—and since then they have been still further improved. You can't buy a finer condenser.



LISSEN Fixed Mica Condensers

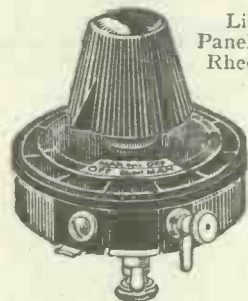
.0001 to .001, 1/- each (much reduced)
.002 to .006, 1/6
A pair of clips is included free with every grid condenser.

NOW COSTS 1/- LESS



The baseboard type of Lissen Resistor is now reduced from 2/6 to 1/6. This type has, of course, no knob; dial or pointer, but is provided with 2 holes for screwing to baseboard, 7 ohms Rheostats; 400 ohms Potentiometer, previously 2/6, NOW 1/6.

ALSO REDUCED

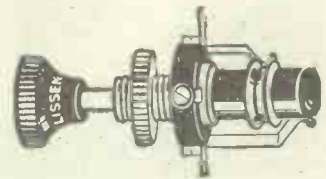


Lissen Panel Type Rheostats

The wires do not loosen, the arm keeps in perfect contact—nothing ever goes wrong.

Rheostats 7 and 35 ohms NOW 2/6
(Previously 4/-)
Potentiometer 400 ohms " 2/6
(Previously 3/6)
Dual Rheostat 35 ohms " 4/6
(Previously 6/-)

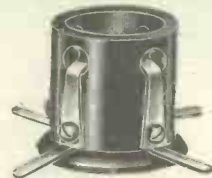
SAVE CURRENT



Energy is often lost at the switch points. These Lissen SWITCHES are designed to prevent energy leaking away while they do their work efficiently. There is one for every switching need—each one is very neat.

Now
LISSEN TWO-WAY SWITCH 1/6
(Previously 2/9)
LISSEN KEY SWITCH .. 1/6
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There is not a square inch of superfluous ebonite in this Lissen Valve Holder. That means low capacity, and therefore stronger, clearer signals. Shown ready for baseboard mounting, but can also be used for panel mounting by bending springs straight. Patented. Previously 1/8. NOW 1/-.

ABSOLUTELY SILENT



Lissen Leaks are absolutely silent in use; their resistances never alter. This was proved some time ago by exposing them to the rain and sun on our factory roof. All resistances. Previously 1/8. NOW 1/-.

WHENEVER RADIO PARTS ARE WANTED—USE LISSEN
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Managing Director: THOMAS N. COLE.

A METAL PANEL FAULT.

By H.J.B.C.

WHENEVER I come across an unusual fault in a wireless receiver I feel it is a good plan to record my experiences so that readers may bear them in mind and profit by the mistakes of others. The fault I was asked to diagnose recently was present in a four-valve receiver of fairly straightforward design. The set had one stage of high-frequency coupling with a split-primary transformer, Reinartz reaction being introduced into the tuned secondary coil connected to the detector valve grid via the usual grid leak and condenser. The detector was followed by two low-frequency stages, transformer and choke-capacity coupling, and the skeleton portion of the circuit in which the trouble was found to exist is shown in Fig. 1.

Inefficient Reaction Control.

The reaction control of the .0003 mfd. condenser was most erratic. The smoothness of reaction generally associated with this type of circuit, was entirely absent, and yet I was assured that the set had been wired up exactly as specified. The routine tests, which are no doubt quite familiar to the readers of this journal, were, however, undertaken in an effort to locate the offending portion, but at first sight everything appeared satisfactory and the components themselves quite above suspicion. It was noticed, however, that an aluminium panel with black frosting had been used, and a moment's thought at once suggested a possible solution.

With the two tuning condensers the moving vanes had been joined to earth through the medium of the metal panel, which, of course, was quite right, and in consequence an insulated bush was not

earthed. A glance at the circuit reveals that the other end of the reaction coil is earthed also and consequently the coil was shorted out. It was therefore not giving any reaction control, and accounted for the peculiar behaviour of the set. By adding an insulated bush and washer to the reaction condenser spindle where it passed through the metal panel and re-connecting, the set at once behaved in a perfectly satisfactory manner.

Anyone desiring to use a metal panel for their receiver, therefore, must pay attention to points such as these or faults of a more serious nature may occur and cause damage to the components.

TRACING FAULTY TELEPHONES.

IF you are uncertain as to whether your 'phones or loud speaker has broken down, carry out the following test without delay: Disconnect from the set and place the tags across a pocket battery, when a click should be heard. In the case of 'phones, try each earpiece separately, as only one may be gone. Having found where the trouble lies, ascertain whether the cords are broken or the windings are damaged, by taking off the cap and applying the same test across the point where the leads make contact inside the earpiece.

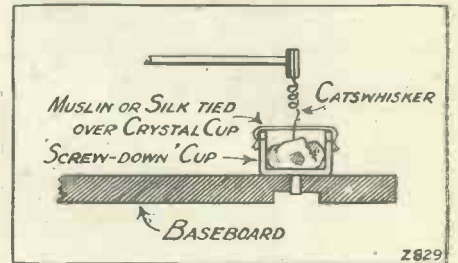
Simple Repairs.

If a click is heard here, but not at the tag ends of the leads, it means that the windings are O.K., but the leads are broken, in which case a new pair of leads are easily attached. New leads, however, are not always necessary, as the break generally occurs where the tag-ends are, and it would, therefore, only be necessary to cut off the tag in question, bare the end of the lead, and secure a new tag. If the windings

STABILISING THE CAT'S-WHISKER.

CONTACT-SLIP in a detector of the usual "cat's-whisker" pattern is an annoying trouble, and it is one which is liable to occur at any time, even with the best of crystal sets. The trouble, however, can be almost entirely eliminated by the procedure illustrated below.

After the crystal has been firmly cemented or screwed down in its cup, tie over the

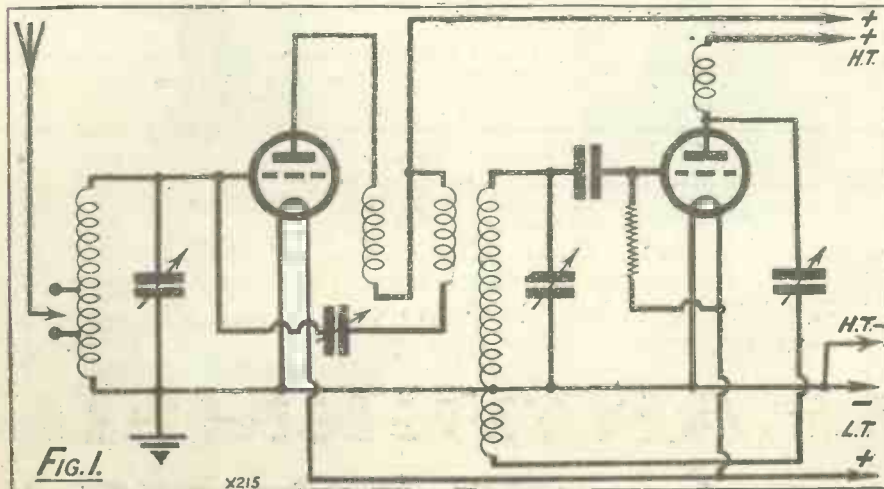


surface of the cup a small scrap of fine silk or muslin. It will be found that the sharp point of the cat's-whisker will be able to penetrate through the pores of the silk or muslin, with the result that a perfect electrical and rectifying contact will be made.

An Additional Advantage.

The presence of the silk or muslin will prevent any medium degree of vibration to which the set may be subjected from throwing the sensitive contact out of adjustment. Moreover, as the fabric will remain permanently over the crystal cup, the crystal will continually be maintained in a dust-free condition. Hence its sensitive qualities will be retained over a much longer period than is usually the case.

The muslin or silk stunt constitutes a useful and an extraordinarily efficient little idea, and it is well worth a trial by any crystal amateur who pins his faith to the use of the cat's-whisker rectifying contact.



necessary to separate each condenser spindle from the panel. But the insulated bush had also been omitted in the case of the reaction condenser, with the result that the moving vanes and hence the condenser end of the reaction coil were

are gone, it is best to send the earpiece out for repair, as this process is not a simple one, although wound magnets may be obtained. The magnet used, however, must be of a corresponding ohmic resistance to the one already in use H.B.

FACTS WORTH NOTING.

If the length of your aerial is 35 ft. or more, a single wire will generally give rather better results than two wires.

Where the aerial lead is connected straight to the grid circuit or to the crystal the use of a centre-tapped aerial coil will improve selectivity.

Although the grid-bias battery does not supply current to the set it deteriorates in time, and should not be expected to last more than six months or so.

Steady knocking or popping noises in the set are generally due to a grid leak of too high a value.

You can use the Lissen Transformer as a choke

by making this one simple connexion



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NCC 304

The Future of the Four-Electrode Valve



The advent of the screened-grid valve has brought the tetrode into prominence once more. An informative article
By J. ENGLISH.

ALTHOUGH valves with two grids have been manufactured and used for several years now, they have never become very popular in this country. The only circuits using a four-electrode valve which have achieved any degree of popularity are the Unidyne and its modifications. These high-tensionless circuits, invented and developed by Messrs. Dowding & Rogers, were perhaps the first real practical application of four-electrode or tetrode valves. Apart from the widespread interest aroused when first made public, the Unidyne circuit showed that the three-electrode or triode was not the last word in the development of valves.

While tetrode circuits and receivers have been sadly neglected by British amateurs, commercial firms and independent inventors have been very busy for several years

development of H.F. amplifiers, super-heterodynes and high mu valves that amateurs could not readily spare time for experiment with circuits using inefficient four-electrode valves

Until quite recently, no special types of tetrodes were available. There were no such things as special H.F. and L.F. valves, and the tetrode was in very much the same position that the triode occupied some three or four years ago. Many of you will remember when there was only one type, the general-purpose valve, available. This, like the four-electrode, consumed an enormous L.T. current relative to the modern valve, while its efficiency was not high.

Important Developments.

Even the Unidyne when first introduced was handicapped by the then available types of tetrode valves, which were often rather uncertain in their operation. Therefore we can safely conclude, I think, that the development of amateur experimental work with tetrodes has been retarded not so much by lack of knowledge of their applications as the lack of proper valves at reasonable prices with which to carry them out.

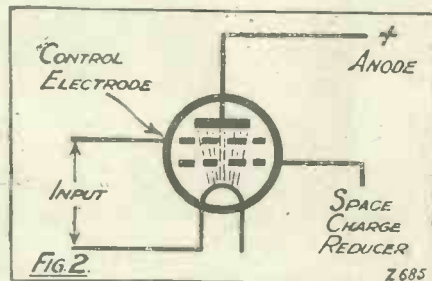
At last the four-electrode valve is getting into its stride and quite recently new types

of remarkable efficiency have been produced. Developments on the theoretical side are leading to the manufacture of tetrodes which rival in efficiency all the special types of triodes we now possess. In fact these new tetrodes will be so efficient in current consumption and amplifying capabilities that the ordinary valve will have to look to its laurels. It is the considered opinion of many serious workers that these new tetrodes

will eventually oust the ordinary valve, except for a few special types, because they will go far to solve the two great problems of radio operation, H.T. supply and H.F. amplification.

Effect of Two Grids.

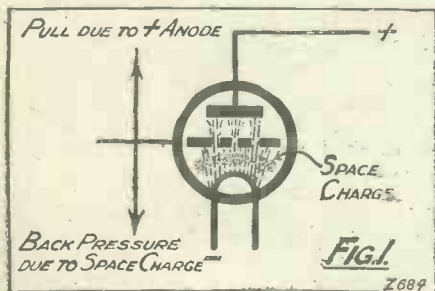
Before considering in detail the new types of four-electrode valves, their great advantages and possibilities, we cannot do



better than examine, quite briefly, the operation of the triode valve and in what respects the tetrode differs.

When a valve is in operation either as detector or amplifier, particularly the latter, a cloud of electrons always collects between the grid and filament, constituting what is usually known as the "space charge." (See Fig. 1.) This negative space charge

(Continued on next page.)



developing new valves and new circuits. Both in England and America a surprising number of tetrode circuits have been patented. On the Continent tetrode valves are widely used, and they have been for some time more readily available abroad than on this side.

Lack of Supplies,

Undoubtedly the reason why tetrode valves have not been more widely used in this country was the lack of suitable valves, without which receivers more attractive than those using ordinary valves could not be designed and constructed. Moreover, so much of our attention has been taken up in the last year or two by the remarkable

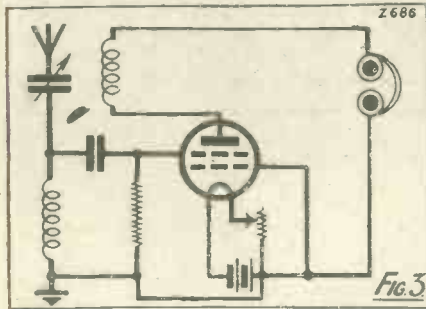


The most popular of four-electrode valve receivers—a two-valve Unidyne.

THE FUTURE OF THE FOUR-ELECTRODE VALVE.

(Continued from previous page.)

tends to limit the anode current since it impedes the flow of electrons from filament to the positive anode. Therefore it requires a high anode voltage, even with the generous filament emission of a power valve, to get sufficient anode current to provide a good, straight working characteristic for the operation of a loud speaker without dis-



ortion. This is mainly the reason why the best loud-speaker results with power and super-power valves can only be obtained with anode potentials exceeding 300 volts.

Now, in the Filadyne circuit, the effect of using the grid as the positive "anode" is to mop up the space charge, because the highly positive grid is much nearer to the filament than the anode and readily attracts the swarm of electrons from the space cloud. Hence the large "anode" current. This is necessary for loud-speaker results which the Filadyne one-valver is capable of giving under suitable conditions.

Overcoming the Space Charge.

It is more important in connection with four-electrode valves, however, to notice the effect of this positive grid on the real anode current. As I have shown in a previous article on the Filadyne, quite a small positive anode voltage gives rise to a large anode current, many times the normal value for the same anode potential. This is

because the positive grid, by dispersing the space charge helps the electrons across to the plate.

The action of the second grid in the tetrode is very similar in effect. The grid nearest the filament is given a small positive potential which partially dissipates the space charge, allowing a large current to flow from filament to anode for a relatively small positive potential on the latter. This anode current is then controlled by the outer grid in the same way as the single grid controls the anode current in the ordinary valve. (See Fig. 2.)

Enables Low H.T. Voltage.

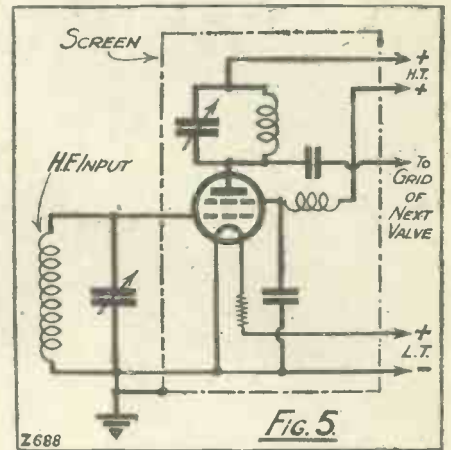
This is the simplest or primary function of the second grid, that of reducing the space charge so that only small anode potentials are required. On this principle was based the development of the high-tensionless Unidyne circuits. (See Fig. 3.) By using modern tetrodes specially designed for L.F. amplification it is easily possible to get remarkably full and distortionless loud-speaker volume with only 40 volts H.T. For the same results using a triode one would require a super-power valve with not less than 120 volts H.T. Of course, for these results with tetrodes filament emission must be high, as in the super-power valve, and until recently four electrode valves with such filament emissions were not made.

Now the employment of these valves as super L.F. amplifiers on low anode voltages is not the only use to which they may be put. In fact, in the light of recent investigations, this use is of secondary importance. As we shall see later, perhaps the most striking advance in radio technique arises from the employment of tetrodes as H.F. amplifiers.

The fact that the tetrode has two grids suggests at once the possibility of its use in reflex and dual circuits. As it can combine in one the functions of two separate three-electrode valves, its flexibility in a dual circuit will naturally be greater than that of an ordinary valve. The advantages of four-electrode valves operating simultaneously as detector and H.F. or H.F. and L.F. amplifiers were realised years ago, and most of the early circuits are of a dual or reflex nature. In the past, dual circuits with triode valves have given very good results; witness the craze for such circuits some two or three years ago. The triode, however, can only perform satisfactorily one function at a time. The tetrode is not so limited, and the great possibilities in this direction of these valves

are only just beginning to be realised. When the new tetrodes are readily available, dual circuits and receivers giving remarkable results will once more become popular.

We now come to a most important application of the four-electrode valve which has only been developed within the



last year or so. The greatest bugbear of the triode valve is the inherent internal capacity between its electrodes which is responsible for more than half our troubles with H.F. amplifiers. This inter-electrode capacity, acting as a coupling between input and output circuits, produces feedback and oscillation when the circuits are brought into tune. In order to get a respectable degree of stable H.F. amplification it is necessary to use such devices as neutrodyning which, by balancing out the internal valve capacity by means of an external circuit, overcomes this instability. Hence the rather complicated design of modern H.F. stages.

Will Revolutionise Future Sets.

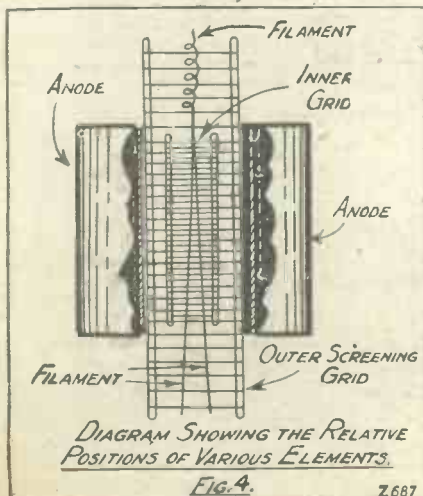
Now it has been found that the outer grid of a four-electrode valve can be used as an electrostatic shield, thus almost entirely eliminating internally the capacity coupling between the output electrode, the anode, and the input or control electrode, the inner grid. This outer grid acts in much the same way as the familiar metal screen which, when placed between the two tuning coils of an H.F. stage, eliminates all external stray capacity between the two circuits. (Fig. 4.)

The use of the second grid as an internal electrostatic shield is an extremely important development which has given rise to the production of special "screened-grid" valves in which the second grid is specially designed to be most effective. (See Fig. 5.) With such valves no trouble is experienced from instability due to inter-electrode capacity, while more important still an hitherto unbelievable degree of amplification is obtainable.

A glimpse into the future reveals to the optimist something of the lines on which new receivers may develop. Imagine a three-valve receiver, H.F., detector and L.F., with a tetrode in each stage. This receiver will give enormous H.F. amplification, the rectifying valve being reflexed, and the last having a full loud-speaker output all on much less than 100 volts H.T. Who said that wireless had reached its zenith?



A two-grid valve in use as an L.F. amplifier.



The "Lo-Cost" Crystal Set

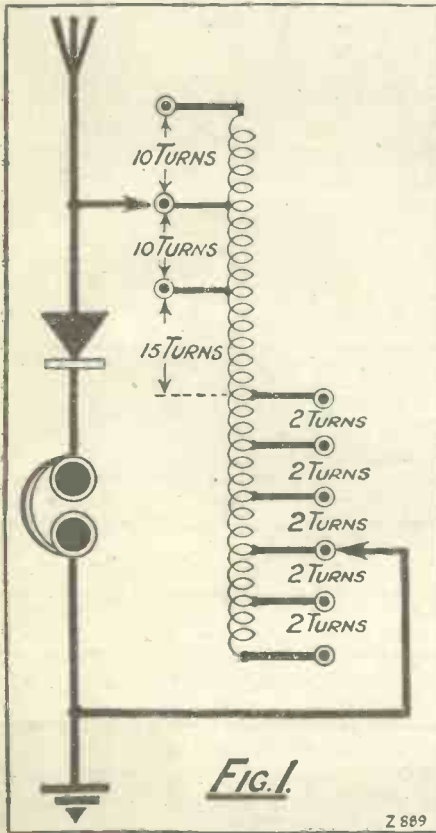
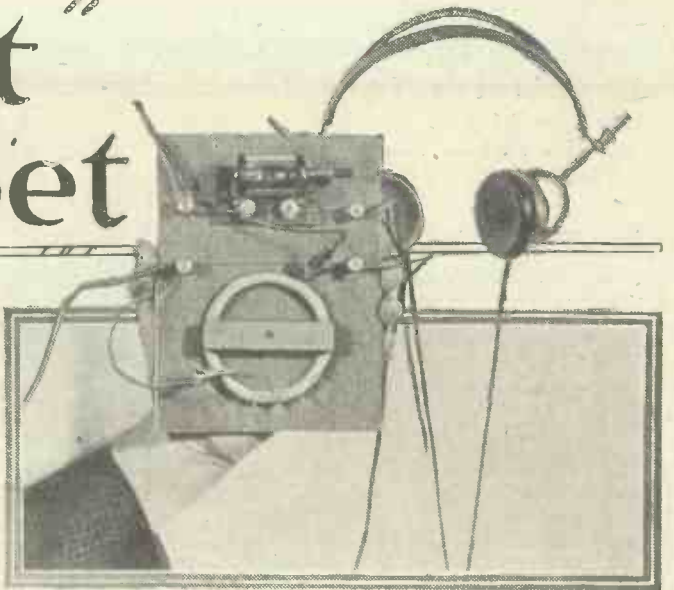
Despite the extreme simplicity and inexpensiveness of the construction of this little receiver it gives a degree of sensitivity of the highest order. Designed, built and described by the "P.W." Research and Construction Department.

ONE of the greatest mistakes which the wireless beginner can make is to think that he can decide at the very outset just what kind of receiver he really wants, choose a suitable design, build it,

another one in the near future. True, he gains valuable experience and, no doubt, has an interesting time with the constructional work, but it is an expensive business, and no one likes to waste cash on a mistake. Very much better is the procedure generally adopted by the older hand, which is to fix up a rough "lash up" in quite a crude form on a bit of board and see whether it gives the particular kind of results he wants, making up a finished job later when he has made up his mind. This scheme is to be specially recommended to the absolute beginner who has not yet really decided exactly what he wants in the way of choice of programmes, 'phones or loud speaker, and so on.

Simple and Cheap.

This article has been prepared specially to help the beginner who is inclined to think that a crystal set will serve his purpose but does not know quite what sort he needs, whether to make a very simple one for the local station only, or to aim at an alternative programme from 5 GB or 5 X X, and so on, all questions very hard to settle without actually listening in for a while and gaining a little practical experience, preferably as cheaply and easily as possible. What we have tried to do is to show how a really ultra-simple and cheap crystal set can be improvised for the purpose, with an expenditure of as little as half-a-crown and perhaps half an hour's work, yet giving really good, clear signals from the local station (up to about 15 miles on an average outdoor aerial).



If you like, of course, you can quite well regard it as a final set, and very likely many constructors will do so when they find how amusing it is to get results equal to those of many a more elaborate set from so simple a little contrivance. Incidentally,

ALL YOU NEED !

- 1 Baseboard, 6 in. x 8 in.
- 1 Crystal detector.
- 4 Terminals.
- 2 Tapping clips.
- 1 lb. No. 24 D.C.C. wire.
- A little wire for wiring up, a small piece of wood to hold the coil down, and some screws.

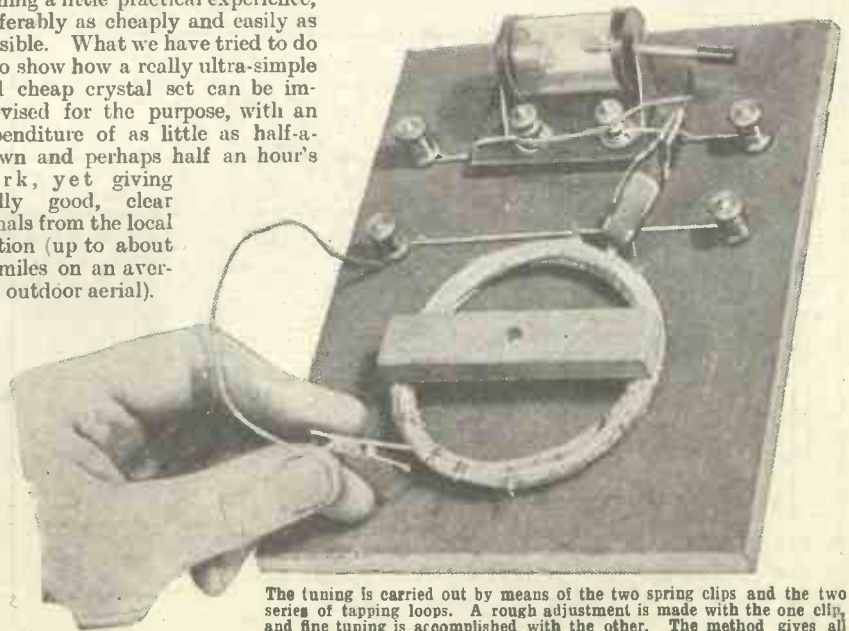
it is a most suitable little gadget for meeting those numerous odd demands for any sort of a set to fill a gap when batteries are being charged, larger sets taken to pieces, and so on, or when friends or relations demand a set for some special occasion and expect

(Continued on next page.)

and then live happily ever after. As a matter of fact, it is scarcely ever possible to decide without a little experience of actual listening exactly what is needed to meet individual programme requirements, to suit particular conditions as regards strength of signals, selectivity, and so on.

A Wasteful Method.

What happens all too often is that the novice makes up his mind that he wants certain things, and proceeds to choose and build some quite elaborate design, only to find after using it for a while that he really requires something rather different to satisfy him for long, and so he must build



The tuning is carried out by means of the two spring clips and the two series of tapping loops. A rough adjustment is made with the one clip, and fine tuning is accomplished with the other. The method gives all the tuning control necessary for the loudest possible results.

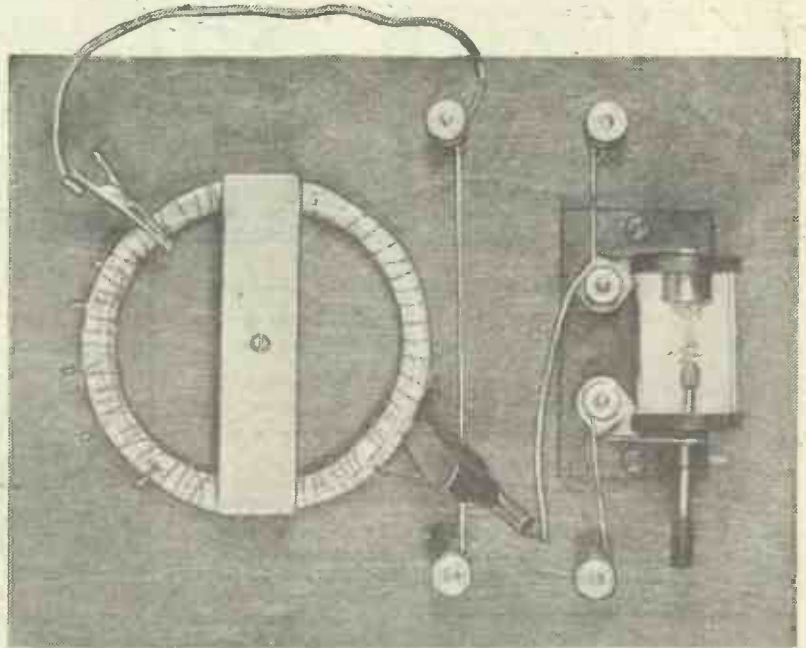
THE
"LO-COST" CRYSTAL SET.

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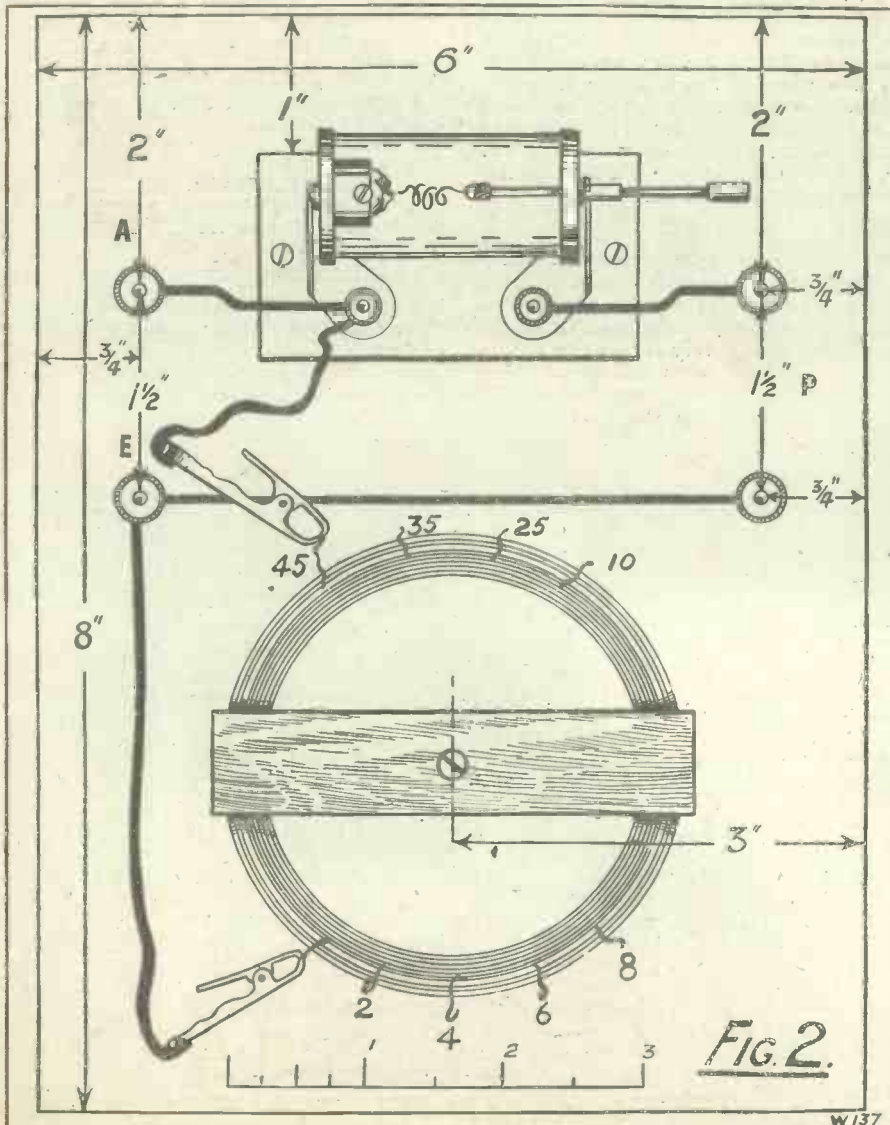
you, as the nearest wireless authority, to fix up something quickly: it is always entertaining to observe their expressions of incredulity when they find that such an unimpressive little outfit not merely works, but works well. (Remember that if you are fairly close to a local station a very crude aerial of the "clothes-line" variety will do quite well at a pinch.)

Making a Start.

We will not waste time over the details of the circuit employed in the "Lo-cost" receiver, because it is about as simple as it can be, but will get straight on to the constructional work. You will want, first of all, a piece of dry wood, about 6 in. by 8 in., about $\frac{3}{8}$ or $\frac{1}{2}$ -in. thick, and on this the crystal detector, 4 terminals, and tuning coil are to be mounted, as the diagrams and photos show. Any cheap detector will do, and one of the simple type mounted on a little piece of ebonite with a crystal cup and



If you compare this photo with the wiring diagram when building the set you should not be liable to confuse any one of the few simple connections.



cat's-whisker can be bought for a shilling or thereabouts.

The four terminals are for aerial and earth and 'phones, and these are of the ordinary small brass type, costing a few pence only. If you want to make a neat job you can recess the nuts into the underside of the wood and cut the shanks off close with a metal saw, so that the set will sit evenly on the table, but you can equally well leave them projecting underneath to act as feet. No harm will result so long as the set is not placed on a metal surface, or a damp one. It will be quite O.K. standing on a table.

The coil is the only item calling for any detailed explanation. It is of the "hank" type, which means that it is simply a roughly coiled-up hank of wire with a diameter of about $3\frac{1}{2}$ in. This is not by any means so inefficient a kind of inductance as you might think, and is quite good enough for our present purpose. It is very simply made by taking a small quantity ($\frac{1}{4}$ lb. is ample) of No. 24 D.C.C. wire, and proceeding to wind it round a small jug, jam jar, or other round object of suitable size, or even round the spread fingers of your left hand. This latter method does not produce a perfectly circular hank, but you can soon squeeze it to shape when finished.

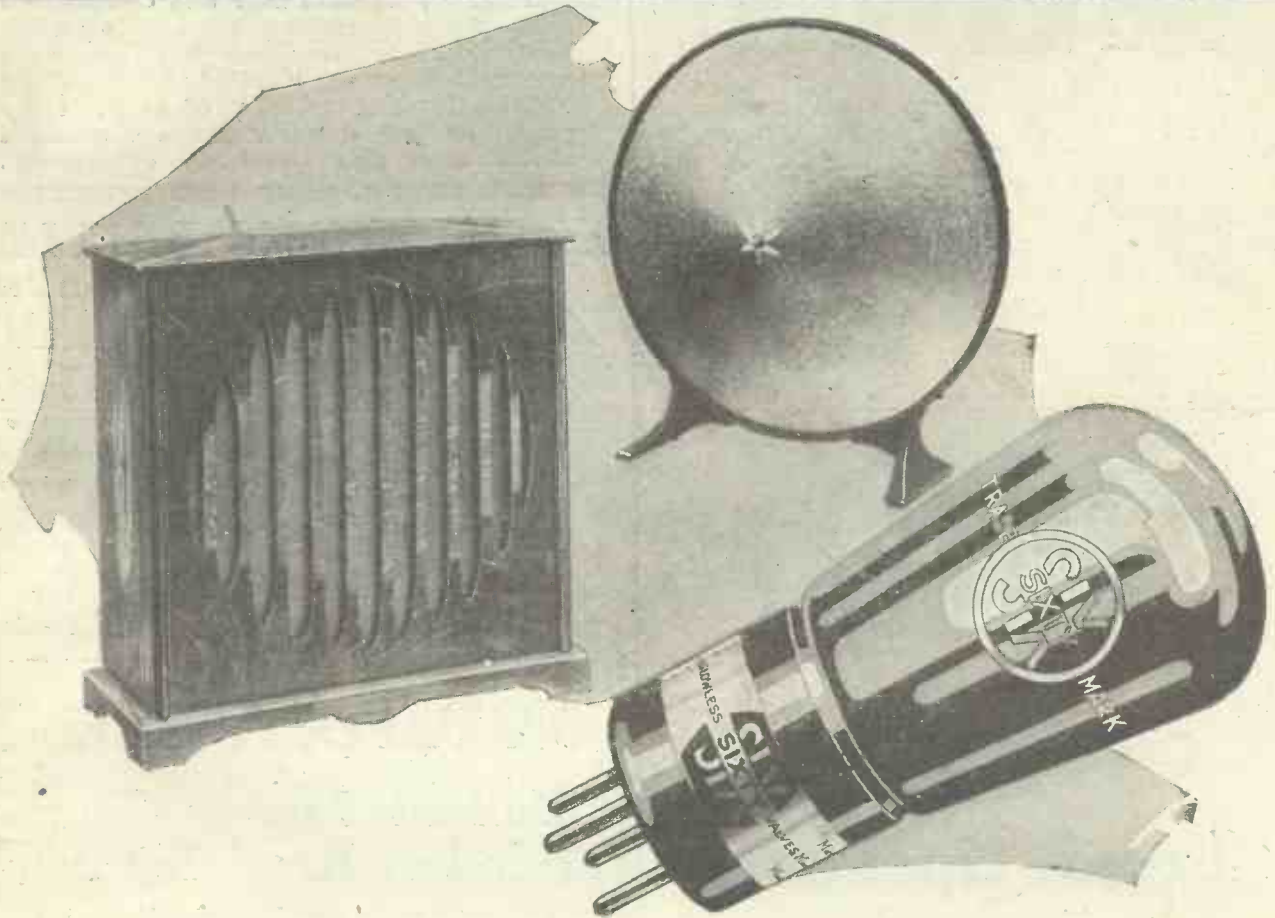
The Tappings.

As you wind the coil you must make some tapping points for tuning purposes, and this is done as follows: First wind on 10 turns, then twist up a small loop in the wire, and carry on winding. When you have put on another 10 turns, make another loop, and see that it comes about an inch further round the coil, that is, about an inch away from the first tapping.

Now wind on another 15 turns and make another loop, again placing it about an inch round the coil from the last one. Next put on two turns and make a loop, this time with a larger space from the last tapping point, so that you will be able to tell which is which later. Now put on two

(Continued on page 1072.)

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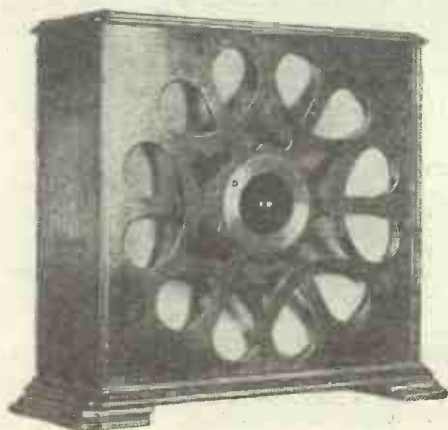
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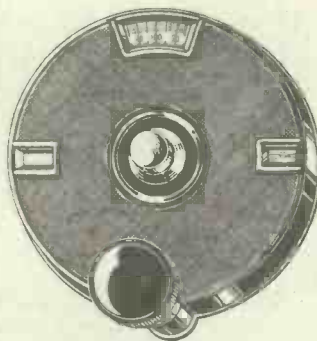
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WE make no apology for once more referring to the Washington Conference. Although that Conference, from the amateur point of view, was chiefly important because of the recommendations made with regard to the status and working conditions of the transmitting amateur, certain things happened which should clearly concern the non-transmitting amateur.

And, in this country alone, there are at least a quarter of a million non-transmitting amateurs compared with a bare twelve hundred transmitting amateurs.

As is well known now, Mr. K. B. Warner, of the American Radio Relay League, was asked by the Radio Society of Great Britain to represent the interests of British amateurs, and Mr. Warner, together with the Vice-President of the A.R.R.L., Mr. Charles H. Stewart, attended the Washington Conference, and, with the support of the American Delegation, managed to secure the acceptance of certain clearly-defined conditions of working for the transmitting amateur.

Our readers will remember that in a recent editorial we quoted Mr. Warner from "Q.S.T.", in which he explained how, when in Canada, he met the advance guard of the British Delegation—chiefly consisting of officials of the Post Office—and was amazed to find their abysmal ignorance on matters relating to amateur wireless workers, not only in this country but in other countries.

Mr. Warner paid a back-handed compliment to the Delegation when he stated that they seemed very glad to learn something about amateur work there, and that then he found them sympathetic and most attentive.

In the January issue of "Q.S.T." Mr. Warner has a long and interesting article, in which he deals with the amateur and the Conference at Washington, and the part he and Mr. Stewart played—and a big part it was, too—in getting recognition for the amateur transmitter. In one part of his editorial Mr. Warner writes as follows:

"Bitter Opponents."

"This seems the proper place, too, to retract the hymns of praise we sang in a recent editorial about the remarkable friendliness and open-mindedness of the British Delegation, as judged from a first impression at Ottawa. We regret that we must alter our opinion of them. The leaders of the opposition, they were the amateurs' most bitter opponents, and unremittantly and relentlessly they pursued us and hacked at us in every committee. The British are said to be the best negotiators on earth. We presume that from their standpoint they may feel that they did a good job at Washington. For our part, we offer our apologies to the British amateurs for our inference that they didn't know their own officials."

It is not possible here to give even a précis of Mr. Warner's full article, but any

NOBODY LOVES THE AMATEUR.

In this article the R.S.G.B. is asked to recast itself into a society capable of representing strongly the interests of amateurs in this country.

By THE EDITOR.

amateur who reads it will come to the inevitable conclusion that the British Official Delegation, headed in this particular instance by Mr. E. H. Shaughnessy, Assistant Chief Engineer of the British Post Office, went to Washington with the fixed idea of settling the amateur's hash once and for all.

That Mr. Shaughnessy and his colleagues did not succeed was not for want of trying, and amateur radio transmitters, not only in this country but in every other country in the world where the great game is played, should send up a vote of thanks to their radio deity for the staunch and devoted work done by Mr. Warner, and the American Delegation in general, in counteracting the heartless proposals and the callous indifference exhibited by the British Delegation to the justifiable requests of the radio amateur.

Multitude of Restrictions.

There is no doubt about it; the amateur radio movement, except in America and possibly New Zealand, Australia and Italy, has many enemies. Even the Canadian Delegate tried to put a spoke in the wheel of the amateur, but it was not until dozens of committee meetings had been held, and until the other delegates realised that America was going to back up the amateur movement, that a satisfactory conclusion

wave-length bands for home work, for experimentation, daylight DX work, but a rather restricted band for international night work. The power of amateur transmitting stations to be fixed by every nation. Each nation is free to permit or prohibit amateurs as it desires; each nation free to withhold from amateurs any or all of the wave-length bands. International amateur message traffic forbidden, except by special arrangements between nations. New system of amateur calls to be instituted indicating nationality. Convention effective January 1st, 1929.

Reorganisation Required.

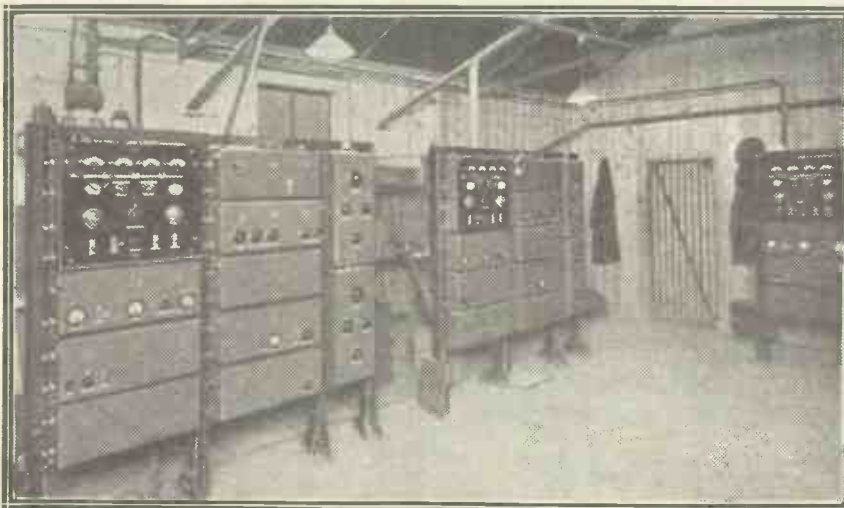
It is quite likely that the recommendations made by the Washington Conference with regard to the amateur will be further impeded by the Post Office officials over here, and that every endeavour will be made to prevent and restrict the amateur, despite the agreements reached at the Washington Conference, because, as our readers will see, there is a clause which allows every nation the right to prohibit amateur work in certain ways if it so desires.

But what is the reason for all this vindictiveness against the amateur; It cannot be said that the amateur has proved himself a nuisance, nor can it be said that he has within the last few years, at any rate, failed to justify his existence. When some time ago the amateur was kicked down to the lower wave bands where, in the opinion of officialdom, he could play about to his heart's content without being in anybody's way, the amateur settled himself down and soon made the best of a bad job, developing and experimenting with short-wave systems until officialdom woke up and found that, instead of being kicked into outer darkness, the amateur had been kicked into a rich and virgin field which he was exploring and developing in a way which soon made it extremely valuable.

At the Washington Conference the British Delegates defended these short-wave bands and wanted to keep them exclusively for official uses. In other words, they attempted to take away from the amateur that which they had given him almost in contempt some time ago, but which the amateur, through his own hard work, had rendered valuable by intensive research work.

Well, we know where we are now, and the amateurs in this country, although few in number, should once again realise what a hopeless position they will continue to be

in until they can show a united front. The Radio Society of Great Britain could help here, and we once again earnestly ask it to reconsider its present conservative and old-fashioned attitude, and, for the good of the amateur radio movement, put itself in the melting pot and recast itself into a society which can show a front against which the malice of officialdom will pit its ugly head in vain.



This is the temporary receiving room at the Somerton beam receiving station. The two large panel groups are the receivers in use for the New York and Rio de Janeiro services.

to the discussions in connection with amateur radio was arrived at.

It may be said that, as a result of the Washington Conference, the following has been achieved from the amateur point of view:

Recognition of amateur radio. Amateur transmitting bands near 160, 80, 40, 20, 10 and 5 metres. Amateurs of every country in the same wave-length bands. Ample

OUR EXCLUSIVE R.S.G.B.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read with interest your editorial in the issue of December 3rd, 1927, re the R.S.G.B. and Q.S.T., and have reason to endorse fully your remark that "undue emphasis has been laid on the amateur transmitter, etc."

I have been dabbling in wireless for a considerable number of years, both in peace and war. I have been a member of the Bengal and Madras Radio Clubs from their early days until the recent winding up of both. I have for the last four years been in frequent communication with the Indian Press with letters and articles, endeavouring in one way or another to foster interest in wireless, broadcasting, etc. I have my own transmitting licence—2 K V—and was transmitting a good deal last cold weather. My name is known over most part of India as a "wireless expert" (this is other people's term, not my own!). A short while ago, seeing a notice to the effect that the Radio Society of Great Britain were anxious to increase their membership, I wrote to them for an application form. This I duly received and filled in, sending along with it two letters, one from

Eric Dunstan, Esq., General Manager of the Indian Broadcasting Co., and the other from

V. Bulow, Esq., Chief Engineer of the same Co., testifying to my technical ability and what services I had rendered to wireless in India.

To my surprise, I received, in due course, a letter from the Secretary, informing me that I had been elected an Associate Member of the Society!

I wrote back thanking the Council for the honour they had conferred upon me, but regretting that my position in the electrical engineering profession in India rendered it impossible for me to accept a position in the Society as an Associate Member only.

Apparently wireless amateurs in the distant parts of the Empire are regarded as very "small fish" and only, at the best, among the second-rate enthusiasts in amateur wireless!

This letter is not intended necessarily for publication, but if you do so, kindly omit name, and let me sign myself,

Yours faithfully,

"SMALL FISH."

Kilpauk, Madras.

CRYSTAL L.S. RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—I must first thank you for publishing my letter relating to the "Crystal Loud-Speaker Circuit," and since it has caused some anxiety among my fellow-readers, I take the liberty to reply to their criticisms.

In the first place, I thank Mr. Webb for pointing out the fact that seven times thirty are 210 ft., not as I said, 240 ft. But I fail to see how this affects my theory.

Secondly, I will consider Mr. R. Jones's letter. He states rightly, that the time taken to travel the given distance is $\frac{1}{4,092,000}$ second (for 240 ft.). Now, assuming a 350-metre wave as being used in the system, 210 ft. represents $\frac{210}{350 \times 3.2808} = .183$ of a wave-length. In cycles 350 metres = $\frac{30,000,000}{35} = 856,000$ cycles per sec.

He then goes on to say that this time is "the difference between the applied D.C. fluctuation," and fails to state the other factor ("difference between"). Again, I fail to see what the handling of frequencies above 10,000 p.p.s. has anything to do with phase difference, and, at the same time, I might mention that if these frequencies could be handled they could hardly be audible. Lastly, I cannot see how I have confused H.F. with D.C.

Now, I have something to say to Mr. Webb. We are both satisfied on point 1.

2. In a radio transmitting aerial the audio frequencies are super-imposed on the radio frequencies by the process of modulation. The R.F. is constant and continuous, and A.F. causes differences in amplitude. The set is tuned to the R.F., and the process of rectification separates the frequencies, one being audible. When I said that the time interval is comparatively large, I was referring to the speed of 186,000 m.p.s. Assuming that all the aeriels are tuned sharply to 350 metres, they will all receive the same signal in order of distance, i.e. the nearest aerial will receive it first and the furthest last. The audible waves (in 'phones) travel at a very slow speed (comparatively), and the first aerial will rectify at a quicker time than the last, since it will take longer for the audible sounds to build up.

3. My small diagram was meant to show the condition of the aeriels when tuned to the same frequency, and by leaving out the bottom half of the cycle we get the rectified or the uni-directional pulsating current. Now, if the waves (rectified) started and fell at the same time the effect would be cumulative, but only under the following conditions:

- The terminal voltage across each secondary should be the same.
- The phase must be the same.
- The frequency must be the same. (This is so.)

Thus we get a synchronising system. All crystals do not pass the same amount of current and, therefore, assuming all transformer primaries and secondaries to be identical, the primary voltage will not be the same (from Ohm's Law, using impedance Z

CORRESPONDENCE.

OUR EXCLUSIVE R.S.G.B.

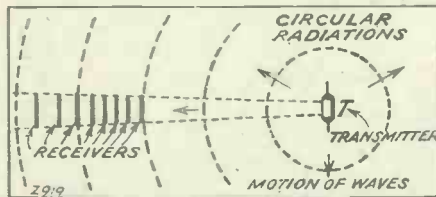
CRYSTAL L.S. RESULTS—AUSTRALIA
"COMES OVER."

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.

instead of resistance R, i.e. $E = Z.I$.) By transformer phasing, I mean that the secondary voltages will rise and fall at the same time, i.e. all windings should be in the same direction. Therefore, since the primaries are not in phase, the secondaries will not be.

If the aeriels could be arranged to receive signals at the same time, as suggested, and the rest of the apparatus identical in all respects (following the above-mentioned conditions), the system should produce a cumulative effect on the rectified current. The ratio of all the transformers should be the same, in order to obtain a common secondary voltage, and will depend upon the current necessary to operate the L.S. It should be noted that I have not mentioned anything about losses, but the practice will tell us whose theory is correct.

Thirdly, or rather finally, Mr. H. V. Small says that, "ordinary everyday transmission is broadcast," but I do not know any other transmission except beam which is not broadcast. In any case, only a small portion of waves can hit the aeriels, i.e. if the aeriels are parallel to the transmitting aerial, only a small part of the circle will hit them.



The above sketch indicates my meaning. Hoping that I have not been too long-winded and that the above will interest you. Also wishing the crystal research worker the best of luck.

Yours faithfully,

S. GOLDSTEIN,
Stud. I.E.E.

Stoke Newington, N.16.

INTERESTING RADIO
FACTS.

Unless very wide spacings have been allowed for a cylindrical screening box this will alter the "wave-length" of a coil which it surrounds.

The first European amateur to communicate direct to the United States was M. Leon Deloy, of Nice, who succeeded in two-way working with American amateurs in 1923. (The first British amateur to communicate with America was Mr. Partridge of Wimbledon, 2 K F.)

A visual indication of distortion in the output of a receiver can be obtained by connecting a milliammeter in the plate circuit of the last valve.

Telephone earpads which have been worn by an invalid can be completely sterilised by immersion in a weak solution of hydrogen-peroxide, or a very weak solution of potassium permanganate.

A LETTER FROM MR. GERALD MARCUSE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been receiving a good many reports from listeners in this country on my transmissions, and, while I fully appreciate them, I would like to point out that the object of my short-wave telephony tests are primarily for the benefit of the distant parts of the British Empire.

Owing to the extraordinary interest shown by those enthusiasts across the seas, I receive huge mails from all parts of the world, and, as a result, it will be impossible for me in future to send individual acknowledgments of reports to listeners in this country.

A good many listeners here appear to have been disappointed that they cannot get good reception of my transmissions after dark, and they must realise that wave-lengths in the neighbourhood of 30 metres have peculiarities after dusk; although between say, four and five o'clock in the afternoon, during daylight, they may receive strong signals, after dark they may not hear me at all, and the same applies to early morning. This is naturally due to the skip effect, which, perhaps, they will take into consideration in future should they be disappointed in not getting my transmissions.

I am continuing these special Empire experiments until April 1st, 1928.

Yours faithfully,

GERALD MARCUSE.

Catcherham, Surrey.

ARE SOLDERING TAGS NECESSARY?

The Editor, POPULAR WIRELESS.

Dear Sir,—Will you permit me to comment upon your article "Are Soldering Tags Necessary"? As these tags are invariably screwed under terminals, I do not see why the wire should be soldered to them. Why not screw the wire under the terminal direct?

Your contention that round section wire only makes a very small contact is easily got over by filing the eye flat—a very few rubs with a sharp file will suffice—and the wire will then give just as good a contact with the terminal as the tag method, with the further great advantage of avoiding any risk of "dry joints" corrosion, or broken connections through jarring, etc., when soldered joints are made.

I have made up dozens of circuits (for my own amusement), and never use solder. On comparing a "soldered set" with a "screw-down" set I cannot trace the slightest gain in efficiency. A terminal screwed down hard with the pliers will bite into the soft copper wire and make a better connection, and with far less trouble, than the average amateur is able to get with the soldering iron.

Further, screw-down connections can be made in the warmth and comfort of the dining-room, where soldering is "barred."

I should like to hear from other readers of your valuable paper on this subject.

Yours faithfully,

A. C. R.

Westcliff-on-Sea.

AUSTRALIA "COMES OVER."

The Editor, POPULAR WIRELESS.

Sir,—I am pleased to say that I received the broadcast programme of station 2 F C of Australia from station 2 M E on 28.5 metres from 5.50 to 7.45 G.M.T. on Sunday, October 30th, 1927. The transmission was received on an underground aerial 2 ft. deep 30 ft. long. Before dawn in Australia, strength R.2; after dawn, R.4. I find by using the above type of aerial that atmospherics are considerably reduced. My receiver is a Reinartz 0-v-1. B R S 88 was the first station to receive 12,000 miles on underground aerial.

Yours faithfully,

C. C. MORTIMER
(Radio, B R S 88).

Bronley, Kent.

THE "SYDNEY" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—I feel I must write you and say what a splendid set the "Sydney" Two is, and how well it works. I read the article about the making up last Thursday, and had the set completely finished by Saturday night.

Previously my short-wave set was the "all-wave" one described in "P.W." some months back, but I consider this new one is much easier to work. As I have been in close touch with experimental work since 1921, before broadcasting commenced, and have had every "P.W." since the first one was issued, I have tried out many various types of receivers published by you from time to time.

When I connected up the "Sydney Two" on Sunday night I immediately received K D K A at fairly good strength, and after experimenting for some time with various adjustments, the Pittsburg station came in excellently.

The last two nights I have also received K D K A at quite moderate strength, so am now to try for 2 X A F and 2 F C, etc.

Wishing "P.W." every good wish for the future, and thanking you for all the excellent articles of the past.

Yours sincerely,

A. W. R.

P.S.—Since writing the above I have had 2 X A F splendidly.—A. W. R.

Chingford, Essex.

DARIO

Stands for Perfection

The famous DARIO valves with the wonderful R.M. dark emitter filament are already well known and widely used in this country. Many wireless experts consider them as the finest valves ever produced.

PLEASE NOTE that, in order to acquaint the public with the **REASONS WHY DARIO VALVES**

**Cost Less Money,
Consume Less Current,
Give MORE POWER and
BETTER TONE**

than any other valves, **THERE WILL APPEAR** in this paper every week a description of one of our types of valves.

NEXT ISSUE full details of the famous 2 and 4 **VOLTS GENERAL PURPOSE WITH ONLY .05 CONSUMPTION.**

A LIST OF DARIO VALVES

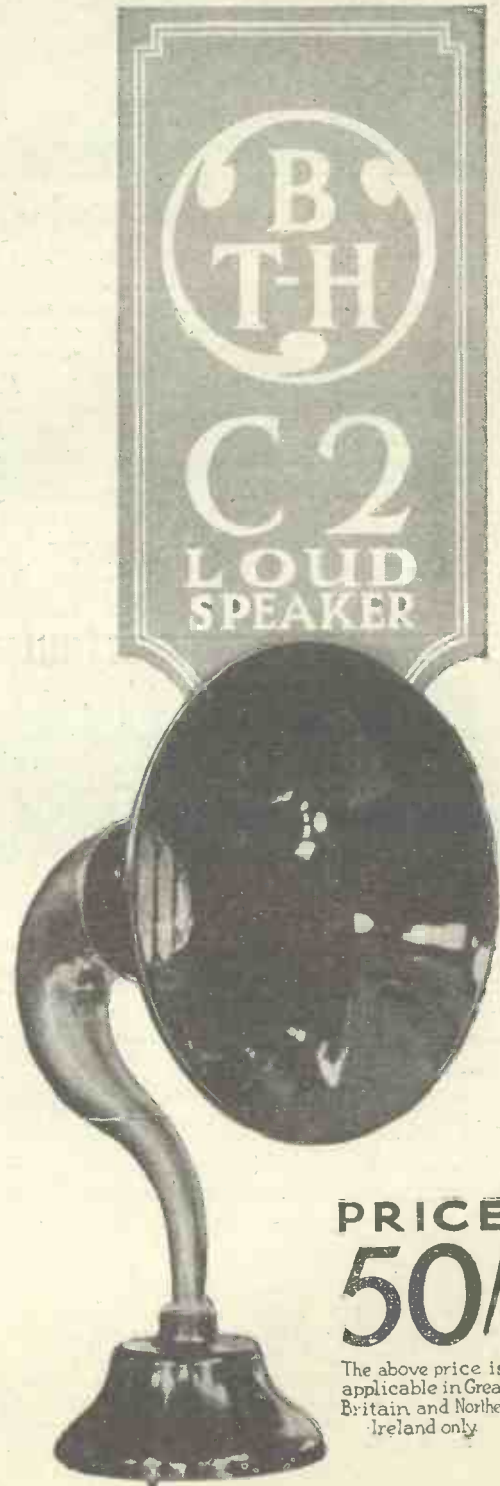
2 VOLT.	4 VOLT.
DARIO MICRO BIVOLT .05 General Purpose - - 7/6	DARIO MICRO SPECIAL .05 General Purpose - - 7/6
DARIO POWER BIVOLT .18 Loud Speaker Valve 10/9	DARIO SUPER POWER .1 Loud Speaker Valve 10/9
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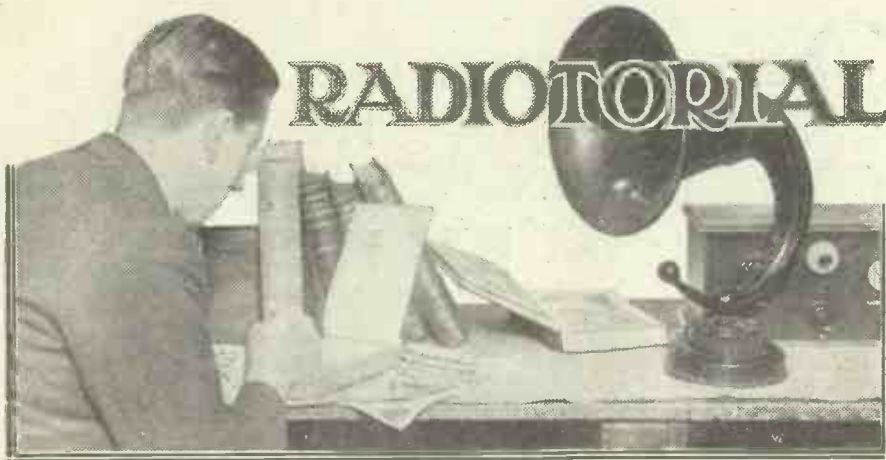
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Ask your usual dealer for particulars and literature—or apply to:—

IMPEX ELECTRICAL LTD.,
538, High Rd., Leytonstone, London,
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IN A CLASS BY ITSELF





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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

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

QUESTIONS AND ANSWERS.

THE ANGORA STATION.

D. R. (Ware, Herts).—"I picked up the new Turkish station at Angora, on 1,800 metres—good loud-speaker strength. As I have not seen a mention of this station being received, I wonder if I am the first 'P.W.' reader to get him?"

Yours was certainly a good catch, but several readers had remarked upon the good strength of this station, before you succeeded in getting him.



Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

TUNGSTONE ACCUMULATORS.

SOME twelve months or so ago we received two Tungstone accumulators for test. One was a large 6-volter suitable for use as a motor-car "starter" battery, and the other an H.T. accumulator (60 volts). It may be remembered that shortly after the arrival of those batteries we published a report concerning them, adding that the only true test for such accessories is the test of time. It is impossible to duplicate the conditions of normal usage spread over a long period in any form of laboratory test occupying a very much shorter space of time. We are now, however, in a position to say a little more about those two Tungstones.

As to their general construction and design these will be known to "P. W." readers. They will have learnt through our advert. columns that the special features of Tungstone accumulators are the incorpora-

tion of special-process lead plates, which give them considerable durability and reliability, and a scheme whereby the plates can easily be replaced even, if need be, in the case of "starter" batteries, by the roadside.

But, additionally, the Tungstones have been proved to have high efficiencies by both the National Physical Laboratory and by "P. W." in an independent test (see page 476, "P.W.", October 29th, 1927), A.H. and watt-hour efficiencies reaching such heights as 95 per cent and 86 per cent. And, by the way, the Tungstone people are to be congratulated upon their courage in handing over their batteries for such grueling tests—or, perhaps, knowing the quality of their products, it did not necessitate a display of that virtue at all!

However, on capacity and other such laboratory tests the Tungstone batteries give an excellent showing, but what is of more vital interest to the listener and

FITTING ANODE-BEND RECTIFICATION.

P. E. (Fareham, Hants).—"The set is a neutralised H.F. (split-primary), Det and L.F., and although it is just about perfect, I have a fancy to try anode-bend rectification. Could I fit a switch or a flex change-over without much alteration to the set? There is plenty of room because the set is spaced out on a big baseboard, so if it can be done fairly easily I should like to try. The grid leak is at present joined to L.T. plus side of its filament."

You can fit a flex and plug change-over quite easily. First of all remove the grid leak's connection to grid, and take it, instead, to a socket (ready for a plug). This will be the "grid-leak" socket, and beside it mount an "anode-bend" socket, connecting this to an H.F. choke or a grid resistance. The other side of the H.F. choke or grid resistance goes to a negative grid-bias plug.

The only remaining alteration is to fit a flex lead to the grid-to-coupling-condenser lead. At the other end of this lead is the plug which fits into either socket, as required.

L.F. TRANSFORMER RATIO.

N. R. (Totnes, Devon).—"Why is it that low-ratio L.F. transformers are still being made and sold, when high-ratio transformers give a bigger step-up in voltage, and more power?"

Because "power" is not the only consideration. In order to get a big step-up, the secondary must have a large number of turns, as compared with the primary. As there is a limit to the number of turns permissible in the secondary, the number in the primary can only be varied within certain limits.

If its number of turns is made low, to give a high step-up, its impedance becomes low and the quality of reproduction suffers. It is because the comparatively high impedance primaries give even amplification over a wide range of frequencies, and enable good-quality reproduction to be maintained, that the low-ratio transformers are preferred to those giving greater "power."

SCREENED-GRID VALVES.

C. G. D. (Victoria St., S.W.).—"I am enclosing a leaflet supplied with the screened (Continued on page 1062.)"

amateur, they stand up to the aforementioned test of time. Those two accumulators, the 6-volt and the 60-volter have had very hard lives. They have been worked hard—very hard at times—and during other periods they have been subjected, intentionally, to misuse and neglect.

To-day both appear to be quite happy. The plates look clean and the electrolytes (which have never been changed) seem to be fairly clear. The only thing that has been done to these batteries bar charging them, is the usual water replenishments. And let it be whispered, it was not nearly always DISTILLED water. They can still hold their charges well and should have further long and useful lives.

The 60-volter can, in a simple manner, be connected up as a 12-volter and charged at an ordinary sort of rate. It has several times been severely overcharged but, despite this and other maltreatment, shows no signs of distress.

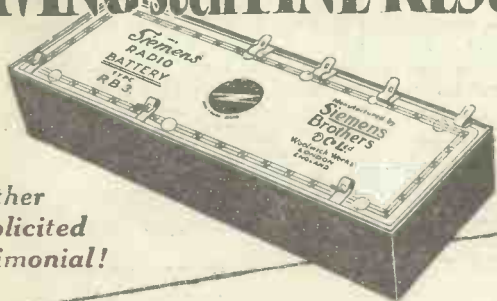
We can certainly recommend the Tungstone accumulator to our readers. Its design (all types) seems to us to be both logically sound and originally efficient and, what is even more important, its electrical robustness something out of the ordinary.

"SELF-REGENERATIVE" BATTERIES.

Messrs. Ripaults, Ltd., of King's Road, London, N.W.1, have produced a series of what are claimed to be "self-regenerative" "dry" H.T. batteries. Of these there are four different capacities—viz., single, double, triple, and quadruple. The lives of these are stated to be 50 per cent longer than normal types. A report concerning these batteries will appear in our columns shortly.

(Continued on page 1070.)

"I KNOW OF NO BATTERY GIVING SUCH FINE RESULTS"



Another Unsolicited Testimonial!

No. 5, Road 58,
Ely, Cardiff.
28-10-27.

Messrs. Siemens Brothers & Co. Ltd.

Dear Sirs,

Your publication of a letter from Mr. R.W. Young, praising one of your 72-volt H.T. Batteries is very interesting, but I have great pleasure in stating that his is not an isolated experience.

I have just discarded one of your batteries of the same type after nineteen months use. During the whole of that period it gave satisfactory service, and for a considerable time it supplied the power to a four valve set with a super-power valve in the last stage.

What seems to me to be especially worthy of mention is the fact that the fall in voltage was gradual, and the internal resistance of each cell was approx. the same at the end of its life.

I know of no battery capable of giving such fine results, and I speak from considerable experience.

You may add my name to your deservedly long list of satisfied customers.

Yours faithfully,
(Sgd) W.H. Wall.

SIEMENS

WIRELESS BATTERIES

TYPE R.B.3 (72 Volts) Price: 24/-

Sizes for other voltages are given in our Catalogue 650.

SIEMENS BROTHERS & Co., Ltd.
WOOLWICH, S.E.18.

SUPERLATIVE REPRODUCTION OVER THE WHOLE MUSICAL RANGE



THE NEW EDISWAN "ONE-DER" LOUDSPEAKER

FULL SIZE MODEL
£2-10-0

Rich tonal purity—flawless reproduction—never a note lost! The delight of music heard at its best at full volume. *Superlative reproduction over the whole musical range.* That's the "One-der" Loud Speaker—wonderful in every sense of the word—it gets the most out of your set!

With its rich brown colouring, the "One-der" will harmonise with almost any scheme of decoration.

Fully licensed under Patent Nos.
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EDISWAN VALVES

CLEAREST • STRONGEST LAST THE LONGEST

A type for every purpose.

THE EDISON SWAN ELECTRIC CO., LIMITED;
123/5, QUEEN VICTORIA STREET, LONDON, E.C.3.

THE MYSTERY FAULT.

Test after test was made, the set was re-built, and then—well, read the result!

By HUMPHREY PURCELL.

PURKIS has a wireless set, of course; a four-valve straight that he and I put together in 1924, and which he vows gives better results than anything invented since. The valves are the same old originals, bright enough to read the newspaper by, and standing all in a row on top of the sloping panel. He switched it on as I sat down.

"Can't make out what's the matter with the set lately," he confessed. "That's big Daventry on four valves. What do you think of it?"

It was pretty feeble, I had to admit.

"2 L O's about the same, and everything else has gone off the map," he said sadly.

The Symptoms.

"What about the batteries?" I asked.

"Test them," he suggested, passing me a voltmeter. "The accumulator was re-charged three days ago."

I tested the high-tension and grid battery. They were O.K.

"Let's alter the wiring a bit," I suggested. "I'll run round and get a high-frequency choke I have on hand, and we'll fix up a three-valve that will knock spots off your ancient four-valve circuit."

He agreed rather reluctantly. He still

pinned his faith on the old circuit, but we took the set out of its cabinet. First of all, naturally, we tested each component, and fixed condensers, grid leaks, transformers, and all came through with honours. Nor was there any flaw in the wiring. The set seemed to be as good as ever.

A Drastic Remedy.

"There may be a touch of senile decay in one of the valves," I hinted, as he unearthed the soldering iron and some pliers. "They ought to have expired long ago. I'll bring a few newer ones round when I fetch the choke."

Two hours later, Purkis was the owner of a newly-wired three-valve set, built to a really up-to-date circuit that I had thoroughly tested and knew I could rely on. There were a few spare components on the panel, and some of the wiring was not exactly according to blue print, but I was satisfied that the set would work.

We took it into the lounge and connected it up. We tried his old valves, and then we tried my new ones. After that we tried them mixed, in various combinations and with various lengths of resistance wire to take up spare volts.

The results were just the same with the new three-valve set as with the old four-

valve. Daventry was weak loud-speaker-strength. London came through just a shade louder, and, apart from these stations the ether was empty.

Daventry closed down before we had solved the mystery.

"Anyhow, you have saved me a valve, old man," Purkis said gratefully, as I went out into the midnight air. "Of course, I used to be able to turn out the high-frequency valve for London, but it's awfully good of you. And you've demonstrated that there's not a fig to choose between your dull-emitters and my old brights."

A big white moon was rising in the heavens. Clouds, grey and black, raced across the sky. The moist states of the houses shone like silver. We both looked up and watched.

Something moving on my host's roof caught my eye.

"When did you last overhaul your aerial, Purkis?" I inquired.

"Don't remember," he admitted. "I fancy you gave a hand when we made it a twin instead of a single wire."

The Mystery Solved.

"Two years ago!" I said. "But it's a twin no longer. One of your lead-in wires is coiled up in the gutter of the roof, leaking away most of what the other picks up."

He gazed upwards for a moment longer.

"I believe you're right," he admitted. "I'll have that fixed to-morrow. And then, sometime when you're not busy, I wonder if you'd mind dropping in and helping me to re-wire the set to the old circuit again?"

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1060.)

valve, but you will see it gives no details of the anode current taken by the 'outer grid' or screen. Can you tell me how much this is, as I have to calculate the correct eliminator resistance to use from the amount of current passing?"

The current to the screening grid of the valve in question is approximately .5 milliamp.

RADIO VITUS.

W. T. (Preston, Lancs).—"What French station is it that transmits on a wave-length half-way between Liverpool and Belfast?"

Probably Radio Vitus, Paris, which sends out concerts on Wednesdays, Fridays, and Sundays from 9 till 10.45 p.m. The wave-length is 302 metres, but there are other French stations on wave-lengths very close to that used by Radio Vitus, so it is not possible to say definitely, unless the above times agree with your reception.

CURRENT FROM DRY CELL.

"JIMMY" (Charlton, Kent).—"How much current is the ordinary dry-cell, as used in small H.T. batteries, capable of supplying?"

Different makes vary, even of cells of the same size, but generally speaking the limit is about five milliamperes.

HOW LONG SHOULD THE GRID-BIAS BATTERY LAST?

D. A. (Blundellsands, Liverpool).—"I have been given to understand that it is necessary to get a new grid-bias battery every time that the H.T. Battery is renewed. Is this correct?"

Hardly, though by doing so you would be pretty sure of never letting a run-down G.B. battery spoil your quality, for generally the H.T. battery gives out more quickly than the grid battery. But there is no direct relationship between the rates at which the two batteries become discharged, so it

may happen that one good grid battery will outlast two H.T. batteries. The best plan is to measure the voltages frequently with a voltmeter, renewing either battery when the voltage drops seriously.

BACK NUMBERS OF "P.W."

"BLUE PRINT" (Hungerford, Berks).—"Where can I get back numbers of POPULAR WIRELESS?"

These are obtainable from The Amalgamated Press, Back Number Dept., Bear Alley, Farringdon Street, London, E.C.4. Price 4d. per copy, post free.

"LIKE THE CRACK OF A WHIP."

"CRAWFORD" (Camberwell).—"I wish to ask your opinion as to a coincidence which occurred to my wireless, during a thunderstorm one mid-day during the summer. I had a crystal set with outdoor aerial, (double line aerial, 65 ft. long), leading in through the sitting-room window; one wire connected to the set and the earth wire lying unconnected on a sofa. A rather strong flash of lightning struck the aerial, and a noise like the crack of a whip, rather loud and sharp, followed by a long blue spark came from the earth wire.

"It did no damage, and the only thing on the sofa was a child's rubber doll. I disconnected the whole lot at once.

"I have told this to several wireless experts, and I am discredited with it. I know very little about wireless, but perhaps you may have heard of similar cases. Can you give me any explanation of this which I am told is an impossibility? There were three other persons in the room at the time and they all witnessed the same thing."

It was lucky that there was only a rubber doll on the sofa, for no doubt the aerial wire was heavily charged for a second, due to its proximity to the lightning-flash.

Had you been employing an earthing switch—which connects the aerial to earth when not in use—the charge would have passed harmlessly into the ground. But by leaving the aerial un-earthed

during the thunderstorm, you forced the charge to jump across the nearest gap to earth. This gap happened to be over the sofa to the earth-wire. But had you been standing very near, part of the discharge might have come your way, with very unpleasant consequences.

The "crack-of-the-whip" sound was caused by the spark, which must have been fairly powerful. We should certainly advise the use of an earthing switch as a safeguard against a similar occurrence.

WHAT SET SHALL I BUILD?

E. B. W. (Swindon, Wilts).—"I want a good, reliable and selective set, not too hard to build and handle, which will give really good phone strength on two or three different stations. I should like to include the following parts which I have on hand:

1 0005 S.L.F. Condenser.

2 valve holders.

1 Transformer (L.F.).

1 Grid condenser and leak.

Set of plug-in coils, rheostats, etc.

Can you tell me where I can get particulars of a good circuit?"

For your purpose we recommend a "straight" circuit consisting of Detector and L.F. amplifier, with reaction. Such a set was fully described in POPULAR WIRELESS No. 280, and all the necessary information for making the receiver has been embodied in the "P.W." Blue Print No. 31. This can be obtained from the Technical Queries Dept., price 6d., if a stamped and addressed envelope is enclosed.

6-PIN COIL CONNECTIONS.

"BUSTER" (Cambridge).—"Am I right in supposing that all of the numerous types of 6-pin coil are really interchangeable, though, of course, the right type will be needed for any particular set, to give best results?"

Quite wrong, "Buster." The spacing of the pins is standardised, so that the coils will fit any make of 6-pin holder; but the connections and windings vary considerably, and if you plug the wrong type of 6-pin coil into a set with batteries attached, you are liable to do some damage. In fact, if the valve is in position, you are quite likely to "bust'er."

(Continued on page 1064.)



**GOOD-
'for good'**

B.T.H. Nickel Filament Valves have a higher emission than other 2 volt valves of corresponding types, and they retain this emission for a longer period. In other words they give better reception and have longer useful lives.

You want to have and to maintain the best results of which your set is capable. B.T.H. Nickel Filament Valves alone will enable you to do this. Get some today and enjoy better radio from now on.

B. 210H B. 210L B. 215P

R.C. and H.F. Gen. Purpose Power
 Fil. Volts . . . 2 Fil. Volts . . . 2 Fil. Volts . . . 2
 Fil. Amps. . . .0.10 Fil. Amps. . . .0.10 Fil. Amps. . . .0.15
 Max. H.T. V. 150 Max. H.T.V. 120 Max. H.T.V. 120

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NICKEL FILAMENT

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The British Thomson Houston Co. Ltd.

B.T.H. NICKEL FILAMENT



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YOUR FATHER.**

I have acted as father and adviser to thousands of others. I give advice free, and when I do so I feel the responsibility of a father, either in advising a career or in guiding our students to success. Having been the self-constituted father and adviser to thousands of others, it is possible I may be able to help you and guide your footsteps so that you may make a success of your life.

Thousands of people think they are in a rut simply because they cannot see the way to progress. This applies particularly to Clerks, Book-keepers, Engineers, Electricians, Builders, Joiners, etc. They do not realise that in these particular departments the demand for the well trained exceeds the supply, also they do not realise that about 1s. per week will pay for all necessary books and tuition, and that by studying in spare time they can qualify for the higher and better paid positions. In Technical trades and in the professions employers are frequently asking us if we can put them in touch with well trained men. Of course, we never act as an employment agency, but it shows us where the shortage is. In nearly every trade or profession there is some qualifying examination, some hall-mark of efficiency. If you have any desire to make progress, to make a success of your career, my advice is free; simply tell me your age, your employment and what you are interested in, and I will advise you free of charge. If you do not wish to take that advice, you are under no obligation whatever. We teach all the professions and trades by post in all parts of the world, and specialise in preparation for the examinations. Our fees are payable monthly. Write to me privately at this address, The Bennett College, Dept. 106, Sheffield.

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from

**Air depolarising
"A.D." PRIMARY CELLS**

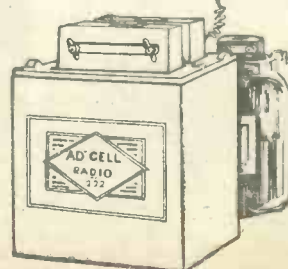
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222	1 amp. 3-5 hrs.	350 days with 5 valves (each 100 m/a.)	30/-
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Pro rata life for other types of valves 1 volt per cell, 2 volts 2 cells in series, etc.

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SOUTH PLACE, LONDON, E.C.2
Works: Portslade, Sussex.



RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1062.)

CONDENSERS IN PARALLEL AND SERIES.

L. E. (London, E.C.2).—"I suppose that nearly every radio enthusiast has, like me, a few odd or spare fixed condensers kicking about in his 'junk box.' And sometimes he requires a value which is not in the spares that he has. I have often been in this position, and have had to buy another condenser to suit a particular set, simply because I do not know how to use two or more in parallel or series, in order to get a certain required value. What are the laws governing such condenser connections? How can I tell what the effect of connecting condensers together will be?"

The effect of connecting two or more condensers in parallel or in series is shown below:

Condensers in Parallel.—Suppose you have a .001, a .0005, and two .00025 condensers. If you connect them all together in parallel you have made in effect a single .002 mfd. condenser. "How," you say, "is the figure .002 arrived at, in such a case?" Simply by adding the separate capacities together. You have a .001, a .0005, and two .00025. So put these capacities down, add together, like this, and the total gives you the effect of connecting in parallel.

mfd.
.001
.0005
.00025
.00025

Total .. .002 mfd.

Similarly, if you had been going to build a set which required two .0005 condensers in it, there would be no need to go out and buy another .0005 just because you had only one marked with that value. A moment's thought will show you that you have, in effect, a second .0005 condenser on hand in the shape of the two .00025's. For if these two capacities are placed in parallel their value will be

.00025
.00025

= .0005

So much for condensers in parallel, the rule in such a case being: "To find the value of condensers when connected in parallel, add the separate capacities together."

Now let us see the effect of connecting Condensers in Series. If we connect one terminal of one of your .00025's to one side of the other .00025, thus placing the condensers in series, what will be the effective capacity across the remaining pair of terminals? It is easily ascertained, provided you take the three right steps.

To find this capacity, first divide each separate capacity into 1. In this instance the first condenser is value .00025, and this divided into 1 gives

$$\frac{1}{.00025} = 4000$$

The second condenser (which happens to be of the same value in this instance), also gives us

$$\frac{1}{.00025} = 4000$$

Having found how many times each capacity goes into 1, the next step is to add these numbers together. In the case given we have found the first step gave us the numbers 4000 and 4000, so the second step is simply to add these, and obtain the figure 8000.

The third and last step is to divide this total into 1, which will give us the capacity we require. To make it perfectly clear, the full working is shown below.

$$\begin{array}{r} 8000 \div 1 = 8000 \text{ mfd.} \\ 8000 \\ \hline 20000 \\ 16000 \\ \hline 40000 \\ 40000 \\ \hline \end{array}$$

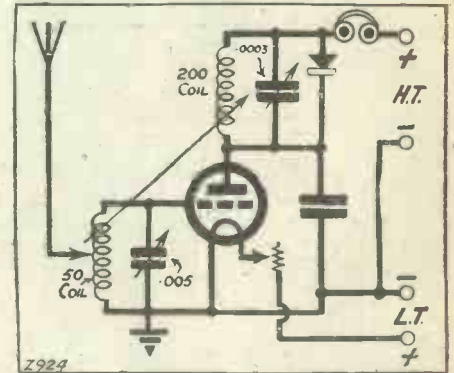
Therefore, if one .00025 is connected in series with another .00025, the total capacity of the arrangement will be .000125 mfd.—which, you will notice, is exactly half the value of either condenser alone.

We have purposely worked out this example before setting down the rule for finding capacities in series, because the rule looks more difficult than it really is in practice. In practice, all that is necessary, as we have seen, is to put down each separate capacity, divide each into 1, add all the answers together, and divide their total into 1; this gives us the capacity of the separate condensers in series.

Now, perhaps you have forgotten that at school we were taught that the number of times that any number goes into one is called that number's "reciprocal." (The reciprocal of 2 is $\frac{1}{2}$, and the reciprocal of $\frac{1}{2}$ is 2, etc.) In order to find out our capacity value in the example above, we divided each number into 1, or, in other words, we found its "reciprocal."

(Continued on page 1066.)

WHAT IS WRONG?



The above diagram is supposed to represent the connections of an H.F. (Tuned-Anode) and Crystal set. But it is wrong and would not work properly.

Next week the correct diagram will be given, and to test your skill we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems, week by week, the reader cannot fail to learn a lot about radio circuits.



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Put a valve in a Lotus Valve Holder.

Immediately the phosphor bronze leg sockets expand and automatically lock. There is a perfect and permanent connection. The floating platform in which the valve is fixed is suspended by four phosphor bronze springs—springs which have great mechanical strength, but are sufficiently resilient to absorb any external shocks liable to damage the valve.

Lotus valve holders are made from the finest bakelite mouldings obtainable. Every one is tested before it leaves the works.

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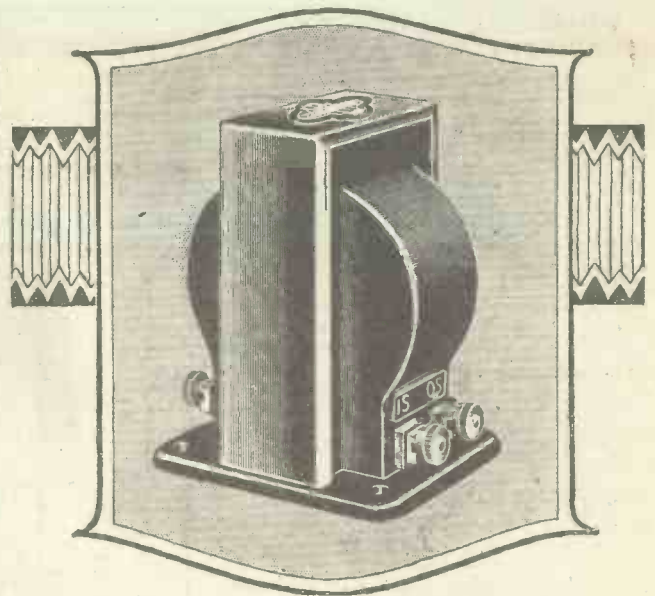
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The "GEM" is not a "baby" Speaker, but a full-sized instrument with a full-sized voice. Its price is the only small thing about it. Send for List. LONDON RADIO MFG. CO. LTD.

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Perfect low-frequency transformer curves obtained under ideal laboratory conditions are utterly useless as an indication of performance under working conditions because of the numerous shunting capacities which exist in a set.

**The Igranic
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has been designed by some of the leading experts in low-frequency transformers to give as near perfect reproduction as it is possible to attain while working in the average set.

You cannot realise how good reproduction can be until you have used this transformer. The low notes and harmonics are brought out in their correct proportions giving a life-like tone that can only be compared with the original.

The Igranic L.F. Transformer, Type "G," is made in two ratios, 3.6:1 for first and single stages (with 20,000 to 30,000 ohm Valves) and 7.2:1 for second stage (with low impedance valves). Two 3.6:1 ratio transformers may be used if desired.

Price 30/-

Send for List No. R77, which gives curves and full information.



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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1064.)

Having seen how easily this is done, the rule for determining capacities in series will not appear difficult. That rule is: *When condensers are connected in series, the reciprocal of the total capacity is equal to the sum of the reciprocals of the separate capacities.*

"HALE"—BUT WEAK!

J. B. F. (Nottingham).—"I am told that the set is a 'Hale,' but it seems anything but hale to me. It is weaker than a one-valver (although there is one valve and a crystal), and there is no reaction or liveliness at all. Should it really be as hale and hearty as one might expect from its name?"

Yes, the Hale circuit is one with plenty of punch, when working properly. All the symptoms you name point to the use of an unsuitable crystal. Try one of the semi-permanent crystals, and probably the set will immediately live up to its name.

TOO MUCH FILAMENT VOLTAGE.

C. L. H. (Goring-on-Thames).—"The valve is a B.5—or, at least, it used to be. I am afraid it is a wash-out now, for I accidentally connected about 15 volts H.T. across its filament, which lit up like a Brock's Benefit. I was going to throw it away, but a friend tells me that these '06 valves can be restored to life again after an accident like that. Is that so?"

Yes. With valves of this type it frequently happens that the filament "pulls itself together" again if switched on for a time at normal filament voltage, with no H.T. connected to the set. The time required for a cure may be anything from thirty minutes to five or six hours.

CONTROL OF VOLUME.

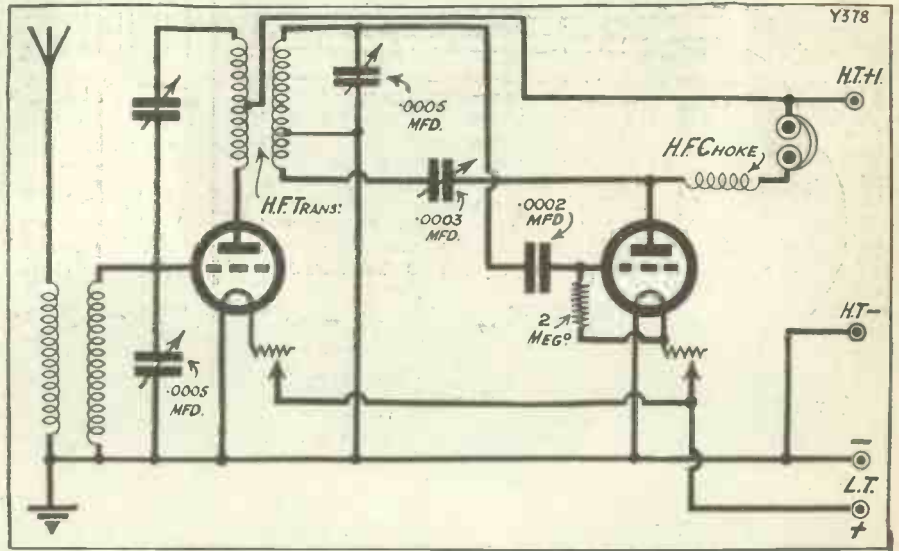
E. C. G. (Crystal Palace, London, S.E.).—"Well, I added the extra stage, just as you advised, and she went like a bird from the

start. The quality is simply perfect—we listen for hours just for the pleasure of hearing how good it is. But there are two queries about the constant reception from 2 L O that I should like to raise, not so much because I want to put anything right, but as matters of interest.

One is, why does it happen that even on what I consider is a perfect set I sometimes detect a single 'jangled' note? Perhaps I don't get one for days and days, and then one comes along quite unexpectedly. Just a single wrong note, that one would never

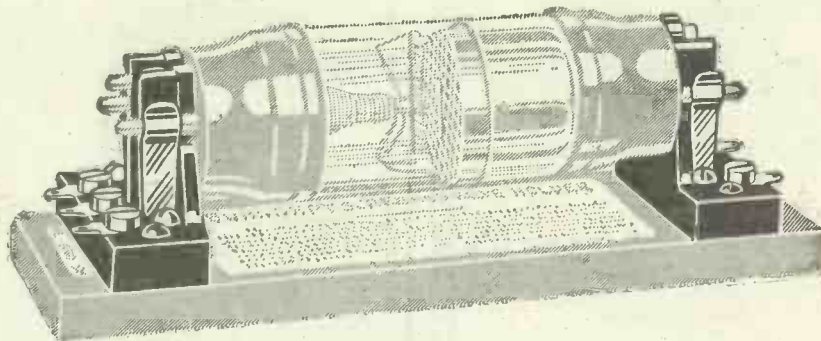
(Continued on page 1068.)

H.F. AND DET. (NEUTRALISED, SPLIT PRIMARY).



The correct connections for an H.F. and Det. set (neutralised split-primary, with condenser-controlled reaction to the secondary) are shown above. In the "What is Wrong?" diagram last week the H.T. and neutralising connections from the primary were reversed, the H.F. choke was omitted, and there was no reaction winding. Also, the secondary tuning condenser was given as .00005 instead of .0005 mfd.

Valve Holder for the Screened Grid Valve



4/-
COMPLETE

ANY constructor who intends to use the Screened Grid Valve in his next set should have no hesitation in selecting this new Burndept Valve Holder, which, as one would expect in a Burndept Production, embodies several novel features. It is so constructed that the valve can only be inserted in its proper position; it can easily be adjusted to the varying sizes of the same type of Screened Grid Valve; all connections are clearly marked and

both terminals and soldering tags are provided; a drilling template is supplied; and the construction throughout is of the finest—highly polished bakelite being used.

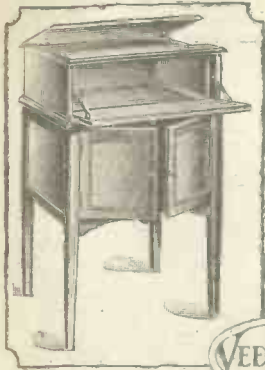
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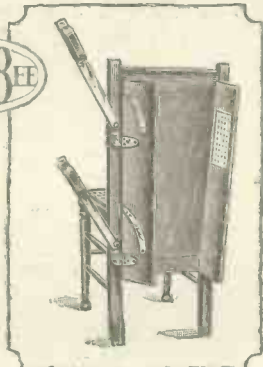
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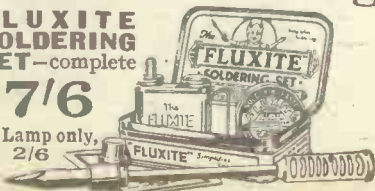
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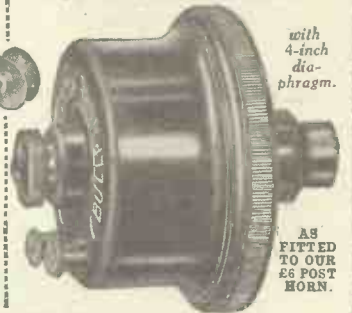
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1066.)

notice unless all the others had been so good as to give the impression of beautiful music actually in the room.

"And one other query—as the set is always stronger than we need it, should I cut down by detuning a little, as now, or would it be better to use a smaller aerial?"

That isolated wrong note heard occasionally is probably due to "blasting" of the transmission. All the time that you are listening the control engineer is adjusting the volume of the different items, bringing up the weak signals, and toning down the very strong ones. But even the most skilful control engineer may get caught occasionally by an unexpectedly loud passage, which "overloads" the transmitter for a second before he can bring its volume down to a suitable degree. As you have noticed, such "blasting" is comparatively rare, and it only lasts a second or so.

To permanently reduce volume, we should be inclined to shorten the aerial a little. De-tuning will do it, but the shorter the aerial the less interference one picks up, which is important when every instrument sounds as though it were being played in the room.

VALVES FOR THE "CUBE-SCREEN" THREE

B. L. (Stansted, Essex).—"I have got the 'P.W.' Blue Print (number 32), but before building the 'Cube-Screen' Three I should like to know if I can use the D.E.L.610 as a detector for this set?"

Yes, this valve is quite suitable, as good results will be obtained with any valve having an amplification factor of anything from 12 to 30, and impedance somewhere on the range between 13,000 and 30,000 ohms.

A HOME-MADE H.F. CHOKE.

G. M. J. (Highbury, London, N.).—"To get the set into the cabinet I want to use an H.F. choke with 800 turns on a cardboard tube 2 in. long. What is the best way of winding it—in layers, or how?"

Divide the winding space into 8 equal sections, and then wind a pile of 100 turns in the first section, another pile of 100 turns in the second section, and so

on till the winding finishes in the last section. This will keep the self-capacity down, and thus ensure a reasonably efficient construction.

TIRED OF 2 L O.

R. B. (Barking, Essex).—"When I wrote to 'P.W.' just over a year ago about the set for my young lady's mother, you advised a Det. and 2 L.F. for good loud-speaker reception at Becontree. I built it up without a hitch from the diagram you sent (det. and resistance-capacity, then transformer), and it went wonderfully. I have never heard 2 L O better

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good" ?

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

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

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

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

anywhere—pure and very strong, and only a switch to put it on and off at a touch.

"But when this 5 G B station started the trouble began. She found by turning the dial up to 128 she could hear the Daventry programme too, and after a time she got a German station in (on the loud speaker), and now she is all the time trying for foreign stations. There must be at least a dozen of them she has heard, but 2 L O wipes out a lot more, and now I shan't get any rest till I make it so she can cut out London and bring in some of the foreign ones.

"I said 'Why not let the set alone, it may spoil it?' but she says she is tired of 2 L O and wants to find out how far the set will go. So can you tell me how to get London quieter, without much alteration, if possible? Because if we alter it much it may not be so good—it couldn't be better for 2 L O, and if I had my way it would be let alone."

Fortunately, it can be altered outside the set itself, by adding a wave-trap. This can be bought ready-made, or it can consist of a home-made tapped coil, tuned by a variable condenser. A good coil to use is a 40-turn basket, or solenoid, wound on a 2½-in. or 3-in. former, tuned by a condenser of .0003 or .00025 mid. The coil should be tapped in several places, say at 20 turns, 15 turns, and 10 turns, and its end should be connected across the variable condenser's terminals.

The whole arrangement constitutes a wave-trap, which will enable the local station's signals to be narrowed down to cover only a few degrees on the tuning dial.

To connect up, take the aerial lead from the set's aerial terminal, and connect it to one of the tappings on the wave-trap. Then join that end of the wave-trap coil which is nearest to the tapping to the set's aerial terminal.

Tune the set as usual, and when 2 L O is coming in at full strength, adjust the wave-trap variable condenser. It will be found that this "sharpen" the tuning, and at the correct setting of the wave-trap 2 L O will be "narrowed down" as required.

Different degrees of sharpness are obtainable by using the aerial lead on different tappings. If it is desired to cut out the wave-trap at any time, all that is necessary is to short its two terminals, or remove it from the aerial altogether, there being no alteration to the wiring of the set itself.

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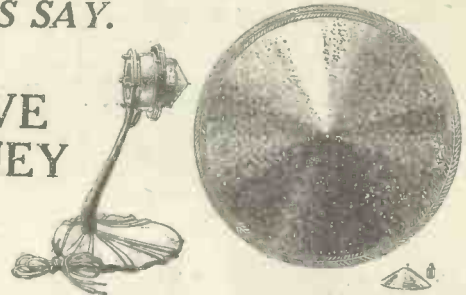
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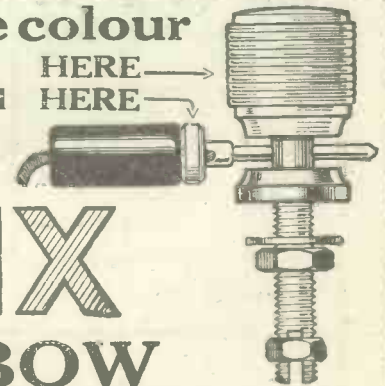
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APPARATUS TESTED.

(Continued from page 1069.)

A "BECO" CONE LOUD SPEAKER.

The British Electrical Sales Organisation of Australia House, Strand, London, W.C.2, recently sent us one of their "Beco" popular model loud speakers. This retails at 47s. 6d. It is one of the neatest little instruments we have come across. Standing on four small rubber "feet" it measures 11 in. in height and is 8 in. wide and 4 in. deep. The casing is of solid polished mahogany, and the cut-away front artistically reveals a green silken material.

The back, too, is cut away to a certain extent, revealing a similar material, and allowing a sound projection from that direction. Here are also the two terminals and a large milled knob for adjusting purposes. That the back of the speaker is of



The "Beco" Popular Model Loud Speaker.

neat design and is nicely finished is a feature which will appeal to many listeners, inasmuch as it enables the speaker to be placed in the centre of a table and other such positions.

This Beco provides a performance well up to, if not above, the class suggested by its reasonable price. It is sensitive and can be satisfactorily coupled to a small set, or it can be adjusted to handle the greater volume provided by a more powerful type of receiver. There is very little coloration and the reproduction is clear-cut and resonance free.

It is very good on speech and it ranges down to the lower notes very credibly. It is, indeed, in this latter respect equal, if not superior, to many speakers selling at much higher prices. Listeners searching for an artistic speaker for the drawing-room and capable of faithful reproduction should make a point of hearing this Beco popular model demonstrated.

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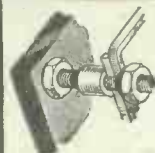
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P.R.6	2	.15	30,000	15	.5	Det.
P.R.7	2	.15	12,000	6	.5	L.F.
P.R.8	4	.06	23,000	15	.65	H.F.
P.R.9	4	.06	19,000	9.5	.5	Det.
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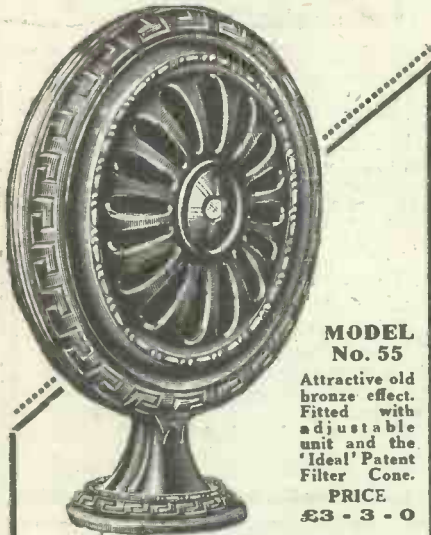
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THE "LO-COST" CRYSTAL SET

(Continued from page 1054.)

more turns, and make a loop spaced again about an inch from the last one, put on two more turns, make another loop (placed an inch further round as before), put on two more, make a loop, then two more, and cut off the wire, for this is the end of the coil. (Note: On the circuit diagram the actual number of turns between the tappings is marked, while on the wiring diagram a different scheme is adopted. Here the total number of turns up to each tapping is marked, working backwards from the end of the coil to the beginning, so that you can check one against the other, and be quite clear where the tappings come.)

Now slip the coil off whatever you have been winding it on and bind it round with thread or thin string to make all secure, and all that remains is then to scrape the wire bare at each loop, and at the two ends, which should each project half an inch or so in order that connection may be made here if desired. You will then have a coil with two sets of tappings, the two sets being separated so that you can tell which are the coarse and which the fine ones later when you are tuning the set.

The coil is next fastened down on the baseboard, and an easy way of doing this is to clamp it under a strip of wood with a small screw through the middle. When you have fixed the terminals you are ready to wire up, and this is not likely to take you more than ten minutes. No soldering is called for, since all the connections can be screwed down under the various points concerned.

Wiring Up.

Bare tinned copper wire, or any material you prefer, can be used for all the connections except two, and these last are the two flex leads bearing tapping clips on their ends. The use of these clips we shall be dealing with in a moment.

When the set is finished this is what you must do to pick up the local station. First see that the cat's-whisker is lightly touching the crystal. Then take the tapping clip which comes from the crystal detector and attach it to the beginning of the coil (the starting point when you were winding it). Take the other clip and try it in-turn on each of the "fine" tappings.

If you hear nothing, put the first clip on one of the "coarse" tappings and again try each of the "fine" ones.

Proceed in this way to try each coarse tap until you find the combination which enables you to hear the local transmission as clearly as possible and then turn back to the detector and search for the best possible setting.

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NEWS FROM SAVOY HILL.

(Continued from page 1042.)

again. Two "thrillers" have been put into the programme for the Daventry Experimental listeners on Tuesday, January 24th, one being "The Test," by J. A. W. Shepherd, which shows how by the power of suggestion a man is killed by a bite from a perfectly harmless snake.

This play was broadcast from London as far back as June, 1926; but the other, entitled "The Witch-Wife," by Mabel Constanduros and Michael Hogan, is quite new. Both plays are sufficiently blood-curdling to upset some people, and listeners who have any predisposition to such susceptibilities will perhaps get a more satisfactory night's sleep if they switch off their sets or tune-in to some other station before the plays begin.

Another play of the same type is also to be performed at the Manchester Station on Thursday, February 2nd. Its title, "The Fatal Mistake," should be enough to commend it as a "thriller"; but when we reveal that the story concerns the midnight discovery of a Mr. James Anderson that strangers have entered his house, you may rest assured that the subsequent twenty minutes will provide sufficient excitement to satisfy the average person for a lifetime. The play is by William Donaldson Smith, and the part of James Anderson will be played by E. H. Bridgstock, that of his wife by Lucia Rogers, and those of the nocturnal visitors by W. E. Dickman and Harold Cluff.

Controversy About Diaries.

Those who heard Mr. Ponsonby recently will recall that he described the art of a diarist as "quite a good habit," and saying that since he had at various times read through more than three hundred diaries kept by all kinds of people, from ministers, generals, writers, and other celebrities, to country parsons, schoolmasters, village store-keepers, and girl shop-assistants, he could fairly claim to be an authority on the subject.

Now that the question of permitting the introduction of more contentious matter into the programmes has cropped up again, it is good to know that Mr. Ponsonby's opinions on such an important topic are not to be allowed to go unchallenged. Mr. Ponsonby will fight out the matter with Mr. Philip Guedalla (whose reputation for things unorthodox is well known) between 8 and 9 p.m. on Monday, January 30th. Mr. Hugh Walpole, the well-known novelist, is to preside.

Tribute to Sir Edward German.

Of all the names in the New Year's Honours List, none perhaps gave more satisfaction to music lovers than that of Sir Edward German, whose essentially British compositions—"Merry England," "Tom Jones," and the "Henry VIII" dances, to mention perhaps the best known—have so long given pleasure to those who like tuneful melody.

It is fitting that broadcasting should pay its little tribute to the distinction which Sir Edward has so deservedly earned, by the inclusion of some of his works in a concert of all-British music, to be given by the Wireless Military Band, under the

(Continued on next page.)

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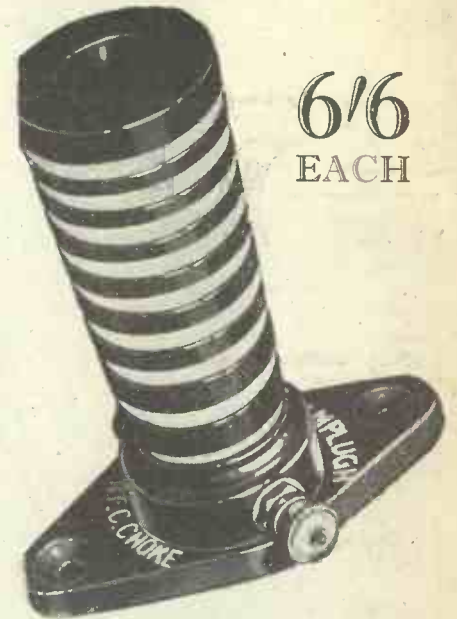
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NEWS FROM SAVOY HILL,

(Continued from previous page.)

conductorship of Mr. B. Walton O'Donnell, in the London Studio on Sunday, January 22nd. Miss Kate Winfer, one of the earliest broadcasters, and always a favourite with listeners, and Mr. Kenneth Ellis, another popular artiste, are to be the soloists.

A Theatre Charity Appeal.

Actors and actresses, stage hands, women employed in theatres, and their families who fall on evil times, look to the Theatrical Ladies' Guild to tide them over their difficulties.

The "Profession," though one of the most alluring of careers, is also one of the most precarious, and many thousands of cases are assisted by the Guild each year. It is nice to hear that arrangements have been made to include the Guild in the list of charities for which appeals are made to listeners for funds. The day fixed for this is Sunday, January 29th, when Dame May Whitty, wife of Mr. Ben Webster, who is appearing with her husband in "Sylvia" at the Vaudeville Theatre, will appeal from the London studio.

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The work, which will be conducted by the composer, is choral, so that the vocal parts will be given by the Wireless Chorus. It employs fox-trot and Charleston rhythm, and is peculiarly interesting if only because its composer, a young Englishman, has already written other works which demand increasing attention.

Brailowsky Next Tuesday.

No one will dispute that broadcasting has been instrumental for introducing many famous artistes to this country who would otherwise certainly not have been heard so soon on this side of the Channel. Another will be added to the list on Tuesday, January 24th, when Brailowsky, one of the most outstanding among young Russian pianists, will give a recital in the London studio from the works of Liszt and Chopin.

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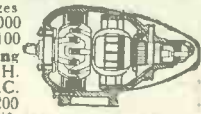
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TECHNICAL NOTES.

(Continued from page 1042.)

have the effect of increasing them. This means that as the coil is shifted to the right, the increasing electro-magnetic coupling is gradually neutralising it whilst, of course, if the coil is shifted to the left, the electro-magnetic coupling is having the effect of assisting the capacity coupling.

An Interesting Experiment.

I have not space to discuss this very interesting experiment any further, but it is well worth trying and by reversing the connections to one coil and then to the other, altering the distance between the coils; and so on, you can find out all kinds of interesting things and get your ideas of "coupling" very much clearer in your mind.

It is, in fact, a little experiment which is well worth the trouble, especially to those who have only recently taken up experimenting in wireless.

Conserving Juice.

If you are using 2-volt valves and you have two or more 2-volt cells, it is generally a good plan to connect these together in parallel and use them all at the same time. Many listeners employ just one cell until that is run down, then put it on one side and put in a second cell (which, until then, has been standing in a supposed fully-charged condition), this cell in due course taking its place beside the first run-down cell, whilst the third cell is put into service. When all the cells are run down they are despatched to the local garage or charged at home.

The result of all this is that some of the cells are heavily over-discharged and in any case the cell which is first put into commission has a considerable time to stand idle in a discharged condition which, as everyone knows, is very bad treatment for an accumulator.

By using the two or three cells connected together in parallel you ensure that they are at any rate in service, which is better than leaving them standing idle.

Large and Small Capacities.

Many people seem to be in doubt whether it is proper to connect a large-capacity and a small-capacity 2-volt accumulator together. There seems to be a sort of idea that the large accumulator will drain its charge away through the smaller one. This fear, of course, is quite groundless. The correct way is to regard the "elementary" accumulator as consisting of a positive plate and two negative plates.

An accumulator which, in fact, consists of (say) ten positive plates and eleven negative plates may be regarded as being really ten "elementary" accumulators connected together in parallel. Another accumulator which has (say) three negative plates and two positive plates may be regarded as two "elementary" cells connected in parallel. This will show that there can be no objection to connecting the two which are in parallel with the ten which are in parallel, making twelve in parallel.

In other words, the point to be considered before connecting batteries together in parallel is the voltage. If all the units are of the same voltage, then there is no objection to connecting them together in parallel.

Of course I am assuming that you are not going to connect in with a good battery a poor battery which is sulphated or likely to lose its voltage pretty quickly, because, if that happens, the good battery will be feeding current into the defective one.

Wire-wound Resistances.

Wire-wound resistances were greatly favoured until recently as anode resistances, and for similar purposes, and of course there is no doubt that a good non-inductive wire-wound resistance takes a little beating for absolute reliability. It is apt, however, to be rather expensive to make, and naturally it is inclined to be comparatively bulky.

With valves of medium impedance, wire-wound resistances are practically essential, but with the modern very high impedance valve, in which the anode resistance may be even up to two million ohms, it is usually quite possible to employ resistances of the grid-leak type. This possibility has been increased by the introduction of the so-called "metallised" types of leaks, which are now turned out to a very uniform standard and of extraordinary reliability. Metallised grid leaks are very compact, and they are capable of carrying quite an appreciable current without the production of any crackling or other extraneous noises.

Another important point is that with the medium impedance valves the current is often quite appreciable, whereas with the high-impedance valves the current is extremely small. This is all in favour of the use of metallised grid leaks as anode resistances with very high-impedance valves, although a wire-wound resistance is no doubt still preferable for anode resistances up to values of say 500,000 ohms, and where appreciable currents are involved.



The Modern Trend of receiver design invariably calls for Larger Capacity Batteries.

Ripaults Self-Regenerative H.T. Dry Batteries, through the elimination of internal resistance, have a greatly increased capacity output, and tests have proved that they possess at least 50% longer life than the normal type.

Is it not better to have a 15/6 battery which lasts, say 9 months, than a battery at 7/9 which only lasts 3?

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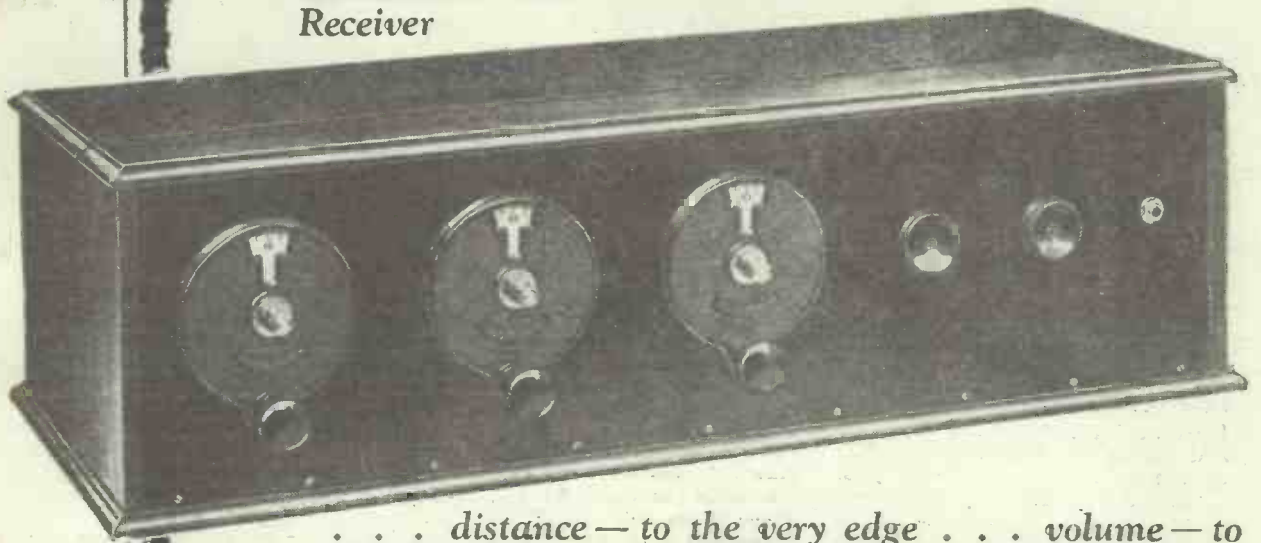
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"I must confess that the final test upon this receiver was a revelation in the capabilities of a five-valve receiver. So utterly simple to handle, it was extremely difficult to believe that a small aerial in Hampstead could bring in a matter of forty odd stations without the slightest demand upon tuning skill. It was infinitely easier to bring in those forty or more stations on this receiver than any reader would believe. I cannot recall a set which in any way approached it for volume and absolute ease of control. It is held that four valves constitute the ideal arrangement; but since this test I am convinced that every home constructor, after having had the opportunity to 'run over the dials' of a friend's Raleigh P.M., will find his ideal in this great set . . ."

"I have built countless sets, but now I have made a real set, viz. your wonderful Raleigh P.M. receiver! I am less than half-a-mile from the Stoke transmitter, but this no longer troubles me, and although I only completed the set last week I have logged 21 stations and there are many more to be brought in, I know. So selective is the set that I can get Stuttgart without a trace of Manchester although there are only 4 metres difference and Manchester is 35 miles away."

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THE secret of really perfect reception is nearly always to be found in the components used. Make sure of the best by insisting on R. I. & Varley, the firm whose products have built-up a reputation for quality and efficiency.

Look at the famous P.M.-Detector, first marketed years ago, and still selling in its thousands. **QUALITY** alone has kept up the sales of this component, for it has not been advertised for almost a year.

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The value of the new R. I. & Varley Multi-Balancer is gradually being appreciated by ever-increasing numbers of wireless enthusiasts who are finding in this one component a host of unique uses. It consists fundamentally of two resistances, two mica condensers, and two 3-point switches, made up in a compact, self-contained unit, costing considerably less than the total price of the various parts if bought separately.



Bi-duplex Wire-wound Anode Resistances, made in a complete range of sizes up to 500,000 ohms. Prices, 5/6 to 17/6.



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One-hole fixing model, 6/6.



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Multi-Balancer, 11/6.



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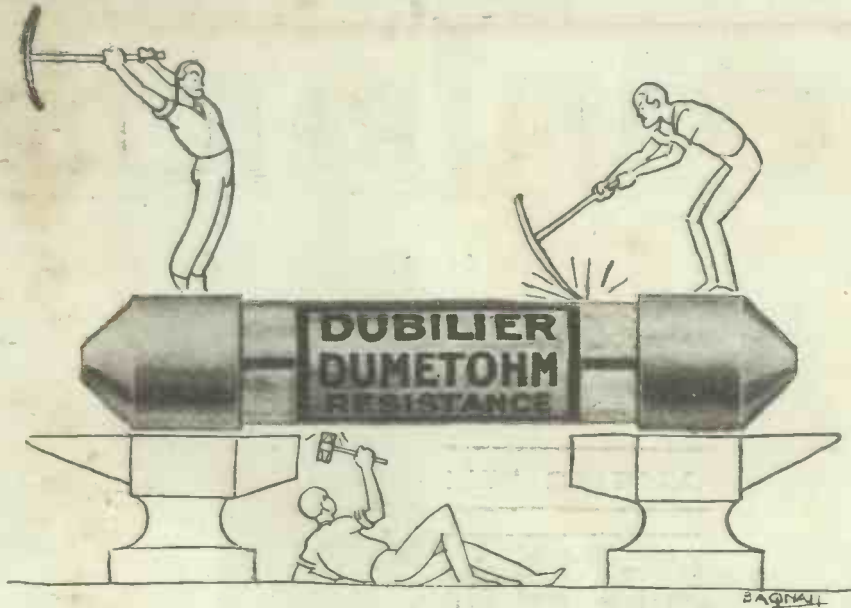
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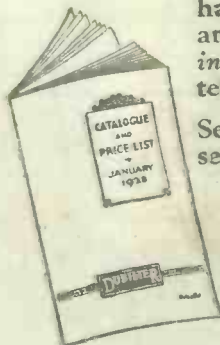
THIS is not an invitation for you to have a Dumetohm broken up to find out what would happen "if the air gets in" or to see what's inside.

In the first place the air is there already—it was never taken out. And if you do break the glass you won't find any form of carbon resistance inside—that type went out when arks were popular.

All you will see is a straight golden rod which has been metallised by a very special process to give just that smooth, unvarying resistance so essential to clear Radio reproduction. Neither temperature nor voltage affects it appreciably, it has no self inductance, no self capacity and is "easily the most popular resistance in the country" as your dealer will tell you.

See that the Dumetohm figures in every set you build.

All Dubilier Products are fully described in the catalogue shown here. In addition there is a lot of information which you may find interesting. If your dealer has run out of copies we will forward you one free.



Dubilier Dumetohm Resistances.
 .25, .5, 1.5, 2, 3, 4.5 and 10 megohms.
 Price 2/6 each.
 Dumetohm Holders.
 Price 1/- each.

DUBILIER DICTA



Have you Electric Light? If so why put up with an outside aerial which implies ladders, masts and much precarious scrambling on the roof?

The Ducon is simplicity itself to use. Plugged into a lamp holder and connected to the receiving set it forms a highly efficient and selective aerial, consumes no current, is perfectly safe, eliminates risks from lightning and reduces noise and atmospheric interference.



To meet all the variety of wiring systems and reception conditions with which we are blessed in this country it is only natural that provision should be made for connecting the Ducon in many different ways. Try them through according to the full instructions supplied with each Ducon.

For instance, your Ducon may give best results when the switch controlling its lamp holder is turned off. It may be found that reception is improved by connecting the Ducon to the Earth terminal as an auxiliary to the existing earth (It is tested at 2,500 volts!)

In short, there are numerous ways in which the Ducon will prove an invaluable thing to have by you if only as a "stand-by" in case your aerial carries away. Send us a P.O. for 5/3 to-day for order C.O.D., mentioning this paper. We guarantee you satisfaction—or your money back—and you will find it the best investment in wireless you have ever made.

Incidentally, if you only have one lighting point in the wireless room, your electrician can supply you with a two-way holder enabling you to use both Ducon and light.

YOU GET MORE FROM MARCONIPHONE

H.T. Supply Units that save you money

Simply plug a Marconiphone H.T. Unit into an ordinary lamp-holder and you obtain continuous and steady H.T. Supply requiring no attention—no renewal. The initial cost is moderate and upkeep costs next to nothing.

Marconiphone Model A.C.2 for Alternating Current Mains

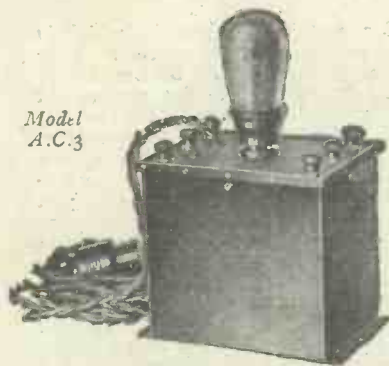
Supplies H.T. to receivers of almost any type. Output exceptionally high—40 milliamperes at 120 volts. Two models available for 100-125 and 200-250 volts. Price, including U.5 valve and royalty, £7 12s. 6d. Also two similar models for 25 cycles.



Marconiphone Model D.C.2 for Direct Current Mains

With output more than sufficient for any standard receiver—50 milliamperes at 120 volts. Tappings at 42 and 84 volts. Suitable for use on 100 to 250 volt mains. Price £4 2 6.

Model
A.C.3



Marconiphone Model A.C.3 for Alternating Current Mains

For receivers employing not more than 2 valves and suitable for 100-125 or 200-250 volts. Complete with valve and royalty, 73/-.

Marconiphone Model D.C.3 for Direct Current Supply

Very neat and inexpensive, this model is for receivers using not more than 2 valves. All components and wiring are enclosed in sealed metal case. Price 35/-.

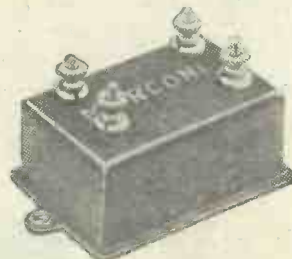
Model
D.C.3.



The modern method of L.F. amplification

Marconiphone Amplifying Devices build up whispers into voluminous sound, yet never do they sacrifice tone purity for the sake of volume. Incorporate them in the L.F. stages of your receiver and it's just as if the music had come much nearer. But volume is the only thing that's added—harshness and distortion have no place in a Marconiphone-built amplifier, especially if Marconi Power Valves are used.

For the first L.F. Stage use one of the new Marconiphone R.C. Units. Remarkably compact, they maintain their stated value under all



Above—R.C. Unit.
Below—Ideal Transformer.



conditions with absolute silence. There are two types. Type "A" for valves of medium impedance—8/-. Type "B" for high magnification valves—7/3.

Follow this with the famous "Marconiphone" Ideal Transformer—proved distortionless throughout the musical scale and guaranteed against mechanical and electrical defects for 12 months. In 4 ratios, 2.7 to 1, 4 to 1, 6 to 1, 8 to 1. 25/- each.

Send for full particulars of all Marconiphone Wireless Apparatus.

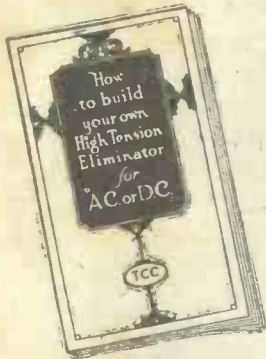
**THE MARCONIPHONE
COMPANY, LIMITED,**

**210-212, TOTTENHAM
COURT ROAD, W.1.**

H.T. FROM YOUR MAINS

FOR YOUR COSSOR
"MELODY MAKER"

If you have electric light you are wasting money every time you buy H.T. batteries. Start saving money—build an H.T. Eliminator and get current from your mains. Send the coupon for a book which shows you how to do it. "How to build your own H.T. Eliminator for A.C. or D.C." is written by an authority for the makers of T.C.C. Condensers. If you follow its concise instructions, clear photographs and simple diagrams you will have no difficulty in building an Eliminator which will give you constant H.T. from your electric light mains—for negligible cost. And, if you use T.C.C. 600 volt Condensers, you will build an Eliminator that is utterly safe and reliable. Send the coupon to-day. It will cost you nothing.



BE SURE TO USE

T.C.C. CONDENSERS

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

I enclose 1d. stamp.
me your book, "How to build
H.T. Eliminator for A.C. or D.C."

Please send
your own
P.W. Jan. 28.

Name.....
Address.....

free!



THERE'S a certain Wireless Set which is puzzling people. If you were to hear its loud speaker you would be perplexed. You would look hard at the Set and would probably ask the owner what were the valves and where was the accumulator. His reply, which would astound you still more, would be that he had neither a valve or accumulator in the place. At that you would look for the twinkle in his eye but not find it. Then he would tell you that his set was the Brown Ideal Wireless Set,* which was so wonderful that it worked a loud speaker without valves or accumulator. "Do as I've done," he would conclude, "stop paying bills for accumulator recharging. Get a Brown Ideal Set and enjoy Wireless without worry or expense." And you would, wouldn't you?

* Complete with BROWN Loud Speaker, it costs £12. 10s. Framé Aerial Model, also with BROWN Loud Speaker, £15.



Brown

IDEAL WIRELESS SET

NONE SO GOOD



The Valve with the NICKEL FILAMENT

For high emission, low filament temperature, economical operation, ability to stand high anode voltages and for all-round excellence of results; there are no 2-volt valves so good as the new B.T.H. Nickel Filament Valves. Buy some to-day—they will last you for years.

B 210 H <i>R.C. and H.F.</i>	B 210 L <i>General Purpose.</i>	B 215 P <i>Power Amplifying.</i>
Fil. Volts 2	Fil. Volts 2	Fil. Volts 2
Fil. Amps. . . . 0.10	Fil. Amps. . . . 0.10	Fil. Amps. . . . 0.15
Max H.T. Volts 150	Max H.T. Volts 120	Max H.T. Volts 120
10s. 6d.	10s. 6d.	12s. 6d.

The above prices are applicable in Gr. Britain and N. Ireland only



VALVES

NICKEL FILAMENT

Made at Rugby in the Mazda Lamp Works.

The British Thomson Houston Co. Ltd.



perfect connection at once!

Put a valve in a Lotus Valve Holder.

Immediately the phosphor bronze leg sockets expand and automatically lock. There is a perfect and permanent connection. The floating platform in which the valve is fixed is suspended by four phosphor bronze springs—springs which have great mechanical strength, but are sufficiently resilient to absorb any external shocks liable to damage the valve.

Lotus valve holders are made from the finest bakelite mouldings obtainable. Every one is tested before it leaves the works.

From all radio dealers

LOTUS

BUOYANCY
VALVE HOLDER
ANTI-MICROPHONIC

REDUCED PRICES:—

Valve Holder with
out terminals .. 1/6

Valve Holder with
terminals .. 1/9

Lotus Valve Holders are
used and recommended in
the Mullard circuits in
"Radio for the Million"
and are ideal for use in the
"Master Three" and the
"Cossor Melody Maker."

Makers of the famous Lotus Remote Control, Lotus Vernier Coil Holder, and Lotus Jacks, Switches and Plugs.

GARNETT, WHITELEY & CO., LTD., LOTUS WORKS, BROADGREEN ROAD, LIVERPOOL.

WIRELESS CONSTRUCTOR ENVELOPES

No. 1. "The Radiano Three" Now on Sale Price 1/6 net.

Here is the first of a new series of Constructor Envelopes which thousands of amateurs have been in need of for many a long day. No. 1 is now on Sale—an envelope containing full instructions for building the famous P. W. Harris receiver

"THE RADIANO THREE"

In this envelope you will find every detail of the set simply explained; photographic reproductions and diagrams are included, as well as a

FULL-SIZE BLUE PRINT

"The Radiano Three" is a set you can build in an hour or two—no soldering necessary, and a wide choice of components and valves open to you.

Stop at the bookstall or newsagents and buy the first of the Wireless Constructor Envelopes, and remember—it is a Percy W. Harris Set.

Details of future Envelopes will be announced later

THERE IS NO SHORTAGE

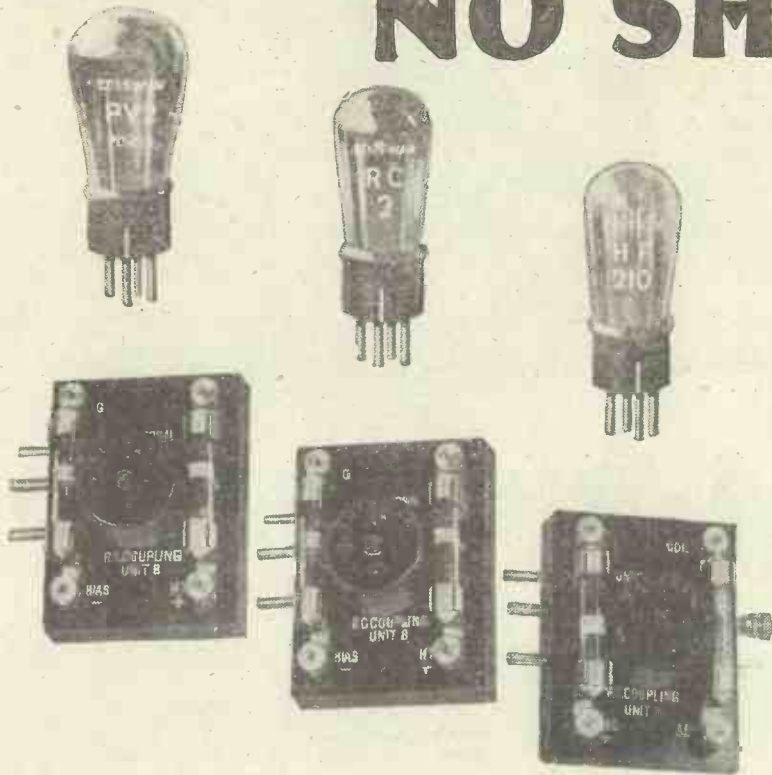
OF THE NEW R.C. THREESOME COUPLING UNITS AND VALVES

Get the parts for this wonderfully simple 3-valve set on your way home. Your wireless dealer now has ample supplies of all the necessary parts.

You can get several stations on the loudspeaker with a wonderful volume of crystal purity.

The New R.C. Threesome has only 5 wiring connections—requires no soldering, and can be made in an hour.

The remarkable results claimed for this set can only be guaranteed if you use Ediswan Valves H.F.210, R.C.2 and P.V.2.



To THE EDISON (Publicity), 123/5, Queen Victoria Street, London, E.C.4.

Please send, post free, presentation copies of the New R.C. Threesome Instruction Book and Blue Print.

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ADDRESS.....

V. 82

EDISWAN VALVES

CLEAREST-STRONGEST LAST THE LONGEST

A type for every purpose



TEAM WORK

SWIFTLY the shells are passed forward from man to man—and fired. Six men acting like a machine. Each in perfect unison with the next—working together. Team work.

Team work is as essential to success in Radio as in warfare. Choose a team of Cossor Valves* and, for the first time, know the full capabilities of your Wireless Set. Because every Cossor Valve is designed to function correctly with its neighbour—as a team—your Set will take on a new lease of life. It will give you purer tone, far more life-like reproduction and greater volume—for less upkeep cost, too.

* Your nearest Dealer stocks Cossor Valves for every purpose, for 2, 4 and 6 volts. From 10/6.

COSSOR Valves

give you
Distance

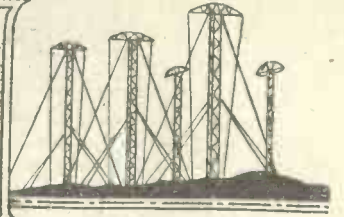
Clarity
& Volume



Popular Wireless



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RADIO NOTES AND NEWS.

Latest About Television—The Year's Howlers—Peeps Ahead—A New Short-Wave Set—
 The Big Shout—Re-opening of PCJJ—Radio Romance.

Latest About Television.

ACCORDING to report, Mr. J. L. Baird has arranged with the Post Office for a trial of his system across the Atlantic by "beam." Interesting and laudable ambition! But we should all be glad to hear something more to the point about things which concern us, namely, an attempt at a service in this country and the appearance of a cheap television receiver.

Topical Talk.

THE Savoy Hill Corporation reminds us of an acquaintance who began this year with a couple of boils on the back of his neck, for they have got "controversial broadcasts" and "spoken English" to demonstrate that troubles crop up even in the most excellent organisation. As to the B.B.C. and the pronunciation of English—let them try to standardise it, and by the time they get their book printed they will have recognised the futility and mischievousness of the effort. As to controversy by radio, my own view is that it would be bad policy to extend it.

A Friendly Word.

A WORD of advice, in friendliness. Not a hundred miles from Savoy Hill—as the gossip-writers say—there is a place where people eat. I go there. I have seen a number of young men lunching together there. They talked "shop" with loud voices. Putting two and two together I gathered that they were employees of the B.B.C.—most of them. I thought it a pity that (1) they were not more particular about pronunciation, and (2) that they were not more discreet in their comments about well-known persons. They may know me by my ginger whiskers and green tie—and speak in whispers next time.

Music Note.

I THINK that most of us were glad to know about Edward German's knighthood. In my opinion, his music exhibits the perfect medium between high-brow and low-brow, and I have never tired of any of it. "P. W.'s" congratulations to Sir Edward.

The Year's "Howlers."

WITH the annual reports of the schools appear the customary list of "howlers," many of which have a radio flavour, due to the B.B.C.'s intrusion into the scholastic world. Here are a few: "Wireless is a voice from a box about sponges and where they grow and other weered subjects. The masters seem to like this and quarrel about turning knobs."

"Atoms are what Sir Lodge talks about on a crystal set and are smaller than mollicoddles."

"Etther is everywhere except between programs. So then London takes a little piano music till it comes back."

More "Howlers."

"INDUCTION is what they do to curates."

"Resistance is two kinds—passive, negative and leased. Leased resistance is a line leading to a thing the easiest way."

"A valve is electric light through a grid-iron on a plate."

EXIT JOHN HENRY.



John Henry was possibly the first really great British microphone humorist, and he and "Blossom," who are seen above, became known the whole world over. It seems probable, however, that J. H. will never be heard again on the ether, for he has asked to be released from his contracts to appear in pantomime. It is stated that there was no quarrel between him and the B.B.C.

"Wave-length is the length of waves and you measure it on a condenser with a killer-cycle."

Station Statistics.

AFTER fun, figures. Extraordinarily interesting statistics have been compiled by the U.S. Department of Commerce. Here are some of them: Apart from the 685 broadcasting stations in the U.S.A. there are in the world 431 stations in 57 countries. Europe has 196, N. America 128, South America 52, Asia 18, Oceania 28, and Africa 9. Cuba is said to have 47 and Italy three! Twenty countries have only one apiece, and France and Mexico have 18 each. The most powerful stations outside the U.S.A. are Motala and Moscow, each 40 kw.

The Mysterious Thirty-Four.

THE ownership of 34 stations has not been reported. I hope this number includes the station which specialises in Bolshevik propaganda. Governments own and operate 77 stations; associations and institutions, 87; commercial establishments, 69; broadcasting companies, 127; private citizens, 33. (Is Marcuse in this total?) Six church organisations run stations; publishers, 15; ministries of war, 4; ministries of education, 2—note the preponderance of war!

Peeps Ahead.

MORE good news! Next week, "P.W." will present its readers with four more *sixpenny blue-prints free*. The date of the issue is February 4th. Chalk it up! On February 1st another "Modern Wireless" will see the light, and it will be a stunner. Amongst other notable tit-bits there will be "The Music Master" set, described by W. James; a free (1/-) blue-print of this remarkable three-valver will be handed to each buyer of the magazine.

A New Short-Wave Set.

THEN you will find more about our friend the 1928 "Solodyne," and there are full details of a "Universal" short-wave receiver, given by the writer of our popular short-wave notes. By the way,

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

the technical gang let out that this set can also be used for ordinary broadcast reception by means of plug-in coils.

Muddling Kids' Minds.

THE education cranks of the B.B.C. still have a strong "pull." Apparently they imagine that our school-teachers need help, and that our children can spare some time from arithmetic and spelling. Fallacies, both. I have before me the B.B.C.'s programme of broadcasts to schools for January 16th to June 22nd. It includes a lot of red ink, an advertisement for a second-hand bookseller, and some impudent instructions to school-teachers. Amongst the subjects on which your children's precious time will be frittered away I note, "Catkins," "How Snipe Drum," "Gliders," "Crete and Sea Power," "Mildev," "Ringworm," "Rot" and "Mould." The B.B.C. has lost control of itself!

A Handy Book.

PITMAN'S—the firm that makes our lady clerks what they are, bless 'em!—I mean the lady clerks—come forward with a very handy little radio year-book. Eighteenpence for 118 pages, including articles by Dr. J. A. Fleming, Captain Eckersley, the Editor of "P. W." ("Amateur Radio in 1927") and Mr. J. F. Corrigan, a well-known contributor to "P. W." There are a number of very interesting photographs which are guaranteed to interest "the famby." Knights of the Cats'-Whisker especially will enjoy Mr. Corrigan's contribution.

Insurance Against "Morse."

SURELY one of the most extraordinary insurance contracts ever made is that which was recently signed by Lloyds and Dodge Brothers, of New York. Dodge's were to give a broadcast of "The Victory Radio Hour," on January 4th, and insured their programme against interruption by S.O.S. calls from ships at sea. In America the stations close down when a distress call is "on the air." The premium was £600 and the consideration was the payment by Lloyds of £200 for every minute the programme was held up by distress calls.

The Big Shout.

IN the U.S.A. they "hook-up" their stations for S.B. when they want to give a specially zippy bit of advertising, and on January 4th, for the famous Dodge programme, there was the biggest "hook-up" ever, on behalf of a motor-car, when more than 30 million listeners were roped in. The broadcast was S.B. to places as far apart as New York, Chicago, Hollywood, and New Orleans; it lasted one hour and cost £200 a minute. For a modest nation these Americans seem to be overfond of advertising.

Amateurs Invade "Movies."

I THINK that for a collection of live wires the Wimbledon Radio Society bears off the palm, for its members have acted and "shot" a cinematograph film, entitled "Tracked by Radio." Shades of poor Le Queux! The film was taken at Leith Hill

in September, during one of the society's field days. We are, of course, a slow lot in England, but I do hope that this bit of enterprise will be noted in the States. Have the "fans" there done the like, I wonder?

Egypt Forges Ahead.

ON January 15th, the Egyptian Marconi Company took over the British Post Office's station at Abu Zabal, near Cairo, and opened a wireless service which links Egypt up with the world-wide Marconi system. The transmitter is of the "arc" type, but that is to be replaced as soon as

telepathy, instead of examining the evidence for or against it, sends me a postcard. He says: "To a stone-deaf man sound is sound and nothing but it." Bless me! What a debater A. N. would make! To a man without mathematics or a detector, radio waves are non-existent. For a man who cannot see, colour does not exist. Does that make it plain to A. N.?

Short-Wave Stations.

NOT necessarily telephony. Los Angeles, K Q T, 44-77; Taganrog, R A V (?); Habarowsk, R A B L, 22; Tommat, R L T, 23; Sebastopol, R C T, 64; Vladivostok, R A O Z (?); Petrozavodsk, R D I, 34-2; Nivegorod, R P P (?); "Radio News," New York, W R N Y, 30-91; Iowa, 6 X U, 61-06; Coteyville, 2 X A L, 30-91; Cleveland, 8 X F, 66-02; Columbus, 8 X J, 54-02; Harrison, 8 X A L, 52-05; Coney Island, 2 X B H, 54-02.

Rival Paradises.

ON January 7th, I reported that Death Valley, California, was claimed as the DX fiends' paradise. Queer coincidence! Ten minutes after writing that I turned up a letter from W. H. B. (Jo'burg) in which he refers to South Africa as "the DX-hound's paradise." W. H. B. is cheerful about radio prospects there, and says that 5 SW is the tonic though not the cure. He got the Dempsey-Tunney fight from 2 X A F, 2 F C, 5 S W, P C J J and A N E (Java). Is a staunch reader of "P.W." and lives in Mayfair. Asks if he is a Valve Bart. No, sir! An I.D.B. (Imperial DX Baron).

Amateur Transmitting Note.

C. H. B., owner of radio station G 2 A X, asks me to say that the correct address of that station is 10, Montemotte Road, London, N.8. He could not choose a better means of publicity than "P.W.," and I hasten to comply with his wish.

Reopening of P C J J.

THIS well-known station, which has been undergoing rebuilding, is once more transmitting regularly every Tuesday and Thursday, from 6 p.m. to 9 p.m. G.M.T., on 30-2 metres. Amateurs over most of the world will be glad to hear this bit of news.

"Mayday."

GLADLY do I avail myself of this new distress call—which means "Help me!" For a report reaches me, by pigeon post—the "little bird" who whispers—to the effect that an Irish orator, speaking of the development of radio since the days of Hertz, said, "All along the sands of time we see the footprints of an unseen hand."

Radio Romance.

THE romance of radio is largely cancelled out by its own destruction of romance. A lady who—presumably in search of the new, strange, and romantic—took a journey through Central Asia, says that the Kazaks, a wild Tartar people, kindly gave her full details of our last coal strike, quoting the names and politics of our political leaders, all of which they had learned by radio. It's a sickening world for an explorer!

ARIEL.

SHORT WAVES.

One of the B.B.C. pronunciation experts has listed twelve ways of saying "Yes." Not counting Edgbaston's "Quite" and Washwood Heath's "That's raiite."—"Birmingham Gazette and Express."

Colour-Scheme, Northcote. No, you will not get Ireland on your crystal set, even if you do cover all the connecting wires in green rubber sleeving.

THIS WEEK'S OSCILLATOR.

A correspondent expresses surprise that the radio trade has not been stabilised when it has coils and condensers which it uses for this purpose every day.—"Southend Times."

Teacher: "What would make a good ground connection for a radio on a farm?"

Pupil: "Well, I think—"

Teacher: "Correct. You may take your seat."

"Imagination is a wonderful asset. Is there a radio enthusiast who can get on without it?"

Wave-lengths will be longer soon with the new marceles.—"Radio Digest."

Householder (savagely, to persevering canvasser of wireless accessories): "I have already told you that I do not buy from canvassers. Do you want me to amplify what I have said?"

Persevering Canvasser: "Yes, sir; but before you begin, let me bring to your notice the merits of the world-famous 'Zogo' amplifier, which . . ."—"London Opinion."

"Who's the stranger, mother dear? Look! He knows us! He is queer!"

"Hush, my own! Don't talk so wild. That's your father, dearest child."

"He's my father? No such thing! Father died, you know, last spring."

"Father didn't die, you dub! Father joined a radio club; But they closed the club, so he Had no place to go, you see. No place left for him to roam; That's why he is coming home. Kiss him; he won't bite you, child. All these radio men look wild!" —"American Paper."

possible by the most modern equipment. How things change! Beam aeriels over the ancient barrows of Wessex and over the hidden tombs of the Pharaohs.

Sweden—Ditto.

THE Swedish Board of Telegraphs announces that broadcasting in that country is not to stand still during 1928. Far from it. The power of Malmö and Göteborg is to be increased from 1 to 10 kw., and a medium-power station is to be erected in the south of Sweden. Subject for broadcast to schools: "How Swedes Swell."

Sound.

DO my readers remember my notes on sound, when I said that sound is not a thing, but a sensation? I added that to a deaf man sound is non-existent. My Oslo pal, A. N., who is still hankering after



COIL-CHANGING every time one wishes to go over from the local to 5 X X certainly is a bit of a nuisance, and listeners who do not mind confessing human laziness are very naturally demanding some way out of the difficulty. Of course, it can always be done fairly easily in a simple set by providing duplicate tuning circuits and a change-over switch, but if this is done in the ordinary fashion, it means a certain amount of complication and also a good deal of expense.

In the "Long-Short" crystal receiver the desired end has been achieved in a very simple fashion, with relatively little complication, and the extra cost is probably not more than about five shillings. The desired simplicity has been achieved by using a rather neat little scheme of plugs and sockets, while the cheapness of the duplicate tuning circuit for the long-wave station results from the fact that the tuning condensers are of the very low-priced compression type, costing about half-a-crown, or 3s. 6d., those actually in the set being "Formodensers." Other makes are, of course, available, such as the Igranite "Pre-set."

Simple Operation.

The simplicity of the change-over scheme will at once be apparent if you will take a glance at the circuit or pictorial diagram on the blue print. You will see that there are five sockets and two flex leads carrying plugs on their ends, and by inserting these plugs in the appropriate sockets you will see that (a) the aerial is connected to either the short-wave or the long-wave tuning circuit, and (b) the crystal and 'phones can be connected across whichever of these circuits is in use.

For example, if the plug on the end of the flex lead from the crystal detector is inserted in the socket nearest to it on the pictorial diagram, and the aerial plug is placed in the socket immediately above the one just mentioned (see pictorial diagram again), the set is arranged for the reception of a short-wave station (the local station, or 5 G B, that is), while to receive 5 X X they are changed over to the other

Here is a crystal set, simple and inexpensive to construct, which has "de luxe" operating qualities. Having set the two easy adjustments, either one of the two stations "registered" can be switched on in a second.

Designed, Built and Described by the "P.W." Research and Construction Department.

pair of sockets, as you will no doubt be able to make out for yourself from the diagrams. We shall be going into this point in greater detail later, and shall then see what the fifth socket (the one immediately below the terminal A₂ on the circuit and pictorial diagrams) is intended to do.

The change-over scheme, as you will now see, is really very simple, and there is no reason why it should cause any loss of efficiency (some switching schemes do cause such a loss) As a matter of fact, the "Long-Short" receiver is quite a good one, judged on efficiency alone, without

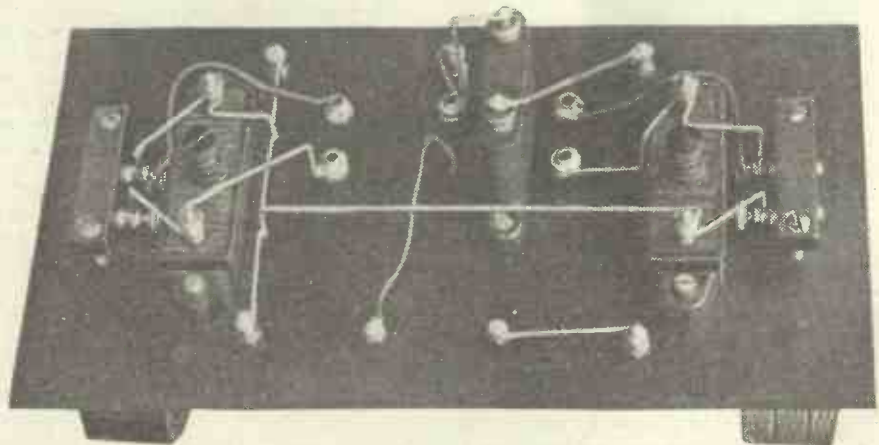
taking its convenience into account, and is well up to standard as regards strength of signals. Its selectivity, moreover, is distinctly good, and can be made better still, if circumstances demand, by connecting the aerial to terminal A₁ instead of to A₂ (the normal one), which brings a fixed condenser of .0005 mfd. in series in the aerial circuit.

Panel and Case.

Turning to matters constructional, the first point to claim our attention is the question of panel and box (it can hardly be called a cabinet!). The panel is 8½ in. by 4½ in., this being a size which has already been used for one or two units of various sorts in "P.W." Any size close to these dimensions can, of course, be used if it happens to be at hand. The thickness can be either ¼ in. or ½ in., and for safety's sake it is wise to choose one of the well-known "branded" materials, such as Becol, Ebonart, Pilot, Radion, Resiston, Trelleborg ebonite, etc., etc.

This panel forms the flat top of the box, which latter need only be about 2 in. deep inside. The one we actually used

(Continued on next page.)



The simple design of this efficient little receiver will be apparent upon examining the above photo. Note the two "variable-fixed" condensers, with which the two stations are tuned-in all ready to provide alternative programmes at a second's notice.

THE "LONG-SHORT" CRYSTAL SET.

(Continued from previous page.)

was a good deal deeper, but this was merely because it happened to be at hand from a previous job.

The original was actually obtained from Messrs. Peto-Scott, and no doubt any of the usual cabinet makers will be able to supply it (Arcraft, Bond, Camco, Caxton, Maker-import, Peto-Scott, Pickett, Raymond, etc.).

Looking at the set from the front, i.e. with the crystal detector nearest you, at the back are three terminals (the earth and the two aerial terminals A_1 and A_2), while to the right is the low-wave coil socket, and to the left is the socket for the long-wave coil. These sockets can be of the proper panel-mounting type, or you can use the ordinary baseboard kind and mount them on the top of the panel.

Assembling the Set.

Near the middle of the panel the sockets and plugs are mounted, while at the front will be found the crystal detector and the two 'phone terminals. Underneath the panel there are only three components, namely, the fixed condenser of .0005 mfd., and the two variable ones. The fixed condenser actually in the set is a T.C.C., but, of course, any of the other good makes can be used (Clarke, Dubilier, Goltone, Lissen, Marconiphone, Mullard, etc.)

The variable condensers, if of the Formodenser type, can be either the panel mounting or the baseboard variety. They were of the latter kind in the original "Long-Short," and it was intended that they should be adjusted once and for all to the two stations

desired (the local on one and 5 X X on the other) before the set was placed in its box, all that was required subsequently being to move the plugs for one station or the other.

If, of course, you expect to tune between your local and 5 G B on one of them, it will be as well to obtain the panel-mounting type. With these the knob projects through the panel and so you can make adjustments without taking the set out of its box. By the way, the capacity indicated for these on the diagrams is that of one of the Formodenser range, and if you choose a different make you will require to select one as near to these capacities as you can get.

Very Simple Wiring.

The wiring-up of the set is a very simple business, and can be done with any of the usual materials, such as Glazite, Junit, bare tinned wire, etc., but you should note carefully the various flex leads which pass through holes in the panel to the plugs, centre-tap terminals on the coils, etc.

THE 6d. BLUEPRINT OF THE "LONG-SHORT" CRYSTAL SET IS ONE OF A SERIES PRESENTED FREE WITH THIS ISSUE OF "P.W."

When the set is finished you will need to obtain two coils before you can try it out, and these will both be of the centre-tapped variety (Lewcos, Lissen, etc.), one being a No. 60 and the other a No. 200. (Of these the No. 60 is for the local (low-wave) station, and the No. 200 for 5 X X. Insert these in the appropriate sockets, and place the plugs as follows for the low-wave station: The plug from the crystal detector goes in the socket nearest the front of the set of the right-hand pair (I assume that you will have the crystal detector nearest you, and so call this the front of the set).

First Tests.

The plug carrying the connection from the aerial (i.e. from the underside of the terminal A_2 or thereabouts) goes in the rear socket of the right-hand pair. Now set the cat's-whisker lightly touching the crystal, and tune in the local station to the best strength, and having done that readjust the detector to give the loudest signals.

Next transfer the plugs to the left-hand pair of sockets and tune the other variable condenser (the one nearest the high-wave coil) to give the loudest signals on 5 X X. (You will probably find the long-wave station not so loud as your local, but that is only natural.)

This completes the

adjustment, and you can now place the set in its box and secure it with a couple of screws in the comfortable assurance that all you will need to do in the future will be to change over the plugs to hear one station or the other, and perhaps re-set the crystal at intervals to be sure of a sensitive adjustment.

Extra Selectivity.

Now for the use of the fifth socket: This is the socket near the A_2 terminal, and it is intended that the plug on the end of the flex lead from the crystal detector shall be inserted here when a little more selectivity is needed on either the short waves or the long. In some cases this will also lead to a slight increase in volume, so it is always worth trying.

If a still further increase in selectivity is needed (for example, when trying to cut out

POINT-TO-POINT CONNECTIONS.

Earth terminal to one 'phone terminal, to one terminal on each of the semi-variable condensers, and to one side of each coil holder.

A_1 aerial terminal to one side of the .0005 fixed condenser.

Other side of fixed condenser to the A_2 aerial terminal, to the socket facing same, and to a plug via a flexible lead.

Remaining 'phone terminal to the crystal side of the crystal detector.

Cat's-whisker side of detector to a second plug via a flexible lead.

Sockets nearest the aerial and earth terminals to the centre taps on the two plug-in coils via flexible leads.

Remaining sides of the coil holders to the remaining terminals on the semi-variable condensers nearest them and to the remaining sockets also adjacent.

This completes the wiring.

a powerful local signal in favour of 5 G B), connect the aerial lead to A_1 , instead of to A_2 . This usually leads to a slight reduction in volume, and always involves a little re-tuning on the condensers for the best results. It is particularly useful when your aerial is large or "heavy," as it is called.

Finally, a word of warning: It is scarcely worth while making a "Long-Short" if your local station is 2 L O, because at present, at any rate, 2 L O and 5 X X practically always have the same programme, except as regards dance music. This set is mainly intended for the provinces, where the local station and 5 X X have different programmes. In the London area a set to give a choice between 2 L O and 5 G B is all that is needed, unless you are particularly keen on the extra dance music given by 5 X X.

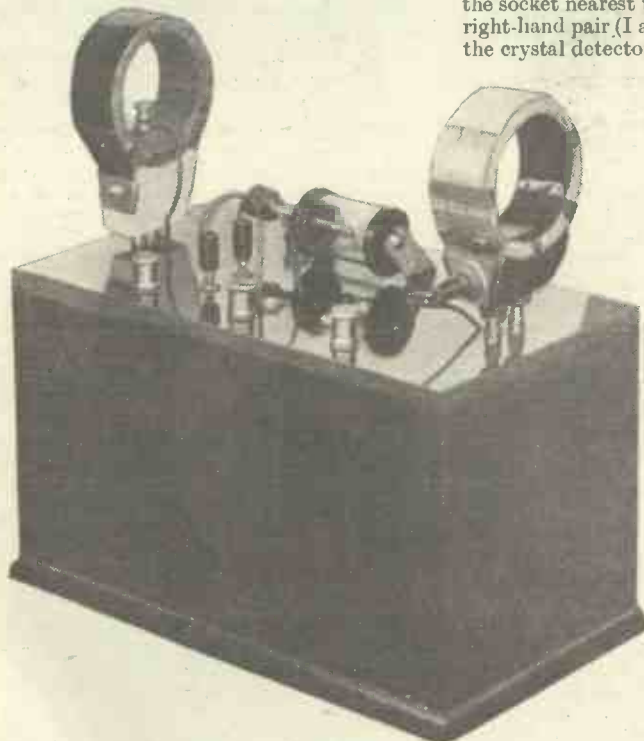
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The easily handled plugs with which the change-over can be made are to be seen in this photo. Also, it will be noticed that the two plug-in coils are of the centre-tapped variety. The three terminals to the left are, top to bottom, Earth, A_2 , and A_1 . When the aerial lead is taken to A_1 the .0005-mfd fixed condenser is brought into series, and the selectivity of the little receiver considerably increased. When the lead is taken to A_2 this condenser is out of circuit.



OVERHAULING A HORN-TYPE LOUD SPEAKER



Some really practical notes which will help you to improve your reception.

By H. D. ALDRIDGE.

MANY readers are in possession of, and derive much pleasure from, a horn-type loud speaker. Quite a lot of these instruments can give very loud and clear signals, and fairly faithful reproduction of the programmes transmitted; but the majority fall far short of doing justice to the excellent quality of the B.B.C. stations. After hearing a good cone-type loud speaker, the drawbacks of an average horn model are often painfully obvious. Wherever it is possible, readers who possess a horn model should couple a good cone speaker to the output of their set. If that does not give satisfactory results, they may be sure that nothing will put things right until the set has been made to alter the quality of its output.

Adequate grid bias, ample H.T., and a low-impedance power valve on the last stage are essential for undistorted output. Correct filament voltage and judicious use of the much-abused reaction coil are equally important.

Stopping That Rattle.

Assuming that one is satisfied with the output from the set, and the needle of the milliammeter does not exhibit symptoms of D.T.'s, the main objective now is the loud speaker itself. The hints that follow on improving the tone of one of these instruments have been very successful in several bad cases of L.S. distortion.

Readers will understand that it is useless coupling a poor little midget-size "Baby Squirming" to a "Rake-em-in Five." The size of the L.S. should be on the "weight for age" principle. The first step is to connect up as usual and switch on, listening for obvious faults for a few moments, such as blasting on the lower scale and fade-outs on the high ranges.

Rattling is often brought about by a loose diaphragm or badly-fitting connection between horn and base. Switch off, disconnect the speaker, and remove the horn from the base. Carefully examine the base, and find out the method by which the cap is connected to the base (some types screw on like a 'phone earcap, others are fastened down by screws). Having removed the cap carefully, the surface of the diaphragm will be exposed. Many surprising objects have been found in this aperture, especially where there are

children; buttons, pieces of orange-peel, and paper pellets being quite common; and dead flies and small moths are not unknown, to say nothing of a good layer of dust.

Having dealt with these, remove the diaphragm by sliding it across the face of the magnets, not by a direct upward pull. The whole magnet and adjusting system is now exposed. Obviously, the first thing one does is to test the strength of the magnets, but not by pulling the diaphragm on and off. A piece of tin will serve for this purpose.

If the magnets do not exercise a good, strong pull, they should be sent, or taken, to a firm who specialise in re-magnetising.



A diaphragm which has become bent or distorted in shape should be carefully straightened, or replaced.

Next the bobbins themselves should be tested very carefully. If they do not fit tight, and slide up and down the laminations, they should be fastened by a few drops of gum being run down inside their centres. Replace the magnets in the base and re-fix the adjusting system, finally re-joining or re-soldering the two leads from the bobbins to their respective poles. These two wires, and also the wire at the rear of the bobbins which joins the two windings together, should be examined for insulation, care being taken that they do not touch the magnets or metal casing, or a "short to frame" will occur and curious troubles result, with the risk of slight shocks.

Adjusting the Magnets.

The face of the magnets should receive careful attention. One may be on a different level from the other, or one end higher than the other. This can be ascertained by placing a steel rule on edge, or a straight knife-back, across the top of the base, adjusting the magnets until a small light gap shows between them and the edge of the rule. They should be equidistant

at both ends, the rule being slid across the flat top of the base, and any variation being compensated by adjusting the spring or springs in the base. If these faces are not level, power will be wasted, as one magnet will stick to the diaphragm before the other can exert its full force.

If they are badly out of alignment, it is advisable to have the faces re-ground; but, with a little patience, a satisfactory medium can be obtained. Attention is now directed to a very important factor—the diaphragm itself. Examine this carefully, as this is the vital part of the instrument. A pronounced dimple will often be seen in the centre, where the clumsy operator has allowed the magnets to press hard against its surface.

Completing the Overhaul.

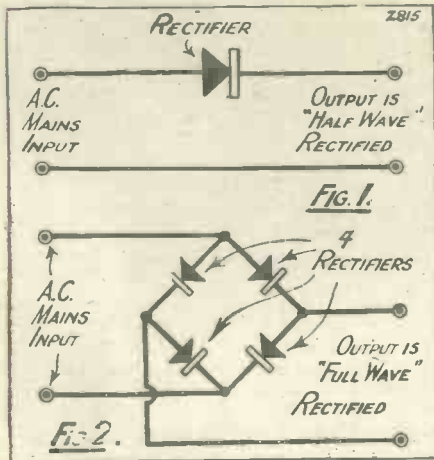
A diaphragm like this, or a bent one, should be discarded. A new one can be purchased for a few coppers, the old one being taken as a pattern. One metal that will serve this purpose satisfactorily is "Stalloy," so see that the new one is marked thus. Then we come to the washers or damping rings. If the old ones are worn or creased, scrap them. New ones can be made by laying the diaphragm on a sheet of thick blotting-paper and marking out a ring a fraction larger than the disc itself. Cut round this and fold the resulting circle exactly in half, then cut out the centre a quarter of an inch from the edge, and an unbroken ring will result.

Four of these should be cut out, two under and two on top of the diaphragm edge. Before replacing the diaphragm, obtain a few pieces of cotton-wool, tease them out, and pack lightly into the spaces around the magnets and bobbins to fill in the air spaces. This prevents a lot of hollowness in tone. Place the first two washers on the edge of the base, and put the diaphragm back in place. Put two more on top, replace cap, and screw up, making sure the washers are perfectly flat and that the magnets are drawn well down from the diaphragm. That concludes the treatment for the base.

Finally, choose the best position for the speaker; the worst is on top of or facing the set. Any reader who cares to carry out the advice given will be sure that he is getting the best from the material on hand.

ONE of these days, as has frequently been predicted, radio receivers are going to be standardised in such a manner that they will be as easy to place in operation as vacuum cleaners or any other household electrical devices. This we have always regarded as an inevitable development. Where there are electric supply mains, why should one have to bother about batteries to work a wireless set? It seems foolish to have to collect electrical energy from outside sources when it is available in one's own home.

With power mains laid on, one has at one's disposal enough energy to operate a score of sets, and the development of dry



rectifiers is just one further step towards the ideal of absolutely domesticated radio. Although there are valves whose filaments can derive their heat from the activities of "raw" A.C., there does not seem at present any likelihood of our being able to supply the anode circuit with anything else other than smooth and "rippleless" direct current.

Rectifying A.C. Current.

Therefore, where A.C. mains are concerned it is necessary first to rectify and then smooth for this purpose. The smoothing is very simple. This merely entails chokes and condensers—components that can permanently be built into a set like low-frequency transformers, or coils, and which do not entail irritating maintenance. But rectification hitherto depended upon such things as electrolytic cells which are like miniature accumulators, or high-emission valves. Now, however, we have what is known as the dry rectifier as an alternative, and one which has many attractions. Let us divert a moment to review the problem of rectification.

The Meaning of "Cycles."

Our A.C. mains deliver a current of electricity which changes its direction many times per second. This current flows first in one way and then in the other. At first the current rises from zero in one direction to a maximum point, then falls again to zero and repeats the operation in the other direction. The one complete rise and fall in each direction constitutes a cycle, so that mains labelled "50 cycles" do this 50 times per second. A rectifier is a device which will enable current to flow through it in one direction only, or, at least, very many times much better in the one direction.

If we connect a rectifying device in one lead of a pair connected to our A.C. mains,

A NEW RECTIFIER.

The description of an interesting device, which, among other things, enables fixed condensers to be eliminated from mains units.

By
A SPECIAL CORRESPONDENT.

as shown in Fig. 1, the current will be what is known as half-wave rectified. Detached impulses will flow from the leads, for the simple reason that when the current reverses it cannot flow because of the action of the rectifier.

But by connecting up four rectifying devices, as shown in Fig. 2, we can obtain what is known as full-wave rectification. We now have a current which flows in one direction only, but which rises and falls. It can easily be smoothed out and made into quite "rippleless" direct current, the sort of energy delivered by ordinary H.T. batteries. A crystal detector is a very excellent rectifying device in some respects, but it will not handle enough current to supply energy to operate valve sets. But quite recently the Westinghouse Brake and Saxby Signal Co., Ltd., have introduced a metal rectifier which is nearly as permanent in its qualities as a grid leak.

A Simple Article.

This firm hold patents on the device which date back six or seven years, but they did not place their appliance into production until they had carried out a great number of experiments. The Westinghouse metal rectifier is a very simple article. Essentially it consists of a copper washer and a lead washer clamped together. One surface of the copper washer is oxidised, and the action of the device depends upon the junction between this oxidised surface and the body of the copper itself.

The whole thing is clamped together into a small and very robust little element. I recently saw this new Westinghouse device very thoroughly demonstrated, and

I must say I was impressed. Its functioning depends upon the fact that the ratio of the resistance from the copper to the oxide coating is very high compared with the resistance from the oxide coating to the copper. The ratio of these two resistances is of the order of one thousand.

The unit has the very high efficiency of an average of over 60 per cent, and this compares exceedingly well with any other rectifying device.

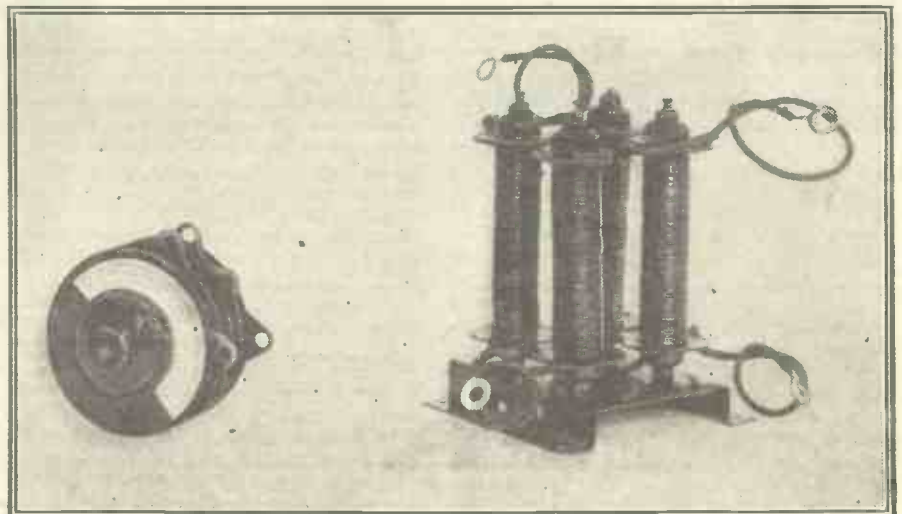
Elements in Series.

There are several sizes of these units available, but the one generally employed for radio H.T. eliminators, and so on, is capable of handling, I believe, 3 or 4 volts and about 5 amperes. But where, as in the case of H.T. eliminators, it is necessary to handle voltages running up to 150 or so, it is a simple matter to clamp a number of these units together in the manner indicated in the photograph, the assembly being quite compact.

Supposing each unit was capable of handling but 3 volts, it would be quite easy to clamp four together, in order to cope with 12 volts. If it were desired to pass more than 5 amp. any number could be placed in parallel, so that it cannot be said that the unit has any current-carrying or voltage limitations!

Several Useful Applications.

In a very interesting handbook the Westinghouse people indicate a number of novel and useful applications of their new metal rectifier. For instance, they show how it can be used for smoothing current similarly to fixed condensers. A group of the elements joined up in series is placed across the output lead from a rectifying unit. With increases in current the resistance to the flow of current of the paralleled rectifying elements in the one direction drops and thus the peaks of the ripples, as it were, tend to be by-passed. The hollows are filled up by the induction action of low-frequency chokes and thus "rippleless" current results. I heard a receiver in operation which was served by an eliminator employing such a scheme and no fixed condensers of any type, and I must say the results were very good indeed. No hum was discernible, and it appeared that the object had been achieved.



On the left is shown a small group of the rectifiers clamped together and all ready for use in a charger unit. Four larger groups of elements "piled" in series for handling H.T. in an H.T. eliminator are shown on the right.

The Microphone

A brief and interesting description of how "Mike" does his work.

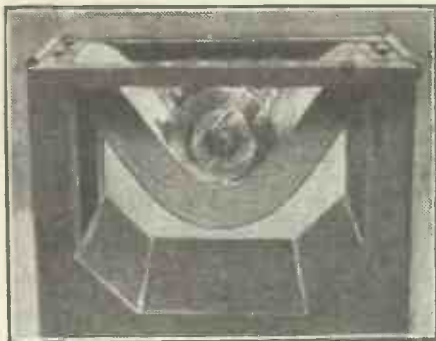
By A SPECIAL CORRESPONDENT.

I SUPPOSE if you had asked people a few years ago "What is a microphone?" not one in ten thousand would have heard of such a thing. In these days of broadcast reception probably there is not one in ten thousand who has *not* heard of the microphone. But I wonder how many of those have any real idea how the microphone—or "Mike" as he is known to his intimates—goes about his work?

Transforming Voices.

Many people will perhaps be surprised to know that they themselves employ a microphone several times every day. For when you speak into an ordinary telephone, at your home or at your office, the little mouthpiece into which you speak catches the sound and directs it into a tiny microphone, about the size of a penny, which is placed just within the instrument and behind the mouthpiece.

What is the purpose of the microphone in a telephone instrument? Its purpose is



A broadcasting microphone of one of the earlier "moving coil" or magnetic types.

to transform the sound of your voice into corresponding vibrations in an electric current. We can transmit an electrical current over great distances by means of a fine copper wire, but we cannot send sound-waves over great distances. Therefore, we use this simple little instrument to produce a varying electric current, and we send the electric current, now impressed with variations corresponding exactly to the sound-waves of the human voice, over the telephone line, this fluctuating electric current then passing at the other end into the "telephone receiver."

What the Carbon Does.

This diaphragm imparts motions to the air, and the electrical variations are once more transformed into sound variations, so that the sound of the speaker's voice is reproduced at the other end.

The action of the ordinary microphone—generally known as the carbon microphone—is very simple. It was discovered many years ago that if a piece of carbon be placed in contact with another piece of the same material, the electrical resistance, that is the resistance offered to the passage of an electric current across the contact, varies considerably with the mechanical pressure between the points.

If the two pieces of carbon are touching each other lightly the electrical resistance will be relatively high, whilst if they are pressed together firmly the electrical resistance will become very much smaller. If, therefore, we connect an electric battery across such a contact, the current which will flow from one carbon point to the other will vary considerably as we vary the mechanical pressure between the points.

In the telephone, what we do is to connect an electric battery through the microphone and include in the circuit certain other devices, which we need not discuss for the moment. The microphone may comprise two tiny oblong carbon discs with carbon granules in between. One of the carbon discs is attached to a small diaphragm, and it is upon this diaphragm that the sound waves of your voice fall when you are "speaking into the telephone."

Electrical Variations.

The result is that one of the tiny carbon discs vibrates in accordance with the voice and therefore exerts rapidly varying pressures upon the carbon granules, so causing corresponding variations in the resistance of the circuit.

As explained above, the electric current which will pass through the microphone will vary with the variations in the pressure, and thus variations are imposed upon the electric current corresponding to the sound-waves of the voice. This electric current then passes through various instruments and passes out eventually to the telephone wire to be carried to a point perhaps miles away.

Now in the case of wireless broadcast an arrangement is used which is precisely similar in principle to the above, although different in details. The microphone in the broadcast studio via an amplifier causes variations in the amplitude or strength of the "carrier-wave" which proceeds from the broadcast transmitter.

The carbon granule microphone, as you know from your everyday experience, is quite satisfactory for use with the ordinary



home or office telephone, but with the very great refinements in radio broadcast it was soon found that the carbon microphone did not sufficiently faithfully transform the sound-waves into electrical variations.

The "Moving Coil" Type.

Radio scientists therefore set to work to improve the microphone, and a type was eventually adopted depending upon the magnetic principle. This magnetic or magnetophone instrument is, in principle, the same as the telephone receiver, that is the part of the telephone which you hold to your ear. A magnet surrounded by a coil of wire is used and a movable part or "armature" is arranged in proximity to this magnet, this armature being free to vibrate in accordance with sound-waves falling upon it.

As it vibrates it sets up, by induction, varying electric currents in the coils of wire around the magnet, and we then have our desired transformation from acoustical energy to electrical energy complete. Many other improvements in design have taken place, but the modern microphone as used for broadcast work is based upon the magnetophone principle.

A PANEL-DRILLING HINT.

WHEN drilling a smooth-surface ebonite or composition panel many amateurs often experience a very great difficulty in maintaining the drill in a perfectly vertical position, and consequently the hole drilled through the panel is not straight.

A good tip to remember when engaged on work of this nature with smooth surfaced panels is to observe the reflection of the point of the drill on the ebonite surface. If the point of the drill is not entering the panel in a perfectly straight manner, the fault will be exaggerated enormously in the reflection. Always, therefore, see that the line formed by the drill point and its reflection is perfectly straight, and you will then have no difficulty in obtaining perfectly true holes in the panel.

This hint cannot be applied to dull surfaced panels, in which no reflection can be seen

TECHNICAL NOTES

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

VARIABLE CONDENSER TROUBLES.

A PRECISION JOB—CURING THE FAULT—USING INSULATING TAPE—THE VARIOMETER.

Variable Condenser Troubles.

ALTHOUGH there are now so many first-class variable condensers on the market which are really excellent examples of engineering design and workmanship, there are still large numbers of "the other kind," and often the scraping, grating and crackling noises which are so frequent an accompaniment to tuning operations are due to defects in the variable condenser vanes. You are always advised to take great care to keep the spaces between the vanes clear of any particles of grit.

With a set which is housed in a proper cabinet, it is hardly likely that actual particles of grit will get between the condenser vanes in the ordinary way, but, of course, if you happen to have been making any alterations in the circuit or doing any work upon any parts within the cabinet, it is quite likely that grit or dirt between the vanes may result. Cleaning between the vanes may be carried out by means of a pipe-cleaner or a small feather, but it should be done very carefully and care should especially be taken not to distort the vanes in any way.

A Precision Job.

Owing to the very small clearance between the moving and fixed vanes, it is a matter requiring some engineering precision to ensure that the clearance shall remain reasonably the same during the whole range of motion of the rotor. This is where the trouble frequently comes in. Vanes may be very nicely spaced for one position of the rotor, but, as you turn it round, you come eventually to a part where one of the moving vanes touches a fixed vane even ever so lightly. You will then find that scratching and sometimes very loud crackling noises are heard every time you move the condenser dial to a position in the region of that particular setting.

Curing the Fault.

If trouble of this nature is experienced, the only remedy is to remove the variable condenser from the set, place it upon the operating table where the light can easily be seen through the spaces between the vanes and then, with great care and patience, bend the offending vane (by means of a penknife blade) until the proper clearance is obtained. But it is very easy to overdo the remedy, and unless you are very patient you will find that you have made the condenser worse instead of better. If the trouble is serious and the condenser a valuable one, it is better to send the condenser back to the makers to be properly adjusted, or for a new vane to be fitted. It is always wise to examine a condenser very carefully before buying it, in case trouble of this kind should be present.

Using Insulating Tape.

Insulating tape can be used for many purposes besides covering joints in electric-light flex. For instance, if you have a length

of busbar which has to lie in close proximity to another, and you happen to be "out of" insulating sleeving, you can very easily cover the busbar with an effective equivalent by wrapping it with insulating tape placed lengthwise, instead of being wrapped around in the usual fashion.

A piece of tape of about $\frac{1}{2}$ in. width is cut, approximately the same length as the busbar to be covered, and laid straight upon the table; if the busbar is then laid along the midline of the tape the latter can be neatly folded over so as to give the busbar an excellent sleeving.

In fact, a somewhat similar method may be used where you wish to cover a portion of a busbar which is already in position in the set. If you wanted to slip over a piece of tubular sleeving you would have to unsolder one end of the busbar, and even then you might find it very inconvenient to get the sleeving into position. But by taking a suitable length of insulating tape and manoeuvring it into position below the busbar you can make quite a fair insulating jacket.

Insulating tape should not be always left in a warm place, as it is

apt to become very dry and to lose its "stickiness."

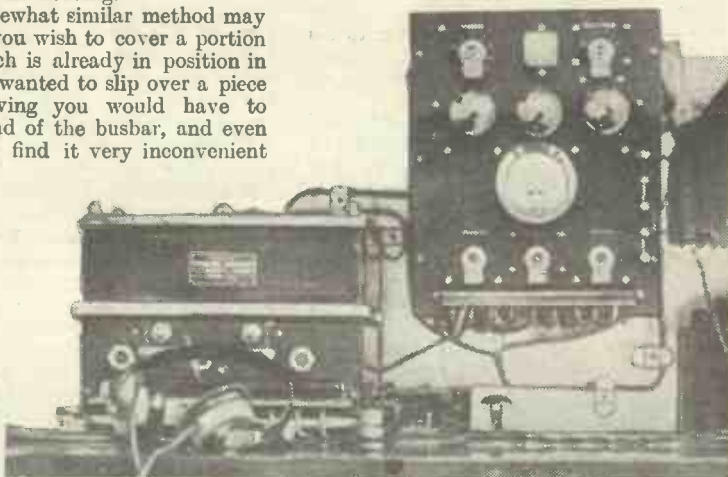
The Variometer.

I wonder how many experimenters still use the variometer? I have had a number of letters in connection with this and the subject of coils generally since my reference in these "Notes" a short time ago to the general question of coupling.

In the earlier days of crystals the variometer held its own, but latterly there has been a tendency to discard it in favour of plug-in coils, used, of course, with a variable condenser.

Frequently when an instrument falls into disuse it is recognised later to have many advantages, and often finds a return to popularity. The variometer has, of course, the advantage that it does not require the use of a variable condenser, and it generally occupies about the same space as that instrument. Since the plug-in coils are not necessary, the space which would have been

(Continued on page 1123.)



A corner of the radio room on the S.S. "Mayheer," a Cunarder on the England-West Indies route, showing the new automatic S.O.S. receiver. This device, which will be a compulsory British ship fitting after this year, picks up all distress calls within a radius of 300 miles, automatically ringing bells in three parts of the ship—viz., the radio operator's room, the radio room, and the chart room.

NEWS FROM SAVOY HILL.

FROM OUR OWN CORRESPONDENTS.

A ROYAL BROADCAST.

SWEDEN'S DAY—"SHADOWS" AGAIN—"OURSELVES AS OTHERS SEE US"—
A GERARD WILLIAMS PROGRAMME.

Duke of York to Broadcast.

THE Duke of York, the Right Hon. Winston Churchill, Chancellor of the Exchequer, Sir Warren Fisher (who is to preside), Sir Samuel Scott, and Sir Herbert Creedy are to make speeches at the annual Civil Service dinner, which takes place in the Grand Hall at the Connaught Rooms, London, on Friday, February 10th. They will be broadcast from 5 G B between 8.25 and 9.30 p.m.

Sweden's Day.

Sweden is the next country on the list of those to be honoured by the broadcasting of special programmes representative of their music, drama, and literature. The date chosen is Sunday, February 12th, when practically every European country will

at some time or other, radiate concerts of items selected by Swedish broadcasters, that from our own stations being heard during the afternoon.

Since this important and systematised interchange of national programmes was instituted some months ago, we have had concerts dedicated to France, Germany, Austria, and Czecho-Slovakia, while these and other countries have also reciprocated by giving British programmes. According to present arrangements, these concerts will be given at intervals until the end of the present year.

The idea underlying the scheme, however, is much more important than most listeners appear to appreciate, though this may be because the present arrangements

(Continued on page 1121.)

"SUPERS" and "ULTRAS"

IN these days when new circuits and improved types of apparatus appear almost daily, it is often a matter of difficulty for the wireless amateur to distinguish between what is really something special and what is merely a conventional circuit or article described by an over-enthusiastic owner or manufacturer.

The extravagant use of the terms *super* and *ultra* is apt to be particularly misleading, for whilst many manufacturers will lay claim to producing goods of super-quality, or ultra-efficiency, there are, nevertheless, a few cases in which these expressions convey a definite technical meaning, and it is proposed here briefly to summarise the more important of these.

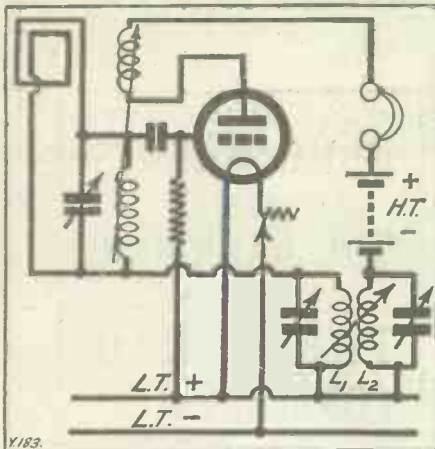


Fig. 1. An Armstrong super-regenerative circuit.

Perhaps the best known example is the famous "Armstrong Super" circuit.

Any circuit giving exceptionally good results may be called a super-circuit, but in the case of the Armstrong circuit the *super* referred originally to an excessive degree of reaction, from which it was called "super-regenerative."

The Armstrong Circuits.

Any circuit utilising super-regeneration may, with some justification, be called a super-circuit, and here the expression may be regarded as a genuine title.

The operation of the Armstrong Super is probably quite familiar to readers, who will recognise the single-valve circuit in Fig. 1. Here the valve receives and detects signals in the ordinary way, reaction on to the aerial coil being employed. In addition

A few of the circuits genuinely deserving the above description are described in an interesting and practical manner.

By C. E. FIELD, B.Sc.

to the usual reaction coupling, the plate and grid circuits are coupled by means of two large coils, L_1 and L_2 , whose values and coupling are such that the valve normally oscillates at a frequency of, say, 10,000 cycles a second, or at the upper limit of audibility.

The result of this relatively low frequency oscillation being superimposed upon that due to the ordinary reaction is that the latter is periodically interrupted before the oscillations have time to build up to a steady value. Thus, excessive, or "super" reaction may be employed and enormous amplification obtained without the valve being paralysed, as would be the case if no interrupting oscillations were applied.

The Supersonic Heterodyne circuit, also associated with the name of Armstrong, is briefly referred to as the Super-Het., and is another instance of a circuit the title of which has a definite technical meaning.

The Ultra-Audion.

Although the circuit is possibly the last word for selective reception, and as such may be said to give super results, this has no bearing on the name Super Het.

In a simple supersonic heterodyne circuit a valve is made to oscillate at a frequency differing from that of the incoming waves by, say, 50,000 cycles per second, and these oscillations are superimposed upon those in the aerial coil, the result being a beat or heterodyne note at a frequency of 50,000 cycles, corresponding to a wave-length of about 6,000 metres.

This is the supersonic (i.e. above-audible) heterodyne from which the circuit gets its name. The long-wave signals are then amplified by transformer-coupled intermediate stages, followed by a second detector valve.

Another circuit with a recognised title is the Ultra-Audion, which has been very frequently described in POPULAR WIRELESS. This is a selective single-valve circuit, in which grid and filament are joined across the series aerial-tuning condenser, reaction being obtained by direct feed-back from the plate of the valve into the aerial coil, as shown in Fig. 2.

The name Audion was originally applied to De Forest's first three-electrode valves, in which a fair amount of gas was occluded, but it is doubtful what was the exact meaning of the expression Ultra-Audion.

A component which certainly merits inclusion in a list of genuine Ultras and Supers is the "P.W." Ultra Coil. This is a tuning coil which may be of the solenoid or honeycomb type, in which two tappings are brought out from points in the winding equidistant from the two ends. The coil is thus an auto-transformer, but differs from the ordinary tapped coil, or double-slider solenoid, in that the structure is perfectly symmetrical, and balanced end effects are produced. The advantage of this is evidenced by the excellent results obtained from a simple crystal set using the device.

Super-Power Valves.

The majority of power valves at one time consumed a quarter of an ampere at six volts on the filament, and had an impedance of about 6,000 ohms. Other valves of different ratings followed, but the increasing appreciation of good loud-speaker reproduction has created an opening for a power valve capable of handling a grid swing of ten or twelve volts, with an output impedance suitable for working with a low-resistance speaker.

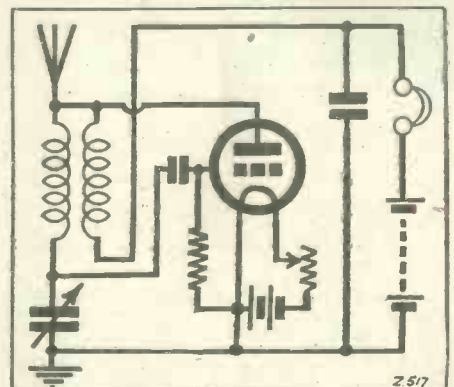
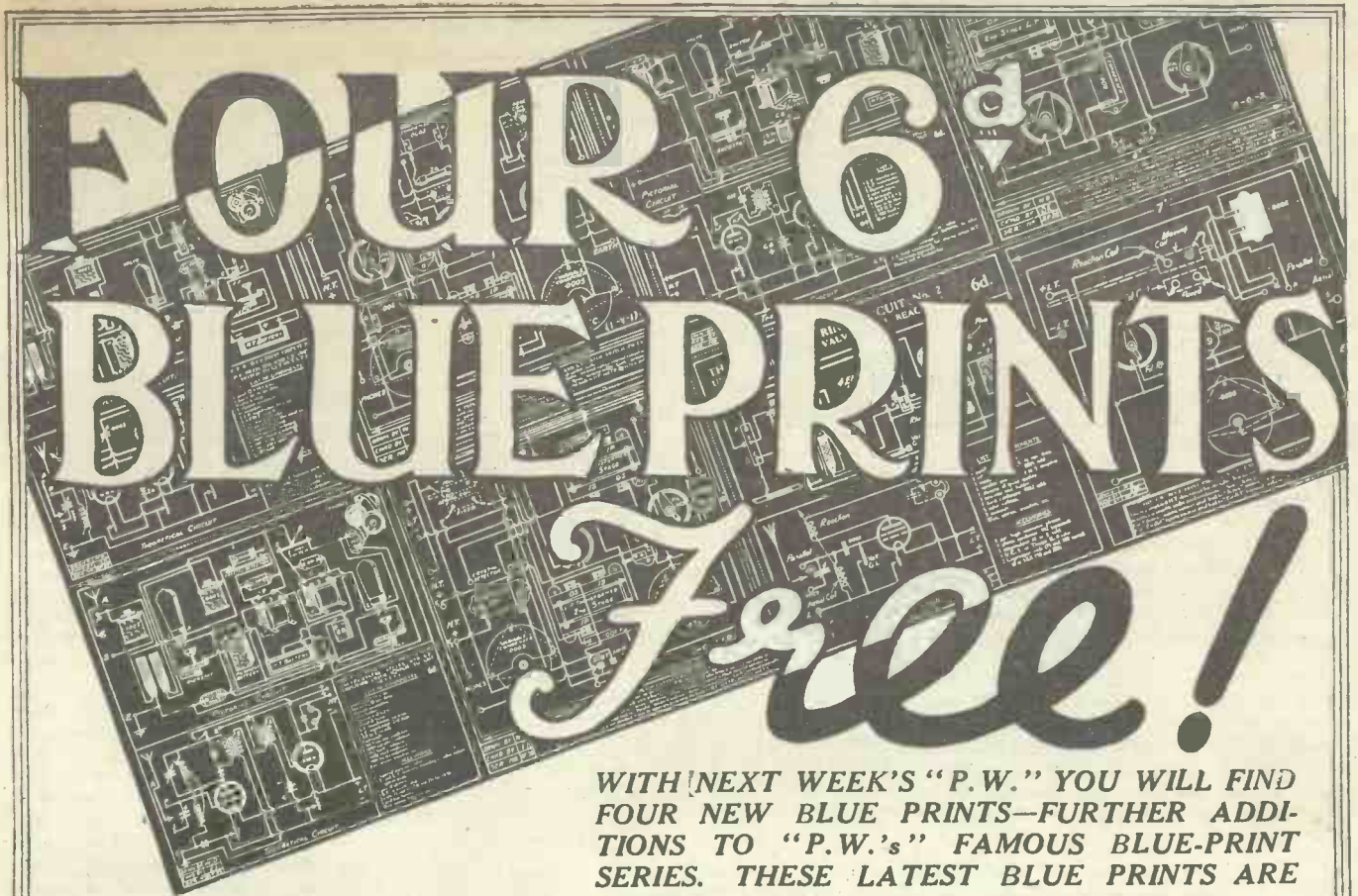


Fig. 2.—A popular one-valve circuit—the Ultra-Audion. The values of components are such as are to be found in an ordinary one-valve arrangement.

For this purpose most manufacturers now produce valves with an impedance of about 3,000 ohms, which can deal with large inputs without requiring excessive plate voltage. These valves, are known largely as super-power valves.



WITH NEXT WEEK'S "P.W." YOU WILL FIND FOUR NEW BLUE PRINTS—FURTHER ADDITIONS TO "P.W.'s" FAMOUS BLUE-PRINT SERIES. THESE LATEST BLUE PRINTS ARE AS FOLLOWS:—

"P.W." Blue Print No. 41. THIS YEAR'S CHITOS ONE-VALVER.—When originally introduced to the public through "P.W.," the "Chitos" scored a phenomenal success on account of its simplicity and sensitivity. Both these features have been improved in the modernised version now available for the first time.

"P.W." Blue Print No. 42. THE "Q. and A." THREE.—An ideal loud-speaker set for household use. The purity of reproduction is almost phenomenal, and to assist the veriest tyro in making the set it is described in the form of Questions and Answers. Easy to make, easy to operate, easy on the pocket!

"P.W." Blue Print No. 43. THE INEXPENSIVE FOUR.—Gives good long-range loud-speaker results at low cost. The circuit employed is a fast favourite: H.F. (neutralised), Detector, and 2 L.F. Amplifiers.

"P.W." Blue Print No. 44. THE ECONOMY FIVE.—Two high-frequency amplifying stages make this set exceedingly sensitive and selective, and two carefully designed L.F. stages give tremendous volume with great clarity of reproduction. (Even if you cannot build this set at the moment, *keep the Blue Print*—you will be sure to need it!)

BLUE PRINTS
ARE
THE BACKBONE
OF
THE RADIO
CONSTRUCTOR'S
HOBBY.

ADD FOUR MORE
TO YOUR COL-
LECTION FREE
OF CHARGE!

Don't Miss This Great Gift Number!

THE ROW ABOUT "TALKS."

Mr. Bernard Shaw Hits the Nail on the Head—The Postmaster-General Sits on the Fence—The B.B.C. Directors Consider the Position—Nothing is Done—But the Remedy Remains.

By THE EDITOR.

THE storm in a teacup which arose over the banning of Captain Reginald Berkeley's play and the subsequent statements made by Mrs. Snowden has resulted in another fierce campaign in the newspapers over the whole question of controversial broadcasting.

As a result of the publicity searchlight switched on to the subject by the newspapers, the Board of Governors of the B.B.C. held a special meeting the other day to consider the whole question of censorship on controversial matter for broadcasting, after which they issued the following statement, which we publish in full:

"The Board of Governors of the British Broadcasting Corporation desire to state that the whole question of broadcasting controversial matter has had for some time past and is still having their careful consideration."

Sitting on the Fence.

The B.B.C. have sent out many announcements, but this may be regarded as their masterpiece. It contains absolutely nothing which may be said to be a contribution to the solution of the problem which is agitating not only the Press but all those who are interested in broadcasting.

The B.B.C. governors are undoubtedly in a very awkward position. They have been interpreting the Postmaster-General's instructions on the question of controversy in a way which, from the political point of view, has been quite safe. But they have forgotten that this point of view may not coincide with the point of view held by their numerous clients, and they have now been forced to realise that to play safe, and thus keep in the good books of the Postmaster-General, has its drawbacks, inasmuch as the majority of listeners are thoroughly dissatisfied with the broadcasting talks; not so much because they are talks, but because, lacking elements of controversy, they are, on the average, so full of milk and water that they are very uninteresting.

The real key to the situation is the Postmaster-General, and if anybody is to blame it is he. The Postmaster-General is sitting on a fence; instead of saying to the B.B.C. Governors: "Experiment with this controversial business, but don't go too far," he should have laid down one way or the other a fixed procedure, and then, if the public was dissatisfied with the ruling, he could definitely have been tackled in the House of Commons on the question.

As it is, the Governors of the B.B.C. are, to use a colloquialism, "getting it in the neck."

G. B. S. Hits the Nail.

There is not much doubt about it: if broadcasting is to become something more important than a source of amusement for congenial idiots and children in the nursery, future talks broadcast from Savoy

Hill will have to be much more controversial. Mr. Bernard Shaw has expressed what is probably the representative view on this question in saying:

"Whole Thing is Silly."

"If you are going to have broadcasting at all, you must have controversial broadcasting. Everything that is broadcast is controversial; even the weather is controversial sometimes. The whole thing is perfectly silly. Members of the Government have broadcast over and over again the most controversial matter, and the Government also took upon itself on one occasion to be very conspicuous in preventing me from broadcasting. I was asked whether I would undertake not to say anything controversial. I, of course, said I would not give any such undertaking, because, in the first place, I should be practically giving up my right of free speech and committing the sin of Esau. The whole thing is silly. I have no sort of patience with it at all."

That is probably what the majority of people think.

The whole thing is "perfectly silly," and people with intelligence cannot possibly have any patience with it at all.

But, nevertheless, if they want to see broadcasting improve they have got to have patience and they have got to make the Postmaster-General realise, and then the Governors of the B.B.C., that broadcasting talks without controversy constitute a mental pabulum which would disgrace the intelligence of the inmates of a lunatic asylum.

"Free" Speech.

This country has always claimed, as one of its great traditional rights, that of free speech; but broadcasting under the present form of control looks like becoming the very antithesis of that tradition.

And there are insidious signs that it is becoming more and more a potential weapon for political ends.

It has not been used by the Government as yet, except unofficially in the recent General Strike, but one can imagine what a tremendous force broadcasting would be for political purposes, and one can imagine how tempting it must be to the political powers that be to reserve this weapon and to keep a very tight rein upon its activities.

The result of this row about Captain Berkeley's play which led up to the review of the whole question of broadcast controversy has had very profound effects at Savoy Hill. There has been much talk of the resignation of Sir John Reith and of other high officials, and rumours of stormy Board meetings have been rife. There is no doubt that things are in a very unsettled state round at Savoy Hill, and that is inevitable when the camp is divided.

Sir John Reith, as Director-General, is undoubtedly a man who has a will of his own; but there are members of his Board who, much to his surprise, have lately given signs of the fact that they, too, have wills of their own, and the clash, which has long been anticipated by students of broadcasting, seems to have been precipitated by the recent publicity in connection with Captain Berkeley's play, Mrs. Snowden, and the whole question of broadcasting controversy.

Preponderance of Talks.

What the outcome will be it is as yet too early to say, but it is to be hoped that the indication given by the public that they are becoming rapidly "fed up" with the B.B.C.'s dictatorial attitude will have a salutary effect, and that Sir John Reith and all those in responsible positions at Savoy Hill will realise once and for all that they occupy their present positions as paid servants of the public, that it is not their prime mission in life to disregard that public and give it what it does not want, but to provide broadcasting programmes which, as the "Daily Mail" ballot showed, the majority of listeners prefer.

As Captain Otho Nicholson, M.P., pointed out in the "Daily Mail" the other day, comparison with the "Daily Mail" ballot result and with the programmes as published in the "Radio Times" is illuminating. To quote Captain Nicholson:

"Whereas the express desire of the ballot placed talks of various kinds fifth and eleventh on the list, with an allowance of eleven per cent. in all of the total, the analysis shows that talks stand easily first in point of time occupied, with twenty-three per cent."

Public Merely-Bored.

It would not be so bad if the talks contained elements of controversy. They would then be interesting, inasmuch as people would disagree about them. But as it is, the majority of people agree at least on one thing about the talks as they are broadcast to-day, and that is that they are dull. Nothing could be more damning.

Many of the subjects which form the basis of talks to-day could be made extraordinarily interesting, but when a namby-pamby attitude is adopted, and any "argument" put forward is strictly non-controversial, then inevitably the reaction of the public to such items must be one of weariness. It is up to the B.B.C., and especially to Sir John Reith and the Directors, to interpret the Postmaster-General's rather vague ruling as regards controversy a little more courageously. The public are with them, and it is much better to take up one definite, firm attitude than to make announcements of the vague and evasive type which we quoted at the opening of this article.

The Remedy.

"The whole question of broadcasting controversial matter has had for some time past, and is still having, the careful consideration of the Board of Directors": no one doubts this, but surely it is time that this "consideration" reached maturity, and that a decision, one way or the other, should be made immediately? If not, the least those in authority at Savoy Hill can do is to hand in their resignations.

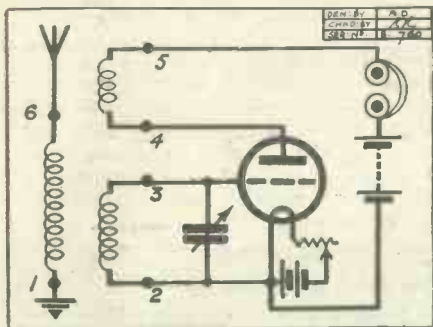
IS YOUR SET "FLEXIBLE"?

There is no reason why your receiver should not be capable of considerable versatility, says the author, provided it has been carefully chosen and constructed.

By W. L. S.

It is often stated nowadays that, wherever possible, a set should be constructed for one specified job, and kept for the purpose of doing the work for which it was originally intended. A receiver constructed for the purpose of working a loud speaker on the local station, say many of the "experts," cannot be expected to give really good DX reception on headphones.

The reasons for this are by no means clear. In the writer's opinion, it is merely a form of prejudice that has unaccountably sprung up and has to be lived down. If a set is sensibly constructed in the first place, surely there is no conceivable reason why it should not be used for a host of different requirements, and, further, there is no reason why it should not meet them all fairly well. By this it is not meant to



Showing the points to which a six-pin coil can be connected in a conventional circuit in the first step towards the modification suggested in the accompanying article.

imply that a set comprising a detector and two stages of L.F. must be expected to bring in all the European stations on the loud speaker, or that a four-valve neutrodyne must be expected to work on short waves. Much may be done, however, with a set to make it "flexible."

Receiving Short Waves.

Take, for instance, the matter of converting a broadcast receiver for short-wave reception. For the purpose of convenience, we will suppose that it is a simple "detector and mag." receiver. We are not, as a matter of fact, concerned with the number of note-magnifiers, since this should have little or no bearing on the performance of the receiver itself. In the first place, there should be no broadcast receiver of this type that refuses to oscillate down as low as, say, 30 metres, on account of the high capacity of the wiring, or the losses in the coil holder and condensers. If this does happen, then the design of the broadcast receiver was definitely bad in the first place, and any alterations made will be bound to improve it. It is, in fact, a good test of a receiver of this type to plug in two very small coils (such as a four-turn in the A.T.I. and a six-turn in the reaction), and see whether it oscillates smoothly. If it does, there is not much wrong with the

detector circuit. Short-wave coils with the turn numbers mentioned above may quite conveniently be fixed to plugs of the standard two-pin type, or may be obtained ready-made from Igranic Electric, Ltd., and other firms.

If the set will not oscillate (with the aerial disconnected, of course), the detector part of the circuit should be carefully rewired, noting the following points in particular:

Two Important Points.

Keep the lead from the grid of the valve to the grid condenser, and also that from the other side of the condenser to the coil, as short as is humanly possible.

Keep the coils as far as possible from any metal objects in the set, such as variable condensers, transformers, or even panel brackets.

There should now be no difficulty in persuading the receiver to oscillate on short waves. The first thing that will be found, however, will probably be that the tuning is so critical that it is almost hopeless to tune in and hold a station at all. Naturally, the variable condensers are much too large. There is, however, no necessity to scrap them, for by the simple expedient of connecting a fairly small fixed condenser in series with the variable, the latter may be made to suit any purpose. Thus a variable condenser of .0005 capacity may be given an effective capacity of .00025 by connecting a .0005 fixed condenser in series with it. If a very small fixed condenser (say .0001 capacity) is put in series, the effective capacity of the variable will be something just under .0001.

A very neat way of doing this is to connect one of the "clip-in" holders for interchangeable fixed condensers between the fixed plates of the variable and the point to which they are connected (the grid condenser, in the case of the A.T.C.). Then for broadcast reception a shorting strip may be inserted in this holder, and a fixed condenser of suitable capacity for short-wave work.

This is quoted more or less as a good example of what can be done with a little thought towards improving the utility of a set that is being used for one purpose only. There are, of course, many similar instances. There is the old trouble of L.F. amplifiers. Plugs and jacks have, of course, made it a simple matter to put the required number of note-magnifiers in circuit, but in the

writer's opinion it is far preferable to revert to the old-fashioned scheme of using a separate amplifier.

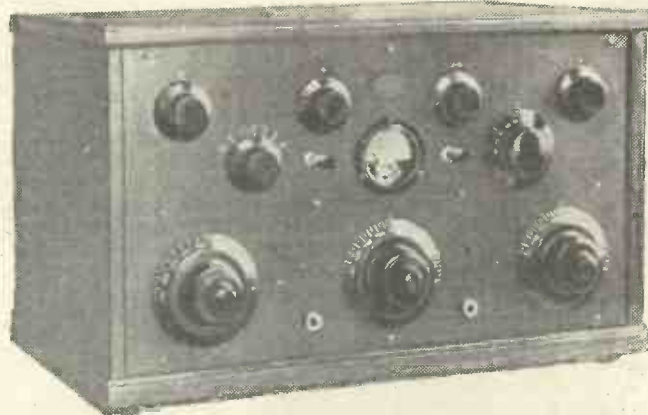
After all, once an L.F. amplifier has been persuaded to give a respectable amount of volume coupled with good quality of reproduction, there is nothing more to be done to it! This being the case, it is difficult to imagine why we scrap a complete three-valve set in order to try another circuit, and then build up another set, the L.F. portion of which is identical with that previously in use, with the exception, perhaps, of the layout. Why not spend a week or so in building a really good self-contained L.F. amplifier consisting of two stages with plug and jack switching to provide one only if necessary? This may be built in a cabinet with the necessary grid-bias batteries, etc., self-contained, tucked away on a shelf somewhere, and forgotten! Leads may be run to the testing table, and the note-magnifier may then be brought into action on the tail end of any receiver that one likes to try out.

It is impossible to do this with H.F. amplifiers, since one can never say when one has struck the most satisfactory arrangement. After all, the only test of an H.F. amplifier is a long search round the distant stations, whereas the local station is good enough for the purpose of testing a note-magnifier. There are, of course, some who have decided on note-magnifiers as the subject of their experiments, and naturally the above remarks are not addressed to them.

Using Six-Pin Coils.

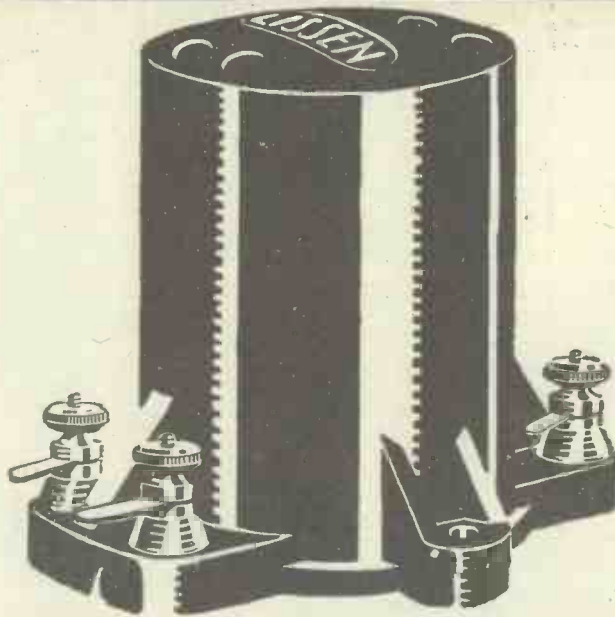
The word "flexibility" is rather apt to conjure up visions of those "pre-broadcast" receivers with 24 knobs and dials arranged in a neat row on the front panel, with switches for connecting the bottom end of the grid-leak to almost any point in the set! That, however, was carrying things to extremes. All that is wanted nowadays is a good opportunity to experiment with certain components without tearing the entire receiver to pieces.

The six-pin-base coils now on the market



There are thirteen dials, sockets, and other such things, as well as a milliammeter on the panel of this early type of receiver. This, however, would now be regarded as "carrying things to extremes." One of the first essentials in the design of a modern receiver is that its panel controls should be reduced to a minimum.

are very excellent aids to "flexibility," since three windings may be accommodated on one former (which may be bought "blank"), the ends of these windings taken out to the six pins, and almost any detector arrangement arranged for.



SOLITARY AND SUPREME—

YOU may think there can be no better transformer for the circuit than the one specified in the booklet to whose instructions you are building—until you remind yourself that there are many advertising manufacturers each of whom you will find obtains a share of use and mention of his products. Then you will understand that the best transformer and other parts have not necessarily been specified. You may think you have to pay a high price before you can get a transformer capable of yielding amplification of the kind that will please you. This may have been so before the new LISSEN came, but now it is so no longer.

Try the new LISSEN, we give you a 7 days' test.

If within that time you do not prefer the new LISSEN Transformer for tone purity and power to any other transformer, irrespective of price, against which you may test it, return it within a week of purchase and your money will be refunded.

GUARANTEED FOR TWELVE MONTHS

Turns Ratio 3 to 1. Resistance Ratio 4 to 1.
Use it for 1, 2 or 3 stages L.F. It is suitable for all circuits and valves you will want to use.

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In its conception, in its price, in its popularity, this new LISSEN is solitary and supreme. It is saving set builders £30,000 a month in the purchase of their transformers alone.

It will save you money and MORE THAN SATISFY YOU.

RELY ON YOUR OWN JUDGMENT WHEN BUYING, CHOOSE YOUR OWN TRANSFORMER.

LISSEN LIMITED, 8.16, FRIAR'S LANE, RICHMOND, SURREY.

Managing Director: Thos. N. Colé.

THE "PROGRESSIVE" FOUR.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been a regular reader of POPULAR WIRELESS since its inception, and I have been building the "Progressive" Set as it went along, and found it very good indeed, and so simple that the veriest amateur could follow it all.

As a one-valver I brought in several European stations as well as at least six English, and, of course, 2 R M. I went on step by step till now I have the best four I have ever had. I tune all stations on L.S. and on a test of one hour I tuned in Dublin, London, 5 G B, Cardiff, Manchester, Glasgow and Liverpool, and also several European stations, notably Rome, Madrid, Oslo, and at least three German and others unidentified.

I thank you for this wonderful yet simple set. No matter what power I put on I simply can't distort. I am situated in rather a bad situation here in one corner of Wexford, and my aerial is badly screened.

Yours,
M. O. G.

Tomhaggard, Co. Wexford, I.F.S.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am writing to tell you that I have put on the "Progressive" Four set described in your paper. It is a grand set, and after I had finished it last night, after the British stations had closed down, I got four foreign stations at loud strength on the loud speaker, I then got a station singing in English, and when he announced, he said, "W G Y, Schenactady, New York, broadcasting from Central Park." The wave-length was about 350 metres.

To-day I tried the set out and got about fourteen normal wave stations on the loud speaker and seven on the long waves. The tone is lovely, and the only fault is that Manchester can be heard on the stations on shorter waves than Manchester. I live about eight miles from this station.

Thanking you very much for the splendid circuit, and wishing your paper every success. I remain,
Yours faithfully,
H. W.

Ashton-under-Lyne,
Lancashire.

The Editor, POPULAR WIRELESS.

Dear Sir,—As a very satisfied constructor of your "Progressive" Four, may I write and thank you very much for the exceedingly clear instructions; I find the result A1, and so does everyone who has heard it, so much so that I have two friends who have started to make one also. I varied many of the makes of the different components; my chokes are all R.I.-Varley, my transformer a Eureka concert grand, my variable condensers Ormond, fitted with their slow-motion control on aerial and tuning condenser. I used an ebonite panel (it was easier to get than a wooden one); I use P.M. 4-volt valves (two P.M.3, one P.M.4, and one P.M.254), the correct grid bias and H.T. accumulators. Volume, purity and clearness are all that can be desired, and to say I am delighted with it is to put it mildly, and feel I must add my thanks to the very many you must have had.

Yours faithfully,
(Mrs.) E. L. M.

Near Oxford.

SOME INTERESTING
RADIO JOTTINGS.

THE American naval wireless stations handle ordinary commercial messages from American ships in order to promote good working between the Navy and Mercantile Marine in case of emergency.

The British Admiralty have now issued a new Order in Council providing for a payment of halfpenny for every ten words in commercial messages handled by naval ratings, at certain coast stations.

The erection of a wireless station at Godhaven, Greenland, has resulted in a radio boom among the Esquimaux.

It has recently been proposed that public libraries should be equipped with wireless receivers so that the general public could attend radio lectures and educational talks.

As no doctor lives upon the island, the inhabitants of Juan Fernandez (near Valparaiso) have installed wireless so that if anyone should fall ill, the symptoms could be described by radio to the Valparaiso doctors.

CORRESPONDENCE.

THE "PROGRESSIVE" FOUR

THE "Q. & A." SET—SHORT-WAVE RECEPTION.

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.

THE "Q. AND A." SET.

The Editor, POPULAR WIRELESS.

Dear Sir,—I recently constructed the "Q. and A." set, and it has worked splendidly right from the start. It took me four hours to complete it. I receive 5 X X, 5 G B, and 2 Z Y on loud speaker, and have had 5 S C, 2 R N, 6 B M, 2 L O, and 2 B E on 'phones, besides a number of foreign stations. Some of the Continentals come in better than our own. My first attempt at making a valve set was the "Inexpensive" One-valver. This was a complete success, and I get as many stations as on the larger set. Your wireless journals are A1, and are very helpful indeed to the constructor. By the way, I get better results—much better on both sets—by connecting L.T. the opposite way round from that specified in the paper.

Again thanking you.

Yours sincerely,
J. S.

Northwick, Cheshire.

"H.T. ECONOMY."

The Editor, POPULAR WIRELESS.

Dear Sir,—Re the above subject in a recent "P.W.," I thoroughly agree with P. Harris regarding H.T. economy. I am sure there must be thousands of valve users who put half-used batteries in the dustbin.

I have used batteries in the suggested way, only with this improvement.

When the new battery voltage drops I immediately break open the cardboard container enclosing battery, and make a small hole in each zinc container and squirt some strong sal ammoniac solution into each container with an ordinary glass squirt with rubber ball.

Close up the holes again, stick on the covers again, and leave it for a fortnight to settle; then put it in circuit again when you will find it as good as new.

After giving it this "monkey-gland" treatment a few times, or the zinc containers start to break up. I immediately disconnect the bad cells and convert them into ordinary Leclanche wet cells, when their life is completely renewed again.

In changing over from one system to another you can always have a spare battery to put in use when special occasions arise.

With best wishes to POPULAR WIRELESS,

Yours sincerely,
Wm. M.

Motherwell, Scotland.

"A SHORT-WAVE ADAPTATION."

The Editor, POPULAR WIRELESS.

Dear Sir,—May I be allowed a little space in your "Correspondence" column to reply to Mr. Murray, of Forres, Morayshire, on the subject of "A Short-Wave Adaptation?"

I may say I followed this practice during last winter with fair results. I have also received 2 X A F by connecting leading-in wire to the window snib instead of to the lead-in tube. If Mr. Murray would desire a really good short-wave set, then I advise him to wire up Circuit "P.W." Blue Print No. 31, given free with "P.W." for week ending Oct. 15th, 1927. For short-wave coils I use No. 16 S.W.G. wire wound on a 1-lb. jam jar and then threaded through small pieces of ebonite which will space the wire and also keep the coil rigid. Using L1 3 turns, L2 4 or 6 turns, and L3 6 turns I can tune in 2 X A F at about R4 to R6 with ease. With this circuit hand and body capacities are practically unknown. I can walk about the room wearing headphones without making any alteration in the tuning, which is so common on short waves.

I can thoroughly recommend "P.W." Blue Print No. 31 for all wave-lengths from above 15 metres to the Eiffel Tower, or higher, if required. I have also had 2 F C, Sydney, twice at about R2 or R3. Thank you for Blue Print No. 31, and best wishes to POPULAR WIRELESS.

Yours respectfully,
J. A. A.

Carlisle, Cumberland.

SHORT-WAVE RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have not seen many reports concerning one-valve short-wave sets, and I am writing to tell you of my experiences with a one-valve Reinartz. I believe you published the circuit some time ago, and I must congratulate you for doing so. It is very efficient. I just "hooked up" the set about a week ago and have had many short-wave stations. English amateurs come in well on 45 metres during the daytime and at dusk the Continental stations begin to come in. The crowning success came, however, on Saturday, January 7th, when 2 X A F was received direct on 32.79 metres.

I began listening at 11.30 p.m., and within a minute had picked up this transmission. After a cello solo the familiar American accent was recognised when the call-sign and wave-length were announced. The schedule for the next week was announced, and after that Morse signals were transmitted. I don't know what the next item was, as I closed down, the time being 12 p.m.

When I first picked up 2 X A F the signals faded at regular intervals, only to appear again with their former strength a few seconds later. Every word of the announcer was heard. The strength of the music varied from R2-R5 and the speech came in at R4.

This is my first experience of short waves and I am sure I shall not desert them. The condensers used were not fitted with slow-motion dials, but, however, tuning was not difficult. Again thanking you for publishing this circuit, and wishing "P.W." every success.

Yours truly,

J. K.

Manchester.

CAUSE OF DISTORTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have read several articles lately in "P.W." on the causes of distortion, and I thought perhaps my experience might interest your readers. I had been getting distortion from my set (a four-valver) for some time, and had tested and tested everything until I felt like putting the set in the dust-bin. Eventually I found it. My tuning is carried out with one dial working a two-gang condenser, and you will know that one set of moving vanes can be moved round the common spindle a few degrees by easing a small set screw and using a tommy supplied for the purpose with the condenser. By continued use (or misuse) these vanes had moved just a shade, thereby throwing the two circuits out of balance. It was not enough to lessen the volume, but just enough to cause the distortion. On readjusting, all trace of distortion disappeared. Wishing "P.W." continued success.

Yours faithfully,
W. T. S.

Havant.

Technical Editor's Note.—It would appear to us that the adjustment made by W. T. S. threw the condensers OUT OF BALANCE. The distortion was probably due to the clipping of sidebands caused by an approach to oscillation. It is more probable that the two circuits were balanced in the first instance.

PRACTICAL ITEMS FOR
YOUR NOTEBOOK.

THE steel of an ordinary drill may be hardened by heating it up to a dull redness, and then immersing it suddenly in a vessel containing a quantity of heavy lubricating oil.

An oscillating receiver spoils programmes not only of the owner but of his neighbours.

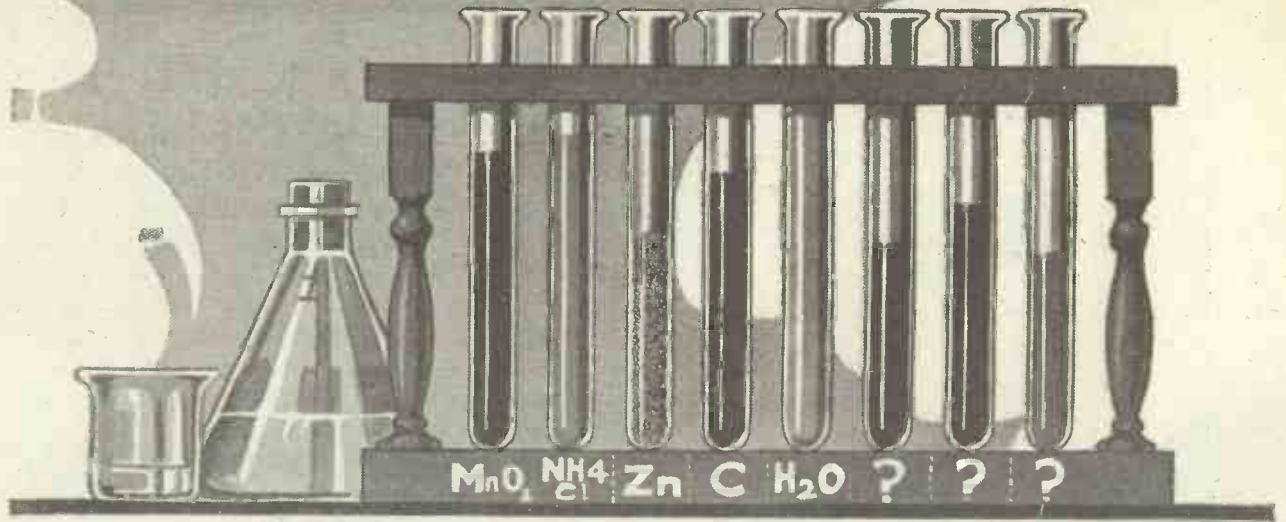
The tuning of a long-wave broadcast receiver is necessarily much flatter than the tuning of a short-wave station?

To test if a pair of telephones are in good order, wear them in the ordinary manner and place one of the tags between the lips. If a key or similar piece of metal is now rubbed against the other 'phone tag a scratching sound will be heard in the ear-pieces corresponding with the rubbing of the key, if the 'phones are in good condition.

The commonest cause of howling and distortion in a set is an H.T. battery which needs replacing.

The golden rule of radio is: Never adjust or alter anything inside the set without removing the H.T. negative plug.

THE SECRET IN THE TEST TUBES



What are the secret chemicals?

YOU KNOW THAT TEST TUBES and the minds of chemists have held secrets which have baffled discovery, but you may not know there have been none more sought after by battery makers than the one so jealously guarded inside each cell of the LISSEN New Process Battery, which makes each cell yield oxygen for your valves in a way *no other cell* does or has ever done before. Copious does not adequately describe this oxygen liberation of the LISSEN New Process Battery.

Since this new energy became available for valves tens of thousands of loud speakers all over the country are reproducing radio broadcast with a freshness of tone and a clear volume which is adding delight to radio. Whenever there is fine music to be heard by broadcast see that you have a LISSEN New Process Battery in your set and hear your loud speaker voicing its appreciation.

10,000 radio dealers are selling the Lissen Battery at a price which has been made low to bring it within the reach of all.

The next time you want a good battery get a LISSEN New Process Battery. Take no other and you will be rewarded for your insistence by a new power smoothness and new tone clarity in your loud speaker.

LISSEN SECRET PROCESS BATTERY

NEW SIZES

Lissen 4½-volt Pocket flash-lamp battery, 5d. each.

LISSEN SUPER POWER 60-volt (reads 66 volts) The battery for big sets, 13/6.



60 volts (reads 66) 7/11

100 volts (reads 108) - 12/11

9 volts (grid bias) - 1/6

LISSEN LIMITED, 8-16, FRIARS LANE, RICHMOND, SURREY.

A Home-made Met-Vick Four

For working off the Electric Light Mains

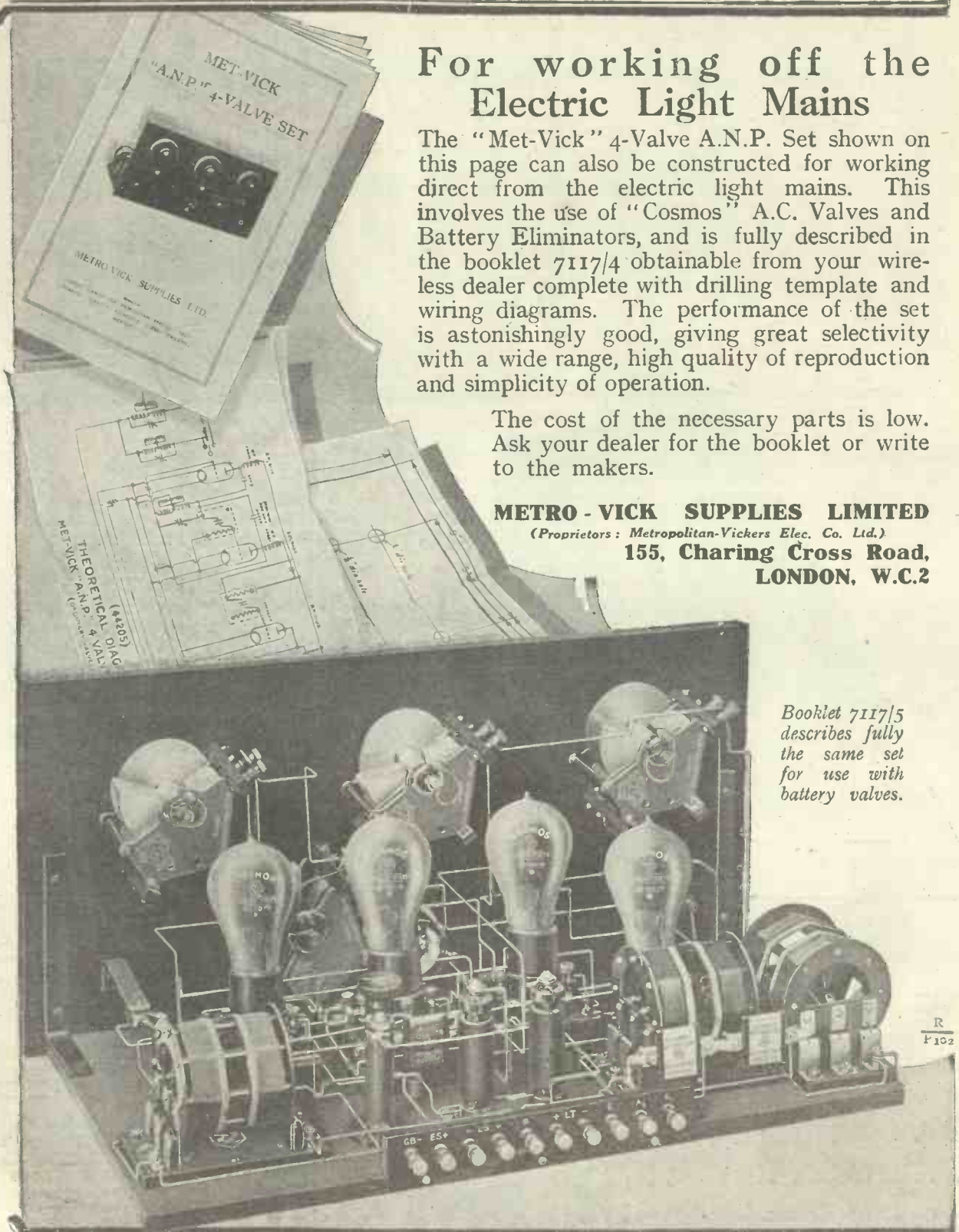
The "Met-Vick" 4-Valve A.N.P. Set shown on this page can also be constructed for working direct from the electric light mains. This involves the use of "Cosmos" A.C. Valves and Battery Eliminators, and is fully described in the booklet 7117/4 obtainable from your wireless dealer complete with drilling template and wiring diagrams. The performance of the set is astonishingly good, giving great selectivity with a wide range, high quality of reproduction and simplicity of operation.

The cost of the necessary parts is low. Ask your dealer for the booklet or write to the makers.

METRO - VICK SUPPLIES LIMITED

(Proprietors: Metropolitan-Vickers Elec. Co. Ltd.)

155, Charing Cross Road,
LONDON, W.C.2

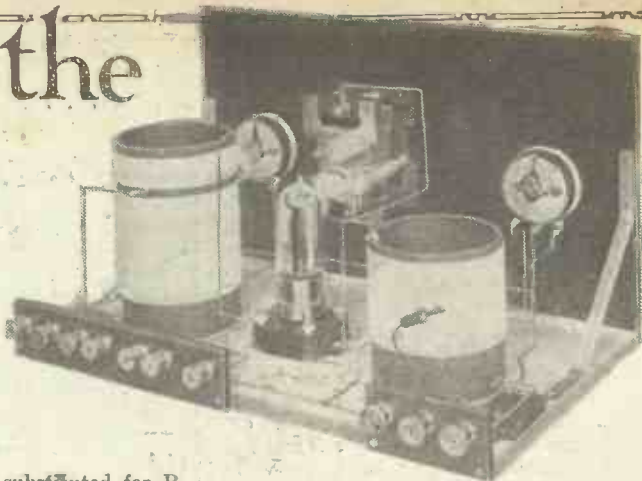


Booklet 7117/5 describes fully the same set for use with battery valves.

Sidelights on the Filadyne

In which are disclosed some new and interesting applications of a highly efficient and interesting method of detection originally due to our Technical Editor.

By J. ENGLISH.



THOSE of you who have constructed Filadyne receivers or experimented with the various circuits will occasionally have come across phenomena which seem to bear no relation to previous experience with ordinary valve receivers. Although the Filadyne receivers are quite as sound in theory and as efficient in practice

If an H.F. choke is substituted for R_2 no reaction effects at all can be produced whatever the anode potential. If the choke is shunted by a variable condenser, however, reaction commences as the capacity is increased. Since increasing R_2 in Fig 1 to maximum completely stops oscillation, it would appear that no reaction can be obtained where the anode circuit contains anything producing an H.F. isolation of the anode, such as an H.F. choke or a large resistance.

Now, in the Filadyne the anode is part of the input circuit, which is connected to the filament and anode instead of to the grid and filament as in the ordinary valve circuit. In the latter we know that isolating the filament end of the tuned grid circuit from the filament results in poor signals and often absence of reaction. Similarly, in the Filadyne, the anode is essentially the "filament" end of the tuned circuit, and, with a fixed reaction coupling between L_3 and L_2 varying the degree of H.F. isolation of the anode must naturally produce a variation in the amount of reaction.

Another feature which has been rather overlooked is that an H.F. current circulates between the anode and the actual filament of the valve. From Fig. 1 it is

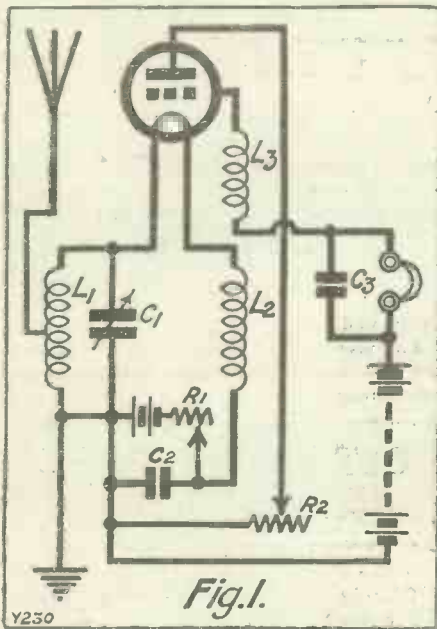
obvious that this current must pass through the coils L_1 and L_2 , and in certain circumstances this alone is sufficient to produce oscillation without any reaction coil in the grid circuit.

Another Method.

This can be demonstrated very effectively by a receiver having the circuit arrangement of Fig. 2. Here the anode is connected to the mid point of the coil L_2 , and under these conditions the circuit oscillates violently. Without going too deeply into the reason for this, it would appear that the anode and grid currents flowing through L_1 and L_2 are now properly proportioned for the reaction effect. There also appears to be an H.F. relation between the anode and grid, as reaction is difficult to obtain without a condenser across the 'phones.

Any form of variable H.F. isolation of the anode will now control reaction as before. For instance, an H.F. choke inserted in the anode lead at AB stops oscillation and reaction, while shunting this choke with a variable condenser immediately produces a simple reaction control. Mechanically and electrically this is not so good as the control

(Continued on next page.)



as the best of ordinary valve sets, the very nature of the scheme must at times give rise to operating features which seem unusual. In attempting recently to clear up a few theoretical problems of the Filadyne, several instances occurred where something which at first appeared unusual proved to be in accordance with accepted ideas.

Reaction Control.

Take, first of all, the latest circuit, reproduced in Fig. 1. This contains a valuable feature due to the original inventor, Mr. Dowding, in that reaction is controlled in a strikingly effective and simple manner by the variable resistance R_2 . For a single-valve receiver with reaction, the circuit could not be much simpler. Now, although reaction is partly controlled by the variation of anode potential produced by altering R_2 , there are other factors at work, as we shall see.



This is one of Mr. Dowding's own versions of the Filadyne. The theoretical circuit is given in Fig. 1. Note the potentiometer which is used to control reaction.

SIDELIGHTS ON THE FILADYNE.

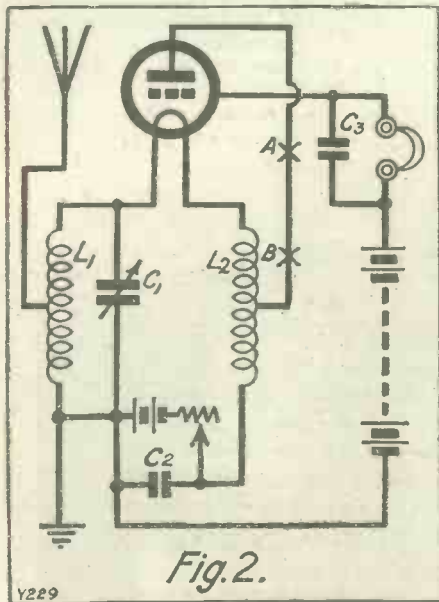
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by the resistance R_2 in Fig. 1. A more practicable and simpler method than the shunted choke is to connect a separate coil to the anode, couple this coil to L_2 with the variable resistance between the bottom of the coil and L.T. positive. The resistance then controls reaction in a similar manner to Fig. 1.

Anyone who has not a suitable resistance can join the bottom of the anode coil direct to L.T. positive, or to the bottom of L_2 for some valves. The anode coil and L_2 should then be mounted in a two-way holder, when varying the coupling between the two coils will control reaction in the same way as the usual swinging reaction coil. The windings of both coils should be in the same direction, changing the connections to the anode coil if reaction is not obtained.

Resistance Coupling.

The few features described so far tend to show that the Filadyne is not so very unorthodox so far as reaction effects are concerned. There is another feature which up to the present has not been disclosed. This is the ability to use the Filadyne valve as a resistance-capacity-coupled amplifier. Experiments which I have been carrying out recently show that the Filadyne can be used quite successfully in this direction. When we consider the steep characteristic curves possessed by some valves under Filadyne conditions, thus

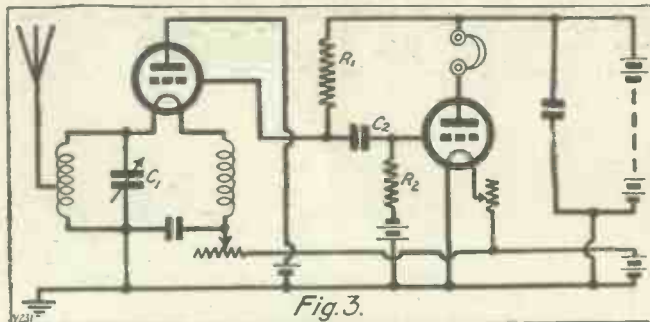


demonstrating a high magnification factor, we naturally expect a good performance in an R.C. amplifier. The volume obtained is not, perhaps, so great as that given by the ordinary circuits with proper high-mu valves. However, the circuit is extremely interesting, and reproduction is full and rich in tone.

The scheme for resistance-capacity coupling is given in Fig. 3. Using a D.E.2

L.F., the "anode" resistance R_1 may have a value as high as 2 meg., C_2 being then .003 mfd. and R_2 5 meg. The "anode" voltage need not be increased much beyond 75 volts, but the filament current of the Filadyne valve must be reduced considerably below the normal value. That peculiarity of all Filadyne circuits, the loss of signals when the filament current is increased beyond a certain value, is quite noticeable here, the correct value now being very low. This produces a further economy in current, the drain on the H.T. battery also being considerably reduced.

The Filadyne is now operating as a voltage amplifier, very similar to an ordinary R.C. coupled detector, except



that we are using different electrodes for the H.F. input and L.F. output.

The working potential of the anode has some effect on amplification, and for different valves the anode should be connected to filament negative or positive or given a slight additional bias until best results are obtained. For the valves I have used positive anode bias gave the best results.

An interesting point in regard to valves is that the high-mu R.C. valves give extremely poor results in this circuit. The design of their electrodes happens to be unsuited to Filadyne conditions, a more open grid mesh being required.

Up to the present I have been unable to obtain reaction effects from this circuit, and when reaction was required a separate reactor valve had to be used. Perhaps some of my readers will be able to evolve a scheme for obtaining a satisfactory reaction scheme, although, as far as I can see at present conditions are against success in this direction.

Saving Space.

However, as it stands, the two-valve receiver of Fig. 3 is quite a good one for local loud-speaker reception.

In conclusion, there is just one point about the filament coils of the Filadyne circuits to which I should like to draw your attention. These two coils are usually wound on separate formers, but for normal wavelengths both coils can be wound on a 4-in. diameter former, thus economising space. When this is done, the best results are obtained by winding the two coils in opposite directions.

The two ends in the middle then go to the filament terminals of the valve holder, and the outside ends to L.T. negative and rheostat respectively. The tuning condenser is joined across either coil, preferably the one connecting to L.T. negative.

FOR YOUR NOTEBOOK.

ONE of the commonest causes of poor reception is that one or more valves in the set have lost emission. (Very often this trouble is caused through the use of excessive filament voltage.)

Although an insulated wire round the picture-rail will make quite a good indoor aerial, much better results can sometimes be obtained by the use of several wires running parallel to each other, 18 inches or so below the ceiling.

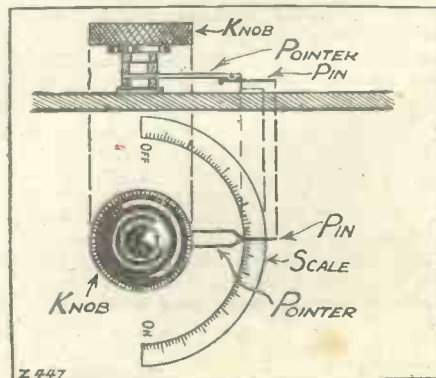
When a pair of 'phones or a loud speaker have become demagnetised and insensitive the makers or firms specialising in that class of work can often re-magnetise and restore them.

If you use a power valve you cannot expect an ordinary H.T. battery to supply its anode current. For such a valve you will need a triple-capacity battery or else some form of H.T. battery eliminator.

If the strength of reception on a crystal set falls off because the crystal is getting dirty, you can give the set a new lease of life by breaking the crystal in two and using the new clean surface which is exposed.

OBTAINING CLOSE READINGS.

FOR obtaining close readings on vario-meter and filament resistance pointers it is useful to solder a pin or piece of wire to the underside of the pointer as



shown in the diagram. The pointer can then be bent down till it just clears the scale.

A TWO VALVE L.F. AMPLIFIER



MOST listeners at some time or other want to work a loud speaker.

Possibly they may be under the impression that it is necessary to build a completely new set. Let me say at once that this is quite incorrect. If the existing receiver is capable of giving decent tele-

POINT-TO-POINT CONNECTIONS.

One filament socket of each valve holder to one side of each of their respective rheostats.

Remaining sides of the rheostats joined together and to one side of the L.T. switch.

Other side of L.T. switch to the L.T. + terminal.

Remaining filament socket of the 1st valve holder to the L.T. — and H.T. — terminals, to the G.B. + plug via a flexible lead, to one side of the 2-mfd. Mansbridge condenser, and to the remaining filament socket of the 2nd valve holder.

Right-hand "input" terminal (looking at terminal strip from back of base-board) to the "H. T. +" terminal on the R.C.C. unit and to one tag of the .0001-mfd. fixed condenser.

"P" terminal on R.C.C. unit to the left-hand "input" terminal.

Remaining tag of the .0001 mfd. fixed condenser to the centre terminal (to the terminal fitted between the two "inputs").

"G" terminal on R.C.C. unit to the grid of the 1st valve holder.

"—" terminal on R.C.C. unit to the G.B. — 1 plug via a flexible lead.

Plate of the 1st valve holder to the "plate" terminal on the L.F. transformer.

"H.T. +" terminal on transformer to the remaining tag of the 2-mfd. Mansbridge condenser, to the L.S. + terminal and to H.T. + terminal on the terminal strip.

"Grid" terminal on transformer to one end terminal on the volume control (potentiometer).

Other end terminal on volume control to the G.B. terminal on transformer and to the G.B. — 2 plug via a flexible lead.

Grid of the 2nd valve holder to the centre terminal (arm) on the volume control.

Plate of the 2nd valve holder to the L.S. — terminal.

This completes the wiring.

This is an amplifier which you can hook on to practically any existing set, including a crystal outfit, if you desire loud and clear loud-speaker results. It is a high-grade amplifier designed for low-grade pockets.

By the "P.W." Research and Construction Department.

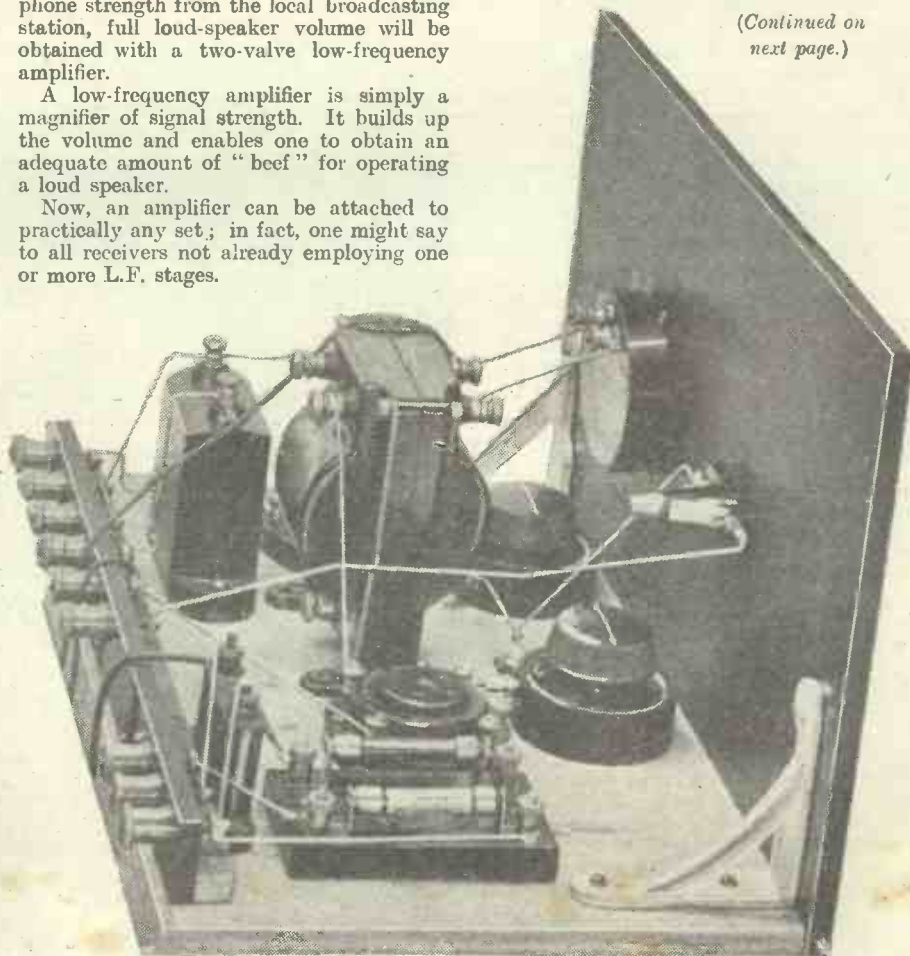
In certain cases it could even be used after an existing low-frequency valve. However, the type of listener most in need of an amplifier is he who has an existing one-valve or crystal set, and for these listeners this particular unit is ideal. It will give first-class quality and at the same time plenty of volume. I do not intend to go into the question of design, because I have a feeling that the average reader will prefer not to be bothered with the theoretical considerations. Briefly, the

phone strength from the local broadcasting station, full loud-speaker volume will be obtained with a two-valve low-frequency amplifier.

A low-frequency amplifier is simply a magnifier of signal strength. It builds up the volume and enables one to obtain an adequate amount of "beef" for operating a loud speaker.

Now, an amplifier can be attached to practically any set; in fact, one might say to all receivers not already employing one or more L.F. stages.

(Continued on next page.)

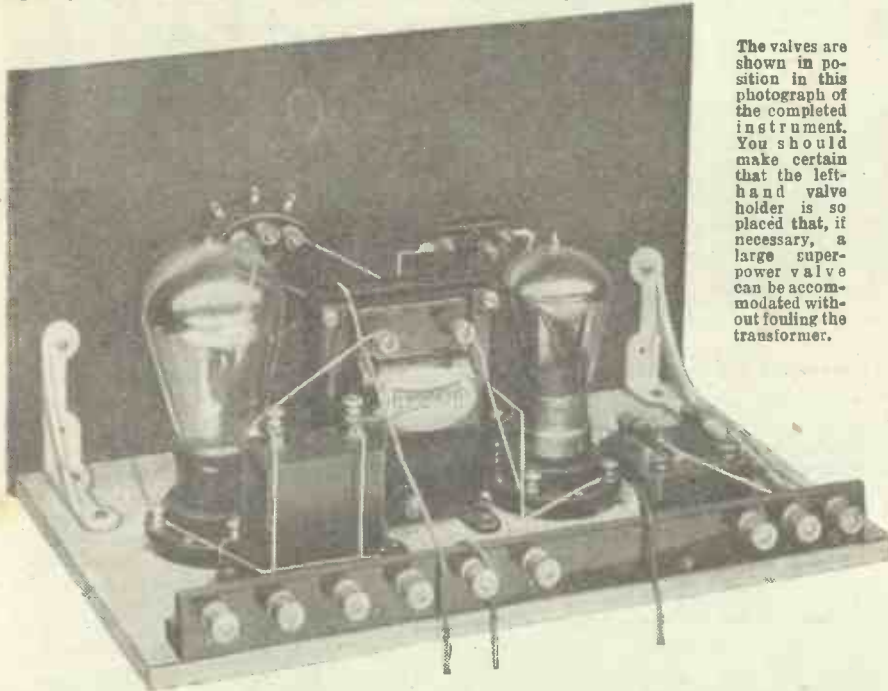


Here is the first of three special back-of-panel photographs which accompany the full description of the Two-Valve Amplifier. These, together with the 6d. Blueprint which is given free with this issue, and the point-to-point check list on this page, should make the work of assembly a very straightforward and simple task.

A TWO-VALVE L.F. AMPLIFIER.

(Continued from previous page.)

circuit is a combination of resistance-capacity and transformer coupling, and



The valves are shown in position in this photograph of the completed instrument. You should make certain that the left-hand valve holder is so placed that, if necessary, a large super-power valve can be accommodated without fouling the transformer.

without a doubt this arrangement is the best for all-round results.

The two essential components in the circuit are therefore a resistance-capacity-coupling unit and an L.F. transformer. There are now a number of really good R.C.C. units on the market, and the reader will have no difficulty in making his choice. Any unit of reputable make will work quite satisfactorily.

With regard to the transformer I would choose one having a ratio of between 2.5 and 4 to 1. The lower ratio will probably give slightly better reproduction, but the higher ratio will enable greater volume to be obtained. Perhaps the best scheme is to compromise and to employ a transformer having a ratio of about 3 to 1. In any case, you won't go far wrong if you purchase a

A 6d. Blueprint of this Two-Valve Amplifier is one of the four presented free with this issue of "P.W."

good make of instrument. If you examine the blueprint you will notice that a 500,000-ohm potentiometer is connected between the two secondary terminals of the transformer. This is to enable you to adjust the volume to the required strength. If the signals are too loud you can cut them down a little.

This is a most valuable feature, because it enables you to avoid those irritating little rattles and "dithers" which denote overloading, and so tend to reduce the pleasure of listening to a first-class broadcast programme.

The constructional work is straightforward and few tools are required. In fact,

a screwdriver, drill, and a pair of cutting pliers will be the only real essentials. A soldering iron can be used on the joints, but even this can be dispensed with, because terminals are also provided, and the electrical connection obtained if the wire is bent round and screwed down tightly beneath the terminal head is perfectly satisfactory.

in conjunction with the photographs of the actual amplifier, and you can't go wrong.

Take, for instance, the R.C.C. unit. This will have four terminals marked H.T. +, P, G, and - (or in some cases G.B.). Connect the H.T. + terminal to the "Input" terminal on the ebonite strip, and P to the "A, Input" terminal. G will go to the grid socket of the first valve-holder, and - to G.B. -1. If you then join up the filament circuits and the transformer connections the wiring is very nearly completed.

To drill the hole for the potentiometer (volume control) and "on-off" switch you will need a $\frac{3}{8}$ -in. twist drill, and for the terminals, if these have 2 B.A. shanks, a $\frac{5}{32}$ -in. drill will suffice.

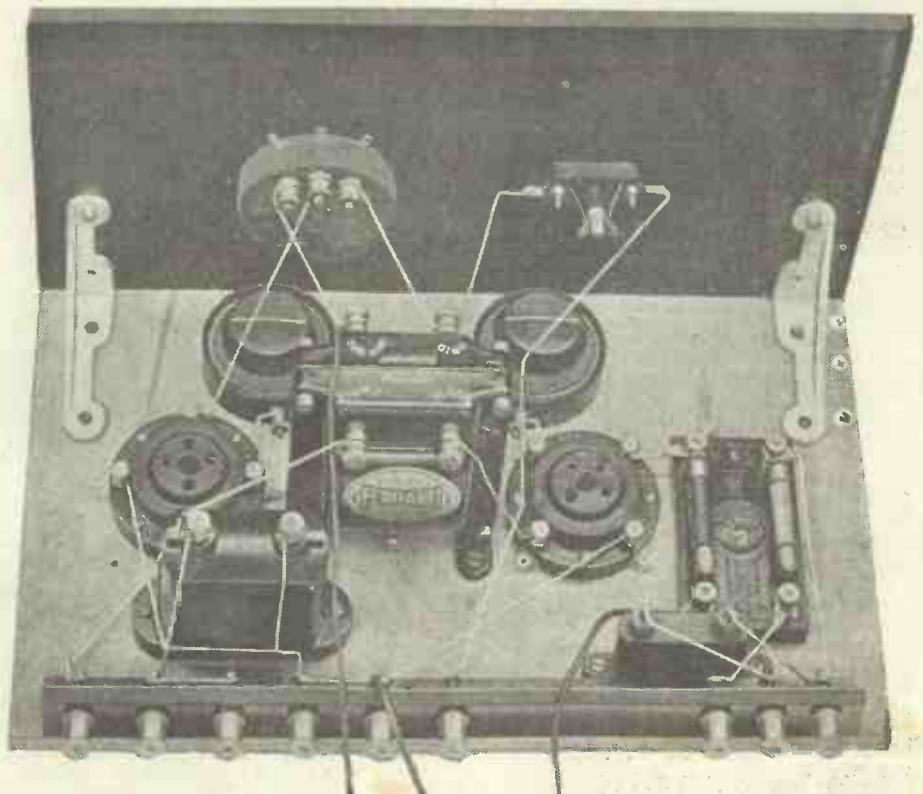
Wiring Up.

You can buy a $\frac{3}{8}$ -in. drill for about one shilling, and a complete set of smaller drills, ranging from $\frac{1}{16}$ in. to $\frac{1}{8}$ in., for two shillings.

It doesn't much matter about using insulated wire throughout, but you will be well advised if you use some form of insulation covering for the L.T. and H.T. leads, because if two of these wires happen to touch, and they are not insulated, you may burn your valves out or damage your L.T. battery. Keep all the wires nicely spaced, and where you use terminal connections grip the end of the lead tightly beneath the terminal head, otherwise the joint may move slightly and cause crackling noises in the loud speaker. If you use Glazite or a similar type of insulated wire an old safety razor blade renders the removal of the covering an easy task.

Having completed the constructional work you will want to know how to adjust

(Continued on page 1124.)



Practically every lead and every component can be seen in this photograph. The filament-rheostats are mounted on the baseboard just behind the valve-holders. The potentiometer mounted on the panel operates as an efficient volume control. The three grid bias leads are in the foreground.

“Sixpence in six months”

“EKCO”

H.T. UNITS

pay for themselves over and over again

Do you realise that if you use your set as much as six hours a day an “EKCO” D.C. Model selling at 17/6 complete will cost you only 6d. in 6 months, and that an “EKCO” A.C. Model selling at £4 : 12 : 6 complete with Valve and Royalty will cost you only 2/6 in 6 months.

Remember, too,

the life of an “EKCO” is many years!

Compare these figures with your battery costs and you will never buy a battery again!

Model	Voltage Tappings	Sets Suitable for	D.C. Price		A.C.*			
			£ s. d.	£ s. d.	£ s. d.	£ s. d.		
M.1.	60 or 90 or 120	1 to 3-valve sets only	0	17	6	3	7	6
M.2.	60 and 120		1	9	6	6	2	6
1.F.	90 and “Power”	Majority of sets of not more than 5 or 6 valves	2	12	6	6	15	0
2.F.	60, 120, and “Power”		3	5	0	7	7	6
3.F.	60, 90, 120, and “Power”		3	17	6	7	12	6
1.V.	0-100 variable } and 120 fixed } “Power”	(A) Multi-Valve (B) Super-Het (C) Sets depending on a critical voltage adjustment (D) Fada, Burndept, Elstree Six, etc.	4	2	6	8	17	6
2.V.	0-100 variable } and 0-120 variable } “Power” 120 fixed }		5	7	6	9	10	0
3.V.	0-100 variable } and 0-120 variable } “Power” 100-150 var. }		6	0	0	9	10	0
C.2.	COMBINED H.T., L.T., G.B. UNIT FOR D.C. Provides: (a) H.T. 60, 120, and “Power” (b) L.T. Current for 3, 4, or 5 .1 amp. valves or for any combination of valves of the same filament voltage, provided the sum total of current consumed by the filaments is not less than .3 amp. and not more than .5 amp. (c) G.B. Tappings at 18, 3, 4, 6, 9 . . . Complete		The wonder unit of 1928.					
			£6 7s. 6d.					



Model M.1., D.C.



Model M.2., D.C.



Model M.2., A.C.



Model 1 V., A.C.

SAFE! SILENT! SOUND!

Write for illustrated folder! There is an “EKCO” model for every purse and voltage.

E.K. COLE LTD Dept. A., “EKCO” WORKS, LONDON RD., LEIGH-ON-SEA

*Extras payable on A.C. Models only
F. & V. TYPE.—Mullard D.U. 10 Valve, 15/-, Royalty 12/6
M. TYPE.—Marconi D.E.5 Valve, 12/6, Royalty 12/6

The Recipe for GOOD RADIO

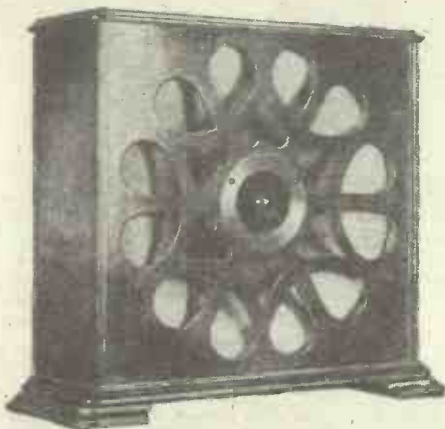
MOST modern receivers are capable of giving good quality reproduction provided they are given a fair chance.

Take a good aerial-earth system. Use little, if any, reaction. Fit the correct valves with a "power" or "super power" type in the last stage.

Provide ample H.T. and a source of supply which will stand up to the load. Add the correct grid bias and there remains but one thing necessary for really good radio.

And that, of course, is an

AMPLION Loud Speaker



AMPLION CONE: the popular Junior Cabinet Model in Oak at £4 or Mahogany at £4/4/0

25 models from 37/6

Announcement of Graham Amplion Limited, 25, Savile Row, London, W.1.

REDUCED PRICES MAKE THIS VALUE UNPARALLELED

**NEW
REDUCED
PRICES**
• 0003
7/6
• 0005 **7/6**
(WITH 3' DIAL.)
With "Two Speed" dial
and Station Recorder.
• 0003 .. 15/-
• 0005 .. 15/6



Last year we concentrated our resources and experience to the production of a first-class precision condenser at a popular price.

Few wireless constructors have not heard of the wonderful success that followed its introduction. The experts described it as a condenser worth at least double its price. Constructors from all parts of the country have expressed their astonishment at finding such efficiency at so low a price.

Now this value is to be even greater. Our new factory, equipped for a far greater output, is able to produce these "Popular" Condensers still more inexpensively. We pass these economies in full to public.

Every good dealer stocks Bowyer-Lowe quality components.

We shall be happy to send you our catalogues on request and to tell you where you can obtain our components in your district.

DETAILS:

Endplates are aluminium pressings. Rotor mounted on ball bearings. No "sloppy" bearings, springs or spring washers.

Straight line wave length curve. Girder construction for strength. Perfect balance and dead accurate adjustment.



Popular Condenser

BOWYER-LOWE CO., LTD., LETCHWORTH

THE development of the aerial through years of experimental wireless may, in a large measure, be regarded as indicating the trend of the development of the science itself. Many of our readers may recollect, with amusement, the lengthy affairs which were regarded as necessary in pre-broadcasting days, when a sea-going operator would have wept at the thought of being assigned to a ship where anything less than a 350-ft. length was considered adequate.

In this more enlightened period, of course, we perforce confine ourselves to a hundred feet of aerial, exhaustive experiment having shown that, on the whole, this allows us quite sufficient for ordinary reception purposes.

An Enterprising Builder.

But it is safe to say that quite forty per cent of the aerials which now adorn (or disfigure) our gardens and backyards, are indicative of the spirit of independence and inquiry which characterises the amateur of to-day. These departures from aerial orthodoxy usually owe their inception to the fact that "Necessity is the mother of invention," and are interesting not only from the standpoint of novelty but also because they illustrate individual attempts to solve



How you can make the most of small spaces for your antennas.

By A. J. BOYINGTON.

aerial problems which must be a source of perplexity to thousands of other amateurs.

For instance, there was a builder whose yard, as frequently happens in the building trade, housed an accumulation of timber, chimney-pots, slates, glazed bricks, piping, ironmongery—all the impedimenta of his calling. This left him without the room to erect even a double 30-ft. aerial.

For the first ten feet or so of the aerial mast, lead-in tubes were "staggered" in a spiral and the wire (an insulated one) connected from one to another of these tubes. The wire was then arranged in "gridiron" fashion, each loop being anchored to the mast by a small staple.

And results? Well, he worked a small "Amplion" at full volume from the Nottingham relay station, ten miles away, through an ordinary straight reaction-and-amplifier two-valve set.

Then an amateur strangely enough, obtained greatly improved reception simply from his consideration for a neighbour's pigeons! Thinking that the birds in their flight might not notice the slender wires and, possibly, get entangled therein, he varied the usual expedient of fitting corks to the wire, and utilised, instead, some short lengths of 7/22's he had remaining from his aerial installation.

The "Gooseberry Bush."

These odd bits he untwisted and affixed, star-wise, between the strands of the wires in order to make them more prominent, and was agreeably surprised to discover that his commendable solicitude for the pigeons' welfare had resulted in 50 per cent improved reception.

I have seen only one example of another type I have in mind.

At first glance it appeared something like a leafless gooseberry bush surmounting a short mast attached to one of the chimney-stacks of the house. Closer inspection proved it to be a bunch of 10-ft. lengths of 7/22's wire, splayed in all directions, and with the free end of each separate length untwisted for an inch or two and spread out star-wise.

The "bush" was confined to the mast by a brass collar, from which the lead-in was taken, while between the

wires and the mast necessary insulation was provided by a thick rubber band extending about an inch higher and lower than the brass collar.

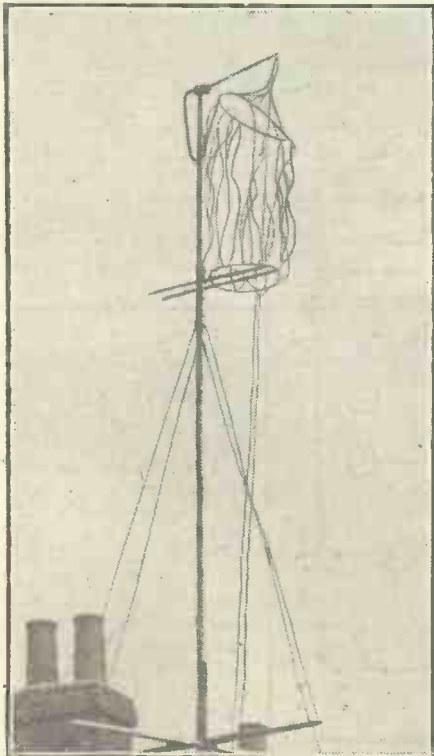
In this instance, the ordinary type of aerial was an impossibility, owing to lack of space, but I very much doubt whether it would have afforded such reception as did the quaint improvisation. There were between 30 and 40 separate lengths of wire in the arrangement, so that the ingenious amateur had something like 400 feet of aerial all told.

It was absolutely non-directional, a wonderful collector of energy, and appeared to give exceptional "DX" results on a single-valve receiver.

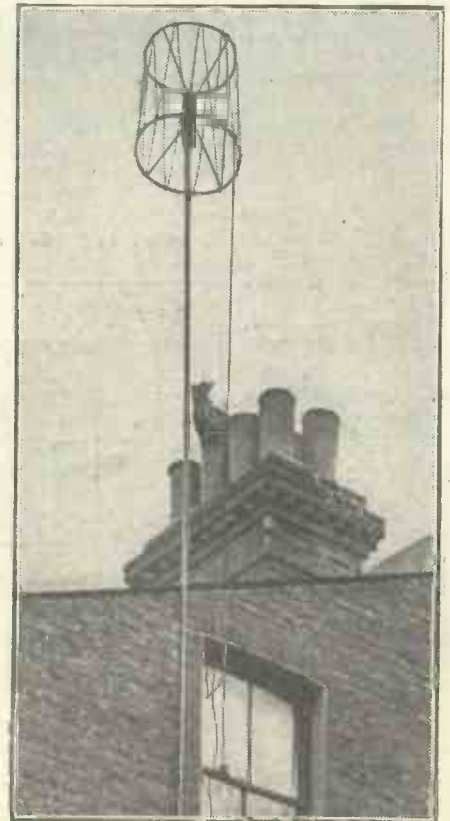
Simple and Compact.

Its great recommendation, of course, was the fact that it occupied very little space and was reasonably simple of construction. For that reason it should recommend itself to many of my readers.

Many problems arise in the erection of a suitable antenna, and the examples noted are typical instances of difficulties overcome by a departure from stereotyped methods.



An amateur's "cage" aerial, which, although rather untidy looking, gave good results. The wire is passed backwards and forwards between ordinary hoops.



A commercial version of the "cage" type of aerial, which looks quite neat and gives very good results.

COMPARATIVELY few experimenters realise the number of useful duties that the humble little flashlamp may be made to perform in the wireless set. A few of them will be described in the present article, but these by no means exhaust the list of possibilities. They will, however, probably suffice to show the reader that the flashlamp is worthy of more attention from the wireless man than he has hitherto paid to it.

Flashlamp Protectors.

There are probably few wireless enthusiasts who have not at one time or another burnt out expensive valves, either by making wrong connections in those moments of temporary insanity to which all of us are liable, or as a result of inadvertently making a short-circuit between H.T. + and L.T. - with a screwdriver, or some other tool whilst carrying out some small adjustment without having troubled to switch off the batteries. Damage to valve filaments by excessive currents can be insured against, so to speak; by using flashlamps as protectors in the way shown in the larger diagram. Some experimenters use only one lamp, in the H.T. negative lead, as shown at A in the diagram. This is all very well where there is but a single H.T. positive lead, but where there are two or three it must be remembered that a portion of the H.T. battery may easily be shorted.

Forty Different Types.

It is much better, therefore, to place a flashlamp not only in the negative lead, but also in each of those running to the positive busbars. When this is done, provided that suitable flashlamps are used, both the valves and the battery are effectively protected. It is most important to safeguard the H.T. battery from big overloads.

To most people one flashlamp is very like another; they are, in fact, bought with as little discrimination as a box of matches or a packet of pins. It will come as a surprise to many to know that there are nearly forty types, with different filament resistances and load capacities made for voltages between 1.25 and 4. A full range of them will be found in the catalogue of any shop which deals extensively in electrical supplies, such as The Grafton Electric Company.

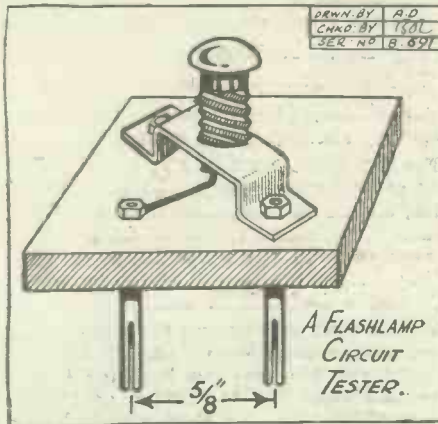
Clearly, what we want to protect dull-emitter valves and H.T. batteries from the effects of wrong connections or short circuits is a lamp which burns out under a very small load. A lamp which I have found most satisfactory for this purpose is one rated to consume .3 ampere at 1.25 volts. Actual tests show that these burn out instantly when the load exceeds .4 ampere. So effective are they as protectors that I have on several occasions demonstrated their qualities to friends by

SAFEGUARDING YOUR SET.

Flashlamps, or pealamps as they are sometimes called, cost only a few pence each, but they can save you causing, by accident, real damage to your set or its accessories.

By R. W. HALLOWS.

wiring up three P.M.4 valves with one of them in series, and then deliberately making connections to the extreme ends of a 100-volt battery. The lamp flashes at once, and the valves are uninjured. It should be remembered that the filament of the average dull-emitter valve will not be actually burnt out if a current as high as



about .7 ampere is passed through it for a brief instant. Old valves of the thoriated-filament type may actually be improved by such treatment! A flashlamp of the kind recommended may be regarded as ample protection for two or three dull-emitters of the low-consumption kind, or for a single valve of the .25 ampere class.

An Inspection Lamp.

A very useful addition to the receiving set is an inspection lamp mounted on the baseboard in some convenient position and controlled by a switch on the panel.

Whenever anything goes wrong with the receiving set, or when some slight adjustment of its inward parts has to be made, the lamp is switched on and you have plenty of light to work by. A lamp of this kind makes it very easy to see whether dust has collected between the vanes of variable condensers, as well as facilitating many little jobs which, if undertaken during the evening, might in the ordinary way necessitate disconnecting the set and moving it out from the corner in which it usually lives.

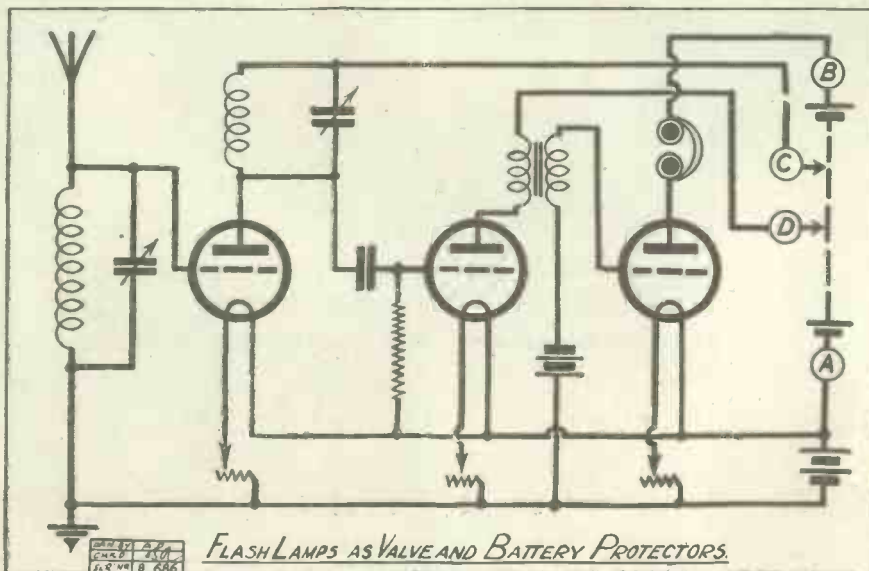
Useful Panel Fitting.

Even in the best lighted room it is not always too easy to obtain exact readings of condenser settings such as are necessary for fine tuning. The process is made infinitely easier by arranging a flashlamp on the panel immediately over the condenser dials. This again is controlled by a switch on the panel. A switch of the press-button type may be used, since the light is seldom required for more than a few seconds at a time. A neat little fitting of this kind may be purchased ready-made, complete with a shade which keeps the light out of one's eyes and throws it down on to the dials. Or a simple device can be contrived in the home workshop. The base of a batten holder is straightened out, and the holes in it are enlarged to take 4 B.A. screws. In the panel is drilled a hole large enough to allow the socket of the holder to pass. The socket is put through this from the back of the panel, and the flat part of the holder is secured by means of a couple of countersunk 4 B.A. bolts and nuts.

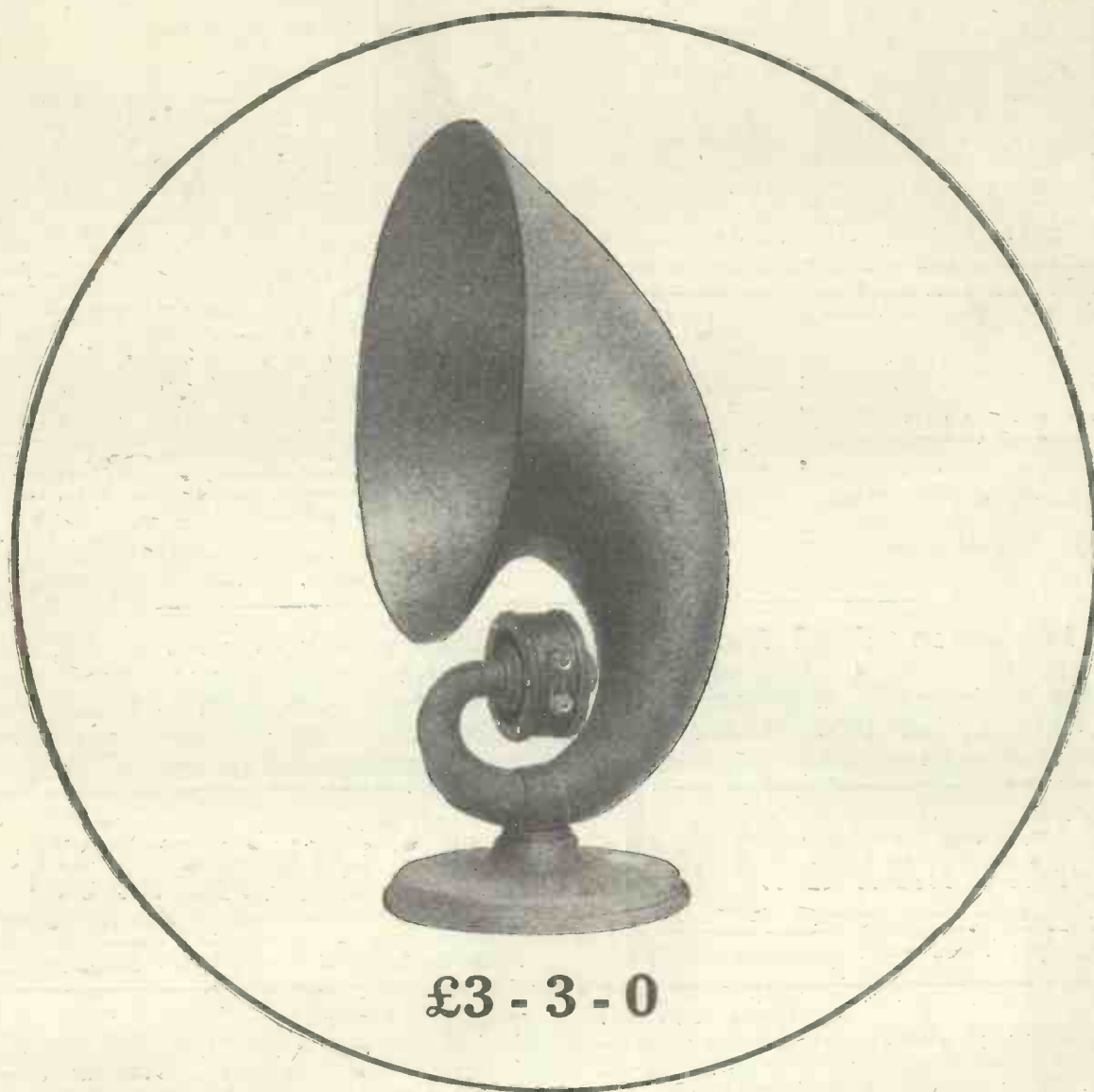
Simple Circuit Tester.

A shade is easily provided with the aid of a short piece of ebonite tubing with an internal diameter of about 1 in. This is cut in half lengthwise, and is secured to the front of the panel by means of the bolts which fix the lampholder in position. A notch large enough to clear the socket of the holder is cut in one edge with a round file.

A last use for the flashlamp is illustrated in the smaller diagram. A batten holder is mounted diagonally upon a small piece of 1/4-in. ebonite through which are drilled two 4 B.A. holes 3/8 in. apart from centre to centre. Through these holes are passed valve pins, one of which goes also through one of the fixing holes in the lampholder. The second pin and securing nut are kept clear of the body of the holder, but a connection is taken from it to the central insulated contact below the socket. The use of such a tester will be at once apparent. With its help you can see in a moment whether your L.T. circuits are in order without risking an expensive valve in the process. Try the tester in each in turn with both H.T. and L.T. batteries switched on.



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

QUESTIONS AND ANSWERS.

REPAIRING ACCUMULATORS.

"SIDDY-BOX" (North Acton, London, W.3).—"At a sale I got two 6-volt accumulators and some half-exhausted dry cells for two shillings, and as the accumulators don't look too bad I should like to try overhauling them. Where can I get a cheap book on the subject?"

A WIRING HINT.

You will find a long illustrated article on the subject of repairing accumulators in the January issue of "Modern Wireless." It contains just the information you want.

H. G. (Leighton Buzzard).—"Since reading P.W.'s hints on wiping over soldered joints with a clean rag whilst they are still hot, etc., I have been very successful with soldering. But I wonder if you can help me with the following snag? Where one is going to put a soldered joint close to another soldered joint, how can it be done without the heat for the second joint unsoldering the first one?"

Try wrapping a damp rag round the joint, to keep it as cool as possible. This generally does the trick.

HOWL AND SHRIEK!

"NANCY" (London, E.10).—"I can get London very loud, but it seems harsh all the time, and when I turn the knob it howls and shrieks like anything. What shall I do?"

Do? Why, you will "howl and shriek like anything," too, if your neighbours catch you, "Nancy"! For your set has been oscillating, and this spoils the programmes of everybody for miles round. PLEASE don't switch the set on again until you have read the reply to "Reaction," which appears below.

DON'T OSCILLATE.

"REACTION" (Southend-on-Sea).—"My set is a 'Regional Two,' built according to the description in 'P.W.,' No. 286 (Nov. 26th, 1927). It goes fine on 2 L O, but not knowing much about reaction I don't try to strengthen much, because it interferes with my friend's set next door. I think I could get a lot more out of the set if I knew how to handle reaction properly. How can I tell when the set is oscillating? Should it be made to oscillate when searching for distant stations after London closes down? How far can reaction

(Continued on page 1110.)

IT is a recognised fact that first-class wireless sets must be constructed of the very best materials if perfect results are to be obtained. Perfect reception and tone depend entirely on the quality of the materials used for baseboards and panels.



Wireless experts have used and tested these materials and report excellent results.

These materials have been used and tested by wireless experts, who report excellent results. Besides tending to give better reception, improved tone and high dielectric properties, these materials have absolute stability in quality. There is no discoloration with age or exposure. They can be worked with ease, no splintering or cracking when machining, tapping, drilling, etc., is experienced. They have deep, brilliant and lasting polish which does not affect surface resistibility.

CELASTOID

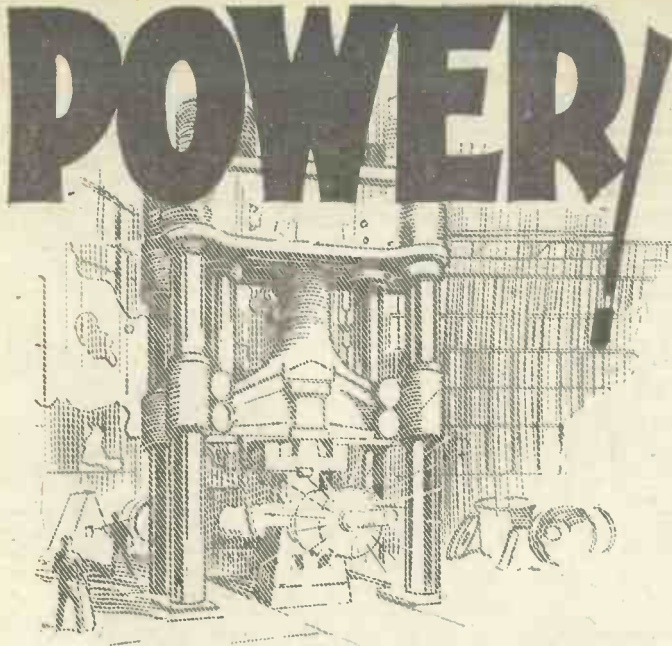
is obtainable in a realistic imitation of Tortoiseshell. It possesses the following characteristics: It is Transparent and can be supplied in both Transparent and Opaque colours. Wireless manufacturers have found numerous applications for the Fancy Patterns which include Tortoiseshell, Marble, Brocades, Moire, Nacre of Pearl.

CELLASTINE

is obtainable in Black, Opaque and Wood colours. Cellastine is also supplied as Cellastine Moulding Powders, which possess the same unique properties as sheets and are ideal powders for moulding components where quality is the main consideration.

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Messrs. Rooke Bros., 55, Cardington Street, N.1.
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Sole Manufacturers: BRITISH CELANESE LTD., CELANESE HOUSE, HANOVER SQ., W.1.



THE Giant Forging Press gives an impression of immense Power. Similarly, the Siemens "Power" Battery, in appearance alone, is sufficient to inspire confidence in its ability to meet the most exacting demands of Power Valves.

If you use a Power Valve, Why not use a "Power" Battery?



READ THIS!

"The 'Power' Battery is beyond all expectations. My reception has improved and I cannot conceive anything better. I shall recommend it to all my friends."

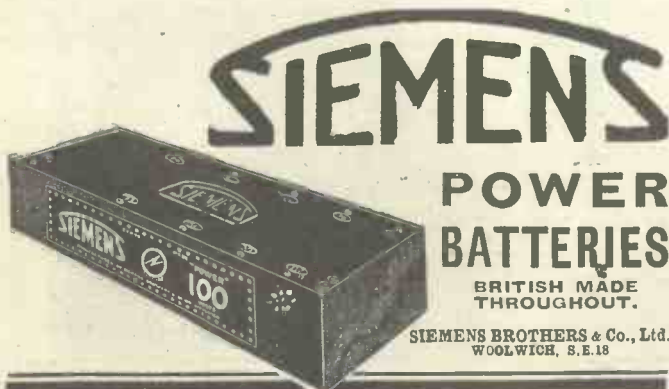
Extract from a recent letter.

A Siemens "Power" Battery will last three times as long as an ordinary battery. It will pay you to use one.

ASK FOR

-  No. 1204 Power 60 volts, **15/-**
-  No. 1206 Power 100 volts, **25/-**

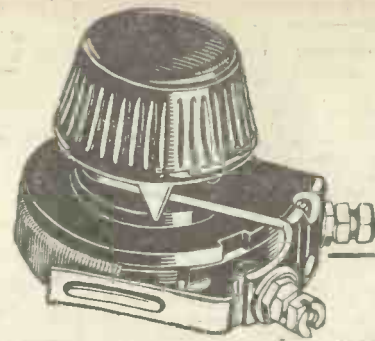
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The extraordinary value of the Igranic C.H. Filament Rheostat has created an unusual stir amongst constructors. The demand exceeds all expectations but fortunately our stocks are adequate to meet all orders.

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possesses every feature essential for perfect filament control. The well tried form of contact finger, with the added refinement of a domed sliding surface, provides a firm, steady contact and allows for smooth turning without chatter or noise. One-hole fixing allows for easy mounting, and the special anchor bites into the panel and prevents rotation of the frame. Terminals are conveniently placed and easily accessible from the top of the set. The resistance element, being held by a spring, cannot slip or wear out of true.

A special feature is its compactness. It is only 1 1/4 in. in diameter, and projects only 3/8 in. behind the panel.

Made in three resistance values, 6, 15 and 30 ohms.

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1108.)

be used without danger? Ought I to use reaction, and is it necessary to good reception?"

The truth about reaction is this: A little reaction helps to get good strength. A lot of reaction gives strength at the expense of quality.

Too much reaction spoils your own reception and that of all your neighbours.

To prove this you can try the effect of reaction for yourself. Choose a morning when 2.L.O. is not broadcasting, turn the aerial-tuning condenser half-way or three-quarters in, and start with the reaction control "all out."

If you listen for ten minutes or so you will probably hear several more or less weak stations, probably sending the dots and dashes of the Morse code. If you can hear telephony, so much the better.

Adjust the aerial condenser so that one station which is working comes in rather weak, and then leave the aerial condenser at that setting and try the effect of reaction.

If you increase reaction, a little at a time, you will find it strengthens results. For instance, if you wet your finger, and tap the aerial terminal with it, you will hear a click every time you tap. With reaction "all out" the clicks will be weak. But when you put a little reaction in the clicks get louder.

Similarly, signals which can hardly be heard without reaction will be quite clear when a little is used—but there is a limit to this process, and the limit is known as the oscillation-point.

Trying the wet-finger test, you will find that as reaction is increased the clicks get louder and louder, till suddenly there is a sort of "plop" or click or thud in the 'phones, and a steady rushing noise can be heard. The clicks from the wet finger become very loud, and these symptoms—the very loud clicks and the rushing noise—indicate that the oscillation-point has been passed, and the set is now causing interference with others. You will notice that signals from any station previously heard are spoiled when your set oscillates—telephony is distorted, and the clear notes of Morse stations become blurred and harsh.

Very often you hear not only a rushing sound, but a whistle as well, and if you alter the tuning condenser this whistle goes up or down. This is certain proof that you are oscillating, and you should immediately slack off reaction until it reaches a point where the symptoms disappear.

Never use more reaction than you can help. For the local station a set should really not need any if it has sufficient valves. But a little may be used without doing any harm to anybody, provided that the set is always kept well below the oscillation-point.

The chief trouble with interference comes from sets which are tuned and adjusted whilst too much reaction is being used on them. Reaction should always be kept low, except when the very highest sensitivity is required to pick up a distant station. Even then

There is no need to oscillate, but as there is a risk of slipping into oscillation without meaning to, the set should not be used for long-distance listening whilst the local station is broadcasting.

WAVE-LENGTH LOWERED BY COIL AND CONDENSER.

R. S. (Stanford, Middlesex).—"The anode coil will be a sixty-turn (basket type), and I am wondering what range it should cover if tuned by a .0003 across it."

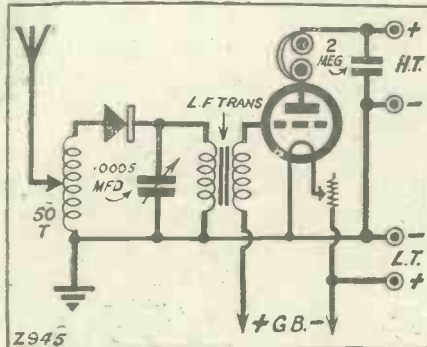
It will tune from about 200 metres to about 500 metres, when shunted by the .0003 variable condenser.

ENOUGH TO MAKE AN AUNT LAUGH!

B. A. B. (Bury St. Edmunds).—"You may not believe it, but these are the exact circumstances. My uncle and I were both sitting together at 11.5 p.m., each of us wearing a pair of telephones. He had been telling me that two nights before the set seemed to go on and off in a very mysterious fashion, but we had been congratulating ourselves that that evening the programme was exceptionally good, clear, strong, and, what is more, well worth listening to. He had the evening paper on his lap, and presently, while we were talking, it fell to the floor. We did not take any notice of that for a moment, but presently uncle bent down to pick it up. As he laid his hands upon the paper all music suddenly ceased. In his surprise he let the paper lay upon the floor and sat upright, when the music immediately recommenced! We looked at one another, wondering if we had heard correctly, and after a few moments' conversation about it my uncle stooped down to pick up the paper again. To our intense surprise the moment he laid his fingers upon it all the signals stopped again. Yet when he resumed his seat they immediately started once more. (At this point again it was at full strength.) It may not seem

(Continued on page 1112.)

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a Crystal Detector, with L.F. Amplifier. But it is wrong, and the set would not work properly.

Next week the correct diagram will be given, and, to test your skill, we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems, week by week, the reader cannot fail to learn a lot about radio circuits.

MEMBER'S CORRESPONDENCE

RADIO SOCIETY OF GREAT BRITAIN

OR RICHARD H. REECE, M.A.
EXPERIMENTAL RADIO STATION
G-2MS.

THE CORNER HOUSE,
62, ADDISON GARDENS,
LONDON, W.14,
ENGLAND.

6th January, 1928.

Dear Sirs,

For some 15 years I have carried out serious wireless experimental work both receiving and transmitting, and during the last 18 months I have devoted much time and money to "quality" reception, involving the use of high anode voltages. One of my greatest bugbears has been the failure of anode resistances and grid leaks of all makes.

I have now fitted the Carborundum resistances with which you so kindly supplied me to my high-powered amplifier, and to my surprise they have stood up to all the harsh treatment they get in this position, and are moreover perfectly silent.

This both interested and pleased me, so I tried to "kill" a 150,000 ohm Anode resistance. 350 volts were applied directly across the terminals for several hours without damaging the resistance. The voltage was then increased to 850 and over 100 M.amps were passing. Such drastic treatment burnt off the paper label, but quite failed to injure the carborundum or loosen the caps, and the resistance was normal when tested for rated value, and still perfectly silent when used in a set.

You may use this letter if you wish, as I consider Carborundum to be a real "find".

Yours faithfully,
Richard H. Reece
G.2MS.

Messrs. The Carborundum Co. Ltd.
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Carborundum Resistance Capacity Coupling Unit	Price each 8/6
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DARIO VALVES

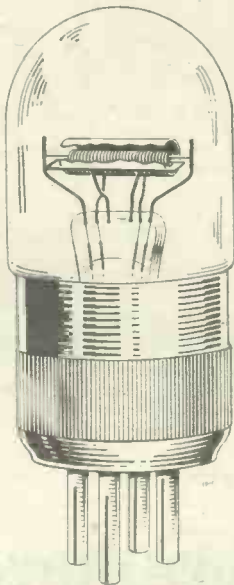
DARIO MICRO SPECIAL . 4 volt '05 amp.
DARIO MICRO BIVOLT . 2 volt '05 amp.

GENERAL PURPOSE VALVES

The 2 Dario Micro Valves are the most popular General Purpose valves ever realised; they have a rather high impedance of 20-22,000 ohms, and a co-efficient of amplification of about 12. They give very good results as H.F. amplifiers and first L.F., and as detectors they have never been equalled. We have recently experimented on short-wave reception with these valves and have obtained on a single valve marvellous results, especially for Australia (Sydney) and America.

The main advantages of the Dario Micro, 2 and 4-volt valves, are as follows:

- 1st. They consume only '05 amps; the figure is guaranteed and has been verified by many experts.
- 2nd. The filament works at a very low temperature, which ensures a very long life of the valve.
- 3rd. They are extremely sensitive, the faintest signals being detected and amplified without difficulty.
- 4th. The electrodes and filament being supported by rigid rods and solid frames, the perfect rigidity of the system is ensured and no micro-phonous effect takes place.
- 5th. The outside appearance of the tube is perfect, the glass is faultless, the cap is made of the best insulating material and milled all round to ensure easy finger grip to withdraw the valve from the holder.
- 6th. The pins are split and nickel-plated, which ensures good and permanent contact.



EFFICIENCY, ECONOMY and SMARTNESS are the three qualities which will decide you to choose DARIO MICRO VALVES.

A LIST OF DARIO VALVES

2 VOLT.

4 VOLT.

DARIO MICRO BIVOLT
'05 General Purpose, 7/6

DARIO MICRO SPECIAL
'05 General Purpose, 7/6

DARIO POWER BIVOLT
'18 Loud Speaker Valve, 10/9

DARIO SUPER POWER
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DARIO RESISTRON '07 R.C.C. Coupling, 7/6

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27/6
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STAND 6'6" EXTRA

Goodman's Loudspeaker Components have stood the test of time. That thousands have found it an easy matter to construct a Loudspeaker capable of wonderfully faithful reproduction, for an exceptionally low cost, is proved by the large number of unsolicited testimonials received. The Goodman Seamless Moulded Cone has established itself as the finest Diaphragm at present obtainable. Our Double-Acting Reed Unit (27/6) is undoubtedly the most sensitive and powerful Unit on the market. The Goodman JUNIOR, a Unit of exceptionally good design, although only recently introduced, is now acknowledged to be far superior to any Unit at near its modest price (14/6); in fact, second only to our Double-Acting Reed type. It is housed in a strong brass case, finished bronze by electrolysis, every part interchangeable, with six screws provided at back, for fitting either to GOODMAN'S Backstays and Frames, or to those made by the constructor. Adjustable by heavily-plated knob at back. Cone bushes and strong leads (for set connections) are supplied with each Unit. Noteworthy features are the specially designed pole piece and bridge, built up from quantities of laminations—not solid. Three heavy magnets are incorporated in each unit. The ample proportions of all parts render this Unit capable of handling considerable volume without overloading or distortion. Its general appearance and finish is equal to that of the most expensive instruments.

It is much cheaper to build your own Speaker, with Goodman's parts. It will give you results equal to any on the market, irrespective of price, and will astonish you in its fidelity of reproduction. Avoid imitations. GOODMAN'S were the pioneers of Specialities for Home Constructed Loudspeakers. Experience counts!

SEAMLESS MOULDED CONES ARE BEST WITH ANY UNIT.

ANY CONE IS BETTER FITTED WITH A GOODMAN UNIT.

If you are interested in COIL-DRIVEN SPEAKERS, see our Lists (C.D.5) of COIL SPEAKER UNITS, etc. Quality and finish are of the usual high GOODMAN standard, and prices as low as possible, consistent with perfect workmanship.

**EASY
TERMS
CAN BE
ARRANGED
IF
DESIRED**



The Goodman Junior. A Reed Unit specially designed for the sole purpose of driving large diaphragms of the Cone, Pleated Disc, or similar type. NOT a converted Earpiece or Gramophone attachment.

**EASY
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DESIRED**

Illustrated descriptive leaflets on request.

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From CIRENCESTER: "Accept my congratulations on having produced the perfect Cone Speaker, and that at a reasonable price."

From BRADFORD: "I am very satisfied with the Speaker, it is the best I've ever heard for tone."

From LIVERPOOL: "The GOODMAN UNIT handles volume equal to a Moving Coil Speaker without overloading. Startlingly efficient, and all you claim as far as volume, purity, and mechanical perfection is concerned."

From CARDIFF: "I must write and tell you how pleased I am with the instrument (27/6 Unit and Seamless Cone). The tone is excellent and superior to most and equal to any other, irrespective of price. I am surprised at the splendid volume, and in this respect it is equal to a large and sensitive horn loud-speaker I have."

From GOOLE: "No praise can be too high. . . . I was positively astounded. . . . the roundness and fullness of tone, mellow yet crisp speech, and the drums are all there, provided the set delivers them. . . . This is quite unsolicited praise."

If you have any difficulty in obtaining locally, send direct to us, enclosing your dealer's name and address.

GOODMANS, 27, Farringdon St., E.C.4.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1110.)

possible, but it is a fact that every time he stooped down and laid his fingers upon the paper he stopped the programme, but the moment he let the paper alone and sat up again the programme went on as merrily as ever! We brought in my aunt, and although she has no time for wireless in the ordinary way, she laughed like anything when she saw the way in which my uncle could stop the programme. I do not suppose you can hardly believe all this, but it just proves to me how mysterious wireless is, and how little mankind knows about this wonderful invention."

We believe it all right B. A. B., and on more than one occasion we have had a faulty pair of telephone leads play this trick on us!

For that is the simple explanation of the "mystery." By listening carefully while movements are being made you should be able to trace which of those pairs of telephone leads is faulty, and when these are replaced by a good pair of leads, your uncle will find that all the touching of the paper in the world will not "stop the programme" (not even if the paper on the floor is a "P.W."!).

Technical Editor's Note:—We quite agree with B. A. B. about the wonder and mystery of wireless. The fact that there is a simple explanation in this particular instance does not detract from the mighty miracle of man's mastery over the ether, and although the "P.W." technical staff must have solved millions of similar "mysteries" in their time, there is no place on earth where the fundamental fascination and mystery of wireless are more keenly felt than in the offices of this journal.

AVOIDING HAND CAPACITY.

J. W. L. (Dunedin).—"When I use the tuning condenser in the aerial circuit I find it absolutely necessary to earth the moving vanes in order to reduce hand-capacity

effects. Now I am going to use it in a tuned-anode circuit where neither side of the condenser is earthed, so that what I want to know is should the moving plates now go to the plate of the valve or should they go to H.T. positive side?"

From a high-frequency point of view that side of the tuned-anode circuit which is farthest from the plate of the valve is directly earthed through the H.T. battery or by-pass condensers; so that in order to obtain the same screening effects from hand capacity you should connect the fixed plates of your

variable condenser to the plate of the valve and the moving vanes to H.T. positive.

SCREENED VALVES ON SHORT WAVES.

"Can the newly invented screened valve be used for short-wave work, and, if so, where can I get a description of such a set?"

The new type of screened valve has been successfully used for short-wave reception, and very recently a receiver on these lines was tested in the "P.W." laboratory. A description of this system and constructional details for making the set will no doubt appear in the course of a short time.

SAFEGUARDING THE VALVE.

"Noticing that one of the screws on the variable condenser was a bit loose, I put a screwdriver carefully down inside the set and tightened it up. I had made quite a satisfactory job of this when, just as I was pulling out the screwdriver, there was a sudden flash, the valve lit up very bright, and then went out! And never since then have I been able to get anything in the way of broadcasting. What have I done?"

You ask what have you done? The answer is that you have demonstrated once more the old, old truth that it is never wise to alter the wiring or interfere with the interior of any wireless set unless you remove the H.T. negative plug from the battery. Time and time again we have warned our readers of the danger of allowing the H.T. voltage to reach the filament. A metal screwdriver, a lead out of place, a terminal dropped inside the set, a short piece of wire straggling, the tags of the telephones touching against the internal wiring—any one of these or similar instances will provide the necessary metal path, and allow the H.T. positive voltage to come into contact with the filament wiring. If this happens the valve, instead of getting 2, 4, or 6 volts (whichever it may be rated), gets the full voltage of the H.T. battery. Whether this is only 16, 60, or 160 the result is equally disastrous, and the valve will probably burn out. The remedy is to remember Radio's Golden Rule, i.e. Before altering the wiring of the set in any way, or inserting a metal screwdriver or other similar tool into the set, remove the H.T. negative plug from the H.T. battery.

(Continued on page 1114.)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

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

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

how many accumulators have you got?

ONE? TWO? OR NONE? If you have only one accumulator, we will lend you one of ours while we recharge yours to ensure a continuous service. We will collect, maintain, and deliver each alternately. If you have two accumulators we will give you the same service. If your accumulators are unserviceable we will keep you continuously supplied with ours.

And at the same time we will loan you, if you like, the famous C.A.V. H.T. Accumulators, which experts agree give far better results for less than the cost of unreliable dry batteries.

RADIO SERVICE (LONDON) LTD., 105b, TORRIANO AVENUE, CAMDEN ROAD, N.W.5.

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14/6



LOW LOSS TWO RANGE COUPLER

250 to 550 and 1,500 to 2,000 metres

This Tuner is constructed on Low Loss Principles with Selenoid and Bankwound Coils, acknowledged to be the most efficient form of coil winding. It is so arranged that a two-contact Pull-Push Switch shorts the high wave coil, leaving only the low wave coil in circuit.

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N.W.2

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The STANDARD TRANSFORMER is worked off your lighting current, and never requires attention. It is porcelain-clad and therefore quite safe. It works on alternating current only. One Transformer will ring all your bells.



The price is 17s. 6d. post free, which please remit with your order, and state voltage of supply, or apply to your local contractor, mentioning the STANDARD PORCELAIN-GLAD TRANSFORMER.

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WERE ~~24~~ NOW

12/6



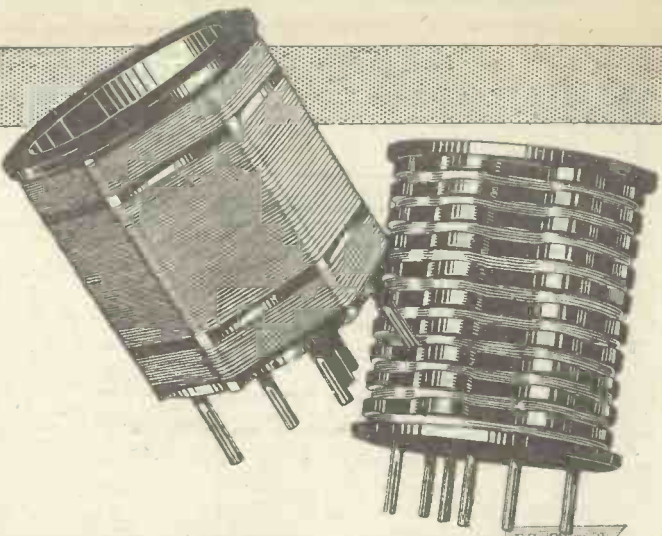
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The **Master Three**

IF you are about to construct the Mullard Master Three Receiver you should remember that there is every reason why you should adhere to the author's specification.

SELECTIVITY to the desired degree is easily obtained with Colvern Coils. A few turns to requirement should be removed from the aerial winding and the end of the wire reconnected to Pin No.4.

RANGE depends to an extremely high degree upon efficient coils and it is very important that these should have a very low high-frequency resistance. To obtain this Colvern Coils are accurate space-wound. Experience proves that the use of Colvern Coils increases the range of a radio receiver. In the case of the Master Three Colvern Coils give maximum range.

VOLUME is similarly dependant upon the efficiency of coils. Logically, the signal strength of distant stations is greatly increased by Colvern Accurate Space-Wound Coils.

Therefore be advised—adhere strictly to the author's specification, you will be most satisfied.

Prices:—

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Accurate Space-wound to give maximum efficiency. **7/6**
- Long Wave.**
Sectional wound to give lowest high-frequency resistance. **8/6**
- Colvern Aluminium Panel.**
is also specified for the Mullard Master Three Receiver 18" x 7" : 14 gauge; sprayed instrument black; drilled for variable condensers switch and panel brackets. **7/6**

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NOTE Drilled High-grade 21 x 7 Polished Panel, with Radion Strip, FREE with above kit.

HANDSOME AMERICAN CABINETS, hinged lid, with baseboard for 16/11 with above kit only. In mahogany 20/- All Cossor Valves stocked.

EXTRAORDINARY OFFER in 3-Valve Sets

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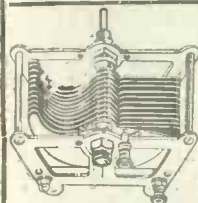
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2 Strips, 1 Base, 2 J.B. Condensers, Climax Choke, 3 Valve Holders, Pair Brackets, Spade Terminals, Broadcast Coil, Bulgin Switch, R.C.C. Unit Type "A", R.I. L.F. Transformer, Mullard .0003, 2 Meg. Leak, 3 Wander Plugs, Flex.

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18x7 CABINET IN OAK, WITH BASEBOARD, FOR 16/11, WITH SET OF COMPONENTS. All Mullard Valves Stocked.



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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1112.)

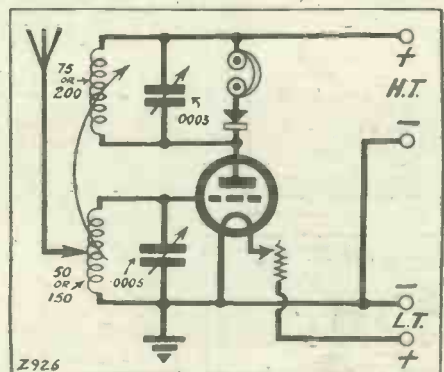
A SIN AND A SHAME!

A. B. C. (Liverpool).—"I think it is a sin and a shame the way that wireless has fell off. When I got the licence last year, Liverpool was as clear as a bell. Even if you took off the 'phones you could hear it. But now if you put on the 'phones and push both the earpieces up against the head until you can hardly bear it, it is as much as you can do to hear the news. If I knew that the broadcasting was going to get weaker and weaker as time went on I would have thought twice about buying the licence."

We are afraid that we cannot blame the B.B.C. for this, for, as a matter of fact, we think there is only one person responsible, and his initials are "A. B. C." The programmes are getting away from the Liverpool aerial all right, but it is after they have reached your own aerial that the trouble begins. In short, the trouble lies at your end of the set, and you can prove it by going very carefully over the whole set, and the aerial, earth, and 'phones.

Perhaps your aerial wire is partly broken through in one place. Or the earth wire has come away from the ground plate. Or the lead-in has become very

H.F. (TUNED ANODE) AND CRYSTAL SET



The correct connections for an H.F. and Crystal Set (Tuned Anode, with reaction) are shown above.

In the "What is Wrong?" diagram last week the 'phones were not connected in series with the crystal across the tuned-anode circuit, the coils were not for corresponding wave-lengths, the tuned-anode circuit was bypassed by a fixed condenser between filament and plate, and the aerial tuning condenser was given as .005 instead of .0005 mfd.

dirty and the contact very poor, or somewhere in the set there is a bad connection. Or the telephones have become weak.

If you have a friend who knows anything about wireless we should be inclined to ask him to look over the set for you, and he may detect the trouble at a glance. If not, let us have some more particulars on the application form of the Query Dept., so that we can form a mental picture of your set and endeavour to discover where the trouble lies. We are quite sure that when it is traced you will find that reception is brought back to all its former vigour and vim.

MOUNTING SOLENOID COIL-HOLDERS

G. T. S. (Balham, S.W.).—"As I am fond of messing about with a box of tools I am going to try my hand at making my own tuning coils, bases and all. The only snag I can see lies in the method of mounting, and I propose to fit a strip of ebonite or wood across the inside of the coil and mount legs in this for plugging the coil into its holder. Will wood do for the strip, as it is much easier to work than ebonite?"

Yes, provided the wood is thoroughly dry it is quite suitable for the purpose you have in mind,

WAVE-LENGTH OF 5 S W.

"CURIOUS" (Ipswich).—"What is the wave-length of the new British Empire short-wave station at Chelmsford?"

The wave-length employed by 5 S W, the Chelmsford Experimental short-wave station, is 24 metres.

JARS FOR WET BATTERIES.

E. Y. (Glasgow).—"In making up my own wet battery, do you advise me to use earthenware jars, or is glass better?"

Glass is better, as there is a certain degree of porosity with earthenware that is liable to lead to leakage troubles.

EASY CHANGE-OVER TO CRYSTAL.

G. L. A. (Gloucester).—"We have an invalid in the house (worse luck!), and my wife is afraid to detune the set because she can't get it back right. Without detuning, it is too loud on the loud speaker for sick-room nerves, so she has to do without wireless. What I want to know is, can I fix up a crystal, using the same coils for tuning, etc., with a very quick and easy change-over between that and the main set?"

"We have a pair of 'phones and I think it ought to be possible without much trouble, but I can't see a way that is both easy to fit and safe to operate. Can you suggest a good method? For if ever we wanted wireless to make us forget our troubles this is the time, believe me."

You can overcome the difficulty very easily, as follows: The idea is to use your 'phones in conjunction with a crystal detector. It will not be necessary to switch your main set on, but you can utilise its aerial tuning arrangement whilst the filaments are off, as the tuning for the crystal and 'phones arrangement.

The only new parts necessary will be a crystal detector and a pair of terminals, mount the crystal detector and the terminals near to the aerial coil on the set, and connect one side of the crystal to the top or grid end of the aerial coil holder.

The bottom or earthed end of this coil is joined to one of the newly-fitted terminals, and the only other connection necessary will be to join the remaining 'phone terminal to the remaining side of the crystal detector.

If now you examine the connections you will see that you have put a pair of 'phone terminals and a crystal detector in series across the aerial-tuning circuit, so that if a pair of 'phones is joined up, you will have, in effect, a crystal set that will operate when the main set is switched off. All that is necessary to listen in on this arrangement is to connect up the telephone tags to the new terminals.

When the "crystal" arrangement is not required simply disconnect the 'phone tags from their terminals, leaving everything else alone. It will be found that when the 'phones are thus disconnected, the main set will operate exactly as formerly, the presence of the new crystal and terminals making no difference whatever to reception. Being permanently connected they can be brought into service in a moment merely by connecting up the 'phones.

PLENTY OF STATIONS.

G. R. C. (Middlesbrough).—"How many broadcasting stations are there in all, including all those overseas?"

The total number of the world's broadcasting stations, according to a recent official publication, is 1,051.

"ALL JANGLY."

F. S. (Bradford).—"It was an old second-hand set, and at first it went as clear as a bell, but this last month or two it has gone all jangly. Now, why did it do that?"

Unfortunately there are several things that might happen after "a month or two" to cause "jangling." The likeliest thing of all is a run-down H.T. battery. Does the set need a new one, or are you still trying to run it on a battery which is really fit only for the dustbin? If so, a new battery will cure the set of its distortion; but if you have no cause to suspect the batteries we should be inclined to suspect the valves. You can get these tested by a dealer or the maker. If they prove to be O.K., too, we shall need further particulars of your set before we can suggest the cause. (See the Query Department's application form). But we expect the trouble is due to a run-down battery or else to the valves;

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GIGANTIC SUCCESS OF THE REDUCED PRICES P.R. VALVES THE FINEST VALUE EVER OFFERED

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Tell us what your circuit is. We can help you to select the right valves. Remember that R.C. Valves require at least 110 volts, and can take more with advantage. For the output our POWER VALVES challenge comparison with any other POWER VALVES ON THE MARKET. TRY FOR YOURSELVES AND BE PLEASANTLY SURPRISED.

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Type	Fil. Vts.	Fil. Amp.	Imp. Ohms.	Amp. Fac.	M/C	
P.R.1	2	.06	35,000	15	.4	H.F.
P.R.2	2	.06	25,000	12	.43	Det.
P.R.3	2	.06	18,000	8	.44	L.F.
P.R.4	2	.06	120,000	40	.33	R.C.
P.R.5	2	.15	40,000	20	.5	H.F.
P.R.6	2	.15	30,000	15	.5	Det.
P.R.7	2	.15	12,000	6	.5	L.F.
P.R.8	4	.06	23,000	15	.65	H.F.
P.R.9	4	.06	19,000	9.5	.5	Det.
P.R.10	4	.06	11,000	6	.55	L.F.
P.R.11	4	.06	120,000	40	.33	R.C.
Power Valves	2V	.20	6,000	5	.82	P.
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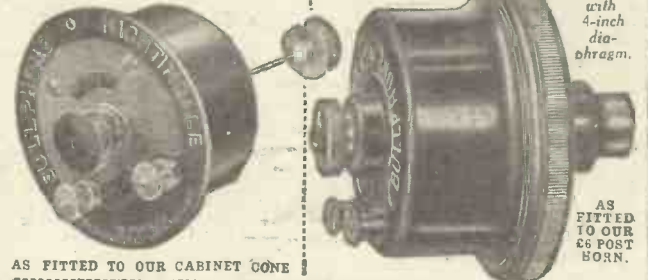
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CONE UNIT



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AS FITTED TO OUR CABINET CONE

From a 3-ply board, 3 1/2 square, cut out a 12 1/2 circle, then cut a strip of wood 1 1/2 x 3 1/2 and make a hole



2 1/2" dia. in centre. This will carry the unit. Fix strip to board as shown.

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Astonishing Results, equal to the most expensive Loud Speakers yet made, are guaranteed with either of these Units.

BUY ON 10/- EASY TERMS 5/- DEPOSIT
10/- SECURES THIS SPEAKER. 5/- SECURES THIS SPEAKER
SEND DEPOSIT NOW.



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Size 17 ins. high by 15 ins., in Mahogany, Walnut or Rosewood finish.



21 ins. high, with 14-inch Bell, Mahogany finished, with plated arm and stand.

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77/6 cash, or **EASY TERMS** 10/- deposit and 12 monthly payments of 6/-

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Apparatus Tested

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

EDISWAN "ONE-DER" SET.

The Ediswan "One-Der" receiver is a one-valve which apparently incorporates a detector arrangement and one stage of L.F. amplification, and the one valve carries out both of the required functions. It is, of course, a special valve, taking 2 amps. at 2 volts.

The receiver is contained in an attractive, small and neat polished cabinet, the front of which can be pulled forwards and downwards to reveal the entire "innards," and to provide access to the two plug-in coil units and the valve. This last, by the way, is much of the appearance and size of an ordinary Ediswan valve, except that it has a six-pin base. On the front wooden panel of the set are an "on-off" switch and the tuning and reaction variable condenser controls. On the left side of the cabinet are the aerial and earth terminals and on the right side

the loud-speaker terminals—note those words!

From a hole in the back of the case issues the multi-way battery cable. This is composed of six distinctively coloured flexible leads, each of which is furnished with a terminal. The set is supplied with a test certificate, which gives the dial readings obtained on a 100-ft. aerial in the case of 2 L O and 5 G B. These readings would vary with different aeriels and local conditions, and a note to that effect on the report would, in our opinion, be a useful addition.

The Maker's Claims.

The task of connecting the set up is greatly facilitated by the multiple-lead. There are three H.T. connections (including the minus), and two values of grid bias have to be arranged. At least 120 volts H.T. and 6 volts grid bias are needed.

Previously we have asked the reader to note the use of the words "loud speaker," for the reason that this Ediswan "One-Der" is retailed as a loud-speaker receiver.

The makers' claims are:

- " Loud-speaker reproduction of a remarkable purity—
- " Ten to fifteen miles from main stations.
- " Three miles from relay stations.
- " Eighty miles from 5 X X (Daventry).
- " Fifty miles from 5 G B (Daventry Experimental).
- " These statements of range assume reasonably good operating conditions."

Additionally—a good point this—it is claimed that the set cannot re-radiate and cause interference with other listeners.

The Ediswan people's technical description of the receiver is as follows:

" It combines in itself both detector and amplifier stages. It will, therefore, work a loud speaker without the assistance of other valves.

" This result is obtained by disposing the electrodes in the valve in such a manner that use is made of what is known as the 'robbing action.' This may be explained briefly as follows: It has been found that if a flat anode and a flat grid be placed in vacuo with a filament between them and a potential applied between filament and anode (the anode being positive with respect to the filament) any voltage variations applied to the grid will affect the current flowing between anode and filament in a manner similar to what would happen if the grid were placed between the anode and filament, as is always done in the case of any ordinary three-electrode valve.

" The E.S.220 Duplex valve operates as an ordinary three-electrode valve on both sides of a common filament, in addition to which the 'robbing action' above explained is made use of to build up the signal variations.

" A study of its construction will show how this is achieved. Starting from the centre we have a rod which is the first anode, surrounded by a grid with a filament next to the grid, but separated from the anode by the grid. This is a simple three-electrode

(Continued on page 1118.)

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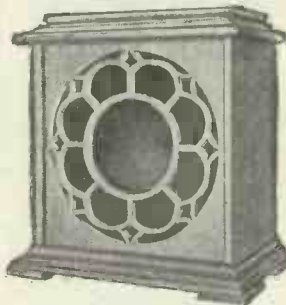
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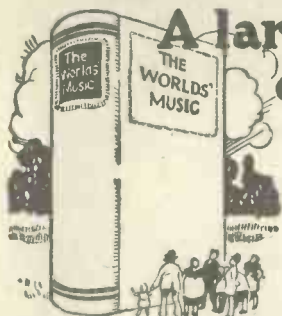
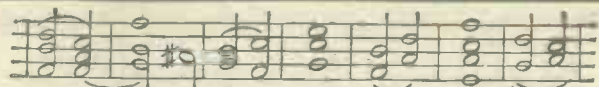
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APPARATUS TESTED.

(Continued from page 1116)

valve. Continuing outwards we find another grid and anode, and here again the grid is placed between the anode and filament, making a second three-electrode system.

"Now, since we have a grid and anode of two separate systems on each side of a common filament, it is clear that any voltage impulse on No. 1 grid will not only affect No. 1 anode, but also No. 2 anode, and the same reasoning applies to No. 2 grid. Now, in spite of the fact that on first sight it may seem that such an action would tend towards inefficiency, this is not so, due to the minute currents flowing in the first stage (a few microamperes).

"It will be observed that the total anode current taken by the whole valve when working the loud speaker is approximately one milliampere, almost all of which is flowing via No. 2. This may be shown by disconnecting No. 1 anode entirely."

We tuned in 2 L O on a "One-Der" at a point some eight miles from that station. A very average sort of aerial and earth system was used. Speech was plainly audible at any point in a medium-sized room, while the music came through with sufficient volume to make the programme quite enjoyable. The volume was not as great as that which one could obtain from a two-valver incorporating a stage of transformer-coupled I.F. amplification, but the reproduction was excellent and much better than that delivered by the average commercial set using two valves. 5 G B was a trifle weaker, but quite comfortably audible twelve or fifteen feet from the speaker.

Impressive Performance.

The set is very selective, and 2 L O could be completely cut out in the matter of a few degrees on the dial. Taking everything into consideration, we must say we were rather impressed by the performance of the little outfit, and we have no doubt whatever but that it will attract considerable attention when facilities are made for listeners to hear it demonstrated in different parts of the country. Those who require a simple-to-handle and easy-to-maintain set capable of providing rather restrained but good quality loud-speaker results, should certainly make a point of closely inquiring about this Ediswan "One-Der," and, if possible, hearing it in operation. It sells at £5 10s., including all royalties, and the valve—an E.S.220 "One-Der" valve—can be obtained at 22s. 6d.

This latter, we must point out, is not an English version of the Loewe valve. The coupling components are contained in the set, the valve itself acting as a special valve only.

A CORRECTION.

The makers of the Accumulator Capacity Indicator recently described in these columns were given as the Fanshaw Manufacturing Co. of Walsall. Will readers please note that the actual manufacturers of this device are The Central Manufacturing Co., Crown Works, Birmingham Road, Walsall.

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SHORT-WAVE NOTES.

By W. L. S.

MY prediction that the bad spell would be followed by the return of abnormally good conditions has been amply borne out, for during the last week the American stations have been as good as I have ever heard them since the short-wave craze originated. The "hams" have been logged literally in their hundreds between 35 and 43 metres, and 2 X A F and 2 X A D have been extremely strong at the most favourable times.

The American commercial stations have one good point, if only one—and that is the manner in which they serve as useful indicators as to what conditions are going to be like on any particular night. WIZ, for example, on 43 metres, on account of his very high power, is audible for a long time before the amateur stations commence to make themselves heard, and consequently the strength of WIZ at, say, 9.30 p.m. is a very good indication of what the amateur stations are going to be like by 11 p.m. or so.

The New Wave-lengths.

The new amateur wave-lengths which come into operation on January 1st, 1929, are, of course, quite different from those now in use, but fortunately they are placed in "harmonic relation," and are very convenient from several points of view. Roughly speaking, the bands set aside for the use of amateur workers are 150-175 metres, 75-85 metres, 41-43 metres, 20-21 metres, and two shorter bands. Incidentally, every British amateur owes a personal debt of gratitude to Mr. Warner of the A.R.R.L. But for him we should not have had even these narrow bands set aside for our use.

The problem of the distribution of stations is going to be even more acute when these wave-lengths come into force, since instead of having the American stations on bands slightly different from our own we shall all occupy one common band. The sudden addition in a band of about 2 metres' width of about 2,000 American stations is slightly apt to complicate things!

The Evening "Fade-out."

Now that we are well past the shortest day the time of the evening "fade-out" is becoming slightly later each day instead of earlier. In view of the wintry conditions at the time of writing one is rather apt to overlook the fact that summer is coming! The European stations (or, at any rate, those in the nearer countries) still seem to disappear fairly suddenly at about 6 or 6.30 p.m., but this time seems to get about three or four minutes later on an average each day, and the distant Europeans will soon be audible right up to midnight.

A friend was arguing the other day that short waves would never be of any practical value until this fade-out effect was conquered, and work could be carried on throughout the twenty-four hours. I gently pointed out to him that it must be a distinct improvement over the old long-wave conditions if one can do, for two hours only, something that could not be done at all before!

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NEWS FROM SAVOY HILL.

(Continued from page 1090.)

are purely experimental and therefore of a temporary nature.

The ultimate intention is the building up of a regular and guaranteed exchange of the best programmes between all European countries, not, as is happening now, by each giving a concert of works selected by another, but by actually broadcasting programmes direct from their places of origin.

"Shadows" Again.

Although it takes but twelve minutes to perform, no play broadcast during the last year was productive of more uninvited letters and appreciations from listeners than "Shadows," a thrilling little drama by Valerie Harwood, which was performed in the London studio on December 15th.

It was therefore, only to be expected that another place would be found for it in a forthcoming transmission—on Monday, February 13th—when during an hour to be filled by the Productions Department it will be given, together with a comedy entitled "Her Tongue," by Henry Arthur Jones. The latter play was also well received when it was given from 5 G B last October.

"Ourselves as Others See Us."

Whoever conceived the idea of the series of talks which for some time past have been given from London and other stations under the title of "Ourselves as Others See Us," deserves the thanks of listeners for providing something of interest in the otherwise dreary mass of talk.

The next talk of the series takes place at 9.15 p.m. on Monday, February 6th, Dr. S. K. Datta being the speaker. Dr. Datta is a distinguished Indian who has devoted his life to social and educational work in his own country, and is the National General Secretary of the Indian Y.M.C.A. He spent five years at the Edinburgh University and has paid several subsequent visits to this country. Until recently he was a member of the Indian Legislative Assembly.

A Gerard Williams Programme.

Mr. Gerard Williams, a short programme of whose music is to be broadcast from London and other stations in Thursday, February 2nd, had the distinction of being an architect before he became a musician, a fact that probably explains why his manuscript is a model of neatness and perfection of detail.

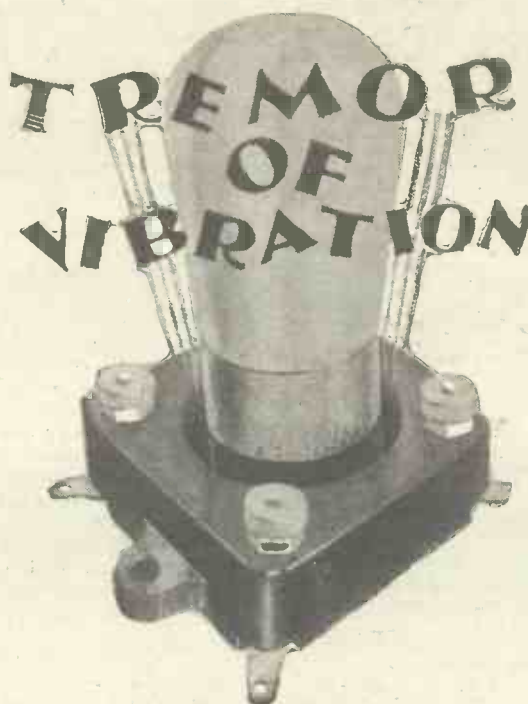
He is one of those natural musicians who have not been through the orthodox collegiate training, and yet by self-study and the aid of friendly criticism achieve elegant style and technique. His work, "Pot Pourri," which was one of his first to attract attention a few years ago will be included in the programme, which Mr. Stanford Robinson is to conduct.

The Lena Ashwell Players.

Few organisations have done so much by unselfish effort and sheer perseverance to bring good plays to the masses than the Lena Ashwell Players, not only by performances in their own little theatre off

(Continued on next page.)

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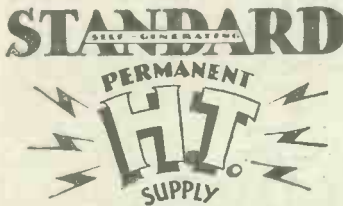
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90 volts	108 volts
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Goods for 10' or over, carriage paid. Deferred terms no deposit. State number & type of valves when writing.

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Hole in Bush	6BA, 4BA, 2BA,	17 5/16", 7/16"				
Price each:	1d., 1d., 1d., 1d., 2d., 2d., 2d.					

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PRICE ONLY 15/- POST FREE.

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S. W. SCOTT & CO., 67, Camberwell New Road, London, S.E.5.

NEWS FROM SAVOY HILL.

(Continued from previous page.)

Westbourne Grove and at the many small halls in the London suburbs, but also in village halls and more pretentiously named buildings in the towns. The company is visiting the London Studio on Wednesday, February 1st, to present scenes from "Macbeth," when Lena Ashwell herself will take the part of Lady Macbeth.

Boy Scouts—Stand By!

All young people, whether or not they are connected with the Boy Scout and Girl Guide organisations, will do well to tune-in to London and other stations on Thursday, February 2nd, for the first of a new series of talks to be given jointly by these associations on alternate Thursdays during the next few weeks. The subjects to be reviewed, such as first-aid, hobbies, scout-craft, and citizenship, should make a wide appeal, and even in these supposedly enlightened times there are many grown-ups to whom a few instructions on first-aid, with which Mr. McNeil Love, Scout Commissioner for Poplar, begins the series, may easily prove to be invaluable in our present life of hustle and bustle.

Belfast Events Next Week.

Anna McClure Warnock, the authoress of two little Irish comedy sketches, "The Wisdom of Fools" and "The Quilt," which Belfast is broadcasting on Thursday evening, February 2nd, will herself play the part of Mrs. Sarah Anne McIlwaine, widow of an Irish farmer, and one of the principal characters in the latter play.

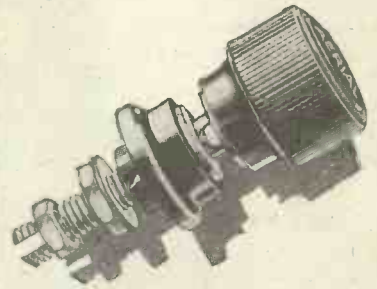
The whole of the programme that evening will be Irish in character, and will include well-known airs, arranged for violoncello and pianoforte by Arnold Trowell, played by James Marshall ('cello). Some jigs, hornpipes, and Leinster song tunes will also be given by R. I. O'Mealy, the well-known exponent of the Villeain pipes. On the following evening a concert of popular music will be provided by the band of the 1st Battalion the West Yorkshire Regiment (The Prince of Wales' Own), interspersed with groups of English and Irish ballads by Ernest Davison (baritone).

Lord Knutsford's Appeal.

Lord Knutsford, Chairman of the London Hospital since 1896, is broadcasting an appeal on behalf of that famous hospital, easily the largest in England, from London and other stations on Sunday evening, February 5th. Not only does the "London" serve the East End, but its benefits to other hospitals all over the country are far-reaching, as it is the centre of curative research and pioneer work for which it is magnificently equipped.

Unfortunately, it is not adequately endowed, and has to depend for four-fifths of its income on the generosity of the public. Lord Knutsford holds the "world's record" in extracting money from the public for charity by radio. At one of his early appeals from 2 LO he was stated to have "lifted" £10,000 as the result of a five minutes' talk. What will he raise on February 5th?

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TECHNICAL NOTES.

(Continued from page 1090.)

occupied by these is saved. Therefore, a variometer has the merit of compactness.

Wave-length Change.

On the other hand, it is very convenient to be able to change the wave-length range of the circuit by means of plug-in coils (or a switch) and tuning by means of a variable condenser, especially with any of the really beautiful slow-motion dials now available, is a matter permitting of considerable precision. The variometer, however, is in my opinion, by no means dead, and I should not be at all surprised to find it regain at any rate a good deal of the favour which it formerly enjoyed.

Variometer Resistance.

Talking of variometers, the resistance of the two coils of a variometer—I mean, of course, the high-frequency resistance—might be expected, at first sight, to be equal to the sum of the H.F. resistances of the two coils, since the two are in series. This has been found, however, to be far from being the case. In fact, experiments on this point have shown (as would be expected after a moment's consideration) that the overall high-frequency resistance of the variometer depends upon the adjustment of the instrument, that is, upon the coupling between the two coils.

So far from the high-frequency resistance of the variometer being constant, it has been found to be roughly proportional to the inductance—that is, the effective inductance—of the instrument. In the case of a variometer in which the maximum inductance was about ten times the minimum inductance, it was found that the high-frequency resistance at the maximum inductance adjustment was also roughly ten times the high-frequency resistance at the minimum inductance adjustment.

Effective Inductance.

If the high-frequency resistance is proportional to the effective inductance, the ratio of the one to the other will be constant, which is simply another way of expressing the same thing mathematically. But it was found in the experiments referred to that, although the ratio of the two is constant for the greater part of the range of the variometer, the ratio of the high-frequency resistance to the inductance increased rather suddenly in the region of the minimum inductance of the variometer. In other words, round about that position the high-frequency resistance was decidedly greater than it ought to have been if the above-mentioned relation had held true. This indicates that, at any rate in the particular case under investigation, the efficiency of the instrument was distinctly lower round about the *minimum inductance* setting.

Tapped Coils.

These results are quite different from those obtained with a tapped coil. In this latter case it is generally found that the resistance increases *more rapidly* than the inductance of the coil, or, in other words, the ratio of the H.F. resistance to the inductance *increases* as the inductance increases.

(Continued on next page.)

ELECTRADIX RADIOS SALE

1,000 ACCUMULATOR FILLERS. Suction bulb, celluloid chamber and nozzle. For changing acid and testing Sp. Gr., 1/6. Hydrometers, 1/6

MARCONI 1-VALVE and CRYSTAL DET. SETS. Specially for Broadcast. Cabinet fitted ebonite panel, nickel fittings, detector, valve-holder, L. and S. wave switch, double spade tuning, two H.F. chokes, T.C.C. condenser, terminal and plug sockets. New, with wiring diagram and Osram valve. List price, £7. Sale, finished complete and tested on aerial, 21/-

THE B.B.C. SAY FIT A NEW AERIAL. Use Navy Special 100 ft. 7-23 super enamel bronze, 3/-; Pocket R.A.F. 110 ft. stranded cop., 1/3. Aeroflex 49-strand cop., 10 ft., 1/4. Electronic, 100 ft., 1/3. Maxi, braided cop., 50 ft., 1/3; 100 ft., 2/-. Indoor, 1/- 100 ft. Frame Aerials, midtap, 10/-; Hovey Indoor Aerials, 2/6.

R.A.F. MASTS. 2 ft. 8 in. Steel Tube, 1 1/2 in. sockets, sections, 15 ft., 7/6; 20 ft., 10/-; and 30 ft., 14/-; Heavy 4 ft. 3 in. sections, 2 1/2 in. dia., 5/- each.

EARTH MATS. Galv. Wave Plate, with Electron wire, 2/-; post 9d. Copper Mesh Earth mat for short waves, 5/6 each. Earth Spikes, 1/3. Earth Tubes, 2/6.

BUZZERS, 1/-. Townsend Wavemeter, 2/6. D.III., 10/-; Siemens' 25 S.A. Signal Outfit, 27/-; Sounders, 16/6. Signal Lamps, 3 cols., 3 Tap Keys, 4 1/2 volts, 7/6. Buzzers with key and phone, 7/6. Signal sets, 22/6.

BOXES. 1 1/2 in. by 10 in. by 2 in., for storing coils, 2-hinge tops, 2/-; Boxes with plugs for H.T. Batteries, 5/-; Valve cases, 1/6. Brown's 2-relay cabinets, with fittings, 5/-; Three-cell valve boxes, padded, 1/6 each.

VARIA CONDENSER SALE. S.L.F. LoLoss.

Mfd.	Plain.	Vernier.	Square	Law.	Vernier.
·001	1/6	2/-		2/9	3/6
·0005	2/6	—		3/-	—
·0003	2/-	2/-		2/6	2/6

POLAR. Full dial sq. law, ·0003 mfd., 3/6; ·0005 mfd., 4/6; list 12/6. Panel 3-gang Triple, 8/-, list 15/-. Penton ·001 Panel, 1-hole fixing Varia. Condensers, 2/6, list 8/-.

DUAL VARIABLE CONDENSERS. ·0005 Square Law, 6/-; 3-gang do., 8/-.

FIXED CONDENSERS. 200 volt ex-W.D., 2 mfd., 1/9; 1/36 mfd., 6d. 1 Jar Glass Dielectric, 20,000 volt, 2/6. Post 1/3. Naval Lab., Mica Dielectric, 2,000 volt, 3 1/2 mfd., with all plugs in, 35/- each. Variable Condensers, ·0015 Oil, 2,000 volt, 20/- each. Post 1/3. 400 volt to 10 mfd., 15/-; 400 volt, 4 mfd., 6/6; 2 mfd., 4/3.

HIGH VOLTAGE CONDENSERS. All guaranteed. 500 volt, 4 mfd., 6/6, No. 20H; 1,000 volt ·05 mfd., 2/6, No. 16B; 2,000 volt 2 mfd., 22/6, No. 20C; 3,000 volt 2 mfd. (oil), 45/-, No. 20FO; 10,000 volt ·0025 mfd., 3/6, No. 16AI; 20,000 volt ·002 mfd., 35/-, No. 20DH; 30,000 volt ·0025 mfd., 10/-, No. 16HW.

STERLING PRECISION LABORATORY standard Variable ·001 Condensers, enclosed, 18/- each. Post 1/-.

CHOKES, VARLEY DOUBLE-WOUND CHOKE COILS, Carry 60 m/a and fitted ebonite panel with terminals, ready for use in H.T. Eliminator Filter circuit from the mains. Bargain, 4/6. 1,000 ohms ironclad chokes wound 40 S.W.G. silk, mid-tap anode coupling, 1/6. Large Chokes for H.T. transmitting smoothers, 10/-; Ironclad, Fuller type, 200, 600, 1,000 ohms, 1/6. Marconi V2, 1,000, 3,000 ohms, 4/6. No. 30 M 400 to 1,000 ohms, 4/6. Large trans., 10/-; Modulation, 12/6.

H.F. CHOKES on Ebonite. Townsend, flat, small, 1/6. Large, 2/6. 1,000 ohms round, Hendon, 3/6. Marconiphone, 800 ohms, 100 milli-henries 4/6.

SUNDRIES. Adj. Spark Saps, Alumin. on Ebonite, 2/-; 3-volt Siemens' Dura Cells, 1/3. Steel Permanent Magnets 1/-, 2/6 & 3/6. Loud Speakers, Western Electric 2,000 ohms, 15/-; W.E. Units, 10/-; Violina Loud Speakers, 25/-; 5-guin. model. Ask for leaflet.

FIXED RESISTORS. Michrome wound on mica, Copper clad, 6d. Polar Rheostats, 9d. each.

LONG MAGNET BELL PHONES, No. 94 B, for making Loud Speakers, 2/6. Ebonite Discs, 1/2 in. thick, 2 in. dia. Dashlamps for Panel or meters, swivel and 3 cut-offs, 1/-; Screwdrivers, 2d. Breast Drills, 3/11. Valve Windows, Nickel, 4d. Basket Coil Holders,

10jd., 1/-; 6-ft. Phone Cords, 1/-, 1/3-. Loud-speaker Cords, 1/-; Empire Tape, 12 yds., 6d. Spade Tags, 6 a 1d. Staples, 6 a 1d. Switch Arms and Studs, 1/-; Wander Plugs, 2d. pair. Nickel Coil-plug and socket, 8d. pair. Ins. Hooks, Egg Insulators, 2 for 1 1/2d., 4-way H.T. and L.T. Cords and Tags, 1/6.

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SPARK SETS. 10-in. Marconi coils, £7; Cox X-rays, £10; Diathermy 1 KW. 100 v. D.C. to 10,000 v. A.C., £15; 250 watt 500 v. Alternators, 70/-

X-RAY VALVES and TUBES, 30/-. Battery Home Chargers, £3 5s. 8-way Lucas Switches, 4/6. Relays, 80D., 7/-; Navy Stabilising Gyroscopes, 15/-; Mains H.T. Unit, D.C. 3 taps, 35/-; A.C., £4. Transformers only, 25/- each.

LOW LOSS INDUCTANCE. 10 taps to plugs, ebonite panel, 5/-; Sullivan Aerial Couplers, 10/-; R.A.F. Coupler, 4/6.

VARIOMETERS. B.B.C. on ebonite, 2/6; Polar Cosmos Mounted Variometer, 8/6. Plug-in Coils, 35, 50, 100, 150, 200, 1/3 each.

H.F. TRANSFORMERS. Aperiodic Superhet, 9/-; 45-metre H.F. 87 S.W., 4/6; Efesca Plug-in Range Switch, 200/2,000 m., 10/-

FULL-WAVE RECTIFYING TRANSFORMERS. Double wound for A.C. mains, 110 or 220 volts, 40, 50 and 60 cycles, two centre tap secondaries for H.T. and L.T., 20-m/a, 25/-; 50-m/a, 37/6 each. Complete Outfit of parts and cabinet, £3 10s. Valves, 8/6.

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SWITCHES. D.P.D.T. Panel, 1/-; S.P.D.T. Panel, 9d. On and off Switch, 1/-; Double Switch, 2/-; Tumbler, 1/-; Push and Pull, 1/-.

SWITCHBOXES. Lucas 3-way Switches, walnut case, flush metal cover, 3 Levers, 1/6. Grid. leaks, R.A.F., 2 and 4 megs., 1/-; 10 megs., 1/9. Marconi Sterling, all ranges, 1/2. Mica Sheets. Best Ruby Mica for Condensers, 2 by 2, ·002 thick, 1/- per doz.

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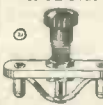
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7x 6, 1/3	9x 6, 1/7
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10x 9, 2/4	12x 9, 2/10
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14x 12, 4/-	16x 9, 3/6
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16x 8, 3/2	24x 7, 4/-
8x 5, 1/2	1/2 in. thick.
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We are now the sole suppliers of the genuine U.G. and Thorpe valves, as specially tested and recommended by the Unidyne inventors and Cash with Popular Wireless. U.G.5 and Thorpe K.4 (both 4-electrode 5-pin valves). Post free. Only direct from **UNIDYNE VALVE CO., 1, CHARING CROSS, LONDON, S.W.1**

PLEASE MENTION "POPULAR WIRELESS" WHEN REPLYING TO ADVERTISEMENTS

A TWO-VALVE L.F. AMPLIFIER

(Continued from page 1102.)

the amplifier for the best results and also how to join it up to your existing set.

You will need two suitable valves, and these can be 2-, 4- or 6-volt, whichever you prefer.

The first L.F. valve can be a small power valve or one of those designed for general-purpose use. The last-named will probably give greater volume.

Amongst those suitable may be mentioned the Coscor 610H.F., Marconi or Osram D.E.L.610, Mullard P.M.5X, etc. These are 6-volt valves, but they have their equivalents in the 2- and 4-volt classes.

In the second-valve holder you will need a small power valve, such as the B.T.H.B4, Coscor 610L.F., Marconi or Osram D.E.P.610, Mullard P.M.6, Cosmos S.P.55/R, etc. Here, again, the equivalent 2- or 4-volt types will be satisfactory.

Connecting Up.

For these valves a 9-volt grid battery, tapped at every 1½ volts, should be used, and the H.T. battery can have a value of 120 volts.

Place the two valves in their correct valve holders, and join up your H.T. and L.T. batteries. Insert the H.T. + plug into the 100 or 120-volt tapping on the H.T. battery, and connect up the grid bias before switching on the valves. For the grid bias which is connected through the R.C.C. unit 3 volts will suffice, and in the case of the second valve about 7½ to 9 volts should be satisfactory at the H.T. voltage suggested. The unit is now ready for use.

Perhaps you are a little doubtful as to the correct manner of connecting the unit up to your set. Well, suppose you have a single-valve set with swinging-coil reaction. Join the "input" terminal on the amplifier to the 'phone terminal on the set, which is already connected to H.T. +. Connect A₁ and A₂ on the unit together with a piece of wire. Join "Input A₂" to the telephone terminal which goes to the reaction-coil load, and remove the fixed condenser (if any) which is connected between the two 'phone terminals.

An Important Point.

You will only need one H.T. battery, and so you can take a second H.T. + tapping from this battery to H.T. + on the existing set. There is no need to take a second H.T. - lead to H.T. - on the set, only one H.T. - being necessary if one H.T. battery is used. Please note, this is important.

If the receiver is a Reinartz single-valver the connections will be the same except that there is no need to join A₁ to "Input A₂," and, of course, the second 'phone terminal will go to the H.F. choke in the set and not to the reaction coil.

If your set is a simple crystal receiver join the existing telephone terminals to "Input" and "Input A₂." The telephone terminal which is joined to earth should go to "Input."

With a crystal set it is sometimes advisable also to connect L.T. - to earth, and this should be tried, because otherwise the L.F. valves may tend to howl.

TECHNICAL NOTES.

(Continued from previous page.)

The fact that the H.F. resistance of a variometer is—at any rate for the greater part of the range—substantially constant is quite an important point in favour of the variometer, and I would like to refer to this point again in a week or two.

"Secret Process" Batteries.

Two or three high-tension battery makers are now advertising "special process," or "secret process" batteries. A notable example is the new Lissen H.T. battery.

The actual processes involved are, of course, trade secrets, but in most cases they are intended to have the effect of preventing the contents of the cells from drying up and also to make them regenerative, so that the chemical action which takes place during discharge is neutralised or compensated for during periods of rest.

As every experimenter knows, the greatest enemy of a "dry" H.T. battery is continued exposure to warmth, since this makes the battery truly dry instead of being only nominally dry. A so-called dry battery is only dry in the sense that the moisture within it is held in such a way as to be completely sealed in or unspillable, but it is impossible for a battery to operate without moisture, and if the moisture is driven off (by leaving the battery in a warm place for long periods) the battery becomes in truth a dry battery and ceases to function. All manner of ingredients have at different times been introduced into dry batteries for the purpose of retaining a sufficient quantity of moisture, and very ingenious and careful methods have been adopted for sealing up the individual cells.

Regeneration.

As to the regenerative process, this, as I have already said, is intended, during periods of rest, to dispose of the products of chemical reaction which are produced during discharge, and also to cope with the polarisation which tends to occur when the battery is in action.

The latest Lissen H.T. battery, judging from the drastic tests to which the manufacturers have submitted their batteries, and also from the considerable use to which I have myself put various samples of this battery which have been submitted to me, seems to be an excellent product and a very great improvement on the type of H.T. battery to which one was accustomed a few years ago.

Corroded Terminals.

A very interesting and useful system for dealing with accumulator repairs is in use by a Yorkshire engineer, who lays himself out specially to deal with overworked or ill-used wireless accumulators. The principal feature of his system is the use of high-pressure steam jets, at a pressure of 80 to 120 lb. to the square inch, for cleaning corroded terminals, for softening the sealing compound (used in some types of accumulator) prior to the removal of the plates, and, finally, for thoroughly cleaning the plates themselves and removing all traces of acid and dirt. The corrosion from the terminals is removed very readily by the use of the steam jet, and terminals which it was impossible to move with pliers become easily manipulated by hand.

"It must have been very skilfully designed"

"Vide 'Popular Wireless,' Jan. 7th, 1928."



15/-
Ratio 1 to 1.

"It must have been very skilfully designed, for it gave results far superior to those its price would lead one to anticipate. In fact, we must admit that we consider its performance falls very little short of transformers in the one-pound class."

This is an extract from a test report by POPULAR WIRELESS, under the heading "An Efficient L.F. Transformer," in their issue of the 7th of January, 1928:

The results obtained with this wonderful little transformer have been truly remarkable. Take the case of the Mullard Master Three. If you substitute a cheaper Transformer the signals from a large number of stations are so faint as to be hardly audible even on earphones, and the quality of reception from the very few that can be heard is distinctly poor. Now, use the R.I. & Varley General Purpose Transformer (that specified by the designers of this efficient Receiver), and at once the number of stations which can be heard at good loud-speaker strength are more than trebled, and the quality of reception is improved out of all proportion. *Actually, 26 stations have been logged at Loudspeaker strength 2 miles from 2 L.O. on the Master Three, using our G.P. Transformer.* Of course, if you want still better results build the Master Three with the R.I. & Varley Straight Line Super Transformer. You will be able to listen in to still more stations on the loudspeaker, and the increased amplification of the very low frequencies will add still further to the "roundness" of the reception. The patented system of winding, which, owing to the small self-capacity takes care of the high notes as well as the low, adds wonderful realism to the reception of both music and speech.

Our 16-page illustrated leaflet C.14—free on application—gives full particulars of all types of R.I. & Varley Transformers.



THE MARK OF



BETTER RADIO

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The Filament that is unique



Huge
emission
long life
strength &
improved
results

Mullard

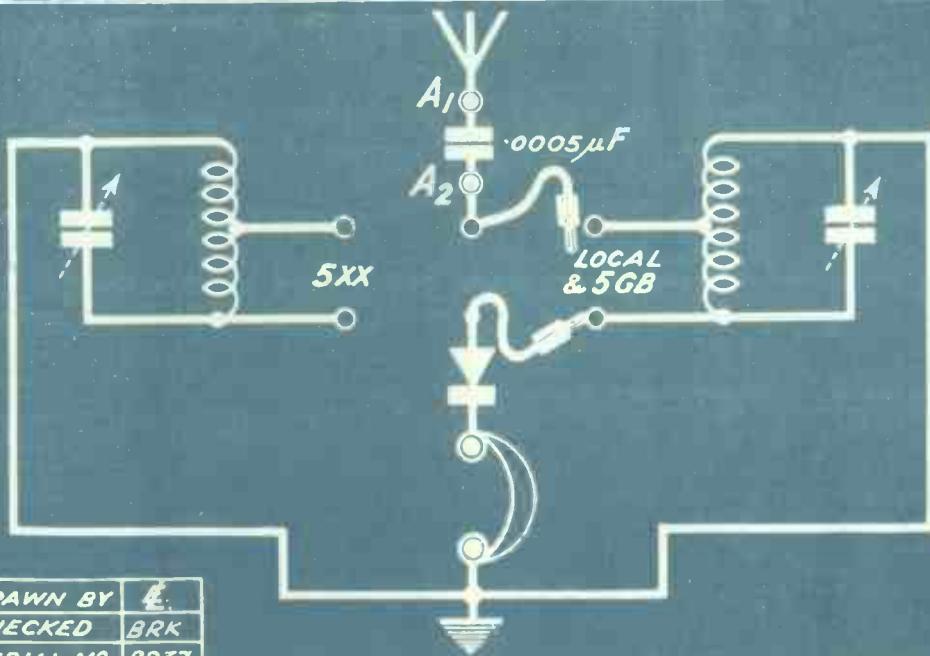
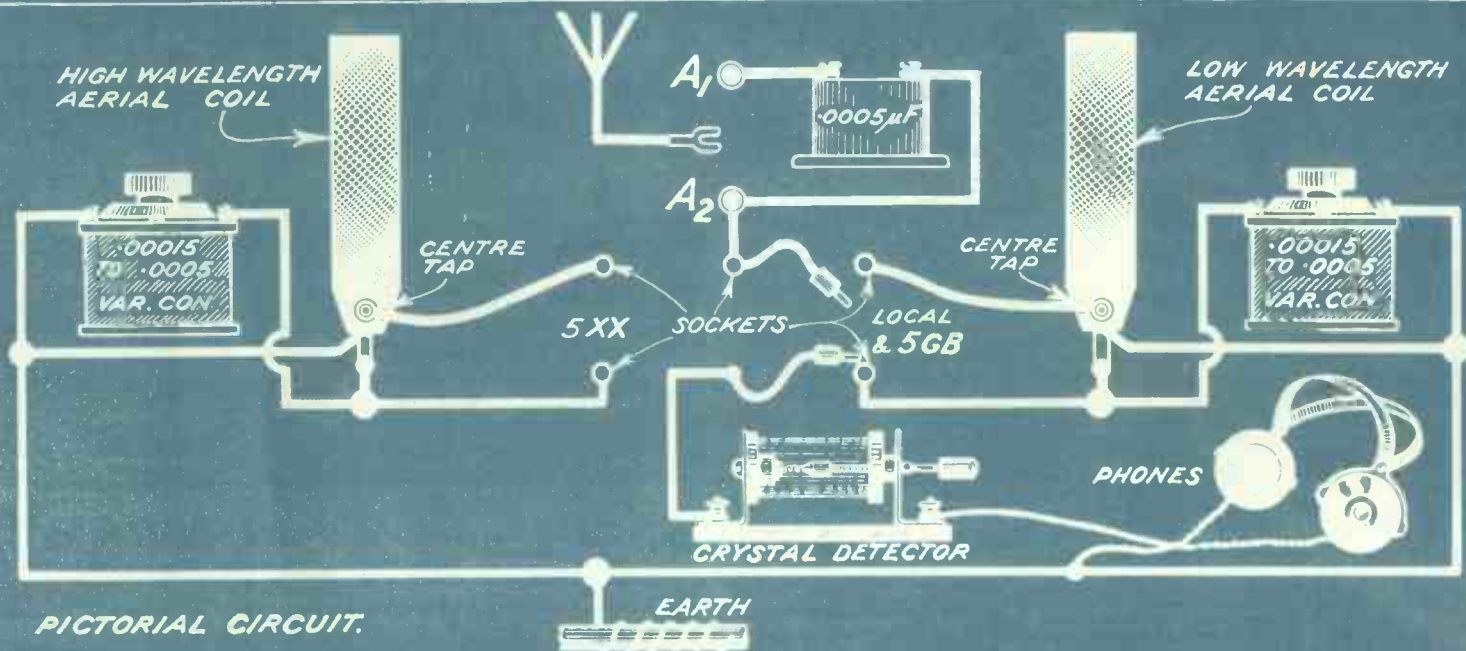
THE MASTER VALVE

WITH THE WONDERFUL P.M. FILAMENT

BLUEPRINTS

THE "P.W." BLUE PRINT CIRCUIT No. 37—

The "Long-Short" Crystal Set



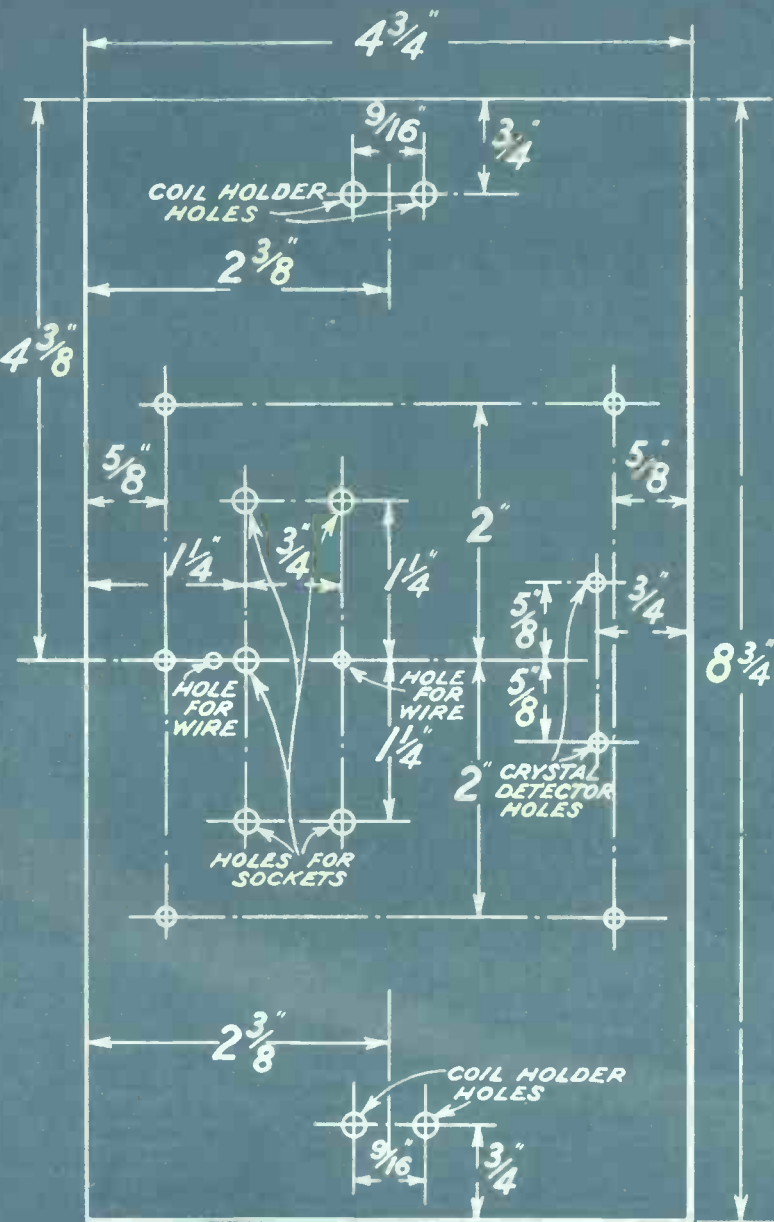
COMPONENTS

- 1 Panel, $8\frac{3}{4}$ in. \times $4\frac{3}{4}$ in. \times $\frac{1}{4}$ in.
- 1 Flat-topped box to fit, about 3 in. deep.
- 2 Panel-mounting single-coil sockets.
- 2 Compression type semi-variable condensers, .0005 mfd. maximum. Either board mounting to be attached to underside of panel, or panel mounting, in which case the adjusting knobs will project through the panel for adjustment from above.
- 1 .0005 mfd. fixed condenser.
- 5 Terminals.
- 5 Small sockets and 2 plugs.
- 1 Crystal detector.
- Wire, etc.

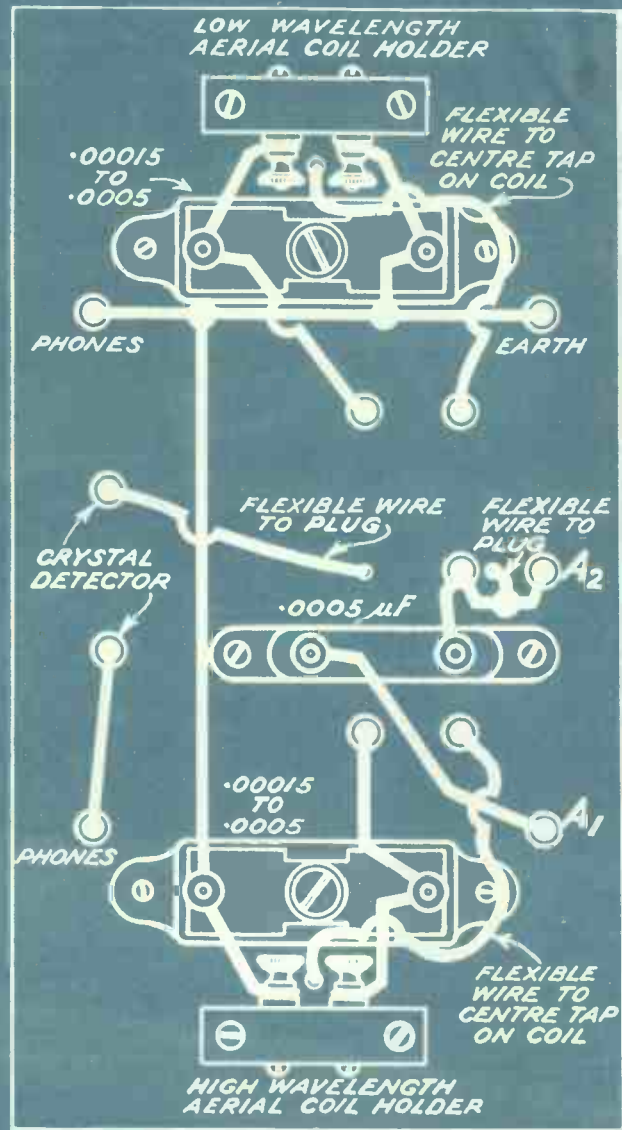
ACCESSORIES

- 1 No. 60 centre-tapped coil.
- 1 No. 200 centre-tapped coil.
- Pair of telephones.

DRAWN BY	E.
CHECKED	BRK
SERIAL NO	BP37



PANEL LAYOUT.



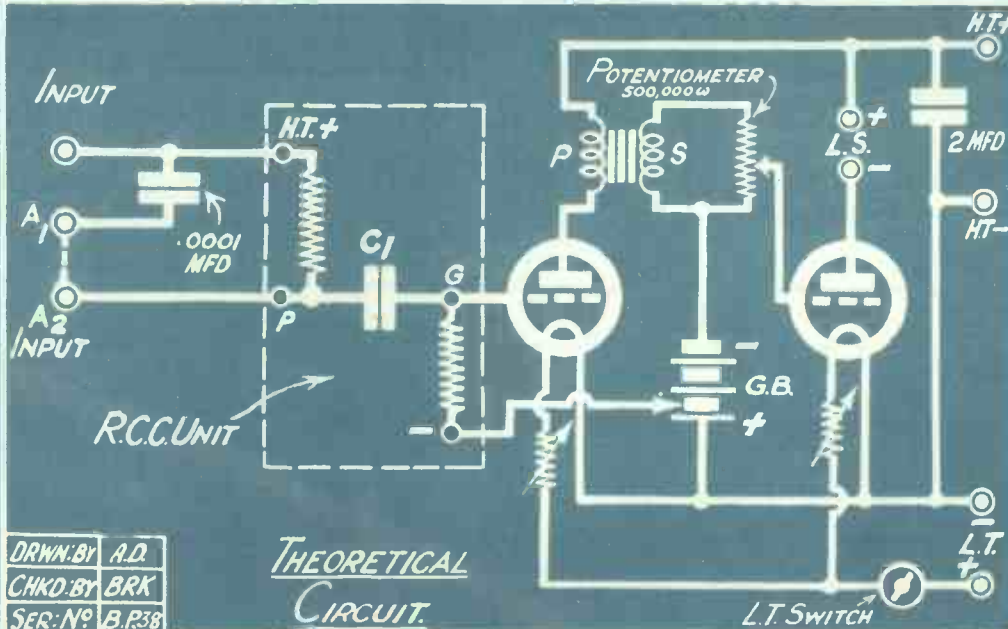
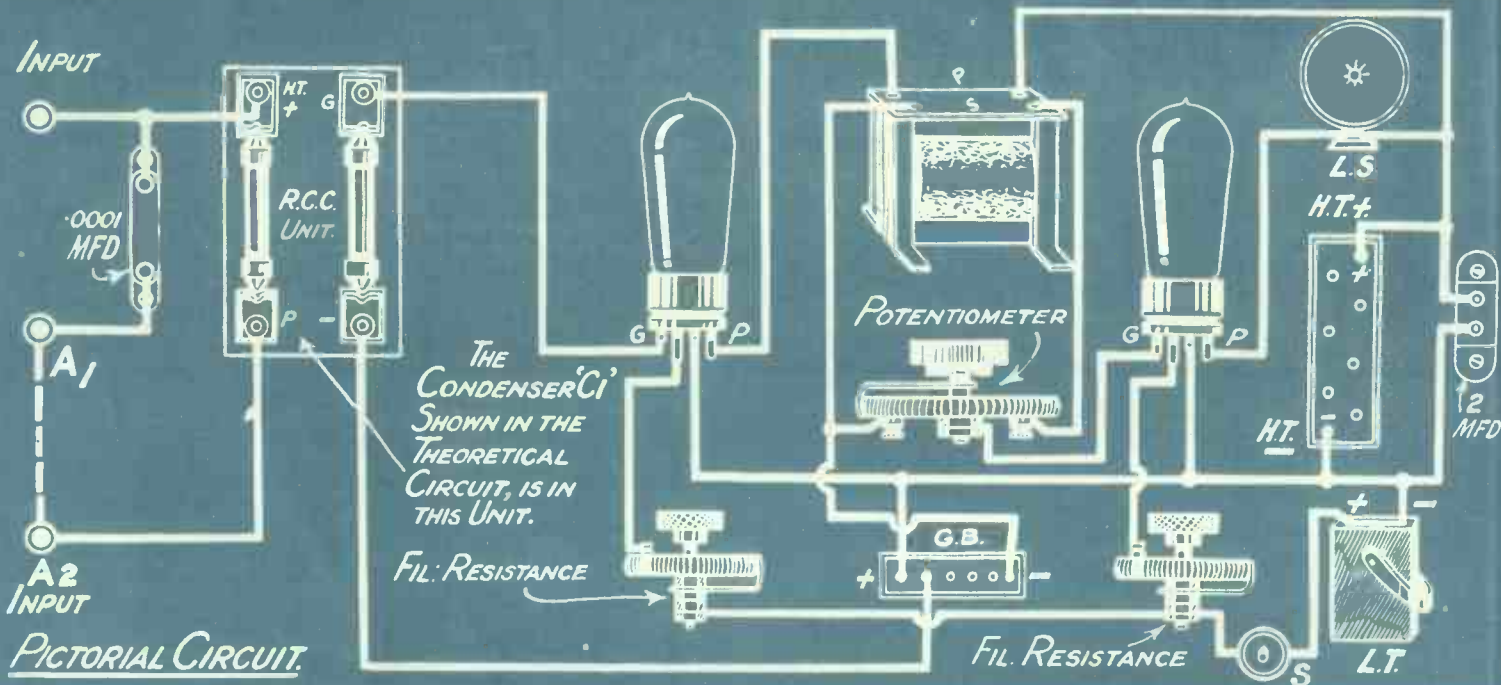
WIRING DIAGRAM.

DRAWN BY	<i>E</i>
CHECKED BY	<i>BRK</i>
SERIAL N ^o	37A

A simple long- and short-wave set for changing over from 5 X X to the local by moving two plugs. To receive shorter wave station put plugs in sockets nearest "low-wave" coil, and vice versa. To increase selectivity put detector plug in socket near A2 terminal. To increase further connect aerial to A1 instead of A2. (Always try this with large aeriaks).

THE "P.W." BLUE PRINT CIRCUIT No. 38—

A Two-Valve L.F. Amplifier



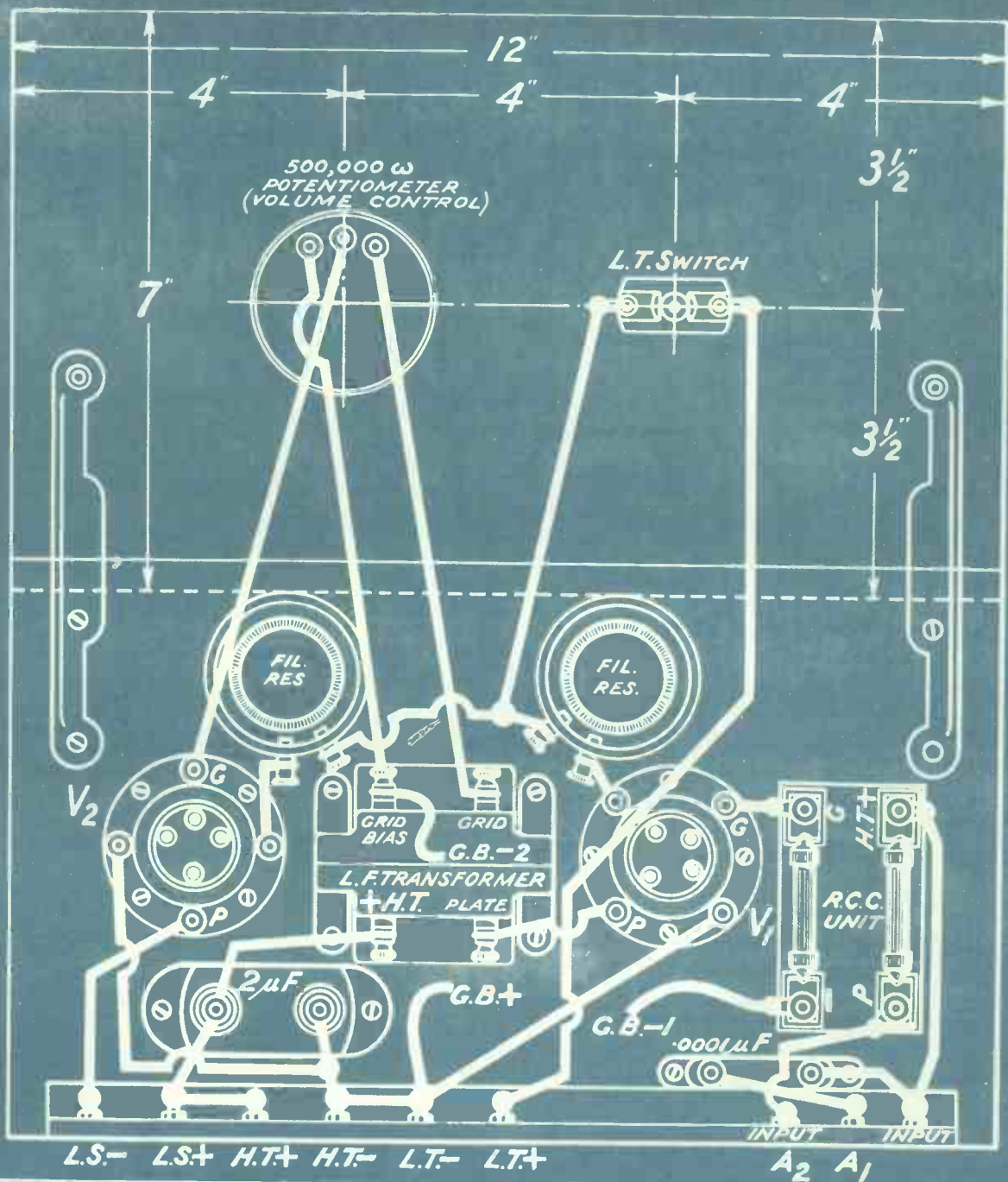
COMPONENTS

- 1 Panel, 12 in. x 7 in. x $\frac{1}{2}$ in.
- 1 Cabinet to fit, with baseboard 7 in. deep, and pair of brackets.
- 1 Resistance-capacity coupling unit, with anode resistance of about 250,000 ohms and grid leak 1 megohm.
- 1 L.F. transformer, low or medium ratio.
- 2 Sprung valve holders.
- 2 Baseboard rheostats or resistors.
- 1 On-Off switch.
- 1 High-resistance volume control potentiometer. Not less than 500,000 ohms.
- 1 Fixed condenser, .0001 mfd.
- 1 Manbridge type condenser, 2 mfd.
- Terminal strips with 9 terminals.
- Wire, etc.

ACCESSORIES

- 1 L.F. or H.F. valve for V1. (See transformer maker's instructions on this point).
- 1 Power or super-power valve for V2.
- H.T., L.T. and grid-bias batteries to suit valves.
- Loud speaker.

DRWN:BY A.D.
 CHKO:BY BRK
 SER:No B.338



DRAWN BY *E.*

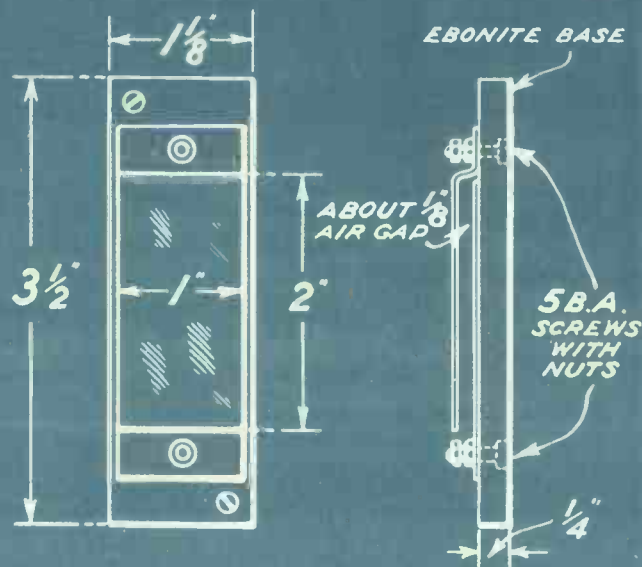
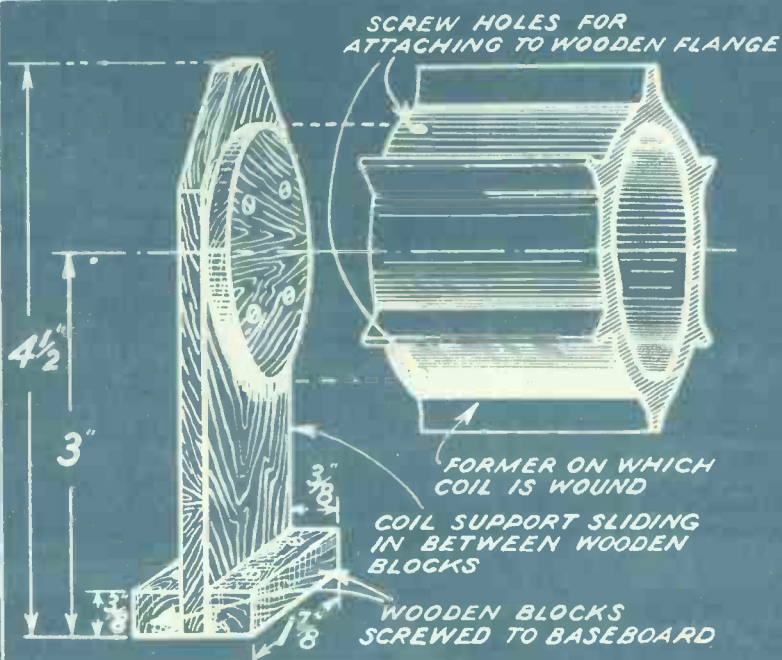
CHECKED BY BRK

SERIAL NO BP38n

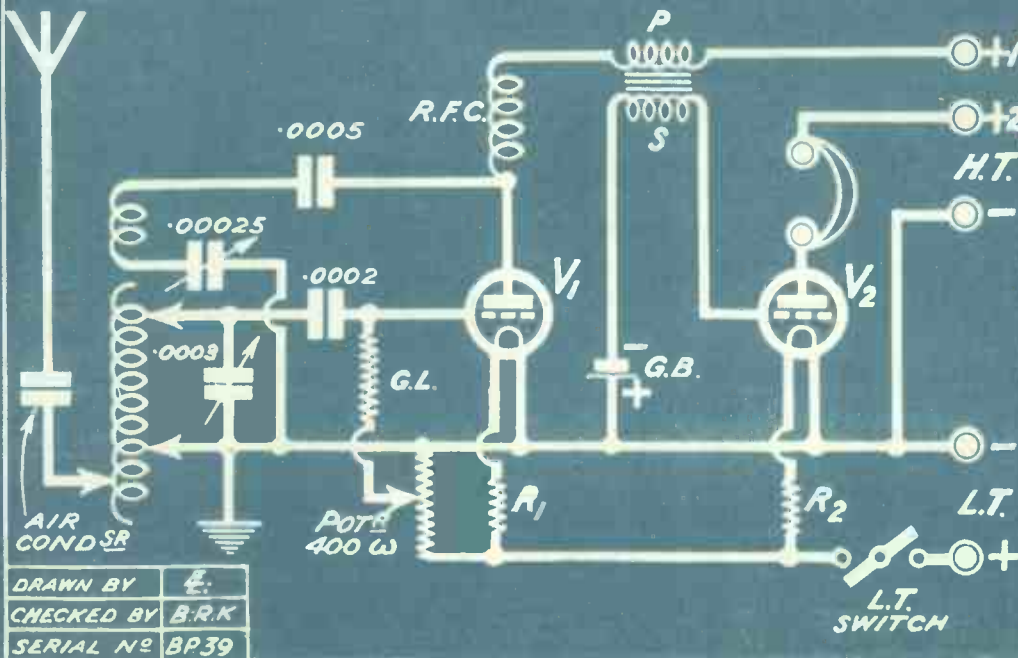
A two-valve L.F. amplifier with one resistance and one transformer-coupled stage. A simple amplifier capable of giving very good quality. Connect "input" terminals to 'phone terminals on receiving set. If results not satisfactory reverse these leads. Try connecting terminals A1 and A2 together. Remember to connect L.T.- to earth with a crystal set. With a valve set and common batteries make no connection to H.T.- on amplifier, but leave it free.

THE "P.W." BLUE PRINT CIRCUIT No. 39-

The "Sydney" Two



DETAILS OF FIXED AIR CONDENSER IN SERIES WITH AERIAL LEAD.



COMPONENTS

- Panel, 14 in. x 7 in. x 1/2 in.
 - Cabinet to fit, baseboard 10 in. deep and pair of brackets.
 - 0003 mfd. variable condenser, square law or S.L.F. with slow-motion or vernier drive.
 - 00025 mfd. miniature reaction condenser.
 - On-Off switch.
 - Baseboard rheostat to suit valves (usually about 6 ohms).
 - Sprung valve holders.
 - Grid leak and holder, 2 meg. upwards.
 - 0002 mfd. fixed condenser.
 - 0005 mfd. fixed condenser.
 - 400-ohm. (200 will do) baseboard-mounting potentiometer.
 - L.F. transformer.
 - 2-in. tube of any good insulating material, 3 1/2 in. long, for H.F. choke.
 - Piece of ribbed ebonite tube, 3 in. diameter and 3 in. long.
 - Tapping clips.
 - Terminal strip with 7 terminals.
 - Terminal strip with 2 terminals.
- Various pieces of wood, copper sheet, ebonite, etc., for series condenser ("air") and coil mounting.
- Small quantity of No. 34 S.S.C. wire for reaction coil and H.F. choke (75 turns on tube) and a few yards of No. 18 plain copper wire for coil.

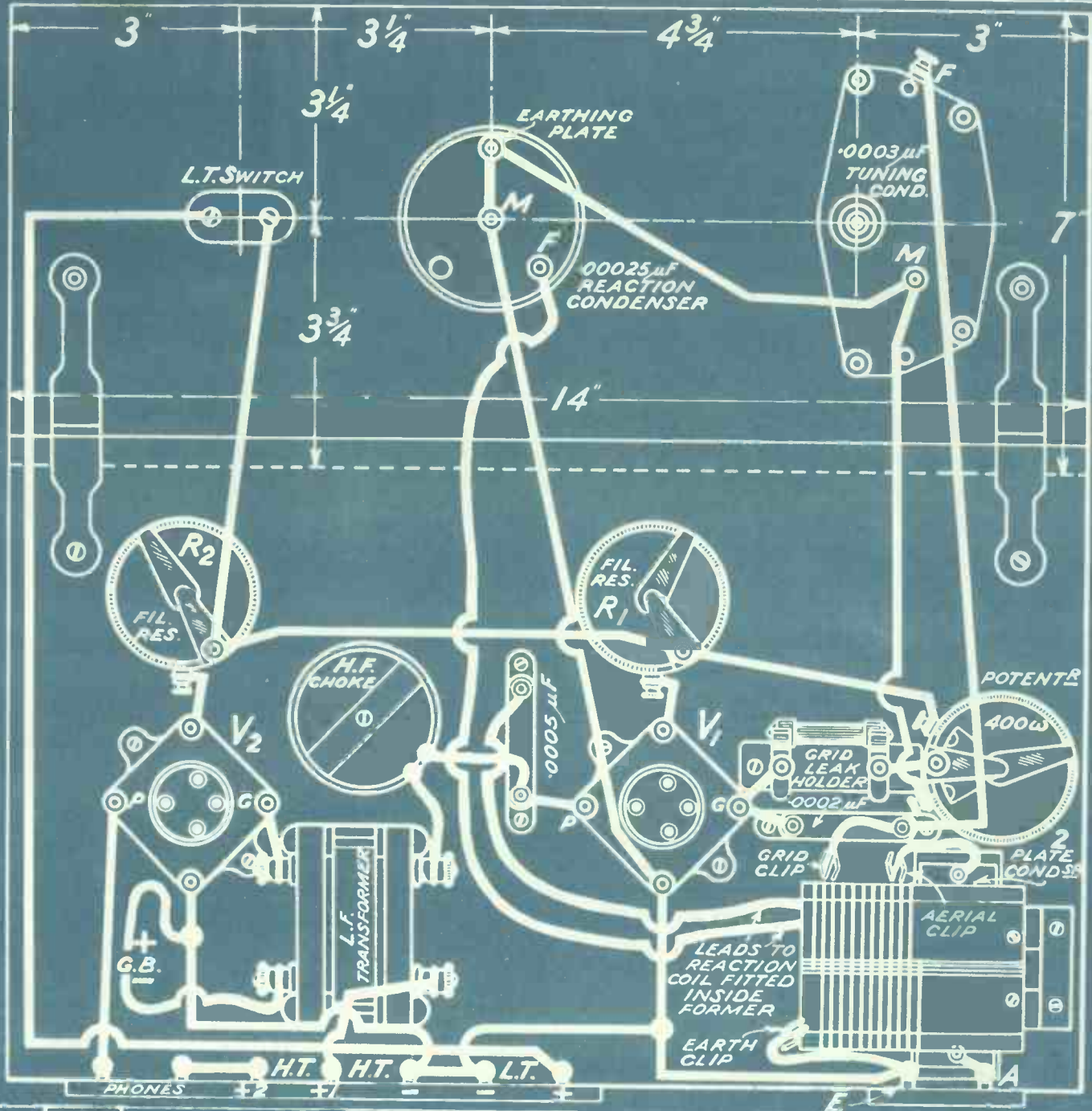
ACCESSORIES

- Valve, H.F. type.
 - Valve, L.F. or power type.
- H.T. and L.T. batteries to suit valves, pair of 'phones, grid-bias battery.

DRAWN BY *E.*

CHECKED BY *B.R.K.*

SERIAL NO *BP39*

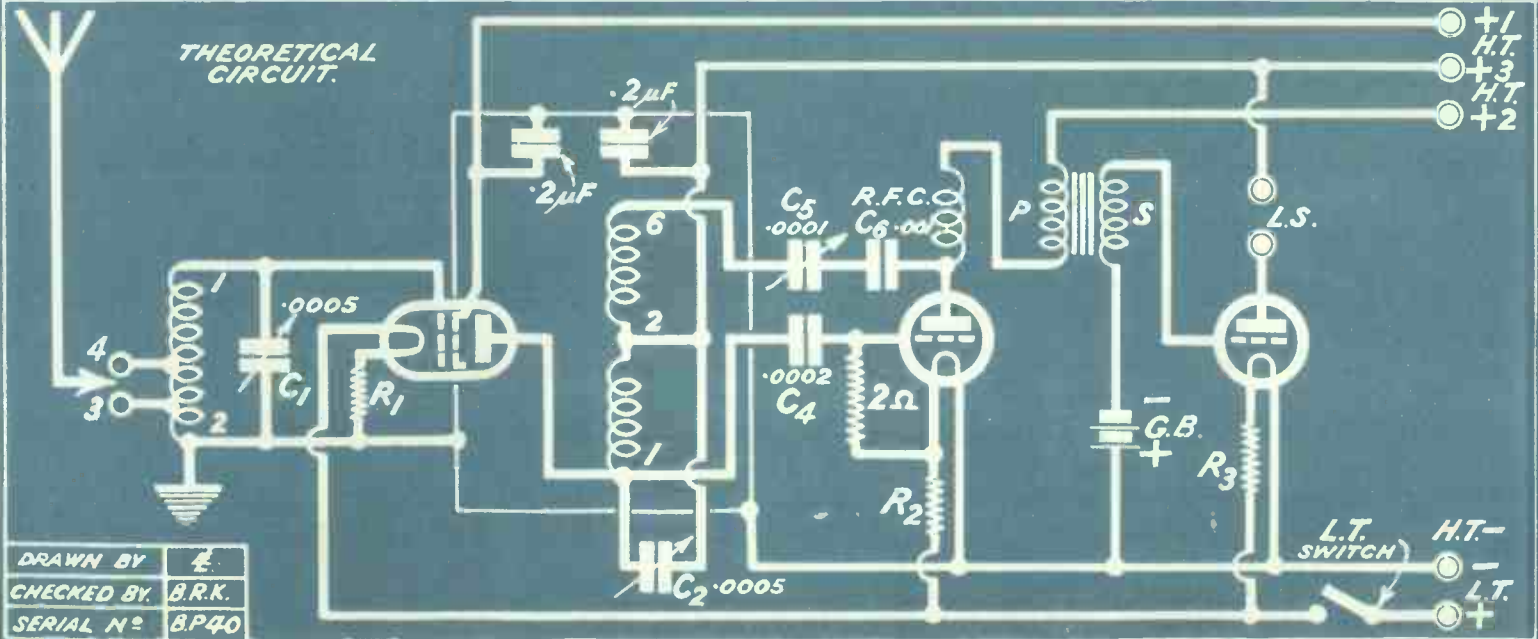
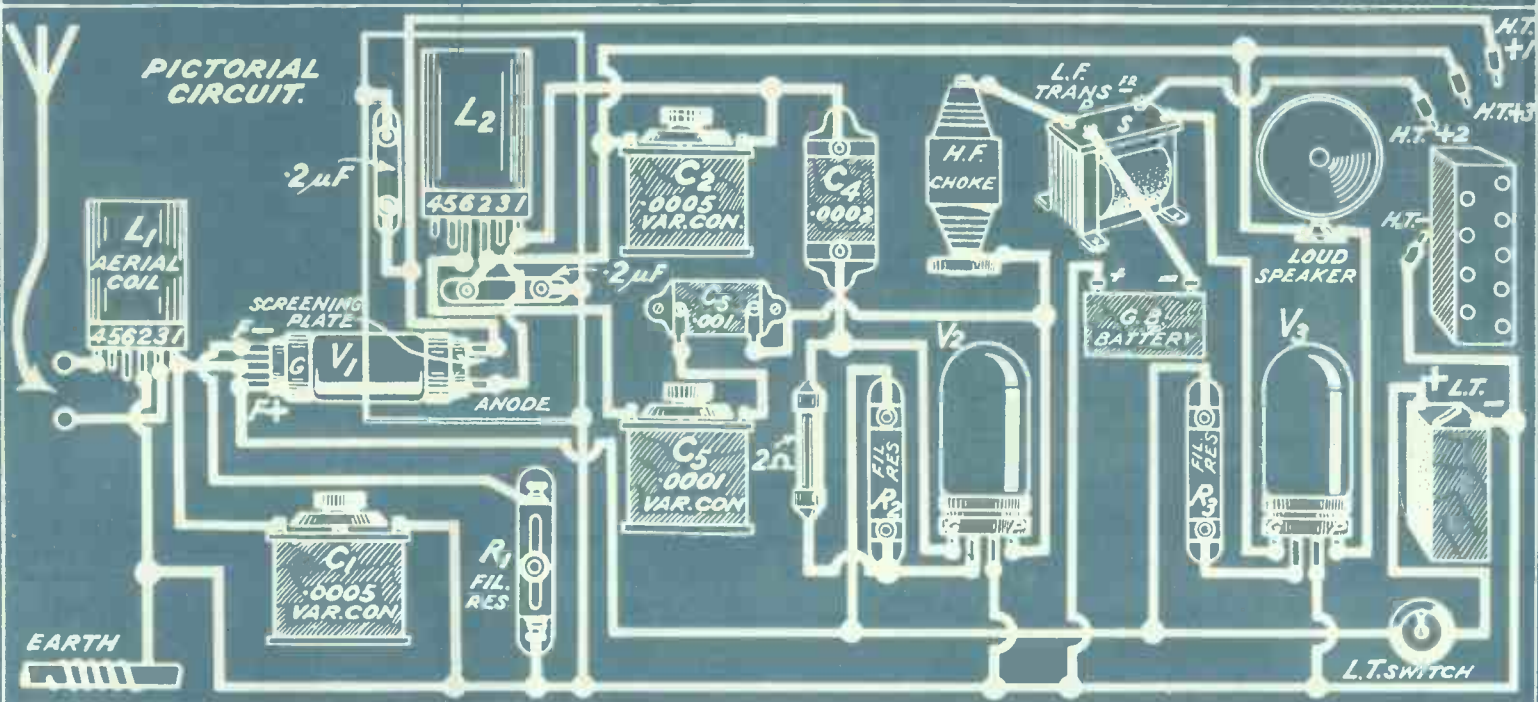


DRAWN BY	EL.
CHKD. BY	B.R.K.
SER. N ^o	B.P.39A

A simple and efficient short-wave set tuning from about 18 metres to 70 metres. Tuning coil consists of 12 turns, with about $\frac{1}{2}$ in. spacing between turns. For details of mounting see drawing. Reaction coil consists of 7 turns of No. 34 S.S.C. wire on a little piece of tube to slip inside the tuning coil. Earth and grid clips control tuning range and aerial clip the degree of coupling to the aerial. For further details see "P.W." No. 284.

THE "P.W." BLUE PRINT CIRCUIT No. 40—

The "Super Screen" Three



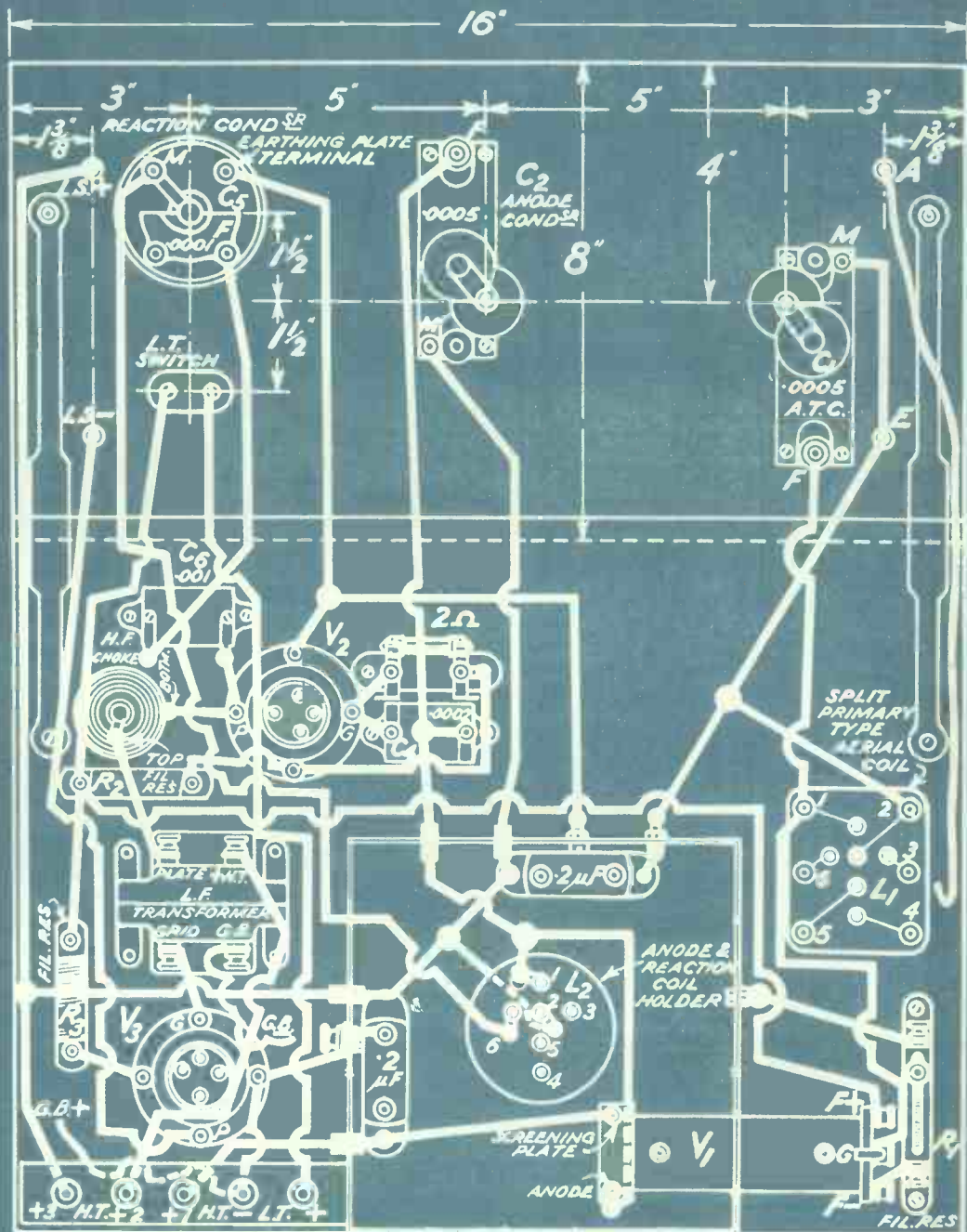
DRAWN BY *E.*
 CHECKED BY B.R.K.
 SERIAL N^o BP40

COMPONENTS

- 1 Panel, 16 in. x 8 in. x $\frac{1}{4}$ in.
- 1 Cabinet to fit, with baseboard 12 in. deep, and brackets.
- 2 .0005 mfd. variable condensers with slow-motion drive or vernier dials.
- 1 .0001 mfd. miniature type reaction condenser.
- 1 On-Off switch.
- 1 H.F. choke.
- 1 L.F. transformer, fairly low ratio.
- 1 Standard screening box with 6-pin coil base, and hole cut in side for screened valve.
- 1 Valve holder for screened-grid valve.
- 2 .2 mfd. Manabridge type condensers.
- 1 6-pin base for aerial coil.
- 3 Baseboard rheostats to suit valves.
- 2 Sprung valve holders.
- 1 .001 mfd. fixed condenser.
- 1 .0002 mfd. fixed condenser.
- 1 2-meg. grid leak.
- 1 Terminal strip with 5 terminals.
- 4 Terminals for panel.
- Quantity of wire, Systoflex, etc.

ACCESSORIES

- 1 Screened-grid valve.
- 1 H.F. type valve for detector.
- 1 L.F. or power valve.
- H.T., L.T. and grid-bias batteries to suit valves.
- Phones or loud speaker.
- 2 "Split-primary" type aerial coils, one B.B.C. waves and one long waves.
- 1 Special anode coil on Colvern "Featherweight" former. Single layer of 55 turns No. 24 D.C.C. wire, lower end to pin No. 2 and upper to pin No. 1. Reaction winding in same direction of 30 turns No. 34 D.S.C. in single layer at lower end of former. Lower end to pin No. 6, upper end (and nearest to lower end of main coil) to pin No. 2 also.
- 1 Split-primary transformer for long waves, to be used in place of above for 5 X X, etc.



DRAWN BY *E*
 CKD BY *BRK*
 SER. NO. *BRK*

A highly sensitive long-range receiver with one stage of H.F. (screened-grid valve), detector, and one transformer-coupled L.F. stage. Will work a loud speaker on a large number of stations. Connect the flex lead from A to 3 or 4 on aerial coil base according to degree of selectivity required.