

Simultaneous Broadcasting & How It Is Done

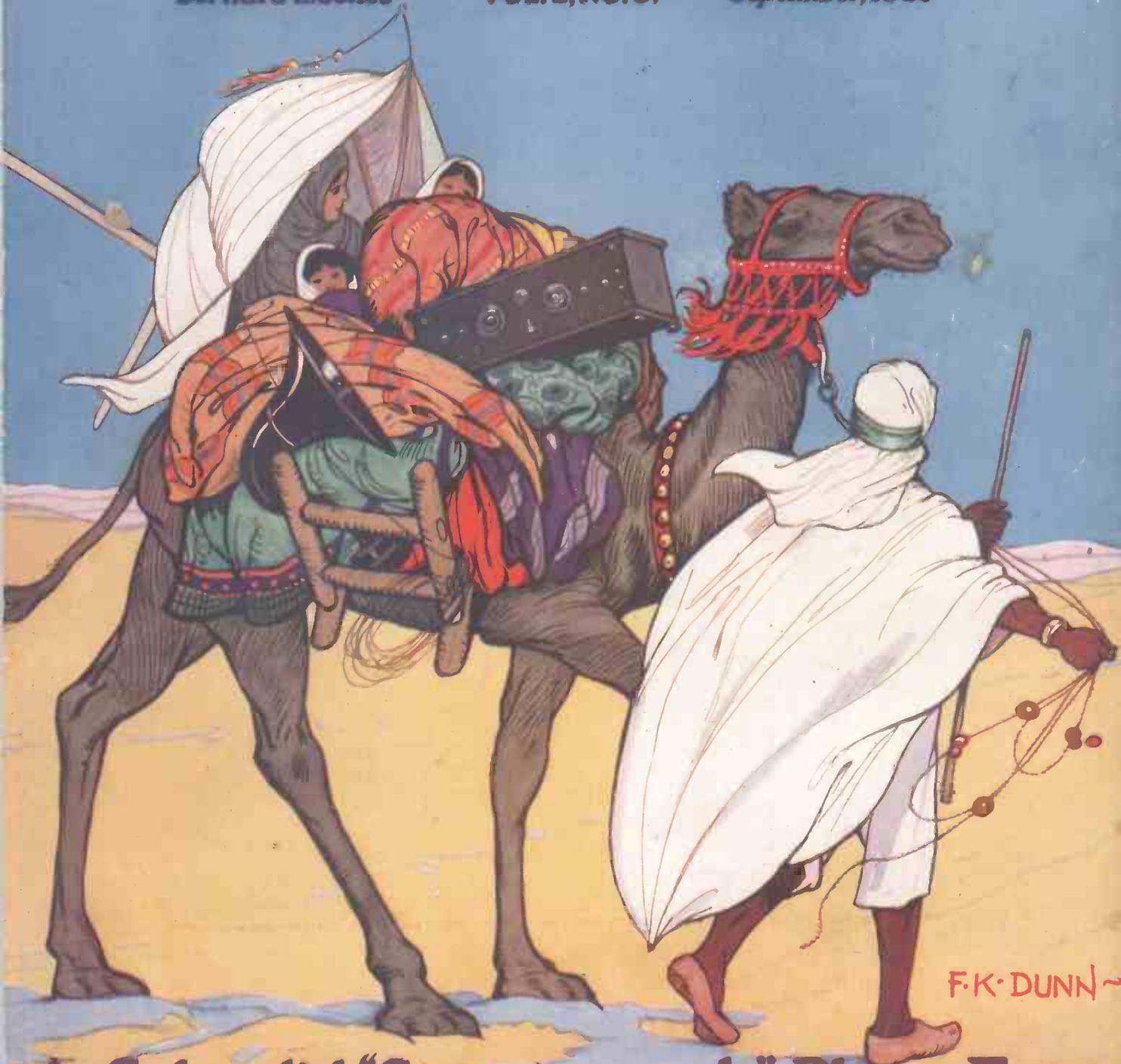
The Wireless Magazine



Edited by
Bernard E. Jones

VOL. 2, NO. 8.

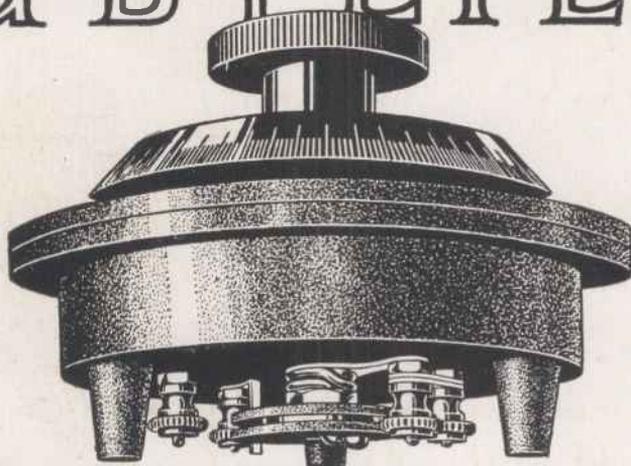
September, 1925



F. K. DUNN ~

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DUBILIER



MANSBRIDGE VARIOMETER 12/6

FOR those occasions where it is more suitable, and for those people who prefer it, the Dubilier Condenser Company are now producing a Variometer. It was designed by C. F. Mansbridge, Esq., the originator of the Mansbridge Paper Condenser. It will thus be seen that the usual guarantee implied by the name of Dubilier is in this case re-inforced by the well-known name of Mansbridge.

The Dubilier Mansbridge Variometer is remarkably compact; it is $4\frac{1}{2}$ inches in diameter, and the overall depth is only 3 inches. It is equipped with three feet which enable it to be used standing on the experimenter's table, while it can easily be mounted on a panel if required. The Variometer consists of two pairs of D shaped coils, one pair being fixed, while the other is rotated by means of the knob. Connection to the moving coils is made through a phosphor-bronze spiral wound on a bobbin made of insulating material—a device which is also incorporated in the Dubilier Vanicon range of Variable Condensers.

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Progress

A FEW months ago the House of Graham announced that there would be **NO REDUCTION IN THE PRICES OF CURRENT AMPLION MODELS DURING 1925.**

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CONCERT MODEL A.R.23

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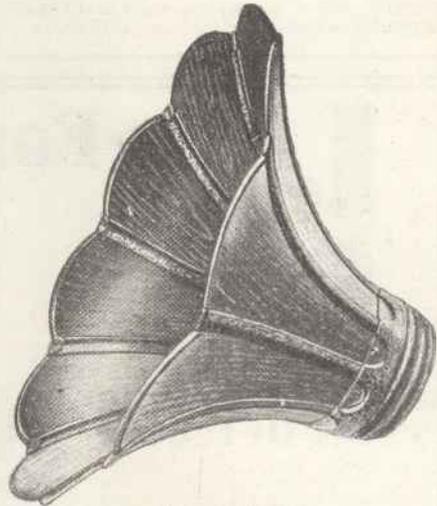
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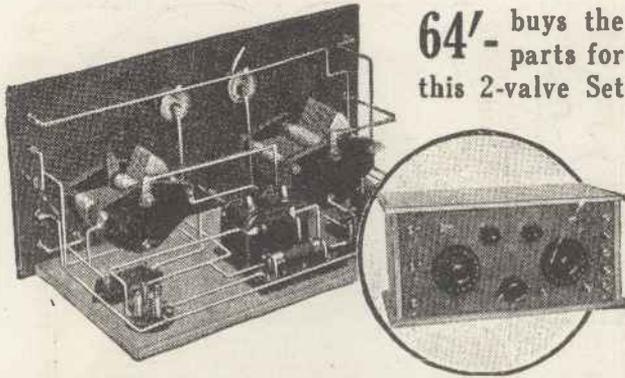
The New DRAGON Type A.R.19.



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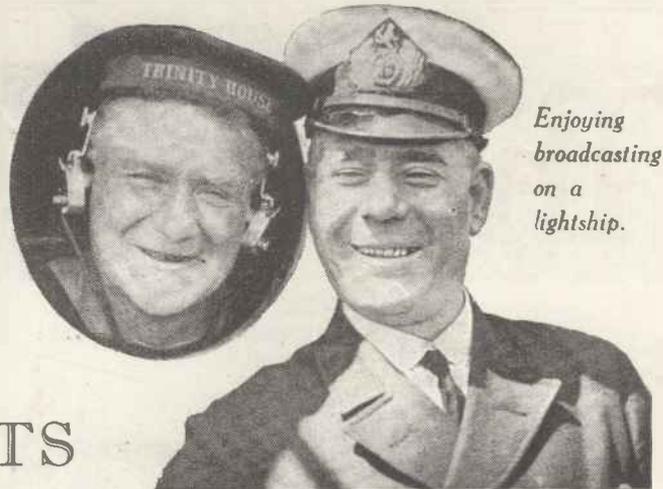
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The Wireless Magazine

September, 1925

Vol. II.

No. 8.



Enjoying broadcasting on a lightship.

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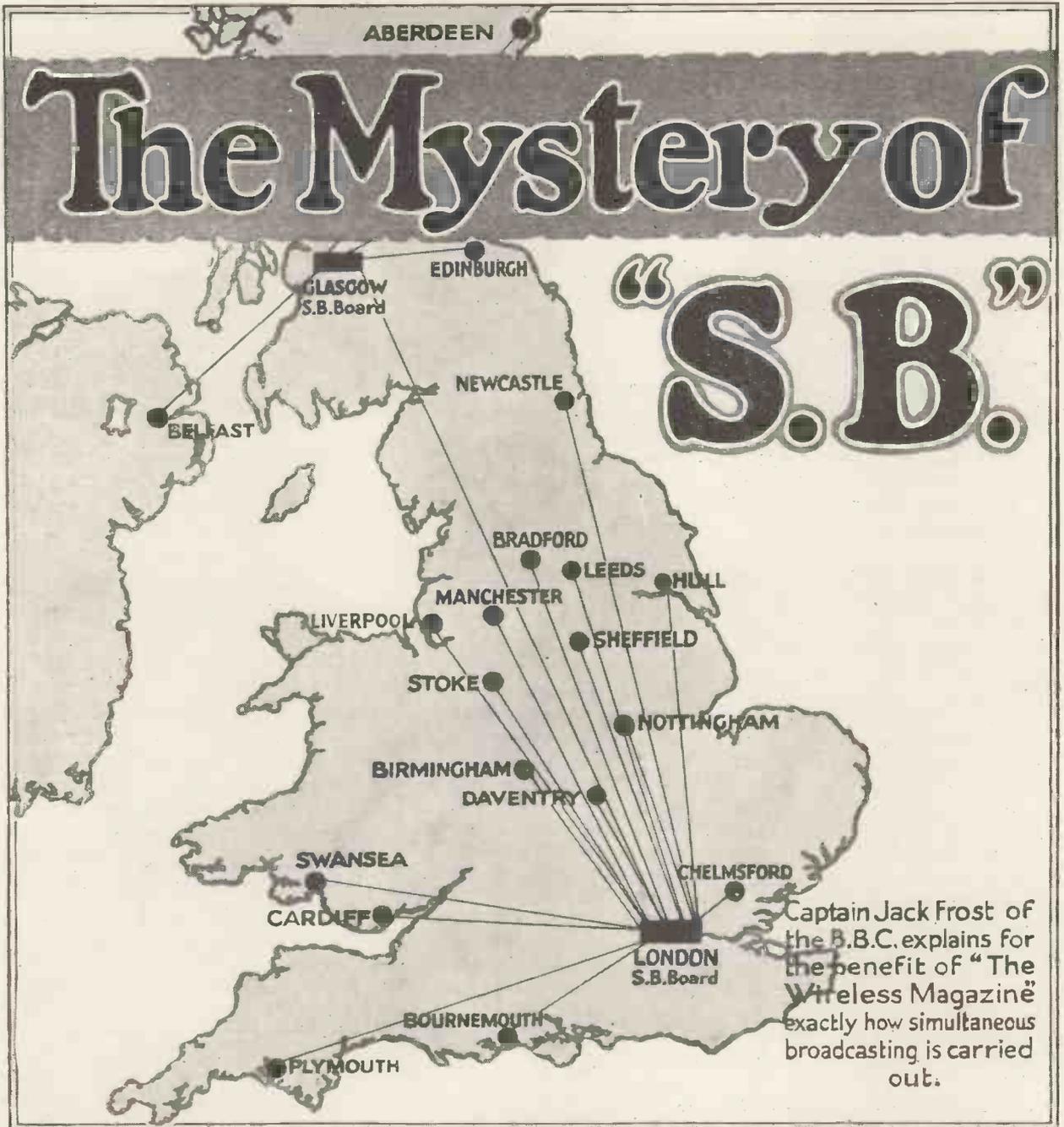
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ANNOUNCEMENTS.—THE WIRELESS MAGAZINE, edited by Bernard E. Jones, is published about the 25th day of the month and bears the date of the month following. One Shilling Net. Subscription rates are 15s. 6d. a year, post free; Canada, 13s. 6d. a year, post free.

Contributions, accompanied by stamped and addressed envelopes, are invited. All editorial communications should be addressed to The Editor, THE WIRELESS MAGAZINE, La Belle Sauvage, London, E.C.4.



“DUNDEE will transmit the Aberdeen programme,” “Swansea is transmitting a programme from Cardiff,” “5 X X will take the Birmingham programme from 8 p.m. till 9 p.m., and the Manchester programme from 9 p.m. until the second news bulletin at 10 p.m., which will be S.B. to all stations,” “The all-star programme as performed in London will be S.B. to all stations of the British Broadcasting Company to-night.”

We have all heard expressions

such as these—we have all read such notes in the Press. But how many of us have ever quietly sat down and considered *how* it is done?

Accepting Things As They Are

Comparatively few people have ever inquired—we are all, I think, just a little inclined to accept things as they are, and to take simultaneous broadcasting, and wireless generally, for granted.

Have you ever sat quietly in your easy chair and enjoyed the quick visits to the various stations upon

those evenings when your local station transmits a little piece of all the other main-station programmes? I have, and I have wondered at the agility of some very busy engineers at what we call the simultaneous board at Savoy Hill.

Suppose that we pay a visit to the control room at 2 L O right now—at a time when no broadcasting is in progress. There will be but little hurry and bustle, and we shall have the opportunity for which we have longed—to see some of the “gear” which is used in providing

How Simultaneous Broadcasting is Carried Out

for us the amusement called "listening."

The control room is apt to be a little bewildering at first acquaintance because so very much is packed into the available space—yet there is really plenty of room for moving about. We shall see presently how important that "moving room" becomes when broadcasting commences.

Imposing Switchboard

To the right of where we are standing is an imposing switchboard that is connected with the charging of the batteries which run the many amplifiers and mysterious "gadgets" that cover long black benches to our right and left. These benches with their mysterious, but none the less important, burdens, are ranged along the two side walls, and number four in all.

The "mysteries" upon them are the amplifiers which work in connection with the London studios. These amplifiers must have mention here because one of them, the B, is controlled by an engineer during the whole time of transmission. So that you may understand the process, you must realise that, next to our microphone—at each and every broadcasting station—are the amplifiers which attend upon its pleasure. So that, whilst the microphone revels in a name all to itself, the amplifiers, which take gratefully that which it gives them, are simply called A and B respectively. The A amplifier is the one next in the circuit to the microphone—the B is the one following that again.

Air Vibration

The microphone receives the sound of singing, shall we say, in the form of an air vibration and works its wizardry by converting the sound into electrical impulses. The way in which it does this must be the subject of another article.

The A amplifier receives this series of electrical impulses, amplifies them, and hands them over to the care of the B amplifier—which, whilst

itself amplifying yet again if and when necessary, at the same time gives "control" by means of a variable intensity device which is operated by the "controlling" engineer.

This engineer, wearing headphones, is able to give to the transmitting station—whether it be in London or in Aberdeen, Belfast or anywhere else—the correct strength and quality of signal strength from the studio to which the B amplifier is connected.

To every main broadcasting station studio are connected A and B amplifiers, in close proximity to the particular microphone operating in the studio concerned. Whether the transmission is only from its own station or whether it is to be from

line, that is, a wire or wires, laid underground for preference.

It may be a very short line if the transmitting apparatus is in the same building as the studio—which is not advisable—or it may be a very long one if the line brought into use is for the broadcast of, shall we say, the London concert through Aberdeen, for the benefit of listeners in the North of Scotland. So much for the object of the amplifier and the control of the sounds broadcast.

Relay "Boxes"

Just in front of where we are standing in 2 L O's control room, and midway between the amplifier benches, out in the centre of the room, is an affair somewhat hard to describe.

An upright wooden frame, about seven feet in height and nine in length, has mounted upon it a number of small boxes, all alike, but each having fixed above it an indicating label engraved with the call letters of the broadcasting station to which it refers—one box for each station, including relays.

Opening the side of one of these boxes as they stand in a neat row like a line of soldiers, we would see two valve holders and the usual transformers, resistances, etc., which prove the box to be an amplifier. One valve is inside and the amplification given by it is controlled by a variable switch fixed below the box—one switch per box and one box per station. Other odd components exist, of course, with each amplifier box, but they are the same for each and need not be mentioned here.

"Simultaneous Board"

At the top of the frame called the "simultaneous board," on to which all of these boxes are fixed, is a strip of ebonite with, sunk into it, a number of jacks. Below the strip of jacks are plugs fixed to flexible leads—one plug to each hole in the ebonite strip. Again we have the family-of-stations arrangement, for there is one plug hole, with one jack behind the hole, and one plug

GOOD THINGS IN THIS ISSUE!

(For Sets, see p. 109.)

"Three-second Waits."

The latest American studios described specially for THE WIRELESS MAGAZINE by Fred Smith, director of the Crosley W L W Studios, Cincinnati (p. 114).

The Not-tonightingale.

A new "Joking Apart" article by F. W. Thomas, the "Star" humorist (p. 139).

The Universal Wireless Clock.

A special article by Dr. E. E. Fournier D'Albe in which he explains his proposal for a continuous wireless time service (p. 126).

The Ideal "Children's Hour."

A special article by Muriel Wrinch.

Deep-sea Fishing.

Walter Wood explains what a boon wireless is to the fishermen engaged in "fishing."

The Modern Tower of Babel.

An article that shows the great advantages of the use of Esperanto in broadcasting.

all stations by simultaneous broadcast, there must be a microphone and one or more amplifiers.

Let us call the amplifier—which is the last one through which our impulses pass before they arrive at the transmitting station with its aerials and transmitting apparatus—the "control amplifier." Then, between the control amplifier and the transmitting apparatus is a telephone

THE MYSTERY OF "S. B." (Continued)

upon its flexible lead, to each station, including relays.

Each and every plug hole in the row of them is labelled with the call-sign belonging to the station to which it is connected. Thus one is labelled 6 B M, another 5 W A, another 5 S C,

the line carrying the music—it may not be a vital trouble, but it can be righted with the co-operation of the engineers at both ends of the line after a moment or so of conversation upon that second line. Yes, it is very valuable indeed for relay

flat case upon the wall are double ended, so that not only may a plug be fixed into its jack to form contact with the line terminating upon this case, but the circuit may also be completed to the strange looking polished wood case standing beneath the table. This wooden case has its hole to receive the plugs and is called an input board.

To this piece of apparatus the B amplifier is connected, and here the electric impulses, somewhat tired after their long journey over the telephone lines from the place of outside broadcast, receive a little amplification—controlled amplification, of course, as I have already explained.

*Is it a
"Zoo"
Broadcast?*



Output Board

Thence our strengthened electric impulses pass to the output board with nine plugs and jacks, and pass over short lengths of cable from the amplifier bench to the board—the central distribution board. This board, as its name implies, distributes the current as may be required to various cables which run to the simultaneous board.

It is a few minutes now to the time when dance music is to be simultaneously broadcast from all stations. All is quite orderly, and no one seems to be in the very least bustling or disturbed. The flat case upon the wall is examined as to its soundness and as to the fitness of the lines concerned. A telephone instrument assists in proving that all is, well—for one of the engineers is speaking to someone at the other end of the line. The double-ended plug has one end inserted into its hole beneath the board and the other end is plugged into one of the holes on the input board.

The B amplifier is switched into activity and an engineer seats himself in front of it and dons a pair of headphones hanging upon the bench in readiness to control the output of his amplifier. The B amplifier is plugged through to the output board and that, in turn, is connected to the cables running to the central distribution board.

Plugs affixed to flexible cords are meanwhile plugged into the row of labelled holes at the top of the simultaneous board, and the valves

and so on. Just over the top of the simultaneous board is a fat bundle of wires bound tightly together.

In this fashion they come to the strip of jacks from the wall at the end of the room, where they merge into a mass of lead-covered cables ere they make their exit through the ceiling on their way to the exchange in London called "Trunks." These are Post Office lines and cost a lot of money to maintain and therefore to hire.

Miles and Miles of Line

Just think of the miles and miles of them that there must be—two to each and every station both main and relay, although in one or two cases the stations are only connected to London via another broadcasting station. There are two lines to each relay station, and a space available for main stations given by the Post Office should occasion arise, because "safety first" must be the motto.

That extra line for relay stations is used, too, for speech, and by its means information is passed from station to station during broadcasting times.

A technical trouble may occur on

stations, which do so much simultaneous broadcasting. With main stations a permanent speech line is not justified.

So that you may understand the movements and actions of the engineers when dance music is being broadcast presently, you must know the working of that flat case affixed to the wall close to the simultaneous board. To small screws mounted upon metal strips are attached the lines which run to many places of outside broadcast—the line carrying the music of the Savoy Orpheans from the Savoy Hotel, the de Groot Orchestra from the Piccadilly Hotel, and from a number of theatres and concert halls.

Labels

Every strip and, therefore, every line is labelled with the name of the place whence it comes. These are all connected to flexible leads carrying plugs, so that which ever line it is required to use may be plugged over to what is called the central distribution board, which you can see fixed high up on the wall over the switchboard by the door.

The plugs affixed beneath the

A Special Article by Captain Jack Frost

within the small amplifiers just below are switched on.

By these processes the central distribution board has been linked to the simultaneous board, and the lines to the distant stations are brought into circuit, the small amplifiers and transformers playing their part in sending clean, strong signals along the lines as they pass away from the simultaneous board.

"Stand By for London"

The engineer at the simultaneous board has just asked the distant stations to stand by to receive that which London has to give—the announcement of the item is now being made in the studio, and the engineer "controlling" and wearing the headphones is slowly increasing the amount of "juice." As he turns his control knob the strength increases—we can hear the effect by means of the receiving set and loud-speakers reposing yonder upon a table.

Transmission is in full swing now, and one can well imagine dance parties all over the country, and upon the Continent too, getting into full swing. And that is that. The main concern of the engineers at both distant stations and in the London control room is that the lines are "good"; if they are not, then a conversation occurs by phone between the S.B. engineer and the fellow at, shall we say, Hull, and the reserve line is brought into use by means of the second plug hole in the strip of ebonite at the top of the board.

It all sounds very simple, but much pioneer work had to be carried out to bring the organisation and technical arrangements to their present state of development. All is not perfect by any manner of means, but great strides have been made and clever brains and much experience have achieved the desired end—the practicability of "S.B."

Father and Grandfather

The father of the present simultaneous board was a similar affair, which differed from it in appearance but little. The grandfather was a far less imposing affair, and was not really a board at all. It was just two planks of wood nailed to the wall of the control room—the small

box amplifiers being mounted upon them. Beneath the planks, a table, and upon the table a couple of magnetic-ringing telephones, a loud-speaker, a transformer for each line, and some spare cables.

The ancestor of this contraption was a plain deal kitchen table with components and terminals screwed upon it—and it was just such an arrangement as this which was used in the tests which were carried out after closing-down time in those days which seem now so very far away, but which were only two years ago.

Such is the speed of development which has enabled millions of people in all parts of Great Britain and Ire-

land, and in all parts of the Continent, to hear a star event—some great singer—some latest news item—which they could not have heard were their local station not linked up in the simultaneous system.

Developments

Some day, perhaps, you may have an opportunity of visiting London's control room—by that time more developments, with consequent alterations, will, in all probability, have changed the appearance of both control room and simultaneous board—and, too, perhaps the system will have changed. Anyway we have seen it as it is to-day, even if it is all altered by to-morrow.

AS FATHER TUNES IN!



"Has the loud-speaker got kittens, too, Mummy?"

“Three-second Waits”

“THE WIRELESS MAGAZINE” readers are shown around the latest American broadcasting studios WLW, by the director, MR. FRED SMITH, of Cincinnati, whose portrait is here given.



IN the very heart of the factory of the Crosley Radio Corporation of Cincinnati, U.S.A., where 1,700 men and women are employed, and where 5,000 sets a day are turned out in the busy season, are situated the Crosley Studios with the call-sign WLW—the broadcasting station that makes a feature of “three-second waits.”

Two Studios

At WLW there is a large studio capable of holding comfortably an orchestra of thirty pieces or a choir of fifty voices, and a smaller adjoining studio for soloists, speakers, dramatisations and small musical ensembles. This latter serves also as the office of the studio director during the day.

At the back, between the two studios, is a small control room where an operator attends the amplifier panel; in front of the studios there is an auditorium with chairs much after the order of a theatre, suitable for seating nicely some two hundred and fifty guests (see photographs).

For the general benefit of the plan, the dividing walls are chiefly of plate glass. Thus the announcer can see and be seen by the operator, the guests can observe the performance without disturbing it, and the artists can feel that they are practically in a concert-hall with the auditors near by.

Curtains of monk's cloth are

draped around the entire interior. For the most part they are caught back from that part of the walls which is glass, as seen in the photographs. However, they can at any time be let down over either or both studios.

This dropping of the curtains finds a practical application when a “mystery” performer, such as Santa Claus, is before the microphone, or when the portable stage for æsthetic dancing is placed in the large studio and the dancers are kept concealed in the smaller studio, which, in such instances, is converted into a temporary dressing-room.

Loud-speakers in the auditorium convey the concert to the spectators. For the further benefit of the guests, soft drinks—lemonade, orangeade, etc.—are served every evening. These drinks are furnished by the city's largest refreshment company, in consideration of which the name of the company is mentioned over the air *once a week*.

Special Signal System

The microphones at WLW have a special signal system attached. In the photograph above one observes two white lines in the cylinder immediately under the microphone. Behind each of these circular white lines, which are openings in the metal covered with a heavy wax paper, is a small electric bulb.

When the light of the lower one is on, the line reveals the word

“Prepare.” When the light above is on, the word “Broadcast” appears.

These lights, or signals, are managed by the operator in his booth upon given signals from the announcer.

They are used in this way: Suppose an orchestra to be playing in the large studio, with a tenor soloist and piano accompaniment to follow in the small one. At the conclusion of the piece the announcer steps immediately to the microphone in the large studio, tells the name of the selection just played, and announces the soloist who is to sing.

“Prepare” and “Broadcast”

In the meanwhile, the operator has received a certain signal of the hand given by the announcer and has thrown the light on “Prepare.” The tenor takes his position. At the next signal, the light flashes on “Broadcast,” and the song begins.

In this manner there is a minimum of time lost, say *two or three seconds*, between selections. There is never a “Wait just one moment, please,” with the ensuing silence of from thirty to seventy-five seconds.

When the thread of the programme is broken for more than five seconds, something very unusual has happened.

The Crosley Studios are open to the public from morning till midnight. When picturesque events are scheduled, special invitations are broadcast.

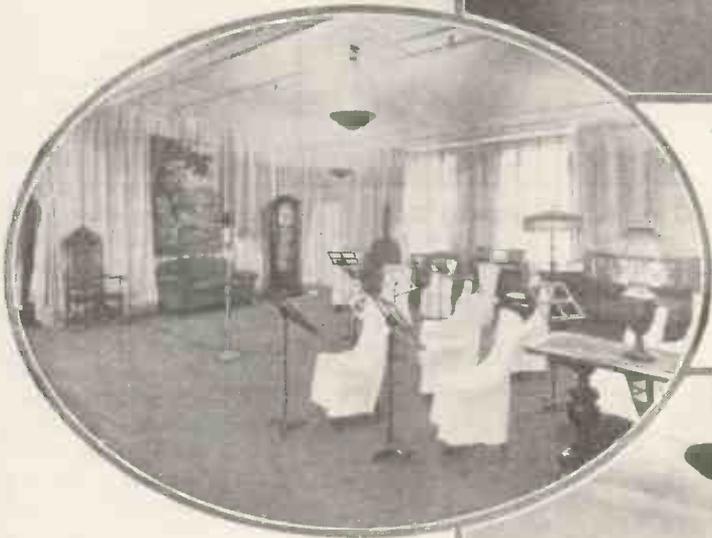
The Latest American Studios

WLW AT CINCINNATI, IOWA, U.S.A.

Comfort is the keynote of American broadcasting studios, as can be judged from these photographs. Space is not stinted, there is plenty of light, and the furnishings are of the best.

All this may reasonably be expected to put broadcasters at their ease (especially those who are not "professionals"), a state of affairs that can only result in better items being "put over the ether."

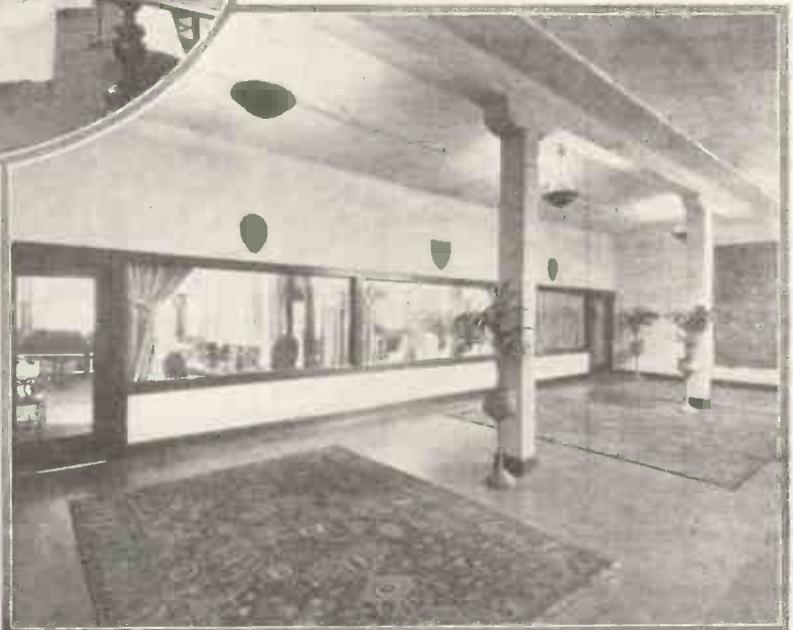
The studios shown in these photographs are owned by the Crosley Radio Corporation, of Cincinnati, U.S.A.



The studios shown by the two top photographs are those shown divided off by glass panels in the bottom photograph. They are both excellently furnished.

Glass sides are provided to the studios so that broadcasters can have something of the atmosphere of an audience to help them. So that the audience can hear what is going on inside the studio, loudspeakers are provided; these reproduce the sounds that have actually been broadcast.

This photograph (right) shows the auditorium side of the glass panels, where guests are entertained and provided with refreshments.



Building A Unit Set

A Valve or Crystal Detector Unit & A Tuning Unit

IN two preceding issues of THE WIRELESS MAGAZINE we have described a two-valve power amplifier and a two-valve high-frequency amplifier. These units are both mounted on panels of the same dimensions and fitted into similar cabinets of the sloping type.

This article deals with the detector unit and a specially designed tuner unit. A switch is employed for the optional use of a valve or a crystal as the detector. This switch is of the push-pull type.

Together with a suitable tuner unit which is described in these pages these three units form a very efficient 5-valve receiver, having switches for any combination from the plain crystal detector with a single coil and condenser tuning system to a 5-valve set using loose-coupled aerial tuning with series-parallel and tune-stand-by switches.

The detector unit is, of course, the simplest of the units to build; the following components are necessary.

Radion ebonite panel, 10 in. by 8 in. by $\frac{9}{16}$ in. thick. (American Hard Rubber Co.).

Six-point push-pull switch (Lissen).

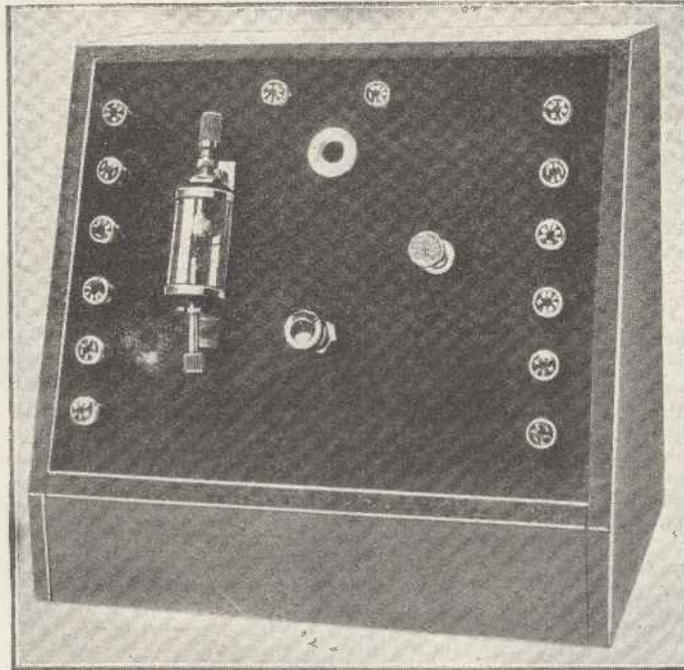
Combined valve holder, valve window and rheostat (Woodhall).

.0003-microfarad grid condenser (Dubilier).

2-megohm grid leak (Dubilier).

14 terminals (Belling-Lee).

Crystal detector (National Wire-
less).



View of Completed Crystal or Valve Detector Unit.

Oak cabinet to fit panel (see sketch on page 395, No. 4).

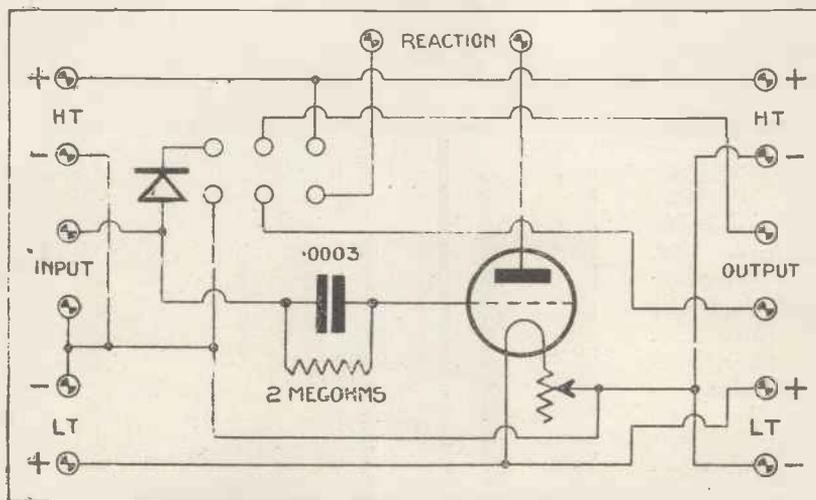
The size of the panel is 4 in. less in one dimension than the nearest stan-

ding diagram and drilling template (given free with this issue) is laid flat over the panel in such a manner that the edges of the

template and those of the panel coincide.

With a sharp steel point mark through at the intersections of the thin dotted blue lines which denote the centres of the holes to be drilled. The template is then taken off and the holes drilled at the points thus made, the sizes of the holes being indicated on the template.

The combined valve holder, rheostat and valve window is mounted centrally on the panel; the crystal detector on the left and the push-pull switch on the right. Two reaction terminals are provided at the



Circuit Diagram of Valve or Crystal Detector Unit.

dard size (12 in. by 10 in.) of the American Hard Rubber Co. The panel as it is bought will, therefore, require cutting; the best and quickest

way to do this being as follows: Mark on the panel the piece to be cut off, and with a sharp steel point and a straight edge placed along the line make repeated strokes until a groove has been cut in the ebonite $\frac{1}{16}$ in. or more in depth. Now place the ebonite on a table so that the groove lies along the table edge.

Pressing the panel to the table, give the projecting piece a smart tap with a mallet. The panel will then break with a clean fracture along the groove. The fractured edge may then be cleaned up with a piece of emery cloth.

After being cut to size the panel is ready for marking out. The combined coloured wir-

top of the panel to enable connection to be made to the reaction coil on the tuner panel.

The remainder of the terminals are arranged in a row down each side of the panel in such a manner that when the detector unit is in use with other units all the external wiring necessary is the cross-connecting of the terminals.

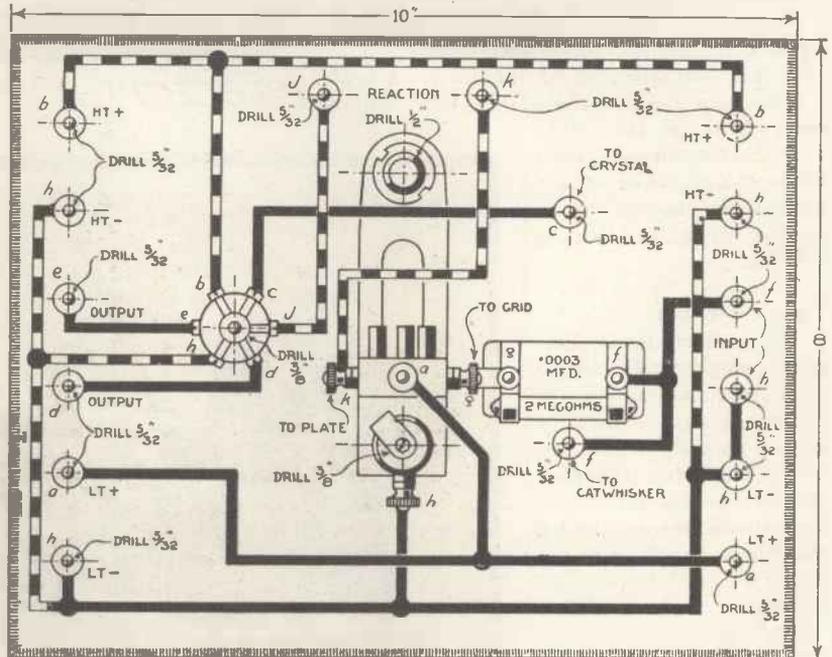
Wiring the Set

Wiring is a very simple matter if reference is made to our full-size combined wiring diagram and template. It will be noticed that on the diagram some of the terminals are marked *a*, others *b*, some *e* and so on. This enables the constructor to know which wire to connect up first. All the terminals marked *a* are joined together with one wire or as few wires as possible.

Afterwards all the terminals marked *b* are connected together in a similar manner. Proceed in this way until the whole unit is wired up. The result should look something like that shown in the photographs of the back of panel wiring.

In order to give the wiring a neat appearance each wire should be perfectly straight and free from kinks. Connecting wire of large square section should be used if at all possible, but if expense is a consideration No. 18 gauge will be found quite suitable. This wire, however, seems particularly prone to develop bends and kinks, but a good method of getting rid of these is to put one end of a 6-ft. length of the wire into a vice and clamp it tightly between the jaws. Hold the other end of the wire with pliers and pull the wire

Reduced Reproduction of the "Structograph" coloured plate of the Detector Unit Given Free with this Issue.



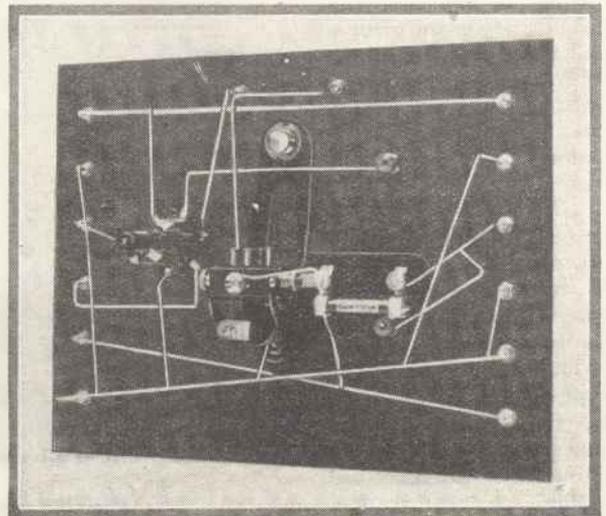
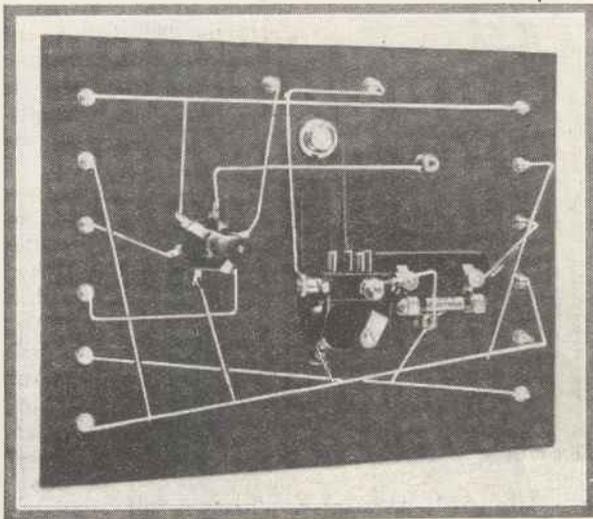
until it stretches. In this way all kinks are taken out, the result being a good length of wire perfectly straight. This can be conveniently cut up into 2-ft. lengths suitable for wiring.

The Right Valve

A great mistake made by the average amateur is the use of an unsuitable valve as a detector. He meticulously chooses the very best of transformers, coils and condensers and yet when he comes to the valve he will probably use the same type for each position.

There are several valves on the market of the bright- and dull-emitter type specially made for rectification, and one of these should be used. Among the bright-emitters suitable for this purpose appears the Marconi R4B, while the dull-emitters include the following: Mullard D3 and D.06, Metropolitan-Vickers Shortpath type SP 1.8 and B.T.H. type B5.

Whichever type is used a suitable rheostat must be employed. In the particular Woodhall valve unit described here rheostats suitable for any type may be obtained.

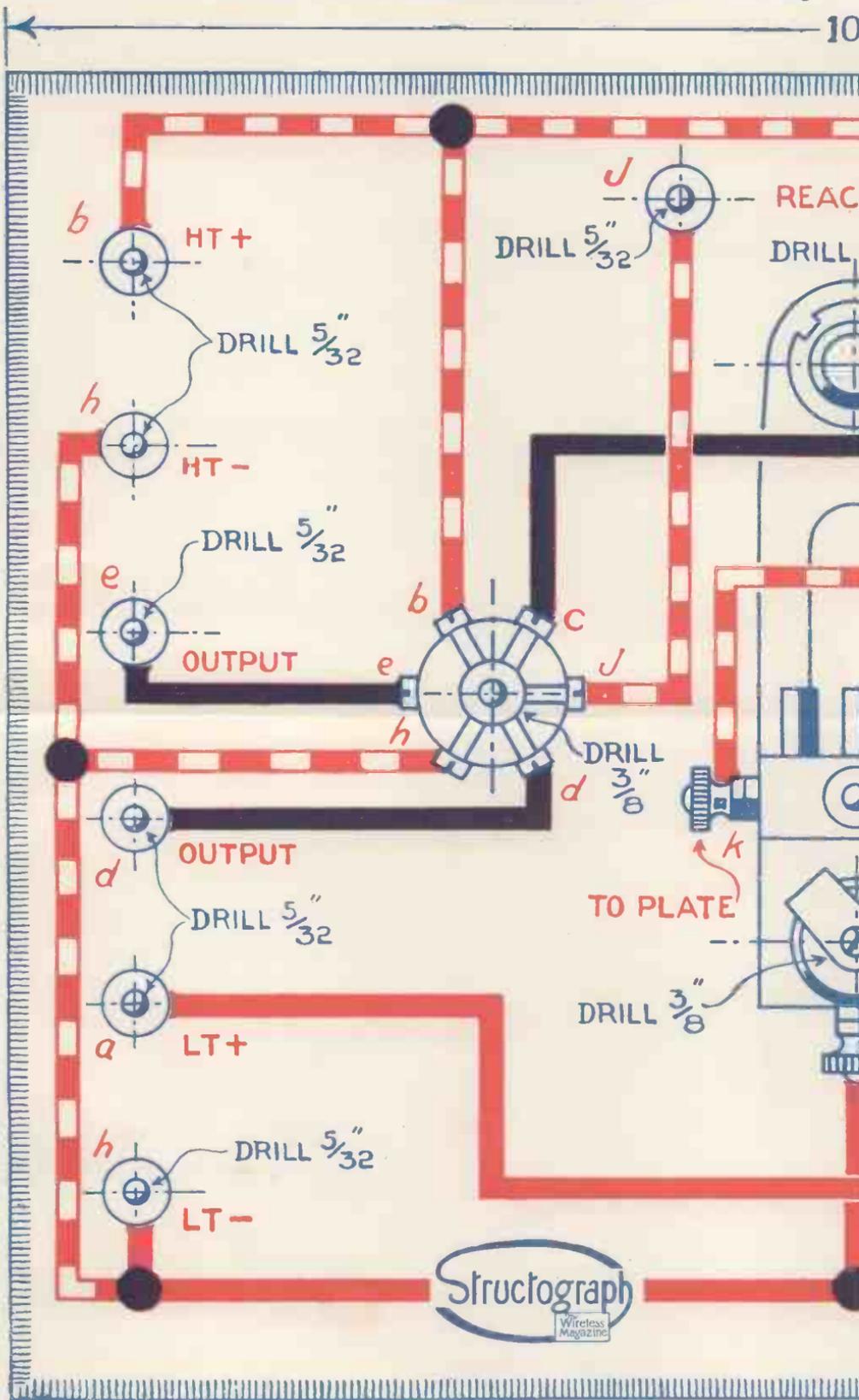


Two Back Views of the Detector Unit showing Disposition of Components and Wiring.

A VALVE OR CRYSTAL

Combined Drilling Template and

For full particulars, see article entitled "Building a U



HOW TO USE THIS DIAGRAM AS A TEMPLATE :—The blue shaded components. This template should be laid on the panel and the drilling of the whole plate being retained for use as a layout and wiring diagram.

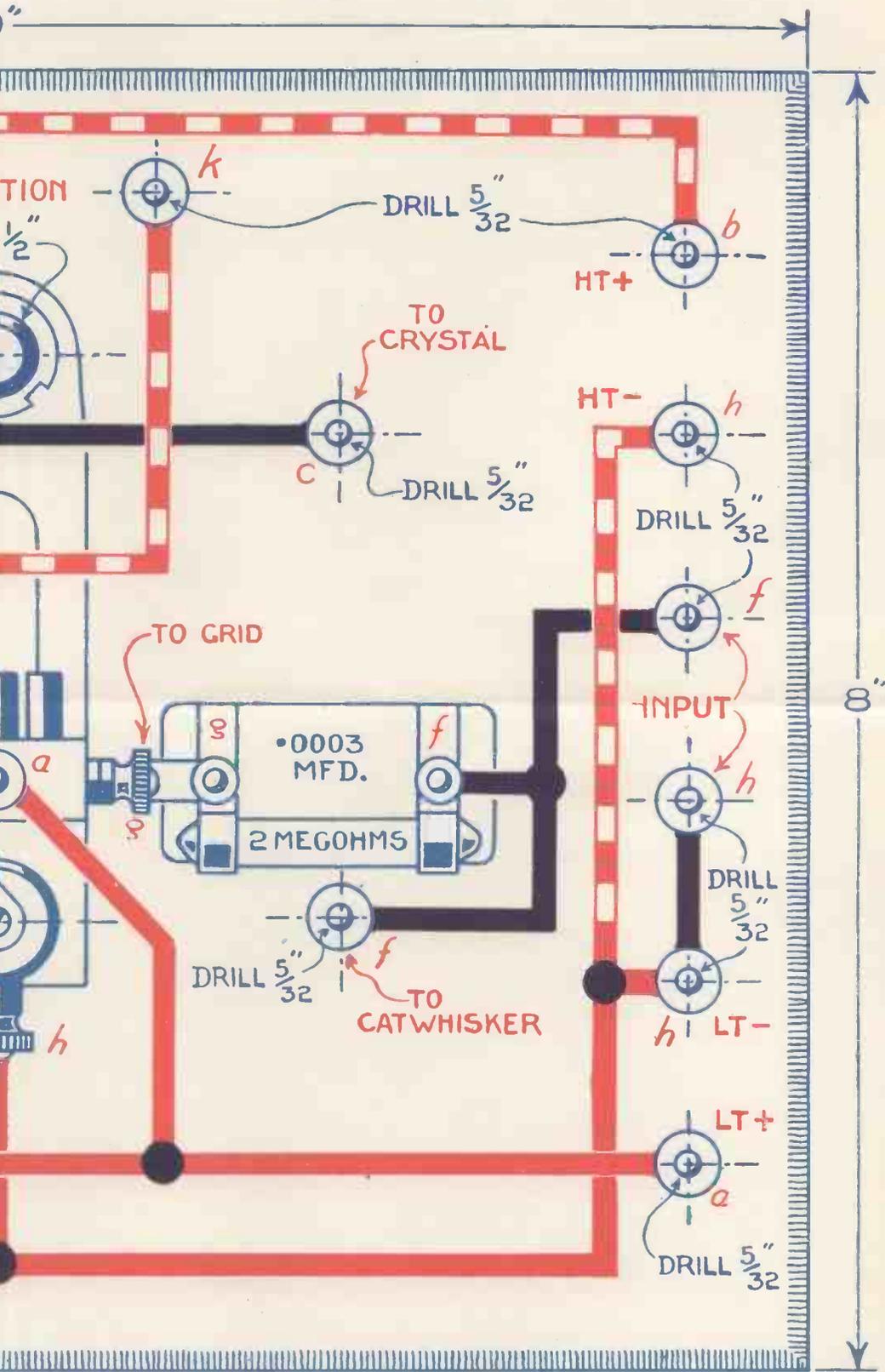
SPECIAL INSTRUCTIONS FOR WIRING :—There is a choice of three main red-and-white lines the H.T. or plate circuit; and black lines the grid circuit soldered together. At all other intersections there is no connection between entirely by means of the red letters shown at the various terminals. You thus all the a's together, all the b's together, and so on, and you should do are careful, it having been carefully worked out to save the home-constr



CRYSTAL DETECTOR UNIT

Full-size Layout and Wiring Diagram

"Unit Set" in "The Wireless Magazine" for September, 1925.



The outline indicates underside of panel; all blue lines relate to either panel or centres pricked through, the template thus serving many times if so required, and

methods. (1) Follow the wiring lines, red lines indicating the filament-lighting circuit; circuit. A black circle at the intersection of two wires indicates that the two are joined on the two wires. (2) You can ignore the lines of the wiring, if you like, and work just connect all like letters together with one wire or with as few wires as possible, so in alphabetical order, the a's first. By this method you cannot go wrong if you neglect both time and worry. (3) The ideal method is to combine (1) and (2).

BUILDING THE TUNER UNIT

TO complete the series a suitable tuner unit will now be described.

This has been designed on the same lines as the other units in that use has been made of a panel of similar dimensions housed in a similar type of sloping cabinet.

Tuner Details

The tuner itself employs plug-in coils as inductances mounted on a three-way coil holder for aerial, secondary and reaction circuits. Included in the aerial circuit is a .001-microfarad tuning condenser with a five-point series-parallel switch.

The closed secondary circuit includes a .0005-microfarad tuning condenser and a tune-stand-by switch. By means of this switch the closed circuit can be cut out altogether for the purpose of tuning the aerial, after which it may be brought into circuit again and be tuned by the variable condenser. The inclusion of the closed circuit gives very good selectivity, but is unnecessary if no interference from other stations is experienced.

The third and remaining coil is the reaction coil. Owing to the fact that the polarity of the reaction coil reverses when a high-frequency valve is switched in or out of circuit a push-pull reaction-reversing switch is incorporated.

These instruments, together with the terminals arranged along each side of the panel for cross-connection purposes, form the tuner unit.

The case is of the sloping type and should be identical in every respect to that used for the other units previously described.

For constructing the unit the following components are required:—

1 Radion ebonite panel, 10 in. by 8 in. by $\frac{3}{8}$ in. thick (American Hard Rubber Co.)

1 variable condenser, .0005-microfarad (Ericsson).

2 six-point push-pull switches (Lissen).

1 five-point push-pull switch (Lissen).

6 terminals (Belling-Lee).

Set of plug-in coils (Gambrell).

The first step in the actual construction of the unit is the preparation of the panel. As the size indicated in the list of component parts is not standard the panel will require cutting. This is best done by marking off the correct size and making a deep groove along the marks.

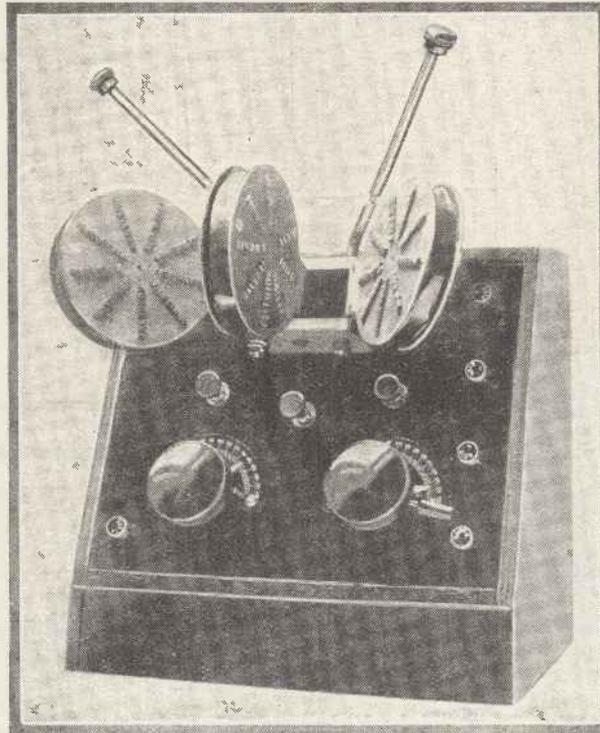
It will then be found quite easy to break the panel at these grooves, leaving a clean fracture. The fractured edges may be finished off with emery cloth.

Drilling

A drilling diagram of the panel is given, showing the positions and sizes of all holes to be drilled. The centres of the holes should be marked on a piece of paper cut to the exact size of the panel. The paper is then laid flat over the ebonite and holes of the sizes indicated drilled through at these marks.

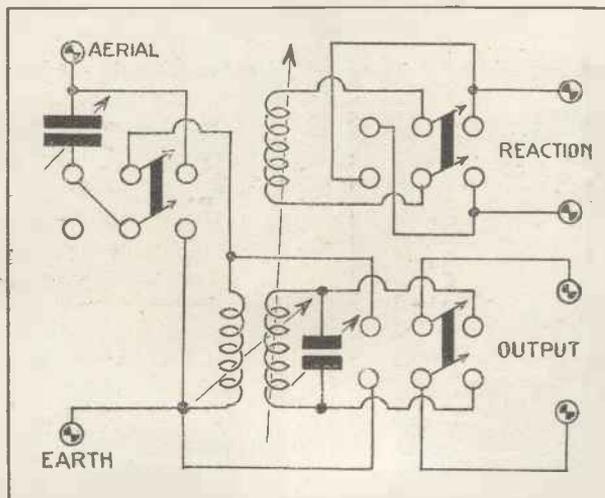
Having drilled the panel the next step is to mount the components on it. Reference to the photographs will show their disposition.

The three-coil holder is mounted on the front of the panel at the top, the three push-pull switches underneath and the two variable condensers at the bottom of the panel. Still looking at the front of the panel, the .001-microfarad aerial-tuning condenser knob dial is seen on the left and the .0005-microfarad closed-circuit variable condenser on the right.



Front View of Tuner Unit.

1 three-coil holder (Fuller's United Electric Co.), as shown in the above photograph.



Circuit Diagram of Tuner Unit.

1 variable condenser, .001-microfarad (Ericsson).

The reaction-reversing switch is the central one; that on the left side the series-parallel switch and on the right the tune-stand-by switch.

Of the three-coil holder the left-hand holder is for the aerial coil; the middle holder for the secondary coil and the right-hand holder carries the reaction coil.

Terminals

The aerial and earth terminals are mounted on the top and bottom left-hand corners respectively, while on the right-hand side reading from top to bottom appear the terminals in the following order: The two reaction terminals, first H.F. valve grid and — L.T.

The wiring at the back is a little complicated owing to the switching arrangements, but any difficulties in this direction should be

easily overcome if reference is made to the wiring diagram. It is advisable to wire up the switches first to

B and A (or B) should be plugged in the aerial, secondary and reaction holders respectively.

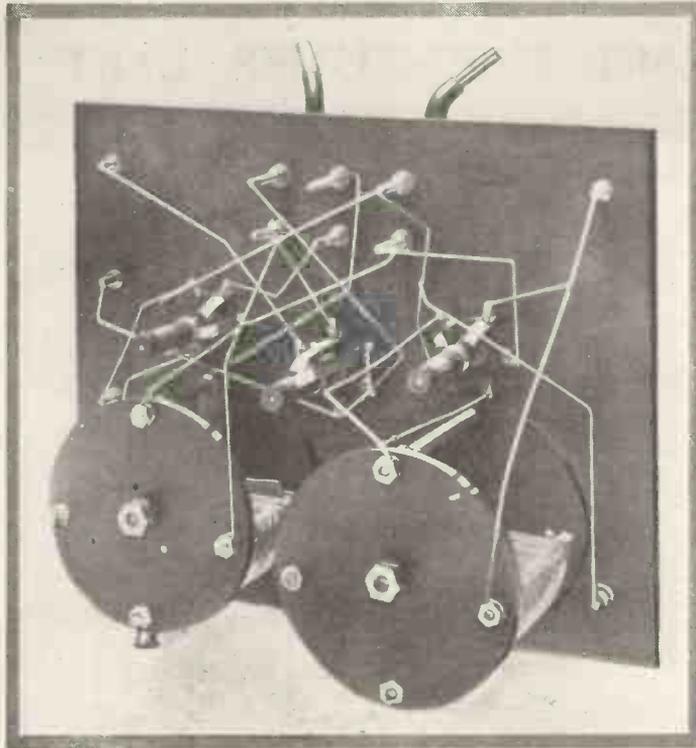
the coil holder and terminals.

A sketch is given showing how to join the tuner to the other units by the cross-connection method. On the left is shown the tuner, after which come the H.F. amplifier, detector (optional crystal or valve) and, lastly, the power amplifier.

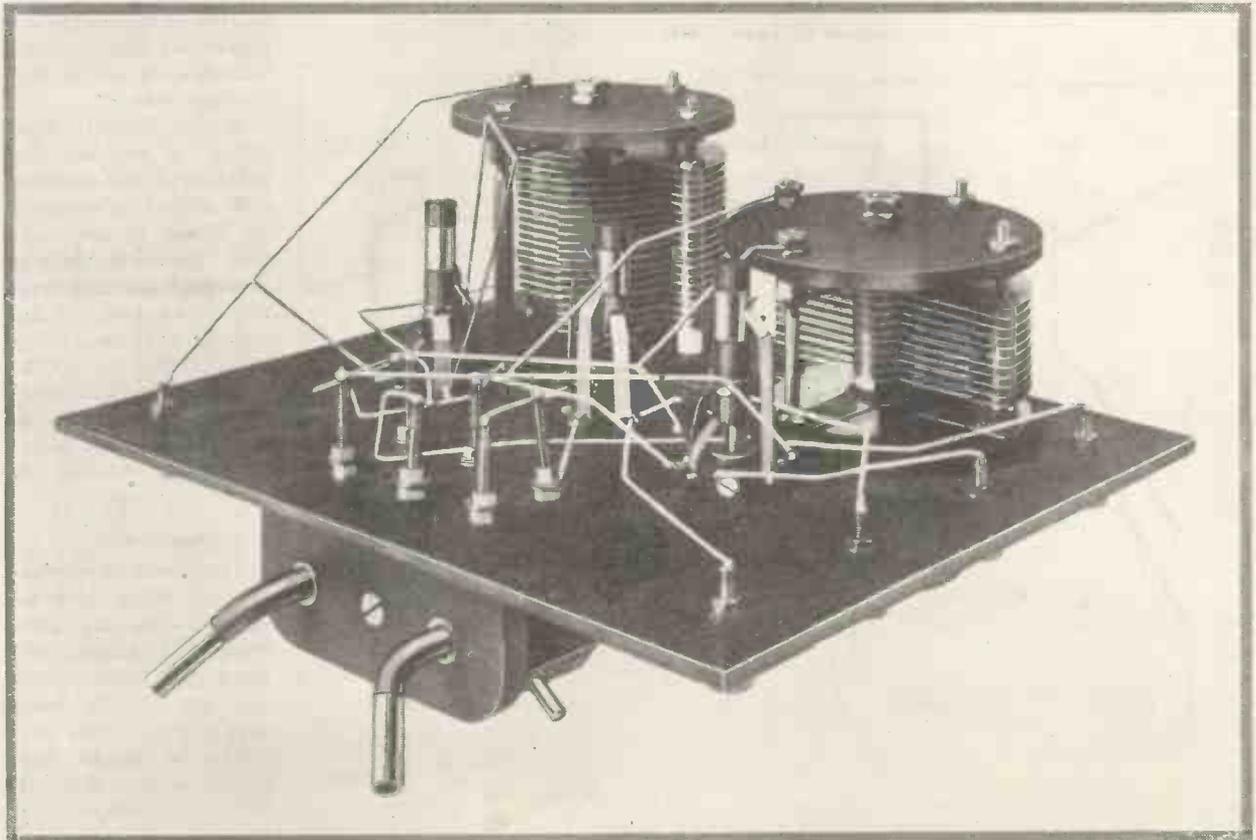
Switching

The switching arrangements give a choice of circuits ranging up from a simple crystal set to one, two, three, four or five valves.

Having connected up the tuner plug three coils in the coil holder suitable for the broadcast wavelengths. If Gambrell coils are used, coils marked A,

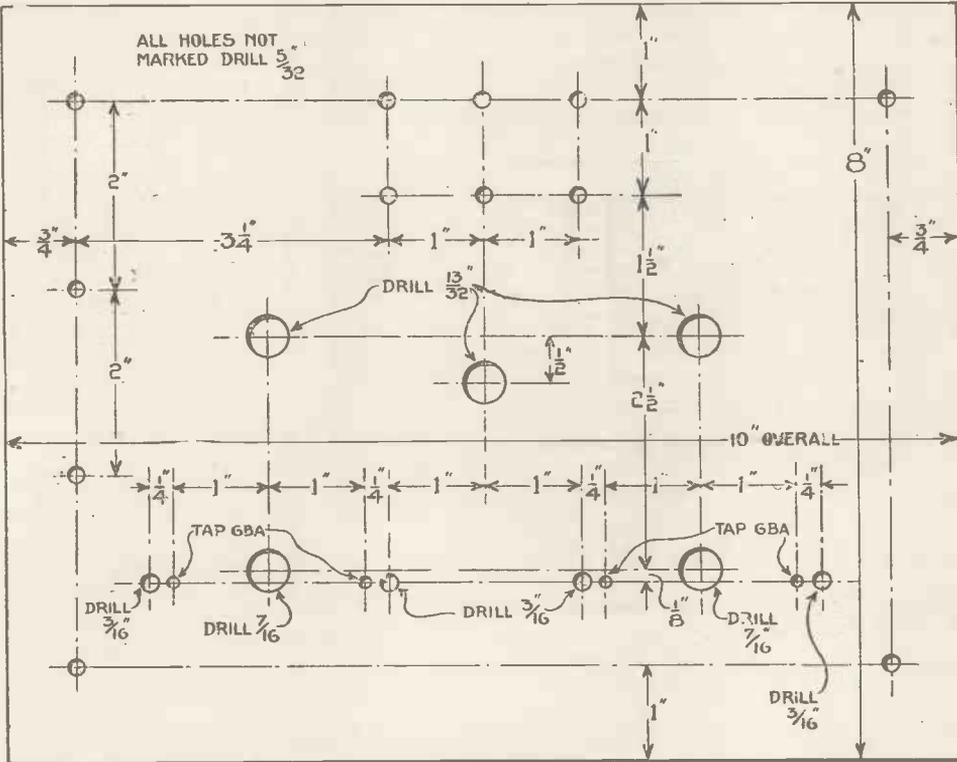


View of Back of Tuner Unit showing Positions and Wiring of Switches.

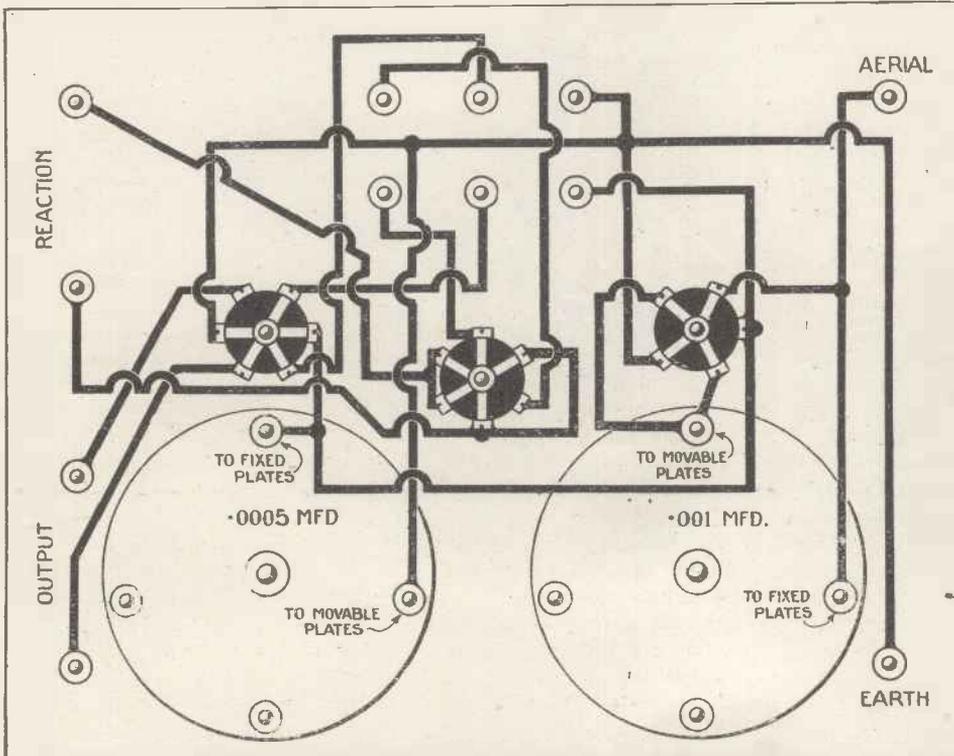


Another View of the Back of the Tuner Unit showing Details of the Switch Wiring.

BUILDING THE TUNER UNIT (Continued)



Layout of Tuner Unit.



Wiring Diagram of Tuner Unit.

If coils of the honey-comb type are used they should be numbered 35, 50, and 35 (or 50) respectively.

Detector and L.F.

Cut out both the H.F. valves and one of the L.F. amplifying valves and use the valve as a detector. Take the secondary coil out of its holder and place the tune-stand-by switch in the tune position. Keep the reaction coil well away from the aerial coil and place the series-parallel switch in the parallel position.

Searching

Now search round for signals by slowly rotating the .001-microfarad aerial-tuning condenser. When signals are received they may be further strengthened by tightening the coupling between the aerial and reaction coils.

If no strengthening effect is noticed the polarity of the reaction coil should be reversed by means of the reaction-reversing switch. Too much reaction must not be used or else the set will start oscillating, thus causing serious interference to other amateurs besides rendering the set incapable of reproducing speech or music.

Interference

The closed (or secondary) circuit is intended for use when any interference is experienced from other transmitting stations. When using this circuit it will probably be found that tuning is more difficult. With a little experience, however, the use of the two circuits (aerial and

BUILDING THE TUNER UNIT *(Continued)*

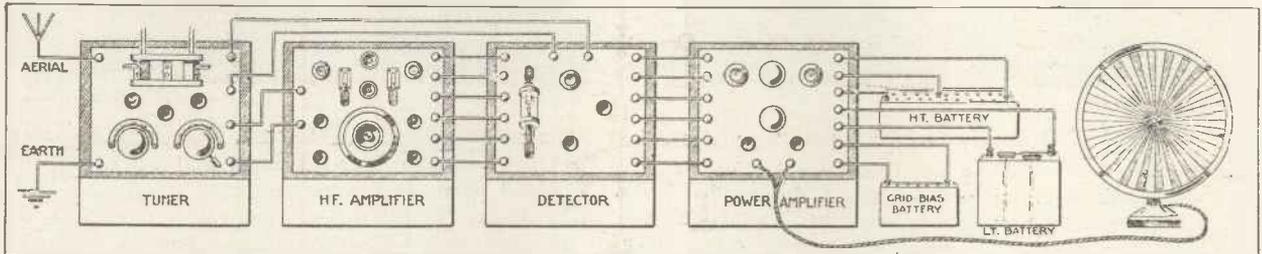
secondary) will become comparatively simple and the loss in signal strength unnoticeable.

For the reception of far-distant stations one or both of the H.F.

amplifiers should be switched into circuit, while for loud-speaker work one or both of the power amplifiers may be used.

A good combination to use for the

reception of the local station would be the crystal as a detector and one of the power amplifiers. This combination would give good distortionless reproduction.



When all the units have been built they should be connected together as shown in the above sketch.

A Novel Circuit (At Last!)

BY dint of sheer hard work from sunrise until dusk, I have evolved a new wireless circuit of entirely original design.

Moreover, by a simple method, I have succeeded in greatly brightening reception in our part of London; what were previously termed "dry talks" are now looked forward to with pleasurable anticipation.

Rush for Sets

The latest reports received from three avenues, two streets and four squares, give me to understand that umpteen antiquated females have invested in crystal sets, based on my new circuit and for which they are seeking instruction, but I am shortly broadcasting a notice to the effect that I hope to be away from town all this next autumn and winter.

Notwithstanding Captain Eckersley's contention to the contrary, reception of distant stations has taken on the same charm as that of the local transmission. I do not intend to transfer my invention to a Secret Radio Syndicate, but have decided to give, without any thought of subsequent remuneration, the benefit of my life's crowning work to readers of THE WIRELESS MAGAZINE.

Now for the circuit; the list of components is but a short one.

Take a young and pretty female relative—a cousin for preference; somebody else's sister will do, in an emergency.

Tune-in your receiving set to the wavelength desired. Now tenderly adjust a pair of headphones over her ears and adopt the same method for yourself. Ask her to hold one of the telephone tags in her hand and fix the twin to the terminal of the receiver. Do the same with your phones.

With your free hand gently draw her towards you and—give her a kiss.

As your lips meet hers you should both hear music, if music is being broadcast, of course, or failing this, a lecture. (If she objects, you may hear other things as well, but this does not detract from the scientific value of the experiment.)

Peculiar Charm!

From my personal knowledge, I can assure you that, in this manner, the most high-brow music takes on a peculiar charm—not necessarily its own—and, if you are lucky in your choice of assistant, you should immediately become a convert to Bach, Handel or Brahms in even their most serious moods.

My experience also prompts me to add that should you demonstrate to your mother-in-law, it will be sufficient to hold her hands or wrists; this course prevents her throwing valuable wireless components at your head.

To readers of a scientific bent let me explain that this is a description of a variation on the well-known "osculatory circuit" whereby the headphones being wired in series, the high-frequency oscillations, the more frequent the better, are bypassed through the—anyhow, it does not matter.

Advantages

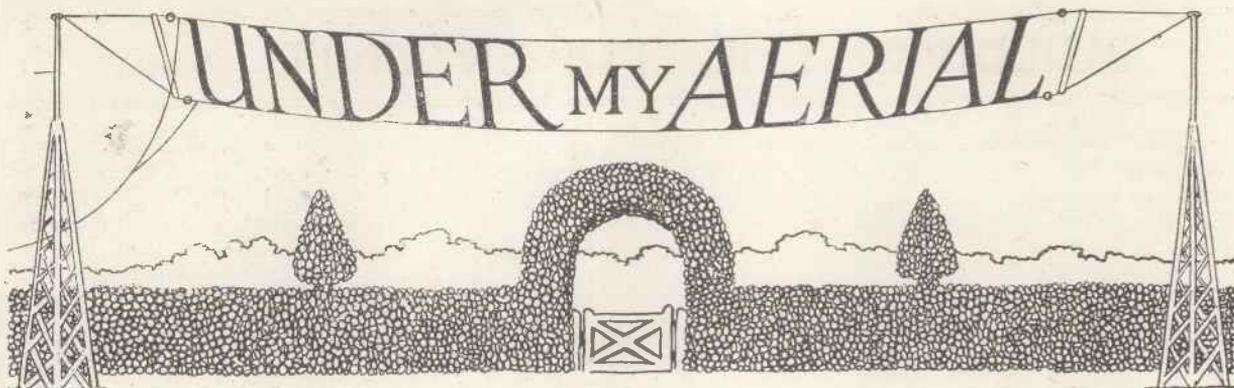
The advantage of the circuit, to my mind, is that, in most instances, however close the coupling, little interference is caused by howls. In my opinion, such a circuit proves itself a boon in brightening broadcast and causes the B.B.C. programmes to be acceptable by all in their entirety. You can hear just as well in the best parlour as in the conservatory, garden or distant summer house. It's it!

Blueprint or wiring diagram will not be given away (I should think not, indeed.—ED.), but it can be had against remittance of 7½d. in unlicked postage stamps sent direct to the inventor.

Special note.—On second thoughts, your assistant need not even be a cousin. This is important.

JAY COOTE.

WIRELESS is being extensively used to guide sailors at sea. It is only fair to wireless to add, however, that it has nothing at all to do with guiding the sailor's footsteps back to his boat after a night ashore.



Wireless Wounds

IF, as you journey about in this busy world looking closely at every man you see carrying an accumulator or showing some other outward and visible sign of more than a passing interest in wireless, you should happen to see a certain wireless man with a nasty cut on the left-hand side of his face, you might hazard a guess that it was the writer of these paragraphs.

I wonder what *your* list of "wireless wounds" would consist of. Like mine, no doubt it would include burns on the fingers of the left hand,



Wireless Wounds.

received from sudden contacts with the business end of a hot soldering bit. It would also include, I am sure, numerous cuts from a hacksaw, again on the left hand unless you happen to be left-handed.

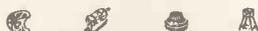
Speaking of cuts reminds me that the very worst "wireless" cut I have experienced was obtained from a sharp edge on a broken insulator. At the time I did not know that I had cut myself. At least, I did not feel the actual cut, but my finger bled most furiously and it was a long time before I could stop the bleeding. The broken insulator was buried deep in the ashes of the dust-bin, and I made a resolve there and then never to touch a broken insulator again.

I suppose I must have damaged my fingers as much as anybody with my wireless work, and in the old days I worked sad havoc on my clothing with shellac and accumulator acid, but yesterday was the first time I ever cut my face

doing wireless. It happened in this way.

Wishing to bring in a lead from my aerial through a window, I threw out a length of insulated three-stranded cable, intending to attach the end of this cable to the end of the down-lead which I had previously taken off the aerial lead-in. I had thrown the cable out through the top part of the window above the open top sash but, as the cable had not fallen just where I wanted it, I pulled it back sharply. In coming back through the open window, the end of the cable struck me in the face. I would not have believed that the sharp, jagged end of a piece of wire could have cut my face as that cable wire did.

But there it is, the wire made a nasty cut on the left-hand side of my nose and you would see the cut immediately if you happened to meet me.



Loud-speaker Strength

The proposal has been made that loud-speaker strength should be given according to a scale determined by the distance at which speech is distinctly audible. Thus, loud-speaker strength on this scale would be termed "very weak" when speech was audible only for a distance of a few feet from the horn, and the strength would be considered "full" when speech was audible over a distance of thirty yards.

Although there is much to commend the adoption of such a scale, a good deal of confusion would arise from the fact that the acuteness of hearing varies greatly from one person to another. It would be highly necessary to calculate for each one of us a distance error corresponding to the "personal error" of the astronomer, or, as we might call it, our "personal 'error.'" "

A wireless enthusiast who possesses a four-valve set and whose wife is unfortunately very deaf, has been talking to me on the subject of loud-speaker reception. He told me, rather to my surprise, that his wife could hear the loud-speaker quite well.

I was somewhat astonished at this, for the lady is really very deaf. However, he went on:—

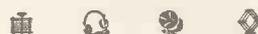
"When she can hear the loud-speaker though, it's a bit too much for me. I have to leave her to it. When she can hear quite nicely in the sitting-room, I can hear all I



"Full" and "Very Weak."

want to hear in the green-house at the top of the garden."

Of course, such a case is exceptional, but you have a difference of hearing in two people equal to the difference between "full" loud-speaker strength and "weak" loud-speaker strength on the proposed scale.



The Goose that Lays the Golden Egg

I was telling my chief local wireless dealer the other day that I had been to see a four-valve set belonging to a comparatively wealthy family in the neighbourhood.

"What do you think of the set?" he asked.

"I did not like it at all," I replied. "It was inefficient, out of order, in fact, it was so bad that I strongly advised them to scrap it and buy another set."

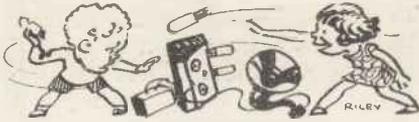
"That's a bit too bad of you."

"Why, what do you mean?"

"If they scrap that set, I shall lose my best valve customer. They come here for more valves than all the rest of the place put together."

"But you might get the order for a new set."

"I might and I might not. Anyhow, no matter who supplies the new set, if they have a new one, I

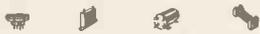


... supply so many valves.

shall only sell about half the valves I am selling now."

The set referred to contained one high-frequency amplifying valve, transformer coupled, one detector valve and two low-frequency amplifying valves.

I wish I knew what it was that was causing my chief local wireless dealer to have to supply so many valves and to be so anxious not to have his wireless golden-egg-laying goose killed.



Valves by Motor

I have been staying in a remote country district and the friend with whom I have been staying required new valves for his wireless receiver.

Accordingly we set out in my friend's small three-wheel runabout for a large town some twenty-five miles away where I knew valves were to be found of every conceivable type.

When we were ready to commence the return journey, my first idea was to place the parcel containing the valves on the back seat of the small car well packed up in a rug.



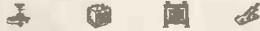
The shock it gave me.

The vibration, however, was so great that I gave up the idea and I carried that parcel of three valves in my hand all the way home through hill and dale, over bad roads and good, round corners and on the straight.

The valves survived the journey and, at the time of writing, are doing their duties admirably, but I do

wish that one of a drove of cows we passed hadn't jumped in front of the car and caused me to drop my valve parcel on to my knee. I managed to stop the parcel from rolling off my knee but I have not quite recovered from the shock it gave me.

I infinitely prefer to buy valves from my usual dealer who only lives a matter of a five-minutes walk from my house.



The Set Next Door

When something goes wrong with your set and you can't for the life of you find out what the trouble is, whom or what do you blame?

Do you put the blame on the domestic cat which sleeps peacefully on the domestic hearth? If the cat gets the blame, I hope it gets nothing more than the blame.

Do you put the blame on Mary Jane who has that day dusted and cleaned the listening-in room, including the wireless set and its accessories?

Or do you put the blame on wireless in general and go out of the listening-in room, slamming the door



The set next door.

hard as you go, with the firm determination of razing your aerial to the ground never to be raised again?

Doubtless you do neither one nor the other of these or any other foolish things but sit you down and write a brief and polite note of complaint to the local B.B.C. station.

Personally, I think the very best and most satisfying plan is to put the blame on the set next door. The idea is not mine. I got it from a letter which has just come to my house from an important member of my family. Here it is:—

"I shall have to swot up wireless so as to know how to work things, for my landlord never knows how to tune his set and he is always fidgeting with it. His advisers always blame the next door set when anything goes wrong. They did over his crystal set and now they do just the same over his two-valve set."

I think it is a grand idea to put the blame on the set next door, such a nice, neighbourly thing to do, too.

Telephones

I have just bought a new pair of telephone receivers, so that I now have three pairs in the house. Apart from the new pair, I have a pair of French phones which I bought over three years ago and a pair of English phones bought about a year and a half ago.

It seemed a matter of interest to



Telephones.

compare both pairs of old telephones with the new pair. Of course, the new pair was far superior to either of the old pairs.

Of the two old pairs, the French phones bought three years ago were appreciably better than the later English pair.

I was rather surprised at the superiority of the French phones, but I think that superiority is due to the fact that the French phones have done nothing like the work the English phones have done.

Probably my new phones will do all the work for a while now, and it is quite likely that my older phones will outlive them.

It is a curious thing that a small loud-speaker bought about three years ago is almost as good now as when I bought it, and it has done far more work than any pair of phones I ever had.



Anode Potentials for Valves

The set I use more than any other for reception has three valves—one detector and two low-frequency amplifying valves.



The potential it requires.

When making up this particular set I incorporated three terminals for the positive high-tension supply so that I could give each valve the particular anode potential it required.

I have never felt more pleased with this little high-tension refinement than I have done this summer. I am quite certain that varying the

positive high-tension supply for the separate valves has been of the utmost use to me in tuning-in the distant stations.

In fact, I will go so far as to say that I could not have done long-distance work at all had it not been for the provision made for varying the anode potentials.

One most interesting point I have noticed is that the first low-frequency valve often requires a higher potential than the second low-frequency valve.

No matter what combination of valves you go in for, I am certain that it pays to have terminals by which different anode potentials can be given to the valves from the same high-tension battery.



Young Salesmen

Have you ever noticed how young the expert salesman usually is in our wireless shops?

I suppose in no other branch of trade is there such a large proportion of young salesmen. Nobody could find fault with these young men for they invariably know their work



Young salesman.

and are able to give their customers valuable advice.

The other day I was many miles from home and I had to make a few wireless purchases. I went to a large wireless store into which I had never been before.

The assistant who served me was a very young man, but he knew his work as well as any wireless salesman I have ever encountered. (Please forgive me this once, I don't often give way to that kind of thing.)

This young salesman talked to me about batteries, switches, condensers and valves.

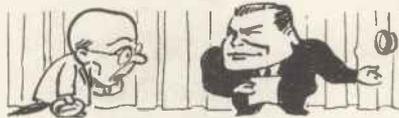
I came away from there with three valves forming a combination of valves which the young salesman specially recommended.

A very good combination it is too. I have given it a thorough trial and I can say that I do not know a better combination of valves for a receiving set containing a detector valve followed by two stages of low-frequency amplification.

My Meteorological Friend

I have occasionally mentioned my meteorological friend in these columns, and I am sure you will be interested to hear that he has been broadcasting from one of the main broadcasting stations.

"How did you enjoy yourself at 1 O Y?" I asked him when he returned from his new experience.



"Like Jack Dempsey."

"Very much," he replied, "I hope they will ask me to go again."

"What shall you give them the next time?" I asked.

"The success of modern weather forecasting."

"That will not take more than a couple of minutes, will it?"

"Modern weather forecasting is more of a scientific subject than wireless, old man."

"Oh! Is it really? What is the announcer at 1 O Y like?"

"Jack Dempsey."

"You took your wife with you, didn't you?"

"Yes."

"Did she go into the studio?"

"Yes."

"What did she think of it?"

"Thought it was a jolly good thing they had bought the silk curtains before the new taxes had been put on."



The Man from Sheffield

One day last week I had business to do with a man from Sheffield. No, it was not Stainless Stephen.

Business of a non-wireless type



The man from Sheffield.

concluded, we got on to a discussion of wireless receivers.

After a most interesting talk, my Sheffield friend told me he could put me on to a pretty good thing as far as wireless sets were concerned.

"Delighted, I am sure," I said, wondering what good thing I was to learn of.

My Sheffield friend thereat pro-

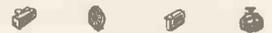
duced from his pocket a crumpled and faded blueprint circuit diagram.

"You can have this one," he said, "I have a spare copy at home."

What do you think the blueprint was?

It was the blueprint of the two-valve Reinartz receiver presented with No. 2 of THE WIRELESS MAGAZINE. My Sheffield friend said it was far and away the best thing he had tried in wireless and he most strongly recommended it to me.

I do not think I was ever so tempted to reveal my identity as I was to that business man from the city of cutlery and steel.



Insulators—Old and New

What is the weight of one of the white porcelain aerial insulators we use these days?

I'll tell you how it is I happen to know myself.

I have been carrying out a few tests with aerials and counterpoises of various kinds in my garden. To do this, I had to hunt up all the insulators I possessed.

One old brown insulator, shaped



Heavyweight versus lightweight.

like a barrel with a couple of deep slits in it, seemed rather a heavy-weight compared with the modern white porcelain insulator.

I do not know where I got this old brown insulator from. All I know is that I have had it for at least three years and that, for the greater part of that time, it has lain on my junk heap.

When I weighed that old and ugly brown insulator on the kitchen scales, I found its weight to be no less than twelve ounces. Imagine the pull of all that weight on an aerial wire.

For comparison, I weighed a modern, white, porcelain insulator of the type you most probably have on your aerial. Its weight was exactly four ounces.

Rather a difference between twelve ounces and four ounces, isn't there? I suppose manufacturers of insulators have realised it is no good putting more strain on a light, aerial wire than is absolutely necessary.

The Loud-speaker

One of my wireless friends has been having trouble with a loud-speaker he has recently purchased. The tone of the instrument was much inferior to what he had expected.

Now I happen to have one of the same type of loud-speaker myself so I knew the remedy. I told my friend to put a .002-microfarad fixed condenser across the loud-speaker terminals.

Meeting this friend a day or two after I had told him what to do, I asked him if the condenser across the loud-speaker had improved matters.

"It hasn't made the slightest difference," was the reply I got to my question.

Considerably puzzled, I decided to have a look at the loud-speaker and the inefficient fixed condenser.

You would never guess what I saw when I looked at that loud-speaker and the fixed condenser across it. The condenser had been placed very neatly on the base of the loud-speaker, but its position was such that the two tags were touching the nickel circular base plate into which



Putting it across the base.

the horn fitted. The condenser was as nicely shorted as it could have been. No wonder it had not made the slightest difference to the tone of the loud-speaker.

My friend sat very resignedly as I went through one of my stock recitations, the one on conductors and non-conductors



Wooden Panels

Amongst the wireless sets which have reposed on my junk heap for some time past, there was one mounted on a wooden panel. I made this set a year or more ago just to see what could be done with wood in the place of ebonite.

This wooden panel set was a three-valve set and no ebonite at all was used to mount the component parts.

The two low-frequency transformers in the set were of an old type not often seen in these days and the variable condensers were of a type now considered obsolete.

Wishing to do a little experimental work of some kind or other recently, I determined to try this wooden panel set against a more up-to-date set mounted on an ebonite panel.

After a good many trials, I came to the conclusion that the old wooden panel set was a pretty good set after all and capable of good



An up-to-date set (absolutely wooden).

work yet. I have lent this old set to a wireless beginner who is perfectly charmed with the results he is getting with it.

There is no doubt at all that wood is an effective substitute for ebonite during the dry summer weather.

When it comes to the damp, dismal days of winter, however, I think I prefer to use ebonite for a wireless panel. You know how necessary it is to dry the sticks for the morning fire in winter.



Wiring a Set

I have just been helping a friend to make an exact copy of one of my three-valve sets. After the cabinet had been made and all the component parts had been mounted on the panel, the question as to the best method of carrying out the wiring of the set arose.

A little discussion led to the conclusion that there were three different methods of following out the necessary wiring. The first method was to do the wiring by working from the circuit diagram. The second method was to carry out the wiring



A little discussion.

by working to a wiring diagram. The third method was to have my wired-up set by us and just copy that.

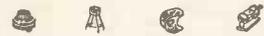
In the end we chose the third method and it was the first time I have ever wired up a set working from a completed set and following the wiring faithfully.

I wonder which way you adopt

in wiring up a new set. Of the three methods mentioned above, I certainly enjoy wiring up a set from a circuit diagram the most. There is always the possibility of spotting some better method of wiring, particularly in the way of avoiding parallel leads or near connecting wires.

The great thing about working from a wiring diagram (colour or blueprint) is to be extremely careful to distinguish the wires which pass each other at a safe distance apart.

As far as speed goes, I think wiring up a set from a made-up set as copy wins the day. You can get along with the wiring at an amazing speed if you have a helper who cuts out and beds into shape the connecting leads you require.



Crystal Names

Have you noticed that crystal manufacturers are showing a decided tendency to depart from crystal names ending in "ite"? When a new crystal is to be placed on the market, the odds are now slightly in favour of a name being chosen which



A crystal detector.

does not end in the familiar "ite."

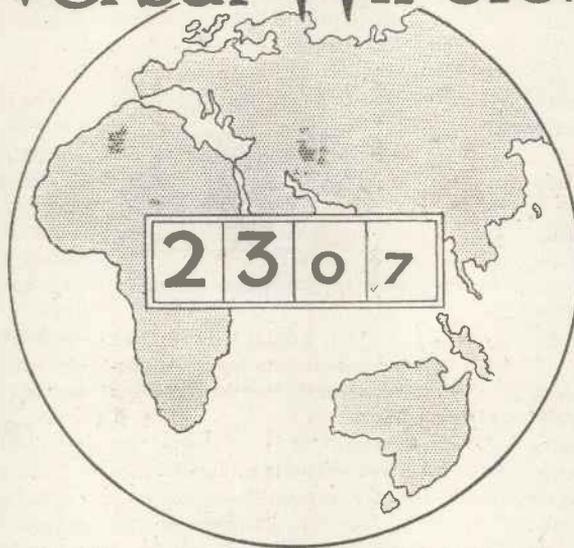
A search through the advertisement pages of THE WIRELESS MAGAZINE and *Amateur Wireless* has given me an interesting list of crystal names. I have divided my crystal names into two classes, the "ites" and the "non-ites," and there was one more of the latter than of the former.

The first wireless crystal, carborundum, discovered nineteen years ago, had a name with a metallic ring about it, for three-quarters of our metals have names ending in "um." If a list be made of those minerals which act as wireless crystals, each mineral being given its mineralogical name, it will be found that seventy-five per cent. of those names end in "ite."

If you look through the advertisement pages of an American wireless magazine, you will find that there is a good deal less mention of the crystal than there is in the corresponding pages of one of our own wireless magazines. HALYARD.

The Universal Wireless Clock

*A Possible
Wireless
Development
of the Future*



*A Special
Article
by Dr. E.E.
Fournier D'Albe.*

IT is sixteen years since a regular wireless time service was inaugurated by the Eiffel Tower authorities. The lead thus taken by the French has been maintained ever since, and the addition of the astronomical "vernier" service has been a priceless boon to the cause of accurate time-keeping, and astronomical and geodetic research.

Greenwich Time

If new developments are contemplated in this direction, it would be but fair that the French should be given precedence, more especially as the time they are so elaborately cultivating and so lavishly distributing is Greenwich time.

The thrill of the F L time pulse is felt round the world. As time goes on and receivers become more sensitive and efficient, the reception of the F L signals and the time signals transmitted by other stations will become possible to every man.

We already have hourly time signals. Why not have signals once a minute, and use them to work clocks controlled by wireless?

Such a clock, to be of universal utility, should be of the simplest possible type consistent with reliable working.

The best sort of dial would probably be one representing the time in four figures, two for the hours from 00 to 23 and the other two for the minutes from 00 to 59. The seconds could be timed with sufficient accuracy by the change in the figures counting the minutes.

Such a clock, mounted, let us say, in a public square at Melbourne,

would no doubt require a local source of power to be brought into action by the Paris signals, but the power should not exceed that required to drive any ordinary timepiece of the same size.

For shorter distances from Paris the ideal to be borne in mind is to design a clock to be driven by the time signals as received by a crystal set, or whatever may be

only put the clock wrong by half a minute, but if it is systematic it may lead to the steady slowing down of the clock.

Variations in Rate

Even a first-class non-synchronised clock may vary enormously in its rate while all its adjustments are perfect.

Thus, in 1913, the great clock on the Chamberlain Tower of Birmingham University was found one morning after a stormy night to be two hours slow, though it was going and striking apparently as usual.

Its anomalous behaviour could only be attributed to the force of the gale acting on the hands on the four clock faces.

When clocks are to be synchronised by wireless the difficulties are enhanced by screening, fading, jamming, and atmospheric.

The F L time signals have been a model of regularity and efficiency since they were first transmitted, although the old spark system was not really suitable for accurate signalling. It would be a great advantage if a definite wavelength could be allocated to continuous transmissions of time signals, and if either the Eiffel Tower or Sainte Assise would undertake the service.

Rugby might also be suitable, but there is no denying the fact that

In this article Dr. Fournier D'Albe elaborates his proposal for a continuous wireless time-service, and describes some experimental results which go to show that the proposal is not impracticable.

the equivalent of our present crystal sets in the future we are contemplating.

Without Local Power

This may, at present, seem impossible, but we know that some mechanical motion, such as that of a silvered-quartz fibre, can even now be obtained from the signals as they come in, without any local source of power; and with increased power of transmission it should not be impossible to work a delicate time mechanism.

The experience gained in the synchronisation of clocks, even with wire connections, has taught us that the problem of keeping clocks

Paris is ahead of every other station in the distribution of time.

The Paris Observatory has at its disposal four master-clocks, placed in a vault 60 feet underground, and wound up electrically from the surface.

Five Years Without a Stop

The most remarkable of these clocks is that numbered 1228 L. This has been going for five years without a stop and without being cleaned. Yet its rate has not deviated by more than a fiftieth of a second in all that time.

This means that the precision with which the clock preserves the time is superior to that with which astronomers determine it.

Paris should, therefore, be invited to accept the onerous but glorious task of timing the world.

One may foresee the time when millions of clocks will be controlled from Paris; when, in fact, the wireless clock (or even the wireless watch?) will have become a common possession of humanity.

It is, surely, not too much to ask that a special wavelength should be set apart for this great task. The signals should also have a fixed audio frequency, which would practically eliminate atmospheric and accidental jamming. Deliberate jamming will, I suppose, always have to be reckoned with.

Some Tests

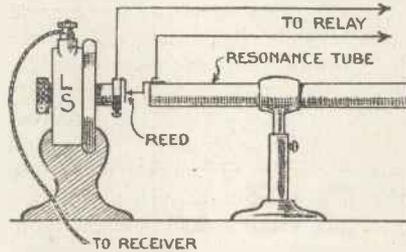
I have made some preliminary experiments to test the practicability of using time signals to synchronise clocks by wireless. The problem reduces itself to that of working a trip-gear to change the numbers on a dial. The current required for this is a fraction of an ampere.

I have obtained currents of two or three amperes from wireless time signals by using an ordinary P.O. relay.

The signals used were:

(1) Big Ben, the hour chime, on a composite note whose main constituent is F, with a frequency of 350 vibrations per second;

(2) The Greenwich Time signals, emitted on a note B of 1,000 vibrations per second.



LS is a loud-speaker with the horn removed and the axis in a horizontal position. A vertical copper reed is attached to a ring screwed over the opening of the loud-speaker. The reed and the resonance tube are tuned to the note of the incoming time signal.

In both cases the signal was made to vibrate a copper-foil reed tuned to the same note and mounted in the opening of a loud-speaker from which the horn had been removed.

In order to confine the vibrations

Using a brass tube $\frac{3}{4}$ in. in diameter, and open at both ends, it had to be $6\frac{1}{2}$ in. long for the Greenwich note, and $18\frac{1}{2}$ in. long for the Big Ben chimes.

With a suitable adjustment the signals worked the relay with absolute regularity and were capable of ringing a powerful electric bell.

They were not interfered with by sounding other notes in the room unless they were of nearly the same pitch. The Greenwich note could be made to exclude the nearest semitones, while the Big Ben relay also worked a semitone above and below.

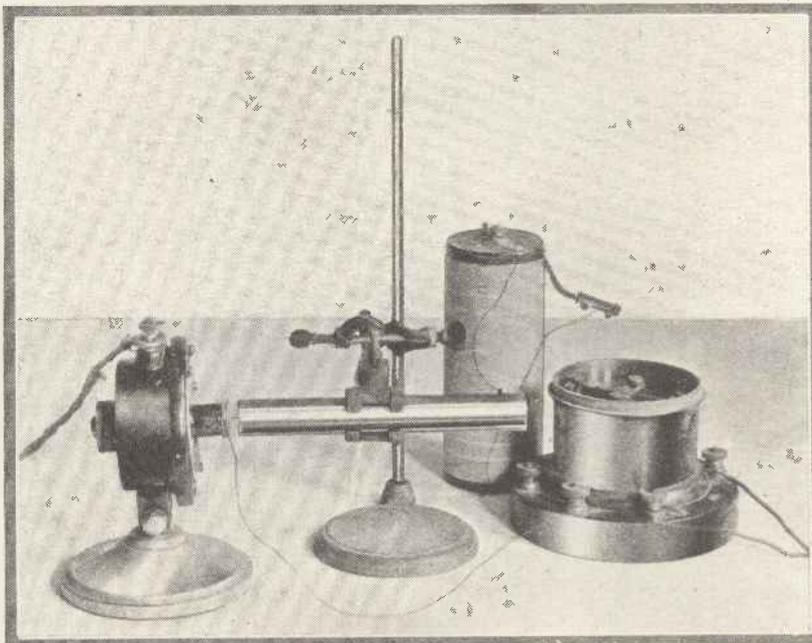
Imitation Atmospherics

Atmospherics were imitated by producing spark discharges in the loud-speaker, but they did not disturb the relays since they only sounded the fundamental note of the loud-speaker case, which did not coincide with the reed notes.

The reception was at Surbiton, with a soft detector valve and one dull-emitter valve for amplification, without reaction.

These experiments show that the scientific problem of the wireless clock is not beyond practical solution. It remains to devise a suitable mechanism, working, if possible, without valves, and sufficiently delicate to receive the time signals from F L in any part of the world.

This will take some time, but there is no doubt the continuous wireless clock is a certainty of the near future.



Photograph of Apparatus shown in Diagrammatic Form above

A Memorandum

The following is a memorandum prepared by Dr. Fournier D'Albe for the Radio Association, of whose Council he is a member:

The system here advocated is a development and extension of the present system of time signals.

The proposal involves:—

1. The emission of a time signal at the commencement of every

to the fundamental pitch of the reed, a resonating tube, tuned to the same note, was placed in front of the reed.

A stout wire attached to this resonating tube projected from its opening and nearly touched the reed. Contact was made as soon as the reed vibrated, and the contact was made to work the P.O. relay.

THE UNIVERSAL WIRELESS CLOCK *(Continued)*

minute of Greenwich mean time throughout the day.

2. Such time signals to be emitted by one central world station, supplemented, if necessary, by relay stations.

3. It is proposed to invite the French Post Office to undertake this emission with the aid of the Paris Observatory, which for many years has taken the lead in accurate time signalling.

4. The time signals to be emitted

signals, such relays to work trip gears changing numbers on an indicator from 00 to 59.

8. The hour signals to be received with relays responding exclusively to the second audio frequency. These relays to work trip gears changing another set of numbers on an indicator from 00 to 23, and automatically (if necessary) setting the minute figure at 00.

9. The wireless clock will thus consist of a four-figure indicator giving

(a) The hour chime of Big Ben.

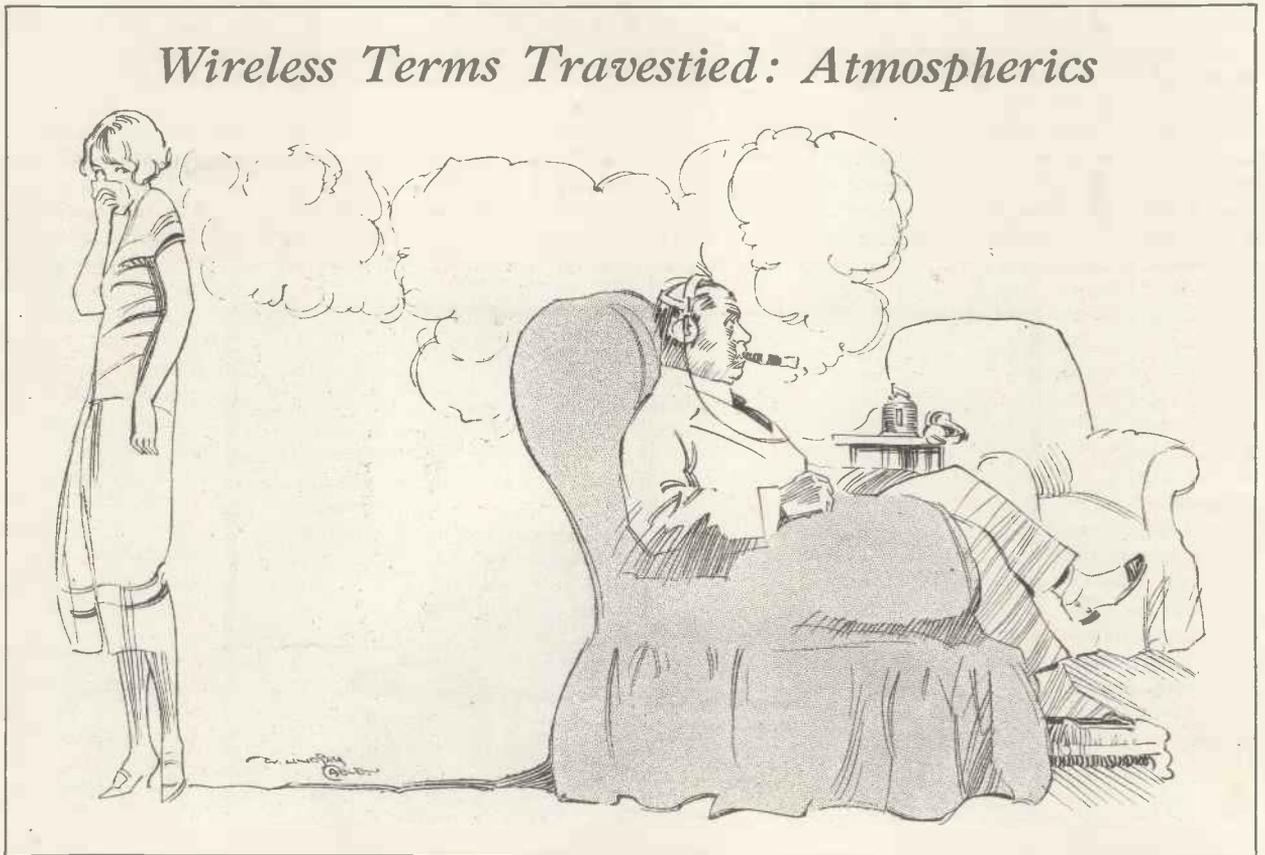
(b) The Greenwich time signal as broadcast by the B.B.C.

Selectivity

With the aid of tuned contact reeds and resonance tubes, Big Ben could be received with an audio selectivity of 15 per cent. in the case of the note F (350 vibrations per second). The Greenwich time signal worked within a 5 per cent. range.

The double selectivity of radio

Wireless Terms Travestied: Atmosphericics



on a fixed radio frequency and in notes of a fixed audio frequency.

5. The radio frequency chosen to be exclusively devoted to these time signals.

6. At the end of every hour, a signal of a different audio frequency to be given to mark the zero of minutes.

Reception

7. The minute signals to be received in loud-speaker sets fitted with electric relays responding exclusively to the audio frequency of the

the hours and minutes according to international system, thus

09 45

for a quarter to ten a.m.

Provisions as to Cost

10. The cost of emission to be defrayed by a small tax on every wireless clock placed in action throughout the world.

Preliminary tests made in the writer's laboratory have shown that relay currents of several amperes can be obtained from :—

and audio frequencies practically eliminate difficulties due to jamming and to atmosphericics.

The actual figures denoting the hours could vary from one world section to another according to the present "zone" system.

The above system, if carried out, will provide a universal automatic time service for the whole earth.

A TRADE journal says that a certain type of set is going like hot cakes. Does this mean that it is economical with the "current"?

There is a right & a wrong way of increasing the wavelength of a receiver.

Adapting Your Set for Daventry

THE removal of the high-power station from Chelmsford to Daventry will enormously increase the number of people within crystal or one-valve range.

The normal range for good crystal reception from a high-power station has been estimated at 100 miles, while a one-valve set with reaction would probably give good results at double that distance.

Wasted Energy

Owing to the geographical situation of Chelmsford, however, a good deal of energy radiated nightly has been going to waste over the North Sea, while millions of listeners in the north and west of England have been well beyond the range of even the best of crystal sets.

It was never intended that Chelmsford should be anything else but an experimental station. The experiment having been eminently successful, the high-power station is now being moved to a spot which is almost exactly in the centre of England and Wales.

The people who will wish to adapt their sets to receive the new Daventry station may be roughly divided into two classes: those who live within a few miles of one of the main broadcasting stations and those whose nearest station is some distance away.

Simple Apparatus

In the latter case it is only necessary to provide some means of tuning the set to 1,600 metres, and the simplest apparatus will usually suffice, but in the former case the set must be sufficiently selective to enable the local station to be cut right out, often a matter of some little difficulty.

In the case of a crystal set being worked at a distance of a dozen or more miles from the nearest main station, the method most usually employed for increasing the wavelength is to connect a loading coil in series with the inductance used for tuning to the shorter waves.

However, simple though this may seem, many people have made the mistake of connecting the loading coil in the wrong place.

Take the case of Fig. 1, which shows a loading coil connected in the aerial lead of a simple variometer crystal set. Here the coil is cer-

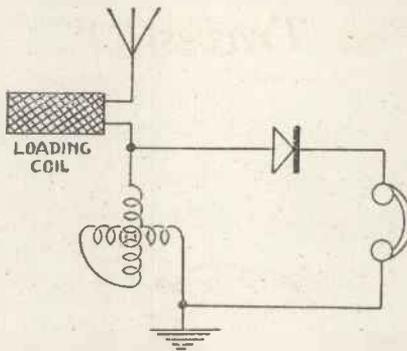


Fig. 1.—Inefficient Method of Loading Variometer-tuned Set.

tainly in series with the variometer, but results will be very poor, if, indeed, any results are obtained at all.

It is obviously desirable that the greatest possible potential should be applied across the crystal and phones,

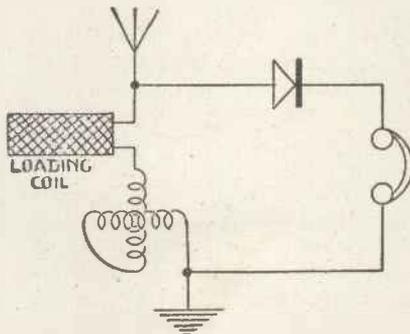


Fig. 2.—Efficient Method of Loading Variometer-tuned Set.

but in a set arranged as in Fig. 1 only the potential drop across the variometer is being utilised; the much greater drop across the loading coil being wasted.

The proper way of connecting a loading coil in a variometer circuit

is as shown in Fig. 2, where, it will be seen, the whole of the voltage drop across both loading coil and variometer is utilised to operate the crystal and produce signals in the phones.

This method of tuning cannot be regarded as very satisfactory because the tuning range is very limited. On the shorter wavelengths the variometer is excellent, as the inductance of the circuit can then be varied within wide limits. But when a large fixed inductance, such as a loading coil, is connected in series with it, turning the variometer dial produces but a very little variation of the total inductance of the circuit.

Size of Coil

A No. 150 coil is usually used for loading a variometer-tuned set to 1,600 metres and this is quite suitable as a rule, though probably a No. 200 coil would be better when a very short aerial is used.

When the set is tuned by means of a coil and parallel variable condenser the loading coil should be connected in series with the fixed coil as shown in Fig. 3, so that the variable condenser is in parallel with both coils and the crystal and phones are connected across the total inductance.

When a No. 35 or 50 plug-in coil is used for the short-wave broadcasting, a loading coil, of course, is quite unnecessary, the small coil simply being changed for a No. 200.

When the aerial condenser is normally used in series with the coil this should always be altered to parallel when attempting to receive Daventry.

Sharp Tuning

The above methods, though they will allow the set to be tuned to 5 X X's wavelength, do not give sharp tuning, so that, although Daventry may be heard quite loudly, so also may the local station if this is within a few miles and is transmitting at the same time.

One of the best methods of obtain-

ing the selectivity necessary to enable the local station to be cut out when tuning to 1,600 metres is to use a loose-coupled circuit, such as is shown in Fig. 4.

A two-way coil holder is used to couple the two coils, and the farther

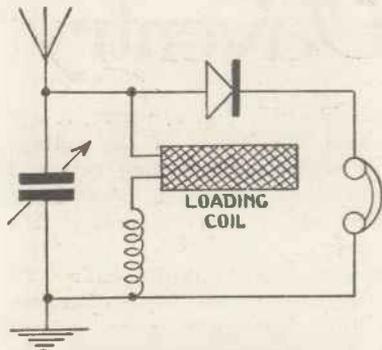


Fig. 3.—Method of Loading Parallel Condenser-tuned Circuit.

the latter are away from each other the greater will be the selectivity. For the ordinary broadcast wavelengths the aerial, or left-hand, coil may be a No. 35 or 50, depending upon the size of the aerial and the wavelength of the local station, while the closed-circuit, or right-hand, coil should be a No. 50 or 75.

When it is desired to receive Daventry a No. 200 coil should be plugged into the aerial socket, while a No. 250 coil should be used in the closed circuit.

Some people may be using sets designed for the short-wave broadcasting only, in which loose coupling is already incorporated. In this case a loading coil will be required for each circuit, a No. 150 coil for the aerial and a No. 200 coil for the closed circuit.

These coils should be connected as shown in Fig. 5, and they should be mounted in a two-coil holder and coupled together, or the coupling will be far too weak even when the two small coils are as close together as possible.

Valve Sets

In the case of valve sets it seldom pays to use loading coils. If it is intended to receive both long and short waves it is better to fit the receiver for plug-in coils than to attempt to load up to the required wavelength by adding inductance in series with the short-wave coils.

If the latter is done in the case of a single-valve set with reaction, for instance, the set can never be brought near the oscillation point until a

large coil has been connected in the plate circuit and coupled to the aerial-loading coil, so that a two-way coil holder and two large coils are required after all.

Reaction

Variometer-tuned valve sets should preferably be converted to coil-and-condenser tuning if it is desired to use them on the long wave. Besides the small tuning range of a heavily loaded variometer-tuned circuit, it is difficult to apply reaction to a variometer, and reaction is very desirable for sharpening the tuning.

In fact a good coil-and-condenser tuned one-valve set with a fair amount of applied reaction is so selective that it will very rarely be necessary to resort to loose-coupling in order to separate Daventry from the local station.

There are some types of valve sets which cannot be used for re-

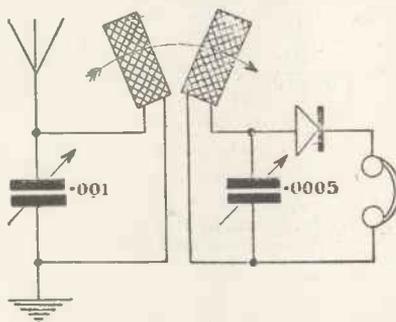


Fig. 4.—Circuit for Obtaining Selectivity.

ception on 1,600 metres, and a knowledge of this may save many listeners much useless work, disappointment, and cash.

The super-regenerative circuits, for instance, cannot be worked above about 500 metres. The theory of these circuits cannot be dealt with here, but for their proper operation it is necessary that the valve should oscillate at a frequency very much longer than, but depending upon, that of the station it is desired to receive.

The longer the wavelength of the station the slower must be the frequency of the "quenching" oscillation, as it is called.

When receiving at about 300 metres the quenching frequency is just audible as an extremely high note, and is not very troublesome, but if it were possible to work such a receiver on a long wavelength the note would be so low that it would merely cause a very loud howl in the phones. The Armstrong "super"

and the Flewelling circuits belong to this class.

"Super Hets"

Then there are the supersonic heterodyne circuits. Their upper wavelength limit is about the same as that of the super-regenerative circuits and so they cannot be used for the reception of Daventry.

These receivers consist of a means of changing the frequency of incoming signals to a much lower frequency so that amplification can be carried out on a long-wave amplifier, even though the original signals were on a very short wavelength.

Long-wave Amplifiers

Although the "super het" will not work, as such, on Daventry's wavelength, the long-wave amplifier can sometimes be used to receive this station direct.

It is possible to use the ultra-audion circuit on 1,600 metres, but it is not very efficient on this wavelength, as the aerial condenser is, of necessity, in series with the coil which should, for Daventry, consist of about 300 turns.

On aerials of the P.M.G. size a series condenser should not be used for wavelengths much above 600 metres, so the ultra-audion cannot be considered as ideal for receiving the high-power station.

The Reinartz circuit can be used for this station, but a suitable size Reinartz coil should be wound for the purpose, as a loading coil is useless in this circuit. It is a matter of controversy at present whether

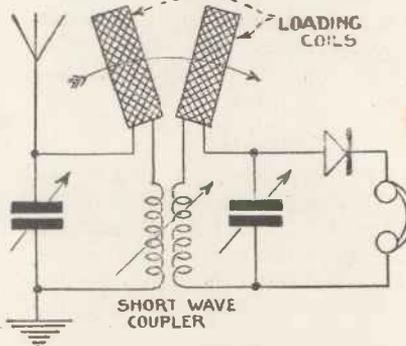
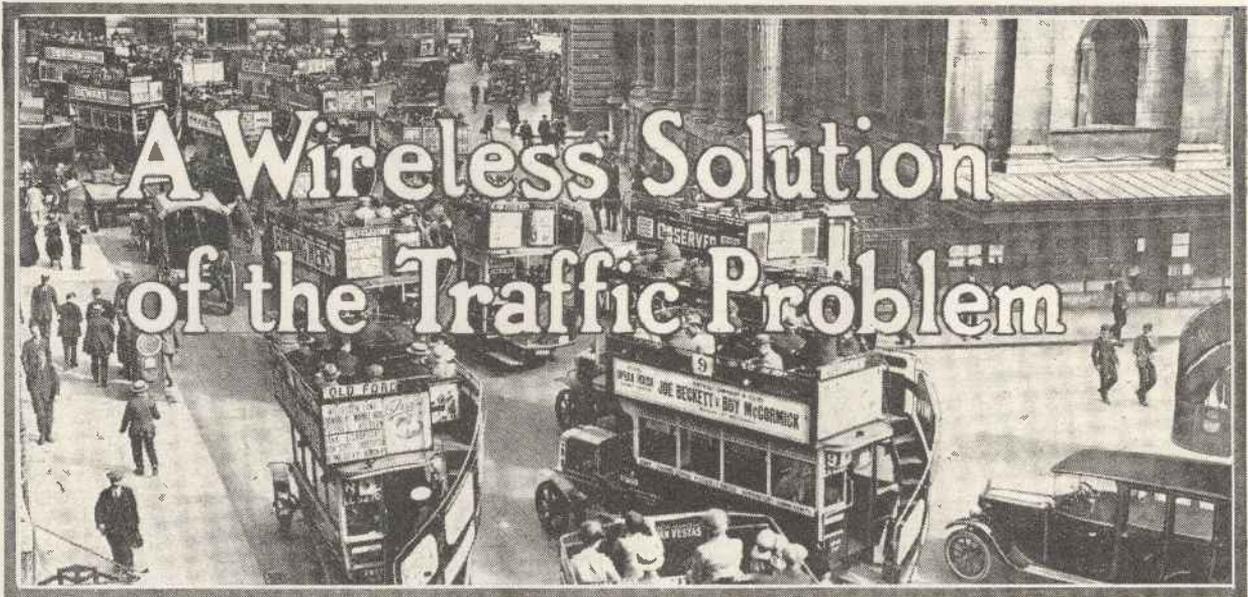


Fig. 5.—Method of Loading Loose-coupled Set.

the Reinartz circuit really works efficiently on such a long wavelength.

The reflex circuits, however, work quite as well on 1,600 metres as they do on the shorter waves, perhaps even better from the point of view of stability. J. F. JOHNSTON.



IT may happen that, in the near future, wireless may play an important part in the solution of the traffic problem. Not only in London, but in numerous provincial cities, the authorities have been concerned with the vital question of traffic control.

Traffic Hold-ups

We are all familiar, at least those who dwell in large cities, with the long lines of vehicles held up, and then progressing perhaps a few feet at a time, to be held up again, and so on.

The crossing at the Bank of England, London, provides a good example when lines of vehicles sometimes stretch as far as a quarter of a mile.

Let us see how wireless could help in relieving traffic congestion. Firstly, it would be necessary to equip a certain number of motor tenders with transmitting and receiving apparatus.

Constant Communication

These tenders would be in constant wireless communication with a central control office, reporting any block or breakdowns, and generally reporting upon the general condition of the traffic in their respective areas.

In addition, there

would be fixed observation posts, also equipped with wireless, at all busy points. These posts could be established in premises overlooking and commanding a view of the thoroughfares in the vicinity.

Briefly, the scheme would work as follows. (For example we will take London, as this is the city where conditions are worst.)

Breakdowns

Suppose a tramcar has broken down at an important crossing such as the Elephant and Castle, with the result that long lines of vehicles are rapidly accumulating. The observation post at the Elephant immediately transmits the news to headquarters, where it is marked upon a traffic map.

Diverting Traffic

The news is then transmitted to the mobile tenders in areas around the Elephant. Upon receipt of the wireless message, the tenders proceed to divert the traffic by alternative routes, and not until the receipt of "all clear" will they allow vehicles to proceed via the blocked road.

In the same way, if a mobile tender came upon an unusually large traffic block, say this time in a northern area of the metropolis, the news would be wirelessed to headquarters, and measures taken accordingly to relieve the congestion.

Co-operation

Such a scheme of wireless control would necessarily need to have the closest co-operation of the tram and omnibus authorities, besides the numerous other users of the roads.

There is no reason why such a scheme should not be successful, and perhaps soon some of us will be listening to "Traffic Tender calling!" S. W.

TO A YOUNG ELECTRON

POOR likkle diddums! How unfairly you've been used!
 Shot off from the filament—burnt, battered, bruised,
 Hauled up by the anode juice; whirled round a coil;
 Shoved through the telephones. Don't it make yer boil!

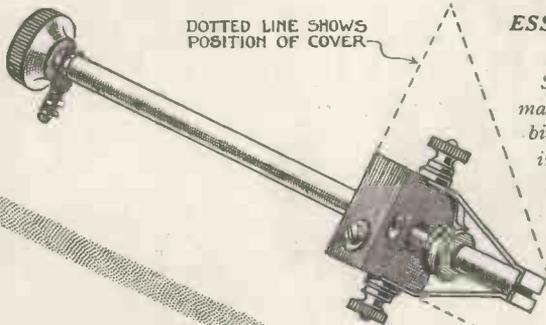
Poor little feller, then. Don't yer like your job?
 Want to be a proton, do yer? What a little snob!
 Want to lead a peaceful life? Can't stand the pace?
 Makes your heart go "minus-plus," jumping through space?

'Fraid yer might your footing miss, land upon the grid,
 Queue-up for the 2-megohms? Oh, you silly kid!
 That way lies your freedom, son; top the aerial stave,
 And when the "master" oscillates—breast the ether wave.

C. T.

WHEN this bottled wireless idea enables us to hear programmes backwards ynnuf dnuos nitellub swen eht t'now.

Novelties and New Apparatus

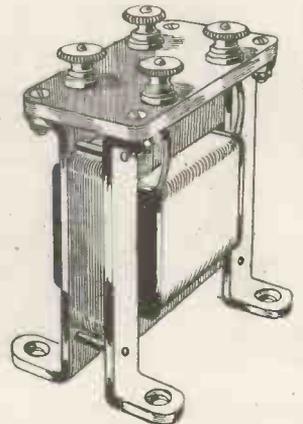


DOTTED LINE SHOWS POSITION OF COVER

ESSANCO LIGHTNING PROTECTOR

So great is the faith of the makers in the Essanco combined lightning shunt, lead-in, and aerial switch that they offer £100, if the device fails to operate, for any loss or damage to property.

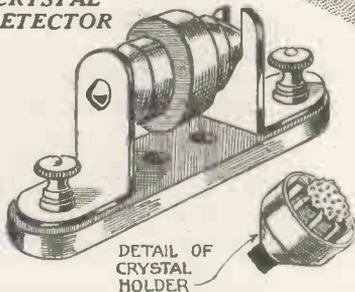
Their address is Essanco Instruments, 13b, High Road, Kilburn, N.W.6.



FERRANTI TRANSFORMER

Brief particulars of the new Ferranti A F 2 L.F. transformer made by Ferranti, Ltd., of Hollinwood, Lancashire, are as follows: Ratio 1 to 4; dimensions, 2½ in. by 4 in. by 1½ in., and weight 1 lb. 4 oz.

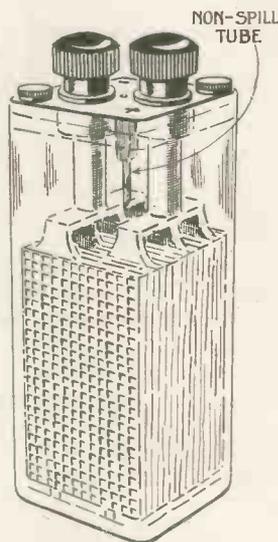
EUREKA CRYSTAL DETECTOR



DETAIL OF CRYSTAL HOLDER

Made by the Portable Utilities Co., Ltd., of Fisher St., W.C.1., the Eureka rotary crystal detector is of the semi-permanent type.

As the holder is rotated the crystal surface is "searched" by spring contacts arranged round the periphery. Adjustment is quite automatic.



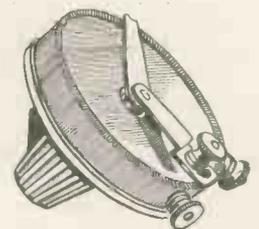
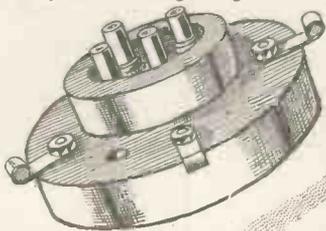
NON-SPILL TUBE

OLDHAM ACCUMULATOR

Although they are more appreciated in portable sets than anywhere else, there is no reason why non-spillable accumulators should not be used in the home in the ordinary way.

MAGNUM VALVE HOLDER

The Magnum valve holder is anti-capacity by reason of the small amount of solid dielectric between the sockets, and anti-phonic because it incorporates a spring mounting. It is made by Burne-Jones, of 288, Borough High St., S.E.1



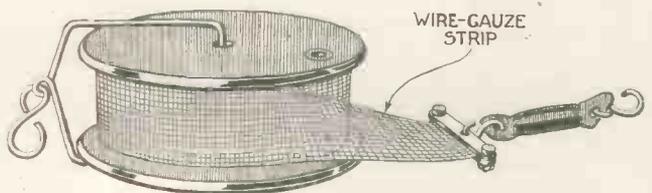
LISSEN POTENTIOMETER

Having a total resistance of 400 ohms, the Lissen potentiometer passes only 15 milliamperes from a 6-volt battery.

The maker's address is Friars Lane, Richmond, Surrey.

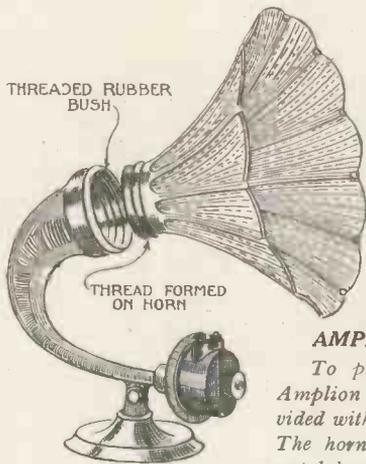
ARIANE AERIAL

Supplied in two different lengths, the Ariane aerial consists of a woven band of treble-stranded enamelled wire wound on a reel. It can be obtained from B. E. N. Patents, Ltd., 100, Victoria St., S.W.



WIRE-GAUZE STRIP

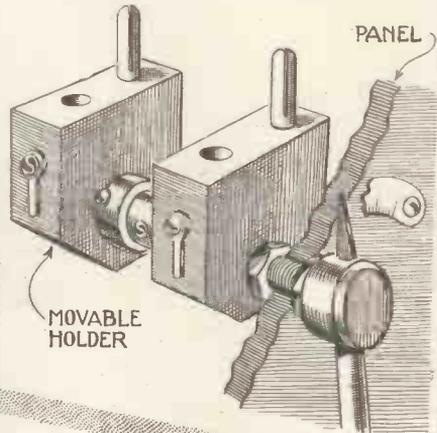
Illustrated and Described



AMPLION IMPROVEMENT
 To prevent unwelcome resonance, Amplion loud-speakers are now provided with threaded rubber bushes. The horn is reinforced with metal beading.

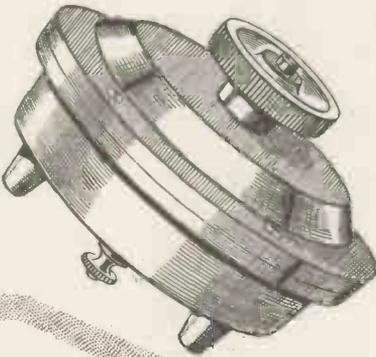
AERMONIC COIL HOLDER

This neat sub-panel mounting coil holder is supplied by A. F. Bulgoin, of 9-11, Cursitor St., E.C.4. One-hole fixing is employed to save trouble to constructors.



DUBILIER VARIOMETER

Incorporating D-shaped coils the Dubilier-Mans bridge variometer has an inductance ratio of 20 to 1. The windings can be placed in series or parallel for long or short wavelengths respectively.



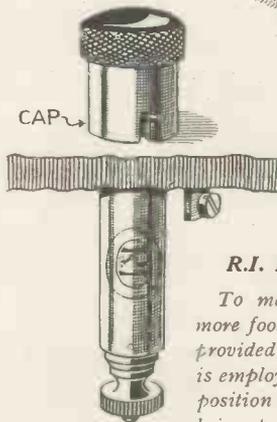
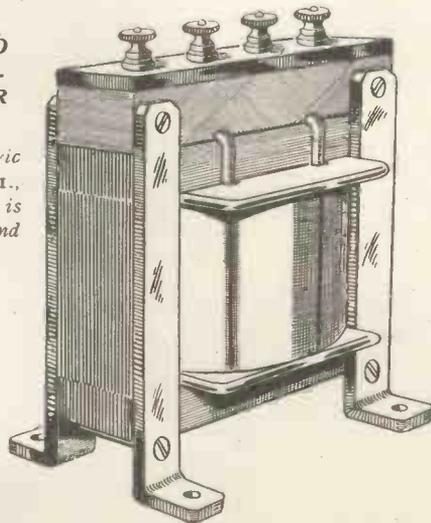
DIAL-O-DENSER

The device shown here is a combined aerial-earth and series-parallel switch, and also gives vernier control.

Dial-o-densers are made by Portable Utilities Co., Ltd.

GRELCO TRANSFORMER

Made by the Grafton Electric Co., of 54, Grafton St., W.I., the Grelco Giant transformer is made in three ratios, 2, 4, and 6 to 1. It is solidly built.



R.I. DETECTOR PROTECTOR

To make the R.I. permanent detector more foolproof still small covers are being provided as shown here. Bayonet fixing is employed. With one of these covers in position there is little risk of the detector being put out of adjustment.

Under False Colours

IT had been a very slack day, and the salesman stretched out his arms and yawned. Then his eyes fastened on a four-valve receiver, the sale of which had long hung fire. Seizing a duster, he polished the cabinet with unnecessary vigour. The receiver, which was a Buster Bros.' Worldwide Model No. 1, had been sold to him about six months before by a young traveller, who, like Hope, told a very flattering tale.

"Hive of Business"

"Place this receiver in your window," he had said, "and your shop will become a veritable hive of business, and the name of Buster Bros. will be on every lip! Our advertising slogan: 'Buy a Buster and Bring in Broadcasting with a Bellow!' will shortly appear on every hoarding in the country; in two hundred different technical journals, and be the subject of a comic song! Say the word, and we will make you our sole agent for the district!"

The salesman had said the word, and he still said a word every time he looked at Buster Bros.' Worldwide Model No. 1, but it was not the same word! He was saying the word now, with several others equally powerful and pithy, when the door bell rang, and a young man carrying an attaché case walked into the shop.

"Good morning," said the young man briskly, as he deposited his attaché case on a chair, and pulled out a cigarette case. "Looks like rain?"

"It does indeed, sir," replied the salesman; "although the B.B.C. told us last night that a continuance of the present fine weather might be expected almost at any time, together with a couple of V-shaped troughs, which are approaching these isles from mid-Atlantic. Wonderfully informing, these meteorological forecasts, sir?"

"They are indeed," agreed the young man, lighting his cigarette and letting his eyes travel round the shop. "You have a fine stock here, and no mistake!"

"Medium to good, sir," said the salesman, with an apologetic air, "medium to good! Not quite so

extensive, perhaps, as some of the large City shops; but I flatter myself that I can supply most articles in the wireless line that I am asked for, and at competitive prices!"

"What have you in the way of valve receivers?" inquired the young man. "I mean decent long-range receivers!"

The salesman glanced round the shop thoughtfully for a moment before replying. What line was he to take? The young man was well dressed, and might be presumed to have money. He might also be possessed of considerable wireless knowledge! Was he one of those young men with experimental licences who only existed for the purpose of tripping up honest tradesmen? It would be well to tread warily!

"I have a very fine Mark VI Woozler," he declared, moving towards a dingy-looking mass of knobs and terminals. "This instrument has received several stations abroad—in fact, one customer, who took a similar receiver to Paris, reported that he had received the Eiffel Tower at quite good telephone strength! Other purchasers have assured me that the range of this instrument is not far short of marvellous. Not

NOT APPRECIATED

*HOW I love my puppy Tim!
So I planned a treat for him,
Saying, "Yes, you shall begin
Now you're big to listen-in."*

*But alas! I must confess
It was not a great success.
When a man began to sing,
Timmy howled like anything!*

LESLIE M. OYLER.

far short' is the term they use, sir!"

"Just so," assented the young man, "I dare say it is a decent enough set, but haven't you anything a little better?"

The salesman mentally classed the inquirer as a "probable starter," and laid his hand affectionately on a bulky-looking receiver in a well polished cabinet.

"This four-valve instrument, sir," he began, impressively, "is one of my leading lines, and possesses many of the refinements only to be found on instruments of double or even treble its value! Vernier adjustments are fitted to all terminals and transformer bobbins. We take a pride in this instrument, sir!"

The young man puffed at his cigarette for a moment. "Has it got loose-coupled tuning, and can you cut out London when you want to?" he inquired.

Loose Coupling

"The coupling is as loose as you could wish, sir," the salesman declared; "the screw threads are specially made so that you could not make it tight if you tried. Of course, there is nothing easier than to cut out London. The method employed on this receiver, sir, is to detach the batteries. And I guarantee you will not hear the ghost of a whisper from London."

The young man still seemed dissatisfied, and turning to the salesman's white elephant, asked, in apparent surprise, "Is not that one of Buster Bros.' famous instruments?"

The salesman started; he felt a singing in his heart, and he rubbed his hands together so violently that the young man asked him if he felt cold. "My dear sir," the salesman said, "that is indeed Buster Bros.' Worldwide Model No. 1, and the finest instrument in the world! Super-reflex and dual-oscillating. If I had a hundred of them I could sell them to-morrow; that is my only trouble, sir!"

"What's that?" asked the young man, eagerly.

"I cannot get enough of them, sir," said the salesman sadly, "although I beg of the makers on my bended knees!"

"That will soon be remedied," declared the young man, putting his card into the salesman's hand, "I am Buster Bros.' new representative. I will book you one hundred for a start."

Crash! The young man looked up from his notebook with a start. The unhappy salesman had fallen into a crate of valves in a dead faint!

ALFRED HEARD.

As Good a Set as Money Can Buy

Some refinements of the straight-circuit four-valver, described in our first number, that has been such a great success.



EVIDENCED by the numbers of appreciations and suggestions received from all parts of the world, it is plain that the principal set described in the first number of

one stage of low-frequency amplification is in use. Switching on the fourth valve apparently produces tremendous amplification together with a slight amount of distortion, due probably to the tremendous grid-voltage swing on the last valve, this making the grid slightly positive at each swing and thus introducing the flow of grid current with consequent distortion.

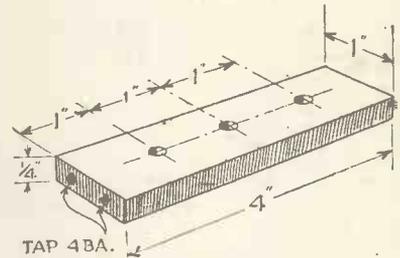
The obvious remedy (and the most frequent request by readers) is the alteration of the circuit giving separate H.T. potential to the plates of the two low-frequency valves, and also allowing for separate grid bias on their two grids.

These modifications do not necessitate much constructional work, the appearance of the set from the outside remaining unaltered except for the mounting of an extra H.T. terminal on the right of the panel (see photograph below).

Constructional Details

The necessary extra components required are as follow:

1 ebonite terminal strip, 4 in. by 1 in. by $\frac{1}{4}$ in. thick.

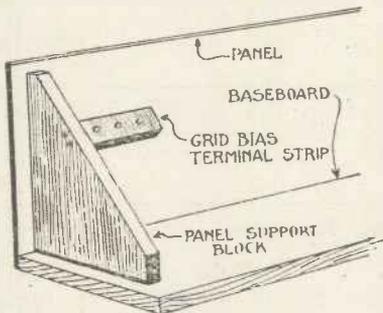


Details of Terminal Strip

4 terminals.

1 grid-bias battery (Trix).

A sketch of the terminal strip showing its dimensions and the positions of the holes to be drilled is given. This strip is attached to



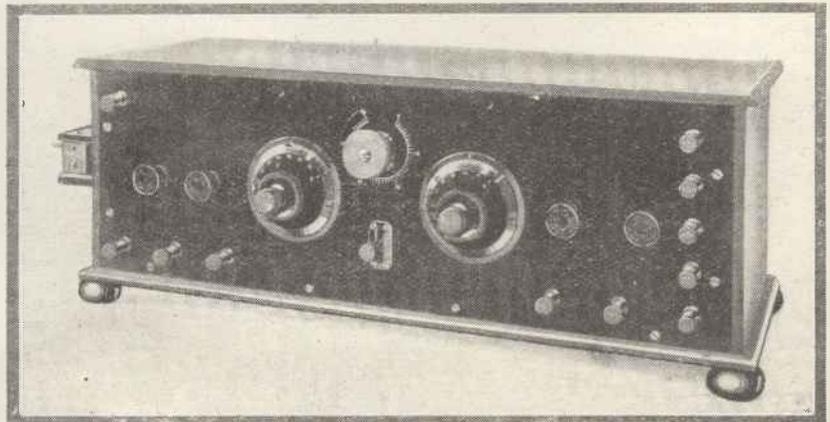
Position of Grid-bias Terminal Strip.

THE WIRELESS MAGAZINE, under the title of "As Good a Set as Money Can Buy," has met with universal approval.

It was intended that this receiver should be as simple in operation and construction as possible. We now feel, however, that one or two refinements could be incorporated without complicating the control to any appreciable extent, yet giving better purity of reproduction, and we have constructed a set on the same lines as the original, employing these refinements, which are explained in this article.

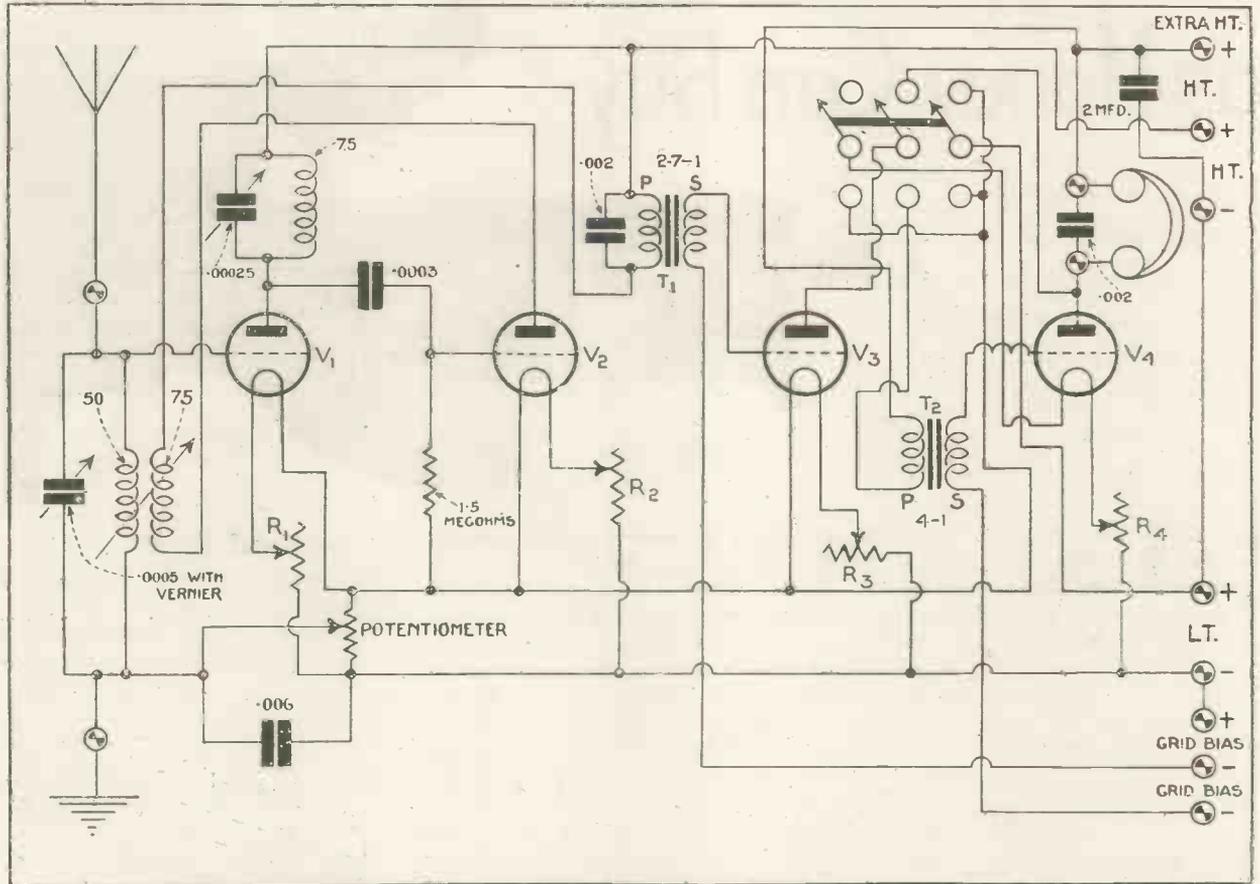
Alterations Suggested

From data collected from letters received on the subject of this set it appears that reception is perfect on three valves—that is when only



Front of Altered Set showing Extra H.T. Terminal.

As Good a Set as Money Can Buy (Continued)



Revised Circuit Diagram of the "As Good a Set as Money Can Buy" Four-valver.

the wood side pieces fixed to the ends of the panel and baseboard, as shown in the accompanying sketch.

Reference to the altered circuit

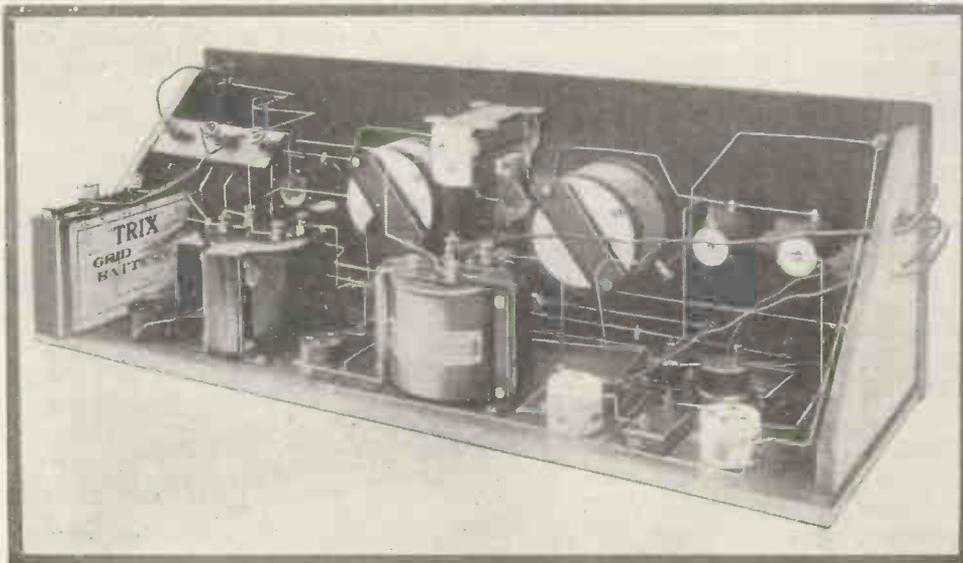
and wiring diagrams will show how the new connections are made. Originally one end of each of the transformer secondaries was joined

direct to - L.T. This common connection is now broken, the same end of each transformer secondary being joined to a separate negative grid-bias battery terminal, whilst -L.T. is connected to the positive grid-bias terminal.

Again, the plates of the two low-frequency amplifying valves are disconnected from the original connection to the common + H.T., and joined to a separate + H.T. terminal. The connections to the switch remain unaltered.

The actual positions of the extra terminals mounted on the panel is of little consequence provided that they are clearly marked for the purpose they serve.

It may be found, for instance, that it is incon-



View of Latest Four-valve Set showing Grid-bias Terminal Strip.

Some Refinements : Adding Grid Bias and Extra H.T.

venient owing to lack of space to mount the extra terminals as shown in the photographs, etc.

The complete modified receiver shown in the illustrations was reconstructed for test purposes and the positions of the terminal holes on the panel layout modified accordingly.

Operation

As far as operation is concerned nothing is different from the original set. The tuning controls remain the same as before, it now only being necessary to adjust the wander plugs on the H.T. and grid-bias batteries until the best results are obtained.

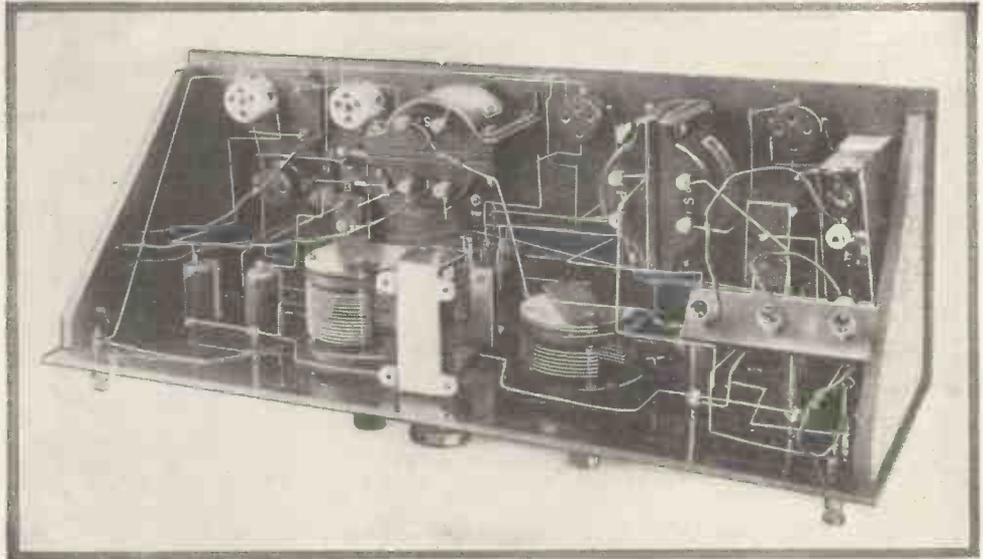
Once these adjustments have been made it will be unnecessary to alter them until the last valve is switched out of circuit, in which case a further

slight adjustment of these batteries may be advantageous.

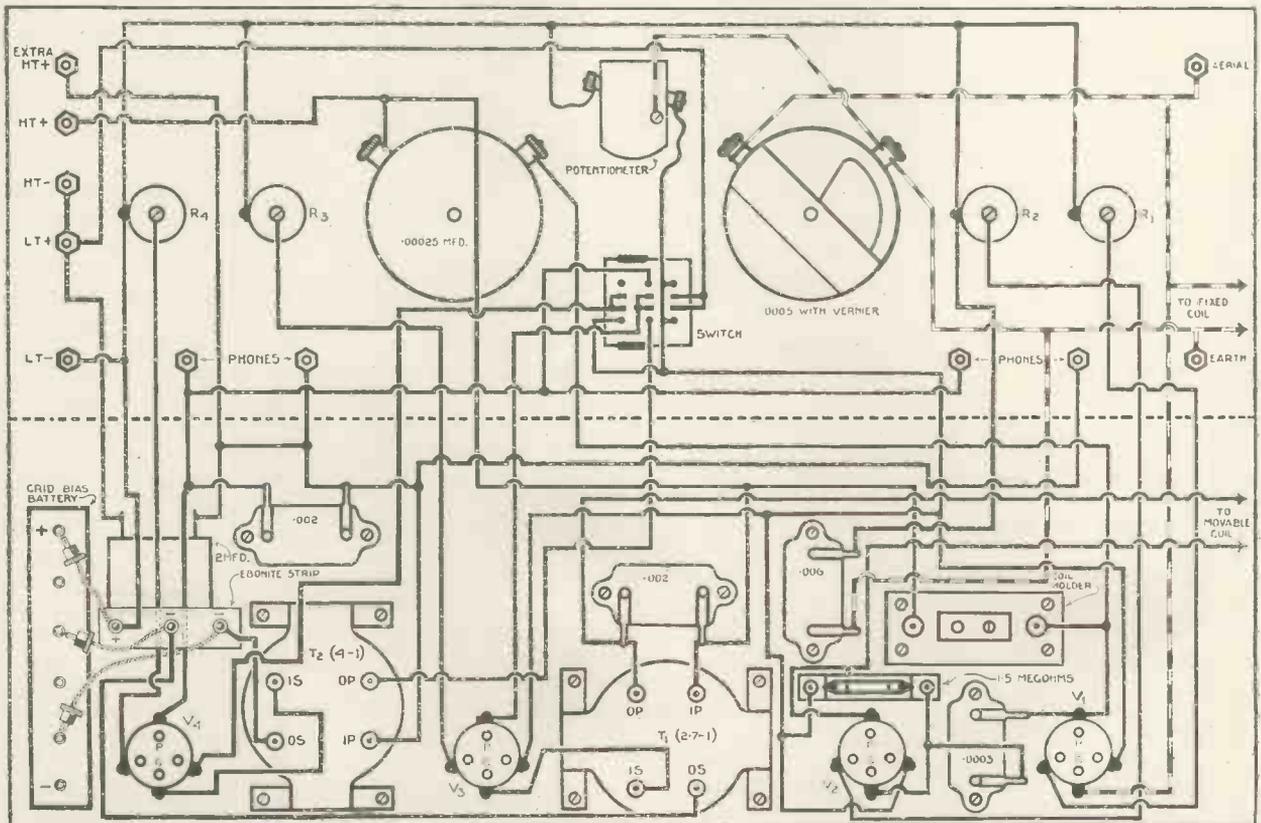
Sensitivity

With regard to the sensitivity of this receiver it may be stated here

that continental stations have been received comfortably on the loud-speaker, while the easy reception of American stations has frequently been reported by many of our readers.



Another View of the Four-valver showing Terminal Strip.



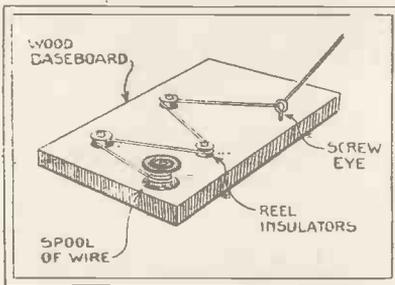
Revised Wiring Diagram of the "As Good a Set as Money Can Buy" Four-valver.

Gadgets, Hints and Tips



Winding Coils

DURING the winding of coils with the usual small-gauge wire there is usually the problem of keeping the wire, as it comes from the spool, taut, and also to straighten it.



Method of Keeping Wire Taut.

The following device will be found to be of great assistance in solving both of these little difficulties.

All that is required are four small insulators of about $\frac{3}{8}$ in. diameter, one metal eye and a board.

The spool of wire should be fitted to the board; by leading the wire round the insulators (which should be free enough to revolve), and finally through the metal eye, it will be found that the wire has not any curl in it at the end. F. C. L.

Loose Knobs

WITH use, knobs are very apt to twist off their spindles, even although locknuts be used.

To avoid this the spindles should be coated with a liberal application of rubber solution, and while this is still "tacky" the knobs should be screwed on and locked with the nuts.

It will be found that the knobs will not work loose, and yet can always be readily detached by the use of a little extra force. F. H.

Testing a Condenser

IN order to test the continuity and insulation of a two-microfarad reservoir condenser it should be held across the contacts of an electric-light switch. If the lamp which is

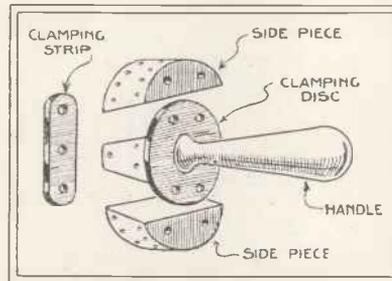
in circuit does not light, the insulation is sound, and if the contacts are immediately shorted with a piece of wire and a sharp spark results, the continuity between the contacts and the plates is good.

If this does not happen, however, when a voltage of 230 volts is applied the tags have probably become disconnected from the plates and the condenser is useless. A. J. C.

Improved Coil Former

WHEN winding honeycomb coils difficulty is often experienced in removing the coil from the former. One cannot remove the legs until the shellac has begun to set and, moreover, the coil itself will not stand rough handling.

The writer's former is of wood



Improved Coil Former.

$1\frac{1}{2}$ in. in diameter, and the legs are of brass rod merely pressed into holes.

This former was cut (see the above diagram) to leave a wedge-shaped piece in the middle.

A disc-shaped piece of thin wood or metal holds the pieces together on one side, and on the other a straight piece is used; this also acts as a handle.

When the coil is wound and dipped in shellac the legs are removed. Then take off the disc and finally remove two screws (the outside ones) from the straight piece. Using this piece to grip by the middle of the former is easily withdrawn and the outside pieces then come away without effort. G. B.

Mind the Lacquer

A POINT the beginner frequently loses sight of in constructing a set is that terminals and other types of clamping contacts, such as the contact screws on coil holders, valve holders, etc., are generally lacquered during manufacture in order to preserve the bright surface or polish of the component.

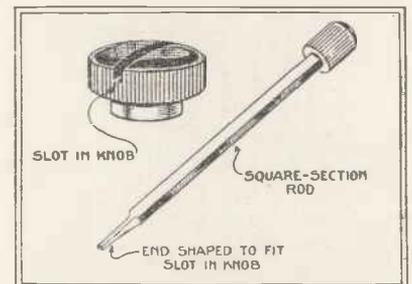
If the lacquered surface is not removed when wiring up there will obviously be a risk of a poor contact at such parts, and the constructor may wonder why his set does not give the results expected.

The remedy is to remove with a small file or piece of emery-cloth every trace of lacquer. W. F. T.

Simple Extension Arm

THERE are many different forms of extension arm upon the market, but for simplicity and smoothness of action the home-made one described below is one of the most satisfactory.

This extension arm is made of an 8-in. length of small-section square rod. Upon one end of this rod an ebonite knurled knob is fixed by means of Chatterton's compound. The other end of the rod is cut away to a wedge-shaped point, as the diagram shows.



Simple Extension Arm.

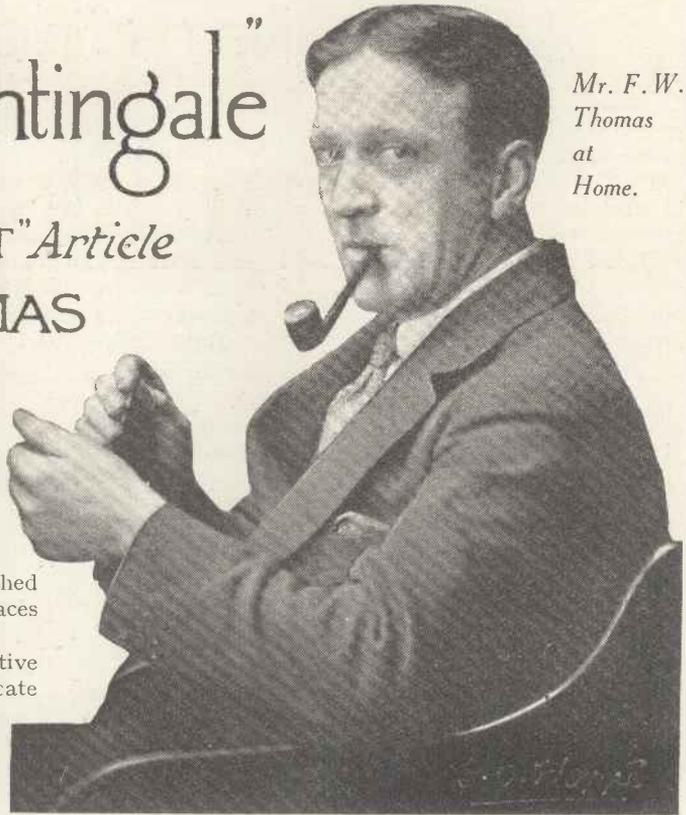
This wedge end is inserted into a slot in the condenser-control knob—the slot being formed by running a saw twice or thrice across the centre of the top of the knob as shown.

"The Not-tonightingale"

Another "JOKING APART" Article

by F. W. THOMAS

Mr. F. W. Thomas at Home.



Photo]

[L. O. ... 1925

If you have never heard of Mr. Wilbur K. Bangs that is not Mr. Wilbur K. Bang's fault. You couldn't have been listening. Because everybody within a five-mile radius of Mr. Wilbur K. Bangs has heard all about him, and more too.

However, let me make you acquainted, and shed the light of his counting-house upon the dark places of your mind.

Mr. Wilbur K. Bangs is the London representative of the Chickahanka Multiform Carrot-scraper Syndicate Inc., and his mission in life is to spread the gospel of uplift among the people of this effete and played-out old country by persuading them to use his Patent Combined Carrot-scraper, Button-hook and Manicure Set; the all-firedest, way-uppest, gar-damdest prarposition that ever happened.

Can also be used as a paper-knife, safety-razor, pipe-cleaner, bridge-marker, nasal douche, spanner, monkey wrench, and for getting the stones out of horses' hoofs. With view of the Statue of Liberty in a little hole in the handle. Get me, Bo?

I have known Mr. Bangs for some months now, but up to the present he has failed to sell me one of his multiform gadgets—chiefly because I don't keep a horse and I hate carrots. However, we wouldn't let a little thing like that come between us. Hell, no!

The Back of Beyond

Not long ago I met Wilbur in a little place off the Strand, where, by a strange coincidence, we had both gone to see the time. I forget what the time was, but there was just enough of it left for us to have two or three more. The which we did. And then some.

Meanwhile the conversation turned upon wireless, and my friend told me of the wonders of his eight-valve set, complete with Carrot-scraper— Oh, no! I beg your pardon. We're getting things mixed. Anyway, this set is just one helluva how-d'ye-do, believe me, and in the course of a single evening Wilbur has contrived to get W K X, K X W, X W K, W G Y and N B G, to say nothing of Tampa (Fla.'s), Oshkosh (Wis.'s), Bungville (Neb.'s), Woonsocket (Pa.'s), Jonestown (Jib.'s), and Medicine Hat (Wob. or Nev. or Min. or something).

Very keen is Wilbur, and if all

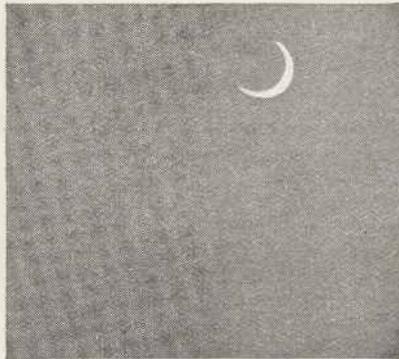
he says is true he must simply play Old Scratch with his neighbours. So keen, that he has had his recently arrived twins christened Dinah and Mo. However!

As I say, we got talking. One does. At least, he got talking and I got listening; and the sum and substance of Wilbur's remarks was that he reckoned British Radio was "Rarten. Just rarten!"

"You build yourself a set," he said, "and when you've got it, what do you do with it? Why, you sit down and listen. You get on to 2 L O and you stay there. And that strikes me as just about as exciting as a slug fight. No, sir! I like to twiddle things. I like to reach out into the great big open spaces where men are men, right to the Back of the Behind of the Beyond; and if I can't put it across the guy next door and get some station farther away than he can— well, I guess he's lying, the coot!

Nature Study

"Still," he added, "there's one thing I'm real interested in, and that's this nightingale stuff. I'd like to hear that. I'm told it's sure some bird, and the way it warbles makes Mrs. Galli-Curci sound like the hooter at the down-town laundry. I've heard a whole lot about this yer nightingale since I brightened up England with my presence, and I believe some of your poets have written a few words about it. So if there should be one on the menu in the near future I'd be happy to

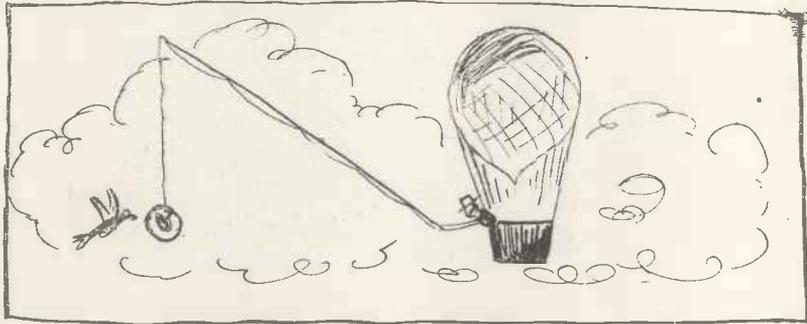


The Not-tonightingale not singing in a Surrey glade.

THE NOT-TONIGHTINGALE :

give it the **once-over**, and see if it meets with my approval."

Thus it was; and on the night in question we forgathered round my box of tricks and waited for Philomel to start up. . . . And we waited . . . and waited . . . and waited . . . each little dot representing five minutes.



Broadcasting the Skylark
from a firewood engraving by Brahms. (A few signed artist's proofs of this picture are available at 4 gns. each.)

Then suddenly into the solemn stillness of the night came a far-away faint sweet sound.

"That's him!" said Wilbur, removing his gum. "That's our little feathered friend, sure pop. Say, but he's a bit hoarse, don't you think? That's what comes of sleeping out nights. Still, 'tisn't so rarten but it might be worse; though in my humble opinion it's an over-rated fowl and doesn't come up to the advertisements by a mile or more." I held up a warning finger.

"Hush!" I said. "Listen . . . Yes, I thought so. That isn't the nightingale. Its your braces creaking. But wait a minute. I thought I heard——"

Caterwauls

But this time it was cats. My own tortoiseshell had been taken bad with the grand passion, and was sitting on the wall singing Love's Old Sweet song to the fleabitten grey next door.

He's a bit of a dog, is our cat. A Mormon by instinct, and somewhat loose in his morals. If all his children were placed end to end they'd be able to keep the whole civilized world in cats' whiskers for seven months.

Removing my headphones I went out and bandied words with that

cat; and some of the words were particularly bandy I'm afraid. I told him sternly to go away and oscillate somewhere else, and after considerable argument he went. And next morning I spent half an hour searching the onion bed for my shaving mug.

Things began to look black, in-

or they'd know the reason why. Like hell it would. Believe him, boy!

"So this is England!" he sneered. "This is the British Empire on which the sun never shines. And here am I, simply pining to give this dam wildfowl the glad mitt and say 'How d'y' dew,' and this is the result. This is what I left my happy home for, way back in Alabam; to cross the broad Atlantic Ocean, to introduce you poor benighted boobs to my Patent Multiform Carrot-scraper and Tonsil remover, and to hear your feathered prima donna. And arl the King's horses and arl the King's men can't get the little ole blighter to put his stuff acrars.

"Well, well! I'm not saying it's your funeral, Mister Tarmas, but for a nation that's always shouting about how it rules the waves, believe me, its pretty thin stuff, and I wish you and Mr. Not-tonightingale a vurry good marning. You needn't count the umbrellas because I don't use 'em."

The Not-tonightingale

Well, I'm not really what you'd call thin-skinned, but that sort of thing gets my goat. It also gets my ox and my ass and everything that is mine. I don't like it. And I decided that the insult must be wiped out, the stain removed from our national 'scutcheon.

Now I happen to have more than a nodding acquaintance with the birds of the British Isles. Not the two-legged birds dressed in lip-stick and lingerie, but the other sort. The ones with the feathers. And I also know of a certain little copse in Surrey where the said nightingale can be relied upon to do his act twice nightly. And there, after promising to buy one of his carrot-scrappers as a sort of half-a-quad pro quo I managed to drag Mr. Bangs.

"You're going to hear it now," I said, "or perish in the attempt. And what is more, it won't be a second-hand warmed up Edison-Bell record affair as heard through the microphone, but the real honest-to-goodness, sure-as-death bird, as immortalised by Messrs. John Q. Keats and William O. Shakespeare. Get that?" And Wilbur said he did.

Another "Joking Apart" Article by F. W. Thomas

It was nearly dark when we arrived at the station, but "That'll be all right," I assured him. "The moon will be up shortly."

"Oh, is that so?" said Wilbur. "You've got a moon in this country, have you? Well, well, who'd have thought it?"

"Yes, we have," I said, a little nettled. "And a better one than yours, any old way . . . Now then, steady! Over this fence, and do try to make less noise when you chew. The nightingale is a very shy bird, and if he hears that he'll think it's the day breaking and down tools. . . . Over here, please! Mind the mud . . . And across here. Please don't damage that barbed wire with your face, because it costs money . . . And along here. Through this hedge . . . Steady! You're not allowed to bathe in that pond. It poisons the fish . . . Careful now. Here we are. And if the nightingale doesn't tune up in less than ten minutes I'm several sorts of a Dutchman."

Alarums and Excursions

It was as dark as the inside of a whale after the lights have been removed. It was as dark as the interior of a nigger at midnight. Not a sound broke the silence but the zooning of the skeeters and the curses of Wilbur picking the prickles out of his trousers with his Patent Carrot-scraper.

Then presently into the warm silence came the distant barking of a dog . . . And again, but not so distant this time . . . Then some more, considerably nearer. And a large and sandpapery sort of voice which said: "I reckon they be in here somewheres, Walter."

"It's all right," I whispered. "It's only some more disappointed listeners, come to hear it first hand. Perhaps we'd better move up a bit and make more room."

So we moved up a bit. At least, I moved up, but Wilbur moved down. He seemed determined to have a swim in that pond, but judging by the fluency with which he cursed, I think the water must have been too cold. Or else he'd swallowed some pollywogs.

"Now then, quiet," I said. "I

thought I heard a chirrup. He's tuning up."

"Well, tell him to wait a minute," coughed Mr. Bangs, "because my ears are full of mud. . . . And what was that?"

"That," I said proudly, "is Philomel, the tawny throated as Keats so beautifully said:

Now more than ever it seems
to die,
To cease upon the midnight with
no pain.

"And that's the truest word Brother Keats ever spoke," hissed Wilbur. "But I can't die now. I'm too busy. I've got my pants hitched up on a gate. And what the Hellespont—"

It was a voice. Not the voice of a nightingale, but the voice of an enormous farmer, with knobs on it. A fierce, three-valve, 16-candle-power voice which addressed us from the outer darkness, more in anger than in sorrow. And after cutting out the purple patches and crimson

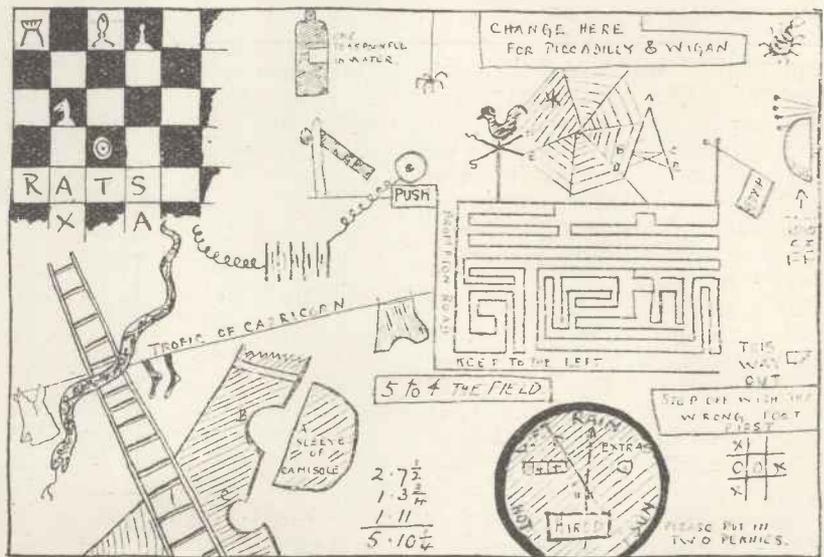
him whispering in the darkness, begging me not to desert him in the hour of his need.

"I've always loved England," he said, "and after all, we come of the same stock. Don't leave me, Mister Tarmas. This is one of those crises when the Nordic peoples must stick together, and blood, you know, is thicker than water. Though that water I swallowed was pretty darn thick."

"Don't get the wind up," I hissed. "They think we're poaching, so perhaps we'd better beat it while the going's good."

"But I can't beat it," whimpered Wilbur. "I can't beat anything because my pants have come unstuck."

"Can't you mend 'em with your Carrot-scraper?" I asked. But further discussion was interrupted by more and more nightingales, and dogs, and alarums and excursions. . . . Well, perhaps not excursions. I could have done with one of those



Another F. W. Thomas Lay-out
Showing the Whatsname for a 600-candle-power 4-seater touring set. Pat. appld. for.

trimmings, its burden was that if we didn't come out of there immediately, if not sooner, and hoppitively, said voice would blow us so full of holes that we should die of the draught. Or words to that effect.

It was at this juncture that Wilbur's trousers tore across with a heartrending sound, and I heard

just then. A nice excursion to Peebles or Pitlochry would have been a real god-send.

"Here they be!" said the oncoming nightingale. "Here they be, Jarge! Where's Tiger? Good dog, Tiger! Bite 'em, boy. Bite 'em. Here, Nero, Casar, Bully, Rover! Eat 'em, boy! Eat 'em all up!"

Back-answers to Correspondents By F. W. THOMAS, The "Star" Humorist

The undergrowth crackled. The nightingales came nearer. Wilbur went farther away. I heard him delving into the unknown, right out into the great open spaces where men are men. I heard him scream. And swear. And gurgle. And gulp!

Though I knew the countryside like a book, he beat me over the measured mile by about three furlongs, and I haven't seen him since.

I'm not at all sure that I want to either. He's not my sort. I don't think he was really interested in ornithology at all. An enthusiastic bird-lover wouldn't have made all that fuss about a few thorns, and barbed wire, and tadpoles, and mud, and split bags. Now, would he?

Back-answers to Correspondents

KATHLEEN.—No, you are wrong. Anode is a lump of poetry with a

capital letter at the beginning of each line. The poet Stilton used to write them.

PERCIVAL BLURGE.—Yes, Perce. You should always wear evening dress when listening to after-dinner speeches. No spats, please.

FOUR-VALVER (Wigan).—Yes, we can hear your loud-speaker at Gunnersbury quite plainly when the wind is in the right direction. But what is that smell? Do you live near the gasworks?

LITTLE HENRY.—Take a spanner to it, old son. Give it one or two good coshes in the midriff, and if that doesn't do any good give it away.

BENJAMIN.—Oh, yes. The live rail on the District will make a very good earth. Be careful to get your

soldering iron nice and warm, and beware of the trains. Those big red things, you know.

CLARENCE.—Sorry to hear that you can't get Brighton. Maybe that is because there isn't a station there. One never knows, does one?

EXPERT.—A good way to test your dull-emitter tubes is to strike them smartly with a hammer. If they ring they are all right. Should they break they are probably out of order.

AUNTIE TABITHA.—No, Parsifal did not write "Them Alabama Blues." Nor did Scott. Aren't you thinking of his "Emulsion"?

MOTHER OF NINETEEN.—No, Mother! On no account should we let the children listen to the "Song of the Vulgar Boatmen." It isn't at all nice.

MORSE MADE EASY FOR YOU

"BOTHER that morse," is an expression often heard during broadcasting hours, when interference is rife. Yet how many listeners would be very glad to know what those mysterious dots and dashes mean and what is the message ship or shore station is flashing through the ether.

As a matter of fact, learning the code is not at all difficult, and this once accomplished patience and perseverance are all that is required to enable morse signals sent at ordinary speed to be understood.

A tapper and buzzer, both of which may be purchased cheaply, and a really enthusiastic friend to aid in practice will very considerably shorten the period of probation.

Various "steps" are detailed below, and if the learner will carefully master each step before proceeding to the next one he will, in most cases, find the task of memorising one of only a few hours. (It should be noted that in a few cases some words are given as "memory aids.") The steps are as follows:

1. Learn thoroughly A, — · — B, — · · · C, — · — · D, — · · and N, — · · · If the difference of one dot

in each case between N (— · ·), D (— · ·) and B (— · · ·) be noted this first step will soon be overcome.

2. Learn E I S H.

E ·
I · ·
S · · ·
H · · · ·

3. Learn T M O.

T —
M — —
O — — —

4. Learn F, · · — · Memory aid: shape of the letter. Two dots representing the top stroke. Dash for upright and one dot for the middle stroke, thus | · ·

5. Learn G, — — · This equals one dash and the sign for the letter N. Memory aid G N (Great Northern).

6. Learn J, · — — — One dot and the letter O. Memory aid, "Poor old Joe."

7. Learn thoroughly K, — · — and R, · — · Note the difference between the two symbols.

8. Learn L, · — · · One dot and the letter D. Memory aid, £ s. d.

9. Learn P, · — — · Equals the

letters A and N. Memory aid, the word "Nap."

10. Learn Q, — — — · The letters T and K joined make this and perhaps the word "technique" mis-spelled tekniqne will aid in memorising it.

11. Learn V, · · · — then note that U · · — is one dot less.

12. Learn W, · — — · This is A and T combined. Memory aid, "at work."

13. Learn X, — · · — D and T. As a memory aid the learner might muse on X's in connection with D.T.'s.

14. Learn Y, — · — — Equalling N and M; the memory aid for this is "Your Name."

15. Lastly Z, — — · · and this with its two dashes and two dots is not hard to remember.

To the casual reader these steps may appear even more complicated than the code itself, but let the morse aspirant honestly devote an hour to them, mastering them step by step. He will find "morse made easy."

H. S.

THE COMPANY OF KINGS

MR. THOMLINSON sat luxuriously in his arm-chair and listened with the greatest complacency to the rain beating on the window panes. A cheerful fire blazed in front of him, a pipeful of his favourite tobacco was in full blast, his feet, encased in comfortable slippers, rested on the fender, in his hand was an evening paper.

Thinking

But Mr. Thomlinson was not reading. He was thinking. He was quietly thinking about wireless. He was thinking of changed times. He was thinking about the days of *his* youth, *his* childhood. There was not any wireless then. There were no cinemas.

When he thought of the present generation, of the attractions, of the varied interests for young folk—aye and for old—that were lacking in his heyday, when even a mild visit to a theatre was frowned coldly upon and the idea of attending a music hall was looked upon with horror. Fancy if he, in this enlightened up-to-date age, was anything like *his* parents—wouldn't he just get socks in the domestic circle.

He could fancy he heard Mrs. T. exclaim: "Oh, Pa, you *are* old-fashioned. What an old fogey! What harm *are* the children doing? If they never do worse——" etc., etc.

Even Ma! Well, thank the Lord he wasn't like that. He had *some* sense. He believed in non-interference. Whatever Mother said went.

Whereat he showed eternal wisdom.

His Family

Let him see. Why, to-night two of his daughters were at a dance. Mrs. T. and the other girl were at the pictures, and the boy—where was the boy? He had heard him go out. Well, the boy would return about 10 p.m. and eat a feed that would do a ploughman. He had no dread concerning the boy.

A steady lad. He had been allowed his head. He would come to no harm. No restriction. Absolutely no restriction. Result, the boy went in for healthy pleasures. He was fit. And he looked it. The

father was proud of his lad. A good upright, straight, honest youth.

There were no secrets, one from the other, in *his* family. It made for confidence. Contentedly, at peace, Mr. Thomlinson reached for the headphones.

What was on to-night? Wasn't it wonderful? Here he was sitting by his own fireside, cheek by jowl with the élite of the land, hobnobbing, so to speak, with princes, earls, dukes—perhaps the King himself, and who knew what foreign potentates! Perhaps the President of the United States?

There might be a general broadcast to-night. Fancy sitting by his own fireside, his pipe going, comfortably installed in his arm-chair and slippers, listening to the great Tetrizzini, that Queen of Song, and Sir Oliver Lodge discussing wireless—the great, the tremendous, the un-understandable. It *was* marvellous. And all for a paltry 10s. per annum—10d. a month!

Satisfaction

Lovingly he gazed at his wireless set—a converted cigar box made by his boy—a bright lad surely. No doubt of it. Some ingenuity there, you bet. No flies—absolutely not one. A great sense of satisfaction suffused Mr. Thomlinson. He was at peace with all mankind. Such was wireless, linking one up with humanity—the great, vast, unseen, human palpitating family. That was it. The great human family!

There was no question of precedence here. All were on a footing. King and commoner—no one had preference. Why, it was the true Socialism, the true welding of the people, the joining up of forces, the lion lying down with the lamb—stupendous thought!—the millenium attained at last! . . .

No one could accuse Mr. Thomlinson of *being* a sloppy sentimentalist. But he may not have entirely lacked imagination. He may have had vision. Such is not the special prerogative of any particular person.

Mr. Thomlinson "let himself go" to the music. He was in gilded halls now. What was it? "The Dream of Gerontius." Ve-ry fine, thought

Mr. T. to himself. Music! *There* was another mystery. The power of music! The swaying power of music—for good or evil! Well, there could be no question of evil where this music was concerned.

Pre-wireless Times

In pre-wireless times Mr. Thomlinson had often marvelled at the hard-headed type of business man who most frequented performances of the "Messiah," and oratorios of that description. Well, human nature *was* strange and hard to understand. Mr. Thomlinson was convinced that there undoubtedly was a great deal of good in the world, and that it *predominated* and would eventually *prevail*.

This was his private and considered opinion, never expressed, and Mr. Thomlinson was no fool; in fact, he was regarded as a somewhat hard-headed business type himself. He was an Army contractor. But business was business. That was another thing altogether.

But to-night Mr. Thomlinson was in the company of kings. He did not know how many kings were listening-in. There was Charlie King—he knew *he* listened-in every night. Well, there you were—King—Charles! And there was John King; again—King John! And there was James King—King James. There was George King and Billy King and Dick King and Harry King.

A Great Family

It was a great family, this of the Kings—a Royal family—a decent crowd. He wished there were more like them. And he knew a few dukes and princes—all good fellows. Many a game of cards he had had with them when kings were trumps—aye and queens—often. And earls and lords. Why Tom Lord was one of his best friends!

Somewhere he had seen it stated that Tetrizzini had broadcast to an audience of three million people. Ah, that great, vast, invisible audience! My word, that was some crowd. What hall could have accommodated that gathering? It was colossal. Fancy that sea of faces. Here was wireless for you.

He had often seen pictures of what were considered colossal crowds at football matches—a mere bagatelle of, say, a hundred thousand people. Fancy a photograph of Tetrzini's audience. The mind quailed before the idea. Where would they house such a production? Where exhibit it? Ha! There was some picture for you. By George!

This Great Wireless!

By Jove! The time signal from Greenwich! Ha! This great wireless! We did not know we were living nowadays. Why, he was as good as any king—James, Charles or Henry. Equally as good. The time signal from Greenwich brought to his door, so to speak! What more could anyone desire?

He *did* like the Savoy bands. Small wonder the young folk went to dances. Fox-trots! That was the stuff to give them. "It ain't goin' to rain no mo'." Whoop! Fine sentiment! What a buzz there apparently was in that Savoy Hotel. He wouldn't mind being there. He could hear them shouting out one to the other. "Hello, Eddie!" "Let her rip!" Well, he wouldn't mind "letting her rip" for a bit himself. Tut-tut. He wasn't at all too old. A mere 65. Simply nothing.

That was the best of this wireless. It took one out of oneself. It made one forget one was—65! It shut off the Army contracting business. . . . Long ago the family had dribbled in and retired for the night. His supper had been left in, "good-nights" said which he scarcely had heard, or answered mechanically, but the supper was long since cold. . . . Midnight struck.

Big Ben

Big Ben! Ah! What would they have thought of Big Ben striking here, in this room in which he was now sitting, a dozen years ago? It was quaint to think of those times now. It seemed so bizarre, so ridiculous. . . .

Mr. Thomlinson removed the headphones. He realised with a start that he had been listening-in for a round five hours! The rain was still coming down outside. He went to bed—even as kings do!

PHILIP AUSTIN.



RUSSIA is using long waves for its wireless. And for the hirsute adornment of its Communist leaders.

Australian Broadcasting

Stations: Wavelengths: Prices: Results.

AUSTRALIA, although one of the last countries to adopt broadcasting, has been hard at work making up the leeway. At present there are seven "A" class stations working. The power used by these stations ranges from 5 kilowatts down to 300 watts, and the distances covered by them bears ample testimony to the capability of their operators.

The wavelengths of the three chief stations, 3 L O (Melbourne), 2 F C (Sydney), and 6 W F (Perth) are 1,760 metres, 1,100 metres, and 1,250 metres respectively. Though these wavelengths must seem very high to B.B.C. listeners, it is claimed by the station engineers that the long wavelengths ensure better daylight reception over long distances.

Reducing Wavelength

However, at the present time a controversy is raging around the proposal by 3 L O (Melbourne) to reduce their wavelength to below 500 metres. The reason given for the proposed change is the desire to adopt the Heising circuit, which, it is understood, has given complete satisfaction in the United Kingdom.

The sternest opposition to this change is being put forward by 3 A R (Melbourne), the smaller-powered station which works on 480 metres. As the power of this station is only 1,600 watts it is claimed that if the high-powered station comes down on to their wave band 3 A R will be swamped.

Trade Opposition

Another quarter from which 3 L O is receiving opposition is the traders. The general opinion among them is that the market will be glutted with cheap American built short-wave sets, to the total exclusion of the locally built product. At the time of writing no definite announcement has been made, and listeners-in are anxiously awaiting results.

Although there has been a big drop in prices during the last six months good parts are still ex-

pensive. Here are some prices which may interest British amateurs. Phones from 35s. to £5, L.F. transformers 30s. to £2 10s., valves (bright-emitters) £1, (dull-emitters) 30s.. These are only average prices.

Results

In view of the excellent D.X. results obtained by British amateurs on crystal sets and one-valvers it is interesting to see how the Australians compare in this direction. Several instances of 2 F C (Sydney) and 3 L O (Melbourne) being received on crystal sets at distances up to 500 miles have been brought to light, but the record for long-distance crystal reception (without amplifiers) stands to the credit of Mr. Hutchison, who resides in Longford, Tasmania.

Using a single coil in conjunction with a .001-microfarad variable condenser, this amateur, under favourable conditions, is able to receive 2 F C (Sydney), distance 650 miles.

He is quite certain that he is not receiving re-radiated signals. With the single-valve sets the distances are even greater.

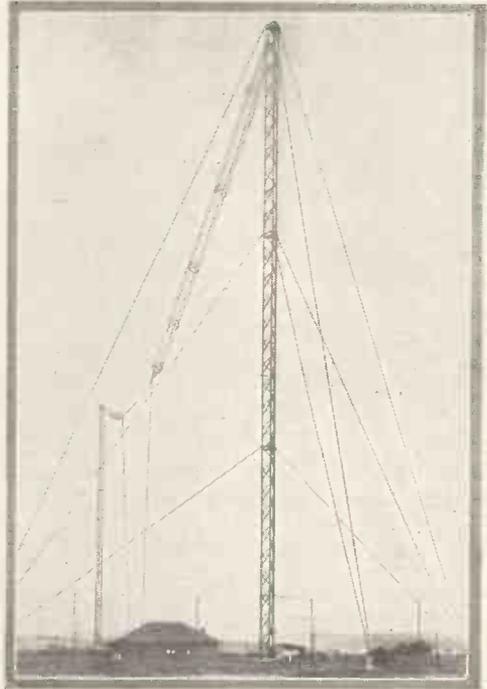
It is a regular thing to get the higher-powered stations at 500 miles, and many of the Melbourne amateurs receive 6 W F (Perth) every night. The distance between these two capitals is nearly 2,000 miles.

With One Valve

Of course all these transmissions are received on sets using reaction. During recent tests with K D K A, inaugurated by one of the Melbourne newspapers, the famous Pittsburg station was received in Melbourne on one valve by a large number of experimenters, the distance in this case being nearly 5,000 miles.

Taking things all round, the future of wireless in Australia is very bright, and it seems possible that in the near future tests on the lines of those conducted with K D K A will be carried out with 2 L O. It is to be hoped that they will be just as successful. A. K. B.

AUSTRALIAN BROADCASTING 3 L O—MELBOURNE



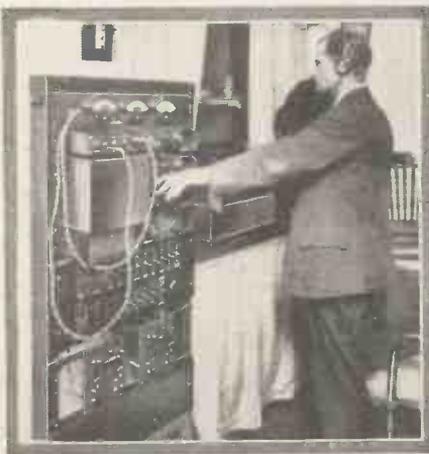
Top (left).—Artistes in the 3 L O studio.
Top (right).—3 L O's masts and aerial equipment at Braybrock, Melbourne.

Left.—The aerial lead-in.
Right.—Reading the news bulletin.



Bottom (left).—Control room at Melbourne, showing speech input equipment and telephone-line switchboard.

Bottom (right).—Transmitting apparatus at Melbourne. Panels from left to right are oscillator, modulator, and amplifier.



How the Reflex Saves a Valve

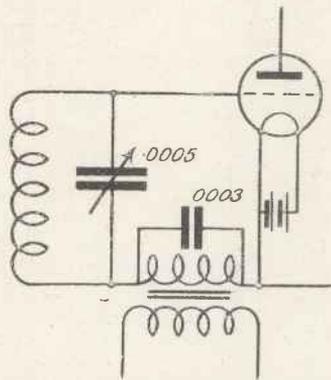


Fig. 1.—H.F. and L.F. Circuits in Series.

MOST owners of multi-valve sets know that the valves placed before the rectifier amplify the signals while they are still at the same high frequency at which they traversed the ether, and that the valves following the detector magnify them after the detector valve has changed them into impulses of low frequency similar to those produced in the microphone circuit of the transmitter.

Before and After Detection

Now, a "reflex" valve magnifies the signals both before and after they have been "rectified." How is this possible?

An H.F. amplifier is very different to an L.F. amplifier. Whilst the former has to be tuned to the wavelength of the H.F. oscillations, and is provided with a coil or transformer surrounded, as much as possible, by nothing but air, with the latter no "tuning" adjustments at all are required, and the field of the transformer is filled with a mass of iron.

Since the requirements of the two types of amplifier are so different, it may be wondered why a single

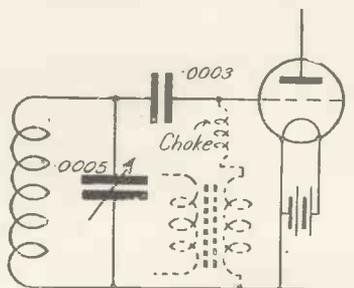


Fig. 5.—H.F. Circuit.

amplifier can be arranged so that it will amplify efficiently both H.F. and L.F. impulses. This is made possible because the essential components of both types of circuit can be so arranged that the iron-cored transformer does not appreciably affect the H.F. oscillations, while the L.F. impulses ignore the tuned circuit.

To do this advantage is taken of

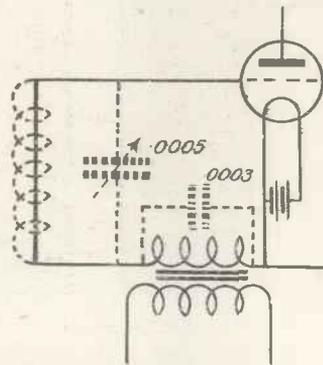


Fig. 3.—Effective L.F. Circuit.

certain fundamental facts concerning the impedance of coils and condensers at different frequencies.

The impedance of an inductive coil increases with the frequency, while the impedance of a condenser

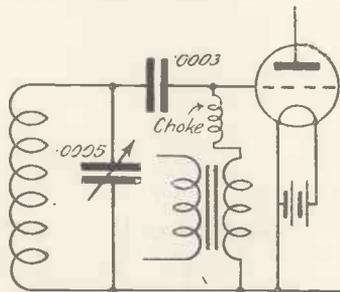


Fig. 4.—H.F. and L.F. Circuits in Parallel.

decreases with the frequency. It is not necessary to go into the mathematics of the subject here, but it may be stated that condensers having a capacity of from .0001 to .001 microfarad offer a very low impedance to H.F. currents of high frequencies, but a very high impedance to L.F. currents of speech frequencies, and that a coil of about 300 turns is practically a short circuit for speech frequencies, but an effective choke for frequencies of the order of 1,000,000 per second.

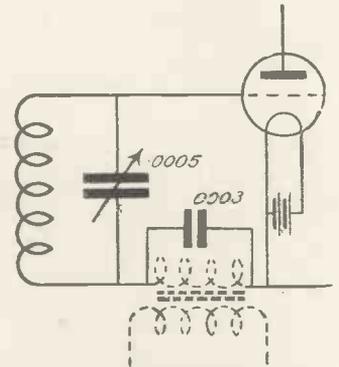


Fig. 2.—Effective H.F. Circuit.

The H.F. and L.F. circuits can be arranged in either series or parallel. The series arrangement is shown in Fig. 1, and the effective H.F. circuit is shown in Fig. 2. It will be seen that the highly inductive transformer secondary will not allow the passage of the H.F. currents, but that they find an easy path through the .0003-microfarad fixed condenser.

L.F. Circuits

In Fig. 3, where the effective L.F. circuit is shown, the condensers will not pass the L.F. currents, but the 50 or so turns of wire in the tuning coil act like a straight piece of wire, as far as they are concerned.

Fig. 4 shows the H.F. and L.F. circuits connected in parallel. High-frequency currents pass with ease through the .0003 microfarad condenser, but the choke coil prevents their being shorted by the self-capacity of the transformer secondary. The equivalent H.F. circuit is shown in Fig. 5.

The L.F. currents, on the other hand, pass with ease through the 300-turn coil, but the small condenser

(Continued on page 189)

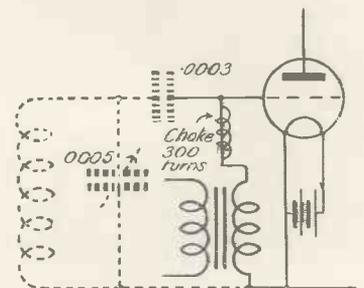


Fig. 6.—L.F. Circuit.

A Low-loss Crystal Set

IN all wireless receivers the sensitivity of the set depends a great deal on the tuning arrangement, and if this is inefficient the maximum amount of signal energy will not be passed on to the detector, whether it be valve or crystal.

In the case of a valve set, losses that may occur in the aerial-tuning circuit can be overcome by the use of reaction.

This, of course, is not possible on a crystal set, and the utmost care must be taken to ensure that there is the minimum of losses in each component part, the most important being the tuning section.

High Efficiency and Low Losses

A glance at the photographs of the receiver about to be described will show the general construction and lay-out adopted, which make what is a highly-efficient low-loss crystal set.

An original feature is the design of the coil. This is of a self-supporting type wound with $7/22$ enamelled aerial wire, and is tuned by means of a low-loss variable condenser.

The coil is conveniently mounted on a baseboard attached to the ebonite panel. This method of mounting is becoming very popular among home-constructors owing to the ease with which components can be mounted, leaving the ebonite panel free for the controls. The appearance of the set is also improved,



Crystal detector and crystal (National Wireless).

Coil

The coil is wound on a former consisting of a piece of ebonite 5 in. square and $\frac{1}{4}$ in. thick into which are fixed nine screws of 2 B.A. rods.

A circle of 4-in. diameter should be marked out on the ebonite and nine holes, large enough to take the rods, drilled equidistantly round the circum-

ference. The rods should then be inserted in the holes and clamped on both sides with nuts.

The coil, consisting of 32 turns of the $7/22$ enamelled wire, may now be started, the windings going outside one rod and inside the next, and so on in sequence.

Before removing the coil, the crossovers of the wires should be bound with string or thin wire. On completion of the coil the rods are removed.

Building

The panel should be drilled as shown in the drilling diagram and then fixed to the baseboard by means of two round-headed $\frac{1}{2}$ -in. brass screws, after which the components can be assembled and wiring begun (see diagram and photographs on the following pages).

The fixed phone condenser is screwed down near the phone terminals and connected up. The wiring is started before the coil is mounted, so that

as no fixing screws are necessary on the ebonite panel.

For constructing this low-loss set the following components are required:

Ebonite panel, 7 in. by 5 in. (American Hard Rubber Co. Ltd.)

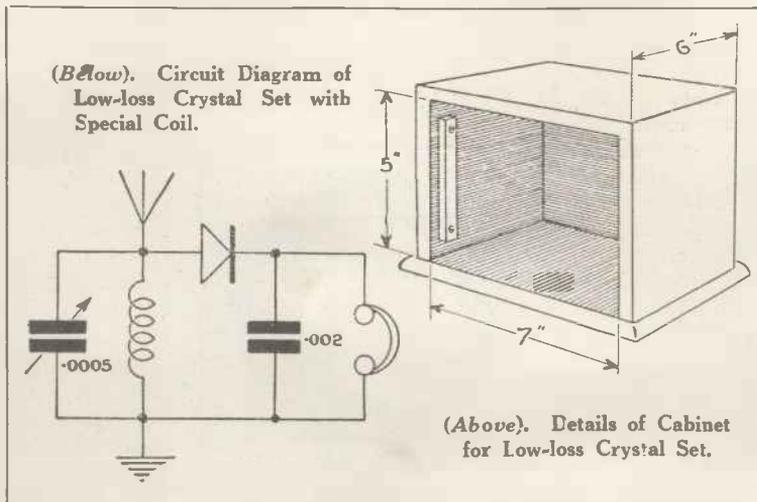
Wooden baseboard, 7 in. by 5 in. This should preferably be of seasoned oak or teak.

.0005-microfarad variable condenser (Atlas low-loss).

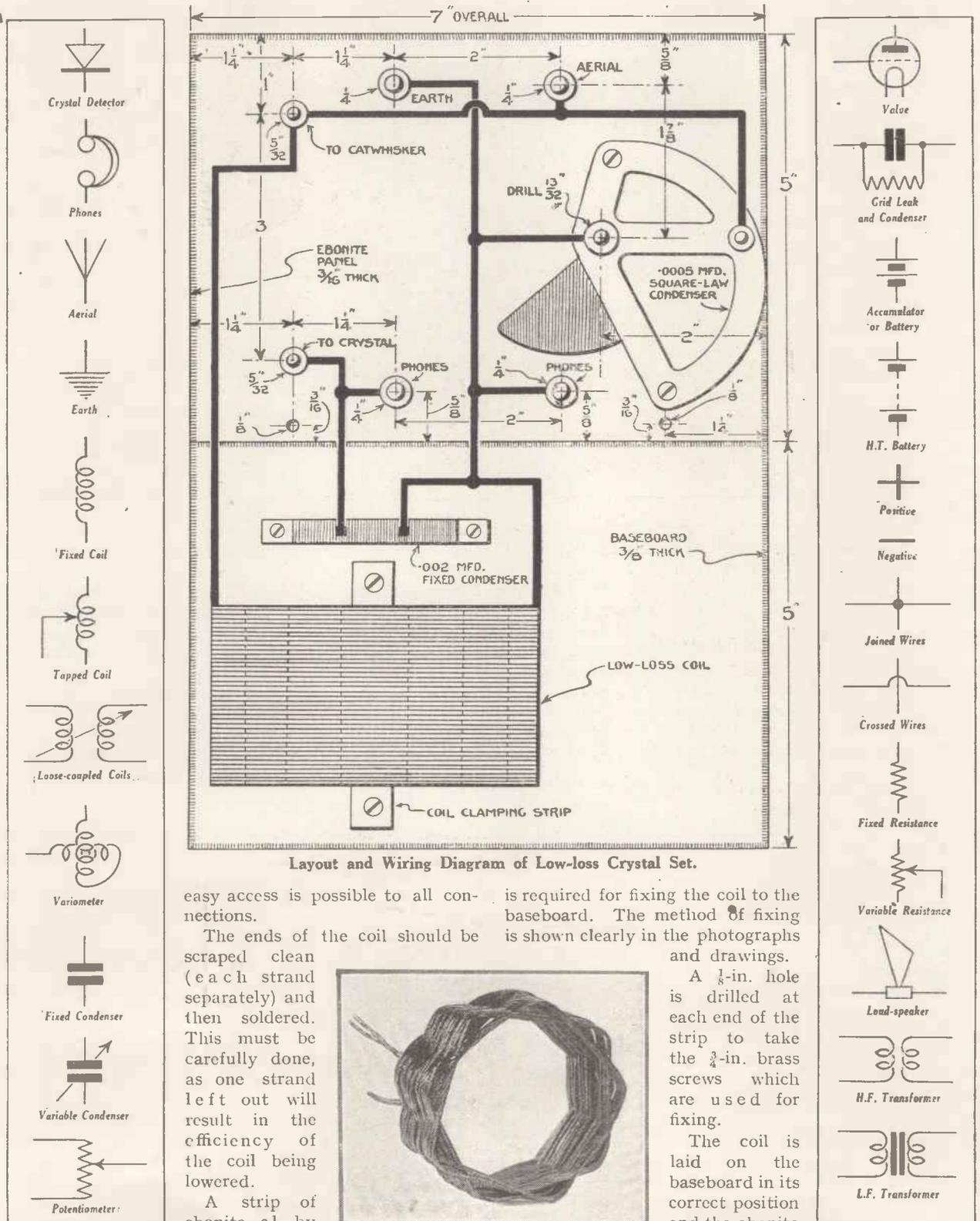
.002-microfarad fixed condenser (T.C.C.).

35 ft. $7/22$ enamelled aerial wire.

4 plugs and sockets (Belling-Lee).



A LOW-LOSS CRYSTAL SET (Continued)



Layout and Wiring Diagram of Low-loss Crystal Set.

easy access is possible to all connections.

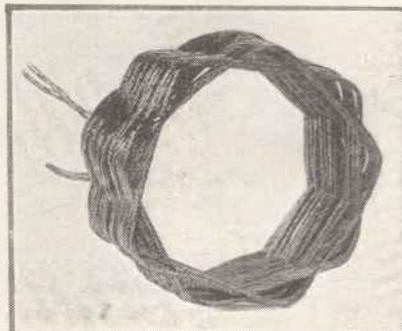
The ends of the coil should be scraped clean (each strand separately) and then soldered. This must be carefully done, as one strand left out will result in the efficiency of the coil being lowered.

A strip of ebonite $3\frac{1}{4}$ in. by $\frac{1}{2}$ in. by $\frac{1}{16}$ in.

is required for fixing the coil to the baseboard. The method of fixing is shown clearly in the photographs and drawings.

A $\frac{1}{8}$ -in. hole is drilled at each end of the strip to take the $\frac{1}{4}$ -in. brass screws which are used for fixing.

The coil is laid on the baseboard in its correct position and the ebonite strip is screwed



Photograph of Special Coil.

Memorise these Symbols.

Memorise these Symbols.

over one side of the coil with sufficient pressure to hold it in place. After being fixed the coil is wired up and the set completed.

Cabinet

A cabinet for the receiver may be constructed from mahogany, the constructional details being given in the accompanying sketch.

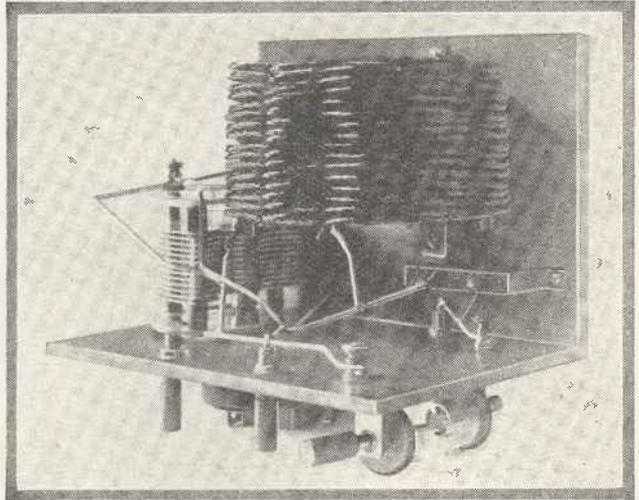
The cabinet shown has no lid, any alterations to the set being made by sliding the panel and base-board out of the case.

Operation and Results

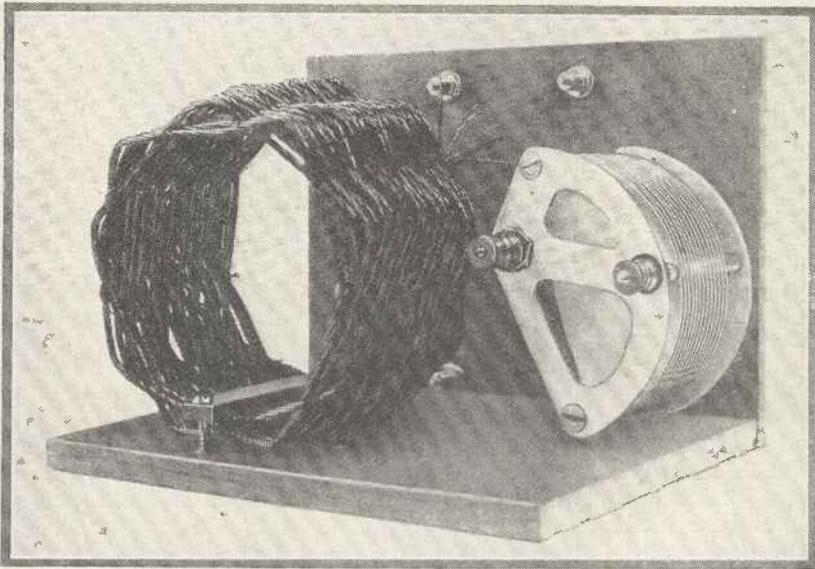
To test the set the aerial, earth and phone leads should be attached to their respective plugs and these pushed into the correct sockets.

Adjust the crystal detector and tune-in the local station by moving the condenser dial.

On a test aerial two miles from the London station 2 L O was received at fair loud-speaker strength,



View of Low-loss Crystal Set Wired-up.



View of Low-loss Crystal Set before Wiring up.

OLD PHONES

WHEN telephones have been in use for a long time they tend to lose their sensitiveness, since the magnets gradually become weaker, even if the phones have always been connected up so that current flows in the right direction and if the greatest care has been exercised in preserving them from jars and jerks.

Old telephones, provided that their windings and diaphragms are in good condition, can be given a new lease of life if they are sent to the makers to have their magnets re-magnetised.

This is not an expensive business, and it usually makes a great deal of difference to their working; in fact, an old pair of telephones so treated will often give just as good results as they did when they were new.

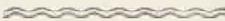
dance music being audible 15 ft. from the instrument.

At five miles from 2 L O there was sufficient volume to work eight pairs of phones without appreciably diminishing the strength of the signals.

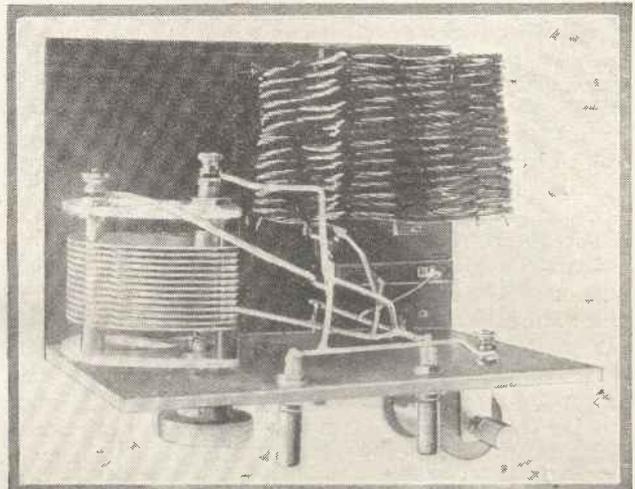
Indoor Aerial

On an indoor aerial at the same distance reception was all that could be desired.

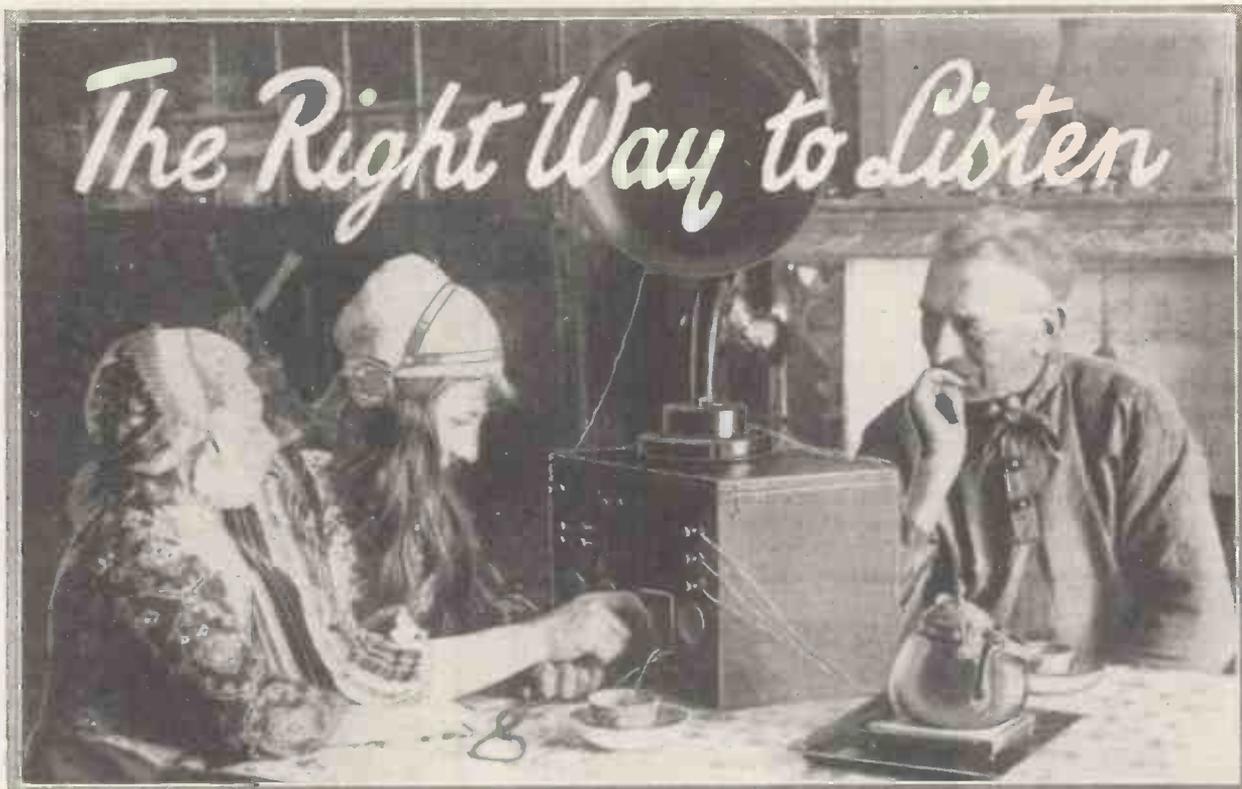
The set was not tested over a greater distance, but it seems from the results obtained at short ranges that good reception should be obtainable up to 30 or 40 miles from a main broadcasting station.



"LIFE Struggle in the Plant World," broadcast from Birmingham, ought to satisfy those people who want more vigour in the programmes. What could be livelier than a ten-round contest between a spring cabbage and a bed of onions?



Another View of the Set Wired-up.



Wireless in the Isle of Marken, Zuyder Sea.

SINCE we came to be ruled by wireless waves much evil has been unfairly attributed to the wireless pastime. It has been variously accused of disturbing domestic harmony; of breaking up the family circle; of imposing unnatural silence upon suburban homes; and of causing a good deal of nervous wear and tear with accompanying heated words from that member of the household who happens to be the wearer of the solitary pair of headphones.

Unsatisfactory Receiver

A great deal of this (if it exists) is due to the employment of an unsatisfactory type of receiver in the first place. Where the full enjoyment of the wireless programmes is limited to only one listener at a time some little discord is bound to occur. A receiving set capable of operating a loud-speaker is naturally indicated here—once the whole family can hear in comfort there is very little fear of untoward interruptions or noises.

But granted that such conditions obtain, how many people really listen with discrimination? To fully enjoy the wonderful fare nightly rendered to us over the ether it is first necessary to appreciate the real psychology of listening. In taking our everyday enjoyments and re-

creations we endeavour quite naturally to fit them to our particular mood of the moment.

Do we feel depressed, out of sorts, at variance with things and people—then away to the sparkling revue, the cabaret, or even to the latest Harold Lloyd picture! Should our mood be thoughtful, philosophical, uplifted—then we hie us to the symphony concert, the serious drama, or the lecture, and keep our heads in the clouds.

To reverse the procedure—to view *Hamlet* when our liver is out of order, or to visit *Legs and Laces* with thoughts of sublimity—is absurd, unnatural and disastrous. Yet, in a measure, this is how many people take their listening-in.

Suppose you have had a good day at the office; a cheque has unexpectedly arrived; a few good friends have dropped in for dinner; your cook has excelled herself; and, full of contentment and good will, you at length sit down (with a large cigar), to listen to some monumental but stodgy concert—that, surely, is not listening with discretion.

Therefore, consider your programme. It may be one of those dull nights we occasionally get—a solo soprano, solo baritone, café orchestra combination—tiresome and

boring for sustained listening. Well, take up your book and obliterate the background of music. A best-seller reads no worse for an accompaniment of mediocre music.

Most listeners will remember the production at Z.L.O. of the sketch *Danger!* The action takes place some hundreds of feet below the ground in a coal mine, and, as an aid to realism, the announcer suggested that listeners might turn down their lights. Together with his intimation that nervous, invalid, or susceptible people would perhaps find the sketch too dramatic, this was the very thing to put listeners into a receptive, anticipatory, and imaginative frame of mind—a circumstance which almost compensated for not seeing the actors themselves.

Going to the Theatre

The ordinary family's visit to the play is something of an event and somewhat of a ceremony. There is a general "sprucing up" and donning of fine linen, possibly a dining-out, and finally, when the tip-up chairs bang downwards, a readiness to fall in with whatever mood, grave or gay, the author and his puppets may inspire.

Do the same for broadcast enter-

(Continued on page 152)

LOCAL BROADCAST NEWS

Our contributor collects and writes the news that is broadcast from the Sheffield Relay Station of the British Broadcasting Company.

"COPYRIGHT by Reuter, Press Association, Exchange Telegraph and Central News." How many times have you heard that? It is the preamble to all news broadcast from B.B.C. stations, whether main or relay.

To hear it every night must be tiring, and even annoying, but the four news agencies who supply the B.B.C. with news stipulate that it shall be given, and the announcer's voice has done more in the last eighteen months to acquaint the general public with the names of the agencies than the small print at the bottom of a report has done in twenty years.

In this article I intend to deal only with local news broadcast in the provinces, but first I think I ought to point out that few people realise the enormous cost of collecting even the smallest item in a news bulletin.

A Shilling a Word

Ten words announcing the death of some prominent personage may easily cost a shilling a word if he dies in England, and a pound a word if he dies abroad. Only the news agencies, who supply news universally, and the richer newspapers can afford to bear this heavy expense.

Quantity in many instances has nothing to do with the cost of news, as telegraphing or telephoning it is about the cheapest item in its collection. The expense mounts up as the result of keeping experts, whose wages and expenses are high, watching and waiting for occurrences of news value to turn up.

This cost applies equally whether the news is broadcast or printed.

When dealing with broadcast news it must be remembered that to prepare a news bulletin for national transmission is much easier than to



prepare one for local ears. The scope of local news is exceedingly limited, especially in some centres, as towns and cities are known as good news centres and bad ones.

For news of national interest there is the whole world to collect from. There are probably two thousand representatives of the news agencies always on the alert to get news for national transmission, whereas in your own town at the most there are only two watching local news.

No doubt you often put down your headphones in disgust when the rule was two local bulletins a night and the announcer said at the hour for the second bulletin: "We have no further local news."

It may be annoying to have heard the London announcer say: "Stations will now transmit their local news," but if there is none, it is not the fault of the man responsible for the local news.

He has made a round of calls which should have produced something but has not. News cannot be manufactured without grave danger to the person doing it and the station broadcasting it.

To this line of argument I have heard the counter challenge: "The newspapers find it."

Do they?

Take a look at your local journal and find out the proportion of local news to national news. You will be surprised to find that the proportion is about five items of national news to one item of local news.

"Thin" News

I know from experience that it very often happens in a newspaper office that decent local news is, as it is termed, "very thin," and one can hear the news editor asking the staff "whether there is a good local tag anywhere."

One of the most experienced journalists in the provinces tells me he has made a certain special news call year after year which has rarely produced a line, when the supposition of the uninitiated would have been that there was an abundance of news from that source. It is easily possible to make a call fifty times without a line being found.

When you examine your local newspaper you will probably find:

LOCAL BROADCAST NEWS (Continued)

The report of the proceedings of the local council, the main points of which you heard in the news bulletin the night before.

The report of a dinner at which the speeches were political. This could not be broadcast because the B.B.C. bar politics.

A string of names of those present at a funeral, which would not have interested you over the wireless,

other items have to be wedged in, and the number of words not exceeded.

The complaint was heard frequently, under the double bulletin system, that the news broadcast at 7.30 p.m. had appeared previously in the evening newspapers. But there are many listeners-in who do not get evening newspapers.

Moreover, in the evening it is

selling soap is. What is required is a reformation of the service and a staff of capable journalists properly organised. H. J. H.

WIRELESS will do as much for England in the future as coal has done in the past, says a well-known professor. But that is only one of its "minor" possibilities.

WE HEAR THAT—

A scheme has been drawn up for providing a £20,000 broadcasting station in Peru. No doubt it will be carefully Peruvianised.

That popular wireless artiste, Miss Dorothy Silk, is in ever growing demand. We hope that listeners won't emulate Mr. Churchill and over-tax her.

A saxophone solo was recently broadcast from Newcastle by a gentleman named Raine. With the aid of a little wind, of course.

Birmingham school children have had broadcast lessons on a lump of coal. In order that they may learn where their slate pencils come from, presumably.

and, in any event, were too cumbersome for a "bulletin."

Controversial subjects cannot be broadcast—in fact few know, or even realise, the restrictions on news which the B.B.C. impose. The gruesome murder which your local paper advertised so prominently was discovered early enough to be included in the news bulletin, but "that would shock sensitive ears" and cannot be broadcast.

When one reads the restrictions on broadcast news one wonders what news there is left which can be broadcast.

Broadcast News

It resolves itself into fires, the work of the council and guardians, non-controversial speeches, non-shocking accidents, and police-court cases. Some station directors, however, bar police-court cases.

The other four are often included, although great difficulty is often met when trying to find a non-controversial speech. Even when one is found the difficulty of condensing it, to fit in with other items in an all-too-short news bulletin, without losing some of its meaning, is extremely difficult.

A speech for broadcasting is easily written if one can allow five hundred words for it, but in a relay-station bulletin of 350 words it is another matter, especially when three or four

almost an impossibility to get hold of news which has not been obtained also by the newspapers. If there are two newspapers in a town there will be fifteen men opposed to the single representative of the B.B.C., so that it is easy to see the chances of getting an exclusive item of news to broadcast.

No Unpublished News

On the other hand the Newspaper Proprietors' Association have an agreement with the B.B.C., by which the latter agree not to broadcast news that has not had time to be included in the newspapers, so, whichever way the matter is argued, the news agency representative is tied.

News broadcast on Sunday is in a slightly different category, because when newspapers have ceased publication of their own free will there is no competition with them.

This applies to Christmas Day and other holidays on which newspapers do not publish.

While the B.B.C. refuse to compete with the newspapers there can hardly be any great improvements in the news broadcast, nor can one man be expected to compete with the newspapers.

At the moment the B.B.C. only get what they pay for, and news, although many forget it, is a commercial proposition just as much as

It is said that the announcers whom the B.B.C. are seeking must have happy voices. This puts travelling greengrocers well in the running.

The Right Way to Listen

(Continued from page 150)

tainment and you will experience a far greater pleasure than the arts of scenic painters and electricians can devise for you. The scene you picture is all your own; it cannot be pictured by, or belong to, anyone else. It is a common disappointment to find an illustration of the heroine in a novel—she is always lovelier in imagination.

It is a remarkable fact that sound suggests far more to the imagination than does sight. The deaf person is more often than not irritable and self-centred. The blind person has always been pictured—and rightly so—as a creature of fairy imagination, a being loved by all. While loss of hearing seems to deprive a man of sweetness, blindness has ever an inexhaustible fund of imagination.

If the work is well performed at the transmitting end (and everyone must admit that there is a dearth of mediocrity in the B.B.C. programmes), there is no limit to the beauty of the sound picture that its plays, its music, and its sketches may evoke. But listen with discretion. A. J. B.

Wiring Made Easy

The Building-up of a Wiring Diagram.

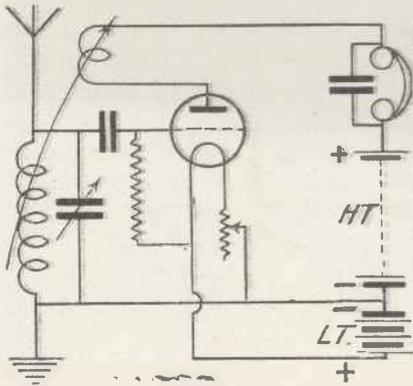


Fig. 1.—Theoretical One-valve Circuit.

ONE of the practical difficulties of the beginner is the wiring up of his set from a circuit diagram. It is not always easy for an amateur, unused to reading circuits and therefore unable to spot the connections at a glance, to transpose even a simple circuit into a wiring diagram. Conventional signs are only interpretable to the experienced constructor.

A pictorial circuit diagram shows at once the circuit and the connec-

tical order; C_1 represents the phone condenser, Ph. the phones, VC the variable condenser, A the aerial, E the earth, FGP the filament, grid and plate connections of the valve, FR the filament resistance, ATI the aerial-tuning inductance, RC the reaction coil, GL the grid leak, and HT and LT high and low tension respectively.

It will be noted that wires are taken from both sides of the symbol (when two connections are taken from it). Fig. 3 is thus a wiring diagram of the circuit shown by Fig. 1.

together; and so on for any additional number of valves.

Where more than two valves are to be used, a little consideration is worth while to superpose the symbols in such a manner that the minimum number of lines are used.

Avoiding Confusion

Perhaps the most confusing feature of the conventional multi-valve circuit diagram is the enigmatical array of lines, due to haphazard layout of the conventional signs, and to the components as typified by the symbols not conforming to their ultimate disposition on the panel.

With the system forming the subject of this article it is scarcely possible to go wrong. And, in the writer's opinion, such a diagram tells the constructor so much more about the set.

Long Wires

For example, he can see from Fig. 3 that long wires are required from the phones to the reaction coil, from the grid leak to L.T. positive, from H.T. negative to A.T.I., and from A.T.I. to V.C. Short leads are soldered on to these wires to complete the wiring.

F. J. CAMM.

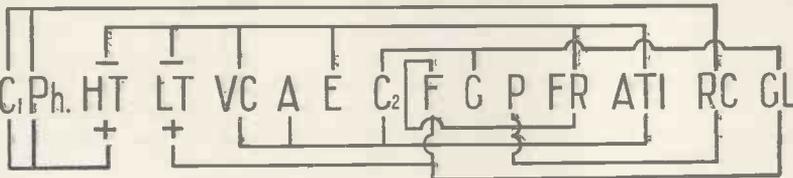


Fig. 3.—New Method of showing the above One-valve Circuit.

tions, and the nature of the components required. Unfortunately, such circuits are not always provided, and the difficulty therefore remains.

Fig. 1 shows a simple one-valve circuit with reaction, and in Fig. 2 the same circuit is shown pictorially.

The New Method

Whilst experts prefer the former method (perhaps resenting an innovation which makes their clever-looking diagrams simple), the pictorial method unquestionably finds most favour with the amateur. Where this does not come to the rescue, the writer suggests that the method shown in Fig. 3 be adopted.

It must clearly be understood that this method is not intended to replace the conventional circuit diagram, but to provide a simple system of making a wiring diagram from an ordinary circuit.

In Fig. 3 the various connections have been written down in no par-

It is in circuits having more than one valve that the system becomes of great advantage. For two valves the same symbols shown in Fig. 3 would be used, with an additional column giving the extra connections required for the second valve. These two columns would be connected

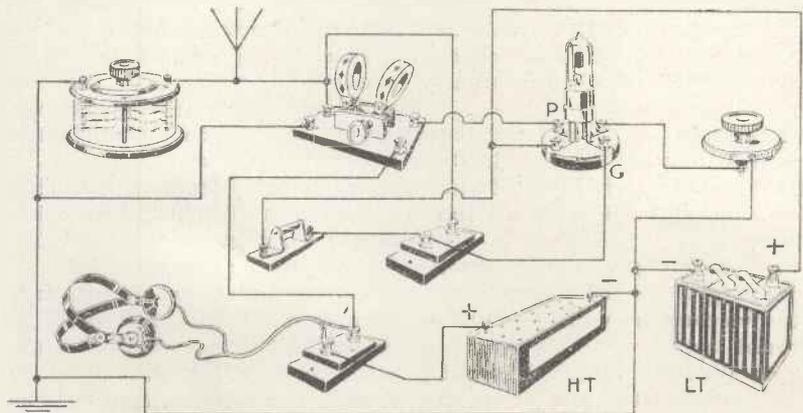


Fig. 2.—The same One-valve Circuit shown Pictorially.



The Ideal "Children's Hour"

by Muriel Wrinch

THE ideal children's hour! "Yes," said an official of the B.B.C. when I was talking of the matter to him the other day. "Yes, but what is a child—from the broadcasting point of view?"

That, after all, is the question. The indefatigable aunts and uncles who entertain our children every evening are talking to a vast unseen audience of little people, an audience of whom it is extremely difficult to gain accurate information.

Some Pertinent Questions

Who are these children who listen in? How old are they? What are their interests? What are their social circumstances? Do they live in town or country? Do they like fairy-tales or stories that are true to life?

It is difficult to please grown-ups of widely differing tastes and intellectual capacity. It is a thousand times more difficult to please their children.

I suppose the only way to succeed in pleasing the big childish audience is to give plenty of variety and some material suited to each stage of growth through which the child passes between the years of five and fifteen.

One form of entertainment all

children love—the telling of a story. There should certainly be one story at least in every children's hour. Sometimes the story will be for the five-year-olds, sometimes for children of eleven or twelve, and it will vary in plot, in interest, and in the method of telling, in consequence.

For the very tiny children, stories involving repetition, like "The Story of Henny Penny," or stories involving dramatic changes of voice, like "The Three Bears," are most suitable.

There is no need to avoid telling the old familiar nursery tales. Children love them best of all, and four-year-olds are often more thrilled to hear an old story told over again than to listen to an entirely new one.

Nevertheless some modern stories about little boys and girls and animals may be introduced with profit. Maud Lindsay's "Mother Stories," and those in her book, "A Story Garden," charm little children. I should dearly like, also, to hear Hugh Lofting's "Story of Mrs. Tubbs" told over the wireless.

Five- to seven-year-olds like fairy-tales best of all, as a rule. We cannot beat that old story of Andersen's of the dog with eyes like saucers, and the dog with eyes like windmills, and the dog with eyes like round towers, nor can most of

the tales of the brothers Grimm be bettered. Bearing in mind, however, that these volumes of stories were not originally collected for children, a careful selection should be made.

Then there are the wonderful stories in Andrew Lang's collections. There are Asbjornsen's "Tales from the Far North," Ballard's "Tales from Far Japan," and Frere's "Decan Days."

Older children will enjoy myths and legends of the Greeks and the Romans and the Norsemen. I would have as many myths of the primitive people and nature legends concerning the procession of the seasons and the sun, moon and stars and trees as possible for the entertainment of nine- and ten-year-olds in the ideal children's hour.

Heroism and Adventure

For those older still I would have tales of heroism and adventure—the old stories of Robin Hood and his Merry Men, and of the Seven Champions of Christendom. I would have stories of General Gordon and Robert Bruce, Florence Nightingale and Nurse Cavell.

There is certainly no lack of material here. The chief concern should be that every story is good

of its kind. The B.B.C. have a serious responsibility on their shoulders—they influence thousands of children and their work plays a large part in developing children's taste.

As Dr. Wingfield Stratford says, "A child, hungering for information, will accept greedily and uncritically whatever comes to him from the outside world. He has not acquired the power of distinguishing between different types of literature; he has still his pathetic faith in the truthfulness and wisdom of his grown-up guides, and the mere fact of a thing being written and countenanced by grown-ups is sufficient proof, in his eyes, of its excellence."

Influence of Broadcasting

How much more even than by a tale in a book must the child be impressed by a story broadcast from the great wireless station of which he hears so much!

Another interest which is almost universal amongst children—the babies of three and four, of course, excepted—is the Nature interest.

In the ideal children's hour, at frequent intervals, there would be broadcast information as to what was to be seen in town and country during the month—information as to the wild-flowers to search for, the type of clouds to be seen in the sky, the development of buds in spring, the scattering of seeds in autumn.

To achieve the personal note which is so desirable in dealing with children—especially in broadcasting, where they cannot see those who are talking to them—I would suggest that the B.B.C. should offer prizes occasionally for the most carefully written and best-illustrated nature diaries.

Children's Gardens

I would also suggest talks on one or two of the plants or animals the children are particularly observing during the month, and also some practical talks on the making of an aquarium, the rearing of tadpoles, and so on. A weekly or monthly talk on work in the garden would also be very popular. Most children have small gardens of their own, but they often neglect them because they have no reliable garden calendar. A talk occasionally on stars we can see would also be popular—I believe one of these figured in the London programme the other day.

Then, of course, there are always children's hobbies to consider. Talks on the care of pets, on stamp-collecting, photography, descriptions of new games, and so on, would be useful.

Here, again, the personal note would come in.

Matters such as these touch children's lives very closely. Advice on how to build fires at picnics—for there is a right way and a wrong way—on folk-lore, on forecasting the weather, on how to keep accounts of one's pocket-money, how to plan homework and map out one's day to the best advantage might be included from time to time under the general title of "Useful Hints."

Nor must music and poetry be forgotten. There is a great deal of poetry written for children by poets of note. Good poetry to please children of every age could easily be found.

Good Music

There is good music, too, in plenty. What of Tchaikovsky's "March of the Toy Soldier" and Gounod's "Funeral March of a Marionette"? What of Elgar's "Wand of Youth" and Schumann's "Birthday"? What of the old folk-lore tunes beloved of the primitive people?

"But," the patient reader will inquire, "what of the time?" But I have not forgotten that the children's hour is rarely longer than thirty or thirty-five minutes.

The suggestion I would make is that in thirty minutes there should be regularly a short story, lasting from seven to ten minutes, a Nature talk of five to seven minutes, five minutes' music, five minutes of personal conversation or jokes, and any items of the day's news which is particularly interesting to children. This leaves a few minutes for poetry or a special talk.

But since it is not possible to interest children of very different ages at one and the same time, it would seem a good thing, after giving out the children's news, after broadcasting the happy returns for birthdays and like features, and after giving some interesting small items for the babies each day, to announce definitely the age of the children for whom the rest of the programme is planned.

On one day the bulk of the programme, after the preliminary few minutes, would be for five- to seven-year-olds, on another for those of nine

and ten, and on another for children between eleven and fifteen.

One Disadvantage

Of course, this arrangement has one obvious disadvantage. On two out of three days there is only a few minutes' talk for each child, but the fact that the programme on the third day is wholly intended for him and other advantages outweigh the disadvantages.

Think of it—in a family of four, there would be no fight for the headphones!

Also, there would no longer be the need for a child of seven to listen through an item intended for a child of five, in order not to miss his particular talk or story.

I know an intelligent little girl of eight who has given up listening-in because, she says, she dislikes the "babyish stuff"—yet such a child would very much enjoy many of the talks given during the children's hour.

Many of these suggestions may seem to be counsels of perfection. There are difficulties in the way of inviting correspondence or of organising competitions with the huge public of children—I know this to my cost, for I invited correspondence through a children's page that I directed once!

There are difficulties in varying the programme.

More than that, there are difficulties in obtaining the right person to broadcast a particular item. A different auntie is required to tell a fantasy from the one who is an adept at recounting rollicking adventure tales.

Practical Difficulties

There are, too, hosts of practical difficulties of which the general public knows little and for which, judging from their letters to the B.B.C., they are disposed to make no allowances.

Yet, in spite of the abundant criticism hurled at its head, the British Broadcasting Company continues in its efforts.

It always strives to make the children's hour recreative as well as informative, entertaining as well as educative, varied and interesting and enjoyable.

And since it looks to psychology for its guide, sooner or later, in spite of all the difficulties in the way, we shall have the ideal "children's hour."

Deep-sea Fishing

and the Wireless "Link"



A Special Article by WALTER WOOD

THERE seems to be an uncanny vitality in everything connected with wireless. Even the most conservative and old-world institutions have apparently hidden fires which shoot up in sympathy with some mysterious and all-powerful spark.

"Fleeting"

Most of us know that our steam trawlers, which fish on the "fleeting" system at considerable distances from land, are now wonderfully helped and made safer because of the use of wireless. Yet the installation of apparatus is so recent and has been so grudgingly provided that those who know what "fleeting" really means hardly realise that wireless has become an inseparable part of deep-sea fishing.

And before we have quite got used to the idea of wireless in steam fishing vessels we find that some enterprising spark has ignited the smouldering fires of old-world sailing craft, so that now there are actually smacks which are fitted with receiving sets that enable fishermen at sea to enjoy the good things provided so lavishly ashore.

This means that our deep-sea fishermen to-day possess something they have never had before, and that is the priceless boon of a living link with home—for what has more life in it than wireless?

The first time I went to a fishing fleet was in a sailing smack which was leaving port for a voyage that would last eight or ten weeks. She was one of a fleet of more than a hundred vessels of the same kind, working

about three hundred miles from home, and, except for the communication with land maintained by the steam carriers which conveyed the fleet's catches daily to London, my smack knew nothing of England.

At the end of her voyage she was in port for a week or so, then back to the fleet for two more soulless months; and so on throughout the year.

This meant that in the whole twelve months a fleeting fisherman had about six weeks ashore; and there are old trawlermen who, out of fifty or sixty years' work afloat, have only spent a few weeks each year on shore.

British industry has never had a branch which was so isolated, so hopeless from the human point of view, as this deep-sea fleeting, for it was essentially a case of out of sight, out of mind. People did not know of the fleeter, therefore they could not, and did not, care.

Little Communication

Wireless in those days was not even thought of. Letters from home were rare, for many of the fishermen could neither read nor write, and at most, all the fleeter could hope for was "a bit o' readin'" that some one would be gifted enough to interpret aloud.

The old sailing fleets have vanished—thank heaven—and many of the old horrors have gone with them, never to return. Steam trawlers now carry on the fleeting system, yet even they work on the old method of remaining at sea practi-

cally all the year round, so that if it were not for wireless they would not have any actual link with home—and by that I mean the living voice and sound ashore, not a mechanical reproduction.

From the point of view of the isolated person there is all the difference in the world between the living link and a gramophone record.

Iceland

Not very long ago I had to make the passage to Iceland in a steam trawler. The weather was bad, and the North Atlantic in bad weather is no desirable region for a traveller by steam trawler. But that in itself was no cause for undue concern, since trawlers are warriors of the storms; but what I did deplore was the absence of wireless.

We were, for the time, while on passage, hurled-about outcasts, knowing nothing of the world, and the world profoundly ignorant of us, for we did not pass a vessel that could report us.

How real the peril is is shown by the case of a Grimsby steam trawler which left for the Icelandic grounds. She was not heard of, and finally was given up as lost and claims were paid and allowances made; then she reappeared from the unknown, and it was learned that she had broken down, had drifted helplessly until not a thing was left to burn and nothing but refuse to eat, and had been, at last, almost miraculously sighted and towed into an Icelandic port by another trawler.

If that vessel had had wireless

untold anxiety and suffering would have been averted—yet vessels are still allowed to undertake such voyages without this protection, leaving out of count the human and enjoyable element.

Many of the steam fleeters are to-day equipped with wireless, and other steam fishing vessels are being provided with receiving apparatus to get weather and other reports; which is as it should be. A fisherman knows a good thing when he gets it—and having got wireless he knows that it is very good indeed.

Little "Hookers"

But the point that interests me most, as an old hand at this deep-sea game, is the little hooker with her wireless, the small, brown-sailed craft that goes out for her week or less and keeps within reasonable reach of port. She can get her reports, and she can get the more human touch of speech and song and the joyful sound of reed and brass—and if you have the drums thrown in, so much the better.

To me it seems an almost incredible development, and it is hard to praise without appearing to exaggerate. You must realise that in the steam trawler and in the sailing craft the conditions of existence are practically the same—you eat and sleep and generally move and have your being in a box of a cabin mostly below the water-line; and that there has not been, so far, any real relief from the monotony and solitude and gloom.

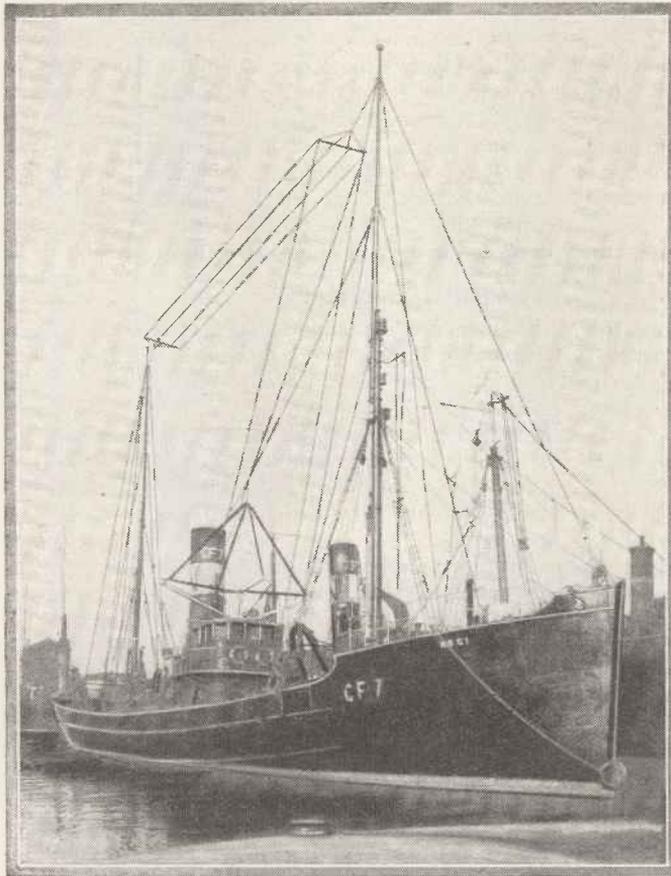
I have known nothing more pitiful than the envy expressed, when I have come away from temporary shipmates, in the sighed words, "I wish I was going home, too!"

Well, the going home is not possible, because men have to work far from land at this peculiar industry, and they have to go on working, hoping for the coming of better things and better times. Both are coming. Individual enterprise has done much, and the law, though a

sluggard beast, is moving in the right direction.

The day is not far distant when we shall be as much amazed that fishing craft of any size were allowed to go to sea without wireless as we now are that the abominable *coper*, the floating grog-shop, was ever allowed to sell her poisons in the fleets and to single-boaters.

Companies and owners generally are doing much, but there is the small man, the part-owner, or even the crew. Such wireless as is needed for a modest and most useful equipment can be furnished at a really trifling cost; and I want to see all who are interested in these relics of a swiftly passing phase of sea life, the sailing smacks and drifters, showing as much determination to have wireless, and so a provision of



Fishing trawler equipped with Marconi wireless. Note the direction-finding aerial on the deck house.

the great home link, as they show in catching fish.

THE London County Council is arranging for a supply of cheaper gas. This may mean that 2 LO will give us more lectures.

PROF. E. SOPP'S FABLES

Specially Revised and brought Up-to-Date for the Edification and Guidance of Wireless Amateurs.

No. 1.—THE APOTHECARY AND THE KNAVE

ONCE upon a Time, a learned Apothecary (who, in his spare Time diverted himself by means of Radio Transmission) was visited late one Night, at a Time long after the Hours at which he dispensed sage medical Advice and ill-flavoured but health-giving Drugs and soothing Compounds.

A Pain

The Stranger begged him with Tears streaming down his Cheeks to diagnose a Pain which caused him much Discomfort, Whereupon the benevolent Apothecary took him into his Den and besought the Suppliant to protrude his Tongue, the which would allow a Pronouncement upon the Case without further Aid of Blueprints or Diagrams.

Having adjusted horn spectacles upon his roman Nose, the learned Man made a careful Examination of the badly-furred Exhibit and voiced the Opinion that a Dose of (*vide* Advertisement Columns) taken that Night would, by the Morn, have dispelled the Evils and Ills which caused the Visitor so profound an Anguish.

Fully Comforted

Fully comforted, the Patient hied him on his Way having, by this Time, purloined the

Apothecary's Pocket Ammeter Beset with Fifteen Jewels, the which had been presented to him by the Lord of the Island.

MORAL: *Instead of examining his Tongue the learned Man should have felt his Visitor's Pulse.*

JAY COOTE.

The Breakdown of the "Intellectuals"

WIRELESS has evolved from a small thing to something of immense value, and of a world-wide importance. And, as far as I can see, it will go on reaching out, until it has become, as it should, an integral part of our everyday life.

Naturally, the British being insular people, it has had to face much questioning. But it is living down all this. Ignorant ones, and also those who should know better, have looked upon the invention, and those who were quick to see its value, with amusement and much superficial toleration. Which is both stupid and unenterprising.

Scepticism

Englishmen are prone to regard new things with scepticism. It is an attitude that sometimes annoys the man of vision. And, at least, it leaves him in an attitude of pity towards his somewhat mentally sluggish brother.

It is a point of view, this position of the slow-minded man, which I do not understand. I am amazed at it; for wireless is so contenting. Possibly it may astonish some of my readers to learn that this article has been more easily written because I am actually enjoying, as I write, the music of the 2 LO Military Band.

I tell you this in answer to those who say that wireless interferes with one's work. It does not. On the contrary it helps and inspires in many ways.

Why is It?

If the superior attitude were not so stupid, it would irritate. First of all, this so-called "intellectual" position is one that seems a little obscure. I wonder why it is? For the life of me, looking at it from every angle, I fail to grasp the value of the criticisms which have been levelled at wireless. There are many untenable objections to it.

One good person says it bores him stiff. You know the type which says this. Another says it distorts. Another speaks of it as a pretty toy. Another says it is quite a nice amusement for the old people, don't you know! And then pass on to what they consider more intellectual pursuits.

Yet there are signs of unbending of the intellectuals. Let me tell you a story. For some time a friend of mine, who is a highly educated man, regarded my enthusiasm for wireless with something akin to patronage, but knowing my temperament he, like the good fellow he is, accepted me with much toleration. I talked to him about it; what it meant, what it did, its entertaining value, its educating usefulness, its power to bring me into touch with the world outside. I spoke of its high standard in music, drama, and literature. And I demonstrated all these things, too.

Now and again—naturally I selected those things which I knew would please the plane of his intellectuality—I connected him with places abroad, I brought him towns in the north. After many months of effort—for I wanted to win him over—he said, one dark, dismal, rainy night, "Old chap, I think wireless is a good thing after all."

Practise Unselfishness

Others are beginning to say it, too. I know of those who used to scoff at the programmes (and who don't?). Yet a man or woman, of the best intellectual attainments would find it hard to criticise our serious programmes. But they can always switch off, and later enjoy the lighter things.

The programmes do, in fact, cater for all tastes, and we must all practise a little unselfishness and surrender a half-hour here and there for those who like the items we do not. Not for one moment would I urge that we should not go to the play, the variety entertainment or the concert.

But what would you have better than those wonderful concerts which the B.B.C. are giving us, seated around the fireside during the long winter nights? Or the lighter things in the summer?

I was never more thrilled than on one Saturday afternoon about midsummer of last year. I have listened to the Hallelujah Chorus in many great places, I have sung it to the beat of batons wielded by many great conductors, but never will I forget it on that afternoon as

it reached me from Paris, where it was being sung by Dr. Coward's choir. And I was cutting and rolling the grass in the garden! Surely this experience might satisfy the most exacting of intellectuals.

High Altitudes

No. Before very long we shall find that wireless has reached the high altitudes of most of our thinkers. They are beginning to realise that it is much more than an amusement. It has extended and broadened the minds of thousands of folk who, never before, and at a cost so moderate, have had the chance of such gorgeous opportunities.

I know many working folk who now get what you and I often had. A new era has opened up for them. Knowledge and experience have come their way. In a measure there has reached their homes a great world of music, of art, of literature; there has come to them—into their actual kitchens and sitting-rooms—a new university.

We have no right to deny them these privileges. In looking over the "talks" for the last six months, one is astonished at the famous men who have spoken to us over the wireless. These things are surely true intellectuality. The nation is bound to benefit by it. There is now much more readiness to broadcast on the part of those whose capacity and intellectuality justify it. This is a sign in the heavens. In addition, a number of persons who came to criticise have stopped to think, to examine, and then to participate.

Tremendous Possibilities

It is pleasing for those of us who see tremendous possibilities in wireless that the intellectuals are realising that this new force is rapidly revolutionising life in a thousand different ways, and that it is bringing us into communication with the furthest corners of the world.

As the years go by—no one may be lonely; no one may be uneducated.

G. H. G.

SOME of the American studios are equipped with antique furniture, says the Press. Siphons and corkscrews, for instance.



ALTHOUGH American "super het" components are exceptionally well made and finished, they are not always the best from the point of view of the British home-constructor. To be more precise, a trouble with American intermediate transformers and other "super het" accessories is to be found in the fact that they do not work efficiently with British valves.

American Components

American valves and those manufactured in this country show widely different characteristics, so that it is not a matter of wonder that, when an American transformer designed with an impedance suitable for an American valve is used with a British valve, the results do not compare favourably with those obtained when a British valve and a British transformer are used together.

In the "super het" described in this article, components manufactured by some of the most prominent British firms have been used.

Among the components required for the construction of this receiver are two coils each of 1,500 microhenries inductance. These have been specially made for THE WIRELESS MAGAZINE by the Igranic Electric Co., Ltd., from whom they may be obtained. These coils are wound on the well-

known honeycomb system and are mounted on a standard plug.

The oscillator unit and the high-wavelength H.F. transformers have been produced specially at the request of THE WIRELESS MAGAZINE by Radio Instruments, Ltd.

Components Needed

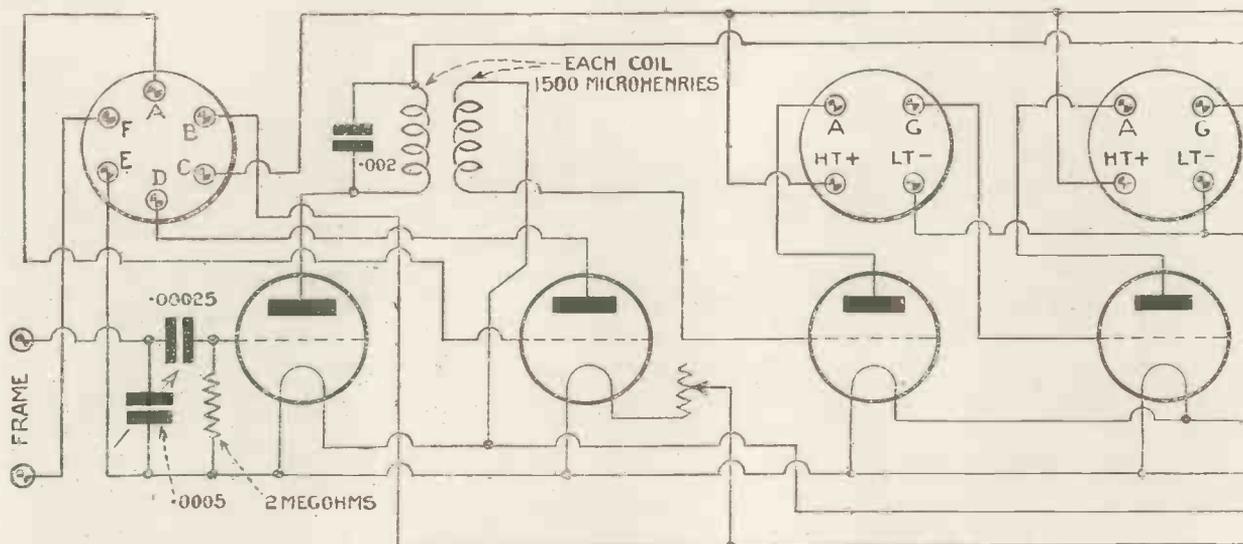
A complete list of all the apparatus necessary is given below:

- 1 Radion ebonite panel, 9 in. by 7 in. by $\frac{3}{16}$ in. thick (American Hard Rubber Co.).
- 2 coils, each having an inductance of 1,500 microhenries (Igranic).
- 4 filament rheostats (Igranic).
- 1 master filament rheostat (Ericsson).
- 3 matched long-wave transformers (Radio Instruments).
- 1 oscillator and coupler (Radio Instruments).
- 1 .0005-microfarad square-law variable condenser (Radio Instruments).
- 7 valve holders (Athol Engineering).
- 2 fixed coil holders.
- 3 1-microfarad fixed condensers (T.C.C.).
- 1 .002-microfarad fixed condenser (Atlas).
- 1 .001-microfarad fixed condenser (T.C.C.)



Special Cabinet for the Seven-valve "Super Het."

AN ALL-BRITISH SEVEN-VALVE "SUPER HET"



Circuit Diagram of Seven-valve "Super Het" Specially Designed—

2 .00025-microfarad fixed condensers (Igranic Freshman).

2 fixed grid leaks, 1.5 and 2 megohms (Darco).

1 4-to-1 L.F. transformer (Pye).

12 terminals (Belling Lee).

1 ebonite terminal strip, 3 in. by 8 in.

1 wooden baseboard, 25 in. by 8 in. by $\frac{1}{2}$ in. thick.

1 cabinet (Carrington Manufacturing Co., Ltd.).

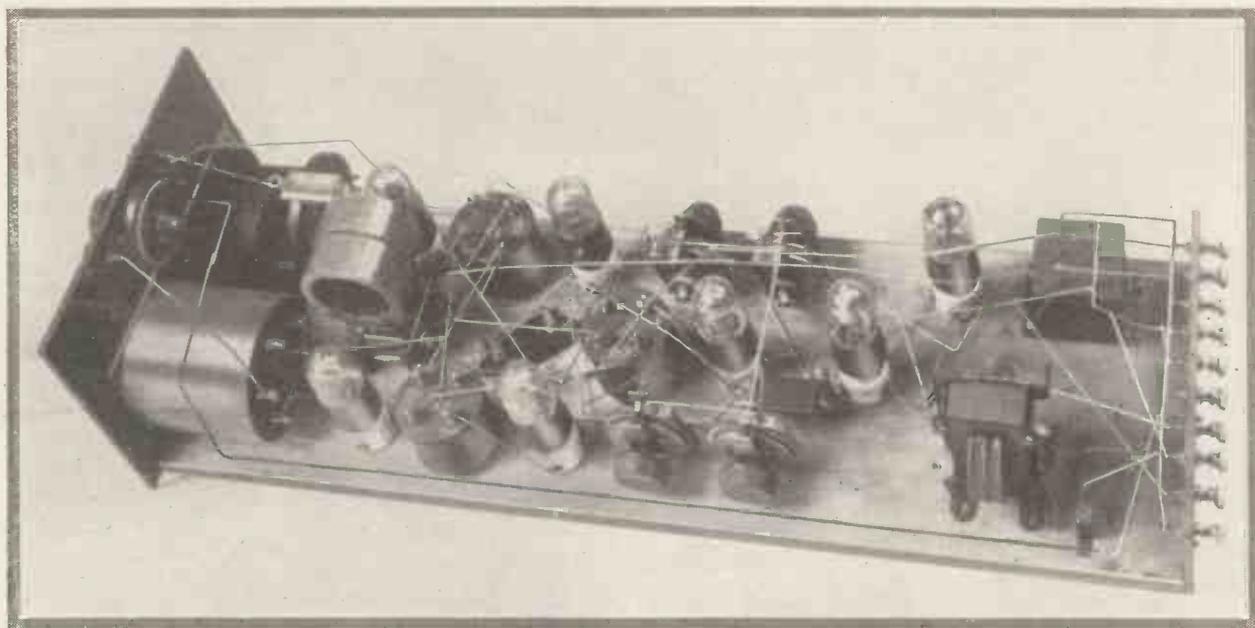
In order to keep the panel dimensions to a minimum and so save considerable expense, the cabinet has been specially designed, and is, as will be seen from the photographs, a departure from the usual type.

Cabinet

This cabinet has been made for THE WIRELESS MAGAZINE by the Carrington Manufacturing Co., Ltd.,

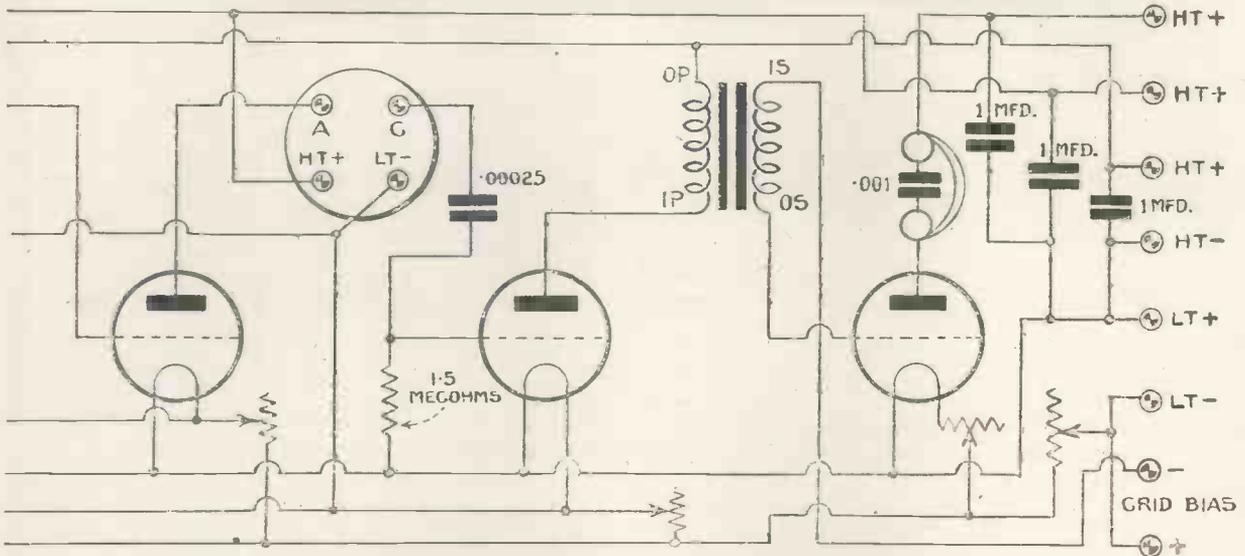
of 18 to 20, Norman's Buildings, Mitchell St., Central St., London, E.C.1, from whom a similar one may be obtained. For those, however, who prefer to try their own skill at cabinet-making a dimensioned sketch is given.

The construction of the set may be conveniently started by cutting and drilling the panel to the size and dimensions given in the drilling diagram. Only eight holes have to



Plan View of All-British Seven-valve "Super Het" showing Disposition of Components and Wiring.

Specially Designed by "The Wireless Magazine"



—by "The Wireless Magazine." All-British Components are Used.

be drilled, including those for fixing the panel to the baseboard.

Panel

Provided the panel is obtained from the firm mentioned in the list of components (who stock this size as standard), no cutting will be required, thus saving a great deal of time and labour. The edges and corners are all trued and squared-up.

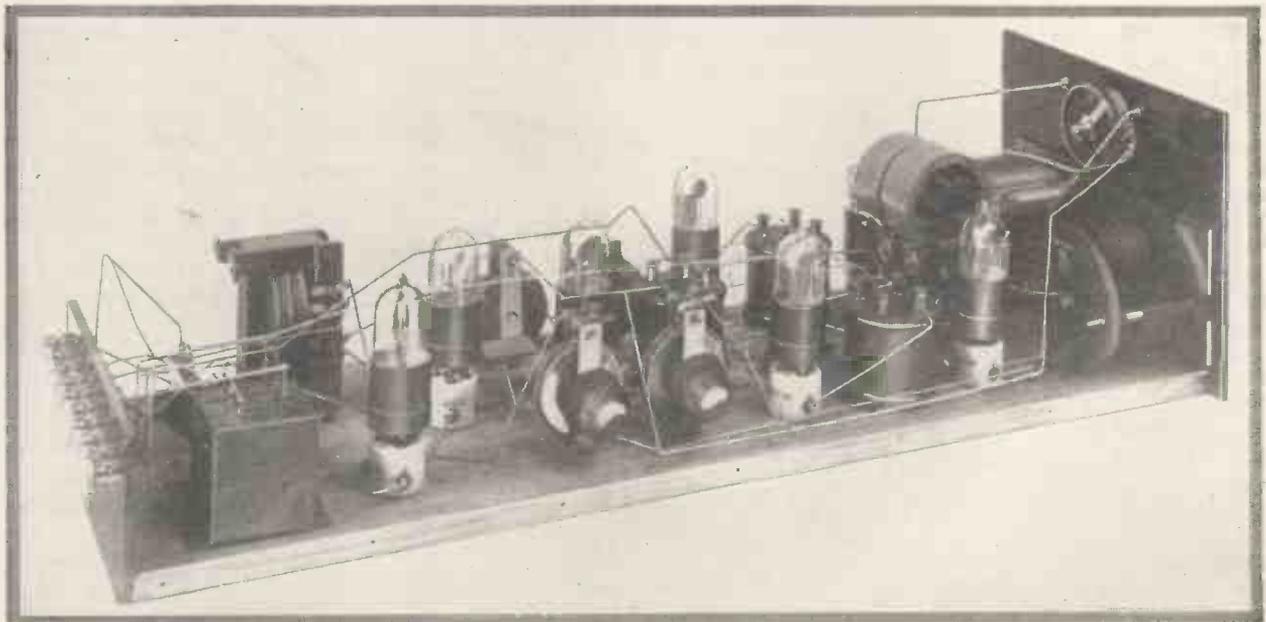
A good method of drilling the panel

is as follows: Cut a piece of paper to the exact dimensions of the panel, that is, 7 in. by 9 in., and mark on the paper the positions and centres of holes to be drilled. Lay the paper flat on the panel and prick through the marks on the paper with a sharp steel point.

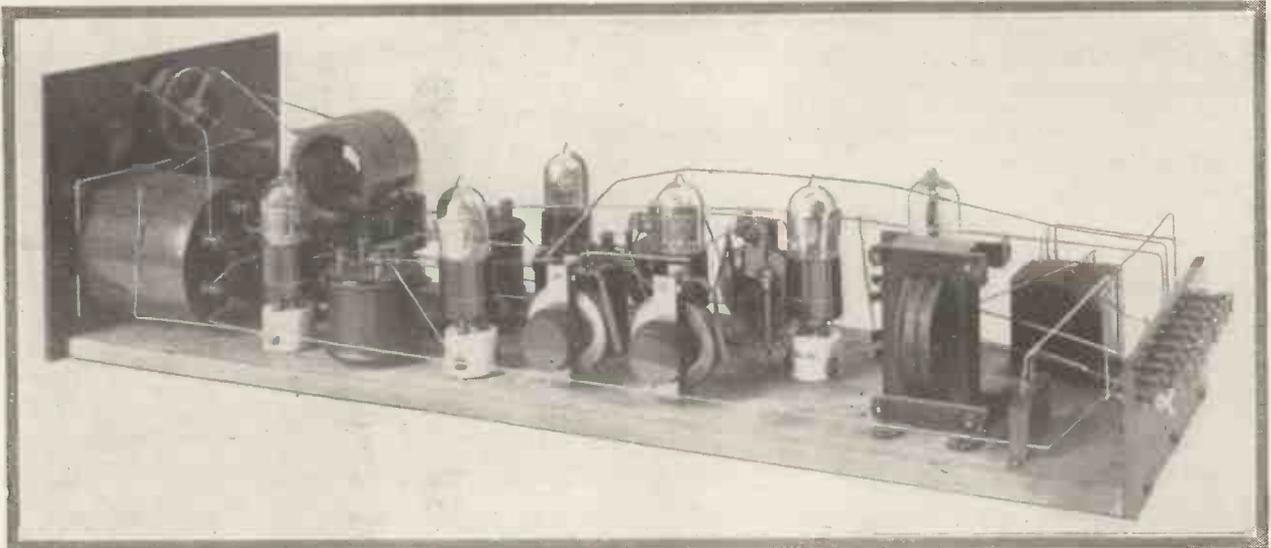
The paper template is then taken off the panel, through which holes of the sizes indicated in the layout are drilled.

The next step in the construction is the mounting of the components on the panel and on the baseboard. All the main controls—the oscillator control, frame-tuning condenser, and master filament rheostat—are mounted on the panel itself together with the frame-aerial terminals. The remainder are screwed down to the baseboard in the positions shown in the wiring diagram.

In order to eliminate as far as



Side View of All-British Seven-valve "Super Het" showing Disposition of Components and Wiring.



Another View of All-British Seven-valve "Super Het" showing Disposition of Components and Wiring.

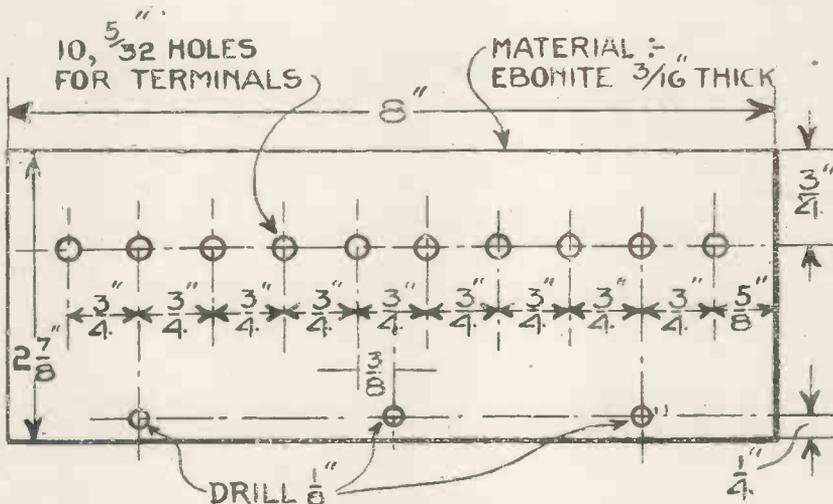
possible stray capacities existing between the wiring, the long-wave transformers have been placed in such a manner as to allow of the shortest possible connections between grid and anode.

For a similar reason the two frame-aerial terminals have been mounted on the panel close to the tuning condenser and first detector valve.

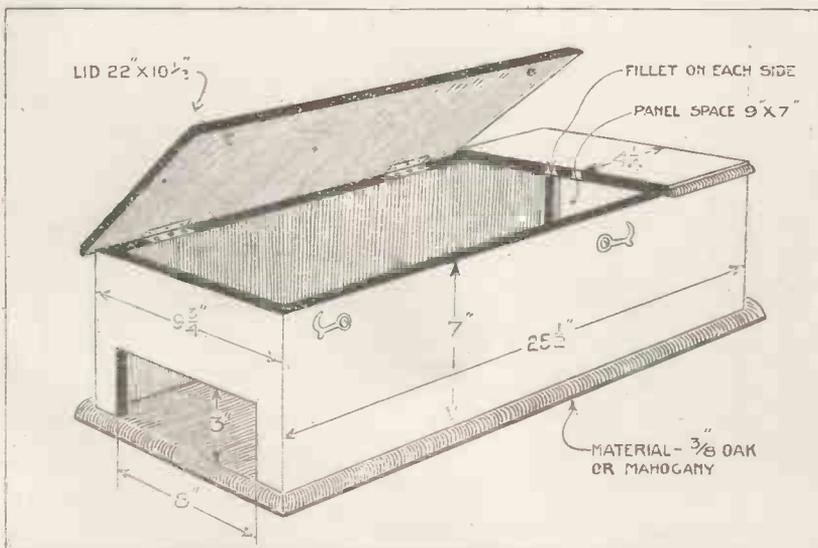
The remaining ten terminals are mounted on the ebonite terminal strip, which is screwed to the back edge of the baseboard and projects through the back of the cabinet.

Filament Control

Four rheostats (excluding the master rheostat on the panel) are used to control the filaments of the seven valves. These rheostats are mounted on



Layout of Terminal Strip of Seven-valve "Super Het."



Details of Cabinet for Seven-valve "Super Het."

the baseboard. Before the set is finally enclosed in the cabinet they are adjusted to give the best results, after which the brilliancy of the filaments is controlled by the single master rheostat on the panel.

Having mounted all the components, wiring may be started. It is advisable to wire up a multi-valve set such as this in a systematic manner. A simple and convenient method is to divide the process of wiring into three parts—the filament, grid, and plate circuits—making sure that each part is complete before proceeding to the next.

Confusion Avoided

In this manner, confusion is avoided and the risk of leaving out or making a wrong connection is minimised.

No. 18-gauge square-section wire is used for connecting all the components, except for the two wires leading to and from the master filament rheostat, which should be of a thicker gauge in order to carry (without overheating) the total current consumed by all the

it. The actual stretching of the wire not only takes out all the kinks but also increases its rigidity. It will be noticed from the photographs that the two grid leaks and condensers have not been fixed to the baseboard, but are supported by the wires to

which they are connected. As both of these components are small and light it is unnecessary to fix them down rigidly.

A Suitable Frame Aerial

A "super het" can produce serious interference within a radius of several miles round if used in conjunction with an outside aerial, but apart from this it will be found that there is not much difference in the results obtained with a frame aerial and with an outside aerial.

A suitable size of frame is one having 3-ft. sides and wound with 8 turns of No. 20-gauge wire spaced $\frac{3}{16}$ in. apart. The wire should be wound on slotted strips of ebonite. Provision should be made for the rotation of the frame, as aeri-

als of this type possess sharply defined directive properties. Before attempting to listen-in, the valve-filament lighting circuit should be tested for (1) continuity and

(2) short circuits. It may be found, for example, that all the valves light up except one, in which case the filament circuit of that valve (including the rheostat)

(Continued on next page)

OPERATING THE "SUPER HET"

Place the seven valves and the two coils in their sockets and connect up the frame aerial, loud-speaker, high-tension, low-tension and grid-bias batteries to their respective terminals.

Adjust the four filament rheostats on the baseboard until the valve filaments are at a suitable temperature.

Search for signals by turning the left-hand dial on the panel one degree at a time, simultaneously slowly turning the right-hand dial through its entire movement of 180 degrees.

When signals are received, re-adjust the filament rheostats until the best results are obtained.

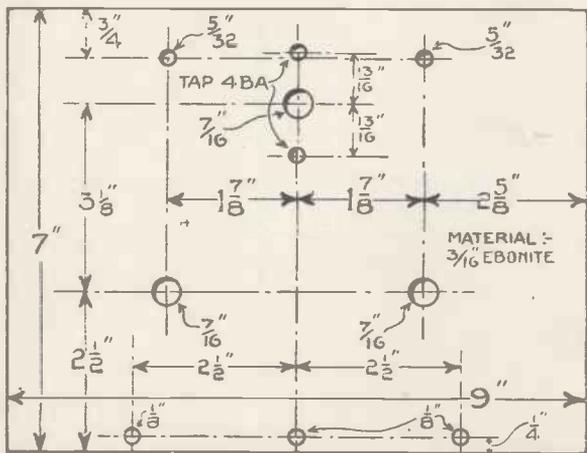
A further increase in signal strength and tone will be obtained by adjusting the positive wander plugs of the H.T. battery and the negative wander plug of the grid-bias battery.

Remember that the same station may be tuned-in at two settings of the oscillator control (the right-hand dial). That setting which gives the best results should be chosen.

It is essential that the frame aerial should point in the direction of the station it is desired to receive. For this purpose the frame should be capable of pivoting on its vertical axis.

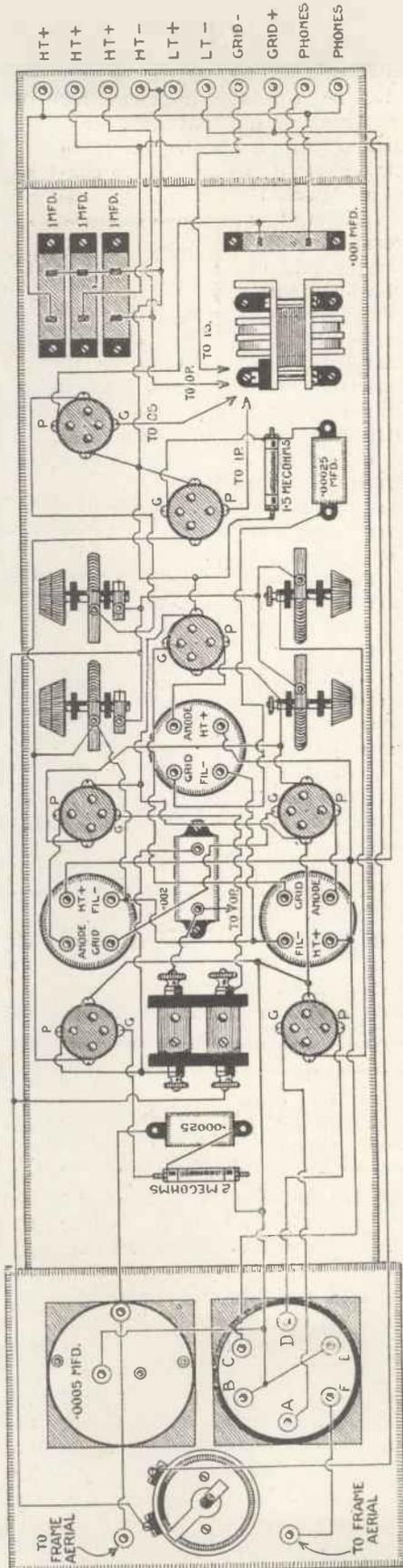
valves. No. 16-gauge wire would be suitable for this purpose.

It will be found that the thinner gauge of wire is apt to develop kinks and bends, spoiling the appearance of the finished receiver.



Layout of Front Panel of Seven-valve "Super Het."

The wire may be conveniently straightened by clamping one end of a six-foot length in a vice, holding the other end tightly in a pair of pliers and stretching the wire a few inches by pulling



Positions of Components and Wiring of All-British Seven-valve "Super Het."

ALL-BRITISH SEVEN-VALVE "SUPER HET" (Continued)

should be carefully inspected for some break or disconnection.

Before placing all the valves in their sockets it is advisable to connect a high-reading voltmeter across the filament sockets of each valve in turn, having previously joined the H.T. battery up to its proper terminals. This test will show whether the voltage of the H.T. battery is, by some short-circuit or wrong connection, applied to the filaments of the valves. Having thus made sure that there is no danger of burning-out the valves the set may be connected up for a preliminary test.

To listen-in first adjust the four rheostats mounted on the base-board until suitable filament temperatures have been reached. Next search round for signals by slowly rotating the two dials on the panel. When signals are received, readjust

the four filament rheostats and the + H.T.appings for best results.

The filament temperature subsequently may be controlled by the

distinct settings of the oscillator dial, this, of course, being due to the fact that the oscillations produced by the oscillator valve heterodyne above and below the incoming oscillations.

If interference is experienced on one setting of this control, it will be found that generally the interference is eliminated, or at least reduced to a minimum, at the other setting.

Always remember to turn the frame aerial so that its plane lies in a direct line with the transmitting station you wish to receive.

On a very short test outside London the main B.B.C. stations were received at good strength together with several stations in France, Germany,

Spain and Holland. The set is extremely simple to control once the necessary adjustments have been mastered.

UNDERSTANDING THE "SUPER HET"

How Each Valve Functions

As amplification on the short waves is not always as stable as could be desired several methods have been developed to overcome this disadvantage, the outstanding example being that which is incorporated in the "supersonic heterodyne" receiver, popularly known as the "super het," the action of which, in a typical seven-valve arrangement, may be explained as follows:



No. 1, **FIRST DETECTOR VALVE**, receives the broadcast waves at very high frequency and detects them.



No. 2, **INDEPENDENT OSCILLATOR**, mixes the high-frequency impulses from valve No. 1 with its own local oscillations, thus creating a new set of oscillations at a lower or intermediate frequency (longer wavelength). These are passed to



Nos. 3, 4 and 5, **LONGER-WAVE or INTERMEDIATE FREQUENCY AMPLIFIERS**, which amplify the oscillations and pass them to



No. 6, **SECOND DETECTOR VALVE**, which detects the oscillations, transforming them into a series of unidirectional impulses, which are sent to



No. 7, **LOW-FREQUENCY AMPLIFIER**, which amplifies at low or audible frequency and passes the impulses to the loud-speaker.

master rheostat mounted on the panel.

It will be noticed that the same station may be tuned-in at two

RIPPLES

ONE of the leading wireless musical critics is named Wild. Other critics, as is well known, are wild by nature.

THE Irish Free State is relaxing its hatred of everything English. It has condescended to "pinch" our wireless programmes.

THE Barcelona broadcast station, being situate in the Hotel Colon, often comes, we are informed, to a full stop in its programmes.

THE latest novelty in London is a refreshment stall fitted with a loud-speaker. In order to hide the noise made by the new laid eggs, perhaps,

A £50,000 wireless station is for sale. Just the thing for a retired munition manufacturer.

A WRITER says that the range of wireless is getting wider and wider. Evidently becoming converted to the Oxford bags movement.

A FELLOW of the Institute of Linguists has been engaged by the B.B.C. For the benefit of Yorkshire listeners, no doubt.

WE could have understood the Aberdeen lecture on the Natural History of Plants had there been any special reference to barley and hops.

THE sound of a coal-miner working has been transmitted by wireless. Why a bricklayer was not selected for this performance requires no comment.

WE are not surprised to hear that a wireless alarm-clock service is being started. We always thought our neighbour's set sounded something like that.

MEDICAL men say that tightly fitting headphones are injurious. But surely it should be possible to put on specially broad fittings when M.P.'s want to use the set.

LISTENERS around New York, boasts an American, have the choice of nearly fifty programmes. But we still beat them so far as the choice of drinks is concerned.

ONE thing that the home-constructor has to learn, says an expert, is how to drill the glass he uses. Like our sergeant-major used to, by numbers, when standing at the bar of the sergeants' mess.

The Modern Tower of Babel

THE NEED FOR ESPERANTO ?

TO the tireless efforts of those great pioneers of the nineteenth century is due the present efficiency of travel and communication. It is almost impossible to conceive this world of ours without the telegraph and telephone, railways, steamships, aeroplanes, automobiles, printing machinery, and the million and one other labour-saving and wealth-gaining devices of the present day.

No Immediate Welcome

It must not, however, be forgotten that not one of these great inventions was welcomed with open arms, or that its greatness was at once acknowledged or even realised.

Even the youngest among us can remember the ridicule and scorn heaped on our pioneers of aviation, while the obstacles that were placed (almost literally—for example, the red flag !) in the paths of our railway and motor-car pioneers were for long a matter of public shame.

As with these, so it has been with those great minds that have, during the past centuries, devoted their lives to the demolition of the Tower of Babel—that curse of thousands of years and the cause of misunderstanding and strife even down to the present day.

Shadow of the Tower

It is really astonishing to any who pause to think that the world has been content for so long to live beneath the shadow of that Tower with its baleful influence in keeping the nations apart. But this is quite understandable when one considers that until less than one hundred years ago England alone was relatively larger than the whole of present-day Europe, judged from the standard of travel facilities.

So little travelling was done in those days, and so slow also were the means of communication, that

each country developed on its own lines and regarded its neighbours with suspicion.

There was therefore very little, if any, need for an international language, such need being met to a very limited extent by that most difficult of languages, Latin.

With the development, however, of steam, and then electricity, followed by aerial navigation and later by wireless telegraphy, the language barrier loomed larger and larger ; but until the advent of wireless telephony, with its robust daughter broadcasting, the peoples of the world never really came up against this barrier.

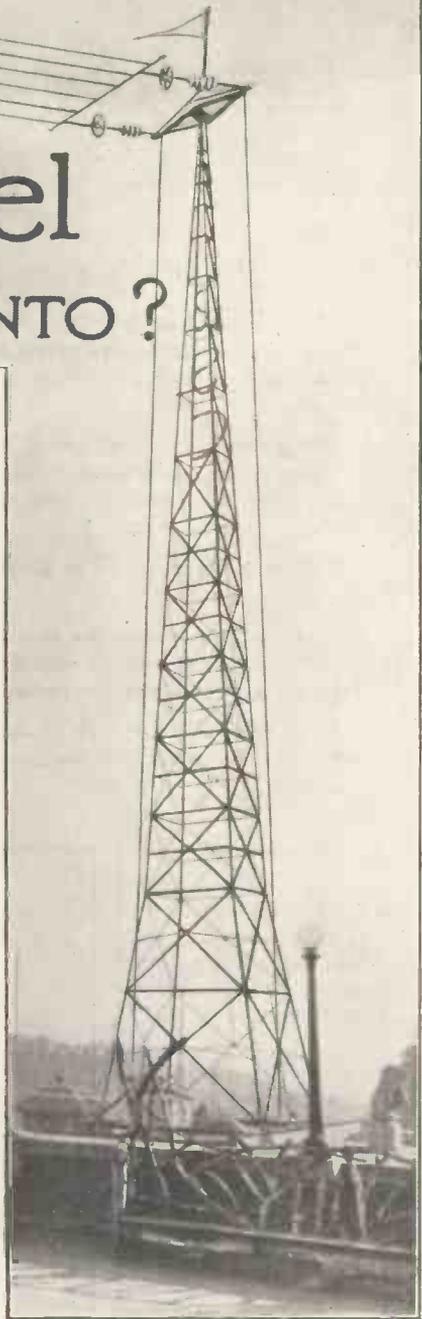
Curse of Babel

Formerly only the comparative few who were wealthy enough to travel, or whose business necessitated communication with foreign lands, felt the need for the solution of the language difficulty ; now the millions who, seated by their firesides or in their gardens, can, by the touch of a magic knob or dial, bring the wide world to their ears, have had the curse of Babel literally brought home to them.

Consider the case of a wireless " fan " who has just built—or bought—a set capable of receiving and sorting out the ever-increasing number of foreign stations. With but slight adjustments he can at will tune-in most of these. Wonderful, isn't it ?

So he thinks at his first attempt ; and is thrilled at the thought that he can hear voices from those strange lands without leaving the comforts of his own home. He probably invites his neighbours—at least those few who have not yet succumbed to its popularity—to share his thrills.

At first he is satisfied at his ability merely to hear and perhaps identify these foreign stations, but



Is the mast of any big broadcasting station a modern Tower of Babel ?

the novelty of hearing without understanding wears off, and he begins to feel that he has spent his money or energy, or both, in vain, and would have been wiser to have remained a humble " crystal-scratcher," content to listen to words he could understand and appreciate.

To come down to brass tacks : If broadcasting is to become truly international in character some means must be found to enable every owner of a receiving set to enjoy not only

Reading Esperanto at Sight

The following passage in Esperanto shows how easy the language is to read.

UNU-VALVA APARATO

UNU-VALVA aparato ordinare konsistas el la jenaj pecoj:—Induktanco iuspeca, krada rezistanco kaj kondensatoro, filamenta reostato, valvingo, kaj taugaj bornoj.

Oni povas aldoni, se necese, pluan bobenon por produkti reakcion, varieblan kondensatoron por akuta agordo, kaj, kiam oni uzas reakcion, trans-kondensatoron.

La cirkvito montrita en la diagramo estas ordinare uzata.

La strio S estas uzata por eligi la reakcian bobenon R. Se oni zorge uzas la reakcian bobenon, oni ne timu, ke oni interferas per radiado.

Estas vere, ke la forto de la signaloj, kaj la riceva trafpozvo estas facile triobligita per zorga uzo de reakcio.

A SINGLE-VALVE SET

A SINGLE-VALVE set usually consists of the following items:—An inductance in some form, a grid leak and condenser, a filament rheostat, a valve-holder, and suitable terminals.

There may be added, if necessary, a further coil to produce reaction, a variable condenser for sharp tuning, and, when reaction is used, a by-pass condenser.

The circuit shown in the diagram is commonly used.

The strap S is used to cut out the reaction coil R. If the reaction coil is carefully used, there need be no fear of causing interference by radiation.

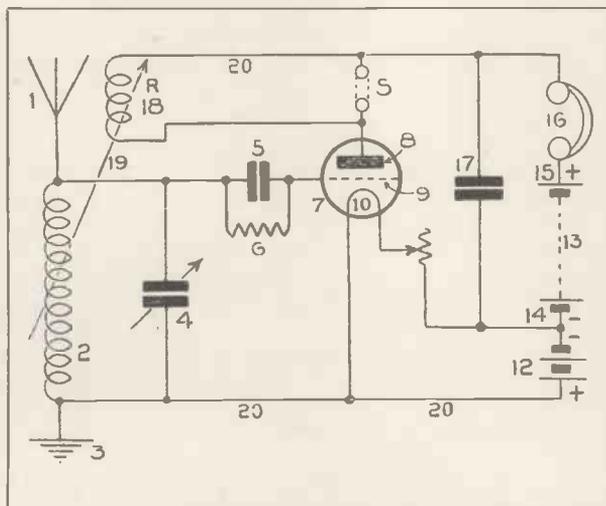
It is true that the strength of signals and the range of reception are easily trebled by judicious use of reaction.

ESPERANTO

is simple, regular and phonetic. There are sixteen rules and no exceptions.

ENDINGS

- Nouns end in O.
- Adjectives in A.
- Plurals in J.
- Adverbs in E.
- Verbs (infinitive) in I.
- Present tense AS.
- Past IS.
- Future OS.



PRONUNCIATION

Vowels:—A as in father; E as in there; I as in pier; O as in pore; U as in poor.

Consonants:—Pronounce C like it is in cats; G hard, as in go; J like j in hallelujah; S as in so. The remaining consonants are pronounced exactly as in English, but there is no Q, W, X, or Y in Esperanto.

VORTARO (VOCABULARY)

- | | | |
|---|---|---|
| 1. Anteno (aerial). | 8. Plato (plate). | 14. Negativo (negative). |
| 2. Antena bobeno (induktanco) (aerial tuning coil). | 9. Krado (grid). | 15. Pozitivo (positive). |
| 3. Tero (earth). | 10. Filamento (filament). | 16. Telefoniloj (phones). |
| 4. Variebla kondensatoro. (variable condenser). | 11. Filamenta reostato (filament rheostat). | 17. Fiksa kondensatoro (fixed condenser). |
| 5. Krada kondensataro (grid condenser). | 12. Filamenta akumulato (filament accumulator). | 18. Reakcia bobeno (reaction coil). |
| 6. Krada rezistanco (grid leak). | 13. Alta tensia baterio (H.T. battery). | 19. Variebla kuplo (variable coupling). |
| 7. Valvo (valve). | | 20. Fadenoj (leads). |

The Modern Tower of Babel (continued)

The Need for Esperanto?

his own local programme, but also those of other lands.

How can this Babel of the ether be demolished? By the adoption of a simple international language, to be used as the *auxiliary* language of every broadcasting station, besides its own national language.

Variety

I have emphasised the word "auxiliary" as I do not wish it to be thought that I advocate the abolition of national languages. It would indeed be a dull world if all nations spoke the one language—variety in this as in other things is the spice of life. But for intercourse with other countries one common language is a necessity.

Which should it be? A "dead" language (such as Latin or Greek), a national language, or a so-called "artificial" language? I think we may safely cut out the first.

A national language—for instance, English? I need only mention that the British Association for the Advancement of Science a few years ago held an inquiry into this very subject and decided emphatically against a national language on the grounds of difficulty and the jealousies which would inevitably be aroused in those nations whose languages were *not* chosen.

No National Language

As recently as April of this year the committee on international language appointed by the International Amateur Radio Congress in Paris was *unanimously* against the adoption of a national language for wireless-telephonic purposes.

Granted that the only course is the adoption of an artificial language, which of the hundreds of schemes outlined during the past century is the one worthy of selection?

One language stands out head and shoulders above all others—Esperanto. As a matter of fact, from the standpoint of number of adherents, of literature, organisation, and practical utility, Esperanto stands alone.

It is the product of one man, Dr. Zamenhof, and not the "spoilt broth" of too many cooks. Neither does it change almost with the

weather. Those who have studied it marvel at its wonderful efficiency, the simplicity of its grammar, and the short time in which it can be learned—a matter of *months* instead of years.

That it is not a mere theoretical project is proved by the existence of a great and growing literature, its use in commerce, science, travel, and every form of international life. Do not imagine, just because the streets are not flooded with electric signs importuning all and sundry to study Esperanto, or because the daily papers do not contain full-page advertisements detailing the many advantages of the language, that Esperanto is as dead as the dodo! On the contrary it is very much alive.

Enormous Organisation

Its organisation can only be described as enormous. Besides the national, district and local societies, there are many specialised bodies catering for scientists, postal officials, railwaymen, Catholics, scouts, vegetarians, churchmen, stenographers, the blind, teachers, policemen, doctors, Freemasons, sportsmen, and others, including even wireless amateurs.

Sixteen great universal congresses have been held, with attendances ranging from hundreds to thousands, every quarter of the globe sending its quota.

Many pages could be filled extolling its virtues and recording its successes. Suffice it to mention that the recent amateur congress above alluded to decided almost unanimously to recommend its study for wireless telephony and telegraphy, and even adopted the language for its own use.

As regards broadcasting, a glance at the "Broadcast Telephony" feature of "Amateur Wireless" will show the extent of its use even now by foreign stations. More than *twenty* stations are at present transmitting regularly in Esperanto, including Radio-Paris, L'Ecole Supérieure, Barcelona, Rome, Vienna, Copenhagen, and Moscow, as well as almost every one of the German stations.

Thus it is possible every evening

of the week, including Sunday, to listen to Esperanto transmissions. Let me say here that it is ideal for telephony purposes on account of its simple vowel sounds.

The King at Wembley

When His Majesty opened Wembley Exhibition last year, his speech was broadcast in Esperanto the same evening from 2 L O, and every word was heard *and understood* in seventeen countries, from Finland to Tunis.

What a glorious prospect does this open up! In a few short years the stations of the world will be linked up by a system of simultaneous broadcasting, similar to our own splendid system but on a much greater scale.

During ordinary programmes local stations may, if they wish to appeal to foreign listeners, announce their items also in Esperanto, but whenever a speech or announcement of world-wide importance is to be made, it will be simultaneously broadcast from all stations, first in the language of the country of origin and then in Esperanto, so that the many millions of listeners may understand and appreciate the transmission without loss of time.

Full Benefits

In this way only will it be possible for wireless-set owners to enjoy to the full the benefits which have been conferred upon humanity by that wonderful and mysterious science, wireless.

ESPERADIO.



LOUD-SPEAKERS have been installed in the club house at a London golf club. This will enable those members who remain in the bar to imagine that they are out on the course.

Now that wireless has become a part of family life, many cynics will suggest that it should cease to be counted as a pleasure.

AN advertiser announces that he has 1,100 valves for sale. He must be the man who described his set to us when we were at Brighton last week-end.

The Danger Fringe

A Story by Lt.-Com. H. W. Shove, R.N., D.S.O.

Illustrated by Charles Crombie

"THE mechanism of thought?" said the Professor of Mental Sciences, blowing a blue cloud into the already hazy atmosphere of the staff common-room. "Yes; most interesting subject. Not very well understood, of course. Still, we make progress every day. You physics men aren't the only ones that do that, you know."

"No," replied the physicist reflectively. "No. But it's as much as a man can do, nowadays, to keep up to date in his own subject. One has to specialise more and more. Look at this business of ether waves, for instance. Thirty years ago practically nothing known about it. Now, hundreds of brains are working at it and nothing else. And we're still only just beginning to explore the field."

"Yes," assented the other, rising and gazing out of the smoke-grimed window over the vista of tall chimneys, the towering masses of the gaunt factories that made up the manufacturing city, whose University, founded by a munificent local iron magnate, gave employment to both their economically useless brains. For neither had enough business sense to make a bargain with a cabman, brilliant though their academic distinctions were. Suddenly the psychologist faced about.

"I wonder," he said, "if there is anything behind what you've just been saying, Marshman. I mean about the field of etheric vibrations, wireless waves, and so on, and your question about the mechanism of thought. Were the two ideas connected in your mind?"

The physicist leaned forward, tapping the ashes from his pipe into the ash-tray on the table before answering. Then he braced himself, as if he had come to a decision, and looked up into the other's eyes.

"Yes, Somerville," he said; "I had thought of the connection. And that was why I asked you the question. For I believe I have hit upon an astounding discovery. But there is, perhaps, great danger. To avert

that danger I need the help of a skilled and trustworthy expert in mental science—in short, of yourself."

Somerville seated himself, resting his elbows on the table, while, chin on hands, he fixed his colleague with steady blue eyes.

"What is it, Marshman?" he said.

Leaning back in his armchair, Marshman stroked his voluminous beard.

"Before I begin, Somerville," said he, "I must ask you to bear in mind what I have just said, and to regard the whole matter as strictly confidential—for the present, at any rate. For should the secret get into unscrupulous hands the results might be terrible. Now let me begin at the beginning. You are probably aware that, in ordinary wireless work, waves of a length down to about twenty metres are used. Some few experiments have been made down to a metre or so, but these ultrashort waves are very difficult to control. Between these wavelengths and those of light and heat, which are the next group whose effects are readily observable, there is an enormous gap. Between the light waves and X-rays, and again, between the latter and radium emanations, there are smaller gaps. Now, the effect of all these groups of waves upon matter is quite distinct. The phenomena which enable us to detect them are widely dissimilar. And, somewhere in the gaps, it is logical to suppose that there must be waves which represent transitional types and even waves having properties quite unlike those of the known groups. We can make apparatus to produce, and to detect, the wireless waves. In a haphazard way we can bring about the emission of light waves. And Nature has provided us with a detector in the eye. Similarly we can produce and detect X-rays. Some experimenters have thought to produce 'death rays,' and so on, by

means of the intermediate frequencies. A few have even guessed that thought energy, which obviously affects the specialised tissue of the brain, might be an ether vibration of an unknown frequency. I have, I believe, proved this to demonstration. The brain is both a transmitter and a receiver of such waves. You are, of course, acquainted with the phenomena of telepathy?"

The psychologist nodded.

"Yes," said he. "They have been pretty conclusively demonstrated, as between certain brains in a peculiar state of record, or under exceptional emotional conditions."

"That is just the point I am coming to," went on the physicist. "The brains must be in accord, the receiver must be tuned to the transmitter, or it is not sufficiently sensitive under normal conditions. As a rule this tuning is carried out by familiar intercourse and constant interchange of ideas, unscientifically and unconsciously. I have not discovered how to do it otherwise. But, as you say, under exceptional emotional conditions, ideas may pass between brains not so attuned. This is what one might expect from analogy with the wireless wave. Very powerful signals can be detected even by an untuned receiver. Under stress of emotion, the transmitting brain radiates more powerfully, the receiving one becomes more sensitive. Now the apparatus which I have produced will 'step-up' the radiation of a normal brain to an extent far beyond that possible to the most powerful brain under the most intense stress of emotion. I have called it a 'thought amplifier.' Such emanations will convey themselves telepathically to all surrounding normal brains. So far the radius of the instrument is not great. But, within its limits, I can, so to speak, broadcast without any receiving apparatus at all."

"I see, Marshman," said Somerville. "But where is the particular danger? Surely evil thoughts could be broadcast quite as effectively by

the ordinary methods, if that is what you fear?"

"Ah, Somerville, that is where I want your advice. I can only say what I believe I can do. You haven't grasped quite what that is. The receivers will be unconscious that the thought comes from without. It will seem to be their own—spontaneous. Under trustworthy control, the nearby receivers will be quite safe. For the transmitted thought will be powerful enough to swamp out their normal mentality entirely. But there will be a fringe—a fringe of interference, so to say—wherein the relative power of the received to what we may call the 'native' thoughts will be gradually diminishing. It is the psychology of this fringe, only partly controllable, that I fear."

"Ah! I begin to see your point, Marshman. What you mean is something like this. Suppose you suggested to a millionaire that he should write a cheque in aid of a hospital, a perfectly good suggestion in itself. If on the 'fringe' as you call it, there were a poor clerk, thinking of putting his money on a horse, the impulse, mingling with this idea, might produce two results. The man might, through the generous idea involved, put his proposed stake in the nearest hospital box. That, of course, would be good. But he might be more affected by the ingredient of reckless expenditure, also, of course, involved and be led thereby to increase his stake. Perhaps beyond his means. That is the kind of thing you mean, isn't it?"

"Precisely, Somerville."

"Well, there is a real danger, I think. You have not yet done any actual transmission?"

"No. I shall be ready by tomorrow evening. I thought of trying on the charwoman, while she is cleaning out the laboratory after the students are gone."

Somerville smiled. "Mrs. Farley?" he asked. "Well, you'll have done a good work if you can inculcate some of the milk of human kindness into that old vinegar bottle."

"Yes. But, of course, for the experiment I must transmit some

thought that involves action. Otherwise I can't be certain of the reception. And there must be an independent observer. You must fill that rôle. I can't use you as the object of the transmission for that very reason. Also because, knowing of the experiment, you might be subconsciously influenced."

"I see that. So you want me to think out a safe idea to put into Mrs. Farley's head? You must give me time to do that."

"Thanks, Somerville. Meet me up in the laboratory about six to-morrow evening, then."



at heart, thought Somerville. Not back-looking in her younger days perhaps. And her voice, shrill and strident now, might have been considered a pleasant tinkle once. Really, he was quite looking forward to seeing her.

He rose, took a step towards the door. Suddenly it was flung open—and revealed the most radiantly beautiful woman he had ever seen!

Intoxicated by the aura of her personality, and feeling that it was entirely the natural and inevitable



Framed in the open doorway stood—the Warden of the University!

About seven o'clock on the following evening, Somerville sat at a desk in one of the ground-floor lecture rooms. He had left Marshman up in the laboratory itself, two floors above, since it was, of course, necessary that the observer of the effects of this new uncanny power should be out of range of the transmitted thought.

Somerville felt vaguely uncomfortable. Twenty-four hours of reflection had opened up to him all kinds of disquieting possibilities. But now, gradually, as he sat waiting, these faded from his mind. He fell to thinking of Mrs. Farley, whose broom could be heard clattering on the landing outside the laboratory door, wherefrom she had just emerged. Not a bad old soul

thing to do, Somerville rushed to her with outstretched arms.

"My darling!" he cried, and in an instant they were lost in a passionate embrace.

"Professor Somerville!"

The amazed ejaculation brought Somerville back from his paradise to the realisation of his surroundings. Framed in the open doorway stood—the Warden of the University!

Confusedly the entangled professor gaped for an instant into that familiar face, whose flanking whiskers—usually mildly drooping—bristled as he had never contemplated the possibility of their doing.

Then, as normal consciousness came fully back, he looked down upon the woman nestling in his arms. An awful chill struck through every

THE DANGER FRINGE (Continued)

By Lieut.-Com. H. W. Shove, R.N., D.S.O.
Illustrated by Charles Crombie.

fibre of his being. For his eyes rested on the rusty, disarranged bonnet, the thin, greying hair, the seamed and doubtfully clean features of—Mrs. Farley!

"Tell 'im to go away, deary," she giggled, with a ghastly contortion of feature which he recognised as an attempt at a roguish wink. With an exclamation of horror, Somerville flung her from him and faced the Warden.

"I—I'm very sorry, sir," he stammered foolishly.

"I will listen to what you have to say later, Professor Somerville," replied the Warden icily. "Meanwhile, Mrs. Farley will please withdraw. Her services will not be required by the University in future. The bursar will doubtless settle with her for work done."

"You wicked man! Oh, you wicked man! A-ruinin' a poor 'ard-workin' widdler's reputation!" burst out Mrs. Farley. "It wasn't my fault, yer reverence—'strewth it wasn't! 'E just come at me and made love ter me."

"That will do, Mrs. Farley. I saw no resistance on your part. The matter is settled, so far as you are concerned."

Mrs. Farley burst into a passion of weeping. "Oh, you viper! You adulterious generation! You deceivin' sheik!" she sobbed. Suddenly she leaped towards Somerville, broom uplifted, making as if to strike.

"Stop!" cried a new voice from the doorway. The whole group turned as into their midst strode Marshman.

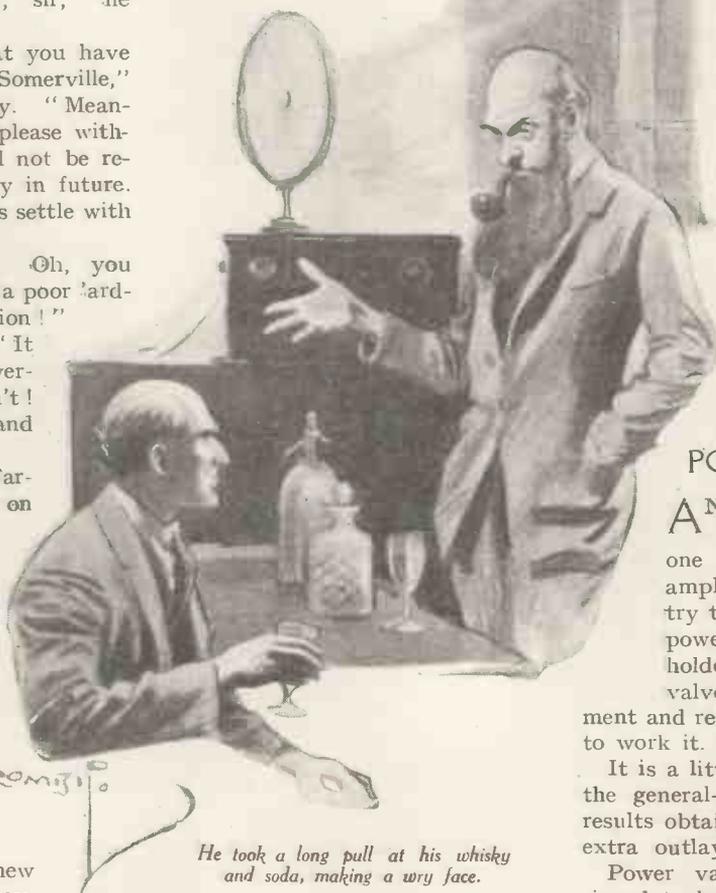
"I can explain the situation, sir," he said, addressing the Warden. "It was merely a little experiment of mine in—er—telepathy. Unfortunately, it has not been wholly successful."

"Obviously not," said the Warden acidly.

"At the same time, sir," went on Marshman, "if any blame is to attach to anyone, if anyone is to suffer for the failure, it should be

myself, not Professor Somerville, still less Mrs. Farley."

"I accept your word for it. The scene I saw was so incredible that, I must admit, I had formed the opinion that Mr. Somerville must have taken leave of his senses." Mrs. Farley



He took a long pull at his whisky and soda, making a wry face.

bridled, but apparently decided that her best line was silence. "As you assure me that Mrs. Farley is also blameless, I will consider the incident closed. But you must undertake not to repeat any such experiment."

"That I gladly do," said Marshman.

Later, in his private room, he repeated his renunciation.

"It'll never do to go on with it, Somerville," he said. "All I did was to suggest to Mrs. Farley, as

you proposed, that she must go to you. You forgot, and I never thought of, the implication such an idea must have to a mind such as hers. And, of course, you got the re-radiation from her passion-distorted brain. You were on that fringe I spoke of. But I'm glad, seeing that the Warden took the right view of the matter and that even Mrs. Farley hasn't lost her job, that the experiment was tried."

"That's more than I am," retorted Somerville. "I kissed Mrs. Farley!" He took a long pull at his whisky and soda, making a wry face.

POWER VALVES

ANYONE who has a multi-valve set with more than one stage of low-frequency amplification should certainly try the effect of using a small power valve in the last holder. The modern power valve has a dull-emitter filament and requires very little current to work it.

It is a little more expensive than the general-purpose valve, but the results obtained generally make the extra outlay well worth while.

Power valves are specially designed to have a long straight portion in the lower part of the characteristic curve, so that loud signals can be dealt with without a trace of distortion. To obtain the best working from a power valve the plate voltage must be high and a high negative potential must be applied to the grid.

All makers supply for their valves tables showing the correct grid bias for use with various plate potentials. The use of a power valve will generally lead to an increase in the volume of sound as well as to an improvement in its quality.

J. H. R.

Broadcast Music of the Month

ALTHOUGH no one will deny the difficulty of pleasing everybody, there is no doubt that the preponderance this last month of classical music in the programmes is having a marked effect in decreasing the number of new licences. I have heard on several occasions that "there's nothing to listen to but talks and tone-poems," and in many homes the set is only used for meal-time music.

Restaurant Orchestras

This is the term applied to the several restaurant orchestras heard during the week, and it must be confessed that there is every excuse for the preference.

Tired of the jazz-band, only really of pleasure to those dancing to its saxophonic rhythm, the average listener turns with relief to those orchestras in miniature which give

Mr. De Groot himself comes of a musical Dutch family, and he taught himself the rudiments of the violin. At his first appearance he attracted the interest of the great Joachim, and to his influence he owed his five years' tuition at the Amsterdam Conservatoire of Music. At seventeen, De Groot was soloist and leader at the Amsterdam Opera House, and at the age of twenty-five, after playing all over Europe, he came to England, where he subsequently became naturalised.

He has been seventeen years at the Piccadilly Hotel and has fulfilled engagements at the big music-halls. He was the pioneer of restaurant music, and also of the small orchestra in broadcasting.

No "Jazz"

From the outset Mr. De Groot has refused to play "jazz." His music



Mr. Norman Allin.

Miss Vera Clarke. The bands of the Hotel Metropole and Holborn Restaurant also furnish tuneful music, while the two best-known cinemas in the town—the new Pavilion at Shepherd's Bush, under the direction of Louis Levy, and just recently the Capitol Cinema, from which were heard Vincent Lopez and his band—are both utilised, though not frequently enough.

A prominent part in the Savoy Band's music is taken by Mr. Billy Mayerl, a famous pianist, and composer too. He is an ex-student of Trinity College and his first appearance was made at Queen's Hall, 1909. Some of his jazz songs are in wide request on both sides of the water.

Opera Singers

There is always a fascination in hearing opera stars sing, whether in their operatic rôles or in the more conventional ballads. During the last month or so we have been fortunate in having many of the British National Opera Company's stars.

For the opening of Daventry, the high-power station, Mr. Norman Allin, who has been well termed the British Chaliapine, was announced. Since the winning of a big scholarship at the age of twenty, Mr. Allin has proceeded from triumph to triumph, and when, in 1916, Sir



De Groot with his Famous Orchestra.

them good, tuneful and familiar works.

For this class of music, David De Groot and his orchestra, eight in all, at the Piccadilly Hotel, have become the most noted, and the alternate Sundays on which they broadcast become outstanding epochs in the programmes.

is drawn from the great operas, the best known and loved composers of the world, and, though some may carp at the artistic licence taken now and then, his success is indubitable.

During the afternoon performances most listeners rejoice in the Trocadero Orchestra, which is led by a clever musician and conductress,



Mr. B. Mayerl.



Miss E. Kelly-Lange.



Mr. Percy Edgar.



Miss M. Stotesbury.



Mr. Samuel Kutcher.

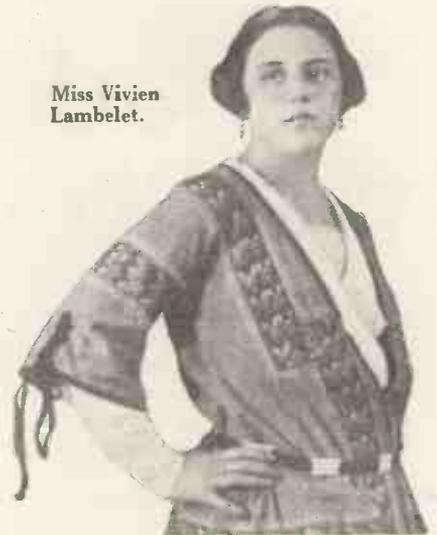
Thomas Beecham heard him, he immediately engaged him as principal bass at Covent Garden and Drury Lane. He makes one of the finest Hundings, in Wagner's *Valkyrie*, possible.

Favourite artists on tour are Andrew Shanks and William Heseltine. They gave last month, with Miss Eda Bennie, a fellow-member of the B.N.O.C., another performance of Holst's opera *Savitri* at the Cardiff Station.

A Scottish Bass

Mr. Shanks is a Scottish bass, and his first important engagement was with Oscar Hammerstein at the then London Opera House in Kingsway (now devoted to the cinema), singing in Holbrook's *Children of Don*.

Mr. Heseltine, the tenor, won the gold medal at Olympia when only twenty-one, and since then has studied under De Reszke. He is especially fine in oratorio work, and



Miss Vivien Lambelet.

Messiah, in which the 'cello parts are particularly dull and uninspiring. When Mr. Fuchs left the Hallé Orchestra he congratulated himself at having got rid of this annual task



Miss Alice Vaughan.



Miss W. Ascott.



Mr. W. Macready.

also in certain songs, such as "Lorraine," which he recorded for the Columbia Company with magnificent effect.

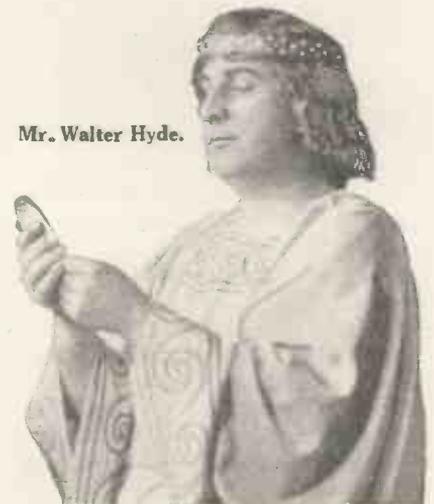
Mr. Walter Hyde, too, is one of the best known of operatic broadcasters, and it is safe to say can undertake over forty rôles in character, making each one a *tour de force* in impersonation as well as in vocalism.

A tremendous variety is exercised in making the instrumental part of the programmes, and really there is not so much room for grumbling on this score. The choice of work is the difficulty. A great favourite, especially at Newcastle, is Carl Fuchs, the 'cellist. He was for many years principal 'cellist of the Hallé Orchestra, Manchester, and he tells a good story against himself.

Chief Annual Event

The chief annual event, as we all know, is the performance of Handel's

Alas, when imprisoned in Ruhleben Camp for three months, during the war, his first task was a performance of *The Messiah*, with 'cello parts as usual! Thus do some people's wishes come true.



Mr. Walter Hyde.



De Groot.

permanently attached to the B.B.C. orchestra.

Other instrumentalists who have been heard frequently are Miss Mercia Stotesbury, a brilliant violinist, Mr. Gordon Bryan, the classical London pianist, and the Irish violinist, Miss Edith Kelly-Lange. An interesting performance was her broadcasting an all-Irish programme from Manchester. Included in her scheme was Sir Hamilton Harty's Irish Fantasia, which is dedicated by the composer to the late Arthur Griffith, the first President of the Irish Free State.

An Irish Violin

A noteworthy point, too, is that Miss Kelly-Lange used a violin actually made in Dublin by Mr. E. Green, who has kept the art of violin-making alive in Ireland.

Miss Kelly-Lange has not only played at the Belfast Station and Manchester, but also in London, and

An instrument which broadcasts surprisingly well is the oboe, and this is especially the case when in the hands of Mr. Leon Goossens, who is a brother of the well-known



Miss P. Norman-Parker.



Mr. W. Heseltine.



Mr. Leon Goossens.



Mr. Vincent Lopez.



Mr. Julius Harrison.



Mr. Gordon Bryan.

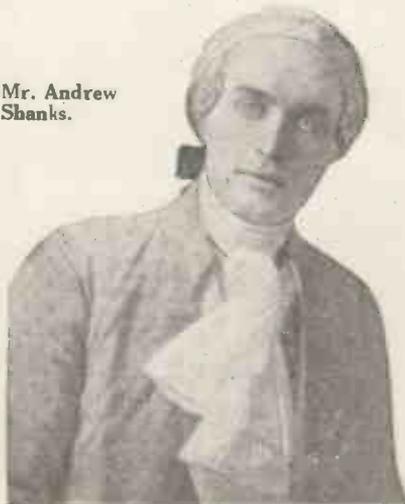
composer and conductor, Mr. Eugene Goossens. The whole family may be said to be well known over the ether, for the sisters, Miss Sidonie and Miss Marie Goossens, are harpists, Miss Sidonie Goossens being

some of her records are particularly good. It is a tribute also to her tone that she has been engaged for the musical demonstration in the Lee de Forest phonofilms, which have been shown at the Tivoli since their first production.

The drama, too, is surprisingly popular, and when one considers the work done at Birmingham under the direction of Mr. Percy Edgar, the station director, it is not difficult to admire the work of the Stations Dramatic Company. One of the earliest plays was Sheridan's *School for Scandal*, and its success, mostly due to Mr. William Macready and his charming wife, Miss Edna Godfrey Turner, led to some of the most difficult plays being successfully broadcast, amongst them *Under Two Flags*, *She Stoops to Conquer*, and *Caste*.

The secret lies in the fact that both Mr. Macready and Miss Turner

(Continued on page 199)



Mr. Andrew Shanks.

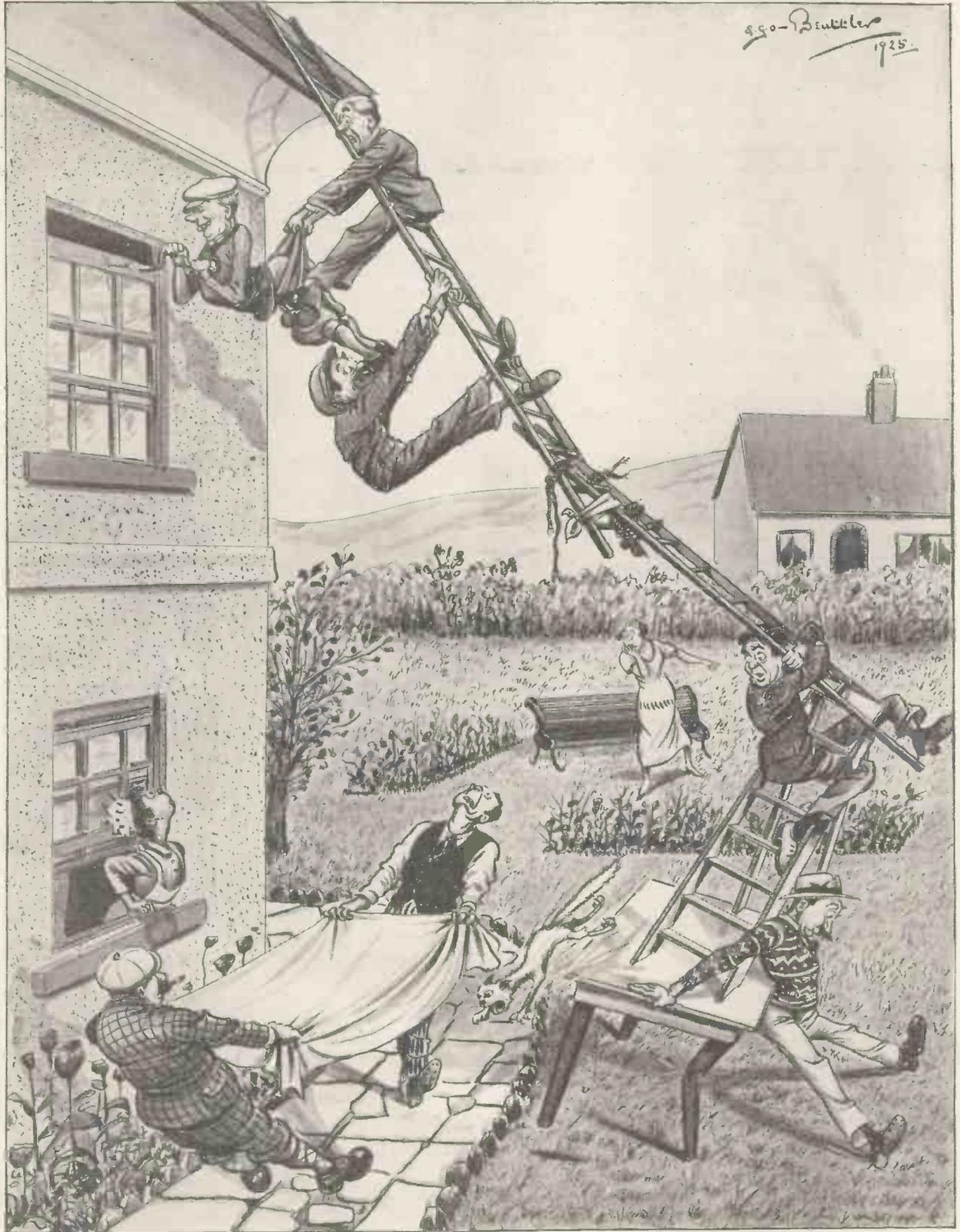


Miss Edna Turner.



Mr. Carl Fuchs.

Fixing that Lead-in Insulator!



How to Prepare Your Panels



THOSE who do not possess wood-working tools and who have no inclination to make their own cabinets can buy any conceivable shape and size in a state ready to fit the panel. The panel is not the least expensive part of a set if guaranteed material is used, as it should be. It can be easily spoiled by errors in marking out and drilling, and careless handling may mar it for life. However, these few notes may save some ebonite from becoming scrap.

Panels

Panels may be bought already cut to size and truly square, but to get what one wants it is sometimes necessary to accept a piece that has been roughly cut from the sheet, or a broken panel may need squaring up afresh to a new size.

The tools which are essential, in addition to the usual light hammer, screwdriver, and hand-drill, with an assortment of drills say from $\frac{3}{32}$ in. by 64ths to $\frac{1}{4}$ in., are a hack saw, a centre punch, and some form of scribe, together with a 12-in. steel rule or its equivalent.

A steel rule is advisable, as it can be used as a straightedge as well as measuring instrument. A taper rimer which will enlarge holes slightly is to be recommended.

Hack Saw

If these tools are not already in the amateur's workshop and have to be bought, it should be remembered that a hack-saw frame will be very much limited in its service if it is too small.

It is better to spend the shilling or so extra and obtain an adjustable frame, which will take blades from 8 in. to 12 in. It will make you independent in the matter of size of blade.

As to the saws themselves, don't choose too fine a setting. For general



Fig. 1.—Driving the Drill-brace just when the Drill is emerging from the other side and is likely to "grab."

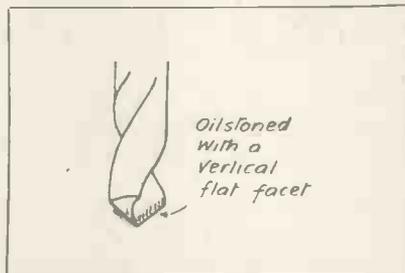


Fig. 2.—Twist Drill, ground to prevent "grabbing" in soft materials.

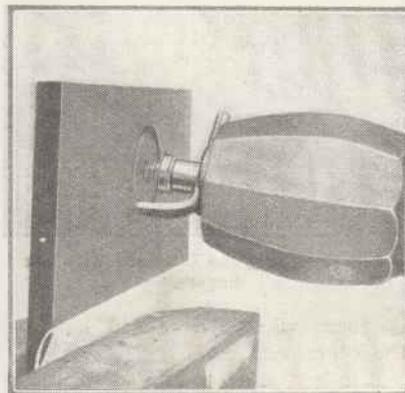


Fig. 4.—Making the window hole with a Carpenter's Brace.

wireless work I like blades with a tooth pitch of about 18 to the inch.

In handling a hack saw, take firm straight strokes. The blades are very highly tempered compared with an ordinary woodworker's saw, and therefore will not stand the slightest twist while being held in a cut—one "kluk" and a new blade is required.

Keeping the Blade Straight

It is just as important to keep the blade in quite a straight path in withdrawing it from a deep and partly finished saw-cut as in the forward cutting strokes.

With regard to drills, the straight-shank twist drills are the most easily obtained, and are the most generally useful. Being designed for working on the harder metals, iron and steel, they have their peculiarities when it comes to drilling soft metals, and "cheesy" substances like ebonite and wood.

In soft materials they are apt to "grab," that is, tend to take a larger cut than they should do, or to deflect from the straight line and bind in the work. This tendency is more noticeable with the highest grade of twist drills, and is at all times present in drilling thin material.

Avoiding "Grabbing"

Just as the drill is emerging from the other side of the material, nine times out of ten it will grab. So long as it is thoroughly tight in the drill chuck the drill may be got through successfully by driving as shown in the photograph (Fig. 1).

Twist drills are also very easily deflected from their course by the presence of hard or soft spots in the material. The same thing occurs if the drill crosses other holes in its path.

Avoiding anything which is not solid material, temporarily plugging up holes which have to be

HOW TO PREPARE YOUR PANELS Drilling Holes and Cutting Valve Windows—(Continued)

crossed, holding the drill tightly in the chuck and working steadily with the hand brace, are the main preventives of serious trouble.

I have also found that the grabbing tendency in soft materials can

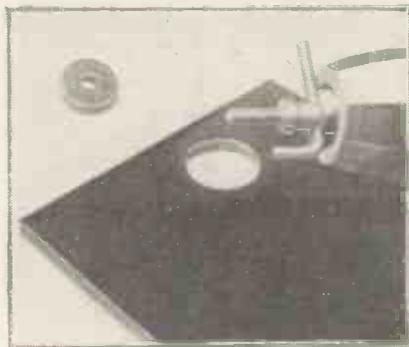


Fig. 5.—The Fin-drill in the brace and the finished hole.

be mitigated by oil-stoning the drill point with a slight vertical facet, inside the twist-groove, as shown in the sketch (Fig. 2).

Cutting Valve Windows

In considering this drilling question, as you may be making up a set which has the "behind panel" arrangement of valves, you may hesitate, and rightly so, before purchasing a large twist drill to cut the circular holes for the valve windows.

A large twist drill is an expensive item, while a carpenter's boring bit, which might be used, is a rather barbarous instrument for the job, and its use might result in a failure.

Personally I got over the trouble by making a "pin-drill" (the right tool for the job) out of a heavy terminal and a stout nail. The shank of the nail should be a tight fit in the terminal tag-hole. The head should be sawn off and the nail bent as shown in the sketches and photographs (see Figs. 3 to 6).

Firm Fixing

To make it quite firm in its fixing, the top of the nail should be filed with a flat on it to take the pressure of the terminal screw which secures it. The projection of the cutter downwards should not exceed $\frac{3}{16}$ in.

This improvised cutter did the work quite well, as is shown by the result illustrated in Fig. 5. It can

be held in the brace, but should the available tool—I used a carpenter's brace—not be of sufficient capacity, I may mention that I cut a very respectable hole in a sheet of $\frac{3}{16}$ in. ebonite with the same cutter, operating it by the fingers as shown in the photograph (Fig. 6). Of course, the job took a little longer to accomplish, but the results were equally good.

Preliminary Hole

A preliminary hole of the same diameter as the screwed shank of the terminal is necessary in the panel, and if the work cannot be held in a vice (or its equivalent), there must be a hole in the wood or bench on which the panel is supported.

When half-way through, the panel

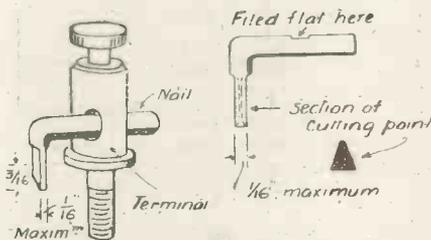


Fig. 3.—Improved Fin-drill for making holes for valve windows.

must be reversed and the hole finished from the other side. Do not attempt to cut right through at once,



Fig. 6.—Using the Pin-drill with the fingers.

or there will be a ragged hole on the other side.

Another point worthy of mention is that the cleanest hole made by this cutter was obtained in a panel

of the best quality—a Radion. That made in a cheap ebonite substitute turned out much rougher.

Should the set involve the cutting of any slots for switches, these are best made by drilling a row of holes

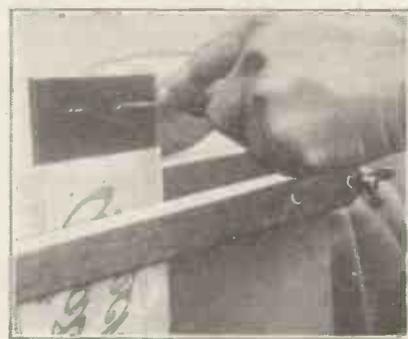


Fig. 7.—Cutting a Slot, showing the holes being drilled close together.

as close as possible together and then breaking through the thin dividing wall with a penknife, chisel, or other small sharp tool (see Fig. 7).

Minding the Surface

Be careful, in doing this work, not to damage the surface, and do not rush the job. The holes should be slightly under size, drilled say $\frac{5}{32}$ in. for a $\frac{1}{8}$ -in. wide slot. This will tend to prevent the slot being made over-size.

A thin flat file can then be got into the rough slot, as shown in Fig. 7, and the points between the drilled holes dressed to a level surface.

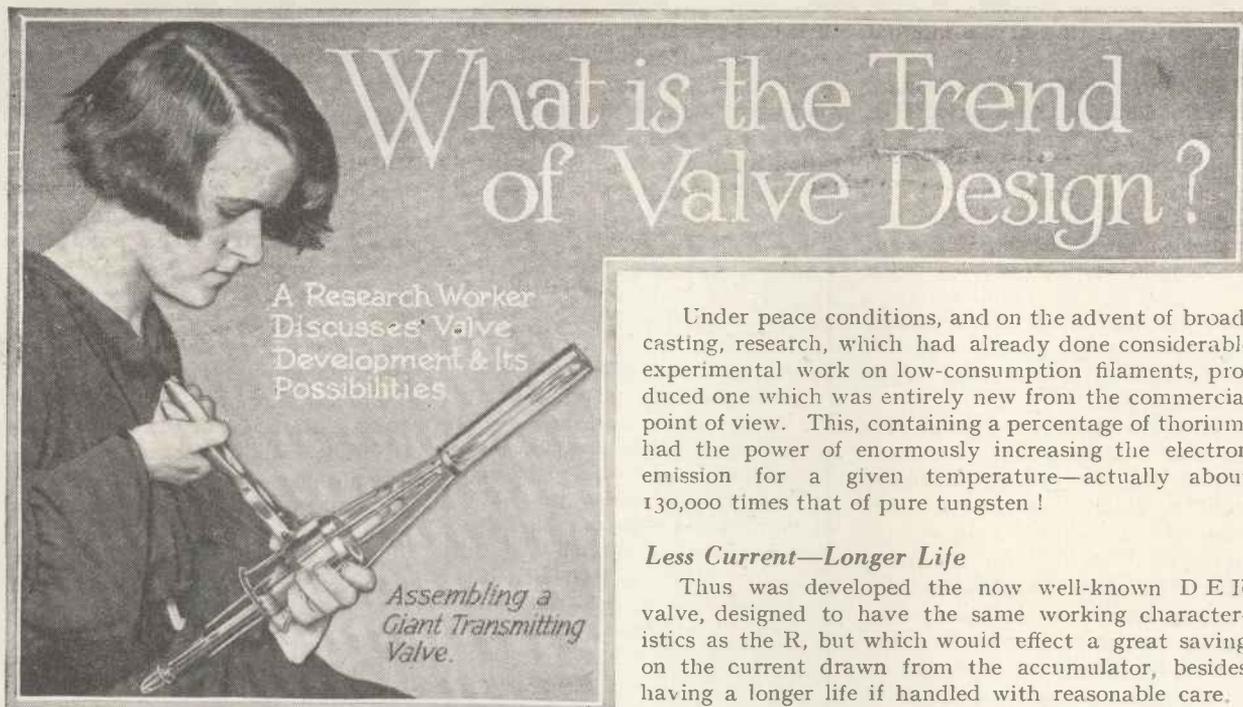
Squares and Centre Punch

With regard to the square that is necessary to truing up a panel, if your other uses for a tool of this kind is for wood-working, then choose a carpenter's 6-in. or 8-in. square. This has a wooden stock and a wide steel blade. The engineer employs an all-steel square, which in the bigger sizes may be an expensive tool. For amateur wireless purposes a 4-in. steel square of ordinary and not precision quality is good enough.

Obtaining an eight centre punch is only a matter of pence, while a stout knitting needle or any other tool steel pointer, sharpened up to a keen point or a knife edge, will suffice for a scribe.

HENRY GREENLY.

(To be continued)



A Research Worker
Discusses Valve
Development & Its
Possibilities

Assembling a
Giant Transmitting
Valve.

LET the reader attempt to imagine a world suddenly bereft of broadcasting. No doubt we should find some substitute for evenings spent with the phones or loud-speaker, but the thought of a million broadcast licence-holders gives an idea of the extent of the spread of the "wireless germ." Yet broadcast wireless telephony is still an infant barely three years old, so who can foreshadow the position of broadcasting at the time when this infant attains its majority?

War-time Developments

During war-time experiments it was considered an immense achievement that conversation could actually be carried on with an aeroplane flying overhead. The secret lies, of course, in the thermionic valve—without it, telephony transmission would be practically impossible and amplification of received signals most unsatisfactory.

At the close of the war there were about three general types of receiving valves manufactured—the R, V 24, and Q, and all these retain their popularity to-day, although being rapidly superseded by their low-consumption counterparts.

No Specialised Telephony Valve

Up to this time valves had only been used by the Government, certain commercial wireless-telegraphy concerns, and a small band of amateurs for receiving and transmitting morse signals, and very occasional telephony—there was thus no demand for the specialised telephony valve of to-day.

Speaking generally, valve development has since proceeded along two definite lines: (1) The production of a type which makes for economy, both in the drain on accumulator supply, and in replacements after expiration of life. (2) Special design of the electrodes to give the best possible results for definite purposes in the receiver.

The first requirement may be now said to be met adequately by the dull-emitter valve.

Under peace conditions, and on the advent of broadcasting, research, which had already done considerable experimental work on low-consumption filaments, produced one which was entirely new from the commercial point of view. This, containing a percentage of thorium, had the power of enormously increasing the electron emission for a given temperature—actually about 130,000 times that of pure tungsten!

Less Current—Longer Life

Thus was developed the now well-known D E R valve, designed to have the same working characteristics as the R, but which would effect a great saving on the current drawn from the accumulator, besides having a longer life if handled with reasonable care.

The advantages of this were at once apparent, and from that date different valve manufacturers began to supply all their newer types with this low-consumption filament, and they were called "dull-emitters."

At this stage it was realised that to obtain the best results in a receiving set the ordinary general-purpose valve was entirely inadequate, and when the loud-speaker was introduced and used in greater numbers, it was noticed at once that results using general-purpose valves in the low-frequency amplifier gave very unpleasant results, music and speech being decidedly "tinny." A new type of valve, therefore, began to appear, having a much lower internal resistance than the former patterns. It was termed a "power" valve.

What a Power Valve is for

At this point it might be mentioned that the word "power" valve must not be taken as an indication that when used in, say a one-valve amplifier, results will show much increase in volume—indeed, if an R and L S 5 be interchanged in a single-stage amplifier, probably little, if any, difference would be noticed. But take the R and insert it in the second and third stage of L F amplification, and it will be an exceedingly difficult matter to get satisfactory results.

A special type of power valve, having a very low internal impedance, is now in general use as the amplifier at the telephone repeater stations of the G.P.O. for use in long-distance telephone lines.

There are one or two points connected with valve design which usually arouse interest. The first of these is the nature of and reason for the silvery appearance of the glass bulb, now becoming so common.

This is a distinctly recent development, and is caused by the necessity for dull-emitter valves to have a particularly "hard" and lasting vacuum. It is simply a deposit of magnesium metal on the inside (occurring as a final stage of exhausting the valve), and has the effect of "cleaning up" the last trace of air which may remain in the bulb. It is *not*, as has

sometimes been suggested, a means of preventing a view of the internal construction.

Two terms used by the manufacturers to describe the behaviour of any valve are "impedance" and "amplification factor," and these are not always clearly understood. It is, however, a good plan to pick out a valve having a low impedance for L.F. amplification, and one with a high amplification factor for H.F. work. Various other requirements arise for a good detector, but to explain these is beyond the scope of this article.

It appears, therefore, that at present valve development is following along the lines of public demand, and so let us see how the two main classes of broadcast listener are catered for. As Captain Eckersley of the B.B.C. has remarked, there is a certain section of the community who are out for miles, and are never satisfied till they have that elusive distant station at good strength in the phones.

Now it is obvious that the several stages of H.F. necessary to attain this can never give satisfactory results with ordinary four-pin cap valves, owing to capacity losses on the comparatively short broadcast wavelengths. For this purpose valves of the tubular type, such as DE V and DE Q, have been developed to meet the needs of this particular section.

The remainder of valve-set listeners are perfectly content with the programme turned out by their local station, their chief aim being to

receive this with the utmost purity on their loud-speakers. We may fairly safely assume that this second section of the public is the one which will increase in numbers, for two reasons—first, it is well known that amplification of weak signals invariably brings in undesirable Morse and

reproduction with a fair amount of certainty, a form of audio-frequency amplification known as resistance-capacity is now being more and more widely employed, and to meet this need also a suitable valve is called for. As is well known, in this method the whole of the voltage step-up must take place in the valve itself, there being no intervalve transformers used. A valve called the DE 5 B, a modification of the DE 5 type power valve, was therefore developed, which has characteristics suited to this work.

Still another possible development of the future lies in the use of four-electrode valves, for use in dual-amplification circuits. A certain amount of experimental work has been done on valves of this type, resulting in the first dull-emitter four-electrode valve being put on the British market, namely, the DE 7.

Summing up, therefore, we can see clearly that the trend of research in valve design undoubtedly points to the perfection and universal adoption of the dull-emitting filament—or, perhaps more accurately, the low-current consumption electron-emitter. Experience having proved that the dull-emitter is in no way behind the bright valve as regards results in a receiving set, it is certain that the day of the latter is passing with all its attendant current extravagance and inefficiency. Who can tell what the future will bring if we have arrived at our present state of development in a little over two years?
F. E. H.

DO YOU WANT TO BUY A SET?

We shall be glad to advise you as to which types of sets are the best for your personal use.

Tell us how much, roughly, you wish to spend; where you are situated; what stations you wish to receive; whether you intend to use phones or a loud-speaker, and we will advise you as to the general lines of sets that will answer your purpose.

Send your enquiry with coupon (p. iii, cover) and stamped addressed envelope to—

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THE WIRELESS MAGAZINE,

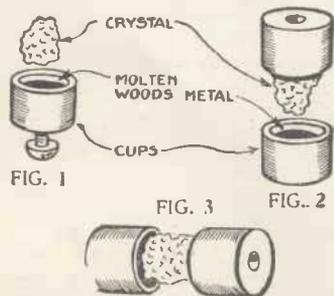
La Belle Sauvage, E.C.4.

atmospheric interruption; secondly, the advent of simultaneous broadcasting, whereby the best in the programmes can always be obtained from the local station, and the erection of the high-power station which transmits an alternative programme on specified days, should supply all needs.

In order to obtain this purity of

MAKING A PERMANENT CRYSTAL DETECTOR

FOR use in reflex circuits, and for experimental work generally, a



Figs. 1 2 and 3.—Various Stages in Construction.

crystal detector that is permanently adjusted will be found very convenient. A simple type can be made as follows:

Melt a little Wood's metal into a crystal cup, being careful to fill up the screw holes, and place a longish piece of crystal in it (see Fig. 1).

Then take another crystal cup, melt some more Wood's metal into it and place the mounted crystal in this as indicated by Fig. 2. A view of the crystal mounted is shown by Fig. 3.

The two cups can be mounted as

shown in Fig. 4. The result is a permanent detector that gives good results.

J.R.S.

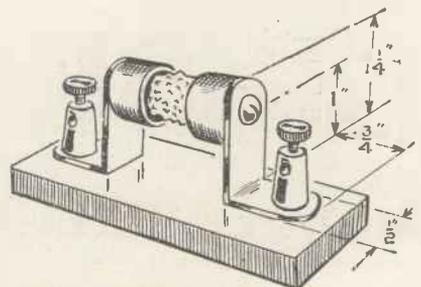


Fig. 4.—Sketch of Completed Detector.

LISSENIUM

Silence

for those distant stations!

MANY listeners would like their local station to close down so that they might search for distant stations without interference. That is, of course, quite out of the question—and certainly most unnecessary, too.

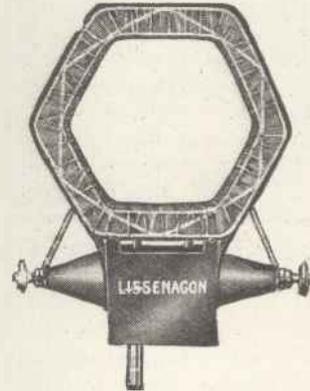
With LISSENAGON "X" COILS, distant stations can be tuned in without the slightest sign of interference, just as though the local station had actually closed down, in fact.

Readers of this magazine who wish to make their receivers highly selective should write for interesting leaflet describing the many uses of LISSENAGON "X" COILS. In many cases no alteration is necessary to a receiver, in others the alteration to wiring is a matter of a moment. Those interested in Neutrodyne and Reinartz circuits, wavetraps, etc., should also have a copy of these particulars of LISSENAGON "X" COILS.

A TEXT BOOK OF LISSEN PARTS will also be sent free on request. It contains a fund of useful information which will be of interest to all readers of this magazine.

In all cases where Standard Coils are required, Experimenters who are only satisfied with the most efficient—

USE LISSENAGON COILS—
the coils which intensify tuning.



LISSENAGON "X" COILS

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No. 60	6/4
No. 75	6/4
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LISSENAGON "X" COILS

are interchangeable with the standard LISSENAGON and other standard coils, and although the tapings make them suitable for special purposes, they are in other respects similar to, and can be used as, standard coils.

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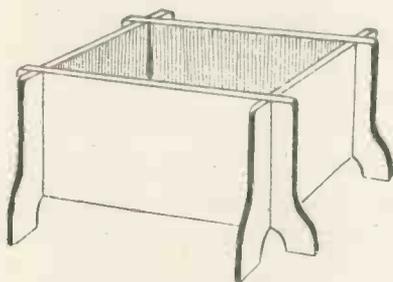
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Liverpool Children's Band Broadcasting from the Liverpool Station.

MAKE YOUR OWN CABINETS

ANYONE who possesses a fret-saw can easily construct a neat cabinet suitable for a small receiving



A Completed Box.

set. Obtain a piece of $\frac{1}{4}$ -in. or $\frac{3}{8}$ -in. fretwood and mark out on it the four sides of the box similar in design to those shown.

The dimensions should, of course, be made to suit the panel of the set itself.

After cutting the pieces to shape they should be carefully glass-papered in order to remove any roughness, and then fitted together to form the box as shown in the diagrams, which show boxes for horizontal and vertical panels respectively. A little glue or secotone may be applied to the joints, although if these are a good fit no fixing medium will be necessary.

Any special shade or colour may be given to the completed box by means of stain obtainable ready mixed at most colourmen's or fretwood dealers, while a final coat or two of shellac varnish will preserve the wood from dampness.

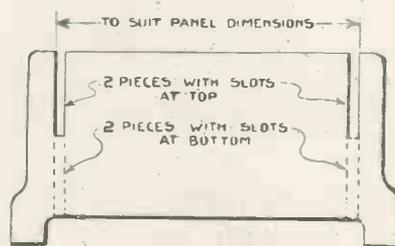
If it is desired to have the panel flush with the front of the cabinet fillet pieces may be fitted into each corner of the cabinet. These will also serve to strengthen the joints.

R. N. W.

USEFUL INSULATING WAX

DURING the course of constructing a set it often happens that a hole is bored in the panel in the wrong place. If left the hole looks unsightly and spoils the look of the finished article.

By the use of a good insulating wax, however, the hole may be



Details of Sides.

filled up and made quite invisible. Such a wax is made up as follows: Mix equal parts of resin and bees-wax and boil them in an old can. While the mixture is still in liquid form add a quantity of black dye.

When set the wax is ready for use. Apply the wax to the hole to be filled with an old knife which has previously been heated. The wax will set almost immediately and the panel will be restored to its former appearance.

M. C.

FAIRY GOSSIP

FAIRIES don't dance upon the green
This year, or so 'tis said,
Because the Fairy King and Queen
Are "listening-in" instead.

The harebells are so very proud,
As you can understand,
Because, you see, they are the loud-
Speakers in Fairyland!

LESLIE M. OYLER.

A TRUE STORY

DAD: "There is an awful lot of jamming on to-night."

MOTHER: "What is jammin'?"

SMALL SON: "Pots!"

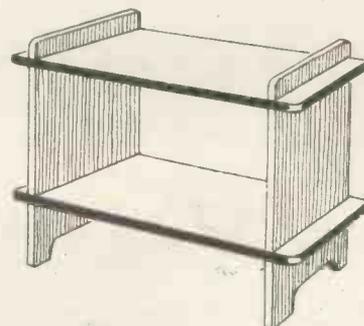
C. J. R. (Southall).

USING BELL WIRE

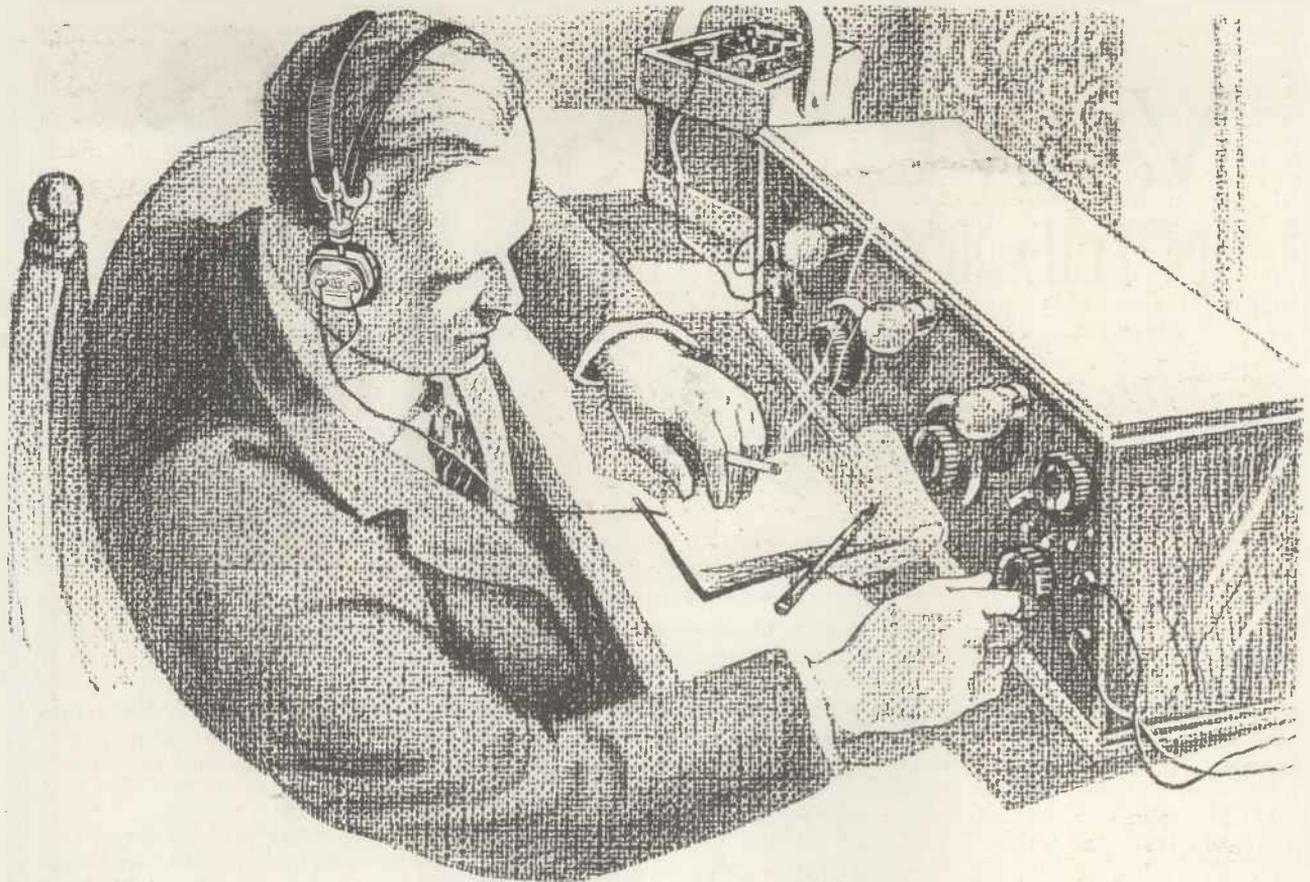
BELL WIRE is commonly used nowadays for making connections and battery leads.

Care should, however, be taken to ensure that the inside rubber insulation is not perished, as if it is no end of trouble will be experienced with the set on which the wire is used.

T. M. Q.



Another Type of Case.



'Matched Tone'
TRADE MARK
Headphones



20'



Table-Talker
TRADE MARK

42'

British Manufacture. (B.B.C. stamped.)

All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This really means a free trial.

Bill, Senior, deftly whirled the dials with the hand of a master. Now a complete circular movement, now carefully "feeling" over a sensitive spot. Sometimes an exclamation of annoyance, and finally, a grunt of satisfaction. With the help of his Brandes that almost indistinguishable tinkle of a distant station which was nearly eluding him swells to clearly defined volume and clarity. Bill sighs with satisfaction and thinks how much pleasure the *Matched Tone* receivers have continually given him. Always it is the same. He knows that Brandes bring every possible distant station within range of his set with unfailing accuracy. *Ask your Dealer for Brandes.*

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VALVE SETS IN THEORY & PRACTICE

What the Valve Does and How It Does It



THE valve in a wireless set, in addition to any other functions it may perform, acts as an electrical relay—it imports local energy to do what distant energy picked up by the aerial is no longer powerful enough to perform. Let us proceed, quite unscientifically, to get a notion of what a valve is, and how it comes to possess this relay action.

Valve Electrodes

If you examine any valve you will see that inside its globe are three separate metal parts. The innermost of all is the filament, rather like that of any small electric lamp, and capable of being lit up, or at least heated to redness, by connecting its terminals to a four- or six-volt accumulator (for a bright-emitter valve), or to two or three series-wired dry-battery cells if the valve is a dull-emitter.

To find which are the filament terminals or pins of either kind of valve, turn it over and look squarely upon the bottom of the valve cap. You will see the four valve pins mark out the long and short arms of an imaginary cross (Fig. 1). The two valve pins which mark the short arms' extremities are the filament terminals.

The Grid

Encircling the filament is a spiral, called the "grid," made of hard black (molybdenum) wire. It is connected to the pin on the valve base that marks the top point of the cross, while outside the grid again, and quite separate from it, is a metal tube, usually made of nickel. This is called the "plate," "sheath" or

"anode" of the valve and is connected to the pin marking the bottom of the imaginary cross on the valve cap.

Though the filament has two terminals, so that it may link up to make a complete electrical circuit like the

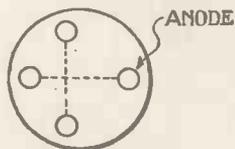


Fig. 1.—Cruciform Arrangement of Valve Pins.

filament of any other electric lamp, the grid and anode have only one terminal each. Moreover, for the purposes of wireless nomenclature, the filament and its two terminals are not regarded as more than a single

The first of three on valves and valve sets, this article is a continuation of our "Absolutely for the Novice" series by Colin Bennett.

The author explains in simple language what a valve is, how it works, and how signals are reproduced.

electrode, so that the valve is called a "three-electrode" valve.

The action of a valve is very intricate, but an attempt will be made here to give a simple common-sense outline of the way it works.

If the filament of any electric lamp is heated to incandescence by the passage through it of an electric current, an emission of electrons takes place from the filament's surface. Electrons are minute corpuscles of matter so small that thousands of

them go to the composition of a single atom of substance; indeed, it has been estimated that, were a piece of matter an inch or two large magnified to the size of the world, the atoms going to make it up would even then only be about the size of "shot."

Filament Life

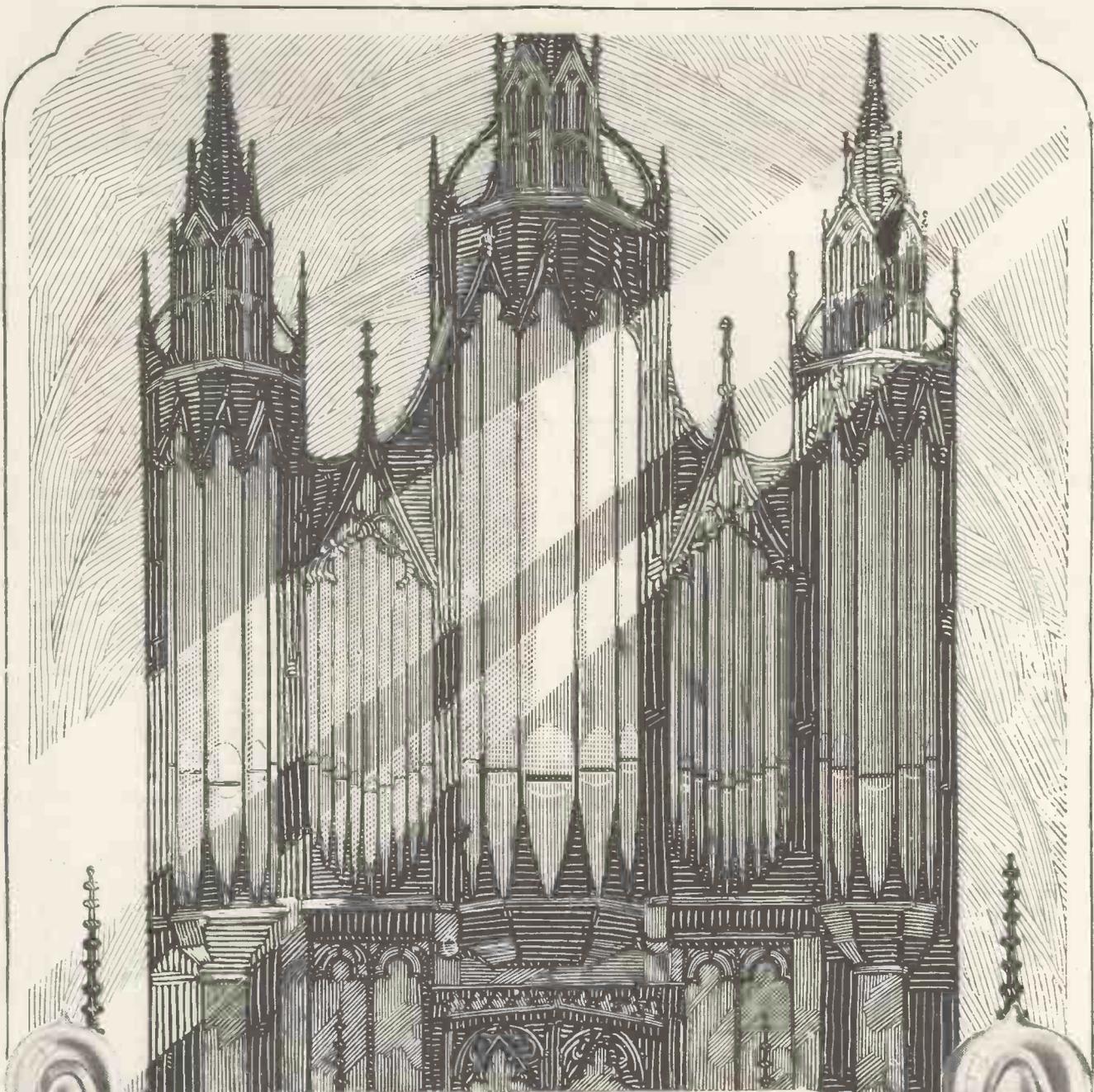
So there need be no great cause for surprise that, even with rapid electron emission going on from the surface of a glowing electric-lamp filament, it takes months of burning life before the filament has become disintegrated to the point of breakage.

In any ordinary electric lamp electron emission occurs in any and in all directions round about the filament, and no practical use is made of it. In a wireless valve that very emission of electrons, and not the light given out from the filament, is what is made use of. For this purpose means are taken of directing the path along which the electrons shall travel. This is done by the valve sheath.

Loosened Electrons

If any electric battery is connected up between the sheath and the filament of the valve, the negative terminal of the battery going to the negative filament terminal, and the positive battery terminal going to the sheath terminal, then so long as the valve filament remains cold no current will flow from this sheath battery, because there is a gap, or break, in the electrical circuit within the valve itself. But turn on separate current from another battery into

(Continued on page 184)



A demonstration of the new Cossor Loud Speaker Valve—the W.3—will instantly recall to the mind of the listener the majestic grandeur of the church organ. Such mellowness of tone, volume and clarity marks a new era in Loud Speaker reproduction and is destined to exercise a significant influence on broadcast reception in the future.



Cossor W.3
Loud Speaker Valve
Filament Volts - 1.8
Consumption .5 amps.
Price 18/6

Cossor Valves

Cossor P.3
Loud Speaker Valve
Filament Volts - 4.5
Consumption .2 amps.
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VALVE SETS IN THEORY AND PRACTICE—(Continued)

the filament to make it glow, and electrons become loosened from the surface of the hot wire.

These are negatively charged and, the sheath of the valve being positively charged (from the sheath battery), the negative electrons become attracted to the sheath (or plate) and, moving towards it, throw themselves against it and so give up their negative charges.

In doing so they carry over the gap a very small but none the less definite amount of current from the sheath battery and thereby set up a slight current flow across the space between filament and sheath.

Direction of Current Flow

At this point, those of us who have been accustomed to regard electricity as flowing always from the positive to the negative terminal of an electrical circuit will probably begin to feel something is wrong with the explanation. In wireless circuits the simple way is to regard electrical flow as going from negative to positive, while those who wish to follow matters a little deeper may bear in mind that, electrons being negatively charged corpuscles of matter, an electron current will necessarily flow in the opposite direction from that attributed, in the ordinary way, to current passing along a closed metallic circuit.

The Action of the Grid

Meanwhile, what of the grid? What does it do? The grid's position is intermediary between filament and sheath. Its situation, therefore, would presumably entitle it to exercise some sort of control. This control is effected by its own independent state of electrical charge. If the grid were to remain uncharged it would exercise no appreciable influence upon the electron flow between filament and sheath. As a matter of fact it never does remain uncharged.

Charge the grid positively and it becomes a second "electron magnet" as it were, tending to assist and reinforce the attraction of the sheath in promoting the emission of electrons at the surface of the hot wire and hastening them on their journey

sheathward. But charge the grid negatively and instead of assisting the attraction of the sheath, it acts as an off-set to it, neutralising its pull on the electrons more or less according to the amount of negative potential in the grid's spiral.

Not only this, but since the grid is so much nearer the filament than is the sheath, a small alteration in the state of electrical charge in the grid, one way or the other, will have

signal trains, or groups, each train of oscillations corresponding to a beat of the note to be produced in the telephone receiver. A rectifier valve in a receiving set has to be so arranged as to pick up and blend together all the oscillations representing each beat of each note, so that corresponding beats may be reproduced by the telephone's diaphragm.

Grid Condenser

This blending and, as it were, "lumping together" of the energy in each group of oscillations is accomplished by the aid of a small fixed condenser (usually of .0003-microfarad capacity) called the grid condenser, and of a very high-resistance electrical conductor called the grid leak, possessing a resistance generally of not less than between one and two million ohms (one and two megohms).

The "leaky grid," as the combination of grid condenser and leak is called, is connected as a branch at the aerial end of the inductance and the other, or output, lead from the condenser connected to the valve leg, or socket, into which fits the grid pin of the valve. Thus, with a valve rectifier, oscillations from the inductance pass first through the grid condenser, with the result that the plate of this condenser nearest the grid, and hence the grid itself, takes a progressively accumu-

lating negative potential during the continuance of each oscillation train, which potential leaks away again through the grid leak in time to make room for the energy of the next wireless wave train to have in turn its due effect.

Negative Charges

The reason why the grid charges negatively is because it starts with an initial negative charge picked up from the electrons sweeping past it.

Creation and subsidence of negative voltage in the grid synchronises with the beat notes of speech and music to be reproduced.

In the next article we shall see how the valve amplifies.

COLIN BENNETT.

(To be continued.)

A WASTED WOOING

*HE wooed her with impassioned zest,
Praising her beauty fervently;
He'd loved her long he now confessed,
And would she listen to his plea?*

*She was the brightest star that lit
His skies. (He knew this sort of thing
Was useful; he was good at it
For he was always practising!)*

*Her face was like a lovely rose,
She was so exquisitely slim,
So full of charm—did she suppose
That she could ever care for him?*

*To hear her sing was sheer content,
Her voice was like some joyous bird,
But, though he was so eloquent,
The maiden answered not a word.*

*His rhetoric had passed her by,
Leaving the heart he hoped to win
Untouched—and then he noticed why,
For she was busy listening-in!*

LESLIE M. OYLER.

a comparatively great effect upon the electron flow between filament and sheath or anode.

Suppose the grid of a valve is connected up with the aerial terminal of a wireless set, as is the crystal in a crystal set, we then have in this arrangement means whereby varying voltages generated in the inductance by energy from the aerial can be translated into an electrical current of varying strength passing through the valve's sheath circuit. In addition to this these alterations in sheath (plate or anode) current will be relatively many times greater than the original alterations of voltage in the aerial inductance.

Wireless oscillations sent out from broadcasting stations may be considered as radiating into the air in

DAVENTRY

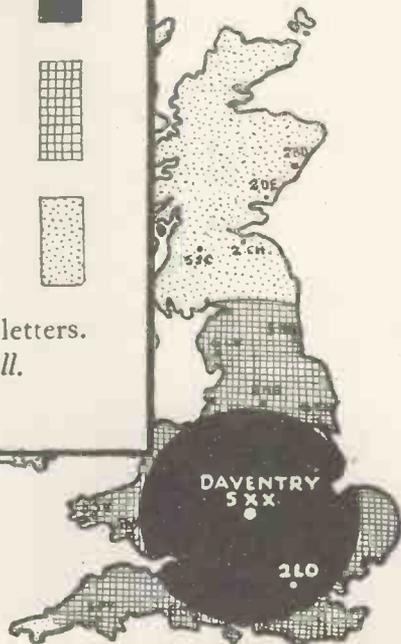
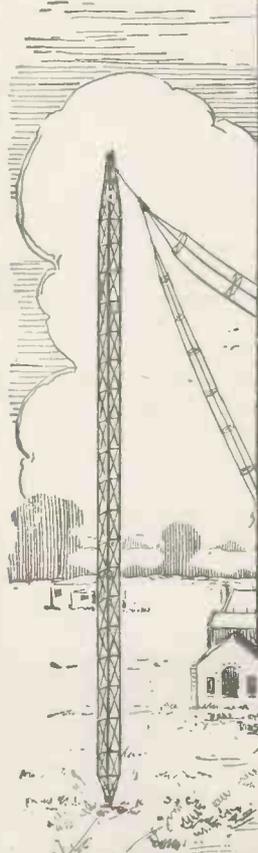
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	up to 100 miles	{ A plus K A plus I plus J B plus K B plus I plus J D plus J	
	up to 200 miles	{ C plus K C plus I plus J D plus K D plus I plus J	
	over 200 miles	{ E plus K G E plus F H	

See illustrations at foot for key to letters.
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Continental Notes

Some More Adventures
with a Portable Set

"THIS," I said sententiously, on hearing the Norag "HAHA" sign, "is Hamburg. A lecture will be given by a well-known man named Esau. Subject——"

"Get another station. That chap Esau is probably the rotter who wrote those idiotic fables, the copyright of which he sold for a plate of somebody's rolled oats." So spoke the college youth.

"Æsop, my boy, Æsop. He did not sell the copyright; neither did he live on oats. Otherwise your information is correct," I retorted. "As it happens, Dr. Esau is a German professor and an authority on all things wireless."

Dull-emitters

"Yes. I know that; but I am on my hols. Some of these talks we get are very boring. Now, you appear to use dull-emitters. Do you think you could pick up a livelier programme if you replaced them by the bright variety?"

"I want notice of that question," I replied. "I should like to put the problem before the B.B.C.'s chief engineer."

We were back at the same old spot about which I wrote last month and were trying out a new set. Luck—or ill-luck—would have it that I could not pick up anything on the "plane" coming over, but, here, it seemed merely a matter of twirling the secondary condenser.

The ether was full of transmissions. It was a case of *embarras de richesse*. We only had to make our choice. It had been a very hot day, but now, in the cool of the evening, such reception would have gladdened the heart of the most pessimistic fan.

British Stations

We tried most of the British stations and there seemed but little difficulty in tuning them in; they all appeared to come in at varying strengths. Obviously the geographical situation of a transmitter is proved to be an important factor as regards distant reception.

Most of the Continental stations which are being rebuilt or erected are adopting Captain Eckersley's reiterated opinion "that it is better

to broadcast from without (a city) to within" and not vice versa as the B.B.C., in the majority of cases, are compelled to do.

There is no doubt that the exceptional carrying power of most of the smaller broadcasters we pick up in the United Kingdom is due to this advantage. Curiously enough—and it would appear to prove this contention—Bournemouth is the one main station which has been built on an outside site. (If I am wrong, please to correct me.)

Of all the B.B.C. transmissions none is heard so well on the Continent as 6 BM, barring 5 XX, *cela va sans dire!*

A surfeit of big stations induced us to try for the smaller fry and, with some patience, we received the concerts from Malmo, Graz and, of course, most of the German relays. Radio-Madrid, Barcelona, San Sebastian and Radio-Toulouse simply romped in.

Radio-Paris and Daventry

I do not mention Radio-Paris or Daventry as it would be a poor receiver which could not pick these up on the Continent.

At the distance we were from any transmitter, no interference, apart from morse, was met with and there was little skill required in separating one from another.

But tragedy was to follow. Clouds—heavy, black, copper-edged clouds—had gathered overhead and spots of rain began to fall. The warning was but a short one. The heavens parted and the rain came down in cascades.

I made a dash for the set. As it was a portable one, I dived at it with one hand, lifted it and let it slip through my fingers. Down crashed the receiver. The college youth, to my disgust, drawled out "I can hear Glasgow!" He did; the tinkle of glass had been audible.

In the scrimmage, I consider I did fairly well as I appear to have retrieved about 38.5 per cent. of the most expensive components. The aerial should still be where we left it as we had no time, in our precipitate flight, to take it down.

Believe me, it was no consolation when the college youth pithily

described it as "from my knowledge of the French Classics, I should term this an *elovèmès!*" JAY COOTE.

A PHONE POINT

It is most important when high-resistance telephones are used that they should be connected to the set in the proper way. The whole of the steady current from the plate circuit of the last valve flows through the windings of the telephone magnets.

Affecting the Magnet

If this current is in the right direction it helps the magnets to retain their qualities; when, however, current is passed through the windings in the wrong direction it acts against the force of the magnets and tends in time to weaken them.

Most telephones of good make have the connection which should go to the positive output terminal of the set marked. Occasionally, however, one comes across a pair of telephones which are not marked.

Here is a simple and quite certain way of discovering which is the positive lead. Place a single drop of water on the surface of a penny. Mark the end of one lead by tying a piece of coloured thread to it. Now place the bared end of one wire in the drop of water but *not* touching the surface of the penny; with the other scratch the surface of the coin.

You will hear a scratching sound in the receivers, rather like the noise produced by atmospherics.

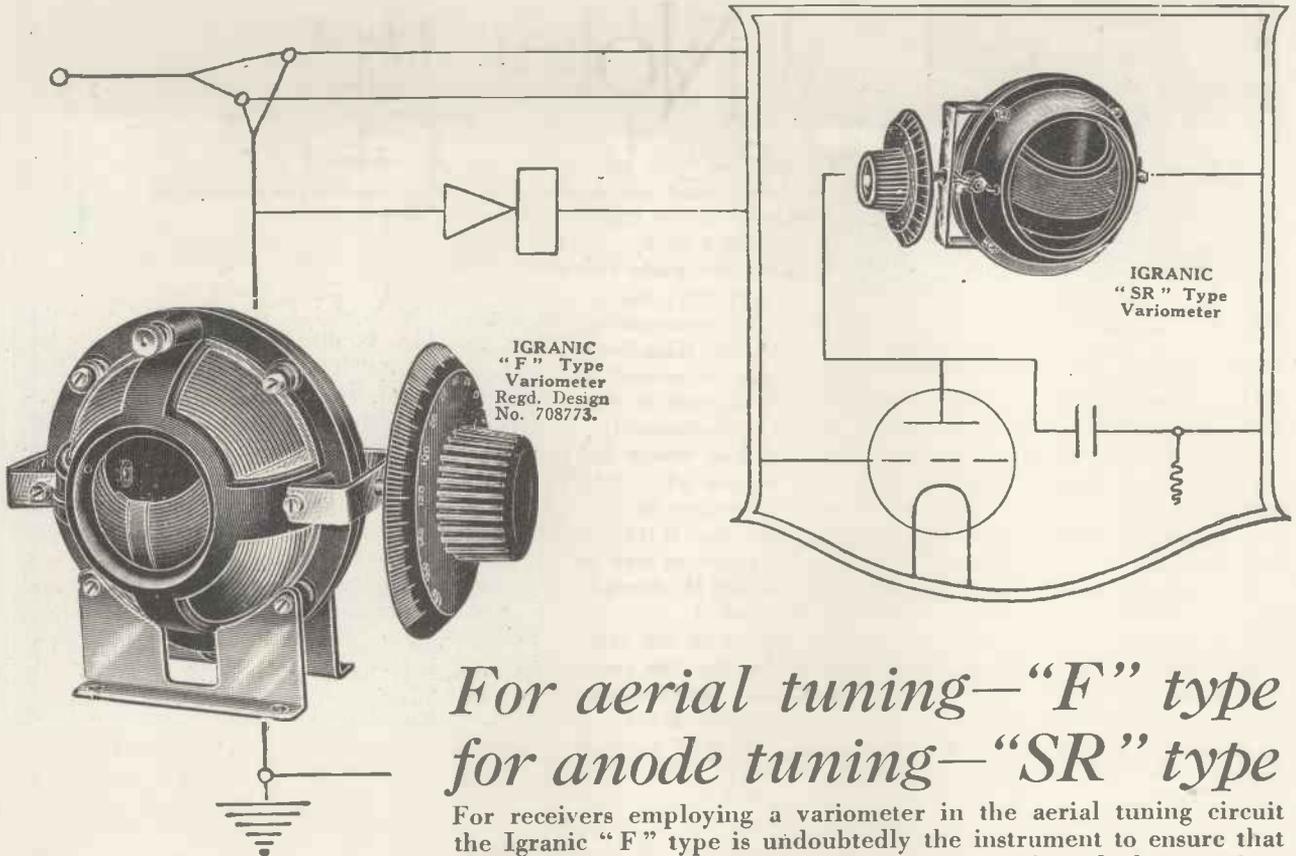
Reversing Leads

Reverse the positions of the leads, holding the one previously used for scratching in the drop of water, and moving the other over the surface of the coin.

One combination will give much louder sounds in the receivers than does the other. The positive lead is the one which when the loudest noises occur is in contact with the water and not with the metal.

J. H. R.

AN American politician has constructed a receiver which is contained in his hat. So that politicians can now listen through their hats as well as talk through them.



*For aerial tuning—"F" type
for anode tuning—"SR" type*

For receivers employing a variometer in the aerial tuning circuit the Igranic "F" type is undoubtedly the instrument to ensure that extremely sharp and highly selective tuning for which one aims. It is a "low-loss" component because the fixed winding is housed in a skeletonised moulding and the movable winding is entirely self-supporting.

For anode tuning it is well to have a variometer specially designed for the purpose—the Igranic "SR" type is ideal when used in conjunction with the "F" type in the aerial circuit.

The stator and rotor are both constructed of a hard moulded material possessing high insulating qualities. The rotor is externally wound with a single layer of double cotton covered high conductivity copper wire in two sections and finished with a hard insulating varnish.

The stator is similarly wound internally and is adequately supported and protected by the moulded former.

Ask your dealer about Igranic Variometers and other components.



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Both the Igranic "F" and "SR" type Variometers have attractive knobs and dials, and fixing brackets are provided to allow of mounting in four different positions. The wavelength range in each case is approximately 250-600 metres.

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"F" type ... 12/6
"SR" type ... 18/-

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What the Reader Thinks

The B.B.C.'s Policy

To the Editor of "The Wireless Magazine."

SIR,—The policy of the B.B.C., as enunciated by Captain Eckersley, aims at crystal reception for 100 per cent. of listeners and potential listeners. From the point of view of tonal values, this appears to be a worthy ideal.

A drawback, however, which is already visible, is that the B.B.C. may lose to a great extent its national character and tend to become parochial in its activities.

A typical instance of what may be feared was seen in the recent broadcast of the events on board H.M.S. *President*. Here an entertainment of intensely national appeal was limited to one area.

Unless this is avoided by a broader view and more comprehensive attitude, the result of providing 100 per cent. crystal service will be the aggravation of the oscillation evil on such occasions instead of the diminution so fondly hoped for by the B.B.C. and all of us.—R. W. LOCKE (Newcastle).

Selectivity

SIR,—For some time I have been troubled with the problem of selectivity. The North Foreland G.P.O. transmitter is very troublesome all over the B.B.C. band of wavelengths, and with a crystal set (variometer tuned) it is possible, where I am situated, to hear him all round the scale.

With a direct-coupled valve set it is impossible to tune-in any station without interference.

I have tried cutting the station out, first with a wavetrap (series and parallel), but this did not seem to cut down the interference very much.

Next I tried loose-coupling, which was more effective, but made it rather difficult to tune-in distant stations without slight interference. Close-coupling was also tried with better results, interference being

almost inaudible except where signals were being transmitted on practically the same wavelength as that to which the set was tuned.

Last of all I tried a semi-aperiodic coil; the grid connection was taken to the first turn, the aerial to the fortieth turn, and the earth and L.T. connection to the sixtieth turn. This, with a counterpoise instead of an earth connection, is the best arrangement I can find for selectivity and ease of handling. Distant stations now come in without a trace of interference.—W. H. MASTER (Ramsgate).

A VALVE FOR A LETTER

At all times we are glad to have our readers' opinions of the things that are going on in the wireless world, and to the writers of the letters that are printed on this page each month we present valves.

The writers of the letters printed this month will each receive a Cossor valve. Next month we shall give Edison valves.

Letters should be kept brief and to the point, and in no case should they exceed 100 words in length.

High or Low?

SIR,—I was very interested in "Halyard's" recent remarks on "fallen aeri-als."

I have, at my home in Northwood, Middlesex, a double-aerial of the inverted L-type, 33 ft. long, suspended between the chimneys of the house, which are about 35 ft. above the ground, and five feet above the roof, which is flat, and covered with lead.

On one occasion, when I lowered the aerial for purposes of cleaning, I went down to the set—an ordinary crystal receiver—and on putting on the phones, I was very much surprised to find that London, about 15 miles distant, could be heard very nearly as loud as when the aerial was drawn up to its full height. The aerial was then lying flat on the lead roof.

On another occasion, when using a single-valve reflex receiver, the set was working very well, when I discovered, on looking out of the window, that the lead-in had fallen off the insulator which prevents its touching the roof, and was in contact with the lead on the roof, providing what would seem to be a direct connection to earth.

On replacing the lead-in, no alteration in signal strength or range was noticed.—H. C. WYNNE (Malvern).

In New Zealand

SIR,—I have now read three issues of THE WIRELESS MAGAZINE and have found them wonderfully illustrated and highly instructive. It is obvious that you spare no expense in securing articles.

There is no wireless book on the market that can compare with yours, both in quality and price, and your articles are clever, to the point and new.

Wireless in New Zealand is very popular in spite of the fact that the yearly fee is 30s.

Soon we are to have four stations of 500 watts power with wavelengths ranging from 350 to 450 metres.

Australian stations are received here with great volume and clarity over a distance of 1,100 miles, using only three valves and no radio-frequency.

I have received K G O, 6,000 miles away, regularly at loud-speaker strength. K D K A (9,000 miles) has come in on several occasions with sufficient volume to be heard all over the house.

There is no difficulty in receiving long-wave stations out here, such as Stavanger, Bordeaux, Arlington, Carnarvon, and St. Assise.

Wishing THE WIRELESS MAGAZINE continued success.—A. E. S. HANAN, Timaru (New Zealand).

For more of What the Reader Thinks, see page 190

VALVE REPAIRS

THERE must be in the wireless cupboards of amateurs an enormous number of old valves which have been discarded because their filaments have burnt out. Not everyone realises that to-day the valve repairer can make a wonderfully good job of a broken filament.

Varying Characteristics

In the early days of repairing, matters were not very satisfactory, since new filaments varied so much in their characteristics and the vacuum in the bulb was seldom so hard as it should have been.

Nowadays the new filaments are very good indeed, and since most repairers have installed first-rate pumping machinery a really hard vacuum is produced. Those who have burnt-out valves should certainly try the experiment of having one or two of them repaired.

J. H. R.

How the Reflex Saves a Valve *(Continued from page 146)*

stops them from reaching the tuned circuit (see Fig. 6).

The above, whilst serving to explain how a single valve can amplify at two frequencies simultaneously is, unfortunately, not quite true. In the series arrangement the fixed condenser across the transformer secondary offers some impedance to the H.F. currents and to a very slight extent by-passes some of the L.F. currents.

In the parallel circuit some of the H.F. energy leaks through the choke coil and transformer capacity, whilst a little of the L.F. energy finds its way through the condenser and tuned circuit.

Separate Circuits Best

It is the H.F. oscillations which suffer most and, therefore, for D.X. work separate H.F. and L.F. circuits will give better results than a reflex.

However, it must be remembered that for short-range reception an H.F. stage does not make a great deal of difference to signal strength, and therefore when used at moderate distances from the transmitting station the reflex really does "save a valve."

J. F. JOHNSTON.

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A paper devoted entirely to helping all who like to turn their hands to some useful domestic job or interesting practical hobby.

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"The Amateur Mechanic" makes all the difference to you between failure and the supreme satisfaction that comes from "something attempted, something done." It is edited by Bernard E. Jones, editor of "The Wireless Magazine," Cassell's "Work" Handbooks, "Amateur Wireless," and other famous technical publications; and the contributors to it—each an expert in his own department—not only know the Amateur's difficulties, but know exactly how to direct the Handyman to achieve his purpose. The articles are simple, practical, clear and illuminating.

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MORE OF WHAT THE READER THINKS (Continued from page 188)

Why Not a Change?

SIR,—Would it not be more equitable if the relay stations in the more populous towns, such as Liverpool, were converted into main stations, working at their present low power, while main stations serving scattered districts like Aberdeen were made into high-powered relays?

Money is a very necessary commodity even to the B.B.C., but those who pay the piper should have some say in calling the tune.—C. J. NELSON (Wallasey).

More Praise from Australia

SIR,—We have just received the first two copies of your magazine out here, and I wish to thank you for a very excellent production.

My set is a three-valver (one H.F., detector, and 1 L.F.) with tuned-anode method of H.F. amplification, and reaction on the anode coil. I am using American dull-emitter valves, WD 12 Radiotrons, and get excellent results.

We have no broadcasting company in Queensland yet, but the Queensland Government are erecting a 5 k.w. station, which should be on the ether very shortly.

In Sydney, which is about 700 miles from Brisbane, there are two 5 k.w. stations—2 F C Farmers, Ltd., on 1,100 metres and 2 B L Broadcasters, Ltd., on 350 metres. Melbourne, nearly twice the distance, has two stations—3 A R on 480 metres and 3 L O on 1,720 metres.

We get them all here in Brisbane at strong phone strength, especially the two Sydney stations. There are many amateur transmitters on 5 watts and upwards, transmitting on wavelengths from 80 metres upwards. Most of these are experimenting on D.X. work, and some of them give us good programmes on Sunday mornings.

The Queensland Wireless Institute (4 A E) transmits every Tuesday night on somewhere about 350–375 metres with an input of about 12½ watts. This station comes in very strongly. Listeners using 3-, 4- and 5-valve sets have received music from K G O, Oakland, California, U.S.A. I have not succeeded in getting to them myself yet, but I'm still trying.

Licences to receive broadcasting

here are granted by the P.M.G. Zone A pays 35s. per year, Zone B, 30s., and Zone C, 25s.

Zone A constitutes a 250-mile radius from the broadcasting station, Zone B a 500-mile radius, and Zone C any other part of the State.

The Government, that is the P.M.G. dept., takes a small percentage of the revenue, and the broadcasting companies have a percentage according to their power and the service rendered.—ALEC M. FRASER (Queensland, Australia).

Distortionless Valves

SIR,—Re Mr. H. M. Lowe's letter published in the April issue of THE WIRELESS MAGAZINE. I advise him to try one of the following: A Dextraudion valve working on 1 volt at .1 amp. or a Weco-valve working at .8 to 1.1 volts at .25 amp.

If he wants a foolproof valve then he should try a Cossor W R 1, working on 2, 4 or 6 volts at .25 to .3 amp. These valves are very strong and give no distortion. When working with French .06 valves on 1.8–2.0 volts all one gets is "pong, pong, pong," if anyone walks across the room.—E. E. THORNTON (Friern Barnet).

A Temporary Aerial

SIR,—I have obtained excellent results from a temporary aerial similar to that described by A. K. in the March issue of the WIRELESS MAGAZINE. The usual aerial is 60 feet in length and is suspended between a 42 ft. mast and a chimney on the house about 35 ft. high. The lead-in is well clear of the roof, etc., and joins the window insulator some 15 ft. below the aerial.

If the garden end of the aerial is taken down to a 6 ft. pole the results on distant stations are a little weaker but still quite good. I received W B Z several times in December with the low aerial. Selectivity as regards the local station is very much better since by careful adjustment of reaction on the tuned anode it is possible to cut this station out completely without a wavetrap, and receive the stations below 5 I T. The set is an ordinary 3- or 4-valve direct-coupled one and is 1½ miles from 2 B D. All the coils used are ordinary basket pattern with the wax melted out.

As regards the making of crystals, it is fairly easy to get crystalline lead sulphide sensitive all over by the method described by H. J. H., using lead, sulphur and a very little silver nitrate. The mixture is heated in a covered porcelain crucible surrounded by fireclay by means of a powerful gas blowpipe.

It is necessary to reach a high temperature to melt the galena. Personally I find a permanent detector consisting of selected pieces of zincite and bornite hard to beat provided that the bornite is next the aerial.—M. J. R. (Aberdeen).

THE GRID LEAK

EVEN with the advent of the variable grid leak its uses are not properly understood. It will generally be found that with hard "general purpose" valves the value of grid leak required for maximum signal strength when not using reaction is high.

A batch of valves tested by the writer showed that maximum rectification takes place with the average British valve when the leak value is about 9 megohms, but the quality of telephony is inclined to "woolliness." The best value for pure telephony was about 7 megohms.

If the set is to be used with extreme reaction effects on long distance stations it will be found that the leak resistance should be low if stable reaction is required.

The best method to adopt is to adjust the filament voltage to the full rated voltage and also the anode potential and place the set into oscillation. By slowly screwing in the grid leak it will be found that there is a point where the set will go slowly into oscillation without a "pop." Such a test must not be carried out when broadcasting is in progress.

It will be seen from the above that unless a variable grid leak is used, a set that is suitable for excellent reception without reaction will be of no use for stable reaction effects on long-distance work. A. J. C.

LADIES are now using phones to match their hair. Won't this be expensive for those red-headed people who persist in calling their hair golden?

The Ideal Dance Music Set



This two-valve, single-dial Loud Speaker set is developed by World-famous Radio Engineers, expressly for the purpose of providing a full, rich volume of true-toned music, at a minimum of initial expense, and without any complications. The "Polar-Twin" set is for use with dry cells or accumulators, can be switched on or off with a single knob. Costs practically nothing for up-keep, and is fully guaranteed.

Dance Music at 400 Miles' range!

Captain W. N. SWINEY, of S.S. "Carody Castle," Union Castle Line, writes from Cape Town:—"I feel it will be of interest to you to know the results of the Polar-Twin Set supplied to me in March last.

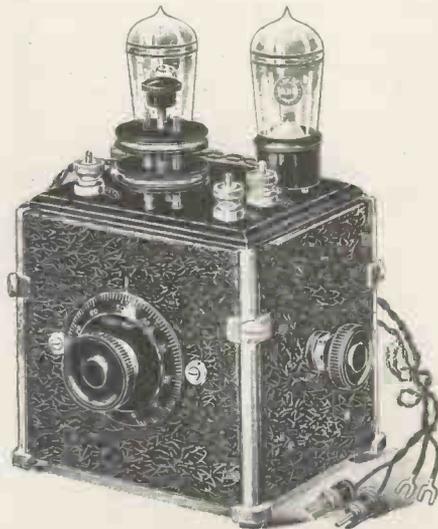
From Marseilles I heard London distinctly with the headphones, also from Genoa and Naples, but I think it will interest you also that I heard distinctly with the headphones from Beira (East

Africa), Johannesburg, a distance of nearly a thousand miles. From Delagoa Bay, I heard very distinctly Johannesburg and Durban at a distance of about 350 to 400 miles with the loud speaker, sufficiently loud to dance to in a room if one chose.

You may make whatever use you like of these statements, and I wish you every success with your valuable little Set."



This illustrates the complete Receiver in special cabinet of highly finished dark oak, suitable for drawing room or outdoor use. The cabinet contains everything except aerial, earth wire and loud speaker. The set can be switched on or off without opening the doors. The price of the Cabinet alone is £2 2s. 0d. Set and accessories are priced below.



Complete Set, ready to connect to Aerial: **£13:10:0**

Accessories include: 2 Mullard D.06 Valves, 2 H.T. Batteries and Plugs, 3 Polar D.E. Cells, 1 short wave Aerial-Reaction Coil Unit, 1 Chelmsford Aerial-Reaction Coil Unit, 1 Amphion Junior Loud Speaker and the necessary connecting wires.

Complete set, as above, but with Head Telephones in lieu of Loud Speaker ... **£12:0:0**

Set, without accessories, but including short wave Aerial-Reaction Coil Unit, Royalty paid ... **£6:15:0**

Polar-Twin Receiving Set

What it will do:

"Polar Twin" will operate a loud speaker, with an outside aerial, at a distance of 20 to 60 miles; or with an indoor aerial, at a distance of 10 to 15 miles from a main Broadcasting Station. With an outdoor aerial of average efficiency it will receive all British Stations and many continental ones on the headphones. It will also receive American Stations with a good aerial and careful tuning.

The "Polar Twin" Set is sold by Polar Service Agents and Dealers in every Town and City. They will willingly demonstrate, install and instruct. Fully descriptive leaflet free from your Dealer, or post free from us.

The Circuit:

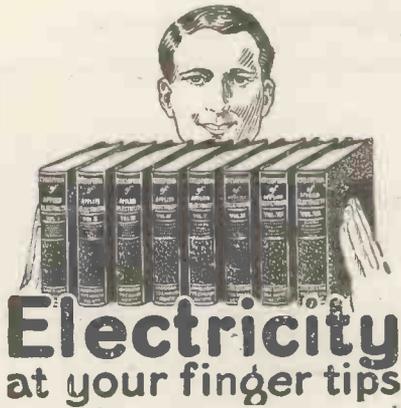
"Polar Twin" is a two-valve set, for use with Mullard Dull-Emitter Valves. It requires no accumulators but operates from Dry Batteries. It embodies H.F. and L.F. Amplification, with interchangeable rheostat and interchangeable Coil Unit, in which is incorporated both aerial and reaction coils. One unit covers all B.B.C. short-wave stations. A unit for Chelmsford is supplied separately at 7/6.

Radio Communication Co. Ltd. 34-35 Norfolk Street, Strand, London, W.C.2

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"WHEN WAR DID BREAK OUT"

A Reader's Adventure

To the Editor of "The Wireless Magazine."

SIR,—I read, with interest, your article "If War Broke Out" in the July issue of THE WIRELESS MAGAZINE, and maybe the following quite true narrative might be of interest. For obvious reasons I shall not disclose the locality I refer to.

For some years prior to the outbreak of war, I lived during the summer months in a small country village quite easily accessible to the large industrial centre in which I was employed.

A Dyke in the Hills

In June of 1914, when no one had any idea of the impending war, I was on the hills one day not far from this little village, and at one point I observed an ordinary drystone dyke. What drew my attention to the dyke was the fact that just against it, and running parallel to it, was a wire fence, and it struck me as remarkable that both a wire fence and a drystone dyke should be necessary. I left the track to examine this fence, and found it to be of rather unusual construction, namely a single wire carried upon the wooden uprights; and on following it for some yards I found, with astonishment, that the wire passed through the dyke in a rubber tube.

Isolated

The place was a very isolated point on an elevation of possibly 900 feet, and well out of the beaten track, but beyond taking a mental note, I dismissed the incident from my mind. In late September of 1914, when the war had broken out in its full fury, the question was asked in Parliament: "Were the authorities aware that a long aerial wire close to the ground was almost as effective as a shorter and more conspicuous high aerial?" This question recalled the curious wire fence that I had seen on the hills in the preceding June, and that evening I, with four other friends, visited the spot. By the time we reached the place, darkness had almost fallen, and on leaving the track to get closer to the curious fence, we were astonished to find that on the other side of it there was a man with a very strong acetylene or electric lamp, which he shone upon us.

One of my friends, who was a native of the district, warned me that there was a private reservoir in the neighbourhood, and that probably the man with the light was keeping guard, and that, therefore, we would be well advised to move on without comment. We did this, but had only left the man some fifty yards behind when he crossed the fence, got astride of a pony which had been concealed in a hollow of the moor, and attaching the light to his stirrup, galloped off over the heather.

We were all quite taken aback at this, as it is a most remarkable thing to find anybody at that time of night on these isolated hills, least of all a man with a pony and a strong lamp. We found the drystone dyke and the fence just as I had seen it earlier in the year.

Leg-pulling?

The circumstances seemed to me to be so remarkable that I thought it worth while to call in at the County Police Headquarters the following morning, where I told my story to the sergeant in charge. He listened to me, and then suggested I had better tell my tale to the Chief, and I was duly ushered into the presence of that official. The old gentleman listened to my tale patiently, and then asked me point-blank if I was pulling his leg. When I assured him that I was not, he intimated that he would get my statement written down and he would ask me to sign it. In due course my statement was typed and signed by me, the names of all my friends present being given.

No Climax!

There ought to be a very fitting climax to a story like this, but unfortunately there is not. I called back at that police station on several occasions asking for information, but I received only the most evasive answers. A couple of years later the fence was still intact.

I had visions of receiving a Government grant of £1,000 a year for having tracked some illicit wireless apparatus to earth, but more probably I was really entitled to a booby prize for having found some of the apparatus erected by our own authorities.—SCOT.

Broadcasting Developments in Germany

IN view of the considerably increased number of licence holders in Germany (now about 750,000), it has been decided to improve the broadcasting service in that country.

Apart from the high-power station now being tested at Königswusterhausen and from which programmes are to be transmitted for the benefit of all Germany and neighbouring countries, Berlin, Munich, Hamburg, Stuttgart, Leipzig, Frankfurt-on-Main and Königsberg are all to be equipped with plant developing a power ranging from six to ten times the energy radiated at present.

For the Rhineland alone, a station is also planned between Cologne and Dusseldorf to operate as soon as the occupying authorities have agreed to raise the ban.

Sites Outside the City

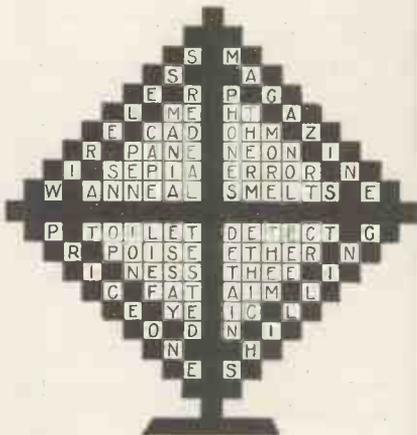
All new transmitters are to be built on sites *outside* the city areas and will be equipped with the latest improvements. Aerial masts 300 feet high will be erected in each instance.

Although the aerial equipment, motors, dynamos, and actual transmitting plant will be supplied at the expense of the Reichs Posts and Telegraphs and will be worked by that government department, the local broadcasting companies will provide the necessary funds for the purchase of the land sites and for the installation of the buildings.

It will be seen, therefore, that in Germany considerable help is given to the broadcasting companies by the State.

J. G. A.

SOLUTION OF AUGUST CROSS-WORD PUZZLE





LISTENING-IN has been proved many times to be a fairy god-mother with a prodigality of gifts—such as stimulating interest in fine literature, fostering intelligent appreciation of music, and so on. But I haven't seen anyone remark on its even more valuable quality in giving free play to the imagination.

In this connection I'm thinking particularly of wireless drama. Those who produce films for the cinema abhor imagination and leave nothing to it. When the hero sighs and thinks of the past, it unrolls itself pictorially before the audience at as great length as the present. It is supposed that the public cannot draw the smallest inference from ordinary facts without the help of illustrations.

But the drama which comes to us through the microphone is another matter.

Individualised Pleasure

By making a demand only on the hearing, it stimulates by imagination the other senses. Coming from the actors to the listener-in, the words wrap themselves in colour and fabric and scent according to the mind of each of the vast audience. Each can place the play in the setting which his own imagination deems most fitting.

Grand opera, too, should be pure, thrilling sound, I always think—and one gets it this way only scappily by gramophone or unified by wireless. There are no singers who

act woodenly or weigh grossly heavy when imagination can play round the marvellous melody they make without being chained to stage artificialities and human imperfections.

If that isn't magic in the best fairy-tale tradition, what is? Andersen and Grimm can relate no wonder more satisfying.

The Practical Sex

Far from being uncertain, coy and hard to please, as men like to suppose, women seem to me essentially the practical sex. But our ideas run to utility and efficiency rather than to the stunts beloved by the male half of the world.

They carry this delight in stunts into wireless as into all their other hobbies. To us women a receiving set is a receiving set, and it is nothing more. We don't care what shape it is; we judge it only by the results it brings us nightly, and by the ease with which it is manipulated.

Killing Two Birds

But the men of the family make so many plain wireless sets that after a bit only stunt ones will satisfy them. They spend time and money and temper lavishly in making a set which is also a lampshade or a cornet or a smoker's companion—but is a worse and more difficult set to get transmissions from because its cornetship or other strange vocation disturbs its wireless digestion!

The dear things call this killing

two birds with one stone. They're quite oblivious of the fact that you never wanted more than one bird, and rather treasured your lampshade when its only function was to shade the lamp.

Delivery at the Microphone

Mr. C. A. Lewis was pointing out the other day how the microphone shows up the smallest defects in voice, phrasing or general delivery of wireless talks. He suggested that those broadcasting should take more trouble to accustom themselves to a form of speaking that requires neither the elocution of the actor nor the method of the public speaker.

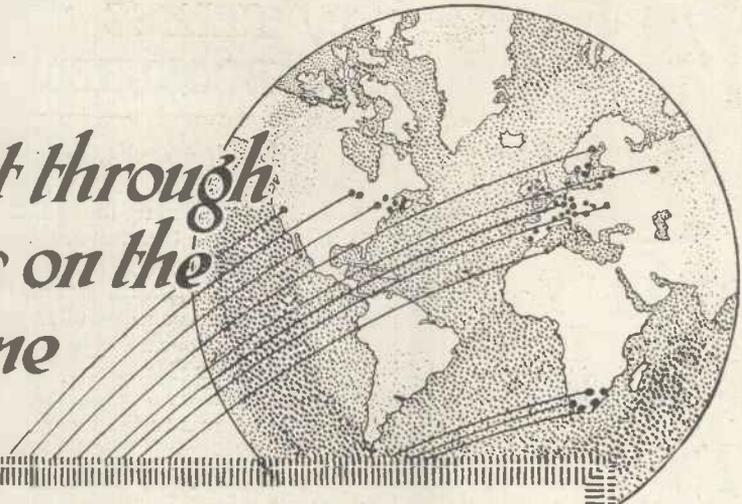
But how is this to be done?

Those of us who have broadcast are as conscious of defects as he or the public can be. But which of us has a microphone at home (not to mention a critical listener at the other end) to practise with till the right pitch, breath control, and so on, have been acquired?

By reading the prepared talk aloud the phrasing is somewhat tested and many broadcasters do this beforehand. But couldn't the B.B.C. hold a few classes now and then, during the morning, which could be attended gratis by all booked to give talks in the near future? It would be easy for them, with their equipment, to give practical lessons.

Alternatively, if any contributor lacks the essentials of a good delivery, could not the announcer read his talk for him? A. M. M.

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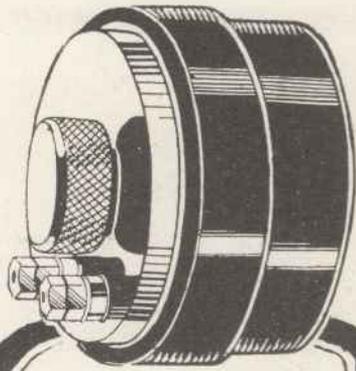
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Wireless Apparatus

For the WIRELESS BOOKSHELF

Personality and Career

TO the listener Mr. J. C. W. Reith is managing-director of the B.B.C. To his old school colleagues he is something more; he is a man who has embarked upon a career and has steered his course successfully.

This being the case it was very appropriate that Mr. Reith should be called upon two years ago to deliver an address to the senior boys of his old school and that he should take for his subject personality and career.

The speech ultimately appeared at length in the press and now, in response to strongly expressed wishes on the part of educationists and parents, it has been incorporated in a little book entitled "Personality

and Career," published by Geo. Newnes, Ltd., London, price 1s.

"The Book of the Wireless Valve"

Although published by Arks Publishing, Ltd., London, for the Mullard Radio Valve Co., Ltd., "The Book of the Wireless Valve," price 1s. 6d., is not in any way to be regarded as a mere advertisement. The book seeks solely to give the reader a clear idea of the functions of the various types of valves and to give a few hints and tips which, if followed, will lengthen the life of this component considerably.

"Your First Steps in Wireless"

A book suitable for the amateur taking up wireless for the first time is "Your First Steps in Wireless," by Hugh S. Pocock, published by Iliffe and Sons, Ltd., price 9d. The book is devoid of all highly technical language and deals in simple words with the various branches of the science.

ELIMINATING "BUZZ" IN PHONE EXTENSION LEADS

THERE are many amateurs who have their wireless sets in one room with extended phone leads passing to other parts of the house. If there is electricity for lighting or power laid on in the house a very unpleasant buzz or hum is often set up in the phones or loud-speaker; this is caused by the proximity of their extension to the electric cables.

The buzz is not unpleasant when a loud orchestral item is being played, but it detracts much from one's pleasure if the music is played *ad lib.*

One Method

A method of getting rid of, or at least considerably reducing, this buzz is to use lead-covered cable for the extension. This consists of two insulated wires protected and thus screened by an outer sheath of lead, which may be earthed. Those amateurs who contemplate laying phone extension leads will find it advisable to use lead-covered cable.

To those amateurs who already have an extension fixed, the following method of eliminating the buzz will probably prove more convenient. Connect the phone terminals of the

set to the primary of an iron-core transformer, and to the secondary terminals connect the extension. The primary should be tried connected both ways round in order to obtain the best position.

If high-resistance phones are used the transformer may be an ordinary intervalve L.F. transformer, but with low-resistance phones a telephone transformer must be used.

Another Method

Another method of eliminating this buzz is to use loose-coupled tuning; here the primary may be tuned or aperiodic. Instead of using two coils a variocoupler can be used. This method is convenient for use with a crystal set. A final method of stopping the buzz is to use a counterpoise instead of the usual earth.

It is to be trusted one of these methods of eliminating buzz will be convenient for readers, but in the words of the Latin poet Horace: "Si quid novisti rectius istis condidit imperti, si non, his utere mecum," which can be translated as: "If you know of a better 'ole, go to it!" P. C. T.

G.A. 3167

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A NEAT REACTION CONTROL

VERY often one wishes to design a receiver that will look neat and compact, as well as be reasonably efficient. And this is not always easy, as in the average valve receiver there are all forms of projections; valves, coils, and coil-holders that jut out and tend to spoil the appearance of what would be otherwise a pleasingly designed set.

Eliminating Coils

There is, of course, a lot to be done in the matter, but the writer has found one point useful—eliminating coils and coil-holders in a broadcast receiver for the purpose of introducing reaction on to the aerial or tuned-anode circuit.

No very great originality is claimed for this scheme, but for broadcast receivers working entirely on the lower B.B.C. band it possesses the advantages of being cheap, efficient, easy to incorporate into any set, neat in appearance and smooth in operation—enabling reaction to be governed by a knob and dial (geared if desired) like a condenser.

The device consists in using a variometer (preferably a good, substantial variometer) and re-wiring it; the stator acting as the aerial coil (alternatively, as the tuned-anode coil) and the rotor as the reaction coil.

Five or six turns should be removed from the stator—or more if a large aerial is in use—as its fundamental is usually about 350 metres, and a small variable condenser (.00025- or .0005-microfarad capacity) connected in parallel.

Wavelength Range

This will now cover the whole of the B.B.C. band (except the high-power station, of course) quite nicely.

The rotor may be left as it is, but better results will be obtained if about half the winding is removed. A touch of shellac will prevent the wire from loosening, but with care in dismantling this may not be found necessary.

Any degree of reaction is available, from complete reversal to "all in," and the less turns on the rotor the less fierce the increase or decrease.

It is really well worth trying: it does away with a coil-holder, and is much nicer to use—and look at.

W. T. D.



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Many a man, at last realizing the tremendous handicap of being untrained, has thought along those lines and then become an I.C.S. student, greatly to his advantage and happiness.

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You, too, by studying at home in your own time, can qualify for the position you want in the work you like best—no matter what your age, your occupation, or your means.

As a first step towards that goal, write to us at once, a post-card will do, or better still

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WAVELETS

WIRELESS does not upset the weather is the definite reply of an expert to certain critics. We wish it would sometimes.

MANY big wireless concerns have been floated of late. The industry evidently means to avoid that sinking feeling.

AN expert advises all experimenters to keep a log. We should think it applies especially to those who are fond of a little Chopin in their programmes.

THE B.B.C. are considering the question of broadcasting breakfast-time programmes. Rasher suggestions might be made, but, then, breakfast is largely a "rasher" question.

THE suggestion that there are 1½ million wireless pirates is absurd on the face of it. Why, there are not that number of aerials in the whole of Scotland.

A SHEFFIELD inventor is said to have patented a valve which has two functions. If these are (a) Works, (b) Doesn't work, then we can only say that we have had one like that for years.

THINGS WE WANT TO KNOW.—Why are not the B.B.C. horticultural talks given by Blossom?

WIRELESS amateurs have been urged recently to keep logs. Evidently for fuel, in the event of a possible coal strike.

THE choosing of a good panel is not an easy matter, says a home-constructor. Like the choosing of a panel doctor.

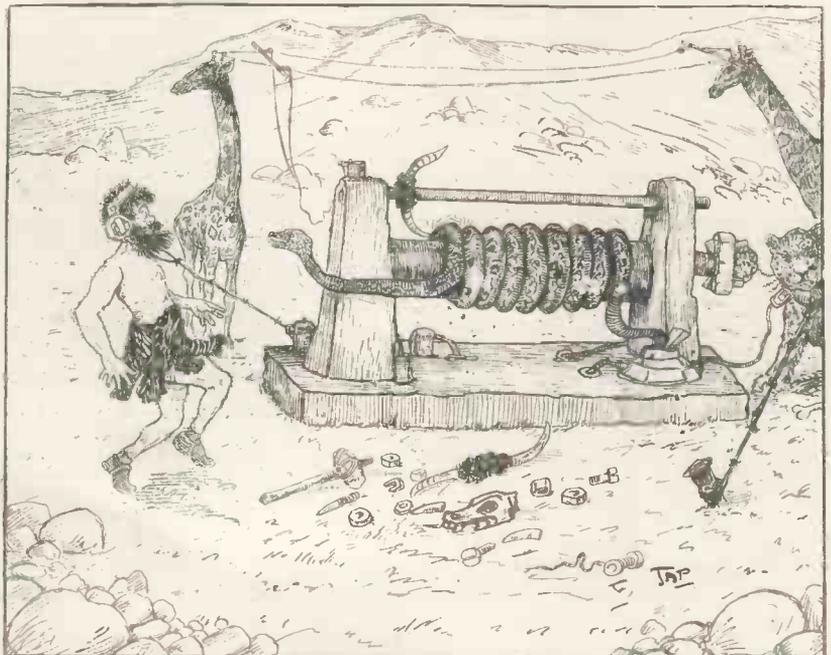
ACCORDING to a 70-year-old listener, wireless acts as a tonic. That is evidently why they intend to give us "bottled" wireless in the future.

AMERICA is said to be troubled with interference far more than Great Britain. Especially from temperance reformers.

THE palm this month deserves to be awarded to the listener who said that the best point about his loud-speaker was that it was so nice and quiet.

LONDON was the last place in the world from which the recent talk on road upkeep should have been broadcast. Some of the roads there are kept "up" almost permanently.

PIONEER DAYS



Early Crystal-set experimenter has a most discouraging time on account of coil troubles whilst trying to find the ideal slider.

In writing to advertisers, please say you saw the advertisement in THE WIRELESS MAGAZINE.

What's In a Name?

Prize Competition Result

IN our June issue we offered wireless goods to the value of three guineas for a name.

We wanted a good name for the panel-drilling template, layout diagram and wiring diagram, all in one, which comprises the coloured plate we give away every month.

And we received hundreds of names, many of them extremely good, and the difficulty of coming to a decision was in no sense slight. Ultimately we chose the word "STRUCTOGRAPH," which name will be found embodied in the plate which we present this month.

Many similar words were offered us, and in some cases two or three competitors offered the same name, but only one competitor—Mr. C. W. Atkinson, of 8 Strawberrydale, Harrogate—offered us the word "STRUCTOGRAPH," and we have written him asking him to choose his prize.

Broadcast Music of the Month (Continued from page 173)

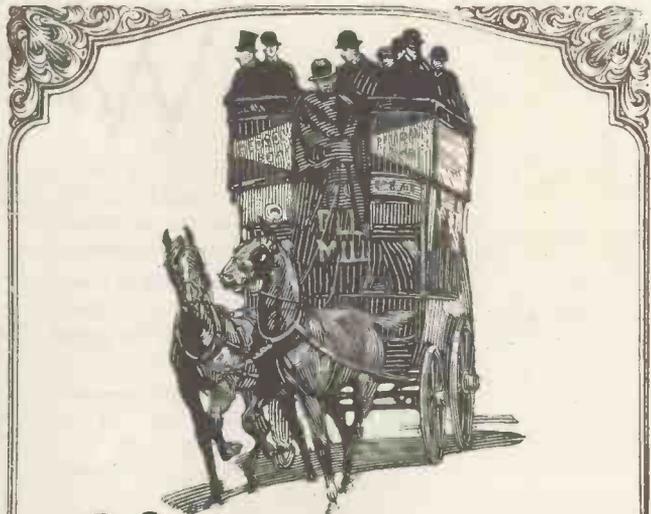
are famous in their art, and invariably have a picked cast to support them.

Two most popular duettists are Nickolds and Howe, who are positively "doubles." They are confirmed practical jokers and delight in their likeness to one another. Sometimes Mr. Nickolds, who is the banjo soloist, when an encore is insisted upon, thrusts his instrument into the hands of his partner and sends him on to bow acknowledgments.

Miss Alice Vaughan was heard to advantage last month, as were also Miss Phyllis Norman-Parker and Miss Winifred Ascott. Favourite artists, too, are Kate Winter and Vivien Lambelet.

Mr. Julius Harrison has figured amongst the conductors of the month, and especially from 5 I T, when, from the Scala Theatre, the first act of *The Magic Flute* was broadcast last month. **STUDIUS.**

"WHAT do listeners want?" asks Mr. de Groot. Surely he is expecting too much if he thinks they know!

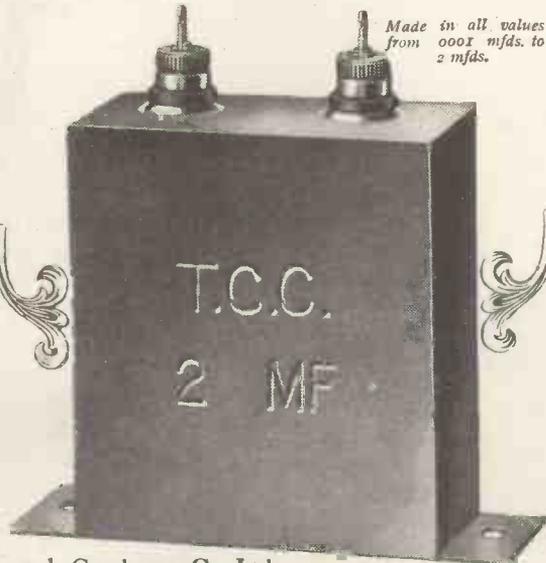


20 Years ago

FOR more than twenty years T.C.C. condensers have been the standard fixed condensers for all electrical requirements. First in telegraphy—afterwards in wireless telegraphy—now in Broadcast reception, their dependability and accuracy have always earned unstinted praise.

Among all your wireless friends you will never have known one who has ever been disappointed with a T.C.C. condenser. And, after all, this feeling of supreme confidence is a great thing. It means that you can accept a T.C.C. Condenser, place it in the circuit, and know that its capacity is exactly as marked and that it cannot possibly short circuit. The most frequent and rigorous tests that can be devised safeguard both of these points for you.

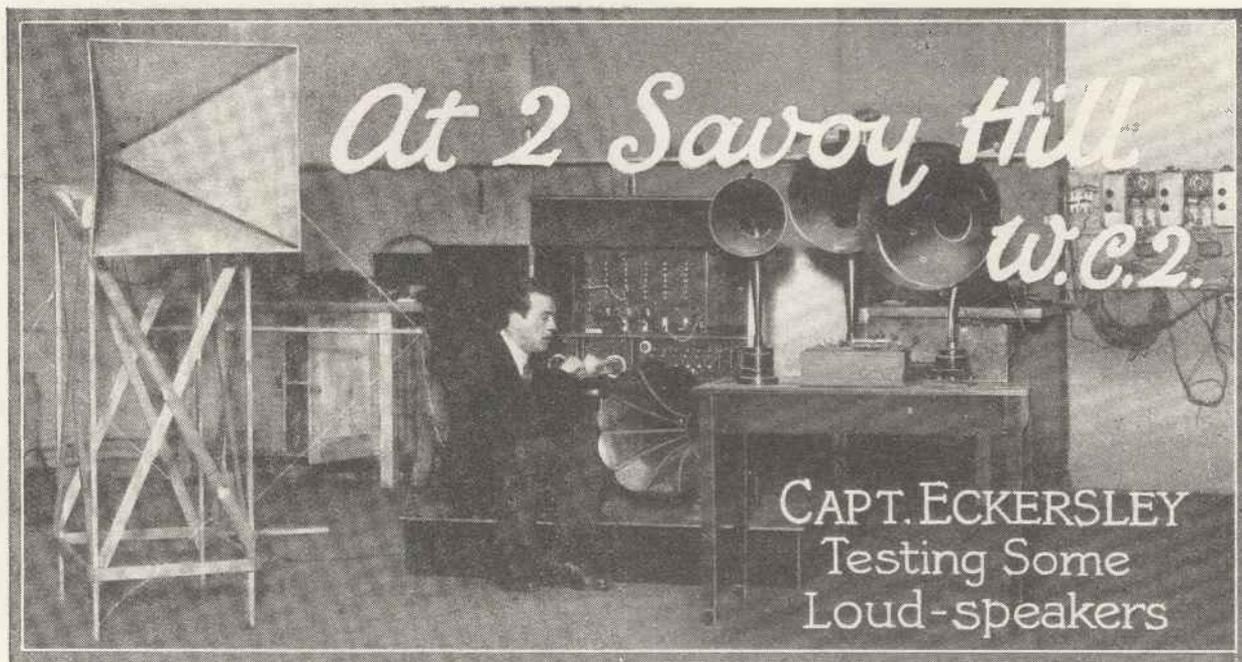
But not all green condensers are T.C.C., and not all condensers produced to imitate the T.C.C. are of the genuine Mansbridge pattern. In fact, very few of them are. But you are always safe if you see the letters T.C.C. stamped on the side of the case.



Telegraph Condenser Co. Ltd.
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In writing to advertisers, please say you saw the advertisement in THE WIRELESS MAGAZINE.



IT is possible that other countries will follow our system of simultaneous broadcasts, but so far as concerns alternative programmes the field is somewhat restricted, and in the endeavour to cater for all tastes with one night's programme, originating, say, from the London studio, a considerable number of listeners may at present feel some disappointment as regards the amount of the programme that appeals specifically to their individual tastes. With the coming of the international era, however, this drawback will disappear.

Autumn Talks

Some important talks have been arranged for the autumn session, which will begin on September 22 and conclude on December 19. One series, which it is thought will attract wide attention, will deal with scientific aspects of human existence. It is believed that this series, which will be called "The Stream of Life," will equal the brilliant talks given some time ago by Sir Oliver Lodge, Prof. J. Arthur Thomson and others.

In "The Stream of Life" series, Mr. Julian Huxley will deal with the "Origin of Life," the "Theory of Evolution" and "Mendelism." Another interesting series will be dialogue talks, bearing the general title of "After-dinner Philosophy."

The adventure side will be dealt with in a series entitled "Opportunity Overseas," in the preparation of which we shall have the co-

*Specially Contributed
by the B.B.C.*

operation of the High Commissioners in London. Savoy Hill is negotiating with prominent people in the Dominions, and the main object of the talks will be to obtain stories of their successes overseas from men who have left Great Britain and have carved out fame and fortune for themselves in the outlying posts of Empire.

"The Engineer in Adventure" will be another series undertaken by Edward Cressey, a *nom-de-plume* which veils the identity of a man well known in educational circles in the North of England. Each of his talks will deal with some great engineering triumph over natural obstacles, and he will tell of misadventures and disasters overcome.

Popular Programmes

Some time ago, a daily newspaper, in ascertaining the opinions of its readers, found, rather surprisingly, that religious matter occupied first place.

More recently, a Sunday newspaper found, as the result of a ballot which it conducted, that religious matter did not figure at all in the list of items which its readers required.

Australian listeners have recently participated in a vote on a list of thirty features in the ordinary broadcast programmes, and the first half-

dozen items in the popular choice were:—

- Brass-band music.
- Popular orchestral items.
- Popular instrumental items.
- Religious services.
- Classical orchestral items.
- News.

To obtain a satisfactory analysis of the votes recorded in plebiscites of this character, it would be necessary to find out to what classes of the community the voters belonged, and whether the voting was effected on responsible lines. Judging by the correspondence received daily at headquarters, which probably cannot be taken as representing the great body of listeners, one is inclined to think that religious addresses, for instance, would not occupy a very prominent place in a properly conducted plebiscite.

Military bands, dance music, news and scientific talks seem to be most favoured, while there is an undoubted demand for musical comedies of the *Radio Radianco* type, and for wireless plays. Operatic and theatrical performances also appear to be in keen demand.

International Programmes

Considerable interest has been shown in the statement made by Lord Gainford that we regard it as essential to provide more alternative programmes than are at present available to the great majority of listeners. There are several schemes

projected as regards alternative programmes, the most ambitious being to place this country in the forefront of a movement to establish an international era of broadcasting.

When the time is ripe, we propose to commence with an American exchange, starting first with an arrangement with the Radio Corporation of America.

Wavelength Problem First

As a preliminary move, unified arrangements with the Continent of Europe were necessary; hence the Geneva Conference. It would be impossible to carry out a scheme of such magnitude without first solving the problem of wavelengths, so as to avoid interference. In the next place, an interchange of programmes with the Continent was desired before tackling the larger question of Atlantic transmission.

This is only part of the scheme in our mind. At some future date Germany and other European countries will be transmitting their programmes to America, and vice versa. How will they do it? We have made no extravagant claims on behalf of the Daventry high-power station, but it is quite feasible that Continental countries will wish to transmit to America through this country, and if the plans materialise the Daventry high-power station will be used as a kind of central clearing house for relaying to the American Continent.

Further, a super receiving station will be established in this country for the reception of broadcast programmes from the Continent and the other side of the Atlantic.

One can foretell the time when broadcasting in this country will develop to such an extent that almost every night will be devoted in great part to international programmes, and we shall have an "American Night," a "German Night," an "Italian Night," a "French Night," and so forth.

AN Aberdeen man has built a three-valve set in one evening. This shows that in their building methods, as well as in their manner of taking refreshment, the Aberdonians don't let dilution worry them.

WIRELESS confers certain benefits on health, says a medical man. And even newspapers who arrange concerts find that it is good for the circulation.



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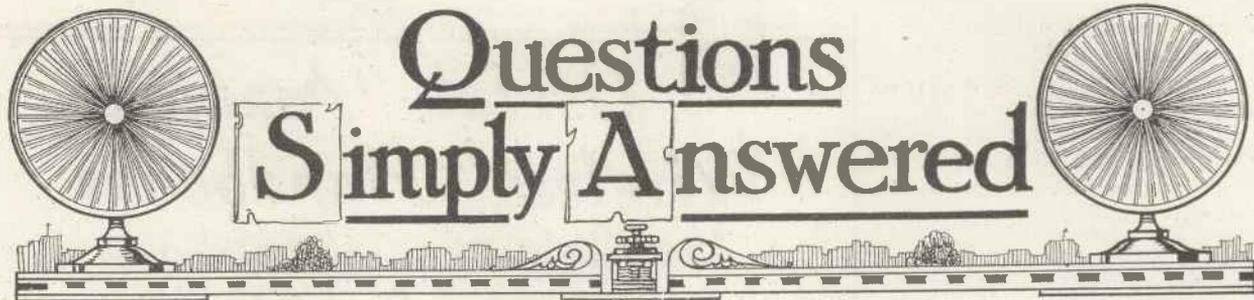
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Lead-in from a T Aerial

Q.—Is it absolutely essential that the lead-in wire of a T-type aerial be joined to the exact centre of the overhead wire?—A. K. M. (Clitheroe).

A.—It is sufficiently accurate to regard the exact centre of the overhead wire as being the best point to which to attach the lead-in wire.

Should one arm of the aerial be suspended over a building or raised obstruction, then that arm of the aerial should be a little shorter than the other.

The correct position in a case of this nature can only be ascertained by experiment.—X.

Breaking the L.T. and H.T. Supplies

Q.—Does the action of switching off the L.T. current break the H.T. circuit? In other words is it necessary to break the H.T. as well as L.T. battery?—H. S. W. (Somerset).

A.—The action of switching off the filaments of a valve set automatically breaks the H.T. circuit through the valves, but it is certainly an asset to fit control switches to break both the H.T. and L.T. circuits.—L. A. C.

Finding the Polarity of D.C. Mains

Q.—How may I ascertain the positive and negative leads of the D.C. mains that enter my house? This information is required for the purpose of charging an accumulator.—M. A. (Teddington).

A.—The simplest plan is to attach flexible leads to the mains and insert the free ends into a tumbler of water diluted with vinegar. Great care should be taken to keep the wires well apart when inserted in the water. The wire from which bubbles emanate is the negative lead.—M. K.

Earth for Valve Transmitter

Q.—I am troubled with varying capacity effects due to the earth at my transmitting station and should be pleased if you could suggest some remedies.—F. M. (Taunton).

A.—Your first consideration should be the finding of a good earth. Either an earth plate or counterpoise may be tried.

In the case of an earth plate or plates, the surrounding ground should be kept in a constant state of moisture.

When the actual earth has been decided upon the next step is to ensure

that all earth connections from the set are common and remain constant in capacity to the aerial. This may be accomplished by fitting a copper disc or ring around the lead-in tube and making this the common earth connection from the set.

The distance between the lead-in tube and the internal edge of the earth ring fitting will best be found by experiment. Three to four inches should serve to keep the capacity practically constant and will not be found detrimental to short-wave work.—L. A. C.

Accumulator Care

Q.—I have a spare accumulator that is not very often used. Does it need charging occasionally, and if so, how often?—T. C. B. (Birmingham).

A.—To keep an accumulator in good condition it should be charged at least once a month, and preferably once a fortnight. This applies to accumulators that are not being used, as there is always a certain amount of local action taking place in the cells. In this case only a very short charge is needed.—X.

YOU CAN'T SOLVE IT ?

You don't know to where that connection should go or why your set works well one day and badly the next ?

Well, why worry ? We keep a staff specially to solve such problems as yours. Let them have your queries so that they may give you the benefit of their long and varied experience.

Replies to queries of general interest are published each month on this page, but every querist is answered direct by post.

Please observe the following conditions :

Ask one question at a time ; write on one side of the paper only ; attach to your query the coupon on cover iii, and send it with a stamped addressed reply envelope to : The Editor, "The Wireless Magazine," La Belle Sauvage, London, E.C.4.

Remember Our Query Service is Free !

Submarine Communication

Q.—The practicality of wireless or other means of communication with submarines below water has often occurred to me, and I should be pleased if you could give me any practical information.—G. S. (Brighton).

A.—Many experiments have been conducted with wireless transmission and reception on submerged submarines, but only satisfactory reception has been obtained from transmissions emanating from ship or shore stations at very short ranges.

It is believed that an underwater oscillator system invented by Mr. Fessenden has been greatly used for intercommunication between ships and submerged submarines, but apart from this the recent innovation of the cable system, as used for directing ships into harbour during foggy weather, suggests at least another system of short-distance or local submarine communication.—C. M. C.

Shielding the Receiver

Q.—Is it advisable to shield the cabinet of my receiver with lead foil in order to minimise extraneous noises due to induction?—H. F. J. (Tooting).

A.—Yes, this is certainly a good plan. A small cabinet may be totally enclosed in a metal case having a hinged front to facilitate access to the tuning dial. Ex-Government receivers are often designed with such shields.—L. A. C.

Extended Phone Leads

Q.—Whenever I attempt to listen-in with extended phone leads I am always troubled with howling in the phones. My set is a single-valve reflex receiver. Can you help me?—T. S. (Pinner).

A.—You should not employ extended phone leads with a reflex receiver. Such leads set up undesirable capacity effects to earth, introducing capacity reaction and consequent oscillation.

Move your receiver to the room in which it is required to listen-in and extend the lead-in wire or use another entrance for your lead-in.—Z.

Electrolyte Evaporation

Q.—Should I make good the evaporation from my accumulator with acid?—S. F. (Deptford).

A.—Acid must not be added to an accumulator which is suffering from loss of electrolyte due to evaporation.

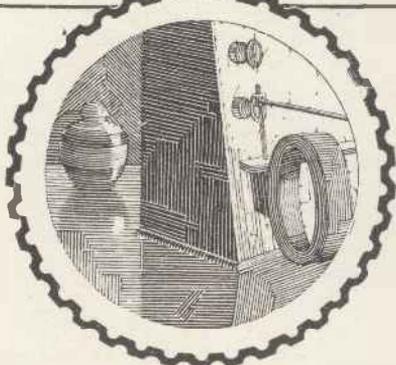
Pure distilled water, obtainable from any chemist for a few pence, should be added until the plates are submerged about a quarter of an inch below the surface.—L. A. C.

The World's Broadcasting

PRINCIPAL EUROPEAN STATIONS

Wavelength Metres.	Station.	Call Sign.	Wavelength Metres.	Station.	Call Sign.
346	Leeds	2 LS	460	Barcelona (Radio Catalana)	E A J 13
350	Cadiz	E A J 3	463	Königsberg	—
350	Marseilles	—	467	Linköping	—
350	Seville	E A J 5	470	Frankfort-on-Main	—
353	Cardiff	5 W A	479	Birmingham	5 I T
355	Karlstadt	S M X C	480	Lyon-la-Doua	—
360	Valencia	E A J 24	482	Swansea	5 S X
365	London	2 L O	485	Münich	—
370	Helsingfors	—	495	Aberdeen	2 B D
378	Manchester	2 Z Y	505	Berlin (Vox Haus)	—
382	Oslo	—	515	Zurich (Höngg)	—
385	Warsaw	P T R	530	Vienna (Radio-Wien)	—
386	Bournemouth	6 B M	555	Prague (Strasnice)	—
392	Madrid	E A J 6	565	Buda-Pesth (Csepel)	—
395	Hamburg	—	775	Copenhagen (Kjøben-Lavns Radiofoni)	—
400	Valencia	E A J 14	850	Lausanne	H B 2
403	Newcastle	5 N O	950	Buda-Pesth (Csepel)	—
404	Graz	—	1,010	Moscow (Sokolniki)	—
410	Munster	—	1,060	Hilversum	H D O
415	Bilbao	E A J 9	1,190	Ryvang	—
418	Breslau	—	1,300	Königswusterhausen	L P
422	Glasgow	5 S C	1,450	Moscow (Central)	—
425	Rome	I R O	1,600	Daventry	5 X X
425	San Sebastian	E A J 8	1,650	Belgrade	—
427	Stockholm	S A S A	1,750	Radio-Paris	C F R
430	Madrid	E A J 7	1,800	Brünn	O K B
439	Belfast	2 B E	1,955	Amsterdam	P C F F
443	Stuttgart	—	2,400	Lyngby	O X E
450	Moscow (Trades Union Council)	—	2,500	Boden	S A S E
454	Leipzig	—	2,650	Eiffel Tower	—
458	L'Ecole Sup.	P T T			

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Radion is available in 21 different sizes in black and mahogany. Radion can also be supplied in any special size. Black 1d. per square inch, mahogany 1½d. per square inch.

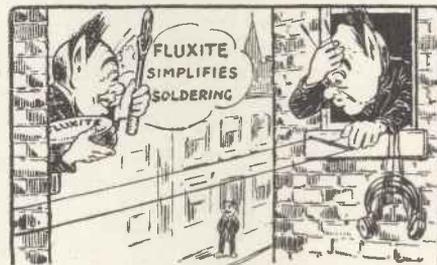
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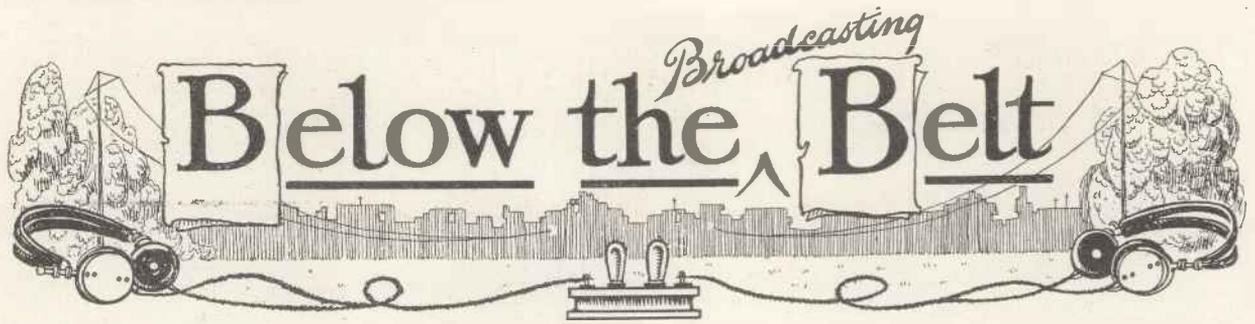
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I AM consumed with curiosity. I want to know who is "Room A" and who is "G1" to whom he was talking recently. There was no other call-sign used, and I suppose I shall never know from whence that most excellent telephony came; but if this meets the eye of "Room A" I would like to congratulate him, to hand him a bouquet, so to speak. Not only has he an excellent voice, but he knows how to handle his apparatus.

I suppose it was some official test or other upon which I happened; but the matter broadcast did not sound like it. It had a distinctly amateur flavour. I sincerely hope that "Room A" is not one of those unlicensed transmitters who occasionally "chance their arm" at times when they think no one will be listening. He is really far too good for that sort of thing.

Listening and experimenting as I do in the afternoons and, upon occasions, in the mornings, I pick up many good things which are lost to enthusiasts less happily placed. This was one of them. I am not going to tell you the wavelength in case it really was a government test; but it was well below the broadcast band.

It is a curious thing that there is frequently far more good telephony about in the afternoons than there is in the evenings. Those of my readers who have a chance of listening on week-day afternoons are hereby advised to shut off their B.C.L. sets and get down to the low waves. The odds are in favour of their being well rewarded.

Work on Five Metres

Some time ago, writing of ultra-short waves, I mentioned working on five metres and thereby raised false hopes in the bosom of a good friend of mine who is also a constant contributor to THE WIRELESS MAGAZINE. He is transmitting on approximately five metres and hoped that I

was in a position to receive and report.

When it came to a show down I was reluctantly compelled to confess that the lowest wavelength to which I could get with any certainty was about ten metres and so I could not co-operate.

Now I am beginning to wonder how many sets there are actually in existence that will receive below ten metres. The thing is quite possible, because there are commercial sets made to receive the very short-wave transmission of the Incheith wireless lighthouse; but there do not seem to be many amateurs about who can manage it.

Of one thing I am quite certain; the ordinary circuits and ordinary arrangements will not do. With the Reinartz or with an ordinary straight circuit, taking a great deal of care in design, you can get down to ten metres—and there things come to a stop. At least that is my experience.

When I have a little more time at my disposal I hope to investigate and see if I can build a set that really will go down to wavelengths of the order of a yard or a yard and a half.

Getting Ready for KDKA

It is quite a long time since I have heard anything of the 63-metre transmissions from KDKA, the famous broadcasting station in East Pittsburg. Of course, it is quite possible to hear him, if you like to sit up until nearly dawn, when there is darkness over the whole of the Atlantic, but there is very little to be gained from listening for him between eleven and midnight.

Now the long evenings are coming on again, however, we shall be hearing him in full blast, and those who like to hear America in the easiest possible way should be getting ready their short-wave sets with pleasurable anticipation.

Contrary to usual beliefs, it is not

necessary to use special low-capacity valves for work on wavelengths in the neighbourhood of sixty metres. The ordinary four-pin type is quite good enough, provided that the circuit is properly designed and low-loss tuning coils are used. I have had excellent results with all sorts of valves; but I think about the best have been with a DE 5.

This is a very quiet valve with which to work. In association with a six to one transformer and another DE 5 valve, it gives very loud, clear signals. As a matter of fact, for code working I used an eight to one transformer, but that is liable to distort telephony. I doubt, though, whether the distortion matters much when you are just listening on the phones. It is, of course, another matter altogether if you want to put KDKA through a loud-speaker. There is likely to be so much distortion already in the reception that the utmost care is needed in the use of amplification before the loud-speaker.

Amateur Morse

There is a movement afoot amongst many amateurs to try and persuade their brother "brass pounders" to "go slow" on the key. To this movement I give my most hearty commendation. Many of our amateurs think it is good form to work as quickly as they can hit the key. This is all right if they have an absolutely pure note, are perfectly steady and are spacing well.

But many of them space abominably, have a note that sways and swings and rises and falls, and the upshot of it is that they are almost impossible to "copy."

I have many times noticed that our best D.X. (long-distance) workers are men who space well, have a pure note, and are not afraid they will be thought "beginners" if they go slow. Something between ten and fifteen words a minute seems to be the rate that "gets there." Some

BELOW THE BROADCASTING BELT *(Continued)*

of the very best men do not go more than about twelve words a minute.

Of course, a paragraph like the above lays one open to the charge of being a slow reader. I freely and frankly admit that I am not a fast reader; but I do know that I get on far better with professionals working up to twenty words a minute than I do with many amateurs working at fifteen. It is all a matter of spacing and a steady note.

Insulating Short-wave Sets

Though it does not seem necessary to take any very special precautions in a set that is designed to work down to fifty metres or thereabouts—beyond careful design and short wiring—it is certainly a good thing to insulate batteries, set and everything, when trying for the ultra-short waves.

With regard to the batteries, they may either be stood on a sheet of glass or else on porcelain feet. Small reel insulators make very good feet and may also be used for the accumulators. The set may be stood

on similar small feet and the telephones should not be connected direct into the circuit of the last valve, but there should be small high-frequency choke coils inserted.

I have not found any advantage in insulation above fifty metres, but below fifteen metres, in one set, insulation made all the difference between oscillation and no oscillation.

By the way, talking about oscillation, I got into trouble with a correspondent the other day. He said: "All day and every day we are told not to allow our sets to oscillate, and yet, in your 'Below the Belt' articles you are always talking about oscillating sets. Surely oscillation causes interference on short waves just as much as it does on the longer waves used in broadcasting?"

Quite right, it does; but most work on the short waves is with continuous wave telegraphy, and continuous waves cannot be received unless the set is oscillating and so heterodyning the note. When the receiver is just oscillating it is in the most delicate

condition for receiving C.W., and we try to work with our sets in this condition. But there is no interference caused by this method of working as there is with telephony.

It is obvious that if a receiver will not oscillate it will not bring in C.W., and that is the reason why I write about getting the set into a state of oscillation.

5 Y M.

WIRELESS is teaching people to appreciate real music, says a critic. That must be why the Amalgamated Union of Jazz Bandmasters are threatening to oppose it.

THOUGH a well-known airman says that aviation and wireless are wedded together for all time, perhaps he won't consider us disrespectful if we say that his ideas are all in the air.

A NEW attachment enables listeners to take their wireless into the garden without any trouble. If we were cursed with some of the sets we have heard we should feel like throwing them there.



Upon the river's bank serene,
A fisher sat where all was green,
And looked it.

He saw when light was growing dim,
The fish, or else the fish saw him,
And hooked it.

He took with high erected comb
The fish, or else the story, home,
And cooked it.

Recording angels by his bed,
Weighed all that he had done or said—
And booked it.

ANON.

Player's Navy Cut Cigarettes.



'It's the Tobacco
that counts.'



P.1201

In writing to advertisers, please say you saw the advertisement in THE WIRELESS MAGAZINE.

Notings on the Month's Progress

IN the new operating theatre of the London Temperance Hospital it is intended to separate the patient, the operating surgeon, and the assistants and nurses in attendance, from the usual audience of doctors and students by a large enclosure of glass, which will enable the operation to be clearly seen from the outside theatre whilst, at the same time, preventing unnecessary intrusion upon the principals during critical moments.

A loud-speaker, mounted outside the screen and connected to a microphone near the patient enables the operating surgeon to explain his work in detail as it proceeds, so that the immunity afforded by the glass housing does not in any way interfere with the normal method of imparting surgical instruction to the students.

Nations in Conclave

Listeners who complain of too much jazz and frivolity in the B.B.C. programmes will have an opportunity of enjoying some more substantial fare during the forthcoming autumn season, when it is proposed to broadcast the proceedings of the League of Nations.

Offers to transmit speeches delivered by the various delegates have already been made by the principal European stations, and if, as is expected, facilities are given by the League for this purpose the B.B.C. will almost certainly follow suit.

At the North Pole

The reasons which led Captain Amundsen to abandon his wireless outfit in favour of an equal weight of extra petrol, before starting on his recent gallant attempt to reach the North Pole by aeroplane, do not appear to have influenced the commander of the McMillan Arctic Expedition.

Each of the three McMillan machines carries a Zenith transmitter radiating a wavelength of 37 metres. An important feature of the equipment lies in the fact that both the plate and filament voltages are sup-

plied from a battery of dry cells, so that communication can be maintained even on the ground with the engine stopped.

In the more usual type of aircraft wireless, transmission is dependent upon the supply of high-tension being maintained by a small windmill motor driven by the "slip stream" or air current from the main propeller. For ground work, the H.T. motor is geared to the engine, provided the latter is functioning; otherwise the set is practically useless.

Wired Wireless for Use in Mines

Extensive experiments have recently been carried on in the Northern and Midland mining districts with the object of exploring the possibility of installing wireless apparatus for life-saving work. Most of the casualties following an explosion are not due directly to the force of the impact so much as to gas poisoning, or to starvation owing to the men being trapped by the subsidence of rocks. A reliable means of locating the position of entombed men may therefore mean the saving of many valuable lives.

Owing to the high rate of absorption of the ether waves in penetrating through a considerable thickness of earth, it is found that a comparatively high-powered wireless installation is required to ensure communication with the surface.

This involves an expensive and bulky equipment and considerable skill in operation and maintenance.

A more practical system lies in the use of wired wireless in which radio-frequency currents are transmitted over any convenient system of metallic conductors that may be available, such as existing power-supply mains, the hoisting-cable, trolley rails, or pipe lines. In this way reliable communication over several thousand feet can be maintained by means of a small 5-watt transmitter.

Directional Transmission

The latest type of directional aerial is a development of the original

Marconi grid-iron arrangement. It consists of a number of vertical wires strung in a row between two or more lateral wires carried by end supports. The vertical wires are spaced apart by one-eighth of the wavelength to be transmitted.

Adjacent vertical wires are connected together through adjustable resistances, and each aerial element is then tuned. The radiated energy is concentrated in two beams, each spreading out at right-angles to the plane of the grid-iron network.

For unidirectional working a second similar network is provided a quarter wavelength behind the first aerial, and acts as a reflector, cutting off the rear beam and increasing the intensity of the forward beam.

Mr. C. S. Franklin states that, using the latter combination and an aerial network of wires corresponding to one square wavelength, he is able to secure ten times the signal strength got on an ordinary transmitting aerial radiating the same total energy.

Another Short-wave Success

The Machelen station near Brussels is now successfully maintaining daily communication with the Belgian Congo, using a wavelength of 100 metres and a power of five kilowatts. Previously the only dependable wireless route between the two countries was by way of the transcontinental station at Assise, near Paris, and the French Congo.

In order to provide a direct service, the Belgian Government decided some time ago to erect a giant transmitting station at Ruysselede, near Bruges. This station is scheduled for completion in 1928, but the increasing use of short-wave transmission threatens to render the new station obsolete before it can be brought into commission.

The Larmor Theory

The late Dr. Heaviside, when postulating the existence of a layer of electrons in the upper regions of the air-ocean, considered its action upon transmitted ether waves to be

approximately that of a mirror, the waves being reflected back from the ionised layer, and, in effect, confined between the zone formed between the layer and the curved surface of the earth.

This certainly explains the somewhat peculiar fact that such waves do follow the curved track between here and the antipodes, instead of keeping the straight path into space as might be anticipated.

Sir Joseph Larmor, on the other hand, considers the bending effect to be due rather to refraction than reflection at the surface of the ionised layer. Just as light waves are bent or refracted when passing from one medium to another of different optical density, so a similar deviation takes place when ether waves come into contact with the Heaviside layer.

The merit of the Larmor theory is that, as with light, the refraction effect should theoretically be more pronounced in the case of short than long waves.

This agrees with observed facts, and may explain the extraordinary efficiency of short-wave transmission as compared with wavelengths of 5,000 metres and upwards. Accord-

ing to Larmor a zone of unequal ionisation exists at the twilight circle, that is, where the effect of the sunlight ceases.

Static Eliminators

One of the earliest solutions consisted in using balanced crystal or valve circuits designed to limit the noise of the atmospheric to that of the actual signal, so that the latter could be "read through" the disturbances. The Weagant system is based upon a theory that "static" disturbances take place at right angles to the earth's surface, originating at some high altitude and striking downwards towards the earth's surface, whereas transmitted signals are known to travel more or less parallel to the ground.

The Weagant receiving aerial system is, therefore, arranged in two parts, one horizontal and the other vertical. The effect of the disturbance on both aerials is cancelled out in the receiving circuit, whilst the signal proper passes through to the telephones. The use of long aerial wires buried some distance under the surface

of the earth is another expedient that has been developed by Dr. Rogers for the same purpose.

Many other schemes have also been suggested, but none of them have so far proved entirely satisfactory in practice.

Atmospherics

The problem of atmospherics and reception is essentially a commercial one, and a fortune awaits the lucky man who solves it. In these latitudes the effect of atmospherics is hardly noticeable when compared with conditions in more tropical regions, where, in summer time especially, a succession of X's, sizzles, clicks, grinders, and full-blooded crashes keep up an incessant roar in the phones for hours upon end, absolutely blotting out any chance of ordinary reception.

The effects are particularly noticeable on the longer wavelengths used in commercial practice, though in the southern states of the U.S.A. they are sufficiently pronounced to make the satisfactory reception of short-wave broadcast a difficult matter. B.A.R.

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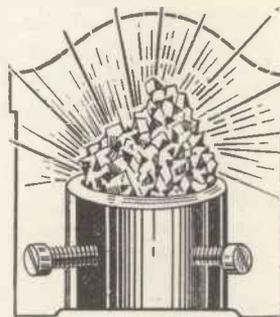
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