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Wireless Weekly

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MOISTURE AND TUNING COILS

By G. P. KENDALL, B.Sc.

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Wireless Weekly

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First-Hand Information for Radio Press Readers

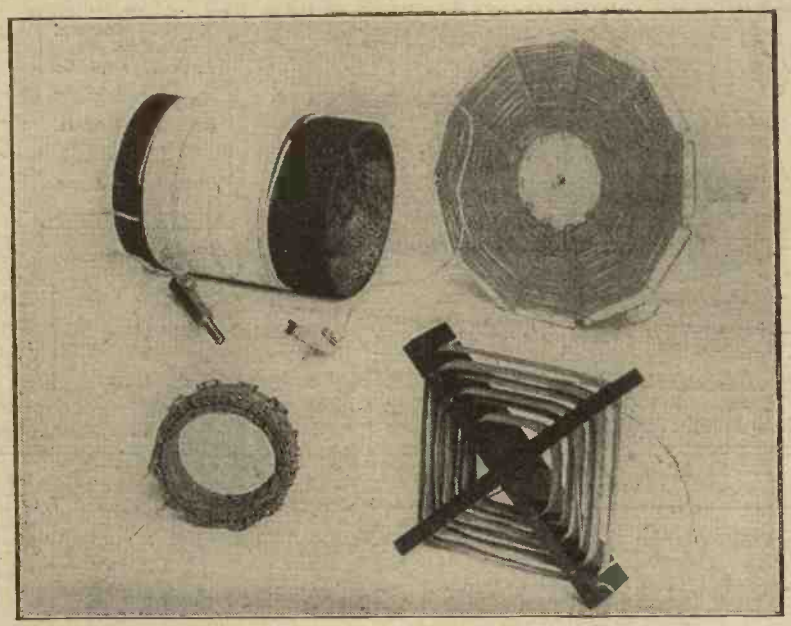
FOR some time past Radio Press, Limited, have been considering how best they can present to their readers a true picture of wireless conditions in America, in regard to both technical developments and the conduct of broadcasting. Although a number of articles by eminent Americans have appeared in the pages of the periodicals controlled by this organisation, it has been realised that a true picture can only be presented by one who is in a position to make accurate comparisons between British and American methods, and who fully realises the true significance of the technique in both countries.

Bearing these facts in mind, Radio Press, Limited, have now arranged to send Mr. Percy W. Harris, Editor of *The Wireless Constructor* and Assistant Editor of *Wireless Weekly* and *Modern Wireless*, on a visit to the United States and Canada. He will investigate thoroughly the present position of radio, while his own prestige in America and the letters of introduction he will carry will enable him to obtain an insight into transatlantic conditions, which will be reflected in an important series of articles he will forward to this country from time to time. Readers of *Wireless Weekly*, *Modern Wireless* and *The Wireless Constructor* will therefore be in the happy position of learning from the pen of one who is known so well to all of them, whether or not the average American receiver is superior in selectivity and range to the average British instrument; just what reliance can be placed upon the reports of long-distance reception which figure so prominently in American radio magazines; if the interference between broadcasting stations is really so bad as is so often suggested; how the American amateur builds his own receiver; how American valves compare with British valves; and hundreds of other matters which are of everyday interest in wireless, and to which satisfactory answers have never yet been given.

Mr. Harris will pay particular attention to the present state of the supersonic heterodyne receiver in America, and will have an opportunity of testing under working conditions all the leading makes and circuits which are in favour at the present time.

Mr. Harris will sail for America on Saturday next, May 16, on the great Cunard liner, the *Berengaria*, and will commence his investigations in New York. From this city he will proceed to other great centres, including the Middle West and the Pacific coast, concluding his trip in Canada. His articles will, of course, appear exclusively in *Wireless Weekly*, *Modern Wireless* and *The Wireless Constructor*, and will be eagerly awaited by the great public for which these journals cater.

CONTENTS.



These four coils were used as typical specimens of their various classes in the measurements described in this contribution.

Moisture and Tuning Coils

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

I SUPPOSE that most of the readers of *Wireless Weekly* will have seen at some time or other statements to the effect that moisture is a most prolific cause of trouble in tuning coils, that extreme care must be taken to exclude it, and so forth. The whole matter is one which has always seemed to me well worthy of investigation, and with the aid of the Moullin voltmeter method for determining signal strength, I have recently been carrying out a long series of simple tests which are designed to determine to what extent damp is dangerous, in what types of coils it is most harmful, and to what extent the effect can be mitigated by the means of impregnations of different types, and so on. The results have been exceedingly striking, and have proved a considerable surprise to me, so that I believe an account of some aspects of them will prove of general interest.

Proposals

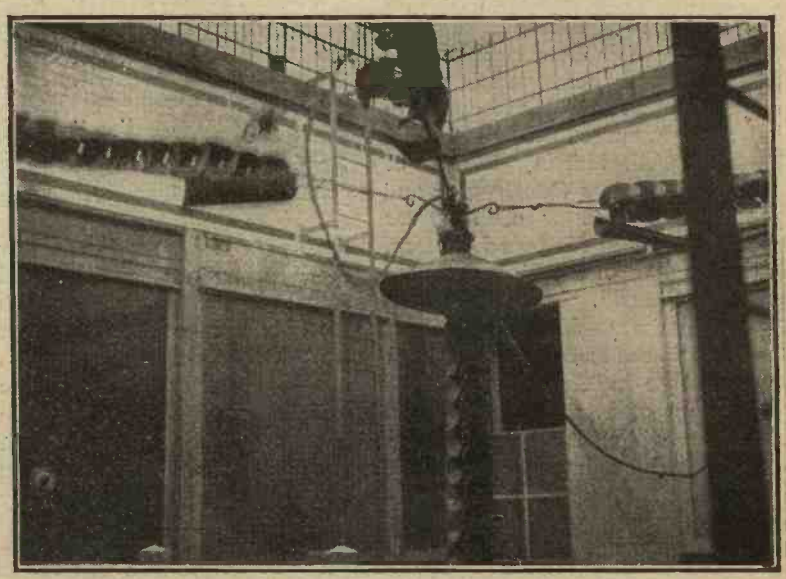
I propose in this article to give a description of certain selected experiments which will show the effect produced by damp in some typical forms of coils, from which I believe the reader will be able to derive some useful information, and which seem to me to decide fairly definitely several of the points at issue.

Experiments

The actual experiments under consideration were of an extremely simple nature, consisting merely of the choice of typical specimens of the various kinds of coils, their exposure to different conditions as regards dampness or dryness of surroundings, and the measurement of the signal strength which was obtained from a more or less constant transmission, comparison being made with a given standard coil in unvarying condition. The exact procedure in each case was to measure the signal strength obtained with the coil in the normal condition represented by its state after exposure for some days to the air of a living room in which a fire was constantly burning, after which the coil was baked for some hours in as hot an oven as the former upon which it was wound would stand, signal strength being then measured.

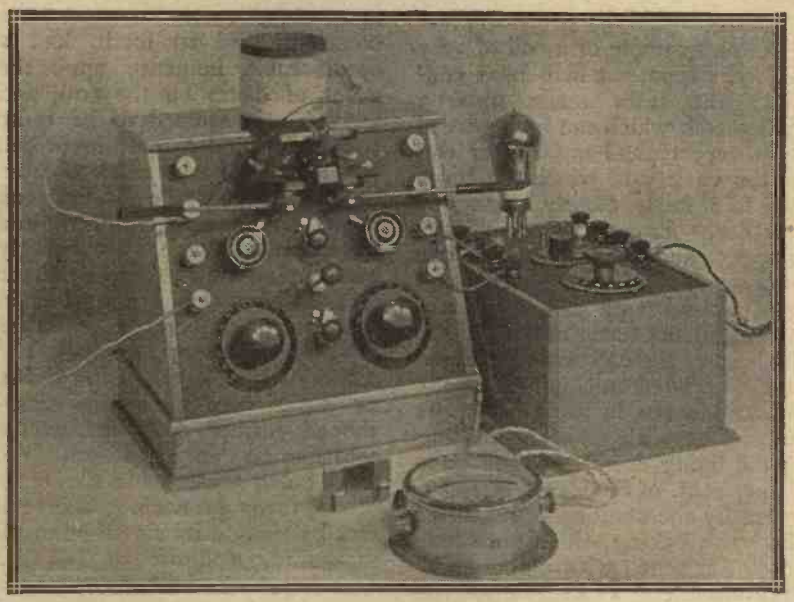
Exposure

The coil would then be exposed to either the air of a somewhat damp and unused room for some days, or in some cases to the outdoor air in damp weather. In either case, the signal strength was measured, with the coil in its damp condition. No attempt was made to determine the actual weight of moisture absorbed by a given coil under varying conditions, since the object was to determine to what extent actual signal strength would be affected by possible working conditions, or conditions to which a coil might conceivably be exposed in the intervals of its use.



The lead-in at the Eiffel Tower station seen from the interior of the building.

Mr. Kendall describes in this contribution a series of experiments undertaken in an attempt to settle some of the vexed questions concerning the effects of damp in inductance windings. His conclusions will be found to possess a very definite practical value to every experimenter.



The actual apparatus used by the author possesses various refinements, but the measurements can be carried out with extremely simple appliances.

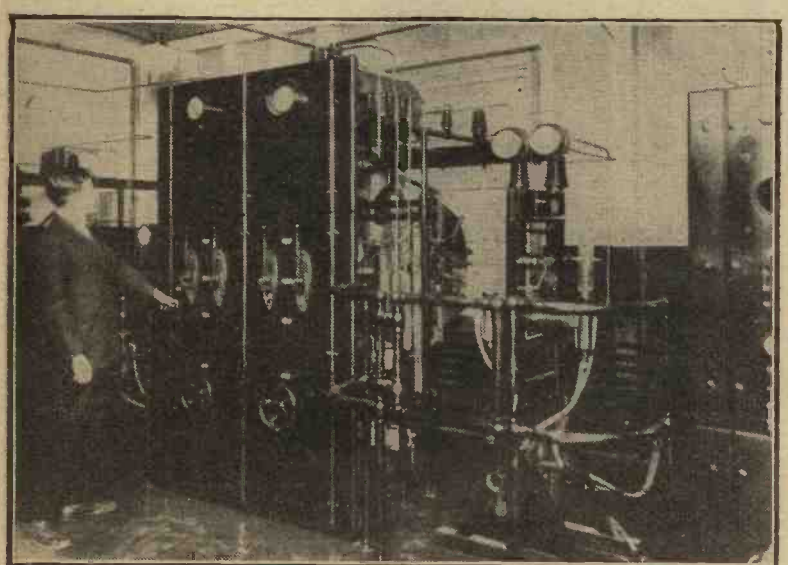
Before commencing upon these experiments, it was necessary to determine what type of covering should be adopted for the investigation, and since double cotton is the form of covering in widest use, this was decided upon, silk being rejected for the reason that inquiry in textile circles showed that silk absorbs considerably more moisture than cotton under given atmospheric conditions. Enamelled wire, of course, is practically impervious to the effect of even a considerable amount of moisture, and does not enter into our calculations.

First Specimen

The first specimen to be experimented upon was a simple basket coil wound upon a thin cardboard former, the former itself being damp-proofed by lightly varnishing. The coil consisted of 60 turns of No. 24 d.c.c. wire, which was, of course, left without impregnation. The coil was left exposed to the air of a moderately dry living room for one week, the signal strength given by the coil was then compared with that of the standard coil which was used throughout these tests, and it was found that adopting the convention that the standard gave 100 per cent. the basket coil gave 102 per cent. The coil was then thoroughly baked, and signal strength again measured, the figure now obtained being 109 per cent. There was no perceptible change in the condenser reading when tuned to the standard transmission.

Exposure to Weather Conditions

Since the gain was represented by only 7 per cent., it began to appear that in the case of this particular coil at any rate, moderate amounts of dampness did not have very serious effects, and accordingly for the next test the coil was submitted to somewhat more severe conditions. It was exposed to the outer air of a cold and misty day in January for 24 hours, and signal strength again measured. It had now fallen to 78 per cent., and the condenser reading had altered by 2 degrees, the condenser being one of .00075 μF capacity, connected in series with the coil and aerial and earth. Although this loss of signal strength may seem a fairly serious one, nevertheless it was very much less than has been obtained with other types of coils under similar conditions, and it was therefore decided that this type of coil was one in which damp did not have very serious effects, unless present in very large quantities, certainly larger than those which were likely to be met with under ordinary working conditions. In justification of this conclusion, it should be mentioned that coils which, after exposure to outdoor conditions of the type mentioned, give a signal strength of 70 per cent. or over when compared with their possible signal strength in a thoroughly dry condition, do not as a rule suffer anything serious in the way of diminution when exposed to any normal indoor conditions.



The main transmitter at the G.E.C.'s station at Schenectady, New York.

A Lattice Coil

As an example of a coil of very different type, we will next consider the tests made upon a lattice coil, which can be regarded as a very typical multi-layer coil of the variety in which the turns are laid fairly closely upon one another, cross in numerous places, and press upon one another fairly heavily. This coil was wound with No. 26 d.c.c. wire, and the turns numbered 58. As before, the coil was connected in the aerial circuit, with a .00075 μF condenser in series. In its normal condition, after keeping in the living room, this coil gave 84 per cent. of the signal strength given by the standard, and, after thorough baking, this figure rose to 96 per cent., with a change of approximately 1 degree in the condenser reading. (This change in condenser reading appears to be some indication of the change in capacity of the coil, due to the presence between the turns of moisture with its high dielectric constant.)

Signal Strength

The coil was now exposed to the same damp outdoor conditions (approximately) as the first coil, again for 24 hours. The signal strength now fell to the extraordinary figure of 2.2 per cent. and the change in condenser reading was no less than 8 degrees. It appeared from this test that the coil was extremely sensitive to damp, and it was therefore once more baked, the signal strength checked, and then placed in a moderately damp disused room, and left there for a period of four days. The signal strength reading was now 49 per cent., this being a discrepancy of 4 degrees in the condenser reading from the figure given when the coil had been specially baked.

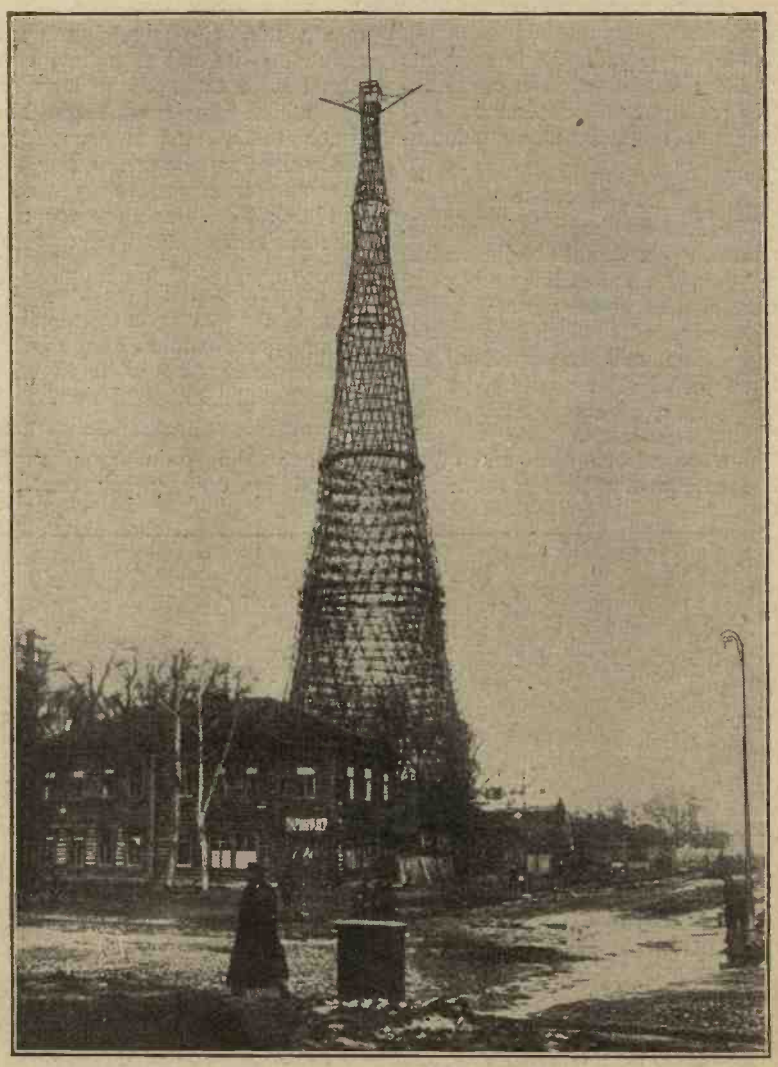
Conclusions

From these figures it will be seen that a multi-layer coil of this general type is extremely sensitive to damp, and the statements with which we are familiar as to the evil effects of moisture are fully justified in this case.

As a result of this test, and several others upon similar types of coils, I gathered the impression that the actual tightness with which the turns were laid upon one another, the number of crossings and so forth, had a considerable influence upon the effect of damp on the coil, and therefore it seemed to be quite possible to find a multi-layer coil which would be no more affected by damp than the basket coil which has been mentioned, and experiments were accordingly made upon one of the multi-layer cross-coils, which I described in a recent number of *Wireless Weekly* (February 11 issue). The coil consisted of 60 turns of No. 24 d.c.c. wire upon the cross-shaped former described in the contribution in question, the turns being arranged in six layers of 10 turns in each. This coil was baked and its signal strength measured, a figure of 122 per cent. being obtained, by comparison with the standard coil.

A Further Test

It was then kept in the living room for a further four days, and the signal strength was found to have fallen to 118 per cent., no perceptible difference being discovered in the condenser reading. This seemed promising, and a more severe test was then applied of 24 hours' exposure to the outdoor air of a misty January day. At the conclusion of this test there were actually beads of moisture in one or two places upon the coil former, and yet the signal strength obtained was still 82 per cent. of the standard. The day upon which this test was carried out was distinctly moister than usual, and therefore it was felt that the coil had turned out exceedingly well in this particular test. It was next baked once more, signal



The Tower of Shablovka, which acts as one of the masts at the Moscow broadcasting station.

strength checked, and placed in the damp indoor conditions for four days. At the conclusion of this period the signal strength was found to be still 114 per cent. of the standard, no change in the condenser reading being noted. It is to be observed that the difference in condenser readings, even after exposure to the outdoor conditions mentioned, was only between 1 and 2 degrees.

A Single-Layer Coil

Finally, experiments were conducted upon a single-layer coil consisting of 50 turns of No. 22 d.c.c. wire, wound tightly and closely upon a 3-in. diameter ebonite tube. This coil, after prolonged exposure to the air of the living room in which all the coils were tested, gave a signal strength of 118 per cent. of the standard, and, after baking, this figure rose to 132 per cent., with a just perceptible change in the condenser reading. The coil was then given four days in the damp indoor condition, whereupon signal strength fell to 96 per cent., with a change of 2 degrees in the condenser reading. It was therefore seen that this particular coil is one in which the effects of damp are only moderately serious, and other tests upon similar coils have confirmed this as a characteristic of the single-layer type. In general, if a single-layer coil is wound rather loosely and without close packing of the turns together, damp is not so serious in its effects as in most other types.

Conditions

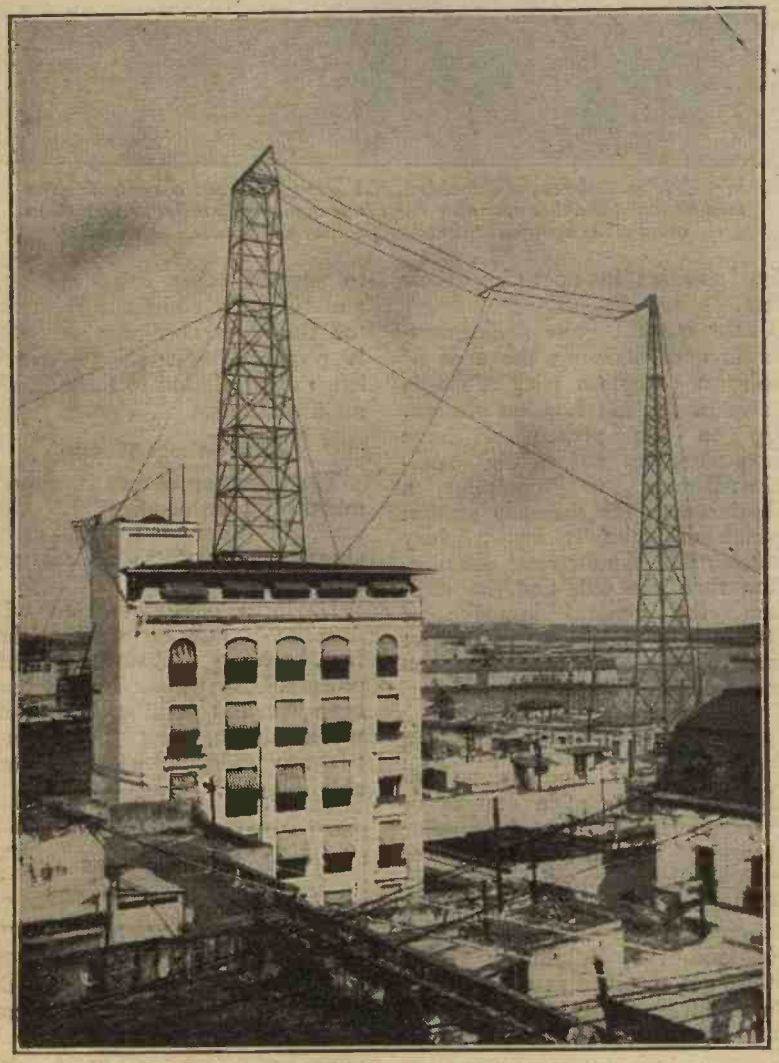
The experiments which have just been described were all carried out under closely similar conditions, in the course of a few days, and therefore the comparative results may be regarded as a fairly good guide to the characteristics of each particular type of coil. A considerable variety of other tests have been undertaken and have confirmed in a general way the results of those we have just been considering; but, of course, it has proved a decidedly difficult matter to secure anything like uniformity of conditions.

Loose Turns

The conclusions to which I have been led by this work may be summarised thus: in a coil in which the turns are comparatively loosely arranged, where they do not press at all heavily upon one another, and possibly only touch each other at intervals, the effects of moderate amounts of damp are not really very serious, and it is arguable that it is by no means necessary to impregnate the covering with any damp proofing material, such as shellac varnish or paraffin wax, bearing in mind that it is usually considered that such impregnation is extremely harmful from other points of view. For an example of a coil of this general type, observe the figures given by the cross coil mentioned, and for a less favourable example refer to the basket coil upon which experiments were carried out. (This particular basket coil had been wound rather loosely.) Where, on the other hand, the coil consists of a number of layers, possibly super-imposed in some fashion which causes the turns to press tightly upon one another, with very numerous points of contact, as in the lattice coil considered, damp is indeed a most formidable enemy.

A Final Remark

A final word as to the figures given by the different types of coil: it should not be thought that the figures obtained with each coil enable the reader to compare the merits from the viewpoint of actual signal strength of the various types mentioned, since to enable such a comparison to be made fairly it is necessary to adjust the inductance of all the specimens to approximately the same value, and this was not, of course, done in this case, since all that was desired was to obtain a series of readings for the same coil under different conditions of dampness.



The masts and aerial at WKAQ, the broadcasting station at San Juan, Porto Rico.

Reception Conditions Week by Week

By W. K. ALFORD.

Review of reception for week ended May 3.

RECEPTION generally has suffered very greatly during the week owing to the prevalent thundery weather which has also brought to the fore the apprehension of a great many people as to the "attraction" for lightning caused by an aerial.

As I said in a recent Broadcast talk, this apprehension is quite unfounded, as an efficiently earthed aerial is more of a protection to property than a danger, and, after all, the fatalistic attitude of some people is even more justifiable than the timidity of others.

Sparks

During the week I have observed sparks, up to one-eighth of an inch in length, passing across a safety gap of a fairly large aerial, which can do quite a lot of damage to coils, etc., in a receiver if left in circuit.

As to the reception of our own broadcasting stations, the heavy "X's" have completely spoilt any enjoyment which might be derived from listening to any of the more distant stations, although the generally agreed excessive amount of S.B. rather damps people's enthusiasm in this direction.

Long-Range Sets

The other evening the Technical Topics broadcast from London ventured on to a very dangerous discussion on the various sets required for long-distance reception, selectivity, and other things. This seems rather a questionable policy, firstly as it will have a direct effect, one way or the other, on the manufacturers of sets who know their market far better than the B.B.C. can ever do, and secondly, the man with what may be termed a "local" set can very often do more in the way of long-distance reception than the man with the "reaching out" set, as the Americans term it, according to their relative abilities in operating their sets.

Mr. Eric H. Palmer, of Brooklyn, N.Y., mapping out a route for the trip he will take this summer for the purpose of studying reception conditions on mountain tops, plains, and in deep canyons.

Last week I gave a diagrammatic map showing the area of uniform reception with a single valve of the old London station. Up to the present I have been unable to obtain sufficient data to compile a similar map for the new station which undoubtedly has a very much more symmetrical distribution than the old, and, in addition, the general increase of strength in almost every district makes the matter of comparison more difficult.

Signal Strength Comparisons

The actual comparison of signal strength of a station of given power with that of a similar station of several times the power at a similar distance away often yields curious results. Thus, at many places in the south of England the Edinburgh relay station is received at roughly the same strength as the Glasgow main station, which I suppose employs about six times the power. The same thing applies to several other relay stations, and the only contributory factor for their extraordinary strength is possibly their shorter wavelengths in relation to those of the main stations.

Ultra-short Waves

The attention of most "experimental" enthusiasts is very strongly directed to the ultra-short waves of 20 metres and less.

Daylight communication with America is now an accomplished fact, using absurdly small powers. Australian signals have been heard at good strength, and we await the first trans-world two-way working with considerable interest.

Marconi-Sykes Microphone

On page 97 of our issue of April 29 mention is made of the Round Microphone at the Rome station. This, of course, should have been referred to as the Marconi-Sykes microphone.

Jottings by the way

The Call of Duty

"DO stay to tea, Mr. Wayfarer," said Mrs. Goop, as I stood chatting with her in the garden at "The Microfarads," after putting in a strenuous afternoon's work with the Professor on the new circuit which is engaging all our spare time at the present moment. "I only wish I could," I replied, taking two steps towards the gate, "but unfortunately I must write my weekly account of the doings of the Little Puddleton club before the post goes." Here I took three more steps, but this time they were in the direction of

. . . *I consumed my third cup* . . .

the front door. "I really could not possibly stay," I said, following her into the hall, "much as I should like to do so. In fact (and here I sat down in a comfortable chair) I have so much work to do that I scarcely like to think about it." "Then don't," said the Professor, coming in at this moment. "Ah, Professor," I said, "if only I had your knack of working quickly I should be able to stay. We slow workers . . . No sugar, thank you, Mrs. Goop." The Professor refused to believe that I was a slow worker, and I had consumed three cups of tea and the best part of a very inviting cake before he was convinced. Then just as I really was going he started a most interesting topic, and I had three more cups.

Coils

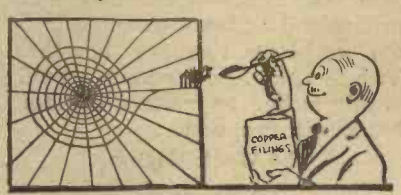
"Have you ever thought much about coils?" asked Professor Goop. I told him that I had; in fact, for weeks at a time I had thought of nothing else. I told him of a scheme that I had once thought out for feeding spiders on copper filings and training them to spin basket coils, and of my other particularly brilliant scheme for obtaining air spacing by winding inductances in the winter time on formers of ice made by filling jampots with water and allowing it to freeze. When the winding was properly completed the former was to be placed in the oven and baked, thus automatically reducing the self-capacity of the inductance to a minimum. I went on to tell him of many others, such as the little idea that I had for self-winding coils.

Wax Dressing

To make these you simply attached a holder for your former to the spindle carrying the hands of a grandfather clock. You then anchored the starting end of your wire and went to bed, leaving the clock to do the rest. There was the idea, too, for obtaining a proper wax dressing for honeycomb coils by placing them, after winding, for a short time in one's beehives. The only time that I tried this the insects went rather too far with the good work, and on endeavouring to make a central tapping I was badly stung by a baby bee, which emerged from one of the cells and fairly set about me, resenting, I suppose, my application of a hot soldering iron. Anyhow, I know how that little busy bee employed one shining minute.

A Miraculous Cure

Talking of bees, I have often been told that their stings are an excellent remedy for rheumatism. I had always been inclined to regard this statement with a certain amount of scepticism until I witnessed one day the miraculous cure of Poddleby. The poor fellow was so doubled up with rheumatism that he could hardly hobble down the garden with the aid of two sticks. Being, as you know, always willing to lend a helping hand I offered to tighten up his aerial for him. Just as I had straightened out the halliards I saw a bee alight on Poddleby's neck. Like a flash, what I had heard about bees and rheumatism came back to me, and as Poddleby's back was turned at the



. . . *Feeding spiders on copper filings* . . .

moment, I was able to give the insect a gentle prod with my pipe. Though Poddleby had been unable to walk for weeks, he leaped at least nine feet into the air, and his run back to the house screaming for the blue bag must have constituted record time for the seventy-five yards welter weight. I would never have believed that any cure could have been so wonderfully rapid.

A New Idea

Let us come back to the Professor once more. Really we have made rather a hole in our manners by leaving the kindly fellow standing so long upon his hearthrug whilst we digressed about bees and things of that kind. The Professor, I gathered, after hearing him talk for some

time, had suddenly been inspired with perhaps the greatest idea ever yet conceived for winding coils of low resistance and small self-capacity. "If," he said, "you wish to reduce the resistance of the wiring of your set, my good Wayfarer, what do you use for making your connections beneath the panel?" "Gloves," I said at once; "I always burn my fingers if I solder without gloves. Those infernal wires get so hot." "Yes, yes," said the Professor; "I am referring, however, not to the method of making connections or to the garments with which it is necessary to clothe oneself.

Square Rod Coils

"What material would you use for connecting terminal to terminal and thingmejig to whatsitsname?" "Oh, square rod," I answered in a flash, for I am very intelligent at times. "Just so," went on Professor Goop. "Now if we use square copper rod for connecting this point to that, why should we not employ the same excellent material for making our inductances?" The idea seemed an excellent one, and the only flaw that I could find was that square rod appears to come into the world in two-foot lengths. Two feet, as I pointed out, would hardly suffice to make a coil for broadcast reception.

The Work Begins

The Professor explained that all we had to do was to solder together end to end as many two-foot lengths as were needed for the purpose. He suggested that we should start at once to make our preparations for the square rod coil. To this I agreed, and we began. The first length was laid down in the Professor's study and we worked gradually down the garden, soldering with the aid of a blowlamp. We then returned to the house and prepared a special low-loss former with notches ¼ inch apart to accommodate the turns of square rod. This being completed, we anchored the "in" end of the windings by soldering it to the shank of the terminal provided. We then made up a neat little attachment by means of which we could fit the former to the spindle of the knife-cleaning machine, which we removed from the scullery and fitted up temporarily by bolting it down to the Professor's writing table. Professor Goop, armed with a pair of gardening gloves, now made ready to feed on the wire whilst I seized the crank.

Winding

I gave two rapid turns, putting my back into it. We athletes seldom realise our own

. . . *Screaming for the blue bag* . . .

strength; apparently I did not in this case, for though the Professor suffered no great inconvenience, poor little Bingo was rather badly lashed by the far end of the wire, which was going on anyhow down at the end of the garden. Eventually, however, by dint of strenuous toil on my part, careful guiding on the Professor's, and discreet retirement to his kennel on little Bingo's, we got the turns safely on. By this time my labours had come to an end, but the Professor was panting hard, for the end of that wire took some holding.

Disaster

Professor Goop now instructed me to hold down the end whilst

. . . *Looking like German students after a duel* . . .

he prepared the soldering iron in order to attach the end to its terminal. I proceeded to carry out this duty, obtaining a good purchase by pressing my foot against the edge of the table.

A Horrid Swishing Sound

Whilst the iron was heating, the Professor applied flux to the wire and the terminal in my hands, with his usual liberality in these matters. Then when green flames were showing, he grabbed the iron, ran about half a stick of solder on to its bit, and advanced to apply the finishing touch. I think that I have told you before that the Professor has a fine free style with the soldering iron. Just before he applied it he looked at me and said, "This is a great moment, my friend." He emphasised his point by a wave of the iron, in the course of which a large blob of solder descended lightly upon my flux-covered fingers, flowing beautifully over them. With a yell I dropped the end of the wire. With a horrid swishing sound it uncoiled, smiting the Professor and myself many a shrewd blow as it did so, and fairly played havoc in his study.

Once Bitten, Twice Shy

At the present moment we both of us look like German students who have recently fought a duel, or schoolboys after their first shave. On the whole, I do not think that I am going to wind my next set of inductances with square rod. The Professor has vowed to have another try, and has, I believe, booked Poddleby's services. That, I should think, would finish off the good work begun by the bee.

WIRELESS WAYFARER

The Marconi International Marine Communication Co., Ltd.

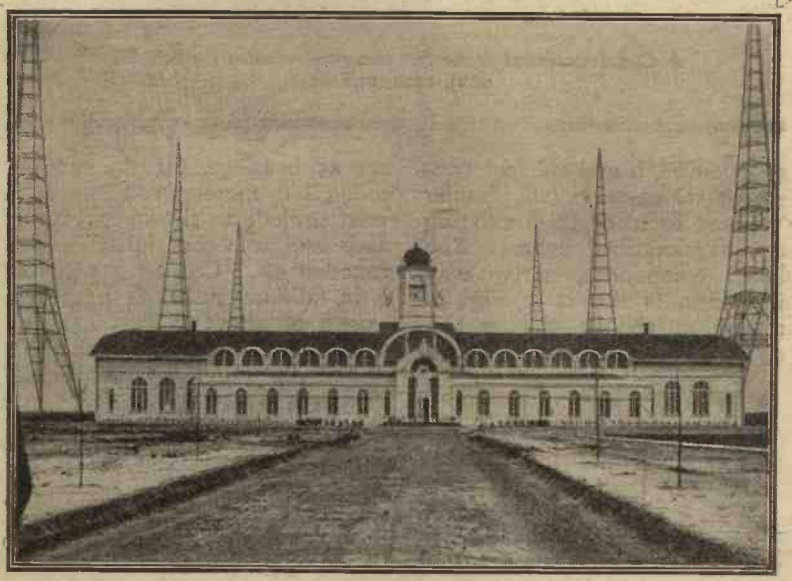
This year the Marconi International Marine Communication Co., Ltd., celebrates its 25th anniversary. Its influence has been world-wide, and there are now few ships of importance that are not fitted with wireless apparatus for commercial and navigational purposes.

The R.S.G.B.

An informal meeting of this Society will be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 6 p.m. on Wednesday, the 13th May, when Mr. R. H. Kidd, B.A., will open a discussion on "An Attempt at Quantitative Experiments on Modulation." Members of the R.S.G.B. and its Affiliated Societies are cordially invited to attend, and a number of seats are also available to the general public.

EARTHS FOR SUMMER CONDITIONS

A note of interest to every listener.



The giant towers at the Lafayette station near Bordeaux are a landmark for many miles.

NOW that the warmer days and (let us hope) drier weather are approaching, the question of the earth becomes an increasingly important one. In winter time reception conditions are extraordinarily good. We do most of our reception during the hours of darkness, the ground is moist and the trees, which later will become full of sap and covered with juicy foliage, are in winter time dry and bare, so that their screening effects are not very noticeable. All this means that quite passable results may be obtained even when the earth connection is not particularly efficient. But as the hours of daylight increase in length it behoves one to pay careful attention to this most important part of the receiving system if the range and signal strength of the set are not to suffer unduly.

A Good Earth

An excellent type of earth which has been advocated by the writer on more than one occasion in *Wireless Weekly* consists of a large biscuit tin or zinc bath buried three feet below the surface of the earth, and immediately under the suspended wires of the aerial. If this is used the soil above it should be made into a

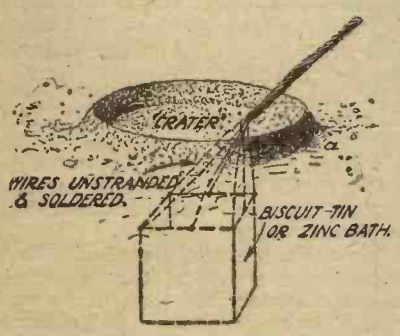


Fig. 1.—A very popular type of earth connection.

kind of little crater (Fig. 1), the raised rim being beaten hard with a trowel. The provision of the crater makes it easy to keep the earth moist even in the most torrid weather. It should be filled with water at frequent intervals, and one can feel confident that this water will soak down to the place where it is most required. The earth lead should consist of heavy stranded cable, and it is probably preferable that it should be insulated until it reaches the surface of the ground. At this point the wire should be unstranded, each strand soldered separately to a different part of the biscuit tin or bath.

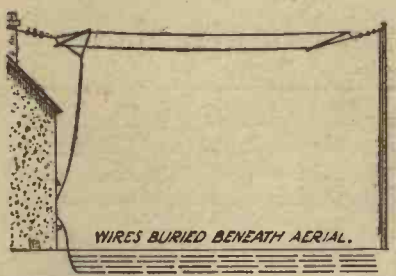


Fig. 2. — Another good earth consists of buried wires beneath the aerial.

Buried Wires

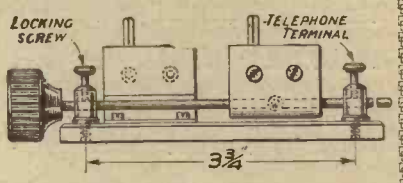
An earth system which is very little affected by drought, and is therefore particularly suitable for summer use, is that shown in Fig. 2. Here from two to six bare wires, each rather longer than those of the aerial, are buried immediately under it and about six inches below the surface of the ground.

As a rule it will be found sufficient to use two buried wires spaced as suggested, but in certain cases results are improved by adding others in between them.

R. W. H.

A USEFUL TWO-WAY COIL HOLDER

A Constructional Note for the reader who makes his own components.



A USEFUL and efficient two- or three-way coil holder may be made from existing parts, as described below. The finished component, a two-way coil holder, is shown in Fig. 2. First cut an ebonite base, 2½ in. x 4½ in. x 3/16 in. or ¼ in. thick.

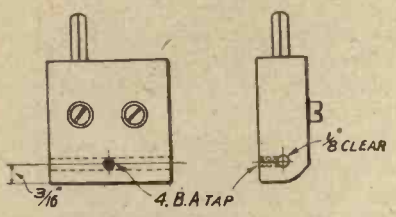


Fig. 1.—Showing how the socket for the moving coil is drilled.

Mount a fixed coil holder in the position indicated. Next mount two telephone terminals, which act as bearings for the moving coil. The moving coil socket is next drilled, as shown in Fig. 1, and one of the lower edges rounded off. Cut off a piece of ⅛ in. diameter brass rod to a length of about 7 in. The rod should be a smooth fit in the hole drilled in moving coil socket.

Two Actions Possible

One end of the rod is equipped with a small ebonite knob, the other end being passed through the hole in one telephone terminal. Pass the rod into the moving coil socket and secure by means of a 4B.A. screw, the rod passing finally through the hole in the other telephone terminal. The moving coil has two actions, one a radial action operated by the

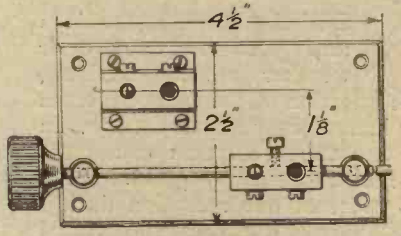


Fig. 2.—Plan and elevation diagrams showing constructional details.

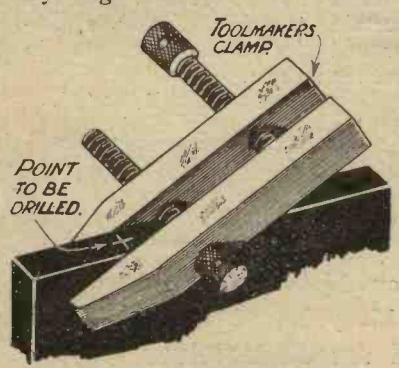
ebonite knob, and the other a sliding action operated by pushing the rod backwards or forwards through the telephone terminals. The moving coil may be firmly locked in any desired position by tightening up the telephone terminal screws. The finished coil - holder, though simple in construction, is quite satisfactory in use. H. B.

□ □ □

Drilling the Edge of an Ebonite Panel

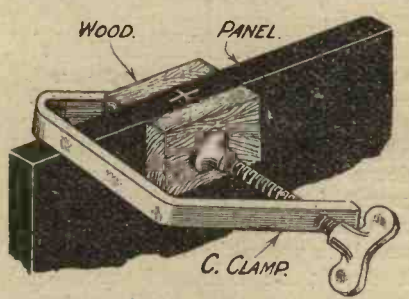
A VERY awkward job that may require doing at some time is to drill a hole into the edge of an ebonite panel. Even if the greatest care is taken the panel is liable to split, and the process becomes more risky if it is necessary to tap the hole.

There is, however, a method by which a hole can be drilled at the very edge itself of the ebonite



The use of a toolmaker's clamp.

without any risk of breakage. First mark the position at which the hole is to be drilled with a pair of dividers or a scriber, then take two small pieces of wood and clamp them tightly on each side of the place where the hole is to



This arrangement may be used when it is not convenient to clamp the panel in a vice.

be drilled. If the hole is at the end of the ebonite the clamping can be done in the vice, but if a large panel is being drilled with the hole somewhere in the centre then a C clamp will be required.

No Risk of Splitting

This should be well tightened and the hole can then be drilled and tapped without risk of splitting the ebonite. If the amateur happens to be in possession of a pair of toolmaker's clamps, then the pieces of wood can be discarded and the clamps tightened straight on to the ebonite itself. The sketches show the two methods outlined above and should remove any possible doubt as to the method to be employed.

C. P. A.

The "A.A. Six" in South Africa

SIR,—Since seeing the articles by Mr. Percy W. Harris on the Anglo-American Six in the January and February issues of *The Wireless Constructor*, I was tempted to build this set.

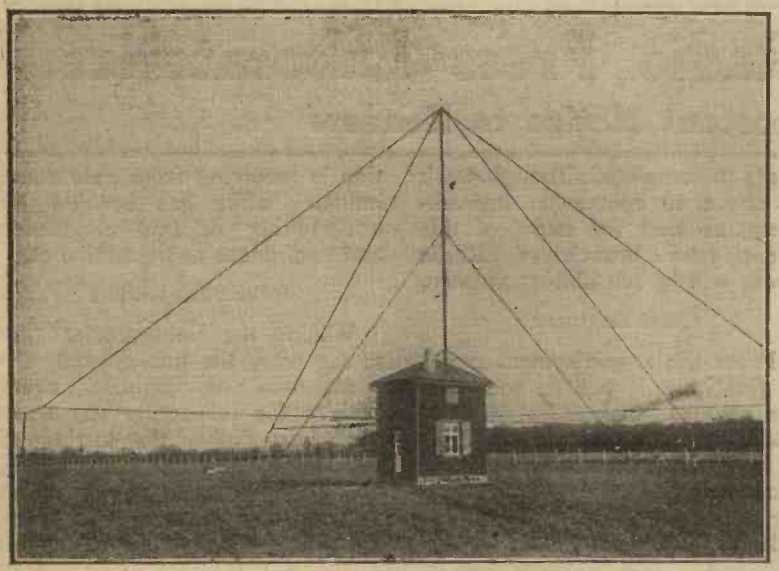
I have, however, been compelled to make many of the parts for it myself, as they were unobtainable in South Africa.

Up to the present I have had little opportunity of testing the receiver, but on February 18, 1925, at about 12 o'clock, I tuned in either London or Bournemouth.

Time does not permit me to give you further details by this mail.

Thanking you for a most excellent receiver, and wishing *The Wireless Constructor* every success.—Yours faithfully, H. ATKINSON.

Cape Town, S.A.



The receiving station at the Basle Aerodrome, Switzerland. A photograph of the transmitting aerial is given on another page.

How to Make a Cheap and Efficient Aerial Mast

By B. BRAMWELL.

A STRONG and reliable aerial mast may be made cheaply on the lines indicated below and illustrated in the accompanying diagrams.

Buy seven or eight cuttings of suitable size of ordinary wrought iron tubing of "black" quality, these being obtainable in any metal scrap yard. The most suitable sizes are 3 in. dia., 2 in. dia., and 1½ in. diameter.

Piece these together, as shown in Fig. 1, using short-cut lengths of suitable sizes to form spigots for joining the larger tubes together. These spigot pieces should be about 18 in. long.

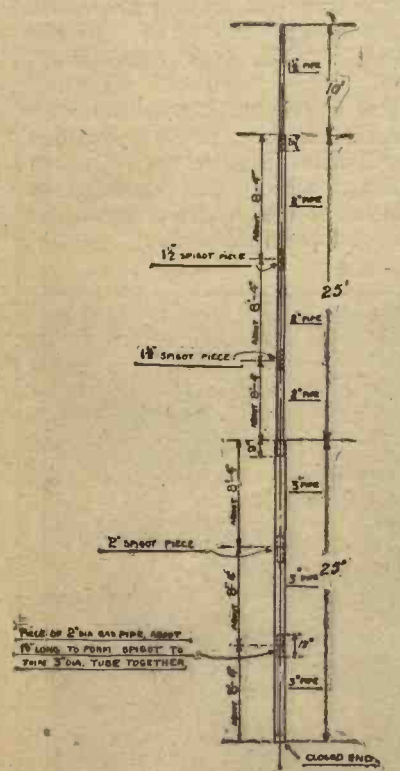


Fig. 1.—Illustrating how spigots are used for joining the larger tubes.

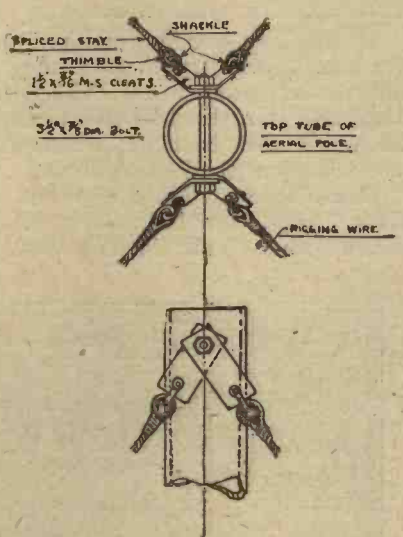


Fig. 2.—Showing how stays may be attached to the mast if desired.

An Example

When the pole is built up with the spigot pieces in place, plug up one end and fill up with concrete grout, the mixture consisting of about four parts sand to one part cement by volume.

For example, to make a 50 ft. or 65 ft. pole use three pieces of 3 in. diameter tube so as to make up a length of about 20 or 25 ft., three pieces of 2 in. diameter tube to make up a length of about 25 or 20 ft., and one length of about 10 or 15 ft. of 1½ in. diameter.

Stays

For attaching stays drill a 7/16 in. diameter hole, for a ⅜ in. bolt in the top of the 1½ in. diameter piece, attach the small cleats for the stays to the pole with the ⅜ in. diameter bolt through the hole, as shown in Fig. 2.

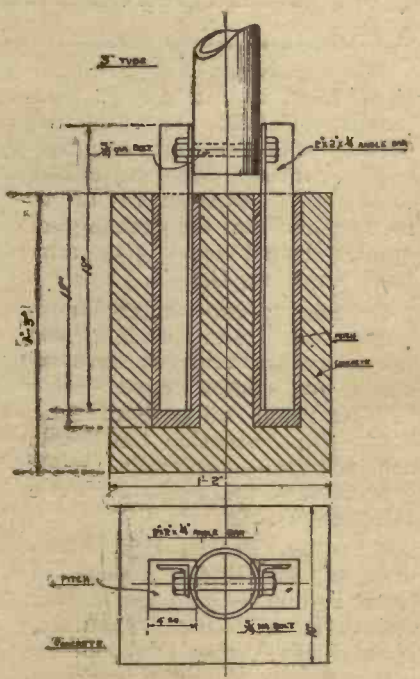


Fig. 3.—The fitting of a hinge to the base of the mast allows for easy lowering.

In order that the pole may be taken down for painting, etc., the

(*Continued on page* 182.)

Great New Radio Press Laboratories

An Important Notice to Readers

RADIO PRESS, LTD., the proprietors of numerous radio publications, including *Wireless Weekly, Modern Wireless,* and *The Wireless Constructor,* have purchased the freehold of seven acres of land at Elstree (twelve miles north of London), as the site for new wireless laboratories which they are establishing for technical development, research work, testing and measurement, and the efficient design of wireless apparatus.

These new laboratories are to be carried on as part of the policy of producing original designs and the placing of technical data on the soundest possible basis. The laboratories in the earliest stages will cost in the neighbourhood of £20,000, and the full scheme will take three years to complete, although work is about to commence immediately, so that the effect of this great new branch of Radio Press will be felt almost at once.

Chief Engineer

From the advertisement pages of this issue it will be seen that the post of Chief Engineer to take charge of these laboratories is offered, the salary being £2,500 per annum. Applications for junior posts will also be considered, but only those highly qualified in the technical side of wireless need make application.

This great new enterprise is to be carried out solely to ensure for many years to come the supremacy of Radio Press in their field of activity, and only the great support this organisation is receiving from public and industry alike has enabled an undertaking of this magnitude and usefulness to be carried out.

Public Inspection

When the laboratories are under way, the public and the trade will be afforded every facility for inspecting the work of Radio Press, the testing of sets, the development of designs, and all its other activities, which will include the carrying out of accurate measurements in all phases of wireless work. The ensuring of development in designs and circuits will do much to maintain and increase interest in radio, and the industry will derive great benefit, as well as those who read Radio Press publications.

□

RADIO NOTES AND NEWS

We understand that on Saturday, May 2, Mr. E. J. Simmonds, G2OD, of Gerrards Cross, established two-way daylight working with Australian 2CM on a wavelength of 20 metres, and that the exchange of signals lasted from 5.52 a.m. until 7.15 a.m. G.M.T.

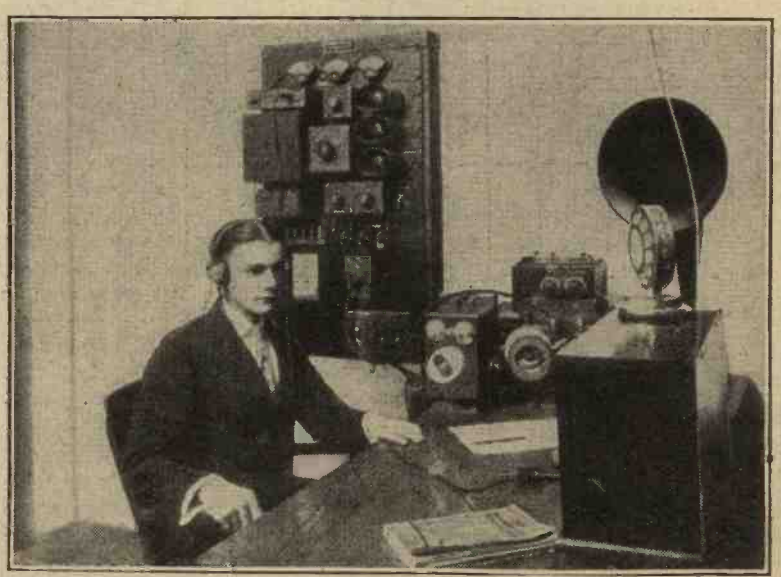
On Sunday two-way communication was re-established, and the following messages were received and acknowledged :—

"To Prime Minister of England,—On occasion of this achievement — Australia sends greetings. (Signed) Prime Minister of Australia."

"To Dr. Eccles, Past President of the Radio Society of Great Britain,—Greetings to your society from Wireless Institute, New South Wales Division, by first 20-metre daylight working. (Signed) Machercan, President."

G2OD sent the following message: "Greetings to Wireless Institute by direct amateur 20-metre working from Radio Society of Great Britain.—Eccles." This was accomplished with a T.250 M.O. valve and D.E.Q.'s for reception.

An amusing and unusual programme is being given from the Manchester Station on Friday, May 29. Mr. Herbert Heyner, the well-known baritone, will be in a frivolous mood and will sing "Half-a-dozen More What Nots," by Sterndale Bennett, and a group of six limericks by E. B. Manning. The 2ZY Orchestra will make merry with such pieces as "The Chicken Reel," "The Jolly Musicians," and the "Village Circus." More merriment, though not of a musical nature, will be provided by Vivian Foster, the Vicar of Mirth, who twice during the course of the programme will be relayed from London.



Mr. Enrique Camunas, the operator of station WKAQ. Some of the apparatus including one of the microphones may be also seen.

Experimenting on Two Metres

By JOHN L. REINARTZ.

In experimenting with these high frequencies Mr. Reinartz has observed some as yet unexplained phenomena, whereby it seems possible now actually to see through metal plates with the naked eye.

THE strangest things imaginable happen when we begin to work a radio transmitter at the ultra high frequencies that lie below the two-metre wavelength band. The experiments to be described were begun only a short time ago, and there are still many points in the collected data which are, so far, unexplained, and many others for which only the merest guesses are at hand.

Peculiar Phenomena

What strange characteristics and phenomena shall we find when we finally reach and are able to control the frequencies higher than 150,000 kilocycles corresponding to wavelengths below two metres? That is

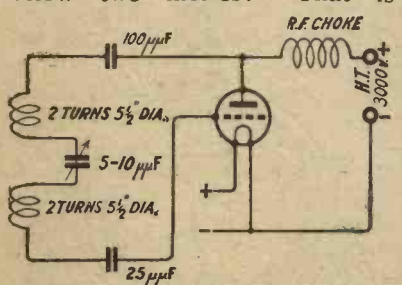


Fig. 1.—A simplied circuit giving the values employed by the author in 5-metre transmission.

the question which will probably be asked when the peculiar effects, obtained by making a half-kilowatt valve oscillate and generate frequencies somewhere in this band, are told.

To start at the beginning: Along with my work on 40 and 20 metres, I have been constantly pushing downward in the wavelength band, seeking greater and greater frequencies. The huge increase in range for the same power input, gained with the use of the shorter waves, leads the experimenter who is after efficiency constantly in this direction.

Mr. John L. Reinartz (centre), who will sail with the MacMillan Arctic Expedition which leaves in June, at his first meeting with Commander Donald B. MacMillan (left) and Commander E. F. McDonald (right).

Experimenting on Two Metres

Some weeks ago, after making my regular transmitter work down to 5 metres, I decided to ascertain how high in frequency it was possible to make the valve oscillate. Accordingly, the clips of the tuning inductances were moved closer and closer to the inside ends of the plate and grid coils and the tuning condenser was moved until the circuit was brought into resonance. The frequency was constantly checked as the clips were moved.

Early Observations

When the aerial circuit was connected to the valve and absorbed the power generated by it, the action of the set was regular in every way. The parts functioned as they should, and everything worked as usual.

But when the aerial and counterpoise were disconnected and removed from the valve, things began to happen which were most peculiar in nature and which, to date, I have not been able to explain satisfactorily.

Refer to Fig. 2, which shows a diagram of the half-kilowatt valve which was used in the experiments. This valve is the standard Radio Corporation product, being manufactured by the General Electric Company. It is rather old, has seen a great deal of service and is of old design.

Valve Construction

About the only point of difference in the form of this valve and those now being manufactured by the company under the same designation is the location and shape of the grid lead, which runs from the element of the valve to the lug at the base which serves to make the outside connection.

The grid connection in question is formed from a small wire of some metal which is used in the regular valve construction. It leads directly from the supporting collar to a larger piece of wire which is carried through the wall of the valve to the base, but it is wound pig-tail fashion. This seems to be of the utmost importance in the results obtained—therefore the detailed description of the difference.

Purple Corona Formed

When the valve was set into operation as described, without aerial or earth, as soon as the plate voltage was applied—in this case 3,000 volts—the first point noticed was a dark blue-purple halo, or corona, which formed itself at both the narrow sides of

the anode, as shown in the sketch. It was not like ordinary brush discharge, in that it seemed a bit thinner and was slightly away from the surface of the anode, there being possibly a sixteenth of an inch between them. The exact nature of the phenomenon

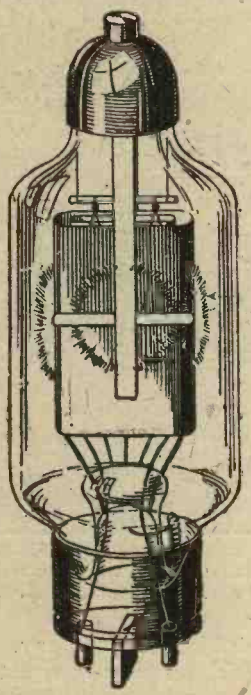


Fig. 2.—Diagrammatic representation of the phenomena referred to in the article. Note the black spot on the anode.

cannot be described accurately. The nearest comparison which may be drawn is that of a spot of very dim blue-purple light seen through a very fine cloth or ground glass screen, with the edges of the spot diffused rather than brought to sharp focus. This was evident on both the small sides of the anode and has persisted in its original form since the first time it was noticed.

Another Peculiarity

The second curious effect was found at the approximate centre of the large side of the anode. Here, as shown in the diagram, another somewhat similar occurrence took place. At first, the spot of light covered a circle about $\frac{7}{8}$ in. in diameter. The characteristics of this light were very similar to the other, except as to the colour, which was more of a pink-purple. It seemed, in other words, to be more of a blue-purple, similar to the first, with a slight tinge of red which was not entirely merged into the other.

From time to time, as the valve was used again and again for observation of the phenomenon, the spot gradually grew in diameter. With the increase in diameter of the spot, the intensity of the glow became less and less at the centre—falling off to total blackness in the centre and stopping abruptly at the circumference.

Visibility Established

But the most important of all was the visibility established through the anode. This was noticed at the same time as the other points, and has given more concern as to explanation. When the valve was put into operation and the light produced at the centre and edge of the anode, simultaneously a spot occurred at the point noted in Fig. 2. It seemed at first to be an incandescent point on the surface of the anode, but investigation proved shortly that such was not the case. In spite of the light that showed on the surface and at the edges of the anode, it remained perfectly cold all during the demonstration.

An Examination

Examination of the spot proved to admit of only one explanation, *i.e.*, that there was a hole through the plate which made the filament, inside, visible! A revolving mirror or various shutter movements before the spot served only to prove this point further. It could be nothing but a hole through the plate made by the emanations from the filament, or some other cause yet to be determined.

One theory which would serve well as an explanation of the formation of the hole is that some parasitic frequency is generated in the valve, when it is operating in the manner described, which has a new and unknown property. It might be rationalised by saying that the emission—whatever its nature—pushes the molecules of the anode metal into some sort of line, thus forming the hole and allowing the passage of the emission.

It is possible that the stream of vibrations from the filament simply crowds the molecules out to one side, in order to make room for their own escape.

Not a Real Hole

Of course, a thorough examination of the anode proves that there is not a real hole in it at other times than when the valve is operating in this strange manner. At five metres, working with or without an aerial, none of the phenomena noted above occur.

A test was made for X-rays with the aid of a dentist's film, and proved the absence of this ray. A number of other tests of the same type were made, but brought negligible results.

Other Experiments

The low wave work led to a number of other experiments which proved exceedingly interesting, if not particularly enlightening. Among the most important of these was the behaviour of a Tungar charger bulb when placed in the high-frequency circuit.

There occurred a number of phenomena in this investigation which are extremely similar to

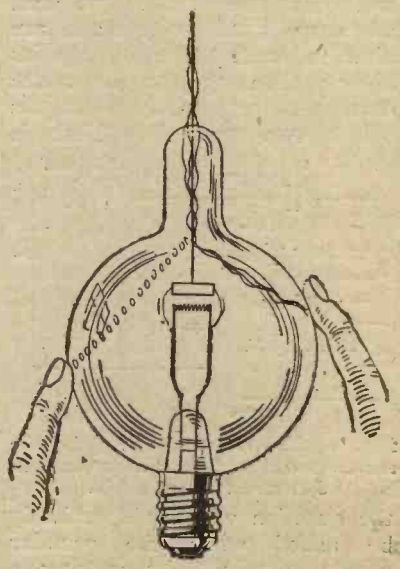


Fig. 3.—Illustrating the effects observed in the experiments with a Tungar charger bulb.

the ordinary Geissler tube discharge, but at the same time have characteristics which cannot be explained by the known laws. The foremost of these is the beading effect shown in Fig. 3. If the finger is placed on the glass of the bulb, a line of current makes its way from the anode or cathode, as the case

may be, to the tip of the finger. If it is gradually moved farther and farther from the elements of the bulb so that the high-frequency current must travel over an increasing path, the stream will gradually form itself into a number of globules or small spheres until, just before the cessation of current to the finger-tip, each of these little balls will be entirely dissociated from the next, while the current is still travelling. The passage of the current is, of course, in the usual form seen in the Crookes tubes.

If a heavy output is employed numbers of bright spots like small stars will make their appearance at points along the elements of the rectifier bulb. What the reason is for such formations is not known. Possibly it may rest in some inherent characteristic of the metal employed in the elements, or it might logically be the result of some electrical cause. The exact determination of the cause is yet to be made.

Visible Passage of Current

One of the most interesting demonstrations, which might well be used in teaching beginners, is the passage of the current along the wires of the elements. It actually *does* pass along the outer surface of them, with the very smallest amount of penetration possible. As a matter of fact, in many instances the current takes the form of a sort of rope, twining itself around the wires and so passing through the bulb.

When holding the bulb in the hand, the current jumps from the elements to the flesh touching the glass, forming a sort of spot, as if making a condenser plate for itself. If the bulb is suspended from the top—near the input terminal—the current will have a tendency to spread out, after the fashion of lightning.

Field Strength

This is the latest branch of the investigation, and has, as yet, scarcely been begun—if the results which may be arrived at are considered.

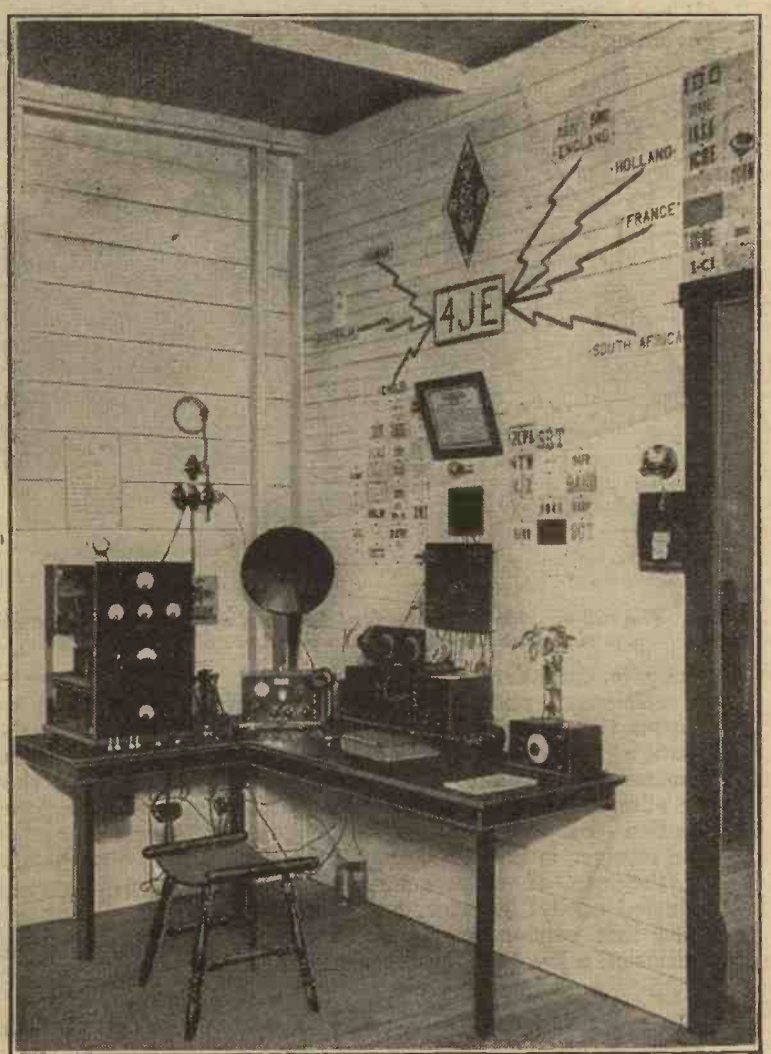
Though it may mean anything or nothing, a test may be made with the same rectifier bulb around the field of the tuning coils of a set working on five metres, which may result in some astounding revelations regarding the location of the maxima and minima in field strength.

Weather Reports by Wireless

AGRICULTURISTS, navigators and airmen derive great benefit from a knowledge of the weather conditions to be expected in their neighbourhood, and the use of wireless for the interception of weather reports is rapidly increasing.

The director of the weather bureau at Rio de Janeiro has just arranged for the installation of wireless apparatus for the reception of the meteorological reports which are transmitted from many of the world's large wireless stations. The receiver is of the Marconi RP 4 B type, which is a special type of portable five-valve receiver. Tuning is effected by means of a single circuit, which makes it extremely flexible and easy to operate. The intervalve coupling employed is the resistance capacity method, and the wavelength range is from 1,000 to 25,000 metres.

A PORTO RICO AMATEUR STATION



The private transmitting and receiving station of Mr. J. Augusty, the announcer at WKAQ.

LOUD-SPEAKER RECEPTION

By STANLEY G. RATTEE, M.I.R.E.,
Staff Editor.

THE receiver to be described is one which fills the need of a simple apparatus which may be operated by any member of the family with a view to tuning in a main B.B.C. station at loud-speaker strength up to distances of about ten miles. Considerably longer distances can be obtained, of course, if telephones are used.

Considerations in Design

The main considerations governing the design are simplicity in operation without loss of efficiency, and for these reasons the difficulties which the average non-technical user of wireless apparatus experiences are eliminated, as, for instance, reaction coupling adjustment. The receiver is further simplified by the use of a permanently adjusted crystal detector, and in order that volume may not be sacrificed, a low-loss coil is used.

Auto-Coupling

In order that the receiver may be selective enough to eliminate local interference for short-wave B.B.C. reception auto-coupling is employed.

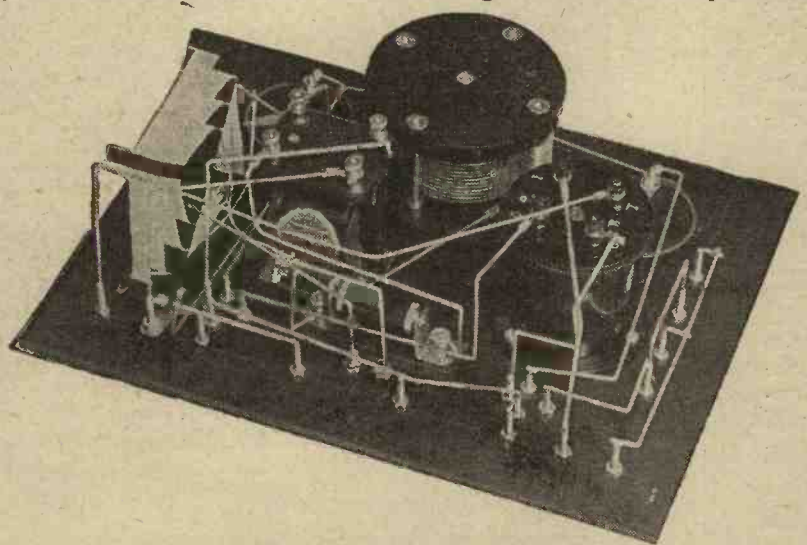
Terminal Arrangements

Two stages of transformer coupled low-frequency amplification follow the crystal, arranged with the necessary separate H.T. terminals for small-power valves to be used if desired; terminals for suitable grid-bias are also provided.

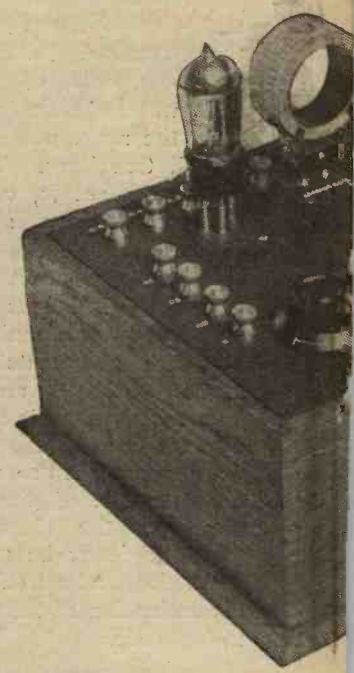
Looking at the centre photographs, the terminals situated along the back of the panel are the various battery terminals marked in accordance with the instructions given in the illustration of the panel layout, whilst those terminals on the left and right sides of the panel are for the aerial, earth and telephone connections respectively.

Simplicity of Control

It will be observed that the only controls which demand the attention of the operator are the two filament rheostats and the variable condenser, the crystal



The components on the back of the panel are disposed with a view to simplifying the wiring, as the above photograph shows.



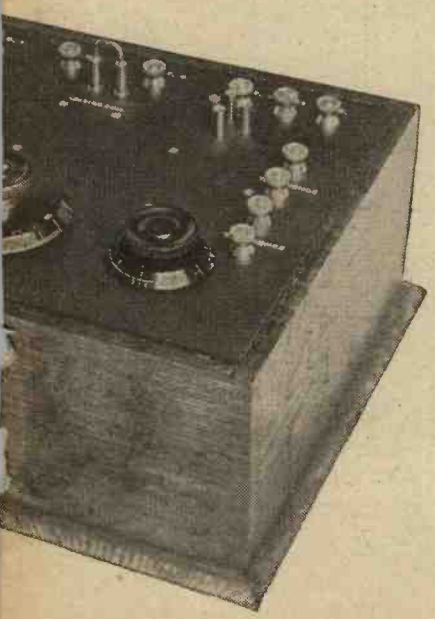
The completed instrument i symmetrical panel layout. Chelmsford is seen insert

In this photograph the valve the socket of the latter no

FROM THE LOCAL STATION

Constructional details are here given for the building of a simple receiver which will allow of the local station being received on a loud-speaker up to distances of about ten miles from a main B.B.C. station

dignified in appearance, due to the A loading coil for the reception of ed in a socket between the valves.



s and loading coil have been removed, v being bridged by a shorting plug.

detector, low-loss coil, etc., all being beneath the panel. The socket in the centre of the panel is for the inclusion of a loading coil when receiving Chelmsford or other stations above 600 metres approximately.

Materials and Components

The receiver as photographed is made up of the following components and materials, and though this list does not necessarily mean that the makes given should be used in all duplications of the set, it is strongly recommended that, where departure is made from this list, the component chosen be of good make and of a suitable value or type to do the work required of it :—

One ebonite panel of guaranteed material measuring 9 in. × 12 in. × $\frac{1}{4}$ in. (Paragon). This may be either matt-finished or polished.

One containing box to take panel and $4\frac{1}{2}$ in. deep.

One H.T.C. fixed detector (H.T.C. Elect. Co., Ltd.).

One variable square law 0.0005 μF condenser (Peto-Scott Co., Ltd.).

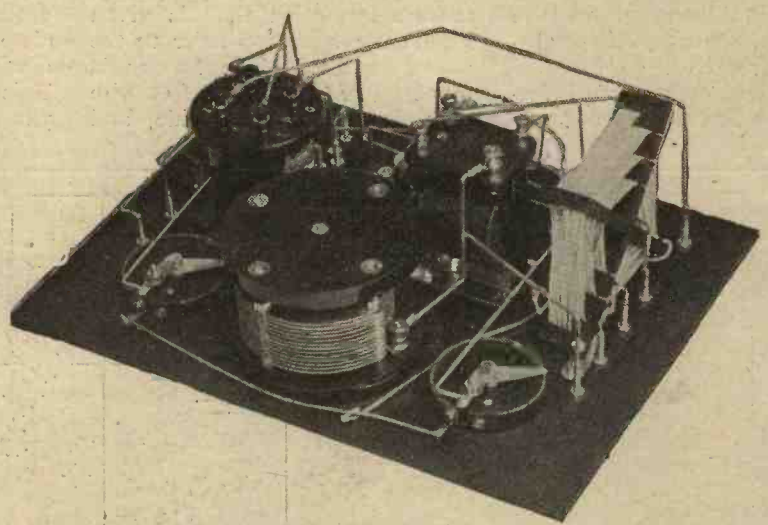
Two dual rheostats (L. McMichael, Ltd.).

Sixteen nickel-plated terminals (Burne-Jones & Co., Ltd.).

Eight nickel-plated valve sockets (Burne-Jones & Co., Ltd.).

One Kendall coil former (Burne-Jones & Co., Ltd.).

One coil socket for panel mounting with short-circuiting plug.



This general back of panel view shows the position of the coil and its method of mounting.

One Super-Success L.F. transformer (Beard & Fitch).

One Powquip L.F. transformer (Power Equipment Co., Ltd.).

Set Radio Press panel transfers.

Half-pound No. 22 d.c.c. wire.

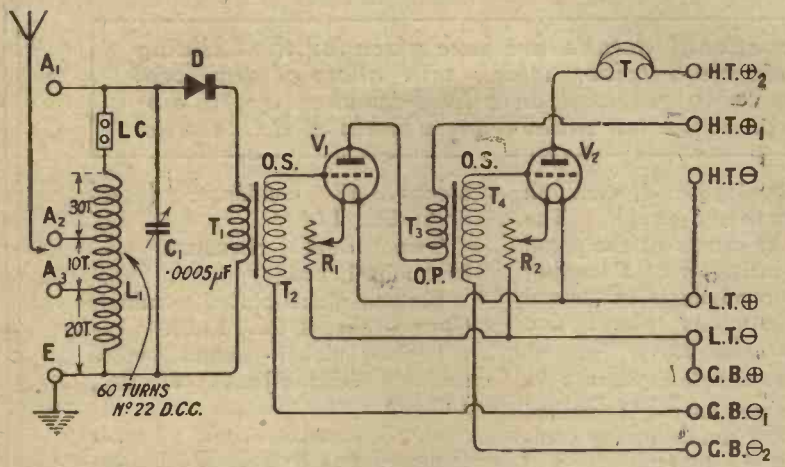
Quantity of square-section or round No. 16 S.W.G. tinned copper wire.

The Coil

The construction of the receiver is extremely simple, and the layout is such that there is easy access to every terminal and

component with even a large-sized soldering iron. Before commencing with the drilling of the panel, however, it is as well to turn attention to the making of the coil, illustrated in the photographs showing the underside of the receiver.

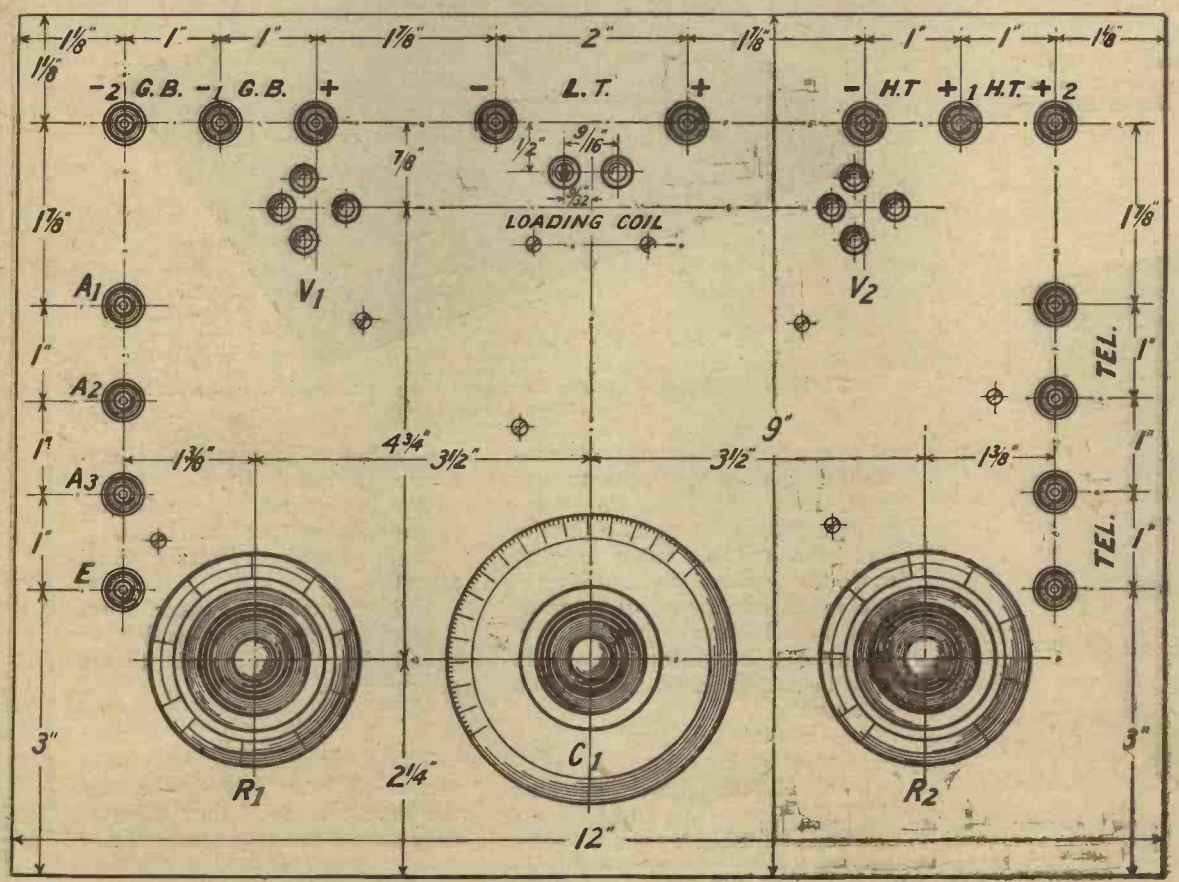
To constant readers of *Wireless Weekly* this type of coil will need no introduction, for its merits and construction were fully described by its designer, Mr. G. P. Kendall, in Vol. 5, No. 17, and readers requiring more information than is given here are advised to refer to the above article. The former is made up of two strips of ebonite 5 in. long and 1 in. wide, and may be obtained completely slotted from advertisers in this and other Radio Press journals. The actual coil in the receiver under description is wound with 60 turns of No. 22 d.c.c. copper wire tapped at the 20th and 30th turns.



The theoretical circuit diagram showing the arrangement of the aerial coil tappings.

Method of Winding

To wind the coil, take the No. 22 d.c.c. wire and secure one end in one of the slots nearest to the centre of the former and proceed to wind round the former, laying each turn in the slot of each arm nearest to the centre until ten complete turns have been wound. With this done, cross over to the next slot on the opposite side of the former and proceed to wind a further ten complete turns, when a tapping should be made by making a loop and twisting the wire round so as to make it secure. Next proceed to wind ten more complete turns in the third slots and again make a tapping as before. This constitutes the last tapping, so proceed to wind the



All necessary drilling dimensions are included in the above diagram of the panel layout. Blueprint No. 116a.

remaining turns ten in each slot until 60 turns complete the coil, the end of the winding being secured by threading the wire through one of the small holes provided on the former.

Fixing the Coil

In order to secure the complete coil to the panel, the most convenient method so far available is the use of two small brass strips and 6 B.A. screws and nuts, as will be seen upon inspecting the photographs showing the underside of the panel.

The Layout

The panel upon which all the components are mounted is, as previously stated, 9 in. × 12 in. × ¼ in., and is drilled in accordance with the instructions given in the dimensioned drawing. Should the reader choose makes of components other than those given earlier, it is as well to lay these out upon the panel before commencing the drilling in order to see that sufficient clearance is given for the moving vanes of the condenser, etc. Again, should the reader choose to use a cat-whisker type of crystal detector, this should, of course, be mounted on the upper side of the panel, when it may be necessary to move the loading coil socket a little nearer the back edge of the panel.

Wiring Up

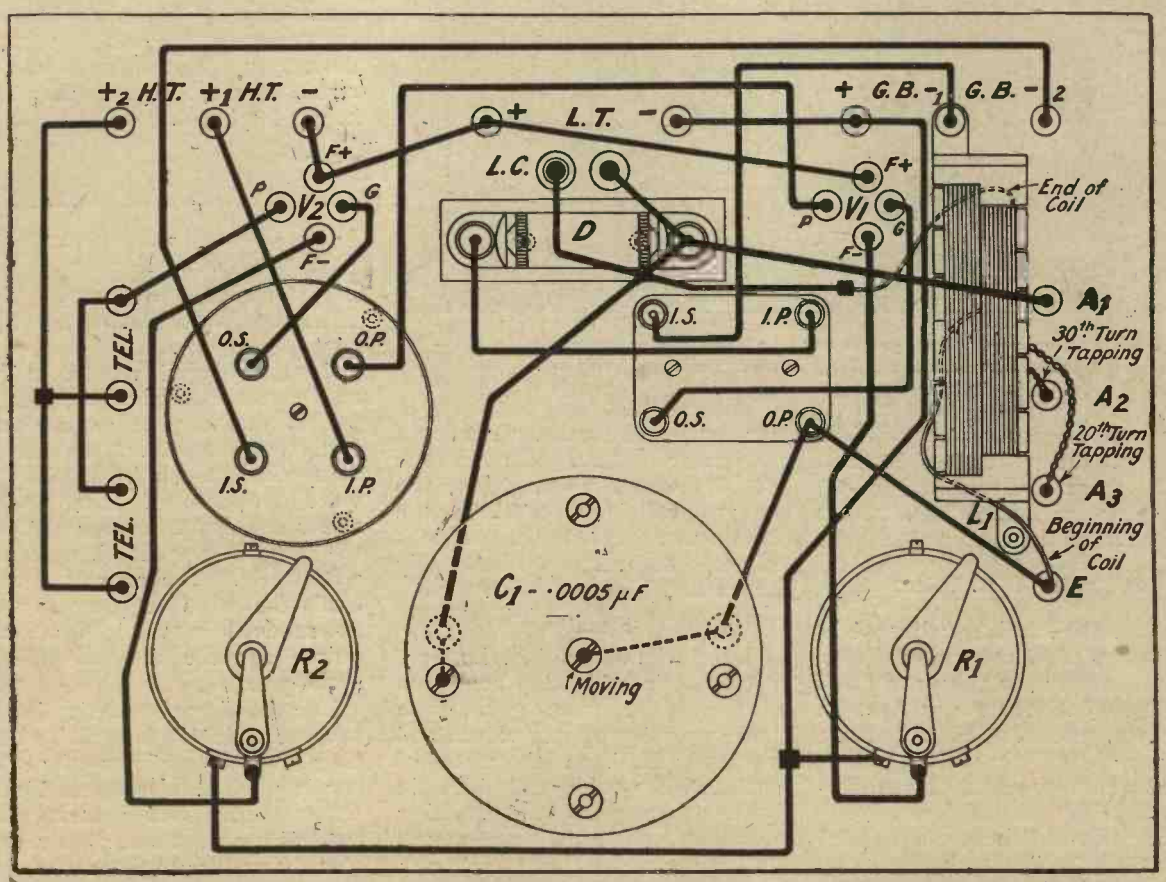
The wiring of the receiver is perfectly straighforward, and so long as the lead which connects the two filament resistances to the L.T. negative is fitted first of all, the remaining connections are easily accessible.

All connections should be kept as short as circumstances will allow and should be well spaced. Those readers who desire to make their connections by securing them with nuts and washers may of course do so, though soldered joints are much to be preferred.

The connections to the low-frequency transformers as shown in the wiring diagram are the best arrangement for the two makes chosen, and should other makes or make be favoured by the reader, then some experimenting with the IP; OP, IS, OS connections may be necessary in each case.

Battery Connections

If the reader does not care to go to the expense of power valves, then the ordinary general-purposes valves may be used even with voltages up to 120 or more so long as attention is given to grid-bias values for the clearest and best results. When connecting this battery to the receiver, the positive connection is made to the G.B.+ terminal of the receiver, whilst the G.B. – 1 terminal (which is connected to the grid of the first valve through the secondary winding of the first L.F. transformer) should be connected to the 1½- or 3-volt tapping with 100 volts H.T. The G.B. – 2 terminal applies to the second L.F. stage and should be connected to the 3- or 4½-volt



The wiring diagram which should be followed carefully when connecting up. Note specially the coil tappings arrangement. A full-size Blueprint, No. 116b, may be obtained, price 1/6 post free

tapping. The three H.T. terminals on the right-hand side of the receiver are connected H.T. – to negative of battery; H.T.+1 is connected to about 100 volts and H.T.+2 to, say, 120 volts. The best values for both batteries for purest results will, of course, be found by experiment, and will vary in all probability with each different valve tried.

Operating

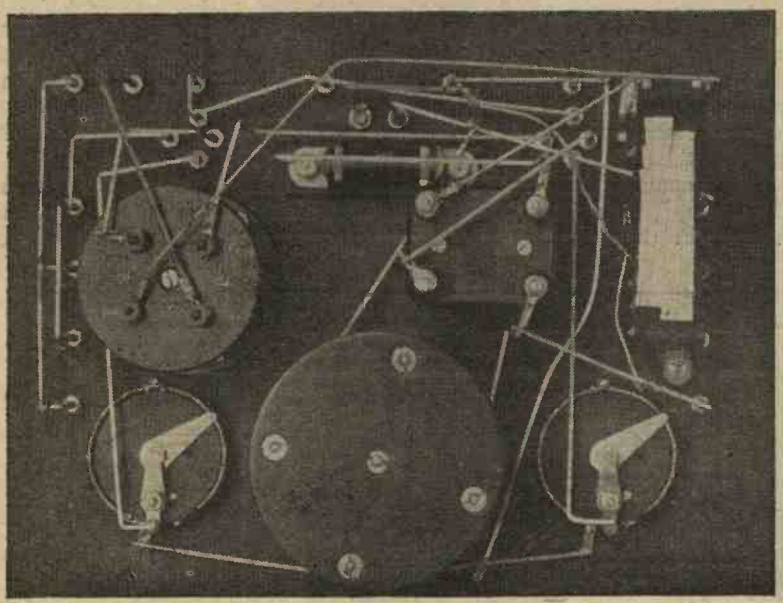
With the receiver completed and the batteries connected in the manner suggested, turn the filament resistances to the off position, insert the valves, connect the telephones, place the short-circuiting plug in position, connect the earth to E, and with the aerial connected to A3, tune for the loudest result from the local station.

Adjusting H.T. Voltage

With the receiver adjusted in this way, experiment should now be made with the values of H.T. and grid bias for the purest and loudest results. Should there be any difficulty in understanding how best to go about this adjustment of voltages, then the reader should make a careful study of the instructions usually given with the wrappers of the valves or else consult the characteristic curves of the particular valves in use. Further, some brief notes upon "How to Use a Power Valve" appear in the current issue of *Modern Wireless*.

The Aerial Connection

The best results having been obtained with the aerial connected to A3, the other connections should be also tried, always retuning on the variable condenser. As the best position for the aerial and earth connections will differ with different aerials the set is tried on, it is obviously a matter of experiment for the reader to find out which are the best positions for aerial and earth with his own particular system. In the case of Chelmsford when a No. 100 or 150 coil is inserted in the loading coil socket, the positions of aerial and earth will invariably be A1 and E respectively.



This back of panel photograph may be used advantageously in conjunction with the wiring diagram when wiring up.

Results

Using the set in S.E. London, a district in which the new 2LO station is far from good, with two general purposes valves and 120 volts H.T. on the plate of each, with 3-volt grid bias in both cases, good loud-speaking was obtained both for speech and music when the aerial was connected to A3 and the earth to E.

Chelmsford

On substituting a No. 150 coil for the short-circuiting plug, Chelmsford was tuned in also at good strength after changing the aerial connection to A1. These connections, though having no bearing upon the best obtaining with different aerials, go to show that some attention should be paid to how the aerial and earth are connected. In cases where interference is being experienced, then the smallest number of turns between the aerial and earth, that is with the aerial to A2 and the earth to A3, will make the receiver extremely selective, though the desired station may be reduced in volume somewhat.

The receiver was also tested upon an aerial of average dimensions at a distance of thirteen miles east of 2LO. Using two ordinary bright emitter valves with 100 volts H.T., and 3 volts grid bias, and with the aerial connected to A3, comfortable loud-speaker results were obtained in a room of normal size. The Chelmsford station (seventeen miles distant) gave noticeably greater signal strength, a No. 150 loading coil being employed.

A Cheap and Efficient Aerial Mast

(Concluded from page 173)

fitting of a hinge is recommended, as illustrated in Fig. 3.

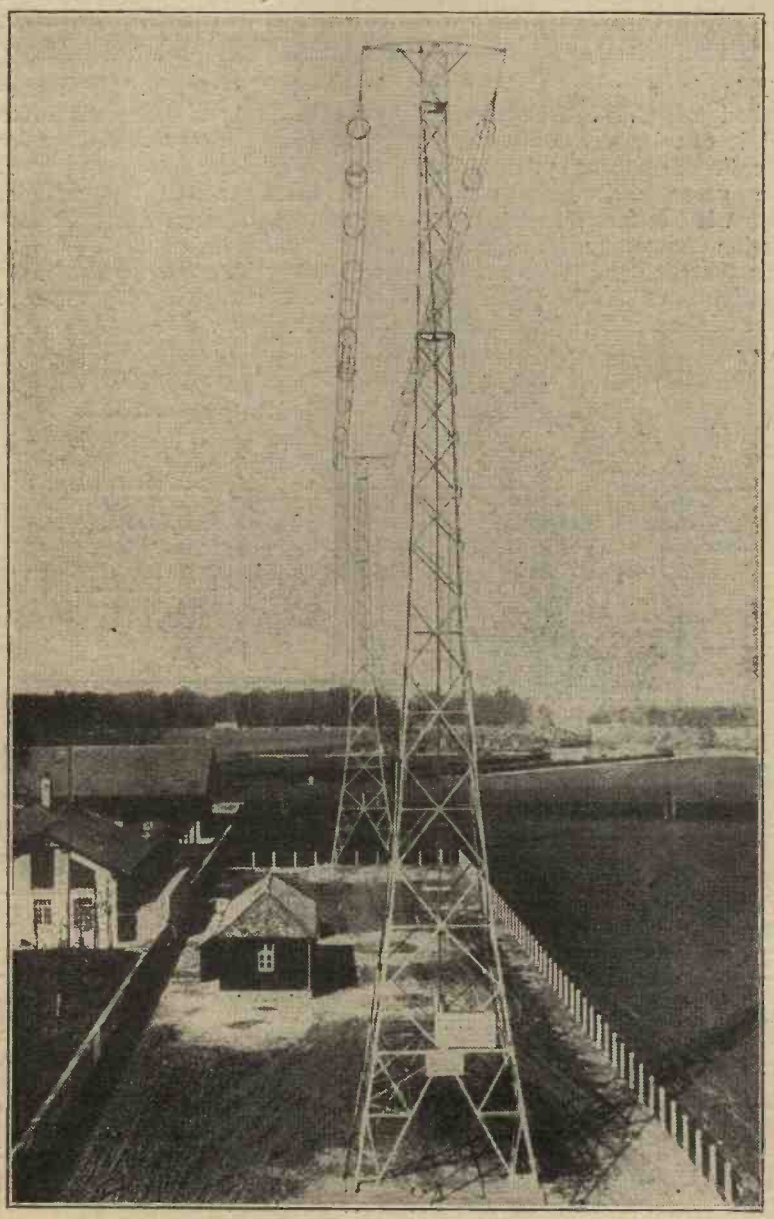
This design provides a cheap and strong mast, and any scrap tube cuttings can be used, provided they are of suitable diameter and that the tubes used for the spigots enter the pieces of the pole freely. The concrete grout binds the tubes together so that no screwed connections are required for the erection of the aerial pole.

The drawing shows clearly the support which is formed by bedding two scrap pieces of angle-bar in pitch in a concrete block. Other methods of securing the base of the mast will readily suggest themselves to those who may be unable to carry out this part of the design as suggested above.

Random Technicalities

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

THE sudden increase in the number of permanent or semi-permanent crystal detectors placed upon the market seems to be due to the discovery that the bright yellow, waxy-looking mineral known as Arzenite works well with Bornite or a similar crystal. Arzenite also works excellently with Tellurium, this combination being hidden beneath the finished exterior of one of the permanent detectors now sold. Certainly these detectors represent a distinct advance, for while it is not possible, save with a few picked specimens, to obtain quite so sensitive an arrangement as an expert can get with a good piece of Galena and a carefully adjusted cat-whisker, it yet gives the average crystal user a far better signal than he would himself be able to get with the old cat-whisker and crystal. Of their robustness there is no question, and I have recently used two or three different kinds in a crystal set which could be dropped a foot on to the table without upsetting the signal strength to any material extent.



The elaborate masts and aerial at the Marconi station at Basle Aerodrome, Switzerland.

* * *

I listened to Capt. Eckersley's technical talk from 2LO recently, and was quite surprised at the information he gave us regarding long-distance reception. Some of us certainly opened our eyes wide when we heard the gallant captain describe the neutrodyne as " three tuned anodes " with a linking of condensers between the plates of the valves. The Hazledyne neutrodyne, of course, is a transformer coupled arrangement, and the neutrodyne tuned anode is that first described in *Wireless Weekly* by Mr. A. D. Cowper. As readers know, I have applied the neutrodyne tuned anode principle to several receivers described in Radio Press publications. In this arrangement there is, in addition to the tuned anode coil, another coil coupled to it and connected to a condenser. I was rather surprised that Capt. Eckersley did not mention this coil, as it is an important part of the receiver. I noticed that he said he was using a set with three neutrodyne tuned anodes, a detector and two stages of note magnification.

I may be wrong, of course, but in any case it is wonderful what

you can get in *The Wireless Constructor* for sixpence!

And even if the set is not on the market we can supply blue prints for a reasonable charge! (Advt.)

* * *

I see that the American magazines are now carrying advertisements of a valve known as the "McCullough A3 Radio Tube." The illustrations in the advertisements indicate that it looks very much like an ordinary valve except that it has an additional cap at the top, which presumably connects to a socket joined to a flexible lead and then to the lighting mains. I have not seen any technical particulars yet, but I should judge that the heat for the filament is provided by a wire in the A.C. circuit which is not in electrical contact with the actual filament connected to the wireless receiver. Of course, if the filament can be lit from A.C. mains this represents a big advance in ordinary receiver construction. Possibly we shall see something of the kind over here shortly.

* * *

It is rather annoying to see that so many British valves appear to be closely modelled upon the American "tubes." Prior to the Americanising of our valves, we largely copied the French! In America practically all work is done upon UV199 or UV201a valves, the UV199 being the .06 ampere type and the UV201a the .25 dull emitting small power valve. The Peanut valve which was so much boosted last year is very little seen these days, save in the instruments of the Western Electric Co., who have standardised upon them, except for power valve work. The inverted "V" shaped filament supported at the pointed end, the grid wound as a flat spiral over two side supports, and the rectangular box-like anode, as well as the magnesium process which gives a silvered appearance to the bulb, are all features copied directly from America. The old "R" type valve with the cylindrical anode, barrel grid and horizontal filament, as well as the four-pin base—even to the actual spacing of the pins—was copied from the French *in toto*. The really distinctive British valves seem to be those of the V24 and Q.X. type (although the electrode arrangements are akin to those of the R type) and the valves with the curved filaments and hood-shaped grid and anode.

* * *

I wonder how many people really have sound ideas on loud-speaker reproduction? It might appear at first that any man with a good ear could judge a loud-speaker, but some experience in listening to other people's opinions on the subject leads me to think that the average man judges a loud-speaker against a standard of a good gramophone. It certainly is astounding how people's opinions differ, and if you have half a dozen loud-speakers of varying quality, half a dozen people will arrange them in about six different orders of merit!

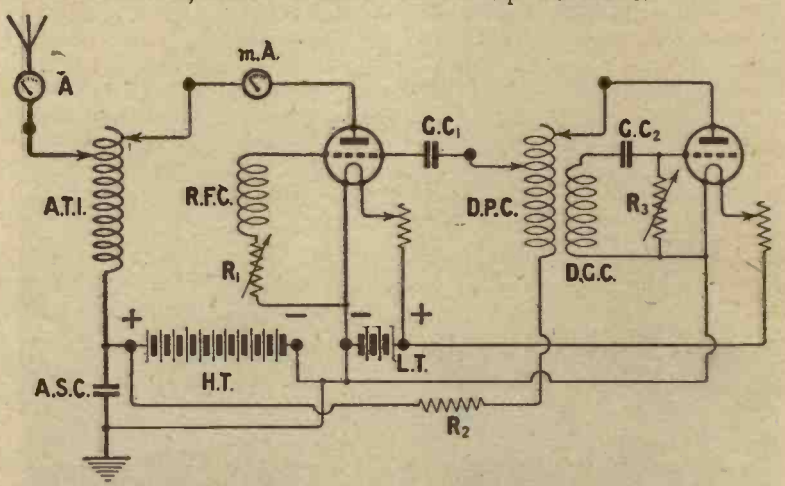
Practical C.W. Transmitting Circuits for 200 Metres

By DALLAS G. BOWER.

(Concluded from Vol. 6, No. 5, page 138.)

THE MASTER OSCILLATOR SYSTEM

This is a very satisfactory method of C.W. transmission, and it can be adapted to work with direct earth or counterpoise. The great advantage of the system is the fact that the transmission frequency is dependent upon the constants of the master or drive circuit rather than upon those of the aerial, hence the note is absolutely steady. The purpose of the resistance R2 is to proportion the correct voltage for the anode of the master oscillator. No values can be given, as this, of course, depends upon the size of the valve being used. Up to 250 watts the oscillator should be capable of supplying 0.3 watts to the main power valve.



Circuit No. 7.—The master oscillator arrangement.

TRANSMITTING CIRCUIT No. 7.

Circuit Symbol.	Instrument.	Description.
A.T.I. ..	Aerial Tuning Inductance ..	60 μH, 30 turns, 6 in. dia. former, 16 s.w.g.
A.S.C. ..	Aerial Series Condenser ..	0.0003 μF to 0.003 μF.
A.	Aerial Ammeter	Hot-wire or thermo-couple 0–2 amperes.
mA. ..	Milliammeter	0–100 ma.
R.F.C. ..	Radio-Frequency Choke ..	2 in. dia., 8⅜ in. long, 500 turns, 26 to 28 d..sc.
R_1 and R_3	Grid Resistances	5,000 to 10,000 ohms. Variable.
G.C.1 and G.C.2 ..	Grid Condensers	0.002 μF.
D.P.C.	Drive Plate Coil	See A.T.I.
D.G.C. ..	Drive Grid Coil	See A.T.I.
R_2	(See text).	

Correspondence

A NEW VALVE-CRYSTAL CIRCUIT

SIR,—I have constructed a one-valve crystal set to the circuit on page 398 of the March issue of *The Wireless Constructor,* by Mr. John Scott-Taggart, and am astounded by the results which I have so far had from it. I have received 2ZY at a little louder than good crystal strength, also Brussels and two other foreign stations whose call signs I could not distinguish. The degree of reaction when tuning the foreign stations was very critical. As I have only used the set since March 28, I have not had an opportunity to pick up other stations. London at 6½ miles comes in at loud-speaker strength, while Chelmsford is not quite so loud. When I have tested this circuit more fully I will let you know the results.

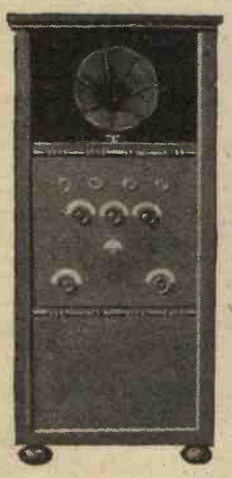
Wishing your journals every success.—Yours faithfully,

H. C. P.

Manor Park, E.

AUTO-COUPLED CIRCUITS

SIR,—Will Mr. Kendall extend his very interesting experiments to



Mr. Stanley E. Shore's Four-valve Family Receiver.

an auto-coupled circuit without a parallel condenser?

Last year I obtained permission to erect a special aerial for long-distance crystal work in the form of an inverted L 175 ft. horizontal, 40 ft. down lead, average height 40 ft., and quite unscreened. No quantitative measurements were attempted, strength being determined by the audibility in speech of various stations. The circuit which invariably gave the loudest results was an auto-coupled X coil of No. 16 d.c.c. tuned by taking the earth

Mr. E. H. Palmer, whose plans to study reception conditions in America are referred to elsewhere.

to six tappings on the bottom six turns and the aerial to five-turn tappings from the twentieth to the sixtieth turn. There were 85 turns in all and the crystal connected to the top end. Tuned entirely by the tappings, the local station (Bournemouth, 38 miles) gives volume which enables the late news to be heard at 12 ft. from a large Amplion. With Brown's A phones London and Cardiff can be heard as a duet, Manchester and Birmingham occasionally, Newcastle always, Belfast and Aberdeen occasionally, the latter on the verge of audibility in speech. Rome, Madrid and several of the German stations have also been heard occasionally.

I have never had anything like such volume when using any kind of variable condenser across the coil, hence my desire to have this kind of circuit compared quantitatively with the condenser tuned form.

Of course 38 miles is considered to be too great a range for a crystal, but if the regulations could be relaxed for crystal users way out in the country, these experiments show that with a similar long aerial (which is generally very easy to erect in such situations), really good crystal reception is quite possible up to 50 miles.

I may mention that to avoid dead ends the tappings were simple small loops bared by rubbing with emery cloth round a stick and connection was made by a wander lead soldered to an ordinary valve pin with an ebonite handle. Thus the valve leg rubbed a clean contact each time it was pushed on to the loop.

It will be appreciated that selectivity *per se* is of little practical use in crystal work while volume is paramount.—Yours faithfully,

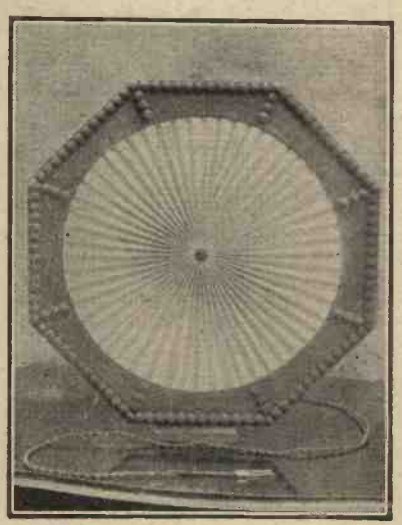
DONALD STRAKER.

Bembridge, I.O.W.

[Mr. Kendall hopes to deal with this subject in an early issue, but of course the question of obtaining maximum signal strength upon a fixed wavelength demands experiments on quite different lines from the original ones, where selectivity was the point most considered.—ED.]

A HOME-MADE LOUD-SPEAKER

SIR,—Enclosed please find photograph of a loud-speaker which I have made from instructions published in the August 6, 1924, *Wireless Weekly.* The front is my own original design, and the construction, in my opinion, is simpler than with



The loud-speaker made by Mr. L. H. Boyce.

the two wooden rings. The front is made of oak 3-ply wood and the pleated diaphragm is secured by means of a 3-ply ring. The inside opening is the same as that of the front and the diaphragm is between the two pieces of ply wood. A Brown's "A" type earpiece is used and the tone is excellent.

Wishing your valued paper every success.—Yours faithfully,

L. H. Boyce.

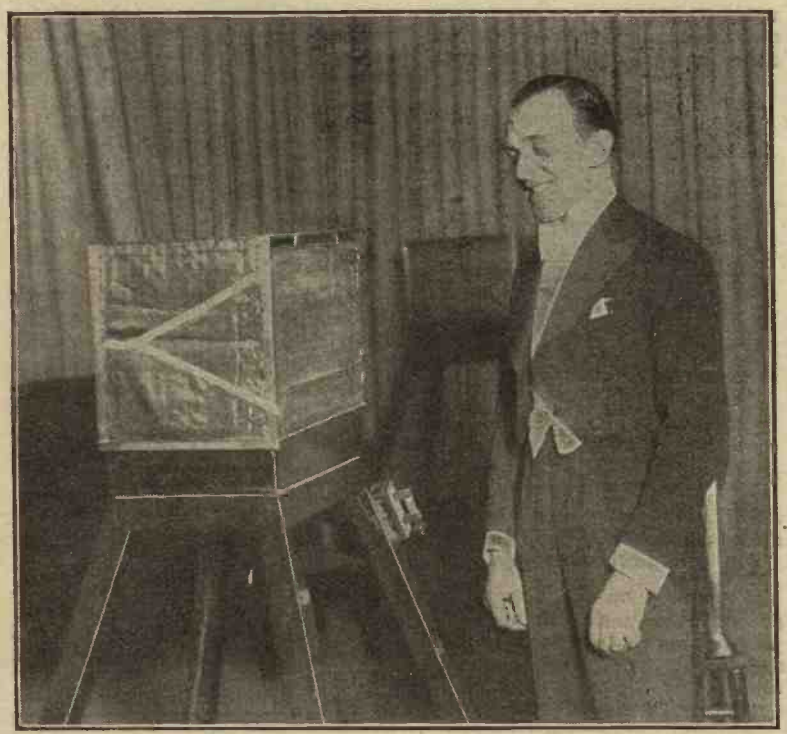
Portsea.

MR. HADDICK'S CLAIM

Sir,—In reply to Mr. Booth, I may state that on Friday night, May 1, Mr. Haddick tuned in for me on his three-valve set (aerial direct coupled) Bournemouth, Newcastle and Glasgow whilst Belfast was transmitting. Bournemouth and Newcastle were received free from any interference, and when receiving Glasgow, Belfast was only a very faint undercurrent which was only audible when Glasgow was silent.—Yours faithfully,

G. A. Lundy, Grad. I.E.E.

Belfast.



Mr. Nelson Keys broadcasting his impressions of America from the London station.

THE FOUR-VALVE FAMILY RECEIVER

Sir,—Enclosed is a snap of a four-valve receiver just built by myself. A few months ago I purchased Mr. Percy W. Harris's "Twelve Tested Wireless Sets," and made up the three-valve All-Concert Receiver, getting remarkable results—perfect loud-speaker reception from Cardiff and Bournemouth always, and on the 'phones, all English and many Continental stations. On one occasion Aberdeen was received at strong loud-speaker strength.

Being so delighted with this, I decided to build the Four-Valve Family Set, also by Mr. Harris, and the photograph shows the completed attempt. In the top section is an Amplion Junior L.S., and the batteries are enclosed in the bottom section. Taking Mr. Harris' advice, I found the cabinet work quite simple, and the one in the photograph is made from 1¼-in. battens and 3-ply, with a few feet of moulding for the top, the whole thing costing less than 10s. It is stained oak and wax polished, and it makes a nice piece of furniture. Thank you for your constant recommendation to attempt one's own cabinet work, for I have found that with patience it is quite a simple job.

You will notice I have re-arranged the panel slightly and put the valves behind. The results from this set are beyond my expectations. Cardiff, Bournemouth and Birmingham come in regularly on three valves, strong loud-speaker strength, and all English stations on four valves, loud-speaker strength. Also many Continental stations come through on the loud-speaker. Aerial 30-ft. twin, 50 ft. high.

Thank you very much for the clear instructions you give novices, and I personally have found endless instruction and amusement from your literature, and you have converted me into a wireless enthusiast.—Yours faithfully,

Stanley E. Shore.

Bath.

THE 'TWIN-VALVE' RECEIVER

Sir,—I have just completed the "Twin-Valve" Receiver as described by Mr. John Scott-Taggart in *The Wireless Constructor*, January issue, and am writing to tell you how very much I appreciate the value of your designs.

The set works exceedingly well, and after having added a single note magnifier, I can get loud-speaker results from practically all B.B.C. stations and 5XX, Radiola, etc. Instead of having a plug-in H.F. transformer, I have a two-coil holder with plug-in coils. Reaction is shorted practically all the time.

Once again thanking you for your wonderful design, and best wishes to all your journals.—Yours faithfully,

E. B. R. James.

Camborne, Cornwall.

AN IMPROVED TWO-VALVE RECEIVER

Sir,—May I offer you hearty congratulations on a very wonderful set published under the name of Stanley G. Rattee in *Modern Wireless*, January, 1925, and entitled "An Improved Two-Valve Receiver." I have built many *Modern Wireless* and *Wireless Weekly* sets, and have had good results from all of them. When I built this set it was only intended as a stand-by while making alterations to a larger set. Being in a hurry, I wired it together very roughly, and as I had only a small piece of ebonite handy, I mounted most of the components on a baseboard.

The set works a big Amplion loud-speaker with truly wonderful power from practically all the British main and Continental stations. Belfast and Birmingham, two stations which are difficult to receive here, come in regularly at fine strength. Also I have had the American stations WBZ and WGY on favourable nights. The set has given such fine results that quite a dozen more like it are being built round here. When a four-valve set at the local school broke down this set was substituted and gave great satisfaction to a large audience.

The valves used are a D.E. 5B for detector and a B.T.H. B4 for amplifier, with 80 volts on each. I have tried many sets up to six valves, but never before believed it was possible to get such volume and clarity from two valves as can be done with this set.—Yours faithfully,

Thomas Johnston.

Halstead.

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