The Wireless Constructor

6D MONTHLY

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

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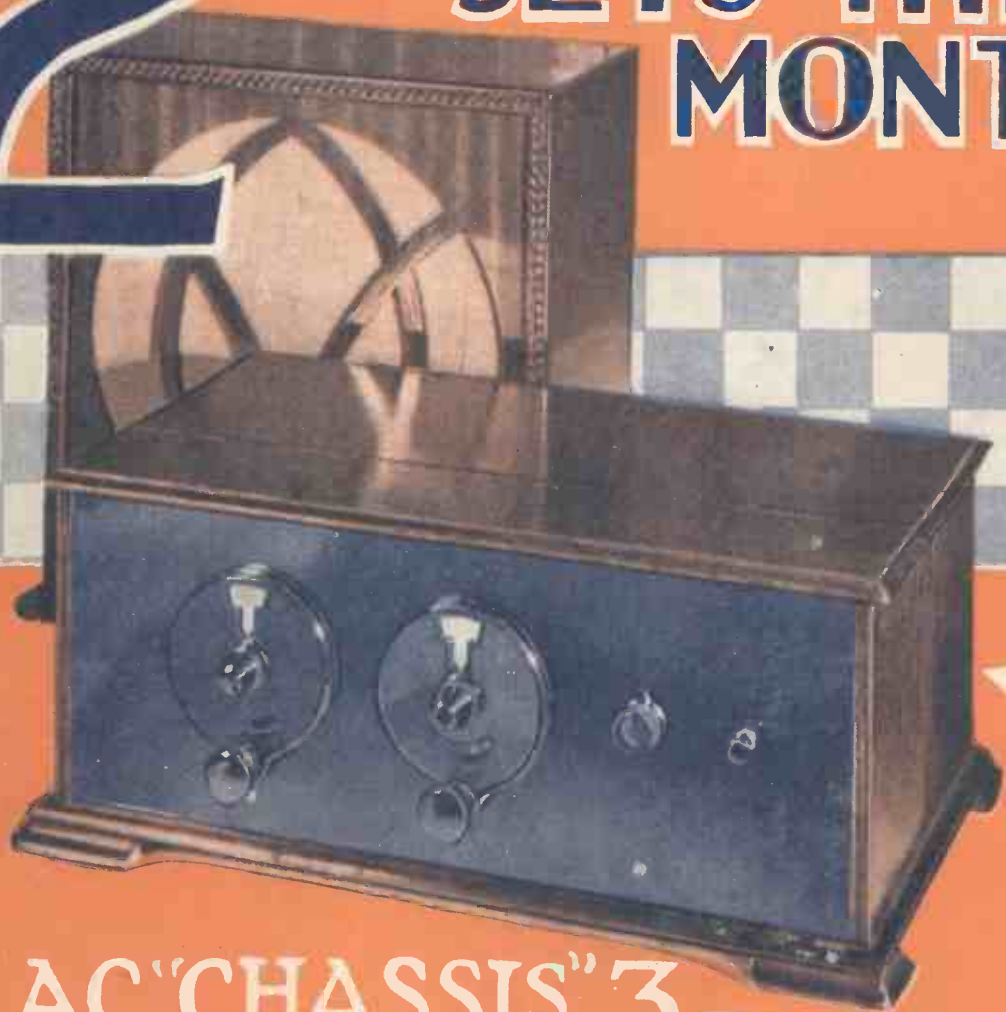
2 MORE "CHASSIS" SETS THIS MONTH



AN A.C. "CHASSIS" 3

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Edited by PERCY W. HARRIS, M.I.R.E.

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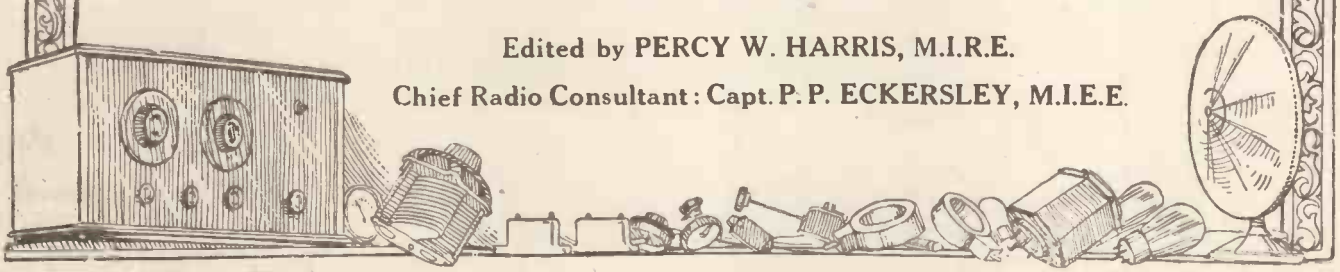

THE WIRELESS CONSTRUCTOR

Edited by
PERCY W. HARRIS, M.I.R.E.

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THE EDITOR'S CHAT

In this article Percy W. Harris, M.I.R.E., the Editor of the "Wireless Constructor," presents the details of a new A.C. Chassis design and discusses the advantages of using mains valves.

EIGHTEEN months ago it was the privilege of the WIRELESS CONSTRUCTOR to present to its readers the first practical design for an apparatus to run the filaments of ordinary valves from alternating current mains.

A Standard Design

In the Harris Stedipower L.T. Unit a transformer stepped-down the mains voltage to a suitable low figure, whereupon the current was rectified by a copper oxide rectifier, smoothed by high-capacity electrolytic condensers and finally adjusted for voltage by a series resistance. This design still remains the standard for such an apparatus, and it is interesting to note that several commercial forms were available at the last Wireless Exhibition.

Another interesting development has been along the lines of valves made to run with raw alternating current as a source of heating. There are two forms of such valves, the directly- and the indirectly-heated.

The directly-heated type, made with very thick, short filaments so as to retain their heat with a minimum of fluctuation (and therefore with comparatively small change of electron emission), have never really caught on in public favour; partly because the first types would not work satisfactorily as detectors, and secondly because their efficiency was much lower than that of the indirectly-heated types.

Highly Efficient

The indirectly-heated types, on the other hand, are highly efficient when properly made—even more efficient than the best of the battery-driven valves—but the supply has been limited until recently, and the makers took some time to come to an agreement on standardised bases (and therefore holders). Fortunately, standardisation now holds and all the leading makers are able to supply suitable types for all purposes.

This being so, we have pleasure in publishing this month a simple design incorporating three such valves, so that readers can build for themselves an inexpensive three-valver quite free from any bother about accumulators and their periodic recharging.

Quite a large number of set-users do not mind buying a new high-tension battery every six or nine months if only they can be delivered from the necessity of dragging a heavy accumulator backwards and forwards to the charging station, and from the risk of it running down just in the most interesting part of a programme. Furthermore, most of the designs have required the purchase of a large number of new parts.

The economical A.C. mains set in the current issue has been specially designed so as to incorporate as many as possible of existing parts, and for this reason alone it should appeal to a wide circle of users.

TAKING THE AIR

Broadcasting a farewell talk before the departure of a long-distance flight in a German air-plane.

Practically all A.C. valve receiver designs so far published have presupposed that the reader would want to build a set to run entirely off the mains, but while this is a very desirable state of affairs, the cost of such a receiver is rather beyond the means of many.

A "Chassis" Receiver

This set, of course, is built up on the new WIRELESS CONSTRUCTOR chassis

The Editor's Chat—*continued*

method, the popularity of which is very steadily increasing as more and more people realise its many distinct advantages. It is completely free from hum, very pure in quality and quite reasonably economical in high-tension current (the figures are given in the article).

High Sensitivity

Added to this its sensitivity is very high, the selectivity good and the cost, even when all new parts are purchased, attractively low. Next month we hope to publish a further article on this receiver, together with the design of a special power unit for the more ambitiously inclined. This power unit will include both H.T. and L.T. supply from A.C. mains, and will incidentally be suitable for the supply of H.T. and L.T. to any receiver using the new indirectly-heated valves.

The chassis form of construction is admirably suited for short-wave work, and our regular contributor, Mr. L. H. Thomas, whose short-wave articles are a regular feature of this journal, and whose transmitter, G 6 Q B, is regularly heard in every quarter of the globe, describes for WIRELESS CONSTRUCTOR readers the new short-wave chassis set he has used so successfully in his recent experiments.

The two-valve enthusiast—and his number is by no means decreasing—is well catered for in Mr. G. T. Kelsey's wave-change two-valver, incorporating the particularly efficient coil designed for the "Chassis" Three. Hints and tips for the practical worker are as numerous as ever, and, in fact, every type and description of set-user will find something to suit his taste in the present issue.

Revolutionary inventions—truly revolutionary that is, and not merely claimed to be!—are few and far between, even in radio. For this reason more than ordinary importance attaches to the publication of preliminary particulars of the wonderful invention by Dr. Robinson of the Stenode Radiostat.

RADIO ON THE ROAD

An American company equips motor cars with special radio sets. The loud speaker is hidden under the facia board, and here we see Mr. Paul Whiteman, the jazz-band leader, listening-in.

This invention, which has been called by leading scientists who have investigated it the greatest contribution to radio since the introduction of the third electrode into the valve by Dr. Lee de Forest, promises to clear the ether of the present intolerable congestion and in my opinion will be of immense importance in every branch of the radio art.

WIRELESS CONSTRUCTOR readers, we are sure, will be interested to hear that a great deal of the practical development work of this invention has been carried out in the Editor's private laboratory, where indeed it was first demonstrated to the leading scientists. P. W. H.

A DIRECTIONAL DIFFICULTY

ONE of the advantages claimed for the self-contained portable set is that the frame aerial gives a greater degree of selectivity, owing to its directional effect, than the outside aerial. This is perfectly true, but, on the other hand, it frequently happens that when the set is turned into the particular direction which gives maximum pick-up, the loud-speaker diaphragm is found to be facing *away* from the audience and giving of its best to an unappreciative wall.

Moving the Set

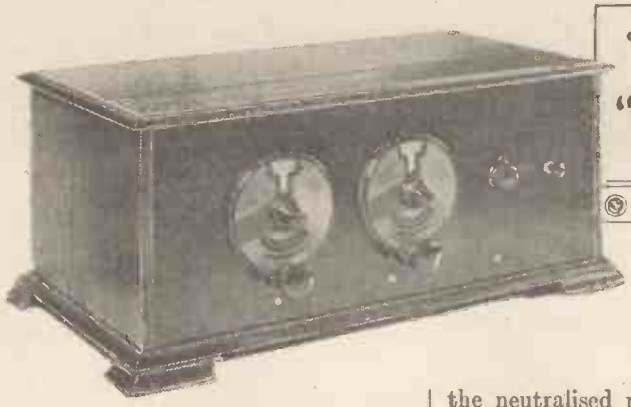
One can, of course, move the set bodily to a part of the room that is better situated strategically, having regard both (a) to the particular station desired and (b) to the position of the audience.

If, however, such manœuvring is often repeated it tends to make the owner wonder if what he gains on the roundabouts fully compensates for what has been lost on the swings—in other words, whether it wouldn't be better to go back to the garden wire, so as to keep the loud speaker fixed permanently in a spot where it can best be heard by all concerned.

Obviating the Difficulty

In some types of portable this difficulty has been foreseen and overcome by mounting the frame aerial on a door or special frame which can be swung about a vertical axis without altering the orientation of the set. In this case the loud-speaker diaphragm will always remains facing the audience.

Another suggestion is to arrange the diaphragm of the loud speaker horizontally, instead of vertically as usual. The sound waves will then always travel vertically upwards towards the ceiling. No matter in what direction the set as a whole is turned, the intensity of reproduction remains unaltered. J. C. J.



AN A.C. "CHASSIS" THREE

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

YOU DO NOT KNOW WHAT TROUBLE-FREE RECEPTION IS UNTIL YOU HAVE BUILT AN ALL-MAINS RECEIVER. THIS WONDERFUL "CHASSIS" DESIGN WILL END YOUR SET PROBLEMS. NO MORE CHARGING TROUBLES. NO MORE BOTHERSOME L.T. BATTERIES.

THOUSANDS of WIRELESS CONSTRUCTOR readers already possess receivers of the high-frequency, detector and low-frequency type incorporating the older high-frequency valves (as distinct from the screened-grid H.F. valve) and using the neutralised method of obtaining stability. Such receivers when well designed and properly made, gave—and still give, for that matter—excellent results both in regard to strength and selectivity.

Indeed, the selectivity of some of the older H.F. sets was distinctly better than that of some modern screened-grid kits! This being so, such readers often do not feel inclined to go to the expense of a complete new set, although they desire to keep reasonably up to date.

A Popular System

With the advent of the WIRELESS CONSTRUCTOR aluminium chassis type of construction many new advantages are made available to the home constructor. Already two chassis receivers have been published in this journal, the first being the "Chassis" Three, the popularity of which is rapidly increasing owing to the good reports spread around by the first constructors of this set, and the "Silver Champion," wherein the advantages of a modern screened-grid circuit, together with wave-change on the short and long band, are made available in compact form.

In the present issue two further chassis designs appear, and the first of these, described in this article, will we think find a warm welcome from those readers who were mentioned in the first paragraph.

The A.C. Chassis set is then designed to meet the needs of readers who have many parts on hand and want to use them while benefiting from the advantages of chassis construction and A.C. valves.

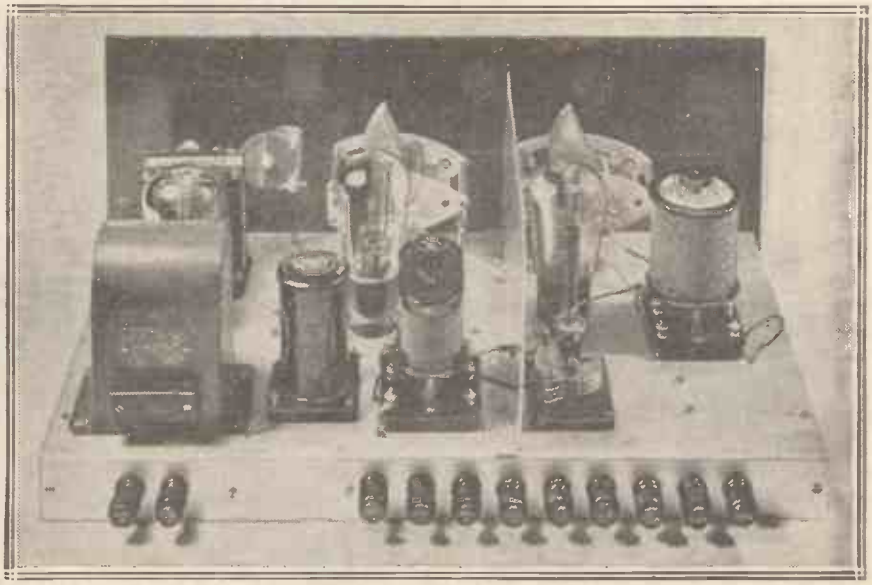
Briefly, the set consists of a high-frequency valve neutralised by the split-primary method, a detector, and a low-frequency stage of the power variety, made up in chassis form and utilising the new 4-volt indirectly-heated valves which can be run straight from a small transformer connected to the A.C. lighting supply, thus dispensing once and for all with the accumulator and the need of frequent recharging.

In order to keep expense down, the set has not been made to include a

COMPONENTS REQUIRED

1 Panel, 18 in. × 7 in. (Resiston). (Ebonart, Becol, etc.)
1 Cabinet for same, 10 in. deep (Cameo). (Artcraft, Raymond, etc.)
1 A.C. chassis—fitted with 3 A.C. valve holders and screen (Magnum). (Ready Radio, Paroussi.)
11 Indicating and insulated terminals (Belling Lee).
2 6-pin bases (Lewcos). (Colvern, etc.)
2 Vernier dials (Igranic). (Formo, Lissen, J.B., Ormond, etc.)
1 Reaction condenser, ·0001 (Lotus). (Lissen, Magnum, Ready Radio, Utility, J.B., etc.)
1 Neutralising condenser (Peto Scott). (J.B., Bulgin, Bowyer-Lowe.)
2 ·0005-mfd. variable condensers (Lissen). (Igranic, Cyldon, Lotus, Formo, Ormond, etc.)
1 On-and-off switch (Wearite). (Benjamin, Lotus, Lissen, Raymond, Bulgin, etc.)
1 H.F. choke (R.I.). (Lewcos, Varley, Igranic, Ready Radio, Lissen, Magnum, etc.)
1 Output choke (Atlas). (R.I., Igranic, Varley, Wearite, etc.)
1 L.F. transformer (Telsen). (Brown, Ferranti, R.I., Igranic, Varley, Lotus, etc.)
1 400-ohm potentiometer for base mounting (Sovereign). (Lissen, Igranic, etc.)
1 ·0003-mfd. fixed condenser (Lissen). (Dubilier, Atlas, T.C.C., etc.)
1 Leak holder (Wearite). (Lissen, (Dubilier.)
1 2-megohm leak (Ediswan). (Dubilier, Lissen, Igranic, etc.)
1 20,000- or 25,000-ohm resistance and holder (Met-Vick). (Ediswan, Ready Radio, etc.).
2 2-mfd. condensers (Lissen). (T.C.C., Dubilier, Ferranti.)
1 6-pin S.P. aerial coil (Any good make, as explained in article).
1 6-pin S.P. transformer (Any good make, as explained in article).
3 A.C. five-pin valves, as per article.
1 4-volt mains transformer (Philips, R.I., Heayberd, Varley, etc.).

THE SET THAT SETS A STANDARD



Ready for action! The A.C. "Chassis" Three wired and ready for use. Could anything be neater or more workmanlike in appearance?

An A.C. "Chassis" Three—*continued*

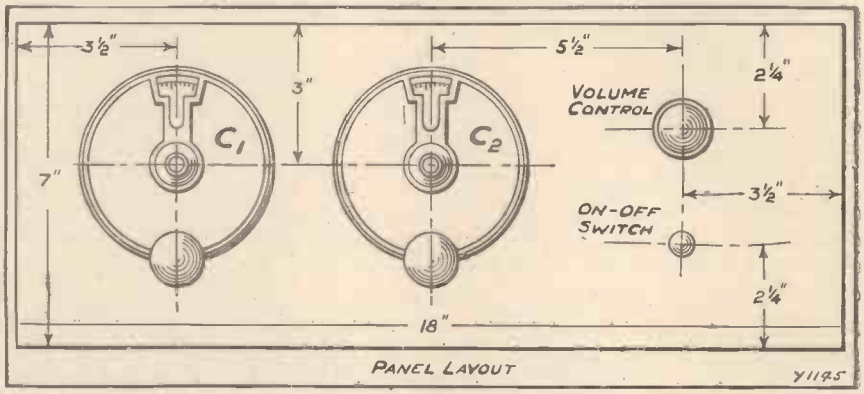
high-tension supply unit, for a receiver including both L.T. and H.T. supply from the mains is necessarily rather expensive. The chief bother with ordinary sets is the necessity for, and the trouble of, getting the accumulator recharged. This means that two accumulators must be kept in service, one on the set and the other at the charging station, in order that there may be no break in the continuity of programme reception.

Often the accumulator must be carried some distance to be re-charged; and while in country districts, where no electric light is available, the accumulator must still remain the source of low-tension current, the increasing use of electricity and the widespread network of mains now available makes the A.C. source of supply particularly attractive.

The H.F. Valve

Both screened-grid and ordinary high-frequency valves are available in the indirectly-heated class, and readers may at first wonder why a screened high-frequency valve was not included in the present set. There is more than one reason for this, but the main one is that of economy.

First of all, the screened-grid valves are more expensive than the ordinary type (whether you get them in the directly or indirectly-heated types); and, secondly, if proper use is to be made of a modern screened-grid valve careful screening and other precautions are needed, which add to the expense of the set. Indeed, the difficulty in getting the most out of a screened-grid valve is so great that these valves are often used in circuits which give very little more magnification than is obtainable in a properly-designed neutralised circuit with the older type of high-frequency valve.



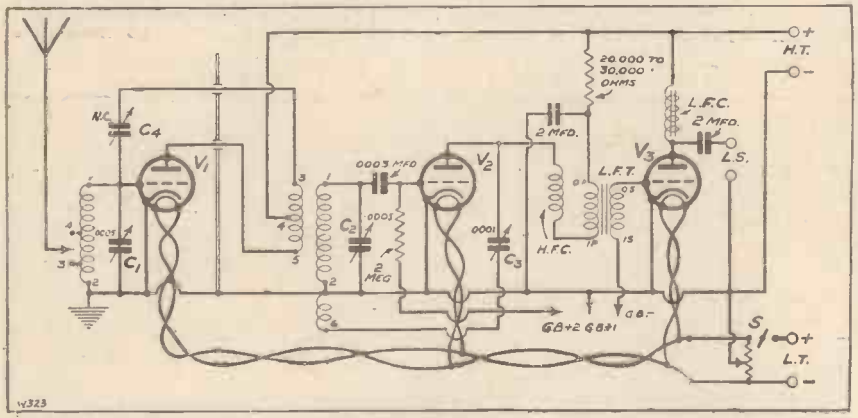
The panel layout is attractive, and makes for easy operation.

In sitting down to design this set I had in mind that a very large number of readers already possess such items as six-pin coil sockets, neutralising condensers, variable condensers, high-frequency transformers, etc., and the present receiver is designed to include as many as possible of the parts likely to be incorporated in the older H.F. sets.

The additional equipment required consists of the chassis, the A.C. valve holders, and one or two small items, while an inexpensive step-down transformer takes the place of the accumulator. So far as high-tension supply is concerned, the user of the set can have either high-tension dry batteries, high-tension accumulators, or an A.C. mains unit for high tension, which ever he possesses or desires to get.

The high-tension demands of this receiver are not high and come within the possibilities of a medium-size high-tension dry battery. So far as results are concerned, the receiver is particularly sensitive and gives excellent sharp tuning, while the quality is first-class and free from any trace of hum. Reaction is smooth and free from backlash, and, indeed, so far as the operation of the set is concerned the results are indistinguishable from those of a first-class battery-driven set.

THE SECRET OF THE CIRCUIT



All the valves are of the special high-efficiency type, with a heater element instead of the usual filament. The circuit is a straightforward H.F., Det., and L.F. The first valve is neutralised on the split-primary principle, the Det. is transformer-coupled to the last valve, and there is also a de-coupling resistance and a choke-filter output to the loud speaker. The twisted "filament" leads are merely to indicate that twisted flex should be used.

The Circuit Employed

Now let us look at the circuit shown in this page. The aerial is joined to a six-pin aerial coil with the usual two tappings, and here one can use the cylindrical six-pin coil, the new Super coil, or a six-pin binocular of the Colvern, Lewcos, etc., type. The high-frequency valve, which is separated from the detector stage by a vertical screen, here feeds into a split-primary high-frequency transformer, a standard neutralising condenser being connected as shown.

The secondary of this transformer supplies grid voltage to the detector valve, in the plate circuit of which is situated the primary of a good low-frequency transformer and the de-coupling resistance scheme which has been incorporated in WIRELESS CONSTRUCTOR receivers for some time past. The output valve is provided with a choke-condenser output, thus giving good reproduction and keeping the high-tension current out of the loud-speaker windings.

It will be noticed that no provision is made for a wave-change switch, as

An A.C. "Chassis" Three—*continued*

the set is designed to enable readers to utilise existing coils and bases, but if the wave-change switching idea appeals strongly, then a very slight modification of the set will enable the type of coil described in the January issue of the WIRELESS CONSTRUCTOR (see the "Silver Champion") to be used.

Five-Pin Holders

Certain alterations of technique are necessary when using A.C. valves. With these valves there are five pins: one for grid and one for plate as usual, two for a filament circuit and a fifth for what is known as the cathode. The filament circuit is fed with unsmoothed alternating current at 4 volts, and is insulated from the cathode. The filament gets very hot and conducts heat through the insulating tube to the surrounding cathode, which in turn gets hot and emits electrons.

The three cathodes in this set are connected together and to earth, and also to the slider of a potentiometer which is connected across the A.C. heating leads, the slider of the potentiometer being placed about centrally. The high-frequency valve has zero grid bias, the detector needs a positive grid bias, and the power valve a negative grid bias.

It may sound strange to talk about the need of a positive grid bias, but it must be remembered that in ordinary receivers the grid of the detector valve is almost invariably taken through the circuit to the positive leg of the valve, and thus has a positive bias applied to it. As there is no positive leg of the valve in the present receiver we must provide this positive bias from the grid-bias battery, and thus we have the unusual state of affairs that there are two positive grid-bias terminals and one negative.

Detector Grid Bias

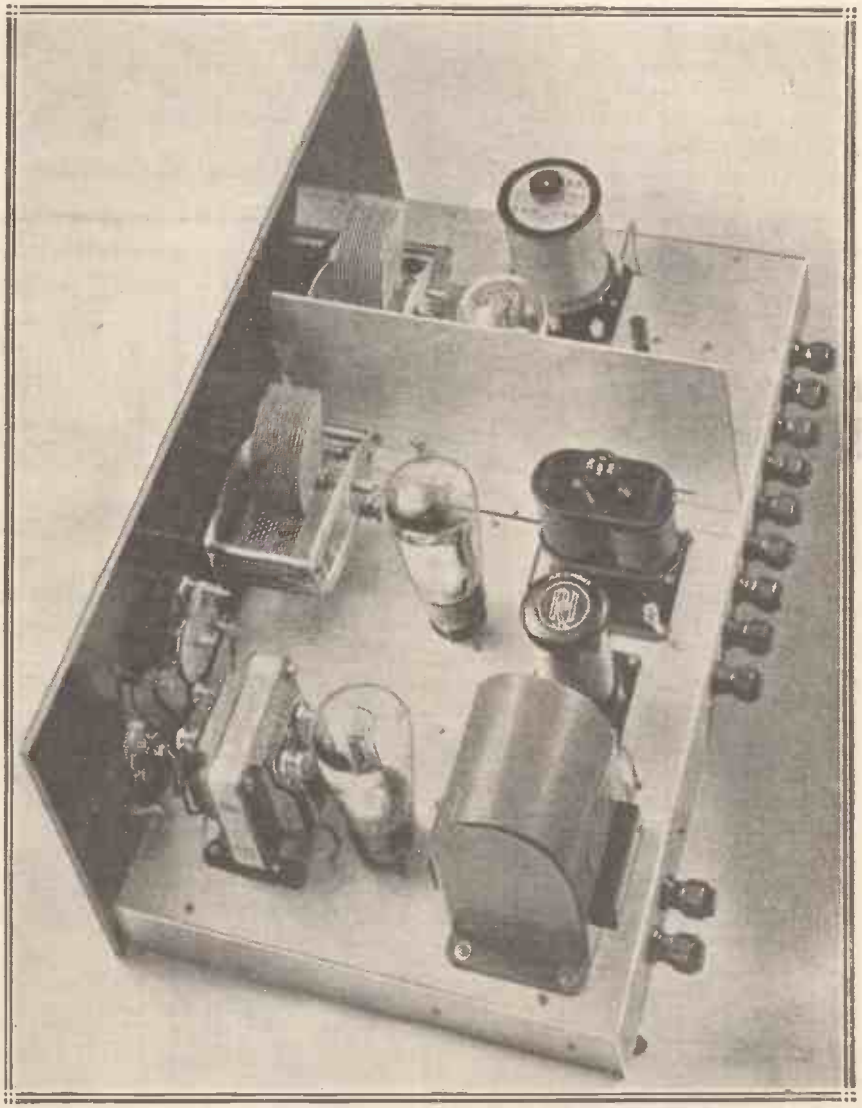
The normal grid-bias positive is placed one and a half volts from the positive end, and the detector grid-bias positive is placed in the ordinary positive socket so as to give one and a half volts positive. The negative grid bias is used according to the high-tension plate voltage as specified by the makers on the leaflet supplied with the valve.

Some readers, while admiring the appearance of the chassis receivers and desiring to make them, have a fear that they might have difficulty in working aluminium. Let me assure them at once that the construction of a chassis receiver is particularly easy, the aluminium being a relatively soft metal, and its drilling just as easy (if not easier) than ebonite. As many readers are not well acquainted with the working of aluminium, the constructional details in this article will be a little fuller than usual.

The method of construction is as follows. First of all, assemble all components for the receiver, including the chassis and panel. The chassis will be purchased ready-drilled for the terminals and valve holders, but free from other holes, as the positions of these will be determined by the makes of components used.

The chassis are all drilled to take Belling-Lee insulated terminals, and when purchasing the chassis it is just as well to have it ready fitted with the A.C. valve holders and the insulated terminals together with their washers. It is one of the advantages of the WIRELESS CONSTRUCTOR aluminium chassis scheme that a number of wires are dispensed with, as all the points which are at earth potential are connected direct to the chassis.

This applies, for example, in the present receiver to earth, one loud-speaker terminal, grid-bias positive, and high-tension negative, these terminals being connected directly to the chassis, making metallic contact with it, and having no wires attached to them. Other terminals are insulated



The wiring was finished when this photograph was taken, though at first glance it is invisible—a very pleasing feature of the "Chassis" system.

An A.C. "Chassis" Three—*continued*

from the chassis, and, in order to effect this, insulation washers are provided by the manufacturers of the chassis.

The First Step

Whenever electrical contact (other than on terminals) has to be made to the chassis a soldered connection is made to a 6 B.A. metal screw locked in a hole by a nut. No attempt should be made to solder to the chassis, as aluminium cannot be soldered in the ordinary way, and, furthermore, if it could it would not look so well as the method chosen.

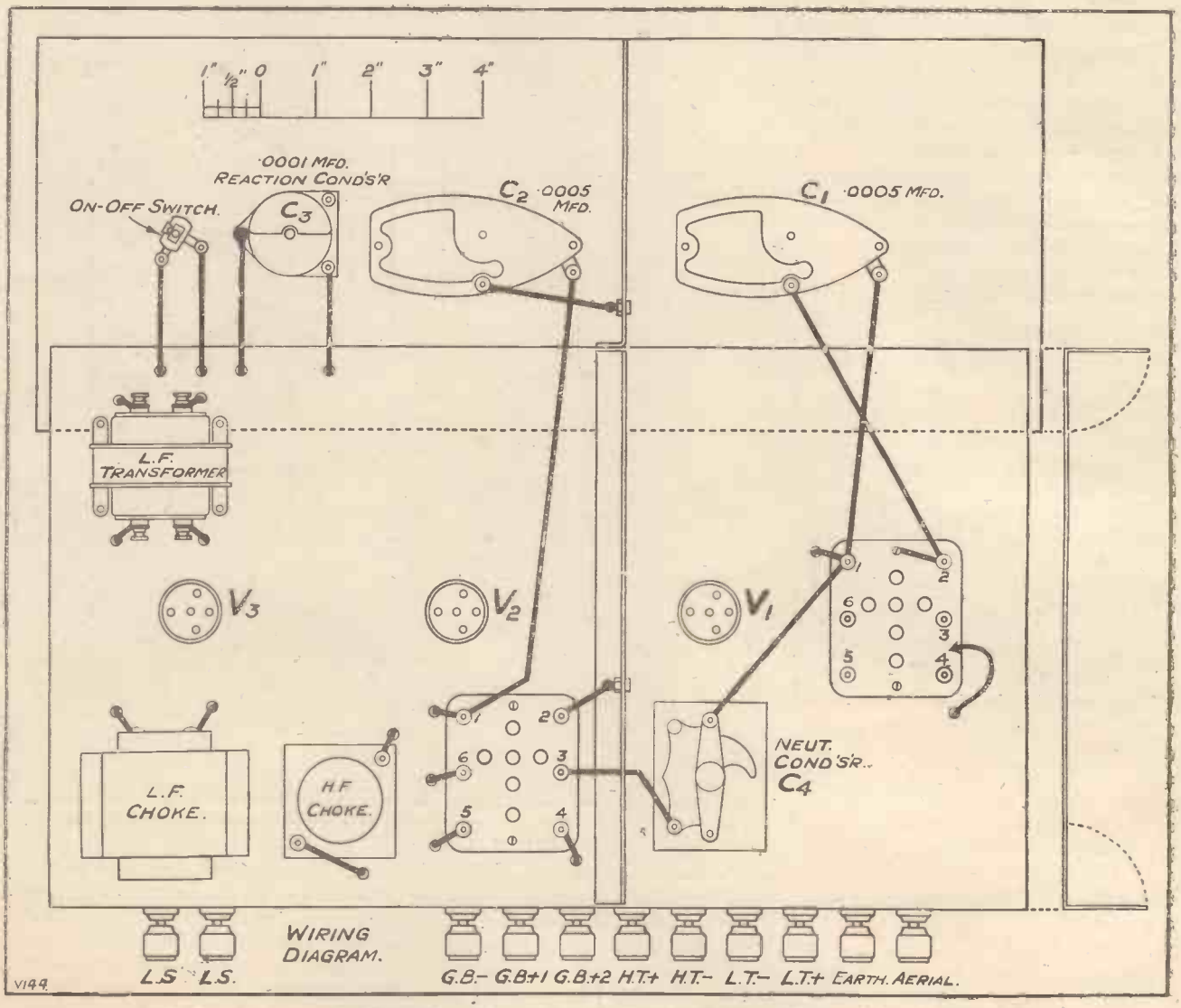
WIRELESS CONSTRUCTOR aluminium chassis are 1½ in. deep and ½ in. shorter than the panel to which they are to be attached. The first step, then, is to take the panel and hold it up against the front edge of the chassis, making sure that there is exactly ¼ in. projecting at each end. A line should then be scratched along the back of the panel to indicate the height of the chassis, and the panel-mounting parts should then be laid out to make sure that they come above the line just marked.

Three holes for securing the panel to the chassis should be drilled on a line ¾ in. from the bottom of the panel, one in the centre, and one at each end. The holes should be drilled first in the panel, which can then be held up against the front edge of the chassis, and the positions for the securing holes in the aluminium marked by using the panel as a template.

The ordinary drills that you use for drilling ebonite can be used for aluminium. Do not press too hard, as the metal cuts very easily. You will find rather a rough burr on the back. This is easily removed by a file, or a still simpler and neater way is to place a countersink bit in your twist drill and give it a few turns on the back of the aluminium. It will then cut off the burr quite neatly.

Mounting the Components

The screws used to hold the panel to the chassis can be either 4 B.A. or 6 B.A. countersunk metal screws ½ in. long, or ⅜ in. if a 3/16-in. panel is used. Do not fix the panel until you have mounted the parts on the chassis, or you will find the set difficult to handle during wiring up. The panel should be carefully



Very few wires are used above the "baseboard," so that a perfectly clean appearance is preserved.

An A.C. "Chassis" Three—*continued*

supported against the front edge of the cabinet while you lay out the other parts.

Completing Assembly

The vertical screen used for this set is 1½ in. lower than usual, so if you have a standard vertical screen the top portion can be cut off with a pair of shears. The position of this screen must be such that it is not fouled by the vanes of either variable condenser, and the position should be as close as possible to that indicated in the wiring diagram. The six-pin coil base and the neutralising condenser are placed in the position shown and their bases are used as templates for marking the position of the securing holes in the chassis.

Lay out all the parts as close as possible to the positions shown, and carefully mark the points for the securing holes. Now remove the panel and drill as required; 6 B.A. cheese-head screws serve to secure all the parts, nuts being used on the back to hold them tightly. Be sure you tighten up all the nuts, and if, by any chance, the set is likely to be subject to vibration, then it is just as well to run on a second nut as a locknut in each case.

The parts on the underside of the chassis are mounted in the same way, but here you must be careful that you do not drill a hole for securing a part in such a way as to pierce a component above. A careful study of the layout will prevent this happening, as there is really plenty of room.

After all the parts are mounted, the next step is to drill holes to take the leads which pass from one side of the chassis to the other. For this it is just as well to drill fairly large holes, such as ⅜ in. diameter, so as to avoid any friction of wire against the sharp edges of the holes. Wiring-up can be carried out with stiff wire of the insulated type, or with bare wire and Systoflex sleeving.

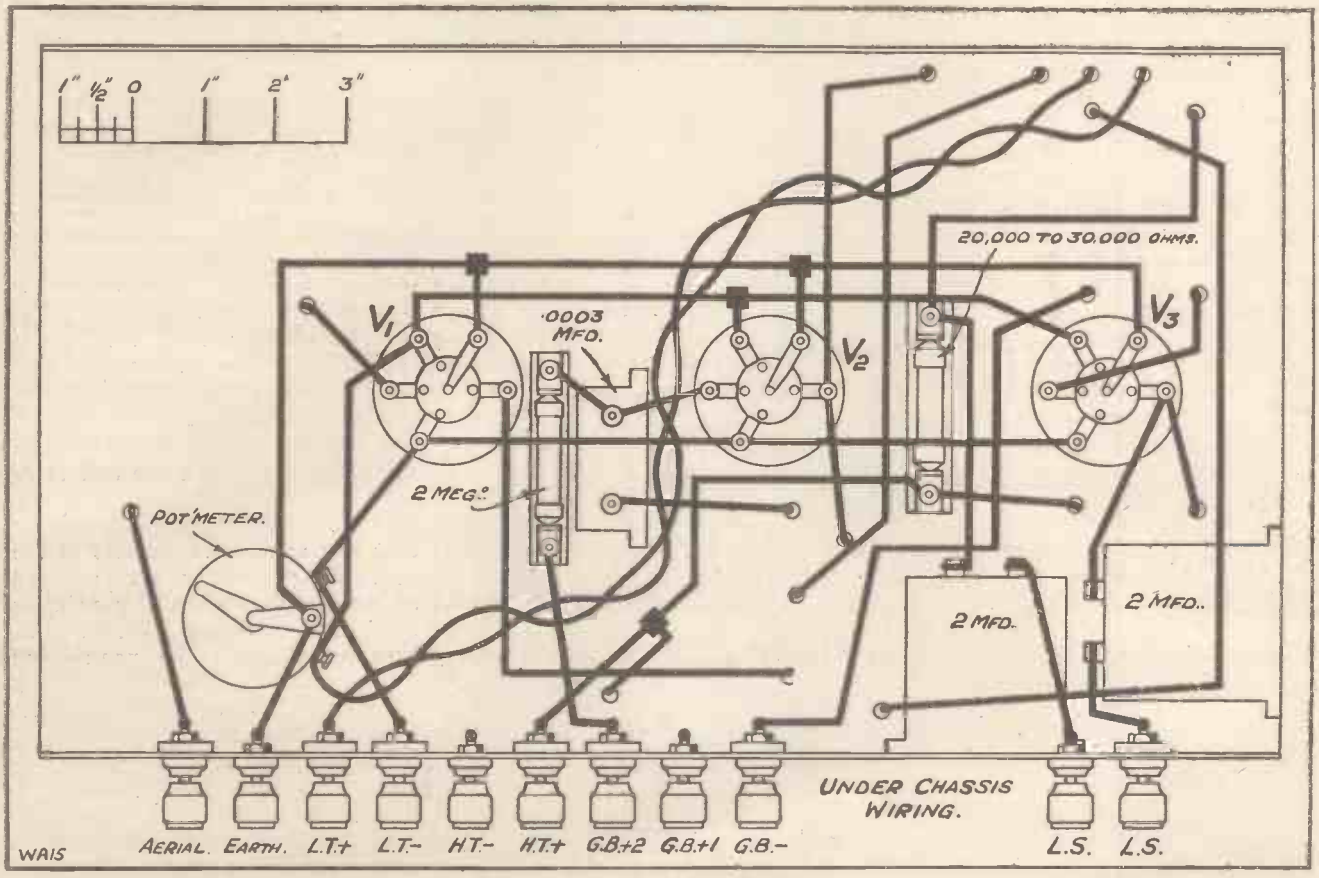
A third method is to use a good quality flexible rubber-covered wire for all work on the underside of the chassis, as well as for the wires which pass through, with stiff wire for the few leads which are above the chassis. So far as the wires connecting the filament terminals to the valve holders are concerned, it is just as well to twist these together to save undesirable induction effects, and for this the flexible rubber-covered wire is very suitable.

Insulated Wire Essential

In all cases where other than the rubber-covered wire passes through the chassis small lengths of Systoflex tubing should be slipped over the wire, even when the wire itself is insulated, as this safety precaution prevents short-circuiting.

Wiring-up is very easy and it is much more fascinating on this type of receiver than on the ordinary set. The layout of the parts has been so arranged that the vital leads are short and no difficulty will be experienced if the wiring diagrams are carefully followed.

When the set is all wired-up the potentiometer should be set at the



The wiring is simple to carry out, but in connecting up the filament sockets for the valve "filaments" twisted flex should be employed.

An A.C. "Chassis" Three—*continued*

middle point, and the two filament terminals connected to the four-volt winding of an A.C. step-down transformer. Be sure to obtain a four-volt transformer specially designed to run A.C. valve filaments, as unless this is done you may get hold of a transformer which will give four volts on a small load, but which will fail badly on a load of three amperes or so, as in this case. Philips, Heayberd, Radio Instruments, Varley, etc., all make suitable transformers for this set.

A high-tension supply of 120 to 150 volts is also necessary, and grid bias should be arranged to give one and a half volts positive, and whatever is specified for the output valve by the makers of the valve. Notice that one grid-bias positive is connected directly to the chassis and is that which is joined to the second hole of the grid-bias battery. Join up a suitable loud speaker and you are ready for the preliminary adjustments.

Neutralisation

Now set the reaction condenser at zero, and the neutralising condenser with all its plates inter-meshed. Switch on and wait for at least a minute, as this period will be occupied in heating up the valves. Do not be disappointed if you do not get results immediately.

After a minute, or a minute and a half, with an aerial coil in the first socket and a split-primary transformer in the second, place the aerial condenser (remember that the aerial and earth are not yet connected) at about 50 on a 100-degree scale, and swing the second condenser backwards and forwards. If the set oscillates at any point reduce the neutralising capacity so that it just does not oscillate, but if, as may quite likely happen, it does not oscillate, advance the plates of the reaction condenser until it does just oscillate at some point or other.

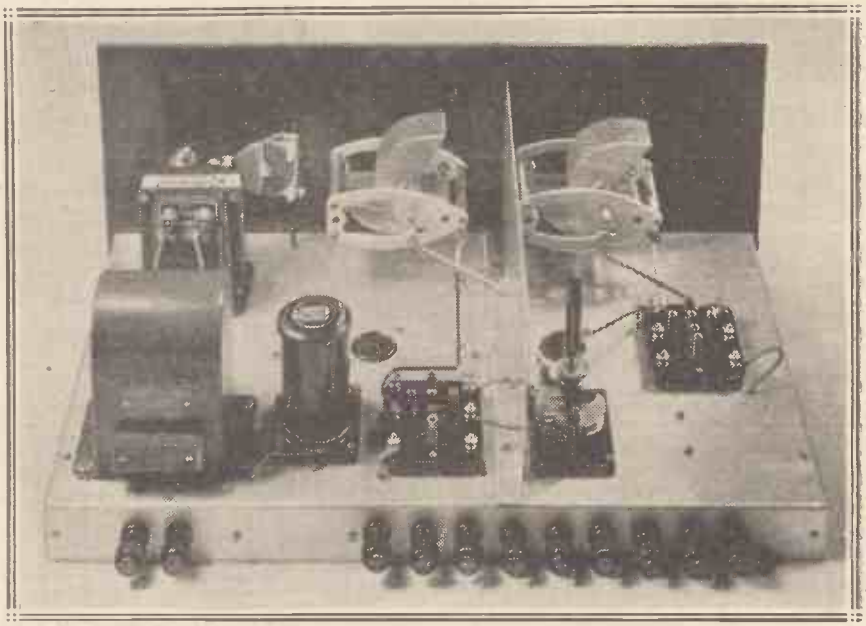
Now reduce the neutralising capacity until the set is just below oscillation point and again advance the reaction condenser until oscillation once more ceases. Reduce the neutralising capacity once more and carry out the same method until you find the reaction setting is carried so far that any increase *or decrease* of the neutralising capacity brings about self-oscillation. When this point is reached set the reaction condenser at zero again, leave the neutralising capacity as adjusted and connect aerial and earth, whereupon your set is ready for normal tuning.

Suitable Valves

With regard to the valves, using Marconi or Osram indirectly-heated four-volt valves I have found either the M.H. or the M.H.L. suitable for the high-frequency, the M.H.L. for the detector stages, and the M.L. in the output socket.

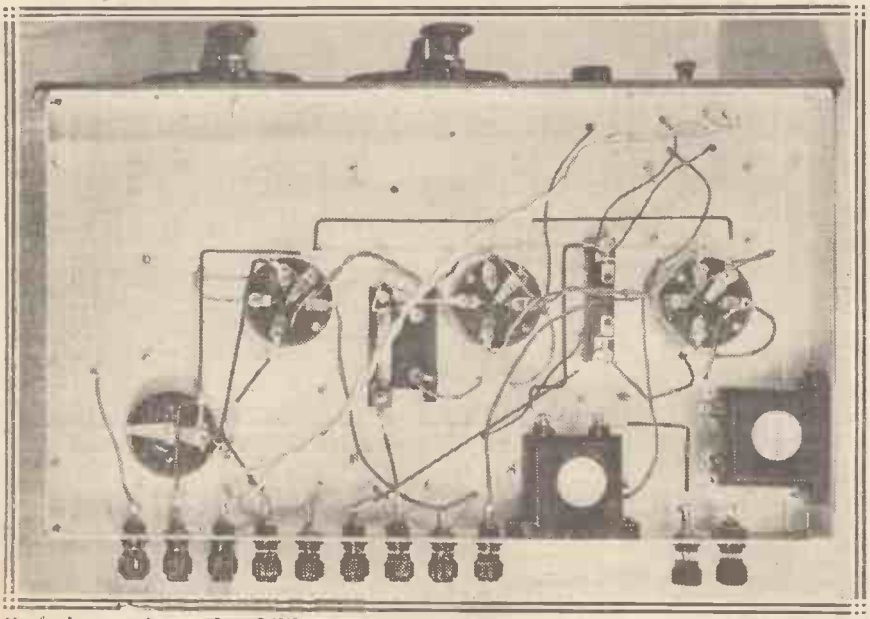
Next month I hope to discuss the results obtained with the set and also its use with *ordinary* valves for the benefit of those who have no electric mains.

WHERE IS THE WIRING?

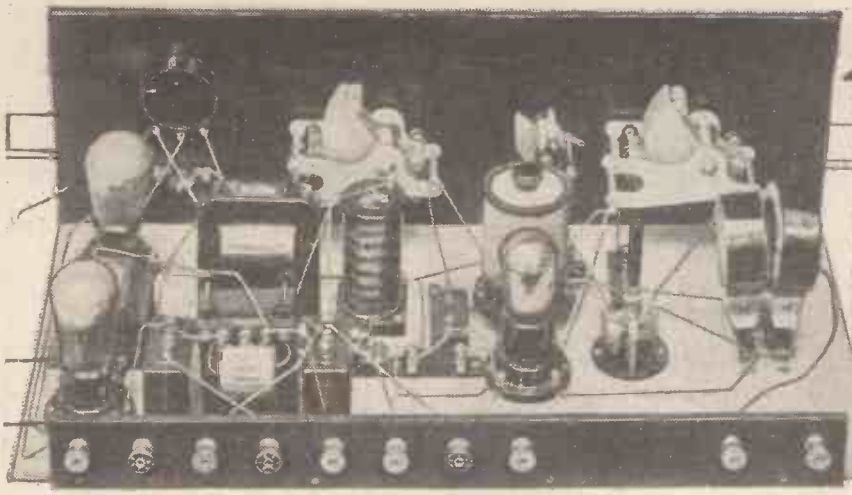


You may well ask this question, for the "upstairs" appearance gives the idea that the set is incomplete, all untidy leads and smaller components being mounted underneath.

PERFECT SCREENING, PERFECT STABILITY!



Perfect screening and stability are features of this set which everyone will welcome. Nothing could be easier to build or to operate.



ALL ABOUT WAVE-TRAPS

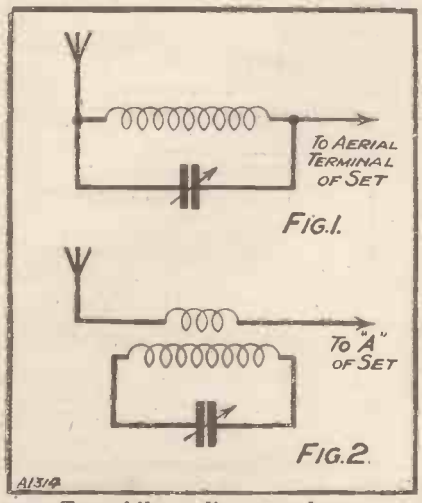
A timely article dealing with the various methods of preventing two different programmes from overlapping.

By G. P. KENDALL, B.Sc.

WHAT is to be done about this Brookmans Park business? Anybody who lives within about seven or eight miles of the new high-power regional transmitter will agree that the question is one of the most pressing ones of the day, and unless he is fortunate enough to possess an unusually selective receiver I think he will be likely to say that he doubts whether the problem is soluble at all.

A Desperate Situation

On the north side of London it has been found that the swamping effect of the new transmitter has proved even more overwhelming than was feared before it commenced operation, and with the advent of the second transmission the situation seems to be growing desperate in these localities.



Two of the earlier wave-traps.

Not merely is it proving difficult to cut out the Brookmans Park transmission in favour of foreign stations or 5 G B, but owners of the simpler types of sets are finding it a very difficult matter to separate the two regional transmissions one from the other.

Except in the really desperate case where a listener is situated within only a few miles of the station, it seems that some form of wave-trap or rejector will give considerable relief, if not a complete cure, and the Editor has asked me to undertake a review of the various types of traps and rejectors in the hope of providing some definite practical assistance in this direction.

The Simplest Form

First of all, a general idea of the working of the simplest types of traps and rejectors will probably be helpful. One of the simplest and earliest types of traps is shown in Fig. 1, this being a form which was actually employed in the very earliest days of broadcasting. It represents a rejector in its simplest and most elementary form, consisting of a plain tuned circuit included in series in the aerial lead, that is to say, between the aerial and the aerial terminal of the receiver.

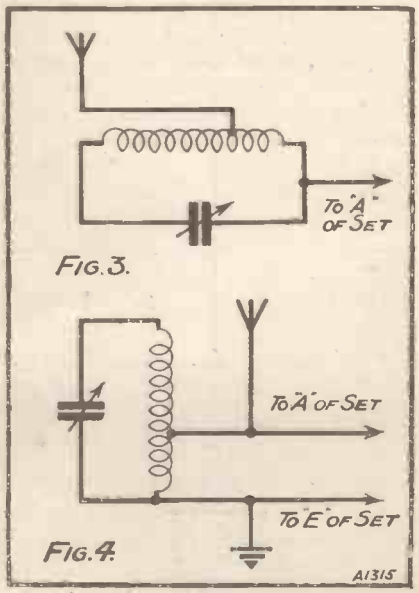
How it Works

The idea of a rejector like this is very simple. The circuit composed of the variable condenser and the coil is tuned to the wave-length of the station which it is desired to exclude. The circuit then presents a very high impedance to the signals of that station, and allows those of other stations to pass through relatively freely. If conditions are right quite a good rejection effect is obtained in this way, and this form of circuit was of considerable help in the early days.

Although, as I have said, when the constants of this rejector are suitably proportioned it gives quite tolerable effects, it is by no means ideal in practice with modern receivers, because it has undesirable effects upon the tuning circuits proper. Moreover, adjustments of the tuning circuit are rather apt to upset the setting of the rejector, and vice versa.

Coupling Methods

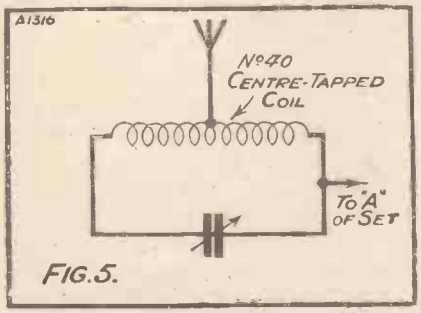
As wave-traps were developed one of the first steps was to take this simplest form and devise methods of coupling it into the aerial lead without actually including the whole circuit in series. One such method which met with a certain amount of success is shown in Fig. 2. Here you have the tuned rejector circuit actually separated from the aerial lead and coupled thereto by means of a small special winding.



Methods of using an "X" coil.

All About Wave-Traps—*continued*

A practical form of this trap might consist of a coil of about 50 turns of wire on a 3-in. tube shunted by a ·0005-mfd. variable condenser to form the tuned circuit, with ten or fifteen turns wound over the top of this inductance to provide the coupling winding. Fairly good trapping effects can be obtained with a device of this type, and it has little effect



Using a centre-tapped coil.

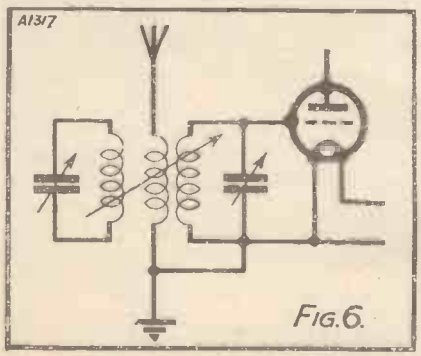
upon the tuning of the receiver, the adjustments being reasonably independent.

Only Moderate Effectiveness

The trapping to be obtained from this form of rejector, however, is not very drastic, and it is not likely to be very effective in the difficult situation produced by the arrival of the Brookmans Park transmitter. It is suggested, though, that it is a type worth trying out by those who possess receivers which are normally fairly selective and only require just a little help to enable them to get rid of this particularly powerful signal.

To get the best results from it, it is desirable to make the coupling winding one of about fifteen turns, with a few tappings so that you can try different degrees of coupling, and so find the one which suits your particular needs best.

A more effective scheme is shown in Fig. 3, which illustrates a form of



A coupled "absorption" circuit.

trap which has become almost standard practice of recent years. This also is by no means a new device, and was, I believe, actually first described by myself some time in 1925, in the form of a special rejector for removing the signals of the 5 X X station.

More Drastic Trapping

Considerably more thorough traping can be obtained with this circuit and indeed it forms the basis of quite a number of commercial wave-traps or wave-selector units at the present time.

A practical form of this particular trap which works quite well can be made up with a standard "X" type coil and a ·0005-mfd. variable condenser. Connect the coil and condenser in parallel and take the aerial lead to one of the tappings on the coil, another lead going off from what is normally the "earth" end of the "X" coil to the aerial terminal of your receiver. By trying the alternative positions for the aerial tapping lead you will probably find one which gives you quite effective trapping when the condenser has been properly set.

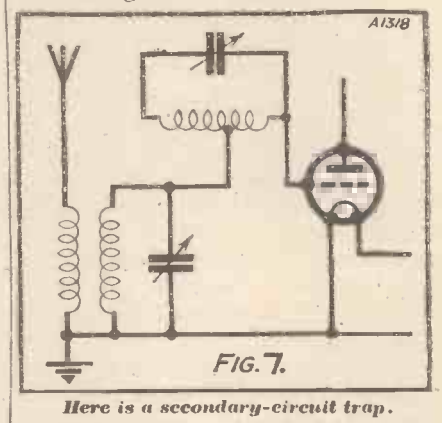
What it Will Do

A trap of this type should enable you to get rid of the Brookmans Park transmitter fairly easily, so long as you are not less than perhaps six miles from the station, and when correctly set its effect should be such that you will only hear the station strongly when you tune it in fully, and it should disappear fairly sharply when you detune in search of other stations.

To set a trap of this type it is necessary that you should proceed along the right lines, and the following method will be found as good as any. First of all, tune in the interfering station without the trap in circuit. Now detune until it comes down to about half volume, or at any rate until you have taken the tuning adjustment fairly well away from the exact setting.

How to Adjust it

Now bring the trap into circuit and proceed to vary the capacity of its tuning condenser. You should presently find a setting which causes the strength of the local transmission to go down almost to nothing, and upon either side of which it should reappear quite strongly. Endeavour to locate this point as accurately as possible, and then you can leave your trap set and make all further adjustments on the tuning of the receiver.

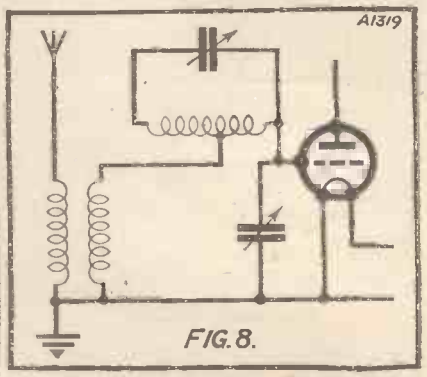


Here is a secondary-circuit trap.

This, of course, is all very well in so far as it enables you to get over the difficulty of one of the interfering wave-lengths, but what about the second one? Well, so long as you are not very close to the Brookmans Park transmitter you will probably find that just this single trap is a great help.

Removing the Longer Wave Station

If you use it to get rid of the longer of the two waves (the 356-metre one) you will find that the greater part of the dial becomes free for foreign stations and 5 G B, since the usual



Another form of the above arrangement.

experience is that the lower-wave Brookmans transmitter only covers just the lower portion of the dial and does not spread much over the upper portion. This, of course, depends very much upon the nature of the set you use, the size of your aerial, and lastly, but by no means least, your distance from the station.

Fig. 4 illustrates another form of

(*Continued on page 296.*)

CLEARING THE ETHER!

Some first-hand details of a remarkable new invention for freeing programmes from interference.

By THE EDITOR

READERS of the WIRELESS CONSTRUCTOR may have seen in the daily press a brief description of a new invention called the "Stenode Radiostat" for which sensational claims have been made. They will also have seen that towards the end of the year demonstrations were given to the Press, in which a degree of selectivity previously unheard of was obtained.

A Startling Demonstration

For example, a receiver containing this invention was tuned to Brookman's Park transmission, while a few feet away was placed a powerful oscillator so tuned as to give a strong heterodyne note with the Brookman's Park transmission when any of the existing forms of receiving apparatus were used. By means of the Stenode Radiostat invention the Brookman's Park transmission was tuned completely free of this interference without the quality being affected!

The beat-note was changed as desired by the listeners, and even when it was brought so low as to give tremendously powerful interference within a few hundred cycles of the Brookman's Park carrier frequency it could still be eliminated completely without loss of quality.

"All Wrong"!

Now this demonstration, according to generally accepted theories, was "all wrong"! The theory, accepted universally, was that in order to get proper quality in reception it was necessary to have a receiver capable of responding not only to the carrier-wave frequency, but to a band of frequencies (the so-called "side-bands") extending to about 5,000 cycles on either side. In the same way it was generally held that if we make our receivers tune sharper than this we "cut off the side-bands," losing the high notes and making the reproduction "plummy." Certainly all receivers so far constructed and capable of tuning to a narrower band of frequencies than about 10,000 have given results which fitted in with this theory.

Now comes the Stenode Radiostat, the invention not of an unknown experimenter, but of Dr. James Robinson, Ph.D., late Chief of Wireless, Royal Air Force, a well-known scientist and, as older readers of the WIRELESS CONSTRUCTOR know, at one time chief of the Research Laboratories of Radio Press, Ltd.

Extremely Important

In the Stenode Radiostat receiver the band of frequencies utilised for reception is well under 100 cycles wide. As was demonstrated to the press, and as has frequently been demonstrated in much greater detail to leading scientists, the quality of both high- and low-note reproduction is at least as good as with any other type of receiver. Obviously, then, we have here a discovery and an invention of major importance.

Working on the assumption that for the proper transmission and reception of radio telephony a band of frequencies must be employed, let us see how the width of this band is arrived at. For the proper reproduction of speech and music we must be able to transmit and receive faithfully all frequencies between about 50 and 5,000 or 6,000.

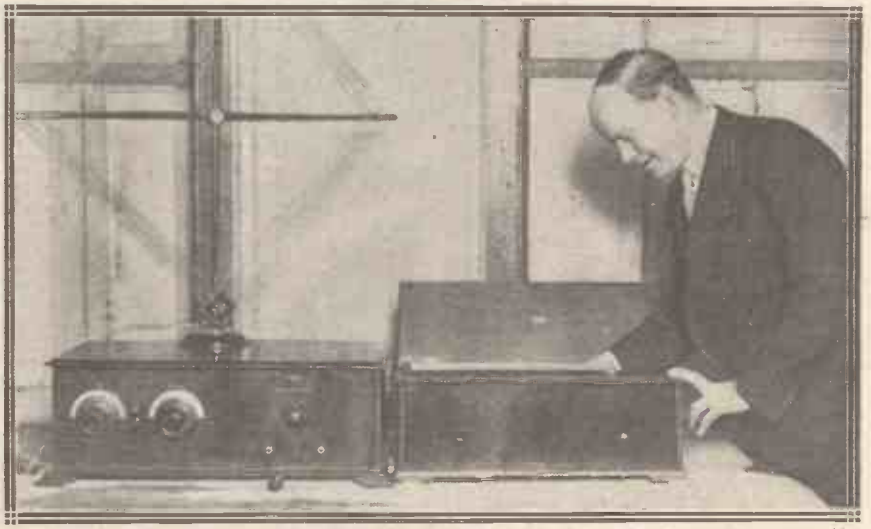
Although we get a slight improvement by transmitting frequencies above 5,000, this is generally considered the upper limit for practical purposes, and if we get faithful reproduction over the whole range from 50 to 5,000, results are uncannily real.

Those Side-Bands

It is generally accepted (or *was*, until the arrival of the Stenode Radiostat) that the effect of modulating the carrier-wave of a broadcasting station was to produce bands of essential frequencies on each side of the carrier frequency; thus the modulation of the carrier-wave by a 5,000-cycle note was held to produce two frequencies, one the carrier frequency plus 5,000, and the other the carrier frequency minus 5,000.

The modulation of the carrier

THE INVENTOR LOOKS INSIDE!



Dr. Robinson, inventor of the Stenode Radiostat, is here shown looking into the instrument, the contents of which had hitherto been a very closely guarded secret.

Just how important this invention is and its bearing upon radio technique is not immediately obvious, until we consider a few vital facts. First of all, let us look at radio according to existing theories and practice and endeavour to understand the present position of the radio art and the congestion of the ether.

Clearing the Ether!—*continued*

frequency with a note of 50 was supposed to produce the frequency of the carrier plus 50 and the carrier minus 50, and so throughout the whole musical scale, each modulation frequency producing a frequency of the carrier plus and minus that frequency. In that way we arrived at the position that in order to transmit and to receive properly we must occupy a band of frequencies of 5,000 cycles on either side of the carrier-wave, giving 10,000 cycles in all.

The Prague Plan

Now between 200 metres and 600 metres there are exactly a million cycles, the frequency of a 200-metre transmission being approximately 1,500,000 and that of a 600-metre transmission 500,000. We thus arrive at a result that between 200 metres and 600 metres there are a hundred "channels." The Prague Plan decided that stations could be run as close as 9,000 instead of 10,000, this being a kind of compromise.

Long-Wave Position

The position on the long waves is much worse, for between 1,000 and 2,000 metres there are only fifteen available channels, and we thus see why there has been a limit to the number of broadcasting stations which can be worked simultaneously. Furthermore, when the stations are placed as close as this it is assumed that they will maintain their frequencies accurately, which quite a number fail to do, as readers know only too well.

Seeking a Solution

Next let us consider what would happen if we placed the stations 5,000 cycles apart, thus roughly doubling the number of available channels. Before the arrival of the Stenode Radiostat there were no receivers capable of tuning to such a narrow band as 5,000 cycles without a very poor and "plummy" reproduction, giving practically no high-note reproduction, and, secondly, high-pitched whistles or beat notes were set up between stations working so close as this.

The problem thus appeared insoluble, and every available channel in the ether seemed to be used up for commercial purposes, Army, Navy, and Air Force work, ship and shore working, broadcasting or some other radio service. Even on the very short waves, which have become so popular during the last year or two, the limits have had to be very carefully set, and the poor amateur transmitter who a year or two ago had this field to himself is now severely limited as to the frequencies or wavelengths on which he may work.

With all these facts in mind, Dr. Robinson sat down a year or two ago to make a thorough and searching investigation into radio problems with the idea of finding some way out. Dr. Robinson told me some time ago that it struck him as absurd that Nature, after revealing to us the immense possibilities of etheric communication by electro-magnetic waves, should within such a short period bring us up against such an obstacle.

Daylight at Last

About the middle of last year he began to see light, and one day, when we were sitting in his club after lunch, Dr. Robinson produced an envelope and a pencil and outlined to me his ideas on the matter. Immediately I saw that here was an invention of immense importance which would enable the ether to be cleared of all congestion. True, as it stood it was only a theory, but to anyone well acquainted with the art it was a theory that "rang true," and in a moment I was sharing his enthusiasm.

Knowing that I had a particularly well-equipped research laboratory, Dr. Robinson asked me whether I would collaborate with him and carry out the necessary experimental work to see whether the principle could be made to operate in practice. Within a day or so I had carried out sufficient preliminary experimental work to show me that Dr. Robinson was on the right lines, and then began some intensely interesting experiments to confirm this theory step by step.

Remarkable Selectivity

By November we had produced in my laboratory a receiver incorporating Dr. Robinson's invention which gave a selectivity vastly in excess of the best obtainable before. The selectivity was so great that the variable condenser for the tuning consisted merely of two brass plates separated by about half an inch, both about the size of a halfpenny, the rear plate being attached to a fine screw thread so that it could be made to advance towards or recede from the second plate, by a very slow

(*Continued on page* 300.)

THE RADIOSTAT'S RAZOR-EDGED TUNING

Dr. James Robinson, Mr. Percy W. Harris, and some interested friends examining the new "Stenode Radiostat" system devised by Dr. Robinson to reduce interference between radio stations.

The "DOMESTIC" TWO

A real "household" receiver which incorporates several unique features and is intended for long- or short-wave reception without the need for coil changing.

By G. T. KELSEY.

THE object of the "Domestic" Two receiver is very aptly summed up by the definition to be found in any standard reference dictionary of the word "domestic," to wit—"Pertaining to the home, not foreign."

But explicit as it is, that is hardly sufficient with which to dispose of the introduction, for actually, although primarily a "home" receiver, the design of the "Domestic" Two has been carried out to incorporate several novel features, with all of which, in turn, I intend to deal.

Dual-Wave Coil

First a point which seems nowadays to gladden the hearts of most people is that although the set is of dual-range type, that is to say, is intended for the reception of broadcast and long-wave stations, there is no coil-changing. This has been made possible by introducing one of the special "Chassis" coils as was used by Mr. Harris in his now famous "Chassis" Three receiver.

The second point of interest is to do with the L.F. stage, which by means of a carefully worked out switching arrangement is optional. Thus if for any reason it is desired to use 'phones with the set, such a procedure can be carried out without the necessity for wasting the current to the second valve as would normally be the case by using a volume control or by de-tuning.

Simplicity of Control

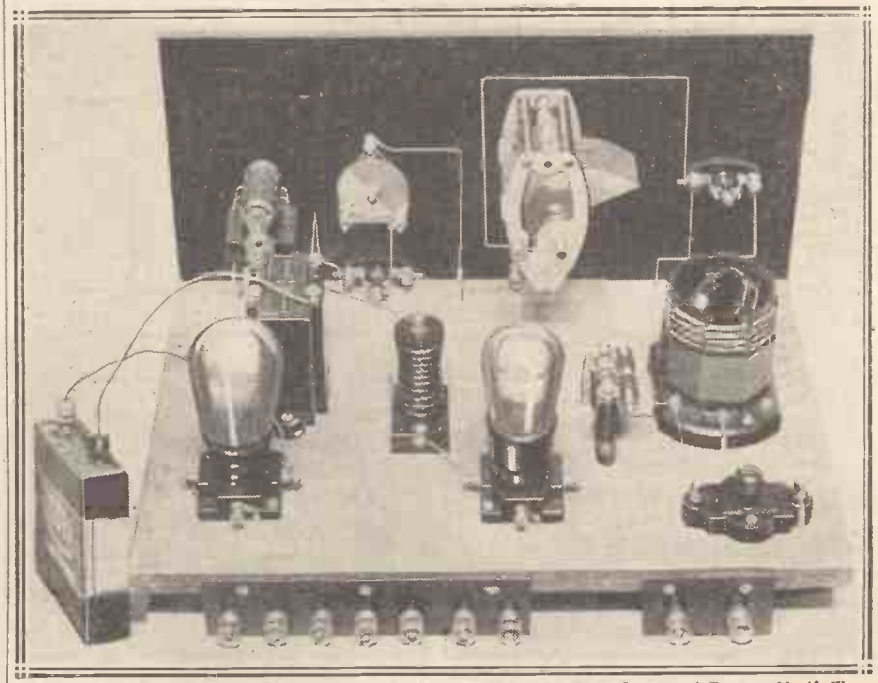
From the point of view of operation the "Domestic" Two is simplicity itself, even though perhaps the "knobby" appearance of the panel does not altogether seem to bear out such a statement. Nevertheless, the fact remains that the set *is* simple to operate, and strictly speaking there are only two knobs which require manipulating. Actually when once the set has been adjusted there is only need to use the L.T. switch when it is desired to switch the set on or off.

Those of you who are not altogether happy at the prospects of the wiring operation should pay particular attention to what, for want of a better name, I have called the "subway" method of connecting employed in the present set.

If you examine the photographs you will notice that, unlike the conventional panel and baseboard arrangements, the baseboard of the "Domestic" Two is raised about one inch up from the base of the actual panel, and is held in position at the back by the terminal strips.

A Neat Appearance

In any set where L.F. switching is employed there almost invariably arises the difficulty of keeping the wiring neat yet efficient on account of the wires to the switch, which for obvious reasons it is necessary to mount on the panel.



Built with the filament and H.T. leads under the baseboard, the "Domestic" Two presents an extremely neat and workmanlike appearance.

The "Domestic" Two—*continued*

For proof of this you need only refer to the diagram of the underside of the baseboard, and visualise what the back-of-panel appearance of the present set would have been like with all these wires carried across and in and out among the various components.

Definitely, then, in the present case there is an advantage in carrying the wiring under the baseboard, particularly that going to the switch. But quite apart from this, in my opinion, the operation of wiring becomes very much more simple with under-baseboard connections.

The Switching Scheme

To those of you who are not particularly technical (nothing of which to be ashamed!) it would perhaps be helpful if I explain the need for three sets of contacts on the change-over switch.

First, as is the usual scheme, it is necessary to arrange for the output of the first valve to be connected either to the primary of the L.F. transformer, or, when only one valve is required in circuit, direct to the output terminals of the set. This then takes up one set of contacts, and since when only one valve is in use the second valve filament will require to be broken, a second set of contacts is so arranged to enable this to be done quite automatically when the switch is moved.

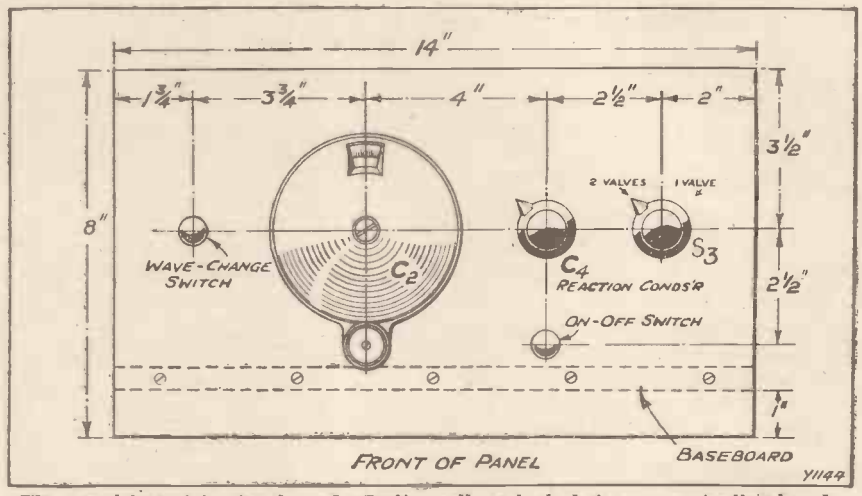
The purpose of the third set of contacts is the one over which I expect the most doubt will exist, although really the explanation is quite simple.

When the switch is arranged so that the output of the detector valve is joined to the primary of the transformer, the H.T. voltage on this valve is, for the purpose of explanation, equivalent to the voltage at which the H.T. +1 wander plug is connected on the battery (usually about 60).

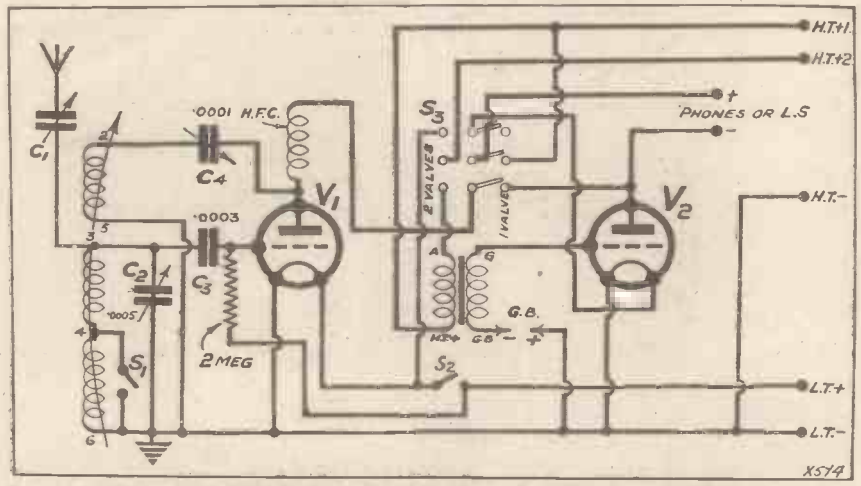
With the switch in the reverse position, however—that is to say, with the output of the first valve connected direct to the set output terminals—the H.T. applied to the anode of the detector valve would be obtained via the +2 tapping (usually at 100 or 120 volts).

It is quite feasible that the sudden increase in the voltage applied to the anode of the detector valve consequent upon the change over would be sufficient to start the set oscillating, a state of affairs which, for obvious reasons, is very undesirable.

The third set of contacts is therefore arranged so that the voltage on the anode of the detector remains practically the same in which ever position the switch is set.



The panel layout is simple and effective, all controls being conveniently placed.



There is nothing "stuntish" in the circuit, as can be seen above. Either one or two valves can be employed and a "chassis" type coil is utilised.

Earlier reference has been made to the fact that the "Domestic" Two receiver is essentially a set for the home, and at this stage I ought perhaps to add that in consequence it is not ultra selective, that is, as modern sets go. For all that, quite a reasonable measure of selectivity is possible by virtue of the fact that within certain limits the degree of selectivity is variable.

Quite definitely, however, this set would not cut out Brookman's Park at two or three miles; and even at six miles, which is still in the swamp area, some sort of wave-trap would undoubtedly be necessary.

Question of Selectivity

From the set designer's point of view, the question of the effect of the Brookman's Park transmitter is one requiring very careful attention, but at the same time we must not forget our hundreds of readers who are not in any way affected by the new Regional station. To them, of course, the necessity for selective circuits is not nearly so great, and since in many cases selectivity is only obtained with some sacrifice in signal strength, the use in their case of a selective circuit is tantamount to sacrificing a certain amount of signal strength unnecessarily.

The "Domestic" Two—*continued*

Of course, even in areas not at present served by a Regional station a reasonable degree of selectivity is desirable, even if only to separate the local station from 5 G B, which station is received satisfactorily in many parts of the country.

WHAT YOU WILL REQUIRE

- 1 Panel, 14 in. × 8 in. (Radion). (Becol, Ebonart, etc.)
- 1 Cabinet for above panel, with baseboard 9 in. deep (Raymond). (Camco, Artcraft, Pickett.)
- 1 ·0005 variable condenser (Lissen). (Igranic, J.B., Lotus, Utility, Dubilier, etc.)
- 1 Slow-motion dial (Lissen). (Igranic, Formo, etc.)
- 1 Reaction condenser, ·0001 or ·00015 (Lotus). (Magnum, Lissen, Ready Radio, Utility, etc.)
- 2 On-off switches (one for wave-change switching) (Lotus). (Benjamin, Igranic, B.A.T., Lissen, etc.)
- 1 Three-pole change-over switch (Wearite). (Bulgin, etc.)
- 1 Special "Chassis" Three coil (Colvern).
- 1 Pre-set condenser, max. capacity about ·0005 (Igranic). (Formodensor.)
- 1 ·0003 grid condenser (T.C.C.). (Dubilier, Atlas, Lissen, etc.)
- 1 2-megohm grid leak (Igranic). (Lissen, Dubilier, etc.)
- 1 H.F. choke (Ready Radio). (R.I., Lewcos, Varley, Igranic, Magnum, etc.)
- 2 Sprung-type valve holders (Marconiphone). (Benjamin, Lotus, etc.)
- 1 L.F. transformer (Hypermu). (Ferranti, Varley, Brown, Cossor, Telsen, etc.)
- 1 Terminal strip with seven terminals, and one with two.
- Connecting wire, Systoflex, screws, flex, wander plugs, etc.

With its flexibility in matters of selectivity the "Domestic" Two is ideally suited for this purpose, and if you are contemplating the construction of a real "home" set—by which I mean to imply a set that can be handled in your absence by the wife (if any!)—then you will not be far wrong in constructing a replica of the set illustrated on this and following pages.

Marking Out the Panel

Closely allied with the question of the suitability of a set is, of course, that of the cost. In the present case, bearing in mind that the set is of the wave-change variety, the expenditure for the necessary parts should not be very heavy.

As is usual practice, a list of those required is given separately on this page, and although the actual components used in the original are in each case mentioned first, it should be understood that any alternatives will be quite satisfactory providing they are of a reliable make.

With the necessary components to hand, commence the constructional work by marking out the panel in accordance with the diagram provided for this purpose. Do not forget, however, that since you will be making all the necessary marks on the back of the panel it will be necessary to reverse the order of things shown in the panel diagram.

The Terminal Strips

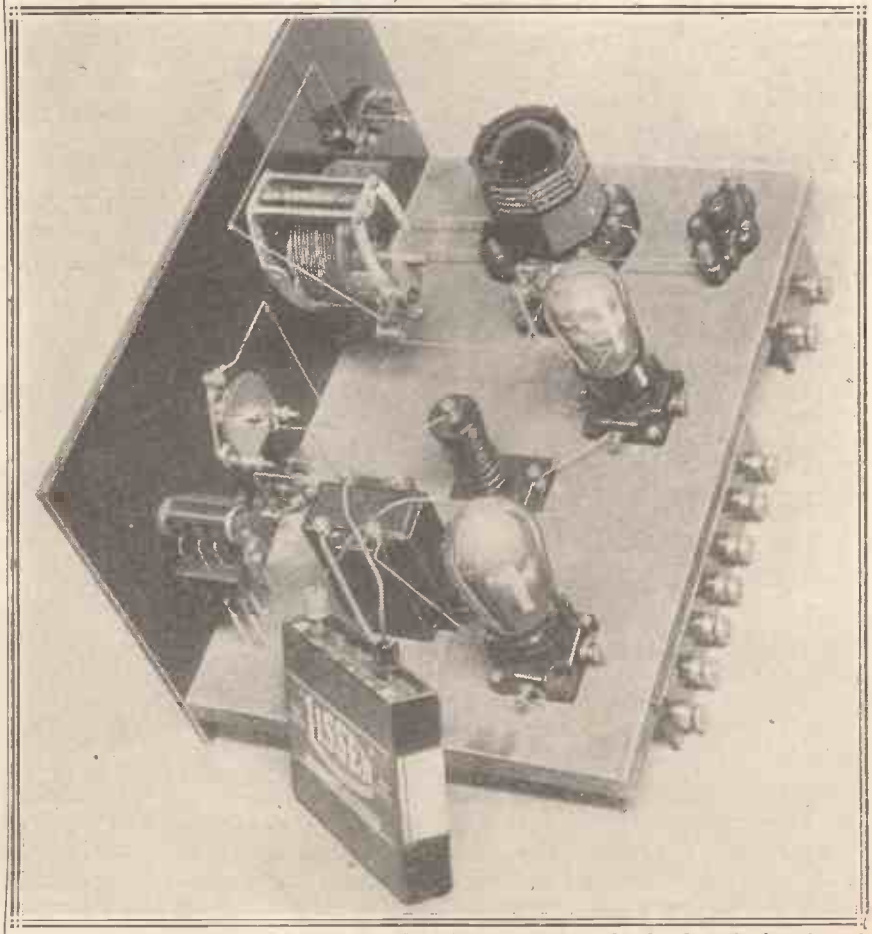
There is nothing particularly difficult in the panel-drilling operation, and when all the required holes have been made the baseboard can be fixed in position. As has been mentioned previously, the baseboard is held in position at the back by means of the terminal strips, and accordingly the depth of these should be arranged so that the amount of ebonite below the baseboard is the same as at the front of the set.

Drilling the Baseboard

The baseboard components are few, and their exact positions can be obtained from the wiring diagram. Before screwing them finally into position, however, carefully mark with a pencil the holes through which ultimately certain of the wires have to pass. You can then drill these holes before any of the components are fixed.

With this task completed, attention can next be paid to the fixing of the panel and baseboard components, and in view of the detail given in the back-of-panel diagram it seems to be quite unnecessary to say anything else in this connection.

Next, then, comes the actual wiring, and for this purpose you will require a quantity of No. 18 tinned copper



There is plenty of room for the 9-volt grid-bias battery to stand on the baseboard. Above it is moved to show the L.F. transformer.

The "Domestic" Two—*continued*

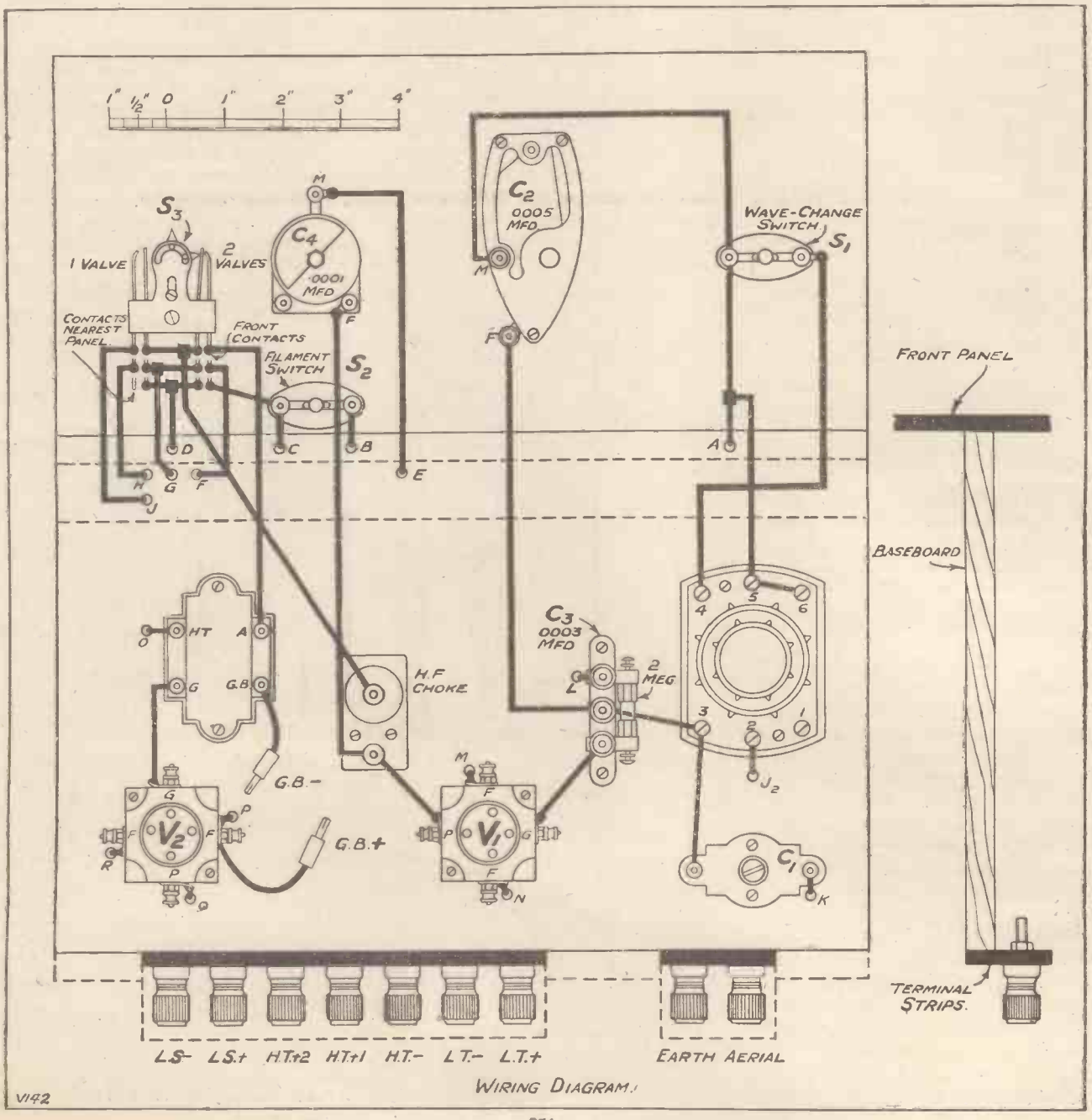
wire and some Systoflex. If you prefer you can, of course, use Glazite, or, for that matter, any of the other types of insulated connecting wires, since departures from the design in this direction are not likely to make any difference to results.

In order to make the wiring task as simple as possible it will be noticed that in addition to the normal back-of-panel drawing there is another one showing the underside of the baseboard, and by using these in conjunction with one another no difficulties are likely to arise. By way of explanation, I should, however, mention that the key letters shown on the main back-of-panel diagram correspond with those on the under-baseboard view.

Under-Baseboard Wiring

For example, the wire passing through the baseboard at "A" in the one view emerges at "A" in the other view, and so on. Just one final note in connection with the wiring before passing on to the operating details, and that is to do with the wires which connect certain of the components *without* passing through the baseboard.

Do not, for the sake of neatness, depart from the original by taking these wires under the baseboard, as otherwise you will be liable to interfere with the efficiency of the set. Grid leads, and certain others in a set, should always be kept as short as possible, hence the reason why in the present set it is desirable to use some direct connections.



The "Domestic" Two—*continued*

The "Domestic" Two is now complete, and the next thing therefore is to test it. First join up the aerial and earth leads and those which will connect the H.T. terminals to the actual H.T. battery. You will require a 100- or 120-volt battery, and the two ends of the battery—that is to say, the positive and the negative sockets—should be joined to the H.T. plus two and H.T. minus terminals respectively.

Detector Valve Voltage

The exact position on the battery at which to connect the H.T. plus one terminal is a matter which will have to be determined by experiment. As a start, however, it can be connected to a socket at somewhere about 60 volts.

Next join up the L.S., and the L.T. battery, the voltage of which will, of course, depend upon the valves chosen. In this connection it should be mentioned that two-, four- or six-volt valves can be used in the "Domestic" Two quite satisfactorily providing the right types are chosen. For the first position (the detector) you will require a valve of the type usually styled "H.F.," and for V_2 a small power valve will, in most cases, be satisfactory. If, however, you are located fairly close to your local station and are desirous of really powerful loud-speaker results, it may be necessary to use a valve of the super-power type for V_2.

With the wave-change switch in the "short-wave" position (in most cases pulled out), switch the set on, and with the reaction condenser set at zero turn the tuning condenser until the local station is found.

Make a special note of this setting, and whatever happens *never* pass through it without first making sure that the reaction condenser is at zero. Having (for the benefit of your neighbours!) uttered this word of warning, you can now, by the *judicious* use of reaction, locate the setting for 5 G B.

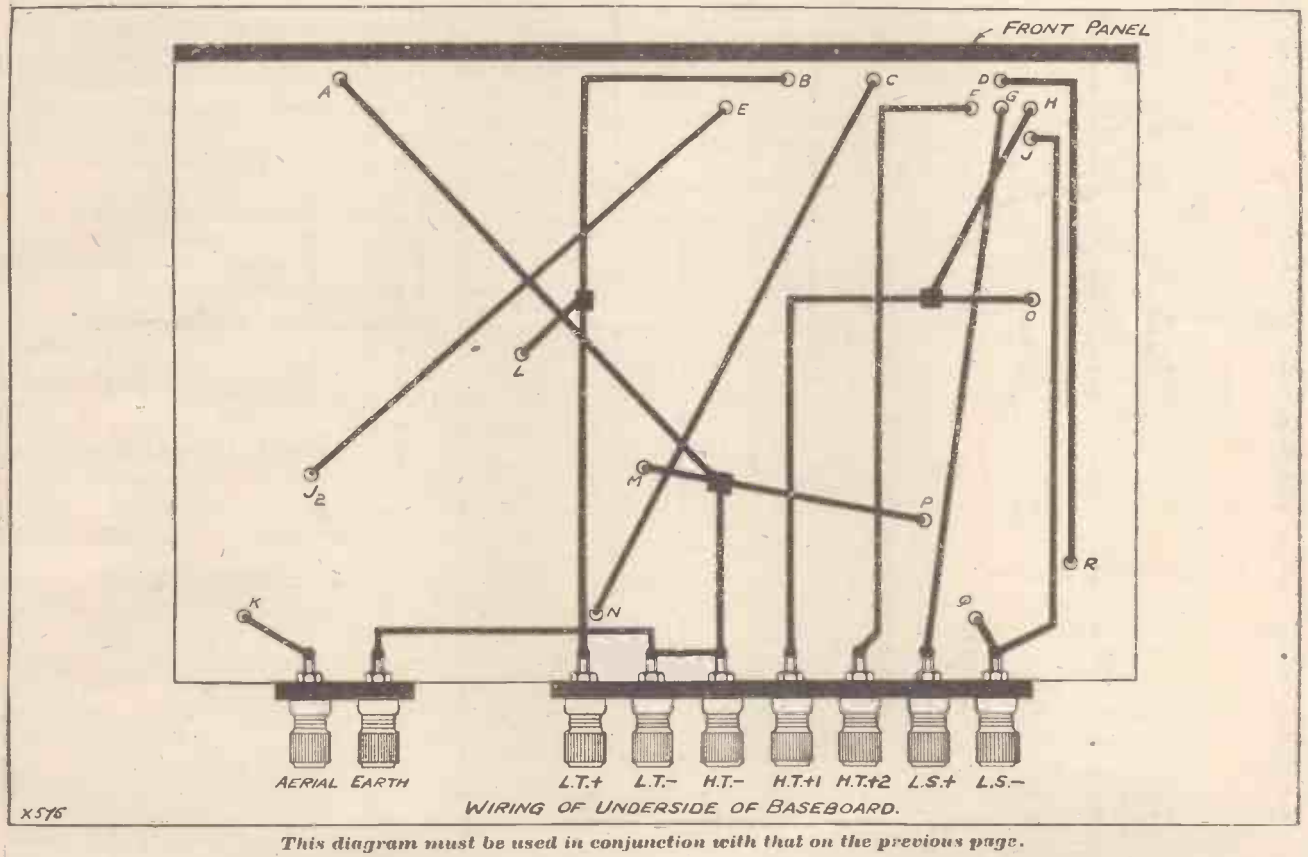
If any difficulty is experienced in making the set oscillate, try altering the position of the rotor inside the special "Chassis" coil. Incidentally, in this connection, not only is it possible to rotate the reaction winding, but if necessary the actual position of the rotor in relation to the outer windings can be altered.

The two metal rotor supports are provided with several holes on either side, and the rotor pivots on two pins which fit into these holes. Thus if reaction control is at all "ploppy," or if the set cannot be made to oscillate, the rotor position can be raised or lowered as necessary.

Adjusting the Reaction

For best results the reaction control must be perfectly smooth, and in this connection it may be found necessary to make adjustments to the H.T. voltage on the detector valve. Alteration of the position of the reaction coil rotor may also help in this respect.

Variations in the degree of selectivity are obtained by altering the setting of the series aerial condenser C_1, and it should be possible to reduce the interference from the local station considerably by reducing the capacity of this series condenser. Having once made all the necessary adjustments, the L.T. switch is the only thing which need be touched when it is desired to switch the set on or off, and it should not take the family long to master this operation!



WIRING OF UNDERSIDE OF BASEBOARD.

This diagram must be used in conjunction with that on the previous page.

Some typical radio faults reviewed and questions answered.

By P. R. BIRD.

Wave-trap Worries!

THE coming of the Regional Scheme and this second-wave-all-the-time is not to be an unmixed blessing! Even the high-power stations, radiating their double programmes, will not satisfy the keen long-distance-getter; but the two tremendous transmissions are likely to blot out many of his much-desired foreigners!

Recently there has been an enormous increase in the interest in wave-traps, and although this particular class of apparatus is so simple that very little goes wrong with it, quite a lot of bother is being experienced. Curiously enough, the chief trouble with wave-traps is not with the wave-traps at all, but with human nature!

The Real Reason!

So many listeners are dashing, impatient, to-blazes-with-the-Brookmans-Park kind of fellows, and they often find to their astonishment that when a good wave-trap is connected up they still hear the unwanted signals. They turn the wave-trap condenser from zero to maximum, and then whizz it back to zero again, and still the station is there!

Pausing for a second to curse the wave-trap, they try again, and still it is there. And, finally, they call in a more experienced man, who, adjusting the wave-trap condenser *slowly*, as it should be adjusted, suddenly finds that tricky point which takes all the sting out of the interference!

Scores of wave-traps have been discarded as useless simply because the user made his condenser adjustment so quickly or so carelessly that the trap had no chance to work.

So whether your own instrument uses an ordinary condenser dial or one of those screw-driver adjustments, remember that half the battle with a wave-trap is to set it right in the first instance, and that this must be done slowly and painstakingly if success is to be assured.

One of the few things which can prevent a wave-trap from working properly is close proximity to a screen. Coils, it will be remembered, are not merely hanks of wire round which programmes flow, but are the centres of magnetic disturbance which reaches out for a space of several inches round the coil. So tuning coils, wave-trap coils, H.F. chokes, etc., require a certain amount of magnetic elbow room.

If you place them close against the metal vanes of a condenser, a metal screen, or similar conductor, you arrange that the magnetic fields, instead of doing their correct work, are all the time setting up currents in this nearby conductor. This is a common cause of flat tuning in the case of tuning coils, and of inefficient wave-trapping.

To place a screen right up against a coil is rather like half-stunning a drowning man by throwing a heavy lifebelt at him, and the lamentable results will remain in spite of the laudable intention!

H.T.B. Renewals

The H.T. battery is generally something of a nuisance, and the reason that so many of these batteries give trouble is that they are incapable of supplying the current required of them. Consequently they are always overworked and rapidly run down.

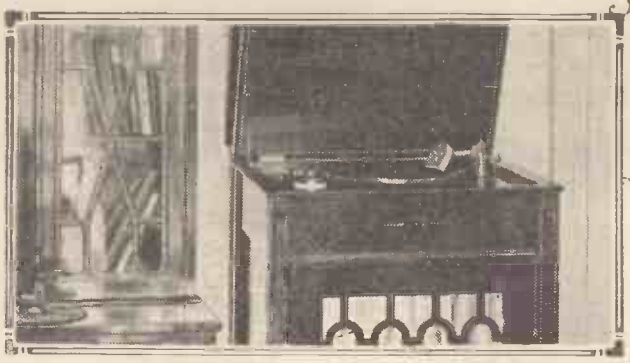
The correct way to choose an H.T. battery is to ascertain how many milliamps your set is taking in H.T. current, and to choose a battery which is able economically to stand up to the current drain imposed upon it. If a milliammeter is connected in the set's H.T.— lead you can actually measure the high-tension consumption of the set. If it is anything up to six milliamps, the ordinary standard H.T. battery is adequate.

If, however, it is more than six milliamps when the proper grid bias, etc., has been applied, a *double*-capacity battery is required, and, of course, if the high-tension consumption is more than ten milliamps a double-capacity type will be inadequate, and one of the triple-capacity variety will be necessary.

Calculating Current

Not everybody has a milliammeter, but fortunately where such an instrument is not available the current taken by the set can be calculated by reference to the valve-maker's curves. If you inspect the grid-volts anode-current curve you will see the line corresponding with the high-tension voltage you employ.

Along the bottom line in the graph is shown the correct negative bias (if any) which is necessary to bring the working point to the required point on the curve of the valve, and opposite to this point the anode current in milliamps is shown. By adding together all the milliamps required by the different valves you have the total milliamp consumption of your set and thus you can ensure buying the right battery.



WITH PICK-UP AND SPEAKER

Volume-Control Resistances—Comparing Pick-Ups—Scratch Filters—Input Transformers—Pick-Up Curves—The "Novotone."

Conducted by A. JOHNSON-RANDALL.

WHAT should be the resistance of a volume control for pick-up work? This is a question which must occur to most pick-up users at some time or other, but it is one on which definite recommendations seem to be very rarely given. Well, this resistance question is really not at all a critical matter. So long as the total resistance of the volume control is not below a certain figure it scarcely matters what it actually is.

Avoid a Low-Resistance Control

If the resistance is too low the volume control begins to draw an actual current from the pick-up circuit, and may have unfortunate effects upon the reproduction characteristics of the instrument, but so long as this does not occur to any perceptible extent almost any figure will suit.

Pick-ups vary considerably in the value of resistance which may be connected across them before sufficient current flows to upset the response curve, but you can take it as quite a safe rule that any volume control of the high-resistance potentiometer type commonly employed in inter-valve circuits will serve the purpose admirably. A value of $\frac{1}{2}$ megohm or 1 megohm seems to suit all requirements, and has never in the experience of the writer of these notes been known to produce any adverse effects.

Quick Pick-up Comparisons

Readers who are keen on getting the very best possible results from their electric gramophone outfit must have at times occasion to compare one pick-up with another, so possibly some hints upon the best method of making such comparisons may be of assistance.

Right at the start, the reader should be warned against the common method which consists in running a given pick-up over a whole record chosen because it is thought likely to show up the qualities of this particular pick-up, then disconnecting the standard pick-up, substituting the one in which you are interested, and then running over the record once again.

Such comparison methods as this are really of little value, because the time which must elapse between listening to one type of reproduction and the other is usually sufficiently great to make it impossible for the ear to make a true comparison, simply because you cannot carry the memory of sounds in mind for a sufficient length of time. To be really effective and instructive it is necessary to make almost instantaneous comparisons, and so some system of very quick change-over between your standard pick-up and the one under test is extremely desirable.

A very excellent method of making comparisons which is often used in laboratory test work is this: Have your standard pick-up mounted on a tone-arm or special carrier-arm as a permanency on the turntable, and arrange somewhere about the gramophone unit a single-pole change-over switch. Then mount up another carrier-arm, preferably one of the types possessing a more or less universal fitting to take different forms of pick-ups, and arrange upon this a pair of flex leads to which the pick-up under test can be connected.

Take this flex lead, and also the twin lead from your standard pick-up, to the change-over switch, and so out to your amplifier, the actual connections being shown in a diagram reproduced herewith. Upon examination of this diagram you will see that the operation of the change-over switch takes you over from one pick-up to the other, and so the desired quick comparison is obtained.

Instructive Testing Method

In use it is a good scheme to start the standard pick-up upon the edge of the record first, allow it to get a lead of perhaps one groove or two grooves, and then start the pick-up under test. Then by operating the switch suitably you can hear a particular passage played by your standard pick-up, and then go over to the one under test and hear the same passage over again, with only a few seconds between the two tests.

BRINGING OUT THE BASS

The "Novotone"—on which a test report appears in these columns—is here shown coupled up to a Woodroffe pick-up. A variable resistance can be placed across two of the terminals to act as a scratch filter.

For some particularly critical comparisons it may be advisable to separate your pick-ups by only, perhaps, half a groove, so that you only hear a very short passage played on each, with a correspondingly quick

With Pick-up and Speaker—*continued*

comparison, so that the ear has not time to forget what it has just heard before it hears the same passage over again as reproduced by the second pick-up.

Identical Volume Necessary

Just one practical point concerning this method of testing. It is most important that all comparative tests should be made at the same volume, and so it is sometimes advisable to connect volume controls across each pick-up separately, so that before you begin your actual comparative test you can adjust the volume given by each one to exactly the same level. These volume controls, by the way, are actually shown in the diagram just referred to.

A word of warning about scratch filters. The improved high-note response of some of the later pick-ups seems to be tending to make needle scratch rather prominent, and so some users may be tempted to turn for relief to some form of scratch filter. It is just as well that they should be warned that this matter of scratch elimination is no simple one, and it is quite easy to impair considerably the quality of reproduction by the use of an unsatisfactory filter.

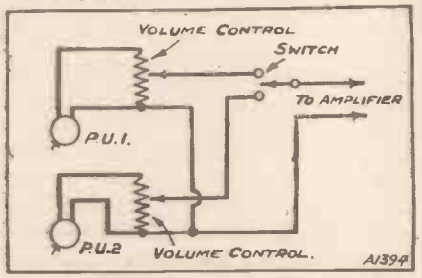
The fact is that the noise commonly described as "scratch" appears to be a mixture of fairly high frequencies, some of which, at any rate, fall within, or very near to, the upper end of the normal reproduction range.

Danger of High-Note Loss

It is quite easy to produce a filter which will eliminate this noise, but to prevent that filter from eliminating likewise some of the actual reproduction is by no means so simple. Some authorities even go so far as to say that it is impossible to remove the scratch properly by means of an electrical filter without also impairing the proper high-note response on the pick-up.

Possibly this is going too far, since a correctly designed and adjusted scratch filter can be arranged to give a sort of compromise which is sometimes worth having. Such a filter will reduce very considerably the amount of scratch heard, without audibly affecting the high-note response, but it must be very accurately adjusted.

The risk of spoiling the high-note response of your pick-up is quite a real one, and it is only fair that the reader should be warned of it, since arrangements are sometimes recommended which when actually tested under critical conditions can be shown to chop off all notes above perhaps 2,000 cycles most effectively!



A simple switching scheme for comparing pick-ups.

Here is a little point about the use of input transformers which every radio-gramophone user should know. The reader is probably aware that an input transformer between the pick-up and the first valve of the amplifier often confers important advantages. It usually gives something like a two-to-one step-up in the voltage applied to the first valve, and so considerably increases the volume obtainable from a given amplifier, but this is not the main argument in its favour.

An interesting radio-gram outfit for mains working is the Igranic A.C.3 seen here.

Much more important is the fact that an input transformer often leads to a definite improvement in reproduction. In the case of probably the majority of pick-ups the effect is a considerably increased response in the upper register. In all such cases an input transformer can be a very valuable device, leading to a general improvement in "brilliancy," which is very helpful in counteracting the tendency to a falling characteristic present in many amplifiers and loud speakers.

Important Exceptions

This effect of giving the pick-up a tendency towards a rising characteristic is not quite universal, however, for there are one or two pick-ups which do not respond satisfactorily to the use of this device. Such pick-ups are very few in number, but it is as well that the reader should be aware that they exist. With pick-ups of this type the effect is just the opposite of the one which we are seeking, the upper register being cut down, and the whole reproduction becoming far too rounded and what used to be called "mellow."

Pick-ups which do not respond favourably to the use of an input transformer appear to be those with unusually high inductance windings, since we have only found this to happen with pick-ups in which an attempt has been made to secure high sensitivity by means of very large windings.

A Matter for Trial

We are not really concerned with the reason for the difficulty here, however, and the point is merely mentioned in order that the reader may be warned that the use of an input transformer does not lead to an improvement in high-note reproduction in absolutely every case. It depends upon the particular pick-up. With the great majority, no doubt, the expected effect is obtained, but it is just as well to be aware of the fact that there are exceptions, lest you may be puzzled when you encounter one.

It is always a very encouraging sign when a stage in the development of any particular component or device has been reached at which manufacturers appear to be sufficiently satisfied with their products to start the publication of actual performance

With Pick-up and Speaker—*continued*

curves. As a result of comparatively recent improvements that point would seem to have been reached in the development of the gramophone pick-up, and it is pleasing to note that quite a number of manufacturers are now issuing curves showing the performances of their pick-ups over the musical scale.

Need for More Bass

There is a point about the best of these curves which may be puzzling to some readers, and really deserves a little explanation, because it is in itself rather interesting. If you examine some of the best of these curves you will probably see that below a frequency of somewhere about 150 or 200 cycles the output of the pick-up begins to rise, so that as you get down into the really very low frequencies the curve rises more and more steeply, indicating that as the frequency is reduced the output should grow louder and louder.

At first sight you might be inclined to think that this indicates a defect in the performance of the pick-up, but in actual fact it is nothing of the sort. It is really an ingenious and praiseworthy attempt to compensate for one of the known imperfections of modern recording.

Weakened Recording

The fact is that in the standard width of gramophone groove there is only room for a certain amplitude of excursion of the needle point, and so a difficulty arises over the recording of the very low notes. You see, as the frequency goes down the amplitude should go up to maintain a constant output, and as you get down to the very low frequencies there is not room to record them at full amplitude. Consequently, all recording in the standard width of groove is done with a gradually falling response for these lowest frequencies.

The rising tendency at the lower end of the pick-up curves to which we have just referred, therefore, is simply an attempt to compensate for this, and give us a more nearly even output over the whole musical scale than we should obtain with a more theoretically perfect pick-up.

One is sometimes annoyed on radio-gramophone outfits to hear the wireless programme as a very faint background to the gramophone reproduction, a phenomenon which has apparently puzzled some of our readers, if one may judge by correspondence. The reason is usually simple enough. It is merely that the radio side of the set is still working, and the signals are getting through faintly into the amplifying side by way of the capacity between the elements of the radio-or-gramophone change-over switch, supplemented possibly by the effects of capacities between wires.

This is achieved with the aid of a special circuit which improves both ends of the curve, thus giving more bass and greater brilliancy.

The instrument itself is contained in a neat black crystalline-finished case, roughly 9 in. by 5 in. by 4½ in.

On test we found that the overall response given with an average pick-up was excellent, and that the magnification with a straight three-stage amplifier was in excess of that required for normal domestic purposes.

'WARE SHOCKS!

When you employ a D.C. mains set for electric gramophone work remember that the pick-up may be "alive" and its lead should be well insulated.

THE GAMBRELL "NOVOTONE"

WE have recently had the opportunity of testing one of the new Gambrell "Novotones." First of all, we may state that the whole idea of the instrument is to increase the upper and lower registers in the pick-up reproduction.

The "Novotone" cannot be used to advantage with every pick-up, and intending purchasers would do well to seek the maker's advice on this point.

It is obviously impossible to design an instrument of this type which will give the desired results with every make of pick-up. There is no doubt, however, that with a number of pick-ups the "Novotone" gives extremely good results, and it is a unit we can recommend.

The device is priced at £5.

IN THE WORKSHOP

A page of practical hints for the home-constructor.

Silent Instability

L.F. FEED-BACK, or instability, does not always show itself by motor-boating or an L.F. howl. These noises only occur when the feed-back is very bad, and it is possible for distortion to take place long before the howling point is reached.

Distortion due to the above can generally be detected by the fact that results seem more or less O.K. until a loud passage comes along in the transmission. The tendency is for these loud parts to be unduly accentuated and to be reproduced with rather a rattly effect.

Since the cause of the above is the same as actual motor-boating or howling, namely, L.F. instability, the same cures should be applied. The two most useful schemes are to fit a decoupling resistance in the plate of the detector valve, with a shunt condenser, and to employ an output filter circuit.

An "X" Coil Point

In most "X" coils the aerial turns are counted from the socket of the coil itself. It will therefore be appreciated that if the coil holder is wired up the wrong way round, nearly the whole of it, instead of a small portion, will be in the aerial circuit. This will cause the set to be unselective, and may account for trouble in getting it to oscillate.

The pin of the coil holder should be joined to earth in practically all cases. If your set employs "X" coils and does not seem as selective as it should be, try reversing the connections to its holder. You will most likely have to reverse the reaction coil connections as well, otherwise the reaction coil will be the wrong way round.

Clean Those Pins

If you count up the number of pins and sockets, or plugs and sockets, in the average set you will probably be surprised to find how many there are. There are four to each valve, two to each plug-in coil, and six to H.F. transformers and similar coils.

Then there are the grid-bias battery plugs and the H.T. wander plugs. In an H.F., det. and L.F. set it is quite possible for there to be as many as thirty separate pin-and-socket connections.

Remembering that in radio we are dealing with very minute currents, particularly on the H.F. side, what losses could occur in these pins and sockets! A poor contact in two or three of them will soon add up so that the effect is considerable, and what source of obscure faults they may be.

You will appreciate that it is a vital matter to see that all the plugs and sockets are clean and make good contact.

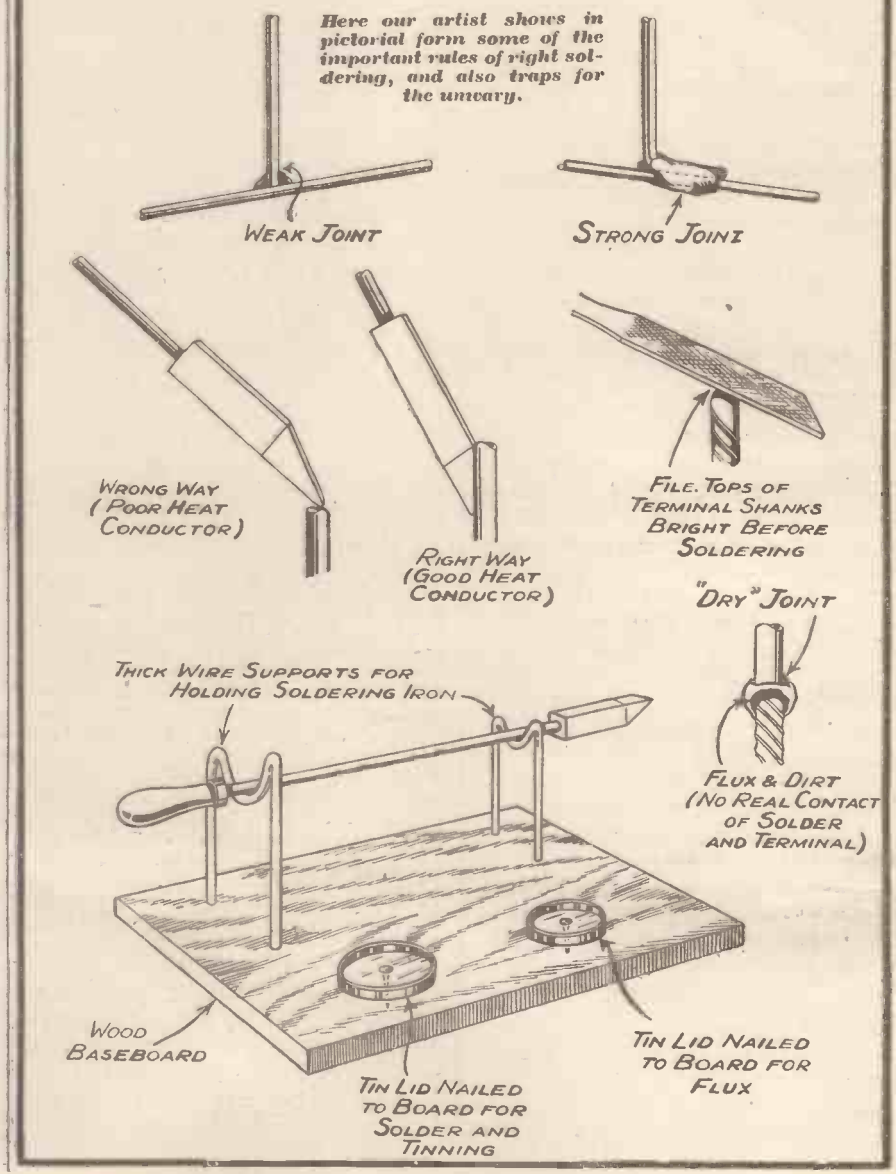
The best thing to clean them with is smooth emery paper. Even the insides of the sockets can be cleaned by a small roll of emery paper.

With plugs of the split-pin variety, and most of them will be found to be this type, a screwdriver is the best way of ensuring a good contact. It should be forced down the cut so that the two halves of the plug are sprung outwards.

If your results are generally poor, go over all the plugs and sockets as indicated; you may be very agreeably surprised by the result.

SOLDERING HINTS

Here our artist shows in pictorial form some of the important rules of right soldering, and also traps for the unwary.



B.B.C. Changes

THIS is the time of year when rumours are usually most persistent about alleged intentions on the part of Sir John Reith, the Director-General of the B.B.C. But the beginning of 1930 appears to be an exception. There are surprisingly few rumours about the inside politics of Savoy Hill.

My impression is that things have settled down, that the Board is working amicably with the Executive, and that the crisis threatened last summer has been avoided. How long calm will prevail in the presence of such a plenitude of explosive material remains to be seen. There is, however, a reasonable chance of the truce being observed for two years.

At the end of 1931 the five years' term of the present Board of Governors will come to an end. Will they be asked to continue ? Probably yes ; if so, will they stay ? What will Sir John Reith do ? My belief is that there will be some changes at the initiative of the Governors.

Sir John's Position

I should not be surprised to see Sir John Reith succeed Lord Clarendon as chairman. Anyway, this is one of the interesting possibilities of 1931. Who would succeed Sir John Reith ?

Sir John himself would have a good deal of say in the matter, particularly if he is on the same intimate terms with the Prime Minister of the day as he is with both Mr. Ramsay MacDonald and Mr. Baldwin.

Taking into account Sir John's intense regard for personal loyalty, he is almost certain to use all his influence on behalf of either Admiral Carpendale or Mr. R. H. Eckersley. But as either appointment might cause some heartburning on the part of the other, it is more likely that the next Director-General of the B.B.C. will be a retired civil servant.

It is known that senior people in the civil service have their eyes on Savoy Hill, and propose soon to bring it into line with the departments of state. But there will be widespread opposition to such a move ; in fact, if it were pressed too far it might well lead to competitive commercial broadcasting as a desperate but preferable alternative.

A Bigger Military Band

However much criticism there may be about most of the work of the B.B.C., there appears to be remarkable unanimity that Mr. Walton O'Donnell's military band is above reproach. It is undoutedly the premier military band in Great Britain, which means in the world.

That there is to be substantial augmentation is not only good news in itself, but it means that the B.B.C. military band will still further increase the margin of superiority it already enjoys over even such organisations as the Guards' bands.

It is proposed to add in the New Year the following : A second clarinet; a second oboe, a solo clarinet, a second bassoon, a bass clarinet, two trumpets, and two horns ; adding something more than a fifth to the cost of the band.

The Gershwin Concerts

The B.B.C. is undertaking in February or March the first performance in London of the Gershwin

MUSIC FROM MUNSTER

A view of the studio at Munster, one of Germany's most popular stations.

Savoy Hill News—*continued*

Concerto, which is regarded as a remarkable work wherever it has been heard abroad.

Cassella for the B.B.C.

Cassella, the great Italian conductor, will take a Chamber Concert for the B.B.C. in April. It is a pity he was not included in the national symphony concert list.

Amalgamating the Spoken Word

It is understood that the changes in the organisation of the spoken word at Savoy Hill have been completed on the lines foreshadowed exclusively in this page last summer. Mr. Siepman, the adult education official, has joined forces with Miss Matheson, the talks director; the latter being promoted.

Mr. Stobart retains responsibility for all work on Sundays, and is to enjoy a sort of roving commission to advise about all other parts of the work. It is likely that he will be able to act for Sir John Reith in the same confidential way as Mr. Filson Young acts for Mr. R. H. Eckersley.

Provincial Orchestras

Since the beginning of the negotiations between the B.B.C. and the Civic Society at Birmingham about the future of orchestras in Birmingham there has been no expression of opinion at Birmingham. But new complications are threatened in other parts of the Midlands, where it has become known that Birmingham may succeed in extracting from the B.B.C. a big subsidy for its municipal orchestra.

Leicester, Nottingham, Wolverhampton, Stoke-on-Trent, and Shrewsbury have all shown signs of disquiet, and there is now a definite possibility of united action to get subsidies for local musical organisations comparable with that which Birmingham may get.

But even if these efforts fail there is still some doubt whether the result of an agreement with Birmingham alone will be less expensive to the B.B.C. than the maintenance of the studio orchestra. Meanwhile, listeners are saying that there has been a marked decline in the proportion of programmes supplied to 5 G B from the Midlands.

There is also talk of demobilising the Northern Wireless Orchestra in the autumn of 1930, substituting a new arrangement with the Hallé Orchestra of Manchester. Savoy Hill is nothing if not courageous to risk a further set of local rows in the midst of all its difficulties about the Regional stations.

For the row in the North is likely to be much more serious and widespread that that in the Midlands. I wonder what the B.B.C. is going to do about the National Orchestra of Wales. This, of course, is merely a grandiose title for Warwick Braithwaite's very competent little orchestra at 5 W A.

The B.B.C. can hardly keep this going after abandoning orchestra effort elsewhere. Anyway, the matter needs clearing up all over the country. It would be better for Savoy Hill to make a definite statement of its intentions in the whole business of centralisation.

The Television Position

The extension of the facilities for Baird television transmission by two half-hours after "close-down" was unexpected. There is certainly no change in the attitude of Savoy Hill towards television. I wonder if their ready grant of this extension was actuated by the feeling that the best way to settle the television controversy is to let people have the chance of seeing what it is like.

And now, what will be the next step in the game? Probably the Baird Company will apply for the use of a second wave-length at Brookman's Park as soon as the alternative transmission there has settled down.

It is reasonable to expect that they will represent that tests are not really of value until the vision transmission can be accompanied by an audible transmission on a separate channel.

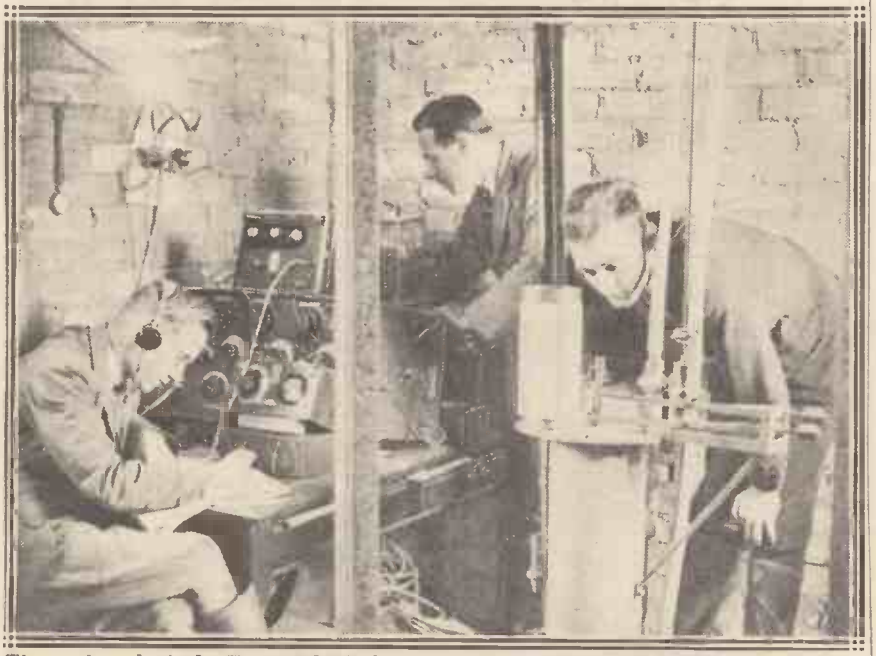
Progress of Broadcasting House

The problem of deciding on studio accommodation for the new building is so perplexing that the first construction of the interior will be largely provisional, leaving it open for barriers and walls to be moved about afterwards without much cost or inconvenience.

Nor is the building work itself being forced on at any exceptional rate. The B.B.C. is wisely anxious to avoid as many as possible of the "bloomers" that usually mar an undertaking of this magnitude and importance. The one thing that seems fairly certain is that there will be not less than twelve rooms capable of being used as studios.

It is also believed that the suite of rooms to be allotted to the Director-General will be extremely spacious, dignified and luxurious.

A WIRELESS WATCH ON WEATHER



The meteorological offices and wireless station at the aerodrome at Howden, Yorks, where weather reports are examined and collated.

The "CHASSIS" SHORT-WAVER

Full details of an extremely successful short-wave receiver built on the famous "Chassis" system.

By L. H. THOMAS.

WHEN I saw the Editor's first "Chassis" receiver—the "Chassis" Three—my first remark was "What a wonderful scheme for a short-waver!" When I had the opportunity of testing it out and proving to my own satisfaction that this first set really did give results well above normal for a three-valve set, I began to be more interested. The second "Chassis" set confirmed my belief, and I am privileged to make the first "Chassis" type short-waver receiver and to describe it for the WIRELESS CONSTRUCTOR.

Results Greatly Improved

There undoubtedly *is* something about this form of construction that materially improves the results obtainable from almost any type of receiver; whether it is the screening of the wiring or the presence of such a screen beneath all the components it is not easy to say, but results speak louder than theory, and there they are!

As you will see from the photographs, the "Chassis" short-waver differs from previous "Chassis" sets in having been equipped with a metal panel as well as the metal chassis itself; thus in the foundations of the receiver there is neither ebonite nor wood to account for stray dielectric losses, and this in itself may account for the results.

Avoiding Hand-Capacity

It has always been a point with me to make short-wavers with such a circuit arrangement that all parts to be handled at all have one side earthed. Thus if capacity reaction is employed (as it always is nowadays) the condenser must not be "up in the air" as in some forms of Reinartz circuit.

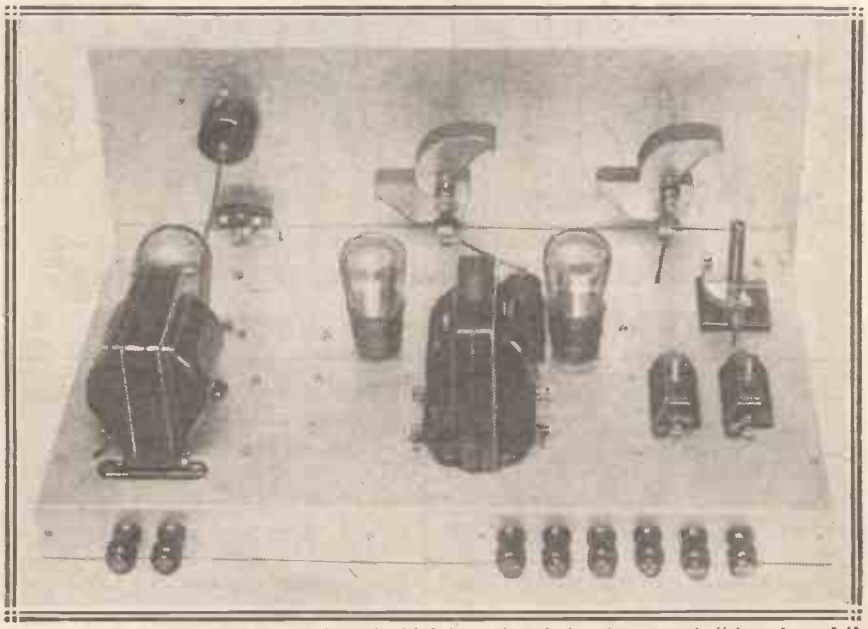
In this particular set there are four components mounted upon the metal panel; none of them is bushed, and every one has its moving part directly earthed on to the panel. This in itself is a very great point, and with a good earth and not too long a lead it is humanly impossible to produce capacity effects with this short-waver, which, it will be noticed, does not resort to "broom-handle tuning" or any of the complicated arrangements which used to be deemed necessary for the purpose of receiving anything below about 80 metres?

I have not yet found the lower limit of this receiver, but with the standard two-turn coil provided by two different manufacturers, with a four-turn coil as reaction, the set will oscillate, reaction control being quite smooth, and transatlantic signals on 10 metres have been received.

The Final Circuit

Concerning the final circuit arrangement adopted there is not very much to be said. The idea of a screened-grid H.F. stage was very attractive, but it was decided that the set would be more popular with two note-magnifiers.

The first is transformer-coupled and the second resistance-coupled, an arrangement giving quite enough amplification to ensure that the volume control is often used, and at



A general view of the set, the wiring of which is mainly below the chassis "baseboard." The variable condensers are "earthed" to the panel.

The "Chassis" Short-Waver—*continued*

the same time providing no difficulties in the direction of instability or a prohibitive amount of background noise.

Choke filter output is employed—I have standardised this system for all short-wave receivers in future—and the volume control is unconventional in that it consists of a variable resistance connected directly across the headphones or loud speaker. This position seems to give definitely better results than any other I have yet tried for short-wave work, particularly on distant Morse signals, for the reception of which, it is presumed, many readers will wish to use a set of this kind. More will be said of this later.

Obtaining Smooth Reaction

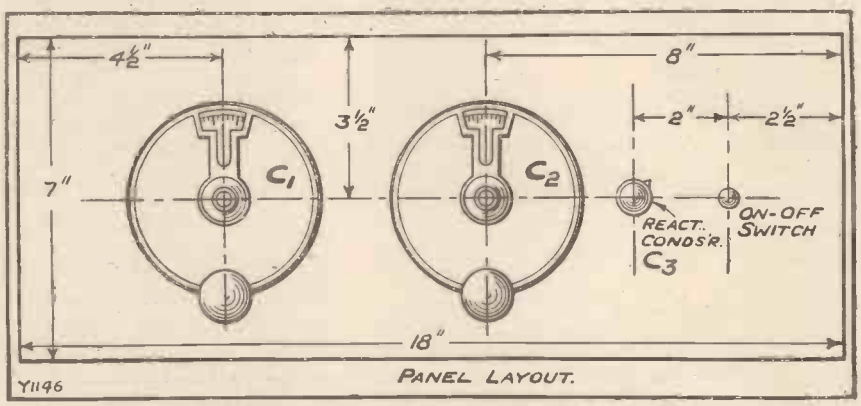
It is well-known that the feature that makes or mars a short-wave receiver, or, for that matter, any receiver that is to be a distance-getter, is the reaction control. Thus it generally happens that any little extra trouble one goes to to obtain as perfect a control as possible is well repaid. No one who has had anything to do with short waves can have been so fortunate as always to escape that awful trouble "threshold howl."

Even the American receivers seem to cause much anxiety with "fringe noise," which sounds suspiciously like another way of describing the effect. In my own opinion (I am always open to conviction) this trouble is simply and solely a form of "motor-boating" at a rather higher frequency than that particular brand associated with mains units and dud batteries; a suspicion confirmed by the fact that any short-waver I have made or handled that has been effectively protected from motor-boating has also been immune from threshold howl.

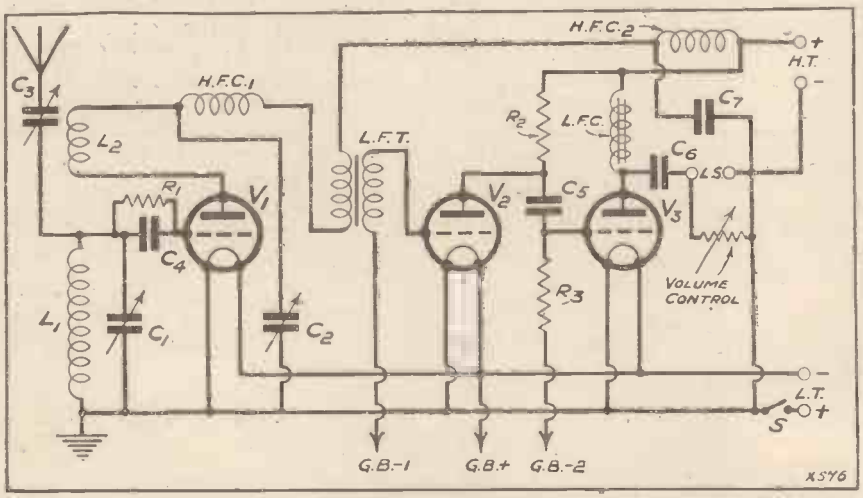
I went to some considerable trouble to find the best method of protecting the defenceless reader from this trouble by experimenting with various systems and cures, and finally used that with which it was quite impossible to produce threshold howl at all.

Then, to my intense annoyance, a change in the low-frequency transformer brought it back again in full force! This proved to be due to the fact that the primary and secondary had greater inductances than those of the transformer originally used, and the connection of a leak across the secondary cured it for good. This is dealt with more fully at a later stage.

The "anti-mobo" device used in series with the plate supply of the detector valve consists of a high-frequency choke in place of the usual resistance of 20,000 ohms or so.



As will be seen, the panel layout is simple in the extreme, and an advantage is the large dial used for the reaction condenser.



The circuit is perfectly straightforward, throttle reaction is employed (C_1), while a very useful volume control across the 'phones or speaker is a prominent feature.

This is, of course, quite separate from the reaction choke and on the H.T. side of the transformer primary.

Thus, tracing the lead right through from the anode, we have first the reaction coil, the far side of which goes through the reaction condenser to earth; then an H.F. choke, followed by the transformer primary. This H.F. choke is unnecessary if the transformer has no fixed condenser incorporated and has a reasonably low self-capacity. From the far side of the transformer primary we have a 2-mfd. condenser going to filament and earth, and finally the second H.F. choke, the remaining side of which goes to the H.T. positive terminal.

Very Effective Scheme

This scheme seems very effective for short-wave work, and has the advantage that an efficient decoupling scheme is thus provided without materially reducing the detector plate voltage. I have always found it advisable to keep this fairly high for really efficient detection on the short waves. In the present case 100 to 120 volts is used successfully.

Both chokes are of the special "short-wave" variety, but it is doubtful whether one of this type is necessary for the second (i.e. "anti-mobo") choke.

No grid leak is permanently in place in the set across the secondary of the L.F. transformer, since unless other things were deliberately adjusted

The "Chassis" Short-Waver—*continued*

to produce a "threshold howl" the set was immune without this leak. If you should experience any trouble, however, the connection of a 2-megohm or 1-megohm leak in a pair of clips across the transformer secondary can hardly fail to put things right.

COMPONENTS REQUIRED

Cabinet to suit (Camco). (Artcraft, Gilbert, Pickett, Handicrafts, etc.)
1 Standard "Chassis" Three chassis, with metal panel and valve holders (Ready Radio). (Magnum, Paroussi, etc.)
2 ·00015 variable condensers (Formo). (Cyldon, Lotus, Igranic, Polar, Ormond, etc.)
2 Single-coil sockets (Igranic). (Raymond, Lotus, Ready Radio, etc.)
1 Set of short-wave coils (Igranic). (Atlas.)
1 L.F. transformer, 3:1 or higher (Lissen). (Hypermu, Nicore, Ferranti, Telsen, Brown, Cossor, Igranic, etc.)
1 Output choke (Ferranti). (Varley, Igranic, R.I., Atlas, Wearite, etc.)
1 Filament switch (Lotus). (Benjamin, Lissen, Raymond, Red Diamond, etc.)
1 Base-mounting neutralising condenser (Bulgin). (Peto-Scott, Magnum, J.B., Gambrell, etc.)
1 Short-wave H.F. choke (Bulgin). (Magnum, Wearite, Igranic, Bowyer-Lowe, etc.)
1 "Volustat" (Harlie).
2 2-mfd. condensers (T.T.C.). (Lissen, Mullard, Hydra, Helsby, Ferranti, Dubilier, etc.)
1 ·0001 or ·0002 fixed condenser and 2-meg. leak (Dubilier). (Lissen, Igranic, Mullard, Clarke, Goltone, T.C.C., etc.)
1 ·005 fixed condenser (Magnum). (Lissen, etc.)
1 250,000- or 200,000-ohm anode resistance (Varley). (Dubilier, R.I., Mullard, Ediswan, Graham-Farish, Igranic, etc.)
1 2-megohm leak in holder (Dubilier). (Lissen, Igranic, etc.)
1 9-volt grid-bias battery and clips.
2 Slow-motion dials (Igranic "Indigraph"). (Lissen, Lotus, Formo, J.B., Ormond, Utility, etc.)
1 H.F. choke, standard or short-wave (Magnum). (Any good standard make.)
Terminals engraved: "Aerial," "Earth," "L.T.+," "L.T.—," "H.T.—," "H.T.+," "L.S." (2) (Belling-Lee). (Igranic, Eelex, etc.)
Ebonite and metal washers for these should be supplied with the chassis.
Glazite, brass bolts, etc., etc., and small quantity of Systoflex.

The anode resistance for the second valve should be of the order of 150,000 or 200,000 ohms, the coupling condenser ·005, and the grid leak 2 megohms. With these values and a valve of the "D.E.H." class really good results are obtainable, the degree of amplification being higher than one would imagine, as was confirmed by actual measurements.

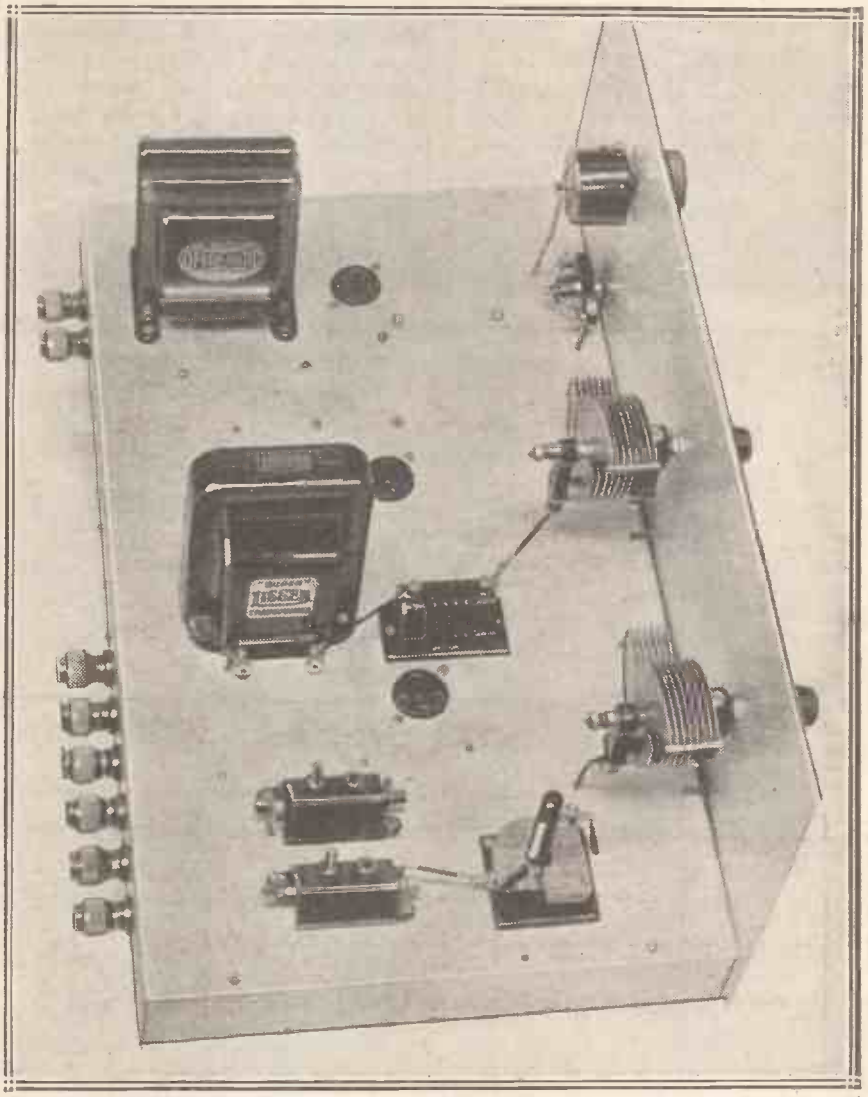
The Output Circuit

The last valve has a good L.F. choke in its anode circuit, and the loud speaker is connected from earth to a 2-mfd. condenser, the other side of this being connected to the anode.

Coming down to more practical details, the reader will probably receive a few shocks on looking over the wiring diagram. It certainly looks as if there are many connections that do not go anywhere, or have been left out. This is on account of the fact that all earth and positive filament connections can be taken directly to the nearest point on the panel or chassis!

Thus the H.T. —, earth, and one loud-speaker terminal are screwed directly into the rear of the chassis. Incidentally, there is one deviation from normal practice, namely, the earthing of the *positive* side of the L.T., which is also connected to H.T. —. This is accounted for by certain switching difficulties and by the fact that, for some reason or other, a parallel-connected grid leak seems to give better results.

Since obviously the bottom of the grid coil must then be connected to positive L.T., it is advisable also to earth this side of the battery, and this is what has been done. Note



An end view of the "Chassis" short-waver, which has a remarkably "clean" appearance.

The "Chassis" Short-Waver—*continued*

that the positive L.T. *terminal* is *not* earthed, but bushed.

It goes to one side of the switch, the plunger of which is, of course, connected to the panel; thus contact is made with the panel, the metal chassis, and the three filaments, which are connected together and taken to the chassis at the nearest convenient point.

The L.T. Terminals

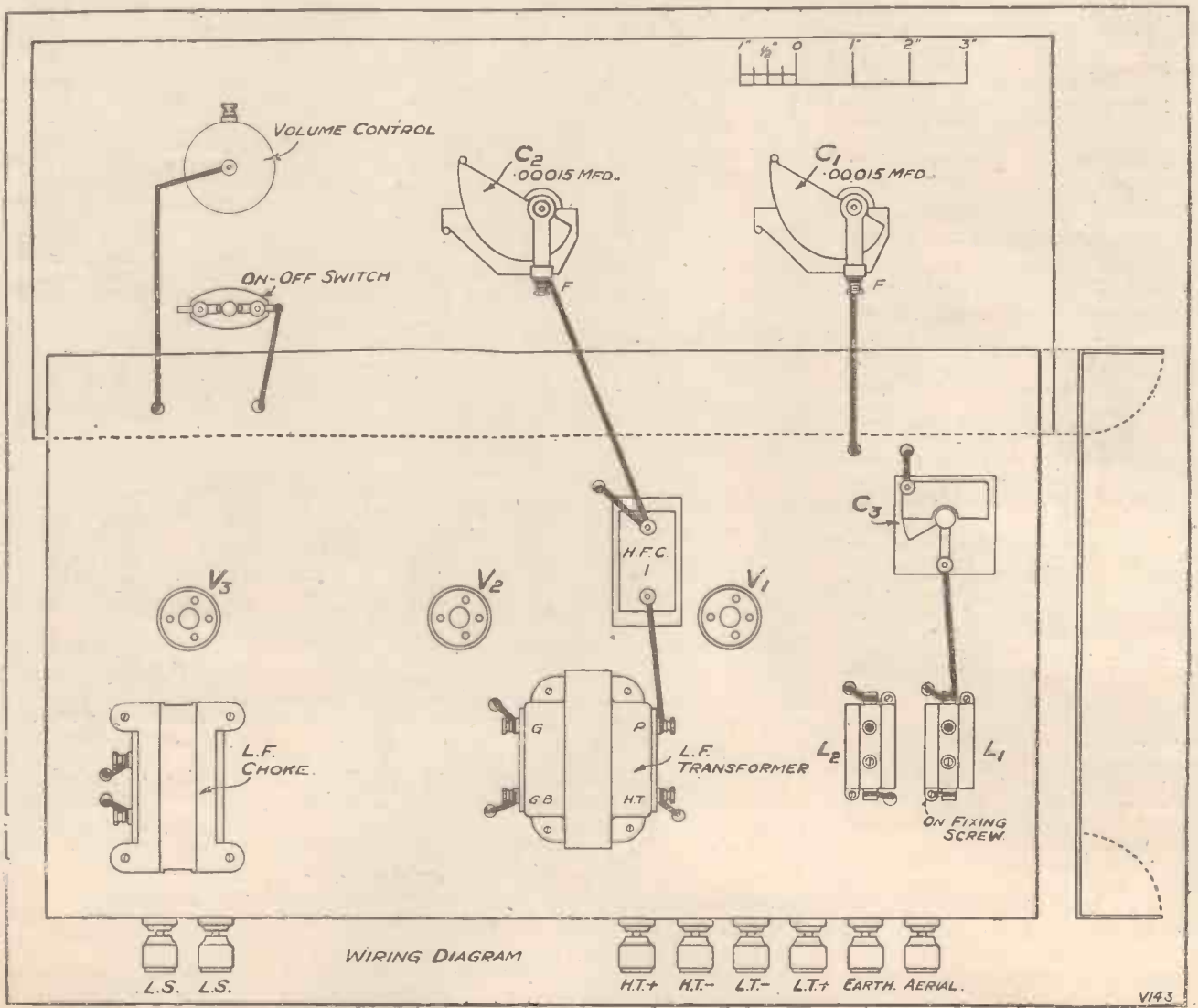
Thus the L.T. negative terminal is bushed and connected to the three negative filament legs and to the grid-bias positive lead; the L.T. positive terminal is connected to the switch and nothing else; and the remaining filaments, H.T. negative, two sets of moving plates, moving element of the volume control, etc., etc., are all earthed in the most convenient way. If this is borne in mind there should be no trouble or misunderstanding about the actual wiring up of the set.

Much has been written about the best coils and condensers to use in a short-wave receiver. A good deal of trouble is often caused by the fact that the set is also to be used on the broadcast wave-lengths, and provision must therefore be made for larger tuning capacities when this is the case; this brings in various minor complications, such as using two condensers in series, or a variable and a fixed condenser in series.

This set makes no pretensions towards being an "all-waver." It is a short-waver, and, as such, will cover all the interesting part of the short-wave spectrum. So that the reader will not spend most of his time changing coils it has been designed for use with condensers of ·00015 capacity; one of this size will cover the whole useful short-wave range with two coils only, and this is certainly a convenience.

Tuning Quite Easy

A short-wave set for myself, to receive Morse on the very narrow amateur transmission bands, would have condensers considerably smaller than ·0001, but even for this purpose a ·00015, equipped with a really good slow-motion dial, makes tuning reasonably easy, and this has been adhered to.



The "upper" wiring is seen here, and the layout of the main components. The rest of the connections are made on the under-side of the "baseboard."

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The "Chassis" Short-Waver—*continued*

Note that the reaction conderser has been equipped also with a slow-motion dial, and not the small and annoying knob labelled "volume control" that one finds on too many sets in these days; the volume control is quite separate from the reaction control, as it always should be.

Standard coils on the usual two-pin plug have been used. These are quite as efficient as most types of short-wave coil on the market to-day, and possess the extra merits of cheapness and convenience.

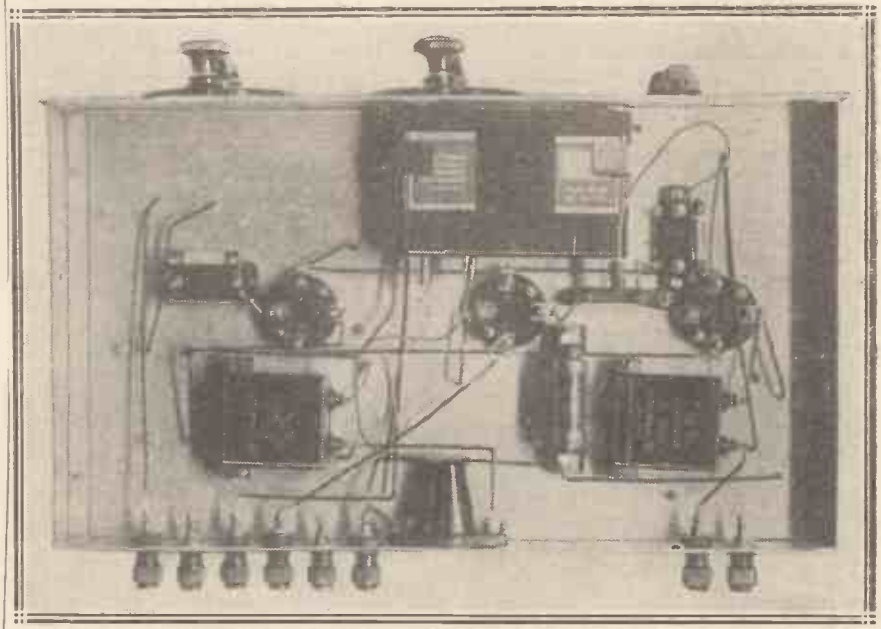
Keep Coils Clear

The chassis is received with the three holes ready cut and the three valve holders bolted in position; the layout of the other components is therefore left to the reader's discretion. If you make any attempt to vary the layout shown in the photographs, remember one thing—that the coils should on no account be nearer to the transformer than they are at present.

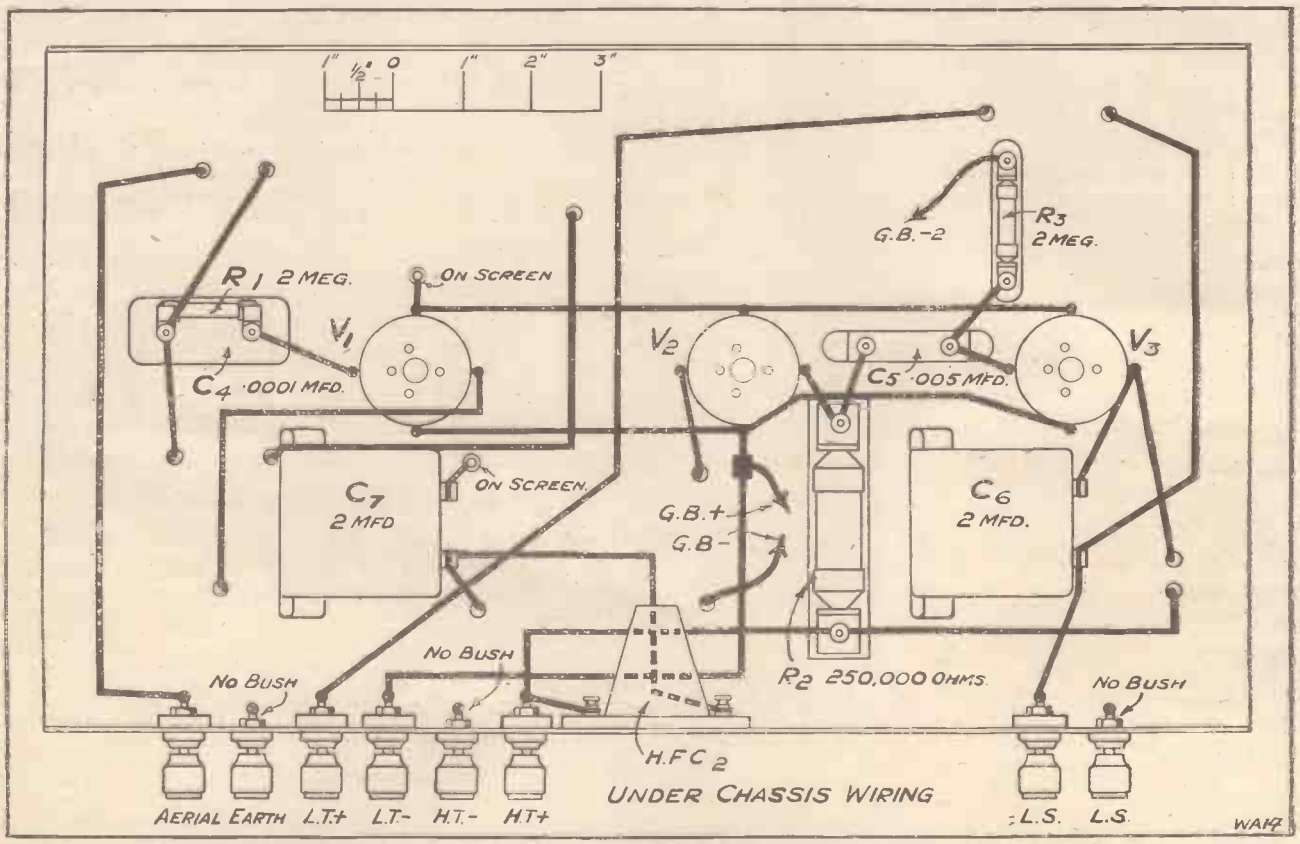
It seems, from referring to articles three years old and more, that we used to be far more particular about keeping large objects out of the field of the coils than we are now. Don't imagine that this is idle theorising—try shifting the component positions about and see what an effect it has upon the way the set "handles!"

By the time you have read as far as this the set will probably be nearly finished and ready for test. Accordingly the rest of my remarks will be

(*Continued on page 298.*)



This photograph should be studied in conjunction with the diagram below when wiring the receiver. Note how the grid-bias battery is mounted.



Most of the wiring can be seen in the above diagram, which should be regarded as supplementary to that on the previous page.

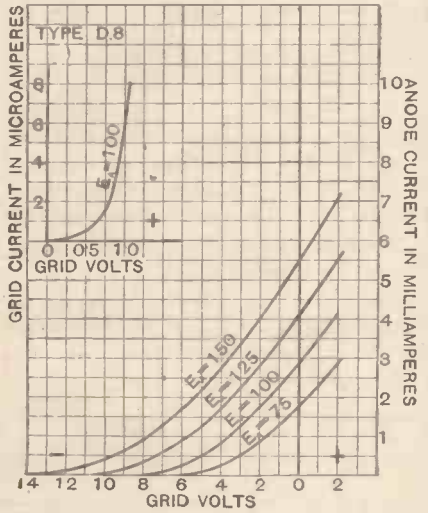
WITHIN THE VACUUM

Some interesting details concerning the direct and indirectly-heated A.C. mains valves.

By KEITH D. ROGERS.

THE various valve manufacturers' lists of mains valves are rapidly becoming complete. Recently I had a selection of the Osram and Marconi valves for test, and these showed that but for one or two exceptions types were being made from which any requirement could be filled.

The type of mains valve that seems most lacking is the super-power ·8 output type, for while among the indirectly-heated cathode variety we have the M.L.4, with its 3,000-ohm impedance and magnification factor of 6, in the directly-heated type the largest valve is the P. point 8, with 6,000 ohms impedance and magnification factor of 6.



The characteristics of the 1·6-amp. filament point 8 valve—the D.8.

Good Grid Swing

This carries a grid swing of about 32 volts (16 either way), but does not compare in output powers with the M.L.4, which can deal with a grid swing of at least 48 volts and give more amplification, especially noticeable in the bass notes.

It may be argued that if you want anything larger than the P. point 8 you should use either the L.S.5A or and L.S.6A valves.

True, these take ·8 amp. in the former case and 1·6 in the latter case, similar currents to the point 8 series, but they require these currents at 5·5 to 6 volts, *not at* ·8 *volt*, and therefore require a separate L.T. input. The M.L.4 requires a 4-volt 1-amp. input for its heater, and so even this can hardly be said to fill the bill.

It would doubtless be of advantage to a number of set builders to have a good ·8 output valve, for the mixing of types is a bothersome process.

The point 8 valve is useful for the "change-over" stage when an ordinary set is to be used for mains with 4-socket valve holders (though indirectly-heated valves can be used), and the super-power output ·8-volt would be a great help to a large number of people.

The "Point 8" Series

The type, as a type, is quite a successful one and consists of the following classes of valves: S.G., Detector (taking 1·6 amp.), H. (55,000 ohms) for R.C. coupling, H.L. (17,000 ohms), and P. (6,000 ohms) for the output stage.

Of these the detector is the most interesting, as it has a special filament of short length so that A.C. hum is kept to a minimum—and a very good minimum it is, too!

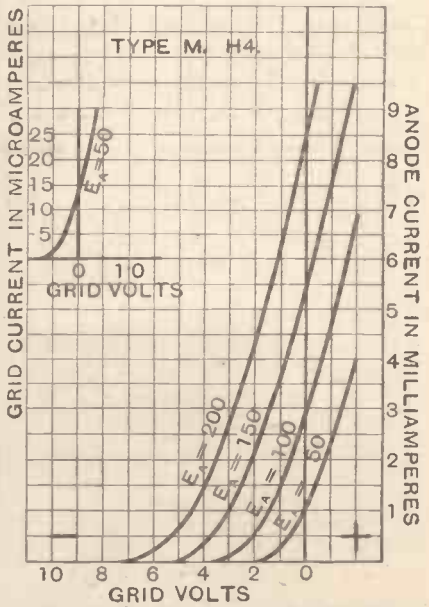
The curve is reproduced herewith, whence it will be seen that with its impedance of 21,000 ohms and mag. factor of 14 the valve is reasonably efficient, though not so efficient as the ordinary valve or the indirectly-heated cathode type.

The H. point 8 has an amplification factor of 40 with an impedance of 55,000, while the H.L. has an amplification factor of 17 and an impedance of 17,000 ohms. This is recommended as an anode-bend detector (not leaky-grid type), or as a first L.F. and as an H.F. valve in a neutralised stage.

Then we have the final valve, the P. point 8, with its 6,000 ohms impedance and mag. of 6. This is capable of a fair output, but for powerful sets we need something much "bigger." All these valves have max. H.T. voltages of 150 volts.

"Indirectly-Heated" Valves

The indirectly-heated cathode types of mains valves are more efficient, though they are the same price as the point 8 series. We have among them the following valves: the S.G. (M.S.4), with a 500,000-ohm impedance and magnification factor of 550 (other makes have different characteristics, the Metro-Vick valve having a mag. of 1,200 with an



The indirectly-heated detector-H.F. valve has these curves. The M.H.4.

Within the Vacuum—*continued*

impedance of 800,000 ohms), the M.H.4, M.H.L.4, and M.L.4.

These have impedances and mag. factors as follow:

M.H.4—23,000 ohms and 53.
M.H.L.4.—8,000 ohms and 16.
M.L.4—3,000 ohms and 6.

Thus we see that we have a good H.F. valve in the M.H.4, a first-class L.F. in the M.H.L.4, and a good output valve in the M.L.4.

The latter valve will carry a grid swing of 48 quite comfortably, and the M.H.L.4 will deal with an input of round about 16 volts without overloading. These grid swings are taken at an anode potential of 200 volts—the maximum recommended voltage for these valves.

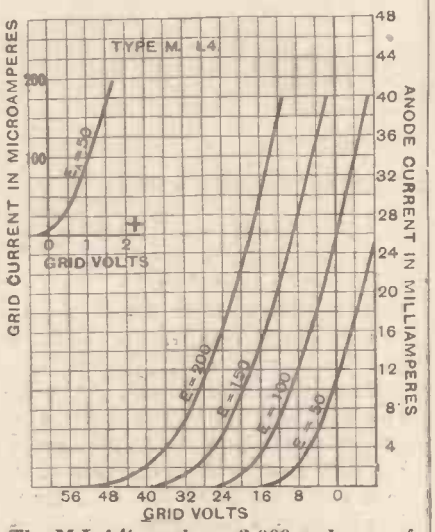
Mixing the Types

If one has a choice between indirectly-heated and directly-heated filament valves, and it does not matter which is employed in any particular set, it is easy to see which type is going to prove the more effective stage for stage.

The indirectly-heated valve will give you more mag., but, because of this mag., back-coupling effects and instability are more likely to occur in the H.F. stages. The screened-grid indirectly-heated valve needs very careful screening if anything like real stability is to be obtained.

When mains valves are employed great care should be taken that correct bias is provided and that a potentiometer be placed across the filament—or heater—wiring, the slider being taken to earth and the grids either direct through the circuit or via a grid-bias battery.

The A.C. valve, when used as a detector on the leaky-grid principle,



The M.L.4 (impedance 3,000 and mag. of 6) gives the above characteristic curves.

usually needs positive bias on its grid, for the filament is taken to the A.C. supply and the grid return is taken to the slider of the potentiometer. In the case of the indirectly-heated valve the cathode also goes to this point.

Thus should you mix the valves, as is done sometimes in sets where a change over from batteries to mains is carried out, and have the point 8 screened-grid valve, with indirectly-heated detector and note-mags., you need to be extra careful about the filament and cathode leads.

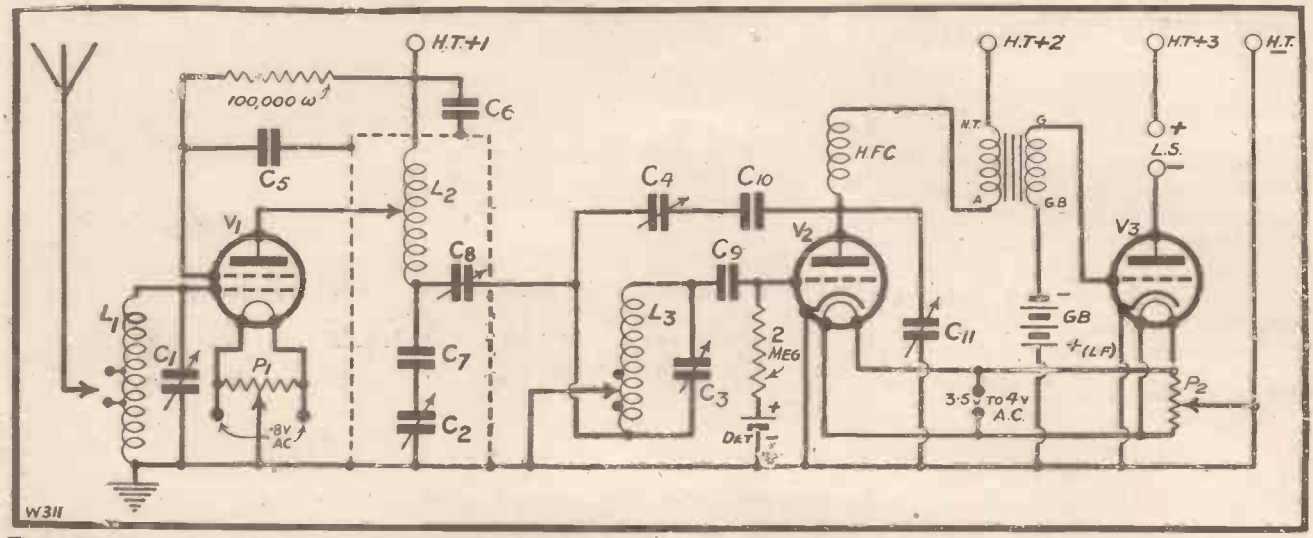
The point 8 S.G. valve will require a transformer winding giving it the correct voltage and current, and a potentiometer across it is shown in the diagram, while the indirectly-heated valves require a 4-volt transformer winding and another potentiometer and are wired as shown on the right of the diagram. Both potentiometer sliders are taken to earth, and all earthed points.

The Detector Bias

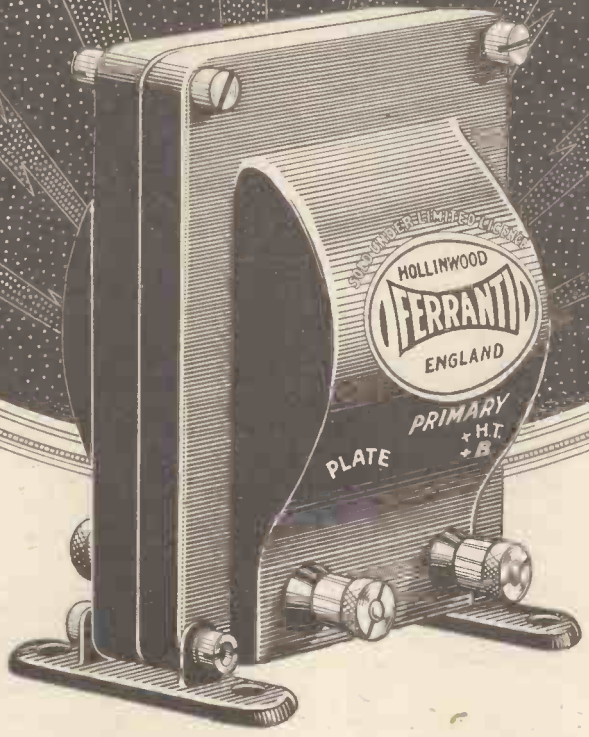
It must not be forgotten that whereas in the case of the point 8 valve the filament is the cathode (as in the case of the ordinary valve), the filament (or heater) has nothing to do with the electronic emission in the case of the indirectly-heated valve.

In this case the cathode is the specially prepared tube round the heater, and that is why it has to be earthed. Obviously, then, in the detector stage the valve has to be given an applied positive grid bias in order that it may operate on the leaky-grid principle efficiently. It is, of course, usual in the case of the ordinary valve to take the grid leak to the positive filament lead, but this is impossible in the case of A.C. valves, and therefore an applied potential usually has to be provided.

Finally, it must be remembered that all filament and heater wiring must be of twisted flex, to avoid setting up A.C. hum, which would be induced into the rest of the wiring and the components if it were not neutralised by the twisted A.C. wiring.



This theoretical circuit diagram gives the connections for "mixed" mains valves. A point 8 valve is used for the screened-grid stage and indirectly-heated cathode types for detector and L.F.



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The Varley Products

THE Oliver Pell Control Co., Ltd., makers of the Varley products for radio, have sent us a number of their new components for test and report. These comprise heavy push-pull input transformers, push-pull output transformers, push-pull choke, a transformer for use with The Westinghouse dry rectifier, and a low-tension choke designed for use in such devices as the Harris Stedipower L.T. unit.

This L.T. L.F. choke is a Varley product.

The push-pull input transformer of the heavy-duty type has several features of interest and will allow the user to pass current up to two milliamperes in the primary. The secondary is wound in two sections, making it possible to apply different grid-bias values to the push-pull valves should it be necessary, although if the valves chosen for push-pull differ to this extent we should much prefer to get others. Another possible use of this arrangement is in the case of two valves used in parallel, for here each can have its own separate winding.

Tested with a pair of P.625A valves in conjunction with the Varley push-pull output transformer admirable results were obtained, reproduction having a brilliance and depth very rarely found in wireless receivers. The price of the push-pull input transformer, with royalty paid, is £1 5s., and it is a thoroughly sound component.

The push-pull output transformer to which reference has just been made has two separate windings on the output side, one for high- and the other for low-resistance speakers, the nominal ratio in the first case being 1 to 1, and in the second it is 20 to 1.

The push-pull output choke is also of double range, and can be used for running high- or low-resistance speakers. Some experimenters prefer an output choke to an output transformer, and there are arguments for and against such a practice, but those who like push-pull output chokes will certainly find a good one in the Varley.

The transformer for metal rectifiers and the low-tension choke for Stedipower circuits have also been found perfectly satisfactory for the purposes for which they were designed, all the components mentioned being confidently recommended to our readers.

New Amplion Speaker

The Amplion loud speaker type AB6, illustrated in the accompanying photograph, is a further addition to the long line of speakers manufactured by this well-known firm. For a low-price cabinet speaker of excellent external finish the performance is quite good, and although, of course, it does not equal that given by the more expensive loud speakers manufactured by this firm (such as the well-known Lion), we are sure it will satisfy a wide circle of users, as its tone is pleasing and natural, without unpleasant resonances which so often mar the performance of this kind of speaker.

We particularly welcome the provision of three terminals so that a low, medium and high impedance is obtainable. In the high-impedance arrangement the speaker is suitable for connection directly in the plate of a pentode valve, and at the other end of the scale the low-impedance suits a good super-power valve.

Having had the opportunity of examining both the mahogany and oak models we can vouch for the admirable finish of both these speakers. Too many manufacturers rather forget that a loud speaker must form a part of the furniture of a room, but in this connection the appearance of the Amplion speakers will not offend the most fastidious.

An Unconventional Aerial

The No-Mast Patent Aerial, manufactured by the No-Mast Patent Aerial Co., of Birkenhead, was submitted to the WIRELESS CONSTRUCTOR recently with a request that we should test it under any conditions we cared to devise, with the idea of determining whether or not the claims of the manufacturers were justified.

It consists of a flat plate of perforated metal about a yard square, attached to a wooden frame and cross-

The Amplion loud speaker which is reviewed this month.

"As We Find Them"—*continued*

piece. The perforated metal has in its centre a terminal to which a down-lead is attached, and the makers' instructions are that the cross-piece should be fixed flat against the wall at some convenient position, such as on the side of a chimney, a wall above the window of the room in which the apparatus is used, or, in fact, any convenient position nearby.

First of all the device was raised to a measured height and the maximum rectified current obtained from a crystal receiver acurately tuned to the local station was taken. The No-Mast aerial was then lowered, and a single vertical wire raised to the same height and measurements taken afresh.

The current in the first case with the No-Mast aerial was 11·25 microamperes, and with a single wire raised to the same height as the No-Mast aerial was 6·5 microamperes. These figures indicate that in order to get the same signal strength with a single vertical wire as is obtainable with the No-Mast aerial a considerably greater height is necessary. In most cases the aerial will have to be half as high again.

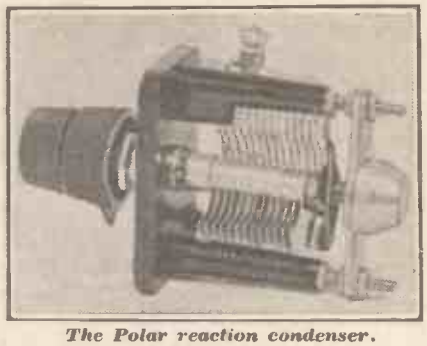
We can thus say that the No-Mast aerial, mounted as recommended by the makers, will definitely act as well as an appreciably larger aerial of conventional form.

Naturally the higher the plate is erected above the receiving apparatus the better will results be, and in many cases this plate erected on the side of the house will give reception far better than is obtainable by a low single-wire taken to a pole at the end of the garden.

The "Radiogrand" L.F. transformer, a review of which appears on this page.

Vernier Reaction Condenser

Messrs. Wingrove & Rogers, Ltd., makers of the Polar components, have sent us one of their slow-motion reaction condensers with nominal



The Polar reaction condenser.

maximum of ·000075 mfd. It is a well-made device of high efficiency electrically, and is fitted with the particularly smooth slow-motion action which has already made the Polar condensers so popular. The main control is operated on the rear half of the conical knob, the front turning the slow-motion drive.

Laboratory measurements show that the maximum capacity is ·00011 mfd., and the minimum extremely low. Both main drive and vernier operate very smoothly and we have yet to find a condenser which is easier to handle on sets using critical reaction adjustment.

Telsen L.F. Transformers

The Telsen Electric Co., Ltd., of Birmingham, have sent us for review specimens of the Telsen "Radiogrand" transformer, sold for 12s. 6d. In appearance and finish this transformer is of very high grade, and careful tests show that the reproduction obtainable with a suitable circuit is particularly good, giving a very uniform response over a wide range of frequencies, together with excellent magnification.

Compared with the best transformers in the WIRELESS CONSTRUCTOR laboratory, the reproduction was up to a very high standard over practically the whole of the scale, and while one or two of the more expensive instruments (selling at about twice the price) maintained uniformity of reproduction to a lower point on the frequency scale, this was only noticeable with careful tests and particularly good loud speakers. The proportion of the bass was certainly distinctly better than we have often obtained with more expensive instruments, and we have yet to try a transformer in this price class which gives a better reproduction.

The component can certainly be recommended to all readers who desire an inexpensive high-quality transformer on which they can rely to do justice to the rest of their receiver. Both 3 to 1 and 5 to 1 ratios are obtainable. The former we should recommend in all cases where a transformer is to follow a fairly high impedance valve. The lower impedance primary of the latter makes it more suitable for second stage work.

Useful Spade Terminals

A particularly neat and ingenious spade terminal has been sent to us for test by Messrs. Belling & Lee, Ltd. Its special virtues are that it springs on to the shank of the terminal and therefore will not fall loose when the securing nut is undone,

An example of the useful Belling-Lee spade terminal which will interest every set-builder.

while it can be obtained marked in a number of ways, such as H.T.+1, H.T.+2, L.T.—, etc. It might, indeed, be called a safety spade, and of its many features the spring clip is that which appeals most to us.

Both wire and flex are securely gripped when the spade is mounted, and altogether it should prove very useful not only for temporary, but for permanent, connections. Every experimenter who changes from time to time from one set to another should obtain a set of these spades, which are offered at quite reasonable prices.

The "S.O.S." Short-Waver

We wish to draw attention to the fact that in the article on the "S.O.S." Short-Waver (December issue), the list price of the Rothermel 50,000-ohm potentiometer was wrongly stated as 7s. 6d., instead of as 10s. 6d.

THE Professor took another huge spoonful from the basin full of queer-looking stuff that stood before him upon the bench of the potting sh— that is to say, upon the table of his laboratory.

"What's that muck you are eating?" I asked.

The Professor's jaws worked rapidly whilst his eyes bulged from their sockets.

"Mmmmm," he replied.

"What a queer name for it," I said, for I presumed that it must be a patent food of some kind. After a few more facial contortions the Professor managed a swallow.

"What's that muck you're eating?"

"It's Goopo, you ass!" he cried. "My new nerve nourisher. Have some?"

"No, thanks," I said, with a shudder. "The last time I visited Mr. Hercy Parris he made me eat some Shaker Groats, with the result that I had to sit up and work all night. In fact, for thirty-six hours I could not stop working, and I was so run down as a result that I have had to take a holiday ever since.

A Nerve Nourisher

Just fancy eating stuff that makes you work! A dreadful idea. What we really want is a food that relieves you from all the necessity for working, or something that makes you sleep by day as well as by night. I can't say that I approve at all of these hard-labour dishes."

"That," remarked the Professor, who by this time had managed another spoonful, "that is where Goopo comes in. So astonishing is the mental energy induced by it in the convolutions of the brain that one does a whole day's work in ten minutes and has the rest of the day and night for sweet repose. *Do* have some."

"I thank you, no," I returned, with dignity. "Once smitten, twice fly. Work in any form is repugnant to my artistic spirit, and high-speed work particularly so. But tell me, from what is Goopo made?"

"Ah!" said the Professor.

"That last remark gave me a beautiful view of your tonsils," I told him, "but hardly answers my question."

Marvellous Foods

After a good deal of humming and hawing the Professor swore me to secrecy and then told me how it was done. Since his remarks were strictly confidential I must ask you, reader, not to give away this closely-guarded secret. You will, I know, realise that what I am saying now is entirely between us girls and will not breathe a word to a soul. Here is what the Professor told me:

"It is quite clear," he said, "that the world just now is filled with marvellous foods, each of which has its own special attribute. Shaker Groats, for example, keep one's nose to the grindstone from sunset to sunrise; Smaxo builds bony babies; Sloshserine tunes up jaded nerves; Cowso gives one the strength of an ox; Burkril wards off colds, coughs, flat feet and epizootic lymphangitis; Fanatogen makes sagging sinews oscillate; Lungbridge's Cough Tonic clears the pipes, and Bones' Ear-Ache Pills pull up your socks. Melmanism enables you to increase your salary to almost anything you like—and there you are."

The Super-Putrodyne

"Where?" I queried.

The Professor waved me to silence.

"I take equal parts of each of these marvellous substances," he said, "and mix them together in a crucible. I then add a modicum of sulphuric acid to increase the electrolytic properties of the mixture, and stir in a quantity of manganese dioxide to depolarise the brain and free it from gassiness. I pass through the mixture the output current of my seventeen-valve super-putrodyne during the reception of a topical talk on health, stirring briskly the while with a paper whisk made by folding one of Sir Long Butnot Plain's chatty little articles about one's in'ards. And the result is——"

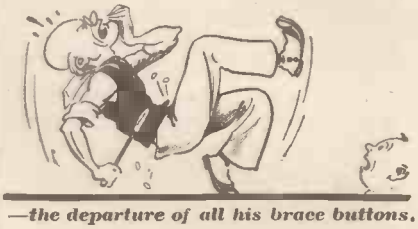
"Yes, yes," I breathed.

"GOOPO. Take Goopo and you will tune in two stations where you tuned in one before."

"That result," I said, "has already been achieved by the recipe of a gentleman who was born in 1820 and is still going strong. His specific, I am credibly informed, can even turn a two-valve set into a four-valver, if a sufficient dose is taken by the operator."

After Effects

"Shut up!" roared the Professor. "Do you, or do you not wish to feel the blood coursing rich and red through your veins? Have you never tried to sit up for America and found yourself falling asleep? Do you or do you not desire to be able to evolve marvellous new wireless sets, to perform prodigies of tuning, to



—the departure of all his brace buttons.

out-distance all your rivals at the club? Are you content to remain a mere passenger in the forward march of wireless?"

"Quite," I answered simply.

The enormous spoonful of Goopo which the Professor took at this moment must, I think, have supercharged him, if I may put it so, for in a single instant of time his tendons were tautened, his sinews strung up, his nerves neutrodyned, his muscles magnified, his latent energy made patent.

He leapt into the air with a scream,

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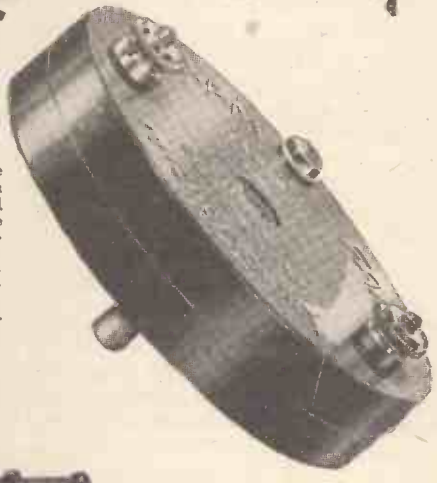
X61 FOR A BRASS-VANED LOG CONDENSER



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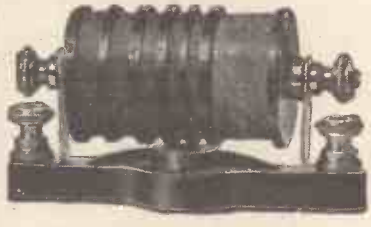

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GRAHAM FARISH

BROMLEY RADIO GF KENT

146/6

In Lighter Vein—*continued*

catching up a heavy soldering iron on his way. But for the fact that the forces so suddenly released by Goopo resulted in the violent departure to various parts of the room of all his brace buttons, he would, I think, have smacked my hand or done something equally violent. As it was, outraged modesty compelled him to subside quickly into a chair, clutching about him his somewhat spacious nether garments.

So far as I can gather from this first practical test the effects of Goopo appear to be rather evanescent. That is the worst of these super things; they so often cause a morning-after-the-night-before feeling to follow a brief period of elation.

A Napoleonic Move

At any rate, I felt that so long as the Professor had not a brace button to bless himself with he was, so to speak, immobilised; the time was therefore ripe to press forward the attack, as any student of the maxims of Napoleon will appreciate.

"I have been asked," I said, "by thousands of readers of the WIRELESS CONSTRUCTOR, to tell them what you consider the ideal aerial. At the moment the position is rather difficult. One set of experts tells us to erect the highest and longest aerial possible, whilst another school declares that to be able to cut out the local station, which the B.B.C. is so insistent that we should receive, it is essential to employ a series aerial condenser,

"Shut up! What is an aerial?"

thereby cancelling out all the excellent qualities which the aerial may otherwise possess. Just what is one to do?"

"The answer," said the Professor, after a moment's thought, "is perfectly plain. Here he made as if to rise to his feet, but remembering (owing no doubt to the dash of Melmanism in his Goopo), what had occurred a few moments before, he desisted from the attempt. The answer," he hissed, "is this."

"Go on," I said, going through the motions of pulling out a notebook (which I had left in my other coat), and poising a pointless pencil. "Go on."

"First of all, what is an aerial?"

"Hi, that's a question! You said that you were going to give an answer."

"Shut up!" roared the Professor. "What *is* an aerial?"

I remained mute.

"An Aerial"

"Why on earth don't you answer?"

"Well, how the dickens can I when you tell me to shut up? An aerial is a length of wire attached at one end to a chimney pot and at the other to a clothes-prop nailed to the roof of the fowl house."

"I didn't ask what your aerial was. I said 'What is *an* aerial?'"

"Well, isn't mine *an* aerial?"

"***!!!***!!!"

"You'd better have another spoonful," I suggested, "then perhaps you will find the answer without asking all these silly questions."

The Professor, who appeared to have had his whack, placed the now half-empty bowl on the floor and flipped his fingers for little Bingo, who emerged from a basket by the hearth and fell upon the Goopo with a will.

Even after the first dozen laps it became evident that Goopo was doing its work. One could, in fact, observe the rapid tuning up of Bingo. Having finished the basin, he licked his lips with a queer glint in his eye, stretched his revitalised muscles and then flew at the Professor.

The Chase

I have never before realised under what a disadvantage a fellow labours when he is endeavouring to flee round a room at something approaching the speed of light with all his brace buttons gone, what time a small but super-energised hound is doing his darnedest to get him by the seat of the pants. For some moments I watched fascinated.

The Professor leaped over a cone loud speaker, whilst Bingo went through, like a circus rider through a hoop. The Professor tripped over an accumulator, clutched at his super-putrodyne to save himself from falling and brought it crashing to the ground. Bingo, in springing after him, knocked a sheet of copper on to the top of a 300-volt high-tension battery, and the resulting blue flames were beautiful to behold.

"Distract his attention from me!" yelled the Professor.

"No fear," I cooed. "Watching you is quite good enough for me."

Knocking over the sofa as he ran, the Professor made a dash for one of the window curtains. He was quite half-way up it before it gave way with a rending noise, allowing him to drop upon a pile of valve boxes that had arrived that very morning. Eluding

. . . at something approaching the speed of light . . .

his small aggressor by a miracle, the Professor went up the other curtain like greased lightning. He remained sitting upon the curtain pole whilst Bingo sat below, gazing longingly upon him.

"Well," I said, "I am sorry to leave you, but I must be going. Before I depart I *do* wish you'd tell me just what is an aerial."

"GET OUT!" roared the Professor.

A RADIO SENTINEL

SELENIUM cells, which are used now for such a great variety of purposes, have been employed in a tunnel between New York and New Jersey for the novel purpose of counting the vehicles as they pass through the tunnel.

The method employed is a comparatively well-known one, a beam of light falling upon the selenium cell being arranged so that it is interrupted by the passage of a vehicle. By means of amplifiers, relays, and so on, a special counting machine is actuated and in this way a record of the number of vehicles passing through the tunnel is made, as well as the actual times at which they pass.

Selenium cells have been used in a similar way to act as burglar alarms, the beam of light being interrupted by the presence of any unauthorised person.

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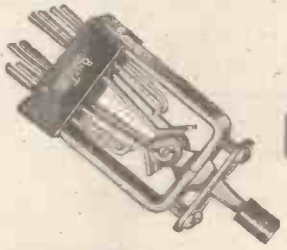

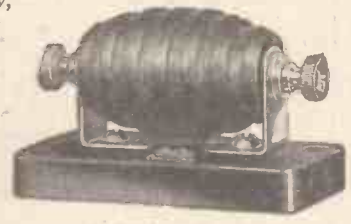

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A PRACTICAL MAN'S CORNER

This is a special section for the set-builder, in which he will find many hints of value.

By R. W. HALLOWS, M.A.

Working in Aluminium

ALUMINIUM has become a very popular metal for screening in wireless sets, and now that it is so extensively used by readers of the WIRELESS CONSTRUCTOR for "chassis" sets a word or two about working it may be found useful. This material is one of the easiest metals in the world to drill; a sharp drill goes through it almost as if it were cheese, and there is no difficulty about making neat, clean holes.

One point, however, should be borne in mind when drilling is in progress. The metal should always have something solid, such as a piece of hard wood, below it, or the presence of the drill may make a cup-shaped hollow and result in jagged, torn edges on the exit side.

Never use a good file for trimming up aluminium if you can help it, for this soft metal has a horrible knack of clogging files as nothing else can. There is only one way to prevent clogging of this kind. Before you bring the file into service rub it with a piece of soft chalk. The chalk then partly fills up the interstices and any aluminium deposit lies upon it.

If a file has been thoroughly chalked first of all, clogging can be easily removed by brushing over either with a file card or with one of those wire brushes that are sold for getting the rust off stoves.

If a sheet of aluminium has become kinked or bent, the best tool for flattening it out is not a hammer, but a mallet. Lay the sheet upon a flat table and place over it a folded newspaper. Tap evenly and gently with the mallet and you will have little difficulty in flattening out the sheet without denting or marking it.

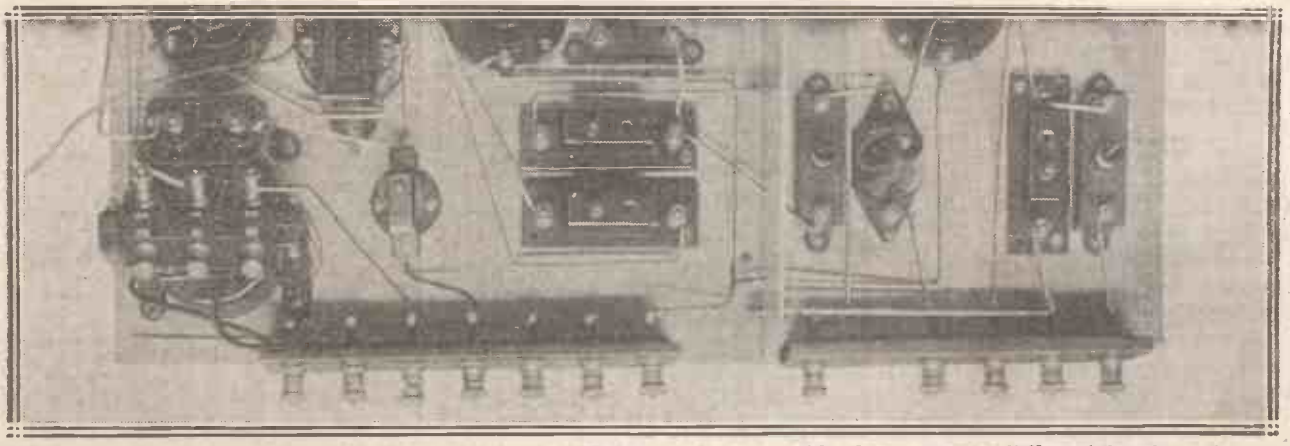
For cutting sheet aluminium a pair of medium-sized tin shears is advisable, but in an emergency the job can be done with a large pair of scissors, provided, of course, that the metal is not of very thick gauge. Large holes for screen-grid valves can be made in the way so often recommended, by marking out the circle required and drilling just inside the periphery a chain of medium-sized holes almost touching one another. The webs are then cut away and trimming up with a file completes the job.

Personally, I prefer to use a plain carpenter's bit with the horizontal cutting portion filed off. All that is then left is the vertical cutter. Mark the centre of the hole to be made and drill through first of all with a small drill. Now put your specially prepared bit into the brace and you will have no difficulty in removing the unwanted piece of aluminium.

The sheet to be drilled in this way must, of course, rest upon a flat block of wood. For most screen-grid valves a 1½-in. hole is required and a bit of this size will therefore be sufficient.

A Safety-First Dodge

Some modern condensers contain very little solid dielectric material. They are robust enough once they are mounted upon the panel, but the constructor, if he is not careful, may



Although sets are designed so that the wiring is simplified as much as possible, there are many little points where the experienced constructor scores over the novice, and many of these are dealt with month by month in "A Practical Man's Corner."

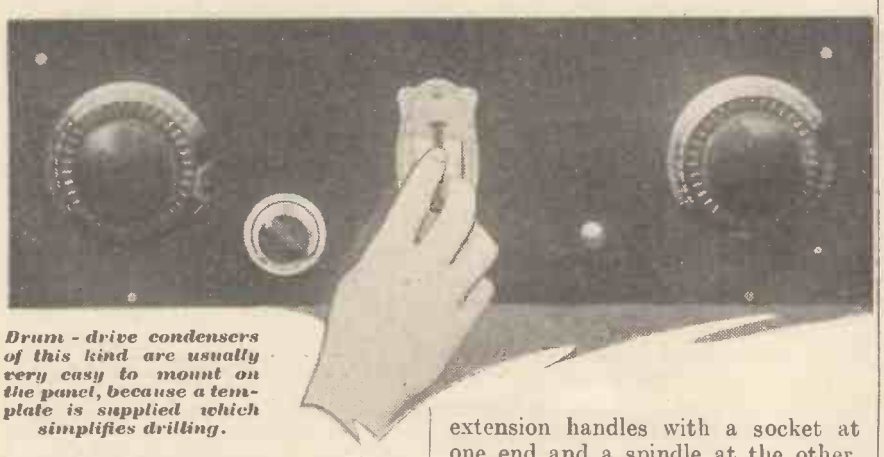
A Practical Man's Corner—*continued*

easily do some damage while he is engaged in mounting them. The danger spot is usually that portion of the ebonite or bakelite moulding through which the spindle passes at the front of the condenser.

The insulating material here may be so thin that one can crack it by holding the condenser against the turning of the one-hole-fixing nut. When a condenser of this rather fragile nature is employed it is as well to remember that prevention is better than cure and to take precautions in time.

Very Easily Fitted

An excellent tip is this. It will be found that over the metal bush through which the spindle passes there is a little rim in the surrounding moulded material. Take two turns of No. 20 bare copper wire round this and pull it tight, crossing over the ends and twisting them up with the pliers. Once the condenser has been mounted this safety wire may be snipped off if desired, but there is no reason why it should not be left in position as a safeguard in case the condenser ever has to be removed from its position on the panel.



Drum-drive condensers of this kind are usually very easy to mount on the panel, because a template is supplied which simplifies drilling.

Butterfly Screws

So long as one does not go down much below 20 metres there is no need to have extension handles for the slow-motion dials of variable condensers, for hand-capacity effects are negligible. For work, however, upon wave-lengths much shorter than this it is a distinct advantage to have them so far as tuning is concerned.

There is, however, one drawback: if the extensions are six inches in length they protrude an unconscionable distance in front of the panel, and the chances are all in favour of somebody doing considerable damage at some time by knocking against them.

For Short-Wave Tuning

I had fully realised that something would happen to mine before long, but with that laziness that is characteristic of most human beings when small jobs come their way. I kept putting off taking steps to ensure their safety.

It did, of course, happen when Amelia Jane barged into them during dusting operations, and one of them "came off in her hand." Incidentally, a perfectly good slow-motion dial was smashed by the leverage exercised upon it. Here's a tip that fellow short-wavers will find proof against not only hand-capacity, but also body weight.

One can buy ready-made 6-in. extension handles with a socket at one end and a spindle at the other.

Detachable Dials

To fit them one removes the knob from the slow-motion dial and fits the socket of the extension piece over the spindle so vacated. The extension piece is secured by means of a setscrew. The knob from the dial goes on to the spindle at the other end of the extension handle.

To make everything safe, remove the extension handles whenever the set is not in use. Quite so, but to loosen a setscrew means that one must fetch a screwdriver, and it is at this point that the innate laziness of the human animal manifests itself.

What is required is a setscrew that can be tightened up or loosened with the fingers, and it is only a few minutes' job to make one that answers excellently. So far as I know, 4 B.A. butterfly bolts are unobtainable; one can, however, obtain butterfly nuts at any large tool shop.

Cut off a $\frac{3}{4}$-in. length of 4 B.A. studding, trim up the ends and turn it into the butterfly nut. On to the studding run a hexagon 4 B.A. nut, and tighten this down firmly against the surface of the butterfly.

The studding is thus locked in place and one has an excellent butterfly bolt, easily tightened or loosened with the finger and thumb. Use this instead of the setscrew, and there is absolutely no excuse for not removing the extension handles when the short-wave set is not in use.

A Coil-Winding Hint

Everyone knows that when winding the solenoid coils that are almost universally used to-day it is astonishingly difficult to get the first and last turns on quite as tightly as one should. When the winding is finished the coil looks very nice, but after a little handling these outside turns begin to sag and to separate themselves from their neighbours.

This is intensely annoying should it happen to the outside turns close to the ends of the former, for they may slip right over, with the result that the coil is transformed very quickly from an inductance into a cat's-cradle! One method of ensuring that the outside turns do not slip is to file shallow cuts in the ribbed former in the positions that the first and last turns would occupy.

This works well so long as there are fins, but it cannot, of course, be employed with cylindrical formers of paxolin or similar materials.

Tightening the Turns

Here's another tip which will be found completely to prevent the slipping or slackening of turns. When all are in position take a little Seccotine on the point of a matchstick and work it in between the first turn and its next-door neighbour. Then press the two turns tightly together.

Treat the last turn and the last turn but one in the same way. Shellac may be used for the same purpose, but Seccotine is available in most households, and it makes a thoroughly sound job. Don't use a great deal of it; the merest touch is quite sufficient to bind the turns together.

H.T.B. ECONOMY—TRUE AND FALSE

There are many ways of keeping down running costs, but not all are so sound as they appear to be. Some of the pitfalls that await the unwary are described in this article.

By O. GERRARD

THERE are many perfectly sound ways of keeping down both initial costs and running expenses when the high-tension supply is obtained from dry-cell batteries. On the other hand, there are not a few roads leading, apparently, to economy which, in actual practice, lead to a very considerable increase in expense.

In previous articles it has been shown that a "saving" of a few shillings in the purchase of a small capacity battery for use with a multi-valve set is invariably turned into a big loss when the running costs per year and the service life obtained are worked out.

Undersized Cells

We have seen, too, that the lower price of many of the cheap foreign batteries is made possible only by the use in them of undersized cells and of the poorest insulation. To purchase either a battery that is too small for the work that it is required to do or a low-priced and dubious foreign battery in place of a well-made article is to indulge in what may be termed an obvious false economy. There are many others which are not so readily realised, and it is largely with these that the present article is concerned.

One of the most important qualities in a battery is what is known as its "shelf life." The shelf life means the number of weeks, months or years during which, if properly stored, it will maintain its E.M.F. when left upon open circuit.

The Deceiving Voltmeter

The reason why shelf life is so important will be appreciated when it is remembered that between the date on which the battery is made at the factory and that on which it passes into the possession of the user there may be a fairly long interval. Every battery begins to deteriorate gradually the moment that the electrolyte is placed within its cells. In the best of batteries the deterioration is so slow that its effects are all but inappreciable at the end of many months; in the poorest it is exceedingly rapid.

The worst of it is that there is often nothing whatever to show the purchaser that a battery has aged badly by being kept for a long time in stock. Owing to the practice of marking the extreme wander-plug sockets of 44-cell batteries "60 volts," whereas the E.M.F. of this number of cells in series should be 66 volts, the voltmeter may be a gay deceiver, for if there *are* 44 cells within the case it will still show 61·6 volts when the E.M.F. is down to 1·4 volts per cell.

Between the Taps

If the battery is of almost square shape one can be sure that it contains 42 cells, and that it should, therefore, have an E.M.F. of 63 volts, or a little more if in good condition. Any battery of this type which shows less than 63 volts should be rejected, unless it is stated on the case that it contains fewer than 42 cells. When the battery is of oblong shape, with the tappings marked in 6-volt steps, one should examine the distance apart of the sockets along the long edges.

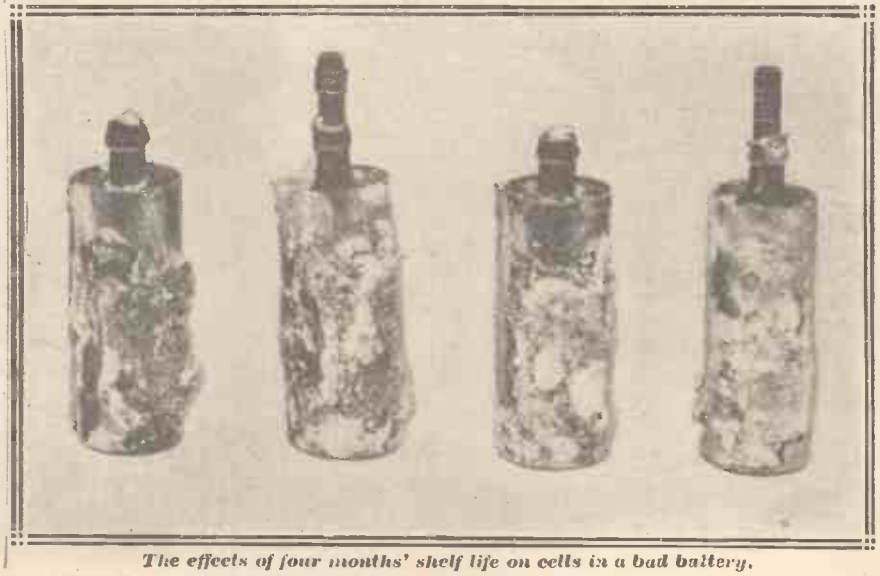
Before me as I write is a Continental battery of this shape with a reputed E.M.F. of 60 volts. The sockets in one row are marked 6, 18, 30, 42, 54 and 60 volts. The distance between each pair of sockets is 1½ inches, and an inspection of the battery makes it clear that each pair from 6 up to 54 volts take in 8 cells in series, thus giving an E.M.F. of 12 volts.

Since the distance between the socket marked 54 and that marked 60 is also 1½ inches, eight cells are obviously taken in here also. The number of cells for the battery is thus seen to be 5 × 8 *plus* 4 (between 0 and 6 volts) or 44. The lowest E.M.F. at which a 44-cell battery may be regarded as in reasonably good condition is 66 volts. Some 60-volt batteries, however, are properly so marked, since they contain only 40 cells arranged in ten rows of four. In these the minimum E.M.F. at the time of purchase should be 60 volts.

Local Action

The deterioration which takes place whilst the battery is on open circuit is mainly due to local action. We saw in a previous article that as soon as the electrolyte paste was placed in the zinc pot chemical action began—atoms being torn from the zinc. It was then shown that a peculiarity of the zinc when attacked by sal-ammoniac solution is that it cannot part with its atoms complete; each of

(*Continued on page* 288.)



The effects of four months' shelf life on cells in a bad battery.

H.T.B. ECONOMY—
TRUE AND FALSE

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them leaves behind one or two electrons. Thus the zinc becomes negatively charged and the electrolyte positive. In a very short space of time the chemical action ceases, since owing to the repellant action of its positive charge the electrolyte can receive no more positive ions.

Impure Zinc

More correctly one should say that chemical action would come to an end if the zinc were perfectly pure. Actually zinc, after being smelted from the ore, is always accompanied by small quantities of a considerable number of other metals, such as iron, silver, cadmium and lead, and to get rid of them involves long and expensive processes.

Now it is clear that if the zinc contains any impurity which is willing to part with electrons when attacked by the sal-ammoniac solution, action will continue even when the battery is on open circuit.

Owing to its being partially neutralised by collecting such electrons the solution is able to receive more positive ions, and therefore continues to attack the zinc. In cheap batteries zinc of very inferior quality is often used. Instead of the white, silvery sheen that good zinc shows when cleaned, this has a blackish lead-like appearance.

Another important point is that money is often saved in the construction of these batteries by using cell-pots made of zinc that is not only impure but also very thin. Under the effects of local action this is comparatively soon eaten right through, causing the battery to become absolutely useless for wireless purposes.

One battery made up of cells of the kind just referred to gave very poor results when tested out by running it through a fixed resistance of 150 ohms per cell for three hours a day on week-days. When it was examined at the close of the test the cells were found to be in very bad condition.

Results of Tests

It was decided, therefore, to see what would happen to such a battery if left upon open circuit. Two were obtained from the vendors in this country (this battery is of Continental make) and were stored under ideal conditions in the laboratory. The voltage of one was 66·5 and that of the other 66·4 when received.

Both showed an internal resistance of ·23 ohm per cell. At the end of two months a high-resistance voltmeter was applied to each. The first showed 66 volts and the second 65·8. The case of the latter was opened in order that the cells might be examined.

They were apparently in quite good condition. The resistance of this battery was found to have risen to rather more than 1 ohm per cell. At the end of a further two months the remaining battery was re-tested.

The voltage had now dropped to 43, whilst the resistance was 110 ohms per cell. Further, it was found that the output was fluctuating badly, the needle of the voltmeter showing an appreciable wobble. On breaking open the case a horrid state of affairs was disclosed. Almost every cell was badly bulged (a selection of them is seen in an accompanying photograph) and in half of them the zinc was eaten right through and the paste was oozing out.

It will be seen, then, that the battery with a small shelf life is a most uneconomical purchase, since it runs down rapidly though it is not in use. We see, too, what advantages there are from one point of view in indicating

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H.T.B. ECONOMY—
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for a battery a much smaller E.M.F. than it should possess if in good condition, and of giving a guarantee to replace it free if the voltage has fallen below the stated figure with the seals unbroken. H.T. batteries should never be bought and kept for a long time in reserve. Don't purchase until you mean to use them.

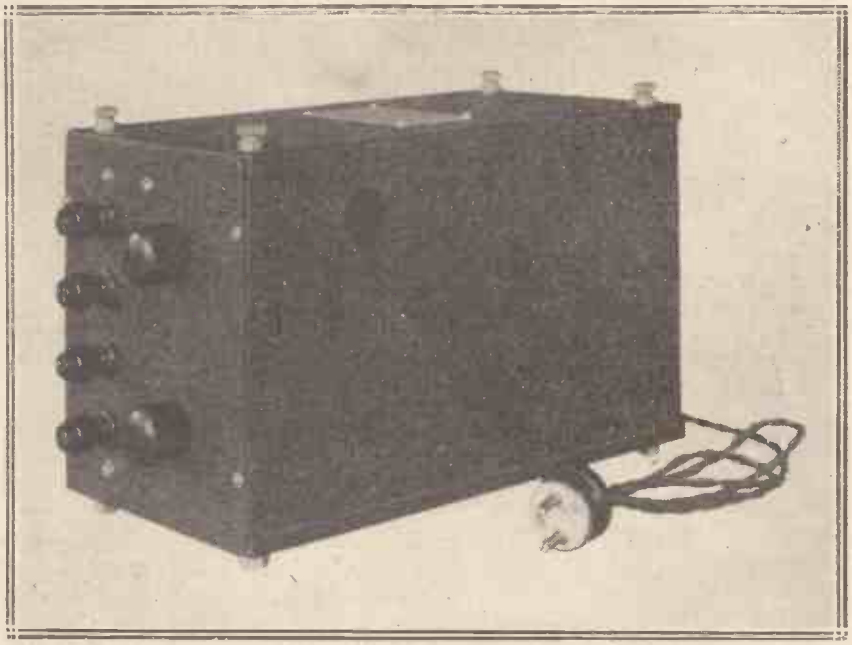
An Unsound Practice

It has become rather popular nowadays to provide batteries of both standard and medium capacities with 1½-volt tappings at the negative end, and to advertise them as incorporating a grid-bias battery. The 1½-volt tappings are admirable if proper use is made of them, but it is unsound practice and most uneconomical to use a portion of the high-tension battery for providing grid bias.

If, say, 9 volts out of 99 are used for grid-biasing purposes, it is clear that only 90 remain for the plates of the L.F. valves. One of the commonest causes of distortion is plate voltage starvation of the note-magnifiers, and the use of part of the H.T.B. for grid-biasing purposes is very apt to lead to such starvation.

If a part of the H.T.B. is used for grid biasing, the cells near the negative end are under no load, whilst the remainder are nearly always under a load that is, at any rate, quite as heavy as is good for them. Consequently, by the time that the portion used for supplying plate current is done for, that employed for grid biasing may be nearly as good as ever. Perfectly sound cells have thus to be consigned to the dustbin.

NO MORE H.T. BATTERY TROUBLES!



The Gecophone H.T., A.C. mains unit which gives up to 40 milliamps. On a load of 25 milliamps it gives a maximum voltage of 180 volts.

OUR NEWS BULLETIN

Some of the More Interesting Happenings in the Radio World this Month.

Falkirk Radio

WE understand that Falkirk has been selected for the site for the high-power Regional station which the B.B.C. intends to build in Scotland. Whether this is a well-founded report we have not yet been able to ascertain, but certainly the rumour is very strong that Falkirk has been selected, although at one time rumours were equally strong that the station would be somewhere near Glasgow.

This rumour also goes on to elaborate the fact by saying that building operations will soon be commenced.

Killing Jazz!

With the idea of killing jazz and educating the public to appreciate fine music, a Determination of Broadcasting Company has been formed in New York. The National Broadcasting Company and the Music Publishing houses of Carl Fischer and Leo Feist have amalgamated, with a combined capital of £1,320,000. These publishing houses will select the works to be broadcast from the stations belonging to the National Broadcasting Company.

Apparently listeners in America are to have their musical senses improved whether they like it or not.

Look at That!

A bank in Berlin has recently been saved the loss of more than £12,500 by means of a wireless picture. According to the "Daily Express," notification had been received from a New York banking house for presentation of a bill for this amount, and, as suspicion was aroused, a copy of the bill was wirelessed. It was found to be a forgery.

As far as we know, this is the first time that wireless has definitely stepped in and saved a bank from a big fraud.

Baird Finance

The report of the Baird Television Development Company for the year to June 30th last shows that two foreign companies have been formed, while in this country experimental transmissions of television have been arranged with the B.B.C. The balance-sheet shows preliminary expenses of £15,040, development and exploitation expenditure £61,400, cash and debtors total £22,031, against creditors £7,684.

The Baird International Television's initial report from the period June 21st, 1928, to June 30th last, states that the proportion of share premium account to be applied to writing off underwriting commission and brokerage is £13,833, and preliminary expenses £27,441; cash and debtors total £208,250, against creditors £5,734.

For the Blind

Fifteen thousand blind people in Great Britain and Northern Ireland are at present in need of wireless

(*Continued on page* 294)

The Sets for RESULTS

"Best Way" TITAN SETS

The Titan One
The Titan Two
The Titan Three
The Titan Four

are profusely illustrated with full diagrams and instructions for building in the

"BEST WAY" BOOK No. 350.

The reader has the choice of anything from a simple one-valver to a de-luxe 4-valve set with built-in wave-trap and wonderful long-distance loud-speaker performance.

6D. Everywhere.

"Best Way" RADIO-GRAMOPHONE SETS

6D. Everywhere.

"BEST WAY" BOOK No. 349.

"BETTER THAN RADIO"

is the verdict of large numbers of radio-gramophone users.

In order to get the best out of your gramophone records—and an amazingly fine "best" it is, too—you must use an electrical reproducer.

This is not difficult, and the "Best Way" Radio-Gramophone book tells you how to use your present set, your present gramophone, and your present loud speaker as an up-to-date electric gramophone.

The Best Way Radio-Gramophone Book is a mine of practical information on all phases of this latest branch of radio, and also includes full directions for building an up-to-date radio-gram. receiver, specially designed for the home constructor. It is amazingly simple to operate, and enables you to

CHOOSE YOUR OWN PROGRAMME.

You can easily build them

OUR NEWS BULLETIN

—*continued from page 292*

sets. This is the estimate of a committee which has been organised by the British Wireless for the Blind Fund, the idea being to provide every blind person with a set. It is estimated that there are sixty thousand blind people above the age of sixteen.

Where to Send

The Prince of Wales is president of the fund, the vice-presidents including the Archbishop of Canterbury, Cardinal Bourne, the Prime Minister, Mr. Stanley Baldwin, and Mr. Lloyd George.

Donations to the fund should be sent to Mr. Reginald McKenna, the hon. treasurer, British Wireless for the Blind Fund, 226, Gt. Portland Street, London, W.1.

A Station for Wales?

It was stated at the Convention of the Court of the University of Wales, at Llandudno, that a committee recently interviewed Sir John Reith and asked him to form Wales and Monmouthshire into a single region for broadcasting purposes, and to erect a high-power station to serve Wales as a whole.

According to the report, Sir John replied that the B.B.C. could not grant this request as the long wavelengths which would have to be used owing to the mountainous nature of the country would interfere with Daventry. A partial solution of the difficulty was to build a twin wavelength station on the north or south side of the Bristol Channel. This station would, if erected, have two wave-lengths for two different programmes, one of which would probably be the London programme, and the other would be devoted to the interests of people living in the Principality.

Germany's Giants

It is understood that a number of super-broadcasting stations—perhaps seven or eight—will be built in Germany to replace the present main stations. There will also be created a parallel system of low-power stations for single-wave transmission.

The power of the new stations will probably be 60 kilowatts, with the possibility of being lifted to 100 kilowatts, which is the maximum power agreed to at the recent Hague Session of the International Consultative Technical Committee.

In Two Year's Time

The stations will cost about £800,000 each, and it is rumoured that the first two may be about twenty miles distant from Stuttgart and Frankfurt. The stations are likely to be finished within the next two years.

5 S W Scores

The Marconi Company informs us that with regard to the broadcast of Marquis Marconi's speech describing the reception of the first transatlantic signal, while the transmission was made by two channels, i.e. from 5 S W, the experimental short-wave station at Chelmsford, and through the Post Office telephone channel from Rugby to New York, Marconis have heard from the Radio Corporation of America that it was the signals received from 5 S W that were used for the re-transmission in America.

Colorado's Quick Work

Within a quarter of an hour of the finish of his broadcast talk, Marquis Marconi received the first telegram of congratulation from the United States, and many others followed in quick succession. The first telegram came from an Italian listener who picked up the broadcast at Denver, Colorado.

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OUR NEWS BULLETIN

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A Transatlantic Thrill

Mr. David Sarnoff, Vice-President and General Manager of the Radio Corporation of America, telegraphed to Marquis Marconi:

"American scientists twenty-eight years ago were proud and glad to recognise your achievement. To-day they were thrilled to hear your personal description of this momentous event. Congratulations and my personal thanks."

The First Across

When Marquis Marconi broadcast his address from Savoy Hill he was accompanied by Mr. G. S. Kemp and Mr. G. W. Paget, two of his earliest assistants, who were with him when he first transmitted signals in the shape of three dots from Poldhu, Cornwall, which were received at St. John's, Newfoundland, twenty-eight years ago.

For the Schools

The B.B.C. states that the programme of broadcasts to schools for the Spring term (January 20th to April 4th) shows that on Mondays the broadcasts to schools will consist of readings and dialogues in foreign languages for secondary schools, history and stories for younger pupils; on Tuesdays, of music, elementary and advanced, French and special talks for secondary schools; on Wednesdays, of nature study and English literature; on Thursdays, of speech and language; and on Fridays, of rural survey and farming, geography, miscellaneous courses, concerts and plays.

Talks to Come

Two new important series of broadcasts will start in January, viz., "Modern Poetry," by Miss V. Sackville West, herself a modern poet; and "Newspapers and the World,"

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OUR NEWS BULLETIN

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by Mr. Wilson Harris, a journalist of wide experience and authority.

The foreign language courses will be undertaken by Mademoiselle Camille Vière and Monsieur E. M. Stéphan, who, in addition to their respective appearances, will on alternate Mondays broadcast together amusing dialogues of everyday French life. Dr. Herbert Schroeder will give German readings, Dr. A. R. Pastor readings in Spanish, and Miss Rhoda Power will continue her history broadcasts.

THE "S.O.S." SHORT-WAVER ON ORDINARY WAVES

THOSE of you who have constructed the "S.O.S." Short-Waver, a full description of which was given in the December, 1929, issue, will no doubt be interested to learn how very easily the set can be converted for use on the broadcast band.

For this purpose you will require a two-coil holder, and to each of its mounts (the fixed and the moving) should be attached two pieces of flex wire roughly about six inches long.

The end remote from the actual mounts of each flex lead should be equipped with a valve pin, and when the four leads have been fitted in this manner the change over from short waves to the broadcast band can very easily be accomplished.

Changing Over Coils

First stand the two-way coil holder on the vacant baseboard at the left of the set (the short-wave coils should, of course, be removed), and join the two leads from the fixed holder to the two valve legs marked "Grid Coil, L_1." The flex leads from the moving-coil socket should next be taken to the remaining valve legs (marked "Reaction Coil, L_2").

Insert a No. 60X coil in the fixed mount, and join the aerial lead-in direct to one of the terminals on the actual coil, ignoring the terminal marked "Aerial" on the terminal strip. For the moving holder (reaction) a No. 35 or 50 coil should be used.

The actual operation of the set remains exactly the same as before.

If any difficulty is encountered in making the set oscillate satisfactorily on the broadcast band, the two leads in the sockets marked "L_2" should be changed over. G. T. K.

ALL ABOUT WAVE-TRAPS

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interference eliminating device which is not, strictly speaking, a wave-trap or rejector device at all. In make-up it is just the same as the last type, but it is connected up rather differently. Instead of being placed in the aerial lead, it is connected in parallel with the aerial and earth terminals of the receiver, and constitutes an extra tuned circuit which requires to be operated when you are searching.

In this case the extra circuit requires to be tuned to the wave-length of the *desired* station, and it is then hoped that the signals from the interfering station will be allowed to pass fairly freely straight across from aerial to earth without affecting your receiving circuit appreciably.

For Large Receivers

In practice this device serves fairly well, but, of course, it is to be understood that it requires to be operated all the time that searching is proceeding on the receiver and really constitutes an extra control.

Consequently, a certain amount of extra skill is called for on the part of the operator and the handling of the set is rendered slightly more complicated. Further, this device usually leads to a slight loss in signal strength amongst the other stations. This is obviously something of a drawback, and so this form of interference eliminator should be regarded as one for use only with comparatively large receivers possessing a good reserve of power.

If this requirement can be fulfilled the device is a decidedly good one, for its effect in removing interference is very considerable, because, as you will see, it does not depend for its action upon any *excluding* of a *single* station. It tends to remove *all* unwanted stations and simply enables the one desired to be brought in.

Use a 60-turn "X"

The constants of this interference eliminator can be exactly the same as those of the Fig. 3 version, namely, an "X" type coil of the usual size for the lower broadcast band (a No. 60) and a ·0005-mfd. variable condenser. It is most important, by the by, that a really efficient coil should be employed in this circuit, and indeed in all interference removing devices.

I have included Fig. 5 in these notes as a suggestion of another

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ALL ABOUT WAVE-TRAPS

—continued from page 296

method of arranging the Fig. 3 type of trap to obtain slightly more drastic rejection. Here, instead of using an "X"-type coil, with its relatively small coupling tappings, one of the centre-tapped variety is indicated. To get the best effect you should have rather a smaller size than in the previous case, and a No. 40 or 50 will usually be found the best.

A Very Effective Type

In order that the circuit may still tune up to the desired wave-length, a rather larger variable condenser, or, at any rate, tuning capacity, is required. One quite practical method of arranging things is to use still a ·0005-mfd. variable condenser and to connect in parallel with this a fixed condenser of about ·0003 mfd. This is suitable for a No. 50 plug-in coil, but if you want to use a No. 40 (this usually gives slightly better effects) it is advisable to increase the size of the fixed condenser to ·0005 mfd.

This trap is suggested as being worthy of attention on the part of those who live very close to Brookmans Park, since it is one of the most drastic interference rejectors which I have tried. The method of operating it, of course, is exactly the same as in the case of the Fig. 3 arrangement.

By the by, I do not know whether I have made clear that all these arrangements can be used for the separation of the two Brookmans Park transmissions one from another. Obviously this can be done by setting the trap by means of its tuning condenser to reject either one or the other of the two stations, leaving your receiver free to bring in the one which you require at the moment.

Wave-Change Switching

You could arrange matters so that you do not require to re-tune your rejector every time you change over from one station to the other by using two variable condensers with a simple change-over switch to connect either one or the other across the coil as desired. You could then find the right setting for each condenser for the rejection of the particular station, and simply change over from one to the other according to the one which it is desired to shut out.

Fig. 6 illustrates an interesting form of interference eliminator which is readily applicable to sets employing plug-in coils for tuning purposes. It

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ALL ABOUT WAVE-TRAPS

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consists of a tuned "loop" circuit which is coupled to the primary coil in the receiver. For example, if you have something in the nature of a Reinartz set with a primary, secondary and reaction coil, you could place this extra coil fairly close up against the side of the primary inductance of the receiving circuit, and connect across in parallel with it the usual ·0005-mfd. tuning condenser.

You will find that this device is very much like the one illustrated in Fig. 2, giving quite a fair rejection effect when tuned to resonance with the signals of the undesirable station. For the rejection of a station on the lower broadcast band a No. 50 or 60 coil is correct.

In Figs. 7 and 8 I have shown two alternative methods of connecting the Fig. 3 type of trap into circuit, these being arrangements which I have found in some cases to suit individual receivers rather better than the plain series aerial scheme. The constants of this trap will be exactly the same as in the Fig. 3 device.

THE "CHASSIS" SHORT-WAVER

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confined to general operating details.

Having inserted the valves, using an "H.L." type for detector, an "H.L." type for the first L.F., and a good power valve for output, connect up suitable L.T. and apply about 100 or 120 volts H.T. across the appropriate terminals. Connect up loud speaker or 'phones, aerial and earth, and see that the grid-bias battery is properly mounted under the chassis, and the plugs inserted.

You cannot do better than adhere to the suggestions of the valve makers in the matter of grid-bias voltages—generally speaking, 9 volts on the output valve and 1½ or 3 volts for the first L.F. will be suitable.

To commence, insert a 6-turn coil in L_1 and a 9-turn in L_2 (reaction), and use the aerial series condenser "all in." This aerial coupling condenser naturally controls the amount of damping introduced into the tuned circuits from the aerial, and therefore acts as an auxiliary reaction control.

With the conditions mentioned above, the set should go into

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THE "CHASSIS" SHORT-WAVER

—continued from page 298

oscillation with the reaction condenser about half-way in, and this setting should not need much alteration as the tuning condenser is swung right round from 0–100°. With these coils the lowest setting of the tuning condenser should give a wave-length of about 30 or 32 metres, just round about which setting is a whole collection of broadcast stations—providing that you listen at the right time.

Many Stations Available

Now, having found that the set works (and, if it doesn't, suspect either your H.T. or the detector valve, and try changing the latter), remove the 9-turn reaction coil, insert in its place a 4-turn coil, reduce the aerial coupling condenser C_3 to rather less than half-way in, and try again. The set should still oscillate strongly over the whole range, and the 32-metre position will now have shifted up to 20 or 30 degrees.

With the coils interchanged, using the four as L_1, the range of about 19–30 metres will be covered, and somewhere about the middle of the dial will be the 25-metre broadcast band, on which will be found 5 S W (Chelmsford), W 8 X K (the short-wave K D K A), and a good many other stations.

Round about the band between 31 and 33 metres the following may be heard at various times of day and night—W 2 X A L (New York), 7 L O (Nairobi), 2 F C (Sydney), P C J or P H I (Hilversum and Huizen), W 2 X A F (Schenectady), 3 L O (Melbourne), two powerful Germans, and the new station at Copenhagen.

Tune Carefully

The best advice regarding operating that I can possibly give is this: Forget that you are handling a short-waver at all. Imagine that it is a selective, critically-tuning broadcast receiver. Take pains over the tuning and you will often improve the reception of a station by 100 per cent, even when you imagined that he was perfectly tuned-in before.

Should the set not oscillate at any time, reduce the aerial coupling condenser and you should have no difficulty in making it do so. With this condenser set towards its minimum value I frequently had to bend the coils apart by brute force to prevent

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THE "CHASSIS" SHORT-WAVER

—*continued from page 299*

it from "squealing," although the natural method of putting a stop to this is to reduce H.T. voltage or increase the amount of aerial coupling!

Among the stations logged during rather poor conditions with this set are: Manila, Philippine Islands; Bangkok, Siam; Malabar, Java; Nairobi; Schenectady; Monte Grande, and all the more usual short-wavers. Actually the Antipodes have not been heard, but they are never prevalent at this time of year and conditions generally have been quite mediocre.

Do not, therefore, be disappointed if you do not hear much at first. Conditions during early February are generally extremely good, and there should be a chance then of putting the set on its mettle.

An article dealing with operation and giving dial settings for short-wave stations will probably appear very shortly.

CLEARING THE ETHER

—*continued from page 250*

motion. With the new apparatus, Brookmans Park could be tuned completely in and out by half a turn of the threaded rod carrying the rear plate!

This tiny condenser was placed in parallel with the ordinary tuning condenser, which, by the way, had fitted to it one of the best of the existing vernier dials. So fine was the tuning that the station could scarcely be found, and certainly not held, by the most delicate manipulation of the vernier dial on the main condenser!

Obviously, then, we were tuning to extremely fine limits. Equally obviously, the width of our tuning band was far below the conventional 10,000 cycles.

Ideas Drastically Revised

Quite apart from other considerations, simple arithmetic proved this, for with a 100-degree condenser of the straight frequency type, tuning from 200 to 600 metres, there were roughly ten thousand cycles per degree, so that in this way tuning to something finer than one degree would involve a narrower selectivity than this. Actually, we were tuning to a tiny fraction of a degree, but what was most remarkable of all was that the quality was not in any way suffering!

Such was the sharpness of tuning that it immediately occurred to us that we should be able to separate the transmission from a powerful heterodyne only 100 cycles or so away, and, sure enough, when such a local oscillator was set up, dissipating roughly half a watt, within a few feet of our frame aerial, the Brookmans Park transmission could be tuned in without the slightest interference.

With an invention of such major importance it was thought desirable that the public should know something of it immediately, and accordingly demonstrations were given to leading scientists, and, at a dinner at the Hyde Park Hotel, to the Press. A very large number of patents are involved in this invention, for which reason a complete disclosure of the technique involved cannot be made in the present article, but before long the method will be described in detail. It should be stated, however, that the Stenode Radiostat invention cannot be made in a separate box for attachment to existing receivers, and the receivers themselves must be designed to incorporate the Stenode circuit.

In any case, Dr. Robinson has shown that such of our ideas regarding quality and selectivity as have been based upon the side-band theory must be drastically revised, and that we are *not* up against an insuperable barrier. The new invention (or I ought to say inventions, for there are a number) comprising the Stenode Radiostat system will enable the number of broadcast transmissions to be multiplied by a very large figure, and will clear the ether of the present congestion much more effectively than any bypass road has ever cleared town traffic problems.

A Complete Disclosure

Leading scientists who have witnessed demonstrations and to whom a complete disclosure of the technique has been made have stated that the Stenode Radiostat invention is the greatest contribution to the art since Dr. Lee de Forest introduced a third electrode into the valve and made modern radio telephony possible.

Readers of the WIRELESS CONSTRUCTOR will, I am sure, be very interested to hear that Mr. L. H. Thomas (6 Q B), whose short-wave articles and receivers have been a regular feature of the WIRELESS CONSTRUCTOR, has been working with Dr. Robinson and myself in the practical development of the Stenode Radiostat. He is seen behind the instruments in the accompanying photograph.

INDEX TO ADVERTISERS

All communications concerning advertising in "Wireless Constructor" must be made to John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Telephone: City 7261.

S.S.

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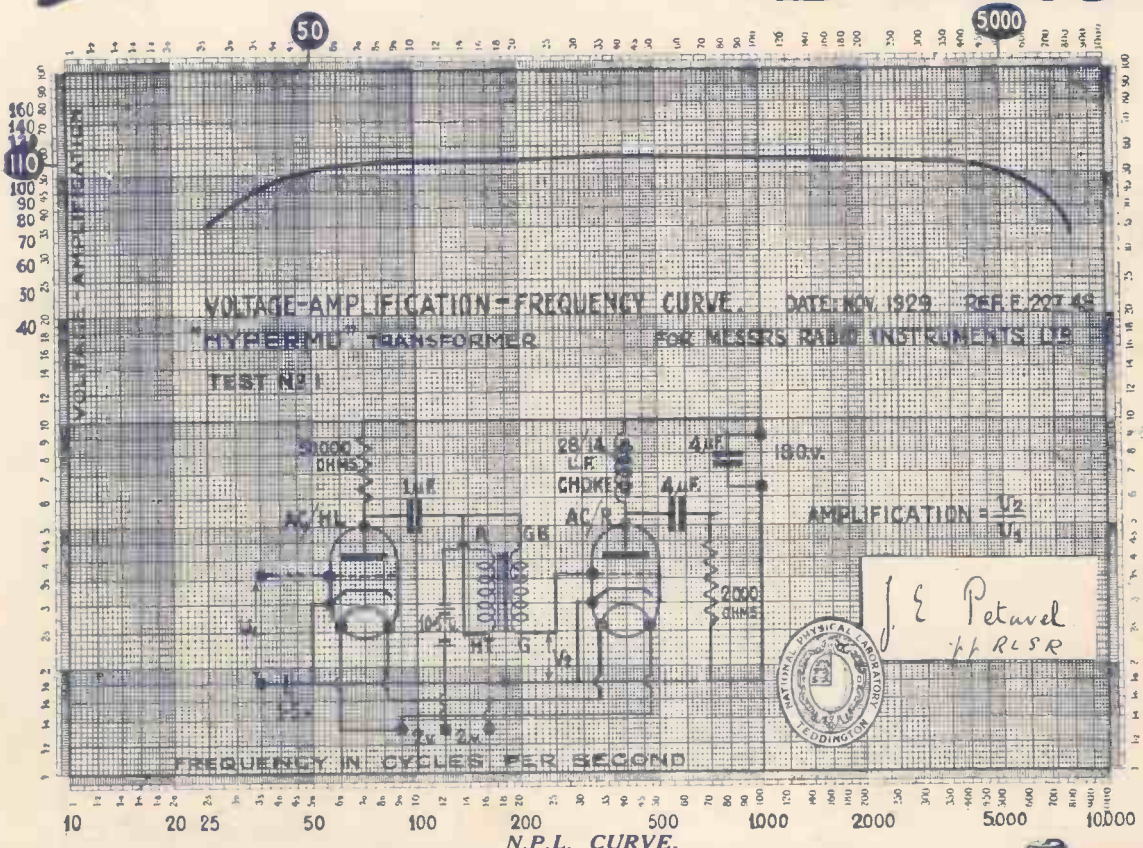

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