The Wireless Constructor

6D MONTHLY

Vol. III NOVEMBER, 1926 No. 1

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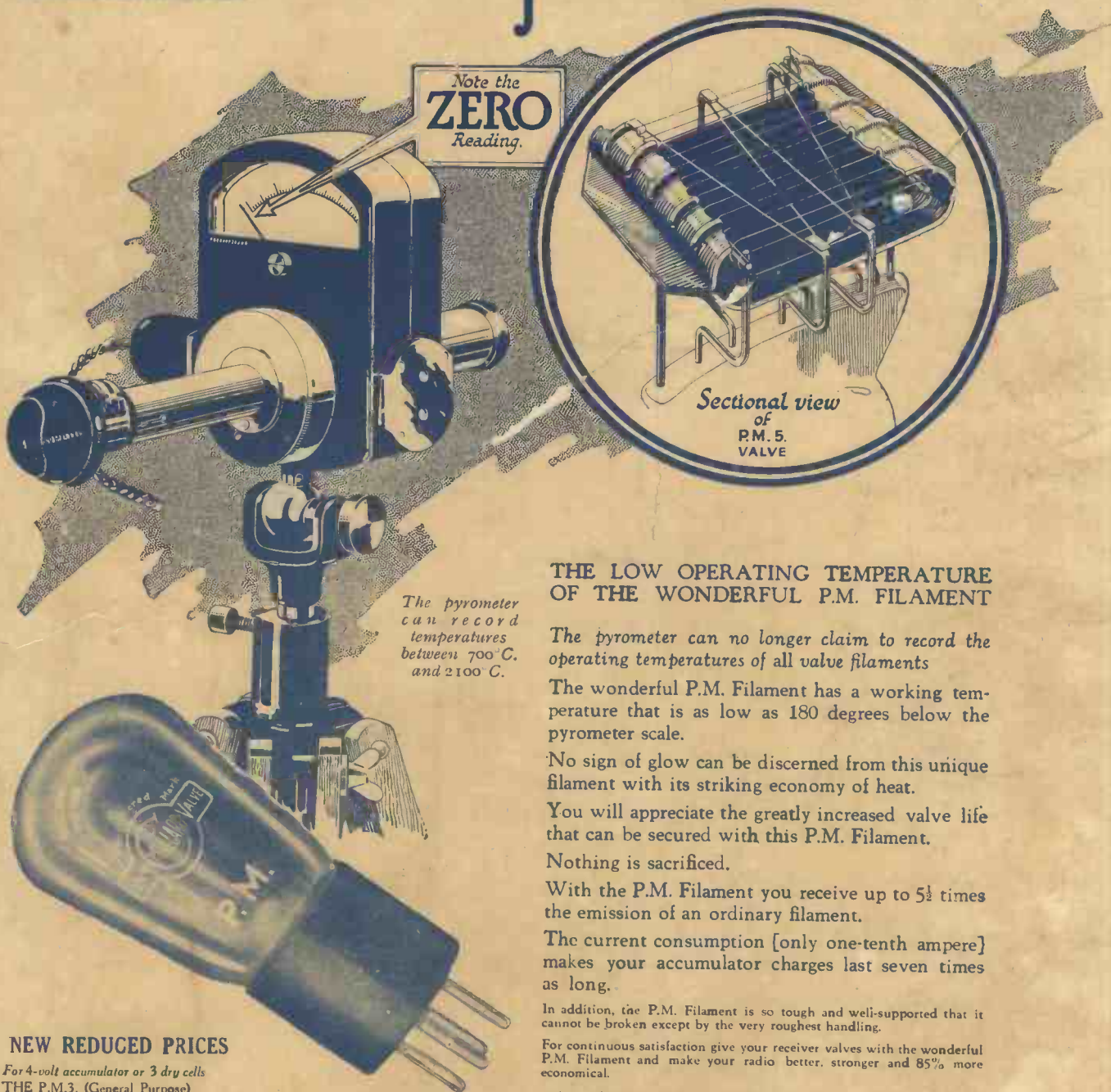

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For 4-volt accumulator or 3 dry cells

THE P.M.3. (General Purpose)	0·1 amp.	14/-
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For 6-volt accumulator or 4 dry cells

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These prices do not apply in Irish Free State

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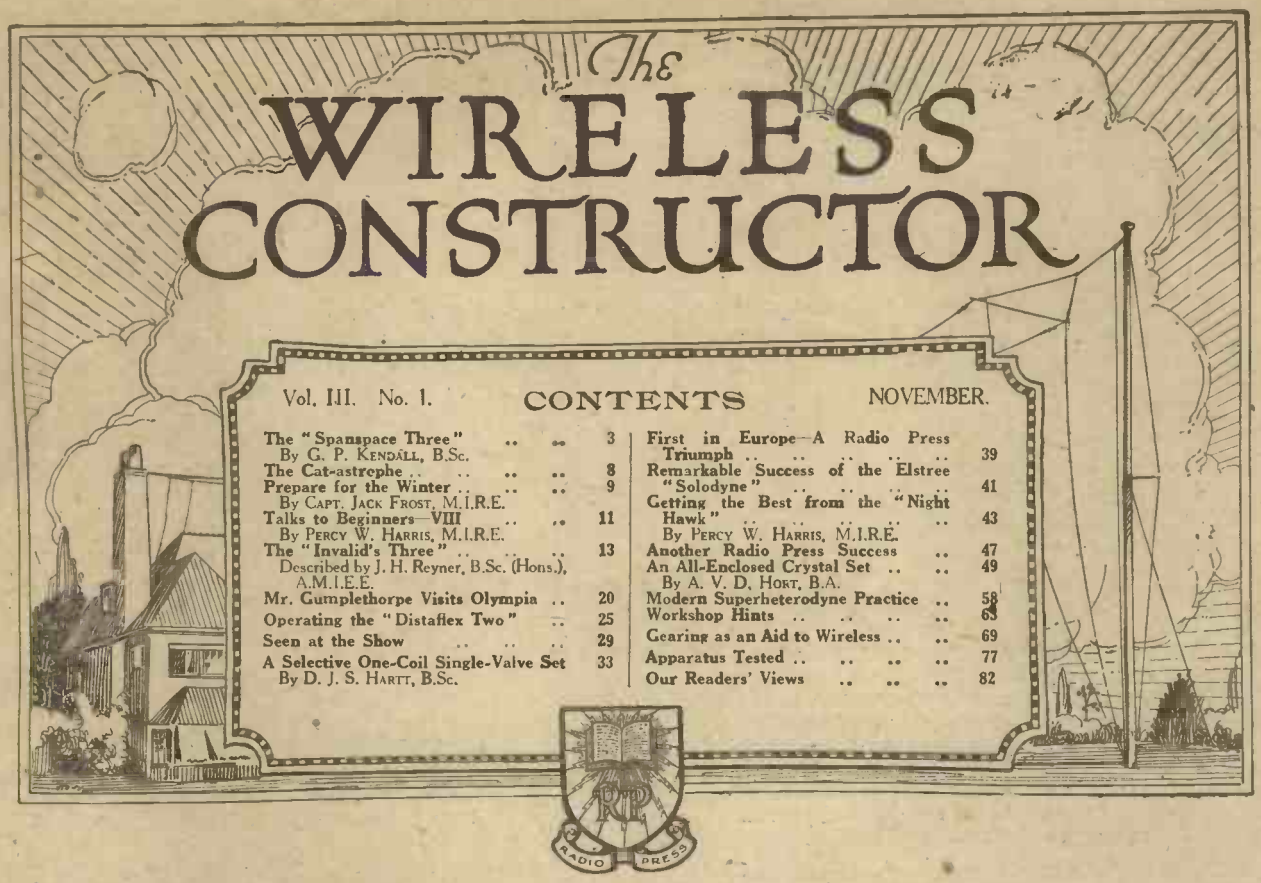

Vol. III. No. 1. NOVEMBER.

CONTENTS

Free with every copy

THIS useful GIFT BOOKLET presented with the next issue of WIRELESS—on sale Tuesday next, October 19th—has been written from an entirely new viewpoint. Reference to its pages will enable you to track down immediately even the most puzzling of faults, and it contains many useful tables by the use of which you are directed in a novel, methodical and systematic way to the source of trouble.

This FREE GIFT will sell this issue rapidly, so buy your copy early, when you will be able to see for yourself why WIRELESS is the most popular weekly wireless journal.

J. H. Reyner, B.Sc. (Hons.), A.M.I.E.E., who writes on the interesting subject of "Problems of Single-Dial Control."

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The Contents of this Issue will include:

The first of the "Wireless" Series of Star Single Dial Receivers.

"PROBLEMS OF SINGLE-DIAL CONTROL," By J. H. Reyner, B.Sc. (Hons.), A.M.I.E.E.

"WHY I CHOOSE RADIO." By John Henry.

WIRELESS 2D
THE ONE-WORD WEEKLY

Obtainable from all Newsagents, Bookstalls and Booksellers, or direct from the Publishers, Radio Press, Ltd., Bush House, Strand, London, W.C.2. Subscription Rates, 13/- per annum throughout the world.

FROM YOUR NEWSAGENT

The WIRELESS CONSTRUCTOR

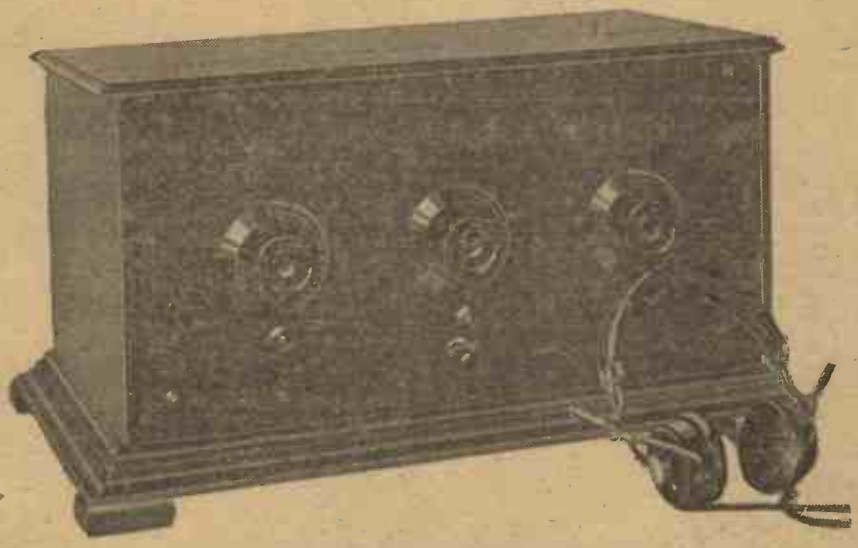
Published by Radio Press, Ltd., Bush House, Strand, W.C.2. 'Phone : City 9911.

THE "SPANSPACE THREE"

A Radio Press Star Set

AN INEXPENSIVE SET OF HIGH PERFORMANCE

By G. P. KENDALL, B.Sc.



THE aim in producing the "Spanspace Three" has been to provide a design giving a degree of sensitivity, selectivity, and stability at least up to the modern standard at a very moderate outlay without compelling the constructor to make any of his own components with the exception of the coils. As we shall see, the complete cost of material for building this set is only in the neighbourhood of £8, and yet the only actual constructional work which has to be done is the winding of some coil formers, and even this can be avoided if desired by purchasing the coil ready wound, which of course can be recommended to those who lack the necessary patience for dealing with fairly fine wire.

The Circuit

The circuit of the "Spanspace Three" is given in one of the diagrams accompanying this article, and it will be seen that the grid circuit of the first valve, which includes the neutralising and "anti-parasitic" arrangements, is of the same type as that which has proved so successful in the famous "Elstree Six." A centre tapping is used upon the coil, and this is connected to the centre point on a small double condenser, through a 100,000-ohms resistance.

This double condenser, it should be explained, is not a full-size tuning condenser, but merely a small baseboard-mounting balancing condenser, which has two sets of fixed plates, and only one set of moving plates, meshing more or less with either set of fixed plates. This component is included simply for the purpose of finding a centre point, which is done by setting the moving plates to engage half and half with each set of fixed plates. Tuning is done with an entirely different full-size condenser.

Intervalve Coupling

A form of tuned-anode coupling is used between the first and second valves, that is to say, between the

The "Spanspace Three"—*continued*

high-frequency amplifier and the detector. A tapping point is used upon this coil, so that only a portion of it is included in the anode circuit of the first valve, and also so that the detector valve is only connected across this same portion. This arrangement leads to a considerable increase in selectivity, and also permits a very simple form of capacity-controlled reaction to be used, sometimes called the "Hartley" circuit. Following the detector valve, there is one stage of low-frequency amplification, transformer coupled, so completing the circuit.

TEST REPORT.

The following stations were received, and definitely identified from the announcements, on an aerial 100 ft. long and 20 ft. high in S.W. London. Those marked with an asterisk were received on the loud-speaker, the remainder on telephones.

Birmingham.*	Swansea.	Radio-Lyon.
Aberdeen.	San Sebastian.*	Brussels.
Glasgow.	Rome.	Münster.
Newcastle.	Radio-Catalaña.	Hamburg.*
Belfast.	Barcelona.	Frankfurt.
Manchester.	Madrid.	Dresden.
Bournemouth.*	Radio-Toulouse.	Voxhaus (Berlin).
London.*	Postes et Tele-	Berne.
Stoke-on-Trent.	graphes, Paris.	Prague.

The Aerial Circuit

A detail of the circuit which perhaps calls for a word of explanation concerns the aerial circuit itself. It will be seen that this is of the roughly-tuned, tightly-coupled type, consisting of a coil wound upon the same former as the grid coil of the first valve and a fixed series condenser which can be included in the circuit if desired.

The size of this coil has been adjusted to suit the average aerial upon the longer broadcast waves, say above about 400 metres, and it is intended that for the shorter waves, say below 400 metres, or for greater selectivity upon the longer ones, the series condenser shall be included in the circuit. This condenser is intended mainly for use upon the broadcast band between 200 and 500 metres, since upon the longer waves in the neighbourhood of the Daventry range it will, as a rule, be found unnecessary. (Larger coils will, of course, be necessary for the reception of Daventry and stations of similar wavelengths, and these will be described in a future issue.)

Practical Details

Turning now to the actual practical construction of the receiver, it will be seen that it is laid out on the now almost standard lines of a vertical panel carrying merely the operating controls, all the rest of the parts being placed upon a wooden baseboard inside the cabinet. Three dials will be seen upon the panel, these being the controls, with their slow-motion devices, of the three geared condensers, the left-hand one tuning the grid circuit of the first (H.F.) valve, and the second controlling the tuned anode, the third being the reaction adjustment.

There are thus only two actual tuning dials, the third being a reaction control which is not often moved when once adjusted. Near the centre of the panel along the lower edge will be seen a small "on and off" switch, which controls the filament supply.

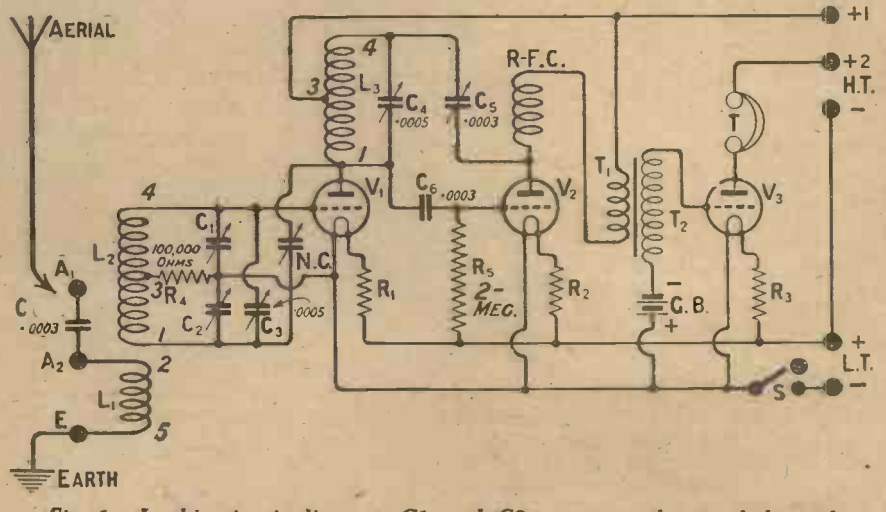


Fig. 1.—In this circuit diagram C1 and C2 represent the two halves of the balancing condenser.

Terminals

No terminals appear on the front of the panel, the necessary aerial and earth, battery and loud-speaker connections being made to the terminal strips along the back of the baseboard. It will be noted that I have used a standard terminal strip for the battery connections, and have used the left-hand pair of terminals (marked grid-bias by the maker) for the loud-speaker leads, a pair of flexible leads terminating in plugs being provided for the grid bias connections.

Since the coils used are not of the screened variety, it is important that you should copy the exact lay-out of the receiver with some care, and for this purpose it will be as well to obtain the blue print of the back-of-panel arrangement, which, of course, is full size and makes everything quite simple.

A Point to Note

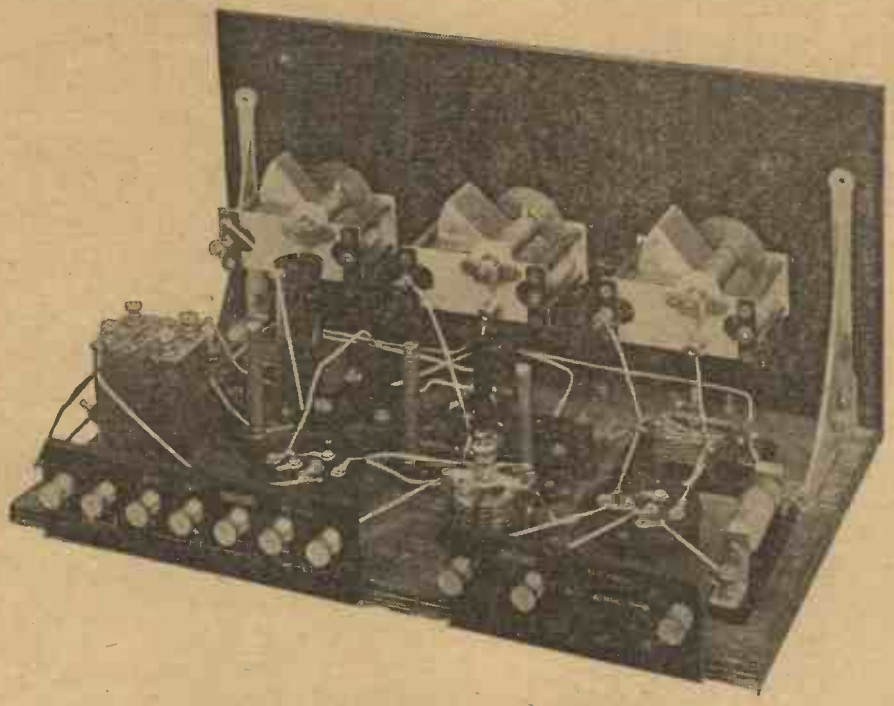
The only point requiring mention in connection with the laying out and fastening down of the components concerns the small balancing condenser, which, it will be noted, has been tucked away under the left-hand tuning condenser in a manner which requires the removal of its ebonite handle. This can quite well be taken off, since this condenser is not actually operated during the use of the set, but is merely set at some convenient value before use. (The value will usually be at a midway position of the movable plates.)

Wiring

The wiring of the set will not be found to take very long, since there are not a great number of connections to be made, but there are certain points which should be observed if it is to be carried out as easily as possible. In the first place, it will be seen that there are quite a number of wires underneath the middle variable condenser, such as those of the grid-leak, on-and-off switch, etc. In order to be able to make these as

A Radio Press Star Set

easily as possible, the middle condenser should be removed from the panel, until practically the conclusion of the wiring operations, the connections to this condenser being almost the last to be made in the set.



The terminals marked GB on the left-hand strip are used for the telephones or loud-speaker.

soldered directly to the appropriate filament soldering tag of the valve socket, and it will be found easier to make this connection if it is done before the valve sockets are finally screwed down upon the baseboard, since if these components are operated upon separately (out of the set) the joint is quite easily made. It will also be as well to solder one end of the wire to the lower end of the high-frequency choke, before the

BUILD THIS SET WITH

One ebonite panel, 16 in. by 8 in. by ¼ in.
One cabinet, with baseboard, 9 in. deep.
Two panel brackets (Peto Scott Co., Ltd.).
Two .0005 and one .0003 geared variable condensers (Jackson Bros.).
One "Keystone" balancing condenser (Peto-Scott Co., Ltd.).
One baseboard mounting neutralising condenser (Burne-Jones & Co., Ltd.).
One fixed condenser, .0003, type 610.
One fixed condenser, .0003, type 600, with grid leak extension, and leak 2 megohms.
One 100,000 ohm anode resistance, baseboard mounting (Dubilier).
One H.F. Choke (Varley Magnet Co.).
Three anti-phonic valveholders (Benjamin).
Three holders and three suitable fixed resistors (Burndept).
One Yaxley on-and-off switch (Rothermel Radio Corporation).
One L.F. transformer (Brandes, Ltd.).
Two bakelite coil formers, with standardised bases (Collinson Precision Screw Co., Ltd.).
One ebonite strip, 5 in. by 2 in., with three terminals.
One ebonite strip, 7 in. by 2 in., with seven terminals (Burne-Jones & Co., Ltd.).
Glazite and a short length of flex.
Radio Press panel transfers.

Approximate Cost - £8

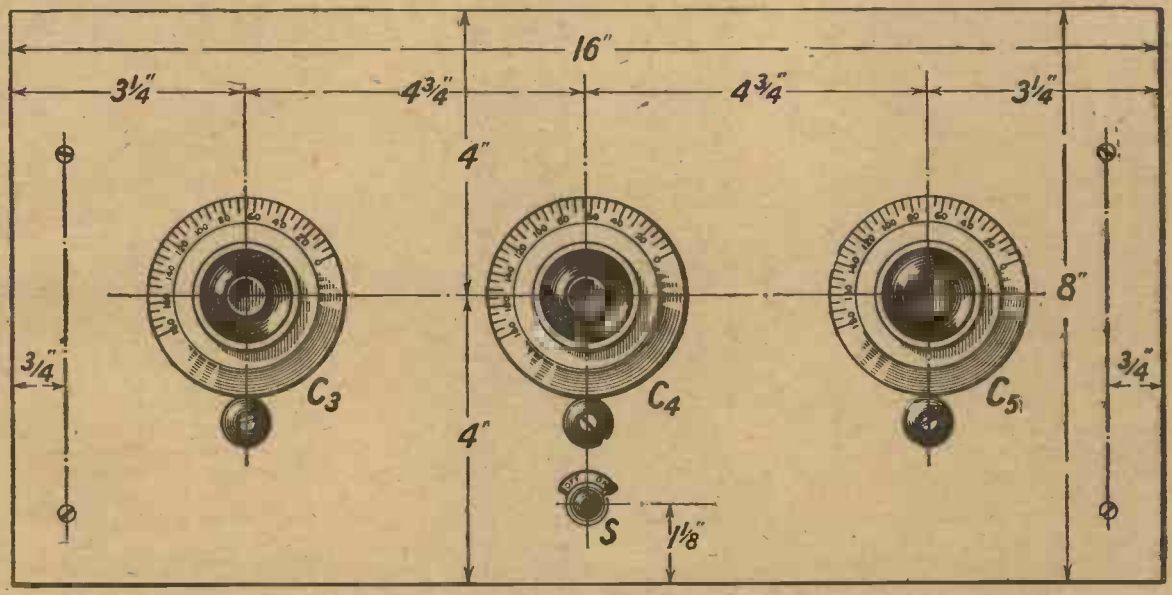


Fig. 2.—No difficulty should be experienced in laying out the panel, with the aid of this drawing. Blueprint, No. C1059A, is also obtainable.

A Soldering Tip

It will be observed that one tag of each of the fixed resistor sockets is

Full Details for Building

latter is screwed into position, a piece of wire about 5 inches long being required. It can be cut to the exact length required after the choke has been fixed in place.

Valves and Voltages

The best results with this receiver have been obtained with valves of the special high-impedance H.F. or resistance coupling type in the first and second sockets, working with anode potentials in the neighbourhood of 80 volts. In the last socket any of the special L.F. or power valves may be

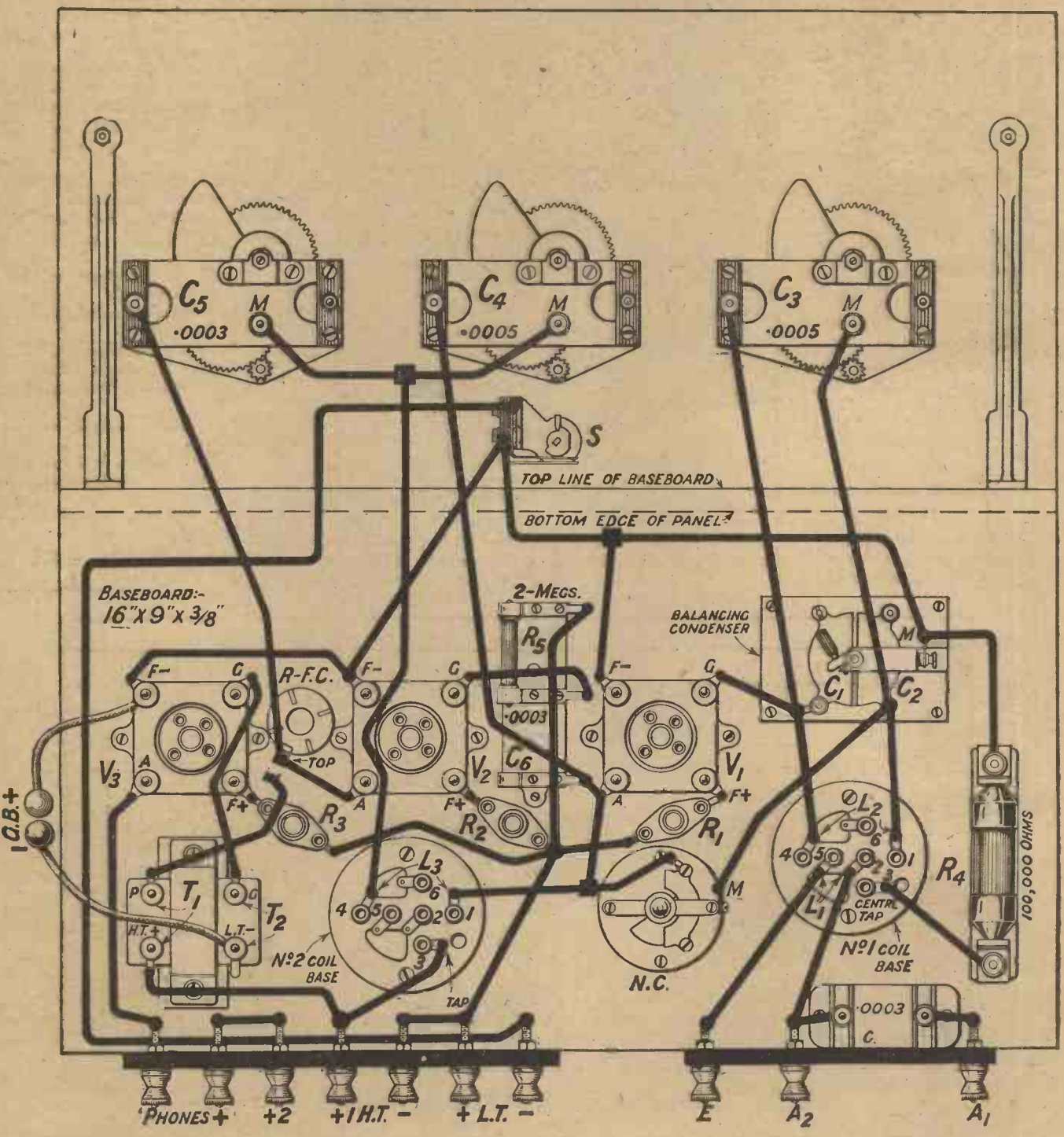
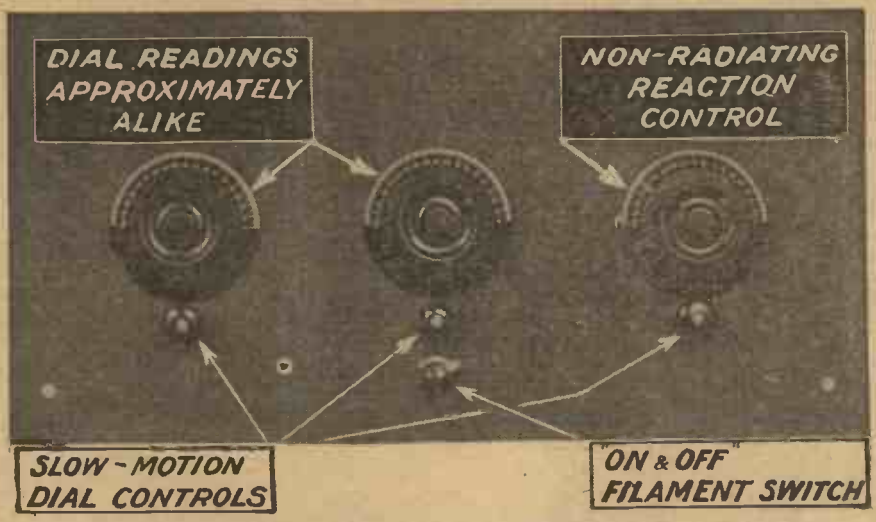


Fig. 5.—The layout of the components on the baseboard should be adhered to accurately. A full-size Blueprint, No. 1059B, may be obtained free by using the coupon to be found on page 84.

THE "SPANSPACE THREE"—*continued*



The tuning controls are simple, full non-radiating reaction is provided, and one switch brings the set into operation.

WIRING IN WORDS.

All directions are given as viewing the set from the back.

Join aerial 1 terminal to one side of condenser C.

Join other side of condenser C to aerial 2 terminal and to socket 2 of No. 1 coil base.

Join earth terminal to socket 5 of No. 1 coil base.

Join socket 3 of No. 1 coil base to one side of anode resistance R4.

Join other side of R4 to moving vanes of balancing condenser C1C2, thence to lower contact of switch S, and to one filament contact of V1, V2 and V3.

Join socket 1 of No. 1 coil base to right (C2) fixed vanes of C1C2, thence to moving vanes of variable condenser C3, and to moving vanes of neutralising condenser N.C.

Join socket 4 of No. 1 coil base to left (C1) fixed vanes of C1C2, thence to fixed vanes of variable condenser C3, and to grid contact of valve holder V1.

Join remaining filament contact of V1 to one side of fixed resistor R1.

Join other side of R1 to one side of fixed resistors R2 and R3, also to L.T.+ and H.T.− terminals, and to end of leak R5 remote from fixed condenser C6.

Join remaining side of R2 to remaining filament contact of V2.

Join remaining side of R3 to remaining filament contact of V3.

Join top contact of switch S to L.T.− terminal.

Join common contact of leak R5 and fixed condenser C6 to grid contact of V2.

Join anode contact of V1 to remaining contact of C6, also to fixed vanes of variable condenser C4, fixed vanes of neutralising condenser N.C., and socket 1 of No. 2 coil base.

Join moving vanes of variable condenser C4 to moving vanes of variable condenser C5, also to socket 4 of No. 2 coil base.

Join grid contact of V3 to G terminal of L.F. transformer T1, T2.

Join socket 3 of No. 2 coil base to H.T.+1 terminal, also to H.T.+ terminal of T1, T2.

Join H.T.+2 terminal to right telephone terminal.

Join left telephone terminal to anode contact of V3.

Join P terminal of T1, T2 to bottom end of R.F. choke.

Join top end of R.F. choke to fixed vanes of variable condenser C5, and to anode contact of V2.

Join flex leads, fitted with battery wander plugs:—

To filament negative contact of V3, *for connection to grid bias positive.*

To L.T.− terminal of T1, T2, *for connection to grid bias negative.*

used, with perhaps 100 or 120 volts on the anode and 4½ or 6 volts grid bias.

Neutralising

The neutralising adjustment on this set can be made in the ordinary way by tuning in the local station, removing the fixed resistor which controls the first valve, and so setting the neutralising condenser that no amount of re-tuning will bring in the local station once more.

It should be noted that full details are given in this article to enable the intending constructor to build the "Spanspace Three." In the next issue of THE WIRELESS CONSTRUCTOR further notes will appear, describing the operation of the set and how to obtain the best results from it.

NEWS IN ADVERTISEMENTS

Messrs. Telephone Manufacturing Co., Ltd., request our readers to send for the new T.M.C. catalogue.

Full particulars of the Standard and Belden products are contained in the catalogue issued by The Standard Insulator Co., Ltd.

"Makers of things more useful."—The Benjamin Electric, Ltd., describe the full range of Benjamin products in their two advertisements.

The International Radio catalogue issued by Messrs. Will Day will be sent upon request.

Full descriptions of Eddystone Radio Products will be forwarded by Messrs. Stratton and Co., Ltd.

Colvern screened coils are announced by Messrs. The Collinson Precision Screw Co., Ltd.

The Weston Pin Jack Voltmeter is the subject of an announcement by the Weston Electrical Instrument Co., Ltd.

A postcard will bring an interesting booklet from Messrs. Peto and Radford.

The Duvarileak—the new variable grid leak produced by the well-known condenser manufacturers— is featured by Messrs. The Dubilier Condenser Co., Ltd.

Experts in the solution of cross-word competitions will be interested in the advertisement of The New London Electron Co., Ltd.

Messrs. A. H. Hunt's Leaflet No. 155 will be sent upon application.

The 1926/1927 catalogue of Duodyne and Curtis' receivers can be obtained by any reader.

Messrs. Pettigrew and Merriman are offering to send the Newey catalogue of radio components.

DETAILS OF COIL WINDINGS

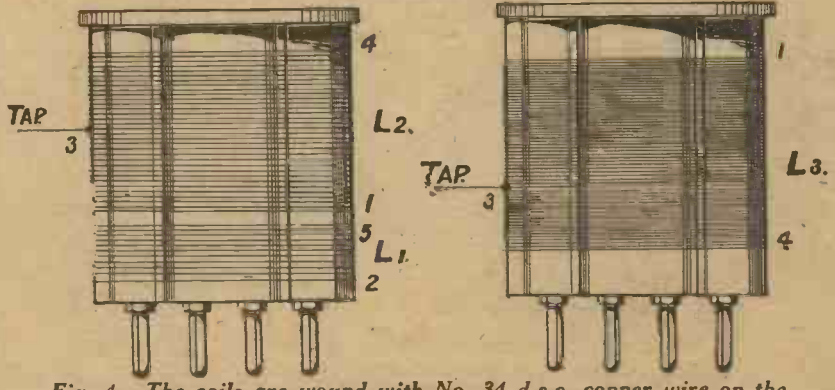


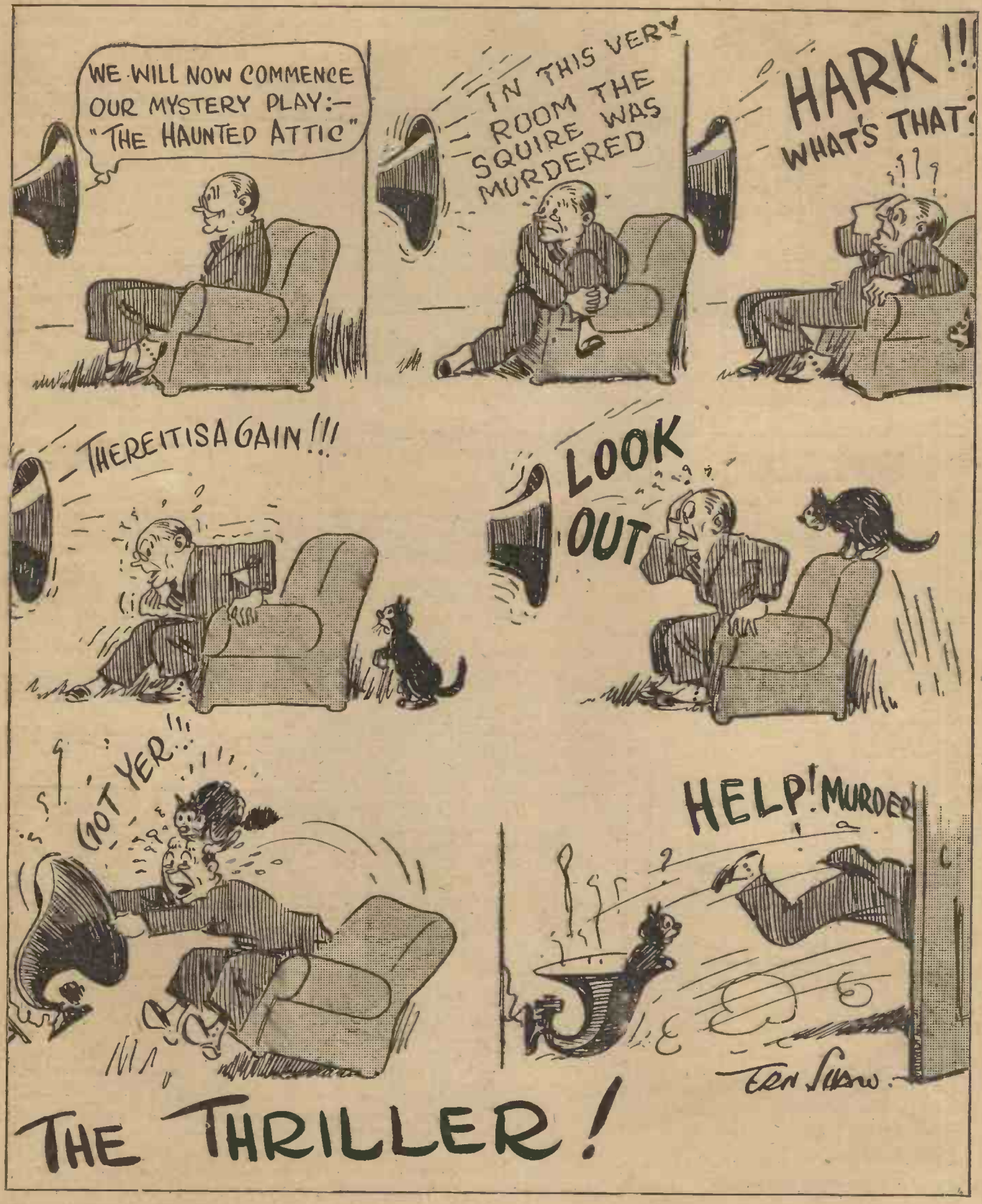
Fig. 4.—The coils are wound with No. 34 d.s.c. copper wire on the bakelite formers, turns touching.

L1— 20 turns. Top end to pin 5, bottom end to pin 2.

L2— 90 turns, on the same former and in the same direction as L1, tapped at 45 turns. Top end to pin 4, tapping to pin 3, bottom end to pin 1.

L3— 90 turns, in the same direction on the other former, tapped at 30 turns. Top end to pin 1, tapping to pin 3, bottom end to pin 4.

THE CAT-ASTROPHE.



PREPARE FOR THE WINTER

The Autumn Overhaul

By Captain JACK FROST, M.I.R.E.

Has your set been laid aside during the summer? The long evenings when you will want it again are coming, so now is the time to overhaul it and see that every part is ready for service. Captain Frost tells you in this article where to look for trouble if the set has been neglected.

HOW many of my readers are folk who, for the sunny, warm weather, put the wireless set away into a cupboard, lock it up and say: "Until the dark evenings come once again, I am saying 'Good-bye' to you, my fireside friend; good though you may be during the winter months, you hold no attraction for me now that the open air is calling"? Sometimes those who think as my imaginary friend thinks do not even trouble to put the set into a cupboard and lock it up.

The Penalty of Neglect

They carefully leave it just where it is, batteries, valves, 'phones and accumulator, all exposed to the sunshine coming in through the near-by window, and all connected just as they were when last the set was used. Dust collects upon the ebonite panel, the sun robs that panel of its insulating qualities. The dry batteries deteriorate and become useless, the low-tension accumulator does something a degree or so worse than that; it commences to sulphate.

And those valves, poor expensive things, exposed to broom handles and sundry knocks when the room is being cleaned, they may well have ceased to be whole, at any rate as regards their filaments. Poor old set! Yet, that set may have to bear a great deal of blame, or perhaps 2LO will, when it fails to do as it has always done when once more you switch it on and the weakness of its voice is evident!

The Set Complains

The set, if it could speak, would say: "I am doing exceptionally well in being able to speak at all. I have had but little food to eat these many months, for my store of filament current has run low, and the high-tension volts for my valve anodes are lower still. I am choked with dust, and my interior is nearly short-circuited by it. My ebonite face is dusty and has lost its insulating qualities. My aerial——". And here speech failed the set, for it gave up with a rapid "fade" into silence.

Don't Forget the Aerial

But what about that aerial? What has happened to it during these many weeks? The skies have rained upon it, soot has choked it, gases in the air have acted upon it, its joints have worked loose by continual swaying in the wind, and it has sagged like a candle in strong sunshine. That which the aerial can give to the set, and no more, the set is able to use. If that be little, the set cannot possibly give you a great deal. The whole game of Radio is to have a good high aerial, so that the set, providing that it is itself efficient, may receive as much energy from the ether as is reasonably possible. The set must be able to take that energy and magnify it without distortion, converting it in the process into audible sound.

Do You Do This?

But what of those of us who do not sit aside in the summer months, leaving Radio to its own devices? We may not do very much to our winter set, but may use a portable set, which we take away with us into the open air and there listen, or not listen, as the mood takes us. At home our set is being "corrupted" by "moth and dust," and much is happening. Nothing in this life seems ever to bide still; when things are not moving forward they are going backward. Anything which we may have done to the installation will be all to the good, but that "little more" in readiness for the "best reception in the town" reputation is necessary. It is not going to cost much either. A little time and a little care which is going to be well repaid.

What Needs Doing

Suppose that we set about it? I do hope that your aerial is as mine is, "lettable down" by a couple of pulleys? If so, then labour will be lightened. When it is down, go along the wire with an old cloth and clean it. See if there are any "kinks" in the wire, or any flaws. If they are too bad, then put in a new length of wire. Look at the insulators; are they cracked? Clean them or renew them as necessary. See that the aerial wire, in passing around the insulators, does not touch any anchoring wires that also pass through the porcelain holes. Unbind and examine the joint between the aerial and lead-in wires.

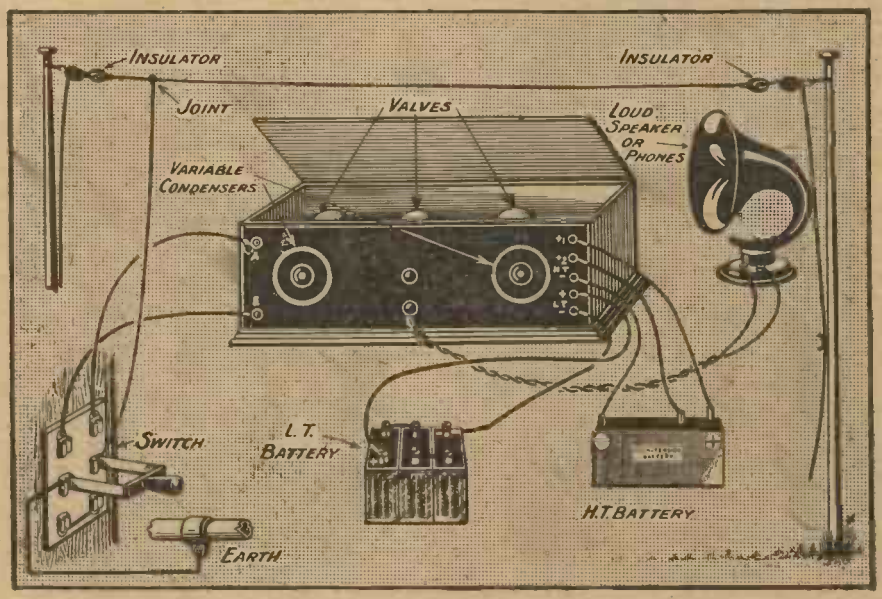


Fig. 1.—Here are the principal points in the set and its accessories which are likely to need attention.

Prepare for the Winter—*continued*

Clean with a knife the strands of wire which form the joint until shining copper is exposed. Remake the joint, re-soldering it for preference. Your lead-in wire is insulated? It may be faulty beneath the insulation. Get a battery and galvanometer and test for continuity. If you cannot do that, feel along the wire for breaks. Examine the lightning switch, and tighten up screws and joints, clean the joint where the lead-in comes on to the switch and where the cable goes through the window frame from switch to set. Test that, too, for continuity and freedom from breaks.

A portable high- and low-tension generator used in the Army training "war" this year.

Testing the Set

Deal similarly with the earth lead. If it is a water-pipe earth, disconnect it from the pipe and clean the strands till they shine again. Then remake the joint. The set comes next. Take out the valves, examine them, and see if they light? You can, for the rest, best test them in the set itself, for if they are broken you will certainly get no signals! With a fine brush, dust the set inside and out. See that it, and the batteries are where the sun cannot get at them. Revolve the condenser dials and see whether, with the set "on," you hear cracklings as you turn them round. If you do, then they may be caused by dust on the plates or by two of the plates coming into contact as they revolve.

If You Can't Do It Yourself

You cannot really do very much to the set unless you happen to be someone who knows a lot about it and can test transformers and leads. If your set is still "dud," or if you really want to have a proper overhaul carried out, then send it along to the makers. They will only charge you a shilling or two, and it will be well worth while. Send the filament lighting accumulator to your local charging depôt, but first see that that station is really one qualified to do overhauls. If so, then you can leave the rest to them. That, too, will cost very little, fresh acid, perhaps, "topping up," and a recharge. If the plates have buckled or shorted, or if sulphation has started, then the proprietor will tell you. That greyish-white deposit at the terminals of an accumulator is the first sign of sulphation. Do not let it get that far, but keep the screw pillars of the terminals well greased with vaseline.

Act similarly with your high-tension accumulators if you are using them. If your high-tension is provided by dry batteries, test them with a voltmeter, but with a good instrument, which the charging station would use for you. You may need to deposit the old batteries in the dust bin, and to get some new ones.

Loud-Speaker or 'Phones

Testing of 'phones and loud-speaker comes next. The terminals on your set, to which your loud-speaker and/or 'phones are connected are marked + and −. One tag of your 'phones is bound with a little piece of red cotton. That is the +, the other being the −. You should have had the + 'phone or loud-speaker lead connected to the + terminal of the set, and the − to the −. If you have not, the odds are that your 'phones or loud-speaker have suffered what is called "demagnetisation," a long word for a run-down condition of the magnet, without which that loud-speaker or those 'phones will not operate. Even if you *have* had them connected correctly, a little overhaul will do no harm. So just send them to the makers whose name is stamped upon them. If they are foreign instruments, then, I am sorry! The makers will make a world of difference to them at the cost of a few pence, and within a day or so.

This is quite a sermon, and a long list of "do this's" and "do that's," but it will do your interest in wireless and in the programmes a whole lot of good, if that old set, overhauled, gives you satisfaction instead of annoyance, at the expense of a small sum which might save you a greater outlay for a fresh set later on.

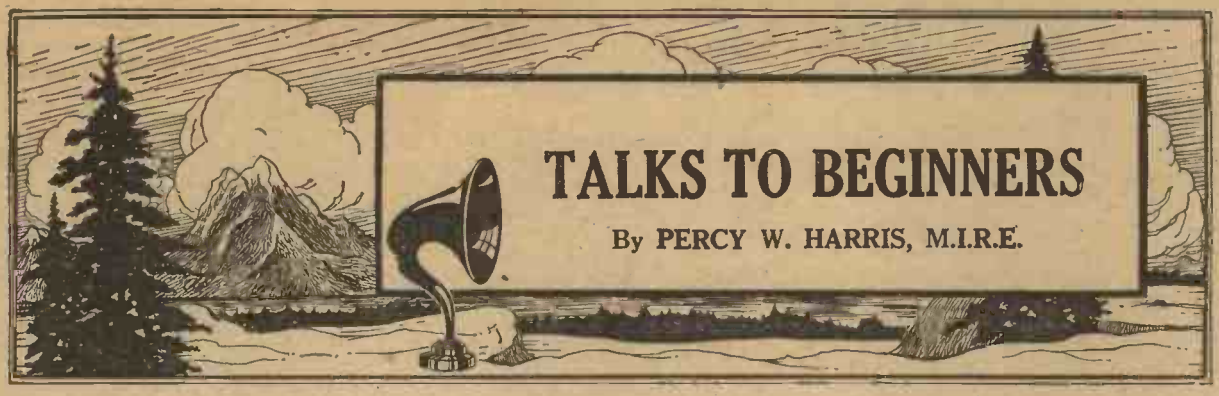
DRILLING LARGE HOLES

THE process of drilling holes of large diameter in ebonite or wood is not an easy one for those who do not possess a good fret-saw. The accompanying diagram shows how this may be done. First scribe the hole to be cut with a pair of sharp-pointed dividers, as shown.

Fig. 1.—When no special tool is available, a large hole may be made in the manner shown.

Next make a succession of fine drill holes around the circumference thus marked. It should be noted that in employing this method, the diameter of the circle described should be somewhat less than the full diameter of the hole required, to allow for the diameter of the drill holes and finishing. When holes have been drilled all round the circumference, a sharp knife will easily and quickly complete the work. A smooth finish is finally obtained by running first a file and then glass paper round the edges of the hole thus made.

H. B.



TALKS TO BEGINNERS

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

VIII.—THE WORLD ROUND US

SO far in these articles I have dealt in the main with the apparatus we use, the reasons for constructing it in certain ways and the manner in which it is operated. As by the time this issue is in your hands, the season of the dark evenings will have arrived and your wireless set will be coming once more into regular use, a talk about the etheric conditions surrounding us may not be inappropriate. And so in this article I want to tell you a few facts about range, ether conditions and what you may reasonably expect in various circumstances.

The Uncertainty of Reception

As is the case with nearly all sciences, the more one learns about radio, the less certain does one feel in making predictions. Only the most inexperienced salesman will definitely guarantee long-distance reception with the set he is trying to sell, for the more experienced investigator will know that wireless conditions vary enormously from place to place and almost from hour to hour. Do not imagine from what I have just said that long-distance reception is impossible—far from it. What I wish to impress upon you is that the fact that a particular receiver has given loud-speaker results from a station a thousand miles away on, say, September 15 in Hampstead is no proof that the same receiver will give such reception in, say, Croydon on the same date or at, perhaps, Clapham on *any* other date. We shall see in a few minutes why this is so.

Day and Night Variations

It was thought at one time, and the deduction was based upon relatively few experiments, that wireless waves travelled out equally in all directions from a station, and that if we drew a circle round the station up to any distance within its range, the strength of signals would be approximately equal (given identical apparatus) at all points on the circumference of the circle. Very soon it was found that day conditions were quite different from those obtaining at night, that some wavelengths travel much better in daytime than at night, while others travel much better at night than during the day, and that a line joining all the points at which signal strength was equal would take the form, not of a circle, but of an extremely irregular figure, its shape much more resembling a large splash of ink than the circle which theorists had been led to assume.

Some weeks ago *Wireless*, the One-Word Weekly, published a map showing a series of lines joining points of equal signal strength around London, and I am reproducing this map herewith for your guidance. You will see how different are the facts from the early elementary theory.

Directive Effect

Now there are a number of factors contributing to the modification of the perfect circle. For one thing the form of the aerial at the broadcasting station may be such that signals are not sent uniformly in all directions. All receiving aerials do not receive equally well in all directions, although, as a matter of fact the type of aerial

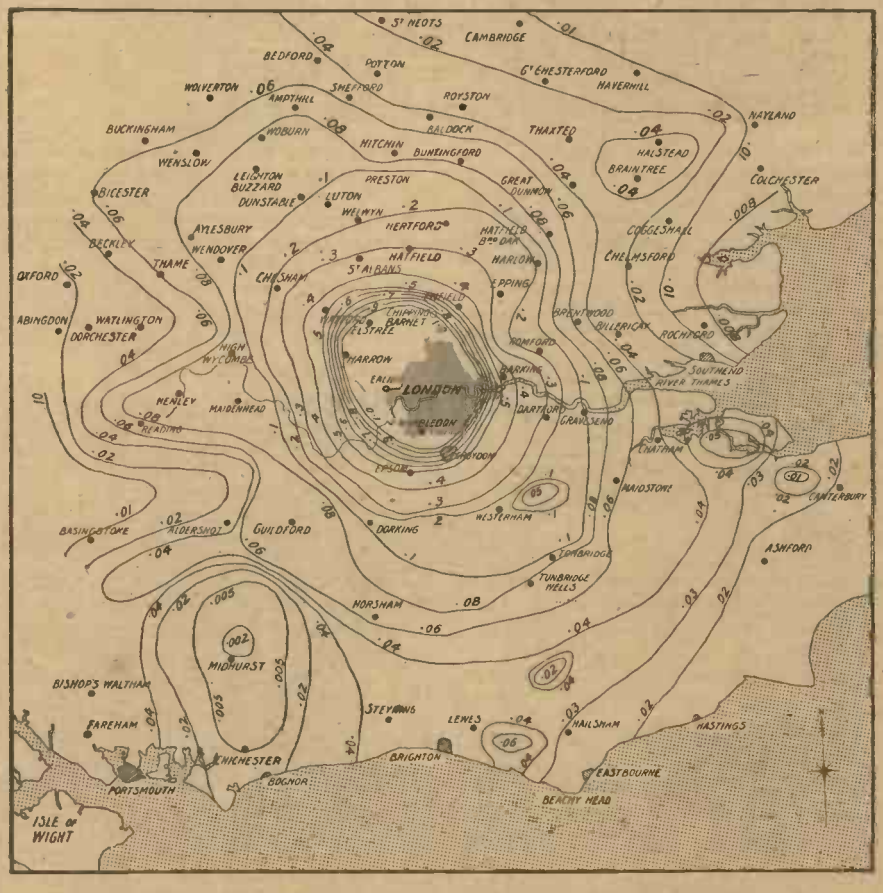


Fig. 1.—This map shows the comparative strength of signals received from the London station as observed over a considerable area.

Talks to Beginners—*continued*

used by the average amateur, in which the top, flat portion is not much more than two or three times the length of the downlead, receives fairly equally in all directions. The 2LO aerial, I believe, radiates better in some directions than in others.

An Interesting Test

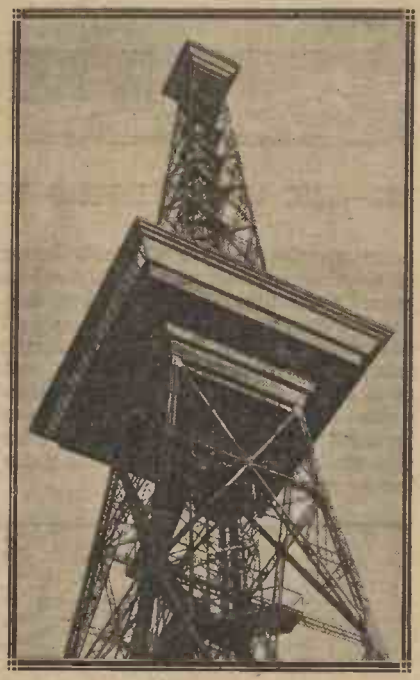
Then again, there may be screening by hills, and in the immediate locality of a receiving station by high buildings. I remember driving home in a friend's car from Bush House to Wimbledon with a portable receiver on board working a loud-speaker all the time. It was most fascinating to observe the differences in signal strength as we proceeded along the route, which incidentally followed the Embankment, King's Road, Chelsea, Putney Bridge, Putney Hill and across Putney Heath and Wimbledon Common.

Screening

Sometimes we would pass a tall building which would intervene between the London station (which was then Marconi House) and the car, and would expect signals to be reduced, but the strength would remain just the same. At other points where the land seemed quite clear and there was no obvious screening, signals would drop to practically zero. All the time they were up and down, sometimes coming intensely strong and at others dropping to a whisper. At the beginning, along the Strand and down Whitehall, signals were quite poor, and it was not until we were on the Embankment that the strength started to rise to something approaching what one would expect. Although I have not tested it myself, I am told that on the high ground at Wimbledon Common there is at least one spot where signals are very weak, although there is nothing around to suggest screening of any kind.

Summer and Winter

Wavelengths on the broadcast band invariably carry much better at night than during the daytime. As most wireless listeners use their sets in the evenings after dark, they may not be aware of this fact. Generally speaking, the winter months are far better for long-distance reception than the summer months, and in passing I may say that wireless conditions during the past summer have in the main been very poor. A couple of years ago we had a most remarkable winter. Long distance reception conditions were so good that there was hardly a set made by Radio Press designers that did not during its test and in the early hours of the morning receive at least one of the American broadcasting stations. During that season I heard WGY, Schenectady, WHAZ, Troy, New York, WJZ, New York, KDKA, and many more, not once, but twenty or thirty times.



This "Radio Tower," recently erected in Berlin, is 400 feet high, and is designed for use in connection with broadcasting in Germany.

A short-wave portable transmitter and receiver "on active service" in the "war" which was fought in the southern counties a few weeks ago.

On one occasion I remember listening on a two-valve set in the early hours of the morning, hoping that I might possibly be able to hear an American station. After less than a quarter of an hour's searching I succeeded in picking up WGY so distinctly as to recognise every word the announcer spoke. Those conditions did not last long, and after about 10 minutes I could get nothing further, but the reception was achieved, and at the time was thought nothing very remarkable. On another occasion, using the Anglo-American Six, to which I referred in my last article, a piano recital from WGY, Schenectady, came over so well that it gave loud-speaker reproduction audible throughout the house as distinctly as if it had been 2LO.

Short Waves

Last winter reception conditions from America were, I think I can safely say, worse than they have been for several years past, and I do not think there was a single night as good as that to which I have just referred. KDKA, the Westinghouse Station at Pittsburg, is now working on very short waves, and as these are not affected so much by seasonal variations and by day and night conditions, they can very often be heard in the daytime, but short-wave reception of this kind needs special apparatus and does not come within the scope of this article.

Bad Conditions

Conditions on the other side of the Atlantic have also been bad, and, indeed, so many complaints have been made to wireless set manufacturers and so many sets returned to their makers as being inefficient that the Government has decided to hold an inquiry into radio conditions and to collate evidence. When I was in America last year conditions were particularly good, as I was able personally to observe, but this year they have been very bad indeed, and the manufacturers are therefore anxious for the Government to prove that it is not the fault of the sets that reception is so bad.

A Good Season Coming

All this may lead you to ask, "What are conditions going to be like this winter?" It is impossible to prophesy, but a few observations

(*Concluded on page* 74.)

THE "INVALID'S THREE"

Described by

J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

A three-valve receiver which will give good volume from the local station or Daventry, a switch bringing in either station, and no tuning being needed when once the receiver has been adjusted.

MANY people must have wanted a set which had only to be switched on to receive either the local station or Daventry at will. A receiver was recently described in these columns by W. Q. Kay (the "Davlow Three," in the August issue of THE WIRELESS CONSTRUCTOR), in which it was possible to change over from London to Daventry by a simple push-pull switch, but at the same time a re-tuning of the condensers was necessary.

Few Controls

The receiver to be described here contains two tuning circuits, one of which is tuned to the local station and the other to Daventry, and the detector and amplifying apparatus is switched from one to the other by a simple push-pull arrangement. As far as controls are concerned, therefore, there are two only. To switch on the receiver one has to insert an ordinary telephone plug into a jack, while the programme from the local station or Daventry can be received at will without any further adjustment by a simple setting of the push-pull switch.

Such a receiver is ideal for an invalid, and in fact a receiver of this nature was actually made up a short time ago for a friend who was temporarily confined to bed. The boon of being able to receive either programme at will without any necessity for tuning was a considerable one, and the idea will probably recommend itself to our readers.

Quality

For a receiver such as this the question of quality is of great importance. There can be no doubt that a really well-designed resistance-coupled amplifier is capable of giving almost perfect quality. The drawback to the usual methods of resistance amplification is that the total amplification per stage is small, and three stages at least are necessary in order to obtain an amplification comparable, say, with that given by two good transformers.

Modern Improvements

Recent developments have changed this state of affairs. The maximum amplification which is obtainable from a resistance-coupled arrangement is given by that of the valve itself. In practice the actual amplification is about 90 per cent. of the theoretical voltage amplification factor. Thus in the ordinary high-impedance valve the limit to the amplification per stage is something of the order of 16 to 18, whereas with a transformer the nett amplification is the product of the valve amplification and the step-

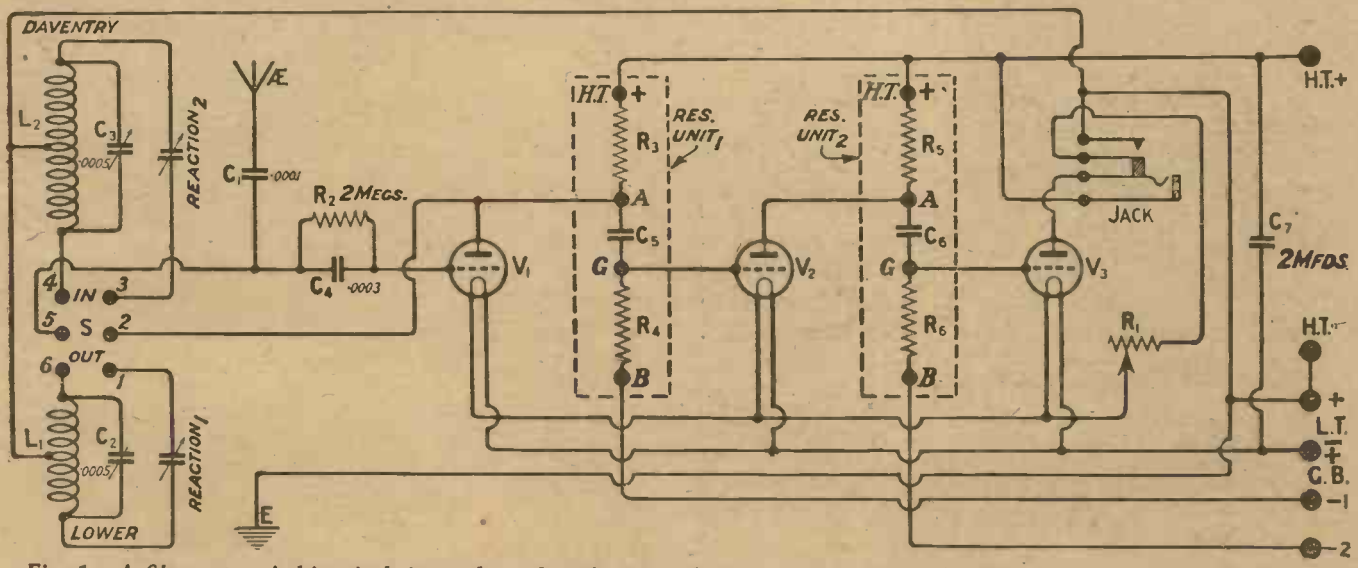


Fig. 1.—A filament switching jack is used, so that the set is brought into operation by inserting the loud-speaker plug.

The "Invalid's Three"—*continued*

up ratio, and this can quite easily result in an amplification per stage of between 30 and 40.

Suitable Valves

Recently, however, valves have been developed having a very high amplification factor, of the order of 35 to 40, and obviously if such valves can be utilised for resistance amplification, then the discrepancy between this method and the transformer-coupled method will not be by any means so marked. Such valves have at the same time a high impedance, of the order of 70,000 or 80,000 ohms, and it is obviously necessary to adopt slightly different constants in the circuit in order to obtain maximum efficiency from such valves.

Excellent Results

This method has been adopted in the present case. The receiver is a simple three-valve one, comprising a detector and two resistance-coupled note magnifiers. The volume of signals obtainable from this is as good as that obtainable from transformer-coupled stages, if not better. The London station at a distance of 12 miles is too loud for the average loud-speaker, and has to be mistuned for pleasant results, while on Daventry the volume is quite as much as the loud-speaker can handle. At the same time, provided adequate precautions are taken, the quality is excellent, owing to the resistance coupling adopted, and there can be no doubt that this type of circuit opens up new possibilities in the art of resistance-coupled amplification.

Circuit

The actual circuit is shown in Fig. 1. It will be seen that there are two tuned circuits, incorporating a centre-tapped coil. One end of the circuit is taken to the grid of the valve, the centre tapping taken to earth and the negative of the filament, while the other end of the coil is taken through a small neutralising condenser on to the anode of the valve. This arrangement enables Hartley reaction to be obtained on the circuit if necessary. In the majority of cases it will not be necessary, but it may be useful for those living in more remote localities.

A simple change-over switch takes

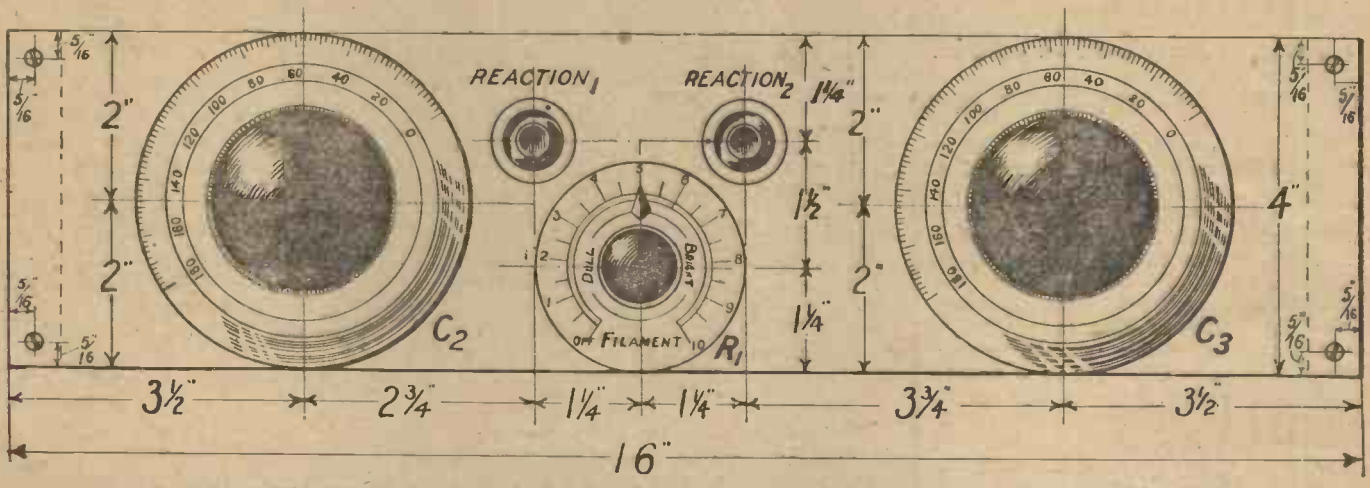


Fig. 2.—The drilling layout of the panel carrying the tuning controls is quite simple. Blueprint No. 1066A.

BUILD THIS SET WITH—

One cabinet, with wooden panel, 18 in. by 9 in., with a circular hole, 2½ in. diameter in the centre, and baseboard 9 in. deep.

Three ebonite panels, one 16 in. by 4 in. by ¼ in., one 6 in. by 3 in. and one 9 in. by 3 in., with 9 terminals.

Two .0005 "Cyldon" variable condensers (S. S. Bird).

Two panel mounting neutralising condensers (Peto-Scott Co., Ltd.)

Three valve holders (Etherplus).

Two baseboard mounting coil sockets (Burne-Jones & Co., Ltd.).

One filament rheostat. In this set a dual rheostat has been used, to allow various types of valves to be employed (Burndept).

One .0003 fixed condenser, type 600, and 2-megohm leak, and one .0001 fixed condenser, type 600 (Dubilier).

One Frost filament switching jack (Rothermel Radio Corporation of Great Britain, Ltd.).

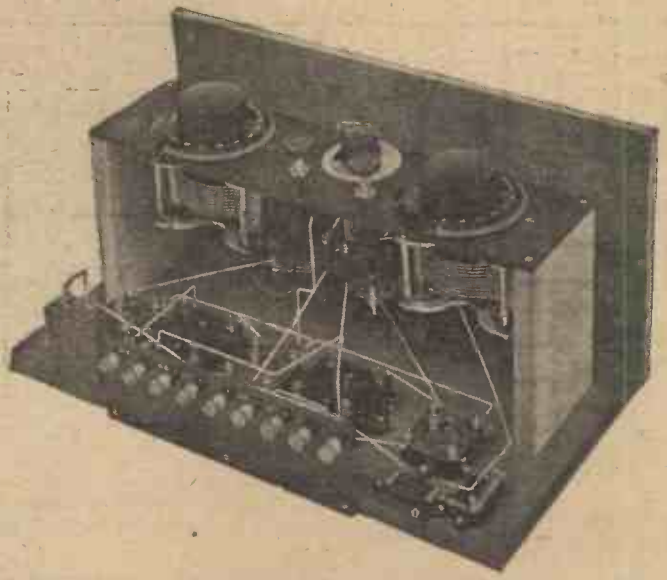
One push-pull change-over switch (Falk, Stadelmann & Co., Ltd.).

Two centre-tapped coils, one for the lower broadcast band, and one for the higher range. In this receiver Gambrell centre-tapped C and E coils were used.

Two resistance coupling units (Cosmos).

One 2-microfarad Mansbridge fixed condenser (T.C.C.).

Glazite and a short length of flex.



The disposition of the components on the baseboard should receive careful attention.

The "Invalid's Three"—*continued*

the connections from the grid and anode from one circuit to the other, while the aerial itself is connected to a small fixed condenser direct on to the grid of the valve.

Resistance Coupling

The anode circuit of the first valve, which of course is the detector, contains a high resistance of the order of 250,000 ohms. The voltages developed across this resistance are transferred through a small fixed condenser on to the grid of the next valve, a leak being provided from this to a point on the grid bias battery, in order to stabilise the potential of the grid.

The second valve is provided with a similar form of resistance coupling, having a very high resistance in the anode circuit, while the last valve, which should be a power valve, simply contains the loud-speaker in the anode circuit. As long as the resistances in circuit are large compared with the impedances of the valves, then practically full amplification is obtainable from the valves in use, and this in practice has been found to be the case, the signal strength obtainable from the arrangement being truly astonishing.

The list of components required to construct this receiver will be found in the accompanying table.

Constructional Work

The constructional work of this receiver is not so straightforward as in many cases. The tuning controls have been placed on a sub-panel behind the main panel, so that they may be adjusted once and for all, and altered from time to time if any change of wavelengths occurs, but beyond that they are not normally touched in the operation of the receiver.

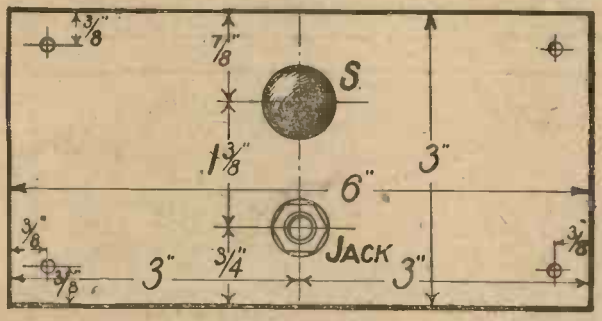
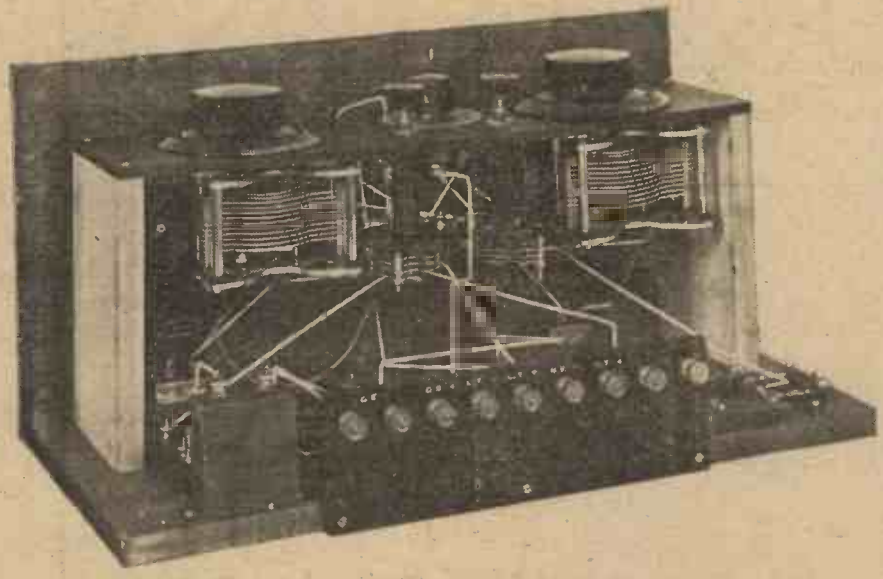


Fig. 3.—The drilling diagram for the ebonite panel which is attached behind the hole in the wooden panel. Blueprint No. 1066B.



This view of the set shows clearly the disposition of the wiring to the components on the tuning control panel.

Wooden Panel

The only controls on the front panel, therefore, as previously stated, are the change-over switch from the local station to Daventry and the jack, which at the same time switches the set on or off. It is not necessary to have a large ebonite panel just to contain these two components, so a wooden panel with a circular hole cut in it has been employed, and these two components have been mounted on a small ebonite panel 6 in. by 3 in., which is placed behind the wooden front panel.

The first operation, therefore, is to mount the push-pull change-over switch and the filament switching jack one above the other in the manner shown in the diagram given. This panel may then be mounted in position behind the main wooden panel, so that the switch and jack show through the hole cut away in the centre.

Sub-Panel

The next operation is the mounting of the two variable condensers, the two reaction condensers, and the filament rheostat on the sub-panel. This panel is 16 in. by 4 in., and is

WIRING IN WORDS

Join aerial terminal to one side of fixed condenser C1.

Join other side of C1 to one side of fixed condenser C4 and leak R2, and also to contact 5 of switch.

Join other side of C4 and R2 to grid contact of V1 valve holder.

Join earth terminal to H.T.– and L.T.+ terminals, thence to top contact of jack.

Join two flex leads to top contact of jack, for connection to centre taps of coils L1 and L2.

Join H.T.+ terminal to H.T.+ terminals of both resistance units, to one side of fixed condenser C7, and to bottom contact of jack.

Join L.T.– terminal to G.B.+ terminal, to one filament contact of each of the valve holders V1, V2 and V3, and to remaining side of fixed condenser C7.

Join G.B.–1 terminal to B terminal of No. 1 resistance unit.

Join G.B.–2 terminal to B terminal of No. 2 resistance unit.

Join G terminal of No. 1 resistance unit to grid contact of V2 valve holder.

Join G terminal of No. 2 resistance unit to grid contact of V3 valve holder.

Join A contact of No. 1 resistance unit to anode contact of V1 valve holder, thence to contact 2 of switch.

Join A contact of No. 2 resistance unit to anode contact of V2 valve holder.

Join anode contact of V3 valve holder to lower right contact of jack.

Join contact 4 of switch to one side of L2 coil socket.

Join contact 6 of switch to one side of L1 coil socket.

The following connections are on the sub-panel.

Join moving vanes of variable condenser C3 to fixed vanes of No. 2 reaction condenser.

Join moving vanes of variable condenser C2 to fixed vanes of No. 1 reaction condenser.

The remaining connections go to the sub-panel.

Join contact 1 of switch to moving vanes of No. 1 reaction condenser (3).

Join contact 3 of switch to moving vanes of No. 2 reaction condenser (4).

Join wire between contact 4 of switch and L2 coil socket to fixed vanes of variable condenser C3 (2).

Join other side of L2 coil socket to moving vanes of C3 (1).

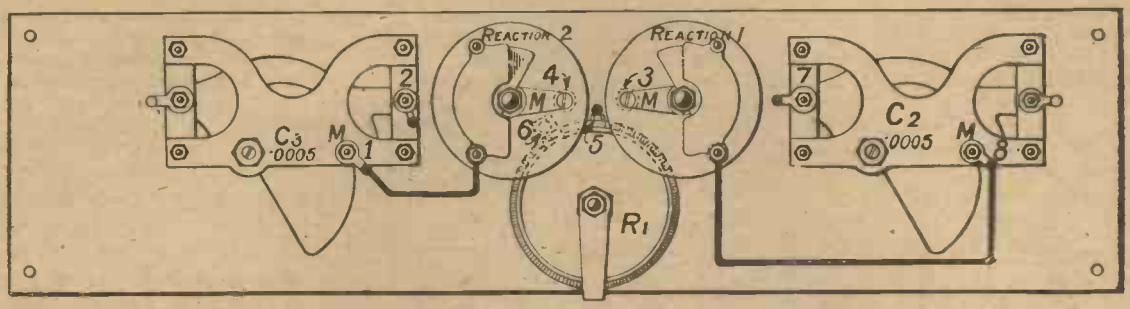
Join wire between contact 6 of switch and L1 coil socket to fixed vanes of variable condenser C2 (7).

Join other side of L1 coil socket to moving vanes of C2 (8).

Join together remaining filament contacts of V1, V2 and V3 and continue to one contact of filament rheostat R1 (6).

Join remaining contact of R1 to top left contact of jack (5).

The "Invalid's Three"—*continued*



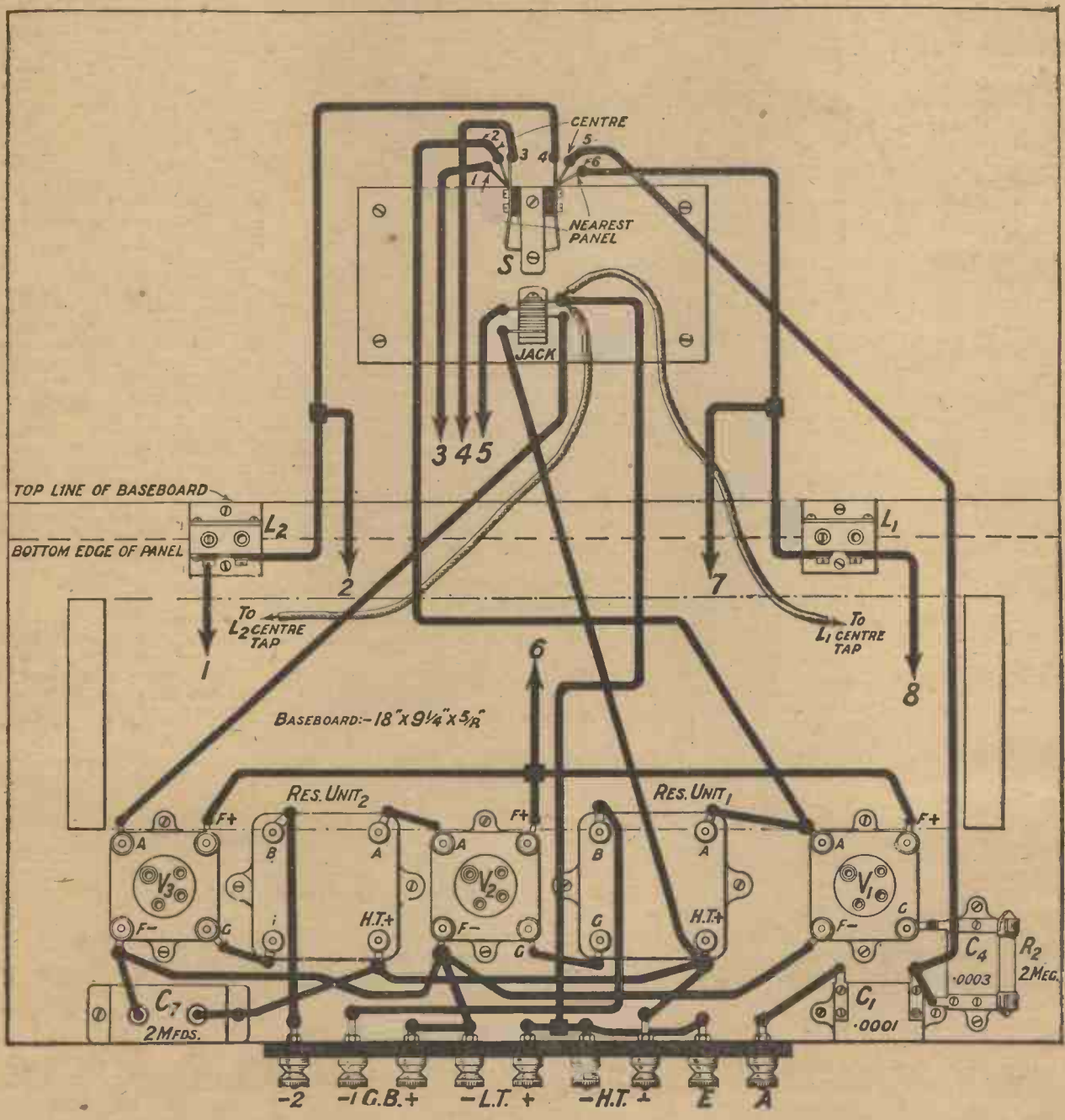
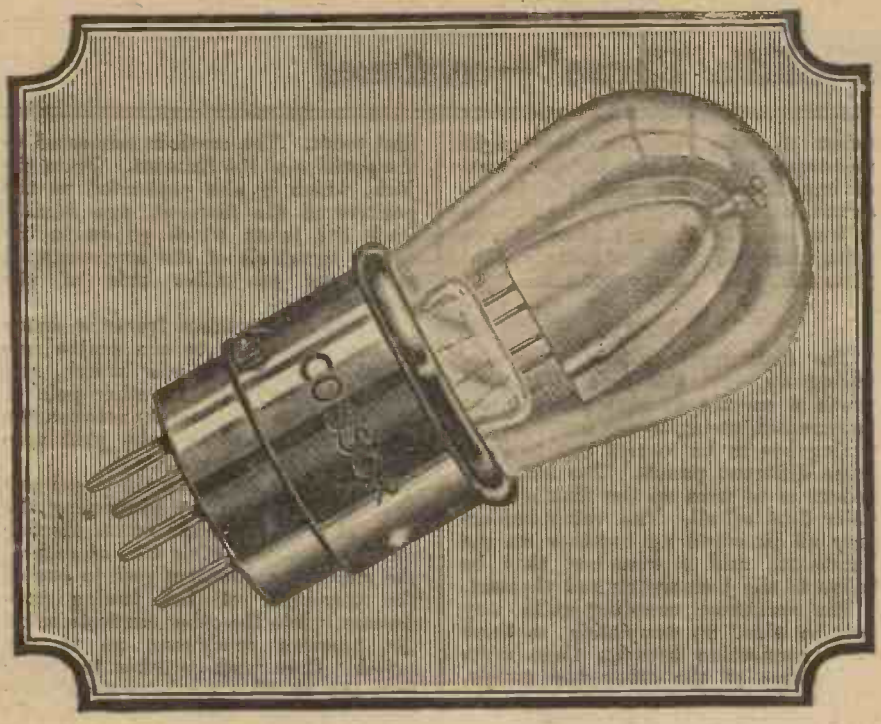


Fig. 4.—The numbered connections on the lower back-of-panel diagram go to the correspondingly numbered points on the sub-panel, shown above. Blueprints Nos. 1066C and 1066D are also available.



New!

from end to end

RATHER more than three years ago Cossor startled the world of Wireless by producing a valve which utilised almost the whole of the electron emission from the filament. Its unorthodox construction provoked astonishment amongst those who had accustomed themselves to the wastefulness of spiral grids and tubular anodes.

But despite the unconventional appearance of the P1 an amazingly large number of wireless enthusiasts bought it — and, in so doing, discovered an easier way to better reception, to louder signals and to a greater economy in maintenance.

The success of the first Cossor Valve was never in doubt — in fact, the famous P1 is still the standard British Bright Emitter. And during the past three years Cossor has steadily forged ahead—winning an ever-increasing public by the sheer merit of its products.

The culmination of many years experience and determination is about to be realised in the new Cossor Point One with its revolutionary system of Co-axial Mounting and its extraordinarily low current consumption.

To the huge army of staunch Cossor enthusiasts the opportunity of acquiring a valve exhibiting such an impressive list of improvements as those shown in the adjoining column will be quickly grasped. Others — who, perhaps, have but lately succumbed to the fascination of Radio — will be glad to read about a British Valve which worthily upholds the great traditions for fine workmanship which this country has built up among the nations of the world.

New Anode

The Anode of the Cossor Point One is deeper and permits a greater length of filament being used. This in turn obviously means that a greater emission surface is available. It is electrically welded to two short, stout electrodes. Movement is absolutely impossible.

New Grid

The Grid is wound around a very stout molybdenum support. Each turn of the wire is electrically welded in no fewer than 30 positions. This method of construction ensures absolute rigidity and ability to withstand the hardest shock.

New Filament

An exceptionally long filament is used which is secured in three distinct places. When the valve is operating it is hardly possible to discern any glow. Although rated at 1·8 volts this new valve will function satisfactorily at a voltage as low as 1·2. It can therefore be used, if required, with dry batteries. No other valve has such a wide range of working voltages.

New Bulb

Its handsome new pipless glass bulb is a further safeguard against accidental damage. Only glass of the finest quality is used on all Cossor valves.

New Base

The same exclusive low loss design of base which has proved so remarkably successful on all other Cossor valves is being retained on the new Cossor Point One. A wide flange is now incorporated to enable the user to withdraw the valve from the most stubborn socket without fear of harm.

New Pins

The new pins on the Cossor Point One is a further indication of Cossor's determination to "do the job properly." Instead of a single slot, each pin is now slotted in two intersecting positions. In addition the points of the pins are tapered. Because of these improvements the valve can be inserted easily and smoothly into any socket and, once in position, perfect electrical contact is ensured.

—and new methods of construction

The Cossor Point One is the only valve to be able to utilise the new patented system of Co-axial Mounting—whereby the Filament, Grid and Anode are rigidly secured to each other in their exact relative positions in permanent alignment at the top and at the bottom. As a result, absolute uniformity of characteristics is ensured throughout the whole life of the valve, whilst the filament is fully protected against damage by shocks.

Cossor Point One

Red Band for H.F. use
1·8 volts, ·1 amp. 14/-

Plain Band for Detector
1·8 volts, ·1 amp. 14/-

Cossor Stentor Two

Green Band Power Valve
1·8 volts, ·15 amp. 18/6

The new Cossor Point One

Issued by A. C. Cossor Ltd., Highbury Grove, London, N.5. Gilbert Ad. 5801.

The "Invalid's Three"—*continued*

mounted on two wooden feet 6½ in. high by 4 in. wide.

Mount the two condensers on the outside positions of the panel, the two reaction condensers towards the centre and the filament rheostat in the middle. With the particular condensers shown, the layout is not perfectly symmetrical, owing to the fact that the condenser spindles are not in the centres of the condensers themselves. This applies to any of the usual types of square-law condenser.

Having mounted these components on the sub-panel, the remaining components may now be mounted on the baseboard itself. These are the three valve holders, the various resistances and condensers associated with the resistance-coupling circuits, and the C.A.T. condenser and grid condenser and leak for the rectifier valve.

Coils

Finally, the two coil mounts should be placed in the positions shown close up against the front panel. The coils are actually inserted between the front panel and the sub-panel containing the tuning arrangement. This position is a little awkward to get at when the receiver is fitted into its case, but since the coils when in position do not require to be changed unless a fault develops, this slight inconvenience need not be considered of importance. The coils can be inserted in position when the instrument is first tested out on the bench, before being inserted into its cabinet, and thereafter no difficulty will arise.

Wiring

The instrument is now ready for wiring up, and this is a matter on which a certain amount of care will be required, owing to the fact that the wiring has to be carried out between three different panels. The best procedure is to wire up the filament circuits first of all. The valve holders may all be wired up together on the baseboard, and a wire can then be taken to the jack switch and rheostat.

The resistance coupling units may now be wired up completely, as there is no connection between these units and either of the other two panels. This part of the wiring may therefore be completed without any difficulty.

Tuning Circuits

All that now remains is the wiring up of the tuning circuits themselves. The aerial is connected through a C.A.T. condenser (.0001 capacity) to one side of the grid condenser of the first valve. The earth is connected to the positive of the filament. From the jack, which is also connected to the positive of the filament, two flexible leads are taken which go on to the centre terminals of the centre-tapped coils, one on either side of the receiver.

A lead is now taken from the anode of the first valve to one centre terminal of the change-over switch, and a lead taken from the other pole of this switch to the junction between the C.A.T. condenser and the grid condenser of the first valve.

The wiring on the main panel can then be completed, by connecting the main tuning condensers across the two coils respectively. One side of each of the reaction condensers goes to one of the terminals of the tuning condensers, while the other connections on the reaction condensers go to the switch. Care must be taken to ensure that the reaction condensers are connected to the correct terminals on the tuning condensers, as if this is not done no reaction effect will be produced. Apart from this, little difficulty will be experienced if the wiring diagram and instructions given are followed carefully.

(*Concluded on page* 81.)

MR. GUMPLETHORPE'S pockets were bursting with catalogues, and he himself with enthusiasm, when he called on me one evening last month to insist upon my accompanying him to the Exhibition at Olympia on the very next day that ever was. I had rather hoped to be able to sneak off by myself, for Mr. Gumplethorpe

Mr. Gumplethorpe fell on it with cries of rapture.

is apt to be a little trying at times, especially when he gets one of his inquisitive fits; but, as no decent excuse occurred to me, I had perforce to agree, with what grace I might. We decided to motor to Olympia in our fine L.G.O.C. car—all the knuts refer to their cars as 'buses, so I do not see why I should not refer to my 'bus as a car—which took us there without losing its way once, despite the merry-go-rounds, one-way streets, and the other little hazards and bunkers of the Metropolitan thoroughfares. Entering the main door, we found ourselves opposite a turnstile labelled "Press." Both Mr. Gumplethorpe and I pressed hard, but nothing happened. Mr. Gumplethorpe had quite a lot to say to the attendant on the subject of silly practical jokes. Not deigning to reply, he directed us to another turnstile, where we were called upon to part with eighteenpence apiece. Since I am one of the world's best fumblers, it was actually Mr. Gumplethorpe who parted with eighteenpence twice; after all, if you have to accompany a fellow like that, I don't see why you should pay to do so.

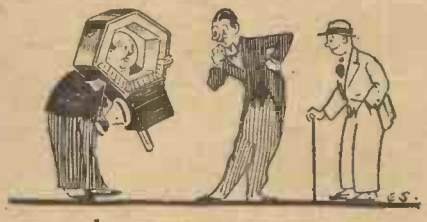
A Man's Size in Sets

The first stand that attracted his attention was one devoted to condensers, which displayed a large-scale model of a variable instrument, a thing about as big as a rabbit hutch. Upon this Mr. Gumplethorpe fell with little cries of rapture. Always, he told the attendant, he had hated those beastly little instruments that were sold as variable condensers in wireless shops. Here was a man's size condenser that was exactly what he wanted. He proposed to buy it on the spot, and to take it home with him.

After some discussion, he was told that he could have it after the exhibition was over, and not before. At another stand he found a similar model of a variable grid-leak with a dial about the size of a bicycle wheel. This threw Mr. Gumplethorpe into a positive ecstasy, and he entered at once into negotiations for its purchase. A stand or two away he came across a gigantic coil, which so tickled his fancy that nothing would prevent him from treating for its purchase. Having bought these things and a Wecovalve, Mr. Gumplethorpe assured me that he would shortly be turning out the finest single-valve set that had ever been seen. Personally, I am quite content to see it, so long as I am not called upon to hear it, for, having lost him for a few moments, I was horrified, on finding him again, to discover that he had purchased a loud-speaker with a horn some fifteen feet in length that decorated one of the stands. I am not quite sure whether he means to get his new components into his present house with the help of an outsize in shoehorns, or whether his intention is simply to dump them down in a field, and have a new house built round them. That, however, is his affair.

Tact

We were getting on quite nicely when Mr. Gumplethorpe put his foot slap into the middle of things. Just as we were passing one of the ebonite people's stands, he pulled out a match to light a gasper of the bespatted, or cork-tipped type that he effects, and struck it thoughtlessly upon a shining panel. Everything seemed to happen at once. Half a dozen demonstrators, speechless with rage, surrounded Mr. Gumplethorpe and myself, raising their arms to the heavens in horror, or brandishing them (with knobby-looking fists at their ends) in our faces. Luckily, my natural presence of mind enabled me to rise to the occasion and to avert bloodshed. "My friend," I said, "always strikes matches on the panels of his receiving sets. He has been sadly disappointed lately by the purchase of several large panels whose nature was such that they simply rubbed the head off the match without producing the necessary flame. Your panels appear to be exactly what he needs, and he will be glad if you will kindly send him a dozen. My friend always pays cash down. . . ." Realising that discretion was the better part of valour, Mr. Gumplethorpe parted with the necessary Fishers, whereupon the scowls were turned miraculously into smiles. This just shows what tact can do. By exercising some more of it on



. . . he came across a gigantic coil . . .

Mr. Gumplethorpe, I am trusting to be provided with free panels for some little time to come.

The Art of Selling

"Phew!" said Mr. Gumplethorpe, mopping his brow, as we moved away. "Give me a cigarette, will you, old chap? I have not a single one left." "Sorry," I replied, "I was just going to ask you for one, for my case is also empty." "Tut, tut," said Mr. Gumplethorpe, "I must go and buy some. I wonder where the stall is where they sell them." Neither he nor I knew, but Mr. Gumplethorpe said that he would find out in two ticks. Advancing to the man in charge of the nearest stand, he began politely, "I wonder if you would be so good as to . . ." "Certainly, my dear sir, certainly," crooned the man in charge. "It is most kind of you to take such an interest in this neat little device, and I shall be charmed to show you exactly what it is for, how it works, and ——"

"Look here!" protested Mr. Gumplethorpe, "what I want to know is ——"

"Exactly," said the man, nipping further protests in the bud. "What you were going to say, my dear sir, is that you wish to know why it is imperative that you should fit this exceedingly neat little device to your receiving set."

The bewildered Mr. Gumplethorpe was told precisely what it did, and how and when and where and why. "Yes," said the salesman, coming to his peroration, "such is this mar-

Mr. Gumplethorpe Visits Olympia—*continued*

vellous component whose usefulness you, my dear sir, thoroughly appreciate, as I can judge from your remarks. Was it half a dozen or a dozen that you said?" Mr. Gumplethorpe raised a feeble protesting hand, but as another torrent of words appeared to be imminent, he caved in and said that he would take half a dozen.

More Components

After some more phewing and some more mopping of his brow, Mr. Gumplethorpe suggested that I should approach a chappie at another stall. As, however, I noticed that he was dealing with aerial masts, for a dozen of which I had no use whatever, I declined emphatically to do anything of the kind.

In the end I grew so tired that I gave up following him on his frenzied excursions, and after a brief visit to one stand, sat down to wait for him to come down to earth. When he joined me an hour or so later practically a ruined man, but still cigaretteless, he gave me one awful look. "Where," he cried, pointing an accusing finger, "where did you get that cigarette?" "From the stall just behind you," I said sweetly. "I tried to tell you several times, but you were so busy buying earth tubes and things that you would not listen to a word I said."

Refreshment

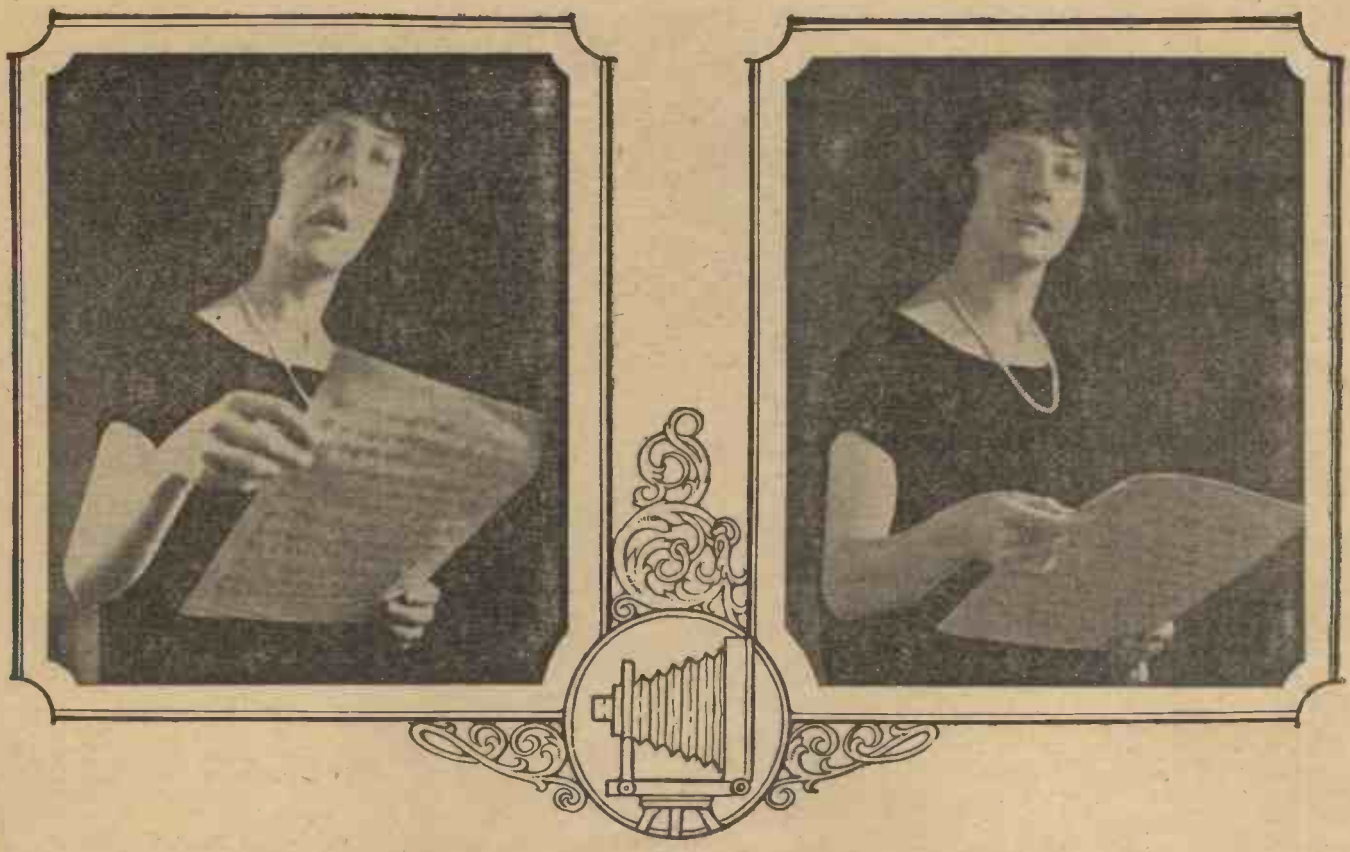
When we had rested a little, Mr. Gumplethorpe insisted upon going to the refreshment stall, where he purchased a lemon, which he had cut in half. He assured me that there is nothing like a lemon to calm one down

. . . *struck it upon a shining panel* . . .

after great mental stress. His progress through the hall with his quaint fruit excited a certain amount of comment, but no great harm was done. It was only when he insisted upon visiting the B.B.C. studio that things really began to happen. We took our places in the queue, Mr. Gumplethorpe still extracting consolation from his lemon. In course of time we found ourselves before the plate-glass window of the studio, behind which the Military Band was in full blast. This interested Mr. Gumplethorpe enormously. Despite the requests of the commissionaire to move on, he planted himself firmly in position, applying the lemon to his lips as he stood in meditation.

The Acid Test

The cornet was the first man to be affected. I noticed funny things happening to his face, and finally he threw down his instrument and shook his fist at Mr. Gumplethorpe. The euphonium and the trombone followed fairly quickly, though the bombardon and the French horn stuck it out for a time, fighting a real he-man battle against the desire to screw up their countenances. At length they, too, gave in, and no one was left but the drummer, who continued in action despite the grimaces that he was making. At this moment firm hands were laid on the shoulders of Mr. Gumplethorpe and myself, and we were conducted down the stairs to the nearest exit. "It is a good thing," remarked Mr. Gumplethorpe, turning out his empty pockets when we were in the street outside, "that one has not to pay to get out of wireless exhibitions."



Just as an inferior lens will create distortion so an inefficient Transformer will distort a voice

The new Eureka Concert Grand

ALMOST any kind of lens will serve to produce an image on a sensitive photographic plate. But no one expects that a simple uncorrected achromatic lens will give such faithful reproduction as an anastigmat. Exactly the same principles apply in wireless. Practically any L.F. Transformer will amplify and give some kind of results.

But if you want to hear the rippling notes of the soprano you must use a Transformer scientifically corrected against distortion. Every Eureka has been scientifically designed by specialists in the science of sound reproduction to give an even amplification throughout its entire frequency range. It does not amplify some notes at the expense of others, but is, in fact, fully corrected against distortion.

And now, through an improved method of "stratum-winding," the efficiency of Eureka Transformers has been still further increased. At no extra cost to you there is now available greater volume and sweeter tone, whilst the possibility of breakdown has been eliminated by the use of interspaced insulation between windings.

These new and exclusive features will place the Eureka again ahead of possible competition. For your next Set, therefore, be sure to use a Eureka—"the Transformer which re-creates the living Artiste."

Types and Prices

Concert Grand	25/-
Ditto for 2nd stage	21/-
Baby Grand (1st or 2nd)	15/-
Eureka Reflex	15/-
Eureka L.F. Choke Unit	25/-

Re-creates the EUREKA Living Artiste

Portable Utilities Co., Ltd., Fisher St., W.C.1.

Gilbert Ad. 5814.

OPERATING THE "DISTAFLEX TWO"

VALVES TO USE

FULL instructions for the construction and preliminary testing of the Radio Press Star Set, the "Distaflex Two," were given in the last issue of THE WIRELESS CONSTRUCTOR. It will be assumed, therefore, that the receiver has been constructed and the wiring checked, and that tests have shown that the receiver is in order. In the photograph at the head of this article the "Distaflex Two" is shown in the special cabinet which was mentioned in the list of components in last month's issue.

Valves

As was mentioned in the previous article on the "Distaflex Two," the choice of suitable valves for use in this receiver is of importance. Valves which are capable of handling considerable volume are especially necessary when the set is used for reception from the local station. For the best results under these conditions it is essential to use a low-impedance type of power valve.

Remedy for Blasting

Such valves need not be used if no very great volume is to be handled when the set is being used for the reception of stations at a greater distance. The tendency to blasting which may be observed when the valves used are called upon to handle too great a volume may be dealt with in many cases by correct adjustment of the grid bias values, ample grid bias being generally the rule.

A list of valves which may be used in the "Distaflex Two" is given in the accompanying table.

Grid Bias

The high-tension voltage should be about 100 to 120 volts if full volume is required, and with this voltage from 6 to 9 volts grid bias will be required. This should, however, be adjusted to suit the valves actually in use.

Neutralising

The first operation to perform on bringing the set into use is to adjust the neutralising condenser controlling the first valve. This condenser is the one mounted on the baseboard in the set as described. To do this the two neutralising condensers, on the baseboard and panel, are set about one-third of the way round, and the local station is tuned in with the telephones in No. 1 jack. If there is any sign of oscillation, the neutralising condensers should be adjusted till it ceases.

VALVES

The following types of valves, among others, will be found suitable for use in the "Distaflex Two," the same type of valve being used in each valve holder :—

MANUFACTURER.	VALVE TYPE.
Benjamin	S.P. 55/R. (Red Spot).
B.T.H.	B. 4.
Burndept	LL. 525.
	L. 525.
	L. 550.
	L. 240.
Cleartron	C.T. 15+
	C.T. 25+
Cosmos (Metro-Vick) ..	S.P. 18/R.
	S.P. 55/R.
Cossor	Stentor Two.
	P. 3.
Ediswan	P.V. 5 D.E.
	P.V. 2.
Marconi or Osram ..	D.E. 5.
	D.E. 5 A.
	D.E. 8 L.F.
Mullard	P.M. 4.
	P.M. 6.
	D.F.A. 0.
	D.F.A. 1.

Non-Radiating Reaction

The dials should then be rotated together from top to bottom of their scales, the aerial condenser being swung backwards and forwards over a few degrees on either side of the tuning point as the other two dials are moved forward. If the set oscillates at any point on the scale, this may be checked by adjustment of the neutralising condensers. When this operation is completed, the baseboard neutralising condenser should be left alone. The neutralising condenser on the panel may then be used as a reaction control, without fear of causing re-radiation of energy and annoyance to the neighbours.

Loud-Speaker Connections

It should be noted that the loud-speaker may be connected either to the terminals at the back of the set or, if preferred, by means of a plug to No. 2 jack. The insertion of a plug into No. 1 jack cuts out the low-frequency amplifying stages, so that this position is most suitable for the insertion of telephones in circuit when tuning-in distant stations.

Transformers

The three transformers required for the set are all alike, being of the split-secondary type. Before these are inserted in their places on the set, the pins should be opened out slightly with a penknife. This will obviate the possibility of poor contacts in any of the sockets on the coil bases, which might well be detrimental to the operation of the set.

Operating the "Distaflex Two"—*continued*

Crystal Detector

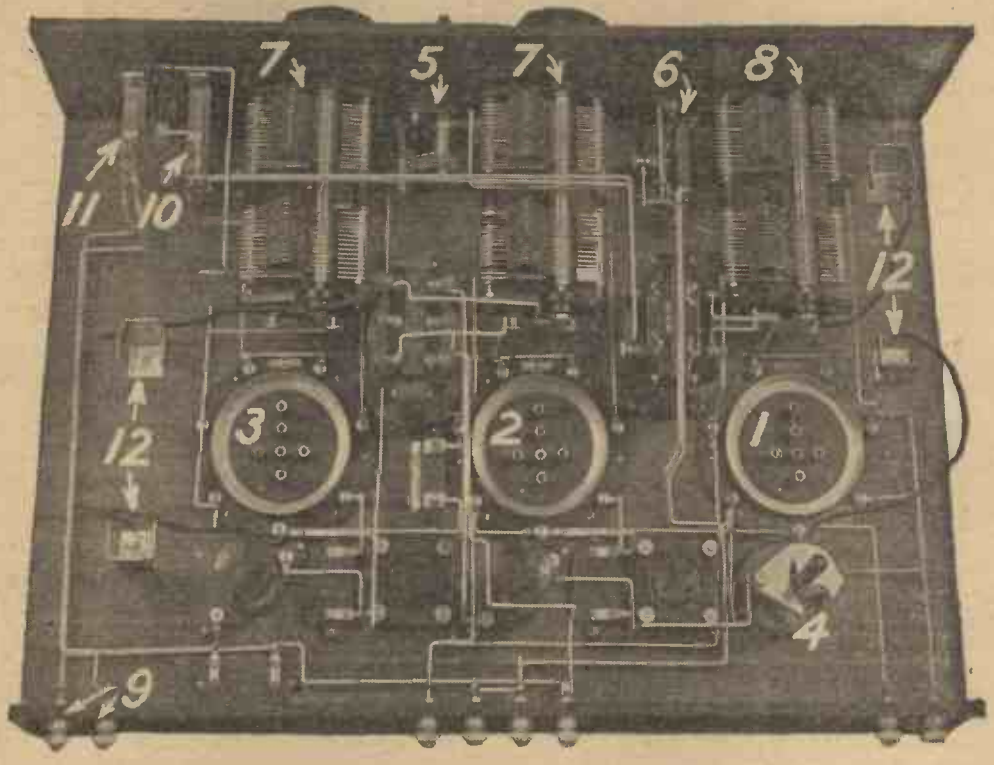
The best setting for the crystal detector should be ascertained when the set is tested on the local station.

batteries will put matters right in this respect.

Reaction

The reaction control, provided by

wave stations received with the "Distaflex Two." Since, however, these coils are not yet generally available, these readings will be given in a future issue of this journal.



SPECIAL POINTS TO NOTE

1, 2 & 3.—Insert here split-secondary transformers for the required wavelength range.

4.—This neutralising condenser is adjusted to prevent oscillation and then left set.

5.—This neutralising condenser provides a non-radiating reaction control.

6.—One filament rheostat controls both valves.

7.—The dials of these two tuning condensers read alike.

8.—The dial of this tuning condenser reads within a few degrees of the other two.

9.—Connect the loud-speaker here for full volume.

10.—Insert telephone plug in this jack. This uses two stages of H.F. amplification and the crystal detector.

11.—Insert loud-speaker plug in this jack (alternative to terminals 9). This uses two stages of H.F. amplification, crystal detector, and two stages of L.F. amplification.

12.—Insert grid bias batteries here, and use ample grid bias to prevent blasting and rectification by the valves.

When once this has been done, the operator will be well advised not to interfere with this setting while searching for more distant stations, since alterations may affect slightly the dial reading of the third tuning condenser. This dial reading may also be upset slightly, and need readjustment on removing the telephones from No. 1 jack and bringing the loud-speaker into circuit.

If it is observed that the tuning of the circuits is somewhat flat, it will probably be found that the grid bias values are incorrect, and that the selection of other tappings on the

means of the neutralising condenser on the panel, will be found useful in locating the settings for distant stations. It should, however, be handled with care and not advanced too far, or the set may show a tendency to howl. This control should be used very sparingly for increasing the volume of initially loud signals, owing to the distortion which will be introduced by the application of excessive reaction.

Long Wave Coils

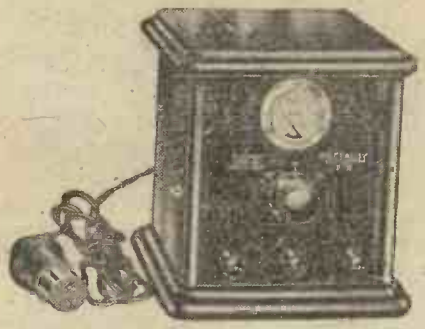
It was the intention to give this month the dial readings for the long-

SEEN AT THE SHOW

An Impression of some of the Exhibits at the National Radio Exhibition.

A general view of the National Radio Exhibition in the New Hall at Olympia.

AN impression gathered at the National Radio Exhibition, held at Olympia from September 4 to 18, was that this year's exhibits have shown the development of wireless sets and accessories to be proceeding along the lines of improving the reception obtainable by the listener. Novelties



A battery charging unit shown by Rectalloy, Ltd.

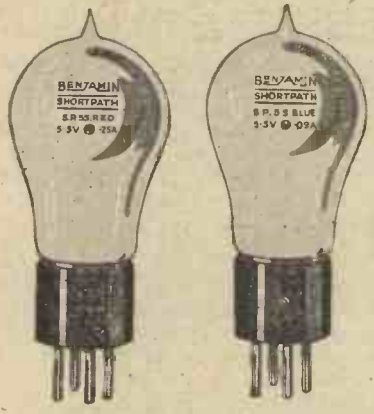
and new lines which are now available to the public do not take the form of "freak" sets or components so much as solid improvements on the designs of the past.

Battery Eliminators

The wireless needs of the home were, for example, well served by the numerous types of battery eliminators exhibited. It is prophesied in some quarters that within a few years time hardly any listener, except perhaps those in the remote country districts, will still continue to use batteries. Dependent as the alternative system is on the universal adoption of electric supply all over the country, there is no doubt that the prospect is attractive.

High Tension Units

Messrs. Burndept were showing their "Ethopower" H.T. unit, an instrument employing a special rectifying valve for use on A.C. mains,



Two new Benjamin 6-volt valves, the S.P. 55/R and the S.P. 55/B.

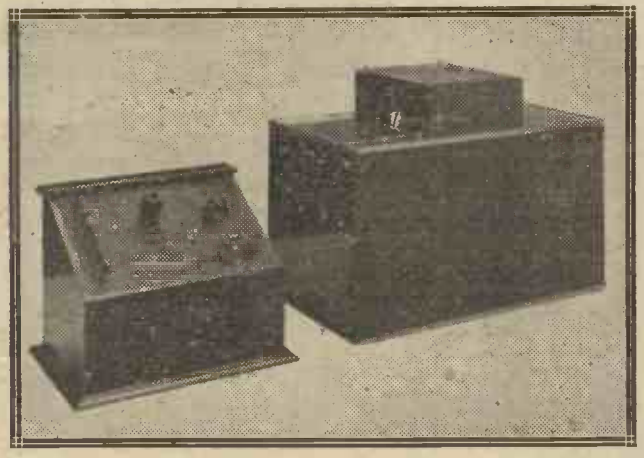
and supplying to the set voltages of 40 to 60 and 120 to 160 volts, so that the needs of individual valves in the set may be served. Two new converters for high-tension supply were exhibited by Messrs. Igranic Electric Co., Ltd., suitable for providing high-tension for the set from A.C. mains. Full-wave rectification is furnished on both models, the valves used being of the double-anode type.

A New Rectifier

The General Electric Co. produce a complete set of parts for the construction of an H.T. battery eliminator, which uses an Osram gas-discharge rectifier. An advantage of this type of rectifier is that it has no filament, so that it cannot be overrun.

High and Low Tension

The "Hiloten" battery eliminator is a product of the Dubilier Condenser Co., Ltd., which incorporates several interesting features. For the low-tension supply there are two accumulators, which are automatically charged alternately as they are discharged. A high-tension voltage of 200 volts for low-frequency amplifiers and a variable voltage with a maximum of 100 volts are also provided. The converter itself may be placed in any convenient position in the house,



Messrs. Dubilier's "Hiloten" battery eliminator is provided with a separate remote control unit.

The new disc loud-speaker shown by S. G. Brown, Ltd.

a control box for remote control being connected to the receiver.

Battery Chargers

With battery eliminators may be associated battery chargers of which a large variety were exhibited. A

Seen at the Show—*continued*.

low-tension pattern shown by Messrs. Rectalloy is suitable for 2-, 4- or 6-volt accumulators and charges at .2 or .4 amperes. Chemical full-wave rectification is employed, and simple operation is a feature of the instrument.

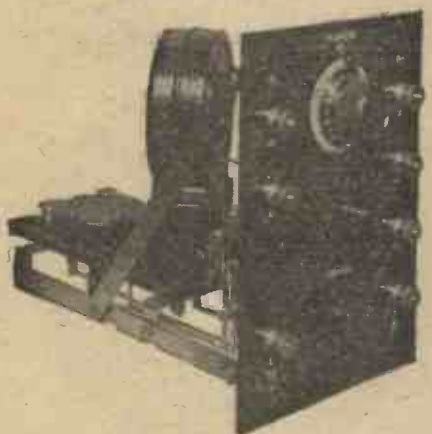
Messrs. Burndept's "Balkite Trichle Charger," for use with A.C. mains, contains a special rectifying cell, and delivers a current of about half an ampere to the accumulator. The latter may thus be switched over from the set to the charger when not in use,

The "Ethopower" A.C. mains battery eliminator for high-tension supply.

ensuring a constant low-tension supply.

Several "Tungar" chargers were shown by the British Thomson-Houston Co., Ltd., these including an instrument supplying 12 amperes at 75 volts and a smaller model to give from .1 to 2 amperes at from 7.5 to 100 volts. These instruments are for use on A.C. mains and give a D.C. output.

Compact unit for obtaining high-tension from D.C. mains is the



A superheterodyne attachment produced by Messrs. Gambrell Bros., Ltd.

"Ekco" eliminator, produced by Messrs. E. K. Cole. Simplicity is a feature of this instrument, four terminals and a standard lamp plug being the only external fittings.

Loud-Speakers

Among the loud-speakers there were several new models to be seen, the aim appearing in the main to be directed towards securing good reproduction.

The C.A.V. "Musicola" loud-speaker, of which a photograph was

The Darimont cell is somewhat of a novelty in primary cells.

published in last month's issue, is of the conical diaphragm type, mounted in a trunnion bearing, so that it is adjustable to any angle. Messrs. S. G. Brown, Ltd., have also turned their attention to the open-diaphragm type of loud-speaker, the diaphragm in this instance being enclosed in a metal screen, which is designed to protect the instrument from damage.

Messrs. B.S.A. Radio were showing three types of "Kone" loud-speaker, one of which, known as "Model C," is illustrated on these pages. On Messrs. Alfred Graham & Co.'s stand was a complete range of the Amplion loud-speakers, improvements in detail and finish being the most noticeable points.

Unusual Designs

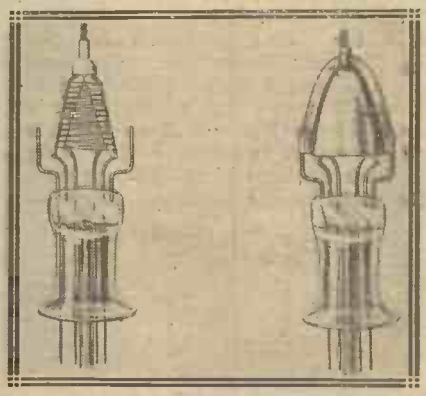
Considerable claims are made for the Donotone instrument, which consists of a complete series of tuned reed mechanisms for the audible frequency range. Several firms have produced loud-speakers cleverly disguised and made to serve an additional purpose. Such are a loud-speaker with a clock

The new B.S.A. loud-speaker, Model C.

in the centre, shown by the Peto-Scott Co., Ltd., and the "Beco" rose-bowl instrument illustrated on these pages.

Valves

Several interesting new types of valves were to be seen at the Exhibi-



Showing the disposition of the electrodes in the Cossor Point One valves.

tion, among which were the new Benjamin "Shortpath" valves. Six examples of these were shown, intended for operation from 2-volt or 6-volt accumulators, three in each category. The new Burndept valves include a "super power valve," the LL525, and the L240, a 2-volt power valve designed to operate with anode voltages up to 120 volts.

Three new Cleartron power valves are the C.T. 08+, the C.T. 15+ and the C.T. 25+. These are of the 3-volt, 2-volt and 5-6-volt types respectively. Some new 2-volt Ediswan valves have been introduced into the range of valves manufactured by this firm,

The appearance of the "Beco" rose-bowl loud-speaker gives little suggestion of its dual purpose.

these being general purpose, special detector, resistance-capacity amplification and power valves.

Variable Condensers

Low-loss construction in accordance with sound design is a feature of the variable condensers exhibited this

SEEN AT THE SHOW—*continued*

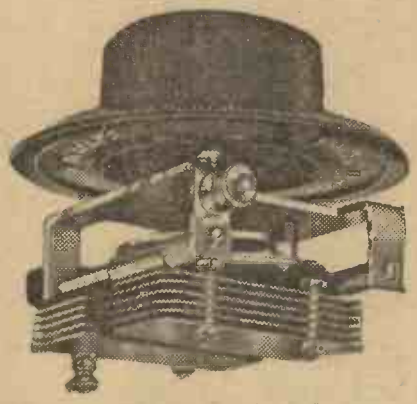
year. Ball bearings are popular for providing a smooth spindle movement, and many instruments are fitted with slow-motion devices, either integral

The Bretwood variable condenser has an unusual form of movement.

with the condenser construction or separately attached in the form of vernier dials.

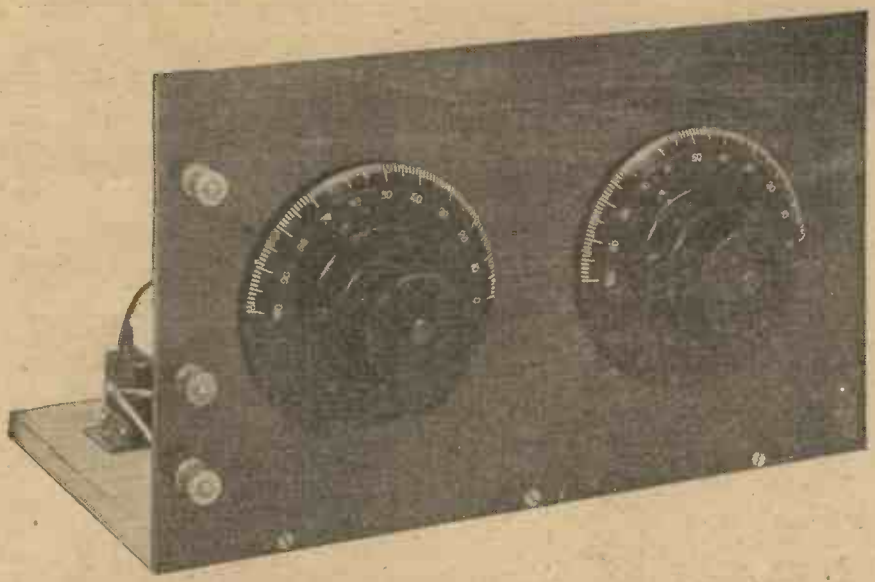
Special Condensers

Several manufacturers have now produced "gang" condensers, designed



Messrs. Ripaults' lateral action variable condenser is an interesting departure from the conventional.

for use in the Radio Press Star Set, the Elstree "Solodyne," a receiver which attracted a great deal of attention at the show. Since the moving vanes of each condenser must be capable of individual adjustment, the construction of these special instruments calls for a high standard of design and execution.



A SELECTIVE ONE-COIL SINGLE-VALVE SET

By D. J. S. HARTT, B.Sc.

Describing an interesting set, involving little constructional work, which gives good selectivity and the full benefits of reaction amplification with a single coil.

I CONSTRUCTED recently a single-valve receiver with the idea of obtaining a high degree of selectivity without too many controls, and I finally adopted a modification of the Reinartz circuit, using a "tight-coupled" aerial, capacity-controlled reaction, and tapped the valve only across a portion of the secondary coil. This scheme proved very effective, but had the disadvantage that it necessitated the use of three coils, one being tapped for every range. Consequently, to be able to cover the whole broadcast range satisfactorily, including the longer waves, about nine coils were required.

Utmost Simplification

It occurred to me that one might achieve the same object in a much simpler manner by the use of only one or two tapped coils for the lower broadcast range, and one for 5XX, thereby greatly reducing the cost of the complete set. This I found possible, and the circuit shown in Fig. 2 is the result, and is used in the receiver shown in the accompanying photographs.

BUILD THIS SET WITH

One panel, 12 in. by 7 in. by ¼ in. (American Hard Rubber Co.).
One suitable cabinet, with baseboard 6⅝ in. deep.
One .0005 and one .0003 low loss variable condenser, with "Utility" vernier dials (Wilkins & Wright, Ltd.).
One Amperite, to suit the valve used (Rothermel Radio Corporation).
One baseboard coil socket.
One valve-holder (Burne-Jones & Co., Ltd.).
One H.F. choke.
One .0003 fixed condenser and 2-megohm leak (Lissen, Ltd.).
Two .0001 clip-in condensers, one with baseboard mounting and one with clips only.
Three terminals.
One ebonite strip, 2 in. by 2 in., with two terminals.
One centre-tapped No. 60 coil. Also centre-tapped No. 250 coil for Daventry, if required.
Glazite and about 3 yds. of rubber-covered flex. Radio Press panel transfers.

Approximate cost, £5.

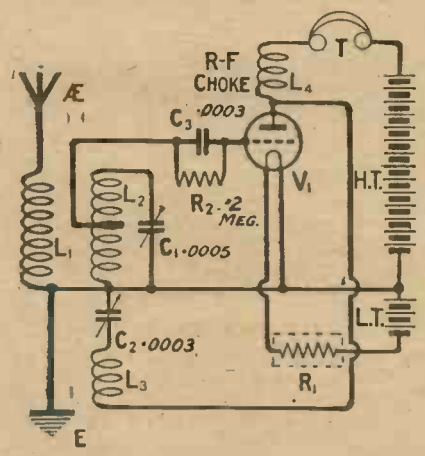
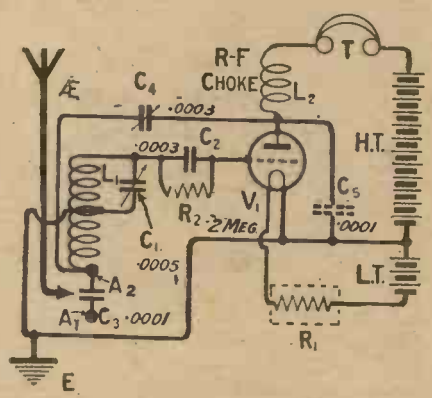


Fig. 1 (left).—This circuit was tried by the author, but was troublesome, since three coils were needed.

Fig. 2 (right).—The set described, which will be seen to require one centre-tapped coil only.



The more complicated circuit from which this was derived is given in Fig. 1.

Reference to Fig. 2 will show that the valve is tapped across half of the coil L_1 only, that the other half is used as a combined aerial and reaction coil, and that half of the coil is tuned by the condenser C_1. The circuit as shown gives results practically identical with those obtained with the Fig. 1 arrangement.

Reaction Control

Initially the circuit was tried without the fixed condensers C_3 and C_5, but some little difficulty was experienced in obtaining the desired reaction control. It was found that without these condensers reaction was possible on the lower portion of the broadcast band, and that with normal high-tension voltage oscillation could not be controlled on the longer wavelengths.

Remedies Adopted

To reduce the reaction effect on the long wavelengths the expedient was tried of providing an alternative by-pass for the H.F. component from anode to earth by the connection of a clip-in fixed condenser between these points. Several values were tried, and it was found that a .0001 condenser made it possible to obtain the desired smooth control.

In order to make reaction possible over the whole of the broadcast range, a small fixed condenser C_3 was connected as shown, so that the aerial

A Selective One-Coil Single-Valve Set—*continued*

could be connected to either A_2 or A_1. With the aerial taken to the latter terminal satisfactory reaction control was possible over the whole of the lower broadcast band. The clip-in by-pass condenser C_5 is, of course, removed when operating on these shorter wavelengths. Thus, although the saving in coils necessitates the use of two extra fixed condensers, the cost of the latter is usually less than the price of a single coil.

Coils Tried

In making the tests on reaction control both Lissen and Gambrell centre-tapped coils were used, with the same results in each case, so that the phenomena observed were not characteristic of any particular make of coil, but appeared to be rather inherent in the circuit.

The remainder of the circuit is probably quite clear; reaction is, of course, controlled by variation of the capacity of the condenser C_4, once the initial changes described above have been made, according to the wavelength range in use.

The usual variable filament resistance has been dispensed with, and one of the constant-current type fixed resistors or barreters substituted. Consequently only two dials appear on the panel, and a simple and attractive appearance is the result.

For the sake of simplicity, battery terminals have been omitted, and flex leads about 2 ft. long are connected to the appropriate points.

Components

The complete list of components required to build this set is given in the accompanying table, with the usual reservation as to substituting those of other makes that these should be of good quality. If this is your first set, however, you are advised to adhere closely to the list given.

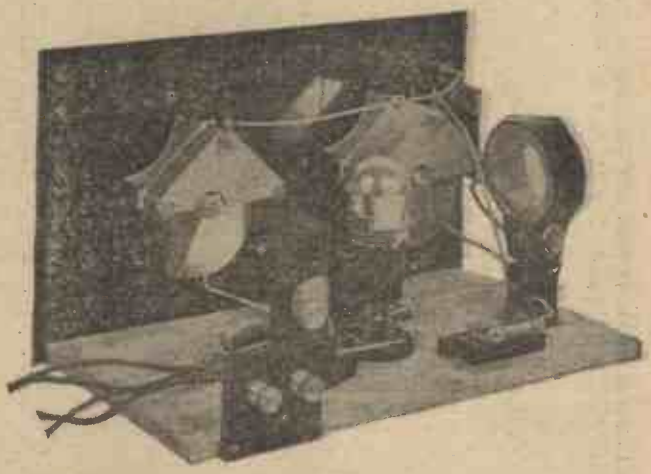
Constructing the Set

Even an absolute novice will find very little difficulty in constructing a receiver such as this. There are only eight holes to be drilled in the panel, two of these, namely, those for the variable condensers, being 9-16th in. in diameter. If you do not happen to possess a drill of this size drill the usual $\frac{3}{8}$-in. hole and carefully enlarge it with the tang of a file or with a small penknife blade.

The condensers are mounted on the panel in the usual way, but do not forget to place the stop in position on the threaded boss before putting on the securing nut.

Vernier Dials

Make sure that the stops engage properly when putting on the vernier dials, and secure these to the spindles with the set screws. Next place the baseboard in the cabinet, put the panel in position and secure it to the baseboard with three brass wood screws through countersunk holes, which should be drilled in the proper positions when the other panel drilling is done.



Ample space is allowed for the mounting of the components, the two terminals on the baseboard being for the telephones.

Next mount the baseboard components in the positions indicated on the wiring diagram and photographs, and you are then ready to commence the wiring.

Preferably solder all connections and give each joint a sharp tug to make sure it is sound. Finally solder the flex connections to the correct points, not forgetting the connection from earth to the centre-tapping on the coil.

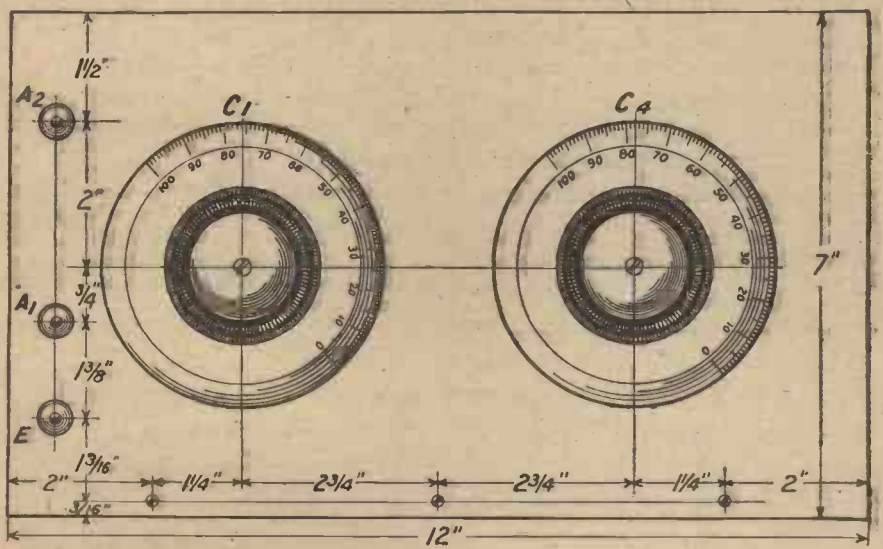


Fig. 3.—There is very little drilling to be carried out on the front panel. Blueprint No. 1067A.

WIRING IN WORDS

All directions are given as viewing the set from the back of the panel.

Join top aerial terminal to fixed vanes of variable condensers C1 and C4, and also to one side of L1 coil socket.

Join earth terminal to moving vanes of variable condenser C1, also to one side of fixed condenser C5, and to one filament contact of valve holder.

Join remaining side of L1 coil socket to one side of fixed condenser C2 and leak R2.

Join remaining side of C2 and R2 to grid contact of valve holder.

Join remaining filament contact of valve holder to one side of resistor R1.

Join anode contact of valve holder to one side of R.F. choke coil, thence to remaining side of fixed condenser C5 and to moving vanes of variable condenser C4.

Join remaining side of R.F. choke coil to one telephone terminal.

Join flex leads to the following points:—

One to the remaining telephone terminal, *for connection to H.T.+.*

One to the remaining side of resistor R1, *for connection to L.T.—*

Two to the earthed filament contact of the valve holder, *for connection to L.T.+ and H.T.—.*

One to the earthed end of fixed condenser C5, *for connection to the centre tap of coil L1.*

Testing

Connect up the aerial, earth, telephones and L.T. battery; insert the

A Selective One-Coil Single-Valve Set—*continued*

valve, and ascertain that the filament circuit is correctly wired by the fact that the valve lights. Next connect the H.T. battery, using, say, 40 to 60 volts, and finally see that you can obtain reaction smoothly over the whole of the tuning range, using both lower broadcast range and longer wave coils, and making the changes referred to previously.

Searching

If everything is satisfactory you are now in a position to search for stations. Set the reaction condenser on the right at zero, and tune in the local station. You will find the tuning condenser adjustments fairly sharp, but when the condenser is correctly adjusted the local station should be audible at good strength, and the application of reaction, by increasing the capacity of the right-hand condenser, should give you a very useful increase in signal strength.

Searching for the more distant stations is done by slowly rotating the left-hand dial and just keeping the circuit near to the point of oscillation by careful adjustment of the reaction condenser. The vernier dials greatly facilitate these operations, but you are advised when searching not to approach too close to oscillation point until you have acquired a certain amount of familiarity with the operation of the set.

Results

On test at 10 miles S.W. of London on a good average aerial, 2LO and 5XX were both heard at very good strength, as was Radio Paris.

Union Radio, Madrid, three unidentified German stations, one other Spanish station, Radio Toulouse, Berne and San Sebastian were also heard at quite good telephone strength. The British stations received were Bournemouth (when 2LO was working), Newcastle, one relay station (faint but intelligible) and Birmingham.

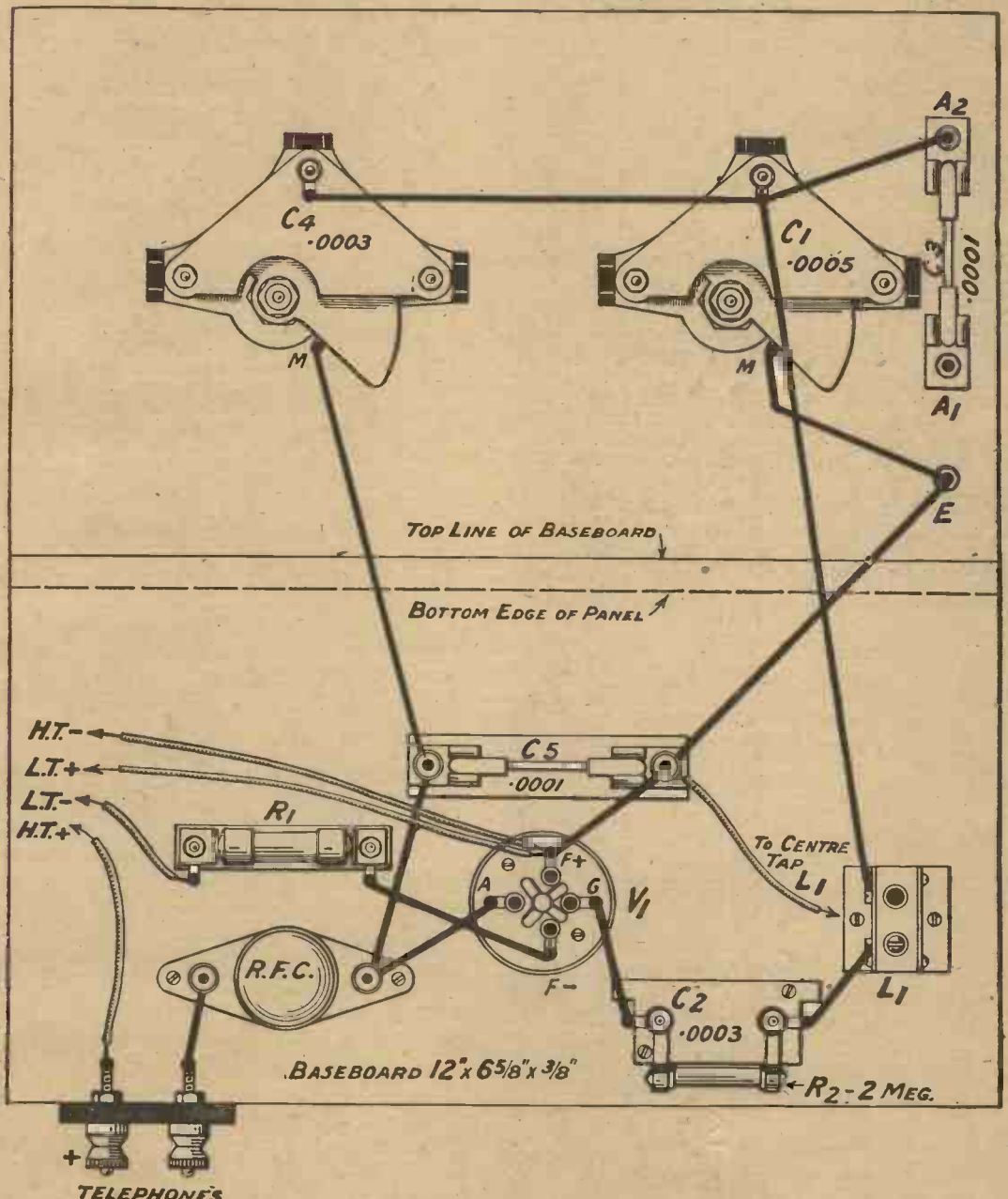


Fig. 4.—The fixed condenser, C5, is removed from its clips when working on the shorter wavelengths. Flexible leads are fitted for connection to the batteries. Blueprint No. 1067B may also be obtained.

FIRST IN EUROPE

RADIO PRESS TRIUMPH IN INTERNATIONAL COMPETITION IN NEW YORK

"WIRELESS CONSTRUCTOR" READER TO GIVE FULL CONSTRUCTIONAL DETAILS NEXT MONTH.

A specially interesting feature of the great annual Radio World's Fair at New Madison Square Garden, New York, was the international competition for home-constructed sets of all types. The principal class, and the only one in which Radio Press readers entered, was the multi-valve (3 or more valves) category.

Entries were invited from all over the globe, and many sets were sent in by British amateurs, a truly international contest of set-builders resulting. The awards were made on a basis of "workmanship, appearance, volume, distance, selectivity and tone," a body of leading American experts, headed by Dr. Alfred Goldsmith, being the judges.

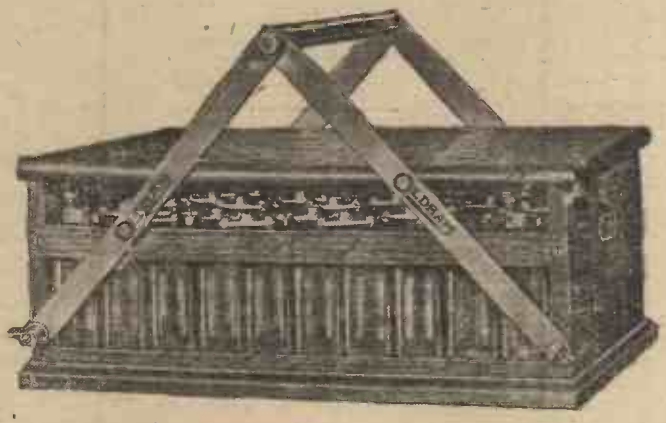
The result has proved to be a triumph for Radio Press readers, and also for Radio Press designs. The third prize in the multi-valve class in the senior competition was won by a set using the "Elstree Six" circuit, entered by Mr. H. E. Hassall, of 40, Norfolk Street, Strand, London, while in the junior equivalent competition a "Mewflex" receiver (described in "Modern Wireless"), entered by a thirteen-year-old British competitor, J. A. E. Black, of Mill Hill School, won the second prize. This set also won a special cup for general fine workmanship.

These Radio Press readers head the list of the British multi-valve entrants in the international competition — another triumph for Elstree, whose circuit and complete design respectively were used.

Mr. Hassall, who thus holds the European championship, will describe his six-valve set in the next issue of "The Wireless Constructor." While using a similar circuit to that of the "Elstree Six," the design is quite different; screened coils are used and the set is much smaller.

Don't throw your Fountain Pen away every time it runs dry!

NO fountain pen user would think of throwing his pen away whenever it ran dry. Yet that is exactly what thousands of wireless users are continually doing — whenever their H.T. Dry Battery "runs out" they are obliged to scrap it and buy a new one. But those who have discovered Oldham are more fortunate; they just charge their H.T. Accumulators whenever they run down (four times a year) and forget them! Thus has the Oldham High Tension Accumulator solved the vexed question of H.T. Supply. There are so many improvements embodied in this latest Oldham triumph that it is difficult to imagine anyone ignoring it for one of different make. The refinements which the Oldham includes have long been eagerly looked for by all who deplored the inefficiency of the old dry battery. Think what it means to have an Accumulator which gives the many following advantages:



A glance at the illustration will show it is built on the unit system—like an expanding bookcase. You can start with, say, 60 volts, and then add to it in 20 volt units as the need arises; 80, 100, 120 volts—just as you will.

The Accumulator is always neat and tidy—fit to take its place in any room. Acid can't be spilt, and when it needs recharging a convenient carrying handle is available. Each of its big capacity cells is a miniature Oldham accumulator capable of holding its charge for months on end. Each plate is made under the same Special Activation Process which has made the name Oldham famous throughout the world.

Which do you prefer—the ordinary dry H.T. Battery with its conseqeunt noises and cracklings—after some of the cells have become weak—its distortion, lack of volume and constant expense for renewals; or the Oldham H.T. Accumulator which will give a new lease of life to your set, more volume, greater sensitivity, and the utmost economy in operation? Once a man chooses this Oldham he never goes back to expensive dry batteries.

Ask your dealer to show you one of these handsome H.T. Accumulators — don't be put off with a substitute. Nothing can take its place for none other can give you the same steady flow of power—the same freedom from sulphation and the same generous length of service.

10d. per volt

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REMARKABLE SUCCESS OF THE ELSTREE "SOLODYNE"

Press Opinions of a Radio Press Star Set

THOSE who were able to visit the National Radio Exhibition at Olympia this year will need no introduction to the Elstree "Solodyne." Our readers, too, will remember that in the last issue of THE WIRELESS CONSTRUCTOR it was announced that Radio Press, Limited, would at an early date commence to give demonstrations of the "Solodyne" and possibly of other Radio Press Star Sets.

Full constructional details of the "Solodyne" were published in the September issue of *Modern Wireless*. It possesses only one tuning control, though two stages of tuned high-frequency amplification are used, and fifty stations have been received on the loud-speaker with its aid.

Press Demonstration

In accordance with the policy of Radio Press, Limited, quoted above, a demonstration was given on August 31 last to a gathering of Press representatives at the Radio Press Elstree Laboratories. Among those present were representatives of the following:—*Morning Post*, *Daily Express*, *Daily Telegraph*, *The Scotsman* and *Dispatch*, *Daily News*, the Press Association and the Exchange Telegraph Company.

Simple Tuning

Mr. J. H. Reyner, who was in charge of the demonstration, explained to the visitors some of the difficulties which had to be overcome in designing the "Solodyne." Subsequently the set was connected up, and numerous British and Continental stations were tuned in, the loud-speaker being employed throughout. It is significant also that the aerial system with which the set was used was a small one of no great height, approximating to the type of aerial system available to the average listener.

When the capabilities of the "Solodyne" had been demonstrated in this way, the Press representatives were then invited to handle the set themselves, and to see how simple an operation is the tuning of it. We give on this page some of the opinions published subsequently.

PRESS OPINIONS

MORNING POST

"A set that in actual test has received 50 Continental stations by merely turning one knob instead of endless fiddling with two or more controls."

DAILY NEWS

"Universal reception made easy. . . . Last night I picked up a dozen stations in as many seconds by turning the dial a few fractions of an inch. Frankfurt, Munster, Bournemouth, San Sebastian, London, Cassel and Dresden tumbled over each other as I turned the dial slowly round."

DAILY EXPRESS

"A wireless receiver which is the last word in simplicity."

One dial—fifty stations on the loud-speaker. The remarkable achievement of the "Solodyne."

DAILY TELEGRAPH

"A remarkable wireless receiving set with an all-Europe range controlled by a single dial was demonstrated to a party of Press representatives at a demonstration at Elstree last night. . . . It is a five-valve set, and simply by the manipulation of this one dial I heard at least a dozen Continental stations as well as the main British Stations. . . . The problem of simple control has thus been practically solved, and, moreover, the set is so constructed that it can be made up by any amateur from components obtainable on the ordinary market."

Choosing Your Star Set

A number of queries have been received from readers, who ask which is the better of the two sets, the "Elstree Six" or the "Solodyne," and which we recommend them to construct. They hesitate to begin building one or other of these Radio Press Star Sets, because they have an idea that one design must be superior to the other.

Each Set the Best in its Class

The answer to these queries is that neither set is superior to the other, and that each is a Radio Press Star Set and is the best in its class.

The "Elstree Six" has three stages of high-frequency amplification, while the "Solodyne" uses two, so that the former set may be expected to give longer range. The "Solodyne," which uses screened coils, has one control, as against four on the "Elstree Six." Alterations in the degree of sensitivity and selectivity obtainable with the "Elstree Six" may be affected by the employment of different anode coils.

Numerous other examples could be taken, and it remains to say that individual preference can be the only deciding factor in determining the choice of one set or the other

GETTING THE BEST FROM THE "NIGHT HAWK"

Dial Readings for Long-Wave Stations

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

THE "Night Hawk," which thousands of readers have already had the opportunity of inspecting at the National Wireless Exhibition at Olympia, is now being built in very large numbers all over the country. Since the article on this Radio Press Star Set was written for last month's WIRELESS CONSTRUCTOR, many further tests have been carried out, which fully justify the claims made for the receiver that it will give long-distance reception for everyone. Full constructional details were given in the last issue, and the article in question, together with the free blue print, will have enabled all who so desire to proceed with the work. I will therefore assume that you have completed building the receiver from the particulars given, and are anxious to get the best from it in adjustment and manipulation.

Filament Circuit

Assuming that you have connected up all wires, and are ready to attach the flexible leads, I would suggest that first of all you connect up positive and negative L.T. leads to your accumulator. As many modern valves, such as the Cossor Point One, give no visible glow to show that the valve is alight, it is of no use trying to see whether your L.T. circuit is correct by plugging in the valves and seeing whether the filament lights up. For this reason if you happen to have handy any valve which shows a visible glow, it is as well to use it for the preliminary test, although, of course, this is not essential. Switch on the current, if you have such a valve, and plug it into each socket successively, having made sure first of all that your filament resistances are adjusted to allow a flow of current through the valves.

High Tension and Grid Bias

When you are sure that the filament circuit is working and that the on-and-off switch operates satisfactorily set the reaction condenser at zero, carefully unscrew the neutralising condensers to the minimum position (in the case of the McMichael condensers this will mean that the knob will be screwed upwards as far as it will go), and if you are using 2-volt valves, set the filament resistances as far as they will go in the "on" position. Connect up the high-tension negative and two positives, together with grid bias as suggested by the valve maker for the anode voltage in use. The actual position for the leads will be found on page 1051 of the October issue, under the heading "Wiring in Words." Do not connect the aerial and earth for a moment.

Preliminary Tests

On switching on and slightly tapping the detector valve with your finger nail, you will probably hear a slight sound in the loud-speaker which will indicate to you that the batteries are properly connected up and the valves are functioning. If you have previously made a set you will know what I mean when I say that set will sound "live." Now set the three condensers at about 5 or 6 degrees in the case of the second and third dial and swing the first dial backwards and forwards. You will probably find that, on reaching a certain position, you will hear a rushing noise, indicating oscillation, and the set will pass in and out of oscillation with a click as you turn any one of the dials.

Neutralising

Now, if you have not already done so, try setting the high-tension voltage at, say, 100 or 120, if you have batteries which reach this figure, for H.T. +2 and about 60 or 70 for H.T. +1. Turn the two neutralising condensers about half-way towards the lowest position, and try swinging the condensers again. You should find a point on the two neutralising condensers where you are just off oscillation at a point where previously the set would have been oscillating. Now place the condensers at about half-way towards their upper reading, say at 90 for a 180 degrees dial, and repeat the process again, leaving the neu-

LONG-WAVE STATIONS

The dial readings for long-wave stations heard on the loud-speaker with the "Night Hawk" are as follows:—

Station	Degrees
Hilversum	45
Kœnigswusterhausen	50
Daventry	135
Radio Paris	146

The above dial readings apply to the second and third dials. The first (aerial circuit) dial may give slightly different readings.

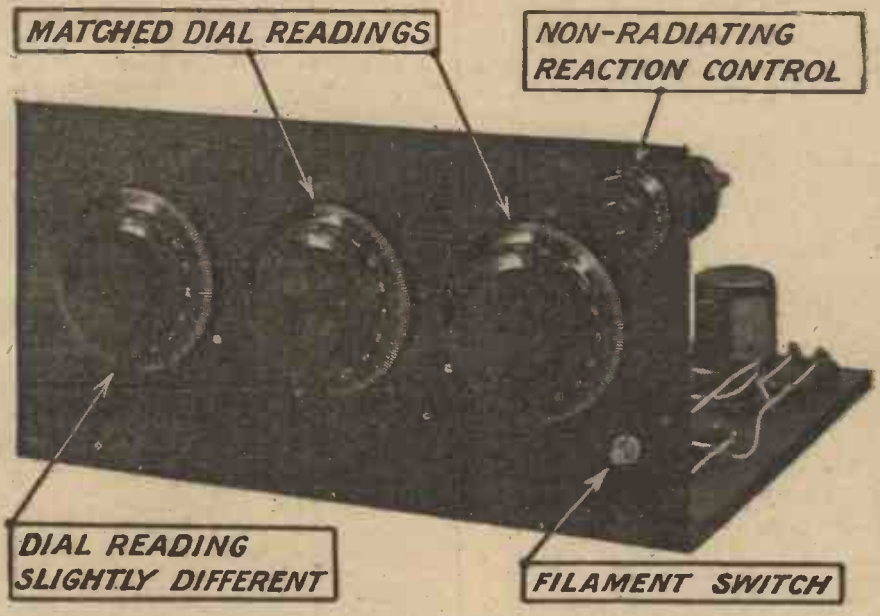
GETTING THE BEST FROM THE "NIGHT HAWK"

—continued

tralising condensers in position as before, but trying to see whether you can make the set oscillate by manipulating the dials. Probably you will find that the set will also be stable at this position. Repeat the process once more on the upper range, and you will probably find the set is stable all through. If, however, you find it is not so, slight readjustment of the neutralising condensers will soon put you right. Generally, about half-way down will be found correct.

Reaction Control

Now try the effect of the reaction condenser. You will find it will bring the set smoothly in and out of oscillation without what is called "backlash." Backlash means roughly that if on turning the dial oscillation begins at, say, 60 degrees, on turning back the dial the set will not pass out of oscillation again until you have gone much below the 60 point. When reaction is correctly designed in such a set as this, the set should pass smoothly in and out of oscillation without any backlash.



The operation of the "Night Hawk" is rendered simple by the small number of controls to be handled. A single switch sets all the valves on or off.

Matched Dials

You may now connect the aerial and earth. Do not be disappointed if you hear no station, even your local station, for the first few minutes, for the set is extraordinarily sharp in tuning, almost as sharp, in fact, as a superheterodyne. You will probably find that the second and third dials read the same for a given wavelength, while the first dial may vary slightly, although in many cases you will find that all three dials will read identically. When you have found your local station, make a note on a sheet of paper of the readings of all three dials, and then gradually proceed to find others. After about half an hour's work on this set, you will find the amazing sensitivity which it possesses.

If you desire to give the set every refinement, then you may care to buy one of the excellent vernier dials now available. Although not essential to the set, many people will find them very useful owing to the sharp tuning. If you purchase one of the types of dial in which you can make a note of readings, I suggest that you mark the positions lightly in pencil. Later, when you have recorded a good number, you may care to remove the dial and carefully ink them in, thus making a really neat job.

Series Condenser

Whether or not you find it best to use the series condenser in the aerial circuit as shown in the last issue, depends entirely on your own aerial. In any case, whatever aerial you use try shorting this condenser with a coin, as indicated last month. On my own aerial I found it better to short the condenser, while others have found it very helpful to keep it in series.

Long Waves

Although the number of stations that can be picked up with one set of coils is very large, some people may prefer also to get Radio Paris, Daventry, Hilversum, and Koenigswusterhausen on the long range. Messrs.

GETTING THE BEST FROM THE "NIGHT HAWK"—*continued*

Lissens have now prepared excellent long-wave binocular coils for this set, and, having had an opportunity of trying them thoroughly, I can recommend them for use.

They, too, are very sharp in tuning, and there is not the slightest interference on the Daventry wavelength from Radio Paris, or on the Radio Paris wavelength from Daventry. Actual readings on my own set of coils are given in the table accompanying this article.

Stable Neutralisation

It is interesting to note that once the neutralising condensers have been set for the short waves, they do not need touching when the longer wave coils are plugged in. This means, of course, that once you have adjusted the set on the neutralising condensers, you do not need to touch it again; nor, for that matter, need the lid be opened, and all you have to do when starting to listen in the evening, or during the day, for that matter, is to pull out the on-and-off switch, and set your dials at the station you want to hear.

Daylight Reception

Of course, your night range will be far greater than the daytime range, as is the case with all receivers, but full loud-speaker strength in daylight is obtainable from Radio Paris, Daventry, Koenigswusterhausen, and Hilversum, as well, of course, as from a number of British stations, depending on your exact location. I am writing this in the morning, and I have just been listening to the morning news transmission from Hilversum. Although the set is working upstairs in my laboratory, it is clearly audible in the dining room. An hour ago I listened to both 5XX and Radio Paris in the same way, finding that there was not the slightest interference from either of them when listening to the other.

Note Your Readings

To give a complete list of stations audible on the loud-speaker after dark is an impossible task, owing to the fact that so many are now working, and, relatively, so few announce themselves, either comprehensively or regularly. The best thing to do is to keep a notebook, and every time you hear a station make a note of its readings, and, if you can, some kind of note which will help you to identify it again.

Readers' results from the "Night Hawk" will always be welcome, as everyone is interested in what other people get, particularly when they find that the reader who is writing about the subject is situated in their own locality.

ANOTHER RADIO PRESS SUCCESS

Blue Riband of the Ether Won at Amsterdam

"ELSTREE SIX" WINS WORLD CHAMPIONSHIP

AMATEURS of all nationalities were invited to submit wireless apparatus constructed by themselves for competition at the International Radio-Amateur Festival, held in Amsterdam between September 18 and 26. The aim of the Amsterdam Radio Society, organisers of the Festival, was to encourage the spirit of goodwill between Dutch radio amateurs and their friends in all countries.

The result of this international competition, open to the world, has gained for a Radio Press reader and a Radio Press design the first place. The gold medal of the competition, the highest distinction possible, has been awarded to an "Elstree Six" set, entered by Mr. R. W. Emerson, of 3, St. Ann's Terrace, St. John's Wood, London, N.W.8. Mr. Emerson is interested in the construction of wireless sets purely as a hobby, being engaged in the fur business.

The "Elstree Six" entered for competition was identical in layout and construction with the original "Elstree Six," the Radio Press Star Set, of which a full description was published in the June issue of *Modern Wireless*.

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1/6

NEUTRON
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Fit Neutron and Detect the Difference in volume, range and purity.

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BRING IN MORE STATIONS ELIMINATE INTERFERENCE

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NEUTRON DULL EMITTER VALVES.

If you want to tune in those distant stations use Neutron D.E. Valves. **Extraordinary filament** emission **unequalled for Crystal clarity** of reproduction—absolutely **Non-microphonic.**

BRITISH MADE. FULLY GUARANTEED.

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Note new price **10/6**
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Signal strength increased by 50%.
Simply dissolve in hot water and pour into earth tube or around your earth connection. **3/6**

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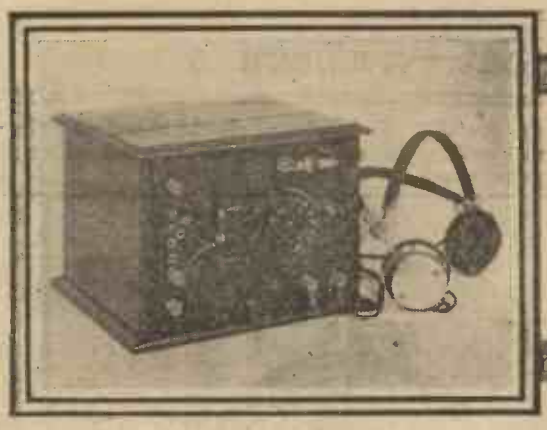


AN ALL-ENCLOSED CRYSTAL SET

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

A simply-constructed crystal set which will give reception of a station on the lower wavelength range or Daventry without change of coils. Selectivity is provided for by means of aerial and crystal tappings.

THERE is a certain attraction, both in elaborate and in simple sets, in being able to make every necessary adjustment of the set by means of controls on the panel. It is sometimes annoying, for example, to be compelled to open the cabinet, or even temporarily to remove the set from it, in order to insert or withdraw a coil.

Simplicity

In the crystal set to be described here, simplicity has been aimed at, consistent with adequate provision for adapting the set to suit different

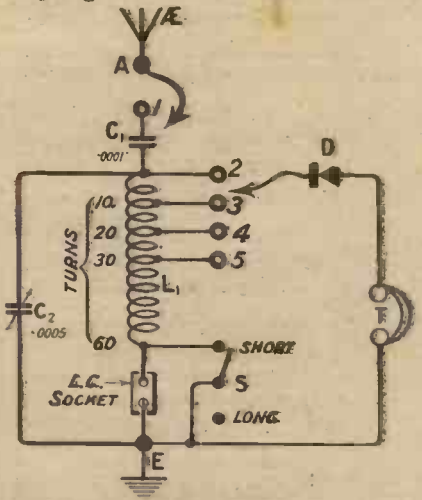


Fig. 1.—The tuning condenser, C2, is placed in parallel with both coils, the loading coil being short-circuited when not required.

aerials, while at the same time all the controls are placed on the panel. The theoretical circuit diagram is given in Fig. 1, and reference to this will show that tapping points are provided on the tuning coil, L_1, which is of a suitable size for the lower broadcast range of wavelengths.

Tappings

By means of plugs and sockets the connections to the aerial and to the crystal detector may be brought to the tappings on the coil found by experiment to give the best results. In addition, a series condenser is fitted, which may be included in the aerial circuit if necessary.

The loading coil for the reception of Daventry is housed inside the cabinet, and is left permanently in its socket, the change from long to short waves or *vice versa* being effected by means of a switch on the panel.

The list of components required for the construction of the set is given in the accompanying table. This list is intended as a guide for the constructor, and it is recommended that if any departures from it be made, the constructor ensures that he obtains only components of good quality.

Winding the Coil

The first constructional operation to be carried out is that of winding the tuning coil, L_1, in the circuit diagram. This is a straightforward matter, the only point worthy of special note being the method of securing the tappings.

Begin by drilling two small holes in the former close together at one end. Pass the end of the No. 26 S.W.G. wire through these, so that it is quite secure, and commence winding the first turn about ⅛ inch from the end of the former. Wind on ten turns and then, holding the former and the winding to prevent the latter coming loose, drill a small hole through the base of one of the ridges on the former.

BUILD THIS SET WITH

One ebonite panel, 8 in. by 6 in. by $\frac{3}{16}$ or ¼ in.
One cabinet to suit, and baseboard 7 in. deep (Peto-Scott Co., Ltd.)
One square law low loss variable condenser .0005 (Ormond).
One fixed condenser .0001, type 600A. (Dubilier.)
One permanent crystal detector. (Brownie Wireless, Ltd.)
One baseboard mounting coil socket. (Burne-Jones & Co., Ltd.)
One panel mounting single-pole change-over switch. (A. F. Bulgin & Co.)
One octagonal ribbed ebonite coil former, 3 in. diameter by 3½ in. long. (Redfern's Rubber Works, Ltd.)
One Daventry loading coil No. 150.
Four Clix sockets and two Clix plugs. (Autoveyors.)
Four terminals.
Glazite, a short length of flex, and about 16 yards of No. 26 s.w.g. d.c.c. wire.
Radio Press panel transfers.

Note the rigid wires from the Clix sockets to the tappings on the coil.

An All-Enclosed Crystal Set—*continued*

Bend the wire back on itself 2 inches from this hole, and pass the end of the loop so formed through the hole in the direction of winding. Pull the last turn wound quite tight before continuing to wind the coil.

Tappings are made in this way at the 10th, 20th and 30th turns, the winding being then continued till 50 turns have been wound, the end of the wire being secured in a similar manner to the start of the winding.

As will be seen from the wiring diagram, the tappings are spaced round the former, so that they shall not come too close together. This arrangement makes it possible for the stiff wire leads to the tappings to be well separated, and also makes it easy to fix these leads in position.

The Panel

The next operation is to drill the necessary holes in the panel. If the components listed elsewhere are used, the drilling diagram (Fig. 2) will supply the required dimensions. When the holes have been drilled, the baseboard and panel should be placed in their proper positions in the cabinet and the four woodscrews inserted along the base of the panel to secure it to the baseboard. Since the panel is small and does not carry any great weight, no panel brackets are used. The screws which hold the panel to the baseboard should therefore be long enough to project into the latter for at least half an inch.

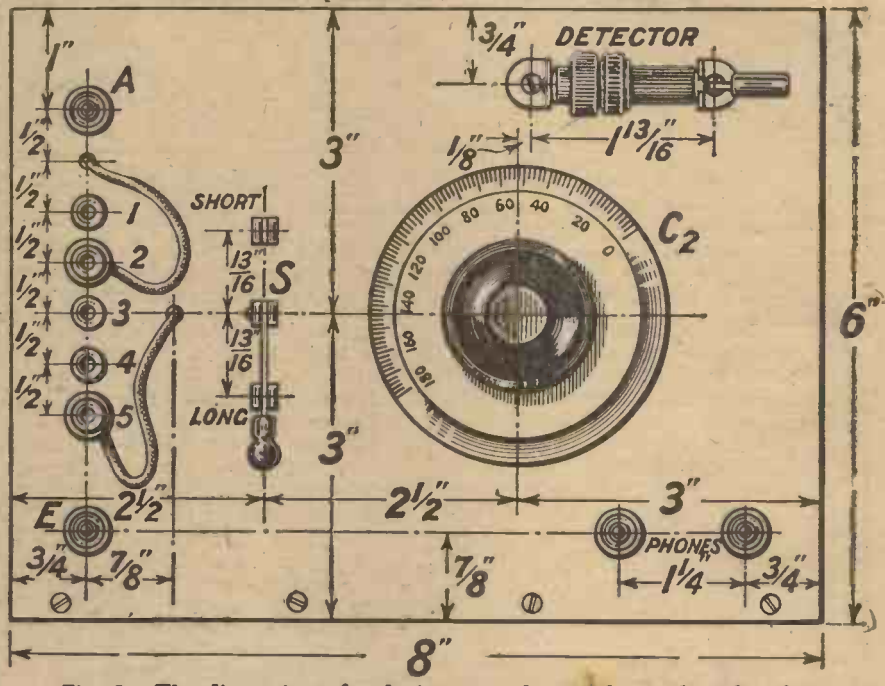


Fig. 2.—The dimensions for laying out the panel may be taken from this diagram. Blueprint No. 1068A is also obtainable.

USE A CONDENSER THAT DELIVERS ALL ITS STORED-UP ENERGY

Use LISSEN FIXED MICA CONDENSERS—made with scrupulous care—accurate to 5 per cent.—THEY NEVER LEAK—THEY NEVER VARY—THEY DELIVER ALL THEIR STORED-UP ENERGY, ALL THE TIME.

Capacities '0001 to '001. 1/- each } (reduced
" '002 to '006. 1/6 " } price)
(One pair grid leak clips included free with each '0003 and '0002 capacity.)

LEAVING GRID-LEAKS ON OUR FACTORY ROOF TO TEST THEM

A case of LISSEN FIXED GRID LEAKS were left on the roof of the LISSEN Factory—they were soaked by rain, they were baked by the sun—then they were handed over to the LISSEN research department and carefully tested—in every grid leak the resistance was found unvaried and true to the marked value.
All capacities, previously 1/8, now 1/- each

DOUBLE PURPOSE VALVE HOLDER

Bend back springs for baseboard mounting—or put through panel for panel mounting—low loss, low capacity, meaning clearer, better signals.
LISSEN VALVE HOLDER, previously 1/8, now 1/- each.

REAL RADIO SWITCHES

There is a LISSEN switch for every switching need. Your dealer has them all, or, if any difficulty, send direct.

	Previously.	Now.
LISSEN 2-way switch	2/9	1/6
" Series-parallel switch	3/9	2/6
" Double Pole Double Throw	4/-	2/6
" Key Switch	2/6	1/6

PARTS THAT PULL TOGETHER

When you are equipped with LISSEN Parts every vital part is pulling strongly with each other, and then you have a receiver which is the best you can ever get.

A Revolution in Transformer Value—

powerful amplifiers now within the reach of all.

Everybody will be wanting to buy this new LISSEN L.F. Transformer. There will be LISSEN home-built amplifiers everywhere, and home-built LISSENOLA loud speakers, too, because everybody can now possess themselves of a powerful LISSEN loud speaker combination that will equal anything you ever heard, and at a price within the reach of all. Telephones can be discarded by everybody and radio made to yield much greater enjoyment in consequence.
By ourselves distributing direct to the retail trade from factory we cut out all wholesale profits. This new policy has been a deciding factor in enabling us to sell this new Lissen part at a remarkable low price.
There is no longer any need for you to pay higher for a first-grade transformer. So good is this new one that we have unhesitatingly withdrawn all our old previous high-priced models in its favour.
Compare it against any for tone, purity, and power—it amplifies every note, every harmonic, and every overtone.
You can get it at your dealer's, or direct from factory if you have any difficulty. If you are not satisfied with it after test take it back to your dealer's or send it back to us. You will find it suits every set and every valve you will want to use.
Amplifies fully every note—every harmonic—every overtone.
Turns ratio 3 to 1.
Resistance ratio 4 to 1.

Build a better Amplifier!

Price 8/6—and guaranteed for 12 months.

Include no postage if you send for it direct, but please send dealer's name and address.

This week-end build your own loud speaker!

First of all go to your dealer and satisfy yourself that the "Lissenola," costing only 13/6, really is fully equal in power and tone to any loud speaker on the market. Ask your Dealer to put on the best loud speaker he has in stock—then use the same horn on the "Lissenola," *and see if you can notice any difference.*

When you get the "Lissenola"* home you can build a horn yourself for a few pence, providing you with a powerful instrument which will compare with any expensive loud speaker you have ever heard. Or, if you prefer a cone-principle diaphragm—very simply made—you should get a Lissen Reed as well (1/- extra). If you have never heard a "Lissenola" there's a surprise in store for you.

**These diagrams and instructions will be sent post free to any address on receipt of 6d. in stamps. Send to-day.*

Before buying ask your dealer to demonstrate the "LISSENOLA."

Important to the trade!

Retailers who have not already been notified of our new direct-from-factory-to-dealer distributing policy should in their own interests communicate with us without delay. All orders must now be sent to us at Richmond, and not to usual factor.

LISSEN LIMITED

Lissenium Works, 26-30, Friars Lane, Richmond, Surrey.

Managing Director: T. N. COLE.

There is a LISSEN part for every radio need.

L69

An All-Enclosed Crystal Set—*continued*

Mounting Components

The components may now be mounted on the panel. In fixing the single-pole switch, the centre clip carrying the switch blade should be secured first. Then the other two clips should be placed in position, the blade being inserted into each in turn as the nuts are tightened, to ensure correct alignment of the clips.

The variable condenser should be mounted last of the components on the panel, and it will render the operation of wiring easier if the wires from the telephone terminals to the crystal detector and the earth terminal are soldered in position before the variable condenser is mounted.

In the set illustrated here the fixed condenser, C_1 in the circuit diagram, is secured to the panel by means of two 6B.A. bolts in "blind" holes tapped in the panel. If preferred, clearance holes may be drilled in the panel and countersunk bolts passed through it with nuts at the back to hold the condenser.

Fixing the Coil

The tapped coil is fixed on the baseboard by means of a wooden crosspiece at the lower end of the former. A strip of wood about ½ in. thick is required, cut to fit inside the end of the former. It is secured by two screws through the walls of the former, two other screws fixing the crosspiece to the baseboard.

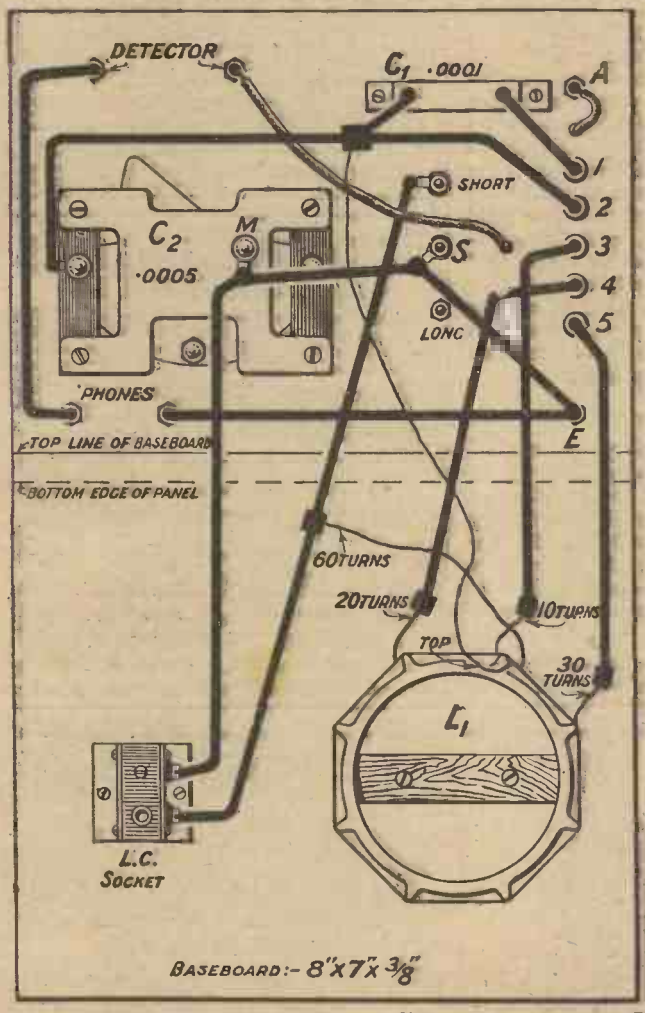
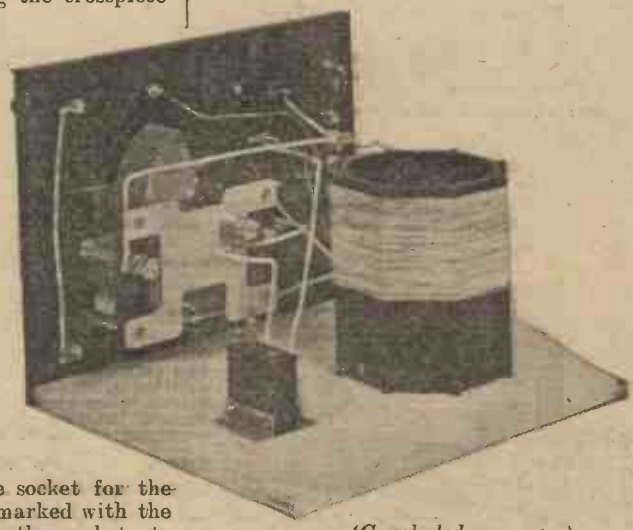


Fig. 3.—Note that stiff wire leads connect the tappings on the coil L1 to the Clix sockets. Blueprint No. 1068B.



The coil has here been removed to show the disposition of the wiring.

The position for the socket for the loading coil should be marked with the correct size of coil in the socket, to ensure that it clears the variable condenser and the back of the cabinet.

Wiring

The wiring of the set should present no difficulties if the wiring diagram (Fig. 3) and the special wiring instructions are followed. The tappings on the coil are soldered to short lengths of Glazite, themselves soldered to the Clix sockets, this making for rigidity of these connections. The insulation is removed from the tapping loops and the bared loops are twisted round the ends of the rigid wires before soldering.

It should be noted that one of the Clix plugs should be fixed to the flex lead by gripping the latter under the nut below the insulating bush. One or other of the plugs should be treated in this way, since if both were attached with the lead down the centre it would be impossible to insert the aerial and crystal plugs in the same tapping socket.

WIRING IN WORDS

All directions are given as viewing the set from the back.

Join earth terminal to right telephone terminal, also to centre of knife switch, thence to moving vanes of variable condenser C2 and to one terminal of loading coil socket.

Join remaining telephone terminal to left terminal of crystal detector.

Join remaining terminal of loading coil socket to top of knife switch, and also to lower end of coil L1.

Join bottom Clix socket (No. 5) to 30-turn tapping on coil L1.

Join No. 4 Clix socket to 20-turn tapping on coil L1.

Join No. 3 Clix socket to 10-turn tapping on coil L1.

Join fixed vanes of variable condenser C2 to No. 2 Clix socket, to top end of coil L1, and to one side of fixed condenser C1.

Join remaining side of condenser C1 to top Clix socket (No. 1).

Join flex leads to remaining terminal of crystal detector and to aerial terminal, fitting the free ends with Clix plugs.

(*Concluded on p.* 54.)

All communications regarding advertisements should be addressed to:

The Advertisement Manager,
"WIRELESS CONSTRUCTOR,"
Bush House, Strand, London, W.C.2

Telephone: City 9911.

AN ALL-ENCLOSED CRYSTAL SET—*concluded from page 53*

Results

Tested on a low aerial of average length in the London N.W. district, at a distance of about one mile from the 2LO aerial, the set gave signals of excellent strength from the London station, with aerial plug in socket No. 1 and the crystal plug in socket No. 2. With these settings tuning was distinctly flat. The best results as far as selectivity was concerned were obtained with both aerial and crystal plugs in socket No. 5, and there was little noticeable reduction in signal strength. With this adjustment 2LO could be tuned out within a few degrees of the tuning condenser on either side of a point of marked maximum signal strength.

Daventry

While in the locality mentioned Daventry could not be picked up on the crystal set alone, the addition of an amplifier made possible the testing of the change-over switch. It was found that the change from long to short waves could be accomplished in a moment and with a minimum of trouble.

The approximate cost of the components required for building this set is £2.

SAFETY FOR YOUR VALVES

THE modern valve holder, as contrasted with the four separate sockets which were common in the past, is designed in such a way that it is difficult to insert a valve incorrectly and burn out the filament by an accidental connection across the high-tension supply. It is, of course, wisest always to disconnect the high-tension battery when moving valves in a receiver, but this is not absolutely necessary if the valves are inserted with due care.

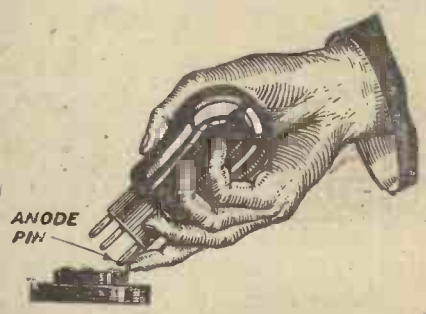
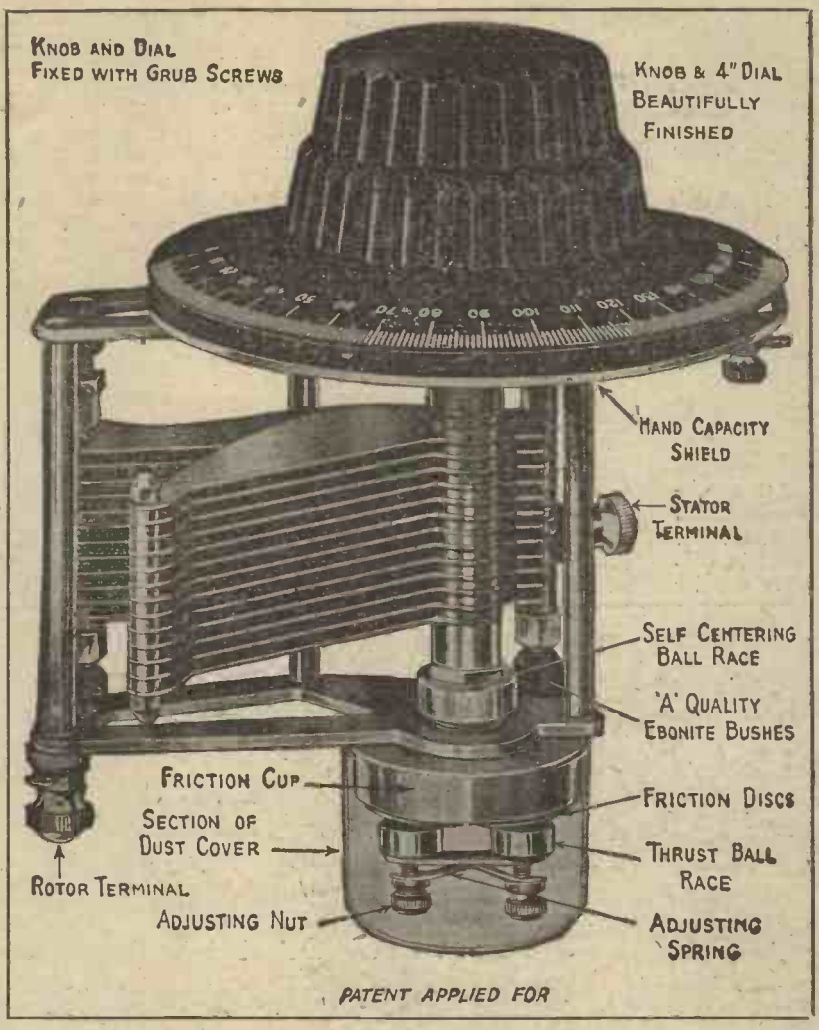


Fig. 1.—This method of inserting a valve in its holder will prevent damage to the filament.

The right way to put a valve in its holder is to grasp the bulb in the hand with the forefinger on the anode leg. The valve is then held at an angle as it is placed in the holder, as indicated in Fig. 1. The tip of the anode leg is inserted in its socket first of all. Then the valve is brought over "level" with the top of the holder, when the remaining legs will drop naturally and easily into their sockets.

IN the handling of wireless components generally it is not unusual for familiarity to breed, if not contempt, at least a certain amount of carelessness. Coils of the standard plug-in type, for instance, should always be gripped by the plug portion when inserted in or withdrawn from a holder. Care is also needed in handling low-loss coils on "skeleton" formers, since ebonite is notoriously brittle stuff. A skeleton cylindrical former, for example, should preferably be grasped by the ends, if not too long for the span of the hand. Too firm a grip round an interchangeable coil of this type may displace the winding or may even break the former, especially if the coil is tight in its mount and tends to come away rather suddenly when withdrawn.

Under the heading "An Improvement Worth Trying," on page 1054 of the October issue of THE WIRELESS CONSTRUCTOR, the description of the diagram should read—"The ebonite strip . . . . is screwed to the inside of the cabinet."



The New Ormond S.L.F. Condenser Dial

is marked to enable you to pick up any station with the minimum of trouble and without any unnecessary calculations. Precise tuning adjustments with noiseless operation are ensured by the general sound construction of this newest ORMOND S.L.F. CONDENSER. The famous ORMOND SLOW MOTION FRICTION DRIVE (RATIO 55-1) is incorporated, and special ball bearings give liquid-like movement to every turn of the Knob. This world-famous ORMOND component is easy to mount, having one and three holes for fixing, with both terminals and soldering tags for connections.

Ask any dealer to show you this new ORMOND S.L.F. CONDENSER. It is by far the best condenser to use under the new "Geneva Plan."

Prices:—With 4in. Bakelite Knob—

·005 microfarad	...	20/-
·00035 ,,	...	19/6
·00025 ,,	...	19/-

(RATIO 55-1.)

Obtainable from all dealers

ENGINEERING "ORMOND" COMPANY LTD.
Registered Trade Mark

Prices:—With Dual Indicator Dial—

·0005 microfarad	...	21/6
·00035 ,,	...	21/-
·00025 ,,	...	20/6

(RATIO 55-1.)

Obtainable from all dealers.

199-205, PENTONVILLE RD., KING'S CROSS, LONDON, N.1

Telephone: Clerkenwell 9344-5-6. *Telegrams: "Ormondengi, Kincross."*

FACTORIES: WHISKIN STREET AND HARDWICK STREET, CLERKENWELL, E.C.1

Continental Agents: Messrs. PETTIGREW & MERRIMAN Ltd., "Phonos House," 2 and 4, Bucknall Street, New Oxford Street, W.C.1

Modern Superheterodyne Practice

WHILE the modern developments in high-frequency amplification have naturally brought before the attention of the public the great merits of neutralised "straight" and reflex circuits in properly designed receivers, the superheterodyne must still rank high in the estimation of many enthusiasts.

Screened Coils

The application of modern methods to the design of a superheterodyne is admirably exemplified in the "Screened-Coil Superheterodyne," described in the October issue of *Modern Wireless*, by Mr. G. P. Kendall. This receiver, which employs eight valves, makes use of the now well-known screening cases, which have been developed by Mr. J. H. Reyner. These cases are used in conjunction with the oscillator coupler and the intermediate frequency transformers, with the result that interaction between the various parts of the circuit is effectively eliminated. Furthermore, a notable freedom from direct pick-up of long-wave interference is achieved.

Radio Press Star Sets

In the same issue of *Modern Wireless* will be found full operating details for the Elstree "Solodyne" and the "Mewflex," the two Radio Press Star Sets, of which complete constructional articles appeared in the previous issue of *Modern Wireless*. The Elstree "Solodyne" attracted very considerable attention at the Exhibition at Olympia, a fact which is not surprising when it is realised that this receiver has to its credit the loud-speaker reception of fifty broadcasting stations, and that one dial controls all the tuning of the receiver.

The "Mewflex"

With the "Mewflex" forty stations have been recorded on the loud-speaker. This set uses a three-valve neutralised reflex circuit, and incorporates the recently developed methods of reflexing which ensure complete stability of the receiver.

"The Design of Loud-speaker Horns" is the title of a most informative article by Captain H. J. Round, providing much useful data for the practical experimenter.

FREE GIFT WITH "WIRELESS"

With the issue of *Wireless*, the One-Word Weekly, dated October 23, which appears on October 19, a Free Gift Booklet is presented to all readers. You will be wise to secure your copy of this issue as early as possible.

A USEFUL HINT

SOLDERING TO ZINC

CONSTRUCTORS who have tried to solder wires to zinc tags, as for instance when making the connections between the cells of a home-made Léclanché battery, will very likely have found that it is not at all easy to avoid melting the zinc tags. This difficulty also applies when soldering on connections to the zinc containers of dry battery cells, such as are used for grid or high-tension batteries. If the soldering iron is hot enough to do its work quickly, the least touch of it on the zinc will usually melt the latter, while if it is cooler the solder will not run.

Preparing the Zinc

Special fluxes may be obtained for soldering to zinc, but in default of these one of the usual paste fluxes, such as Fluxite, will be found quite suitable. Resin is not much use for this work.

To solder a wire to zinc without any danger of melting it, the following procedure may be adopted. Clean the surface of the zinc with a piece of emery cloth and put on it a trace of flux. Then make the soldering iron quite hot and apply the stick of solder to its tinned face until quite a large blob has run on to it.

The Point to Watch

Now bring the blob of solder on the iron into contact with the cleaned surface of the zinc, being very careful to let only the blob of solder, and not the iron itself, come into contact with the zinc. In a few seconds the solder will run on to the zinc and take. The connecting wire may then be tinned and, placed in position on the zinc, when a further application of the iron in exactly the same way as before, the solder blob being the only thing to touch the zinc, will result in a good joint being made. There will be no danger of the zinc melting even if the iron is held close to it for some time, so long as it does not come into actual contact with it.

A. V. D. H.

In the table of "Drill Sizes" given on the concluding page of the Free Gift Booklet, "How to Build Your Own Wireless Set," presented with the last issue of THE WIRELESS CONSTRUCTOR, the third heading, "Tapping Size, Morse or ins.," should read "Clearing Size, Morse or ins."

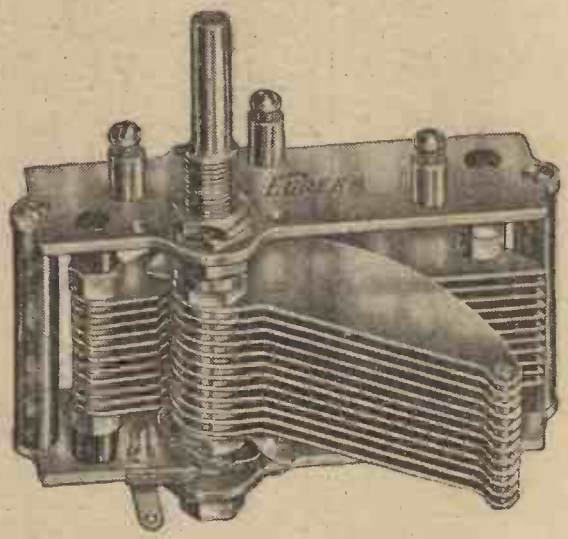
There are three kinds of Variable Condensers

—here are the results you'll get from each

No. 1
Ordinary Condenser

(Straight line capacity)

The ordinary Variable Condenser as used in the vast majority of Wireless sets jumbles together no less than 51 wavelengths (of 10 kilocycles separation) in the first 15 degrees of dial setting; while the remaining 85 degrees of the dial cover only 49 wavelengths. This might have been good enough in the early days when any sort of reception was gratefully received. But science has moved since then and there is no longer any need for your set to remain an obsolete jumble of conflicting and jamming stations.



No. 2
Square Law Condenser

(Straight line Wave-length)

The square law condenser made a serious—if not very successful—attempt to overcome this aerial traffic tangle. But even this type of condenser bundles together into the first 15 degrees no less than 36 wave lengths (nearly 2½ stations to every degree of dial setting) and thus falls far short of solving the tuning riddle with which every ambitious Set user is confronted. As a proof of this it should not be forgotten that square law condensers have been available on the market for more than a year—yet selection has been just as difficult to obtain.

—and the Eureka Ortho-cyclic

NOW comes the new principle of tuning by which, with the Eureka Ortho-cyclic Condenser, a definite separation of wavelengths evenly and exactly over the whole scale is accomplished. By this new principle of design each movement of one degree of dial setting (with 100° dial) gives a definite separation of ten kilocycles over the whole scale.

Thus, instead of 51 conflicting wavelengths in the first 15 degrees, you get exactly 15 wave lengths in 15 degrees. And so on, right through the scale, the same exactitude of station separation is maintained

In this way scrambling and crowding of stations is entirely eliminated; tuning is made easier, more regular and more certain. Vernier plates are rendered obsolete and the danger of stations heterodyning each other at the cost of purity in your reception is materially reduced.

Which kind does your Set deserve?

IF you possess a Set capable of receiving distant stations, that Set deserves Eureka Ortho-cyclics. The true pleasures of distant reception are only possible where the Ortho-cyclic principle of tuning is employed. Take out your obsolete Condensers and replace them with these beautifully made Eureka Ortho-cyclics.

Owing to their compactness they require only a panel depth of 2 inches—they can be fitted in a few minutes by either one-hole fixing or four-point mounting, whichever method you prefer. Ball-bearing—superbly finished—they represent a standard of efficiency far in advance of present-day levels. Ask your Dealer to show you one—you'll be proud to see such an outstanding example of British workmanship.

Prices:
·0003 mfds 14/6
·0005 mfds 15/6

EUREKA ORTHO-CYCLIC

Equip your Set also with Eureka Transformers and Coils.

Manufactured only by Portable Utilities Co. Ltd. (Eureka Radio Products) 8 Fisher Street, W.C.1

WORKSHOP HINTS FOR THE HOME CONSTRUCTOR

The Soldering Question—A Fine Keyhole Saw—For Slow-motion Dials—Countersinks—Useful Gauges.

THE SOLDERING QUESTION

CONSTRUCTORS of wireless gear are divided at present into two camps, one of which favours soldered joints whilst the other is strongly opposed to their use. Though I was at one time a strong supporter of the use of solder wherever possible for making joints, I must confess that my faith in this form of connection has slowly waned. Theoretically it would seem that for connections in high-frequency circuits, at any rate, where it is essential to eliminate all possible sources of resistance, the soldered joint should be superior to the screw-down connection. In the perfect soldered joint there should be an amalgamation between the surfaces of the metals and the solder itself, and a connection of very low resistance

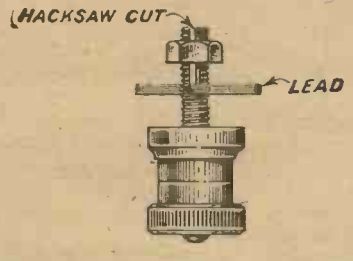


Fig. 1.—This method of adapting a terminal for connections is easiest with 2 B.A. shanks.

should result. There can be little doubt that this actually takes place when the joint is first made, but the most important question is—how long does this almost ideal state endure?

Deterioration

The other day I undertook the job of dismantling a receiving set made two or three years ago in which solder had been used throughout, resin having been employed as a flux. One would have expected to find the joints in perfect condition, but this is far from what had happened. There was no need to use a hot soldering iron in order to disconnect leads from the tips of terminals or even from other wires; only a small amount of force was actually needed to pull them apart; there was in fact hardly a joint that could be classed as sound in the whole piece of apparatus. But I would like to emphasise the fact that the surfaces had been properly cleaned before soldering was done, that a hot iron had been used, that the flux was of the least "active" kind, and that all were originally thoroughly good joints.

Chemical Action

Yet when they were pulled apart it was clear that the majority of them were in a thoroughly unsatisfactory condition from a wireless point of view. The solder was white and powdery looking, and it was obvious that chemical action had taken place. I have no doubt that many readers must have come across instances of receiving sets falling off in their performances when they have been in use for some time. Such a falling off is often ascribed to a variety of causes, such as the deterioration of the ebonite under the influence of light, the formation on insulating surfaces of a semi-conducting coating of dust mingled with moisture and the like. When, however, a receiving set shows signs of declining sensitiveness, of a loss of selectivity and of kindred symptoms, it can often be restored to its original efficiency by the simple process of applying a hot iron to each of the soldered joints, so that the solder is made to run and afterwards allowed to set again. This seems pretty conclusive proof that the soldered joint is hardly stable enough for use in wireless apparatus where long service is expected.

When one comes to think of it, it is not surprising that action should take place in time in a soldered joint, since so many dissimilar metals are involved. In the solder itself we have lead and tin, whilst if we fix a wire to a terminal we are dealing with copper in the wire itself and with an alloy of copper and zinc in the brass terminal. In the finished joint there are thus lead, tin, copper and zinc, all of them probably containing slight impurities and possibly traces of yet other metals.

What Can We Substitute?

If we condemn soldering for wireless purposes, what are we to substitute in its stead? My own belief is that in the near future we shall probably employ spot-welding. There is no reason why a simple little apparatus enabling the home constructor to carry

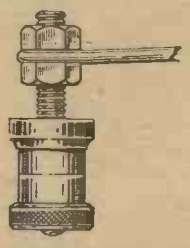
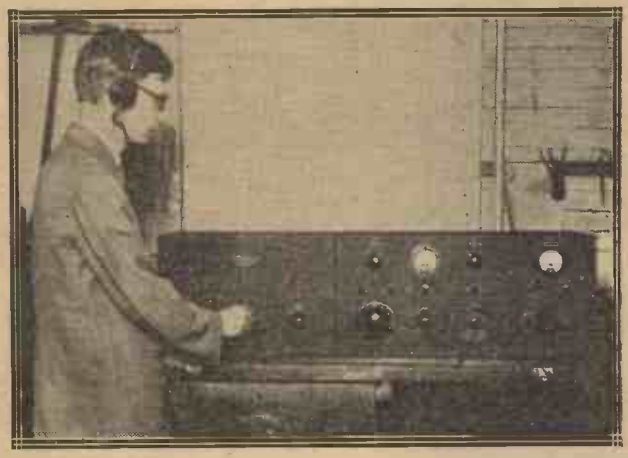


Fig. 2.—A closed loop at the end of the wire gripped tightly between two nuts makes a good connection.

out this highly efficient form of jointing should not become available, but at present it is a job that comparatively few readers will be able to undertake. Meantime, a method which I have found very satisfactory is that seen in Fig. 1. The shank of the terminal is split for about half an inch down from its point by means of a jeweller's or dentist's hacksaw. A nut is then started on the threads and the

Workshop Hints—*continued*

lead is passed through the slot. As the nut is tightened down the edges of the slot are pinched firmly on to the lead, holding it in a grip that is literally vice-like. Where 4 B.A. terminals are used, rather a fine gauge of wire must be employed for making connections, but with 2 B.A. terminals it is possible to make the cut with an ordinary hacksaw and to use fairly stout wire. A simpler connection consists in making at the end of the lead a loop which is a fairly tight fit for the shank of the terminal. This is placed between two nuts, which are tightly locked together. In making this connection hold the lower nut with a flat spanner and turn the upper one hard down with a box spanner.



With the assistance of powerful transmitting stations in various parts of the world, longitudes may be checked with great accuracy. This photograph shows the receiver to be used for this work at San Diego, California.

A FINE KEYHOLE SAW

HAVING to tackle the other day a rather awkward little job of cutting away the superfluous ebonite from a "finned" former on which a short-wave coil was to be mounted, I found myself badly in need of a little keyhole saw with a fine blade and a sharp point. There was nothing quite suitable in the tool box, so something had to be improvised. This was done

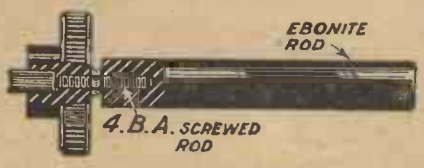


Fig. 3. — An easily fitted extension handle for a condenser dial.

very successfully with a jeweller's hacksaw blade. Since the backs of these blades are quite soft, there is no difficulty in bringing one end to as fine a point as may be required with a pair of tin shears; if a harder blade is used, its point can be shaped with an emery wheel. This having been done, the blade was mounted in the universal tool handle—a skeleton iron affair costing about a shilling—to which reference was made in these notes recently.

An Excellent Tool

The effectiveness of the tool so made surpassed all expectations, for it enabled the work to be done with almost incredible ease and quickness. These keen little blades go through ebonite almost like a wire through cheese. Buckling may occur if you are not careful, but a bent blade can always be straightened with a hammer, whilst should the point break off it is the work of a moment to re-shape the tool. The great secret of using such an improvised keyhole saw is to start by pushing the blade as far as it will go into the handle, allowing only about 2½ inches to project. If the point breaks off, you can pull out a little more of the blade from your reserve within the handle, to allow for the loss in length when repointing has been done.

FOR SLOW-MOTION DIALS

IN certain types of slow-motion dial, in which a small pulley wheel actuated by the knob drives a metal disc connected to the condenser spindle, hand-capacity effects may be found rather a nuisance when certain kinds of circuit are in use. The reason is that the small spindle within the knob is in electrical contact *via* the pulley, the disc and the main spindle with the moving plates of the condenser. This fact makes some of these excellent dials rather difficult to use for short-wave work. A simple method of overcoming the difficulty is that seen in Fig. 3. The knob is removed and placed boss-uppermost in the drill vice. A No. 33 drill is then carefully centred in the recess made for the spindle and is run right through. The hole so made is tapped 4 B.A. Into this is screwed a short length of 4 B.A. studding, which must not be allowed to project so far into the recess as to prevent the knob from going properly on to its spindle. The studding is locked in place by means of a nut. In one end of a piece of ½-inch round ebonite rod a central 4 B.A. tapped hole is made, after which the rod is screwed tightly on to the projecting end of the studding. If desired, a short piece of 2 B.A. studding may be screwed into the other end of the rod and a standard knob mounted with its aid. The only difficulty that the constructor may find in making these extension handles, which are useful for a variety of purposes other than that indicated, lies in marking the hole made in the ebonite rod truly central. So long as the rod itself is straight, this is quite a simple business, if the tip mentioned a month or two ago in these notes is adopted; the work is placed in the chuck of the bench or the hand drill and spun rapidly; it is then quite easy to mark the centre with a pencil.

Fig. 4.—Countersinks (b) and (c) will be found most suitable for use on ebonite.

COUNTERSINKS

MANY constructors find it difficult to do countersinking easily and quickly. This is largely because they do not employ the best tool for the purpose. If an ordinary metal countersink, such as that seen in Fig. 4a, is used the type required is that which has a 90-degree bevel. For ebonite working, however, I find either the two-flute countersink (Fig. 4b), or the rose head, better than the tool designed for metal working, for both seem to cut ebonite more quickly and cleanly without any tendency either to polish or to tear the material. One great advantage of the two-flute type is that when it becomes blunt it can be sharpened without difficulty with a fine file. If a rose head is chosen, it should be of small size with a large

WORKSHOP HINTS—*continued*

number of ribs. One of the most satisfactory that I have ever had for ebonite working I bought at Woolworth's for sixpence! Given the right kind of tool, there is no difficulty at all about letting screws neatly into panels. A few experiments should be made first of all with a piece of scrap ebonite to discover the best speed for the tool, that is, the speed at which it makes the cleanest and easiest cut. If you are careful to apply the same amount of pressure every time, you will not find it hard to get the heads of all screws flush with the surface of the panel. Whilst experimenting with your piece of scrap ebonite, count the turns that you make with the crank and ascertain the number required to sink 2, 4 and 6 B.A. screws to the proper level. This done, you then remember the numbers recorded in order to be able to do neat and accurate work whenever countersinking is undertaken in future.

GEARING AS AN AID TO WIRELESS

By C. P. ALLINSON, A.M.I.R.E.

With the development of selective receivers needing accurate tuning, a good deal of attention is being paid to mechanical devices to assist the operator. Some of the forms which these take and their methods of application are described in this article, together with some additional hints for the constructor.

EVERYBODY knows what a gear-box is and what it does, for without it motoring would be a very different matter from what it is now. In some cars methods are applied which differ from the conventional gear-box; for instance, the ubiquitous Ford employs epicyclic gearing, while in certain older makes of car a friction reduction drive that was variable in a number of steps was used. Similar methods are made use of for helping the listener to receive music on his wireless set, and it is interesting to see in what way these principles are employed.

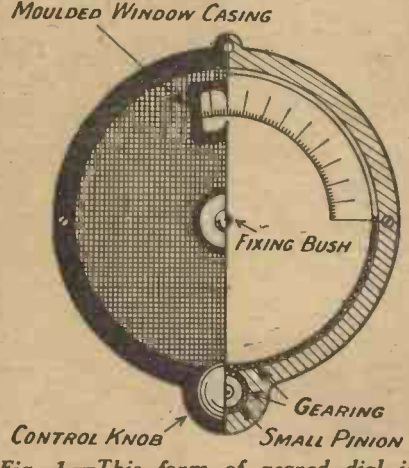


Fig. 1.—This form of geared dial is rotated by means of the small knob at the bottom, which turns a pinion engaging with the large gear wheel fixed on the spindle.

Slow-Motion Condensers

The most obvious use for these forms of reduction gear is in the slow-motion dial for controlling variable condensers. With the increased efficiency of circuits now in use, the tuning has automatically become sharper, and even the most skilled and experienced experimenters find a vernier control of some description helpful at times.

Some fine adjustment dials make use of straightforward gearing, in which a small knob used for making accurate adjustments carries a small pinion which is meshed with a large gear wheel fixed to the dial itself. In some cases the whole mechanism is cased within a moulded insulating case which is fixed to the panel, while the scale of the dial appears through a small window in this casing. This form of construction is particularly favoured by American designers. This method does not as a rule give a very large reduction, since mechanical considerations make it a rather difficult matter.

Avoiding Backlash

There is, however, a dial in which a reduction ratio of 80 to 1 is obtained by the use of straightforward gearing, and this is ingeniously arranged by means of a train of gears. In order to avoid backlash, these are carried on jockey arms which hold the gears in constant mesh by means of small springs, so that any variation in the true running of the gears is taken up automatically.

A different method followed in several dials of British construction is the worm reduction gear. In some cases the gear with which the worm engages is fixed rigidly to the dial and provision is made for engaging and disengaging the worm, thus allowing coarse or fine adjustments to be obtained. In others the gear wheel is frictionally engaged with the dial, so that the spindle of the condenser may be rotated independently of the fine adjustment, a separate knob being provided for this purpose. With this form of reduction gear a very high ratio can easily be obtained, and this may well be in the region of 120 or even 200 to 1.

Fine Readings

In one make of dial that I have in mind the small spindle carrying the worm is provided with a scale engraved on the circumference of a small cylinder affixed to it, which, in conjunction with a pointer, enables fractions of a degree to be read with ease and certainty. Backlash, it is clear,

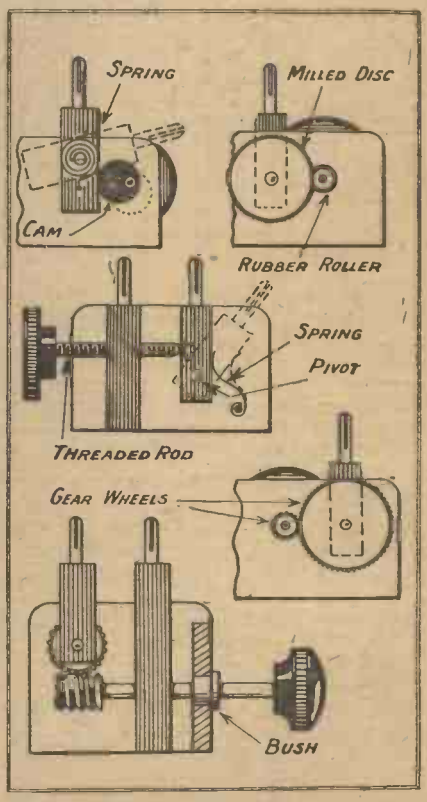


Fig. 2.—Some of the mechanical principles applied to the slow-motion control of coil holders are illustrated here

must be obviated with an arrangement of this description, and in order to do so the worm drive spindle is spring loaded so as to keep it always in tight mesh with the gear wheel.

Most of these dials show a high degree of mechanical perfection in their construction, the gear wheels

Gearing as an Aid to Wireless—*continued*

being correctly cut and the worms generated in the proper manner.

An Ingenious Method

Another method which is extremely ingenious is employed in an American dial and also in a British one. This is what may be termed the "wobble-plate" method. In the American dial the reduction is obtained by gearing. One set of teeth is cut on the inside of a brass ring within which a slightly smaller ring, provided with teeth on its periphery, can revolve. This latter is mounted so that it is always at an angle to the outer ring, and the teeth therefore only mesh at the one point where the two rings are in contact. A spring arm rotates on a track provided on the smaller ring, this arm being controlled by an insulated knob. As this knob is turned, the spring arm forces the skewed ring to mesh with the internal gear. Since both gears are cut so as to have a different number of teeth, the forcing into mesh of the inner ring with the outer will cause the latter to be rotated slowly at a rate equal to the difference between the pitch of the teeth.

Supposing there are a hundred teeth on the outer ring and ninety-nine on the inner one, then one revolution of

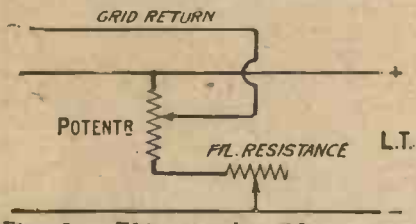


Fig. 3.—This simple addition to a potentiometer will render fine settings of this control easily possible.

the spring arm (which causes the inner gear wheel to wobble once) will cause the outer ring to move over a distance corresponding to one tooth or one-hundredth of a revolution.

The British dial employs a somewhat similar principle, except that friction drive is incorporated instead of actual gearing. This dial gives a delightfully smooth action, and backlash is, of course, entirely absent.

Friction Methods

Various forms of vernier control utilise friction entirely. In one case, for instance, the vernier knob of the dial is in frictional contact with a small rubber roller which is inclined at an angle to it and is fixed to a small shaft carrying another rubber roller. This presses against the panel on which the condenser is mounted, and a reduction ratio in the neighbourhood of 10 to 1 is obtained. The dial is simple in construction and easily fixed, while it has the advantage that there is nothing to go wrong with it.

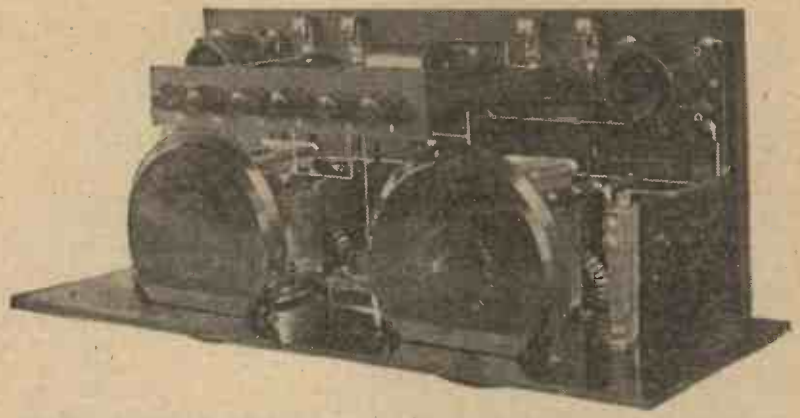
A number of attachments that are available make use of a rubber roller which engages with the bevel edge of the scale and are exceedingly useful where a large reduction is not required. They have the advantage of being cheap to buy and easy to fit to existing apparatus with a minimum of trouble.

Integral Verniers

A number of makes of variable condensers now incorporate some form of fine adjustment in the condenser itself. The most usual form is that in which an integral vernier is used. This generally consists of one or two moving vanes with one or more fixed vanes, the moving vanes being controlled independently of the main bank of moving vanes. As the capacity range of the vernier portion of the condenser may be from 1/10th to 1/20th of the total capacity of the variable condenser a very fine adjustment is provided. Another method which is employed is to gear a spindle carrying the dial and control knob to the moving spindle of the condenser either through plain gears or through a worm reduction gear. A variation of this method is to provide a separate control for the vernier adjustment by means of a small rubber wheel which is connected to the main spindle by means of some form of friction drive. This allows a rough setting to be obtained by means of the ordinary control knob and the final setting is obtained by the vernier knob.

Application to Coil Holders

A component in which some form of vernier adjustment is of great use is in the coil holder. When magnetic reaction is used, it is necessary in order that the maximum sensitivity be obtained that the set be kept just off the oscillation point, and in order to do this a fine control of the swinging coil is often advisable. An examination of some of the leading makes of coil holders shows that all types of gearing are employed. Straight gears, epicyclic, friction and worm drives and ingenious cam arrangements are used, all with the object of giving positive and accurate control of the coupling between two or three coils.



In the American Grebe receiver a form of "reduction gearing" is provided by presenting only the edge of the dial to the hand of the operator.

Aerial Coupling

As regards the coupling between aerial and grid coils, this is by no means critical and a vernier adjustment is hardly necessary, nevertheless there are cases occasionally where it is an advantage. A very satisfactory means of getting a fine control is obtained by the use of a special cam. In this type of coil holder one socket is adjusted by the usual spindle fixed directly to the coil holder, this giving the coarse adjustment. The coil which is usually kept fixed in this case is free to move and is kept in engagement with a small eccentric or cam by means of a stiff spring. It will readily be appreciated that rotating the cam gives a very fine control and by this means the coupling between coils can be accurately adjusted.

A Variety of Methods

A very simple method of getting the desired fine adjustment is by means of a threaded rod which presses against the moving coil socket which is held up against the end of the rod by a spring. This gives a fine continuous variation of the coupling, but suffers from the disadvantage that if it is desired to swing the coil over the whole of its travel it takes some time to do so. Various forms of vernier action that are used are shown sketched in Fig. 2, and some of the methods can be applied by the home constructor who possesses the necessary skill and tools.

(*Concluded on page* 80.)

A READER'S APPRECIATION

THE POWERFUL THREE

SIR,—I write to you to give a few of the stations which I received on my set, the "Powerful Three-Valve," described by Percy W. Harris, M.I.R.E., in the April, 1925, issue of THE WIRELESS CONSTRUCTOR. I live in the West Riding of Yorkshire, about twelve or fourteen miles from Leeds and about forty or just over from Manchester. My aerial is screened, the pole at the opposite end from my set being 27 ft. high. My thanks to THE WIRELESS CONSTRUCTOR, and good luck in future days. The stations received were as follow:—Leeds and Bradford, Manchester, and Daventry, all on loud-speaker, and could be heard twenty yards away; three foreign stations, which I could not make out, as I could not recognise the language. Newcastle on the loud-speaker was about the same strength as is given by one valve on the 'phones.

JOSEPH W. SMITH.
Liversedge, Yorks.

TALKS TO BEGINNERS

(Concluded from page 12)

recently tend to suggest that they will be much better than we have had them. I have noticed that they are tending to be "freaky." On one night they will be exceedingly good and the next night very bad, variations sometimes taking place during the evening to a very marked degree. Previous experience has taught me that a good season is usually preceded by a good deal of "freaking," so that I should not be surprised to find that we have a very good season this winter. If so, reception conditions in this country will be very remarkable, for we now have available receivers far more efficient and sensitive than any available during the previous good seasons.

Don't Blame the Set

Do not be disappointed, then, if your new set, when tried the first night, does not bring in as many stations as you have been led to anticipate, or if you find that the wonderful results you got on the first night cannot be repeated a week later for the benefit of a friend.

A Curious Phenomenon

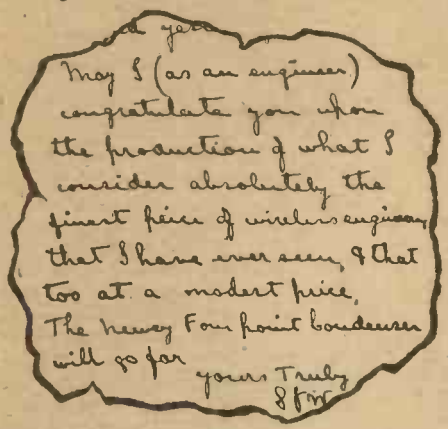
There is another phenomenon which is only just beginning to be observed, but which is of great interest to the listener who is keen on long-distance reception. For some reason or other—probably reflection from some other strata in the atmosphere—stations 500 and 600 miles away, or even further, will come in much better than stations perhaps 200 miles away. I noticed in America that listening in the neighbourhood of New York one could always very easily hear the Chicago station after dark. If you look upon a map you will see that Chicago is some 700 or 800 miles at least from New York, taking a direct line, but at the same time stations much nearer were not audible or, if audible, were much weaker.

Useful Comparisons

I put this down at the time to some exceptionally freak conditions pertaining to the American ether, but on discussing the matter with Capt. Round on my return to this country, he suggested that if I were to draw a circle round London of a radius equal to the distance from New York to Chicago, and if any stations fell on the circumference of the circle, they would probably be found to come in very well indeed. I did make a number of observations of this kind, and then noticed that Madrid, Rome, Prague and a number of other stations at a considerable distance from London came in extraordinarily well considering their power. Madrid, for example, can be received almost any night after dark on the most simple receivers.

THE Newey "4 Point" Condenser

"The finest engineering production of the year"—an unsolicited testimonial. We reproduce below one of the numerous letters we have had from users of the Newey 4-Point Condenser: in every case there is the same enthusiasm regarding the perfect design and workmanship of this famous Condenser.



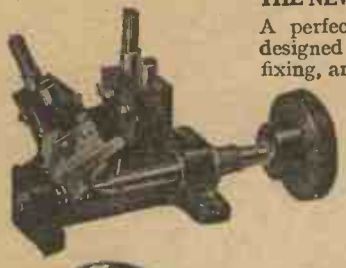
What the Wireless Technical Press thinks of the Newey 4-Point Condenser.

"Amateur Wireless." "In construction it is of the ultra low-loss type, and in this respect it is one of the finest examples we have seen."

"The Broadcaster." "A noticeable feature is the high-class workmanship throughout, and that all rubbing contacts from vanes to connecting terminals are avoided by the use of soldered flexible wire connections."

"On test we found the maximum capacity very close to the nominal (.0005 mfd.), while the minimum was lower than that of the usual vane type of condenser. Testing in critical oscillating circuits, no losses were apparent, while on practical test in a valve receiver tuning the aerial inductance, the actual performance was highly satisfactory."

THE NEWEY VERNIER COIL HOLDER.

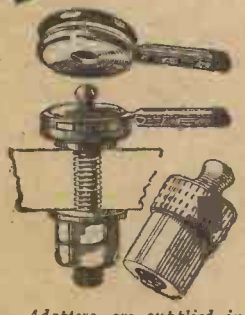


A perfectly constructed coil holder, designed for Back of Panel One-hole fixing, and in addition provided with lugs for fixing in any position on panel. Bakelite moulding throughout. Worm geared by means of metal segment and worm, and fitted with patent stop plate to prevent over winding in extreme positions—gearing ratio 8-1 giving fine critical tuning and permitting the use of the heaviest coil.

PRICE 7/6

NEWEY SNAP TERMINALS

The Terminal with 1,000 uses.



No set complete without them. The use of these Snap Terminals, which have been reduced in price and are now only

1d. each (nickel-plated 1½d.)

ensures Convenience, Simplicity, Multi-Purpose, Certain Contact, Finish.

Experimental sets in boxes.

Brass **1/6** Nickel plated **2/-**

Adapters are supplied in sizes No. 2 and No. 4 B.A.

Ask your nearest dealer for the Newey Catalogue of Radio Components. If you have any difficulty, write direct.

Sole Distributors.

PETTIGREW & MERRIMAN (1925) Ltd., PHONOS HOUSE, 2 & 4, Bucknall, St., New Oxford St., London, W.C.2 (and Branches).

Telephone: Gerrard 4248-49. Telegrams: Merrigrew, Westcent, London.

Apparatus tested

For "The Wireless Constructor" at our Elstree Laboratories.

P.M.3 Valves

WE have received from Messrs. The Mullard Radio Valve Co. three P.M.3 valves. These valves are similar in appearance and construction to the P.M.4 valve, and are designed to work with a filament potential of 3 to 3.7 volts, with a filament current of .1 volt. As in the case of the P.M.4 valve, the filament does not glow visibly when working.

On test, these valves were found to be quite satisfactorily uniform, taking a filament current of .1 of an ampere at a filament potential of 3 to 3.5 volts, which is well within the maker's rating.

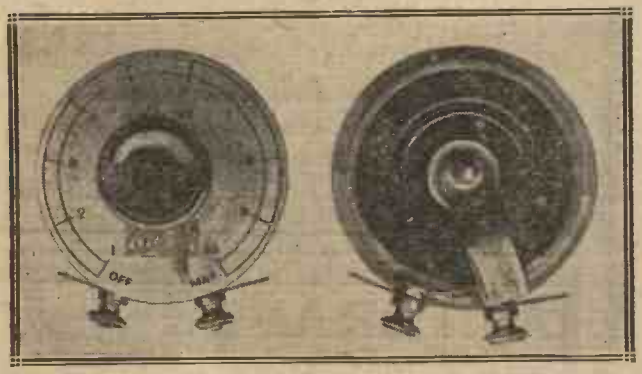
When measured at an anode potential of 80 volts, the impedance was found to be 17,000 ohms in two cases, and 18,000 in the other, while an average amplification of 11.6 was obtained.

C.E. Precision Rheostat

WE have received from Messrs. C. Ede & Co. several of their rheostats for test and report. The samples submitted are improved models in which several detailed refinements have been incorporated. All these components are constructed on the same lines. The resistance winding is carried on a fibre former which is bent around a circular insulating moulding. There is a positive stop both for on and off positions, and connections are provided for by means of terminals and soldering tags. One-hole fixing is employed and a graduated metal scale is provided with each instrument. A small knob and pointer control the movement of the slider, which was found to be exceedingly smooth in action.

When placed on test, the brightemitter rheostat was found to have a resistance of 5.5 ohms, while it would pass a current of .7 amps. without any appreciable heating. The 30 ohms resistance was found to have an actual value of 32 ohms, and this, again, would pass .5 amps. without overheating.

All these rheostats were found to be silent in operation, and gave smooth control.



The C.E. Precision Rheostat submitted for test by Messrs. C. Ede & Co.

L.F. Transformer

WE have received one of their L.F. transformers from Messrs. Brandes for test and report.

This transformer is of the shrouded type, ratio 5 to 1, being about 2¼ in. by 1¾ in. and just over 3 in. high. Four terminals are provided, together with soldering tags for making connections, while the terminals are marked giving the actual connections to be employed, which is a useful feature.

When placed on test on our standard transformer test panel it was found that a degree of amplification somewhat about the average was obtained in the first stage, the quality of reproduction being very good. Used in the second stage, the amplification obtained was equal to that given by the standard transformer which is actually of a higher step up ratio than the transformer under test. The quality in the second stage was also very good. The insulation resistance between primary and secondary was found to be infinity, and this transformer can be thoroughly recommended.

High Tension Accumulator

MESSRS. The General Electric Co. have submitted to us for test and report one of their high-tension accumulators.

This battery is contained in a polished mahogany box, the cells being carried in a wooden cradle, which can be lifted out intact for inspecting and examining the cells. The cells are tubular in form, each containing a single positive and negative plate separated by a corrugated separator.

Messrs. Brandes low-frequency transformer is unconventional in appearance.

The whole assembly makes a rigid workmanlike job.

This H.T. accumulator can be tapped off at every 2 volts, and it is possible to obtain two separate H.T. positive voltages from this battery, by means of the plugs provided.

This battery is rated by the makers as having a capacity of 2,000 milliampere hours. The capacity obtained under severe test conditions was found to be 1,800 milliampere hours before the voltage had dropped to below a satisfactory working value. Even then the plates were found to be of a good colour, and the cells appeared to be in an excellent condition. This high-tension battery is excellently constructed, and highly satisfactory in operation, and we can thoroughly recommend it for use.

"M.L." L.F. Transformer

MESSRS. S. A. SMITH, LTD., have sent us one of their "M.L." L.F. Transformers for test and report. This instrument, which is partly shrouded, is of an unconventional design. The core is of very substantial dimensions, being circular in form. The upper part of the instrument consists of black moulded insulating material carrying four ter-

Apparatus Tested—*continued*

minals at the top, each of which is marked for connections. The whole instrument is well finished.

When placed on test in our standard transformer test panel, the amplification obtained in the first stage following a valve detector was found to be a little below average. The quality was of quite a good order, but its tone was a trifle thin, though clear, and with no signs of roughness.

The insulation resistance between primary and secondary was found to be infinity, and this component is soundly constructed.

Radion Valves

WE have received a number of valves from Messrs. Radions, Ltd. The D.E. .06 type are 3-volt valves, consuming .06 of an ampere, while the anode potential is rated at 30 to 90 volts. When tested with 80 volts on the anode, an average impedance of 25,000 ohms was obtained for several of these valves, with an amplification factor of 6.3, a very satisfactory degree of uniformity being noticed.

When tested in a three-valve set employing one stage of neutralised high-frequency amplification, detector and one stage of low frequency, the results obtained were quite satisfactory for a low-consumption valve of this type. Both as detector and low-frequency amplifier these valves gave quite a commendable performance.

D.E. .34 Type

The D.E. .34 type are designed to take a filament current of .34 at a filament potential of 1.6 to 2 volts. Under test it was found that 2 volts were required to pass the rated filament current while, with 70 volts on the plate, one of these valves gave an impedance of 25,000 with a maximum amplification factor of 6.3, while the other gave an impedance of 20,000 ohms with an amplification factor of 3.

The "M.L." low-frequency transformer sent for test by Messrs. S. A. Smith, Ltd.

When tested in a three-valve receiver used for the previous test, these valves were found to function satisfactorily as H.F. and detector, the best results being obtained with a fairly low value of grid-leak.

Power Valve

Another valve produced by this firm is the Radion Pyramid power valve. This is of the 5.5-volt type, consuming a filament current of .34 amperes. It was actually found that a filament potential of 5.2 volts was required to pass the rated current. With an anode potential of 80 volts an impedance of 11,000 and an amplification factor of 6.1 was obtained, while the valves showed a satisfactory degree of uniformity.

Tested in the receiver previously used, excellent results were obtained with these valves, a degree somewhat above the average for H.F. amplification, being obtained. As a rectifier these valves gave results up to the standard whilst for low-frequency amplification they can certainly be recommended.

Gearing as an Aid to Wireless

(*Concluded from page 70*)

Filament Control

In certain critical circuits there is need for a vernier control of the filament current. Such circuits are the Ultraudion and Mr. A. D. Cowper's Negadyne. In both these circuits reaction is controlled by the filament temperature and it is extremely important if distant reception is to be successfully carried out that it be possible to bring the set just up to the oscillation point (though without actually letting it oscillate) and hold it there.

The usual vernier adjustment on a filament resistance consists of a single turn of resistance wire over which a separate sliding contact can be moved independently of the main contact. The adjustment is obtained as a rule by means of a small knob concentric with the main control thus allowing the filament temperature to be adjusted with great accuracy.

In one ingenious design only one knob is provided for both coarse and fine adjustment. Through a certain angle the knob varies the resistance over a short length of wire connected in series with the main resistance winding, while on either side of this degree of travel the rheostat slider is moved over the main winding in the usual manner.

A Useful Hint

Another form of control that may occasionally require fine adjustment is the potentiometer. An easy method of obtaining a vernier control is by connecting a 30-ohm filament resistance in series with the potentiometer winding. The method is shown diagrammatically in Fig. 3, from which it will be seen that when the value of the filament resistance is decreased it has the effect of bringing the slider of the potentiometer nearer to the negative end of the potentiometer. Since the resistance of every turn of the filament resistance is probably about 1/5th of that of the potentiometer an adjustment is obtained that is five times as accurate.

Good Control

I have used this scheme with success in a superheterodyne receiver and it gave a delightfully smooth and certain control of oscillation on the long wave side. It is seldom, however, that such careful setting of a potentiometer is required, and it is only necessary in cases such as that mentioned above that this device need be made use of.

Since the whole art of obtaining the best from a receiver lies in making such adjustments as are required with exactness, the beginner who has not yet acquired the skill to do so without adventitious aid is enabled to call to his help the resources of mechanical engineering so that he may, without difficulty, tune in those elusive distant stations.

THE "INVALID'S THREE"

—concluded from page 18

Operation

This receiver requires for its operation the use of very high-impedance valves. The detector valve should be a Benjamin S.P.18 Blue, the Cosmos Shortpath Blue Spot, the Ediswan R.C.2, or a similar valve. These valves all have very high impedances of the order of 70,000 to 100,000 ohms, and amplification factors of between 35 and 40.

Valves

A similar valve may be used in the second stage, but in the particular case of the receiver under test it was found that if this was done the second valve was overloaded. It was necessary, therefore, to utilise a valve having a slightly lower impedance, and a Benjamin S.P.18 Green or a Cosmos Green Spot was found to give better results in this stage. The amplification obtained from such an arrangement was naturally a little less than would be obtained if the Blue Spot valve had been used in the second stage, but since the amplification was more than was desired, this sacrifice of signal strength could well be afforded.

The last valve should be any suitable power valve.

High Tension

The H.T. voltage need not be excessive, and excellent results were obtained with only 90 volts high tension. Only one high-tension tapping is employed, so that the battery is uniformly discharged. A particularly interesting point about this receiver is that the consumption of high-tension current with all three valves in use, including a power valve in the last stage, is only 5 or 6 milliamps. when the correct values of grid bias are used. The grid bias used was 1½ volts on the second valve and 9 volts on the last. Of this amount the power valve is responsible for the greater part, since the first two valves both take .7 or .8 of a milliamp. only.

Easy Control

The operation of the receiver is simplicity itself. When the switch is pushed in the receiver is connected to Daventry, and when the switch is pulled out the local station is received.

To tune in to Daventry, therefore, push the switch in and turn the right-hand dial until Daventry is received. If necessary, increase the strength a little with the reaction adjustment, which is the right hand of the two reaction condensers. This is all that is necessary. Now pull the switch out and tune into the local station on the left-hand dial, utilising reaction again if necessary.

The lid of the cabinet may then be closed, the receiver being subsequently controlled with the jack and switch only. The approximate cost of the components for this set is £8.

Our Readers' Views

"SINGERS" BY WIRELESS

SIR,—Now that wireless speakers have been drilled in the niceties of pronunciation, what of the sins of the singers?

When a speaker used one of two alternative pronunciations for a word the listener-in did at least know what he meant. Can the same be said of the impression left by certain singer's songs?

It may appear incredible, but it is a fact that there are wireless singers to-day who actually do not trouble about the words of the songs they sing. They think of the voice, of how they

Mr. S. Hedgeland has designed a loud-speaker on ingenious lines, concealing the mechanism in a picture.

can arrange for a particular effect, and the result of all this posturing is quite disastrous for the unhappy listener-in.

"Nerves" are another frequent cause of failure. I myself do not broadcast, but in my gramophone work I sing into a microphone, and I am never nervous there unless I have been away for a time, and then I perhaps an hour before I get into my stride.

Many wireless singers, on the other hand, do get a fit of nerves when they remember the millions who are listening to them, and that makes them go for the song with too much voice. Now, economy in voice is the greatest asset of a wireless artist. A whisper is heard where a shout would become a blur, and the singer from whom the listener-in hears every word is the one

(*Continued on page* 83.)

who sings quietly at the microphone mouth.

Surely a little gentle supervision here would be at least as welcome to listeners-in as the selection of the more correct of two correct pronunciations of "idyll"?

Yours faithfully,
PETER DAWSON.

Ealing, W.5.

A LOUD-SPEAKER HINT

SIR,—With regard to the hissing sound caused by overloading a loud-speaker, mentioned by the writer of "Notes and Jottings" in the September WIRELESS CONSTRUCTOR, I have

The diaphragm control of the "picture" loud-speaker shown opposite is accessible from the back of the picture.

found that a by-pass condenser across the primary of the last L.F. transformer (of the order of .001) will cure this without producing the muffling effect too often caused by shunting the loud-speaker itself with a condenser.

Yours faithfully,
M. K. O'DWYER.

Plymouth.

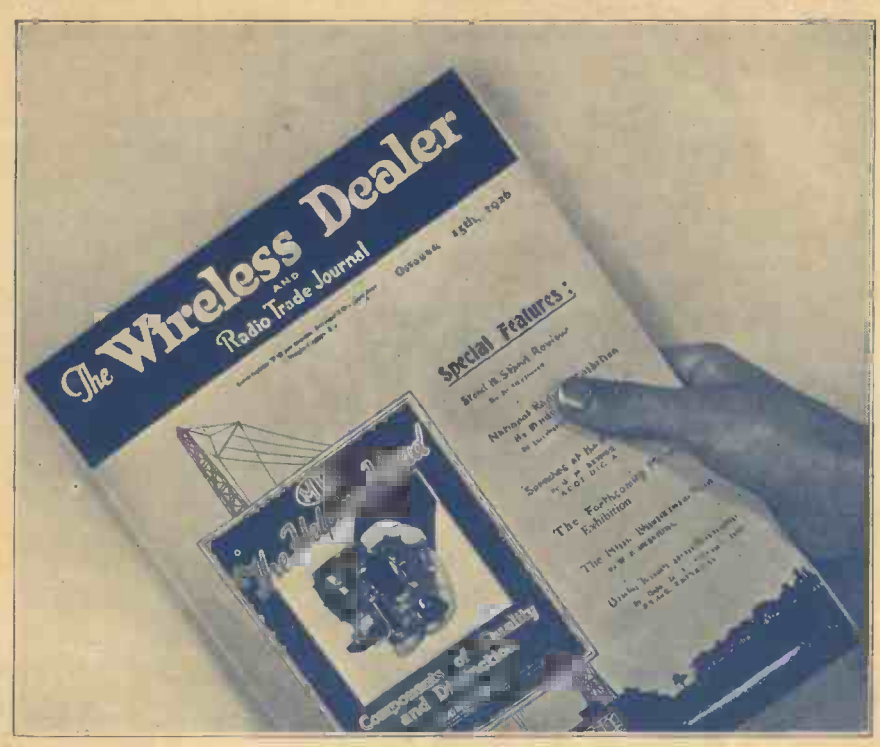
A SHORT-WAVE SUCCESS

SIR,—I have the two-valve set, "Australia on Two Valves," described by Percy W. Harris, M.I.R.E., in the August issue, and at midnight a few weeks ago I tried it for the first time. Will you believe me? At 12.5 p.m. I got W.G.Y., Schenectady, New York, clearly—dance music, then sports news, then time, 6.31 Eastern standard time, and closing down. I use P.M.1 and P.M.2 valves (two-volt). There was *not the slightest hand capacity* present, so I am delighted.

Yours faithfully,
W. C. SANSON.

Dorchester, Dorset.

INDEX TO ADVERTISERS.



Wider scope—greater power from this acquisition

This is to inform you that in accordance with the policy of consolidating this business, we have acquired the "RADIO TRADE JOURNAL" after negotiations covering the last six months.

The "RADIO TRADE JOURNAL" is now merged into "THE WIRELESS DEALER" which will henceforth use the title of the weekly paper as a sub-title.

This is an acquisition, the effect of which will be to enlarge the already wide scope and usefulness of "THE WIRELESS DEALER," giving it an even more powerful and prominent position in wireless trade journalism.

"THE WIRELESS DEALER and Radio Trade Journal" will be published as usual on the 15th of every month.

Now is a suitable time to add your name to the growing list of subscribers.

SUBSCRIPTION RATES:

7/6 per annum (abroad 10/-). Available to the Trade only. Trade card or business heading should accompany every subscription to the SALES MANAGER, *Radio Press, Ltd., Bush House, Strand, London, W.C.2.*

The Contents of the October issue include:
Important Speeches at the Opening of the Exhibition; The Anniversary Dinner; Reviews of: Berlin, New York, Birmingham and Ulster Exhibitions; The forthcoming Manchester Exhibition.

The Wireless Dealer
AND
Radio Trade Journal

Published by RADIO PRESS, LIMITED, Bush House, Strand, London, W.C.2, on the 15th of each month, and Printed for them by THE AVENUE PRESS (L. Upcott Gill & Son, Ltd.), 55-57, Drury Lane, London, W.C.2. Address for Subscriptions and Editorial Communications:—Bush House, Strand, W.C.2. Address for Advertisements:—Advertisement Manager, THE WIRELESS CONSTRUCTOR, Bush House, Strand, W.C.2. 'Phone: City 9911. Registered as a magazine for transmission by Canadian Magazine Post. Subscription rates U.K. and abroad:—8s. 6d. per annum, 4s. 3d. for six months; Canada, 7s. 6d. per annum, 3s. 9d. for six months. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD. American Agents:—INTERNATIONAL NEWS CO., New York. Canadian Agents:—THE AMERICAN NEWS CO., LTD., also IMPERIAL NEWS CO., LTD.

Supplement to "The Wireless Constructor," November Issue, 1926.

HOW TO MAKE THE MIDGET REFLEX RECEIVER

PRICE 1/6

The Midget Single-Valve Reflex Receiver

By A. S. CLARK

COMPLETE CONSTRUCTIONAL DETAILS

This receiver is particularly easy to operate, since there is only one tuning control and a reaction adjustment, and even the novice can build it. Full size blue-prints, detailed instructions, reproductions of photographs, etc., are given.

Presented as a Free Gift Supplement to "The Wireless Constructor" for November, 1926. Published by Radio Press, Ltd., Bush House, Strand, London, W.C.2.

THE MIDGET REFLEX RECEIVER.

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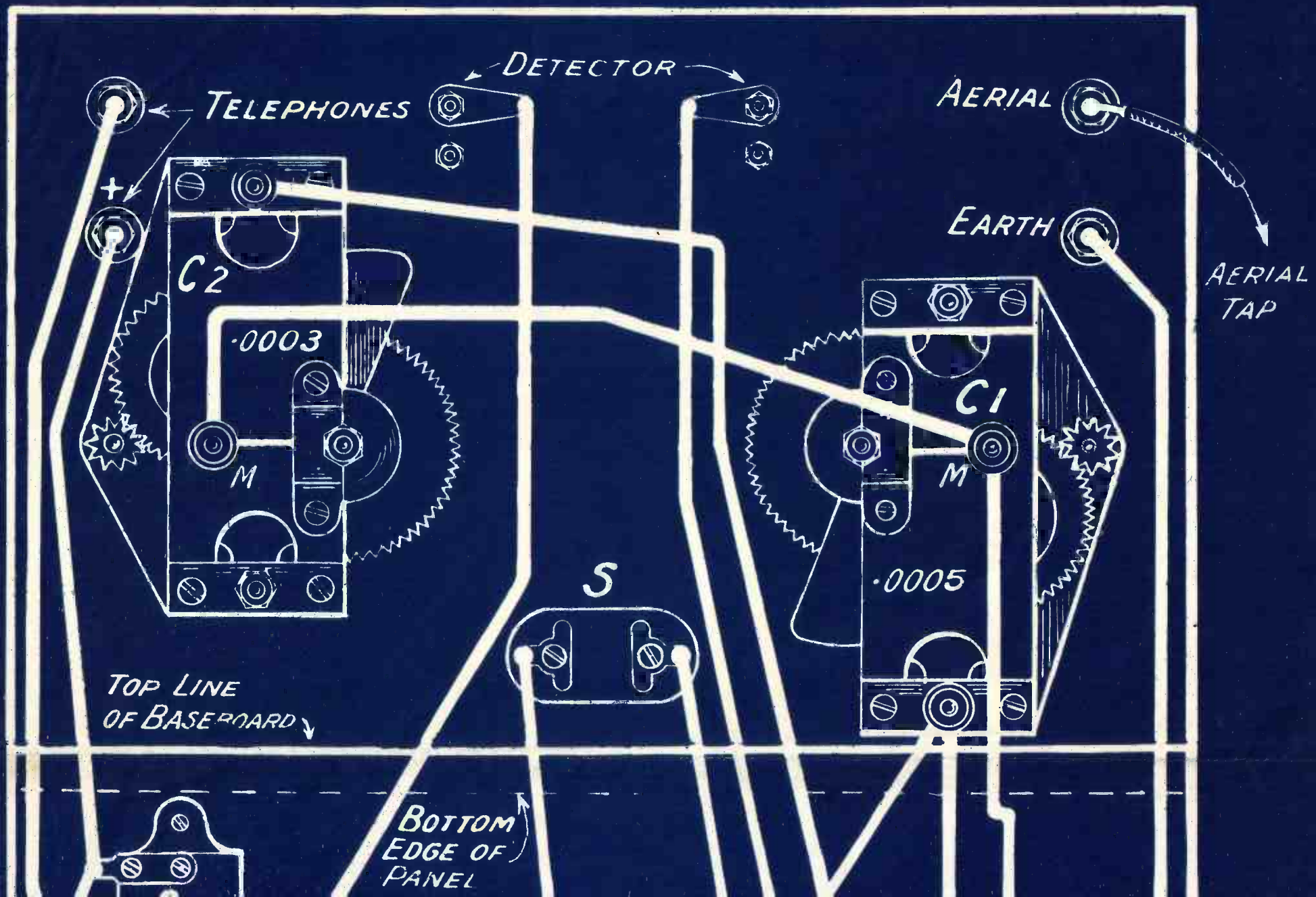

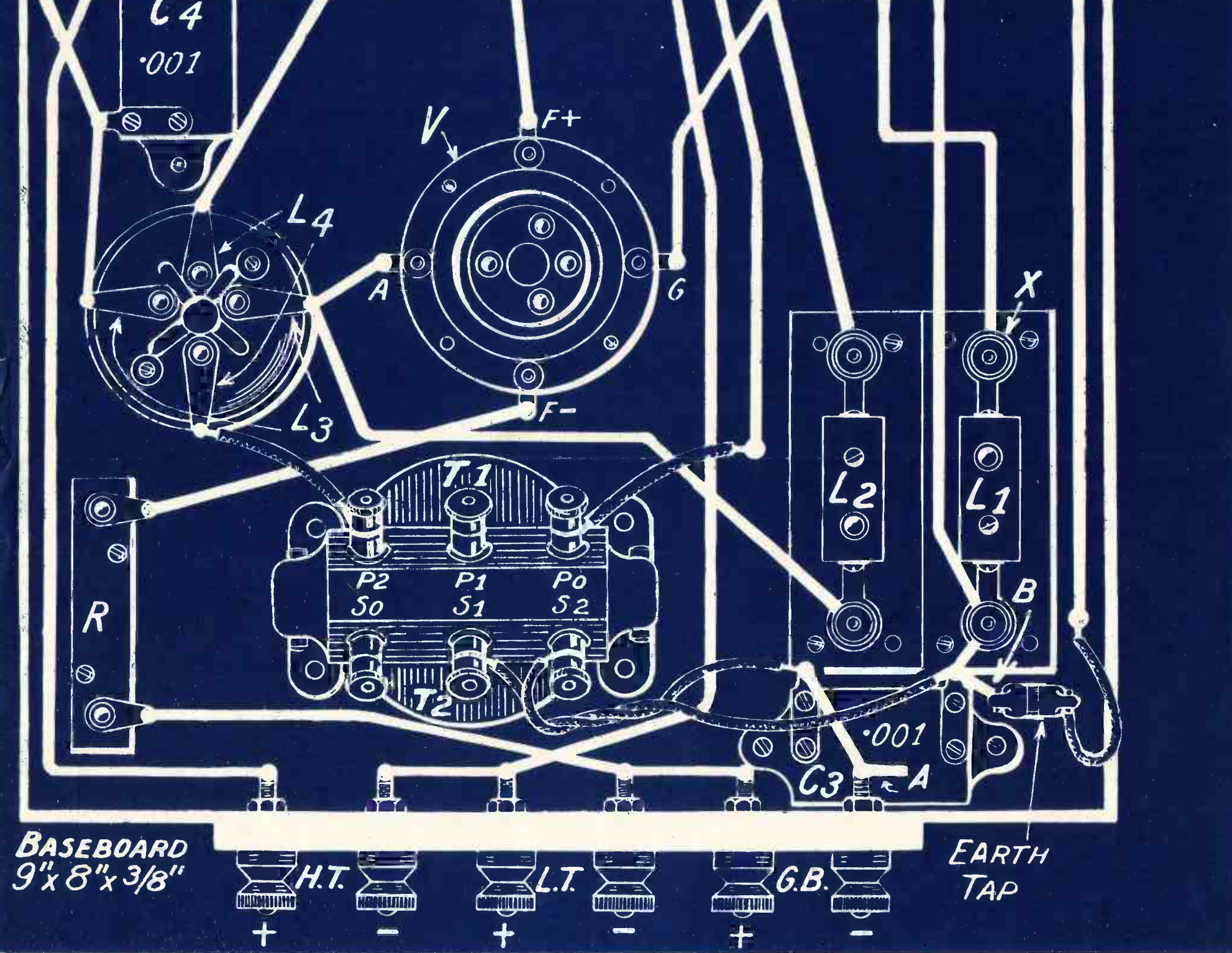
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THE MIDGET REFLEX RECEIVER.

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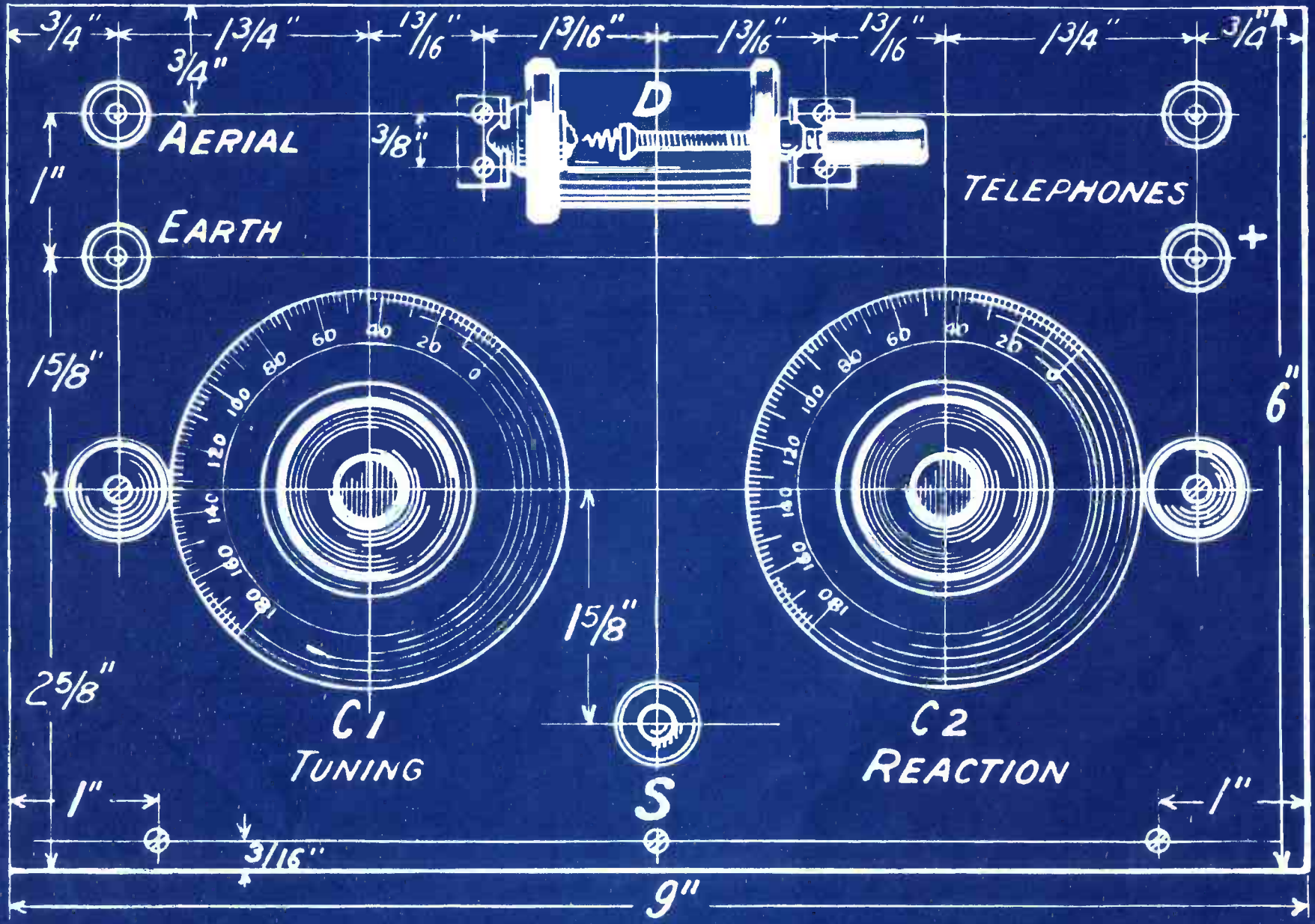

Supplement to "The Wireless Constructor," November Issue, 1926.

HOW TO MAKE THE MIDGET REFLEX RECEIVER

By A. S. CLARK.

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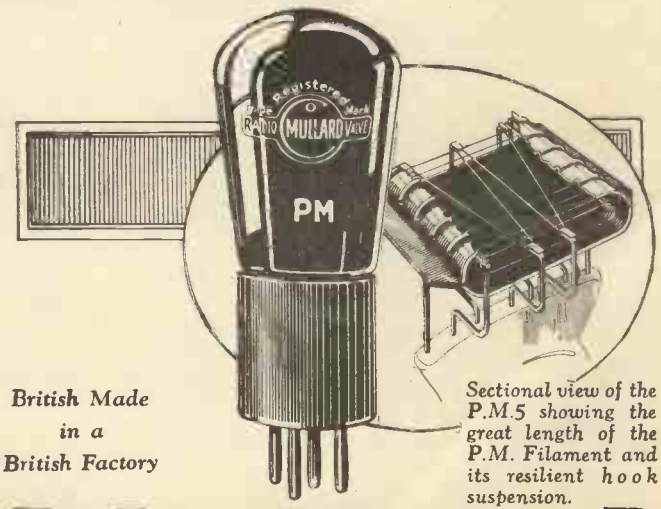

Sectional view of the P.M.5 showing the great length of the P.M. Filament and its resilient hook suspension.

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THE MULLARD WIRELESS SERVICE CO., LTD., MULLARD HOUSE, DENMARK ST., LONDON, W.C.2.

THE MIDGET SINGLE VALVE REFLEX RECEIVER.

Reflex receivers are by no means so dead as some people would have us believe. It is true the old circuits are more or less obsolete, but their place is being taken by new ones. The early reflex circuits suffered from several disadvantages, which are disappearing in the modern designs. The circuit used in the set described in this envelope has been so arranged that nearly all the disadvantages usually found in a single valve reflex receiver are absent. Apart from the adjustment of the crystal detector, there are only two controls, thus making it much easier to tune in distant stations than if there had been the usual three. A form of Reinartz reaction has been employed, which gives very smooth control, and is vastly superior to coupling the grid coil to a tuned plate circuit.

SELECTIVITY.

Another great advantage of the set is sharp tuning. With some reflex receivers it is impossible to cut out the local station, it being heard all round the dial, but with the Midget reflex it is possible to enjoy listening to other broadcast stations on a wavelength near to that of the local station, while the latter is working.

THE APPEARANCE.

On looking at the photograph of the front of the set, it will be seen that it is very neat and has a symmetrical layout. The panel is small, and the general compactness of the set makes it well worthy of its name. The valve and coils are enclosed inside the cabinet, the only external accessories being the telephones and the batteries. Terminals for the aerial, earth and telephones will be seen on the front panel; those for the batteries are carried on a strip of ebonite at the back of the set. Condensers with a slow-motion control are used to facilitate fine tuning, the small knobs at the sides of the variable condenser dials being for this purpose. A fixed resistor has been employed to remove one of the variable controls, and a switch on the panel enables the set to be turned on and off.

THE CIRCUIT.

Reference to the theoretical diagram will help to make clear the working of the circuit. It will be seen that in order to obtain good selectivity a tapped coil is used for the tuned circuit

of the valve. The aerial is connected to one of the taps on this, which may be an X coil, and so produces an '' aperiodic '' aerial circuit. As far as the H.F. currents are concerned the secondary of the L.F. transformer has no effect due to the by-pass condenser across it.

In the plate circuit is connected one winding of a semi-aperiodic transformer, across the other winding of which are the crystal detector and primary of the L.F. transformer. This semi-aperiodic transformer does not need tuning, and thus one control is dispensed with.

HOW IT WORKS.

The H.F. currents which are applied by the tuned circuit L1 C1 across the grid and filament of the valve, appear in an amplified form at the plate of the valve. The transformer L3 L4 passes them on to the crystal detector for rectification. After this the currents pass through the primary of the L.F. transformer T1 T2 and the resulting secondary potentials are applied across the grid and filament of the valve for audio amplification. Finally the varying currents reach the telephones where they are converted into sound waves.

Grid bias is employed to make certain that the valve is worked on the best part of its characteristic for amplification, namely the straight part to the left of the ''zero'' line and also to avoid rectification by the valve taking place.

COMPONENTS REQUIRED.

A list of all the parts required to build this set is given, together with the names of the manufacturers who made the actual ones used in the original set. It is not, however, imperative that these makes should be adhered to, since any other suitable components of good quality may be substituted, and should give as good results. As far as the L.F. transformer is concerned, it is as well to keep to the same make, as this is tapped, and makes it possible to find the best ratio for any valve.

The components are as follows ;-

One ebonite panel 9 in.×6 in.×$\frac{3}{16}$ in. (Peto-Scott Co. Ltd.)
One cabinet for same with baseboard 9 in.×8 in.×$\frac{3}{8}$ in. (Peto-Scott Co. Ltd.)
One ebonite strip 6 in.×2 in.×$\frac{1}{4}$ in. (Peto-Scott Co. Ltd.)
One .0005 variable condenser with slow-motion control, low-loss type (Jackson Bros.)

One .0003 variable condenser, the same as before (Jackson Bros.)
One crystal detector (Burndept Wireless Ltd.)
One ''push-pull'' on and off switch (Igranic Electric Co. Ltd.)
Ten terminals.
One multi-ratio L.F. transformer (Radio Instruments Ltd.)
One Lotus base-board mounting anti-vibratory valve holder (Garnett Whiteley & Co. Ltd.)
One ordinary base-board mounting valve holder (Burne-Jones & Co. Ltd.)
One Magnum aperiodic H.F. transformer 300-600 metres (Burne-Jones & Co. Ltd.)

If it is desired to use the set on the long waves another transformer covering the required wavelength should be purchased.

One fixed resistor base and fixed resistor to suit valve to be used. (Burne-Jones & Co. Ltd.)
Two single coil mounts (Beard & Fitch Ltd.)
Two .001 fixed condensers (Dubilier Condenser Co. Ltd.)
Glazite wire.
Packet Radio Press panel transfers.
One small spring clip.

It is as well before commencing any of the constructional work to collect all the necessary components together so that there will be no delay once the work has been started.

CONSTRUCTION.

The constructional work involved in making this set is not difficult and does not require great skill. If the instructions are carefully followed it is possible for an absolute novice to turn out a set which will work well and give him satisfaction.

First take the blueprint of the front of the panel, which will be found in this envelope, and with this as a guide mark the points at which holes have to be drilled in the panel. This may be done in one of two ways. First, the blueprint may be laid on the panel and the hole positions pricked through with a sharp instrument such as a scriber or secondly, the panel may be marked out with a square and scriber according to the dimensions shown on the blueprint. If this latter method is followed, there is no need to reverse the positions of the holes, since the panel is symmetrical about the vertical centre line. The blueprint is drawn looking at the front of the set, and, of course, the panel has to be marked out on its back.

DRILLING.

Having ascertained the positions for the holes, all points should be centre punched before drilling. Clearance size drills are used in all cases, and in making the three large holes for the two variable condensers and the switch, a small size drill should first be used so as to make a small hole to guide the large drill. No difficulty will be found in the drilling, so we can pass on to the next step, that is, mounting the components.

MOUNTING THE COMPONENTS.

Before any components are mounted, it is as well to tin all points on them to which soldered connections are to be made. This does not, of course, apply to terminals, which should be fixed in place before tinning, although it is as well to do this before the other parts are mounted.

Mount the components on the panel first. Then with the base-board in the cabinet, screw the panel and terminal strip to it. This will ensure that the set will fit into its cabinet when it has been completed. The remaining components can now be screwed to the baseboard. Follow the layout on the back of panel blueprint so that you are sure to allow room for the valve and coils when these are put in. Also take care to put the coil mounts the same way round as shown or trouble may result from more than one source.

WIRING.

Attention can now be turned to the wiring. It is as well to take plenty of time over this, since neat wiring not only enhances the appearance of a set greatly, but also adds to its efficiency. Glazite wire is used, and since this is covered with an insulating material, trouble which might be caused by two wires touching is obviated. A list of connections to be made is given under wiring instructions. These are arranged in the order in which it is best to make the connections and should be followed in conjunction with the wiring shown on the back-of-panel blueprint. The two flexible wires which run to the secondary of the transformer are twisted together for neatness. Be careful in arranging the wires, that they do not run in positions which may foul the valve, H.F. transformer or coils. To avoid this it is best to have these in place when bending the wires into shape. When the wiring is complete, the panel transfers may be affixed, and the lettering required is shown on the blueprints.

VALVES TO USE.

This receiver will work with any general purpose valve, such as a bright emitter, one of the .06 type or one with a different rating altogether. Of course the right type of resistor must be used, and when ordering it is best to specify the type of valve to be used, and the voltage of the accumulator which will be employed. A valve of the small power type is very effective and gives extremely good volume on the local station, but sometimes is not quite so good for distant reception. In all cases it is necessary that the valve is worked properly otherwise it may partially rectify. This can be avoided by using sufficient H.T. and grid bias. How to tell whether the valve is working properly is explained later. Different transformer ratios should be tried to find the one which best suits the valve in use. This is easily accomplished by means of the flexible leads provided as connections to the L.F. transformer.

TYPES OF COILS.

Any type of plug-in coil may be used when direct coupling is employed. The flex lead from the aerial being placed under the terminal nearest the panel on the aerial coil holder and marked X. If selectivity is not great enough when direct coupling is employed, an X coil or a centre tapped coil may be tried for the aerial circuit. In this case the aerial lead is taken to one of the X coil taps or the centre tap. It will be as well to try all three since in some cases it is possible that a loss of signal strength might result. This, of course, depends on local conditions entirely, especially on the particular aerial which is being used.

TESTING THE SET.

When the set is first used, it will be found best to start with a general purpose valve with a high-tension voltage of from 60 to 80 volts. Direct coupling should also be used, and a No. 35 or No. 50 coil inserted in the aerial socket. The value of the reaction coil varies under different conditions, but a No. 25 or No. 35 should be found suitable.

ADJUSTING THE GRID BIAS.

The grid bias terminals are temporarily shorted. With the reaction condenser at its zero position and with the catwhisker touching the crystal detector, tune in the local station. Now remove the

catwhisker from the crystal. You will probably still be able to hear the local station at some strength. Now connect up the grid bias and adjust it to such a value that signals are weakened as much as possible. The catwhisker can now be replaced and the effect of the reaction condenser tried.

REACTION ADJUSTMENTS.

The control of reaction will be found very smooth and to build up strength very well. If you are very near to your local station, it is possible that you will not notice much improvement on that station by increasing reaction.

Always use the reaction control judiciously, increasing and decreasing slowly in conjunction with the tuning condenser ; otherwise you may cause interference, because once past the useful point of reaction, the set soon gets into self oscillation.

RESULTS.

Loud-speaker results may be expected up to about 6 miles with the average aerial, or up to about 8 miles with an extra good one. It is possible to receive a few other broadcast stations at very good telephone strength while the local station is working.

As many as 10 stations on one coil have been tuned-in easily and at very good strength when the local station was closed down.

These include Birmingham, Bournemouth, Barcelona, Hamburg, and Ecole Superieure, but all were not identified since no wavemeter was used at the time.

DAVENTRY.

Long wave broadcasting stations may be received, appropriate coils being used and, of course, a long wave H.F. transformer. With a No. 150 coil in the aerial circuit and a No. 75 as reaction, Daventry was received at very good headphone strength.

EARTH CONNECTION.

So far no mention has been made about the earth clip. As will be gathered from the wiring blueprint, this may be attached to either side of the secondary of the L.F. transformer. Not much difference

will be noticed between the two sides, but where there are electric light mains in the house and interference is experienced in the form of a hum, it will often be found best to connect the earth so that the secondary of the transformer is not in the aerial circuit. To do this the clip is put on to the ''B'' connection.

WIRING INSTRUCTIONS.

Join GB + to LT- ; LT- to one side of R; join other side of R to F- of V.

Join F+ of V to one side of S. Join other side of S to LT+; LT+ to H.T.-.

Join one side of L4 to one side of Detector. Join other side of Detector to length of Glazite with flex wire on end for one side of TI.

Join flex lead to remaining side of L4 for connection to remaining side of TI.

Join P of V to one side of L3; same side of L3 to socket of holder for L2.

Join G of V to fixed plates of C1; fixed plates of C1 to socket of holder for L1.

Join fixed plates of C2 to pin of holder for L2.

Join moving plates of C2 to moving plates of C1; moving plates of C1 to pin of holder for L1; pin of holder for L1 to one side of C3, and leave wire projecting from here for earth clip.

Join remaining side of C3 to GB-, and leave wire projecting from here for earth clip.

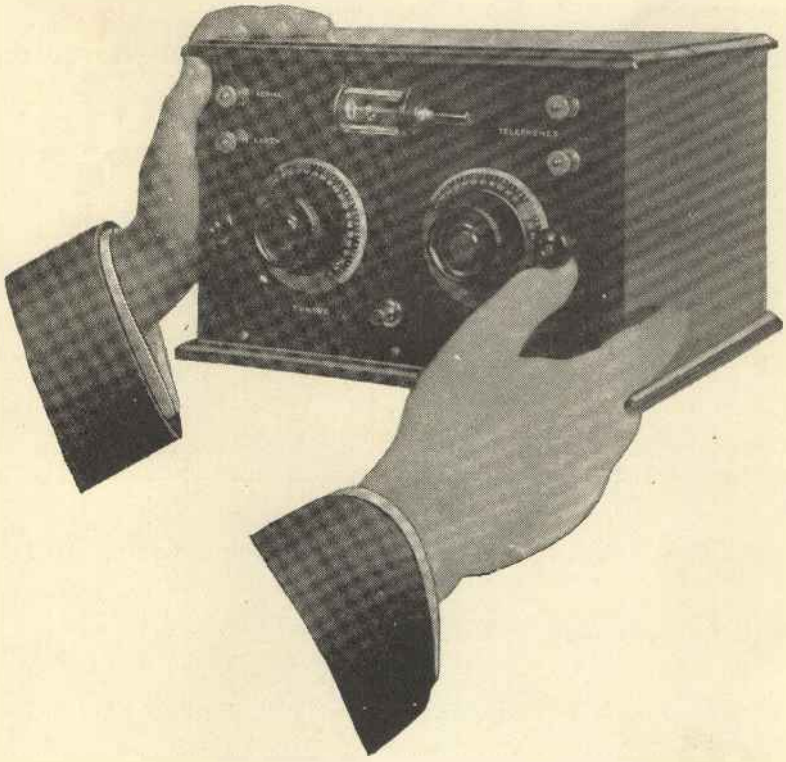
Join flex leads to both sides of C3 for connection to T2.

Join Earth to length of Glazite with flex lead on end for earth clip.

Join flex lead to Aerial for connection to L1.

Join telephone+ terminal to one side of C4; same side of C4 to H.T.+.

Join remaining telephone terminal to remaining side of C4; same side of C4 to remaining side of L3.

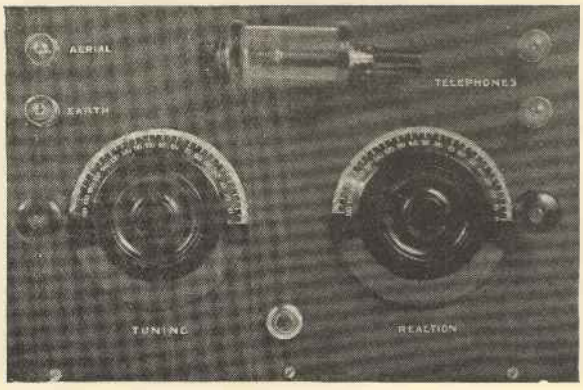


THE COMPLETED SET:

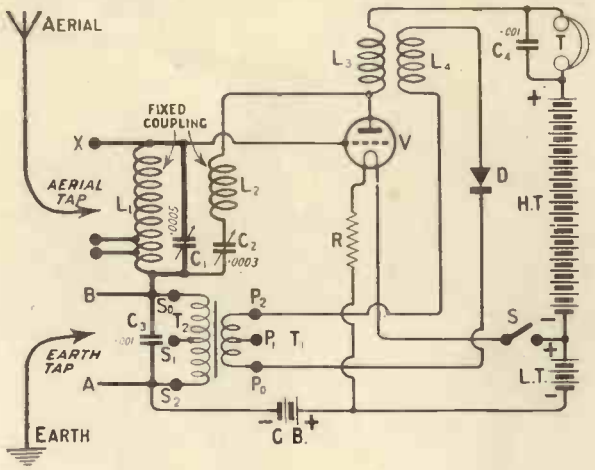
The Midget Receiver certainly justifies its name, being smaller than many forms of hand camera.

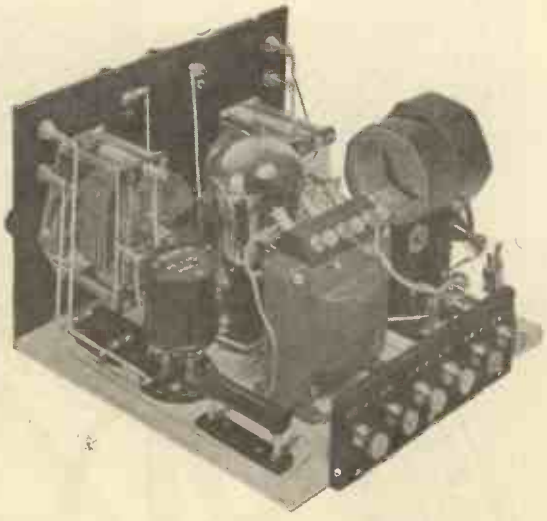
Its proportions are also very pleasing to the eye.

A plan view of the panel layout, showing the symmetrical disposition of the components. Notice the perfect balance, which simplifies the task of panel drilling.



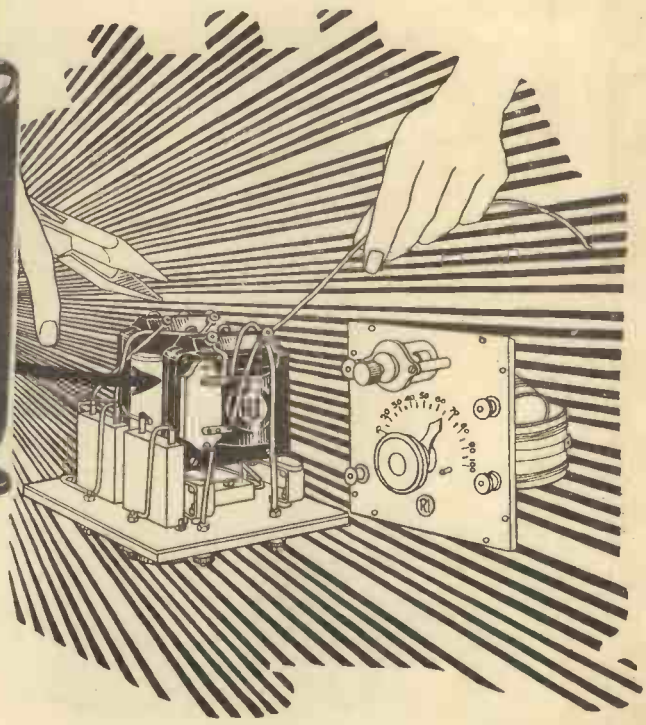
This theoretical diagram will be of interest and help to those who study the technical side of the subject. It is not, however, necessary for the successful building of the set, which can be undertaken entirely from the blue prints, text and photographs.





Study this photograph carefully and you will see just how the various parts stand in relation to one another. It will also help you with the wiring.

It's Right—in every case!



You can rest assured when you fit the R.I. Multi-Ratio Transformer in your set, no matter what circuit or valves you are using, that the amplification will be of the maximum power and purity obtainable.

You need have no hesitation because the R.I. Multi-Ratio Transformer is designed to meet all requirements—7 ratios to give perfect amplification in any stage in any circuit—3 Impedence values to operate correctly in conjuction with any valve—all facts to give you complete confidence in the success of your set.

Further than these you have the knowledge that this instrument is an R.I. Product, that its design and execution are the finest examples of British craftsmanship.

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