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# MODERN WIRELESS

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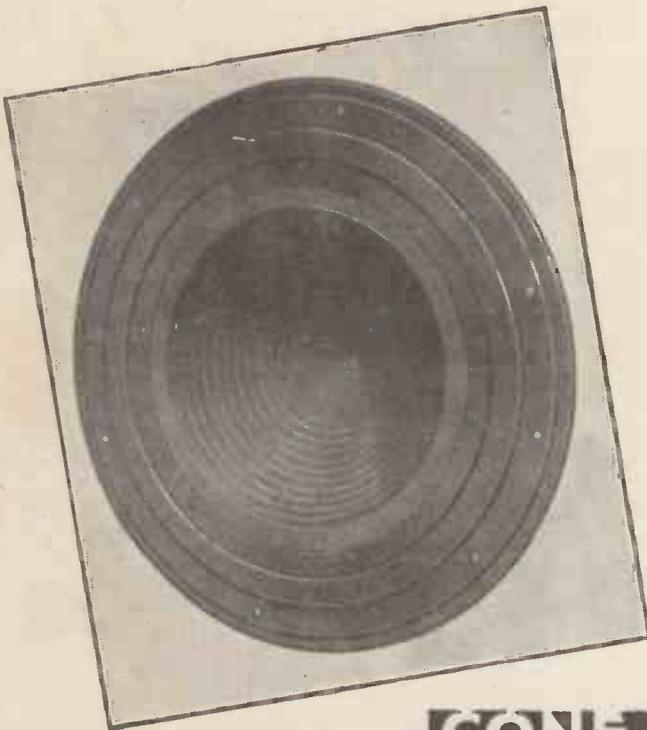
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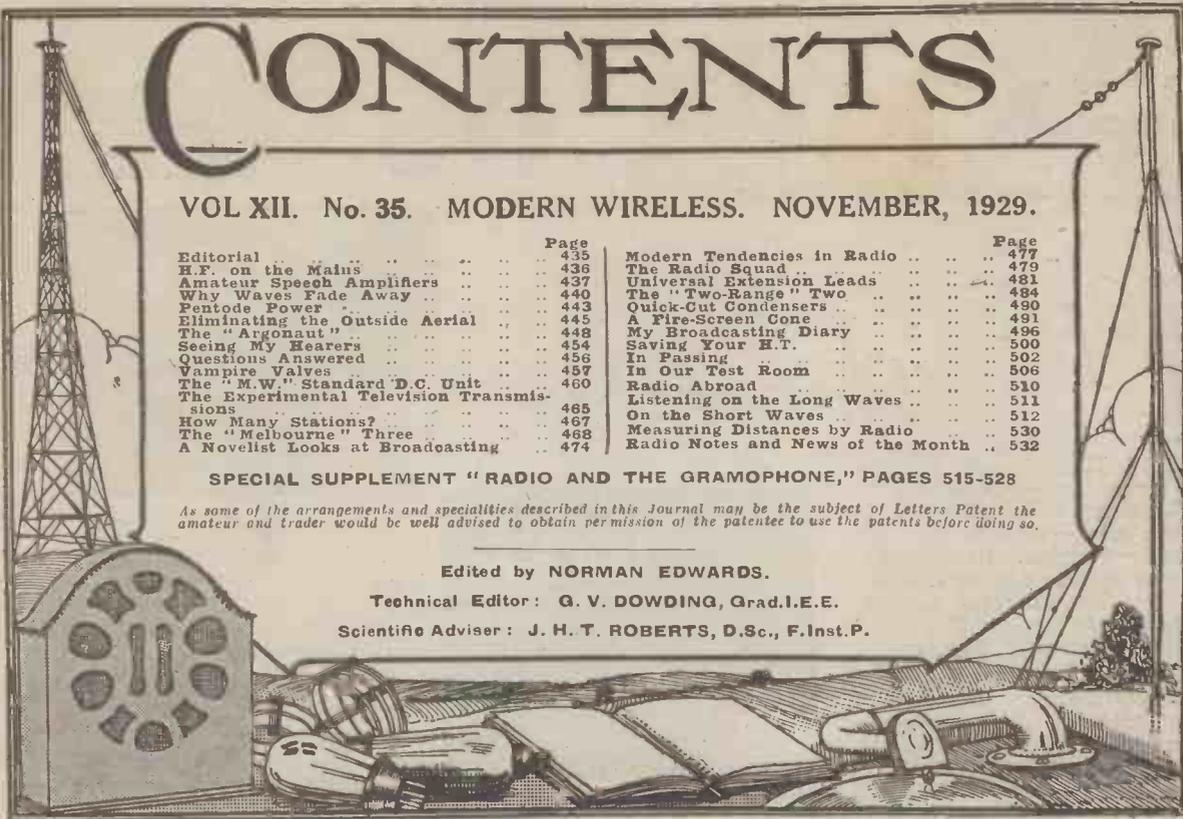
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*As some of the arrangements and specialties described in this Journal may be the subject of Letters Patent the amateur and trader would be well advised to obtain permission of the patentee to use the patents before doing so.*

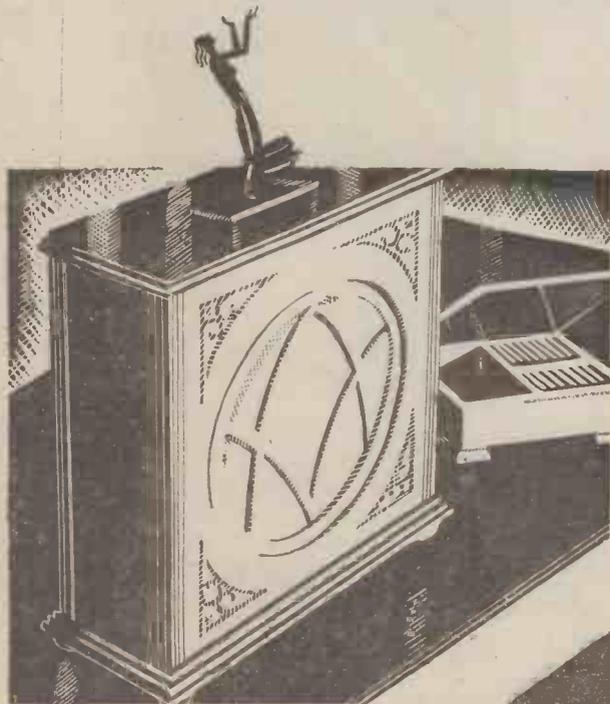
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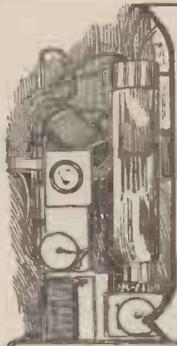
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# MODERN WIRELESS



Vol. XII. No. 35

November, 1929.

## Our Four-Shilling Gift—Four More Fine Sets—A New Wave-Length Classification.

IN this special issue of MODERN WIRELESS we present to every reader a gift which we venture to describe as unique. No other wireless paper in this country—or, for that matter, in any other country—has ever before presented to its readers a gift to the value of 4s.; and the eight MODERN WIRELESS 6d. Blue Prints which you will find in this issue must certainly create something of a record.

### Eight Blue Prints

Blue Prints are expensive things to prepare and to print, and even when they are marked at 6d. each it is a fact that that price may be described as extremely low. We doubt whether readers will be able to purchase at 6d. each Blue Prints which have been so carefully prepared, carefully drawn and tested, as those which constitute this month's gift to MODERN WIRELESS readers.

A glance at the Blue Print sheet will show that it can be cut up into eight separate Blue Prints if necessary, and another even cursory glance will show that the circuits which have been selected cover a very wide range. The eight circuits, in fact, are as follows:

1. A High-Selectivity Crystal Set;
2. A High-Power Five-Valver;
3. A Switch-Over One-Valver;
4. The "Titan" Two-Valver;
5. The "Full Tone" Amplifier;
6. A "Simple Change" Three-Valver;
7. An "Every-Purpose" Three-Valver;
8. The "Simple Screen-Grid" Four.

These circuits have been in preparation for some time, and although one or two of them have appeared before, in connection with the construction of receivers, there has been such a wide demand for them that we have decided to include them in the Blue Print sheet we give away this month. The others, however, have been specially prepared, and the circuits not included until they have been tested in every practical way by the MODERN WIRELESS Research Department.

We trust that this 4s. gift will appeal to our readers, and that they will let us know how they feel about it; for it is only by judging the evidence of readers' appreciation that we shall be able to ascertain whether further Blue Prints of this nature would be welcomed.

### This Month's Sets

THE sets which are described in this issue of MODERN WIRELESS consist of the "Argonaut," the "Melbourne" Three, the "Two-Range" Two and the "M.W." Standard D.C. Unit.

A glance at the pictures of the "Argonaut" will show that it is a very fine four-valver, and another product of the Research Department. This receiver uses two

"Titan" coils and embodies an efficient wave-change method, which has given very excellent selectivity results. It also embodies all modern refinements, and provides for a pick-up and a smooth volume control. A screened-grid valve is used and, on the whole, the "Argonaut" may be said to be one of the most powerful programme collectors which has been yet designed by the MODERN WIRELESS Research Department.

The "Melbourne" Three is something rather extra-special in the way of short-wave receivers, and here the Research Department have gone all-out for super-efficiency on the short waves. But constructors will note, however, that the set can be adapted with more than usual efficiency for general broadcasting purposes.

The "Two-Range" Two is a wave-change set of the straightforward type, using standard components throughout. It is a very reliable, conventional receiver which the less-experienced amateur will find easy to build and quite simple to operate.

The "M.W." Standard D.C. Unit includes a special system of smoothing. The primary object in its design was to unite all that was best in this season's MODERN WIRELESS unit designs, and this one may be said to embody not only cumulative experience of the Research Department, but also a special scheme for voltage induction.

Readers are reminded that all the necessary parts for the receivers mentioned above may be obtained at very reasonable prices from the British radio manufacturers who advertise in MODERN WIRELESS. Whatever set you build, don't order the necessary component parts until you have carefully studied the "M.W." advertisements. They can be studied more than once—and with advantage.

### Wave-Lengths Classified

THE International Consultative Committee for the technique of radio electric communications recently classified wireless waves as follows:

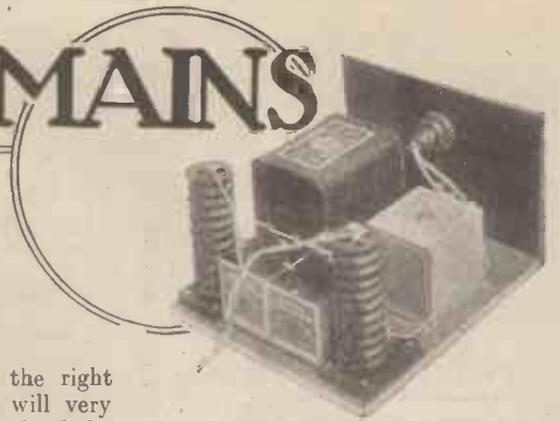
Long	3,000 metres and upwards
Medium	200 to 3,000 metres
Intermediate	50 to 200 "
Short	10 to 50 "
Ultra-short	Below 10 "

This is the first authoritative classification of wave-lengths which has been made for some considerable time, and the Committee also recommends that, to minimise interference, regulations drawn up at the Washington Conference last year in connection with the limiting of power of transmitters in North America should be brought into force as soon as possible.

# H.F. ON THE MAINS

*How to eliminate peculiar interference effects.*

By AN "M.W." STAFF TECHNICIAN.



H.F. chokes, in series, will often effect a great improvement.

WHEN we first started using the direct-current mains in the present MODERN WIRELESS laboratory for the supply of H.T. current to receivers, some rather peculiar effects were noticed. For example, some quite simple types of H.T. units gave reasonably silent working, whereas others of much more elaborate design with apparently much better smoothing circuits allowed quite a strong hum to get through. This was so noticeable in one case that we suspected broken-down components!

## A Clue to the Trouble

Considerable differences were also noticed when the smoothing chokes were placed in the positive or the negative leads, and this put us on the track of the cause of the trouble. It turned out to be a matter of something in the nature of high-frequency impulses, such as might be generated at the sparking brushes of a badly-running dynamo or motor, and once this was decided it was a comparatively easy matter to get rid of the noise.

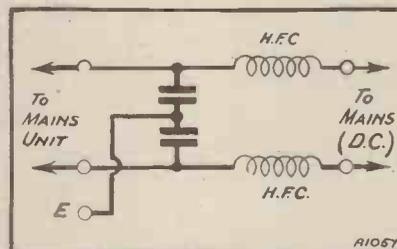
In our own case we found that with quite a number of H.T. units it was quite sufficient merely to insert an ordinary H.F. choke in series with the negative lead between the unit and the mains, the noises thereby being cut down to quite a low level.

## The First Test

This, then, should be the first step to take if you are getting a very noisy background with an H.T. unit which seems to be capable of giving quite good low-frequency smoothing. Just break one of the mains leads to the unit and insert a high-frequency choke and see what happens. If things do not seem much better, take out the choke and put it in the other lead. One position or the other is pretty sure to make a decided improvement if H.F. currents are your trouble. This first simple test, although it may not provide a complete cure, will

at any rate put you on the right track. For example, you will very likely find that just one single choke used in this way does not provide a complete cure, but does seem to produce a distinct improvement.

If this seems to be the case, the next step is to try two H.F. chokes, one in each mains lead, that is to say, in series in the leads from the input side of the mains unit to the mains themselves. This should provide almost a complete cure; but to carry the matter a step further, try the following elaboration. Get two Mansbridge type condensers of the usual high working voltage required for mains working (not less than 250 volts working rating), connect these in series with each other and shunt them across the mains after passing through the chokes, that is to say, on the mains unit side of the two



This is the circuit used for eliminating the interference.

chokes and not on the mains side. Now try connecting the centre point of the two condensers straight to earth and you will probably find that the last of the noise disappears, or at any rate goes down to such a level that it is no longer audible, unless you listen quite close to the loud speaker.

## Making up the Extra Unit

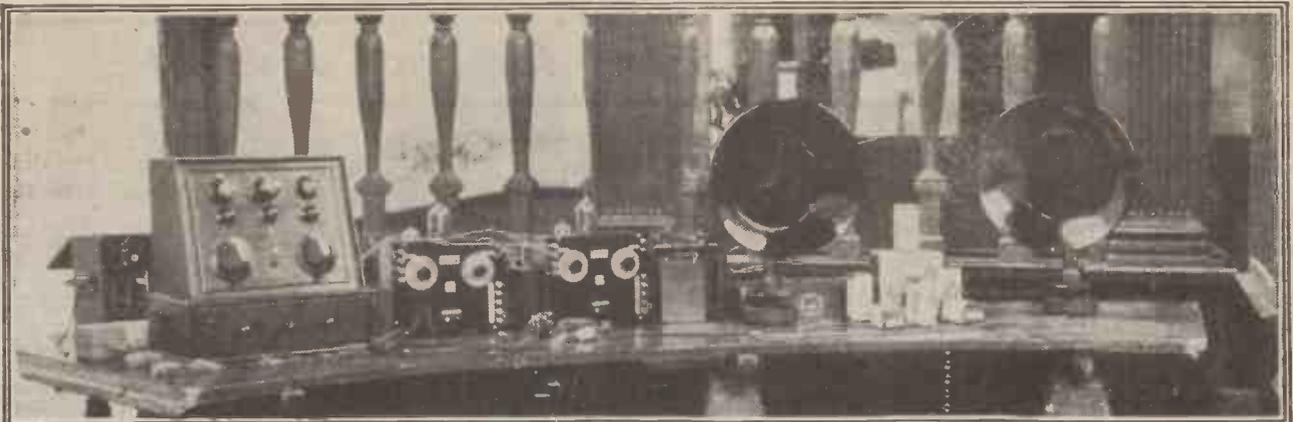
This expedient we have found is a complete cure in the case of our own mains, and since they seem to be particularly bad ones from this point of view, we think it is safe to say that it is practically certain to do so in any likely case. It is quite easy to rig up the parts on a board

and try them, and then if you find that the desired cure is effected you can make up a little enclosed unit with flex leads brought out.

A convenient method of make-up, by the way, is to use a wooden baseboard with a wooden case fitting over the top which can be secured in place with screws after the unit is assembled and with the following system of connecting up. From the mains side of this H.F. filtering unit take a flex lead, with the usual lamp socket adaptor or two-pin plug for connection to the mains. On the other end of the unit provide an ordinary lamp holder wired to the output side of the extra smoothing unit. In this lamp socket you then insert the lamp socket adaptor from the mains unit and you then have an extra filtering unit which can be connected up in a few moments when required.

## Type of Choke Required

Now a word about the H.F. chokes required. In many cases the perfectly normal type of H.F. choke used in receivers is satisfactory, it being understood that when such chokes are employed a large current must not be passed through the unit. Thus you will see that they serve quite well for ordinary H.T. units, but for use with sets of the all-mains type where the filaments are run off the mains as well as the anode circuits, the heavy-duty type of H.F. choke, such as the Wearite, are desirable. These chokes are specially intended for this particular purpose and will pass quite a large current. Moreover, their direct current resistance is low and so there is very little loss of voltage in the unit. They should therefore always be used when the available mains voltage is not very high, say under 200 volts, even though it is not intended to pass a large current through the unit.



# Amateur Speech Amplifiers

**M**OST wireless experimenters find from time to time that they are able to do a day's good deed by placing their knowledge and resources at the disposal of some deserving cause. One of the most deserving causes, in the writer's opinion, is that of deaf people who

An interesting account of a special speech amplifier and address system  
 Described by  
**LAURENCE COUSSELL.**

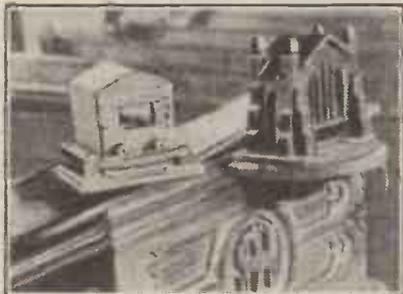


Fig. 1 The two types of microphones employed.

are unable to hear a word of the service at church.

Many such people will probably possess "deaf aids" of some kind or other, but they all invariably fall short when it comes to reproducing distant or complicated sounds. It is the intention of this article to put before the reader the main details of a church amplifier which has been giving excellent results for some considerable time, and which has enabled really deaf people to hear every word of every service.

## Clear, Crisp Tone

It is not of the magnitude of a minor public address outfit, for it is considered that the main requirements of the equipment are that it should reproduce speech in a clear, crisp tone at ample volume, and that the whole outfit should be as inexpensive as possible. Bearing in mind these

points, we will proceed with our plan of attack.

Among the available low-priced microphones we can choose between the ex-government watch-type or those made by Graham Amplion, etc. The equipment to be described employed the former for a considerable time, but recently it was replaced.

In either case, it is as well to mount the microphone in a small wooden case of soft sponge or other shock-absorbing material, and to arrange the instrument so that it tilts forward at an angle of about 25 degrees. A small window about one inch square should be cut in the front of the casing, and across the inside of this one or two thicknesses of velvet or

some similar material may be glued. This helps to keep out unwanted noises and echoes which are very troublesome in churches.

The detailed design of the microphone casing can be left to the ingenuity of the designer, as a lot depends on what facilities exist for fixing it. The accompanying photographs in Fig. 1 may serve as a guidance—one commends itself especially as it takes the form of a small model of the church hand-carved from pitch-pine by one of the church officials.

## Two Microphones

Should the pulpit be so arranged that the preacher frequently turns about to address various parts of the congregation, it is a wise plan to arrange a microphone each side of the pulpit and to connect them in series or parallel according to results on test. Now let us run a twin bell wire or lighting flex from the pulpit microphone points to the control point, and consider the amplifier.

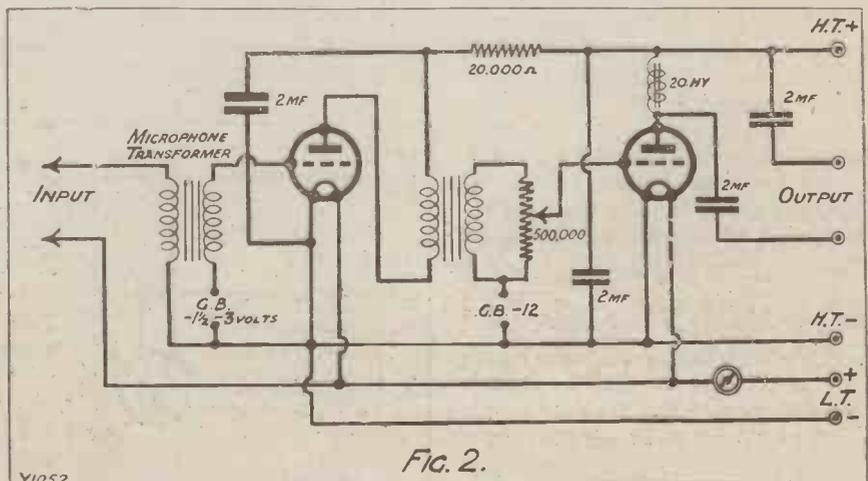


Fig. 2.

Y1052

## Separate Volume Control for Each Listener

Two transformer-coupled stages will suffice for our purpose, and the input transformer should be obtained from the same source as the microphone. These instruments are very inexpensive, costing only three or four shillings. By using 2-volt valves we save expense on the L.T. accumulator, and we are also able to supply the microphone current from the same source.

### A Simple Amplifier

The microphones pass quite a considerable current (of the order of 100 milliamps or so), and the input to the amplifier is sufficient to warrant an L.F. type valve in the first position.



Fig. 3. Showing how the listening sets are arranged.

A valve with an impedance of ten to fifteen thousand ohms is most suitable.

Fig. 2 shows the theoretical circuit of the complete amplifier, and it will be seen that the first valve is transformer coupled to the output valve via a potentiometer volume control. The output valve should be a super-power for best results, but if dry batteries are to be used, the maintenance cost of the set will be rather high.

### Mains Unit Best

However, when dealing with speech only it is quite possible to allow a certain amount of overloading on the output valve before the result becomes very undesirable, and it is therefore possible to use an ordinary power

valve, thereby reducing the heavy drain on the H.T. batteries.

In the set in question, however, a small H.T. eliminator was employed to deliver 120 volts at 50 milliamps, and this proved satisfactory in every way. The best course to adopt will depend on conditions at the church. In any case, the output valve should supply the output lines to the listening sets through a filter circuit, and it is advisable to insert a 2-mfd. condenser in each output lead. The circuit diagram will make this quite clear.

The construction of such an amplifier should present no difficulties, and as it will doubtless be housed in some cupboard or under a pew, only a plain cabinet is required. The master volume control once adjusted for best results can be left alone, and to prevent tampering it is as well to mount it inside the cabinet.

### The "Receiving" End

Now we come to the listening set for the "subscribers." As no two people are likely to be deaf to the same degree, we must have a form of volume control on each earphone. Fig. 3 shows an arrangement which might well be copied.

A single earphone on a handle is connected to a small control panel fixed to the book-rest of the pew. This panel holds a simple 100,000-ohm variable resistance, which is wired in series with one of the 'phone leads. Two 'phone terminals at the back of the panel engage the tags at the end of the 'phone cord, and one side of the church line is taken to one of these terminals and the other to one side of the volume control (see Fig. 4).

Under the control panel is fixed a suitable wooden case with a hinged lid, to house the earphone when not in

use. These listening sets can be fixed in the deaf folks' own pews and each set is connected in parallel across the line.

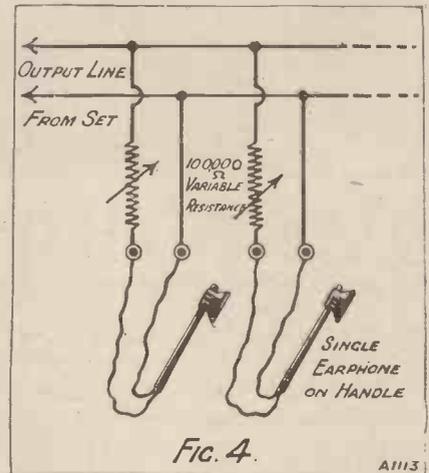


FIG. 4.

A1113

The output lines may be of the same wire as the microphone leads, and need not necessarily be lead-covered.

Where a really permanent and lasting finish is required, however, it is advisable to use twin lead-covered telephone cable throughout and to earth the lead covering.

During preliminary tests a certain amount of experimenting with the microphones will soon reveal the best available position for them—in any case, it is unlikely that there will be a great variety of positions to choose from.

### The Extra "Mike"

In some churches, certain parts of the service take place from points other than the pulpit, and where this is the case an additional microphone may be permanently wired. If the extra point is only occasionally used, it is as well to incorporate a single-pole cut-out switch so that the instrument

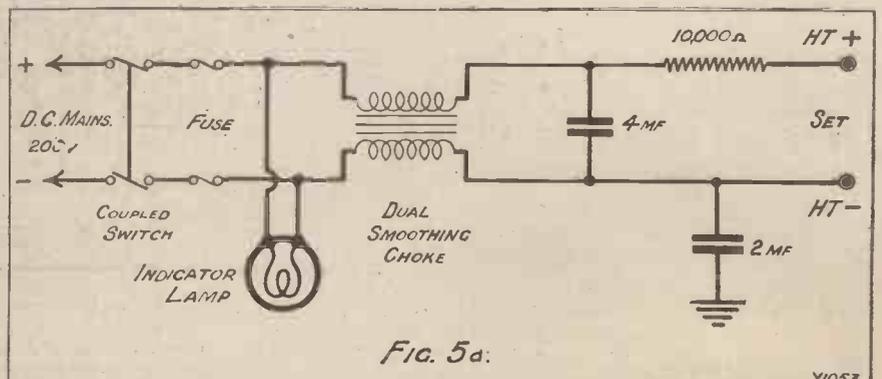


FIG. 5a.

Y1053

can be switched in only when required. This is desirable as a certain amount of unwanted echo may result from this extra point.

**Master Volume Control**

Another point to attend to during tests will be the master volume control. This should be adjusted for maximum volume without undue overloading, and once this position has been ascertained it may be left permanently without further adjustment. Each person on the system should then be able to regulate his own volume from nil to maximum



Two microphones (see arrows) are necessary in most instances in order to avoid fading as the speaker turns his head from one direction to another.

without noticeably altering the volume in other listening sets.

Where lighting mains are available, and it is desired to derive the H.T. from their source, quite a simple eliminator will serve the purpose. Fig. 5 gives suitable circuits for 200 volts A.C. and D.C. Where mains are employed, it is very necessary to have the fixed condenser in BOTH output leads and to earth the H.T.-L.T. negative via a 2-mfd. condenser. Where dry batteries are employed for H.T. it is quite in order to earth direct.

**GRID LEAKS ON SHORT WAVES**

ONE of the difficulties of short-wave reception is to get anything like a silent background to the signals you are trying to hear. One of the reasons, of course, is simply that to get much on short waves you generally have to work

pretty close up to the oscillation point, and that naturally magnifies up all the atmospherics, mush, and general noise which may be about. The fact that short-wave reception tends to be noisy makes it all the more worth while to take every step to eliminate causes of noise in the set itself.

Most of these "anti-noise" precautions are fairly obvious, such as seeing that coils fit really tightly in their sockets, and so on, but there is one point which does not, as a rule, occur immediately to the set user, and that point is the grid leak.

Whatever may be the reason, the fact undoubtedly is that it pays to pick your grid leak for short-wave work rather carefully. Excellent as the modern grid leak may be for all general purposes, a certain number of them appear to be perfectly satisfactory on broadcast use, but are definitely noisy on short waves.

**Improved Reaction Control**

You will see that all this is merely leading up to a suggestion that you should try several grid leaks and pick the quietest one for short-wave work, and this looks at first sight to be something of a waste of money. Let it be added quickly that this is not an unmixed evil, since it is always worth while trying different values of grid leak in a short-wave set; the standard 2 megohms being not necessarily the very best for short-wave work.

The standard value is a good average one for most valves, but to get the very best out of a given valve and circuit it is often worth while to try one or two other resistances, usually higher ones, such as 3, 4, and 5 megohms. The improvement in reaction control and signal strength when you happen to get the right value for your particular valve is often quite noticeable.

G. P. K.

**PORTABLE SETS**

THE keen competition existing between manufacturers of portable sets has led to yet another piquant situation in the radio industry. Ardent radio enthusiasts are finding that in many instances they can purchase portable sets far cheaper than they can make them.

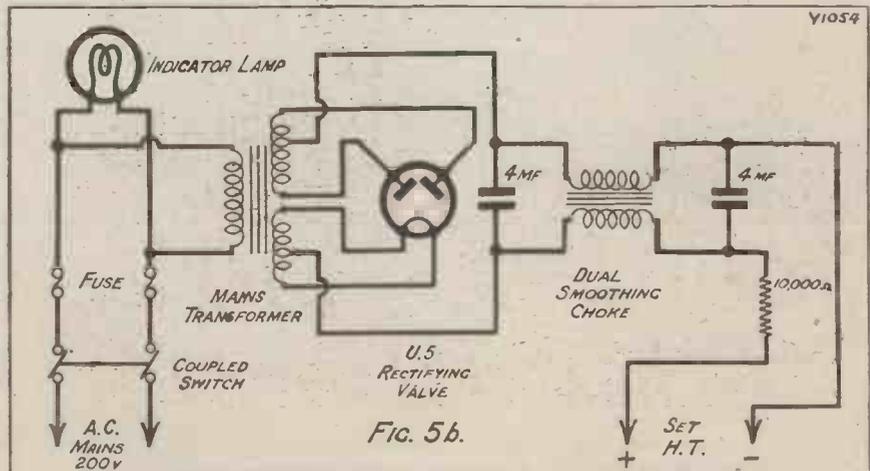
This fact was borne home to me by a friend when discussing a portable set I described recently. He pointed out that while the set may have been all that it was claimed to be, yet its cost (£14 5s. 0d. to be exact) did not represent an economical proposition when compared with the many fifteen guinea or so portable outfits now obtainable.

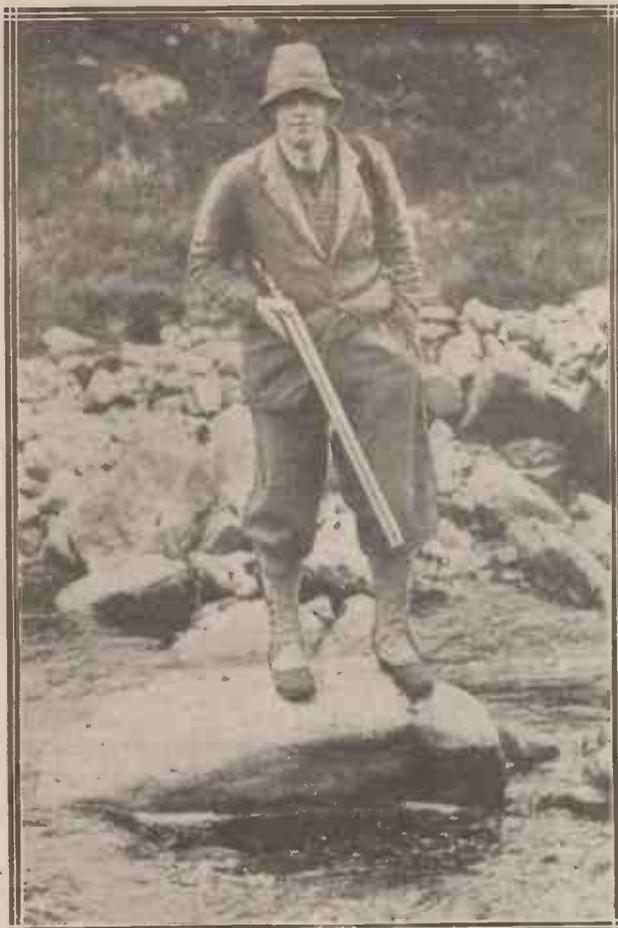
**Question of Price**

Is this a fair comparison? Without question it is not, because taking into consideration the quality of the components incorporated in the home-made version, this compares very favourably with many portables selling at twenty-five to thirty guineas.

Unfortunately, it is a difficult matter to prove one's case, as unless one can examine the components in a commercial model, the exact percentage of the price they represent cannot be gauged. Constructors, however, may be certain that the quality of the components incorporated in the commercial versions cannot be nearly so good as those employed in a home-made model costing the same because it is logical to assume that if the manufacturers are to give discounts to wholesalers, the cost of the components must only represent, at the most, but fifty per cent of the total retail value of the receiver.

G. V. C.





The author, Capt. P. P. Eckersley, is shown above in holiday mood. The lower illustration depicts Swaledale, near Richmond, Yorks, where he went in search of fading waves.

# Why Waves

THERE are some jobs, particularly when one has almost handed over one's more irksome responsibilities, which are really delightful. They are the more delightful as they deal the more in the practicalities of the service one is bound up in, and allow one to leave behind the bitterness and fret of the irrational employments of daily routine.

I count it as one of my most delightful jobs to have had the necessity to make a personal study of the attenuation of waves in mountains, to choose for my itinerary the rolling abruptnesses of the Pennine chain, and spend ten days in a car seeing a thousand miles of mountain and hill.

## *Long Waves Last Longest*

For several years we have been led to believe that wireless waves, as they pass over ground, "attenuate" or die away. Short waves die away very quickly (at least, that part of them which can be said to travel over the earth); long waves die away, but far less perceptibly. It is just the difference between the high-frequency steps of a child, who is bothered by the smallest irregularities in the intimate ground, and the long strides of the seven-league boots of the storyteller's imagination which carried the third son so far and so fast.

But waves of the same length die away more or less quickly according to the type of ground, or the type of things on the ground, over which they travel. Thus if a wave of 200 metres passes over that sleepy, but often thunder-stricken, Constable country (known in treatises on this subject of attenuation as "open pastoral") its strength dies away to one-tenth of its value at 2.5 kilo- metres in 10 kilometres from the aerial; but when it find



# Fade Away

By  
Capt. P. P. ECKERSLEY,  
M.I.E.E.

*Why do broadcasting waves fade away as they get farther from the transmitting station? This was one of the questions Capt. Eckersley—our Chief Radio Consultant—had to answer in his recently held position as Chief Engineer of the British Broadcasting Corporation. Below he tells in his own inimitable style of his adventures on the trail of disappearing signal strength.*

only the sea to obstruct it, it dies away to one-tenth of its value at 2.5 kilometres in 25 kilometres.

One can put this another way. A wave of 2,000 metres dies away at the same rate if it passes over open pastoral country as a 200-metre wave does when it passes over the sea.

One can make a still more dramatic and interesting statement than this even. One can say that if we had a ship and sailed it 30 miles due south of Southampton, and on it erected a 200-metre wave-length, 25-kilowatt broadcasting station, one would serve the densely-populated fringes of the English south coast as well as if one moved Daventry to Newbury.

## Collecting Practical Data

This is a simple case, but suppose we consider other cases; what happens to the waves, for instance, if they pass over tree-covered, or house-covered, or rocky, or broken, or peaty and marshy, or mineral, or deep-soiled, or chalky land? Who is, in fact, going to tell one how the waves are affected by different types of ground?

The answer, up to a short time ago, was that Mr. Barfield, of the National Physical Laboratory, would be able to tell you if you could tell him how many trees there were on the bit of ground you wanted to deal with.

As an engineer for some time responsible for forecasting the service area of broadcasting stations, I was particularly grateful to Mr. Barfield's pioneer work in taking the field-strength contours of the London station; it gave me some very pertinent data. Later on, my brother, T. L. Eckersley, of the Marconi Company, was induced to simplify the Sommerfeld theory of attenuation so that an engineer

(as differentiated from a mathematician or physicist) could use it to help him solve his problems.

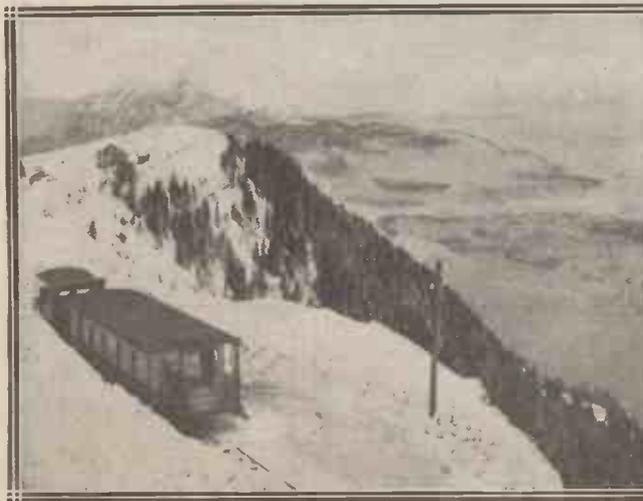
Add to this that a field-strength measuring van was purchased by the benevolence of the B.B.C., and you will see that one really was getting towards some theory of one's own. At first, as results came in, I could do no more than register a grave doubt (chiefly in my own mind) of the value of what Mr. Barfield calls being a vegetarian, i.e. accounting for attenuation in terms of the density of trees. As I began to correlate results and particularly study some work done in Switzerland by a Mr. Amis, of the Standard Telephone and Telegraph Company, I came to the conclusion that, while undoubtedly dense forests must discourage wireless waves, the waves were as much, if not more, upset by the hilliness or mountainousness (what can one say: degree of mountainosity?) of the ground over which they were driven.

I determined to make a study of this point myself, because it was of the utmost importance to be able to calculate service area in advance by knowing something of the nature of the ground over which the waves must pass.

## We Start on Our Tour

We started at Leeds one Tuesday morning. I in my old, but faithful, car, the field-strength measuring van behind, and John MacLaren, who specialises in this work, giving me the benefit of the "tricks" of the trade in measuring field strength.

It was particularly fascinating for me to watch the confirmation of my theory growing from the bedrock of fact—continuous and ceaseless measurement. I had



What part do mountain peaks play in attenuating wireless waves? All sorts of experiments have been made to determine this both among the Swiss Alps (left) and in our own picturesque peaks of the Pennines (right).

.....  
**“It’s the Hills that Kill the Wireless Waves”**  
 .....

previously worked out the theoretical attenuation of the waves from Daventry 5.X X, plotted these on a curve and was now busy putting in the actual experimental points alongside.

We took the first measurement a mile from Appletreewick, tucked away in the heart of the Yorkshire hills, the silver ribbon of the River Wharfe following our twistings and turnings to dodge the ubiquitous telephone wire. It was pouring with rain, that sort of continuous rain which makes one’s elbows and knees wet at once even though they are really dry. A bedraggled holiday camp took interest in us; as who would not, seeing a van 8 ft. high by 8 ft. long in the body, a cube of green wood perched on the chassis of a touring car and all stamped B.B.C. ?

It is a strange, eerie feeling, if one refuses to be the blasé engineer, to climb into a box, click a few switches, and to hear the Daventry morning concert squeaking out of the overloaded ‘phones (needless to say, the field-strength measurer is not designed for quality); just the hiss of rain outside, and the feel of the hills and silence, and then this queer, thin, mechanical noise redolent of the daily round and common task far away in the noisy bustle of London.

**As Far North as Edinburgh**

There is neither time nor space to trace our long journey north, which tried ever to burrow in the deepest valleys and then abruptly climb to the highest hills. I have so many varied pictures, seen always through the silver slats of vertical rain, that it’s hard to recapture them even if you, my reader, wanted to hear about it all. But for my own sake, I’d like to recall a terrific first-gear climb up Buttertubs over to Swale Dale from Wensleydale, and how we “took a point” 1,500 ft. up while white mist drove round us and we heard the river roaring in the deep valleys below.

I would like you to see with me again the huge, brown, elephant back of the High Force waterfall, swollen by rain,

with a wet, yellow sunset shining through its spray, or, if you like the little things enough to enjoy shooting them, see a covey of grouse burst out from the wet heather at the roadside, and, like brown teapots on wings, go twisting out of sight. And all the time more points, more readings, and the theory and the practice hatching out side by side, long lines falling away over the graph paper.

And so, with great wide views lit by pale sun or peeped at under trailing mists, with worse and worse roads as we hit the wilds of the Scottish border hills, we finally found farthest north, and tried to sleep the sleep of the just while the Edinburgh tramways competed against our desires.

**Back Through Peak District**

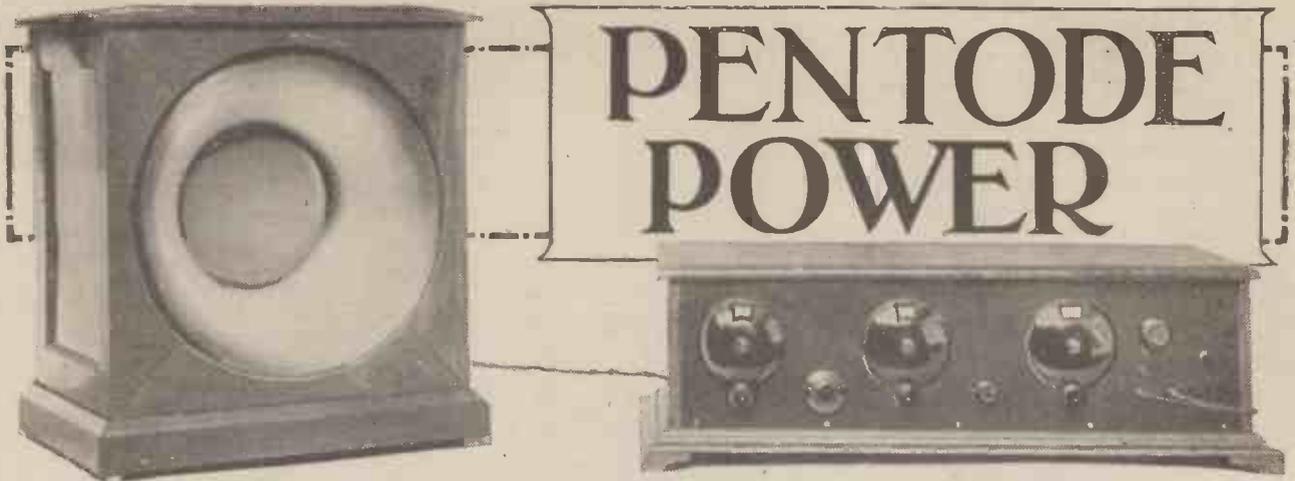
We came back by the peaceful pastures of East England, hit the hills above Sutton Bank, passed York to Leeds, Leeds to Halifax, and then over the Peak and into Derbyshire, back on the Watling Street to Daventry itself, and points, points, points all the way. We made Daventry on Sunday night, spent August Bank Holiday on some local readings, and were in London that night cursing the holiday traffic and incidentally breaking a record for the run Weedon to St. Albans.

And now I am a vegetarian no longer, it’s the hills I know that kill the wireless waves. How they do it, why they do it, is for a theoretician’s wet afternoon to explain. It may be nothing to do with brokenness, it may be the nature of the rock:

I hope it will be necessary some day to investigate a newer theory in still more detail. All I know now is that “I will lift up mine eyes unto the hills from whence cometh my (attenuation).” Let them who may “hang their in the trees”—and therein is a mathematical joke!



The Eden Valley, above Kirkby Stephen, is in the heart of England’s hilly country. Capt. Eckersley says that one of the most delightful tasks he ever undertook in connection with British broadcasting was to travel among the hills watching for wave-attenuation.



# PENTODE POWER

**I**N my article on "Pentode Purity" last month I explained in outline the methods I have adopted to obtain a large output from a pentode valve for moving-coil work, and mentioned that I have found an intermediate L.F. stage a considerable help, provided that it is one of quite low magnification.

In my own amplifier I also found it desirable to provide an anti-coupling filter for the intermediate L.F. valve, although I have not found this of any practical value in any other type of amplifier. The one actually used consists of a 40-henry L.F. choke and a shunting condenser of 2 mfd., which you will see in the diagram which gives the connections of the final arrangement of the amplifier. Quite possibly you would not find this necessary with a different mains unit, but as to this I cannot speak definitely.

## A Peculiar Trouble

The amplifier, when first tested out, after the really complete system of anti-coupling devices had been incorporated, showed a most distressing tendency to go into oscillation at a quite high super-audible frequency on very slight provocation. What this frequency was I never found out, but a Weston thermo-galvanometer in series with the moving-coil winding showed a considerable reading, although no sound could be heard. Also, I

*The obtaining of real undistorted "punch" from the Pentode valve is not always an easy task, but it can be done if you follow the lines laid down in this article.*

**By G. P. KENDALL, B.Sc.**

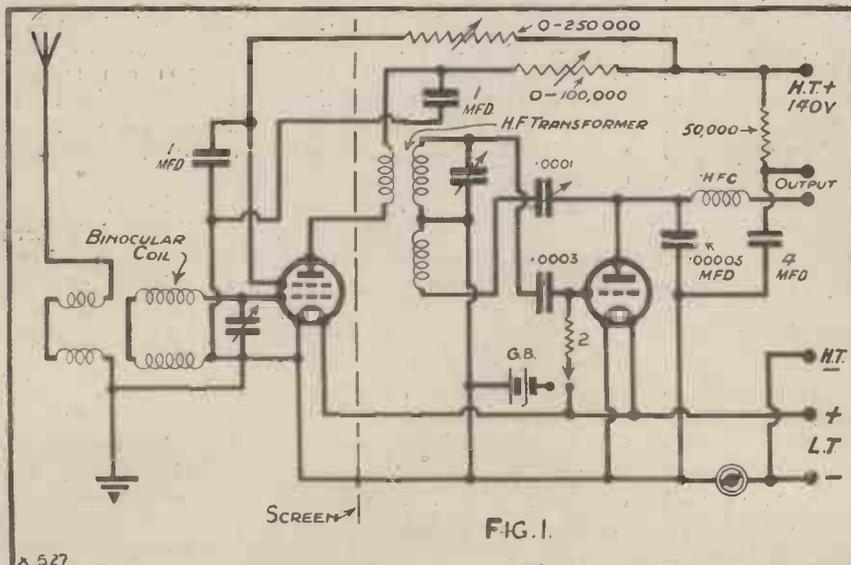
noticed that when the receiving circuit was made to oscillate, a series of chirps could be heard, indicating beats being formed between two frequencies somewhere in the set, and I considered that this must be between the oscillations of the receiving set and harmonics of the frequency at which the L.F. amplifier was oscillating. The first remedy which I tried was to insert 100,000-ohm stopping resistances in series with the grid leads to the L.F. valve and to the pentode, but all this did was to bring the oscillation just down into the audible range, a very high-pitched whistle indeed being then heard.

A number of dodges were tried, some of which seemed to reduce the trouble a little, but none really stopped it until I discovered more or less by accident that by shunting a fixed condenser of only .0005 mfd. from the plate of the pentode valve straight down to L.T., the oscillation ceased and the amplifier appeared to be extremely stable. This condenser should have a negligible effect upon reproduction, and it has been left in as a permanent feature. The subsequent behaviour of the amplifier was in every way exemplary.

## Stabilising Precautions

A few notes may be helpful to those who may consider trying out a similar amplifier for their own purposes, particularly as regards obtaining complete stability. Well, the first and most important point is to include anti-motor-boating filters at every point where you think they may do any good, since my experience is that it is much easier to have too few than too many of these filters. Next, take very great pains to see that your actual receiver portion is as stable as you can make it, and if, as in my own case, you find it necessary to use a stage of H.F. in front of the detector, to get a really adequate input, more particularly for anode-bend rectification, put in all you know in the way of safety and stabilising devices.

In my own case I use a screened-



The H.F. and detector portion of the outfit used by the author in his experiments.



# ELIMINATING THE OUTSIDE AERIAL

*A practical article on the subject of frame-aerial reception.*

*By J. ENGLISH.*

NOT so very long ago the owner of a large and lofty twin aerial with wide spreaders and many insulators was much envied by neighbours with less pretentious aerials. In fact, newcomers to the art were wont to judge your abilities by the size of your receiver and the height of the aerial masts!

All this is changed nowadays, and in the search for selectivity under modern conditions of ether-congestion a big aerial is actually a handicap where a sensitive receiver is used.

We find that a short, moderately high wire increases selectivity, and accordingly aerials tend to become smaller. We lose, of course, something in input signal strength, but this is more than made up by the increasing efficiency of our H.F. amplifiers, now that the S.G. valve has at last come into its own.

## *Need for Selectivity*

Many of you living near the local station are doubtless working your sets on quite small aerials in order to get selective tuning, and even then having difficulty in getting rid of the local as well as you would wish. When the new regional stations come into full operation your difficulties will be increased, and you will have to prune down the aerial still farther. Even wave-traps will not completely solve your problems.

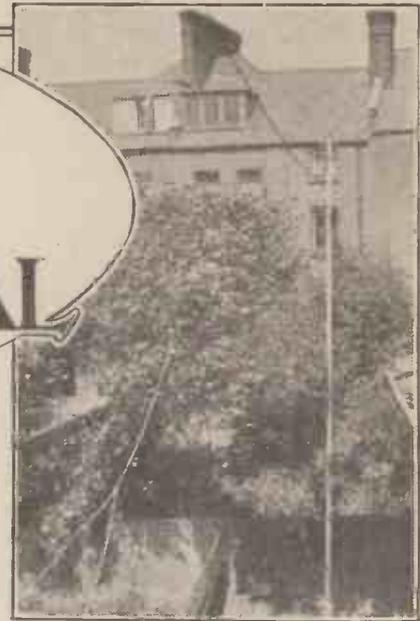
Because of the growing need for greater selectivity, and the increasing efficiency of H.F. valves, it seems to me that the outside aerial has outlived its usefulness, and before a great length of time those often unsightly poles and aerial wires will be numbered with bright emitters, reflex circuits, and suchlike memories of the past.

Of course, crystal and small valve sets require as large and as efficient

an aerial as possible, but such receivers are undoubtedly diminishing in number, while multi-valve sets are rapidly increasing in popularity. After all, when you come to think things out, the advantage of the higher pick-up efficiency of the open aerial compared with indoor and frame aerials is outweighed by the disadvantages of the outside wire.

Under the best of conditions the damping load of the latter makes it very difficult to obtain adequate selectivity, and the best that you can do is to weaken the aerial coupling, thus sacrificing a lot of the signal pick-up, and then use a receiver with at least two tuned circuits.

Again, the open aerial is a very fine collector of such undesirable things



as spark signals and general "mush," not to mention innumerable atmospheric interferences in summertime. In fact, when storms are about you have to earth the aerial and shut down the set altogether.

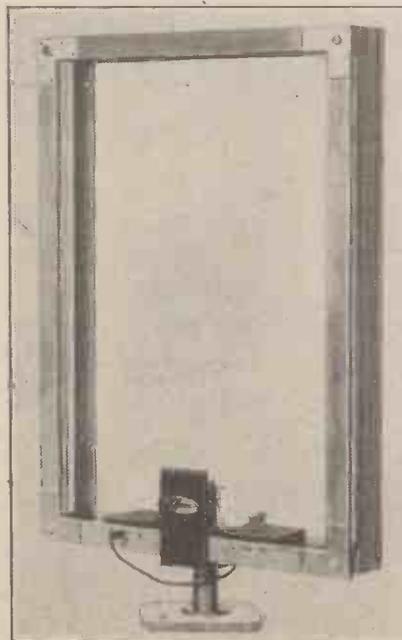
These disadvantages apply in a lesser degree to the indoor aerial, but whichever you use, outdoor or indoor wire, your set is chained to one position and has not the mobility and general convenience of the transportable receiver working on a self-contained frame aerial.

## *Advantages of the Frame*

Now if we eliminate the outside aerial the only collector of energy which suffers none of the disadvantages already mentioned is the frame aerial. This has always had a bad reputation as a very poor collector of signals, but its pick-up efficiency is not nearly so small as most amateurs think. In fact, if you use a really efficient frame of adequate size, backed up by a four-valve receiver with at least one S.G. H.F. stage, quite remarkable results are obtainable.

As an instance of the results obtainable with a modern frame-aerial receiver, you have only to operate some of the well-known four- and five-valve transportables with S.G. valve H.F. stages. On quite a small frame these receivers put up a performance rivalling that of a big set on a good outside aerial, but with all the advantages of a high degree of selectivity and the great convenience of compactness and mobility.

The performance of the better-class receiver is equally good on long



The "Universal" frame aerial designed by Mr. G. V. Colle. It carries its own wave-change switching.

and medium wave-lengths. As an additional advantage we must not forget that frame-aerial receivers are immune from the dangers of lightning.

Certain models having two S.G. valve stages completely screened give really extraordinary results, numbers of foreign stations being received at full loud-speaker strength in daylight. In fact, the degree of H.F. amplification is rather more than adequate, so that amplification has to be reduced for comfortable reception.

In my own mind I have no doubt that the frame-aerial receiver will be the set of the future, and it is the advantages of the frame aerial and not so much their portability that has made transportable sets so popular. Of course, when we are making up a frame-aerial receiver for indoor use we need not study so carefully those considerations of compactness and portability which figure so largely in the design of the modern transportable.

### Successful Two-Valver

In fact, we shall be on the right lines if we use a frame aerial of larger dimensions than that found in the normal portable and construct our receiver in cabinet form with plenty of space for batteries of ample capacity.

As an instance of what can be done with a frame aerial of generous, though not at all unweildy, dimensions, I would mention the results obtained with a simple det. and L.F. receiver I made a little time ago, and which had a frame about 2ft. 6in. square.

Although only two valves are used, the receiver provides satisfactory loud-speaker reception from 2 L O at a distance of twelve miles, tuning being

sufficiently selective, even at shorter ranges, to cut out this station within a few degrees of the condenser setting for maximum signals.

After sunset during the winter and spring an extraordinary number of foreign stations could be received at readable 'phone strength, many being quite clear and free from interference. Anyone doubting the efficiency of a frame-aerial receiver has only to operate one of this type to be agreeably surprised by the results obtainable with so few valves.

### Adding an H.F. Stage

Now if we were to use an efficient and stable S.G. valve stage with this type of receiver, signals would be boosted up tremendously, and the general performance would then be very nearly as good as that of an ordinary three-valve set on an outdoor aerial. The latter, of course, would lack the selective tuning and other advantages of the S.G. frame receiver.

As there is a considerable field for development of this type of frame-aerial set, offering at the same time opportunities for new ideas in construction and circuit design, you will not be wasting your time if you commence experimenting now with this class of receiver, which in time will lead to the elimination of the outside aerial.

As a basis for experiment, I would suggest a rough layout at first, using a frame of about 2ft. 6in. square and so arranged that the chassis supports both frame aerial and compartments for the receiver proper and the batteries.

A choke-coupled S.G. stage is a good form of H.F. amplifier to start with, for although a transformer-

coupled stage will give more amplification it requires careful screening for complete stability. If you use a pentode after the detector you will have a powerful three-valve combination, and if careful consideration is given to the efficient design of the frame aerial and to the choice of the H.F. coupling choke, the performance



A frame aerial built into the lid of an "all-in" suit-case set

of the set should rival that of the average four or five-valve transportable.

Since we are not limited for space as in the portable frame-aerial receiver, there is no reason why the design of the set should not include operation from the mains.

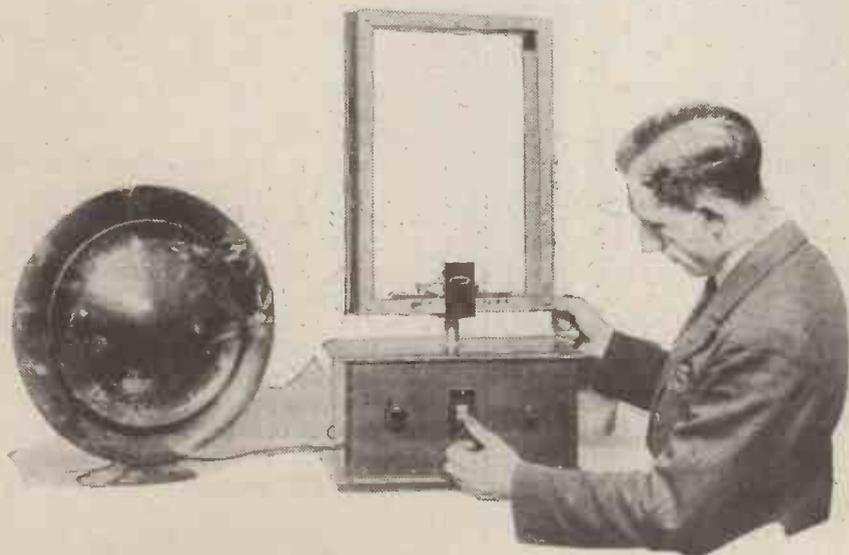
Of course, this requires more careful design than the battery-operated set, but it offers us the very tempting opportunity of using that remarkable new valve, the Cosmos AC/S screen grid, wherewith we can obtain enormous H.F. amplification even with choke-coupling.

### Set of the Future

It is very easy to make prophecies about the future, but judging by the general trend of development in receiver design there is every possibility that the de luxe receiver of the future, when open aerials are no more, will have a specification very similar to the following:

A completely enclosed, ornamental wooden cabinet, measuring perhaps 3 ft. high, 2 ft. wide, and 10 in. to 12 in. deep, will accommodate inside an efficiently designed frame aerial for long- or medium-wave reception. Inside there will also be a mains-operated receiver, complete with eliminator for L.T. and H.T., sufficient space being available for a cone loud speaker opening out on the front of the cabinet.

(Continued on page 447.)



The "Universal" frame aerial fitted to the "Flat-Dweller's" Four, which was described in "M.W." some months ago.

## OVERHAULING YOUR SET

By H. BRAMFORD.

**D**o you ever overhaul your set? If you do not you will be astounded at the amount of dust and dirt which collects in and around all the components, inside and out, and between contacts, and so forth, even though the instrument is housed in an entirely enclosed cabinet.

Nor is this all. Contacts, for apparently no reason at all, become loose, terminal connections slacken, and a high path of resistance is set up at innumerable points from this cause alone, and you probably wonder why the set is not working as well as it used to do.

### Complete Clean Required

You blame the accumulator, the batteries, the speaker, or think that the valves have lost their emissive properties, when none of these things is the cause. Valves do in time lose their original properties, but their life is long if they are not over-run in any way, such as by excessive H.T., with insufficient G.B., or overheating of the filaments.

But in many instances it is that overhauling job which sadly needs attending to. After all, one does not expect a machine to run for ever

all valves, clean round the holders, look for dust in the sockets, remove the coils and take out every other part that is removable. Pay attention to condenser vanes, see that they are running true, look for loose nuts, screws, and contacts, and if the set is in a really bad condition it even pays to take it to pieces and put it together again, seeing, of course, that the necessity for this does not rise again; and while you are about it you might as well incorporate those improvements you have been going to add for so long, or rig up that new circuit which has interested you so much of late.

### Surprising Results

When you have done all this, you will be surprised at the improvement in results. Remember, that one loose connection in a set will cause any amount of trouble, and will account for a very familiar low whistle in a set and other indications.

When you have made sure of the set, look at the batteries, see that the plugs are tight, that the leads are in good condition, that there are no broken strands of wire at the connection between flex and plugs. Then look at the aerial-switch for similar faults, and finally the earth connection, where a bad joint is often to be found, and which will cause signal strength to drop at least 50 per cent.

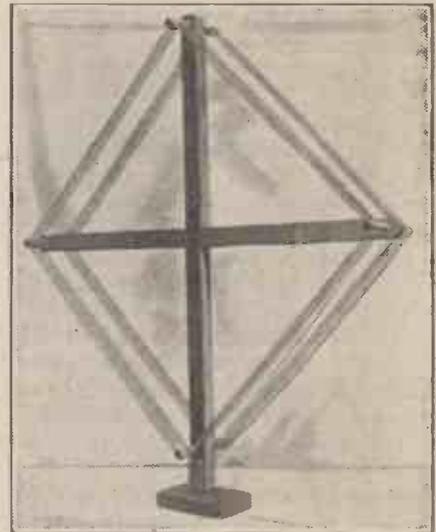
Finally, see that the valves fit well in their holders, and that all the pins

the leads have not become heavily coated with verdigris. If such is the case they must be scraped clean, and the accumulator terminals cleaned and then treated with vaseline.

## ELIMINATING THE OUTSIDE AERIAL

—continued from previous page

The circuit of the receiver would comprise one, or at the most two, A.C. screened-grid valves, followed by a detector transformer—coupled to a pentode, with the usual pentode transformer output. Single-dial



A straightforward frame aerial of neat and simple design.

tuning would be an essential feature of control, while one small switch would serve to turn the set on or off, and also to change from one wave-band to another.

As you can well imagine, such a receiver, although somewhat expensive to construct, would put up a phenomenal performance, and for selectivity and range, quality and convenience, would easily rival the open-aerial receiver of to-day.

## REMEMBER THAT—

The commonest cause of distortion is the H.T. battery voltage falling.

One advantage of using a cupboard in which to keep the H.T. and I.T. batteries is that it tends to keep them at an even temperature.

Crystal sets should be kept free from dust, dirt, etc., especially the crystal itself, which should be kept covered and not handled with dirty fingers.

## A VITAL USE FOR RADIO



This aeroplane, the Yellow Bird, in which three brave Frenchmen successfully crossed the Atlantic, was fitted with a radio outfit. Dario valves were used and very good results given.

without overhaul or cleaning, so why a wireless set? Yet it is often imagined that no kind of attention whatever is needed.

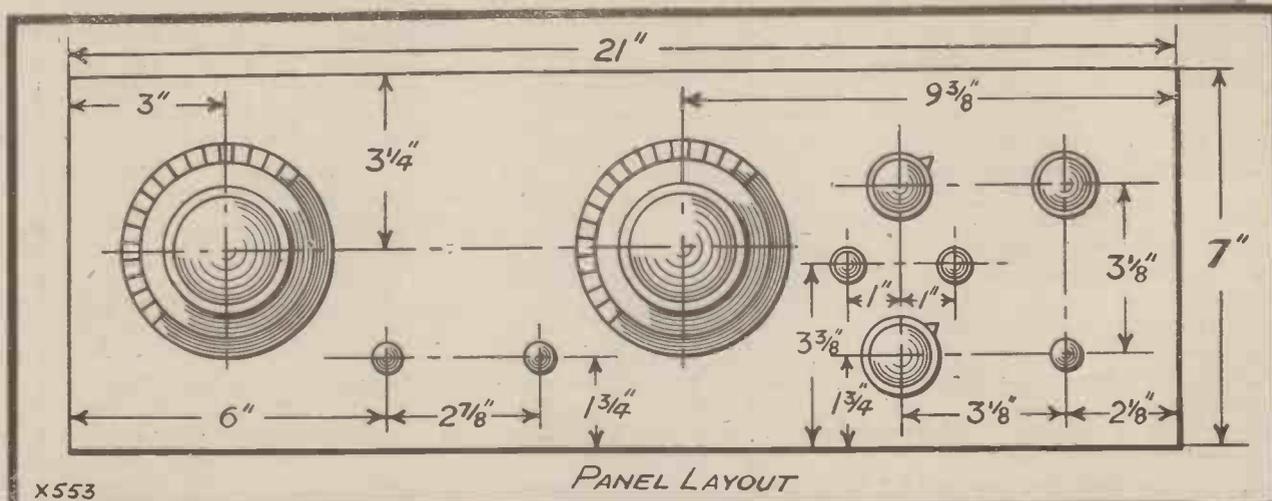
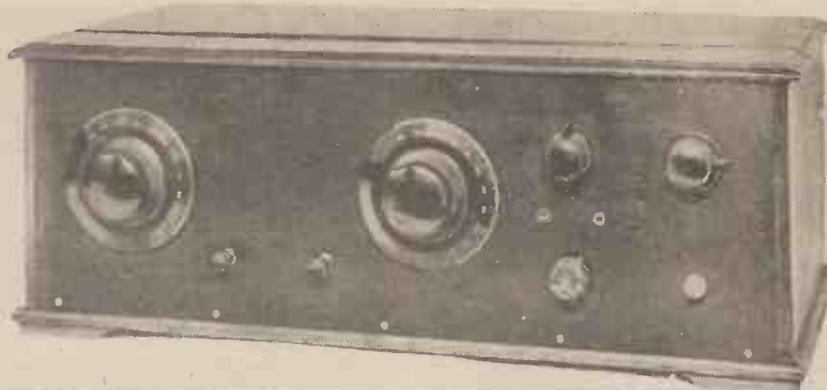
It is a sound idea periodically to look over your set, clean it up, remove

make good contact in their sockets. If it is suspected that they do not, open them out a little. Do not forget the accumulator, and see here also that connection is well made to the terminals, and that the spades from



A four-valve receiver of outstanding merit, giving remarkable power and selectivity with simple operation and possessing many novel and attractive features.

Designed and described by the "M.W." RESEARCH DEPT.



The set has a number of special refinements, and so there are quite a few knobs on the panel, but it is not complicated to operate. The wave-change switches are between the tuning dials, to the right and below are the reaction condenser and L.T. switch, above these are the radio-gramophone switch and the volume control.

of H.F. coupling usually gives ample selectivity for any normal requirements. The problem is really only met in an acute form in the case of a set with a single H.F. stage, and it is to this type that we have devoted most of our time.

We have obtained some very excellent results from this combination of a high selectivity and moderate amplification H.F. stage and extra powerful L.F. side, and the work has now proceeded far enough to permit us to place our readers in a position to reap some of the benefits thereof. The present design for a four-valve set is the first specimen of the new type, and we present it to our readers with every confidence that they will find that it provides them with a very effective solution of the problem, with a full share of the expected advantages of moderate cost and simplicity of construction and operation.

### Selectivity and Magnification

The essence of the design is this. A screened-grid valve is used, and provision is made for weakening the coupling between the output side of this valve and the grid circuit of the

detector valve to an extent which gives the desired amount of selectivity at a definite sacrifice in possible amplification. The result is an H.F. stage of good selectivity and quite moderate amplification. Then following upon this we have two very powerful L.F. stages which bring up the overall performance of the set to a high level.

Such a scheme has the obvious advantage that it can be carried out

.....  
 This fine receiver provides a very unusual combination of good selectivity and high over-all amplification and incorporates many special little devices which will appeal to the discriminating constructor.  
 .....

with only two tuned circuits and perfectly standard components, while it also lends itself very readily to the use of wave-change switching. You will note that we have actually used a pair of Titan coil units.

The first Titan unit is employed in a perfectly normal manner to provide the aerial coupling arrangement for the screened-grid H.F. valve, but the second is used in a way which

readers of MODERN WIRELESS have probably not yet seen. If you examine the circuits of the detector valve you will see that they are very much like those of a simple reaction receiver, with the exception that instead of coupling the aerial to the circuit, the anode circuit of the screened-grid valve is "parallel fed" to it, using the customary primary circuit for the coupling winding.

### Improving Detector Sensitivity

Comparatively weak coupling can be obtained in this way, and is finely variable by means of the tapping arrangements on the long- and short-wave portions of the coils, and so a very good control of the actual degree of selectivity and amplification is obtainable. Reaction is provided in just the normal manner, and the detector valve also has our standard sensitivity-improving scheme of an adjustable plate-to-filament bypass condenser.

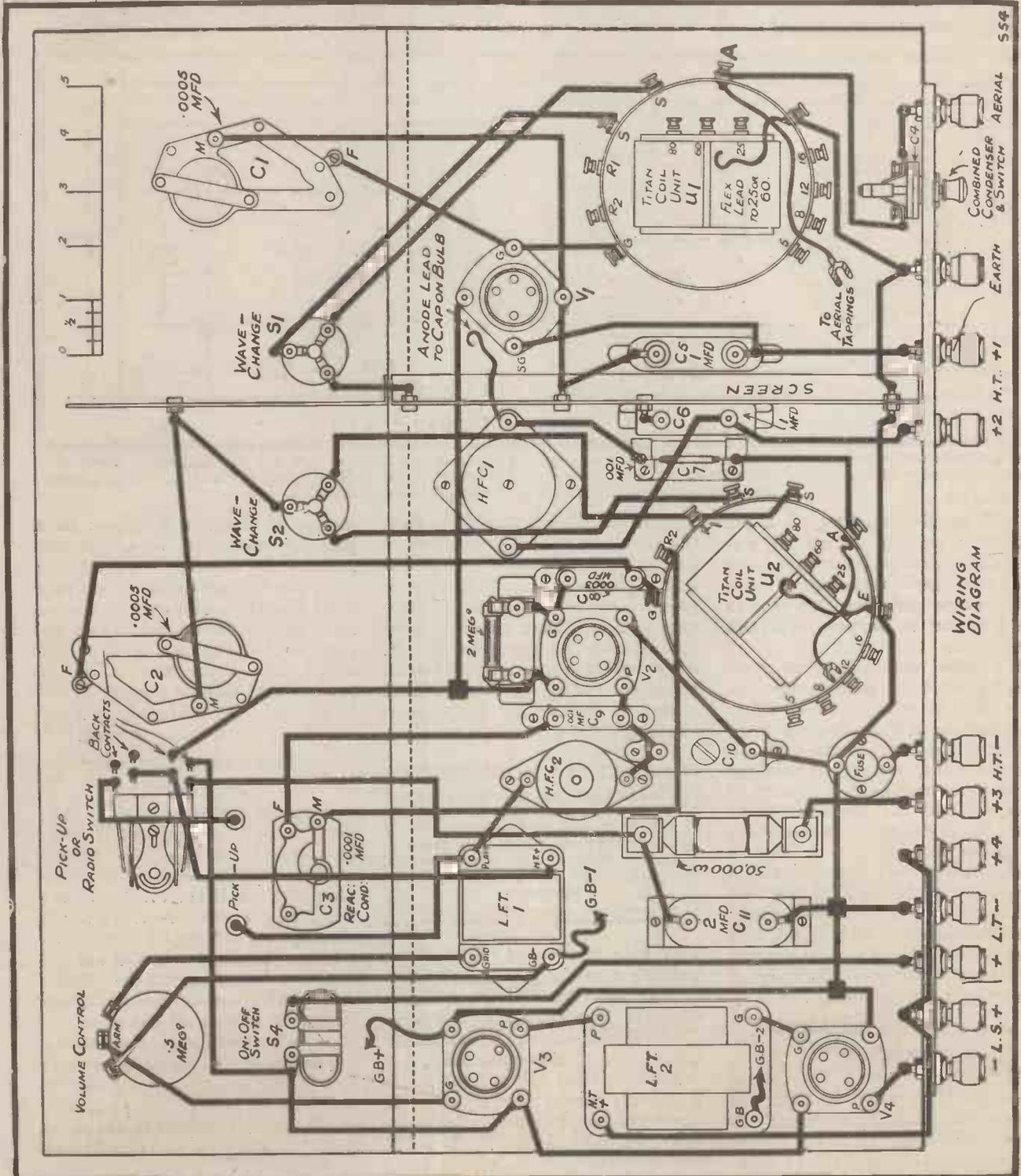
Mention of this device reminds us that it may be new to some readers, therefore we will just explain very briefly that it improves the functioning of the detector valve by providing a free H.F. escape path from

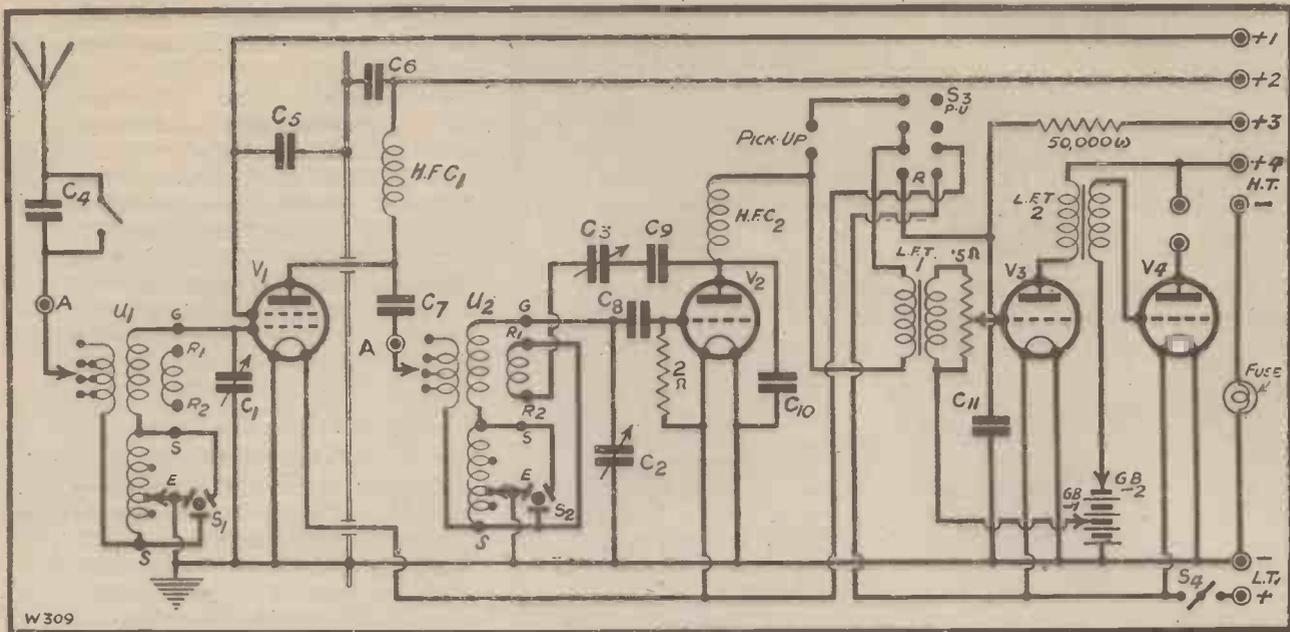
plate to filament, which is independent of the normal reaction circuit. In use, this is customarily a baseboard-mounting compression-type condenser of the screw-down variety, and is adjusted as follows: Start with the knob of this little condenser unscrewed to the limit of its travel, and then gradually screw it down, noting that as you do so it becomes more and more difficult to obtain reaction through the normal path.

As you increase the capacity of this condenser ( $C_{10}$ ) you will find that you have to use a larger and larger setting of the reaction condenser to get the same reaction effect, and the best point for  $C_{10}$  is found when you can only just get reaction with the reaction condenser nearly full-in when working at the top of the long-wave tuning range.

Before we leave the H.F. side there is one little device we should perhaps

mention, since it has not before appeared in a MODERN WIRELESS design. Instead of having the usual pair of alternative aerial terminals, one of which brings in a series condenser for weakening the aerial coupling beyond the control which can be obtained on the coil, and so getting high selectivity, we have incorporated a little component which consists of the necessary fixed condenser and a shorting switch made up in one unit.





This is mounted upon the terminal strip in the usual position, and by pushing the knob inwards you have the series condenser in action, while by pulling it outwards the condenser is cut out of circuit. With the aid of this device and also the tappings on the low-wave primary winding and upon the long-wave loading coil, you can obtain a very wide control of selectivity and can suit greatly differing conditions.

The extremely powerful L.F. side needed for our present purpose presents no special problem, since the modern method of using two high-quality transformers with careful layout and an anti-battery coupling filter at the detector stage provides us with an effective solution. So far as the general arrangement is concerned, then, the L.F. side of the set presents no particular departures from standard practice.

There is, however, one interesting feature on the L.F. side which may be new to many readers, and that is the

method of switching a gramophone pick-up into circuit. Now, the usual scheme of connecting the pick-up across grid and filament of the detector has certain drawbacks, which we have set ourselves to remove in the present case. The main objection to this conventional method, of course, is to be found in the fact that it is not a very nice thing to do to insert switching in the grid circuit of the detector, from the point of view of efficiency in the radio circuits, but there is also the fact that three L.F. stages are usually rather too much for the modern more sensitive type of pick-up.

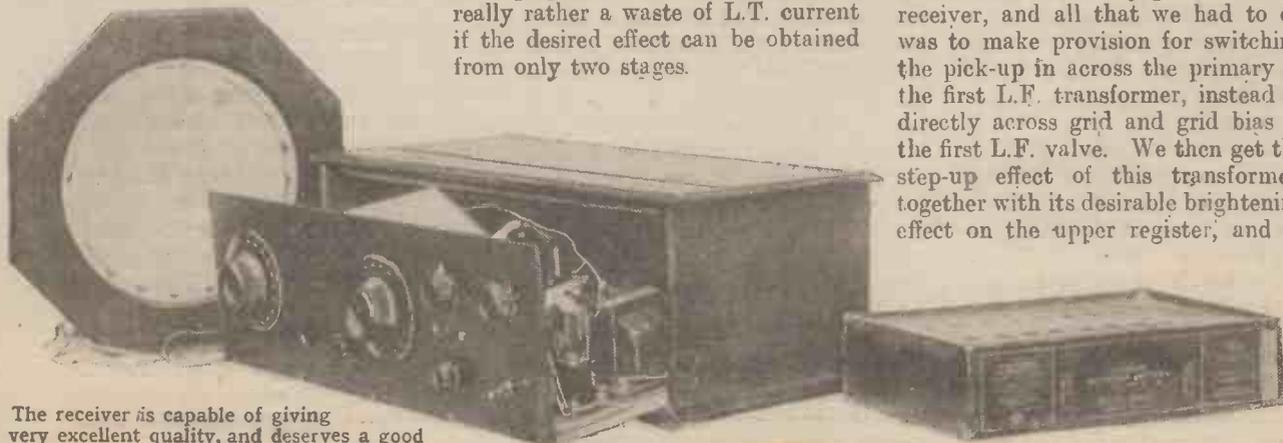
### A Problem to be Solved

When this method is used one generally has to volume control the circuit heavily in order to keep the output down to manageable limits, which means that one is constantly operating the volume control at a point where the adjustment is far from pleasant; and, moreover, it is really rather a waste of L.T. current if the desired effect can be obtained from only two stages.

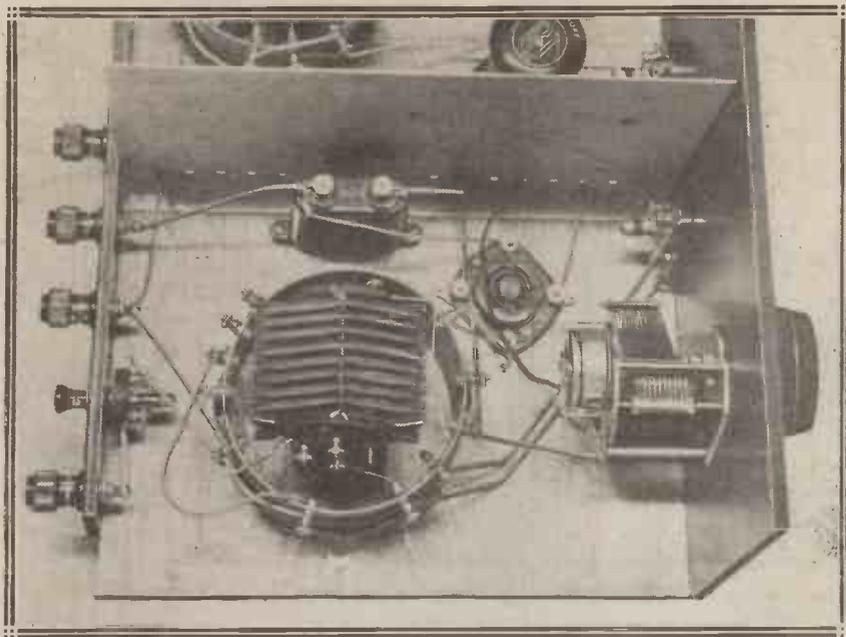
Two normal stages in which the pick-up is connected directly across grid and filament (or grid bias) of the first valve do not always provide sufficient volume with the less sensitive types of pick-up, and so we have to seek for a more satisfactory scheme. It is not often, of course, that one comes across a pick-up which does not give sufficient volume when used with only two stages in the manner just mentioned, but we desired to make provision for even such cases. We have provided in this set a solution which at the same time materially improves the reproduction obtained from many pick-ups, brightening the response in the upper register quite perceptibly.

### An Effective Scheme

The device we have employed is what is known as an input transformer placed between the pick-up and the valve, a very simple matter in the present set. The necessary transformer is already present in the receiver, and all that we had to do was to make provision for switching the pick-up in across the primary of the first L.F. transformer, instead of directly across grid and grid bias of the first L.F. valve. We then get the step-up effect of this transformer, together with its desirable brightening effect on the upper register, and so



The receiver is capable of giving very excellent quality, and deserves a good speaker and an adequate power valve.



Note the special series condenser and shorting switch for the aerial circuit mounted on the terminal strip.

make sure of both adequate volume and improved reproduction from very many pick-ups.

Since we are now only using the last two valves in the set for gramophone work, it follows that we can save the L.T. current of the first two valves, and we have used accordingly one pole of the double-pole change-over switch to turn out the filaments of these two valves. The actual switching required to carry out all this is comparatively simple and does not make a serious addition to the complication of wiring. Moreover, since we are no longer inserting our switch on the grid side of the detector valve we need have no fear as to its effect upon the efficiency of the set when used for radio purposes.

### How the Switches Work

Mention of the switch in question reminds us that we ought perhaps to give a key to all the switches on the panel at this point. First of all there are the two-wave change switches  $S_1$  and  $S_2$ , which are of the usual push-pull type, with three spring contacts. These are really three-point on-off switches which at the "on" position join all the points together, and at the "off" position separate all three. These two switches are operated as follows: With the knobs pulled outwards the set is switched to the medium broadcast wave-band, and with the knobs pushed in the set goes over to the long wave-band. The "pick-up or radio" switch operates thus: With the knob turned clockwise the set functions as a radio receiver,

and with the knob anti-clockwise the first two valve filaments are turned out and the pick-up is brought into circuit. The L.T. switch  $S_4$ , of course, simply controls the filaments of all four valves in the normal way.

### The Pick-Up Leads

Socket connecting points are provided on the panel for the pick-up lead, so that it can be disconnected and the lead removed in a moment if desired, a convenient point for those who have a gramophone standing at some little distance and do not want a permanent lead trailing from it to the set. On the panel you will see two small sockets for the pick-up, and it is intended that the pick-up leads should be furnished with two small plugs for insertion in these sockets.

Now there are a few practical and constructional points which we would like to give you. First of all about the anti-battery-coupling filter. You will see that conventional values of 50,000 ohms for the resistance and 2 mfd. for the condenser are indicated in the design, but it is to be understood that practically any value of resistance from about 25,000 to 50,000 ohms will serve perfectly well, so that if you have an odd one on hand by all means use it.

A capacity of 2 mfd. is usually sufficient for the shunting condenser, but if you like to make doubly sure, so that you may be quite safe on even the oldest of batteries or a mains unit which has a tendency to motor-boating, you can increase this to 4 mfd., either by means of a 4-mfd.

unit or by placing another 2-mfd. condenser in parallel with the one shown in the set.

As regards the two L.F. transformers, we would give the usual recommendation that these be of two different makes or types, since in this way it can generally be assumed that there will be freedom from L.F. howling troubles. By the way, if your transformers are provided with a means of earthing the cores, by all means make use of this and wire it up to a convenient point on the L.T. circuit.

### Reservoir Condenser Capacities

Mention of reservoir condensers reminds us of a point concerning the two shunting condensers for the H.T. feed leads to the screened-grid valve. These are shown as having a capacity of 1 mfd. in the design, but, of course, it is to be understood that the usual range of capacities from .2 up to 1 mfd. will serve perfectly here. There is nothing critical about these capacities.

There are just two points we should like to mention about the actual construction and wiring-up of the set. You will find it best to leave the attachment of the two tuning condensers  $C_1$  and  $C_2$  to the panel until the last possible moment in the construction, since in this way you will find the rest of the assembly and wiring-up is made considerably easier. Drill the holes on the panel for these condensers while you are carrying out the main drilling operation, of course, but do not attach them until all the rest of the set is finished and wired up. The addition of the two leads to each condenser will then complete the operation. You will find that this will make it very much easier to carry out the rest of the wiring, particularly that of the radio-or-pick-up switch, which is otherwise rather difficult to get at.

### Valves and Battery Voltages

Now for some summarised operating data. Valves: one screened-grid valve of the upright type, one H.F. valve for the detector, one H.F. or L.F. type for first L.F. stage, and a power or super-power for the final socket; 2-, 4-, or 6-volt valves all work satisfactorily in this set, and our own tests on the receiver were based upon the use of 2-volters.

The H.T. voltages should be as follows: H.T. +1, which is a separate terminal supplying the screening electrode of the screened-grid valve,

# Power, Purity and Selectivity!

## COMPONENTS

- \* 1 Panel, 21 in. x 7 in. (Resiston, Ripault, Kay-Ray, Becol, etc.).
- \* 1 Cabinet and baseboard 10 in. deep. (Pickett, Lock, Camco, Raymond, Ready Radio, Osborn, etc.).
- \* 2 .0005-mfd. variable condensers, slow motion or with vernier dials (Dubilier, Lissen, Cyldon, J.B., Lotus, Raymond, Bowyer-Lowe, Ormond, Gecophone, Formo, Igranic, Colvern, etc.).
- \* 1 .0001- or .00015-mfd. reaction condenser (Keystone, Lissen, J.B., Lotus, Cyldon, Ormond, Raymond, Bulgin, Bowyer-Lowe, Magnum, etc.).
- \* 2 Three-spring wave-change switches (Wearite, Ormond, Bulgin, Pioneer, Ready Radio, etc.).
- \* 1 L.T. switch (Igranic, Lissen, Lotus, Bulgin, Benjamin, Raymond, Wearite, Keystone, etc.).
- \* 1 .5- or 1-meg. volume control, 3-terminal type (Gambrell, Igranic, Varley, Magnum, R.I., etc.).
- \* 1 Double-pole change-over switch, panel-mounting type (Wearite, etc.).
- \* 4 Spring valve holders (Benjamin, Lotus, Igranic, W.B., Formo, Bowyer-Lowe, Dario, Wearite, etc.).
- \* 2 "Titan" coil units (Ready Radio, Paroussi, Magnum, Goltone, Wearite, Keystone, etc.).
- \* 2 1-mfd. condensers (Dubilier, T.C.C., Lissen, Hydra, Ferranti, Mullard, etc.).
- \* 1 2-mfd. condenser (Ferranti, Lissen, etc.).
- \* 1 .001-mfd. fixed condenser (Igranic, Lissen, Goltone, Clarke, Dubilier, Magnum, T.C.C., Mullard, etc.).
- \* 1 .001-mfd. fixed condenser, edgewise type (T.C.C., Lissen, etc.).
- \* 1 .0003-mfd. ditto (T.C.C., Lissen, etc.).
- \* 1 Compression-type semi-variable condenser, maximum capacity about .0001 mfd. (Formo, Igranic, etc.).
- \* 1 2-meg. grid leak and holder (Lissen, Dubilier, Igranic, Ediswan, Loewe, Mullard, Carborundum, etc.).
- \* 1 H.F. choke for parallel-feed circuit (H.F.C.<sub>1</sub>) (R.I., Lewcos, Wearite, Varley, etc.).
- \* 1 H.F. choke for reaction circuit (H.F.C.<sub>2</sub>) (Magnum, Lissen, Raymond, Dubilier, Igranic, Lotus, Bowyer-Lowe, Climax, Varley, Bulgin, Wearite, Lewcos, R.I., etc.).
- \* 1 50,000-ohm resistance and holder (Precision, Lissen, Dubilier, Ferranti, Igranic, Cosmos, R.I., Mullard, Varley, etc.).
- \* 2 L.F. transformers of low ratio (Varley "Ni-Core" and Brown in set. A few other good makes are these: Lissen, Cossor, Ferranti, R.I., Phillips, Lotus, Igranic, Mullard, etc.).
- \* 1 H.T. fuse, bulb type (Magnum, Ready Radio, Bulgin, etc.).
- \* 1 Standard screen, 10 in. x 6 in. (Ready Radio, Paroussi, Wearite, Magnum, etc.).
- \* 2 Sockets for pick-up (Clix, Eelex, etc.).
- \* 1 Terminal strip, 19 in. x 2 in. x 1/4 in.
- \* 11 Terminals (Belling and Lee, Igranic, Eelex, Clix, etc.).
- \* 1 Series aerial condenser and switch unit (C<sub>4</sub>) (Wearite).
- \* Flex, wire or Glazite, screws, G.B. plugs (Lisenin, Clix, Eelex, Igranic, etc.).

requires the usual experimentally-adjusted value of 60 to 80 volts, while H.T.+2, which feeds the anode of this valve, requires about 120 to 140 volts. H.T. +3 is the feed for the detector valve, and here, again, the conventional value of 30 to 60 volts should be used, with adjustment to obtain the smoothest possible reaction. The remaining terminal is for the two L.F. stages, and here, again, you want 120 to 140 volts or thereabouts.

Grid-bias voltages will be these: 1 1/2 to 3 volts negative on G.B. - 1, and such a voltage on G.B. - 2 as may be indicated by the maker's data slip for the particular valve you are using, and the exact amount of H.T. voltage employed.

### Aerial Coupling Controls

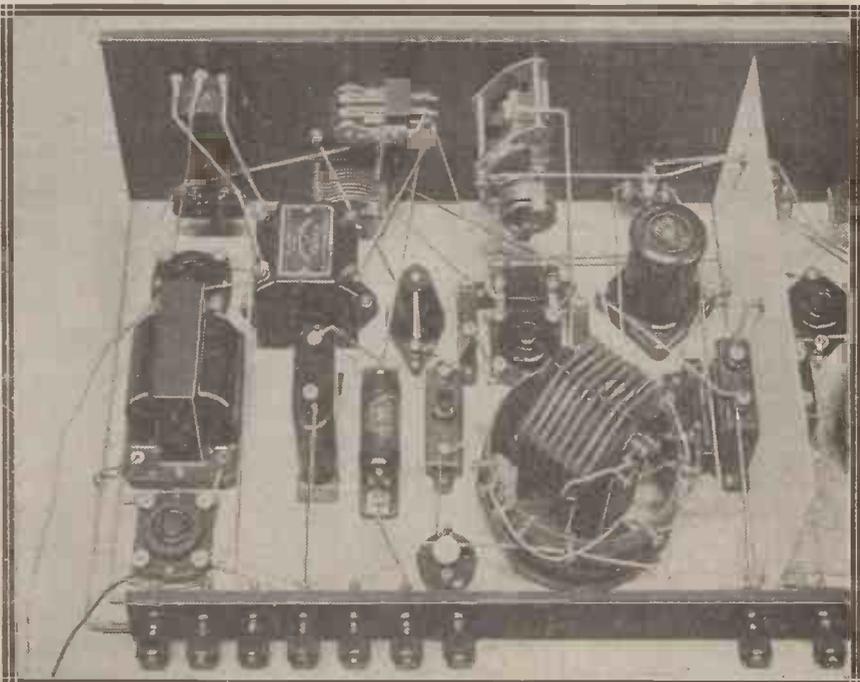
The coupling adjustments on the two coil units are the only remaining points on which you will require information in order to obtain the best possible performance from this set, and you will find this a very simple matter. The low-wave adjustment in the case of this unit is made by means of the flex lead coming off the A terminal on the coil and terminating in a tapping device which enables the best coupling adjustment to be found on the low-wave primary winding. These points are usually

marked 5, 8, 12, and 16, these numbers indicating the number of turns in use when connection is made to each particular point. On the first coil unit you will usually find points 5, 8, and 12 give the desired range of adjustment, with point 8 a good average setting for normal conditions. The highest selectivity is obtained on point 5, and the greatest volume on point 12.

### Selectivity and Amplification

On the second coil unit (U<sub>2</sub>) the low-wave adjustments are much as before, but in this case you will find that points 12 or 16 usually give the best results, with quite adequate selectivity and good volume. The lower points here will give you somewhat greater selectivity still, but the drop in signal strength is usually quite noticeable.

On long waves the adjustment is made by means of a flex lead from the E terminal of the coil unit, which goes to tapping points on the loading coil. On the aerial coil you will find this best at 25 or 60, the former giving the higher selectivity. On the intervalve coupling unit (U<sub>2</sub>), points 60 and 80 should be tried, the former being usually the correct one for general purposes. As before, greater selectivity will be obtained on point 25, but at a sacrifice of volume.



This view of the detector and L.F. portion shows the anti-battery-coupling filter and the adjustable plate-filament bypass condenser (just to the left of the coil unit).

# Seeing My Hearers

*Some personal patter by one of the most popular broadcasters*

I AM doing one of the strangest things I think anyone can do. I am seeing thousands of people who, until now, only knew me as a voice, and thousands of people are seeing me in the flesh and are having their dreams realised, or broken, as the case may be. It is a most curious sensation for me, and I daresay it has its strange side for my audience.

It is four years since I last appeared on the stage. Since then my time has been devoted almost exclusively to broadcasting. And I am not decrying broadcasting in any way when I say that "the boards" have the same effect on me as a draught of champagne.

## A Novel Experience

The most novel experience I had when I first changed my environment was that of hearing laughter at my jokes. For years I have cracked every kind of joke, from the topical quip to the hoary "chestnut," and I have never heard a soul laughing all that time. You can understand, therefore, that I was quite taken aback at the laughter which greeted my sallies on the first night of my return to the stage.

Another strange thing was the fact that I wanted to "time" my gags by artificial methods, instead of according to the laughter. When telling the microphone a joke one has to pause to

let the laugh (if any) sweep round a million homes. One just has to imagine that the listeners are laughing.



Mr. Thomas Handley, microphone mirth-maker.

But to be confronted suddenly with a loud roar of laughter is a rather unnerving experience. Once the first shock is past, however, it becomes immensely invigorating. One feels

one's comic powers intensified by the personal contact with the audience.

People have asked me if I found much trouble with facial expression on the stage. That is a question which I can answer with a triumphant "No!" I have always used facial expression in my wireless parts. I find it helps to convey the sense of the words over the ether.

I must confess that I did have one difficulty, though. My new part is a very long one. In fact, I am hardly ever off the stage. When I saw the script first of all I nearly swooned—and *not* with delight! I thought I should never remember all that.

## Learning the Part

You see, one need not learn one's part thoroughly in broadcasting. A good knowledge of it is all that is required, because the script is always there. I found, however, that my old stage memory returned and I have had no difficulty at all in memorising my lines.

This transition from the studio to the stage has its funny side. I have received a great many letters from listeners in the various towns in which I have appeared. Some of them say that I do not look at all like I sound! Others say quite the opposite.

One person imagines me as a stout, little man with a noticeable lack of



"The 'boards' have the same effect on me as a draught of champagne."

# By TOMMY HANDLEY

hair on the top of my head. Another thinks of me as a gay young man in what he calls the "Oxford" style! I wonder what they feel like when they see me?

One pleasant compliment I received was from a listener who said that, during my performance, he sat back in his seat in the stalls and closed his eyes, and he could imagine that he was listening to his own radio set. It is very reassuring to hear that sort of thing, because an actor's "microphone voice" often differs altogether from his ordinary voice.

## Visualising the Audience

As far as possible I try to see listeners who write to me when I visit the town in which they reside. I have some curious adventures, and more than once there have been cases of "mistaken identity." On the whole, however, they are very pleasant experiences, and I find, almost invariably, that people are as nice to meet as their letters are to read.

I sometimes wonder if I come up to the expectations of my hearers. It really depends, of course, on what they expect to see. There is an ancient proverb to the effect that "He who expecteth nothing is never disappointed!"

I shall never forget the thrilling



As you can see, "Tommy" thoroughly enjoys himself before the microphone, and much of his success is due to the enthusiastic way he tackles the job.

experience I once had with (oh, whisper it!) a lady admirer.

## A Peculiar Experience

At a certain town on my tour I received a letter from a woman who evidently considered me the greatest since Adam. She had been writing to me for some time and appeared to listen faithfully whenever I broadcast my turn. She was most insistent that I should come to what she described as a "little party" that at

length, more out of curiosity than anything else, I accepted her invitation.

Accordingly, at the stated moment, I presented myself, not without a slight feeling of trepidation, at the large doors of a very large mansion. I raised my hand to knock on the portals when they opened to reveal a tall woman of forbidding aspect.

"Mr. Handley?" she snapped.

"Yes," said I, blushing modestly.

At that she smiled—at least, that's what I thought—and told me to come in. The house was magnificently furnished, but appeared to be empty. I was ushered into a dining-room and had one of the finest meals I have ever had. But my hostess did not sit down with me. She just stood around and looked at me and cleared away the plates and brought in the next course, and so on.

## Once Bit . . . !

I began to feel rather uncomfortable. My small talk fell flat and she contributed nothing to the conversation. At length I rose and said I would have to be returning to my wife. She let me out and said "Good-night," and I travelled homewards as fast as I could.

I discovered some time later, by means of discreet inquiry, that she was the housekeeper of the house in which she had entertained me. The family were on holiday when I was there!

Since then I have not been quite so keen on accepting my hearers' invitations!



Tommy Handley and Miss Heather Thatcher sing a duet before the fortunate microphone.

# QUESTIONS ANSWERED



### Switching-off the Set

E. S. (Blackheath).—"I have a two-valve set in which H.T.— is joined to L.T.—. The filament on-off switch is in the positive L.T. lead. When this switch is in the "off" position is it necessary to disconnect the H.T. battery by pulling out the wander plugs?"

We have published this question because it is one of many which are received of a similar nature. It does not appear to be understood that when the valve filaments are not alight no anode current will flow except in unusual circumstances. For instance, if there existed a D.C. leak in one of the valves, possibly a small current would pass between plate and filament. In addition, a fault in the H.T. shunting condensers, or in some other component part, might produce a current flow. In ordinary circumstances, however, there is no likelihood of any anode current being passed when the "on-off" switch is in the "off" position.

### The "Exhibition" Five

A. C. (London, S.E.11).—"I am not quite clear as to the exact coils required for the 'Exhibition' Five, described in the October issue of MODERN WIRELESS. What size primaries am I likely to require?"

The coils used in this set are the Lewcos C.A.C. and C.S.P. type. In the aerial circuit you will need one C.A.C.5 for the medium broadcast band, and one C.A.C.20 for the long waves.

In the H.F. sockets you will require two C.S.P.5's for the medium waves, and two C.S.P.20's for 5 X X and the other long-wave stations.

Regarding the primaries, this is largely a matter for experiment, because a lot depends upon the local conditions and the degree of selectivity required. Probably a No. 6 or 8

will be suitable for the smaller coils and a No. 14 or No. 16 for the larger ones. Two of each are necessary for each wave-band. If you find that greater selectivity is essential you will have to try smaller primaries, such as a No. 4 on the medium waves, and a No. 12 on the long waves.

### Sausage Aerials

T. B. C. (Leyton) is thinking of erecting a sausage aerial in place of

## THE TECHNICAL QUERIES DEPARTMENT

Are you in trouble with your set?

The MODERN WIRELESS Technical Queries Department is now in a position to give an unrivalled service. The aim of the department is to furnish really helpful advice in connection with any radio problem, theoretical or practical.

Full details, including the revised and, in cases, considerably reduced scale of charges, can be obtained direct from the Technical Queries Department, MODERN WIRELESS, Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: on receipt of this all the necessary literature will be sent to you, free and post free, immediately. This application will place you under no obligation whatever. Every reader of MODERN WIRELESS should have these details by him. An application form is included which will enable you to ask your questions so that we can deal with them expeditiously and with the minimum of delay. Having this form you will know exactly what information we require to have before us in order to solve your problems.

London readers, please note: Inquiries should not be made in person at Fleetway House or Tallis House.

his existing single wire. He says that a friend has informed him that the increase in the number of wires will give greater range.

He asks us whether we advise the change.

No, T. B. C., we do not recommend the use of a sausage aerial.

For ordinary broadcast reception a single wire cannot be beaten. The multi-wire aerial has certain advantages from the transmitting standpoint, and for this reason is employed to some extent commercially. In

your case we strongly advise the retention of the single wire.

### Fieldless Coils

L. H. R. (Coulsdon).—"If a binocular coil is really fieldless, why is it that screening is sometimes used between these coils?"

A binocular coil is not absolutely fieldless, but the field is certainly very small. In a set employing two or more H.F. stages the slightest interaction will produce instability, and it is therefore advisable to reduce this possibility by employing screening. This is also an advantage from the point of view of stray capacity effects, which are just as troublesome in causing "feedback" troubles as the direct interlinkage of magnetic fields.

### Rejuvenating Batteries

R. N. (Chatham).—"Is it possible to rejuvenate a dry H.T. battery which is partly run-down, or shall I have to throw it away?"

Once the battery voltage has dropped below 10 or 15 per cent of its rated voltage it is best to discard it altogether. A "dry" battery consists of certain chemical constituents such as sal-ammoniac, manganese dioxide, zinc, etc.

The sal-ammoniac paste dries up and the zinc container is usually partly "eaten away." It is really a waste of time to try and give new life to the cells, and it is more economical and generally satisfactory to purchase a new battery. A partially run-down battery produces all kinds of troubles in the set.

### Condensers in Series

L. V. (Huddersfield) wishes to know the formula for working out the capacity of condensers in series, and asks what value fixed condenser he must use in order to reduce the capacity of his .0003 reaction condenser to .00015.

The formula is:  $\frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{C}$ . In

words, the sum of the reciprocals of all the condensers in series is equal to the reciprocal of the resultant capacity.

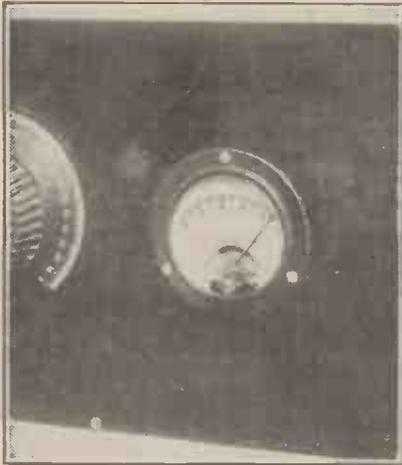
The value of the fixed condenser you will require is .0003. Two .0003 condensers in series give a value of .00015.

In the case of condensers in parallel you simply add the capacities together.

In the case of resistances in series, however, the values are simply added together. Therefore do not confuse resistances with capacities.

## —and Avoid Overrunning Your H.T. Battery

consumption, it is usually better to use an ordinary power valve, biasing that down as far as possible consistent with good results. Similarly, if you are not out for the maximum amplification on the H.F. side, it will pay you to use a neutralised H.F. valve



Watch your H.T. consumption (and, incidentally, obtain warning of distortion, oscillation, inaudible motor-boating, etc.) by placing a milliammeter in the negative H.T. lead of your set.

rather than one of the screened-grid type if you are hard up for H.T.

Do not forget that to double the consumption of the H.T. cuts down the life of the battery by far more than half; a battery which will last five months on 5 milliamps will not last two and a half months on 10 milliamps, assuming you use the set for the same number of hours in each case. More likely will it last about six weeks.

### Under "False Pretences"

In many cases which have been brought to my notice the screened-grid and the pentode valves have come to the homes of home-constructors under more or less false pretences, the constructors in these cases being of the opinion that these valves could be used to replace the ordinary H.F. and the ordinary small power, or whatever output valve was in use.

This definitely is not necessarily the case. The screened-grid valve does not replace an ordinary H.F. valve in the true sense of the word. Primarily it requires a different circuit to couple it to the next stage, and, secondly, it requires a very different H.T. current and it requires biasing. Similarly the pentode should not be used to replace in the last stage an ordinary valve

without due consideration as to what duty it will have to perform and how much H.T. it will require.

The average 2-volt 4,000-ohm valve takes 10 or less milliamps when properly biased on about 150 volts H.T. When properly biased and with the same H.T. voltage, the pentode will take something like 14 milliamps, and unless your H.T. battery can stand it you are going to find the use of a pentode a very unprofitable business.

It is no use blaming the valve for this. The makers are in no way reticent about the H.T. consumption and the requirements of their valves. Curves are published for each valve, and in many cases where the pentode is concerned the H.T. current and maximum H.T. and proper grid bias are given, but in spite of this a great number of people are attempting to run these valves off the ordinary small H.T. battery, which they use to run two ordinary valves, taking not more than 6 milliamps.

### Safeguard Your H.T.

One of the largest causes of this is the fact that, comparatively speaking, so few possess milliammeters. These instruments are not cheap, but a milliammeter which will give you an indication of your H.T. current is not dear when you consider what it may save you in the cost of batteries during the first year of its use. The milliammeter is the most useful instrument which the home-constructor

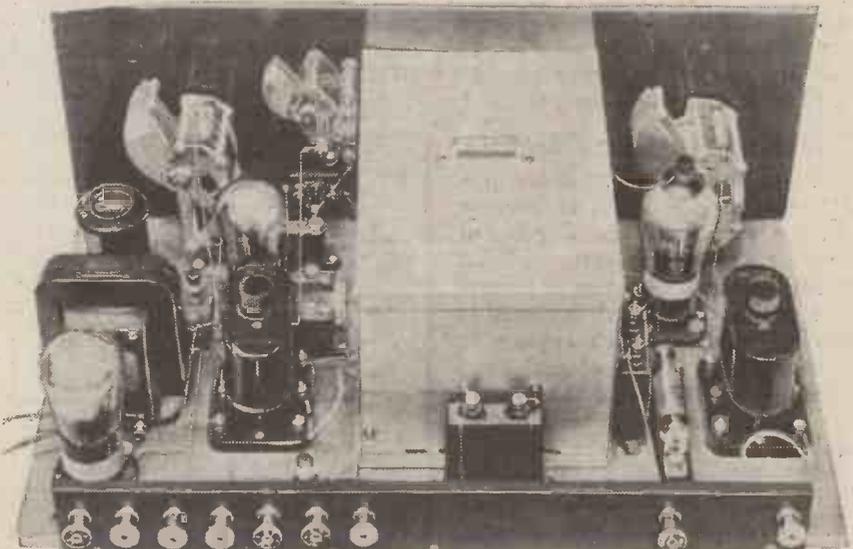
or listener can possess, and I would advise all my readers who do not possess one to get one without delay.

Usually the type which reads up to 25 milliamps is quite sufficient for all ordinary needs. It tells at a glance the state of the H.T. battery, how fast it is running down, tells you the emission of your valves, it tells you when you have got correct grid bias, if you are overloading, and should you be faced with distortion it will tell you whether it is due to ordinary overloading, to too much bias, too little bias, lost emission of your valves, oscillation of the set at super-audibility, inaudible motor-boating, and many other causes.

### Keep Inside the Limit

For really economical running, an H.T. battery should be run well inside its limit. Thus if you want to take 7 milliamps, use a battery which will supply you with 10, and if you want to take 12 or 14 milliamps, use a battery which will supply you with 18.

If you want really economical running, never use an ordinary small type H.T. battery with a screened-grid or a pentode valve. If you do the battery's life will be shortened, unsatisfactory reproduction is likely to occur, and your running costs of the set will be increased out of all proportion to the advantages which you are getting from the screened-grid or the pentode.



A set of this description should be used with a double-capacity H.T. battery—unless a pentode or super-power output valve is used, when a triple-capacity battery will be required. A mains H.T. unit, of course, obviates any bother about H.T. current consumption.

# The "M.W." Standard D.C. Unit

*A carefully worked-out design for a high-tension unit with extremely thorough smoothing and a special system of voltage control which takes the guesswork out of mains operation.*

*Designed and Described by the "M.W." RESEARCH DEPARTMENT.*

IN producing this design we have set ourselves the task of achieving three definite ends which we do not think have been combined before in any one design for a D.C. mains H.T. unit.

Our first and most obvious requirement was extremely thorough and

conversation with visitors to our stand at the last wireless exhibition.

### Voltage Uncertainties

The point is that with the average mains unit the user is decidedly in the dark as to the actual voltages he is getting on the various positive

all, even though the set may appear to be working satisfactorily.

The fact is that with the average type of mains unit there is really no means of finding out for oneself just what voltage is available on the different terminals when any particular load is put upon the unit, and although general rules can be given for the use of each instrument, the user is never quite sure just what he is getting. We realised the need of some cure for this state of affairs a considerable time ago, and the reader may remember that we published a design for an alternating current mains unit in which a special device was provided to enable the voltage on each terminal to be measured to a fair approximation of accuracy, but, so far as we are aware, no really satisfactory solution has yet been provided in a design for D.C. mains.

### Low-Frequency Smoothing

Now let us take a look at the circuit diagram of this unit and see how these various objects have been achieved. First of all, there is the question of really thorough smoothing so that quiet operation can be obtained on even the worst and noisiest of mains. If you examine the circuit diagram you will see that there is a double "cascaded" smoothing circuit consisting of the low-frequency chokes

### COMPONENTS REQUIRED

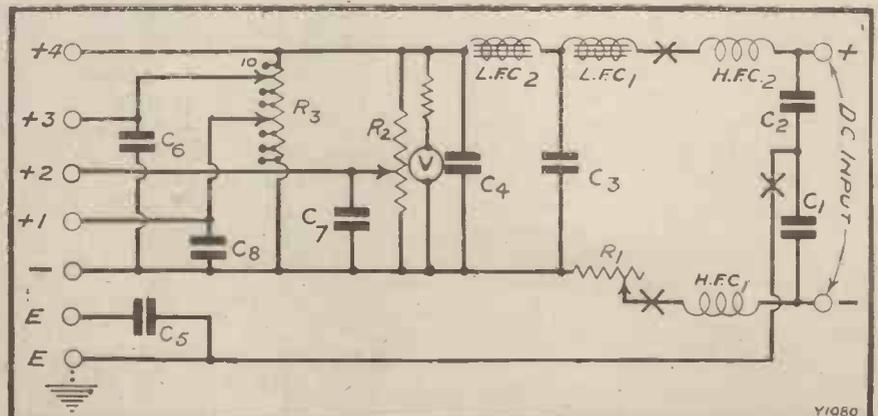
- 1 Panel 7 in. x 9 in. (Resiston, Becol, Kay-Ray, Keystone, Paxolin, etc.).
- 1 Cabinet to fit, with baseboard 14 in. deep (Cameco, Raymond, Pickett, Osborn, etc.).
- 1 0-300 voltmeter (Sifam, Goltone, Ferranti, Weston, etc.).
- 1 10,000-ohm variable power resistance, potentiometer type, but used as plain resistance (Varley, Truvolt, etc.).
- 1 50,000-ohm variable power resistance, used as potentiometer (Varley).
- 9 Insulated terminals, or plug and socket connectors (Belling & Lee).
- 1 15,000-ohm potential divider (Igranite).
- 5 1-mfd. condensers (see text re voltage) (Lissen, Dubilier, Hydra, T.C.C., Mullard, Ferranti, etc.).
- 2 2-mfd. ditto.
- 1 4-mfd. ditto.
- 2 Smoothing chokes (see text). (Ferranti B.1, R.I., Wearite, Varley, etc.).
- 2 Heavy-duty H.F. chokes (see text, also about the condensers C<sub>1</sub> and C<sub>2</sub>). (Wearite).
- 1 Terminal strip, 3 in. x 2 in. x 1/4 in. Wire, screws, plugs, etc.

perfect smoothing, adequate for even the worst of mains, with proper precautions against motor-boating. Secondly, we wished the unit to be as universal in its application as possible, so that it could be regarded as a standard design for use with practically any one of the current season's MODERN WIRELESS set designs.

### Removing the Last Obstacle

Our third requirement is one presenting a certain degree of novelty, and the reader will probably find it a rather interesting feature. What we set out to do here was to remove the element of guesswork in regard to working voltages, which appears to us to be one of the few obstacles still remaining in the way of the average man's use of the mains for his H.T. current supply. Correspondence with readers has shown us that this uncertainty as to the actual voltages being obtained from the different tappings on a mains unit presents a real difficulty to the average user, a point which was amply confirmed in

terminals, and very few people possess sufficiently high-resistance voltmeters to enable actual measurements to be made with any degree of accuracy. There is consequently a good deal of "cutting and trying" to be done, and a feeling of uncertainty as to the actual figures at the end of it



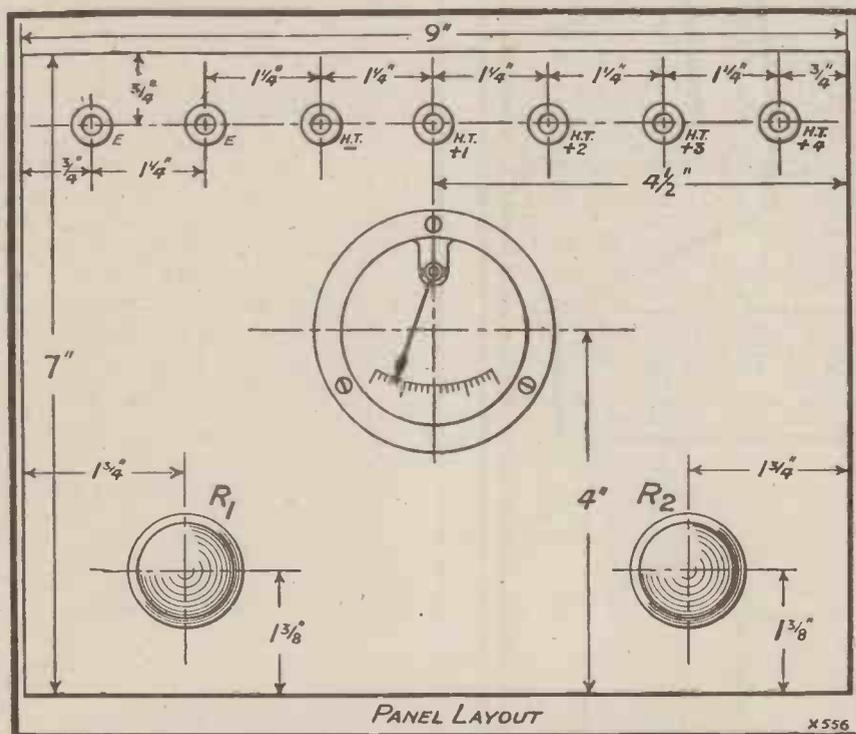
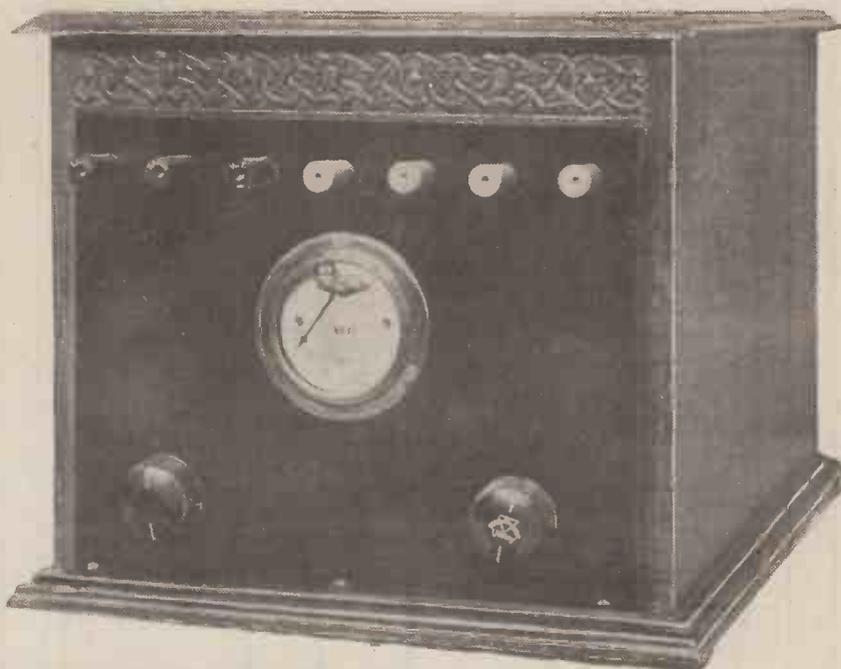
The circuit is a straightforward one, but capable of smoothing-out ripple from even very "rough" mains. If H.F. smoothing is not required the circuit can be simplified at the points marked X, as explained in the article.

L.F.C.<sub>1</sub> and L.F.C.<sub>2</sub>, and the condensers C<sub>3</sub> and C<sub>4</sub>. The two chokes are of adequate size, condenser C<sub>3</sub> is of 2 mfd. and condenser C<sub>4</sub> of 4 mfd.

This double filter circuit is in itself adequate to suppress any ordinary low-frequency hum very thoroughly, but experience has shown us that some D.C. mains carry a considerable H.F. component, which appears to arise from sparking at the commutators of electrical machinery in the neighbourhood, and possibly even at the generators at the power station, and we have found it desirable to make some provision to stop this from getting through the eliminator circuits into the set.

### The H.F. Filter

The D.C. mains which supply the MODERN WIRELESS research laboratory are of this troublesome type, and so we have had ample opportunities



Simple but effective voltage control is obtained with this unit.

for testing out various remedies. We have found that by incorporating a very simple system of H.F. filtering a complete cure is obtained, and we have accordingly provided such a filter in our standard D.C. unit. You will see that a special type of heavy-duty high-frequency choke is placed in each lead at the input end of the unit, these chokes being marked H.F.C.<sub>1</sub> and H.F.C.<sub>2</sub>.

On the mains side of these two chokes two fixed condensers of the usual high-voltage type (marked C<sub>1</sub> and C<sub>2</sub>) are connected in series across

the mains, and their junction or centre point is connected to earth. This arrangement, simple as it is, we believe will be found effective in every case of such interference, but, of course, it is not always needed. Many mains give perfectly satisfactory operation when low-frequency smoothing alone is employed, and accordingly we will explain at a later point how the H.F. filtering device can be at first omitted and incorporated only if a trial shows that it is necessary.

So much for smoothing. Now there

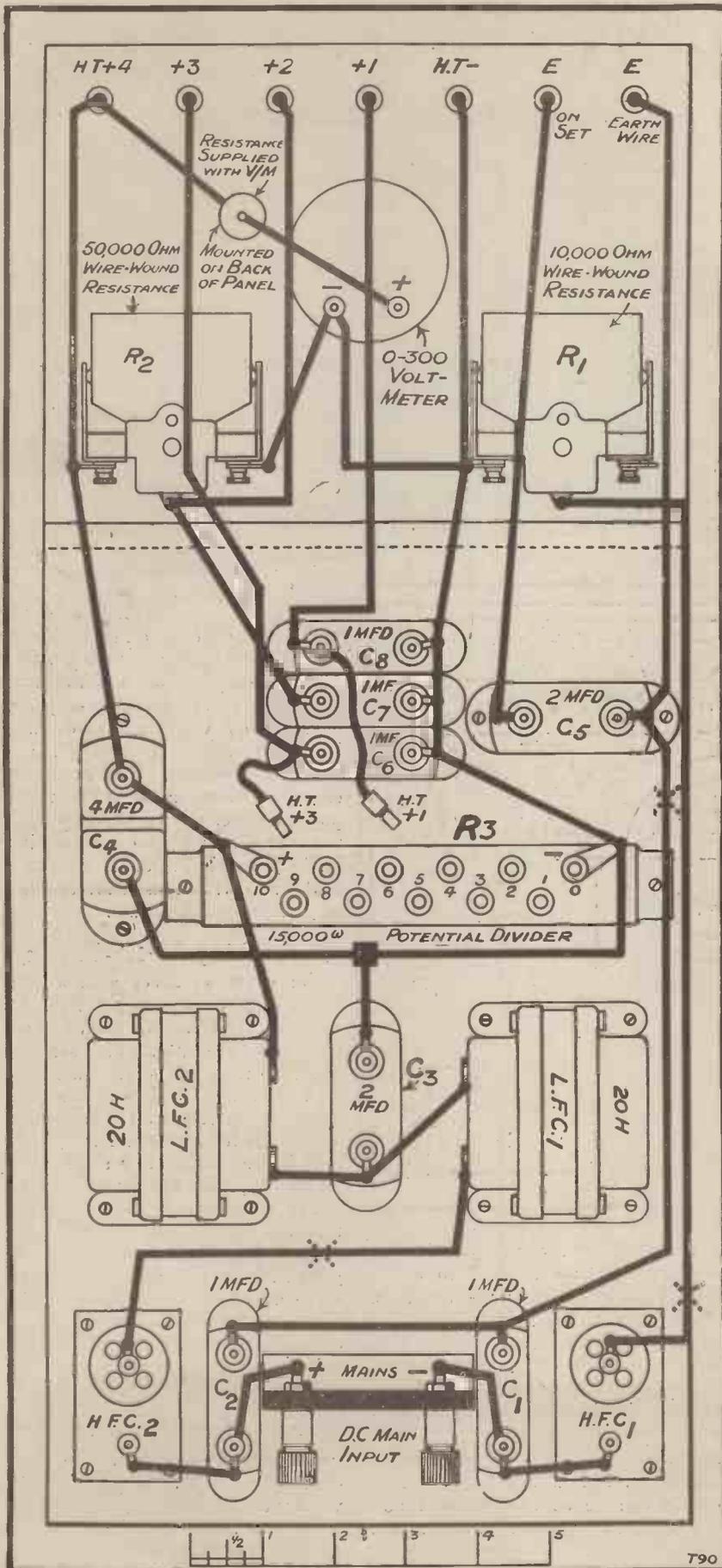
is the question of motor-boating prevention, and we have made what we think will be quite adequate provision for safety in this connection by making use of separate voltage-adjusting devices for different groups of valves in the receiver, so that an anti-coupling effect is obtained. For example, there is a main tapped potentiometer device which provides the variable voltages on terminals H.T. +1 and H.T. +3, the idea being that these will be used for the H.F. stage or stages in the set.

### Preventing Motor-Boating

For example, a set with a single screened-grid stage might have the anode of the screened-grid valve supplied from H.T. +3 and the screening electrode from H.T. +1. An entirely separate continuously variable potentiometer device gives the adjustment of voltage for terminal H.T. +2, and it is intended that this shall usually be employed for the detector valve.

The control here is obtained by means of a 50,000-ohm potentiometer, marked R<sub>2</sub>, and if it is used as suggested for the detector valve it forms quite an efficient anti-motor-boating filter, in conjunction with the bypass condenser C<sub>7</sub> shunted across from the H.T. +2 terminal to the negative side of the circuit. These separating and anti-coupling arrangements have so far proved quite effective in eliminating motor-boating in the course of a long series of tests on a great variety of different receivers.

Next, about our scheme for getting standardised voltages from the various tappings. The essence of the idea



is quite simple, and consists merely in placing a voltmeter (which need not be one of the expensive high-resistance type) right across the positive and negative sides of the circuit, and then adjusting a master control until the instrument reads the right figure for our L.F. valves. We then know that this voltage is being applied between the negative terminal and H.T.+4, and so are sure that your power valve is getting the correct treatment. Next, we can determine the voltages on H.T.+2 and H.T.+3 by referring to the figures which we shall give in a few moments.

### Standardised Voltages

The majority of power and super-power valves nowadays will safely stand a voltage of 150, and so in the majority of cases we should adjust our master control so that the voltage reads 150 when the unit is actually delivering current to the set. This is quite a simple matter; because all you have to do is connect up the set, switch on (with correct bias on the power valve), and turn the master control  $R_1$  until you see a figure of 150 on the voltmeter.

Then, assuming that the H.T.+1 terminal will be supplying the screening electrode of a single screened-grid stage, and H.T.+3 the plate of this same valve, you will find that the various sockets of the potential divider are giving the following approximate voltages: No. 5, 70 volts; No. 6, 80 volts; No. 7, 95 volts; No. 8, 115 volts; No. 9, 130 volts; and No. 10, 150 volts. Thus the usual procedure will be to insert the +3 plug in No. 9 socket and the +1 plug in sockets 6 or 7, trying them both and noting which gives the best results.

### Constant Output

The actual voltages available on the different sockets of the potential divider are not very much affected by the actual current drawn so long as this is of the small order required by one or two H.F. stages. Consequently the same recommendations apply to a receiver employing two screened-grid stages, and you will see that the standard procedure, therefore, is to insert the H.T.+3 plug in the No. 9 socket, it being assumed that the H.T.+3 terminal will be used for the anodes of the H.F. valves. The H.T.+1 plug will go in the 5, 6, or 7 socket; Nos. 5 and 6 being almost certain to suit a single screened-grid H.F. stage; No. 8 only being required as a rule with two H.F. stages, which, of course, draw

rather more current and thus produce a slightly greater voltage drop in the potential divider.

The figures we have given assume that any single screened-grid valve will only draw the moderate current of perhaps 3 milliamps, which was taken by last season's valves when worked without grid bias. The current season's screened-grid valves appear to be rather more greedy and

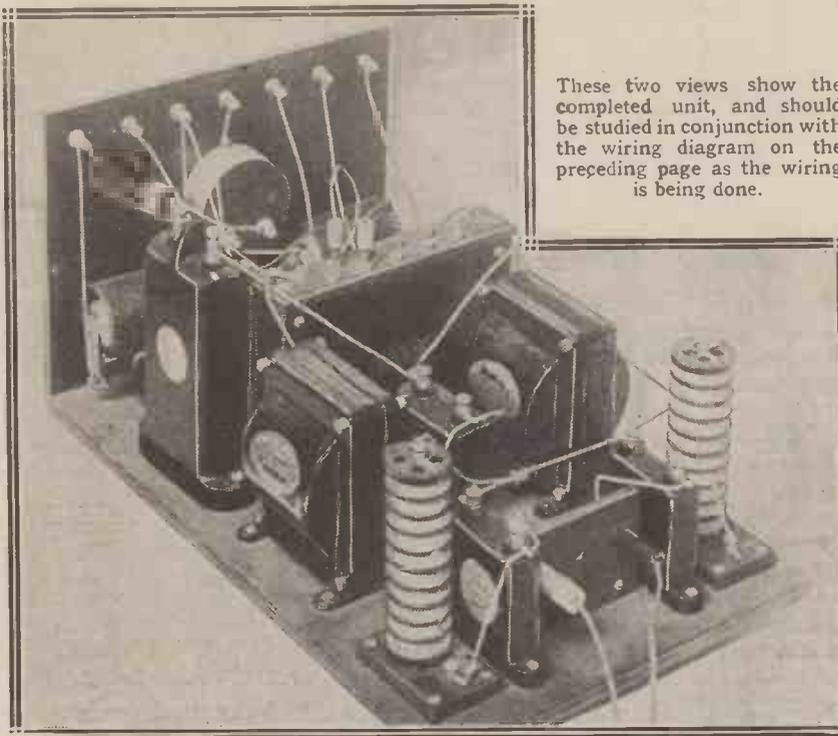
terminal, and the voltage here is governed by the wire-wound potentiometer  $R_2$ . You do not require to know the actual voltage available here, since you have a very simple indication in the behaviour of the set as to the correct adjustment for the detector valve in the form of the smoothness or otherwise of the reaction control.

All that one does here is to start

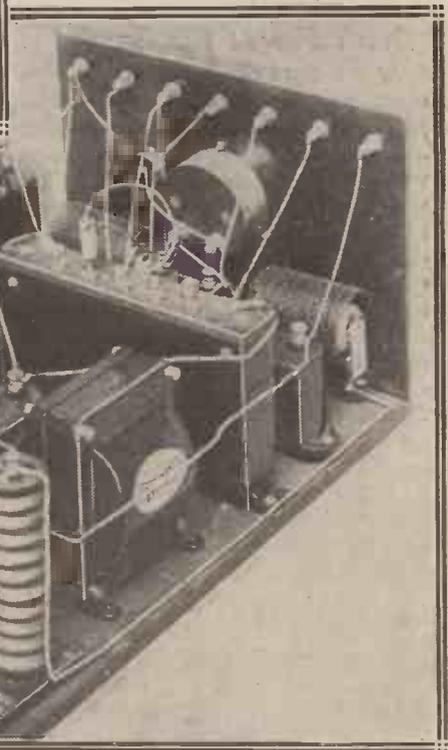
find such a position as gives you smooth reaction and good signal strength. It may be useful to you to know that you can estimate roughly the voltage on the detector as follows: With the knob turned fully to the left you are getting practically zero volts, and turned fully to the right you are getting the same voltage as that on H.T. + 4, namely, 150 volts in our standard setting. With the knob at the midway position you will be getting about 75 volts, and so on.

### Higher Voltages

In some cases you may be using a super-power valve of the type rated to stand up to 180 volts with this unit, and in these circumstances you should proceed rather differently. With the set connected up and taking current as before, turn the master control  $R_1$  until you see the correct reading on the voltmeter of about 180 volts, and then you will find that H.T. + 3 can go in the No. 7 socket to get the necessary 120 volts or thereabouts for the anode of the H.F. valve. The H.T. + 1 plug will then go in the 3, 4, or 5 socket to get the necessary figure of between 60 and 80 volts for the screening electrode. The adjustment of  $R_2$  for the detector valve will be as before,



These two views show the completed unit, and should be studied in conjunction with the wiring diagram on the preceding page as the wiring is being done.



may take as much as twice this current, or even more under the same conditions. Since, however, it is now standard practice to recommend the use of negative grid bias on these valves, it can be assumed that the current will come down to such figures as will enable our recommendations as to the use of the tapping points to hold good.

### The Detector Voltage

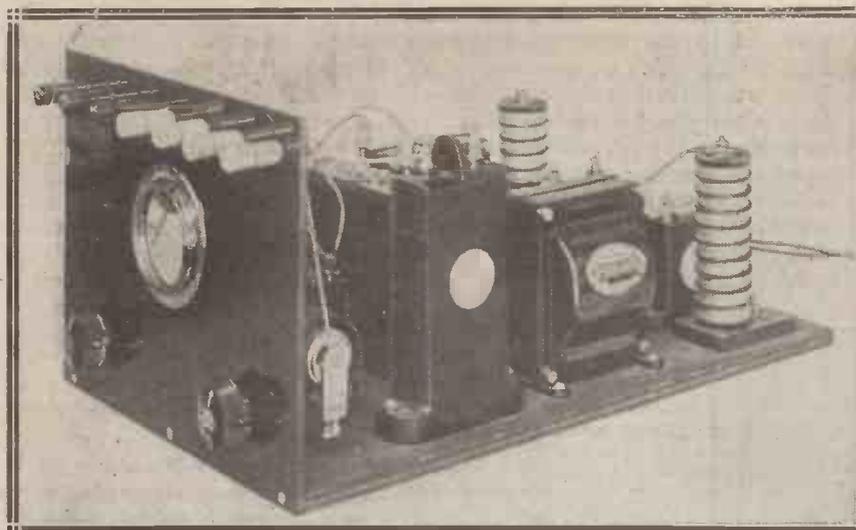
There is nothing very difficult about the adjustments for a high-frequency screened-grid stage with this unit, as you will see. In practically every case you will place the H.T. + 3 tapping in the No. 9 socket of the potential divider and experiment with H.T. + 1 in various sockets until you find the one which gives the loudest signals. You will find this is quite easily done with the aid of the guide we have given you.

It is intended, as we have already explained, that the detector valve shall be supplied from the H.T. + 2

with the knob of  $R_2$  turned as far as possible towards the left (at which position you obtain practically zero volts on the detector valve), and then turn to the right gradually until you

except that at the midway point you will now be getting about 90 volts, and so on in proportion.

You will find that the unit will give you the desired 180 volts of



The special H.F. stopping filter is placed at the back of the unit. Note the heavy-duty H.F. chokes.

mains of 200 and upwards quite easily, on any reasonable load of perhaps 20 or 30 milliamps. It is to be understood, of course, that if you employ this unit on lower voltage mains, such as the rather unusual voltage of 150 which is met with in some areas, you will have to turn the master rheostat  $R_1$  right round so as to get the maximum possible reading on the voltmeter and then proceed as in the first case.

### Don't Forget the Earth!

As a matter of fact, if your mains are of only 150 volts there is no real point in incorporating the master control at all, and you can quite as well leave it out and join together the two wires which are shown going thereto. On the lower voltage mains of only 100 or 110, of course, our special scheme cannot be used, and in any case such mains will not give the necessary high voltage for the satisfactory operation of a set with a screened-grid valve, for it must be remembered there is an inevitable loss of voltage in the smoothing circuits.

Before we go any further, let us just remind you that we have provided the standard earthing scheme in this unit of a 2-mfd. condenser

and of two terminals on the panel. One of these earth terminals should be joined to the earth terminal on your set and the real earth lead from your earth connection should be joined to the other earth terminal on the unit. In this way the necessary safety condenser is automatically connected in the earth lead, and so you are insured against any possible accidents due to earthing one pole of the main directly. This is important, so do not forget to take your earth lead off the set and transfer it to the correct terminal on the unit when you first put it on test.

### Omitting the H.F. Filter

You will have gathered by now a good general idea of the design of the unit and its purpose, so we can proceed to go into details as to its construction and use. First of all, about the extra H.F. filtering arrangement at the back of the unit. This, we have already mentioned, is to be regarded as optional, and we would suggest that you first build the unit without it and see whether you get adequate smoothing.

If you find that the unit without this H.F. filtering circuit still gives you a hum, you can then decide to incorporate the extra parts, and

you can then be practically certain that you will secure silent operation. At first, therefore, we would suggest that you should omit the four parts at the back of the baseboard, namely, the two H.F. chokes and the two 1-mfd. condensers  $C_1$  and  $C_2$ .

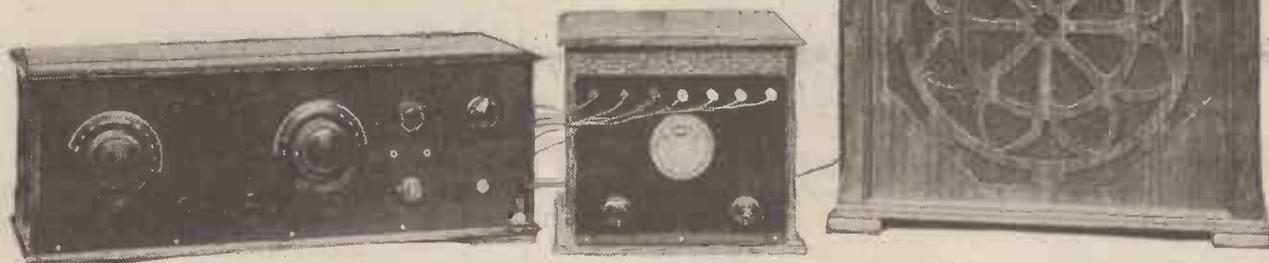
The alterations required to the connections will be as follow: You will notice that the two leads from the top terminals of the two H.F. chokes are marked with dotted crosses, and these are the main connections requiring to be altered. Instead of these leads going to the tops of the H.F. chokes, they will go straight to the positive and negative mains terminals. The lead from the choke L.F.C.<sub>1</sub>, instead of going to H.F.C.<sub>2</sub>, should now go to the positive mains terminal, and the lead from the master control  $R_1$  should go straight to the negative mains terminal instead of the choke marked H.F.C.<sub>1</sub>.

### Building the Unit

The lead coming off the 2-mfd. condenser  $C_3$ , and going to one side of each of the fixed condensers  $C_1$  and  $C_2$ , should be omitted altogether. This completes the modification. Of course, if you know already that your mains are decidedly noisy ones, you may perhaps just as well build the unit exactly as it is shown and so be sure that all will be well from the first.

Now for a few constructional points. All the fixed condensers in the set should be of the type rated to withstand at least 250 volts "working." In most makes this means you must obtain the special type made for use in mains units, but in the particular make we happened to choose (Lissen) the standard receiving type is guaranteed to withstand this voltage, and this is the kind we have employed.

(Continued on page 548.)



The unit has been designed with great care to make it suitable for use with practically any of this season's "M.W." sets.



*A review of the present position.—By The Editor.*

**A**T last the pertinacity of the Baird Television Development Co. has been rewarded, and, as this article is being written, experimental transmissions are being broadcast for half an hour, five times a week, from 2 L O. How long this facility which has been granted to the Baird Co. will remain in force is uncertain.

We understand, however, that the B.B.C. can terminate the arrangements made with the Baird Co. at three months' notice, so it may be regarded as fairly certain that experimental television transmissions will continue until the end of the year. Whether they will continue into the New Year remains to be seen.

### *Still No Sets*

In order to justify the criticisms made in this article it must be made clear that these experimental transmissions have only been given for the last fortnight, and therefore it is possible that by the time this issue of MODERN WIRELESS is on sale television receivers, complete or in "kits of parts," will be ready for the public.

Nevertheless, the fact remains that at the moment they are not, and so far the public have not had an opportunity of deciding whether television is worth while or not.

From a business and general publicity point of view the Baird Co. have made a very bad mistake in not having televisors ready for immediate delivery when the experimental transmissions began. A psychological opportunity has been missed, and if

the delay in marketing television outfits continues it is inevitable that public interest will wane.

The first transmissions were heralded by a good deal of valuable newspaper publicity, which, from a business point of view, should have been taken advantage of by the Baird people, but unfortunately television receivers are still not ready for delivery to the public.

We ourselves ordered a complete outfit as long ago as September, 1928, when orders were accepted by the

Baird Co.'s stand at the Radio Exhibition, but so far we have not had delivery. Why this delay? The public have been primed time after time with sensational television publicity announcements, and now that transmissions have actually started, no doubt thousands of amateurs are eager to buy or build television outfits and so see for themselves what television is really like.

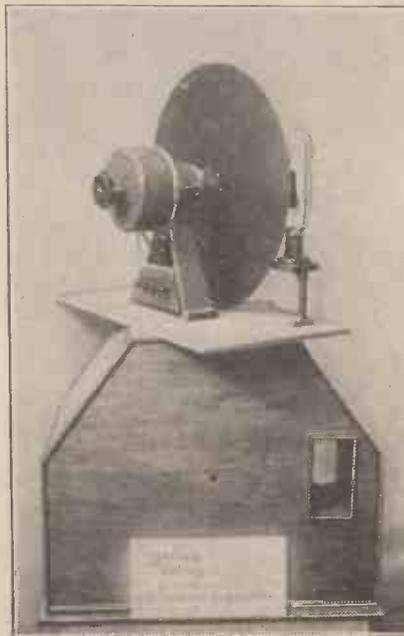
### *Manufacturers Diffident?*

We hope this delay will not continue. One explanation is, of course, that the manufacturers who, under licence from the Baird Co., may market television outfits are not anxious to undertake the manufacture and sale of television outfits until they have a guarantee that the B.B.C. will not suddenly terminate the experimental transmissions.

If our information is correct—and we have no reason to believe it is not—that the B.B.C. will give three months' notice before doing so, then we fail to see why manufacturers should be shy of television sets, complete or made up in constructors' kits.

### *Of Scientific Interest*

Even if television proves to be but a scientific toy—which is still the opinion of Captain Eckersley and other experts—and even if it is not yet sufficiently developed to warrant the B.B.C. including television broadcasts regularly in programme hours, there must be a large number of



This photograph shows the synchronising motor, disc and television lamp.

## Accounts from Television Eye-Witnesses

amateur experimentalists who would quickly avail themselves of the chance of purchasing a television outfit—especially as foreign broadcasting of television may begin shortly.

### Press Demonstrations

However, whatever the business difficulties which have resulted in the delay in marketing television sets and the consequent postponement of the verdict of the public, press demonstrations in connection with the first week's experimental television transmissions have enabled newspaper representatives (including representatives of this and other radio journals) to witness Mr. Baird's latest televisor set operating though under "land-line" conditions, and the

Mr. William Graham, President of the Board of Trade, sent a message which was read as a prelude to the first transmission. He observed that he looked to television to provide a new industry and fresh employment, describing the occasion as historic in the evolution of a new science.

Sir Ambrose Fleming and Professor Andrade also paid a tribute to the work of the inventor, Mr. J. L. Baird.

### "Flickered Considerably"

The "Manchester Guardian," in the course of a report of a demonstration, stated that:

"As seen by the assembled guests the images were about an inch and a half long and half an inch wide, and they were certainly steadier and

"Though of great interest, I do not think television in its present state of development will become popular. People who expect anything comparable with the talkies will be disappointed."

The "Daily Sketch" representative wrote:

"While the faces of the speakers hummed through the ether, each face and object having its own characteristic note, there was difficulty in determining when the television was complete.

"Sir Ambrose Fleming, the president of the company, appeared in the glass panel of the receiving apparatus, which also contained the loud speaker, after he had broadcast, but he was not well defined.

"Professor Andrade flickered on and off again, but Sidney Howard, the comedian, made a much more successful appearance. Miss King, a vocalist, was scarcely recognisable."

The above extracts indicate the diversity of opinion expressed by the newspaper representatives who were invited to a demonstration.

### Strain on the Eyes

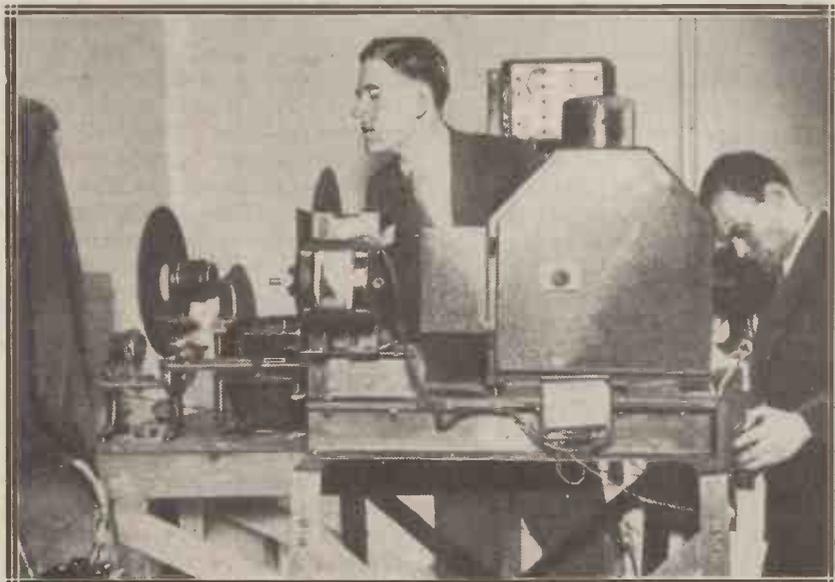
Our own opinion of the test was that it showed a noticeable improvement on the results obtained by Mr. Baird in the past, and although the images were clearer, the flickering still proved a drawback and, after a while, no small strain on the eyes.

As to the great problem—whether the public will be satisfied with television in its present state of development—we feel that it would be hazardous to make a forecast in the emphatic terms of the "Daily Herald's" representative, but we do feel that as a "scientific toy"—to borrow Captain Eckersley's phrase—television will greatly intrigue amateur experimenters, and that a new aspect of the hobby of radio will be appreciated and studied by experimenters.

That television sets will immediately be in wide public demand at anything approaching the scale of portable receivers, or gramophones, etc., we certainly do not anticipate.

Meanwhile, when outfits are available, we have no doubt public opinion will inform the B.B.C. whether television transmissions should be continued experimentally, incorporated in regular broadcasting programmes, or finally abandoned.

### AN AMERICAN ATTEMPT



This photograph from the U.S.A. claims to show a television transmitter that "enables you to both see and hear your radio favourites in your home."

various reports published make interesting reading.

At the conclusion of the premier B.B.C. television broadcast, Mr. Baird said:

"As these tests proceed the quality of the transmission will improve. We could already put on plays and boxing matches, but the figures would be so small that they would appear ludicrous.

"I am experimenting with a screen on which televised pictures can be thrown, very much as in a cinema theatre. We hope shortly to get more time from the B.B.C. for television broadcasts."

clearer than was possible a few months ago. First, Mr. Sydney Moseley, the announcer, read a message of goodwill from Mr. William Graham, president of the Board of Trade, and afterwards Sir A. Fleming spoke a few words in a similar strain. He was then televised. Professor Andrade, a leading authority on the science of wireless, spoke and was televised, his face being clearly discernible."

According to a representative of the "Daily Herald":

"The image flickered considerably, and resembled the earliest cinematograph films. It was, however, clear in its details.

# HOW MANY STATIONS?



*Every owner of a new set asks how many stations he may expect to tune-in with it. Some interesting questions of the range of radio reception are dealt with in this article.*

**W**HATEVER the B.B.C. people may say about it, listeners are interested in distant stations.

If we were all efficiency-mad business-men we might always be asking for Service, as advocated by the American advertising agents. But listeners do not always want reliability and regularity—they sometimes want romance! Songs straight from Spain, a tinkling tune from Tunis—in fact, something unknown and unexpected.

The question of how many stations a set can receive is always interesting. Most people do not realise, or else under-estimate, the extraordinary sensitivity of a simple set. Many owners of crystal sets, for instance, assume that without a valve they are tied down to the local station, but others more enterprising or better situated, listening-in when the local station has shut down, have in innumerable cases succeeded in tuning-in Continental broadcasting stations with a strength and clarity that would satisfy the most sceptical.

## *“Freakish” Reception*

Although the crystal is never so sensitive as the valve, and its regular range of reception may not be more than twenty miles (i.e. the local station), it is quite possible for such a set occasionally to pick up stations on the mainland of Europe anywhere from Germany to Gibraltar. In all cases, apart from the set itself and the aerial-earth, etc., much will depend upon the conditions prevailing at the time reception is attempted.

Long-distance results on simple sets are, in fact, “freakish,” and it is this very fact that gives them a charm

all their own. Energy from a broadcasting station appears to be radiated in different ways. In the first place there are the direct rays which, travelling along the ground, are strongest in the immediate vicinity of the transmitter and get weaker and weaker as distance increases, becoming attenuated and too weak for crystal reception at distances of perhaps twenty miles from a main station.

## *Reflected Rays*

These direct rays are very reliable and not much affected by external conditions, so they are used by the B.B.C.



For long-distance reception get your aerial as high as possible and clear of trees and buildings.

as the basis of their service areas.

In addition to the direct rays, stations send out indirect rays which are not earthbound. They do not travel along the surface of the ground, but are given off into space. After they have reached a height of sixty miles or so away from the earth's surface they are, owing to a peculiarity of the rarefied atmosphere at that distance, reflected back to earth again. But they come to earth again at a tremendous distance from where they originated.

It is this indirect radiation that is the cause of the extraordinarily long-distance results we hear about and sometimes experience. The remarkable thing about it is that not only are the waves bent back, but sometimes the effect appears to be concentrated at certain points so that reception is really loud and good whilst conditions are favourable.

## *Many Programmes Available*

But mysterious alterations in the reflecting properties of the upper layer may occur at any moment and immediately fading sets in and the receiver's wonderful long-distance properties are gone.

Such indirect radiation is sufficient to affect a good crystal set only occasionally, but with a single-valve the skilful use of reaction will generally enable the set to pick up at least half a dozen European programmes any time after sunset. Two-valve sets, of course, are better still, whilst three-valvers and over can be depended on, if well handled, to bring in quite a number of stations with absolute regularity and dozens more when conditions are suitable.

# The "Melbourne"

A specially designed short-wave receiver that is capable of bringing in transmissions from all corners of the globe. Broadcasting from Australia is easily heard on this set.

Designed and Described by the "M.W." Research Department.

IN these days of multi-purpose receivers, wherein every short-waver is expected also to work with high efficiency on the broadcast bands, and so have a tuning range of, perhaps, 20 to 2,000 metres, it is quite a refreshing change for a designer to be able to sit down and produce something intended for one specific purpose, with all the special refinements required for that purpose alone. Such a set is the present one, which we have tried to make a really powerful and de luxe short-waver, capable of pleasing the most hardened short-wave listener, and giving him results which he will really and truly feel are worth demonstrating to his friends.

### Broadcast Waves if Required

By the way, we do not wish to imply that the set cannot be used for broadcast reception, because we have taken care that it shall be possible, as a concession to the man who wants to use one outfit for all purposes. What we have done, however, is to take the greatest of pains to make the set highly suitable for short-wave work, and to omit some of the

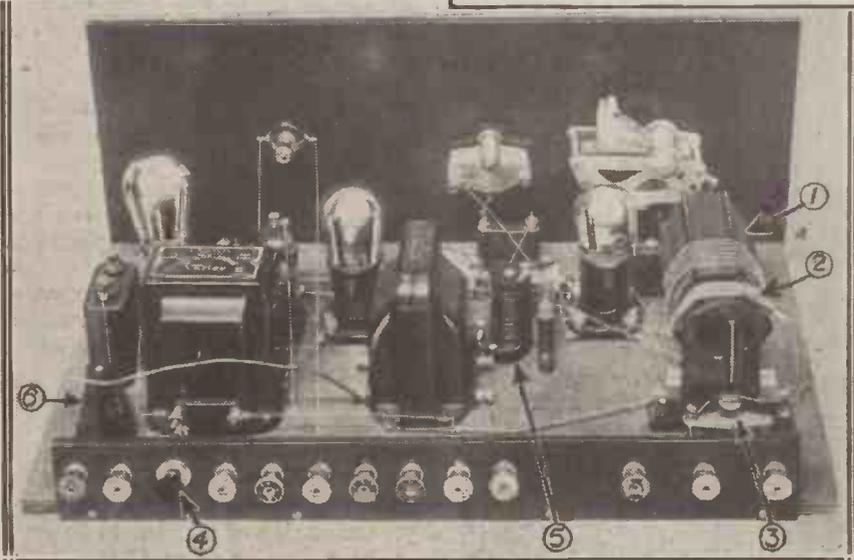
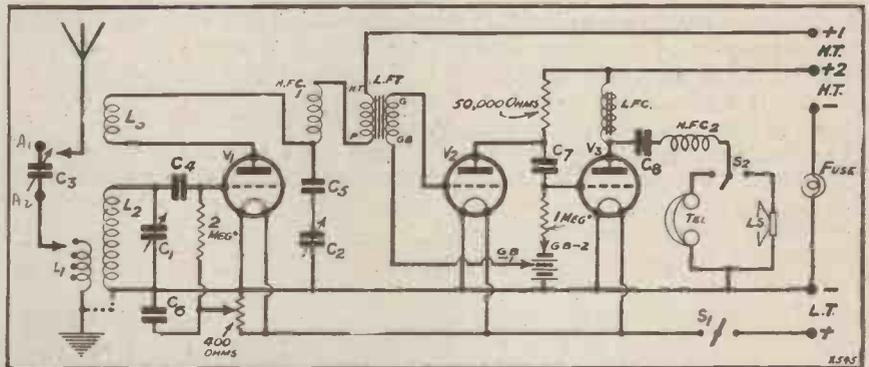
"frills" usually thought necessary for a set whose main object in life is to give good service on the broadcast band.

All the special features in this set make for utmost efficiency on the low waves, and it is intended, frankly, to appeal most strongly to the man who wants to run a separate and super-efficient short-wave set in addition to his ordinary broadcast equipment.

For example, the coils are arranged to give extremely high efficiency and convenience on the low waves, with the fullest control of aerial coupling, and something of a makeshift is needed for the adaptation of this

part of the circuit for ordinary broadcast work. Its main appeal, then, is as a really "hot-stuff" short-waver, and the results we got from the finished set when it was put through its paces indicated clearly that we had achieved our object.

It proved particularly pleasant to work, and there is ample power on the L.F. side to bring almost every signal up to good strength without that excessively critical setting of reaction which is so worrying in sets of low power. During its first evening's test the set brought in three short-wave American broadcasting stations at adequate loud-speaker strength, and extended tests since



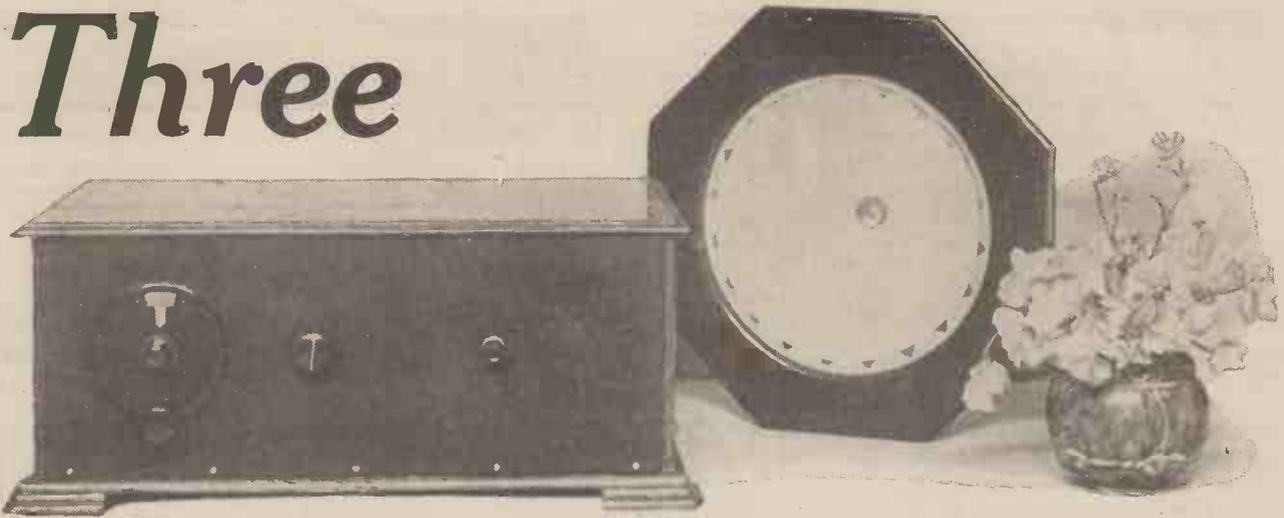
A general view of the set. (1) and (2) are the reaction and tuning coil, and the aerial coil respectively; (3) the series condenser C<sub>3</sub>; (4) the loud-speaker switch; (5) the reaction H.F. choke, and (6) is the output H.F. choke.

then have clearly shown that it conforms to a very high standard indeed. Actually, it is one of the pleasantest short-wave sets which we have tried for many a long day, being singularly free from those annoying vices of prominent hand-capacity effects, threshold squawks on the reaction control, and so on.

### A Straightforward Circuit

There is nothing abnormal about the circuit of the receiver, as you will see at a glance when you examine the circuit diagram. Its claims are based rather upon a particularly well-worked-out system of layout and close attention to those details which make all the difference in short-wave work. We have first of all an aerial circuit with an optional small series condenser of the neutrodyne type for dealing with flat spots on the reaction

# Three



due to the aerial constants, terminals  $A_1$  and  $A_2$ , bringing this condenser into circuit or cutting it out as desired.

There is also in the aerial circuit a movable aerial coupling coil with tappings, which gives a very close control indeed of the exact degree of aerial coupling. This, as the more experienced reader will know, is a most valuable feature in a short-wave set, enabling one to overcome all sorts of difficulties which are apt to be annoying in the absence of any such device. The aerial coil consists of a small number of turns wound upon a short section of ribbed former, mounted so that it can be hinged against the end of the main tuning coil. This variation of position, together with the fact that there are tappings upon the winding and a tapping clip for connection thereto, gives a very flexible control indeed.

## Throttle-Control Advantages

The tuning and the reaction circuits are of the popular throttle-control type, which we find almost unbeatable for general short-wave work, giving, as it does, a particularly pleasant control of reaction with the minimum of hand-capacity effect and considerable independence of the exact type of H.F. choke employed.

This latter point may, perhaps, come rather as a surprise to the reader who has not thought very closely about the matter, but if you look at the circuit you will see that the function of the H.F. choke is to PREVENT the set from reacting, not to give a high impedance which enables one to GET reaction when desired. The choke, as you will see, is actually in series in the anode circuit of the valve, that is to say, in series with the reaction coil, and so would naturally prevent the set from oscillating.

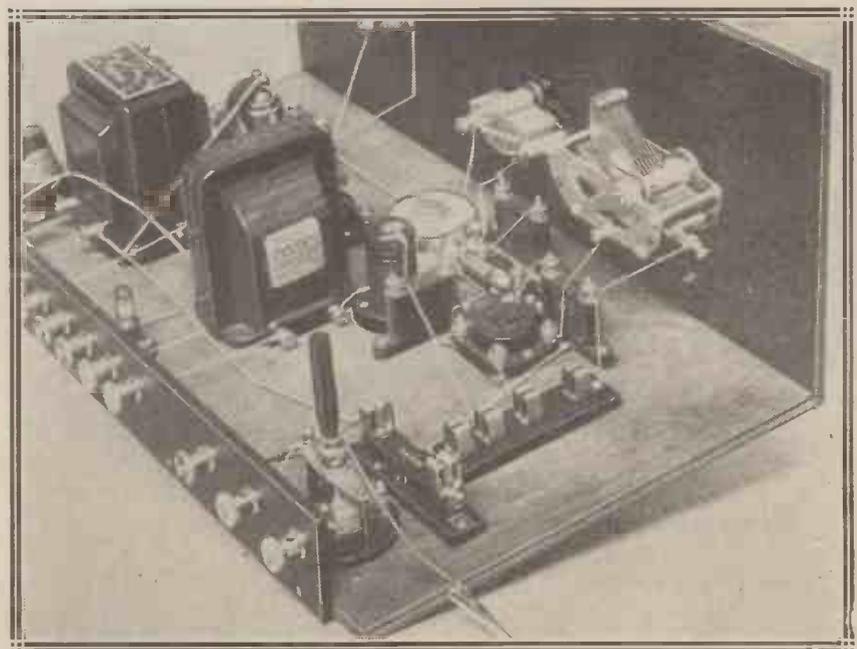
Our reaction condenser now provides a variable bypass effect across this choke down to filament, and so enables us to get reaction. Thus the better the H.F. choke the less readily the circuit will oscillate, until the reaction condenser is brought up to a certain capacity. A poor H.F. choke, on the other hand, merely means that the circuit will oscillate MORE readily, and you will not need to work with the condenser at quite so large a setting to produce oscillation.

The detector valve is provided with the usual potentiometer for the adjustment of its grid potential. This is a considerable help in getting pleasant operation in a short-wave set, since it enables one to set the grid voltage to such a value as to produce the smoothest possible reaction. In the circuits following after

the detector we begin to see where the set differs from the usual general-purpose type of receiver, because you will note that the L.F. side is arranged definitely for the best possible working on short waves, regardless of that last ounce of refinement usually sought for in broadcast sets.

## The L.F. Side

We should perhaps make this a little clearer. In a set intended for the highest possible quality of reproduction on the broadcast waves it is customary in a low-frequency side of this type to place the resistance-capacity coupling after the detector and the transformer coupling between the first L.F. and the power valve. In this way the best possible quality is obtained and also the best arrangement for handling considerable volume.



This photo shows how the coil holder and the aerial coupling condenser are placed and connected.

## World-Wide Reception is Easily Obtained

Good as the arrangement is from this point of view, however, it is not quite ideal in all cases in a short-wave set, since it does not represent the best possible way of preventing H.F. currents from getting into the L.F. circuit. Moreover, it is not by any means the easiest thing in the world to obtain really perfect reaction control from a detector which is resistance-capacity coupled to the succeeding valve. With transformer coupling between the detector valve and the first L.F. valve, on the other hand, there is considerably less tendency for H.F. currents to get through, and smooth reaction control becomes decidedly easier to get.

### A Correcting Effect

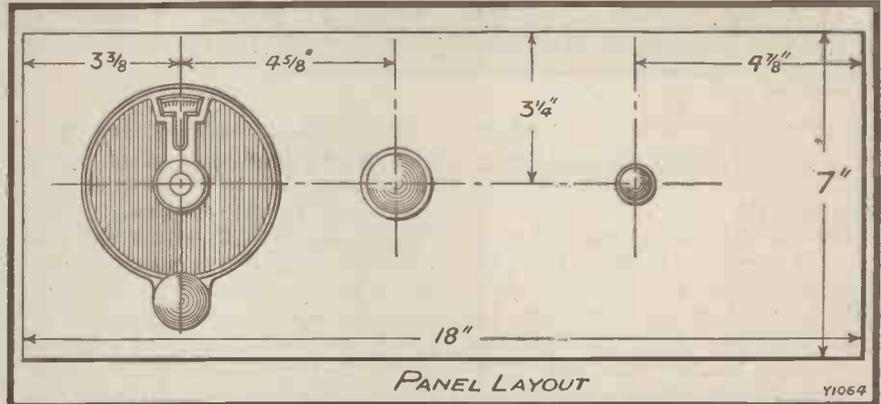
Accordingly, for purely short-wave work the alternative arrangement of the transformer first and the R.C.C. stage second has many advantages, not merely because of the points we have just enumerated, but also because there is a further little-appreciated one. This arrangement in the normal course tends to reduce the reproduction of the bass to some slight extent as compared with the more usual scheme, and this is an advantage on short waves, strange as this may at first sight appear. The fact is that many short-wave stations

sound unduly "bassy" because of the amount of reaction which has to be used to get adequate strength, and so we get something of a correcting effect.

In the output arrangements of the last valve you will see a further scheme for securing the best possible behaviour on short waves, namely, an H.F. stopping device, intended to reduce body-capacity effects and

possible to achieve our end still more thoroughly by connecting a fixed condenser of .0005 mfd. or .001 mfd. straight down from the plate of the last valve to any convenient point on the filament circuit.

Mention of the output circuit reminds us of a device in the receiver which will probably be much appreciated by the more experienced short-wave



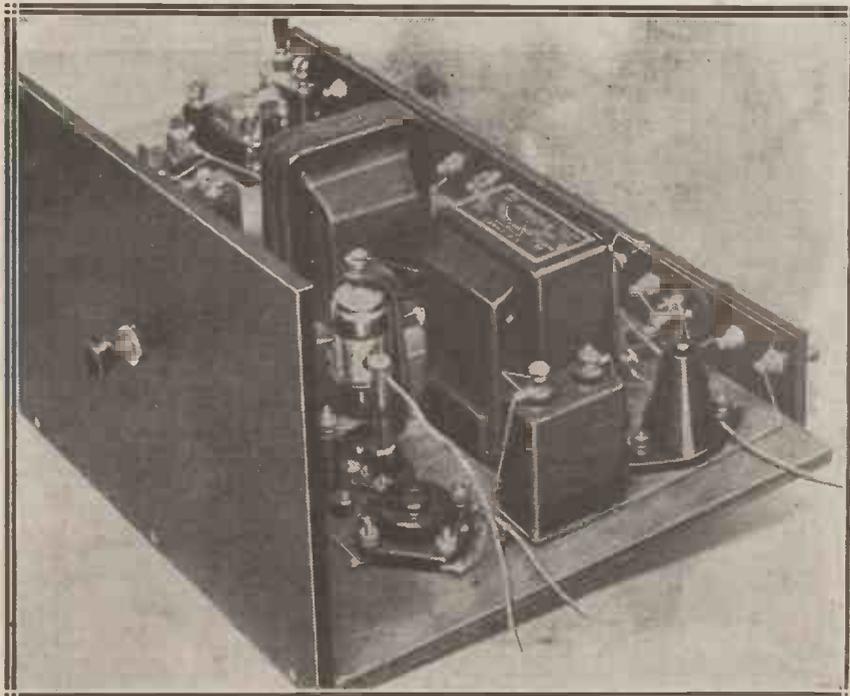
general misbehaviour of the reaction control. The device is just the usual one of a properly connected output filter circuit, with a high-frequency choke in the lead going to the loud speaker or 'phones. This in itself is usually quite a sufficient precaution, but it is just worth noting that it is

listener. It is only a small device, but it is one of those little things which make a great deal of difference to the operator's convenience. It takes the form of a single-pole change-over switch which connects the output circuit to either the loud speaker or a pair of 'phones, these two reproducing devices being wired up to the terminals on the back terminal strip. Thus you can tune-in your station on the 'phones, reach round the back of the set and operate the switch, and there you have your station on the loud speaker, with perhaps a trifle of retuning.

### Where a Compromise is Needed

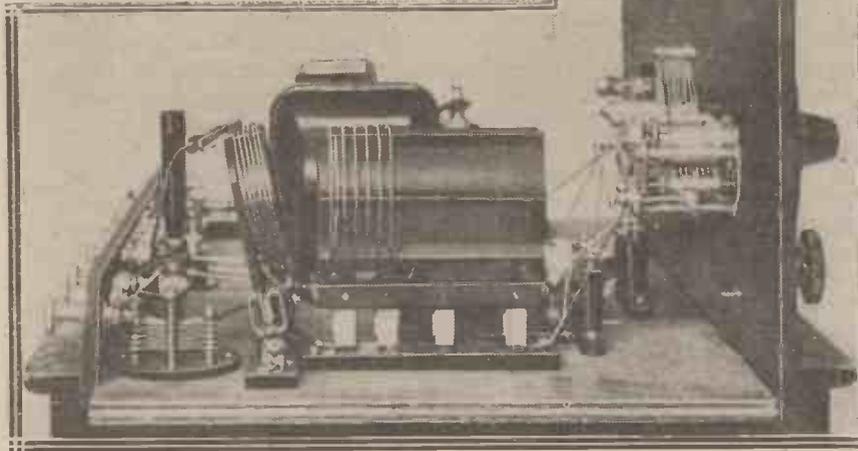
You may perhaps wonder why, when we had in mind the factor of convenience, we placed this switch on the back terminal strip, but as a matter of fact this is one of those cases where we must make a compromise between efficiency and convenience. The switch could easily be placed on the panel, but it would so complicate the wiring that we think you will agree that it is decidedly better to place it where we show it; anyway, it is so near to the right-hand end of the terminal strip that you will find it is quite easy to reach round the end of the set, and, after all, it is only operated once in a while.

So much for general details. Now we can now take a look at the set as



An unusual L.F. side and a special choke-output circuit are employed, making the set particularly well-behaved on the short waves.

An end-on view of the set. Note the variable coupling of the aerial coil.



a constructional job. Well, it is a particularly simple one, because we have built it on rather a large scale in order to obtain the ample spacing so desirable in a short-wave receiver, and this naturally makes it a very easy matter to lay it out and wire it up.

### A Practical Tip

There is just one hint we should like to give you about the constructional work, and that is that you should not fix the reaction condenser and tuning condenser finally in position on the panel until practically the whole of the rest of the circuit is finished and wired up. If you leave these two items till the last, you will find that a good deal of the other wiring becomes very much simpler, and when you place them on the panel as your last operation you will find it easier to run the necessary four wires to them in the most direct manner.

The main constructional job in building the set is the winding of the coils, and here you require a little

more information than the diagrams given you. In the first place, the small aerial coupling coil carries six turns of No. 22 gauge bare wire spaced very slightly apart between the turns.

Tapping points are made at 2, 4, and 6 turns, this last being, of course, the end of the winding. An easy way to do this is to solder to these points about one inch of the same wire, so that the end sticks up slightly and provides a gripping point for the tapping clip (on the end of a flex lead from terminal  $A_2$  and one side of  $C_3$ ). This coil unit serves for all short-wave purposes, and you can get the right coupling effect to meet any conditions by altering the tapping clip or moving the coil itself.

The main coil unit carries the tuning and reaction windings, and this unit is provided with blade contacts which fit into particularly strong and large-surfaced clips on the base. For the interesting main short-wave band of about 20 to 40 metres or so the tuned winding should consist of six turns of No. 22 or 20

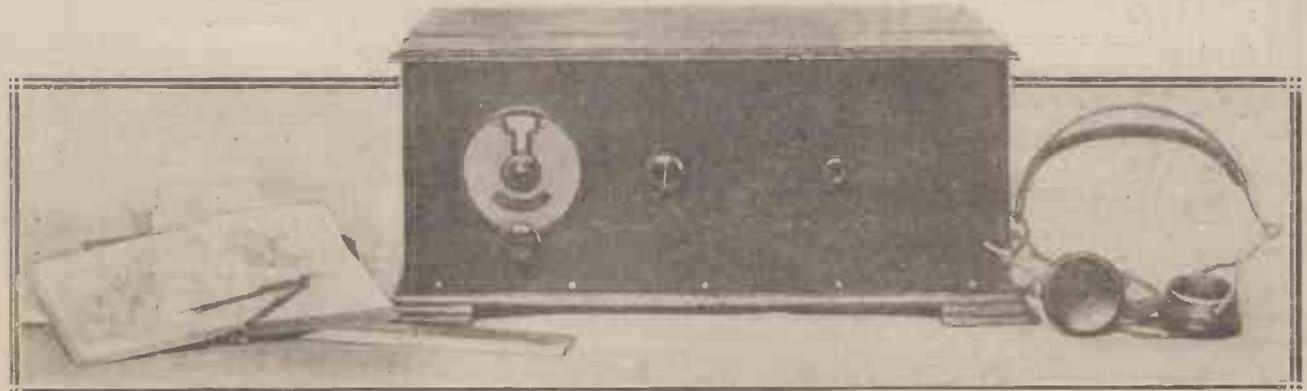
bare wire, wound with about  $\frac{1}{8}$  in. or a little more spacing between the turns, the starting end of the winding going to the E contact blade and the finishing end going to the G contact blade. (Place the winding near to the E end of the former.) The direction of this winding is immaterial, as is also that of the aerial winding.

### Reaction Winding Adjustment

The reaction winding is placed in a single slot produced by making saw-cuts in the ribs of the former, just inside the E end of the tuned winding, spaced between the two first turns of the main winding. The reaction winding should consist of quite a fine gauge of wire, say, No. 30 or 32 D.S.C., and the number of turns ought really to be found by experiment for best results.

What you should do is to start with seven turns, and then pull off turns until you find that the winding is only just large enough to enable you to get proper reaction control over the whole tuning range of this particular coil. The exact number of turns, as you will see, depends upon the particular detector valve you are using and other factors. You can usually come down to about four turns in most cases, and it is quite a simple matter to find the best winding for your particular conditions.

The direction of this winding should be such that it appears to form a continuation of the tuned winding if you imagine that the E end of the tuned winding is joined to the end of the reaction winding which goes to the terminal blade nearest to the E blade. In case you do not quite follow this, we will give you a much simpler rule: put on the reaction winding, connect it up, and see whether the set will oscillate properly. If it will not, just reverse the connections to the reaction winding, and there you are!



A general view of the "Melbourne" Three, which is capable of providing surprisingly good results from the short-wave stations across the Atlantic and in the Antipodes.



## 'Phones or Speaker at Touch of a Switch

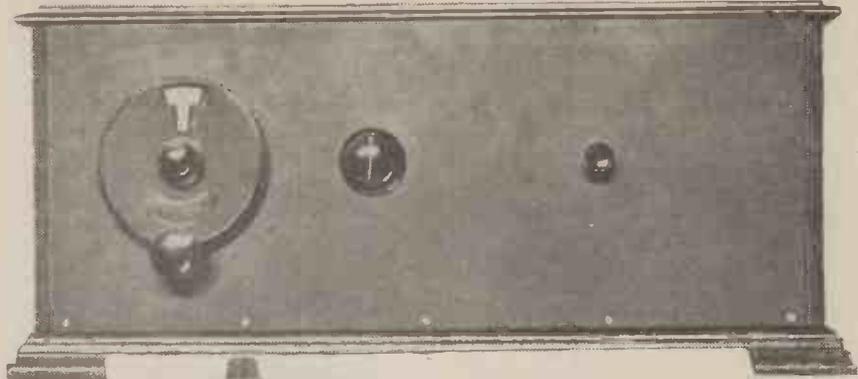
It is worth trying the set both with and without this lead; so when it is finished try it as it stands and also try running a lead from L.T. — to the earth terminal and see whether the receiver works better or worse with this in this place. You will soon find which is the better arrangement.

Just two points about the components. The reaction condenser you will see is quoted as having a value of .0002 mfd., and it is worth noting that one of the conventional .0001 mfd. will also serve here, but .0002 mfd. is somewhat to be preferred, since the reaction requirements of a short-wave receiver vary rather more

over the tuning range than those of the average broadcast set.

Further, one of .0002 mfd. will

enable you to work with a smaller reaction winding and so provides a better H.F. by-pass circuit from the



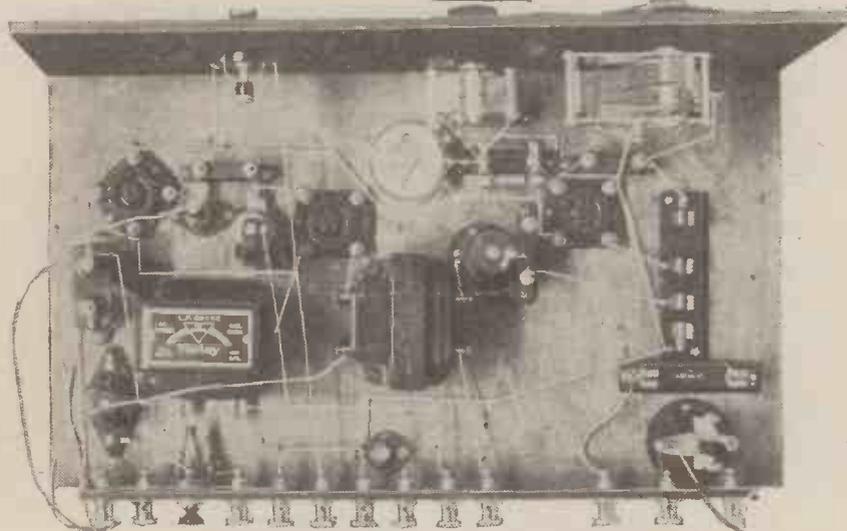
The panel layout is simple and gives a workmanlike appearance to the set.

plate to filament of the detector valve, with a consequent rise in sensitivity. This is just another way of getting the H.F. bypass effect so often provided in modern sets, whether by means of a differential condenser, a special by-pass of an adjustable type placed direct from plate to filament, or in some other way.

### The Tuning Capacity

The tuning condenser also calls for a word of mention. In the original set we used one of .0005 mfd. and a rather slow motion vernier dial, which is quite a good combination in the hands of the more expert operator, and is a convenience when the set is to be used to a considerable extent

(Continued on page 550.)



Most of the wiring is clearly shown in this photograph, which should be studied in conjunction with the diagram on the opposite page when building the set.

### LIST OF COMPONENTS

- 1 Panel, 18 in. × 7 in. (Resiston, Ripault, Becol, Kay-Ray, etc.).
- 1 Cabinet to suit, with baseboard 10 in. deep (Camco, Raymond, Pickett, Ready-Radio, Osborn, etc.).
- 1 .00025-, .0003-, or .0005-mfd. tuning condenser (see text) (Lotus, Lissen, J.B., Formo, Bowyer-Lowe, Dubilier, Ormond, Pye, Utility, Igranic, Colvern, Cyldon, Gecophone, Raymond, etc.).
- 1 Vernier dial, if tuning condenser is not of slow-motion type (Igranic, Lissen, Utility, Ormond, J.B., Brownie, etc.).
- 1 .0002-mfd. (or .0001-mfd., see text) reaction condenser (Dubilier, Lissen, J.B., Utility, Ormond, Raymond, Formo, etc.).
- 1 L.T. on-off switch (Lissen, Benjamin, Lotus, Igranic, Bulgin, Wearite, Ormond, Magnum, Keystone, etc.).
- 3 Sprung valve holders (Benjamin, Lotus, Bowyer-Lowe, Igranic, W.B., Formo, Wearite, Magnum, etc.).
- 1 Baseboard-mounting type neutralizing condenser (Magnum, Keystone, Bowyer-Lowe, etc.).
- 1 Set of coil sockets and coil formers (number to be settled according to number of wave ranges to be covered) (Magnum).
- 1 All-wave H.F. choke (Wearite, Varley, Lissen, R.I., Igranic, Dubilier, Ormond, Raymond, Precision, Ready Radio, Magnum, Bowyer-Lowe, Climax, etc.).
- 1 Special short-wave choke (Magnum, Wearite, Bowyer-Lowe, Igranic, etc.).
- 1 200- or 400-ohm baseboard-mounting potentiometer (Igranic, Lissen, etc.).
- 1 Bulb type H.T. fuse (Ready Radio, Magnum, Raymond, Bulgin, etc.).
- 1 Single-pole change-over switch, push-pull type (Bulgin, Lissen, etc.).
- 1 Low-ratio L.F. transformer (Lissen, R.I., Igranic, Brown, Cossor, Philips, Marconiphone, Lotus, Varley, Mullard, etc.).
- 1 50,000-ohm anode resistance and holder (Varley, Lissen, Igranic, Ready Radio, Precision, R.I., Dubilier, Mullard, etc.).
- 1 Output filter L.F. choke (Varley, Ferranti, Igranic, Wearite, R.I., etc.).
- 1 2-megohm grid leak and holder (Dubilier, Igranic, Lissen, Carborundum, Mullard, etc.).
- 1 1-megohm grid leak and clips (see above).
- 1 Fixed condenser of .0001 mfd.; 1 of .001 mfd.; 2 of .01 mfd. and 1 of 2 mfd. (T.C.C., Dubilier, Lissen, Goltone, Igranic, Clarke, Mullard, etc.).
- 1 Terminal strip, 16 in. × 2 in.
- 12 Terminals (Eelex, Igranic, Clix, Belling & Lee, etc.).
- Wire, screws, flex, tapping clip, G.B. plugs, etc.

# A Novelist Looks

*"I myself am investing in a portable wireless set, because I honestly believe that it will teach me much." Such is the statement of a famous novelist, who once hated broadcasting, until . . . but you must read the story for yourself in the following interesting article.*

I AM about to buy myself a portable wireless set. For many months I have withstood the persuasions of my wireless enthusiast friends; I have maintained that I could see no point in broadcasting, and that I thought that it was boring. I have stated that I could not be interested listening to someone else discoursing on some subject which did not interest me; my husband said that the real reason why I did not care about wireless was because I could do none of the talking myself; a very husbandly remark!

## *Programmes "Too Dull"*

Then I queried the programmes. "Too dull!" I said, and I picked out items at random. "How to lay a tennis court," "An easy method of bottling fruit," "The problem of unemployment insurance." Before I became personally interested in broadcasting, I maintained that they must revise their programmes, and that the items must be of more general interest.

But I have re-shaped my opinions. I find that however broadminded one tries to be one is always tempted to be suspicious of any innovation. It is narrow, but we are all narrow when it comes to it. Programmes to suit everybody must at times be dull to somebody. Though bottling fruit may bore me stiff, the woman next door who is an ardent and virtuous housewife may be thrilled with the idea. I cannot have it all my own way.

## *A Growing Influence*

For a long time I could not associate myself personally with an interest in broadcasting, but after all I find that broadcasting impersonally interests me.

It has an influence in the home daily growing stronger; it is broadening, it is an intelligent method of acquiring knowledge, and it is gradually becoming a necessity to modern living. I have a bad memory. The books that I read assiduously are not retained for any appreciable time. I have tried



A group of jolly girls enjoying the afternoon programme by means of a portable set.

# at Broadcasting

## By URSULA BLOOM

to overcome this lamentable weakness, but I cannot do so. Things that are spoken to me I retain with ease. Some brains are balanced this way, and the only thing to do is to concede to that balancing; another point definitely in favour of broadcasting.

### No Need for News

I was living in London when I criticised broadcasting harshly. News came to me swiftly and completely.

I had a telephone; I visited theatres and concerts regularly. I also attended lectures. I was on the spot, and in touch with all the things and conditions that mattered to me for my literary career. When I came home I did not want to be bothered, I only needed to lie down and rest before rushing out again. Now I am living in the country, and if I am to keep in touch at all a wireless set is indispensable to me.

I receive news several hours late. The theatre where I live does not produce London plays by brilliant companies, but old dramas by inferior players. There are no concerts save of the very mediocre type; even the cinemas are behind the times. It is vital to a novelist to be alive to the latest news, to understand plays and good music, to keep herself steeped in the gentle art of continually acquiring knowledge.

### A Vital Necessity

I find that the programmes which I once fancied so ridiculous, now seem to be vastly entertaining; I want to be kept alive to the current news, and many of the talks would interest me. I never before realised fully the vital necessity for broadcasting in my home.

Wireless must have metamorphosed the nation. In July I was staying in a rural village buried in the heart of England, literally six miles from anywhere. Ten years ago that same village was inhabited by people who lived outside the world, and had no interests the other side of the small bridge which spanned the approach. They were charming rustic people, but although they were keen to know more, and appreciative of knowledge, their position in the heart of the



"I am living in the country, and if I am to keep in touch at all a wireless set is indispensable to me . . . To-day nearly every cottage has its own wireless."

**"There are no Limits to Broadcasting"**

wilds was their hindrance. To-day nearly every cottage has its own wireless.

It is a godsend. News has a fresh meaning for them. They have learnt much from the talks, much from the music. As time goes on they will learn more.

I, myself, cycling in the wilds of Worcestershire, saw the cottagers listening-in to the King's Thanksgiving Service being broadcast from Westminster Abbey. There was something about it that could not fail to make you think, and continue thinking.

**A Gurgling, Groaning Infancy**

During that stay I learnt of the effect of wireless upon the home very forcibly; one could not see those little families through the open doors grouped round their hearths and listening to the wireless without realising that it was having a lasting effect. The men were not out poaching; they were not in the public

and not only will it maintain that big position, but it will encroach further.

We who heard it in its infancy, and a gurgling, groaning, whistling infancy it was, interspersed by fog-horns and ships sending out messages and electric shocks of all sorts, judged it too soon, and too harshly.

**Home-making Propensities**

The first wireless that I ever heard was by the seaside, when a gentleman who professed thoroughly to understand it was to tune-in on some important affair of national interest. The parish hall was taken, and we all paid eighteenpence for the privilege of an uncomfortable seat therein. Alas, something went wrong; either the instrument was faulty, or the expert gentleman managing same was not quite so expert as he had supposed himself to be. We got a most excellent imitation of the midnight cat pursuing his amatory enterprises; we heard much the same sort of sound that I invariably hear when my dentist

acquire a beginning; perhaps an end; but here the end is not in sight. There are no limits. I see all manner of possibilities before it, all manner of good points attributable to it.

Not the least do I admire it for its home-making propensities, and the wider knowledge that it is bound to distribute. That is how I look at broadcasting.

**PRACTICAL POINTERS**

It is a good plan to look over all your wander-plugs occasionally to ensure that they are fitting tightly in their sockets, have no "whiskers," and that they are reasonably clean.

Listeners who are careless about the use of reaction, and find they are interfering with their neighbours' reception, run the risk of having their receiving licences withdrawn.

One of the conditions upon which a wireless licence is issued is that when a listener changes his address the fact should be notified immediately to the head postmaster of the district in which he has been living.

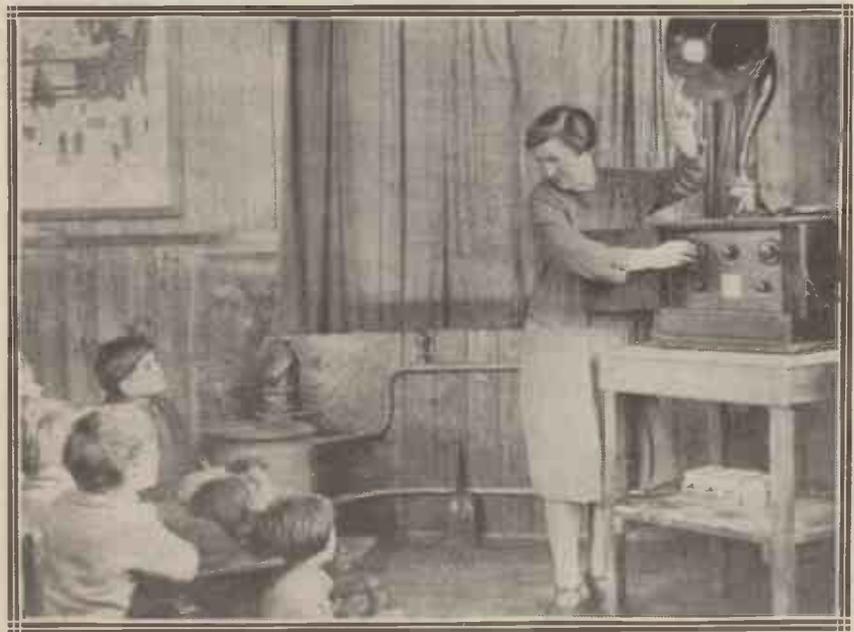
It does not matter which way round telephone receivers are connected to a crystal set.

In multi-valve sets where one large grid-bias battery is used, the use of a long H.F. grid-bias lead may give rise to instability.

Although a frame aerial is nothing like so sensitive as the large usual aerial-earth connection, it should be remembered that where interference from electric mains is very bad, such an aerial has very great advantages.

Trouble due to gassing or popping in an accumulator can often be greatly reduced if a small layer of medicinal paraffin oil is carefully poured on to the top of the electrolyte.

One advantage of the use of wooden separators in an accumulator is that by completely separating the negative from the positive plates they prevent particles of metal from one set of plates getting on to the other, and thus setting up local action.



During the school broadcast. A class of youngsters receiving a lesson by means of the loud speaker.

houses; they were listening to something edifying, and I defy anybody to continue listening to something edifying without being edified.

I myself am investing in a portable wireless set because I honestly believe that it will teach me much. I find "last night's over the wireless" being quoted more and more. Broadcasting has taken up a big position,

gives me gas, without the pleasant aftermath, "Well, that's all over, and it's out, and it didn't break!" In the end we all got out eighteenpences back. That was broadcasting as it used to be.

Naturally it put me off. You cannot help being put off by an affair of that sort; too many of us are far too easily put off. All good things have to

# MODERN TENDENCIES IN RADIO

*In this interesting article the latest ideas in wireless design—as revealed by the manufacturers at the recent Radio Show at Olympia—are discussed in detail. The coming of the Regional Scheme has altered the outlook for the listener and for the set-designer, and here are outlined the principal improvements and advances for 1929/30.*

*By J. C. JEVONS.*

VARIETY was so much in evidence at the Radio Exhibition that when it comes to the point of drawing any general conclusion as to the trend of modern circuit design one is forcibly reminded of the old adage concerning the difficulty of seeing the forest for trees.

One fact seems certain, however. For those who are prepared to use screened-grid amplification there is no longer any need for the outside aerial. The supremacy of the garden pole has, of course, been threatened for a long while, but never so effectively as at present.

## *Frame Becoming Popular*

The frame aerial has the advantage of convenience and portability. It is not unsightly, and it is a distinct asset in the search for selectivity. Furthermore, it picks up much less static and outside disturbance than the outside wire. On the other hand, it is a poor collector of signal energy. Owing to its relatively small size, it cannot intercept more than a minute portion of the passing wireless wave.

The remedy is, of course, to compensate for the small amount of natural pick-up by using additional high-frequency amplification. In the early days this could only be achieved with fair success by the supersonic type of circuit. Ordinary high-frequency valves used in cascade were not successful in practice, owing to lack of stability, and to high-frequency losses.

The development of the screened-grid valve, and particularly the new indirectly-heated or equipotential type, has introduced an entirely new standard of performance. Instead of having a magnification of forty or so, the new valves have a "mu" factor of several hundreds, which naturally puts an entirely new complexion on the problem.

The first practical result of screened-grid amplification was seen last year in the sudden flood of portable sets. Some of them were very good, and more were not, but the keynote in every case was the high-frequency side. Apart from neutrodyning, the screened-grid valve affords the only

feasible way of securing efficient and stabilised high-frequency amplification, and without ample high-frequency amplification it is not possible to get either range or loud-speaker volume from a small frame aerial.

Whatever may be said of last year's portables, this year's models represent a vast improvement, due in part to better screening, but mostly to the higher standard of performance of the new valves.

## *Most Significant Feature*

But the most significant feature is the development from the portable of the so-called transportable receiver. I particularly refer to the transportable models fitted with an eliminator unit for operation from the electric-light mains.

To get the best out of a screened-grid amplifier it must be supplied with a steady plate and screen voltage. This cannot, in practice, be obtained from a high-tension battery except for a comparatively short period of time, a limitation which is a serious handicap to the true portable—at



The scene at the Radio Exhibition at Olympia, London, where the new sets make their first appearance, and the public are introduced to the latest designs evolved for the forthcoming radio season.

least, so far as running expenses are concerned.

The combination of the so-called portable type of circuit with a mains eliminator, so that it can operate on an adequate and steady voltage derived from the mains, represents a definite forward step in design, and one which brings certain specific advantages in its train.

**Tremendous Amplification**

For instance, the amplification factor of the screening grid is combined with the increased mutual conductance which comes from using an indirectly-heated filament. A further gain is secured on the low-frequency side, since the power or pentode stages can be run with a really adequate plate voltage, up to 200 volts or more.

receivers are now being fitted with provision for plugging-in a pick-up, so as to allow for gramophone reproduction as an alternative to the broadcast programme.

It is rather amusing in this connection to recall the fears of the gramophone industry when broadcasting was first introduced. In those days radio was regarded as a deadly enemy of the older industry. Instead, however, of succumbing to its rival the gramophone has gained a fresh lease of life, so that the two interests are now working hand in hand and sharing a common harvest.

**Multi-Stage H.F. Sets**

This happy result must be laid to the credit of the thermionic valve, which first made it possible to use the new electrical method of gramophone recording, and also made manifest the superiority of the electric amplifier for reproduction.

frequency side. It contains no fewer than three stages of screened-grid high-frequency amplification to one low-frequency stage. The amplified radio-frequencies are fed to an anode-bend detector, which is followed by a single stage of resistance-coupled low-frequency amplification.

It must be admitted that this is a striking variation from the standard practice of using at least as many low-frequency as high-frequency stages.

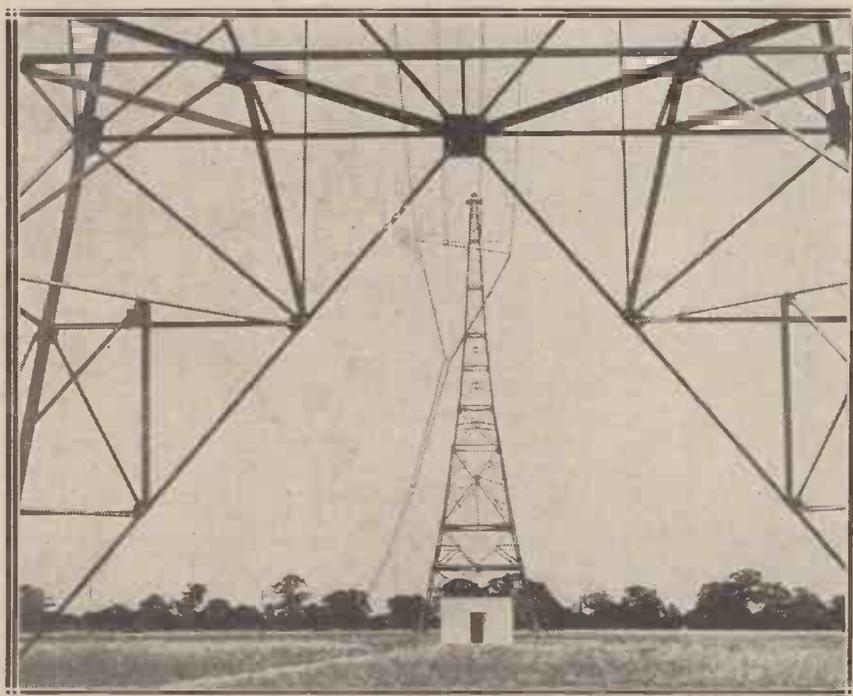
Automatic switch-tuning is another feature of special interest. In one Exhibition model the selection of any desired programme is effected by a number of push-buttons which control twenty different condensers. The condensers are of the semi-fixed type, so that they can be pre-set to different values. The operation of the switch automatically selects one of the condensers and throws it across a fixed inductance to tune the input circuit to the required wave-length.

**Distinctly Promising**

To increase selectivity the super-sonic principle is used, the incoming signals being heterodyned by a local oscillator, and then amplified at intermediate frequency by two screened-grid valves. The low-frequency side consists of a single pentode stage, making six valves in all.

The difficulty in all switch-tuned sets is that of making the circuit sufficiently selective to bring in a variety of stations without interference. The problem has already been tackled on the lines of using two S.G. or neutralised high-frequency stages, with elaborate switching means for effecting the necessary changes in the input and tuned intervalve stages. The application of the super-sonic principle as described above is an ingenious alternative of a distinctly promising nature.

**AN UNUSUAL VIEW OF BROOKMAN'S PARK**



One aerial system of the new 2 L.O., seen from under one of the masts. The building shown houses the complete aerial tuning equipment, which is supplied with H.F. by means of a feeder line connecting it with the main transmitter in the main building.

Equipped with such a set, any listener who objects either on æsthetic or other grounds to the garden pole can get all the range and volume he requires from a small frame aerial. In addition, he can reap the additional advantage of increased selectivity, besides enjoying his programmes free from atmospheric and similar disturbances.

Another obvious tendency which was emphasised at the Exhibition is the growing popularity of radio-gramophone combinations. In nearly every case the better-class wireless

phone recording, and also made manifest the superiority of the electric amplifier for reproduction.

In conclusion, the Exhibition produced one or two outstanding features of circuit design which, although not yet in common use, deserve honourable mention as significant "pointers" for the future.

The new Marconi model No. 56 receiver is a case in point. This set provides an interesting illustration of the latest tendency to regard the high-frequency side of a receiver as of more importance than the low-

**HINTS ON INTERFERENCE**

It is an offence against the conditions of your receiving licence to cause interference with the working of neighbours' sets. In particular reaction must not be used to such an extent as to energise neighbouring aerials.

Interference is taking place when a continuous note or whistle is heard in the set, and if this whistle alters in pitch as your tuning is adjusted the interference is being caused by your own receiver. (Reaction must be reduced immediately, until no note or whistle is audible.)

# The Radio Squad

by D. GLOVER

An entertaining account of an adventure with a detachment of the Flying Squad. Radio plays an important part in this exciting narrative.



THE bull-necked gentleman sitting opposite me in the railway carriage flung his magazine down on the seat beside him and glared aggressively at it.

"High-brows! That's what they are," he grunted.

Seeing that it was a copy of MODERN WIRELESS, I suppose I registered a certain amount of resentment, for as the man looked up and in my direction his aggressiveness subsided slightly.

"That fellow Glover," he explained somewhat less heatedly, "gets me right under the collar. Talks about im-impeddants, he does. I've got a first-rate crystal set, I have, and if that's got any im-impeddants I for one can't find 'em. High-brow, that's what he is."

"Impedance, you know, A.C. resistance and all that," I murmured apologetically.

## "Number Ten Bunch"

"Young fellow," said the bull-necked gentleman, quite kindly, but with one-hundred-per-cent-firmness, "high-brows aren't any good *anywhere*—you mark my words. I'm a plain policeman, I am, and I can tell you a thing or two about high-brows."

"A policeman, perhaps, but," said I facetiously, "plain, surely not—handsome is as—"

The quip failed and, as I saw the rising scowl, I hurriedly turned towards the window pretending to be vastly interested in the fleeting panorama.

A tap on the knee brought me round again with a start, and I shrank back defensively into the corner.

"High-brows are all right in their proper places—colleges, museums, chemical works, and what not—but in ordinary life—" the plain but talkative policeman shook his head. "Just this time last year it was," he grumbled. "With London X Flying Squad, I was. Rotten business that. Like to hear about it?" he concluded loudly and hopefully.

I resigned myself to the situation and nodded. Regretfully I closed my book and laid it down.

"London X is fitted with twenty vans and ten of them have got wireless on 'em," started the policeman. "You know them vans—leastways, perhaps you don't know

'em. They look like milk vans, laundry vans and what not, but all the time they're filled with policemen and wireless they are! Do seventy miles per on the level, too.

"One night I was standing by at the Yard with the usual Number Ten bunch—eight policemen, sergeant, wireless man and driver—when we got a call to see the 'soop' immediately. In we went and there he was at his desk very solemn and important. Sort of excited, too. Standing by him was a feller with glasses, thin and hungry and miserable looking." (Here the policeman paused and looked at me appraisingly, and I know I reddened visibly, for I wear glasses and I am not given to undue *avouirdupois*.)

"The 'soop' started in right away," went on the bull-necked narrator. "'Out you go to Leyton right now,' says he, 'and just burn the road. Cruise around the Whipps Cross area until you get a call from us by radio.' And turning round to the thin chap with glasses he says: 'I'll give Mr. Kentish, our assistant chief operator here, the name of the house in Whipps Cross you've got to raid, just as soon as it comes in. Got a man tailing the Carews and he's going to 'phone us the name of the house they go to. Knows it's along Whipps Cross somewhere. Get going my lads, and take automatics.'

"You know, we got a real big thrill out of that mouthful. Remember the Carews? Three brothers suspected

of the Camden Town murders they was. Real tough boys; all done 'time' and about as big a handful as you'd meet from the Bowrie to Bow Street. Go down fighting like rats in the corner they would.

## On the Road

"I tell you, I saw them stripes I was waiting for—you bet I did! Stripes, my eye! Some of us were going to get it that night. Well, out we went, not running, you know—policemen don't run if they can get out of it,



"Mr. Kentish, our Assistant Chief Radio Operator."

“Real High-brow, that Kentish was. . . .”

regulations says it isn't dignified. That's high-brow if you like. Oh, no, we didn't run, but we got into that Number Ten pretty smart and was up the Lea Bridge Road before you could count the wires in our aerial, which you can't see on the squad vans.

“Our radio man got ‘O.K. for speaking’ checks through all the way, and you ought to've heard him when old ‘glasses’ at the Yard says what's his grass strength. Rotten high-brow!” (“Field strength radiation constant,” I murmured gently, but quickly subsided before a ferocious scowl.)

**With the Raiding Party**

“Up and down Whipps Cross we cruised, and told an old lady that stopped us we'd call for the washing in the morning. At last we got the message. ‘The Parasites,’ says our radio man. ‘Parasites!’ says the Sarj. puzzled.



“They look like milk vans, laundry vans and what not, but all the time they're filled with policemen and wireless . . . .”

‘Funny name for a house, that.’ ‘Quite clear,’ says the radio man. ‘Got a repeat to confirm it. Parasites it is.’

“Well, we cruised gently up and down and couldn't find any house called The Parasites. But right up at one end was a house all by itself which we couldn't see the name of. We stopped round the corner and the Sarj. slipped out. He was gone some time and you can bet we were right on the jump. Couldn't see a thing in that van. Dark as a black hat it was. Hot, too, and you bet there was just a bit of wind-up. Tough guys those Carews. Man-killers, every one of them!

“At last the Sarj. comes back. ‘All right,’ he whispered, ‘Paradise is what it is. That's the house O.K. Out you come—take it quietly. Round the back, you and you and you. Slip up to the front behind me the rest of you. Door's all right—got it on the latch now I have. Take it cool and no shooting unless things break badly.’

“We all slipped out, putting up the safety catches on our guns and pulling our caps down hard. All in plain clothes we were, and as hefty a bunch of chaps as you could meet in a day's march.

“I was in the front-door detachment I was, and we creeps along the path behind the Sarj. Nervy job waiting at the front. Waiting for the signal from the back to say our chaps had that covered, we were. Then it comes—a low, soft whistle.

“‘Now, then,’ says the Sarj. quietly. ‘Take it easy, boys. No shooting if you can help it.’ Then he throws open the door and in we go as quickly as we could without making too much noise. We soon found there wasn't anything downstairs, so upstairs we went, me well in front, feeling like we were going over the top in France. All the place was nearly black dark, till we saw a crack of light under a door.

“The Sarj. creeps up and puts his ear to the key-hole. I could just see him raise his hand one, two, three times, then, satisfied—‘In you go,’ he shouts, and bursts open the door.

**Some Slight Confusion!**

“We piled in and stood there blinking in the light. Quite peaceful it was. No shooting, no excitement at all. In the middle of the room was three old chaps sitting at the table playing cards that hard they didn't take any notice at all of us. ‘Disguise,’ says the Sarj., staggered like. ‘James, Albert, and Horace Carew, I arrest you, etc.’ he says. No notice takes the old chaps till the Sarj. lays his hand on one's shoulder. Then up he jumps and shouts blue murder.

“There was a bit of a mix-up, but no shooting, and we drags them into the van and away back to the Yard.

“Of course, they weren't the Carews,” said the policeman disgustedly. “Town Councillors they were—or something. Kentish, he mixes it up, he did. Shows you what a mess them high-brows makes of real men's work. Soop told him to say plain, straightforward L-I-C-E with a fancy La in front—that's what the name of the house was. Not that it wasn't—”

“Stop!” I cried agonisingly. “La Leese, French for arena, fields, lists, etc.”

“Well, I dunno,” grumbled the policeman, “if you high-brows aren't talking math-i-matics you're off on Latin and Yu-ker. Real-high-brow, that Kentish was.”

“Was?” I queried sympathetically.

“Yes. Inland Revenue he is now. All high-brows go there, they do. No good for real men's work they aren't.”

*All rights reserved. Characters mentioned are purely fictitious.*

**CAPTAIN P. P. ECKERSLEY, M.I.E.E.,**

late Chief Engineer of the British Broadcasting Corporation, contributes exclusive articles to “Modern Wireless” and acts as Chief Radio Consultant.

**ANOTHER PROOF OF “M.W.’s” LEADING POSITION.**



# UNIVERSAL EXTENSION LEADS

New scope for radio experimenting is offered by the simple schemes of remote control described in this fascinating article. It is shown that by various ingenious devices two single wires can be made to carry currents for tuning the set and for switching it on and off, and, at the same time, accommodate the loud-speaker currents. All this can be done without mutual confusion in a novel way that is detailed.

By G. V. DOWDING, *Grad. I.E.E.*

**L** OUD-SPEAKER extension leads are used by a large proportion of owners of loud-speaker sets. The receiver is permanently installed in one room and loud-speaker points are arranged in other rooms where radio programmes are desired. In many cases the leads are "built in," like electric lighting wires, and in others thin flex is cunningly led around wainscoting, picture rails, etc.

Fig. 1. This makes use of the existing loud-speaker extension leads and in no way interferes with their normal operation. At the loud-speaker end there is a simple press-button switch, and when this is open 2 L O is heard. On closing the switch there is an immediate change-over to 5 G B. One can switch-in either of the stations.

The metal sleeve contacts  $C_1$  and  $C_2$  are then drawn into connection with the small brushes  $B_1$  and  $B_2$ , and in this way the pre-set condensers are brought into circuit. When the actuating current ceases to flow through the magnet the armature is released and the two contacts are broken.

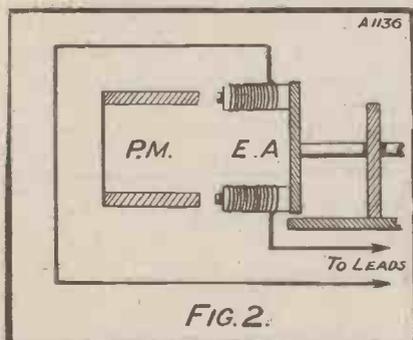


FIG. 2.

In most cases the programmes are taken alternately from the local station and one of the Daventrys, 5 G B or 5 X X, and it is necessary to go to the receiver to re-adjust the tuning in order to effect the change-over. When one is comfortable seated in an armchair, perhaps in front of a cosy fire, this is a nuisance. Generally when people are listening at a distant point the one station is taken throughout and the advantages of being able to pick and choose items are lost.

### Using Existing Leads

A little while ago I resolved to evolve a simple way out of this unhappy state of affairs. My set is in an upper room, and there is a simple flex connection to a point in a frequently used room downstairs. These leads were installed by the electrician, and to add further wires would be a complication I wanted to avoid if possible.

After a certain amount of scheming I arrived at the idea illustrated in

The apparatus is very simple and I built it up mostly of scrap material. The set is a four-valver having one stage of H.F. Across the aerial tuning circuit and the grid circuit of the second valve there are normal .0005-mfd. tuning condensers. These are adjusted for 2 L O. In order to bring in 5 G B two pre-set condensers are joined across the tuning condensers by the simple automatic device.

### A Magnetic Switch

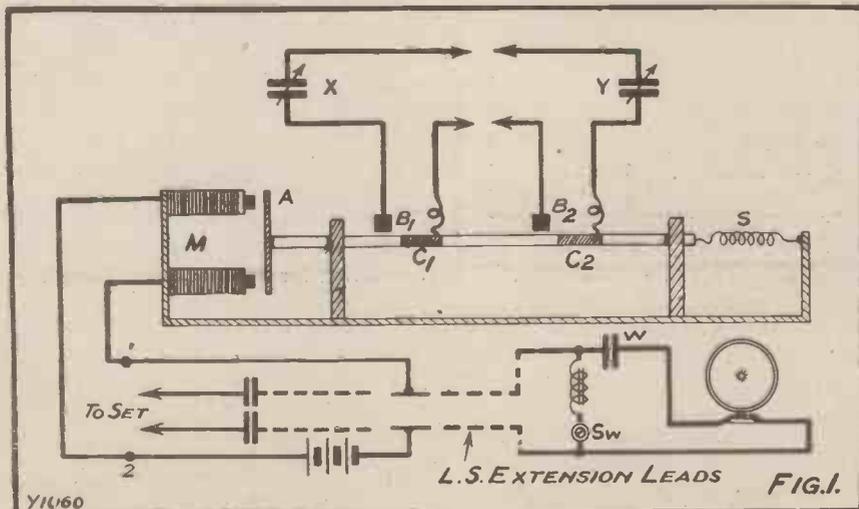
The reaction control is at minimum in most cases and does not have to be altered. The main part of the device is a sort of magnetic switch. When the magnet is actuated it affects the armature A, and this pulls the rod forward against the tension of the spring S. The rod is of an insulating material.

### Preparing the Paths

If the set had three tuning circuits, three contacts would have been needed, and these could easily have been accommodated.

It will be appreciated that the current required to actuate the magnet is of a D.C. character, so that the loud-speaker extension leads have to be arranged so that this D.C. circuit is isolated from the set.

This is quite easily done by the insertion of fixed condensers which offer no barrier to the low-frequency currents that work the loud speaker. In most cases these will already be present at the set end in the form of a loud-speaker shunt. Such, of course, is quite essential to the proper running of the extension leads, quite



L.S. EXTENSION LEADS FIG. 1.

apart from their use for distant control purposes.

The insertion of the fixed condenser W in Fig. 1 is necessary at the loud-speaker end so that the loud speaker itself shall not complete the D.C. circuit. This fixed condenser should be of the order of 2 mfd. or so, in order to offer a low impedance path to the L.F.

It is necessary to have a low-frequency choke in series with the switch so that when the switch is closed the loud speaker is not short-circuited. Obviously this low-frequency choke must have a low ohmic resistance and be able to carry the current necessary for the actuation of the magnet.

### The Condenser Contacts

Providing the loud speaker bypass at the set end is properly arranged, and the magnet and the other factors concerned are of a suitable nature, it might be possible to use the L.T. battery of the set. If not, an additional one is needed. In either case, the magnet M should be of a high resistance in order that the current drain shall be low. In view of the fact that one can get equal magnetic strength by having a large number of turns and small current as with a large current and small number of turns, this is no disadvantage.

The condenser contacts on the armature rod must be widely spaced, as otherwise the device may introduce circuit interaction. Also, the additional wiring must be short, so that it is advisable to have the device mounted very close to the set. It would obviously be highly advantageous to have it behind the panel or on the baseboard.

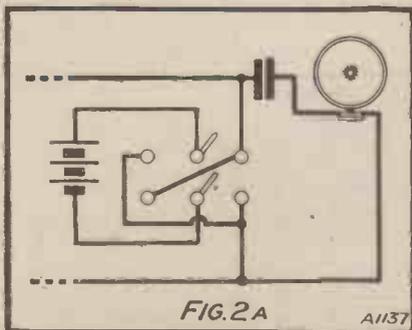


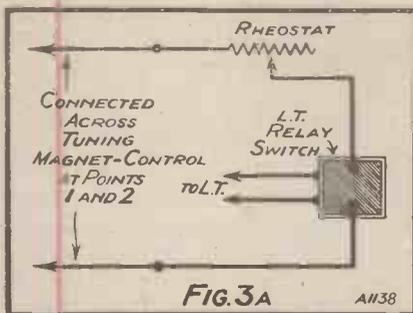
FIG. 2A

A1137

I have a cabinet type of set, and I have rigged up the device just in front of the panel, and the leads of the pre-set condensers pass through the panel only an inch or two away from their respective tuning condenser connections. In practice, the scheme works delightfully. There is no interference at all with the

working of the set, and the effect of switching over from the one station to the other merely by the pressing of a button near the loud speaker is almost uncanny.

By the way, it will be noted that there is no L.F. choke at the set end to prevent an L.F. short-circuit. The reason for this is that the inductance of the magnet M is, at least in my



case, sufficient. This acts as a complete barrier, and there is no appreciable diminution in signal strength.

After having got the arrangement in operation I began to wonder whether I could not do it in some better way. I do not mean from the point of view of operation, for, as I have said, this was perfect, but there are two slight criticisms which could be raised against Fig. 1. These are that there is a current drain, however small, all the time that the one station is tuned in, and that a rather expensive component in the nature of a low-frequency choke is needed at the loud-speaker end.

### One or Two Refinements

Ultimately I evolved one or two refinements which I have yet to put into practice. Instead of the magnet M, I propose to have a permanent magnet of a fairly powerful character. Armature A will be replaced by an electro-magnet EA in Fig. 2, while the spring S will be dispensed with. At the loud-speaker end there will be a small battery and a reversing switch, as in Fig. 2A. This reversing switch will send the current from the battery on to the loud-speaker extension wires in either of two directions.

When the current flows in the one direction the electro-magnetic armature EA will develop a strong attraction for the permanent magnet PM, and the rod carrying its contact will be moved in the one direction. When the current flows the other way the two magnet arrangements will be in opposition, and the rod will be forced in the other direction.

This polarised scheme has but one objection, and that is that an additional battery must be used.

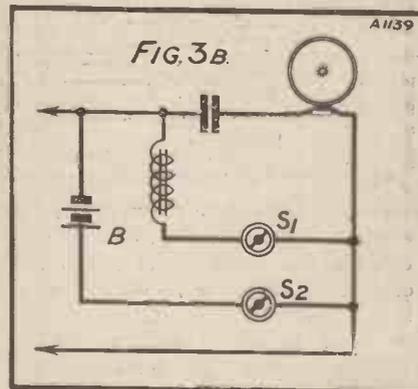
But providing the windings of the magnetic armature—which is really just an ordinary electro magnet—are large in turns, the current drain will be very small, and only a tiny dry battery need be used.

The reason I have not yet polarised my outfit is that I have further complicated it by the addition of a set on-off distant control, and a very extensive reorganisation will be necessary in order to affect the change-over. I am not sure that I shall make it, in view of the fact that there is only a tiny additional drain on the battery (and I have an L.F. choke at the loud-speaker end, anyway).

### The "Magic" Box

There is a small box at the loud-speaker end, and this can be carried to any loud-speaker point and therein inserted. On the box are two switches. You press one switch and the set in the distant part of the house starts to work. By operating the other switch one can tune-in either of the alternative programmes at will.

Inside the box there are a small battery, a low-frequency choke, and a fixed condenser. The connections to these are shown in Fig. 3B. S<sub>1</sub> operates the programme change, and



S<sub>2</sub> switches the set on and off. Across the loud-speaker extension leads at the set end are the additional items shown in Fig. 3A.

There is an L.T. relay switch of the type that alternatively opens and closes a contact which switches on the L.T. The contact makes and breaks the L.T. circuit of the set, and I have so arranged this that I am sure the L.T. battery is not in circuit through the wave-change shunt should the station requiring the operation of the magnet M be tuned-in when the set is switched off.

The purpose of the rheostat or variable resistance is to adjust the sensitivity of the relay switch so that this is not operated when the

## Distant Set Switching and Tuning

switch  $S_1$  at the distant point is closed to work the tuning control. The adjustment is very simple.

You close switch  $S_1$  and quite possibly the L.T. relay switch is actuated. The rheostat is then adjusted until the L.T. relay switch goes out of action. The additional battery marked B in Fig. 3B is switched in when the switch  $S_2$  is closed, and this, supplementing the voltage of the other battery, operates the relay switch.

### Mechanical Cunning!

There are one or two important points to note. The operation of switch  $S_2$  might cause an interference with the functions of  $S_1$ , and retune the set, but, having either switched the set on or off, its duty is done, and the relay cannot be worked by whatever you do with switch  $S_1$ . But both switches must not be closed together, as in this case battery B is short-circuited. If both switches operated on the impulse plan, it would require the deliberate pressing of both and the needless endeavour to do two things at once to cause trouble. With the Fig. 1A and 2A tuning controls this could be the state of affairs. But using the Fig. 1 scheme, switch  $S_1$  remains closed while the one station is tuned in. Then you can only switch the set off at the expense of a battery short-circuit. It is not a complete short-circuit, for you have the choke in series, and the electrical character of this might be such that no harm was done to either set or the battery.

Actually, on the control I have fixed up a little mechanical cunning which prevents the closing of both switches at once. The knobs of the switches are staggered, and if you press both they come together so that neither switch can be worked. The switch  $S_1$  must be opened before  $S_2$  can be closed. It is the principle of railway signal interlocking applied in a very simple manner.

### A Detachable Unit

As I have said, the device as described occupies but very small space. The loud-speaker control is contained in a small box but a few inches cube, and I have fitted this with a flex so that it can be taken to any convenient point in the room, such as the armrest of a chair or other handy place.

There is a junction plug, the ordinary loud-speaker plug being withdrawn from the jack in the wall and inserted in the junction and this takes its place in the jack. Obviously, the scheme would not work if two or three loud speakers were working in series. It demands that only one loud speaker is in operation.

### Using Several Points

All the other loud-speaker points in the house are short-circuited; that is to say, when the loud-speaker plug is withdrawn from the jack this short-circuits. There is never any occasion when more than the one loud speaker is required to work. It would not be impossible to have any number of loud speakers in series in operation, in conjunction with any number of small boxes, although obviously only one control box can be worked at the one time.

The H.T. has had to be completely isolated from the extension leads by means of a fixed condenser in each arm. With care, the more common one large condenser would suffice, although safety first in these matters is a good watchword.

The whole makes a neat bit of radio engineering, and it is certainly most fascinating and extremely useful in service. No doubt there will be readers of "M.W." who will be able to devise even simpler methods than those I have outlined.

### Quite Straightforward But—

I would not advise those who do not know their installations very thoroughly to endeavour to include both controls. The on-off switching alone is a very straightforward proposition and one which presents no complications. And much the same can be said of the timing control, but

## TELEVISION IN BERLIN



The daylight television transmitter such as is installed at the Berlin G.P.O. and which was shown at the recent German Radio Exhibition.

The way to introduce this refinement would be to connect low-resistance L.F. chokes across the operating loud-speaker points, to provide a D.C. path for the D.C. control current. In this manner two loud speakers could be operated easily; and the full effectiveness of the control box enjoyed at the one point.

At the set end the automatic device is not enclosed in a case, but is mounted on a small baseboard which is narrow but rather long. Great care has to be exercised in regard to the various connections in order to avoid any interlinking. It is so easy to forget a common negative wire which might, if not attended to, have the effect of short-circuiting one of the points.

one has to go really carefully to work when one endeavours to use two wires for three independent electrical purposes.

### TWO USEFUL TIPS

When using headphones or handling radio apparatus great care should be taken not to touch any metal switch, electrical heating or cooking appliances, etc., as if the apparatus in question is faulty such metal may have accidentally become "alive."

Generally speaking, paper dielectric condensers should NOT be used for coupling one valve to the next, but a condenser with mica dielectric should be employed for this purpose.

# The Two-Range Two

*A highly efficient but simple little receiver with a special wave-change scheme which is carried out with standard plug-in coils.*

*Designed and described by the "M.W." Research Dept.*

THIS receiver is the result of some recent cogitations upon the subject of wave-change switching in the simpler and more inexpensive types of sets. Such sets are really rather more of a problem to us than the larger and more elaborate instruments, because we always endeavour to work to a very strict price limit, and, moreover, we endeavour to make the set as far as possible suitable for construction from such parts as the average experimenter is pretty sure to have at hand without purchasing many fresh ones.

already have a set of plug-in coils in their possession.

This plug-in coil solution is quite a good one, and it certainly is a very inexpensive way out for the man who already has a set of coils, but it possesses certain natural drawbacks which we set ourselves to remove in the present case. The main trouble is that in the earlier schemes a group of something like five coils has been necessary, three of them forming the primary, secondary and reaction for the low waves, and the odd pair forming the loading primary and secondary for long waves. As a result, the set is

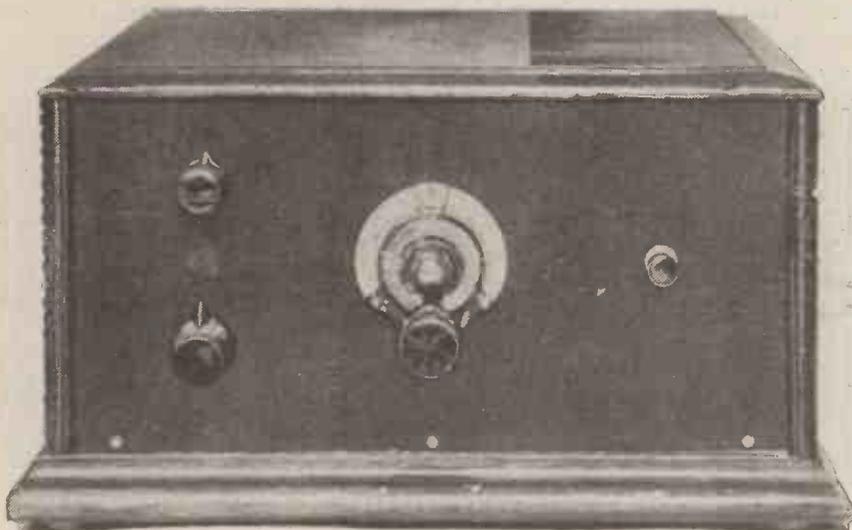
case we have sacrificed just a little of this simplicity of switching and have used a double-pole change-over switch, since we found when we came to work it out that the actual wiring required was still quite satisfactorily simple and presented no real difficulties.

By arranging the coils and the switching in a judicious manner the efficiency remains high, and, indeed, as we have just said, it seems to be slightly better than the shorting-out schemes previously used. By the use of a double-pole change-over switch for the wave-changing we have been able to provide a complete change-over from the low-wave coil to the high-wave one, and by choosing that very useful type, the "X" coil, for the circuit, we have been able to get rid of the separate primary coil otherwise required.

## *Special Reaction Device*

This brings us down to just two coils for actual tuning and aerial coupling purposes, and there remains the question of reaction. We had a little difficulty here, since we desired if possible to use only one coil for reaction to cover both low and high waves, which is no easy matter when one is limited to plug-in coils. When it is possible to adjust the size of the reaction winding within close limits, and also perhaps to vary the coupling to the two tuned coils, it is not a very difficult matter to arrange this common reaction coil for both wave ranges, but under the present conditions it is by no means easy.

A way out was found in the end by using a portion of each "X" coil for a supplementary reaction winding, that is to say, the aerial coupling portion was made to serve also for reaction. In this way a greater reaction effect was obtained on the long-wave setting, since naturally the coupling portion of the long-wave coil is larger than that of the low-wave one. This winding alone does not give quite enough reaction as a rule, and so we in the end arrived at the scheme of a small separate reaction coil which gives an additional effect on both wave-bands.



Real simplicity in construction and operation is the key-note of this neat little set.

You see, one of the easiest ways of arranging a wave-change circuit is to use some form of special dual-wave coil, such as our Titan unit or one of the many commercial designs, but that means that the builder of the set will almost invariably have to purchase the coil unit specially for it. Such special units cannot in the nature of things be really cheap, and so up goes the cost of the set right away, although it must in fairness be admitted that the result is usually a very satisfactory type of receiver.

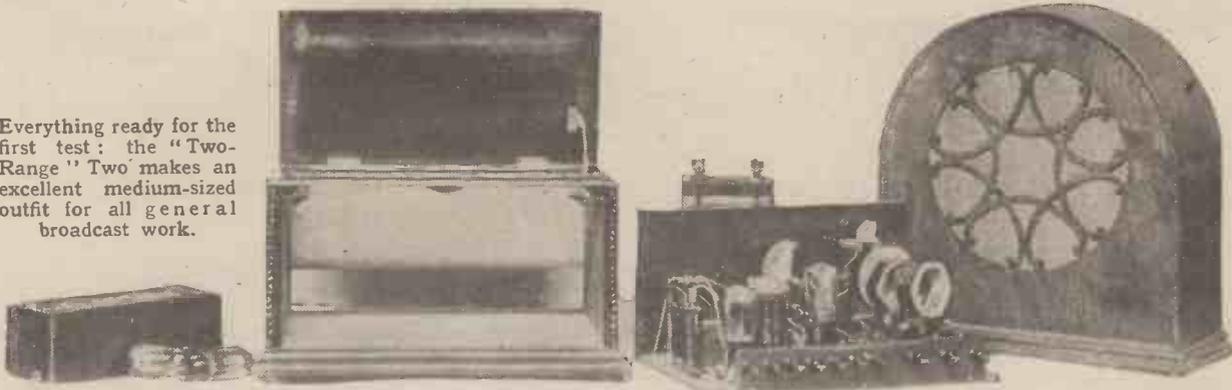
To meet this cost difficulty a combination of plug-in coils is often used in a wave-change receiver of the simpler type, because designers assume that very many constructors

decidedly bulky and so many coils are called for that the constructor may find it necessary to purchase some extra ones, thereby partly defeating the designer's object.

## *Only Three Coils*

In this set we have kept the total number of coils down to three, and we believe we have at the same time produced a slight improvement in the actual functioning of the receiver. This is how it has been done. In the previous scheme the large number of coils has resulted from the fact that an endeavour was always made to obtain the simplest possible switching, a three-point on-off switch being employed as a rule. In the present

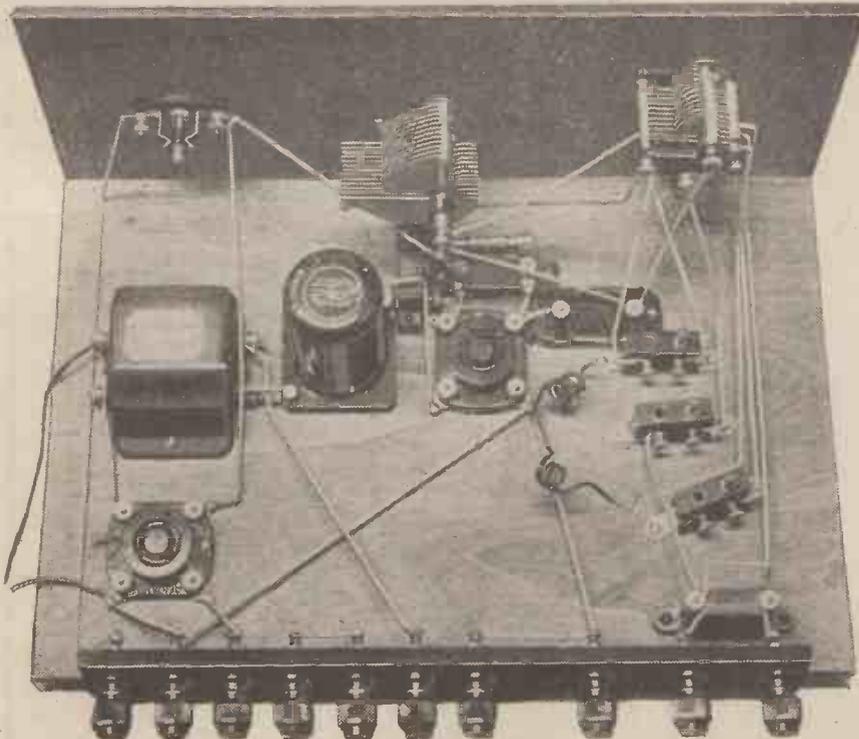
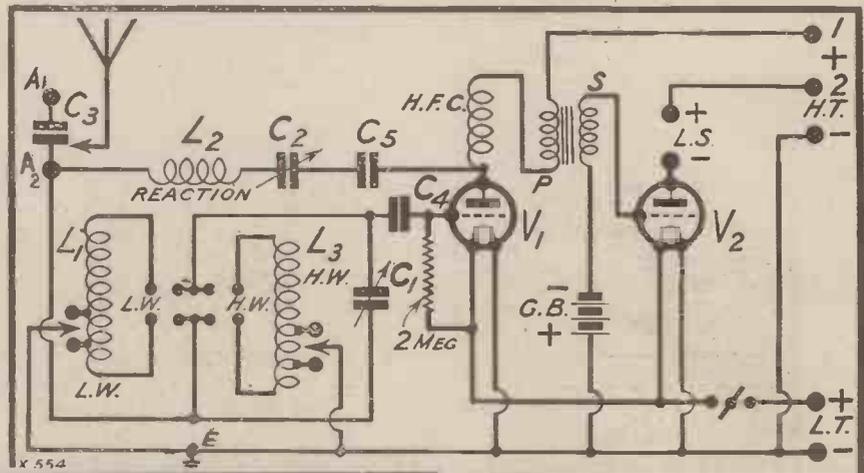
Everything ready for the first test: the "Two-Range" Two makes an excellent medium-sized outfit for all general broadcast work.



Now this supplementary reaction coil must be arranged to couple with both the low- and the high-wave coils, and the scheme we have adopted (see photographs) is quite a simple one. The low-wave and high-wave tuning coils are placed on the outside of the group of three and are set at a suitable angle. These are the coils  $L_1$  and  $L_3$ , which you will be able to identify with the aid of the wiring diagram. In the middle of the group is the reaction coil  $L_2$ , and a suitable position for this is quickly found by trial, the correct scheme usually being to couple it fairly closely to the long-wave winding  $L_3$ , and more weakly to  $L_1$ . It is quite a simple matter when the set is finished and put on test to find a suitable adjustment of the coupling between the reaction coil and the other two, and while we are dealing with the subject we may as well explain the method.

First or all screw down the holders for  $L_1$  and  $L_3$  in the positions indicated on the wiring diagram, and fix the  $L_2$  socket roughly as shown, but only put one screw to hold it down, namely, the screw nearest to

the right-hand end of the baseboard (looking at the set from the back). Now, with a coil of about No. 50 or 60 for  $L_2$ , test the reaction and see whether you get something like the same effects on long and short waves.



The two neatly-spiralled flex leads you see here are the connections to the tapping points on the two "X" coils. (The photographer coiled them up to make them more prominent.)

If you find you are getting more reaction on the long waves than on the short, swivel  $L_2$  so as to couple somewhat more closely with  $L_1$ . If, on the contrary, you are getting too much reaction on the low waves and not enough on the high, move  $L_2$  to couple more closely with  $L_3$ , and proceed in this way until you find you are getting roughly equal reaction on both wavebands. You can then put in the odd screw which holds the  $L_2$  holder and the job is done.

### Coupling the Aerial

While we are mentioning coil sizes we may as well give those for  $L_1$  and  $L_3$  as well. These, as we have mentioned, both standard "X" coils, and  $L_1$  should be a No. 60 and  $L_3$  a No. 250.

A pair of flex leads from a convenient point on the earth circuit wiring go to the tapping points on these two coils, and you have here the usual control of selectivity. A little testing will soon show you the best tapping point on each coil for these flex leads, and once found it will not usually need



is nothing critical in this little design, and any good standard makes can be used throughout.

The circuit, by the by, is a very simple and straightforward form of capacity-controlled reaction arrangement, and can be described as a slightly modified Reinartz. Following on the detector valve there is the usual single stage of transformer-coupled L.F., with a plain output circuit for the loud speaker. We have taken care to allow rather ample space upon the baseboard for this little set so that you may make any slight modifications you may feel inclined, to suit it more exactly to your own particular purposes. For example, if you intend to use a super-power valve in the last stage to cope with a very nearby local station it is quite easy to incorporate a filter circuit instead of the plain one shown.

### Fitting an Output Filter

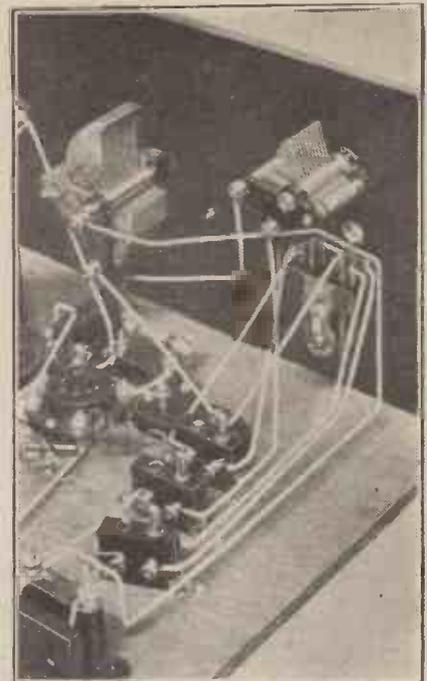
There is ample space for such an output filter on the baseboard beside the L.F. valve, and the alterations in connections, if you desire to use it,

The rather wide spacing out of the components makes this a particularly simple and easy little set to assemble and wire-up, and there is really only one point about the constructional work calling for mention. You will find it will make the set particularly easy to wire-up if you adopt the following procedure.

### Drilling the Panel

After drilling the panel for the four components which go thereon and seeing that they fit nicely in their holes, remove the tuning condenser and reaction condenser from the panel, leaving merely the change-over switch and the on-off switch in position.

Now fix the panel to the baseboard and proceed to assemble all the parts on the latter and screw them down in the correct positions. Next wire-up as far as you can without the reaction and tuning condensers, completing the wiring as far as possible without these two components. When everything else is finished, mount up the two condensers and proceed to wire them in, so completing the set. In



The wiring of this part of the set calls for a little care. Space out the leads a trifle and check up the connections to the switch methodically.

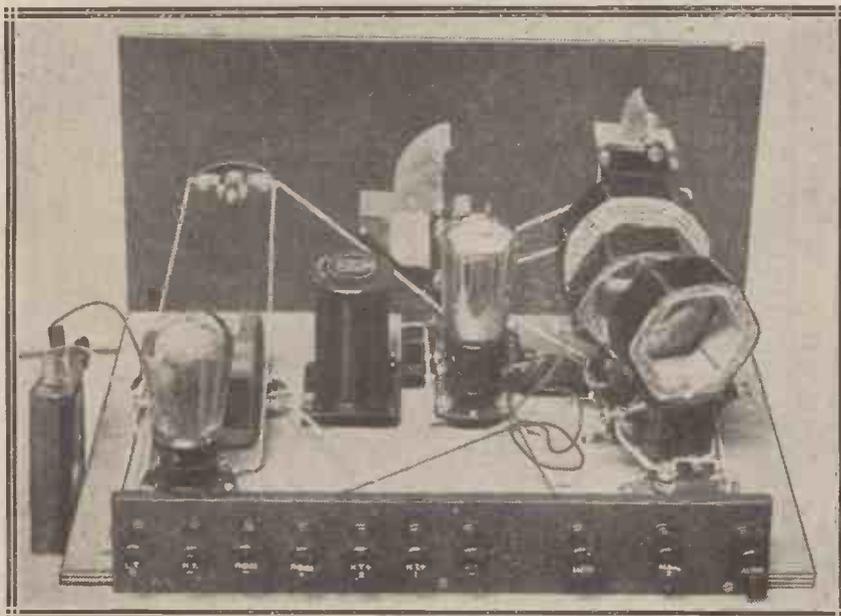
omitted some of the small refinements which would be provided in a circuit intended to appeal to the more advanced constructor and there is just one of these we should like to mention.

In most of our recent receivers of the capacity-controlled reaction type we have made some arrangement for getting an H.F. bypass path from plate to filament of the detector valve, to improve the sensitivity of the latter. For example, in many sets we provide one of the small compression type semi-variable condensers connected straight between plate and filament of the detector, to give this bypassing effect, and in others we have used a differential reaction condenser, which automatically produces the same effect.

### A Recommended Refinement

This little refinement is omitted in the present case, and we are mentioning it to suggest that if you like to do so you can quite well add it later, with a consequent decided improvement in the functioning of the set. What you want is the compression type of adjustable condenser, such as a Formodensor or Igranic Pre-set condenser, with a maximum capacity of about .0001 mfd. Connect one terminal of this to the anode terminal of the detector valve socket and the other terminal of the condenser to a convenient point on the L.T. circuit.

When the modification is finished, start with the bypass condenser.



There is plenty of vacant space in the set for the accommodation of the small grid-bias battery required. The little unit illustrated, for example, could stand upon the baseboard beside the L.F. valve socket.

would be as follow: Remove the lead from the plate of the last valve to one loud-speaker terminal, and instead wire the plate to one side of the output filter choke and to one side of a 2-mfd. condenser. Wire the other side of this choke to the H.T. +2 terminal, and remove the wire shown from H.T. +2 to one loud-speaker terminal. Instead, wire this loud-speaker terminal to the other side of the 2-mfd. condenser. Join the other L.S. terminal to L.T. — and the modification is complete.

this way the connections to the switch and to the other parts will be rendered considerably easier to make.

### In Search of Simplicity

We have deliberately made this little set as simple as possible, since it is intended to appeal most strongly to the man who has not previously built a fair-sized set, even a two-valver, and who may consequently be expected to appreciate a really simple and easy job. Accordingly, we have

## Simple Wave-Changing With Standard Coils!

at minimum capacity, that is to say, with the knob unscrewed to the limit of its effective travel. Next proceed to screw down the knob of the compression condenser slowly, noticing that as you do so you have to use larger and larger settings of the reaction condenser to produce oscillation. Carry on with this adjustment until you find you can only just get sufficient reaction with the reaction condenser nearly full in. This is the correct setting for the bypass condenser, and it can be left so adjusted permanently and will continue to serve its useful little purpose of improving the sensitivity of your detector.

### Choosing Your Valves

To get the best effect when this device is incorporated, by the way, it may be advisable to use a slightly larger size of reaction coil, say a No. 60 or 75, but this is a matter which depends upon the particular detector valve employed, and we leave it to you to check up by actual test.

Now you will want some working data for the operation of the set and then we can leave you. First of all, about valves. For the detector the standard recommendation is one of the H.F. type with an impedance of 20,000 to 30,000 ohms, suitable

specimens being available in all the well-known makes in both the 2- and 6-volt ranges. As an alternative you should note that valves of the more recent resistance-capacity type with an impedance of from 40,000 to 60,000 ohms also make good detectors, suitable specimens giving a particularly smooth control of reaction.

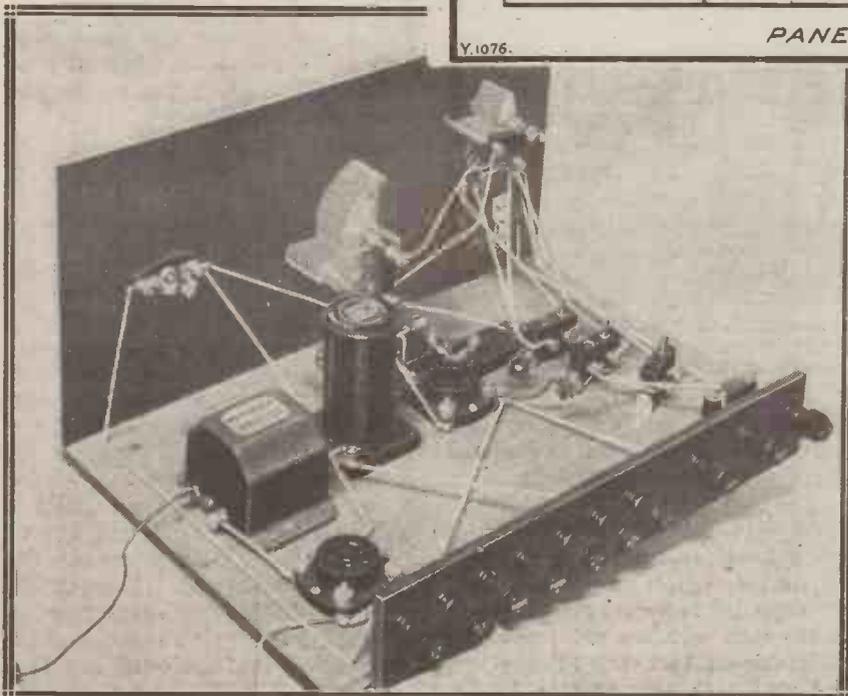
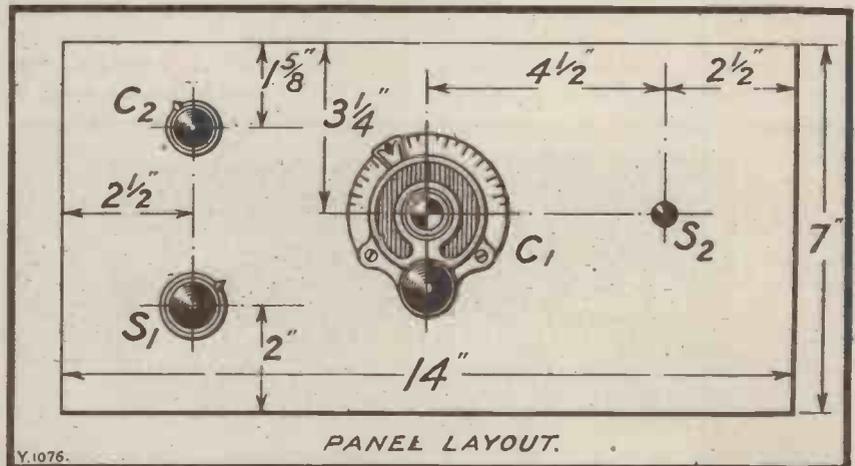
For the L.F. stage you want a valve whose characteristics rather depend on your distance from the local station. Under normal conditions, where you are some little way out from the local an ordinary power valve will give you the best results, since you will not obtain extra-powerful signals with only a two-valve combination, and a valve of the ordinary power type will give you slightly more magnifica-

tion than one of what is often called a "larger" type.

If you are fairly close to the local, on the other hand, it may be worth while to use a super-power valve and so be able to handle without distortion the stronger signals you will get. Such a valve gives you better quality under these conditions, but it should be noted that it does not give you quite so much amplification and so reduces slightly the volume you will get on distant stations.

### Working Voltages

The H.T. voltages should be as follows: The detector valve is supplied by the terminal H.T. +1, and here you want about 30 to 60 volts, adjusting it carefully when the set is first put on



There is ample space in the layout to add an output filter if you wish to do so at some future date.

test to give you the smoothest possible control of reaction. H.T. +2 feeds the L.F. valve, and here you want the usual 100 to 120 volts, or perhaps a little more if you have it available and your power valve is rated to stand a high pressure.

The wave-change switch operates in the rotary fashion, and this is how it works. If you insert the coils in their various sockets in the manner we have already described, with the long-wave coil in the L<sub>3</sub> holder and the low-wave coil in the L<sub>1</sub> holder, the set is switched for the lower wave-band when you turn the knob to the right, and to long waves when you turn it to the left.

This applies, of course, only to the particular type of switch used in the original set, and if you employ another make you may have to work out the positions to give you the long or ordinary wave-lengths for yourself.

Now about grid bias. Using the comparatively small type of power valve customarily employed in two-valve sets you will not require a very great deal of grid bias, especially if you only use about 100 volts H.T. Somewhere about 4½, 6, or 7½ volts negative will be required, according to the particular type of valve you are using and the H.T. available, and you will quite easily find space upon the baseboard for a little battery of this kind.

With the smaller types of power valves a 4½-volt unit may be sufficient, and this can be fitted in almost anywhere. With the slightly larger types of valves, requiring, perhaps, 6 to 7½ volts, you will require to use a



The first test: don't forget to adjust the speaker!

9-volt unit, and this, again, can be squeezed in fairly easily. For example, a battery of the narrower type can stand along the left-hand edge of the baseboard (looking at the set from the back).

We ourselves rather prefer the scheme of mounting the grid-bias battery in special clips on the inside of the cabinet at the back, but if you like to make a definite provision for it upon the baseboard it is quite an easy matter to do so.

**Space for Grid Bias**

If you look at the photograph of the set on the second page of this article you will see that there is quite a large unoccupied space in the middle of the baseboard towards the rear. Two

wires cross this space in a slanting fashion, and if you intend to mount the grid-bias battery here you should take these two wires by a rather more roundabout route and thus preserve a clear space. The two wires in question are not critical ones, and it will do no harm to lengthen them a little.

The vacant space in question is large enough to accommodate both the grid-bias battery and also an output filter if you so desire, while if you employ a valve of the super-power type it is still large enough to hold two 9-volt units so as to give you the necessary amount of grid bias. These valves require considerably more grid bias, of course, but since their needs vary considerably between the different types and makes, we cannot give you any very definite figures. However, any valve which you obtain will be accompanied by an information slip, and this will give you the necessary data.

**PRACTICAL RADIO WRINKLES**

**N**EVER attempt to alter the wiring inside a set unless you undo the battery leads, for failure to take this simple precaution is the cause of most valve burn-outs. (The battery leads should always be disconnected at the battery end, and not at the set end.)

A common cause of crackling noises is a loose terminal on a valve-holder which prevents proper contact.

To harden the steel of an ordinary small drill all that is necessary is to heat it up to a dull redness, and then to immerse it suddenly into a quantity of heavy oil.

Coupling condensers for resistance-capacity or choke amplifiers should be of the mica and not of the paper dielectric type.

A very satisfactory medium wave length frame for use with a .0005-mfd. condenser may be made by constructing a 2-ft. square framework and winding upon it thirteen turns of No. 22 wire.

If you cannot get your short-wave set to oscillate, try the effect of altering the H.T. voltage to the detector, and also the effect of loosening the aerial coupling.

Reversing the leads to the variable condenser will very often be all that is necessary to cure troublesome hand-capacity effects.

**COMPONENTS REQUIRED**

- 1 Panel, 14 in. x 7 in. (Becol, Kay-Ray, Paxolin, Ripault, Resiston, etc.).
- 1 Cabinet and baseboard, 9 or 10 in. deep (Camco, Raymond, Pickett, Osborn, Ready Radio, Lock, etc.).
- 1 .0005-mfd. variable condenser (Formo, Lissen, J.B., Lotus, Igranic, Cyldon, Pye, Dubilier, Ormond, Geophone, Colvern, Raymond, Utility, Bowyer-Lowe, etc.).
- 1 Vernier dial, if condenser not of slow-motion type (Lotus, Igranic, Lissen, Utility, J.B., Raymond, Ormond, Formo, etc.).
- 1 .0001-mfd. reaction condenser (Burton, Lissen, Cyldon, Dubilier, Raymond, Keystone, J.B., Ormond, Bowyer-Lowe, Lotus, Formo, Magnum, Utility, etc.).
- 1 L.T. on-off switch (Lotus, Lissen, Bulgin, Benjamin, Wearite, Igranic, Raymond, Magnum, Keystone, etc.).
- 1 Panel-mounting double-pole change-over switch (Wearite).
- 2 Sprung valve holders (Benjamin, W.B., Precision, Lotus, Formo, Magnum, Igranic, Ashley, Bowyer-Lowe, Wearite, etc.).
- 3 Single-coil holders (Lotus, Igranic, Keystone, Raymond, Wearite, etc.).
- 1 H.F. choke (R.I., Lissen, Climax, Varley, Dubilier, Igranic, Bowyer-Lowe, Lotus, Precision, Raymond, Wearite, Colvern, Ready Radio, etc.).
- 1 Low-ratio L.F. transformer (Cossor, Lissen, Varley, Ferranti, Brown, R.I., Igranic, Lotus, Telsen, Marconiphone, etc.).
- 2 .0003-mfd. fixed condensers (T.C.C., Dubilier, Lissen, Igranic, Goltone, Clarke, Mullard, etc.).
- 1 .001-mfd. fixed condenser (Goltone, etc.).
- 1 2-meg. grid leak and holder (Dubilier, Lissen, Igranic, Ediswan, Mullard, etc.).
- 1 Terminal strip, 12 in. x 2 in. x ¼ in.
- 10 Terminals (Belling and Lee, Eelex, Igranic, Clix, etc.).
- Wire, screws, flex, etc.

# QUICK CUT CONDENSERS

**A**n ordinary wire-wound anode resistance, rated at, say, 20,000 ohms, is a hard path for any current to pass through. Even if the wire of which it were wound could carry it, it would take an electrical pressure of 20,000 volts to drive a current of one ampere through this component. Its resistance would be about the same for alternating as for direct current.

A fixed condenser, however, will not pass direct current, although it will offer a path to alternating currents, and the higher the frequency of the alternating current the lower the resistance a condenser of a given capacity will offer, and the larger the capacity of the condenser the lower its A.C. resistance.

These are facts the constructor should bear in mind. It would be no use using a .0002-mfd. fixed condenser in connection with a loud-speaker bypass shunt. The effective A.C. resistance such a component would offer to a frequency of 1,000 is somewhere around eight megohms. For such work a condenser having a capacity of 2 mfd. is generally specified, and, at the same frequency, its effective A.C. resistance would be only 80 ohms (this is small in comparison with the resistance of the average type of loud speaker).

For the .0002-mfd. fixed condenser to assume an effective A.C. resistance of 80 ohms the current handled would have to have the frequency of a million cycles, and this is not a low frequency, but a radio frequency such as is encountered when 2 L O is tuned in (at this frequency the 2-mfd. condenser would offer an impedance of a mere 1/12th of an ohm).

## An Alternative Path

Condensers of the 2-mfd. order are frequently used as H.F. shunts or by-passes. A 2-mfd. condenser is often connected from the "priming" grid of an S.G. valve to earth, and, as you can see, it offers a very short-cut to H.F. currents. The resistance of the H.T. battery might be 100 or 200 ohms, but not much H.F. would reach this while there is an alternative path available of only 1/12th or so of an ohm in resistance.

And regarding condensers, comparatively recently the electrolytic variety has become available for general use. The electrolytic condenser is a remarkable device in that



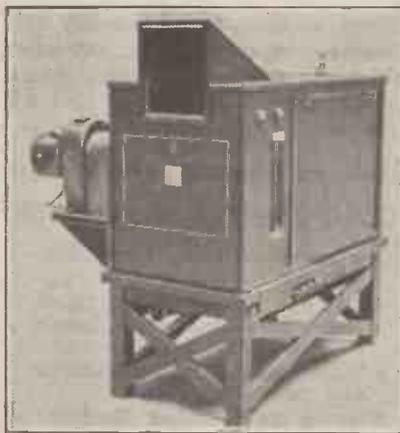
Some valuable and interesting facts for the set-builder are explained  
By H. A. R. BAXTER.

it achieves an enormous capacity with remarkable compactness. An electrolytic condenser rated at 2,000 mfd. will be only a matter of a few cubic inches in size.

## The Electrolytic Type

In principle it is something like a battery that has no depolarising agent. When a voltage is applied across its two terminals, thin films of gas are formed across the plates that are immersed in the chemical solution. The plates and the electrolytic solution act as do the plates in an ordinary condenser, while the thin film of gas forms the dielectric. And it is because the gas film is so thin that the great capacity is obtained.

You will notice that it is by the application of voltage that the gas



A Karolus-Telefunken television receiver shown at the recent Berlin Radio Exhibition.

film is formed, and that therefore this type of condenser cannot be used purely for A.C. work. A steady potential must be applied for the device to function. It can, of course, deal with alternating currents that

are super-imposed on D.C., such as are met with across the output terminals of an L.T. unit, but the A.C. must not exceed a certain proportion of the total current.

Electrolytic condensers are most effective as smoothers of irregularities in L.T. supplies. Here one often meets low-pitched hums of the order of 120 or so cycles. At this frequency an electrolytic condenser of 2,000 mfd. will have an A.C. resistance of only two-thirds of an ohm, while its resistance to pure D.C. will be at least a thousand or two ohms.

You may be surprised that these devices have resistances of such a character and not of almost infinity, as in the case of the ordinary type of condenser, but you must remember that it is, as its name implies, of an electrolytic character!

## Remarkably Low Resistances

At a frequency of 1,000 cycles, such as one might come across in the commutation ripple of D.C. mains, the 2,000-mfd. electrolytic condenser will have an A.C. resistance of about 1/12th of an ohm, and its resistance to frequencies of the order of 3,000 cycles will drop to 1/40th of an ohm. These are remarkably low resistances in comparison with the resistance of a filament circuit, which will at least be of the order of tens of ohms.

Thus when the current irregularities divide between the two paths, that constituted by the bypass condenser and the other by the filaments of the valve, the proportion that flows through the latter is dropped to a negligible degree. Meanwhile the D.C. flows through its usual channel in an uninterrupted manner.

It is interesting to note that the resistance of the 2,000-mfd. electrolytic condenser to a radio frequency of a million will be about a thousandth part of an ohm, but, of course, there are no duties to be found for a component of that nature on the purely R.F. side of a receiver.

# A FIRE-SCREEN CONE

Here are details for making a loud-speaker unit into a handsome and efficient instrument at the cost of only a few shillings. Excellent reproduction is obtainable and, in its form as a fire-screen, the baffle-board makes quite a handsome article of furniture.

By E. D. SELWAY.

WITH various loud-speaker movements now on the market, and intended for use by the amateur in the construction of complete instruments, instructions are generally supplied for making up either a simple bracket and stand for a free-edge cone speaker, or for mounting the whole in a baffle board.

There is no doubt that the baffle gives best results, but unless forming part of an elaborate and comparatively expensive cabinet, it is apt to be a rather unweirdy and not a very attractive-looking device.

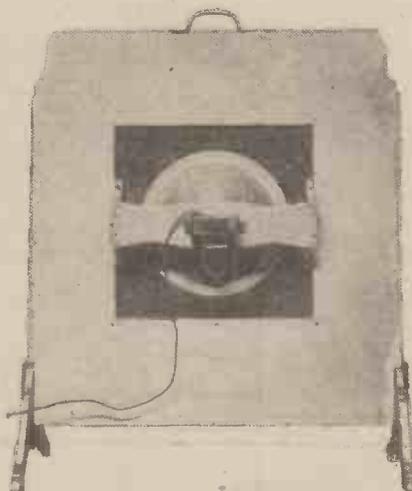
## Exceedingly Cheap

Bearing this in mind, I have produced the design now described. The actual unit used was an Ideal "Blue Spot," but there are several others on the market with which readers are familiar, and which are equally suitable, any slight modification necessary to the supporting bar at back of the screen to suit a different unit being easily made.

This new model is, of course, intended for home construction, and when completed will be found to comprise not only an excellent loud speaker capable of surprisingly good reproduction, but also a very handsome ornament for any room, all obtainable at relatively small cost.

Apart from the cost of the unit, the outlay need not exceed 7s. or 8s., though I venture to say the completed article would ordinarily be priced at £5 5s. or more if bought at a store; so to those whose hobby is "wireless," the few pleasurable evenings devoted to the task of making up this new model will amply repay them.

The necessary drawings have been very carefully made, and full details are given, so that even a novice can understand them; and if the instructions are faithfully followed, the work of producing the completed instrument will prove well within the abilities of any constructor possessing an elementary knowledge of the few simple tools required. Little else than a fretsaw, a screwdriver, and sandpaper for smoothing off the edges of woodwork is needed.



The back of the Fire-Screen Cone, showing the essential simplicity of the arrangement.

A glance at the heading, which is a view of the instrument, shows that it is of novel and very attractive design, and consists of a cone loud speaker mounted in an ornamental baffle board, standing vertically on two bracket-shaped legs, and in general appearance somewhat resembling a fire-screen.

For ease of construction the baffle board consists of two parts; firstly, the main board and supporting legs, and, secondly, a central ornamental raised panel to which the cone and unit are attached, and which is easily fixed to the main board after the unit and cone have first been properly mounted up and fitted together ready for operation.

## Material Required

The following materials should first be obtained, or those of them that you have not already on hand:

1. Piece of five-ply wood,  $\frac{3}{8}$  in. thick, about 2 ft. square (actual size 1 ft. 10 $\frac{1}{2}$  in. by 1 ft. 11 in.), and a further small piece of the same for cross-bar to support unit at back of board.
2. Sufficient three-ply wood, in one or more pieces, from which one 13-in. square and two 12 $\frac{1}{2}$ -in. squares may be cut.
3. Two small sheets "two-sheet thickness" Bristol board, large enough to cut 9 $\frac{1}{2}$  in. and 8 $\frac{1}{2}$  in. diameter (approx.) circles respectively.
4. A piece of chamois leather about 10 $\frac{1}{2}$  in. square.
5. The necessary loud-speaker unit selected.
6. Sundries, consisting of round-headed brass wood-screws, a few sheets fine- and medium-grained sandpaper, liquid glue such as "Croid" or similar, celluloid gold paint, such as "Luc" or similar.

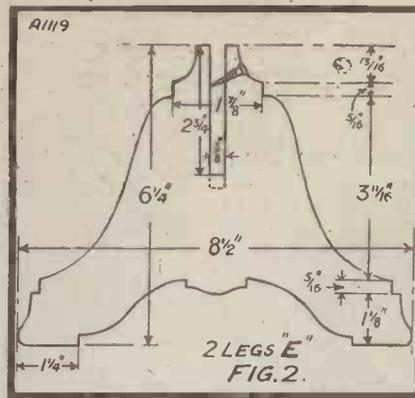
## Ready to Start

Having collected our materials, we are now ready to commence actual operations; but first a word about the drawings and how the patterns

are to be transferred to the wood we have to saw out.

The shapes to which the pieces of wood are to be cut are all drawn out and are also dimensioned. The patterns should be drawn out full size and then transferred to the wood to be cut by pinning the sheet of drawings down on the wood with a few drawing-pins, having first well rubbed over the back of the drawing with a soft lead pencil, or alternatively interposing sheets of typewriting carbon paper face downwards between the drawing and the wood.

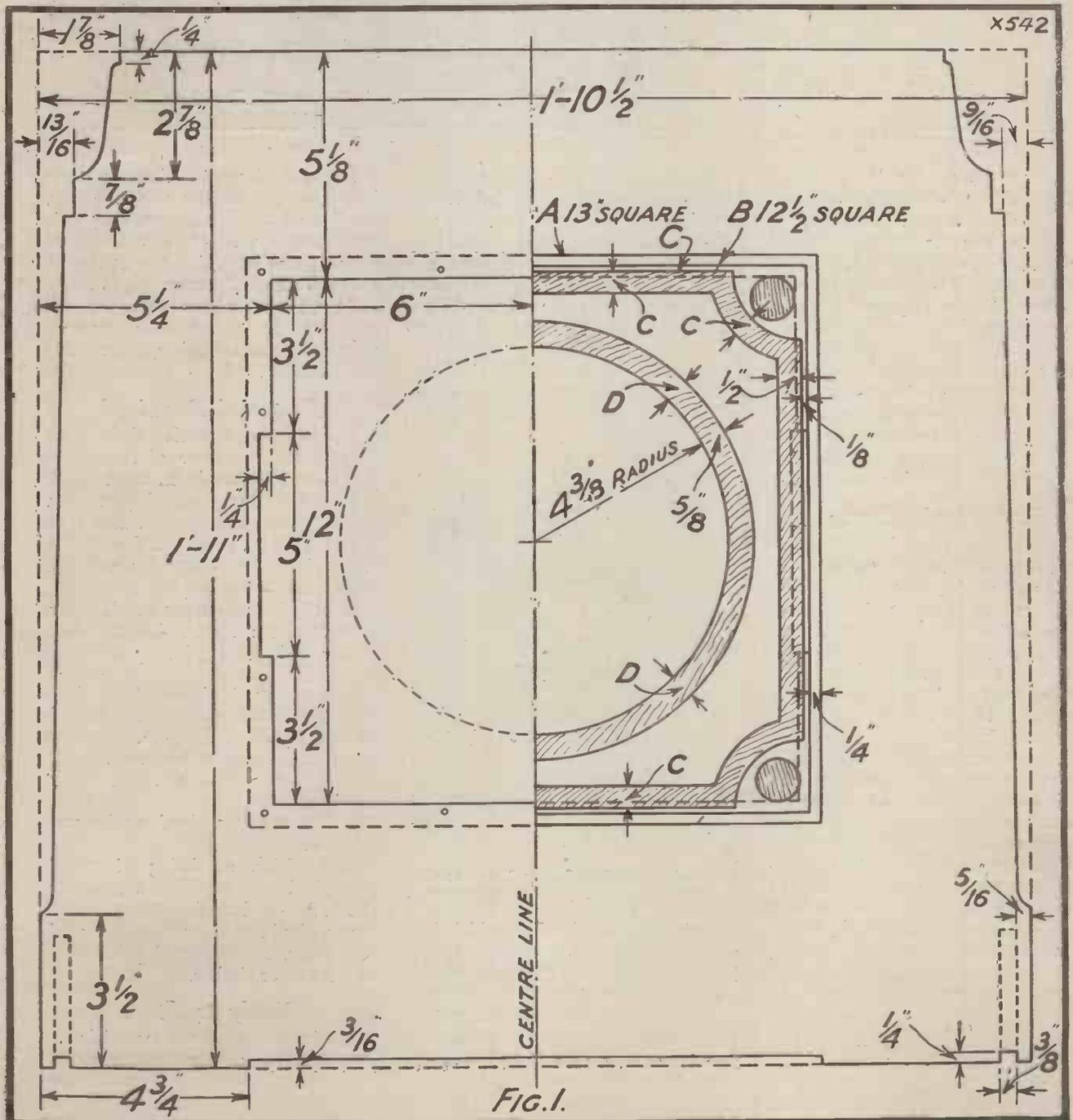
The lines of the drawing should



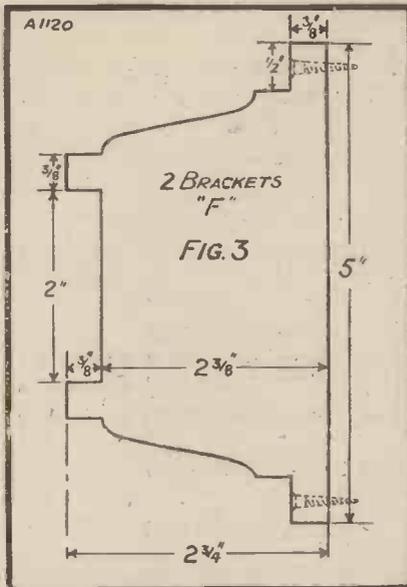
then be traced over with a well-pointed pencil, using a straight-edge where practicable, and taking care to trace the whole of a pattern once (and only once) before lifting the drawing from the wood.

If a little "lining in" is necessary on the wood, do this with pencil before commencing to saw out, as it is much more easy to work accurately with a fret-saw to a well-defined line.

Commence work with the preparation of ornamental centre panel. To avoid confusing the drawing, only one half of this is fully drawn out on the



# Solves the Problem of "Placing" the Loud Speaker



The dimensions for the brackets that support the cross-piece.

Next mark out the panel margin strip with quadrant-shaped corners. This is shown by hatching on Fig. 1 and marked C. The pattern can be transferred as before described, or you may proceed direct to draw out a square with 12½-in. sides on the three-ply wood, drawing a ½-in. margin all round inside the square and then marking out the shaped corners with compasses.

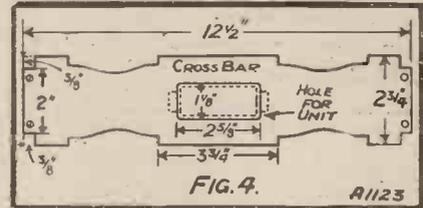
### For the Cone

On the same piece of wood, inside the square, mark out the cone-mounting ring D, Fig. 1, and then proceed to cut out the panel margin and the ring with fretsaw and smooth all edges with sandpaper. Save the centre circular portion cut from the

ring for a temporary use hereafter described. Cut four small circles, Fig. 1; also from three-ply.

### The Main Screen Board

Assuming the glued-up panel formed of squares A and B is now firmly set,



mark out and cut from the centre of it a circle 8½ in. in diameter and smooth up the inner edge as before. Carefully mark on the panel the position of the

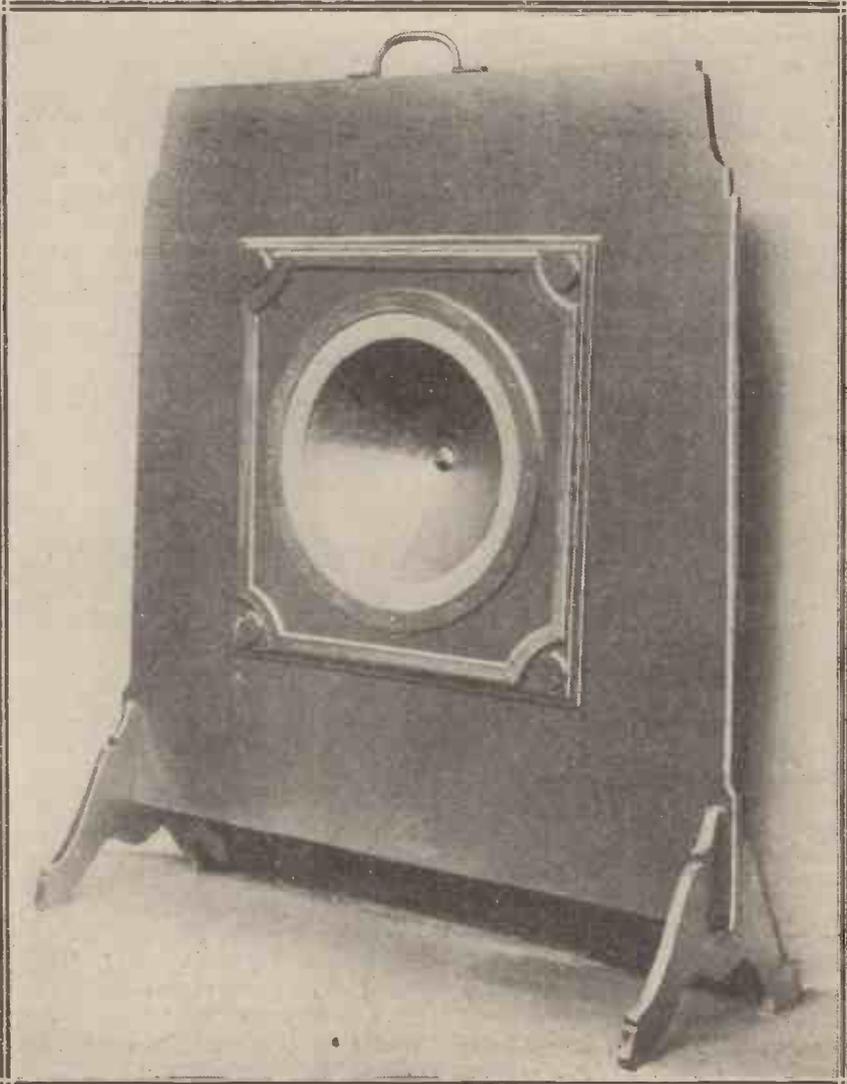
right-hand side of centre line, Fig. 1, but it will be understood that both halves are symmetrical about the centre line.

On three-ply wood mark out a square "A" with 13-in. sides, and a square "B" with 12½-in. sides; cut out these separate squares with fretsaw and smooth off all edges by holding the squares upright and rubbing the edges firmly, lengthwise, on a sheet of sandpaper placed flat on the workbench or table.

### The Centre Panel

Select the most presentable face (i.e. the smoothest and most free from blemish) of the smaller square (B) to face outwards to front of instrument, apply a thin, even coat of liquid glue over the reverse face, and stick this square down on top of square A. Take care that an equal ¼-in. margin of A is left visible all round the edge of B, and if the face grain of B runs, say, right and left, across the instrument, see that you place B on A in such a way that the face grain of A runs to top and bottom.

With the principal grain in the two squares thus crossing at approximately right angles we get a good strong panel not likely to warp when completed. Place the squares thus glued-up on a solid, flat surface and cover with a heavy weight, having first wiped off any surplus glue that exudes under pressure. Leave until following day to set thoroughly.



The completed loud speaker has quite an artistic appearance and can be finished in any desired wood or colouring.

margin strip and of the four small circular "patterns," glue these and the strip margin on to the front face of the panel, wipe off any surplus glue

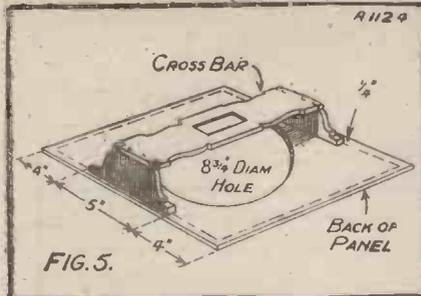


FIG. 5. How the cross-piece and brackets are fitted together.

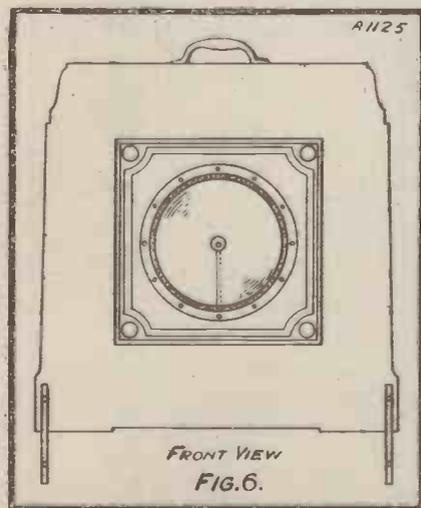
and set aside to dry, placing weights on the work to keep it flat.

Having got so far, we can now give attention to the main screen board. This is to be cut to the shape and sizes shown on Fig. 1, using  $\frac{3}{8}$ -in. plywood, and it will be noted that a 12-in. square with shallow projections from right- and left-hand sides has to be cut out from the middle of it.

### Fixing the Legs

The piece cut out is sufficiently large, with a little judicious spacing out of the patterns, to cut the two legs E, Fig. 2, and the brackets F, Fig. 3.

Prepare these and also the crossbar, Fig. 4, for which a separate piece of  $\frac{3}{8}$ -in. ply is required. The crossbar



Compare this sketch with the photograph on the preceding page.

is for supporting the unit, and has a hole in the middle to accommodate this.

The screw holes marked on patterns of legs, brackets, end of bar and on screen board should all be carefully drilled with a twist drill, and if so done there is no risk of splitting the laminations of the plywood apart.

The legs should next be fixed to the screen, making sure that they stand upright and evenly before glueing and putting in screws at back; and the screen board is completed by fixing to the top of it a brass "sash-pull handle," which will be obtainable at any ironmonger's.

Now assemble the supports for the unit on the back of the ornamental panel. These consist of the two brackets (Fig. 3) and the crossbar, and the position is shown in Fig. 5.

### The Brackets and Crosspiece

Be very careful to get the position of the brackets correct, as this is important for several reasons. When satisfied that you have this right, glue the underside of the brackets and also screw them down to the back of the panel with fairly thin, round-headed brass screws, which must not be so long that they pierce through to the front of panel. Also temporarily screw (but do not glue) the crossbar in place, and do not remove until glue on bottom of brackets is hard.

If your aim is best reproduction and a really professional appearance, for this it will be worth while to follow accurately the description, which, though a little lengthy, ensure first-class results.

Commencing with our two pieces of Bristol board, mark out one as Fig. 10 and one as Fig. 13, and carefully cut with scissors and a sharp penknife accordingly.

To make the bevelled lap joint down the side of cone, place the material on a clean, flat, hard surface. Take an odd strip of the Bristol board which has a straight edge, and with the fingers of one hand hold this strip firmly down on the piece to be bevelled off; keeping it  $\frac{3}{16}$ -in. from the edge, proceed to rub down the exposed edge to be bevelled with a small piece of fine-grained sandpaper.

### Preparing the Cone

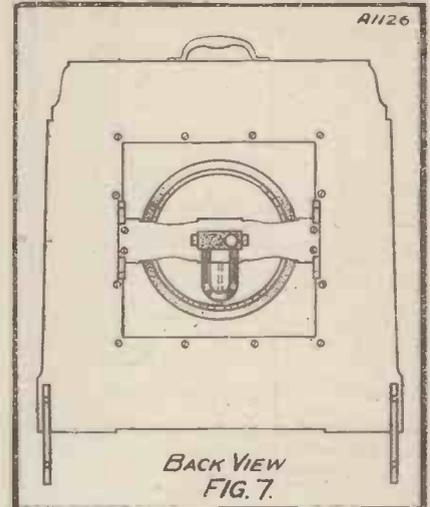
After a time it will be necessary to move the loose strip back just a shade farther from the edge, and you can judge how evenly you are effecting the bevelling by holding the work up for the light to shine through it.

Do not carry the process too far, of course; that is to say, be careful not to rub so vigorously that the line of the actual edge is destroyed. Having treated one edge next the V-shaped wedge in this way, turn the Bristol board over and similarly treat the corresponding opposite edge of the V, but on the reverse surface.

When applying adhesive to make the joint, do not forget that it is to

one of these surfaces that have been actually rubbed down with the sandpaper that you apply it. Fig. 11 shows a much-enlarged view of the bevelled joint, in section, to help explain what is intended.

It will facilitate sticking the joint if the shaped piece, Fig. 10, is now rolled up somewhat lightly in the



Note that the cross-piece is sunk into the brackets for strengthening.

form of a dunce's cap, being careful not to dent or crease the material in any way, but retaining it in that position for a few minutes, when it will have assumed a conical "set" or shape. The actual process of sticking the edges neatly and accurately together without a tendency for them to spring apart whilst this is being done then becomes easier.

### Sticking the Paper

The best adhesive is a fairly thick, not too moist, paste, and "photo mountant" is what I advise. This should be quickly and evenly applied, but rather sparingly, to one of the



# Anyone Can Make this Loud Speaker with Few Tools

bevelled edges for the width of the lap, and as quickly as possible (so that the moistened edge does not have time to expand and buckle) the other edge should be stuck down on to it, the joint then being rubbed down with the bone handle of a knife or the like, any surplus paste that exudes being cleaned off.

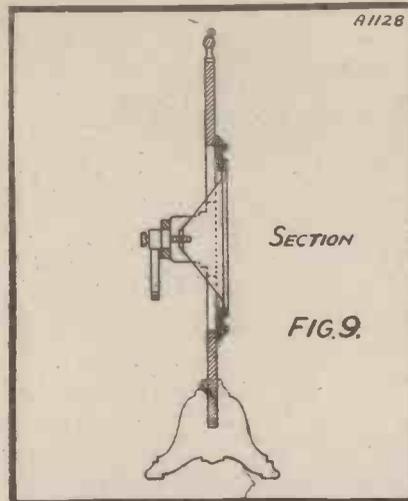
As soon as this is completed, set it aside to dry perfectly hard, placing a narrow, weighted strip of wood over the newly-made joint and putting it on a clean, flat surface so that the joint remains flat while drying out.

### Reinforcing the Rim

When quite dry, proceed to make a series of scissors' cuts at even intervals of about  $\frac{1}{4}$  in. all round the edge of the cone, continuing the cuts up to the marginal line drawn on the material.

Then carefully bend back the small flaps, thus forming a serrated rim round the base of the cone. Having done this, place the cone on a flat surface to see if it now sits down flat and evenly all round, and ease and

The second piece of Bristol board, Fig. 13, is used for reinforcing the rim of the cone, and in the first instance is cut to a circle only, i.e. the



A side elevation showing the methods of support.

centre portion is not yet to be removed, and it merely remains as a flat disc at this stage.

Offer the cone in position over this disc as in Fig. 12, and if the dimensions have been accurately followed it will be found to exactly fit the disc, which should now be given a thin coat of adhesive for a width of about  $\frac{3}{8}$  in. round the outer edge.

Place the cone on top of this, adjusted to proper position, and rub down the serrations of the rim, seeing that all are firmly stuck down to the disc. When you are satisfied that this is so, set the cone aside to dry, and place a few small weights at intervals on the rim to keep it flat whilst drying.

### The Leather Surround

When the cone is dry it has next to be mounted on the leather surround and the wood ring "D," and the order of procedure is as follows:

Take the piece of chamois leather, spread out evenly, and pin down the edges on a flat piece of board with a few drawing-pins, using just sufficient tension only to ensure that there are no creases or folds left.

Take the three-ply ring "D," Fig. 1, and, having first drilled the necessary small holes for  $\frac{1}{4}$ -in. round-headed brass fixing screws and smoothed the whole off nicely with fine sandpaper, apply a thin, even coat of liquid glue to one face and press the

ring down in place on the chamois leather. Apply a few weights to keep flat and leave to dry.

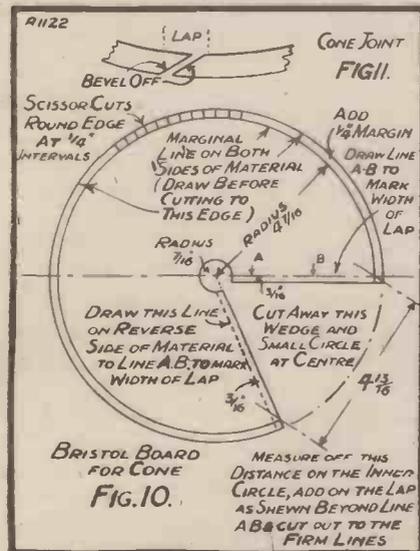
When dry trim off the surplus leather outside the ring, cutting close up to the edge of the wood with scissors; then turn over and place on a flat surface so that the leather is now uppermost, and temporarily replace the centre piece of three-ply (cut out to make the ring) in its original position so that the middle, loose portion of the leather now has a temporary flat support at the same level as the ring.

### The Final Operations

Offer the cone, with its disc-shaped base in position, on top of the leather so that an equal margin of the leather is left visible all round the base of the cone, and then make a few marks on the leather with a soft pencil so that you can be sure of replacing the cone in that position.

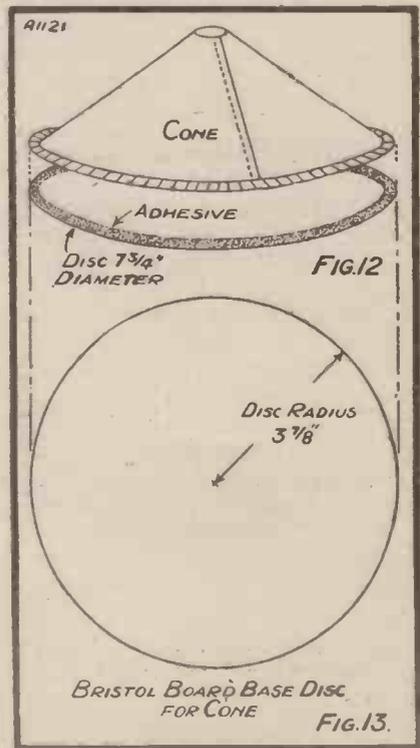
Now apply a thin coat of glue to the underside of the disc base of cone, but only for a width of about  $\frac{1}{2}$  in. all round the margin; then press the cone down on the leather again and once more apply a few weights to the rim to keep flat whilst drying, aided by an additional one which you may balance on the apex.

(Continued on page 647)



smooth down any slight irregularities that are apparent.

Pay particular attention to the small segment of the rim that comes at the lap joint, as if the jointing causes the least extra thickness here a slight bulge in the cone is likely to result. But this tendency can be overcome by the use of the fine sandpaper on the underside of the rim at this position, making this part of our serrated rim perfectly level with adjacent parts.



Details of the paper cone.

# MY BROADCASTING DIARY



*Under this heading month by month our Broadcasting Correspondent will record news of the progress of the British Broadcasting Corporation, and will comment on the policies in force at B.B.C. headquarters.*

## **Baird Television Begins**

**F**OLLOWING a last-minute change, the Baird Company decided to begin the experimental transmissions from 2LO with the "straight stuff," and not with telegraphy and teletextography, as had been planned. The message from the President of the Board of Trade, Mr. W. Graham, M.P., was a particularly happy inauguration. Mr. Graham is obviously a television "fan." He said he looked to its development into a great new industry helping to solve the unemployment problem.

There seems to me to be a good deal of "talk" in the time reserved for Baird transmissions. No doubt this is necessary in the early stages, when there are no receivers in the hands of listeners. There is the same sort of "lag" in the supply of "televisors" as there was in the case of Fultograph instruments when that process came on the air through the B.B.C. last year.

## **Mrs. Philip Snowden to the Fore**

Ever since her return from the Hague, Mrs. Philip Snowden has devoted herself unremittingly to broadcasting. The luncheon given by the R.M.A. to the Press was the first big public occasion on which Mrs. Snowden has spoken for the B.B.C. Although perhaps not in her best form, she created an excellent impression of friendliness and desire for co-operation.

There was only one slip, and, of course, some newspapers were quick to take this up. Mrs. Snowden put cultural activity as the first of the objectives of the Corporation. She added entertainment, but the damage had been done. People who dislike talks at once concluded that the Governors stood for that sort of thing exclusively. This is not the case, but Mrs. Snowden should not lose any opportunity of putting the matter right. I would like to hear her on the microphone now and then. She is, after all, an accomplished public speaker.

## **The Position in Birmingham**

The decision of Savoy Hill to "axe" the Birmingham orchestra that has "made" 5 GB in the past two years has aroused widespread and serious opposition throughout

the Midlands. Large-scale petitions are being signed. Public meetings under mayoral auspices have been held in most of the larger centres. The Press is united in its determination to secure a reversal of the decision. Members of Parliament have been stirred out of their recess enjoyments.

The agitation has reached such proportions that, to avoid difficulties in Parliament, the Governors of the B.B.C. are now considering possible modifications. The storm has already produced a much more amenable attitude at Savoy Hill. The staff there have gone so far as to suggest that of the subsidy which the B.B.C. will give to the Birmingham City Orchestra, some part may be devoted to paying for the continued employment of some of the instrumentalists dismissed from the B.B.C. orchestra.

Another move is to arrange for all members of the orchestra who so desire to have free auditions for the National Orchestra in London. But these half-measures will not satisfy local opinion. My own view is that the B.B.C. will be forced to keep on about twenty instrumentalists, and that the remaining seven will be accepted by the City orchestra. Better this than a serious

## **PROGRAMMES FOR PENSIONERS**



The Commissioner of Works recently made an appeal for sets for Chelsea Pensioners, some of whom are here shown listening-in.

## All the Latest News for Listeners

Parliamentary crisis involving a public inquiry into the whole broadcasting service. But the people at Savoy Hill must begin to recognise that they cannot go on forever in contemptuous disregard of public opinion.

### Scottish Broadcasting Headquarters

I hear Scottish broadcasting headquarters will shortly move from Glasgow to Edinburgh. This is a move which will be warmly welcomed everywhere in Scotland, except at Glasgow. It has been felt for a long time that the organisation of the B.B.C. north of the Tweed was anomalous, in that it was hardly represented in the real capital of the country. Mr. Cleghorn Thomson has now completed his demobilisation of staff, and the B.B.C. in Scotland can be considered to be on a basis of permanent establish-

### BERLIN'S INTERVAL SIGNAL



Berlin's automatic interval signal is controlled by clockwork enclosed in the lower box. The microphone used is visible through the glass window in the smaller box.

ment. While Edinburgh is to be the new headquarters of Scots broadcasting, Glasgow will remain an important, if subsidiary, centre. The regional transmitter will be half-way between the two cities.

### Mush Area Difficulties

Last winter the B.B.C. found it possible to transmit some "group" programmes on the national common wave. Thus while normally all stations on the common wave would be taking the London programme, occasionally, in the afternoons before dark, it is possible for the northern group stations to put out their own programme different

from the Scottish or Welsh group programmes, although all are working the same wave.

From the technical point of view, results at best were unsatisfactory; but signals did get through in a recognisable form, and local opinion overlooked the technical deficiency because of local interest. Will the same sort of thing be possible this winter when the nights lengthen out? It seems more than doubtful, particularly after October 31st, when Newcastle joins the common wave.

Already acute trouble is reported from Edinburgh when Bournemouth has attempted to put on a different programme on the same wave. I should think that the B.B.C. will find it necessary to give up all group programmes for relay stations and complete the centralisation process in this particular. If this is done, then the argument of these who would wash-out the regional centres is considerably strengthened.

### Soccer Broadcast Plans

The state of war between the B.B.C. and the Football Association continues. But, despite this, the B.B.C. has been able to do some business with individual clubs, and there is a respectable list of features already booked up. But deadlock persists in connection with both the Semi-Finals and the Cup Final.

The spokesmen of the F.A. are as adamant as ever. In fact, it is stated that they will see to it this year that the B.B.C. is effectually prevented from doing the commentary as it did last year; that is, by relays of observers leaving the ground every few minutes and broadcasting through the telephone in a nearby flat. Great secrecy is being maintained about the plans and counter-plans, but it is known that feeling runs so high that violence is more than a remote possibility. The B.B.C. is credited with having something rather startling up its sleeve. This is all very interesting and diverting, but it does seem to me that a State Corporation such as the B.B.C. should not let undignified proceedings of this kind go too far.

### No Physical Jerks for the B.B.C.

The B.B.C. has once again turned down the broadcasting of physical jerks. The main argument is that the average Britisher is different from the average foreigner in that he does not care either to be dragooned into taking exercise or to feel that thousands of others are taking precisely the same exercises at the same time. Then the Ministry of Health will not give its blessing to any standardised system of exercises for all ages and classes of the community. I am disposed to think that the B.B.C. is right, if not on these grounds, at least because the cost of introducing the new series would be out of all proportion to its programme value.

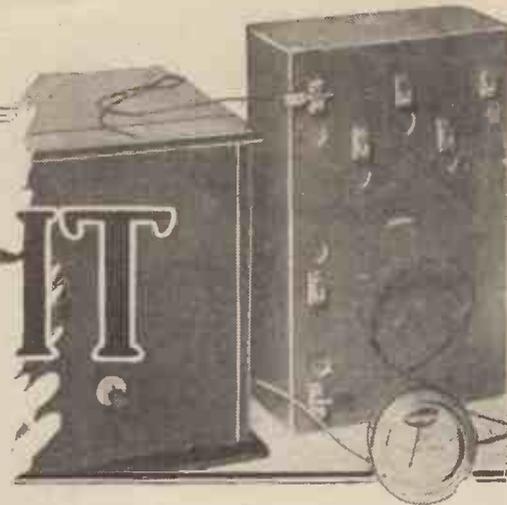
### Reorganisation at Savoy Hill

It is perhaps only natural that in a comparatively new business such as broadcasting there should be almost continuous staff adjustment, with an occasional "general post." Apparently one of the latter is about to take place. I hear a lot of officials are to be changed round during November. Among those likely to be affected are the following: Mr. Rose-Troup (Education Executive), Mr. Stobart (Education Director), Miss Matheson (Talks Director), Mr. Siepman (Adult Education Chief), and Messrs. Suthery and Dailey (Programme Organisation).

# Saving Your H.T.

A helpful article for the listener who is not getting full value from his H.T. battery.

By P. R. BIRD.



EVERY listener who uses the ordinary type of H.T.B. for his high-tension supply becomes familiar after a time with the symptoms of a run-down battery. The quality of reception falls off, there is a tendency to howl, and a test with a voltmeter will show that the voltage has dropped.

If the battery in question has given good long service, nobody objects to the cost of replacement, but sometimes batteries seem to run down much faster than they should. What is the remedy in such cases? The first thing to do is to make sure that you are using a battery of the correct size or capacity for the set.

## Current and Capacity

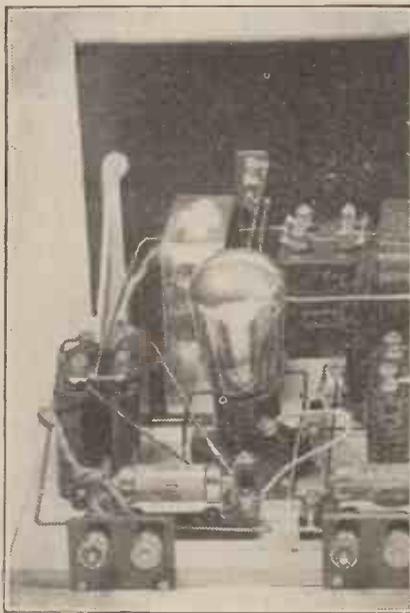
The ordinary small H.T. battery is capable of supplying about 5 milliamperes. If you look at the valve-makers' figures for the plate current required by the types you are using, you will find that the detector valve is taking, say, 1 milliamperes, and a power valve, at the most, 3 or 4 milliamperes. So two valves can be supplied from such a battery, but it is generally being overworked when called upon to supply the current for three valves. (This is particularly true if the H.F. valve is of the screened-grid type, or if the L.F. valve is of the pentode or super-power type.)

## The Battery to Buy

If the total anode current of your receiver as measured by a milliammeter in the H.T. negative lead, or as calculated from the valve-maker's curves, exceeds 5 milliamps, you require something more than the ordinary small H.T. battery; and it will be cheaper to buy a larger capacity battery (sometimes called double capacity, or power battery), for these types are capable of supplying about

twice as much current as the ordinary small battery. The important point to remember is that if a battery is called upon to give more current than it was designed to give, it deteriorates very rapidly indeed.

One very important factor in economical H.T. maintenance is the provision of correct grid bias. To a very great extent the steady drain upon the battery is dependent upon



A pentode used in the last stage of a powerful receiver. Instead of long loud-speaker leads an output filter (or output transformer) should be employed in multi-valve sets.

the grid-bias voltage being applied, particularly in the case of L.F. and power valves. If super-power or pentode valves are being run it is absolutely vital that the full negative grid bias recommended by the makers for the H.T. employed should be impressed upon the grid, or otherwise a heavy and totally unnecessary

drain is being imposed upon the battery all the time the set is in use.

Even when a suitable type of H.T. battery has been chosen and the valves are given their correct negative grid bias, it sometimes happens that the H.T. battery runs down sooner than it should. In most instances of this kind the trouble is found to be due to the fact that long loud-speaker leads are being used, and that the insulation of these has become defective, so that a drain is taking place in the form of leakage.

## Out-of-Sight Wiring

If the loud-speaker leads are laid under the floor or behind boards, to supply radio to the other rooms, it may be impossible to check the insulation of the various leads and, fortunately, it is not necessary to do so. The correct procedure in such cases is to employ a loud-speaker filter unit, which, by the insertion of a large fixed condenser, ensures that all the H.T. current is confined to the set itself, and only the speech and music currents (which do not give rise to H.T. leakage) are run over the long extension leads to other rooms.

## Lengthening the Life

Such filter units can be purchased complete or made up and fitted to the set, and although the necessary L.F. choke and condenser cost about twenty shillings, this is money very well expended. Not only does it eliminate the loss of H.T. current, but it prevents all possibility of accidents due to shorting of the leads, and also, by relieving it of the necessity of carrying unnecessary current, prolongs the life of your loud speaker.

If the above recommendations were carried into effect, 95 per cent of the H.T. battery renewal troubles would disappear altogether.

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**I**N the strenuous period during which I have been privileged to relate—and you thrice happy to read—so many moving instances of Life in relation to Radio, I have drawn several pictures illustrative of how radio, coming into a man's life (*pinched that from a "talkie"*)—er—life can raise him from the uttermost



... He lay half-prone, in the posture which the playful dog assumes ...

depths, even of share-pushing, to a fine and delicate comprehension of all that is—er—best and—er—best, so to speak, in—er—something better. You know what I mean.

Wiping our brow after that effort I proceed to advise you that I have purposely withheld from you the best of the bunch, the very flower of the flock, the *crème de al menthe*, because it was too good to be given credence by an intelligent but sceptical public. Besides, the bloke's name was Rushbun; hardly a cognomen to moralise about! Absalom Rushbun!

### I Met Swilcher

However, as I gave away the whole yarn to Swilcher the other night, I hasten into print before he has time to adopt it as his own child.

I met Swilcher outside Olympia, cursing the L.G.O.C. for not sending along an empty bus. I helped him out with a few new good words which

I had recently acquired from a B.B.C. announcer, and then we agreed to share a taxi. As we dillied and dallied in that circumlocutory vehicle we exchanged yarns. Swilcher told me a beauty about a man he knew who invented a thing for destroying "atmospherics." One day he reversed its action, put the bitters in before the gin, I suppose, with the result that it brought on a thunderstorm and three cows were struck by lightning.

After that I decided to trot out Absalom. Last Easter (I said), I descended upon the town of Lewes, one of those places which defy the law of gravity by clinging to a slope of 85 degrees. Having mellowed the organ of digestion by the judicious introduction of malted medicine, I walked to the summit of Firlr Beacon and sat down to find out what was making my knees creak. I decided that I had been too sparing with the malt. But that was past mending. They could do with a—hem—dispensary on Firlr.

### A Funny Little Man

As I lay a-thinking, a-thinking, there came into view from behind a furze bush a funny little man who had apparently dropped some article of value. He was bent double, and as he moved slowly along he glared at the ground, muttering the while, his face betokening the intensest pleasure. Presently he stopped and remained with his hands on his knees. Then he knelt down and fetched his nose to within six inches of the turf. Next, he lay half-prone, in somewhat the same posture which the playful dog assumes—forepaws outstretched and stern raised wagfully aloft. Only I and an amazed gull witnessed this act of adoration.

I strolled over and stood looking down upon the sacred spot. There was a bare patch on the turf, a couple of burnt matches, and several ants briskly moving about. They appeared to be asking each other the time and saying, "Sorry, my watch has stopped." And there was a sort of beetly brute crawling around, all hinges correct and working well. If you ask me I should say he would be six-cylinder. But I don't swear to that.

### "Try Me in Aztec"

Becoming aware of the shadow which my form cast over his little menagerie, the funny little man looked up and said excitedly, "You see it! You see it, sir?"

"Which is *it*? The big ant which has just described a rhomboid in the dust? Or that second-hand wax vesta?"

"No-no! No-no! *Phynchophora Bloggsii*."

"I am sorry," I said. "I don't come from Wales. Try me in Aztec."

He beamed on me most pleasantly.

"Ah, of course. I should have known. *Do you see that coleopterum?*"

"Since you put it like that," I replied, "I will be equally frank. *I do not*. Probably that beetle has eaten it."

"On the contrary, I refer to that—beetle, as you call it."

"Well, what do you call it, anyway?"

"*Phynchophora Bloggsii*."

"Just as you please. What of it?"

He became impatient.

"Chut!" he said, "look again."

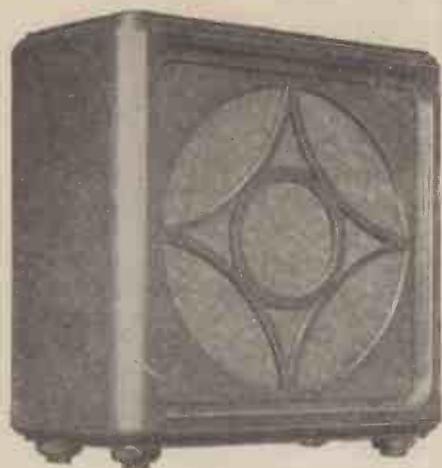
I did. The measly beggar was still churning along on the same gear



... Beaming upon each other most beetly ...

Probably his hinges had seized. "Is this one of those filthy bugs that cock up their tails when alarmed, or does it roll up into a ball and make a noise like a bit of clay?"

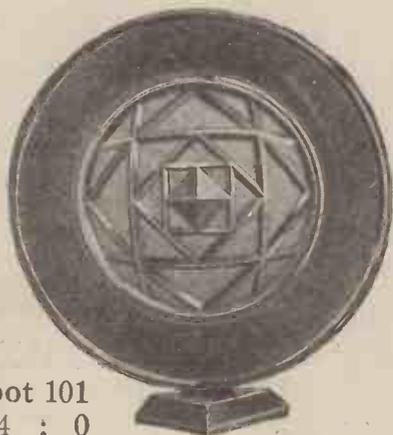
"My dear sir, do you know so little of the coleoptera that you fail to remark the extraordinary variations of this fellow's antenna? Did you



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## Radio Completely Transforms the Old Fossil

ever see *Bloggsii Alpha* with an abnormal antenna?"

"No, but I have seen Cookson with one."

"Cookson? Never met the species."

"Ah! They're very common in my locality," I said.

"In-deed! But this fellow is unique. Note the stratificated carapace!"

"Absolutely!"

"And the anterior maxillipede."

"Baby, you said it!"

"Baby? Said what?"

"What you said."

"Ah! And the ankylosed ischiopodite!"

"I saw that immediately."

"It proves Rushbun's Theory up to the hilt."

"With a rush! Congrats!"

"My dear sir, you are too generous."

"Not at all. That beetle is the gooseberry's clean shave."

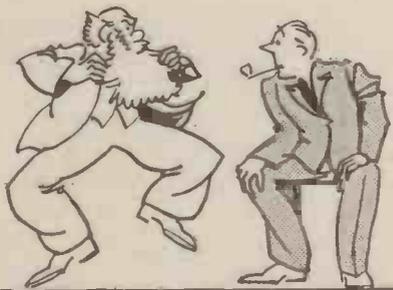
### "Beaming Most Beetly"

Upon reaching this point we sat back and lit our pipes, beaming upon each other most beetly. I told him that I knew a specimen with one antenna horizontal and the other done up in a coil, with its organ of reception totally enclosed and with its prime mover on top instead of underneath. That it was found at Ealing and was called Andrew Fagg.

"Ah! Allied to Adephega, doubtless," he said, nodding his head.

"Probably," I replied. "He is a fish-curer with a radio receiver."

He choked on that, but came up like a sport.



... Passion, resolution, gleamed in his eyes...

"He, he! Modern humour somewhat subtle. See Spencer's *Evolution of the Heterogeneous*. But we must really see more of each other, Mister—er—"

"Plain Jones."

"And I'll get you to tell me more

of this new craze. I'm afraid—that is—my *menage* is—fact is, I'm somewhat of a recluse. Never read the papers. Except beetle things you wouldn't have heard of. My name is Rushbun. Absalom Rushbun. Shrewsbury and Cambridge. My card!"

"I'm Jones. Barclay and Perkins."

"Hrm! Probably Australian colleges."

### I Call at Rushbin's

It seemed a shame to palter with the old mummy any longer, so I gave him a light, led him back to friend *Bloggsii*, and hastened off to the nearest dispensary to save my life again.

Some weeks later (I said to Swilcher) I chanced it and called at Rushbun's place with a portable. You never saw such a den—one ghastly mass of beetles, every bug in creation. A toothless old housekeeper gibbered at me, and I followed her through a labyrinth of beetle-covered passages till old Rushbun heard us and came to meet me.

"Well, well! So here you are, *Jonesii*. Very kind of you. P-r-mm! Sit down. Mind that *Atalantoposii Cockalorum*. They bite sometimes. Now, now, have you brought your microscope—I should say gramophone? Tut! What's that? You will now give an imitation of a blue-faced ape laughing? Oh, yes—it's your machine speaking. What—"

"How do you like this?" I said, turning on a talk about cheese-mites.

He listened for a minute.

"Never cared for *Crawlycreeperum Kicksii*. No antennæ. To speak of."

Well, I ran him round the stations, picking out as many talks as I could, and drew nothing but blanks. He lingered lovingly over one on "Insects and their relations," but it was not beetle night at Belfast, and he began to count the hinges of a green horror which he said lived in slaughterhouses in Mexico.

### The False Theory

Presently I let him try his hand at tuning and—you'll say I lie—he scored beetle at the first shot and sat drinking in the sublime words: "The ankylosed dorsal thingummy clearly marks the cleavage between the brachiote group and its whatsits-name."

Suddenly he sprang to his feet, a man transformed. Passion, resolution, gleamed in his eyes.

"After twenty years! Still at it! I'll stand it no more! I—I'll nail the lie to the—er—I'll throw the false—"



... Uncle Abie, the announcer with the perfect S.O.S. manner...

hood in his—er— Anyway, I'll stop his lighthearted corruption of the youth of this country. The—"

"Hul-lo!" I said. "Why this unbeetlelike resolution? He was only saying that the third leg on the left past the cloak-room was a vestige of the *Periostylutii*. I quite agree."

"That's the lie. I denied Colter's 'Theory of Vestigial Digits' in 1889, and imagined I had killed it. This time I'll explode it and scatter the dust. That's Colter himself. Gimme my hat."

### The Fossil is Transformed

"No you will not. You will have a shave and get a new rig-out. I'm seeing this through myself."

A shave took twenty years off him. I got him a pair of *pince-nez* and some gloves and a hanky. You'd never believe it was the same man (I said to Swilcher)—he looked like a throat specialist about to flick a tonsil out. The feel of a good hat seemed to put new soul into him, and he stamped about, burning to explode Colter.

And Colter got it in the neck. Old Absalom fairly walloped his beastly theory in a series of talks. The listening public just howled for more.

Now! Where is Absalom to-day? That fossil which radio animated and recreated into the likeness of a man? Not lecturing on our old pal *Bloggsii*. Not scattering the dust of Colter's wicked theory.

Have you ever heard of Uncle Abie, "the announcer with the perfect S.O.S. manner"? Everyone has. That's Mr. Rushbun. The B.B.C. wouldn't let him go (I said to Swilcher as he paid for the taxi).

# DO YOU REMEMBER?

Number  
One!



"Sorry! Sold out"—The same story from every newsagent. "Sold every copy first thing this morning." You couldn't get a copy for love nor money. Such was the demand for the first issue of the B.B.C.'s "own" book. Such was the hold that "wireless" had already when "number one" Radio Times was published—September 28th, 1923. Six years ago! Early days in radio—but not too early for T.C.C. Condensers. They had already been used in radio gear years before—indeed they were cradled in the industry. T.C.C. was the standard condenser then—it's the standard condenser now. For safety's sake specify T.C.C. always.

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J. Bennett

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Foundry Work  
Heat Engines  
Heating, Ventilating  
and Lighting  
Internal Combustion  
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Marine Eng., B.O.T.  
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Matriculation  
Metallurgy  
Motor Engineering

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*New R.I. Catalogue—Celestion Loud Speakers—“Colourware”—Ediswan Radio Apparatus—A Loud Speaker—Electrad Super “Tonatrol”—An Attractive “Lewcos” Set, etc.*

**New R.I. Catalogue**

**T**HE new R.I. catalogue is an excellently produced publication. In it there are full details of the complete three-valve screened-grid, all-electric receiver, which is of a unique design, in that it uses the loud-speaker leads as an aerial. The remaining pages deal with a fine range of R.I. productions.

**Celestion Loud Speakers**

The most remarkable thing about Celestion loud speakers is their consistency of performance. We recently had a C.12 on test and found its response, for all practical purposes, identical with that of another C.12 that we examined some months ago. Curiously enough, however, it was not until some few weeks back that we had a C.14 on the bench.

This is one of the larger Celestions, and, in common with all the other models, its price has recently been reduced. It is contained within a handsome cabinet, the appearance of which will be gathered from the accom-

panying photograph. The finish imparted to the woodwork is brilliant, and it is a finish of a durable character and not one that is very easily lost. Almost any kind of wood can be faked up with a glossy surface for show-room purposes, but it needs good wood and conscientious craftsmanship to get the kind of finish that these Celestion loud speakers carry.

And it is pleasing to note that the virtues of a Celestion extend further

Manufacturers and traders are invited to submit for test purposes radio sets, components and accessories to the “Modern Wireless” Test Room at Tallis House, Tallis Street, London, E.C.4. Under the personal supervision of the Technical Editor all tests and examinations are carried out with the strictest impartiality. Readers can accept the Test Room reports published monthly under the above heading as reliable guides as to the merits and demerits of the various modern productions of the radio industry.

than merely that of appearance. They are undoubtedly of a high-class character. The C.14, for instance, has a wide range of even response, and it goes down much lower than most cones. Additionally, it handles the upper range brilliantly and does not cut off before reaching the harmonics, as do too many other loud speakers.

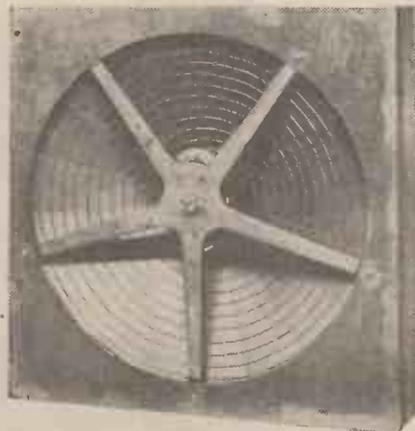
By the way, we have had some of the new Celestion Shell-Case loud speakers on test. These are complete loud speakers except that they are not provided with polished cabinets. They are built into wooden shells and can, of course, operate efficiently just as they are. They have been produced for the home constructor to embody

in his own case or cabinet. They are, for instance, just the instruments you want for building into radio-gramophone outfits, or transportable sets. They are, of course, thoroughbred Celestions and give Celestion results, and the most critical of constructors could hardly ask for more than that.

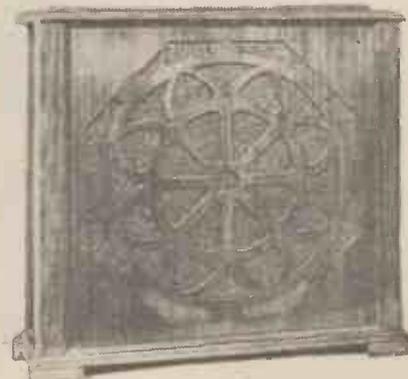
**“Colourware”**

Colourware, a sample of which was recently sent us by Colourware, Ltd., is stated to be a new synthetic material principally derived from coal-tar products, and not a cellulose or casein substance. Among its many advantages are that it will not shrink, warp or twist, and that it is easy to work. It has as good insulating qualities as ebonite. It can be produced in practically any colour and with graining and marking effects.

It is excellent for radio panel purposes, and we certainly agree with the makers in their claim that it adds a touch of elegance to a wireless set. It provides a pleasing break-away from conventional materials for this purpose, and, as is indicated

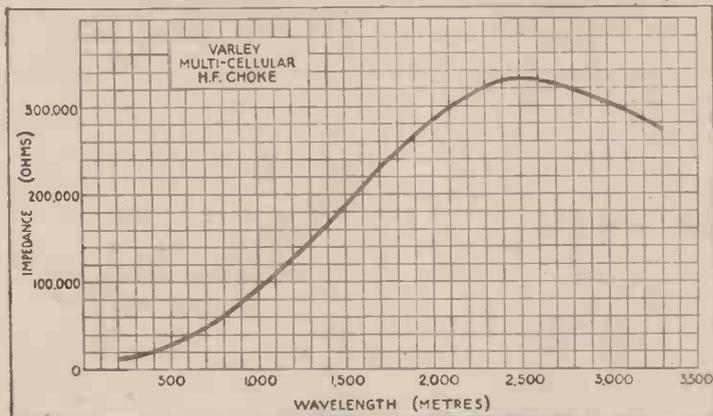


One of the Celestion Shell-Case models.



The handsome and efficient Celestion C.14.

# NO PEAKS IN THE VARLEY CURVE



Look at the impedance frequency curve of practically any other H.F. Choke. What do you see?—a series of small peaks pointing to the presence of minor resonances.

This means that, suitable as they may be for use in the anode circuit of a reacting detector valve, they cannot be considered for a parallel feed circuit.

Not so the VARLEY H.F. Choke. A glance at the curve will show that, whilst resonance occurs at 2,500 metres, it is entirely free from subsidiary resonance. And the resonant frequency is well outside normal broadcast wavelengths so that self-oscillation is impossible.

This H.F. Choke has VARLEY quality; it is a component with all the Varley research and painstaking workmanship behind it. Satisfaction is assured when you specify Varley—the best H.F. Choke on the British Market for choking efficiently up to 4,000 metres.

MULTI-CELLULAR 9/6  
H.F. CHOKE



above, it has definite advantages over ebonite and other such materials.

### Ediswan Radio Apparatus

We recently received a copy of the first radio catalogue produced in the name of Ediswan, covering the products of the B.T.-H. Co., the Metro-Vick Supplies, and the Edison-Swan Electric Co., Ltd. It deals with loud speakers and other sound-reproducing equipment, and covers, in an interesting manner, output transformer ratios for moving-coil speakers. There is a chart and easy formula for the amateur's guidance.

### A Loud-Speaker Unit

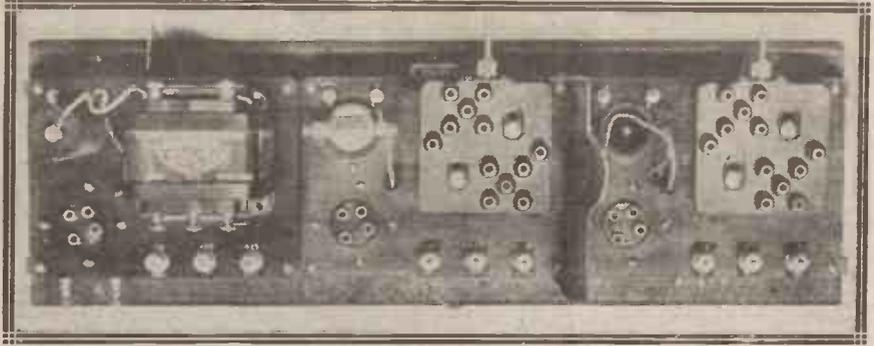
We have recently had the opportunity of examining and testing one of the new Wates' Star Duplex loud-speaker units, a product of the Shaftesbury Radio Co. In design, it assumes a form that is a breakaway from the conventional. There are two large magnets having laminated pole pieces. There are four bobbins, and the armature reed is placed in a well-concentrated magnetic field.

The position of the magnets on the armature can be varied by means of two large milled screws. The unit is built on robust lines and is a sound engineering job. It is very different from those rather obsolescent types of loud-speaker units which are nothing more or less than telephone receiver earpieces having suitable trimmings.

We mounted the Wates Star Duplex loud-speaker unit in a chassis carrying a semi-free-edge diaphragm. A baffle board was fitted. The reproduction was undoubtedly first-class,

the small inputs, such as those representative of the average two-valve set, with a general effect equal in quality to that when the input was from a four- or five-valve set.

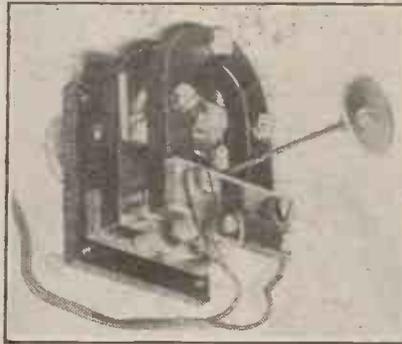
an indicating arrow engraved on it. Its movement is wonderfully smooth and its electrical action perfect. In fact, it is one of the most satisfactory components of its kind we have



A "bird's-eye" view of the excellent Lewcos set chassis.

We should certainly advise loud-speaker constructors to keep this unit well in mind when considering their next purchases.

examined, and we can thoroughly recommend it to those constructors who may be waiting for just such a component.



The Star Duplex loud-speaker unit.

### "Lewcos" Three-Valve Kit Assembly

The chassis consists of three units, namely, H.F., detector, and L.F., the components for each being mounted and wired. The usual terminals for batteries, L.S., etc., are provided on the back edge, while in addition a number of terminals are mounted on the front edge of the chassis so that connections can be taken very easily to condensers when mounted on a panel; indeed, it is hardly an exaggeration to say that a complete receiver can be constructed from this chassis in about fifteen minutes.

The circuit comprises screened-grid H.F., detector and L.F., with option of power valve or pentode, as desired.

The coils consist of the well-known Lewcos binocular type, namely:

	235/550 m.	1,000/2,000 m.
Aerial coil	BAC5	BAC20
Screened-grid H.F. transformers:	BSG5	BSG20

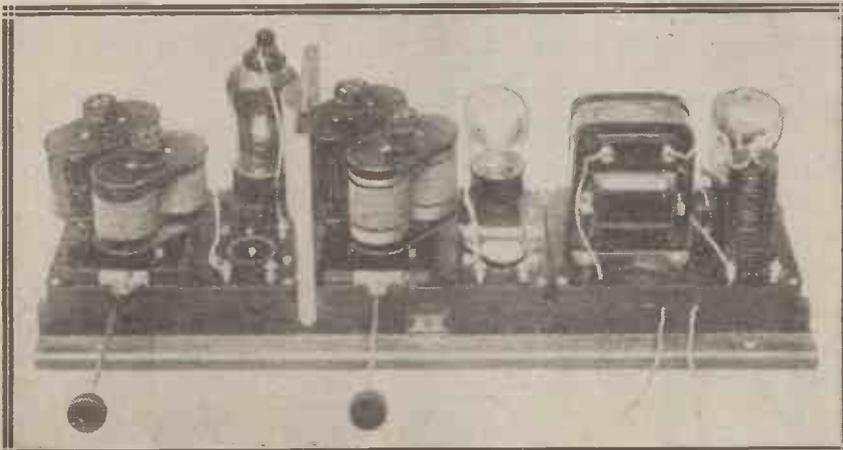
The coils for both wave-bands are mounted side by side on a dual six-pin base, which is operated by a control knob from the panel.

There are several novel features incorporated on the chassis which permit the use of screened-grid and pentode valves of the usual type or, alternatively, the recently developed mains valves with indirectly-heated filaments.

The price of the three-valve kit assembly, including coils, is £7 retail (valves extra).

The foregoing is a description in their own words of the latest product

(Continued on page 549.)



This latest Lewcos production is almost a complete three-valve set and makes radio receiver assembly a simple job with the certainty of first-class results.

the response curve keeping up well into both the high and low frequencies. The device proved to be adequately sensitive and could handle

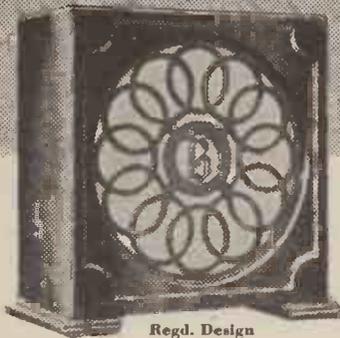
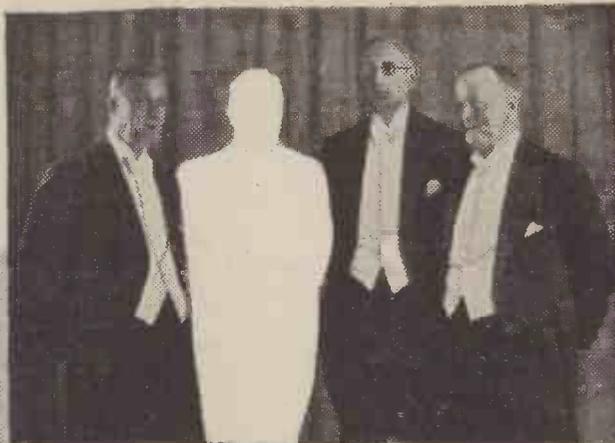
five watts. Its list price is 12s. 6d. It is a one-hole panel-mounting component built into a substantial metal case. It has a large milled knob, with

**FOUND!**

**THE  
MISSING  
TENOR**



The Westminster Singers



Regd. Design

BY THE  
WONDERFUL

**NEW**

**THERE** is now a loud speaker that does not cheat you of half the broadcast! In its reproduction the tenor is no longer missing. It gives you notes you've never heard before. It reveals instruments that have hitherto been silent. In short, it gives you the broadcast in your home as it is played in the studio. It is the new Brown Duplex Loud Speaker.

Because it incorporates entirely new features in design—the wonderful "Vee" Movement and the Duplex Cone—this latest Brown triumph sets a new standard in Radio reproduction. Its tone is sweeter and more mellow. Its volume is richer and more magnificent. Its appearance is finer and more handsome. Ask any Wireless Dealer!

**IN THREE MODELS:**

*Design as illustrated. Mahogany or Oak.*

**V10 £5 10s. 0d. V12 £7 10s. 0d. V15 £12 10s. 0d.**

*Also obtainable by easy payments, ask your Dealer for particulars.*

**Brown**

**DUPLEX LOUD SPEAKER**



# RADIO ABROAD

*Notes and News of Wireless in Other Lands.  
By Our Special Correspondents.*

### Radio and Crime

**R**ADIO has already played a considerable part in the detection of crime and the capture of the criminal. As you know, it is used by the police of many countries, in particular by the police of some of the cities of the United States. In Chicago, according to the impression of many people, every other citizen is a gunman, and this city has done itself "proud" in the matter of radio-equipped detective forces.

A special flying squad has been set up with over a hundred fast motor-cars, each equipped with a radio receiving set, and these can keep in communication with a central station having a power of 5 kw. In addition to the radio receiving sets, some of the cars are armed with machine-guns, bombs, and so on, and carry also cameras and other apparatus for detection of crime.

### Radio-Gramo-Pictures and Television

Although doubts are frequently expressed as to whether television will at any reasonable date become a practical proposition, many of the leading radio and picture concerns in different parts of the world are taking time by the forelock and are forming alliances which will put them into a favourable position should television ever be called for by the public.

I see that the Paramount-Famous-Lasky Corporation of the United States has obtained a considerable interest in the Columbia Radio Broadcast system. According to the President of the Columbia Radio Broadcast concern, radio broadcasting and talking pictures, together with

the development of television, will bring about a state of affairs between radio and movies similar to that which exists between the gramophone and radio; in other words, it cannot, in his opinion, be very long before radio, gramophone, cinema and the television interests are merged together. A merger of this kind opens up a tremendous vista as to what the future may hold in store. Already it is possible by radio, and in a perfectly simple and practical way, to "tell the world," and if it should become possible for a world audience not only to hear, but simultaneously to see, it would mean, in a very real sense, the annihilation of space.

### Private Broadcasting

One of the first hotels to have its own broadcasting studio is the Chateau

Laurier at Ottawa, belonging to the Canadian National Railways. The enterprising management of this hotel have had a complete broadcasting studio fitted up in the hotel, together with a public address system; this is intended in the ordinary way to provide a service throughout the hotel itself, so that entertainments enacted in the studio can be received by visitors who so desire.

At the same time, however, the studio may be connected up with the Ottawa broadcasting station or with any of the broadcasting stations operated by the Canadian National Railways between Halifax and Vancouver. The S.B. system by which the various stations belonging to the Company can be linked up with the capital is very ingenious.

### Tunis Kasbah

The new 600-watt station built by the French P.T.T. at Tunis Kasbah is now sending out a concert every day (except Saturday and Sunday) on 1,350 metres. These concerts generally take place between nine and half-past-ten in the evening.

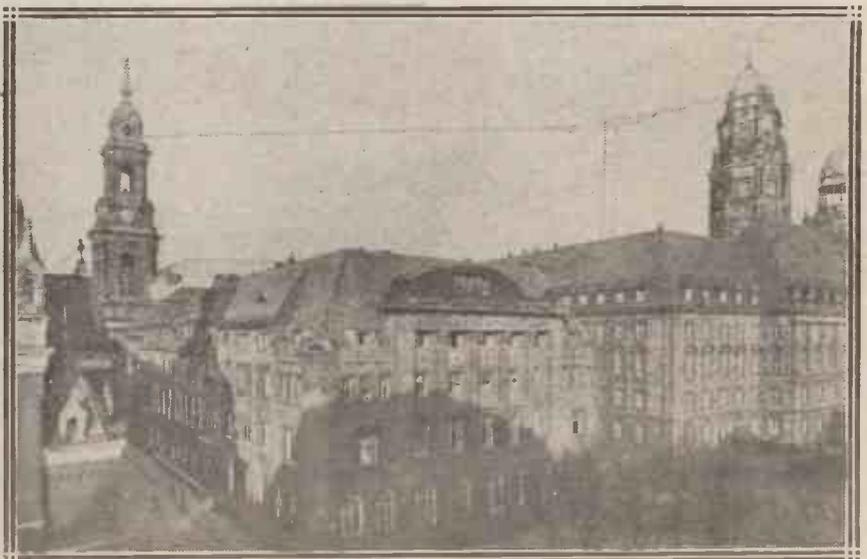
### Strasbourg and Radio Paris

The apparatus and machinery which has hitherto been used by Radio Paris is to be all transferred to the new Strasbourg transmitter at Brumath, working on 12 kw. The Radio Paris station will be equipped instead with a new transmitter of 50-kw. power.

It is expected that the completion of the Strasbourg station will take some time and that the transmissions will not be instituted on a regular

*(Continued on page 551.)*

## HAVE YOU HEARD DRESDEN?



The Dresden aerial is supported by two tall city towers, which act as masts.



# LISTENING ON THE LONG WAVES

**M**ANY set-owners do not appreciate the fact that listening on the long waves has certain advantages over and above the alternative programmes which are available there. These advantages apply both in country and town districts. In the town, for instance, a change-over to long waves will generally enable the listener to escape from a local oscillator, the most annoying blot on the fair face of broadcasting!

## Evading Oscillation

In some populous districts a good set may prove disappointing because near at hand there is an inexperienced listener who, switching on a set with too much reaction, spoils the quality or strength of his neighbour's reception. Such a spoil-sport is rarely to be found upon long waves, so if you are unfortunate enough to suffer from this form of interference, a set of long-wave coils is the gateway through which you may escape from it.

In country districts the silent-point oscillator is generally unknown, but as the listener is not usually cramped for space, he can erect a really long aerial. This often gives—even with a simple set—the advantage of being able to hear long-wave broadcasting from abroad *in daylight*.

## Europe's Best Programmes

Wave-lengths above 1,000 metres are not so adversely affected by sunlight as the shorter waves, so no listener to the daylight programmes should fail to investigate the advantages of the long-wave stations.

The wide choice of programmes available on the long waves will be apparent from the accompanying list of stations, including as it does the most popular European stations. Daventry 5XX is a host in itself (especially for those listeners who do not in the ordinary way tune in to 2L O), the strength and efficiency of this station being now traditional. Paris has two powerful long-wave stations, whilst Germany's high-power

station at Zeesen, near Königswusterhausen, is famous for its orchestral items.

All the other transmissions are of interest on the long waves, but the programmes from Hilversum, Kalundborg, and Motala deserve special mention on account of their strength and reliability. In certain districts, Lahti (Finland), Warsaw (Poland), or Stamboul (Turkey) take pride of place after the French and German stations, so it is very rare that a set of long-wave coils on a good receiver fail to produce an enjoyable alternative programme.

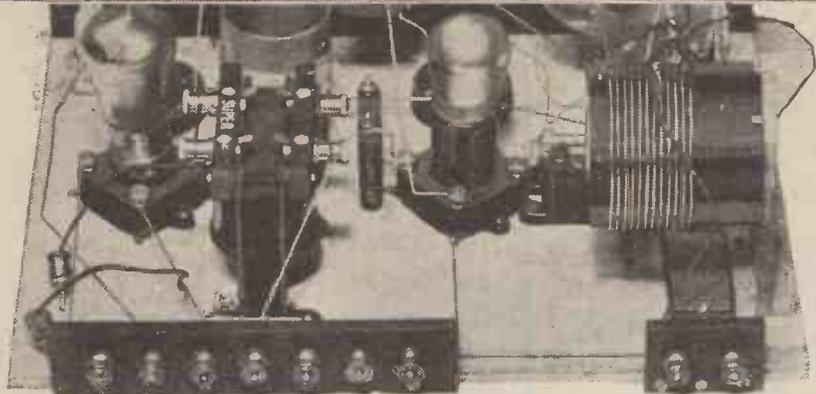
## Future Possibilities

The future, too, is full of promise on these wave-lengths, for not only is Zeesen installing new land-lines, so that the pick of the German programmes may be radiated from there on the long waves, but several new stations to operate above 1,000 metres are being planned, and their programmes will eventually be available to the British listener.

## STATIONS SHORT-WAVE COILS CAN'T CATCH!

Wave-length in Metres.	Name of Station.	Remarks.	Wave-length in Metres.	Name of Station.	Remarks.
1935	Kaunas (Lithuania)	Power of 7 kw.	1071	Hilversum (Holland)	Opens when Schevevingen Haven closes at 5.40 p.m. Power of 6.5 kw.
1875	Hilzen (Holland)	Power of 6.5 kw. Programmes from Hilversum.	1010	Basle (Switzerland)	Power of .25 kw.
1796	Lahti (Finland)	Power of 40 kw.	1000	Leningrad (Russia)	Power of 20 kw.
1725	Radio Paris (France)	Call-sign C F R. Power 12 kw.	938	Moscow (Russia)	Power of 2 kw.
1635	Königswusterhausen (Zeesen) (Germany)	Power of 26 kw.	870	Tiflis (Russia)	Power of 4 kw.
1554	Daventry 5 X X (Gt. Britain)	Power of 25 kw.	840	Nijni Novgorod (Russia)	Power of 1.8 kw.
1481	Moscow (Russia)	"Old Komintern." Call-sign R A I. Power of 12 kw.	806	Kiev (Russia)	Power of 1.2 kw.
1444	Eiffel Tower (France)	Call-sign F L. Power of 12 kw.	778	Petrozavodsk (Russia)	Power of 2 kw.
1411	Warsaw (Poland)	Power of 8 kw.	770	Ostersund (Sweden)	Relays Sundsvall. Power of .6 kw.
1348	Motala (Sweden)	Relays Stockholm on 30 kw.	760	Geneva (Switzerland)	Radio Geneva. Power of .25 kw.
1304	Kharkov (U.S.S.R.)	Power of 4 kw.	700	Minsk (Russia)	Power of .4 kw.
1200	Stamboul (Turkey)	Power of 5 kw.	680	Lausanne (Switzerland)	Call-sign H B 2. Power of .6 kw.
1200	Boden (Sweden)	Power of .6 kw.	570	Freiburg-in-Breisgau (Germany)	Power of .35 kw.
1153	Kalundborg (Denmark)	Power of 7.5 kw.	570	Hamar (Norway)	Relays Oslo. Power of .7 kw.
1118	Novosibirsk (Russia)	Call-sign R A. Power of 4 kw.	568	Ljubljana (Yugoslavia)	Power of 2.5 kw.
1073	Rostov-Don (Russia)	Power of 4 kw.	565	Smolensk (U.S.S.R.)	Power of 2 kw.
1071	Schevevingen Haven (Holland)	Closes 5.40 p.m. Power 2.5 kw.	560	Augsburg (Germany)	Power of .25 kw.
			580	Hanover (Germany)	Relays Hamburg. Power of .35 kw.

# ON THE SHORT WAVES



*Notes of Interest on Short-Wave Receivers and Reception.*  
By W.L.S.

THE general trend of short-wave work nowadays has changed so enormously that the man just starting off finds himself confronted with a problem that never used to arise at all—namely, that of the choice of a suitable type of set for his particular purpose.

Four years ago the term “short-waver” conveyed a detector and note-mag. with wonderful-looking coils and extension handles sticking out for several inches. Now it means almost anything. It was very significant that at the Show the great majority of short-wave sets exhibited had one stage of screened-grid H.F. (in most cases untuned), and I think this is the one definite feature about short-wavers—that they are heading very certainly in this direction.

### Merits of S.G. Valve

I hardly need to write at any length about the merits of screened-grid amplification for short-wave work, but I should like, in response to one or two letters, to explain more fully the “buffer effect” which I claimed some time ago to be its chief advantage.

The term is really almost self-explanatory, but it really means that the S.G. stage acts as a kind of cushion between the aerial and the detector. With an untuned stage which gives little or no amplification this effect is most marked. Variations in aerial capacity due to swinging, etc., have no effect upon the signal being received; one can catch hold of the aerial without upsetting the note of the signal.

There is also the distinct advantage that atmospherics do not seem to upset the detector so much, chiefly because it is not now necessary to work it right on the very edge of oscillation in order to squeeze the utmost sensitivity from it, and that a heavy atmospheric or interference of other kinds does not have the awful “spill-over” effect that it does with an oscillating detector only.

### Choke Coupling

The plate of the screened-grid valve is best coupled to the existing detector

grid coil by means of a small condenser (a neutralising condenser is very suitable), and the H.T. is naturally fed to the S.G. valve through a good H.F. choke. The grid circuit is untuned, and may consist of another H.F. choke or of a 10,000- or 20,000-ohm resistance.

If the input circuit is tuned, screening is desirable, but with a mere “buffer stage” it is entirely unnecessary.

### A Good Detector

I have been using a screened-grid valve recently as detector, and hope to publish a set incorporating the fruits of my labours at an early date. Much improved sensitivity and a beautiful reaction control appear to be the immediate advantages, while there are others that are not so apparent. I certainly haven't struck any “threshold howl” trouble, but this may be sheer luck or a mere coincidence.

It may be taken for granted that with fully-tuned circuits, neutralising where necessary, and complete screening, quite high H.F. amplification may be obtained right down to 10 metres, and I think that for telephony reception at any rate this will certainly be the trend of future short-wave receivers of a commercial nature.

My own receiver at the moment is of the American “bear-cat” form, with a stage of strongly peaked L.F. amplification. With an L.F. stage peaked somewhere near 1,000 cycles  
(Continued on page 540.)

## SHORT WAVES ON THE HIGH SEAS



The short-wave transmitter (centre) on board the German liner “Bremen.” The receiver is shown on the left.

# Radio and the Gramophone

*In this section of MODERN WIRELESS each month will be discussed both technical and other data of interest to the set owner who is also interested in gramophones.*

*Besides articles of a practical nature, a brief survey and critique of the latest gramophone records is included, making the section of vital interest to all music-lovers*

Conducted by **KEITH D. ROGERS.**

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	Page		Page
<b>Varying the Volume</b> .. .. .	2	<b>Points about Needles</b> .. .. .	6
An interesting research article which settles in a rather surprising manner a long-discussed problem concerning the effects of the placing of a volume control in different positions in a gramophone amplifier.		Changing over from one type of gramophone needle to another may greatly alter the tone as well as the volume of reproduction. This interesting article throws much light upon an important branch of record reproduction.	
<b>Seen at the Show</b> .. .. .	4	<b>The Lissen Needle-Armature Pick-up</b> ..	7
A general review of the main points of interest seen at the recent Radio Exhibition.		This type of pick-up is quite new, and this is the first of its class to make its appearance on the market. This report upon its behaviour will therefore be of unusual interest to users of radio-gram receivers.	
<b>An Interesting Instrument</b> .. .. .	5	<b>Recent Record Releases</b> .. .. .	8
A brief report of some tests carried out on the new Magnum Pick-up placed on the market at the Show.		Our regular review of some of the records published during the month, written from the point of view of their suitability, or otherwise, for electrical reproduction in the home.	

## Many New Improvements

**T**HE Radio Exhibition has now been over for several weeks, long enough to enable us to visualise the various developments in their true perspective—mains sets, portables, pick-ups, radio-gram receivers, and loud speakers, can now be seen and heard away from the glitter and bustle of Olympia, and, incidentally, very often under far more natural and favourable conditions

### *Extremely Interesting Items.*

And what a large number of radio-gram sets and pick-ups there were at the Show! Such a variety that it was exceedingly hard to pick out the best. Of the pick-ups the needle armature type were the most interesting, though the curve of the new Marconiphone instrument is exceedingly attractive.

Two of the new pick-ups have been tested in the MODERN WIRELESS laboratory, and are reviewed in these pages, while others are under examination and will be reported on in the near future.

In addition to the test reports a short article, a retrospective of the Show, is included in the supplement for the benefit of those readers who were unable to visit Olympia.

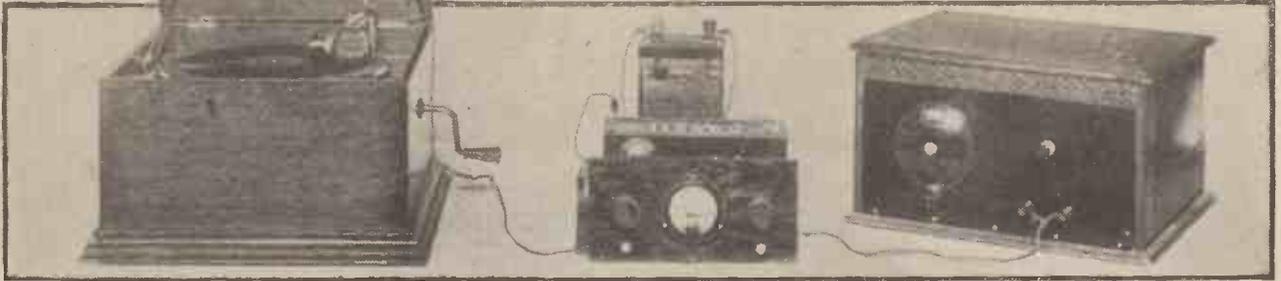
### *Specially Useful Articles*

Two other articles of special interest are one on the effect of volume controls upon the response curve of a pick-up, and the other upon the effect of various needles upon the reproduction.

These are both essentially practical articles, and will be of vital interest and assistance to all owners or prospective owners of radio-gram receivers.

Finally, we should like to inform readers that tests are being made with a specially cheap but efficient radio-gram receiver, to meet the requirements of the ordinary man-in-the-street who wants an easy-to-build, easy-to-operate and, above all, no-trouble "quality" receiver, that will give him either broadcasting- or gramophone reproduction.

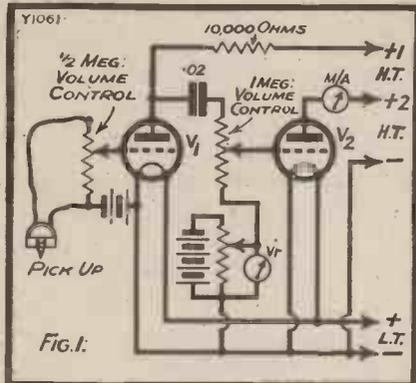
# VARYING the VOLUME



DOES the use of a volume control across a pick-up affect the fidelity of the latter's performance? It is often suggested that it does, consequently this was one of the first questions I tackled when I recently purchased a set of H.M.V. "constant frequency" test records, for I had a lurking suspicion

*It has often been stated that the volume control across a pick-up affects the response characteristic of the latter unfavourably: in this interesting article some rather surprising experimental results bearing on the problem are given.*  
By G. P. KENDALL, B.Sc.

might be a "catch" in it, for this reason: the scratch sound is at a considerably lower level of audibility than the music, and if both were reduced equally it seemed possible that the ear would cease after a while to take any notice of the scratch, although it was still at the same relative intensity. Obviously if the reduction were taken far enough, the scratch would become truly inaudible, although the music could still be heard, simply because of the initial difference of level, and it seemed feasible that this was the real explanation of the apparent suppression of scratch which is noticed even with a normal reduction of volume.



seems to have been a typical example of the way even the careful experimenter can be led astray by aural tests. What people have noticed is that as the volume is cut down by this method the "needle-scratch" seems to disappear to a considerable extent, and hence it was argued that the volume control must be cutting down the higher frequencies unduly. The idea was, of course, that the scratch was a mixture of quite high frequencies, and hence could be taken as a guide to the effect of the volume control upon the higher notes of the musical range.

**Type of Control Used**  
It is to be understood, of course, that I am referring throughout this article to the modern high-resistance potentiometer type of volume control, not the earlier form of plain variable resistance shunted across the pick-up. The latter functioned by drawing current from the pick-up, and so reducing the voltage across it, and is open to serious theoretical

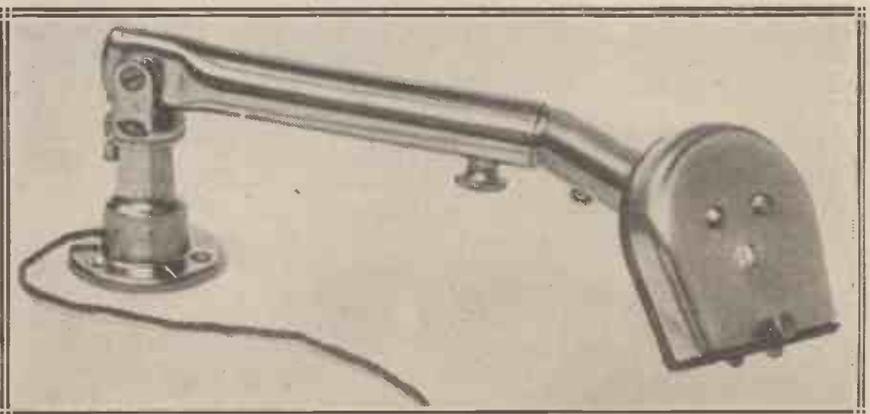
that this was one of those cases where an aural test might be most misleading.

These records, by the by, promise to be a most valuable aid in reducing a great number of electrical reproduction problems to a matter of reasonably exact measurement, replacing the unreliable "ear" tests on which one must otherwise depend. Tests performed with the car as an indicator, of course, are always full of potential sources of error, because in the first place the result may be confused by the characteristics of the loud speaker employed, and again by the fact that the ear behaves differently at different volume levels, to mention just two of the many error factors.

Although I have heard this effect often enough, I suspected that there

**The Misleading Ear!**

This question of the effect of a volume control across the pick-up



The pick-up and carrier-arm used during the test—the pick-up has since been redesigned by the makers and now has different characteristics from those shown overleaf.

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			£	s.	d.
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„ 108	180/300 v. D.C.		6	7	6
„ 200	6/12 v. D.C.		6	0	0
„ 400	110 v. 50 cy. A.C.		8	5	0
„ 404	200/240 v. 50 cy. A.C.	..	8	5	0

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## No Difference Worthy of Consideration

objections. It is rarely used now, of course, except in special cases.

With the aid of the special test records to which I have referred it is evidently possible to investigate the point, and one of the first things I did with them was to fix up a suitable measuring circuit for the purpose. These records, I should perhaps explain, provide a series of pure tones of known frequency and strength ranging from, approximately, 25 to over 8,000 cycles per second. By measuring the output of the pick-up over that part of the range in which one is interested they obviously provide a basis for all sorts of valuable test work with the fallible human ear eliminated.

### How Measurements Were Made

For the purposes of the tests on volume-control effects which I am describing, I used the circuit illustrated in a somewhat simplified form on these pages. The first valve is an amplifier resistance-coupled to the second, which is the measuring valve. The values of the components constituting the intervalve coupling were chosen to give substantially

then noted, likewise the anode current (measured by m/a, a low-reading milliammeter). Next, the pick-up was placed on the record, and when the "signal" arrived upon the grid of the second valve, its anode current rose to a new figure. The grid-bias potentiometer was then adjusted to bring the anode current back to its original value, and the new grid-bias voltage noted. The difference between this new voltage and the initial setting was a measure of the audio-frequency voltage reaching the second valve, and hence could be taken as a measure of the output voltage of the pick-up at that particular frequency.

By taking readings in this way at suitable intervals all the way up the frequency range it is evident that one can obtain a "characteristic curve" for that particular pick-up. If some circuit change in which one is interested is now made and the measurements repeated a new curve can be plotted which will show the effect of that change.

In the present case I was concerned with volume-control effects, and accordingly I placed two volume controls in the circuit, one in the usual position between the pick-up

These readings were then taken as giving the true curve of that particular pick-up, since preliminary tests had shown that the first volume control had no measurable effect when set to maximum.

Next, the second volume control was set to maximum and the first to a point which gave approximately the same reduction of voltage as before, and a fresh series of readings was taken at intervals along the frequency scale from 230 cycles to a little over 6,000 cycles (the practical upper limit of the particular pick-up I was using). I did not go below 200 cycles because it was unlikely that any effect would be found here.

### Evidently Negligible

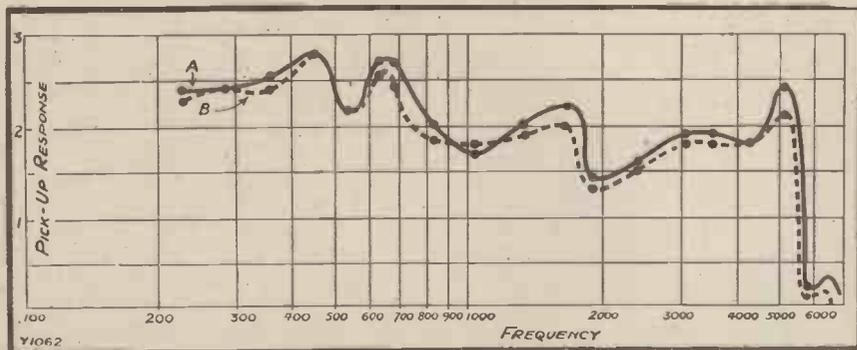
The two curves are reproduced in the diagram accompanying this article, in which A is the true curve of the pick-up, as obtained from the first set of readings, while B shows the effect (if any!) of the volume control.

As you will see, there is no difference between the curves worthy of consideration right up to nearly 6,000 cycles. Above that point curve B seems to show signs of falling off a little faster than curve A, so perhaps there may be some slight effect after all. Slight it would appear to be, however, and the effect on the practical range of frequencies is evidently negligible in this case with a volume control of not too low a resistance.

### The Upper Limit

You will note that I have referred to the practical range of frequencies as being up to about 6,000 cycles, and I should perhaps explain that this is because I have yet to find a pick-up which goes above this point and also gives a good curve over the rest of the range. As a matter of fact, the majority of those I have tested do not go even as high as this, and it is arguable that it is not desirable that they should do so. Over the range below this point you will see that the two curves differ only by amounts which can reasonably be attributed to experimental errors due to slight differences in individual needles, and so on.

I only plotted these curves with a comparatively small number of readings, by the way, because I was only interested in their general shape and not in their minor "ups and downs."



The curves obtained with and without the volume control in action across the pick-up. Note how closely they correspond.

uniform amplification over the range of frequencies in which I was interested. In any case, of course, since the test was to be a purely comparative one, this point was not of much importance.

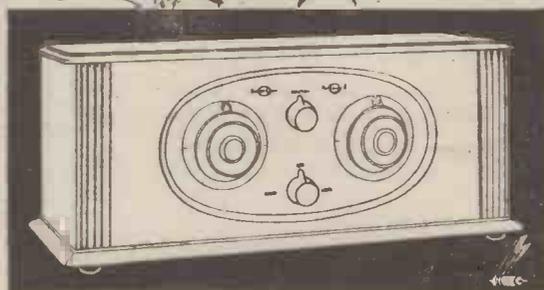
### The "Slide-Back" Method

The actual measurement of strength was made in this way: the second valve was biased down to the lower bend in its characteristic by adjustment of the potentiometer controlling its grid bias. The grid voltage, as indicated by the voltmeter  $V_2$ , was

and the first valve, and one between the valves, i.e. in the grid-leak position. At this latter point, of course, it is usually considered to have a negligible effect on the reproduction. The reason for the use of two volume controls, by the way, was that it was desirable for practical reasons to make all the measurements at about the same level of strength.

What I did, therefore, was to take first of all one series of readings with the first volume control set to maximum, and the second adjusted to cut the voltage figures down to one-half

# NOW FOR THE CONTINENT



## SWITCH ON...

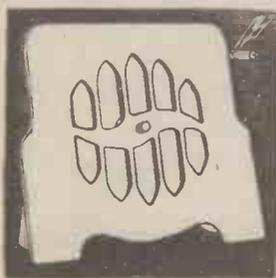
to London and listen to the quick-fire patter of the Cockney Comedian. Then to Paris and hear the gorgeous massed orchestra. But for the true lilting music of the Spanish dance, you must go to Spain. So—a turn of the dial of the Pentovox Three and you are there with the rhythmical click of the instruments in your ear. Everything comes easily to the Pentovox Three.

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**T**HIS year's Wireless Exhibition has been like no other exhibition ever seen in this country, for foremost among the exhibits must be placed the tremendous number of radio-gramophone receivers and pick-ups of all types shown, in a multitude of designs and at all prices.

Of the complete radio-gram receivers one had a choice of small portable receivers with incorporated turntables and motors, and pick-up attachment, to receivers of more



This portable radio-gram receiver, priced at 25 guineas, attracted much attention at Olympia.

ponderous size right up to the large pedestal and console models costing round about a hundred pounds or more.

### Large Display of Pick-Ups

There was an enormous display of pick-ups, and it was interesting to note that a large number—one might almost say the majority—of complete radio-gram receivers included a pick-up of the well-known B.T.H. type.

Unfortunately several of the firms had only models of their pick-ups, not having gone completely into

The recent Radio Exhibition was noteworthy for the number of pick-ups and complete radio-gram receivers on view.

production. Such pick-ups as the Burndept and the Marconiphone are at the time of writing only known to us by their appearance and the response curve of the first models made. The ordinary standard commercial model has not yet been placed upon the market, so we cannot give any opinion as to the type of reproduction obtained.

The Burndept and the Lissen pick-up, both of which work on what is known as the needle armature principle, attracted great attention. This principle does away altogether with the ordinary armature and needle chuck, the needle itself acting as the armature and being lightly but firmly held between the poles of the permanent magnet. The vibrations of the needle cause the necessary variations of the magnetic flux to occur, and these variations, of course, are passed on to the first amplifying valve.

### Interesting Examples

The Burndept pick-up, however, is not particularly sensitive, although the curve given is a very good one, having a rising characteristic from about 150 cycles downwards to somewhere about 50 or even less. The Lissen pick-up, which we have tested, is reviewed elsewhere in this supplement.

Another new pick-up which made its appearance at the show is the Magnum, which is a greatly improved model when compared with their last pick-up. The reproduction is very even and it gives a good amount of the

bass. This also is reviewed in another column.

The Marconiphone pick-up has an excellent curve, with a rising characteristic right down to 25 cycles, while the reproduction of the higher frequencies appears to be completely adequate, and the sensitivity is of a high order, something like well over a volt R.M.S. being available to the grid of the first valve.

### Better Tracking

It is interesting to note that great improvements have been made not only in the response of the pick-ups, but in the tracking arrangement. Most of the pick-ups now on the market can be obtained either for ordinary tone-arm use or with their special pick-up carriers, in which the tracking has been carefully worked out, while the record wear for quite a number of the pick-ups is, contrary to the opinion of most people, even less than that caused by many of the quite well-known gramophone sound boxes.



This Gambrell model of radio-gramophone uses the B.T.H. pick-up.

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The question then arose as to what could be done with this pick-up in order to make it follow the record which had passages below that figure. Weighting was an obvious suggestion, but this would very much add to the record wear, and was decidedly put aside. The next obvious thing to do was to change the needle.

**Highly Damped**

On close examination it was seen that the pick-up was exceedingly highly damped, which accounted for the difficulty it had in keeping in the groove when very low notes were encountered. Slacking off the damping probably would have had the result we were looking for in that the needle would be enabled to follow the low notes very faithfully, but the reproduction of the high notes would probably also suffer.

The next thing to do was to find a needle which would give the result of slacking off the damping somewhat and yet would preserve the brilliancy of the high notes as far as possible; in other words, we wanted a needle which had a certain amount of give in it, to enable passages of the very low notes to be followed without any additional weight on the pick-up being necessary.

**A Useful Needle**

Soft-tone needles, of course, were too rigid for the job, and so were the tungstyle type, in spite of the compliant nature of the tip itself. Finally, the Edison-Bell Sympathetic Chromic needle was obtained and tested after careful examination.



The angle the needle makes with the record has a large bearing on the reproduction. Usually some 60° to 80° is used, but needle-armature pick-ups require an angle of about 90°.

This needle is extremely thin and is designed to be used with a special needle grip. This grip was found to be unnecessary in the case of the pick-up under test, and was discarded with beneficial results. It is obvious that a certain amount of "whip" occurs in the needle during operation, and this is usually a bad thing to have; but in this case the end justified the means.

On test with this needle the pick-up was enabled to go down to about 120

cycles without any difficulty, thus covering any of the low notes which are found in ordinary everyday records, while the brilliancy of the high notes was not very noticeably decreased.

The main part of the curve of the pick-up remained approximately the same, with perhaps a slight falling-off in the higher register at about 4,000 cycles, but the pick-up was certainly enabled to travel over the bass register far more easily than had hitherto been the case.

**Different Characteristics**

Soon after this the makers redesigned their pick-up and it is now on the market with a very similar appearance, but with different damping and rather a different characteristic.

Owing to the less damping the need of these Sympathetic Chromic needles is no longer felt, as ordinary needles in the new pick-up enable it to go down to 75 cycles with the utmost ease.

We are now, however, faced with a peak at the top of the piano scale, which is rather disconcerting when a loud needle is employed, and in this case an ordinary spear-point needle seems to have a beneficial effect—why this is so has still to be investigated.

**Improving Reproduction**

I hope by the foregoing you will see how the needle can help the reproduction from a pick-up, remembering that a needle that is fairly flexible will assist in bringing out the bass notes, while a loud or hard needle will add brilliance in most cases, but may cause chatter and trouble on the lower register.

**THE NEW LISSEN PICK-UP**

WE have recently received for test and report a sample of the new Lissen needle-armature pick-up, which is illustrated herewith.

This pick-up is quite unlike anything else that has yet appeared on the market in that there is no ordinary armature between the poles of the magnet, the needle itself taking the place of the armature.

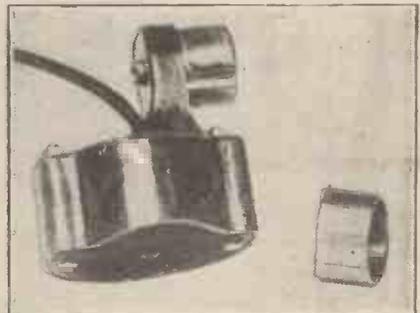
Using the pick-up direct upon the grid of the first valve, with the special

spear-point needles which are recommended, the reproduction is very pleasing. The pick-up has a curve, singularly lacking in peaks, which rises at the lower end from somewhere about 1,200 cycles downwards. The reproduction of notes of 70-odd cycles is very loud indeed.

**Good Bass Response**

This means that the most is made of any bass that may be in the record and the middle register is given full amplification. On the average speaker the reproduction obtained from the Lissen needle-armature pick-up is very "mellow."

It must not be forgotten that spear-point needles are essential, owing to the design of the instrument; if you try to use the ordinary needle you will almost certainly lose the needle inside the pick-up, and have a great deal of trouble getting it out again.



The new Lissen needle-armature pick-up in which a spear-point needle is essential—the needle acting as the armature of the pick-up.

The wear on the record is extremely slight; and though not insensitive at the same time the pick-up is not over-sensitive, so that three stages of amplification are really necessary, while it is advisable to use the pick-up on a gramophone drive which has a sound-proof lid, as the noise of the needle itself is distinctly more than in the majority of pick-ups.

**Easily Fitted**

This chatter, however, is not the sort of chatter which mars the reproduction, but is merely the result of the way in which the needle is used, for it must not be forgotten that this needle is not clamped tightly in the pick-up, but is only just what might be termed a "comfortable" fit.

The price of the pick-up is 30s., and it is available for fitting on all types of arms.

# Do you use a pick-up?



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Read this extract from "The Wireless World," August 21st, 1929, Page 177.

"In ordinary records it is necessary to restrict the amplitude of notes below about 250 cycles, in order that the vibrations may be contained within the standard pitch of the groove."

TURN LOSSES INTO GAINS WITH THE NOVOTONE.

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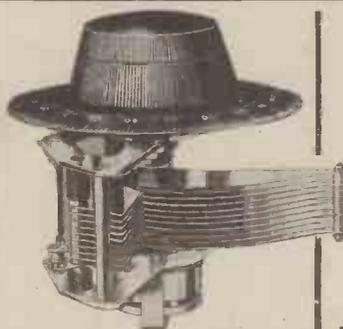
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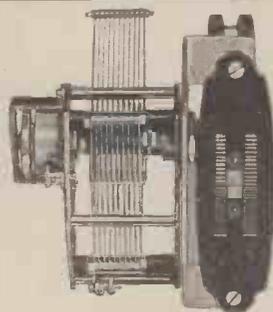
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# RECENT RECORD RELEASES



Our monthly review of Gramophone Records.

LAST month we went to press so early that it was impossible to include a great number of the records that had just been issued, and so some of them will be included in the present issue, although it is not possible to discuss them all owing to lack of space.

## Broadcast Records

Among the Broadcast Twelves we have a very interesting series in the complete recording of the *Unfinished Symphony*, on three discs, 5094, 5095 and 5096, while we also have the band of H.M. Life Guards, on 5097, giving us *Morning, Noon and Night Overture*. All these records are excellent value for money.

The new organ at the Stoll Picture Theatre, London, played by Herbert Griffiths, provides *Narcissus* and *The Bells of St. Mary's*, on 5098, while we have from the same organ on the smaller Broadcast record *The Broken Melody* and *Annie Laurie*, on 431. For some reason or other this has not quite the quality that it ought to have, and the organ is not given full justice.

Among the Super Dance Records of the Broadcast Twelves, Al Benny's Broadway Boys and The Manhattan Melody Makers give us some very interesting selections, and perhaps the best is *I've Got a Feeling I'm Falling* and *Blue Hills of Pasadena*, on 2507, by the former band, while *There's a Four-Leaf Clover in My Pocket* and *To Be in Love*, by the latter band, on 2511, is also a very good recording.

Sandy Rowan, the famous Scottish broadcast comedian, provides us with a couple of typical items in *The Lass o' Killiecrankie* and *Wanderin' Willie*, on 437, while Martin Howard, tenor, gives us a couple of

old favourites in *Where My Caravan Has Rested* and *I'll Sing Thee Songs of Araby*, on 440. These latter two, of course, ear Broadcast 1s. 3d. records.

## Parlophone

The Parlophone list this month is extremely interesting, and offers an unprecedented opportunity to pick-up users and experimenters to test their radio-gramophones. The orchestra of the State Opera House, Berlin, provides us with an excellent two-part item in *Salome's Dance*, by Strauss, on E.10894, a twelve-inch record of amazing realism. Another good test for the pick-up is *The Daughter of the Regiment*, a two-part overture played by the Grand Opera Orchestra of Milan, on E.10899. At the opening of this record is some remarkably fine horn playing, while farther on (in part 2) we have the side drums exceedingly well recorded.

Coming to the lighter side, Sophie Tucker and Fred Hall's Sugar Babies provide a record which tests the electric gramophone reproducer to the utmost. The one side of the record by Sophie Tucker (accompanied by Ted Shapiro) of *I Ain't Taking Orders From No One* provides an excellent test of piano reproduction and vocal reproduction, for Sophie Tucker is not exactly an easy person to deal with when one has to reproduce her voice in its true quality.

On the reverse side is *Come on Baby*, by Fred Hall's Sugar Babies, and this is a very brilliant piece of recording of a band which is up to all the latest tricks of the modern American dance bands. Some very brilliant trumpet and violin playing taxes the upper register of your repro-

ducer to the utmost, while the vocal gymnastics and "hot" instrumental effects give the pick-up something to think about. This record is R.423, and should certainly be heard by every owner of an electrical reproducer.

Further variety in the way of dance tunes is provided by Arthur Rosebery and his Dance Band, playing a selection from the *Fox Movietone Follies*, on R.425, Sam Lanin's Arkansaw Travellers, playing *Am I Blue?* on R.426, and Joe Venuti and his Concert Orchestra, playing *Little Pal* and *I'm In Seventh Heaven*, on R.427. In addition the "saw" is used to advantage in the tango *In a Little Cafe*, played by the Pavilion Tango Orchestra on R.411.

## Zonophone

Among the Zonophone records for the last two months (for we missed the last month) must be mentioned the *Flying Dutchman*, by the National Military Band, on A.364, and the same band playing *In a Monastery Garden*, on A.365. This latter is a beautiful band record, exceedingly well recorded.

Sir Harry Lauder gives us another of his favourites in *Portobello Lass* and *Ta-Ta My Bonny Maggie Darling*, on G.O.90, while the Zonophone Salon Orchestra gives us two favourite waltzes, *Destiny* and *Ecstasy*, on 5387.

Jimmy Rogers, whom we do not care for very much, although the reproduction and recording of his numbers leave nothing to be desired, provides us with his *Blue Yodel No. 4* and *Waiting For a Train*, on 5380. We find it difficult to understand why the Zonophone Company are running Jimmy Rogers so very strongly.

*Solemn and Gay*, on 5394, are really excellent, both from the point of view of light and melodious entertainment, and from the technical point of view of recording and reproduction. They give us *I'm Perfectly Satisfied* and *Huggable, Kissable You*.

The Rhythmic Eight are found in the October list a little more than they have been lately, in company, of course, with the Arcadian Dance Orchestra. These two bands are conducted by John Firman, and include many of the best instrumentalists in London dance circles. *A Cute Little Flat*, played by the latter band, and *My Troubles Are Over* and also *Deep Night*, by the former band, are numbers well worth hearing.



# PRECISION CONDENSERS now as always

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6. H.F. & CRYSTAL (Transformer Coupled, without Reaction).
7. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling with Reaction on Anode).
10. OUT OF PRINT.
11. OUT OF PRINT.
12. OUT OF PRINT.
13. 2-VALVE REFLEX (Employing Valve Detector).
14. OUT OF PRINT.
15. OUT OF PRINT.
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17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (With Switching).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
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21. THE 2-VALVE LODGE "N."
22. "THE GUARANTEED REFLEX."
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31. OUT OF PRINT.
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33. A "KNIFE EDGE" CRYSTAL SET.
34. AN H.F. AND DETECTOR TWO-VALVER.
35. THE "UNIVERSAL THREE" (Det. and 2 L.F. stages resistance-coupled).
36. THE "SPANSACE FOUR" (H.F., Det. and 2 L.F.).
37. THE "LONG SHORT" CRYSTAL SET.
38. A TWO-VALVE L.F. AMPLIFIER.
39. THE "SYDNEY" TWO.
40. THE "SUPER SCREEN" THREE.
41. THIS YEAR'S "CHITOS" ONE-VALVER.
42. THE "Q AND A" THREE. A simple set (Det. and 2 L.F.).
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# MEASURING DISTANCES by RADIO



Some ingenious schemes are described  
By a Correspondent.

**A**LTHOUGH there have been many attempts made to devise a simple method of ascertaining the exact distance (as distinct from the bearing) of a ship or aeroplane from a given spot by wireless, the problem is by no means as easy as might be imagined.

Of course, directional methods can be used to find the ship's bearing relative to a known wireless beacon or transmitter. Then, by repeating the same operation on a second-beacon station, it is possible to ascertain one's precise distance or location by a method of triangulation. This is too complicated to be popular.

Then there are systems in which a transmitting station sends out two signals simultaneously, one being a sound signal and the other a wireless signal. Sound waves travel through the air at a velocity of approximately 330 metres a second, whilst for all practical purposes, we can regard the wireless signal as arriving instantaneously.

## For Short Distances

If, therefore, the operator on the ship or aeroplane notes the interval which elapses between the receipt of the wireless signal and the subsequent arrival of the sound signal, and then multiplies this time in seconds by 330 (the velocity of sound), he will get a very fair approximation of his actual distance in metres from the beacon station.

This method is, of course, only applicable over comparatively short distances, though it has distinct possibilities when navigating near the coast in foggy weather, or for preventing collisions between ships at sea under similar conditions.

A more ingenious suggestion has

recently been made to solve the "distance" problem by utilising the well-known fact that true wireless radiation does not set in for a distance of approximately a quarter of a wave-length from the transmitting aerial.

It is known that for ordinary or true radiation the signal or field strength diminishes with distance according to a straight-line law. In the case of pseudo-radiation (i.e. within a distance of  $\frac{\lambda}{4}$  from the transmitter) this law does not hold good. Accordingly a distinction can be made between two such signals received simultaneously from the same transmitter, and in this way a measure of the actual distance of the transmitter can be obtained.

For instance, suppose the transmitting beacon sends out the letter *a*

on a wave-length of 20,000 metres, interlaced with the letter *n* on 1,000 metres. Adjustments are so made that at a radius of 3 kilometres both signals are received at equal strength.

## A Radiation Boundary

Then, as a ship approaches the transmitter, the operator will first hear the shorter wave-length (the letter *n*) at greater strength. As the ship draws nearer the letter *n* weakens, until at the critical distance of 3 kilometres both signals merge into a continuous dash. At still closer distances the long-wave signal *a* predominates. This allows the ship's operator at any time to ascertain within reasonable limits his relative distance from the warning station and, tells him the exact moment he crosses the 3-kilometre boundary

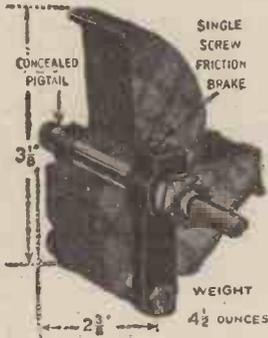


The transmitting apparatus at the Munich broadcasting station. This German station operates on a wave-length of 533 metres with a power of 1.5 kw. It can easily be received in this country on simple valve sets.



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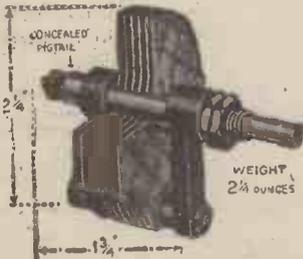
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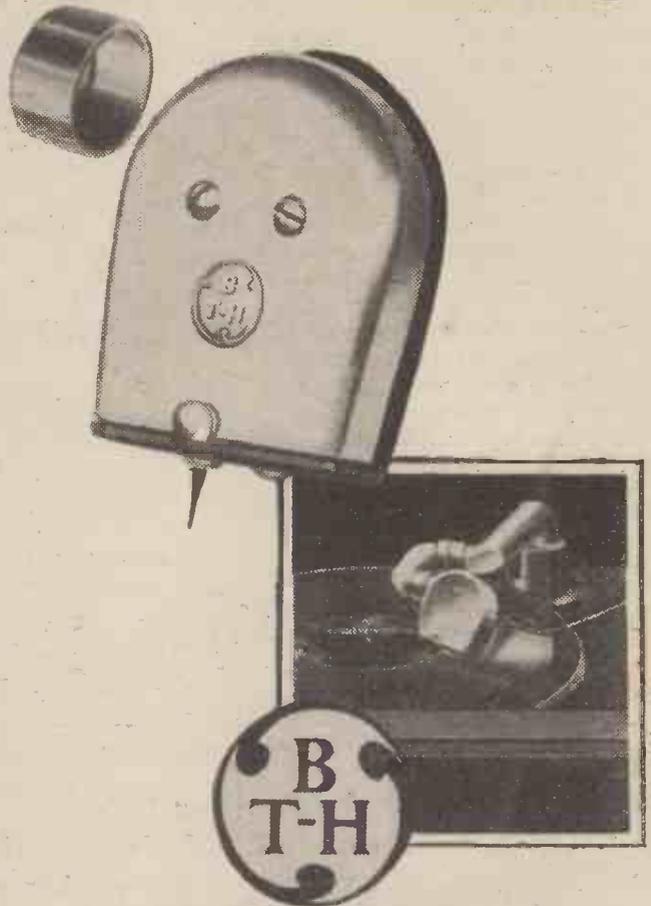


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SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

W. 29.

**RADIO NOTES AND NEWS OF THE MONTH**  
—continued from page 532

cells in the new buildings of the famous Sing-Sing Prison, and each convict has earphones and can listen-in to various forms of radio entertainment. There is only one drawback, for the convict cannot tune-in anything he wants particularly, or try for distant stations.

It is left to the prison officials to decide what programmes the convicts shall hear. This seems to be based on the idea that it does away with the possibility of wireless communication by friends of convicts, who might get close to a night-club microphone and thus convey a message. Prisoners are allowed to listen-in until 10.30 each evening.

**Those Pirates**

It was reported in the press the other day that during the past four years 2,330 prosecutions have been undertaken by the Post Office under the Wireless Telegraphy Act.

**The Lost Licence**

In connection with the above, it is rather interesting to note that a listener the other day, who has been in possession of a three-valve set for three years, had his licence withdrawn by the G.P.O. for alleged

three times by the officials who visited him, the fourth visit resulted in his being told that his set was not quite what it should be, and a report would be made. The result was his licence was withdrawn.

We trust this matter will receive further attention and publicity in the press, for it certainly seems a rather high-handed way of doing things.

**His Own Invention**

I cannot resist quoting the following letter to the B.B.C., printed in the "Radio Times":

"It occurs to me that among the more constructively-minded of your readers there may be some who would care to relieve the tedium of the coming winter evenings by making a sock-dollager. Obtain the hub of a farm cart-wheel. Plug up the spoke-holes, and in each plug drive a large coach-bolt, leaving the head projecting. Take a shaft of hickory 3 ft. 6 in. in length and 1 1/4 in. in diameter (good, well-seasoned ash will serve the purpose nearly as well if hickory is not available). Fix one end of the shaft firmly into the axle-hole and the wheel-hub. Bind the other end for about 10 in. with catgut or stout whip-cord. Give it two coats of varnish,

(Continued on page 536.)

**The "ECKERSLEY" THREE**

is one of the magnificent receivers to be fully described in "M.W."

**NEXT MONTH**

Don't forget to order your copy as the December issue of

**MODERN WIRELESS**

Will be the Great **CHRISTMAS DOUBLE NUMBER**

Price 1/6 Order your copy now.

oscillating and interference with broadcast reception in his vicinity.

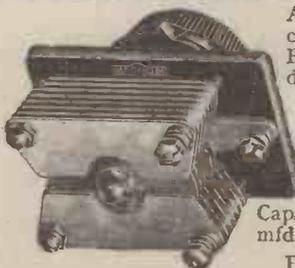
It appears the Post Office officials examined his set after a complaint had been made and, although the set and aerial were passed as satisfactory

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Converts your set into an efficient Short-Wave Receiver suitable for all Battery-operated Sets, including Super-heterodynes. Including 2 coils, 20/40 and 40/80 metres, £4 10s. 6d. Send for particulars.

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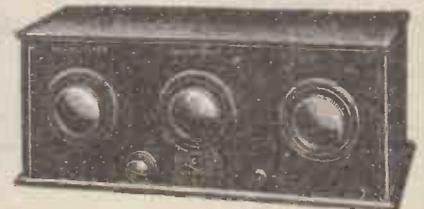
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**MAGNUM "UNIVERSAL" THREE**

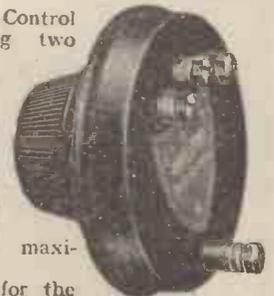


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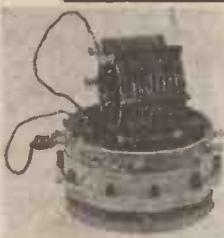
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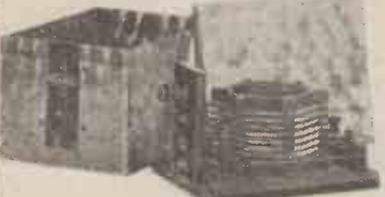
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STANDARD SCREENS as specified 10" x 6"  
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**RADIO ABROAD**  
—continued from page 510

basis until about the middle of next year; the wave-length will be 346 metres.

*Canadian Short-Waver*

A Canadian short-wave station which is very popular with S.W. experimenters is CJRX, which has only recently been established at Grain Exchange Building, Winnipeg. This station has now been transferred to a new building about twelve miles outside Winnipeg, and is again on the air on 25.5 metres, the power being 2 kw. The owners of the station, Messrs. James Richardson and Company, Grain Exchange Buildings, Winnipeg, Manitoba, ask amateurs in any part of the world who may receive their transmissions to let them have a report as to the reception obtained.

*San Sebastian*

Another popular station, this time on the broadcast band, is San Sebastian, which has for some time been shut down for alterations in the plant, but is now broadcasting on 368 metres. Generally the Madrid programmes are relayed via San Sebastian, but on certain days the programme is obtained from the local casino. I think you will find that the casino programmes are arranged for Monday, Wednesday and Friday of each week, the Madrid programmes being on intermediate days.

*Cutting-out Cutting-in*

A very curious apparatus has been installed at the experimental short-wave station of the International Telegraph and Telephone Corporation at St. Cyr, France, intended to prevent telephony transmissions from being picked up by broadcast listeners.

(Continued on page 552)

**The W.B. Chassis**



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**FREE** Bargain List of Receivers, Amplifiers and Components.

**M. TAYLOR, 57, Studley Road, Stockwell, London.**

**RADIO ABROAD**

—continued from page 551

This apparatus has the effect of converting low frequencies into high frequencies and vice versa. A similar or converse arrangement is provided in the various receiving sets so that the frequencies are brought back to their proper values. If the transmissions are received upon an ordinary radio receiver they simply produce a succession of unintelligible screeches and low growls.

**Out in the Cold**

One of the latest contracts secured by the Marconi Company is for the erection of a high-power broadcasting station at Reykjavik, the order being, of course, from the Government of Iceland. A special feature of this station is that it will be used not only for broadcasting but also for the transmission of telegraphy. The power in the aerial is intended to be 15 kw., and the circuit is specially arranged for the dual function of broadcasting and telegraphy. Incidentally, I understand that the thousandth anniversary of the discovery of Iceland is due, and it is hoped to open the new station on this auspicious occasion.

**Easy Money**

With radio sets, as with many other things, there is a good deal to be said for the plan of having the article on 'so many days' or weeks' free trial before deciding as to purchase. This system is in vogue in this country, but to a much greater extent in the United States. Owing to the special circumstances of the case, however, the dealers have found themselves rather

badly "bitten," and quite a number of cases have been discovered where the user simply takes a set "on trial" for, say, a month, and then very conveniently finds it not according to his requirements and obtains a set from some other manufacturer. This is a good game played slowly, and enables unscrupulous listeners to obtain their broadcast "free gratis and for nothing."

Radio Algiers (wave-length, 351 metres).

It seems very probable that interference is actually caused by this station, partly on account of its wave-length and partly also owing to its aerial power of 12 kw.

The method of modulation at low power, as used in the new B.B.C. Regional station, is also employed in the station at Radio Algiers. Incidentally, this latter station was built by the same firm as Radio Paris.

**NEXT MONTH**

Don't miss

**THE  
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THREE.**

The Set of the Year.

Fully described in the  
**SPECIAL DOUBLE XMAS  
"MODERN WIRELESS"**

Order Your Copy Now.

PRICE **1/6**

Those manufacturers who trade on this plan are at present scratching their heads and wondering what to do about it.

**Radio Algiers**

Many listeners have complained of heterodyne interference with the 2 L O wave-length, believed to be due to

**Getting over the Microphone**

A well-known American lighting engineer, Dr. Luckiesh, has worked out an ingenious system of lighting whereby, at the touch of a switch, he can apparently "convert" the scenery in the broadcasting studio, so that whereas at one moment it may represent the interior of a church, at the next moment it resembles an amphitheatre. U.S. broadcast engineers and producers seem to attach great importance to having the right "effects" in the broadcast studio, as, although these cannot have any direct effect upon listeners, they believe that they play an important part in giving the right atmosphere which indirectly affects what gets over the microphone.

**The Transatlantic Service**

The transatlantic telephone service has just lately been extended in Canada to include Saskatoon, which is in the province of Saskatchewan. It is a comparatively short time since the service was extended at this end to include Dublin, Belfast, and the Isle of Man. As time goes on this service will be extended to include various other parts of Europe not yet accessible, and it is intended to bring into the scheme the more remote parts of Canada.

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Lotus H.F. Choke, 5/6

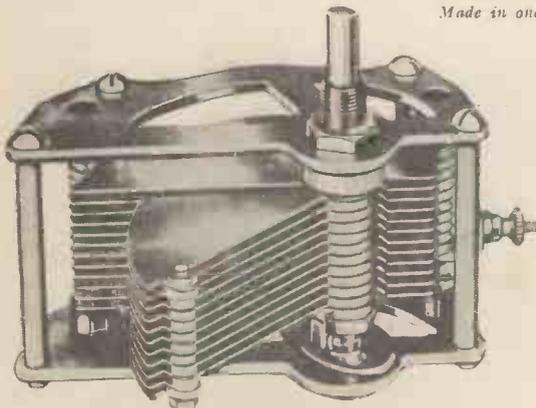
Lotus L.F. Intervalve Transformer, 12/6.

Lotus L.F. Power Choke, 15/-.

**ASK YOUR RADIO DEALER TO GIVE YOU A COPY OF THE NEW LOTUS CATALOGUE OR SEND DIRECT TO THE MAKERS AND IT WILL COME POST FREE**

## LOTUS COMPONENTS

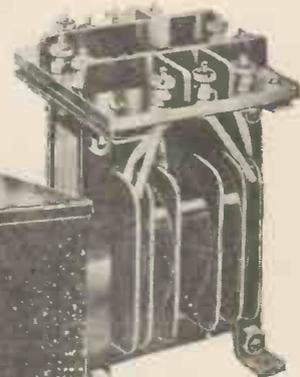
Made in one of the most modern radio factories in Great Britain.



Lotus Logarithmic Condensers in all capacities, from 5/-.



Lotus All-Mains Unit, £7 7/0.

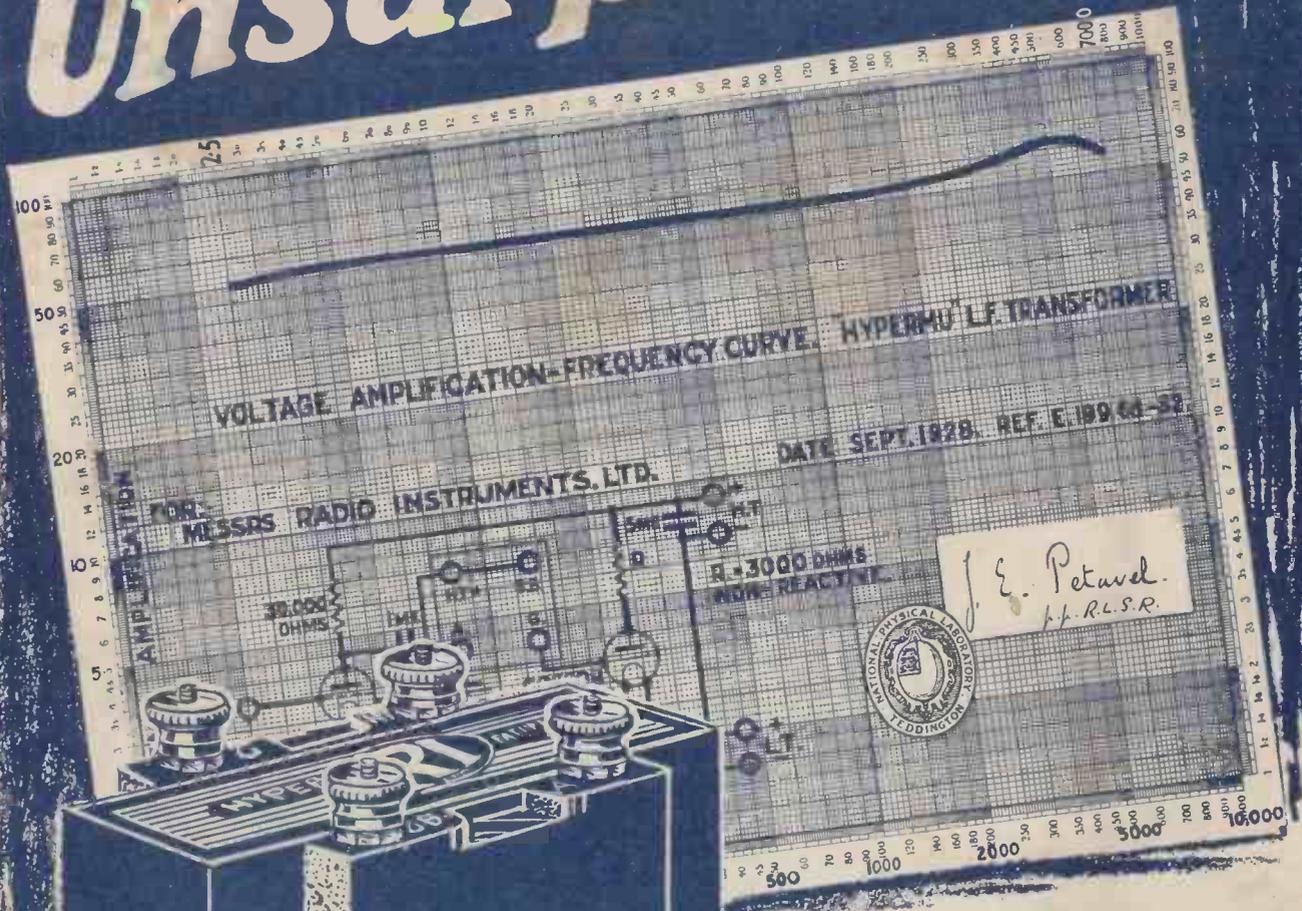


Lotus Power Transformer, £1 15/0.

**Garnett, Whiteley & Co., Ltd., Lotus Works, Liverpool**

Causton

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**The N.P.L. Curve  
OF THE  
HYPERMU  
issued Sept. 1928**  
still remains unbeaten as  
the most complete curve  
giving maximum uniform  
amplification from  
**25 to 7,000 cycles**

The importance of the continuity of this curve below 50 cycles back to 25 cycles is obvious, whilst the advantage afforded by the slight emphasis of sideband frequencies in the region of 7,000 cycles contributes added brilliance to musical reproduction. Moreover, the absence of resonant frequencies below 50 cycles absolutely precludes the possibility of low-frequency oscillation.



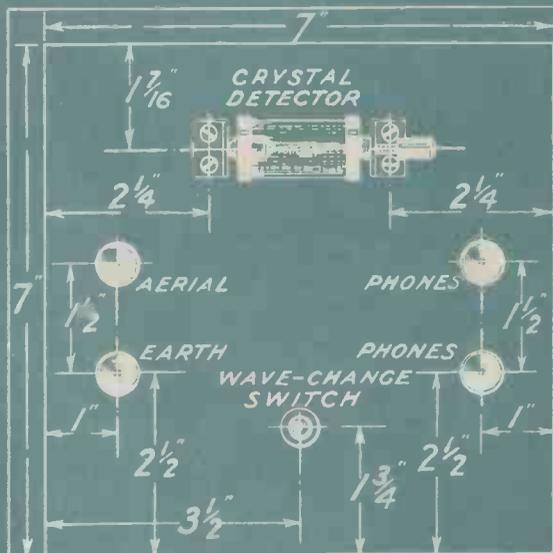
**21/-**  
Write for Hypermu Leaflet

RADIO INSTRUMENTS LTD., 12, HYDE ST., LONDON, W.C.1.

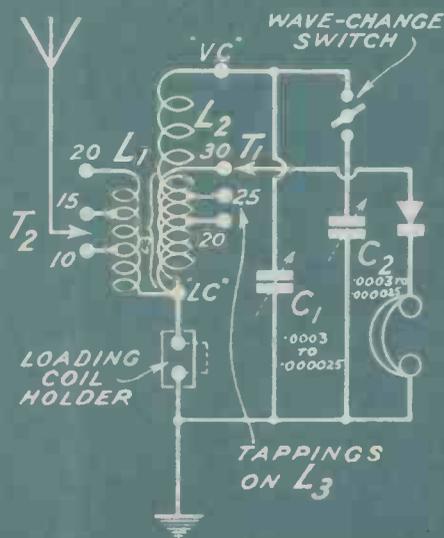
**Blueprints follow.**

# EIGHT SIXPENNY BLUEPRINTS

These eight sixpenny blueprints, based on circuits which have been tested and found satisfactory in every way, are presented free with this issue of "Modern Wireless," and home constructors will find that the circuits selected cover a comprehensive range of reliable and up-to-date receivers.



PANEL LAYOUT.



THEORETICAL CIRCUIT.

## COMPONENTS AND MATERIALS.

- 1 Panel, 7 in. x 7 in.
- 1 Cabinet to fit, with baseboard 9 in. deep.
- 2 Baseboard-mounting compression-type semi-variable condensers, maximum capacity about .0003 mfd.
- 1 On-off switch.
- 1 Crystal detector.
- 4 Terminals.
- 1 Coil former, 4 in. diameter by 3 in. length.
- Half-a-pound of No. 24 gauge D.S.C.
- 1 Ounce of No. 34 D.S.C.
- 2 Spring clips.
- 1 Baseboard-mounting coil holder, with short-circuiting bar or link.
- Wire, screws, flex, etc.

DRAWN	E.
CHECKED	45R
SERIAL NO	M.W.I.

### "M.W." BLUE PRINT No. 1. A HIGH-SELECTIVITY CRYSTAL SET.

A special crystal set for the Regional scheme. Two adjustable condensers are arranged so that one alone tunes to lower wave station, and when second is switched in and correctly adjusted the upper wave station is brought in. The switch alone then gives change-over from one station to the other. To get 5 X X insert No. 100 or 150 coil in loading coil holder and tune on C<sub>1</sub> with C<sub>2</sub> out of circuit. (Put shorting link in here at other times.)

## WIRING DIAGRAM.

### "M.W." BLUE PRINT No. 1. A HIGH-SELECTIVITY CRYSTAL SET.

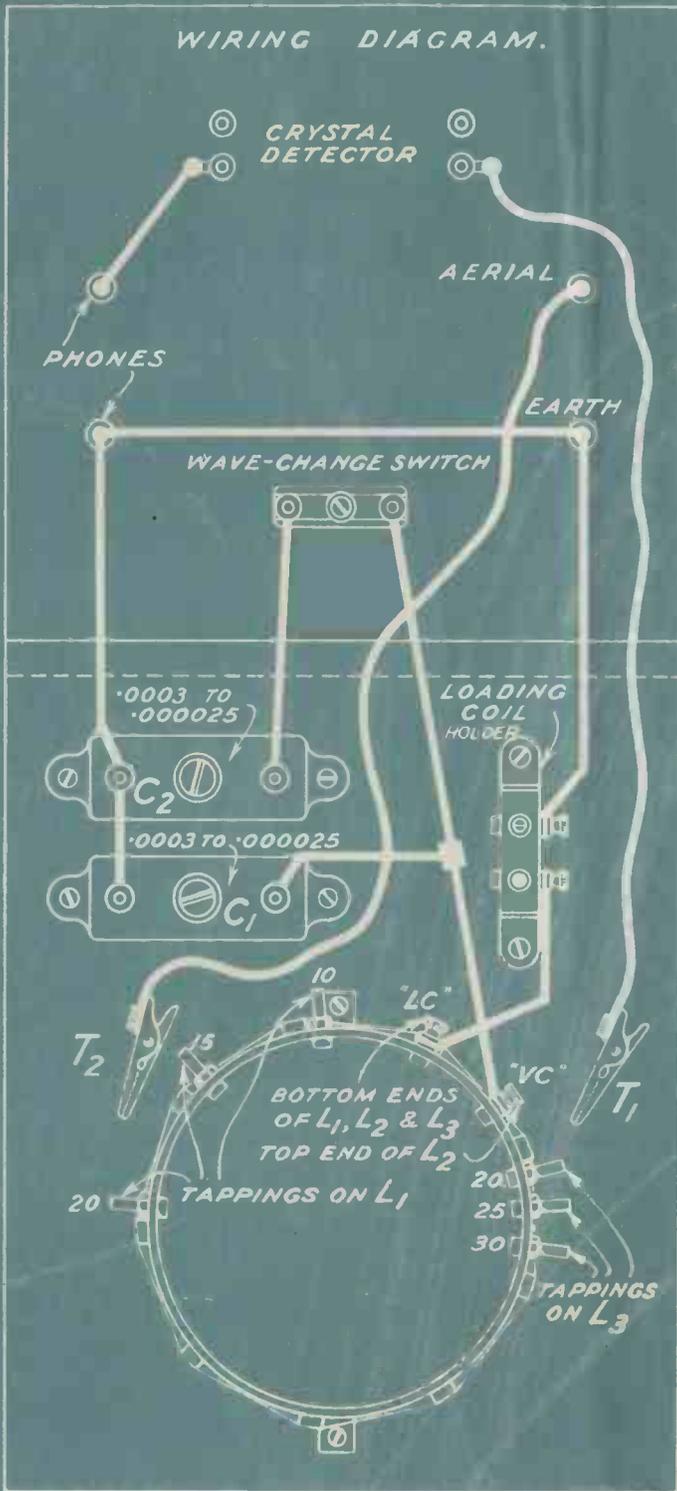
The coil is wound on a former 4 in. in diameter, and 3 in. in length.

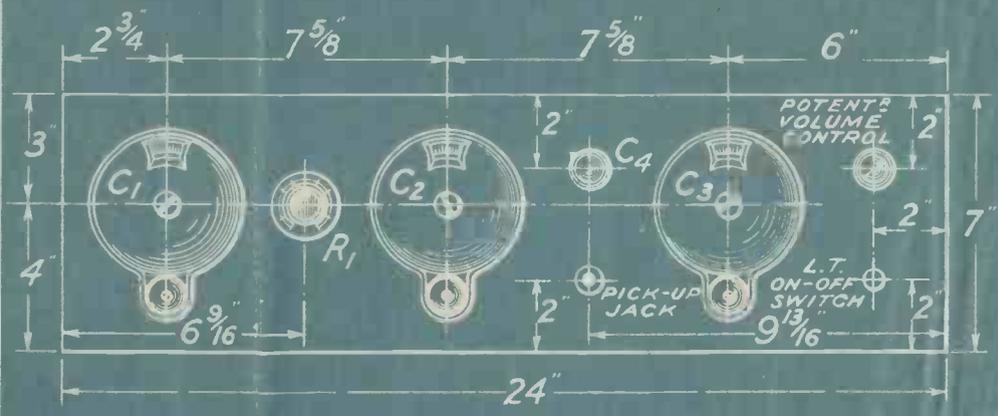
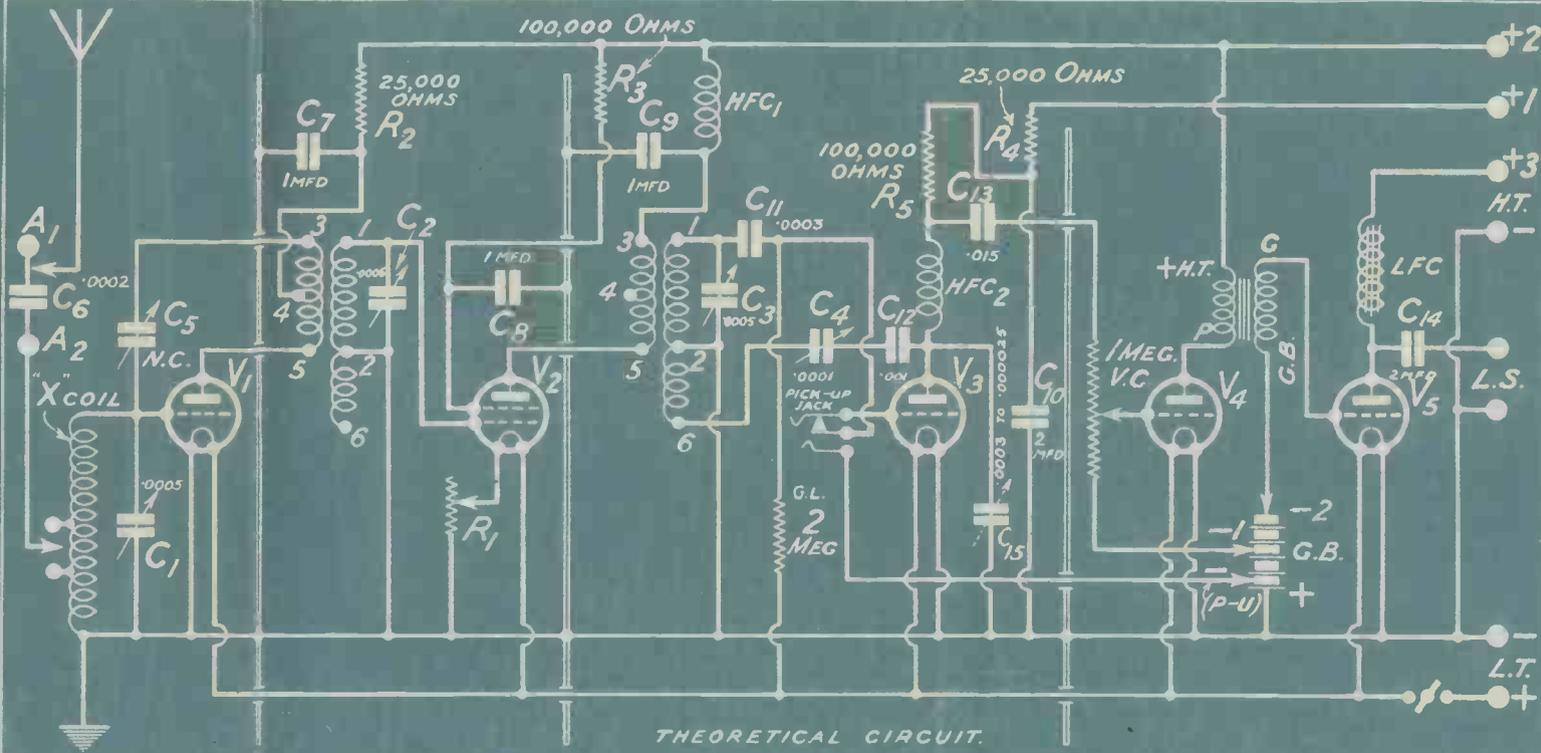
First of all a hole is punched near the bottom of the former and a 4 B.A. screw and terminal fitted. Then the bared end of a length of No. 24-gauge D.S.C., together with the end of another length of No. 34 D.S.C., are twisted and secured beneath the terminal (L.C. in the diagram). Next commence to wind on the turns together so that you have the thin wire interwoven with the thick wire turns. At the 20th, 25th, and 30th turns along the thin wire winding take tapings, joining these taps to the 4 B.A. screws marked "tappings on  $L_1$ " in the diagram. This completes the fine wire winding, but you must now continue with the thick wire winding until you have wound

on 50 turns in all. This is the secondary coil  $L_2$ , and the end is joined to the terminal "V.C." on the coil former.

You are now ready to wind on the primary turns  $L_1$ . You will need nine flat strips of wood or ebonite about  $\frac{1}{4}$  in. by  $\frac{1}{4}$  in. to space the primary from the secondary. Commence the primary turns near the beginning of the secondary and join the start of the winding to L.C.

Wind on 10 turns and take a tapping, then wind on another 5 turns and take the second tap at the 15th turn. Then complete the primary by winding on another 5 turns, making 20 altogether. The end of the winding goes to the terminal on the former marked 20 ("tappings on  $L_1$ "). The general scheme can be seen from the wiring and theoretical diagrams. The primary winding can consist of No. 24-gauge D.S.C. wire.

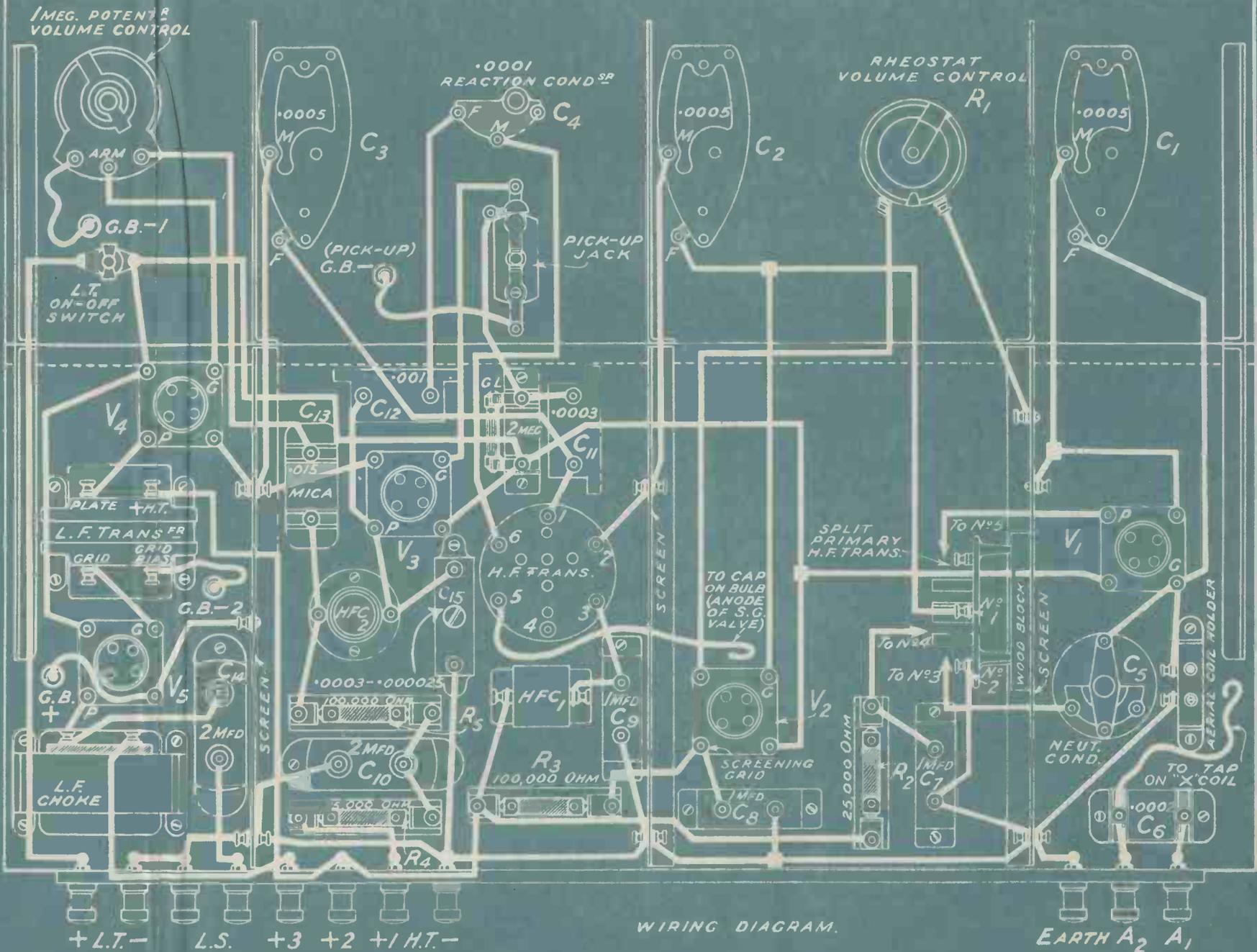




**"M.W." BLUE PRINT No. 2. A "HIGH-POWER" FIVE.**

**COMPONENTS AND MATERIALS.**

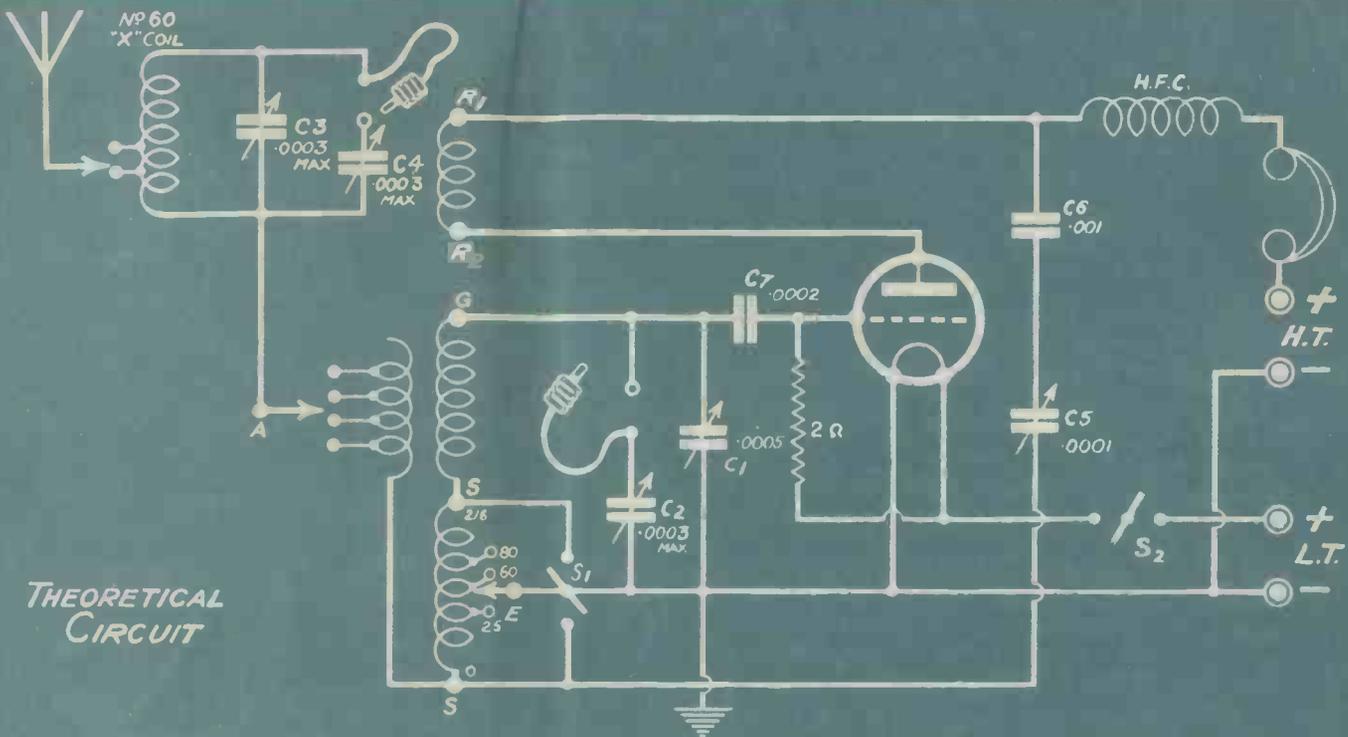
- 1 Panel, 24 in. x 7 in.
- 1 Cabinet to suit, with baseboard 10 in. deep, and pair of panel brackets.
- 3 .0005-mfd. variable condensers.
- 1 .0001- or .00015-mfd. reaction condenser.
- 1 Panel mounting rheostat (10 ohms for 2-volt valves, or 20 to 30 ohms for 4- and 6-volters).
- 1 Jack (single circuit closed).
- 1 1-meg. or 2-meg. potentiometer volume control.
- 3 10 in. x 6 in. standard screens.
- 5 Sprung valve holders.
- 1 Baseboard neutralising condenser.
- 1 Single-coil holder.
- 2 6-pin coil holders and block of wood to attach one 6-pin coil holder to screen.
- 3 1-mfd. and 2 2-mfd. condensers.
- 2 100,000-ohm and 2 25,000-ohm resistances, with holders.
- 2 H.F. chokes
- 1 Compression-type adjustable condenser, .0003-mfd. maximum.
- Fixed condensers of .0002, .0003, .001, and .015 (one of each).
- 1 2-meg. grid leak and holder.
- 1 On-off switch.
- 1 Low-ratio L.F. transformer.
- 1 L.F. filter output choke.
- 1 Terminal strip, 22 in. x 2 in., and 11 terminals.
- Wire, screws, flex, G.B. plugs, etc.



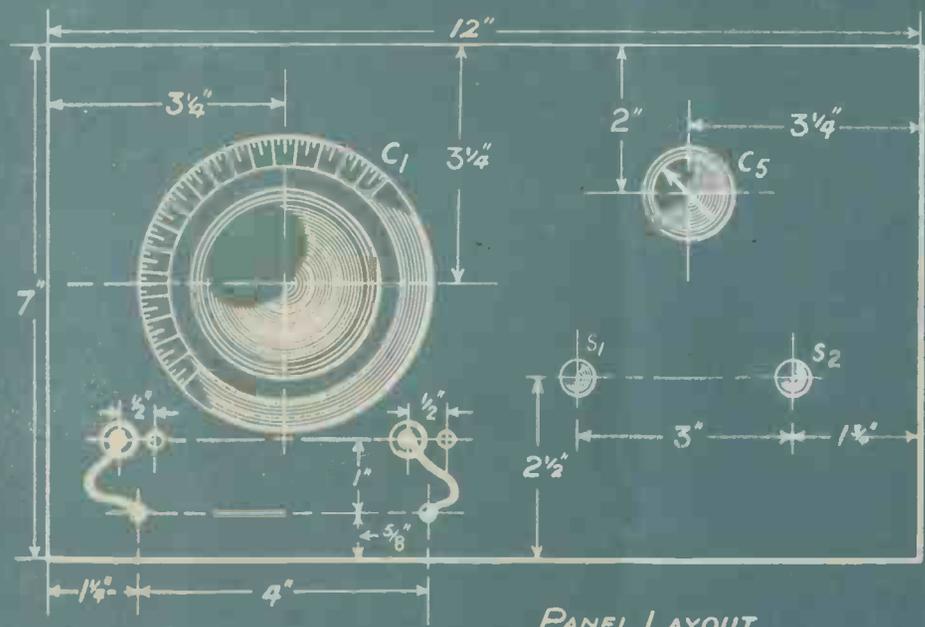
"M.W." BLUE PRINT No. 2. A HIGH-POWER FIVE.

A powerful and selective five-valve receiver, using one neutralized and one S.G. H.F. stage. First coil is of the X type (60 or 250), first H.F. coupling is an ordinary split-primary transformer (note method of mounting on side of screen), and the second is a transformer of interchangeable primary type. R<sub>1</sub> adjusts filament of S.G. valve and gives a pre-detector control of volume. Another volume control is provided in the L.F. circuits. Note the special voltage dropping and anti-coupling resistances. R<sub>5</sub> should be adjusted to give suitable screened-grid voltage (try 50,000 ohms with this season's types).

DRAWN	E.
CHECKED	696
SERIAL NO	MW2



THEORETICAL  
CIRCUIT

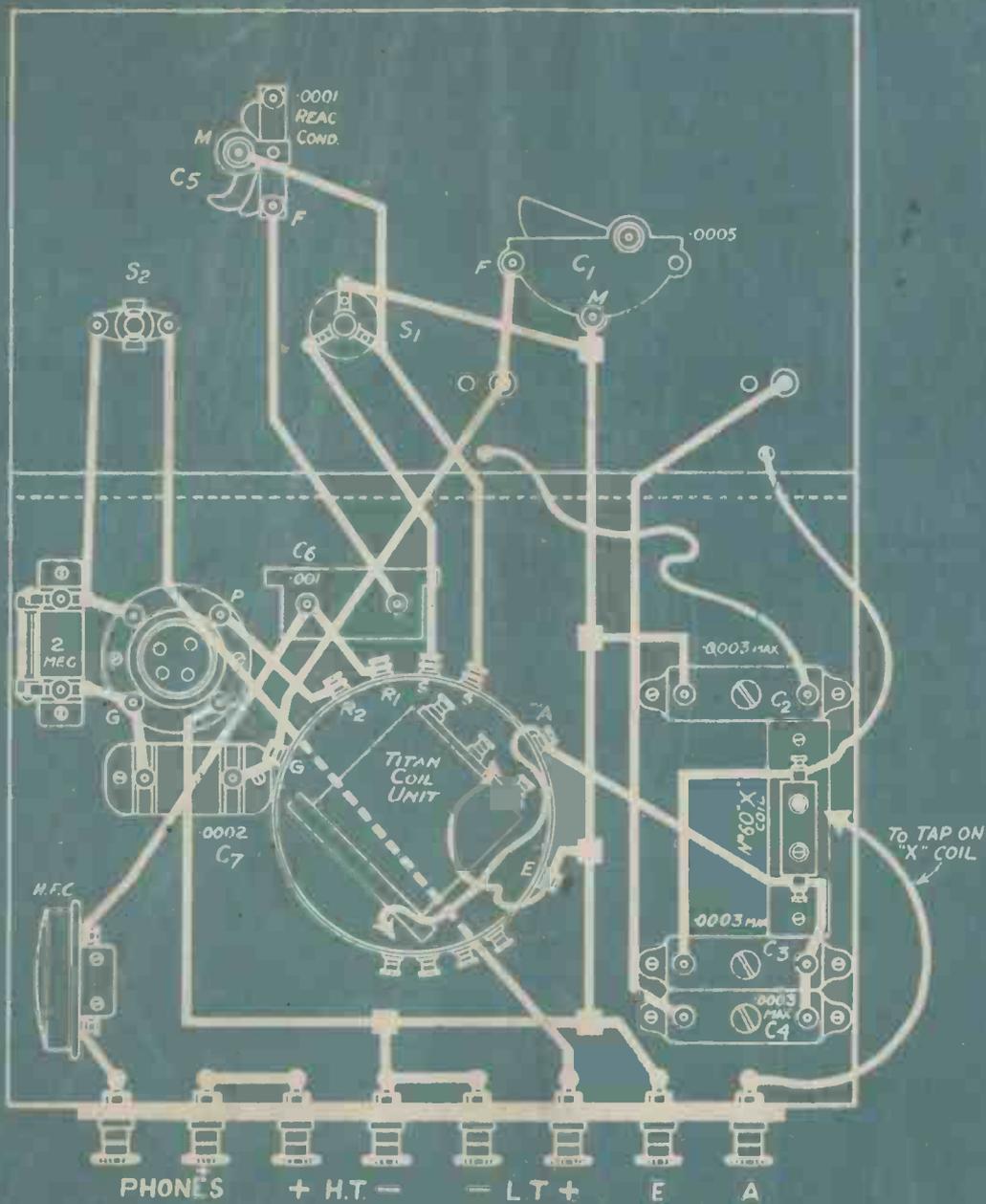


PANEL LAYOUT

"M.W." BLUE PRINT No. 3. THE  
"SWITCH-OVER" ONE-VALVER.

COMPONENTS AND MATERIALS.

- 1 Panel, 12 in. x 7 in.
- 1 Cabinet to fit, and baseboard 9 in. deep
- 1 .0005-mfd. variable condenser.
- 1 .0001-mfd. reaction condenser.
- 3 Compression type condensers for baseboard mounting, maximum about .0003 mfd.
- 1 .001-mfd. fixed condenser.
- 1 .0002-mfd. fixed condenser.
- 1 2-meg. grid leak and holder.
- 1 H.F. choke.
- 1 Baseboard-mounting single coil holder.
- 1 "Titan" coil unit.
- 1 3-point wave-change switch.
- 1 L.T. on-off switch.
- 1 Valve holder.
- 2 Plugs and sockets.
- 1 Terminal strip, 10 in. x 2 in.
- 8 Terminals.
- Wires, screws, flex, etc.



PHONES + H.T. - - LT + E A

WIRING DIAGRAM

DRAWN BY *EL*

CHKD. BY *OSK*

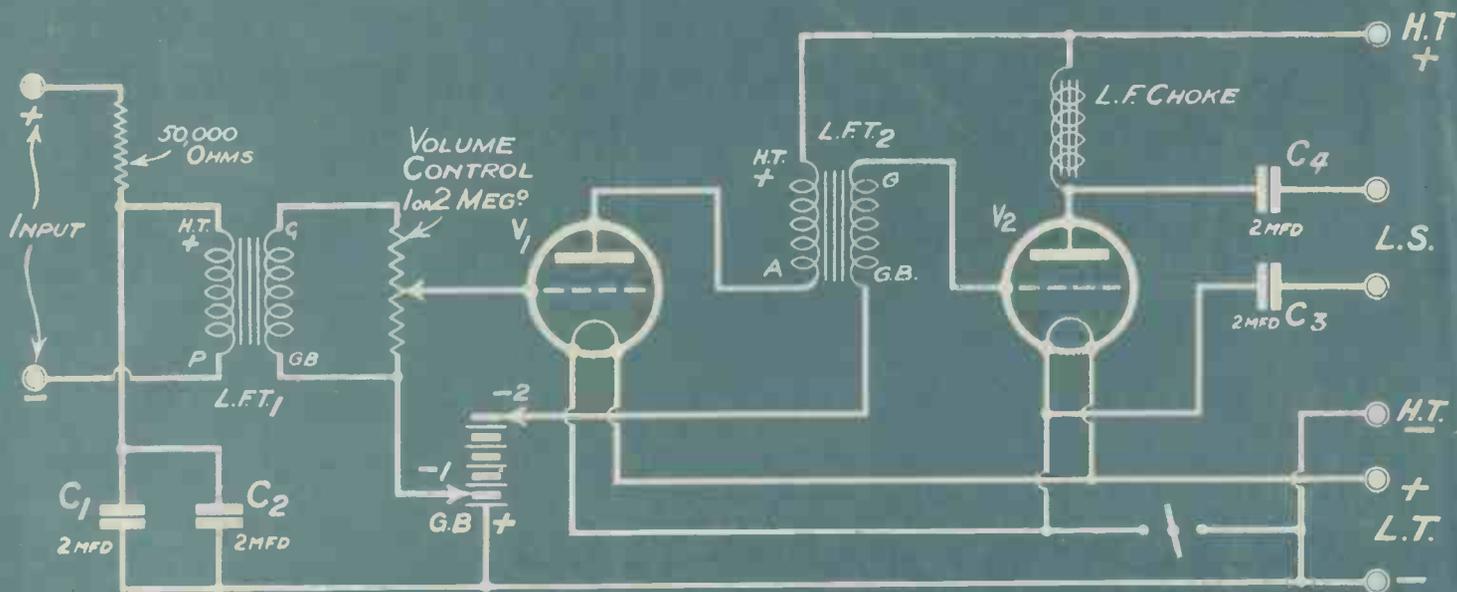
SERIAL NO *MW 3.*

"M.W." BLUE PRINT No. 3. THE "SWITCH-OVER" ONE-VALVER.

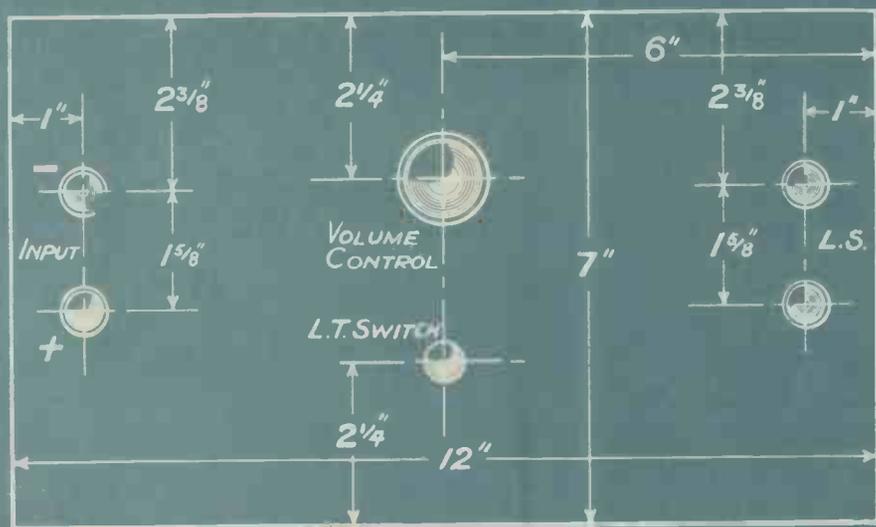
A little set intended for use in the Regional area. A simple switching scheme enables you to change from one station to the other without re-tuning, and a twin-wave trap permits you to trap out either of the two stations at will. A "Titan" coil provides operation on both wave-bands without coil changing. Tune lower wave station with right plug out of socket. (Front of panel.) Now place plug in socket and set C<sub>2</sub> to bring in upper wave station. Treat trap circuit similarly. (To out out undesired station.)







THEORETICAL CIRCUIT



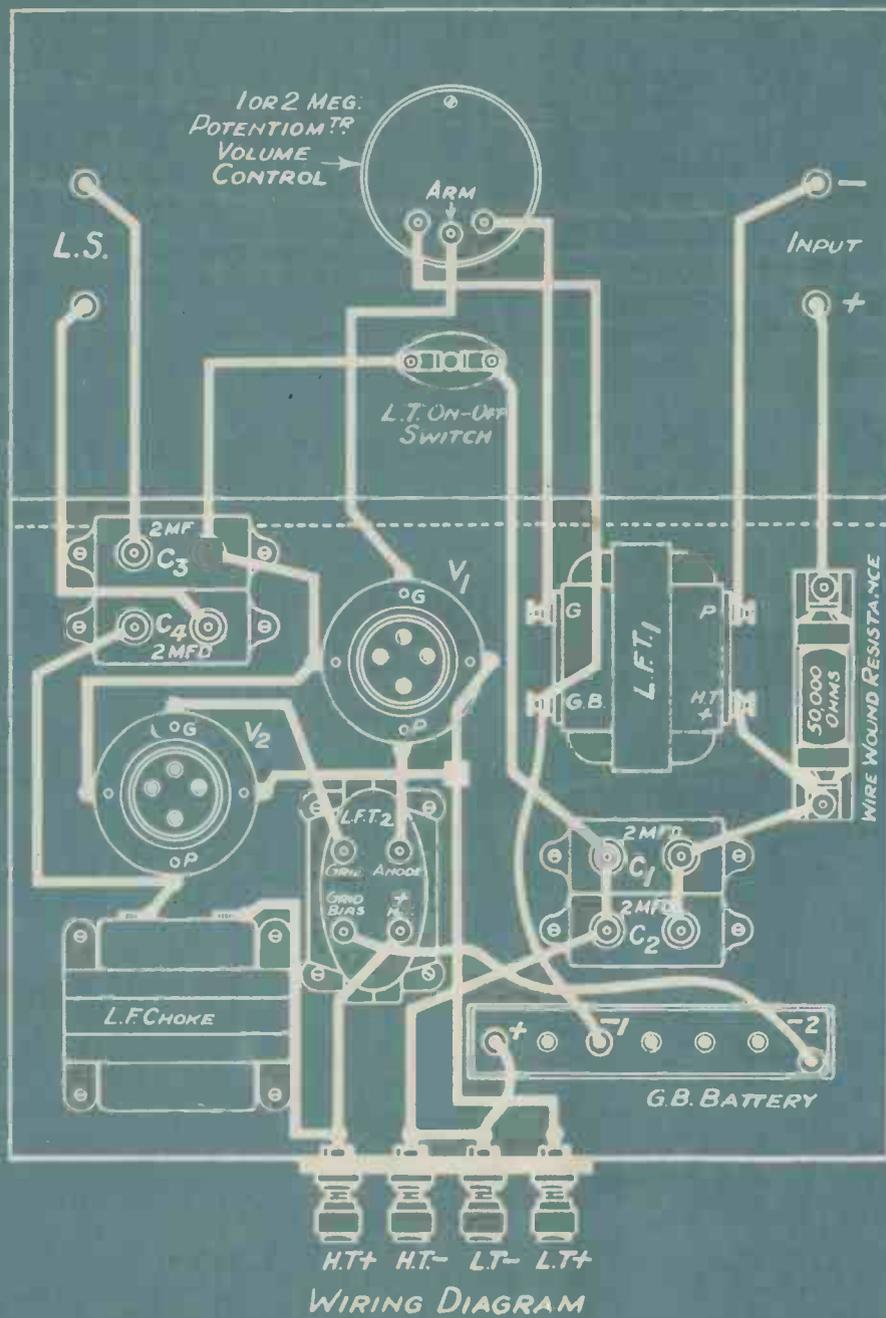
PANEL LAYOUT

\* \*  
 "M.W." BLUE PRINT No. 5. THE "FULL TONE" TWO-STAGE AMPLIFIER.

COMPONENTS AND MATERIALS.

- 1 Panel, 12 in. x 7 in.
- 1 Cabinet to suit, with baseboard 8 in. deep.
- 1 1- or 2-meg. potentiometer.
- 1 "On-off" switch.
- 4 2-mfd. Mansbridge type condensers.
- 2 L.F. transformers, low-ratio type.
- 2 Sprung valve holders.
- 1 Filter output choke.
- 1 50,000-ohm anode resistance.
- 1 Terminal strip, 4 in. x 2 in., and 8 terminals.
- Wire, screws, G.B. battery clips and plugs, etc.

\* \*



WIRING DIAGRAM

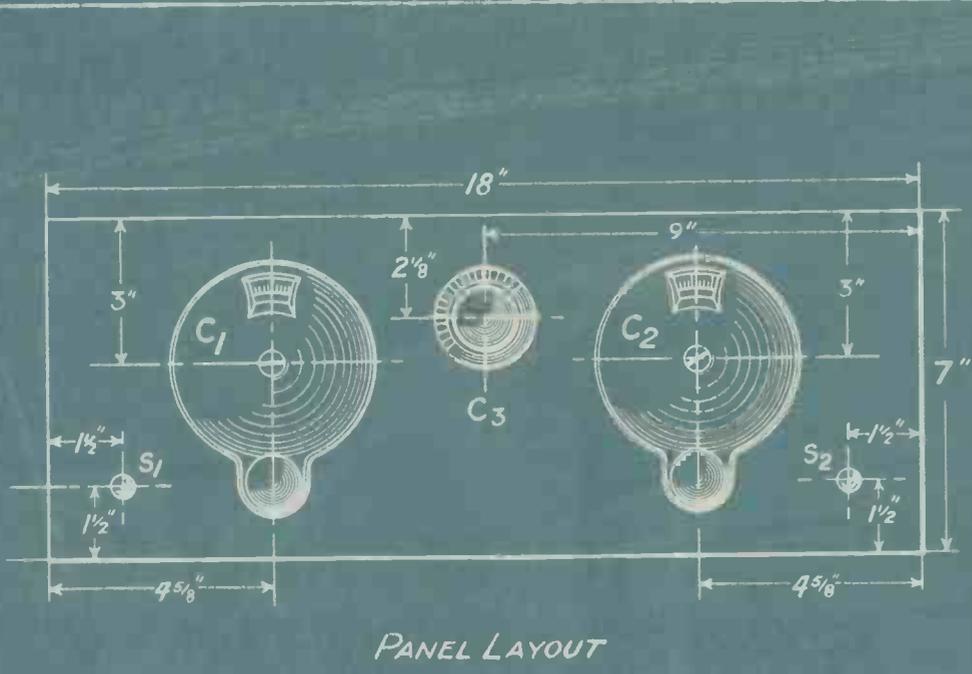
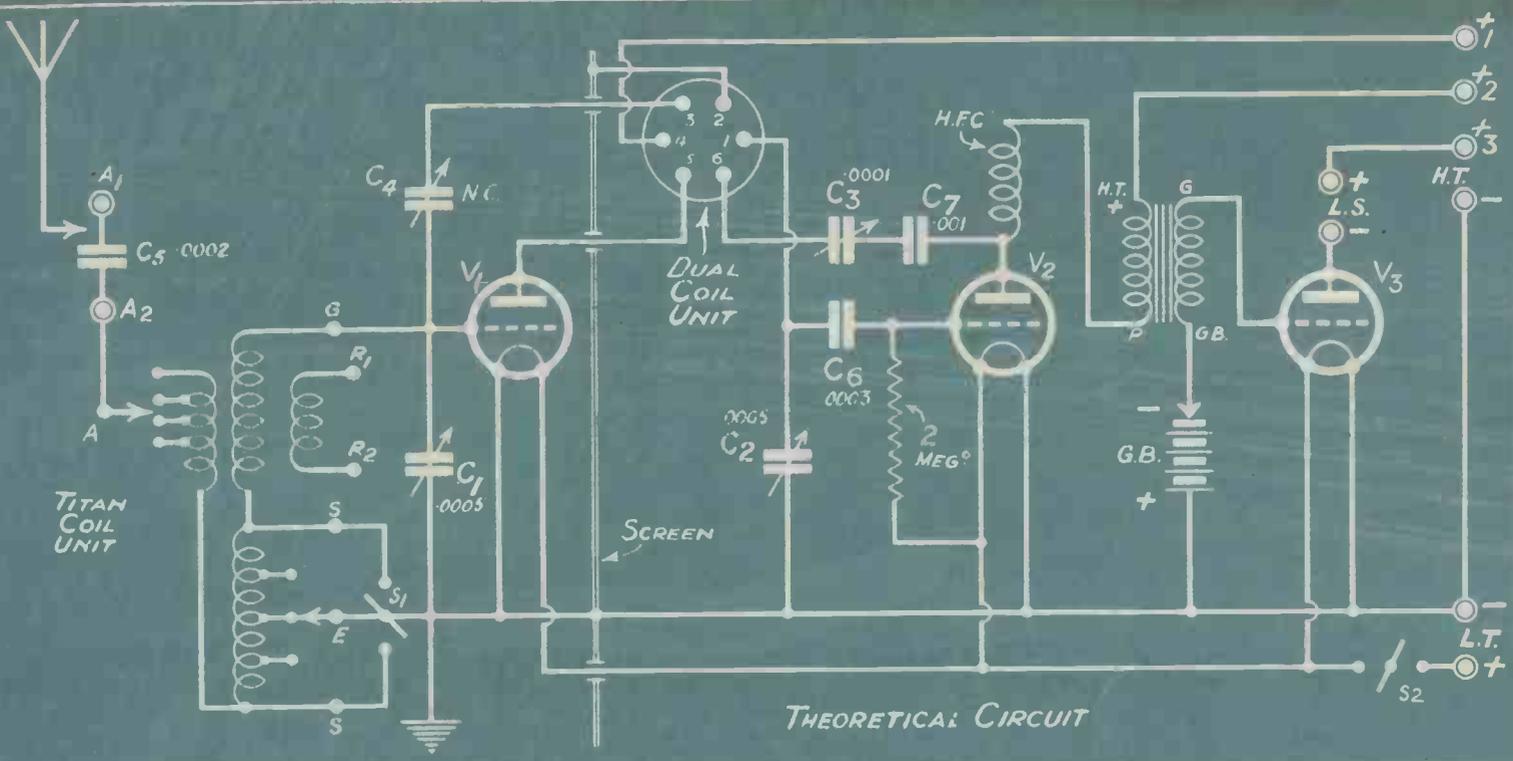
DRAWN BY E

CHKD BY J.L.

SERIAL No MW 5

"M.W." BLUE PRINT No. 5. THE "FULL TONE" TWO-STAGE AMPLIFIER.

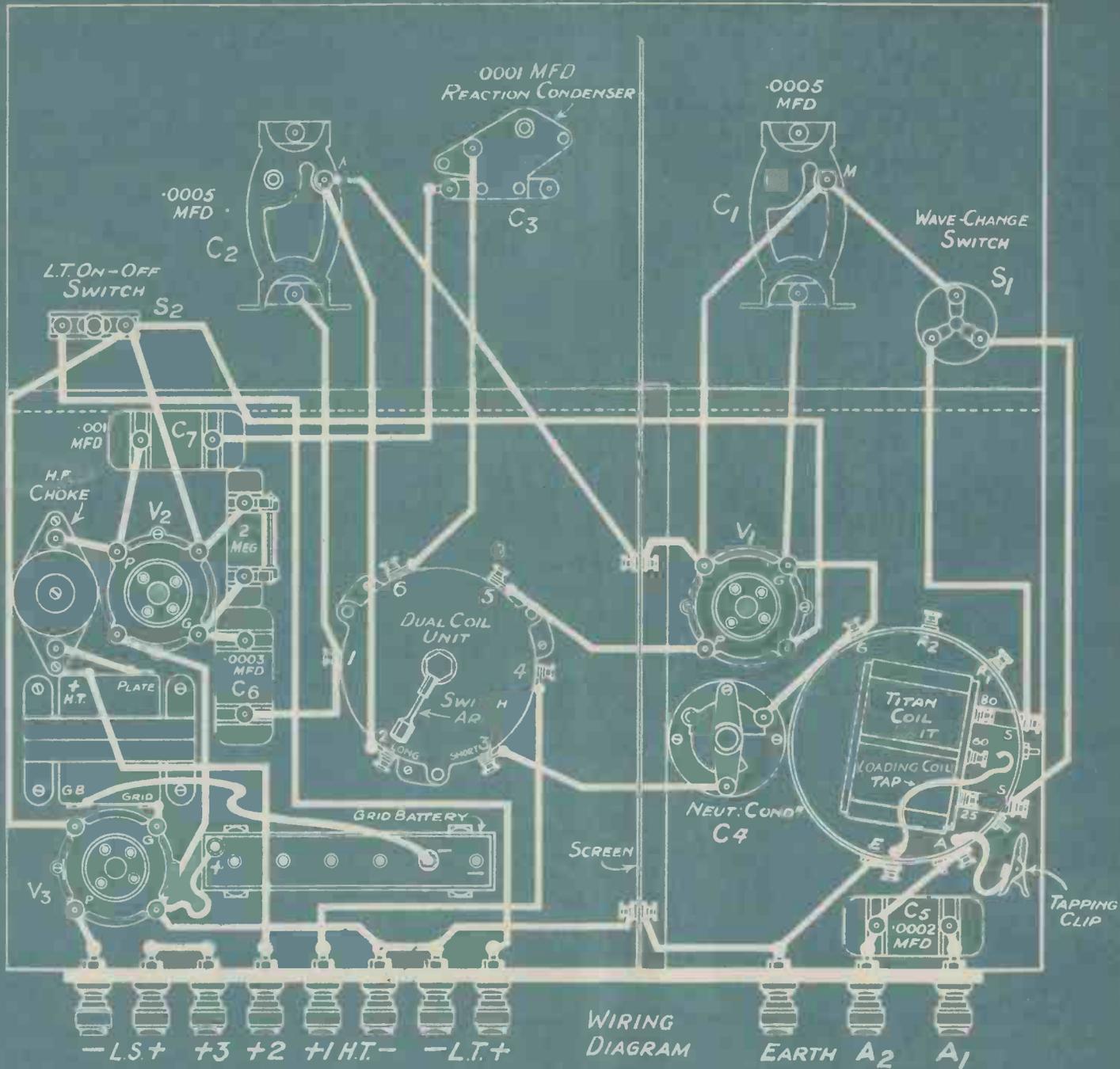
A very powerful two-stage L.F. amplifier using transformer coupling in both stages. A standard type of anti-battery-coupling filter is provided in the input circuit and this, together with the output filter for the loud speakers, makes the amplifier very stable. Note carefully that no connection should be made between the H.T. battery and amplifier "H.T. -" when the same batteries are used for set and amplifier. Valves: L.F. or G.P. type for V<sub>1</sub>, power or super-power for V<sub>2</sub>.



**"M.W." BLUE PRINT No. 6. A "SIMPLE CHANGE" THREE.**

**COMPONENTS AND MATERIALS**

- 1 Panel, 18 in. x 7 in.
  - 1 Cabinet, and baseboard 10 in. deep.
  - 2 .0005-mfd. variable condensers.
  - 1 "Titan" coil unit.
  - 1 Special dual-wave coil unit arranged as split-primary transformer.
  - 1 Screen, 10 in. x 6 in.
  - 1 .0001-mfd. reaction condenser.
  - 1 L.F. transformer.
  - 3 Valve holders, sprung.
  - 1 On-off switch.
  - 1 Three-spring wave-change switch.
  - 1 H.F. choke.
  - 1 .001-mfd. fixed condenser.
  - 1 .0003-mfd. fixed condenser.
  - 1 .0002-mfd. fixed condenser.
  - 1 2-meg. grid leak and holder.
  - 1 Baseboard-mounting neutralising condenser.
  - 2 Grid-bias battery clips.
  - 1 Terminal strip, 16 in. x 2 in.
  - 11 Engraved terminals.
- Quantity of wire, screws, flex, etc.



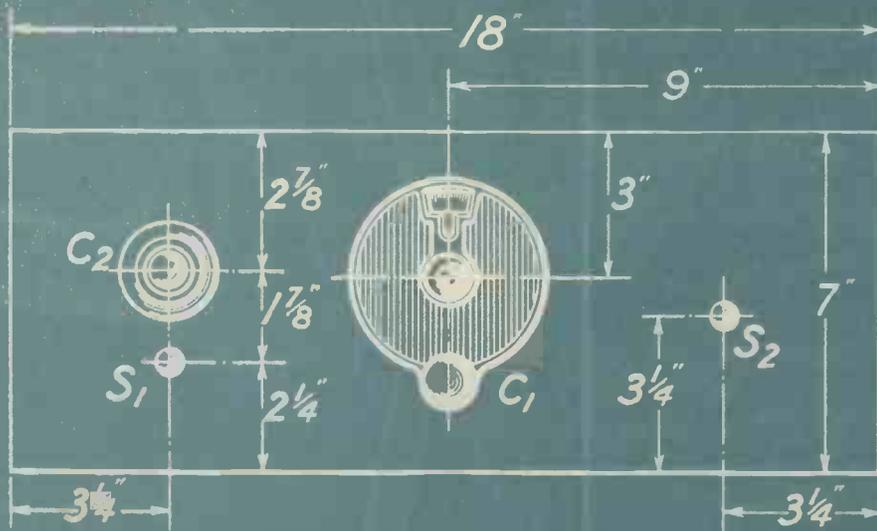
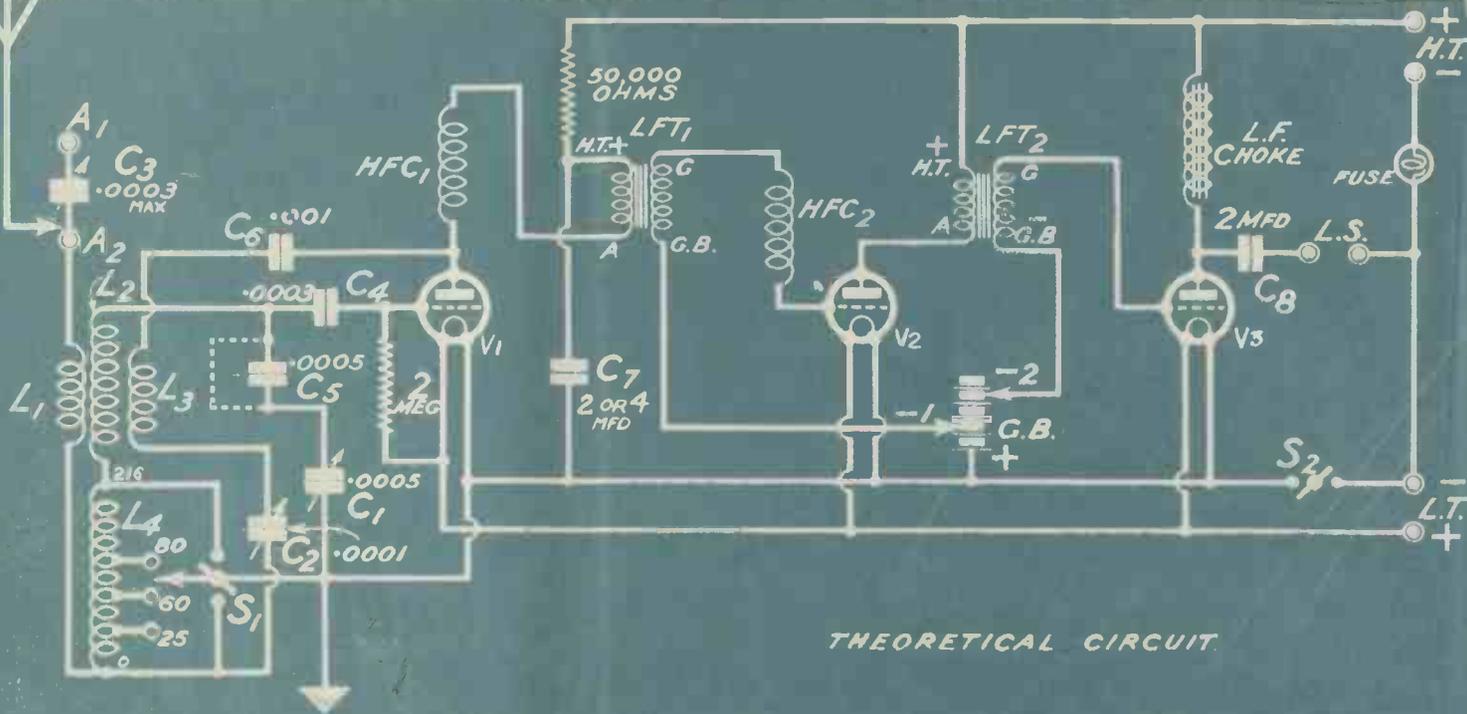
DRAWN BY *E*

CHKD. BY *MW*

SERIAL No. MW 6

"M.W." BLUE PRINT No. 6. A "SIMPLE CHANGE" THREE.

A simply-made but highly efficient H.F.-detector-L.F. receiver with wave-changing. The first circuit incorporates a "Titan" coil, with the usual 3-spring on-off type of wave-change switch (S<sub>1</sub>). The H.F. coupling is a dual-range split-primary transformer with integral wave-change switch (H.F. stage is of neutralized type.) Selectivity is controlled by tapping devices on "Titan" coil and by optional series aerial condenser (C<sub>5</sub> (place aerial on A<sub>1</sub> or A<sub>2</sub>)). Valves: one H.F. type for V<sub>1</sub>, H.F. or R.C. for V<sub>2</sub>, power or super-power for V<sub>3</sub>.

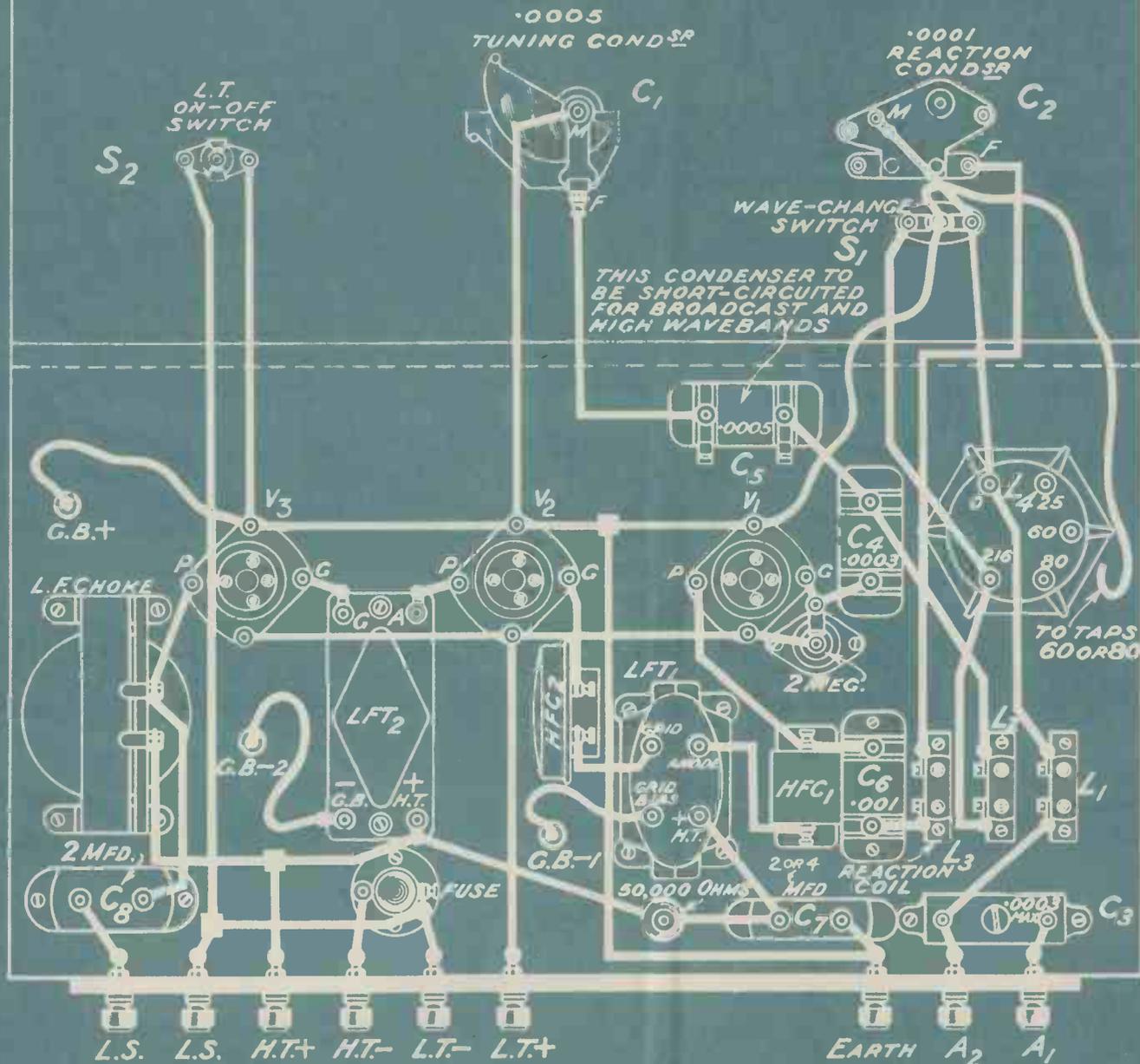


**"M.W." BLUE PRINT No. 7. AN "EVERY PURPOSE" THREE.**

**COMPONENTS AND MATERIALS.**

- 1 Panel, 18 in. x 7 in.
- 1 Cabinet to fit, with baseboard, 10 in. deep.
- 1 .0005-mfd. variable condenser.
- 1 .0001- or .00015-mfd. reaction condenser.
- 1 L.T. on-off switch.
- 1 3-point wave-change switch.
- 1 Standard loading coil, "M.W." type.
- 3 Baseboard-mounting single coil holders.
- 1 Baseboard-mounting compression-type semi-variable condenser, maximum capacity about .0003 mfd.
- 1 Fixed condenser .001 mfd., 1 of .0003 mfd., and 1 of .0005 mfd., the last to have grid-leak clips.
- 1 2-meg. grid leak and holder.
- 2 H.F. chokes.
- 1 2-mfd., and 1 2- or 4-mfd. Mansbridge type condensers.
- 3 Sprung valve holders.
- 1 H.T. fuse.
- 1 Output filter choke about 20 henries.
- 2 L.F. transformers of fairly low ratio, preferably of different makes or types.
- 1 Anode resistance 50,000 ohms.
- 1 Terminal strip, and 9 terminals.
- Wire, screws, plugs for G.B., etc.

WIRING DIAGRAM.



DRAWN *E.*  
 CHECKED *J.K.C.*  
 SERIAL NO. MW7

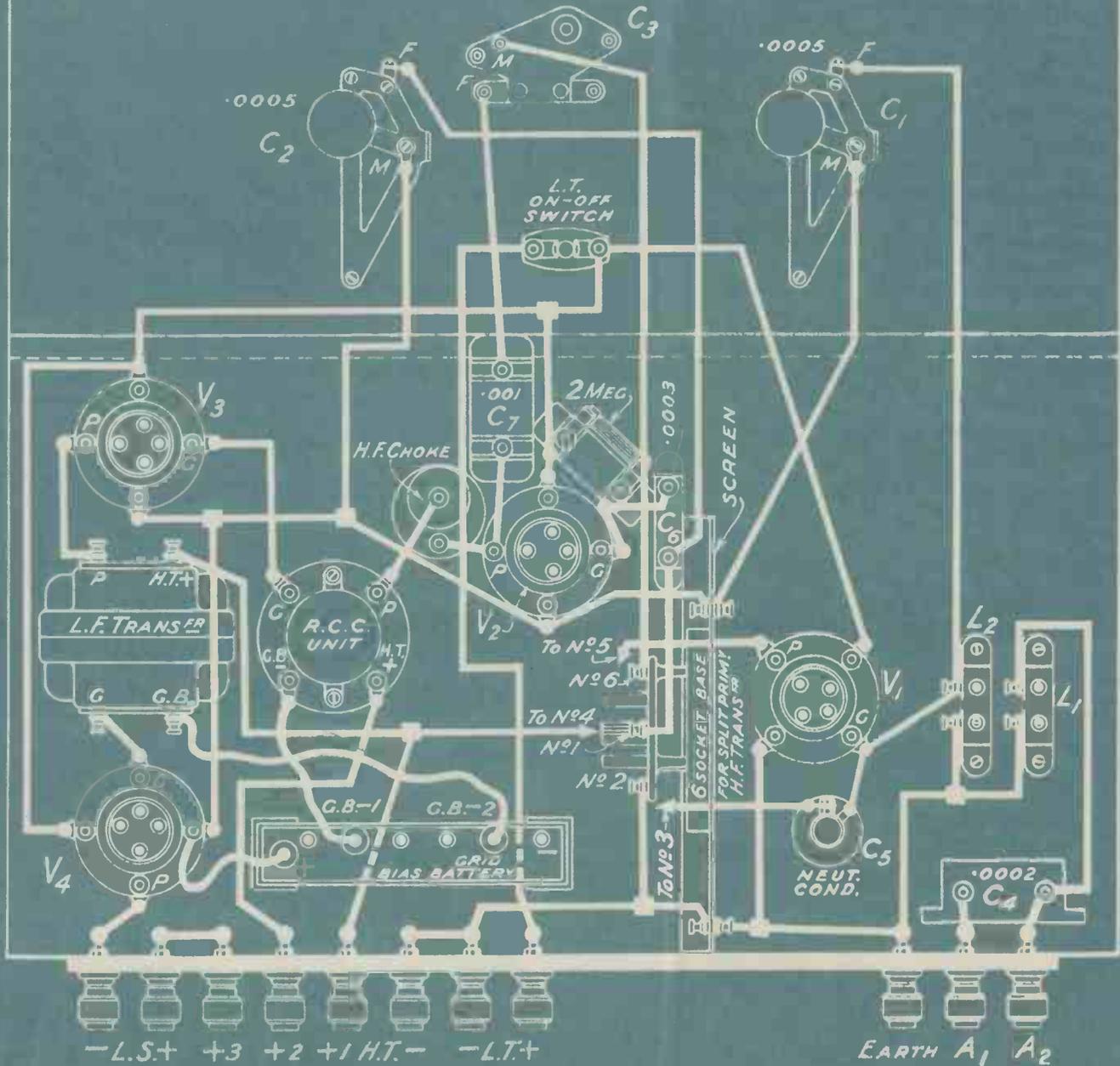
"M.W." BLUE PRINT No. 7. AN "EVERY PURPOSE" THREE.

A very powerful detector and L.F. three-valver, with wave-change switching for medium or long waves. By changing the plug-in coils it will also work on short-waves. (Note condenser C<sub>2</sub>. Short this with piece of brass or copper rod when not required.)  
 Coil sizes: for broadcast band, L<sub>1</sub>, No. 25 or 35, L<sub>2</sub>, No. 60, L<sub>3</sub>, No. 50. For 20 to 35 metres, L<sub>1</sub>, No. 2, L<sub>2</sub>, No. 4, L<sub>3</sub>, No. 4 or 6.  
 Valves: V<sub>1</sub>, H.F. type, V<sub>2</sub>, L.F. or G.P., V<sub>3</sub>, power or super-power.



WIRING DIAGRAM

.0001  
REACTION  
CONDENSER



DRAWN *E.*  
CHECKED *W.B.*  
SERIAL NO. *M.W.B.*

"M.W." BLUE PRINT No. 8. THE "SIMPLE SCREEN" FOUR.

A simple and straightforward general-purpose four-valver. Standard components are required throughout, and the H.F. stage is of the neutralised type. Aerial and grid circuits are made up with plug-in coils and a split-primary H.F. transformer gives the intervalve coupling. Coil sizes:  $L_1$ , 25 or 35 (75 or 100 for long waves).  $L_2$ , 60 (250 for long waves). H.F. transformer to be long or normal wave-range to match. Valves: 3 of H.F. type and 1 power or super-power.