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Vol: XVI. N°60

DECEMBER 1931

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THE "ECKERSLEY" THREE

RADIO-CONSULTANT-IN

M.I.E.E.

CONTENTS

Vol. XVI. No. 60. MODERN WIRELESS DECEMBER, 1931.

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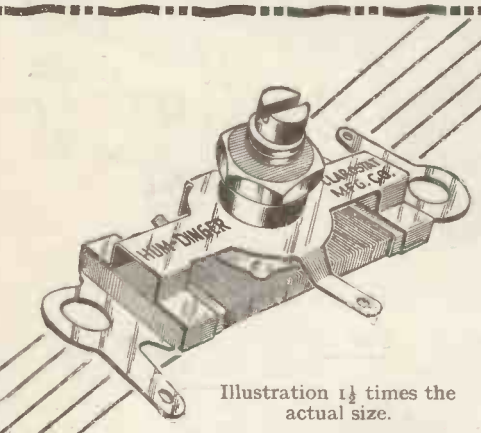

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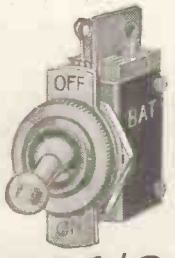

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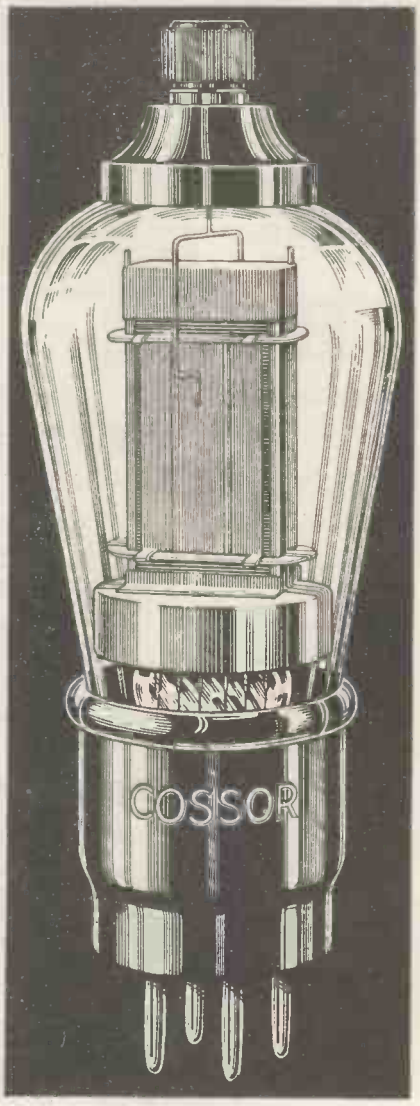

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Vol. XVI. No. 60. BRITAIN'S LEADING RADIO MAGAZINE DECEMBER, 1931

Introducing Capt. Eckersley's First Set for the Home-Constructor.

THIS is a very special number of MODERN WIRELESS for more than one reason. To begin with, it contains full details of how to construct the "Eckersley" Three—the first set actually designed, built and described by Captain P. P. Eckersley for home assembly.

It is a set which he has been working on for some time, with a view to providing the home-constructor with a first-class three-valve receiver capable of holding its own—and more than holding its own—in the congested ether conditions which prevail to-day.

You all know how the Rome Conference failed; how the delegates representing various countries refused to agree to the B.B.C.'s plan that every country should give up one wave-length in order to relieve ether congestion. And you know from the interviews Mr. Noel Ashbridge, the Chief Engineer of the B.B.C., has given in various newspapers, that only the slightest modifications are being made to one or two British stations as regards wave-length changes.

Nothing further may be expected in the way of clearing up the ether situation from the transmitting end until the Madrid Conference in 1932—and perhaps not then.

For some time past Captain Eckersley has been concentrating on the design of a special tuner to meet bad ether conditions, and in the design of the "Eckersley" Three this tuner is incorporated for the first time in any wireless receiver.

Captain Eckersley has made arrangements for this tuner to be available to the constructor public at a very moderate price. And I can vouch for the fact that it gives a magnificent performance. It is certainly a very worthy key component for the first three-valve set ever designed by Captain Eckersley for home-constructors.

A full-sized blue print of the "Eckersley" Three is also presented to you in this issue, and I shall look forward to receiving letters from readers describing the results they obtain when they have built up this notable receiver.

Your Way to Perfect Radio

IT being the Christmas season, and this being a Christmas double number of MODERN WIRELESS, I thought it a good opportunity to include in this issue a section which would be of assistance not only to the new amateur, but to the older hand who has perhaps allowed his knowledge of radio to get a little rusty. This section bears the general title of "Your Way to Perfect Radio." It is a rapid guide devoted to the needs of the constructor who desires to obtain a short cut to a general understanding of the essential technicalities of radio.

The "M.W." Alpha

THE compilers of this section have worked on an entirely practical basis. The articles include constructional details of a first-class S.G. three set—the "M.W." Alpha. And in building this the veriest novice should not find any difficulty. It is described in such clear and practical detail—in fact, wire by wire—that anyone should be able to assemble it. In fact, I maintain that anybody without the slightest radio experience could build this receiver with the expenditure of just a little time, patience and commonsense.

I strongly recommend to your notice the review of the theory of radio, in which the text and novel illustrations run parallel, but independently.

I cannot deal with this invaluable section in detail, but you will find it full of informative articles concerning the installation, operation and maintenance of receivers for best results at minimum expense and trouble; in fact, the A.B.C. of radio practice.

A Tyrant Who Rules Sir John

SIR JOHN REITH is always kind at Christmas, and is now making quite a habit of contributing a special article to MODERN WIRELESS. The one which you will read in this issue I have entitled "My Private Tyrant."

It is a fine example of how Sir John can express, in a style which is worthy of Sir James Barrie, sentiments which, perhaps, we do not usually associate with the head of a great organisation like the B.B.C.

I think you will be rather surprised on reading this article. The heading will, perhaps, mislead you a little, but you will, I think, get an intimately new insight into the personality of the Director-General of the B.B.C. when you have appreciated the sentiments which inspired him to write this special article for MODERN WIRELESS.

The "D.G.'s" Disclosure—

My

The approach of Christmas has caught the Director-General of the B.B.C. in reminiscent mood. And remembering the spectacular rise of radio we can all sympathise with the point of view he so whimsically outlines below.

Broadcasting House to-day—a silent tribute to the genius of Sir John.

MY first knowledge of the B.B.C., or that anything of the sort was under discussion, was in the middle of October, 1922. The lot was cast—theirs and mine—just two months later. On December 19th I set out to find offices for the B.B.C.

An interesting recollection that. Arthur Burrows and Cecil Lewis accompanied me. There was also another member of the party—a gentleman who had apparently been selected to be Chief Engineer.

In the course of the afternoon he informed me that he had no intention of accepting the position. There was no security attached to it. I have often wondered if he subsequently regretted his decision.

How Savoy Hill Was "Found"

This was my first visit to Savoy Hill. Not being an electrical engineer, I had not previously heard of any of the Savoy group, except the Chapel and the Hotel.

To be more accurate, it was to 2, Savoy Hill that this visit was paid; the present West door was the entrance, and was, in fact, the only one in the street. Savoy Hill was then, and presumably officially still is, only that little street which runs at right angles to the Embankment and ends in the steps and the steep incline to the Strand.

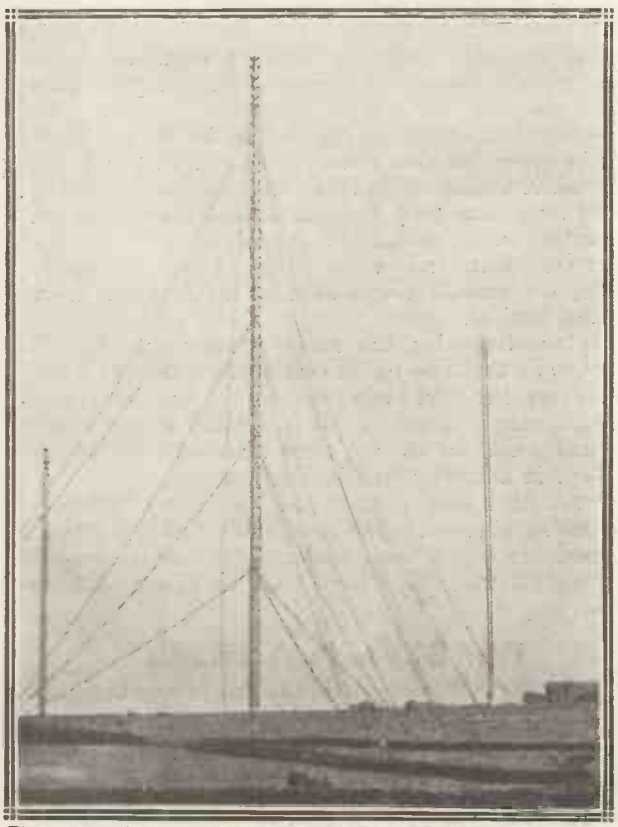
In due course the numeral was abandoned and Savoy Hill was understood to include also the street parallel to the Embankment beside the Chapel graveyard. This street did not appear to have any name before, though the buildings in it were known as Savoy Chambers.

The absorption of more and more of the space at No. 2 (on all of which an option had fortunately been secured at the outset), the rebuilding of the corner block (demolished by a Zeppelin bomb) between it and the Chambers, the gradual penetration into the latter, their complete occupation and reconditioning from top to bottom—all this was done well within two years.

The March from Magnet House

It was on March 19th, 1923, that a band of thirty-one originals, including a commissionaire, a cleaner and an office boy, migrated from the temporary quarters at Magnet House, Kingsway, to Savoy Hill. There are fourteen of them left to-day to participate in the forthcoming "flit"—as they say in the North.

On March 22nd I took possession of my own room and have retained it ever since. When first I saw it, it was just one end of a vast hall, out of which a large general office, and many other rooms, were to be made. It has probably as fine a view as any in London.



The progressive policy of the B.B.C. has provided the industrial North with this fine station at Moorside Edge.

Private Tyrant

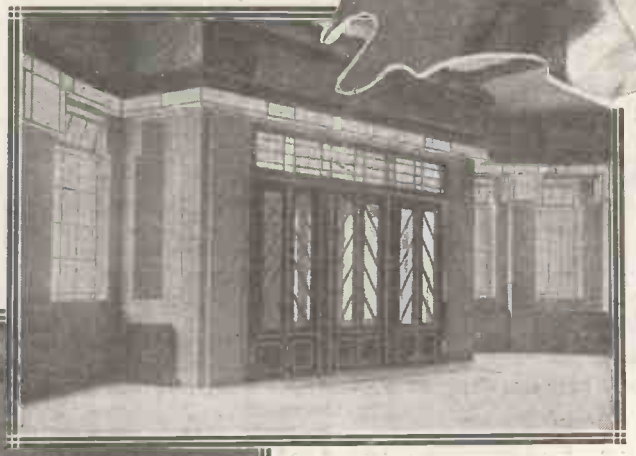
By SIR JOHN REITH

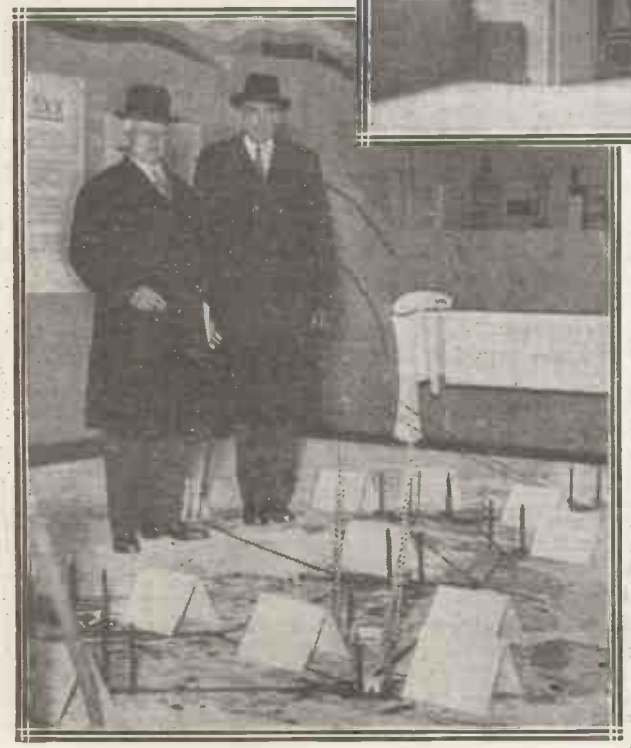
Foreign visitors find it very convenient. One can see Lambeth Palace, the Houses of Parliament, Westminster Abbey, Cleopatra's Needle, St. Paul's Cathedral and, I think, the Tower of London. I have always meant to investigate this last. There is over a mile of the River to be seen, and three great bridges.

Nine years is not necessarily by itself a long spell. But it is longer in some occupations than in others. It must, I imagine, be quite a long time in a gaol for instance. In the B.B.C. it is a very long time.

And for all this time I have gone up and down, to and from, that room. Up and down. Soon I shall be doing so no more, and I am proposing a little ceremony.

I do not look for ceremonies in which to take part; in fact, I take considerable pains to avoid them; but in two or three months' time I propose to stage one, and to take a leading part in it.





Under the portrait of the author himself is a picture of the fine entrance hall at Broadcasting house, showing the massive bronze doors and the artistic diffused lighting. Below, the Rt. Hon. J. H. Whitley, Governor-Director of British broadcasting with Sir John Reith at a Radio Show.

There is no photographic or other public record of the entry into Savoy Hill, either on December 19th or on March 19th; though there is, by the way, a photograph of the first B.B.C. nameplate.

It was a postcard, and it was affixed in some manner to the stone by the door of No. 2. On it was written: "WIRELESS BROADCASTING COMPANY." In fact, I think, "WIRELE33."

Written on a Postcard!

Through the title ran a wavering line to denote lightning. It was due to the initiative of the first door attendant. I salute him. I think he was aggrieved when the brass plate arrived a few days later.

At any rate, he did not remove his own handiwork until it was represented to him that it was no longer required.

Some newspaper being at that moment occupied with an attack on the B.B.C. on the score of extravagance, a photograph of this first nameplate—the postcard one—

He's Going To Do the Locking-Up Himself!

was published over the caption "Opulence." A far cry from that day and that style to this!

To revert to the matter of ceremonies, I was the first to enter Savoy Hill. I propose to be the last to leave it; but the little ceremony to which reference was made above will be quite private. There will be no reporters or press photographers present.

I propose to come down the stairs, to lock the door behind me and take out the key. Then I will take it round the corner and hand it over to Mr. Rowell, of the I.E.E., in his office. If he cares, he is welcome to attend on the pavement to receive it.

How I shall feel when shutting the door of my room for the last time I do not know. Nor does it matter. The prospect is, as I have indicated, extensive, varied and less friendly than it was. Once I had a great affection for it, but that waned. It was not the fault of the room, nor, I think, my fault.

However, I feel that I do not wish to leave it, and that I can hardly imagine myself doing the same sort of work anywhere else. That, of course, may be mere perversity.

And what a tyrant it has been and what a toll it has demanded—on one's time, thoughts, energies, abilities of every kind, and on one's life!

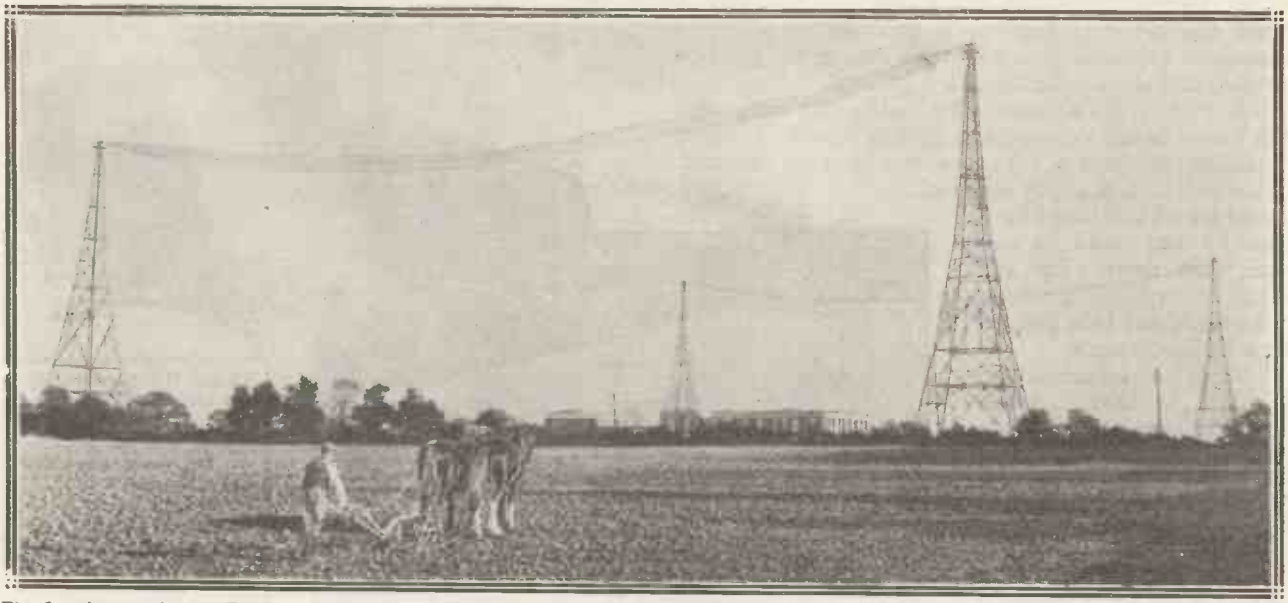
"What a Biography It Could Write . . ."

How many other useful and desirable things it has prevented one doing in the same building. This room, with its tables and chairs and desk lights, its telephones, its memoranda and letters, statistics and reports, its ideas and its schemes, its interviews and meetings, its doors for ever opening and shutting. How much it has seen and heard. What a biography it could write if it had perceptions and intelligence.

As a matter of fact, I have done that for it. I have kept a Diary for twenty-one years, and not a day has been missed. It was really on the subject of Diaries that I meant to write just now, but I have occupied the space with the introduction.

I have written about a Room instead of a Diary. For the past nine years, though, there has not been much difference between them. And soon the room will know no more of, and be no more known by, the B.B.C. I find it hard to believe.

Old and New—A Tiller of the Soil at Brookmans Park



The London station at Brookmans Park was designed by Capt. Eckersley, and was the first successful twin-wave broadcaster in the world

romantic. The trees of the Embankment Gardens rise to the level of the windows, and one can note the passage of the Seasons in this way if in no other.

Sounds That Become Familiar

Extraneous sounds borne in to the room range from the periodic hoot of a river tug—which is pleasing and stimulating—to the clatter and roar of obsolete tramcars rounding into a gloomy subterranean passage, a process which appears to necessitate the day-long presence of a policeman and another official, and, of course, the suspension of all other traffic. This sound is disgusting and infuriating.

The room is spacious and comfortable enough, but it is

RADIO GIFTS FOR CHRISTMAS

Perhaps you hadn't yet thought of the possibilities of giving radio presents? This article shows you that you couldn't possibly do better!

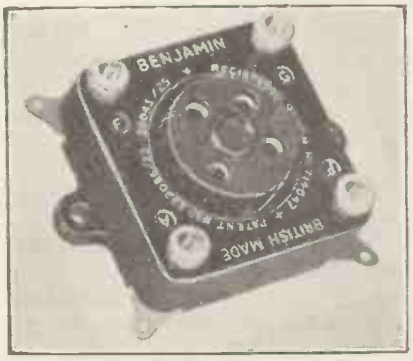
THIS year, as perhaps never before, the choosing of radio Christmas presents will seem to be a difficult task to many "M.W." readers. For this is the year of the Emergency Budget, the year of increased taxes and decreased returns; in fact, the year of strict economy.

Money Well Spent

Alike to those who have already given some apprehensive thoughts to the matter, and to those who have shelved it until the calendar makes the present-giving problem unavoidable, these suggestions of radio gifts should appeal with considerable force. For the Christmas present which makes possible or which assists wireless reception is in a class by itself, so far as the possibility of pleasures-to-come is concerned.

It would be futile to deny that times are unusually hard this year and money uncommonly "tight,"

GET A GOOD ONE



Many a good set "falls down" over a poor valve holder, so be sure you get a good one.

LITTLE—BUT EFFECTIVE

This "Midget" is capable of putting up a really big performance.

but is not that fact one of the strongest arguments in favour of giving radio as compared with any other competing form of Christmas present?

Where else can you find a gift that lasts throughout the dark days and the bright days till winter comes again, that is constantly fresh and vital, that is ready to serve you with music or mental stimulation, that keeps the cottager in touch with town, and links the home at will with the whole wide world outside?

Helping the Trade

Yet that is what broadcasting does for us, and those who realise that fact and who make their Christmas presents on a radio basis will certainly have done something towards keeping the Christmas spirit alive in difficult days, as well as in assisting trade by just that wise spending which is now so necessary.

There are some truly wonderful bargains to be had, and, as an instance, let us first look at just one aspect—loud speakers.

Only two or three years ago the loud speaker was a really difficult thing to buy, because people had ideas about the different "tones" they preferred. Some liked the deep, boomy (and then very expensive) moving coils; others preferred this or that make, according to various fancied tonal qualities.

Plenty of Bargains

What a change we have seen recently! Nowadays you can get, at a reasonable price, a *realistic* loud speaker, free from "tones" and "mellowness" of its own, but instead marvellously life-like in its reproduction.

THAT H.F. CHOKE

Modern circuits demand very high efficiency in the H.F. choke, and this (Paroussi) is a good example.

Radio's First Advantage—It Lasts!

Moreover, the range of these modern loud speakers is as varied in regard to price and to appearance as is their ability to reproduce both high notes and low notes. Just as you now can hear by wireless the deep drums or the light, sweet swing of the violin's top notes from any good, up-to-date design of loud speaker, so you can range from quite low prices to really expensive presents.

Loud Speakers

Those modern balanced-armature loud-speaker units are just as good, in their own sphere, as the very latest moving-coil, inasmuch as they have improved almost out of knowledge during the past few years. They can be fitted to a good chassis—home-made if you like—and installed in a cabinet or attached to a baffle-board, and the resultant music from a good set will be *real music*, not to be sneezed at nor sneered at by the most critical.

So far as value for money goes, you can to-day get more real melody from a single pound invested in up-to-date loud-speaker equipment than was possible a few years ago for £50. Startling? Yes, but true, because of the great advances in technique which are such an amazing feature of radio development.

Always Useful

It is perhaps this fact which makes this giving of a radio gift such a truly pleasurable business. If you give away a tin of tobacco, say, or some such conventional present—well, that's that. It will be like last year's present, or that of five years ago.

But with radio the case is different. You can give something new, something surprising, something which makes the recipient rub his eyes and take notice.

There is no need to labour the point, nor to stress the fact that it is not applicable to loud speakers alone. They were quoted as an instance, but all radio equipment has a touch of this vivid vitality which comes about only in a technique that is continually transforming itself into better and better instruments.

Now for some brief suggestions that may be helpful in your own problem of what to give. First a word as to accessories.

Tremendous Choice

Don't think only of valves and of the set itself, but remember that radio is rich in side-line possibilities. If you spend sixpence or so in stamps for the catalogues and lists so often mentioned in "M.W." you will realise what a rich store of "possibles" you have tapped.

Such catalogues and a close study of radio advertisements will convince you that no matter what price you want to pay there is wonderful value to be had in radio gear. And an amazing variety.

"Batteries," for instance, may seem to be a very limited field. But if you have only a few pence or shillings to spend you can launch out on an orgy of battery clips, or battery cords, or battery carriers, or battery testers, or battery connectors.

A New Battery

You can get not only a new battery (often an extremely welcome present), but a new *type* of battery. For nowadays there are all sorts of special ones—unspillables, "jelly" types, slow-discharge types, indicating batteries, and so forth, cunningly contrived for specialised radio results.

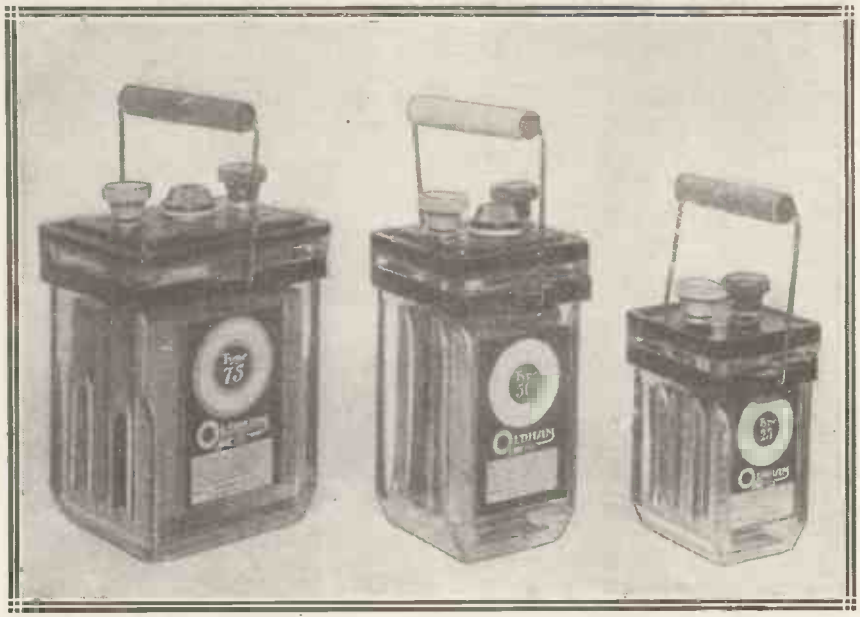
The radio-gramophone field is another one that is full of possibilities, and nobody who has a gramophone should fail to link it with his loud speaker. Pick-ups and tone-controls and also volume-controls are all candidates for consideration here.

One extremely useful present that often gets overlooked is that comprised under the general heading of "meters."

Useful Meters

The really keen experimenter is not the only person who would appreciate this kind of gift, for as a matter of fact every owner of a three-valve set, or of anything more ambitious than that, should have at least one good measuring instrument,

WHAT ABOUT THAT ACCUMULATOR?



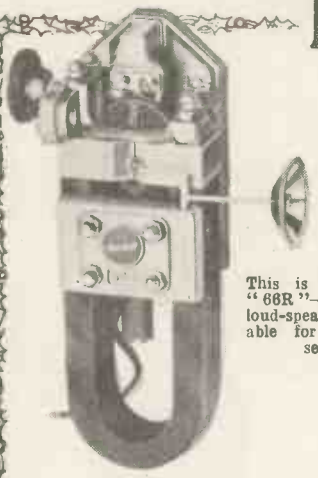
These are three of the Oldham range, of different sizes to meet the needs of different sets.

A double-range voltmeter for L.T. and H.T. is probably the most useful, although a milliammeter in the hands of a knowing experimenter affords an even keener pleasure, and just as much practical assistance in preventing distortion.

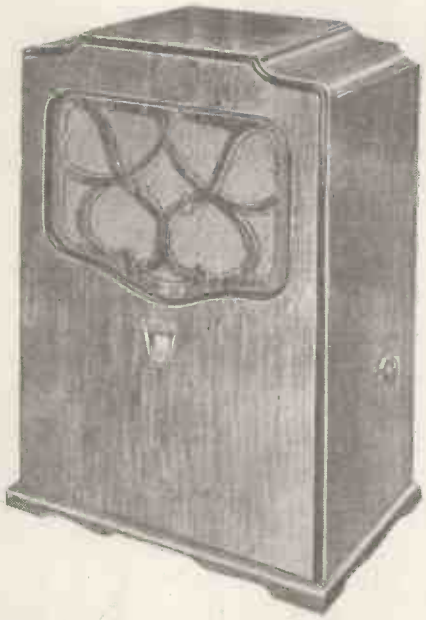
Some of these measuring instruments are now being sold at wonderfully tempting figures, and for the small purse there is often a good opportunity in a hydrometer. Every owner of an L.T. battery has heard of its aid in condition-keeping, but a great many have never purchased one, and would be delighted at the feeling of surety it brings.

Cabinets are a good line also, and there is a whole market-place of temptation in condensers alone, exhibited best perhaps in that latest marvel of simplified tuning, the Extenser.

RADIO PRESENTS IN PICTURES

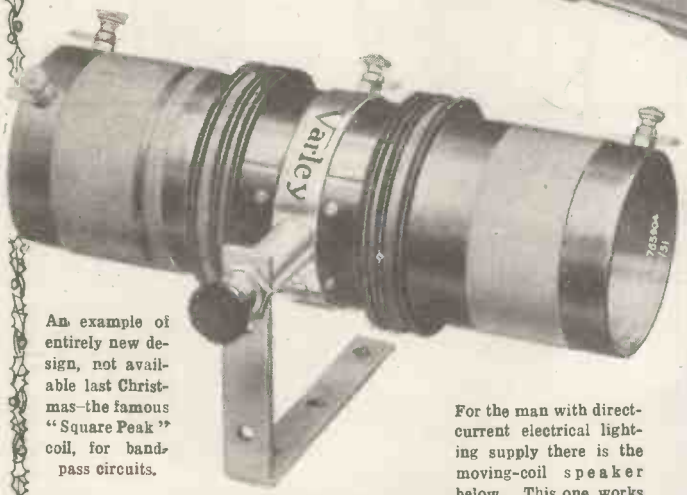


This is the famous "66R"—a Blue Spot loud-speaker unit suitable for home assembly.

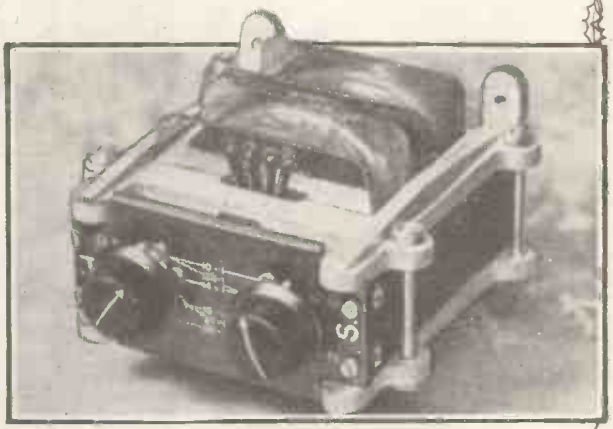


The handsome set depicted to the right is the Amplion Six. This particular model is of the table type, and it harmonises beautifully with modern furnishing.

Better valves have enhanced the popularity of frame aerials, and the one above is a Lewcos product, with windings for long as well as for medium waves.

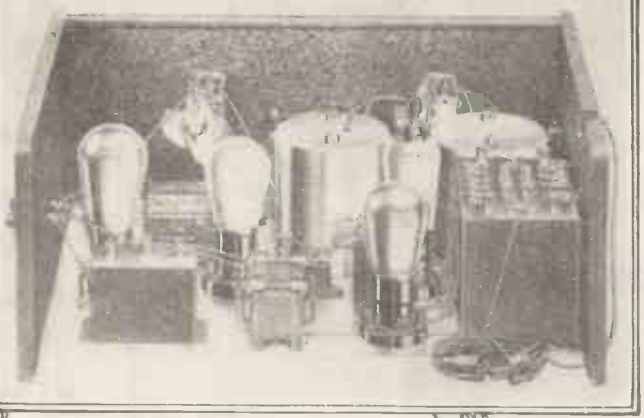


An example of entirely new design, not available last Christmas—the famous "Square Peak" coil, for band-pass circuits.



For the man with direct-current electrical lighting supply there is the moving-coil speaker below. This one works from any voltage between 200 and 250. To the right of it is an Atlas H.T. unit. This one is for A.C. mains, and employs a dry rectifier.

The "Instamat," a Ready Radio output transformer for instantly matching the output to the last valve, is shown above.

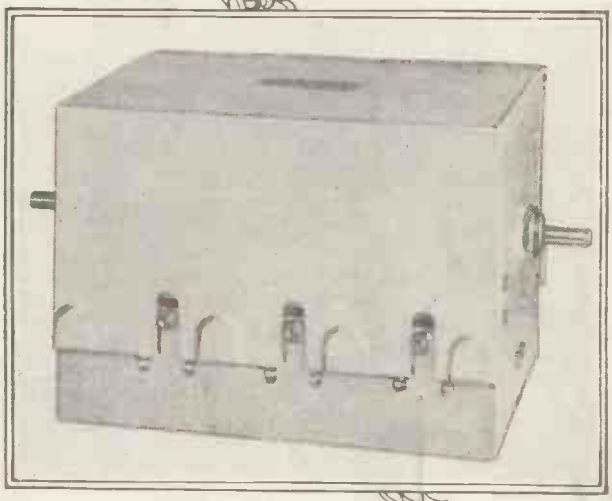


This is the inside of the famous Cossor Melody Maker, as made from the Mains Kit.

Three very attractive items are shown to the right. First there is a complete A.C. mains receiver (G.E.C.), and below it an example from the range of Tungsram valves, and the Graham Farish A.C.4 loudspeaker chassis.

Above is a close-up revealing the structure of the Mazda A.C. Pentode.

Below, a handsome "Utility" Condenser Assembly.

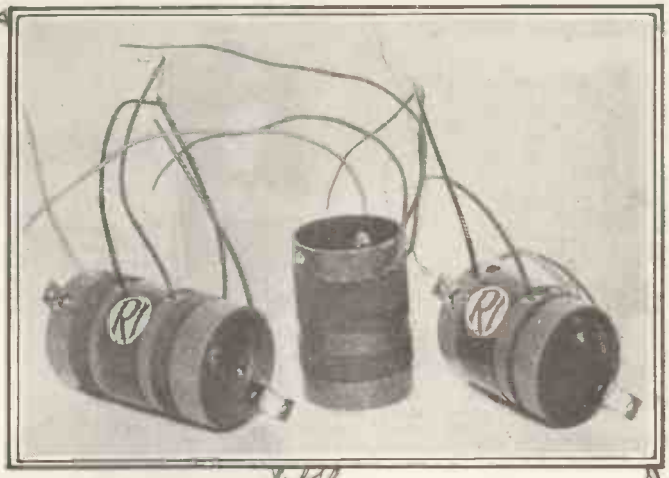


Most readers will recognise the compact Aerial Coil below as one of the famous Telsen lines.

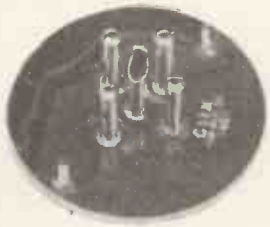
The "Magnum" Dissolver provides for a smooth and silent change-over from radio to records.

"His Master's Voice" Gramophone Pick-up Unit and Volume Control.

All radio-gram enthusiasts will be interested in the Diehl Induction Motor (Claude Lyons), for silent-running gramophone work.

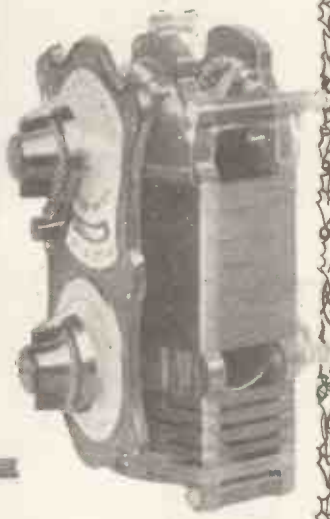


Above is a group of the famous P.J. coils, from the Radio Instruments' factory at Croydon. Right, a low-loss panel-mounting valve-holder (Lectro Linx).



Here is another group of the P.J. coils that are so often used in "M.W." sets. Like the ones above them they have the distinctive coloured leads to facilitate easy connection into the circuit. They are from the "Wearite" range of components.

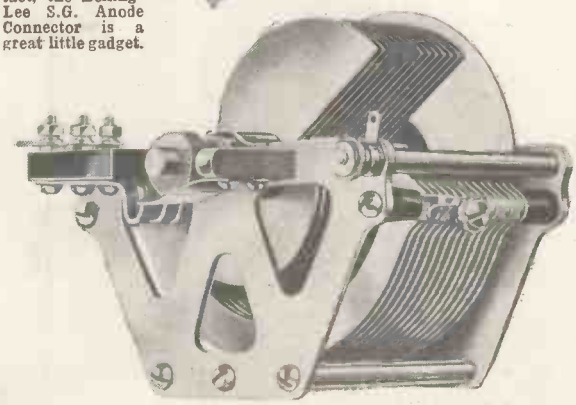
The three attractive components to the left are examples of "Formo" technique.



The complete tuner above, embodying neat switching and skeleton-former construction, is a British General production.

With its complete insulation of exposed parts, and efficient contact, the Belling-Lee S.G. Anode Connector is a great little gadget.

Another step to simpler radio—the Peto-Scott Coil Quoits.



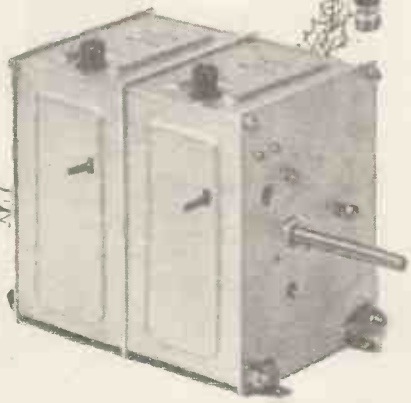
The Extenser—a fine piece of work by "J.B.'s."

The completely-screened condenser (left) is an example of "Polar" workmanship. To the right is an A.C. unit for H.T., L.T. and charging. (Heayberd.)

A Westinghouse Metal Rectifier (right) which gives direct current from alternating-current supply.

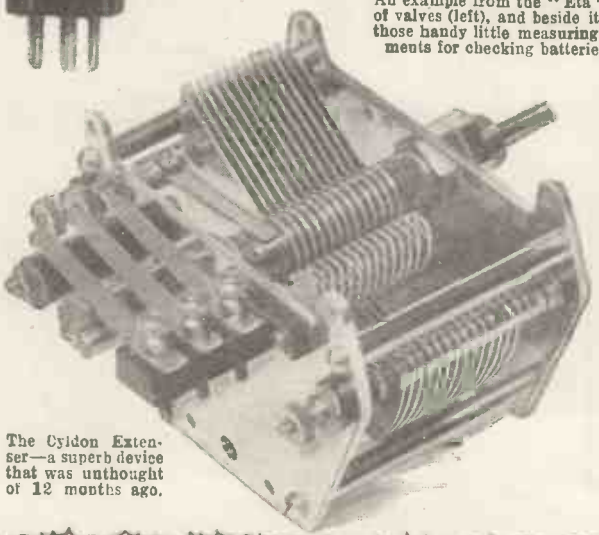
Switches are always handy. These two (right) are from the Bulgin range.

Condensers for mains work should always be "rated." This "Helsby" is clearly marked.

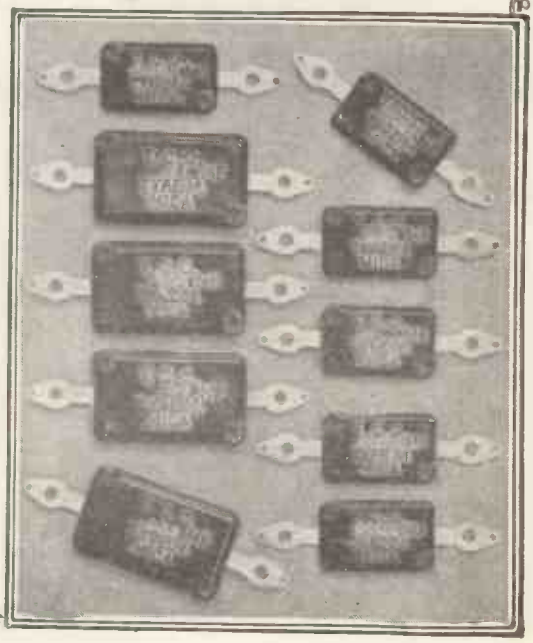


Since last year most ganged variable condensers have completely changed in appearance owing to the thorough screening now adopted. The two-gang assembly to the left is a "Lotus." Below are some T.C.C. fixed condensers. These are extraordinarily compact, with efficient tags instead of terminals.

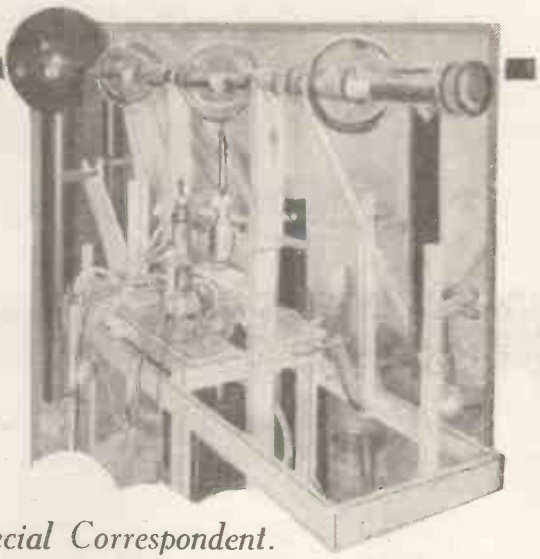
An example from the "Eta" range of valves (left), and beside it one of those handy little measuring instruments for checking batteries, etc.



The Cyldon Extenser—a superb device that was unthought of 12 months ago.



A RADIO SPEED-TRAP



By a Special Correspondent.

How scientists measure the speed of electrons with the aid of radio and other apparatus.

SCIENTISTS have found that wireless apparatus has many uses besides that for which it was originally intended, and an interesting case in point is to be found in some research work done by two American scientists at Harvard University.

In connection with some measurements they were conducting on the

AN ELECTRON GUN

A cathode ray tube, which is really a powerful electron gun. One of these tubes is used in the apparatus described in this article.

electron, they wished to produce a stream of rapidly moving electrons, and then measure their velocity. Their apparatus reminds one of a police trap, for they provided the electrons with a straight stretch of road to travel along, marked out a portion of this path, and then found the time it took to travel over this distance.

The only difference was that instead of the speed being 30 miles per hour, it was something like 50,000 miles per second; a speed which would surely defy the most ardent policeman.

In order first to produce the stream they used what was really a kind of two-electrode wireless valve with an indirectly-heated cathode. The anode was a long, cylindrical tube of aluminium, several feet in length, and placed end-on with respect to the cathode and a short distance away from it.

Providing a Path

It was arranged in this manner so that the electrons should not immediately be absorbed by the anode, but would travel in a straight line along its axis to the end of the tube. Until they reached the anode the electrons would gradually accelerate, but once inside the tube they would travel along with a constant speed. It was this speed that the observers wished to measure.

The course over which the measurements were taken was marked by two pairs of plates (A, B, in the figure), and these plates were connected to a high-frequency oscillator driven by wireless valves, and with a variable inductance for rough tuning and a variable condenser for fine tuning.

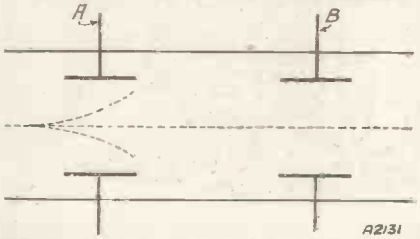
Opposing Fields

In this way the frequency of the oscillations could be varied over wide limits. Matters were so arranged that when the electric field at one pair of plates was in one direction it was in the opposite direction at the other.

We thus see that the plates might be in either of three conditions. The first pair of plates might have a positive charge on the upper plate and a negative charge on the lower, while the second pair would have a negative charge on the upper plate and a positive charge on the lower, or else the opposite might be the case

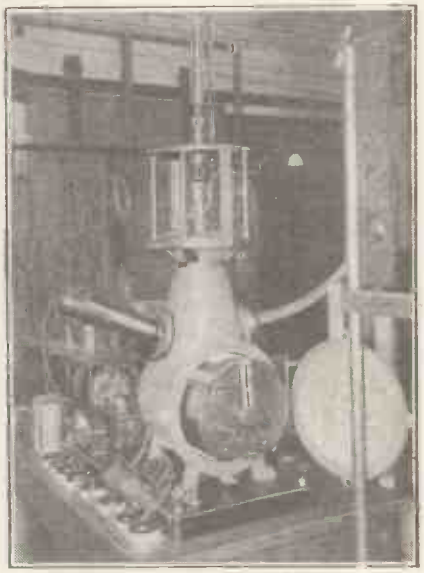
(*Continued on page* 672).

"FULL STEAM AHEAD"



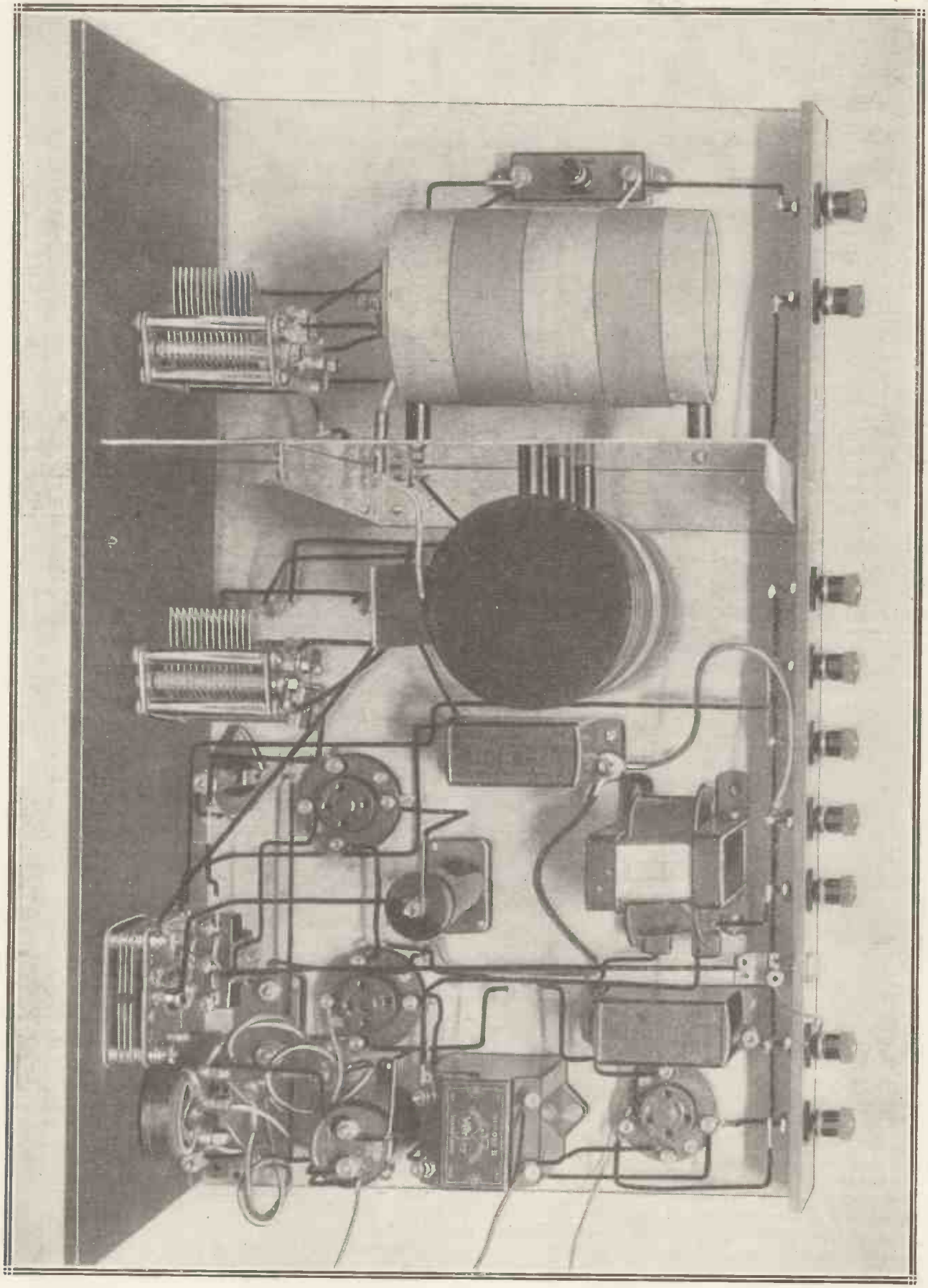
The sets of plates, A and B, are the starting and finishing lines in the high-speed course over which the electrons are timed.

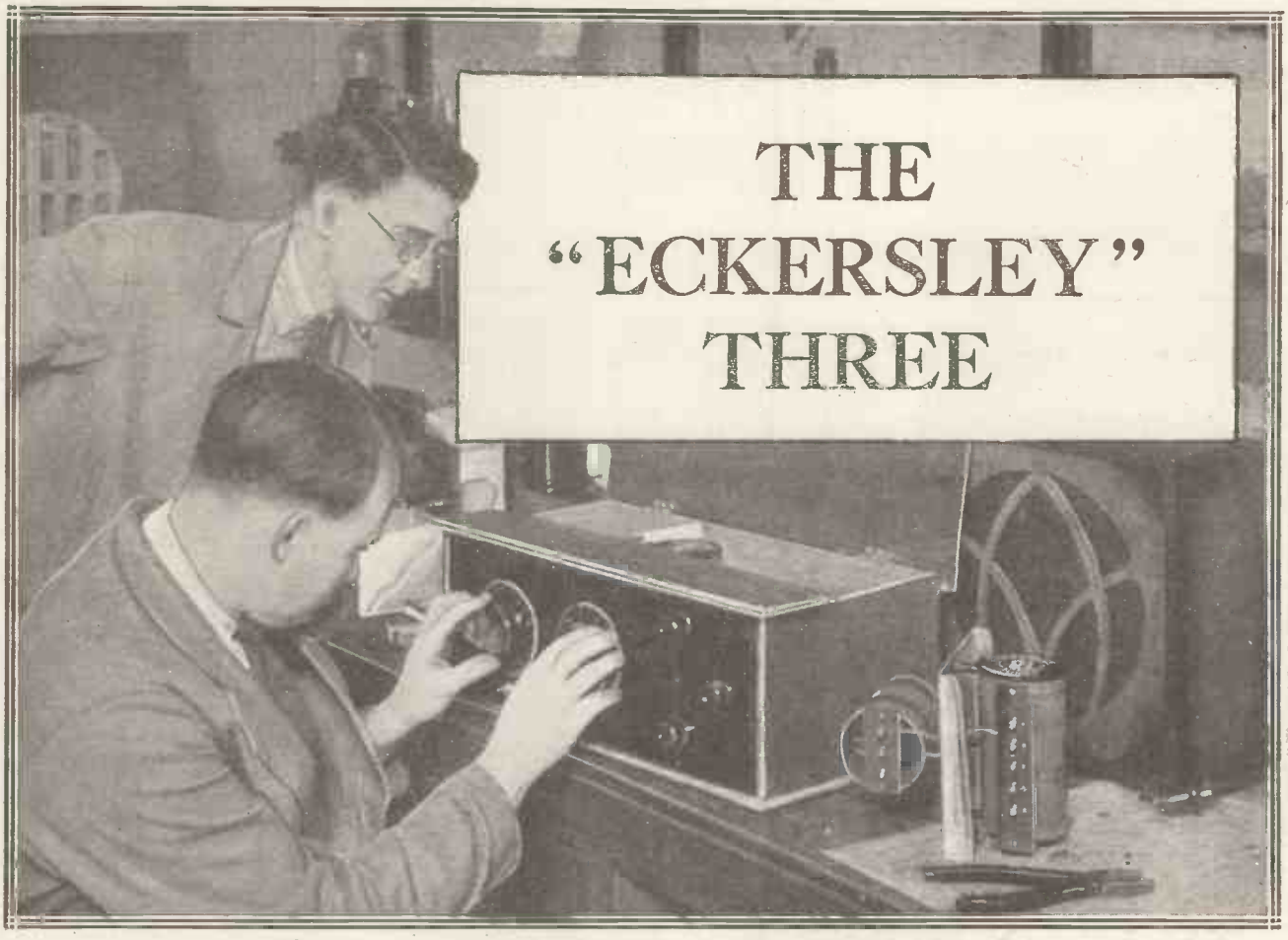
THE TIMING GEAR



This is the apparatus which is used for timing the electrons. The actual speed is recorded photographically on a film which is located in a special drum seen on the right, partly withdrawn.

Capt. Eckersley's First Set for Home Constructors





THE "ECKERSLEY" THREE

DESIGNED AND DESCRIBED BY CAPT. P. P. ECKERSLEY, M.I.E.E.

Our Radio Consultant-in-Chief, the "founder" of British broadcasting and originator of Britain's Regional system of twin stations, has prepared a home-constructor radio set design especially for readers of "Modern Wireless." Capt. Eckersley's set embodies two entirely unique features—features evolved by his own fertile brain in a successful attempt to overcome certain fundamental obstacles that stand in the way of clear-cut reception.

The "Eckersley" Three includes an "Eckersley" Tuner, and is the first set in the world to do so. This tuner enables a higher degree of selectivity and a greater power to be obtained than does any equivalent device hitherto invented.

THE objects of the design of my set are as follow :

1. A lot of sets, expensive ones at that, are not sufficiently selective to get even the local station without foreign station interference. My first object is to design a reasonably-priced selective set.

2. Selective sets are sometimes difficult to adjust. The tuning circuits "pull" one another. Band-passing is quite pretty theoretically, but band-pass circuits are sometimes difficult to adjust to get the wanted effects. My object is to design a set for very simple operation.

3. While realising that the complete solution of "perfect" quality and required selectivity is unattainable, whatever money is paid for the design, it is obvious that, if fundamentals are right, an expensive set could be made to give the very best possible quality and the required selectivity.

At the Right Price

But not everyone can afford the price of such a set. So my third object is to make my selective set for a reasonable price. Thus it is not absolutely theoretically perfect. Theoretical perfection costs too much.

4. I realise that the right technique is to do the selecting part of high-frequency tuning before you get to the first valve, partly because that is right theoretically, partly because a tuner, as such, is ubiquitous.

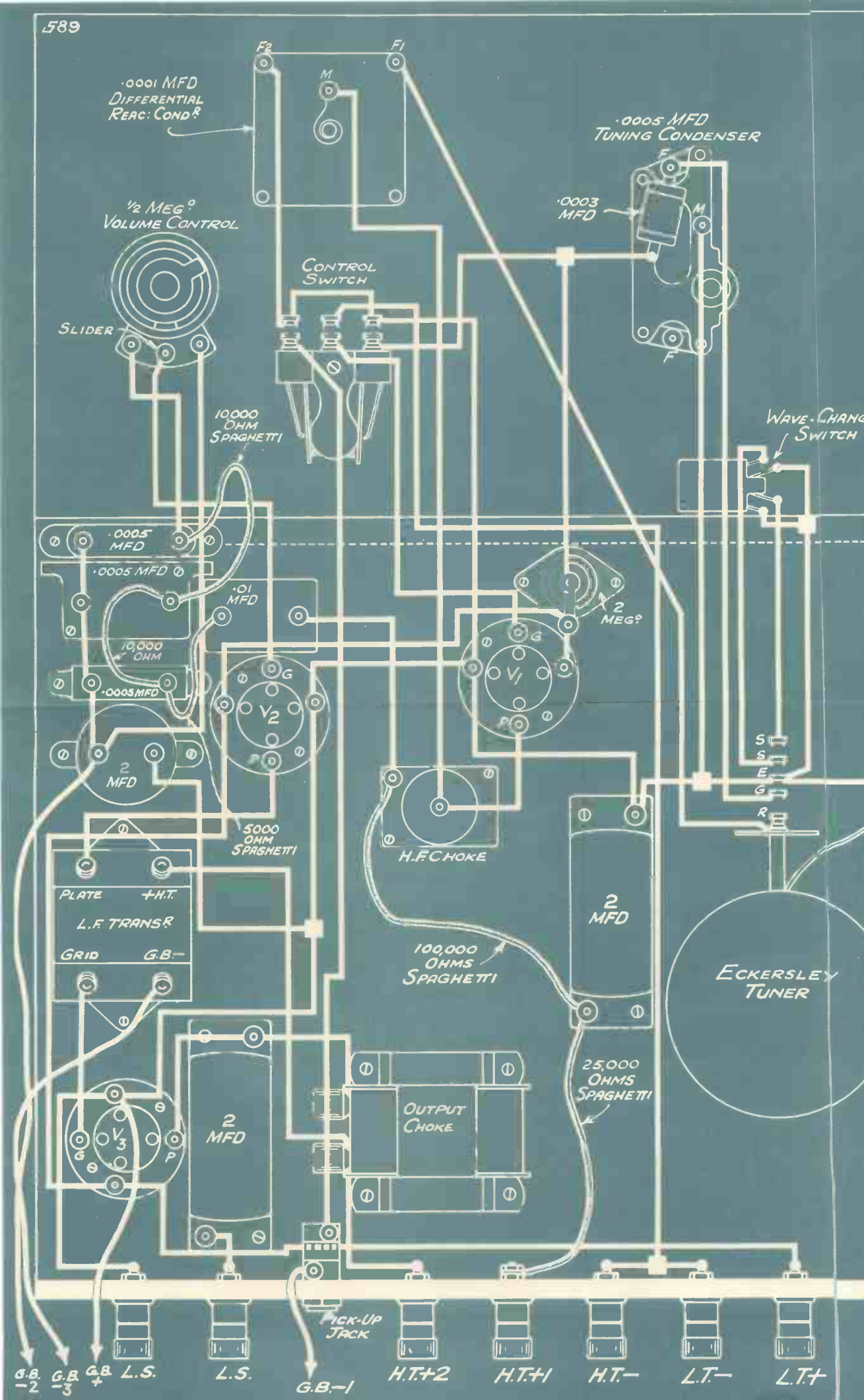
I shall deal in this article with the tuner as applied to a simple detector and two-note magnifier circuit.

This is its simplest application, and will give you a set capable of a selectivity not frequently met with in more elaborate designs.

But even then there is an added novelty in the connections of the amplifier proper. This is a heterodyne interference eliminator. However selective a practical high-frequency circuit is, it is frequently impossible, at a price, to produce a circuit which is so selective as to eliminate the high-pitched whistle caused by foreign station heterodyne, and yet give decent quality.

Shunts that Squeal!

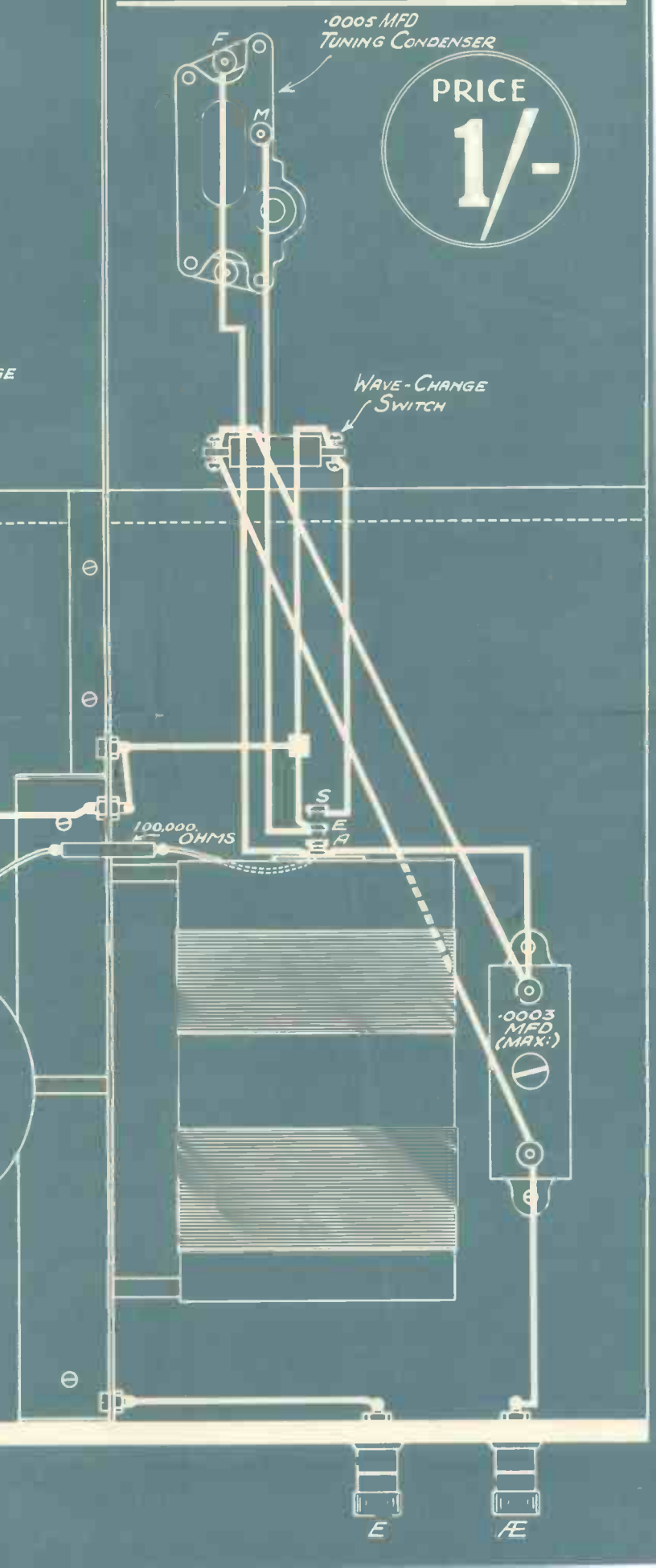
But if the circuit is sufficiently selective as to produce what is called demodulation effects in the detector, the heterodyne can be removed by making the *low*-frequency circuits selective, as it were; that is, by making them to cut off all frequencies above 5,000 cycles (say). Of course, you want all the frequencies up to 5,000 (say) for reasonably good reproduction, and the frequencies above 5,000 are frequently jammed by foreign station sidebands.


F2
F1
M
·0001 MFD
DIFFERENTIAL
REAC: COND.R
·0005 MFD
TUNING CONDENSER
F
·0003
MFD
M
F
½ MEG.Ω
VOLUME CONTROL
SLIDER
CONTROL
SWITCH
10,000
OHM
SPAGHETTI
WAVE-CHANG
SWITCH
·0005
MFD
·0005 MFD
·01
MFD
10,000
OHM
·0005MFD
2
MEG.Ω
G
V1
P
G
V2
P
2
MFD
5000
OHM
SPAGHETTI
H.F.CHOKE
S
S
E
G
R
PLATE
+H.T.
L.F. TRANS.R
GRID
G.B.−
2
MFD
100,000
OHMS
SPAGHETTI
ECKERSLEY
TUNER
25,000
OHMS
SPAGHETTI
G
V3
P
2
MFD
OUTPUT
CHOKE
PICK-UP
JACK
G.B.
−2
G.B.
−3
G.B.
+
L.S.
L.S.
G.B.−1
H.T.+2
H.T.+1
H.T.−
L.T.−
L.T.+

MODERN WIRELESS DEC. 1931.

FULL SIZE BLUE PRINT

THE "ECKERSLEY" THREE



It is possible to design low-frequency filters which cut-off very sharply at any desired frequency, but the sharpness of their cut-off is in proportion largely to the expense and complication of their construction.

Furthermore, if my solution is not perfect, what the ——'s the good of making the perfect solution if it's so expensive a job as to be outside the means of the average man?

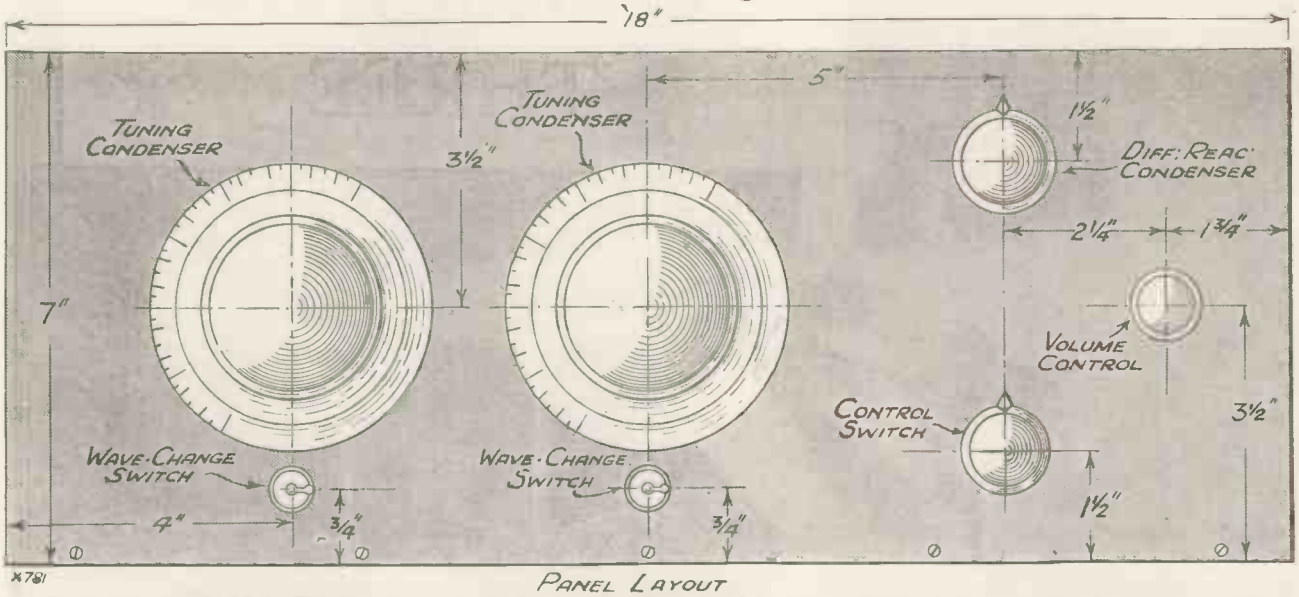
No! The object of my set is to do the best I can for a reasonable price, and I know from my own impressions, and from the impressions of others better qualified to judge of performance of simple sets, that the resulting quality from my set will give you lots of pleasure because of its *clean quality, free from interference, and that's better than any amount of jammed top.*

The filter may not be necessary in *all* cases and when listening to a very powerful local station, and it remains for the ingenious to cut it out or put it in as they want to listen to strong or weak stations.

The construction is an easy business, and with the aid of the full-size blue print will give you no trouble.

The most important part of the design, of course, is the arrangement of the tuner and its accompanying tuning condensers and switches. The latter are for wave-changing, and the one in the "aerial compartment" also short-circuits the series compression condenser when one is switched on to long waves.

It Tunes Like an Extremely Stable H.F. Set



PANEL LAYOUT

There are two main tuning controls, and while these are easy to handle they give one the sensation of tuning an efficient and stable H.F. set, so sharp is the tuning and so powerfully do the stations come in.

I am limited in price. I still feel that while the filter I incorporate is far from theoretically perfect, it is within the means of all, and the resulting quality is clean if truly it lacks "top."

About that "Top"

Now "top" is very desirable, but if part of the top of the local is all muddled up with the bottom of the jammer, what the ——'s the good of that top?

The Coupling Resistance

In order that there shall be minimum interaction between the aerial and grid circuits, other than the desired voltage coupling via the

QUITE INEXPENSIVE, CONSIDERING THE REMARKABLE RESULTS

PANEL
18 × 7 in. (Permcol, Wearite, Peto-Scott, Becol, Goltone, Parex).

CABINET
Panel space 18 × 7 in., baseboard 10 in. deep (Peto-Scott, Gilbert, Ready Radio, Camco, Osborn, Pickett).

VARIABLE CONDENSERS
2 ·0005-mfd. (Cyldon, J.B., Polar, Astra, Lotus, Telsen, Wavemaster, Igranic, Dubilier, Graham Farish, Ormond).
1 ·0001-mfd. differential (J.B., Telsen, Ready Radio, Astra, A.W., Igranic, Lotus, Parex, Formo, Cyldon, Wavemaster, Graham Farish).
1 ·0003 max. compression (Formo, Goltone, Graham Farish, Lewcos, Telsen, R.I., Sovereign, Polar).

SWITCHES
1 Single-pole change-over switch (Bulgin, List S81).
1 Double-pole on-off (Bulgin, List S88).
1 Double-pole, double-throw rotary control-switch with terminals (Wearite).

RESISTANCES
1 100,000-ohm "Spaghetti" (Varley, Lewcos, Bulgin, Telsen, Igranic, Sovereign, Graham Farish, Goltone, Peto-Scott).
1 25,000-ohm "Spaghetti" (Bulgin, etc.).
2 10,000-ohm "Spaghettis" (Bulgin, etc.).
1 5,000-ohm "Spaghetti" (Peto-Scott, etc.).
1 2-megohm grid leak and holder (Dubilier, Mullard, Ready Radio, Lissen, Telsen, Varley, Ferranti, Ediswan, Graham Farish, Lewcos).
1 ·5-megohm volume control (Igranic, Wearite, Bulgin, Sovereign, Varley, Magnum, R.I., Ready Radio).

VALVE HOLDERS
3 4-pin type (Graham Farish, Lotus, Telsen, Wearite, W.B., Lissen, Igranic, Clix, Bulgin, Formo).

FIXED CONDENSERS
1 ·01-mfd. (T.C.C., Mullard, Telsen, Ediswan, Dubilier, Lissen, Formo, Graham Farish, Goltone, Igranic, Ferranti).
1 ·0003-mfd. tag type (Graham Farish, etc.).
3 ·0005-mfd. (T.C.C., Telsen and Sovereign, etc.).
3 2-mfd. (Telsen and Dubilier).

CHOKES
1 H.F. choke (Ready Radio, Telsen, Lewcos, Varley, Wearite, R.I., Sovereign, Polar, Igranic, Atlas, Tunewell, Parex, Dubilier, Lotus, Graham Farish).
1 L.F. choke (Lotus 30-henry, Telsen, Igranic, Varley, Wearite, Tunewell, R.I., Ferranti, Bulgin, Graham Farish).

TRANSFORMER
1 L.F. (Varley, Lewcos, Lotus, R.I., Telsen, Igranic, Lissen, Ferranti, Goltone, Atlas, Formo).

COIL
1 "Eckersley" Tuner (R.I.).

JACK
1 Single-circuit open (Bulgin, J.B., Lotus, Igranic).

MISCELLANEOUS
1 Terminal strip, 18 × 2 in.
9 Terminals (Igranic, Belling & Lee, Clix, Eelex, Goltone).
G.B. and H.T. plugs, spade terminals, etc. (Belling & Lee, Clix, Eelex, Igranic).
Flex, screws, etc.
1 Metal screen, 6 × 3 in. (Ready Radio, Peto-Scott, Parex).
Glazite, Jiffilinx, Quickwire.

The First Set to Use an "Eckersley" Tuner

100,000-ohm resistance, the two coils and their tuning condensers and switches are screened.

The coil unit, which comprises the inductance windings, also includes a separating screen with the resistance running through it, and connecting the high potential ends of the two windings.

In our layout, therefore, we place the tuning controls close to the two coils—one on either side of the screen, which is extended by a piece of standard screen to the panel.

To Suit Your Aerial

A ·0003-mfd. maximum compression condenser is wired in series with the aerial-coil lead, and serves to provide a valuable control which enables the coil unit to be suited to any size of aerial.

The switches are of the Bulgin snap toggle type, the first being of two-way variety (type S88), and the second a simple three-pole change-over switch (type S81). They are wired so that when the knobs are both to the left (looking at front of panel) tuning is carried out on the medium wave-band, and the series aerial condenser is in circuit.

With the switch controls over to the right the long waves are available, and the series aerial condenser is shorted out.

RECOMMENDED ACCESSORIES.

Loud Speaker.—(H.M.V., Amplion, Undy, Celestion, W.B., Blue Spot, Graham Farish, Mullard, R. & A., B.T.-H.)

Valves.—1 Det., 1 L.F. and 1 super-power type (Mazda, Osram, Mullard, Marconi, Six-Sixty, Cossor, Lissen, Dario, Tungsram). Milliamp. consumption at 120 volts, using average super-power valve, 16 m.a.

Batteries.—H.T., 120-volt triple capacity (Pertrix, Drydex, Ever Ready, Magnet, Ediswan, Columbia).

G.B., 9-18 volts, to suit output valve (as above).

Accumulator.—2-, 4- or 6-volt, to suit valves (Exide, Lissen, Ediswan, Pertrix, G.E.C.).

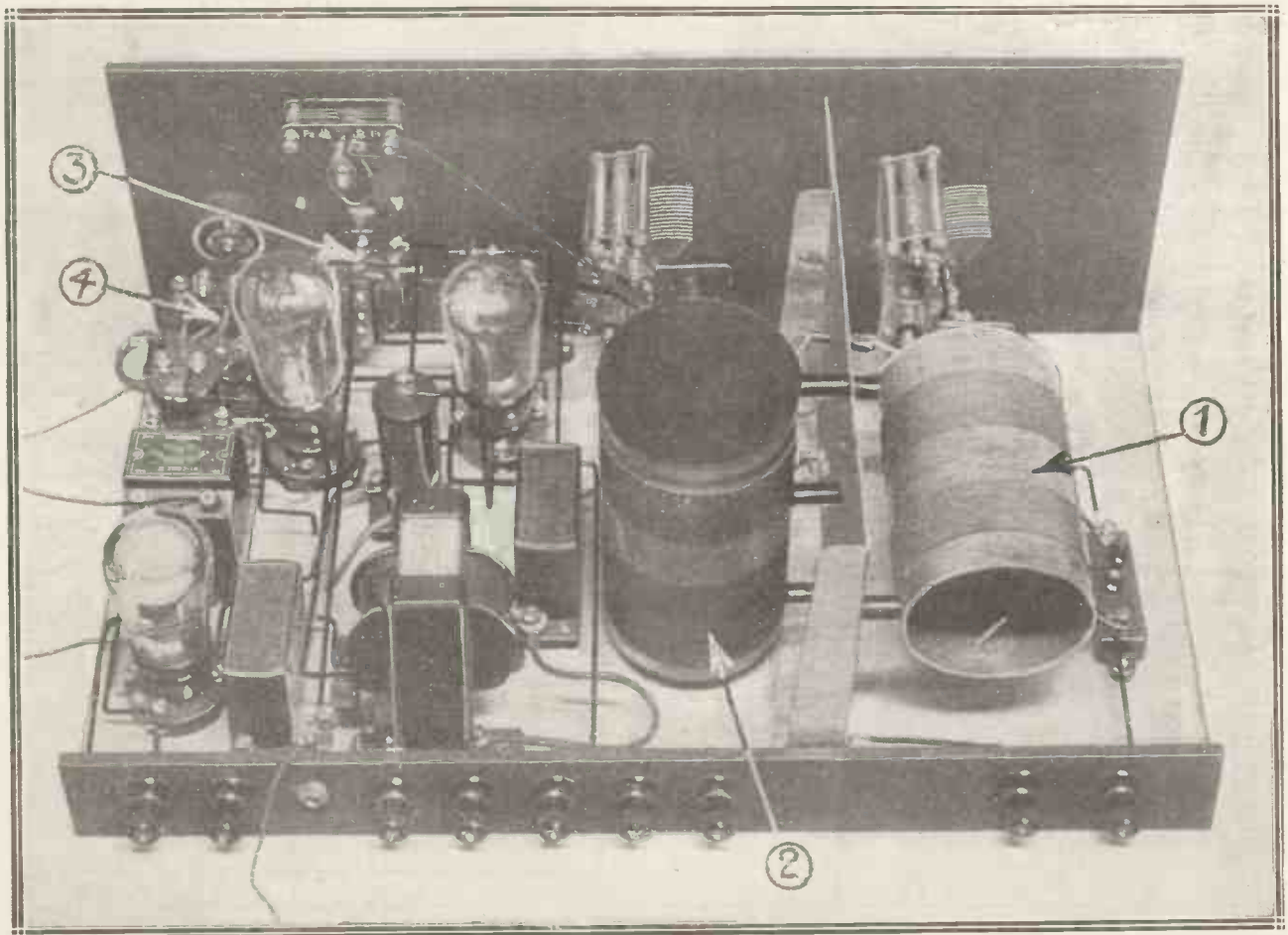
Mains Unit.—(Regentone, Formo, Atlas, Tannoy, Ekco, R.I., Heayberd, Lotus, Tunewell. (State type and voltage of mains and give details of set when ordering.)

Efficient Filtering

The circuit, as you can see from the theoretical circuit diagram, is of the Det. and 2 L.F variety; but apart from the novel tuning system, a special low-frequency filter in the form of a series of resistance-capacity high-note attenuating circuits is employed.

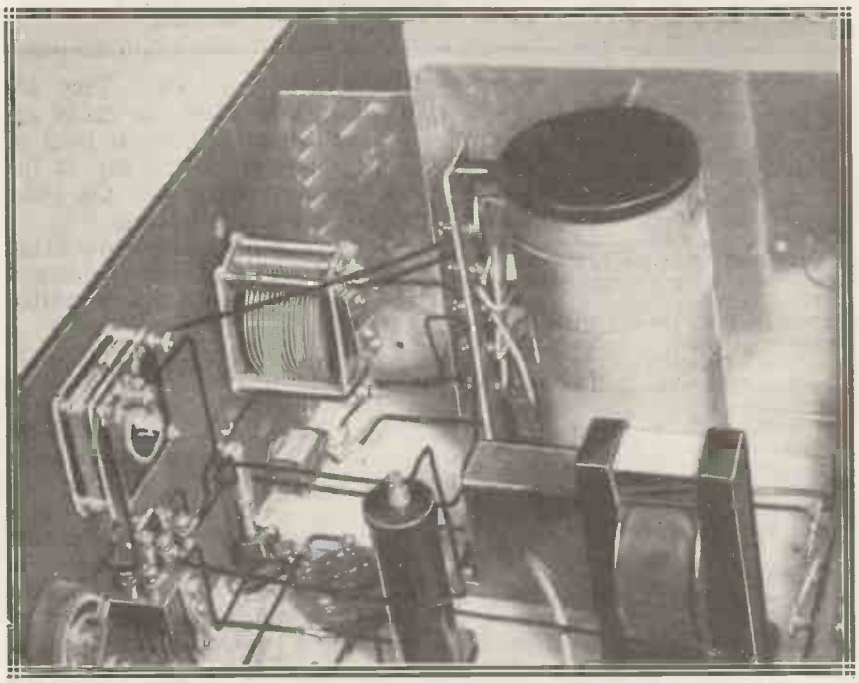
This, as I explained earlier, has the effect of cutting off high notes having frequencies above about 5,000 cycles, and thus that worrying heterodyne

Exclusive Features Which Do Vital Work Together



(1) and (2) are the two sections of the "Eckersley" Tuner. Working in conjunction with this at the L.F. end of the set is a special filter, the component parts of which are indicated at (3) and (4); (3) shows the fixed condensers, and (4) the Spaghetti resistances. The tuner and the filter together provide remarkable selectivity, and distant stations come in with extraordinary freedom from "mush."

SKILFULLY ARRANGED COIL WINDINGS



The windings of this coil are arranged so that the reaction is divided into two portions, which are placed at the top and bottom to assist the screen in eliminating capacitative and inductive coupling.

whistle caused by two stations butting in on each other is eliminated.

The filter is efficient, easily arranged, and, moreover, ridiculously cheap, and with the double tuning scheme forms a most effective solution to the present chaotic interference between neighbouring broadcasting stations.

But I have explained all this before, so let us return more closely to the subject in hand—the actual construction of the receiver.

Let us deal first with the panel. The controls on this are of usual type. From left to right they are: Tuning, tuning, reaction (above), and radio-gram-cum-on-off switch (below), and, finally, a volume-control. Nothing at all "gadgety" or difficult to manipulate in these?

Oh! I have forgotten the wave-change switches below the tuning controls. These complete the bits on the panel.

On the baseboard, besides the coil unit and the compression condenser, we have the three valve holders with their attendant components, anode resistance, L.F. transformer, output filter scheme, etc.

Concentrated Filtering

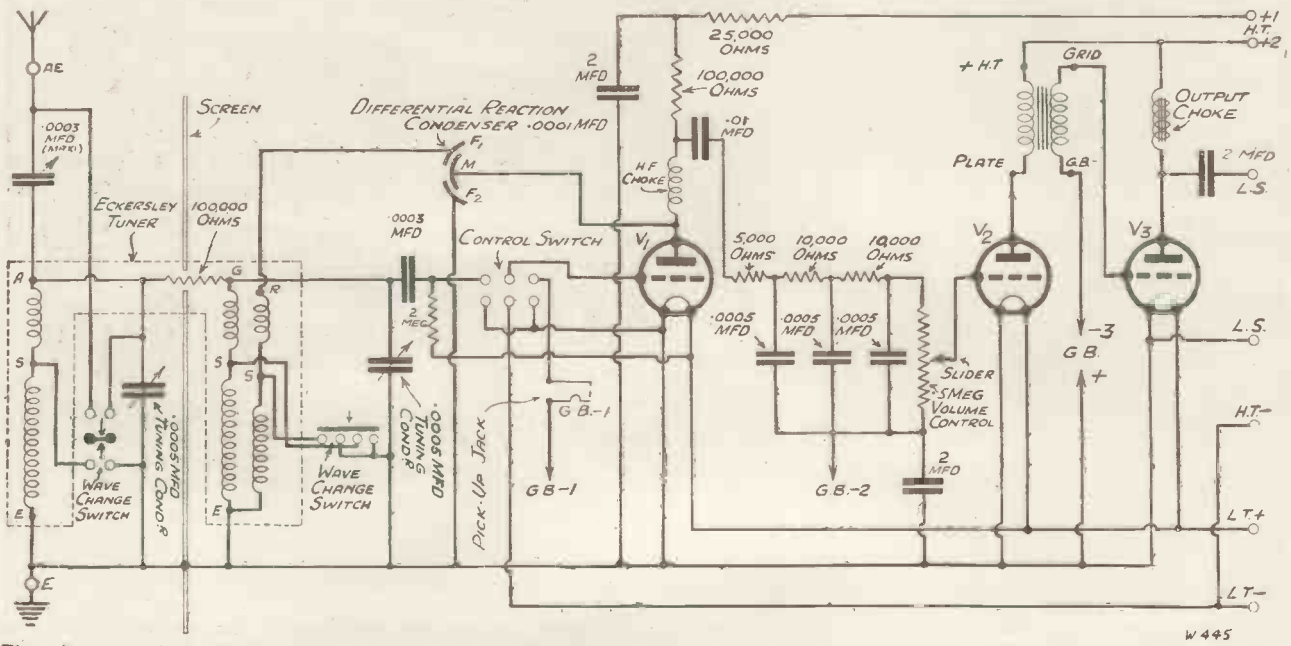
The most interesting part of the L.F. end is, of course, the special filter, which is neatly tucked away between the volume control and the L.F. transformer.

This compactness is achieved by means of Spaghetti resistances, for the three filter resistances consist of a 5,000- and two 10,000-ohm Spaghettis, together with three small ·0005-mfd. fixed condensers. It is absolutely *essential* that the values of resistances and capacities given in the blue print be adhered to, and also the order of their connection.

The 2-mfd. condenser associated with the "filter group" is for by-passing the section of the grid-bias battery that biases the first L.F. valve.

The blue print of this receiver, given away with this issue of MODERN WIRELESS, should be used as a template when laying out the components, for it is most important that correct positioning should be secured, especially in the H.F. end of the receiver.

A Circuit That Will Solve Your Interference Problems



The almost perfect selectivity given by this circuit is due to the separately tuned aerial and grid circuits. All stray coupling effects are entirely absent, the only connection between the two coils being through the special coupling resistance.

A Special Filter Cuts Out Mush and Heterodynes

The coil unit must be placed as shown, and the leads to the coils and condensers should be wired direct, being kept as short as possible and always well below the level of the top of the metal screen.

The actual wiring of the set is so simple that I do not think I need say anything about it, except perhaps to warn you against badly soldered joints and unnecessarily long leads.

When Tuning In

So now let's get on to the operating details—the most interesting part of the set. The operation is very simple provided you bear in mind one very important thing. *The two tuning dials must be kept reasonably in step.*

This does not mean that they will necessarily read the same at any point on the tuning range—the odds are against this happening, but they will increase by a regular ratio. The aerial tuning condenser will probably be behind that tuning the second coil, but the exact position of the aerial dial relative to the other will depend upon the adjustment of the series aerial condenser. (I am talking about the medium wave-band, of course.)

The tuning is so sharp that it is easy to lose a transmission if care is not exercised, though when properly tuned in it will be found that a surprising volume is obtained. Most selectivity systems also mean a serious loss of strength, but this method does not suffer from this disadvantage as do the usual band-pass systems.

But in order to get the very utmost out of the set it is essential that the compression condenser be used properly. For the higher band of the medium-wave stations best results are usually obtained with this screwed down towards its maximum setting, while the London National and lower medium-wave transmissions require the capacity of this condenser reduced.

The Aerial Condenser

The reduction depends on the characteristics of the aerial, and it is possible to find a setting that will enable good results at both ends of the tuning scale to be obtained. The adjustment is not at all critical, however, and you will soon find out for yourself how the scheme works. Remember also the smaller the series condenser the more selective but the less sensitive the arrangement.

The rest of the operation is normal, reaction being carried out in the usual way, and volume control of the L.F. end being quite standard. The radio-gram switch controls the filament, the "off" position being central, and "radio" to the right.

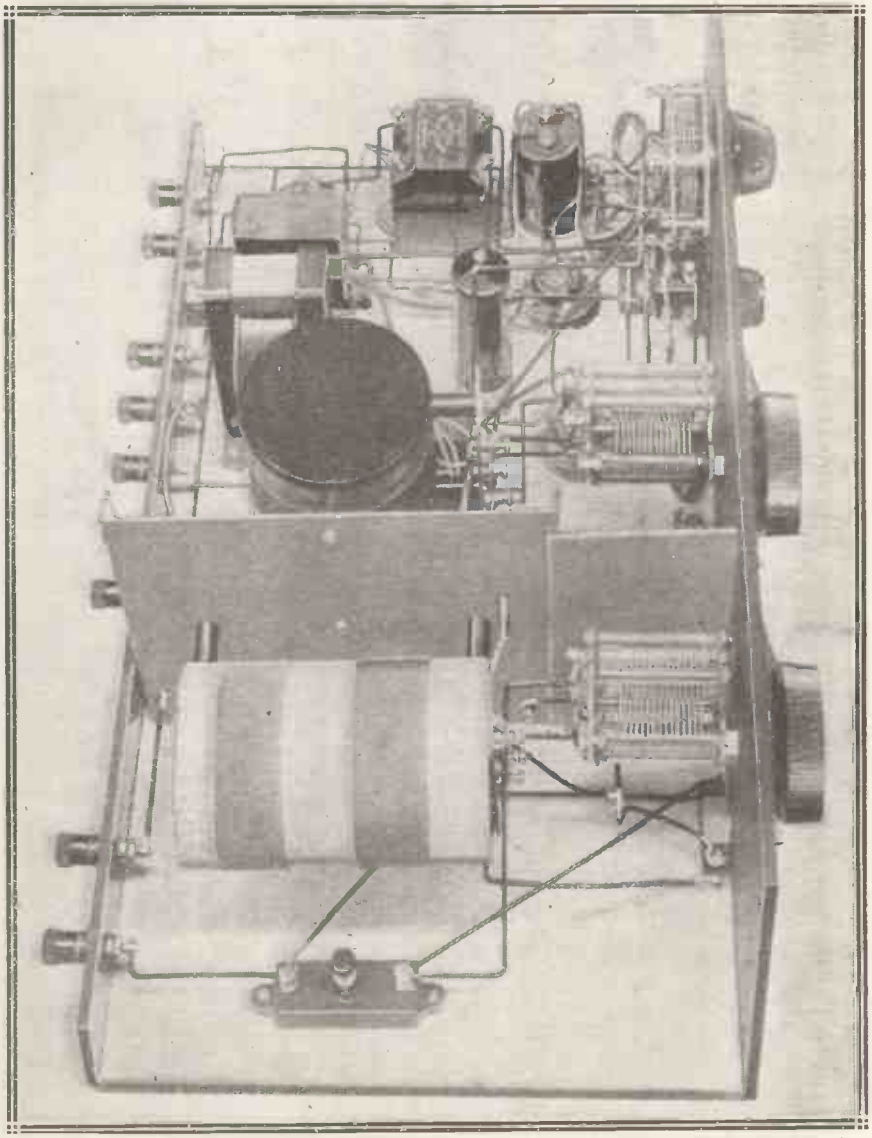
The valves required are normal det., L.F. and power types, and are not critical. Any good pick-up can be used with the set for gramophone reproduction, the pick-up being connected to the plug, which is inserted in the jack mounted on the terminal strip.

H.T. voltages are, roughly: Det., 80 volts (H.T.+1); and L.F. and power, 100-150 volts (H.T.+2). The bias should be set to suit the valves, about 1·5 negative being O.K. for the pick-up bias, 3 for the first L.F., and 9–18 for the output valve, dependent upon its type and the H.T. voltage employed.

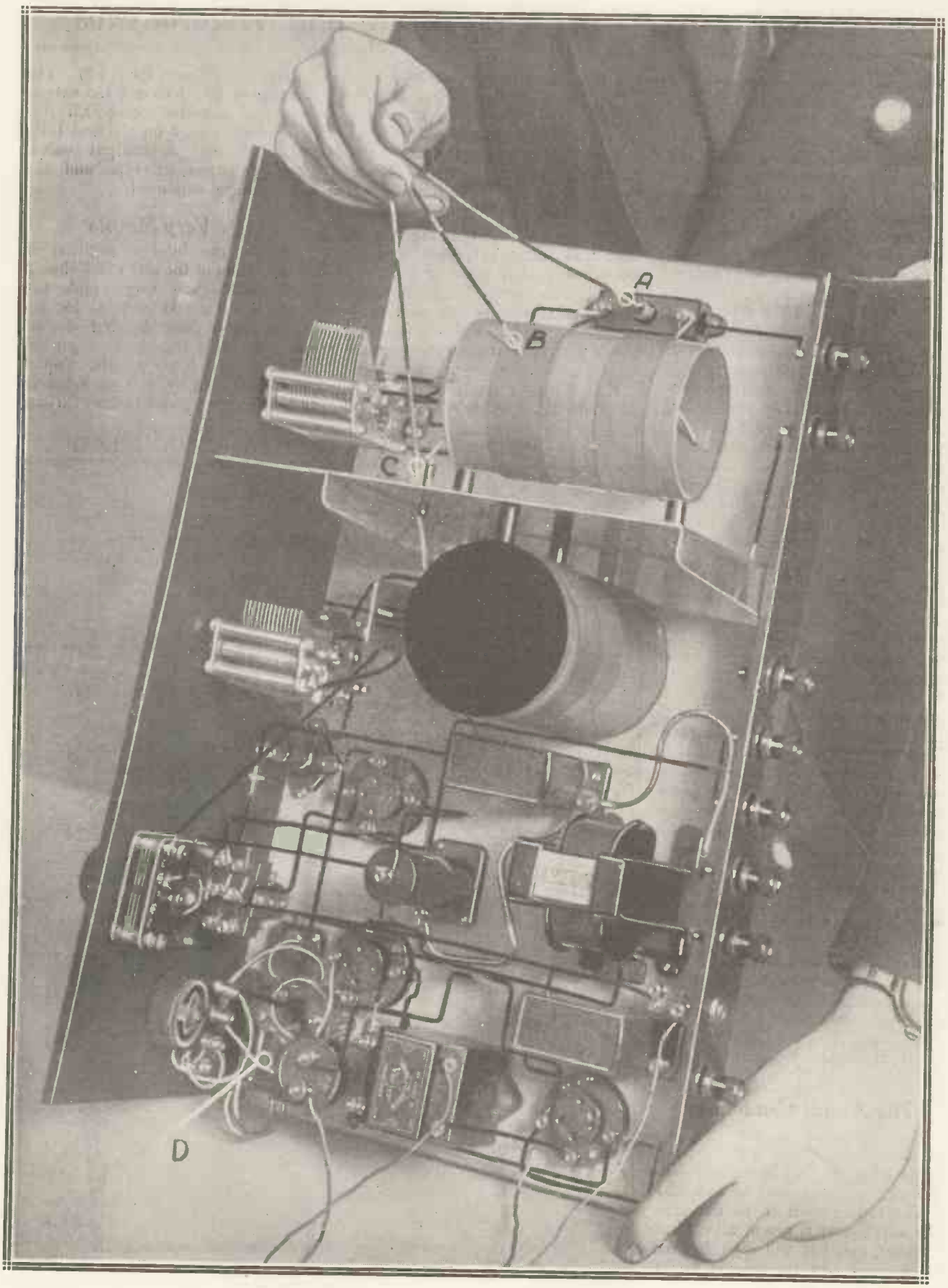
It's Very Simple

Such is the brief description of the operation of the set, which should show readers how very simple the whole thing is. It remains for me to give some more detailed idea of how the set is employed to get rid of the heterodyne whistle, should you be afflicted by it when listening to a programme, and to give further

THE TWO COILS ARE RESISTANCE-COUPLED



The two coils in the "Eckersley" Tuner are coupled by a resistance so that the tuning of the one does not tend to upset the tuning of the other.


A
B
C
D

Super-Het Selectivity on a Simple Set

directions as to the best method of station finding when using this unique receiver.

Calibrate the Second

I advise quite a large aerial, but a small series aerial condenser. You need not be afraid that a large aerial will make the set very unselective, provided always the series aerial condenser is small.

It would be a good idea if the tuned circuit connected to the first valve was calibrated. Find out the dial settings on the second circuit for the stations you want, and you may be sure that that condenser can always be the same for those stations (unless the wave-lengths of the transmitters change, of course).

Then suppose the station you want comes at 115° on the second dial and you want to tune in that station, set the dial to 115° and turn the aerial circuit tuning condenser till you get the result you want. The aerial condenser is bound to vary according to the series compression condenser setting, and this, to get the full joy of the set, ought to be used.

If you simply want one of two locals (say), then according to the size of your aerial you can find one setting for the series condenser (which is only in on medium-wave band, remember) which is quite suitable for both.

If you want to do a bit of searching, the series condenser must be bigger, for maximum sensitivity, and selectivity will thereby suffer. So if you have calibrated your second dial you will know how to set this on the wavelength of a station you want, then you increase the aerial *series* condenser and search with the aerial dial condenser until you find the station

What You Will Find

If this is very loud, decrease first the aerial series condenser, so as to gain selectivity, and when you have a comfortable volume you have best selectivity. What you will, I think, notice is a remarkable absence of background noise when listening to distant stations and a remarkable selectivity.

By the way, do not oscillate! Use reaction as little as possible. You will be greatly helped in tuning if, as I say, you will write down, after first tests, the dial settings on the second dial for the stations you want to receive.

On the long waves the series aerial condenser is shorted out by the first wave-change switch, and so it is of no avail to try alterations of its capacity while listening above 1,000 metres.

As a matter of fact, one can usually find a compromise setting where the condenser is sufficiently " out " to give good selectivity, and sufficiently " in " to provide good sensitivity.

Tallis House Tests

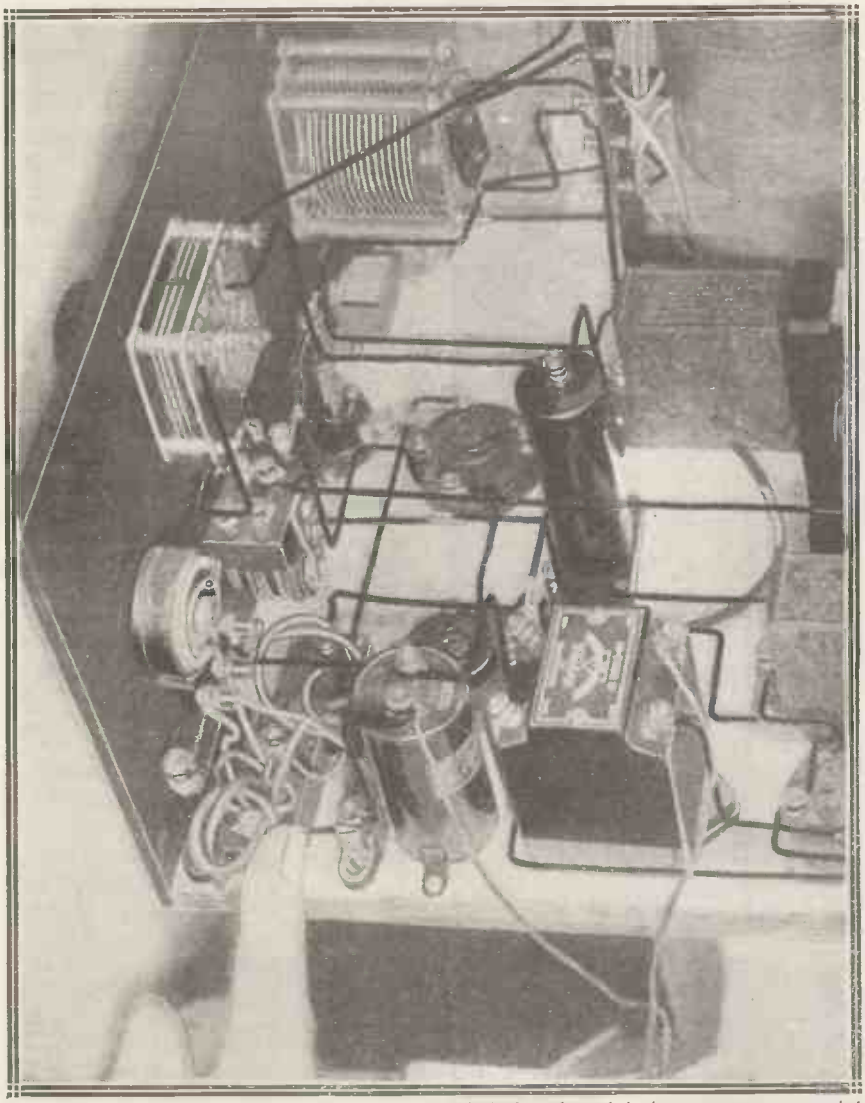
On the aerial at Tallis House, a fairly large aerial, I found a condition where with the condenser adjusted to about half its maximum capacity I could get down just below the London National, and at the other end of the scale the North Regional came in at really good volume.

This showed that the sensitivity was good, and later on a local oscillator system proved the selectivity of the set beyond all doubt.

Exhaustive tests with varying degrees of selectivity and sensitivity have been carried out during the last few months, and the values of series condenser and of the coupling resistance between the two coils were decided only after much experimentation and calculation.

Obviously, without going into calculations, the value of that resistance

FULLY-CONTROLLED L.F AMPLIFICATION



The L.F end of the receiver is extremely well designed, and it incorporates a special high-note filter circuit for cutting out a lot of that annoying heterodyne whistle caused when stations work with insufficient wave-length separation between them. The associated volume control can be seen on the panel in the foreground.

Distant Stations Receivable with Great Volume

greatly controls the selectivity besides the sensitivity, and we have to compromise between the extremes of these two—both desirable features.

Some Interesting Tests

Any increase in the ohmic resistance of the coupling between the coils means a decrease of sensitivity and a corresponding increase of selectivity. With a value of 500,000 ohms the sensitivity falls to such a low order that the North Regional, at Tallis House, is inaudible without reaction, and only just properly audible on the loud speaker when regeneration is made use of.

On the other hand, the cut-off of the local is superb. In short, at that value we approximate to the sensitivity of the present-day average band-pass coil, though we have increased the selectivity far and away above that of the usual band-pass system.

Finally, a resistance value of 100,000 ohms was decided as the best compromise, and this gives selectivity better than the average band-pass and a sensitivity very much greater.

Remember in tuning the set that the second condenser is the sharper of the two, and it is very easy to miss even the local if this condenser is rotated too quickly. The condensers should be kept roughly in step when tuning, but, as I said before, a calibration of the second condenser will enable you to find the various stations much more easily, and you can look upon the first condenser as being a comparatively rough tuning control.

In a receiver of this description one realises to the full the value and beauty of differential reaction control.

Experimental Proof

With the ordinary reaction condenser any alteration of the reaction setting would seriously affect the tuning of the second coil, and thus distant searching would be rendered very difficult.

As it is, however, with differential reaction the set can be brought up to oscillation point and the reaction reduced as desired without any danger of serious tuning-throw-out.

By this means it is easy to find a distant station by getting the breathing sound of its carrier—with the set just *not* oscillating—on the second tuning condenser, and then leaving that set adjust the first tuning condenser till the set is properly tuned in.

Then a final touch on the adjustments will leave the required programme coming in loud and clear.

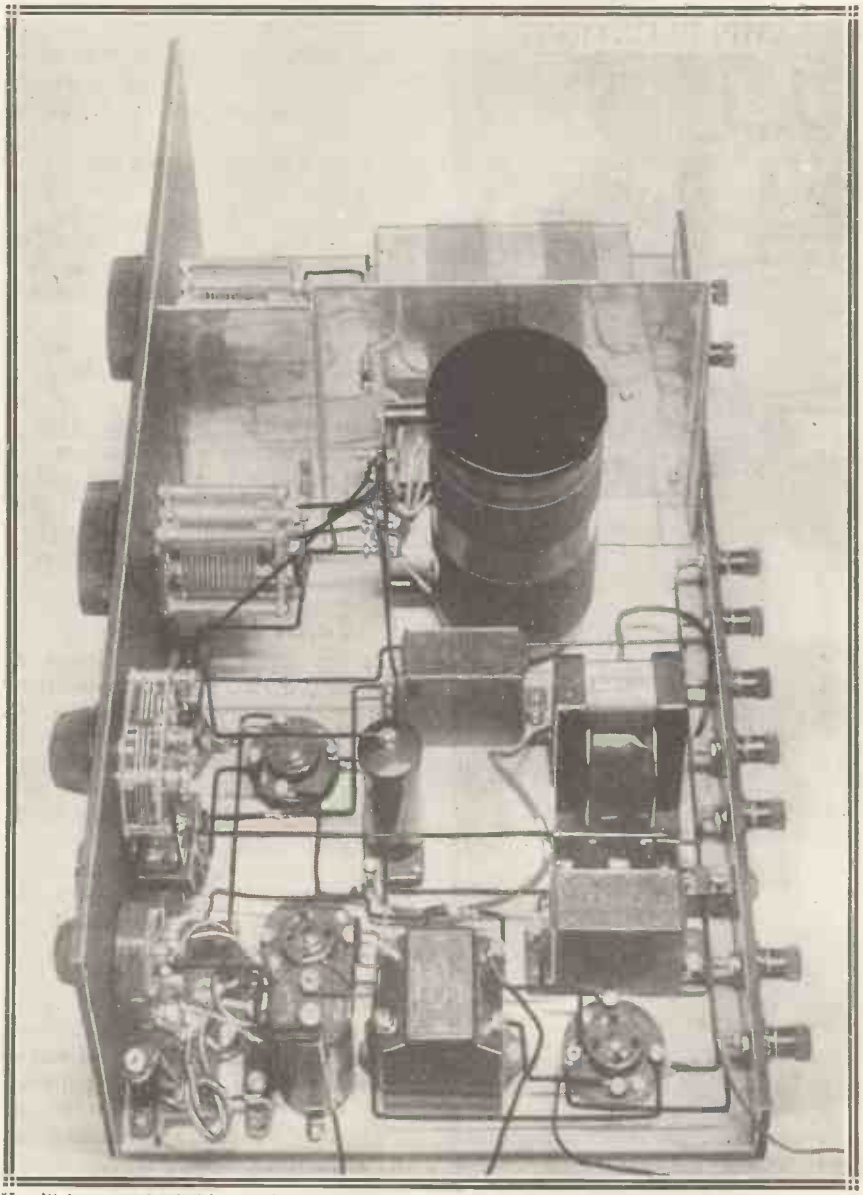
The independence of the two tuned circuits, too, is a great asset. Although you should not carry out this test in broadcasting hours, by setting the receiver oscillating and tuned by the second condenser to a distant station, so that you hear his carrier heterodyned, you can vary the first condenser until the strength of that carrier is increased to a maximum, and then past it and reduced to a minimum *without altering its note in any way.*

Where the Resistance Scores

This shows the freedom of the second tuned circuit from any but resistance coupling with the first, a feature to which the whole success of the system is due. Get any marked degree of capacitative or inductive coupling between the two coils and this freedom would be gone, and with it the efficiency of the set's operation.

The screen between the coils and the tuning condensers is really necessary, so don't be tempted to do away with that little extra bit continuing the screen of the coil unit to the panel. It is an essential part of the set

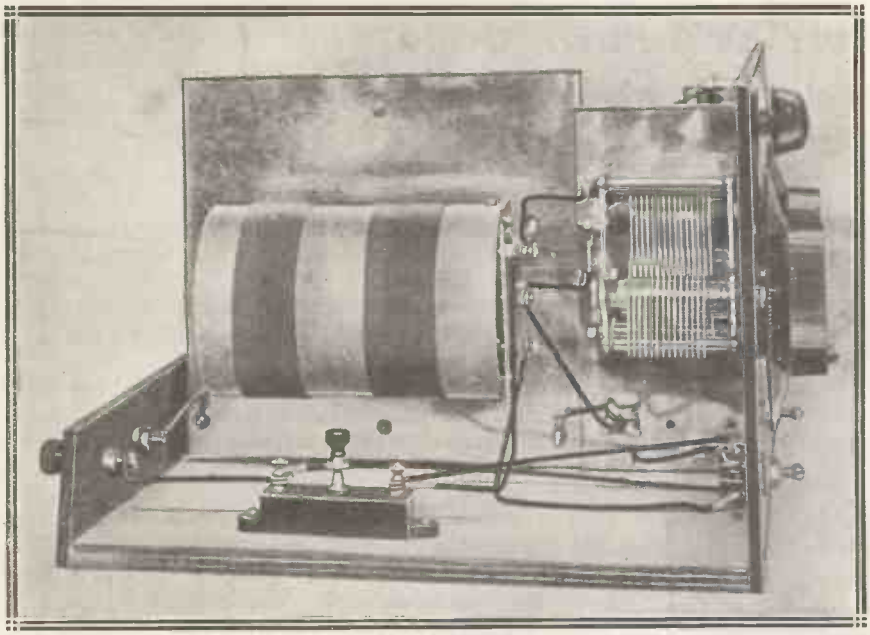
IT GIVES PERFECT STATION-SEPARATION



You'll be proud of this receiver. It gives you selectivity previously unattainable, except in the most elaborate designs, and the punch—well, you try it and see!

Selectivity Far Above Band-Pass Standards

COMPLETE AERIAL-CIRCUIT COMPENSATION



A small series condenser enables the set's aerial circuit to be exactly adjusted whatever the length of aerial used.

design and you will lose efficiency by its omission.

Continuing on the same lines, I should ask you to be careful about your aerial and earth leads. It sounds unnecessary, perhaps, but it is distinctly advisable to keep these going out well away from the set.

Those Straggling Leads

If they trail along past the second coil, or in the case of the aerial, as I have seen them before now, over the top of the cabinet, you will cause quite considerable induction to take place between the aerial and the second tuned circuit.

This must quite definitely *not* take place, or the whole of the receiver, with its "free" circuit, will be ruined.

You may think I am making a fuss about a small point, but just you try taking the aerial off its proper terminal and letting it lie across the top of the set, near the second coil. You will be surprised at the amount of energy you can pick up.

With the Aerial Off!

Loud-speaker reception of the local station up to 15 miles or so may even then be quite possible, and if this is practicable it shows that with such a condition existing—as it would with a badly-placed aerial lead—the selectivity of the set must very seriously suffer.

And now a word about the switches. One is a Bulgin S.88 type double-pole on-off toggle switch. It has four contacts, arranged in two pairs, and inside a couple of metal rollers, insulated from one another, come along and short-circuit each pair of contacts in the "on" position.

Thus by joining one contact of the one pair to one of the other pair by a lead we get a three-contact switch in which at "on" (medium wave) all three are shorted together, and at "off" (long wave) are separated. Just what we want!

In the case of the other switch we want to join two contacts for medium-wave working, and join another two for long waves, at the same time opening the first two.

The switch I have chosen is the Bulgin S.81, which is described by the makers as a single-pole double-throw toggle switch.

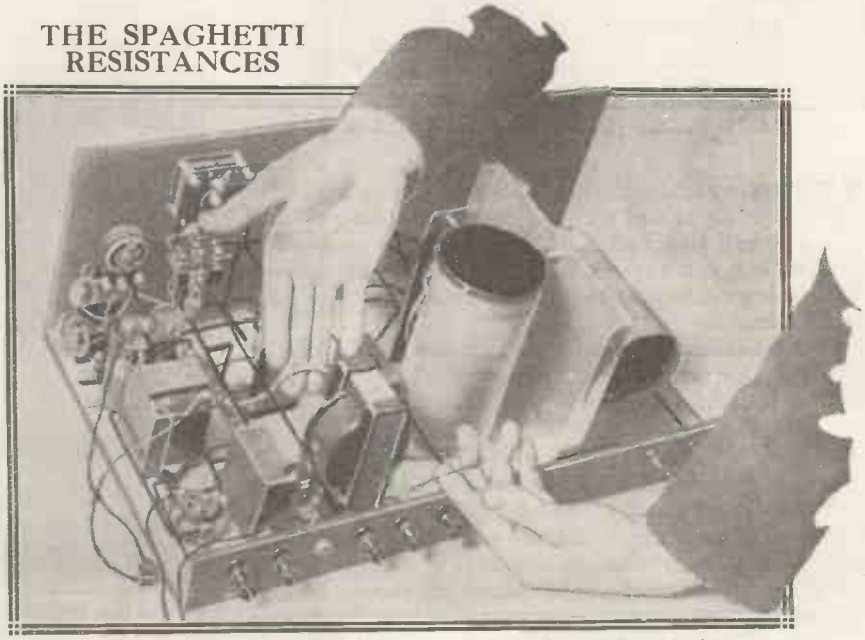
But I am not using it as such at all, to do so it would be necessary to join together externally one contact of each pair.

Instead, I arrange for one pair to be connected across the long-wave winding of the aerial section of the coil, and the other pair to be connected on to either side of the compression condenser.

Now by moving the switch lever one way the first pair is shorted (we are on medium waves), and in the other position these are opened (long waves) and the other pair are shorted (series condenser shorted).

Thus by arranging the pairs so that the two switches work in the same direction for medium or for long waves I got exactly what I required.

THE SPAGHETTI RESISTANCES



Both these resistances are joined at one end to the de-coupling condenser.

HAVE YOU A RADIO

By RAYMOND RUTHERFORD

Every listener recognises that mysterious quality in a broadcasting personality who "gets over" successfully—and what a world of difference it makes to him and to us! Here is an attempt to analyse the charm of some of our microphone favourites.

OUR RADIO JAZZ-KING—JACK PAYNE

WITHOUT taking sides in the controversy as to whether radio is still a child hardly out of long clothes, or a young adult whose future course is more or less set, one can nevertheless make a more or less safe observation concerning the radio personalities who have so far emerged.

This concerns the scarcity of names which, solely by virtue of their appearances before the microphone, have become household words.

That Mysterious "Something"

Perhaps I had better define what I mean by use of the term "radio personality," and if I point to A. J. Alan as the outstanding example this will serve as a more useful guide than a dozen laborious sentences of explanation.

I am not thinking of names which have become famous for some special reason; Jack Payne, Adrian Boult, Sir Walford Davies, and Leonard Henry are in a sense all famous radio personalities, but they each appeal to special sections of the vast radio audiences and are famous in their own particular sphere of work.

A. J. Alan or, to name another, Harold Nicolson are radio personalities in the special sense in which I am now using the word.

They have impressed themselves as entertaining and strongly individual personalities on large bodies of listeners drawn from every class of the listening population. Their appeal is universal.

Small Percentage Successful

But the number of broadcasters of whom this can be said is startlingly few, even considering the short time that wireless has been established. Why is this?

There was never any dearth of would-be candidates for radio fame. The B.B.C. talks department could tell the tale of the rush of people anxious to impress their personalities on an expectant world through the medium of the microphone.

From cities, towns and hamlets throughout the length and breadth of the United Kingdom came applications from benevolent folk who thought that listeners would be anxious to hear their views on so-and-so.

The number of famous people who have made appearances before the microphone from time to time is impressively large. But the number who have revealed themselves as radio personalities in the A. J. Alan sense of the word is as impressively small.

Perhaps an analysis of the special requirements of the microphone in this respect will be of some assistance in

GOLDEN-VOICED "UNCLE ARTHUR"

Arthur Burrows, who will be affectionately remembered by many listeners as "Uncle Arthur," achieved an immense microphone popularity.

PERSONALITY?

determining why this should be so, although the analysis itself is no easy matter.

Probably the chief reason for the failure or only partial success of some of those who rushed before the microphone in the early days was that they confused literary with verbal appeal. These, of course, are two entirely distinct and different things.

But because they both employ words in order to get their effect many of the early broadcasters assumed that they were roughly the same, just as many people slip into the error of supposing that a clever writer is necessarily a clever speaker, and vice versa.

They Have Nothing in Common

Nothing could be farther from the truth.

Some of the least successful broadcasts read well when reproduced in print in the pages of "The Listener," and sometimes a sparkling, amusing, and entertaining broadcast seems to lose everything which made its hearing such a delight when reproduced in the same medium.

The truth is that there is little or nothing in common between the written and the spoken word. That is why many of the literary gentlemen who rushed forward so confidently when broadcasting began failed so dismally in front of the microphone.

And the famous orator is also likely to find that his accustomed technique will avail him little in front of the microphone. The inspiration of a visible audience, and the possibility of playing upon the emotion of the members thereof, are alike denied to him.

HAROLD NICOLSON

A regular broadcaster who manages to "get over" very well, although our contributor does not credit him with a quite perfect microphone personality.

THE INIMITABLE LEONARD HENRY

Orators are listened to by a crowd; radio speakers are listened to by a crowd of individuals separated from each other, and, as everyone knows, the reaction of a crowd and of an individual to a given statement may be, and probably will be, entirely different.

That is why the impassioned rhetoric of our most respected orators often sounds so futile when it comes to us through the loud speaker!

Working at a Disadvantage

No, the radio speaker, to be successful, is forced to consider the limitations under which he works, and to be guided thereby. His invisible audience is probably more diverse in character than any audience which the greatest orator of the past ever had to face.

Its members are listening as individuals, in the intimacy of their homes, and cannot be swayed by mob hysteria or mob emotion. He cannot hope for any indication as to what sort of reception he is getting, and his sole means of communication is his voice; his only possible appeal, a verbal appeal.

At the same time, he dare not try to curry favour by eccentricities, mannerisms, or extravagance of style, for, as a few aspirants to radio honours have discovered to

"There are Dozens of 'Mute, Inglorious' A. J. Alans"

their sorrow, these damn a wireless speaker more quickly and more finally than anything else.

He is not like an author who has a little coterie of people who admire his own peculiar tricks and capers. He is speaking not to a coterie, but to a very considerable part of the population of the British Isles.

A GREAT FAVOURITE

Sir Walford Davies, whose "Music and the Ordinary Listener" series endeared him to an enormous audience.

And many of these people are listening, not to him in particular, but to "the wireless." It is a subtle distinction, for which the would-be radio personality must make full allowance.

Nor has he a tradition and the long experience of others to guide him as is the case with author, artist or musician. He is working in a new medium and must seek his own salvation.

Is it really so surprising, therefore, that so few radio personalities have emerged?

There is no lack of interesting personalities in the world; one meets them continually in everyday life. But only one in ten thousand could transfer any worth-while conception of personality over the ether; the limitations of the broadcasting studio would swamp the rest.

Where are Those Story-Tellers?

The trouble is partly that for centuries the best minds have taken to expressing themselves in print, and the public exploitation of personality by word of mouth has dwindled to a shadow of its former self.

If radio had been discovered in the Middle Ages, when the itinerant story-teller lived by pleasing his hearers, there would have been no difficulty about finding radio personalities! But the art of story-telling by word of mouth has, to a very great extent, been allowed to lapse.

I suggest, and I am not alone in this, that A. J. Alan is as near to being a perfect radio personality as it would be possible to get, and it is rather a pity that he confines himself to his own particular kind of story.

If A. J. Alan were announced as speaking on Gasometers or The Habits of Sticklebats, thousands and thousands of people would suddenly discover an interest in these not very interesting subjects, because, seen through the genius of his personality, gasometers and sticklebats would become enthralling.

His delivery is perfect. It is intimate, apparently careless although no doubt studiously cultivated, and conveys just the right illusion of spontaneity. We feel, when he is announced, just the kind of pleasure with which we welcome the "Have you heard this one?" of our most entertaining friend.

Harold Nicolson, amusing, provocative, entertaining, was almost the perfect radio personality, but not quite. To many listeners he seemed a little too cold and distant, a little too literary, a little too far removed from the outlook of the ordinary man.

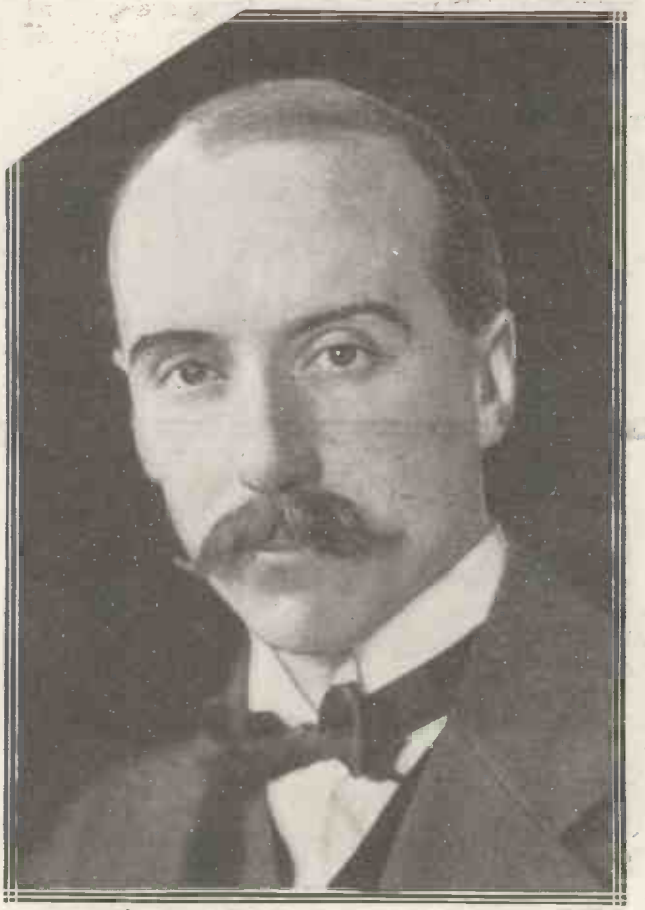
A Well-Remembered Series

Nevertheless, in his "People and Things" series he came as near to being the Charles Lamb of the microphone as any broadcaster yet. Why not give A. J. Alan the same opportunity? Of all radio personalities he is the best liked among listeners and should fill the bill admirably.

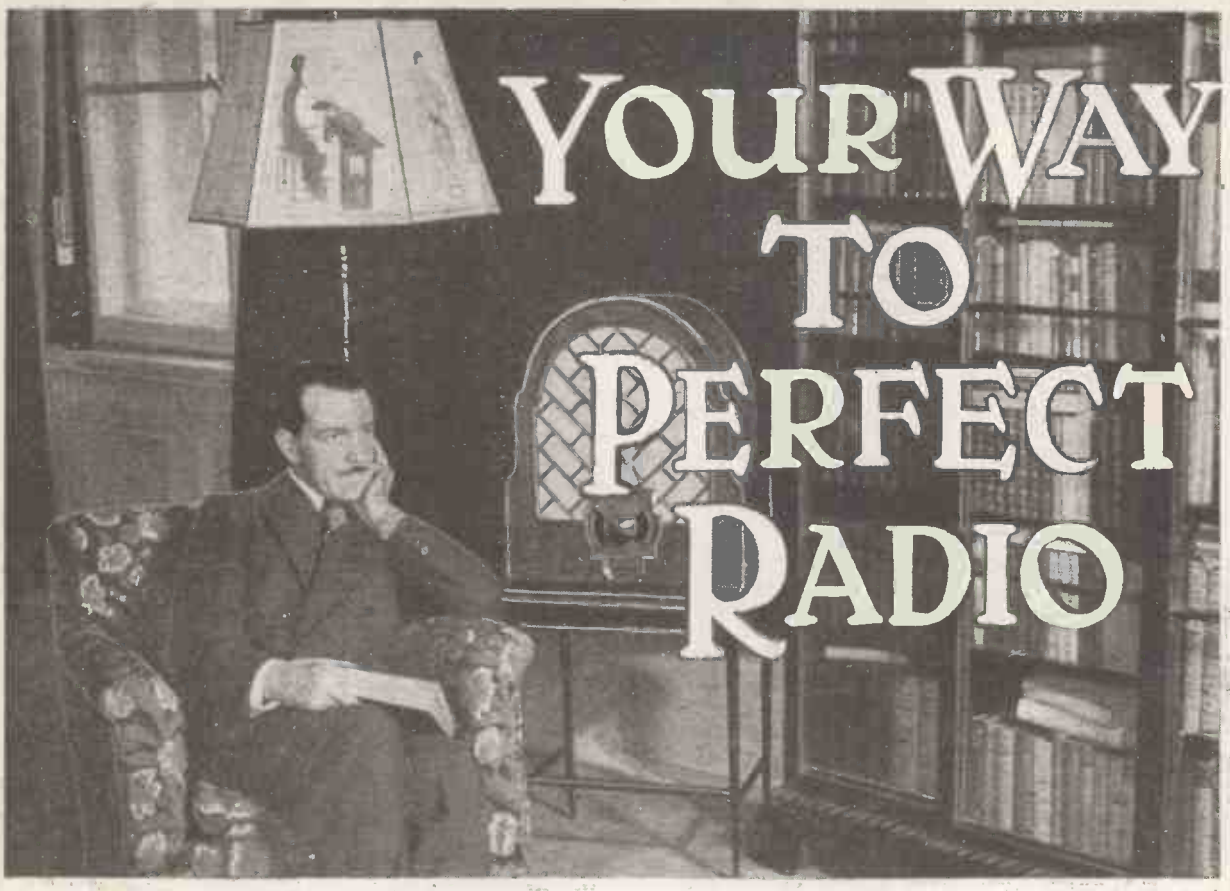
No doubt there are dozens of "mute, inglorious" A. J. Alans who have not yet had an opportunity of showing the listening public what they can do, but one cannot envy the B.B.C. the task of discovering them.

The only valid test is to find likely candidates, allow them to broadcast, and see what sort of a job they make of it. And this, one imagines, would mean a considerable increase in the weight of the already heavy B.B.C. letter-bag!

THE MAN BEHIND THE MUSIC



Dr. Adrian Boult is steadily increasing his circle of admirers by his evident sincerity before the microphone and by his extraordinary success as Musical Director of the B.B.C.



YOUR WAY TO PERFECT RADIO

RADIO is one of the youngest and most virile branches of electrical science. Growing slowly at first, it has made tremendous strides during the last few years, and "perfect" radio reception is rapidly becoming less and less of a dream, and more and more a reality.

But to attain perfection, or anything approaching thereto, one must have knowledge. The theory of radio must be understood, and as much practical experience as possible should also be gained.

It is with a view to helping our readers to take a short-cut to perfection that the following special supplement was prepared.

Of unique form, it contains a wealth of information that will help you in all branches of radio.

Leading off with an entirely novel pictorial outline of radio theory, we follow on with practical articles of various types, and conclude with a detailed account of the construction of a really efficient modern three-valve receiver.

The supplement is profusely illustrated, and in the first and last sections it has been our aim to enable a complete grasp upon the subject dealt with to be obtained from the illustrations alone, the reading matter being an amplification rather than an inseparable part of the photographic scheme

Thus you have two articles in one, as it were—the first conveyed solely by the illustrations, and the second running parallel with them, telling the story in words.

By this means we feel we have done a great deal not only to make the subject more fascinating, but to give more lucidity to it. Moreover, we have been able to combine a satisfying technical explanation with an interesting and, indeed, fascinating article for the general reader, and thus to render the maximum of aid to the seeker after the way to perfect radio.

CONTENTS

RADIO IN OUTLINE

By G. V. DOWDING, Associate I.E.E.

This is probably the longest and most comprehensive survey of the theory of electricity and radio which has ever appeared in any one issue of any magazine. It is also entirely unique for another reason, and that is that there are no formulæ and very few figures of any kind included. Further, the illustrations, although "running parallel" with the text, are quite independent and there are no cross references.

You can glance through the illustrations and read the text at different times without losing a thing. Finally, it is not necessary to study this section with headaching concentration. You will find it enjoyable reading, and you will learn more than you thought it possible to learn without deliberate study.

HAVE you ever asked yourself this question: "Why and how does my radio set work?" And if you have, has your answer been anything like this? "I suppose I tune in electricity pushed into the air by the broadcasting station—something like the telephone without its wires."

Your airy dismissal of the subject in such a way marks you as just that kind of individual I want to buttonhole for half an hour, because I am going to try very hard to convince such people that the theory of radio is one of the most intensely interesting things in the world.

At the outset I will ask you to dismiss from your mind the notion that a radio set is a static box of fathomless mystery—mystery which is the realm of the scientist only—and to think of it as being alive with fascinating processes, each one independent yet inter-dependent, and all relying upon the very fundamentals of life and matter for their working.

We cannot see or hear or feel or smell any of these processes; in a sense they are as intriguingly ghostlike as the very ether of space itself (of which more anon), and our study of them is like a gigantic game of blind-man's buff. But yet you will find that there is none of the hit-and-miss of that game.

We are able to sail through this sea of knowledge with the certainty and sureness of a liner navigated by night: unable to see or hear this or that, but absolutely positive of the presence of certain things.

Our Starting Point

And every now and then we shall obtain sudden and unexpected confirmation that we are on the right course, and will note, perhaps with surprise, perhaps with just wonder, that everything fits together with the deftness of a mosaic.

I read the following remark only a few months ago in the journal of one of our scientific institutions:

"It is impossible to detect the presence of electricity in a static (stationary) condition. So far no instrument has yet been devised that will do this. All our electrical measurements are based upon electricity in motion."

Do you agree? Perhaps you feel you are not yet in a position to criticise the words of an electrical pundit. But go back to this after you've read my review. Our vital starting-point is: What is electricity? Last century the reply to this would have been: "No one knows, but we think——" Now, however, it appears fairly certain that electricity is the stuff you and I, our houses and furniture, the earth, the sun and moon and the stars are made of!

Each illustration in this section shows, photographically, the practical arrangement of the devices concerned and the equivalent theoretical symbols and circuits. After studying these numerous pictures you should have no difficulty in interpreting radio receiver theoretical circuits.

Take a small piece of any substance, a splinter from a chair leg, or a small piece of meat, and give this to a chemist and ask him what it is made of.

With flask, flagon and fire, test-tube, beaker and pipette he will conduct his analysis. "So much carbon, so much water, so much starch," he will say, giving a full list of the component parts into which he has split the specimen.

Probably most of these will be what are known as elements, i.e. substances which are not mixtures of other things. (Water is not an element; it is a mixture of hydrogen and oxygen.)

If you take any element—carbon, gold, oxygen, etc.—and divide it up into its smallest parts, you arrive at the atom, which, from the practical chemist's point of view, is the smallest possible particle of matter.

Inside a Speck of Dust

But, although it is extremely small, the atom comprises a group of still tinier particles—a proton and a certain number of electrons. And thus we arrive at the very basis of material things, and find that it is—electricity!

A proton is a nucleus, a central concentration of force around which the electrons—particles of electricity—move. No one has ever seen an electron, and it is probable that no one ever will, for it is so infinitely small that the mind reels when one endeavours to compare its dimensions with things which can be seen.

The tiniest speck of dust is built up of *millions* of *atoms*, and each atom is as St. Paul's Cathedral to a grain of sand in comparison with the incredibly tiny electron.

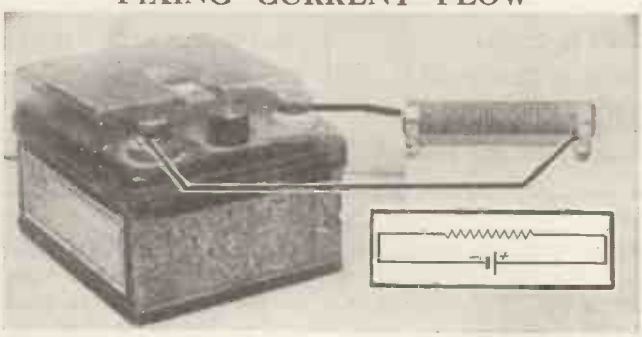
Electrons can be moved from atom to atom, and when a number migrate in this way we have, as is quite obvious, a flow of electricity—in other words, an electrical current.

Universal Balance

But such a movement is never haphazard. There is a universal balance to be maintained. And if there is a deficiency of electrons anywhere, there will be a flow of electrons to that point in an attempt to maintain an equilibrium.

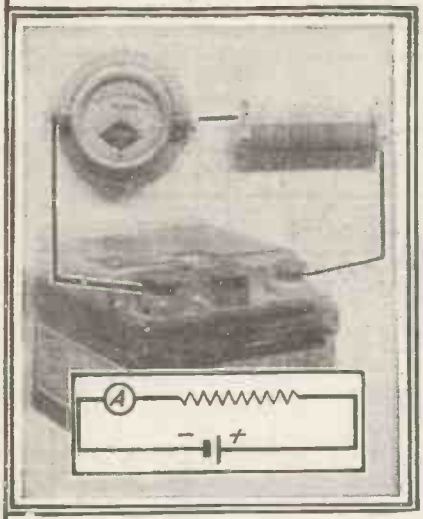
This is fact that we turn to excellent account, so much so that we are able to make electric trains move, electric lights illuminate our houses, etc. All the thousand-and-one practical uses of electricity are based upon that striving of electrons to make good any shortages which may exist.

FIXING CURRENT FLOW



The current (in amperes) which will flow through this simple circuit depends upon (1) the electrical pressure (in volts) which is available at the terminals of the accumulator—that will be about 2 volts, as there is only one cell; and (2) the resistance (in ohms) which is present. There will be some slight resistance (probably only a fraction of an ohm) in the two connecting leads and accumulator itself, but the bulk of the resistance is in the spiral of special resistance-wire to which the battery is joined.

Radio In Outline—continued



MEASURING CURRENT

An ammeter measures current in amperes and is therefore so arranged that all the current must pass through it. Current in amperes is not just the quantity of electricity which flows, but is a measure of the amount of current which flows during a stated time. The Coulomb is the unit of quantity, and one Ampere is the passage of one Coulomb in one second.

The job of a battery is to create an electron shortage, and it does this by means of a chemical action. If two different kinds of metal are immersed in sulphuric acid—say, a piece of copper and a piece of zinc—a chemical process is started, with the result that the one piece of metal becomes shorter of electrons than the other. This will be the *positive* element. *Positive* always implies an electron shortage and *negative* a superfluity of electrons.

Conductors and Insulators

Thus our primitive battery has two elements, the one *negative* and the other *positive* in character.

And if you join these together with metal wire there will be a flow of electrons *from* the *negative* to the *positive* piece of metal in an attempt to regain an equal balance of electrons. But the chemical action continues, and so there will be a steady stream of electrons passing through the wire until the acid has eaten the zinc right away and the battery is worn out. Thus we have our electrical current.

It flows through the metal wire because metal is a *conductor*. There are many substances, such as glass, rubber, ebonite, porcelain, mica, paper, etc., which do not offer easy paths for electrons to pass through, and these substances are therefore known as *insulators*.

The simple type of battery we have just described is known as a primary battery, a description which applies equally well to the "dry" H.T. battery used in wireless, although this is not really "dry"; there is a paste material in it which chemically attacks zinc plates.

Batteries and Accumulators

There are also secondary batteries, but these are more familiarly known to listeners as *accumulators*. Charging an accumulator is a simple process; it comprises the application of electricity to the battery in order to change the chemical nature of its elements.

Then the accumulator becomes similar to a primary battery, in that the change back to its original condition involves a reverse chemical action, which produces the required electron shortage on the *plates* connected to the terminal marked *positive* (red colouring or a plus sign). The *negative* terminal will be indicated by a black or blue colouring or a minus sign—or both.

Electrical current is measured in *amperes*. This is a rather hard term to understand. It does not mean merely the quantity of electrical current that is flowing through a circuit; the ampere is not the analagous equivalent of a gallon or pint as applied to water.

When it is said that there is an ampere of current, it is implied that a certain quantity of electricity has flowed during the space of one second. The expression "gallons per minute" as used in water engineering will give you the right idea.

The number of amperes or parts of an ampere which flow in a circuit (circuit—the two points between which there exists a difference in electron accumulation and the conducting path connecting them) directly depends upon two things, and these are the magnitude of the electron-discrepancy and the easiness or otherwise of the conducting path.

We use *volts* to express the first. The volt is the unit of electrical pressure, and obviously the greater the electron discrepancy the greater will be the pressure.

We Meet the Ohm

In the second case we meet the *ohm*, which is the unit of *resistance*. Some metals are better conductors of electricity than others, and these are said to have "less resistance." And if the metal is in the form of a wire, the *thicker* and *shorter* the wire the less its resistance.

Current (amperes), pressure—or voltage as it is often termed—(volts), and resistance (ohms), are very definitely related, so much so that they conform to a very convenient law styled Ohm's law.

This is that voltage (in volts) equals current (in amperes) multiplied by resistance (in ohms). From which you will see that if you know any two of the factors you can quickly discover the third.

It sometimes happens that we have to deal with much smaller values than the above units represent, so to facilitate calculations we employ the prefixes "milli" and "micro" to represent thousandth and millionth parts respectively. A milliampere (milliamp for short) is a thousandth part of an ampere, and a microvolt is a millionth part of a volt.

You will probably frequently come across the expression "difference of potential." This is merely a variation of *voltage*, another way of saying the same thing, although, in a sense, it is more expressive.

Voltage is apt to give the impression that an electrical pressure can be developed at an isolated point; but, as we have seen, the presence of electrical pressure depends upon the existence of a difference in electron supply between two points.

So "difference of potential" as an alternative to *voltage* has a lot to be said for it. The voltmeter provides a practical illustration. You join the two terminals of such a device across any two points in a circuit and so introduce an alternative path for the current (through the voltmeter). The voltmeter has a definite *resistance* (generally a very high one, hundreds or thousands of ohms). The greater the "difference of potential" existing across its two terminals, the more the current (amperes) which will flow through it, and the farther its needle will move across the printed scale, and the more the "volts" which will be recorded. (All very logical, isn't it?)

How An Ammeter Works

An ammeter measures current in amperes, and naturally it is connected up so that all the current passes through it. It works very much in the same way as a voltmeter, although, of course, it has a low resistance—offers an easy path to the current. If it did not do this it would tend to restrict the flow of current, and so alter the very factor it was intended to measure.

There are one or two further important facts about batteries which you should note before we leave them. The type of *accumulator* most generally used in radio consists of a single *cell*; that is to say, there is only the one pair of *electrodes* in the form of a set of *positive* metal plates, and a set of *negative* plates interleaved and immersed in a solution of sulphuric acid (the electrolyte).

The area of these plates determines the *capacity* of the cell, and its capacity is rated in *ampere hours*. A capacity of one ampere hour implies that the cell can deliver a current of one ampere for one hour, or half an ampere for two hours, or a quarter of an ampere for four hours, and so on.

A common capacity is twenty ampere hours, the power to deliver one ampere for twenty hours, or two amperes for ten hours, etc.

But the electrical pressure developed by the cell is quite independent of its physical dimensions, it is fixed by the principle of its construction, and in the case of an accumulator cell it is approximately two volts. It will be slightly more immediately after charging, and slightly less towards the end of its period of discharge.

On the other hand, the voltage of a "dry" cell constructed on the widely employed Leclanché principle will be about 1½ volts.

Cells can be joined together in either *series* or *parallel*. In the first case the *negative* terminal of the one is joined to the *positive* terminal of the other, and a continuous chain of cells formed. The voltage across the end terminals of this chain will be the sum of the voltage of all the individual cells.

And as the voltage of all similar-type cells will be the same, you merely have to multiply this figure by the number of cells to get the total pressure.

Forty "dry" cells connected in series will give you 40 × 1½, *i.e.* 60 volts.

If you join a group of cells in *parallel*, by connecting all the positive terminals and all the negative terminals together, you get an ampere hour capacity equal to the capacities of all the individual cells added together, but the voltage remains that of a single cell.

The terms series and parallel are also applied to resistances. When a number of resistances are, for instance, so connected to a battery that the current has to pass successively through each in turn, you have a *series* arrangement and the total resistance is the sum of all the individual resistances.

A number of resistances in *parallel* provides as many alternative paths to the current as there are resistances, and it is obvious that the total resistance will now be less than that of the smallest individual one.

But the actual calculation is rather involved. However, it must be tackled for it introduces factors which will be met with again in this review.

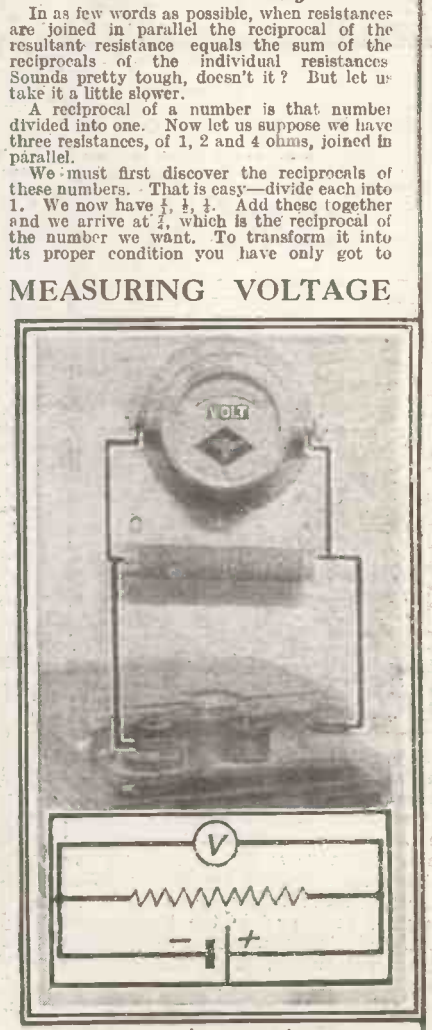
Take This Bit Slowly!

In as few words as possible, when resistances are joined in parallel the reciprocal of the resultant resistance equals the sum of the reciprocals of the individual resistances. Sounds pretty tough, doesn't it? But let us take it a little slower.

A reciprocal of a number is that number divided into one. Now let us suppose we have three resistances, of 1, 2 and 4 ohms, joined in parallel.

We must first discover the reciprocals of these numbers. That is easy—divide each into 1. We now have 1, ½, ¼. Add these together and we arrive at 1¾, which is the reciprocal of the number we want. To transform it into its proper condition you have only got to

MEASURING VOLTAGE



This voltmeter is measuring the electrical pressure across the battery terminals.

A Comprehensive Survey of Radio Reception

turn it upside down, which makes it ½, and that is the answer to our little problem, ½ ohms.

We have examined more or less closely the various conditions which govern the current flowing from a battery, and we must now see what the current does *when* it flows from one terminal of a battery through a wire to the other terminal.

A certain amount of heat will be generated. If the voltage is such that a big current is sent through a comparatively thin wire, there may be so much heat that the wire gets red-hot or even melts.

It is necessary to arrange our electrical conductors so that they are able to carry the required current without undue heat being developed—that is, unless we actually want heat, as in an electrical fire!

The second effect caused by the current is the creation of a field of magnetic influence which will surround the whole of the conductor through which the current passes. The intensity of this magnetic field is determined primarily by the extent of the current.

But it can be greatly intensified by forming the wire into a spiral. When the wire is in this coil form the magnetic field intensity is directly measurable on an ampere-turns basis. Increase the current or the actual number of turns of wire in the coil, or both, and you increase the magnetic force surrounding it.

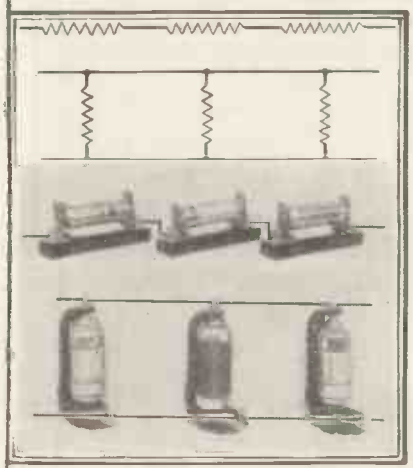
When a Current is Changing

It will be, I trust, quite clear, too, that the building up of this field of magnetic force must, in its turn, react in some way on the flow of current. But this reaction occurs only at the commencement of the current flow and at its termination.

Supposing we connect a battery, a switch and a coil of wire in series. When the switch is closed the current starts to flow, but the creation of the magnetic field around the coil momentarily opposes the current, and so there is a minute space of time during which the current builds up to its full strength, which it then maintains evenly.

The opening of the switch breaks the circuit, and current ceases to flow from the battery; but there will not be a sharp cessation of current flow in the coil, but a graduated fall as the magnetic field collapses, and in so doing creates a further tiny current flow of short duration in the coil.

CONNECTING RESISTANCES



The top half of the diagram and the top half of the photo illustrate, theoretically and practically respectively, three resistances joined in series—the current has to pass through each successively. The total resistance is obtained merely by adding up the three resistances. But when resistances are connected in parallel, as shown in the lower parts of the illustrations, the current divides into three paths, and the effective resistance is then smaller than the smallest individual resistance.

The current-retarding and lagging effect due to the field of magnetic force that is always set up and broken when current commences or concludes its flow in a circuit is known as *inductance*, and this is measured in *henries*.

We have only considered the part inductance plays in the extreme cases of the commencement and conclusion of current flow, but in actual fact inductance opposes *any change* in current.

About those Lines of Force

If you were suddenly to increase the current flowing in the circuit by applying a greater voltage or by decreasing the resistance, the inductance would initially oppose this change, just as it would momentarily attempt to maintain the same current if you were to decrease it.

The intensity of the magnetic field around a coil of wire (and similarly, of course the coil's inductance) can also be increased by introducing an iron core—sticking a rod of iron through its centre. The reason for this is that the magnetic field comprises a series of what are known as "lines of force," and iron is an infinitely better conductor of these lines of force than is air.

And so the lines of force tend to concentrate closer around the coil, and, clearly, by this concentration the magnetic field is intensified. A direct measurement of the strength of the magnetic field is given by the number of lines of force existing per square inch (and that is flux density).

And now we are ready to tackle *induction*.

We will wind another coil of wire round the same iron core that we introduced into the original coil in order to increase its inductance.

The moment this first coil is connected up in the new conditions a current starts to flow through it and, as formerly, a magnetic field is thrown out. But this time the lines of force cut through the new coil, and by so doing induce into or, in other words, *generate* a current of electricity in it.

How the Transformer Works

However, this current persists only during the time of the creation of the magnetic field. As soon as the current flowing from the battery, and through the first coil, has overcome the inductance effect and reached its full strength, the magnetic field is stabilised and there is no further current generated in the second coil.

When you disconnect one of the ends of the first coil from the battery, current ceases to flow from it, the magnetic field collapses, and, in doing this, induces a further small flow of current in the new coil.

The two coils and their common iron core constitute an elementary *transformer*, and, as we have seen, this transformer does nothing at all while steady, unchanging current is passing through its *primary* winding. In these conditions no current at all is generated in its *secondary* winding.

From all the foregoing it may be thought by some of my readers that electrical currents always tend to pass in the one direction to a *fixed* point of electron shortage. This is certainly the case with all kinds of batteries, but not with rotary electrical generators, or, as they are more frequently called, dynamos.

It is true that there are dynamos which do produce *direct current* (D.C.), but there are also others which generate *alternating current*. This is electrical current flow which changes its direction many times per second.

Alternating Current and Frequency

But first a few words about the operation of a dynamo. It is very easily explained now that we have dealt with the transformer.

If current is generated in a coil of wire through which a magnetic field is caused to rise and fall, it should not be difficult to understand that we can produce current with a fixed magnetic field and a moving coil instead—the effect must be the same.

So in the dynamo, coils of wire (the armature) rotate rapidly through a field of magnetic influence.

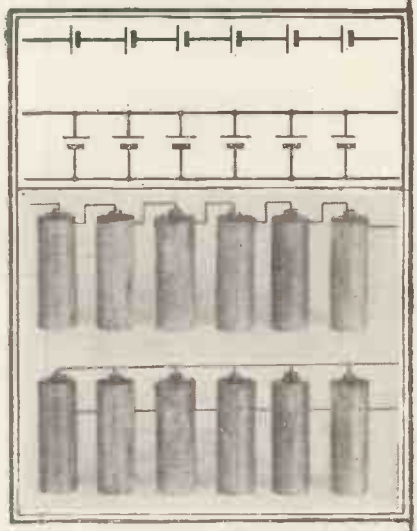
A "straightforward dynamo" will have two terminals just like a battery, but the terminals of that type of dynamo which produces alternating current are not unchangingly positive and negative. First the one is negative and then the other.

And this change-over will occur fifty or so times per second.

Supposing we connect the primary winding of our simple transformer to the dynamo terminals and set the dynamo in action. First the current rises from a zero to a maximum value in the one direction, and then falls again to zero, and then a current rising from zero to maximum and falling again to zero is set up in the opposite direction.

That is one *cycle*. And the number of times per second the cycle is repeated determines the *frequency* of the *alternating current*.

And, as the magnetic field rises and falls coincidently, an alternating current is *induced* in the secondary winding.



ARRANGING CELLS

When the cells of any battery are joined in SERIES, as at the top, the resultant voltage is the sum of the individual voltages. If there were six 1½-volt cells in series the result would be 9 volts. A parallel connection leaves the voltage unchanged, but the capacity resulting is equal to the sum of all the individual capacities.

Do You Remember?

Do you remember what *inductance* does? It opposes any change in current, and so inductance must obviously seriously affect the flow of alternating current, for this is in a state of change all the time!

Therefore, with alternating current it is not resistance alone which determines the current flow. A steady *direct current*, which always passes through a circuit in the one direction, is not affected by inductance except during the moment following its initial switching on, and the moment following its switching off.

In order to calculate how much alternating current will flow through a circuit you have to take into consideration voltage, resistance, inductance, and a factor we have not yet discussed—capacity.

For convenience, resistance, inductance and capacity are grouped together and styled *impedance*. Impedance is measured in ohms, just as is resistance alone, and Ohm's law applies equally well to alternating current (impedance replacing resistance).

It is rather confusing that impedance should so often be spoken of as A.C. resistance.

As to capacity—well, all electrical conductors have capacity. It is a measure of the quantity (not current) of electricity they are able to store.

You come across *capacity* in its most "practical" form in the *condenser*. A condenser is essentially nothing more than two pieces, or groups of pieces, of metal separated by air or some other kind of insulating material.

Some Interesting Condenser Facts

A condenser stores electricity in this way. It has two terminals, just like a battery, and these terminals merely connect to the two pieces of metal. Join the two terminals of a battery to them, and what happens?

It is clear that there cannot be a maintained flow of current from the battery through the condenser, for the simple reason that the two "halves" of the condenser are separated by an insulating material.

But the one plate, or set of plates (as the pieces of metal are called), in the condenser is joined to a terminal of the

Radio In Outline—continued

battery which is starved of electrons, so electrons will flow out of the condenser plate into the battery.

Meanwhile, the electrons on the opposite condenser plate will be trying to get across to the other condenser plate and preserve the electron balance of the condenser. But they cannot get across if the insulating material is good, unless such an intense electron shortage on the other set of plates (or plate) is created that the electrons are able to smash their way across the insulator (spark across).

Measuring Capacities

The intensity of the electron shortage communicated to the one condenser terminal depends upon the voltage of the battery or other source of current supply to which it is connected.

(By the way, it is curious to think of storing *shortages*, isn't it? Actually, we could speak of the action of a condenser as the creation of a superfluity of electrons on the one set of plates as compared with the other. But we believe it is simpler to follow the shortage idea throughout.)

The unit of capacity is the farad, although for practical purposes the farad is vastly too large a unit, and so we divide it up into millionths, and work with the *microfarad* (mfd.).

The calculation of a condenser's capacity is quite straightforward business. It depends upon three things—the area of the plates, the distance between them, and the nature of the insulator. The bigger the plates or the closer they are together the greater the capacity.

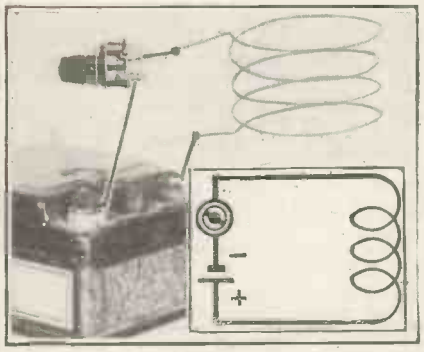
The capacity is also increased to varying degrees if, instead of an air separation, you have mica or glass or ebonite or bakelite or paper or some other kind of *solid dielectric*.

That Electron Equilibrium

It is often said that while direct current cannot pass through a condenser, alternating current can. Now, this is not strictly true. It would be better to say that alternating current can be *communicated* through a condenser.

Let us suppose we have a condenser connected across the terminals of an A.C. dynamo. Electron shortages will be alternately created on each of the two plates of the condenser.

INTRODUCING INDUCTANCE



The inductance of a length of wire is considerably increased if the wire is wound into a coil.

And there will be a rushing to and fro of electrons through the two wires connecting the condenser to the dynamo. But electron equilibrium, or an attempt to maintain such, will not be achieved by electrons jumping from the one plate to the other of the condenser through the intervening insulator. (If they did the condenser would have "broken down.")

However, we will refer to "A.C. passing through condensers" because, though loose, it makes for simplicity of explanation when dealing with A.C. circuits.

The World's Biggest Conductor

Even a straight piece of wire has *inductance*, and it also has *resistance*. It may be more difficult for you to grasp the fact that it has capacity, too, because you will have assumed that it takes two pieces of metal to create something having capacity.

Well, there always must be another *conductor* somewhere in the vicinity of any piece of wire, even if it is only the earth beneath our feet. We say *only*, but, in fact, the earth is the biggest piece of conducting material that we know!

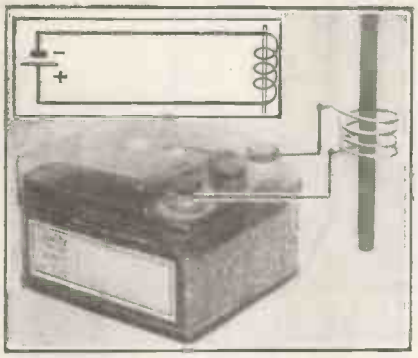
We have dealt with the direct part played by resistance in the determining of current flow values, but with A.C., as we have said, there are also inductance and capacity to be dealt with.

Their composite effect is expressed as impedance, but we fear we will not have the space to examine this factor in detail. However, you should by now be able to visualise fairly clearly what it is.

Making a short cut, let us connect an inductance, a resistance, and a capacity in series with the A.C. dynamo (these will be in addition to the small quantities of those factors present in the actual wire used for making the connections).

The inductance, we will assume, is found in a large number of turns of wire wound on an iron core. Now that is an *L.F. choke*, nothing more nor less, for it will tend to cut down or "choke" currents of LOW FREQUENCY.

INCREASING INDUCTANCE



Inserting an iron core increases the inductance still further, for iron is a better conductor of magnetic lines of force than is air, so the iron core tends to cause a concentration of these, and that is the same as saying the intensity of the magnetic field immediately surrounding the coil is increased—which is also equivalent to an increase in inductance.

Connecting in Series or Parallel

The *frequency* of the current from our dynamo will probably be of 50 or 60 cycles, and that is decidedly a low frequency, which you will the more appreciate when we come to currents which qualify for the description *high-frequency*.

Right away we trust you can see that the "bigger" the choke (the greater its inductance), the smaller will be the A.C. current flow for a given pressure or voltage.

If the resistance is in the form of a considerable length of fine wire, it, too, will offer many ohms of resistance to the current flow.

Finally, the smaller the capacity of the condenser, the greater the resistance it will offer to current flow. Note the "smaller" in the case of the condenser.

Condensers can be connected either in series or parallel, as in the case of resistances, but with an opposite kind of effect. With condensers the resultant value of a number in parallel is the sum of the individual capacities.

"Smaller than the Smallest!"

The capacity of a number of condensers in series will be smaller than the smallest individual capacity, and the reciprocal rule which applies to resistances in parallel is used.

Inductances follow the same general laws that apply to resistances. Connect them in series and you must add their individual values, while you apply the reciprocal rule to inductances in parallel.

I could expand all this very considerably, because I have already covered enough ground to warrant a fat text-book. But if you have read my words moderately carefully you ought, at any rate, to be well acquainted with the "high lights" of the theory of electricity.

A firm grasp of these is quite essential to a proper understanding of radio, in which you will find little or nothing which is not quite consistent with the simple electrical rules and regulations I have dealt with.

When Tommy Handley Sings a Song

It is now necessary for us to transfer our attention to the broadcasting studio, for it is essential that you should obtain something of an insight into the processes of radio concerned with the transmission of speech and music.

The following few hundreds of words have already been published elsewhere, but they so succinctly deal with this part of the business that I think they deserve to be placed on permanent record in this special review.

To commence with, we will suppose Tommy Handley is singing a song to the accompaniment of Jack Payne's Dance Orchestra. Their joint efforts produce a medley of sound waves—the whole of the air of the studio is in a state of vibration.

Tommy Handley's contribution to this disturbance is caused by the movements of his vocal chords plus variations in the air stream from his mouth due to voluntary actions of his tongue, teeth, lips, etc.

This is a quite complicated process, and so we will stop the whole performance and ask Jack Payne to produce and strike a tuning-fork. Ping! He does so, and you hear a thin, clear note.

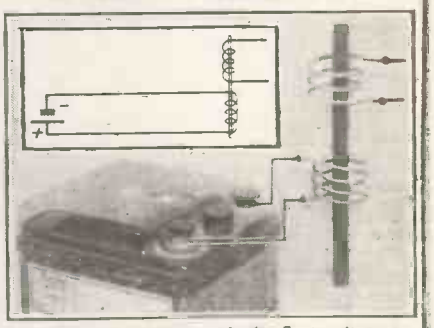
There are two things about this note that are immediately apparent; one is that it has a certain *pitch*, and the other is that it has a certain volume or loudness.

The sound is produced by the steel prongs vibrating and so causing the air in their immediate vicinity to *rarefy* and *compress*. If your eye could follow the movements of the tuning-fork prongs you would be able to see that they waggled backwards and forwards hundreds of times per second.

Setting Up Sound Waves

As they move forward in the one direction they press the air back. Air is compressible, and it can be squeezed up like indiarubber to occupy a smaller space when under pressure. That part of the surrounding air the prongs move away from is attenuated or reduced to below its normal pressure.

A TRANSFORMER

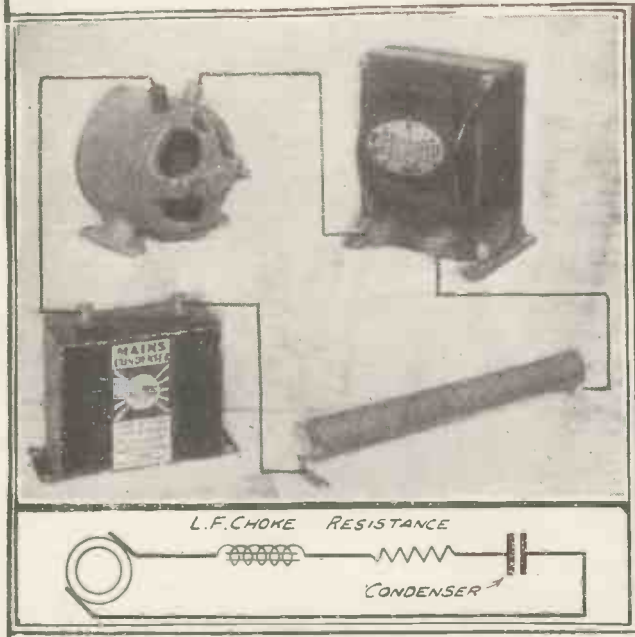


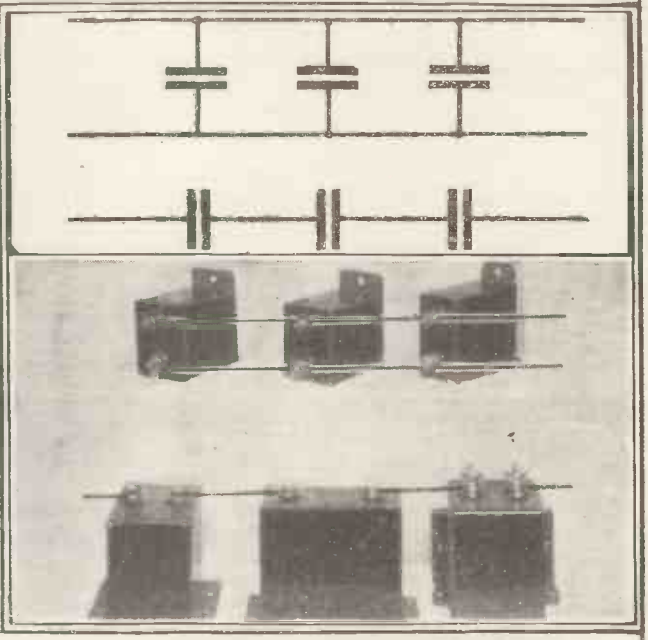
Current passing through the first coil sets up a field of magnetic influence which envelopes the second coil. Current is induced in this second coil every time the magnetic field changes in intensity. In the above case the switching on and off of the battery produces the effect.

These rarefactions and compressions are communicated outwards to the more distant air in the form of a series of similar effects which get weaker and weaker the farther you go from the centre of the disturbance, i.e. the tuning-fork.

They are called *sound waves*, but don't get the wave idea too much mixed up with waves in the sea. These are analogous only in that the crests of sea waves, where the water is lumped up above the normal level, can be compared with the compressions of sound (here the air is compressed above its normal pressure). The troughs of sea waves where the water has sunk below the normal level are comparable with the air rarefactions.

Not One Single Formula is Included





EXPLAINING IMPEDANCE

The three factors which affect A.C. current flow are shown in the photo in practical forms, and the circuit is reproduced theoretically in the diagram. The combined effect of inductance, resistance and capacity is styled Impedance, and impedance is reckoned in ohms.

CONDENSER CONNECTIONS

You merely add up the capacities of condensers in parallel (top), but when they are joined in series then you must take the reciprocal of each value (divide it into 1), add these reciprocals together and that is the reciprocal of the resultant capacity. The same rule applies to resistances or inductances in parallel.

(The action of a loud-speaker diaphragm is fundamentally similar to that of a tuning-fork prong. It moves backwards and forwards and creates air-pressure waves.)

The loudness of the tuning-fork note depends upon the extent of the movement of the prongs. The bigger the waggle, the greater the noise, for the simple reason that the prongs impart greater pressure to the surrounding air.

Harmonics and Overtones

The pitch of the note emitted is determined by the number of times per second the prongs vibrate. The faster they waggle, the higher the note. But you cannot vary the pitch or rate of vibration of a given tuning-fork; this is fixed by the thickness and length of its steel prongs. However hard you strike it, the note remains the same.

If you made the prongs longer, they would waggle more slowly and the note would drop in pitch.

And now we will ask the violinist to produce a note of exactly the same pitch from his instrument. He can vary the loudness by increasing the strength of his bowing, and that makes the violin string vibrate over a greater distance.

But the violin note sounds different from the tuning-fork note because it has an individual tone or *timbre* of its own, whereas the other has not. The reason for this is that a violin note does not only consist of one fundamental vibration.

The violin string vibrates as a whole, and the *frequency* of its vibration (number of waggles per second) depends upon its length and tension. But, in addition, fractions of the string vibrate—halves, thirds, quarters, fifths, sixths, sevenths, etc.

And these produce independent, though much weaker, notes which are known as *harmonics*. And because these are due to sections of the string (they are, in effect, shorter strings) these *harmonics* or *overtones* will be of higher pitch.

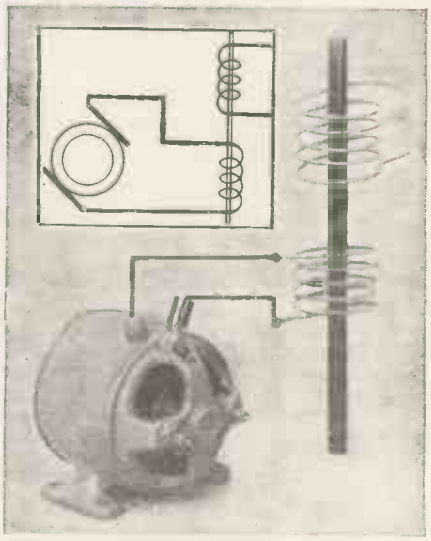
The Fundamental Frequency

Their frequency bears a definite relation to the frequency of the vibration of the complete string, which is known as the *fundamental* frequency. Supposing this is 256 vibrations per second (corresponding with middle C on the piano), then the first overtone (halves of the string in vibration) will have a frequency of $256 \times 2 = 512$, the second (thirds) $256 \times 3 = 768$, etc.

Now, these harmonics are not theoretical conceptions, but are vitally practical. It is quite possible to eliminate the fundamental frequency of a note and leave only one or more of its harmonics, which are heard, of course, as notes of higher pitch, but much weaker in volume.

Indeed, this is the sort of thing that often happens in radio. A very low note is in evidence on many sets merely as a group of harmonics. The effect is a ghostly imitation of the full-blooded original note.

LINKED BY INDUCTION



An alternating current dynamo produces current which alternates in its direction of flow and thus causes the magnetic field round the primary winding of the above primitive transformer to fluctuate and induce current in the secondary winding.

A violin is played by a bow being drawn across its strings, but a piano is operated by *percussion*: little hammers are made to strike the strings and set them into vibration. The moment after a string has been struck a *damper* (a felt-covered arm) comes down and stops the vibration. That is, unless the loud pedal is depressed.

Putting a Damper On!

When this is done the damper is made inoperative. Let us ask Jack Payne's pianist to strike a note with his feet hard down on the "loud pedal." You will hear a marked difference: there is a hollow, resounding, *resonant* effect.

All the strings are free to vibrate as long as they like (until the loud pedal is released), and a number tend to vibrate in sympathy with the struck note.

If there were two pianos in the studio and the same note on the other were struck heavily, the effect would be even more marked, for the sympathetic vibration is greater when the pitch is identical.

Here is a simple experiment. Depress the loud pedal on any piano and then loudly sing any note you like. It will be repeated by the appropriate string on the piano *resonating*.

That is how Caruso used to break wine-glasses. He would tap a glass with his finger, note the pitch of its vibration, and then let his superb voice go on that same note. The glass would sympathetically vibrate so energetically that it would fall to pieces.

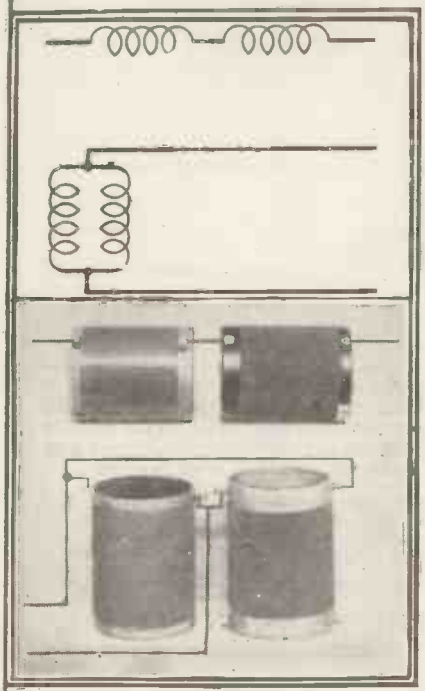
They have to be very careful in regard to resonance when they install large cinema organs, for before now big girders have been found to have *periods* of a musical frequency, and if one of these girders started to vibrate every time a certain organ key were touched it might be structurally weakened. At the least there would be a distorting effect on the music when this unofficial instrument started to play!

Saxophone Tone

Before we finally leave the broadcasting end of radio and transfer our attention to reception, I have a few more facts to bring to your notice about the way in which individual musical instruments build up tone.

Supposing one of the saxophone players produces a middle C note. Although it has exactly the same pitch and, perhaps, approximately similar volume to that of the violin middle C, it does not sound like

Radio In Outline—continued



CONNECTING COILS

The rules for coils in series and parallel are the same as those for resistances. (The inductance of coils in series is the sum of the individual values, etc.) This is all right so long as the coils do not magnetically couple together—if they do that, Mutual Inductance enters the field to complicate matters!

violin note. That is because although it has exactly the same fundamental frequency, its harmonics differ (Not in their frequency relations, but in their number and comparative strengths.)

The saxophone belongs to the "wood-wind" family, and it does not have strings like a violin. Instead, a column of air is made to vibrate.

Pitch of Pipes

The same principle is seen in the organ. An organ has a number of pipes of different lengths, just as a piano has a series of strings of differing lengths. By blowing air past a reed, the column of air within any one pipe is set into vibration, and the frequency of the vibration (and the pitch of the note) depends exactly upon the dimensions of the air column.

An organ has eighty or ninety pipes, each giving a note of a definite pitch. There is only the one pipe, as it were, in the saxophone, and the length of this is artificially varied by the performer as he operates the keys.

When all the holes in the tube of a wood-wind instrument are closed, you get the lowest possible note (the longest air column). As the holes are opened (by lifting the keys or, as with a flute, lifting the fingers off the holes) so the air column is, in effect, shortened and the note increased in pitch. The material of which the tube is constructed tends to vibrate when the air column is active, but not necessarily at the one fundamental frequency. It will develop harmonics or *partials* of its own, and so add something to the tone (timbre) of the note.

"The Things You Bang"

That is why a clarinet that is made mostly of wood sounds slightly different from one that is of all-metal construction. By the way, it is curious that an instrument made entirely of metal can be included in the "wood-wind" category, isn't it?

Now you can probably see why the quality, density and age of the wood from which the body of a violin is fashioned have such an important bearing on the quality of the sounds produced by the instrument.

So far we have touched upon only two classes of instrument; there are still those known as "Percussion." These comprise the drums, triangles, xylophones, etc. In short, the things you bang!

But most of the "bomp, bomps" you hear from orchestras of the nature of Jack Payne's are due to the pluckings of the strings of the string-bass—those giant fiddles—or to the grunts of a bass trombone.

These have definite melodic values, whereas the beating of a bass drum, which, however, is often used, is quite non-musical. It emits mere noise, as opposed to the regular vibrations which are necessary for the musical sound.

Odds and Ends of Acoustics

Speech is a more complex medley of sound waves than an ordinary musical note—indeed, it is probably true to say that it comprises a mixture of the kind of irregular frequencies generated by percussion instruments plus a modicum of those that are of a musical character. The proportions of this mixture will, of course, vary immensely.

Anyway, the frequency range covered in ordinary speech is approximately 180—3,200. When a person starts to sing, some of the complexities met with in speech are removed, for he uses his vocal chords more and his tongue and teeth less!

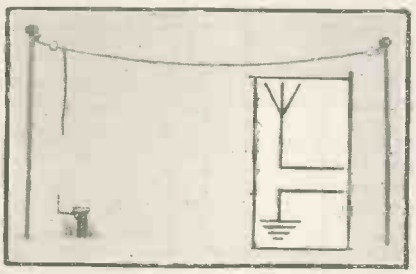
And now for a few odds and ends relating to acoustics which you should try to remember.

The human ear is vastly more sensitive to frequency change than to alterations in loudness. An increase or decrease in volume of twenty-five per cent will pass unnoticed by the average observer, though he would immediately discern a five per cent frequency variation, even if he were not "musical."

The ear is more sensitive to the "middle frequencies" (say, 300 to 1,000) than to higher or lower notes.

Considerably greater power has to be expended on a low note than on a "middle frequency" in order to achieve the same apparent volume in both cases.

THOSE RADIO WAVES



As the wireless waves pass a suspended wire aerial they induce electrical currents in it, just as would a moving magnetic field from a huge coil. This kind of aerial system demands a good contact with the earth—note the earth tube!

The high notes produce sound waves that are more directional than the low notes. Thus while high notes tend to be projected from a loud-speaker diaphragm like a searchlight beam, the low notes spread outwards in all directions. (That is why you need a baffle board or good cabinet, or the low-note air disturbances thrown off from the back of the diaphragm will wander round to the front and produce a nullifying effect—the compressions being neutralised by rarefactions and vice versa.)

But now we are ready for the full studio performance to commence, and the time has arrived for us to move over to the microphone. The full orchestra operates, the vocalist sings, and the whole studio quivers with sound waves.

The studio audience (if any) hear the result because their ear drums vibrate and their aural nerves communicate these vibrations to their brains.

What the Microphone Does

"Mike" is not unlike a human ear in many ways. For instance, in place of the thin skin that forms the ear drum it has a thin metal diaphragm, and as the sound waves impinge on this it is set into vibration.

Behind the diaphragm there is a quantity of carbon. The electrical resistance of this mass of carbon changes with the varying pressures imposed upon it. That is to say, it will enable more or less electricity to pass through as it is packed together with varying degrees of pressure in accordance with the movements of the diaphragm.

If you were to press the diaphragm in with your finger the current flowing through the microphone would leap up to colossal dimensions, and listeners would hear a very loud click.

Some of the microphones used by the B.B.C. are exceedingly sensitive, and can be actuated by extremely tiny noises, but others are deliberately made insensitive. For instance, it is not required that the microphone used by the commentator at a football match should be able to pick up everything that is going on around (a separate mike is usually used for "crowd noises"). So it is made sufficiently insensitive to operate properly only when the speaker speaks clearly and closely into it. Subsequently, a bit of extra amplification is given to the electrical energy to compensate for this lack of sensitivity.

Sounds Converted into Currents

However, you will probably be unable to appreciate that point properly until we have dealt more fully with the part "Mike" plays in the radio chain.

The microphone circuit comprises a battery (similar to the kind you use for the L.T. on your set), the one winding of an L.F. transformer and the microphone itself.

Even when the microphone is not in action a certain amount of current will flow from out of the one terminal of the battery, through the mike and the transformer winding back to the other battery terminal.

The microphone is in effect a variable resistance when sound waves are causing its diaphragm to vibrate.

The amount of current that will flow in the circuit depends upon the resistance that is offered against its flow. If the resistance is large, the current will be small; if the resistance is small, the current will be large.

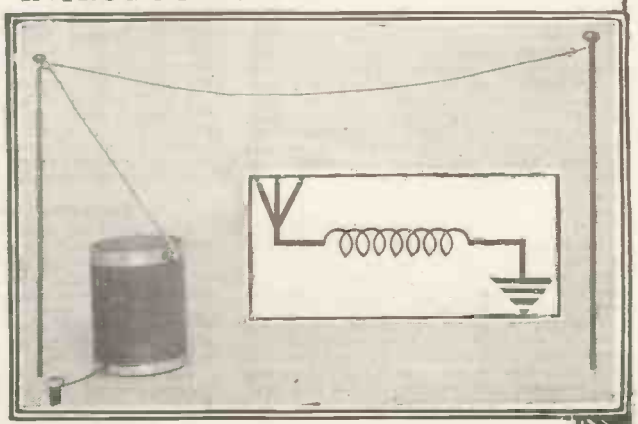
Thus it follows that if the resistance varies, the current must also vary. And so the sound waves, acting on the microphone, produce current variations in the microphone circuit.

These current variations are passed on to an amplifier by means of the transformer.

The amplifier, as its name suggests, magnifies the electrical impulses.

In the meantime, the bulk of the transmitting gear is at work producing current variations of an extremely high frequency in a manner similar to the way in which a radio receiver can be made to oscillate (and in so doing interfere

INTRODUCING THE "TUNING COIL"



The coil completes the simple aerial circuit.

Mathematics and Calculations are Avoided

with the reception of other listeners) by the over-application of the reaction control—of which more anon.

As the current impulses generated by the microphone faithfully follow the sound waves, it is obvious that these will be of similar frequency. That is to say, the sound wave created by the middle C note of a violin will be represented in the microphone circuit by a current that varies 256 times per second in strength.

That is a *low frequency* (L.F.). But the radio transmitter produces current variations of something in the neighbourhood of one million per second, and that is a *high frequency*.

The next step in the process of getting Jack Payne "on the air" is to combine the microphone currents and that steady high-frequency current that is being generated. This business is known as *modulation*.

After this the H.F. current is led to the aerial and made to dash up and down that.

This creates a disturbance in the ether, and other waves, which are not unlike sound waves in form, are radiated over the countryside.

"A Bit Tricky"

Wireless waves, though, are a bit tricky. They definitely are not electrical currents, although they are produced by them and they do not occur in the air. That is to say, they are not air waves, and can, in fact, pass through a vacuum with the greatest of facility.

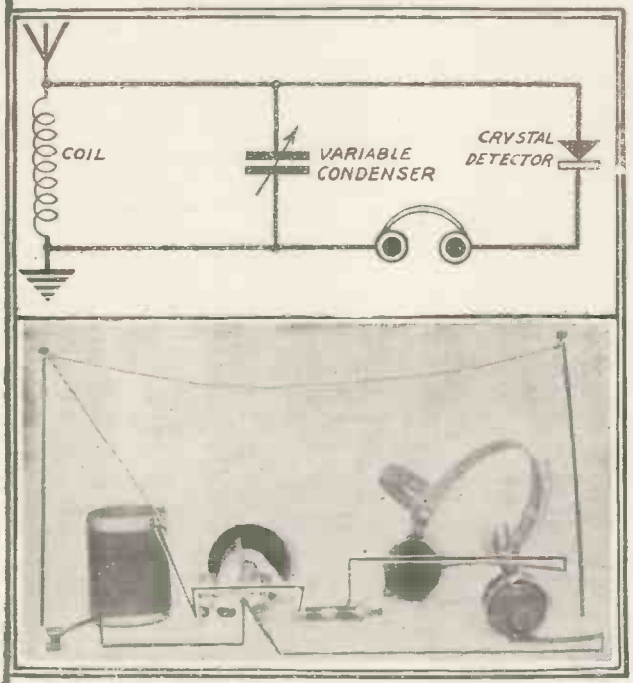
The medium in which radio waves are formed is known as the ether of space, and although there are many scientists who discredit the ether, that need not worry us at all, for the ether provides us with an excellent basis for our reasoning.

You must imagine an all-pervading substance which soaks through everything just as easily as water soaks through porous fabrics. The ether is presumed to permeate the very spaces between electrons, and so be present even within the structure of atoms.

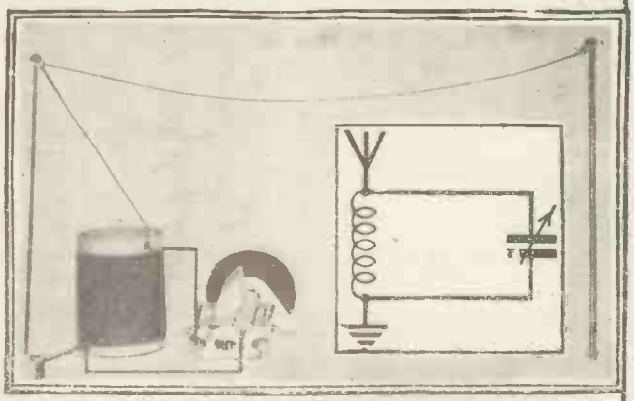
Take a glass bottle and extract all the air from it, and you still have a bottleful of ether! But don't confuse this ether with the stuff they use as an anæsthetic. You can see, smell and feel this, but you have only my word for it that the other kind of ether exists!

The ether of space conveys light waves from the stars, and radio waves travel at the same speed as light waves, i.e. 300,000,000 metres (186,000 miles) per second.

A COMPLETE "CRYSTAL" SET



The crystal detector is a better conductor of electricity which passes in the one direction than it is of that which flows in the other direction. By connecting up the detector and telephone receivers as above, the latter receive the unidirectional flow of current necessary for their working.



The wave-length to which the aerial will best respond can be increased either by adding inductance or capacity. The coil adds a certain fixed amount of inductance and then the variable condenser adds desired degrees of capacity as required, so that you can cover a fairly wide band of wave-lengths.

But they are much longer waves than are those of light, and that brings us to *wave-lengths*. You cannot vary the speed of a radio wave, but you can vary its length.

Think of your aerial as a conveniently fixed object. The radio waves of some broadcasting station are passing it. In the space of one second a train of waves 300,000,000 metres in length will have flashed by. The number of waves in this 300,000,000-metre train is the *frequency*.

Supposing there are 1,000,000 waves in the train—which is the same as saying the broadcasting station is sending out one million waves per second—then it is quite clear that each wave must be 300,000,000 divided by 1,000,000 metres in length.

The Reason for Tuning

One radio wave is often referred to as a cycle, for the simple reason that it comprises one complete wave-form—a crest and a hollow, as it were—just like a wave in the sea. A *kilocycle* is 1,000 cycles or waves.

When the radio waves ripple past your aerial they act on this just in the same way as a moving magnetic field would—they induce currents of electricity into it.

But, you might well ask, why is it that every radio aerial doesn't have currents induced in it by all the waves from all the broadcasting stations? The answer is that this does happen, but only the one series of waves is going to be able to induce to its full effect, and those will be the waves from the station to which the aerial is *tuned*.

I have spoken of the aerial as though it were just a length of wire suspended in the air, but it is usual to interpret the term "aerial" as the complete aerial-earth system, for a good connection with the ground is necessary to complete the aerial circuit.

They Clash and Cancel

Now let us see what happens as the radio waves stream past the aerial. The one wave creates a current of electricity which dashes off along the aerial, down to earth, and back again along the aerial. If there were only the one radio wave this induced current would continue to dash up and down the aerial system—or, as we say, *oscillate*—until it had worn itself out.

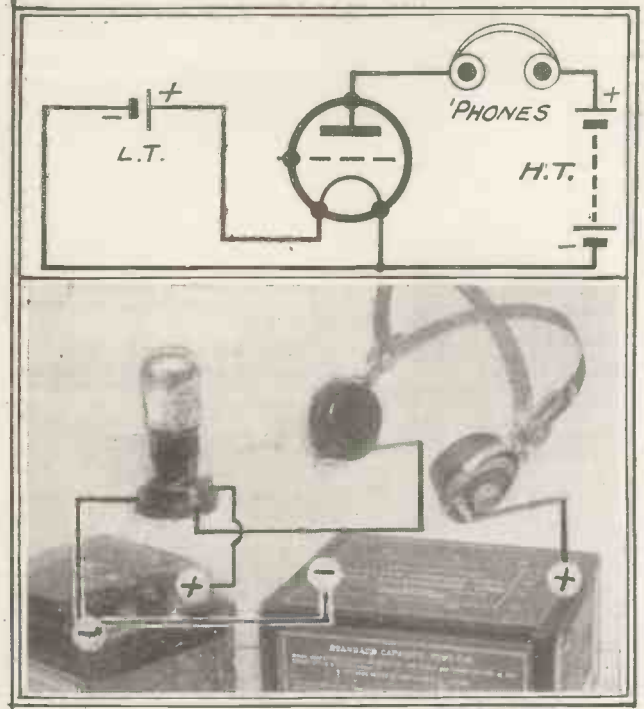
But the next radio wave in the continuous train starts off another current, and if the first current hadn't quite completed its journey, it will meet this, the two will clash and cancel each other out, because they are travelling in opposite directions.

Had the second wave come along after the first current had completed one journey through the aerial system there would have been a second current induced, which would

THE FILAMENT CIRCUIT

The filament is heated by the current from the L.T. battery, and electrons are thrown off from the hot wire.

Radio In Outline—continued



ADDING AN ANODE CIRCUIT

The stream of electrons passes from the filament to the anode (plate) of the valve because the plate is made very deficient of electrons (positive) in regard to the filament by the introduction of the H.T. battery.

have gone chasing after it, to clash with it and cancel it out at the "turn" at the other end.

Therefore, if a sustained *oscillating current* is to be maintained in the aerial system, each induced current must be only just able to complete one round journey before another is set up.

A good analogy is a garden swing. To keep it swinging properly you give it a push at exactly that moment when the seat has swung right forward one way and has returned to its limit of travel in the other direction. If you push before the *cycle* is complete the force of the swinging seat opposes the push you give it.

The Timely Touches

And if you were too late with your push and "followed through," and shoved just as it turned the other end, you would again be pushing against the force of the swing, and at least tend to slow it down, instead of keeping it swinging.

What determines the length of time it will take for a current to dash up and down the aerial? I'll answer that with another question. What tends to oppose any current change? And, remember, currents induced in an aerial by radio waves are alternating in character—changing in value all the time, first in the one direction and then the other.

Of course, you haven't forgotten our old friend, *inductance*. And, additionally, there is capacity—the aerial constitutes one plate of a condenser and the ground the other.

Fundamentals of Tuning

Therefore, an aerial wire which is joined directly to an earthing connection in the form of a metal plate or tube buried in the ground, or a water-pipe, will give the most sympathetic consideration to radio waves of a length which match, as it were, just that amount of inductance and capacity the aerial system possesses.

The greater the inductance and the greater the capacity, the longer the time the induced current will take in its journey, and the longer the wave-length to which the aerial will best respond.

So you will observe we have a ready means to adapt the aerial system to any wave-length we desire. It can be done by varying the actual length of wire used in the aerial, but that is not a convenient method. It is far better to add inductance by connecting a coil of wire in series.

A close adjustment over a certain band of wave-lengths can then be made by means of a *variable condenser*, joined across this coil. Is it necessary, these days, to explain what a variable condenser is?

Selectivity

The very name is self-explanatory; it can only mean a condenser whose capacity is variable, and the usual manner of making it variable is to arrange that the one set of plates can be movably interleavable with the other.

With our complete aerial-tuning system, comprising an aerial and earth and coil and variable condenser, we are now able to select any one wave-length from a wide group merely by varying the capacity of the condenser. But it is one thing to have a nice and healthy oscillating current generated in one's radio aerial, and quite another matter to make good use of it.

A broadcasting station transmitting on a wave-length of 300 metres will generate an alternating current of 1,000,000 cycles in a *tuned* aerial system. (That's equivalent to a current which changes its direction one million times per second.)

Now, that is a very *high frequency*, far too high a frequency for a loud speaker or telephone to reproduce. If we want to operate such instruments we must first of all *rectify* the current. This we can do in one way by a process of crystal detection.

One-Way Traffic

A crystal detector is a device which will allow electrical currents to pass through it much more easily in the one direction than in the other. So if we arrange that some of our aerial current passes through a crystal detector (with which telephone receivers are connected in series), this will act as a sort of valve, and suppress most of that current which tries to travel through it in the one direction, while providing an easy path for the other *half-cycles*.

The result is, to all intents and purposes, that we now have, not an alternating current, but a unidirectional or direct current.

The telephone receivers will respond to this.

It should be noted that the telephone receivers, with the crystal detector in series, are joined across the coil and condenser and so constitute an alternative path for the aerial circuit currents. It would not do to have the crystal detector sitting right in the aerial circuit itself, this must be left as a free path for the oscillating currents to build up in.

I do not blame you if you are puzzled as to why the electrical currents, even after rectification, cause speech and music to be heard in the telephone receivers, for I have not yet dealt with this point. I will do so now.

Size and Strength

A telephone earpiece consists of an electro-magnet and a thin sheet of metal, the diaphragm. Varying currents passed through the electro-magnet will cause this to attract the diaphragm with varying magnetic force. Supposing a current which rose and fell in strength one hundred times per second were passed through the wire windings of the electro-magnet. The diaphragm would bend backwards and forwards one hundred times per second. And these vibrations would naturally be communicated to the air.

These sound waves, for such they are, would be heard as a low note. On the other hand, if the vibrations occurred at the rate of fifteen hundred per second the subsequent sound-wave would be high in *pitch*.

Here comes a jump back. The radio waves do not comprise continuous trains of waves of all exactly the same size—same length, yes, but not similar sizes or, shall we say, heights.

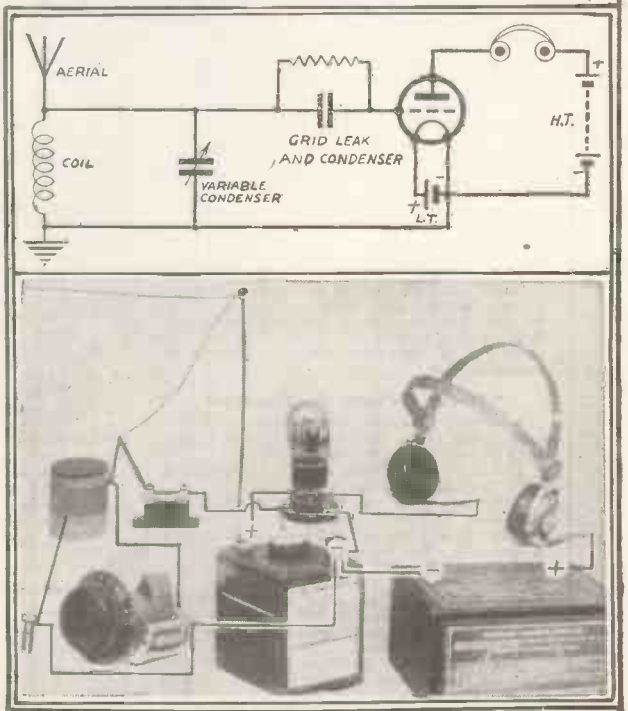
The size or height or magnitude of the wave (just as you will) indicates the energy it represents. If the waves vary in height, not length, mind you, so will the currents induced in the aerial vary in strength. But not vastly from wave to wave as it were.

The Low Frequencies

There will be a high wave followed by a series of waves of diminishing height, to be followed by another bunch gradually increasing in height, etc., etc. (a super-imposed wave form).

And leading back again to the *rectified* current that passes through the telephone receivers, is it hard for you to grasp that this current will be rising and falling in strength at a *low frequency* which corresponds with the

A ONE-VALVE "DETECTOR" SET



The voltages on the grid vary the anode current, and the grid leak and condenser cause detection (rectification).

No Wonder Circuits Are So Fascinating!

gradually increasing and decreasing heights of the train of radio waves?

The exact patterning of this *low-frequency* rise and fall of current strength depends upon the kind of *modulation* the radio waves have been ornamented with by the broadcasting station. And this, in its turn, depends upon the speech or music that has been handed to the microphone in the broadcasting studio.

I know I'm asking a lot of you to take all this in one pretty quick stride, but elaboration is just as likely to confuse you, unless you are prepared for a course of intensive study. But a sound grasp of fundamentals is worth much more than a superficial knowledge of minor processes, and I hope you will easily absorb the fundamentals.

Less Than a Fly-Power!

The energy developed by a broadcasting station in an ordinary receiving aerial is very small. It is probable that a fly expends more energy when it shakes its leg than could at any time be collected from your radio aerial.

It is a tribute to the sensitivity of modern telephone receivers that they are able to turn such small electrical currents into clearly audible sounds.

But if the broadcasting station is more than a comparatively short distance away, a crystal set will not work even telephone receivers. For the reception of distant stations and the operation of loud speakers *amplification* is necessary.

"Boiled" From the Filament

A crystal detector cannot amplify, it can only *rectify*. But the *thermionic valve* is able both to rectify (detect) and amplify.

The valve is, in effect, an electric light bulb with internal additions.

There is a glass bulb from which all the air has been extracted (but no special gas is pumped in as with the light bulb), and there is a filament. The filament is a very thin wire, and current is driven through this by the L.T. battery (usually a two-volt accumulator).

The voltage of the L.T. battery and the resistance of the filament are such that sufficient current passes to make the thin wire quite hot.

The result is that electrons boil off the wire just as steam rises from hot water. And special alloys are used in the construction of the filament to facilitate this throwing off of electrons. So much advance has been made in the making of these metal alloys that all the electron ejection required is obtained at moderately low temperatures—barely red heat—though at one time our valves had to run at almost a white heat.

Also inside the valve's glass bulb is a piece of metal surrounding the filament, known as the *plate* or *anode*, and between this and the filament is a third *electrode* styled the *grid*.

If the positive terminal of another battery is connected to the plate, and its negative terminal to the filament, an electron shortage is communicated to the plate of the valve and the electrons which are boiling off the filament will tend to fly to the plate in order to make good that shortage. And they will fly across in a constant stream because the filament-plate gap in the valve is a part of the new battery's circuit.

Grid Control

But, remember, that every electron has to negotiate that intervening *electrode*—the grid. If we were to apply yet a third battery to the grid and filament of the valve and communicate electron shortages or superfluities to the grid, it is plain to see that we would seriously upset the filament-plate electron stream.

Should the grid be short of electrons, as compared with the filament, then there would be a diversion of electrons to the grid instead of to the plate. Were the grid overloaded with electrons (negative), then the electrons boiling off the filament would not be attracted across to the plate.

From all this it will be seen that *fluctuating* electrical "voltages" on the grid would be immediately followed by fluctuations in the current flowing in the filament-plate (anode) circuit.

Supposing we were to remove the third battery (the one connected across the filament and grid), and substitute the connections of our aerial tuning circuit, which are vacated by the removal of the crystal detector and telephone receivers, then the oscillating currents generated in the system by the broadcasting station will cause *high-frequency* variations in the current flowing from the anode battery, which we might just as well start referring to as the "H.T. battery."

But if you inserted telephone receivers you would not hear anything because the current is unrectified H.F. current. The insertion of a grid leak and condenser in series with the grid of the valve transforms the valve into a *detector*.

Detection

The grid leak is nothing more nor less than a very high resistance. A usual value is 2 megohms (two million ohms). The action of the grid leak in combination with the grid condenser is to cause the oscillating current which flows in one direction to have less effect on the valve than that which flows in the opposite direction, and so "detection" is obtained.

This is also possible without using a grid leak and condenser by the "anode bend" method. To appreciate what an "anode bend" is, I must ask you to visualise the "characteristic curve" of a valve. I know that sounds a tall order, but I think you will find it simpler than it sounds.

Take a pencil and paper and draw a horizontal line and then a vertical line rising up from one end of it. Mark equal divisions up the latter (figure them 1, 2, 3, etc., the actual values won't matter), these will represent the milliamperes (thousandths of an ampere) of current we will presume are flowing from the H.T. battery to the filament of the valve and thence by a boiling-off process to the plate of the valve and so back to the H.T. battery.

Make Your Own Curve

Along the horizontal base line mark equal divisions to represent values of electron over-crowding imparted to the grid of the valve (negative voltages) by the oscillating currents in the tuning circuit. Mark in any progressive figures—starting at, say, 1 at the first division from the upright line, and running 2, 3, 4, and so on.

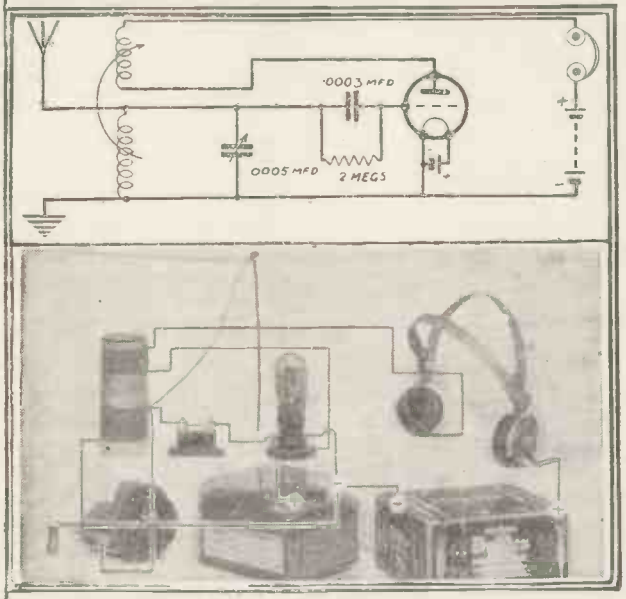
You now have the skeleton of a simple graph. If a grid voltage of, let us suppose, 6 changed the anode current to 6 millianperes, and 5 to 5 and 4 to 4 and so on, your graph would assume the form of an absolutely *straight line*.

In short, you have that condition when equal grid-voltage changes produce equal anode-current changes over the whole scale. But no valve enables that to happen. Over a range of grid voltages from, for instance, *zero grid volts* to four grid volts negative, there certainly might be a straight line, but then at the *bottom end* there will be a *curving*, additional grid volts negative having a less and less anode current diminishing effect. At the top end we cross the zero point and enter the realm of *grid volts positive*, and we find in actual practice that as the grid is made more and more positive there is not an even increase in anode current.

Biasing the Grid

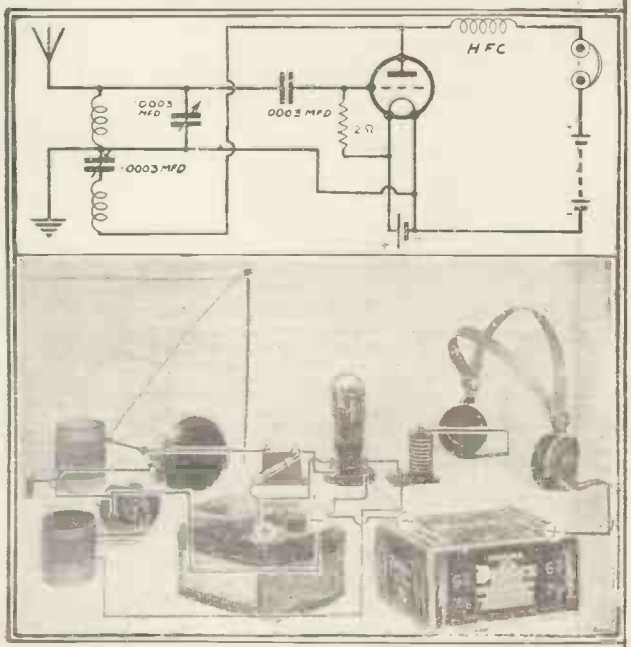
It will be, I trust, clear from this that we ought to be able to make the grid initially so much negative or so much positive by applying a battery that the condition of the grid is biased—so that, in fact, the oscillating current from the tuned circuit has less effect on the

AND NOW FOR SOME REACTION!



Energy can be fed back from the anode circuit to the grid of the valve for further amplification. A coil is inserted in the anode circuit and is coupled to the tuning coil. The strength of the reaction effect can be controlled by varying the distance between these coils.

USING A CONDENSER INSTEAD



In most modern sets the degree of reaction is controlled by a variable condenser. This enables you to vary the H.F. current which flows through the reaction coil, and thus vary the intensity of the magnetic field built up round it.

Radio In Outline—continued

plate current when it is making the grid negative than when it is making it positive or vice versa.

And thus you have the mechanics of either "bottom bend" or "upper or top bend" detection. The former is accomplished by applying a small battery, a grid-bias battery; although "anode-bend rectification" is not so popular as the grid leak and condenser method, which does not call for a battery.

The operation of a grid leak and condenser is rather involved. But my review would be incomplete without a description of this interesting process, though you can jump the next paragraph or two if you like.

How the Grid Leak Works

The condition for "grid rectification" is best obtained when the grid leak is connected to the *positive* terminal of the L.T. battery, and the grid of the valve is made deficient of electrons. This ensures that there will be a minute current flowing *from the L.T. battery to the grid* through the grid leak.

Obviously, this current will vary when the grid's voltage is varied by the H.F. voltage variations communicated to it by the tuned circuit. But the current does not vary equally as with these H.F. fluctuations—there is, in fact, a curve in *this* volts–current characteristic!

And thus a rectified current is developed in the *grid circuit* which, in its turn, is reproduced in the anode circuit in an amplified form by the primary action of the valve.

The grid leak can be connected up in two ways, viz., it can be joined across the grid condenser (that is, a parallel connection) or it can be taken direct to one of the filament terminals (that is, a series connection).

In the first case, the grid condenser mainly acts as an alternative and easy path for the H.F. energy. In the second case, too, it does this; but also, *by offering a high resistance to L.F. impulses*, it prevents the tuning coil from *short-circuiting* (providing a too easy alternative path) the L.F. impulses developed across the grid and filament of the valve.

The general practice is to arrange the circuit so that the grid leak is joined to the positive end of the filament, and this gives better all-round results than a negative filament connection.

But if the very greatest efficiency is desired, some midway point between these positive and negative points may be desirable. This is possible with the aid of a *potentiometer*. This comprises a resistance having a sliding contact running along it.

Its two ends are joined across the filament (externally to the valve), and the position of the slider then determines the difference of potential between that point and the ends of the resistance from minimum up to the maximum created by the L.T. battery.

That "Solid" Bar of Iron

Although the current in the plate circuit of the detector valve is a magnified version of the kind of current that flows through a crystal detector circuit, and is able to work telephone receivers at low frequency (and thus produce sounds), there is still an H.F. aspect of the current even though the original H.F. current (in the tuned circuit) has been able to affect the valve to its full extent only with that half of it which flows in the one direction.

By practically eliminating one half of each cycle you have broken the current (and its resultant anode-current variations) into a continuous series of detached impulses. But these breaks occur at high frequency, and so do not prevent us, from a low-frequency point of view, from regarding the result as a continuous current. (A bar of iron comprises a packed mass of isolated particles, but the particles are so small and the spaces between them so tiny that we rarely think of a bar of iron as being anything else but "solid.")

The Reaction Circuit

Nevertheless, the fact that the current in the plate circuit of a detector valve *does* retain a chopped-up form can be turned to very good effect.

If we connect a coil in series with our telephone receivers and H.T. battery, a magnetic field will be set up round this coil. And that magnetic field will vary in intensity at a high frequency.

By placing that coil near the tuning coil, H.F. current will be induced in this—and so we get *reaction*. A feeding-back of energy, from the plate circuit to the grid circuit of the valve, for further amplification. The extent of the feed-back can be controlled by varying the distance between the two coils.

And that is magnetic reaction—reaction controlled by directly varying the magnetic effect between the two coils concerned.

But the more usual form of reaction is one that is capacity controlled. For this we still have our plate and grid coils coupling together, but the degree of current that is allowed to flow through the coil (and the intensity of the magnetic field thrown out) is adjusted by a variable condenser joined in series with the coil.

Reduce the capacity of the condenser and you increase its opposition to current flow—increase its capacity and you reduce its opposition or resistance.

Obviously, however, you cannot have the variable condenser in direct series with the H.T. battery and telephone receivers, so an alternative path for the H.F. feed-back is constituted (the plate of the valve being joined to the *reaction condenser* and this being connected to the reaction coil) in addition to the plate–'phones–H.T. battery path. An H.F. choke is inserted in this latter path in order to increase its resistance to the H.F. fluctuations (or current changes, to put it in other words).

On the Straight Line

As its name suggests, an H.F. choke is a coil of wire of many turns having sufficient *inductance* for this particular purpose.

After the energy has been rectified by the detector it can be passed on to a second valve for L.F. amplification, an L.F. transformer being used to provide the necessary link. An *L.F. valve* is asked to handle only L.F. current, and it must give the voltages developed on its grid by this equal treatment in all its variations.

Therefore, the grid is *biased* so that the fluctuations build up and down from a point right in the centre of the grid-voltage base line, representing the straight-line part of the "characteristic curve." And it is the job of the grid-bias battery to do the required biasing.

H.F. amplification is the amplification by a valve of the energy developed in the aerial before it is handed over to a detector valve for rectification. And an H.F. valve is nothing but a valve carefully arranged not to detect!

Screened Grids and Pentodes

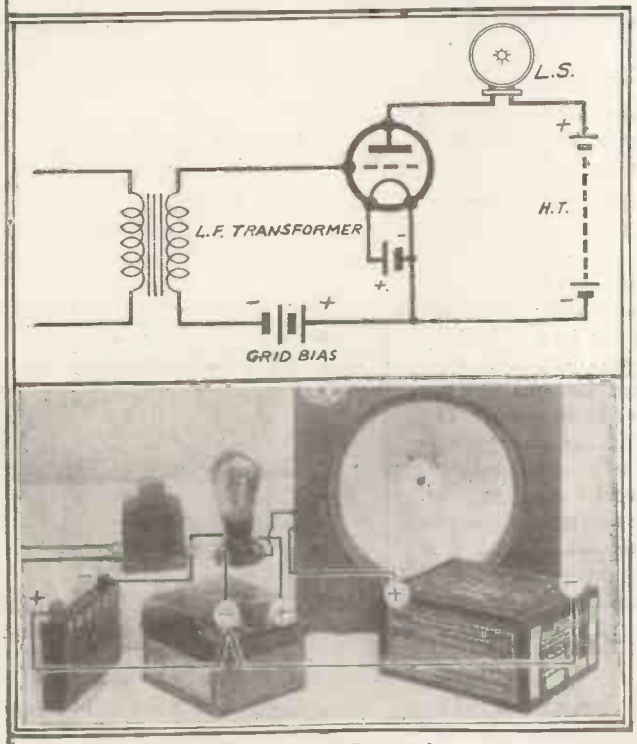
The majority of valves used for this purpose are of the *screened-grid* type. An extra grid is introduced between the "control" grid and the plate in order to prevent these two elements acting as a small condenser and providing a capacity link between the anode and gridcircuits.

Such a link would introduce an unwanted and uncontrollable reaction effect. The extra grid is connected directly to a positive terminal of the H.T. battery, and so, additionally, the electron flow is greatly stimulated and the operating efficiency of the valve increased.

The pentode is really a screened-grid valve adapted for low-frequency amplification.

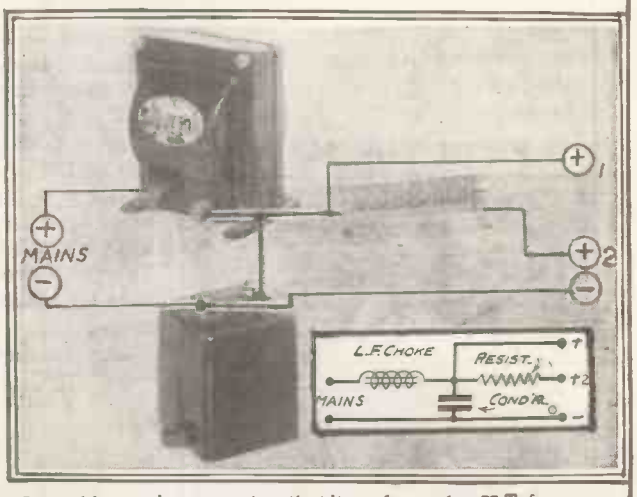
Finally, a word about mains units. The most important section of such a device deals with the smoothing out of irregularities in the current. These are mostly of a definitely L.F. character. L.F. chokes are introduced to offer a high resistance to the ripples, and large fixed condensers to provide easy alternative (by-pass) paths. A resistance as shown in the diagram below can be used to reduce the current flow from the plus terminal.

THE L.F. TRANSFORMER'S TASK



After the rectification an L.F. transformer may be used to couple the anode circuit of one valve to the grid circuit of the next.

A SIMPLE "SMOOTHING" CIRCUIT



Smoothing mains current so that it can be used as H.T. for a set by taking advantage of the varying degrees of opposition offered by a condenser and an L.F. choke.

Mains or Batteries?

THE question as to whether mains or batteries shall be used arises in every set-

TWO "TWO'S"

A couple of Exide two-volt accumulators of average capacity.

owner's house where electric light supply is available, and the answer depends upon two things.

The first is cost—do mains or batteries cost more? And the second is convenience.

Different Methods

In the latter is wrapped up the problem as to whether in a set already in use it is worth discarding the battery supply and building or buying a mains set, or whether a

FROM THE MAINS

This Heayberd mains unit gives H.T. and L.T from A C. mains.

half-and-half system (mains H.T. and battery L.T.) should be adopted.

Let us deal with the second part first. The convenience of mains operation is so vastly greater than that of battery that there can never be any doubt as to which of the two systems is the better—as regards actual operation.

The Better Course

When the question is whether a set should be altered for all-mains working, or whether H.T. should be mains and L.T. should be battery, we would unhesitatingly advise the latter course.

Solving a minor problem that confronts large numbers of listeners.

Many sets will not convert easily or satisfactorily, and unless you are likely to be building or buying an all-mains receiver in the near future we would say keep to the battery L.T. and use mains for H.T.

As regards cost the question resolves itself into two sections. The initial cost of the mains supply is more than in the case of battery, but the running cost is much smaller. Therefore, over a matter of years you save on mains operation, and it is undoubtedly the more economical of the two methods.

Trickle Charging

This applies whether your mains are A.C. or D.C., but the owner of the former type of mains has an additional advantage in that he can trickle-charge his L.T. battery and

SIXTY OF THE BEST

One of Ever Ready's famous 60-volters.

thus get practically the same advantages as if he had an all-mains receiver. The D.C. man cannot easily charge his accumulator at all economically.

Almost Everlasting

A good mains unit (especially the D.C. variety, which has no rectifier wear and tear) is practically everlasting. The H.T. battery, on the

A GOOD WORKER

A popular 100-volt H.T. battery of super-capacity.

other hand, will have a life varying according to the demands made upon it by the receiver, but not likely to be more than five months.

INSTALLING YOUR SET

Some useful notes upon the choice of a radio receiver.

THE first thing to decide when you elect to "instal" a radio set is whether or not you are going to use an outdoor aerial. If not, you will need a fairly sensitive receiver if you are to hear programmes other than those which emanate from the local station.

Secondly, are you going to buy a set ready made, or make it at home from a kit of parts?

Three Vital Points

Thirdly, is it to be a mains-driven outfit, or are you going to run it from batteries?

Three very vital points, aren't they? And they should be decided before you set out to search the radio dealer's for a suitable solution to the actual problem before you.

Let us take each point in turn. In the first place, with an outdoor aerial the features to look for in the set are good selectivity, average sensitivity and, of course, quality of reproduction. Especially if you are near a broadcasting centre will the first qualification be important. It is useless to have a powerful, sensitive receiver if it won't cut out the local station, or refuses to attempt the sorting out of the jumble that is European broadcasting.

Should it be impossible to use an outdoor aerial, you have, if you have electric light supply, two courses open to you. One is to use a frame or open indoor aerial, and the other to make use of the mains as an aerial.

Many commercial mains-driven receivers have facilities for using the mains supply as an aerial, and in such cases no further aerial is necessary.

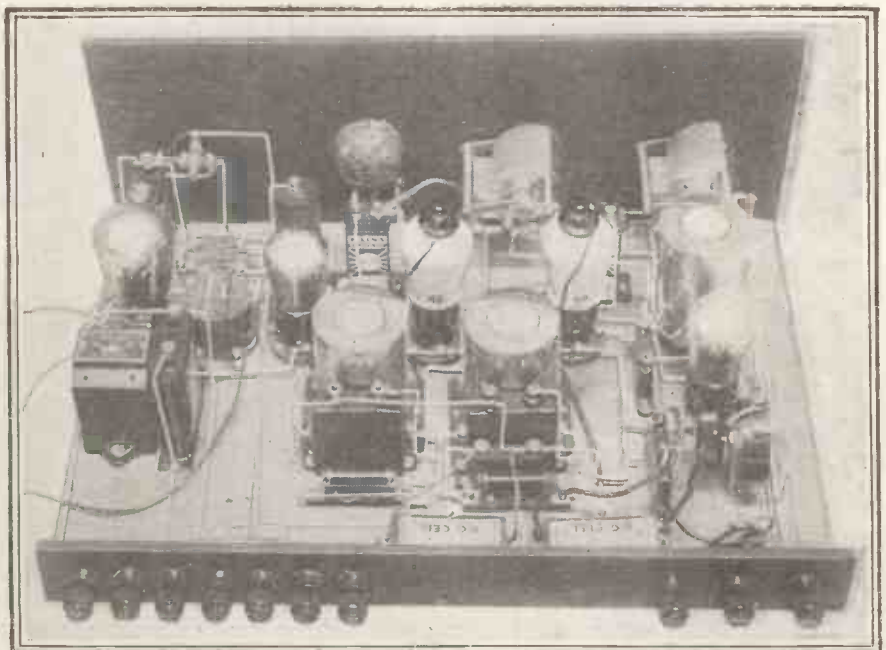
The Aerial Question

Without a supply from the mains, however, such a device is impossible, and you are forced to use a frame or an aerial suspended across the room or in the loft.

In either event the set should be as sensitive as possible—the super-het is quite a good solution to the problem of the indoor aerial man—while selectivity becomes of slightly less importance than in the case of the outdoor-aerial receiver.

The second question—home-made or bought—will depend upon the skill of the individual and his degree of liking for constructional work. He will

SIMPLE TO BUILD—EASY TO OPERATE



A modern super-heterodyne five-valver, the simplicity of which is in marked contrast to earlier models.

find, of course, very much greater choice among the kit sets—including those the designs of which are published in the radio papers—and, moreover, he will have the great advantage of being able to adapt his set as time goes on to keep it in the forefront of radio design, rather than having to scrap it and buy another, as would be the case if he bought a ready-made receiver

Advances in Technique

Radio set design is always changing, and while it would be more than foolish to put off purchasing a set because "receivers will be even better soon," it is nevertheless a great advantage to be able to modify your receiver as time goes on from time to time, adding the refinements that are born of the advance of radio science.

Cost will naturally come into the matter, and here again the home constructor scores.

Question number three is almost decided for you, because if electric light mains are available it would be foolish to ignore them and use a battery-operated receiver.

Low Running Costs

Mains sets cost a little more than the battery type to buy, but they are very much cheaper—even if the price of the unit is high—to run than the latter sets.

No H.T. replacements, no grid-bias worries, no L.T. accumulator charging—everything is made easy and automatic for the mains-set owner.

Further, though every additional valve in the battery set means heavier running costs, this does not hold in the mains receiver. Additional valves increase the cost initially, of course, but they hardly effect the power consumption of the set.

Whatever set is chosen, however, if it be of the ready-made variety, it is almost essential that it be demonstrated before purchase, not only in the dealer's showrooms, but also in your own home.

Some Demonstration Hints

Sets sound so different at home from what they do in a large shop, with all sorts of acoustic peculiarities and the roar of traffic going on outside.

And the extraneous noises that one has to put up with in the shop can quite well cover up any little acoustic faults in the set. It may be deficient in bass notes, but you won't notice that if a continuous rumble from traffic is going on.

Furthermore, that same rumble would act as a perfect cover for any mains hum in the receiver, and hum should not be tolerated to any degree more than just audibility when no programme is on.

With a D.C. set no hum at all should be heard, but with A.C. it is very difficult to get rid of the last traces, especially if the set is a powerful one and the mains are bad.

Set and Speaker

The hum question is another reason why the set should be tried at home. Your mains may be worse than the supply at the dealer's, and so in the quietness of the average living-room the hum may assume impossible proportions.

Finally, do not forget to try the set with the particular loud speaker you fancy. Set and speaker should go together (they may be combined in one unit), and the demonstration should include both.

This loud-speaker test is extremely important, because neither the average receiver nor the average loud speaker is perfect.

Each has its failings, perhaps a tendency to under-reproduce the bass notes there, or to be "peaky" on the high notes here, and such failings can be largely nullified if care in selection is taken.

Suppose you get hold of a set with a bad peak at, say, 2,500 cycles. This will not sound bad if the speaker used with the set is not inclined to reproduce notes round about that frequency.

Troughs and Humps

Similarly, a bass "trough" in the set characteristic will be offset by a "hump" in the loud-speaker's curve.

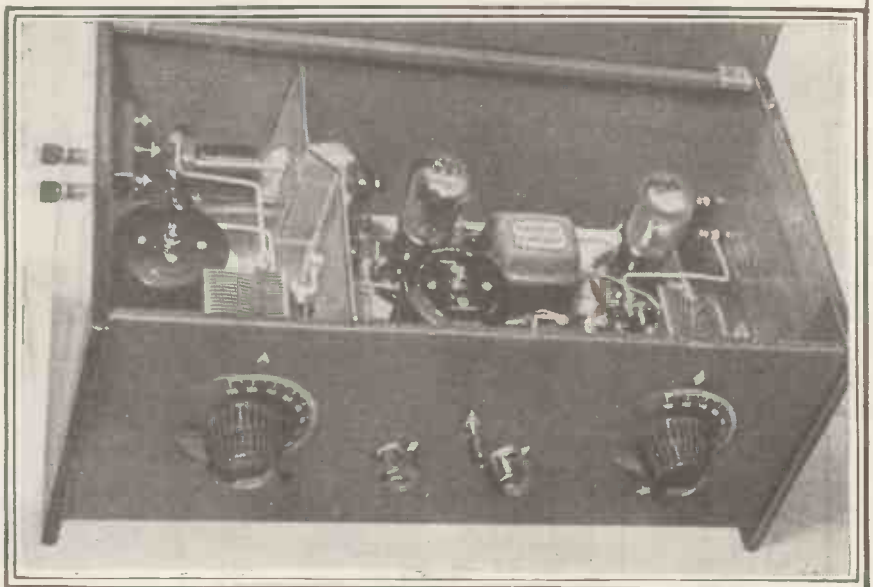
But imagine a set with a bad "peak" at 2,000 being used with a loud speaker with a peak round about the same frequency. What terribly unbalanced reproduction would result!

Therefore it is very advisable to choose your set *and* your loud speaker, if not at the same time, certainly with a view to their pulling together as a team.

If you already have a loud speaker and are buying a set which does not incorporate one — many modern sets do—take the speaker along when you are having the set demonstrated, or, better, get the set tried at your own home.

The same, of course, applies to the speaker being chosen to suit a set: but that is dealt with on another page of this supplement. We mention it here, however, because the point is a very important one, and we want to give it due emphasis.

A POPULAR TYPE OF KIT RECEIVER



This is one of the Cossor kit sets, whose great popularity vouches for their efficiency and ease of construction.

YOUR AERIAL AND EARTH

By FREDERICK LEWIS

Some useful hints on a most important part of your set installation.

THE importance of the aerial-earth "system" of a radio receiver cannot easily be over-estimated. It is the gateway through which the energy that is conveying the broadcast programme enters your set.

Loss of Energy

If the gateway be narrow (that is, if the aerial-earth system be poor), then there will be a loss of that energy and you will not get anything like the results that should be achieved.

There are many points about an aerial that need attention, especially if you are erecting a new one. In the first place, too large an aerial is not the advantage we would expect, knowing that size means strength of reception. If it is too large, then serious loss of selectivity is likely to occur.

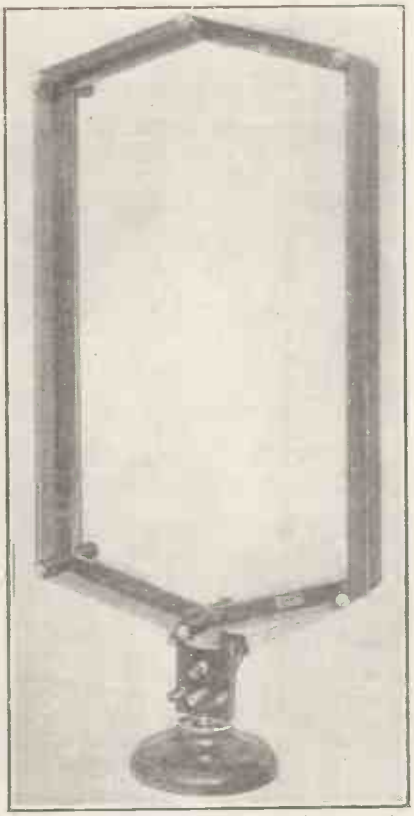
About 70 ft. *total* length, from set to far end of the aerial, is somewhere near the best "size," unless you happen to be using a super-heterodyne receiver, when a much smaller, or even indoor, aerial, is all that is required.

Direction Unimportant

Nowadays, with stations practically all round us, it does not matter much about the directional properties of the aerial. There is little need to arrange the L aerial so that the far end points north-west, so as to get the directional property acting to aid Continental reception.

As long as the aerial is free of near-by screening, such as trees, walls, gasometers, hills, etc., the wire can be slung in any old direction—the direction that gives it the best run to the set without passing near buildings or trees.

A TYPICAL FRAME



One of the neatest frame aerials on the market is this Junior Wearite model. It covers medium- and long-wave bands.

In most cases the L aerial is best, as it allows a single length of wire, free from soldered joints, to be used. A "T" aerial is good provided the down-lead joint, which should be in the middle of the horizontal span, is well and truly soldered.

Height is important up to about 35 ft. After this it rapidly loses its importance, owing to the fact that every extra foot of height means something off the length that can ill be afforded; 35 ft. in height leaves us 40 ft. of length.

G.P.O. Regulations

The Post Office regulations allow a maximum of 100 ft. altogether. but, as we said before, above 70 ft. one is apt to lose selectivity, and in most cases a "shortish" aerial is by far the best.

The precaution against nearby "screening" of the aerial holds good inside the house as well as externally. Too many otherwise good aerials are ruined by lead-in wires that run through badly insulated holes in the window, and then round the wall of the house for some distance before the set is reached.

This state of affairs means heavy loss of strength, due not only to ordinary leakage at the badly insulated point (especially in wet weather), but also due to capacity leakage where the wire (no matter how thick its insulation) runs round the wall. Leakage at the point of entry can always be prevented by using a good lead-in tube.

Keep your aerial well insulated everywhere, at lead-in tube as well as at the rope or wire halyards that support it, and don't spoil a good aerial by running the set connection to it all round the room.

Use Short Leads

The receiver should be placed as near to the lead-in tube as possible, and the earth lead, too, should go out from the set as directly to earth or water-pipe as can be.

But we have not finished with the aerial yet, so we must leave the earth out of the picture for a moment.

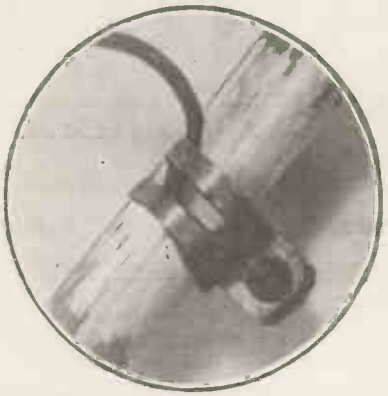
The actual aerial supports, whether poles or trees, should be as rigid as possible, as a swaying aerial is a perfect nuisance. The aerial should not be slung too taut, especially if rope halyards are used, for in wet weather these will shrink and possibly break if they are too tightly hauled.

Parallel Wires

If you have aerials running near you next door, try to get yours out of parallel with them, so that interaction is at a minimum. The same applies to telegraph wires and overhead electric cables.

Remember, too, to keep it away from gutters or roofs, from walls, etc., because, apart from ordinary losses due to the proximity of earthed objects, the aerial may quite easily sway and touch these during stormy weather, and each time it touched you would probably hear a crackle in the loud speaker.

AN IMPORTANT POINT



A water-pipe earth clip that makes a good connection.

Snow is an enemy of aerials, and a bad snowstorm usually brings several down. Transmitting stations with large aerials usually arrange to pass heavy currents through the aerials at intervals during heavy falls, to melt the clinging snow and thus prevent its weight from breaking the aerial.

Such a current is unnecessary in the case of receiving aerials, but it is just as well to give the supporting ropes a jerk or two to dislodge some of the snow during bad winter weather.

Very Rare

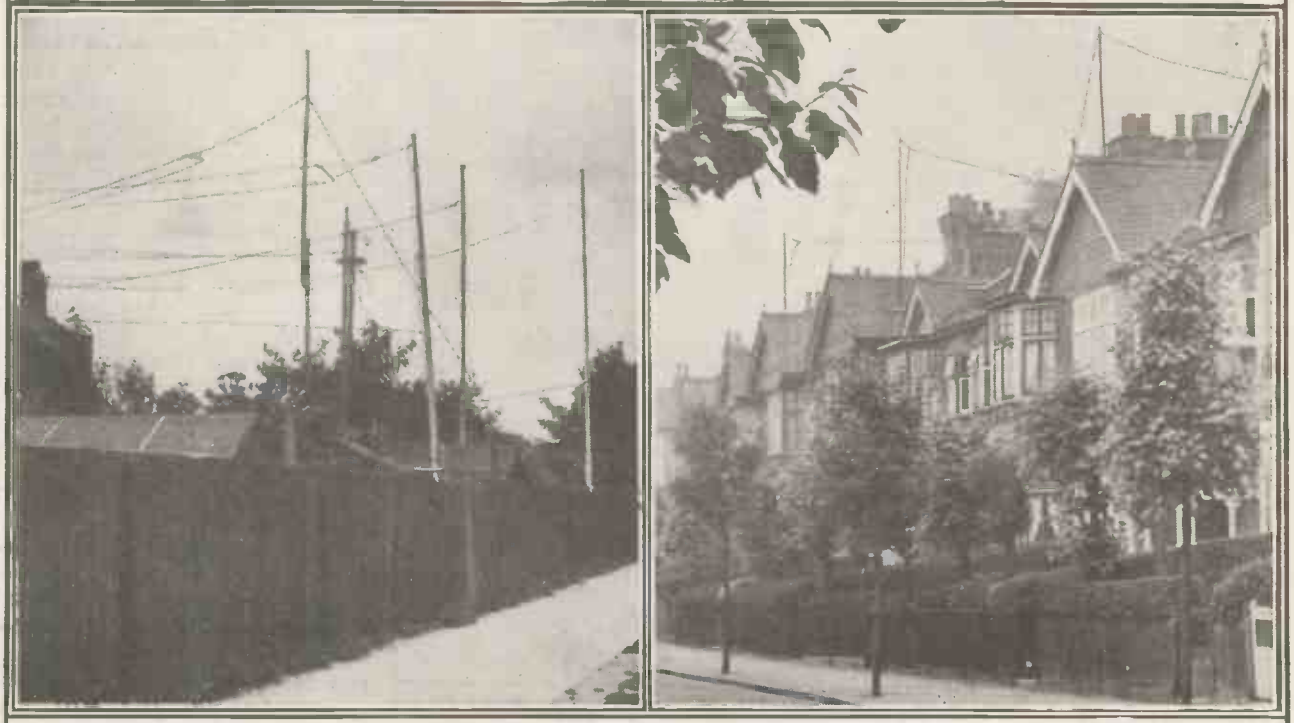
Many aerials have lightning arresters or earthing switches to protect the set in case of direct strike during a thunderstorm.

Such an occurrence is rare, but during thundery weather it is an advantage to have an earthing switch to prevent heavy atmospherics from coming to the set. The direct strike by lightning, however, is a very unlikely event.

Special Switch

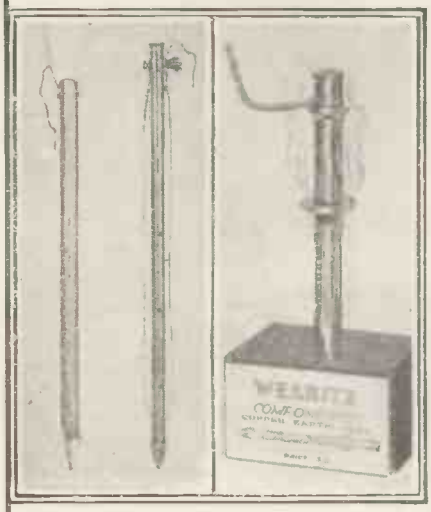
The earthing switch should be covered over so that it is protected from the weather, and should preferably be of such a type that allows the aerial to be earthed and at the same time disconnects the set from the aerial.

Is Your Aerial Like Those on the Left or the Right?



Two views of suburban aerials. On the left we see them badly crowded together, while the aerials on the right are well spaced and are efficiently erected.

GOOD "ANCHORS"!



Three earth pins—excellent "anchoring" for your set. The one on the right has a novel soldering system.

Also, the switch should be outside the house, directly below the aerial, and if the set is earthed to a water-pipe a direct earth for the aerial itself should be arranged below it. It is no use to earth to the water-pipe inside the house.

About Poles

The aerial pole should be well fixed by guy ropes, as well as being concreted in position if possible. The base should be well tarred to prevent it from rotting, and the pulley at the top should be large and free running.

A shell insulator makes a good pulley, by the way; one which cannot jam owing to the rope coming off the wheel. A point which is often forgotten at first is to place an endless rope through the pulley block before hoisting the pole into place. Without the endless rope it is sometimes difficult to get the aerial down, especially if the lead-in is at the far end and there is not much space in the garden. Also, with a single rope, if the aerial breaks, where are you?

Plenty of Insulators

Insulators at either end of the aerial should be of good porcelain, and there should be two or three in series at each end if you want to be sure that the leakage, even in wet weather, will be really low.

Keep these insulators clean, too, for accumulations of soot and grime soon render them slightly conductive, with the result that quite a serious proportion of the incoming energy is lost.

And now what about the earth? This part of the aerial system—for it is really only a continuation of the aerial—is quite as important as the section that stretches between the two masts. A poor earth can ruin reception just as "efficiently" as a poor aerial.

Watch Your Earth

The ideal earth is a good metal sheet or a copper earth pin buried well down in moist soil, connected to the set by as short a lead as possible.

A long earth lead is a definite disadvantage, and often is the cause of instability in large receivers having one or more stages of H.F. amplification.

If the lead wanders about round the room before reaching earth it has a definite damping effect on the system and tuning will be flatter in consequence.

Also, a long earth lead will often act like an aerial—inefficient, it is true—and thus placing the set somewhat "up in the air," so to speak.

A water-pipe earth, the connection being made to a main pipe, and not to the hot water or other cistern system, is the next best thing to a direct earth, and sometimes a water pipe "anchorage" will be better than the direct link if the latter would be unavoidably long.

Solder All Joints

In the earth connection, as in the aerial, perfect joints are essential, and every precaution must be taken by soldering or very tight clipping (in the case of the water pipe) to see that this is the case.

With a water pipe earth it is a good plan to get a plumber to wipe a joint on, as this will make a very much better connection than a home-soldered joint or a screw clip.

For it must not be forgotten that these joints have to stand the test of time, and although they may be good enough at the start, damp will soon mean verdigris and dirty contact if the connection is only a pressure one.

Indoor Aerials

The motto for all aerial and earth connections is perfect joints everywhere and you will not go far wrong.

Of indoor aerials we need not say much. As a rule they are best arranged by experiment. Try first one and then another type, but usually a straight wire, or two wires, across the room or in the attic or roof will be much better than the "round the picture rail" type, which latter type is usually very inefficient.

KEEP THAT SWITCH CLEAN

A dirty earthing switch can cause all sorts of trouble. Keep the contacts clean.

LISTENING TO LONDON

Another example of badly crowded aerials. In such a district a shorter aerial will often help matters.

WHAT VALVES SHALL I USE?

The success of a radio receiver depends upon the use of suitable valves. In this article the problem of picking the best is briefly dealt with.

WHENEVER a new receiver is built the question inevitably arises: "What valves will work best in it?" And the question is invariably a difficult one to answer with any great degree of decisiveness.

Alternative Types

One cannot take the average screened-grid stage, for instance, and say right off—we must have an S.215 there. Why not an S.220?

No reason at all, of course, either would do equally well, and, as a matter of fact, practically any average S.G. valve will act as well as any other average S.G.

make it definitely a different type.

We are discussing 2-volt valves, because these are the most popular battery valves nowadays, and their efficiency is quite equal to that of the 4- or 6-volt types.

In the detector and L.F. sides of a receiver the same trouble arises. Should an H.L., H., L., or special detector type of valve, such as the D.X., be used in this stage?

A Safe Choice

It is impossible to lay down any golden rule, and where no indication is given by the designer of the circuit, the special detector or the H.L. type of valve is a pretty sure choice. Although we have such valves as the H.2, H.L.2, L.2, 2D.X. and so on, they do not make all that difference in the detector stage as the variation of their classification would suggest.

According to Coupling

In most cases, especially where resistance coupling follows the detector, the H.L. type of valve will be best, while for transformer coupling the special detector and the L.2 type often give more satisfactory results.

In the L.F. stages the difficulty is not so apparent, and in the output stage one usually chooses one's valve according to its output power

Output

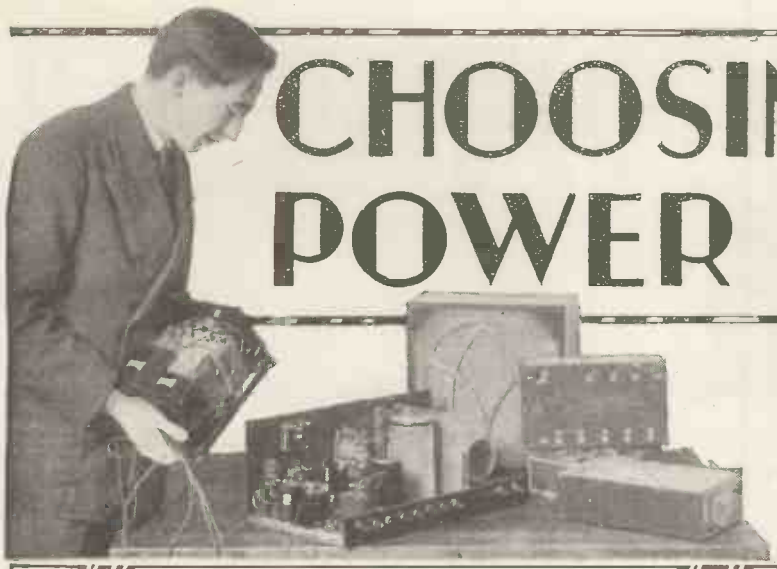
On the whole, however, output valves such as the P.2, P.220A., P.M.2A., S.S. 230S.P., and so on, are good types to use, and the anode consumption is the main thing to watch if you are going to run the set from a small mains unit or a dry H.T. battery.

Two-Volters

The trouble nowadays is that there are not only so many good makes of valves, but so many types that vary by only small factors. Factors that would make no audible difference to the average receiver, but sufficiently at variance with those of other valves to

A SELECTION OF MODERN TWO-VOLTERS

This photograph shows a group of highly efficient 2-volt valves. From left to right we have Cossor S.G., Osram HL2, Mullard P.M.1HL, and Mazda Pen.220, with Marconi and Eta S.G. valves in front.



CHOOSING YOUR POWER SUPPLY

One of the most important tasks that a set owner has to undertake is that of choosing the power supply, H.T. and L.T., for his receiver. This short article will assist him tremendously.

WHICH SHALL IT BE—

A typical "Atlas" H.T. unit for A.C. mains.

IN another short article in this supplement we have described, briefly, the problem "Mains or Batteries?" Here, therefore, we shall carry the discussion a little further, and bring out one or two points that may be of assistance to the listener who has decided which type of power unit (mains or battery) he is going to use, but has still the actual choosing of the unit to do.

L.T. Accumulators

We are assuming that an ordinary battery set is to be employed, so that the all-mains receiver does not come into the discussion. This therefore leaves us with three things to pick: (1) The L.T. accumulator; (2) the H.T. battery, or (3) the H.T. mains unit.

The accumulator is easy. All you have to do is to decide on the valve voltage you will employ (2-volters are most popular and most economical), and then reckon up how much L.T. current they will need.

You will find the current of each valve given on the box, or on the slip inside the box. Most of them like ·1 amp., but some power valves need ·2 or ·3 even.

Having found the current of each, add them all together. For a three-valve set the total will probably come to ·4 or ·5 amp.

Next, how often will you use the set? Two hours per day? Then you will consume $\cdot 5 \times 2 = 1 \cdot 0$ ampere hours per day. That is 7 ampere hours per week.

Accumulator capacities are reckoned in ampere hours and

—H.T. DRY BATTERY—

The brother of the Exide accumulator.

if you want to run your set for a fortnight without having to re-charge (a long run is not really advisable, for the battery should be charged fairly frequently), then you will have to have a battery that will give a good 14 ampere hours before it wants re-charging.

What Capacity?

Allowing for slight consumption errors and for a safety margin, we find a 20-ampere-hour battery will suit. Thus all you have to do in this case is to ask for a 20-ampere-hour (*actual*) 2-volt accumulator, and there you are.

In the case of the H.T. battery and the mains unit another procedure is adopted. The same maker's slip will give you the anode current of your valves at the voltage you are going to use them (say, 120 or 150 volts) and at the proper grid bias for that voltage.

Take the anode current and add them together. For the same three valves you will probably have: detector 1 milliamp, first L.F. valve 3 milliamps, output valve 7-12 milliamps. Total, 11-16 milliamps.

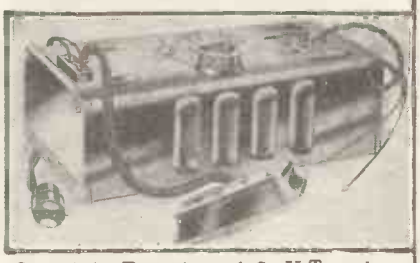
Three Types

Suppose this is at 120 volts H.T. Then you need a battery capable of supplying 11 or 16 milliamps with ease. That is, a triple- or super-capacity battery will be required.

Roughly, the capacities of the average batteries are as follow: Total 5-7 milliamps, standard battery; 7-10 milliamps, double size; above 10 milliamps, super or triple size.

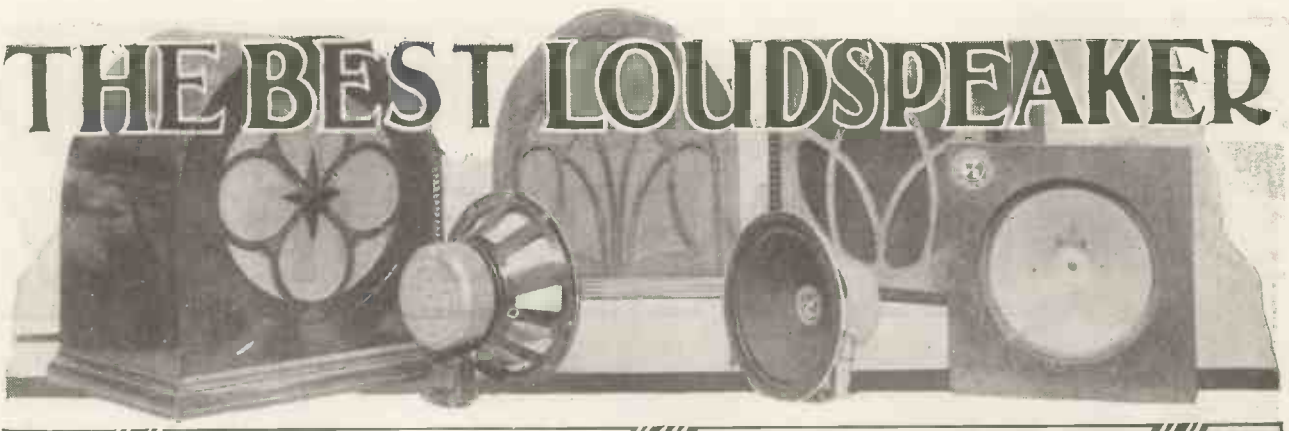
With mains units you need the requisite voltage and a safety factor of about 25 per cent on the current supply. Thus a 16-milliamp set should have a mains unit capable of supplying 20 milliamps.

—OR A MAINS UNIT?



One of the Regentone A.C. H.T. units.

THE BEST LOUDSPEAKER



It is difficult to say which is the best loud speaker, but the following article will help you to choose one.

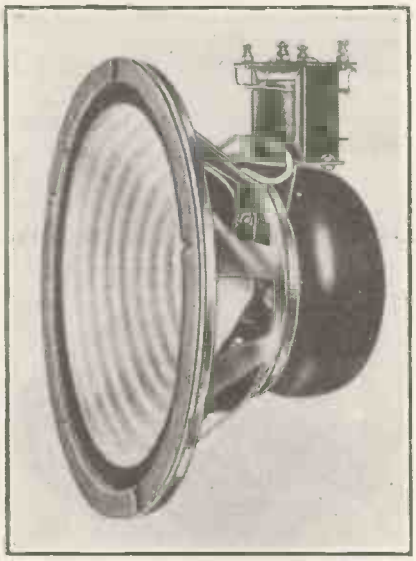
THE average set, good though it is, is not yet perfect, and the same applies to the average loud speaker. Perfection in radio reproduction is nearer than it was a few years ago, but we have a long way to go yet, especially in loud-speaker design, before that goal is reached.

There are many exceedingly good loud speakers on the market, but they vary a great deal as to "tone." The perfect speaker should have no "tone." It should be a reproducer pure and simple and should not impart any "character" to the reproduction.

A musical instrument has "tone" and its value lies in that characteristic. The loud speaker is *not* a musical instrument and never should be, and the fact that various "tone" qualities are present is a sign of falling short of the ideal. The speaker should reproduce in sound form the exact acoustic translation of the electrical impulses in your set.

Individual Differences

It should neither add nor subtract from these, and upon hearing an imperfect reproduction we should immediately be able to blame either the broadcast or the set, instead of as at present having to qualify our criticism by making allowances for the loud speaker.



This is the Amplion permanent-magnet moving-coil chassis—an excellent example of modern design.

But all this will give you the impression that the modern loud speaker is a pretty poor piece of work. A quite erroneous impression, for the average is remarkably good.

Loud speakers have, however, as we have been pointing out, their own particular characteristics, and it is these that make it so difficult to choose the best for any particular purpose.

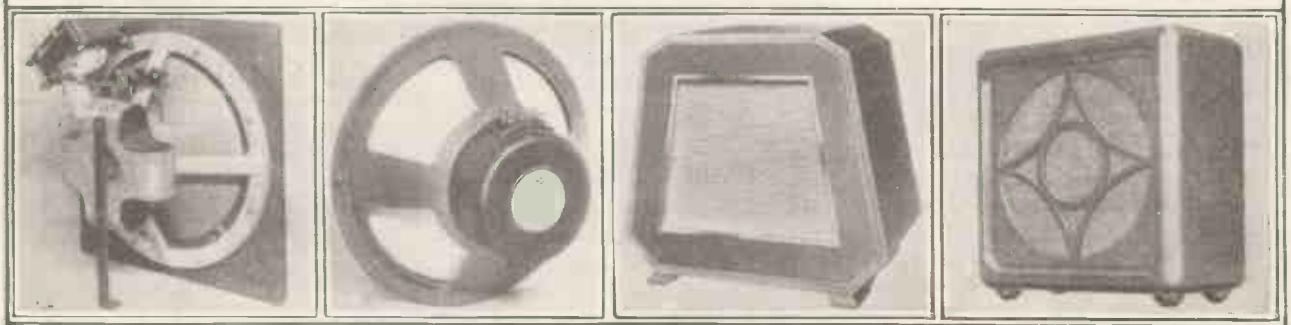
The moving-coil type, especially when mounted on a straight baffle and not in a cabinet, is generally reckoned to be the nearest to perfection, while the inductor type runs it fairly close, as do some of the good balanced-armature and reed-driven cones.

A Balancing Effect

In choosing the "best" for your own set, however, an effort should be made to have several types tried on the set itself.

If your set is inclined to be "hard" and lacking in bass, then a speaker inclined the other way will effect a balance and give very much more pleasant reproduction than would a loud speaker which also emphasised the high notes. The reverse, of course, also holds true.

So, in choosing your speaker, try and pick one that is reasonably even in its response; and then if your set is unbalanced you can easily correct that by tone control.



These typical loud speakers are: W.B. moving-coil, Lamplugh Inductor, G.E.C. moving coil, and Blue Spot "Goliath," while in the heading will be seen further views of the Amplion and W.B., the H.M.V. LS7, Amplion Cone and small Epoch speakers.

THE "M.W." ALPHA

This is a first-class receiver capable of bringing in a large number of stations, and has been described in the minutest detail so that every stage in its construction can be closely followed.

THE construction of a radio receiver is really a very simple business. And having said that, we can hear many of our readers protesting that it is nothing of the sort, and that they would often build themselves sets but for the fact that they "know very little about radio."

Not Difficult

We stick to our statement, however, for it is quite unnecessary to know *anything* about wireless in order to build a radio set. Knowledge of radio, theory or practice, is useful, of course, but the veriest tyro can build a wireless receiver and get it going without knowing anything at all as to why or how it works.

The average constructional article is quite easy to follow, and with photographs and diagrams it should not be difficult to build any set described in this journal. To prove still further how very simple, and, indeed, rule-of-thumb, set construction is we have decided to illustrate every step in the building of a typical three-valver.

This set—The "M.W." Alpha—is quite a normal sort of set, constituting a high-frequency stage using a screen-grid valve, a detector, and finally a low-frequency stage to enable loud-speaker results to be obtained.

Three Valves

The main part of any wireless set is the detector, without which you would hear nothing. The high-frequency stage enables distant stations to be received, and the low-frequency stage brings up the strength of reception so that a loud speaker can be used.

Quite Inexpensive

Having only the three stages, or sections, the "M.W." Alpha is not expensive to build, because not many components are required for it. Those you will need are shown in the list on this page, and the names of the makes are so arranged that the actual make used in the original set is given first in each instance, followed by alternative makes that can be employed with confidence that they will give good results.

THESE ARE THE COMPONENTS YOU WILL REQUIRE

PANEL
18 in. × 7 in. (Permcol, Becol, Peto-Scott, Wearite, Goltone, Ready Radio).

CABINET
Panel space 18 in. × 7 in., with baseboard 10 in. deep (Camco, Pickett, Ready Radio, Peto-Scott, Osborn, Gilbert).

VARIABLE CONDENSERS
2 ·0005-mfd. (Formo, J.B., Cyldon, Lotus, Polar, Dubilier, Lissen, Igranic, Astra, Telsen, Graham Farish, Ormond, Wavemaster).
1 ·0001-·00015-mfd. differential reaction condenser (Lotus, Telsen, Ready Radio. A.W., Igranic, J.B., Polar, Dubilier, Formo, Graham Farish, Cyldon, Wavemaster, Parex).

SWITCHES
2 3-pole wave-change (Ready Radio, Telsen, Bulgin, Goltone, Lotus, Colvern, Peto-Scott, Graham Farish).
1 Double-pole double-throw with terminals (Wearite).

RESISTANCES
1 25,000-ohm Spaghetti (Varley, Igranic, Telsen, Lewcos, Ready Radio, Peto-Scott, Varley, Bulgin, Graham Farish, Goltone).
1 600-ohm Spaghetti (Bulgin, etc.).
1 2-meg. grid leak, with holder if required (Igranic, Telsen, Graham Farish, Ready Radio, Peto-Scott, Dubilier, Mullard, Lissen, Ferranti, Ediswan, Varley).
1 ½-meg. grid leak with vertical holders (Dubilier, etc.)

VALVE HOLDERS
3 4-pin type (Telsen, Graham Farish, Lotus, Wearite, W.B., Igranic, Formo, Clix, Bulgin).

FIXED CONDENSERS
1 ·0003-mfd. (T.C.C., Mullard, Telsen, Ediswan, Dubilier, Graham Farish, Formo, Goltone, Ferranti, Lissen).
1 ·001-mfd. (Dubilier, etc.).
1 ·1-mfd. (Igranic, etc.).
1 2-mfd. (Telsen, Dubilier, T.C.C., Hydra, Helsby, Formo, Ferranti, Igranic).
1 1-mfd. (Telsen, Peto-Scott, etc.).

CHOKES
2 H.F. (Lewcos and Telsen, Wearite, Ready Radio, Graham Farish, R.I., Lotus, Varley, Sovereign, Tunewell, Parex, Dubilier).

L.F. TRANSFORMER
1 Medium-ratio (Igranic Midget, Telsen, Lewcos, Lotus, R.I., Climax, Lissen, Ferranti, Varley, A.W., Graham Farish, Goltone, Formo).

COILS
1 P.J.2 (Ready Radio. Lewcos, Formo, Goltone, Parex, Melbourne, Peto-Scott, Wearite, R.I.).
1 P.J.3 (Formo, etc.).
2 P.V.2 (Lewcos and Goltone, etc.).

MISCELLANEOUS
Copper foil and ¾ in. wood, 10 in. × 6 in., or metal screen (See text.)
10 Terminals (Belling & Lee type R Eelex, Igranic, Clix, Goltone).
1 Terminal strip, 18 in. × 2 in.
Wire (Glazite, Lacoline, Jiffilinx, Quickwire).
2 Crocodile clips (Bulgin, Goltone).
Flex, screws, etc.

How to Make the "M.W." Alpha

Before we discuss the actual construction of the set, let us give you some idea of what the set will do, and what it will not do.

Covers Both Bands

In the first place, having a screened-grid high-frequency stage, the set will be capable of bringing in a large number of foreign stations, provided a good aerial and earth are used. Also, being of the wave-change variety, both medium- and long-wave broadcast bands (200–500 and 1,000–2,000 metres) can be covered.

The low-frequency portion will enable you to put your locals and several foreign stations on the loud speaker at quite good volume, especially if a pentode valve (as described later) is employed.

But having only one L.F. stage it will not "shake the floor" or be "loud enough for a dance hall." The strength will be ample for any ordinary living-room, and a moving-coil speaker can be used just as well as an ordinary cone or inductor type.

Provision For Pick-Up

There is one other interesting point about the "M.W." Alpha that we have not mentioned. This is that the set is so arranged that by a turn of the main control switch a gramophone pick-up may be used with the set.

This pick-up is plugged into the two sockets of the panel, and when the control switch is over to the right the first valve of the set is switched off and the other two are used to amplify the gramophone music and thus to give electrically reproduced record programmes.

The receiver operates with 2-, 4-, or 6-volt valves, and either H.T. batteries or a mains unit can be used to supply the high tension. This needs to be from 120–150 volts maximum, and the low-tension should be an accumulator of either 2-, 4-, or 6-volt variety, to suit the valves chosen. We will give further details concerning the batteries later on.

Where the Wiring is Commenced

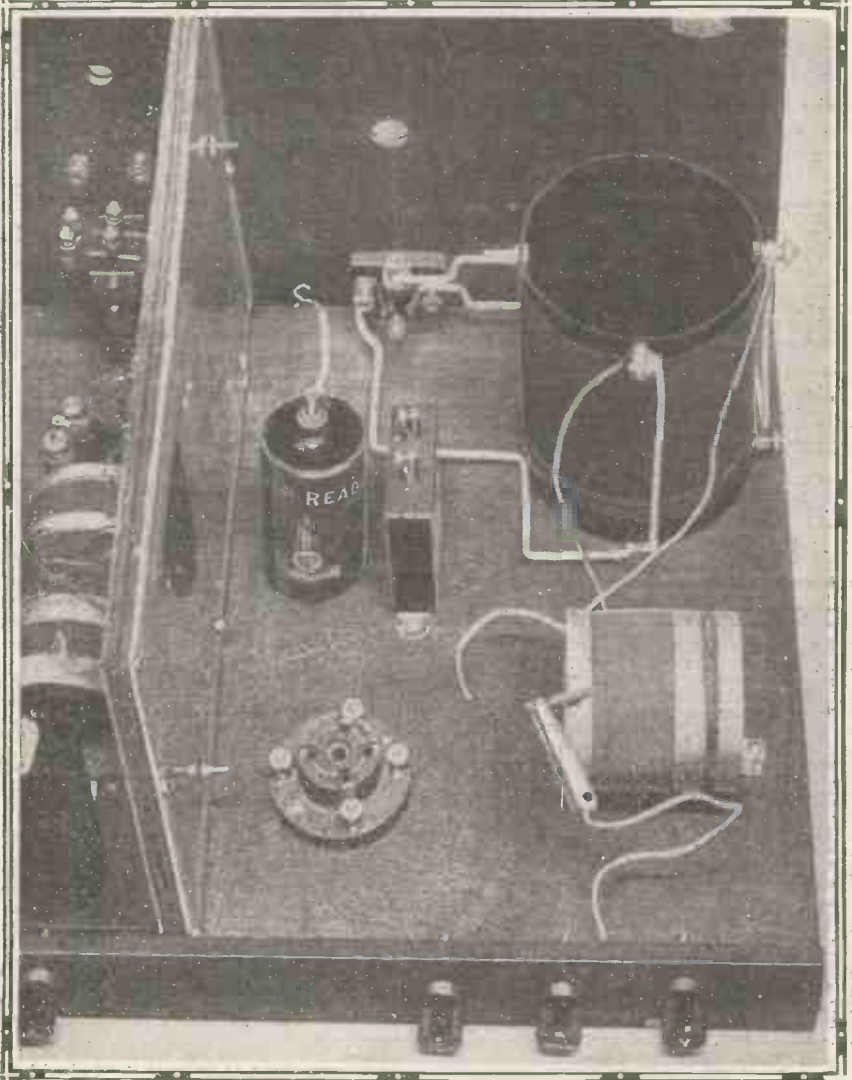


Fig. 1 shows the first few leads, and where and how they are put on.

Using Old Parts

Now for the actual constructional details.

The first thing to do when you have decided to build a set is to look through the list of components and see if you have anything on hand that really suits the set. If so, so much the better, but unless the part or parts you have are among those mentioned in our list it is best to buy new ones, and you can get the complete list of parts from several firms.

When the complete kit has been assembled or bought, spread the bits out in front of you and check it over. See that you have an assortment of small brass screws, $\frac{1}{4}$ in. and $\frac{1}{2}$ in. and $\frac{3}{4}$ in. long, and also some flex for battery leads, Glazite or Jiffilinx for wiring, and so on.

Drills Required

Also a hand-drill and a selection of bits will be necessary, the actual sizes of drills required for this set being $\frac{1}{2}$", $\frac{3}{8}$", $\frac{1}{4}$" and $\frac{1}{8}$", provided the panel components used in the original receiver are chosen. Other components may require different sizes of holes, so unless you have a stock of drills check up your components and the sizes of holes they need and choose your drills accordingly.

The panel is bought ready squared-up and polished, and the drilling is quite a simple thing to carry out. It should be done before any other step towards the construction of the set is made.

The panel-drilling dimensions are provided in a special photograph

Follow the Circuit Lead by Lead

showing how the panel looks when drilled, *from the front*. This must be reversed if you choose—as is best!—to drill from the back, but being a symmetrical panel layout this is not difficult.

Start at the Back

The reason why we recommend drilling from the back is that you can scratch on the panel the necessary lines and intersections showing the drilling points without fear of disfiguring it. These marks obviously cannot be made on the front of the panel, and moreover they should be scratched on with a scriber or a sharp steel point, and not made with a pencil.

of panel), mark the position of the second wave-change switch.

Then, in the centre of the panel, 9 in. from either end and $2\frac{1}{8}$ in. down, mark the position of the reaction condenser. Below it, $1\frac{1}{8}$ in. up from the bottom of the panel, mark the control switch. Then between the two, and $\frac{1}{2}$ in. on either side of a vertical line joining the reaction condenser and the control switch, mark holes for the pick-up sockets exactly $3\frac{1}{4}$ in. up from the bottom of the panel.

Step by Step

Now we move along and mark the positions for the first variable condenser and the first on-off switch.

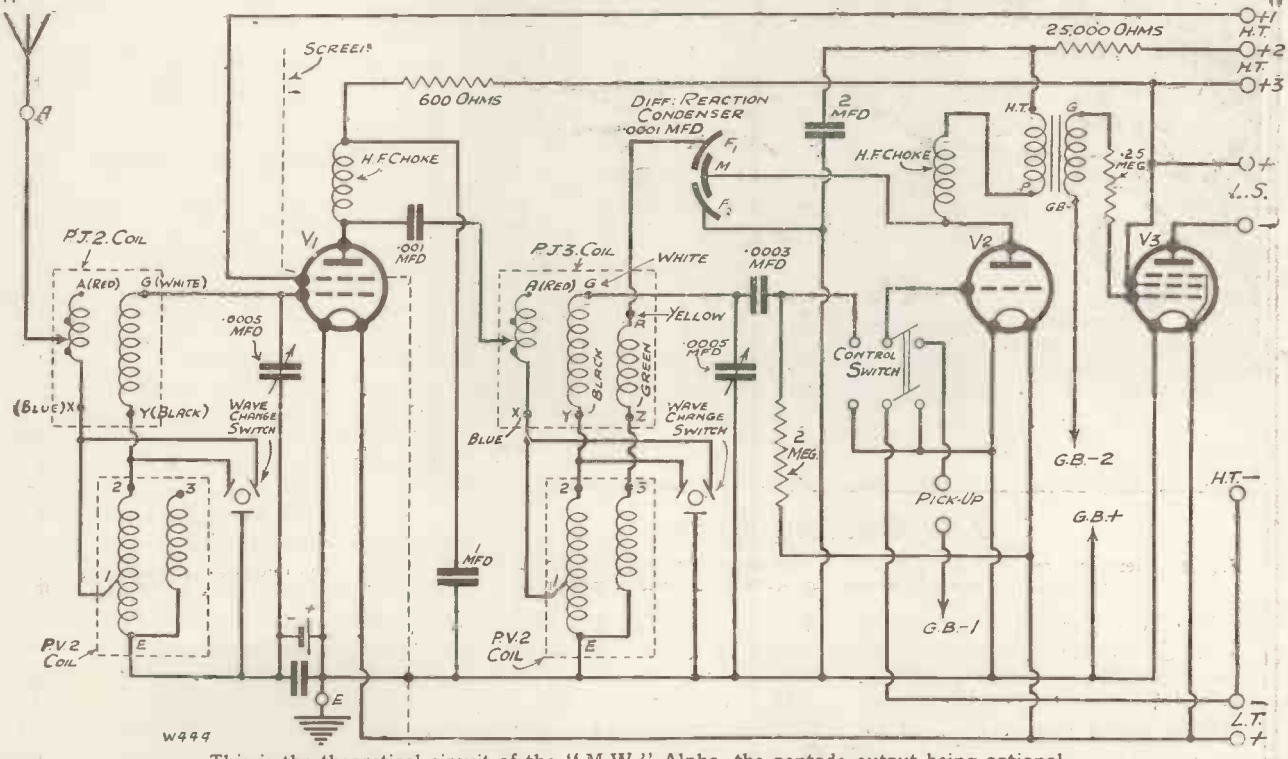
commencing from the left-hand end. These are for the screws fixing the panel to the $\frac{3}{8}$-in. thick baseboard.

Mark these points very carefully with a sharp point, and placing the panel face downwards on a piece of soft wood commence to drill.

A "Pilot" Hole

Do not use too much pressure, and be sure the panel is perfectly flat, otherwise you may break it. When the drill pierces the other side (the front), continue turning the drill in the same direction while withdrawing the bit. This will ensure the drill coming out smoothly, leaving a perfectly clean hole.

A Simple But Very Effective Design



This is the theoretical circuit of the "M.W." Alpha, the pentode output being optional.

Pencil lines are electrically conductive and would be inclined to upset the operation of the receiver.

The panel-drilling photograph should be reversed, therefore, so that the dimensions on the *back* of the panel are as follow:

From the left: $5\frac{1}{2}$ in. in and $3\frac{1}{4}$ in. down make a point for the hole for the second tuning condenser. Below this, $2\frac{1}{2}$ in. down ($1\frac{1}{4}$ in. from bottom

These come $5\frac{1}{2}$ in. from the right edge of the panel, $3\frac{1}{4}$ in. down in the case of the variable condenser and $1\frac{1}{4}$ in. up in that of the wave-change switch.

Three other small holes, for fixing screws, must be drilled along the bottom of the panel, a matter of $\frac{3}{16}$ in. up.

These are placed in the following positions: 3 in., 9 in., and 15 ins.,

In the cases of big holes more than $\frac{1}{4}$ in. diameter it is a good plan to drill the hole with the $\frac{1}{4}$-in. bit first and then re-drill with the larger one. This will obviate the likelihood of the drill clipping the front surface of the panel on emerging—a thing that often happens if a large drill is driven through without a smaller guiding hole having been made first.

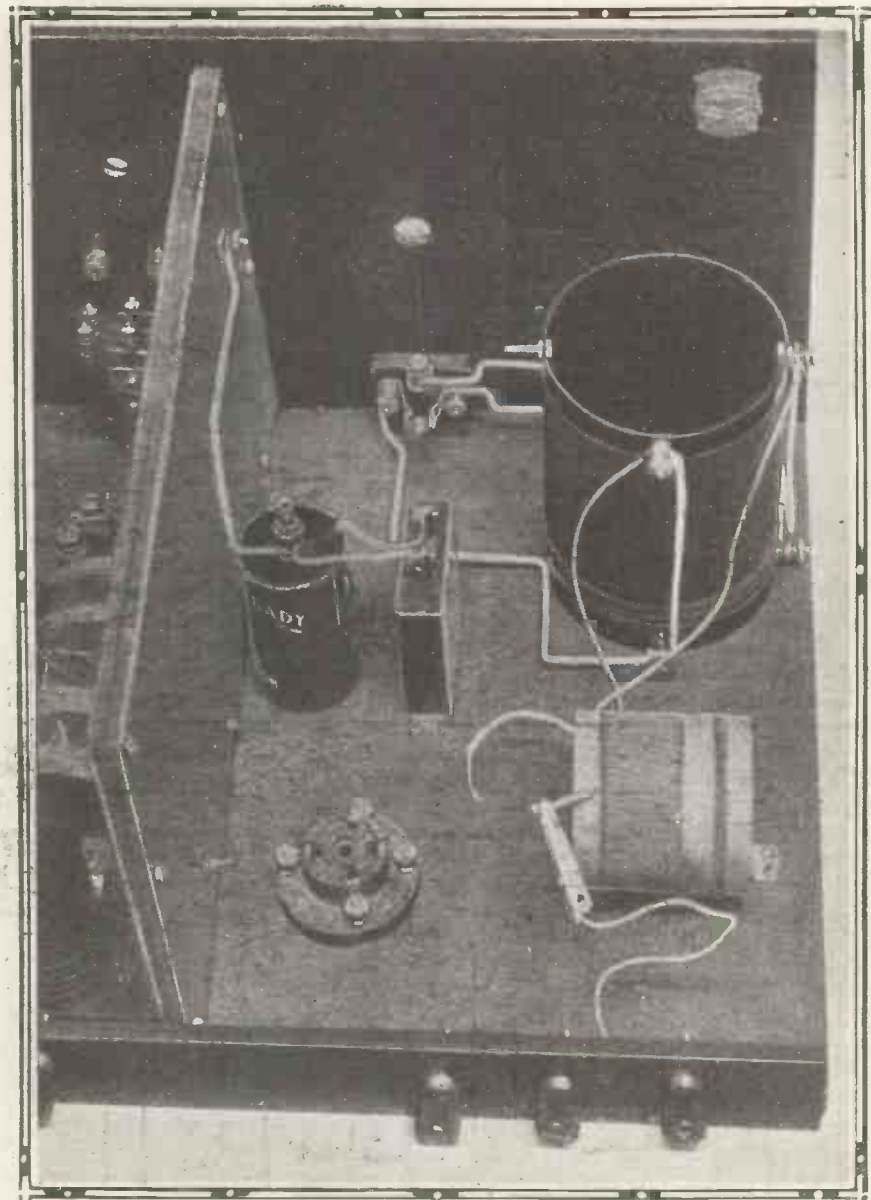


Fig. 2. Here we see the H.F. grid-bias cell wired up and connected to the metal pin on the side of the copper-covered wooden screen.

The Second Step

The holes for the fixing screws along the bottom of the panel should be made with a $\frac{1}{16}$-in. drill, and then $\frac{1}{2}$- or $\frac{3}{4}$-in. screws with countersinking heads should be used for fixing the panel.

Hiding the Heads

After drilling these holes, however, they should be countersunk (from the front this time) by means of a small countersinking bit, the countersinking being carried on until the head of the screw comes level—not below—the surface of the panel. It is only arranged to sink below if it is intended to fill in the hole with some black wax compound afterwards, so that the screws do not show.

After drilling the panel, mount all the components to make sure all fit properly, and then remove all except the three switches—the control switch and the two wave-change switches—and the two pick-up sockets.

The Terminal Strip

Put the panel on one side and take the baseboard and the components that fix on it. These include the terminal strip, which may or may not be obtained ready drilled and made up.

If not, it should be drilled with the holes about $\frac{1}{2}$ in. down from the top, and with four or five screw holes for fixing to the baseboard $\frac{3}{16}$ in. up.

In Two Groups

The terminals are arranged in accordance with the wiring photograph, being $1\frac{1}{4}$ in. apart, starting $1\frac{1}{2}$ in. from either end, and grouped as shown.

The terminal strip measures 18 in. by 2 in., and on completion is fixed along the whole length of the back edge of the baseboard. This latter, by the way, is of standard type, measuring 18 in. by 10 in. by $\frac{3}{8}$ in., being constituted of plywood.

Before mounting the parts on the baseboard we must make the screen which runs vertically across the board from panel to terminal strip, 7 in. from the right-hand side.

(*All these dimensions are taken with the constructor looking at the set from the back.*)

Making the Screen

The screen consists of a piece of wood (same plywood as baseboard will do) about $\frac{3}{8}$ in. thick, and cut so that it is 10 in. by 6 in. On one side is screwed with brass screws a piece of copper foil (quite thin foil will do) 10 in. by 6 in. in size, and the screen is mounted either by means of screws driven through from underneath the baseboard, or else by two or three angle-brackets. With a plywood screen the screw method will be quite secure provided long screws are used.

Earthing the Foil

Before mounting the screen, but after the foil has been fixed on it, a $\frac{1}{8}$ in. diam. hole is drilled through it about $3\frac{1}{4}$ in. from the back end (nearest the terminal strip) and about 1 in. high. The foil, by the way, is placed on the screen so that it is on the right face when mounted. Two more holes are drilled to take two 4 B.A. brass bolts, one about 2 in. from the back of the screen and 1 in. high, and the other near the other end, about $1\frac{1}{2}$ in. in and about $4\frac{1}{2}$ in. up.

Through these two holes are passed brass bolts of 4 B.A. variety

All Connections Should be Tightly Fixed

with a washer at either end and a couple of locknuts on the side of the copper foil. The nuts are left loose until the time comes when wires have to be anchored to them.

Placing the Parts

When the screen and terminal strip have been mounted on the baseboard we can proceed to arrange the layout of the components.

This should be carried out with the utmost care, and the orientation should be exactly as shown on our photo diagram of the layout and wiring connections. Mount the various parts exactly as we have them in the original set, and you will be sure to get the wiring right. If the positions of the parts are altered the connections also will be thrown out of place, with possibly disastrous results where the efficiency of operation of the set is concerned.

Ready to Wire

Having mounted the components on the baseboard, we proceed to mount the panel, and then we are ready to make a start on the most important job of the lot, that is the wiring.

Having mounted the parts on the baseboard, and the few components already mentioned on the panel, we can commence this part of the work (see Fig. 1).

The first lead to put on—carrying out the connections logically—is the flex wire from the right-hand terminal of the terminal strip (terminal "A") to a crocodile clip.

Variable Coupling

This clip will have to fit on to the red wire of the first coil (P.J.2 coil), which wire should be cut short as shown, or else on to one of the two tappings on this coil. The flex should therefore be about 3 in. or 4 in. long.

Next we take the black wire on the same coil and connect it to terminal 2 on the large coil, mounted vertically (P.V.2 coil), cutting the black lead to the right length and baring the end for about $\frac{1}{2}$ in.

From the same terminal (No. 2) we go by means of a piece of Glazite or a Jiffilinx to the left-hand terminal (looking from the back of the set) of the three-point wave-change switch. After the wire has been put on we return to the P.J.2 coil, and take the flex coloured blue and join it to terminal 1 on the P.V.2 coil.

Thence by a stiff wire we go to the right-hand terminal of the wave-change switch.

This leaves us with one more terminal on the switch—the centre one. This we connect via a lead travelling round behind the P.V.2 coil to terminal "E" on that coil.

The Next Stage

Now turn to Fig. 2. Some more wires have been added, this time in connection with the G.B. cell and its by-pass condenser.

The positive of the battery (the centre terminal) is joined to the nut and bolt through the screen and near the panel, and also to one side of the ·1-mfd. fixed condenser. The side nearest the terminal strip is the more convenient.

A Step Further

Next to the negative of the battery, which is already provided with a short flex, we join the remaining terminal on the ·1-mfd. condenser.

Turn next to Fig. 3. Here we see that the first of the two variable condensers has been mounted on the panel, and this mounting is the

H.F. End Nearly Finished

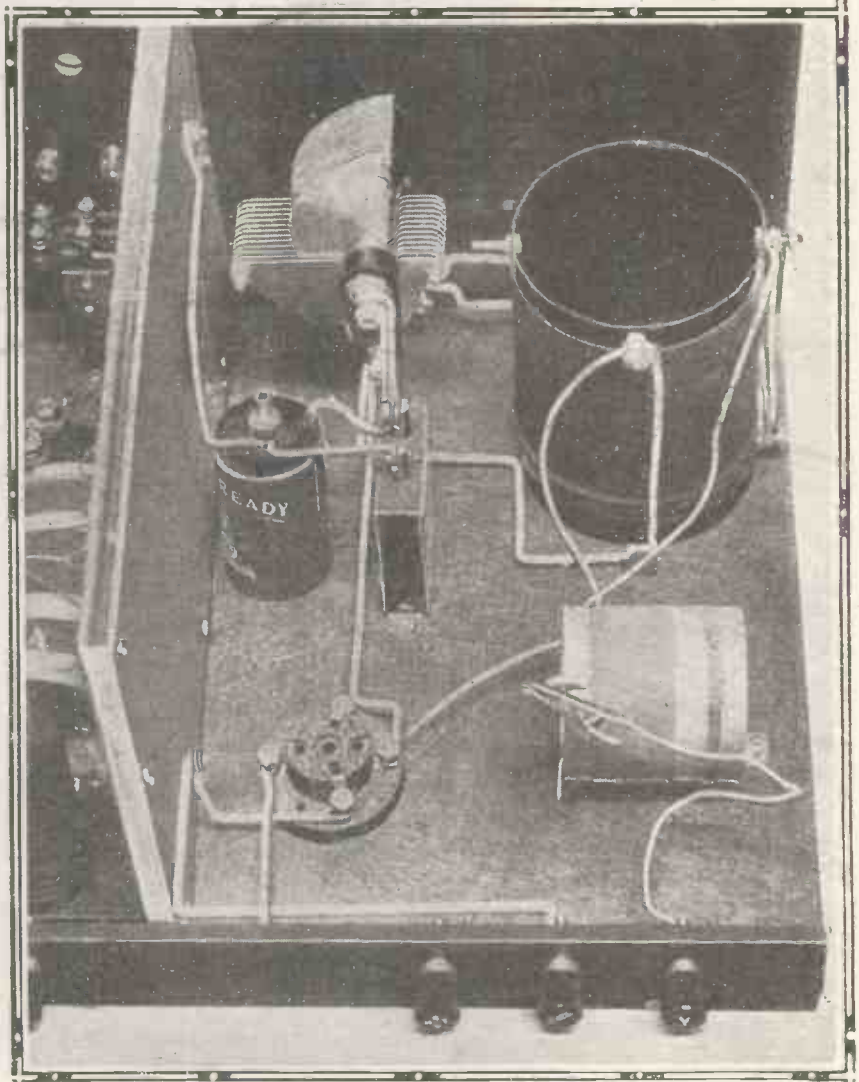
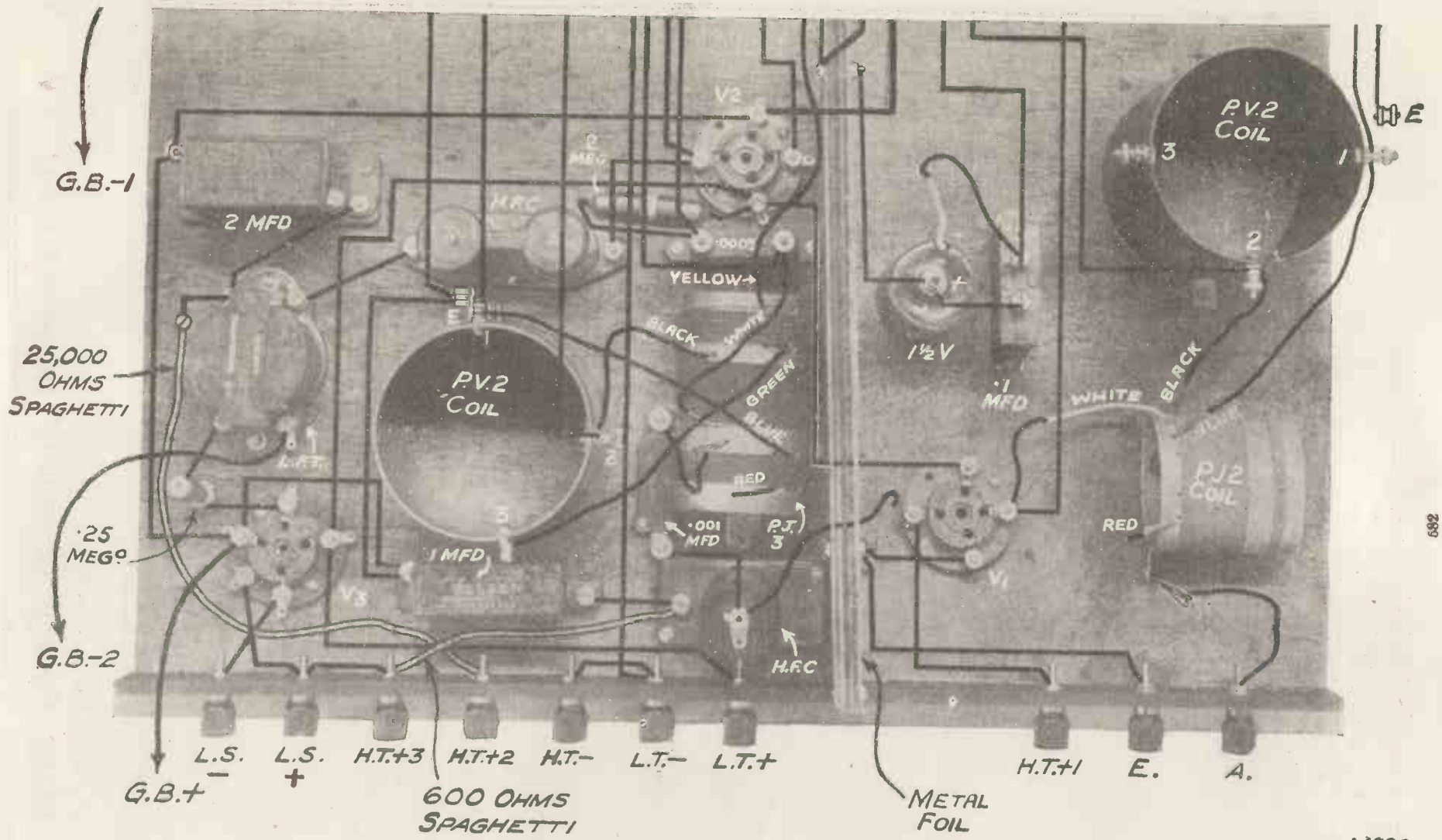


Fig. 3. Only the L.T. positive filament connection remains to be done on the H.F. side.

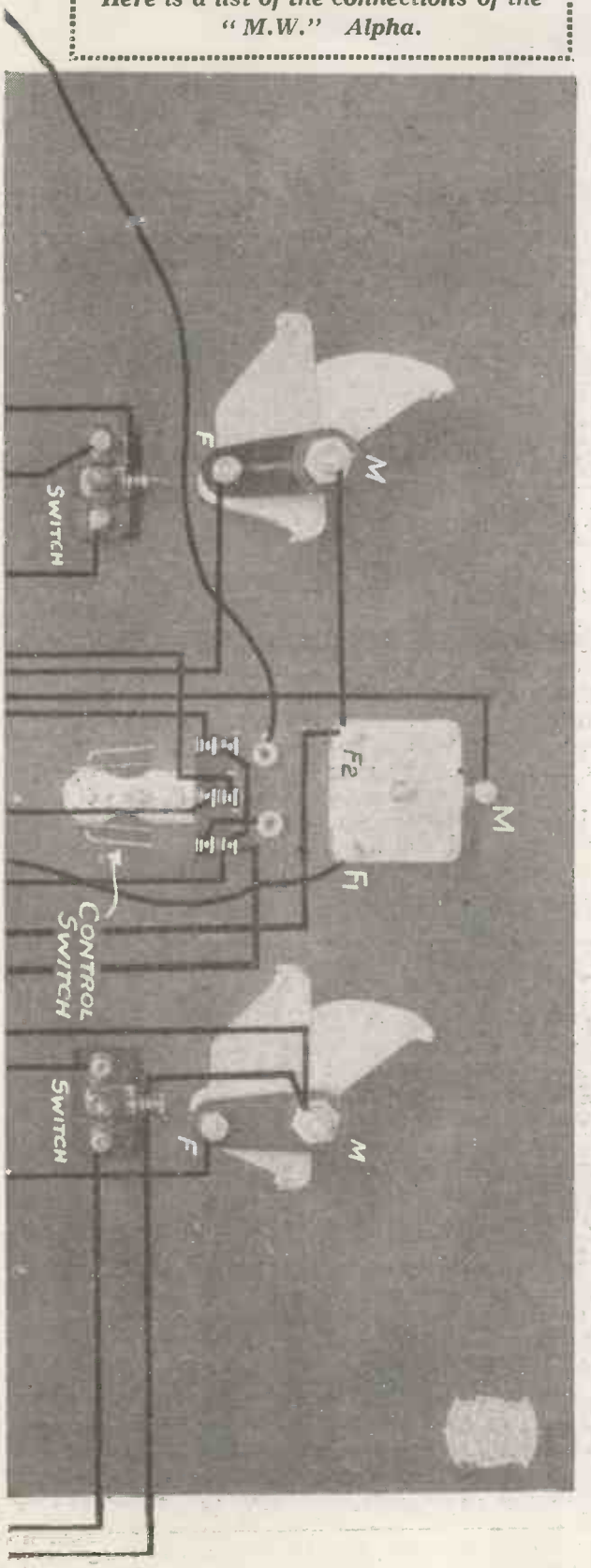


V222

Above is a wiring photogram of the "M.W." Alpha, which will show exactly how the various wires run. In addition, the photograph provides all the necessary information regarding the layout of the set. The positions and orientation of the components should be copied as closely as possible, otherwise difficulty in making a replica of the wiring will be experienced. Note especially the vertical plywood screen with its one copper-covered side, and the anchoring of certain leads to the foil by means of screw-head bolts and nuts. Unless this anchoring is done as shown the set will not work. After wiring the set in accordance with the directions given in the text, the connections should be carefully checked over by means of the above photograph.

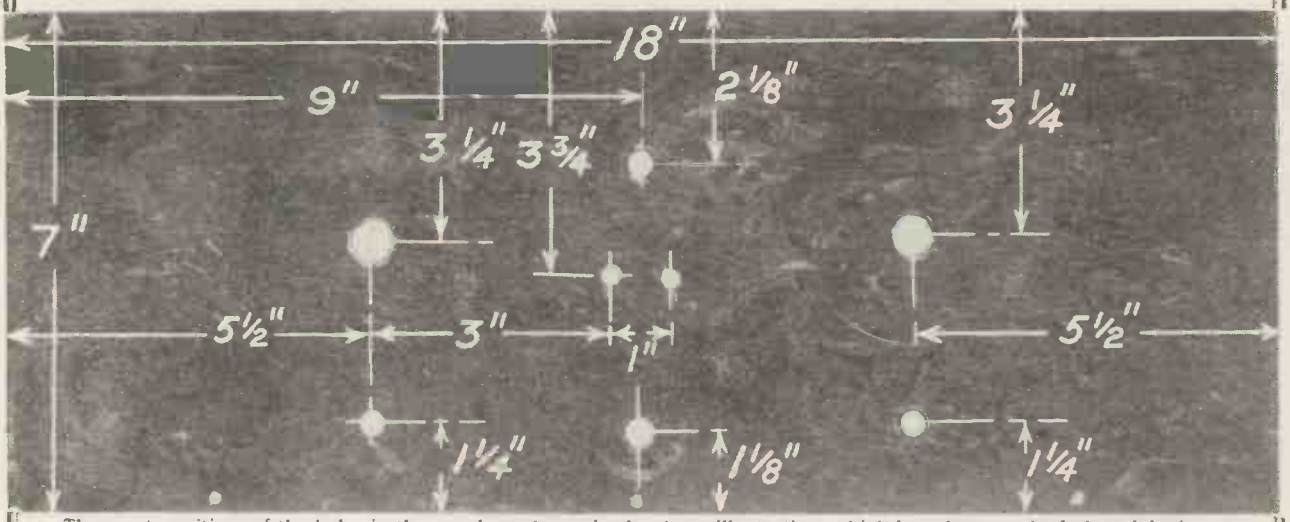
WIRING IN WORDS

Here is a list of the connections of the "M.W." Alpha.



1. From terminal "A" on terminal strip to spring clip for connecting to P.J.2 coil.
2. Black wire of P.J.2 coil to terminal 2 of first P.V. 2 coil.
3. From terminal 2 of P.V.2 coil to one contact of first wave-change switch.
4. From blue wire of P.J.2 coil to terminal 1 of P.V.2 coil.
5. From terminal 1 P.V.2 coil to another contact of wave-change switch.
6. From "E" terminal of P.V.2 coil to remaining contact of wave-change switch.
7. From positive of 1½-v. G.B. battery to screen.
8. From positive of 1½-v.G.B. battery to one side of ·1-mfd.condenser.
9. From negative of 1½-v. G.B. battery to other side of ·1-mfd. condenser. Mount ·0005 variable condenser (1) on panel.
10. From moving-vanes terminal of this ·0005 variable condenser to ·1-mfd. condenser.
11. From moving-vanes terminal of ·0005 variable condenser to centre of first wave-change switch.
12. "G" terminal of V_1 to fixed-vanes terminal of ·0005 variable condenser.
13. "G" terminal of V_1 to white wire of P.J.2 coil.
14. S.G. of V_1 to H.T. + 1 terminal on terminal strip.
15. "E" terminal on terminal strip to metal screen.
16. From screen to negative filament of V_1.
17. From right-back terminal of change-over switch to left back of change-over switch.
18. From right back of change-over switch to screen.
19. From right back of change-over switch to negative filament of V_2.
20. From front centre of change-over switch to "G" terminal of V_2.
21. From left front of change-over switch to one side of ·0003 fixed condenser.
22. From right front of switch to right pick-up socket on panel.
23. From one terminal of second wave-change switch to terminal 1 on second P.V.2 coil.
24. From L.T. negative terminal on strip to centre-back terminal on change-over switch.
25. From "C" terminal of V_2 to right-hand L.S. terminal on strip.
26. From negative filament of V_2 to one side of 1-mfd. condenser.
27. From negative filament of V_2 to one side of 2-mfd. condenser.
28. From same side of 2-mfd. condenser to negative filament of V_3.
29. From L.T. negative on terminal strip to H.T. negative on terminal strip.
30. From positive filament of V_2 to positive filament of V_1.
31. From positive filament of V_2 to positive filament of V_3.
32. From positive filament of V_2 to L.T. positive terminal on terminal strip.
33. From positive filament of V_2 to one side of 2-megohm grid leak.
34. From other side of 2-megohm grid leak to left terminal of ·0003 grid condenser.
35. Flex lead from one terminal of H.F. choke to P. of V_1 (S.G. valve).
36. From same terminal of H.F. choke to one terminal of ·001 fixed condenser.
37. Flex wire from other side of ·001 fixed condenser to clip for P.J.3 coil.
38. Blue wire of P.J.3 to terminal 1 of second P.V.2.
39. Black wire of P.J.3 to terminal 2 of P.V.2.
40. Green wire of P.J.3 to terminal 3 of P.V.2.
41. Terminal 2 of P.V.2 to another terminal of second wave-change switch.
42. "E" terminal of P.V.2 to remaining terminal of wave-change switch.
43. "E" terminal of P.V.2 to left terminal of 1-mfd. condenser. Mount differential condenser and other ·0005 variable condenser.
44. From white of P.J.3 coil to remaining side of ·0003 grid condenser.
45. From fixed vanes terminal of second ·0005 variable condenser to right of ·0003 grid condenser.
46. Yellow wire of P.J.3 coil to right fixed vanes terminal of differential reaction condenser.
47. From terminal of other fixed vanes of differential condenser to screen.
48. From same fixed vanes terminal of differential condenser to moving vanes terminal of ·0005-mfd. variable condenser.
49. Moving vanes terminal of differential condenser to P. terminal of V_2.
50. P. terminal of V_2 to one side of H.F. choke.
51. Other terminal of H.F. choke to P. terminal of L.F. transformer.
52. Other terminal of 2-mfd. fixed condenser to H.T.+ on L.F. transformer.
53. H.T.+on L.F. transformer via 25,000-ohm Spaghetti resistance to H.T.+2 terminal on terminal strip.
54. "G" terminal of L.F. transformer to terminal on ·25-megohm grid leak.
55. Other terminal on ·25-megohm grid leak to "G" terminal of V_3.
56. G.B.−2 (flex wire) from G.B. of transformer.
57. G.B.−1 (flex wire) from other pick-up socket on panel.
58. G.B.+ (flex wire) from negative filament of V_3.
59. From H.T.+3 terminal on strip via Spaghetti resistance to first H.F. choke.
60. From choke to remaining side of 1-mfd. fixed condenser.
61. L.S. terminal next to H.T.+3 to H.T.+3 terminal on strip.
62. P. terminal of V_1 to remaining L.S. terminal.

Drill Your Panel From This "Photogram"



The exact positions of the holes in the panel are shown in the above illustration, which is a photograph of the original

next step in the construction of the set.

Mount it so that the moving vanes swing upwards out of mesh with the fixed ones, and you will have the two terminals of the condenser in the most convenient position for subsequent wiring.

Some More Wiring

This we now tackle. The first lead is from the moving vanes—the upper terminal of the two on the variable condenser—to the terminal on the ·1-mfd. condenser nearest the panel (the one that goes to the negative on the grid-bias cell).

This lead is followed by another from the moving vanes' terminal to the centre of the wave-change switch.

From the fixed vanes' terminal on this condenser (the lower terminal) we run a wire along to the grid terminal on the valve holder (we are still dealing with components to the right of the screen), and to this terminal on the valve holder we connect the white flex on the P.J.2 coil.

Peculiar to S.G. Valves

The plate terminal of the valve holder (which becomes the screened-grid terminal when we use a screened-grid valve) is now connected to the left-hand terminal of the group of three on the right of the terminal strip, i.e. to H.T.+ 1.

The remaining terminal of the three, the middle one, is for earth connection and is now taken to the nut and bolt through the screen nearest the terminal strip. From this a lead is also taken to the filament terminal on the valve holder nearest the terminal strip.

This terminal will be the negative filament side of the S.G. valve.

We now take our attention to the other side of the screen and start connecting up the six terminals on the rotary switch.

If you look at Fig. 4 these connections will be quite clear, and this is the order in which they are made.

The Rotary Switch

The back (nearest panel looking from the terminal strip) right switch terminal is joined to the back left terminal, and also by another piece of wire to the screen by means of the nut and bolt to which we have already connected the grid-bias cell on the other side of the screen.

Controlling the "M.W." Alpha

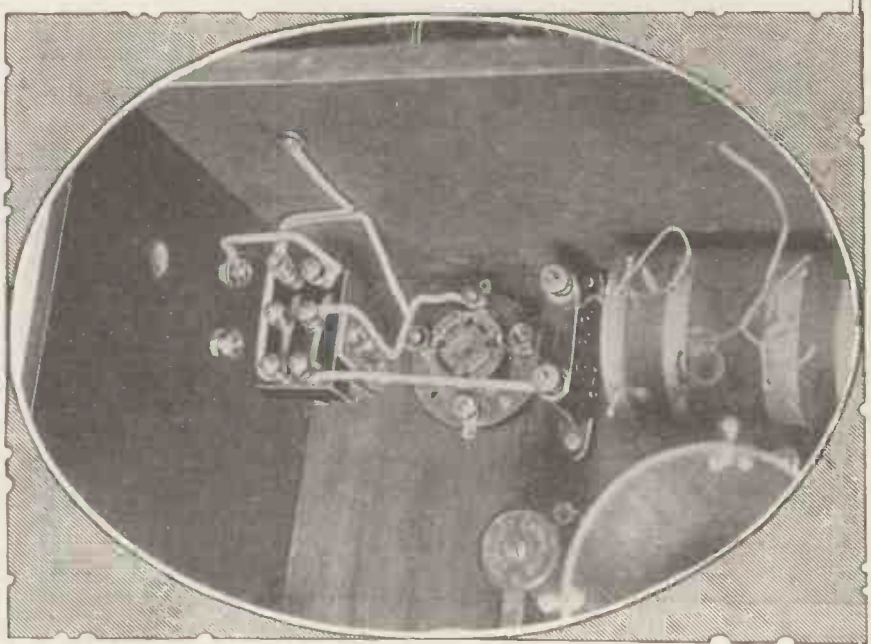


Fig. 4. The next step in the construction deals with the mounting and wiring of the control switch, illustrated above.

Simple to Build—Simple to Operate

The third lead is taken from the back right terminal of the switch (or it can go from the back left terminal if you find it easier) to the filament terminal of the valve holder close to it and on the panel side of the valve holder.

This will be the negative filament connection for the detector valve.

Now go back to the rotary switch and join a lead from the centre front (nearest you as you look from the back of the set) to the grid terminal of the detector valve holder.

"Pick-Up" Sockets

From the front left terminal of the switch take a wire a bit to the left of the valve holder to the ·0003-mfd. fixed condenser, using the left-hand terminal on this.

Finally, before we leave Fig. 4, run a lead from the front right terminal on the switch to the right-hand socket on the panel.

This is immediately above the switch, and is one of the connections for the pick-up.

Fig. 5 now continues the wiring in picture form. Here we find we are looking down on the set more, and the second wave-change switch is to claim our attention first.

SUGGESTED SPEAKERS

AMPLION, H.M.V.,
CELESTION, UNDY,
BLUE SPOT,
B.T.-H., MULLARD,
GRAHAM FARISH.

From the left-hand terminal on this we take a lead running between the H.F. choke and the 2-mfd. fixed condenser, and bending right and then up to terminal 1 on the second P.V.2 coil.

Next the last lead to the rotary switch is to be put on. This is the one from terminal No. 6 from the left of the terminal strip (L.T.—) to the centre back terminal of the switch—the only terminal left unattached.

This lead is best run right up, as shown in the photograph, to the panel and then up vertically and bending right to the terminal on the switch.

For Pentodes Only

So far we have done two dozen leads. The twenty-fifth is the one from the fifth terminal of the third valve holder (marked C on the holder) to the second terminal on the strip (L.S.+).

If you are not going to use a pentode valve, or are using one with only four pins and a side terminal, this lead can be omitted. In the case of the four-pin pentode the side terminal will go direct to the L.S. + terminal by means of a piece of flex.

Lead 26 is the one from the

Rapidly Beginning to "Take Shape"

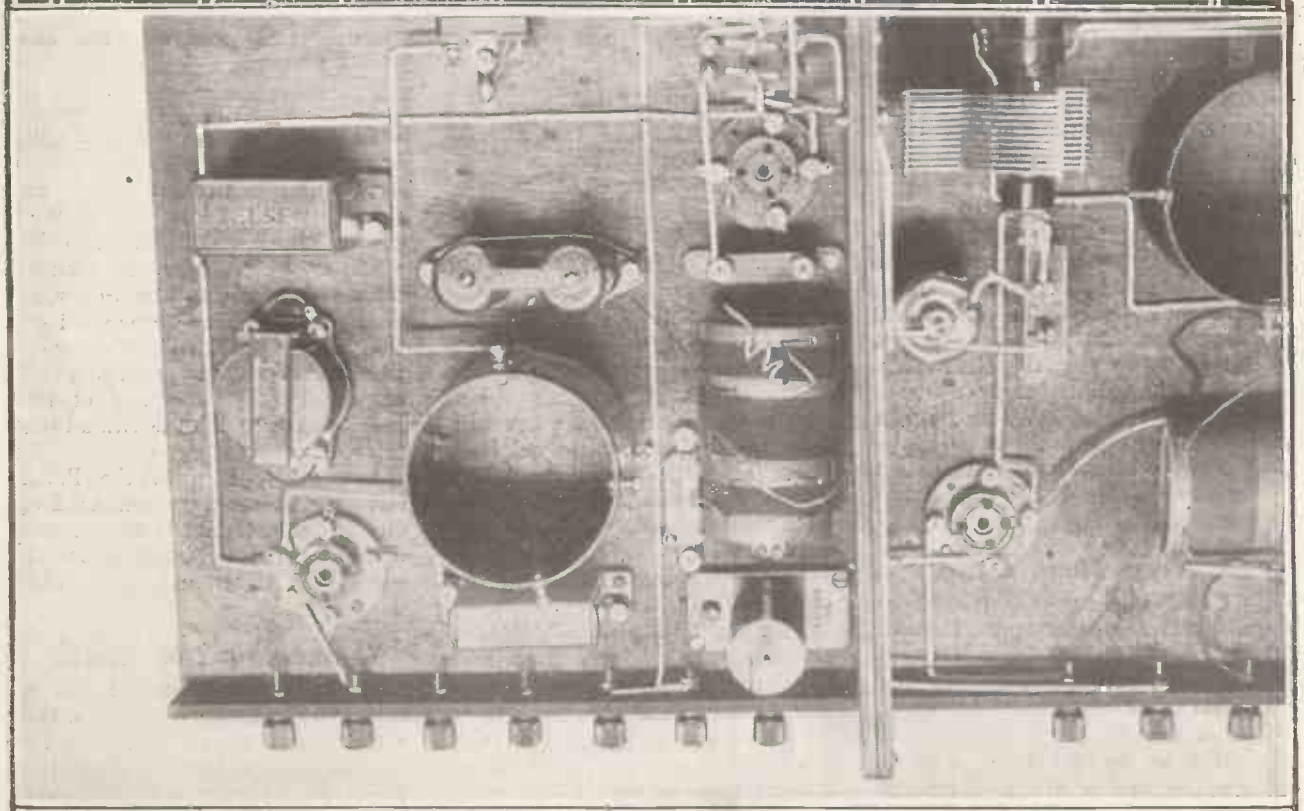


Fig. 5. The wiring is continued in this photograph to its fifth stage, when some of the components on the det. and L.F side of the screen are connected.

left-hand filament terminal of the third valve holder (V_3) to the left-hand side of the 1-mfd. fixed condenser (near the terminal strip).

"Earth" Return

This is followed by a lead from the same terminal on V_3 to the left-hand terminal on the 2-mfd. fixed condenser. From thence we proceed by another wire to the negative filament terminal on the detector valve holder.

Now join the L.T.— terminal on the strip to its left-hand neighbour, H.T.—, and we are ready to turn to Fig. 6.

We have carried out the main connections to do with the negative side of the L.T. supply, so now we can transfer our attention to the positive filament wiring.

L.T. Positive

This is commenced by running a lead from the unused filament terminal on the second valve holder to the unused filament terminal on the first valve holder.

This is on the other side of the screen, and so we must drill a hole through the screen opposite the filament terminal on the first valve holder. Then the wire is taken through this hole and bent so that it runs along beside the screen on the left-hand side. The lead goes between the screen and the P.J.3 coil.

Holder to Holder

Following the L.T. positive wiring we next proceed to join the same terminal of V_2 to the remaining filament terminal on the third valve holder. This lead is best carried along past the H.F. choke and then turned sharply down to the left of the P.V.2 coil till it comes to the terminal required.

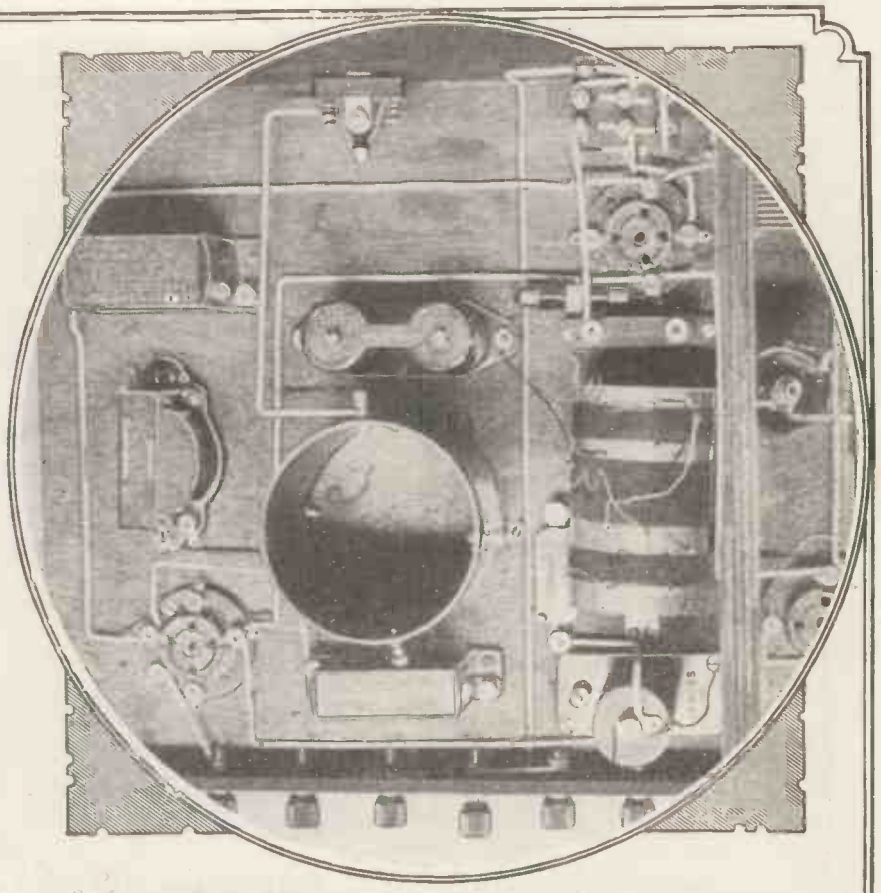
Now continue from this last terminal to the L.T. positive terminal on the strip.

Keep Them Down

Here it might be of help to advise all constructors to keep the filament leads as low as possible, so that they will not interfere with the important grid and plate leads which follow shortly.

Now we go back to V_2, and we join one end of the grid leak to the positive filament terminal on the valve holder, and the other end of the leak to the side of the ·0003-mfd. condenser that already goes to the rotary switch.

If the grid leak is of the type demanding a holder, you will, of course, join the ends of the holder as stated, clipping the leak in position afterwards.



A Vital Part of the Set

Fig. 6. The tuning coils of the detector section of the receiver. Great care should be taken to get these connections correct.

The Anode Circuit

Next we can start joining up the anode circuit of the first valve. This is done by running a flex wire from the top terminal of the H.F. choke near the screen through a hole in the screen about 1 in. down from the top and opposite the first valve holder. This flex will be joined to the terminal on the top of the valve.

Also join by a piece of stiff wire the same terminal on the choke to the nearest terminal on the ·001-mfd. fixed condenser.

The remaining terminal on this is used for connection to the end of a short piece of flex whose other end has a crocodile clip on it. (See Fig. 7.)

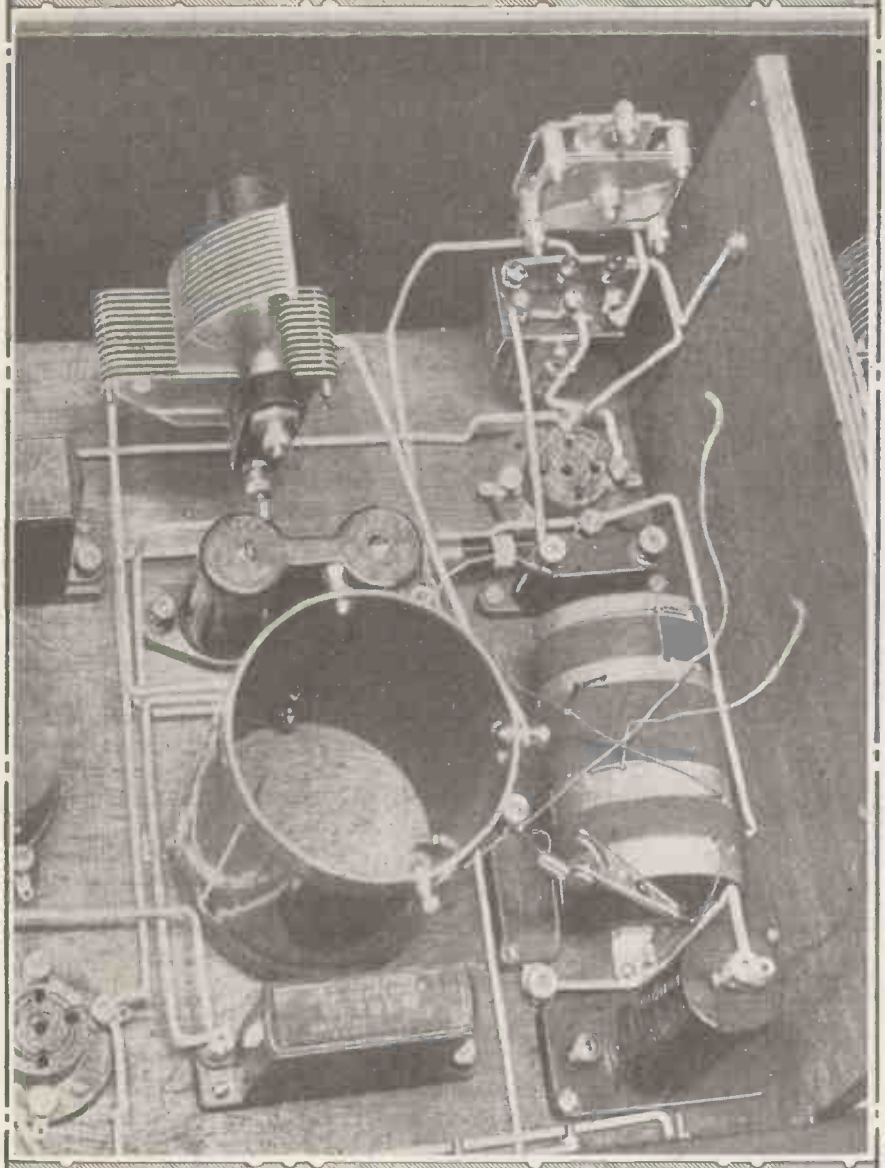
This clip is later to make contact with the red lead on the P.J.3 coil, or one of the two tappings.

We now commence wiring up the P.J.3 coil, taking the various coloured leads, cutting them to the required length, and, of course, taking the ends to the following points: Blue goes to terminal 1 on the second P.V.2 coil, black goes to 2 on that coil, and green goes to 3 on the P.V.2. The rest of the P.J.3 leads we will deal with a little later on.

Instead we turn to the P.V.2 coil again and join up terminal 2 to one of the remaining two contacts on the second wave-change switch —say, the right-hand one. (See wiring photo.)

Connecting the Switch

The E terminal on the coil is taken to the centre terminal of the wave-change switch and also by another lead to the terminal on the 1-mfd. fixed condenser that already goes to the filament of V_3. (See wiring photo.)



Follow These Connections Carefully

Fig. 7. With the exception of one or two leads we have now finished the tuning circuits of the detector section. Note the positions of the various wires.

Now we can mount the differential reaction condenser on the panel and also the second ·0005-mfd. variable condenser. The differential reaction condenser should be mounted so that the terminal for the moving vanes comes at the top; while the ·0005-mfd. variable should be mounted in like manner to the first one.

P.J.3 White Lead

The white of the P.J.3 coil should be taken to the free terminal on the grid condenser (·0003 mfd.), and from this terminal a lead is run to the fixed vanes' terminal (the lower one) on the ·0005-mfd. variable condenser. (Fig. 8.)

Reaction Wiring

Continuing with the P.J.3 coil we take the yellow lead to the right-hand fixed vanes' terminal of the reaction condenser, and the left-hand fixed vanes' terminal is connected by a stiff wire to the nut and bolt on the screen to which one of the rotary switch terminals is connected.

The same fixed vanes' terminal on the reaction condenser is also taken to the moving vanes' terminal (upper one) of the ·0005-mfd. variable condenser.

Direct to Anode

The remaining terminal on the reaction condenser, the centre moving vanes' one, is connected to the anode terminal of the second valve holder.

This terminal is then joined across to the nearest terminal on the H.F. choke (the choke nearest the panel). (Fig. 9.)

The other side of this choke can also be connected to the P. terminal of the L.F. transformer, and the remaining terminal of the 2-mfd. fixed condenser can be joined to the H.T. + terminal on this transformer.

De-coupling Resistance

To this terminal is also connected one end of a lead which after about three inches length is anchored by means of a short screw to the baseboard. Anchored with it, however, is one end of a 25,000-ohm Spaghetti resistance, the other end of which is connected to the H.T. + 2 terminal on the terminal strip. This is the detector de-coupling resistance and it works in conjunction with the 2-mfd. condenser.

Continuing with the connection from the L.F. transformer, our next task is to join the G. terminal to one end of a ·25-megohm grid leak. This, if provided with terminals, will not need a holder, and can be supported vertically by means of the wire.

The Grid Stopper

The other end of the leak goes to the grid terminal of the valve holder V_3.

Now let us turn to the last of the figures, No. 10. Here we see that the remaining leads have been put on. A G.B. flex has been taken from the G.B. terminal of the transformer (G.B. — 2), another G.B. flex and plug has been taken from the remaining pick-up socket on the panel (G.B. — 1), and a third flex (and this time a red plug) has been joined to the negative filament terminal of V_3. (G.B. +.)

Reaching the Final Stage

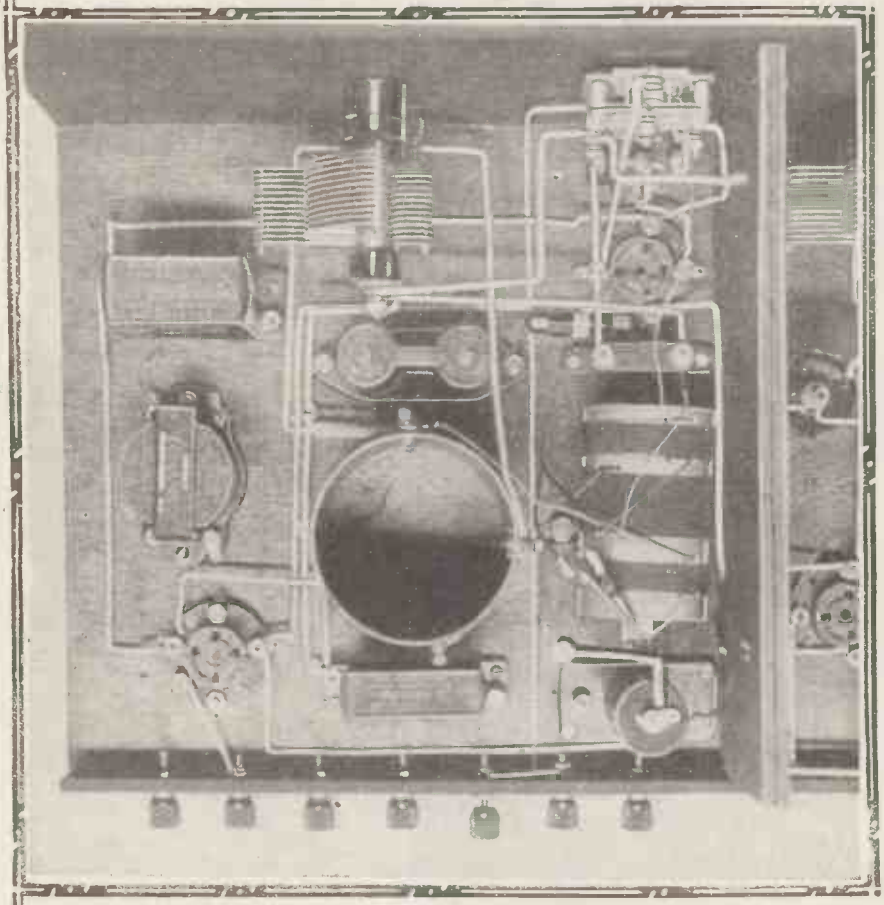


Fig. 8. The last two leads from the P.J.3 coil—the yellow and white flexes have been anchored to their correct positions and we are about to pass on to the L.F. circuit.

There remain four more connections to do. The first is from the H.T. + 3 terminal via a 600-ohm Spaghetti to the free terminal on the H.F. choke nearest the terminal strip.

The Last Lap

The second is from this choke terminal to the unused terminal on the 1-mfd. condenser, the third is from H.T. + 3 terminal to the L.S. + terminal on the strip.

The last lead is the connection from the plate terminal of V_3 to the last terminal on the strip, L.S.—.

The set is now ready for testing, but before doing so it is advisable to check over the connections very carefully, not only by the verbal directions we have given, but also by the wiring diagram earlier on in the article. Unless the wiring is correctly carried out it is a sheer waste of time to attempt a test of the set.

After checking the connections we can set about testing the set. In the accessory list will be found the types of valves and batteries advised, and also a selection of thoroughly reliable loud speakers and mains units.

We will assume, however, for the purposes of this article, that dry batteries are to be used, with the usual 2-volt accumulator and 2-volt valves.

Let us choose the valves first, for upon them depend the size, or rather capacity, of the H.T. battery, and also the voltage of the grid-bias battery.

Suitable Valves

For the H.F. stage any good screened-grid valve will do, examples that come to mind being the Mazda 215, Osram and Marconi S.22, Cossor S.215, Mullard P.M.12, Six-Sixty S.215, Tungsram S.215, and so on. All these are 2-volt S.G. valves of undoubted merit, and quite suitable for use in the "M.W." Alpha.

The detector valve provides even more choice, for here any H.L. type of valve or special detector can be used.

Specially suitable are the Mullard P.M.2D.X., Mazda L.2, Osram and Marconi H.2 and H.L.2, Cossor 210 Det., Six-Sixty 210 Det., and so on.

Power or Pentode?

The last stage offers two distinct alternatives: (1) a small power valve such as the Marconi and Osram P.2, Mazda P.220, Mullard P.M.2A., etc., or a small pentode such as the Mazda Pen.220.

To cover all these various valves as regards grid bias it is advisable to have a 9-volt battery, while from an H.T. point of view a double-capacity battery of 120 volts maximum should be quite suitable. Or, better still, one of the super- or triple-capacity type.

The L.T. accumulator will be of the same voltage as the valves, of course.

In connecting the set up make absolutely sure that the valves are in their right holders, and that the flex lead which comes through the screen to the anode of the S.G. valve is tightly fitted on this latter before connecting up the batteries.

About Batteries

The grid-bias battery can easily be housed in the cabinet by fixing a clip on the vertical back of the cabinet and placing the battery in it.

Or you may use the type of battery which already has a hinged cardboard top, which on placing vertical enables the battery to be suspended by means of a couple of drawing pins.

The H.T. voltages for best results will probably be 120 on H.T.+3, 60 on H.T.+2, and 60 to 80 on H.T. + 1.

The aerial, which should be of the usual good outside variety, is connected to the aerial terminal, and the earth to the next-door terminal, marked E.

The loud speaker goes to the two terminals marked L.S.+ and L.S. —, and the set is ready for the great moment.

Variable Selectivity, High Sensitivity

The control switch in the centre of the panel not only enables radio or gramophone to be obtained (we will discuss the gramophone side of the set later), but also enables the set to be switched "off" or "on."

From Radio to Records

In its central position the switch is "off." When to the left all is ready for radio reception, while a turn to the right switches out the filament of the S.G. valve and places the pick-up in the grid circuit of the detector.

By the way, we have not said anything about the actual grid-bias voltages to use. You have three G.B. plugs on the set. The red one makes contact through its flex with the negative filament terminal of V_3, and the plug is placed in the positive socket of the grid-bias battery.

The flex from the pick-up socket, bearing a plug labelled G.B.—1, goes in the $-1\frac{1}{2}$-volt tap of the battery, though it does not do anything unless a pick-up is used.

Grid Bias

The third lead, labelled G.B.—2, is placed between $-4\frac{1}{2}$ and -9 volts, in accordance with the instructions of the makers of the particular L.F. valve you are using and the voltage applied to H.T.+3. Probably the grid bias here will be -9 volts for a P.2 valve, about $-4\frac{1}{2}$ for a P.220 or P.M.2A. or for one of the new small pentodes.

For radio, then, we turn our switch over to the left and the set is "on," ready to be tuned in to broadcasting.

Practice Makes Perfect

Obviously, until a little experience with the set is obtained, it is not reasonable to expect to be able to tune in programmes from all over the Continent.

The first thing, then, is to tune in the local, and to get the selectivity tapping scheme right. Tuning is accomplished by the usual method —rotating the two variable condenser dials—and for the medium-wave local the wave-change switch should be pulled out.

RECOMMENDED VALVES

OSRAM, MAZDA, COSSOR, MULLARD, SIX-SIXTY, MARCONI, ETA, DARIO, TUNGSRAM.

For furthur details see text.

Before this, however, place the crocodile clip from the aerial terminal on the end of the red flex on the P.J.2 coil, and the clip from the ·001-mfd. fixed condenser on the red lead of the P.J.3 coil.

Selectivity Adjustment

This gives medium selectivity, and you should have no difficulty in separating your two local stations provided you are not nearer to them than, say, 10 miles.

If you should have trouble, however, the selectivity is best increased by moving the clip from the red flex on the P.J.2 coil and placing it on one of the tapping points on the aerial winding. This will reduce the aerial input to the set somewhat, but the receiver will still be very sensitive.

Maximum Strength

It is possible, however, that living some distance from a broadcasting station you may not require a high degree of selectivity at all. In this case full use can be made of the magnification of the screened-grid valve by removing the clip from the red lead on the P.J.3 coil and placing it on the white lead. To do this a small portion of the insulation on this lead should be removed.

Now it will be found that the set is still more sensitive, but the

Nearly Ready for a Try-Out

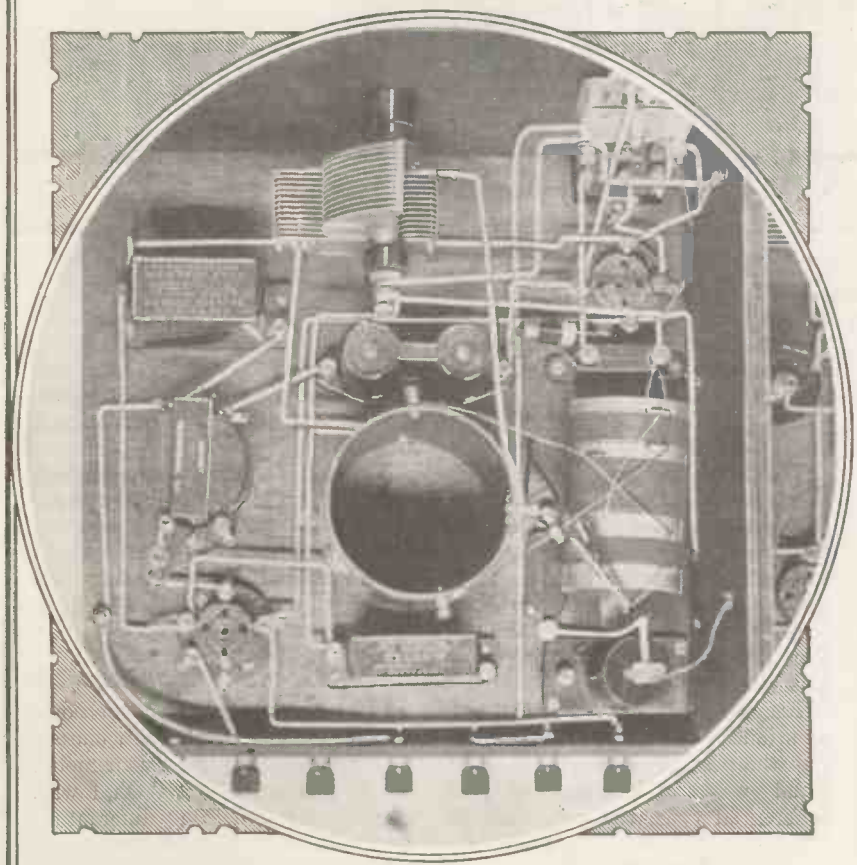


Fig. 9. With the exception of the G.B.—2 lead, the L.F. transformer has been wired up and the L.F. circuit from the detecto valve is now complete.

tuning on the second tuning condenser is very flat.

The crocodile clip method of getting various degrees of selectivity is simple but very effective. There are lots of combinations that can be arranged by judicious use of the clips, and a short time spent in juggling with them will be time well spent.

Reducing the Input

If you alter the clip in the H.F. stage and move it on the tappings on the P.J.2 coil you vary the selectivity of the aerial circuit, making the tuning of the first variable condenser sharper or flatter, and varying the strength of input into the set.

Varying the tappings on the second P.J. coil, the P.J.3, varies the amplification obtained from the S.G. valve, and it is usually better to try and get the required selectivity by adjusting the clip on one of the taps on the P.J.2 coil, leaving the clip on the red, or even the white, flex of the P.J.3, than to attempt a sort of 50–50 basis of selectivity, getting a little on each circuit.

Found by Experiment

But the final arrangement must be found by each home constructor, who has to suit the set to his own particular aerial and local conditions. The foregoing is merely intended as a guide.

With the local stations tuned in, first one and then the other, it is best to make a note of the tuning condenser readings. Then you will see that if they are not reading the same on any one station they will be a definite number of scale divisions out.

For instance, on, say, the London National you may find the first condenser reads 20 and the second 25, while on the London Regional the readings have increased to 46 and 49.

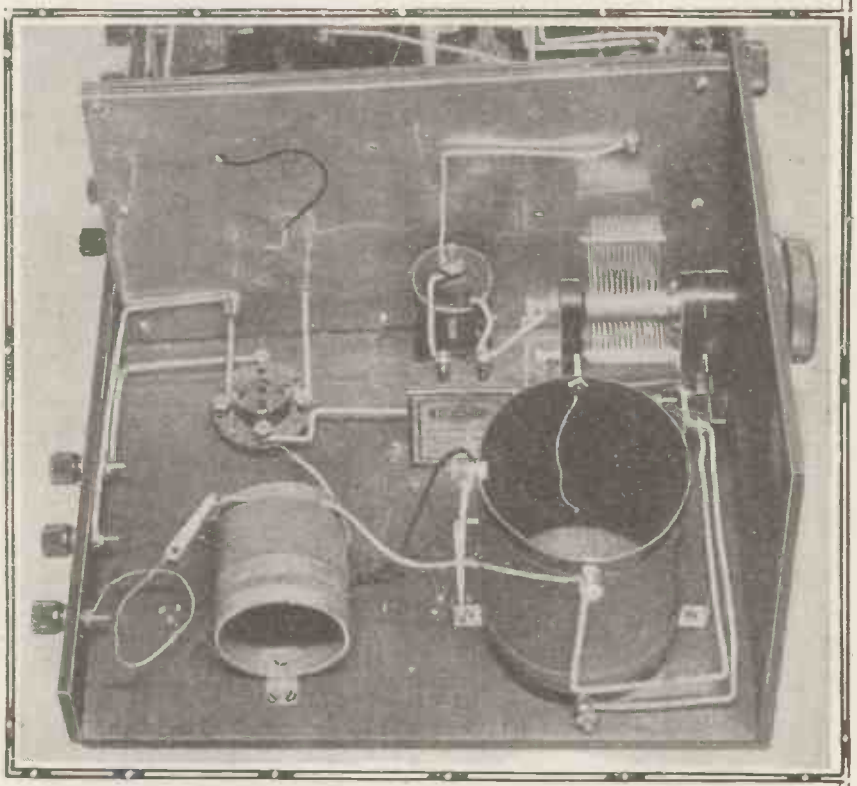
Preparing a Graph

These show the condensers are keeping pretty well in step, but that the aerial one is gradually creeping up.

On the Northern Regional, perhaps, the readings will show the aerial condenser to have caught up the other, and even passed it—something like 80 and 82, perhaps (we are considering hypothetical cases with 100° dials).

With a few stations logged like this you know roughly how to keep your dials in step during tuning, and after picking up a few foreigners it is easy, if desired, to draw a tuning graph, or write a list of the various readings so that the stations can be found again without any loss of time.

The Distance-Getting Part of the Set



A further view of the H.F. end, showing the aerial tapping clip on the end of the red flex. Note the flex lead for the S.G. valve.

Easy to Handle

The foregoing are only suggestions, however, and it must not be thought that the "M.W." Alpha is critical in its tuning, and therefore rather tricky to handle. It is not at all critical, and it will be found the easiest thing in the world to go station hunting with this receiver.

Reaction we have so far not mentioned. It is applied to bring up the signal strength in the usual way, and, being of the differential type, the variations of the reaction condenser will not affect the tuning to any noticeable extent.

Thus you can vary reaction with a programme tuned in without any fear of losing the station.

Easy handling is one of the main features of the "Alpha," and you will be surprised at the rapidity and sureness with which both distant and local stations can be brought in.

Now, what about the use of the set with a pick-up for the electrical reproduction of gramophone records?

The use of a gramophone pick-up with a radio receiver at once doubles the value of that receiver, for no longer are you dependent upon broadcasting for your musical programmes, but are able to have music when you please.

A Great Advantage

Moreover, the gramophone scores over radio in that you can choose your item exactly to fit your mood. There is none of that "Oh, I wish they'd play something different!" complaint that one so often hears when a group of people are listening to broadcasting.

Check Your Wiring Very Carefully

The item can be chosen, and all can be satisfied. Further, radio and gramophone music can be "mixed," as it were. You can have a few minutes of radio, and then when an item comes along which is not to your taste you can switch over to "gramophone" pick-up connected and ready for operation.

Not Essential

But the use of a pick-up and its inclusion among the accessories of the set is not essential. The receiver will act as a radio receiver until the broadcast programme is once more to your liking.

A turn of the switch is all that is necessary, provided you have your only, and the two pick-up sockets below the reaction control on the panel can be neglected if desired.

In this way the pick-up part of the outfit can be added later on if required, after you have got thoroughly used to the set as a radio receiver pure and simple.

For the benefit of those who wish to get the pick-up part working right away the following remarks and advice may be of value.

In attaching the pick-up all that has to be done is to connect the leads from the pick-up, or the volume control (for the latter is really desirable), to a couple of ordinary plugs—H.T. wander plugs will do—and these are inserted into the two sockets on the panel.

How It Looks When Completed

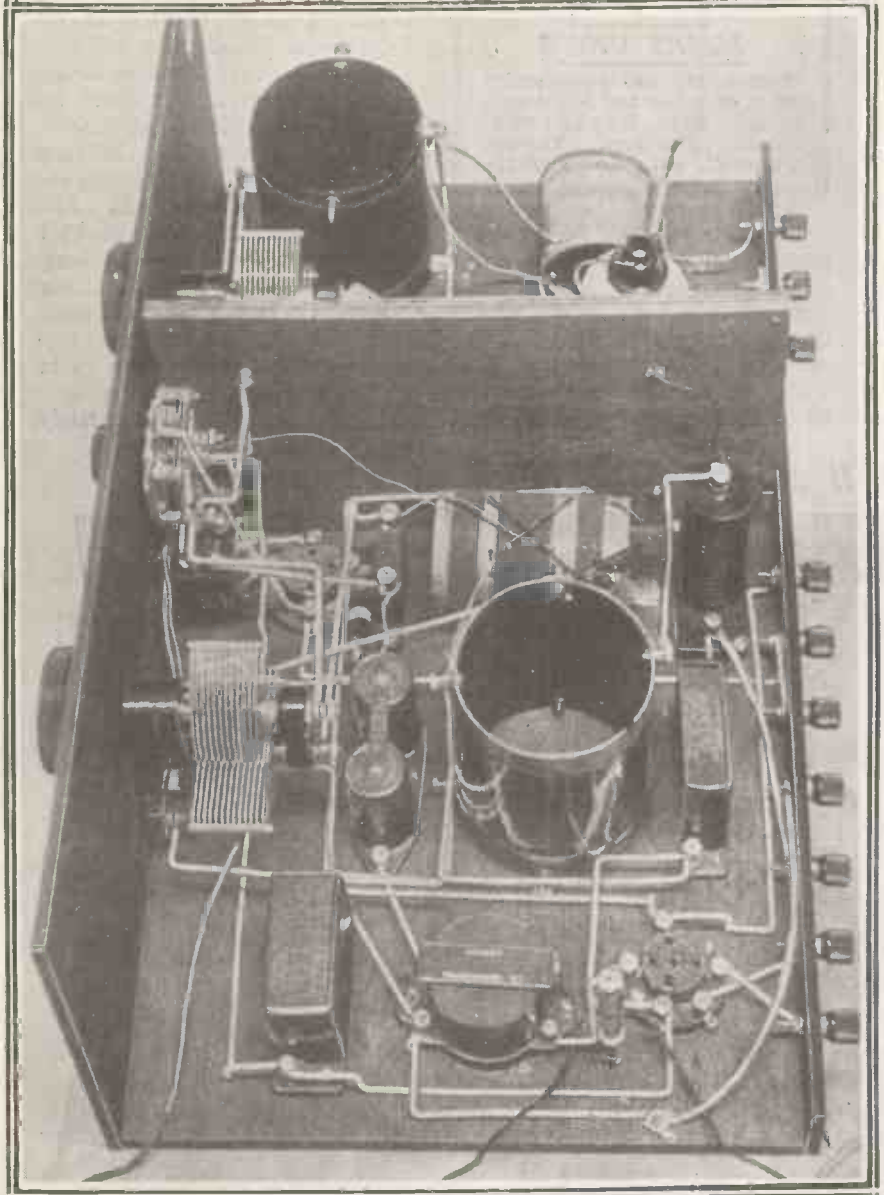


Fig. 10. "The last lap." The final connections have been made, and the wiring is now ready to be checked over before the set is tested.

Pick-Up Bias

The G.B.—1 lead and plug (coming from one of the sockets) is inserted in the —1½-volt socket of the grid-bias battery, and all is ready for operation as far as the set is concerned.

BATTERIES

H.T., 120-volt double capacity.
G.B., 9 volts for L.F. valve.
G.B., 1½ volts or 9 volt for S.G. valve.
(Drydex, Pertrix, Ever Ready, Magnet, Lissen, Columbia, Ediswan.)

Now let us consider the pick-up part for a bit. These instruments look something like the sound-box of the ordinary gramophone, and take the place of the sound-box in their operation.

In order to operate one, therefore, a gramophone motor and turntable are necessary, or if you have a gramophone already you can use that.

Two Alternatives

In this latter event two alternatives are open to you. The first is to buy a pick-up and tone-arm complete, mount it on the motor-board of the gramophone, and thus leave undisturbed the sound-box and tone-arm. The second is to slip off the sound-box and put in its place a pick-up "head," so that a record arm is unnecessary.

Either way is perfectly satisfactory as regards operation; *but*, in view of the fact that many of the "not-the-best" gramophones

Radio or Gramophone Concerts at Will

have their sound-boxes mounted badly out of truth, it is usually advisable to get the separate pick-up and arm, full directions for the mounting of which are always given by the maker.

If you have no gramophone you can get either a motor and board and assemble your own, or else buy such an instrument as the H.M.V. table pick-up unit, or the automatic record-changer. These both work from the electric light supply.

A Useful Instrument

If you have no mains, then a clockwork motor and turntable are easily rigged up, and a pick-up mounted on the motor-board. In the case of the H.M.V. units, however, it must be mentioned that for the price asked you get in the one case a pick-up, electric motor, volume control, and walnut-finished cabinet, and in the other all the above plus an automatic record-changing device which allows you to run off eight records without paying *any* attention to the machine.

But to get back to the case where either an ordinary gramophone or a new motor and board are used, what about the choice of a pick-up and a volume control ?

SUITABLE MAINS UNITS

(State voltage and type of mains when ordering and full details of set). Ekco, Regentone, Formo, Heayberd, Tannoy, Tunewell, R.I., Lotus, Atlas.

The pick-up should be chosen, if possible, after a trial, preferably on your own set, or alternatively a demonstration by a dealer with a loud speaker like yours.

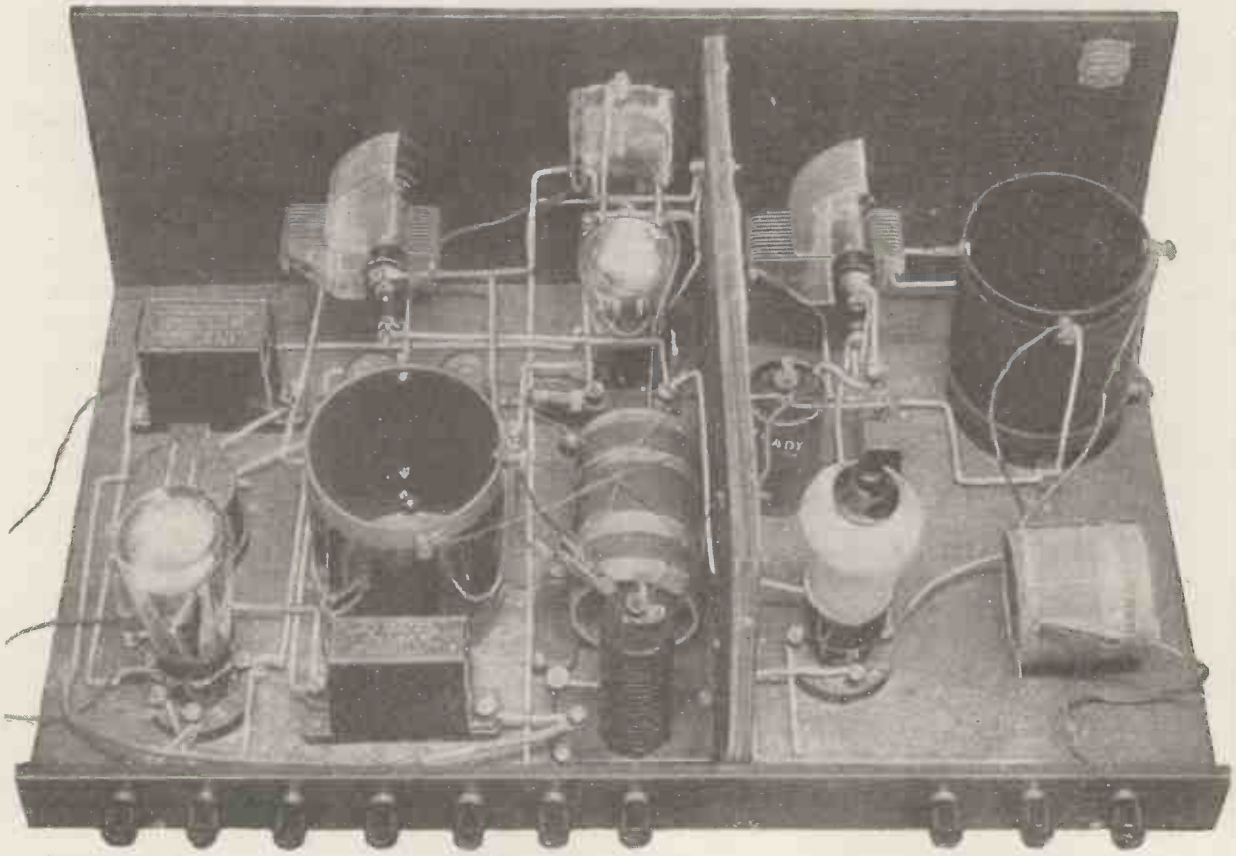
The reason for this is that pick-ups vary in their characteristics. Some are more brilliant than others, and some emphasise the bass much more than the rest. So if you have a " bassy " or " mellow " (a most detestable word where loud speakers are concerned) loud speaker, then choose a pick-up that is bright and has not very much bass.

Pick Your Pick-Up

On the other hand, if the speaker is not too good in bringing out the bass, try a pick-up that will give plenty of this very necessary section of the musical scale. There are many good makes on the market, and some of the brightest that come to mind are the B.T.-H. Senior and Junior, Zonophone, and Blue Spot ; a good all-round pick-up is the Celestion W.5 ; while for plenty of bass, together with a brilliant " tone," the H.M.V., Marconiphone, and " Audak." are excellent.

The volume control may be included in the pick-up unit, or it may have to be attached separately.

This Set Will Bring In Plenty of Programmes



This general view shows the valves in position, the set being ready to connect up to aerial and earth, loud speaker and batteries Note the metallised screen-grid valve, a feature that is very important.

A RADIO RECKONER

By W. A. BARCLAY M.A.

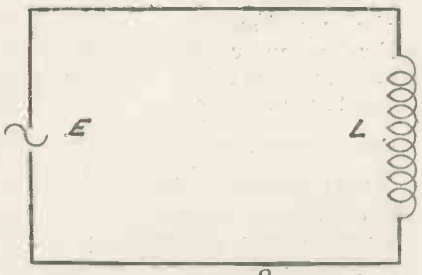
This article of our valuable series enables you to find with comparative ease the different values of inductance and capacity required to tune to various wave-lengths in the broadcasting ranges. If you keep these articles by you for future reference they will save you endless time and trouble.

IN previous instalments of this series we have been considering the peculiar kind of opposition which is met by alternating currents when the circuit through which they flow contains inductance or capacity. We found that this "reactance," as it is called, is "positive" when due to inductance, and "negative" when due to capacity—a fact which is of the utmost importance for radio science, as upon it turns the whole question of "tuning" circuits.

A Series Circuit

Readers will remember that we examined last month the case of the simple circuit shown in Fig. 1,

A.C. "RESISTANCE"



R2390 FIG 2

If an alternating E.M.F. of E volts be placed across an inductance, the resulting current is equal to $\frac{E}{X}$ amperes, where X is the reactance offered by the inductance at the frequency of the applied E.M.F.

consisting of an inductance and a capacity in series. For the sake of clearness we shall return to this circuit, and illustrate it by a concrete example.

Let us suppose, then, that the inductance has a value of 300 microhenries, while the capacity is 0·00015

AN EXCELLENT EXAMPLE

FIG 1

Inductance and capacity in series. If L is 300 microhenries and C is 0·00015 microfarad, the combination is "resonant" to a wave-length of 400 metres. These values may be checked by using the first of this month's charts.

microfarads. Now, the reactance due to each component varies with the wave-length, and, in general, at any given wave-length the reactances will be different in amount.

Nevertheless, at some one wave-length it will happen that the positive reactance due to the 300 μH. will exactly balance the negative reactance due to the 0·00015 μF. At this wave-length, then, the two reactances cancel out, leaving a net reactance of zero, and this we define to be the "*resonant*" wave-length of the circuit, to which it is "*in tune.*"

Inductance and Capacity

It is important to notice that the value of the resonant wave-length depends entirely upon the values of inductance and capacity in the circuit, so that we may alter the resonant wave-length of a circuit by altering the value of the inductance or capacity of which it is composed.

This, as readers know, is the broad principle underlying the "tuning" circuits of a receiver. Meanwhile, the great question is, of course, how can we find the wave-length to which any given circuit is resonant?

The practical business of doing this is simplified very much by the use of the two Alignment Charts which are reproduced herewith. The first of these, Fig. 4, consists, as is seen, of three vertical scales. The two outer scales carry values of inductance and capacity, while the inner scale is graduated in wave-lengths over what is known as the "medium" band; that is, from 200 to 500 metres.

Finding the Unknown

A straight line placed across this chart between any two known values will enable us to find straight away the value of the third or unknown. In the present case, we simply join the value of 300 μH. on the left-hand scale to 0·00015 μF. on the right, and

OHM'S LAW

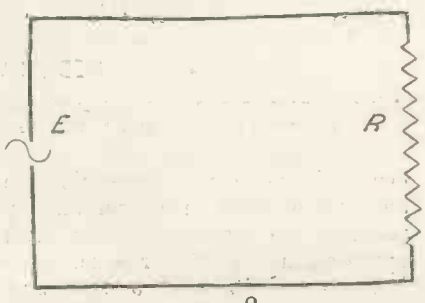


FIG 3

If an alternating E.M.F. of E volts be placed across a resistance R ohms, a current of $\frac{E}{R}$ amperes will flow through the resistance.

read the required wave-length, viz., 400 metres, at the intersection of the joining line with the inner scale.

It will be seen that by using this chart we have entirely dodged the necessity of finding the values of the reactances of the components. We would be expected, therefore, the two balance exactly.

However, in dealing with tuned circuits it is seldom necessary to take the actual reactance values into consideration. Luckily, the fact that in the "tuned" state they balance out

A REAL LABOUR-SAVING DEVICE!

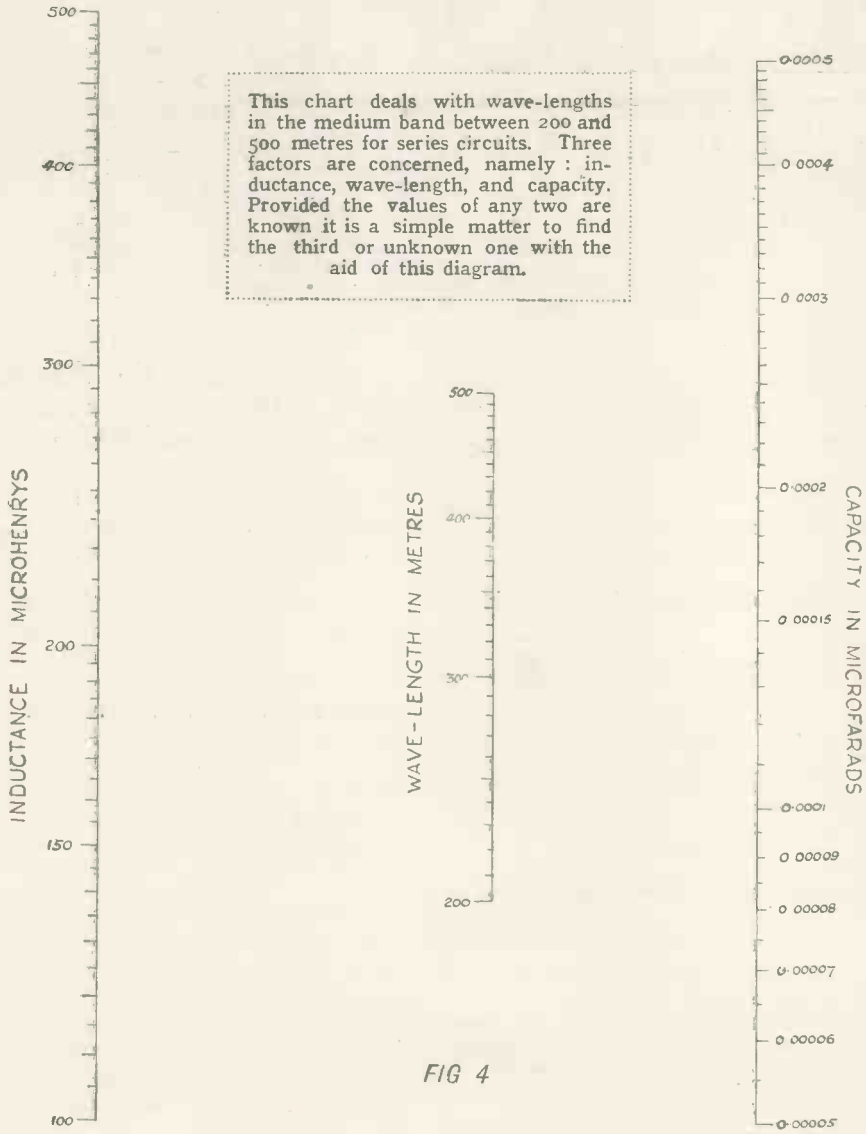


FIG 4

TUNING CHART
FOR
MEDIUM WAVE-LENGTHS

It is only necessary to place a "straight-edge" across the chart so that it cuts the two known quantities and it will be found also to cut the required factor.

could, if necessary, ascertain the amounts of these in a twinkling by means of the Reactance Charts which appeared in the October issue.

We should find that, at the wave-length of 400 metres, 300 μH. has a reactance of + 1,410 ohms, while at the same wave-length 0·00015 μF. has a reactance of — 1,410 ohms. As is sufficient to absolve us from troubling further with them! For "tuned" circuits we need only consider the relation between the component inductance and capacity and the resulting wave-length, and this is easily done by the charts now presented.

The second of the two charts this month (Fig. 5) gives the same relation for the longer wave-lengths used in European broadcasting, the centre scale being graduated to show wave-lengths of from 800 to 2,000 metres. It will be noticed that the values of inductance shown on the left-hand scale are throughout much greater than those required for the "medium" wave-band, while the range of tuning capacities in the two charts is much the same. This is so for the following reason.

Different Size Coils

In most broadcast receivers the same variable condensers have, perforce, to "tune" the circuits for both medium and long wave-bands. The coils employed, however, differ considerably in inductance values for the two cases, the long-wave coil having often ten times the inductance of the medium-wave coil, though the actual ratio varies considerably with the set design. In the long-wave chart, therefore, provision is made on the left-hand scale for coils of inductance as great as 4,000 μH.

Let us now pause and consider a little more closely what is meant by saying that our circuit of Fig. 1 is "resonant" to a certain wave-length or frequency. We have seen already that if an alternating source of potential be connected across the ends of a resistance R ohms, as in Fig. 3, an alternating current will flow through the resistance.

The Current Flowing

If the maximum value or amplitude of this varying E.M.F. be E volts, then the maximum value or amplitude of the current can be found by Ohm's law—it would, in fact, be $\frac{E}{R}$ amperes. Similarly, if an alternating E.M.F. of E volts amplitude were applied across an inductance coil of L henrys, as in Fig. 2, the amplitude of the resulting current would be $\frac{E}{X}$ amperes, where X is the reactance in ohms of the inductance at the frequency (i.e. wave-length) of the alternating potential. As X can be ascertained by inspection from the charts given in this series in the issues of September and October last, we can readily find the amplitude of the current passing through the coil of Fig. 2.

But now suppose we apply our alternating voltage of known frequency and amplitude across the ends of a series combination of inductance and capacity, as shown in Fig. 6. If, as usual, we let the symbol X stand for

How to Cut Out Complicated Calculations

the reactance of this combination at the frequency of the applied E.M.F., the amplitude of the current flowing through the circuit will, as usual, be $\frac{E}{X}$ amperes, the current impulses, of course, having exactly the same frequency (or wave-length) as the voltage oscillations.

Now, the circuit is said to be "tuned" to this wave-length when the value of X is zero, and, as we have seen, the condition for this is satisfied by all values of inductance, capacity and wave-length which lie on the same straight line on the accompanying charts. The expression for the magnitude of the alternating current flowing in the tuned circuit is thus $\frac{E}{0}$ amperes and readers who know something of algebra will know that this means an infinitely great quantity.

A "TUNED" CIRCUIT

FIG 6

Here an alternating E.M.F. is applied across a circuit which may be "tuned"—in which case the reactance will be zero. But there is always a certain amount of resistance with which to reckon.

We are, therefore, led to the strange result that if we apply a finite value of alternating voltage across the series circuit of Fig. 6, a theoretically infinite alternating current should flow if this circuit is resonant to the applied frequency!

Another Factor

Now, an infinitely great current would be by no means a healthy thing to experiment with. Indeed, the current in a lightning flash, while by no means infinite, is capable at times of doing considerable damage. It is surely impossible that we can deal with such huge currents in our tuning circuits—we must have made some mistake! Where, then, lies the snag?

The trouble in which we have landed is a good example of the dangers of trusting overmuch to theory. All along we have considered our series combination as consisting exclusively of an inductance and a condenser. If our circuit really contained nothing else but these two things, theory would lead us to a correct result; however, in this workaday world, such a circuit is never to be found.

PROVIDING FOR ALL CONTINGENCIES

This diagram is very similar to the one shown on the previous page, with the exception that it concerns waves in the longer broadcast band between 800 and 2,000 metres. It is, however, used in exactly the same manner.

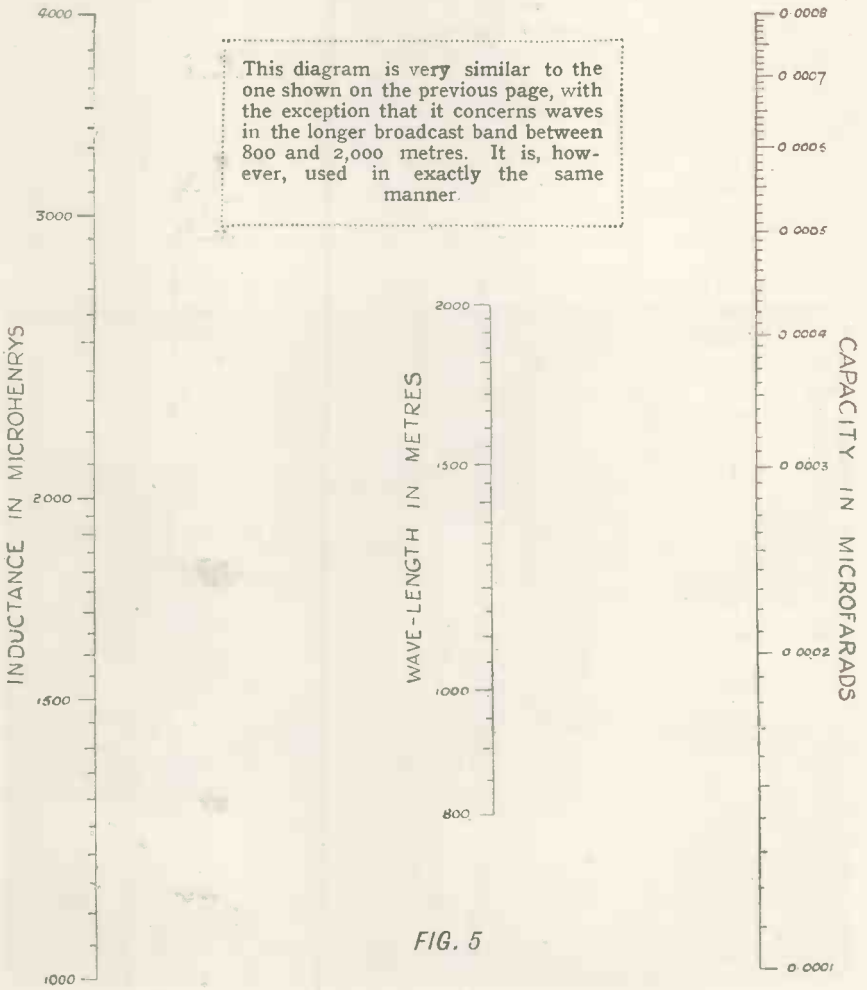


FIG. 5

TUNING CHART FOR LONG WAVE-LENGTHS

Although in actual practice a tuning condenser seldom exceeds a capacity of ·0005 microfarad, in this chart provision has been provided for dealing with condensers as high as ·0008 microfarad, thus covering all possibilities.

The wire of which the inductance coil is wound will always offer a certain amount of resistance to current, and this fact, operating through Ohm's law, limits the amplitude of the current passed. The connections and construction of the condenser, too, exercise a slight resistive effect, so that *although at resonance the reactance is zero, there is always a certain amount of resistance present.*

Nevertheless, if this resistance is small the resulting A.C. in the circuit may be very high. This is one reason why, in certain portions of some receivers, it is important to use "low-loss" coils, i.e. coils whose actual resistance is very low and which, consequently, allow comparatively big currents to pass easily when they are tuned.

Such coils are useful, too, in enhancing the selectivity of the circuit—but this is quite another question, the discussion of which must be postponed meantime to a future article

FROM OUR READERS

Matching Impedances—An "M.W." Speaker in Sweden—The "M.W." "Super-Quad."

Matching Impedances

Sir,—May I draw your attention to an article by D. Glover on "Using Transformers," in the October issue of MODERN WIRELESS?

In the latter part of this article reference is made to the matching of impedances by the means of a transformer. He states that the ratio of the transformer should be the same as the ratio between the two impedances to match them.

At first sight this would seem correct, but, unfortunately, it is not quite so easy to calculate as this.

The impedance thrown across one coil of the transformer by the load on the other is not directly proportional to the ratio, but to the ratio squared.

The first example in this part of the article would then be:

$$\text{Ratio}^2 = \frac{2{,}000}{10{,}000}$$

$$\text{Ratio} = \sqrt{1:5} = 1:2{\cdot}24.$$

By Mr. Glover's calculation this ratio comes to 1 : 5; it would be very convenient from some points of view if he were correct. Take, for example, the case of the inter-valve transformer, assume the grid to filament impedance as 1 megohm. The impedance, in effect, across the primary, using the high ratio of 1 : 20, would be $\frac{1\times10^6}{20}$ = 50,000 ohms. This figure is comparatively high, and would hardly effect the working of the transformer at all, therefore a tremendous amplification would be obtained.

But in actual practice the effective load is $\frac{1\times10^6}{20^2}$ = 2,500 ohms. This would place a big load on the primary, and thereby reduce the efficiency to such an extent that a 1 : 4 ratio transformer would give a louder result. This effect constitutes the main objection to the high-ratio transformer.

Mr. Glover goes on to say that, as the two ratio examples (calculated in his article) are being applied to the matching of valve to speaker, a greater undistorted output is obtained when the anode resistance (speaker) is twice that of the valve. He states that they will now be 1 : 2·5 and 1 : 10 (they were 1 : 5 and 1 : 20 respectively). Surely this is only correct in one instance (the first). In the latter case I think it would be found to work out to 1 : 40, since:

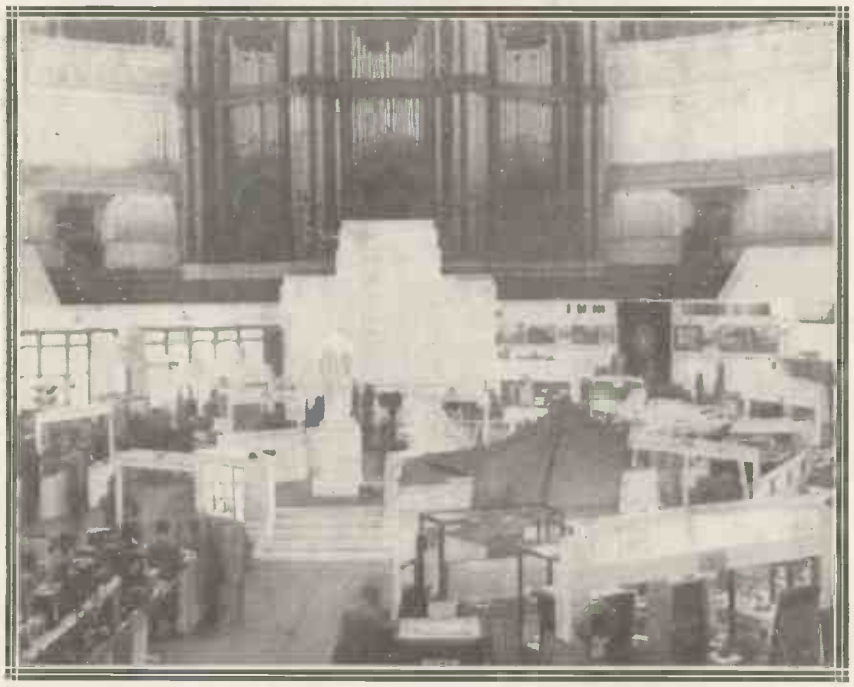
$$\frac{\text{anode resistance} \times 2}{\text{speaker resistance}} = \frac{2{,}000\times2}{100} = 40{:}1.$$

Actually, as pointed out earlier in my letter, the ratio should be $\sqrt{40:1} = 6{\cdot}32:1$.

Yours faithfully,
H. VENNER.

Gravesend.

LOOKING BACK AT THE LAST CENTURY



Those readers who visited the Faraday Centenary Exhibition at the Albert Hall will no doubt recognise this photograph. It was a wonderful display, of great radio interest; a lot of Faraday's early experimental apparatus being exhibited. It was after this great pioneer of electricity that the unit of capacity (the farad) was named.

An "M.W." Speaker

Sir,—I have built the fire-screen model of the "M.W." loudspeaker, described in the February issue of MODERN WIRELESS, and I am really surprised at the results obtained. It reproduces a soft bass without any boom, and also talk is nearly perfect. "Wonderful," say my friends. I have made the speaker exactly according to your design, that is, with a 66R unit and a 24-in. baffle board.

Since 1923 I have been a regular reader of MODERN WIRELESS, and I have made several of your sets. At the present I have a 3-valve receiver with your dual-range coil, which also is home-made.

Yours,
VALTER CARLSAN,

Kristianstad, Sweden.

The "M.W." "Super-Quad"

Sir,—It occurs to me that you might be interested in my first impression of your "Super-Quad." I have had no experience in the building of sets, and it was with some misgivings that I decided to have a go at it.

It took me nine hours to build the set, and as a novice I am delighted with the appearance and results. When I first switched on the set appeared to be as dead as mutton, and in going round the whole dials the only sound I got was a slight plonk whilst passing from one wavelength band to another. However, after re-checking the wiring, which proved to be correct, I managed to get Königwusterhausen, and subsequently I tuned in 42 stations, all at good strength on the loud speaker (Blue Spot 100U), and many others at less strength. The tone is excellent, there are no back noises, and many stations were so loud that they had to be cut down considerably.

I was able to cut the London Regional out in one degree on the dials.

Yours faithfully, H. M. Cox.

Sunningdale, Berks.

THE WORLD'S PROGRAMMES

HOW, WHEN AND WHERE TO HEAR THOSE FOREIGNERS

The B.B.C.'s recent decision to erect a British Empire station at Daventry has given great satisfaction overseas.
The picture above shows the Prime Minister at the microphone.

CONTENTS OF THIS SPECIAL SUPPLEMENT

ON THE LONG WAVES

Some practical and completely up-to-date notes on reception above 1,000 metres, where many of Europe's best programmes are found.

Many people do not realise how good the long-wavers are. Others fail to recognise the various stations; but it is really quite easy, as this article shows.

Although there are only about twenty-five stations in the whole of the long wave-band between 1,000 and 2,000 metres—as compared with about eight times that number in Europe on the medium wave-lengths—it is on the long waves that we find some of Europe's best and most reliable programmes. And moreover, it is on the long waves that we may look for some of the striking developments expected in broadcasting this winter.

* * *

Most readers will know that there is a proposal afoot to greatly strengthen and improve the Daventry National station on 1554·4 metres. But it is not generally realised that the proposal for this was made necessary by corresponding improvements abroad.

A Starting Point

This year's long-wave stations as compared with last year's are strikingly superior, and likely to become more so.

* * *

We will take Daventry 5 X X as our starting-point and work upwards. On 1,635 metres there is Konigswusterhausen, the German station situated at Zeesen, near Berlin. Since last year it has been greatly improved and its power increasod to 75 kilowatts.

* * *

It relays the Berlin programmes, and although its close proximity to our own National station makes it a little difficult to receive free of interference it will often be found working very obligingly when Daventry is closed, and its musical transmissions are almost invariably worth listening to.

Recently Improved

A few degrees higher on the dial we have, on 1,725 metres, the Radio-Paris station. This station again is an instance of recent improvements in long-wave working, for its power has been increased, its aerial system improved, and in many parts of England it is now a firm favourite as a daylight provider of programmes.

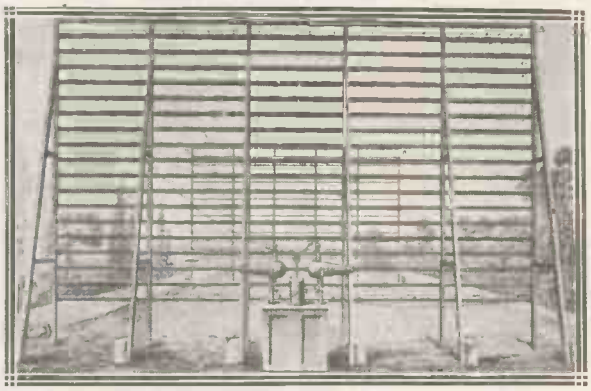
* * *

Above the Radio-Paris transmissions there are three other stations, but only one of these, namely, Huizen, Holland, on 1,875 metres, is of importance to British listeners. It is of relatively low power, but nevertheless comes in well over the Eastern and South-Eastern districts of England and is frequently worth looking for in other areas.

* * *

Most of the long-wave stations lie below Daventry 5 X X, and although the two immediate wave-lengths in descending order are not well received as a rule, Eiffel Tower, on 1445·7 metres, which is next, is a station of great interest to British listeners At the moment it appears to be experimenting with higher power—at any rate, it is coming through in fine style and often can be heard conducting tests.

NO, IT'S NOT A LONG-WAVE STATION!



It looks very modern—possibly even a beam station, you might imagine—but, as a matter of fact, it was a very early form of telegraph, built in 1823! It was erected at Hammersmith, and they used a Leyden jar to energise it!

Immediately below this is Warsaw No. 1, Poland, on 1,411 metres. This is Europe's most powerful broadcasting station and it employs the phenomenal power of 158 kilowatts.

* * *

This is more than five times the power of our own Daventry station, 5 X X, and at the time of writing, Warsaw, for all its great distance, sounds exactly like the giant that he is. Employing both men and women announcers, the call "Rahdio-Varshovwa" is readily recognisable.

Interesting Transmission

Immediately below Warsaw is an unimportant North African station, but next in descending order is Motala, Sweden, on 1,348 metres, and this is often a very strong "signal." Below it is another very interesting transmission, namely, Moscow Trades Union.

* * *

Moscow frequently sends out programmes directed to British listeners, mostly of a propaganda nature, and although there is a great preponderance of talks from this transmitter, it is certainly an interesting one to locate.

* * *

Still descending the scale, we find three other stations sharing the next two wave-lengths, and below them comes one of the best of the long-wave stations—Kalundborg, Denmark, that usually relays the Copenhagen programmes. Despite the low power used (it is less than that of Huizen, Holland), and the very considerable distance covered, the Kalundborg programmes are received remarkably well in England.

Noteworthy Station

Of the five or six remaining stations only one is really noteworthy from a programme provision point of view, and this is Oslo, Norway. Oslo uses a wave-length of 1,083 metres, but has been subjected to considerable heterodyne interference of late and is also prone to wide variations in strength from week to week.

* * *

Gramophone records are a favourite item of the Oslo station, and when he is coming in well they certainly provide an excellent programme for listeners in this country.

THOSE D.X. RESULTS— *A Listener's Letter*

SIR,—I am in agreement with Mr. Hotchkiss's remarks ("Mod. Wire," Sept.) that a person receiving a station should be able to back it by programme items. However, I am sure he will agree with me I cannot help feeling that were a person with a large log to send such details there would be very little room for anything else. Mr. Hotchkiss's details of P C J and G-5 S W used up half a column.

I keep a log of the programmes heard from all stations, and have verifications from the stations themselves in many instances, besides records to prove my claims.

It is my opinion that most persons who claim distant stations have such proof, as it might be rather awkward if they had not.

Yours faithfully,

LESLIE W. ORTON.

Uxbridge, Middlesex.

PROGRAMMES IN PLENTY

Some really practical notes on medium-wave reception which will aid you in identifying your latest radio "catch."

THE prophecies that the season upon which we have now fairly entered will be a good one for long-distance reception are being amply borne out in fact. Nearly every set seems able to get foreign stations, some swarm with them, and the easy reception and great strength of some of the trans-ocean programmes have caused much favourable comment.

* * *

There has been a good deal of bewilderment, too! Listeners who have not done much long-distance reception since last winter are being completely amazed by the strength of some of these foreign stations and the apparent impossibility of identifying them from announcements made during the programmes.

* * *

Here are some hints on identification of the more important newcomers whose programmes are especially interesting.

A "Landmark"

If your set is one the tuning of which goes well down below the 230-metre mark, you may have been puzzled by the strong French station which comes in immediately below the Cork transmission. Its wave-length is 219·9 metres, and it is usually listed as "Fécamp."

* * *

The programmes frequently arrive at enormous strength in the South of England from this station situated in Normandy, but the word "Fécamp" is seldom heard. Instead, the station calls itself "Radio-Normandie," and if you listen for this, especially as given by the lady announcer, you will soon identify this particular transmission.

* * *

Another very interesting programme is that from the new Italian station at Trieste. This station is also very low down on the dial, and may be quite near the limit of sets which cannot tune down to Cork and Fécamp. The best way to identify it is to remember that it appears just a degree or so above Belfast.

Well Down the Dial

The wave-length is 247·7 metres (Belfast is 242 metres). At the moment of writing, Trieste is employing a very clear-voiced lady announcer who enunciates the station's call-sign with great frequency and perfect clarity. She calls it "Rahdio-Tree-est-tay." The power is 15 kilowatts, but it is frequently louder than Rome.

* * *

Another Italian station which proves very puzzling to the uninitiated listener for long-distance reception is Turin. "Radio-Torino," they call it, and it is a puzzling station not because of any peculiarity of announcements so much as the fact that it invariably works on the wrong wave-length!

* * *

Officially, Turin is supposed to occupy the wave-length immediately below Heilsberg, the powerful German regional station. This wave-length is 274·2 metres, but "Radio-Torino" is never to be found there.

* * *

Instead, for a very long time it has been occupying the wave-length immediately below Hilversum, the powerful Dutch station that in turn occupies one wave-length lower than the Northern National. Except in districts where the North programme is strong, it is a very easy station to pick up, because no less than four easily identifiable stations occupy adjoining wave-lengths.

* * *

If you can get any of these you should certainly have no difficulty with Turin. The stations in question with wave-lengths being as follow: Cardiff, 309·9 metres; Bordeaux Lafayette, 304 metres; Northern National, 301·5 metres; Hilversum, Holland, 298·8 metres.

DANCING TO DAVENTRY

At the moment "Poor Jenny is a-Weeping" (centre), but presently they will be dancing to Jack Payne's music provided by the set on the window-sill. So typically English, isn't it?—And yet, as a matter of fact, this photograph was taken in a Hamburg backyard!

"Who Is That Just Below Cardiff?"

Farther up on the dial a foreigner which has been puzzling many people is the loud French-speaking station on the next wave-length above Midland Regional. This is one of the new Swiss regional stations, working on a wave-length of 403 metres, and located at Sottens. The station calls itself "Radio-Suisse-Romande."

A Big "Mouthful"!

This rather cumbersome name is generally dropped by people who know the station well in favour of the word "Sottens," but if you remember that it calls itself Radio-Suisse-Romande, and comes in on your set immediately underneath Dublin and Katowice, and immediately above the Midland Regional wave-length, you should have no difficulty in definitely placing it.

* * *

If we have cause to complain of Radio-Suisse-Romande for using a confusing name, what can we say of its fellow regional Swiss station, Beromunster? It has chosen to call itself "Schweizerischer-Landessender." The announcements are in German, the programmes come from Basle, Berne, Zürich, and as the station is as powerful as our own latest regionals, its strength is usually very good indeed.

* * *

The easiest way to place this station on a dial which is not calibrated is to remember that it lies just about halfway between the Northern Regional transmission and Rome. Its actual wave-length is 459 metres and just above it are to be found Lyons La Doua on 466 metres, and Langenberg, Germany, on 473 metres.

One other station near the top of the dial which deserves special mention is the Prague station. It is usually announced as "Radio-Praha" and is the next station to Northern Regional in ascending order, coming just below Milan and Brussels.

* * *

Brussels, by the way, is another easily-confused station, because it has two transmitters, working on different wave-lengths. The particular station referred to in the paragraph above is "Brussels No. 1," which works on 509 metres. For the Flemish programmes there is "Brussels No. 2," which works on 338·2 metres.

* * *

It often happens that distant stations quite near the top of the dial are missed because on simple sets the reaction "falls off" at this part of the dial. A very simple cure can generally be effected by joining a small condenser (fixed or semi-variable, of ·0001 mfd. or so) across the appropriate terminals of your reaction condenser.

A Tip Worth Remembering

When this latter is a "differential," the extra condenser should be joined on one side to the moving vanes and on the other to that set of fixed vanes which is permanently connected to the reaction coil.

* * *

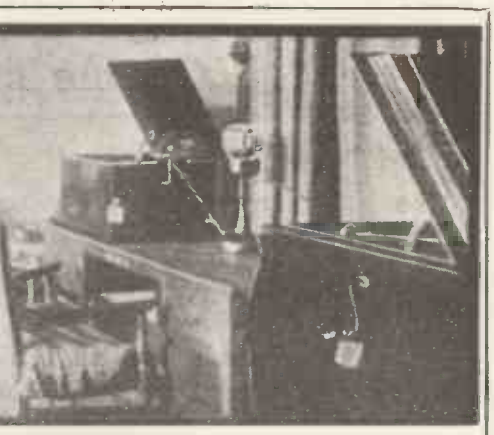
Vienna and Budapest are other near-the-top-of-the dial stations, and both announce themselves clearly, the lady anouncer at Budapest being particularly good in this respect.

HOW MANY MILES?

SOME DISTANCES—	
MORAVSKA-OSTRAVA	820
MOSCOW	1552
MOTALA	886
MUHLACKER-STUTTGART	453
MUNICH	570
NAPLES	1003
NURNBERG	508
OSLO	720
PARIS	214
POZNAN	728
PRAGUE	640

—FROM LONDON	
1175	REYKJAVIK
1050	RIGA
890	ROME
465	SOTTENS
886	STOCKHOLM
400	STRASBOURG
552	TOULOUSE
767	VIENNA
899	WARSAW

THE STATION YOU CANNOT HEAR



Maybe this title is an exaggeration! Perhaps you have logged the Bombay station of the Indian Broadcasting Corporation, and perhaps it will not close down as has been so persistently reported. Either way, this personal account of this strange broadcaster will intrigue you.

By Our Special Correspondent.

RUMOUR has been busy of late with Bombay radio station. And whether it will eventually be closed down or not seems uncertain. But I am writing (at the Editor's request) a first-hand account of my impressions of the station whilst it is still working.

Many Problems

Everything is so much in contrast to the B.B.C. stations at home that it is extremely difficult to make an accurate description; but I should just like to impress you with one thing.

Certain papers have made slighting comments on our programmes. They forget that here ordinary programme difficulties are magnified enormously by the need for catering for different nationalities.

Really we get quite good programmes, and only the real enthusiasts trouble to buy short-wavers to hear Chelmsford (5 S W) direct. It's not worth it. 5 S W is often relayed here.

The Waiting-Room

And now for the station.

The waiting-room where I am writing is certainly not an over-elaborate affair, but as it is used not only for reception of the artistes, but as a general meeting-place for all the engineers, accountants, native beggars and strolling players who think they have a place before the microphone, it probably wouldn't do to have it furnished in any way ornate.

Homely cane chairs and Indian rugs have converted this ante-room into a tolerably pleasant waiting-room, and all the time the transmitter is going a big cone speaker is switched on so that the waiting artistes can know when to come in.

A rather impressive thing is the banner over the door leading into one of the ante-rooms bearing the I.B.C. (Indian Broadcasting Company) insignia with an elephant's trunk. An electric clock on the wall is synchronised with one in each studio.

Red for Danger!

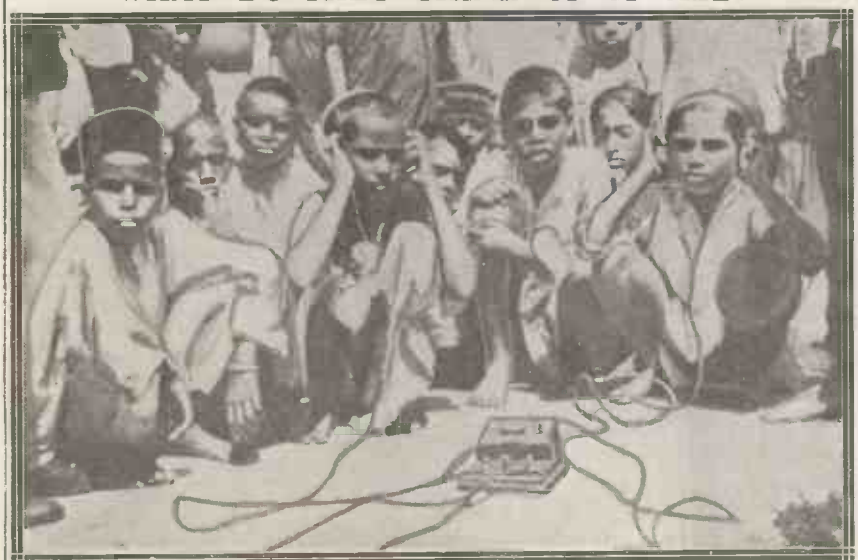
A small door over which a red light burns while the programme is on carries the humble sign "*Studio,*" and this leads through to the main studio, or what is known at the station as the "Grand" studio.

Compared with European studios this is striking, because, although there are rows of American-type folding chairs all round the room, the artistes use divans, only about a foot or so from the ground.

BOMBAY'S DIRECTOR

Mr. C. B. Sethna, the Bombay Station Director.

WHAT DO THEY THINK OF IT ALL?



A scene in an Indian village just outside Bombay, with native children listening to fairy stories.

On the Model of the Old 2LO

It is a surprising mixture of East and West. In front of the native divans is a Reisz-type "mike" on a stand. Over in a corner of the room, which is about 60 ft. long, is a grand piano; while along the same wall is a small organ.

There are heavy rugs on the floors and the familiar draping around the walls of which the Marconi engineers are fond. However, as there are lofty curtained windows running down almost the entire length of the right-hand wall as one enters the studio, there is not too much echo.

Warm Work

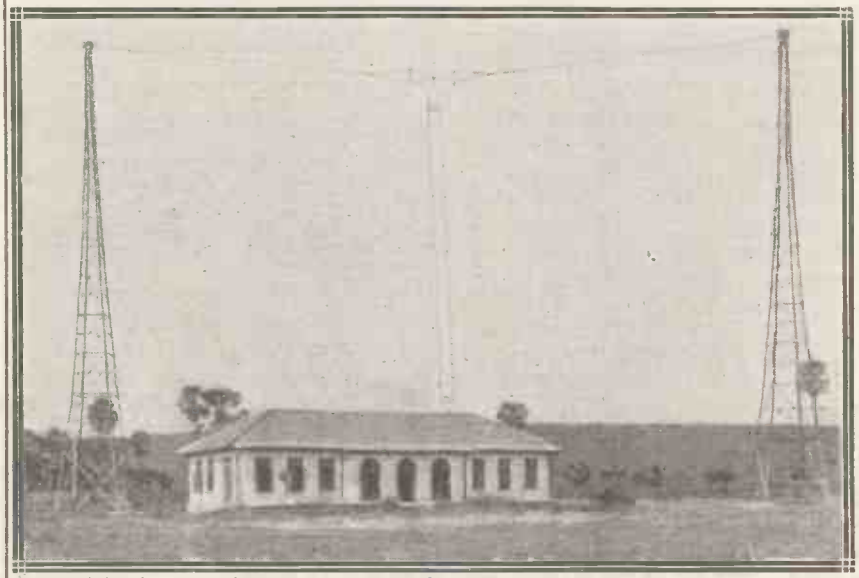
Of course, it gets unbearably hot, and there are four big electric fans hanging down from the ceiling. These caused trouble when first erected, because the noise they made was apt to be picked up on the microphones, but now fortunately this trouble has been overcome and they run the fans to keep the place tolerably cool.

A striking thing is the decoration scheme carried out on the ceiling with big streamers, and culminating in a big Union Jack placed at the far end of the studio. They have orchestral broadcasts on occasions in this studio, and forty or fifty people could be accommodated fairly comfortably — if it were not for the heat!

In contrast is the talks studio, which, according to present studio arrangements, is used all too often, not only for talks, but for gramophone recitals when original programme matter cannot be given from the "Grand" studio.

This talks studio has two gramophones, one a console type and the other a table model (the latter fitted with a pick-up), a writing-desk on which stands a pedestal microphone, and, the most surprising thing of all, a grandfather clock in the corner.

THE AERIAL IS NEARLY ALL LEAD-IN!



An upright "sausage" with a very short top is used at the transmitter situated at Worli.

The transmitter at present puts out at 12 kw., and is a type known by the engineers as the model "Q." All the transmitter gear is on separate panels behind a railing, in the centre of which is a lift-type safety gate, so that only the man in charge who has the key of the gate can get near any of the high-voltage points.

Built to Last

They have taken elaborate precautions to insulate the transmitting gear from vibration and from climatic changes. The steel frames are rigidly bolted to the stone floor, and fans above the glass-bottle type valves (not water-cooled) keep the temperature fairly constant.

The transmitter is of standard type, as at Calcutta, and is really a development of the outfit which was the transmitter of the old 2 L O station at the top of Marconi House.

The engineers estimate that that type of gear has a "service area" (to use a B.B.C. expression) of 200 miles for a two-valve set and between 35 to 50 miles for a crystal set.

Of course, reliable reception is possible at a greater distance than this, and this transmitter was installed largely on account of the fact that in 1923 the old 2 L O station had been received in India and South Africa.

WHERE THE ENGINEERS CONTROL IT

This is the main control desk (foreground), with standard receiving sets on the bench to the left, near the switchboard.

STATION INFORMATION

Condensed notes and news from broadcasting centres in various parts of the world.

JOHANNESBURG. The short-wave station at Johannesburg now works on 49·4 metres every evening from 5 p.m. to 8.30 p.m., G.M.T., and most days from 10 a.m. till noon.

* * *

BRUSSELS. The new Belgian short-wave station intended for communication with South America and the Belgian Congo will employ a daylight wave-length of 15·62 metres. At night the wave-length will be altered to 29·04 metres.

* * *

TOKIO. The regular short-wave broadcasts from Tokio have been abandoned.

* * *

G 2 Z L. Crystal control has now been fitted to this well-known amateur station. Address: 158, Bristol Road, Gloucester.

* * *

NEW ZEALAND. Amateur transmitters who wish for schedules with New Zealand are invited to communicate with Z L 4 B K. Address: Mr. J. W. Booker, 41, Argyll Street, Mornington, Dunedin, N.Z.

* * *

G 6 Q F. This Manchester amateur transmitter is a low-power outfit, and runs entirely from dry cells.

* * *

MILAN, which is to have one of the most powerful stations in Italy, expects its new transmitter to be ready next February.

* * *

LUXEMBOURG'S much-talked-of high-power propaganda station is said to be considering attractive advertising offers from American manufacturers.

* * *

PARIS is to have two 100-kw. stations under the General Ferrie plan, one on medium and the other on long waves.

* * *

GRENOBLE, which lies rather outside the areas of the proposed French Regional scheme, would be allotted a supplementary 20-kw. station under the plan.

* * *

BARI, the new Italian station, will probably be testing in the next few months, and is provisionally due on the air with regular programmes in April, 1932.

* * *

PALERMO runs an interesting competition for its licensed listeners in connection with unannounced gramophone records. Those correctly naming the music and executants draw lots for the records, several of which are given away weekly.

* * *

FLORENCE is now testing its new station.

* * *

RADIO LYONS has been testing its new transmitter from about 8 to 11 p.m. on 286 metres.

HEARD FROM HAMBURG

This delightful lion cub was so interested in the Hamburg mike that it tried to bite it during a recent zoological broadcast !

BELIZE, British Honduras, had its newly-erected and improved radio station completely destroyed by the tidal wave and hurricane in September.

* * *

BERLIN recently broadcast a modernised version of "King Lear," with the characters and incidents appearing as they would have done if the scene of the play had been the poorer quarter of Berlin.

CARDIFF City Education Committee runs a Tuesday morning course in Radio Technology at the Cardiff Technical College, from 9.30 a.m. to 12.30 p.m. Fee £2. Details from the Principal of the College.

* * *

LANGENBERG expects its new transmitter to be working "all out" this month.

* * *

PEGAU, a small town about fifteen miles south of Leipzig, is the actual site of the new Central German Regional station.

* * *

BOLZANO, which was ready for testing at the end of October, is another of the stations to be erected or improved under Italy's broadcasting scheme.

* * *

STOCKHOLM now gives its weather forecast and news twice nightly, at 6.15 and 8.45 p.m.

* * *

BUFFALO is getting tired of radio commercial advertising, and stations W G R and W K B W now ban such talks between 6 p.m. and midnight.

* * *

GERMANY lost the race to reach the four-million radio licences' mark, Great Britain reaching that total in October, whilst her rival was about 200,000 behind.

* * *

LILLE was due to open its new studio during November. It is one of the largest in France.

* * *

MARSEILLES has opened an emergency station to replace Marseilles P.T.T., which was burnt down not long ago.

* * *

PONTOISE, the French Colonial short-wave station, is arranging further broadcasts of Paris street noises for the benefit of overseas listeners.

Some informative notes on German investigations into the new ultra-short-wave scheme. B.B.C. engineers also are experimenting along similar lines.

By DR. ALFRED GRADENWITZ.

RECENT research work on the propagation of ultra-short waves has proved the practicability of wireless broadcasting on waves below about 11 metres.

New Sets Unnecessary

Dr. G. Leithäuser, who is in charge of the ultra-short-wave department at the Heinrich Hertz Institute, is of the opinion that the wireless industry is even now in a position to turn out ultra-short-wave receivers as simple to operate and just as efficient as ordinary broadcast receivers. Such receivers could be run from the mains without any hum being experienced.

Screening in connection with ultra-short-wave receivers, of course, requires to be more efficient than in the case of normal broadcast waves. Valves and tuning circuits can be influenced by the radiation of very short waves from the connecting leads themselves.

It has been found that there is no need to provide entirely new receivers for the reception of ultra-short-wave broadcasting, it being sufficient to supply additional apparatus. This comprises one valve and the necessary tuning circuits.

Using "Record" Terminals

Such additional apparatus can simply be connected up to the terminals which, in connection with ordinary receiving sets, are used to reproduce gramophone records. The output from the additional apparatus will then be handed on to the standard wireless receiver, using its amplifier for the reproduction of ultra-short-wave broadcasting. This scheme, of course, greatly simplifies the receiver problem and cuts down the cost of ultra-short-wave reception.

There are, of course, many elaborate circuits bound to prove particularly effective in the case of ultra-short-wave reception, and which, after having been temporarily abandoned, will again come to the fore. These circuits will have to be investigated very carefully, in order to find out the most suitable one for ultra-short-wave reception.

The reason why a really sensitive receiver is particularly important in the case of ultra-short waves is the fact that the propagation of such waves in large cities, according to actual tests, is not so favourable as that of the usual wireless waves. At the same time, received currents in the range between 11 and 5 metres can be amplified much more effectively than longer ones.

Interference Much Less

This is due to the well-known interference by the operation of machinery, engines, therapeutic apparatus, and electric railways, which is apt greatly to reduce the enjoyment of longer wave reception, but the intensity of which is known to decrease as the wave-length decreases. In fact, if the same intensities of receiving currents as in the case of standard broadcast transmitters could be relied upon it would be easy to eliminate completely such interference.

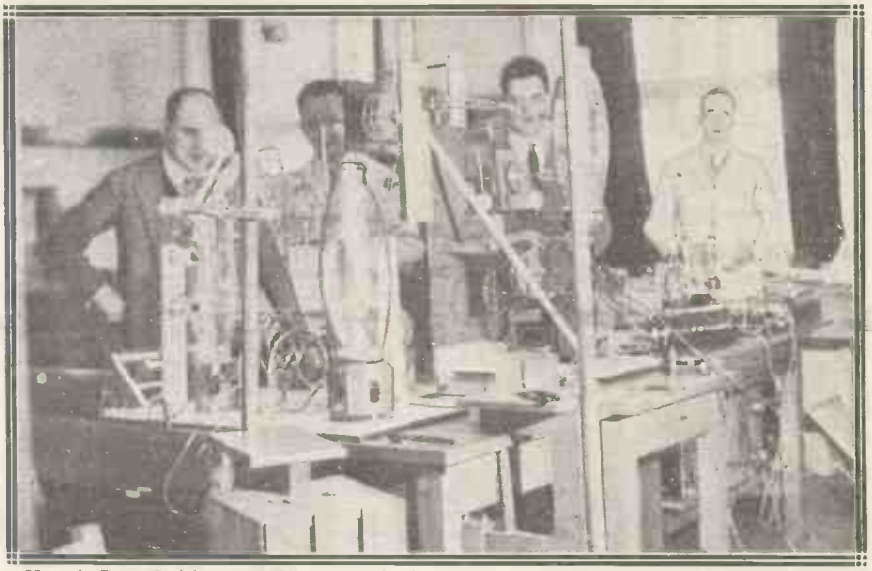
Elevated Stations

However, inasmuch as the propagation of such waves is less satisfactory, a greater amplification is generally required.

As regards the installation of ultra-short-wave transmitters, this must be carried out in a somewhat different way from the general practice in broadcasting. In order to allow the ground wave to be utilised, the absorption by buildings should be reduced to a minimum by making the waves to strike the city in as nearly a vertical direction as possible.

In fact, the transmitter should be installed at a considerable height, and there is some reason to expect in the near future the installation of very high towers of insulating material carrying at their top an ultra-short-wave transmitter.

WORKING ON WAVE-LENGTHS BELOW 1 METRE!



Here is Prof. Leithäuser with some of his assistants in the ultra-short-wave laboratory at the Heinrich Hertz Institute, Berlin.

HERE AND THERE

News Items for the Long-Distance Man.

DANZEY GREEN, in the Birmingham area, is reported to be a "blind spot" for radio, and local wireless societies are investigating results there with directional receivers.

* * *

LUXEMBOURG'S giant station, shortly to be opened for propaganda purposes and advertising, is being erected under French control.

* * *

NEW YORK is keenly interested in its newest station, being built by the Columbia Broadcasting System, in which the steel lattice-work tower is itself to be used as the aerial.

* * *

PARIS police welcome reports on the test transmissions from F.P.C. The times (G.M.T.) and wave-lengths are as follow:

9.0 a.m.	1,050 metres.
11.45 ,,	1,140 ,,
5.30 p.m.	1,200 ,,

On short waves:

10.0 a.m.	44·75 metres.
10.15 ,,	59·00 ,,
10.30 ,,	84·00 ,,
4.0 p.m.	44·75 ,,
4.15 ,,	59·00 ,,
4.30 ,,	84·00 ,,

* * *

KALUNDBORG has been suffering from interference, and probably is increasing its power shortly.

* * *

SOVIET radio experts propose to obtain meteorological information from the Behring Straits by means of an automatically operated radio buoy, to be cast adrift next spring.

* * *

HUNGARY is to have a 120-kw. station, working on 210 metres, with four low-power relays.

* * *

RADIO SUISSE ROMANDE (Sottens) has announced that its powerfully-received programmes are not to be considered as finality, the station still being in the experimental stage.

* * *

SIMFEROPOL, the Russian station, has been heterodyning the North Regional programme.

* * *

LEIPZIG, already liable to interfere with the London National programme, is to increase its power from 2·3 kw. to 150 kw.

* * *

TRIESTE, the powerfully-received Italian station on 247.7 metres, is situated about 754 miles from London.

* * *

ECUADOR (S. America) is one of the distant points to have complimented the Trieste station on its programmes.

* * *

RADIO VITUS, the Paris station on 312·8 metres, has been the cause of recent interference with programmes in the Cardiff area.

* * *

REYKJAVIK, the Icelander on 1,200 metres, closes down (usually about 11 p.m.) with the words "Goda nott," meaning Good-night.

FALKIRK listeners are hoping to hear tests from their new station in about six months from now.

* * *

CHI-HOA is the actual site of the "Radio Saigon" station in French Indo-China. Its wave-length is 49·05 metres.

* * *

FRENCH STATIONS now broadcasting Esperanto transmissions include Lille, Radio-Normandie, Paris P T T, and Lyons-la-Doua.

* * *

KHABAROVSK, the U.S.S.R. short-waver, on 70·1 metres, usually works from 9 a.m. till noon.

RADIO TO FIGHT THE GANGS!

Here is an American police officer, with the special short-wave set that keeps headquarters in touch with the police patrol-vans and auto-cycles.

COPENHAGEN is due to occupy its new Broadcasting Building within a few months.

* * *

MONT PARK has been selected as the site for a short-wave receiving post, by the Government of Victoria.

* * *

TORONTO, hitherto the most thickly-licensed city of Canada, is now being overhauled by Montreal.

* * *

RADIO PARIS has arranged to broadcast a series of the famous Conservatoire concerts.

* * *

WESTERGLEN (near Falkirk), the Scottish Regional station, will have only two masts for its twin-wave station.

GENOA has been getting over well with its new transmitter.

* * *

ZEESEN has been working on 19·72 metres with the U.S.A., in connection with a Berlin-U.S.A. radio link for exchanging programmes.

* * *

BRUSSELS employs a power of 20 kw. at each of its popular stations. Brussels No. 1, 509 metres; Brussels No. 2, 338 metres.

* * *

MUHLACKER'S interval signal—the musical notes C, D, G—is produced by clockwork hammers striking metal bars.

* * *

RADIO PRAGUE was erroneously referred to under "A German Radio Museum" in the September "M.W." Prague is, of course, the capital of Czecho-Slovakia.

* * *

LIBICE, the great new station near Prague, should be working its full 120 kw. by the time these words are in print.

* * *

ST. RÉMY-L'-HONORÉ is to be the name of the new Radio Paris station, which was at first styled "Essarts-le-Roi."

* * *

REALTOR, the proposed new station near Marseilles, is to use a power of 30 kw. at first, increasing up to 60 kw. if necessary.

* * *

LYONS sometimes relays the Polish "Radio Circle" broadcasts sent out by Katowice on 408 metres.

* * *

HESTON AERODROME weather reports are transmitted at the following times: 08.45, 09.30, 10.30, 11.30, 12.30, 14.45, 15.30 and 16.30.

* * *

TOM THUMB is the name affectionately given to W E E, a complete miniature broadcasting station belonging to a Philadelphian announcer. Its aerial masts are 8 ft. high.

* * *

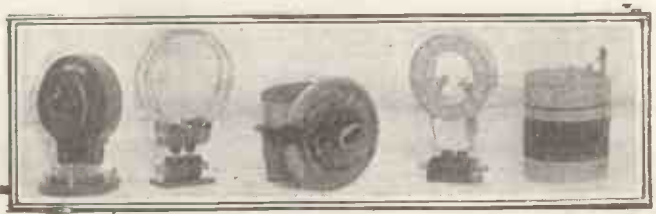
VILLA ACUNA, the new Mexican station near Coahulia, is to use a power of 75 kw., and is expected to be on the air by 1932. (Wave-length, 450 metres.)

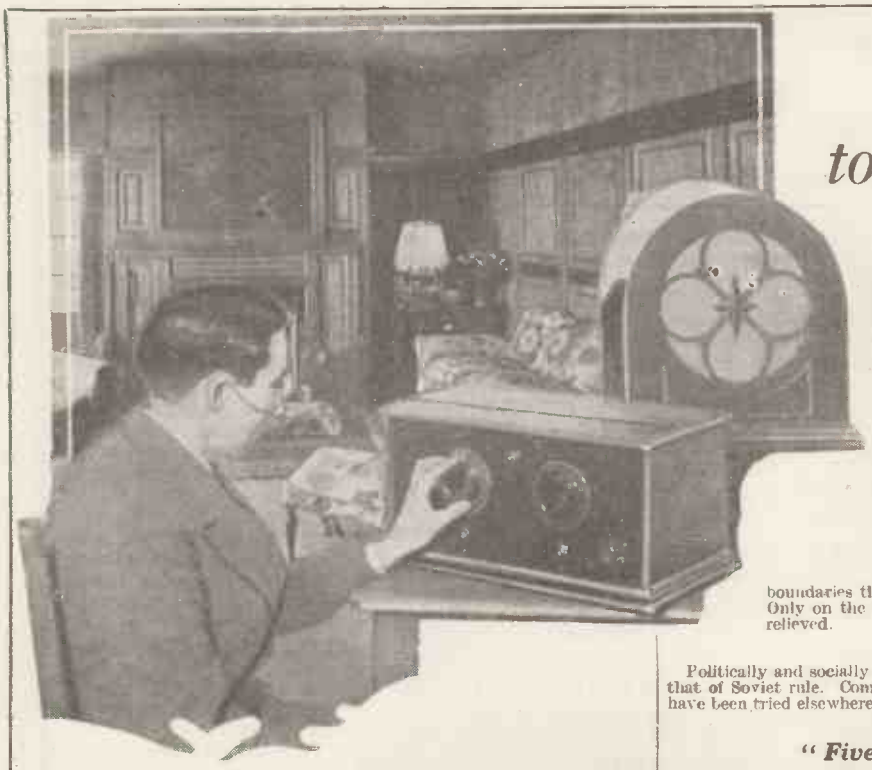
* * *

EIFFEL TOWER now divides its "Radio Journal" into two parts, the first from 5.45 to 6 p.m. (news), and the second consisting of topical readings, etc., from 6.30 to 7.20 p.m.

* * *

BORDEAUX-SUD-OUEST is run by a private company, and it was recently decided to move the transmitting plant to Pau, at the same time enlarging it and increasing the power.





Countries to Listen for—

RUSSIA

Some details of the broadcasting fare provided by stations in the Union of Soviet Socialist Republics.

THERE is a peculiar interest in listening to Russian stations, for Russia is unlike any other country in the world. Its size, its natural features, its history, its government—all are unique.

* * *

Geographically, its huge expanse is interposed between the rest of Europe and Asia: and politically its sway extends from the Baltic to the Pacific, and from the frozen Arctic seas of the north to Turkey, Persia and China.

* * *

If we disregard the huge Asiatic possessions, and consider only Russia-in-Europe, we find this is almost fantastically large compared with other European countries. About 1,000 miles wide, and measuring almost 2,000 from north to south, it dwarfs all its neighbours.

* * *

A singular flatness is the outstanding physical feature of the country. In the whole enormous tract between the Ural mountains and the European boundaries there are no heights of more than about 1,200 ft. Only on the fringes, east and south, is the great plain's monotony relieved.

* * *

Politically and socially the land is now the subject of a vast experiment—that of Soviet rule. Complicated and far-reaching schemes, unlike any that have been tried elsewhere, are being worked out.

"Five Year" Plan for Radio

Included in the famous "Five Year" Plan, as a part of the industrialisation scheme, was the construction of a network of wireless stations. Some of them can be heard in this country, but usually only on special sets, or when conditions are particularly good.

* * *

Moscow is probably the only Russian station which has a considerable public in Britain; and although Moscow boasts several transmitters, it is by the "Trades Union" programme on 1,304 metres that it is best known.

THE BROADCASTING STATIONS OF RUSSIA-IN-EUROPE

Name	Call-Sign	Wave-length	Name	Call-Sign	Wave-length
Archangel	RW36	389·6	Naltchik	RW51	401
Astrakhan	RW35	690	Nijni Novgorod	RW42	761·4
Baku	RW8	1260·5	Odessa	RW13	450
,,	RW43	1260·5	Orenburg	RW45	650
Dnepropetrovsk	RW20	587·1	Ufa	RW22	675
Erivan	RW21	742·6	(Under construction)		486·2
Gomel	RW40	483	Penza	RW56	468·8
Groznyi	RW23	443·8	Petrozavodsk	RW29	640
Ivanovo-Voznesensk	RW31	497	Piatigorsk	RW24	640
Kazan	RW17	545	Pokrovsk	RW55	411
(Under construction)		465·8	Rostov-Don	RW12	848·7
Kharkov	RW4	937·5	Samara	RW16	575
,,	RW20	426	(Under construction)		742·6
Kiev	RW9	815	Simferopol	RW52	476
(Under construction)		1034·4	(Under construction)		413·8
Krasnodar	RW33	461·5	Smolensk	RW24	565
Leningrad, Kolpino	RW53	1000	Stalino	RW26	370
Makhatch Kala	RW27	377	Stavropol	RW32	495·4
Minsk	RW10	700	Sverdlovsk	RW5	825
,,	RW62	46·72	Tiflis	RW7	1071·4
Moscow	RW39	378·5	Tiraspol	RW57	253
,, Komintern	RW1	1481	Vladikavkaz	RW64	398·9
,, Popoff	RW58	1117·3 / 1100	(Under construction)		
,,	RW37	378·5	Voronej Gouberniski	RW25	778
,,	RW2	720	(Under construction)		666·6
,, Trades Union	RW59	50			
,, ,,	RW49	1304			
,,	RW61	5·8			

This programme can often be tuned in on good long-distance sets after dark, just below Motala, the separation on a 100-degree dial being generally 3 or 4 degrees. Below Moscow a new Viennese experimental station has recently been transmitting (1,237 metres), so the identification is not difficult in cases where Motala can be received clearly.

* * *

Much of the programme material is of a propaganda type, directed at other countries. Sometimes the announcements are in German, sometimes in French, and sometimes in English, but, of course, Russian is the language chiefly spoken.

The Russian Long-Wavers

The English announcements are clearly and deliberately spoken, and invitations are extended to listeners in this country to communicate with the Moscow Station Director by post. Lessons in spoken English are frequently broadcast, generally in the form of dialogues.

* * *

When the programme is a musical one the announcer may sometimes be heard stating that the orchestra is under the direction of "Comrade ——"; this term "Comrade" is a sure sign that you are listening to a Soviet station.

* * *

Two or three other long-wave Russian stations can sometimes be received, in addition to Moscow Trades Union. Chief among these are Moscow Popoff, 1,117·3 metres; Moscow Old Komintern, 1,481 metres; and Leningrad, 1,000 metres.

The wave-length of Leningrad happens to be the same as that employed by the British navigation "beacon" stations, which send continuously for the benefit of ships needing bearings. This position-finding service interferes so badly with Leningrad his programmes are usually not worth listening to.

* * *

The strength of Leningrad is generally as good as, or better than, that of the other Russian long-wavers, but none of these stations compare in reliability with such popular Continental stations as Kalundborg, Oslo, Motala, Warsaw or, of course, the nearer stations like Huizen and Paris.

Moscow on 50 Metres Also

There are, however, several Russian test programmes in different parts of the long-wave band, and it is possible that eventually one of these may get over better than the present stations referred to above.

For the benefit of listeners with suitable receivers, the Russian programmes are now being relayed on the short waves. The Moscow (Trades Union) programme, on 50 metres, is already well-known for strength and reliability, and it seems probable that this success will result in other short-wave relays being inaugurated.

* * *

In the past the unusual political position has resulted in a great deal of of uncertainty as to the whereabouts of the various Russian stations. On the preceding page, however, we give a map showing the location of them all, according to the latest official information. And in the accompanying table full details of wave-lengths will be found.

THE CITY OF RADIO

Some details of an amazing American scheme for centralising New York's radio in a city of its own.

Excavation work has already started for the world's first Radio City—a gigantic scheme for concentrating the television and radio activities in New York.

* * *

A very costly central site has been selected, and of this land valued at nearly £4,000,000 will be left open for gardens to beautify the site. It is proposed to cover all the main walls, etc., with living ivy and other creepers.

Seven acres of waterfalls, lawns, pools, trees, fountains, flower-beds, and similar landscape effects, are to cost the promoters about £100,000 to prepare, and the roofs of the buildings will be an amazing sight, especially at night when flood-lit.

* * *

Right above the main wing of the central building—sixteen storeys from the street, but far below the towering skyscrapers on and around the site—will be a gigantic waterfall, with cascades ending in a reflecting pool, and a 50-ft. spill-way. Even in New York, "the City of the Spectacular," this unique concentration of natural beauty and business will be likely to break all records as a centre of public interest.

* * *

Nothing of the kind has ever before been attempted in any part of the world, and Radio's experiment will be watched with interest by the other leading industries.

A Relic of the Russia That Has Passed Away

This view was taken from the Moskoretzke Bridge, Moscow, and shows the famous Kremlin, the great bell of which is broadcast daily from the Moscow stations.

PLACING YOUR PROGRAMMES

Most long-distance enthusiasts use charts or tuning curves, but there are still a great many who are not clear how these can be drawn up for their own sets. Here is the whole method interestingly described in detail.

Do you have difficulty in placing your stations?

Have you ever envied the man who, when you have asked him for Rome, knows exactly where to turn his tuning dials for that station? Who switches over to Heilsberg merely by glancing at a chart? The man who, in fact, does not have to hunt for his stations, but knows the points at which to expect every one of them?

Simplicity Itself

A great many people possess good receivers capable of picking up foreign stations, but are still uncertain about the tuning. They have never properly mapped out the dials.

* * *

This mapping-out process is simplicity itself. It is made beautifully easy by one fundamental fact—the fact that to tune to a given wave-length with a given coil and condenser you will *always* have to adjust that condenser to a certain number of degrees.

* * *

Therefore, once you have located a station, you will, if you are wise, keep a record which will enable you to go back and listen on *exactly* the same wave-length again, at any time you wish.

* * *

Provided the coil conditions remain the same, the dial reading for that wave-length also remains the same. It does not matter if you alter the H.T., for instance.

Quite Good Fun

As a matter of fact, there is sometimes a semi-exception to this in sets where reaction is employed, because in some such receivers the reaction adjustment slightly affects tuning. But this is always a minor effect, which in practice is easily allowed for.

* * *

The charm of placing your stations, however, does not lie merely in keeping a record of those received so that you can refer to it again. That would seem to be a very dull job. Actually there is any amount of fun in this "placing" business.

What we have to do is a job that Sherlock Holmes would have loved. We can tackle our job like he would have tackled a cold-blooded murder. We must get together the few facts at our disposal, consider them in their relation to one another, imagine that every foreign station is a criminal who can be caught if we go about it in the right way, watch for him at the haunts he is known to favour, and, finally, when our chain of evidence against him is complete, arrest him!

* * *

It sounds quite thrilling put that way, doesn't it? And in practice you will find it an intensely interesting job. "So pull yourself together, my dear Watson, and we will have this gang of foreigners in custody forthwith!"

* * *

There are several ways of tackling this problem of the elusive foreigners. The easiest way is to use some of that squared paper known as graph paper, with a sharp pencil, indiarubber, and ruler, backed up by this copy of "M.W."

The First Steps

You will need several sheets of the graph paper (which can be obtained for a penny or so), because we shall proceed from the known to the unknown, and therefore your final page will be much more complete and definite than the earlier series which we shall lay down.

* * *

The first step is to marshal the known facts about these foreigners. A list of the stations with the wave-lengths is here, under our hands, so next let us see what we know about the dial readings.

* * *

Get a sheet of plain paper, and put down the exact dial readings of all the well-received stations.

* * *

Let us take a typical set of dial readings, and see how the figures work out. We will suppose that the four most easily-received programmes are the London National, London Regional, Midland Regional and Northern Regional. And careful adjustment of the dial shows that the London National comes in at exactly 24 degrees, the London Regional at exactly 53 degrees, the Midland Regional at exactly 62 degrees, and the Northern Regional comes in at exactly 77 degrees.

* * *

With these four facts to work on we can make a start on our squared paper, and get on the track of the foreigners. Take a piece of the squared paper about 10 by 10 inches, and notice how it is ruled off into thousands of little squares formed by the upright lines and horizontal lines. We will now make all those upright lines represent dial readings and all the horizontal lines represent wave-lengths.

* * *

To do this, start near the bottom left-hand corner and mark one of the upright lines with a nought. (Usually certain of the lines on this type of paper are thicker than the others, and it is convenient to start at one of these thick lines with 0.)

* * *

The next *thick* line to the right will represent 10 degrees, the next thick line 20, the next 30, then 40, 50 and so on, up to 100 or 180, according to the number of degrees on the dial.

Dial Readings

In this way every degree on your dial (or every two degrees, according to the kind of paper you are using) is represented by an upright line running from top to bottom of the squared paper. In the same way we can then make the horizontal lines represent the wave-lengths covered.

If we are tuning from about 250 to 550 metres, which is the usual range of a medium-wave coil, we can call the heavy line at the bottom, say, 230 metres, the next thickened line above it 250 metres, the next 270, and so on, going up by twenties until we reach the top line marked 550 metres.

Putting Them In

Now every line that runs from left to right across the paper represents a certain wave-length, and every line which comes up and down represents a certain number on the dial, according to the markings we have just put on the chart. And the next thing to do is to put in on this diagram the stations we already know—namely, the London National and Regional, Midland Regional and Northern Regional.

* * *

Let us take the case of the London National first and consider what we know about it. We see from our list of wave-lengths that it works of 261·3 metres; and we know the exact dial reading, which on this set is 24 degrees.

* * *

One of the up-and-down lines on the chart stands for 24 degrees on the dial. Similarly, the left-to-right lines stand for wave-lengths. So we go *up* the 24-degree line, and at the point where it crosses the 261-metre line we put a dot, and mark it "London National."

* * *

So far, so good. We next do the same for London Regional, putting his dot where the 53-degree (dial reading) line crosses the 356 (wave-length) line.

* * *

By the time we tackle Midland Regional we are getting expert. Dial reading 62—wave-length 398·9 (near enough 399); and where the

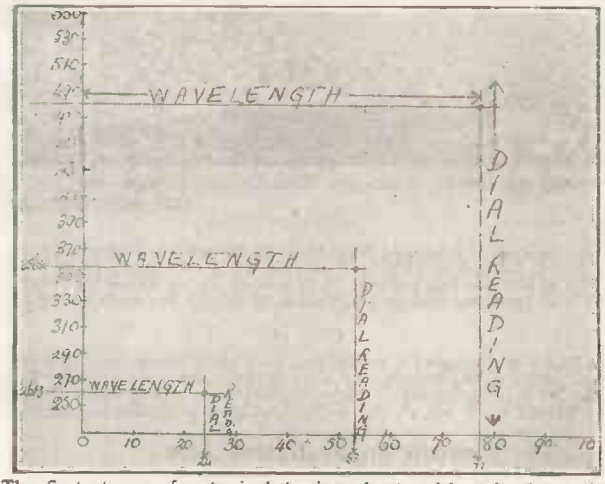
THE LONG-WAVERS

Wave-length	Station
1935	Kaunas (Lithuania).
1875	Huizen (Holland).
1796	Lahti (Finland).
1725	Radio Paris (C F R).
1635	Konigswusterhausen (Zeesen) (Germany).
1554·4	Daventry National Station
1538	Ankara (Turkey).
1481	Moscow (Old Komintern) (Russia).
1445·7	Eiffel Tower (F L E).
1411	Warsaw No. 1 (Poland).
1350	Kasbah (Tunis).
1348	Motala (Sweden).
1304	Moscow (Trades Union).
1260	Novosibirsk (Russia).
1229·5	Boden (Sweden).
1200	Istanbul (Turkey).
1200	Reykjavik (Iceland).
1153	Kalundborg (Denmark).
1116	Moscow, Popoff.
1083	Oslo (Norway).
1053	Tiflis (Russia).
1000	Leningrad (Russia).
937·5	Kharkov (Russia).
848·7	Rostov-Don (Russia).
815	Kiev (Russia).
778	Petrozavodsk (Russia).
770	Ostersund (Sweden).
761·4	Nijni Novgorod (Russia).
760	Geneva (Switzerland).
720	Moscow (Experimental).
700	Minsk (Russia).
680	Lausanne (Switzerland).

FROM 600 TO 400 METRES

Wave-length	Station
574·7	Ljubljana (Yugoslavia).
570	Freiburg-im-Breisgau (Germany).
566	Hanover (Germany).
565	Smolensk (Russia).
560	Augsburg (Germany). / Kaiserslautern (Germany) / Hamar (Norway).
550	Budapest (Hungary).
542	Sundsvall (Sweden).
533	Munich (Germany).
525	Riga (Latvia).
517	Vienna (Rosenhugel) (Austria).
511	Archangel (Russia).
509	Brussels No. 1 (Belgium).
501·7	Milan (Italy).
497	Moscow (Russia).
493·4	Trondheim (Norway).
487	Prague (Czechoslovakia).
479·2	North Regional (Manchester).
473	Simferopol (Russia).
473	Langenberg (Germany).
465·8	Lyons (La Doua) (France) / Tartu (Estonia).
459	Schweizerischer Landessender (Beromunster) (Switzerland.)
453	Bodo (Norway). / Danzig (Free City). / Klagenfurt (Austria). / Porsgrund (Norway). / Salahranca (Spain). / San Sebastian (Spain). / Tromso (Norway). / Uppsala (Sweden).
447·1	Aalesund (Norway). / Notodden (Norway). / Paris (P T T) (Ecole Supérieure) (France). / Rjukan (Norway).
441	Rome (1 R O) (Italy).
436	Maimberget (Sweden). / Stockholm (Sweden).
430·4	Belgrade (Yugoslavia).
426	Kharkov (Russia) (R V 4).
424	Madrid (Union Radio). (E A J 7) (Spain).
418	Berlin (Witzleben).
416	Rabat (Morocco).
413	Dublin (2 R N) (Ireland).
408	Katowice (Poland).
403	Radio Suisse Romande (Sottens) (Switzerland.)

"FIXING" THE KNOWN STATIONS—



The first stages of a typical tuning-chart, with only three dial readings marked in.

two lines cross in goes the Midland Regional dot.

* * *

The Northern Regional, where 77 degrees and 479·2 meet, comes next. And when that is placed in position we can see how the dots lie in line across the page.

* * *

If you lay a ruler along them you will see they are not quite straight in line, but they tend to form a gentle curve. Sketch it in with a pencil as shown.

* * *

This is your first tuning curve. It will be improved later, as experience shows you how to shape it properly, but already it is able to prove its worth. For it roughly connects all dial readings with their wave-lengths.

And so it is with all the other wave-lengths when once your curve is sketched in. By means of it you link every known wavelength and every known dial-reading to all the unknown wave-lengths and the unknown dial-readings. In fact, you have thus placed your stations.

* * *

When you have completed the first tuning chart the whole system on which such "calibration" is based will become clear. And the first rough chart can then be followed by others, more accurate, which will give you an *exact* knowledge of the dial-readings.

* * *

For long waves a separate chart can be made if desired; or the long-wave curve can be superimposed on the same sheet of graph-paper as that showing the medium-wave stations. (This is easily arranged, the second wave-length scale being moved up or down a little, so that the curves do not come together, or inconveniently near.)

* * *

Another variation that will suggest itself is wide-scale charts, in which station-positions are separated by comparatively wide gaps that will make for extremely accurate "placing." Here again two (or more) curves on one sheet may be convenient; in fact, there is no end to the pleasure obtainable from "placing" your stations.

FROM 300 TO 250 METRES

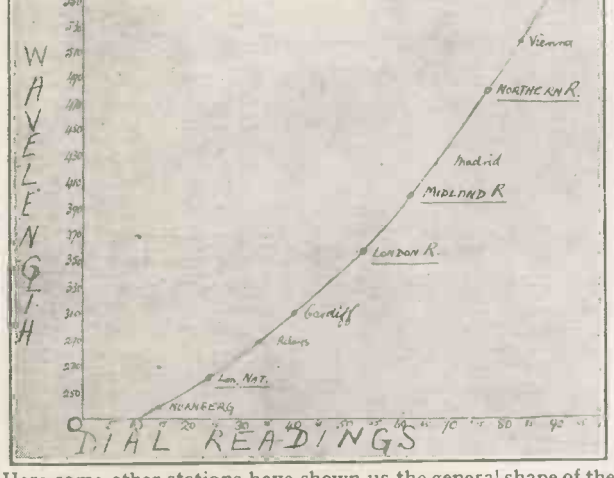
Wave-length	Station
298·8	Hilversum (Holland).
296·1	Tallinn (Estonia).
	Turin (supposed to work on 274·2 metres) has "bagged" this wave-length, and has been working on it for many months.
293	Kosice (Czechoslovakia). Limoges (P T T) (France).
291	Pietarsaari (Jacobstad) (Finland). Tampere (Tammerfors) (Finland). Viipuri (Viborg) (Finland)
290·5	Lisbon (Portugal).
288·5	Aberdeen (2 B D). Bournemouth (6 B M). Dundee (2 D E). Edinburgh (2 E H). Newcastle (5 N O). Plymouth (5 P Y). Swansea (5 S X).
286	Lyons (Radio) (France). Montpellier (France).
283	Berlin Relay (Germany). Innsbruck (Austria). Magdeburg (Germany). Stettin (Germany). Varberg (Sweden).
281	Copenhagen (Denmark).
280	Radio Liége (Belgium).
279	Bratislava (Czechoslovakia).
278·5	Heilsberg (Germany).
272	Rennes (France).
270	Bremen (Germany).
268	Radio Valencia (Spain).
267·6	Oviedo (Spain).
265·4	Lille (P T T) (France).
263	Moravska-Ostrava (Czechoslovakia).
231·3	London National.
259	Leipzig (Germany).
257	Horby (Sweden).
255	Toulouse (P T T) (France).
253	Gleiwitz (Germany).
252	Almeria (Spain). Barcelona (Association National) (Spain). Trollhättan (Sweden).

Let us look for Cardiff, for instance. Previously we may have heard that station, but we were not sure of it. *Now* the tuning curve tells us something definite about Cardiff.

* * *

We already know from the list that its wave-length is 309·9. And we see from the curve that that wave-length corresponds with 40 degrees on the dial. So we can now tune to 40, and listen there, or within half a degree or so of it, knowing that if Cardiff is coming in that is the approximate place where he will appear.

—AND FINDING THE UNKNOWN



Here some other stations have shown us the general shape of the curve, with dial readings linked to wave-lengths.

BETWEEN 400 AND 300 METRES

Wave-length	Station
398·9	Midland Regional Station (Gt. Britain).
394	Bucharest (Romania).
390	Frankfurt (Germany).
385	Toulouse (Radio) (France).
381	Lwow (Poland).
376·4	Glasgow (5 S C).
372	Hamburg (Germany).
370·4	Radio L L (France).
368·1	Bolzano (Italy). Helsinki (Finland). Seville (Union Radio) (Spain).
367·6	Fredrikstad (Norway).
364	Bergen (Norway).
363·4	Algiers (N. Africa).
360	Stuttgart (Muhlacker) (Germany).
356·3	London Regional.
352	Graz (Austria).
351	Leningrad (Russia).
349	Barcelona (Radio Barcelona) (Spain).
345	Strasbourg - Brumath (France).
342	Brno (Czechoslovakia).
338·2	Brussels No. 2 (Belgium).
335	Cadiz (Spain). Poznan (Poland).
332	Naples (1 N A) (Italy).
328·2	Grenoble (P T T) (France). Poste Parisien (Paris).
325	Breslau (Germany).
322	Goteborg (Sweden).
319	Dresden (Germany). Sofia Rodno-Radio (Bulgaria).
315	Marseilles (P T T) (France).
312·8	Cracow (Poland). Genoa (1 G E) (Italy). Radio-Vitus (France).
309·9	Cardiff (5 W A).
307	Zagreb (Yugoslavia).
304	Bordeaux - Lafayette (P T T) (France). Falun (Sweden).
301·5	North National (Manchester).

SHORT-WAVE JOTTINGS

Some notes on new stations.

Several new short-wave broadcasting stations are now to be heard on the air, for two reasons. In the first place, a certain number of stations have increased power, so that we can hear them for the first time; in the second, the time of the year is such that signals are coming in from countries that have been quiet all through the summer and early autumn.

Particularly are the "Easterners" to be noticed nowadays. The writer has logged Suva, Fiji, on 20·8 metres, and H S 1 P J, Siam, on 24·45 metres, a number of times. The latter is usually very strong indeed.

* * *

There is a chance of hearing Australian broadcasting stations in the region of 20 metres at midday, since the Australian amateurs come over well then. On the other hand, the stations between 30 and 40 metres from that part of the world are best either during the early morning (between 6 and 8 a.m.) or in the evening at about the same hours.

* * *

An interesting station, not often to be found, is V S 6 W X, Singapore, on 28·75 metres. According to the information on hand, he transmits only on Tuesdays and Thursdays during the early afternoon, but he has been heard on other days. Another is K A Z, Manila (Philippine Islands), on 30·3 metres.

* * *

The lowest wave-length on which you are ever likely to hear a full broadcast programme is 15·93 metres. On this wave P L E (Bandoeng, Java) gives a broadcast every Tuesday from 1.40 to 3.40 p.m. The strength as received in this country is usually very great.

* * *

At the other extreme, P K 1 A A (Batavia, Java) transmits on 77·5 metres every day except Saturday from 11.40 a.m. to 2.40 p.m., and also on Sundays between 3.40 and 5.10 *a.m.*

* * *

Short-wave broadcasting stations are now in action in at least forty-four different countries of the world.

* * *

Ecuador's first regular short-wave broadcast is now to be heard fairly regularly. The station is announced as "El Prado" and works on almost exactly 40 metres. Unfortunately he is only audible between 2 a.m. and 4 a.m. in this country, but at those hours he is generally a very good signal.

Another irregular transmission from the same country is Quito, on 47 metres.

* * *

The longest wave-length used by a so-called "short-wave" broadcast station now appears to be 124·1 metres, which is shared by seven or eight American stations, mostly in the central or western States.

BELOW 250 METRES

Wave-length.	Station.
249	Juan-les-Pins (France).
247·7	Kalmar (Sweden).
247·7	Trieste (Italy).
246	Berne (Switzerland). Cartagena (Spain). Cassel (Germany). Eskilstuna (Sweden). Kiruna (Sweden). Linz (Austria). Saffle (Sweden). Schaerbeek (Brussels). Turku (Abo) (Finland).
244·1	Basle (Switzerland). Wilno (Poland).
242	Belfast (Ireland).
240·6	Stavanger (Norway).
240	Radio Beziers (France).
239	Nurnberg (Germany).
237·2	Bordeaux Sud - Ouest (France). Radio-Nimes (France).
237	Orebro (Sweden).
235·5	Christiansand (Norway).
235	Lodz (Poland).
232·2	Kiel (Germany) Norrkoping (Sweden).
231	Halsingborg (Sweden). Malmo (Sweden).
229	Uddevala (Sweden).
227	Aachen (Germany). Cologne (Germany). Munster (Germany).
224·4	Cork (6 C K) (Ireland).
219·9	Fécamp (Radio Normandie) (France).
218	Flensburg (Germany). Pori (Bjorneborg) (Finland). Salzburg (Austria).
217	Konigsberg (Germany).
216	Halmstad (Sweden). Radio Chatelineau (Belgium).
214·2	Warsaw No. 2 (Poland).
212·4	Palermo (Italy).
207	Boras (Sweden).
204	Gavle (Sweden).
203	Kristinehamn (Sweden).
202	Jonkoping (Sweden).
196	Karlskrona (Sweden).
175	St. Quentin (France).

A VISIT TO SAN SEBASTIAN

A reader and his daughter, now on holiday in Spain, describe how they paid a visit to the broadcasting station at San Sebastian.

PEGGY spotted it on our first day in San Sebastian. Peggy knows no more about wireless than the pseudo-expert twiddling of a reaction knob, but she seems to have a nose for wireless stations.

A Rude Awakening!

On the way down via Biarritz—a ghastly thirteen-hour train journey from Paris—she woke me up in the misty dawn to peep at the aerial masts of Bordeaux. I swore at her then, mildly. I still swear they were not aerial masts, but power-cable supports!

But she was undoubtedly right about San Sebastian. The broad bay of this town is to my mind one of the most picturesque sights in Europe, and as it opens out to sea there is on the left the Monte Igueldo with the tiny island of Santa Clara in front of it (so that the bay is almost a bottle-neck), and on the right the historic Castillo de la Mota.

On the top of the Igueldo is the transmitter of San Sebastian, and although the aerial is a tiny affair, Peggy spotted it when we first went down to the Plaza de la Concha to see the sea.

"Daddy, *do* let's go and see inside the studio," she begged. "They mightn't be so strict as the B.B.C., and we might even have the chance to *see* something!"

That heavy sarcasm referred to one evening when we were invited up to see Stainless broadcast from Savoy Hill, and were ushered in and out of the building like so many sheep!

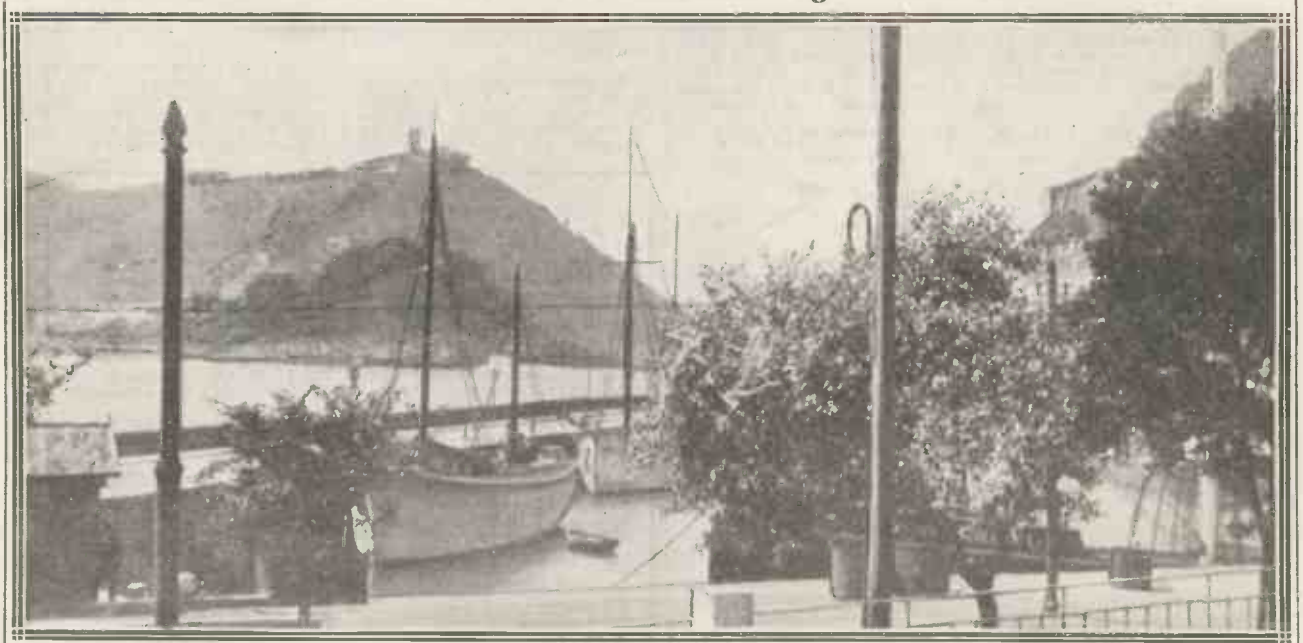
I hesitated. I didn't feel that my Spanish was strong enough for a job like that, and our "Spanish for All" concerned itself with porters, hotels, and tickets, and not with useful phrases such as "Please, señor, may we see round your wireless station?"

"He Who Hesitates—"

I should not have hesitated. He who hesitates, I know, is lost; and I lost that time. She wheedled me into promising to see what I could do.

And when we had seen the sights, the casino, the "plaza de toros" (bull-ring)—complete with fight and death of five bulls—the Rio Urumea and dozens of historic churches, I

San Sebastian's Station as Seen by "the Sebastians"



Right on the top of the hill in the distance is the San Sebastian station's aerial, thus situated centrally in one of the most picturesque scenes in Europe.

was weak enough to give up half a day to visiting E A J 8.

One of the men at the hotel made arrangements for us, and introduced us to an English-speaking official who could show us round. "English-speaking" was a gross over-exaggeration I found, but by dint of much hand-wagging and scrawling on scraps of paper we managed to find mutual understanding, and, by the end of the day, almost friendship!

then that we should have chosen a cooler day, or come up in the evening twilight!

On a "Common" Wave

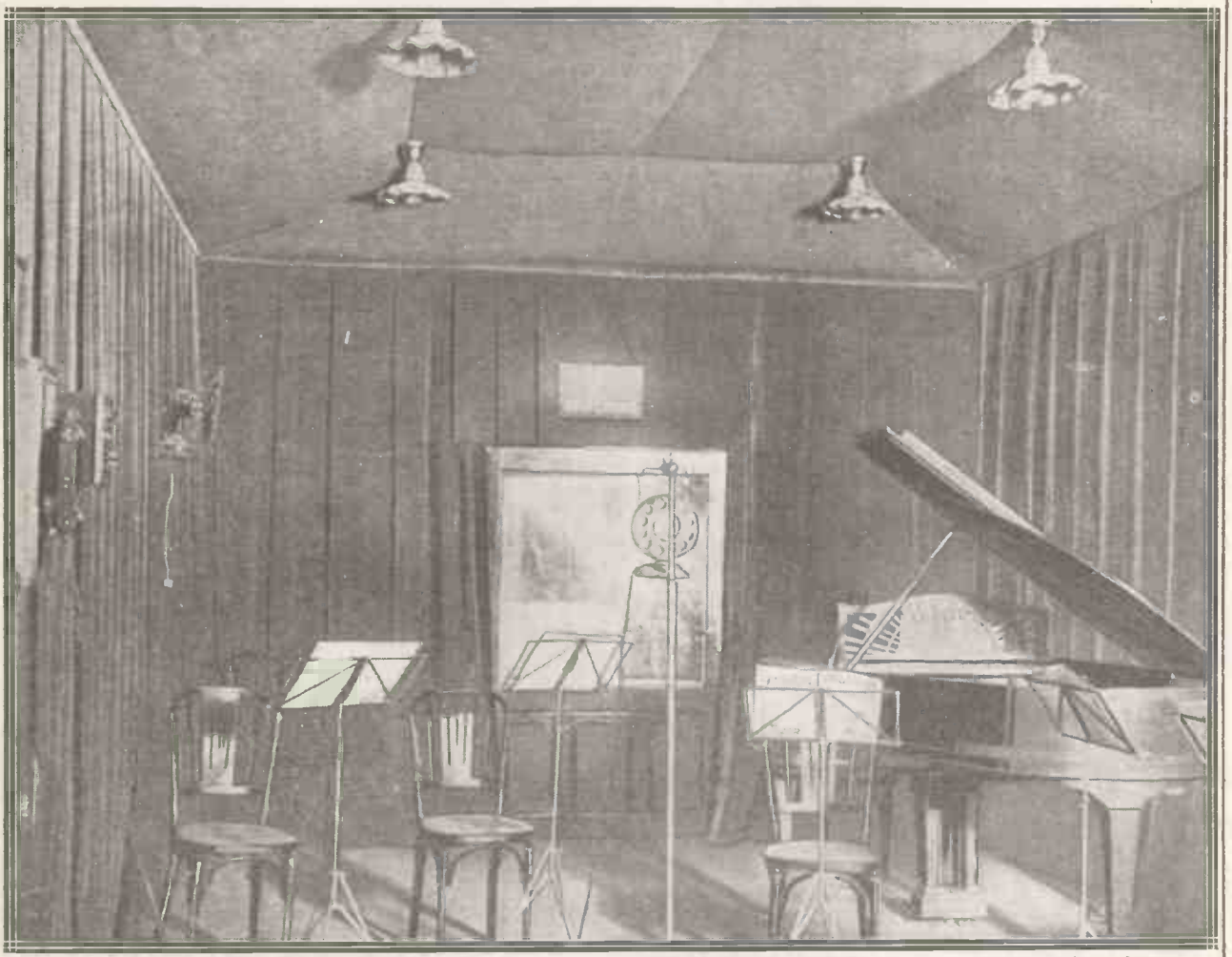
At last, Peggy, the E A J 8 official and I stood on top of the island edge and looked back from under the transmitting aerial to the town of San Sebastian. It reminded me of Brighton. It was much better to be in San Sebastian looking out to sea!

"Many of our bed-fellows are powerful stations, too. On the same wave-length there is our own Salamance, E A J 2 2, which is even more powerful than our station. There is Klagenfurt, in Austria. There is Danzig. There is Bolzano. There is Bodo, in Norway."

I made a note of these. With the exception of Danzig, these are not stations I have ever logged in London.

"These are not all powerful

Where All That "Tinkling" Music Comes From



"They are rather tight for space," the author says, but there certainly seems ample room in the main studio. Note the domed effect of the roof, to which he refers.

On the top of the Igueldo there is a castle-like building, under the shadow of which is the E A J 8 aerial. It seems so close that I, a fair swimmer, had one day vowed to trudgeon across the bay to the edge of Santa Clara and walk up to the station; but the distance was deceptive.

Actually, it took us half an hour in a decrepit taxi along the Campo de Ondarreta, and then on foot to the station building. That was a real half-hour's hard work. We realised

"It's a nice open site for the aerial," I said to the guide. "The station should have a good range."

"A good range, yes," he replied, "but great reception, no."

I looked surprised, and he hastened to explain.

"We work on 453·2 metres"—that he had to write down; he could not count in English, nor I in Spanish—"and there are many other stations on that wave-length, too."

He produced a notebook.

stations," continued our guide. "Salamance has one kilowatt, and Klagenfurt point six kilowatt. Fortunately, they do not all work quite on our 662 kilocycles; they vary from evening to evening. Some evenings we get good reception even in Madrid; but not often."

Peggy and I were taken in to see the transmitter; rather double-Dutch to us, but even Peggy was interested to see the massive power cables, the rectifiers changing the A.C. power to

A Gramophone Usually Provides the Programmes

direct current for the transmitter, and the actual oscillator valve which Peggy called the "transmitter," because she saw the aerial wires connected up near it, and in total disregard of all the other glowing glass bulbs in the outfit.

Then we went back to the studio. That interested us more.

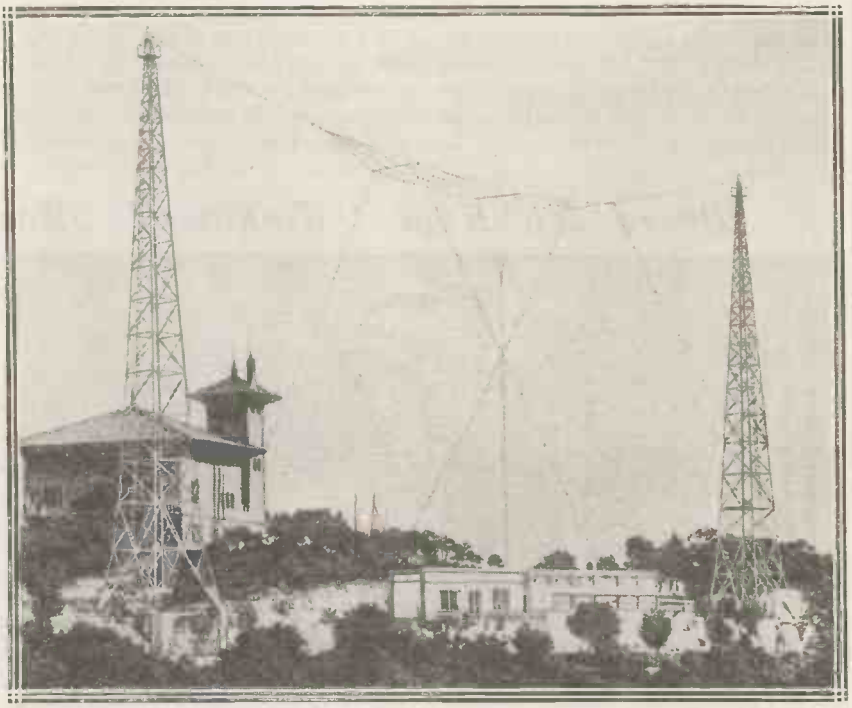
They are rather tight for space, and even the office 'phone has to be in the room with the microphone; but then this 'phone also connects up with the transmitter.

In the Studio

It is an ordinary square room of the usual office size which has been converted by hanging heavy drapings on the walls and door. It is not a low room, and the appearance of height has been strengthened by placing the draping on the ceiling so that there is a kind of "dome" effect, which I will not attempt to describe, but which is obvious from the photograph. Behind this draping are three layers of canvas and some felt packing.

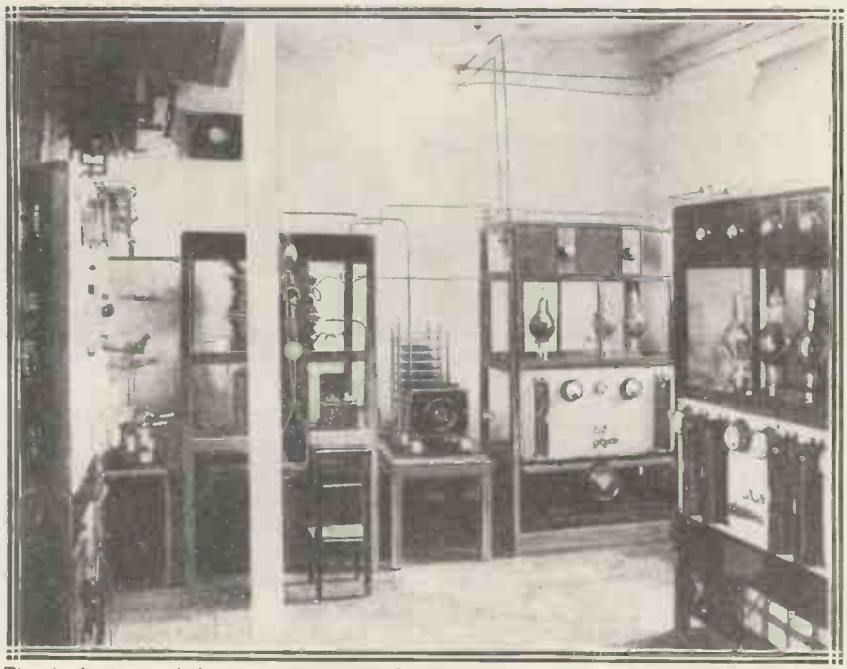
This makes the studio very stuffy, and the fan was out of order. I dread to think what it must be like after a prolonged spell of chamber music. There is accommodation for half a dozen artistes. A full-size grand piano is the main article of furniture.

SET IN PICTURESQUE SURROUNDINGS



Another Spanish station, Barcelona, E A J 1, which is situated on Mount Tibidabo, in the most picturesque surroundings it is possible to imagine. It works on a wave-length of 349 metres, and is often heard in this country.

A NEATLY-ARRANGED TRANSMITTER



This is the transmitting apparatus at the Seville station. It has a power of about 1½ kilowatts, and shares the wave-length of 368·1 metres with the powerful Helsinki station. For this reason it is audible in the British Isles only when the latter transmitter is closed down.

In the next room sits the engineer, and he can see what is going on through a large glass window. At his side is the electric gramophone, which, if I can believe what was told me at the hotel, usually provides the programmes.

Money is scarce for broadcasting in Spain, as for everything else. Our guide was a revolutionist. He pointed out from the station grounds what used to be the royal summer palace—a big building on the actual sea-front, overlooking E A J 8.

More Money Required

"At times we have had to close our station for lack of money," ventured the official. "There are all manner of expenses. Other stations find it hard, too.

"Radio Espana, E A J 2, in Madrid, has had a hard financial time, and has only just come back. Now that there is money for programmes, there is no wave-length! It has to share the wave-length of E A J 7, the old Madrid station.

He sounded almost pathetic. Peggy thanked him in her very best Spanish, and we set off on our journey back to the town.

DOWN BELOW FIFTY

Some helpful notes regarding short-wave stations and their peculiarities.

The chief trial of the listener to foreign stations on the ordinary broadcast wave-lengths is that he cannot always identify the station call, although it may be given frequently. The short-wave man is quite differently placed, for one short announcement would almost certainly give him a clue to the station. *His* trouble is that he sometimes has to wait for endless periods before the programme is interrupted for even two or three words in the way of announcement.

Easily Identified

Whereas on the ordinary band we have stations broadcasting in several languages that sound somewhat similar to anyone not experienced as a linguist, we have, on the short waves, a limited number of stations arranged in groups. For instance, in the group round about 31 metres there is Sydney (Australia), PCJ (Holland), the Zeesen station, the Danish relay of Copenhagen, and the Americans, W1XAZ and W2XAF.

* * *

We cannot say, if we hear two stations transmitting music, where they may be situated, since the strength of the transmission has so little bearing on its distance. The weak one may turn out to be German, while the one that rattles the 'phones is coming from the other side of the Atlantic.

* * *

Thus the best method to use is to be patient and identify at least one station in each group, thus giving us a rough calibration of the receiver; then from this we can generally tell what the other stations are. The only help necessary is a list of short-wave broadcasting stations, and this is published in "M.W." from time to time, and also appears in the various journals intended especially for short-wave fans.

In the 31-metre group, for instance, leaving out many small stations that only come in on "freak" occasions, we have OXY (Denmark) at the top, using a wave of 31·51 metres. A mere fraction below him is W2XAF (Schenectady), on 31·43. Lower still we find Zeesen, on 31·38, and almost "touching" him, on 31·35, is Sydney. Establish one of these, and even if all four are on together you can at least hazard a guess about the others.

* * *

Similarly, with the bunch near 25 metres. Unless the French station at Pontoise is on (and he is usually rather weak), the "top limit" is our own station 5SW, at Chelmsford. He works on 25·53 metres.

Next to him, tuning downwards, is Rome, on 25·4 The latter station is nearly always the strongest in this group, at least in England. A fair step below this is W8XK, who is, of course, the short-wave edition of the famous KDKA. His wave is 25·25. If you find a small station in between him and Rome it may be either Chicago (W9XAA, 25·34) or Calcutta (VUC, 25·27).

A Lonely "Yank"

Below 20 metres W2XAD stands out more or less as a solitary lighthouse. He works on 19·56 metres, announces frequently, and is often the only station audible in that part of the wave-length scale. Like all the Americans, he uses the full announcement formula—"This is station W2XAD, Schenectady, New York, transmitting the WGY programme on 19·56 metres." Further, every night at about 10·30 p.m. he gives the programme schedule for two days ahead first on Morse and then by telephony.

"A WEIGHT ON HIS CHEST!"

This German outside broadcast announcer carries the microphone slung round his shoulders.

PROGRAMMES FROM U.S.A.

When the American short-wave stations are coming over well they are always well worth listening to. Contrary to the general opinion of their programmes, advertising, in its more blatant forms, takes a very small part indeed. The big national advertisers bind their names with some turn which people will look forward to from day to day, and do not "push" themselves any more than that.

* * *

Anyone who has listened to W2XAD or W2XAF for any length of time will have been impressed by the extraordinary popularity of Gilbert and Sullivan. The listeners in the States certainly hear far more of their works than we are ever allowed in this country. Quite recently we heard a performance of "H.M.S. Pinafore" from W2XAD, broken into by quite delightful announcements explaining the changes of scene and the songs.

These announcements certainly added to the enjoyment rather than detracting from it.

Programme Particulars

Unless the programme schedule has been radically changed before this appears in print, the following are some of the items that are regularly given from W2XAD, on 19·56 metres, and W2XAF, on 31·43 metres. Times are given in *Greenwich* time, to avoid confusion.

9 p.m. News Bulletin, followed by "The Musical Ad. Men," a short and varied musical turn.

9.45 p.m., the "Tea Timers," from New York.

10.45 to 11 p.m., "The Stebbins Boys," a very humorous act.

11.45 p.m., "Trials of the Goldbergs."

2 a.m., Eastman Kodak programme.

2.30 a.m., R.K.O. programme.

3.30 to 4 a.m., Vincent Lopez Orchestra.

These items are not necessarily to be heard on *every* day of the week, but at least on one day. Several of them are, however, regular daily features. Incidentally, W2XAD stops at 11 p.m., G.M.T., and W2XAF carries on through the small hours.

SHE SPEAKS FROM POLAND

Most short-wave listeners know this lady's voice from Poznan, Poland, on 31·35 metres. She is Frau Krygier Bernecke.

ON THE "OUTSIDE" WAVES

Considerable use of the waves below ten metres has been prophesied of late. Read all about them below.

The honour of being the broadcasting station with the shortest wave-length on the official lists goes to Moscow, RW61, who is said to be transmitting on 5·8 metres. He has not yet been heard in this country, and in any case a transmission on a wave-length of this order is not likely to reach us.

* * *

A Berlin transmitter operates on 7·05 metres, and next in the scale is the Amsterdam station, PF-1PH, now giving regular programmes on 7·85 metres.

The Ultra-Short "Shorts"!

We already allude to wave-lengths of the order of 20 metres as "ultra-short" waves, so that unless we adopt some suggestion similar to that given in these pages two months ago we are rather stumped for a description of 7 metres. Perhaps "plus-ultra" or "hyper-ultra" will have to be called into commission, in spite of their resemblance to the preliminary advertisements for the talkies.

* * *

Wave-lengths round about 10 metres have already covered most of the world. British amateurs alone have worked all continents except Australasia using this very short band. When conditions were good for this work, the United States stations were heard as well on 10 metres as they have ever been on "20" or "40."

* * *

Ten metres is also a good wave for local work, and signals, for instance, across London on this wave are very reliable and quite strong.

* * *

Five metres is a different tale, and although up to a range of a few miles the signals *can be* very strong indeed, they are apt to vary suddenly with conditions. Probably 7 metres, which seems to have been adopted as one of the most likely pitches for short-distance broadcasting, is eminently suitable for the job.

* * *

Incidentally, it is amusing to note that our present broadcasting band (200 to 600 metres, or 1,000 kc.) could be accommodated more than seven times between 6 metres and 7 metres. The frequencies corresponding to the latter waves are 50,000 kc. and 42,857 kc., giving a band width of 7,143 kc. Between 5 metres and 10 metres there is a band width of 30,000 kc. When we consider that the entire radio band from 200 metres up to the longest wave-length used (20,000 metres or so) is only about 1,500 kc. wide, we begin to see the advantages of these very short waves.

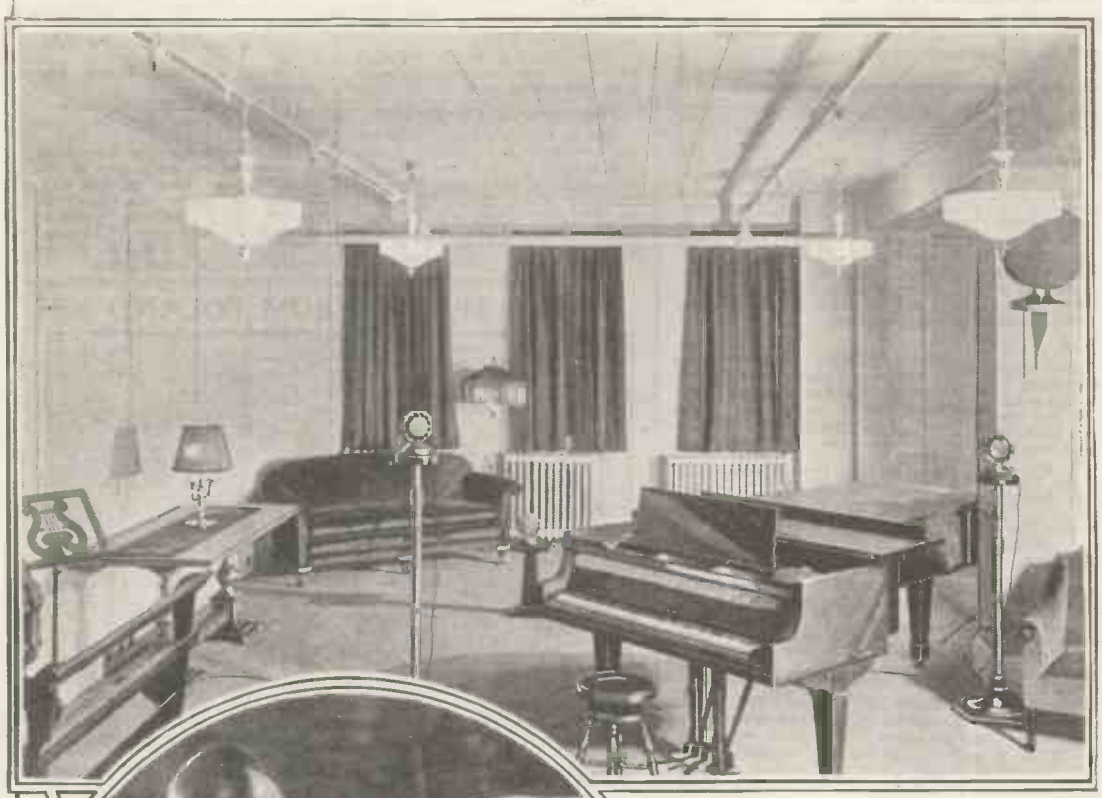
Sets of the Future

A vision of the broadcast receiver of the future becomes rather terrifying if we allow ourselves to think of the 5- and 10-metre receivers that have been illustrated from time to time. Actually, however, if these wave-lengths were used to any extent a great simplification in the general run of receivers would almost certainly be the result.

* * *

For one thing, H.F. amplification is so difficult to obtain at these frequencies that it would probably not be attempted. Again, the carrying distance of the stations would be so small that a large number of low-powered transmitters would probably be used, and great sensitivity in the receiver would be unnecessary.

Broadcasting in Baltimore

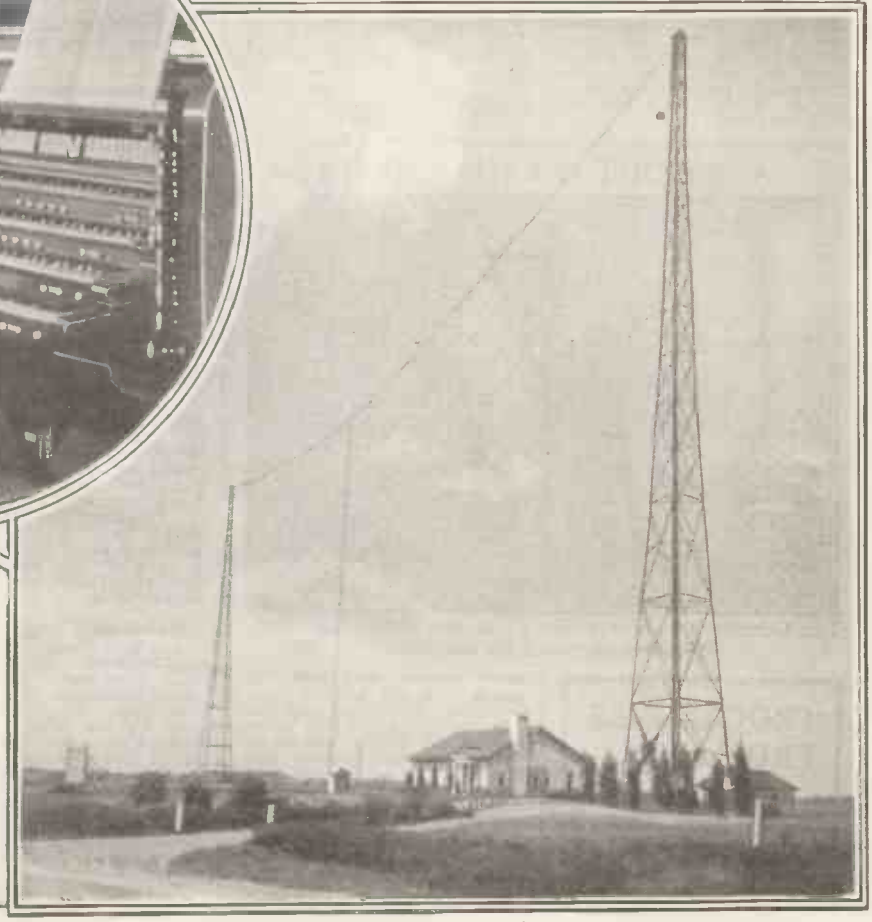


This is the main studio in the WBAL, Baltimore-Ohio station.

Note how the walls and the ceiling are quite free from draping, with the exception of the three window curtains.

Two ordinary microphones will be seen near the piano, and between it and the radiator behind is another microphone of the "low-down" variety, to pick up sounds from nearer the floor.

In the circle is shown a photograph of John Eltermann, WBAL's organist, who broadcasts a regular weekly feature of organ music which is very popular.



To the right is a general view of the transmitting station located at Glen Morris, twenty miles from the heart of Baltimore itself.

ARE AMERICAN STATIONS BETTER THAN OURS?

If you have ever asked this question, read what an "M W." correspondent experienced on visiting W B A L, and judge for yourself.

New York is, of course, a vast and affluent place, and the Columbia and N.B.C. headquarters there certainly put our Broadcasting House to shame. But this is not a typical comparison. All over the country are small stations, comparable in size with B.B.C. stations.

A Typical Station

Before I visited America I wanted to know how these really did compare in efficiency and programmes with British standards, and I eagerly took the opportunity when I spent a week in Baltimore of visiting the

"HALLO, EVERYBODY!"

American announcers favour the personal touch, and frequently give their own names so that their hearers shall feel there is a real man in the studio and not a mere voice.

local Baltimore station, W B A L. Let me describe it.

The studio is in the heart of the business section of Baltimore, and the transmitter is in open country on one of the main motor roads about twenty miles out at Glen Morris. The transmitter building is a stucco affair, looking rather like a country club, placed directly under the two 200-ft. steel towers which carry the aerial.

The transmitter is designed chiefly for the residents in Baltimore, and they get very good reception, because the station site is 660 ft. higher than the centre of the city.

Well Flood-Lighted

The W B A L people own a large amount of ground around the transmitter, and they have fitted up a battery of white flood-lights to make the station appear to be a blaze of light at night. When I first saw the station, which was at night-time, I thought it was an advertising display.

The main drive up to the entrance of the transmitter building passes a little watchman's hut out in the ground which encloses the aerial transformer, so that the lead-in from the aerial above can be taken from the exact centre and go down at right angles to this transformer apparatus. A horizontal lead on a long pole carries the H.F. input to the transformer itself.

The Speech Amplifiers

A notice-board announces to all passers-by that "This is W B A L's high-power station."

There is a small entrance hall, and then one goes straight into the control-room. Here, on two panels, looking very much like the speech amplifiers of the talkie gear in a cinema, are the low-frequency amplifiers which boost up the programme energy on the land-line from the studio.

The amplifiers are contained in metal cases which slip into the panel frames and carry spring sockets at the back. These serve two purposes.

Quickly Changed Sections

For one thing, if it is necessary to examine the back of the amplifier gear, the power is automatically cut off as the cases are withdrawn. Secondly, in case of breakdown, it is a matter of only a minute or two to slip in another amplifier section.

I noticed that this initial amplifier equipment is mostly mains-driven, but dry batteries are used for grid

THE SPEECH INPUT

In this corner the weak microphone currents from the studio land-line receive their first "boost"

Plenty of Music—No "Uplift" Talks

bias and similar purposes in the first stages, where absolute silence of operation is essential. The valves are enclosed, too, in the metal boxes, and the big power valves which have to project out from the front of the panels are shrouded with copper gauze screens so that there is no coupling between the stages.

The Control Apparatus

There is the usual control desk with volume and tone controls, and the engineer in charge has a battery of 'phones linking up with various parts of the transmitter building and with the studio back in town.

He has a cone speaker in the corner which can be switched on to give a rough idea of the quality, and he also has a microphone on which it is possible to make emergency announcements between programmes.

The transmitter is a 10-kilowatt job, not a very high power as American transmitters go, but it covers a big range because of the fine aerial position. It made me think of Slaithwaite's 70 kilowatts.

Safety Gates

There is not much to see in the actual transmitter room. All the high-voltage gear is carried behind safety cabinets, and one can walk between "avenues" of high-voltage condensers and anode connector points in perfect safety because the power is cut off while the gates are open.

Wave-length Adjustments

The leads carrying the current from the apparatus on one side of the pathway between the transmitter to the gear on the other side are carried above head level and are copper tubes supported on ribbed insulators.

There are controls on the outside of the panels, but the transmitter is, of course, controlled as regards its wave-length, and only occasional adjustment is necessary.

Every morning an engineer checks up the the wave-length and sees that all the voltages are correct. The power, of course, comes from the mains via step-up transformers, but ordinary receiver-type high-tension batteries provide the grid bias in cases where this is not much above 100 volts or so.

There are fuses everywhere, much more so than is customary in B.B.C. transmitters, and I see that they have adopted the scheme, now universal in American cars, of colouring and numbering each connecting lead so that in the case of a circuit breakdown the work of tracing out each part of a transmitter is greatly simplified.

THE RECEPTION ROOM AT WBAL

This is a part of the reception room where the nervous broadcaster-to-be is welcomed and set at his ease before he meets the mike.

Back in the city one gets rather a different idea of the Baltimore transmitter. There are two studios and the W B A L offices in a twenty-storey building in Baltimore's business section.

Everything is on rather a lavish scale, although, as the studios are fitted up in what is normally office accommodation, they are not spacious. There is a cosy reception-room which rather puts into the shade the way the B.B.C. does these things, and this is flooded with music relayed from the transmitter.

A Studio Organ

The main studio one might almost call typically British, for it is fairly low-roofed, and is furnished in a straightforward manner. A small organ is fitted in one of the studios, and there is also a loud speaker which can be switched on when the other studio is being used and the waiting artistes want to get their "cue."

There is a surprising amount of wireless gear at the studio end, and most of the actual control work is done here on the initial speech amplifiers.

Midget Transformers

Facing into each studio is a glass window through which the control man can signal. This does away with the rather complicated system of warning lines which are used in several American stations.

There are a number of land-lines available between the studios and Glen Morris, and the amplifier gear in the control-room, which is made by Western Electric, is surprisingly elaborate. There are meters in practically every circuit, and even the heavy power units—the filament transformers and so on—are of midget construction owing to the use of new alloys for the cores. These, I am told, will later be used for talkie film work.

Good Programmes

Programmes from W B A L are, if one may judge by what I heard during a week's stay, rather above the average—taking the big sponsored programme combines as an example. There is a fair amount of "heavy" music, but no B.B.C. style educational talks.

RADIO PICTURES

ADMIRALTY ORDERS.

The Admiralty sets us all a good example by periodically overhauling its aerials and insulators. These men are working on the Whitehall mast.

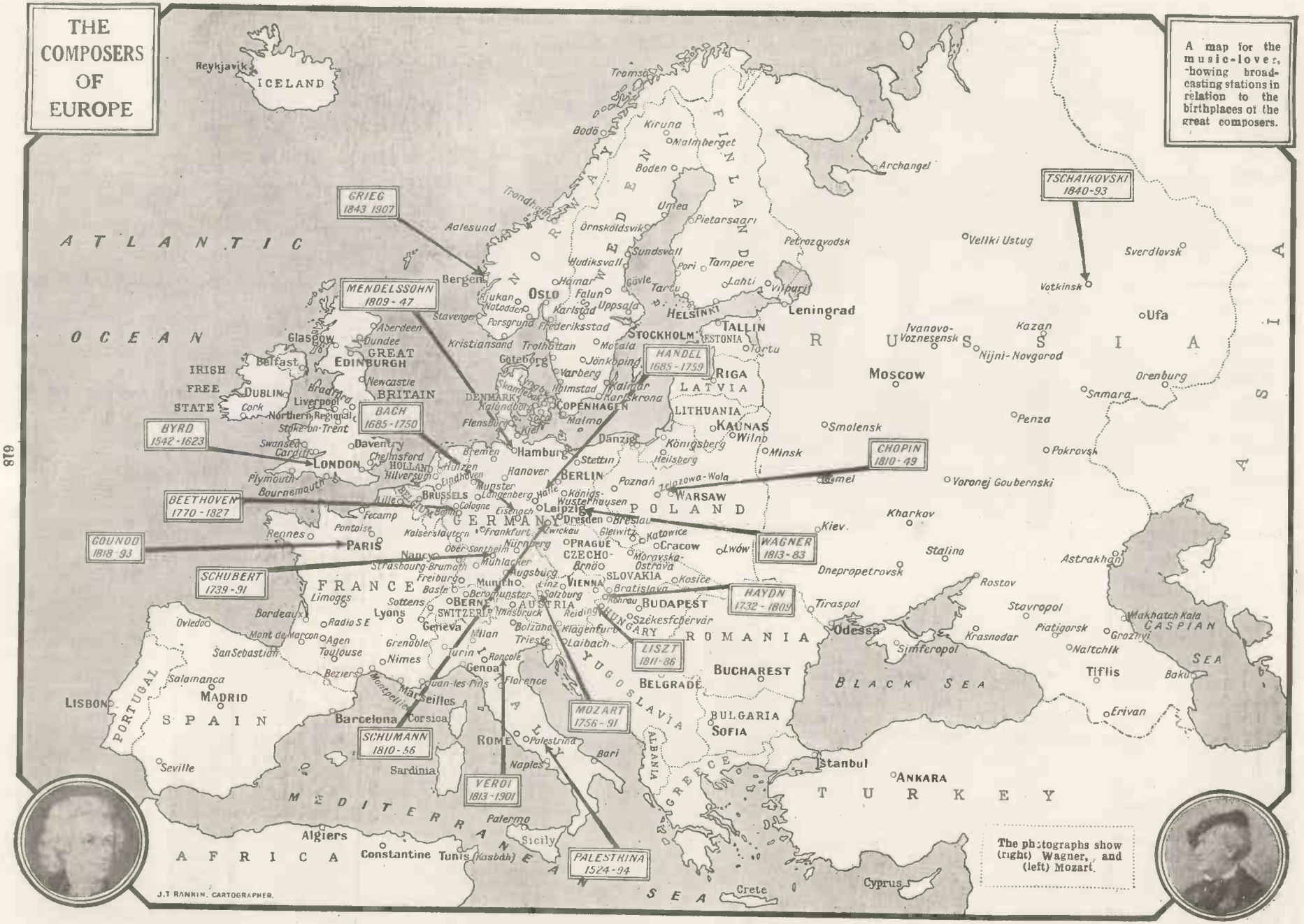
WHERE WIRELESS WAS CONCEIVED. A replica of Faraday's laboratory in which he investigated electro-magnetism.

THE WAR ON PIRACY.

The G.P.O. vans shown above are specially fitted to detect wireless sets, and are being used in connection with the latest drive against unlicensed listeners.

RADIO EDUCATION IN GERMANY.

A loud-speaker class in the Fredrich Ebert School, Luckenwalde. In this school sand-covered playgrounds are used so that the children can play in bare feet, after which they enjoy hot and cold shower-baths !


THE COMPOSERS OF EUROPE
A map for the music-lover, showing broadcasting stations in relation to the birthplaces of the great composers.
GRIEG 1843 1907
MENDELSSOHN 1809 - 47
BACH 1685 - 1750
BYRD 1542 - 1623
BEETHOVEN 1770 - 1827
GOUNOD 1818 - 93
SCHUBERT 1739 - 91
SCHUMANN 1810 - 56
VERDI 1813 - 1901
PALESTRINA 1524 - 94
MOZART 1756 - 91
LISZT 1811 - 86
HAYDN 1732 - 1809
HANDEL 1685 - 1759
CHOPIN 1810 - 49
WAGNER 1813 - 83
TSCHAIKOVSKI 1840 - 93
ATLANTIC OCEAN
IRISH FREE STATE
GREAT BRITAIN
FRANCE
SPAIN
PORTUGAL
GERMANY
HOLLAND
BELGIUM
DENMARK
NORWAY
SWEDEN
FINLAND
RUSSIA
POLAND
LATVIA
LITHUANIA
ESTONIA
CZECHO-SLOVAKIA
AUSTRIA
HUNGARY
SWITZERLAND
ITALY
YUGOSLAVIA
ALBANIA
GREECE
ROMANIA
BULGARIA
TURKEY
MEDITERRANEAN SEA
BLACK SEA
CASPIAN SEA
AFRICA
Reykjavik
ICELAND
Tromsö
Bodö
Kiruna
Malmberget
Archangel
Boden
Umea
Pietarsaari
Aalesund
Örnsköldsvik
Sundsvall
Hudiksvall
Petrozavodsk
Velliki Ustug
Sverdlovsk
Votkinsk
Ufa
Bergen
Oslo
Hamar
Gävle
Tampere
Pori
Lahti
Vyborg
Leningrad
Helsinki
Tallin
Tartu
Stockholm
Ivanovo-Voznesensk
Kazan
Nijni-Novgorod
Moscow
Orenburg
Samara
Penza
Smolensk
Pokrovsk
Voronej Goubernski
Kharkov
Kiev
Astrakhan
Stalino
Dnepropetrovsk
Rostov
Tiraspol
Stavropol
Odessa
Krasnodar
Simferopol
Piatigorsk
Grozny
Naltchik
Makhatch Kala
Tiflis
Baku
Erivan
Istanbul
ANKARA
Aberdeen
Dundee
Glasgow
Belfast
Dublin
Cork
Liverpool
Bradford
Newcastle
Northern Regional
Stoke-on-Trent
Swansea
Cardiff
Daventry
Chelmsford
LONDON
Plymouth
Bournemouth
Stavanger
Porsgrund
Frederiksstad
Kristiansand
Trollhättan
Göteborg
Jönköping
Varberg
Halmstad
Karlskrona
Malmö
Skamlebaek
Kalundborg
Flensburg
Kiel
Bremen
Hamburg
Hanover
Stettin
Danzig
Königsberg
Heilsberg
Minsk
Wilno
KAUNAS
Grodno
Poznań
Zelazowa-Wola
Warsaw
BERLIN
Hilversum
Eindhoven
Hilversum
Münster
Langenberg
Hulzen
Brussels
Lille
Cologne
Bonn
Leipzig
Dresden
Breslau
Eisenach
Frankfurt
Zwickau
Gleiwitz
Katowice
Cracow
Lwów
Prague
Morovska-Ostrava
Brno
Pontoise
Fecamp
Rennes
PARIS
Kaiserslautern
Nancy
Strasbourg
Brumath
Freiburg
Basle
Munich
Augsburg
Linz
Vienna
Bratislava
Kosice
Budapest
Székesfehérvár
Limoges
Bordeaux
Lyons
Sottens
Bern
Innsbruck
Salzburg
Reichenau
Klagenfurt
Laibach
Trieste
Milan
Turin
Roncole
Genoa
Florence
Geneva
Grenoble
Nimes
Agen
Toulouse
Radio S E
Mont de Marcon
Oviedo
San Sebastian
Beziers
Montpellier
Marseilles
Juan-les-Pins
Barcelona
Corsica
Sardinia
Salamanca
MADRID
LISBON
Seville
Rome
Palestrina
Naples
Bari
Palermo
Sicily
Algiers
Constantine
Tunis (Kasbah)
Crete
Cyprus
Belgrade
Bucharest
Sofia
The photographs show (right) Wagner, and (left) Mozart.
J.T RANKIN. CARTOGRAPHER.

ECKERSLEY designed this set— KENDALL chose the components for the Ready Radio Kit

MATCHED KITS for the "ECKERSLEY" THREE

Kit "A" (less valves and cabinet)

£5:13:6

OR BY EASY PAYMENTS

10/6 down and 11 monthly payments of 10/6.

Kit "B" (with valves, less cabinet)

£7:1:0

OR BY EASY PAYMENTS

13/- down and 11 monthly payments of 13/-.

Kit "C" (with valves and cabinet)

£7:18:6

OR BY EASY PAYMENTS

14/6 down and 11 monthly payments of 14/6.

APPROVED LIST for the "ECKERSLEY" THREE

	£	s.	d.
1 Panel, 18" × 7", drilled to specification		5	6
1 Waldor cabinet, 18" × 7" × 10", as specified		17	6
2 Lotus ·0005 variable condensers		7	0
1 ReadiRad ·00015 differential condensers		2	6
1 Sovercign ·0003 max. compression condenser, type J		1	3
1 Bulgin change-over switch, type S.81		2	0
1 Bulgin double pole "on/off" switch, type S.88		2	9
1 Wearite double-pole rotary switch, 1-22, with terminals		4	0
1 Lewcos 100,000-ohm spaghetti resistance		1	6
1 Lewcos 25,000-ohm spaghetti resistance		1	6
1 Lewcos 5,000-ohm. spaghetti resistance		1	0
2 Lewcos 10,000-ohm Spaghetti resistances		2	0
1 ReadiRad 2-meg. grid leak and holder		1	4
3 Junit valve holders		2	0
1 T.C.C. ·01 fixed condenser, type S		2	6
1 T.C.C. ·0003 fixed condenser, type S		1	3
3 T.C.C. ·0005 fixed condensers, type 34		4	6
3 T.C.C. 2-mfd. fixed condensers, type 50		11	6
1 ReadiRad Standard H.F. Choke		4	6
1 Lotus 30-henry L.F. choke		15	0
1 Eckersley Tuner		15	6
1 Lotus single circuit jack, J.k.1		2	0
1 Terminal strip, 18" × 2" drilled to specification		1	9
9 Belling-Lee terminals, type R		2	3
2 Spade terminals			3
1 Aluminium screen, 6" × 3"		1	6
1 Packet Jiffilinx, for wiring		2	6
3 Valves as specified: 1/P.M.2 D.X., 1/P.M.1 L.F., 1/P.M.2	1	7	6
7 Belling-Lee wander plugs		1	2
1 R.I. Dux transformer		6	9
1 ReadiRad ·5-megohm volume-control		5	9
Flex, screws, etc.			6
	£7	18	6

Any component can be supplied separately.

Every Ready Radio Kit is composed of chosen components which have been tested and passed before dispatch under the supervision of Mr. G. P. Kendall, B.Sc., Chief Engineer Ready Radio, for many years Chief of Research for "Popular Wireless" and "Modern Wireless." By building your receiver with a Ready Radio Tested Kit you are consequently assured of the finest possible results obtainable from the circuit of your choice.

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To READY RADIO LTD., Eastnor House, Blackheath, S.E.3.

Please dispatch to me at once the following goods.....

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for which { (a) I enclose / (b) I will pay on delivery } (*Cross out line not applicable*) £.....

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..... M.W.12/31

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Please dispatch to me the following goods .....

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Advt. of Ready Radio Ltd

Trouble Tracking

On this page the Chief of the "M.W." Query Dept. discusses, month by month, some of those common difficulties and troubles which can be so perplexing. This month he gives some further hints on distortion and its remedies.

I MENTIONED a number of common causes of distortion on this page last month. I said nothing about stray H.F. currents getting through into the L.F. side—a common trouble in these days when powerful high-frequency amplifiers are used.

The trouble is very liable to occur with sets incorporating resistance coupling, and any H.F. in the detector anode circuit may easily be amplified up by the R.C. stage and passed through into the output circuit.

Stopping H.F.

How can we stop these H.F. currents from wandering? One of the best methods is to insert a ·25-megohm grid leak between the grid of the L.F. valve and the coupling condenser.

An H.F. choke is also effective, but a more expensive remedy.

In the plate circuit of the detector valve itself it is usual to employ an H.F. choke for reaction purposes. It is sometimes a good plan to shunt this choke with two ·0001-mfd. condensers in series, joining the mid-point between the condensers to earth.

All these schemes, however, will be of little value if the layout is a bad one. I have seen sets in which the L.F. and H.F. sides were arranged side by side with no screening between them. The output ends of these receivers had been placed in close proximity to the aerial portions, and then the owners have wondered why there is difficulty in stabilising the set.

A Practical Demonstration

I once built a compact design which taught me in a practical manner the importance of isolating the pre-detector and post-detector portions of a set.

There were two H.F. stages, and these were arranged in copper screening boxes; in fact, the first three valves were almost completely screened.

In order to economise in baseboard and cabinet size I placed the two R.C. stages alongside the H.F. portion.

Nothing would stabilise the set, although the two H.F. stages were in themselves perfectly stable, as was proved by tests with the L.F. side disconnected.

H.F. stopping resistances in each L.F. valve grid lead partly remedied the trouble, but a re-arrangement of the layout on conventional lines completely cured the instability.

This shows the importance of a good layout.

Use It Properly

I notice that pentodes appear to be causing a certain amount of trouble in some cases. This is chiefly because they are often used by listeners who do not carry out the makers' instructions. The pentode valve, when employed in a suitable circuit, gives splendid results without any instability whatsoever. But if you use it *after* two transformer L.F. stages you are not only liable to get howling, but you will also overload the output stage.

The latest battery pentodes will give an output of something approaching 800–1,000 milli-watts, but you mustn't ask them to carry the grid swing of a very low impedance super-power valve. The pentode is a steep-slope valve, and its undistorted output is obtained from a comparatively small grid sweep, about 18 volts maximum, which means a negative grid voltage of about 9.

A grid swing of this magnitude is obtained from one transformer stage or two low-magnification R.C. stages, and a volume control of some kind is practically essential.

Unsuitable Output Circuits

Moreover, the L.F. side must be a good one, otherwise you will get peaks at certain frequencies, with the result that the valve will overload if it is being worked at its maximum output.

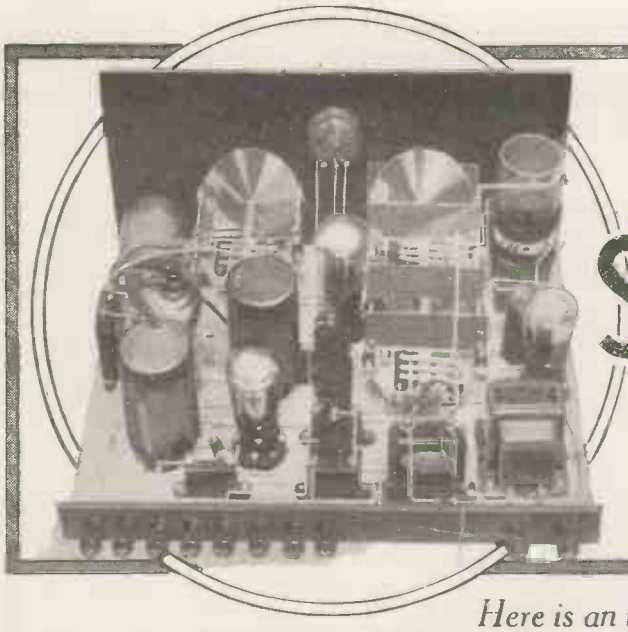
This, of course, applies equally to any other type of output valve, but when the grid swing is small there is very little margin of safety.

I am afraid that many listeners do not achieve the results they aim at owing to unsuitable output circuits. The maximum undistorted output of a valve at a given frequency is obtained when the impedance of the load in the anode circuit is equal to twice the impedance of the valve. In the case of a pentode this entails the use of a proper output transformer or choke.

Eliminating Heterodynes

These chokes and transformers are readily obtainable these days and so there is no excuse for those who are employing unsuitable components.

It may be desirable to connect an impedance equaliser across the choke or transformer primary, and that can also act as a tone control. The scheme comprises a resistance and condenser in series, the condenser value being about ·01 mfd. and the resistance variable up to, say, 25,000 ohms.



YOUR SUPER-QUAD

Here is an interesting article on the most fascinating series of sets that have ever been described. It deals with many of the points raised by the home constructor as to the whys and wherefores of super-het construction and operation.

By K. D. ROGERS.

WITH the October number of MODERN WIRELESS began the publication of a series of three super-heterodyne receivers based on the famous "Super-Quad" circuit.

Three Fine Sets

This series has not yet been completed, but two of the sets have been released, and the third will follow very shortly, and will, I think, be the most interesting of the three.

Those of our readers who have been following these sets will recall that, so far, a battery and an A.C. "Super-Quad" have been described—leaving, of course, a D.C. model to complete the range.

It is not of this latter set that I am writing, however interesting as is its history, but of super-hets in general and the "Super-Quad" series in particular.

The super-heterodyne receiver used to be popular in this country—it originated in the United States—some five years ago. It then died out, and for years it was looked upon more or less with disdain as a tricky contraption that was not worth the candle.

"If the Yanks like it, let 'em have it!" was the tone of the radio section of the British community. And to a certain extent they were right.

In those days the H.F. side of the super was a veritable demon to get operating properly. It had to be neutralised, and even then the magnification was not particularly great, though the stability of the receiver was fairly good.

But the trouble of getting the intermediates properly neutralised was quite sufficient to put the home constructor off making such a set, and with the vagaries of the valves of the period it was a difficult matter to get a supply of good matched specimens.

Laying Dormant

So the super fell out of favour, and most people thought they had heard the last of it. It was with regret that the radio enthusiast said "good-bye," for once working properly the super could do wonders. The difficulty lay in getting it to operate properly.

WHAT WAS USED IN THE "M.W." "SUPER-QUAD"

PANEL
16 × 8 in. (Permcol, or Wearite, Goltone, Peto-Scott).

CABINET
Panel space 18 × 8 in., baseboard 12 in. deep (Pickett, or Cameo, Osborn, Peto-Scott, Ready Radio).

EXTENSERS
1 Double-gang ·0005-mfd. Extenser with insulated cam, and disc drive (Cyldon).
1 Single-disc-drive Extenser with metal cam (Cyldon).

SWITCH
1 Double-pole toggle switch (Bulgin).

RESISTANCES
1 25,000-ohm Spaghetti (Ready Radio, or Magnum, Telsen, Peto Scott, Bulgin, Varley Graham Farish, Lewcos).
1 2-meg. grid leak with wire connector or terminals (Igranic, or Graham Farish). (Other makes with holder can be used, such as Telsen, Ediswan, Dubilier, Ferranti, Mullard, Ready Radio, Watmel.)
1 50,000-ohm potentiometer (Sovereign, or Regentone, Varley, Magnum).

VALVE HOLDERS
5 4-pin holders (Lotus for valves, and Bulgin for intermediate coils, or Telsen, Clix, Formo, Igranic, Wearite).
1 5-pin holder (Lotus, etc.).

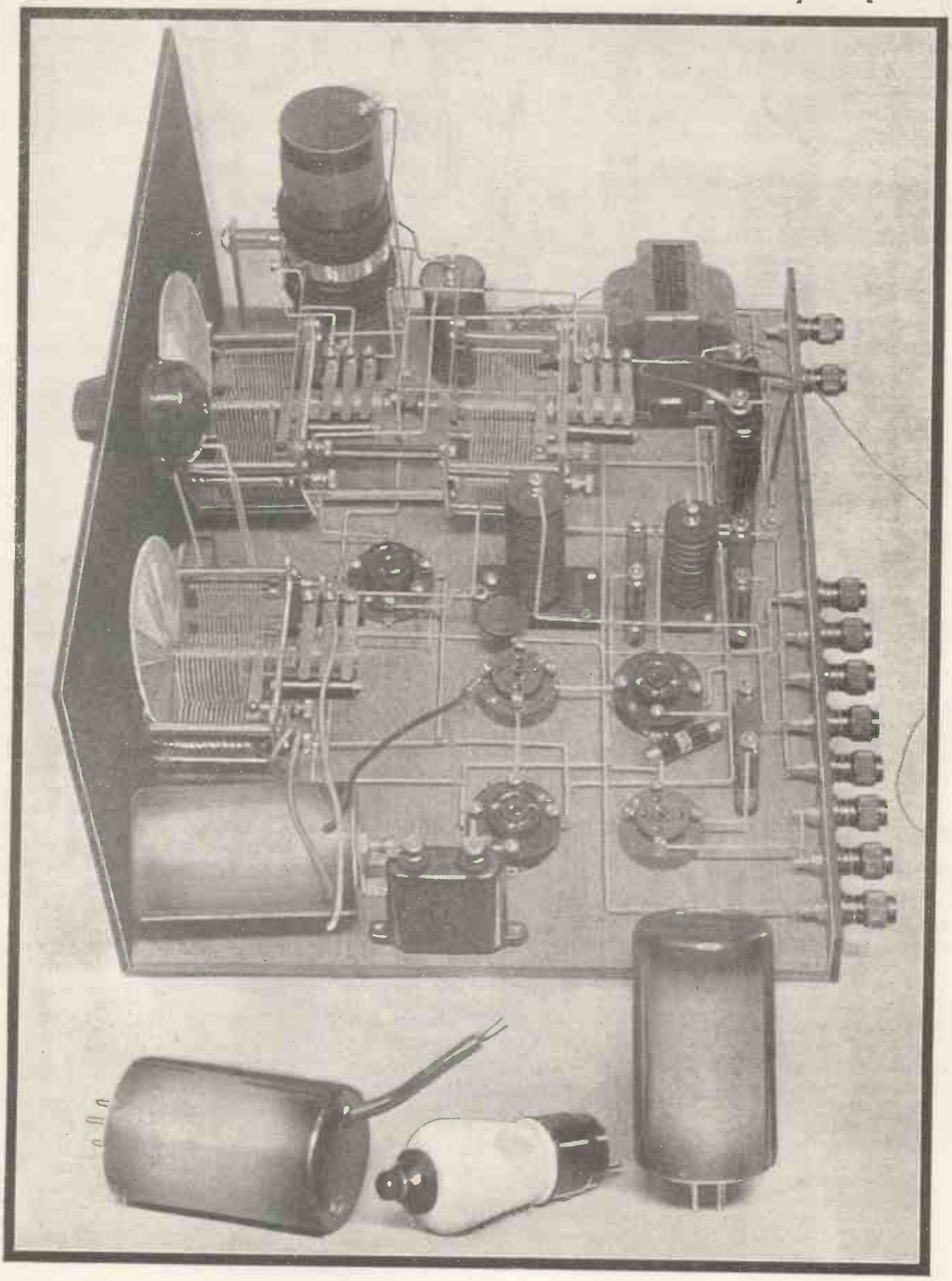
FIXED CONDENSERS
1 ·0002-mfd. (T.C.C., or Telsen, Ready Radio, Goltone, Ferranti, Igranic, Lissen, Ediswan, Mullard, Dubilier).
3 ·001-mfd. (T.C.C. and Formo, etc.).
1 2-mfd. (Ferranti, or Telsen, Peto-Scott, Mullard, T.C.C., Dubilier, Helsby).
1 1-mfd. (Dubilier, etc.).
1 ·04-mfd. special non-inductive (Dubilier).

CHOKES AND COILS
2 H.F. (Ready Radio and Lewcos, or Telsen, Varley, R.I., Wearite, Peto-Scott, Magnum, Dubilier, Lotus).
1 Square Peak Extenser coil (Varley).
1 Oscillator coupler (Ex.Osc.126) (Lewcos, or Wearite), with baseboard-mounting bracket.
2 Bandpass intermediate (1 I.F.T.126, and 1 I.F.T.P.126, Lewcos).

TRANSFORMER
1 L.F. (Telsen, or Ferranti, Igranic, R.I., Varley, Lewcos, Lotus, Goltone, Formo, Atlas).

MISCELLANEOUS
1 Terminal strip, 16 × 1½ or 2 in.
10 Indicating terminals (Belling & Lee, or Igranic, Clix, Eelex, Goltone).
G.B., H.T. and L.T. plugs, etc. (Eelex, Belling & Lee, Clix, Igranic).
Flex, Glazite or Lacoline, screws, etc.

The Finest "Four" of the Season—The "M. W." "Super Quad"



But, as has been said before in these columns, the coming of the screened-grid valve changed the outlook of the radio world concerning the much-maligned super. Obviously one of the great bugbears had disappeared; there would be no need to neutralise the intermediates any more.

With this advantage came another—the high stage gain possible with the S.G. valve; a gain greatly in excess of that obtainable with the ordinary old-fashioned H.F. valve.

Renewed Life

So in this country and the States the super-het was again taken up with renewed interest, and this time it has achieved a popularity that would be astounding if one did not realise the advantages accruing from the use of a receiver of this description.

And before we examine the part that MODERN WIRELESS has played in the development of the super-heterodyne receiver—in the "Super-Quad" sets—let us consider what those advantages are.

Present-day radio-receiving conditions can hardly be called ideal—in fact, I think that most listeners would be inclined to describe them by a very different adjective. But whatever you think about them will not make one jot difference from a practical point of view. Just go and listen on an ordinary set to a few foreign stations—or some of our own, for that matter—and you will agree with me that reception is certainly *not* all that could be desired. That is where the super-het comes in. It enables you to get the adequate selectivity for getting rid of most of the interference—especially from local stations—and at the same time *increases* your programme-getting powers, without complicating the operation of the receiver.

Easy to Work

The super-het usually has three controls besides the on-off switch—two for tuning and one for volume.

But until "M.W." and its associated contemporary, "Popular Wireless," took the matter in hand the super-het was essentially a frame-aerial receiver, and it suffered from a multiplicity of valves.

Unless one has a particularly valuable and interesting circuit arrangement I consider that more than five valves in a super-het is sheer extravagance—even if that set be mains operated. For all average purposes five is too many where a battery set is concerned.

Ousting the Frame

Let me explain. Owing to certain circuit limitations the early super-hets—of 1925 and this year—were designed to operate from frame aerials. This was a necessity because their circuits were such that, in justice to neighbouring listeners, one could not possibly use them with an outdoor aerial, and, more important still, they required a frame aerial to give them sufficient selectivity.

Consequently, the pick-up was small, and two intermediate stages, with their attendant disadvantages, were employed to give the necessary sensitivity. Result—much more background noise than is desirable.

A certain "breathing" background is, I am afraid, a *sine qua non* with a super at the present stage of development, but it is indeed a pity to amplify this by using a second intermediate.

This fact was clearly recognised by the "P.W." and "M.W." research departments, and it was decided that if anything like a successful range of super-hets was to be published this feature must receive very close consideration.

To cut a long story short the result was the "Super-Quad," in which the frame aerial was done away with and a satisfactory non-interfering scheme adopted so that the standard outdoor aerial, or a small indoor one, could be used instead.

Fewer Valves

This also had another very desirable effect; it allowed us to get rid of that second intermediate stage, and so reduce not only the number of valves, and, consequently, the H.T. current consumption, but also the background noise due to the oscillator and the S.G. valves.

In fact, so marked is the decrease in background that it is difficult to tell whether or no a "Super-Quad" is "on" unless a programme is actually being tuned in.

The band-pass aerial system also reduces the number of harmonic receiving points, because of its great selectivity.

Thus we have an extremely easy-to-build, easy-to-operate, and

RECOMMENDED ACCESSORIES for the "M.W." "Super-Quad."

Loud Speaker. (B.T.-H., Blue Spot, Undy, H.M.V., Mullard, R. & A., Celestion, Graham Farish, Amplion.)

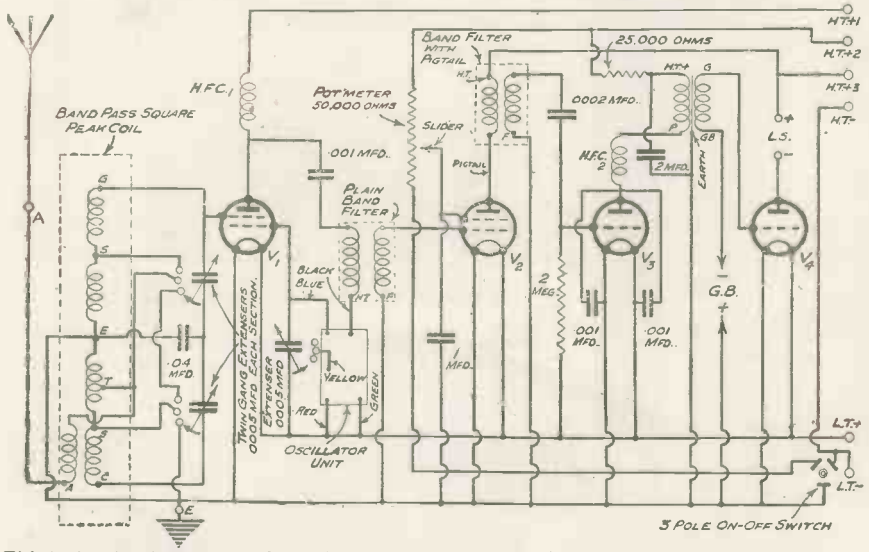
Valves. 1 D.G. valve (Cossor). 1 S.G. (Cossor S.215, or Mazda, Osram, Six-Sixty, Mullard, Eta). 1 H.2 or H.L.210 type (Osram, or Six-Sixty, Mullard, Mazda, Eta, Cossor, Fotos, Tungsram, Dario). 1 Super-power (Six-Sixty 230P., or Mazda, Cossor, Osram, Mullard, Fotos, Dario, Tungsram, Eta).

Batteries. 1 H.T., 120–150 volts super-capacity (Drydex, Pertrix, Ever Ready, Lissen, G.E.C.). 1 G.B. to suit output valve (Ever Ready, etc.). 1 G.B., 1½-volt, for S.G. valve (Ever Ready, etc.).

Accumulator. 2-volt L.T. (Exide, Ediswan, Lissen, Pertrix, G.E.C.).

Mains Unit. State type of set, voltage, and type of mains when ordering (Regentone, Ekco, Tannoy, Lotus, Heayberd, Atlas, R.I.).

THE FIRST EXTENSER SUPER EVER BUILT



This is the circuit diagram of the "M.W." "Super-Quad," the world's first "Extensered" super-het.

From 200 to 2,000 Metres Without Switching

economical four-valver, with a performance so great as to seem out of all keeping with the fewness of its valves.

As you will see from the theoretical circuit, this cutting down of the number of valves is partly due to the inclusion of the bi-grid valve, which acts both as oscillator and "mixer." It is, indeed, a very vital part of the set.

For A.C. Mains

The second of the range—the A.C. "Super-Quad"—employed five valves, and was described last month. The reason for five valves was the very simple one that when the set was designed no bi-grid A.C. valve was available, and consequently a separate oscillator valve had to be employed. I understand, however, that the first bi-grid A.C. valve will be brought out—by Cossor—very shortly, as it is realised that there is a very real demand for this sort of valve.

Separate Oscillator

But because such a "mixer" was not available do not run away with the idea that the A.C. "Super-Quad" is necessarily deficient in some respect. On the contrary, a separate oscillator is all to the good where one can justly claim that its inclusion will not increase the running costs of the set by any appreciable amount, nor put up the initial cost to any marked degree.

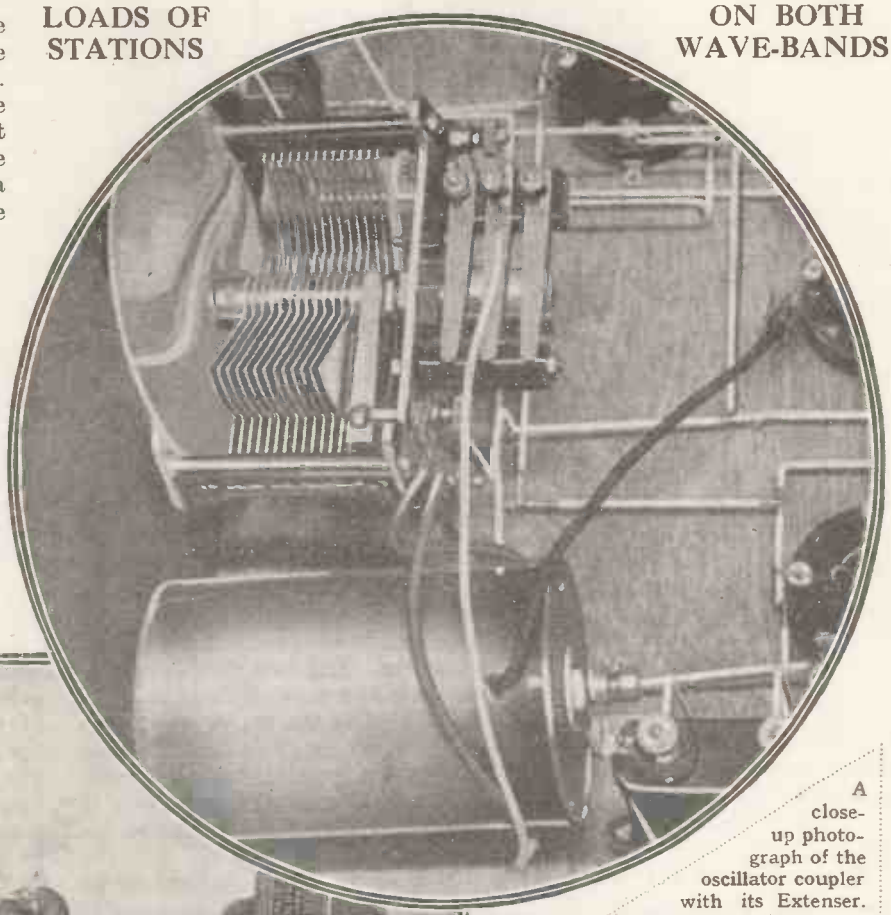
In a battery receiver the added freedom from harmonics and the more powerful oscillations one obtains from a separate oscillator are not worth the extra cost of its purchase and maintenance, but in a mains set these costs become less important, and here the separate valve becomes more of an advantage.

More Sensitive

In the A.C. "Super-Quad," therefore, we have a receiver that is slightly better than the battery model in this respect, and, of course, due to the extra efficiency of the mains valves, even more sensitive.

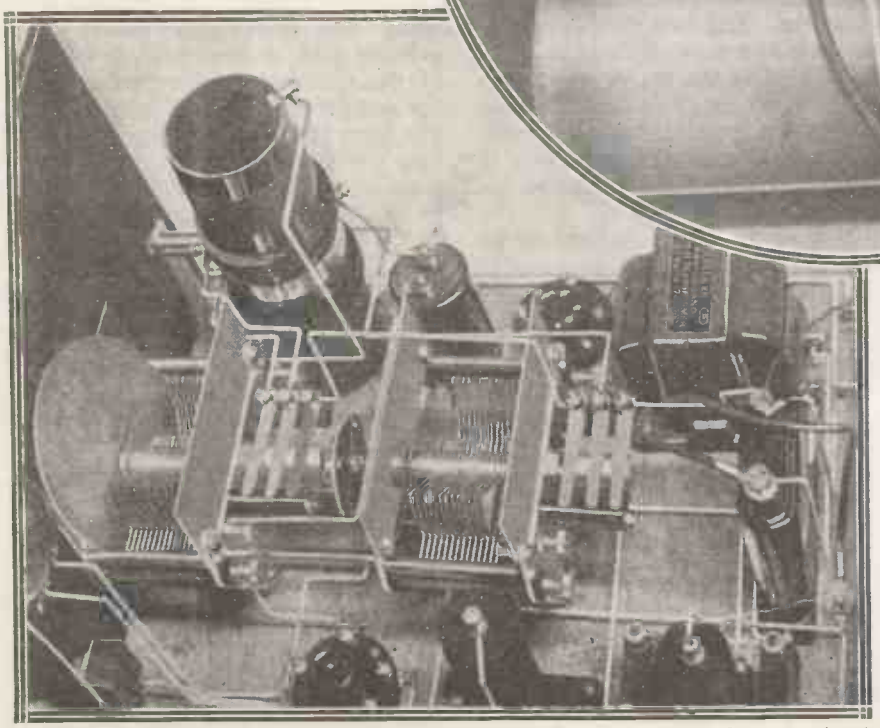
Of the D.C. super that follows I will say nothing at present, except to reiterate the statement that it will be the last word in supers, and will astonish all who read about it, to say nothing about those who build it. It will be a worthy successor to the A.C. model, which in itself was a worthy follower of the original battery "Super-Quad."

LOADS OF STATIONS ON BOTH WAVE-BANDS



A close-up photograph of the oscillator coupler with its Extenser. Note the self-changer on the shaft end.

AUTOMATIC SWITCHING



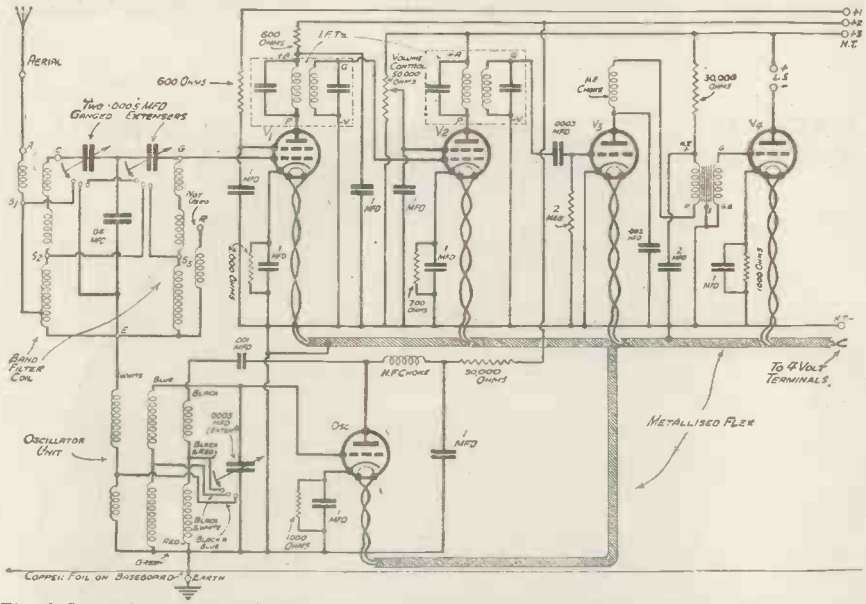
The ganged Extenser eliminates switches and enables the change-over from one band to the other to be carried out automatically.

And now a few words about super-heterodynes in general. In my opinion, and I think in those of many others, the ideal distance-getter is the super-het; but it must be used properly. And I think it is a waste of a good set to confine its use to a frame aerial where a reasonably decent indoor or outdoor aerial is available, and a good earth.

have working at the moment in the Research Dept. is hopelessly overloaded by an outdoor aerial, and gives best results on an indoor aerial about 12 ft. long.

It sounds wrong, but it is a fact that with a good super you get *more* by using a medium-sized indoor aerial than you do by employing the full outdoor 100-ft. variety.

ALL FROM THE A.C. MAINS



The A.C. version of the "Super-Quad" uses a separate oscillator valve, and is operated from a commercial mains unit.

As a matter of fact, a large outdoor aerial is more of a drawback than an advantage, for the input is often so great in such a case as to paralyse the set or to render it unstable.

Short Aerials Better

During recent experiments with a six-valve mains super I found it was impossible to use an aerial more than 5 ft. long without grave risk of paralysis due to too much pick-up, while a five-valve battery super we

The reason is that the super has a sort of limit point of input acceptance, and when the point is reached no more can be accepted without trouble occurring. And that trouble usually occurs in two ways. Either the added input renders the stages overloaded and unstable, or else, and this is more likely, the general level of mush becomes so great that the ratio of programme to extraneous noise becomes exceedingly low.

It is of no value whatever to be able to receive voices from the ends of the earth if what they say is completely obliterated by static, natural and man-made.

Try This Experiment

So if you are tempted to use your perfectly good super on an aerial much larger than you are employing at present, by all means do so; it will be an eye-opener. You won't like it, but it will remove that ever-present feeling you have until you try it that the set *cannot* be "getting all the stations" because it's working on an indoor aerial.

Actually it can—and probably is. And, to illustrate the point still farther, I would like to draw your attention to the set that is being published in our contemporary, "Popular Wireless," on December 5th.

It is a receiver of particularly fine properties, and if you build it and test out my contention re aerials you will have a real eye-opener as to what a super-sensitive set requires and what it can do.

And now for another interesting point—this time concerning the double-grid valve. These seem to vary somewhat in characteristics, and we have found instances where a particular valve will not oscillate properly all over the dial, even though another of its factory brethren has behaved itself perfectly.

An Interesting Point

In the "Super-Quad" method of using the double-grid valve the priming grid, or inner grid, is taken via the oscillator coupler windings to the positive side of the filament. If you have trouble in getting satisfactory oscillation, try taking it to the negative side. Theoretically, it appears to be a disadvantageous thing to do, as the negative bias on the grid will

THE PARTS INCORPORATED IN THE A.C. "SUPER-QUAD"

PANEL
16 in. × 7 in. (Permcol, Peto-Scott, Becol, Wearite, Goltone).

CABINET
(Ready Radio, or standard type Cameo, Peto-Scott, Pickett, Osborn, Gilbert). (Baseboard 12 in. deep.)

EXTENSERS
1 Double-gang ·0005-mfd., with cams insulated, and disc drive (Cyldon).
1 ·0005-mfd. single disc drive, with cam not insulated (as above).

RESISTANCES (see text)
2 600-ohm Spaghettis (Bulgin, Telsen, Varley, Lewcos, Graham Farish, Goltone, Lissen, Igranic, Magnum, Ready Radio, Peto-Scott).
1 700-ohm Spaghetti (Bulgin, etc.).
2 1,000-ohm Spaghetti (Lewcos, etc.).
1 2,000-ohm Spaghetti (Varley, etc.).
2 30,000-ohm Spaghetti (Varley, etc.).
1 50,000 volume control (Colvern, Sovereign, Regentone, Varley, Wearite, Igranic).
1 2-meg. grid leak, with terminals, or with holder (Dubilier, Mullard, Igranic, Graham Farish, Telsen, Watmel, Ferranti, Ediswan, Lissen).

VALVE HOLDERS
4 Large 5-pin (W.B.).
3 Ordinary 5-pin (W.B., Telsen, Igranic, Lotus, Wearite, Bulgin, Graham Farish, Burton, Lissen, Clix).

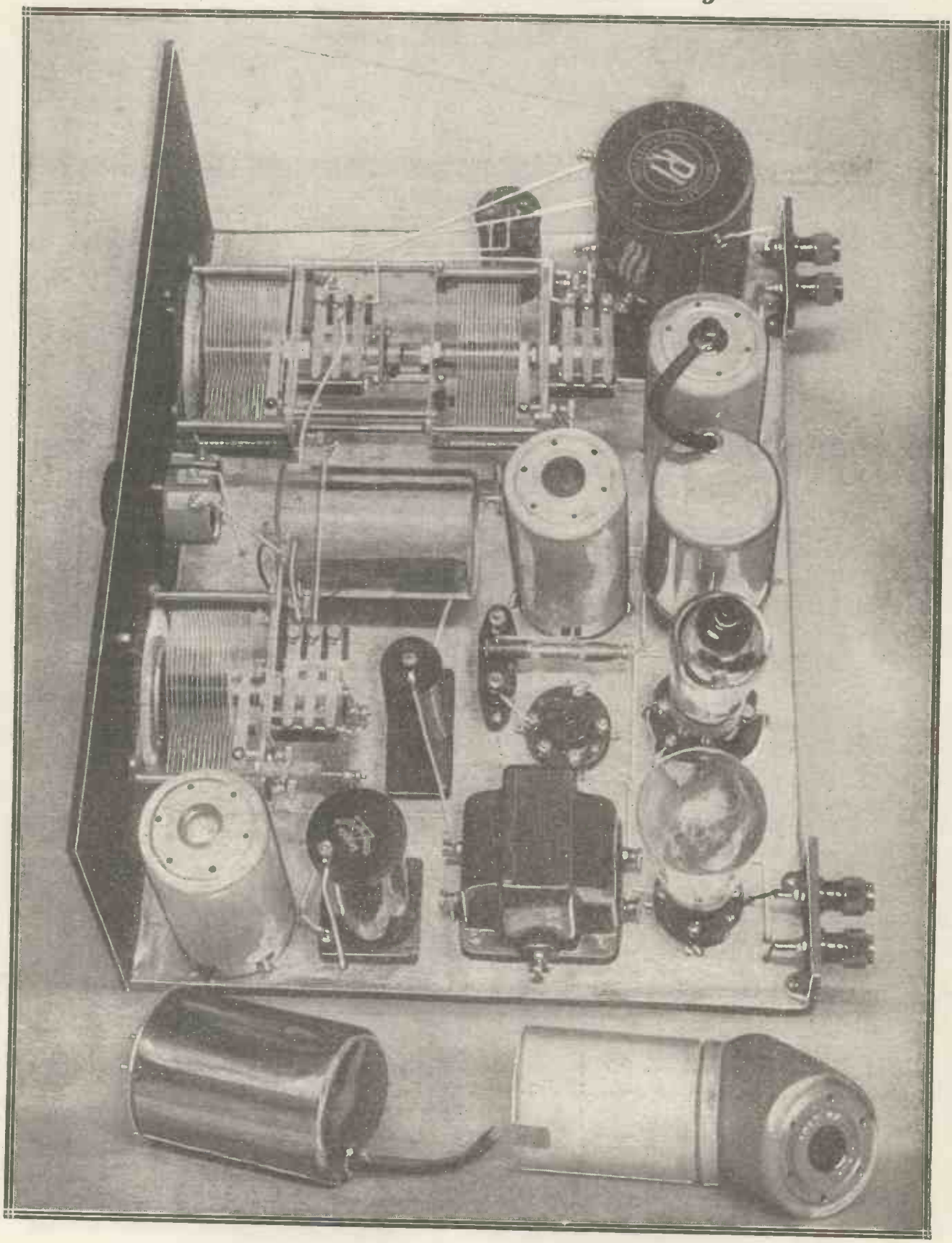
FIXED CONDENSERS
1 ·0003-mfd. grid condenser (Ferranti, Mullard, Graham Farish, Telsen, Ediswan, T.C.C., Dubilier, Igranic, Lissen, Goltone).
1 ·002-mfd. (Telsen, etc.).
1 ·0001-mfd. (Telsen, etc.).
8 1-mfd. (Formo and T.C.C., Dubilier, Telsen, Igranic, Lissen, Helsby, Ferranti).
1 2-mfd. (T.C.C., etc.).
1 ·04-mfd. (Dubilier non-inductive).

CHOKES AND COILS
2 H.F. chokes (Lewcos, Varley, Ready Radio, Telsen, Sovereign, Atlas, Lotus, Graham Farish, Parex, Wearite, R.I., Tunewell).
1 Band filter coil (R.I., Lewcos, Varley band-pass coil).
1 Oscillator unit (Wearite type A.C. Extenser, Lewcos, Colvern type K.O.M.W.).
2 Band-pass intermediates (Wearite, Lewcos with pigtails, Colvern).

TRANSFORMER
1 L.F. (Telsen 1–7, R.I., Ferranti, or medium-ratio Igranic, Graham Farish, Varley, Mullard, Lotus, Lewcos, Lissen).

MISCELLANEOUS
4 Screening covers for valves (Colvern type V.S.).
2 Two-terminal mounting blocks (Sovereign, Belling & Lee).
4 Indicating terminals (Belling & Lee, Eelex, Igranic, Clix, Goltone).
Metallised flex, flex, screws.
Glazite, Lacoline, Jiffilinx, Quickwire.
H.T. plugs, etc. (Belling & Lee, Clix, Igranic, Eelex).

All-Mains—All Stations—All Right!



Scores of Stations at Full Loud-speaker Strength

tend to effect space charge adversely. But in practice this negative bias assists the valve to oscillate, and I have come across several instances where super-hets have been improved by this simple circuit twist.

ACCESSORIES FOR THE MAINS MODEL

Loud Speaker. (Amplion, Undy, H.M.V., Celestion, Blue Spot, B.T.-H., Mullard, W.B., Graham Farish, R. & A.)

Valves. 2 A.C./S.G. valves, 2 A.C./detector valves, 1 A.C./power valve (Mullard, Mazda, Cossor, Osram, Six-Sixty, Tungsram, Eta). (The bias resistances for the S.G. valves vary slightly in value according to the make, and the correct value should be obtained from the makers. Usually 700 ohms is about correct for the amplifier and 2,000 ohms for the S.G. detector.)

Mains Unit. (Heayberd type M.W., Tunewell.)

In cases where separate oscillator valves are used it is important that the H.T. be adjusted properly, for it is not uncommon for the oscillator to rectify as well as to amplify and oscillate, and if it does then it's good-bye to satisfactory reception.

Oscillator H.T.

About 100–120 volts H.T. will usually give good, strong oscillation without danger of rectification.

When one goes on to a super-het for the first time one gets the impression of being all at sea as regards the tuning. Twiddle how you will, there seems to be no hope of even the local coming in.

The reason is that the oscillator dial is being rotated too quickly. As a start it is best to test the set on the local and with the loud speaker very close to one's ear.

In this way you will be able to hear when the tuning is in step. A slight "live-ness" denoted by faint "breathing" will show the desired condition, and then having got it, it is easy to keep it by slow and systematic dial turning.

Some Tuning Tips

Then you will get the local, and if wise will enter up both the two oscillator readings on which you hear it in a notebook or on a station chart. Then after trimming the ganged condenser, if necessary, proceed to search for other stations, keeping the dials in step and remembering that the oscillator dial will need much more careful adjustment than the aerial dial. Every time you hear a station mark down the oscillator readings (both of them, for one setting of the aerial condenser you will have two on the oscillator), noting which of the two gives better results, and also mark the aerial dial reading.

Note the Readings

Usually one or other of the oscillator readings will give greater freedom from interference or greater strength, and after you have compiled a list of readings and identified the stations you will be able to strike out the inferior alternative oscillator reading, and you will have a list of stations, enabling you to pick them up at a moment's notice by just setting the oscillator dial and aerial dials to their proper settings. Haphazard swishing of dials never gets you anywhere in a super. Ordered handling is essential, not only if you are to get the most stations out of the set, but if you are to hear any but the more powerful. Hours may be wasted in unsystematic tuning without hearing anything but your local.

Protect the Windings

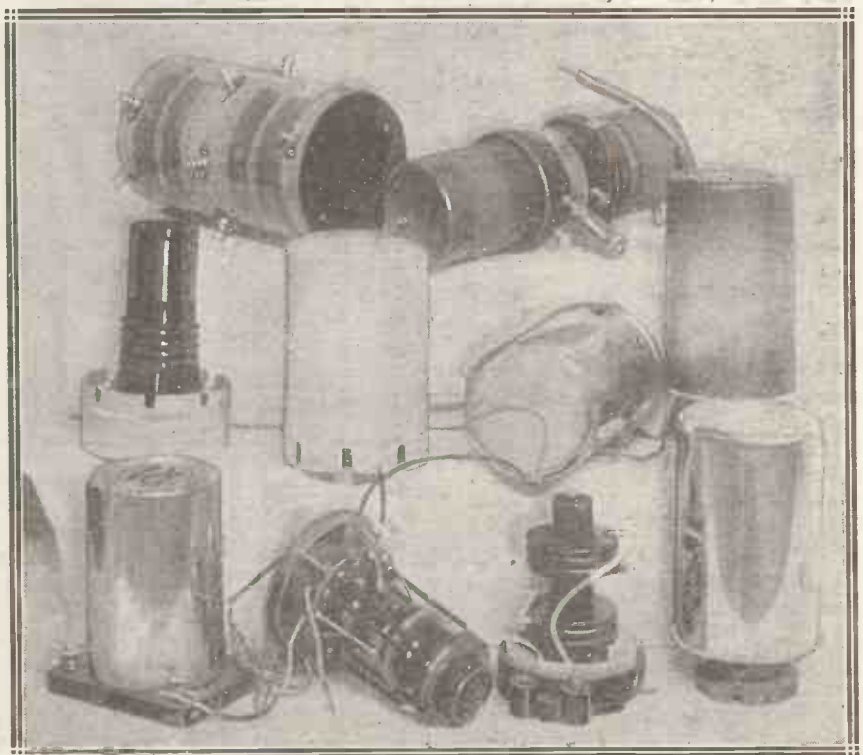
And now a final word about a small practical point in the A.C. "Super-Quad." The output current of the last valve is something like 25 milliamps at 200 volts. If a small speaker (not a moving-coil or other heavy-duty type, using either heavy gauge windings or a transformer input) is employed, it is advisable to protect its windings by means of an output filter or transformer.

A choke system is essential if an A.C. pentode is employed—a possibility that has been queried by readers—for this is quite practicable and the Heayberd "M.W." unit will stand up to it quite well. In this case a pentode choke and an impedance equaliser across it should be employed.

This can take the form of a resistance of 10,000 or 15,000 ohms in series with a .01-mfd. fixed condenser, the whole being placed across the output choke.

This latter also should be of the tapped pentode variety if really satisfactory results are to be obtained with the pentode valve.

THE SECRET OF THE "SUPER-QUAD" SUCCESSES



Here are some of the key components used in the "S.Q." series. You will recognise the R.I. Dual Astatic band-pass coil; the Varley Square Peak coil; the R.I. super-het coil; and the Colvern, Lewcos and Wearite intermediates, and oscillator coil units.

MY BROADCASTING DIARY

Our own Broadcasting Correspondent records the progress of the British Broadcasting Corporation, and frankly comments on the policies in force at B.B.C. headquarters.

B.B.C. and the New Year Honours

THOSE who follow broadcasting closely will remember that Sir John Reith's knighthood, awarded when the Company became the Corporation, followed within about six months of the General Strike, during which the old B.B.C. played such a conspicuous part.

This recognition met with widespread approval, for there was a general feeling that broadcasting had proved itself of national importance, and worthy, like other services, of representation in the list of honours.

Added to the consistently good work of the past five years, and taking into account the fact that the Corporation, now five years old, has run half the course of its "allotted span," there would seem a strong case for fresh public recognition. The matter has been discussed in Downing Street and a number of alternative proposals are known to be under review.

As advance public discussion tends to prejudice and sometimes cancel prospective honours, I shall not go into detail at this juncture except to suggest that the retiring Governors, if any, are almost certain to be suitably rewarded in the New Year's List.

Staff Reorganisation

By the middle of February the whole of the B.B.C. Staff, except a few research engineers, will be housed in Portland Place.

The change-over is being made the occasion of a general reorganisation of staff, partly to suit the new accommodation and partly to effect economy, through reduction and concentration. I hope the powers-that-be are not losing sight of the need of new blood here and there. More particularly on the creative side of programme work.

I get the impression that there is not nearly as much liveliness and enterprise as there used to be.

If this impression is a true one, the cause of the deficiency may be either the staleness of staff or faulty, oppressive administration.

In either case it calls for remedial measures, and I suggest that reforms of this kind, bearing as they do directly on microphone products, are infinitely more important than attempts to secure a mathematically smaller staff, even better disciplined and more tidily housed!

B.B.C. and "Re-diffusion"

A big struggle is imminent about the B.B.C. attitude towards what has become known as "re-diffusion," or "wireless exchanges," which are increasing steadily up and down the country.

The B.B.C. has naturally looked upon this enterprise with a great deal of suspicion. For one thing, the B.B.C. owes its origin to the wireless manufacturing industry, and it would appear that the progress of wireless exchanges contains a serious menace to that industry.

For another thing, the B.B.C. would be naturally alarmed at the possibility of a rival corporation securing control of a network of exchanges covering the whole country.

Then, again, the wireless exchange companies would naturally desire to make their programmes as varied and novel as possible.

Altogether it seems an interesting situation, and one that will loom more largely as time goes on.

BROADCASTING FROM BOMBAY

Quite a powerful broadcasting station was installed at Bombay, and the above photograph shows a view of the general waiting room. Owing to lack of funds there is talk of closing it down, or at least reducing its hours of working.

The 'ECKERSLEY' TUNER

A Miracle in Station Separation

for the "ECKERSLEY 3"

R.I. have produced the original Eckersley Tuner to Capt. Eckersley's specification. It is a supreme triumph of British inventive genius and production that gives REAL SELECTIVITY to the million at a price within reach of all

A REVOLUTIONARY TUNER

The Eckersley Tuner is absolutely revolutionary in principle and operation. It comprises two coils, separated by a metal plate and *coupled by a resistance* — an entirely new coupling method replacing the usual valve connection.

SIZE determines SELECTIVITY

The Eckersley Tuner is not small because *size has been definitely established as essential to real selectivity,* which is impossible with small high-resistance coils unless elaborate costly tuning apparatus is employed.

INTERFERENCE REJECTED *BEFORE* VALVE AMPLIFICATION

The modern practice of coupling two tuned circuits by a valve magnifies interference. *The Eckersley method of resistance coupling tunes first,* cuts out mush, obviates sideband jamming and passes only clean, selected signals for first and subsequent amplification.

EASY TO FIT AND OPERATE

The Tuner is easy to fit, easy to connect and easy to operate. It is beautifully made and finished.

CRITICAL LABORATORY TESTS

This R.I. model has been fully approved by the inventor and the Editor of "Modern Wireless" and each Tuner, is subjected to the most critical laboratory tests before release.

SELECTIVITY at a PRICE WITHIN REACH OF ALL 15/6

List No. BY.30. Provisional Patent 29404-22.10.31

Ask your dealer, or us, for the "Eckersley Tuner" Leaflet and the 1931-32 Catalogue.

The Advertisement of Radio Instruments Ltd., Croydon, Surrey. 'Phone: Thornton Heath 3211

Latest News Items for the Listener

Talks—A Possible Change

I understand there is a distinct possibility of a change in the attitude of the B.B.C. about Talks. This formerly discredited and unpopular part of the service has come very much to the fore in recent years.

But it is still the cause of much bitter criticism. There is never lacking a section of opinion which believes itself unjustly treated by any definite or individualistic exposition.

In a way, the very excellence of the specialised talks has been their undoing. They have attracted so much attention and discussion in the inner circles of "highbrow society" that they have become rather too difficult for the man or woman in the street.

Miss Matheson, the competent Talks Director of the B.B.C., aided by a zealous and active staff, has achieved remarkable results; possibly, too remarkable.

The problem now is to get Talks back to more elementary and less specialised lines. I shall not be surprised to hear of important changes in the methods of the B.B.C. in dealing with this.

Admiral Carpendale—Peacemaker

The return of the B.B.C. Delegation from Rome, coinciding as it did with the General Election, gave little opportunity for reviewing the work of the delegates in the right perspective.

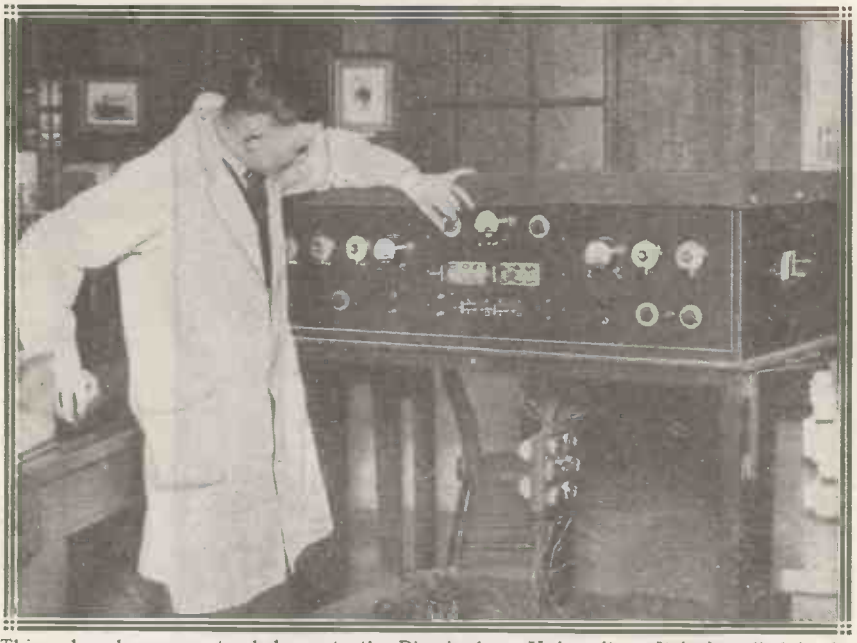
I have already dealt with the very able work of Mr. Noel Ashbridge in the face of appalling difficulty. I would like now to put on record that Admiral Carpendale once again gave unmistakable evidence of his powers of leadership by reconciling and smoothing out an unusual crop of acerbities and troubles at Rome.

A foreign delegate has told me that, in its spontaneity and fervour, the final acclamation of the conference to its President, Admiral Carpendale, has never been excelled. Personally, I believe that it would be a good thing to "second" Admiral Carpendale from his B.B.C. work in order that he might devote all his time as a kind of permanent President of the International Union of Broadcasters.

There is a lot to be said for this, from various points of view. To begin with, Admiral Carpendale is the only potential presider generally trusted.

Secondly, as long as Admiral Carpendale has to combine presidency with B.B.C. representation, the B.B.C. is handicapped, so from both points of view a change is indicated.

FOR MEASURING WIRELESS WAVES



This colossal wave-meter belongs to the Birmingham University. It is installed in the laboratory and has done a lot of very useful work. You will notice that a number of broadcast receiver components have been used in its construction, which speaks well for their quality and reliability.

B.B.C. Bias—A Gross Injustice

There has been altogether too much sniping at the B.B.C. because of its alleged "outrageous" partiality during the General Election. The fact is that the B.B.C., through Sir John Reith, carried out its task with extraordinary skill.

What with an unparalleled number of new political groupings and an equivalent clamour for programme time, Sir John Reith's handling of the situation, in my opinion at least, left nothing to be desired.

In actual analysis, the opposition party, with its three broadcasts, received much more consideration than any of the other parties or groups of parties would have admitted in the absence of the guiding hand of the Director-General of the B.B.C.

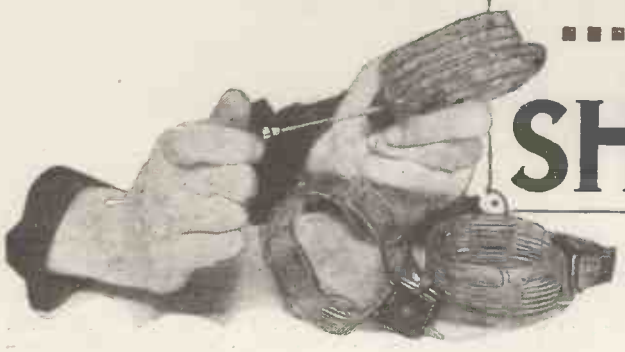
The Board

There has been a great deal of movement behind the scenes in connection with the B.B.C. Board of Governors, which is due for replacement or re-appointment by the end of this year.

I have been looking into it carefully and have come to the conclusion that, whatever happens to the rest, Mr. Whitley, the Chairman, and Mrs. Philip Snowden will certainly be re-appointed. The other three, namely, Lord Gainford, Vice-Chairman, Sir Gordon Nairne, and Dr. Montague Rendall, may or may not resign.

In either case, the Prime Minister will have to reconsider the whole position before the end of the year. He might, indeed, find a way out of the difficulty by taking advantage of the clause in the report of Lord Crawford's Committee on Broadcasting of 1925, which permits the Board to be extended from five to seven at the discretion of His Majesty's Government. My only concern is that Dr. H. R. L. Sheppard should be invited to become a Governor of the B.B.C.

I do not profess to be able to distinguish between the rival claims of the other aspirants for this distinction. If, however, there is a second Governorship going, there is no one I should prefer to see in it than Sir Arthur Stanley, still head of the Wireless League, and a very able leader of pioneer movements.



... ON THE SHORT WAVES

By W. L. S.

Our popular contributor discusses the problems encountered through the congested state of the ether on certain short-wave bands, and probes into the possibilities of the waves below 10 metres. He also mentions a scheme which is in hand to enable enthusiasts to get in some Morse practice.

TAKEN on the whole, there is very little news of outstanding interest this month. Conditions have been distinctly good, although rather patchy. All the more familiar of the DX broadcasting stations have been logged at good strength, and many new stations, chiefly from the East on account of the good conditions prevailing from that direction.

On ·5 Metre

On the technical side we have had the somewhat startling announcement of Marchese Marconi's successful transmissions on a wavelength of ·5 metre. This is to me more interesting from the general point of view than as an isolated achievement. It shows just how important the short waves are at the moment, and how no efforts are being spared to utilise them for relieving the awful congestion on certain other wave-bands.

It is practically certain, in my opinion, that even if the B.B.C.'s projected 7-metre experiments come to nothing we shall see enormous use made of these wavelengths for other purposes. Thousands of the stations working at present on the long waves would be served equally well by slices out of the "unexplored" band from 10 metres downwards.

Suitable Wave-lengths

The point is that, whatever knowledge is missing about the behaviour of these waves over long distances, we do know for certain that they are very effective for purely short-distance work. And a surprising number of the commercial stations using high power on the longer waves and on the more congested parts of the short-wave band are doing so only for very short-distance communication.

Perhaps we shall see, during 1932, a real effort to give to every station a wavelength that suits its own particular job. One example strikes me at once. All the amateur transmitters who use the highest amateur band—150–175 metres—for telephony experiments with another man not more than twenty miles away, might do the same work equally well, and with far less interference to worry them, on 10 metres.

True, considerable technical skill is necessary to get a transmitter functioning well on this wave, but surely that is all to the good. Does not the real amateur want something difficult to attack? Too many of those that stick to 150 metres are developing into mere "amateur broadcasters," and have long since put away all thought of real experimental work.

While we are on the subject of amateur transmission, it is nice to be able to record that the P.M.G. has just handed the "hams" some real "plums." Plums worth having, too, in the form of an extension of the wave-bands allotted for amateur use. The actual change is the reduction by 50 per cent of the "tolerances" cut off the ends of the wave-bands.

Extended Bands

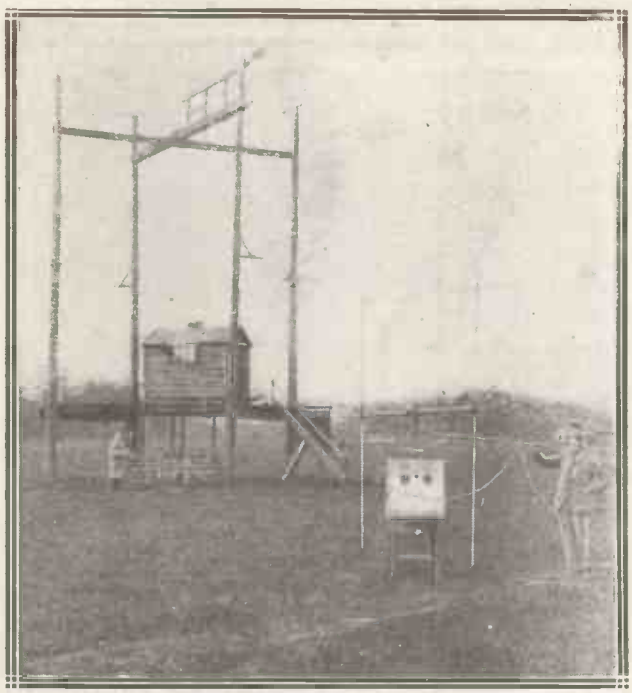
To take one example, the real amateur band in the 43-metre (7,000 kc.) region is between 7,000 and 7,300 kc. Hitherto the British amateur has had to forfeit 50 kc. at each end, leaving him with 7,050–7,250 kc. Under the new conditions he is allowed 7,025–7,275 kc.

This is probably a reward for the excellent way in which British amateurs have managed to keep within the bands. Undoubtedly they are the best in the world in this respect, and also as regards the proportion of them that use crystal control. One never hears a Britisher straying on top of the trans-atlantic telephony service—yet hundreds of American amateurs have been severely "sat on" for this offence.

"The Time of His Life"

If 7-metre broadcasting *does* come, the short-wave enthusiast is undoubtedly going to have the time of his life. With his knowledge of operation and construction of short-wavers he is going to find little difficulty in getting a set to work really well down

TRACKING THUNDERSTORMS



Locating thunderstorms by radio. This is accomplished with the aid of a pair of short-wave direction-finders, one situated at Leuchars, Scotland, and the other, which is illustrated above, at Slough. By means of the ingenious apparatus it is possible to track disturbances right across Europe.

Will We Have 7-Metre Broadcasting?

there. He should be miles ahead of the ordinary broadcast listener in getting really good results.

Naturally, there is sure to be a crowd of commercial sets produced for this wave, but the real experimenter will prefer to tackle the problem on his own lines, and he is sure to get plenty of fun from it!

It can't fail to be an interesting business, because the range of the transmitting stations—judging by the present state of the art—will be very small indeed. There will thus be real credit attached to the man and the set that start breaking "DX" records.

Room to Spare

It is a peculiar situation, in that there is such a colossal amount of room even between 7 and 7·1 metres! And yet all this space will not be necessary, since the B.B.C. could have two transmitters 50 miles apart working on *exactly* the same wave-length without interfering with each other. They will not be audible together, even at the mid-point between them! Probably at that point *neither* will be heard at all.

It may well prove the solution of television troubles, for with so much space to let there will be no need for 9-kc. separation; 90-kc. separation should not be an unreasonable amount.

Pity the poor man who wants an "all-wave" set if those days ever arrive. Wave-change switching will be something of a problem, and the wiring of sets will have to improve considerably!

It may seem incredible to you, but many existing broadcast receivers will tune roughly to 7 metres simply by shorting out the coils altogether. The stray lengths of wiring, together with the stray capacities, will tune to about 7 metres, or, in many cases, an even higher wave-length.

Tuning Without Coil

I know of one broadcast receiver that will actually oscillate and tune in 10-metre signals when the plug-in coils are removed and shorting-plugs inserted in the coil sockets. This is a freak case, but if you are interested you might just try this experiment with your own set.

Is it not strange nowadays to observe the inside of a typical short-wave receiver and to note the entire absence of any "un-standard" components? In the early days one would find valves with the bases removed, space-wound H.F. chokes, two-plate variable condensers with micrometer-thread action, and all manner of similar freaks. The modern high-efficiency valve is, I think, chiefly responsible for the disappearance of all this. Try an old "French R" valve nowadays in a short-wave set and see if you can make it oscillate.

Items that Count

Another point that I seem to be always harping on, but that is worthy of comment, is the "schooling" action of short-wave work on home-constructors. Having made three or four sets, and having found the points on which one has to be careful, an enthusiast is a far wiser man. And this is reflected in the construction of the next broadcast receiver that he tackles; which works far better as a result of it.

MEASURING SOUND

The new H.M.V. apparatus used for recording the strength of the voice, the volume of sound being recorded on the dial. A child, after its test, is surprised to hear the stentorian voice of a sergeant-major.

All the little points that make all the difference to a short-waver must also have their effect on the broadcast waves. Yet the effect there is far less conspicuous and is therefore apt to be overlooked. On short waves a small oversight that might have no noticeable effect "up above" is quite enough to stop a set from working at all.

I refer particularly to such details as the length of grid leads; the length of the leads from the condenser to the coil that it tunes; the matter of taking earth-return leads directly to earth instead of running them all round the set, and perhaps through a filament switch en route; and other similar things.

The winter is a little boring for the short-wave enthusiast whose business keeps him away from home until late in the evening.

Unless one can start listening by about 6 p.m. there is nothing much below 30 metres worth listening for at all. Certainly the 20-metre group of stations and those below are very poor nowadays by 6.30 p.m., or even earlier.

It is rather strange to reflect how 20 metres was once considered a "daylight wave." This points to the fact that it must have been "discovered" in the winter, for during the summer it is at its best until after midnight for quite long periods.

Australian 'Phone Service

Even in March one can always hear the American stations up till 11 p.m., and during most of the spring and autumn the South Americans come over quite late in the evening.

An easy Australian to receive nowadays is Sydney, V L K, working a commercial 'phone service with London on 28·5 metres. He is a very reliable signal, at the time of writing, in the afternoon, but I believe he also comes over well in the early morning.

As a concluding news item, it is pleasant to note that the R.S.G.B. has now organised a scheme for Morse practice "over the air." Various members are voluntarily undertaking the work. The programme is such that, in effect, at least one station in the country will be sending dead slowly at practically any time between 9 a.m. and midday every Sunday. The London transmissions will take place on December 13th and 27th, and fortnightly thereafter; the provincials being on the other Sundays.

London Transmissions

As soon as the full scheme reaches me I will give details of the stations taking part and the exact wave-lengths used. London readers, however, can take it for granted that they will be able to hear a transmission on about 160 metres between 10 and 10.30 a.m. on the Sundays mentioned, the station operating being either G 6 N F or G 6 Q B for South London. The North London stations are not yet decided.

On the

By the Technical Editor

Some "Wavemaster" Productions

WE have had the opportunity of examining an extensive range of "Wavemaster" variable condensers. Among them are some decidedly attractive items, such as the "Polished Minor" and "Bakelite Log" models.

But we believe that most constructors would visualise a variable

WELL-MADE CONDENSERS

A selection of variable condensers made by the Webb Condenser Co., Ltd.

condenser styled the "Bakelite Log Condenser" as an inexpensive construction having thin vanes separated by a bakelite material instead of air.

The "Wavemaster" "Bakelite Log" is certainly inexpensive, it costs only 3s. 6d., but it is of air-spaced design and has rigid vanes of hard aluminium. The bakelite is to be found in its stout end-plates.

There are two "Wavemaster" Extenser gangs deserving of note. The two-gang model is particularly attractive, and both the direct and slow-motion drives are good. The slow-motion control of the three-gang is also smooth and indeed entirely free from blemish, but the direct drive is rather harsh and stiff.

A Mains Component

Mains enthusiasts should note that the Standard Battery Company (despite its name!) are making some fine mains apparatus.

One of their latest mains components is the Wates' potential divider. This is designed and built on very sound lines and is able to carry its load safely and without developing noticeable heat.

As merely a potential divider it would be worth attention, but it embodies in it a novel scheme which really entitles it to a more expressive description. We suggest "Potential *Sub*-Divider"!

Instead of fixed tappings, each of the four intermediate connecting points is equipped with a small slider device which can be adjusted in exact accordance with voltage requirements, and then rigidly locked in position by the turn of a screw.

It is a scheme which will strongly commend itself to the constructor desirous of getting the very best out of his mains set by the close adjustment of H.T.'s.

A "Two-in-One" Condenser

Messrs. Ferranti manufacture a dual-fixed-condenser specifically for mains smoothing which can usefully be added to many existing outfits in order to reduce hum.

It comprises two 1-mfd. fixed condensers built into a compact casing and provided with a common terminal serving the one set of plates of each condenser.

Thus the two condensers are permanently connected in series. The practical application of the component will be familiar to all who have studied the radio use of mains supplies.

The common terminal is joined to earth and the other two terminals are connected to the mains.

The advantages of having the two condensers built into one in such a way are pretty obvious. The connections are simpler, and there is saving

A USEFUL RESISTANCE

This is the Wates' Potential Divider.

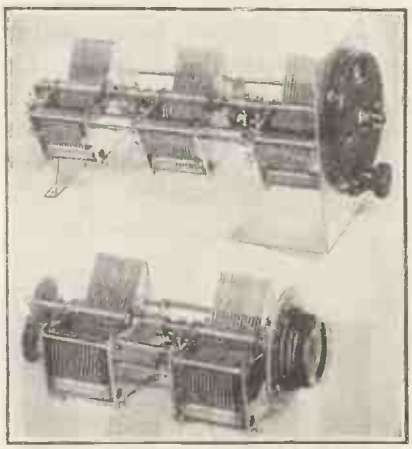
in both money and space, for this Ferranti condenser is cheaper and of less overall bulk than two separate condensers.

We have tested the component and find it to be well up to the usual high standard set and achieved by its makers.

The "Atlas" H.F. Choke

An H.F. choke needs to be much more than merely so many turns of wire wound on a former if it is to prove capable of adequately meeting

GANGED EXTENSERS



"Wavemaster" dual-gang and triple-gang Extensers.

Test Bench

Wavemaster, Wates, Ferranti, Atlas, Lotus, and Puretone products form the subjects of this month's impartial reviews.

some of the exacting requirements of modern radio set design.

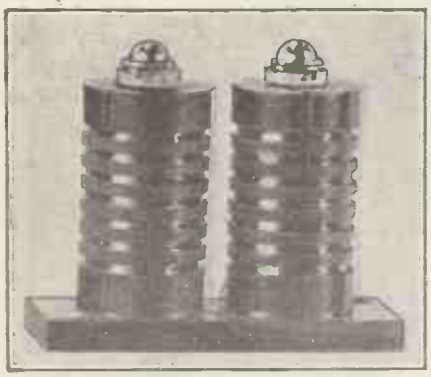
It is necessary, for instance, that it should have sufficient inductance properly to "choke" at long waves as well as at ordinary waves. That means that a large number of turns of wire are needed.

This Ferranti fixed condenser is a double type designed particularly for mains smoothing purposes.

But unless these are carefully disposed on the former, capacity of a destructive order will be introduced. Messrs. Clarke divide the windings of their "Atlas" H.F. choke into two sections, as can be seen from the accompanying illustration. Also, the two formers are slotted and the winding still further split up in these.

The result is a choke that has a very low self-capacity, and one that can confidently be used where the greatest possible efficiency in choking is needed.

AN EFFICIENT CHOKE



The Atlas high-frequency choke proved on test to be an excellent component.

There are occasions when it does not matter if the H.F. choke is not quite up to scratch—the reaction circuits of many sets are examples; but in such an instance as the H.F. coupling of a screened-grid valve the greatest possible effectiveness is vital to the obtaining of good results.

Little more need be said than that the "Atlas" H.F. choke can be used for such a purpose.

The "Lotus" Gang

When developments demand new components you can be sure that at least our great condenser manufacturers will meet that part of the demand which concerns them with first-class gear at reasonable prices.

Thus the band-pass has occasioned a demand for two-gang condensers, and "Lotus," with their two-gang, were quickly to the fore with a component which may be new in design, but which has the polished appearance of an article that has adventured through years of refinement.

But, then, "Lotus" condensers have long been aristocrats of their class, and in producing a two-gang tuning condenser "Lotus" Radio Components are, after all, still right in their element.

This new product of theirs (new in terms of months, anyway!) is completely screened, and is, in fact, ideal for band-pass sets.

Its construction is on particularly solid lines, although it is in no sense clumsy. The trimmers are most conveniently placed, being at the top and within easy reach whatever the layout of the set. They can quickly be adjusted either with the fingers or with a screwdriver.

The matching between the two units is indicative of precision engineering, just as is also the smooth mechanical operation of the device.

The "Lotus" two-gang condenser.

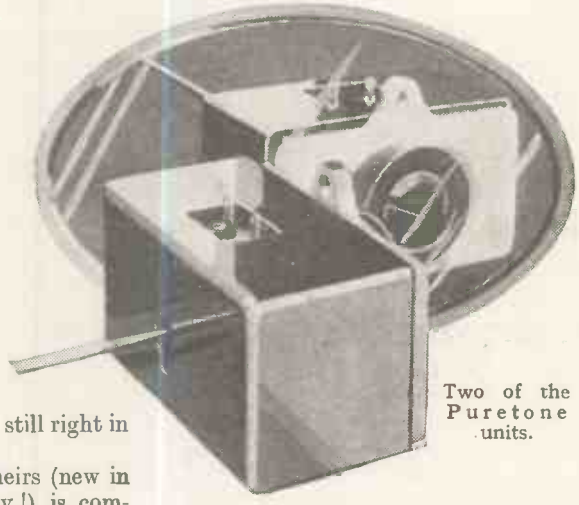
The constructor will find no fault with this Lotus device, either in price or operation.

An Attractive Accessory

The "Puretone" loud-speaker unit, which is a product of J. and H. Walter, Ltd., is a very interesting example of modern mass-production scientifically applied. An amazing fact is that there is not one single screw or bolt in the whole of its construction!

But it must not be thought that it has either the appearance or performance usually associated with a "cheap stamped-out" article. On the contrary, it is quite a good unit; moreover, it is sent out with a twelve months' guarantee.

"PURETONE" L.S. UNITS



Two of the Puretone units.

The retail price is 7s. 6d., and while it is not in the "moving-coil class" (so called), it is a sensitive electro-magnetic unit having a response equal to many others selling at higher figures.

Constructors who assemble their own speakers should make a point of hearing a "Puretone" when they have the opportunity.

BROADCAST RECORDS

As usual, let us first take a selection of the "Tens" that have been released during the past month and on December 1st.

Sandy the Schoolmaster, a humorous sketch by Sandy Powell, on 762, is a broadly comic turn that will have a wide appeal. Yodelling does not attract us, but it no doubt has its followers, so that George Van Dusen's recording of By the Side of the Zuyder Zee and Silver Threads Among the Gold deserves mention (Z68).

Another broad comedy is The Laughing Lover and the Laughing Speed-Cop, on 765. Quite good and well recorded.

A dance number that will have quite a vogue is the "sequel" to "The King's Horses," namely, The Queen Was in the Parlour. Recorded on 774, it makes a very lively and fascinating comedy work. It is coupled with Song of Happiness on the reverse side, the band being Harry Roy and his Rkolians.

Just One More Chance, on 772, is just one more rendering of a real dance hit. It is well played and well recorded by Bidgood's Good Boys, and is doubled with a comedy fox-trot, It Always Starts to Rain.

TWELVES

We have picked out a couple of "twelves" for inclusion in this review. The first is Sonata in A for Violin and Piano, by Cesar Franck—(Allegro movement)—forming an excellent double-sided disc by Winifred Small and Maurice Cole (5257). The second record is Further Selections of Famous Waltzes, played on 5259 by The Ylonnese Light Orchestra. A tuneful disc.

THE SUPER TWELVES

Released on December 1st are a series of special Christmas recordings in the famous church of St.-Mary-le-Bow, and featuring the choir and organ there. They form a selection of Carols and Christmas Hymns, including O Come All Ye Faithful, Good Christian Men Rejoice (3106); See Amid the Winter Snow, Good King Wenceslas (3104); Christians Awake, Hark the Herald Angels Sing, (3105); The First Nowell, While Shepherds Watched (3107); and, finally, a Christmas Service (double-sided, 3120). They are first-rate records.

The Plantation Song Medley (3109) is another instance of the popularity of "Nigger" music. Those old spirituals and plantation songs have a fascination of their own, and it is no wonder that such records are in demand. This time the artistes are our old friends Bob and Alf Pearson.

The Beaufort Cinema Organ, Birmingham, is a popular outside broadcast, so that the recording of it as Reginald New plays At the Temple Gate and You Are My Heart's Delight, on 3122, will be a favourite disc.

Among the dance records there are two which we want specially to bring to your notice. The first is: Ten of To-day's Best Tunes, a syncopated piano solo, with trumpet, saxophone and vocal effects, on 3113; and the second is a recording of one of the most haunting dance numbers of the day, Got a Date With an Angel.

It is a "hit" from the comedy "For the Love of Mike," recently introduced at the Saville Theatre, and has a most fascinating lilt. It is excellently played, with vocal refrain, by Jack Harris and his Grosvenor House Band. (3118.)

Other dance records worth noting are Mausie and Good Night! and Pardon Madame (3116), and Nevertheless with If They Ever Had an Income Tax on Love (3119).

COLUMBIA

We received only a few of the latest Columbia releases this month, and of these we have chosen the following wide assortment to bring to readers' notice as really excellent pick-up test and entertainment records.

The first gives your radio-gram every chance to "show off." It is Sacred Songs—Vocal Gems. Recorded in the Central Hall, Westminster, this is an excellent disc. It contains some old favourites of more sectarian days, and the artistes are Isobel Baillie, Clara Serena, Francis Russell, and Norman Allin. (DX.296.)

A quite different twelve-incher is the Fantasia on Irish Airs, played by Albert Sandler and his Orchestra, on DX.293. Lovers of light salon orchestral combinations will fully appreciate this record.

Mr. Jetsam gives us an excellent record under his own name—Malcolm McEachern, The Changing of the Guard, and The Roman Road, on DB.630, a record that all pick-up users should possess. It contains a couple of rollicking songs that suit our old broadcasting friend to perfection. Make sure you hear it if you like the "hail-fellow-well-met" type of song.

The National Chorus is a good test of recording and reproduction alike, and Here's a Health Unto His Majesty and The Bay of Biscay, on DB.632, provides a volume of sound that is amazing.

Finally, we picked out two of our old favourite Jack Payne records. CB.358 contains Kiss Me Good-night, a rather uninteresting waltz, relieved by an excellent quick-step, That's What I Like About You. The second record, CB.356, contains an excellent comedy number from "Sunshine Susie," To-day I Feel So Happy, with Just One More Chance on the other side. A good half-crown's worth!

H.M.V.

A most varied selection of items is to be found in the H.M.V. "latest" this month. The pearl, in our opinion, is Lawrence Tibbett singing Largo Al Factotum Della Citta, from the "Barber of Seville." It is a superb recording of a superb song. The reverse side is just as fine, though not so popular. Eri Tu, from "Un Ballo in Maschero," by Verdi. Every gramophile should hear this record. (DB.1478. Red Label.)

A brief selection from some of the records released during the month. They have been chosen because of their special value to the pick-up user.

Saint-Saens' suite—he wrote it quite as a jest, we believe—Carnival of the Animals, recorded on D.1992, 1993 and 1994—three excellent records, the second side of the last being filled with Tchaikovsky's Song Without Words (A minor, Op. 40, No. 6).

Quite different in type is the Echoes of the War, by the New Mayfair Orchestra, on C.2286, with Male Chorus. It is an excellent record, and coming out just before the Armistice anniversary was completely appropriate. The other side contains Old Army, "an incident of Remembrance Day," by W. P. Lipscomb & Company. We won't spoil it by telling you about it. You should hear it.

Walter Glynne records well, and good examples of his latest work are: June Music, and Faery Song, from "The Immortal Hour," by Rutland Boughton. The latter is a perfect gem. (B.3905.)

"Viktoria and Her Hussar" has created a deal of interest in theatreland, and great areas of wax have been used in the recording of various items from this popular musical show. On B.3954 we have Winnie Melville and Derek Oldham singing Only One Girl in the World For Me and Star of My Night. They won't please everybody, but they are excellent recordings.

Jeanette Macdonald, the famous film star, is disappointing in Good-night and Pardon Madam, items from the same show, recorded on B.3952.

Getting lighter still we come to Derickson and Brown playing and singing Just One More Chance and Whistling in the Dark, on B.3943. This is a perfect record of its style and should be heard by all interested in light syncopated music. The piano interludes are excellent.

Jack Hylton has been busy again, and has recorded quite a variety of numbers. His twelve-inchdisc, Good-night, Sweetheart and My Sunshine Is You (C.2283), is notable for its restraint, but we prefer him in When the Circus Comes to Town, a very much more "Hyltonish" recording. (B.6076.) The other side of this contains Song of Happiness. A third Jack Hylton recording is Jolly Good Company with Would You Take Me Back Again? on B.6069.

Finally, we should like to mention Ambrose and his Orchestra in Smile, Darn Ya, Smile, and Nevertheless, on B.6067. An excellent disc.

ZONOPHONE

The Zonophone November selection of records contains the usual good variety, and we mention a few of the very best below:

First comes No. 5956—the London Orchestra playing two talkie selections of renown with brilliance and volume. This orchestra has a number of these talkie selections to its credit, and all talkie fans should look them up in the Zonophone main catalogue: Smiles (selections, with vocal refrain), Le Chemin Du Paradis (selection). (5956.)

Solemn and Gay beguile us with two great favourites, especially the former, which is going very strong at the moment. These two duettists are most popular—they are so ideally suited to one another and they sing with such verve. I Like a Little Girl Like That and Honeymoon Lane. (5962.)

We have here also two excellent records for Christmas. Last year the Zonophone Company issued Parts 1, 2, 3 and 4 of the "White Blackbirds"—the famous Blackpool Minstrels—and these records were such a great success that they have now issued Parts 5, 6, 7 and 8, which we think are even better entertainment.

These records were recorded actually in the Blackpool Opera House, under the personal supervision of Mr. John Firmin, the leader of the well-known Zono. Orpheus Dance Band; and we are quite sure you will not miss hearing them at your dealers. The White Blackbirds—parts 5 and 6—including "Kentucky Home," "Belle of the Barbers' Ball," "Way Down in Dixie," "Goodbye, Liza Jane." (5963.) The White Blackbirds—parts 7 and 8—including "Song of the South," "Mobile Bay," "Uncle Joe Plays His Banjo." (5964.)

We hear from the Zonophone Company that Jack and Jill, their new duettists, have been splendidly welcomed by the public, and the titles they sing on record No. 5965 will persuade everyone to buy without our advice to do so. For You and The Twilight Waltz.

Then come two dance records which we have chosen out of the four issued this month for their up-to-date titles: Sally—(Film—"Sally in Our Alley"), Fall In and Follow the Band—(Film—"Sally in Our Alley"), by the Orpheus Dance Band. (5967.) Whistling in the Dark and Wrap Your Troubles in Dreams, by the Rhythmic Eight. (5969.)

All four titles are played with marvellous rhythm and melody, and we specially recommend the last disc.

By the way, though, we have not yet received any for test, a new series of Zonophone records has been issued.

These are special dance records at the usual price of 1s. 6d., by Jack Hylton and his Boys, who have been retained under a new arrangement to record for Zonophone.

The records so far released are three in number, and perpetuate some of the most delightful of modern dance numbers.

Most haunting of these is Got a Date With An Angel, which tune we have already mentioned in reference to another record, from the play "For the Love of Mike." It is coupled on No. 5993 with a medley For the Love of Mike, in which two other musical hits from that show are introduced.

No. 5992 is a record that will be popular, for it contains an excellent novelty foxtrot, The Wooden Rocking Horse, together with Guilty; both having vocal refrains.

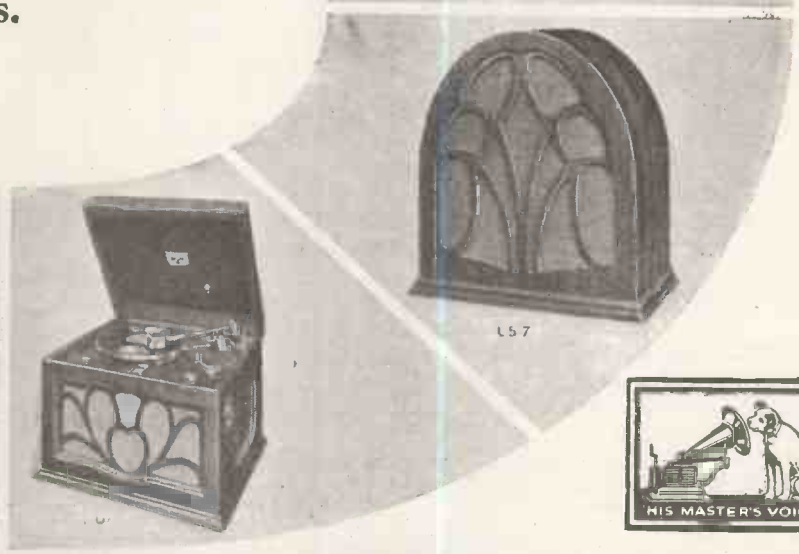
The third of this first short series, also with vocal refrains—a fact that counts very much in making a dance record a seller—comprises On a Cold and Frosty Morning and Life's Desire. The number is 5994, and this record, too, is really excellent.

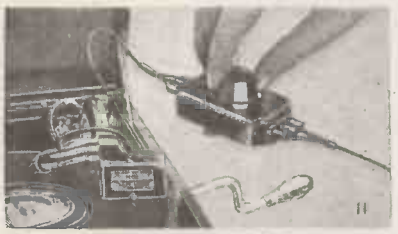
RECOMMENDED PICK-UPS

Here are some gramophone pick-ups which we can confidently recommend to the attention of readers for the playing off any of the above records. H.M.V. (types C and 15), Zonophone, B.T.-H. (Minor and Senior), Celestion (W.5), Blue Spot, Marconiphone, Claude Lyons ("Audak"), A.E.D.

GIFTS for discerning GIVERS

"His Master's Voice" Instruments for yourself and your friends.





"His Master's Voice" RECORDS FOR CHRISTMAS . . .

"His Master's Voice" December list comprises over 90 records. Every type of music for the festive season is included . . . Dance, Vocal, Instrumental, Orchestral and Humorous, also Hymns and Carols . . . and every one is made by wor'd-famous artists exclusively for "His Master's Voice." No matter what your taste in music may be, you cannot fail to find in the list the records you want.

The Gramophone Company, Ltd., London, W.1

Automatic Record Player

(*Model 117*). In a handsome walnut cabinet of compact design is fitted the new "His Master's Voice" automatic record-changing mechanism, pick-up and volume control. By connecting it to your radio receiver, eight 10 or 12 inch records (unmixed) may be played at one loading or a single record repeated up to eight times. A unit you have been waiting years for. A.C. or D.C.

Price 18 guineas

Moving Coil Loudspeaker

(*L. S. 7*). A permanent magnet moving-coil loudspeaker in an arched walnut cabinet of attractive design. It is extremely sensitive and will handle up to 3 watts without difficulty. A universal input transformer incorporated in the instrument enables it to be matched to receivers with triode, pentode or push pull output.

Price 5 guineas

Portable Gramophone

(*Model 102*). Entirely new cabinet design. New, all-metal, one piece sound-box. New metal detachable record tray—capacity 14 ten-inch records. New "slip in" winding handle. New lid-stay, one hand operated. Chromium plating. Automatic brake works *without previous setting*, on any record. Fittings include leather carrying handle, new lid lock, pivoted needle container, spring clip for box of "Tungstyle" needles.

Black £5 . 12 . 6

Armchair Record Player

(*Model 116*). The new "His Master's Voice" pick-up, volume control, electric turntable motor and automatic start and stop, housed in an oak cabinet of pleasing design. By connecting it to a loudspeaker radio-receiver records may be played from one's armchair. Interchangeable resistances may be clipped in to the volume control to match the pick-up to any radio receiver. A.C. or D.C.

Price 10 guineas

Table Radio-Gramophone

(*Model 501*) 3-valve all-electric (A.C. or D.C.). Moving Coil Loudspeaker. One operating switch. One tuning knob. One volume control. Illuminated wave-length scale. Mains aerial. New type gramophone pick-up — with reversible head — operating automatic brake. Plugs for two additional loudspeakers. In walnut cabinet. **Price 29 guineas**

Pick-up (*Model 11*).

This pick-up is similar to the one fitted to all our new instruments. It can be attached easily to any type of tone-arm and is supplied complete with a logarithmic volume control and connecting leads. The weight of the pick-up is 5½ ozs.; it has an input of over 1 volt R.M.S., and a D.C. Resistance of 6,000 ohms.

Price Complete 2 gns.

"HIS MASTER'S VOICE"

USING MAINS VALVES

Some practical hints on the operation of mains-driven valves on either D.C. or A.C. electric-light supplies. This article will help you to get the most out of your set.

By K. D. ROGERS.

WHETHER you regard it in the light of a branch of electrical science or from the viewpoint of the set-constructor, radio is fascinating. In its very difficulties it is engrossing—though I must admit, often exasperating, too—and the most interesting, as well as trying, branch is that concerning mains-driven receivers.

Mains receivers offer greater scope for design, and at the same time leave more loopholes for failure, because the needs of the battery valve are as nothing compared with the requirements of its mains-driven brethren.

Take the S.G. valve. Admittedly the battery type needs screening well, but much more elaborate screening is usually necessary when it comes to a mains S.G., besides certain precautions relating to shielded heater wiring.

The battery detector is, well, just a detector, and is prone to no particular snags. The mains detector, however, needs careful watching, or "hum" will be one of the unenjoyable parts of the broadcast programmes.

Hum and D.C. Mains

One would think that heater-conveyed mains hum would be more likely to occur in an A.C. set than in one using the D.C. mains. This, provided ordinary precautions re shielded heater wires, is not the case.

We are not here dealing with hum picked up via the aerial, which type of interference is all too common, but of the hum due solely to pick-up between various points of the internal wiring of the set—notably the heater and grid connections of the detector valve.

Normally, provided a sensible layout has been used and the heater wiring is shielded, the A.C. detector will not raise its voice at 50 cycles. But with D.C. mains—at first thought very much easier to work with, but on consideration just the opposite—one is up against largely different voltages between the various cathodes and heaters; a feature that does not arise in the case of A.C.

Voltage Differences

Let me explain. Take the ·25-amp. type of indirectly-heated D.C. valve. This has a heater of 64 ohms, causing a voltage drop of 16 volts across it. That is, the voltage between the heater at the positive end and the cathode of the valve is 16 volts, provided only one valve is used, and the cathode taken as usual to H.T. –.

Place two valves in series and then the cathode of the valve at the positive end of the heater wiring is 32 volts above the heater. So it continues until with six valves of this type a voltage of 96 volts is applied between cathode and heater of the "nearest-positive" valve.

The ·25-amp. valves are designed to withstand a heater-cathode potential difference of 100 volts, so that we are safe up to six valves as regards any danger of breakdown due to this voltage.

Order of Connection

But another point arises where hum elimination is concerned, and this is the actual order of heater series connection with D.C. valves. Any old order will not do.

It would not be advisable to connect, say, a 2 S.G., det. and 2 L.F. set in logical order with the S.G., det. and

FIRST COUSIN OF THE VALVE

Mr. Frank Hodges, J.P., examining one of the latest X-Ray tubes on show at a recent exhibition.

TELSEN RADIO COMPONENTS

TELSEN VALVE HOLDERS (Prov. Pat. No. 20286/30). The Telsen four- and five-pin valve holders embody patent metal spring contacts, which are designed to provide the most efficient contact with split and non-split valve legs, and are extended in one piece to form soldering tags. Low capacity and self-locating.

Telsen 4-pin Valve Holder .. .. **Price 6d.**
Telsen 5-pin Valve Holder .. .. **Price 8d.**

TELSEN MANSBRIDGE TYPE CONDENSERS

Made in capacities from ·01 to 2·0 mfd. From 1/6
Telsen Fixed Mica Condensers are made in capacities from ·0001 to ·002 mfd. Price 6d.

TELSEN BINOCULAR H.F. CHOKE

Hailed unanimously by the leading experts as the perfect H.F. Choke. The Telsen Binocular Choke is called for wherever highest efficiency is desired. Its highest inductance (180,000 microhenrys) and exceptionally low self-capacity (·000002 mfd.) ensure a very high impedance at all wave-lengths, and its excellent efficiency curve is free from parasitic resonances.
Price 5/-

TELSEN LOUD-SPEAKER UNIT

The Telsen Loud-speaker Unit is pleasing to the most sensitive ear. The deep notes of the bass, the brilliance of the soprano, and the crispness of diction are clearly reproduced without distortion.
It employs cobalt steel magnets, and the detachable rod which carries the cone is fitted with cone washers and clutch. The entire unit is enclosed in a beautifully moulded bakelite dust cover .. .. **Price 5/6**

TELSEN

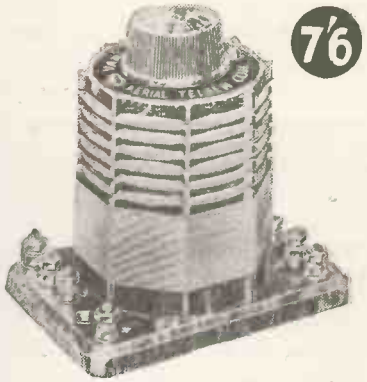
ALL-BRITISH

RADIO COMPONENTS

Also include :

Output Transformers	.. ..	12/6
H.F. Chokes	.. from	2/-
Output Chokes ..	.. "	8/-
Power Grid Chokes ..	.. ..	8/-
L.F. Coupling Chokes	.. ..	5/-
Slow-Motion Dial ..	.. ..	2/6
Fixed Condensers ..	.. from	6d.
Pre-set Condenser ..	.. ..	1/6
Variable Condenser ..	.. ..	4/6
Spaghetti Resistances	.. from	6d.
Loud-Speaker Chassis ..	"	5/6
Fuse Holder	.. ..	6d.
Grid-Leak Holder ..	.. ..	6d.

Send for the "Telsen Radio Catalogue" and book of "All-Telsen Circuits" to The Telsen Electric Co., Ltd., Aston, Birmingham.



TELSEN DUAL-RANGE AERIAL COIL

It incorporates a variable series condenser and is suitable for all districts. It has been tested in various parts of the country, and down to distances of five miles from Regional stations a single tuned circuit will definitely separate the Regional programmes. A reaction winding is provided .. .. **Price 7/6**
Telsen H.F. Transformer and Aerial Coil, **Price 5/6**

TELSEN GRID-LEAKS

Telsen Grid-leaks are absolutely silent and non-microphonic, and practically unbreakable. They cannot be burnt out and are unaffected by atmospheric changes. Telsen Grid-leaks are not wire wound and therefore there are no capacity effects. Their value is not affected by variation in the applied voltage.

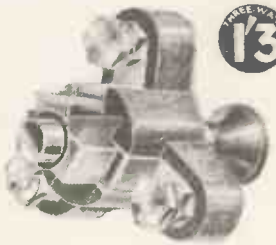
Made in values from ½—5 megohms.

Telsen Grid-leak .. .. **Price 9d.**

TELSEN BAKELITE DIELECTRIC CONDENSERS

The moving vanes are keyed on to the spindle and there is a definite stop at each end of the travel. The connection to rotor is made by a phosphor-bronze pigtail so there is no crackling due to rubbing contacts. The connection to the stator vanes is absolutely positive—a very important point. All Telsen Bakelite Condensers are supplied complete with knob.

Differential Condenser—
Capacities ·0003, ·00015, ·0001, Price 2/-
Reaction Condenser—Capacities ·0003, ·00015, ·0001, Price 2/-. ·00075, ·0005, Price 2/6.
Tuning Condenser—
Capacities ·0005, ·0003, Price 2/-



TELSEN PUSH-PULL SWITCHES

(Prov. Pat. No. 14125/31).

The Telsen Push-Pull Switches employ a proper electrical knife switch contact and are soundly constructed on engineering principles. The centre plunger is wedge-shaped, so that as it is pulled out it forces the inner fixed contacts outwards, tightly gripping the moving contacts. There is no fear of crackling with Telsen Push-Pull Switches. Their low self-capacity makes them suitable for use in H.F. circuits.

Two-point .. .. **Price 1/-**
Three-point .. .. **Price 1/3**
Four-point (2 pole) .. .. .. **Price 1/6**

Advt. of The Telsen Electric Co., Ltd., Aston, Birmingham. CVS—63

Stopping Hum in a D.C. Receiver

L.F. valves following one another from positive to negative end of the heater line. If this *were* done, then the detector cathode-heater voltage would be 48 volts at the positive end of the heater, and in some cases this would set up a hum. It is best to make the detector the last of the line on the negative end.

A Complication

With D.C. sets, where commercial designs are concerned, an earthed case and chassis is often employed; a fact that rather complicates the design when either positive or negative mains may be earthed.

With the ·25-amp. valves there is no necessity to include smoothing chokes in the heater leads, but with the inclusion of a smoothing choke in the H.T. supply (a real necessity) difficulty arises in the event of the positive main being earthed, due to the fact that hum may be set up between the valve cathodes, which will be joined to H.T. —, but not to the chassis and screens, and the earthed chassis and screens.

The Detector Stage

This occurs most often, as might be expected, in the detector stage, and to overcome the trouble quite elaborate preparations are advised by the makers of the ·25-amp. valve. Let me quote from their own notes on the operation of these valves:

"To overcome the difficulty (of hum in the detector stage) it is desirable to mount the detector valve, its associated screen, and accompanying circuits such as grid leak, condenser, and following transformer, in a screened can which is connected to the cathode of the detector and to negative main, not to earth."

Double Screening

This is quite O.K. where a home-constructed set is concerned and where the builder is not desirous of earthing everything that can be touched.

Otherwise it is not sufficient in the case of positive earthed mains, for these new screens and their connection to the cathode and negative main will mean that they are well below earth potential, to an extent equal to the voltage of the mains, and this is unsafe.

In such a case a further *earthed* screen should surround (but be insulated from) the cathode connected detector screen and the two be connected together via a small condenser.

The value of this condenser must be a compromise between a low value sufficient to ensure H.F. stability and yet not to give rise to hum.

As this condenser virtually shunts the H.T. smoothing choke, care should be taken that its value is no larger than is absolutely necessary to give high-frequency stability.

Output-Choke Effect

Though I have not yet come up against the phenomenon myself, the valve manufacturers state that the use of an output choke-filter scheme, especially if used with a pentode, is not an uncommon cause of hum. In such an event the solution is the use of an output transformer.

H.F. chokes (one in each mains lead) of about 25 microhenries inductance, and capable of carrying ·5 amp., are often a help in getting rid of the "singing" type of hum or noises caused by electric light switches. The chokes should be enclosed in a metal box, which should be earthed.

This choke remedy is often a valuable one where A.C. mains are concerned, and where one is troubled by what might be termed tunable hum; that is, the hum is only present when a station's wave is tuned in. In this case the chokes should be placed in series with the feed from the mains, and as far from the set as possible.

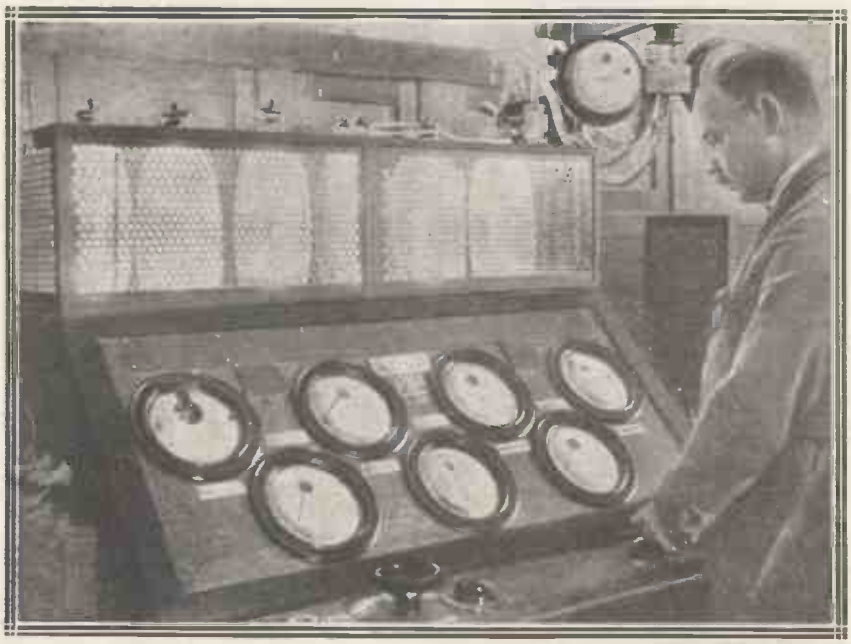
"Anode-Current" Bias

Correct biasing of mains valves is easily obtained by means of the series cathode resistance, the value of this depending upon the anode current of the valve and the bias required. Thus 1,000 ohms will give you 1-volt bias for every milliamp. of anode current, while 500 ohms gives ·5 volt for every milliamp. Average values are 750 ohms for S.G. valves, 750–1,000 for H.L. type, 600 for L.F. type (7,000 ohms impedance), 300–350 for power, and 300 for super-power. With mains pentodes about 300 ohms is usual.

Adequate Output

But in using mains valves, most important of all is the choice of an H.T. unit. This must be capable of providing the voltage and *current* required without so losing its smoothing efficiency as to cause hum. A unit that will only just stagger home, as it were, with any particular output will not be likely to allow humless reproduction from the set, and a 25 per cent factor of safety is advisable in every mains unit if one is to be sure that this part of the equipment will not let one down.

A GIANT OF THE ETHER



Watching the indicator meters on one of the panels of the giant station at Koenigswusterhausen.

The Mystery of the Man on the Moor

ONCE more a jolly old Christmas number, the journalist's milestone, is on the stocks, and I have to tune my note accordingly. Only too glad to do so, I assure you, for it gives me a chance to frolic and kick up my heels, although I have a bias towards ghost stories—inherited from a great-aunt, name of Doole, who wore crêpe for half a century and used to talk to the late Doole every Christmas Eve at midnight sharp. He was well out of it.

My Radio Retirement

(Break away !) Now, this Christmas stuff ! Christmas is an abnormal season in a number of important ways. Easter is a neck and a half behind. At this time we nourish ourselves on unusual victuals (and spend Christmas afternoon in repenting) : we give things to people freely, with no ulterior motive (so I trust), and donate utterly useless articles to hopelessly useless relatives.

And one day, when I have retired from this confounded radio business to a cottage by the sea, I shall occupy certain evenings in discussing the reason why sedate, elderly men don coloured paper caps and play with air-balloons till two o' the Boxing Day.

Those "Boxes"

Ah ! Box-ing Day ! Christmas boxes ! About December 20th the lift attendant begins to call me "sir." How patiently he waits for me ! How kindly he bids me "Mind the step, sir !" How brisk becometh the office-boy ! And how colloquial the ticket-collector finds himself !

How delicately knocketh the postman ! ETC. All this is abnormal. This forced gaiety, this overflow of the milk of human kindness. Heaven forbid that it should ever be otherwise, but it gives me an excuse for departing from my customary prosing into a real old-fashioned Christmas yarn, albeit in a modern setting. So here goes !

THE FAMILY PARTY !

Find Grandma's ear-trumpet, and give the figs a shove in her direction.

Gather round the fire ! Pa, light your pipe and snuggle down into your chair. Find Grandma's ear-trumpet and give the figs a shove in her direction. Young Alf can stop up for once, but he must not sniff or eat one more chocolate.

Bert and Milly had better sit back there, in the shadows. They won't hear the yarn, anyway ! Aunt Maud, here's your hassock. Don't talk to Grandma about the Vicar till I have finished ! Mother, sit by me and don't lose your spectacles again, there's a sport.

The kitchen chimney won't catch fire, and Mary, the housemaid, has lots of things to eat, and is quite happy because the milkman's young man has come up to the scratch at long last. All set ? Then here we go.

A Set for My Friends

Christmas Eve some few years ago found me at Hesslevale, in the East Riding, which I reached about six o'clock in the evening after a dreary ride from Driffield. My intention was to travel on to Hessle Manor to instal a radio set for my friends, the Hurcombs, stay the night, and motor to my mother's place at York for Christmas. Prosaic enough, surely ! But Fate painted, as the scroll of time unrolled, in lurid colours.

Recuperation

I was so miserable with cold and hunger that I decided to have a bite and sup at the Archers' Inn, Hesslevale, before continuing my journey, even though I had to eat another dinner at Hessle Manor. So I put myself on the outside of some roast turkey and half a bottle of sherry.

"No, sir," said mine host of the Archers', "there's no conveyance to the Manor to-night, I'm afraid. But it's a plain road and a matter o' four miles only. Snow's been well trod down, too, and froze over hard-like."

"Ah, well," I replied, hunching my shoulders into my greatcoat, "that's

A Timely S.O.S. Saves the Situation

an hour's walk. I ought to be there by eight."

When I struck out, I found myself walking due east into the teeth of the most biting wind I had ever felt. Snow was beginning to fall, and had it not been for the tracks of men and motors on the road I should assuredly have strayed on to the wolds and been lost.

Presently the wind dropped and the snow began to fall heavily, so that in half an hour I was a mere moving island in a whirling ocean of whiteness.

I encountered several bad drifts, and once I fell, jarring my entire nervous system.

A DEAD MAN!

The dark patches led me to a dead man.

After a time I had an uneasy feeling that I was no longer on the road. Moreover, a clump of trees for which the landlord of the Archers' had bidden me look' refused to show up.

I fell into a panic, changed direction twice, and then realised that I was completely at sea, so to speak. Then the snow stopped and the wind resumed its onslaught. I decided to plod on and chance my luck.

A Little Symphony

I walked carefully, keeping my eyes on the surface of the snow in front of me, not relishing another fall. I hummed as I walked—just to show that my tail was up—Elgar's Second Symphony, last movement. Very inspiring!

Eventually I realised that there were on my left hand something very like to a pair of car-wheel tracks. "Good egg!" I muttered. "I'm on the road all right." And so I was—on the road to that ghastly-faced, silent woman and the fright of my life.

The snow seemed to be dirty a little farther on. Dark patches appeared here and there on its tablecloth whiteness. Heather, I supposed. Suddenly my heart missed a beat; my eyes took in the scene and my mind construed it. The dark patches led me to a dead man.

Real Drama

I had seen plenty of his sort during the war, but a *civilian* corpse seems to give one quite a nasty jolt. All smashed, and a great gash in his head! Looking up, I saw a dark object to the west. It was a small saloon car, all smashed, too.

The marks in the snow told me that the car, for some reason which I could not see, had hopped on its bonnet for some distance and then turned over and over. Mr. "Civilian" had staggered away, bleeding, and had collapsed where I found him.

I took the number of his car and toddled on. What a yarn for the Hurcombs! Meanwhile, I was lost on the wolds. So I decided to pull up at the first place I struck and get help for myself—and for Mr. "Civilian" out there.

Then I saw, looming up like a battleship in a sea-fog, the outlines of a great house. I broke into a jog-trot and at last reached a massy portico and a colossal door.

POOR "RECEPTION"

"Come in," she said, in a voice which reminded me of icicles hanging from the roofs of Antarctic caves.

I knocked. What a frightful row that knock made! It seemed to have a separate echo for every room! A footstep sounded lightly on the inner side of the door; there was a click, and then the great barrier slowly opened, revealing, thanks to a light far down the hall, the figure of a woman.

She spoke. "Come in," she said, in a voice which reminded me of icicles hanging from the roofs of Antarctic caves.

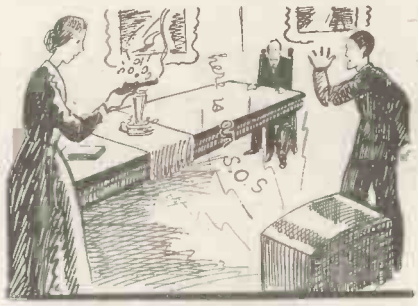
"Bang!" went the door, leaving me on the inner—and wrong—side. "Come in," said Lady MacBeth, leading the way.

"I am sorry to intrude——" I began.

"Hang up your things," said the Icicless, "all the servants, except cook, are gone for the holiday."

"Well," I answered, in a tone of forced humour, "so long as the cook stands by the ship—eh? Ha, ha!" But she didn't respond. Instead she said: "Come in here."

RADIO TO THE RESCUE



Then a bullet sang past my head and turning that member, I saw the lady with an automatic in her hand.

"Here" was a panelled room—most cosy and romantic, I must say. Ancestors all round the walls, log fire, books—but, seated at the end of a long table, a fellow with a mug as grim as Mephistopheles himself.

"Here he is," said my conductress; "a little late, but nevertheless here!"

"Good!" rapped out Satan.

"There's a man——" I began.

An Undesirable Tone

"There *was* a girl," came the icy, level, deathly voice of the woman. After that she never uttered another word in my hearing, but stood with white, set face, erect as a grenadier—*with her back to the door.*

"Sit down," commanded the man. "Just there!"

I obeyed and hastened to bring the interview into rational channels.

"My dear sir," I said, "this is an extraordinary reception for a strayed traveller who comes seeking only to be directed to——"

"Stop that fooling," snapped my host, "and listen to me."

"But, I assure you—er—my name is Wayman, and——"

(*Continued on page* 676)

Choose your stations

with the famous EKCO Station Dial

The fact that you may know Rome has a wavelength of 441 metres helps you very little with the ordinary radio set. You must refer to schedules of tuning positions and you must seek diligently and patiently . . . .

How vastly different with the new EKCO Sets. Here is a single knob which you turn . . . . and as you turn a pointer moves. Moves around a dial on which are printed the actual **names** of stations. All the principal stations at home and abroad awaiting your choice; no complicated adjustments; no doubts or difficulties, each station definitely identified by **name**. This exclusive EKCO feature is but one of the many which make the new EKCO Sets so different from ordinary radio — so far ahead in simplicity, performance and reliability; as, of course, you have a right to expect from sets made by the Pioneers and leading Specialists in British All-Electric Radio.

The new EKCO 4-valve Consolette, here illustrated, is complete in itself — an all-electric receiver combined with a moving-coil speaker of the very latest design. Figured Bakelite Cabinets in three delightful shades — dark jade, mahogany and walnut. You need no additions, no accessories, no batteries Just plug in to the electric light and switch on, that's all. (For A.C. Mains).

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or by easy payments
over one or two years

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EKCO

ALL-ELECTRIC RADIO RECEIVERS

Woburn

AT YOUR SERVICE

by OUR TRADE COMMISSIONER

Under this heading each month will be given news of the radio trade that should prove of interest to the home constructor, general reader, and wireless dealer alike. In order to enable us to provide a close link between the manufacturer, retailer and the general reader, news of the doings of the wireless trade will be welcomed for inclusion in these pages, for it is only by the close co-operation of the manufacturer and the consumer that both sides can be sure that they are getting the best that radio can offer.

Over Two Score

I HAVE been having a close run through some of the latest catalogues issued by well-known radio firms, and some surprising facts have come to my notice.

One expects to find that Varley, Ferranti, R.I., etc., have wide and varied ranges of L.F. transformers covering all kinds of needs. One also expects Amplion, Epoch, Celestion, B.T.-H., and other loud speaker manufacturers, to have a large range of speakers.

But what I had not expected, because I had not given the matter more than a thought, was that Messrs. Colvern, Ltd., have over forty different types of tuning coil on their regular list.

Condensers—Now Coils

Running very close in number of types in a definite component is Sydney S. Bird & Sons, Ltd., makers of the famous Cyldon variable condensers and Extensers. Here we find the latest catalogue contains just under forty variations of such tuning devices—and a remarkable range it is, too.

Whether it's a single Extenser, triple-gang type, midget gang condenser, trimmer, short-wave series gap condenser, or a special type to your own design, Cyldon's can supply it. And all their products have a *five years' guarantee* against faulty workmanship in construction.

And now, with their new works all ready, Messrs. Sydney S. Bird & Sons are going to expand into the coil market. We wish them every success; by good workmanship they have built up a reputation second to none, and they deserve it.

The "Clarostat Book"

Have you seen a copy of this interesting 48-page book? Issued by Claude Lyons, Ltd., 40, Buckingham Gate, S.W.1, it contains rectifier circuits, a wealth of practical data concerning the famous "Clarostat" resistances, volume controls, potentiometers, etc., and also details for the home construction of mains units, and so on. Given free to all interested in radio, this book and its previous editions have reached a circulation of over 150,000. You should get hold of a copy—it's full of interesting reading.

B.A.T. transformers are described, and the famous Audak pick-up and

A MAGNIFICENT BUILDING

This is the fine building that has been planned as the final home and works of Telsen Electric at Birmingham.

After all, one expects a coil firm like this to have, say, a dozen or fifteen standard variations of coils, and to be able to make special inductances for special jobs. But a stock of over forty really different types, obtainable at a moment's notice, was something I had never dreamed would exist.

This does not exhaust the supply of radio components from this go-ahead concern, however, for resistances, volume controls, screens and switches of various types figure in the list.

TELLING THE WORLD

This giant searchlight loud speaker can be heard several miles away.

More Components Than Ever Being Produced

Diehl electric gramophone motor are fully discussed.

"Bread and Butter" Before "Cake"

I have it on reliable authority that no more Glazite (as now known) is being made. Instead, a new wire of better insulating powers, and more attractive appearance, is being prepared ready for release as soon as the stocks of Glazite are exhausted. So it's up to you. If you want some of the new wire, which will have a pretty transparent cellulose-base covering, whack into our old friend Glazite and get those stocks polished off as soon as you can.

There is just one more piece of bread and butter, as it were, to eat before we come to the cake.

Components from Kent

Near Bromley there is a go-ahead factory which is rapidly becoming known as the home of reliable and inexpensive components. Though their grid leaks, fixed condensers and L.F. transformers were known eleven years ago, a large number of new lines have been added during the last few months.

I am referring, of course, to Graham Farish, Ltd., whose reputation for sound manufacture and reliability has long been established.

The latest list from this firm includes a wide range of components, from the grid-leak and resistance holders to loud-speaker units, chassis speakers, pick-ups and cabinet loud speakers.

Components worth special attention are the differential reaction condensers, the volume controls, H.F. chokes, Spaghetti resistances, and the L.F., smoothing and output chokes.

The illustrated folder I have received shows that not only are the goods right, but the price also. Sixpenny valve holders and fixed condensers, transformers and loud-speaker units at 5s. 6d., volume controls at 3s. 6d., and "Ohmite" resistances at 1s. 6d.—such are typical examples of the low-price, high-standard programme of this ambitious firm.

STILL EXPANDING AT CROYDON

The R.I. factory near Croydon to which a huge wing has been added owing to expansion of business.

From the North

Going up North we find Messrs. Wingrove & Rogers, Ltd., manufacturers of the Polar products, have been busy with several new lines.

FOR YOUR RADIO-GRAM

This is the H.M.V. pick-up playing desk model 116, which sells for 10 guineas.

Most interesting among these are the "Aperture" slow-motion condensers at the extremely low price of 7s. 6d., and the cheaper slow-motion Polar No. 2 at 6s. 6d., and its cousin the No. 4, which has direct drive, and costs only 4s. These are all sure of tremendous sales.

Comprehensive Catalogues

The 1932 Peto-Scott catalogue is a most comprehensive affair. It includes all the apparatus likely to prove most popular during the coming season, and gives one an idea of the tremendous selection of radio goods which awaits the customers of this old-established firm.

From radio-gram cabinets down to on-off switches a tremendous range is included and illustrated, and it is difficult to conceive of any component not covered by this extensive book. Over 100 pages of condensed radio component information.

Equally comprehensive is the 1932 catalogue of New Times Sales Co., which covers an enormous range of components and accessories, kit sets and so on. "Everything New In Radio on the Easiest of Easy Terms" is the slogan, and the fine catalogue certainly supports this extremely ambitious motto.

Guaranteed Speakers

The Baker's Selhurst Radio permanent-magnet moving-coil loud speakers are guaranteed for six years—a gesture of confidence that augers well for their trade during the coming season.

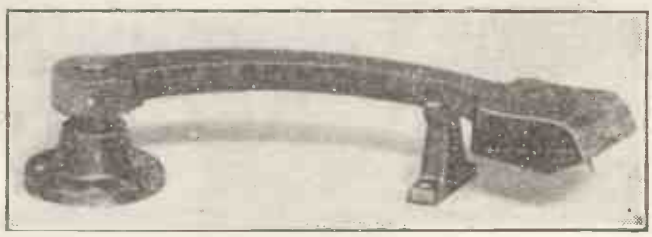
The range is large and the prices are remarkably reasonable.

Most interesting of all, however, I find the "Klock" moving-coil speaker, illustrated in the Baker's catalogue on page 8. It has a red clock, which operates from A.C. or else by a dry battery, dependent upon whether or not the owner is on frequency controlled mains. At £12 it is an attractive proposition.

Finally this catalogue contains details of mains units and complete receivers marketed by this well-known firm and of equally excellent workmanship.

A SENSITIVE PICK-UP

The junior B.T.H. pick-up is both attractive and sensitive. Here is a photograph of it.



RELEASED BY LIGHT

A description of the photo-electric cell and some of the wonderful things that can be done with it.

An interesting, informative article

By

R. W. HALLOWS, M.A.

SINCE it was first brought out, a good many years ago, the simple vacuum tube has been developed by scientific research work into quite a host of wonder-working appliances. Amongst them are the wireless valve, the X-ray tube, the cathode-ray tube, and last, but possibly most astonishing of all, the photo-electric cell.

How They Work

The average man is probably not very clear in his mind regarding what difference, if any, exists between the photo-electric cell and the selenium cell, though probably he has noticed that the selenium cell, which used to be very much to the fore, is hardly so nowadays.

The difference is just this. The selenium cell may be likened to a length of resistance wire. Place a piece of this wire in a circuit and vary the temperature; the current will also show small variations, since the resistance of the wire changes with the temperature.

The selenium cell is a variable resistance which is affected not by heat but by light. The photo-electric cell, on the other hand, is comparable with a two-electrode wireless valve, as shown in Fig. 1. Heat up the filament of such a valve and it emits electrons which can be drawn in a stream through the valve by connecting the negative of a high-tension battery to one leg of the filament and the positive to the plate.

Like a Valve

The photo-electric cell also contains two electrodes, the cathode and the anode. Light, not heat, causes the cathode to fling out electrons, and if a battery is used in exactly the same way as with the valve, an electron current passes from cathode to anode. Fig. 1 makes plain the similarities and the difference between the photo-cell and the diode valve.

In Fig. 2 is seen a diagrammatic representation of one kind of photo-electric cell. This cell is in appearance strongly reminiscent of the modern wireless valve, since the bulb is silvered on the inside. Though the "silvering" of the valve is really magnesium, the genuine article is used in the photo-electric cell.

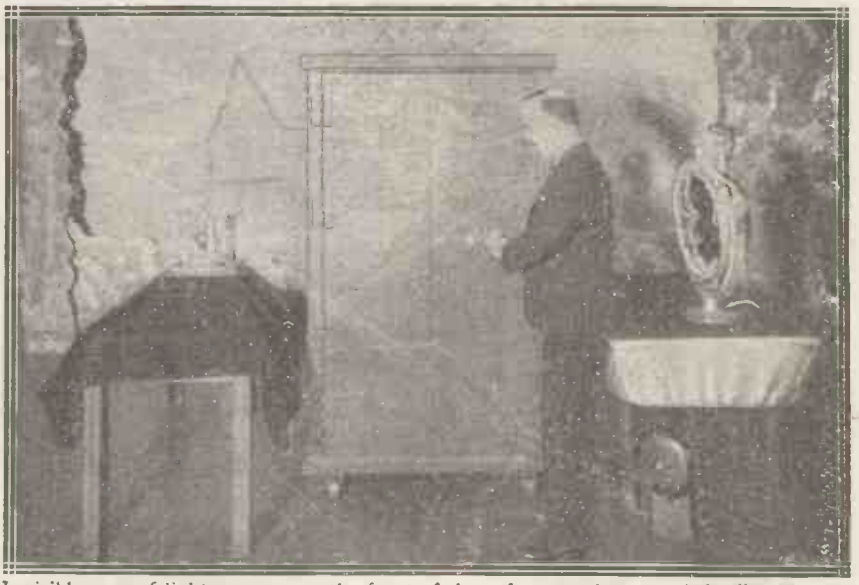
The current passing through the average photo-electric cell is far smaller than that of any wireless valve. Still, it IS a current, and by means of valve amplifiers it can be harnessed to greater power in a whole host of ways.

The silver coating does not itself form the cathode. It is placed there partly so that there shall be a good contact with the cathode lead and partly because it makes an excellent foundation for the very thin coating of sensitive metal that is deposited upon it.

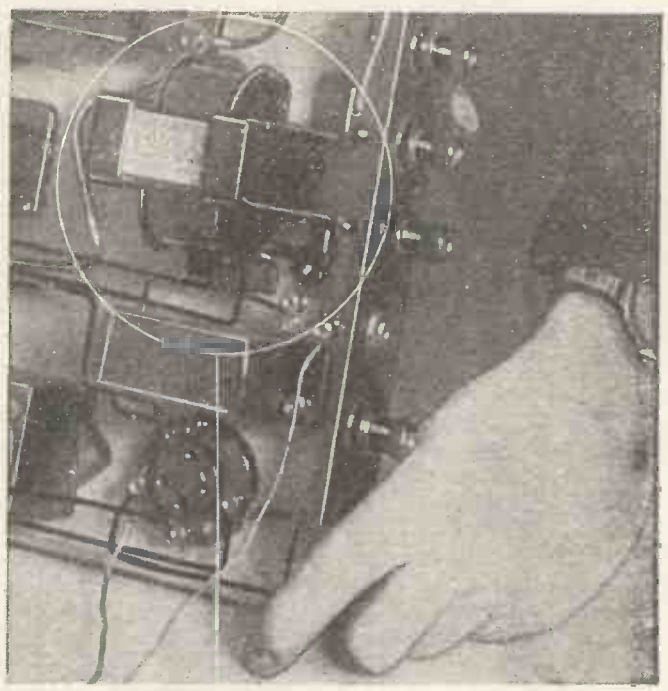
Rare Metals Used

It will be seen from the drawing that the metallic coating does not entirely cover the inside of the bulb; a small portion, known as the window, is left clear so that light may enter. The anode is a small metal ring suspended in the middle of the bulb. Light entering by the window causes the sensitive coating to emit electrons, which are drawn through the tube to

DEMONSTRATING THE INVISIBLE DETECTIVE



Invisible rays of light pass across the front of the safe seen above, and the little instrument to the left works burglar alarms if anyone cuts off the rays by going near the safe. This scheme was employed at a recent London exhibition to protect a particularly valuable exhibit.



THE "ECKERSLEY" THREE

described in this number

SPECIFIES THE LOTUS L.F. CHOKE

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This is a general-purpose component, and may be used wherever a low-frequency choke is required. The core is ample and heavy gauge windings give high inductance with low D.C. resistance.
Efficient design makes this choke small in size and particularly useful, therefore, to the home constructor.
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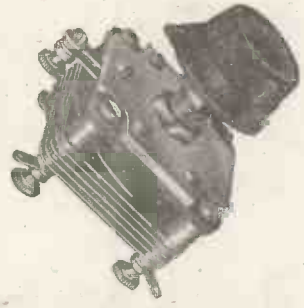

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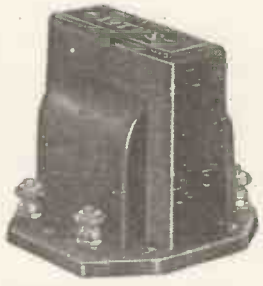

THE LOTUS AUDIO TRANSFORMER, No. 1

An inexpensive instrument for the home constructor. It is remarkably efficient and has a good straight-line amplification curve. Ratios 3–1 and 5–1.
Each **5/6**

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M.W. 12/31

LOTUS

GUARANTEED COMPONENTS

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It Tells the Doctor Exactly When to Stop

the anode when the latter is set at a positive potential.

What metals will emit electrons under the influence of light? So far, only seven are known that will emit when visible light falls upon them. These are barium, cæsium, lithium, potassium, rubidium, sodium and strontium. Only four of these, though, have been used at all generally: cæsium, potassium, rubidium and sodium. With the others it is exceedingly difficult to prepare a sensitive coating.

Of the four mentioned, potassium has, until recently, been by far the most commonly used in photo-electric cells, but during the last few months a wonderful new cell with cæsium as its sensitive metal has been developed by the G.E.C. Investigations show that all other metals produce photo-electric effects, but only under the impact of ultra-violet or X-rays.

A Tiny Current

The electron current passing through the average photo-cell is far smaller than that of any wireless valve. In their excellent little book on photo-electric cells, Mr. Norman Campbell and Miss Dorothy Ritchie, who have probably done as much experimental work upon them as any two people in the world, state: "In a typical cell with a window 3 centimetres in diameter, exposed to a 100-watt lamp at a distance of 20 centimetres, this current is about one micro-ampere."

HEAT OR LIGHT?

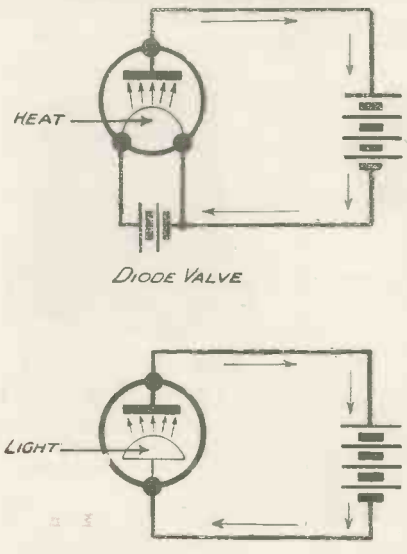

FIG. 1. PHOTO-CELL Y1431

There is little difference between a diode valve and a photo-electric cell, so far as operation is concerned. The main difference lies in the way the electronic emission is obtained.

Still, it *is* a current, and in electricity nowadays the tiniest current can be made by means of valve amplifiers and relays to do useful work. As we shall see, the photo-electric cell has been harnessed to serve man in a whole host of valuable ways.

Releasing More Electrons

A greater emission can be obtained by filling the bulb of the cell with an inert gas such as argon, or a mixture of neon and helium. The process which then takes place is similar to that which we used to see in the old "soft" wireless valve.

An electron leaving the cathode at high speed collides with a gas molecule, the shock detaching from it one or more electrons, according to the speed of the first.

In this way the stream of electrons to the plate is greatly enriched, since the inert gas is ionised by the collision. Just as the old soft valve would "blue-glow" if the plate voltage were made too high, so a gas-filled photo cell will show a similar effect if the anode voltage is excessive.

The actual current passing through the photo cell depends entirely upon the amount of light reaching the cathode. If the light is varying or flickering the current will vary and flicker exactly in step with it. Most wonderful of all, there seems to be no practical limit to the speed at which the photo cell will respond to light variations.

Some of the applications of the photo-electric cell are fairly well known. Most readers, for example, will be aware that it is used for the transmission of still pictures by wire or wireless.

Makes Television Possible

The photo-electric cell also makes television possible, and it is with its help that the sound track is imprinted upon a talkie film.

And there are many other less well-known uses. When, for example, a patient is undergoing treatment with ultra-violet rays there would be a great risk of inadvertently causing a burn if there were no electrical means of knowing when he had had enough! A special cell has been designed for this purpose; it enables the doctor to know exactly when to stop.

The photo cell is used for automatic burglar-alarms, the cells in this case being of a pattern sensitive to invisible infra-red rays.

Another application is for automatic signalling. Here a passing train cuts the ray passing from a source of light on one side of the metals to a photo cell on the other. The train thus automatically records its passage and operates the signals.

THE ELECTRIC EYE

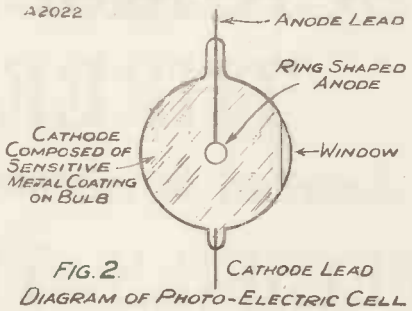

FIG. 2. DIAGRAM OF PHOTO-ELECTRIC CELL

The whole of the inside of the glass, apart from a small window, is covered with a thin layer of silver on top of which the light-sensitive material is spread.

Commerce is rapidly waking up to the usefulness of the photo cell. It is now used for counting articles too light to work any mechanical counting device, for telling whether fruits such as oranges and grape fruit are in good condition without opening them.

Dozens of Uses

Dyers, weavers, drapers, and others employed in many great industries find it most useful for colour matching. In metal foundries it can measure the temperatures of molten metal as no other device can, since it responds to the tiniest change of colour. Astronomers are making use of the photo cell for measuring the light given out by stars so distant that they are quite invisible without the aid of a powerful telescope.

New uses for this wonderful tube are continually being found. The photo-electric principle has even been used for the operation of a wireless set. Instead of heating the filaments of the valves, these were provided with photo-sensitive cathodes activated by beams of light.

So far the photo-electric wireless set is only a laboratory curiosity, but any day a tube with a much more copious emission may be developed, and it is quite possible that the wireless set of the future may operate by light alone.

"ATLAS" WON "W.W." OLYMPIA BALLOT 1930

HERE'S THE NEW MAINS UNIT WINNER FOR THIS YEAR

SPECIFICATION	CLARKE'S ATLAS
1 Variable Tapping	0/100 V.
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1 Fixed "	150 V.
Output at 150 V.	25 m.A.
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Charging Rate	0·5 A.
4 Grid Bias Tappings	1½,3,9,16 V.
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Yours for	10/- down

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ALL-MAINS UNIT MODEL A.C. 290

H.T., L.T. & G.B. from A.C. Mains

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4 OTHER NEW MODELS

2 new "ATLAS" H.T. Units at 52/6 and 59/6 and 2 new "ATLAS" All-Mains Units at 77/6 and 90/- respectively are introduced for A.C. Mains. They include many remarkable features and are undoubtedly the finest value ever offered.

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A FINE MAINS SET

By T. B. SANDERS
("M.W." Technical Staff.)

WHEN broadcasting first became established in this country it was the novelty of receiving speech and music from a "distant" transmitter which inspired most people to acquire a receiver. No one was in the least concerned with what the speech and music sounded like.

This contentment with mere reception regardless of quality soon gave way to a feeling that broadcasting would be vastly more entertaining if what was received in the home bore even a remote resemblance to the sounds produced in the studio. And then some unknown "pioneer" suggested the magic words "resistance coupling."

That was the solution. Only couple your L.F. valves with a resistance and a condenser and "purity" was achieved. Everyone agreed that the principle was right, but where was one to obtain a suitable resistance?

Those who tried the then available grid leaks as a substitute for suitable anode resistances were enabled to produce atmospherics in profusion, but to the searcher after "purity" that was not quite the idea.

An Established Firm

It was then that the firm of Varley made itself known to the radio public. They came forward with the famous "bi-duplex" *wire-wound* anode resistance. Every enthusiast immediately coupled his L.F. valves by the resistance-capacity method, and the better quality of reproduction thus achieved recreated the popular demand for broadcasting as a home entertainment.

This early contribution, which the Varley concern made to the betterment of radio reception, has been built upon by the whole industry so that high-grade radio reception is a purchasable commodity within the reach of all. But from no one can it be better purchased than from the still progressive firm of Varley themselves. The receiver here to be reviewed is a case in point.

Their Latest "Three"

Its official title is the Type A.P.24 3-Valve Mains Receiver. It is intended to be operated from A.C. mains of from 40 to 100 cycles, and can be supplied for use on mains voltages of 100 to 120 or 200 to 250. A counterpart is also available for use on D.C. mains of from 200 to 250 volts. The price is 24 guineas.

As would naturally be expected from a firm who pioneered "quality" reception, the design of the receiver has been arrived at after most exhaustive consideration of the factors affecting reproduction.

With this end in view, more than ordinary attention has been devoted to "de-coupling," and this has been made so comprehensive as to absorb no small proportion of the 24 guineas purchase price.

Preserving the Bass

In a mains receiver this matter of "de-coupling" is of paramount importance—especially in connection with the use of automatic grid bias. Any tendency to economise in microfarads or ohms where the "de-coupling" of automatic bias circuits is concerned is very liable to result in a complete absence of bass notes.

It is not enough merely to prevent instability. Quality must be preserved as well, and in the A.P.24 receiver the Varley people demonstrate conclusively to how great an extent final results depend on detail refinements.

Such considerations possibly have no immediate appeal to an intending purchaser, who is often apt to wonder whether a wireless set *can* contain 24 guineas of real value. The technical man who examines the Varley A.P.24 receiver is in no doubt on this point.

The three valves employed fulfil

(*Continued on page* 673.)

LISTENING TO GHANDI'S FIRST BROADCAST

New York members of the India National Congress listening in the studio of station W O R to Ghandi's first broadcast from Kingsley Hall, London. This talk was not put on the British ether by the B.B.C.

WHY BATTERIES WEAR OUT

An instructive and very readable article.

By J. F. CORRIGAN, M.Sc., A.I.C.

THE bugbear of all batteries is that not only do they wear out in actual use far too quickly for the average owner's liking, but even when they are not used and are stored away for any length of time a species of deterioration gradually sets in and eventually renders them more or less inert.

And this, despite the fact that a really tremendous amount of research has been carried out by manufacturers in order to cut down the "storage deterioration" of dry batteries and to give them a much longer working life.

Naturally, the modern high-class dry battery is immensely more efficient in these respects than the products of years ago. Nevertheless, I think all my readers will agree that we have still a long way to go before we attain even an approximation to the ideal dry battery.

The Dry-Cell Principle

Dry batteries operate on the well-known principle of the Léclanché cell. You can very easily make a simple form of this cell merely by immersing a carbon and a zinc rod in a moderately strong solution of sal-ammoniac (ammonium chloride).

Now, the action of this simple Léclanché cell depends upon the fact that when the carbon and zinc elements are connected together externally, a chemical change goes on in the cell. The zinc and the sal-ammoniac react together, forming zinc chloride, which dissolves in the water. Hydrogen is liberated, and minute bubbles of this gas travel through the solution, or the "electrolyte," as it is called, and collect on the carbon rod.

Polarisation Effects

In actual practice, a simple cell of this type would very rapidly run down. It would succumb to a sort of internal choking, known as "polarisation."

The collection of hydrogen around the carbon rod would quickly render the cell inactive, because the adhering layer of this gas, being an insulator, would stop the flow of the current, and also because the carbon rod and its adhering layer of hydrogen gas would form a cell on their own account, the current from which would act against the main current of the cell.

Such a cell, therefore, would be said to be in a "polarised" condition, and it would be utterly useless as a current generator. Every dry battery works upon this principle, but in order to overcome the polarisation difficulty as much as possible a special construction is given to it.

Practical Details

The component cells of, say, an H.T. battery comprise small cylindrical zinc cases—these, of course, taking the place of the zinc rod in our previous example. Around the central carbon rod of each component cell is tied a rough canvas bag containing a mixture of powdered coke or carbon and manganese dioxide, whilst the space between this bag and the inner walls of the zinc container is packed with a paste of sal-ammoniac—this paste being substituted for the solution of sal-ammoniac in the simple cell quoted above.

As a matter of fact, the exact method of packing the elements in the cell and the precise composition of the active paste have a lot to do with the resulting efficiency of the cell, and often enough these details are rigorously guarded trade secrets.

Removing the Hydrogen

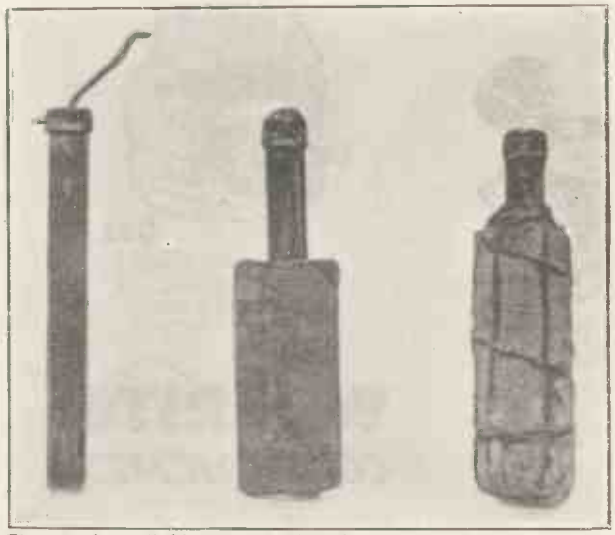
However, when a dry cell of this description is put into operation, what happens is this: chemical action takes place between the sal-ammoniac paste and the zinc container, hydrogen being liberated. The hydrogen passes towards the carbon rod, but, surrounding that element, it comes into intimate contact with the manganese dioxide—the "depolariser," as it is often called—which is a material of high oxygen content.

The admixture of this depolariser with powdered coke is made for the purpose of rendering the mass more porous. Owing to its contact with the depolariser, the hydrogen liberated by the cell's action is oxidised to water:

$$2H + O = H_2O.$$

And, therefore, it is prevented very largely from collecting in an adherent layer around the carbon element and so interfering seriously with the action of the cell.

HOW DRY CELLS ARE BUILT UP



First we have (left) the central carbon rod, and then you see the carbon rod fixed in the bag containing the depolariser, around which a sal-ammoniac paste is packed. Two different types of bags are shown.

WHY BATTERIES WEAR OUT

(*Continued from previous page*)

Why, now, does a dry battery constructed on this principle—as they all are—run down, even when it is not used?

This progressive deterioration is attributable to a number of factors. Firstly, the depolariser may be all used up after the cell has been working for any length of time. Secondly, the zinc may, perhaps, be similarly used up—which is very rarely the case. Thirdly, the zinc may have deposited upon its surface a layer of insoluble matter resulting from "side-actions" taking place in the cell.

Effect of Impure Zinc

This latter is a very common case of cell-deterioration, especially in the cheaper class of batteries in which impure materials are used. An insoluble layer deposited upon the zinc surface will naturally totally prevent the interaction between the zinc and the sal-ammoniac paste, and so completely cut out the action of the cell.

Indeed, you can often detect the presence of this insoluble matter adhering to the zinc case of an old dry battery merely by scraping a little of it away and by heating it up with water in a test-tube. A considerable proportion of your scrapings will refuse to dissolve.

Again, a cell may go dud owing to the slow drying-up of the moist sal-ammoniac paste. And here we note that a "dry" battery must be anything but dry.

Still further, cell-deterioration may progressively take place owing, first, to faulty insulation between the component cells of the battery; secondly, on account of slightly conductable paths being formed internally in the cell between the zinc and carbon elements; and, thirdly, by virtue of little "side actions" taking place within the cell.

If, for instance, impure materials are used in the construction of the cell, particles of the impurities may form miniature cells on their own. Each of these cells will, of course, only deliver a very minute amount of current, but as their action will go on uninterruptedly, even when the main cell is not in use, the active material of the latter will gradually deteriorate.

Future Improvements

There are other reasons also which account for the running down of cells, even when they are not used. Nevertheless, I think I have enumerated many of the chief factors which work towards a cell's ultimate ruin.

Without a doubt many of these deteriorating influences will in time be overcome by battery manufacturers, and a more nearly perfect and lasting type of cell will arrive. It has not done so yet, however, and therefore battery users must perforce put up with cells which, no matter how satisfactory their working may be in actual practice, are heirs to many internal ills and disabling diseases.

THE SIMPLEST CELL

An elementary Léclanché cell formed by zinc and carbon rods immersed in a sal-ammoniac solution.

RIGHT INSIDE

A sectional view of a dry battery cell with the zinc case removed. A certain amount of sal-ammoniac paste is adhering to the fabric of the bag. The bag is packed with a coke or carbon and manganese dioxide mixture.

TIDY TERMINAL TAGS

A simple idea which will improve both the appearance and efficiency of joints between flex wires and terminal tags.

TIDINESS is more than a blessing in many of the details of radio constructional work. It is, indeed, one of the essentials of efficiency.

'Phone and loud-speaker terminal tags, for instance, are cases in point. Can you imagine a terminal tag similar to the one on the right of the photograph remaining efficient for any length of time?

No, the tag will quickly come apart from its connecting wire. The insulation of the wire will fray, and when eventually the tag has to be freshly attached to the lead wire a portion of the latter will have to be cut away in order to remedy the loss of insulation.

The Neatest Way

By far the best and the neatest way to deal with terminal tag connections is to slip a short length of narrow-bore rubber tubing over the joint, as illustrated by the example seen on the left of the photograph.

If the rubber tube is rather too wide to make a perfect fitting, ram down both ends of it a little Chatterton's compound in order to make the joint dustproof and airtight. A terminal tag connection made on these lines looks neat and workmanlike.

WHICH WILL YOU HAVE?

No one would have any doubts about which of these two was more preferable. The joint on the right would not be expected to last long, and the one on the left is no more difficult to make.

RADIO NOTES and NEWS of the MONTH

IT is announced by the P.O. that the campaign against radio pirates in London, which lasted four weeks, netted £125,000 in licence fees.

"Some 250,000 new licences have been taken out in four weeks," an official said. "Detector vans touring London picked out pirates and 350 prosecutions are in hand now, while several hundreds more are being considered. A most significant feature is that 146,000 new licences have been taken out in the provinces, and the G.P.O. "detectives" have not started there yet.

A Successful Campaign

There is no doubt the G.P.O.'s campaign—despite the many points open to criticism—has been successful. Exactly how many "pirates" still remain in London is a poser—but although many have had the "wind up," there are probably many thousands who have still to pay up their "ten bobs."

B.B.C. Governors

The term of office of four of the Governors of the British Broadcasting Corporation expires on December 31st, and the question of their re-appointment, or replacement by others, is engaging the attention of the Prime Minister.

Under the charter of the B.B.C. the appointment of the Board of Governors, with the exception of the chairman, ends automatically at the end of five years.

The four Governors concerned are: Lord Gainford (vice-chairman), Mrs. Philip Snowden, Dr. Montague Rendall, and Sir Gordon Nairne.

Mr. J. H. Whitley, the Chairman, was appointed in June, 1930.

In considering the constitution of the board for 1932–1936, Mr. MacDonald may also have before him the question of adding further members. The charter permits a board of seven.

New Blood?

It seems that a lot of speculation is going on regarding these possible new appointments.

Among the names mentioned are those of Sir Harry Brittain, Sir Robert Donald, the Rev. Dick Sheppard, and Captain Ian Fraser, the blind M.P.

The chances of the first two, I think, are rather remote; although the useful work done by Sir Robert Donald in the matter of Empire communication leads some people to believe that his name will certainly be considered.

Unfortunately, no real entertainment expert—such as Mr. Cochran—has been mentioned, but there is still a chance that the board will be strengthened by the addition of one

(*Continued on page* 664.)

"THE ECKERSLEY THREE."

The Modern Set of the Season incorporates the new screened coil specially built to Capt. Eckersley's specification by

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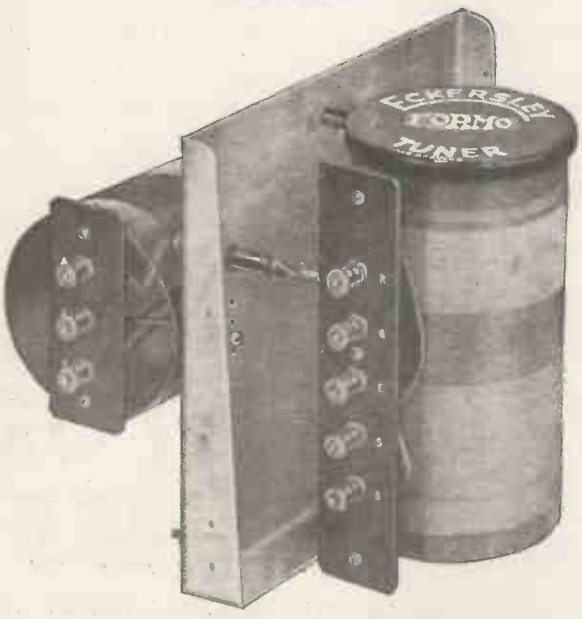

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See also pages 669 & 670.

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PIFCO ALL IN ONE RADIOMETER

℗ P. 3a

RADIO NOTES AND NEWS OF THE MONTH

—continued from page 662

or more members who have a thorough knowledge of the psychology of public entertainment.

At the Vatican

It is reported from Paris that the Pope has conferred the order of a Grand Officer of St. Gregory the Great upon M. Edouard Belin, who invented and supervised the installation of the television apparatus recently inaugurated at the Vatican.

An American Tour?

I learn that next February all Europe will "hook in" to the B.B.C. National Programme, when Dr. Adrian Boult will conduct a programme of modern British music.

Recently, American agents approached Dr. Boult to go to America to become a permanent conductor there, and many of the American radio interests have approached the B.B.C. to get the Symphony Orchestra to visit the States. Rumours of an American tour are certainly not without some foundation. But if the tour failed financially (which I don't suppose it would) there would certainly be a fuss when licence payers had to foot the bill!

For the Blind

The first free B.B.C. pamphlet available for the blind has just been issued—in Braille. It is "The Modern State," and its importance lies not so much in its subject-matter as in the B.B.C.'s recognition of an important section of their listening audience. The blind, of course, already receive their wireless licences free of charge.

Right Next Door!

According to the "News Chronicle," one of the B.B.C.'s vaudeville producers, after looking all over London for talented instrumentalists to give solo performances in broadcast variety, found what he wanted in a studio next door to his office at Savoy Hill.

Two members of the B.B.C. Theatre Orchestra—Mr. Lambert Flack (flute and piccolo), and Mr. George Clarkson (saxophone)—were practising when the producer heard their efforts. The result was an immediate engagement with the likelihood of more to follow.

The B.B.C. announces that at Broadcasting House British pianos will be used exclusively. An order has been placed for the necessary instruments for use, both at Broadcasting House and in the provinces.

When these have been delivered artistes who wish to play on some make of piano other than that provided by the B.B.C. will be allowed to bring their own, but at their own expense.

A.B.C. Next!

The Prime Minister of Australia, Mr. Scullin, announces that the Government has decided to abolish the private control of broadcasting and to establish a system similar to that in Great Britain. The change, it is stated, will take place on June 30th next, when a corporation similar to the B.B.C. will take control.

Still Soaring

It is reported that there is such a demand for wireless sets that in many cases dealers are unable to obtain supplies.

According to an official of the R.M.A., nearly 73,000 sets were

(Continued on page 666.)

RADIO NOTES AND NEWS OF THE MONTH

—continued from page 664

purchased in October, compared with about 36,800 in the same month last year.

Last year the total number sold by British manufacturers was 649,100 but it is expected that this year's total will be well over a million. At the end of October more than 200,000 people were directly employed in making wireless sets and parts, an increase of 60,000 compared with the same period last year.

The Problem of Africa

Tremendous interest has been excited at home and in the Dominions and Colonies by the B.B.C.'s decision to build an Empire short-wave broadcasting station at Daventry.

Mr. Gerald Marcuse, one of the pioneer short-wave experimenters, told a reporter recently that even with beam services—the most efficient method of covering long distances yet developed—there are hours, corresponding with the English afternoon, when communication fails. We have not so far discovered why.

Africa represents another special problem. For some reason not yet explained, South Africa is one of the most difficult parts of the world to reach by wireless from this country.

Five Aerials

In order that the maximum benefit may be obtained all over the world from the new Daventry station, the B.B.C. proposes to erect two transmitters and five aerials. These will probably be designed on the half-wave basis (the effective part of the aerial having a length equal to half the wave-length used).

Consequently, parts of the Empire which do not receive a programme well from one aerial may get it from another of different shape and size, and pointing in a different direction.

The wave-lengths which have been found most suitable for all-round long-distance wireless are in the neighbourhood of 16 metres and 31-32 metres.

A Crying Need!

There has been a crying need for a first-rate Empire station for years. Canada, Australia and South Africa, with their own broadcast systems, have said that such a link with home would be very welcome. It has seemed strange to British people the world over that Holland, Germany, France, and the United States provide programmes that can be heard in almost every corner of the earth, whilst the voice of London during the last four years has been dependent on a small experimental station at Chelmsford. The estimated cost of the new station is £40,000.

They are Looking Up!

According to Mr. O. B. Hanson, Chief Engineer of the N.B.C. of America, there are probably more than half a million television amateurs in the United States to-day.

Mr. Hanson believes that the future of television lies in the cathode-ray system, rather than the scanning disc, the method now used in the Baird system.

Mr. Gerald Chatfield, supervisor of programmes and art technical director of the National Broadcasting Company, was recently in London with Mr. Hanson. They have toured Germany, Russia and England, seeking new ideas for Radio City, the gigantic broadcasting scheme in New York.

HOW TO LOAD A BELLING-LEE WANDER PLUG

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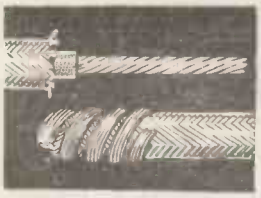

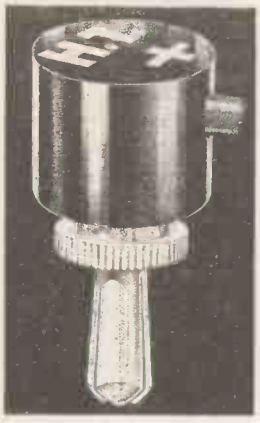

Having bared the wire for three-quarters of an inch, wind it back tightly over the cover for about a quarter of an inch: Unscrew sufficiently to insert the prepared end of the flex into the side hole and tighten up again—that's all. Copper, rubber *and* braiding are all securely gripped, putting an end to frayed, straggling ends.

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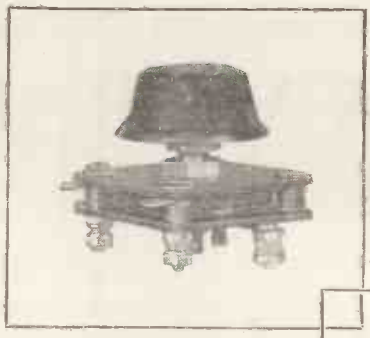

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Direct Drive. Constructed of highest quality materials. Smooth action gives very accurate control. Insulated spindle. Supplied with knob.

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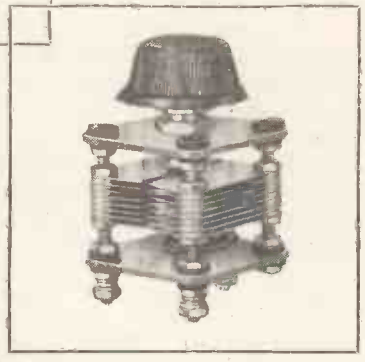

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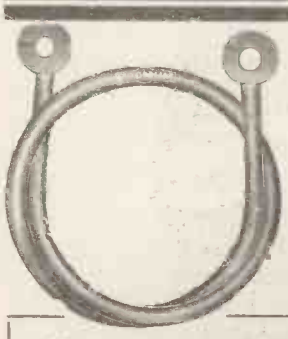

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RAILWAY RADIO

An incident concerning the use of a portable set on a train journey.

"YOU'LL like my little place at Winklesea," observed Dare as he settled himself comfortably in a corner of the railway carriage, "and I'll reckon a week-end there'll see you a fatter, redder Blazer than ever was."

"Hey, not so personal, young fellow," grinned his companion. And then the guard's whistle blew, there was a snorting and puffing from the locomotive and the train began to move. Dare had hoped that they would have the compartment to themselves, but at this last moment a man dashed up and just managed to clamber aboard. However, he quietly took possession of one of the farther corners and immediately immersed himself in the newspaper he produced.

Dare's Tiny Portable

"I suppose you have a radio outfit down there?" Blazer asked his companion, breaking the silence that had followed this intrusion.

"No, I don't keep one at the bungalow. I usually take a portable down with me though, a fact which, my peeler, should be well known to you," replied Dare.

"That's when you go down in your big Blitz, I suppose," observed the old detective pointedly. He was remembering the size and weight of his own portable radio receiver!

"As it happens, I've got one with me now." Dare smiled. Blazer glanced up at the luggage rack and wrinkled his brows as the other stood up and lifted down a tiny attaché case that was not much larger than a lady's handbag.

"It's an invention of my own, as the Red Knight said," laughed Dare, dropping back on to the seat and laying the article down beside him. Then he snapped back the fasteners and threw open the lid.

A Police Message

"We'll just catch the first news bulletin," he observed, "might as well listen to the weather report." He clicked over a switch and operated two miniature black dials. A thin, clear whistle issued from a three-inch square silk-covered aperture. Dare gently eased back one of the controls and the whistle roughened and became a mumbling chatter of unrecognisable speech. Another careful adjustment and the distortion disappeared, leaving almost stridently clear-cut voice-sounds which were easily audible above the background of swishing, metallic train noises.

"Heck, that's wonderful!" exclaimed Blazer, gazing wide-eyed at the diminutive portable. He wondered how on earth batteries, loud speaker and aerial, let alone the set itself, could all be crammed into such restricted space!

GOLDEN RADIO!

A golden-haired artiste, Miss Margaret Huntley, whose "golden" voice is a star item in American radio programmes, and an appropriately coloured set—it is finished entirely in gold.

"I have a police message"—the radio voice was saying as the two friends interestedly listened—"the police are anxious to trace the whereabouts of a man named John Jackson. Here is the description of the missing person. He is of average build, has fair hair, rather prominent teeth, age about forty-five. He was last seen wearing a grey overcoat and a fawn-coloured soft felt hat. Will anyone who may have seen the missing person, or have any information as to his present whereabouts, please telephone New Scotland Yard, Victoria seven thousand, or any police station? And now here is the weather report——"

But Dare switched off.

"John Jackson? Surely that is the Streatham murderer, Blazer?" he said.

"Is it? Haven't been following the crime reports lately," returned the ex-C.I.D. man.

"Don't blame you for that, after your forty years of it. I think it is the name. If so, though, he must have escaped from chokey. The B.B.C. don't often——" The radio expert stopped abruptly as his eyes fell on the third occupant of the carriage. "Grey overcoat? Fawn-coloured soft felt hat?" Yes, the latter was on the rack. "Fair hair?" Yes, that also was plainly visible, and he felt certain that behind the concealing paper there was a set of "prominent teeth"! He noticed that Blazer, too, was covertly examining the fellow. Their eyes met, and the old detective answered Dare's questioning look with a significant nod. At this juncture the object of their interest lowered his newspaper and beamed disconcertingly at them.

The Wanted Man?

"Might easily have been me, mightn't it?" he remarked pleasantly, and, as neither of the others responded, "I could hardly help hearing what that remarkable little radio receiver said, gentlemen," he continued apologetically, "and I've seen enough of myself in mirrors to know that the—er—'missing person' is a man that resembles me too closely to be pleasant. Also, I observe that I am not alone in this belief. That is the case, is it not?" He laughed lightly.

"Well, sir——" Dare commenced, and was mighty grateful when the fair-haired man relieved him of the necessity of scraping together a conclusion to this utterance by breaking in merrily again.

Marks of Identity

"It is quite obvious that I really am under suspicion already! Goodness knows what I shall have to go through before I can change this wretched coat and hat for something else! Then he adopted a more serious tone. "But I must relieve your minds, gentlemen, for it would be intolerable for you to have to complete this journey believing you are accompanied by a person wanted by the police authorities—and none too comfortable for me, either. Happily, my name is not Jackson, though it is uncommonly close to it! Jeffrey

(*Continued on page* 670.)

RAILWAY RADIO

—continued from page 668

Flaxon. That, my dear sirs, is my name. Still, it is, I trust, sufficiently different from John Jackson to clear me of all suspicion ? "

Dare decided to leave the situation in the hands of his old friend, so he sank back deeper into his seat to signify that he was going to adopt the role of spectator. But Blazer scratched his bristly grey hair and seemed unusually at a loss for words. Finally, however, he moved up the seat, leant forward and tapped the man on the knee.

On the Mystery List

" That's quite all right, Mr.—Flaxon," he grunted, " it wouldn't be the first time by about twenty million per year that someone else has looked like a police suspect ! Suppose you've a card or an envelope about you that's got your right title on, eh ? Not that it's any business of mine, mind you, but you did say you've got ideas about getting yourself rubbed off the mystery list, didn't you ? "

" Of course ! Certainly ! Now, just a moment," he threw his newspaper on to the floor and energetically delved about in his pockets. " Ah ! Here we are ! Look, here is a letter posted to me from Liverpool, J. Flaxon, see ? F L A X O N ! Plain as a pikestaff, isn't it ? And, yes; look inside my ' fawn-coloured soft felt hat.' " He reached up and brought the article down and held it out so that the others could examine the " J. Flaxon " that was inscribed in ink on the inside of the band.

Completely Cleared

" There is also my cigarette case. Nearly forgot that. You will observe that ' J. Flaxon ' is engraved on the shield. Lucky I didn't tell 'em to scratch just my initials on, isn't it ? Nearly did when they said that they'd have to charge three shillings extra for my full name ! That was ten years ago now, and you'll see the lettering's beginning to wear down. Well, I think that clears me of being John Jackson, don't you ? Anyway, who is John Jackson ? And what do the police want with him ? "

" That clears you all right, sir," agreed Blazer, who had listened with keen attention. " As for John Jackson, blest if *I* know what he's wanted for ! You said it was murder, didn't you, Dare laddie ? "

The radio expert shrugged his shoulders.

" I'm not sure," he said, " maybe I'm confusing names."

" Don't, I beg of you, confuse Flaxon with Jackson," laughed Mr. Flaxon; " but it would have been over-stretching the long arm of coincidence if I *had* been this mysterious J. Jackson, and I *had* leaped into a railway carriage where there happened to be a wireless portable, which, in its turn, *had* happened to be switched on just as the police announcement was coming through, wouldn't it ? There can't be many portable sets working in trains this particular day and time, and there is certainly only one Mr. Jackson ! Coincidence ! It would be a miracle, would it not ? "

" It certainly would seem so to me," admitted Dare lightly, while Blazer guffawed politely.

Then a general conversation ensued in which the weather, the financial situation and other such inconsequential subjects were discussed as the train thundered on its way to the coast. At length Mr. Flaxon returned to his newspaper, and Dare, to pass away the time, idly twiddled the knobs of the small radio instrument. After successfully picking up several of the more powerful distant stations, which came through quite loudly, he again tuned-in the London Regional programme. A dance orchestra was playing, and he lifted his hands from the set's controls and allowed this cheerful music to come through uninterruptedly. But at the conclusion of the first " little number " the announcer took over the microphone.

The Last Word

" I have a correction to make in connection with the police message which preceded the first general news bulletin," said his cultured, urbane voice, " the name of the missing person is John Flaxon——"

There was a hasty, scrabbling sound as the man in the far corner of the carriage hurriedly thrust his newspaper beneath the seat and stood up.

" I get out at the next station, gentlemen," he said loudly.

" So do we—the train don't go any farther, Mr.—*Flaxon*," observed Blazer, grimly.

NEW BOOKS ON RADIO

Some brief reviews of interest to the wireless man.

From Telegraphy to Television. By Lt.-Col. Chetwode Crawley, M.I.E.E.

The romantic and absorbingly interesting story of electrical communication is the theme of this well-bound and well-illustrated book, published by Fredk. Warne & Co., Ltd., at 6s.

The author, whose name will be familiar to most readers of this journal, sets out his facts clearly and concisely, so that the reader has not gone far into the 200-odd pages before he falls under the spell of the subject. And this compact survey of it embraces virtually all its widely different aspects, with inside knowledge and sound comment on every page. A thoroughly enjoyable book, interesting alike to the general reader and to the student.

* * *

Quartz Resonators and Oscillators. By P. Vigoureux, M.Sc.

This is an important work for the advanced student, summarising the main aspects of piezo-electric quartz resonators. Prepared under the auspices of the Radio Research Board, and published by H.M. Stationery Office at 7s. 6d., it co-ordinates and clarifies much that has appeared in papers and articles on the subject. The work of Langevin, Cady, Dye, Giebe, Scheibe, Meissner and others is capably reviewed, and an attempt has been made to indicate the various points which specially require further research.

This is a book that will prove of real service to every serious student of the subject, covering, as it does, a field that has been inadequately dealt with in the past.

* * *

Experimental Radio Engineering.

This work is by a well-known American worker, John H. Morecroft, E.E., D.Sc., and is specifically directed to the teaching of radio principles in the laboratory. Fifty-one experiments are detailed and illustrated with clear diagrams, and it is anticipated that the practical work described will be carried out in parallel with class-room work.

There are nearly 350 pages, admirably bound, and at 17s. 6d. the book represents excellent value to the laboratory worker. It is published by Chapman & Hall, Ltd.

A RADIO SPEED-TRAP

—continued from page 543

throughout, or else there might be no charge on either pair of plates.

Entering the Course

This last condition, which, of course, occurs twice in every cycle of the oscillator, is the one on which the experiment depends. Suppose that a stream of electrons sets out along the axis of the tube as represented by the central dotted line. If it has to pass between the first pair of plates while there is a positive charge on the upper plate, it will, by reason of its own negative charge, be attracted upwards, as represented by the upper dotted line, to an extent depending on the strength of the field at the particular instant.

When there is a positive charge on the lower plate the stream will be deflected downwards, as indicated by the lower dotted line. When there is no charge on either plate the stream will continue along its path without being deflected at all. As the field is rapidly alternating in direction, what actually happens is that the electron stream is deflected first in one direction, then undeflected, and then deflected in the opposite direction, so that a fan-like effect is obtained, and we notice that only twice in every cycle are any electrons allowed to continue along the axis, there being thus a series of little spurts along the axis occurring every half-period of the oscillator.

The Finishing Line!

Now these electrons have to go past the other pair of plates, and there they have to go through the same experience. In the experiment only these undeflected electrons were allowed to get past the first pair of plates, and so we are not concerned with those that were deflected in the first case. Remembering that the field at the second pair of plates is changing in direction at exactly the same rate as that at the first pair, we see that if it should so happen that any electrons get past the second pair of plates at all then all the others will get past without being deflected, for they will arrive always at a time when there is no electric field between the plates.

On the other hand, if one lot of electrons should be deflected, then all the others will also be deflected, first in one direction and then in the other. If, for example, we imagine a road with one car passing along every five minutes, no matter what their speed, and a level-crossing gate also opened once every five minutes, then if one car arrives just in time to pass through the gate, then all the others will just be in time to pass through.

The stream of electrons will then generally be deflected first in one direction and then in the other, but in the exceptional case all the electrons passing the second pair of plates will be travelling in a straight line along the axis of the tube.

What Velocity?

This last condition, by suitable adjustments of the apparatus, was achieved, and then the velocity could be found. For in the simplest case, when the electrons started from the first pair of plates the electric field at both pairs of plates was zero, and when they arrived at the second pair the field was again zero.

Now the time taken for an oscillating field to go from a zero value to the next zero value is, of course, what we call the half-period of the oscillations Hence, by measuring the frequency of the field, which can readily be done. the time taken for the stream to travel between the pairs of plates is known. and hence by measuring their distance apart we know the speed of the electrons.

WHEN WRITING TO "M.W."

Please remember that ordinary Editorial communications should be addressed to Tallis House, Tallis Street, London, E.C.4.

Technical Queries to Fleetway House, Farringdon Street, E.C.4

Applications for Back Numbers and Blue Prints to the Back Numbers Dept., Bear Alley, Farringdon Street, E.C.4.

AN INTERESTING EXPERIMENT

INSTEAD of broadcasting its news bulletins in the usual way, Radio Paris is now broadcasting them in the form of talks, broadcast by a prominent journalist. It has been found that the monotonous presentation of Bourse reports, traffic accidents, thefts, sports items, and weather forecasts cause many to switch off until something brighter is broadcast.

A FINE MAINS SET

—continued from page 656

the functions of H.F. amplifier, detector, and power output stage. For the H.F. stage an S.4.V.B. is used. The detector is a 354V., while the power valve is a P.X.4.

Alternative makes of valves are also recommended by the manufacturers, but the model sent to us for test was equipped with the above-mentioned types.

The H.T. Supply

Rectification of the A.C. supply is by means of a 4-volt rectifying valve of the U.12 class.

The condensers tuning the aerial and the H.F. stage are, of course, ganged, and are operated by a single "knob" of comfortable dimensions. Under the main tuning control a smaller knob is provided which ingeniously rocks the stators of both condensers so that any small discrepancies in the ganging may be offset when endeavouring to extract the utmost sensitivity from the set.

An additional aid to sensitivity is provided in the form of a reaction control. The set also, of course, possesses a volume control, which operates in front of the detector.

These controls, together with a wave-change switch, are mounted on a bakelite panel of similar "grained" appearance to the figured walnut of which the cabinet is constructed.

An unusual feature is the disposition of the loud speaker. The top of the cabinet is hinged to form a lid, as is the case with the cabinets housing most home-constructed sets. Opening the lid, in the case of the A.P.24, however, reveals not the interior of the set, but a loud-speaker grill.

Deflecting the Sound

Sound is, therefore, projected upwards, and is deflected forward by the lid. A moving-coil loud speaker is employed with a particularly freely suspended cone.

Much time has elapsed since the firm of Varley earned the amateur's gratitude by giving a really good anode resistance.

The A.P.24 3-valve mains receiver provides ample evidence, by its high quality and performance, that this time has been profitably spent by Messrs. Varley in developing products which will continue to earn for them the wide radio public's esteem.

Testing the H.M.V. Pick-up—Controlling Tone—Shielded Input Leads—An Excellent Table Radio-Gram.

By "TONE ARM."

I HAVE been having an orgy of testing during the last few months. Not only commercial apparatus, but some of my own amplifier and pick-up units as well.

One result is that I take off my hat to people like H.M.V. for the excellent way they have achieved the proper mean in their electric gramophone reproduction.

The Happy Medium

Every reproducer can be criticised on some score or other by someone or other. You cannot please everybody from every point of view. Some, probably the majority, like a preponderance of bass (I am not going to say if it is good or bad) and some plenty of brilliance, but H.M.V., whose pick-up and table model radio-gram I have been testing, have struck the happy medium. Their results are undoubtedly good and are always pleasing, whether the listener be a low- or high-note enthusiast. In other words, they have achieved good musical balance.

A Fine Pair

Having said that, let me get on to the detailed description of the two H.M.V. items I wish to draw your attention to this month. One is the Model 11 pick-up unit, and the other the cabinet table model radio-gramophone.

Here are the main details of the pick-up unit. It consists of the new type pick-up with a universal adaptor, enabling it to be attached to any type of gramophone tone-arm, a volume control and connecting leads.

The pick-up is similar to the Model No. 15, which is fitted to all the new "His Master's Voice" instruments, having a high output, the pick-up being screened.

The volume control can be adjusted "electrically," in order to secure the desired tone quality of reproduction for various inputs, or, in some cases, output valves, by means of a clip inside the case of the volume control, to which can be attached suitable values of resistance.

In other words, the response curve of the pick-up is altered to compensate for accentuation or suppression of high or low notes in the amplifier or loud speaker.

Armchair Listening!

The volume control is arranged so that it can be either screwed on to an existing fitting or used on the arm of a chair, or on a table.

An earth lead to the pick-up passes through the same braided covering as the single leads, and the triple plugs which terminate the leads from the head of the pick-up can be inserted either into the volume control provided, or directly into the amplifier or radio unit with which it is to be used. The length of lead supplied is very generous, being about 12 ft.

The price of the No. 11 pick-up, complete with volume control and leads, is the exceptionally low one of 2 guineas.

Technical Details

Here are some technical details that will be of interest.

Output of pick-up, 1 volt R.M.S.

Resistance of coils (D.C.), 6,000 ohms.

A.C. impedance at 800 cycles, 37,000 ohms.

(*Continued on page 675.*)

ROUND THE TURN-TABLE

—continued from page 674

Pressure on record, 5¼ oz.

Suitable needles, loud-tone "Tungstyle" or ordinary loud needles.

The pick-up is arranged to give a rising characteristic at the lower frequencies to compensate for bass attenuation of the recording. The volume control has a resistance of 250,000 ohms.

Those who have not heard the H.M.V. pick-up should do so, for it is undoubtedly one of the finest on the market.

Remarkably Compact

The table grand radio-gramophone utilises the Model 15 pick-up, together with an A.C. (or D.C.) motor and a three-valve set. This consists of a screened-grid stage, detector, and pentode, all of the indirectly-heated type. A moving-coil speaker is included.

The reproduction is extremely good, and the whole outfit is one of the most compact I have ever seen, being little larger than the well-known table model acoustic gramophones.

Mains or ordinary aerial can be used, and there is provision for the addition of an external speaker should this be desired.

The power is adequate for all ordinary purposes, and the whole "tone" is up to the usual high H.M.V. standard. The price is 29 guineas.

BROADCASTING HOUSE IS NEARLY READY!

WIRELESS performers, according to Mr. M. T. Tudsbery, the B.B.C. Civil Engineer, may have to be prepared to exercise a little forbearance in the matter of damp walls when Broadcasting House, in Portland Place, is in full working.

The giant tower of studios which forms the core of the building is artificially ventilated, and the 3-ft. thick wall contains many tons of water which must gradually be "sweated" out over a period of months.

All the studios, including the great concert hall, will be working regularly by the end of the year. A large number of the outer offices are already completed and decorated.

IN PASSING

—continued from page 646

"*We* know that."

"*How on earth*——"

"Have we not good cause to know it? Where is our daughter—*and* the money?"

"You have mistaken me for somebody else," I protested. "I am on my way to——"

"You are on your way to Gehenna to-night, if you do not tell us what we want to know. Once more! Where is our daughter?"

What with hunger, cold, fatigue and horror, my self-control broke.

"Confound your silly daughter! If she's half as mad as you I hope I never see her!"

"Here is an S.O.S."

The man's face darkened with anger and his teeth ground together. He made a convulsive movement and half rose, but mastered his fury and became ominously cold.

"Wayman," he said, "this is no mere joke, no matter which can be carried off by bluff. I tell you seriously that we are desperate. We have definitely decided that we will either wring the truth from you, or we will send you where you belong, and ourselves where we deserve.

"And the Almighty shall judge between us. One thing is certain! We cannot and will not spend another Christmas in the agony with which we have endured the last two. Now—speak, or pay!"

Mad! Mad as a hatter! So I thought then, and perhaps I was right. But I saw no loophole of escape. Indeed, I felt that I would rather try my strength on the man than face that cold female fury at the door.

"I know nothing," I said. "It's all a mistake about names. Let me——"

"Very well," replied the man, rising. "You have till ten. Meantime, I will delight our last moments with music." He switched on a radio set and sat down. *It was a quarter to ten!*

The woman slipped out of the door. I begged the man to listen to reason, but in vain. I was Wayman, and I had lured his daughter and £2,000 out of his house, and the fact had been gnawing at his vitals for three years.

In desperation I rose and tried to open the door. Of course, the she-fiend had locked it. I looked at the window and then at the man. I braced my muscles and slowly advanced towards him. Then a bullet sang past my head and, turning that member, I saw the lady with an automatic in her hand.

I paused—naturally—and there was a moment's silence. Then the loud speaker said: "Here is an S.O.S. The dead body of Arthur Wayman has been found on the moors near Hesslevale, Yorkshire. Will any relative or friend of the deceased man kindly communicate——"

My Namesake

There was another bang. My fair, would-be murderess had fainted. While we were bringing her round I mildly explained that I was not Arthur Wayman, but Theophilus ditto. This news sobered up the whole outfit. My "Mr. Civilian" was the villain of the piece. But was he?

It came out that in his pocket were banknotes to the value of £2,000 and a letter consigning them to Mr. Madman, as I may call him. The daughter—and you won't believe me—had been my private secretary for nearly three years!

And my wife for twelve months!

Wake up, grandma! The villain had joined the Salvation Army and was going to return the £2,000, when his baby car turned on him. And that's the end of the story.

INDEX TO ADVERTISERS

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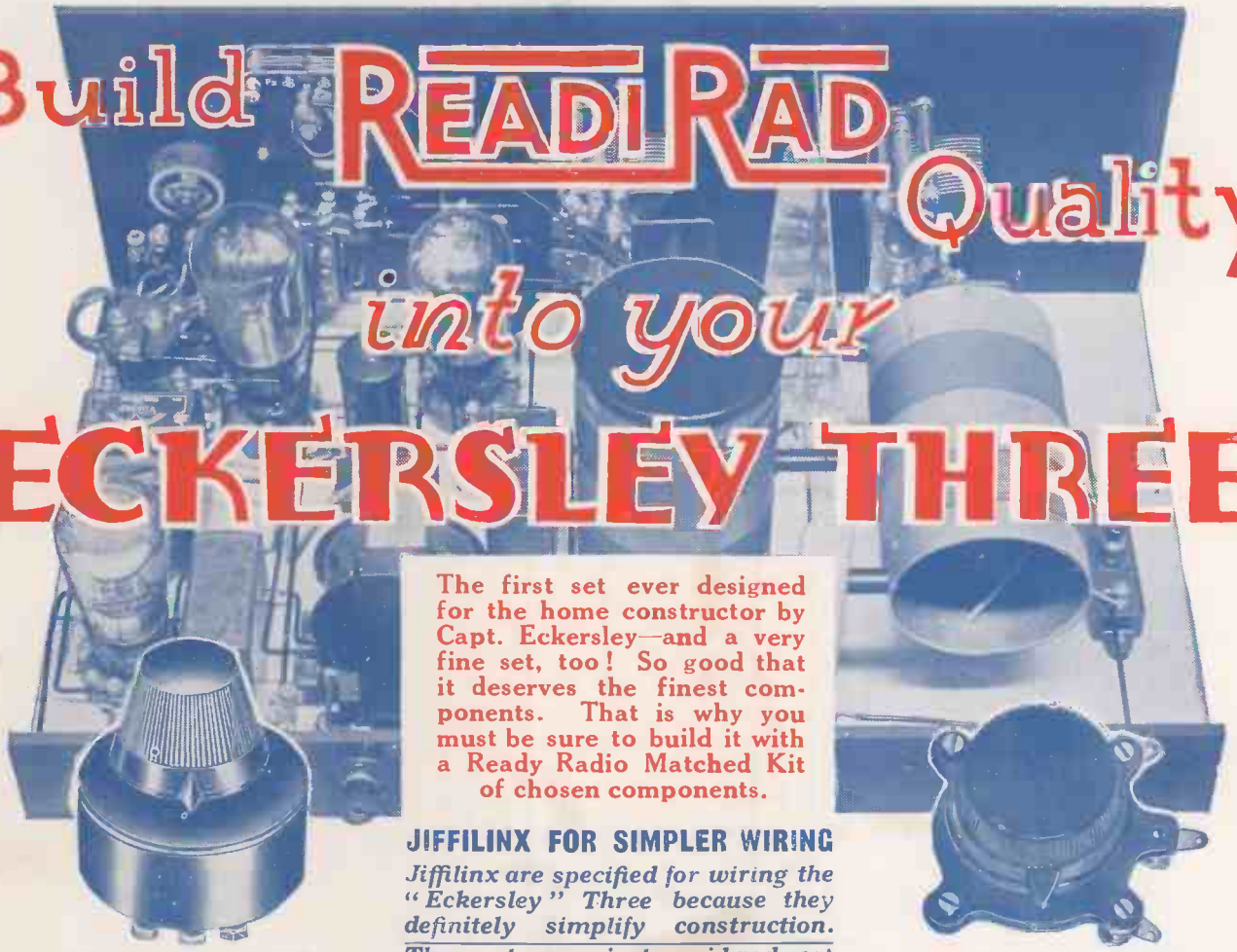
S.G.

Build READIRAD Quality into your ECKERSLEY THREE



The first set ever designed for the home constructor by Capt. Eckersley—and a very fine set, too! So good that it deserves the finest components. That is why you must be sure to build it with a Ready Radio Matched Kit of chosen components.

JIFFILINX FOR SIMPLER WIRING

Jiffilinx are specified for wiring the "Eckersley" Three because they definitely simplify construction. The most convenient, rapid and neat method of wiring a set. Eliminate soldering and give perfect contact.

Price 2/6 per packet.

READIRAD L.F. VOLUME CONTROL.

Specified for the "Eckersley" Three. Highly efficient volume control of potentiometer type. Positive contact with entire absence of noise. Will give constant and lasting service without fluctuation in resistance values. One-hole panel mounting. Three resistances. ½, 1 and 2 megohms.

Price 5/9 each.

READIRAD H.F. CHOKE.

Specified for the "Eckersley" Three. Continually specified by famous British designers. High inductance, extremely low self-capacity. Solid ebonite former on bakelite base takes up minimum baseboard space.

Price 4/6 each.

READIRAD GRID LEAK.

Specified for the "Eckersley" Three. Extremely accurate. Permanent reliability. In resistances ranging from ·25 megohm to 5 megohms.

Grid Leak, 10d. each.
Holder .. 6d. each.

READIRAD SCREEN.

Readirad Aluminium Screen, 6 in. x 3 in., specially designed and specified for the "Eckersley" Three.

Price 1/6 each.

The Kit you need for the "Eckersley" Three is described in our other advertisement (see Index opposite).

Ready Radio

Eastnor House, Blackheath, S.E.3
'Phone: Lee Green 5678. 'Grams: Readirad, Blackvil.

Showrooms: 159, Borough High St., S.E.1
'Phone: Hop. 3000.

READIRAD DIFFERENTIAL REACTION CONDENSER.

Specified for the "Eckersley" Three. Incorporates two banks of fixed brass vanes; bakelite dielectric. Improves tuning, prevents short-circuiting and gives smooth control. One-hole fixing. Capacity ·00015 mfd.

Price 2/6 each.

READIRAD PANEL LIGHT.

Recommended for use with the "Eckersley" Three. A worthy component for a really good set. Shows the word "ON" in glowing red when the set is switched on, prevents current wastage through forgetfulness to switch off. Equipped with a special quick-release clip holder for the bulb.

Battery or A.C. Mains Models, 2/3 each.