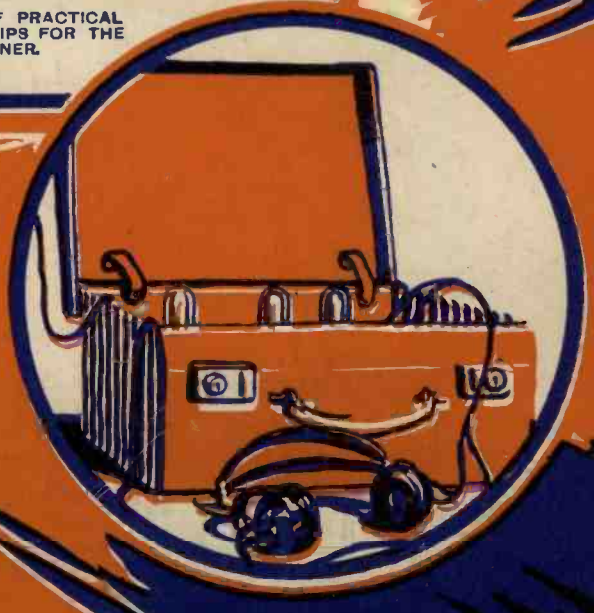
The Wireless Constructor

6D MONTHLY

EDITED BY
PERCY W. HARRIS

CONTENTS

Vol. 1. No. 7. MAY, 1925



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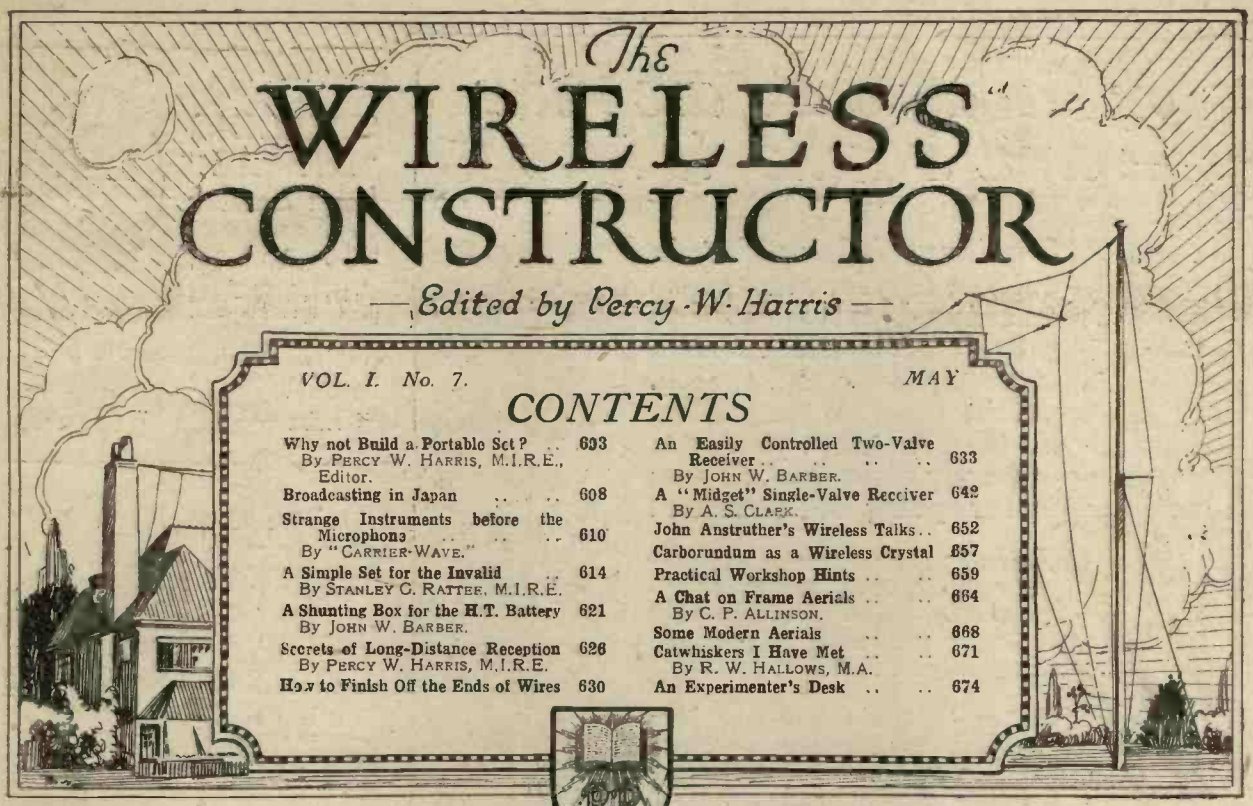

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Vol. 1 MAY, 1925. No. 7.

Why Not Build a Portable Set?

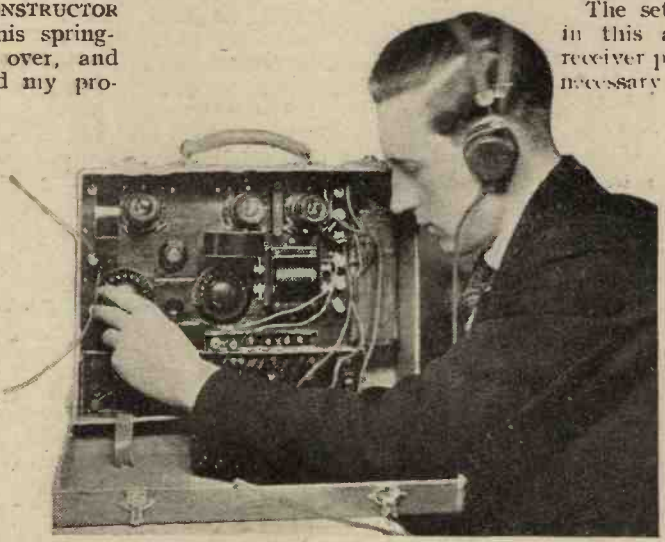
ENJOYING RADIO IN THE OPEN AIR

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

A good portable set must be carefully designed. This article shows you how to build a compact, highly sensitive and easily-handled receiver

AS I write this article Easter is drawing near. By the time the WIRELESS CONSTRUCTOR reaches your hands, this spring-time holiday will be over, and at present it is beyond my prophetic powers to say whether the country will be bathed in warm sunshine or drenched in icy showers. Anyhow, for your sake (and for mine) I hope it will be fine.

At Easter time we think of the open air, and many of us spend a good part of the holiday in the open country, walking, cycling or motoring. As the year grows older and more and more bright, and fine days occur, we frequently find ourselves, as the evenings draw on, many miles from home and glad of a rest. It may be that we are visiting friends and relatives in the country, and in the evening want some form of relaxation. What better fills this need than radio? Of course you have your own set at home, and do not want to take it away. Probably it would not be convenient to move it, and so it would be very handy to have some form of portable set that could be slipped on the luggage rack of the railway train or dropped in behind the car as part of the ordinary luggage. How can we set about making one?



A member of Radio Press staff operating the Portable Receiver. All batteries are in the case.

The set you will see illustrated in this article is not merely a receiver packed into a bag with the necessary battery supply, it has been specially designed for the work it is destined to perform. The requirements of the set were, firstly, that it should give good loud signals from the nearest broadcasting station (even if this were fifty or a hundred miles away), with a very small aerial, such as could be made by throwing an insulated wire over a tree; secondly, that it should be very easy to manipulate even by the unskilled; and, thirdly, that it should be really portable in the true meaning of the word. It was also desirable that when connected to a properly erected aerial it should bring in all of the B.B.C. stations and several of the Continental, so that if it should be taken into a remote village where

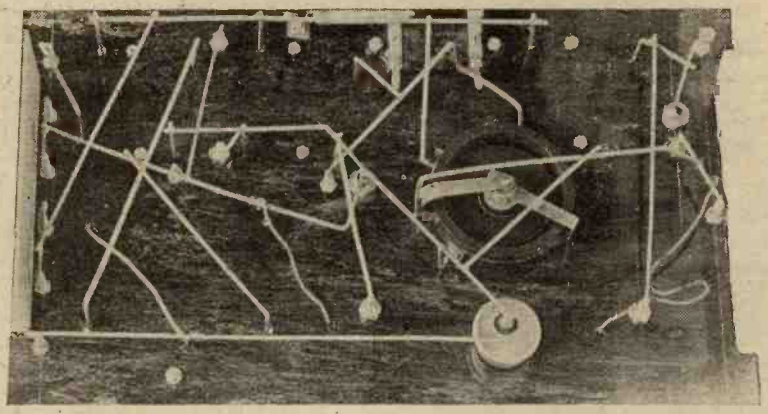
wireless is practically unknown, it would give a proper demonstration of the value of broadcast reception. Experience tells me that for satisfactory working in all conditions three valves are required—one for high-frequency amplification, the second as a detector, and the third for low-frequency magnification. The high-tension voltage can of course be supplied by the conventional dry battery, but I am not much in favour of the use of dry cells for filament lighting of even a single-valve set.

The Circuit

The first point to decide was the circuit, and for this I chose the well-known tuned-anode method of high-frequency amplification, using for the aerial tuning instead of the usual plug-in coil, a tapped coil, so that semi-aperiodic aerial coupling could be used. The advantages of this form of aerial coupling are that not only is a wide band of wavelengths covered with one coil, but the selectivity is increased and good results are obtainable on all kinds of aerials. The Lissen X coil filled the bill quite well, and was therefore incorporated in the design. For the anode coil another plug-in coil was used (75 turns is quite suitable), this latter coil being placed at right angles to the X coil.

Reaction

You may perhaps ask on examining the photographs, where is the reaction coil and how is reaction obtained? The answer is that with a semi-aperiodic aerial coupling and a sharply tuned anode circuit the set will oscillate quite freely when the grid circuit and the anode circuit of the high-frequency valve are in tune with one another. If we keep the set just off the oscillation point then we shall get the maximum reaction effect without self oscillation. As a matter of fact, the tendency to oscillate can be easily controlled by means of a potentiometer, and such an instrument is therefore included. Reaction control is thus obtained by a movement of the potentiometer knob. At one end of its travel the set will be very stable and will show little tendency to oscillate; at the other end the set will oscillate freely, and some intermediate point will be found where the set can be kept off oscillation with maximum sensitivity. That the sensitivity of the set is really high is indicated by the fact that on an outside aerial of average dimensions all of the B.B.C. stations can be heard at good strength, three or four of them being audible on the loud speaker in a small room, and the remainder at good strength in the telephones.



A photograph of the back of panel wiring. This photograph should be studied in conjunction with the wiring diagram.

A number of Continental stations are also heard, and by sitting up until two o'clock I found it possible to hear a band selection from one of the American broadcasting stations on a wavelength just below that of London. It will thus be seen that the receiver has ample sensitivity, so that even with the smallest of portable aerials the nearest station can be heard at excellent strength.

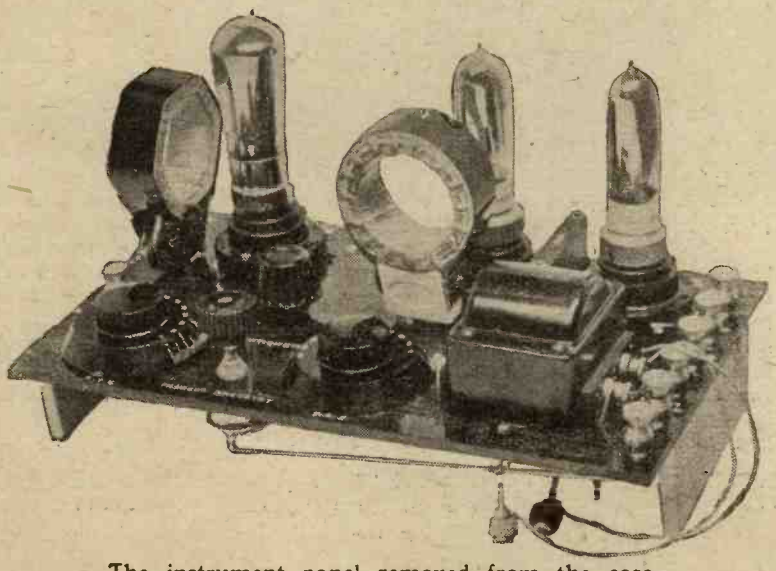
The three batteries used.

One Filament Resistance

The second point making for simplicity was the use of one filament rheostat for all valves. It is true that this method is not the ideal, and the advanced experimenter may prefer to have a separate filament control for each valve, but in practice the arrangement will be quite efficient for such a set. If you have three valves of the same make, you will find they all work at the same filament voltage in whatever part of the circuit they may be used. Again, simplicity dictated the use of one high-tension terminal for all three valves.

The Layout

The layout of the set is somewhat different from the normal, for by placing the low-frequency transformer above the panel, by using special variable condensers (the



The instrument panel removed from the case.

whole of the mechanism of which is concealed inside the dials alone), and by one or two other special arrangements, the wiring projects only about one inch below the panel itself. This means that when the panel is placed in a suitable case there is room for valves on the top of the panel without obstructing the lid. So far as the valves are concerned, these are naturally to be treated with the greatest care, and for this reason three "Antiphonic" or antivibratory valve sockets are used. I do not recommend the ordinary type of valve-holder, as the jars and jolts inseparable from a portable set are likely seriously to damage the valves and their filaments.

By a suitable choice of components and by the arrangements already indicated, it has been possible to construct the whole of the three-valve set on a panel measuring only 12 in. by 7 in. This gives ample room for the high-tension battery and an accumulator of the non-spillable type in a bag which is not too large to be carried conveniently. The actual disposition of the parts will naturally depend on the case to be adapted.

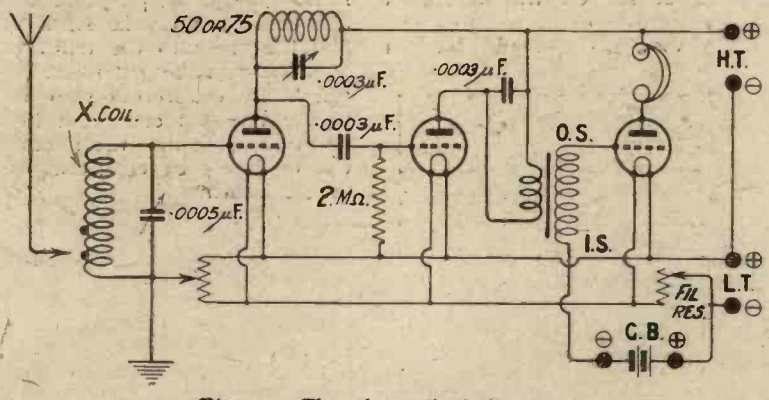


Fig. 1.—The theoretical diagram.

Components Used

Here is a list of the components I have incorporated in the set. It is, of course, possible to change several of them, but if you desire to make changes, it is well to see that those you substitute are of the correct size and are not too bulky.

One panel of guaranteed ebonite (Radio Mahoganite was used), 12 × 7 × $\frac{3}{16}$ or $\frac{1}{4}$ in.

Two special variable condensers, one of ·0005μF in the aerial circuit, and one of ·0003μF in the anode circuit (Portable Utilities, Ltd. Dial-o-densers).

Two coil sockets for panel mounting.

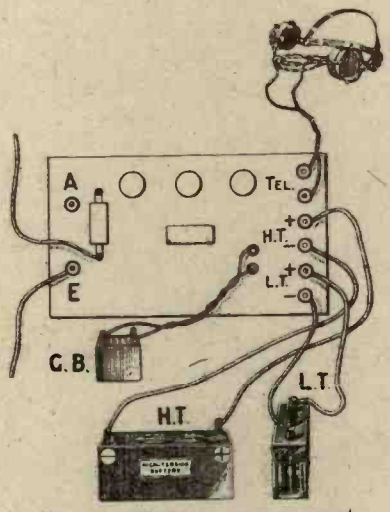


Fig. 2.—Battery connections.

Three valve sockets, "Antiphonic" (Burndept, Ltd.).

One first-stage intervalve transformer (C.A.V.).

One fixed condenser, ·0003μF, with clips (Dubilier).

One 2 meg. grid leak (Dubilier), with single clip.

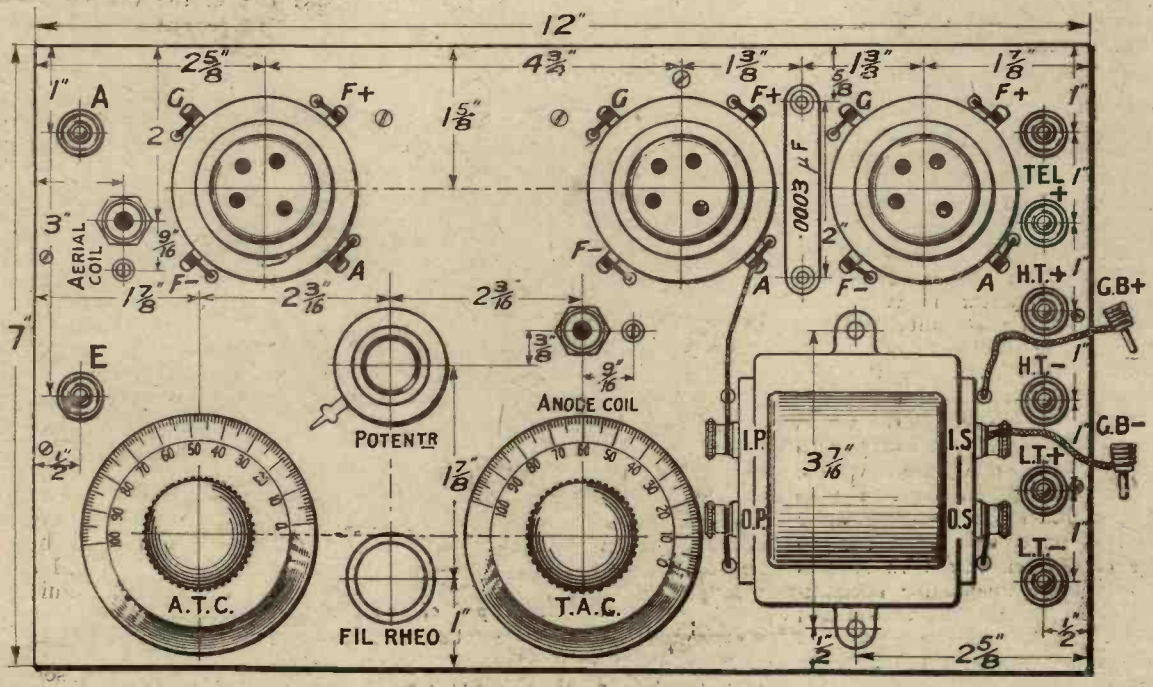


Fig. 3.—Dimensions and markings of top of panel. Blueprint No. C1012A can be obtained from Radio Press Ltd., price 1/6 post free.

One filament resistance (Microstat, Wates Bros.).

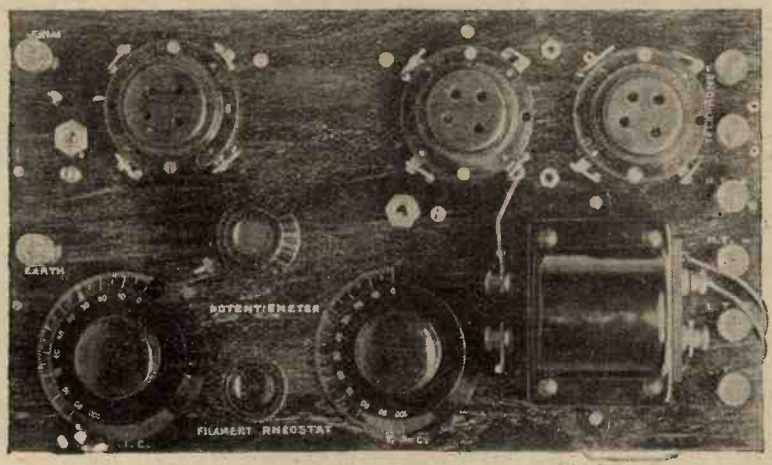
Eight terminals and nuts.

One fixed condenser with panel socket, ·0003μF (Peto-Scott, Ltd.).

One potentiometer (R. A. Rothermel, Ltd.).

One Lissen X coil.

One No. 75 coil. (If you want to get 5XX, then you will also need a No. 150 coil for the aerial and a 200 or 250 for the anode.)



A mahogany finished panel improves the appearance.

One high-tension battery of suitable dimensions. (That shown is a General Radio Co. "Radiobat.")

One unspillable accumulator, 2 volts (Oldham & Sons, Ltd.).

Three valves.

One grid bias battery (Ever-Ready.)

Two Clix sockets or wander plugs for same.

Valves

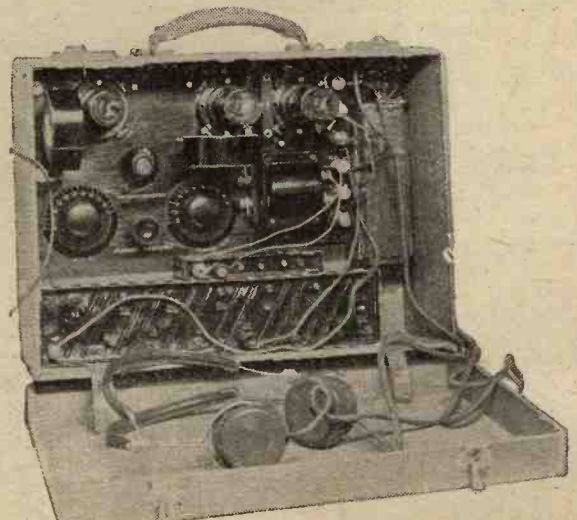
So far as the valves are concerned, you have a wide choice, but whatever make they are they must be of the dull emitter type so as to run from a small accumulator, such as that shown. I recommend you to choose dull emitters which will work from a 2-volt accumulator if you want the maximum portability. If you prefer to use the ·06 type of dull emitter you will require two unspillable accumulators of the size shown. Personally I have found the set to work excellently with the new Cossor Wuncell valves, the three of which together take slightly under one ampere at 2 volts. I have also used the ·06 type of dull emitter with success by using two unspillable accumulators. Mullard, Marconi-Osram and British Thomson-Houston all make valves suitable for working from a 2-volt accumulator. Whatever valves you choose the total current should not exceed about one ampere, as this is the maximum safe rate of discharge of the type of accumulator indicated. The maximum economy of current will, of course, be obtained by using the ·06 type of valve which, with the accumulator shown, will run for about fifty hours without a re-charge. Against this, of course, you must set off the additional weight of the extra accumulator. Three Wuncells will run for ten hours without a re-charge on this accumulator, which is probably as much amusement as you will require in a week-end holiday.

Constructional Work

The photographs and drawings, together with the free blueprint presented with this issue will give you practically all the constructional data you need, but I should like to point out that it is essential that the sockets for the aerial coil should be so arranged that the projecting pin is connected to the earth side. This is very important, as the Lissen X coil is so made that the earth side of it is connected to its socket (corresponding to the pin on the panel socket). The Lissen X coil has two terminals in addition to the plug and socket, one connected to the sixth turn, and the other to the tenth turn. You will probably get much better results by connecting your aerial to the terminal connected to the tenth turn, though the selectivity will be higher by connecting it to the sixth turn.

Chelmsford

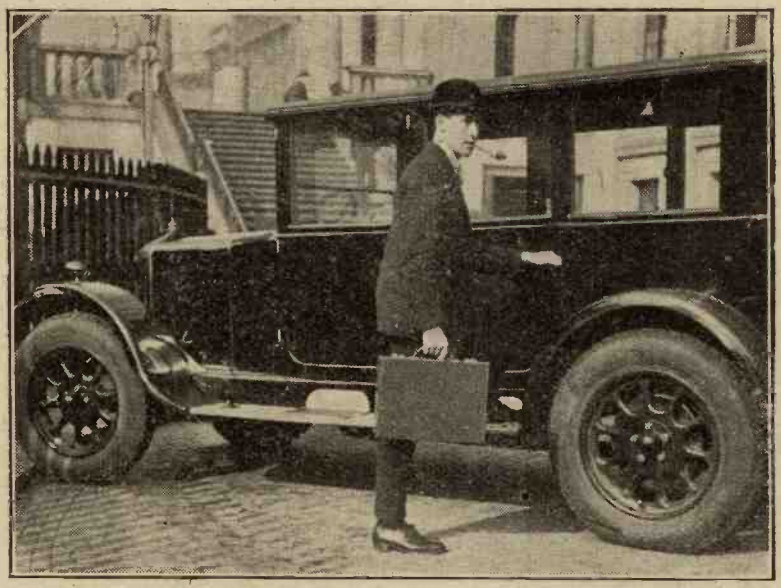
When using the X coil the aerial terminal of the set will be left free, but if you are desirous of receiving 5XX you will substitute for the X coil a No. 150, in which case the aerial should go to the aerial terminal proper, as marked. Be particularly careful of your connections to the potentiometer. All potentiometers have three terminals and the order is not always the same. Examine your potentiometer and you will find that one terminal (often the central terminal) is connected to the slider while the other two terminals are connected to the ends of the windings. In wiring up notice that one end of the winding goes to the positive bus-bar, or common connection to all three valves, and the other end of the winding goes to the negative bus-bar. The slider is connected to the variable condenser in the aerial circuit and to earth.



A "close-up" of the complete receiver with batteries in place.

The Variable Condensers

The special and highly portable variable condensers in this set are very simply fixed by drilling a hole to take the spindle and securing this to the panel by means of the nuts provided. You will find on the central spindle several washers. These are placed there to enable the dials to be held just off the top of the panel and to allow them to be turned without touching the panel. To mount the condenser, drill a central hole and a further hole about an inch to one side of it. Pass the flexible lead from the variable condenser through one hole and the central spindle through the other. The flexible connection is made to the moving plates and the central spindle to the fixed plates. Notice that the flexible lead on each condenser must be soldered to a piece of the stiff wire at a suitable point.



Motorists will appreciate the advantages of the self-contained outfit.

Supports

When you have finished wiring up the panel, screw to it two pieces of wood of just sufficient depth to hold it off the table in such a way that the wiring of the underside does not touch the table. You should then choose a suitable container from among the bags available and make whatever arrangement suits you for securing the panel to the box and the high tension battery and the accumulator in place. To use the set it is merely necessary to open the box, connect the aerial (which may consist of a piece of rubber-covered flex thrown over a tree) to the correct terminal on the Lissen X coil (generally the tapping of the tenth turn) and connect the flexible earth wire to the earth terminal. This earth wire may consist of 20 ft. or 30 ft. of flexible rubber-covered wire thrown on the ground, or may consist of a shorter length fixed to a suitable earth tube, for which purpose I can recommend the Climax Earth Tube, consisting of a copper rod easily driven into the ground.

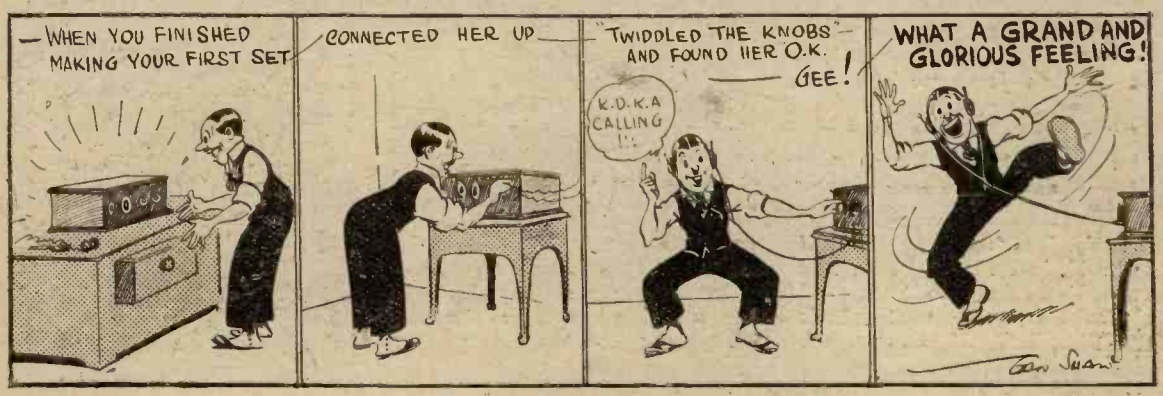
Tuning is effected by turning the knob of the filament resistance down until the valves light up. If you are using a two-volt accumulator, there is no danger of burning out your valves and the filament resistance can be screwed down as far as it will go without exercising force. Do not be misled by the lack of light with the Wuncell valves if you use them, as these valves give practically no light at all when turned on. In broad daylight it is impossible to see if the filaments are turned on at all, and even in a darkened room it is only just possible to distinguish a slight red glow. If you are using the ·06 type of valve and two accumulators, you should exercise care in turning the filament resistance on so as not to burn these valves too brightly.

When you are taking this set out it is just as well to include in the kit a small loud speaker, for the volume obtainable will be ample to operate it from the local station.

SPECIAL NOTICE

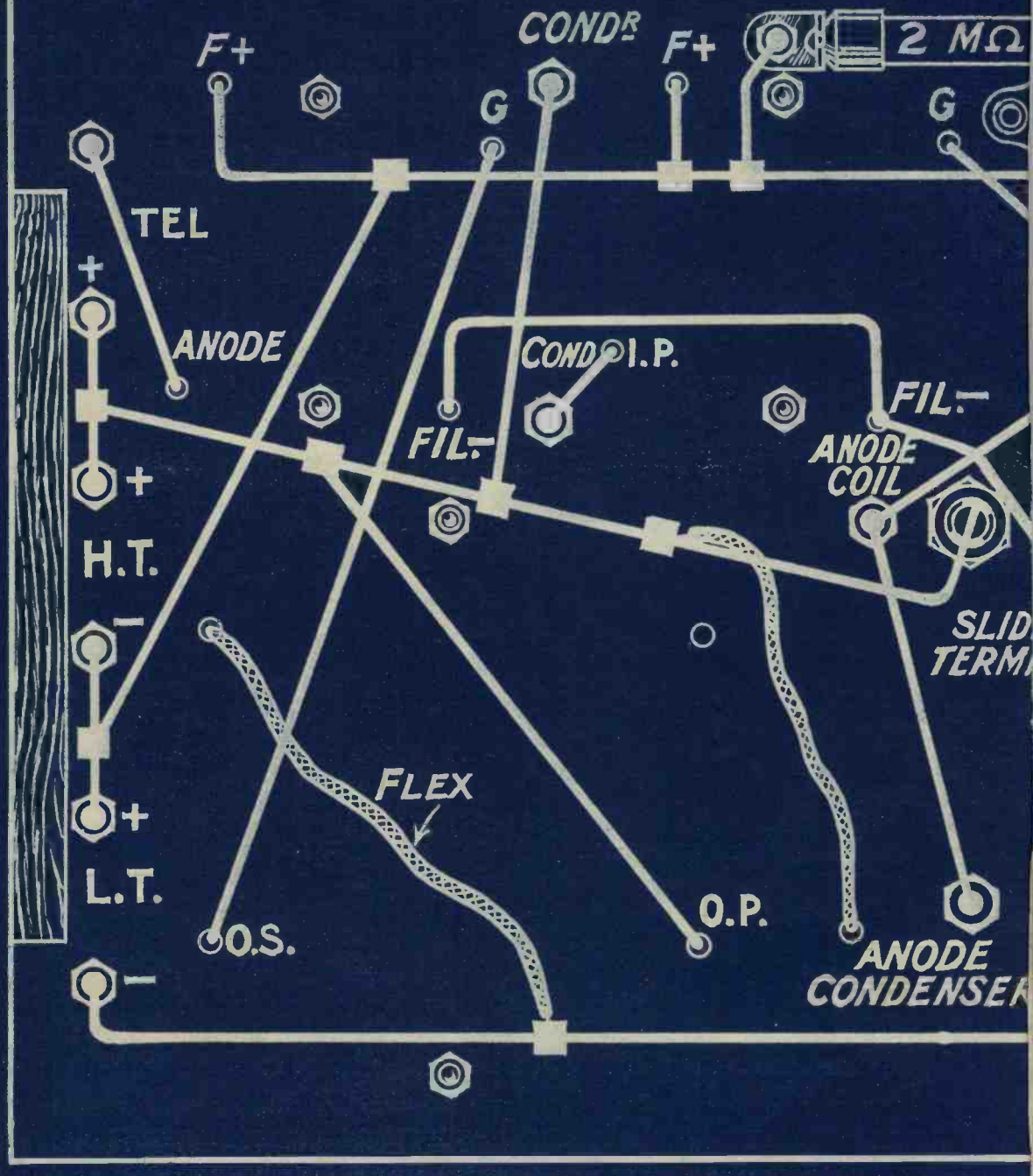
Query Department

Owing to the enormous increase in correspondence as a result of the publication of this Journal, the above department is temporarily unable to deal with further queries, although every effort is being made to provide further facilities and new staff.



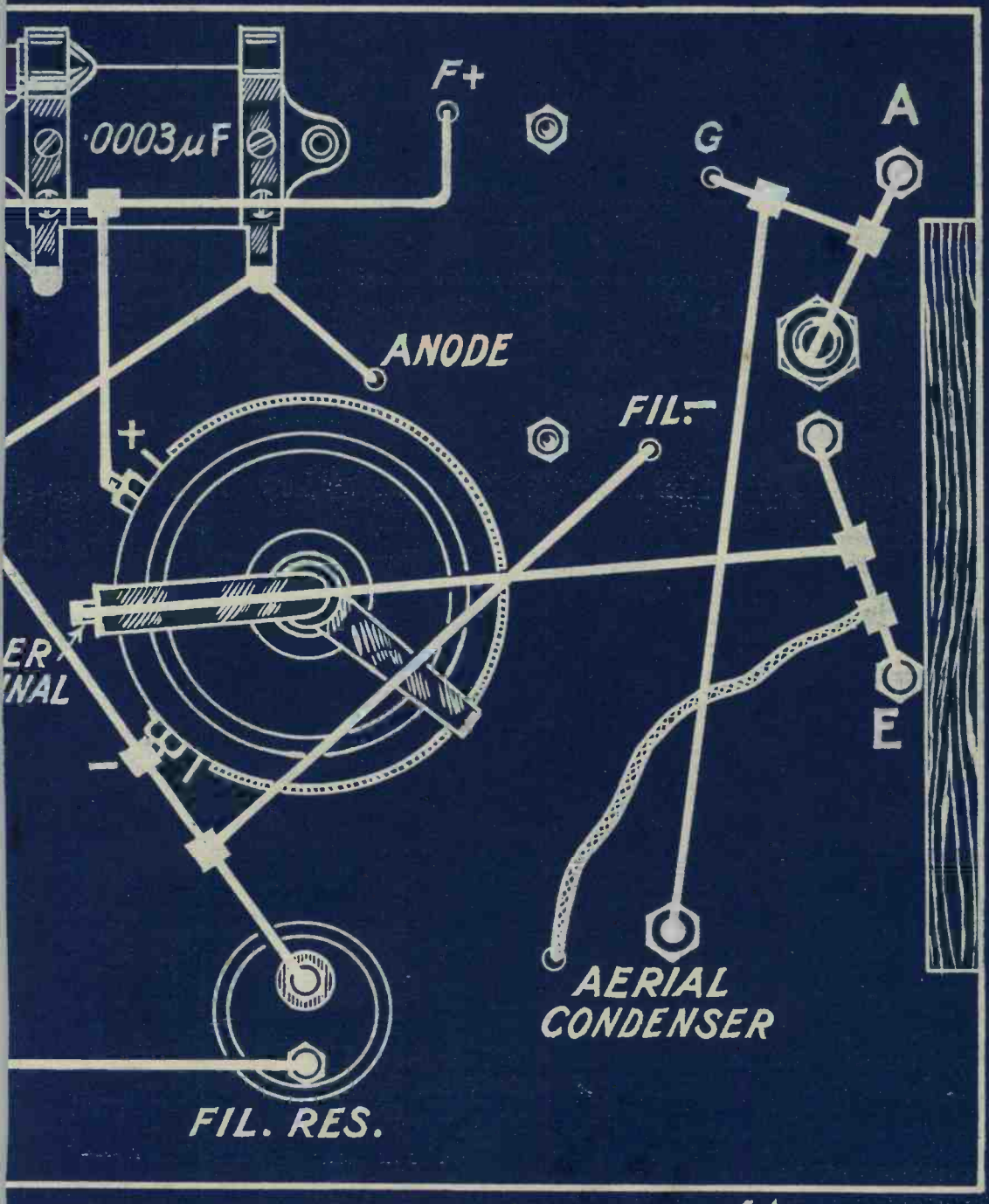
Have you ever felt like this ?

"THE WIRELESS CONSTRUCTOR" 3 V



RADIO PRESS LTD., BUSH HOUSE, STRA

ALVE PORTABLE RECEIVER.



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Beneath the Shadow of Fujiyama

JAPAN TAKES TO BROADCASTING

Viscount Goto broadcasting a message through the microphone.

Mr. Kojiro Yoshimura's troupe rendering "Maganta."

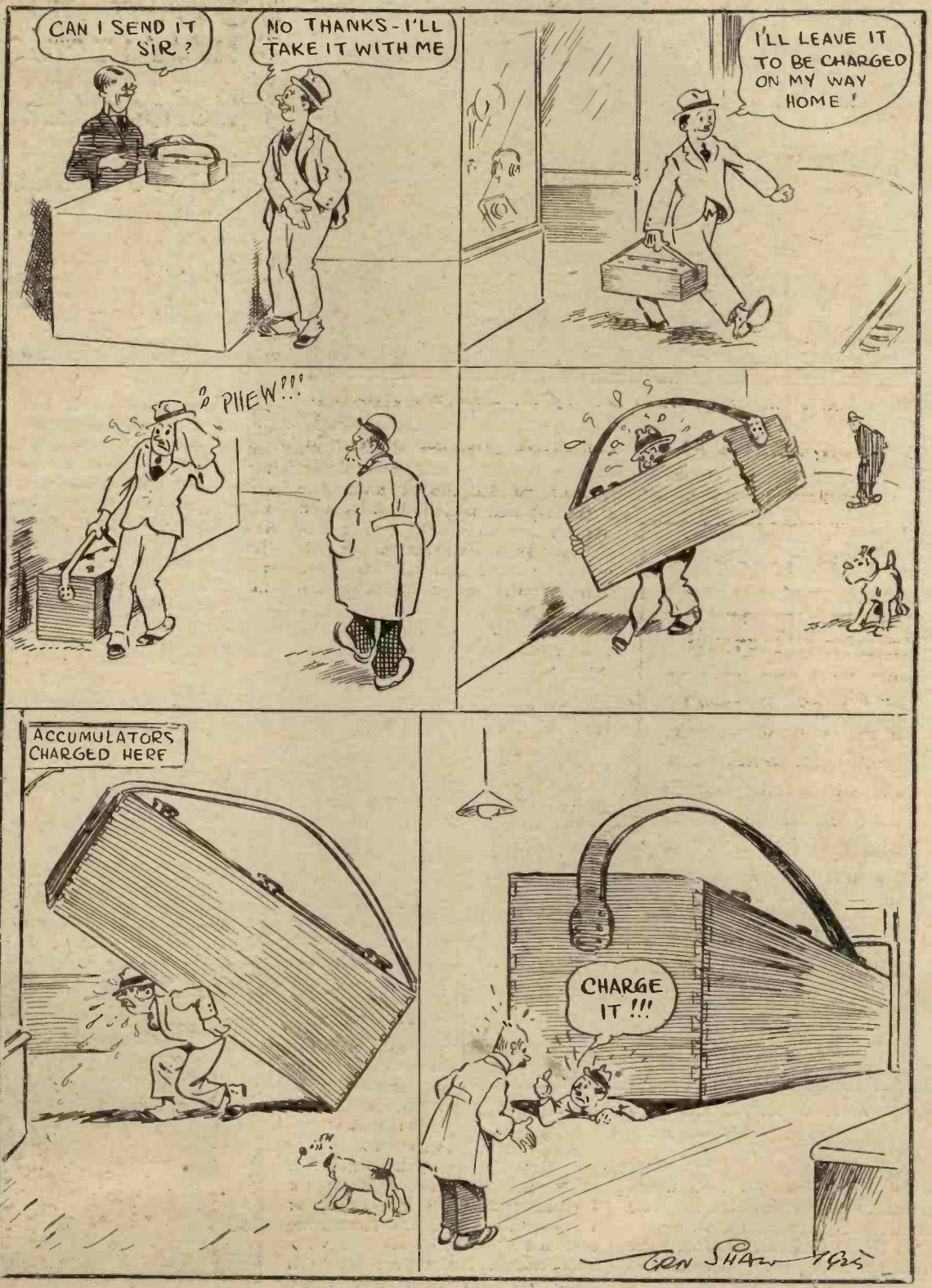
Above:—Mr. Chikufu Takamine, a famous Japanese musician, broadcasting.
Below:—A trio of players—Mr. Seifu Yoshida, Mrs. Yoshida and Miss Makise.

JAPANESE scientists have always taken a keen interest in wireless-telegraphy and telephony. Some of the earliest wireless telephony experiments were conducted in Japan, the system being known as the Teishinsho, the chief feature being a special form of arc generated between substances, one of which was a crystal. Furthermore, Japanese liners were some of the first to carry wireless telephony installations.

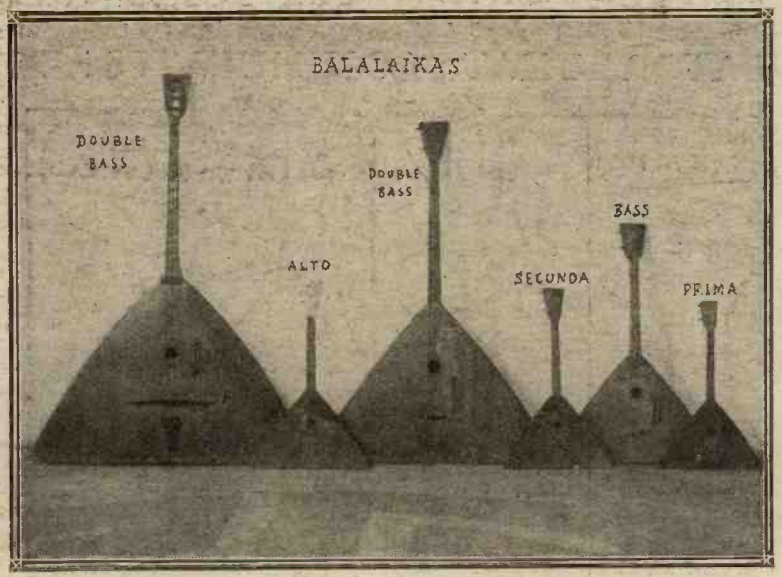
It is therefore not surprising that broadcasting has taken a firm hold upon the public of this distant land. Our photographs illustrate some well-known Japanese people before the microphone. So far, few technical particulars are available, but we notice that a Western Electric microphone figures in all the particulars.

It will be decidedly interesting to see whether at any time Japanese broadcasting can be heard in this country. Low-power Morse signals from New Zealand have been heard on several occasions, so that there is a good possibility of the broadcasting coming through on such a wavelength as that used by KDKA (68 metres).

THE ACCUMULATOR THAT ACCUMULATES!



It grows on you!



A collection of the instruments used by the Balalaika Orchestra.

Strange Instruments Before the Microphone

By "CARRIER-WAVE"

PROBABLY every traveller has experienced that moment, when, half-way up a stiff ascent, he halts to survey not only the summit of his climb, but the arduous ground he has just covered. So, too, might the listener-in, who looks back on the thorny path covered by the pioneers of entertaining a world.

Instrumental music and the stage owe their beginnings to the priestcraft of the world, for, whatsoever be the nation, the priests and witch-doctors have had to devise strange sounds with which to distract its peoples from the more useful task of earning a living.

A member of M. Vladimoff's Orchestra playing the Goosli.

To the monks can be traced the first morality play, which has developed into the "Grand Guignol" of to-day, while the cinema, the Cinderella of the arts, is due to a natural curiosity in other nations' affairs, so that the "magic lantern" and the zoetrope of our youth has become the "super-production" of every film renter.

Wireless, once divorced from its scientific value, has appealed most strongly through the innate laziness, or, at least, the disinclination, of the average man to "turn out" again for the outside entertainment, and from the first song sent to us from Writtle by that "arch-entertaingineer" Captain Eckersley, the armchair audience was made for all time, and it is to this audience that the B.B.C. has striven to appeal, tickling its palate with divers and strange sounds before the microphone.

The Organ

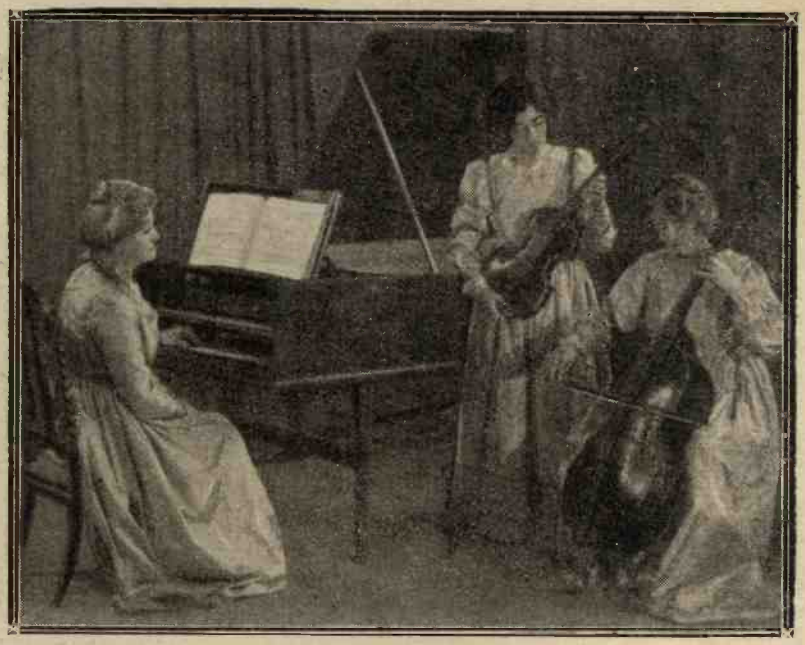
One of the earliest of the instruments to be heard outside of the actual studio was the pipe organ, and, though it is not the best medium for broadcast music, a fine exponent was found in Mr. Frank Armstrong and his "golden pipes" at the Æolian Hall. He has probably given more concerts than any other organist, and the results were excellent, considering the nature of the instrument. Experiments were also made with the organ at the National Institute of the Blind, where it was played by Mr. William Wolstenholme, the blind organist, and Mr. Goss Custard, the best results, however, being obtained when Mr. Stanton Jefferies, then Musical Director of 2LO, as well as a famous organist, made the broadcast of organ music a revelation, probably by his use of the gamba and reed stops.

The Power of Jazz

From the atmosphere of the church to the dance of the ball-room is a far step, but very early

Mr. Will Van Allen, a well-known exponent of the banjo, mandoline and ukulele.

Have you wondered what the Balalaika looks like? Do you know what a Domra is? This article both explains and illustrates these instruments and many others.



Old world music was broadcast recently, when the Chaplin Trio, seen above, gave a special studio performance.

was the compelling power of jazz recognised, and the Savoy bands being but a stone's throw, as it were, the best was "good enough" for the B.B.C. The Savoy Havana and Orphean Bands have become firmly established in London by the sheer artistry of their performance, jazz though it be. This is not surprising, as the players are not imported merely from America, but drawn from all quarters of the globe, and new instruments and formations are being constantly welded into the whole combination. It is reckoned that in the course of an evening the band use some forty different instruments. Chief amongst them is the two-manualled piano, which gives the power and effect of two instruments without requiring two players or losing in precision. The two manuals can be coupled like those of an organ, or played separately. Though first used by the Savoy bands, these pianos are now in use in most of the big dance bands of America.

A Great Russian Band

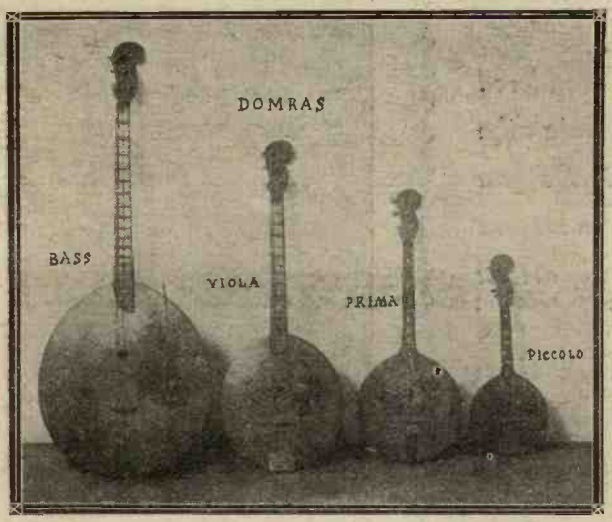
In considerable contrast, but equally popular, is the orchestra formed by the national instruments of Russia — the domra, balalaika, and the goosli. Here, again, the B.B.C. went to the most famous band in the world, that formed by M. Vladimir Vladimoff, a former Russian diplomat, and a friend of M. Andreeff, who had revised the use of these instruments in pre-war days. Balalaika bands have been imitated, but there can be no comparison between them, for M. Vladimoff's orchestra, at present also the only one in England, is composed of old Russian instruments, without the addition of any modern type or those of different nationality. The most ancient is the domra, developed from the tambur of the Persians and Arabians. An oval-shaped body with a long neck on which are stretched three strings, it was plucked by the fingers. The balalaika was evolved from this in about the tenth century, but it is triangular in shape, and made in three different sizes to approach the bass sounds. The goosli is like a harp placed horizontally, but is played with a keyboard as well as the medium of the strings. Like most of the stringed instruments, they carry well over the aether, and M. Vladimoff, heard again last month, is always assured of a welcome before the microphone.

Mr. Thomas Dickie, of the B.B.C., and his contra bassoon.

Mr. Cramer, a member of the Balalaika Orchestra, is soloist at Bournemouth on Hawaiian instruments.

The Hawaiian Instruments

Though it is a wide step between Europe and the Pacific Islands, few people know that the national instruments of Hawaii have originally sprung from the Spanish and Portuguese guitars, especially the "ukulele," which, though now the national instrument, was originally copied from the guitars which the Portuguese sailors of the seventeenth century often enforced upon the natives instead of money. The native words "uku lele," or in the sailors' slang, "bounced pay," were gradua ly applied to these instruments. These too gained improvement, and became the Hawaiian steel guitar, which are here reproduced by the courtesy of Messrs. Hawkes, the makers of the finest modern types of all stringed and jazz instruments. The improvement of the Hawaiian guitars was made by accident rather than design. While being played by a young native, Kekuku, at Honolulu, a screw was broken. Picking up the first thing handy, an ordinary steel bolt from the railway track, Kekuku started to repair his instrument. The steel bolt slipped along the strings, and the effect fascinated not only Kekuku, but other players. At first a steel knife was used, but this required sterner stuff for strings than gut, so that steel wires and a fixed slide made the guitar



A collection of Domras. These instruments were originally developed from the Tambur of the Persians and Arabians.

of to-day. Mr. Cramer is an adept on this, as well as the balalaika, for he is, too, a member of Vladimoff's orchestra.

Mr. Will Van Allen

Another expert on the strings is Mr. Will Van Allen, once known as the "Musical Tramp," when he could hold an Alhambra audience for months with his manipulation of the banjo, mandoline, and the "ukulele," on which he is a great authority All of these he has played before the microphone, with tremendous success.

Old-World Music

Naturally the piano has been the most tested instrument, but a still more interesting experiment was made when an attempt to broadcast the harpischord and the old world instruments took place. For the former the first was made with Mrs. Violet Gordon Woodhouse, and the success with this 18th century instrument led to further recitals, notably the most recent one, when the famous Chaplin Trio broadcast old-world music for a special studio performance of the "Beggars Opera," which they accompanied, as they had done throughout its four years' run at the Lyric Theatre, Hammersmith. The three sisters have made

The Balalaika Orchestra, which is now so popular among listeners-in. M. Vladimoff is seated in the centre of the group.

a special study of the harpischord, (Miss Nelly Chaplin) the viola da gamba (Miss Mabel Chaplin) and the viola d'amore (Miss Kate Chaplin), the immediate forerunners of our modern piano, violoncello and violin, of which they are also noted exponents. Amongst the many experiences are the revivals of Olda Dances, a year or so spent in France playing to the troops with Miss Lena Ashwell's Concert Parties and their present engagement at the Lyric Theatre for "The Rivals."

Miss Nellie Norway, the only lady bell soloist, who has been heard several times from the London station.

Another famous player of the viola d'amore is Mr. Percy Frostick, at the Leeds-Bradford station. A prodigy violinist at Queen's Hall, and known subsequently all over the world as violinist as well as conductor, Mr. Frostick has made a special study of this instrument. He possesses a particularly valuable specimen. This has six strings, with a corresponding number of wire strings running under the bridge and finger-board, which are known as sympathetic strings, the vibrations of which give the tone a singularly beautiful quality. Though it may be termed a semi-obsolete instrument, many musicians have recognised its value, amongst them Berlioz, Meyerbeer, who wrote a big obligato for it in "Les Huguenots," and Charpentier, who used it in his score of "Louise." Mr. Frostick broadcast recently the second Sonata of Ariosti (1716), and several modern solos which were vastly improved by being thrown a century back, though this was due as much to the artistry of the player as to the instrument.

The Orchestra

The strings of course invariably broadcast best, as evidenced by the 'cello solos of Mr. Cedric Sharpe, Miss Daisy Kennedy and Miss Nancy Lee, the latter being no longer connected with the B.B.C. The harp, however, is equally successful, in the hands of Miss Sidonie Goossens, the harpist at 2LO, and of Miss Jeanne Chevreau, the brilliant young harpist of the B.N.O.C., whose solos at 2LO formed a very enjoyable item

Mr. Percy Frostick, with his viola d'amore.

Another unique experiment was made by the B.B.C. in order to avoid the use of a double-bass. This was overcome by using the contra bassoon, and though this instrument has very few exponents, luckily Mr. Thomas Dickie, of the London Symphony Orchestra, was at hand. The particular instrument which he uses is the only one of its kind in England. Other players are Mr. Charles Draper, of the Royal Albert Hall, and Mr. Foote, A.R.C.M. Mr. Dickie has made the playing of this instrument a fine art, and its importance at 2LO cannot be minimised.

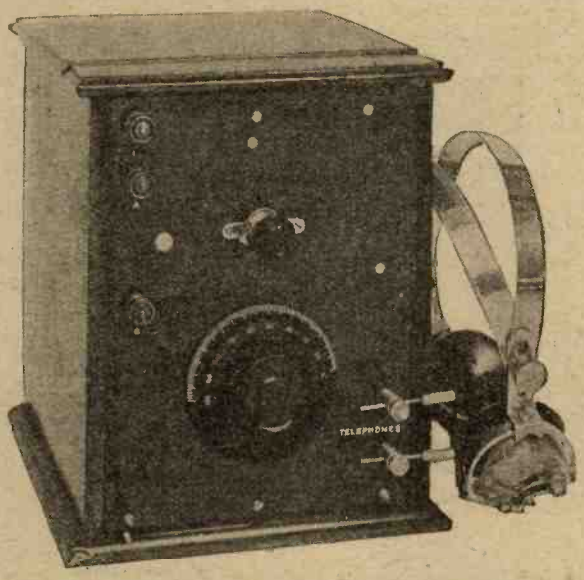
Mr. Frank Armstrong, the well-known organist, at the Æolian Hall Organ.

Amongst the strange instruments also may be placed the bells of Miss Nelly Norway, though they have given most beautiful effects. She enjoys the distinction of being the only lady bell soloist, and was the first to specialise as an individual artiste at the famous Maskelyne and Devant Home of Mysteries. Her bells have been heard several times at 2LO, and have unique effects over the aether.

Broadcast Stunts

We have had various experiments at the Zoo, from the first attempt to discover whether the elephant obeyed the voice or the stick of the keeper, to the sounds of the hyenas and parrots, not forgetting the nightingales wooed and won by the 'cello of Miss Beatrice Harrison.

Then, too, comes the booming of Big Ben, though now a regular artist and "on the staff" of the B.B.C. Several stunts also have been in the way of queer visitors, including the Indians who were brought over last year to illustrate the big famous Lasky film "The Covered Wagon," and they were persuaded to come to 2LO and give their famous war-cries.



The complete receiver is quite compact.

A Simple Receiver for the Invalid

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

THE receiver to be described is one designed for the special consideration of the infirm or aged, or for those people who, not having any interest in the adjusting of their apparatus, wish only to turn a knob to receive the broadcasting. In view of these conditions, everything in the way of adjustment which can be fixed is adjusted to give the best result and then protected by the containing box to prevent mishandling or interference.

The receiver is made up with a special low-loss coil, arranged in such a way as to permit auto-

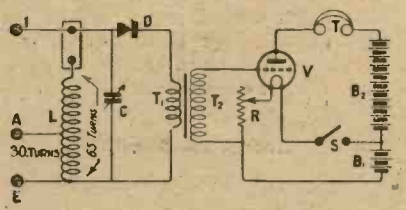


Fig. 1.—The circuit in theoretical form.

coupling, with the consequent selectivity which such an arrangement gives. The tuning circuit is followed by a permanently adjusted crystal detector, which is, again, followed by a low-frequency transformer-coupled valve; the circuit, in short, is a crystal receiver with one low-frequency stage.

Enclosed Filament Resistance

In order to make the operation of the receiver as simple as possible, the filament resistance for the valve is enclosed within the box and, after being adjusted for the correct position, all further control of the valve filament lighting is given by the "on" and "off" switch seen in the photograph. Apart from this switch, the only other control which the operator is called upon to operate is the variable condenser, and, since a low-frequency valve is used to amplify the signals, tuning need not be carefully carried out for loud signals, though with proper tuning results will, of course, be even louder.

Chelmsford

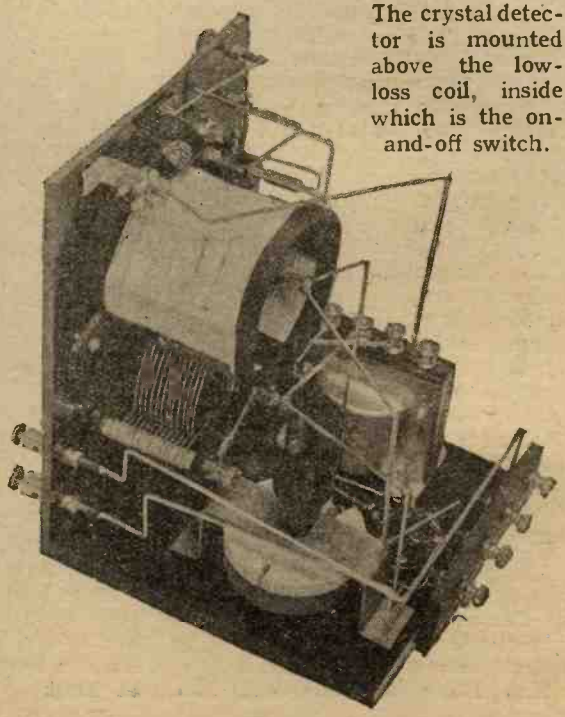
Allowance is made for the inclusion of a loading coil when it is desired to receive the Chelmsford station, and, whether or not this coil is used, the operation of the receiver remains precisely the same, the only difference in the manner in which it is used being that for the reception of the 300-500 metre station the aerial is connected to the lower terminal of the three seen on the left of the set, whilst for the reception of Chelmsford (with the loading coil added) the aerial is connected to the top terminal.

Components and Materials

For the building of a receiver to the specification given herein the following materials and components are required, and for the guidance of readers the names of the manufacturers of the parts illustrated are also given. This information is intended merely as an assistance to readers, and does not necessarily imply that other makes of the same values may not be substituted; on the contrary, so long as the components are of good make, the reader may make his choice with the full knowledge that his results will be the same.

One ebonite panel measuring 6 in. by 8 in. (That in the photograph is a Radion "Mahoganite" panel and is $\frac{3}{16}$ in. thick.)

One permanently adjusted



The crystal detector is mounted above the low-loss coil, inside which is the on-and-off switch.

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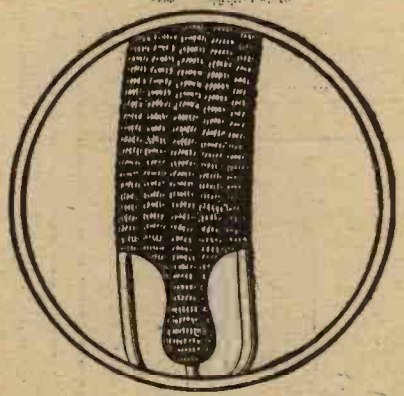

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Table-Talker 42/-

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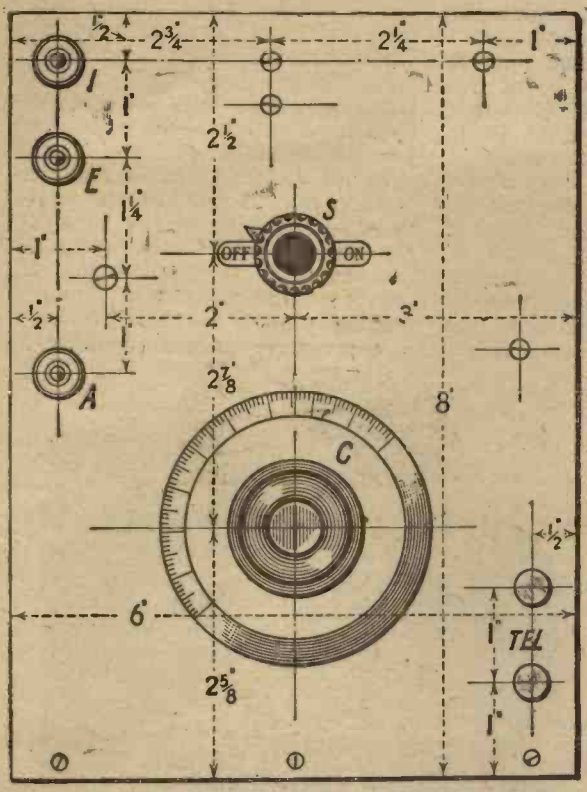


Fig. 2.—The drilling diagram. Note that very few holes are required.

crystal detector (Radio Instruments, Ltd.).

One ·0005 μF square-law condenser (Jackson Bros.).

One low-frequency transformer (Formo).

One valve socket for board mounting (Burne-Jones).

One A B C wavetrap coil former (Burne-Jones).

One coil-socket for board mounting (McMichael).

One filament resistance for board mounting of a suitable type for the valve it is intended to use, i.e., bright or dull emitter (Metropolitan-Vickers).

One strip of ebonite, 4 in. by 1 in. by ¼ in.

One baseboard measuring 6 in. by 6¼ in. by ⅜ in.

Nine terminals.

One short-circuiting plug.

One containing box (Camco).

One "On and Off" jack (Frost-Rothermel).

Quantity of connecting wire.

Half-pound No. 22 d.c.c. S.W.G. wire for winding the coil (Burne-Jones).

One set of Radio Press panel transfers.

One strip of ebonite measuring 4 in. by ½ in. by ⅛ in.

The Coil

Before commencing to drill the panel, it is probably better to prepare the coil, which is wound upon a former similar to that used in the A B C wavetrap. As these formers are easily procurable from most retailers, it is not recommended that the constructor make one himself and for that reason no dimensions for the former are given. To wind the coil, first drill a small hole in the side of the former and through this thread the end of the reel of No. 22 wire and twist it round in such a way that it is held secure. With some one holding the reel of wire, hold the former in the two hands and, after taking up the slack, turn the former towards you so that the wire winds itself upon the former, taking care that the turns are tight and are wound straight. Proceed in this manner until 30 complete turns are wound, when, with the thumb of the left hand holding the turns so that they do not unravel, make a 6 in. loop with the wire in the right hand and twist it round until the twist reaches the former, when proceed to wind a further 35 turns, making in all 65 turns upon the former.

With these 65 turns successfully wound, leave about three spare inches and cut the wire, securing it from untwisting in the same way as was done with the beginning of the winding.

The Circuit

The circuit of the receiver is shown in theoretical form in Fig 1, and it will be seen that if we short-circuit the loading coil socket and connect the aerial to A and the earth to E, the total number of turns in circuit is sixty-five. With this arrangement of connections we are using what is called auto-coupling, which arrangement gives a considerably higher degree of selectivity than would be the case were we to connect the aerial to terminal 1, still retaining the earth at E.

If, on the other hand, we insert a loading coil in the circuit, we may make our aerial connection to the terminal 1, still with the earth at E, and so dispense with auto-coupling in favour of direct coupling, for upon the longer wavelength the chances of spark interference are fewer and the call for selectivity less important.

Still another arrangement is that, with or without the loading coil, the aerial may be connected to 1 with the earth to A, leaving E perfectly free, and it is largely a matter of experiment to ascertain which is the best arrangement for each individual aerial, and to retain the best connections for further use upon that particular aerial; if the set is taken to a friend's house for trial upon any other aerial, then the connections as given above should be again tried.

The Panel

The panel should be drilled in accordance with the instructions given in the panel layout, and with all the drill holes made with countersinking when necessary, the

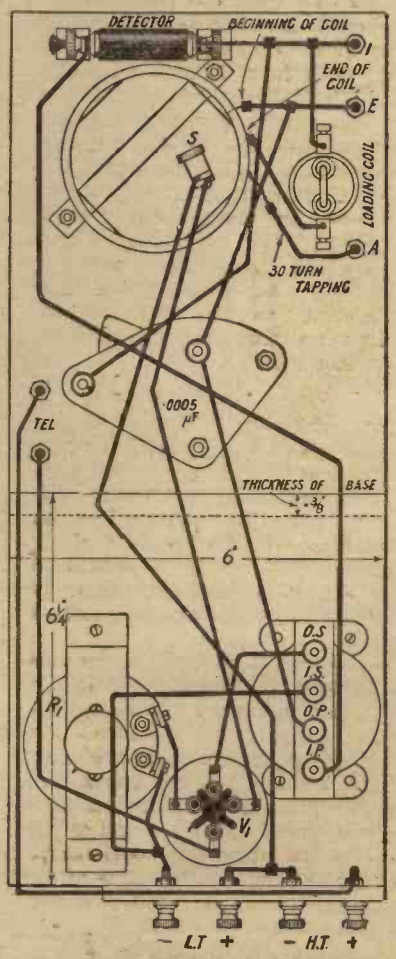


Fig. 3.—This shows the wiring as if the panel and baseboard were "flattened out."

components may be mounted. In connection with this work, it is advocated that the "on" and "off" switch be mounted first as the projections from this are situated *inside* the coil when the latter is mounted.

With the switch in position the variable condenser should next be mounted, after which the coil should be secured to the panel in the following manner: Place the coil over the switch and between the lower edge of the former and the coil winding, insert the ebonite strip whose dimensions are 4 in. × ½ in. × ⅛ in., and secure temporarily by means of two 6 BA screws as is shown in the photographs. Now position the coil, by sliding it about, until it clears the moving vanes of the variable condenser, when the two 6 BA screws should be tightened up. The mounting of the remainder of the components upon the panel depends upon the constructor's inclination, and when all have been mounted, attention should be given to the baseboard.

Before securing the panel to the baseboard, the ebonite strip, measuring 4 in. × 1 in. × ¼ in., should be fitted with four terminals equally spaced, and the whole secured to the baseboard, as shown in the photographs, by means of two wood screws. With this done, the panel should be secured to the baseboard by three further wood screws and the mounting of the components upon the baseboard proceeded with in the order most convenient to the constructor, though no alteration in position must be made.

Wiring the Receiver

The wiring-up of the set should present no difficulty, in that every component is easily accessible, even with a large soldering iron. The wiring must be carried out in accordance with the practical wiring diagram, and all leads should be well spaced from each other, in addition to being kept as short as possible.

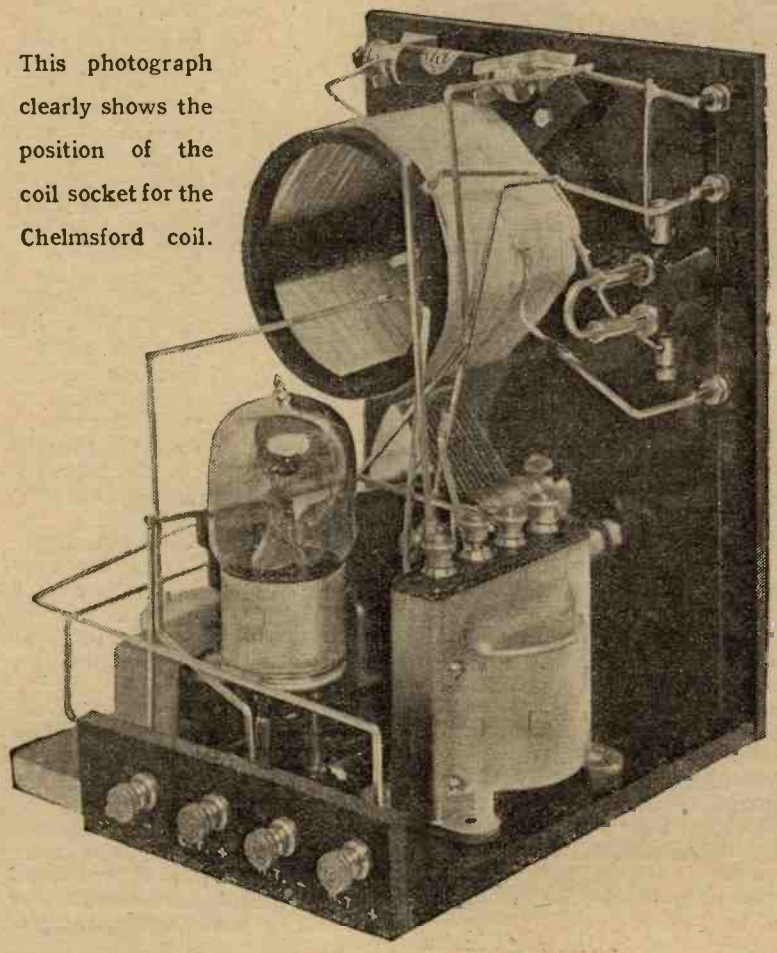
With regard to the connections to the coil, these are made in the following manner: The thirty-turns tapping is connected to terminal A, whilst the two ends of the low-loss coil are connected, one to one side of the loading coil socket, whilst the other end of the low-loss coil is connected to the earth terminal E, the moving vanes of the 0·0005 μF condenser, and one side of transformer primary.

Operating the Receiver

Having decided upon the type of valve to use insert it in the valve socket, turn the "on" and "off" switch to the "off" position and the filament resistance also to an "off" position, and connect a suitable accumulator giving the required voltage. Turn the switch "on" and test the lighting circuit by means of the filament resistance; assuming all is well, connect the H.T., the telephones, short-circuit the loading coil socket, connect the aerial to A and the earth to E. Now adjust the valve to a suitable degree of brilliancy and slowly turn the condenser dial until the local station is heard, when adjust the filament resistance of the valve for the best results. With these obtained, again turn the condenser for the very best signals, and with these obtained change the aerial and earth connections as suggested above for the loudest results.

Having decided upon the best arrangement, turn the switch "off" leaving the filament resistance alone and place the set in its containing box. It will now be found that all that is required to operate the set is to turn on the switch and tune upon the variable condenser. If it is desired to receive Chelmsford, the lid of the box should be lifted, and the short-circuiting plug in the loading coil socket substituted for a No. 150 plug-in coil, tuning being again made with the variable condenser. The aerial must be joined to termnial 1.

It will be found that in time, it is necessary to readjust the filament resistance, indicating that as the accumulator is running down less resistance is required in the circuit; further, before finally leaving the set as a fool-proof instrument try readjusting the crystal detector in accordance with the instructions given by the maker.



This photograph clearly shows the position of the coil socket for the Chelmsford coil.

Results Obtained

Using the receiver in S.E. London upon both indoor and outdoor aerials really excellent signals were obtained from both the old and the new 2LO stations, signals, when using the outdoor aerial, being audible on the loud speaker at small room strength. Using the same aerials with a No. 150 coil in the loading coil socket good signals were obtained from Chelmsford in both cases.

(Continued on page 650.)

Duodyne

The LONG RANGE LOUD SPEAKER RECEIVER

Guaranteed Range under average conditions:

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". . . . With an indoor aerial on my Duodyne III I receive all B.B.C., most Continental, and four American stations nightly, whether London is on or not . . . Tuning is absurdly simple, as there is 'music all round the dial' . . ."

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BUILD YOUR OWN DUODYNE—the genuine long-distance Receiver. Circuit diagrams, layout & SIMPLIFIED WIRING CHART, detailed instructions and list of essential components in sealed envelope **1/6**

Increasing the Range, Selectivity and Stability of your Super Heterodyne Receiver

The present rising popularity of the Super Heterodyne Receiver has revealed a surprising absence of suitable intermediate frequency transformers. Three or four stages, employing tuned transformers with a steep resonance peak, encourages the inherent tendency of the intermediate long wave stages to burst into self-oscillation.

Experiment has also discovered that, in all super heterodyne work the efficiency of the long wave amplifier contributes largely to the success of the complete receiver.

Where provision is made for three intermediate stages, it is suggested that two should be tuned and the remaining stage—preferably the second—aperiodic. In the case of four intermediate stages, alternate stages of tuned and aperiodic are advised.

This arrangement introduces a very desirable compromise, and permits comparatively accurate balancing up of the long wave intermediate frequency amplifier. The Curtis Constant-Tuned H.F. (Aperiodic) Amplifier provides a very efficient aperiodic coupling. It is designed with the four-pin plug-in mounting, and is interchangeable with the ordinary plug-in transformer.

The efficiency of this Curtis production is proved by its remarkable performance in the famous Duodyne Receivers. Its use in the long wave intermediate amplifier will stabilise this very important unit and will give you the control over the tendency to self-oscillate.

Finally, in such cases where an H.F. Valve is employed in front of the first detector, the Curtis Constant-Tuned H.F. (Aperiodic) Amplifier is particularly efficient. It gives just the required amount of amplification and selectivity without adding another control.

Full information and diagrams can be obtained upon request.

Type A 300 to 800 Metres. Price 15/-
Type B 800 to 3,000 Metres. Price 17/6
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(Specially designed for Super Heterodynes)
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The Radio Mail

Published periodically in the interest of Valve Users

A new type of Dull Emitter

Experts declare new Wuncell Dull Emitter likely to revolutionise Valve design

TO produce a Dull Emitter Valve which operates with a glow that is almost invisible in daylight is a feat that has just been accomplished by the London firm of A. C. Cossor Ltd. This new Valve—called the Wuncell because it requires only *one cell* to operate it—is certainly the nearest approach to the ideal of a "cold valve" that we have yet seen. Viewed under working conditions the filament could just be seen glowing in daylight, while in a dark room it could readily be likened to the embers of a dying match.

Asked to give some approximate idea of the actual temperature, a representative of the firm stated that, according to pyrometer tests, the reading was 800 degrees as against the 2,000 degrees required by Bright Emitters and even some types of Dull Emitters. For our benefit actual tests were made between the amount of heat (or light) generated by a Wuncell and other types of Valves. The differences were most marked, and demonstrated to the lay mind in a very striking manner that such a low filament temperature must mean a vastly increased life for the Valve.

The British Valve still the best

But it was on actual Broadcasting tests that this new Wuncell showed that, so far as this country is concerned, we have nothing to fear from Continental Valve manufacturers. For the purposes of demonstration a good four-Valve set was used. For the first Valve—which acted as a high-frequency amplifier—a Wuncell type W.2 was used, while for the last stage one of the new Wuncell Loud Speaker Valves was used as a power amplifier. The other two Valves were the standard W.1 Wuncells.

Connected to a fairly good aerial in North London, 2LO had to be considerably de-tuned even for three Valves in order to prevent "blasting" from the Loud Speaker, while with the fourth valve in operation every B.B.C. main station, with the exception of Cardiff, was brought in with incredible volume and exceptional purity. Cardiff—owing to our close proximity to 2LO—could not be tuned in. The following Continental stations were also received at good Loud Speaker strength: Hilversum (a Dutch broadcasting station with call sign HDO), Bremen on 330 metres, Zurich, Radio Iberica of Madrid, and a further Continental station which could not be identified owing to "fading" but which corresponded in wave-length to Vienna.

Wuncells just as sensitive as Bright Emitter Valves

The result of these tests certainly demonstrated that the new Wuncell Valves are not one whit less sensitive than standard Bright Emitter Valves. Another remarkable feature of these Wuncell Valves was their complete freedom from microphonic noises. It has hitherto always been an inherent disadvantage of other dull emitters that even footsteps in the room or other slight vibrations are communicated to the Valve to cause ringing noises in the headphones or Loud Speaker. All the usual tests, such as tapping the table on which the receiver was placed, adjustments of the rheostats, etc., failed to produce the slightest suggestion of a microphonic noise.

We understand that the reason for this improvement is to be found in the special Wuncell method of mounting the filament. Instead of being supported between two electrodes, sprung apart to counteract expansion and contraction, its filament is arched (following standard Cossor practice) and supported at the centre by a third electrode. No doubt, too, the grid—cleverly designed and very rigid—is a contributory factor to this result.

Use Wuncells along with Bright Emitters in the same Set

We were most impressed, not only by the very neat appearance of the Wuncell, but with the vast amount of forethought and research work that must obviously have been put into its construction. For instance, because it was realised by the designers that many multi-valve users would like to try out one Wuncell in conjunction with their ordinary Valves, a special base was designed. This base carries a resistance in series with the filament to permit the valve being used with either a 4- or 6-volt accumulator. Normally, of course, the Wuncell functions at rather less than 2 volts. This excellent idea gives any amateur a chance of trying out one of these new Dull Emitters and comparing its behaviour with the Bright Emitters he may be using. At any later date—by the use of a small screw—the resistance can be short-circuited and the Wuncell used at its correct current of 2 volts. It is worth while noting, too, that all Wuncell Valves are being supplied with the new black low-capacity base in which air only is used at the dielectric between the leads to the four valve legs.

Experts that have witnessed demonstrations of Wuncell valves have expressed their satisfaction at the production of a Dull Emitter which can compare most favourably with the best Bright Emitters. It has always been felt that hitherto a sacrifice of at least 20 per cent. in volume has been the price that must be paid to obtain the conveniences offered by Dull Emitters.

How long should Valves last?

Many keen wireless amateurs get over twelve months' service

How long a Valve lasts depends very largely on how it is used. Some men can make their suits last very much longer than others—a little care and attention now and again will prevent creases forming and the material from losing its freshness. The same applies to Valve. For instance, how many amateurs know that the use of filament switches in a Receiving Set—although a great convenience—shorten the lives of the Valves very considerably. Rheostats should be used for the purpose of turning current on and off; to throw the full load on at the turn of a switch is to cause a sudden expansion of the wire used in the filament, and to switch off suddenly is to cause a sudden contraction. No Valves built can withstand such strains indefinitely.

Treat your Valves properly and you'll find they'll last very much longer. For instance, Mr. G. H. Hasemer, of 9 Galliard Road, writes as follows:—

"I think it is only right to testify to the excellence of Cossor Valves, more particularly as far as I am concerned the P.1. On December 1, 1923, I purchased two of these Valves and they have been going strong ever since, and are functioning well now.
They have been in use on an average of 2½ hours per day from date of purchase, which brings present life up to nearly 1,000 hours. How long they will last I cannot say—perhaps you can estimate. However, I shall certainly repeat a selection of Cossor P.1."

While Mr. J. Harris, of 13 Stepney Bank, Newcastle-on-Tyne, thinks that sixteen months' regular service for one Cossor Valve is something of a record. Writing on January 27, 1925, he says:—

"In September of 1923 I purchased a P.1 Cossor Valve, and wish to state that it has given me excellent service until to-day. The Valve in question has never missed the Savoy Bands, nor Official News of the B.B.C.
Total life of Valve, sixteen months.
Perhaps there are others who can beat this record, but I, as an old user of Cossors, am perfectly satisfied."

Even this record would seem to be eclipsed by a Cossor P.1 which has been doing yeoman service every day for a period of 1,700 working hours on a One-Valve Reflex Set. The owner, Mr. Harold Cooper, of 8 Cotherstone Road, London, S.W. 2, expresses his satisfaction in these terms:—

"I should like to mention that I have used a Cossor No. V. 9132 in use since last September, and averaging at four hours per day (very moderate average for afternoons and evenings) it has given over 1,700 working hours, and is still going strong, and therefore bears out conclusively all you claim in your advertisement; my circuit is One-Valve Crystal Reflex."

Valves to be in sealed boxes

One well-known manufacturer definitely decides to issue all future Valves in sealed cartons only

A move of the utmost importance has been made by A. C. Cossor Ltd.—the well-known British Valve manufacturers. They have decided that, in order to protect the public and to ensure their Valves being used in absolutely new condition, they are now sealing every Valve in its carton at the Works. Asked how it would be possible for the shopkeeper to be certain that he was selling a sound Cossor Valve, a member of the firm explained to a representative of the *Radio Mail* that this was a matter which had certainly presented some difficulties. Various methods had been carefully tried out, including sealing the legs of the Valves and other devices, but none had proved to satisfactory in practice as the method they were now adopting. This consists of wrapping the Valves in a very generous covering of cotton wool, after having first brought two copper wires from the filament legs to two studs on the end of the box. When a customer wants a Cossor Valve, these two brass contacts are placed in series with an electric flash-lamp battery and a bulb. If the filament should happen to be damaged, the circuit will not be complete and the lamp will not light. This test can be easily carried out without breaking the seal of the box by means of a very ingenious showcard, which we understand Cossor's are supplying free of charge to all Wireless dealers.

A prominent manufacturer of Broadcast Instruments exphatically endorsed this new idea. He agreed that it was a wise move that had been long awaited. The public, he declared, welcomed any method of purchasing usable accessories under a seal. In his opinion the Wireless dealer—while not shirking responsibility—considered that the manufacturer ought to take steps to see that his (the manufacturer's) responsibility ended only when the article reached the actual user.

Have you got down to the short waves yet?

Get ready for the new Broadcasting Stations operating on 100 metres or less

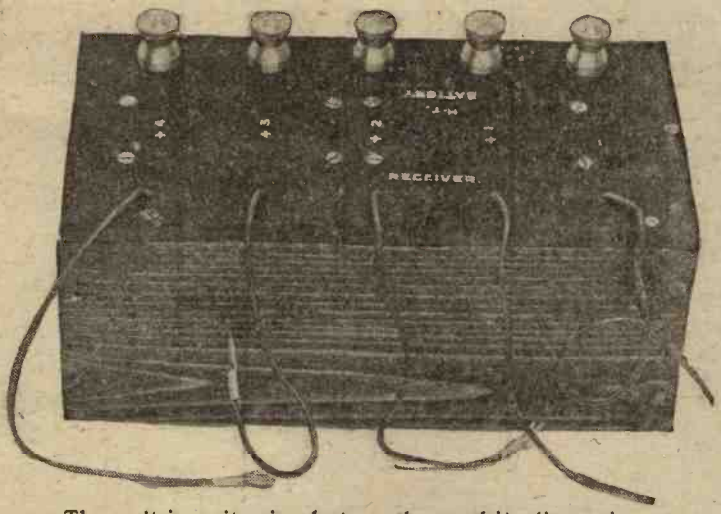
There's lots of enjoyment to be obtained from short-wave reception. If you can read Morse, you should certainly alter your set so that you can get down to 80 metres and under. Any evening will find scores of British amateurs corresponding with their friends across the seas. The most extraordinary thing about these short waves is their tremendous power of penetration. Using but very little power, amateurs can send messages immense distances. Incidentally the tuning of short waves means the use only of high-grade components and suitable Valves. How far American amateurs can send on short waves is a matter of conjecture—it is sufficient to say that signals have been received in this country without aerial or earth. In this connection, Mr. J. Gordon Richie, the well-known Glasgow experimenter, writes as follows:—

"10th December, 1924.

"Some time ago I wrote you concerning the excellent reception of American broadcasting obtained with two of your P.1 Valves. They have since demonstrated their capabilities in another way.

I am now using a Reinartz-type receiver on the very short waves of 80 metres and under, consisting of detector and one low-frequency, and during the past fortnight have logged 105 American amateurs, of which twenty were heard on one night without either aerial or earth. Either of my two 'Cossors,' now almost two years old, are the only Valves I have got to oscillate below about 60 metres.

Considering the constant use and incidental knocking about to which these Valves have been subjected, I think this speaks highly for your products, and I am looking forward to a further period of their usefulness."



The unit is quite simple to make, and its dimensions are made suitable to the condensers used.

A Shunting Box for the High-Tension Battery

A useful gadget for use with multi-valve sets, which require different tappings on the high-tension battery for the various valves

By JOHN W. BARBER

WHEN a high-tension battery is newly purchased, and, therefore, is, presumably, reasonably fresh, one can be fairly sure that noises in the receiving set are not attributable to this accessory, and must look elsewhere for the trouble. As the battery wears out, however, noises will occur, even in an otherwise quiet receiver,

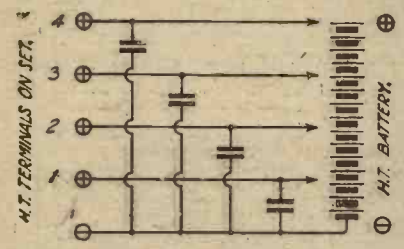


Fig. 1.—This shows the connection in the theoretical manner.

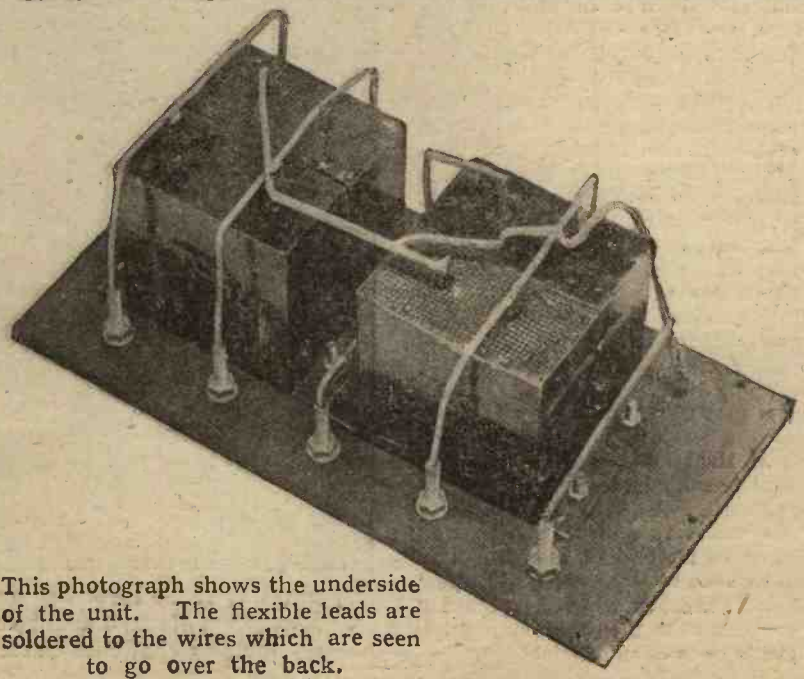
which will seriously affect the enjoyment of the musical item being received. When such noises, which usually take the form of cracklings or splutterings, are noticed for the first time after a new battery has been put into commission, they may be almost entirely eliminated by the simple expedient of joining a large "reservoir" condenser across the positive and negative tappings on the battery. This condenser, which should be fairly large, say, 2 μF, acts as a smoothing device for the little irregularities in the supply from the battery, and we shall find that our reception is once more quiet.

Multi-valve Sets

This remedy is quite effective in the case of a single valve receiver, or a receiver employing more valves, but which is only provided with a single terminal for the H.T.+, but when we come to consider a multi-valve set with separate high-tension terminals, perhaps, for each valve, it is obvious that our previous arrangement is useless, for the condenser cannot be joined across all the tappings at once, and thus, while the condenser quietened down one section, all the others would still be noisy.

A Condenser for each Tapping

The obvious thing to do is to connect a condenser across each tapping and the negative end of the battery, but this becomes a problem if one uses more than one set, or if one wishes to change the high-tension battery from one set to another. I have never included a condenser across the high-tension terminals in my sets, because I do not see the necessity for tying up such a condenser in each set, or, rather, one for each tapping in each set, and I have made up the box seen in the photographs in order that the shunting condensers may be kept together without any loose wires trailing all over the bench. The battery tappings are joined to the row of terminals on the right of the box, the bottom terminal



This photograph shows the underside of the unit. The flexible leads are soldered to the wires which are seen to go over the back.

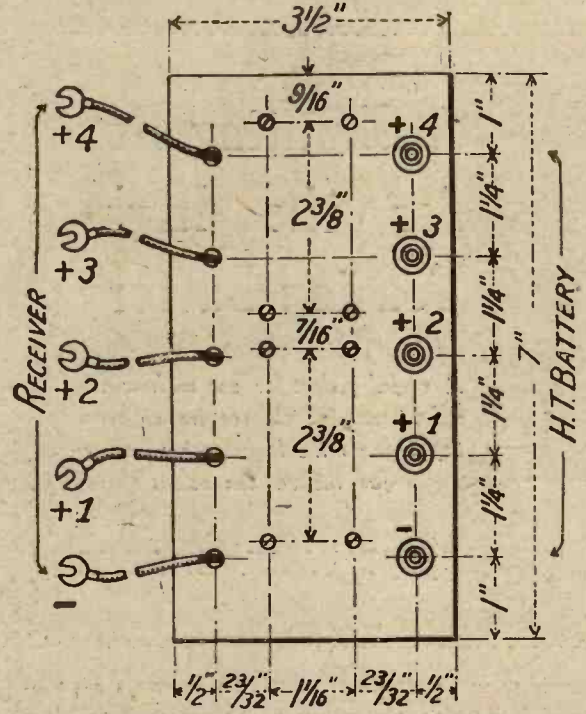


Fig. 2.—When using 2μF T.C.C. condensers, the dimensions given above will be found quite suitable.

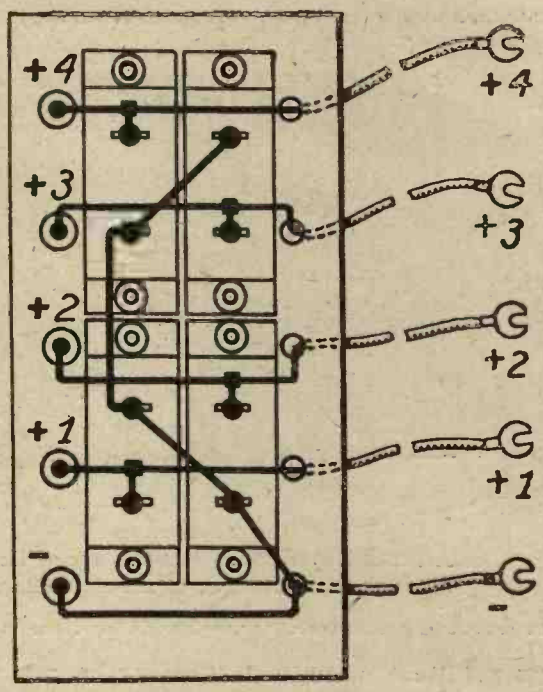


Fig. 3.—This shows how the condensers and terminals are joined up to the flexible leads.

being that to which the negative of the battery (or batteries, if one is used for each tapping) is joined. The flexible leads which are on the left or receiver side of the unit, terminate in spade tags, which are easily slipped under the correct terminals of the receiving set.

A convenient size for the piece of ebonite upon which the condensers and terminals are mounted is 7 in. by 3½ in., and may be either ¼ in. or 3/16 in. thick. This leaves sufficient room at the sides for the terminals and a row of holes for the flexible leads to pass through.

Parts Required

To make such a shunting box, you will require a piece of ebonite of the size mentioned, four condensers, each of 2 microfarads capacity, five terminals, eight 6 B.A. screws and nuts, some tinned copper wire for wiring up, and flexible wire for leads. The parts specified above are necessary if you want four positive tappings, but should you require more, add one condenser and one terminal for each tapping above the number given.

It may be regarded as essential in such a shunting box, to suitably mark the terminals in order to prevent possible error through wrongly joining up either to the battery or the receiver, and a simple and effective method of marking may be utilised by means of Radio Press Panel Transfers, which are placed in position as seen in the photograph at the head of this article.

The Construction

The construction of the unit is quite simple, and will be easily followed from the diagrams, while the wiring is also quite simple. If you prefer it you may replace the terminals with flexible leads ending in wander plugs, and many will consider this arrangement the more useful, as it reduces the number of connections necessary when joining up a receiver on the test bench, or when in use.

Fewer Tappings

If you use this unit with a set employing, say, two H.T. tappings only, all you need to do is to leave two of the terminals free, and join up, say, H.T.+ 1 and 2 and H.T.− terminals and leads to battery and set respectively.

Visiting day at the Liverpool station is Saturday. Above we see a happy group of small members of the Children's Radio Circle enjoying a chat with Uncle "Pip" and Auntie Muriel.

THE "SHORT-WIRE" VALVE PANEL.

SIR,—I have made up the "Short Wire Valve Panel" from the January issue of THE WIRELESS CONSTRUCTOR. I wish to report results obtained, although I have not had time to test it thoroughly.

I am situated, roughly, about 30 miles from Manchester and about 12 from Liverpool. I can get both these almost too loud for 'phones. I get London and have had a couple of German stations. On Monday night, at 9.50, I tuned in a station which I believe to be French. It was the opera, or some part of the opera, "Les Cloches de Co[illegible]ville." I was using a 50 coil in the aerial and 75 in reaction, .0005 variable condenser in series.

Yours faithfully,
ALBERT TAYLOR.

St. Helens, Lancs.

USING RADIO PRESS PANEL TRANSFERS.

SIR—I thought you might be interested in the following improved method of applying Radio Press Panel Transfers to wireless panels which does away with the hot pad business. Place the transfer on panel and moisten back with methylated spirits, press down with thumb and then apply cold water to remove paper by slowly drawing this away, leaving the transfer on panel intact.

I found that the above method takes about a third of the time occupied by adhering to the printed instructions.

Yours faithfully,
GEORGE J. PULLIN.

Chester.

THE "SHARP-TUNING" SINGLE VALVE RECEIVER.

SIR,—As a first set I have just mounted the "Sharp-tuning single valve set," by Stanley G. Rattee, and beg to inform you that I have very good results with same, although being in a very bad position, as I use the electric mains for an aerial and for earth the water tap, which is three rooms away.

I have used this set with a roughly connected L.F. amplifier, but the results were too loud for phones.

With compliments to THE WIRELESS CONSTRUCTOR, to which you could add "and Encyclopædia."—Yours faithfully,

Paris. DUBOIS.

THE SINGLE VALVE REFLEX RECEIVER.

SIR,—I feel that yourself and particularly your readers, will be interested in the results I have obtained from the single valve reflex receiver, as described in THE WIRELESS CONSTRUCTOR February issue, by Mr. Percy W. Harris.

In building this receiver I followed the circuit, but mounted the valve (Marconi R 5) and coil-holder on the outside of the panel, and fitted an Igranic transformer in place of a Royal.

On connecting the set to the aerial and earth I was surprised to get Madrid faintly, within five minutes afterwards getting Cardiff at good strength on two pairs of phones.

I might mention that although having a fair knowledge of wireless, gained chiefly from THE WIRELESS CONSTRUCTOR, I have not handled any set previous to this.

Last evening, the 11th, at about 8.45, I tuned in Cardiff at good strength (two pairs 'phones), which continued until they closed down. I then picked up the following stations:—

London, 2LO, very loud.
Manchester, fair.
Bournemouth, very faint.
Madrid, very clear.
Newcastle, fair.
Glasgow, clear.
Belfast, very faint.

On 2LO closing down I had very clear reception from Glasgow (dance music and close down). I then had Madrid at excellent strength until 12.15 a.m., when I closed down.

A No. 50 coil in the aerial and 75 in the reaction was used throughout the evening.

Aerial 65 ft., 7/22 copper, stranded 25 ft. high.—Yours faithfully,

Swindon. G. HARDING.

This set, made by boys at St. Paul's School, Dorking, was exhibited at the Schools' Wireless Exhibition, held recently.

Secrets of Long-Distance Working

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

HAVE you, as a new-comer to wireless, wondered how it is that people with no better equipment than yourself are able to listen to stations very many hundreds of miles away, while you can only hear the nearest? Have you felt annoyed that after spending £40 or £50 on a set you cannot get such good results as some schoolboy round the corner? Have you, in fact, been reduced to a state of chronic doubt regarding the achievements of those people who say they can hear all the B.B.C. stations on a single-valve set? If you answer "Yes" to any of the above questions, then this article may help to make matters clearer.

Good and Bad Spots

I have already explained in a previous issue why it is that some crystal users get far better results than others. It was pointed out last month that there are good and bad spots throughout the country—that is to say, spots which differ considerably from one another in regard to the strength in which the nearest station can be heard. Sometimes such good and bad spots may be within a mile or two of one another, and at one of them a station a hundred miles away can be heard quite loudly on a single-valve set, whilst at the other there is great difficulty in hearing a station 25 miles away.

Highest Efficiency

While general use of a wireless set is something which can be learned very rapidly (unless it is a very elaborate multi-valve set with some special circuit), to get the highest efficiency out of even a single-valve set requires much skill. Furthermore every detail has to be "right." The aerial must be well insulated, must not run close to and parallel with the wall for any distance, the earth connection must be good and sound, the earth lead (that is to say, the lead from the earth itself to the actual instrument) must not be too long, and the aerial must be perfectly insulated where it is let in through the wall. Given these preliminaries, the valves used must be suitable for the circuit with which they are used, the filaments must not be too bright, and not too dull, the value of the high-tension voltage must be correct,

Mr. Harold W. Arlin, the announcer at KDKA, whose voice is well known to many listeners in this Country.

the coils used must be suitable for the wavelength band it is desired to listen to, tuning must be accurate, and the control of reaction properly carried out.

Proper Use of Reaction

Last month Mr. G. P. Kendall, B.Sc., explained to you the use and abuse of reaction. Proper adjustment of reaction is helpful in every valve set, and the greatest sensitivity can only be obtained when this is properly attended to. A matter which does not receive the attention it deserves is the correct adjustment of the valves, as well as their choice. Fortunately, in this country at least, the manufacturers of valves issue plenty of information regarding them, making quite clear the purpose for which they were designed.

Types of Valves

We have, for example, what are known as general purpose valves, which will suit either high-frequency amplifiers, detectors or note magnifiers; we have special valves for high-frequency amplification, special valves for low-frequency amplification, and what are known as power valves. Power valves are designed for low-frequency magnification only, and their sole virtue is that they can handle very loud signals, giving them further amplification, without any distortion resulting. There is no magic in the power valve, and a substitution of one for a general purposes valve will only show a marked improvement when the signals being handled are already very strong, and it is desired to distribute them at great strength from a loud speaker to a large room or a hall.

On the box in which each valve is supplied or else on the small slip on the valve, you will find certain figures. Filament voltage is given as, say, 4, plate voltage as from, perhaps, 30 to 85. Of the two the filament voltage is the more critical, and if this is attended to it is probable that your long-distance results will be greatly improved.

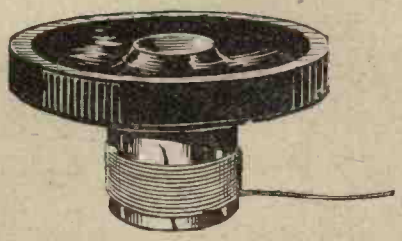
Filament Voltage

Let us consider for a moment the question of filament voltage. We will say that the filament voltage is stated as 4, and you have a 6-volt accumulator attached to your set. The current, in passing from the accumulator to the valve filament, passes through a filament resistance, and the effect of this is to reduce the voltage applied to the valve

itself. With a 6-volt accumulator, a bright emitter valve, and an ordinary filament resistance the voltage will be brought down to 4 when the resistance knob is turned a little way "on." As the knob is turned round to the maximum position, so the voltage across the valve filament will rise. The best way to ascertain the correct adjustment for your valve is to buy a small voltmeter (the kind sold for testing accumulators is quite good for this purpose), and with the filament resistance on, carefully make contact with each of the filament legs. You will then see the actual voltage applied to the valve filament, and the filament resistance can be adjusted accordingly, until you get it to the figure indicated by the makers. I do not recommend this procedure with the very low consumption valves taking .06 ampere, but it is quite accurate enough for bright and semi-bright emitters now available. Set all your valve filaments correctly, and it is probable that your reception will be greatly improved in quality and strength. Be careful, however, not to burn the valve filaments brighter than stated by the makers. You will not notice any great difference in signals, but the brighter the valve burns above the rated voltage the shorter will be its life, and even at 11/- each, valves are too dear to waste!

Repairing a Cracked Ebonite Knob

EBONITE is brittle stuff, as most of us have found to our cost at one time or another. A mishap which is very liable to occur is the cracking of the boss of a control knob into which the spindle of a condenser, variometer or rheostat is screwed. When the crack occurs the threads in the ebonite become so loose a fit for the spindle that the knob cannot be fixed. Quite a good repair can be effected in the way shown in the sketch. The boss of the knob is bound very tightly with the strong fine wire that florists use for making up "buttonholes." Remember that it is essential to put the wire on very tightly indeed. Winding should always start from the top of the crack so that it may be drawn together more and more as the wire is put on. If you work the other way the job will not, as a rule, be at all satisfactory. If the crack does not gape at all when the knob is removed from the spindle, it can often be repaired satisfactorily in another way. Remove the knob and place its boss between the jaws of a vice, tightening them until the crack is all but invisible.

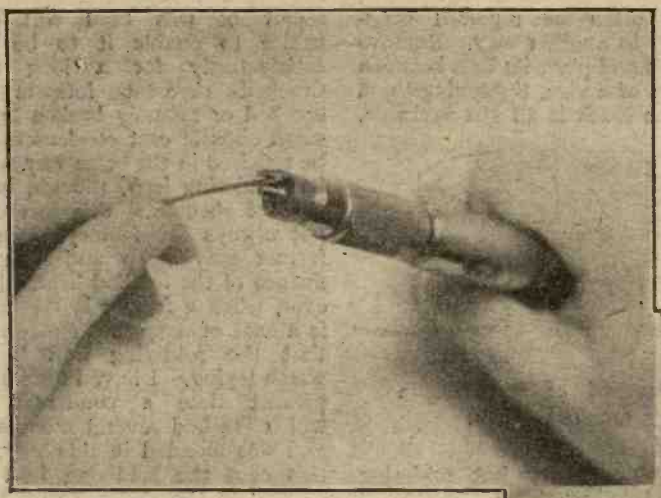


A method of repairing a cracked knob.

Now, take a very hot soldering iron and follow down the line of the crack with its point, making the ebonite run. This usually suffices to weld up the ebonite, and, provided that the knob is not forced too hard on to the spindle, a repair of this kind will often suffice to enable it to be used satisfactorily for a long time. Cracked rheostat formers and cracked or actually broken lugs of small ebonite cast condensers may be repaired in the same way with a hot soldering iron, though, in the case of rheostats, this method is not always satisfactory, since the former may warp under the influence of the applied heat. However, when a former is cracked it is a case of desperate remedies, so that the soldering iron is well worth trying. I have in use at the present time a condenser dial which cracked several months ago and was mended in this way. In this case the soldering iron was applied to the underside only, the edges of the crack being held tightly together by placing the dial horizontally in the jaws of a vice. R. W. H.

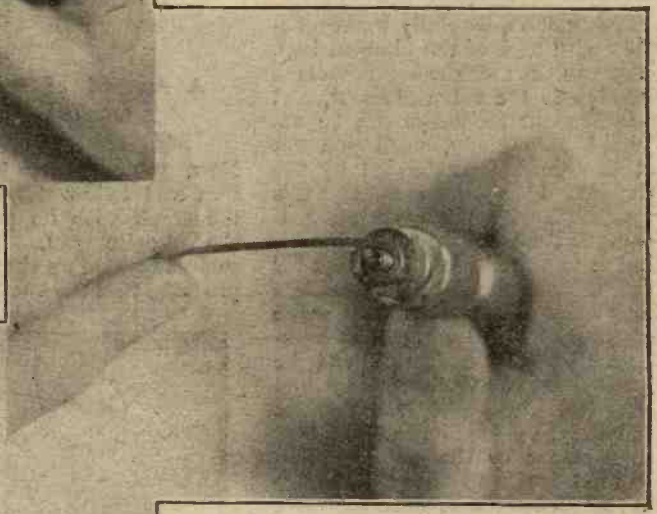
M. Vladimir Vladimoff, the Director of the famous Balalaika Orchestra, with his instrument.

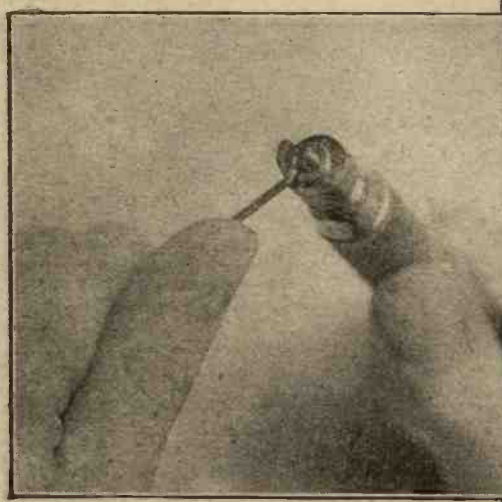
How to Finish Off Your Wires

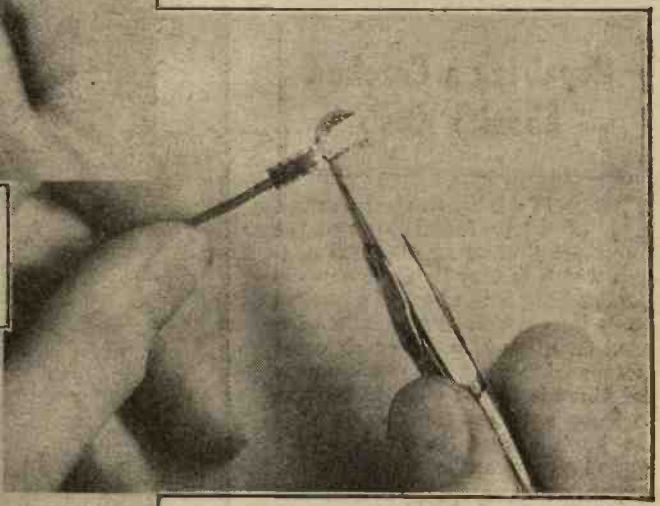


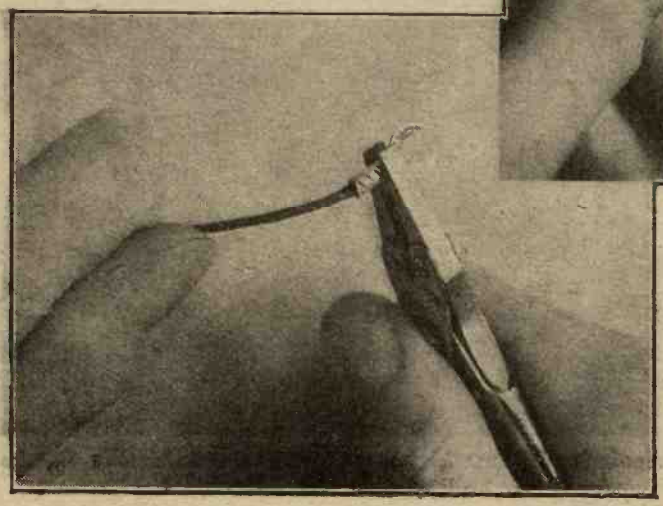
WHETHER or not your set has a neat and "finished" appearance depends to a large extent upon the way you finish off the wires. Here are a few photographs that will help you.

Many constructors find difficulty in making a neat loop in the heavy-gauge square section tinned copper wire now so deservedly popular. Fortunately this work can be simplified by the use of a small bending tool now available. Our first three photographs show the Yankee bender, one of the Yankee radio tools. A similar tool is also sold in the Wade tool outfit.



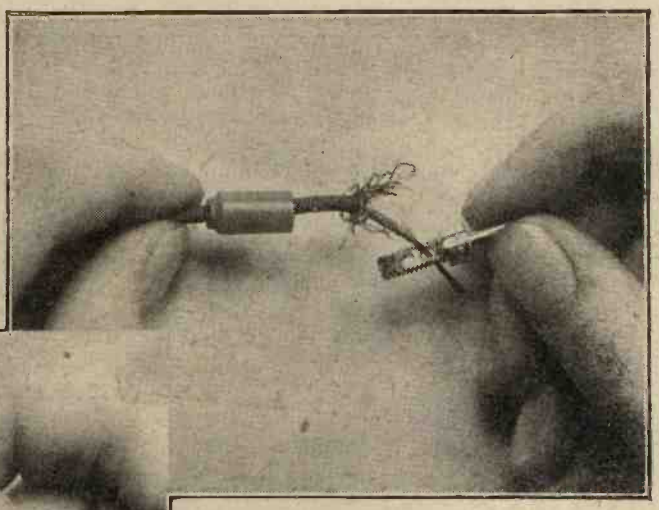


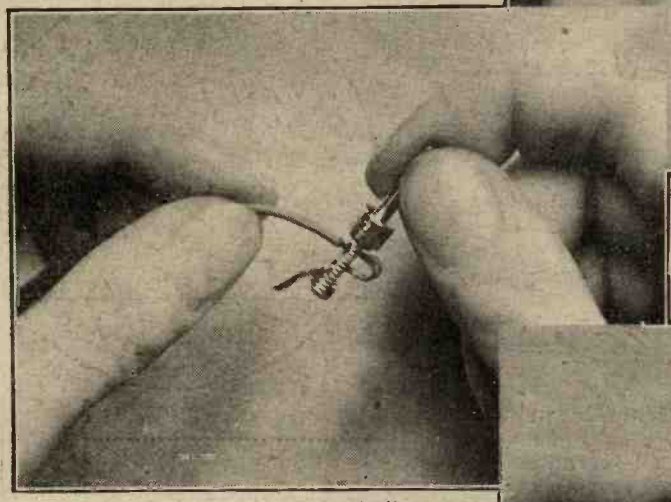




Spade terminals can be readily fixed to the ends of flexible wires by pinching them on, as shown in the fourth and fifth photographs. A good firm grip of the pliers is required.

On the second page the method of using the Gibson terminals is shown. These make a strong sound contact by threading the wire through two holes, bending the wire over the top, and screwing on an insulating sleeve, which must be threaded over the flex prior to inserting the wire in the terminal holes. These terminals are obtainable in several forms and with both red and black sleeves. Other terminals, such as the

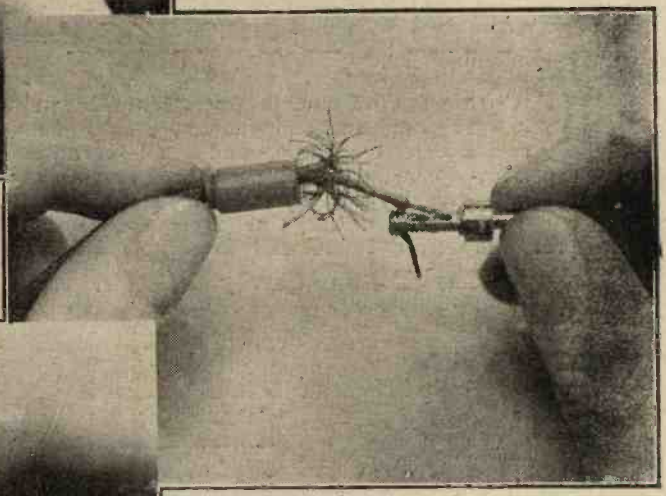




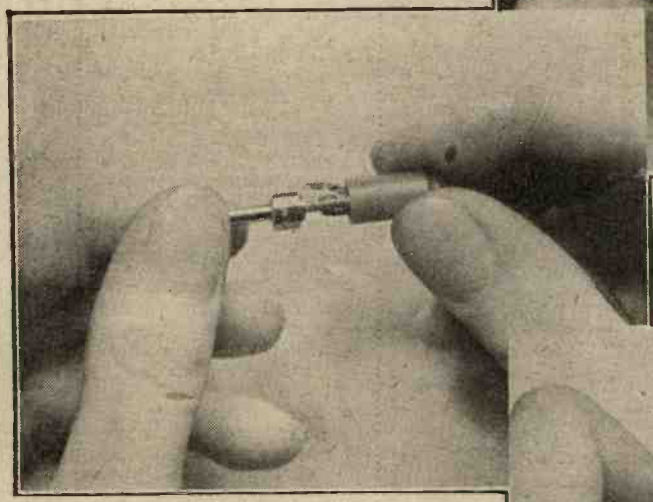
the remainder. Make sure that all strands are properly held. The best way is to clean the individual strands and solder them

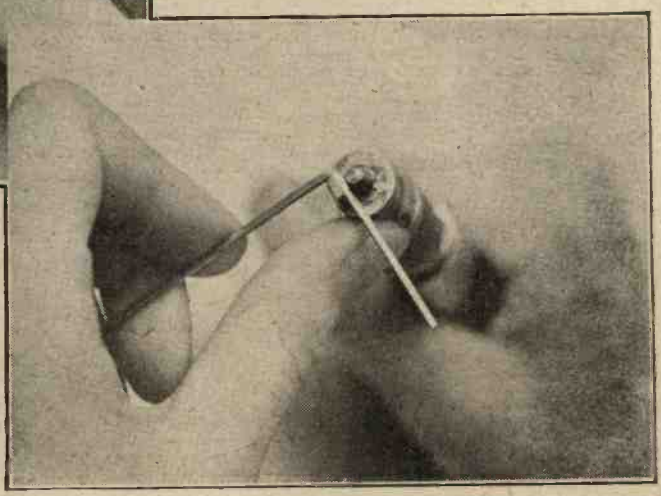
G.E.C. and the Tapa, give a similar neat finish to flexible wires.

The final photograph shows how a neat right-angled bend can be made with the



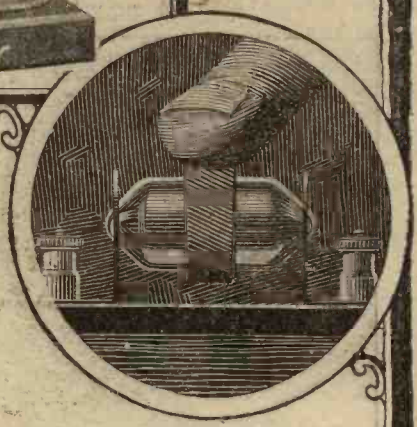
together. A still better way is to solder them to a small brass plate which can be firmly gripped beneath the screw.





wire bender. This bend can be sharp or rounded, according to how the tool is used.

One wire often badly finished off, with a resulting bad effect, is the aerial lead-in where it makes contact with the lead-in insulator. Unfortunately, the size of the screw terminal of the average inexpensive lead-in tube is too small to grip the comparatively heavy aerial wire. Usually just one or two strands get gripped, leaving



Here's the only reloadable cartridge Crystal Detector——

IF the 1925 Radio Season is famous for nothing else it will be noteworthy for the heavy crop of new crystal detectors. Large and small—cheap and expensive—permanent, semi-permanent or with catwhisker—every type is represented. But one stands out from the crowd. One is so unique in its principles that it cannot fail to attract attention.

The Eureka Gravity Detector.

The Eureka Gravity utilises all the sensitiveness of the catwhisker Detector but with none of its disadvantages. Its principle is just this: The crystal is held in a cup within the centre of the cartridge. Around the periphery of the case is placed a row of catwhisker points, each one of which is weighted at the head. When the Gravity is rotated these points are caused to drop one by one to make contact with the Crystal. Thus it is only necessary to give the Detector a twist until the loudest signals are heard.

No factory-sealed permanent Detector can ever hope to compare with the Eureka Gravity because the user can utilise any favourite piece of crystal known to be absolutely sensitive.

Besides, no crystal lasts for ever—its sensitiveness is bound to fall off in time. In any case, the present immense popularity of catwhisker contact is proof positive that any double-crystal combination is of little value under present-day conditions.

To change the crystal in the Gravity is but a moment's work. Just lift it from the spring clips, separate the two halves, lift out the old crystal and drop in a new piece, and the job is done. Quicker in fact than describing it. And the crystal is protected against dust, fingering and light.

No matter which type of Set you are using the Gravity will improve it. If it is a Reflex it will stabilise it and yield wonderful tone. Experience has proved that half the trouble in reflex Sets is due to the incorrect pressure of the catwhisker. In the Gravity this is done for you automatically. We have calculated the pressure at which the contact should be made—no more, no less.

Get your Dealer to show you one of these handsome Gravity Detectors to-day — the fact that it is a product of the manufacturers of the Eureka Transformer is a sure guarantee of its excellence.

Portable Utilities Co., Ltd.,
Makers of the Eureka Transformer
Fisher Street, London, W.C.1.

And from all Dealers

Six advantages you get with no other Detector.

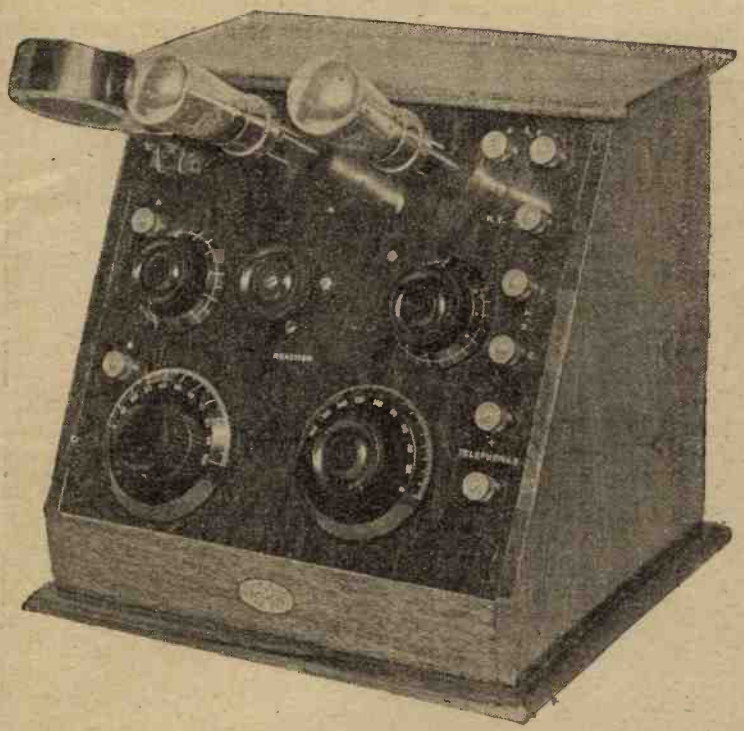
1. *The Crystal is firmly held in a spring cup and the moving points fall to make contact with it as the holder is rotated.*
2. *When the Gravity Detector is in use the Crystal is fully enclosed and protected from dirt.*
3. *The Gravity Detector can be reloaded with a new crystal in a moment. Nothing to unscrew or solder.*
4. *The slightest turn of the Detector automatically brings into use a new spot on the crystal and a new contact point.*
5. *Nothing to wear out—the Gravity Detector will last a lifetime.*
6. *Stout plated spring clips are supplied and the base can be removed for fitting the Detector direct to the panel.*

Complete with Crystal

6/6

EUREKA GRAVITY Detector

Gilbert Ad. 2512



Note the reaction control, mounted between the filament resistances.

An Easily Controlled Two-Valve Receiver

By JOHN W. BARBER

A description of a receiver employing one high-frequency amplifier, followed by a detector valve, which is capable of receiving many distant stations in the telephone receivers

WHILE many listeners desire a receiving equipment capable of operating a loud speaker on the local station only, a great number want a set upon which they can "go the rounds" of British and Continental stations, using the telephone receivers. It is true that remarkable results may be obtained with quite a simple set in favourable conditions, and on broadcast wavelengths a useful combination may consist of one high-frequency amplifying valve followed by a detector.

Alternatives in Design

In deciding upon the design of such a receiver, one is faced with several possibilities; for example, the high-frequency valve may be coupled to the detector by the well-known tuned-anode method, or alternatively by the tuned transformer method, the latter offering several different arrangements in itself. Resistance-capacity coupling is not of much use upon the ordinary 300-500 metre waves, but if the receiver is to be used solely for the reception of long-wave stations, such as Chelmsford and Radio-Paris, then this form of H.F. coupling may with advantage be employed, the operation of the set being much simplified. Again, considering either of the two "tuned" methods, we may either couple the reaction coil to the aerial coil, or to that in the anode circuit of the first valve. It is often quite erroneously stated that, by adopting the latter course, the set is rendered practically incapable of radiating, and thus the user need have no fear of causing interference when his set is oscillating. This, however, is, far from being always the case, and whichever course is followed, the utmost care should always be taken to keep the set from oscillating.

The Method Employed

In the case of the present receiver, it was decided to employ the tuned-anode method, coupling the reaction coil to this circuit, and in order to simplify the construction and operation, a Sterling Anode Reaction Unit has been incorporated. This consists of two coils, one of which constitutes the reaction coil, and is rotatably mounted with respect to the outer or anode circuit coil, the whole being enclosed and so kept dust-free, control being effected by a knob on the front of the panel,

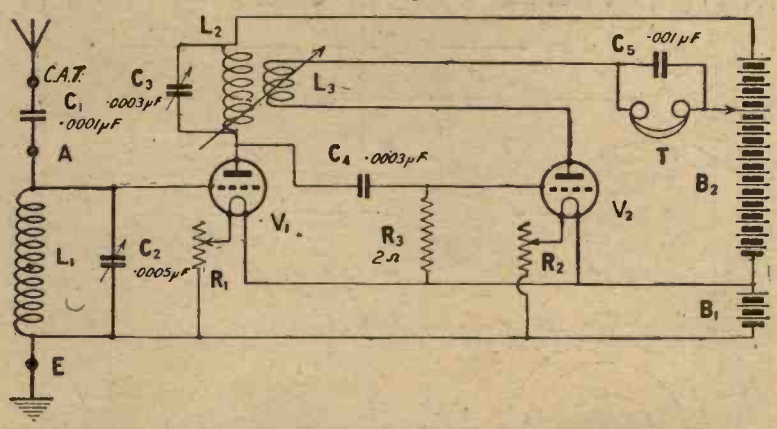


Fig. 1.—This shows the connections in theoretical form. The coils L_2 and L_3 are contained in one unit.

in this case situated between the filament resistances.

A glance at the photographs of the finished receiver will show the method of control. The variable condenser on the left is in the aerial circuit, while that on the right is shunted across the anode coil.

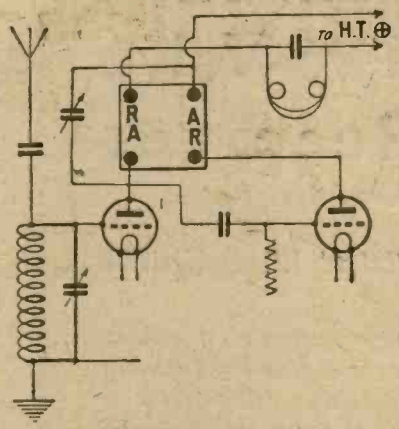
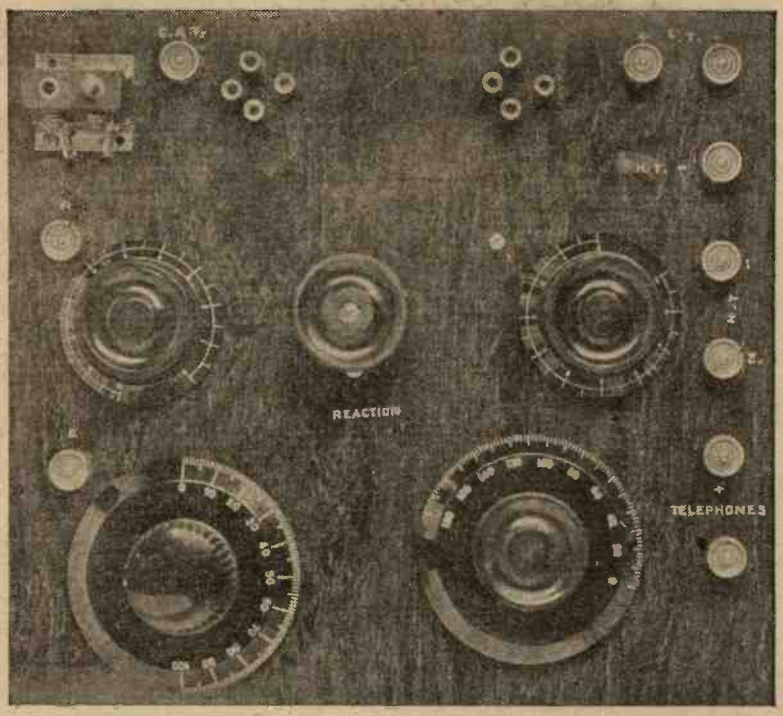


Fig. 2.—Showing how the connections are made to the Sterling unit employed.

The filament resistances are situated above these condensers, while the L.T. terminals are at the back of the panel to the right. On the left of the panel are seen the aerial and earth terminals, while the constant aerial tuning system may be employed by joining the aerial, not to A, but to the terminal marked C.A.T., seen at the top of the panel, between the coil socket and the first valve.



This shows how the parts are mounted upon the panel. Note especially the somewhat unusual arrangement of the terminals.

The rather unusual arrangement of terminals on the right of the panel is adopted on account of the simplicity in wiring which it effects. The two terminals at the back are for the accumulator, next being H.T.—. The other details are made clear in the drawings and need not be gone into here.

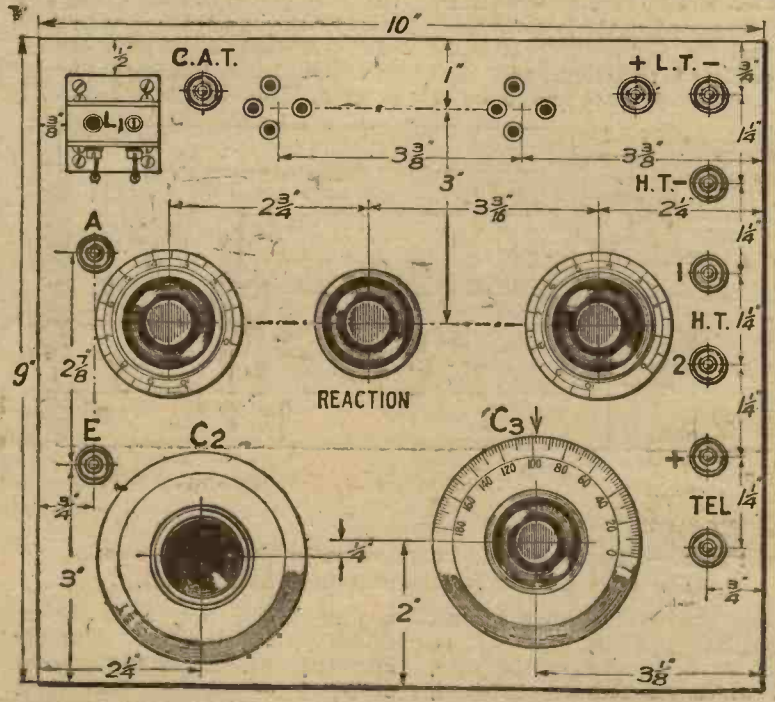


Fig. 3.—The drilling diagram. If you use components other than those mentioned, be sure you drill the holes correctly. Blueprint No. C1013A.

The Circuit Diagram

The circuit arrangement of the receiver may be seen in Fig. 1. The aerial circuit comprises the coil L_1, which is plugged into the socket seen on the left of the panel, and across which is connected the variable condenser C_2. The coils in the anode circuits of the valves have been drawn diagrammatically, and the anode coil L_2 is shown with the condenser C_3 in parallel with it. Fig. 2 shows how the actual connections are made to the Sterling unit, which has two soldering tags marked "A" and two marked "R," the former being the connections to the anode coil, while the reaction leads are joined to the "R" tags.

Parts Required

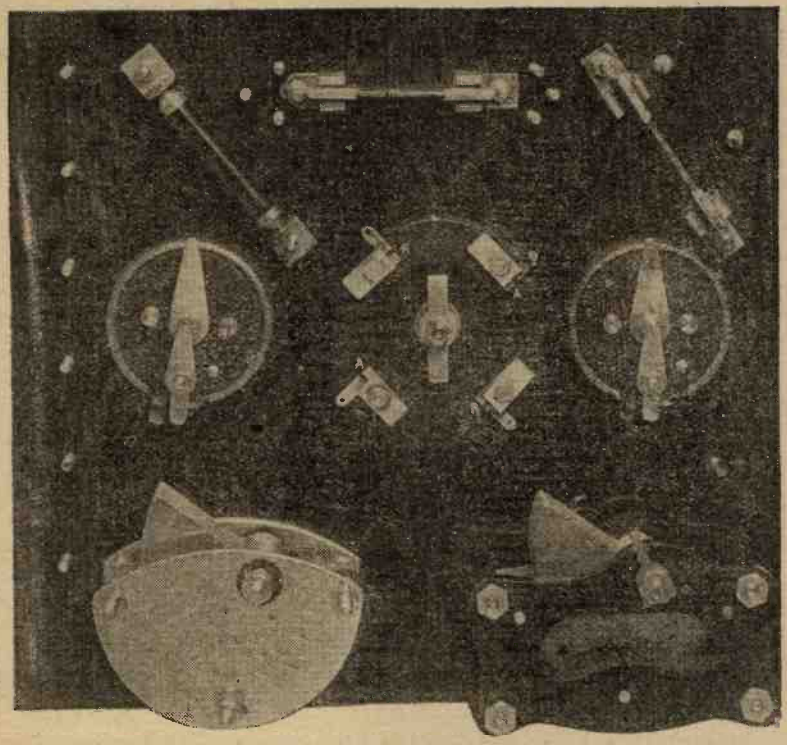
In order to make a set similar to the one seen in the photographs, the following parts will be required, and whilst it is not essential to use the actual makes given, you should be certain that the parts you do use are of the best quality, in order that satisfactory results may be obtained.

One ebonite panel 10 in. × 9 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in. (Radion Mahoganite).

Suitable cabinet. That shown is of the "desk" type, made by the Carrington Manufacturing Co.

Suitable wire for connections.

One packet Radio Press panel transfers.



This photograph shows the back of the panel before wiring is commenced, the positions of the parts being clearly indicated.

One 0·0005 μF. variable condenser. That shown is a new model being produced by the makers of the "Success" components, and is of a new type submitted to me for trial. It has a geared motion with a reduction of 4 to 1, giving a very smooth and regular control, while the provision of a fibre gear keeps the hands well away from metal parts in actual contact with the moving vanes. A suitable dial for the double rotation of the controlling knob is being produced. It is of the square law pattern.

One ·0003 μF variable condenser (L. McMichael, Ltd.). Square law.

Two filament resistances (L. McMichael, Ltd.).

One Sterling anode reaction unit for broadcast range. For Chelmsford a suitable coil unit will be required, these being interchangeable on the standard adaptor.

One coil socket for panel mounting (Magnum).

One ·0003μF, one ·0001μF condenser, clip-in type, and one 2 Ω grid leak, all with clips (McMichael).

One ·001 μF condenser (Dubilier)

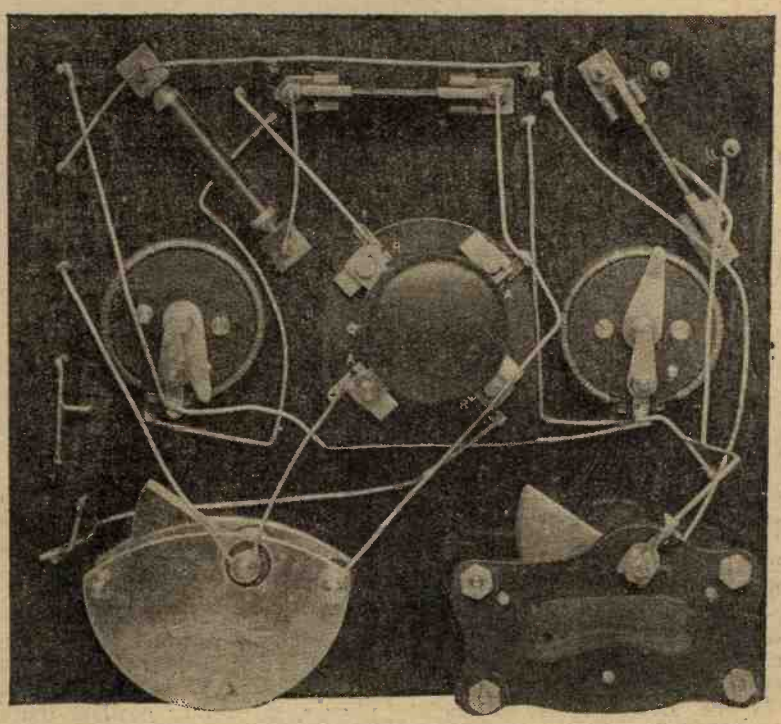
Two sets valve sockets, or alternatively two complete valveholders; and ten nickel terminals (Magnum).

Drilling the Panel

The panel is drilled in accordance with the details given in Fig. 3, and should present no difficulty. If separate valve sockets are used, it is best to use a template for marking out the positions of the holes, and several firms are now marketing excellent templates for valve sockets. I have tapped all the terminals and valve sockets into the panel, because I find it, on the whole, more satisfactory than using nuts, but this is purely a matter for individual taste, and the constructor may decide for himself as to the course to be adopted in his own case. Messrs. McMichael are now making a one-hole fixing type of resistance, which is improved in several details, and the number of holes necessary in the panel is thus reduced.

Wiring

If you look at the photographs on this page, you will see that one shows the back of the panel without the wire, whilst the other shows the completed set. These two should prove valuable when wiring up, as they enable you to follow every detail. The wiring diagram shows the actual connections necessary, and should in all cases be consulted during this operation. The condenser across the telephone terminals is held in place by the wiring, and therefore



When used in conjunction with the above photograph, this view, which was taken from the same angle, will make perfectly clear the connections necessary.

is not seen in the "wire-less" photograph.

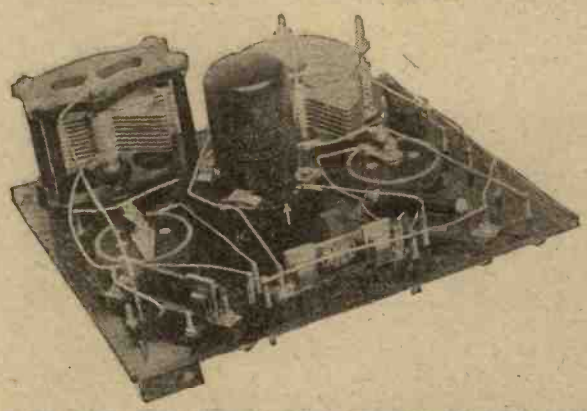
Fixing the Transfers

In affixing the transfers, a point which will assist the constructor is that if a touch of varnish is applied to the panel where the transfer is to be, and the usual process then followed after the varnish has become tacky, a permanent job may be made.

Mounting the Receiver

When completed, the set may be mounted in the cabinet, the choice of which must be left entirely to the reader. The method of securing the panel in position will obviously depend upon the manner of mounting employed, and no hard-and-fast rule can be laid down. In general, however, where the panel fits in on fillets, one wood screw in the middle of each end will suffice to retain the panel in position.

Having mounted the receiver in a suitable cabinet, turn the filament resistances to the "off" positions and join up to the L.T. terminals a suitable accumulator for the valves in use. Insert the valves and test the filament circuits by gradually turning the rheostats toward the "on" position. If the valves light correctly, turn the rheostats off again and join up the rest of the leads. As an initial test on the local station, the aerial may be joined to the C.A.T. terminal, and a number 50 coil inserted in the socket on the panel. In the case of the London station, the aerial condenser setting will be toward the lower end of the scale. The anode condenser is turned slowly over its scale until the best signal strength is obtained, when the reaction knob may be slowly rotated, careful attention being given to the setting of the right-hand condenser. Care should be taken not to allow the receiver to oscillate, for reasons already given, the effects of ignoring this rule being well known by all listeners. A suitable filament resistance should be substituted for the bright-emitter type used here, if dull-emitter valves are to be employed. These may be obtained from the firm mentioned in the list of components.



Note how the clip-in type condensers and grid leak are secured in position.

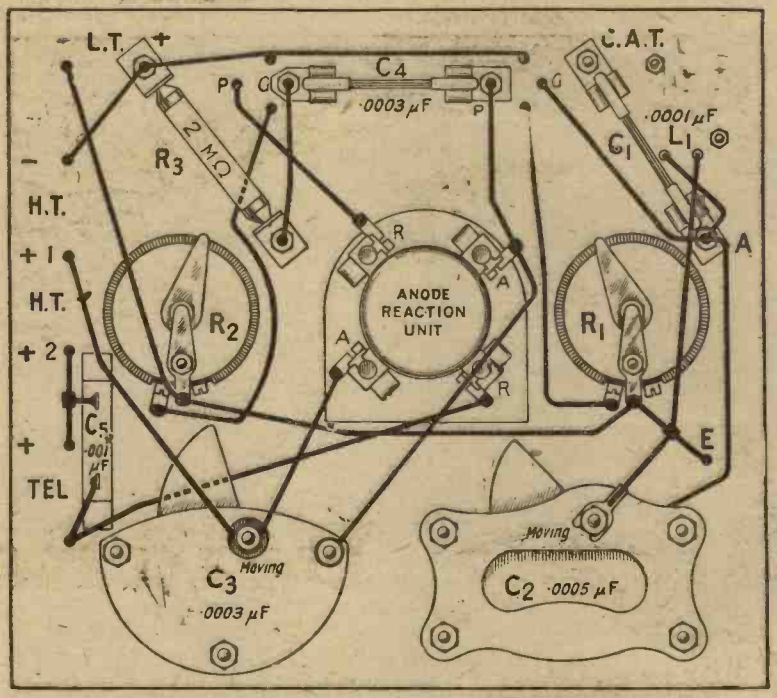


Fig. 4.—Practical wiring diagram showing the values of the components. Full size blueprint No. C1013B may be obtained. Whatever type of condenser is used for C_2, note that the wire from A goes to the fixed plates.

Results Obtained

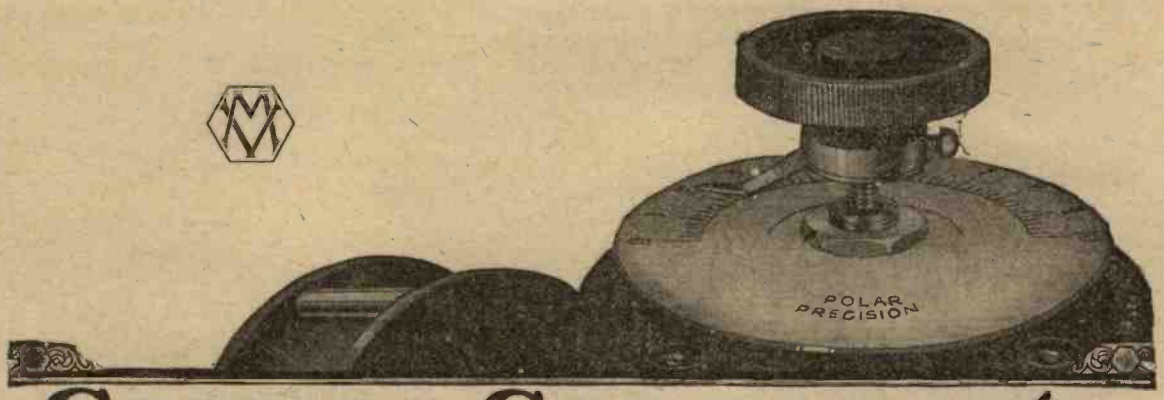
The receiver is in use at my station, 6DD, situated at about five miles from the 2LO station in the Strand, which is still operating at the time of writing. Very good signals are always obtained from that station, although at such a distance very little benefit is obtainable from a high-frequency amplifying valve.

The receiver, which, as already stated, is designed for the reception of distant stations in the telephones, gives very good all-round results on an aerial which, very unfortunately, is badly screened by a church and many trees. Bournemouth and Birmingham are receivable at comfortable strength, while the Postes et Télégraphes station in Paris comes through with no interference from London, which is very pleasing, considering the proximity of my station to London. On another evening, Glasgow and Newcastle were heard at good strength, while two German stations, unidentified, also came through. After the British stations had closed, Madrid was tuned in at good strength, the reception, however, being, as usual, entirely spoilt by the efforts of oscillating fiends in the vicinity.

I shall be very pleased to hear from readers who make up this set, as I am convinced that upon a better aerial than mine it will show up remarkably well, judging by its performance in comparison with similar sets I have tried.

Test Department

The popularity of this department has necessitated greatly increased staff, and while it is not intended that the department should pay for itself, this fac together with the high cost of the necessary standard testing instruments compels us reluctantly to increase the cost of testing to 5/- per valve in a "straight" receiver, 10/- being charged for a "dual" valve. In addition, we cannot undertake to test any set in which a departure from Radio Press design has been made



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are constructed on a new principle which results in Low Resistance, Low H.F. Resistance, Robust Constructions, and Low Self Capacity. With regard to the last feature, a report on an independent test conducted by "The Wireless Trader" (issue March 4th) reads as follows:—

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20	12.5	4	9
25	25	4	9
35	50	4	6
40	100	4	9
50	150	4	9
75	300	5	0
100	700	6	0
150	1,000	6	6
175	1,400	7	0
200	2,500	7	6
300	5,000	8	9
400	9,000	9	9

"POLAR" PRECISION VARIABLE CONDENSERS are made in the following capacities, all having the same outside dimensions:—

Max. Capacity.	Price.	
·001 mfd.	12/6	unmounted
·0005 mfd.	12/6	"
·0003 mfd.	12/6	"

Mounted 5/6 extra.
SEPARATE VERNIER ATTACHMENT 3/6.

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is a remarkably Compact Robust Dustproof Component with low minimum capacity, low losses, high insulation and a smooth movement. The last named feature is so effective that a Vernier plate is really unnecessary, but to provide for those amateurs who require exceptionally fine tuning, a separate Vernier attachment can be obtained. The "Polar" Precision Condenser is conveniently mounted by means of one hole in the panel.

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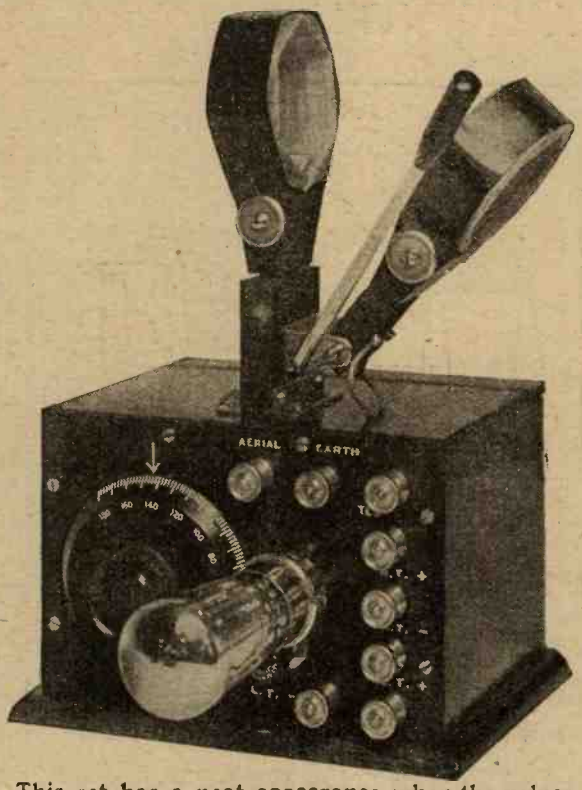
TAKE WARNING!!

The "Midget" Single Valve Receiver

By A. S. CLARK



This set has a neat appearance when the valves and coils are inserted.

THE single-valve receiver about to be described, although quite complete, has a panel only 4 in. by 6 in. This not only makes the set very compact so that it takes up very little room, but it also keeps the wiring quite short. And the fact that the shorter the wiring on a single-valve set the more efficient it becomes is amply proved by the good results obtained on this receiver, an account of which is given at the end of this article. The coil-holder is placed on the top of the cabinet, which is a most convenient position for it, and it allows plug-in coils to be used for any wavelengths. The Lissenstat Minor, which is used for filament control, is suitable for controlling the filaments of both bright and dull-emitter valves, providing a little care is used when working with dull emitters. Although not an inch of space is wasted on the panel, all the components will fit on with enough clearance provided that the dimensions on the drilling diagram of Fig. 2 are followed properly.

Use of Other Components

For convenience in collecting the necessary parts together to make this set, a list of components is given. The names of the makers are added so that the receiver may be exactly duplicated if it is so desired. But, should other components be used, first ascertain that they will fit in place of those used on the actual receiver.

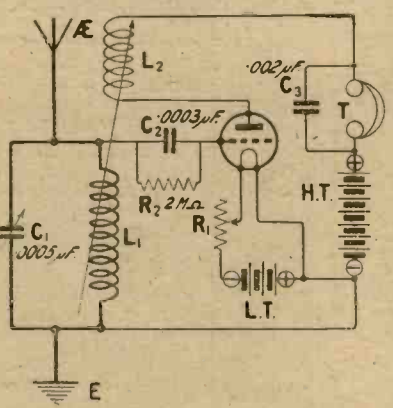


Fig. 1.—The circuit diagram, which is of the ordinary reaction type.

List of Components

One ebonite panel, 6 in. by 4 in. (Paragon).

One ·0005 μF variable condenser (Jackson Bros.' square law).

One two-way coil-holder (Burne-Jones, right hand).

Eight W.O.-type nickelled terminals (Burne-Jones).

Four nickelled valve sockets.

One Lissenstat Minor.

One ·002 μF fixed condenser (Dubilier).

One ·0003 μF fixed condenser with 2 megohm grid-leak (Dubilier).

One suitable-sized cabinet, 4 in. from front to back (Camco).

One packet Radio Press panel transfers.

Square-section wire, flex and wood screws.

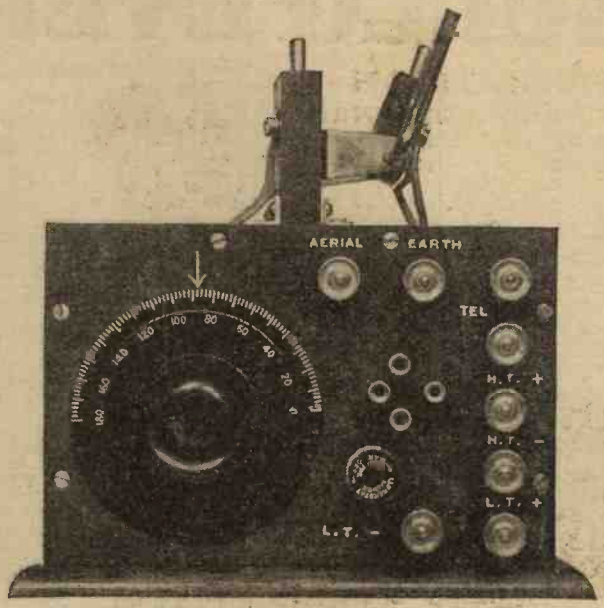
The Construction

Having collected together all the parts required, we can now commence the construction. The first thing to do is to drill the panel; this is done in accordance with the drilling diagram. The marking out of the panel must be done with a scriber and not with a pencil, and care taken to see that the distance from the aerial terminal to the grid socket is as marked, because this distance is the same as that of the distance apart of the soldering tags on the Dubilier condenser. It is as well, while the drill is in use, to drill the holes on the top of the cabinet for the coil-holder. This is fitted with 6 B.A. nuts and bolts, the shanks of which should be cut off close up to the nuts, as they are likely to get in the way of the wiring and some of the internal parts. Four holes also have to be drilled on the top of the cabinet for the flexible wires, two of which go to each coil.

Mounting Components

At this stage of the construction it is best to fix the transfers, having first made quite sure that the holes are all in the correct positions. The transfers, when put on carefully and firmly, greatly help the

This compact and efficient single valve receiver is just the set for the constructor of small means who desires to log as many stations as he can.



This photograph shows that every inch of panel space is utilised.

appearance of the set, and will last. The correct lettering may be gathered from the drilling diagram and the photographs; an arrow head is used as the zero indicator for the variable condenser.

Now carefully mount all the components in their right places, putting on the small parts, such as the terminals and the valve sockets, first. The terminals should have a washer placed on before the nut, but not the valve sockets, as these are close together and this would make it easier for a short to occur between them. In order to prevent damage during wiring, the condenser dial and knob should not be put on yet. It will help to keep the wiring neat if all the terminals and valve sockets have their shanks cut off to about ½ in. below the panel.

The Wiring

The wiring is now undertaken. This is not difficult, and is as shown in the wiring diagram of Fig. 3. If the photographs of the wiring are inspected, it will simplify matters, and an attempt should be made to copy it as near as possible. The soldering on of the fixed condensers is left to the last thing. The two flexible wires which go to the reaction coil, are not attached directly to the terminals from which they come, but are soldered to two short pieces of square wire, and these are soldered to the terminals. This prevents these wires sagging about too much. The short pieces of square wire should be about 1 in. long.

As the clearance for the fixed condensers is very small, it will be found that the end pieces which are provided for fixing screws must be cut off. These are not required in this set, because, as already mentioned in the case of the grid condenser the fixed condensers are soldered straight on by means of their soldering tags. Care should be taken to see that they are placed the same way round as they are on the actual set. If this is not done, they may not clear the sides of the box, which, it may be mentioned here, are made of not more than ¼ in. wood. The flexible wires are threaded through the holes in the top of the cabinet, and the panel screwed to the front. Connect the wires to the coil holder, and the set is completed, although it may be found necessary to reverse the reaction leads if they are the wrong way round.

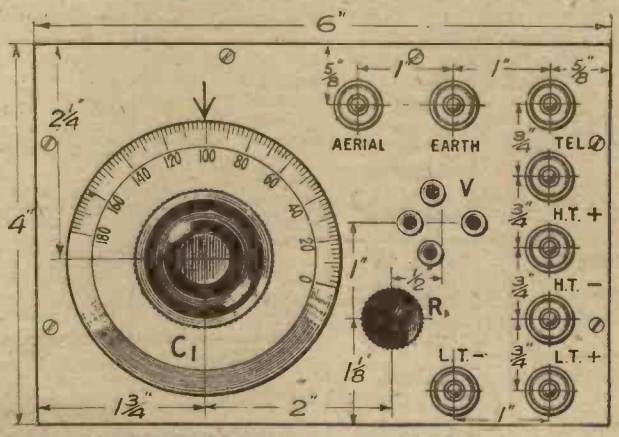


Fig. 2.—From this diagram the marking out and drilling of the panel is quite easy.

Using the Set

Any type of ordinary plug-in coils may be used with this set; the correct sizes to use for receiving the different stations will be found in the test report. If it is desired one of the tapped coils for aperiodic aerial tuning may be employed, when the aerial is connected to the most suitable tapping on the coil, instead of to the terminal marked "aerial." Any general purpose valve of either the bright or dull emitter variety is suitable for this set, with a tapped high-tension battery of somewhere about 60 volts maximum, according to the type of valve used.

Connecting Up

Connect the aerial, earth, batteries, and telephones to their correct terminals, and after inserting valve and coils the set is ready to receive signals from one of the several stations which may regularly be tuned in on it any night. The tuning is the same as any other ordinary single valve reaction receiver. The reaction coil must only be brought near enough to the aerial coil to bring the set to the point just before it

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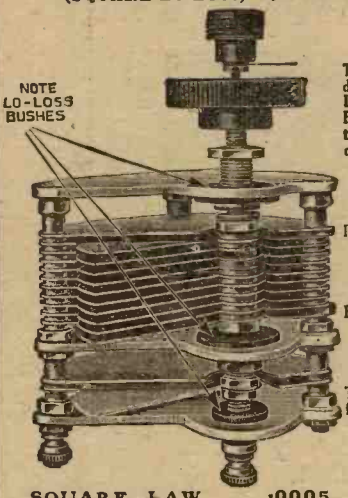

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·0005 - -	8/-	·0005 - -	7/-
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Crystal Set. Sloping cabinet. Fitting for Chelmsford. Splendid results. 17/-, including aerial wire, lead-in, and insulators.
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4,000 ohms .. 16/6
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Set of 5, 1,300/2,100,
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ONE for Chelmsford,
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Do. 3-way coil std. 3/8
2-way, ex-handles, nickel 2/9
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H.T.C. both types.
Basket holders, 7d., 8½d.
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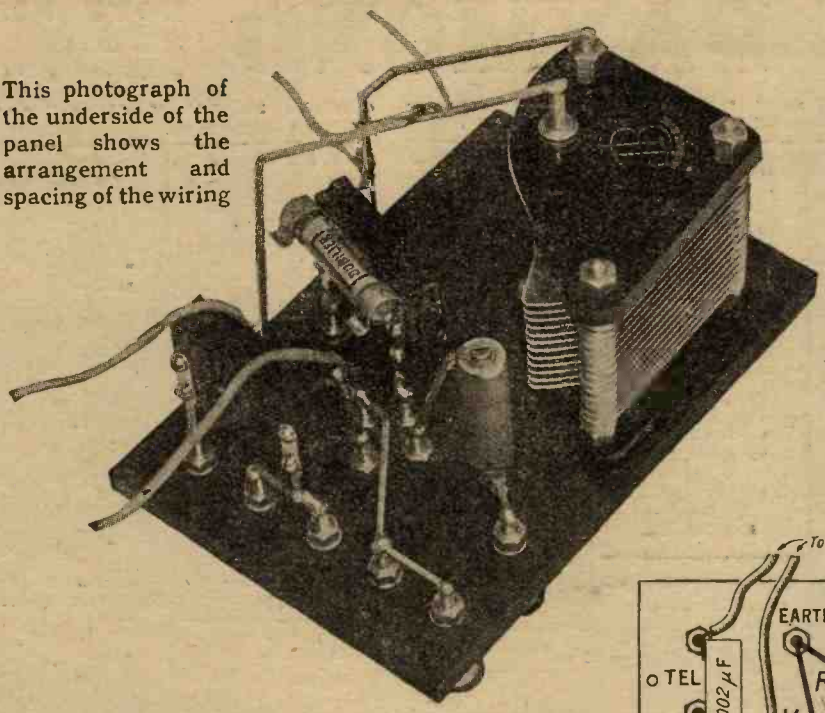


This photograph of the underside of the panel shows the arrangement and spacing of the wiring

breaks into oscillation, and the coils and variable condenser adjusted simultaneously. After a little practice it will be found easy to bring in the distant stations without being a nuisance to one's neighbours.

Further Notes on Design

It may at first be thought that the filament resistance is placed in a very awkward position, but in actual practice this will not be found to be so. It is easily controlled with the right hand, especially if the hand is turned so that its palm is uppermost. But after using the set for the first time, the position of the rheostat will feel quite in the right place. The reader may wonder why the valve was not placed inside the set. This would have entailed the use of a larger panel, also the wiring would have been considerably longer. Whilst in its present position it is easily changed for another one of a different type, and a single valve set is the best to compare the efficiency of valves as detectors.

Connecting Telephones

If your telephones are marked positive and negative, that is, if one end of the cords has some red cotton wound round it (which should be the case on all telephones), this lead should be connected to the lower telephone terminal. This will prevent your telephones becoming insensitive, due to the current passing through them in such a way as to reduce their magnetism.

Reception in General

In testing out this receiver, all expectations were exceeded to an almost impossible degree. In fact, so many broadcasting stations of both short and long wave-lengths could be received, that it was difficult to decide to which one to listen. So that in writing this test report it is very difficult to know how to begin. To give a list of all the stations received would not be possible, because there are so many that it would have taken much longer than the time available to identify them all. So the outstanding ones in signal strength are mentioned, while the reception of the others is described collectively.

The Local Station

The local station is 2 LO, and it is situated about 8 or 9 miles from the testing station. At this distance the results are astoundingly loud, real moderate loud speaking being easily obtained—that is, loud speaking which could be heard on the floor below the operating room. For listening on the telephones for entertainment it was, therefore, necessary to slightly detune the receiver. These results were obtained with different makes of plug-in coils, a No. 35 or 50 being used in the aerial socket, and a No. 50 or 75 respectively being ample to give sufficient reaction, which was very smooth.

Reception from Chelmsford in S.W. London was almost as good as 2 LO, and the selectivity of the set may be gathered from the fact that Radio Paris could be tuned in while Chelmsford was on.

Tuned on Loud Speaker

Results on the loud speaker were so good that an attempt was made to see how many stations could be tuned in on it without the aid of 'phones. The following are those obtained. While they did not give loud speaking their strength may be gathered from the statement that they were tuned in without placing the head almost inside the horn. They were London, Chelmsford, Glasgow, Radio Paris and one German and one French station which were not identified. For the longer wave-length stations a 150 or 200 coil is used for aerial, and a suitable reaction coil is chosen.

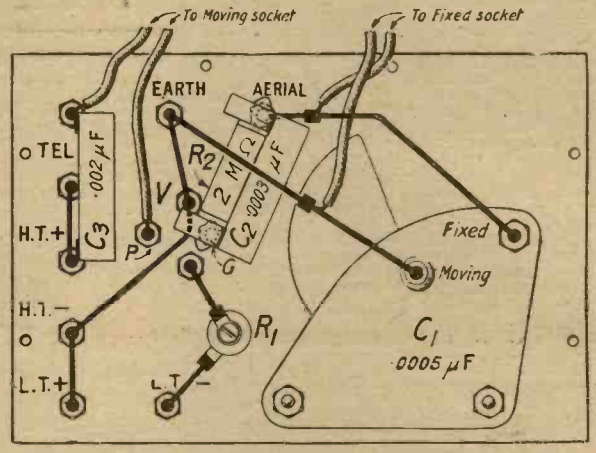


Fig. 3.—The wiring diagram from which the set is wired.

Stations on Telephones

On the telephones it was possible to obtain all the B.B.C. main stations, and one or two of the relay, although it was naturally not easy to obtain those of a wave-length near to London while this station was working.

Four or five French stations and about the same number of German and a few other Continental stations could be tuned in with ease on any night, and most of them were up to crystal strength on the local station.

Conclusion

In conclusion, it should be pointed out, once more, that receiving conditions vary considerably, and at the author's house they seem above the average. In spite of this, the set described can be relied on to give good all-round results in practically any location.

IT is doubtful whether any aspect of wireless can assume a more intense and painful interest than that which even the best of us must at times devote to the art of fault-finding. Even the expert is liable occasionally to be so unlucky as to incorporate a component of whose history he is not quite certain, or which represents the "one in a million" chance of a dud specimen of good make, while the beginner is open to numerous risks of mistakes in wiring and assembly, and so on. It would seem, therefore, a certainty that the next of the Radio Press book series to be published will have an extraordinary vogue, since it is entirely devoted to "Wireless Faults and How to Find Them" (R.P. Series No. 24, price 1s. 6d., post free 1s. 8d.), and the very title should make it plain that this is a book which no wireless man can afford to miss.

The author is R. W. Hallows, M.A., Staff Editor, whose articles in our journals are so well known for their wide scope and thorough grasp of detail.

The assistance given by this most interesting and original little book is extremely thorough, and it is difficult to see how even the most

Radio Press News

A New Book which no one should miss

stubborn of concealed faults can evade for long anyone who has read it and who carries out the ingenious methods of trouble tracing which the author has devised, so searching are the tests which he describes.

Numerous Illustrations

The book has been so written and arranged that it can be understood and used with perfect ease by even the absolute beginner, who will particularly appreciate the very full and complete way it has been illustrated. Every difficult point, and, indeed, practically every point which could be made clearer by means of a diagram, is illustrated, so that there is an illustration of some sort on almost every page.

No one who has built, or who intends to build, *any* sort of wireless receiver should fail to obtain a copy, for it must be remembered that when such assistance *is* wanted it is wanted badly, and at once: when a set goes wrong, the owner does not, as a rule, feel inclined to wait until he can obtain a book of assistance from his local bookseller or by post from the publisher, however prompt the service may be. Moreover, it is most undesirable to be compelled to absorb the whole contents of a book on fault-finding in the course of an hour or so and then try to put one's newly acquired knowledge into practice immediately. A far better plan is to study the book in a leisurely manner without the urgency produced by the presence of a defective set in the background. Then, when the day arrives for the first attempt to locate a fault, a reference to the summarised portion of the appropriate section of the book serves as an adequate reminder of the procedure to be adopted in that particular case.

A Useful Appliance

The book opens with a chapter giving the necessary details for the construction of an extremely cheap and simple but effective little appliance which is used in conjunction with a pair of tele-

phones for the greater part of the testing of the set and its constituent parts. The author then proceeds to deal thoroughly with the testing of all those of the principal components of a set which are commonly responsible for faults, such as condensers (fixed and variable), transformers, coils, detectors, and so on, passing from components actually forming a part of the set to such accessories as valves, batteries, and aerial and earth.

A Simple Method

These sections of the book are to be regarded as preliminary to the chapters on actual set testing, and a very useful and time-saving method has been adopted here; the author gives (and explains fully) a complete series of tests for the set under consideration, which are designed to narrow down gradually the possible area of the trouble until it is finally tracked down in a particular circuit, say, the anode circuit of a low-frequency amplifying valve, and then at last, in a particular component, perhaps the L.F. transformer. The reader then refers back to the section on the testing of L.F. transformers, and proceeds to find out exactly what is wrong with his defective specimen.

Complete Set Tests

A complete separate chapter is provided to explain the testing of crystal sets, and another for single-valve sets, while general tests for the common types of multi-valve sets form the subject for another section. The last chapter deals in full detail with the subject of fault-tracing in reflex circuits, which demand somewhat special treatment, as most readers are no doubt aware. The symptoms which they display and the particular types of faults which may occur are naturally somewhat different from those of "straight" circuits, but the whole matter is treated most lucidly, and anyone who has had the misfortune to incorporate a dud component in a reflex set will be able to set about its location with entire confidence with the aid of this book.

A specially valuable and time-saving feature will be found in the summaries appended to these chapters, which take the form of clearly-arranged tables, with headings for "Symptoms," "Possible Causes," &c., so that the whole provides a brief summary upon a single page of the preceding chapter. One can, therefore, use it as an aid to memory and run through the whole series of systematic tests for any given set very rapidly, having previously read the whole chapter.

(*Date of publication*, 16*th April*.)

A Simple Set for the Invalid

(*Concluded from page* 618)

Various experiments were made with the aerial and earth connections, and whilst with the indoor aerial 2LO was best received with the aerial at 1 and the earth at E, with the outdoor aerial, the best results were obtained with the aerial at A and the earth at E. For the reception of Chelmsford upon the indoor aerial the same conditions as with 2LO held good, whereas with the outdoor aerial the loudest signals were given by connecting the aerial to 1 and the earth to A. As a matter of personal interest I shall be most pleased to hear from readers who build this little set, particular interest being expressed in their experiences with the aerial and earth connections, for it would seem from past experience that hardly any two aerials require the same connections for the best results.

John Anstruther's Wireless Talks

"I WONDER," asked Richmond, when we assembled for our next informal meeting at John Anstruther's rooms, "I wonder if any of you would mind if we discussed mainly problems about the crystal detector and the receiving sets in which it is used this evening?"

"Personally," said John, looking round the circle, "I think that it would be a jolly good idea, if you fellows agree. There is a lot more in the crystal and its working than most people think, and we are far too apt to regard it as a thing so simple that it is hardly worth studying. I am a strong supporter of the crystal myself, for it gives the clearest and best reception. We must not forget, too, that the vast majority of receiving sets in use at the present time employ the crystal."

The idea caught on at once, for, when we came to think about it, there were quite a lot of points about the crystal upon which most of us wanted information. It was Ainsworth who started the discussion by putting the first question.

Why the Valve is Generally Louder

"Will you tell us," he said, "just why it is that if I build two sets with precisely similar components, except that in the one I use a crystal detector and in the other a single valve, I get louder signals with the valve and have a much longer receiving range?"

"Like the crystal," answered John, "the valve can be made to rectify, but there is just this difference between the two: When you use the valve for rectifying it is doing two things at once. Besides changing oscillating impulses into impulses in one direction it is also amplifying them, or making them stronger. And then there is reaction, which cannot yet be produced in the ordinary crystal set. On a future evening, when we come to talk about valves, we will go into this in detail. The crystal can perform only one of these two functions; it is a rectifier pure and simple, and not an amplifier. Some experiments have been made recently which show that crystals can be arranged to produce oscillations, and I am not going to say that in the future we shall not be able to amplify without valves. The current brought in by the aerial, even if you are quite close to a main broadcasting station, is only a matter of a few micro-amperes—a micro-ampere is a thousandth part of a milli-ampere, and a milli-ampere is a thousandth part of an ampere. At ten miles from 2LO, for example, the unaided crystal detector might deliver about

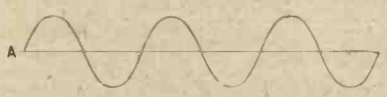


Fig. 1.—The unrectified wave.

15 micro-amperes to the telephones, whereas in the single-valve set a loud note may cause a change in the output current of as much as a quarter of a milli-ampere, that is to say, 250 micro-amperes."

How does the Crystal Rectify?

"Now," said Painter, "I am going to ask you to explain something that I don't quite follow. How does the crystal rectify?"

"Before we deal with that question," Morris interposed, "I think that it would be a good thing if we all felt quite clear about rectification itself. What exactly does it mean?"

"Right you are," smiled John. "We will have a look at rectification first of all, and then try to see how the crystal does its job. The oscillations which the aerial brings into the set are surging up and down at what we call radio-frequency. The rate at which they swing depends upon the wavelength. If, for example, we have a station sending upon 300 metres, the frequency will be found if we divide 300,000,000 by the wavelength; the figure 300,000,000, by the way, is the speed at which all ether waves travel measured in metres a second. Working out that simple sum, we discover that in this case the frequency will be 1,000,000 a second. Now, our ears are absolutely unaffected by such oscillations as these—in fact, we have no sense that will respond to their influences. To make them audible we must reduce their rate of undulation to something with which our ears can deal. Audible frequencies lie roughly between 15 and 15,000 a second. The detector acts as a kind of sergeant-major, forming up and marshalling these very rapid impulses and then passing on to the telephones "companies" of impulses consisting of the combined energy of hundreds or even thousands of individual radio-frequency oscillations."

A Simple Analogy

"I want to be quite sure that I really do follow this," said Morris, as John paused for a moment to put a match to his pipe. "I wonder if you could give us a simple analogy? They do help somehow to fix things in one's mind."

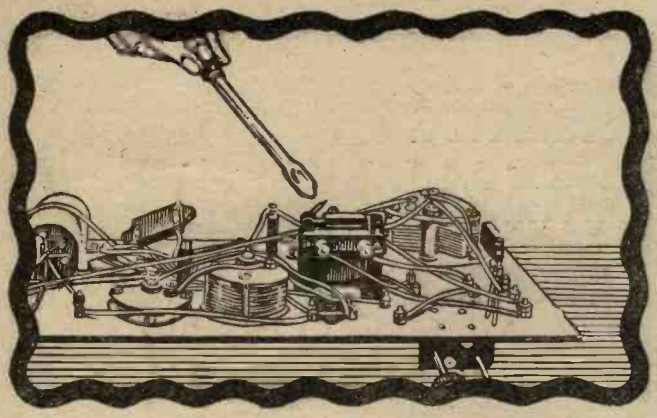
"Well," replied John, when he had got his pipe into full swing once more, "I think I can. We will try a simple little experiment."

He handed Morris a copy of one of the illustrated daily papers that were lying upon the table and a very powerful magnifying glass.

"Take the paper under the light," he suggested, "and look at it through the glass."

Morris did so, and then handed the two on to the rest of us, who followed John's instructions in turn.

"When you look through the



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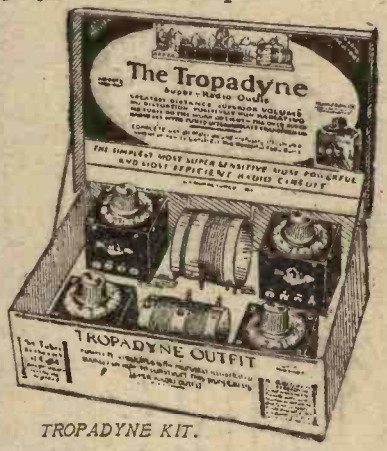

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glass," John asked, "could you see the picture as a picture?"

"I couldn't anyhow," cried Richmond; "all I could see was a collection of dots, some black, some white."

"That's what all of you found, didn't you?" John went on.

Why we Cannot Hear H.F. Oscillations

"The reason is that the only method we know of reproducing photographs in a way suitable for quick printing is to do so by means of dots. They are so small that when the eye sees them without the aid of a magnifying glass they run together into groups; but when we use a magnifying glass we separate them up into individuals, and then there are so many of them that the eye is bewildered and sees them as nothing but little points of light and shade. The effect is even more startling if you examine a finely made block through the microscope. Your eye is in much the same position then as is your ear to radio frequency oscillations. Neither can make anything of a message that is conveyed by vast numbers of individual dots or impulses. Remove the magnifying glass, and the dots are marshalled into groups which give a clear impression. Apply the detector, and in the same way the impulses are passed to the ear blended into companies."

We all felt that we followed the idea pretty clearly, and now wished to know how it was done.

What the Crystal Does

"And now do tell us," I said, "just how this grouping and blending is done by the crystal?"

John glanced round the circle. "I am afraid that I shall be telling some of you what you know already. Still there is no harm in going over

Fig. 2.—The shaded portions of the wave are eliminated.

old ground again, and I can see that there are one or two who are puzzled about this question of rectification. By doing the grouping we have to sacrifice one half of the oscillations which the aerial brings in. Each wave, as you know, consists of a crest followed by a trough; or, if you like, a push and a pull, both of equal strength. The crystals which we use in wireless have a peculiar property of offering quite a small resistance to one half of the wave, and an enormously high one to the other. Let us suppose that we have mounted a crystal which will pass the crests, or the positive half-cycles, easily, but which will have nothing to do with the troughs or negative half-cycles. What will the result be?"

The Result

He took two sheets of paper and drew two diagrams which I have copied here.

"At A," he continued, "you see the unrectified waves just as they come to the detector, whilst at B we have the same waves after they have been rectified or strained by its action. I have shaded the troughs to show that they have been eliminated. The result is that we have a succession of positive impulses delivered by the detector."

"But," objected Ainsworth, "there is no grouping here. If a million waves a second are coming in, the detector, according to you, is passing on the same number of half-waves to the telephones."

John smiled. "That is quite a sound objection," he said, "so far as it goes. The detector does pass on rapid, unblended impulses,

all in the same direction. They are dealt with by the telephone condenser. What happens here is that as the impulses reach it they combine to build up a charge upon its plates. This means that what we call a potential difference is produced across the condenser, which, when a charge has been built up by a company of impulses, discharges and sends a single 'whiff' of direct current through the telephones. This 'whiff' represents the combined efforts of a vast number of small impulses."

When the Condenser is Omitted

"Yes, but look here," cried Painter. "How do you explain this? I find that it does not make the slightest difference to my crystal set whether I have a condenser across the telephones or not. You cannot charge up a condenser if there is not one there!"

"This is quite true," said John, with a laugh in which we all joined. "But, if I may be allowed to say so, there is always a condenser there, whether you place across the telephone terminals a 'gadget' consisting of a number of copper plates separated by pieces of mica or whether you don't."

"How's that?" queried Morris, looking a little puzzled.

"What is there between the receivers of your telephones and the output terminals of the set?" asked John.

"Why, flex leads, of course," replied Morris.

The Telephone Leads form a Condenser

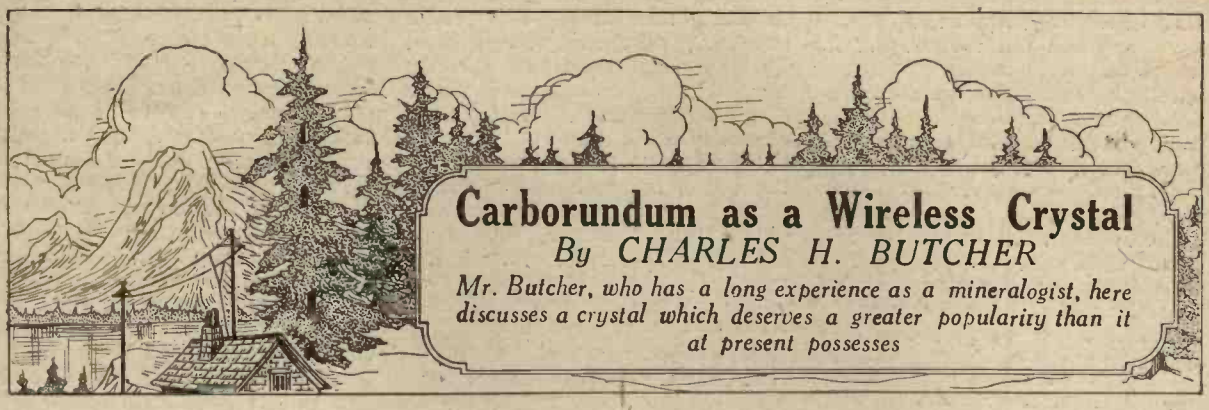
"Just so," said John. "If you care to examine the telephone leads, you will find that they consist of two sets of fine stranded wires or of lengths of tinsel. They are insulated from one another by a covering of cotton, silk, or some other non-conducting substance. Now, a condenser consists of two conductors separated from one another by insulating material, which we call the dielectric. Capacity between them occurs when one is at a higher potential than the other. The telephone leads form a condenser, for one of them is connected to the detector and is receiving positive impulses from it, whilst the other is earthed. And there is capacity, too, in the windings of the magnets, as well as between the receivers and your head, which is also earthed! If you take away the telephone condenser, the grouping is done mainly by the condenser effect of the telephone leads, and in many cases it does not matter a bit whether you have a condenser or not."

As the meeting had begun rather late that evening no time remained to go further into the question of crystal sets; but, before we left him, we made him promise that on the next occasion he would deal with the question of obtaining the greatest possible degree of efficiency in the crystal receiver.

The Hale-Lyle System

Radio Press Demonstration

In view of the interest in the Hale-Lyle system of broadcast reception, described in last month's issue of "The Wireless Constructor," Radio Press, Ltd., have arranged for demonstrations in London so that readers may hear the system in actual operation. Particulars will be sent free on receipt of a stamped addressed envelope.



Carborundum as a Wireless Crystal

By CHARLES H. BUTCHER

Mr. Butcher, who has a long experience as a mineralogist, here discusses a crystal which deserves a greater popularity than it at present possesses

IT is now nearly twenty years since the rectifying property of carborundum was discovered by General Dunwoody, of the United States Army. During this lapse of time the carborundum detector has held its place as one of the most reliable and satisfactory of crystal detectors, particularly as regards freedom from the ill effects of mechanical vibration and the close proximity of electric discharges. It is, moreover, unaffected by changes in atmospheric conditions, such as damp air and the presence of dust particles.

Detector Design

In general design, the detector comprises a small fragment of selected carborundum, mounted in Wood's metal, pressing against the face of a steel plate carried on a steel spring. A certain amount of pressure is necessary at the point of contact for sensitive working, and this is adjusted by means of spring and screw attachments. It is only in the actual form of the latter, and in minor details, that the design of detectors may differ. Maximum rectification is only obtained when an external E.M.F. is applied across the crystal. This E.M.F., which causes the contact to become heated, is generally supplied by means of dry cells in series with a potentiometer, which can be adjusted to suit crystal fragments varying in resistance and in rectifying power.

Telephone Resistance

Some specimens of carborundum will give excellent results without the use of an external battery and potentiometer, but out of a batch of fragments very few pieces will be found suitable. Some form of potentiometer voltage is generally necessary in order to obtain the results worthy of a carborundum detector. High-resistance 'phones are also necessary, and these should be wound to a total of 8,000 ohms, or 4,000 ohms each earpiece. The area of contact between the crystal fragment and the steel plate should be reasonably large, and may vary from 1 to 2 square mm. in extent.

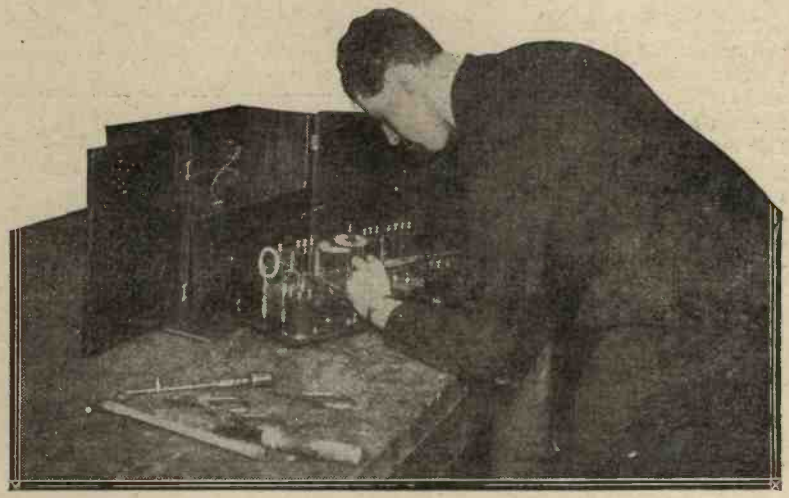
Composition of Carborundum

Carborundum is not a natural mineral crystal, but is an artificial carbide of silicon manufactured on a large scale by the fusion of coke and quartz sand in the electric-resistance furnace. It is extensively used as an abrasive, and as a substitute for the diamond in rock drills. In the actual process of manufacture a quantity of salt is added to the mixture of coke and sand charged into the furnace. This is found necessary in order to increase the fusibility of the product; sawdust is also added to give porosity to the charge. During the operation of fusion, which is carried on continuously for about thirty-six hours, the temperature of the mass reaches the neighbourhood of 7,000°F., and carbon monoxide escapes and burns freely around the sides and at the top of the furnace. For the greater part of the time, the current is maintained at about 6,000 amperes and 125 volts, and, when the reaction is completed, the furnace is allowed to cool down.

The Product of the Furnace

The product taken from the furnace is found in the form of rough masses of beautifully coloured crystals, with sharp edges and an exceedingly brilliant lustre. On closely examining a lump of the material it will be seen that the crystals making up the mass are hexagonal and tabular in form, with their edges modified by narrow faces of varying degrees of steepness. Individual crystals, however, are rarely found, and in the mass crystals are usually aggregated together in parallel or irregular growths. Their colour usually ranges from a deep grey to a violet purple or greenish blue and is very striking and characteristic in reflected light.

It is not the highly coloured and lustrous crystals of carborundum



His Majesty the King has had a four-valve set made for his stable lads at Newmarket. Our picture shows the receiver in the course of manufacture.

which are used for wireless purposes. Indeed, the majority of the "glass-like" crystals are useless. It is fragments of silver-grey colour, with a somewhat amorphous structure, which are found to be the most efficient. The selection of suitable specimens, however, is a matter requiring careful consideration, for there are many grades of carborundum on the market which differ widely in character. The following notes may serve to give some idea of the particular grade which is likely to give the best results in practice.

Poor Specimens

Generally speaking, highly coloured crystals, with a brilliant metallic lustre and sharp crystalline form, have very poor rectifying properties. Where rectification is found among such material it will be noticed that the fragments in question are bluish grey in colour and have a heavy graphite deposit between the intergrown and twinned crystals. The pieces themselves are extremely hard, and break up into sharp, splintery flakes when struck with a hammer.

The Most Sensitive Pieces

Carborundum of a silvery-grey colour, with an amorphous formation, devoid of graphite deposits, will be found the most satisfactory in regard to sensitivity and stability. Dark-grey crystals, with a hard granular and fused appearance, and no graphite deposit, are practically useless. Those of grey colour, with a very irregular and rugged appearance, but no definite crystalline form, and with a fairly heavy graphite deposit, have a reasonable amount of rectification. In the most satisfactory fragments the amorphous structure predominates and the colour is distinctly silvery grey. Examined under the microscope, the fragments will be found to have a kind of honeycomb structure, and the tiny cells formed by the intergrown, microscopic crystals may or may not show deposits of graphite. The presence of this material does not appear to influence rectification one way or the other, as specimens with and without graphite, but otherwise identical in structure, have been found equally suitable for wireless purposes.

This small receiving set, made in a match-box, costs 6½d. in Germany!

Undoubtedly the best results are obtained by actually testing a number of promising fragments, selected for silver-grey colour and amorphous surface structure. When a good specimen has been obtained it will be found that the sensitivity of the detector is not impaired when the point of the "crystal" has been accidentally broken off, for the characteristics of a good piece of carborundum are fairly uniform throughout its effective area. Of course, this is not always the case, and when a good point gets broken away there may be some difficulty in finding another equally good point on the same piece of material. It may be necessary to break away the greater portion of the fragment before another sensitive spot is found, but this is rarely so.

The rectifying power and resistance of carborundum vary with the temperature. At the temperature of liquid air, −190°C., its resistance is greatly increased and its rectifying power is reduced to a minimum. On heating, however, it becomes very efficient as a rectifier, and at temperatures between 400 and 500°C. its sensitivity reaches a maximum and its resistance is correspondingly reduced. It is to this property that the efficiency of the carborundum detector is largely due.

The Twin-Valve Receiver

SIR,—I have been using a twin-valve receiver, as described in your January issue, since January, and have nothing but praise for it.

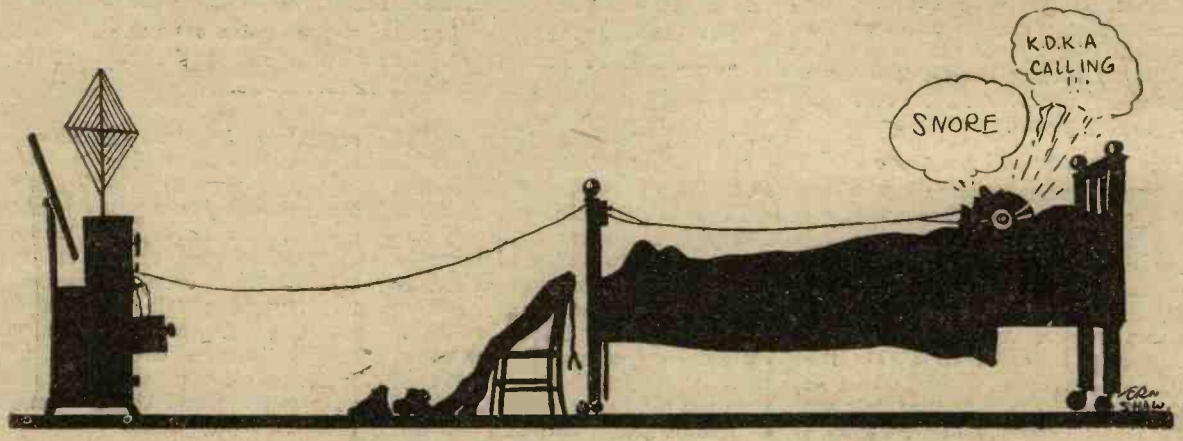
All the main British stations, with the exception of Aberdeen, are received both loudly and clearly, as are also Radiola, Petit Parisien, and Madrid.

Altogether it is a great success, and I can thoroughly recommend anyone to build one. The Blue print and the directions make everything clear, so that there is no excuse for failure.

Wishing you and THE WIRELESS CONSTRUCTOR every success,

Yours faithfully,

Birmingham, R. W. B.



"The night shall be filled with music."

Practical Workshop Hints

Making Large Holes—A Home-made Scriber—Scribing Circles—Finishing Wood—Centre Punches

For Making Large Holes

A MOST useful tool for making large circular holes in ebonite panels is the expansion drill seen in Fig. 1. It is really designed for making holes in boiler plates, and will tackle ebonite with the greatest ease. The drill point itself is ¼ in. in diameter, and as it is removable it can be replaced when it becomes blunt. The cutter is also removable, and a spare one can be obtained very cheaply. By means of the thumbscrew the cutter may be set at any distance from ½ in. to 2½ in. from the centre of the drill, so that holes from 1 to 5 in. in diameter can be made. This tool fits into the brace. When it is used the ebonite panel should be placed on a thick piece of wood, so that the drill point may have something to work in after it has passed through. It is best not to go right through from one side, for if this is done the

Fig. 1.—The expansion drill.

edge of the hole on the far side will probably not be clean, since the cutter will chip the ebonite as it makes its exit. Instead, go about half-way through on one side; then turn the panel over and work from the other. In this way you can be quite sure of turning out a perfectly clean hole. Large holes in wood such as those required when ammeters, voltmeters or milliammeters of the flush-fitting type are mounted upon cabinets are best made with an expanding bit designed for wood cutting. This is a tool made upon much the same lines as the expansion drill just described, the differences being these: Instead of the pilot drill it has a gimlet screw which pulls the tool in. The cutter has a vertical scriber point and a horizontal cutting edge. For wireless work, where the wood used seldom if ever exceeds ¾ in. in thickness, the horizontal cutting edge is not really needed, and I find it best to remove

it by grinding it away. One then uses the tool as previously described, cutting about half-way through from one side, then turning the work over and finishing upon the other. When the horizontal edge has been ground away the expanding bit can be used quite well for cutting large holes in ebonite as well as in wood. It is only necessary to make a pilot hole big enough to take the gimlet screw. Expanding bits can be obtained in various sizes, and each is sold with two cutters. A useful size is that which makes holes from ¾ in. to 3 in. in diameter. Neither

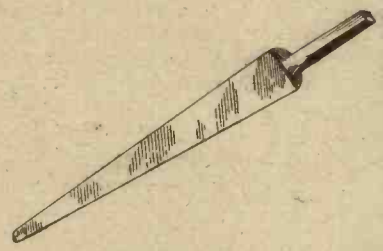


Fig. 2.—The reamer bit is useful for enlarging holes.

the expansion drill nor the expanding bit is an expensive tool, and either will be found extremely useful by the constructor.

Enlarging Holes

Another extremely useful tool for the constructor, and again an inexpensive one, is the reamer bit seen in Fig. 2. Though really designed as a wood-working tool, it cuts ebonite very well indeed. The reamer bit, whose blade is about 7 in. in length, tapers gradually from about ¾ in. at the shoulder to ¼ in. at the point. Its section is D shaped, and cutting is done by the sharp edges formed by the junction of the flat and the curved surfaces. This is also a brace tool. It will be found very useful by those who have purchased hand drills whose chucks have not sufficient gape to take a ⅜ in. drill. In wireless work it is frequently necessary to make a hole of this diameter to take the bush of a spindle. Proceed in the following way: Make a hole in the required position with the largest drill that your chuck will take. Then place the panel, protected by pieces of wood, in the jaws of a vice, so that it is held vertically. Insert the point of the reamer bit into the hole made and turn the brace slowly. After a few turns withdraw the bit, and see whether the bush will enter for a short distance. As soon as the hole is large enough to allow it to do so, reverse the panel and repeat the process from the other side. By adopting this method the hole can be made quite a good fit for the bush, for the taper of the bit is very gradual, and since the distance from the surface of the ebonite to the mid depth of the hole is only ⅛ in., its effects will hardly be noticeable. On the other hand, if the reamer is run straight through from side to side until the bush will seat itself in the hole there will be a good deal of play, since the hole will now be tapered for the full ¼ in. of its depth. The D-bit is also very useful when an unbushed hole of medium size has been made, owing to an error, slightly out of its proper position, so that the spindle or shaft binds in it. If the hole is enlarged with a round file the resulting job is usually rather unsightly; but when the reamer bit is used it remains circular, and so does not cry aloud that a certain amount of botching has been done.

A Home-made Scriber

A very useful scriber can be made in the home workshop in the way shown in Fig. 3. The only materials needed are a short piece of ⅜ in. round brass rod, a 6B.A. screw, and a discarded gramophone needle.

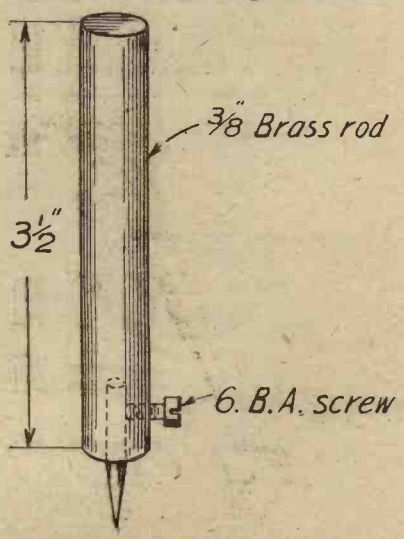


Fig. 3.—Details of the home-made scriber.

Three and a half inches is a convenient length for the rod. In the centre of one end of it drill a hole about ⅜ in. in depth into which the butt of the needle is a good fit. At right angles to this hole and running into it drill and tap a 6B.A. hole. Insert the needle as shown in the drawing, and clamp it in position with the screw. One gramophone needle will last for quite a long time as a scriber point, and when it becomes blunt it can be renewed in a moment at

no cost. This tool also makes a most useful punch for fine work if the needle, instead of being dead sharp, has its point very slightly rubbed down. Here again the advantage of having an easily renewable point is obvious.

Scribing Circles

Another very useful little tool which can be made up in a few minutes with the aid of a pair of terminals, two old gramophone needles and a length of 3/16 in. round brass rod is the beam compass seen in Fig. 4. This instrument is used in the following way: We will suppose that we wish to mark out a circle 2¼ in. in diameter. Make a punch mark on the panel to indicate the exact centre of the circle required. Loosen the binding screw of one of the terminals slightly, so as to enable it to be moved upon the rod, fixing the other one firmly by seeing that its screw is turned hard down. Place the needle point of the fixed terminal on one of the inch divisions of a ruler, and move the other terminal until its point is exactly 1⅛ in. away. Then clamp it in position. Put one of the needle points into the punch mark made in the panel, and hold the terminal to which it belongs with the left

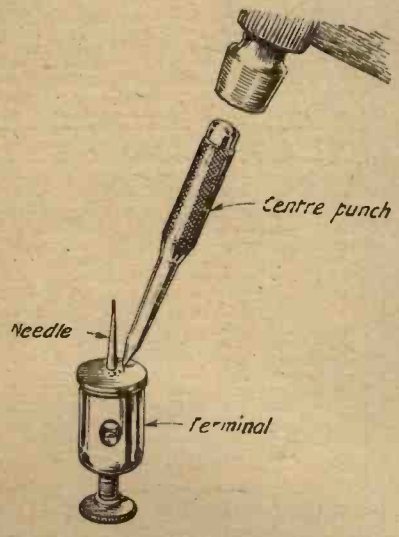


Fig. 5.— How the needle points are prepared.

hand. Take the other in the right hand, and with its needle make a small scratch on the panel. Verify with the ruler that the radius is exactly 1⅛ in., adjusting if necessary until it is. It should, of course, be exactly 1⅛ in. after the first adjustment, but this second check is advised so that there may be no possibility of an error. Now hold the two terminals as before and scratch out the complete circle.

The beam compass is also extremely useful in marking out where many centres have to be punched the same distance apart from one another. The points are set at the required distance, and marking out can then be done with the greatest ease. To make a beam compass, run first of all a 3/16 in. drill through the holes in the terminals. The terminals, by the way, should be of large size. Now cut off the screwed shanks close to the body of each terminal, and in the centre of the flat surface drill a hole. No. 52 Morse drill will be found exactly right for the purpose. This hole should not run into the 3/16 in. hole already made. Insert the butt of

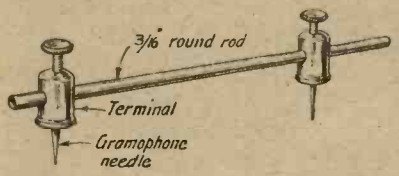


Fig. 4.—A useful gadget for scribing large circles—the "beam compass."

the needle into it, and fix by a method known as "prick punching," which is shown in Fig. 5. Fix the terminal tightly into the vice, and with a fine punch make three or four deep indentations in the brass round the needle. It will be found to be very tightly gripped.

Finishing Wood

Many wireless constructors who are fond of working in ebonite and brass do not care much about making up their own cabinets. If finished sets or pieces of apparatus are made up on panels of standard size ready-made cabinets can be obtained from a number of firms. Personally, however, I prefer to make the panel fit my design rather than the design to fit the panel, for there is then no tendency to crowd one's components. It means of course, that the panels will not fit ready-made cabinets, and one is then faced either with making the necessary cabinet oneself or of getting it made up. I have found it a good plan in this case to make rough dimensional drawings of the cabinet required and to get it made by a joiner capable of doing neat work. This is not an expensive business, and one can save a good deal by having cabinets delivered in the rough and finishing them up oneself.

Suitable Woods

Woods that I have found very suitable for wireless cabinets are oak, walnut and mahogany. American whitewood also looks very well pro-

vided that it is stained, for it will take a very good finish. Here is a simple and satisfactory way of finishing up a cabinet delivered in the rough. Obtain a large cork bung from two to three inches in diameter. Round this wrap a piece of the finest glass paper. You now have a tool which will enable the necessary rubbing down to be done very easily. Work carefully over each surface, not forgetting that in this case *elbow grease* is the secret of success. When you have got all the surfaces so smooth that they feel like silk when the hand is passed over them, soak a rag in linseed oil and rub them over one by one. Do not be too niggardly with the oil.

Repeat the Process

Leave the cabinet for two or three days to dry. At the end of this time you will probably find that owing to the soaking in of the oil the grain of the wood has risen a little. Rub down afresh until the surface is quite smooth again and oil once more. With certain woods it is necessary to repeat the rubbing down and oiling process three times in order to obtain a finish that will remain permanently good. This does not mean that you must wait a week or more before mounting the set in the cabinet. There is not the least reason why it should not be brought into use as soon as the first rubbing down and oiling process is complete, though when oiling has been done afresh the set should stand on several layers of newspaper, so that the oil may not mark the top of the table on which it rests, or the table cloth.

The Final Polish

As I do not care very much about varnished cabinets, I generally obtain the final polish by using the mixture of beeswax and turpentine which housemaids make up for use upon floors. As soon as the last dressing of oil has dried in thoroughly, apply a little of this compound to the cabinet with a rag, rubbing it well in. Then use a polishing cloth. Provided that you once more administer plenty of elbow grease a handsome lasting polish will result. If beeswax and turpentine do not happen to be available, brown boot polish will do quite well, for it consists mainly, I believe, of these materials.

The Centre Punch

I have often heard people in a tool shop asking simply for a centre punch and seen them take the first one that was handed out to them. For wireless work *any* centre punch will *not* do, and many constructors spoil their work by using punches that are far too coarse to make real accuracy possible. What is needed is a small fine-pointed punch, for with this you can mark your drilling centres exactly where they ought to be. Take care, by the way, when you purchase a centre punch that you get one of really good quality. Not long ago I bought one of unknown make because I had not time to go to my regular tool shop. After a very small amount of work it had ceased to have a point at all, being made of metal that was far too soft.

Use a Small Drill First

When a fine punch is used, as it ought to be, large drills such as those $\frac{1}{4}$ in. and $\frac{3}{8}$ in. in diameter should not be started directly in the little marks that it makes. Instead, place first of all a smallish drill, say, a No. 26 Morse or a $\frac{1}{8}$ in. in the drill chuck and with it make a little hollow at the point marked with the punch. The big drill can then be put through without there being any chance that its point will slip.

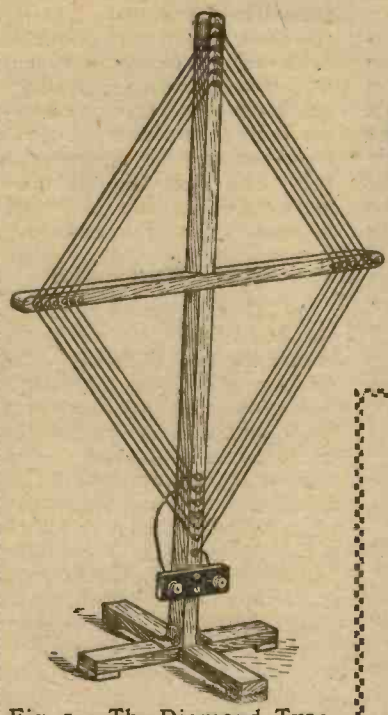


Fig. 1.—The Diamond Type.

A Chat on Frame Aerials

By C. P. ALLINSON

A comparison of two types of frame aerials which gives a suggested explanation as to results obtained

NO doubt many listeners have tried out the frame aerial at one time or another, and have discarded it as being too inefficient. Or, where it has been installed on account of its directional properties, not being sufficiently so.

Now there are two main types of frame aerial which we may call (a) the diamond type, and (b) the box type. As will be seen from Fig. 1, the diamond type consists of a winding which is a flat spiral, every turn being larger than the one which precedes it. It is this form that the writer has found as being less efficient and much less directional than the box type frame aerial shown in Fig. 4.

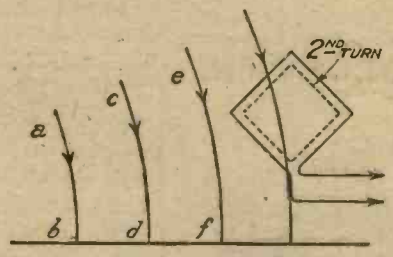


Fig. 2.—The frame is directional to the transmission.

How it Works

It will not be amiss if we consider the action of a frame aerial. In Fig. 2 let ab, cd, ef, &c., represent successive wave trains. Then the frame aerial (consisting in this case of one turn of wire only) is set at right angles to their plane. It is then directional to the transmission. It is not intended in this article to consider the theory of frame aerial reception, and we will therefore take it for granted that in this position, with the frame pointing towards the transmitting aerial, that each wave train will cause a maximum current to flow in the frame aerial. It is understood, of course, that this is tuned to the required frequency. As is known,

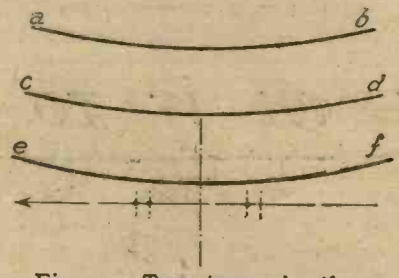


Fig. 3.—Two turns in the minimum position.

if the frame aerial is now turned through an angle of 90 deg., the energy received is a minimum.

Adding a Second Turn

Supposing we now wind a second turn of wire inside the first, and place the frame directional to the station we wish to receive. This second turn, as is clearly to be seen, is almost entirely, if not quite, shielded by the first, and it therefore picks up but little extra energy, and practically its only effect is to increase the total inductance of the frame aerial without making it much more sensitive. If we now rotate the frame into the minimum position we can see from Fig. 3 that we present a larger conducting surface to the oncoming wave train, double in fact, resulting in an addition to the signal strength at the minimum

position. The preceding argument applies to every succeeding turn of wire added in this manner, and

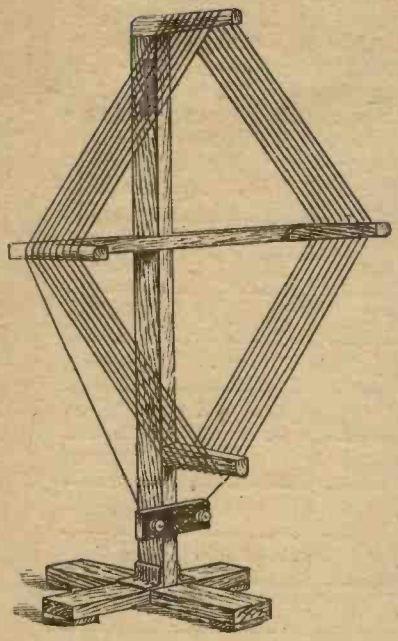


Fig. 4.—The "Box" Type.

so each extra turn detracts from the directional properties of the aerial.

Let us, however, wind this second turn alongside and parallel to the first. With the frame directional towards the station we wish to receive, we see that the surfaces of two conductors are now presented to the wave train instead of one. An examination of Fig. 5 will make this clear. Now when the frame is rotated into the minimum position Fig. 6 shows us that only one conductor surface is exposed to the signal wave, however many turns there may be in the frame aerial, and that, therefore, any increase of signal strength that may occur in this position will be very small.

The Box Type Better

It would appear from the foregoing remarks that a box type frame aerial should not only be more sensitive but much more directional than an equivalent

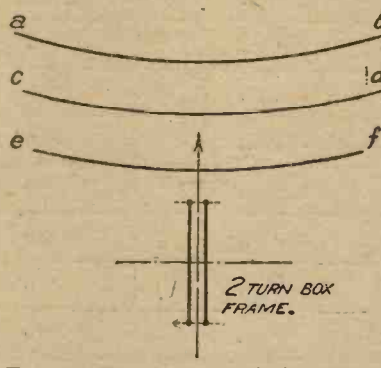


Fig. 5.—Two turns side by side in the maximum position.

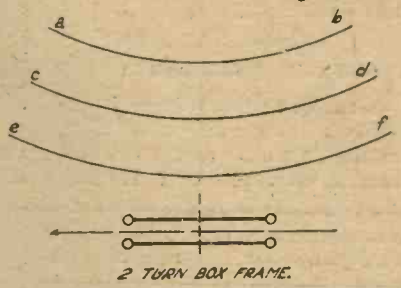


Fig. 6.—The Fig. 5 frame at right angles to the transmission.

frame aerial wound diamond fashion. This has been found to be so in actual practice by the writer in a series of experiments carried out by him. It is important, however, that the turns of wire be amply spaced, as a frame aerial with 12 turns spaced ¼ in. showed no improvement over one with 8 turns spaced ⅜ in. It is also advisable to mount the frame aerial with one of the diagonals vertical, so that no one limb of the winding becomes parallel with the earth, thereby causing losses due to increased capacity to earth. For broadcast reception, a frame aerial

wound with approximately 100 ft. of wire (which is the length of a standard P.M.G. aerial) has been found satisfactory.

Controlling Oscillation

A useful hint when using a frame aerial with several stages of H.F. which may then be rather difficult to control on account of the low damping of a frame aerial, consists in placing a carbon compression variable resistance in the grid return lead from the frame aerial as in Fig. 7. By this means it is possible finely to control the damping introduced into the first grid circuit, and so control oscillation to a very accurate degree, which is most useful when trying to pick up weak or distant transmissions.

Some Dimensions

For the convenience of amateurs who have not yet tried frame aerial reception there is appended a table of suitable dimensions, number of turns and spacing of same, covering various ranges of wave length. I certainly advise the experimenter who has not yet done so to try this very interesting method of reception. He will find there is

No. of turns, spaced ½ in. apart.	Side of square.	Inductance.	Max. λ with ·0003.	Max. λ with ·0005.
2	2 ft.	16 μH	130 metres	170 metres
4	2 ft.	50 ,,	230 ,,	300 ,,
6	2 ft.	80 ,,	290 ,,	380 ,,
8	2 ft.	125 ,,	375 ,,	480 ,,
10	2 ft.	175 ,,	440 ,,	560 ,,
12	2 ft.	240 ,,	500 ,,	650 ,,
4	4 ft.	110 ,,	350 ,,	450 ,,
8	4 ft.	320 ,,	580 ,,	750 ,,
12	4 ft.	600 ,,	810 ,,	1,100 ,,

These figures are for the box type frame aerial, and do not apply to the diamond type. If the wires are only spaced ⅜ in. apart (less is not advisable), the maximum wavelength obtainable may be increased a little. A suitable size wire is 18 S.W.G. copper wire, a smaller size not being advised.

far more thrill in getting all the B.B.C. stations with a 1 or 2-valve set on a frame, than in receiving them on an outside aerial. It is possible to pick up most of the B.B.C. stations even without H.F. amplification, and in order to obtain reaction the reaction coil may be coupled to a small coil placed in

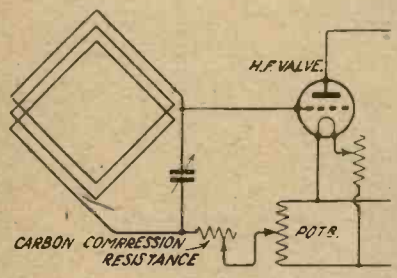


Fig. 7.—Controlling oscillation by means of a resistance.

series with the frame aerial in the grid circuit, or the anode coil may be tuned with a variable condenser, regeneration being obtained through the inter-electrode capacity of the valve. Other methods will suggest themselves to the experimenter, and very interesting results may be obtained.

"The Wireless Constructor" Neutrodyne Receiver

SIR,—You may care to hear of my results with the three-valve Neutrodyne Receiver described in No. 1 of THE WIRELESS CONSTRUCTOR.

This set was built to your plans with a few minor changes. I am using a D.E.V. valve as H.F., a D.E.Q. as detector, and can use either a D.E.V. or ordinary type of valve as L.F. I am actually using a Cossor bright emitter as L.F.

On the top of the valve cabinet I have fixed a McMichael Reversine coil holder, and attachment for plugging into transformer valve holder.

My best results on broadcasting have been obtained using the H.F. transformer of Mr. Donald Straker, and described in "Wireless Weekly" of December 17, 1924. Using this transformer, the set is remarkably selective. I can receive Manchester without a trace of London or Bournemouth. I have, however, made this transformer slightly wider than Mr. Straker's, and wound it with 28 D.C.C. wire, about 100 turns secondary and 100 primary.

On the higher wavelengths I find that I get better results by using the coil holder on the top of the cabinet as a vario-coupler. Radio-Paris, for instance, is very good with 300 across secondary and 250 across primary, both these coils being home made, the 300 being 4 basket coils mounted in series (28 enamel wire), and the 250 a lattice wound coil 28 D.C.C.

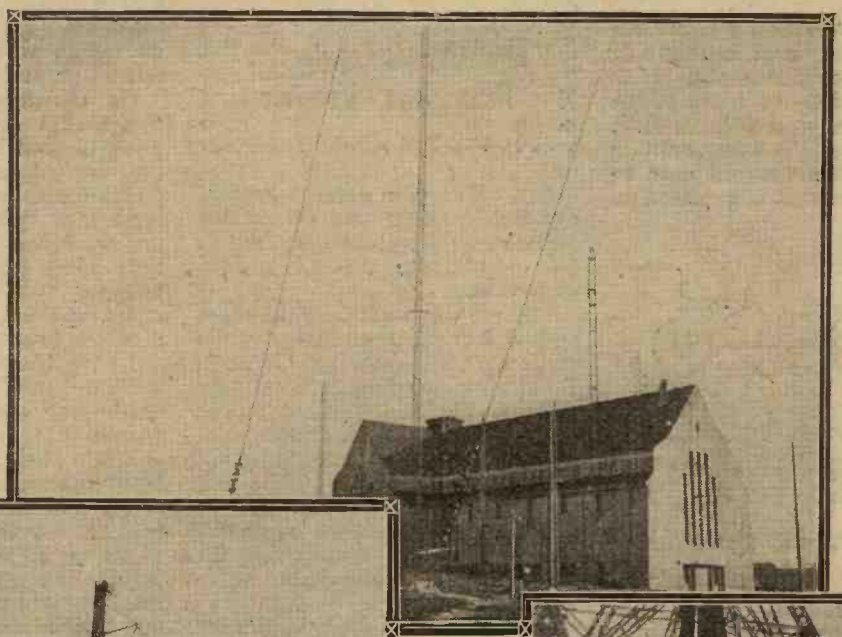
I have been agreeably surprised to find how good this set is for short-wave work. Using specially wound coils, I get from 65 to 100 metres. Here I find that I get the best results using miniature frame-aerial coils in the McMichael coil holder. On 6 in. frame aerials 16 turns 28 D.C.C. and 11 turns for sec. and prim. are used. I am making some rather larger frames, and shall wind with 18 bare tinned copper.

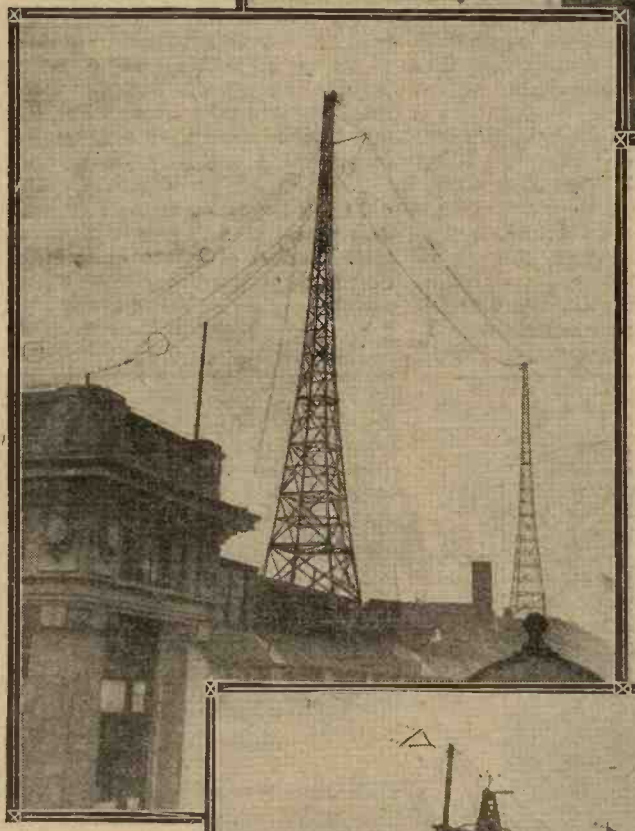
The Italian press report, sent out from Rome, comes in very well on 100 metres, and I have logged a large number of amateurs on from 65 to 90 metres, checked by wave meter.

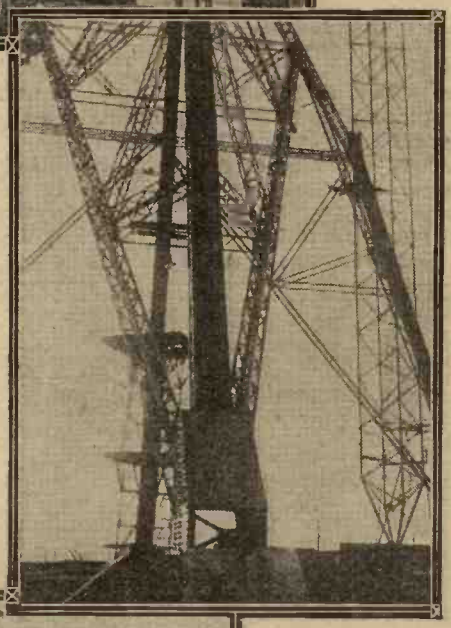
Yours truly,
NORMAN GUTTERIDGE.

Haslemere.

Some Modern Aerials







At the top of this page is seen one of the transmitting houses at Koenigswusterhausen, in Germany, where the largest station in the world is being erected. Some of the masts may also be seen, while, on the right, is a picture showing one mast in the course of erection.

On the left:—The aerial of the new London station, at Selfridge's. The "flat-top" aerial and "cage" lead-in may be clearly discerned.

Below :— The aerial at the Royal Observatory, Greenwich.

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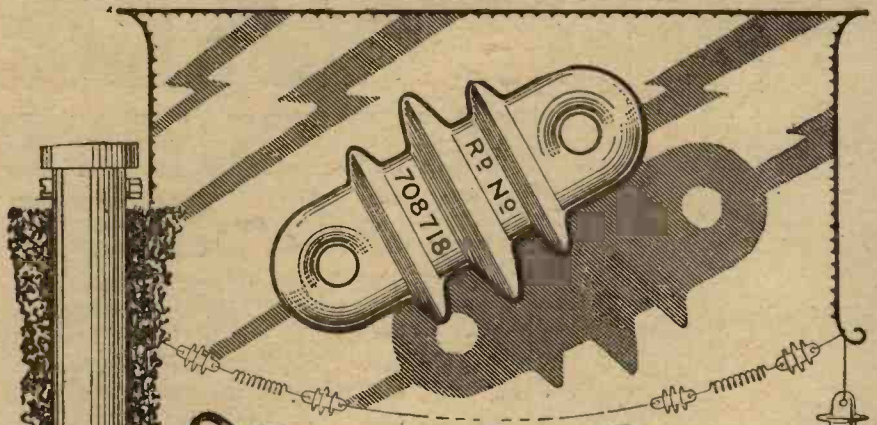

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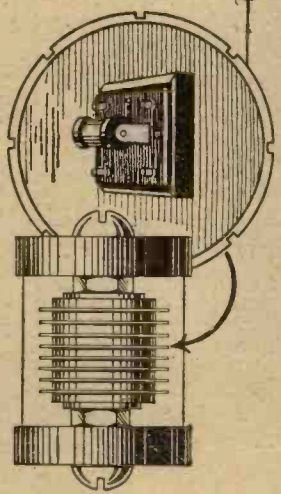

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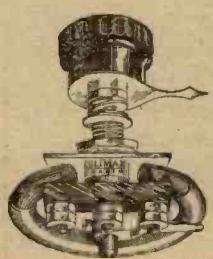

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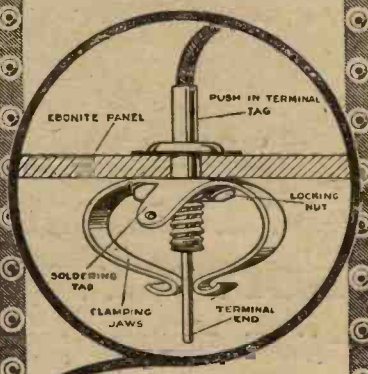

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Catwhiskers I Have Met

By R. W. HALLOWS, M.A.,
Staff Editor

MANY crystal users who endeavour to get the last ounce of efficiency out of their receiving sets give a good deal of attention to the catwhisker question, trying all kinds of types with contact points made of a large variety of metals. I do not know how many kinds of catwhisker there are on the market at present, but there must be a very large number indeed, and the crystal user's endeavour is to find the best. Actually, I believe that good results depend more upon the way in which it is used than upon the nature of the catwhisker. With most crystals the problem resolves itself into that of finding a really sensitive spot, and then adjusting the pressure of the catwhisker until the best results are obtained. Most of the popular crystals consist of galena in some

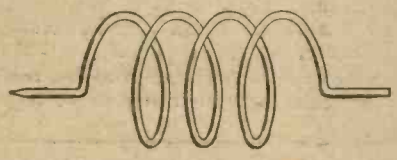


Fig. 1.—A common form of whisker.

form or other, and with galena a very light contact is generally required to give a good flow of current through the telephones. Unless the detector is so designed that very fine adjustments can be made it is not easy to obtain just the right amount of pressure between the point of the catwhisker and the surface of the crystal; further, a very light contact means that the slightest jar will disturb the setting, often arrived at after a good deal of work.

The Spiral Type

It may be said that nearly any kind of catwhisker will work satisfactorily if it is properly used. Fig. 1 shows the spiral type, which is fitted in probably ninety per cent. of crystal receiving sets. It should be noticed that greatly increased efficiency can generally be obtained by keeping the contact point fine and sharp. An occasional touch up with a fine file will suffice for this. In order to obtain greater stability in the crystal detector

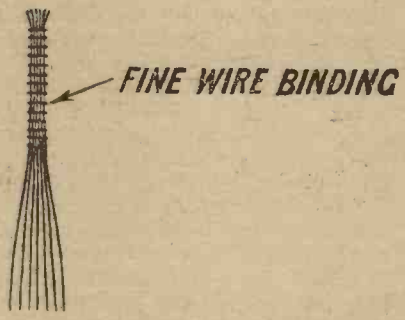


Fig. 2.—A form of whisker giving many points of contact.

with a catwhisker of this kind and a light contact it is a good tip to cover the surface of the crystal with a piece of very fine muslin, which can be secured in place by anchoring it to the contact screws of the cup with a few stitches. The fine point of the whisker penetrates the muslin easily, and once the sensitive spot has been found it is held in place by the mesh.

A "Brush" Contact

Fig. 2 shows a kind of whisker very easily made, which makes searching for a sensitive spot a simple business, besides assuring a respectable amount of stability. To make it strip off the insulation for about an inch at the end of a

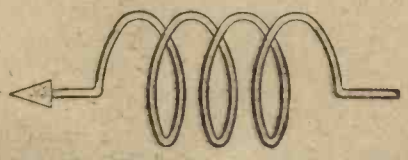


Fig. 3.—The "spear-point" type.

piece of flex containing a large number of thin wires. With a piece of fine wire bind the strands firmly together to within about ¼ in. of the end. Snip off the little bundle with a pair of wire cutters, and the whisker is made.

The free ends of the wires should be splayed a little, so as to give them a spread. When the multi-point catwhisker is used it will be found that in almost any position one at least of its wires is making contact with a sensitive spot, and that good results can be obtained with the minimum amount of searching.

Another Type

A very good type of catwhisker is the spear-point pattern, seen in Fig. 3. Its great advantage is that it is easy to keep the point sharp and fine, and that it gives a very delicate contact. A very satisfactory form of spear-point whisker can be made in a few minutes in the following simple way. Take a piece of No. 30 copper wire about 2 in. in length, and flatten its end by hammering it gently. With a pair of sharp scissors cut the flat-

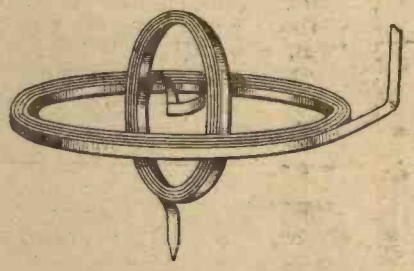


Fig. 4.—A very stable form of contact.

tened part to a point. Then coil the rest of the wire tightly round a stout knitting needle.

The "Gyro" Pattern

One of the most ingenious catwhiskers that I have come across is the "Gyro" pattern, seen in Fig. 4. This is made from a piece of thin, flat, springy metal, wound first into a horizontal spiral, and then into a vertical spiral lying within the former. The double coils at right angles to one another take up any jars or jolts that may come the way of the detector, and once the correct adjustment has been found the point of the catwhisker will remain in place in spite of quite rough handling.

The Best Metal

Which is the best metal to use for the catwhisker? This depends very largely upon the particular crystal with which it is employed. Both brass and copper give good results with galena, whilst some amateurs pin their faith to catwhiskers tipped with gold or silver. My own experience is that with the majority of "ite" crystals a silver contact point gives slightly better results than any other.

Not too Stiff

The most important thing about any kind of catwhisker is that it should not be too stiff, for this results generally in a harsh contact. But no matter what kind of catwhisker is used it cannot perform well unless the surface of the crystal is perfectly free from dirt and grease. There is no greater mistake than to handle crystals, for if they are touched they collect a thin film of grease, which soon becomes covered with minute particles of dust. The crystal should be washed from time to time in absolute alcohol, obtainable from any chemist—do not use petrol or methylated spirit, both of which contain solid impurities, which they deposit as they evaporate. Pick up a crystal always with a pair of tweezers. Some crystals seem to lose their sensitivity in time; this can generally be restored by chipping away the old surface with the point of a penknife and exposing a new one.

How to Fix Your Crystals into the Cups

IT is not always realised that the contact which the crystal makes with its cup is every bit as important as that between the crystal and the catwhisker. If you have a bad contact between crystal and cup you cannot hope for good signal strength, and you will find it extremely difficult to obtain any kind of stability in your detector. Some amateurs mount the crystal by running molten solder into the cup and pressing it down until the solder solidifies. This is a very bad practice, for crystals, especially those of the synthetic-galena type, are very susceptible to the effects of heat, and the melting point of solder is high enough to impair their sensitiveness. If you wish to imbed your crystal in metal, do not use solder, but purchase a stick of Wood's metal, which has a very low melting point. The best way to mount the crystal with the aid of Wood's metal is this. Grip the cup in a pair of gas pliers and place in it two or three short pieces cut from the stick. Hold it in the flame of a Bunsen burner or spirit lamp until the metal runs, then withdraw it from the flame and, just before solidification sets in, pick up the crystal in a pair of tweezers and press it well down, holding it there until the metal has set.

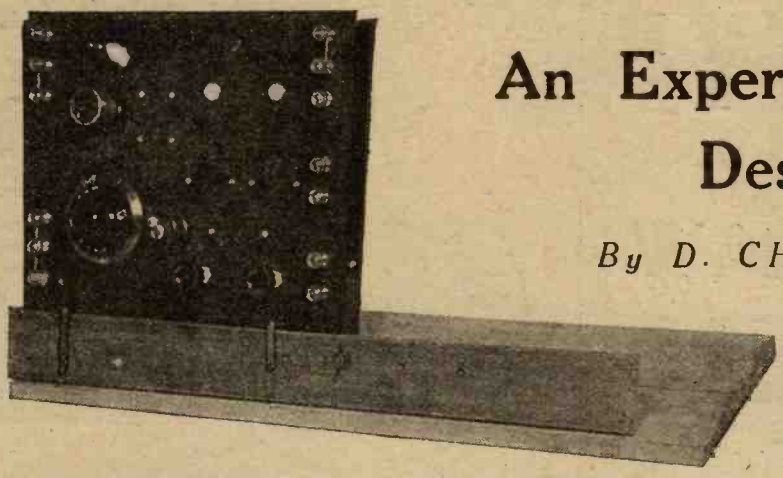
Use of Tinfoil

If you use a cup of the type fitted with three contact screws you may find it exceedingly difficult to fit in an odd-shaped piece of crystal so that it is firmly gripped. A good way of obtaining a better hold, and at the same time a better contact, is to wrap the piece of crystal in two or three layers of tinfoil, working it well in until it follows the contours of the crystal. Take care not to touch the crystal with the fingers. When the crystal has been fixed, the tinfoil which covers its top may be scraped away with a penknife. Whether tinfoil is used or not, it is better to shape your crystal a little with the aid of an old penknife until the part to be gripped by the screws is roughly of the shape of an equilateral triangle. Most crystals can be chipped quite easily with a knife, and shaping it in this way ensures that the screws have a good surface to grip.

The Fixing Screws

Should you be one of those constructors for whom tapping has no terrors, you may find it an advantage to increase the number of fixing screws to four or more by drilling holes through the sides of the cup, tapping them and inserting screws. With a good number of screws it is usually quite a simple matter to fix even the most irregular crystal firmly in position.

The Savoy Bands have gained great popularity among listeners. They are seen above with a collection of their jazz instruments.



An Experimenter's Desk

By D. CHARLES

A useful addition to the workshop of the man who constructs wireless sets

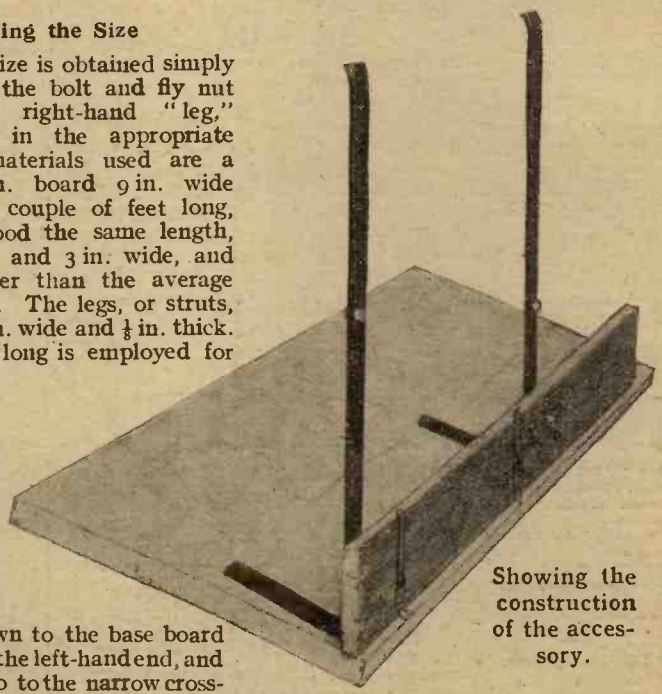
This photograph shows how the desk may be used as a testing stand for the completed receiver.

EVERY builder of wireless sets must have felt the need of some simple support upon which he can stand his panel during the period of construction. Then, again, on completion he will require to put his instrument through its paces, before fixing it in the cabinet, in case of possible modifications or adjustments being required.

The device illustrated fills this want very effectively, and it offers the advantages also of being most inexpensive and easy to make up. In fact, this was constructed entirely from odd "junk." It will accommodate securely any panel from eight to eighteen inches in length. Whichever size is under construction, the desk enables one to get at either side without any obstruction being present to hinder one's work.

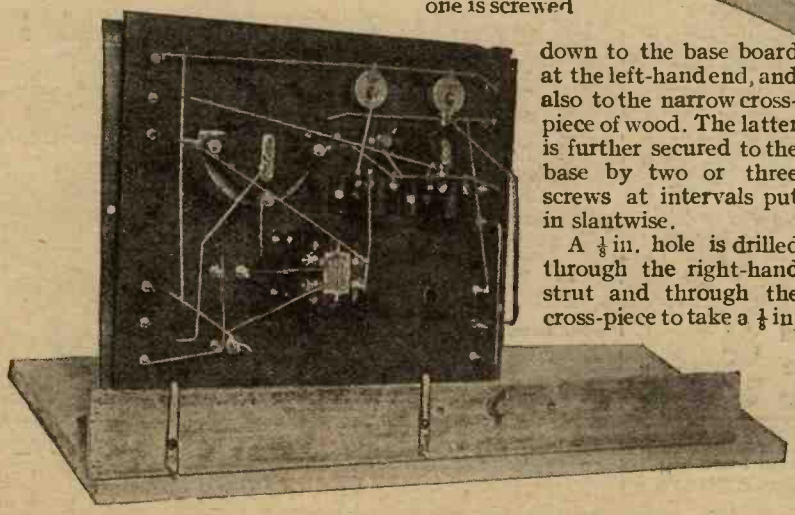
Varying the Size

Change of size is obtained simply by removing the bolt and fly nut securing the right-hand "leg," and refixing in the appropriate hole. The materials used are a piece of ¾ in. board 9 in. wide and about a couple of feet long, a strip of wood the same length, between 2 in. and 3 in. wide, and a little thicker than the average ebonite panel. The legs, or struts, are of iron ½ in. wide and ⅛ in. thick. A piece 18 in. long is employed for each. Bent at a convenient angle by heating to redness in a Bunsen burner and bending in a vice, the short 3 in. end of one is screwed down to the base board at the left-hand end, and also to the narrow cross-piece of wood. The latter is further secured to the base by two or three screws at intervals put in slantwise.

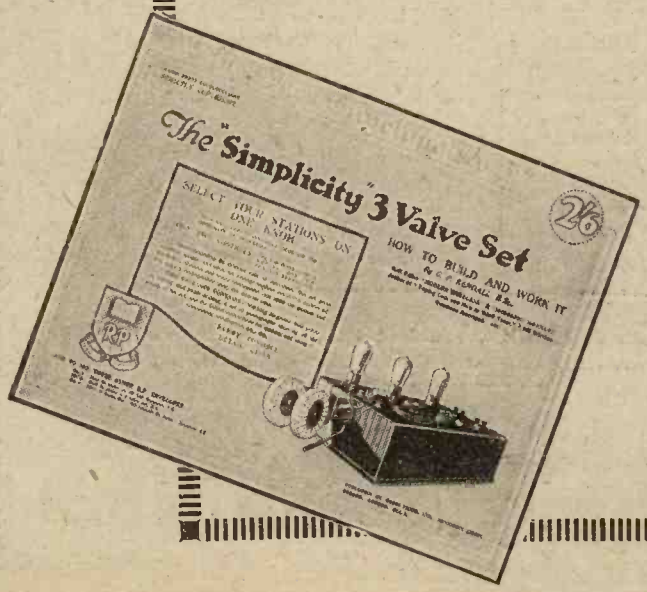


Showing the construction of the accessory.

A ⅛ in. hole is drilled through the right-hand strut and through the cross-piece to take a ⅛ in. bolt and fly nut. This is found to give quite sufficient rigidity. Further holes in the cross-piece are bored at 2 in. intervals, so that the strut can be attached for taking panels of various sizes. It will be noticed that a cheese-head screw is put through each strut also, and secured by a nut behind. The holes for these are drilled rather outside the centre line of each iron strip, in order to allow a fair width for supporting the panel, and the purpose of the cheese-head is to prevent the same slipping sideways. Similarly, a couple of pieces of metal scrap are screwed to the cross-support further to ensure safety.



The panel is rested in this way on the desk while wiring up is in progress.



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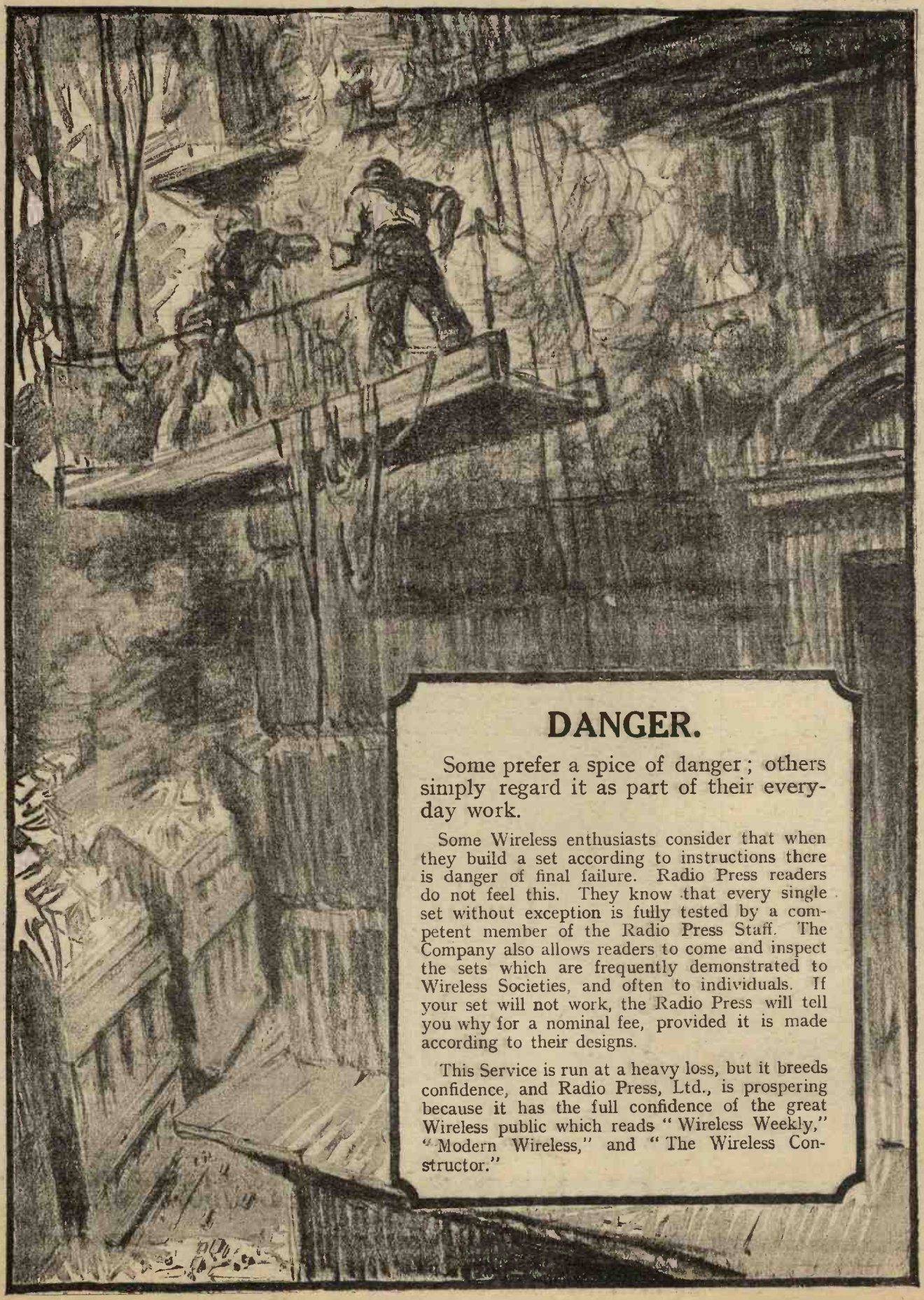

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JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.
Editor-in-Chief of all Radio Press Publications.

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The Daily Express in its issue of November 5th, 1924, says "Among the British experts who are keeping the British Radio Flag Flying is Mr. J. Scott-Taggart, the energetic editor of several popular technical journals. It is doubtful if any other one person—unless perhaps Captain Round, of the Marconi Company—has been responsible for more original radio circuits and ideas than has Mr. Scott-Taggart."

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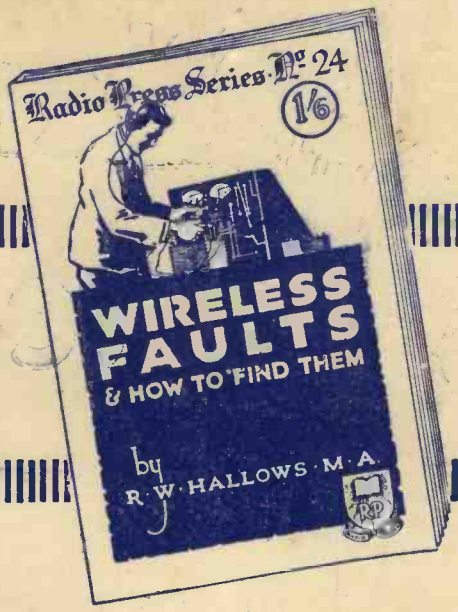
ANOTHER NEW RADIO PRESS PUBLICATION



TAKING THE TROUBLE OUT OF RADIO

THAT is the object of this, the latest Radio Press book (Series No. 24). We know what it is to have a fault in the radio receiver that obstinately refuses to reveal itself. An evening wasted in futile trouble-hunting, a good programme missed and perhaps family and friends disappointed. Yet a word or two of expert advice would probably have enabled you to speedily remedy the defect, and this is what the new addition to the Radio Press publications actually does.

Entitled "Wireless Faults and How To Find Them," and written by R. W. Hallows, M.A., Staff Editor of "Modern Wireless," "Wireless Weekly" and "The Wireless Constructor," it is so complete in its scope that there are few faults likely to occur in a radio set that cannot be easily traced with the aid of the valuable advice which it contains. This makes it a book that should be in the hands of every radio enthusiast. The book is clearly written and illustrated throughout so that even the veriest beginner in radio will be able to understand it. Get a copy at once and stop all that trouble and waste of time in fault hunting.

Here is a brief description of the book's contents.

Opening with instructions for making a very effective yet inexpensive little appliance which is used in conjunction with a pair of telephones for testing the set and its components, the author proceeds to deal with the testing of every radio part likely to cause faults, and gives complete series of tests for all types of receivers from crystal to multi-valve sets. Special attention is given to the testing of reflex circuits.

When purchasing ask for Radio Press Series No. (W)24
"Wireless Faults and How to Find Them"

¶ NO WIRELESS ENTHUSIAST CAN AFFORD TO BE WITHOUT THIS BOOK.

Date of publication, Apr. 16th
On Sale Everywhere

1/6

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