

The Wireless Constructor

6^D
MONTHLY

EDITED BY
PERCY W. HARRIS, M.I.R.E.

Special Birthday Number

Vol. II No. 1

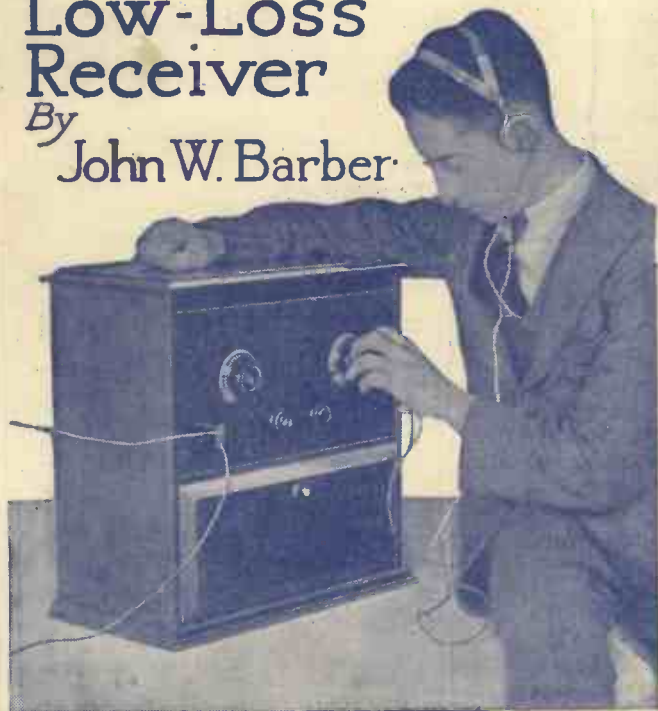
NOVEMBER

1925

An All-Enclosed Low-Loss Receiver

By

John W. Barber



Special Features :

Will Valves Die Out?

By Major James Robinson,
D.Sc., Ph.D., F.Inst.P.

Selectivity and the Ultraudion Circuit—An Interesting Two- Valve Receiver

By Percy W. Harris, M.I.R.E.

A Wireless Wanderer in Spain

By Capt. L. F. Plugge,
B.Sc., F.R.Ae.S., F.R.Met.S.

Low-Loss and the Crystal Set

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The set builder is catered for extensively in this issue. Of special interest among the many sets described is "THE COASTAL THREE" (illustrated above), by A. Johnson-Randall. This highly efficient and selective set uses a "trap" circuit and will reduce considerably the interference to which coast dwellers are subjected. Full constructional details are given. Altogether five sets are described in "MODERN WIRELESS," ranging from crystal to multi-valve. Many other articles of practical value to enthusiasts.

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- A TWO-VALVE SET. By John W. Barber.
- A ONE-VALVE RECEIVER. By Stanley G. Raltee, M.I.R.E.
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- THE LIFE OF A VALVE. By Cap. H. L. Crowther, M.Sc.
- H.F. TRANSFORMER DESIGN. By Percy W. Harris, M.I.R.E.



The WIRELESS CONSTRUCTOR

— Edited by Percy W. Harris —

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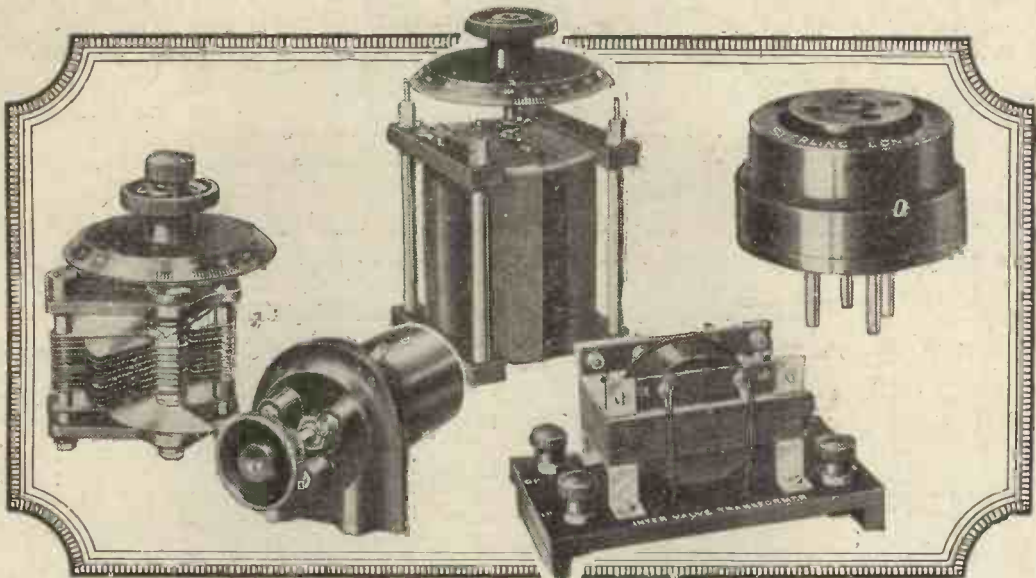
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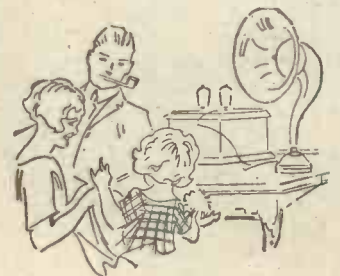
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Selectivity and the Ultraudion Circuit

An Interesting Field for Experiment

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

THE circuit to which the name Ultraudion was given by its inventor, Dr. Lee de Forest, is one that has not received the attention it deserves among British experimenters. The circuit itself is shown in Fig. 1, from which it will be seen that the circuit $L_1 C_1$ is connected, not, as is usual, between grid and filament of the valve, but between grid and anode. Such a circuit, unless it is specially damped, for example, by connecting the aerial directly to it, will readily maintain itself in a state of self-oscillation. If the inductance L_1 be a frame aerial, and if the grid leak is made smoothly variable we can use the arrangement as a very convenient portable set, its chief disadvantage being, however, that the adjustment to keep it just below the oscillation point (thus obtaining the fullest amplification from the valve), requires some little skill. The Ultraudion circuit is the basis for many portable receivers for which great claims have been made; and I have known splendid results obtained with it in favourable circumstances.

The Cockaday Circuit

A couple of years ago Mr. Lawrence M. Cockaday, technical editor of our American contemporary, *Popular Radio*, published an account of what



This receiver utilises an American Circuit which the Editor has adapted for British plug-in coils.

he called a "Four-circuit Receiver." It was claimed to be extraordinarily selective as well as sensitive, and it has since proved one of the most popular receivers in America for the home constructor. This circuit is shown in Fig. 2; the values given are those of my own experiments.

Upon analysis it reveals itself as an Ultraudion oscillating detector

circuit, very loosely coupled to the aerial, and also coupled to a "free" circuit consisting of an inductance and variable capacity. The purpose of the free circuit is to absorb sufficient energy to keep the detector circuit off oscillation. The more it is detuned, the less energy it absorbs, hence the reaction control. In his original description Mr. Cockaday went to some pains to describe special forms of windings for these coils. It will be noted, for example, that there is a kind of loading coil in the aerial circuit, placed at right angles to the coupling coil. This loading coil in the original Cockaday arrangement was bank-wound with a number of tappings, where as the coupling coil consists of a single turn of thick wire wrapped round the solenoid winding forming the inductance of the "free" circuit. The detector circuit inductance and the other inductance were wound on the same former side by side; while the loading coil was placed at right angles to these immediately above them. The aerial is semi-periodic, so that



wide variation of the value of the loading coil is possible.

Plug-in Coils

I have often thought it would be interesting to experiment to see whether it would be possible to

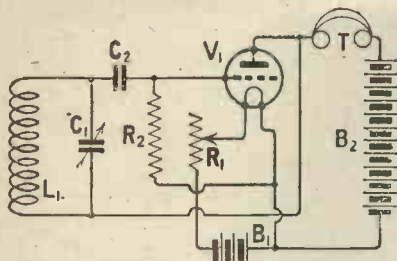


Fig. 1.—The De Forest Ultraudion Circuit.

utilise the British plug-in coils in place of special windings, and I have recently completed a receiver, illustrated in the photographs, incorporating my ideas on the subject. There are two valves, the second being an ordinary note magnifier.

Constructional Work

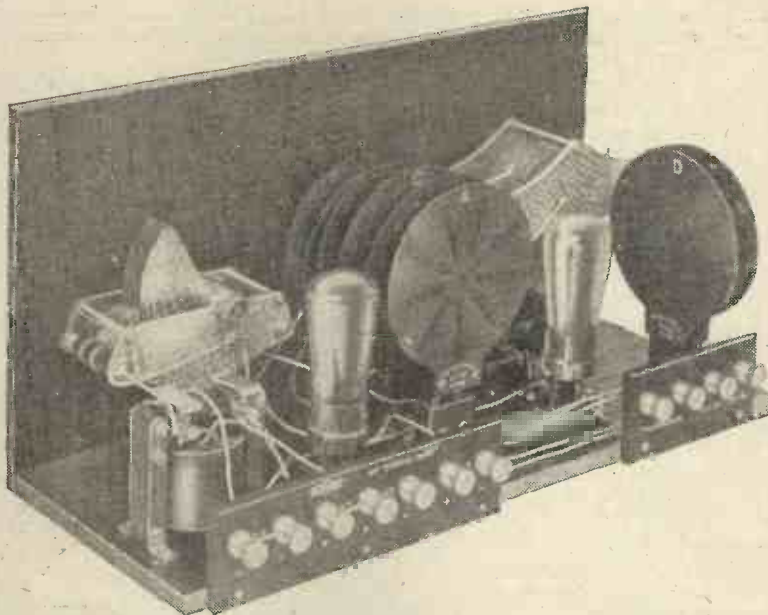
The constructional work is very simple. The front panel carries the two condenser dials, and the single filament resistance used to control both valves. This filament resistance serves also as an on-and-off switch. Two resistances can be fitted, if desired, and I will recommend this where it is desired to use bright emitters, for there are few filament resistances which will carry the current for two bright emitters without overheating. In my own receiver only one filament resistance is used, for it was intended to use the set for .06 ampere dull emitters or the .25 ampere small power

valves. The ordinary dual filament resistance will easily carry sufficient current for these.

Components

The following is a complete list of the components required to reproduce the receiver as shown. It is by no means necessary to use the exact parts specified, for nowadays there is a wide range of excellent components available.

- One standard "All-Concert" cabinet, to take panel 16 in. by 8 in. by 1/4 in. (S. A. Cutters, Ltd.).
- One panel of guaranteed ebonite (Bowyer-Lowe).
- One square-law variable condenser, .0003 μF (Igranic).
- One dual filament resistance (McMichael).
- One L.F. transformer (McMichael).
- Four coil sockets for board mounting (Magnum).
- Two valve-holders for panel mounting (Bowyer-Lowe).
- One grid leak and condenser mount with .0003 μF clip-in condenser and 2 megohm grid leak (McMichael).
- One terminal strip ready engraved with terminals (Magnum).



The coil sizes shown here are those ultimately used.

One square-law variable condenser, .0005 μF (Igranic).

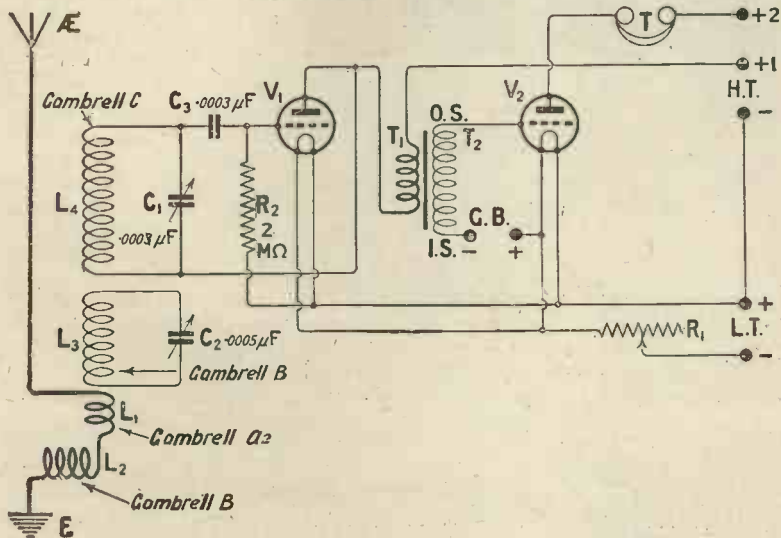


Fig. 2.—The Cockaday circuit as first adapted for plug-in coils. The circuit L₃C₂ was afterwards placed on the side of L₄ remote from L₁.

One terminal strip for four terminals (aerial, earth and tele-phones).

One baseboard as supplied with the cabinet.

Glazite wire for wiring-up.
Radio Press panel transfers.

Set of plug-in coils for experimental purposes.

Notice particularly that there is no fixed condenser across the primary of the L.F. transformer. With such a condenser the set will not work.

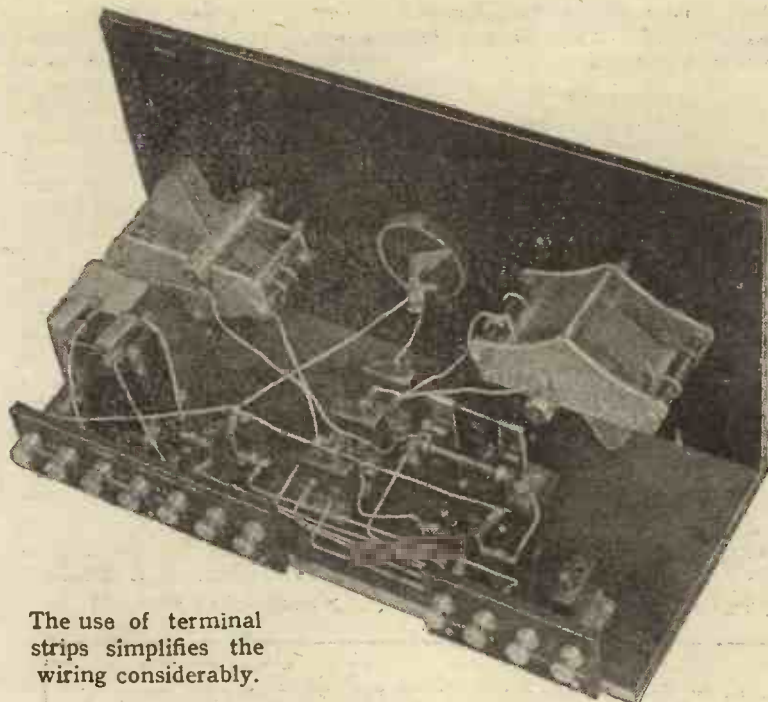
The wiring of the set is very simple, particularly as the absence of terminals on the front panel enables short leads to be used at the back of the instrument. The photographs and diagrams indicate all details necessary for the successful construction of the set.

In the circuit published by Mr. Cockaday, the primary winding used for coupling the aerial to the closed circuit is wound over the absorption circuit, and in re-designing the set for plug-in coils,

in each of these. The reason is that with the free circuit tuning it is necessary to go on one side or the other of a definite tuning point, and the additional condenser value gives this necessary flexibility.

Operating the Set

The operation of this set is somewhat tricky at first, as it is quite different from that to which one is normally accustomed. Almost any valves will do, so long as both are of the same type, and the first step should be to plug-in a C coil into the detector socket, leaving the other socket free. Connect up the necessary batteries, but do not connect aerial and earth. Join a pair of telephones to the terminals provided; adjust the filament of the valve to the normal brightness and listen. If all is well, the set should now oscillate freely all round the tuning condenser. If you have any doubts whether it is oscillating

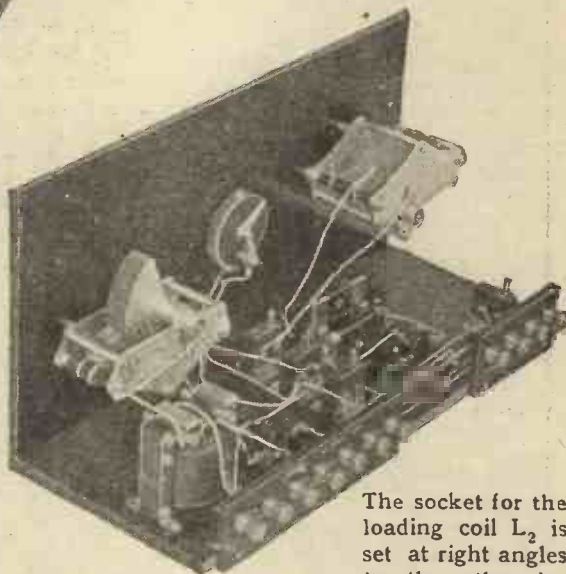


The use of terminal strips simplifies the wiring considerably.

I first wired it up so that the coils were placed as follows: First, the aerial coupling coil; second, the "free" circuit coil; and third, the "detector" circuit coil. The fourth coil, placed at right angles to the others, and some little distance from them, is the aerial loading coil. The circuit is then as shown in Fig. 2, and in this Fig. I have given the sizes of Gambrell coils used in my first experiments. The set can, if desired, be wired up this way by only a very slight alteration of wiring from that given in the wiring diagram. I found, however, that superior results were obtained by making the order of coils, aerial coupling coil, detector circuit coil, and, finally, the free circuit coil. I have now found that both free circuit and detector coils are preferably C coils.

Coil Sizes

For the maximum selectivity—and the selectivity of this set can be extraordinarily high—it is best to use Gambrell a/2 as the aerial coupling coil. The loading coil can be a B, C or D, or even an A. Experiments should be conducted to find which gives best results on your aerial. It will be noticed that the detector tuning condenser is .0003 μ F, whereas the free circuit condenser is .0005 μ F, although I have recommended C coils



The socket for the loading coil L_2 is set at right angles to the other inductances.

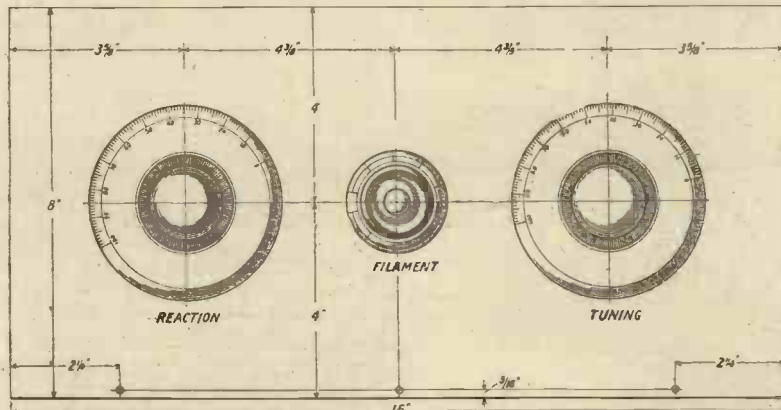


Fig. 3.—The panel is very easily drilled. Full size Blueprint No. C1024A may be obtained by those who so desire, price 1s. 6d. post free.

or not, a touch on the grid connection of the detector valve will give you the characteristic "plop" indicating that the set is oscillating.

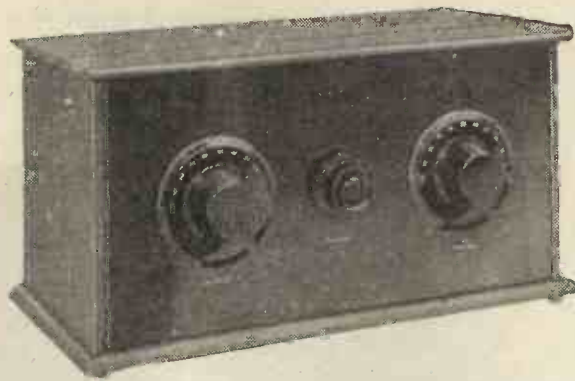
Oscillation Control

Now insert a second C coil in the free circuit socket. At any arbitrary setting of the detector tuning condenser you will find that there is a band on the free circuit condenser (marked "reaction" in the picture) over which oscillations will cease. At each end of this band there is a kind of fringe, where the detector valve is working on the edge of oscillation, and you will pass smoothly from oscillation into a non-oscillating state through this

fringe at each end of the band. At the bottom end of the detector tuning scale the band will be narrow, and at the upper end it will be fairly wide. If you find that at the lower end the set will not stop oscillating by turning the reaction condenser, make a slight alteration to the filament voltage or anode voltage of the valve, until it is found that you can stop the valve oscillating by means of the absorption circuit condenser.

Searching

The best way to hunt for stations is to set the right-hand condenser at a low value, and adjust the left-hand condenser until the set is just not oscillating. Now gradually increase the reading of the right-hand condenser, at the same time moving the left-hand dial, still keeping the set just off oscillation. A final adjustment can be made on



All leads to batteries, etc., being at the back, the receiver is of particularly neat appearance.

both condensers after a station is picked up.

Do not expect to obtain the best results from this circuit at once. Remember, too, that it consists

merely of a detector, followed by a stage of note magnification, this detector not being preceded by any high-frequency amplification. I do not think this set is any better than the Cockaday circuit in its original form, or even that it is the best possible form for using plug-in coils, but as designed I think it is the first plug-in coil Cockaday circuit produced, and it is at least interesting enough to make it well worth while for the experimenter to build it. It is not a set

(Concluded on page 73.)

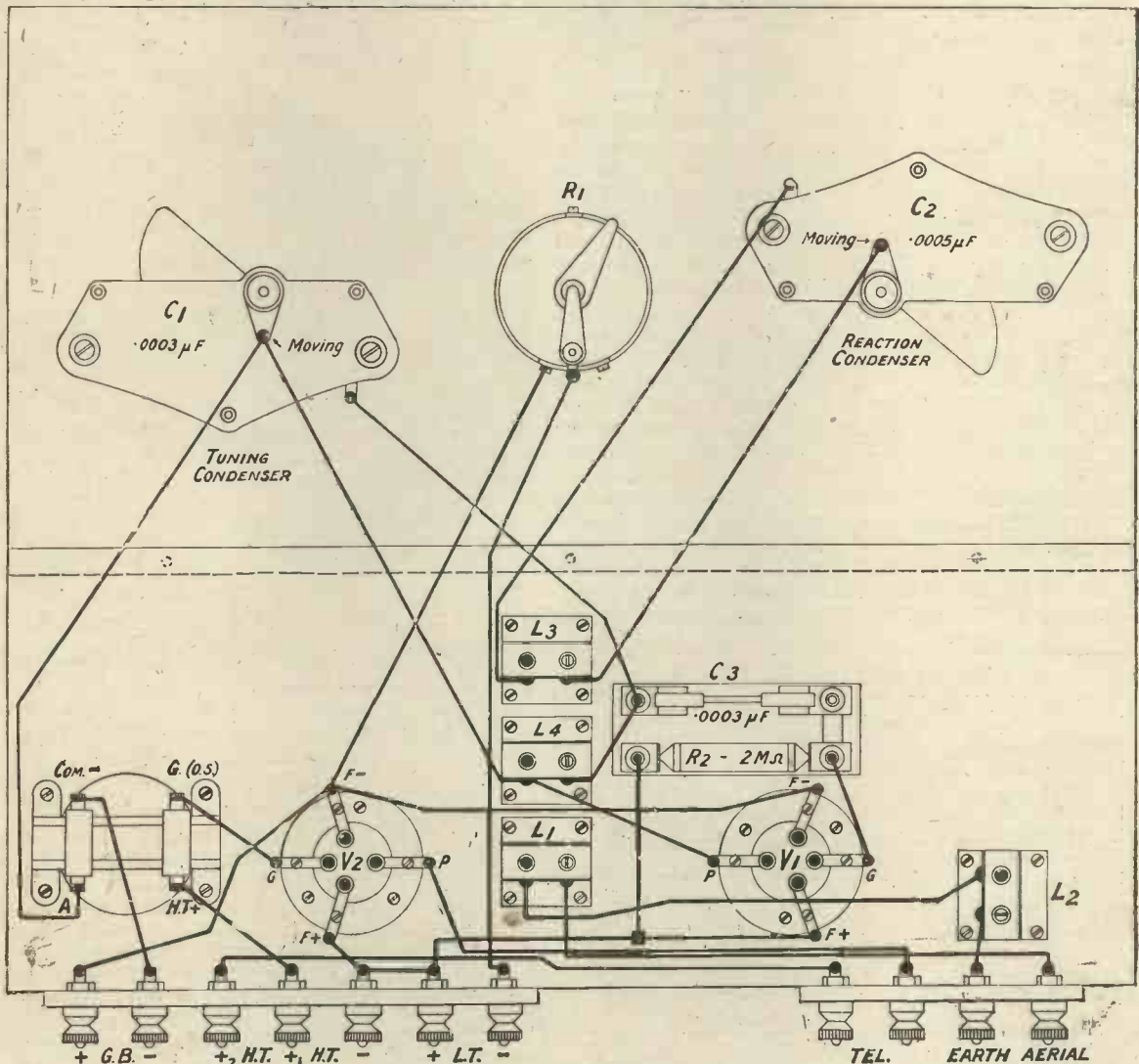
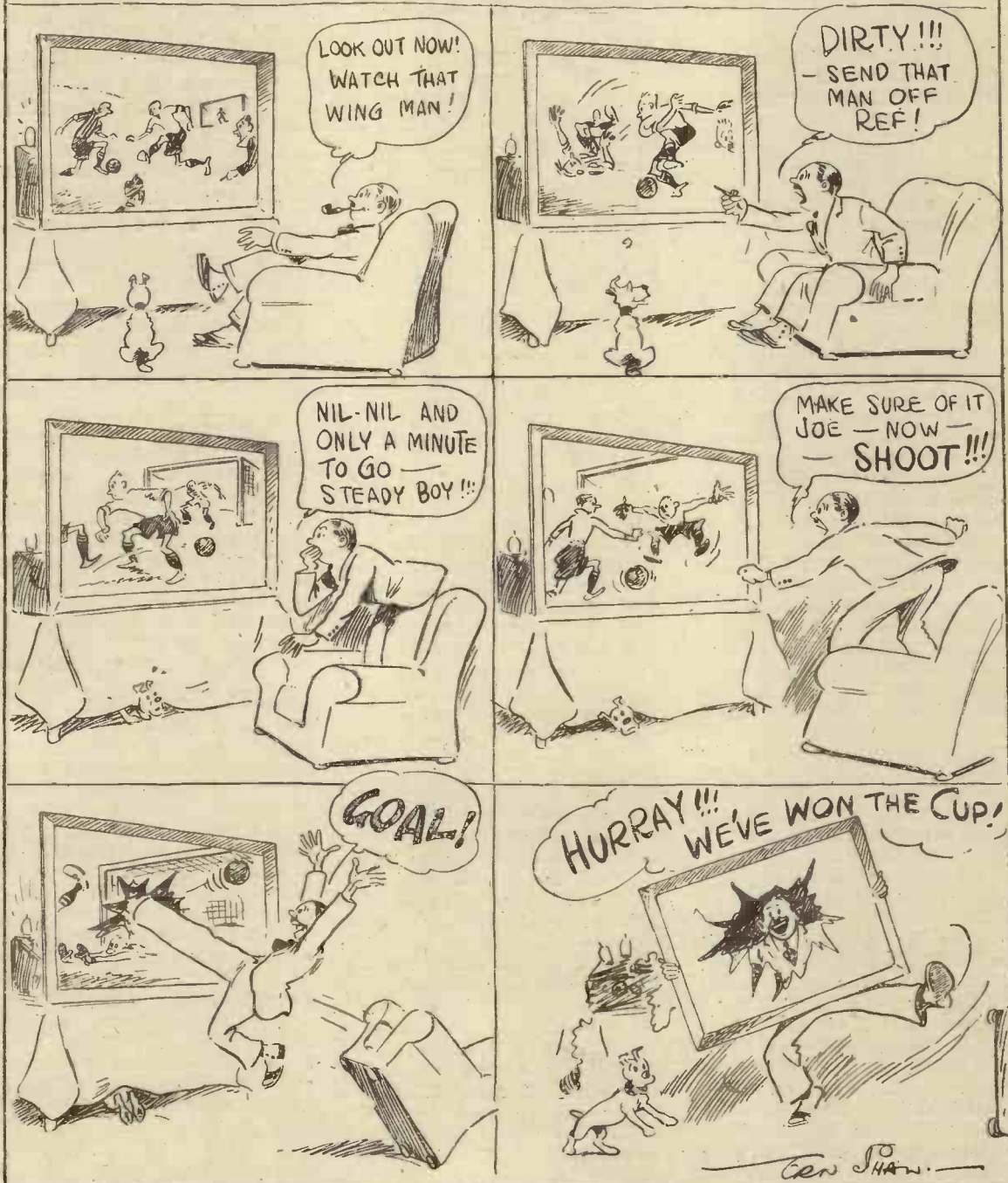


Fig. 4.—The transformer used was marked as seen above. If yours is not so marked, join OS to grid and try which way round the primary works best. Blueprint No. C1024B. Price 1s. 6d. post free.

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Our cartoonist's idea of a Radio Cup Final bids fair to introduce destruction into the home?



Some Readers' Experiences with the "Midget" Single-Valve Receiver

SIR,—I feel that I must write and let you know the fine results I am enjoying from the "Midget" single-valve set, made from the description by Mr. A. S. Clark, in the May issue of THE WIRELESS CONSTRUCTOR. The set was easily and cheaply constructed, and presents a neat appearance as it stands in the sloping cabinet, the only component, I should mention, which differs from the original. The stations I have logged up to now are as follows: Leeds-Bradford, extremely loud; Manchester, very loud; Newcastle, loud; Belfast, loud; Daventry, very loud. I can switch on to any of these programmes at will, so this shows the set's selectivity when I tell you I am only $1\frac{1}{2}$ miles from Leeds-Bradford.

Birmingham is plain.

Bournemouth is weak during the day, but plain at night.

London, Aberdeen and Glasgow are all readable in the phones.

Some of the relay stations come in well, among them being Sheffield, Nottingham, Hull and Liverpool.

Of the foreign stations I can receive Radio-Paris, Petit Parisien, Radio-Toulouse, Brussels, Radio-Catalana, Madrid, Hamburg, and two German stations below 300 metres, whose identity I cannot establish. I understand French, having learned it at school, and I think your wonderful little set is helping me along with it.

What puzzles me is that Mr. A. S. Clark tuned in Glasgow on the loud speaker, whilst I, being practically 200 miles nearer, can only get it readable in the phones. Anyway, I think this is a fine performance for a single-valve set, and I might safely say that I am more than satisfied with it. I have not got a loud speaker, but I dare say one might be worked from this set on the local station. Being only sixteen, I am glad to think that my first valve set was made from your admirable book, to which may be tendered my heartiest thanks. May it continue to be successful.

Yours faithfully,

Leeds.

RONALD ADDIS.

IN AUSTRALIA.

SIR,—I feel that you should know of the very excellent results I have obtained with the "Midget Single-Valve Receiver," described by Mr. A. S. Clark, in your issue of May, 1925.

I put this little set together and without any trouble tuned in the two local stations (5CL and 5DN) both working at present on 150 watt power and being respectively four and two miles from my house. Both stations came in at small loud-speaker strength. I next tried for 3LO, Melbourne (working on 371 metres and 5 kw. power), and had no difficulty at all in hearing them with the phones laid on the table in front of me. After that I logged 2BL, Sydney (350 metres and $1\frac{1}{2}$ kw. power), and 2FC, Sydney (1,100 metres and 5 kw.), securing both of them at very fair telephone strength, the lower power station seeming to be slightly the stronger. Both 3LO and 2BL came in without interference from the local station, SCL, working on 395 metres. Later, I was agreeably surprised to find that I could get 6WF, Perth (1,250 metres, $1\frac{1}{2}$ kw.) almost as strongly as the two Sydney stations. The approximate distances of Melbourne, Sydney and Perth from my place are 450, 800 and 1,500 miles respectively, so that there can be nothing but praise for the performances put up by the "Midget" set, the only alteration to which was the substitution of a Burndept 30 ohm ordinary rheostat in place of the filament resistance specified in Mr. A. S. Clark's article, and this alteration increased the size of the panel to 7 in. by 5 in.

I may say that my place is situated right at the foot of the Mount Lofty Ranges, which rise to a height of 2,000 ft., and are directly in the path of waves coming from Melbourne and Sydney. The aerial I am using is an ordinary single-stranded wire 65 ft. long and 37 ft. high, and the valve used was an Ediswan A.R. '06 dull emitter.

I wish your publication the success it so well deserves, and I

assure you that while you maintain your present high standard you will always have as a satisfied subscriber,

Yours faithfully,

L. H. HAMBRIDGE.

Kingswood, S. Australia.

* * *

SIR,—I have just made the "Midget Single-Valve Receiver" described by Mr. A. S. Clark, in your May issue, and it is as good as any "two-valver" I have heard. Though I did not use the same components, and I used a sloping cabinet with a panel 8 in. by 6 in. by $\frac{1}{4}$ in., I kept to the design of the panel. The whole assumes such a neat appearance that many compliments have been showered upon it. My aerial is a fairly good one, on the side of a valley in a very hilly coal-mining district of South Wales, about 20 miles from 5WA, and 100 miles from 5XX.

On the first test I logged the following stations at very good phone strength: 5XX, 5NO, 2LO, 5WA, 6LV and Petit Parisien. After the B.B.C. stations had closed down for the night, I logged Madrid, Berlin, San Sebastian, and someone else, who was using a foreign language.

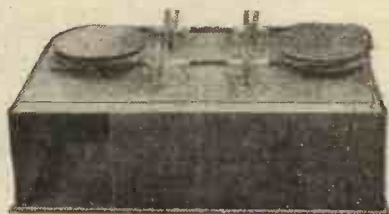
On the second night I logged Radiola, 5XX, 5NO, 2LO, 5WA, 2ZY, 2BE, 6BM, 5IT, 5SC, 5SX (Swansea), and another of the relays, whose call sign I did not quite catch (I think it was Stoke). We are delighted with the set, since all these stations were received while 5WA was working at full strength, though 2LO, 5WA, and Petit Parisien jammed slightly, but it is not difficult to separate them. I used home-made coils, and a bright emitter Cossor valve with 54 volts on the anode.

Yours faithfully,

J. K. BROOKS.

Mountain Ash, Glam.

P.S.—I am only seventeen, and have picked up all my knowledge of wireless from THE WIRELESS CONSTRUCTOR and other journals.



The original magnetic detector used by Marconi for the purpose of detecting wireless signals.

Will Valves Die Out?

By Major JAMES ROBINSON,
D.Sc., Ph.D., F.Inst.P.

(Director of Research to Radio Press, Ltd.)

The valve is a modern invention, and although it is extensively used to-day, it is a matter for discussion whether it may be regarded as permanent

THERE have been many changes in wireless since the first discovery of the great possibilities of electro-magnetic waves by Marconi 30 years ago. The whole field of wireless in the early days was bound up with spark transmission, and as regards reception, with coherers. Improvements were made in spark transmitters and also in the method of reception, the latter going through the phases of the magnetic detector and the crystal detector. The next stage was the use of continuous-wave telegraphy, by arcs and by high-frequency generators. For reception the method of the heterodyne or beats was introduced. Before the heterodyne became general, continuous waves were detected by means of an instrument called the Tikker. In the last few years we have entered a new era which can be called the valve era. This is particularly the case as regards reception, and in this respect the valve is almost universally used. As regards transmitters valves are very largely used indeed at the present moment, and their use is increasing constantly. However, for transmission their use is not so universal at present as for reception, and some high-power stations still use high-frequency generators and others use arcs. Also at sea there is still considerable use of the spark transmitter. For low-power transmitters valves are used very considerably, and their use in high-power transmitters is increasing very rapidly, and now we have valves which are capable of dealing with a power of 50 kilowatts or more. The large transmitter stationed at Rugby uses a considerable number of such high-power valves.

What will Replace the Valve?

A great topic of conversation amongst wireless people is "What will replace the valve?" Is the valve only a stage in the general development of wireless, and, if so,

what will take its place? Or is it to take a permanent place in wireless for all time? Some discoveries and inventions are mere stages of development. Take, for example, the magic lantern, which had a considerable vogue for a large number of years. It was exceptionally popular, and entertainments used to be given, and also lectures, where a considerable number of stationary pictures were thrown on a screen. The magic lantern has, however, lost its popularity, and has been replaced by moving pictures or the cinematograph. However, it was a useful invention and still has certain uses, and is not yet absolutely dead. Again, in wireless we have the crystal detector, which has been



Two mounted coherers, which were used by Marconi.

very largely replaced by valves, although crystal detectors are still in considerable though not universal use. The crystal stage was merely a phase.

Permanent Inventions

On the other hand, there are inventions which are of a more permanent nature. Take, for instance, the simple invention of the "screw," which is used for very many everyday purposes. Screws have been used for many years, and they will continue to be used permanently as far as we can see. Then, again, there was the discovery of the printing machine, which we can consider to be permanent. It is over 400 years since the printing machine was discovered, and it is used more and more every year, so that we may consider the discovery of printing as a permanent institution. Then we have railways, which are 100

years old, and as far as we can see they are also a permanent institution; motor cars also may be considered permanent, although this is perhaps a more controversial subject.

Uses of Valves

In which of these two classes are we to put valves? Let us consider for a few moments what is done with valves at the present time before attempting to answer this question. Valves are used as detectors of wireless signals. They are then used to amplify the signals, and they can be used one after the other in cascade to obtain very large amplification. They are used as oscillators at any frequency up to the highest wireless frequencies known. This is a feature of valves which is very uncommon, and is not known with any other form of oscillator. Many oscillators are good at comparatively low frequencies, such as the arc and the high-frequency generator. As oscillators, valves are used for transmission purposes, and in this form they are constructed in fairly large sizes. They are also used as oscillators for the detection of continuous waves by the heterodyne method of reception. This involves also their use as oscillators for the supersonic type of receiver. They can be used to convert alternating current to direct current, as each single valve only allows current to flow through it in one direction. This use as converter from alternating to direct current is an excellent feature of valves, and it is getting considerable application. Another application of valves is to limit the current to a definite value. There are many cases where it is absolutely essential that an electric current shall not exceed a certain value, and valves can be used quite simply to obtain this condition. They are becoming matters of everyday use in most laboratories for physical measurements. All students of physics, whether they

become specialists in wireless or not, are using thermionic valves for various purposes. In very many developments of industry valves are being used for measurement purposes. In astronomy they also have uses. In cable work and general telegraphic purposes they are used very largely. These are only a few of the uses to which valves are being put at the present time.



An early type of Brown Relay, used for amplifying signals.

The present-day uses of valves are thus seen to be very large, and we have a difficult problem to answer in stating what can be used as a substitute for valves. It is possible to obtain instruments which will substitute valves for probably some one or two of the present functions of valves, but to answer the question "Will valves die out?" we must find a substitute which will fulfil all the functions that valves fulfil at the present time.

How Valves have Developed

Whilst some people are trying to find a substitute for valves, it must not be forgotten that valves themselves are being improved. There is no reason to suppose that we have reached the limit of their development. It will be interesting to consider briefly how valves have developed in the last few years, and then it will be obvious to all of us, when we realise the huge developments which have been made, that further developments in valves are to be expected.

The Lieben Reisz Valve

One of the first valves which was used for practical purposes was called the Lieben Reisz Valve.

This was a German production, and it was used for amplification purposes. Although the valve has the three electrodes filament, grid and anode, these electrodes are not of the type at present in use. The anode, for instance, consists of just a small piece of wire. The filament consists of a platinum strip which was coated with barium and calcium oxides. This is of interest as showing that one of the earliest valves used a principle which is now being largely used, after being in the background for a number of years. This is the principle of the dull emitter valve, of the coated type. This platinum was comparatively thick and required a considerable current to heat it, although the temperature required was not very high. In order to heat the filament it was necessary to use a battery of 30 volts. Again, the valve had gas in it at a low pressure, so that when the valve was in operation a discharge passed through the gas which was visible, similar to the Geissler tube effect. In fact, the actual current which passed through the valve was judged from one of the features of this discharge called the dark space. Using four of these valves in series, it is stated that an amplification of 20,000 was obtained.

The Audion

Somewhere about the same time just two years prior to the war, De Forest, who was the inventor of the three-electrode valve, demonstrated his form of valve which he called the Audion. His anode was not cylindrical, but consisted of two parallel plates.

The next development was by Captain Round, of the Marconi Company, who produced the well-known valve called the Round Valve. This employed a filament current of 3 amperes, and made use of an anode voltage of from 200 to 400 volts. This valve was also soft, or in other words, operated by having gas present at a low pressure, so that the current passed by making use of ionisation of the gas. The actual pressure of the gas was of the utmost importance, and it was necessary to keep it absolutely correct. For this purpose the valve usually had at the top a small extension in which was put some material which could absorb gas and could be made to give it out by heating it. When such a valve became insensitive, the method to bring its sensitiveness back was to apply a lighted match gently to this small extension. The Round Valve gave really remarkable results with amplifica-

tions much greater per valve than that which is obtained with the present ordinary type of valve. However, the trouble required to keep the valve in constant operation was somewhat great.

The Round Valve

The Round valves were the valves in the early amplifiers used by our fighting Services and the Post Office in the early days of the war.

The next development was the discovery that it was not necessary to use the phenomenon of ionisation, and thus that it was possible to evacuate the valve completely, so that almost an absolute vacuum was obtained inside the valve. This was done at the sacrifice of amplification, but a considerable amplification could



Spark gap used with a 1 1/2 kilowatt spark transmitter.

still be obtained by hard valves. The excellent feature was obtained, however, that valves could be made much more uniform, so that it was possible to use them easily in cascade and so to obtain very large amplification.

Dull Emitters

The next stage was a return to the very earliest type of filament, that of the Lieben Reisz, at least to some extent. This was to make use of the excellent properties of some oxides of giving off electrons at a comparatively low temperature. Oxides, such as those of calcium and barium, were used in the early days, but other materials have better results, such as thorium. By means of using thoriated filaments it is possible to cut down the temperature at which the emission is obtained, and thus it is possible to use much smaller filament currents, and thus it is possible to use smaller accumulators, and even in some cases dry batteries.

Another attempt at improvement has been made in recent years, and that is to abolish the anode voltage altogether. Some people have obtained excellent results with this

device, but it has not become of universal application up to the present time.

This brief sketch of the improvements which have been made in valves during the last few years will show that we may expect still further improvements.

Objections to Valves

Now, let us consider what are the objections to valves, and what incentive there is to make us attempt to seek an alternative. Probably the greatest objection to valves at the present time is their comparatively high price. Then, again, accessories are required to make valves useful. These accessories are filament batteries, which, of course, need re-charging from time to time, and anode batteries which have a comparatively short life, and thus need replacing. Again, the life of valves is sometimes not too long, although since dull emitter valves have been introduced, considerable improvement has been made in this respect, and valves can be made to last for thousands of hours. With respect to the life, there is another point which is that valves are brittle, and they will not stand much rough handling. A little carelessness on the part of the user, and the valve will break.

Alternatives

It is, of course, to be expected that with the large number of ingenious people in this country and others, alternatives to such a useful article as the valve will be sought for and from time to time suggestions are brought forward. We shall consider briefly a few of these suggestions.

Oscillating Crystals

The most recent suggestion and that which perhaps contains the most hopes is the oscillating crystal of a similar type to that which has been used for rectifiers and detectors. Crystals rectify because they do not obey Ohm's law which states that the current is always in the same direction as the voltage and that the current is actually proportional to the voltage. A typical characteristic is shown in Fig. 1, where it is seen that the current is by no means proportional to the voltage. Rectification is produced by working at the bend, so that when we apply oscillating voltages to the crystal we obtain current only when the voltage is in one direction, or perhaps it is better to state that we obtain more current when the voltage is in one direction than

when it is in the other direction. Now the conditions to be fulfilled in order that we should obtain amplification and oscillation in a crystal, is that still further deviation from Ohm's law shall be obtained. The condition for this is that as we increase the voltage in one direction, the current should not increase but should diminish. When this effect is obtained the crystal is stated to have negative resistance. If we find such a point and work with it, the resistance is negative, so that the crystal will act as if it is diminishing the actual resistance in the receiving circuit. This, of course, is equivalent to amplification. If we go farther and obtain a negative resistance larger than the actual resistance in the circuit, we naturally obtain oscillation.

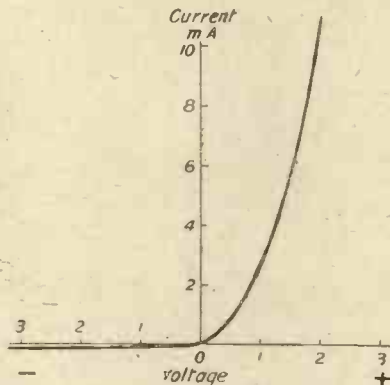


Fig. 1—A typical crystal characteristic curve.

Arzenite

Certain crystals have been obtained which show the negative resistance principle at certain points. Zincite is one of the commonest materials which is used for this purpose. It is preferable to use not a crystal of zincite in its natural form, but first of all to melt it in a furnace. Touching this with a catwhisker it is sometimes possible to find points which give such negative resistance. Another material which gives the effect is called Arzenite. Experience with these crystals, however, has shown that once a good working point has been found, care is necessary to maintain this. Such crystals are merely useful at present for demonstration work.

This is a hopeful line of development, and any real solution of this problem will only be obtained by having a very thorough and laborious search through all possible materials in existence to discover those which have a negative resistance effect and which will pass currents of reasonable quantity. It

is, of course, at present impossible to state whether such a material will ever be discovered.

The Arc

Another possibility is that the arc might be made use of. One of the earliest means of producing continuous waves was by means of the arc. The negative resistance effect exists with arcs, and thus we have the means of obtaining amplification and oscillation. The objection to arcs is that they operate at very large currents and voltages, and that they are cumbersome. In addition, it is usually necessary to make use of magnetic fields to obtain good operation. Certain investigators are trying to find whether it is possible to operate with arcs which are not so cumbersome and which do not need the same accessories as the carbon arc. This might be possible by using some form of mercury arc.

We may obtain similar effects with the electric discharge through gases. Neon lamps or Osgrum lamps have been made to oscillate.

Ordinary flames have been used as rectifiers. It is preferable to use the Bunsen type rather than the luminous type of flame. Again, it is preferable to feed some form of salt into the flame in order to give more ionisation, and thus to obtain larger currents through the flames. When two plates are inserted into the flame and potentials applied between them it is found that we obtain more current in one direction than in the other, and thus we obtain the rectification effect.

Other Lines of Progress

Other methods along which progress might be made are to obtain the electron emission in other forms than by heating a filament. Electrons can be obtained by means of radium. Allowing rays from radium to impinge on metals, we can obtain a supply of electrons. Again, some form of radio-active materials actually emit electrons. Thus, with radium, we already have a source of electrons, and it should be possible to make use of this supply of electrons direct. However, the supply of electrons from radium is very small compared with what we obtain from heated filament. Again, the cost of radium is very high indeed, and in order to obtain an electron stream equivalent to what is obtained from a thermionic valve we should have to expend some hundreds of pounds in purchasing radium.

Photo-Electric Effect

Another hopeful means of producing electrons without the heat-

ing of filaments is by means of what is called the photo-electric effect. When light falls on certain substances electrons are emitted. An active material is zinc. Other, and much more active materials, are sodium, potassium and cassium. With a zinc plate of about 1 in. square, if we allow a powerful arc lamp to illuminate this plate, it is possible to obtain a current of about 1/100th of a micro-ampere, which, of course, is very much smaller than what is obtained with a thermionic valve. On the other hand, if we use a sodium surface of the same area it is possible to obtain current of about the order of 10 micro-amperes; again very much smaller than what is obtained from an ordinary valve.

Such means of producing sources of electrons do not appear to be very satisfactory substitutes for thermionic valves, for we have so many accessories to use in order to get the various materials to emit the electron stream. In the case of photo-electric cells it is essential to make use of a powerful source of light. Various investigators, however, are attracted by this idea of the photo-electric cell, and, although success has not been attained along these lines, sodium has been used in valves in the form of vapour. A valve of this type has been called the sodium valve, and is very good as a detector.

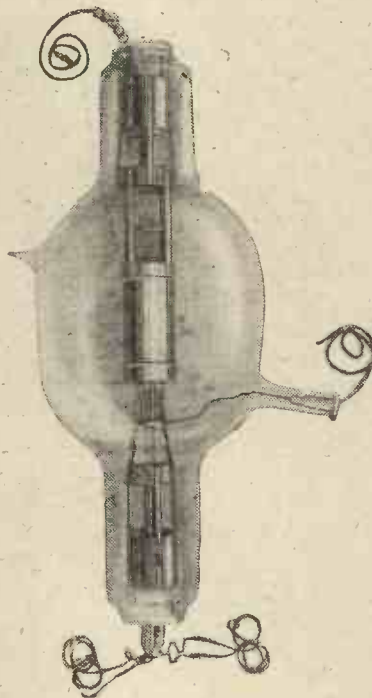
Relays

Some of the older forms of amplifiers need a brief reference. Before thermionic valves came into such general use a considerable number of relays had been proposed. Relays of the ordinary electro-magnetic type had been proposed in large numbers. One of the most successful investigators in this branch was Brown, and the Brown relay was of very considerable use before the advent of valves. The principle of electro-magnetic relays need not be described here, for it is similar to the principle of the simple electric bell. The main difficulty about such relays is that they can only be used on comparatively low frequencies. However, it is quite possible that relays of this type might be evolved as amplifiers of low frequency. In order to obtain the highest possible frequency it is essential to cut down as much as possible the inertia of the moving part of the relay.

The Jet Relay

Attempts to cut down the inertia of the moving part were made by various people, and perhaps the

most ingenious was to use a jet of liquid as the moving part. With a fine jet it is possible by touching it very lightly where it emerges from the nozzle to produce quite a considerable deflection of the jet. If we make this jet conductive by adding a small amount of acid to the water, it is quite conceivable, or easy to understand, how a relay action could be obtained. A simple way is by deflecting the jet for the purpose of giving the jet a longer path, and thus altering its resistance. Various other applications have been made of this principle. Again, however, such a principle can only be applied at frequencies which certainly do not exceed the frequencies of sound, and thus any



A modern high power transmitting valve.

type of relay on this principle can only have application to low-frequency effects.

Other principles which have been suggested are connected with electrolytic effects. A substitute for a valve is such a desirable feature that any claims made that a complete substitute has been obtained must be carefully examined. Unjust claims might often be put forward. Comparatively recently a valve was marketed as a high-frequency amplifier, and it was claimed that no form of battery was required with it. On close examination it was found to be a simple condenser.

No Serious Rival

From this brief description of the various attempts which have been made so far to replace valves it is obvious that up to date there is no serious rival to the valve. Some device may be obtained which will have application in place of some of the present uses of the valve, but, generally speaking, there is no development in sight which will bring out a complete substitute for valves.

Why do we want to replace valves at all? Whenever we attempt to find a substitute for any useful article it is in order to get rid of some enduring disadvantages with that article. There is no doubt that the advantages of valves completely outweigh the drawbacks. In fact, for wireless purposes, at the present time they are an absolute necessity. Apart from their present price, the chief drawbacks to valves are the accessories which are necessary in order to make it possible to use them, that is filament accumulators and anode batteries. Here we have an instrument of vital and almost universal utility and in order to make it very easy to use we need certain accessories. Whenever there is a great national need a means of satisfying it is usually soon discovered. The situation is very similar to that of the incandescent electric lamp for domestic lighting purposes. There we had a device of great national utility.

Power Distribution

Its utility was great, but an important accessory was required—that of the supply of electric power. This need was satisfied by laying cables over the whole of the country, the cables being taken to a large number of individual houses and distributed into the various rooms of each house. As regards valves, again we have a great national asset, and it is almost worth while considering a special supply of electric cables for replacing the accessories required with valves. But why do this, for most houses already have a source of electric power?

Use of Electric Mains.

As soon as the available electric power is employed generally for valves the problem of replacing valves by some other device will be enhanced many times in difficulty. Then valves will continue to live as long as the incandescent lamp lives, and so long as the electric power is supplied to each individual house.

Simplifying the Low-Loss Crystal Set

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

It is not an easy matter to crystal receiver, and, for the so, Mr. Kendall gives below his

apply the low-loss idea to a benefit of those who wish to do experiences with such a receiver

IT is not a perfectly straightforward matter to apply the low-loss idea to the ordinary crystal set, since, unless special precautions are taken, the mere use of one of the latest low-loss coils does not by any means suffice to constitute the complete receiver a low-loss instrument. The main difficulty is to be found in the fact that in a crystal receiver there are two sources of heavy damping. By damping, of course, I mean that quality of a wireless circuit which tends to choke out any high-frequency oscillations which may be induced in it by incoming signals, in much the same way as the friction of a water pipe tends to limit the flow of water through it.

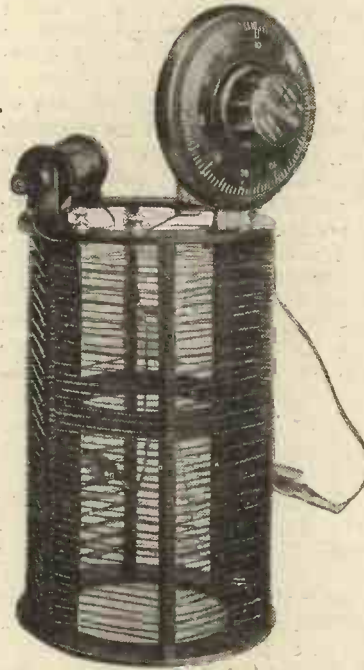
Damping

The lower the damping of a circuit, the more freely will it "oscillate" when excited by incoming impulses, and the better the signals obtained. Now, every circuit must have a certain amount of damping, since perfection is impossible, and it must be understood that damping is the result of the presence of losses. The total losses may be composed of a number of items, such as the resistance of the tuning coil, the losses in the variable condenser, and so on: in general it may be said that anything which *withdraws energy* from a circuit is a cause of damping.

Thus, the mere fact that a crystal and pair of telephones is connected across a tuned circuit produces damping, since we are then withdrawing energy to produce audible signals in the telephones. This is one of the main difficulties of the employment of the low-loss idea in the crystal receiver, the other being the fact that another heavy source of damping is the aerial and earth circuit. Here it is usual to find quite a high resistance, and if this is included in circuit with our low-loss coil and condenser, true low-loss effects are generally impossible.

Reduction of Resistance

It will, therefore, be seen that before we can make good use of the



This simple crystal set employs a "Three-step" coil.

low-loss idea in a crystal set we must do two things. First, we must reduce the effect of the crystal and 'phones circuit in producing damping, and secondly, we must minimise as much as possible the influence of the high resistance of the aerial and earth circuit.

Aerial and Earth Damping

The damping of the aerial and earth circuit can be removed to a large extent by the simple expedient known as auto-coupling, which consists in connecting aerial and earth across only a few turns of the whole coil, so that a sort of auto-transformer effect is obtained. The signals are in this way transferred to the main tuned circuit, which is then more or less loosely coupled to the aerial circuit itself.

What one does in practice is merely to earth the lower end of the coil, and connect the aerial to a tapping point perhaps one-fifth of the way up the coil, the variable condenser occupying its usual position across the whole coil. This expedient sharpens the tuning very materially, and in my experience actually improves signal strength in most cases. I have certainly

never known it to *reduce* signal strength upon any aerial, and I have investigated this point upon quite a variety of aerial and earth circuits.

Crystal Damping

The damping produced by the crystal itself is a somewhat more difficult problem, since obviously one must abstract *some* energy from the circuit in order to produce audible signals. However, a good effect can be obtained by a rather similar method, namely, tapping the crystal and telephones across only a part of the whole tuned circuit. In this way the damping effect is considerably relieved and tuning becomes much sharper, while signal strength may actually improve. In this particular set I find that the increase in signal strength mentioned actually takes place with every setting of the crystal and every pair of telephones which I have tested.

This scheme, of course, is quite a well-known one, but I had not, before making this set, tried it upon a low-loss circuit, and the results have certainly surprised me.

Crystal Tap

In this set I find that the best results are obtained when the crystal and phones are connected across approximately one quarter of the total inductance, in the sense that the signals obtained are then as loud as at any point on the coil, while tuning becomes really remarkably sharp for a crystal set.

As the tapping point is moved upwards along the coil, that is, so as to increase the number of turns across which the crystal and phones are connected, no increase in signal strength is observed, but tuning begins to fall off in sharpness. As the tapping point approaches the upper end of the coil, so that the crystal and phones are connected across practically the whole inductance, signal strength falls off considerably and, of course, tuning becomes still flatter. The whole arrangement forms undoubtedly the loudest crystal set I have yet tested.

My object in constructing this set was to arrive at a method of making a low-loss crystal receiver, so that many readers could try what a reasonable application of low-loss methods can do in crystal reception, without the necessity of making up anything in the nature of an elaborate set, with the usual cabinet and ebonite panel. I therefore selected a coil former upon which all the necessary parts could be mounted, and the result is seen in the photograph.

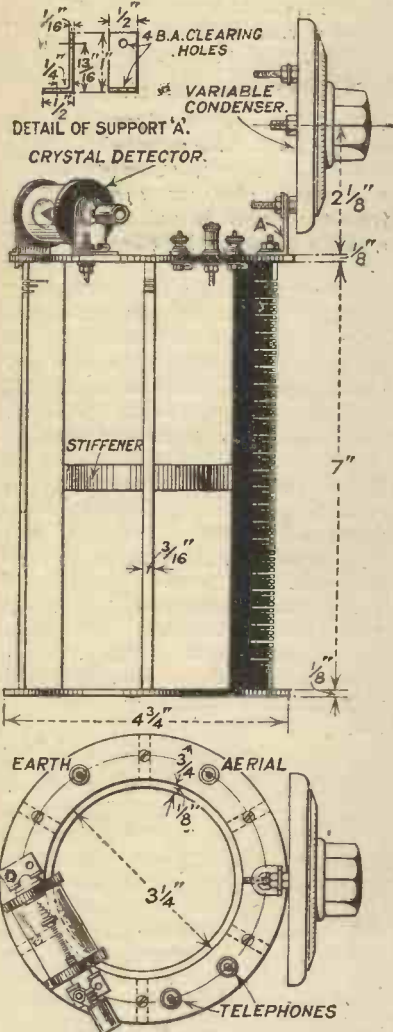


Fig. 1.—Details of construction of the coil former, and of the upper end ring, upon which the condenser and crystal are mounted.

The Coil

The coil is one of the type which I have named the "Three-Step," and which I described in the first number of *Wireless*, the new Radio Press Weekly Journal. This coil is a fair example of the more recent low-loss types and possesses par-

ticular attraction from the present point of view. Upon the upper end ring of this coil are mounted the aerial and earth and telephone terminals, a Burndept glass-enclosed crystal detector and the variable condenser. The latter is mounted in the edgewise position shown, in order to remove it as far as possible out of the magnetic field of the coil and to put it in such a position that the lines of force from the coil do not cut very directly across the plates, in order that eddy current losses may not be unduly serious. It was in consideration of eddy current losses that this particular type of condenser was chosen, since the moving vane air dielectric type would not have been suitable. The one shown is a G.R.C. instrument with two thin copper plates and a sheet of mica between, a simple adjustment pressing these plates together.

Other Parts

The only other parts requiring mention are a couple of Burndept tapping clips and a small angle piece of brass cut and bent from narrow strip. This latter is for the purpose of mounting the condenser in the edgewise position which can be seen in the illustration, one end of the bracket being gripped under one of the nuts of a terminal of the condenser, and the other by a screw and nut passed through the end ring of the coil former.

The terminals chosen should be as small as is conveniently possible, since they are placed in the more intense part of the magnetic field of the coil, and might be expected to produce eddy current losses. Similarly I do not advise that the Burndept detector be replaced by one with large masses of metal incorporated in its construction.

The Coil Former

The coil former can be made fairly easily by anyone possessing a fair amount of patience and a suitable saw, making the cuts at intervals of a tenth of an inch, in sets of three with depths of $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{8}$ of an inch, or it may be obtained ready made, the one which I used having been made by Messrs. Burne-Jones & Co., Ltd.

The actual construction of the set is extremely simple, and I took care in making my own to make no soldered joints at any point, in order that the reader may see for himself that although soldering is no doubt strongly to be recommended in all sets, a really efficient receiver can be made without it if necessary.

Wiring

Almost all the wiring-up of the set was done by means of the ends left over after winding the coil, only one wire being an exception to this general statement. First mount the four terminals, the variable condenser and the crystal detector, as shown in one of the diagrams. Then take a $\frac{1}{2}$ lb. reel of No. 20 enamelled wire and scrape the end bare. Secure this end under the telephone terminal nearest to the variable condenser, then take the wire under the lower variable condenser terminal, scraping it bare before screwing down the nut upon it. Next take the wire across and secure it under the earth terminal, of course baring it before doing so, and take it down the centre of the coil former to the opposite end. Take care to leave

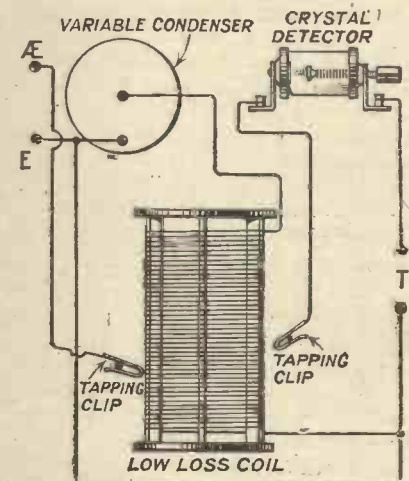


Fig. 2.—A pictorial drawing of the circuit, showing how to join up the various parts.

enough slack in this wire to arrange it at something like the centre of the coil, in order that it may be as far as possible from the turns of the completed winding.

Winding the Coil

Now proceed to wind the coil, starting from the opposite end to that on which the various parts are mounted, winding first a turn in each of the first saw cuts, then in the second and then in the third, etc., all the way up the former. (Do not fill the last two slots at the top of the former, in order to leave a little space for the shanks of the terminals and the various screws used in securing the parts.) Leave a few inches over, cut off the wire from the reel, and finally secure the end under the upper terminal of the condenser. Join the other telephone terminal

to the nearest connecting point upon the crystal detector, and the actual wiring is complete. Two other connecting links, however, have yet to be inserted, and these are flexible leads, bearing the tapping clips upon their ends.

Tapping Clips

These may consist of thin flex, preferably rubber-covered, about 8 in. long. The end of one is to be secured under the remaining detector connecting point, and the other under the aerial terminal. The clips are now to be allowed to grip the turns of the winding at various points and the set is finished, and ready for testing. I should, perhaps, explain in connection with the use of the tapping clips, that it is not necessary to scrape the wire bare at the various points where the clips make contact with it, since all that one needs to do is to allow them to grip the wire and then twist them a little, whereupon the teeth will bite through to the bare wire beneath the enamel, and ensure good contact. Carrying out the "no-soldering" idea, I did not even solder the ends of the flex to the Burndept tapping clips, but placed them in the sleeve of the clips where the edges join and then pinched them up tightly with a pair of pliers, so that the wire was gripped. Of course, all those who possess the necessary small amount of skill with a soldering iron are recommended to solder all connections in the usual manner.

Operation

To put the set in operation, connect a pair of telephones to the two telephone terminals, and aerial and earth to their respective points. Place the tapping clip from the aerial terminal upon a point about one-fifth or one-quarter of the way up the coil, while the one from the crystal detector should be about half the way up the coil. Proceed to set the crystal and revolve the tuning condenser until signals are heard, whereupon you can adjust the crystal to the best point. Now try lowering the aerial tapping point, checking the adjustment of the condenser each time you move the clip.

The construction of the coil, of course, is such that every third turn is accessible to the clip, and to be able to make this variation in steps of three turns, gives quite a sufficiently fine adjustment. You will probably find that as you move the aerial tapping clip downwards, the tuning becomes sharper and sharper, but that if a certain point is passed, signal strength begins



Showing how the coil is wound. Although the wire must be tightly wound, a stiffening ring supplied with the former removes the risk of crushing the side strips inwards.

to fall off unduly. Having secured the best adjustment for the aerial clip, turn your attention to the crystal clip, and each time you move it, of course, check the tuning of the condenser and also try the effect of varying the crystal adjustment slightly.

I do not think anyone will regret the time and trouble spent in

constructing this little receiver, especially when it is remembered that it can be completed in about an hour's easy work if a ready-made coil former is used, and, of course, it is a very cheap receiver to make. Next month I hope to show how two valves can be added as low frequency amplifiers to permit a loud-speaker to be worked.

For Twin-Wire Aerial Users

IF your aerial is of the twin-wire type, the following notes will be of practical interest to you.

In many cases at the end of a twin-wire aerial, the wires are joined to a spreader via an insulator, as shown in the diagram Fig. 1, at A and B.

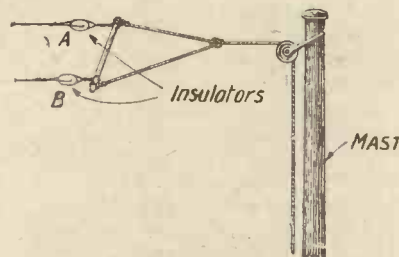


Fig. 1.—Insulators in parallel.

If we examine this arrangement, however, we shall see that here we have two similar insulators connected in parallel in the aerial-earth system. The total resistance of them, therefore, to the aerial currents will be one-half of the resis-

tance of one of them, and, further, the total capacity across them must be double that across one alone.

Now, resistance is what we desire, whilst capacity here should be avoided as much as possible, therefore greater efficiency will be obtained if we use these two insulators in the position shown at A in Fig. 2.

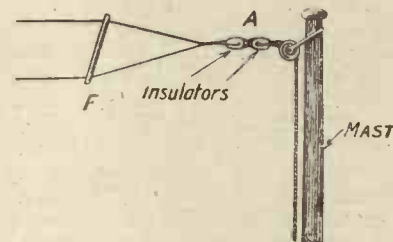


Fig. 2.—Series connection is better.

Here they are connected in series, and the resulting total resistance is double the resistance of one alone, whilst the undesired capacity is only one-quarter of what it was before. E. J. M.

Our Birthday

A selection of the congratulatory messages we have received upon the occasion of the anniversary of publication of "The Wireless Constructor"

From Prof. J. A. FLEMING, F.R.S.,
Inventor of the Valve.

To the Editor, THE WIRELESS
CONSTRUCTOR.

SIR,—I desire to congratulate THE WIRELESS CONSTRUCTOR on its first birthday. It is certainly a precocious infant for one year old, and if its life is spared we may hope for much useful service from it for wireless amateurs. The present month (November) and year (1925) is, however, the 21st birthday or "Coming of Age" of an invention, viz., the thermionic

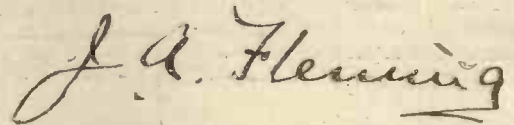
of unusual utility," and although it did not reach its greatest utility until the "grid" was added, Mr. Justice Sargant said that he did not think that the three-electrode valve "would ever have come into being but for the previous invention of the 1904 Fleming Valve."

This pioneer invention has formed the starting-point for inventions and improvements of the greatest importance; without which there would certainly be no broadcasting, and therefore no amateur wireless construction.

The two-electrode rectifying valve invented by me in 1904 is

used to-day in exactly the form I then described it for rectifying the low frequency alternating currents for providing the direct current voltage for generating valves; although its place as a wireless detector rectifier has been taken by the crystal detector. Nevertheless almost all broadcasting transmitters involve the use of a Fleming Valve. Its 21st birthday should, therefore, not be forgotten by those who find pleasure in listening-in, and to whom the thermionic valve and its improvements has brought an added pleasure and interest in life.

Yours faithfully,




Prof. J. A. FLEMING, F.R.S.

valve, without which there would not be much amateur wireless to guide. My basic patent for the two electrode rectifying valve, applied for in Great Britain on November 16, 1904, No. 24,850, was absolutely the first application for the utilisation of the emission of electrons from an incandescent filament for any technical purpose connected with telegraphy or telephony. The United States equivalent patent was upheld after long litigation as a master patent.

In giving judgment on a Petition for prolongation in Great Britain in 1918, Mr. Justice Sargant called it a "pioneer invention" and "one

From Prof. W. H. ECCLES, D.Sc., A.R.C.S., F.R.S.

Prof. of Electrical Engineering, Finsbury Technical College.

SIR,—That THE WIRELESS CONSTRUCTOR has achieved a vast and steady circulation during the first year of its existence is surely one of the outstanding triumphs of journalism. Such a success seems to me to prove, firstly, that the journal has consistently published interesting and useful matter, and, secondly, that the British public appreciates a good thing. I think that the diffusion of wireless science in an attractive form, and the welcome given to it by the British public, augur well for national progress, and I have therefore great pleasure in wishing THE WIRELESS CONSTRUCTOR many happy returns of its birthday.

Yours faithfully,

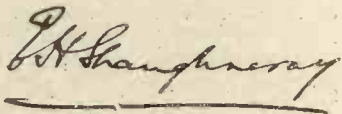



A recent portrait of DR. ECCLES.

From Mr. E. H. SHAUGHNESSY,
O.B.E., Assistant Engineer-in-Chief,
General Post Office.

SIR,—The reliable and useful information contained in THE WIRELESS CONSTRUCTOR merits the success which you have attained for it, and must prove very helpful and encouraging to those interested in the study of radio matters. I wish you continued success in the future.

Yours faithfully,



From Commander F. G. LORING, R.N.,
Inspector of Wireless Telegraphy,
General Post Office.

SIR,—In sending Birthday Greetings to THE WIRELESS CONSTRUCTOR, I remind myself that it is one of the few wireless periodicals which I do not see regularly, for though a circuit of sorts is always to be found on my workshop bench, I should be ashamed to show it to any self-respecting constructor. I have met some of these gentlemen, and have the deepest respect for their skill and patience. One such lives near me. His hobby used to be model ship building, but his wife wanted a loud speaker. He had practically no knowledge whatever of electricity, so he bought one of the well-known Envelopes and set to work on a three-valve loud speaker set. The construction took him nearly three months, and I can testify that the result is a beautiful piece of work, which gives admirable

results. But three months before he got a signal! I couldn't do it! and there are lots of others like me. When we start in on a set we want a signal off it that evening if not sooner. We should love to have a superheterodyne set, but we shall never have one if the possession of it depends on our exertions as constructors.

But to return to Birthday Greetings and the expenditure of

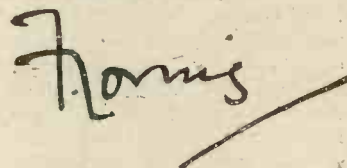


A recent portrait of
Mr. J. C. W. REITH,
Managing Director of the British
Broadcasting Co.

sixpence on a copy for the purposes of this letter. I have intended for some time to try my hand on a Low-loss Two-valve Neutrodyne

Receiver, but have never come across a description of such a set, and here on the first page of the October number of THE WIRELESS CONSTRUCTOR I find the detailed description of just such a circuit. It is therefore with enhanced feelings of goodwill that I wish Mr. Percy Harris and his staff Many Happy Returns of the Day, and every success in the coming year. I fear, however, that my edition of the Low-loss Two-valve Neutrodyne will never be found inside the nice neat box, which he indicates as its final destiny.

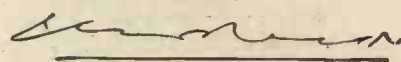
Yours faithfully,



From Mr. J. C. W. REITH,
Managing Director of the British
Broadcasting Co.

SIR,—We are glad to hear of the continued success of your enterprise, and to know that you are now looking forward to the second year of exceptional promise. We fully appreciate how much we owe to the activities of the wireless technical press. Without efficient receiving apparatus no programme service would be of any avail. Moreover, the distribution of accurate technical knowledge is of great importance to us. THE WIRELESS CONSTRUCTOR, therefore, has our best wishes for the future.

Yours faithfully,



“The Wireless Constructor” in South Africa

SIR,—I want to thank you for the design for a “Midget” one-valve set, which appeared in the May number of THE WIRELESS CONSTRUCTOR, by Mr. A. S. Clark. As I had a number of components by me they are not all exactly as specified. The coil holder and variable condenser were made by myself, and the coils I also wound.

I put the condenser in series, as I found I got better results in that way. The panel is slightly larger, 6 in. by 6 in., as I wanted to arrange the terminals so that a L.F. amplifier could be easily linked up.

The results are as follows: Cape Town, 540 miles, relayed service from St. Mary's Cathedral, very clear, every word of the sermon being audible.

Johannesburg, 420 miles.—I mistook this station for Durban, as it was so loud.

Durban, 240 miles.—I came on to another service here, result, of course, louder than Johannesburg reception, very clear; at the end of a hymn the rustle of the congregation, coughing, moving of hassocks, &c., was very marked.

To sum up, results were equal to

a professionally made two-valve set in town (H.F. and detector), and I am extremely delighted with it.

Yours faithfully,

GEO. R. MALLORY,
L.D.S., R.C.S., Eng.

Cathcart, South Africa.

P.S.—We obtain most of our components and parts from Home, as South African firms charge at least 50 per cent. more, despite the absence of Customs duty. Even your own papers, &c., cost more. THE WIRELESS CONSTRUCTOR costs 11d.



MR. GUMPLETHORPE

Hears America

By "BROADCASTER"



I TOLD you last month how our old friend Mr. Gumplethorpe constructed a vast valve set—"entirely my own work, my boy"—with the help of three manufacturers, half-a-dozen friends, a neighbour's small boy and the Radio Press Service Department. His system has been found by many amateurs by far the most satisfactory for the construction of home-made sets, and in case you are at the present time battling with the soldering iron or entangling yourself in coils of wire, you might do much worse than



Doing in seventeen chickens.

follow his lead. Having once got the set working it was only natural that Mr. Gumplethorpe should immediately start to improve upon it. For some curious reason, which is doubtless very laudable in theory, though distinctly the reverse in practice, no amateur, particularly if he is a beginner, is ever quite satisfied with the performances of his set. He feels somehow that his very best signals should be just a *leettle* bit louder, or finds to his horror that Aberdeen or Rome is just outside his range. This infuriates the man, who promptly reads all the articles that he can find upon efficiency in the wireless set and then sets out to practise what others preach. Having entangled himself seriously in the mathematics of Mr. Brainer, the dialectics of Mr. Bendall (Mr. Bendall's dialectic coefficient is high, but do not confuse it with dielectric), and the mental acrobatics of Mr. A. D. Snooper, Mr. Gumplethorpe came to the conclusion that inefficient coils are much more to blame than inefficient condensers for bad working and *vice-versa*. He next consulted various helpful friends, by the

first of whom he was told that the only thing that really mattered was the aerial.

Insulation

The important thing, they said, was insulation. Mr. Gumplethorpe put up so many insulators that the wire fell the next night, doing in seventeen of his neighbour's chickens and two of his own chimney-pots. He decided that insulation could be overdone. The next friend said that insulation did not matter two hoots—Mr. Gumplethorpe knew all about hoots, having Persevering Percy, who can never let well alone, as a neighbour. This friend assured him that if you wanted good reception the only thing to do was to stick up a really high mast. Mr. Gumplethorpe stuck up a mast, but unfortunately it came unstuck in the next few days, and then he knew what a third party was. Friend No. 3 recommended short aerials, whilst friend No. 4 proved conclusively that they were utterly useless. In the end he compromised, erecting an aerial that was neither very high, nor very low; neither very long, nor very short; and neither very well nor very badly insulated. All his friends criticised this, but then friends always do.

Earths

Earths were the next perplexity. The first expert friend consulted recommended a 7-lb. biscuit tin, and Mr. Gumplethorpe ran about all over the place trying to find a biscuit tin that weighed 7 lb. As he was unable to do this he bought one of the largest size and buried it with its contents of cream crackers still inside it. These naturally produced crackling noises, and he tried in its stead an old frying pan which refused to give up its habit of frying. He cast longing eyes upon his young hopefuls' bath, and they were perfectly willing that he should have it. At this point, however, Mrs. Gumplethorpe became a loud-speaker, whilst Mr. Gumplethorpe ceased to function. He dug down to the bowels of the earth, or so it seemed to him

burying bundles of wire netting and all kinds of things. One friend said that the only kind of earth that was of any use at all was a mat. Mr. Gumplethorpe promptly buried the doormat, but in spite of the "Welcome" imprinted upon it wireless waves refused to be attracted. In the same way having been told that (a) pins and (b) plates could not be beaten, he tried both one of Mrs. Gumplethorpe's hat-pins and a dinner plate without marked success. Later he learned that copper formed the best contact, and Mrs. Gumplethorpe being



Removed the geyser bodily . . .

away from home, he removed the geyser bodily from the bathroom and interred it with most excellent results.

Real Assistance

The alterations that he had made to his set now began to give a certain amount of trouble—when I say certain I mean certain; at any rate, Mr. Gumplethorpe and all those who came round to hear the thing working were quite certain about it. He was almost in despair when one day he saw upon the bookstall a neat little book, called "Wireless Faults, but Never Mind Them," by Mr. R. H. Wallows. Having read the book through a first time he was quite convinced that the high-tension battery was suffering from housemaid's knee. Second and third readings proved to him that this diagnosis was quite correct, and he was also quite sure that his valves were defective, that the ebonite of his panel was leaky, that his transformers were burnt out, that his telephones were demagnetised, that his rheostats had gone on strike, that his condensers were shorted and that his coils were "dis." In this invaluable little

LISSENIUM

The New LISSEN Wire Wound ANODE RESISTANCE

THE outstanding purity of resistance-capacity amplification is fully recognised, but its use has been retarded owing to the difficulty of obtaining a suitable resistance.

TO successfully carry the heavy current without partial disintegration and consequent noise, for the best work it is necessary to use a wire-wound resistance. It is also necessary to have a high resistance—80,000 ohms has proved to be the most suitable and is the one usually recommended.

In the majority of the very few wire resistances on the market, difficulties of manufacture have resulted in a compromise between cost and efficiency, and the results obtainable with the new *Lissen Wire Wound Anode Resistance* are a great improvement when compared with what was previously possible. The *Lissen Wire Wound Anode Resistance* has a full 80,000 ohms resistance,



will carry heavy currents, is always perfectly silent under all conditions of service—amplification is strikingly pure.

The method of winding results in a very low self-capacity. The coil is wound in sections which inductively neutralise each other. The resistance is hermetically sealed and cannot be affected by atmospheric changes.

The *Lissen Wire Wound Anode Resistance* is essentially a "heavy duty" laboratory component at a popular price. In addition to its use for L.F. coupling it will also be found very suitable for H.F. work on the higher wavelengths.

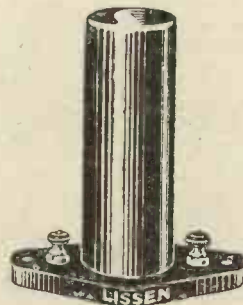
Price - - - - - 10s.

The LISSEN H.F. CHOKE

IN some circuits, such as the popular Reinartz, an air-core choke is necessary. Hitherto the experimenter has had to face the difficulties of winding his own choke or use a large plug-in coil.

There is now available the LISSEN H.F. CHOKE which has many advantages over the home-made choke or the plug-in coil used as a choke. For instance, with the LISSEN H.F. CHOKE there is no risk of the H.F. currents being by-passed across it—it is so designed that its influence on stray fields in a receiver is negligible—its inductance value is so high that it is as effective on 4,000 metres as, say, on 300.

If a plug-in coil is used as a choke, a No. 200 coil is usually recommended, but this size of coil



has the disadvantage that the natural wavelength of the coil, although well above the broadcast band would be below, say, Daventry, and consequently ineffective on that wavelength. This difficulty can be overcome by using an ultra large coil, but such a coil is expensive, and its use would be limited to the higher wavelengths owing to its comparatively large self-capacity, strength of magnetic field due to its bulk, and so on.

The LISSEN H.F. CHOKE therefore fills a very useful need, because it is conveniently formed and also efficiently covers all wavelengths up to 4,000 metres.

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Brandes

The Table-Talker

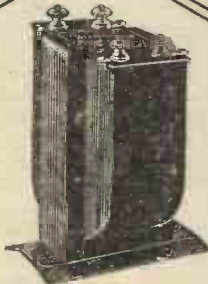
designed with expert knowledge of acoustics

NOTE: Acoustics: the science of sound. Radio Acoustics: transforming the electrical impulse into audible sound.

The ultimate excellence of the Brandes instrument does not lie solely in the hands of the master craftsman. True, his care and ingenuity must be exercised during construction, but the basic principles are laid down for him by technical experts in the Brandes laboratories. There the secrets of acoustics are thoroughly investigated and finally built into our plans. The electrical impulse is captured by your set. Transformed to audible sound by a Brandes loudspeaker that transmitted sound is perfectly reproduced.

The new goose-neck design is the result of research in radio acoustics, which definitely establishes its value in relation to the diaphragm fitted. One feature remaining unchanged is the patent material used in the construction of the horn which eliminates any suggestion of harshness. It is now possible to control volume with the small lever located at the rear of the base and to adjust to a finer degree. Elegantly shaped, it still has that tasteful neutral brown finish and felt-padded base. Height 18 ins., bell 10 ins.

Ask your Dealer for the Table-Talker.



Audio Transformer
Ratio: 1 to 5
17/6



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Headphones

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The Brandola

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Brandes Limited

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book (Mr. Wallows is a friend of mine, so I trust that you will purchase it without delay) the keynote struck is system, system and again system. You or I when something goes wrong with the set simply have a dash at it, and get the thing working again in about two twos. Mr. Wallows, however, shows us how utterly wrong we are. By far the best way really if you have a thoroughly baffling breakdown is to call your neighbour's small boy, and retire to an armchair with a pipe. In the whole of his book Mr. Wallows never mentions small boys, armchairs or pipes. He is all for energy and, as I have mentioned before, system. I remember once seeing Mr. Wallows systematically trace a fault, which he found in the end consisted in his failure to attach the aerial wire to its proper terminal. On this occasion I occupied the armchair and smoked the pipe whilst he supplied the system. I have always felt that you never really know a



Woke him in the afternoon . . .

man, especially if he has written a book about it, until you see him tracing a wireless fault to its source.

Fault Tracing

Poor Mr. Gumplethorpe was amazingly systematic in the tracing of his faults, so much so that after several hours' investigation he usually found that he had forgotten to switch on, or to connect up the loud-speaker or something of that kind. But still the set would not function. His efficient inductances, being home-made by the best manufacturers, proved fully up to their work, and his valves when tried, as recommended, upon neighbours' sets gave excellent results. All things considered he came to the conclusion in the end that the wiring necessitated by the alterations (during and after which he had endeavoured unsuccessfully to carry on business as usual) left something to be desired. Your neighbour's small boy may be, and in fact is, generally, an adept at finding faults, but he is also equally skilled in making them if you turn him loose with a soldering iron and a supply of square tinned rod. Mr. Gumplethorpe found eventually that the best way to find faults was

to borrow a spare small boy from another neighbour to check the wiring perpetrated by the original. Small boy No. 2 announced that small boy No. 1 could not do that kind of job for toffee. Mr. Gumplethorpe had noticed a certain stickiness about his panels, but he put it down to fluxite and not to toffee.

He Succeeds

At long last, thanks to the efforts of numerous expert friends, corrected by numerous small boys (the last one of these mentioned little apples, though none of these were used beneath the panel of the set), the thing was got to work, and Mr. Gumplethorpe was soon, to quote those who really understand the poetry of wireless, "travelling upon the magic carpet of radio over the far-flung map of Europe." Things like that sound awfully jolly, and I can assure you there is some truth in them. I know that Mr. Gumplethorpe flung the radio atlas of the world twice into the fire and several times through the window when the magic carpet refused to take him much further than his own hearthrug. However, he did eventually conquer Europe, and this having been done, his ambition carried him further and further afield. He felt somehow that he would be unable to hold up his head much longer amongst the fellows with whom he travelled daily Citywards in the train unless he could report something rather better than Oslo or Czrqplswyz. His companions, he observed, though they looked fit and fresh enough, were always able to tell one another—and, in fact, anybody who listened to them—that they had excellent reception of WHIZ or OOH at half-past three that morning. After making extensive inquiries, he found that this was the only time at which really good transatlantic reception could be expected, and that all genuinely enthusiastic wireless men, if they went to bed at all, never thought of doing so until five or six o'clock in the morning. Not liking to ask further questions of people who were almost strangers, Mr. Gumplethorpe consulted his very best friend, and four or five others after him. Acting upon their combined advice, he laid in a dozen packets of firelighters, a thermos flask, a fur coat, Eskimo boots and a hot-water bottle. He also purchased an alarm clock, which he kept permanently set at 3.30. This woke him several times during afternoons when he was trying to sleep off the fatigue

engendered by his early-morning labours.

America!!

Night after night Mr. Gumplethorpe managed somehow to be at his post. I cannot say that to begin with Mr. Gumplethorpe heard America; but I can assure that all his neighbours heard *him* as he endeavoured to tune in, or resolve, as the experts have it, the elusive carrier-wave of WGY. And then on one particularly early morning everything happened all at once. Previously there had been weird fizzing, crackling and squealing noises in the telephones; and Mr. Gumplethorpe had become thoroughly exasperated. He gave every condenser, rheostat and other knob a hearty tweak, first this way and then that. Clear as a bell (with several cracks in it) came through those nasal accents whose coming gives the wireless man his greatest thrill. Some station or other was recommending the purchase of face powder, and Mr. Gumplethorpe listened enthralled. There could be no doubt that he really had discovered



Unanimously elected him a
F.I.S.R.

America, since he caught the words "uplift," "hundred per cent.," "go-getter" and other linguistic gems of that kind. The next morning Mr. Gumplethorpe entered his compartment on the 8.43 with a step that might have been described as elastic had not the length of his strides caused both his sock suspenders to give out *en route*. He listened quite patiently whilst the other occupants of the carriage mentioned this and that American station as having been received in the chilly hours of the early morning. When they had all finished, Mr. Gumplethorpe looked up from his paper with a bland smile. "I had seventeen different American stations on the loud-speaker this morning," he said. There was utter silence in the carriage. A codfish-eyed man opposite shook him by the hand without a word, whilst the rest, after a slight pause, unanimously elected him a Fellow of the Incorporated Society of Radioliars. Mr. Gumplethorpe felt that life had nothing further to offer.

How to Mount Your Basket Coils

By A. V. D. HORT, B.A.

BASKET coils, whether single or double, possess the advantage, from the point of view of the amateur constructor, of being easy to wind. By suitable methods of tying the finished windings they can readily be made self-supporting without the use of wax or varnish, though a light dressing of the latter may be needed merely as a protective covering to keep out moisture. But these coils, especially if they are "air-wound"—that is to say, wound on removable spoked formers—are by no means robust, and however well they are tied up, they will not stand much handling without tending to fall to pieces.

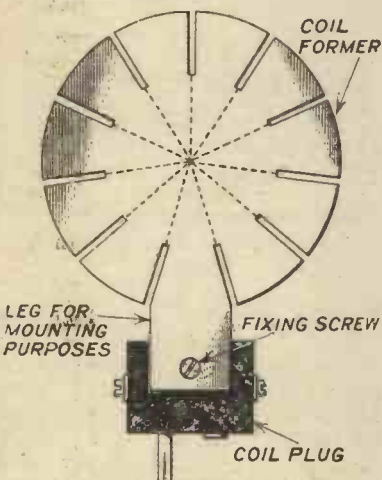


Fig. 1.—Showing how the coil former is secured to a plug.

It is, therefore, a good plan to mount the finished windings permanently in some way, so that they can be handled without risk of damage. For most general purposes it will probably be convenient to fix them on a plug-in mounting of some sort, so that various sizes may be interchangeable for use in an ordinary coil-holder.

The First Type

Dealing first with the type of coil which is wound in slots round a card or thin ebonite former, a simple method of mounting will serve in this case. The former for the coil is cut to the shape shown in Fig. 1, a "leg" being left

between two of the slots, in the centre of which a hole is drilled for a bolt. Between the pin and socket of a standard ebonite coil plug a similar hole is drilled, and the completed coil is secured to the plug with a suitable bolt and nut,

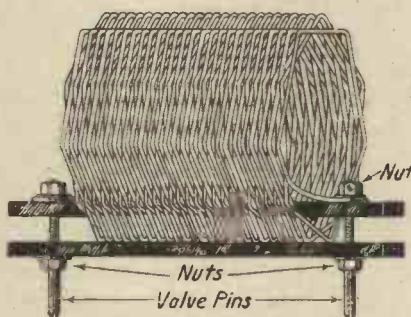


Fig. 3.—Edgewise-wound basket coils may be mounted in this manner, the valve pins plugging into sockets arranged to fit.

the ends of the winding being made off to the connections of the plug in the usual way. By drilling the hole in the leg of the former in the correct position, coils on different sizes of formers can be mounted so that their centres come at the same height when they are placed in the coil-holder.

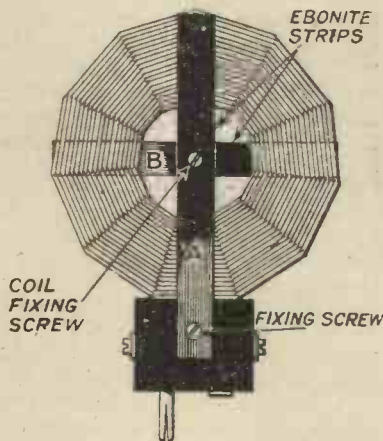


Fig. 2.—A method of mounting coils without a former.

Air-spaced Coils

In mounting "air-wound" basket coils it is best to secure them to a strip of thin ($\frac{1}{8}$ in. or $\frac{1}{4}$ in.) ebonite, which is itself bolted to a

plug, as already described. The coil may simply be tied to this strip, but a stronger method is shown in Fig. 2. Here the length of the strip B should be equal to the diameter of the coil, and the strip A $\frac{3}{4}$ in. longer than this. The coil is lightly clamped between the strips as shown, by means of a nut and bolt through holes drilled in the strips. Care should be taken when making the connections to the plugs that the windings of all coils are connected the same way round, as otherwise the receiver may not work as it should when two coils are coupled together.

Edgewise-wound Coils

Edgewise-wound basket-weave coils, if they have only a very few turns, may be mounted in a similar manner. If they are large, however, the windings will require more support. A suitable method of mounting such coils is shown in Fig. 3. It will usually be preferable to attach such coils to the baseboard or panel, and to connect the ends of the winding direct to the appropriate points of the circuit; whichever method is used, two strips of $\frac{1}{8}$ in. ebonite will be needed, each 1 in. longer than the coil. The coil is clamped between them in the manner shown. For baseboard mounting, the legs are replaced by wood screws which pass direct into the board. For plug mounting standard plugs or valve legs are used, sockets at a suitable distance apart being mounted on the panel.

Before removing the coil from the former on which it is wound, it should be tied up tightly with thread passed up and down through the "cells" formed by the windings.

Any coils mounted by these methods should always be held by the plugs, and the windings themselves should never be handled when inserting the coils in or removing them from a coil-holder.

An Open Letter to every WIRELESS USER

An important WIRELESS DEVELOPMENT

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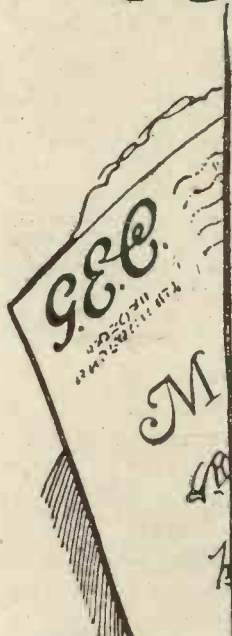
These valves, which are marketed by The General Electric Co. Ltd., will in future be sold under the name **OSRAM**—a name known to everyone in connection with electric lighting and one which has always been associated with sterling quality.

You may, therefore, have the assurance in purchasing an **OSRAM VALVE** that you will obtain the same high degree of satisfaction unflinchingly given by **OSRAM Lamps**.

What the **OSRAM Lamp** is to light, the **OSRAM VALVE** is to wireless. It is the proved and universally trusted wireless valve.

Yours faithfully,

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The GAMBRELL L.F. INTERVALVE TRANSFORMERS have been designed to give you that distortionless reproduction which is the ultimate aim of every experimenter. Designed and manufactured by a firm with 30 years' experience in the manufacture of Scientific and Electrical Instruments, these Transformers are the leaders of their class.

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THE TRANSADAPTA with its detachable and interchangeable legs for use either with valve sockets or for mounting direct to the panel with screwed legs, nuts and soldering tags, and with its totally enclosed switch for reversing the connections, makes it possible for you to drop those highly inefficient fine wire H.F. Transformers and use air spaced coils of maximum efficiency. Use the Transadapta and Gambrell Coils for H.F. Transformers, Neutrodyne Coils, Transfer Circuits and Long Wave Amplifying Transformers thus obtaining greatest selectivity and signal strength.

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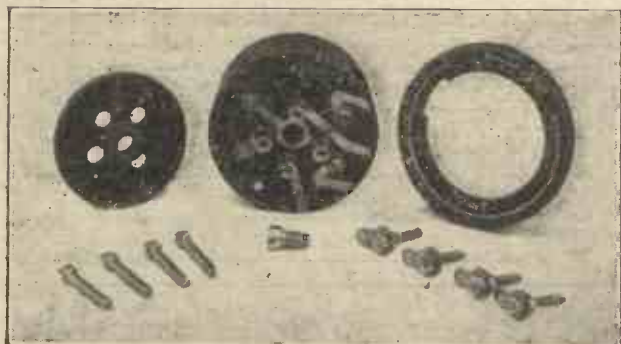
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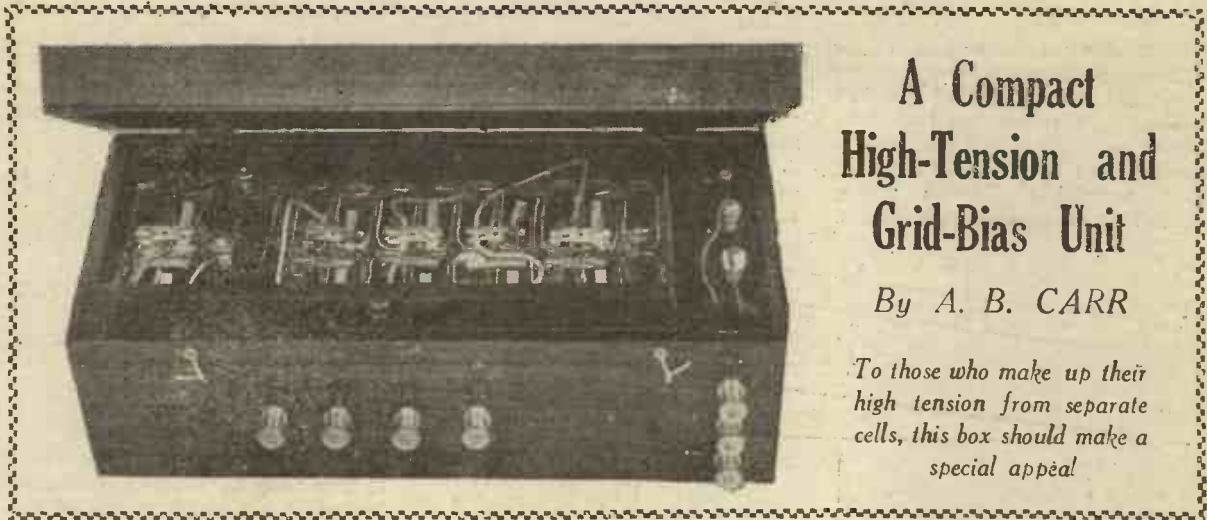
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By A. B. CARR

To those who make up their high tension from separate cells, this box should make a special appeal

THE average listener pays but little attention to his high-tension battery. Once bought he is content that it should rest unprotected on his bench, unheeded, until weakened or noisy reproduction sets him searching for possible faults. Neglect of the high-tension battery will certainly lead to a reduction in the efficiency of the receiver, probably to cracklings, which may be quite erroneously ascribed to atmospherics, and eventually to a complete breakdown. If doubts arise whether cracklings in the receiver are due to "X's" or the H.T. battery, disconnect aerial and earth for a few moments. The continuation of the unwelcome noises undiminished will indicate that the battery is at fault, provided there are no loose connections or wander plugs to cause trouble.

Advantages

The unit described below offers several advantages which will make its construction well worth while. It protects the batteries from dust, a fertile cause of surface leakage, and hence of short life in a battery, and from moisture, leading to shorts between adjacent cells, especially if of the paper-covered flashlamp type, as well as to surface leakage. Furthermore, since the batteries are totally enclosed, the risks of mechanical damage and accidental short-circuiting are reduced to a minimum, while the protection from excessive heat afforded by the cabinet prevents the premature drying-up of the paste which forms the electrolyte of the "dry" cells. The safety unit eliminates all risk to the valves. It will be noticed that pocket flashlamp batteries are employed, allowing the removal of faulty units, but if the

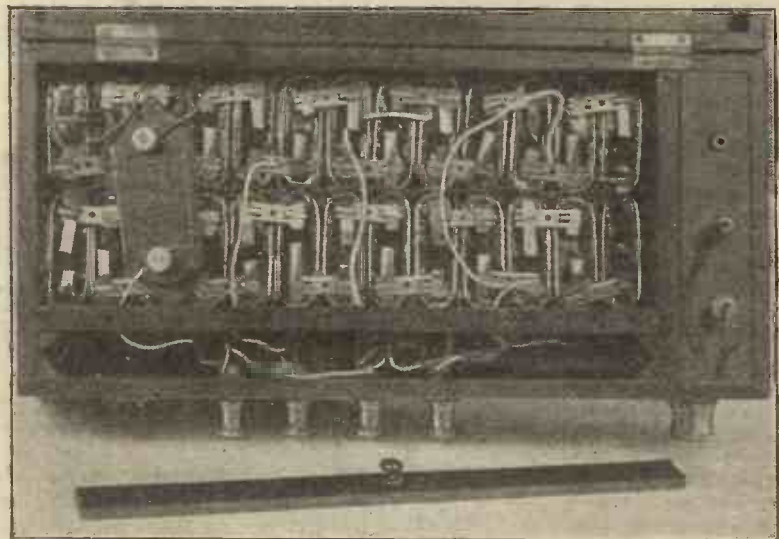
constructor possesses a commercial battery it may be utilised if of suitable size for the cabinet. Provision is made for grid batteries and H.T. blocking condensers, and the whole apparatus provides a handsome and convenient unit for use in conjunction with any valve receiver.

Appearance and General Lay-out

Reference to the illustrations will show the neat appearance of the unit. The four terminals in the centre are marked H.T.—, 1st+, 2nd+, and 3rd+ respectively, while the vertical row of three seen on the right are connected to the grid-bias batteries. The seven terminals are brought out through ebonite bushes,

Internal Construction

Lifting the latter discloses the fact that the cabinet is divided internally into three parts. The right-hand division contains three grid-bias cells, and is closed by an ebonite panel carrying three Clix sockets. The largest section houses the cells of the H.T. battery, which, as will be explained later, is provided with wander plugs. The division nearest the front of the cabinet is closed by a small wooden lid, and holds the three large condensers, these being connected to the four terminals mentioned above. The safety unit, being cased in ebonite, can lie on top of the H.T. batteries.



The safety unit may be laid on top of the cells as shown.

and are the only visible components, all the remaining parts being completely hidden when the lid is shut down.

Components

To duplicate the unit described, the following components will be required, and makers' names have

been given to assist constructors to purchase the necessary parts. Other makers' products of equivalent specifications may be employed, but it should be remembered that in buying batteries it will pay best in the long run to purchase those of some reputable English make, rather than cheap Continental cells.

It may be necessary to cut short the shanks of the four H.T. terminals in order to afford sufficient clearance for the condensers mounted behind them. Four small holes of sufficient diameter to take flex must now be drilled in the wooden partition separating the H.T. batteries and condenser com-

partment; about $\frac{3}{8}$ in. below the top of the partition will do. The ebonite lid of the grid battery section is drilled with three 2 B.A. clearance holes for the Clix sockets,

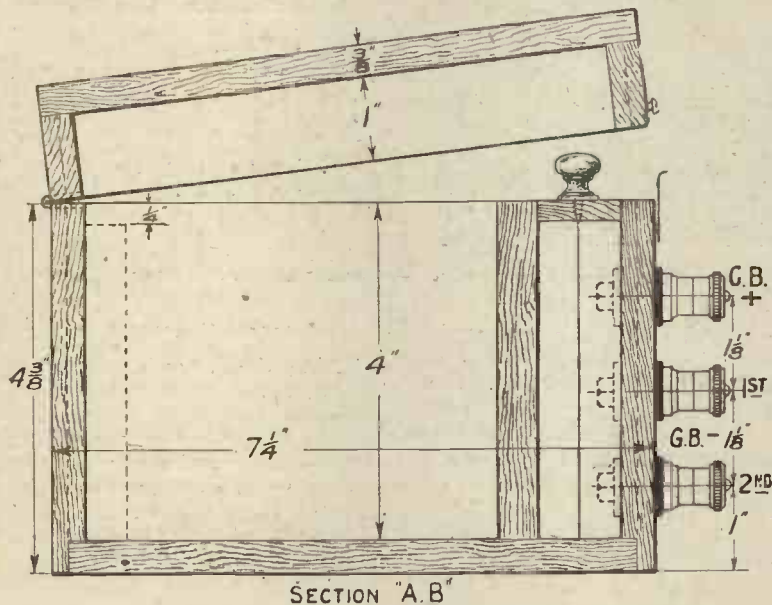


Fig. 1.—A section of the box showing the internal construction.

One ebonite strip, $6\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{1}{2}$ in.

One "Dubrescon" safety unit (Dubilier Condenser Co., Ltd.).

Seven 2 B.A. (W.O. type) terminals.

Twenty-five "C.W." brass battery links (Burne-Jones & Co., Ltd.).

Two Clix plugs and three sockets (Autoveyors, Ltd.).

Four wander plugs.

Fourteen ebonite bushes.

Three $1\mu\text{F}$ Mansbridge condensers (Telegraph Condenser Co.).

Twenty-six $4\frac{1}{2}$ -volt "flashlamp" batteries ("Ever-Ready").

Three type U.W.1 dry cells ("Ever-Ready").

Cabinet, with lid, as specification (Carrington Manufacturing Co.).

Radio Press Panel Transfers.

Quantity of flex, corrugated cardboard, paraffin wax.

Drilling and Other Constructional Work

Seven holes $\frac{1}{2}$ in. in diameter must be made in the front of the cabinet in the positions shown. These should be made with a brace and bit, and are to take the terminals, which may now be inserted, each passing through two ebonite bushes placed one on either side of the wood to secure effective insu-

lation. Their position is not critical, as long as they are below the level of the lid which covers the

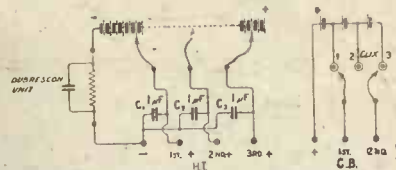


Fig. 2.—The wiring arrangement.

and with two small holes to take flex leads.

Batteries

The $4\frac{1}{2}$ -volt batteries are arranged in two rows of thirteen, and connected in series by means of the brass links. These links have three prongs at either end, two of which go under, and one over, the brass strips forming the battery poles. Remember that the short strip is the positive pole of the battery, and the long strip the negative. Between the batteries are placed strips of waxed cardboard to give improved insulation. To make these strips, a quantity of the corrugated cardboard commonly used for packing purposes should be baked in an oven to remove moisture, and then dipped in boiling paraffin wax until thoroughly impregnated. The best method of assembly is to cover the bottom of the battery compartment with a



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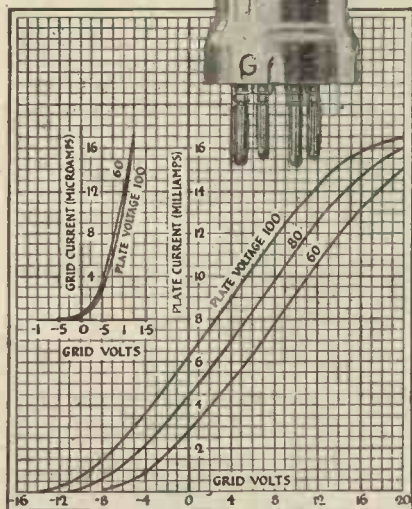
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B3	Filament Voltage 1.8 Volts. Filament Current 0.35 Amp. Max. Plate Voltage 80 Volts.	14/	B6 Filament Voltage 2.8 Volts. Filament Current 0.42 Amp. Max. Plate Voltage 120 Volts.
B5	Filament Voltage 2.8 Volts. Filament Current 0.06 Amp. Max. Plate Voltage 80 Volts.	16/6	B7 Filament Voltage 6 Volts. Filament Current 0.06 Amp. Max. Plate Voltage 120 Volts.

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sheet of this waxed card, and to pack the cells in one by one, placing pieces of card between the cells, between the two rows, and between the cells and the sides of the cabinet. The links, which are provided with holes for wander plugs, may be clipped on when the batteries are in the box.

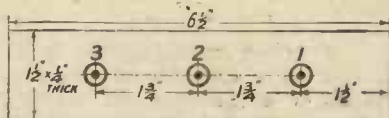


Fig. 3.—How the grid-bias strip is drilled.

The three grid cells are connected in series, the central terminal of each being the positive pole, and the wire the negative.

Wiring Up

Solder (either directly or by the spade tag method) fairly long flex leads to the three grid-bias terminals, and connect the lead from the top terminal to the positive pole of the first grid cell. The negative of this latter is connected to the positive of the second cell, and by means of flex to the first Clix socket (the one nearest the front). The negative of the second cell is connected to the positive of the third and to the second Clix socket, while the remaining negative lead of the third cell is connected by a soldered flex lead to the third Clix socket. The flex leads from the two lower terminals are now brought out

through the holes in the ebonite lid, and fitted with the Clix plugs, which should be fitted with insulators of different colours to avoid confusion. The ebonite lid may now be fitted in, and the sockets numbered 1, 2 and 3 with the aid of panel transfers.

Connections to Condensers

The connections to the condensers etc., are fairly obvious from the circuit diagram, and are made as follows: The H.T. negative wander plug is connected by flex to one terminal of the Dubrescon unit which lies on the top of the batteries. The other terminal of the unit is connected by a lead through the wooden partition to the terminal marked "H.T.—" and to one tag of each of the three 1 μF condensers. A second flex lead with wander plug attached is taken through to the "1st +" terminal and to the remaining tag of the 1st condenser; similar leads with plugs attached go to "2nd+" and the second condenser, and to "3rd +" and the third condenser respectively. It will probably be found best to solder the terminal connections first, then to insert and screw down the condensers with the flex leads attached, next soldering the remaining condenser connections, and finally attaching the wander plugs, whose insulators should be distinctive in colour to avoid confusion, when the highly desirable panel transfers have been affixed, the unit will be complete.

How to Use It

The negative terminal must be attached to the H.T. — terminal of the receiver. The "+" terminals allow of from one to three different H.T. tappings being taken to the set, so that any valve can be given extra anode voltage if desired. By means of the wander plugs the value of the H.T. voltage applied via any terminal may be altered at will, the large condensers minimising unwanted noises when the batteries are getting old. The Dubrescon safety unit consists of a resistance (sufficiently large to prevent damage to even .06 amp. valves if the high voltage is accidentally put through the filament), shunted by a mica condenser of fairly large capacity, which allows H.F. currents to pass.

The G.B. plus terminal (the highest of the three) is connected to the appropriate place on the receiver, while the two negative terminals allow two different values of grid-bias to be employed, each value being determined by the position of the Clix plugs in the sockets.

After the necessary plug adjustments have been made the lid may be shut down, thus hiding in a handsome cabinet what is usually a very untidy accessory to every valve receiver. Should any battery of the high-tension unit become faulty, or register less than 3 volts on test, it may very easily be withdrawn and replaced by a new one.

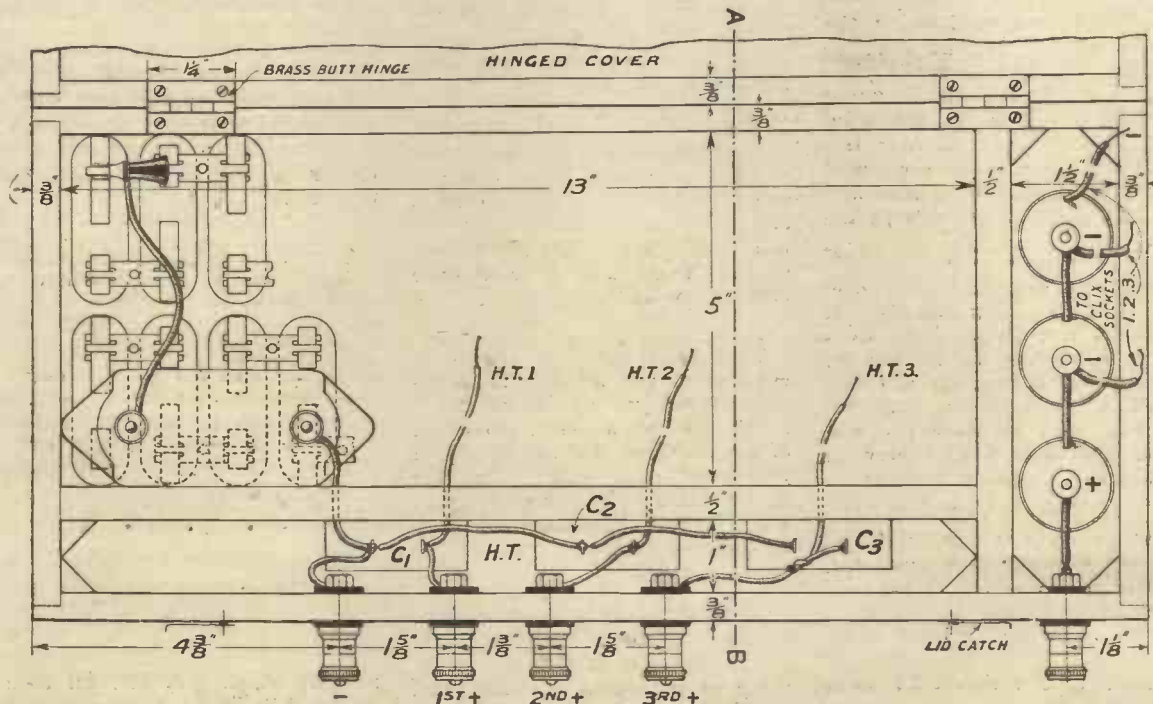


Fig. 4.—Showing how the wiring is carried out, together with the terminal markings. The H.T. tappings may end in wander plugs if desired.

Do You Know—?

By C. P. ALLINSON

THAT if a really good soldered joint is to be made, it is best thoroughly to file or scrape the parts to be joined before applying the solder. All metals oxidise more or less owing to exposure to the atmosphere, and even the thinnest film of oxide is sufficient to prevent a sound joint being made.

That the time taken to acquire the gentle art of soldering is well worth while. Not only is it quicker to wire a set or make alterations to existing wiring in a set that has soldered joints, but once skill has been acquired there is little risk of the set becoming noisy due to poor contacts developing.

That acid fluxes should not be used for soldering wireless connections. Not only is some of the flux liable to spray on to the panel when the iron is applied, resulting in a semi-conducting film being deposited, but if any of the flux remains on the join it may corrode the wire, eventually giving rise to a bad connection and trouble.

That a means of keeping the panel free from flux, and therefore leakage, is to keep a small piece of paper handy and slip it under each joint as it is made. Similarly, pieces of paper pressed over terminals and other connections near to the panel will catch any flux that may splutter away from the joint.

That you should always drill an ebonite panel horizontally. If the bench is cluttered with tools it may seem the easiest way to fix the panel in the vice and drill it vertically. If this is done the drill will tend to wander downwards, and holes drilled may be as much as $\frac{1}{8}$ in. out of position.

That small holes can be drilled in glass by means of a small file. A triangular file should be used sharpened to a very fine point at the end. This is then used in an archimedean drill, preferably of the kind that revolves in both directions. The lubricant used is turpentine, and only the lightest pressure should be applied.

That when you wish to mix sulphuric acid and water in order to "top up" an accumulator which has been upset, or to fill a new accumulator that is going on charge, remember ALWAYS to add the acid to the water. Sulphuric acid and water have a strong affinity for each other, and when mixed give rise to great heat. If the water is put into the acid this amount of heat may be great enough to cause the acid to boil and spit violently, and if any of it goes on your face or hands serious burns may be received.

That acid should never be added to an accumulator when "topping up," except when acid has actually been spilt through the accumulator being upset, and then dilute acid only should be added. At all other times distilled water only should be added.

That the greatest care should be taken not to let accumulator acid fall on the phone leads. Sulphuric acid is so highly corrosive that though no harm may appear to result at the moment, in a few days' or weeks' time the cord will become rotten and puzzling and annoying sizzling and crackling noises may result.

That care should be taken when unrolling a hank of aerial wire not to get kinks in it. Although kinks do not, of course, interfere with reception, they weaken the wire so that the aerial may break in the first high wind.

That when you are unable to erect an outside aerial it is preferable to put up an indoor aerial rather than use a frame, providing, of course, there is not some special reason why you wish to use the frame aerial. The indoor aerial will, however, be more efficient as an energy collector.

That aerials should not be run above telephone, telegraph or power lines. There is always the possibility of the aerial breaking, and if this happens, the telephone or telegraph services may be interfered with while in the case of

power lines a short may occur, or the person listening-in may receive a serious shock.

That the free end of an aerial fastened to a tree should be at least 6 ft. from the foliage, while if there is room it is better to increase this distance to ten.

That noises in a receiver that do not arise either from atmospherics or a run-down H.T. battery may be due to a poor grid leak. Cheap grid leaks should, therefore, be avoided, for, as well as giving rise to noises in the receiver, they may be totally unsuitable in their values.

That dust should be kept off the surface of a high-tension battery, for when the weather is damp the dust will soak up moisture and current will slowly leak across this damp dust from socket to socket, and the battery will run down more quickly.

That a simple method of cleaning in between variable condenser plates is by means of an ordinary pipe cleaner. Just double it and pass it between the plates, it will then remove all dust and dirt that may be giving rise to noisy operation of the receiver.

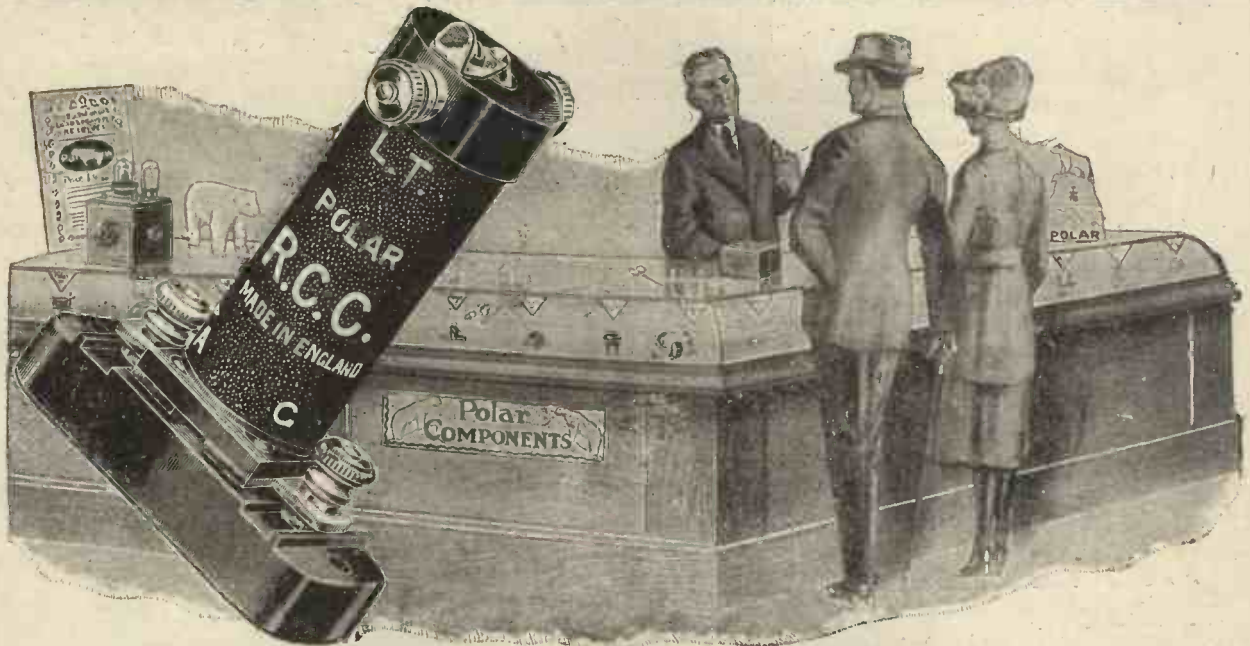
That crystals for detectors should never be touched with the fingers. However clean the hands may be there is always a small film of grease present on the skin which will be transferred to the crystal, thus impairing its receiving properties. Always use a pair of tweezers.

That Radio Press Transfers can quickly be applied by means of a little methylated spirits. Just moisten the transfer with the spirit, having removed the backing. Press it on to the panel where it is required and let it dry. If you then moisten the thin paper that is left with water, it will come away quite easily, leaving the transfer tightly fixed.

That particular care should be taken not to drop a sensitive pair of phones on the floor or on to the bench. Every shock they receive may weaken the permanent magnets on which they rely for their action, till finally they will give only the poorest, if any, signals.

(To be continued.)

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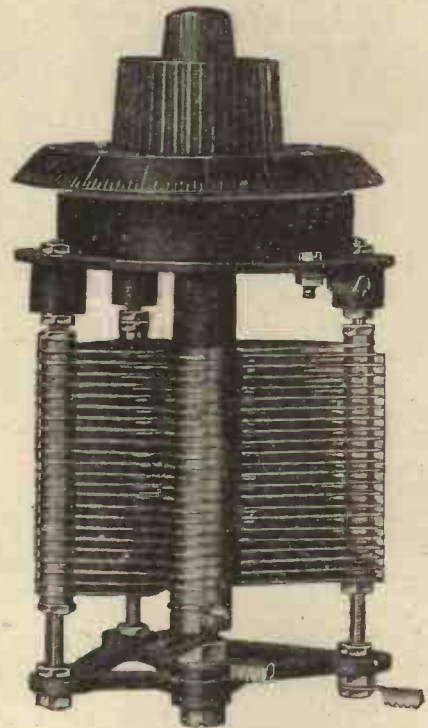
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A Wireless Wanderer in Spain

by Cap^{tn} L.F. Plugge, B.Sc., F.R.Ae.S., F.R.Met.S.



Our readers will no doubt be interested in the following article, which we have just received from Spain, where our correspondent is on a motor tour. In the lines below he is giving the readers of THE WIRELESS CONSTRUCTOR the benefit of his experiences in that country.

THERE is no doubt in my mind that in years to come all touring cars will be supplied complete with their Supersonic Heterodyne Receiving Set.

We all remember the day when the self-starter was considered a great luxury, and this usually coupled with the fact that it never worked, whereas to-day it would be difficult to find a car not so equipped—and equipped with a self-starter giving every satisfaction.

It is doubtless interesting to do a thing for the first time, and long distance Continental touring by car equipped with wireless had probably not been attempted before I affixed to my 25/70 h.p. Paige a Western Electric seven-valve supersonic heterodyne receiving set.

The summer is not the time to go to Spain, many people will say, but in the dismal climate of London one develops a longing for the days of perpetual sunshine. After all, to bear the heat is only a question of dress, and then when touring by car one also remembers that it is not only the radiator which is air-cooled.

Preliminary Arrangements

There is a great fascination in travelling according to one's own personal inclinations. Your car, yourself and your party form a unit of their own; they are not subject to any time-table, although they may be subjected to numerous delays, but then nobody else is responsible for them but yourself, and this makes all the difference.

When preparing for a big Continental tour of this description, the first thing to do is to make an extensive number of enquiries

as to conditions, state of roads, climate, what gear you have to take, and so on. A careful note should be made of all of these, and then, of all probabilities these can be utterly disregarded, as you will find that, in nine cases out of ten they are erroneous. I, for one, was informed that the roads in Spain were very bad indeed; in fact, in many cases, they were described as mule tracks. In the itinerary that I received from the Touring Associations I read; "Very, very dangerous corners"; "Gully at 300 yards"; "Narrow and unsafe bridge." The difficulty I encountered was not how to avoid them, but how to discover where they were, and to those who are contemplating taking a motor tour in Spain I would say that the roads are quite good indeed taking it all round, although not as good as those we have at home. I did not encounter in Spain the pieces of ragged and torn-up surfaces which are the lot of the motorist when going through certain parts of France. Far be it from me, however, to minimise the value of careful preparations when starting on a 4,000 mile tour by car in countries where customs and conditions are different, where the language is not known, where the customs officials have to be faced, and where, last but not least, a wireless set has to be introduced. It is on the careful preparation that the ultimate success of such a tour entirely depends.

To equip a car with a wireless receiving set and to travel by one's own means from London to Gibraltar, passing through France, Spain and Portugal, is an under-

taking of some magnitude. The last War has brought into existence many regulations with regard to wireless, and it is no doubt still feared that wireless may be used by foreigners who might eventually become spies in a subsequent war for intercepting messages of national interest.

The Car and the Set

Reception on board the car with the use of my portable set proved to be very satisfactory. The car was equipped with a 7-valve supersonic heterodyne receiving set, which was mounted on a specially constructed wooden platform, affixed by means of iron stays to the off-side running board of the car. This platform was level with the steering wheel, making it possible for me to control the tuning condensers whilst driving. The aerial, a 15 in. frame, with some 20 turns, was fitted on another platform, mounted on cross stays from the running board, but nearer to the bonnet. This platform was of special construction and so arranged as to pivot round a centre pin and yet to remain rigid in any position by means of four steel balls pressed upwardly by steel springs enclosed in four vertical cylinders. This permitted the frame being orientated in any suitable direction and allowed it to keep rigid in any such direction.

In traversing the long ribbon-like roads of France, where in some cases straight stretches of 15 to 20 miles occur, this arrangement proved very successful, permitting orientation for best reception whilst running. In Spain, however, where the roads are winding as they are

in our country, the possibility of being able to orient the frame was of little or no value, and it was better to place it in a position where it interfered least with passing obstacles, signals being allowed to fade or increase according to the way in which the road was winding.

The car was fitted with five headphones, neatly suspended in front of each passenger's seat. These were connected in series through a permanent installation on board, and each passenger was able to listen in at will.

Loud-speaker or 'Phones?

At first, I had considered equipping the car with a loud-speaker, but on testing, I realised it was better to revert to the headphones only. In the case of a travelling car, it is useful to eliminate as much as possible the noises produced by the car itself. Headphones were found to be the best for this, and the traveller need not take so much gear when headphones are used. The use of headphones also permits some of the passengers listening in whilst the others may devote their attention elsewhere.

The set was worked with an 8-volt dry battery as the valves were of the dull emitter type, using 1.1 volts, .25 amps., and were connected in series in the instrument. The battery consisted of 6 ordinary bell cells and was sufficient to run the instrument continuously throughout the trip. I carried with me an 8-volt accumulator for use should the dry battery run out; it was, however, never used for the wireless, but was very useful as a spare battery for the lights, which gave me a good deal of trouble on one or two occasions.

On landing at Dieppe the Customs Officials had to be passed. I did not find much difficulty in convincing them that the set had to be allowed to come into France without hindrance or obstacle. So the set passed through evoking many comments from the onlookers.

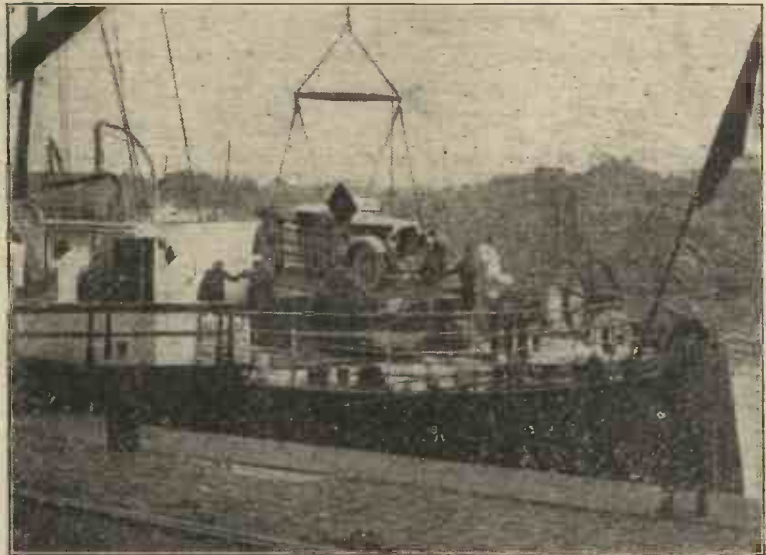
The journey through France was made by way of Rouen, Alençon, Le Mans, Tours, Châtellerault, Poitiers, Angoulême, Barbezieux, Bordeaux, Bayonne, and Biarritz, some 700 miles being accomplished in four days.

Reception of Daventry

Whilst travelling on the roads of France, the new Daventry station was received at great power, and one of the first items of news received was that the Chelmsford station had been burnt down:

this being heard between Le Mans and Tours whilst the car was travelling at some 30 miles an hour. The foreign stations of Radio-Paris and Eiffel Tower were received equally well by day and night. Listening-in during travelling brought many interesting points to my notice. First there were a considerable number of "silent spots," but they would only last a few seconds. Such "fading" occurred very often in the open for no apparent reason. On other

immediately detected. To eliminate this interference completely it was necessary for the engine to be completely at rest, as switching off the engine only, *e.g.*, short-circuiting the magneto circuit, increased interference instead of reducing it. One of the remedies to car interference would appear to be screening the magneto altogether, and also the heads of the sparking plugs. I propose trying this arrangement on my return. Reception was quite impossible



The car being landed at Dieppe. Note the waterproof covers over the wireless apparatus.

occasions, the difference in signal strength could be easily explained by the screening of trees and also by the very marked differences which one could notice when passing down through a valley and on the apex of a hill where signals were received with maximum strength. This was to be expected. In villages where I anticipated a certain amount of screening, I often received louder signals than in the outskirts. The question of interference from the electrical gear coupled to the engine of a motor car is evidently a point which will have to receive the consideration of motor engineers of the future. The magneto could be clearly heard superimposed on any signal I was receiving; it was slightly unpleasant but was not sufficiently strong to hamper the reception of either speech or music. When coasting down hills with the engine stopped the difference, however, was very noticeable. Incidentally, it provided an excellent method of following the running of the engine, as the slightest misfire in any one of the six cylinders was

while the lighting dynamo was charging, and in order to make reception possible I disconnected this instrument altogether on the early stages of the journey, and relied for lighting on my main and spare batteries only.

Interest Shown

In every town through which the car passed enormous interest was evoked by the wireless apparatus. Crowds quickly gathered round the car at every stoppage, and interesting and curious remarks were passed, many questions being asked by the more bold onlookers. As one enthusiastic spectator in Rouen exclaimed, "Ca c'est du vrai tourisme." This remark pleased me to no small extent.

The Set and its Travels

The set proper was enclosed in a leather case which I had previously had made for the transport of the set by rail. Under such conditions this very set had already travelled some 5,000 miles on the Continent when I took it down to the south of Italy and to the north of Germany.



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It is in resistance to adverse effects that **MH** Components conclusively demonstrate their superiority.

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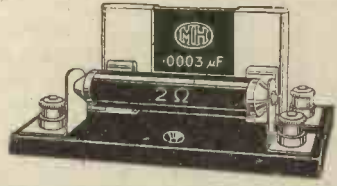
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IT is a remarkable fact that the Wuncell—alone among Dull Emitters—actually improves with age. Whereas in most dull emitters the filament loses much of its emission through course of time, that used in the Wuncell actually gains in productivity of electrons.

The Wuncell filament is unique. It is built up layer upon layer under an entirely new process. As a result it is exceptionally robust. When next you get the opportunity to examine a Wuncell compare its filament with that used in any other dull emitter—or even in any bright emitter. You will be amazed at its thickness. It is practically as stout as that used in the average

bright emitter. Yet its wonderful economy of current will enable a six-volt accumulator (with its cells re-connected in parallel to give 2 volts) to give 70 hours' use where it gave but 9 before.

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 W3 Cossor Loud Speaker Valve
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 Price 18/6

Cossor



through Holland, Switzerland and Belgium, before affixing it to the car. It is interesting to note that, although a further 2,500 miles have now been covered by road with the set affixed as described, yet the seven valves are working just as well to-day as they did when the set was first bought. This is all the more extraordinary when one considers that certain of the French roads were very bad indeed, and that the platform on which the set

Dieppe. The leather case containing the battery was placed underneath the side of the running board, and was the original one made for rail travelling.

Entering Spain

The first real difficulty encountered with regard to the wireless equipment was that placed by the Customs officials on entering Spain. The "Guardia de la Aduana" strongly objected to my using wire-

second inspection the building proved to be headquarters, so he was not really at any time in danger. The "Guardia Civil" were men who would stop the car from time to time, and very many more times than we would have wished, thoroughly examining our papers in all cases. Travellers on the Continent very often complain of the nuisance of having to show their passports, but those who travel by car have a special portfolio containing the mass of papers equivalent to a dozen passports, and all of these had to be examined by the Civil Guards, each having his turn, and both dwelling for some considerable time on each paper in order to appear as if he understood something of what it was about. As these papers were mostly written in English and French, and as it is a noticeable fact that in Spain no other language than Spanish is known, it was necessary for them to spend this amount of time in order to save appearances.

Driving Licences

In Spain a permit to drive is not issued for the country as a whole, but for one county only, and this has to be renewed for each county which the motorist enters. Although I passed through some six or seven counties, however, I only took out one permit. I expect that my wireless papers dazzled the four eyes of the "Guardia Civil," for they never appeared to be aware of this breach of regulations.

San Sebastian

The first Spanish town of interest that we reached was San Sebastian, which may be regarded as the Biarritz of Spain. The town is delightfully situated on a picturesque bay, which makes it an ideal seaside resort with its imposing Casino, and the towering Monte Igeldo, with its beautiful hotel, which dominates the whole town and bay. On this imposing cliff a wireless station has just been erected, and as these lines are going to press it is carrying out tests on 856.6 k.c. (350 metres). The gear which was installed is a standard Western Electric 500 watts transmitting equipment. The station will no doubt prove very efficient, and will certainly be easily received in Great Britain, as there appears to be no screening whatever, and the aerial dominates all the neighbouring country with the sea on the north side. The aerial is very similar in form to the one installed at Zurich—two steel lattice masts, with a cage aerial and sheet counterpoise.

(To be continued.)



Whilst lunching at the Café de Bordeaux, large numbers of people examined the car and apparatus with great interest.

is lashed is quite rigidly affixed to the running board by means of iron stays, thus no elastic suspension is provided. I carried three spare valves on all my travels, but I have not had to use them yet. The only change I had made to the leather valise which contained the set for rail travelling was to have the lid made entirely detachable, so that it could be removed when required without hindering the steering. The tuning dials were thus made perfectly accessible immediately at the right of the driver. In view of possible rain a further cover, the shape of the case, was provided, which could be slipped over the case to protect it in such an emergency. The frame aerial, which also possessed a leather case for rail travelling, was not taken on this occasion, but was affixed to the car as it stood. A special waterproof cover, however, was made to shape and carried on board. It can be slipped over the frame in a similar manner to the way in which a tennis racquet is protected from the weather. These two waterproof covers can be seen in position in the photograph, where the car is shown being hoisted ashore at

less in their country, which is at present at war, without my previously having taken out a licence and made a declaration that I was a Spanish subject, and several other formalities which I did not quite understand. I do not want to enter into all the words which were exchanged during the two hours that I was detained, suffice it to say that, after these two hours, I was gaily listening to the Savoy Hotel afternoon dance music, and enjoying the bright Spanish sunshine, the warm Spanish breeze and the beautiful Spanish scenery. Unfortunately, Spain is overrun with "Guardia Civil," armed to the teeth with rifles, pistols, revolvers and daggers, who resembled pigeons both by colour and shape of the tails of their coats, and because they were always seen in pairs. There was an exception to this, however, as on one occasion we saw a "Guardia Civil" alone, and one of my party remarked, "He must feel frightened." He was not frightened very long, however, as he was standing close to a door, and although we passed him very quickly, we just had time to see his companion come out. On

A Year's Work

The Editor reviews the progress made by "The Wireless Constructor" in the course of its first volume

LAST month saw the completion of our first volume, and with this issue we commence the second volume of THE WIRELESS CONSTRUCTOR with a special Birthday Number. The progress made during the year, and the extraordinarily wide popularity which the journal has achieved, can only have resulted from a policy which filled a real gap in the world of wireless journalism.

Simple Instructions

Prior to the advent of THE WIRELESS CONSTRUCTOR, there was certainly no paper which catered specially for the beginner in providing simple and yet entirely trustworthy and practical instructions in the building of sets, with only the most elementary theory, and this was the gap that THE WIRELESS CONSTRUCTOR was intended to fill. Its success in so doing can best be gauged by the certified net sales of over 253,000 per month.

It has been our constant endeavour to produce sets which shall retain the ultra-simplicity and ease of construction which our readers demand, and yet shall be of refreshing interest and novelty, so far as this may be done without sacrifice of reliability. At the same time, it has been our hope to maintain the interest of the more advanced constructor, and the appearance of such sets as the Anglo-American Six, and the Twin-Valve Receiver, with the popularity which they have won, lead us to believe that the constructor of more advanced technical knowledge has appreciated our efforts.

Appeal to the Beginner

Moreover, the fact that our magazine was intended to be of a nature to appeal even to the beginner has not prevented us from giving in this journal the first descriptions of a number of important new developments. One need but take such examples as the original article by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., describing the Resistoflex circuit, and the first description of the method of assembling a Neutrodyne circuit

with the aid of a form of plug-in transformer, to remind the reader that we have not failed to keep him supplied with the latest technical information.

The Crystal User

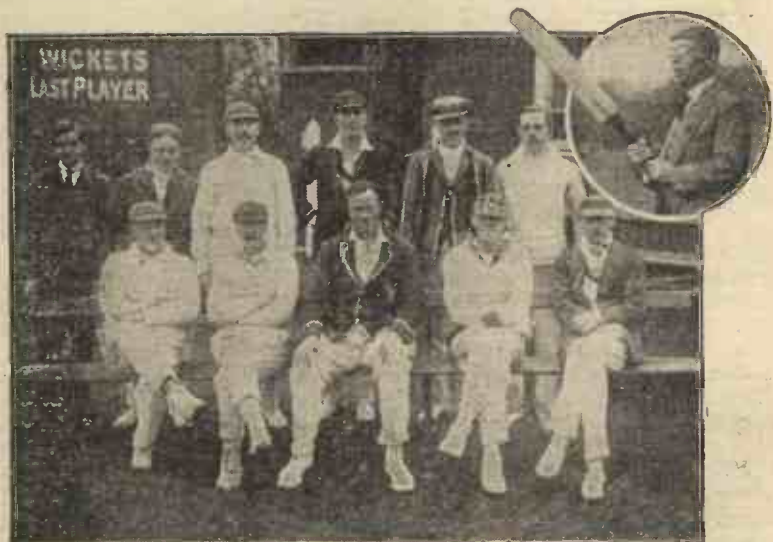
The success which has been achieved by THE WIRELESS CONSTRUCTOR must be based to a considerable extent upon the fact that we have at all times endeavoured to keep very closely in mind the needs of the crystal user. Not merely have we given a long succession of new and interesting designs for crystal sets, each of which presented some special point of interest, and each of which could claim some special merit, but also we have made a point of giving a number of articles of a general type intended to enable any given crystal user to obtain yet better and more satisfying results from his set. Some of these were of an instructional nature to enable him to understand the working of his receiver, while others were of a severely practical nature, such as those giving him instructions on the fitting of a new crystal in the

detector, operating the set and maintaining it in the most sensitive condition, and so on.

The Elstree Laboratories

With the opening of the great new Radio Press Laboratories at Elstree there became available to our readers some very important advantages which cannot be obtained from the magazines of any other wireless publishers in the world. This fact will undoubtedly play a great part in still further popularising THE WIRELESS CONSTRUCTOR, for our readers have already realised the very great advantages which they will derive from the operations of this new organisation.

In the establishment of these Laboratories our readers have seen a very significant indication of the future policy of this journal, in common with those of all the other Radio Press publications. It is our intention that this magazine shall present the most up-to-date and progressive articles of unimpeachable technical dependability that it is possible to produce, and in this aim the Radio Press Laboratories will of necessity play a large part.



The B.B.C. Cricket Team, which has completed a very successful season. Inset:—John Henry holding up Jack Hobbs' autograph bat for auction.



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THE only Super-Heterodyne circuit designed for Broadcasting conditions existing throughout the world *excluding the U.S.A.* The Broadcasting conditions existing in the U.S.A. do not prevail in any other part of the world.



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"As mentioned in my previous letter to you, wonderful results are still regularly and consistently received on my Duodyne V at home. The latest result to hand, the write, being at sea, is, up to August 3rd, the loud-speaker reception of KFI, Radio Central, and KHJ, THE TIMES, PACKARD MOTOR CAR BUILDING, LOS ANGELES, CALIFORNIA. Time of reception, 05.15 G.m.t. to 05.50 approx. G.m.t. Loud speaker medium strength, signals then weakened, but excellent phone reception was possible from Los Angeles until 06.30 G.m.t., which is 7.30 a.m. standard time and full daylight. Other stations heard were WTAM, WJL (special test), KGO and XAD, two latter stations unknown—possibly American.

The above mentioned results were obtained on the ordinary £18 18s. Od. Model of your manufacture.

Hope I am not boring you with this long account of results, but anyone wishing to receive long-distance broadcasting—specify the Duodyne V, and extreme satisfaction and many hours of enjoyment will result.

F.V., s/s, ———."

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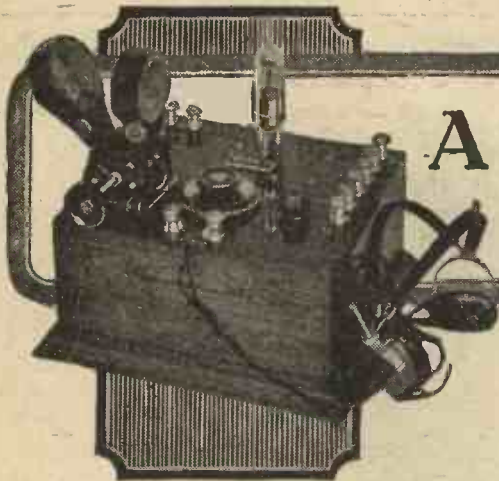
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All Curtis Productions are on demonstration at the Wireless Exhibition, Horticultural Hall, October 10-16th, 1925 (inclusive). Stands Nos. 27, 28, 29.



A DETECTOR AND AMPLIFIER IN ONE

By A.S. CLARK

EVERY constructor who has a crystal set is bound at some time to want to construct a valve set, but whether to construct an L.F. amplifier for his existing set, or to make an entirely separate set, is often a difficult question to settle. The set to be described is a combination of the two, and can be used either as a single-valve receiver with reaction on to the aerial circuit, thus making it possible to bring in the more distant stations, or as a single-valve amplifier to increase volume. This double purpose is obtained at a cost only very little more than that of an ordinary single-valve receiver. But this is not the only advantage.

Use as a Change-over Set

A switch is provided which makes it possible instantly to change from the crystal set and L.F. amplifier to the single-valve circuit with reaction, at will. So it is possible to have two stations tuned at once, and to change from the programme of one to that of the other in a second. The local station may be tuned in on the crystal receiver; and a weaker one on the single-valve circuit, the reaction making it possible to hear a station which cannot be heard on the crystal set. If a station is at all strong on a crystal set, signals are generally more powerful if an L.F. amplifier is added than they would be if received on a single-valve set with reaction. This is another advantage which the apparatus has over an ordinary one-valve receiver.

The Circuit

The theoretical circuit is shown in Fig. 1. Constant aerial tuning is provided, as it may be found an advantage, and the aerial tuning for the valve as a detector is by means of the variable condenser C_3

in parallel with the coil L_1 . The terminals to the left are for connecting to the crystal set, and how to do this is explained later.

The Reaction Coil

It will be noticed that the reaction coil L_2 remains in the plate circuit whichever way the valve is used. It is unnecessary to have it shorted when using the valve as an amplifier, as practically the only currents in the plate circuit then are low-frequency currents, and the reaction coil will offer a negligible resistance to these.

Components Used

Before describing the construction in detail, a list of the components required will be given. This is useful in enabling the constructor to collect all the necessary parts together before commencing work. As a guide, and as a matter of interest to those who wish to use exactly the same make of components, the manufacturers'

names supplying those used by the author in the original set are given. But it must not be taken as imperative that these makes be used, as any others of equal quality and suitability may be substituted.

Radion black panel, $9 \times 10 \times \frac{3}{16}$ in. (American Hard Rubber Co., Ltd.).

"Super-Success" L.F. transformer (Beard & Fitch, Ltd.).

Two-way coil-holder (Peto-Scott Co., Ltd.).

Bradleystat filament resistance (R. A. Rothermel, Ltd.).

Two-pole two-way switch (Wilkins & Wright, Ltd.).

.0005 μ F square-law variable condenser (A. J. Stevens & Co., Ltd.).

.0001 μ F fixed condenser (L. McMichael, Ltd.).

.001 μ F fixed condenser (Peter Curtis, Ltd.).

.002 μ F fixed condenser (Herbert Bowyer & Co., Ltd., Dorwood).

.0002 μ F condenser with grid-leak

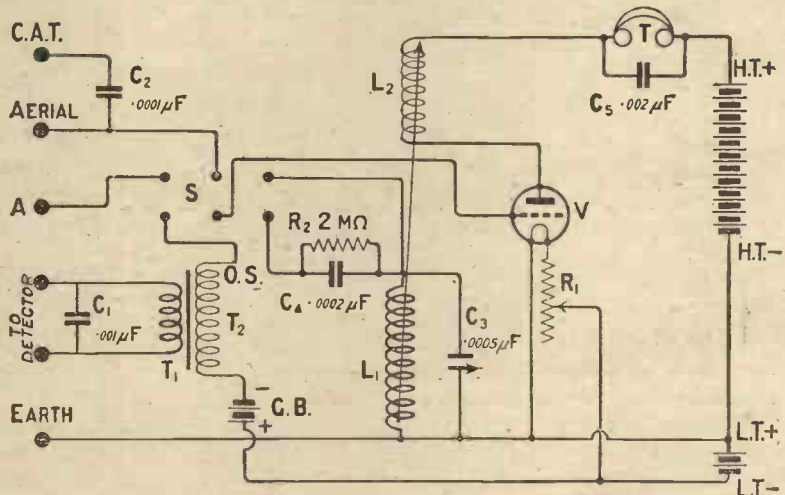


Fig. 1—The circuit shown diagrammatically. The change-over switch is marked S.

clips (Herbert Bowyer & Co., Ltd., Dorwood).

Two MΩ grid leak (Dubilier Condenser Co., Ltd.).

Fourteen large terminals.

Four valve legs.

Sundry screws, square wire flex, etc.

Radio Press panel transfers.

Suitable cabinet (W. H. Agar).

Drilling the Panel

Having collected together all the necessary parts, the construction may be undertaken. This is not difficult and will not occupy a very long time, since it is quite straightforward in every detail.

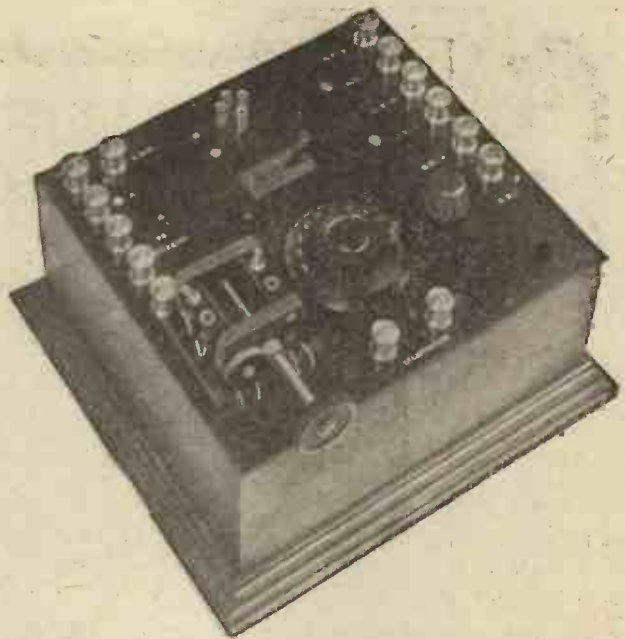
First of all, we must drill the panel. Fig. 2 shows a diagram of the necessary holes, and it is drawn looking down at the top of the panel. It will therefore be necessary to remember to reverse the positions of the holes when marking out with a scriber on the back of the panel. But this operation will be greatly simplified by obtaining a copy of the drilling diagram in the form of a full-size blueprint from the publishers, price 1s. 6d., post free. No. C1022A should be mentioned. The blueprint can be laid on the front of the panel and the points to be drilled pricked through with a sharp point. When drilling, the panel

should be laid on some sheets of tissue or soft paper so as to protect the surface. This is especially necessary if the panel is polished.

The holes through which screws pass to hold the various components to the panel should be countersunk so that the heads of the screws come flush with the panel.

Mounting the Components

When the drilling operations are completed, and before the components are mounted, is the best time to apply the panel transfers. If they are left until the set is complete it will not be so easy to apply the hot-pad. The necessary transfers to fix on, and the correct positions to apply them, are shown in the drilling diagram of Fig. 2.



When the switch is over to the right the unit is used as an amplifier. For use as a single valve receiver the switch must be over to the left.

Assembly

Mounting the components is an easy job, the only point to remember is to mount the small parts such as terminals and fixed condensers first. If this is not done, the weight of such things as the transformer will make the panel unwieldy to hold.

Preparing for Wiring

Having tightened up the last nut, the set must be prepared for wiring. This consists of cleaning all points to which soldered joints are to be made, and generously tinning them. Where terminals are provided, such as on the variable condenser and the transformer, it is only necessary to twist the wire into a loop and place under the terminal screws, and secure by screwing down with a pair of pliers. Or, if desired, soldering lugs may be placed under the terminals and the wire soldered to these.

Wiring

Inserted in this issue will be found a full size free blueprint of the wiring of this receiver. This must be followed carefully, as a single error is capable of preventing the set from working at all, or of burning out the valve. The work of wiring should not present any difficulties, there being only one point which needs special mention. This is the grid leak and condenser. It will be seen that there are three soldering lugs, and they are referred to as the top, middle and bottom. As the grid leak has to be in parallel with

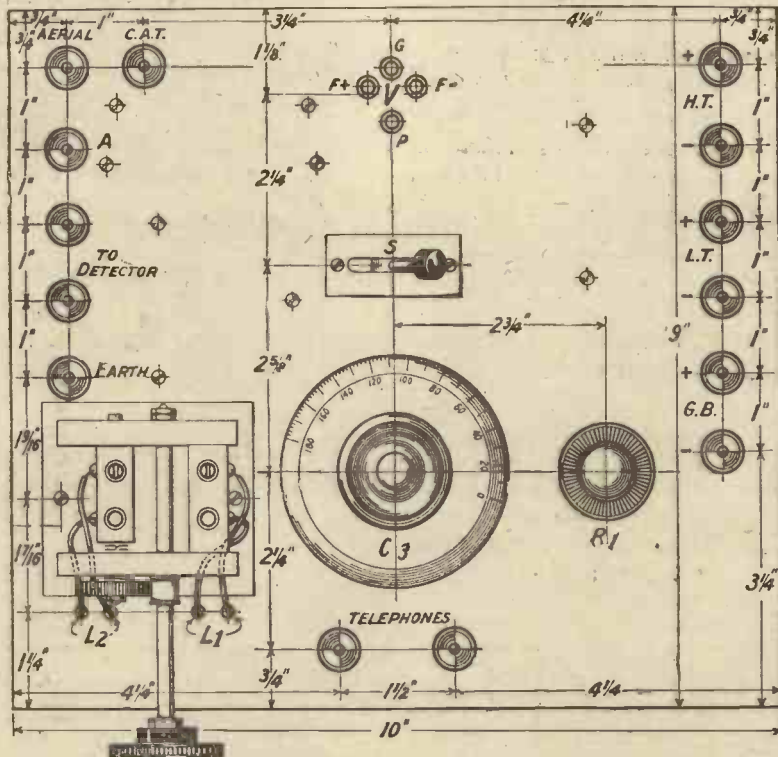
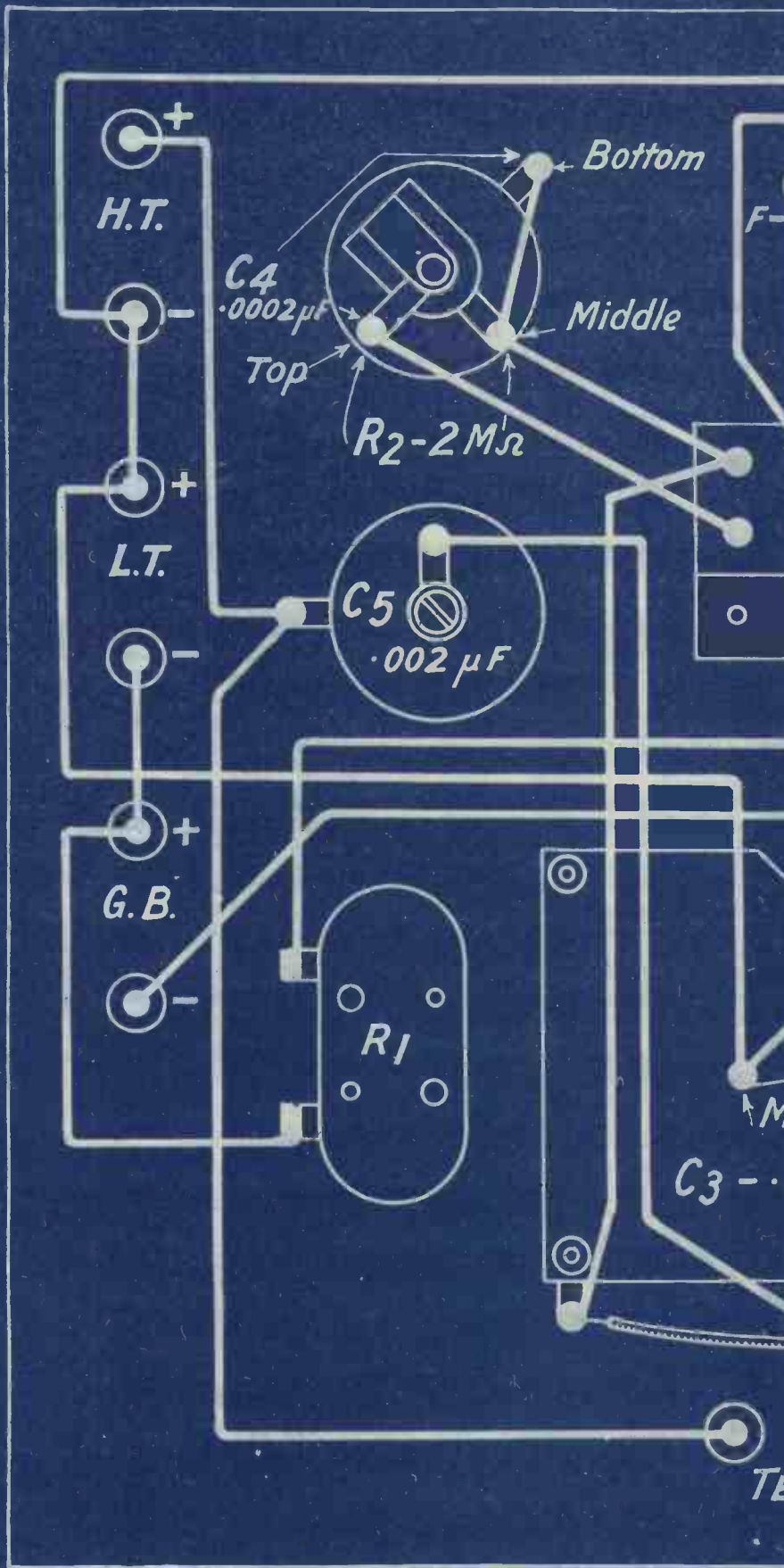
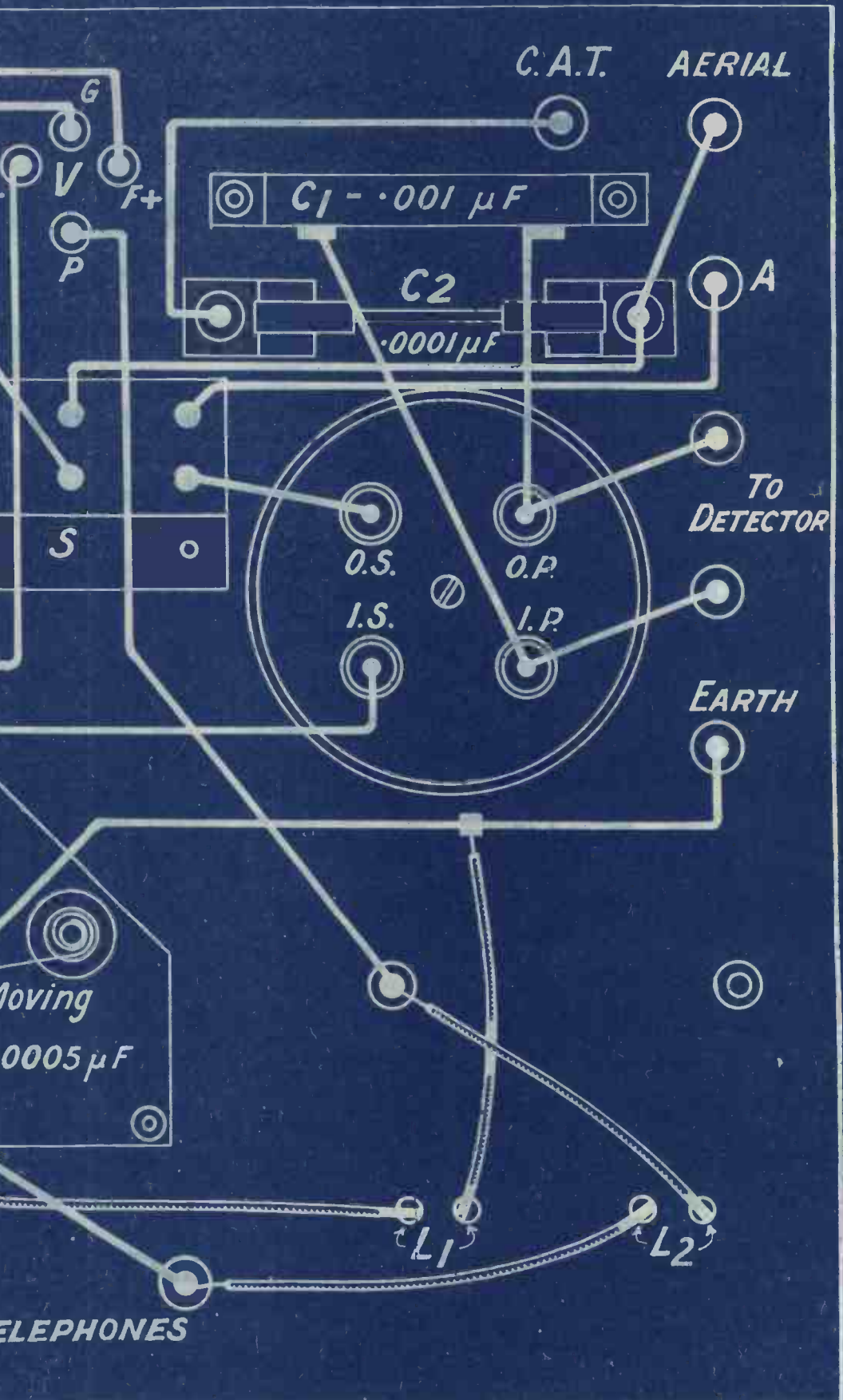


Fig. 2.—The panel transfers may be put on as shown here. Blueprint No. C 1022A.

A DETECTOR AND AMPLIFIER IN ONE







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the grid condenser, it is necessary to join two of these lugs together, and then to treat them as one. The two to join together are the middle and bottom ones.

When the wiring is complete, the receiver is finished, and it has only to be fixed in its cabinet before trying out.

Connecting Up

Fig. 3 shows how the crystal receiver is connected. The terminal A goes to the aerial terminal of the crystal set, the two terminals marked "To detector" go to the crystal set telephone terminals, and the earth lead is connected to "Earth," which is in turn connected to the earth terminal of the other set. The aerial is placed on the terminal marked "Aerial," or, if constant aerial tuning is required, on to the terminal "C.A.T." The battery and telephone terminals

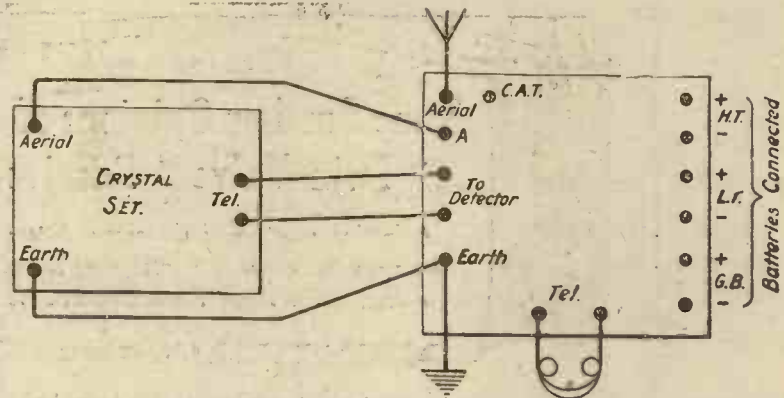


Fig. 3.—Showing how the unit is joined up to a crystal set. The batteries are connected in the usual way to the terminals at the right.

amplifier, and to the left for use as a single valve set. In other respects the working is the same

miles from 2L.O. The aerial, although moderately high, was short. The change-over switch did all that it was intended to, it being possible to leave a very weak station tuned in on the single-valve circuit and to switch back to it without having to alter the tuning whatever.

Reception

First of all the set was tried out connected to an ordinary crystal receiver. A general purpose dull-emitter valve of the .06 amp. type was used with 60 volts on the plate. London was received louder with the unit as an amplifier than as a single valve receiver, but in both cases signals were almost too loud for the telephones, and would probably have worked half a dozen pairs with ease.

Signals from Daventry

Daventry was received better on the single-valve circuit, and (Continued on page 79.)

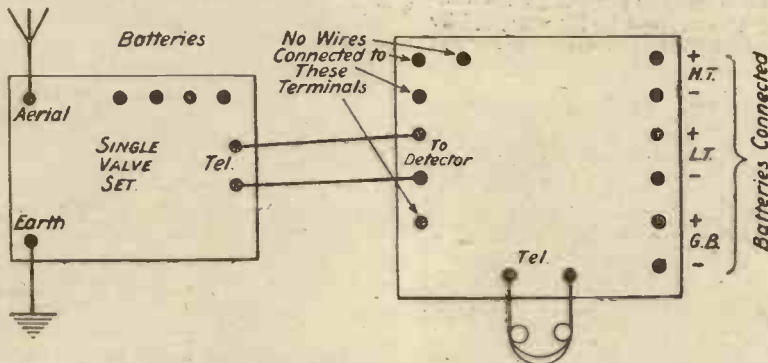


Fig. 4.—When in use as an amplifier after a valve set, connections as above should be made.

of the valve unit are self-explanatory, and are connected in the usual manner.

Valves to Use

Any type of general purpose valve may be employed, and it may be either of the bright or dull emitter variety. The H.T. should not be too high, as it has to be suitable for detecting as well as amplifying. Anything up to about 66 is suitable. The value of the grid-bias must be found by trial, that giving the best quality when using the set as an amplifier being employed.

Adding to a Valve Set

If it is desired to connect the set as an amplifier to another valve set, the connections to make are as shown in Fig. 4. The terminals "A," "C.A.T.," "Aerial" and "Earth" are neglected. Common batteries may be used for the two sets, and the switch has to be over to the right.

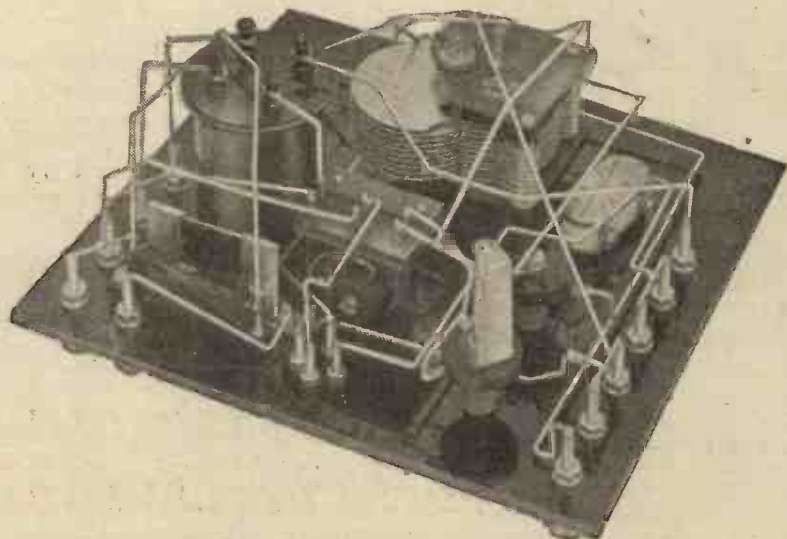
Working

When the set is connected to a crystal receiver the switch is placed over to the right to use it as an

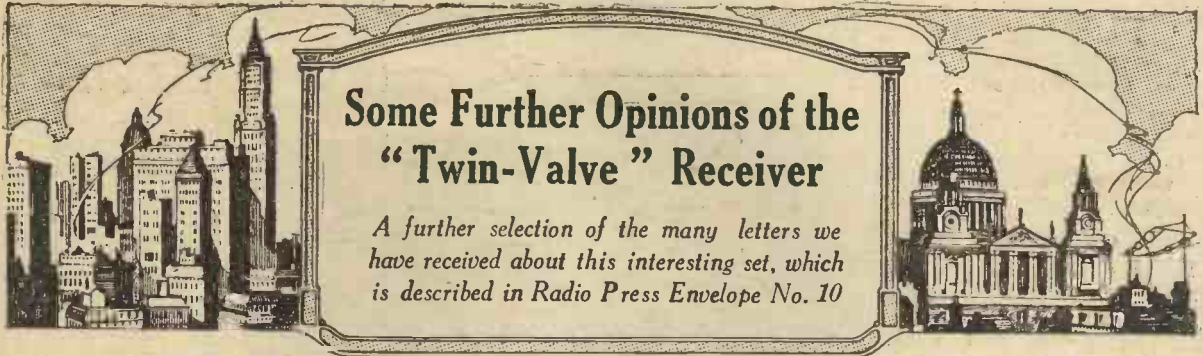
as any apparatus serving one purpose only.

Test Report

The receiver was given a thorough test in S.W. London at about 10



The connections to the change-over switch should be carefully noted.



Some Further Opinions of the "Twin-Valve" Receiver

A further selection of the many letters we have received about this interesting set, which is described in Radio Press Envelope No. 10

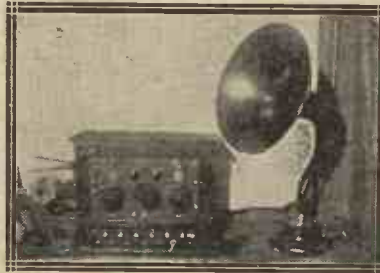
SIR,—I have been a regular reader of your three popular journals, *Wireless Weekly*, *THE WIRELESS CONSTRUCTOR* and *Modern Wireless* ever since No. 1 of each book was printed. I just had an ordinary crystal set until three months or so back, when I naturally developed a longing for a valve set, which I now have, and of which I enclose a photograph. It is the "Twin-Valve Reflex" as described by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., in Radio Press Envelope No. 10, and I am very proud to own a set so good, even though it is my first attempt at a valve set. I have kept to your directions almost to a screw; but some of the components are of different makes from those given, and I have incorporated a few switches. All the other parts that are used are the same as Mr. Scott-Taggart used. Also I have put the unsightly batteries in the box out of the way.

The three switches are for cutting the L.T. and H.T. batteries completely out. The reason for my adding these is to enable my people at home here to use the set whenever I am not there, as they would not touch it otherwise, for fear of damaging the valves. Whenever I leave it I set it for London, and then all they have to do is to put the switches in and then enjoy the wireless. At night time when all the stations have closed down I just pull out these switches as well as a main aerial and earth switch which is outside and leave the valves and coils in. The valves are a D.E.R. and B3 (B.T.H.), and I use Igranite coils.

Now for a few results. London is really too loud on a Baby Sterling, in fact, when I point it to the window, neighbours at 80 yards away can hear music comfortably. All the English and Scotch stations I get quite easily, most of them on the loud-speaker at a nice strength. Madrid, Hamburg and Petit

Parisien I receive at loud-speaker strength. I also get quite a lot of unknown stations.

I have had quite a few wireless experts to view and listen to the set, and most of them say it is the clearest and loudest for its size they have ever heard. Considering my aerial is only 24 ft. high on low-lying ground and badly screened by houses, with the Metropolitan Railway Power Station close by, I think



The "Twin-Valve" Receiver
made by Mr. E. Cornish.

I get very good results. I take this opportunity to thank Mr. Scott-Taggart for publishing such a good set, and to wish your journals further successes.—Yours faithfully,
E. CORNISH.

Neasden, N.W.10.

* * *

SIR,—Having read the letters published in the July issue of *THE WIRELESS CONSTRUCTOR* regarding Mr. John Scott-Taggart's "Twin-Valve" Receiver, described in Radio Press Envelope No. 10, I should like to confirm the various reports as to the excellence of this circuit. Both for power on the local station and range it would be hard to equal, but it is as a portable set that I am particularly pleased with it. I have just rebuilt the set in a suit case with a frame aerial in the lid. Signals at six miles from 2I.O are so strong that the set has to be detuned slightly for comfortable hearing, and although I have not had the opportunity yet of taking it further afield, I have no doubt that it would

have a considerable range on the frame.

Thanking you for publishing such a fine circuit, and wishing your excellent papers every success.—
Yours faithfully,

C. H. MARRIOTT.

Bedford Park.

* * *

SIR,—Not having seen many reports on the "Twin-Valve," I think you will be pleased to hear my experiences with that circuit. I can claim to some experience, having been an experimenter for several years, and having built many sets, the "S.T. 100," which is improved for distance by putting the crystal in the anode circuit of the second valve, followed by the "All Britain," "Three-Valve Dual" in both forms, "Resistoflex," and several single-valvers. The best of all for distance, volume and flexibility is the "Twin-Valve." I have not yet heard any other disposition of two valves to approach it. On the B.B.C. wavelength tests I tested its capabilities. Every B.B.C. station but Swansea can be received, the more distant improved and found only by vernier condenser adjustments, seven German, three French, Zurich, Vienna, Budapest, and, at suitable times, Rome and two or three American stations. The aerial is long and low, earth is also $7/22s$, 12 ft. long, buried under aerial 6 in. deep. C.A.T. is always used. The secret seems to lie in a good grid-leak for V_2 . A variable resistance in grid-filament circuit of V_1 to the "Twin-valve" is a distinct asset. The "Three-Valve Dual" is the "big brother" to the "Twin," and brings 18 stations in at loud-speaker strength.

My congratulations to the Radio Press and all its publications, which are educating the wireless public more than any other source, and I can only wish them all the luck and good wishes from one of their many followers.

Yours faithfully,

A. W. H.

Oldham, Lancs.



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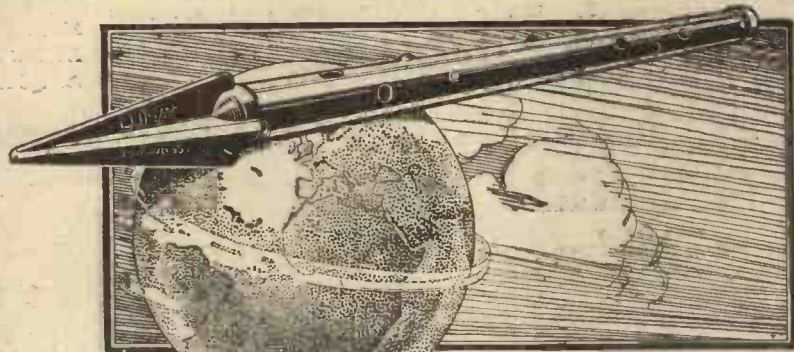
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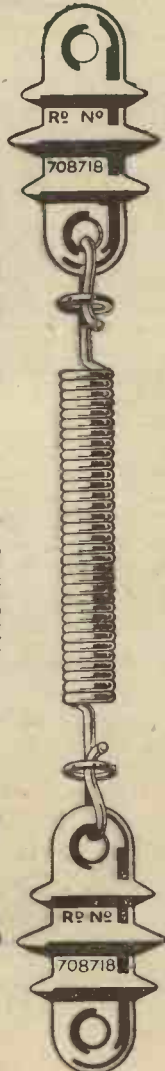
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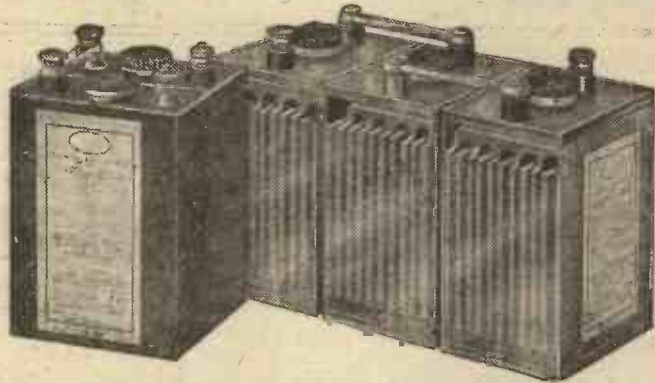
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Do you Charge your own Accumulators ?

By L. DUNBAR

Some notes on how to charge your filament batteries correctly, together with some precautions to be observed



Elimination of Fire Risk

NO doubt a number of you have followed the excellent advice contained in a recent article in this paper, and are now charging your own accumulators. Unfortunately, there are quite a number, even among those who charge accumulators for profit, who consider that the charging is merely a matter of connecting up and leaving till done (as the cookery books say). Although you may have some experience in this subject, I would warn you that there are at the present time frequent cases of fires caused by charging accumulators in celluloid cases from the ordinary house-service mains. The results are, of course, disastrous to the accumulators, and very often much more serious damage is sustained.

I have, however, no wish to deter you from charging your own accumulators. These fires are usually, if not always, due to carelessness or lack of experience, and, if the following points are very carefully observed, the liability to fire or accident will be eliminated and the charging may be carried out with safety.

Points to be Observed

1. *Don't use the dining-room table for a charging stand. Apart from the corrosive effects of spilt acid, cells on charge give off a quantity of gas which, on coming into the air, forms an inflammable mixture. Tiny particles of acid also come off with the gas. The room should be well ventilated, and charging carried out close to an open window.*

2. *Don't smoke, or allow*

any naked light, within at least 6 ft. of any cell on charge.

3. *When several accumulators are connected in series, and charged together, make sure there is a clear space of at least 1 in. round each separate container. This does not, of course, apply to several cells permanently cemented together.*

4. *All wire connections to batteries must be securely connected, and all battery terminals tightly screwed down. A loose connection is liable to cause sparking, and even a small spark can cause the top of a celluloid container to ignite, when the whole case will quickly flare up and burn away.*

5. *Keep the outside of the container as clean and dry as possible. Celluloid quickly loses its insulating properties when it becomes damp.*

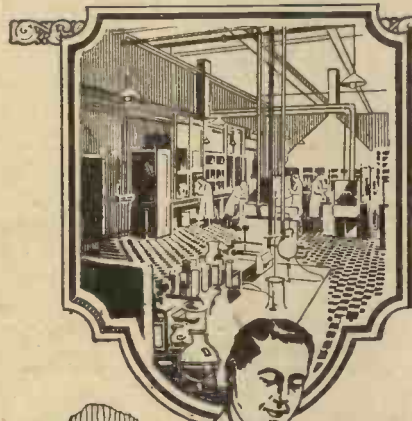
6. *Never stand an accumulator on*

wood or any other absorbent material, while on charge. If the accumulator is in a wooden carrying case, it must be removed from this case before being put on charge. When connected to any live circuit, all accumulators should stand entirely on glass, glazed earthenware, or porcelain, which should be kept clean and dry and there should be no woodwork or absorbent material within 6 in. of any one of the accumulators on charge, excepting, of course, the stand for supporting the glass or porcelain insulators. Special battery insulators may be obtained from an electrical dealer for quite a moderate sum, consisting of two flat glass cups which fit together. The bottom one has a circular groove in which oil is poured, and the top one fits into this groove. Even if



Early wireless apparatus at the Royal Albert Hall—Senatore Marconi (right) with some of the apparatus used in the first transatlantic experiments.

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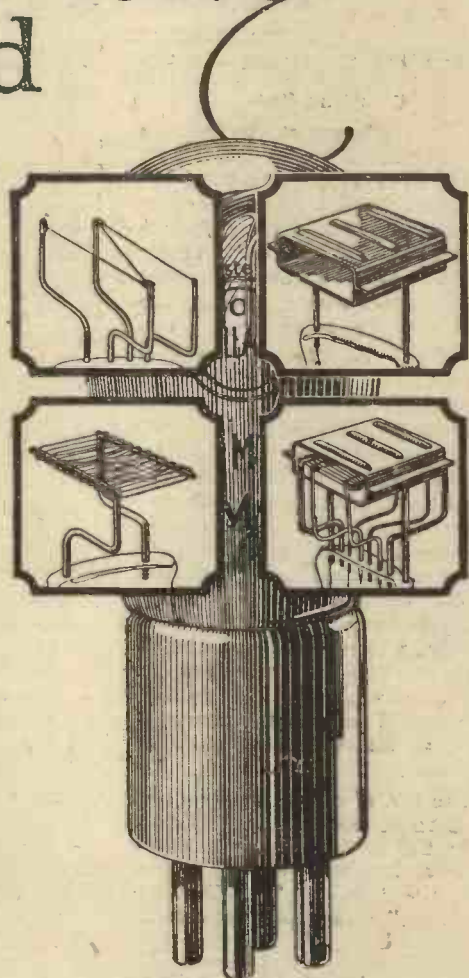
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the top cup becomes wet, the oil prevents leakage to the bottom cup, which remains dry. Failing this, a large glass dish or an earthenware bowl will form an excellent substitute; but be sure that the earthenware is glazed.

7. Don't forget to remove the gas vents before commencing the charge.

8. Keep the level of the liquid at least $\frac{1}{4}$ in. above the level of the plates by adding distilled water only. If any acid is spilt, or after long service, acid should be added only on expert advice.

Charging Rate

9. Don't charge at too high a rate. The reading on the ammeter should never be greater than the charging rate stated on the accumulator. If several accumulators are connected in series, the charging current must not exceed that given on the accumulator having the lowest charging rate.

10. Don't let the accumulators get very hot. The temperature of the electrolyte should normally be under 100°F., and if it rises above this the charging current must be reduced. Under no circumstances should the temperature be allowed to rise above 110°F. It is possible to judge by holding the outside of the case whether the temperature is rising too much, but it is far preferable to use a suitable thermometer, which may be purchased for a few shillings. The bulb of the thermometers should be inserted in the liquid and the thermometer moved at intervals from one cell to another.

There are, of course, many other details to be observed in order to obtain the best from your accumulators, but they do not come under the heading "Elimination of fire risk," with which this article is concerned.

The Charging Board

We will now turn for a few minutes to the charging board itself. It may be separately wired from the mains, or it may be provided with a flexible lead and adapter for inserting in a lighting socket. In the latter case particular care must be taken to avoid putting too great a strain on the house wiring, as lighting circuits are usually wired to carry a small current only. It should be a simple matter to find out from the contractor who installed the wiring, or the local supply authority, what additional current may be permitted on any particular circuit, after allowing for any lights or other appliances that may be in use on that circuit at the same time.

The Fuse

Should the additional allowance be, say, two amperes, then be sure that the reading of the ammeter on the charging board is never greater than this. On no account put in a stronger fuse on the house circuit to overcome the difficulty (should a larger current be required) except under expert advice. The fuse has been put there for safety, and a stronger fuse may constitute a danger.

A Combination Bearing and Mounting for Variometers

A SIMPLE method of mounting a variometer or variocoupler which may be interesting to the constructor is described below.

A variometer or variocoupler, light in weight, preferably made of thin ebonite tubing or cardboard, should be used in conjunction with this mounting.

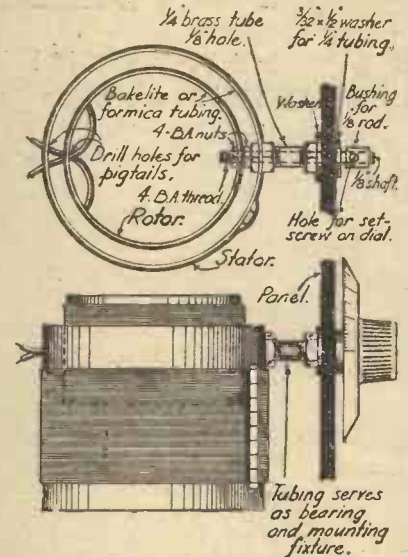
Details of the Mounting

The mounting consists of a $\frac{1}{4}$ in. brass tube about 2 in. long, with an inside diameter large enough for a $\frac{1}{8}$ in. brass rod to rotate freely inside, this rod to be about 1 $\frac{1}{2}$ in. longer than the tube. The tube should be threaded at both ends for about $\frac{3}{4}$ in. A brass washer should be threaded to fit a $\frac{1}{4}$ in. tube. A nut and a plain washer are now placed on one end of the tube, and the tube is inserted through the panel from the rear, through a $\frac{1}{4}$ in. hole.

Assembly

The threaded washer should be screwed on the projecting tube so that the end is flush with the face of the washer.

The nut on the inside is now tightened and the tube is rigidly held at right angles to the panel.



Constructional details of the bearing.

Two nuts are now screwed on the other end of the tube with primary of the variometer or coupler between them, but these nuts are not tightened until the secondary is in place.

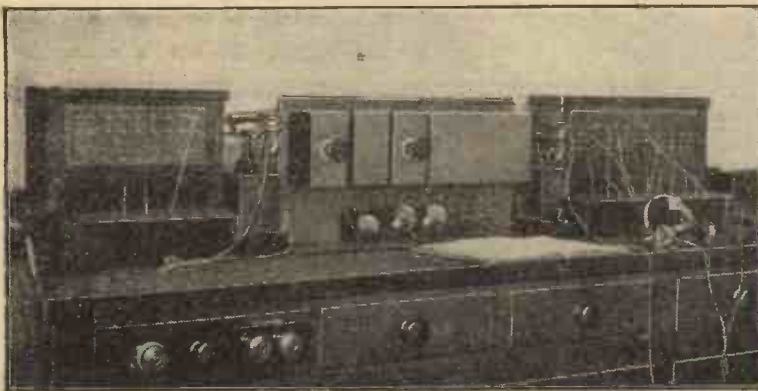
The Secondary

To mount the secondary, the rod is inserted in the tube from the outside and the secondary securely fastened on it between two nuts.

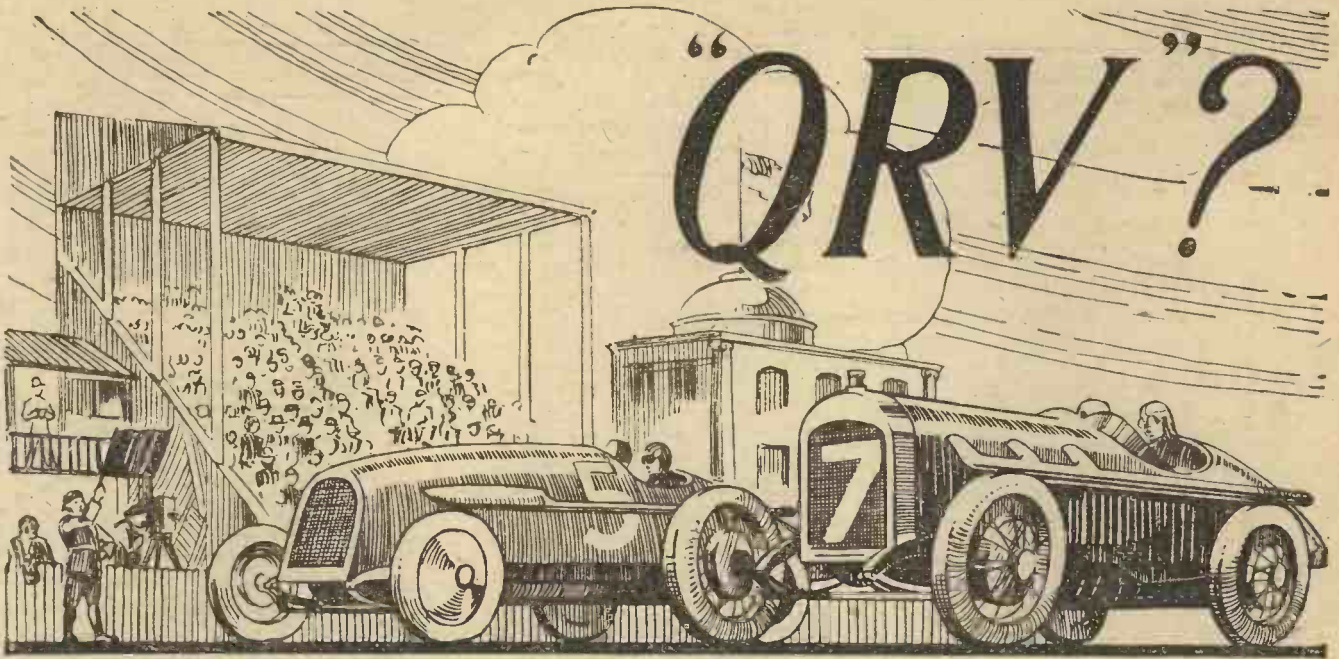
The secondary can be centred in the primary by moving the nuts on the tube backward or forward.

When the correct position is found, these nuts are tightened.

A bushing is made of a piece of $\frac{1}{4}$ in. brass tube $\frac{1}{2}$ in. long, to be slipped on the rod so that a standard dial may be employed. This bushing should have a small hole drilled through one side so that the dial set screw may be fastened on the rod beneath.



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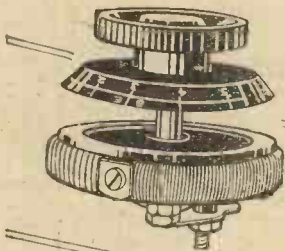
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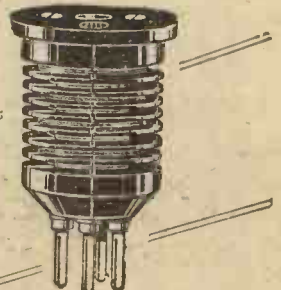
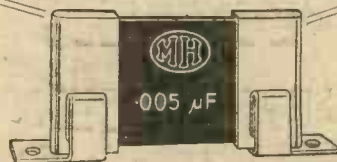


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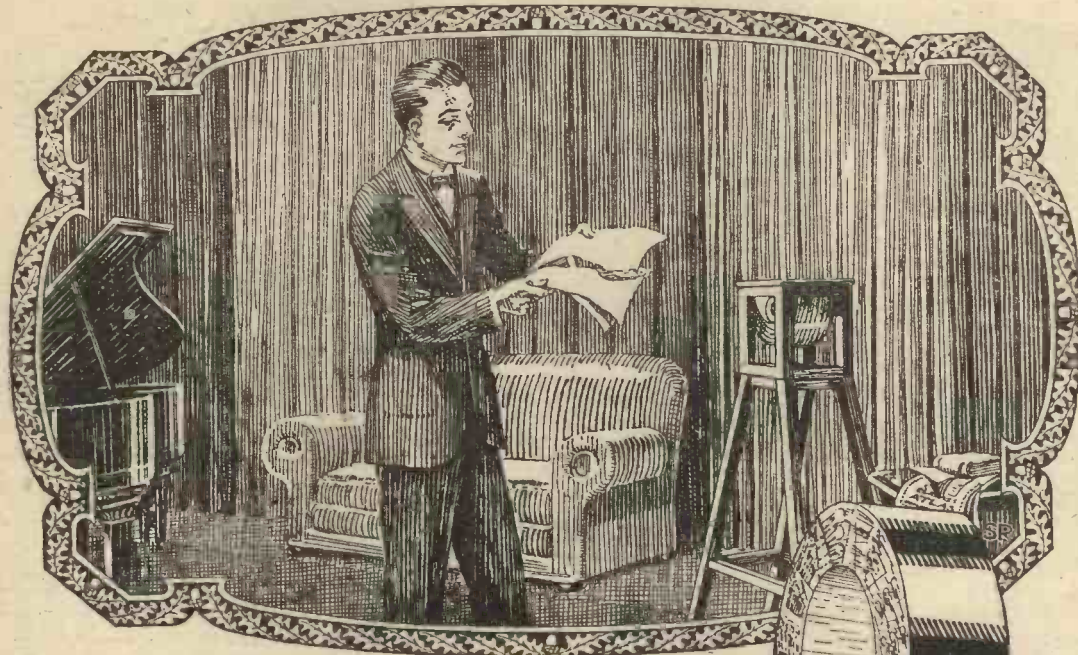
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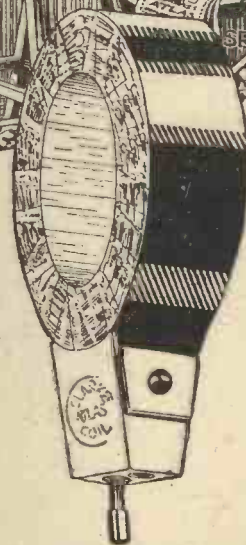


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Some Further Simple Experiments

By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., Staff Editor

In a previous issue Mr. Reyner gave some simple methods of illustrating the action of waves in a wireless receiver, and readers will be interested in the following further experiments

As a result of my previous article on "Some Simple Experiments" which could be carried out with readily made apparatus, and which was intended to describe some of the fundamental principles underlying wireless transmission and reception, I have received a number of queries. Some of these queries are in connection with the experiments which I described in the previous article, while others are suggestions for more experiments to describe different components of a wireless receiving set.

One of the queries which I have received concerning the previous experiments raises a rather interesting point. My correspondent refers to the experiment in which two pendulums were suspended from a

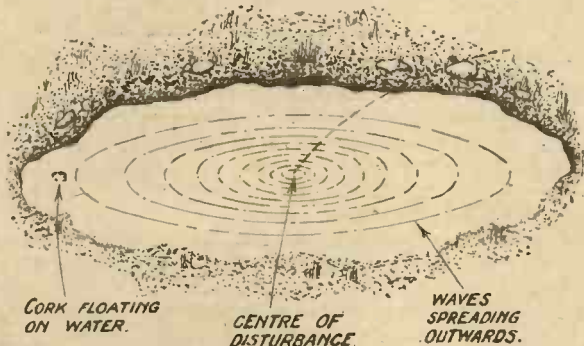


Fig. 1.—The waves, caused by the stone being thrown into the pond, travel outwards and make the cork move up and down.

common triatic fixed across the room. When one pendulum is set in oscillation the other pendulum at the other end of the triatic will also commence to swing if the length of the two pendulums has been adjusted to the same length, so that their times of swing are equal. No response will be obtained from the second pendulum unless it is tuned to the first pendulum in this manner.

Pendulums Suspended from Ceiling

My correspondent has tried this experiment and finds that everything works as described. Next, however, he tried attaching the two pendulums direct to the ceiling of his room, and he then found that the motion of the first pendulum had no effect whatever upon the other. From this he concludes that the motion was transmitted from the first pendulum through the string stretched across the room, and thus the second pendulum was affected.

This explanation appears to him to invalidate the whole experiment, for he says that he cannot understand how this is an adequate analogy of the condition of affairs in a wireless receiver, because in the wireless case there is no connection between the transmitter and the receiver.

The explanation is as follows: The impulses are certainly transmitted through the string, as my correspondent has suggested. And in the case of a wireless system the electrical impulses which are set up at the transmitting station are communicated to the receiving stations through the medium of the *aether*.

This *aether* is not easily defined. It is impossible for our minds, however, to conceive physically of any action at a distance without some medium through which the necessary force may be transmitted. If we wish to remove an apple from a tree which is beyond our reach, we may do so by using a long rod, by means of which we can cause the apple to be removed from its existing position. This is a simple representation of action at a distance.

In this case the medium through which the force was transmitted was the long rod, which of course is visible and tangible. If, however, we hold the apple up in the air and then release it it will drop. Why? Because of the ordinary everyday force known as gravity. Gravity is the attraction between the earth and other bodies, which causes the two to come together; or, in other words, causes the apple to fall to the earth. There must be some force exerted between the apple and the earth to enable this to happen, and this force must be transmitted by some means which we do not see.

If we take a magnet and hold it near a piece of steel the steel is attracted to the magnet, even although there is no visible contact between them. Here we have another form of action at a distance. The magnet exercises some force on the steel which must be transmitted through some invisible medium.

The Aether

In the same way, if we cause currents to flow in a wireless aerial we can produce disturbances which are capable of causing currents in other aerials many miles away. Here, again, the mind cannot conceive of such a state of affairs unless there is some medium through which this force is transmitted.

Now this question of a suitable medium has been troubling the minds of scientists and investigators for many years.

It is impossible, of course, in a short article to go very deeply into the question, nor would it be possible to convey very much impression without recourse to mathematics. We can say, however, that in order to account for these various forms of action at a distance, a medium has been assumed called the *aether*, which is supposed to exist everywhere and to permeate all matter. (Matter itself is assumed

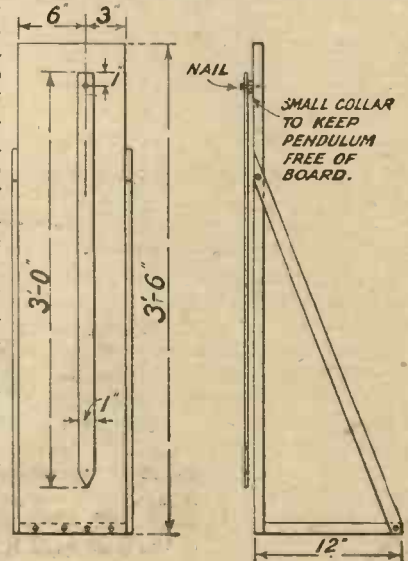


Fig. 2.—Construction of the apparatus for illustrating the action of a crystal detector.

under modern theories to be composed of a large number of atoms separated by relatively large spaces, so that it is possible to imagine a medium as permeating all matter and filling up the spaces between the individual atoms.)

Waves in the Aether

By giving this fictitious aether suitable properties, we can explain reasonably satisfactorily the various phenomena which are observed, such as the force of gravity, the magnetic force exerted by a magnet, or an electric current, and even the phenomena we get in wireless transmission and reception.

How this medium is supposed to convey wireless waves from one point to another may be represented by considering the aether as a sort of sea or a pond. If we have a pond such as is shown in Fig. 1, with a cork floating at the outside edge, this cork will normally rest more or less still and undisturbed. Suppose,

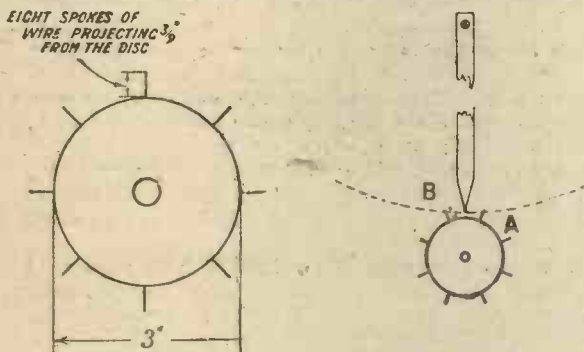


Fig. 3.—Details of the toothed wheel, showing how it is mounted in relation to the pendulum.

however, that we throw a stone into the centre of the pond. This stone will immediately create a disturbance where it enters the water, and this will cause ripples to spread out in all directions. These ripples will travel outwards, and will ultimately reach the cork at the edge of the pond, and will cause it to bob up and down.

In a somewhat similar manner, the current in a wireless transmitting aerial creates a disturbance in the aether, and these disturbances travel out like ripples on all sides of the transmitting station, and any receiving aerials which are set up will be affected by the ripples, and the electrons in the wire will be caused to bob up and down; or, in other words, we shall obtain currents in the receiving aerial.

Some Medium Necessary

We see, therefore, that in order to obtain any communication between the two points by wireless, or indeed by any means, it is necessary to imagine some medium as existing between the two points through which the necessary impulses can be transmitted. In the case of the pendulum experiment described in the previous article, we represent the aether by the string stretched across the room, so that if this string is removed then the experiment fails.

I should like to comment on the spirit which is exhibited by this reader. He was not content with just trying the experiment as I outlined it, but he went one stage further and met with blank failure when he tried to repeat the experiment with the pendulums attached to the ceiling. By so doing he has raised a most interesting point, namely, the necessity for some sort of medium before any impulses can be transmitted. It is this type of spirit which underlies all research work, and, indeed, is responsible

for all the progress which science has made since it first commenced.

Mechanical Analogy to Illustrate Rectification

With reference to some of the other queries, I have received several requests from readers for a simple experiment to demonstrate the working of a crystal. Now, the function of a crystal, or a valve detector is to rectify the currents which are received on the aerial. When wireless telephony is being received, the aerial contains a series of groups of high-frequency oscillations. These oscillations themselves are at a frequency of about one million in the case of the ordinary broadcasting, and neither the human ear nor the telephone receiver is capable of responding to such enormously high frequencies.

It is necessary, therefore, to adopt some method of rendering these currents audible, and what is actually done in practice is that the currents are passed through a crystal detector, which only enables currents to flow through it in one direction. The effect therefore is that there is a small pulse of current through the telephone for each group of high-frequency oscillations, and the aggregate of all these little pulses causes the telephone diaphragm to vibrate and give out a musical note.

Non-Return Arrangement

Now, the mechanism by which the crystal or other detector rectifies these currents is somewhat similar to the action of an ordinary non-return valve. But the effect will probably be understood better by the following mechanical model. Unfortunately, it is not possible to demonstrate this effect quite so simply as in the previous experiments, but the apparatus required is still comparatively simple.

For this experiment we require a somewhat more rigid pendulum than was used in the first experiment, and for this purpose a rod of wood 3 ft. long, about 1 in. wide and 1/4 in. thick should be obtained. One end of the rod should be tapered, as shown in Fig. 2. If a small hole is made at one end of the rod, which is then mounted on a suitable bracket, as illustrated in Fig. 2, we have a fixed pendulum which will swing in the same manner as the pendulum constructed from cotton thread with a weight at the end, which was described in the previous experiment. The pendu-

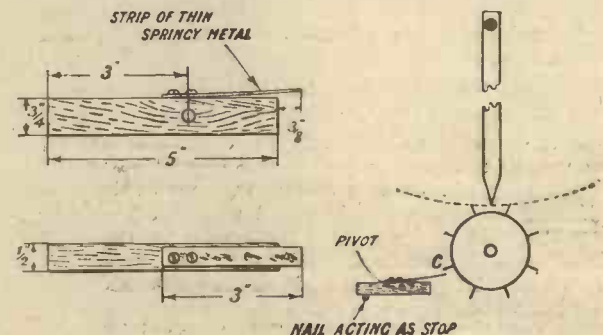
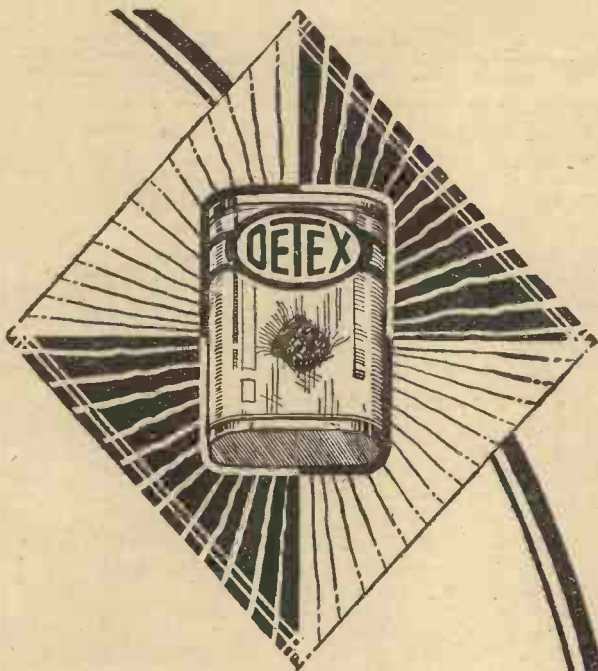


Fig. 4.—Details of the non-return device and how it is secured in position.

lum, of course, may be fixed to a wooden wall, if desired, instead of making up a special bracket.

The time of swing of this pendulum is again dependent on the length thereof, although in not quite such a simple manner as with the cotton-thread type. The swinging of this pendulum, then, will represent the oscillating currents in the wireless receiving aerial.



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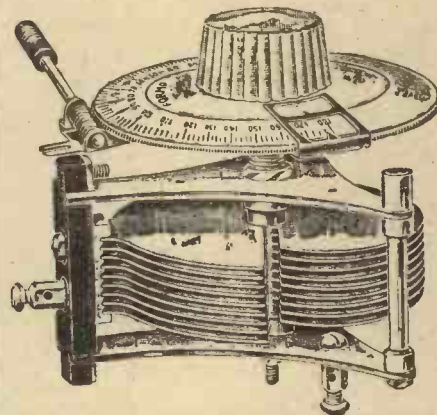
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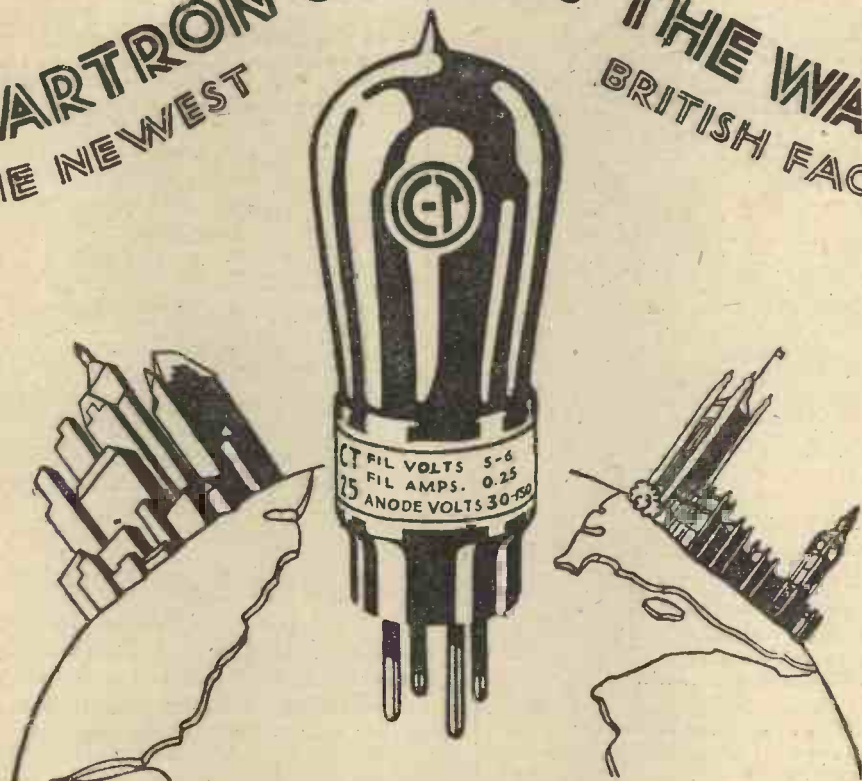
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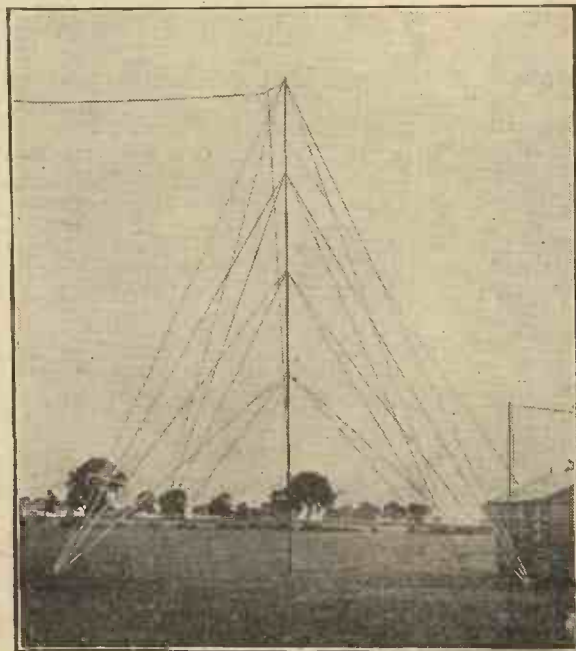
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The Telephone Receiver

We may represent the telephone in this particular case by a small wheel having a number of spokes radiating from it. This wheel may be constructed as illustrated in Fig. 3, and should be fixed to the same board as the pendulum. If the whole apparatus is mounted as illustrated in Fig. 4, we have the material for demonstrating the effect of a crystal in a wireless circuit.

If the pendulum is now set swinging and the wheel is correctly adjusted, the end of the pendulum, at each swing, will catch one of the spokes on the wheel and will push the wheel slightly to one side, causing it to rotate. On the return swing of the pendulum however, the end will catch the next spoke, B, in Fig. 4, and will push this to the opposite side, so causing the wheel to rotate slightly in the opposite direction. The net effect will be that the wheel will rotate slightly one way and then slightly back again, the final result after each swing being that the wheel is exactly where it was before, and however long the pendulum continues to swing, no resulting rotation of the wheel will take place, but only a slight oscillation from side to side. The wheel should be adjusted, relative to the pendulum, until this part of the experiment is working satisfactorily. This state of affairs corresponds to the high-frequency current in a wireless aerial, which will pass through the telephone receiver, but which will have no resultant effect, the



The B.B.C. has erected a receiving station at Hayes, Kent, where the programmes from foreign stations will be picked up for relaying purposes. Here is one of the aerial masts.

effect produced by one impulse being immediately cancelled by the next one.

Ratchet Device

In order to make the pendulum cause the wheel to rotate, we have to fix a small ratchet device, as indicated in Fig. 5. This is made up of a piece of thin strip of springy metal, mounted on a block of wood, and is arranged to rest lightly on the spokes of the wheel in the position shown in Fig. 6. The spring must not be too stiff or the pendulum will not

be able to overcome the resistance during its swing. A strip of cocoa tin serves the purpose very well. It will be seen that a nail is driven in underneath the block which prevents the right-hand side from moving upwards.

Consider, now, what happens when the pendulum is set in motion. On the first swing from right to left the wheel is moved round in an anti-clockwise direction. This causes the spoke C to push the block down out of the way, so allowing the wheel to rotate slightly. On the return swing of the pendulum, however, the wheel cannot rotate because the spoke C comes up against the spring, and the block itself cannot move out of the way because of the nail. This spring gives sufficiently to allow the pendulum to continue swinging, after which the spoke returns to its original position.

Consequently the net result of this one swing has been that the wheel has rotated slightly in an anti-clockwise direction. Correspondingly, at each swing the wheel will be caused to rotate one spoke, and the net result will be that a continuous rotation of the wheel will result, instead of just an oscillatory motion, as was the case in the first experiment.

Representation of Crystal Detector

This wheel with the spring attached to it, therefore, represents a crystal detector in a wireless receiver, in that it will permit rotation in an anti-clockwise direction, but not in the reverse direction. In an exactly similar manner a crystal detector will permit currents to flow through it in one direction, but not in the other direction. Just as in the mechanical case we have just considered the motion of the pendulum causes a definite revolution of the wheel in the second case, where the uni-directional arrangement was fitted, so in the wireless receiver the high-frequency oscillations will cause a more or less steady current to flow through the telephone as long as the signal lasts, provided a crystal detector, or other form of device, is incorporated which allows currents to flow through it more easily in one direction than in the other.

Care Required in Making Model

As was previously mentioned, this steady current through the telephone causes the diaphragm to move, giving a small click, and the aggregate of these several clicks, all occurring at a musical frequency, cause the telephone to give out a musical note, and so the music is reproduced.

It should be observed that this model is a little more complicated than those previously described, in that the dimensions given in the diagrams must be carefully adhered to, or else the model will not work. A certain tolerance is permissible, but, unfortunately, it is not possible to construct a "rough and ready" model to illustrate this action.

A "Slow-motion" Picture

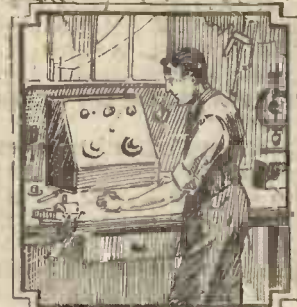
It may be pointed out that the apparatus just described really gives a slow motion representation of the condition of affairs in a wireless receiver.

When receiving telephony we have groups of wireless waves arriving at rapid intervals, each group comprising up to 1,000 oscillations or more, the several groups following each other at a musical frequency.

Each group produces a small current through the telephone. In a similar manner every time the pendulum is set oscillating the wheel will rotate a certain distance, but in this case the operation takes several seconds, whereas in the wireless receiver the corresponding current pulse occurs in $\frac{1}{100}$ sec. or less.



Great Success of New Radio Press Weekly



THE phenomenal demand made for the great new Radio Press weekly *Wireless* proves that it is indeed a popular weekly containing just the information that the wireless public, both technical and non-technical, require. So great was the demand for No. 1 that the whole issue of 450,000 copies was disposed of within three days after publication.

Wireless is in a class by itself. Although the contents generally are of lighter character than some of the other Radio Press periodicals, the same soundness of fact regarding all matters, technical or otherwise, is maintained.

The Death Ray

Some of the articles are of extreme interest to not only wireless experimenters, but also to the general public. For example, "Death Ray Secrets Revealed," by Major James Robinson, D.Sc., Ph.D., F.Inst.P., could not fail to arouse the interest of all classes of readers.

Dr. Robinson was actually concerned with the subject of "Death Rays" when wireless head of the Royal Air Force; the information, therefore, in this article is absolutely first hand.

Mr. Harris' American Tour

Mr. Harris, the editor of this magazine and of *Wireless*, has recently returned from an extended tour of the United States of America, where he made a very thorough study of the wireless conditions obtaining there, and of the progress made in various directions with regard to radio reception. The knowledge gained by him is being put before every reader of *Wireless*, and his articles will be found of value by wireless manufacturers as well as experimenters.

The new "S.T.100," which is a distinct improvement on the well-

known circuit, was fully described by John Scott-Taggart, F.Inst.P., A.M.I.E.E., in the first number of *Wireless*. The original S.T.100 circuit achieved a wonderfully extensive popularity, and there is no doubt that this improved circuit will be made up by many thousands of constructors.

Circuits to Use

A feature which, without doubt, will be widely appreciated by wireless experimenters, is the series of special articles which Mr. Scott-Taggart is contributing to *Wireless*, entitled "Circuits you will Use this Winter."

Enthusiasts will find in these an indication of the direction which their experiments should take. The circuits dealt with, are, for the benefit of certain readers, shown in pictorial as well as theoretical diagrams.

An instrument which will make a strong appeal is "The Centodyne," by Percy W. Harris, M.I.R.E., Editor. This might be described as a junior "Omni" receiver, as only one valve and crystal detector are used, but over a hundred different circuits can be tried out on it without altering the internal arrangements.

Most serious experimenters will, at some time or other, have used tuning coils of a type suggested by G. P. Kendall, B.Sc., whose investigations and experiments with this type of component are widely appreciated by them. Resulting from extensive experiments, Mr. Kendall has recently designed a totally new coil of ultra-low-loss type, and this was described in detail in the first number of *Wireless*. A new type of skeleton former is used which can be very easily constructed by the experimenter of very ordinary ability.

Apart from the above, the crystal user will find various sets described, each of them possessing

special merits. In the issue for September 26, Mr. A. S. Clark described a crystal receiver in which a special coil was incorporated. It was designed primarily for the reception of Daventry transmissions, although the ordinary broadcast stations may be received on it at good strength.

Hundreds of hints and tips appear regularly, as well as a wealth of information which is invaluable to the experimenter.

Other Noted Contributors

The contributors to *Wireless* include, in addition to the laboratory staff, all the well-known Radio Press authors, and also outside contributors of outstanding ability such as Earl Russell, Captain H. J. Round, M.C., M.I.E.E., William Le Queux, Captain P. P. Eckersley, and others. Thus the whole wireless community, from the non-technical listener to the advanced experimenter, will find much in this new weekly of direct interest to them.

The expenditure of 2d. per week will now enable you to keep absolutely up to date in matters appertaining to radio, and bring you a large amount of authoritative information written by acknowledged wireless experts.

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A Selection of Contents of the Oct. 10th issue of "WIRELESS"

DID MARCONI INVENT WIRELESS?

By A. H. MORSE, A.M.I.E.E., M.I.R.E.

GIANT LOUD-SPEAKERS AND THEIR POSSIBILITIES

By Capt. H. J. ROUND, M.C., M.I.E.E.

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An All Enclosed Low-Loss Two-Valve Receiver

By JOHN W. BARBER

MANY people, while desiring to have a wireless receiving set in the home, at the same time object to having batteries standing about, with the consequent loose leads trailing round. This is a quite reasonable objection to the installing of a set, as few things could look worse in the drawing-room than a handsome receiver, with high-tension batteries, accumulator and grid batteries standing beside, or even behind, the set, whilst the necessary leads certainly constitute an eyesore.

Of course, many constructors do not place their sets in such a conspicuous position, and hence the objection referred to does not exist, but there are undoubtedly many houses where strong opposition is encountered on the score mentioned. The receiver to be described has, therefore, been designed to fill this need, and all batteries are enclosed in the cabinet, the only external leads being those to aerial, earth, and loud-speaker or telephone receivers.

The Circuit

The circuit employed may at first sight appear a little unusual to some readers. It will be seen to consist of two valves, a detector followed by one stage of note magnification, the aerial being tapped off at only a little way up the main grid circuit coil. This auto-coupling, as it is called, results in considerably reduced damping in the circuit $L_1 C_1$, due to the fact that the aerial is only joined across a few turns, so that we can, with advantage, make the coil L_1 one of the popular "low-loss" variety. In the anode circuit of the detector valve, we have the tuned circuit $L_2 C_2$, which serves to give a reaction effect. The coils L_1 and L_2 do not require to be coupled

together at all, the reaction being obtained by reason of the capacity of the valve itself. This coil L_2 may also be of the familiar low-loss type, or alternatively should be one of the best makes, if plug-in coils are used. The upper end of the circuit $L_2 C_2$ is joined, through the primary of an iron-cored transformer, to high-tension positive, the secondary being joined

leads, with the attendant possibility of short-circuits occurring.

The lower portion of the cabinet is provided with a hinged door, and it is in this compartment that the batteries are housed. The vertical panel is secured to the false base-board in the American fashion, and this portion then slides into the cabinet on fillets. The battery leads are brought out through

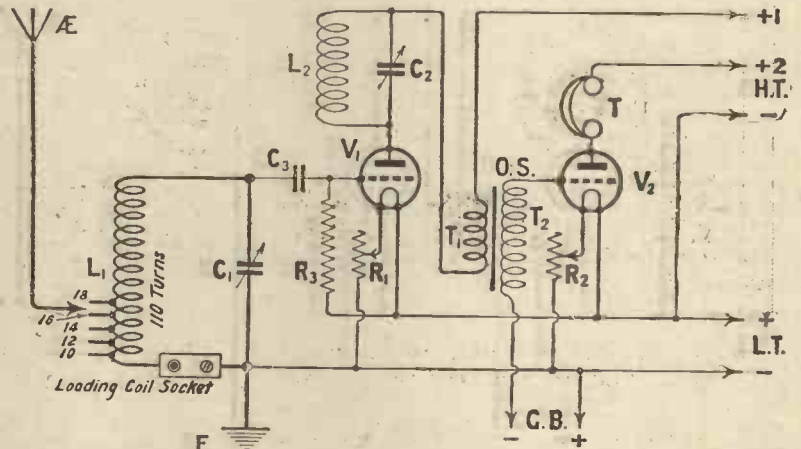


Fig. 1.—With some makes of low-frequency transformers, a fixed condenser of $.001\mu F$ may be necessary across the primary winding.

across grid and filament of the second valve in the usual manner.

General Appearance

From the photographs it will be seen that the receiver is of quite neat appearance, there being only two condenser dials and two filament resistance knobs to control. The aerial and earth and telephone leads are brought respectively to two plugs, which plug in to the sockets provided on the left and right of the receiver respectively; thus it is possible by simply removing these plugs, to remove the set from one place to another without having to disconnect several

holes in the baseboard of the receiver portion, and are joined to the batteries underneath.

Batteries

A Siemens' No. 960 battery of $4\frac{1}{2}$ volts with a tapping at 3 volts, is used for filament lighting, and when used in conjunction with low consumption valves will last well and can be placed inside the cabinet without any fear on the score of acid fumes, which would be present if an accumulator were used in the same position. The lower compartment, which should be not less than $7\frac{1}{2}$ in. deep, accommodates the filament battery in

a vertical position at the back, while the H.T. battery may be placed as shown in the photograph, with the grid battery on top of it. With such an arrangement there is room on the right-hand side for a pair of telephones, which may be put away when not required.

List of Components

For the benefit of any reader who may wish to make up a set along the lines of the present one, I am giving a list of parts required, together with the names of manufacturers of the parts I used. There is no need for you to use identical parts, as there are many similar ones which will give equally good results.

One ebonite panel, 16 in. by 8 in. by $\frac{1}{4}$ in. (Peto-Scott Co., Ltd., Red Triangle).

Two variable condensers, .0005 μ F (Jackson Bros. square law low-loss type).

Two filament resistances (Polar, Radio Communication Co., Ltd.).

One skeleton coil former, 8 in. by

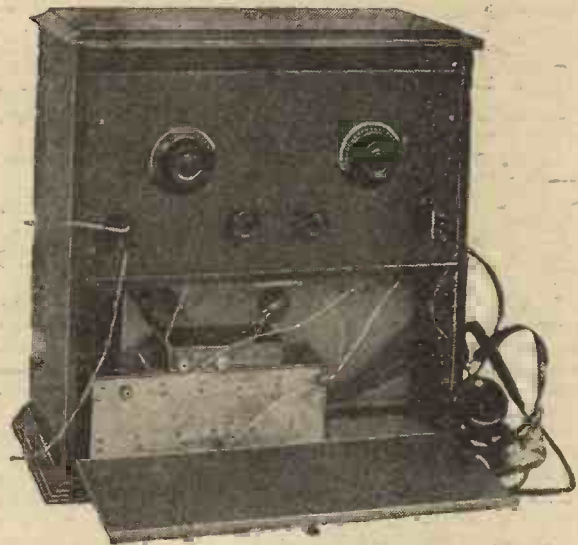
a hinged top to facilitate inspection, and is 9 in. deep from front to rear inside, thus giving ample room for the batteries mentioned.

Quantity of No. 20 enamelled wire.

One Burndept spring clip, or other similar device.

Square wire for connections, and some flexible wire for battery leads.

Five battery plugs (the L.T. battery is provided with terminals).



The value of H.T. or grid bias may be easily adjusted if the lower door is opened.

Panel Drilling

Fig. 2 shows the panel layout, together with dimensions for drill-

and resistances being of the one-hole fixing variety. The plugs used for aerial, earth and telephones have a distance of $\frac{1}{4}$ in. between centres, thus it is a very simple matter to drill holes correctly. In this connection it may be pointed out that the holes should not be drilled too large, as the sockets are of a driving fit, and will tend to pull out if the holes are on the large side. A $\frac{1}{8}$ in. drill should be used.

The Polar rheostats are provided with interchangeable bobbins, and when ordering it is only necessary to state the particular type of valve you intend to use, and the voltage of your L.T. battery, for a bobbin of the correct resistance to be obtained. Should you at any time change your valve, you can obtain another bobbin suitable for your new valve.

Some care is called for in fitting the panel to the baseboard, and in this connection you should be sure that the edges of panel and baseboard are quite flush, otherwise you

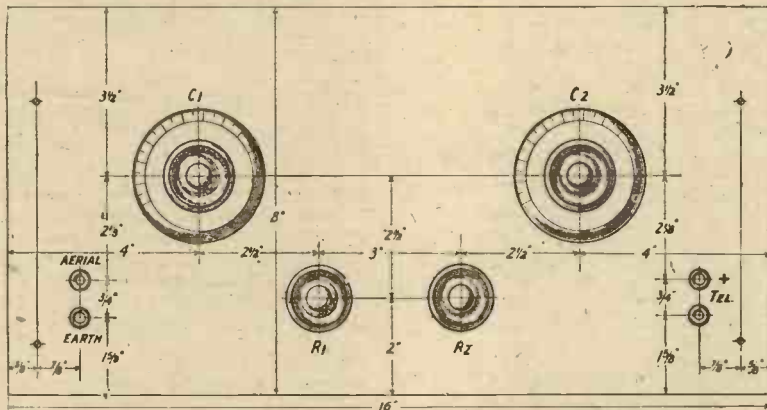


Fig. 2.—Twelve holes only are required to be drilled through the panel. Full size blue print No. C1023A, price 1/6 post free.

$3\frac{1}{2}$ in. (Collinson Precision Screw Co., Ltd.).

Two valve sockets (Bowyer-Lowe "Anti-pong").

One first stage low-frequency transformer (C. A. Vandervell & Co., Ltd.).

Two coil sockets (Magnum).

One grid leak and condenser mounting, with .0003 μ F condenser and one megohm leak (L. McMichael, Ltd.).

One pair angle brackets (Magnum).

Two large type battery plugs and sockets (General Electric Co., Ltd.). One of these is used for aerial and earth, the other for telephones.

Suitable cabinet (W. H. Agar). This cabinet, details of which will be clear from the photographs, has

ing. It will be seen that only twelve holes are required, the condensers

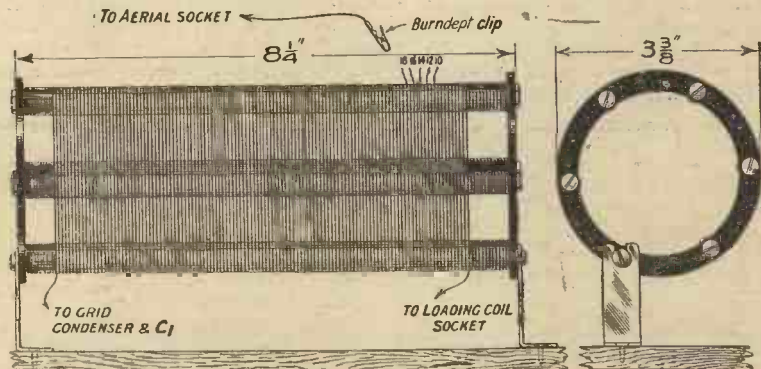


Fig. 3.—Details of the coil and to where the ends are taken. The tapping points are also indicated.

A handy reference for the home constructor — the Burndept Components Catalogue

Copy of Latest Edition sent FREE on request

THE Burndept Components Catalogue will be found most useful when prices and full technical particulars are required of Burndept Components used in apparatus described by writers in popular radio publications. Moreover, this Catalogue, which has been considerably increased in size, is invaluable to any man who builds sets, for it describes in detail the extensive range of Burndept Components, which includes everything for the home constructor.



The Burndept Super-Vernier Dial LOOKS like an ordinary dial. It is 3½ in. in diameter. The mechanism is concealed.

Special interest will be taken in two important additions to the Burndept range—new-pattern coils, and the Super-Vernier Dial. The new Coils cover all waves from 20 metres upwards, and are enclosed in hermetically-sealed containers, on which tuning ranges are indicated. These Coils fit all makes of tuners and coil holders. The 1924-25 pattern Coils have been considerably reduced in price. The range of Ethovox Loud Speakers has been enlarged, all-metal, mahogany-horn and junior models and a gramophone attachment now being available. The popular Ethovox Standard Loud Speaker (with Metal Horn) has been reduced in price to £4 10s. 0d.

For making fine adjustments to condensers, reaction-couplers, or variometers nothing gives such splendid results as the new Burndept Super-Vernier Dial. The gear ratio of 7:1 enables such minute adjustments to be made that it

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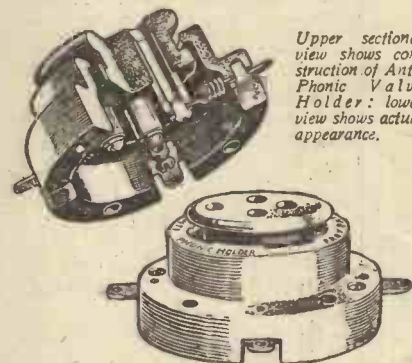
Model A (No. 905). As fitted to Burndept Instruments and Condensers. Designed for ¼ in. spindles where there are no projections above the panel immediately below the Dial. The diameter of the engraved dial is 3½ in. Complete with knob, etc., and full instructions. 7s. 6d.



The simple mechanism of the Burndept Super-Vernier Dial. The ratio is about 7 to 1.

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A component which has increased in popularity ever since its introduction is the Burndept Anti-Phonic Valve Holder, which has established itself as the best means of eliminating microphonic noises in dull-emitter valves. It is both strong and efficient and is built of materials which do not deteriorate. No rubber is used, the valve holder proper



Upper sectional view shows construction of Anti-Phonic Valve Holder; lower view shows actual appearance.

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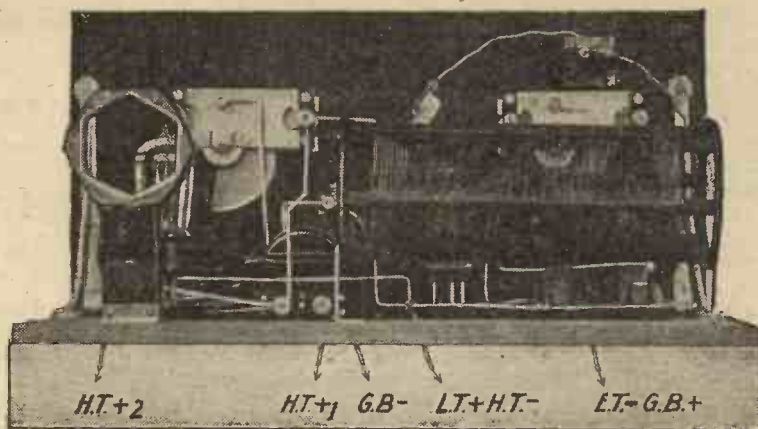
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may experience difficulty in fitting the whole into the cabinet. I would advise you to do this part of the work before mounting up any components, in order that you may be free to handle the panel as easily as possible.

The Coil

Having mounted the components upon the panel, we may now turn our attention to the coil. This is extremely simple to wind, but requires just a little patience. My advice is, don't try to rush it, or the coil may slip out of your hands, and you will have to start again, not to mention untangling a lot of wire. (Experience teaches!) Leave a space of $\frac{1}{2}$ in., and commence winding. I put on 110 turns, and find that the set will



The flexible battery connections are taken through the baseboard to the points indicated. These will be clear if Fig. 4 is referred to.

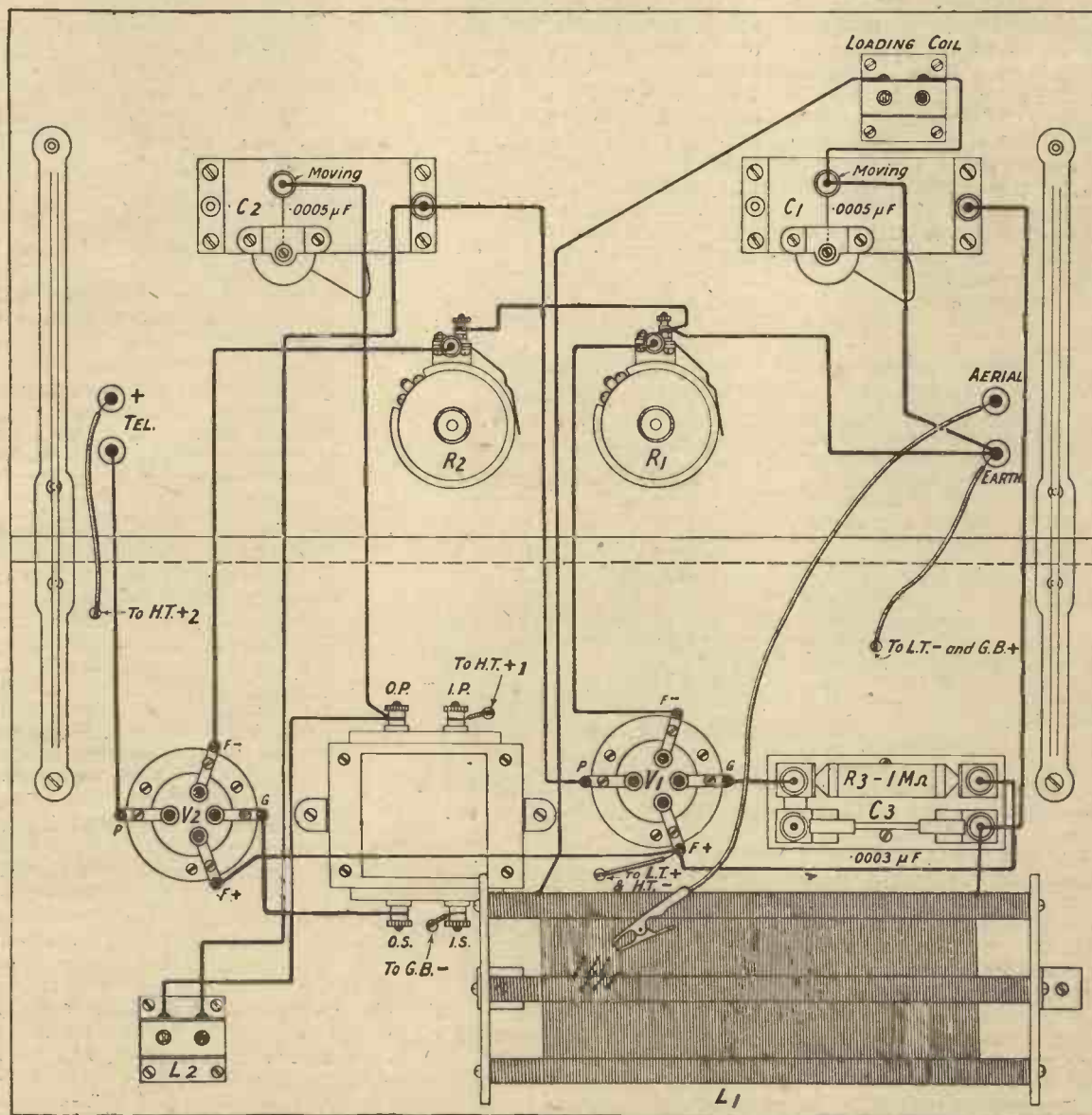


Fig. 4.—Details of the wiring. The leads to batteries may be easily traced out. Blue print No. C1023B.

easily cover the 200 to 600-metre band, with a few degrees to spare at each end of the condenser scale. At 10 turns from one end scrape a portion of the wire clean, and solder a small piece of wire on, to which connection will afterwards be made. This is done every alternate turn up to the 20th turn. This may sound difficult, but will be easily accomplished with a little patience.

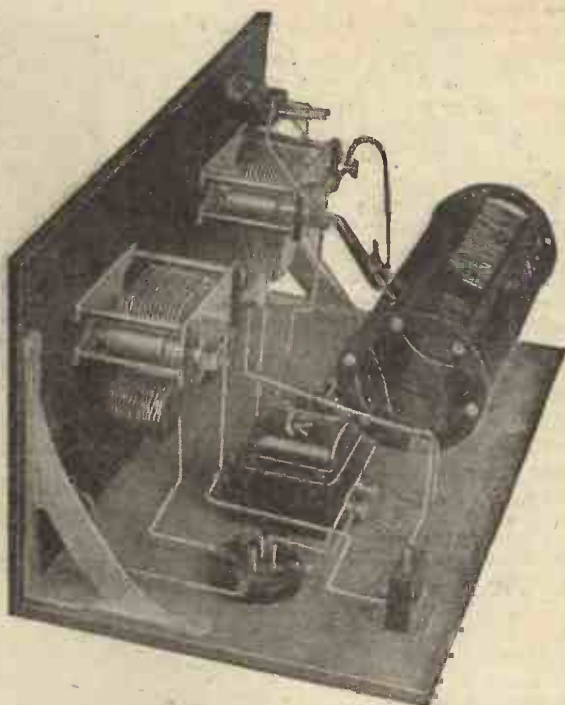
Now mount up the components which go upon the baseboard, and drill the necessary holes for the battery leads to pass through. Secure in position the strips for mounting the coil, which are supplied with the former, but do not mount up the coil until some of the wiring has been carried out.

Wiring

I would advise you to wire up the filament connections first, taking care to see that the leads from the rheostats to the valve sockets leave sufficient room for the bobbins to be removed. The remainder of the wiring is fairly simple, and will be easily carried out if the diagram, Fig. 4, and the photographs are consulted. Lastly, the coil may be mounted up and its ends secured to the correct points as seen in Fig. 3. The aerial socket is connected by means of a flexible lead ending in a spring clip, to one of

The panel assembly may now be placed in the cabinet, and the lower door opened, when it will be a simple matter to join the leads to the batteries. The valves may now be inserted and aerial-earth and telephone plugs inserted in their sockets, and a Gambrell A or B coil, or Nos. 50 or 75 in the numbered series, should be inserted in the L_2 socket. See that the loading-coil socket is shorted.

Switch on the filaments, and set the condenser C_1 to its minimum value. Turn the reaction condenser also to zero, and note whether the set oscillates. If not, turn each condenser to about 10 degrees, and rotate the tuning condenser slightly until a point is found at which the set breaks into oscillation. Slacken back the reaction condenser until the set



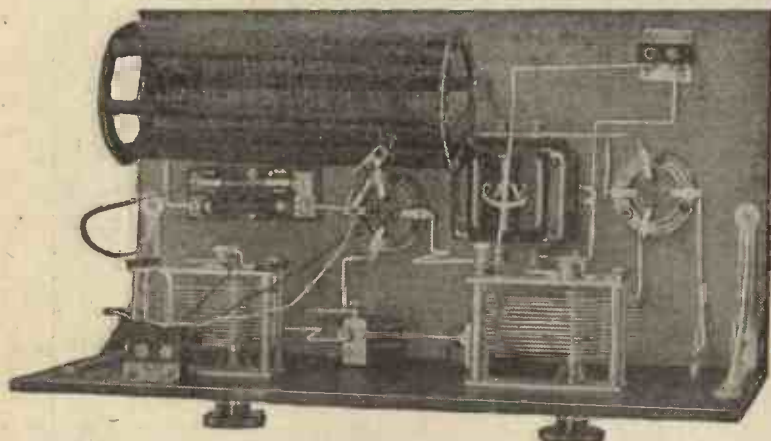
The loading coil socket is situated over the tuning condenser as shown.

increased by reducing the number of turns included between aerial and earth, but signal strength will be improved by increasing the turns, so that a medium will have to be found.

For Daventry, plug in a loading coil in the socket provided, move the aerial clip either to the fixed plate terminal of C_1 or to the grid condenser, to which it is easily attached, and insert an F or No. 250 coil in the L_2 socket. Tuning is carried out as before.

Capabilities

At five miles from 2LO I use about 16 turns in the aerial circuit, and am able, upon my standard P.M.G. aerial, to receive that station at full loud-speaker strength, signals being audible on the ground floor with the set on the second. London is tuned out remarkably easily, and several other stations have been received during transmission from 2LO. At night, when British stations have closed down, I have heard San Sebastian and Madrid, while one evening a foreign station, slightly lower in wavelength than London, was received on the loud-speaker. This latter is, of course, exceptional, and is not to be taken as indicative of the set's general capabilities. Several amateur telephony stations working near 200 metres (1499 kc.) were heard around 5° on the tuning condenser, while at 165° ships on 600 metres (499.7 kc.) are heard at good strength.



This view gives a very good idea of the lay-out of the parts, a shorting strap is shown inserted in the loading coil socket.

the tappings on the lower or earth end of the coil, the best tapping to use being determined by trial. The flexible leads passing through the baseboard are next to be prepared for connection to their correct batteries. Leads for H.T. or grid batteries should be attached to plugs, while those to the L.T. battery may either be just bared or secured to spade tags. A lead is taken from the positive of the L.T. battery to H.T.—, and one from L.T.— to the positive of the grid battery.

just does not oscillate. Tuning is now carried out by rotating the tuning condenser slowly, following up with the reaction, so that the receiver is just off the oscillation point the whole time. By this means you will easily pick up stations within your range. If the set will not oscillate over the whole range of the tuning condenser, a size larger coil should be tried in L_2 . The position of the aerial tap may be varied for the best results, remembering that selectivity is



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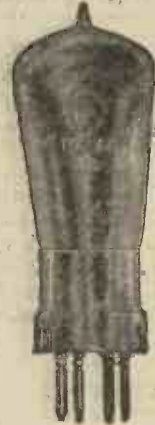
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Are Dull Emitter Valves Really Economical ?

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

The recent changes in prices of valves and accumulators have rendered it necessary to review the position with regard to the use of dull emitters from the financial point of view. Below will be found estimates for both types, covering the period of one year



THE word "economical" in the title of this article is meant to be taken in its financial sense, since there can, of course, be no question that the modern types of dull emitter are highly economical in the electrical sense. We have only to remember that the really low consumption types only require for their filament current such a value as will flow in the anode circuit of quite a small transmitting valve to realise that a considerable amount of electrical economy has been achieved.

Financially, however, the matter is not so easily settled, and although various calculations were made when dull emitters first appeared as regards running costs and so on, recent changes of prices for valves and accumulators make it seem desirable that the matter should be reconsidered.

Dry Cells

I propose to take a few typical examples, and work out the running costs for certain common types of dull emitters, working upon the basis of the latest prices. At the outset I may as well say that I have something of a prejudice against the use of dry cells for the filament supply of valves, chiefly on account of the tiresome voltage variations which dry cells exhibit during use, and therefore I propose to assume that small accumulators will be used for the dull emitters in the estimates which I shall give in the course of this discussion. Where charging facilities are available there is little doubt that the accumulator is the preferable source of supply for even quite low consumption valves. Most other types of battery are merely substitutes for use in country districts where accumulator charging is impossible. As a matter of fact, the costs work

out rather similarly with both dry cell and accumulator supply.

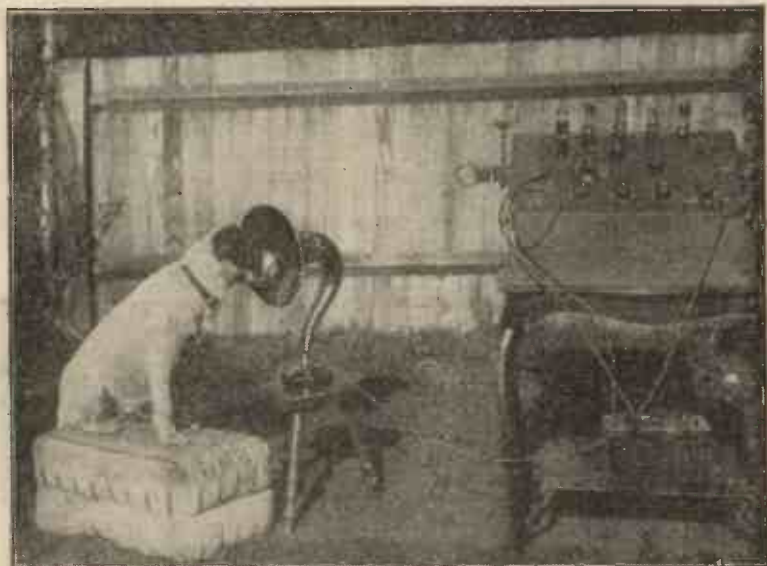
Valve Life

The question of valve life also calls for a word of explanation, and it may be as well to remind the reader that the actual longevity of a valve is an extremely variable factor. Neglecting such factors as possible breakage or burning out before the end of its normal life, I propose to assume that each of the valves being considered will give one year's service with a moderate amount of use each night.

First Example

Our first example is of the running expenses of a single-valve set for one year, assuming that both valve and accumulator must be

purchased at the commencement of the year, it being understood that we are considering the establishment for the first time of a wireless receiver. Further, we will assume that the dull emitter valve to be considered is one of the type taking 0.6 ampere for the filament, and that this will be run from a small 4-volt accumulator. The accumulator may quite well be of the small glass box type, which is sold in 2-volt units. Two of these will cost about 10s., and should be recharged, perhaps, every two months according to its type. Where charging is difficult, however, it may quite well be charged once every three months, in which case a suitable correction must be made to the estimate which I give overleaf.



Animals, as a general rule, are very interested in loud-speaker reproduction of the broadcast programmes. Our canine friend is "wondering where it comes from!"

Accumulator Size

The bright emitter valves may be of any general purpose type, and it will require a 6-volt 30-ampere actual capacity accumulator to run it to the best advantage. A smaller accumulator could, of course, be used, but it is never advisable to obtain one much below the size indicated because it must always be remembered that a single-valve set is likely in the end to lead to a larger one, and it is a pity to buy an accumulator only just big enough to run one valve. An accumulator of this size will probably require about 16 charges in the year, and the cost will work out as given below. The prices for accumulator charging which I have assumed throughout are those which are charged at the nearest accumulator charging establishment to my own home, but I think they are fairly representative of current prices:—

<i>Dull.</i>		s.	d.
Valve ... ..	...	16	6
Accumulator ... ..	...	10	0
6 charges ... ..	...	4	6
		<hr/>	
		31	0

<i>Bright.</i>		s.	d.
Valve ... ..	...	8	0
Accumulator ... ..	...	40	0
16 charges ... ..	...	24	0
		<hr/>	
		72	0

It will be seen that the advantages are overwhelmingly in favour of a dull emitter from the financial point of view, the discrepancy in running costs being about two to one. Let us now take the case of a 2-valve set. For this the previous sizes of accumulators will serve in both cases, the number of charges for the dull emitter accumulator will now be six as before, while the bright emitters will require their battery to be

charged something like thirty-two times in the course of the year.

<i>Dull.</i>		s.	d.
2 valves ... ..	...	33	0
Accumulator ... ..	...	10	0
6 charges ... ..	...	4	6
		<hr/>	
		47	6

<i>Bright.</i>		s.	d.
2 valves ... ..	...	16	0
Accumulator ... ..	...	40	0
32 charges ... ..	...	48	0
		<hr/>	
		104	0

As before, we see that the cost of installing and running two valves and their accumulator for a year is something like twice as great in the case of the bright emitter as



in the case of the dull. This relation is to be observed again in the last example concerning this particular type of valve, namely, the one given below for a three-valve set:—

<i>Dull.</i>		s.	d.
3 valves ... ..	...	49	6
Accumulator ... ..	...	10	0
9 charges ... ..	...	6	9
		<hr/>	
		66	3

Bright.

	s.	d.
3 valves	24	0
Accumulator	50	0
32 charges	64	0
	<hr/>	
	138	0

A somewhat lesser-known type of valve is the general purpose dull emitting variety, which is run from a 2-volt accumulator, taking about .25 of an ampere, and I show below a final comparison between the running costs of one of these valves and an ordinary bright emitter:—

Dull.

	s.	d.
Valve	14	0
Accumulator (2-volt, 20 amp-hour actual)	15	0
12 charges	12	0
	<hr/>	
	41	0

Bright.

	s.	d.
Valve	8	0
Accumulator	40	0
16 charges	24	0
	<hr/>	
	72	0

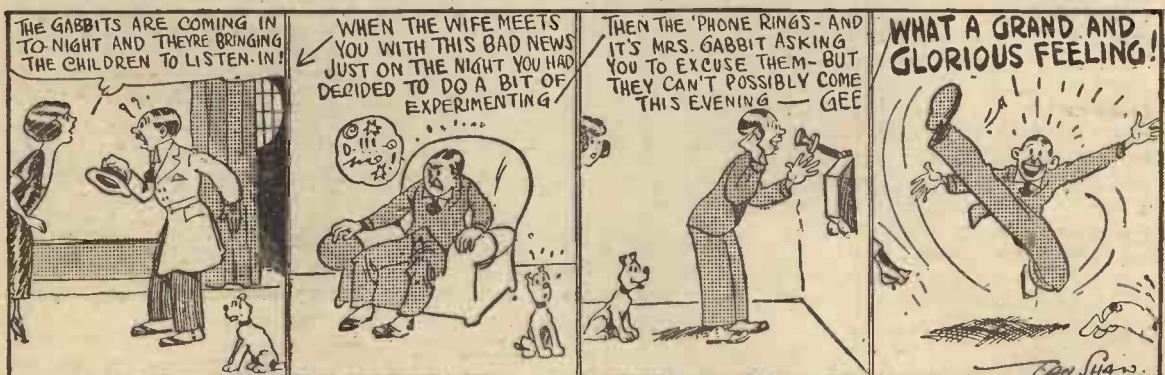
As before, the dull emitter is shown to have a very considerable advantage in running costs as compared with the bright emitter.

In conclusion, I must remind the reader that the prices for the accumulators and charging which I have taken are purely arbitrary: the first will vary according to the quality purchased, and the second according to locality, while it is equally impossible to quote hard and fast figures for the frequency of charging. The actual relation of bright to dull, however, will be found a dependable guide.

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NOTE THE GUARANTEE





SUMMER has gone, Autumn is passing by and Winter will soon be upon us. Already the evenings are long, and with the resulting improvement in conditions as affecting wireless reception enthusiasts who have laid by their hobby during the past six months are resuming their work. Many no doubt contemplate rebuilding their sets, using more up-to-date components than those which were in use last year, others may be improving or overhauling the actual components themselves where their skill allows, and others are mapping out work ahead for the Winter. All this activity will require the use of tools and small parts, tools,

moreover, which have been lying neglected through many months.

Clearing Up

The first thing to do in preparing for the resumption of work in the workshop is to examine exactly how things stand. Look through the box of spare components and examine these to see which are suitable for further use and which are merely junk. The latter will generally be received with open arms by some local enthusiastic school-boy whose purse, like that of all school-boys, is not too well lined; the former can be put aside wherever convenient. If there is an ebonite scrap box look through this

and determine what is worth keeping and what not.

In this matter of deciding what to keep and what to get rid of one must be really ruthless. The temptation is great to say, "Well, this might come in useful some time, I won't throw it away just yet." You know it has been lying about for over a year and has never been wanted yet—of course we all know that having got rid of it you will find a need for it within the week!

Keep Screws Together

Next it is a good idea to gather together all the nuts, screws, terminals, wood screws, bits of brass and copper, odd switches, sockets,



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studs and other metal parts used in the construction of wireless receivers (and their name is legion) and sort them out. Place all the nuts together, all the screws together and so on. A small nest of boxes may be made either out of empty cigarette tins or other suitable little boxes into which the various heaps of parts can be placed. This enables any little "gadget" that may be required to be obtained with the least delay.

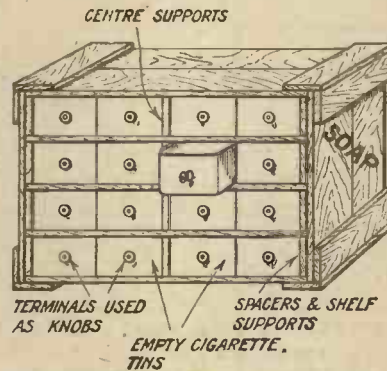


Fig. 1.—The "cabinet" for screws, nuts, etc., made from old cigarette tins.

The writer made a very useful cabinet out of an old soap box and empty cigarette tins for this purpose.

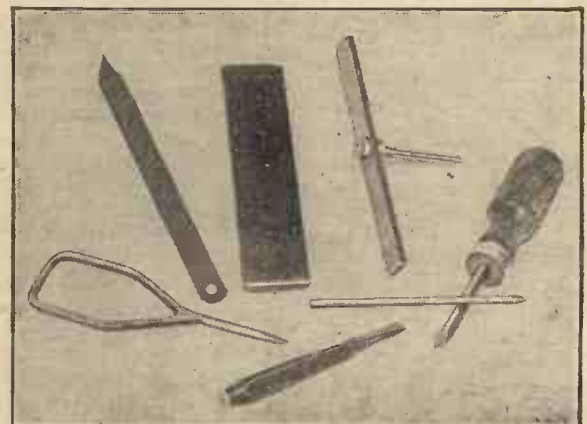
Details of the Cabinet

The sketch shown in Fig. 1 gives the details as to how this was done. First of all three horizontal partitions were fixed by means of lengths of batten fastened to the inner sides of the box, lengths of matching being cut to size just to slide in, making what are in effect very shallow shelves. The distance between these is a little greater than the depth of the cigarette tins. As each shelf holds four tins, and these are rather heavy when filled with small metal parts, short pieces of battens about 1/2 in. wide were cut the same depth as the shelves and pushed in to support them in the centre. Old terminals were fixed in the front of each tin to provide a knob or handle for pulling them out and the contents of each tin painted on with black enamel.

Last but not least is the question

of tools. The English summer is not exactly renowned for its dryness, and the past months have showered us with rather a lavish quota of rain. Under these circumstances it is hardly surprising to find tools have become rusty. These should, therefore, be carefully cleaned with a little fine emery paper and then lightly rubbed over with vaseline. Some workers are inclined to use paraffin when cleaning tools as it makes the emery cut better; this practice is, however, strongly to be condemned, for once this has been done the metal tends to rust far more easily than before. A little pure vaseline well rubbed in after the tool has been cleaned will not harm, however, and the excess should be rubbed off with a clean rag, as hands should, of course, be kept free from grease when doing electrical work. Other tools that may require attention are screwdrivers, scribers, and other tools that have to have prepared edges or points. All these should be carefully ground up, and if they are correctly tempered they may then be expected to keep their edges or points, as the case may be, over the busy season. Drills should be examined to see whether their cutting edges are sharp and not chipped, and if they are in bad condition should be re-ground. Those who have not the necessary means for doing this, or who perhaps have not the skill, can get them done for a small sum at a local ironmongers or motor repair shop.

Then, of course, files should be examined, and if badly rusted and



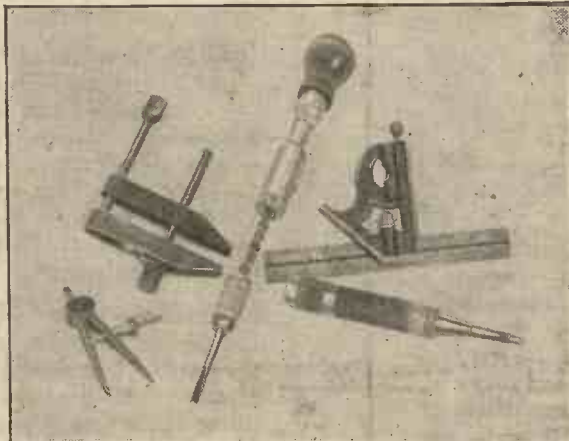
Some home made tools. The tap is seen at the top right, while on the left is seen a scribe.

worn should be discarded, although some may like to try putting them in dilute spirits of salt as a means of reconditioning them. As a good file, however, can be obtained for about 1s. 6d., this practice

appears, hardly worth while. Files that are merely rusty may be cleaned with a scratch brush or file card.

Taps and Dies

The more advanced constructor with a fairly extensive kit of tools, such as taps and dies, etc., should look carefully through these and see that they are all in good condition and that none are missing. There is nothing more annoying than to start on a job and when half-way through it, discover that a particular tool is not there. Those who do not possess taps and dies and who have acquired skill in mechanical work may wish to buy a few of these to help them in their work. The most usual sizes are 2, 4 and 6 B.A., although occasionally one finds 5 B.A. threads used in some cases. Taps are obtainable in three types, taper, seconds and plug. Of these the most useful all-round type is the second cut. The taper is rarely needed in wireless work, nor is the plug, this being only required when blind holes are to be tapped.



Some tools for the more advanced experimenter.

Home made Tools

The constructor with limited means who cannot afford to buy many tools can spend a little time in knocking up those he requires most. Taps for ebonite may be made from brass screws or studding (screwed rod) by cutting a couple of slots lengthways along the thread, screw drivers can be made out of lengths of silver steel which can be purchased for a few pence. A tang for fitting into a wooden handle is easily made by heating one end to red heat and hammering it out square. A scriber can be improvised from a piece of broken hack-saw blade ground to a narrow chisel edge at one end, while a centre punch may be made from a stout wire nail ground to a fine point. Other handy little tools can be made from material at hand or that can be purchased for a few pence, and they are well worth a little time and trouble taken, as with their aid work can be done more quickly and accurately.

Further Tools

The man who does a lot of constructional work and who can afford

to spend a little on tools will find such gadgets as an automatic centre punch, a combination rule and set square, a ratchet spiral screw-driver, tool-makers' clamps, etc., of the greatest value in enabling work to be done with despatch and precision.

Above all, method should be employed in constructional work, and every tool should have its own place to which it should be returned after use, thus much time will be saved in looking for tools and accessories, which, if mislaid, invariably turn up in the very last place looked in. This, of course, is not good for the temper!

Cleaning Terminals

TERMINALS frequently get dirty owing to a thin coating of oxide, due to atmospheric effects, and this film, which may only appear as a dullness, detracts from the efficiency of the set. Other terminals which get dirty, and very dirty, too, are those on the accumulator. It is quite easy, however, to make a very simple little device, which obviates scraping the contact faces of the terminal with, say, a penknife, and getting dirty, and at the same time probably not efficiently carrying out the cleaning process.

Procure a wooden tube or an old screwdriver handle, and on the end which is already bored, after first smoothing it, glue a piece of emery paper. This can then be pushed on to the terminal shank, and if twisted once or twice will completely clean the contact surfaces.

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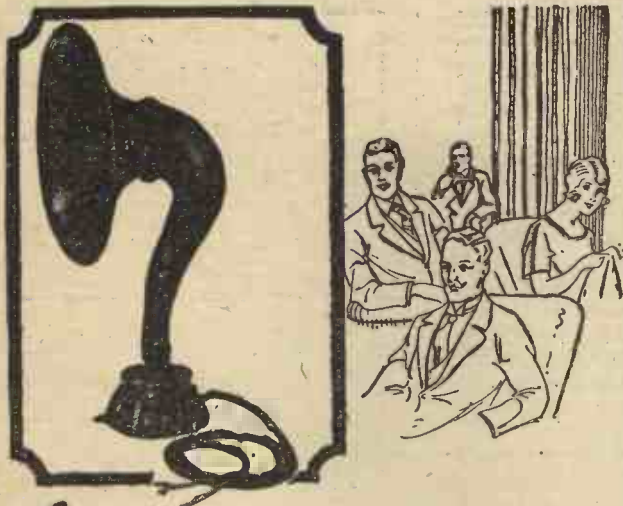
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No Condenser of the "Mansbridge" Type is a genuine Mansbridge product unless the words "Mansbridge Condenser" are plainly embossed on the metal case. The colour of the case is maroon.

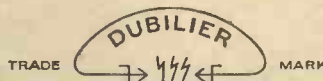
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E.P.32

Selectivity and the Ultraudion circuit

(Concluded from page 6)

for the beginner, who will find great difficulty in tuning in with it.

Results

The results I have obtained with this set indicate that very high efficiency is to be obtained from the detector valve. On an indoor aerial at Wimbledon I have received two Spanish stations at quite comfortable telephone strength, and several of the British broadcasting stations, but not all, have come in quite well. When you have become accustomed to the adjustment of the set, selectivity will be found higher than in any other set I have previously described, although to get the most selective point of adjustment requires a little practice. This is due to the fact that there is a certain interaction between the detector circuit and the free circuit, making it possible to get the stations desired, at two or three different settings, although

the loudest results will only be obtained at the correct setting. The wavelength range with the particular coils given is 275 to 590 on my own instrument. Louder signals, at the expense of some selectivity, can be made by placing a larger coil in the socket for the aerial coupling coil (the rear socket).

I have mentioned Gambrell coils throughout this article, as these were the coils on which the experiments have been carried out to the fullest extent; but other makes of coils can be used quite successfully. I shall be most pleased to hear readers' results with this set.

Once more, do not expect to get the best results with it on the first evening on which it is at work, and hunt for your stations very carefully.

Longer Life for Telephone Tags

AN accidental jerk on the telephone cord attached to a receiving set, if it does not damage the receiver, will at any rate put a severe strain on the leads at the points where they are soldered to the tags. By a simple

device the tags can be protected, and the main stress thrown on the stouter part of the cord, which is better able to withstand it. A small wooden or metal eyelet, or "pulley," is required, about $\frac{1}{4}$ in. to $\frac{1}{2}$ in. in diameter. As shown in the sketch, this is secured at the



How the phone cord is held to prevent damage to the tags.

point where the separate leads divide to the tags. A bolt is passed through the panel from inside at the point indicated, a nut keeping it secure. On this bolt is placed the eyelet carrying the leads, and another nut or a threaded ebonite knob is placed on the top; this arrangement allows of the telephones being detached readily, if required. The leads between the eyelet and the telephone terminals should be left slack.

A. V. D. H.



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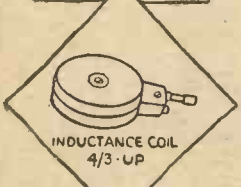


10/6

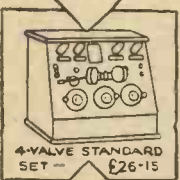
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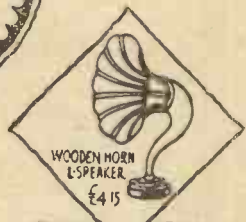
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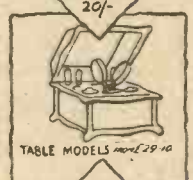
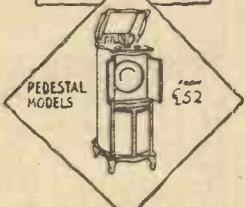
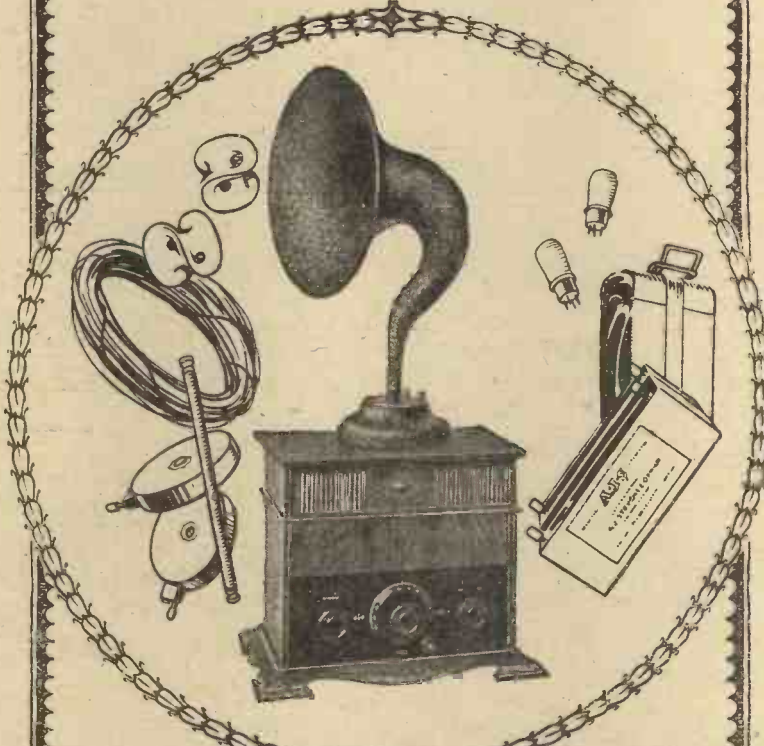


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SELECTIVITY is still the main objective in the design of wireless receivers, and big strides have been made in this direction recently. For those who only desire to receive their local station sharp tuning is not so important, except in the case of coastal dwellers, to whom ship transmissions may be troublesome.

In the current issue of *Modern Wireless* full details for building a complete range of sets, from a selective crystal receiver to a four-valve set will be found, and those constructors who are troubled with interference should on no account fail to read this number.

In most of the sets described selectivity is obtained to a remarkable degree.

The "Coastal Three" was designed by A. Johnson-Randall especially for coastal dwellers, as was the "Sharp-tuning Crystal Set" by E. J. Marriott; while the "DX Four," by D. J. S. Hartt, B.Sc., will receive the distant Continental stations, and possesses considerable selectivity.

Most experimenters are keen on trying out new circuits, and they will find the "Two-valve Hartley-Reinartz Receiver" described by John W. Barber an interesting field for experiment.

Selectivity

Mr. A. D. Cowper, M.Sc., gives full details of a single-valve circuit with which he has received 2 I.O., 12 miles distant, at full loud-speaker strength.

An acceptor wavetrap is also described by G. P. Kendall, B.Sc., who is so well known as the designer of the famous "A B C Wavetrap," described in Radio Press Envelope No. 6.

How Valves Work

There are many wireless enthusiasts who do not know how the valves they use do their work. This information is given in a clear and concise manner by John Scott-Taggart, F.Inst.P., A.M.I.E.E., in an article entitled "The Valve as a Rectifier." Further, the chief factors which govern the life of a valve are ably discussed by Capt. Crowther, M.Sc., whilst Major James Robinson, D.Sc., Ph.D., F.Inst.P., deals in an interesting manner with some of the difficulties encountered in the manufacture of wireless valves, and how they are overcome.

High-frequency coupling between valves has received more attention in America than on this side of the Atlantic, and Percy W. Harris, M.I.R.E. who recently returned from the States, gives his views on how H.F. transformers may be improved.

American Short-Wave Stations

While in America, Mr. Harris was enabled to visit most of the well-known short-wave stations and the more important research laboratories, and his series of articles appearing in *Wireless Weekly* make not only interesting, but educational reading, for both technical and non-technical readers.

A "Trigger" Circuit

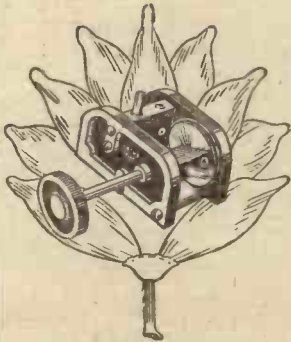
In the September 2 issue of the same periodical a new method of I.F. coupling was described by G. C. Beddington. This is an ingenious method of obtaining a trigger effect, and it provides considerable experimental interest, its outstanding feature being the quality of the reproduction obtained.

The short-wave experimenter should on no account fail to read the various articles frequently appearing in *Wireless Weekly*, all written by acknowledged experts.

The GROWING SALES prove

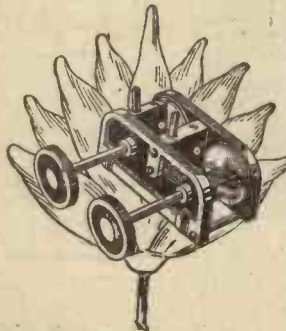
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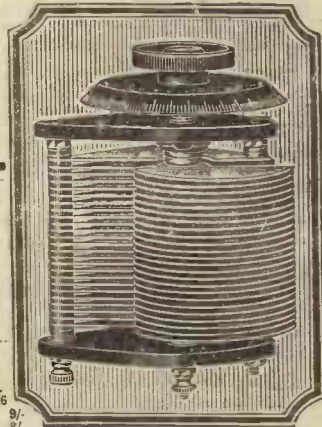
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How to Adjust Your Grid-Bias

By A. JOHNSON-RANDALL, Staff Editor

I HAVE been asked to tell you how to adjust your grid-bias for good reproduction, but I wonder how many of you know what the object of grid-bias is. Fig. 1 shows the characteristic curve of a valve plotted at a certain H.T. value, in this particular case 60 volts. To the right

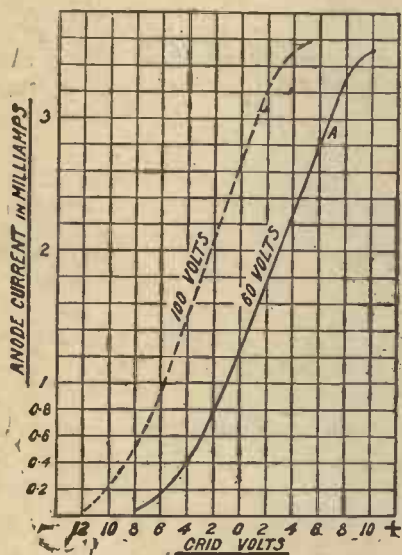


Fig. 1.—The characteristic curves of a valve at two different H.T. voltages.

of the vertical line called the zero ordinate are plotted various values of positive grid volts, and to the left similar negative values. Up the left side you will see values of anode current in milliamperes.

Static Characteristic

When you buy a valve you will probably be given the average characteristic curve for that particular type, and in any case the makers will always readily supply one upon application. In adjusting your grid-bias you should take note of this curve. It is really quite simple. You will notice that your curve, which will be similar to that in Fig. 1, has a long straight portion, with a bend top and bottom. For good reproduction you must work your valve so that its operating

point lies on this straight portion, and furthermore upon that part to the left of the vertical line. To do this it is necessary to apply a negative potential to the grid of the valve (remember it is the L.F. valve I am referring to), and this negative potential or grid-bias should be adjusted so as to place the operating point not higher than the centre of the straight portion.

The Minimum Value

Let us take an example. Curve A in Fig. 1 begins to bend at 4 volts along the horizontal axis. Halve this value, and you will see that a vertical line drawn from this point parallel with the zero ordinate would cut the curve midway between the commencement of the bend and the zero axis. The minimum grid-bias for this particular value of H.T. will therefore be 2 volts negative. If you increase your H.T. voltage the curve will move to the left, as shown by the dotted curve and the straight portion to the left of the zero axis will become longer, hence bearing in mind what I have said previously, it will be necessary to increase the grid-bias to 4 volts negative. In this way any adjustment of H.T. voltage will necessitate an alteration in

voltage, within the maker's limits, and to adjust the grid-bias to suit. Really strong signals require a curve with a very long straight portion if valve distortion is to be avoided, and for this reason special valves designed to handle a big input are commonly used for loud-speaker work. You should now be in a position to be able to read the correct grid-bias from the maker's characteristic curve of your valve.

Valves to Use

If your set employs two stages of L.F. amplification you will in all probability obtain satisfactory results by using a general purpose valve in the first stage with a small-power valve in the last. In this case it is convenient to use an H.T. value of, say, 80-100 volts on the first valve, with 1½-3 volts negative bias (you can obtain this information easily from your curve), and about 120 volts with 6 volts negative bias on the second valve.

The Grid Battery

You will require a small grid battery, consisting of a number of dry cells joined in series, and tapped at every 1.5 volts. A nine-volt battery is a useful size. One end of this battery will be marked with a

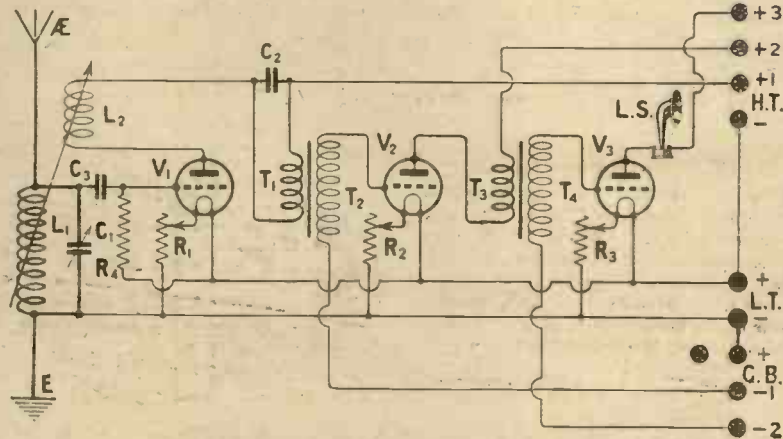
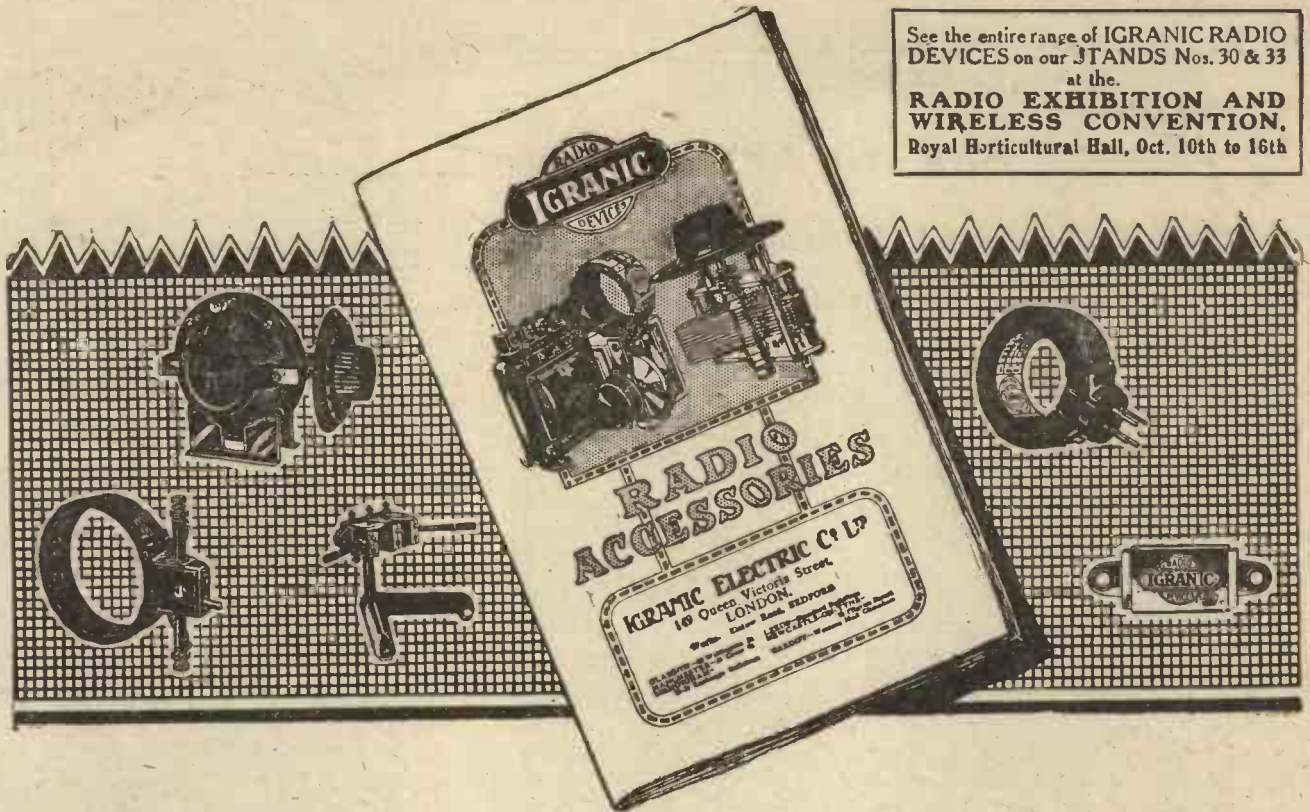


Fig. 2.—A popular three-valve circuit suitable for loud-speaker work.

grid-bias, and for low-frequency amplification it is good practice to work with a fairly high H.T.

+ Connect this to the L.T. busbar and attach flexible leads terminating in plugs to the second-

See the entire range of IGRANIC RADIO DEVICES on our STANDS Nos. 30 & 33 at the **RADIO EXHIBITION AND WIRELESS CONVENTION**, Royal Horticultural Hall, Oct. 10th to 16th



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Intensive research work has been carried out in the past few months by Igranic radio engineers with the result that many notable additions have been made to the range of Igranic Radio Devices. Among the new components there are Combined Instruments for filament

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5. Smooth action, spindle tension is maintained by a specially designed friction washer.
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This condenser is fitted with optional soldering Tags, or Terminals, and can be supplied with or without Vernier as desired.

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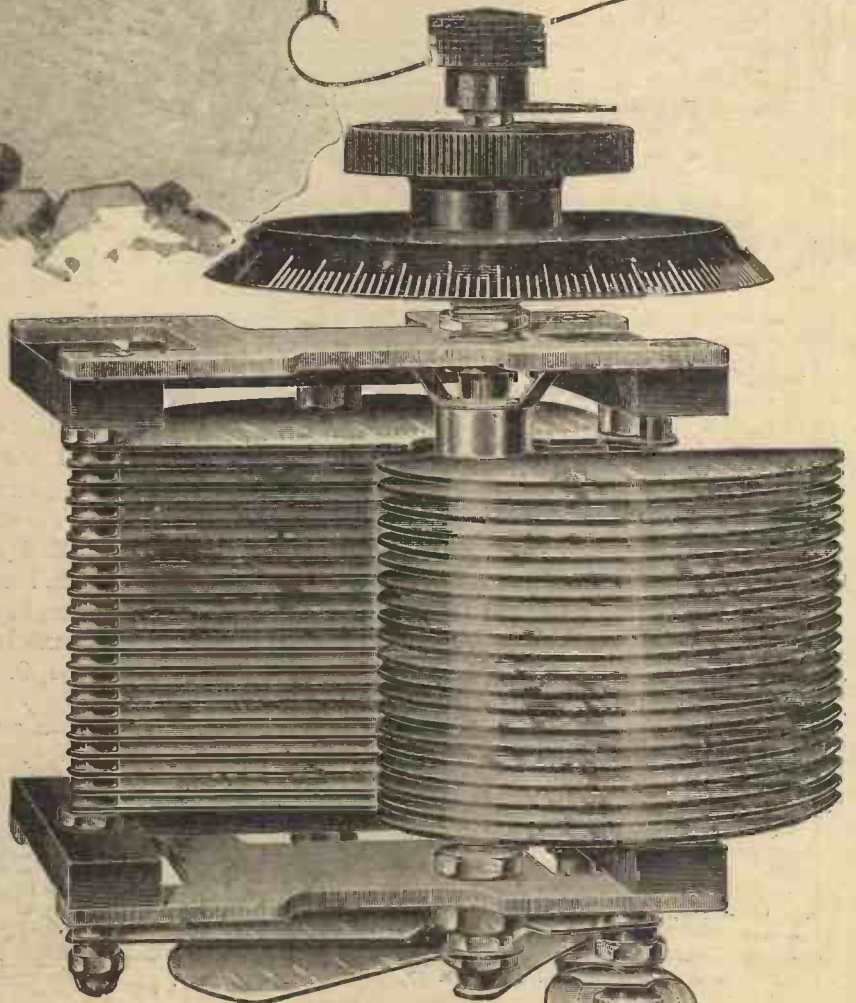
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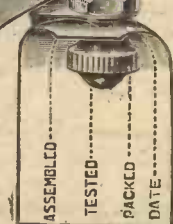
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any terminals on the I.F. transformers, which would otherwise be joined to low-tension negative. You will now be able to apply the desired potential to the grids of

it is often possible to work lower down the curve than is evident from the ordinary characteristic curve. In other words, it would be more convenient in practice if we could

volts was enormous, and the transformer handled the power without any appreciable distortion. When using as an amplifier after a valve set, if the reaction coil is taken out, the reaction coil socket must be shorted.

The author hopes that this receiver will find favour with many readers, and details of results obtained will be greatly appreciated.

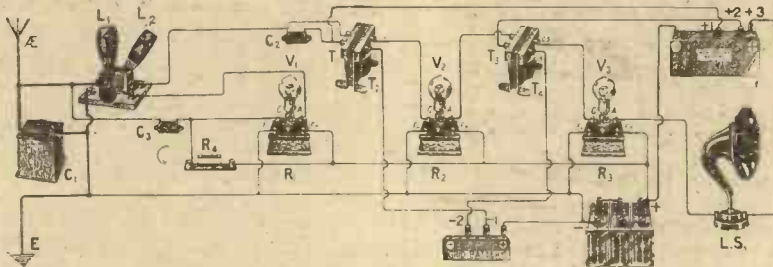


Fig. 3.—A pictorial representation of the Fig. 2 circuit.

The "Twin-Valve" Loud-Speaker Receiver

SIR,—It may interest you to know that, having had great success with the "All Concert" (*Modern Wireless*, September, 1923, by Percy W. Harris) and "Family Four-Valve" Receivers (Envelope No. 2, by Percy W. Harris), I decided to "hook up" the above receiver for trial purposes.

The results with only two valves have exceeded all expectations, as with the components mounted on a piece of old ebonite and with unsoldered joints and roughly constructed, I have had Leeds-Bradford, Manchester, Newcastle and Bournemouth at loud-speaker strength, enough to work a large Dragon type wooden Amplion.

My aerial is 70 ft. long, 30 ft. high, and on the phones I have logged all the B.B.C. stations, one French station, Hamburg, and another German station in addition, within an hour of commencing testing it on my aerial. The signals of the distant stations, Aberdeen, Birmingham, Bournemouth, Glasgow and the foreign stations were as loud as on any three-valve straight-circuit set, and I am extremely pleased with my results at first attempt with a roughly wired receiver, and intend to stick to the circuit. I have also received KDKA, WGY, WBZ at exceptionally good phone strength, the receiver displaying remarkable stability. I have also had Petit Parisien, Madrid and German stations (two) which as yet I have not identified. The B.B.C. stations (main) with a note magnifier all come in at good strength on a large Amplion.

This set is extremely selective. I live within 3½ miles of the Bradford relay station, and I can cut it out in 2 degrees on either condenser. Speech and music are perfect and free from distortion.

Yours faithfully,

MAURICE H. WILKINSON.
(Radio 2AVX.)

Shipley, Yorks.

your I.F. valves by plugging in each of the plugs at the correct tapping on the battery.

It should be noted that in all cases the values obtained from the maker's static characteristic curves are the minimum values of grid-bias to use. For reasons which cannot be dealt with in this short article

adjust our grid-bias with a knowledge of the working characteristic.

A Further Advantage

Not only does correct grid-bias improve quality, but at the same time it decreases the anode current, thus reducing the load on the high-tension battery.

A Detector and Amplifier in One

(Concluded from page 43)

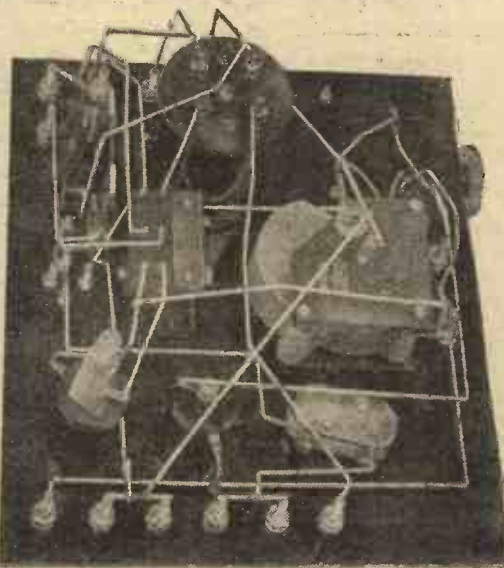
came in at very good phone strength. Radio Paris was also received with the same coil as Chelmsford. On the shorter waves, even while 2I.O. was working, it was possible to tune in three or four other B.B.C. stations with ease. Two French and two German stations were tuned in at the same time, but no attempt was made at identifying any of the stations, as they are so numerous and give their call signs so infrequently. With D.E.5 Valve as Detector

A D.E.5 valve was tried as a detector, using 120 volts on the plate. This provided real loud-speaking at even 10 miles from 2I.O. Signals were loud enough to be heard on the floor below, and they were quite as loud as is necessary for a moderate size room. But distant stations were difficult to tune in owing to reaction overlap. Using this valve as an amplifier after the crystal receiver, signals were much louder than with the ordinary valve, but

were not louder than with this valve as the detector.

Excellent Power Amplifier

The set makes an excellent power



Flexible wires are taken to the coil holder from suitable points on the stiff wiring.

amplifier, and was used as such after a two-valve set. The amplification using the D.E.5 with 120

What to do with Three Valves

Some interesting circuits employing three valves which may be tried out. The circuits range from a simple loud-speaker circuit to a very selective arrangement for those troubled by interference

THE first circuit which we will consider is that shown in Fig. 1, and consists, as will be seen, of a detector valve, with reaction on to the aerial circuit, followed by two stages of note magnification, the low-frequency coupling in this case being effected by means of iron-core transformers. The aerial circuit comprises the coil and condenser circuit L_1C_1 , the ends of which are connected across the grid and filament of the first valve, and, since we wish this valve to rectify, we have to insert a grid condenser and leak C_2R_4 as shown, between the grid and top end of the aerial circuit. In the plate circuit of this valve we join a coil L_2 , which is coupled back to L_1 , in order to produce reaction effects. The other end of the reaction coil is joined, through the primary winding of the first transformer, to a tapping, marked

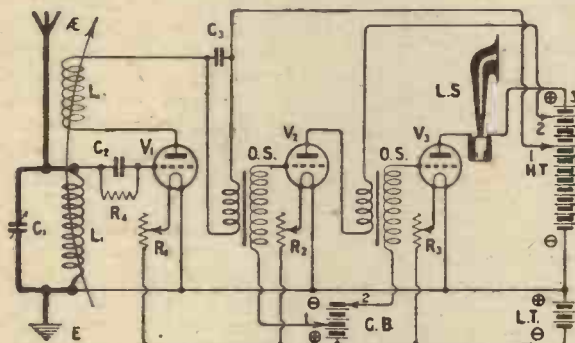


Fig. 1.—A simple loud-speaker circuit.

H.T.1, on the high tension or anode battery. A fixed condenser must be connected across the primary winding of the transformer, in order to by-pass any high-frequency currents which may be flowing in the anode circuit, and should have a capacity not less than $0.0005\mu F$, $0.001\mu F$ being a usual value. The OS connection of the transformer is joined to the grid socket of the second valve holder, while the IS lead is taken to a tapping on a small dry battery, known as a grid-bias battery, or sometimes more simply, a grid battery.

The anode of the second valve is joined, through the primary of the second transformer, to another tapping, marked H.T.2, on the anode battery, a higher voltage being required in this case than in that of the detector valve. Regarding the secondary winding of this transformer, the OS goes to the grid of the third valve, while the IS is joined to a second tapping on the grid battery.

The loud-speaker is joined in the plate circuit of the last valve, a higher anode voltage being required here than in either of the previous cases. The filament circuit calls for no comment, and the grid battery positive end is joined to L.T.—, the tapings being taken on the negative side.

For reception of the short wave broadcasting

stations, a No. 35 or 50 coil may be used as L_1 , while L_2 may be a No. 50 or 75. C_1 is a variable condenser of $0.0005\mu F$ maximum capacity, while C_2 and R_4 may have the usual values, namely, $0.0003\mu F$ and 2 megohms respectively.

This circuit will be found quite satisfactory for loud-speaker work from the local station, up to, say, 25 miles, while in favourable circumstances two or more other stations may be heard. For the reception of Daventry, L_1 may be a No. 150 coil, a No. 200 or 250 being used for L_2 ; the other values remain as before.

A Circuit for Daventry

Many people, who live in places served by the new 5XX station, will require a set to receive signals from that station, and the circuit given in Fig. 2 will be found quite suitable for this purpose. It will be seen that we have a high-frequency amplifying valve, V_1 , followed by a detector and one stage of resistance-coupled low frequency amplification. The use of a resistance to couple the high frequency valve to the detector makes the receiver exceedingly simple to operate, the only tuning control being the aerial circuit condenser. This method of H.F. coupling is, however, of little use below 1,000 metres, but on waves such as that under consideration, namely, 1,600 metres, the simplicity of this method greatly outweighs any slight defects, as far as broadcast receivers are concerned, always provided that the resistance is of reliable make and reasonably free from unwanted crackling and hissing noises.

The aerial circuit of this circuit calls for little comment, as it is practically the same as that of the previous circuit, the coil L_1 being a No. 150 and the condenser a $0.0005\mu F$.

Reaction is obtained by coupling L_2 , a No. 200 or 250 coil, back to the aerial coil, and care should be

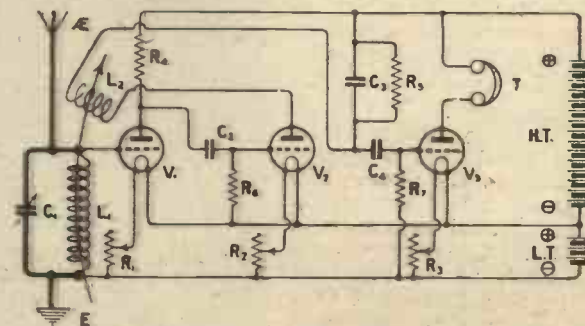


Fig. 2.—This circuit is especially designed for reception of Daventry.

taken not to tighten the coupling to such a degree that the set commences to oscillate.

A receiver made upon these lines will be found very easy to control, and may be relied upon to satisfy



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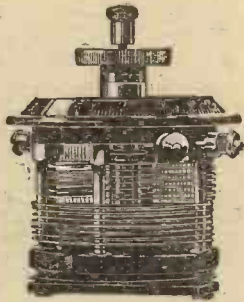
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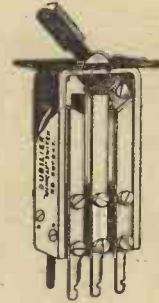
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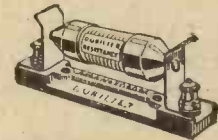
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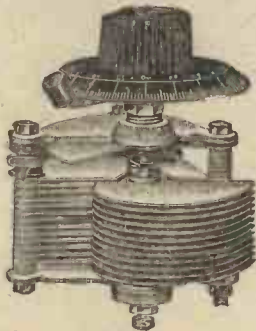
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A Tri-Coil Circuit

The third circuit is one which will be found useful in cases where high-frequency amplification is required on the 300 to 500 metre broadcast band, the coupling employed being that known as "Tri-coil Coupling," originally described by Mr. John Scott-Taggart. The aerial circuit comprises the coil L_1 and condenser C_1 , the grid and filament of the first valve being joined across this circuit. In the anode circuit of V_1 we have an untuned coil L_2 , coupled to which is a coil L_3 tuned by a variable condenser C_2 , across which circuit the rectifying valve V_2 is connected, this being followed by a stage of note magnification.

The three coils are mounted in a conventional type of three-way coil-holder, the untuned coil L_2 being

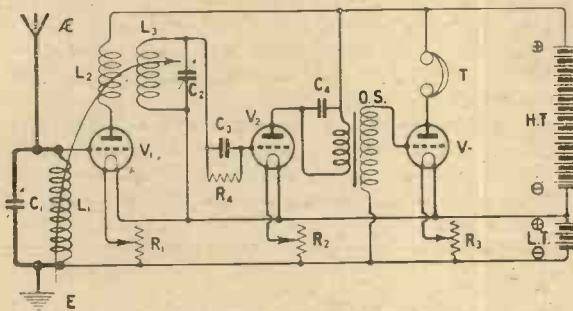
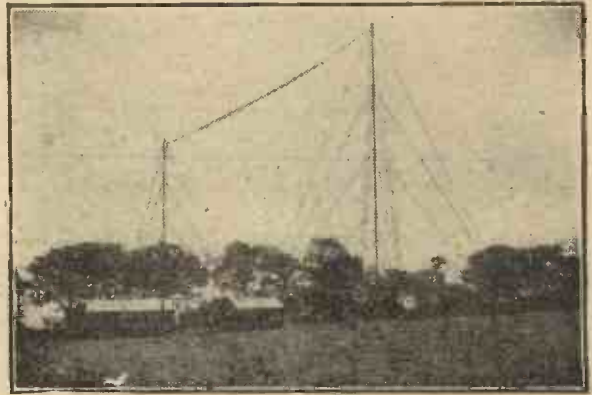


Fig. 3.—An interesting circuit employing one H.F. valve.

the central coil of the three, in order that each of the other coils may be varied in position with relation to it. Reaction is obtained by bringing L_1 closer up to L_2 , while sharper tuning is made possible if the coupling between L_2 and L_3 is fairly loose.



A view of the complete aerial system of the B.B.C.'s receiving station at Hayes. It was here that Mr. Austen Chamberlain's speech was picked up from the continent for re-broadcasting from the British stations on September 10.

Operation

Operation of this circuit will be found slightly more tricky than either of the first two, but will repay time spent in learning how to operate it, as one will be able, in average circumstances, to hear distant signals,

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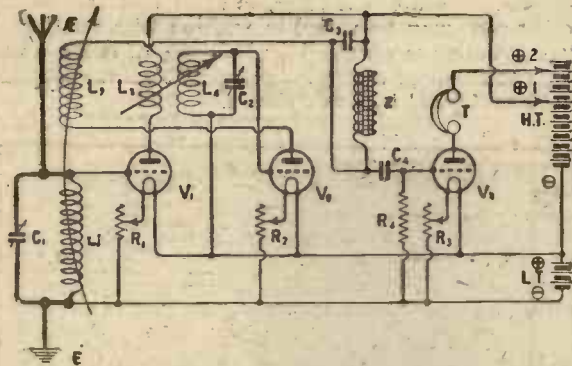


Fig. 4.—A useful arrangement giving selectivity.

which may need separating from unwanted interference, and the circuit will then provide some interesting hours in the elimination of such signals.

Some values are:—

L_1 , No. 35 or 50; L_2 , No. 75; L_3 , No. 50. R_1 , $2M\Omega$. C_1 , $0.0005\mu F$; C_2 , $0.0003\mu F$; C_3 , $0.0003\mu F$; C_4 , $0.001\mu F$.

For the long wave station, L_1 may be a No. 150, L_2 a No. 300, while a No. 200 or No. 250 will serve for L_3 .

Loose-coupled H.F. Transformer

The fourth arrangement of three valves is interesting, as it employs a high-frequency amplifying valve, transformer-coupled to the detector valve, the latter being followed by one stage of choke-coupled note magnification. The high-frequency transformer, the secondary of which only is tuned, consists of two plug-in coils, mounted in a two-way coil-holder, in order that the coupling between them may be varied, thus making the arrangement capable of more selective

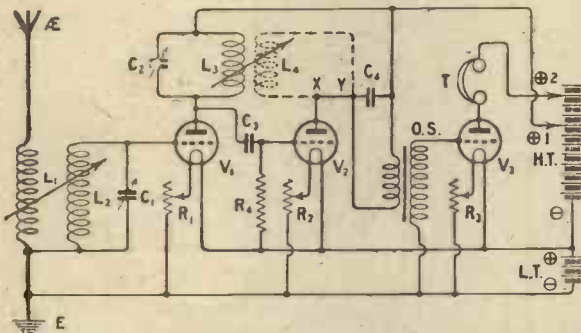


Fig. 5.—Another selective arrangement.

tuning than when the two windings are closely coupled together.

Reaction is introduced by means of a coil L_2 , in the anode circuit of the detector valve V_2 , this coil being coupled to the aerial coil L_1 by means of a two-coil holder.

This circuit is somewhat more complicated than those we have previously discussed, and more care will be called for in its operation, due to the fact that there are, in addition to the two variable condensers, two two-coil holders to operate. With practice, however, very good results will be obtainable with this arrangement, which should prove of interest to those desiring a circuit which is somewhat more selective than the more conventional tuned anode system.

Coils and Condensers

The two variable condensers C_1 and C_2 may be of $0.0005\mu F$ and $0.0003\mu F$ maximum capacity respect-

tively, while for broadcast reception on the lower band the coils L_1 to L_4 may respectively be Nos. 35 or 50, No. 50 or 75, No. 75, No. 50.

The choke coil should be of a suitable design for low-frequency amplification, and in this connection the reader will be interested in an article entitled "A Unit Choke Amplifier," by Mr. John W. Barber, which appeared in our April, 1925, issue.

Other values for this circuit are as follows: C_3 , not less than $0.0005\mu F$; C_4 , any value from $0.007\mu F$ up to $25\mu F$, $0.01\mu F$ being a suitable figure. R_4 , $\frac{1}{2}$ to 1 megohm.

Coils for Daventry may be, in the order L_1 to L_4 respectively: Nos. 150, 250, 300, and 200 or 250.

Semi-Aperiodic Aerial Coupling

The fifth circuit which we have to consider has an untuned or "semi-aperiodic" aerial circuit, L_1 , coupled to a closed secondary circuit L_2 C_1 , which is joined across grid and filament of the first valve, and which is earthed at its lower end as shown. In the anode circuit of V_1 we have a tuned circuit L_3 C_2 , which constitutes the conventional tuned anode arrangement,

As a general rule, this circuit will not require an additional reaction coil, but should it be necessary to introduce such a coil, it should be connected up as shown dotted (L_4), the connection between the points



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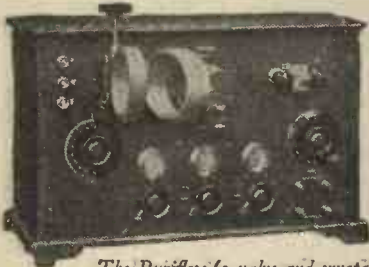
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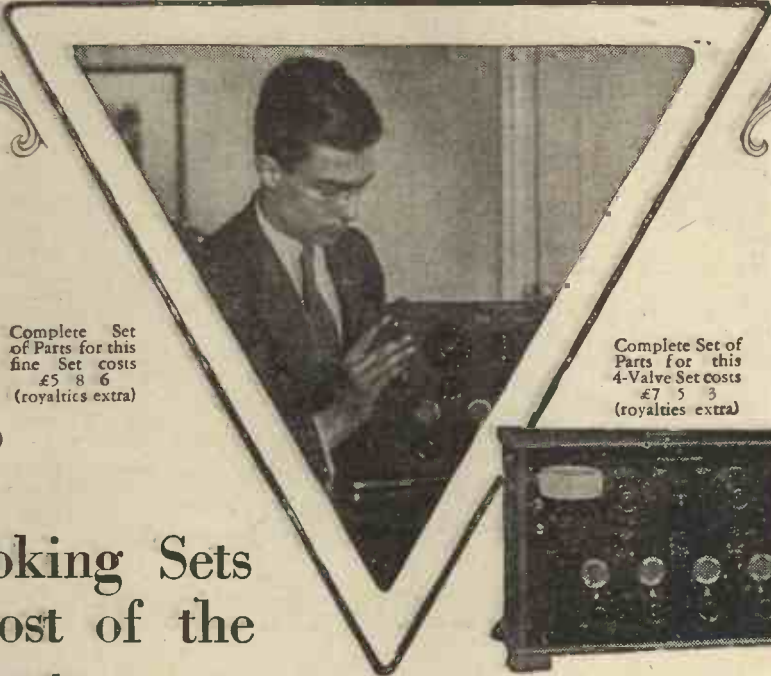
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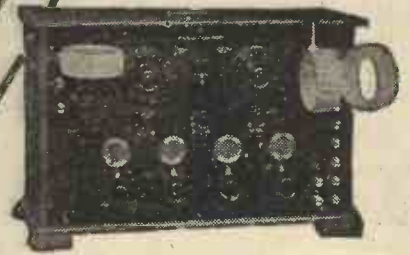


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X and Y being omitted. The low-frequency valve in this case is transformer-coupled, the OS connection being taken to the grid of V_3 . No definite rule can be laid down with regard to the primary winding

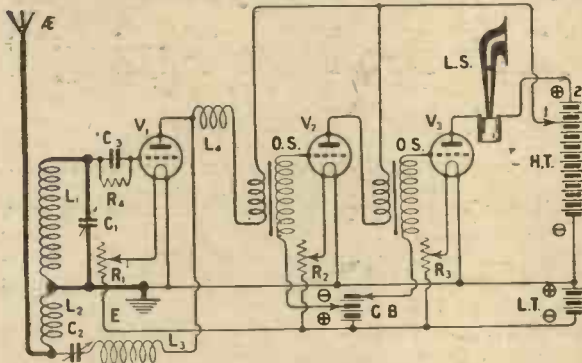


Fig. 6.—A Reinartz circuit.

connections, as some transformers work best with OP, some with IP, joined to the anode of the preceding valve.

Signal strength will, in general, be greatest when L_1 and L_2 are close together, but an increase in selectivity will result when these coils are separated to some extent.

Values are as follows: C_1 , $0.0005 \mu F$; C_2 , $0.0003 \mu F$; C_3 , $0.0003 \mu F$; C_4 , $0.0005 \mu F$ to $0.001 \mu F$. R_1 , 2 megohms. L_1 , No. 25 or 35; L_2 , No. 50; L_3 , No. 50; L_4 , when required, may be a small coil, say, No. 35.

A Useful Selective Circuit with Reinartz Coupling

A more complicated form of circuit is shown in Fig. 6. This is what is known as a "Reinartz" circuit,

being developed by Mr. John L. Reinartz, the well-known American experimenter.

In this circuit the aerial is semi-aperiodic, being coupled by means of the coil L_2 to the grid circuit coil L_1 , the latter being tuned by means of the variable condenser C_1 . Reaction is obtained by means of the coil L_3 and condenser C_2 , the amount of reaction being controlled by the condenser C_2 . These three coils may be mounted in a three-coil holder. The coil L_1 is a high-frequency choke coil, which may consist of a No. 300 plug-in coil, or alternatively 300 turns of No. 30 d.c.c. wire may be wound on a $3\frac{1}{2}$ in. diameter tube.

The remainder of the circuit calls for little comment, the remaining two valves being shown transformer-coupled, although resistance or choke-coupling may be substituted if desired. No fixed condenser is required across the primary winding of the first transformer in this case.

This arrangement is primarily suitable for the short wave broadcast reception, and coils may be as follows: L_1 , No. 50; L_2 will be small, the exact size depending upon your aerial for the best results, but at first a No. 25 may be tried; L_3 , No. 50 or 75. C_1 , C_2 , $0.0005 \mu F$.

In operation, the coils L_1 and L_2 should be set close together, L_3 being kept away. Set C_2 at zero and rotate C_1 . Reaction will probably be absent, and in this case bring up L_3 to such a position that reaction commences when C_2 is set at about a half its scale reading. Reaction control will then be quite smooth and easily controlled by the condenser.

Further values are: C_3 , $0.0003 \mu F$; R_1 , 2 megohms; the values of H.T. and grid-bias will be dependent upon the valves in use, while the grid-bias will depend upon the voltage applied to the anodes.

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An Auto-Coupled Crystal Receiver for Fine Tuning

By H. BRAMFORD

where the variable condenser is used across a small portion of the aerial tuning inductance. Should the constructor find, however, that he does not require the extra capacity across his tuning condenser, a slight alteration in the wiring will allow this fixed capacity to be placed across the telephones.

The components and materials required for constructing this receiver are as follows. (As there may be

some constructors who will wish to copy this receiver in every detail, the names of the manufacturers, as well as the components, have been given for their guidance.)

Materials Required

- One piece of ebonite 4½ in. by 9 in. by ¼ in. (or ⅜ in.).
- One variable condenser, .0001 μF (K. Raymond).
- Four small pillar terminals.
- Twelve Clix sockets (Autoveyors).
- Three Clix plugs having different colours (Autoveyors).
- One coil socket (K. Raymond).
- One shorting plug.
- One cardboard or ebonite tube 2½ in. long by approx. 2¼ in. diameter.
- One clip-in fixed condenser of, say, .0003 or .0004 μF (L. McMichael, Ltd.).
- Small quantity of 22, 24 or 26 S.W.G. D.C.C. wire.
- One permanent detector (Liberty).
- Suitable box.

Constructional Details

The panel lay-out shown in Fig. 2 gives the necessary dimensions in order that the panel may be drilled. The holes to receive terminals are drilled 4 B.A. clear while those to receive Clix sockets need a ⅜ drill.

Assembling

The various components may next be assembled on the panel, all the necessary details required being shown in Fig. 2. The aerial, earth, and two telephone terminals are first mounted on the panel, after which the coil holder and Clix sockets (X, X₁ and 5-50) are fixed. The variable condenser, in this case one of the single-hole mounting

type, is fitted in the usual manner. A small pointer made of white celluloid, which provides a reference point for dial readings, is secured to the panel by means of a 4 B.A. screw and nut midway between the two telephone terminals. Small indicators of this type are now on the market, and

THE receiver described in the following article is simple in design, and will be found to give good results. For the reception of the local broadcast station a 50 turn coil is used, which is tapped at every 5 turns, while for the reception of signals from 5XX at Daventry a loading coil may be inserted in the circuit by means of the socket provided. For fine tuning a variable condenser is used, which has a capacity of .0001 μF.

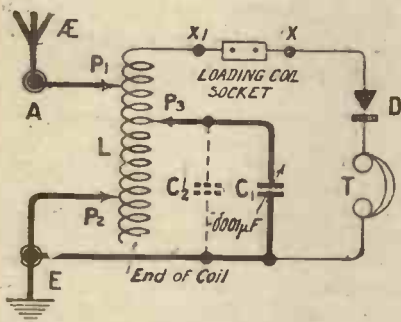


Fig. 1.—How the tapings on the coil are arranged.

The circuit is so arranged that by means of a Clix plug this condenser may be used across that part of the inductance which is included in the aerial and earth circuit, or across the whole of the inductance in use. Should it be desired to use a larger value capacity than that provided a clip-in condenser may be connected in parallel with the variable condenser by means of the clips provided on the panel. This will probably only be found necessary

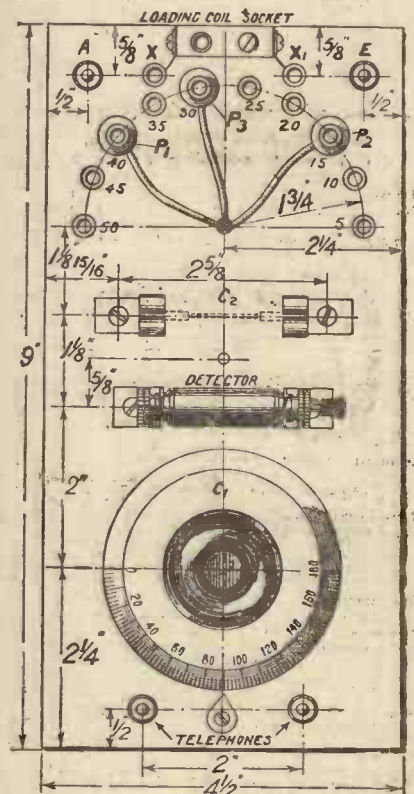


Fig. 2.—Showing how the panel is drilled and the positions of some of the components.

may be purchased by those who do not wish to make them at home. The dial should be locked on the spindle, so that when the 180° reading is opposite the indicator the moving vanes of the condenser are full in. All that is now left to complete the assembly above the panel is to mount the detector and the clips for the fixed condenser.

Tapped Coil

The next stage in the construction of this receiver is to make the

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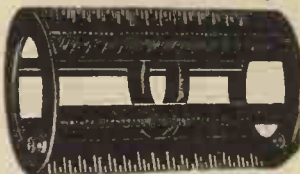
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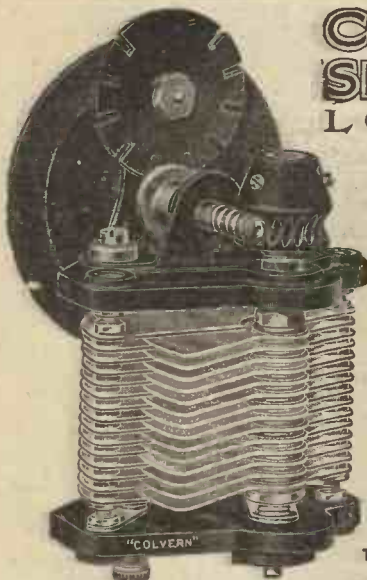
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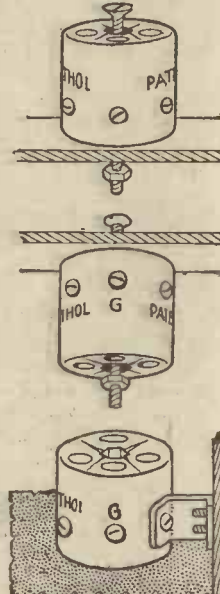
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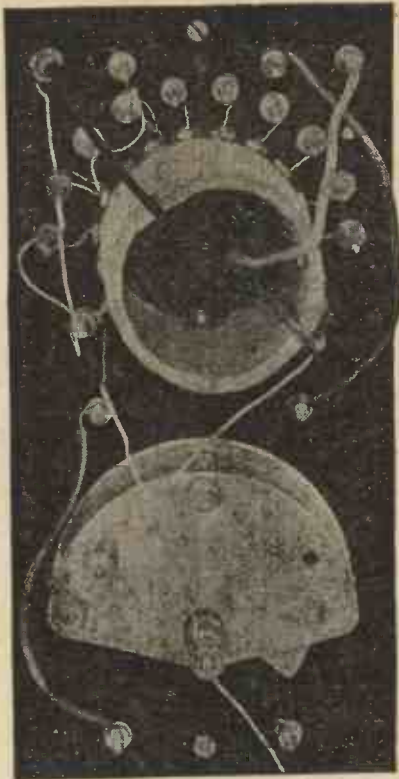
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The coil is secured to the panel by a piece of right angle brass.

tapped coil, which is used for the reception of the local broadcast station. Fig. 3 gives full details of the construction of this coil and the method employed in mounting it beneath the panel. It will be necessary to procure a piece of cardboard or ebonite tubing about $2\frac{1}{2}$ in. in diameter, the length of which will be in accordance with the gauge of wire used for winding the inductance. Fifty turns are required, and if 26 S.W.G. wire is used, $2\frac{1}{2}$ in. of the former will be sufficient, while for 24 or 22 S.W.G. 3 in. will be the correct length. Having cut the former to the length required, holes should be drilled half way round one edge to receive eleven short 4 B.A. screws and nuts, as shown in Fig. 3. A small hole should now be drilled to secure the end of the winding which is connected to the screw marked 1. Having wound on five turns, perforate the former directly in a line with the screw marked 2. Make a loop in the wire and pass it through the hole thus made. This loop is bared of its cotton covering, and secured between the head of screw 2 and the former. The wire is then pulled tight, the screw tightened up and the winding proceeded with for another five turns. Similar tappings are taken at every five turns until 50 turns in

all have been wound on. The end of the wire is then fixed to screw 11. The inductance should now be secured to the panel. A small piece of brass is bent at right angles and fastened to the former by means of a 4 B.A. screw and nut, the bracket being attached to the panel in a similar manner. The set is now ready to wire up.

Wiring

The actual wiring diagram taken from the back of the panel is shown in Fig. 4. The procedure in making the connections will be as follows: First connect one side of the coil socket to Clix socket marked X, and pass from this point to one side of the detector. The other side of the detector connects to one of the telephone terminals, the other telephone terminal connecting to earth terminal, also to the moving vanes of the variable condenser, and to one of the fixed condenser clips. The other side of the coil socket is connected to the Clix socket marked X₁ and thence to the beginning of the tapped coil. The fixed vanes of the variable condenser are connected to the remaining fixed condenser clip. A grey flexible lead P₃ passes from this point through a hole drilled in the panel, the end of the lead being provided with a Clix plug having a blue insulating bush. Connect a red flexible lead P₁ to

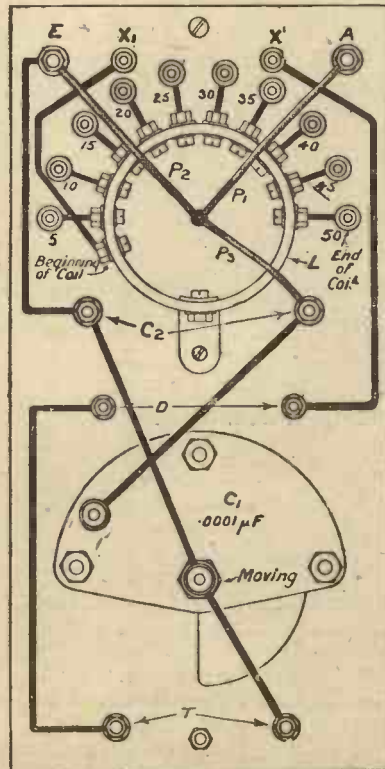


Fig. 4.—How the panel is wired up.

terminal A on the under side of the panel, and pass through the panel hole as before. The fixed

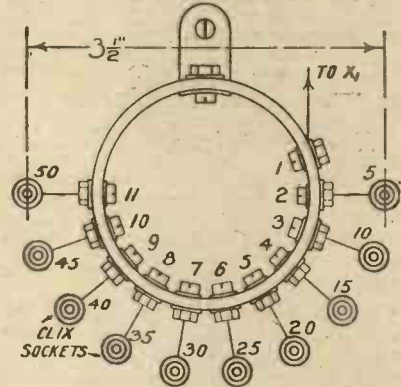
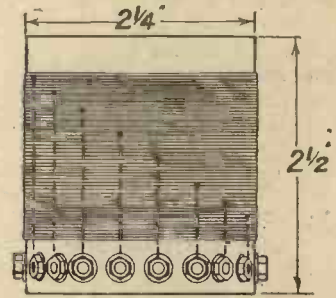


Fig. 3.—The tappings on the coil are connected up as shown.

plug on the end of this lead is provided with a red insulating bush; a black lead from the earth terminal is designated P₂ and ends in a white bush. The three colours enable the constructor easily to differentiate between the aerial earth, and condenser plugs.

Operating the Receiver

As a guide to the operation of this receiver the theoretical circuit diagram, shown in Fig. 1, will be of use. The 50 turn tapped inductance is shown at L, while C₁ is the variable condenser. The aerial plug is P₁, and the earth plug P₂, and the condenser plug P₃. The procedure to follow when receiving the local broadcast station is as follows: Connect the aerial lead to terminal A, and the earth to terminal E, and insert the earth plug P₂ in one of the sockets running from 5 to 50, doing the same with the aerial plug P₁, trying different sockets until signals are heard. For the local station the coil socket will, of course, be shorted with the shorting plug. In most cases the tapped coil will prove sufficient for local reception. Next insert the condenser plug P₃ into the socket preceding that in which the earth plug is placed. You can then tune by means of the variable condenser in the usual

manner. The effect can next be tried of shifting the earth and condenser plugs, a socket at a time in either direction, and similarly the effect of shifting the aerial plug may be tried until the local station is received at its loudest. With some aerials a small loading coil may be required. This will be inserted in the socket provided for the purpose.

Reception of 5XX

In order to receive transmissions from 5XX the procedure will be similar to that just described, except for the fact that a loading

coil should be inserted in the socket provided. A suitable size for this coil will be a No. 150 or 200.

If it is desired to use direct-coupling, the aerial plug P₁ is inserted into the Clix socket X.

When it is desired to use auto-coupling the aerial plug may be inserted in any one of the sockets 5 to 50. To use the variable condenser across the inductance between aerial and earth, the condenser plug should be inserted into the aerial plug, while to place the condenser across the whole of the inductance in circuit, the condenser plug should be put into fixed socket marked X.

Test Report

This receiver was connected to a small aerial at a distance of about 8 miles east of 2LO. Signals were exceptionally clear. On a particularly small indoor aerial a No. 25 coil in the loading coil socket was found necessary. With a 250 turn loading coil, 5XX was easily received. The condenser C₁ gave fairly sharp tuning and was found to operate best when used across the inductance from aerial to earth, the best position having been first located on the coil by means of the earth plug.

A Handy Soldering Lamp

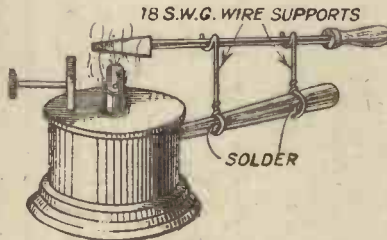
How a spirit lamp may be converted for use in the wireless den

IF you are lucky enough to have electric light in your house, and wise enough to provide yourself with an electric soldering iron, you know nothing of the difficulties experienced by those who are not so fortunate. In my house I have no supply of electricity, and the gas is so dirty that even when a Bunsen burner is used one's soldering iron requires constant attention when heated in this way. For wiring work I always use a small iron, chiefly because it is so handy, enabling one to get without difficulty to places that would be inaccessible with one of larger size. Recently I have discarded altogether the use of gas for iron heating purposes, and have been using instead the spirit lamp illustrated in the drawing. This is the kind of lamp used for boiling kettles at picnics. It can be purchased at almost any ironmonger's at a very small cost.

Reconstruction

These lamps usually have three L-shaped supports for a kettle or saucepan fixed to them, but the supports should be removed, either by cutting them off with a hacksaw or by drawing them out with a pair of pliers, and soldering over the holes left after their removal. The next process is to make a pair of supports for the soldering iron similar to those shown. For this purpose either copper wire of No. 18-gauge or square tinned rod may be used. Personally I prefer the former, since it is easily bent into any shape that one likes; the holders can thus be altered in a moment to suit any kind of small soldering iron that may be in use. Fix the supporting pieces firmly to

the handle of the lamp and solder them in place. This is a simple operation, since the surface of the handle is already tinned. The best type of lamp to purchase is one which has a movable sleeve round the wick holder. This can be raised or lowered by means of a rack and pinion arrangement operated by a small knob, and enables the flame of the spirit lamp to be made larger or smaller according to one's requirements. When the iron is being heated up in the first instance the flame may be pretty large, but



The completed heating lamp.

once it has been made hot quite a small flame will suffice to maintain it at the proper temperature or to reheat it from time to time.

The Tinned Point

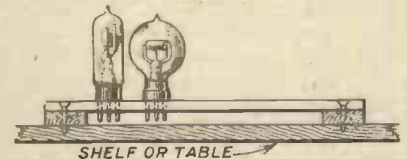
Even methylated spirit may slightly soil the tinned surfaces of a bit in time if care is not taken. I find it a good tip never to put the tinned point of the bit in the flame, but always to arrange the iron as shown in the drawing, so that the point is outside the flame. If the latter is at all smoky, any solid matter that there may be is deposited on the untinned portion of the bit, where it does not matter in the least.

R. W. H.

A Rack for Spare Valves

WHEN carrying out experiments which involve constant circuit changing, or when comparing the performance of different types of valves in a receiver, a rack in which to put the valves when not in use will be found very handy; valves placed loose on the table have an annoying habit of making for the floor, and also they are exposed to the risk of being broken by tools, etc., falling on them.

The only materials required for the rack are a strip of wood 1 1/2 in. wide, 1/2 in. thick, and of a length



The construction of the rack.

suitable for the number of valves to be placed in it; two small blocks of wood to be used as supports, and two long wood screws. In the wooden strip holes for the valve pins are drilled as shown in the sketch, a valve template or any other convenient method being used.

The two blocks of wood are placed under the ends of the strip, and two long screws secure the rack to the back of the workshop table or to a shelf. The valves are then ready to hand at any time, while they are reasonably immune from risk of damage.

A. V. D. H.



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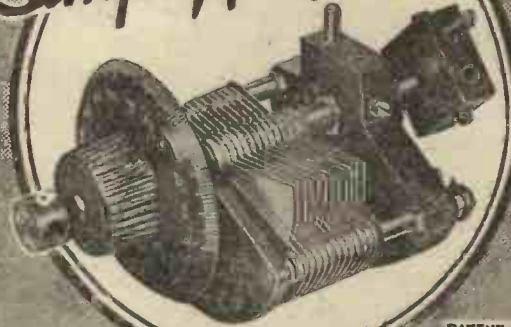
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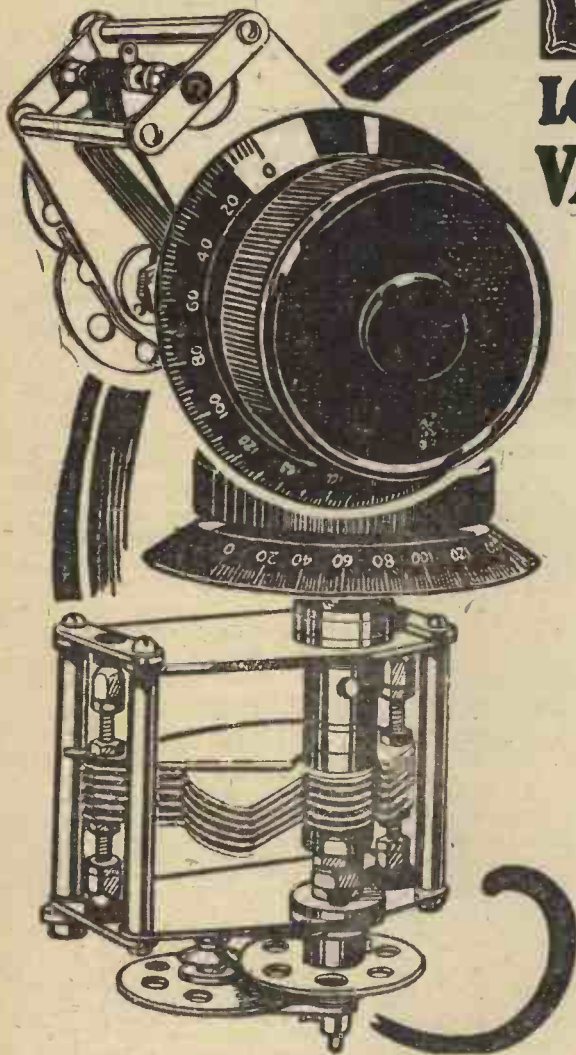
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Other unique features:

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A Useful Light Aerial Mast

By W. H. KING

In this short article, our contributor tells how he made a pair of light masts from inexpensive materials

ALL over the country, in schools and homes, there must be groups of enthusiasts who have started informal "clubs."

Wishing to conduct experiments in the country, away from towns, they have found that a portable

to carry about. The size and length of these sections is immaterial, but 6 ft. lengths of 1½ in. bamboo are suggested.

The number of sections will depend upon the height of the proposed mast, but it should be remembered



Fig. 1.—The masts when erected form a neat and useful outfit.

aerial mast is too heavy, and a set capable of working on a "frame" undesirable in view of bulk, or instability. To overcome these difficulties the author devised the mast described in this article.

Sectional Construction

Roughly, the mast consists of a wooden pole which is cut into light sections, easy to fit together, and

A Few "Don'ts" for Crystal Users

DON'T imagine a crystal will last for ever.

Don't use or buy only one specimen and form your opinion of crystals by its results.

Don't handle crystals; tweezers are very cheap or can easily be improvised.

Don't heat crystals on mounting more than necessary.

Don't use solder for mounting crystals, unless it is definitely stated that solder may be used as in the case of some crystals sold.

that the more sections there are, the more stays will be required.

Making the Ferrules

After cutting the pole into sections, the ferrules shown in Fig. 2 must be made. A piece of stout zinc sheet, measuring at least 1 ft. length, and of breadth 22/7 times diameter of pole chosen is rolled into a tube and soldered

Rings of stout zinc wire (A, Fig. 2) are soldered round at each end, and in the middle to strengthen. The ferrule is then pushed over the end of one section of the pole, up to the middle ring of wire, and screwed on (B, Fig. 2).

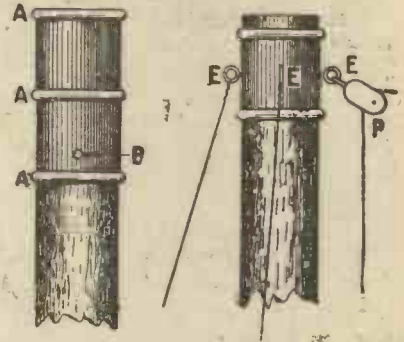


Fig. 2.—Details of the rings and ferrules. The right hand drawing shows how eyelets are used to hold the guy wires.

The Second Ferrule

Another section of pole is then taken, and a ferrule made as before, but about 3 in. long, and omitting the middle ring of wire. The ferrule is bored with four holes about ¼ in. diameter about where the middle ring would have been. The ferrule is slipped over the top of the section of pole, and through each of the four holes is screwed an eyelet (E, Fig. 2). The mast can then be varnished and is ready for use. To erect, the section last described is fitted into the one first mentioned. Through three of the four eyelets lengths of blind-cord are passed, to act as stays, while to the fourth is fixed a pulley (P, Fig. 2), by which the aerial may be pulled up when required.

□ Don't leave crystals lying about in the dust.

□ Don't consider that high-resistance phones are necessary in a crystal circuit. Low resistance telephones will often work equally well without a telephone transformer.

□ Don't forget that a light contact usually gives greatly improved results with the catwhisker-galena type of detector.

□ Don't forget that an applied potential is necessary for carborundum detectors.

□ Don't clean crystals with petrol. Use benzine or alcohol.

□ Don't throw an old crystal away. Restore its sensitivity with alum.

□ Don't omit occasionally to snip off the end of your catwhisker.

□ Don't condemn a crystal after trying only one catwhisker. Try several.

□ Don't forget that a buzzer is useful for testing crystals, especially in selective crystal sets.

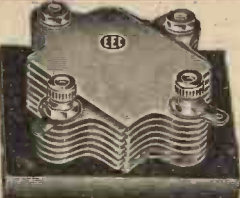

□ Don't forget that adjustable-grip crystal cups can be bought and are very useful for experimenting.

□ Don't break your crystal with pliers. Top them with a sharp-pointed instrument.

□ Don't use an open crystal detector if you can procure or afford a closed one.

□ Don't forget that crystals may be wrapped in tinfoil for temporary mounting.

E. H. B.

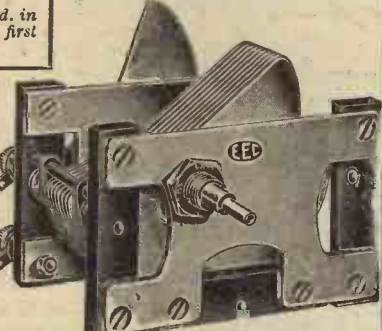
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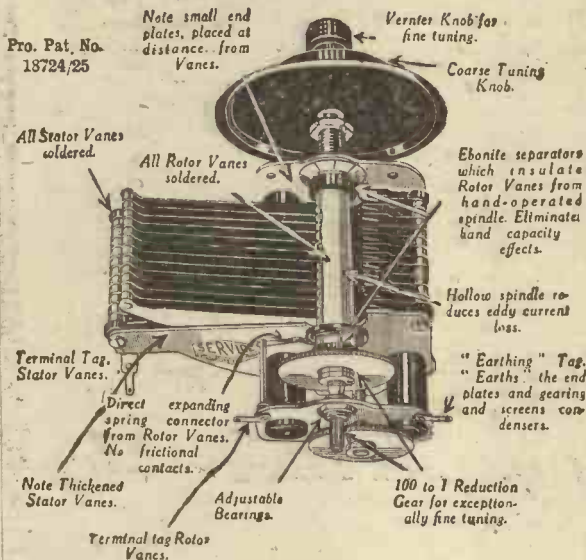
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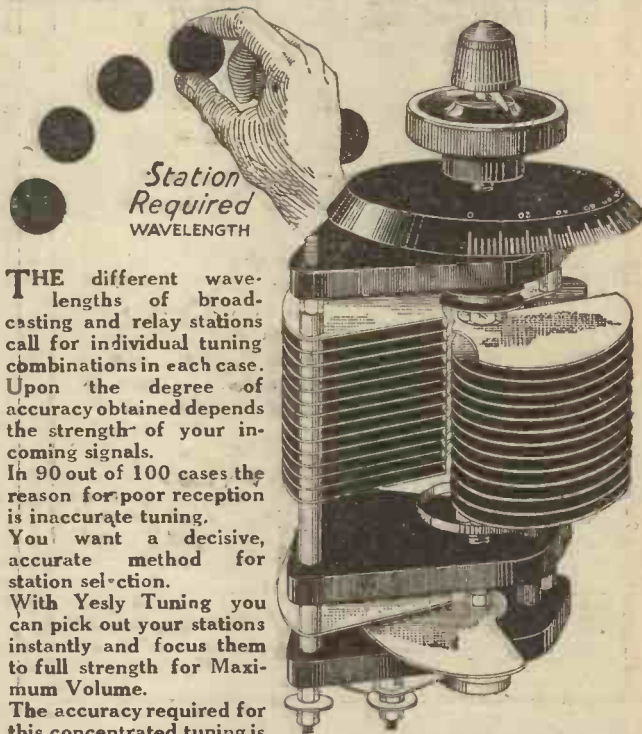
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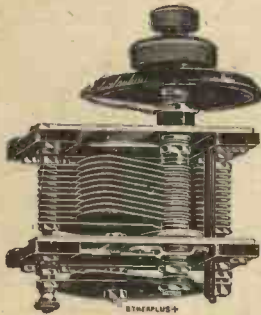
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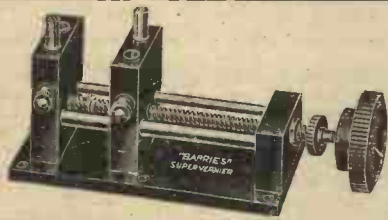
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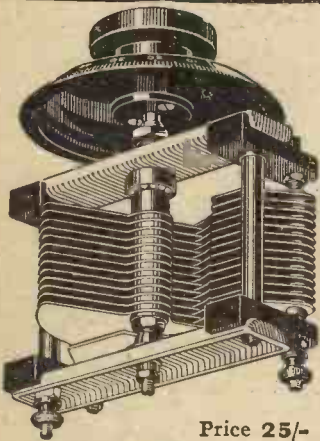
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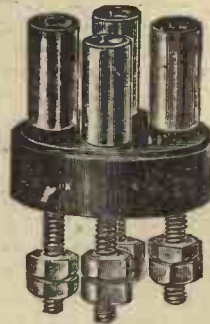
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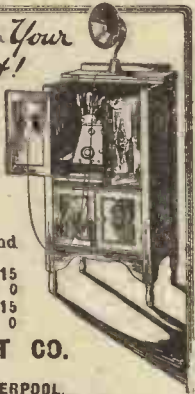
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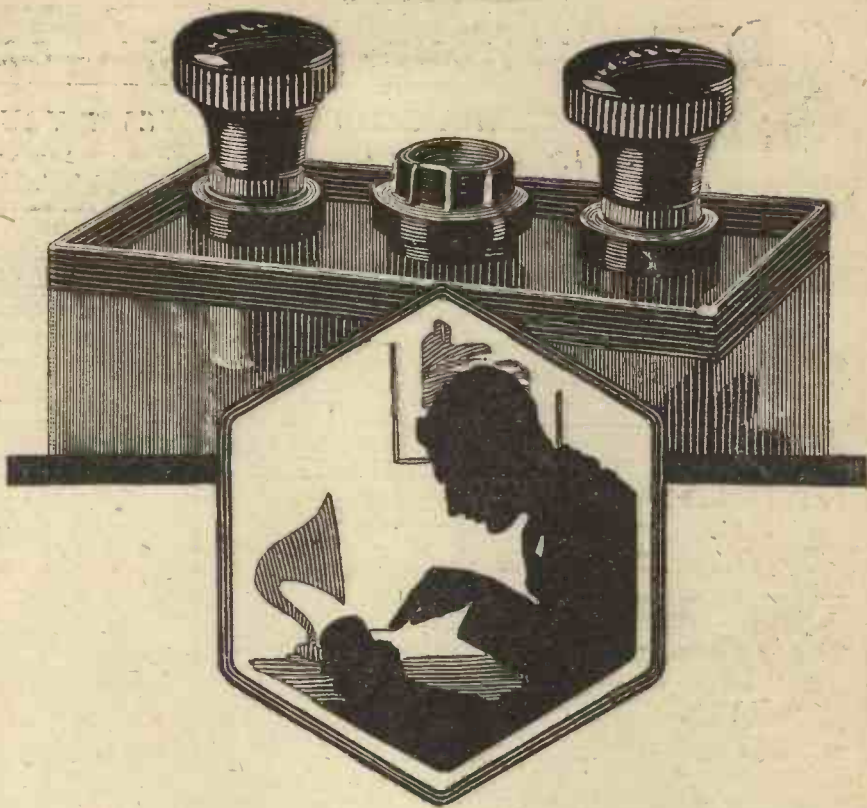
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No. 517 Flare 14" Price - 15/6

All above post extra Trade Enquiries Invited

SCIENTIFIC SUPPLY STORES
128, NEWINGTON CAUSEWAY, S.E.1 'Phone HOP 4.77

Branches: 80, Newington Causeway, S.E.1 7, St. George's Cir. W., S.E.1
16, Manette St., Ch. ring Cross Rd., W.1 21, Edgware Rd., W.2.
94, Ch. ch. Rd., Upper Norwood, S.E.23

DIFFICULTIES SOLVED

Before making your own Receiving Apparatus—CONSULT US

Panels drilled free. Expert advice free for the asking. Full instructions sent for construction of sets. Every class of component part in stock at the right price. All goods sent carriage paid on approval against cash. Do to-day what you failed to do yesterday—send us a post-card.

NOW READY—Blue Prints showing complete construction of 2-Valve Set, including Valves, Coils and Batteries for **£5 1s. 6d.**
Blue Prints Free. Send for yours NOW.

WALTER E. REYNOLDS
(Member of B.E.C.)

4, South Street, Fenton, Stoke-on-Trent, Staffs.

INSIST UPON

CARMALITE

H.T. BATTERIES
L.F. TRANSFORMERS
and
AHEMO HEADPHONES

MERCHANTS & AGENCIES Ltd.
38, Gt. Russell Street, London, W.C.1. 'Phone: Museum 6634/5

DORWOOD CONSTRUCTOR'S GAUGE

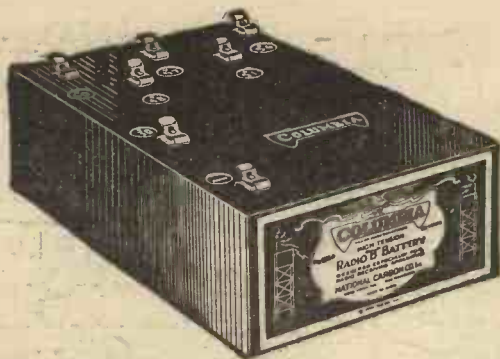
REGISTERED. BRITISH MADE.

1/9

FROM YOUR DEALER, OR POST FREE FROM MAKERS.

NOTHING gives your panel more character and finish than neat accurate setting out of the parts. The Dorwood Gauge is indispensable to constructors. It comprises a Valve template, Contact Stud Spacer to any radius, B.A. tapping and clearing drill gauges, 3 in. Rule and Square. Made in hard plate, silvered and finely engraved.

Sole Makers—
DORWOODS, 274a, Kentish Town Road, London, N.W.5



No. 4780

Price 22/6

60 Volts

COLUMBIA HIGH CAPACITY HIGH TENSION BATTERIES are the most satisfactory plate batteries you can use. The extra large sized cells used in the construction of the batteries not only supply sufficient power for the finest reception, but give an unusually long service life as well. The heavy spring clips ensure quick and secure connections.

There is a size or combination to suit every requirement.

Columbia RADIO BATTERIES

MANUFACTURED ESPECIALLY FOR WIRELESS BY THE WORLD'S FOREMOST BATTERY MANUFACTURERS, these batteries supply that constant energy so essential and necessary for

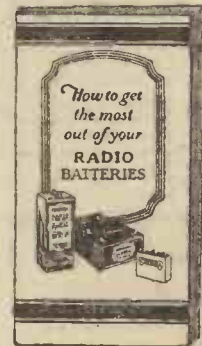
CLARITY—VOLUME—DISTANCE

Stocked by all Leading Wireless Dealers



The FAMOUS
RADIO "A"
CELL
FOR DULL
EMITTER
VALVES

Price
2/6



Send for our new Free Booklet—35 pages of valuable information pertaining to care and operation of your batteries

ADVERTISEMENT OF J. R. MORRIS, 15, KINGSWAY, LONDON, W.C.2

DON'T BLAME THE SET!



Nine times out of ten there is a fault in the circuit which can be put right in a minute or two with the aid of **FLUXITE**.

Solder all joints with **FLUXITE**, and they cease to be joints, but become one unbroken piece of metal. No chance of leakage there!

It's so easy, too. A child could do it. No wireless enthusiast should dream of making joints any other way.

Ask your Ironmonger or Hardware Dealer to show you the neat little

FLUXITE SOLDERING SET

It is perfectly simple to use, and will last for years in constant use. It contains a special "small space" Soldering Iron with non-heating metal handle, a Pocket Blow-lamp, **FLUXITE**, solder, etc., and full instructions. Price 7/6. Write to us should you be unable to obtain it.

Price 7/6

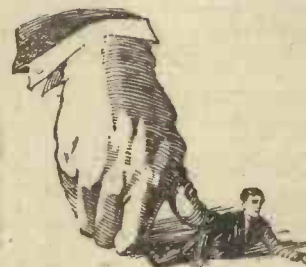


FLUXITE SIMPLIFIES SOLDERING

All Hardware and Ironmongery Stores sell **FLUXITE** in tins, price 8d., 1/4 & 2/8.

Buy a Tin To-day!
FLUXITE, LTD. (Dept. 330), West Lane Works, Rotherhithe, S.E.16

ANOTHER USE FOR **FLUXITE**
Hardening Tools & Case Hardening
ASK FOR LEAFLET on improved methods



What's holding you down?

Just one thing is holding you down. It isn't that you "never had a chance," or that somebody else "has all the luck," or that your employer "doesn't like you."

No—it is none of these. It is lack of training. Deep down in your heart

YOU KNOW

that the reason why others are getting ahead is that they can do things you can't. They know more because they have been trained.

Why don't you study some one thing and get ready for a real job at a real salary? Think what that would mean to your family as well as yourself! The I.C.S. can prepare you in your own home and in your own time for something much better than you now have.

The I.C.S. originated spare-time technical training by post 34 years ago, and is by far the largest institution of its kind in the world. It has teaching centres in eleven countries, and students in fifty.

Write to-day for full information as to how the I.C.S. can help you in your chosen vocation. There are 300 I.C.S. Courses, of which the following are the most important groups:—

- | | | |
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| Accountancy | Wireless Telegraphy (Elementary and Advanced) | Salesmanship |
| Advertising | Draughtsmanship | Scientific Management |
| Architecture | Engineering (all branches) | Showcard Writing |
| Building | French and Spanish | Textiles |
| Commercial Art | General Education | Window Dressing |
| Commercial Training | Professional Exams. | Woodworking |

International Correspondence Schools, Ltd.
172, International Buildings, Kingsway, London, W.C.2

WHY BUY ACCUMULATORS?

WHY BUY ACCUMULATORS?

If you add depreciation to the expense and inconvenience of having your own accumulators, unskillfully recharged, it costs you considerably more than our inclusive Hire Service.

and suffer the depreciation and many annoying inconveniences caused by unskilled charging. WE SUPPLY and deliver a New Rotax Wireless Accumulator of suitable size for your set. We call and exchange it for another fully-charged one weekly or fortnightly for 13 weeks from 8s. inclusive.

If you have your own accumulators we give the same continuous service from 6s. per quarter—and if you have only one, lend you one of ours, alternate exchanges.

RADIO SERVICE CO., 105a, TORRIANO AVENUE, KENTISH TOWN, N.W.5

REAL SERVICE—Hire or Maintenance

WRITE FOR FOLDER "Z-3" 'PHONE—NORTH 4161, 4162

The New MAXEL Accumulator

Specially designed for Wireless
GUARANTEED TWELVE MONTHS.
 If you live too far away to call and see the Battery Mail your Order to us for the size you want. We will willingly return your money if you are disappointed.
 Now fitted with NON-CORROSIVE Wander Plug Terminals.

	AMPS.			
	4	60	80	110
2 VOLT ..	7/6	9/6	11/9	14/6
4 VOLT ..	15/-	19/-	22/6	26/6
6 VOLT ..	22/6	27/9	33/6	39/-

Packing 1/- extra per battery.
 60 volt
H.T. Batteries 7/6 post free

MAXEL ELECTRICAL CO., 28, Clipstone Street, Great Portland Street, W.1
 Telephone: MUSEUM 706

SUPER SETS and ACCURACY



For efficient results, absolute accurate capacity and low loss are essential.

You must therefore fit THE

Dorwood Precision Condensers

which are guaranteed by our work's laboratory test. The only grid condensers having a three point connection.

The DORWOOD has often been used in sets described in Radio Press publications. This is another guarantee of its efficiency.

GET DORWOOD PRECISION CONDENSERS direct from us if your dealer cannot supply at once, post free at list prices as follows:

PRICES:

Capacities '0001 to '0009 MF. with or without Grid Leak Clip	2/6
.. '001 to '006	3/-
.. above '006 to '01	4/6

Sole Manufacturers **HERBERT BOWYER & CO., 16, Railey Mews, Leverton Street, LONDON, N.W.5**

THE "SECURITY" VALVE HOLDER

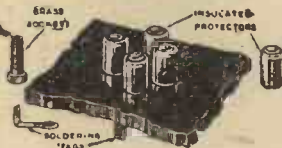
(Prov. Pat. No. 2187/25).

ANTI-CAPACITY

PROTECTS THE VALVE

METAL DRILLING
 TEMPLATE Included.

OBTAINABLE FROM ALL RETAILERS & FACTORS.



Advert. of Williams, Ellis & Co., London.

TUNING

Keen as a Razor!

Successful reception of distant radio demands the utmost tuning accuracy. Every radio enthusiast of experience appreciates this fact which accounts for so many having incorporated the Microhm Vernier Condenser into their receivers. They have proved it to be an instrument capable of sharp and accurate tuning always, with the greatest ease of adjustment. Until you have fitted the Microhm into your set, you cannot know what fine tuning really is. For a negligible outlay you can greatly improve upon present results. Remember it must be the—

MICROHM VERNIER CONDENSER

24 turns of tuning adjustment. Single 1/4 in. hole fixing. Maximum capacity '00015 mfd. Minimum capacity Negligible. Price 2/6 postage 3d.

For use in parallel with aerial and anode tuning condensers. Indispensable for "Neutrodyne's."

MICROHM ENGINEERING CO., VARSITY WORKS, COLLEGE ST., LONDON, E.9
 Phone CLISSOLD 2887
 Scottish Agents: KEITH & IRWIN, 35, Robertson Street, Glasgow, G.2

circuits 1510

25% saved

Western Electric LOUD SPEAKERS

Here is an opportunity you surely must not miss. We have acquired the whole available stock of these standard Western Electric Loud Speakers and are able to offer them more than 43% cheaper than you can obtain them elsewhere.

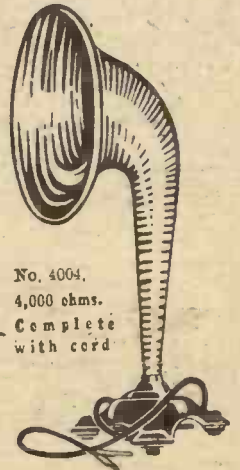
You have long wanted a really good Loud Speaker, not a toy, but prices have been too high. Here is your chance to get a really efficient instrument, admittedly one of the finest ever placed on the market by The Western Electric Company Limited, giving full volume of tone, of excellent quality, and at a price that you can afford. The non-sonorous trumpet avoids all metallic twang, whilst the large diaphragm with adjustable air gap gives ample margin for modulation.

57/6
 full size
 Speaker

Guaranteed by Western Electric Co. Ltd. to be of their manufacture, fully tested and not despatched unless in perfect order.

Send remittance 32/6 with order, plus 1/3 for carriage, and Speaker will be sent at once.

These Loud Speakers have never previously been offered at less than 57/6 each.



This is absolutely a genuine offer

No. 4004,
 4,000 ohms.
 Complete with cord

AND CANNOT BE REPEATED
 RADIO DISTRIBUTORS
 (Dept. W.C.), 34, MARK LANE
 LONDON, E.C.

for 32/6

big bargains for Wireless Dealers

The Superlamp Net Trade List No 9 contains hundreds of bargains in British, American and Continental Radio goods. Write for a copy today. Trade only supplied.

SUPERLAMP
ELECTRICAL AND WIRELESS ACCESSORIES LTD.
97-99, Paul St, London, E.C.2

NEW
WESTERN ELECTRIC LOUD SPEAKERS
COMPLETE WITH CORD IN MAKER'S SEALED CARTON

20/- Cheaper than Elsewhere.

We have acquired the entire surplus stock of these Standard WESTERN Electric Table Talkers. Famous for their purity of tone.

4,000 ohms - - - - - 22/6
120 ohms and 70 ohms - 17/6
"M" Type Headphones.
New London made.
4,000 ohms. Lightweight.
Complete with cord - 12/6

ELECTRADIX RADIO STORES
Lambeth Hill, Upper Thames St., E.C.1



CABINETS for Wireless CONSTRUCTORS

DESCOT
TOWER
FLATTOP
M-LUXE
CONDENSER
LIDDED

PICKETT'S HIGHLY POLISHED CABINETS
from 1/6 each
They're good Value

Send for constructors list free.
PICKETT'S CABINET WORKS
BEXLEY HEATH, S.E.

ESTIMATES & LISTS (W.C.), SEND SIZES

THE CLINCHER CONNECTION

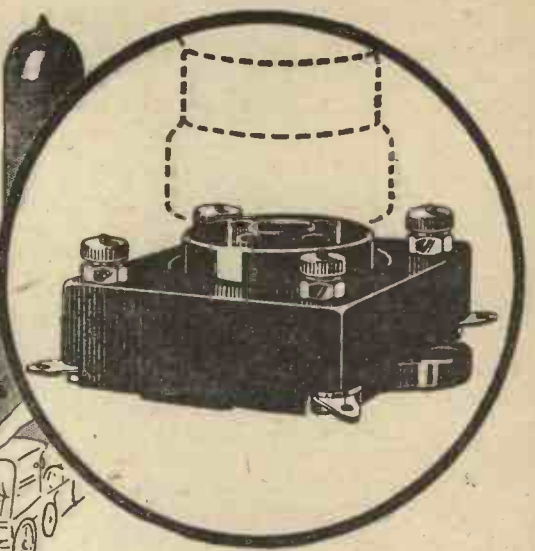


Patentee **G. H. PARKER**
Wireless Stores, Muswell Hill, N.10

No more soldered joints to break loose the first knock the set gets. Just drop two CLINCHER connections on terminal with grooves facing each other, screw nut on loosely, put wire or wires in grooves, then tighten nut. No more bending wires under nuts that work loose. CLINCHER connections never work loose as they act as spring wash-r under nut. Attention in circuits can be effected in a few seconds by loosening nut, pulling wire out and inserting elsewhere.

1/- per doz. pairs, single or double groove. Send stamped envelope addressed, 3 doz. pairs post free

Vibration-distant shocks - they are always here



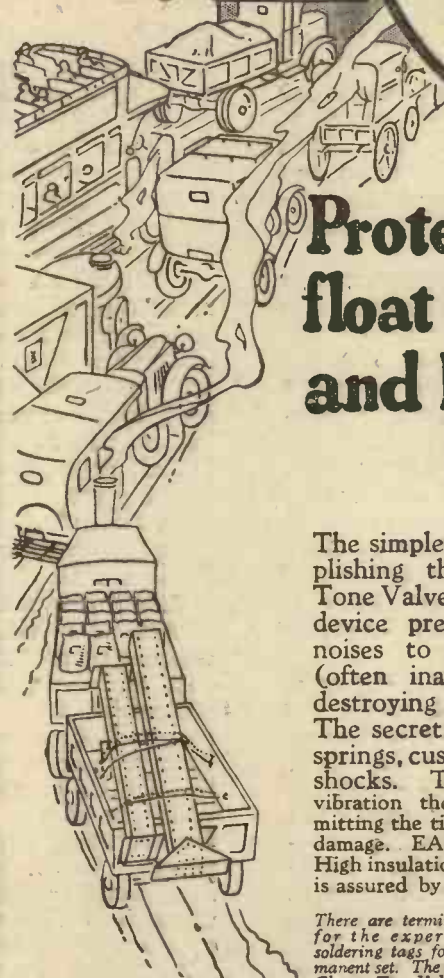
Protect your valves - float them on springs and kill noise in the filament!

The simplest, most efficient method of accomplishing this is to use a Benjamin Clearer Tone Valve Holder. This new shock-absorbing device prevents the transmission of outside noises to the filament. Outside vibrations (often inaudible to the ear, yet invariably destroying pure tone) are completely dissipated. The secret lies in the four delicately adjusted springs, cushioning the valve against all external shocks. Though responding to the slightest vibration these springs are immeasurably strong, permitting the tightest valve to be inserted without fear of damage. EACH SPRING HAS ONE TURN ONLY. High insulation, low capacity and great mechanical strength is assured by using Bakelite for the body of the holder.

There are terminal connections for the experimenter and soldering tags for the permanent set. The Benjamin Clearer Tone Valve Holder is easily cleaned - little or no dust can collect in the sockets. The springs themselves, as shown in the lower of the two diagrams, form the valve pin sockets. No soldered

joints - all one solid metal piece from tag to valve leg. No flexible wire connections. The spring supports are not affected by stiff bus bar wiring. For Good Reception with Dull Emitter Valves Benjamin Clearer Tone Anti-Microphonic Valve Holders are absolutely essential.

2/9
Each.



Sectional View of Holder



Detail of Spring Feature



BRITISH **BENJAMIN** MADE
CLEARER TONE VALVE HOLDER

Patents (ANTI-MICROPHONIC) Pending

From your Dealer or direct from:

THE BENJAMIN ELECTRIC LIMITED
Brantwood Works, Tariff Road, Tottenham, N.17.

• The Benjamin Battery Switch gives perfect current control, 2/- each.

The truth about the Mansbridge Condenser

In view of certain misconceptions, it is well that the public should know the facts about the Mansbridge Condenser—its origin and development.

THE Mansbridge Condenser was invented in 1906. Up to this time all condensers were made by assembling alternate sheets of either mica or paper with tinfoil. This process was carried out by hand and was, therefore, relatively slow and expensive. The Mansbridge patent effected several improvements.

Firstly, it enabled the condenser unit to be assembled at a rapid rate because the dielectrics and conductors are fed in continuous strips. Secondly, by reason of the very thin layer of metal which is used in the foiled paper forming the electrode (or conductor), the condenser is not easily short-circuited. This feature forms its well-known self-sealing property.

Undoubtedly the Mansbridge Condenser was a wonderful advance—and even to-day is unexcelled where a compact condenser of large capacity is required.

As a pioneer condenser-making firm, it was only natural that these improvements should attract the attention of the Telegraph Condenser Co. Ltd., and negotiations were early concluded between this Company and the inventor for manufacturing condensers under his patents. Since then T.C.C. Mansbridge Condensers have been supplied in large quantities to the British and Colonial Post Offices, while during the War the

T.C.C. supplied the Army with the majority of Condensers for field telegraphs and many other purposes. In fact, there is hardly a corner of the globe into which these familiar little green condensers have not found their way.

The Mansbridge Patent lapsed in 1919 and, provided that it possesses the requisite scientific resources, the right kind of machinery and a capable staff, any firm can now make Mansbridge Condensers.

But—and special emphasis is necessary here—experience plays a very big part in condenser making. The T.C.C. reputation has been built up over a period of 20 years. Obviously, the mere possession of a plant will no more ensure accurate Mansbridge Condensers than the purchase of a kit of tools will make a man a skilled mechanic. The manufacture of Mansbridge Condensers presents its own difficulties—just as any other product. These difficulties must be faced and overcome. For many years T.C.C. experts have been co-operating in making in the T.C.C. Mansbridge a Condenser which, in all the world, is unequalled for accuracy, dependability and constancy. When you choose a T.C.C. in its familiar green metal case in any value from .004 mfd. to 2 mfd., you obtain a *genuine and fully guaranteed Mansbridge Condenser*.

T.C.C.
genuine
Mansbridge
Condensers

Millions of these T.C.C. Mansbridge Condensers have been made.



Backed
by 20 years'
Condenser
Knowledge

Telegraph Condenser Co. Ltd.
West Park Works, Kew, S.W.

Gilbert Ad. 3557

STOP PRESS

In addition to the Pilot Receivers described in our whole page advertisement in this issue we can now offer the special sets below. Both of these Receivers are described in this issue. Royalties of 12/6 per valve holder extra when all parts and panel are purchased at one time.

THE HARRIS-GOCKADAY

(described in this issue)
"Pilot" Type "B" Kit of Components comprises the following:—

2 P.S. "De Luxe" Square Law Condensers £ s. d.	
0005 and 0003 mfd.	1 11 6
1 Buri dept Dual Rheostat	7 6
2 Benjamin Valve Holders	5 6
1 Max-Amp L.F. Transformer	19 6
1 Dubilier Grid Condenser 0001 mfd. and 2 meg. Grid Leak	5 0
4 B.M. Single Coil Holders	6 0
2 Terminal Strips drilled and engraved	3 6
12 Mark III Terminals	2 0
Radio Press Panel Transfers, square wire, screws, nuts, etc.	1 6
Radio Press Blue Prints	3 0
	£4 5 0
1 "Red Triangle" ebonite panel 16x8x1/4" cut square and matted ready for use	8 0
Drilling and Engraving, extra if required	6 6
1 Polished Mahogany Cabinet with baseboard	1 8 6
	£6 8 0

COMBINED DETECTOR AMPLIFIER

(described in this issue)
"Pilot" Type "B" Kit of Components comprises the following:—

1 P.S. Standard Square Law Condenser with Vernier 0005 mfd.	£ s. d.
1 Max-Amp L.F. Transformer	19 6
1 P.S. Friction Drive 2 coil holder	10 6
1 2 pole Utility Set ch.	5 0
1 Dubilier fixed Condenser 001 mfd.	3 0
1 do. do. 0001 mfd.	2 6
1 do. do. 0003 mfd. with 2 meg. Grid Leak	5 0
1 Dubilier fixed Condenser 002 mfd.	3 0
14 Mark III Terminals	2 4
4 Valve Sockets	4 4
1 Lissenstat Filament Resistance	3 6
Radio Press Panel Transfers, square wire, screws, nuts, etc.	1 4
	£3 6 6
1 "Red Triangle" ebonite Panel 10x9x1/4" cut square and matted ready for use	5 8
Drilling and Engraving, extra if required	4 6
Polished Oak Cabinet	9 6
	£4 6 2

PETO-SCOTT CO., LTD.
Head Office: 77, CITY ROAD, E.C.1
See who's page Ad. elsewhere in this issue P.S. 3647

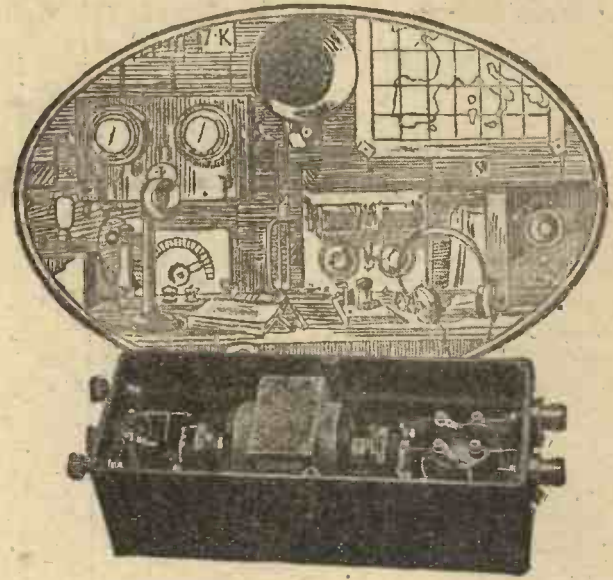
2-VALVE AMPLIFIER, 35/-
1-Valve Amplifier, 20', both perfect as new; Valves, 4/6 each; smart Headphones, 8/6 pair; new 4-Volt Accumulator, celluloid case, 13/-; new 66-Volt H.T. Battery, guaranteed, 7/-; 2-Valve All-Station Set, £4. Approval with gly
C. Taylor, 57, Studley Rd., Stockwell, London

TRADE **DECKO** MARK
HEAVY GAUGE
VALVE WINDOWS
MAKE & FINISH OF THE HIGHEST QUALITY, FOR SETS OF DISTINGUISHING OBTAINABLE FROM ALL THE BEST DEALERS.
A.F. BULGIN & CO.
9-HICURSOR ST.
CHANCERY LANE E.C.4.
PRICE 6/- EACH
N.P. P.D. OR BLACK IN PACKETS

ELECTRADIX RADIOS
The increasing scope of wireless apparatus has necessitated a wide increase in our already large and comprehensive stock in London.
Our new July edition of our famous Catalogue of Radio Bargains now contains 500 illustrations of radio sets, components, and electrical instruments of great interest. Many of these are unobtainable elsewhere and our prices are the very lowest.
The experimenter on short waves, the expert transmitter or the crystal novice will all find it advantageous to have a copy of
"The CATALOGUE that SAVES YOU POUNDS"
Its scope ranges from a 5s. pair of British Headphones or a 12s. 6d. Milliammeter to a 20,000 volt Generator, and covers all requirements.
If you cannot call and inspect goods in our showrooms between 9 a.m. and 6 p.m. it will pay you to send 1/4d. for our Catalogue at once. Goods promptly despatched all over the world.
LESLIE DIXON & COMPANY,
9, Colonial Avenue, Minories, E.1
Phone: Avenue 4168 Teleg: (Electradix Ltd.)
Colonial Avenue is the first on left down the Minories from Fenchurch Street or Aldgate Underground Station

COUPON
QUESTIONS AND ANSWERS
This Coupon must be accompanied with a 2/6 P.O. and stamped addressed envelope
"WIRELESS-CONSTRUCTOR," N.V. 1925

S. SMITH & SONS (M.A) LTD



The M-L anode converter

THE M-L Converter is designed to replace H.T. Batteries.

It consists chiefly of a small motor-converter, being fed from an accumulator through a controlling rheostat. The high-tension current is generated by a specially wound motor of high efficiency, and supplied at the output terminals free from any ripple or hum due to the machine. This is secured by smoothing circuits, which are incorporated in the complete converter.

The M-L Anode converter is particularly recommended for use with Power Amplifying Valves or Transmitting Valves where a smooth and constant supply of H.T. current of the order of 20 to 30 milliamps is required. The current consumption of the motor is extremely low owing to its high efficiency and it is absolutely silent and free from vibration in working.

Single Voltage Types:	Type B (6/120v. or 4/80v.)	£11 5 0
	Type C (12/300v.)	£13 10 0
	Type D (12/500v.)	£18 0 0
Two Voltage Types:	Type BX (6/120v. or 4/80v.)	£12 15 0
	Type CX (12/300v.)	£15 0 0

We shall be glad to send full particulars of all M-L Anode Converters and auxiliary apparatus on request.



S. SMITH & SONS (M.A) LTD.
179-185 Great Portland Street, London, W.1
Telephone: Langham 2323

E.P.S.7.



No more
Accumulators
to be charged


RECO

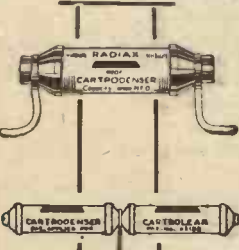
Continuous L.T. & H.T. Batteries

WRITE FOR PARTICULARS AND
DEMONSTRATION TO

The Radio Equipment Co., Ltd.
5, Dyer's Bldgs., Holborn,
LONDON, E.C.1

No more
H. T. Batteries
to be replaced





The Cartrodenser
a new fixed condenser of
most convenient form

No fixing required, damp proof, instantly
changed, simply fixed in the run of the
wiring it occupies no panel space whatever.

'00025, 1/6; '0003, 1/7; '0005, 1/8;
'001, 1/10; '002, 2/-

The Cartroleak is an accurate and invariable
gridleak of similar form:
1.5, 2 or 3 megs. 1/6

The Leakodenser
Includes Shunt Gridleak and Condenser, 2/3

The series model gives choice of connections
and consists of one Cartrodenser and one
Cartroleak. Price 3/-

Send for special leaflet free or Catalogue of all
components, sets for constructors, etc., 3d. stamps

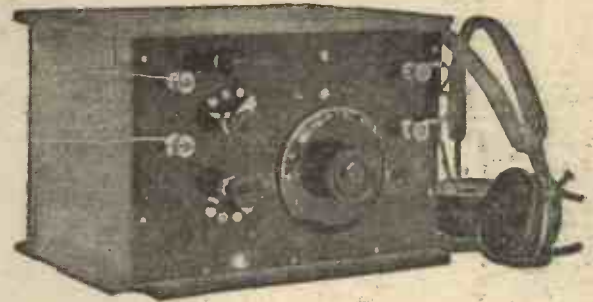
RADIAX, Ltd., 44, RADIO HOUSE, 4, Percy
St., Tottenham Court Rd., W.1

Just send a subscription for your favourite Wireless
Journals.
Promptly delivered through the post.

MODERN WIRELESS	Twelve months - - 15/-	Six months - - 7/6
WIRELESS WEEKLY	Twelve months - - 32/6	Six months - - 16/3
THE WIRELESS CONSTRUCTOR	Twelve months - - 8/6	Six months - - 4/3
WIRELESS	Twelve months - - 13/-	Six months - - 6/6
WIRELESS DEALER	Twelve months - - 7/6 (U.K.); 10/- Abroad.	

RADIO PRESS LTD. BUSH HOUSE, STRAND
LONDON - - W.C.2

RADIO PRESS ENVELOPE No. 11



"An Adaptable Crystal Set"

The efficiency of a crystal set depends to a large extent on the aerial. No two crystal sets will give similar results on the same aerial.

The Adaptable Crystal Set, however, described in Radio Press Envelope No. 11 by Percy W. Harris, M.I.R.E., by an arrangement of switches can be made to match any aerial and earth in a few moments.

You are thereby enabled to obtain the last ounce of efficiency from your aerial and earth, ensuring maximum results. This set will receive 5XX at good strength within reasonable range.

1/6

POST FREE
1/9

RADIO PRESS ENVELOPE NO. 11 gives details on how to construct this unique crystal set. The contents include full instructions, blueprints of wiring and panel layouts, reproductions of photographs and working drawings. The instructions on building the set are simple and clear, and those unfamiliar with set building will find it easy to construct.

Obtainable from all Bookstalls, Newsagents, your local Wireless Dealer, or direct from Dept. W, Radio Press Ltd. For prompt and sure delivery, when ordering direct, write your name in BLOCK LETTERS

RADIO PRESS, LTD.

Bush House, Strand, London, W.C.2

"The Set for DAVENTRY"

Positive micrometer adjustment



British made
in
every detail.

Price:
10/6

Extraordinary selectivity can be obtained by using this new "Eclipse" Micrometer Coil-holder. By means of a specially designed micrometer screw action, the most minute adjustments can be made, with absolute rigidity at any required angle. The blocks and milled handle are of moulded bakelite. Other parts metal and machined ebonite. Connections above or below the panel.

Ask your radio supplier to get it for you.
2-way holder only at present available. (3-way coming shortly)

Eclipse MICROMETER COIL-HOLDER

P. & C. MANUFACTURING COMPANY, LTD.
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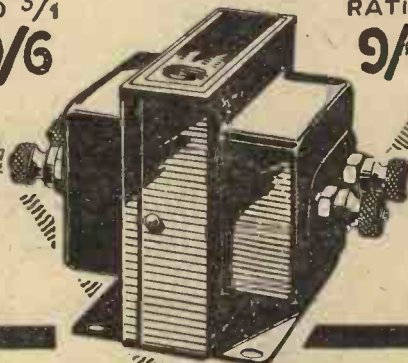
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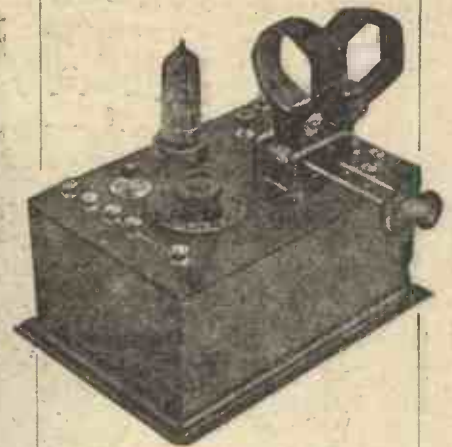
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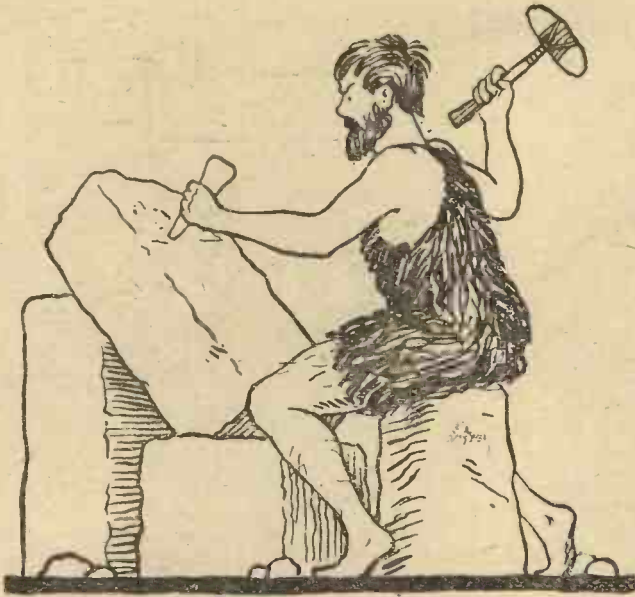
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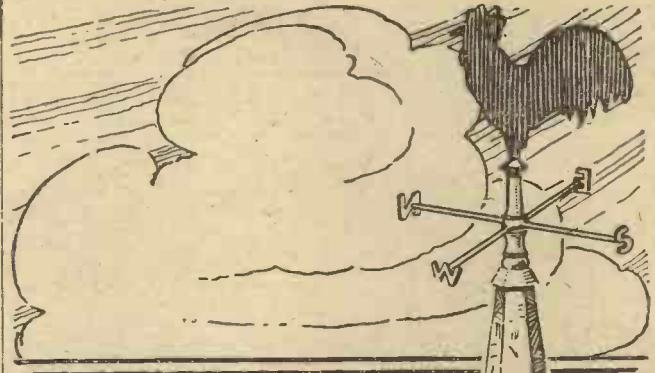
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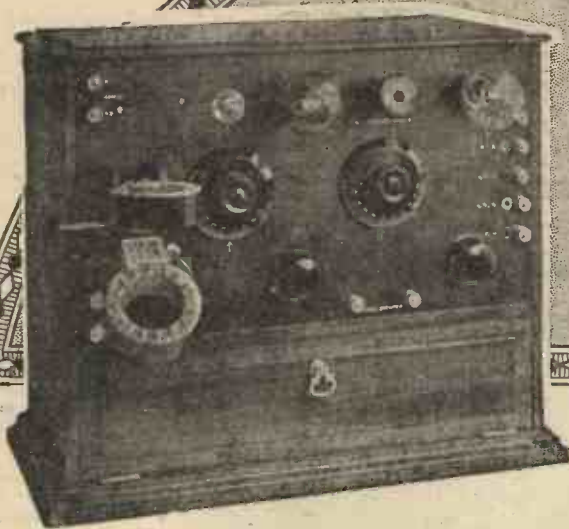
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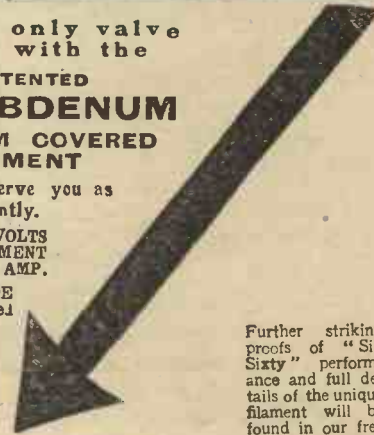
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WIRELESS

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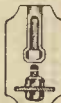
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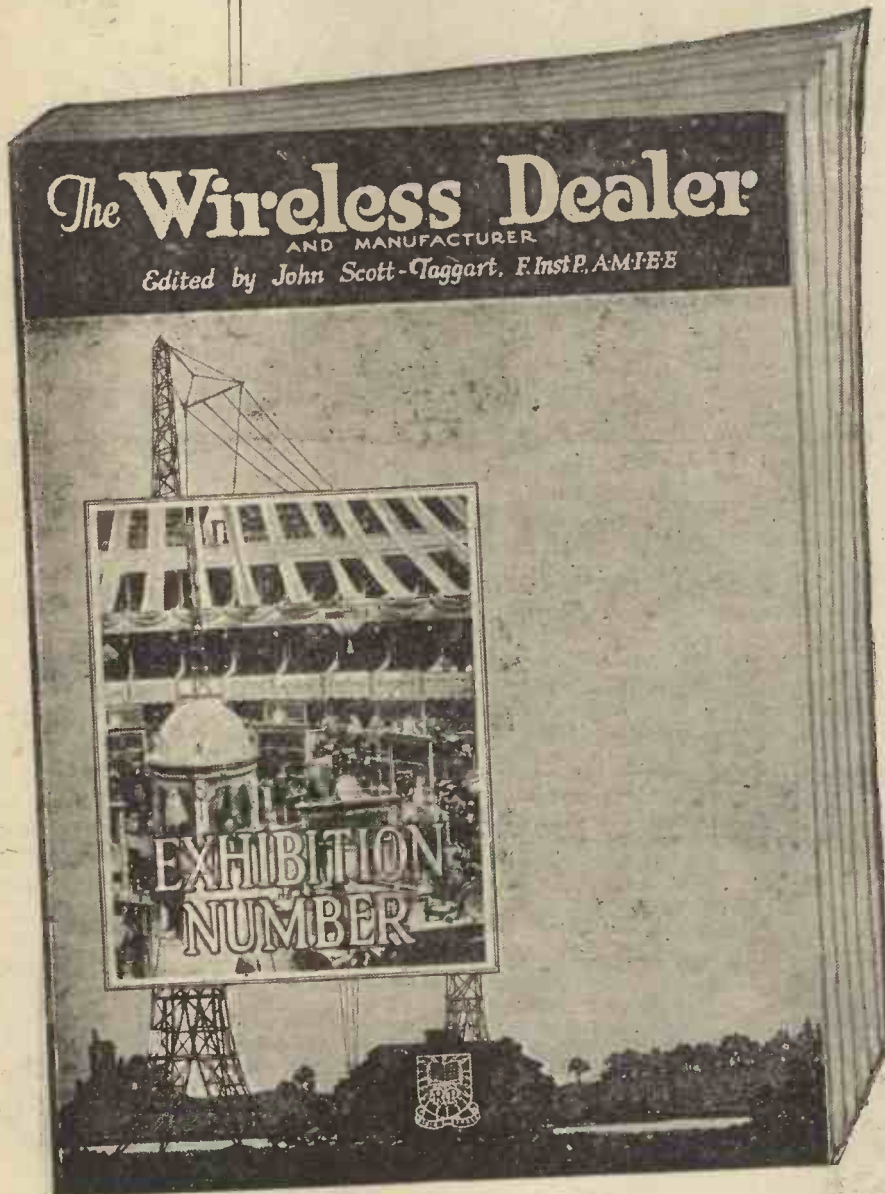
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For purposes of illustration, section of panel is not shown in correct position.

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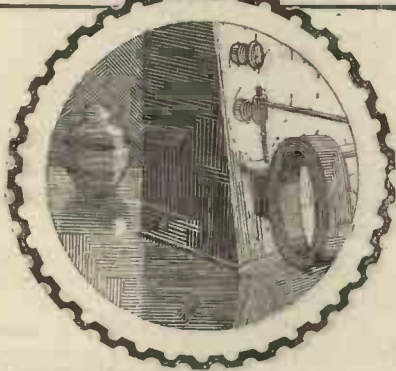
VICTORIA ELECTRICAL (Manchester) LTD.
VICTORIA WORKS, OAKFIELD ROAD,
ALTRINCHAM, CHESHIRE

Barclays Ad.

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THE PANEL DE LUXE



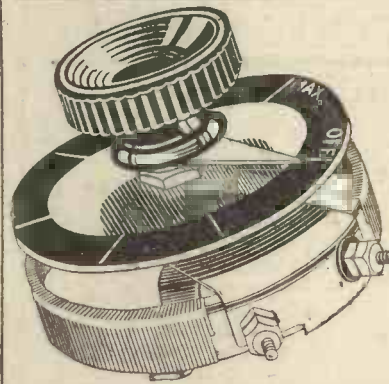
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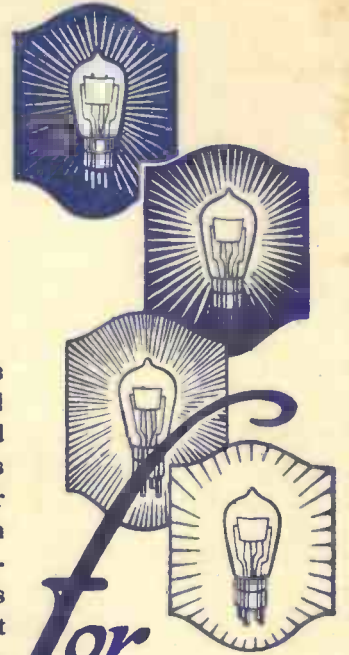
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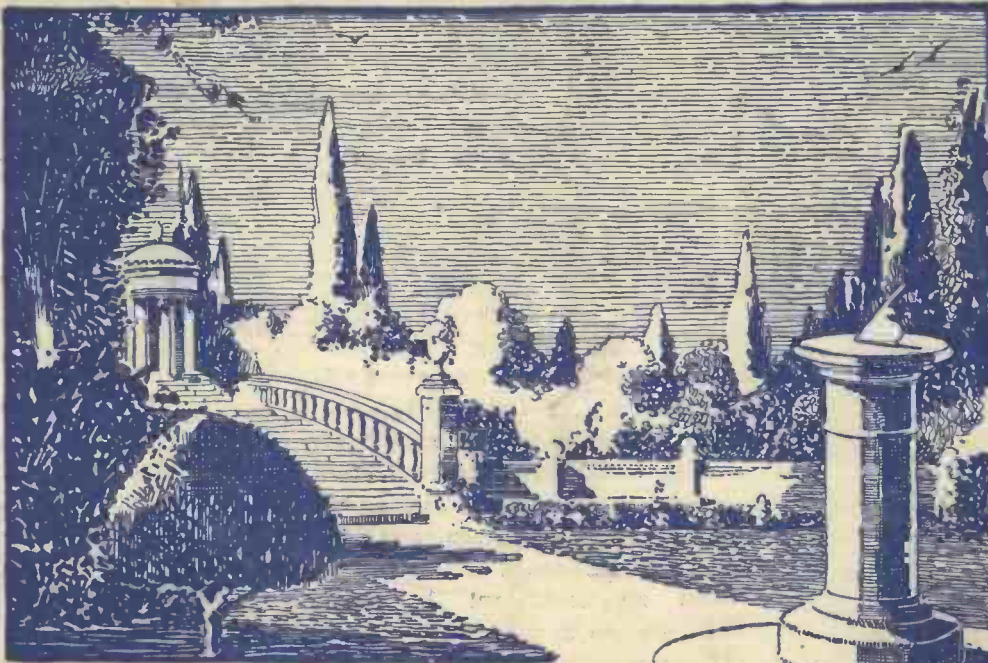
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