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Amateur Wireless

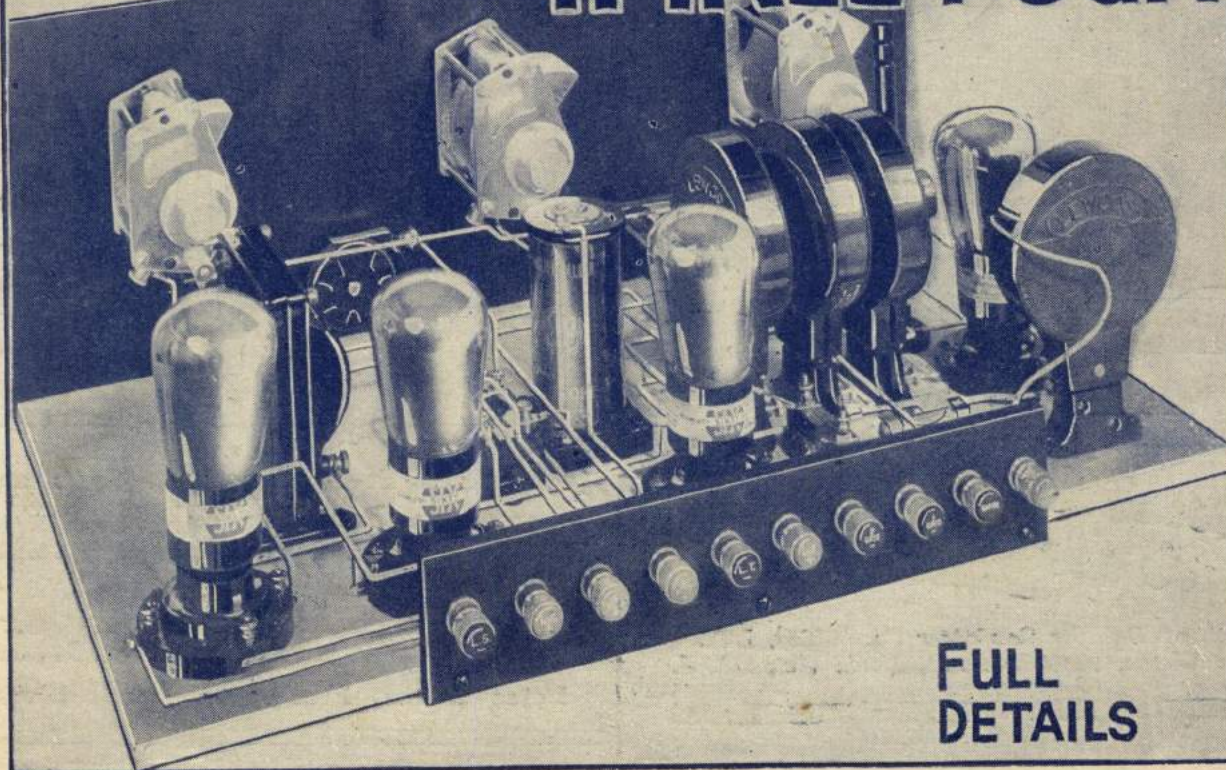
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Every
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Vol. XII. No. 315

Saturday, June 23, 1928

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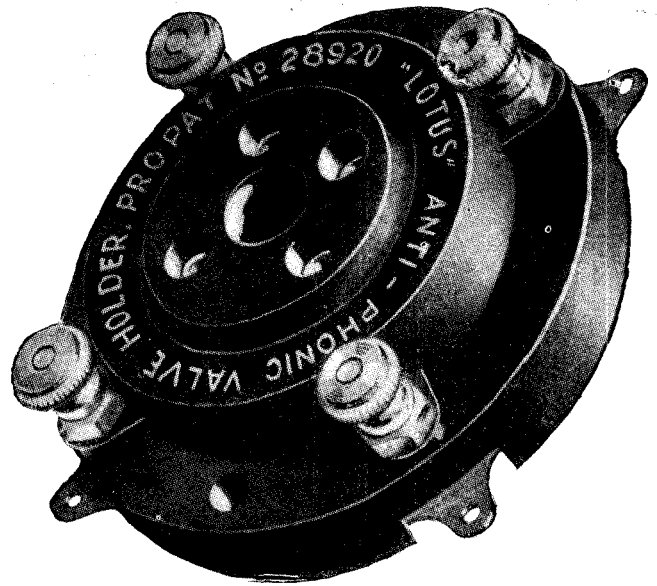
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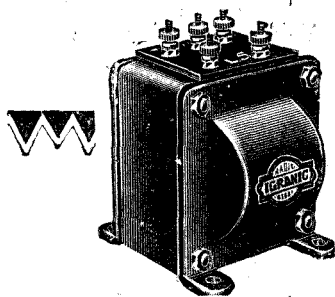
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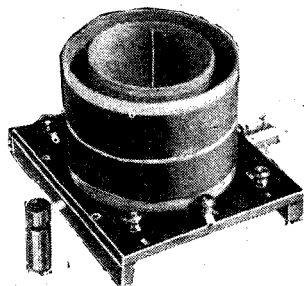
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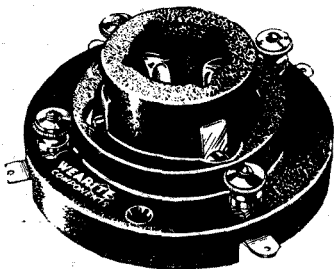
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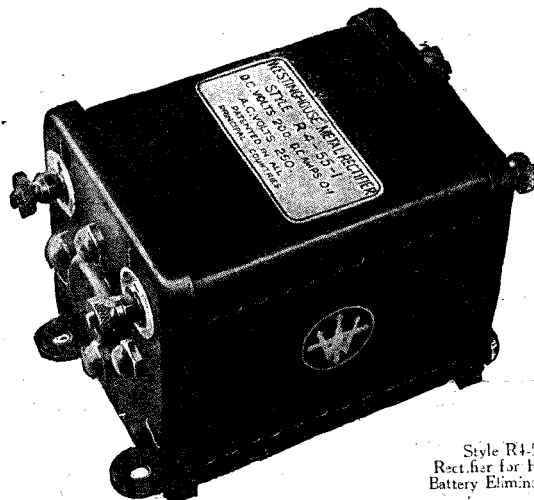


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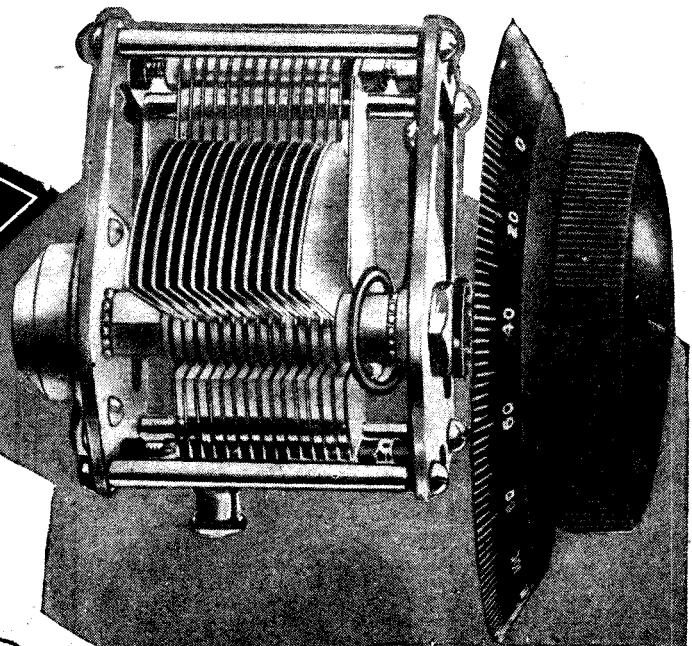
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Amateur Wireless

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The Leading Radio Weekly for the Constructor, Listener and Experimenter

Vol. XII. No. 315

Edited by BERNARD E. JONES
 Technical Editor: J. H. REYNER, B.Sc.(Hons.), A.M.I.E.E.

JUNE 23, 1928

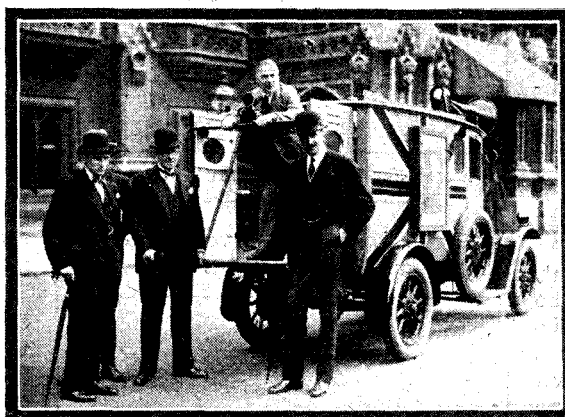
"Near and Far" Three-Four—B.B.C.'s National Chorus—News Competition—Air Force Pageant—PCJJ Calls "Italia"—The "House-and-Garden" Four

The "Near and Far" Three-Four—The four-valver described on page 898 this week should make a strong appeal to the family and to the expert member of it, for the "Near and Far" Three-Four, as it is called, combines the functions of broadcast receiver and short-waver. Let us know what you think of the idea.

B.B.C.'s National Chorus—Definite steps are being taken by the B.B.C. towards the formation of a National Chorus (about 250 strong) to be composed entirely of amateurs. Applications have been invited from all amateur choristers in the London area, and these will be asked to pass an audition in singing and sight-reading. Rehearsals, which will begin in September under the direction of Mr. Stanford Robinson, will take place regularly once a week.

News Competition—The Council of the Federation of Retail Newsagents, Booksellers and Stationers "views with alarm the adverse effect on newspaper sales caused by the broadcasting of racing, football, and election results, and other news by the B.B.C." The government is called upon to take "remedial action." Short of abolishing the present meagre news bulletins altogether, we fail to see what "remedial action" could be taken—unless we devote the whole of the bulletin to the Chinese situation!

Air Force Pageant—Part of the Royal Air Force Pageant on June 30 will form the subject of a descriptive broadcast narrative by Colonel the Master of Sempill and Flight-Lieutenant W. Helmore. The events to be described include a low-bombing attack, an air battle and night bombers in flight. Unfortunately the popular R.A.F. Band will not be heard as it will have left for a Canadian tour by the time the Pageant takes place.



Our photograph shows a van which has recently been presented to the Conservative party for use at big meetings. A microphone can be erected on the tail-board where the speaker stands, the amplifying apparatus is contained in the van, and the loud-speaker mounted on the top at the front. Mr. Alfred Denville, the donor of the car is seen at the microphone.

A Prince of Wales Broadcast—On June 30 listeners will have the opportunity of hearing the Prince of Wales' speech relayed by the Glasgow station from Hampden Park, on the occasion of the great Royal Scottish Rally. Afterwards will follow a description of the arena displays of the Wolf Cubs. The Pack Song, and the Grand Howl will then be heard. Music will be supplied by the Pipe Band of the 21st Glasgow (L.M.S.) Rover crew.

PCJJ Calls "Italia"—PCJJ, the powerful Philips short-wave station, made an attempt to call the airship *Italia* on Friday evening, June 8, between 5 p.m. and 7 p.m. A wavelength of 31 metres was used and messages were sent every three minutes in French and Italian, but no reply was received. North Cape, Spitzbergen reported good reception of the signals. Any amateurs who may have heard these signals are requested to communicate with Philips Lamps, Ltd., of Charing Cross Road, London.

New Waveband Scheme—At the International Conference held at Lausanne (Switzerland), the following suggestion for new distribution of the higher wavelengths between the chief European countries was endorsed: Huizen 1,852 metres, Radio-Paris 1,752 metres, Königswusterhausen 1,649 metres, Daventry 1,561 metres, Moscow 1,483 metres, Warsaw 1,414 metres, Motala 1,352 metres. The remaining European countries will have to be contented with the middle band. This suggested division will be finally considered at the next technical conference, to be held at Brussels, at the end of July.

PRINCIPAL CONTENTS

Current Events	887
A Remarkable New Valve?	888
Making a Moving-coil Output Unit	889
For the Newcomer	890
The All-metal Rectifier	891
Practical Odds and Ends	892
On Your Wavelength	893
The "Best-yet" Crystal Set	895
Broadcasting Pictures by the Fultograph	896
Without Fear or Favour	897
The "Near and Far" Three-Four	898
"A.W." Tests of Apparatus	902

The "House-and-Garden" Four

A specially - designed screened-grid four-valver of the "transportable" type, has just passed through its laboratory tests and full details are to be given next week, when the AMATEUR WIRELESS Technical Staff will explain how to make a frame-aerial receiver of truly remarkable sensitivity. Everything except the loud-speaker is included in the cabinet—batteries, accumulator, frame aerial and four-valver itself. The construction is simple and the results outstanding. The "House-and-Garden" Four will add yet another "super" "A.W." receiver to an ever-growing list:

A REMARKABLE NEW VALVE!

THIS week we are able to reveal some advance details of a five-electrode valve of considerable interest. We must emphasise the fact that the Pentone, the Mullard pentode valve, is not yet on the market and, according to the Mullard Wireless Service Co., Ltd., who are introducing the valve, at least two or three months must elapse before it is in production.

THREE GRIDS
LARGE POWER OUTPUT

Meanwhile, our readers will be interested to know that Mr. Reyner, the Technical Editor, and the Technical Staff, have been conducting experiments with the pentode for some weeks past, and there is no doubt that when the new valve is available we shall be provided with some very interesting "hook-ups."

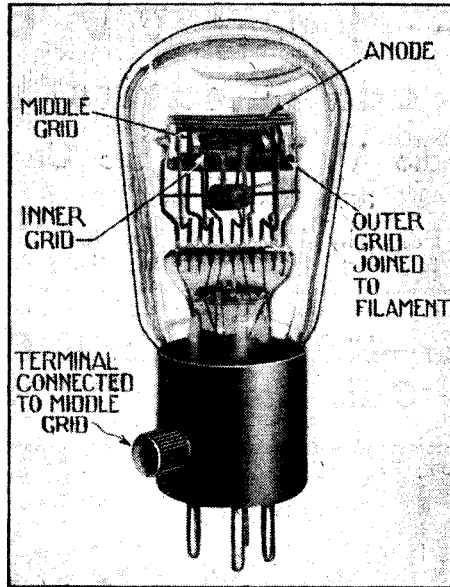
Construction

In any pentode there are three grids, in contrast to the one grid in the ordinary three-electrode valve.

The first grid, arranged near the filament, is the control grid, corresponding to the usual grid in the three-electrode valve. The second or auxiliary grid is connected to a terminal on the side of the valve base, and this grid must be maintained at the same potential as the anode. The third grid, nearest the anode, is connected internally to one of the filament pins. A "W" filament and the usual anode complete the assembly, which is clearly shown by our illustrations.

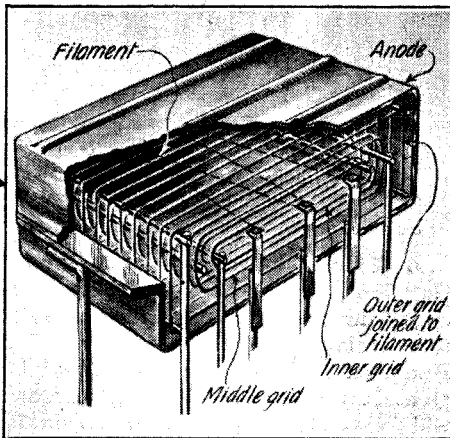
Standard Base

It will be seen that this five-electrode valve is very similar in appearance to the three-electrode valve, the only difference being the extra terminal on the side of the base. The Pentone can be inserted in any



Except for the extra terminal the valve outwardly is of the usual design

existing valve holder—a very convenient feature—and the only extra connection is



A sketch showing the arrangement of the electrodes

STANDARD BASE
VERY HIGH AMPLIFICATION

tion. Thus, instead of two valves and two inter-valve couplings after our detector valve, we only need one coupling—and a pentode. We not merely save in expense and complication—we are quite definitely going to gain in purity of reproduction, since we eliminate a source of distortion—an inter-valve coupling. In other words, this pentode dispenses with the first stage of L.F. amplification by virtue of its immense amplifying properties.

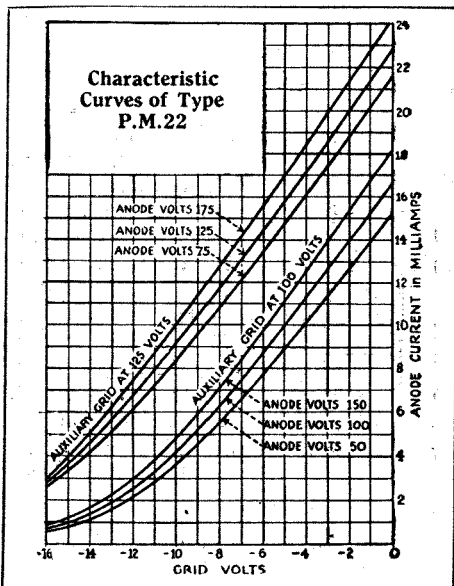
High Impedance

A quite natural question that might be asked is how we can reconcile the high impedance of the pentode (in the PM24 this is 28,600 ohms!) with previous advice on the necessity for a very low impedance output valve. The characteristic curves give the answer, for it will be seen that in spite of its high impedance, the Pentone has a large anode current.

Now, in the normal three-electrode valve the only way to get a large anode current is to keep down the impedance; but, unfortunately, as the impedance is lowered, so also is the amplification factor. In the Pentone, however, which is a form of screened-grid valve, it is practicable to keep the amplification high and still obtain a large power output. As this is so, we can ignore the comparatively high impedance, since it is the power output, and not the impedance, that is the main consideration in designing a power valve.

Two Types of Pentone

The two types of Pentone we have been (Continued on page 910.)



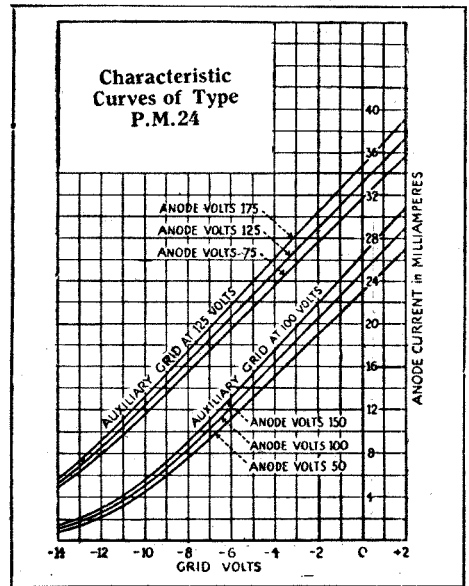
the wire from the auxiliary terminal to the H.T. + terminal.

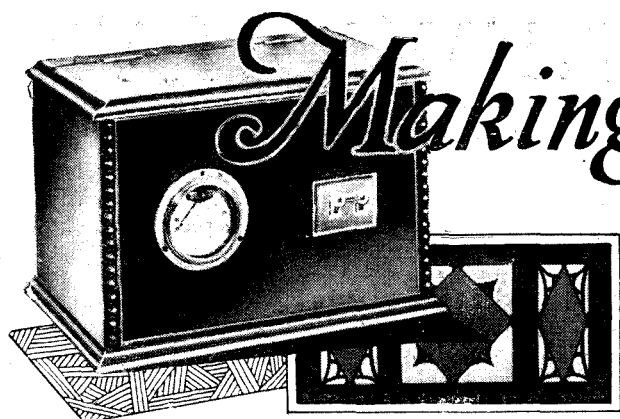
The special construction of the Pentone provides for a very high amplification factor and at the same time a super-power output. For example, the PM24, which is the 4-volt Pentone, has the enormous amplification factor of 62; yet its mutual conductance is 2.3 milliamps per volt.

Super Power and Amplification

This valve has a super-power-valve anode swing and, at the same time, a grid swing which is similar to that of an ordinary power valve. As most readers know, the amplification factor of the normal super-power valve is usually below 5; so that the Pentone provides over ten times the amplification usually obtained.

It is obvious that a super-power valve with such a high amplification factor will enable us to reduce our stages of amplifica-





Making a MOVING-COIL OUTPUT UNIT

By the "A.W." Technical Staff

ALTHOUGH any receiving set that will give good undistorted volume on the loud-speaker may be successfully used with a moving-coil loud-speaker, it is essential that a suitable output system be employed.

Readers who contemplate using a moving-coil loud-speaker will find the output unit here described very suitable for use with an ordinary set which is not provided with any special output system.

Besides a choke-filter output, the unit also incorporates a quick-break switch and back E.M.F. absorbing resistance while the milliammeter will prove a useful guide as to

Terminal strip, 9 in. by 2 in. (Becol, Raymond, Pertinax).

Cabinet, 9 in. by 6 in. by 6 in. (Carrington).

Nine Terminals, H.T. +, Anode, L.S., L.S., L.T. -, Output, Output, Input, Input (Igranic, Belling-Lee).

Wire-wound power resistance (R. I. and Varley).

The resistance of this last item will depend on whether the current for the "pot" winding is obtained from an accumulator or from the mains.

For accumulator use a resistance of 1,000 ohms will be suitable, while for mains current up to 240 volts a 10,000-ohm resistance is required.

Construction

A fret-saw will be found useful for cutting the two large holes in the panel, the necessary drilling dimensions of which are shown in Fig. 2.

Having fixed the panel to the baseboard, the various components may be mounted in position with 8B.A. screws and nuts in the case of the panel-mounted components, while 1/2 in. No. 4 wood-screws will be required for fixing the baseboard parts.

Before wiring up, the terminal strip (which holds nine equally spaced terminals) will have to be drilled and the terminals firmly mounted on it.

For use when wiring up and also as a guide for accurate placing of the components the full-size blueprint of the unit (obtainable from this office, price 1s.) will be found a good investment. The actual connections required are shown in Fig. 2 and may all be made without soldering.

Using the Unit

Fig. 3 shows the method of connecting up the unit to an ordinary set, using a moving-coil loud-speaker having a "pot" wound for use with an accumulator or mains.

Reasonable care should be taken (when the mains are used) in making the outside connections to the unit "pot" and it is advis-

able to use power flex for these connections, while the current should be taken from a main tapping point provided with switch

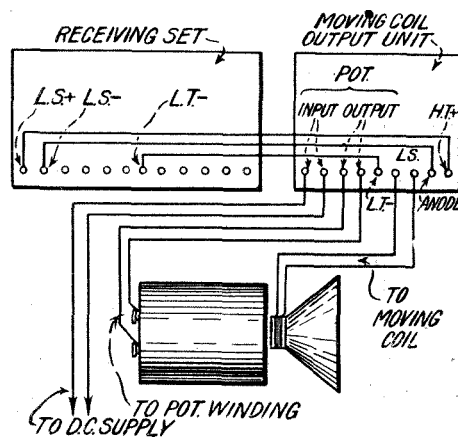
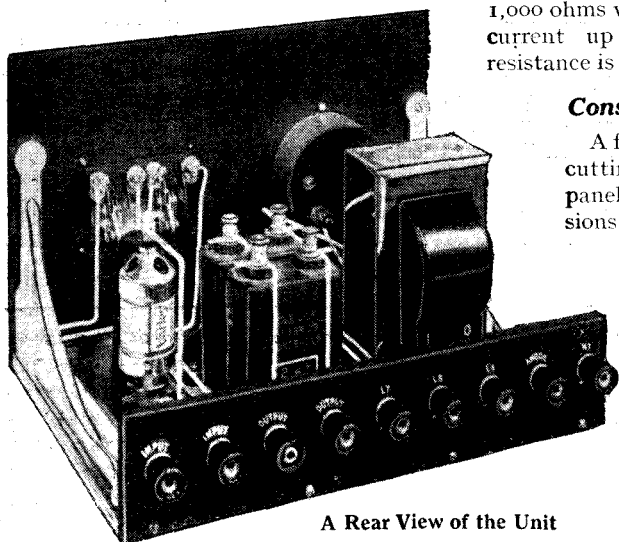


Fig. 1. The Circuit Diagram

and socket such as is usual when an electric iron or floor lamp is installed.

(Continued at foot of next page)



A Rear View of the Unit

whether overloading of the output valve is taking place.

The unit therefore incorporates everything which is likely to be required by the moving-coil loud-speaker user.

The circuit is shown by Fig. 1.

Components Required

To build the unit the following components will be required:

Panel, 9 in. by 6 in. (Becol, Raymond, Pertinax).

Baseboard, 9 in. by 6 in. by 3/8 in. (Carrington).

Two panel brackets (Carrington, Bulgin).

L.F. choke (Igranic type "G," R. I. and Varley).

Quick-break switch (Marconiphone).

0-50 milliammeter (Sifam).

Two packets of Glazite (Lewcos).

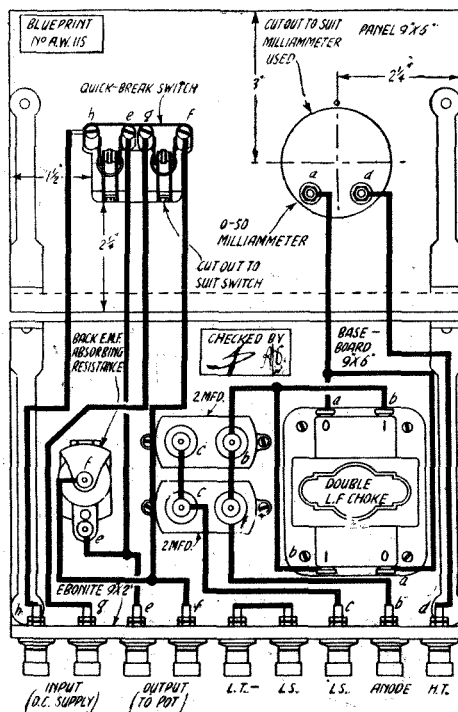


Fig. 2. Wiring Diagram.

Blueprint available, price 1/-.

For the Newcomer to Wireless : Reaction

COULD you tell me something about reaction? I know that it enables one to get a high degree of amplification, but I don't quite understand how this is brought about.

It'll be easiest if we think, to begin with at any rate, of a single-valve set. You know that the energy brought in by the aerial and applied to the grid of the valve is very small indeed.

Yes, I have realised that.

Well, now, in the plate circuit we have quite a respectable amount of energy, sufficient to move the diaphragms of a pair of telephones, though the set is hundreds or in some cases even thousands of miles from the transmitting station. Where does this energy come from?

I have never thought about it. I suppose it comes from the high-tension battery?

Exactly. We might compare the plate circuit with a pipe carrying steam at high pressure and the grid circuit with a tap in this pipe. The tap can be opened or closed by the expenditure of very little energy, but its opening or closing may make an immense difference to the amount of energy delivered by the steam pipe.

Then the grid really controls the flow of current from the high-tension battery?

That's precisely what happens; it

causes that current to fluctuate. That is the *action* of the grid.

I see what you're driving at—action and reaction.

You are quite right. We will come in a moment to the reaction of the plate circuit upon the grid circuit. Meantime you know probably that the exhaust from the cylinders of the steam engine is led up the smokestack.

It is for that reason, of course, that a mixture of steam and smoke comes out of the funnel of the locomotive in a series of puffs.

Just so. Now why is this done?

Well, the passage of the steam up the funnel or smokestack leaves a vacuum behind it and air rushes through the furnace to fill this vacuum.

In other words the greater the volume of the exhaust steam the more air will be drawn through the furnace and the hotter it will become.

And conversely the hotter the furnace the greater will be the amount of steam delivered to the cylinders and, therefore, the greater the volume exhausted, I suppose?

That is quite true until a certain limit is reached. You see then what happens. The furnace acts upon the steam pressure and the steam pressure reacts upon the furnace heat.

Yes, I follow that.

It is just the same with the wireless valve. We can feed back into the grid circuit energy from the plate circuit by coupling coils together.

Just what happens if we do?

Think of it in this way. A tiny impulse reaches the grid of the valve. Its incidence causes the grid to modify the plate current. There is a change in the amount of energy that it delivers. Owing to the coupled coils this change is passed back to the grid circuit, amplified inside the valve and passed on once more to the plate circuit in very much larger form. It is now re-transferred to the grid circuit and the cycle of operations continues. The net result is a huge building up of energy in the plate circuit.

Does this go on for ever?

In theory it might but in actual practice there is a limit, for the valve bursts into oscillation if we carry things too far.

Then by making the reaction coupling adjustable we can control the feed back of energy?

You've got it exactly. If the reaction control is smooth we can work up signal strength to something considerable before the valve goes into oscillation. You will see that reaction does give us a wonderfully handy means of increasing the sensitiveness of the receiving set.

"A MOVING-COIL OUTPUT UNIT" (Continued from preceding page)

If the output unit is to be coupled to a "mains" receiving set, or used with a set employing a mains eliminator for H.T., it is essential that the "pot" field winding be perfectly insulated from the "pot" casting. Any leakage at this point would be liable to cause the moving coil to be burnt out, if the coil happened to scrape the side of the air gap in working.

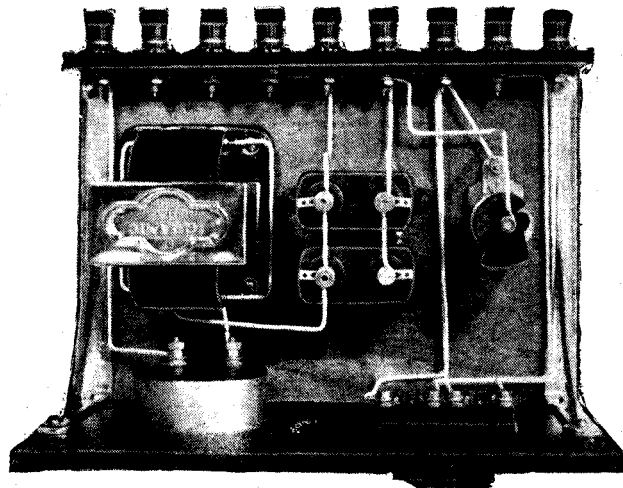
If any doubt is felt as to the insulation

of the field winding, a couple of 2-microfarad fixed condensers, joined in parallel, should be connected between the terminal marked L.T.— on the unit and the L.T.— terminal on the receiving set.

When the set is switched on the needle of the milliammeter will swing over until it is pointing to the number of milliamps

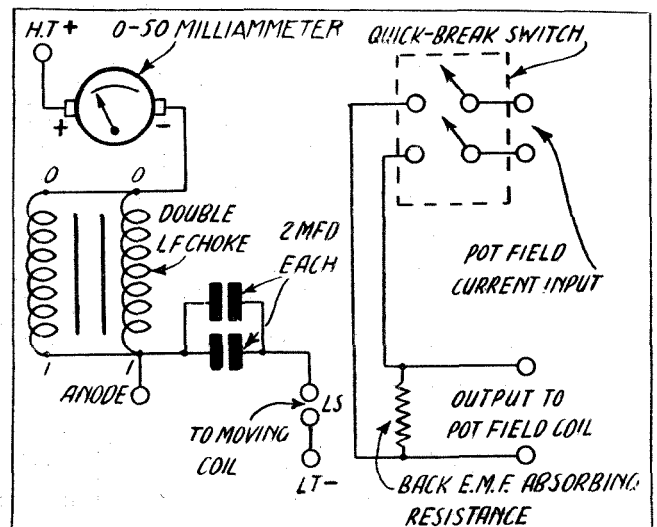
actually passing through the output valve.

Sudden kicks of the milliammeter needle denote either insufficient or too much grid-bias on the output valve or valves, or alternately that the output stage is not capable of dealing with the signal voltage passed on to it by the preceding stages of the receiving set.



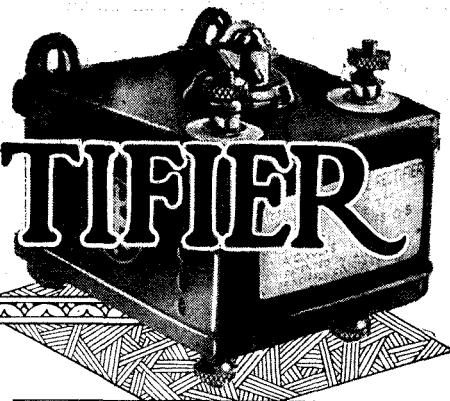
Left.—A plan view of the Unit

Fig. 3 (right) Method of Connecting Unit to Receiver





The ALL-METAL RECTIFIER



Our Technical Editor Describes the Construction and Discusses the Features of the New Copper-Oxide Rectifiers

**NO VALVES
NO MOVING PARTS
NO CHEMICALS**

JUST before the end of last year, reference was made in AMATEUR WIRELESS to a visit made by the Editor and myself to the Chippenham Works of the Westinghouse Brake & Saxby Signal Co. in order to inspect a new metal rectifier which had been developed by that company. The increasing use of alternating-current mains for the supply of the various voltages required in a wireless receiver has focused considerable attention upon rectifying and smoothing circuits. The average thermionic rectifier used for high-tension eliminators and the gas-discharge tube employed for low-tension supply both possess several disadvantages, not the least of which is the comparatively fragile nature of the rectifiers themselves.

A No-trouble Rectifier

Clearly, if a rectifier can be produced by arranging a contact between two different metallic substances we shall have a robust unit which, with proper care, should be "ever-lasting." This idea has occurred to many engineers in different parts of the world, and, indeed, many readers will probably be aware of the Kuprox metal rectifier, which has been available for use in the United States for some considerable time.

The Westinghouse Brake & Saxby Signal Company began to investigate this problem some five years ago. The problem of rectification is, of course, of great importance in the general world of electrical engineering, of which radio engineering is only a branch. Considerable time was spent in patient research, as the result of which the metal rectifier emerged as a commercial and thoroughly sound proposition.

Numerous applications of the principle were shown at the visit already referred to, but the device at that time was only available to the manufacturers. Indeed, the Ferranti trickle charger, which is a well-known instrument employing the Westinghouse metal rectifier, had just made its appearance on the market, and since that time several other units have appeared, marketed by various firms.

The Editor of "A.W." and I felt that it

would be a matter of great interest to the general public if they could obtain these rectifiers for experimental purposes. The disadvantage of such a proceeding from the manufacturer's point of view was that there are certain limits within which it is essential the rectifier be used. We expressed the view, however, that if these disadvantages and limits were clearly pointed out to the public this difficulty would disappear.

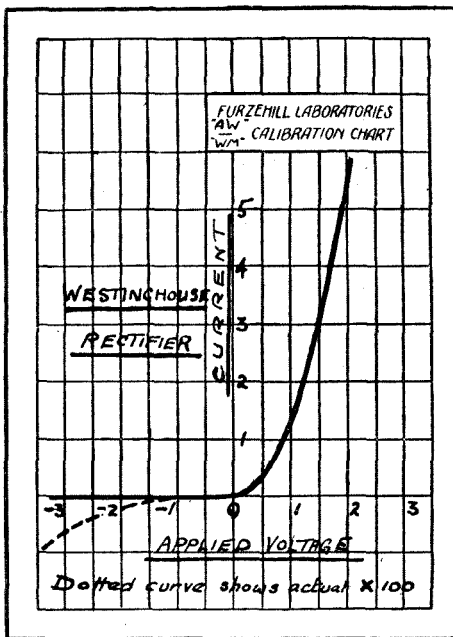


Fig. 1. Curve showing rectifying properties of Copper-oxide-Metal Contact

Subsequently a number of experiments with these rectifiers were carried out at the Furzehill laboratories. These convinced us, more than ever, that the unit should be available to the general public. We found that the factor of safety was quite good and that, provided that the rectifier was not mishandled, it would give excellent service without trouble. We are pleased to note, therefore, that the Westinghouse Company has now produced three types of metal rectifier, made up specially for the home constructor and the experimenter.

These are particularly neat in form, as will be seen from the photographs accompanying this article. The units made are two L.T. rectifiers and one H.T. rectifier.

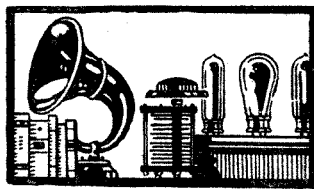
The L.T. rectifiers each deliver up to 6-volts D.C., depending upon the alternating voltage applied, while they deliver current outputs of 1/2 ampere and 1 ampere respectively. The high-tension unit will give an output of 100 milliamps at 200 volts, although in practice the actual output available is somewhat less than this, owing to the current taken by the filters; but, even so, this gives ample reserve for most practical purposes. This point will be discussed in greater detail in a future article.

I propose in this article to describe the construction of these rectifiers and show what their limitations are. Next week I shall describe the way in which the rectifiers are built up into units and give details as to how the units may best be employed in various kinds of circuit, and shall also give figures regarding the resistance of the rectifier unit and so on, based on the results of tests made in our laboratories. Following issues will contain descriptions of both H.T. and L.T. eliminators incorporating these units.

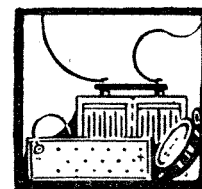
Double-wave Rectification

One point to which attention may be drawn is that the units all work on a bridge-rectifier arrangement. The advantage of this is that double-wave rectification is obtained without the necessity for the double voltage on the transformer. Thus in the case of the unit required to deliver 200 volts output an ordinary rectifying arrangement would require a transformer delivering about 450 volts with centre tapping. Apart from the greater convenience and less risk of unpleasant shock, the saving on this part of the equipment should be taken into account when assessing the value of the unit. In the case of the H.T. unit in particular, the production of 100 milliamps output is a matter of no little difficulty with the methods in general use to-day.

(Continued on page 910)



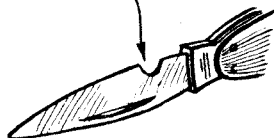
PRACTICAL ODDS & ENDS



Baring Wire

WHAT wireless fan does not use a pocket knife when wiring up and how many have never cut into the wire when scraping insulation off?

FILED NOTCH



The Best Way to Scrape off Insulation

If with a small round file a semi-circular notch is cut into the blade of the knife, as shown in the drawing, this will not happen.

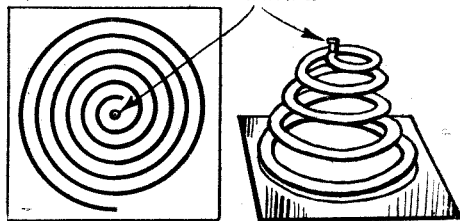
When stripping insulation, roll the insulation, at the point to be cut away, lightly between the ball of the thumb and the edge of the blade, just allowing the surface to be cut, then slide the wire back into the slot in the blade, grip firmly, and the insulation will come away with a slight pull. F. T.

An Excellent Earth

A REALLY excellent earth can be made in the manner indicated in the drawing given below.

A square of zinc, copper, or lead—which ever is easiest to obtain—is cut as shown in the left-hand drawing, the centre being drilled to take a terminal to which the connection to the set is made. A direct soldered connection can be made and if strong, is preferable. A plate of not less than 18 in. should be used, this giving a spiral some six feet in length. The writer has used his with great success. A. H.

TERMINAL



How to Make a Good Earth-plate

Facilitating Rapid Wiring

MANY amateurs make use of a "hook-up" board on which circuits may be given a preliminary test. On the board are usually several insulated terminal strips to which components may be roughly wired.

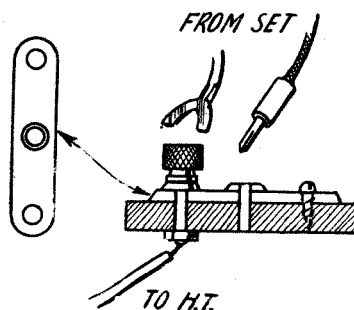
To facilitate rapid connection and disconnection, it may be considered worth

while replacing the heads of the terminals used with small butterfly wing nuts. These are more easy to screw up than ordinary milled-head terminal tops, and so remove the danger of loose connections. The wing nuts may be obtained from most ironmongers and are tapped in all sizes from about 2BA. M. L. B.

Tapping the H.T. Battery

WHERE an H.T. accumulator is used, it is often found that the tapping points are somewhat difficult of access. The following method will appeal to many readers, especially those who are fond of trying out new "hook-ups," as the actual tapping points are suitable for wander plugs, clips, or even bare wire.

First obtain a number of H.T. connectors, according to the number of tappings required, and a similar number of pillar-type



Tapping the H.T. Battery

terminals and round-headed screws. Then prepare a strip of plywood, about 2 1/2 in. wide and of a length to suit individual requirements.

Space the connectors evenly along the board and screw down, using the terminals and screws for this purpose, as shown in the drawing. Finally, connect up the tappings from the H.T. battery to the terminals and mark the panel accordingly. The panel is then ready for use and can be fitted in the most convenient place. F. T.

Cutting Paper Diaphragms

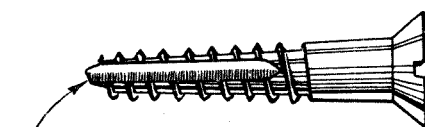
A LITTLE difficulty may be experienced in marking out paper diaphragms for cone loud-speakers. After cutting a circle of the required diameter it is necessary to cut a V-shaped section from the circle, so that when the two ends are joined the cone will form the requisite angle—usually 120 degrees.

It may be a help to amateurs to know that for a 120-degree cone, and allowing a reasonable margin for joining the edges

when the V-piece has been removed, the angle of the cut-away piece should be 50 degrees. This may be measured by a protractor, or by a 0—180 degrees condenser scale or the protractor markings on the backs of most 12-inch rulers, if the proper instrument is not at hand. K. B.

Improved Taps

USEFUL taps for small holes in soft material such as ebonite can be made



GAPS CUT WITH FILE

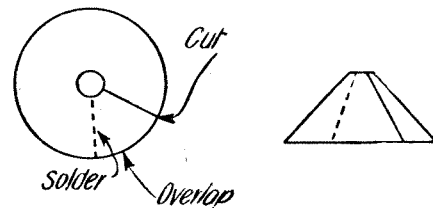
A Useful Tap made from a Screw

from ordinary brass screws. A screw of a suitable size for the hole should be selected and slots filed down its sides with a half-round file, thus forming cutting edges. Three or four slots will usually be sufficient. The threads at the ends of the screw should also be tapered off a little to permit the "tap" easily to be inserted into the hole.

The tap may be operated by means of a screwdriver placed in the nick in the head, or, alternatively, the head may be filed square so that it may be placed in a tapping wrench. M. B.

Making Cone Washers

TO those readers who have difficulty in obtaining the little metal cone washers required for attaching the cone to the reed of the unit when making up cone loud-speakers, the following tip, describing how they may easily be made, will be of interest.



Making Cone Washers

Discs, an inch to an inch and a quarter in diameter, should be cut from thin sheet metal and 3/8 in. holes drilled in the centre. The disc should then be cut as shown in the drawing given above and the cone formed. The overlap should then be soldered.

When doing this it is advisable to see, before soldering, that the metal cones fit the paper cone. W. McK.

On Your Wavelength!

Talkies!

I HAVE never been quite sure whether the gramophone or broadcasting could properly be referred to as "talkies," the audio equivalent of "movies." Supporters of either of these forms of sound reproduction have made no claim to this rather undignified name. However, the weighty problem has now been solved by the perfection and commercial use of a new form of sound reproduction—sound photographs. For a year or two, experiments have been carried out by workers on "acoustic films," "movietones," and "phonofilms," all of them trying to obtain perfect quality reproduction of photographic sound records, with the ultimate object of synchronising them with cinema films. Public demonstrations have been given from time to time, but it was not until comparatively recently that anything like perfection was obtained.

The Battle of the Gauges

Unfortunately, there is a very big fly in the ointment, so far as sound films are concerned. With the exception of one process (which uses a gramophone record) all the systems make use of sound photographs on a moving band of film—and the form of band is different in almost every case! One system has the photographic sound impressions on the left edge of the movie film and of a certain "width," another has a different "gauge"—on the right side—and yet another puts the sound image on a completely different film to the "movie" using the full width of that film, and obtaining synchronisation by mechanical means. Thus, a cinema which is equipped with, say, "A's" apparatus, can only use "A's" talking films, "B's," "C's," and all the others being of a different gauge.

That Cough!

Several times lately, I have noticed that one of the musicians in the London Wireless Orchestra has been afflicted with a cough. One is brought to earth with a bump from pleasant dreams of moonlights and Spanish serenades, by that gruff "Hem!" Perhaps the B.B.C. will be good enough to supply their musicians with cough lozenges, or large handkerchiefs, with which to stifle these human atmospherics.

Moving-coils

Moving-coils certainly seem to have won the day so far as quality loud-speaker reproduction is concerned. A good many receiving sets, however, will not take very kindly to this type of loud-speaker—the receivers' faults are shown up in their true and terrible tonal colours. The moving-coil principle may also be applied to headphones, where quality is preferred to

quantity. I do not suggest suspending large and heavy electro-magnet pots over one's ears, or that a "sixty amp-hour actual" should be carried about in the waistcoat pocket! Permanent magnets may be used and the coil can be made to drive a small mica diaphragm suspended on rubber bands. No! I am not talking through my hat! I have actually listened for long periods with such a pair of headphones, and I can assure you that the quality was wonderful. A friend of mine, who is a moving-coil enthusiast, constructed these headphones more out of curiosity than anything else, and now he is taking out a patent!

Big Ben

In the early days of broadcasting, it was wonderful to hear the deep tones of Big Ben chime the hours. But now we have become so sophisticated that the wonderful old clock has lost its sentimental appeal. Indeed, when the clock has to chime its long, long, hours, it makes many of us use unpleasant adjectives. Unfortunately there is no radio device that will speed up the chimes! Perhaps on certain occasions, the B.B.C., would "take it as read" at the end of the first chime and thus give us much relief. Or could they relieve the monotony by making a tour of the clocks of the metropolis?

An Instrument that Went Wrong

I had an amusing experience the other day at Boreham Wood. Mr. Reyner, in his new laboratory, has some very delicate apparatus for measuring high-frequency resistance. It consists of a small thermo-couple which is heated by passing the high-frequency currents through a very fine wire. The whole gadget is so fine that you have to look hard to see the wires, and it is enclosed in a little glass bulb from which a large part of the air has been exhausted.

I asked whether this was done for protection first and foremost, as it appeared to me that otherwise the risk of damage would be high indeed, with such very fine wire. I was told that this is not the primary reason, although the glass bulb certainly did serve as a protection. The principal reason, however, was to increase the sensitivity, it being found that by reducing the pressure of the gas inside the bulb the sensitivity of the arrangement can be increased some fifty times. In addition, the glass bulb serves to shield the thermo-couple from draughts which affect the temperature and consequently give rise to misleading results.

On this particular measurement, which I saw him conducting, he was taking readings on a sensitive microammeter which was indicating the voltage developed by this little thermo-couple. Incidentally, this

meter is so sensitive that one can read $1/10$ th of a *micro-amp*. I ask you! To resume, however, I noticed our Technical Editor burbling to himself as if he were dissatisfied about something, and he finally told me that he could not get the results correct. He went through several calculations at the end of which he brandished a sheaf of figures in my face. "There," he said, as if it were my fault, "If the test was satisfactory, these points all ought to lie on a straight line and I'm blown if they do!"

Old Sol

At this moment, the sun shone in and blazed through the windows of the laboratory, on to the apparatus. At the risk of appearing untruthful, I pointed this fact out, and to our surprise we found the needle of the meter tripping merrily up the scale. With a shriek registering some strong emotion—I do not quite know what—Mr. Reyner put his hand over the thermo-couple when the needle immediately proceeded to retrace its steps.

I suppose I ought to say that he turned with a smile of quiet triumph and said: "There—in this interesting demonstration of the powers of the infra-red rays in the sun's light—we have the explanation of the discrepancies in my measurements." What he actually said was: "Well of all the prize mutts. I ought to have thought of that!" I quite agreed with him because, with a flash of unusual intelligence, I had been able to see what was happening myself. The sun's rays were beating down directly upon the thermo-couple as a result of which it was becoming heated and giving an indication on the meter, in addition to that produced by the heating effect of the high-frequency current. The variations in temperature, as the sun went in and out of the clouds, was sufficient to introduce discrepancies in the results.

Insulation

The use of systoflex and other forms of what the Americans call "spaghetti," is again becoming popular with amateur wireless-set constructors. Where the wires are not above earth potential, so far as H.F. currents are concerned, a number of wires may be run quite close together, if they are protected by "spaghetti." But even if you use this form of insulation on the wiring of your set, it is well not to have any wire carrying "H.T. plus" touching an L.T. wire. The insulation may prevent a short circuit, but other troubles, such as I had a few nights ago, may develop. My particular trouble was a nasty crackling noise, similar to that caused by a bad H.T. battery. As the set was working entirely off the electric light mains, however, this

:: :: **On Your Wavelength! (continued)** :: ::

particular source of trouble was ruled out. Eventually the trouble was traced to actual arcing from a 100-volt H.T. feed wire through the "spaghetti" to the copper screen. The set had been in use for several months before the trouble developed, and it wasn't too easy to trace, for no wires appeared to be touching or "shorting" in any way.

Timely Help

After a long period, during which the worst was feared, the Italian airship which set out for the North Pole has got into touch with civilisation, and it was through wireless alone that this was possible. If, as is to be hoped, a rescue is effected, General Nobile and the members of his crew will owe their lives to the fact that their equipment included transmitting and receiving sets. A point of particular interest to readers is the part played by amateurs in establishing contact with the crew of the wrecked airship. It was a Russian amateur, searching round with his short-wave receiver, who first picked up the *Italia's* S.O.S. Signals were so faint that they were barely readable, but he was able to get down the greater part of the message.

Short Waves and Distance

The exact position of the airship's crew was discovered by amateurs again, for it was two living in America who received the message, giving the latitude and longitude. Once it had been ascertained that the airship's apparatus was capable of transmitting and receiving, pretty regular communication was soon set up between the various shore stations and the crew. One curious fact is that at most times, signals from Rome were better received than those from stations within the Arctic Circle and, therefore, at quite short range.

Our Debt to the Amateurs

I don't suppose that the man-in-the-street realises quite how much we owe to the work that has been done by amateurs in this country, and in others. It is not too much to say, that it was they who first showed the possibility of transmitting over enormous distances with small power and it is very largely due to them that so much use is now made of the short waves. The amateur transmitter, you see, jolly well had to be efficient if he wanted to obtain any respectable results. The power that he might use was, and still is, limited. In many cases the length of his purse limited the watts, even more drastically than did the authorities. He had, in fact, to set himself the task of getting the very utmost out of every valve, coil, and condenser in his apparatus. The result is that we now have S.W. transmitters that can cover enormous distances with tiny power behind them.

Rapid Progress

The simple short-wave receiving set, too, with its detector valve and one or two stages of note-magnification, owes its development almost entirely to the work done by amateurs. Here, again, efficiency and low cost were prime considerations. If you compare the smooth-working easily-operated short-wave receiver of to-day with the squealing, chattering, unstable thing of four or five years ago, you will realise what a debt we owe to the amateurs. And they are still hard at it, as you may see any week-end at almost any hour, by searching over the band a little on either side of 45 metres.

Rather a Shame

I cannot, for the life of me, understand why on the short waves, where there is room for so many stations to work without mutual interference, certain commercial stations and a few foreign amateurs should make a habit of transmitting on waves either right on top of, or very close to, those used by short-wave broadcasting plants. PCJJ is a case in point. He had the use of a wavelength of 30.2 metres for years, and had, therefore, established a pretty good right to it. Some months ago a morse signal began to be heard right on top of the Dutch station. During one of his twenty-four-hour tests, this signal interfered for hours on end. In self-defence, PCJJ has now had to go up to 31.4 metres. For a time he was clear of interference there, but the trouble has now broken out again.

An Increasing Nuisance

Matters are made all the worse by the fact that this wavelength is shared, though at different hours, by the American 2XAF. The other night this station's transmission was ruined by morse interference and the nuisance is becoming worse and worse. Why should morse stations choose the wavelengths of broadcasters? One would think that the telephony must interfere to a certain extent with their own reception, and the foolish part of it is, that a rise or fall of a tiny fraction of a metre would suffice to make all clear.

The broadcasting stations, as a rule, cannot alter their wavelengths from time to time, for very good reasons. Many of the more important ones are crystal controlled and they are always conducting experiments on definite pre-arranged wavelengths with a view to discovering the ranges obtainable under various conditions, the presence or absence of fading, and so on. There is room for thousands upon thousands of stations below 100 metres with ample separation and this kind of ether hogging is utterly contemptible.

Another New Valve

Almost since the day when I first began to write these notes, I have urged the need

for a special detector valve. When the old general-purpose valve gave way to specialised types, we got the H.F. valve, the R.C. valve, the L.F. valve, then the power valve and lastly, the super-power valve. But there was not a special rectifier; we had to put up with the H.F. valve, and to use it for the job. It is good hearing to learn that one enterprising firm of manufacturers has at last placed upon the market a genuine rectifier of a very promising kind. At present, only one type is available, requiring .1 ampere of current at 4 volts. A noticeable thing is its very high mutual conductance. The impedance is of the order of 6,000 ohms, whilst the magnification factor is 12.5.

Unique Characteristics

Owing to its specialised design, the grid-current curve shows a very sharp and pronounced bend. This is exactly what is wanted for good results with a grid-leak-and-condenser rectifier. The grid-volts-anode-current characteristic also shows a well-shaped lower bend, which means that the valve should function nobly as an anode-bend rectifier. I hope to be trying one of these valves within the next few days, and I am much looking forward to doing so. One point of interest is that, owing to its low impedance, it should make for exceptionally good reproduction of the bass notes when used in a multi-valver. It should also improve the quality of the single-valve set. I do hope that the valve will be as non-microphonic as possible.

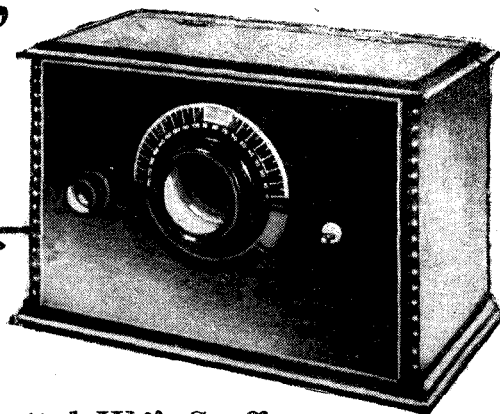
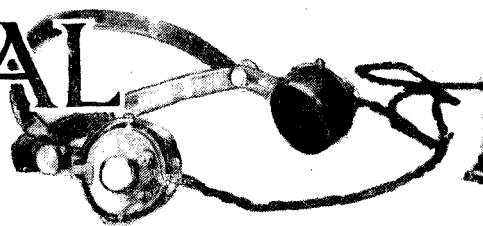
Don'ts for Radio Motorists

I have often seen it stated that it is quite a simple business to charge up one's own wireless accumulators with the aid of the car. All that you have to do, one reads, is to place the L.T. battery in the box usually occupied by that of the lighting set and go out for a drive. On your return you change over again and there is the filament accumulator ready for work. Mmmm, yes. If yours is a six-volt lighting set the thing can be done without much difficulty, and if you have a 12-volter you *could*, of course, devise a suitable resistance. Still, if you are wise you won't go tinkering about with the wiring.

But there are further points of some importance. If you do think of charging up your wireless accumulator in this way for heaven's sake remember not to use the self-starter, or you will possibly not have much left in the way of positive plates. And do bear in mind that unless yours is a very large accumulator you will probably charge it at far too high a rate.

There is only one way really in which you can make use of the car legitimately for accumulator-charging purposes. You can use it very handily to convey your battery to the charging station.—THERMION.

The 'BEST-YET' CRYSTAL SET



A Receiver of Unique Design by the "A.W." Staff

TO ensure greatest signal strength from a crystal receiver, it is advisable to tap the crystal across a portion of the tuning circuit. If this is done, the heavy damping effect exerted by the comparatively low-resistance crystal is considerably reduced, and greater signal strength is obtained than with the crystal across the whole oscillatory circuit.

Special Tapping

The optimum tapping point is quite

small condenser, the signals attain a maximum strength, waning on either side of the critical setting. A point is reached where the damping due to the crystal is reduced as far as conditions permit and at the point of minimum damping the signals are loudest.

One advantage of this system of "tapping" is the fineness of crystal-tap control—a far more gradual variation is possible by varying the condenser than by varying coil tappings.

The complete circuit consists of a simple plug-in coil tuned by a .0005-microfarad variable condenser across which are shunted two series arrangements, one the variable condenser and high-frequency choke and the other the crystal and phones.

Construction

To build the crystal receiver illustrated in the photographic views and reduced reproduction of the blueprint the constructor will require the following components. Those mentioned first are the ones actually used;

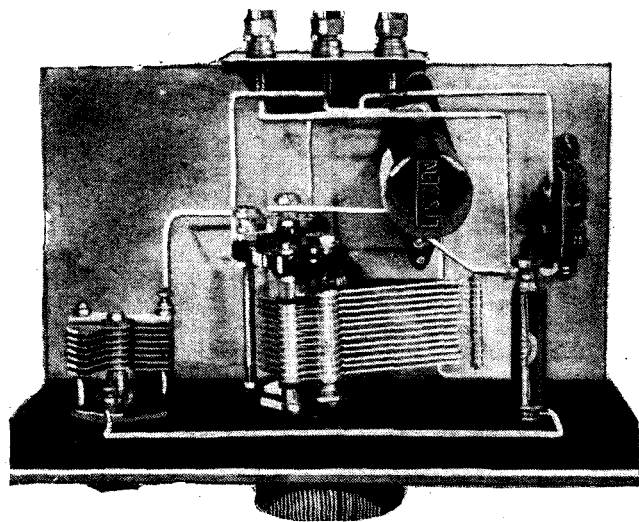
- the others may be considered as suitable alternatives.
- Ebonite or bakelite panel, 9 in. by 6 in. by 1/4 in. (Ebonart, Raymond, Becol).
- .0005-microfarad variable condenser (Burton, Burndept, Polar, Igranic, J.B.).
- .0001-microfarad variable condenser (Bulgin, Cyldon).
- Crystal detector, permanent type (R.I. and Varley, Jewel Pen Co.).
- High-frequency choke (Lissen).
- Single-coil holder (Lotus, Lissen).
- Terminal strip, 3 in. by 2 in. by 1/4 in. (Ebonart, Raymond, Becol).
- 3 terminals, one each, marked Aerial, Earth, and Phones (Belling Lee, Eastick, Igranic).
- Baseboard 9 in. by 5 in. by 3/8 in. (Carrington).
- Cabinet to take panel and baseboard (Carrington).

The assembly is quite simple, especially if a careful study is made of the illustrations. The tuning condenser and 4-inch dial are mounted in the centre of the panel; on the left is the capacity-tap condenser and on the right the crystal detector. Three large holes are drilled in the panel to take these components and two small ones for wood screws to secure the panel to the baseboard. The choke and single-coil holder are screwed on the baseboard, and at the back is fitted the terminal strip, previously drilled to take the three necessary terminals.

One phone connection is common to earth, but if desired a separate terminal can be fitted, in which case the strip should be 1 inch longer and the extra phone terminal connected to earth.

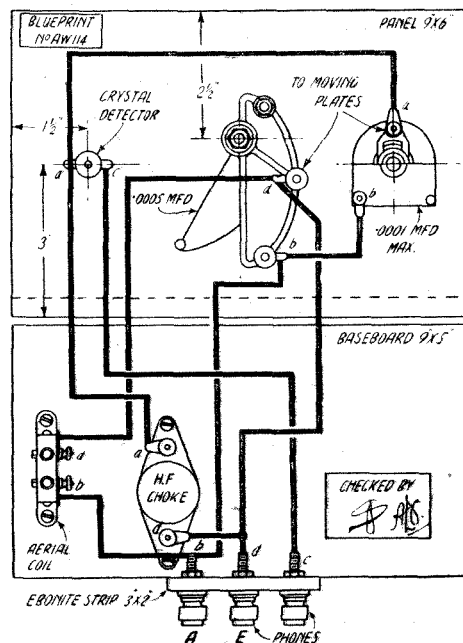
Wiring

A neat job can be made of the wiring if Glazite insulated wire is used. The con-



The Construction is Quite Simple

critical and unless a specially-tapped coil is constructed, the system is not very practicable. There is, however, a good scheme whereby the equivalent of a crystal tap is achieved, but with a simple untapped coil and a small variable condenser. The arrangement is depicted in the theoretical circuit diagram and is embodied in the crystal receiver illustrated. Instead of taking the crystal to a point some way down the coil, we connect it through a variable condenser to the top of the coil. Variation of this condenser gives us the same effect as a variation of coil tapping. But since the variable condenser is connected in the crystal circuit, it is necessary to provide a path for the D.C. component of the rectified current. A high-frequency choke is, therefore, shunted across the crystal and phones. It will be found that on one particular setting of the



The Wiring Diagram, Blueprint Available price 6d.

structor can refer to the theoretical or blueprint diagrams when wiring. The following are the point-to-point connections: (1) Aerial terminal to one side of coil holder, also to fixed vanes of variable

BROADCASTING PICTURES by the FULTOGRAPH

BY the courtesy of Messrs. Selfridges, we were given an opportunity last week of seeing a demonstration of the Fultograph, a system of photo-transmission by no means new in its bare essentials, but embodying some improvements invented by Capt. Otho Fulton, who was present and personally conducted the demonstration. Naturally, the system would work equally well for transmitting photographs over a land-line, but broadcasting has the advantage that an infinite number of pictures can be radiated from one point. For example, if the Fultograph were installed at 2LO, and corresponding receivers placed in a million homes, then it would be possible for a photograph of, say, the broadcasting artiste to be transmitted to the million people, who would then not only listen to his voice, but see a "still" picture of him. This is not television, as generally understood, for the B.B.C. would not be broadcasting a photograph of the artiste as he stood in front of the microphone, but just a previously prepared photograph of him. By Capt. Fulton's method, it takes about three quarters of an hour to prepare the original negative from which the



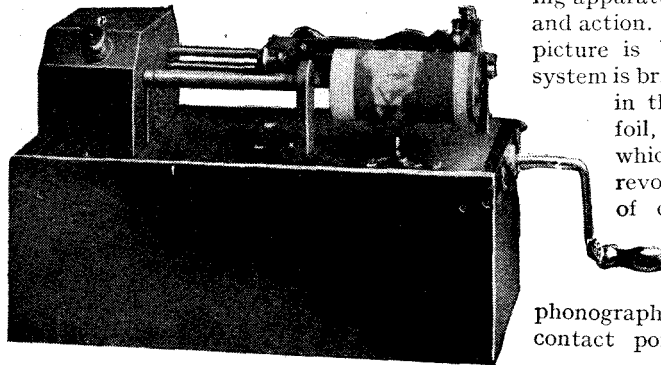
Capt. Fulton (centre) with his apparatus

transmission is made, and the picture itself, which measures approximately $4\frac{1}{2}$ in. by $3\frac{1}{2}$ in., occupies about three and a half

minutes to build up at the receiving end.

Before describing Capt. Fulton's particular method of sending pictures by broadcasting, it should be said that he informs us that he has given many successful and interesting demonstrations on the Continent, and that it is likely that a number of Continental stations will be broadcasting pictures by his system during the coming autumn.

As can be seen from the illustrations, the Fultograph apparatus is by no means complicated. The transmitting and receiving apparatus is very similar in appearance and action. The sequence of events when a picture is broadcast by the Fultograph system is briefly as follows: The photograph in the form of a prepared copper foil, which is wrapped round a cylinder, which is rotated at about fifty revolutions per minute by means of clockwork, a contact needle slowly traversing the cylinder and acting in much the same way as the needle in the old phonograph. At the receiving end a contact point is slowly traversing a

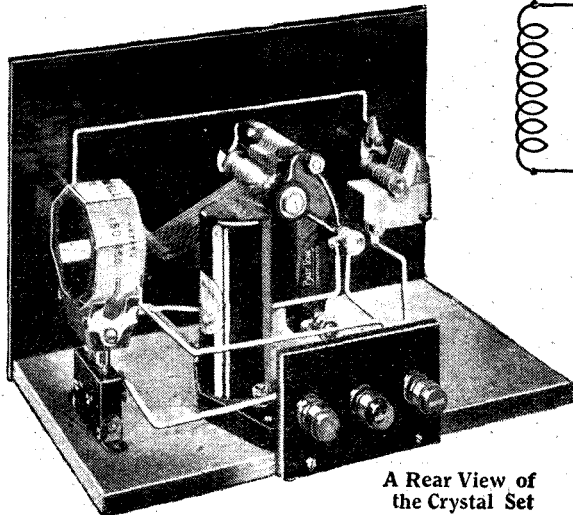


The Fultograph Receiver

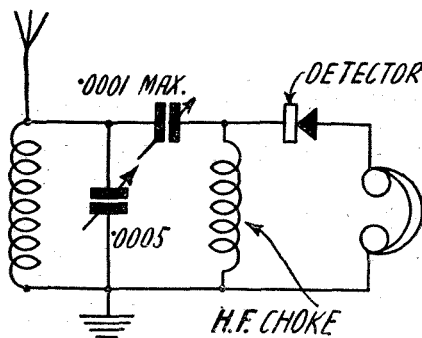
(Continued on page 912)

"THE 'BEST-YET' CRYSTAL SET" (Continued from preceding page)

tuning condenser, also to fixed vanes of .0001-microfarad variable condenser; (2) Earth terminal to one side of choke, also to moving vanes of tuning condenser, also to



A Rear View of the Crystal Set



The Circuit Diagram

other side of single-coil holder; (3) Phones terminal to one side of crystal detector; (4) Other side of crystal detector to moving vanes of .0001-microfarad variable condenser, also to other side of choke.

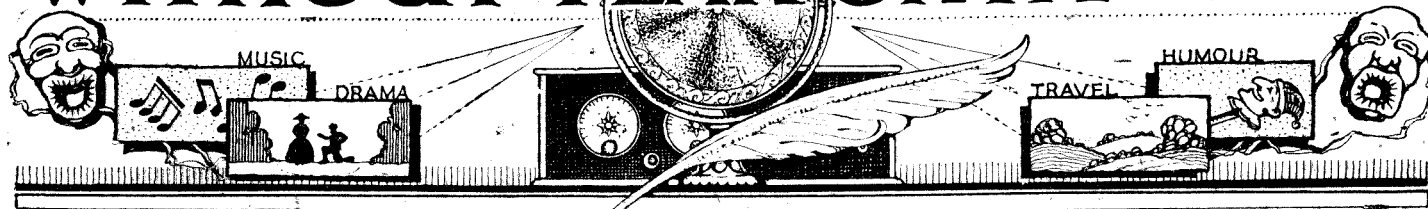
When these four "runs" of wiring are finished, check over

the connections to make sure everything is all right, and then connect up aerial, earth and phones, and plug-in a No. 35 or 40 coil, such as the Lissen, Atlas, Igranic, Tunewell or Lewcos makes. Pull out the knob of the R.I. and Varley crystal detector and gently return it until a sensitive "spot" is found. Set the small condenser about half-way in, and rotate the tuning condenser until the local station is heard. Then very slowly adjust the capacity-tap condenser, until at one quite definite setting the signals will come in at greatest intensity.

If the long-wave Daventry is within range (about 100 miles) it is worth trying for as an alternative. A No. 150 tuning coil is required. We shall be glad to receive readers' comments on the circuit embodied in this receiver.

What is the reason for the almost complete absence of talks from the Cork programmes?

WITHOUT FEAR OR FAVOUR



A Weekly Programme Criticism by Sydney A. Moseley

DON'T think I am irritable because I didn't draw anything in the sweepstake, but the radio play on this theme did not quite come over. As it happens, I had read the story in a Sunday newspaper a few days previously, and thought it was well written. It is a different matter altogether, however, dramatising for wireless purposes an episode that reads well. Especially if it relates to dreams. In the written story, Mr. Arthur Applin's *denouement* was quite well brought out. But to suggest a dream over the ether is often a nightmare of a proposition!

On the other hand, the broadcast of the Derby itself by Mr. R. C. Lyle was quite an interesting affair. This is one of the few occasions where realism comes over well. The hoarse shouts of the bookmakers and the general movement of the crowd lend colour to the story, and I think altogether the Derby constitutes the best of outside broadcasts.

A finer operatic broadcast than *La Boheme* from Covent Garden the other night is hard to conceive. It was perfectly rendered by the principals, the tenor, Signor Pertile, being an absolutely tip-top Rudolf. Here is a case in point where patience in understanding the good things is well rewarded. I daresay lots of listeners who are not familiar with the opera were bored in parts, especially in the quartets, where over the ether they might have sounded somewhat chaotic.

If you but had the time and opportunity to analyse the parts, however, you would marvel at the skilful manner in which they are interwoven; the flippant Musetta, checking her irate and jealous lover, what time the love-sick pair, Mimi and Rudolf, are chirping about loneliness in springtime. Two totally different themes, but all harmonising beautifully.

My point is this: Once you get over the "fag" of understanding worth-while things the sheer joy of what it has to offer is yours for ever. I sat listening enthralled, picking up each line, picturing the coquette rushing across the stage away from her pursuing lover, while the two lovers sang their delightful duet in each other's arms. Some ladies who were in the room with me at the time talked about the weather!

Believe me, a fine opera, like a fine poem—such as, say, Gray's "Elegy," or a classical picture such as you pass by in the National Gallery—has earned its fame. Therefore, you cannot afford to deride these big things. The most you can say is that regretfully you have never had the chance of appreciating them. Wireless offers unbounded new opportunities in this respect.

All this is inspired as a result of the masterly performance of *La Boheme*. Not by any means a high-brow opera, but one full of colour, tunefulness, sentiment, and movement. An excellent transmission for which grateful thanks to all concerned. Small wonder it was one of the few operas the King attended at Covent Garden.

Didn't you think that Sir Alan Cobham had certain little tricks of speech which have made the Prince of Wales a popular broadcaster? A little slurring here and there! The airman was only able to generalise on his vast theme, and no doubt he was brought to the microphone rather hurriedly. But it is an achievement in itself to be able to do this. And many of us—when we are retailing our experiences to our grandchildren!—will certainly not fail to recall this talk among the B.B.C.'s many achievements.

A word about the luncheon-hour con-

certs. A study of the last week's programmes shows that we are given between one and two o'clock on Tuesday an orchestral concert from the Savoy, on Wednesday from Frascati's Restaurant, on Friday from the Hotel Metropole, and on Saturday from the Carlton. Monday there was an organ recital, and on Thursdays, we appear to be given gramophone records.

This, on the whole, is an excellent arrangement; but, since so many listeners are away from home during these recitals, one wonders why the teashops, the cafés, and the small restaurants which are without music do not broadcast this highly popular feature.

And which, by the by, is the most enjoyable? I have been canvassing my friends in the matter, and I find that many of them plump for the Frascati programmes because they are so light and popular. Personally, I like the Carlton Hotel Octet, directed by René Taponnier, which gives, on the whole, a well-balanced programme.

If there was one criticism at all, it was that I noticed a tendency to the frills and flourishes which used to characterise De Groot (of immortal memory). One seems to hear the striving of the pianist and the second violin trying hard to anticipate the mood of the moment of their leader. I suppose the reply to all this would be that they are "gingering up" things.



Miss Gertrude Lawrence, the famous actress, at 2LO

IT is quite easy to adapt the average broadcast receiver so that short-wave transmissions can be picked up; often it is only necessary to change the size of the tuning and reaction coils. We have in mind receivers of the type exemplified by "Britain's Favourite Three," a simple Reinartz detector and amplifier fully described in the January 28 issue and later adapted for short-wave reception as described in the April 7 issue.

As long as the first valve is the detector valve, as in the receiver mentioned, the conversion of a broadcast receiver to short waves is usually a simple business. When, however, we consider the problem of adapting a more complicated receiver—one incorporating a stage of high-frequency amplification—we begin to ask ourselves whether it is worth while, and often we decide to forgo the thrills of the short-waves simply because the necessary circuit alterations that would be involved, such as cutting out the high-frequency valve, do not seem to be warranted.

Dual-purpose

But why adapt the broadcast receiver for short-waves when there appears to be no legitimate reason why a specially designed receiver should not fulfil the functions of broadcast receiver and short-waver? As soon as we looked into the matter we saw

The "NEAR & FAR" THREE-FOUR

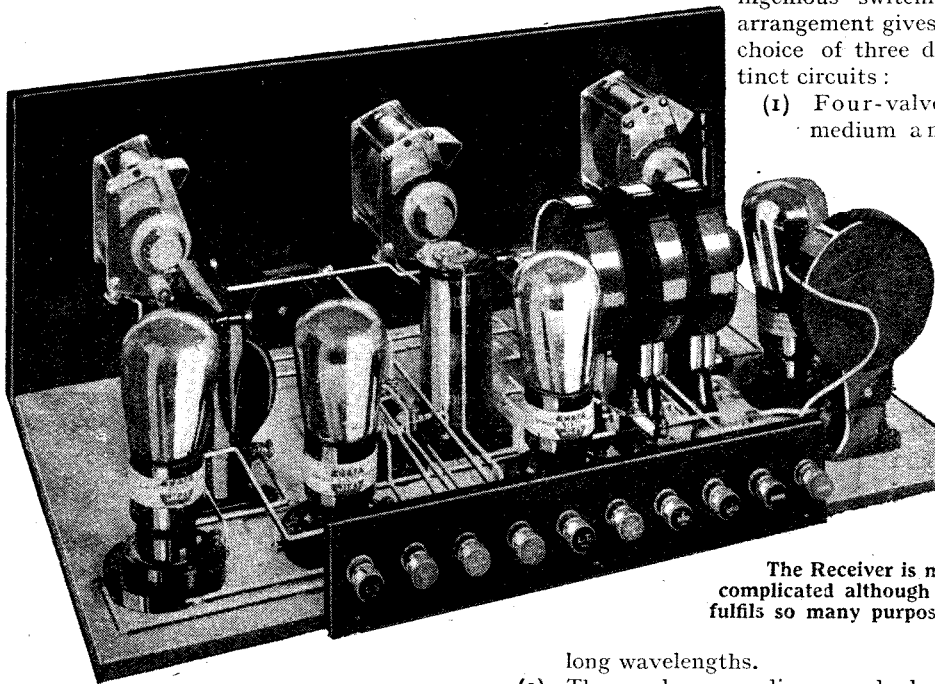


DESIGNED AND BUILT BY THE

new receiver to all who desire to operate the short and broadcast wavelength bands with one receiver.

Briefly, the "Near and Far" Three-Four is a four-valver comprising one stage of neutralised high-frequency amplification, a detector and two stages of low-frequency amplification, the first resistance-capacity and the second transformer coupled. An ingenious switching arrangement gives a choice of three distinct circuits:

- (1) Four-valver, medium and



The Receiver is not complicated although it fulfils so many purposes

that there were distinct possibilities in the "dual-purpose" idea and experiments were put in hand without delay.

The "Near and Far" Three-Four illustrated and described here is the outcome of these experiments and the Technical Staff have every confidence in commending this

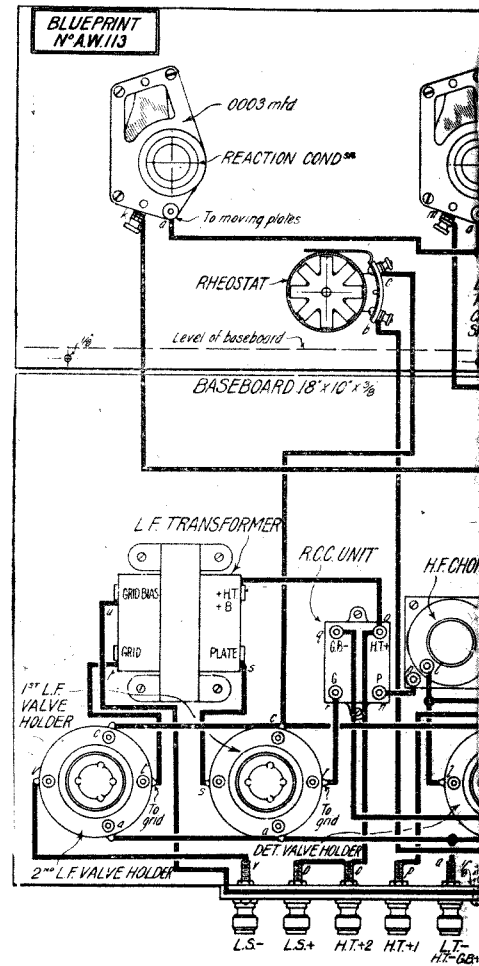
long wavelengths.

- (2) Three-valver, medium and long wavelengths.

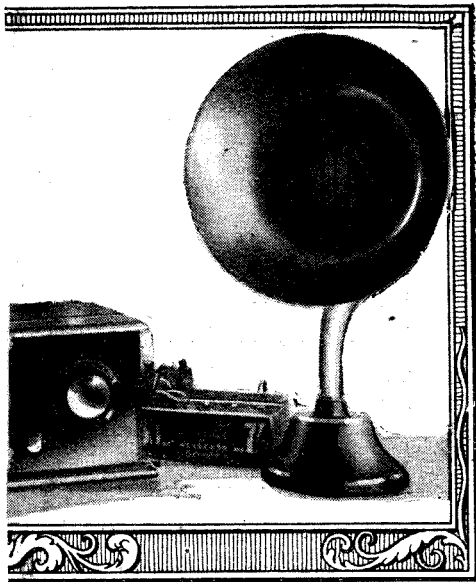
- (3) Three-valver, short wavelengths.

With No. 1 arrangement the listener has a choice of at least six different Continental stations on the loud-speaker, including the long-wave Hilversum and Zeesen stations. No. 2 arrangement provides a

good "local" choice,—say 5GB, 5XX and one other main B.B.C. station. And then No. 3 opens up that vast field of reception—the short-wave broadcasting stations and amateur transmitters of the whole world.



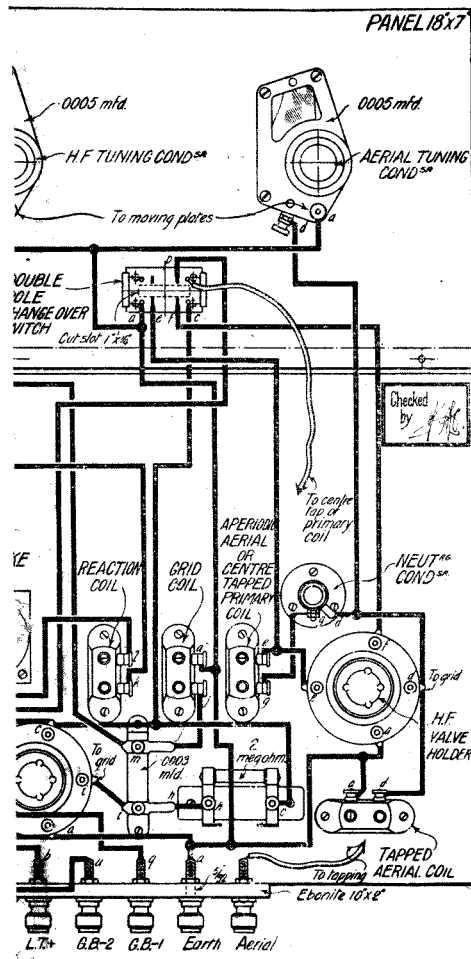
The Wiring Diagram. Bl



THE "A.W." TECHNICAL STAFF

H.F. Valve

A properly neutralised high-frequency amplifying valve more than justifies its existence when used on medium and long wavelengths, but as soon as we drop below



AS DESIRED—

A FOUR-VALVER
(MEDIUM AND LONG WAVELENGTHS)

A THREE-VALVER
(MEDIUM AND LONG WAVELENGTHS)

A THREE-VALVER
(SHORT WAVELENGTHS)

As a Three-valver

If the reader will cover up that part of the circuit diagram consisting of the aerial circuit, high-frequency valve and switching, it will be seen that the three separate coils forming the transformer might just as easily represent the aperiodic aerial coil, tuned-grid coil, and Reinartz reaction coil of a typical short-waver. Connect the aerial lead to the top end of the primary, earth the other end, and there you are! That is the central idea in the design of the "Near and Far" Three-Four—to utilise as far as possible the high-frequency transformer connections for the short-wave tuning and reaction. Of course, the sizes of coils for short-wave work differ from the sizes necessary for the high-frequency transformer, but then one does not change wavelength bands very frequently, so there is no tedium on that score.

Ingenious Switching Arrangement

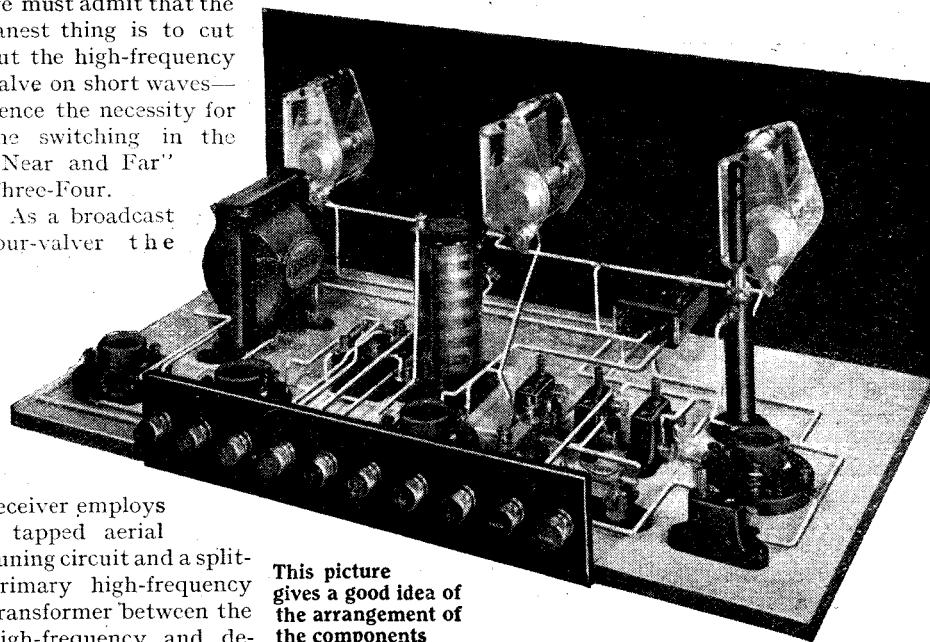
The switch is necessary to cut out the high-frequency valve. By cutting out the high-frequency valve we mean breaking the high and low tension supplies. At the same time, we can quite easily make the switch do another necessary change—connect the lower end of the primary to earth.

The eight-point switch, therefore, performs the treble duty of filament on-off switch, H.T. supply switch, and coil-earthing switch. As viewed from the circuit

about 150 metres its efficiency rapidly deteriorates until at 100 metres the high-frequency stage is a mere "passenger"—and worse, for it is adding to the complication of tuning without appreciably building up the signals.

There are ways and means looming ahead which seem to point to some interesting developments in the art of short-wave high-frequency amplification, but, confining ourselves to present practicable methods, we must admit that the sanest thing is to cut out the high-frequency valve on short waves—hence the necessity for the switching in the "Near and Far" Three-Four.

As a broadcast four-valver the



This picture gives a good idea of the arrangement of the components

receiver employs a tapped aerial tuning circuit and a split-primary high-frequency transformer between the high-frequency and detector valves. Reinartz reaction is applied to the secondary of the high-frequency transformer. The split-primary winding of the transformer is a centre-tapped plug-in coil, the secondary and reaction coils being simple plug-in coils.

diagram, the right-hand position of the switch gives a "through connection" for the high-frequency valve. One side of the filament of this valve is then connected to the L.T. + filament lead, H.T. + 1 is led through the switch to the centre tap of the primary

"THE 'NEAR AND FAR' THREE-FOUR" (Continued)

of the transformer and the anode of the high-frequency valve is left connected to the lower end of the primary.

The left-hand position of the switch indicates a total disconnection of the filament of the high-frequency valve from the L.T.+ lead and of H.T.+1 from the centre tap of the primary and in this position the lower end of the primary of the transformer (now the aperiodic aerial tuning coil) is connected to earth and so the change-over from four-valve broadcast to three-valve short-waver completed, with the exception of the aerial lead, which must, of course, be transferred from the now inoperative aerial coil to the top end of the erstwhile primary of the transformer.

The aerial can be connected to the top of the coil or to the centre tap; in the latter case greater selectivity is obtained.

The fundamental connections of a standard high-frequency transformer must be familiar to all, and it is sufficient here to point out that it is only constructionally that the transformer in question differs from the standard three coils instead of one 6-pin coil.

By the way, when using the receiver as a three-valver for medium or long wavelengths, the aperiodic coil can be dispensed with and the aerial lead can be taken direct to the grid-tuning coil of the detector valve, either to the grid end or to the centre- or "X"-tap of the coil in use.

The choke in the anode circuit of the detector valve is part of the reaction system and should be a good one, since its function is to divert the high-frequency component of the rectified current through the reaction condenser and coil. As the choke has to do this on all wavelengths between 30 and 2,000 metres, it must have a small distributed capacity and at the same time a high inductance.

The low-frequency side of the "Near and Far" Three-Four is so straight forward as to pass without comment. The detector and two low-frequency valves have a common high-tension supply through H.T.+2. A

filament switch in the positive low-tension lead gives a master "on-off" control of the filament supply to all four valves.

The intending constructor of the "Near and Far" Three-Four will require the follow-

Components

Ebonite or bakelite panel, 18 in. by 7 in. (Raymond, Becol, Pertinax, Ebonart).

Two .0005 slow-motion variable condensers (Polar Ideal, Burndept, Igranic).

One .0003 slow-motion variable condenser (Polar Ideal, Burndept, Igranic).

Four anti-microphonic valve holders (Wearite, Ashley, Benjamin).

Four single-coil holders (Lissen, L. & P.).

H.F. choke (R.I. & Varley, Wearite, Lissen, Trix, C.D.M.).

Resistance - capacity - coupling unit (Ashley, R.I. & Varley, Lissen, Dubilier).

Low - frequency transformer (Ferranti A.F.3, R.I. & Varley, Igranic, Lissen, Powquip).

Double-pole change-over switch (Wearite).

Panel-mounting rheostat (Igranic, Lissen, G.E.C.).

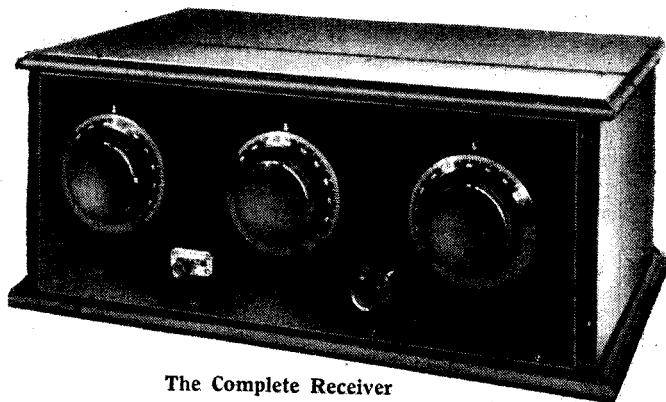
.0003-microfarad fixed condenser (Ashley, Lissen, Dubilier, C.D.M.).

2-megohm grid leak and grid - leak holder. (Lissen, Dubilier, C.D.M.)

Neutralising condenser (Gambrell, Igranic, J.B.).

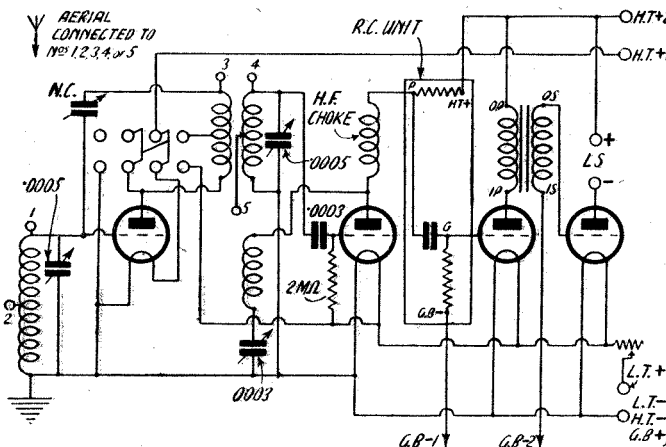
Terminal or bakelite strip, 10 in. by 2 in. (Raymond, Becol, Pertinax, Ebonart).

10 terminals marked Aerial, Earth, G.B.-1, G.B.-2, L.T.+ , L.T.-, H.T.+1, H.T.+2, L.S.+ , L.S.- (Belling-Lee, Eelex, Igranic). Baseboard 18 in. by 10 in. by 3/8 in. (Carrington). Three dial indicators (Bulgin). Glazite for One foot rubber-covered flex.



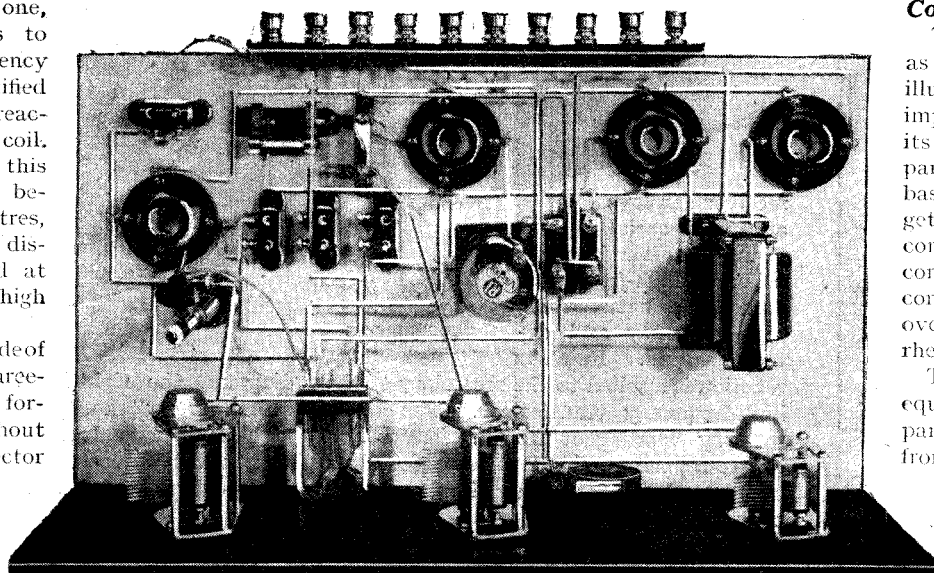
The Complete Receiver

ing components before starting the assembling. Note that the components mentioned first are those actually incorporated in the



The Circuit Diagram

original receiver, and the additional names can be considered as suitable alternatives.



This plan view shows the straightforward wiring

Construction

The complete receiver, as clearly shown by the illustrations, presents an imposing appearance, with its symmetrically laid-out panel and business-like baseboard. There are altogether five panel controls, comprising the two tuning-condenser dials, reaction-condenser dial, change-over switch and master rheostat.

Three four-inch dials are equally spaced along the panel and looking from the front (from left to right) these are for aerial tuning, high-frequency transformer tuning and reaction.

(Continued on page 908)

'OUR LIZ'

HEAR HELENA MILLAIS again
in her inimitable character
study on June 23rd

-but

hear her this time with a —
Lissen Battery in your set



Your sense of humour will be tickled when Helena Millais broadcasts this week. Do not miss hearing her. Make up your mind to enjoy her funny character sketches this time with a Lissen New Process Battery in your set. You will hear her every word clearly and every priceless inflexion of her voice will be true to life. For in the Lissen Battery you get a new process and a new chemical combination which yields pure D.C. current. And all the time the current flow is absolutely noiseless, smooth flowing, steady, and sustained. This lasts throughout the longest programme and throughout months and months of use.

You should make a special point of having a Lissen New Process Battery in your set in time for "Our Liz." 10,000 radio dealers sell it. Be sure you ask for it in a way that shows plainly you intend to take no other—delightful radio reproduction will be your reward.

60 volts (reads 66)	7/11
100 „ (reads 108)	12/11
60 „ Super Power	13/6
9 „ Grid Bias	1/6
4½ „ Pocket Battery	each 5d.
	4/6 a doz.

LISSEN LTD., 16/20, Friars Lane, Richmond, Surrey
Managing Director: Thomas N. Cole.



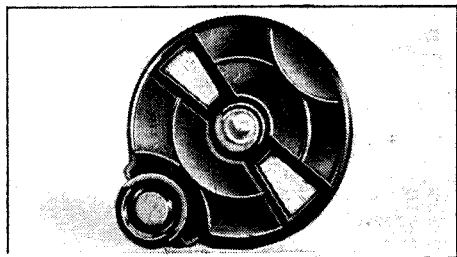
Advertisers Appreciate Mention of "A.W." with Your Order

"A.W." TESTS OF APPARATUS

Conducted by our Technical Editor, J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

Polar Slow-motion Dial

SLOW-MOTION dials, once looked upon as luxuries, are now recognised as necessities; it was with interest that we tested the Polar slow-motion dial sent in by Wingrove & Rogers, Ltd., of Mill Lane, Old Swan, Liverpool. This is provided with two windows mounted horizontally and not vertically, as is usual. An indication is obtained on a hair line on either side and



Polar Slow-motion Dial

the celluloid window is cut away over a portion of the dial so that actual indications may be written on the dial in pencil or ink as required. For this purpose, the two sides of the dial are useful, since a run of stations very close to one another can be logged alternately on one side and then on the other.

The dial is of the friction-drive type, giving a rotation of approximately 16-1, its overall diameter being 4 in. The motion of the operating knob is in the reverse direction to that of the condenser, as is the case with a large number of slow-motion dials. The dial is fixed to the condenser with a grub screw, a further hole being drilled in the panel to accommodate the spindle of the operating knob, this serving to register the dial on the panel and prevent it from rotating.

The dial is finished in an attractive moulded composition and is provided with an adaptor whereby it can be made to fit either a $\frac{3}{16}$ -in. or $\frac{1}{4}$ -in. spindle as desired. It should find a ready sale.

Bulgin Panel Brackets

THE sloping panel has always exercised a certain fascination. There are minor disadvantages associated with its use, but there are many readers who prefer to mount their front panel on a slight slope. The panel bracket which enables any desired angle to be obtained is, therefore, useful since it allows of the best arrangement being achieved in any specific circumstance.

The panel bracket which we have received for test from A. F. Bulgin and Co., of 9/11 Cursitor Street, Chancery Lane, E.C.4, is designed to give this flexibility. It con-

sists of two cast aluminium arms clamped together at one end by means of a screw and nut. At this point there is a boss on each arm, which is provided with a serrated face. By loosening the nut so that the serrations disengage, the arms may be rotated relative to each other until the desired angle is obtained. On screwing up the nut again, the whole is rigidly fixed. The brackets are attractively finished in black crystalline lacquer.

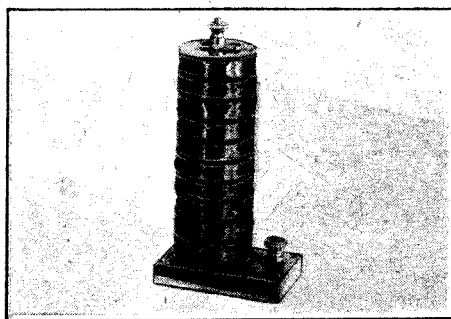
Wright and Weaire H.F. Choke

A HIGH-FREQUENCY choke is sometimes required which will carry a fairly heavy current. This is particularly useful for eliminators where it is desired to prevent high-frequency currents from leaking back into the eliminator. Such chokes, however, must be able to carry the full high-tension current without serious voltage drop.

We have received from Messrs. Wright and Weaire, Ltd., of 740 High Road, N.17, a special choke constructed on these lines. It is similar in general construction to their well-known standard H.F. choke, having ten sections filled with enamel-covered wire. The dimensions, however, are rather larger, the bobbin being $1\frac{1}{4}$ in. diameter and $3\frac{1}{4}$ in. high.

On test it was found to have an inductance of .94 henries, the maker's rating being 1 henry; so that there is satisfactory accordance in this respect. Tested on our standard choke bridge, it was found to choke adequately over the broadcast band, no sign of peaking being experienced between 50 and 3,000 metres.

The D.C. resistance was 72 ohms and



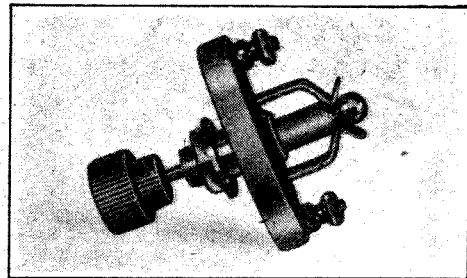
Wright and Weaire H.F. Choke

the choke was found to carry a current of 250 milliamps without appreciable temperature rise.

Lotus Push-pull Switches

LOTUS jacks and switches are well known, but one of the disadvantages hitherto has been the fact that soldering

connections were necessary. Recently, Messrs. Garnett, Whiteley & Co., Ltd., of Broadgreen Road, Liverpool, have produced a range of jacks and switches in which terminals are fitted and we have received for test one of their battery switches which is a particularly pleasing job. It is of the usual push-pull variety, a sharp snap action being obtained with a good contact. The motion is not large,



Lotus Push-pull Switch

while the contact is positive. A neat operating knob is provided, and the component can be recommended for use.

TRANSFORMER TROUBLE

TRANSFORMER trouble is one of the bugbears of the amateur constructor, as it either means replacing the burnt-out component with an entirely new one at considerable expense, or else sending the burnt-out transformer to be rewound—a lengthy performance during which time the receiver is usually out of commission.

It is generally assumed that transformer breakdown is due to one of two causes: (a) a burn-out due to the passage of excessive current, or (b) actual breakage of the thin wire, caused by mechanical vibration or rough handling. Neither of these explanations appear to be very convincing. In the first place the passage of 20 or 30 milliamps is not likely to melt even the thinnest transformer wire used in actual practice; whilst as regards the effect of mechanical vibration, it is not easy to conceive the set being subjected to such violence as to fracture wire firmly wound in position on a solid core.

It is more likely that the trouble arises from the effect of electrolytic leakage currents driven by the high-tension voltage across the thin layers of insulation. Once a small leak current is started, corrosion would set in at the point where the current leaves the metal wire, especially if small traces of moisture are present. In the course of time the electrolytic action eats into the wire until it causes an actual fracture.

B. A. R.



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and dance—
to Lissen's new
portable
gramophone**

LISSEN has entered the gramophone trade — with a determination to make good in it. The first productions are two portable gramophones in different price fields. These are LISSEN'S first contributions to the gramophone buying public. LISSEN has got to make good in gramophones right from the very beginning, and you can be sure, therefore, that there is fine value for money concentrated in the two portable models illustrated on this page.

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**LISSENOLA
MODEL No. 1.**

(Thorens motor)
12 1/2" x 10 1/2" x 6"

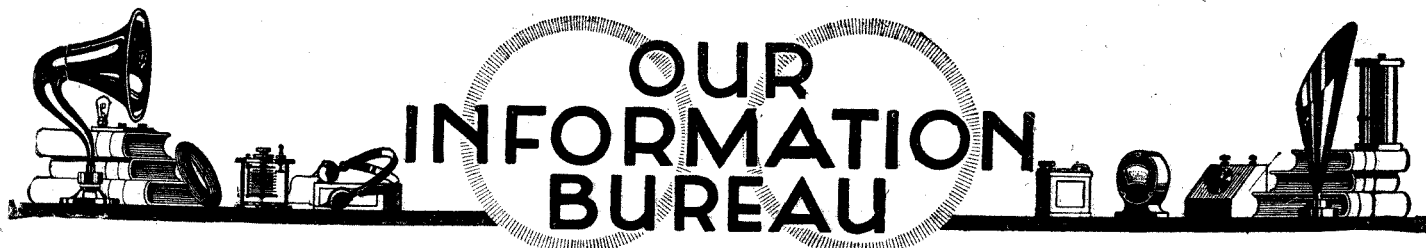
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**LISSENOLA
MODEL No. 2.**

(Garrard motor)
14" x 11 1/2" x 7 1/2"

£3 : 7 : 6





RULES.—Please write distinctly and keep to the point. We reply promptly by post. Please give all necessary details. Ask one question at a time to ensure a prompt reply, and please put sketches, layouts, diagrams, etc., on separate sheets containing your name and address. See announcement below. Address Queries—AMATEUR WIRELESS Information Bureau, 58/61 Fetter Lane, London, E.C.4

High-resistance Moving Coils.

Q.—Is any advantage to be gained by using high-resistance moving coils in moving-coil loud-speakers?—D. R. (Hindhead).

A.—It is certainly best to use high-resistance moving coils, since as they have more turns than low-resistance coils to "cut" the magnetic field created by the magnetic system, they enable greater volume to be obtained.—C. L.

A Frame-aerial Tip.

Q.—Can you suggest a way in which a frame aerial may be connected up to a receiver without the necessity for using straggling pieces of wire?—G. F. (Welling).

A.—Instead of taking the ends of the frame winding to terminals, they may be connected to an ordinary jack plug. The latter can be fixed to the lowest arm of the frame and when required in use may be plugged into a suitable jack incorporated in the actual receiver. In this way wires connected between the frame and the receiver are obviated.—C. A.

Neutralising Condenser Short-circuit.

Q.—I recently burnt out a split-primary H.F. transformer, the cause of which was a short-circuit across my neutralising condenser. I have traced the trouble to a loose fitting between the

moving plate spindle and the bush through which the latter passes. The trouble is now remedied, but to avoid damage, should the spindle again

When Asking Technical Queries

PLEASE write briefly and to the point

A Fee of One Shilling (postal order for preference) must accompany each question and also a stamped, addressed envelope and the coupon which will be found on the last page.

Rough sketches and circuit diagrams can be provided, but it will be necessary to charge a special fee (which will be quoted upon request) for detail layouts and designs.

become loose, I should like to incorporate some safety device. Is this latter possible and, if so how can it be arranged?—G. H. (Newcastle).

A.—You will obviate further damage from this source by connecting a fixed condenser

between one side of the neutralising condenser and the grid of the H.F. valve. The capacity of the fixed condenser need not exceed .001 microfarad, but must have mica dielectric.—C. L.

Moving-coil Loud-speakers.

Q.—As I intend to construct a moving-coil speaker I shall be pleased to receive your advice regarding the use of a suitable magnet system. If good results can be obtained by using a permanent-magnet system, I should be saved some trouble with regard to current supply, although it is not impossible for me to obtain the necessary current for an electro-magnetic system. I do not wish to spoil the efficiency of the finished article for the sake of a little further expense in upkeep.—F. G. (London).

A.—We have tested many designs of moving-coil loud-speakers, and although we have found that permanent-magnet systems give quite good results as far as reproduction is concerned, we cannot help but admit that by using an electro-magnetic system greater volume and more "punch" is obtained. In country districts, where neither current supply nor charging facilities are available, permanent-magnet systems are, of course, most valuable.—S. J.

FURTHER NOTES ON THE "Q" COIL

By J. H. REYNER

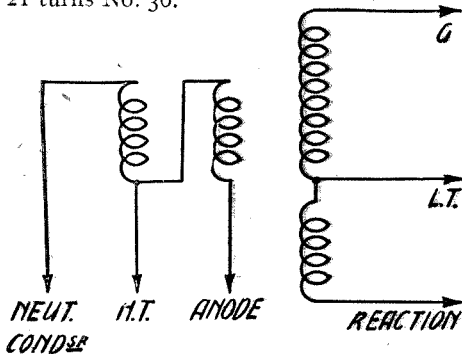
I HAVE received a number of letters from listeners expressing their appreciation of the "Q" coil and the trouble it saves in the design of receivers. It is certainly an advantage to be able to go ahead with the make-up of a receiver or experimental layout of some sort, without giving any particular attention to the dual wavelength problem. The circuit can be arranged to make use of a standard type of coil, when the problem is automatically solved.

Transformer Windings

One or two readers have asked concerning the windings for a transformer. This can be made up by taking the details for a simple aerial coil as already given in AMATEUR WIRELESS No. 303, and winding a suitable primary over the bottom end of the outer secondary section. The switching must be so arranged that this bottom end of the outer secondary section is the point connected to earth or L.T. as the case may be. The primary winding can then be placed right over this end of the winding, without introducing very serious capacity effects. If the precautions just mentioned are not adopted, then the primary winding is close to a high potential point on the

secondary and heavy capacity effects will result.

The windings are as follows: Secondary—same as for aerial coil—see A.W. No. 303. Reaction—same as for aerial coil. Primary—21 turns No. 36. Neutralising—21 turns No. 36.



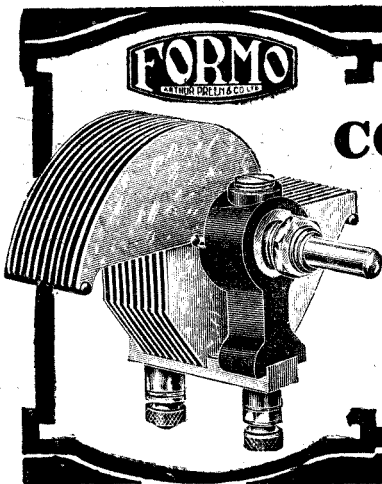
Connections of "Q" coil Windings

The best method is to take a length of Empire tape, about 1/2 in. wide, and to wind this over the bottom end of the winding. The primary winding may then be placed on, over this layer of tape. If a neutralising winding is required, a second layer of tape should be wound over the primary and the neutralising winding then placed on top.

Split Primary

The reaction winding is exactly the same as that for the aerial coil, so that no further description is necessary, but it should be particularly observed that when making a split-primary arrangement such as just described, the primary and neutralising winding must both be wound in the same direction as the outer secondary section. The end of the primary winding must be connected to the beginning of the neutralising winding, so that the two form one continuous winding in the same direction. If the two ends are connected, the neutralising winding will be in the opposite direction to the primary and this will result in instability and poor signal strength.

The correct connections are shown in the diagrams. The beginning of the primary winding goes to the anode, the common point (i.e., the end of the primary and the beginning of the neutralising winding) goes to H.T., whilst the end of the neutralising winding is taken to the neutralising condenser. Any standard split-primary circuit may be used for the purpose, as for example, that shown in the "Q-Coil Four," recently published in AMATEUR WIRELESS.

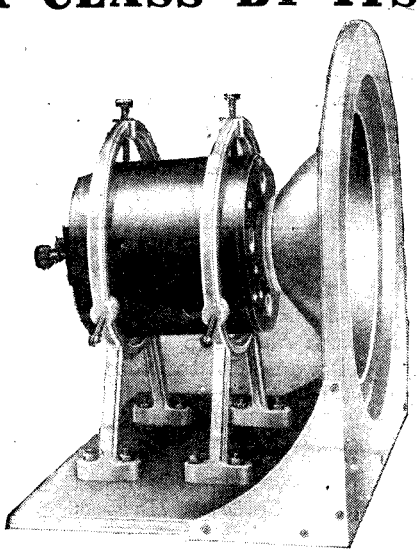


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ON July 6 listeners will have the pleasure of hearing the Duke and Duchess of York from Weston-super-Mare, when they will open the Queen Alexandra Memorial Hospital. At 4 p.m. an orchestral concert will be given by the Somerset Light Infantry Band, and Mogg's Military Band.

Franz Baumann, one of Germany's favourite radio entertainers will be heard from 2LO and 5XX on June 26. He sings cabaret songs in several languages, and has probably been heard before the microphone more often than any British artiste.

Listeners to 2LO and 5XX on July 3 and 7, will hear the famous ventriloquist, Arthur Prince.

On June 27, a one-act comedy, entitled *Widow Engaging*, by Beatrice Forbes-Robertson, the well-known actress, will be broadcast from 2LO and 5XX. The part of Bessie Chilcote, the widow in the play, will be taken by Gertrude Elliott (Lady Forbes-Robertson).

William Thamson will give a novelty broadcast from Glasgow on June 30. He will play an instrument, the sound of which, according to a B.B.C. engineer, resembles that of either a large concertina or a harmonium. Listeners will be asked to try and guess the name of the instrument. As an aid to listeners, the instrument is small and is played with the mouth.

5GB listeners, will enjoy an attractive variety programme to be broadcast on June 29. The cast will include Clapham and Dwyer, in *Another Spot of Bother*, Tommy Handley, and the Johnson brothers.

A novel entertainment will be given on July 1 from the same station, in the form of a consort of ancient instruments. These will include treble viol, a viola d'amore, possessing metal strings, viola da gamba, an instrument resembling a modern 'cello in compass, an ancient bass viol and a harpsichord, rather like a modern grand piano.

An original musical comedy and revue entitled *The Linkman*, will be broadcast on July 7 from 2LO and 5XX. The production will be in the hands of George Grossmith.

On July 1, a service for the League of Nations in York Minster, will be relayed to 2LO. This service is in commemoration of the signing of the League Covenant. An address will be given by the Bishop of Winchester.

Belfast listeners will have the opportunity of hearing the song of the nightingale on July 6, when a complete concert will be

relayed from a rose garden by the side of Belfast Lough.

On July 7, listeners will hear Wish Wynn, who will broadcast impersonations from the 2LO studio.

For the first time on June 27, the Newcastle station will relay the Pitman's Derby, the Northener's name for the famous race for the Northumberland Plate. A running commentary, similar to when the Derby was run, will be relayed from the roof of the grandstand.

The popular radio artistes Olive Groves and Aubrey Milward will be heard in excerpts from nine musical comedies to be relayed from the Birmingham studio to 5GB on July 2.

Canny Crack, a "summary revuesical entertainment in Five Gusts" by E. A. Brian of Gateshead, will be broadcast from the Newcastle station on June 25.

One hundred and sixty-two broadcasting stations in the United States, who have not satisfied the Federal Radio Commission that their services are of public interest, convenience, or necessity, have been ordered to close down by August 1.

In the course of the next few months the African Broadcasting Corporation proposes to increase the power of the Johannesburg transmitter to 15 kilowatts, and to transfer the plant at present being used to Bloemfontein. It is stated also that the Durban and Cape Town equipments are to be improved.

As a result of a national survey undertaken by retailers of wireless components it is computed that receiving sets in the United States now total approximately 12,000,000, not including crystal sets or one-valve receivers of an obsolete type.

A new 1-kilowatt broadcasting transmitter erected by the French Posts and Telegraphs at Strasbourg can be frequently heard testing after midnight on a wavelength of 1,040 metres. For experimental purposes gramophone music is transmitted, all announcements and calls being made in both the English and French languages.

From the present date to August 1, Moscow will transmit concerts through the great Komintern station only; its wavelength is 1,450 metres. The old Popoff transmitter has now closed down.

Although, in many quarters, the new Vienna Rosenhugel transmitter has been referred to as a 60-kilowatt station; according to the rating set down by the Union Internationale of Geneva, its aerial power is 15 kilowatts.

French—and probably foreign—listeners, who have picked up regular transmissions at 1.15, 6.15, and 8.15 p.m. with the announcement: *Ici nouveau Poste Radio-telephonique regle sur 1,370 metres*, will be interested to learn that the call is put out by the Naval station at Brest, which proposes on June 24, to broadcast a commentary on the motor races organized by the Automobile Club du Finistere.

ANE and ANH, Bandoeng (Dutch East Indies) now broadcast regularly every Tuesday, Wednesday, and Thursday between 12.40 p.m. and 4.10 p.m. G.M.T., on 31 and 17 metres respectively.

It is reported from France that the power of Radio Paris has been increased from 3 to 10 kilowatts. The Eiffel Tower will shortly also be testing the new 100-kilowatt transmitter which is being installed by the Campagne Radio France.



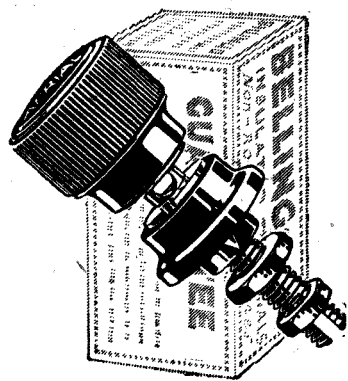
A Derby Scene.—Making a Movietone picture of the famous race.

BROADCAST TELEPHONY

(Broadcasting stations classified by country and in order of wavelengths).

Metres	Kilo-cycles	Station and Call Sign	Power Kw.	Metres	Kilo-cycles	Station and Call Sign	Power Kw.	Metres	Kilo-cycles	Station and Call Sign	Power Kw.
GREAT BRITAIN											
24	12,500	Chelmsford (SSW)	20.0	266.4	1,126	Lille (PTT)	0.7	557.1	538	Budapest	15.0
252.1	1,190	*Bradford (2LS)	0.2	267	1,123	Strasbourg	0.5	ICELAND			
272.7	1,100	*Sheffield (6FL)	0.2	272.4	1,101	Bordeaux	0.5	333.3	900	Reykjavik	1.0
275.2	1,090	*Nottingham (5NG)	0.2	273	1,098	Limoges (PTT)	0.5	IRISH FREE STATE			
277.8	1,080	*Leeds (2LS)	0.2	291	1,030	Radio Lyon	1.5	319.1	940	Dublin (2RN)	1.5
288.5	1,040	*Edinburgh (2EH)	0.2	295	1,016	Rennes	0.5	400	750	Cork (5CK)	1.5
294.1	1,020	*Stoke-on-Trent (5ST)	0.2	302	993	Radio Vitus (Paris)	1.0	ITALY			
294.1	1,020	*Swansea (5SX)	0.2	310	967	Algiers (PTT)	2.0	333.3	900	Naples (Napoli)	1.5
294.1	1,020	*Dundee (2DE)	0.2	310	966	Agen	2.0	450	666	Rome (Roma)	3.0
297	1,010	*Liverpool (6LV)	0.2	315.7	947	Marseilles	0.5	549.3	540	Milan	7.0
306.1	980	Belfast (2BE)	1.5	340.9	880	Le Petit Parisien, Paris	0.5	399	970	Zagreb (Agram)	1.25
312.5	960	Newcastle (5NO)	1.5	370	811	Radio LL, Paris	1.0	400	652	Belgrade	2.5
326.1	920	*Bournemouth (6BM)	1.5	389.6	770	Toulouse (Radio)	25.0	569	530	Ljubljana	10.0
353	850	Cardiff (5WA)	1.5	400	750	Mont de Marsan	0.3	LITHUANIA			
361.4	830	London (2LO)	3.0	415	722	Grenoble (PTT)	1.5	2,000	150	Kovno	15.0
384.6	780	Manchester (2ZY)	1.0	416	721	Rabat (Radio Maroc)	2.0	LUXEMBURG			
400	750	*Plymouth (5PY)	0.2	447	671	Paris (Ecole Sup., PTT)	3.0	217.4	1,380	Luxemburg	0.25
405.1	740	Glasgow (5GC)	1.2	477.5	628	Lyons (PTT)	1.0	370.4	810	Bergen	1.0
491.8	610	Daventry (5B)	2.5	1,040	—	Strasbourg (testing)	1.0	412	728	Notodden	0.7
500	600	Aberdeen (2BD)	1.0	1,750	171	Radio Paris	8.0	434.8	690	Fredrikstad	1.1
1,604	187	**Daventry (5XX)	25.0	1,850	162	Radio Carthage (Tunis)	2	448	670	Rjukan	1.5
*Relay stations. **Relays 2LO.											
AUSTRIA											
258.6	1,160	Linz	0.5	37.65	7,908	Doeberitz	5.0	461.5	650	Oslo	1.5
272.7	1,100	Klagenfurt	1.5	45.3	6,062	Kaiserslautern	0.5	504	594	Porsgrund	1.0
277.5	1,080	Salzburg (under const.)	0.5	67.65	4,434	Stettin	0.75	553.8	540	Haman	0.7
294.1	1,020	Innsbruck	0.5	204.1	1,470	Munster	3.0	POLAND			
357	840	Graz	0.5	236.2	1,270	Nurnberg	3.0	270.3	1,110	Lemberg (under construction)	10.0
517.2	580	Vienna (Wien)	15.0	241.9	1,240	Cassel	1.5	343	874	Posen (Poznan)	1.5
577	530	Vienna (Radio)	0.75	250	1,200	Kiel	0.7	422	721	Kattowitz	10.0
BELGIUM											
230	1,304	Schaerbeek	0.5	252.1	1,190	Danzig	0.75	435	689	Wilno	1.5
275	1,090	Ghent	0.5	272.7	1,100	Bremen	0.75	506	530	Cracow	1.5
291	1,030	Liège	0.25	275.2	1,100	Dresden	0.75	1,111	270	Warsaw (Varschava)	10.0
508.5	590	Brussels (Radio Belgique)	1.5	283	1,060	Cologne	4.0	ROUMANIA			
CZECHO-SLOVAKIA											
272.1	1,101	Kosice	2.5	297	1,012	Hanover	0.7	1,800	187.4	Bucharest	2.0
300	1,000	Bratislava	0.5	303	990	Koenigsberg	4.0	905.5	301	Leningrad	10.0
348.9	860	Prague (Praha)	5.0	322.6	930	Breslau	4.0	1,450	209	Moscow (Moskva)	30.0
441.2	680	Brno (Bruno)	2.4	329.5	910	Gleitwitz	4.0	1,703	176	Kharkov (Kharkov)	15.0
DENMARK											
337	890	Copenhagen (Kjbenhavn)	2.0	366.3	819	Leipzig	4.0	309	970	Oviedo (EAJ19)	0.1
972	308	Soro	2.5	380	789	Stuttgart	4.0	327	917	Almeria (EAJ18)	1.0
1,153.8	260	Kalundborg	7.0	390	757	Hamburg	4.0	335	893	San Sebastian (EAJ8)	0.5
ESTHONIA											
403	735	Reval (Tallinn)	2.2	401	748	Aachen	0.75	333	893	Cartagena (EAJ16)	0.5
FINLAND											
375.9	798	Helsingfors (Helsinki)	1.8	428.6	700	Frankfurt-Main	4.0	341.8	870.7	Barcelona (EAJ1)	1.5
1,522.8	157	Lahti	25	470.9	637	Langenberg	25.0	374	804	Madrid (EAJ7)	1.5
FRANCE											
40.2	7,463	Lyon (PTT)	10.0	484.6	619	Berlin	4.0	400	750	Cadiz (EAJ3)	0.5
37	8,108	Vitus (Paris)	2.0	533.7	569	Munich	4.0	405	741	Salamanca (EAJ22)	0.55
47.5	—	Radio LL (Paris)	1.0	566	530	Augsburg	0.5	434.8	690	Seville (EAJ5)	1.0
158	1,899	Biarritz	0.6	574.7	522	Freiburg	0.75	434.8	690	Bilbao (EAJ9)	0.5
198	1,515	Chambery	0.25	1,250	240	Zeesen	25.0	462	649	Barcelona (EAJ13)	2.0
210	1,428	Chambery	0.25	1,800	167	Koenigs-wusterhausen (testing)	20.0	SWEDEN			
230	1,304	Ste Etienne	0.25	1,829	164	Norddeich	10.0	260.0	7,150	Malmö	1.0
230	1,304	Nice-Juan-les-Pins	0.5	2,523	119	Berlin (News)	8.0	315.8	952	Falun	0.5
231	1,298	Nîmes	0.5	2,900	103	"	8.0	416.7	720	Goteborg	1.0
238.1	1,200	Bordeaux (Radio Sud-Ouest)	2.0	4,000	70	"	8.0	453.8	661	Stockholm	1.5
252.1	1,190	Montpellier	0.5	HOLLAND							
259	1,160	Toulouse-Pyrenées (PTT)	0.5	18.75	—	Kootwijk (PCLL)	30.0	545.6	550	Sundsvall	1.0
GERMANY											
37.65	7,908	Doeberitz	5.0	31.4	—	(Wed. 13.40 B.S.T.) Hilversum (PCJJ)	25.0	720	416	Ostersund	2.0
45.3	6,062	Kaiserslautern	0.5	310.9	880	Huizen (until 5.40 p.m.)	4	1,190	252	Boden	2.0
67.65	4,434	Stettin	0.75	1,069	280	Hilversum (ANRO)	5.0	1,380	277	Motala	30.0
204.1	1,470	Munster	3.0	1,870	160	Huizen (after 5.40 p.m. and on Sundays)	4	SWITZERLAND			
236.2	1,270	Nurnberg	3.0	1,950	154	Scheveningen-haven	5.0	411	730	Berne	1.5
241.9	1,240	Cassel	1.5	TURKEY							
250	1,200	Kiel	0.7	1,190	252	Stamboul	5.0	1,804	105	Angora	7.0
252.1	1,190	Danzig	0.75	UNITED STATES							
272.7	1,100	Bremen	0.75	A few weeks ago. The company most active in the matter in this country, agreed in September last to give his officers a further demonstration, but so far this promise had not been fulfilled.							
275.2	1,100	Dresden	0.75	He had seen a statement in the Press that television tests were recently conducted by an American broadcasting station, but that after a week of tests no one had reported reception.							
283	1,060	Cologne	4.0	Mr. Albery inquired if the Minister of Transport proposed to take any further steps to safeguard pedestrians, and whether he would consider obtaining the co-operation of the British Broadcasting Corporation towards this end?							
297	1,012	Hanover	0.7	Col. Ashley said as far as he was aware, accidents were not commonly caused by a lack of knowledge of the rules of the road.							

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From Our Own Correspondent

MR. MALONE asked the Postmaster-General how many demonstrations of television had been witnessed by technical officials in his department; what was the date of the last demonstration, and whether his department had received any information concerning the progress made in America.

Sir W. Mitchell-Thomson said that technical officers of his department had witnessed four demonstrations of television—three in this country and the fourth in the

United States a few weeks ago. The company most active in the matter in this country, agreed in September last to give his officers a further demonstration, but so far this promise had not been fulfilled.

He had seen a statement in the Press that television tests were recently conducted by an American broadcasting station, but that after a week of tests no one had reported reception.

Mr. Albery inquired if the Minister of Transport proposed to take any further steps to safeguard pedestrians, and whether he would consider obtaining the co-operation of the British Broadcasting Corporation towards this end?

Col. Ashley said as far as he was aware, accidents were not commonly caused by a lack of knowledge of the rules of the road.

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1928 Five (2 HF, D, 2 Trans) WM46
All-the-world Five (2 HF, D, 2 RC) WM63
Cataract 5 (HF, D, RC, Push-pull) WM79

SIX-VALVE SETS (1s. 6d. each)

Short-wave Super-6 (Super-het, Trans) AW 67
Adaptor for above (See Misc. List) AW67a
Nomad (2 HF, D, RC, Push-pull Trans) WM31

AMPLIFIERS (1s. each)

Utility (RC, Trans) AW 68
Screened-grid HF Unit AW 75
One-valve LF Unit AW 79
Add-on HF Unit AW 82
Super-power Push-pull AW 86
Hook-on Short-waver AW104
Purity Amplifier AW108
Range Extender (HF Unit) WM38
True-tone (3 valves) WM47
Gramo-radio Amplifier (2v) WM72

MISCELLANEOUS (1s. each)

Heterodyne wavemeter AW 7
Rectifying Unit AW 62
HT from AC Mains AW 73
"A.W." Moving-coil Loud-speaker AW 97
H.T. Eliminator for A.C. (200 v. output) AW102
Moving-coil Output Unit AW 115
Volume-control Unit (6d.) WM40
A.C. Mains Eliminator WM41
Cone Loud-speaker WM55
A.C. Adaptor for "Simpler Wireless" Sets WM57
Moving-coil Loud-speaker WM58
D.C. Mains Eliminator WM59
Wavetrap WM64
Valve Tester and Paralleling Unit WM65
Portable Cone Loud-speaker WM73
Hook-on Short-waver (Amplifier) AW104
Permanent Magnet Moving-coil Loud-speaker WM75
"Junior" Moving-coil Loud-speaker WM81
Adaptor for Short-wave Super-6 (6d.) AW67a

PORTABLE SETS

Easter (Super-het, RC, Trans) AW 89 1/6
Table Grand (HF, D, 2 RC) AW 93 1/6
Attaché (HF, D) AW 96 1/-
Companion (2 HF, D, RC, Trans) AW100 1/6
Daventry Portable (D, Trans) AW105 1/-
Daventry Loud-speaker Portable 5 (2 HF, D, RC, Trans) AW107 1/6
Daventry Portable (D, Trans) AW105 1/-
Town and Country (HF, D, RC, Trans) AW111 1/6
Sunshine 5 (2 HF, D, 2 Trans) WM74 1/6
Chummy 4 (HF, D, RC, Trans) WM80 1/6

Send, preferably, a Postal Order (stamps over sixpence in value unacceptable) to Blueprint Service

AMATEUR WIRELESS 55-61 FETTER LANE, LONDON, E.C.4

"THE 'NEAR AND FAR' THREE-FOUR" (Continued from page 900)

Between the two tuning condensers is the panel-mounting change-over switch and between the H.F. transformer condenser and reaction condenser is the master rheostat. The condensers are one-hole fixed, as is the rheostat, but a small slot must be cut away in the panel to fit the switch. The metal fixing plate can be used as a template when scribing the rectangular slot, which is cut away with a fret saw or by drilling a series of holes inside the scribed lines and knocking away the waste ebonite.

Four substantial woodscrews hold the panel firmly to the baseboard, but, if desired, two panel brackets could be used to give additional rigidity to the panel. With the panel fitted to the baseboard the constructor will be able to see just how much baseboard space is available for the rest of the parts. The general layout should be clear from an inspection of the blueprint and photographs.

Right at the back of the baseboard is screwed a terminal strip, carrying the aerial, earth, loud-speaker and battery terminals, mounted in the order shown. From a back view of the receiver (as in the blueprint) the low-frequency transformer is fitted at the extreme left, just behind the reaction condenser. The high-frequency choke is behind the H.F. transformer tuning condenser, and the neutralising condenser with its extension knob comes behind the aerial tuning condenser. Three single-coil holders are placed between high-frequency choke and neutralising condenser, and care should be taken in spacing these so that when the three coils are subsequently inserted they clear each other. At the extreme right-hand end of the baseboard, near the back, is the single coil holder for the aerial coil. The four valve holders, resistance-capacity unit, grid condenser, and grid-leak with holder are grouped round in convenient wiring positions, as indicated.

Wiring

Before starting on the wiring, make a careful study of the blueprint (available, price 1/6, from this office). The switch contacts are well separated from each other and no difficulty will be experienced if the wires are carefully soldered. The top right-hand contact goes to the centre tap of the plug-in coil used as the primary of the high-frequency transformer and a short length of rubber-covered flex should be soldered to the contact for this purpose.

The aerial lead, which is taken to either the aerial coil or the aperiodic or grid coil, according to the number of valves in use, is also a short length of rubber-covered flex terminating in a plug or spade tag to facilitate quick changes.

Testing

When using the receiver as a four-valver, the following size coils are required :

Aerial coil, 60 tapped coil for broadcast

band, 150 tapped coil for long waves. High-frequency transformer. Split-primary coil, 60 centre-tapped coil for broadcast band, 150 centre-tapped coil for long waves. Secondary coil, 60 untapped coil for broadcast band, 150 untapped coil for long wavelengths. Reaction coil, 25 or 35 for broadcast band, 40 to 100 for long waves.

As a medium and long-wave three-valver, the grid coil should be a 60 or 150 tapped coil, according to wavelength required, and for reaction a 50 to 100 untapped coil is necessary.

On the short waves a 4-turn aperiodic coil, a 6-turn grid coil and a 6 or 9 turn reaction coil will cover the most interesting wavelengths, i.e., between 30 and 60 metres.

Valves

The high-frequency valve should be a medium-impedance H.F. valve, such as the DEHL210, the detector an R.C. valve, the first low-frequency valve an L.F. valve of the DEL210 type and the second low-frequency valve a power or super-power valve, such as the Mullard PM2 or PM252.

To use all four valves, set the switch to the right, turn the filament rheostat on to nearly maximum and provided the specified valves and coils have been inserted, and at least 120 volts high-tension is available, there is every reason to expect that good signals will be heard straightaway.

Rotate both tuning condensers until something is heard of the local station and having made sure that the various circuits are functioning, proceed to "neutralise" the effect of the inter-electrode capacity of the high-frequency valve. Set the reaction at zero—remove the reaction coil if necessary—and then adjust the two tuned circuits until, at one particular combination of dial readings, feed-back oscillation (as distinct from the Reinartz reaction) is experienced. Then slowly turn the neutralising knob until all trace of oscillation is eliminated.

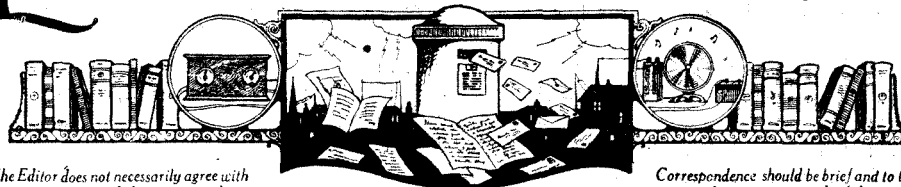
Reinartz reaction can be applied to build up the strength of distant stations, though this will hardly be necessary on the "local."

The three-valver (detector and 2 L.F.) is brought into action by setting the switch to the left, transferring the aerial lead from the aerial coil holder to the aperiodic-cum-primary coil and, of course, changing coil sizes where necessary.

At Ostend a wireless telephony station has been erected, which is intended to serve flying services principally. The station works on wavelengths of 900, 1,400 and 1,680 metres.

A lecture and demonstration of a "wireless heart" was recently given in Paris by the chief of the Philips Laboratories at Eindhoven, Holland. The heart was electrically controlled.

LETTERS TO THE EDITOR



The Editor does not necessarily agree with the views expressed by correspondents.

Correspondence should be brief and to the point and written on one side of the paper.

A Good Circuit

SIR,—I built up the "Ether Searcher Three," and I wish to thank you for such a good circuit.

Any of your readers may build up this set with every confidence as, if the instructions are followed, success is certain with a decent aerial.

There are two alterations, or I ought rather to say additions, I have since made that are worth while: One is the fitting of a 250,000-ohm grid-leak between the grid of second valve and grid side of coupling condenser. Of course, I am referring now to the Lissen R.C. unit, which does not have this leak, which some have. The other small additions are Gambrell centre-tapped coils with Gambrell holder, and an extra aerial terminal, wired to the centre tap. Either aerial terminal may be used and I find that using the connection to grid end of coil gives best results on the long waves, and the centre-tap is far better for waves from about 250 to 500; reaction is much easier to control. W. (Preston).

Pleasing Everybody

SIR,—I am writing to express an opinion which I feel is shared by many fellow listeners, for I feel that generally speaking, the majority of listeners are almost entirely satisfied with the B.B.C. programmes; and that it is only a minority of rather high-brow listeners who are urging for more educational talks and controversial debates.

For it is only the dissatisfied who complain, and the satisfied do not write to say they are satisfied, but wait satisfied until they become dissatisfied, which they will speedily become, if the B.B.C. satisfy the dissatisfied. Therefore, let not the B.B.C. satisfy the dissatisfied by making the satisfied less satisfied.

I feel sure that, as soon as the B.B.C. start broadcasting controversial debates and speeches, their offices will be flooded with letters of complaints. The programmes are steadily approaching the ideal, but, if the B.B.C. takes this step of broadcasting controversial speeches, etc., it will, in all probability, be a backward step. Why cannot we be conservative about programmes, and if there must be changes, as of course there must be, why cannot we have fewer talks and more comedians, jazz, short plays, and vaudeville concerts?

I am almost certain that the average listener uses his wireless apparatus for amusement and enjoyment, rather than education, and does not wish to be made to

use his brain violently after a hard day's work to follow obscure arguments in some controversial debate.

I ask for the support of all listeners who do not wish to be forced, either to listen to endless debates and controversies (if I may use so contraverted a word), about dull, dry, and distorted subjects, occasionally interrupted by time signals and the announcer tearing off the calendar at the end of each month, or to switch off.

Another point is that very frequently a talk is given between 8 and 9 o'clock on a subject in which only a very few people are interested. At this time more people are free to listen than at any other time during the day.

In conclusion, surely the B.B.C. ought to cater more for the amusement-loving majority than the education-loving minority and if "*Vox populi, vox Dei*" is not a good motto in politics, I am sure you will agree that it is a good motto to follow in the choice of programmes by the B.B.C.

S. T. (London, W.).

Gas-pipe Earths

SIR,—I am a very keen and interested reader of your fine paper, my only regret is that some of the articles are too technical for me. Perhaps you would like my experiences of a wireless set. After I had made my set, I bought a copper earth tube, because I had been told, and had also read that a gas-pipe, and also a water-pipe, were bad earths. I knocked the earth tube into the ground very deeply, and it seemed to be very good for the London station only; when I tried to get Daventry, and foreign stations, I met with failure, I might mention that the copper wire connected to the earth tube was soldered securely. The following day, I connected the earth wire to the water pipe, which I well cleaned beforehand; this turned out to be even worse. In desperation I tried the gas-pipe and found that I could get foreign stations as easy as anything, and at great strength on a loud-speaker.

A. C. C. (London, N.).

The "Favourite Two"

SIR,—Having constructed the "Favourite Two," I am writing you in appreciation of the fine results obtained. I can get a number of foreign stations, but the two outstanding are Toulouse and Langenburg, which come in as loud and clear as London.

I am using very low high-tension, and

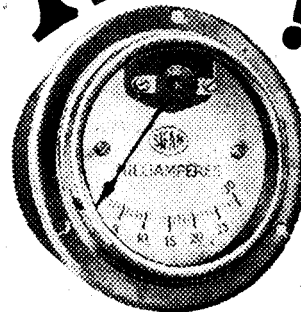
at 36/24, it is as much as I can bear, with 9 volts grid-bias. I am using Mullard valves as set out in your list; they work together well.—V. L. (Ickenham).

The *Corriere d'America*, an Italian daily newspaper published in New York, has erected a broadcasting transmitter at Cliffside, on the banks of the Hudson River, with a view to giving its subscribers regular news bulletins in both the Italian and English languages.

Austria has added a further relay station to its broadcasting system, Radio Linz, which during the past week has been broadcasting on 258.6 metres.

On the tops of its aerial masts the Posen station has installed, to warn aviators, electric lamps which flash every four seconds.

HERE IT IS!



MILLIAMMETER THE CHOICE OF THE EXPERTS FOR THE MOVING-COIL OUTPUT UNIT!

None know better than the experts the wonderful accuracy of control ensured by Sifam Radio Meters. Haphazard control no longer holds good. Accurate measuring instruments are now the recognised need of every valve set user.

For the Moving-Coil Output Unit described in this issue "Amateur Wireless" chooses and recommends the Sifam 0-50 Milliammeter. You cannot do better than follow their lead.

Apply for free booklet "Detecting Distortion" and catalogue of full range to DEPT. A.

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New address: Radlometer Headquarters,
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Aldwych, Strand, W.C.2

M.B.

"THE ALL-METAL RECTIFIER" (Continued from page 891)

So much for the general description of the unit. The rectifiers themselves consist essentially of two discs in contact. One surface is of pure copper or other suitable metal, while the other surface is of a particular oxide of copper. Copper is a peculiar substance in that it forms a variety of oxides depending upon the atmospheric conditions and the temperature. If an ordinary piece of copper is cleaned up and then held over a flame for a few moments it will be found to acquire a number of graded colours. Each one of these represents a different oxide, depending on the different temperatures to which the copper was heated. One particular oxide of copper is found to exhibit this rectifying property, and the rectifier disc has to be so arranged that this particular oxide, and no other, is formed thereon.

Efficiency

Now, a copper-oxide-metal contact has the property of passing currents very much better in one direction than in the other. The curve shown in Fig. 1 illustrates this property. Fortunately, it is also highly efficient, as in this case the reverse current is very small, the ratio of the two-directional resistances at the proper working point being of the order of 1,000. The reverse current, indeed, cannot be distinguished if plotted to the same scale as the forward current. To show the form of the curve in Fig. 1 a dotted curve has been shown which represents the actual reverse current multiplied by 100.

With the ordinary thermionic valve the reverse current is practically negligible, there being no current whatever when the

voltage on the anode is negative, unless the valve is soft; but in this particular instance there is a very small reverse current, which, however, is not large enough to cause any difficulty in operation. In fact, it will be seen later, when we come to consider the question of the use of these units, that this reverse current is a definite advantage, for it acts as a safety discharge arrangement, preventing the reservoir condensers in the eliminator from remaining charged should the set be inadvertently switched off before the mains.

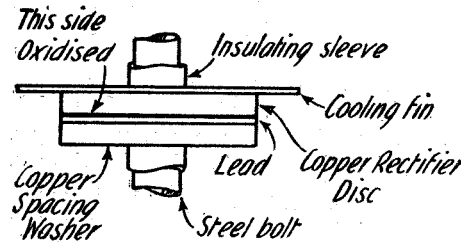


Fig. 2.—Details of Construction of Rectifier

Fig. 2 gives a diagram of the actual construction of a single rectifier. Actually, the contact does not take place between copper and copper oxide, lead being employed instead of copper. This is done principally because lead is a soft material, and can be pushed under pressure into a very intimate contact with the copper oxide. Thus, any irregularities on the surface are automatically compensated for, since the lead conforms to the shape, and this results in an appreciably lower resistance than would otherwise be the case.

The whole rectifier is mounted on a steel spindle around which is an insulating tube.

Mounted over this is the oxidised copper disc in contact with the lead washer. On one side of the rectifier is a cooling fin; on the other is a copper spacing washer. This completes the assembly of one unit, and any number of these units may be arranged in series or parallel, as required, in order to obtain a rectifier capable of working under any given conditions.

As has been pointed out, there is an optimum working point for the rectifier, and numbers of rectifier elements are built up to form one complete unit, so arranged that each disc is working at the correct operating point.

Cooling

The cooling fin is an important point, particularly where large currents have to be handled. In the high-tension rectifier unit the cooling fin is omitted, since the current is relatively small and the discs are of such a size that there is adequate cooling surface present. If the discs become seriously overheated the copper oxide is "reduced." That is to say, the oxide changes its state and tends to revert to pure copper, in which case the rectifying action falls off and in due time ceases. It is most important, therefore, in using these rectifiers, that the rated current shall not be exceeded for any prolonged period. Momentary excess current is not likely to do any damage, but only provided that the rectifier has not time to heat up can an overload be handled with safety. Provided this precaution is complied with, no difficulty is likely to be experienced in actual use.

CHIEF EVENTS OF THE WEEK

- LONDON AND DAVENTRY (5XX)**
- June 25 British Women's Symphony Orchestra.
 - " 27 *Widow Engaging*, a play by Lady Forbes Robertson
 - " 28 *Charlot's Hour*.
 - " 29 An Open Air Programme.
- DAVENTRY EXP. (5GB)**
- June 25 *Progress and the Builder*, a play by Edwin Lewis.
- CARDIFF**
- June 25 The "Vivatones" in a medley of melody, mirth, and mimicry.
 - " 30 An International Vaudeville Flight.
- MANCHESTER**
- June 25 Folk Songs of Yorkshire.
 - " 28 "The True History of Henry VIII," by L. du Garde Peach.
 - " 30 *On with the Show of 1928*.
- NEWCASTLE**
- June 25 *Canny Cracks*, a summery revuesical entertainment in five gusts.
 - " 29 Concert by the Municipal orchestra, relayed from the Spa, Whitby.
- GLASGOW**
- June 29 *Stewart of Ardsbeg*, a one-act play by C. Stewart Black.
- BELFAST**
- June 27 A Military Band programme.
 - " 30 A Light Russian programme.

"A REMARKABLE NEW VALVE" (Continued from page 888)

testing are the PM22 and PM24, for 2- and 4-volt accumulators respectively. Here are the main characteristics:

	PENTONE	PM22	PM24
Max. fil. voltage ...		2	4
Filament current3 amp.	.15 amp.
Max. anode voltage		150	150
Auxiliary grid voltage		As H.T. +	As H.T. +
Anode impedance ...		62,500 ohms	28,600 ohms
Amplification factor		82	62
Mutual conductance		1.3 m.a. volts	2.3 m.a. volts

The above are the specifications of the Mullard Wireless Service Co., Ltd. When, in a few months' time, the valve is released to the public we shall, of course, publish a full test report from the Furzehill Laboratories. Our own experiences with the Pentone lead us to believe that it has a great future. In our next issue our Technical Editor will write on the theory and use of pentode valves.

FREQUENCY MODULATION

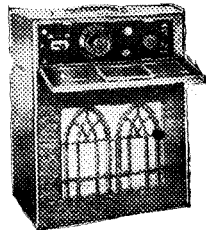
IT is not generally realised that one result of modulating a carrier wave with speech or musical frequencies, is to cause a slight detuning of the transmitter circuits, so that fluctuations in frequency occur in the transmitted wave, in addition to the more pronounced fluctuations in amplitude which are subsequently rectified in reception. Generally speaking, such frequency-variations are undesirable, because they naturally introduce a certain amount of distortion in a receiver tuned to a constant wavelength.

It is, however, possible to transmit speech entirely by means of frequency-fluctuations, keeping the carrier wave at constant amplitude. A somewhat special arrangement of receiving valves is necessary in this case, but the response is kept strictly proportional to the original signal. Frequency-modulation of this type is now being applied in actual practice to the transmission of pictures by wireless.

B. A. R.

THE NEW No. 3 ORMOND S.L.F. CONDENSER

.00025, 5/6; .00035, 5/9; .0005, 6/-; With 4-in. Dial. With Friction 55-1 4-in. Dial, 6/- each extra.
ORMOND Square Law Low-Loss. .0005, 9/6; .0003, 8/6 (1/6 each less no vernier); Friction Geared, .0005, 15/-; .0003, 14/6; .00025, 13/6. **Straight Line Frequency Friction Geared.** .0005, 20/-; .00035, 19/6; S.L.F. .0005, 12/-; .00035, 11/-.
FILAMENT RHEOSTATS, Dual, 2/6; 6 ohms or 30 ohms, 2/-; Potentiometer, 400 ohms, 2/6. .0001, Reaction, 4/-; Air Dielectric, 2/-; Neutralising, 4/-; Neutrodyne, 2/-; Twin Gang, .0005, 32/-; Triple, 40/-; H.F. Choke, 7/6. Geared Dial, 5/-.



Halcyon "De Luxe"
5-Valve Portable
FINEST ON THE MARKET
35 Guineas
 (Trade supplied)
 Also on Deferred Payments
£5 Down
£2 : 17 : 6 Month

MAKE YOUR MULLARD MASTER 3 INTO A SHORT WAVE SET. SHORT WAVE COILS

20-45 metres. 40-90 metres. 7/6 each or C.O.D.

Must Clear, owing to new design being shortly placed on the market.

THREE-VALVE LOUD-SPEAKER SETS

Gets London, 5GB, 5XX, and many Continental stations

D. & 2L.F.

LIMITED NUMBER

Call and hear one demonstrated.



Set with 3 Dullemitter Valves (1-Power) and Tuning Coils (Tax Paid), as shown in Oak American Cabinet. Switch for 2 or 3 valves, parts enclosed. SPECIAL Clearing Offer. Batteries, Aerial, and Speaker Extra.

59/6

Carriage Paid to Addresses in U.K. for 65/- or C.O.D.

BLUE SPOT CONE UNIT 25/-

Valves, all latest stocked. D., L.F., H.F., P., 10/6 and 12/6 each; D.U. 10. 15/-; Mullard, Ediswan, Marconi, Osram, Six-Sixty.

CONE SPEAKER CABINETS take 12 in. cone (will take Blue Spot unit) handsome design, all enclosed, 16/11. Post. Is.

WE ARE OPEN ALL DAY SATURDAY ALL DAY THURSDAY ALL DAY EVERYDAY
 Hours 9 a.m. to 8 p.m. Sat. 9 a.m. to 9 p.m. Sunday morning 11-1

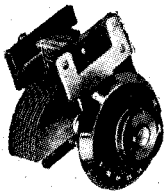
THE "CONCERT" FOUR

By Percy W. Harris, Editor, "Wireless Constructor." COMPONENTS AS SPECIFIED:
 2 Ormond .0005 mfd., with S.M. Dials, 22/-; Panel Mounting, .0001 Var. Condenser, 5/6; Utility D.P.D.T., Lever Pattern, 4/-; 2 P.P. Switches, Ormond, 2/6; Copper Screen, 8/6; 2 to stand on baseboard, 2/6; 4 Lotus or W.B. Valve-holders, 7/-; 2 Coil Stands, 2/-; 4 Temprytes and Bases (cartridge type), 10/-; Neutralising (Jackson), 3/6; 2 Lissen .0003 Fixed, 2/-; .0001, 1/-; .01 Mullard (Mica), 3/-; Lissen 2 meg., 1/-; Dubilier 1/2 meg. and Clips, 2/9; Lissen H.F. Choke, 5/6; R.I.-Varley (Type A), R.C.G. Unit (important), 20/-; Geophone 4-1 L.F., 20/-; Lissen or Dubilier, 2 mid., 3/6.

List Total **£5 17 9**

FREE 21 x 7, High quality panel (drilled); Strips, 8 x 11 and 2 x 11; Pair Brackets; 12 Engraved Terminals; Wood Screws and Connecting Wire; 5-ply Baseboard, 21 x 10 1/2.
ALSO SELECTION NO. 2, £3 10. List Free.

C.O.D. if desired



LOW LOSS, SQUARE LAW .0005, .0003, .00025, with 4-in. Triolite Dial,
5/11 each.
 Ball Bearings. Post 4d.

BRITAIN'S FAV. 2

Ebonite Panel, .0005 Ormond S.L.F. and S.M. Dial. Igranite 6 ohms, geared 2-way, 2 Lotus Valve-holders, .0003 and series clip 2 meg. Leak, R.I. and Varley L.F. Transformer. .0005 Fixed, Strip 4 x 2. 8 marked Terminals, G.B. (Taps, 2 Wander Plugs Square Wire, Screws, **45/- ABOVE LOT with Lissen L.F., 37/7.**

BRITAIN'S FAV. 3

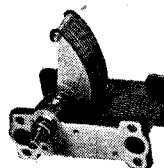
ORIGINAL COMPONENTS Ormond .0005 and .00025 Log Mid-line Condensers 12/- and 13/- each. 7-ohm Panel Rheostats, 2/-; 3 B.B. Valve-holders at 1.9. 2 Single Coil-holders, .0003 Fixed and Series Clip and Dubilier 2-meg. Leak, 5/-; H.F. Choke, 5/-; R.C. Dubilier Unit, 7/-; R.I. Transformer, 25/-; 7 Terminals at 9d. (5/3). 2 Strips 1 by 2, Total 81/6. Sent post free for 74/6 net.
 Second selection of Good Components (which includes the 25/- R.I. Transformer) post free for 59/6.

LISSEN

Valve-holders, 1/-; Fixed Con., 1/-, 1/6. Leaks, 1/-; Switches, 1/6, 2/6. Latest 2-way Cam Vernier, 4/6. Rheostats, 2/6. B.B., 1/6. Lissenola, 13/6. L.F. Transformers, 8/6. Coils 60X, 6/4; 250X, 9/9. 60-v. H.L., 7/11; 100-v., 12/11; Super 60-v., 13/6. Grid bias, 1/6; 1-5. 5d.
ALWAYS IN STOCK

EDISWAN NEW THREESOME

Three Coupling Units, Tubular Fixed Condenser, Multi-flex Cable and Plug, .0003 Variable with S.M. Dial 2-way Geared Coil Holder, Connecting Wire, Red and Black Flex.
 The lot post free, 42/- net Panel and Baseboard Free.



LOG-MID-LINE BALL BEARINGS

Try our NEW VARIABLE CONDENSERS, made on the Log-Mid-line principle. .0005 or .0003, with a 4-in. Triolite Dial, the best you can buy, for the moderate price of **6/11** Post Free.
 Telsen L.F. Transformers. Radiogram, 12/6. Telsen Ace, 8/6. Ratios 3 or 5 to 1.

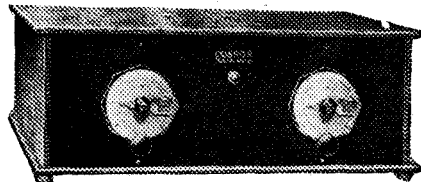
Amplion Vivavox Gramophone Pick-up, with volume control plug, adaptor, and leads, 50/-.
Amplion A.C. 13, cone unit assembly, 50/-.
Browns, B.T.H., Sterling, and all best makes of headphones.
Bulgin Short-Wave Chokes, 8-80 metres, 3/-; Post 6d.
Bowyer-Lowe Aluminium Screening Box, with screws and base, 6/-; Post 6d.
Bowyer-Lowe "Elfin", .00015, 6/-; Supplied with pointer, knob, and template.
Climax Autobot Transformer, 35/-; Heavy Mains Choke 21/-; Pot Divider, 5/-; Special Choke, H.T., 10/6; H.F. Choke, 8/6.
Colvern Set of four S.W. Coils, 10/130 metres, with base, 35/-.
Colvern Formers, 4/-; Bases 1/6; Featherweight, 4/6; SPHFT Long or Short-wave, 9/6; Mullard Master 3 coils, 7/6 and 8/6.
Climax H.T. Unit, 100 to 240 volts, 10 tapings, 34/-.
Ebonite cut while you wait at d. square inch, also 1/2 in. at d. Only the best supplied. No cheap rubbish.
Ekko H.T. Units, all voltages.
Ferranti Trickle Chargers 55/-;
Ferranti AF5, 30/-; AF3, 25/-; AF4, 17/6. Output push pull, meters and chokes stocked.
Formo 1928 Log, 5/- (.00035 and .0005). Post 6d.
Gambrell Neutrovernia, 5/6. .0001 Midget Bulgin, 5/6; .0001 Ormond Reaction (for P or B.B.), 4/-.

HYDRA CONDENSERS Tested on 500 volts D.C. (working voltage 240 d.c.). 1 mfd., 2/6; 2 mfd., 3/6; 4 mfd., 5/3.
Igranite L.F. Choke, Type G, 27/6; Smoothing Choke 25/-; Indigraph Dial, 7/6; Universal High Resistance 5/6; Patent Jacks, from 2/-; Ask for List No. J.546.

KEYSTONE (PETO-SCOTT) Midget .0001 Condenser, 5/6; Neutralising, 5/-; Six-pin Base, 2/9; Standard Wave Trap, 15/-.
Lissen Electrical Pick-up The finest at the price. Without adaptor, 15/-; With adaptor, 16/6.
Lissen New Model Headphones, at an incredible price for the quality, 8/6. Post 3d.
Lotus 2-way Coil Stand, panel mounting, 7/4.
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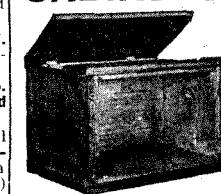
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"BROADCASTING PICTURES BY THE FULTOGRAPH"

(Continued from page 896)

chemically-prepared sheet of paper, wrapped round a cylinder, almost identical with that at the transmitter, and worked by a similar clockwork motor. Line by line, the paper is marked by the electrolytic action of current passing from the needle through the paper to the cylinder underneath.

We understand the sequence of processes in preparing the transmitting photograph to be sent as follows: Suppose we have a photograph of a man wearing a black hat and white collar. This is photographed through a line screen, thus obtaining a negative (white hat and black collar, etc.) on glass or film. A positive print of this negative is then taken, which will be identical with the original positive, except for the line screen effect.

This positive transparency must now be printed on to a copper foil, coated with fish-glue containing bichromate of potash, an addition which renders the glue insoluble once it has been exposed to light. The copper foil—slightly larger than the picture to be transmitted—is approximately as thick as the cover paper of this issue of AMATEUR WIRELESS. The coated foil is now used as the basis of a photographic image. Taking the lined positive transparency, we can print from it on to this chromatised glue, a negative image which, when properly finished by methods well known to photographers and photo-mechanical workers, will show the fish-glu

adhering thickly in parts that have been affected by the light, whereas parts not so affected have remained soluble and have been largely removed. Thus we now have on the copper foil a negative photographic image in which the white collar is represented by solid fish-glue, whereas the black hat, on the other hand, is shown by very nearly bare metal.

The surface of the prepared foil will, therefore, vary in its conductivity, according to the white or black contrasts of the original picture and as the transmitting contact passes over this surface, the current flowing in the circuit, of which the needle forms a part, will vary. These variations are amplified and then impressed on the carrier-wave of the broadcasting station.

At the receiving end, the received energy is again amplified by means of an ordinary 2-valve amplifier and as the varying current passes from the contact needle through the chemically-prepared paper to the cylinder underneath, the electrolytic action—the decomposing effect of the current—produces a brown coloration varying in depth, according to the amount of current flowing.

It is, of course, absolutely essential that the transmitting cylinder should rotate at the same speed as the receiving cylinder. In the Fultograph, the cylinders are synchronised by means of an electro-magnetic relay.

Going back to the transmitting end, it should be explained that the ends of the copper foil do not meet round the cylinder, and between the two ends is a metal conducting strip, fitted flush with the cylinder. It follows that as the cylinder revolves, the needle must at every revolution come into contact with this strip. As it does so, a pulse of current flows as long as the needle is in contact with the strip. It is this pulse at the end of each revolution that affects the electro-magnetic relay device on the receiver, causing the receiving needle to be lifted from the cylinder between each revolution.

Thus, although the cylinders are not revolving at exactly the same speeds, they perform the same number of revolutions per minute, and for all practical purposes their speeds are synchronised.

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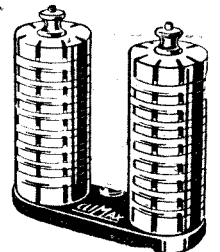
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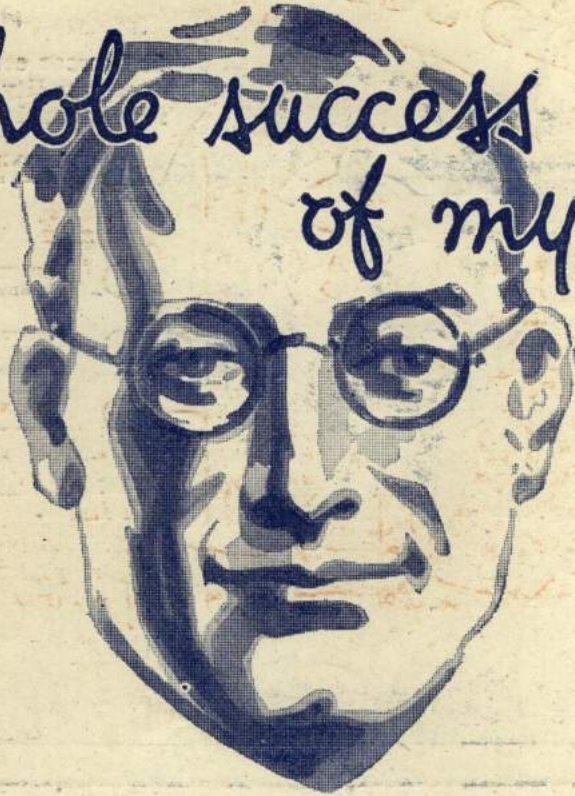


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