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Wireless Weekly

and the Wireless Constructor.

Vol. 4.
No. 12.

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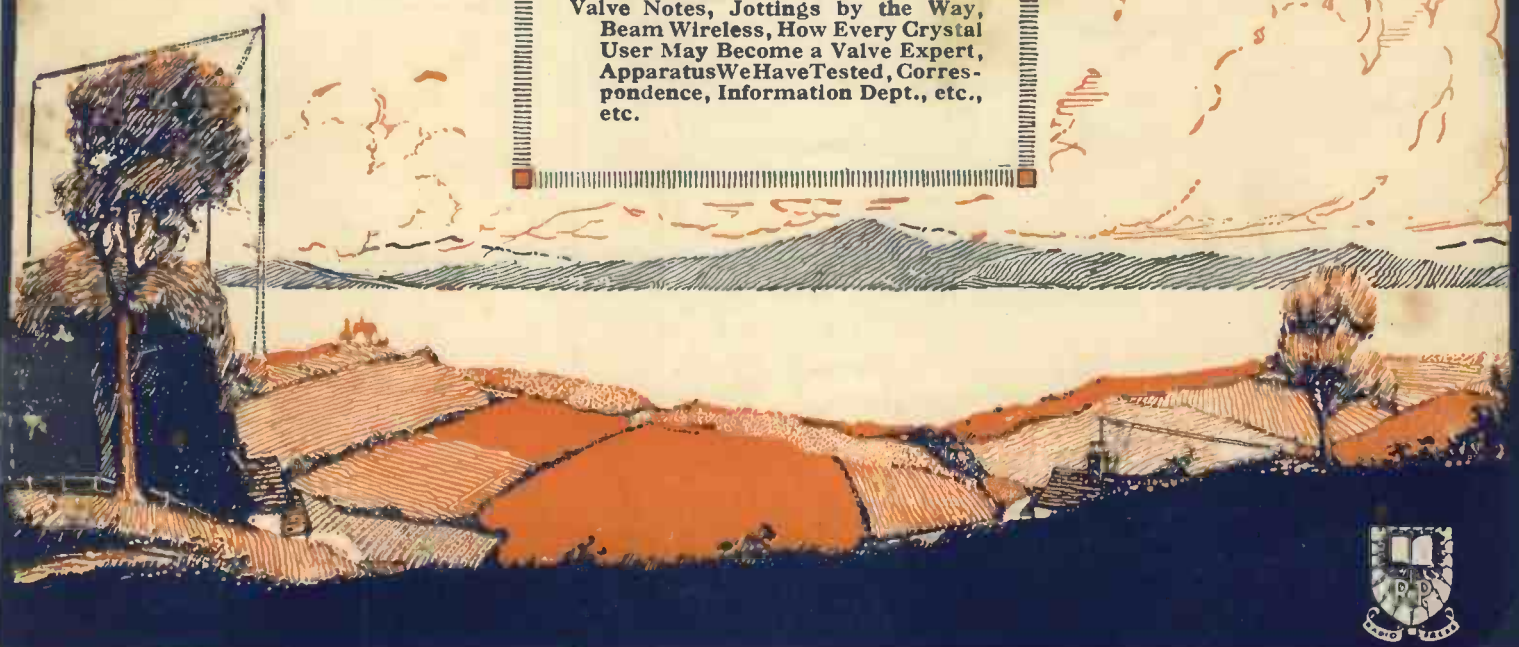
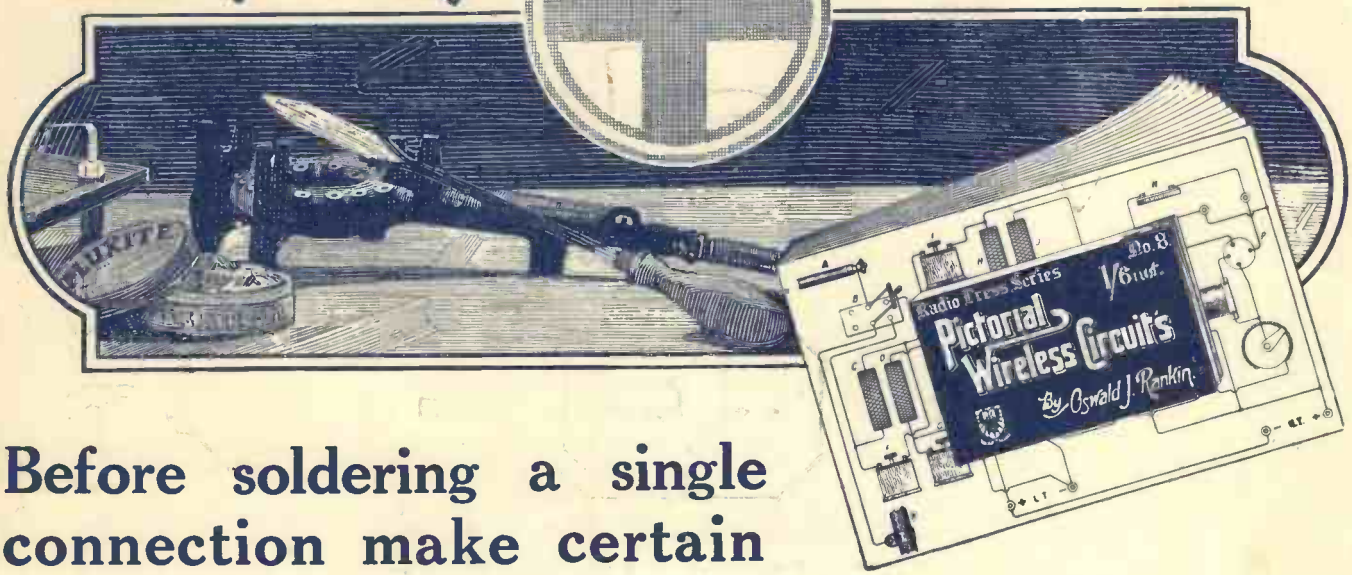


Special 1,600 Metres Number

Safety First



Before soldering a single connection make certain your Circuit is correct.

MANY a man has built up a Receiving Set, inserted the Valves, coupled up the batteries and . . . . hoped for the best!

Perhaps at the worst the result of his efforts has only been complete silence, but if he has been really unlucky, and his wiring inextricably mixed there has been a blue flash indicating the premature decease of his valves.

And almost invariably the cause of the whole trouble is inability to read a Circuit diagram.

Now Radio Press, Ltd., have published an entirely new Book, "Pictorial Wireless Circuits," which makes use of a different principle to that usually employed. Instead of conventional signs every Circuit is shown with illustrations of the actual components connected together. It gives, in effect, a bird's-eye view of the finished set.

Naturally such a method makes wiring up extremely simple and as a very wide range of circuits is shown, ranging from simple Crystal Circuits to multi-valve Circuits, it is a Book which should be in the hands of every Wireless enthusiast.

Obtainable from all Booksellers or direct from publishers (postage 2d. extra).

Every Circuit is individually described and its advantages explained. Full details of all variable components, such as condensers, resistances, grid leaks are given, so that the home constructor can build up a Receiving Set from the information furnished.

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Radio Press Ltd., Devereux Court, Strand, W.C.2

1/6

Pictorial Wireless Circuits

By Oswald J. Rankin.

G.A. 1147.

Wireless Weekly

Vol. 4, No. 12
July 23, 1924

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.
Assistant Editors: P. W. HARRIS. E. REDPATH.

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Publishers of Authoritative Wireless Literature.
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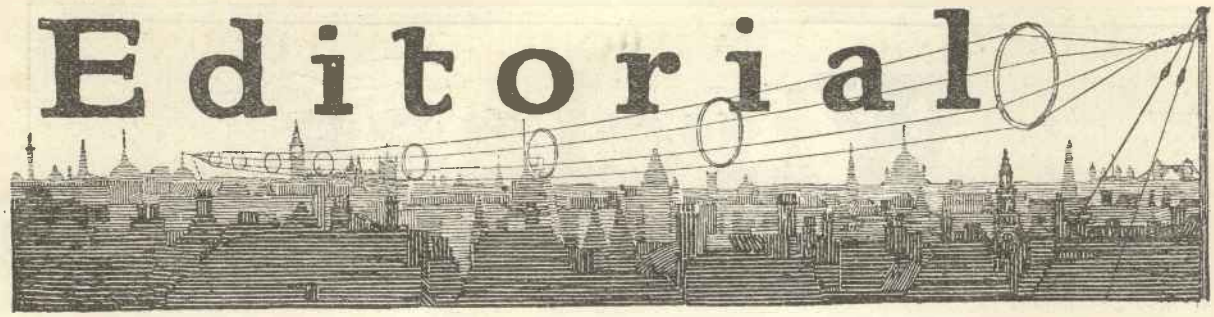


Truth in Advertising

The holding in London of the International Advertising Convention has once again drawn attention to the importance of clear and accurate statements in advertisements of every kind. While we can say with certainty that the day has passed when blatant falsehood could pass unchallenged, we are still some distance from the ideal of perfect truth in such announcements. In this regard it may be said that perfect truth is a matter upon which philosophers will always dispute.

Between a flamboyant disregard of accuracy and an academic ideal, there must, of course, be a happy medium. Wireless as a new industry, has still much to learn in the matter of truth in advertising, although in this country at least we may congratulate ourselves that there is a very little deliberate misrepresentation. There are a few points, however, to which we would direct the attention of advertisers most earnestly; as the present unsatisfactory state of affairs is harmful not only to the public, but also to the advertisers themselves.

Condenser Values

Take, first of all, the question of the actual and reputed values of variable condensers. Practical experience has shown that certain capacity values are most useful in wireless receivers. Perhaps the four most popular values are .001, .0005, .0003 and .0001 μF. The largest of these, and, until a year or two ago, the most popular, is gradually passing out of use with the realisation that high values of capacity shunt are often detrimental to signal strength. The .0005 μF value is immensely popular, and is of just the correct value for aerial tuning when used in a suitable circuit.

Let us take the case of the home constructor who desires to build one of the sets described in these pages. He will choose the design, and soon afterwards order the component parts from his dealer. For the successful functioning of the particular set it is probably necessary that the full capacity values should be available. What does he usually find? The condenser sold to him as .0005 μF on actual measurement may have a value as low as .0003 μF. The probable result will be that the set will fail to tune the wavelength range required, and the design may be condemned.

If such mis-statements of value occurred in a few isolated cases of little-known manufacturers, it might be overlooked, but it is doubtful whether one condenser in three now sold is properly rated. Certain manufacturers are guaranteeing the capacity of the condensers sold, and these should be encouraged.

Another matter of importance is that of the range of receiving sets. It is far too common a custom to make a statement that all stations can be regularly received upon a set which is only capable of receiving them all in most favourable conditions.

In this connection the value of the independent test reports conducted by this journal is quite evident. The careful tests and measurements and the practical use of components in the constructional articles published in this journal afford an excellent guide and assistance to our readers in their own work. It is in this way that the confidence awarded to our publications has been built up. This, combined with our policy of accepting only advertisements of genuine goods, serves to protect our readers' interests in the fullest possible way.

In our issue for 2nd July, we published our test report of a "Success" transformer submitted by the makers for test. Out of a sense of fairness we have permitted to be published on another page an advertisement in which the makers state their own claims.

Chelmsford Without Interference

A Wave-trap for 1,600 metres Crystal Sets.

By G. P. KENDALL, B.Sc., Staff Editor.

BY the time these lines appear in print a considerable proportion of the readers of *Wireless Weekly*, who use crystal sets inside a distance of perhaps eight miles from 2LO, will have discovered for themselves that to tune-in 5XX while the local station is working is not nearly so easy as they had anticipated. The average crystal set is designed for reasonably loud signals with the minimum of trouble, and there has been little need, prior to the opening of the high-power station, for more than elementary selectivity. In any case, obtaining high selectivity is a matter of some difficulty in crystal sets, unless unduly complex circuits are used, since the damping effect of the crystal is so great that the tuning

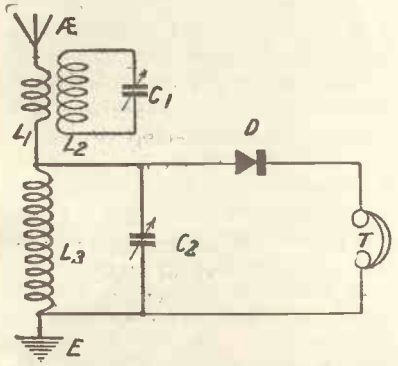


Fig. 1.—The B type of wave-trap applied to a simple crystal receiver.

is necessarily very much flattened, even when the crystal is tapped across only a part of the total inductance.

The result is that when the average crystal receiver is used within a fairly short distance of a main station it will usually be found that when a loading coil is inserted for the reception of the Eiffel Tower time signals the local programme continues to be heard at somewhat reduced strength. Further, when an attempt is made to receive 5XX on 1,600 metres the problem is still more difficult, and it may be found that the two stations are heard with equal volume, even when the best possible tuning adjustments have been made for the high-power station. This is exactly my own experience when using a commercial crystal set upon a rather high aerial at eight miles from 2LO.

Valve Reception

With a valve set the problem becomes much simpler, since tuning is normally sharper when no crystal is connected across the tuned circuits, and the proper use of reaction enables one to make the aerial or anode circuit really sharply resonant, and little trouble should be experienced at distances of less than about three miles of a main or one mile of a relay station.

Selective Circuit or Wave-trap

Turning to remedies for the trouble, it will be seen that there are two main lines of approach, the first depending upon the use of more selective circuits, and the second involving the provision of some definite absorbing device to eliminate the unwanted station.

In the majority of cases the second method is to be preferred, since it does not involve any alteration in the set itself, consisting of the use of an additional unit of some kind, and does not seriously increase the complexity of the set.

The adoption of a more selective type of circuit, on the other hand, requires a considerable amount of alteration to the set itself, and specially selective circuits are in their very nature more difficult to handle, and hence less desirable for general purposes. I would therefore always advise the use of a circuit of a perfectly straightforward type, to which an external eliminator can be added when needed, possibly with a switch to bring the trap into circuit without trouble.

Suitable Wave-traps

By comparison with the problem of cutting out the local station in favour of another working on a wavelength within the ordinary broadcast band (300-500 metres), it is an easy matter to devise a trap which shall completely eliminate interference on 1,600 metres. The trap need not be of a very drastic nature, and hence it is unnecessary to use one of the types which upset the tuning adjustments seriously, and render the set less simple to work.

I have found best the trap known as type B, and a modification thereof which I propose to call type D. Type B is illustrated in circuit form in Fig. 1 as applied to a crystal receiver, and it will be seen that it consists of a trap circuit tuned to the unwanted signals, coupled as tightly as possible to the aerial circuit by means of a relatively small number of turns wound directly on top of the main trap coil. These turns are connected in series between the aerial and the aerial terminal of the set, and, of

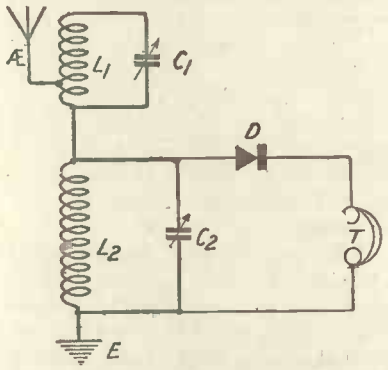


Fig. 2.—A modification of type B.

course, only affect tuning to a small extent.

Type D is illustrated in the same way in Fig. 2, and differs from B only in that no special turns are wound on for coupling purposes. A suitable number of turns of the trap-winding are tapped off and used for coupling, the arrangement resembling an auto-transformer. Of the two, I have found type B slightly more dependable (there is a very small element of uncertainty in the behaviour of almost any wave-trap), but type D is much less troublesome to make. In any given case they are both worth trying, since different traps seem to be required by different aerials.

The two types are shown pictorially in Figs. 3 and 4, which

give the actual connections of the components.

Efficiency Wave-traps

One hears exceedingly conflicting opinions expressed by experimenters of experience as to the effectiveness of wave-traps, and it appears that aerial and earth conditions modify their action to a considerable extent, that there are instances where no known type of trap is of much use. These cases are certainly rare, however. Recent experiments upon various types of traps have convinced me that, although the H.F. resistance of the aerial-earth circuit is important, the discrepancies between the results of different experimenters are more often due to the use of traps of inefficient construction.

The efficiency of a wave-trap as an eliminating device appears to be very largely dependent upon keeping all energy losses in the trap circuit as low as possible, paying great attention to such matters as possible dielectric loss in coil formers and wire covering, resistance losses, and so forth.

The variable condenser, for example, *must* be of the best, preferably of the air dielectric type, and with ebonite end plates. A really sound electrical connection to the moving vanes is also essential.

The coil former should be of ebonite of good quality; it is desirable that as little dielectric material as possible should be included in the field of the coil. I have obtained a perceptible improvement by using a sort of skeleton former cut from ebonite tube, but such refinements as this are unnecessary in traps used for the purpose which we are considering here.

Single layer winding appears best, and double cotton-covered wire should be used, no varnish or wax being employed for impregnation. Leave the cotton without impregnation and try to keep the coil dry. Wire of large gauge (not less than No. 22 S.W.G.) is essential, fine wire being one of the commonest causes of failure in wave-traps.

Constructional Details

The diagrams give the connections of the two types of trap, and it only remains to provide practical data as to tubes and windings.

Type B requires a tube (ebonite) 3 inches in diameter and length, upon which 40 turns of No. 22 S.W.G. d.c.c. wire are wound in a single layer. Over the top of this winding put ten turns of No. 18 S.W.G. d.c.c. wire, to be connected in the aerial circuit. A variable condenser of 0.001 μF is connected to the

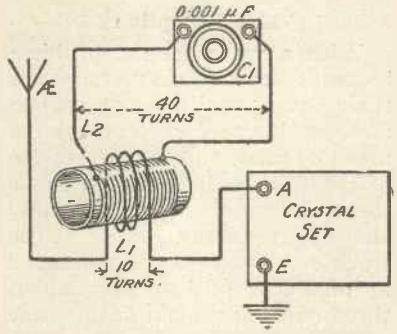


Fig. 3.—Type B represented pictorially.

ends of the 40-turn winding, and the trap is complete.

Type D consists of the same tube and trap-circuit winding, but the ten turns of No. 18 wire are omitted. Instead, a tapping is taken out, so that eight turns can be brought into the aerial circuit. The connections of the variable condenser are as before.

Operating the Trap

The use of traps of this type is very simple. Set the controls of the set very roughly to the settings required for 5XX, and pro-

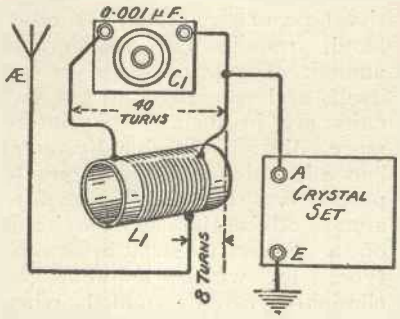


Fig. 4.—The actual connections of type D.

ceed to vary the capacity of the wave-trap condenser. Signals from the local station will be heard almost all over the dial, but with a little patience a point will be found at which they disappear, and upon *either side* of which they reappear. Leave the trap set to this value, and proceed to tune in the desired station.

A Tip for the Tapless

IF you are one of those who have not yet acquired the art of threading holes by means of taps, or if at any time you wish to be able to insert a screw for which you have not a corresponding tap, here is a simple hint which will enable you to get over your difficulties when engaged in wireless construction. The tip is to make plain holes two sizes smaller than the clearance size for any particular screw. Thus, supposing that you wish to fix, for example, a 4 B.A. screw tightly you proceed as follows:— By reference to a table you find that the clearance size for 4 B.A. is a No. 26 drill. You therefore use a No. 28—note that the drill numbers increase as the sizes become smaller; No. 1 is the largest Morse twist drill, No. 60 is the smallest. Now take a 4 B.A. screw, and, with a file, bevel off the last two or three threads so as to make the end rather pointed. Moisten the screw with a little turpentine or oil, and you can turn it in with a screwdriver. Go easily, and do not use too much force, especially with very small screws, or they may twist off. The clearance sizes for other B.A. screws which the constructor uses are 12 for No. 2, 19 for No. 3, 30 for No. 5, and 34 for No. 6. In order to drive screws straight in without tapping one would therefore drill plain holes with No. 14, 21, 32 or 36 drills.

It will be found that screws of any size inserted in this way grip quite tightly, and that they can, as a rule, be driven in without the least trouble. It must be noted that metal screws only can be used for ebonite. Never attempt to use wood screws which are almost certain to twist off whilst being screwed home. Even those who do use taps will find the "two sizes smaller" tip most useful for putting screws into "blind" holes, that is, those which do not go right through the panel. Here tapping is often very difficult, even if one has a plug tap, and it is really better to make plain holes of the sizes indicated. R. W. H.

The Great Idea

IT is not often that Poddleby has a really good inspiration, but there are times when, like Felix of the films, he experiences a kind of boiling up of ideas which explode with startling results to all around. The other day, when the Little Puddleton wireless club was holding one of those meetings which have now become so famous, General Blood Thunderby, who was in the chair, asked for suggestions for a summer outing. My own contribution, which I regret to say was promptly turned down, was that we should visit the North Foreland and contemplate the beauty of GNF, whilst lying quietly upon our backs in the summer sun. I have always felt that the hot weather calls for something of a peaceful nature. Others proposed that we should journey to some great factory and see how wireless things are made. But, mindful of the old saying that the epicure should never go into the kitchen if he wishes to preserve his appetite, I strenuously led the opposition against this. It was Poddleby, our own Poddleby, who had the meeting with him at once when he said: "Why not go to Wembley?" Admiral Whiskerton Cuttle rose promptly to his feet to protest against a wireless club wasting its time in watching tennis tournaments. As everybody started to speak at once, we had a little difficulty in explaining to him that it was not wimbling to Wimbledon but wembling to Wembley that was being mooted. Eventually he saw the point and withdrew his objection. Poddleby and other speakers pointed out that there was no need for us to visit one factory or one wireless station when all the radio wonders of the Empire were collected together within the boundaries of the Exhibition. Breadsnapp told us that we could spend the whole day in the Palace of Engineering, and, having been there once himself, volunteered to act as guide-lecturer. This offer was tactfully declined.

We Start

After an animated discussion it was decided that we should all go, making use if possible of a convenient excursion. Reference to the handbills, however, disclosed the fact that the only excursion was timed to leave Little Puddleton at 3.30 in the morning, and, as most of us are making up during the summer months for the sleep which we lost in the winter when Trans-Atlantic reception was in full blast, it was thought that this would not be good for our health.

A Sad Incident

We agreed, therefore, not to go by train at all, but by the ever useful charabanc. I have little to tell you of our journey Exhibitionwards—in fact, the only event that marked it was the demise of the General's beautiful white bowler. Gubbsworthy, who was sitting beside him, rose from his seat in order to exchange some light badinage with Winklesworth in the row in front. As he stood up the General thoughtlessly placed his hat upon the seat, with the result that it became a casualty when Gubbsworthy resumed his place. The General's fury was not lessened by Gubbsworthy's insisting that it was not seemly for the chairman of the wireless club to play practical jokes in a public conveyance.

Some Progress

Poddleby's scheme for the day was this: It would be just midday when we were decanted at the main entrance, and we were all to spend the first hour on our own to obtain some idea of the wonders of the Exhibition. At one o'clock we were to rendezvous for lunch, after which we were to proceed to the Palace of Engineering until tea-time. From then onwards we would visit the remaining wireless marvels of the Exhibition. When the General called the roll at one o'clock it was found that several members were lost, stolen or strayed, and not until three-quarters of an hour later was the entire club able to assemble round what the reporters call the festive board. Luncheon over, we sat round the table sipping our coffee whilst the details of the afternoon's programme were discussed. This took some little time, since not all of us were in perfect agreement as to details, and various counter proposals were made to each suggestion. When perfect accord had been reached Gubbsworthy looked at the clock, and said that as it was now half-past four we might as well have tea. This was the first proposal of the day to be carried by acclamation. Poddleby hurried off after a hasty meal, bidding us proceed independently to the Palace of Engineering, and meet him at 5.15 at the magnificent stand of a firm of wireless manufacturers whose name is a household word, though for the moment I have forgotten it.

A Fall from Grace

As I loathe unpunctuality, I did not linger too long over my tea, and with the help of a bath-chair reached the appointed place very shortly after 5.30. I was amazed to find Poddleby absolutely alone before the wonderful stand. On seeing me he leapt forward with joy in his eyes, and

would, I believe, have embraced me had I not kept him at rather more than arm's length with my walking-stick.

A Solitary State

It appeared that I was the sole member of the club to put in appearance. Poddleby was quite willing to work off upon me the lecture that he had prepared for the club, but I persuaded him to keep it for an occasion more worthy of its quality. After we had stood making conversation for some minutes I said: "Well, this does not seem much use, and time is slipping away. Let's just have a look at the Amusement Park before it is time to go." Poddleby agreed with alacrity, and we went. You probably know the thing called the Jack and Jill. You get on to a little trolley built on the lines of an Irish jaunting-car, so that passengers sit back to back. This is wound up to the top of a steep incline by a chain arrangement, and when it gets there the seats simply turn over and tip their occupants on to a long curving slide, down which they career madly sitting on mats. You may imagine Poddleby's amazement and mine when, as we watched, we saw that the occupants of one of these cars were the General and Admiral Whiskerton Cuttle. Rushing up, I was just in time to witness the descent of the warrior, all flying arms and legs and a beaming smile, whilst Poddleby, going to the other side, found the admiral in a similar state of beatitude. "Why, General," I called. "Get out of the way," was the only retort. "Come on, Whiskers, I'll race you again for another bob." I hastily joined Poddleby, and found that he had been similarly rebuffed by Whiskerton Cuttle. We went away musing upon the sad fall from grace of two of our most respected members.

And the Professor

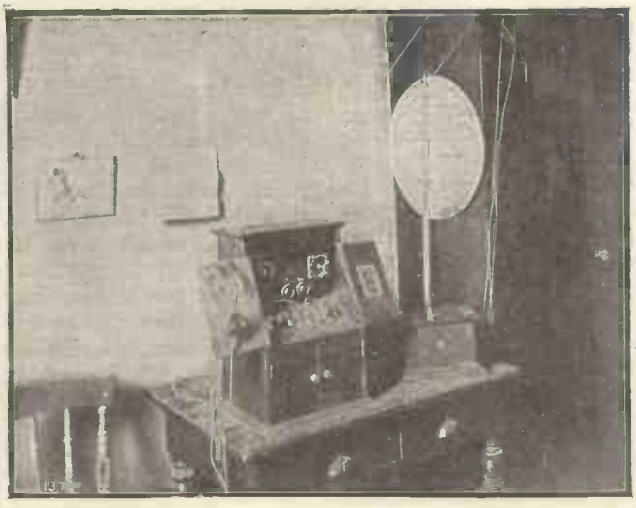
If the Jack and Jill surprised us the Witching Waves did much more than this, for there, careering round in a small vehicle like a cross between a bath-chair and a motor-car, his hat off, his collar undone, and the ends of his tie flapping all over the place, was—can I write it? No, I can't. Yes, I must. Well, here goes—was no less a person than Professor Goop, who appeared to have taken leave of his senses. Seldom have I seen upon any face the expression of reckless abandonment. As soon as the professor completed one round he waved wildly with his arms, and the blue-jacket fellows on duty pushed him off again for another. When at length he came into port Poddleby and I sought him out with reproachful glances. The Professor, like most of his kind, is absent-minded and not infrequently at a loss for words. Wishing to inquire his way to the wireless part of the Palace of Engineering, he suddenly found that he had entirely forgotten the name of the great science of which he is so illustrious a devotee. All that he could say to the policeman was "Oscillations. Undulations. Waves." The policeman at once handed him over to a guide, who rushed him on to the Witching Waves. As he had no words with which to expostulate, he was duly launched in a chariot, and at the end of each round the gestures by which he tried to indicate that he wished to stop were taken by the attendants to mean that he wanted to go round again. Little by little the thing grew upon him, and it was not until he had run up a bill of £2 14s. 6d. that he joined us.

What a Day

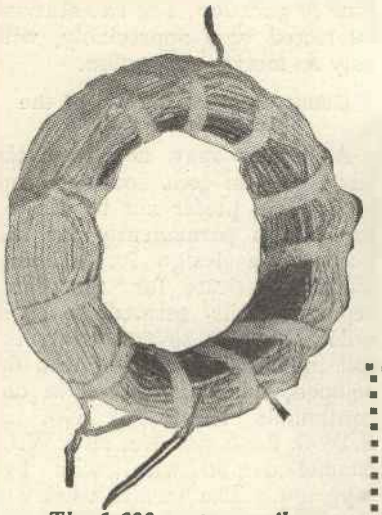
As we passed the Jack and Jill again we saw that the General and the Admiral were still hard at it; but perhaps the worst sight of all was provided by the Racer. As we came opposite to this two cars reached the top of the steepest bit of it and rushed madly down amidst the wildest yells from their occupants. As they crawled up the opposite slope we were able to see that each was crowded with members of the Little Puddleton wireless club, who were apparently divided into crews, and were racing under the leadership of Gubbsworthy and Breadsnapp. Such members as we had not so far accounted for we found either playing Skeeball or having their brains rattled on the Whip. Poddleby grew sadder and sadder over the terrible conduct of his flock, until with a certain diffidence I suggested that, as all the others were doing it, we might as well sample some of these things ourselves. When the party was finally ejected from the Exhibition at closing time we all agreed that we had spent a most instructive day. The only person whom I do not envy is the General, who, before the visit was made, undertook to read a paper at the next meeting upon the Wireless Wonders of Wembley!

WIRELESS WAYFARER

EDITORIAL NOTE:—*We regret to state that the necessary twopence which Wireless Wayfarer had saved up, in connection with the article, "Telephones for Twopence," was expended in the Amusement Park, and the article is thus delayed.*



Our photograph shows an interesting two-valve set designed by the British Thomson-Houston Company.



The 1,600 metres coil.

Efficiency on 1,600 Metres

By A. D. COWPER, M.Sc., Staff Editor.

A New Coil for long wave reception.

THE activities of the new B.B.C. high-power station, operating on a wavelength of 1,600 metres or thereabouts, have necessarily turned the attention of British experimenters in the direction of longer waves, largely unexplored territory for the majority of the new generation of broadcast listeners. Some Continental stations, of course, have been operating on long waves for a considerable period, but it is the exception rather than the rule to hear these discussed in radio circles, so that comparatively few can be receiving them regularly. Eiffel Tower on 2,600 metres used to be a regular stand-by in the early days; one seldom hears of him nowadays.

5XX

The frequent tests carried out (on just over 1,600 metres) by the Chelmsford station (5XX) recently have given a welcome opportunity of experimenting with a view to finding the best conditions for successful reception. In London these test transmissions come in well on the crystal, though presumably they are not sent on full power yet.

Experiment showed that better results in crystal reception were obtained by using a two-coil tuner, loose-coupled primary and secondary, each inductance being tuned by parallel tuning-condenser, and coupled at, say, 2 in. centres—in the method developed for long-wave reception before short-wave broadcasting was thought of. A No. 150 plug-in coil for primary, and a No. 200, or, better, 250 for secondary, were called for, with .0005 μF tuning condensers.

Aperiodic Aerial Coupling

To many, however, even with the flat tuning associated with a crystal receiver, the three simultaneous adjustments demanded by this equipment may be irksome, especially when a wavemeter is not available for the preliminary search. It seemed desirable, therefore, to see if the semi-aperiodic aerial coupling which has become popular lately for short-wave reception could be adapted here. A little experimenting brought out the fact that a No. 150 semi-aperiodic (i.e., not actually "tuned") primary coil, jammed close up against the No. 250 secondary coil, the latter being tuned as usual by a .0005 (or .001) μF parallel tuning condenser, gave excellent signal-strength on either the high double 40 foot P.M.G. aerial, or on the single low 70 foot. This corresponds to the Chapman-Harris type of short-wave tuner.

With a view to economising wire, and using smaller coils, it was thought that this might be modified so as to be in line with the aerial-tap auto-transformer type of aerial coupling lately developed in some detail in various circuits by the writer: here the aerial portion of the coil is also common with the secondary circuit, but the latter has an extra loading coil superimposed on the other coil, and is tuned across the whole by the usual tuning-condenser. The circuit No. 1 resulted: this gave excellent signals on the two pairs of 'phones from 5XX in London, with good crystal-setting. Changing from one aerial to the other required less adjustment of the tuning condenser than might be expected, though the effect of varying aerial characteristics is considerably greater, naturally, than when a very small aperiodic primary is used, as can be done with short waves.

Coil Sizes

Practical trial showed that the use of a primary of much less than 150 turns involved a considerable loss of signal-strength: the precise size of the primary is not critical, but nothing is gained by departing much from the size indicated, i.e., from the inductance-value implied (in case other types of coils are used than the ordinary standard plug-in coil indicated here).

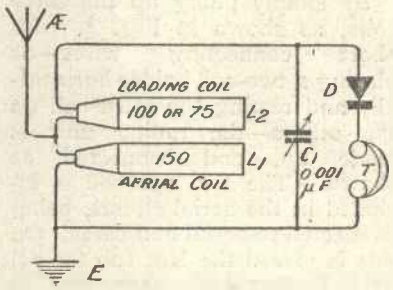


Fig. 1.—A simple auto-transformer circuit for 1,600 metres.

Valve Receivers

Turning to valve-reception, the question of suitable and really smoothly controlled reaction arises. Of course, a No. 200 coil used in a three-coil holder as usual, provides an immediate solution. But only a small proportion of listeners possess a three-coil holder on their sets; and the swinging reaction-coil offers what appears to the writer to be a very serious defect in the inevitable change in tuning pro-

duced when adjusting the reaction-coil; this makes the fine tuning necessary for distant telephony reception an extremely irritating process, and one not in the least likely to be successful in the hands of the non-technical in daily reception of broadcasting. Accordingly the well-tried method of reaction associated with the Reinartz receiver was adopted, modified for the particular conditions. This method, as is well known, gives an extremely smooth and easily-controlled reaction effect, with a fixed reaction coil and a reaction-condenser; and the wavelength is very little affected (in general) by reaction-adjustment.

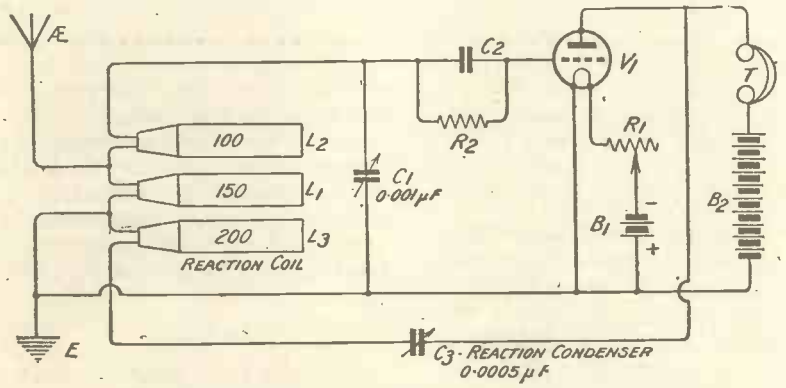


Fig. 2.—A single-valve circuit for plug-in coils.

The Tuning Unit

By simply piling up the three coils, as shown in Fig. 2, with short connecting wires—or placing a two-coil holder horizontally and resting the third coil on the others—the tuning unit is made up, and connected as shown. The No. 150 coil is included in the aerial circuit, being connected to aerial and earth. On this is placed the No. 100 (or 75) grid loading-coil, connected in series with the first. The tuning condenser is placed across the whole. The No. 200 reaction coil is put at the other side of the primary, and connected up with the earth end of the No. 150. With these longer waves the effective resistance ("reactance") of the capacity-path to earth via the casual and distributed capacities in the 'phones and their leads is high enough to divert the H.F. impulses coming from the plate of the valve, largely to the reaction condenser and coil. A reaction-condenser of, say, .0003 or .0005 μF should suffice, with a good R valve and 50 or 70 volts H.T., to give oscillation over a wide range.

Continental Reception

With the circuit as shown (Fig. 2) Eiffel Tower telephony on 2,600 metres came in quite well in London on the single valve, and also another telephony station (speaking French) a little higher (about 2,660 metres). Radiola was distinct on 1,780 metres in day-time, but was badly jammed by a station on 1,800 metres, extremely powerful—coming in like the local broadcast station on an average crystal-set—giving a long series of (apparently) market-reports or weather bulletins, etc., in a harsh language which was not French, German, Dutch, Spanish, or Italian certainly, but might possibly have been one of the Scandinavian languages, with which the writer is unfamiliar. Prague, in Czecho-Slovakia (about 600 miles) is scheduled for meteorological bulletin and news on this wavelength and at the time in question. The two stations interfered very appreciably, with only 20 metres separation.

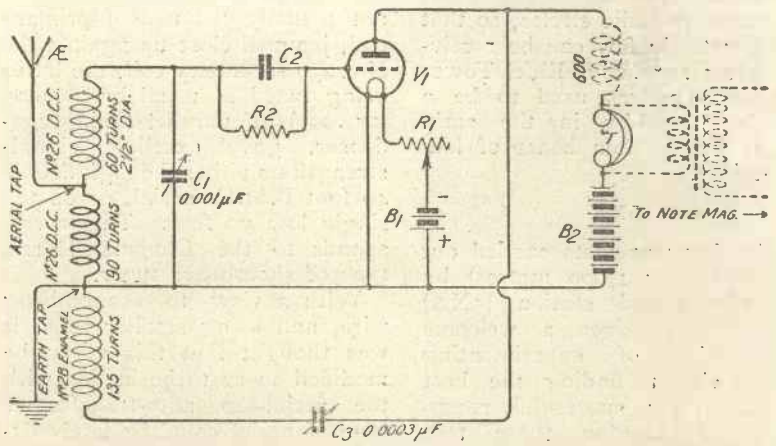


Fig. 3.—A long wave telephony receiving circuit, on the Reinartz principle.

Constructional Details of the 1600-Metre Coil

As many may not have the large plug-in coils specified, and others will prefer not to tie up three coils permanently for this purpose, a design for a home-made substitute for the three separate coils seemed to be in order. After several trials the coil indicated in Fig. 4 was developed, which is wound in one continuous length of No. 26 S.W.G. d.c.c. and No. 28 S.W.G. enamel-covered wire, with two tappings. The former used was the Watmel, 2 in. diameter and effective width of 1 in., with two rows of spokes of 11 each, staggered. The winding was done alternately simple single-layer or solenoid type, and zig-zag across the former to make a spacing layer of only five turns after the fashion of the familiar lattice-coil. (Actually the wire was passed across and around the third spoke on the opposite side each time, giving an effective spacing layer.) A total of 10 single layers resulted, the No. 28 being of 30 and the No. 26 of 20 turns: a total, with spacing layers, of 285 turns. The innermost reaction-coil part was of 135 turns actually of No. 28: this is by no means critical, and can be departed from fairly widely. Thus at first 200 turns reaction were used.

Aerial Turns

The aerial-coil part consists of 90 turns of No. 26; the grid load-

ing-coil part of 60 turns of No. 26. The effective diameter of the finished coil was about 2½ in. It was simply bound with narrow tape, no wax or varnish being used.

The wavelength range on a P.M.G. aerial was found to be about 1,100 to 2,800 metres, with a .001 μF actual tuning condenser. The writer used a new-pattern Raymond for this purpose. With the circuit arranged as shown, without radio-choke in the plate-circuit, Radiola (Radio-Paris) on 1,780 metres came in at night on the single valve in London steadily and at excellent 'phone strength, with an extremely quiet background. The writer has never heard him so well: on most elaborate commercial receivers, if found at all, he comes in unsteadily, distorted, and jammed by numbers of noisy Morse stations, with marked fading effects, so that it is an unpleasant ordeal to have to seek him. With a single note-mag. reception was excellent on three 'phones (two double and one single ear-piece); another valve would have given loud-speaking good enough for a small dance—American dance-music was being

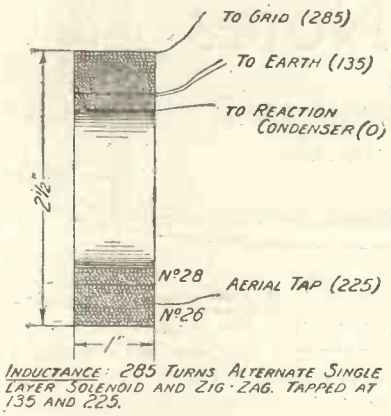


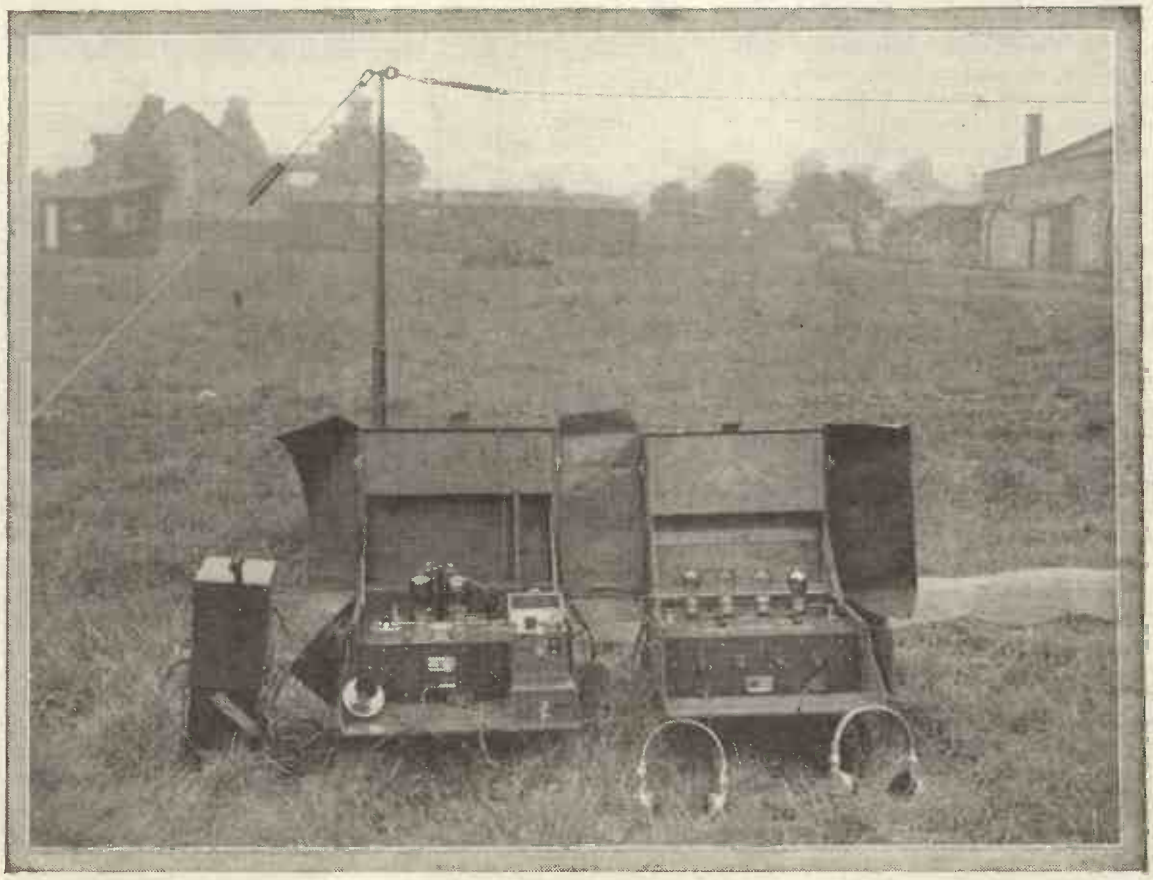
Fig. 4.—Constructional details of the new coil.

played by a small jazz orchestra at the moment.

When a second valve is used, the H.F. path to earth via casual and distributed capacities through the L.F. transformer may be too easy, so that reaction cannot be obtained. In this case a very large radio-choke coil should be included in the plate circuit of the first valve, as indicated in Fig. 3: the writer used a No. 600 plug-in coil, which happened to be available. It is a matter for trial: in any case there must not be a shunting condenser across the transformer primary here. The circuit works more smoothly if this path is stopped completely by a large choke.

A Curious Phenomenon

A curious and unexpected phenomenon was observed with these circuits, in connection with the local broadcasting: the No. 150 coil in the aerial-circuit can act as an effective radio-choke for short waves, leaving an aerial tuning-circuit consisting of a No. 100 (or 75) coil *in series* with the combined capacity of the grid-filament and the tuning condenser, and at low settings of the latter this can tune exactly to the local station's wave. The latter then comes in at good strength, with sharp tuning. But, of course, without reaction-effect, on apparently 1,200 metres or so!



A complete portable telephony transmitting and receiving station, manufactured by Marconi's Wireless Telegraph Co., Ltd., and exhibited at the British Empire Exhibition.

Valve Notes

By

JOHN SCOTT-TAGGART,

F.Inst.P., A.M.I.E.E.

Mixing Valves

A rather interesting point arises when valves are mixed in a receiver. This is particularly the case where low-frequency amplifiers are employed.

In the first place, different anode voltages are required for different kinds of valves in many cases, but the greatest trouble likely to be experienced is in connection with the filament battery. In the ordinary way all the filaments are lit by current from a single accumulator, and if we have, say, a valve taking 4 volts and another valve taking only 1 volt (*e.g.*, the 1-volt Ora), the feeding of these valve filaments from the same accumulator will result in varying potential differences across the rheostats used for controlling the filament current. If we use a rheostat, such as the Lissen, Burndept dual or Microstat, we can employ any kind of a valve, but the potential drop across the rheostat will vary with different valves, according to the amount of current the filament takes. If, for example, a 6-volt accumulator is in use and a 4-volt valve is employed, the potential drop across the filament rheostat will be 2 volts, whereas if a 1-volt filament valve is worked off a 6-volt accumulator, the drop of potential across the used portion of the rheostat will be 5 volts. It is customary to include the rheostat in the negative lead to the filament, and this means that the negative terminal of the filament accumulator will be negative with respect to the negative side of the filament in each case.

Grid Voltage

In the case of a low-frequency amplifier, the secondary windings are connected to the negative terminal of a filament accumulator, so that the grid is always at a negative voltage with respect to the negative side of the filament, in the case of each valve. This, of course, is desirable because it eliminates, or lessens, grid currents which would introduce damping into the grid circuit and so lessen the built-up potential on the grid, thereby decreasing amplification.

A Practical Example

Fig. 1 illustrates a three-valve receiver in which a detector valve is followed by two note magnifiers. It will be seen that the valves V2 and V3 are of different types, the second valve, for example, being an Ediswan A.R. valve and the third a 1-volt Ora. Both these valves have their filaments heated by current from the accumulator B1, which gives 6 volts. In the case of the valve V2, the rheostat R2 is adjusted so that the voltage across the filament F2 is 4 volts and the drop in potential across the used portion of R2 is therefore 2 volts. The potential of the grid with respect to the point W will therefore be −2 volts, which is quite suitable for ordinary purposes with a valve of this kind used as a low-frequency amplifier. In the case of the valve V3, however, the resistance R3 has to be much greater, and the potential drop across the used portion of R3 becomes 5 volts. This means that the grid of the valve V3 is at −5 volts potential with respect to the point Y.

The Second L.F. Valve

In the case of this third valve, the operating point on its characteristic curve may be entirely unsuitable. Fig. 2 shows a typical characteristic curve, and it will be seen that when −5 volts is applied to the grid we are working near the bottom bend, an entirely unsuitable point for operating the valve as an amplifier. A much more suitable potential would be about −2 volts.

We could, however, still keep the grid of the third valve at −5 volts, and move the characteristic curve over to the left by increasing the anode voltage of the third valve.

If, therefore, we mix valves in our receiver it is desirable to be

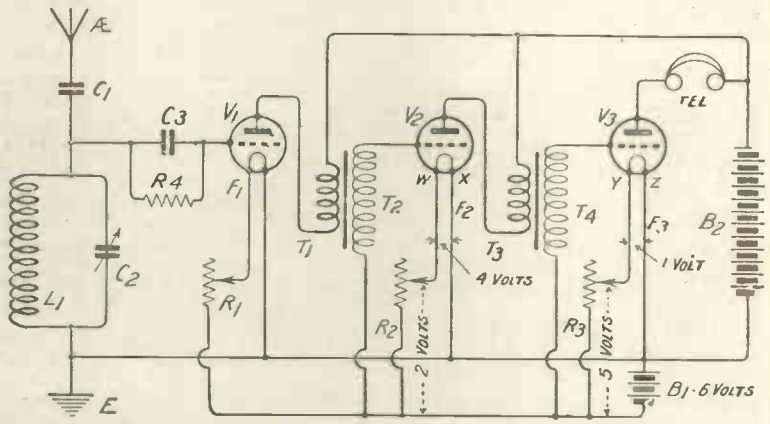


Fig. 1.—Illustrating the varying potentials across the filament resistances, resulting from mixing valves, with a common L.T. supply.

able to vary the anode voltage of each valve.

If it is desired to use a common high-tension battery, we can use the arrangement of Fig. 1, but connect the secondary T4 of the last intervalve transformer, not to the negative terminal of the accumulator B1 as shown, but to the point Y, *i.e.*, the point on the side of the filament rheostat nearest the filament. This, however, will not result in any negative potential on the grid, and, in the case of fairly strong signals, some loss in signal strength will be sustained, and a certain amount of distortion will also probably result.

An Alternative Method

An alternative scheme, of course, in the case of the last valve, would be to connect the rheostat, not in the negative lead to the filament, but to the positive lead, still connecting the bottom of T4 to the negative terminal of B1. Still another solution, which is probably the best of all, only the most expensive, is to connect a rheostat both in the negative and in the positive leads. In this case, the 5 volts, which has to be distributed over a filament resistance or resistances, may be distributed in any suitable manner between the two rheostats. For example, we might have a 1-volt drop across the negative lead rheostat and 4 volts across the positive lead rheostat; or we might have 2 volts in the negative lead rheostat and 3 volts in the positive, or 3 volts in the negative lead rheostat and 2 volts on the positive lead rheostat. The rheostat in the positive lead, of course, does not affect the grid potential of the valve.

Microphonic Reaction

Some little time ago I explained a rather peculiar buzzing effect obtained in the case of a low-frequency amplifier, due to a negative resistance effect in the grid circuit of the valve. This trouble, it was explained, could be remedied by changing the valve or by increasing the negative potential on the grid.

Another buzzing cause which, although probably well known, never seems to have been commented upon, is microphonic reaction, which is particularly prevalent in the case of valves having very fine filaments, such as the 0.06 amp. dull-emitter valves. These valves are certainly microphonic, and the buzzing, or rather booming, noise which is sometimes heard in receivers is due to the sound-waves coming from a loud-speaker striking the valves and setting up a vibration which causes a variation of anode current through the valve, which is amplified by the next valve, and ultimately produces the sound-waves which repeat the whole process. There is therefore a chain of reaction in which part of the coupling is effected by sound-waves. The effect is certainly very peculiar and interesting, and it may be exaggerated, very often, by turning the loud-speaker so as to face the valves in the amplifier. If the loud-speaker is turned away from the

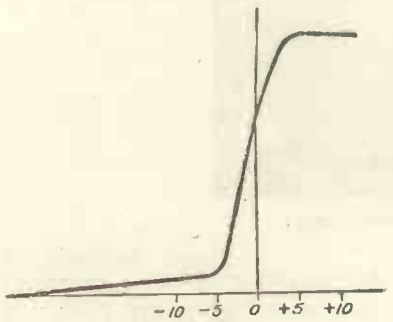


Fig. 2.—A characteristic curve showing how a negative potential of five volts brings the operating point near the lower bend of the curve.

valves the booming will frequently stop. It will be found that this kind of oscillation is not set up suddenly, like ordinary low-frequency reaction; it starts feebly and swells out until a loud, booming roar is produced. If this booming is stopped by switching off the set, it will start up slowly again on switching on the receiver once more. The booming may be stopped by holding the valves tightly in the hand, and this indicates clearly that the effect is a form of mechanical reaction, and explains why it takes some time for the peculiar reaction effect to build up, since it takes some seconds for the valve to vibrate fully.

A Remedy

The effect is specially noticeable in sets where the loud-speaker is built into the main apparatus, because the vibration of the loud-speaker is communicated to the valves.

Apparently the only remedy is to lessen the filament current through the valves. Altering reaction does not make any difference, as the effect is confined to the low-frequency side of the set. The effect is specially noticeable when two or more low-frequency amplifiers are employed, as would be expected. The enclosure of the valves would, of course, help considerably, and the separation of the loud-speaker from the set would also help matters. The loud-speaker should also be pointed away from the valves. The trouble is not a serious one, and the dulling of the filaments usually stops the booming, but many experimenters, when they first experience the phenomenon, may attribute the effect to something more harmful.

□ □ □

Burndept of Australasia

OUR large number of Australian readers will be interested to hear that Messrs. Burndept, Ltd., realising the possibilities of a great future in the wireless industry in Australasia, have established a branch, to be known as Burndept of Australasia, with their head office at 219, Elizabeth Street, Sydney, New South Wales. (Manager, Mr. A. W. Dye.)

The Radio Society of Great Britain

The Society is in touch with the Postmaster General regarding the restrictions concerning transmissions to the Dominions and Foreign Countries recently introduced into the Experimental Transmitting Licences now being issued. It is hoped that an official announcement may be made at an early date.

What the 1,600 Metres Station Means to You

SPECIAL "WIRELESS WEEKLY" INTERVIEW WITH CAPTAIN ECKERSLEY

A recent portrait of Captain Eckersley.

MANY readers will be wondering exactly what the 1,600-metres wavelength will mean to them in regard to their reception of broadcasting and in the handling of apparatus. They will also, perhaps, be wondering whether the new wavelength will be retained or whether some other wavelength may be chosen at a later date. With a view to elucidating this and many other points of like nature I sought out Captain Eckersley, the famous Chief Engineer of the British Broadcasting Company, in his sanctum at 2, Savoy Hill.

In the Sanctum

Now, Captain Eckersley, quite naturally, is a very busy man, and I was lucky to be able to obtain even a few minutes of his time. On being ushered into his private office I found the genial Captain feverishly wrestling with an automatic telephone, which seems slightly less automatic than it was designed to be. With this mastered, and a few more letters signed, he leant back to answer a few of my questions.

"Yes," he said, in reply to the first and obvious question, "the new high-power station is coming right up to expectations. We planned, as you know, to give listeners good signals in crystal receivers up to a distance of a hundred miles, and we have had numerous reports from much greater distances in every direction. I, personally, went out yesterday to a spot a hundred miles away and was astounded at the strength and freedom from interference.

A Mistaken Idea

"Some newspapers," continued the chief engineer, "have made out that the results are disappointing. So far as we are concerned, they are emphatically not so. Most of the comments of this nature appear to have been derived from the experiences of listeners in London, who found that Chelmsford was but slightly, if any, stronger than their local station two or three miles off. Their disappointment can only be due to a total misunderstanding of the position. We will assume, for example, that a man is situated three miles to the west, or south-west, of 2LO. To him Chelmsford will be some thirty miles away or ten times the distance of London. Now for Chelmsford to be as loud as London at ten times the distance would require, not ten times the power, but something nearer one hundred times, and, of course, Chelmsford is by no means so powerful as that. You can take it from me that if in such circumstances Chelmsford is as strong as London, it is doing pretty well!"

Many Reports

"Have you many reports yet?" I asked.

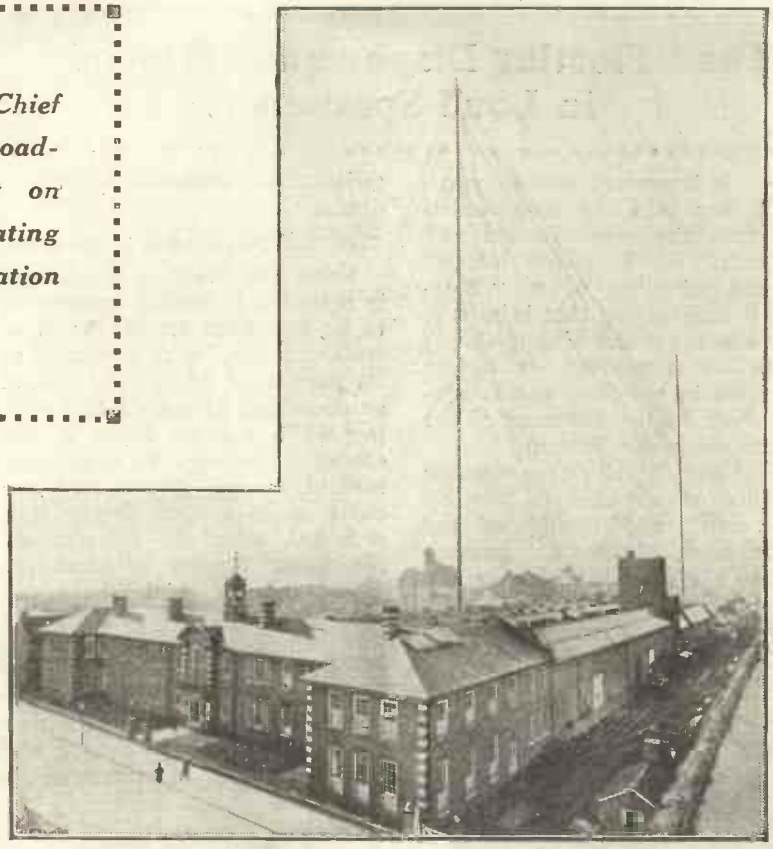
"Yes, very large numbers," replied Captain Eckersley. "Within the first couple of days we had over two thousand, and they are still pouring in." Here he rang for an assistant, and asked him a few questions, so that I might be right up to date with my information. From these questions it transpired that in the thousands of letters received there had been scarcely a single complaint, the vast majority of correspondents expressing complete satisfaction with the results obtained.

Few Bad Spots

"What about bad spots?" I next asked. "Are there many?"

"No. It is one of the characteristics of the longer wavelength that it is far less susceptible to shielding, and many spots which seemed to be shielded from 2LO are quite good for the reception of the longer wavelength. You may say quite definitely that there will be practically no blind spots for the longer wave, although in other direc-

In this interview the Chief Engineer of the British Broadcasting Co. throws light on many interesting points relating to the new high-power station 5XX at Chelmsford.



The Marconi Works at Chelmsford, where the 1,600 metres transmissions originate.

tions, such as in dielectric losses in walls and so forth, there may be some loss of efficiency with indoor aerials."

I next asked Captain Eckersley why Chelmsford had been chosen as the site of the high-power experiments, and whether it was likely to remain the transmitting centre. It appeared to me that it was one of the least suitable from many points of view, seeing that it was desired to supply the needs of a very large number of people with crystal receivers. A circle of 100 miles' radius described around Chelmsford passes over a considerable area of the North Sea, so that a large portion of the area covered is wasted. A spot in the Midlands would have appeared much more preferable.

Why Chelmsford was Chosen

"It is quite true," said Captain Eckersley, "that we lose a good deal in that way, but there are a number of most important considerations which have led to the selection of Chelmsford, and which will probably make it necessary to retain the position. We must, for example, have distortionless communication between the broadcasting centre chosen and the high-power station itself. London has been chosen as the centre for the obvious reason that it is bound in the nature of things to have the best programme. This is not any reflection upon the Provincial centres, but naturally the capital of the Empire is the best possible situation for a broadcasting studio. Now, we must communicate the programmes from the studio to the high-power station. How can this be done? Only by wire or wireless. Although we have done some very interesting experiments in the wireless relaying of programmes, the method is still in the experimental stage and cannot be relied upon. Ordinary land lines are far too unreliable. They give rise to distortion, and in addition we cannot allow, possibly, a tree falling across an overhead wire to suspend our operation for many hours. We must therefore have an underground cable. The only practicable means of avoiding distortion in an underground cable is by means of loading coils, and the only short distance cable containing loading coils that is available is that which runs through Chelmsford. Chelmsford was therefore chosen as it is far enough away from 2LO to be free from serious interference, and is near enough to give, on a loaded cable, the requisite purity of reproduction."

Jamming Problems

Captain Eckersley and I discussed the jamming problems for a few minutes. "Listeners within reasonable crystal range of London will, of course, not be interfered with by Chelmsford, and we think the difference of wavelength is sufficient to prevent any real trouble in this regard. Of course, when a listener is right up against 2LO he will not be able to receive Chelmsford without interference unless he makes his receiver really selective. But then, of course, the high-power station is not designed for him. He is already getting what he needs from the London station."

Readers of *Wireless Weekly* will thus see that a hundred-mile crystal range is already assured.

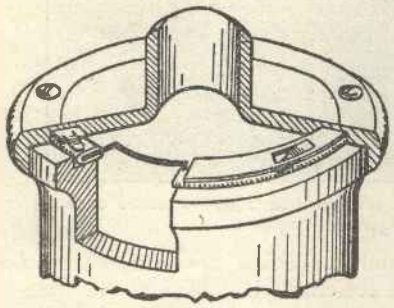
Still Experimental

"Let me impress upon you," said Captain Eckersley, as we parted, "that the work on the high-power station is still in an experimental state. We do not intend to form an opinion on the matter until a week or two has passed. The wavelength, you may take it, will not be changed, as it has been carefully chosen in consultation with the Services so as to cause as little interference as possible, and my own tests have shown that this particular wavelength is quite reasonably free from interference."

The "Floating Diaphragm" Principle in Loud Speakers

AN important feature entering into the construction of the new Amplion and a detail of technical interest is the adoption of a "floating" diaphragm, that is to say, the vibratory diaphragm simply rests on a seating, is lightly retained in position, and is subject only to the influence of the electro-magnetic system.

Hitherto the vibrating member has been rigidly clamped between the cover and casing of the instrument, screws passing through clearance holes in the diaphragm to ensure such rigidity, and it will readily be



The Clamping Ring in position.

understood that by this means of clamping, periodicity is imposed which involves the unpleasant diaphragmic resonance so noticeable in the majority of loud-speakers, particularly when a power amplifier is associated with the receiving set. This defect, as indeed it is, has undoubtedly prejudiced loud-speakers in the eyes, or rather the ears, of many "listeners-in."

Clamped Diaphragm May Cause Distortion

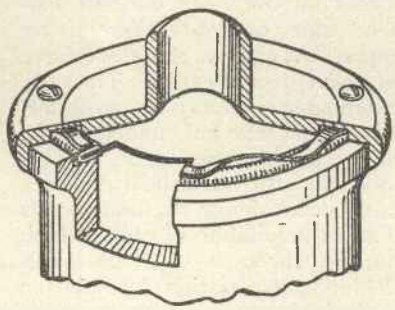
Although every material of a character suitable for application as a telephonic diaphragm possesses a fundamental note, the natural frequency of vibration of a diaphragm in the free or unclamped condition is or may be so low in the musical scale as to be, to all intents and purposes, aperiodic, but as soon as in a state of tension by reason of firm or substantially rigid clamping, and subject to the strains and stresses thereupon, the diaphragm becomes decidedly periodic, and distortional characteristics are immediately in evidence.

How the Diaphragm is Mounted

Now, the Amplion diaphragm is mounted in such a manner as to be free from strain, stress or undue tension, being embraced at its peripheral edge by a gasket or sheathing of rubber and resting on a narrow ledge in the casing. Between the uppermost surface of the gasket and the cover piece a light spring ring provided with six downwardly projecting fingers is arranged. These fingers reach the upper side of the gasket and exercise just sufficient pressure to retain the diaphragm on its seating and prevent "chatter" when the loud-speaker is associated with a set affording large output and the amplitude of vibration is increased.

The Spring Ring

The spring ring referred to is embodied in the latest Junior and Standard models, but in other types of Amplion units under manufacture an alternative style of spring washer is employed. This latter washer is of undulatory conformation and has six points of contact with both the inner side of the cover and the



An alternative ring of undulatory form.

gasket surrounding the diaphragm. The accompanying figures illustrate the two types of retaining rings described.

Advantages of the Floating Diaphragm

It will be appreciated that the "floating" diaphragm vibrates in correspondence with variations of the current flowing in the operative windings of the electro-magnetic system, so that faithful reproduction, throughout the entire musical range, is obtained.

Two Aerial Hints

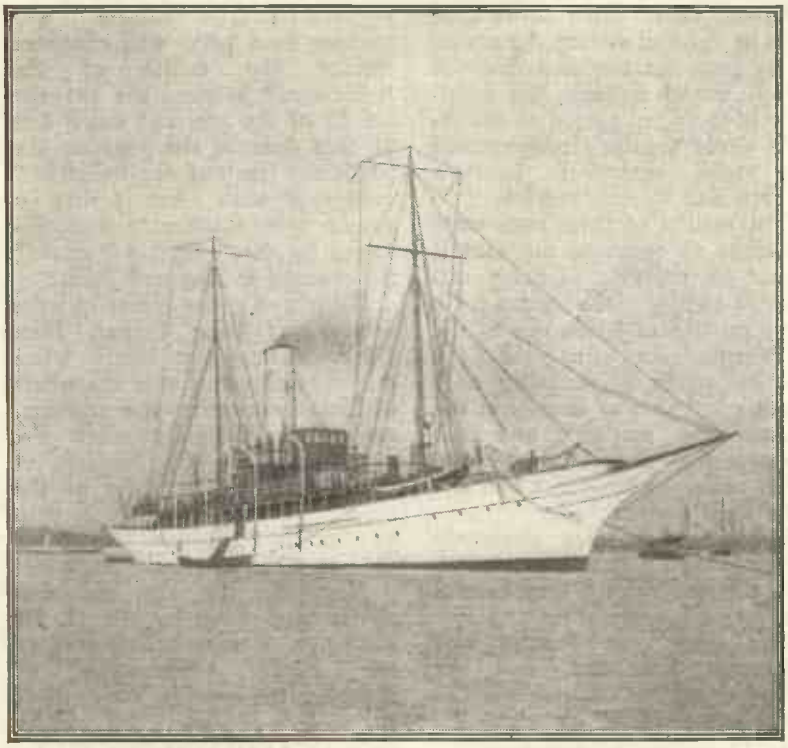
Most of us have had trouble at one time or another with the pulley fixed to the top of the aerial mast. Sometimes it happens, particularly when wire is used, that the halliards become jammed between the pulley wheel and the sides of the block; or, again, the wheel may stick through lack of lubrication, and unless the mast can be lowered, or one is something of an acrobat, oiling it is out of the question. The best tip I know for avoiding pulley troubles is not to use a pulley at all.

An excellent substitute is an ordinary shell insulator. This is fixed to the mast by a very short length of cord passing through one of its holes whilst the halliards simply run free through the other. There is very little friction against the polished surface of the insulator, and the halliards simply cannot jam, no matter what happens. When using a shell insulator in this way one must, of course, be careful in lowering the aerial at any time. If it is let down with a run the insulator will probably strike the mast violently and be broken, but if reasonable care is taken no trouble of any kind will be experienced. Not the least of the advantages of using this substitute for the pulley is that it provides an extra insulator at the free end of the aerial wire, which is the point at which it is most needed.

One of the great disadvantages about using rope for aerial halliards is that it is very much affected by the state of the weather.

Good rope can be rendered weatherproof by the very simple process of immersing it before use in a pan of melted tallow, and allowing it to soak up as much as it will take. This not only eliminates the tendency to stretch, but also preserves the rope from rotting. It is well worth while to undertake the task which renders the aerial much more satisfactory.

R. W. H.



The S.Y. "Elettra" upon which many of these experiments were conducted.

Beam Wireless*

By SENATORE GUGLIELMO MARCONI, G.C.V.O., LL.D., D. Sc.

Continued from page 341. Vol 4, No. II.

A first series of tests was carried out without the transmitting reflector.

After rounding Cape Finisterre it was anticipated that the intervening land would have cut off signals during daytime and also would have considerably weakened them during the night.

These expectations were not verified.

Signals during the day weakened according to the distance and altitude of the sun, but were received right up to Seville (780 miles from Poldhu) although practically the whole of Spain, consisting of over 300 miles of high and mountainous land, intervened between the sending and receiving stations.

Night Signals

The night signals were always so strong as to appear almost as powerful as those received when the yacht was at her anchorage in Falmouth Harbour at only 12 miles from Poldhu.

It should be stated that the yacht, when at Seville, was moored in the Guadalquivir River, in a situation particularly unfavourable for the reception of signals, as the adjacent banks of the river were high and surrounded by trees and buildings.

At Gibraltar (820 miles), notwithstanding the greater distance, a better strength of signals was noticed during the hours of daylight, probably in consequence of the fact that the yacht was anchored in a more open space, and therefore in a more favourable position.

Similar results were also obtained at Tangiers (840 miles) and at Casablanca (970 miles).

I find it almost unnecessary to refer to the night signals, as these were always and in all places throughout the whole of the cruise extraordinarily strong and capable of being received at all times without using an amplifier, and with the aerial out of tune, or disconnected.

At Casablanca

At Casablanca I telegraphed instructions to hoist the reflector aerials at Poldhu.

The " Elettra " then proceeded to Madeira, but at Funchal was obliged to anchor in a very unfavourable position for the reception of wireless signals from England, being at the far end of the island and immediately under the mountains of Madeira, some of which rise to heights of over 6,000 feet.

On May 17 tests were recommenced between Poldhu and the " Elettra," but although the night signals were, as always, extremely strong, I considered it desirable to carry out daylight tests in positions not so completely screened by the immediate vicinity of mountains.

Thus it was ascertained that signals could be received from Poldhu by day up to 1,250 nautical miles when that station was using 12 kw. of energy.

On May 21 we sailed for St. Vincent, Cape Verde Islands, and although at St. Vincent our anchorage was at a position partly screened by mountains, day-light reception was still possible for a few hours after sunrise and for some time before sunset.

Cape Verde Islands

The night signals continued to arrive from Poldhu at all times with apparently unabated strength, notwithstanding that our distance had increased to about double what it was at Madeira, that is, to 2,230 nautical miles.

At St. Vincent, as at Madeira, the Poldhu signals could always be received with the receiving aerial disconnected, or with the heterodyne or L.F. amplifier switched off.

Mr. Mathieu estimated the strength of the night signals at St. Vincent from 400 to 500 microvolts per metre in the aerial, and with such a strength on the wavelength we were using no trouble was ever experienced in consequence of atmospherics or x's. In fact, for greater convenience, all messages from Poldhu were read with the aerial

* A paper read before the Royal Society of Arts, July 2nd, 1924.

out of tune or disconnected from the receiver.

At St. Vincent the signals received from the Post Office station at Leafield were weak and often unreadable, I therefore gave instructions that all wireless messages addressed to me should be transmitted by our short wave station at Poldhu. No difficulty was ever experienced in the accurate reception of these messages.

As, in consequence of my having to return to England, it was decided not to carry on these tests to still greater distances, I instructed Poldhu to gradually reduce the transmitting power from 12 kw. down to 1 kw., but even with this small amount of energy the signals received at St. Vincent were still stronger than would have been necessary for the carrying out of commercial work over that distance.

Low Power

Mr. Mathieu calculated that the signals would still have been readable at St. Vincent even should the power at Poldhu have been reduced to 1-10th of a kilowatt.

I might add that the night signals received at St. Vincent, even when Poldhu was using only 1 kilowatt, were stronger than those received from Carnarvon, or than those which could be received at either St. Vincent or Madeira from any of the other European or American high-power stations.

The signals by night or by day did not appear to be subjected to lengthy fluctuations in strength, nor inclined to give what have been termed freak results. The results obtained could always be repeated over the same distances under similar conditions in respect to the sun's altitude.

Periodical Fluctuations

Short periodical fluctuations of strength, lasting less than a minute, were constantly observed, but I believe that these variations were mainly caused by slight changes of the wavelength determined by imperfections of the arrangements in use at Poldhu, and also by the movements and rolling of the ship at the receiving end.

Although sunrise at St. Vincent occurred about three hours later than at Poldhu, during the period of the tests nothing was observed which would indicate the existence of the weak period so noticeable under similar circumstances in radio reception between Europe and North America.

The results of these tests were sufficient to convince me that it would be possible to carry out reliable commercial services for a large portion of hours out of the 24 over distances of at least 2,300 nautical miles by utilising only about 1 kilowatt of energy at the transmitting stations, and that the practical range of the system when using 12 kilowatts had not even been approached.

These results were obviously so encouraging that I decided to give the new system very careful study and consideration.

The station at Poldhu was somewhat improved, and the energy employed was increased to about 20 kilowatts.

Since February of this year a further series of tests have been carried out over ranges which included the greatest possible distances separating any two places on earth.

A Special Short Wave Receiver

A special short wave receiver was installed on the S.S. "Cedric," and reception tests were carried out with Poldhu by Mr. Mathieu during a journey of this vessel to New York and back. No reflectors of any kind were employed at either end.

For the tests to the "Cedric" the wavelength was 92 metres and the transmitter comprised two oil-cooled valves of special design controlled by an independent drive circuit to ensure steadiness of wavelength. The power supplied to the main valves was 21 kw., giving a radiation of approximately 17 kw.

These experiments were conducted with the object of supplementing our information on the general behaviour of short waves over long distances.

The results showed that on the "Cedric" signals could be received during daytime up to a distance of 1,400 nautical miles, and it was confirmed that the signals' intensity is symmetrical to the mean altitude of the sun at all times. As a consequence of this, the day limit of the signals on the "Cedric" was greater than what was observed during the cruise of the "Elettra," because the average height of the sun was much less at that time of the year on the particular track of the "Cedric" compared with what it was on the far more southernly track followed by the "Elettra" during the months of May and June.

Signals of great intensity were received at Long Island, New York, during the hours when darkness extended over the whole distance separating the stations, and of less intensity when the sun was above the horizon at either end, the intensity of the signals varying inversely in proportion to the mean altitude of the sun when above the horizon.

According to the measurements carried out by Mr. H. H. Beverage, Research Engineer of the Radio Corporation of America, the average strength of the signals at New York was 90 microvolts per metre.

Received in Australia

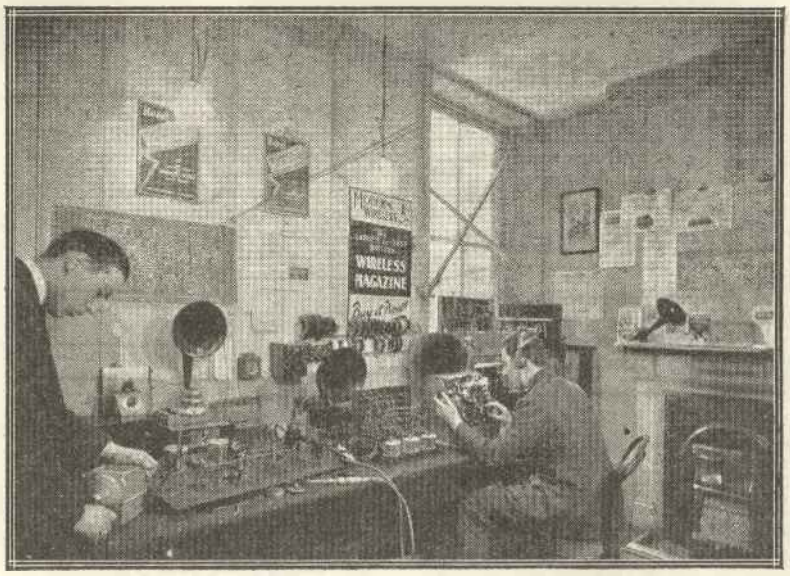
I might mention that a few days prior to the commencement of these tests between Poldhu and the "Cedric," the Chief Engineers of the Amalgamated Wireless (Australasia), Ltd., of the Marconi Wireless Telegraph Co. of Canada, Limited, and of the Radio Corporation of America had been requested by telegraph to attempt to receive the transmissions radiated from Poldhu in their respective countries.

Rather to my surprise, I must admit, Mr. Ernest T. Fisk, the Managing Director of the Amalgamated Wireless (Australasia), Ltd. reported to me by cable that he could receive the Poldhu transmissions at his house in Sydney every day perfectly well from 5 to 9 p.m. (Greenwich), and also that he had received them between 6.30 and 8.30 a.m., informing me also that for most of the time the signals were clear, steady and strong on an improvised receiver consisting of a 2-stage high frequency tuned plate and grid with one rectification. He also added that he had read every word that was sent and that the signals were better than those he had yet received from the high power station at Carnarvon.

(To be continued)

. . The . . Radio Press . Service . Dept., Ltd.

Some Further Notes upon the New Organisation.



Part of the test room.

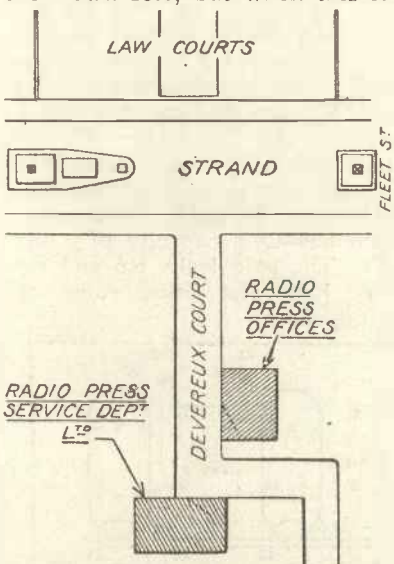
THE work of the new organisation is steadily increasing, and it seems that readers of *Wireless Weekly* have been quick to realise that it provides the one remaining link in the chain of Radio Press reliability. With the co-operation of the new department, our service of the set-builder becomes complete, in that in the first place he is given articles and diagrams of the greatest possible accuracy and clearness; next, that for a period of three weeks after the date of publication he can come to the offices of the Service Dept. and inspect the original set for himself; and, finally, if he will follow out the design faithfully we can positively guarantee that his results will be equal to those of the original, and that if he has any trouble in getting the set to work properly as a result of the presence of a faulty component, a trifling error in wiring, or some other cause, all that he has to do is to take the set to the Service Dept. and they will see to the rest. Thus at one stroke is abolished for all readers of Radio Press publications that feeling of uncertainty which has been the bugbear of the amateur constructor since the earliest days of the movement—the fear that at the end of all his expenditure of time, trouble and cash the set may not work properly.

A few further practical notes based upon the first few weeks of work should be given for the benefit of those who find themselves desirous of taking advantage of the services of the new department. The approach to the new offices from the Strand is given upon the accompanying plan, and it should be added that the nearest tube stations are the following:—

Temple (District Railway).
Holborn (Piccadilly Railway).
British Museum (Central London Railway).

The 'buses passing Devereux Court are Services No. 6, 9, 11, 13, 15, 96, 60, 67, 48 and 94.

It is best for readers to bring their own sets, but when this is impossible they can be sent by post or rail. They should always be most securely packed in a stout wooden crate, cardboard boxes having proved to be quite useless, and the set should always be either insured or registered. A similar precaution is taken by the Service Dept. in returning them. The set is, of course, at the owner's risk during the whole period that it is out of his hands, but every possible care is taken by the Test Dept.



The approach to the new offices.

The scale of charges for the ordinary set testing work has been provisionally fixed at 2s. 6d. per valve in multi-valve sets, dual valves being counted as two. This was announced last week, but it is necessary to remind readers that in view of the great amount of trouble which is given to the test staff by sets which have been made up with heavy alterations from the original design, an additional charge of 25 per cent. is made where any serious modification has been made. In these cases also it is not possible to guarantee that results fully equal to the original set will be obtained, since, of course, the placing of parts in a set is often very crucial to its proper performance. (This rule is only enforced in cases of real necessity.)

The Service Dept. can undertake a great variety of other services besides the mere testing of defective receivers, dealing with all sorts of components, visiting localities to investigate cases of special difficulty, giving advice by post, and so on. Visitors are asked to remember, however, that the testing staff are not authorised to give advice or answer readers' queries themselves, and these matters must either be submitted by post in the ordinary way as postal queries, or an appointment for a consultation must be made for which a fee of 2s. 6d. for a ten minutes' interview has been fixed.

A Modified "Puriflex" on the Omni Receiver

A further interesting circuit which may be experimented with upon this famous receiver.

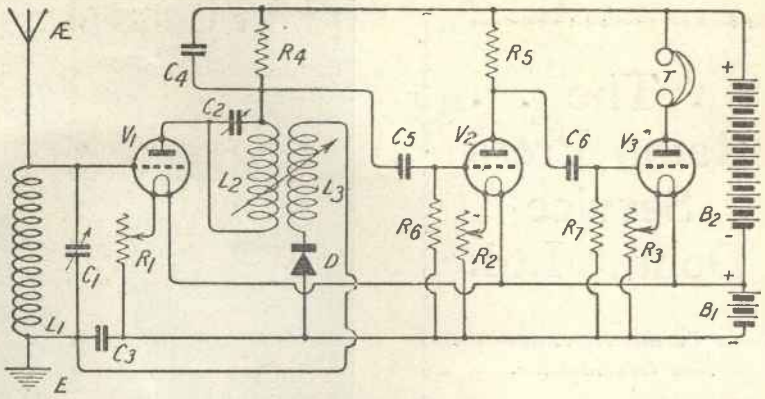


Fig. 1.—A modified "Puriflex" circuit as used on the Omni Receiver.

THE "Puriflex" receiver designed by Mr. Percy W. Harris, and described by him in the July number of *Modern Wireless*, has created great interest, and those readers who possess Omni receivers will be pleased to find that the "Puriflex" circuit in a somewhat modified form may be easily wired up on their sets.

The Circuit

The circuit to be used is that shown in Fig. 1, in which the reaction coil is not included, as the three-coil holder is to be utilised for the transformer coupling. To suit the Omni receiver the values of the original 0.25 μF condensers have been reduced to 0.002 μF. The only modification necessary to the Omni receiver is the temporary external addition of a fixed 80,000 ohm resistance, or alternatively a variable anode resistance may be used. To commence with, a common voltage will be applied to the anodes of the three valves, and the grid-biasing battery will not be included.

Since constant aerial tuning is not employed, the value of the aerial tuning coil L1 for any given wavelength cannot be definitely given, and the usual sizes of coils should be tried. C1 is a variable condenser of .0005 μF capacity, and may be placed either in series or parallel with L1. The inductance L2, tuned by the condenser C2 of 0.0005 μF, may be a No. 50 coil, and L3, across which are the detector D and condenser C3, should be a No. 75 coil. L2 and L3 are generally closely coupled, so that the condenser C2 suffices to tune both coils simultaneously. R4 and R5 are 80,000 ohm resistances, the condenser C4 of .0001 μF being placed across the former. C5 and C6 are the low-frequency by-pass condensers, each having a capacity of 0.002 μF. The grid leaks R6 and R7 may have the usual value of 2 megohms.

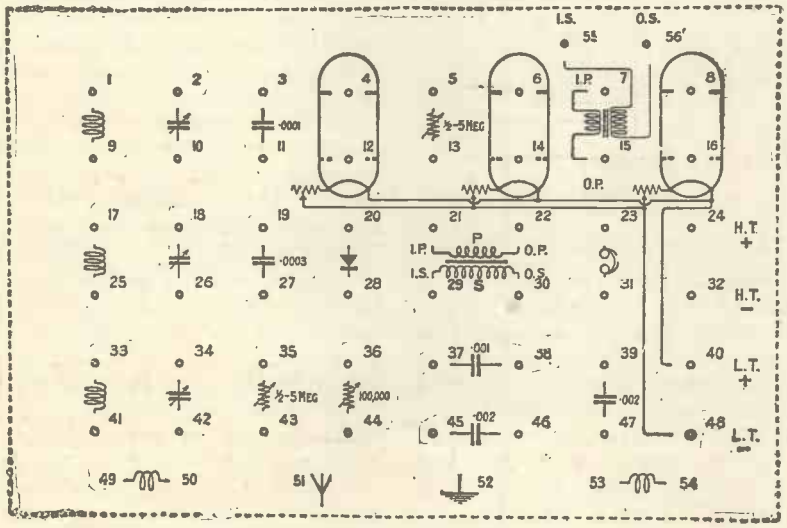


Fig. 2.—The terminal board.

Probably the most interesting point about the circuit is the total absence of low-frequency iron-core transformers, despite the fact that three stages of low-frequency amplification are used, and the natural result is great purity in reproduction, the usual loss in resistance-coupled amplifiers being counter-balanced by the reflex action of the first valve.

Wiring Connections

The circuit is easily adapted to the Omni receiver by making the following connections on the terminal board :—

51—49	47—14
49—34	14— 5
34—12	13—48
42—50	6—45
50—52	46—16
27—42	46—43
4— 1	35—48
26— 9	8—23
18— 1	31—24
9—44	17—20
36—24	28—35
3—36	35—19
11—44	25—27
44—39	32—40

Two more leads will be necessary for the extra resistance mentioned, these being taken from terminals 45 and 24, and the resistance connected across them. Into the centre socket of the three-coil holder a No. 75 coil should be plugged, and a No. 50 coil placed in the rear socket. The fixed socket on the left of the panel is that of the aerial coil, for which a No. 35 or No. 50 will probably prove suitable. The circuit is now complete, and the batteries, etc., may be connected to their respective terminals.

Operating the Set

The two coils which comprise the high-frequency transformer should be brought close together and tuning carried out by adjustment of the aerial and anode-tuning condensers, the former being that on the right of the panel, and the latter that in the centre. The adjustment of the cat-whisker on the crystal is not at all critical, and having obtained a point which gives results, it is best left thus until the other variable components have been adjusted. These include the two variable grid leaks, the resistances of which are not critical in this circuit, and the two anode-resistances (if the one added externally is variable). These, again, do not need special care in adjustment. An anode voltage of not less than 80 volts should be used.

With the particular size of coil used for aerial tuning, it may be found that best results are obtained with the aerial tuning condenser at its maximum or minimum value, in which case a size smaller or larger coil should be placed in the aerial socket. If signals are loudest with the condenser at its maximum value, a larger coil is obviously required, and *vice versa*.

Experiments to Try with the Circuit

Series aerial tuning may be used instead of parallel tuning by making the following alterations on the terminal board:—Disconnect 42—50, 27—42 and 51—49, and join 51—42 and 27—50. A size larger coil will probably be necessary.

It will be found that the 0.0005 μF anode-tuning condenser gives rather sharp tuning, and its capacity may be reduced by connecting in series with it a fixed condenser of 0.001 μF. Disconnect 4—18 and 18—1; join 4—1, 18—37, and 38—4. The maximum capacity of the variable condenser is now roughly 0.0003 μF, and finer tuning will result.

The anode of the first valve may be given a separate potential to that of the last two by disconnecting 36—24 and connecting a lead terminated at one end by a wander-plug to terminal 36. By connecting the wander-plug to different tappings on the high-tension battery the voltage on the anode of the first valve is varied independently.

If the quality of reproduction is not absolutely perfect, a few volts negative grid-bias should be applied to the last two valves. This is effected by disconnecting 35—48, 28—35, 35—19, and 13—48, and joining 19—48, 28—48, 13—35, 13 or 35 to negative terminal of grid battery and 48 to positive of grid battery. A flashlamp battery will be quite suitable for this purpose.

The results obtained with this circuit are naturally inferior to those obtained with the original "Puriflex" circuit, owing to the modifications necessary for its adaption to the Omni receiver, the greatest drawback being, probably, the exclusion of the reaction coil. The purity and volume obtained, however, will at least show the possibilities of this excellent circuit.

□

Some Neat Flush Fittings

I HAVE just obtained from one of *Wireless Weekly* advertisers two very neat little fittings which will make a strong appeal to the man who likes to have his wireless set just so. The first of these is a set of flush-fitting valve sockets of the kind in Fig. 1. These are only half an inch in length and furnished with a very small nut for fixing. For these one requires to make holes in the panel with a No. 4 twist drill. If they are fitted in the way which has already been described for the prevention of capacity—by drilling a central hole and making cuts from it between the valve legs—these little fittings make particularly neat and efficient holders. Personally I prefer to screw them into the ebonite and to dispense with the retaining nut, for I believe that everything which reduces capacity is a very marked gain, especially upon the high-frequency side of the set. These sockets have many other uses besides forming parts of valve holders. They can be used to replace terminals for making quick connections anywhere, and they make it possible to construct basket coil and other mountings on the plug and socket system, using these small legs and ordinary valve pins. They will be found very handy for low-tension and high-tension battery plugs.

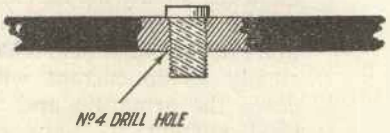


Fig. 1.—The flush fitting valve socket shown mounted.

The second gadget is a pair of flush-fitting plugs and sockets.

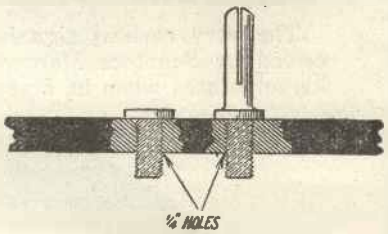


Fig. 2.—The coil socket and plug shown fitted.

These require ¼-inch holes in the panel, and though there is not much harm in fixing them with nuts they can, of course, be tapped in if desired. The amateur with an inventive turn of mind will find a great number of uses for the flush-fitting plugs and sockets as well as for the valve legs.

R. W. H.

SIMPLE WIRELESS RECORDING

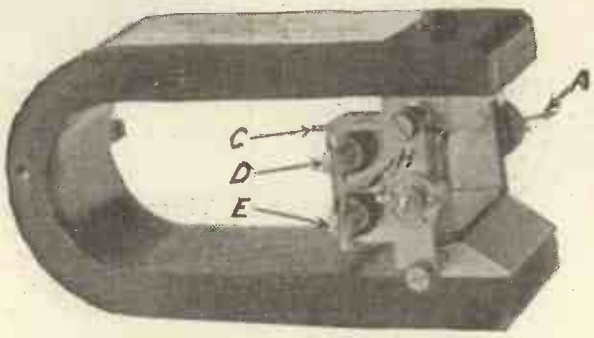
By PERCY W. HARRIS,
Assistant Editor.

The complete ap

THE owner of wireless apparatus who is anxious to try his hand at something other than the simple reception of broadcast signals will find that many a pleasant hour can be spent in experimenting with simple Morse recording. Contrary to the general opinion, elaborate and expensive apparatus is not required, nor is much experience needed. For example, an ordinary and fairly efficient three- or four-valve set containing two stages of note magnification can, with the auxiliary apparatus about to be described, faithfully record a considerable number of those Morse-signalling stations which are to be heard on 600 metres and above.

Principles of Wireless Recording

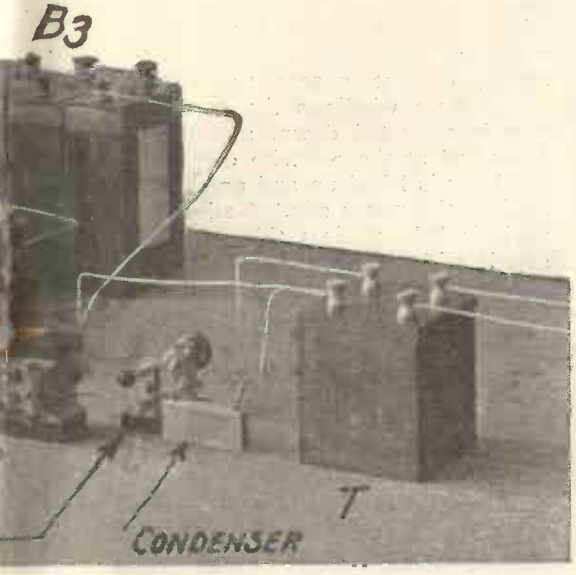
The very earliest signals received by Senatore Marconi on his apparatus when he first came to this country were taken down on a standard Morse inker (a device used in wire telegraphy for making dots and dashes on paper tape). It was the Marconi coherer, a small tube, the resistance of which was suddenly lowered on the arrival of wireless signals, permitting currents to flow through it that allowed the use of the inker; but with the advent of the magnetic detector and, subsequently, the crystal and the valve detectors used with telephone ear-pieces, recording apparatus fell temporarily into disuse. The reason was that loud signals are obtainable in a telephone headpiece with currents far smaller than the minimum necessary to operate the average relay.



D and E are the fixed contacts, H the moving tongue, and C the soldering lug for the tongue.

Difficulties of Using Relays in Wireless

A relay is, of course, a piece of apparatus which, when a feeble current passes through it, will bring into action a much stronger current. Most relays are electro-magnetic devices, the feeble current operating them passing through a fine wire coil with an iron core, this drawing towards it an armature to which a tongue is attached. This tongue vibrates between contacts, permitting a strong current from the local battery to pass through. The trouble about using such a relay in wireless work is that in the plate circuit of a valve we have the steady anode current on which are imposed the fluctuations of the signal current. This steady anode current will draw down the armature and cause a local current to pass continuously, whether signals are arriving or not. If we use a telephone transformer, to eliminate the steady anode current, we get alternating currents which will not operate such a relay properly. In the ordinary way we are driven to use elaborate balancing devices to cancel out the effect of a steady anode current.



pparatus set up.

The experimenter who wishes to try a new line of work will find simple Morse recording a fascinating new field to explore. This article gives full practical details of one successful method

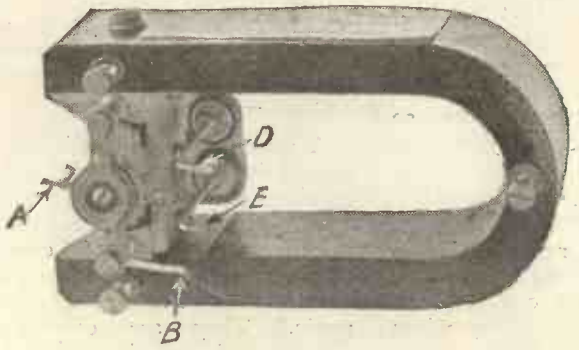
A Simple Method

A very simple and efficient method which is by no means new, and which I find is very little known even among more advanced experimenters, consists in the use of a crystal detector in the circuit of the step-down side of a telephone transformer, rectifying the alternating currents set up in this winding, so as to operate an ordinary electro-magnetic relay. The crystal detector will, of course, rectify low-frequency alternations just as well as those of high frequency, as it pays no regard to the frequencies impressed upon it. Therefore if we use a circuit as shown in Fig. 2 we shall obtain the results we desire. One winding of the telephone transformer indicated in the diagram is connected to the telephone terminals of the receiver, whilst the other winding of this transformer is connected as shown to a crystal detector and a fixed condenser of about .01 μF or larger. The crystal detector and the condenser must be well insulated. Personally I use a Dubilier condenser type 577 of .01 μF value, but a good Mansbridge condenser will do.

Across this condenser are shunted the windings of the relay (to be described later). When signals are impressed upon the telephone transformer they are rectified by the crystal detector, and energy is stored in the condenser. This will discharge through the windings of the relay, thus permitting currents from the battery B_3 to pass through the windings of whatever recording apparatus may be attached.

A Suitable Relay

An excellent and exceedingly sensitive relay with which the experimenter can begin his experiments in recording is the "Weston." Thousands of these devices were used during the war, and are now available through the disposal dealers at prices which are ridiculously low compared with their original cost. The relay which is illustrated in the photographs sells for a price varying from 15s. to £1 (17s. 6d. being quite a usual price). It consists of a large permanent magnet with specially shaped pole pieces, between which moves a coil of wire mounted on a very light former. To this former is attached a tongue which makes contact with one or other of a pair of fixed contacts. The relay is almost incredibly sensitive, but suffers from the defects of being sluggish in action. However, when suitably adjusted, it will suffice for recording speeds up to 18 or 20 words per minute, and thus will enable the experimenter to record time signals and many of



The relay viewed from the other side. A and B are the soldering lugs for the moving coil, and D and E the connections for the fixed contacts.

Morse transmission which can be heard with a good receiver.

Mounting the Relay

The simplest way to mount the relay, which is generally sold without any form of mounting whatever, is to take a piece of wood measuring approximately 7 in. by 4 in., and to stand the relay on one side in the middle of this. A strip of wood about 4 in. long and 1 in. wide should have two holes drilled in it to take large wood screws, the separation between holes being about 3 in. Wood screws can then be passed through these holes, and the relay gripped on to the board as shown in the illustration below.

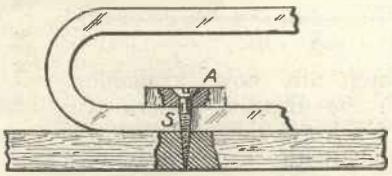


Fig. 1.—Method of mounting relay.

Connections

You will need to make soldered connection to five points on the relay, and these connections should be taken to five terminals suitably disposed on the base board. These terminals should be mounted in ebonite. The points of contact are as follows :—

Two to each end of the moving coil into which the received currents are fed, two to the fixed contacts of the relay, and one to the contact for the tongue. According to the direction of current in the winding, the tongue will move against one or the other of the fixed contacts. Obviously in using this relay for recording Morse, you will use one fixed contact only. It is just as well, however, to connect terminals to both contacts, so that, if necessary, you can change over.

Soldering Points

You will have no difficulty in locating the two soldering points for the two fixed contacts, as these latter have long wires attached to them. On the same side of the relay as the long stiff wires from the fixed contacts, you will find one long soldering lug attached to the bridge piece carrying the moving coil pivot. A shorter arm in the middle of the bridge piece will also be seen. These two arms, the long and the short, make connection with the two ends of the coil. On the other side of the relay you will find a further soldering lug, which is connected through a hairspring to the relay tongue. These contacts are made clear in the illustration.

Adjustment of Relay

On the side of the relay, where the contact for the tongue is situated, you will find a ring held by three screws. The two smaller screws can be slightly loosened, whereupon you will be able to rotate a kind of collar which will vary the pressure of the moving tongue against one or the other of the contacts. As you buy the relay it will probably be arranged to keep the tongue halfway between two contacts. These two fixed contacts should be adjusted to have a very narrow space between them, and the bias should be made so that the tongue rests lightly against one of them. When connected to the correct terminals, the signal current will then cause the tongue to move against the opposite contact, and by careful adjustment you will be able to make the relay work quite rapidly.

carried on the end of a lever, the opposite end of which has attached to it a soft iron armature which is attracted by a pair of magnets. Whenever a fairly strong current passes through the magnet windings the armature is attracted down, and the ink-wheel at the opposite end of the lever is lifted up and presses against the paper slip. So long as it is held against this paper slip it will make a continuous mark, so that, according to the length of time it is held against it, so it will make a dot or a dash. The terminals of the Morse inker are connected as shown in the circuit diagram.

Precautions Necessary

Unless we take special precaution, the apparatus will not work satisfactorily owing to the inductive nature of the magnet-windings, as when current is made and broken between the relay contacts there will be a bright spark which will quite likely weld the contacts together. To avoid this sparking at the contacts, the terminals of the Morse inker should be shunted by a large Mansbridge condenser of a value of one to two microfarads.

Those readers who do not find it convenient to purchase a Morse inker will probably devise their own recording apparatus with the

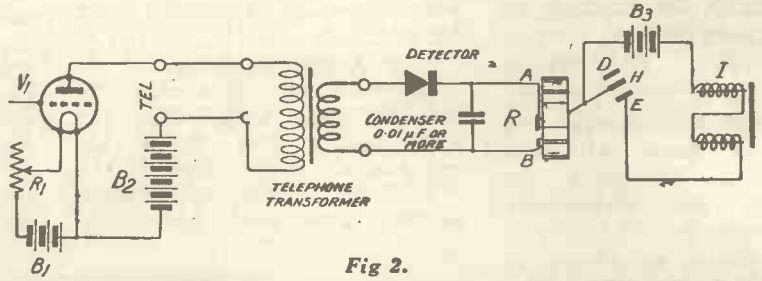


Fig 2.

Circuit for recording with Weston relay. A and B are leads to moving coil of the relay, H is the moving tongue which can be adjusted to make contact with D or E.

The Morse Inker

A really good Morse inker by one of the leading makers can be obtained second-hand from one of the "disposal" dealers at a price from £4 to £6. Of course, they cost a great deal more when new, and are exceedingly well made. They are clock-work driven, and are simply devices which cause a paper tape to move steadily past a small disc, the edge of which is immersed in a special ink-well. This disc is aid of an old post office sounder, the end of the armature of which can be attached to a lever carrying a small wheel rotating in an ink-well. A gramophone motor will suffice for drawing the paper tape over the roller.

Results Obtainable

It will be found that if signals from Morse stations are just a little too strong for comfort in the telephone, they will be strong enough to operate the relay device if the crystal is carefully

set. Using a four-valve set (H.F. detector and two note magnifiers), together with a separate oscillator, I have frequently recorded several of the high-power stations on the east coast of the United States. Very frequently these stations are working at speeds as low as 10 and 12 words a minute, although when conditions are good very much higher speeds are used. However, long-distance recording of this nature requires some skill and experience, very careful adjustment of tuning and a combination of critical tuning and reaction, which will not be found easy by the beginner. Stations such as Eiffel Tower and other European high-power stations using spark transmission will be found quite easy to record, if their speed of working is not too high at the moment. To get satisfactory recording from continuous wave stations, however, is not quite so easy, as the marking wave must be well separated out in strength from the spacing wave. It must be remembered that the difference in note of the marking and spacing wave makes aural reading quite easy, but in the recording device changes of note will not be differentiated.

A Peculiar Effect

One of the most amusing experiments possible with this device is to connect up a recording apparatus in parallel with the loud-speaker, so that the armature of the Morse inker will be drawn down sharply by strongly modulated signals. If the set is connected up when the Savoy Havana Band is playing, the armature of the inker can be made to beat time in the most intelligent way! The amazement of one's friends when observing this experiment is most interesting to behold.

□ □

The Useful Drill Plate

A TOOL which every wireless man who makes up his own apparatus will find one of the greatest aids to the turning out of neat, well-finished work is the drill plate. The most useful kind for his purposes is that giving the Morse twist drill sizes from No. 1 to No. 00. This consists of a steel plate 5½ inches in length by 1½ inches wide, in which are rows of accurately drilled holes, each marked with the number of the corresponding drill and with its diameter as a decimal part of an inch.

Uses for the drill plate will suggest themselves at once. Suppose, for example, that you wish to make clearance holes for a batch of screws. All that has to be done is to find by trial the hole in the plate through which one of them will just pass, and then to use the drill indicated for work upon the panel.

Again, let us suppose that it is desired to make either in the milled nuts of terminals or in a brass rod, holes into which valve pins will fit tightly. Since those sold by shops which specialise in components vary a little in diameter, it is not possible to give a standard drill size which will be suitable for all cases. But the drill plate will tell you in a moment, for it is the easiest matter to discover with its help the diameter of the hole into which the pins available fit comfortably, and the correct drill to use.

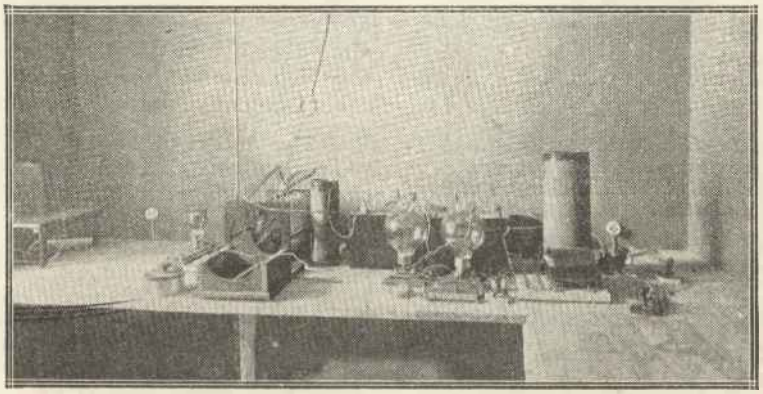
When wires have to be passed through panels one can make a neat job by drilling holes that are only just large enough to pass them—the drill plate will show the right size. With the drill plate, too, you can make your own brass bushes for the spindles of condensers, variometers and other instruments with a rotary movement.

It happens not infrequently that the knob actuating the moving coil of a tuning stand will insist upon coming loose. Condensers and variometers may offend in the same way, but tuning stands seem to be the worst. Sometimes the knob is tight, but the plug-and-socket block carrying the coil works loose. Here is a simple way of setting matters right. Take a stoutish piece of copper wire and pass it through the plate to ascertain what size of drill will make a hole into which it is a very tight fit. Make a hole of this diameter right through both the ebonite and the brass. Now cut off a piece of the wire long enough to protrude ⅛ inch or a little more at each end when inserted into the hole made. Place the wire in a vice and make a head, like that of a nail, at one end by tapping it with a light hammer. Then run the wire through the hole, cut off the plain end fairly short and rivet it tightly down. As the wire is an exact fit for the hole there will be no shake, and the knob or coil holder will give no further trouble.

If you do not wish to purchase a drill plate you can make a very useful one for your own set of drills by obtaining a piece of brass or milled steel of suitable dimensions and ⅛ inch thick and making in it a hole with each drill.

R. W. H.

100-METRE AMATEUR WORK



In view of the interest aroused by Senatore Marconi's work on 100 metres, we show above some of M. Leon Deloy's short-wave transmitting apparatus. M. Deloy (8AB), of Nice, was the first amateur to communicate with America on this wave.

How Every Crystal User may become a Valve Expert

By E. REDPATH, Assistant Editor

In the following article the theory of high-frequency amplification is dealt with, and some simple methods of using a single valve as a high-frequency amplifier in conjunction with a crystal receiver are explained.

WHILST dealing with low-frequency amplification in the preceding articles, reference was made to the fact that such method of amplification should be used only with a view to obtaining louder signals, and not with a view to increasing the range of reception.

There will no doubt be many readers who do not particularly desire loud signals. Their existing crystal sets enable them to obtain excellent results from their

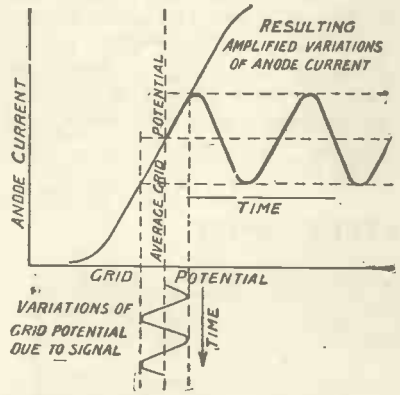


Fig. 1.—Graph illustrating the H.F. variations in anode current produced by H.F. changes of grid potential.

local broadcasting station in one or two pairs of telephone receivers, but they would be interested in an addition to their set which would enable them to receive one or more distant stations, still using the telephone receivers.

It will now be found that the addition of a single high-frequency amplifying valve to a suitably arranged crystal receiving set will effect a considerable increase in receiving range.

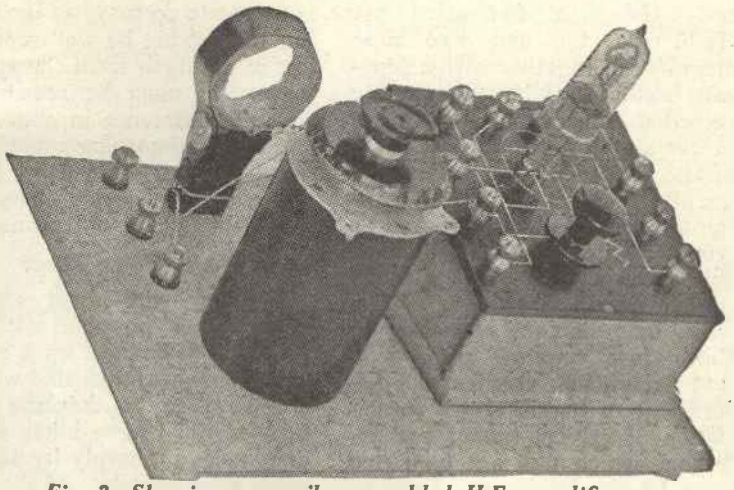


Fig. 3—Showing an easily assembled H.F. amplifier comprising a coil holder, variable condenser and "diagram" panel.

The Principles of H.F. Amplification

In the preceding articles the fundamental principle of the three-electrode valve was mentioned, namely, under proper working conditions the flow of electrons from the hot filament to the anode is controlled by the potential of the grid with respect to the filament.

With this fact it should also be remembered that a small change of grid potential will cause a comparatively large change in anode current, whilst the control, being purely electrical and involving no movement of working parts possessing inertia variation, can be effected at extremely high frequencies.

A three-electrode valve, therefore, can be made to act as a relay for electrical potentials whose value varies at frequencies altogether beyond the frequencies at which any relay of a mechanical nature could possibly operate.

The Action of the Valve

To explain the action of a three-electrode valve, when functioning as a relay or amplifier of high-frequency potentials, is by no means easy. It can, perhaps, be illustrated best by means of a graph as shown in Fig. 1. Readers who are not well acquainted with the graphic method of illustrating electrical conditions are urged to examine Fig. 1 carefully, bearing in mind that there are five important variable factors. Firstly, there are the varying grid potentials, positive and negative to the right and left respectively of the dotted line which represents the initial or steady average grid potential.

Secondly, there is the increase and decrease in anode current consequent upon each change of grid potential. In the earlier diagrams which were given to illustrate characteristic curves of valves, the grid potential was adjusted to various values, and the resulting anode current for each value was duly noted and marked upon the chart in order to form the curve. Under actual working conditions, however, the variations are occurring continuously, and, in order to represent such action in a clear manner upon our chart or graph, the different changes must be indicated progressively.

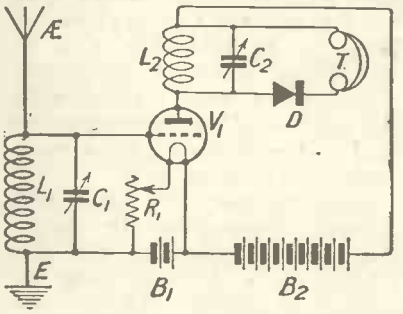


Fig. 2.—The simple but very effective "tuned-anode" method of H.F. amplification, which may readily be applied to almost any crystal receiver.

In other words, the time factor must now enter into our calculation, and accordingly changes in grid potential over a certain very small fraction of time are repre-

sented by the wavy line moving downwards from the horizontal base line. Similarly, the resulting changes in anode current are represented by another wavy line moving to the right from the point at which the "average grid potential" dotted line intercepts the anode current curve. This "time factor" is the third important point to be noted.

The fourth and fifth points are the amplitude of the changes in anode current and the amount of variation in grid potential which produces them, whilst, in this connection, it should be observed that the wavy line representing the anode current is an exact enlargement of the smaller wavy line representing varying grid potentials.

If the dotted line representing the average grid potential was moved either to the right or left for a distance of, say, half an inch, the anode current would not be varied *equally* on either side. Anyone interested may easily try this, but it will be found that the wavy line representing the varying anode current will no longer be the same shape as the grid potential line. In other words, the incoming signals, though duly amplified, will be considerably distorted.

From the foregoing, it will, no doubt, be appreciated that, in order to obtain distortionless amplification (as far as the valve itself is concerned, of course), it is important to obtain and maintain the correct average grid potential.

Fortunately, with the ordinary modern receiving valve, connecting the grid (via a tuning inductance) resistance, etc., to the negative side of the filament lighting battery maintains an approximately correct average grid potential for all ordinary anode voltages.

From Fig. 1 it will also be seen that, as in the case of low-frequency amplification, there is a limit to the amount of variation of grid potential. If this limit be exceeded, as may conceivably occur when several valves are used as high-frequency amplifiers, the resulting variations in anode current may reach, or at any rate approach, the upper and/or lower bend of the anode current curve. That is to say, saturation or extinction point may be approached with consequent lack of further amplification and the introduction of considerable distortion.

Some Simple but Useful Applications

Fig. 2 is a theoretical circuit diagram illustrating a particularly simple but, at the same time, quite effective method of using a three electrode valve as a high-frequency amplifier in conjunction with almost any type of crystal receiver.

In the diagram, L2, C2, D and T represent the tuning inductance, variable condenser, crystal detector and telephone receivers of an ordinary crystal set, connected as shown in the anode circuit of a valve.

By the provision of an additional inductance L1 and variable condenser C1, as a means of tuning the aerial circuit, the incoming signals which, in the ordinary way, would be applied to the crystal receiver direct are now applied to the grid-filament

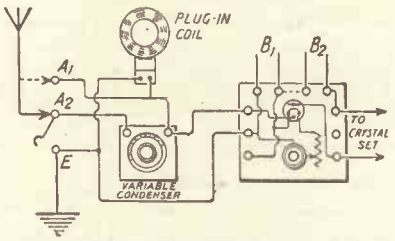


Fig. 4.—Wiring diagram of the apparatus shown in Fig 3.

or input side of the valve, thus causing the potential of the grid with respect to the filament to vary at a frequency to which the aerial circuit is tuned.

Controlled by the varying grid potential, electrons flow from filament to anode, equivalent to high-frequency pulses of current from the positive terminal of the high-tension battery B2, flowing to the anode via the inductance L2.

If the oscillatory circuit formed by the inductance L2 and the variable condenser C2 is tuned to the same frequency as the aerial circuit, the high-frequency pulses from the battery will be built up into comparatively powerful oscillations in that circuit, and these oscillations will be detected by the crystal D and made audible in the telephones T in the usual manner.

In this arrangement (Fig. 2) the valve acts as a relay or amplifying link between the two oscillatory circuits L1, C1, and L2, C2. The photograph (Fig 3) shows a practical form of the circuit of Fig. 2, comprising a "diagram" valve panel as previously described, a variable condenser (capacity 0.001 μF), a plug-in coil and fixed coil holder, and three terminals, the whole being mounted upon a convenient baseboard and connected up as indicated in Fig. 4.

As will be seen, the arrangement is extremely simple. Any kind of coil holder, coil and condenser may be used. On actual trial, the apparatus illustrated in Fig. 3, used in conjunction with the inductively-coupled crystal receiver with untuned secondary circuit, as illustrated in last week's issue, two distant British broadcasting stations were heard, as well as L'Ecole Superieure (Paris) and Radiola (Paris).

To obtain really satisfactory results it is important that the crystal receiver should be capable of tuning to its maximum wavelength *when included in the anode circuit of the valve*—i.e., without the usual capacity of the aerial to which it has previously been connected. To ensure that this condition can be complied with, the use of a variable condenser (maximum capacity 0.0005 μF) in *parallel* with the tuning inductance is recommended. In most cases of 0.0003 μF will be found suitable.

Readers already possessing crystal receiving sets, in which the aerial is tuned by means of a variometer, will be able to obtain quite good results by connecting a small fixed condenser in parallel across the variometer. The value of the condenser should be such as to compensate for the absence of the aerial, and, in general, a capacity of 0.0003 μF will be found quite satisfactory. The longer waves, such as 1,600 metres, cannot be tuned in this way owing to the small inductance range of the average variometer.

(Next week the use of reaction and the construction and operation of a compact all-wave valve and crystal receiver will be fully described.)

Daily Transmissions from Leading Continental Stations

Additions and Amendments

WEEK DAYS.

British Summer Time.	Name of Station.	Call Sign and Wave-length.	Locality where situated.	Nature of Transmission.	Closing down time or approx. duration of Transmission.
a.m.					
10.30	Lyons	YN. 470 m. ...	Lyons ...	Concert	Until 11.15 p.m.
10.40	Eiffel Tower ...	FL. 2600 m. ...	Paris ...	Cotton and coffee quotations ...	5 minutes.
p.m.					
12.14	Eiffel Tower ...	FL. 2600 m. ...	Paris ...	Time Signal in French Summer Time (Spoken), followed by Weather Forecast.	5 minutes.
1.00	Haeren	BAV. 1100 m. ...	Brussels ...	Weather Forecast	3 minutes.
1.15	Geneva	HB1 1100 m. ...	Switzerland	Weather Forecast, followed by Lecture.	One half-hour.
4.50	Haeren	BAV. 1100 m.	Brussels ...	Weather Forecast	3 minutes.
5.30	Eiffel Tower ...	FL. 2600 m.	Paris ...	Stock Exchange, closing prices (Saturdays excepted).	8 minutes.
8.15	Lausanne	HB2 800 m. ...	Switzerland	Concert (Thursdays excepted) ...	Until 9.30 p.m.
8.30	Ecole Sup. des Postes et Telegraphes	PTT. 385 m. ...	Paris ...	Lecture, followed by Concert. (Usually Outside Broadcast. Sometimes begins at 8.15 or 8.45 p.m.)	Two to three hours.
10.30	Madrid	—— 408 m.	Spain ...	Concert	Until midnight.

SUNDAYS.

p.m.					
8.30	Ecole Sup. des Postes et Telegraphes.	PTT. 385 m. ...	Paris ...	Concert or Lecture. (May begin a quarter-hour earlier or later).	Ends between 10.30 and midnight.
9.00	Radio-Paris ...	SFR. 1780 m. ...	Clichy ...	Concert, followed from 10 p.m. by dance music.	Until 10.45 p.m.
10.30	Madrid	—— 408 m.	Spain ...	Concert	Until 12.30 a.m.

SPECIAL DAYS.

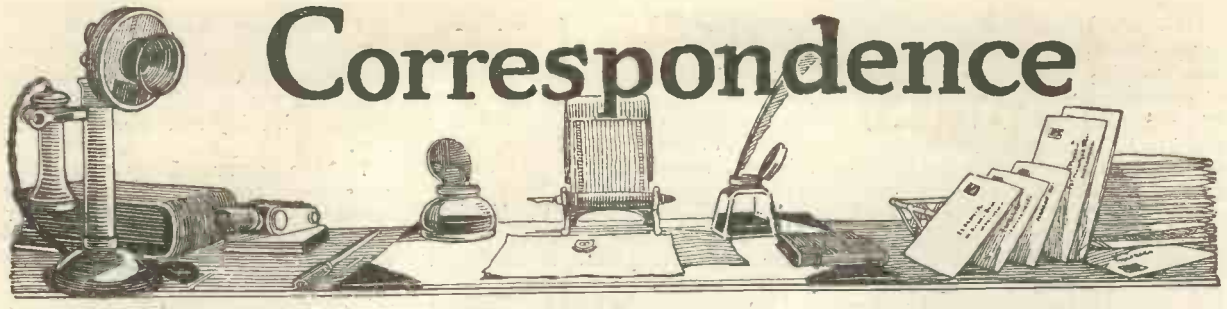
p.m.					
3.00	Ecole Sup. des Postes et Telegraphes.	PTT. 385 m. ...	Paris ...	Fridays, Concert or Lectures ...	Two hours.
5.00	Lausanne	HB2 800 m. ...	Switzerland	Thursdays, Children's stories ...	One hour.
10.00	Radio-Paris ...	SFR. 1780 m. ...	Clichy ...	Mondays, Thursdays and Fridays, Dance Music.	Until 10.45 p.m.

WIRELESS IN THE EMPIRE PAGEANT

IN the representation of Mr. Marconi's first experiments in Transatlantic Wireless Telegraphy at Signal Hill, Newfoundland, which is being included in the British Empire Pageant, the scene will be re-enacted as faithfully as possible to the events which took place in December, 1901.

Wireless instruments and apparatus of the type used at that time have been assembled for this purpose, and Mr. G. S. Kemp, Mr. Marconi's chief assistant in the Signal Hill experiments, is taking the same part in the Pageant that he did at Signal Hill. The instruments themselves will be exhibited in the Newfoundland Pavilion when not being used in the Pageant.

Correspondence



FROTHING

SIR,—I cannot allow the letter from Messrs. Peto & Radford in your issue of the 9th inst. to pass without a word of protest.

To any user of accumulators it would appear as if they have given their blessing on the use of "Hudson's soap" as a remedy for frothing. I do not for one moment disagree with the statement that it does stop frothing, and this is probably due to the formation of a slight film of oil on the surface of the electrolyte caused by the action of the acid on soap. The great point, however, appears to me, that the addition of this soap is detrimental to the plates themselves.

I have to-day tested several samples of "Hudson's soap," and in all cases I found that a solution in distilled water showed a far greater percentage of "chlorine" present than anyone who has had any experience in accumulator work would think of introducing into the electrolyte.

The frothing of accumulators is almost, if not entirely, confined to cells in which the containing cases, and especially the separators, are composed of celluloid. This material usually contains a considerable quantity of camphor, as it greatly adds to its plasticity and facilitates the operation of rolling into sheets, as owing to its high boiling point it retains the volatile solvents which are necessary in manufacture.

Camphor may be converted by oxidants into several acid bodies, such as camphoric acid, camphoronic acid, campholic acid, and others; and although, according to D. G. Fitzgerald, who carried out much research work on accumulators, these acids may not be detrimental to the actual working of the cells, their formation is at the expense of the celluloid cases and separators used, and are undoubtedly the basic cause of frothing.

It is questionable whether any amount of washing out with water and refilling, as suggested by Mr. Peto, will effectually cure the frothing, as it only means that a fresh surface of the celluloid is laid bare for a further attack during the next charge. It is probable that a small amount of the special light petroleum oil, which has been introduced by Prices and called "Blancol," would greatly minimise, if not stop, the frothing, although it would not touch the root of the trouble. The oil has been largely used by the Post Office for their storage batteries, and they have found that there is almost an entire absence of spray during charge, when this oil is used.

Yours faithfully,

ARTHUR W. FITHIAN, M.I.E.E.
Wandsworth Common,
S.W.17.

DOUBLE REACTION RECEIVER

SIR,—I have recently completed the double reaction receiver as designed by Mr. Stanley G. Rattee in the issue of *Wireless Weekly* of April 16, 1924.

The results are quite excellent, all B.B.C. stations and the Continental stations coming in at very good two-valve strength. The set is a good example of what can be done by careful designing, as although the set is as compact as possible, there is not the smallest sign of the bugbear of "hand-capacity." Naturally any experimenter also appreciates the testing of the "double reaction," which is most interesting and instructive.

Having long since subscribed to all the modern wireless publications, including, of course, your own *Modern Wireless* and *Wireless Weekly*, I would like to offer you my best congratulations on your productions. I think that I may fairly voice the opinion of the majority of genuine "C.Q.s" when I say that you have never published a "dud" number.

The amount of really useful information which you put into both your publications, including the very excellent whole-page photos and working diagrams, is a very great pleasure to me personally, and to all of us who enjoy this interesting scientific hobby.

Wishing you the continued success which you deserve,—Yours faithfully,

"TEMPLATE."

Norwich.

A specimen of the large Amplion loud-speakers which are used on the B.B.C. kiosk at Wembley for the public demonstrations of broadcasting.

THE RADIO ASSOCIATION

[In view of the recent alterations in the conditions of issue of amateur transmitters' licences and the apparent restrictions in facilities hitherto granted to transmitting amateurs by the P.O., the Radio Association communicated with the P.M.G. on the subject. Appended is the reply received by the Association.—ED]

"SIR,—In reply to your letter of June 27, I am directed by the Postmaster-General to say that the main changes recently introduced in the conditions of permits for the use of wireless sending apparatus are as follows:—

"(1) The use of spark transmission is forbidden as being unnecessary now for research purposes and causing the maximum amount of interference.

"(2) In the general interest, the use of the 440-metre wavelength is forbidden between 5 p.m. and 11 p.m. on week-days and during broadcasting hours on Sundays. This condition had been imposed for some time past in all new licences, and it is now being applied in all cases in connection with the scheme for re-licensing.

"(3) An additional band of wavelengths, *i.e.*, 115-160 metres, is granted in approved cases.

"(4) The licensee is required to keep a log of transmissions and to produce it for inspection, if desired. The Postmaster-General understands that it has hitherto been the general practice for experimenters to keep such a record for their own purposes.

"(5) Experiments in sending are normally restricted to sending messages to stations in this country which are co-operating in the experiments, and this fact is now stated in the permit. The Postmaster-General is prepared, in accordance with the practice hitherto followed, to consider favourably any application for an extension of the normal facilities for experiments which cannot be conducted with stations in this country, on receipt of particulars of the experiments and evidence of an arrangement for co-operation by a foreign or colonial station or stations.

"There has been no change in the general conditions which all applicants for sending licences must fulfil. The Postmaster-General is anxious that all reasonable facilities should be afforded to applicants who have in view experiments that are likely to be of real value, and who are competent to carry them out.

"Your Association will recognise the need for careful scrutiny of all applications, in order to ensure that the *bona-fide* experimenter is not hindered by unnecessary and unskilled transmission.—I am, sir, your obedient servant,

"(Signed) F. J. BROWN."

A SINGLE-VALVE CABINET RECEIVER

SIR,—Allow me to congratulate Mr. Rattee on the one-valve reaction receiver described in *Wireless Weekly* of June 18. I have built this set, and here is a list of the stations received:—

2LO, 5XX, 5IT, 2ZY, Konigswusterhausen, 6BM, FL, Nauen (time signals), 5WA, Radio-Paris, 5NO.

I do not say all these stations are comfortable to listen to from a music-lover point of view, but I certainly say that the set gives me the choice of 2LO, 5IT, Radio-Paris, 5XX and the Eiffel Tower, these coming in beautifully.

I am greatly indebted to Mr. Rattee for my success, this being my first home-built set.

Wishing *W.W.* and *M.W.* the best of success.—Yours faithfully,

F. AZER.

Potters Bar.

The neat Omni Receiver referred to by Mr. Jewell.

THE "ALL-CONCERT" RECEIVER

SIR,—I think I ought to let you know how pleased I am with your famous "All-Concert Receiver," about which I read in the September number of *Modern Wireless*. After Christmas I decided that my two-valve set was not powerful enough, and finally considered that the "All-Concert" would meet my requirements. It has now been in constant use for some months, and has given unfailing good service all the time. Besides WGY I have logged over 100 amateur stations (telephony), Petit Parisien, L'Ecole Superieure, SFR, and all of the B.B.C. stations; also GED, GEG, Berlin and Brussels. A fair number of these I have had at loud-speaker strength; I very much improved the quality of LS reception by placing a resistance of one megohm across the secondary of the L.F. transformer, together with a .0001 fixed condenser. Music on the loud-speaker is now as faithful and pure as one could wish.—Yours faithfully,

G. J. MARCUS.

THE OMNI RECEIVER

SIR,—I enclose a photograph of my enlarged Omni receiver, upon which I try all circuits given in *Wireless Weekly* and *Modern Wireless*.

I have arranged by means of a switch the ability to use a standard three-valve set, so connected that either one, two or three valves may be used.

Connections are made with rubber-covered wire with spade terminals.

One useful feature is the provision of external terminals which enables me to use a variometer or Reinartz tuner.

The D.P.D.T. is to enable either a perikon or cat's whisker type of crystal to be used.—Yours faithfully,

G. JEWELL.

London, S.E.

THE FOUR-VALVE FAMILY SET

SIR,—You will be pleased to hear I was able to pick up Vienna the other night on your four-valve family set.

I am situated 21 miles from Glasgow, and can tune-in almost all the B.B.C. stations easily, except Aberdeen. Radiola and Eiffel Tower (France) are easily heard on LS if conditions are good. All B.B.C. stations come in strong on three valves. The fourth I only use for LS for distant stations. Glasgow and Manchester come in on LS using three valves.

I had difficulty at first to tune out Glasgow, as it came in on all other stations. I experimented with a wave trap, but was not satisfied. At the present moment I am very successful in tuning-out Glasgow and all stations in without much loss of signal strength by using a .0001 variable condenser in series with aerial terminal. The method in use is certainly elementary, being aerial terminal to one side VC and other side VC to A1 on the instrument. I am able to tune-in Glasgow, 415 metres to Edinburgh, 325 metres with 35-50-75 coils. Cossor H.F. Red top, Thorpe Det. and 2 Marconi R5 as amplifiers.

Aerial, electron wire, height 25 ft., and full 100 ft. in length.

The first time I tried out the set my aerial was run through window and tied round four iron posts 6 ft. high without any insulation except the wire. I obtained Glasgow on the LS and several other B.B.C. stations strong on 'phones.

I am pleased to say I had good results from the commencement with this set. I intend making your last month's *M.W.* five-valve set in near future and trust to get equally good results.

This is the fourth conversion of sets described by you I have under-

taken and obtained good results. I have not attempted fancy circuits, as I consider that the best thing is to obtain good, pure reception of the various transmissions without noises, distortion, etc. I would not be without a set for worlds now.—Yours faithfully,

H. B. JONES.

Ayrshire.

A USEFUL COIL HOLDER

SIR,—It is a general opinion that the usual kind of coil-holder is not very efficient if heavy coils are used owing to the weight of the coil causing slipping and so requiring continual adjustment.

The enclosed sketch of an arrangement which I fitted to my set is very effective, and keeps the coil perfectly steady and also allows of fine tuning. It is very simple, cheap and easily fitted, consisting of a "Meccano" worm and gear wheel, a piece of spindle and collar, also a small piece of sheet brass with sleeve and knob.

The sketch speaks for itself and needs no further explanation.—Yours faithfully.

JAS. S. BARCLAY.

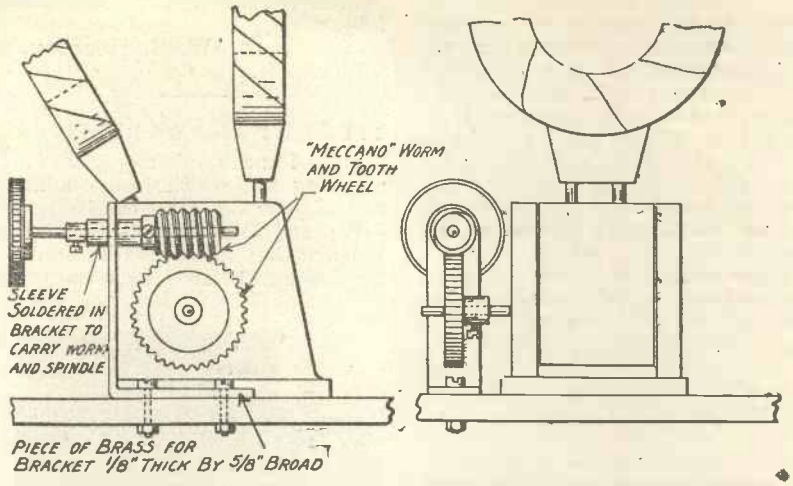
Kilmarnock.

A NEW SINGLE-VALVE CIRCUIT

SIR,—In the *Wireless Weekly* of November 21, 1923, a "New Single-Valve Circuit" is described by Mr. G. P. Kendall.

Mr. Kendall, very modestly, makes certain claims for his set, and those who have taken the trouble to construct it will have found that it surpasses all expectations. Indeed, it is surprising that more has not been said about this very peculiar type of circuit.

I have worked it for some time now, and, where local broadcasting is concerned, there is no trouble whether bell wire, gas pipe or ordinary aerial be used.



The addition of the "Meccano" worm and gear wheel to a coil holder prevents slipping as explained by Mr. Barclay.

I have, however, also discovered its shortcomings. There is lack of stability when tuning in distant stations, and the set does not seem to take kindly to loading coils. Possibly the author, in the course of experience, may have devised some means of overcoming these defects. I would be obliged for any advice you could give me on those two points.—Yours faithfully,

NELSON T. FOLEY.

Woodford, Essex.

NOTE.—The whole essence of this circuit is a very delicate control of

the reaction, reception of distant stations being entirely dependent upon smooth adjustment in the neighbourhood of the oscillation point. The circuit, therefore, requires careful adjustment of H.T. and L.T. supply, and a suitable valve. A valve which produces the slightest over-lap is practically useless for the distant stations.

The method of obtaining reaction is only suitable for the shorter waves and hence loading coils are not advised, although they can be used for so strong a station as 5XX. G. P. K.

H.F. ON THE ST100

SIR,—Having made your latest ST100 three-valve set I wish to say how satisfied I am with the results.

The nearest station is 110 miles away, and having acquainted myself with the method of using three condensers I get all B.B.C. stations and most of the Continental ones easily on the loud-speaker. London, Newcastle and Bournemouth are really *loud*, and the others are loud enough to be pleasantly audible.

The only difference in the choice of components is that I have used three Polar condensers with Lissen verniers. Thanking you for this useful addition to an already famous circuit.—I am, yours faithfully,

W. C. HODGSON.

Lowestoft.

TYPES W1 AND W4 RECEIVERS

SIR,—I enclose photographs of my receiving set, which is a combination of your two most excellent sets —W1 and W4. I constructed the W4 first, but soon was overcome by the desire to be able to use one, two or three valves at will. The results obtained with W4 were quite all that you claimed for it, and I got all stations at loud-speaker strength during April and May. Of late signal strength has fallen off, but I still get excellent telephonic signals on all stations. The new high-power station, 5XX comes in beautifully on one, two or three valves, and when the dark nights come again I feel sure that loud-speaker signals will easily be received.

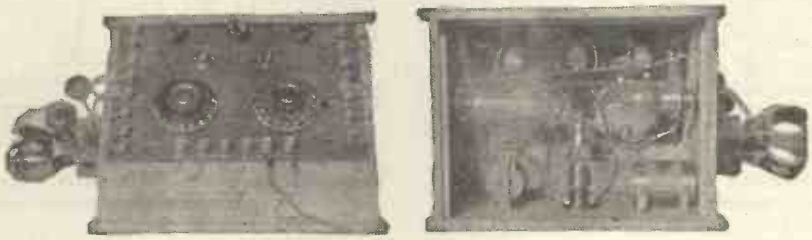
The general efficiency of the set has, if anything, improved since I modified it to the W1 type, but I have retained the Vernier condenser of W4 and Simpson connection across the second transformer—a Powquip. The first transformer is Eureka concert grand.

In this set, as you will see, I have enclosed the valves, so as to be out of the way of my maid whose cleaning is admittedly a "sweeping" success!

Wishing further success to your two most excellent journals,—I remain, yours faithfully,

WILLIAM SCOTT, M.B., Ch.B.

Dumbartonshire.



The compact receiver which was made by Mr. William Scott.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

O'Keefe Inductance Coils

We have received from Messrs. the D.E.M. Company a set of four coils of the plug-in type, Nos. 35, 50, 75, and 100, of ordinary dimensions.

These are of a "double-basket" type of winding, for which low-distributed capacity is claimed. The inductance values measured were about 60, 120, 270, and 550 microhenries respectively, corresponding closely with those of the usual commercial coils. It was noted that these coils, though very light in weight, were wound with a reasonably large gauge of wire; offset against this is the point that with this type of winding there is a large proportion of inactive wire passing at an acute angle to the direction of the axis of the coil, so that the effective H.F. resistance was not so small as might be expected from the gauge of wire chosen. The coils were taped lightly, and mounted in a moulded cradle carrying the conventional plug-and-socket fitting, but provided with reversible plugs for turning the coil around (though, of course, this has no effect on the direction of the magnetic field).

The measured tuning-range was, with a 0.001 (actual) μF parallel tuning condenser of moderate minimum capacity, No. 35, 120—450 m.; No. 50, 160—660 m.; No. 75, 225—980 m.; No. 100, 350—1,380 m. On a P.M.G. aerial of .0003 μF capacity the minimum is accordingly about 260, 375, 570, and 780 metres. The requisite range of reaction and second-circuit coils was found available.

In actual tests, measuring signal strength in crystal and valve reception, satisfactory results were obtained, the results being exactly comparable with those of a well-known standard type of plug-in coils.

Terminal Clips

From Messrs. Runbaken Magneto Co., Ltd., come a sample pair of terminal clips, especially

suitable for making connections to accumulators, where the existing terminals have become corroded and stuck fast.

These are strong spring clips, with toothed jaws which open wide enough to clip on to the end of the terminal stem or even the top of a small terminal, and close with enough force to cut through any superficial coating of corrosion. The clips are 2 in. long and about ½ in. wide; a powerful steel spring within the clip gives it a vice-like grip. Connection is made with a flexible lead by means of a small screw—which might with advantage be rather larger—and tags which can be closed down on the insulated cover of the cable to provide a strong fastening.

On extended trial on our accumulator battery and charging plant, these clips were found to be invaluable, making the change of accumulators in the middle of an experiment, or the tapping of 4 volts from a six-volt cell, etc., a matter of a couple of seconds only; whilst the electrical connection was always sound—more so, in fact, than often happens with old accumulator terminals with a wire pinched apparently securely under a brass nut. The clips could also be pyramided for multiple connections with perfect security.

A Wide-Range Filament Control

The Gerrard Radio Stores have brought to our notice a new fine-adjustment filament resistance, suitable for both dull-emitter and ordinary bright-emitter valves, possessing a wide range of resistance values with narrow adjustment throughout that range.

The instrument (which incidentally is marketed at an extremely moderate price) is enclosed in an ebonite cylinder about ⅞ in. diameter and 1⅜ in. long, with single-hole fixing. A large ebonite knob outside the panel controls the mechanism, which is apparently of the screw-compression type. Small terminal screws are provided at each end of this cylinder for connections.

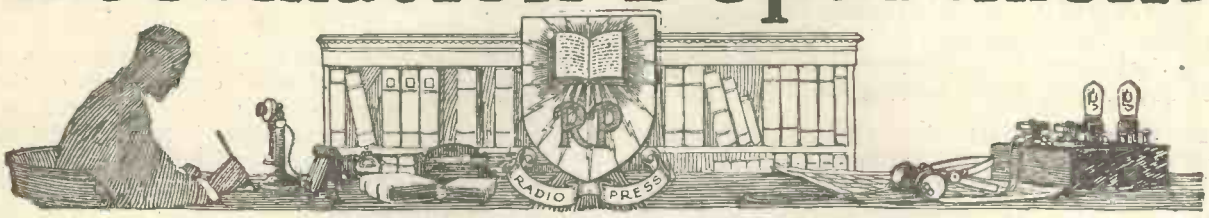
The resistance, on measurement, ran from about 200 ohms practical maximum (nominal 50 ohms) to a very low figure; and smooth and continuous variation was possible throughout this range. It is thus eminently suitable for a double-purpose resistance, as when both dull-emitters of the .06 type and ordinary valves—or even small power valves for power-amplification—are used in the same set. Actual test showed that it could pass the current for a small power valve at 6 volts without signs of distress; and control the supply to two R-type valves successfully. On extended trial with both .04 and .06 types of valves, R valves, and L.S. valves, several of these resistances have given most satisfactory service. They can, accordingly, be thoroughly recommended. In conjunction with the dull-emitter type of valve in particular, very nice control over rectification and reaction was observed.

□ □ □

A Gradual L.T. Switch

On page 310 of our July 9 issue, the wire with which the former should be wound is No. 20 S.W.G. enamelled Eureka, and not, as previously stated, No. 26.

Information Department



SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

R. D. (STOCKPORT) submits a diagram of his receiver, which he complains gives very distorted reproduction, and inquires as to the causes and remedies.

The diagram indicates that two stages of low frequency amplification are being used, the lower ends of the transformer secondary windings being connected direct to the negative end of the valve filaments. No grid bias is being used, and since the low-frequency transformers are both of good quality, this is the probable cause of the trouble. Take the connections from the transformer secondary windings direct to the low-tension negative terminal, and transfer the filament resistance of each low-frequency valve to the negative lead. With your present valves and a six-volt accumulator, this will give a negative bias of about two volts to the grid, which will probably be sufficient.

O. R. Q. (NORWICH) states that he has been informed that he is likely to cause interference with neighbouring listeners if he allows his receiver to howl at low-frequency. He explains that his receiver consists of a single valve set to which he has added a two-valve low-frequency amplifier.

So long as you are quite sure that the howling is the result of true low-frequency oscillation in the circuits of the amplifier, there is no chance of causing interference, but you must take great care to discriminate between such howling and that which results from operating the rectifying valve in the oscillating condition, thus producing a beat note with the carrier wave of the station which you are listening to.

To make the necessary distinction, try varying the capacity of the tuning condenser. If this makes no difference whatever to the pitch of the

note which you hear, you can be fairly sure that no interference can take place.

F.P.A. (BLACKPOOL) refers to the special method of mounting coils known as the Gimbal method, and asks what is the object of supporting coils in this way.

The principal object of arranging coils in this way is to enable a real minimum coupling to be obtained, which is quite impossble in the majority of cases with the ordinary two-coil holder and plug-in socket type of mounting. With the Gimbal method the coil can be revolved upon its axis, as well as moved away from or towards its neighbour, and the power to make adjustments of this nature is often most valuable when working with loose-coupled circuits. An incidental advantage of the method is that the two ends of the coil are brought out to points which are very widely separated, and there is no need to use a plug of material which may or may not be good from the insulating and dielectric point of view.

R. H. V. (GUILDFORD) refers to a certain popular type of anti-capacity valve socket, and asks whether we consider there is any real advantage to be gained by using such components.

With sets employing two or more stages of tuned high-frequency amplification, it is probable that some arrangement of sockets of this nature is practically essential to get anything like good results. Until such sockets were introduced, and their value appreciated, it was generally laid down as a rule that such receivers could only be worked with anti-capacity valves of the type of the V 24. The method of construction of the majority of these special sockets also reduces the chances of leakage through the material of which the socket is made, and further, eliminates the possibility of touching the filament pins of the valve across the wrong sockets, and thereby burning out the filament.

C. R. W. (KILDARE) states that he is making up the Trans-Atlantic Five receiver, and intends to use bright emitters throughout, and inquires whether there is any reason why he should use the special double resistances shown in the design. He desires to use another make containing considerable masses of metal, and asks whether this will be objectionable in the circuit in question.

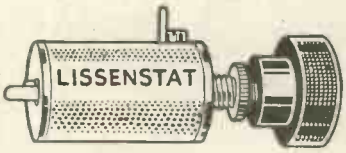
Since you intend to use bright emitters, there is no reason why you should not use any convenient type of filament resistance, and the presence of metallic masses at this point in the circuit should be quite harmless. Most of the metal in question, of course, is connected to earth.

Stepping in with LISSENSTAT Control

Oftentimes physical alteration of the tuning inductance or condenser fails to give just that acute control which means so much in long distance telephony. It is when this critical condition is reached that one realises how important LISSENSTAT control is to fine detection. Where further physical adjustment of the reaction control is ineffective then it is that you step in with that final touch of LISSENSTAT control. Immediately tuning becomes transformed—at once it is so acute that the distant station which previously was so elusive comes in clearly.

It is now generally known that LISSENSTAT control improves fine detection of long distance telephony in a truly remarkable manner.

LISSENSTAT (prov. pat.)



Critical electron emission is absolutely dependent upon the exact control of filament temperature. LISSENSTAT control gives that indescribable sensitivity to detection which has to be experienced to be understood **7/6**

LISSENSTAT MINOR (prov. pat.)

Such a high degree of LISSENSTAT control is provided by the LISSENSTAT MINOR and at a popular price, that no inefficient rheostat need longer be tolerated. The LISSENSTAT MINOR makes it worth while discarding any existing device. For dull emitter and all valves **3/6**

LISSENSTAT Control is an indispensable part in the building of any efficient receiver.

Why Transformers Break Down—

It is commonly assumed that transformers always break down because of overload. Oftentimes, however, the cause is far different. The windings of an audio-frequency transformer are called upon to carry comparatively heavy low-frequency impulses of varying audio-frequencies. The louder the signals the stronger are these audio-frequency impulses.

If the windings of a transformer were microscopically examined whilst audio-frequency impulses of varying frequencies were flowing through them, it would be seen that they were vibrating in sympathy with the frequencies they were passing.

If the windings had not been designed bearing in mind the conditions of service, although the effect of the vibrations might not be immediately obvious, the ultimate effect would be to alter the molecular formation of the copper in the windings and render the wire crystalline. Once the windings have reached this condition, it is only a question of time before the user will one day be surprised to find his transformer no longer amplifying. Unfortunately, even expensive transformers are not immune from this fault. That is why these break down even though in the factory testing room they may have withstood thousands of volts.

Apart from perfect mechanical constructions, LISSEN AUDIO-FREQUENCY TRANSFORMERS have certain technical attributes which place them above every other. For amplification of radio telephony they are unsurpassed.

The Low Tones of an Orchestra—

(1) **THE LISSEN T1 TRANSFORMER** is the only transformer which has a sufficiently high impedance value that it forms the ideal transformer for use immediately behind the detector valve. THE COIL WOULD AMPLIFY BY ITSELF WITHOUT ANY IRON CORE AT ALL. The secret of its beautiful amplification is in the expensive coil. Even the low tones of an orchestra are faithfully reproduced, perfect in every note **30/-**

(2) **AUDIO FREQUENCY IN REFLEX CIRCUITS.** Besides being exceptionally pure and powerful in all reflex circuits, the LISSEN T2 Transformer can be used for all stages. Recommended also to follow the LISSEN T1 where the latter is not used throughout **25/-**

(3) **SKILFULLY BALANCED DESIGN.** The LISSEN T3 Transformer actually compares with many expensive transformers of other make. It is certainly the best light transformer made. For all stages ... **16/6**

Fit a LISSEN Transformer—and make sure.

Altering Leak Resistance

Once a fixed leak is put into a circuit it offers no opportunity to the operator to alter its resistance either way. Although some circuits do not immediately respond to variation of grid potential others are decidedly susceptible to it. Valves also vary, and variable grid control is, therefore, highly necessary in many cases, and it is always reassuring to know that one has the means of controlling grid potential, so that the correct value is obtained for each circuit or valve, or the particular conditions under which a valve may be working on any given signal. With the LISSEN Variable Grid Leak fitted, a receiver is equipped to yield the utmost sensitivity which correct grid potential under all conditions implies.

LISSEN ONE-HOLE FIXING, OF COURSE—POSITIVE STOPS BOTH WAYS **2/6**

LISSEN Variable Anode Resistance—20,000 to 250,000 ohms, same outward appearance as the LISSEN Variable Grid Leak **2/6**

You just gently pull or push

LISSEN two-way switch, **2/9**

—and you hear these little switches "make" with a reassuring click. The contacts do not short when changing over—they are self-cleaning. There are no neater or handier switches. LISSEN ONE-HOLE FIXING, OF COURSE. Take up hardly any room.

LISSEN Series-parallel switch, **3/9**

Is this your nightly problem ?

Puzzling how to cut out your interference, so that distant stations may come in uninterrupted? How easy it is with LISSENCEPTOR, broadcasting and Morse, although there is some type of Morse which is more difficult to eliminate. Even this, however, can be so subdued that it ceases to be troublesome.

A separate tuning condenser should be used with the LISSENCEPTOR—diagram with each shows easy connections.

LISSENCEPTOR Mark 1 type for 600 metres **7/6**

" " 1 " " broadcasting **7/6**

LISSENCEPTOR Mark 2 type for broadcasting and 600 metres (combined with switch for more selective tuning)

The LISSENCEPTOR acts as a sentinel beside your Receiver. **15/6**

Why Use Mixed Parts ?

There is a LISSEN part for every vital place of a receiver. If you build with all LISSEN parts your finished receiver will be far above the average

The Text Book of LISSEN parts contains a lot of useful information. Post Free 8d. Free to the Trade.

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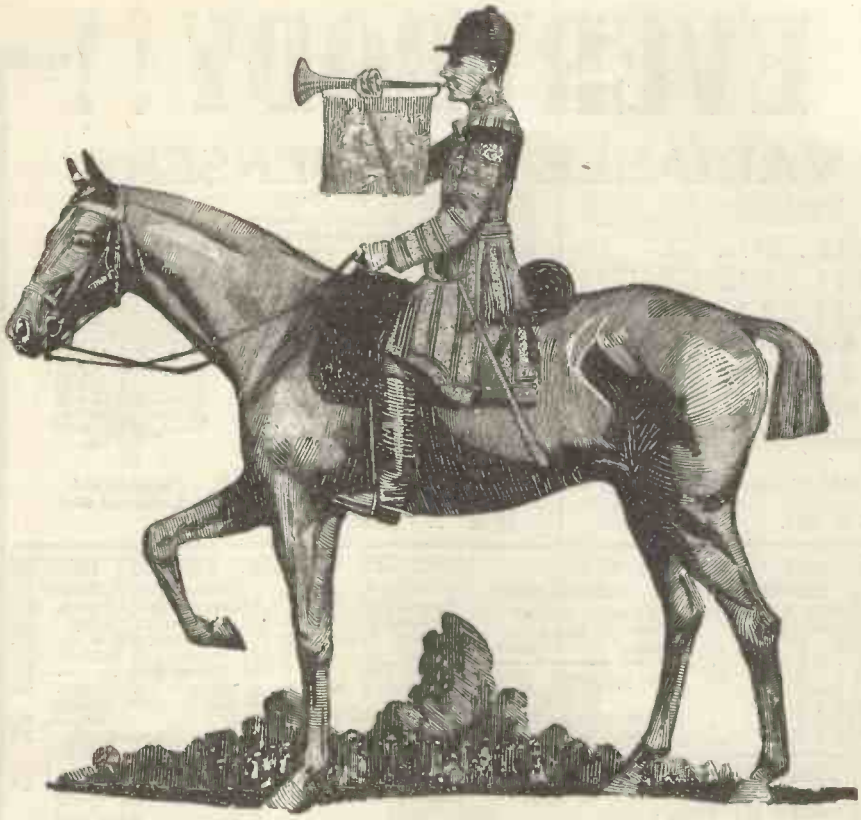
30-32, WOODGER ROAD, GOLDHAWK ROAD, SHEPHERD'S BUSH, LONDON, W.12

Telephones: Hammersmith 1072, 3380, 3381 and 3382.
Telegrams: (Inland) "Lissenium, Shepherds, London."
(Foreign) "Lissenium, London."

It will pay you always to watch WIRELESS WEEKLY *Advertisements.*



Marvellously fine tone

—*without a trace of blast or blare*

RADIO enthusiasts are gradually appreciating the fact that 75 per cent. of the responsibility for poor tone rendering is due to the Transformer, with the remaining 25 per cent. divided between the Valves and the Loud Speaker.

It has been a common fallacy to believe that the L.F. transformer merely amplifies and for this reason many of them are badly designed. Amplification in a transformer for Loud Speaker use must always be considered in relationship to tone purity. Any transformer can be made with a high amplification factor—that means merely a mathematical calculation as to the ratio between the number of turns on the primary winding and those on the secondary. But to eliminate distortion and yet retain the volume is entirely another matter.

The Eureka Concert Grand is such an exceptional Transformer because no money has been spared on its construction. For instance it is the only L.F. Transformer in the world that contains 2¼ miles of wire. It is the only one that will stand a 14-day total immersion in water test. It is the only one that can be bolted together in pairs without interaction. And it is the only one that will give twice the volume of an ordinary Transformer even when used with a standard Valve and not power Valve. In face of these outstanding advantages it is not surprising that our output has had to be trebled in an endeavour to keep pace with the demand.

Made in two types

Concert Grand	.. .. ..	**30/-**
Eureka No. 2	.. .. ..	**22/6**
	(For second stage)	

Sold by all Dealers and manufactured only by

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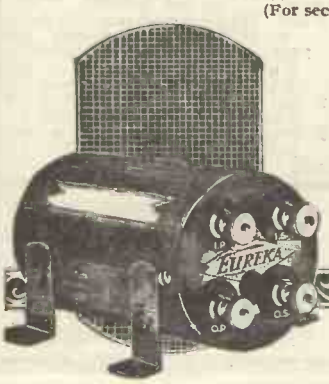
7 & 8, Fisher Street, London, W.C.1.
Scottish Agents: FULLER, BLACKIE & RUSSELL, Ltd., 30, Gordon St., Glasgow.



EUREKA Transformer

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"RADIOHM" BUS BAR ⅛th square copper wiring rod, as used on many "Wireless Weekly" sets, 2/- per dozen, 2 ft. lengths with tags, postage 3d.

"RADIOHM" COPPER STRIP makes a most efficient aerial, 3/- per 100 ft., postage 5d.

FLUSH PANEL MOUNTING COIL SOCKETS and plugs, also valve sockets 8d. per set, post free.

Send your enquiries to the real Radio Service House,

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43, Gt. Portland Street, London, W.1.
Telephone: Langham 2463.

6/6 "C" BRITISH MADE "C" 6/6

R.A.F. "C" Valves made by Osram G.E. Co., Ltd., and Ediswan Co., the finest H.F. and Det. valve ever offered under 13/-. Fit Mullard "Ora B" sockets. Adaptors for "R" Valves supplied at 1/- each.

"C" Valves were made under Government supervision for W/L of the Broadcast Bands, and there is no valve to touch them under DOUBLE THE PRICE. 5-valve New R.A.F. Receivers with valves £7, post free.

5 v. ¼ amp.

Four Electrode "R" Valves, 17/6 each.

Limited Number delivered from Stock. Trade Supplied.

Send 3d. stamps for Illustrated Catalogue of Radio Bargains.

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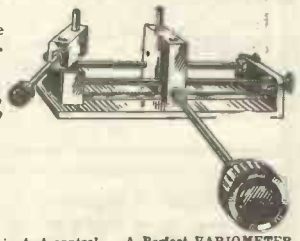
EL-BE UTILITIES

The "MIKROTUNE" MAKES TUNING SIMPLE & CERTAIN

Reversible Coil-holder.

Adds 50% value to any set.

12/6



Coils under minutest control. A Perfect VARIOMETER.
Send us the name of your Dealer and we will arrange a demonstration for you.

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Telephone: MUSEUM 4192.

Hullo, Everybody! This is Uncle Fellows calling. I have not the pleasure of knowing you all personally, and yet we seem to be old friends.

Do you remember the days when the obliging gentlemen from Wr-r-rittle used to give us concerts? That was in the pre-B.B.C. days. Only a couple of years ago, but what a lot of water has flowed under the bridge since then! Even in those days the Fellows Works were manufacturing and experimenting hard—had been for some years.

No one could quite see how Broadcasting would turn out, or what type of set you would demand. It seemed fairly certain that you would need apparatus which would give really good results and be simple to operate, and yet we must, above all, keep the cost low by cutting out all "gadgets" or expensive finishing processes.

Put in a sentence, our policy was:

"Quality apparatus at Low Cost."

We have been working on that policy for two seasons, and the job we are now having to keep pace with your demands proves that when we decided upon that policy we were building even better than we knew.

By the way, have you noticed what good value our Lightweight Headphones are? Write for the illustrated folder which gives full details of these and the other patterns we manufacture.

FELLOWS WIRELESS

THE LIGHTWEIGHT HEADPHONES.

Highly finished, good workmanship and extreme sensitiveness. They are very comfortable, headbands are duralumin and will not rust or tarnish. Weight with cord, 6 oz. Resistance 4,000 ohms.

Price 18s. 6d.

Advt. of The Fellows Magneto Co., Ltd., London, N.W.10. E.P.S. 76a.

A Valve for Every Wireless Circuit

THE P.A.

THE MULLARD P.A. VALVES are designed to give loud speaker volume without distortion. The P.A.1 is used chiefly for power amplification at wireless concerts and requires 200-400 anode volts. For general loud speaker purposes, however, the P.A.2 with a working anode voltage of 150, gives sufficient volume for large rooms. The P.A.3 is similar to the P.A.2, but only requires a normal H.T. battery of 70-120 volts.

For further information write for leaflet V.A.2 (Dept. W.W.)

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AGENTS WANTED.—WIRELESS VALVE REPAIR BUSINESS. Deal with the actual repairers. Lowest trade terms. All types repaired. A hard vacuum guaranteed. Also old valves bought for cash, 6d. each.—M. & G., 60, Churchfield Road, Acton, W.3. Telephone: Chiswick 2681.

THE Newtonia Wireless Factory can save you time and worry on the supply of Component Parts. Home Trade and Export. Send for Lists to 13-15, Whitcomb Street, London W.C.2

Fix your crystal in

GOLD SEAL PLASTIC METAL

the best contact possible, and get LOUDER & CLEARER SIGNALS. Contains no mercury. Of all Wireless Stores.

Enough for 3 cups **6d.** per packet.

Wholesale enquiries (or sample packet 6d.) to

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CABINETS YOU WANT

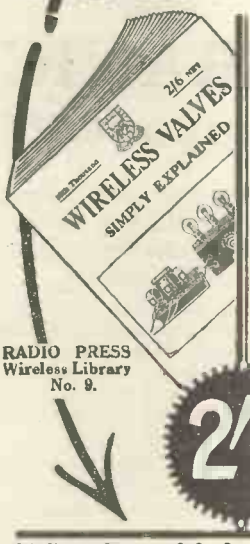
PICKETT'S Cabinets—they're good value, from 1/6 each, highly polished. Cabinet Works, Albion Rd., Bexley Heath, S.E. *Write for Lists W.L.*

Radio Press Information Dept.

2/6 QUERY COUPON 2/6

WIRELESS WEEKLY. Vol. 4. No. 12. July 23, 1924.
This coupon must be accompanied by a postal order of 2/6 for each question, and a stamped addressed envelope.)

It answers your queries



RADIO PRESS Wireless Library No. 9.

IF you are at all keen and enthusiastic you will continually find little queries which will puzzle you. Exactly what is Reaction? How does a Valve oscillate? What is Tuning?

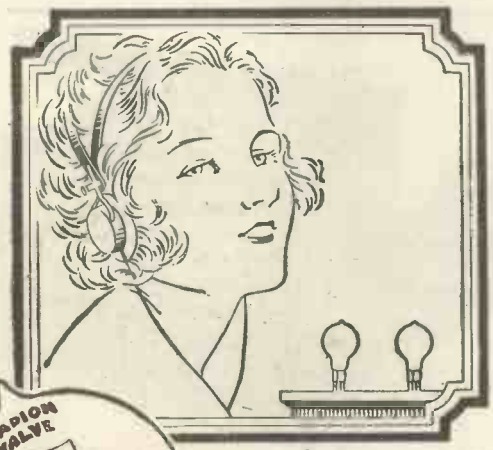
These are the sort of questions answered in this Book by the Editor of *Modern Wireless*. Get a copy to-day—master its contents and you will begin to make *real progress* at once.

2/6

From all Booksellers or Radio Press Ltd. Devereux Court, Strand, W.C.2.

Wireless Valves simply explained

By John Scott-Taggart F. Inst.P.



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and fit Radion to the "lasting" benefit of your accumulator and your pocket. These valves use only a third of usual filament current.

Use only .25 amps. at 3.5 to 4 volts. Anode Volts 30 to 90.

On all normal plate voltages no grid bias is needed.

Two Types: A2 for amplifying. D4 for detecting.

Same price for each. Same filament and anode current also. If your dealer does not stock this efficient and economical valve, write direct to us and we will see that you are immediately supplied.

Sole Manufacturers:

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VALVE REPAIRS

(Most makes)

Valves repaired by us are guaranteed:—

(1) Not to consume more current.
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Ordinary types.

Price 6/6 Post extra.

Trade enquiries invited.

10/- EACH

Patent applied for.

fit the New RADION LOW CONSUMPTION VALVES

TRADE ENQUIRIES INVITED.

—— and amplify enjoyment! B. & D.

VISION

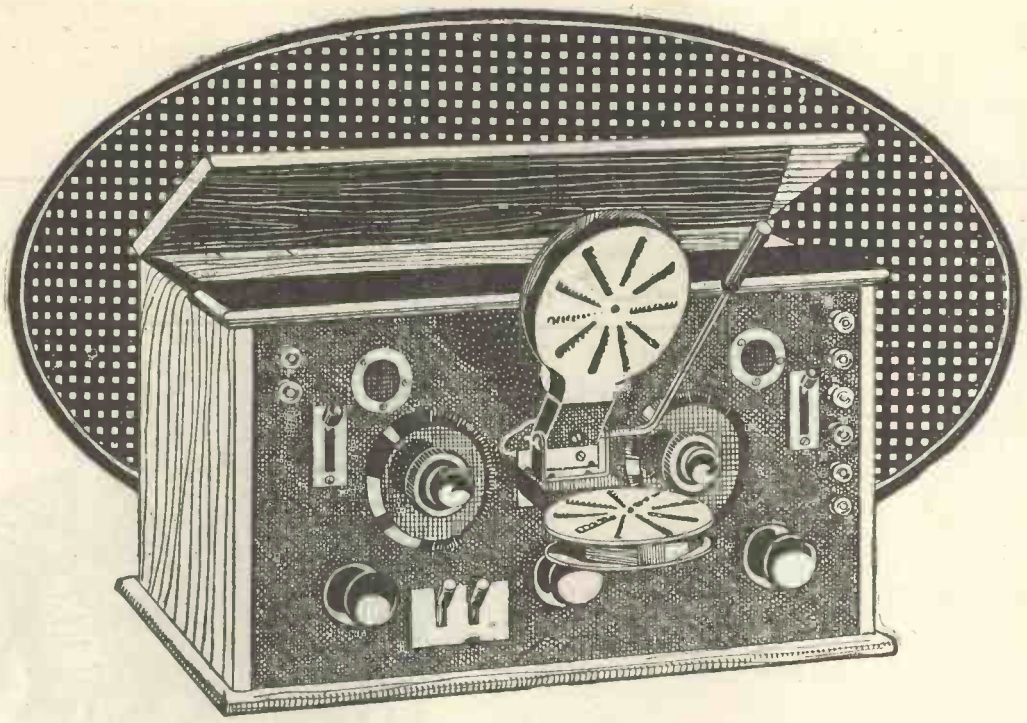
THE Roman road, the embodiment of unity, control, defence, and commerce is perhaps the greatest example of vision and foresight that the world has ever known. Without the Roman road there could have been no empire—without the Roman Empire the progress of civilisation must have been stayed a thousand years.

Wireless demands vision and foresight, too. The ability to peer into the future, to decide the trend of coming developments, to discard ruthlessly that which is out of date comes only to the qualified. Every man on the Editorial Staff of Radio Press Ltd. is a technical expert able to anticipate future ideas and to differentiate between the new and practicable and the merely sensational.

Every day sees some new phase of Radio. Yesterday telegraphy—to-day telephony—to-morrow, maybe, television. Truly this newest of all Sciences requires vision and foresight if we are to remain in the van of progress.

No. 2. of a Series of Advertisements for Radio Press Ltd., Devereux Ct., Strand, W.C.2

Gilbert Ad. 1152.



The Famous All-Concert Receiver

—designed by Percy W. Harris (Assistant Editor of this Magazine)

THE All-Concert Receiver was described in one of the first Constructional Articles ever written for MODERN WIRELESS by Mr. Percy W. Harris.

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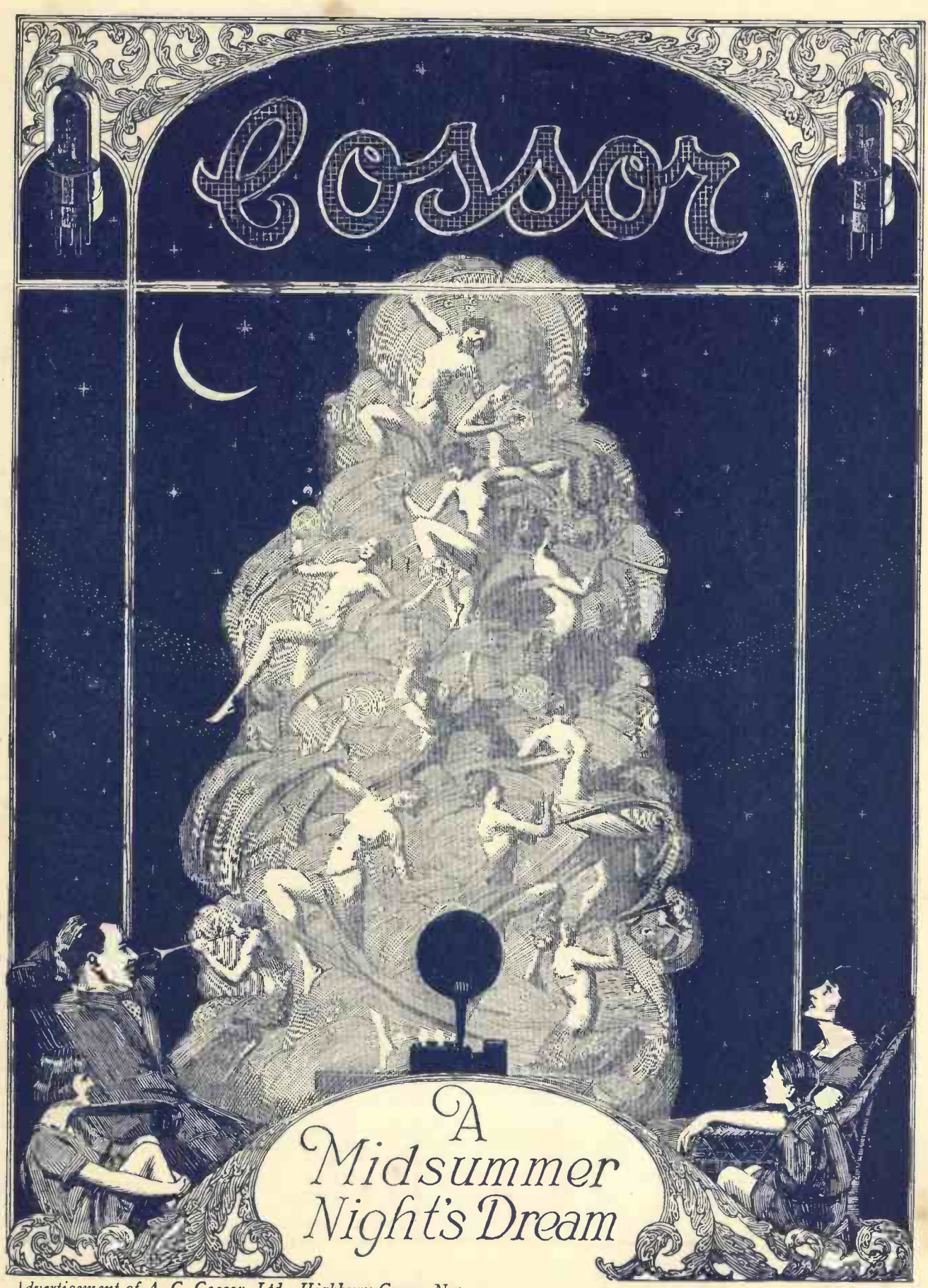

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