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MODERN WIRELESS

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Vol. XV. No. 50

February 1931

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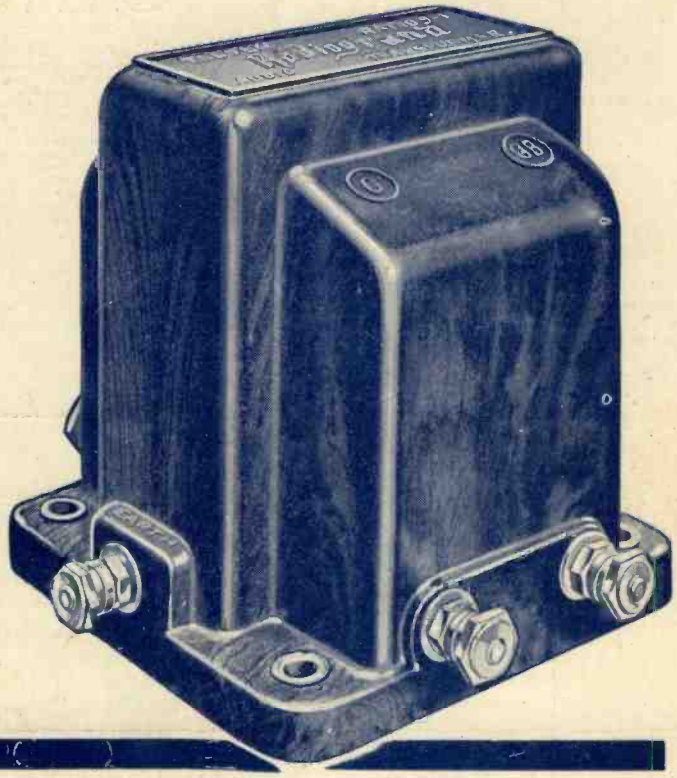

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CONTENTS

VOL. XV. No. 50. MODERN WIRELESS FEBRUARY, 1931.

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

Edited by NORMAN EDWARDS.
Technical Editor: G. V. DOWDING, Associate I.E.E.
Radio Consultant-in-Chief: Capt. P. P. ECKERSLEY, M.I.E.E.
Scientific Adviser: J. H. T. ROBERTS, D.Sc., F.Inst.P.

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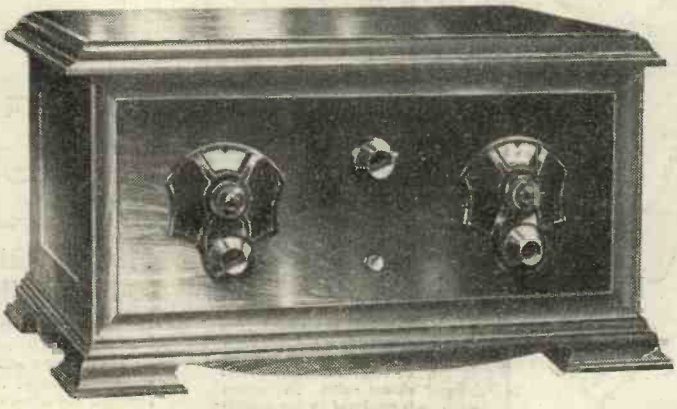

The famous

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tested by "Modern Wireless" experts and described in this issue on page 201.

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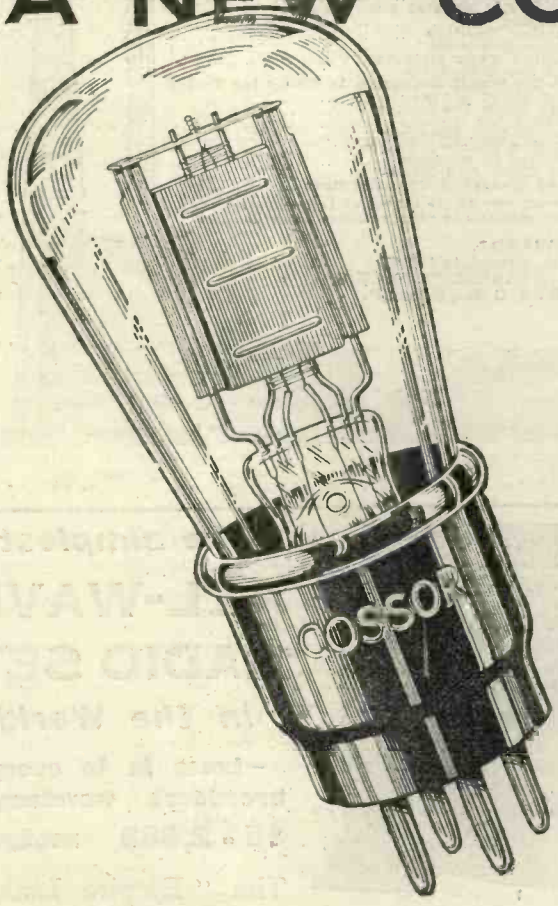
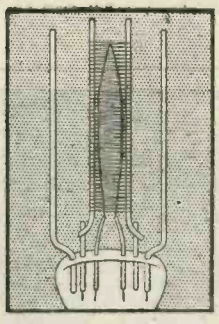
210 HL

A NEW COSSOR VALVE

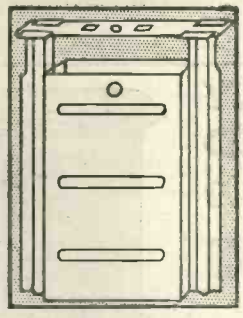


DESIGNED especially for more efficient H.F. amplification in non-screened grid Receivers, the new Cossor 210 H.L. possesses features of vital interest to all users of that type of Set. Amongst these may be instanced its special grid current characteristics. By the complete elimination of grid current in this valve a remarkable degree of distortionless H.F. amplification is ensured without the necessity of employing grid bias. As a result the Cossor 210 H.L. can be worked under the most efficient operating conditions—its amplification unimpaired by the effect of bias. Because of this and because of the other special features of the Cossor 210 H.L. detailed below the use of this new valve will effect a considerable increase in the efficiency of any non-screened grid Receiver.



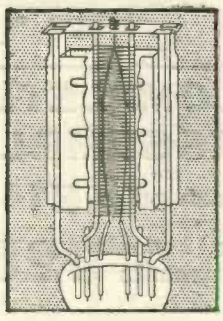
SEVEN POINT SUSPENSION

Practical experience has shown that the Cossor 7 point suspension system definitely eliminates microphonic noises. Th system is employed in the support of the exceptionally long filament of the Cossor 210 H.L.



MICA BRIDGE MOUNTING

Permanent alignment of the electrode system is ensured by a stout mica bridge which forms an integral part of the anode assembly. When finally secured in position the whole structure becomes one interlocked unit.



UNIFORM PERFORMANCE

The Cossor mica bridge construction permits no variation of characteristics due to differences in inter-electrode spacing. Complete uniformity of performance is therefore ensured between all valves of the same type.

The new Cossor 210 H.L. 2 volts, ·1amp. Impedance 22,000. Amplification Factor 24, Mutual Conductance, 1·1 m.a./v. Anode voltage 75-150. Price 8/6

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THE NEW COSSOR 210 H.L.

A. C. Cossor Ltd., Highbury Grove, London, N.5.

♡ 7232

Vol. XV. No. 50 BRITAIN'S LEADING RADIO MAGAZINE FEBRUARY, 1931

The Sets of the Month—Our Gift to Readers—A New Television System—Very Promising Results

Two Fine Mains Sets

THIS month we have several fine constructional features to offer our readers. Here is a brief summary. We are offering, first, two magnificent mains versions of the "Star-Power" Three (one D.C. and one A.C.). The set is based on the battery-driven "M.W." Three which appeared in our December, 1930, issue.

Incorporating the new "M.W." dual-range coils, "M.W." Interwave tuning and "Star-Turn" selectivity, these mains models have no batteries whatever—not even grid bias. Nevertheless, they are comparatively easy and inexpensive to build; and they are most economical in use.

The "M.W." "Tri-Coil" One uses only one ordinary plug-in coil for each wave-band in conjunction with simple home-made coils. It is one of the most effective and least expensive one-valvers we have ever described in "M.W."

The "M.W." Special Short-Waver has been designed expressly for short waves, yet nearly all its parts are absolutely standard and easy to obtain. It is a "hot" design for the high frequencies—is extremely pleasant to handle, and will pull in the transatlantic programmes in surprising style.

The "Forward" Four

THE "All-Power" Unit can be used in combination with a trickle-charger of simple design. This handy device completely solves the power problem (including G.B.) for practically any set up to and including four- and five-valvers. And, finally, the "Forward" Four. This set is a break-away from the conventional. It has the appearance of a first-class commercial set and is yet well within the scope of the moderately skilled home-constructor. Its compactness, unified tuning controls, panel wave-change, etc., make it an outstanding receiver, and one that will no doubt have a very wide appeal. Turn to it and examine the photos and the circuit, and you will appreciate the attractive features of this definitely progressive set.

Our Gift to Readers

AGAIN we present to our readers a free book: "50 More Guaranteed Circuits"—all tested and tried. Together with our last month's gift, readers now have an unequalled reference work of immense practical value.

A New Television System

ELSEWHERE in this issue our readers will find details concerning a new British television system which has lately been developed by the engineers of H.M.V.

In a letter which we have received from H.M.V., it is stated that this system, which is based on already well-known principles, has been developed with the idea of attaining definite entertainment value. The H.M.V. Co. point out that this has been so far realised, as received pictures can be projected on to a screen of any convenient size and that the illumination and definition are so good that even the finest details, such as the numbers on the trams in a London street scene, are clearly visible.

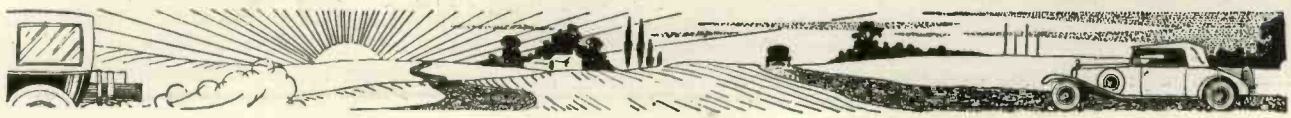
Very Promising Results

THE system adopted by the H.M.V. Co. is certainly interesting, and the results obtained, although far from perfect, are certainly the best we have yet had the opportunity of noting.

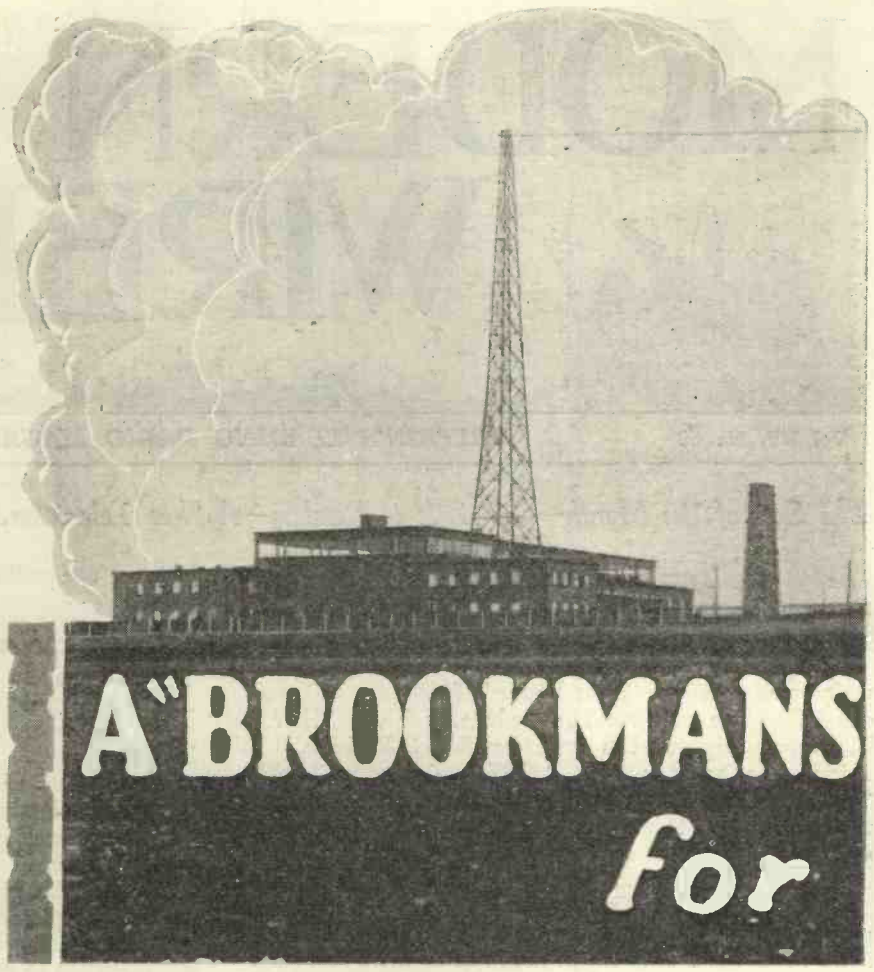
We wish the H.M.V. Co. good luck, and hope that in the near future we shall be able to report that even greater progress has been made. In any case, it is good news to be able to state that such a famous concern as H.M.V. have entered the television lists, and that their engineers realise from the outset that before television can be even remotely compared with the cinema first-class entertainment value must be obtained.

With this goal in view it is obvious that the H.M.V. engineers will not exploit the system publicly before research work of a sound and thoroughly reliable nature has evolved something more than a laboratory curiosity.

Admittedly there is much to be done; the task is severe, the technical difficulties numerous and complicated; but with time and care and a disregard for the dubious value of "flash-in-the-pan" effects, we feel confident that a television public entertainment system is well within the bounds of an early and practical realisation.



A "BROOKMANS" for



BUSINESS compelling me to be in Stuttgart at the beginning of November, I foresaw a wonderful opportunity to hear the first tests of Germany's first Regional station—a 75-kilowatter similar to Brookmans Park.

So I managed to stay in the neighbourhood for a further few days until by a lucky chance I met a Telefunken official—a friend with authority to take me over the station while the transmitting gear was having its final touches put to it.

The Wooden Masts

The station is actually at Muhlacker, a small town about midway between Stuttgart and Karlsruhe, and, as I learned later, is connected by landline with both these places. There is a large studio centre in Stuttgart.

B.B.C. engineers themselves could not have located a better position for the Muhlacker station, which is designed to serve the south of Germany. If you glance at a map you will see that Stuttgart (to which the Muhlacker station is nearer) is in a good transmission centre for the south of the country. Other similar stations will be built to cover the rest of Germany, and all the old stations will in course of time be scrapped.

The surrounding country is fairly flat, with just a few low hills, and there are not many houses near the aerials, as is the case with Brookmans Park and the new Northern Regional. The lattice masts are of wood. Apparently the German Telefunken engineers believe that the absorption effect of steel masts would make the aerials too directional.

The masts look like those at Brookmans Park, and they are roughly about 250 ft. high. The earth connection is not a counterpoise, but consists of a number of wires running to long copper tubes buried underground.

As the low brick building where the transmitter is situated is some distance from the aerial masts, a long "feeder," supported on telegraph poles, is run out from the transmitter to a small hut under the aerial itself.

This encloses the giant high-frequency transformer coupling the last stage of the transmitter with the aerial. It is a sort of secondary tuning circuit. It is at a high potential above earth, and a barred door prevents trespassers on the station ground from probing into the dangerous "mysteries" of the transformer house.

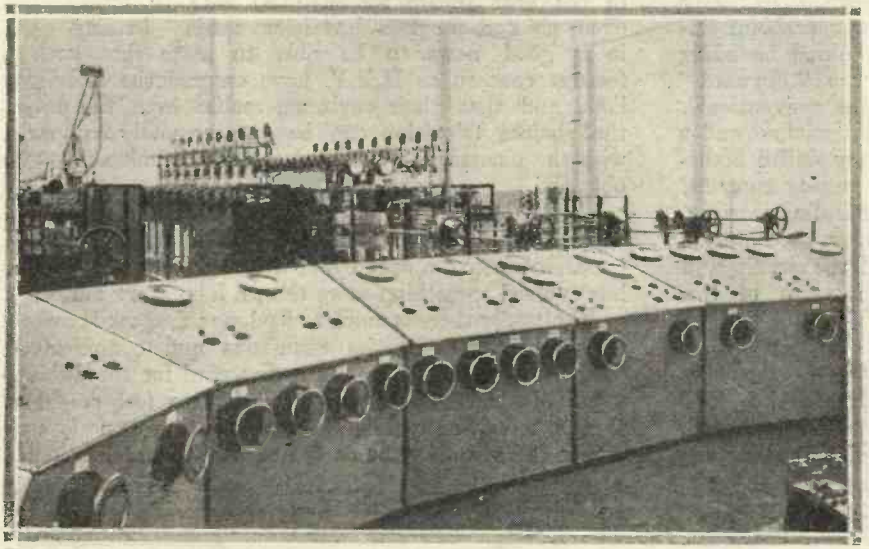
The first "Regional" for Germany is Muhlacker—truly a giant broadcaster, which has several features reminiscent of our own "B.P."

Not a Counterpoise

My guide unlocked the door and showed me a very uninspiring big tuning coil arrangement, not looking very dangerous. And, in any case, the "juice" was not on then.

We walked back to the transmitter house. I noticed some small trees under the electrical shadow of the aerial, but as a direct earth is used,

NOT A ONE-KNOB CONTROL!



This is only a part of the long row of desks on which the various check meters and controls of the huge transmitter are mounted.

PARK" GERMANY

AN ACCOUNT OF A PERSONAL VISIT BY

Our Own Special Correspondent

and not a counterpoise, these should have no adverse effect.

An elaborate covered lead-in arrangement (more correctly a " lead-out ") juts out from the wall and holds the cables linking up the little hut, some 150 yards distant, with the transmitter.

"One Up" for London

Engineers were busy with the final wiring tests. The big rotary converters were being put through their paces. These converters are fed with the local high-voltage power coming on power lines from Stuttgart, and they change it (alternating current at 50 cycles) to direct current for the anodes.

There are smaller reserve generators, and generators for grid bias (amounting to several hundreds of volts) and filament current supply.

I was rather surprised to see that there are no batteries at Mühlacker, and that the reserve generators (which would be useless in the event of a failure in the land-line carrying power from Stuttgart) are the only provision made for emergency working. Our big Diesel engines at Brookmans Park certainly put us " one up " in this respect.

The actual rated power of the station is 75 kw., although the power can be pushed up to practically twice this amount and the quality is stated still to be quite good. A novel modulation system is employed, working on somewhat the same lines as that at Oslo. The transmitting gear at Oslo was built by the engineers now responsible for Mühlacker.

Coloured Warnings

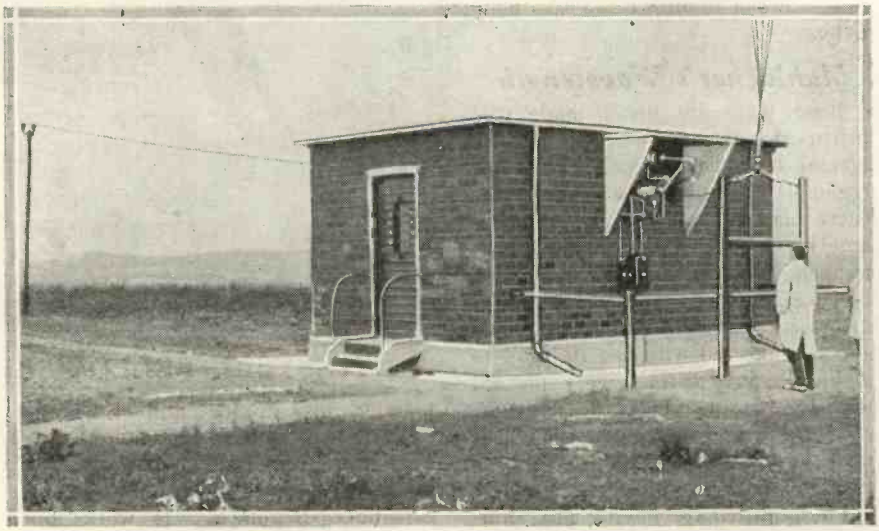
A striking feature of the transmitter house is the control desk—totally unlike those at any B.B.C. station, and distantly resembling that at Huizen. It is semi-circular in shape, and the engineer standing before it has complete control of every part of the transmitter and, by reason of the " desk's " shape, can see practically all the apparatus except the generators.

" Desk " is hardly the right word. It is a curious metal table affair carrying the smaller switches and rows of coloured indicating lamps on the top and the bigger controls on a vertical panel facing the operator.

There are meters showing the voltage and current in each anode, grid, and filament circuit. There are pressure and flow meters and thermostats for the valve-cooling water.

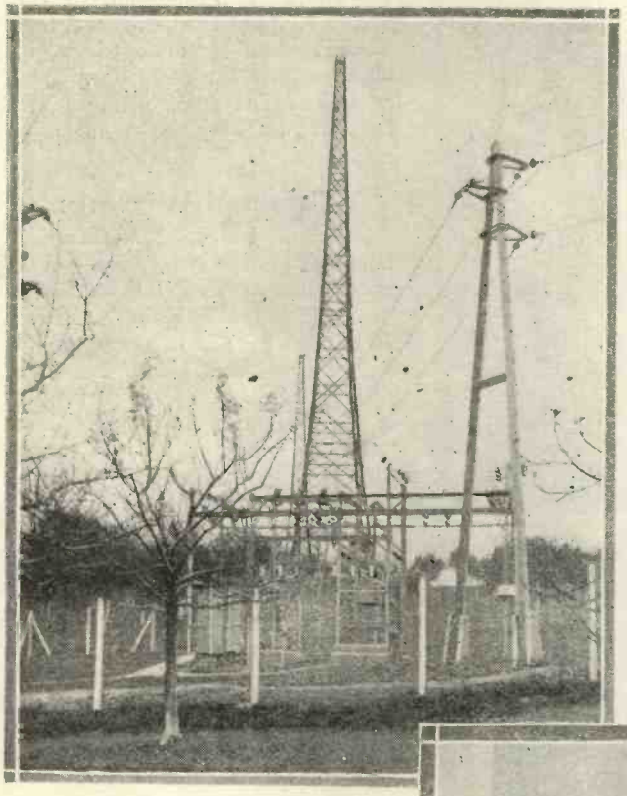
The multi-coloured lights show a failure in any circuit, and others glow or are extinguished as the various circuits are made or broken. It is very important in a transmitter not to turn on the anode-voltage generators until the valve-cooling water is in circulation and until the filaments have been turned on—a fraction at a time—and the proper working temperature reached. The coloured lights

A HOUSE FOR AN H.F. TRANSFORMER!



In this building is a huge H.F. transformer that couples the last stage of the transmitter with the aerial.

Each Valve Handles 20 kw. of Power



Here you see the two aerial masts. They are made of wood, and each is about 250 ft. high. The distance between them and the station building is roughly 500 ft.

(Below.)

A part of the transmitting gear. The pipes you can see carry the water that constantly flows around the anodes of the great valves to cool them.

on the control desk prevent a mistake in any of these matters.

Immediately in front of the desk is a bank of twelve giant water-cooled valves—the last stage, before the aerial, of the transmitter. *Each* valve handles 20 kw. of power!

The couplers and condensers are operated by geared slow-motion controls, and although the wave-length is kept constant by a master oscillator valve, these slow-motion controls are checked every morning before the day's transmission. I saw this being done.

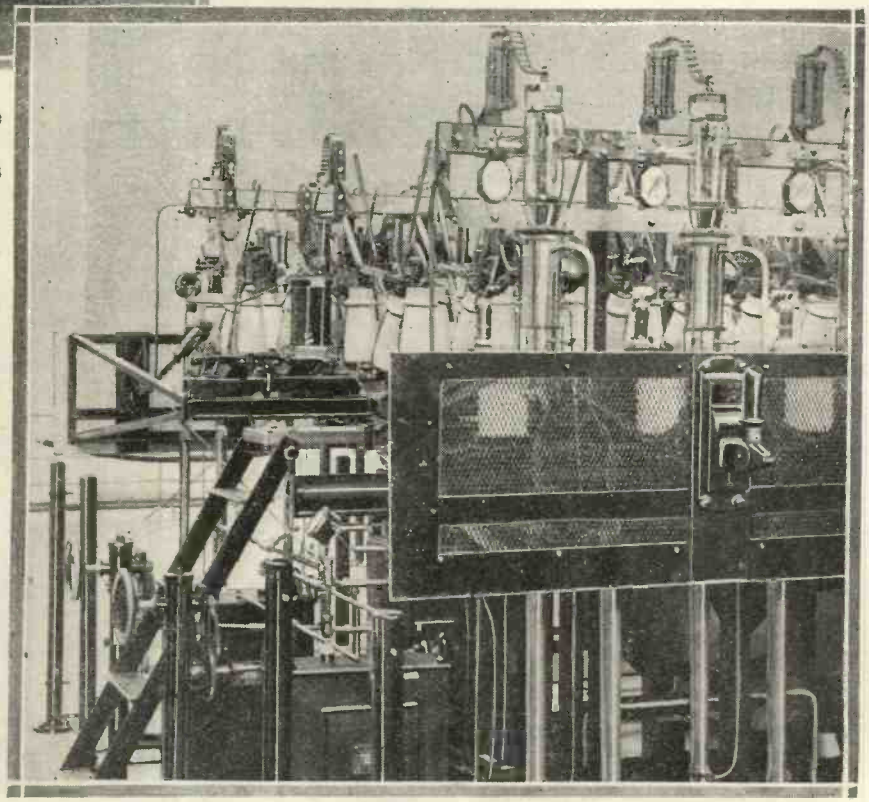
Muhlacker's Wavelength

First tests are being made with Stuttgart's own wave-length of 360·1 metres, but when the other projected regional stations come into action there may be an exchange of wave-lengths. This will certainly not happen till the end of the year, however.

Several wireless people in Stuttgart—not connected with the station—to whom I spoke seemed very pleased with the idea of a giant station right at hand; and although they had read in the wireless papers of our Brookmans Park interference, they did not anticipate having any difficulty in cutting out Muhlacker and picking up France and England.

Yet not more than fifty miles away over the Rhineland border is the powerful new French station at Strasbourg-Brumath. It works on a wave-length of 345 metres, which is uncomfortably close to Muhlacker's 360·1.

Much closer still in wave-length position is the London Regional, and as this station is well received in Germany it seems to me as though a certain amount of background on the new station's programmes is inevitable.



THIS BIG FELLOW REPLACES STUTTGART

SOME SHORT REMINDERS

Humming—H.T.—Rectifiers.

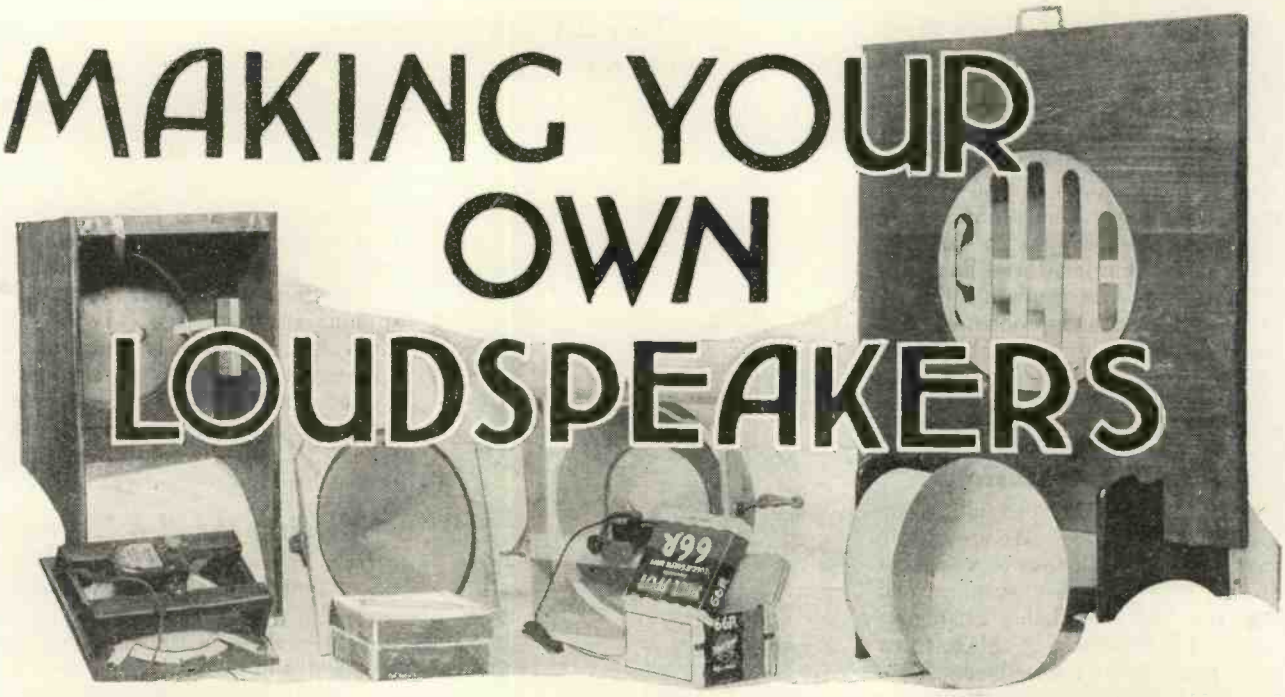
One method of getting rid of humming interference is to use a separate aerial coil and to couple this to the ordinary aerial coil in the receiver.

* * *

The high-tension voltage which is actually on the plate of the valve is always less than the figure at the corresponding H.T. plug on the battery, because there is a voltage drop through any resistance, primary winding, or other device in the circuit.

Values of current lower than the proper rating can be taken from metal rectifiers without damage, but no attempt should be made to take more current than the rectifier was designed to give.

MAKING YOUR OWN LOUDSPEAKERS



Here are full constructional details of a complete range of home-construction loud speakers, designed by the "M.W." Research Department, on entirely new lines. First, a senior cone and chassis are described, and you are then told how to build a handsome fire-screen loudspeaker. Finally, a portable model is detailed. Now these cone speakers incorporate a novel "free-edged" principle—the result of considerable research and experiment—and we confidently claim that unsurpassed realism is possible by its employment. It will cost you little of either time or money to build one of these cones and try it for yourself, and if you do so you will be very amply rewarded.

THE "M.W." "INTER-AXIAL" SENIOR CONE-SPEAKER ASSEMBLY

THE free-edged cone is not a new idea, and we did not invent it. Rather a strange way to start an article? Well, maybe, but we are going to claim such a lot in a minute that we thought it advisable to be careful how we set about it!

Really Effective

To begin, then. We believe that what we have done is to take a known idea of very great, but quite unexplored, possibilities and make it available for the first time in a really effective form.

It has been realised for some time that the free-edged cone was potentially capable of bringing about a genuine and definite improvement in loud-speaker performance. The practical difficulties of its application, however, seem to have prevented any real success with it, and those versions which have appeared have mostly been obvious compromises in which the full benefits of "free-edging" had been sacrificed.

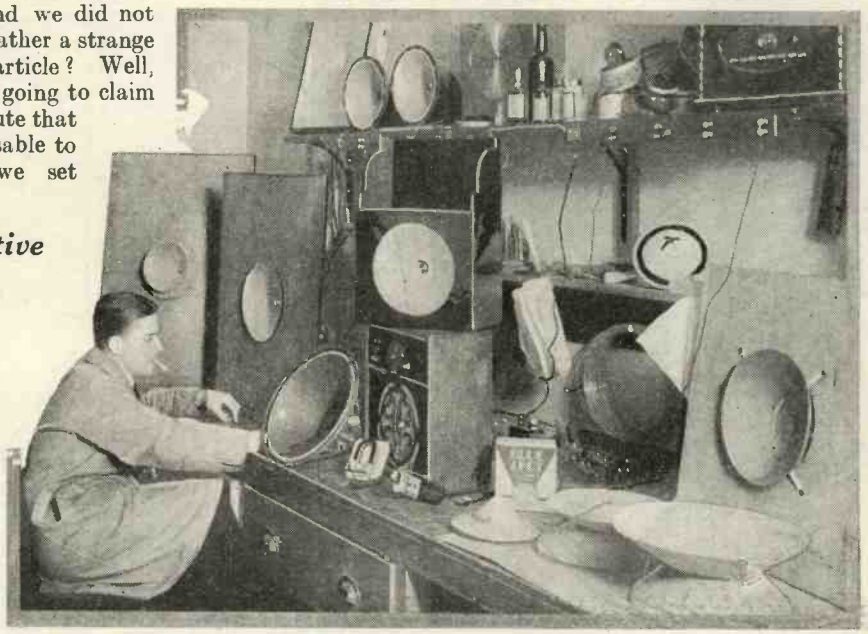
The difficulties of maintaining a true free-edge and yet devising a system of suspension having the necessary mechanical characteristics would seem to have been responsible, for it is hard to see what else could have prevented the wide exploitation of this remarkable principle.

As matters stand, we have not had brought to our notice any commercial loud speaker in which the free-edge system has been properly applied, with the possible exception of an expensive moving-coil instrument.

New Standard

Remembering how long the potentialities of the system had been known, this seemed to us a state of affairs

THE CONES NEARING COMPLETION



This is not a specially posed photo, but a "snap" taken by our staff photographer during the testing of some of the special "M.W." cone constructions in the "M.W." Research Dept.

which should be remedied, and we set ourselves the task of overcoming these apparently difficult problems.

Difficult they have indeed been proved, but we believe the solutions have been found, and now we are presenting the result of our work in practical designs which any handy constructor can copy with ease.

Speakers built on these lines will definitely set a new standard of fidelity and naturalness of reproduction, and our only fear in describing the results obtainable is that our claims may sound so extravagant as to shake the reader's faith in our truthfulness!

Brilliant Music

Choosing our words carefully, then, we will first say this: We are certain that anyone who listens to a speaker of this type for a few evenings and discovers its remarkable characteristics will never again be able to listen with pleasure to the ordinary type. Once he has discovered the difference he will find he cannot endure the latter's tendency to a lifeless tone on music, boomy "false" bass, and lack of crispness and clearness of speech.

To be more explicit, he will find that the free-edge type, properly arranged, gives him true and natural bass without boom, brilliant music, and speech in which the consonant sounds are as well reproduced as the vowels, with a consequent great gain in clearness and definition.

What these things mean, of course, is that the free-edge cone is practically free from the severe "peak" in the bass usually present, and that its response is extended much farther up into the really high frequencies. It is that last fact which permits the higher notes of different instruments to be reproduced in their natural qualities and does so much to render speech lifelike.

With the scientific reasons for these phenomena we shall not be able to deal here, for space is limited and we must get down to practical details as quickly as we can. It must suffice to hint that the bass "boom" so often heard is largely due to the resonant frequency of the cone as a whole on its customary edge suspension, while the anchoring of the edge tends to damp severely its response to the highest frequencies.

Solving the Problems

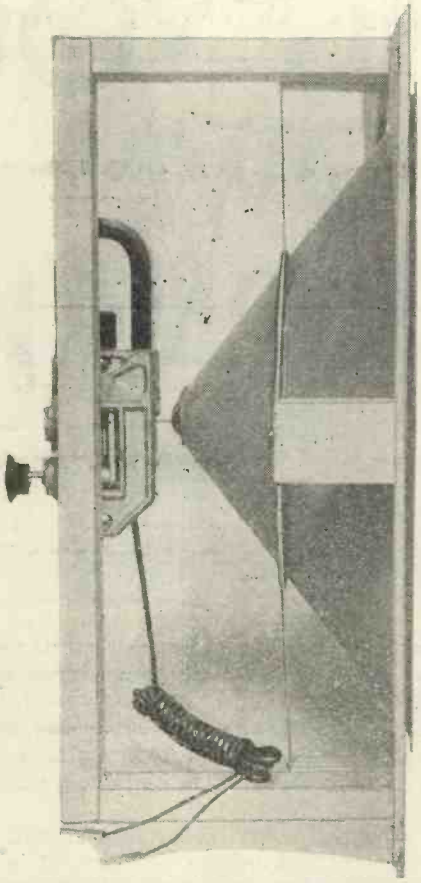
Now, in the past the main difficulties of applying the free-edge principle successfully have been three: First, it is the problem of stiffening the edge sufficiently to make the cone keep its shape without the damping trouble appearing; secondly, there is the need for a mechanically satisfactory suspension system with a natural period right down below the bottom limit of the main audible scale; and, thirdly, the difficulties of proper baffling.

How these problems have been solved you will discover as we describe the loud speakers you see illustrated.

Before we start, however, let us just explain how we are presenting these various designs.

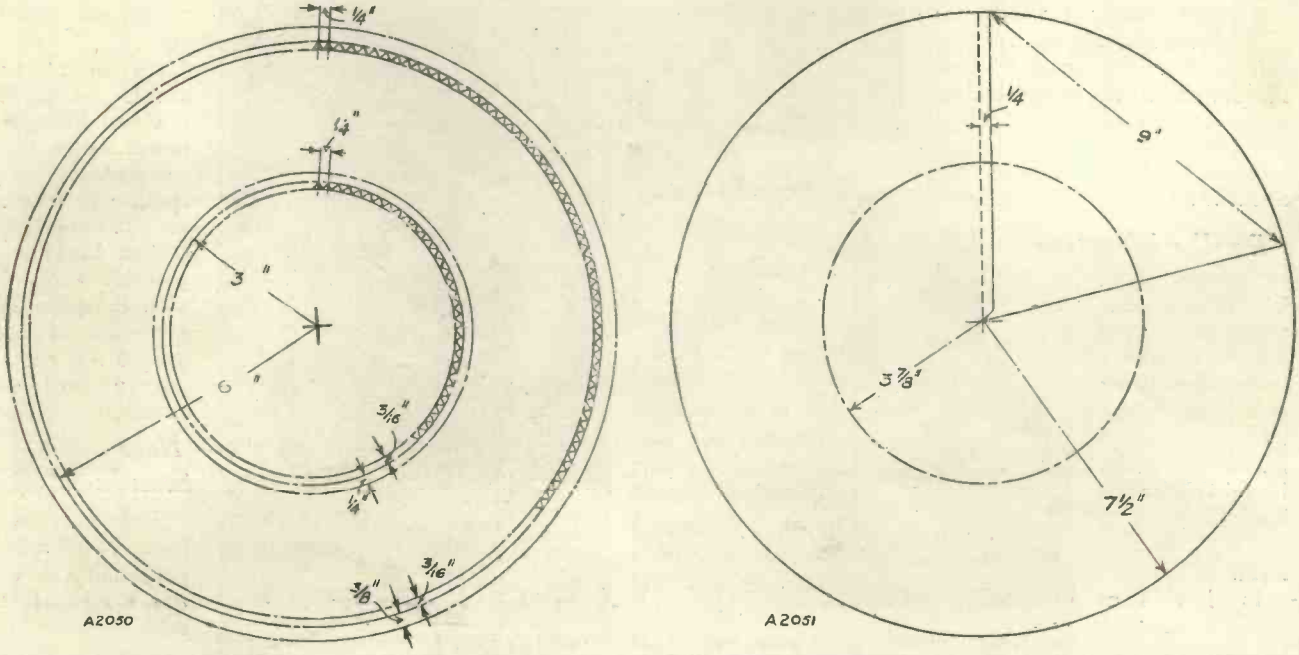
In the first section of the article we describe a chassis-assembly for our main type of free-edge loud speaker.

INTER-AXIAL SUSPENSION



The edgewise view clearly shows you the special inter-axial suspension carried out by four paper strips anchored to wooden blocks.

THE SIMPLE DIMENSIONS FOR CUTTING THE CONE

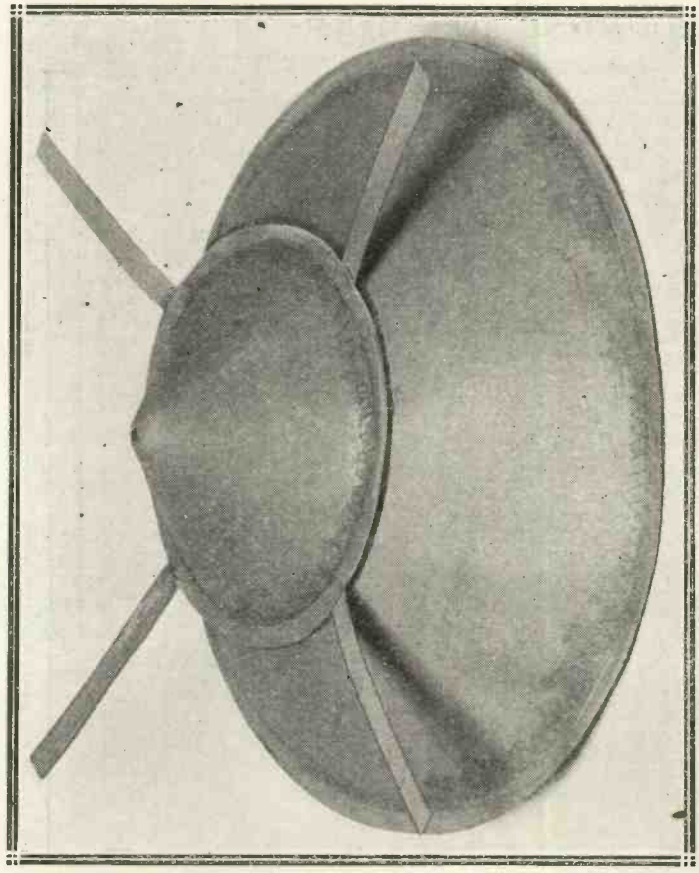


On the right are shown the cone cutting dimensions, and on the left the details regarding the sizes for cutting out and toothing the suspension (inner) and baffle (outer) rings are illustrated.

Full-Bodied Bass Without Spurious Boom

This chassis is designed for mounting in a cabinet or for attachment to any desired type of baffle, and on this subject you will find some notes in our second section, with practical details of a convenient form of self-supporting baffle.

In our third section we give the construction of a specially compact model of the chassis for incorporation in portable sets. The performance of this latter model is naturally not quite so remarkable as that of the full-sized one, but it is still far ahead of the usual standard.



RIGIDITY

The suspension and baffle-rings give the cone a tremendous rigidity in comparison with its exceptional lightness—an ideal at which all loud-speaker designers have aimed for years. Note the four suspension strips.

Commencing Construction

Now the construction of the main type of chassis. You want first a sheet of plywood (about $\frac{3}{8}$ in. thick; $\frac{1}{4}$ in. will do) 14 in. square. Cut in this a circular hole 12 in. in diameter, and there is the foundation of your chassis. The unit is carried on a wooden strip running across the back in a fashion quite clear in the photos and diagram. (They give dimensions to suit the Blue Spot 66R unit.)

The cone and its method of stiffening, suspension, and edge-jointing to the baffle is the whole secret. The suspension consists of four paper strips (same material as cone, about $\frac{1}{2}$ in. wide) coming off a special suspension ring placed half-way between edge and apex of the cone. (Hence the name "inter-axial" suspension.) These strips are made mildly taut and secured with drawing pins to four wooden blocks (see sketch of back of assembly). All the weight of the cone is thus taken up and it can be centred in the hole in the front by shifting the drawing pins.

The suspension ring is made of the same paper as the cone, and is stuck thereto with Seccotine, greatly stiffening it in the process. The photos of the completed cone show the details of this ring very clearly, particularly the serrations or teeth which provide the means of sticking it on.

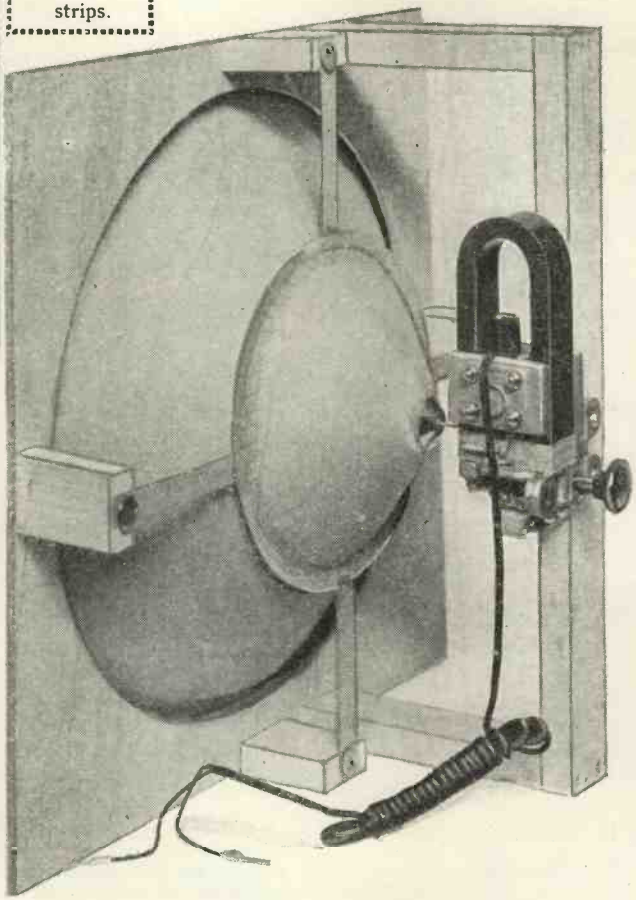
FREEDOM

As you will see if you closely examine this photo of the complete outfit, the cone has an unparalleled freedom for movement in a horizontal plane—a factor that enables it to give bass impulses adequate treatment.

The Baffle-Ring

One photo also shows another very important feature, i.e. the "baffle-ring." This is almost exactly similar to the first one, but it is stuck to the edge of the cone and serves the double purpose of stiffening it further and solving the difficult problem of securing a reasonably good acoustic "joint" between cone edge and baffle.

There must be no touching here, of course, or there will be a buzz, but the effect of the baffle-ring has been found to give quite adequate baffling. Examine the photo showing the completed chassis-assembly edge-on and you will see the relative positions of baffle-ring and chassis front.



The effect is to prevent loss of bass due to "leakage" between the front and back of the cone. This would be apt to occur if there were any serious gap between the edge of the cone and the edge of the hole in the baffle.

The special method of mounting to the baffle, by the way, adds completeness to the precautions taken in the design to prevent this loss. This is explained in the next section.

These general details, taken in conjunction with the photos and diagrams, will be enough for many constructors, but those without very much previous experience will find a lot of helpful matter in the two following sections.

A FIRE-SCREEN LOUD SPEAKER.

TURNING THE CHASSIS INTO AN ARTISTIC PIECE OF FURNITURE

In this section we shall be dealing with the mounting of the larger chassis on a baffle of the fire-screen type.

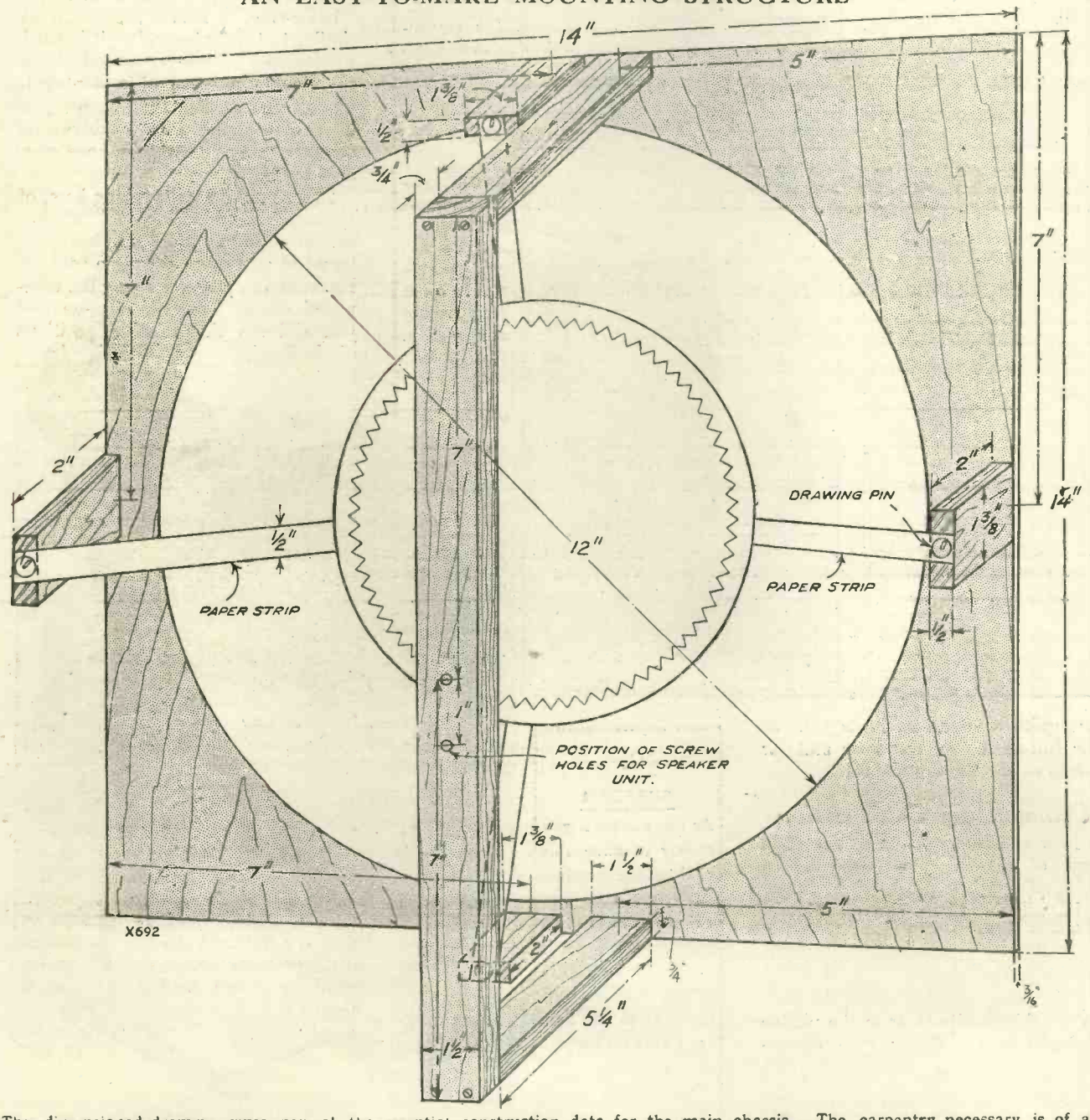
The object of the baffle, of course, is to ensure proper reproduction of the bass, and it is necessary to use one of at least a certain minimum size. It is difficult to lay down definite rules in this matter, but we are inclined to fix 20 in. square as the minimum for this loud speaker.

The instrument is capable, with a good driving unit, of excellent bass reproduction, and it is a pity to lose any of it as a result of inadequate baffling. For the best results we therefore advise one about 24 in. square, or even a little larger.

By the by, we have just qualified a statement with a proviso to the effect that a good driving unit is assumed, and this is a point we have not had space to mention previously.

Well, the point is probably obvious

AN EASY-TO-MAKE MOUNTING STRUCTURE



This dimensioned drawing gives you al the essential construction data for the main chassis. The carpentry necessary is of a particularly elementary character, so that the least mechanically-minded reader could build a correct duplicate.

An Uncanny Realism in the Reception of Speech

enough to anyone who has had any experience of loud-speaker construction, but it deserves mention for the benefit of those who have not. It is this. The design will permit a good unit to give a wonderful performance, but it won't make a good unit out of a bad one.

Now, you will already have gathered that the basis of the chassis is a front consisting of a square piece of plywood with a large circular hole through which the mouth of the cone projects. It actually sticks through to a distance of about a quarter of an inch, and there is a narrow gap all round between the cone and the wood.

"Sound-Leaks"

If this gap is at all large it is apt to lead to a loss of bass, because it represents a "sound-leak" in the baffle system. For mechanical reasons it is rather difficult to keep it sufficiently small, although it is possible by careful assembly.

To overcome the difficulty we devised our "baffle ring" scheme. This is a narrow paper ring cemented round the edge of the cone, and lying parallel to the front board. It acts as a sort of acoustic washer, and covers up the gap round the edge of the cone, besides providing valuable stiffening. It has proved very effective in enabling excellent baffling to be obtained.

It must be well forward from the front surface of the front board, of course, for false sounds would be produced if it touched anywhere. We have found a clearance of about a quarter of an inch satisfactory here. A fair clearance is advisable to allow for any irregularity in the paper ring. It is difficult to get it to dry quite flat, and with this amount of space a little "frilliness" won't matter.

Mounting the Chassis

Coming to the baffle proper, what you want is a good solid board which won't vibrate or act as a "sounding board," so it should be fairly thick, say, $\frac{5}{8}$ or $\frac{3}{4}$ in. The circular hole in its centre should be of the same diameter as the mouth of the cone *without* its baffle ring, although this is not critical and a variation of $\frac{1}{8}$ in. either way will not matter.

Since the cone cannot pass into the hole in the baffle on account of the baffle ring, you cannot screw the chassis direct to the back of the baffle. You require to space the chassis back a little from the rear surface of the baffle, a distance of $\frac{1}{2}$ or $\frac{3}{4}$ in. being suitable.

This allows either $\frac{1}{4}$ or $\frac{1}{2}$ in. between the baffle ring and the back of the baffle, so allowing for movement and any irregularities in the edge of the cone and baffle ring. To achieve this spaced method of mounting we adopted and recommend the simple expedient which you can see in a photo on another page showing the chassis attached to the back of a "fire-screen" baffle.

We first screwed four strips of wood to the baffle in the form of a square, outlining, so to speak, the front board of the chassis. The chassis was then screwed to the strips, and since they were $\frac{3}{4}$ in. thick the desired spacing effect was secured. A close inspection of the photo will tell you all you need to know about the details of the job.

This method of mounting, by the way, is not a mere wangle to get over the difficulty of the cone mouth projecting from the front of the chassis. That projection, the overlapping of the baffle ring and its location behind the edge of the hole in the baffle proper are all details carefully worked out. They are essential features of the special and highly efficient system of baffling used in this loud speaker.

With the general details of the fire-screen baffle we do not think we need to deal. The photos really tell the whole story, and this is only intended as a general suggestion capable of modification to suit the ideas of the individual. The important points are those we have already covered.

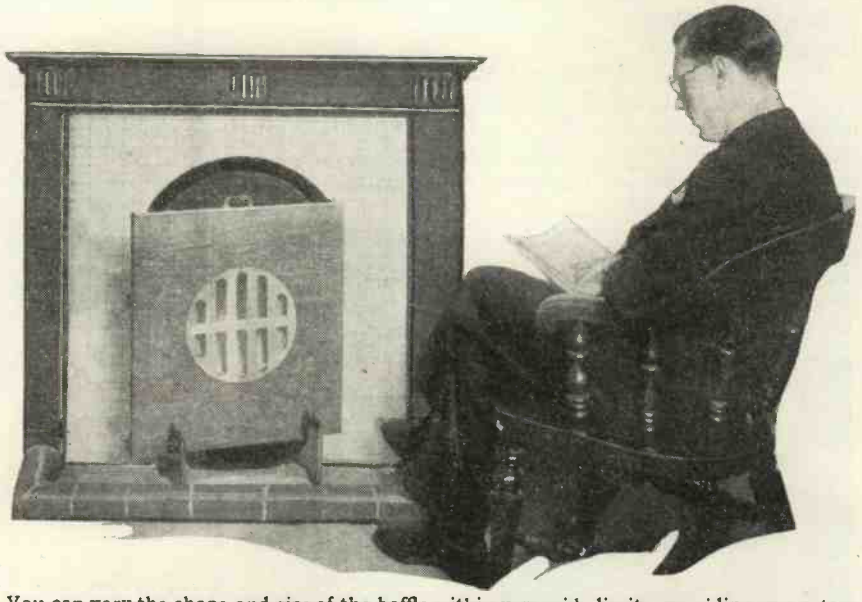
"Box Resonance"

You will observe that the baffle is of fair size (21 by 24 in. actually), and it is thick and solid (1 in. thick). It is fitted with a mildly ornamental wooden feet, attached with panel brackets, and a brass handle at the top for carrying about. It is intended to stand in a disused fireplace in summer, or in the corner of a room in winter, or in any other position where its exposed "works" at the back will not be seen.

To give a finish to the front we covered the hole in the front with a simple "fret" of thin plywood, secured with small screws and stained a different shade. Additionally, a piece of coloured gauze could be placed behind the fret if desired.

A final hint. If you decide to fit the speaker into a cabinet of any sort, beware of "box resonance." Leave the back open, or let it be a skeleton back covered with gauze.

A LOUD SPEAKER WORTH HEARING



You can vary the shape and size of the baffle within very wide limits, providing you retain an adequate baffling surface as mentioned in the article. And you can paint it any colour you like or stick decorative transfers on it.

Unequalled Brilliance and Virility of "Attack"

THE "INTER-AXIAL" JUNIOR

A first-class loud speaker for portable sets.

Right at the beginning of this section, where we hope it will catch the eye, let us remark that we shall be giving some constructional hints herein which will be helpful to those who intend making the larger model as well as those interested only in this miniature version. Space limits compelled us to deal with the assembly of the full-sized one rather briefly.

Specially Compact

Now to make a fresh start in more seemly fashion. It occurred to us when we were planning this special section that loud speakers for home-built portable receivers were always a bit of a problem.

The set itself is of a type which appeals most to the man who really enjoys constructional work, and he generally wishes to make the speaker as well, but is deterred by the excessive size of the usual home-assembled types. He is accordingly compelled to use one of the special small commercial chassis types, and although some of these give quite good results, others don't.

It seemed to us, therefore, that it would be as well to include a design for a specially compact version of our free-edge speaker, carefully worked out to preserve its excellent reproduction in spite of its reasonable dimensions.

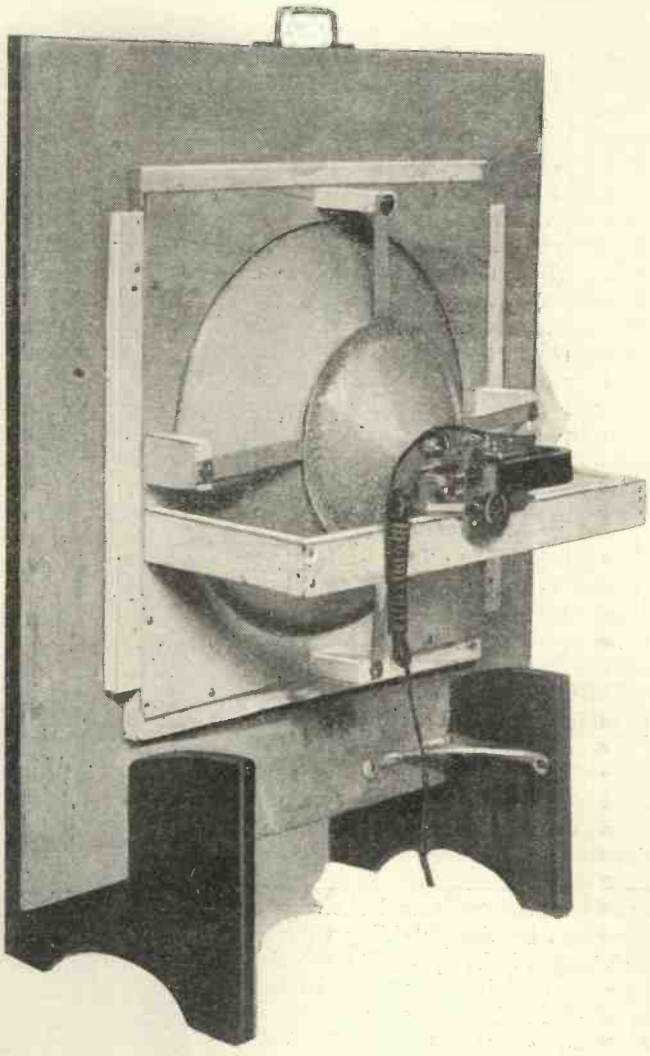
A Definite Advantage

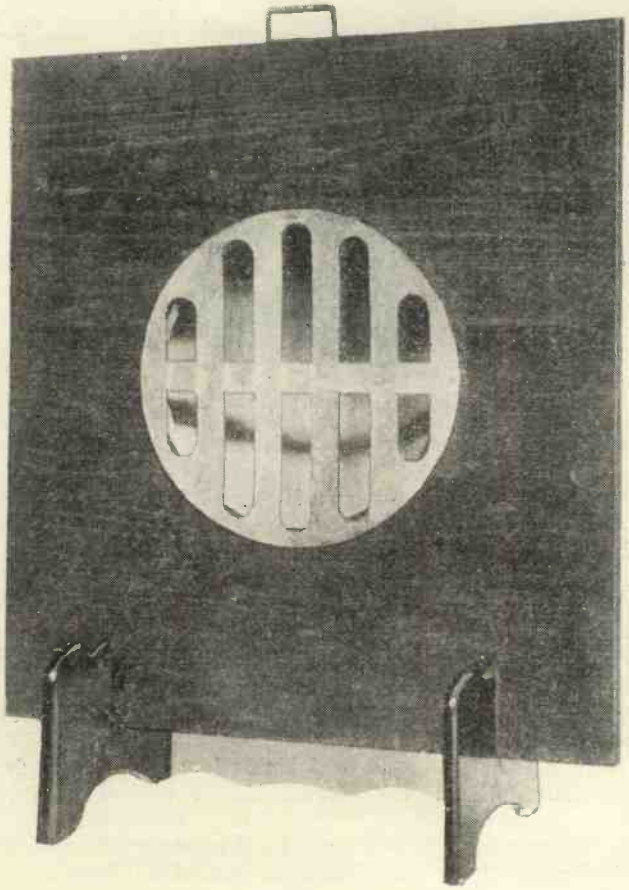
Naturally it cannot be expected to give *quite* the results of the full-sized model, but it is not far short, and it is still very good indeed. The difference is mainly in the bass, for the large instrument gives slightly fuller and more adequate low notes.

Since, however, there is usually a certain amount of boominess due to what is called "box resonance"

Complete

The chassis assembly should be kept a bit back from the baffle screen, so that the cone's movement is not restricted. In the above instance four pieces of ¾-in. wood are employed to constitute a spacing frame.



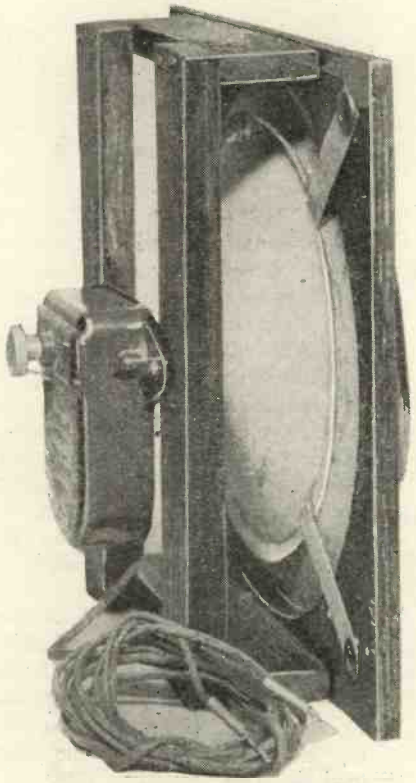


Ornamental

The ornamental fret can be of any shape, although it needs to be open in design to permit a free passage of air-waves. It can be cut from three-ply with a fret-saw and screwed to the front of the baffle. The fret can be stained a different shade from that of the baffle. Gauze fixed behind provides a final artistic touch.

A Quality Speaker Assembly for Portable Sets

NO DISTORTION



This is the " Junior," a smaller " Inter-Axial " chassis assembly especially designed for portable sets, and for small cabinets.

when a speaker is placed inside a portable set cabinet, this is probably not such a weak point as you might imagine. The slightly reduced output at the bass end of the scale is often an advantage in these circumstances, since it reduces the boominess due to the box resonance and may thus actually lead to better balanced reproduction.

Slight Differences

The main points of difference in this model as compared with the Senior one are concerned with, or arise from, its size. The front board on which it is assembled is only 9 in. square (about $\frac{3}{8}$ in. thick), and the hole therein is 8 in. in diameter.

The cone is smaller, full dimensions for cutting it out being given on one of the diagrams, and the suspension ring is differently placed (nearer to the front edge of the cone). The suspension method is a trifle different, too. The same paper strips are used, seccotined at one end to the suspension ring as before, but attached direct at the other to the front board with drawing pins.

In fitting the cone in place its apex should first be fixed to the driving rod of the unit, care being taken to tighten up the nuts really well. The paper strips are next secured under their drawing pins, so that the cone is nicely centred in the hole and the strips are just, and only just, tight and free from slack.

The material for the cone of this and the Senior model should be the medium weight (120 lb. per ream) of " Kraft " paper, obtainable from most large stationery firms. Other materials can be tried if desired, but we obtained the most pleasing results with this type of paper.

Now a few hints about fitting the baffle ring and the suspension ring. These are both cut from the same kind of paper as the cone, and the drawings give you the dimensions. To assist you in getting the suspension ring cemented on in the right place it is suggested that you should draw a light pencil line on the cone paper before it is cut out, the radius for this circle being $3\frac{5}{16}$ in. for the Junior and $3\frac{7}{8}$ in. for the Senior model.

Serrated Edges

The rings, you will note, are cut out with dog-tooth serrations round their inner edges, and it is these which are stuck to the cone. Smear them lightly with Seccotine, being careful to get none on the flat portion of the ring or on the wrong side. Let it nearly dry, then apply a second light coating. (A small brush or a pipe cleaner is a useful implement for this job.)

Now wait until the adhesive is tacky and then proceed to press the teeth firmly on to the cone. It is a job calling for a little care and dexterity, so take it slowly, and go round several times to make sure every tooth is well and truly stuck. Finally, put the cone aside to dry, mouth downwards, on a flat surface, and with a small weight on the apex.

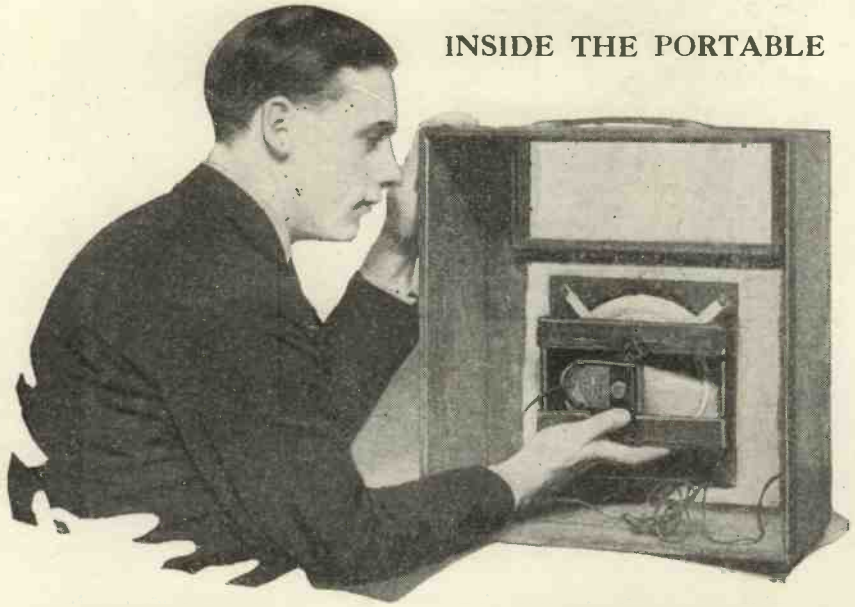
Cutting the Cones

The actual cutting out of the cones for both speakers is a simple job, and the diagrams really tell you all you want to know. Note, however, the amount of overlap to allow when sticking the cone together. This is indicated by the dotted line in the diagrams, and it amounts to $\frac{1}{4}$ in. in the large speaker and $\frac{3}{8}$ in. in the smaller. It is as well to put in the dotted line in pencil when laying out the cone in the first place, to serve as a guide later.

The framework of the portable model is arranged to take the Brown " Vee " unit, and the details are made quite clear, we think, by a dimensional photograph. A little modification will enable any good unit to be employed.

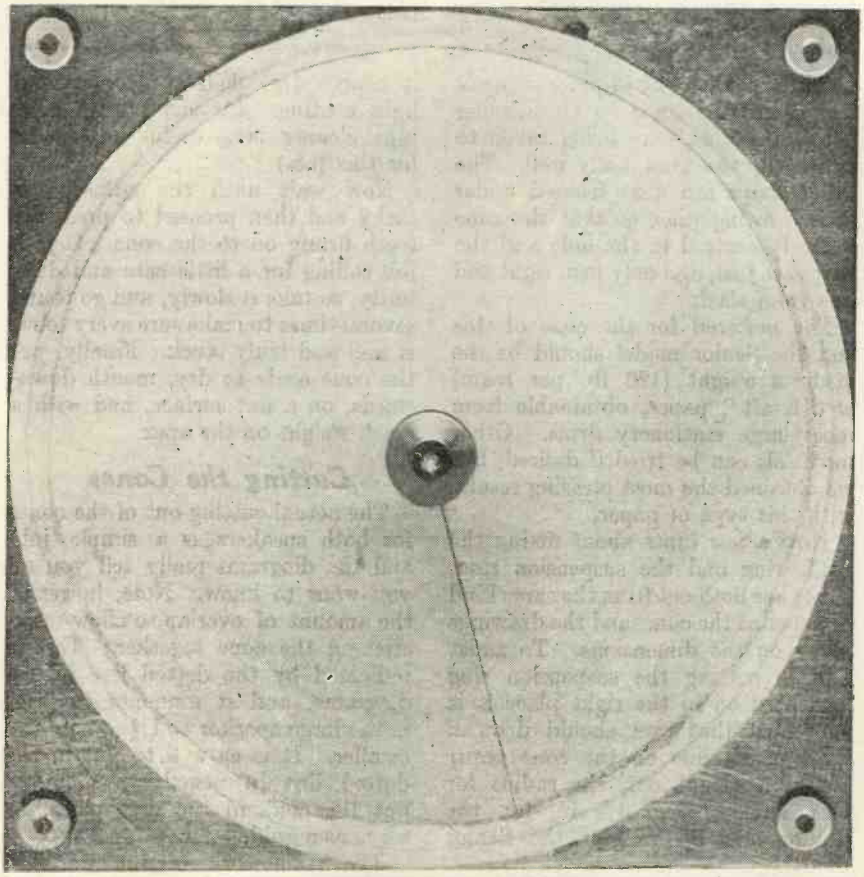
The mounting of the chassis into a portable is a matter which will depend largely on circumstances, but which you will find easy enough.

INSIDE THE PORTABLE



Fixing the " Junior " chassis inside a standard size of portable cabinet. As can be seen it goes in very easily, leaving plenty of room for batteries and other gear.

KEEP THAT EDGE FREE



You will ruin your otherwise superb results if you artificially restrict the edge of the cone. Therefore, when mounting the chassis up to a baffle, as in a set or cabinet, use one of those little rubber buffers at each corner, as shown in the photo and explained in the text.

It requires to be spaced back about ½ in. from the fret of the loud-speaker aperture in the cabinet, and to ensure this we fitted four rubber feet (such as are often placed under-neath cabinets), to the corners of the front board. The method used in mounting the large model to its fire-screen baffle could also be used in some cases.

As we have a little more space available we shall be able to go into several matters which we feared we should have to leave to the reader's discretion, and which have not been dealt with.

Lest the reader think we are insinuating anything by so doing, let us explain hurriedly that what we are really after is to save him trouble; we don't doubt his discretion!

Make a Trial Cone

The explanations and instructions we have already given would be sufficient to enable him to go ahead by the light of his own common-sense, but we may be able to indicate some short cuts to him which experience alone can teach.

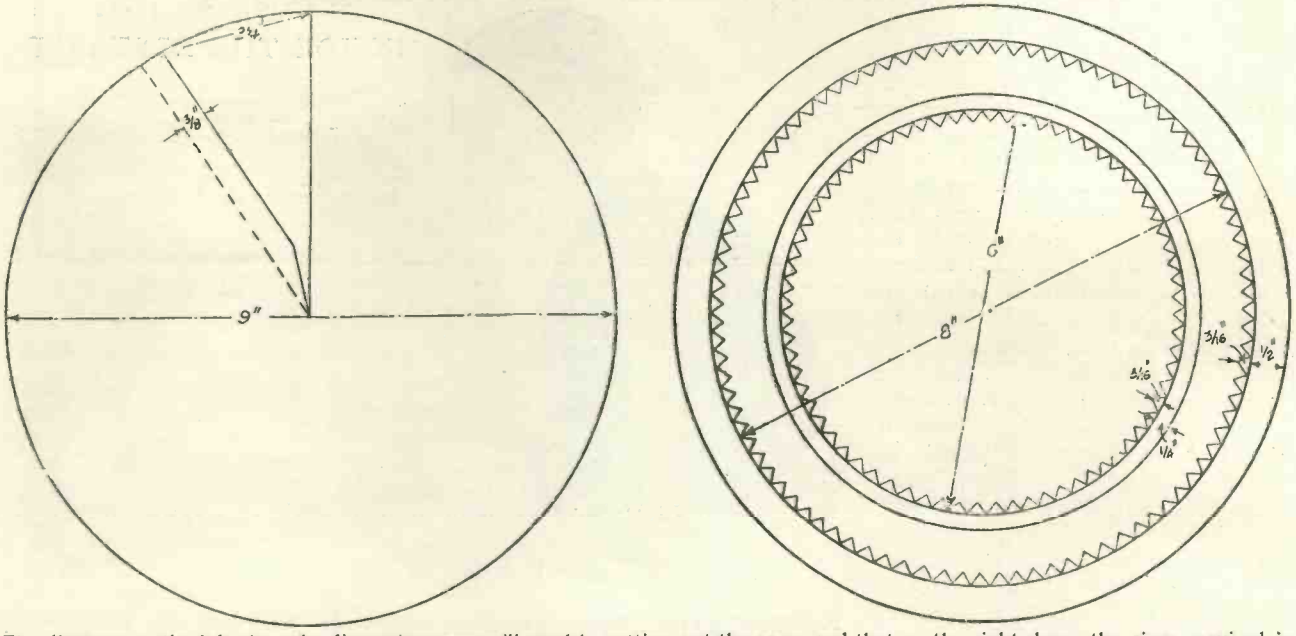
Take, for example, the apparently elementary matter of the cutting out of a cone. Those who have done it before will doubtless think this an obvious and easy affair, but it is apt to prove otherwise to anyone making a first attempt.

To the novice, therefore, we would offer the advice that he should first cut out an experimental cone from any piece of paper of sufficient size which may come handy, and stick it together to make sure he has grasped the idea properly.

Use Adhesive Carefully

This trial run will also teach him some useful things about the best methods of handling what is apt to prove a rather refractory piece of paper, especially after the overlapping

CONE DETAILS OF THE "M.W." "INTER-AXIAL" JUNIOR



The diagram on the left gives the dimensions you will need in cutting out the cone, and that on the right shows the sizes required in cutting the suspension and baffle rings.

These Loud Speakers Speak—They Don't Mumble

edges which form the joint have been smeared with adhesive.

He will discover that some little care is needed in handling the embryo cone and bending it round into shape to make the edges of the joint meet, with the correct amount of overlap, and in pressing those edges together.

He should above all avoid making creases in the paper and getting any of the adhesive on his fingers. If he should chance to get his fingers sticky it is hopeless to proceed. There is only one thing to do, and that is to have a quick wash and then resume.

The Cutting Out

In preparing to cut out the cone the first step is to obtain a large pair of compasses and describe the outer circle shown in the appropriate diagram on these pages. The diameter of this circle for the larger (senior) cone is 15 in., and for the smaller (junior) it is 9 in.

This circle represents the line along which you will presently cut, but before doing so you should describe the circle which is to indicate the position of the suspension ring to be fitted later. Now cut out the cone along the larger circle, a rather small pair of scissors being advised for this operation.

You then have a circular disc of paper from which you must cut a triangular piece so that when the edges are brought round and stuck together, the flat disc will become a cone. The provision for an overlap at the joint has already been mentioned, and is made pretty obvious on the diagrams. Note the full and dotted radial lines.

When preparing to stick together the overlapping edges which form the joint in the cone it is as well to smear *both* surfaces with the adhesive (Seccotine is good for this purpose). Give each a light but even coat, then wait until they are "tacky" before pressing them together.

Making Proper Joints

Then press firmly together, and see that they adhere properly over every little bit of the overlap. If any points do not seem to be sticking well, part the edges a trifle and apply a little more adhesive, wait a few moments, and squeeze into contact once more.

At all such joints as this, i.e. wherever one paper surface is stuck to another, it is of vital importance to see that perfect cementing is achieved. If one surface touches another without being properly stuck a buzz or rattle is very likely to be heard from the finished speaker.

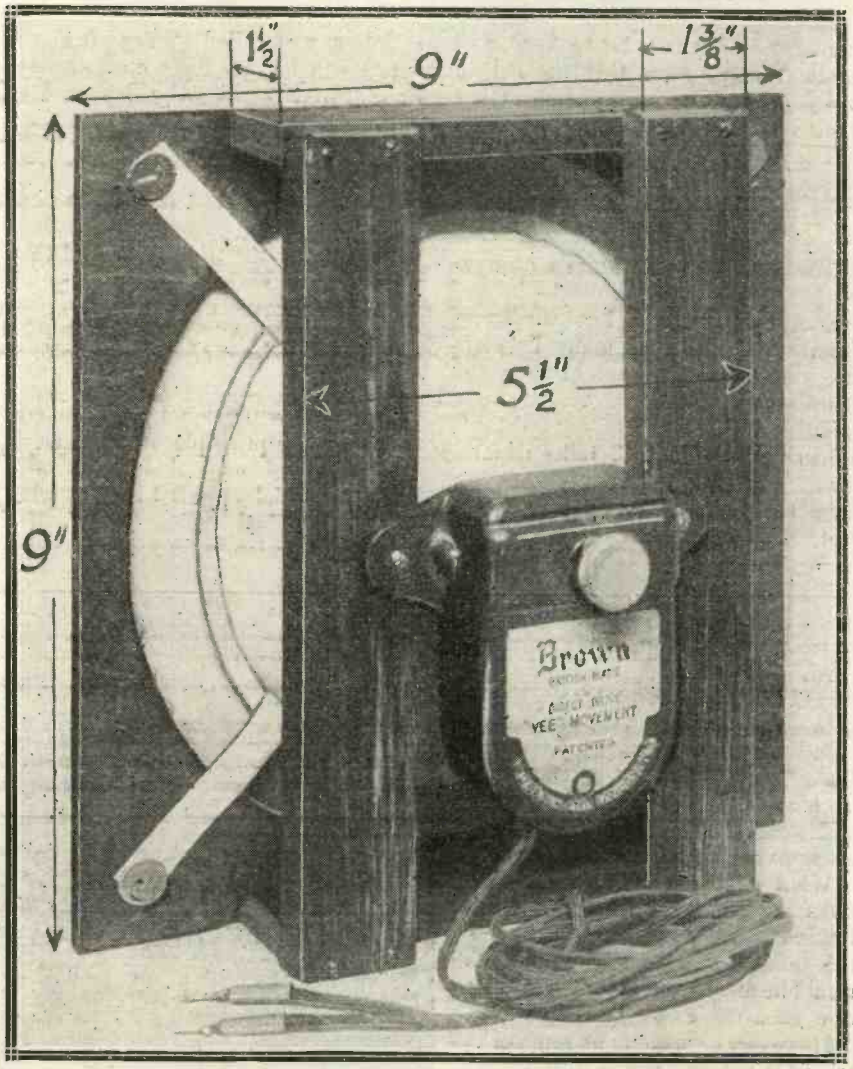
See, therefore, that the surfaces of the joint not merely adhere when pressed together, but remain in adhesion while the joint is drying. To make sure of this it is as well to keep squeezing the joint together at intervals for a quarter of an hour or so while it is commencing to dry.

This applies, obviously, to the other joints involved as well, and the same procedure should be followed in sticking on the suspension and baffle rings. It involves a little trouble, but it is really worth it to be sure of perfect functioning when the instrument is finished.

Mention of the suspension and baffle rings reminds us of one or two points about their preparation. They are much alike, the only real difference being in dimensions. What we should like to point out is that you need not be alarmed at the prospect of cutting out all those teeth exactly to size.

They do not really need to be very accurately cut, and if you draw circles to define their tips and bases, you will find the cutting quite a quick job with small scissors, estimating their size by eye. This question of accuracy, by the way, need not worry you. It is decidedly difficult to put together an assembly like this so that everything works out just right to a sixteenth of an inch, but small discrepancies do not really matter a bit.

THE LITTLE SPEAKER WITH A BIG VOICE



Note the simplicity of the mounting of this excellent little "M.W." "Inter-Axial" loud speaker.

THE NEW TALKS

By THE EDITOR

There is some excellent material in the B.B.C.'s latest series of talks, but the presentation of these features leaves much to be desired.

By the time this issue of "M.W." is on sale readers will have had an opportunity of forming an opinion of the B.B.C.'s latest series of "Talks." The new list covers a period from January 1st to April, and again it would seem that the B.B.C. has failed to appreciate some of the subtleties of presentation.

The titles of some of the talks are, to say the least of it, uninspiring.

"What's in a Name"?

The trouble is that quite a number of these talks may prove to be extremely interesting; but we know from experience that many listeners will not listen to them because the titles lack appeal.

Titles are tremendously important. When will the B.B.C. talks department realise this? Sometimes we have the feeling they do realise this fact. For example, the titles of some of Sir James Jeans' talks were excellent; they stimulated interest, they made one anxious to hear the talk—to look forward to it.

All this quite apart from the attraction of Sir James as a talker. Even if he were not a really good broadcaster, many would listen to him solely for the sake of his subject matter, which is always informative, interesting, and generally set forth in a most attractive and enterprising way.

What a pity it is the majority of talks are not dealt with in a similar fashion! We have the feeling that the talks department at Savoy Hill would be all the better for the addition of a good sub-editor to the staff.

However, let us look at some of the talks for the immediate future.

Heard "The Scoop"?

The return to the microphone of Mr. Vernon Bartlett on "The Way of the World" is welcome; and so is Dr. George Dyson on "The Progress of Music." Both these gentlemen are now "old hands" at broadcasting. They have a good grip of the technique, the subject matter of their talks is good—often very good—and their personalities sufficiently attractive always to make their appearance before the microphone welcome.

Mr. Harold Nicolson will also continue his weekly talks on "People and Things" on Fridays.

Six of the best known writers of detective fiction are combining in a serial story called "The Scoop," which will be broadcast on Saturday evenings. Miss Dorothy Sayers, Mr. Freeman Wills Crofts, Miss Clemence Dane, Mrs. Agatha Christie, Mr. E. C. Bentley, and Mr. Anthony Berkeley will each contribute two instalments. This feature will already be familiar to readers by the time they read this issue of "M.W." So far the serial looks like proving a "winner."

"Numbering the People"

The serial talks at 7.25 p.m., designed for educational purposes, are based on the principle of continuity, and many of general interest will make a special appeal to those who have followed the relevant series in the past session. "Marriage, Past and Present" is a series of talks and discussions by Dr. Briffault and Professor Malinowski. This series follows talks on the population question, and it will be succeeded by a series entitled "Numbering the People," in which the Registrar-General and others will explain the objects and workings of the Census. Those interested in literature will find six more talks by Mr. J. C. Squire on "The Enjoyment of Literature," and, to celebrate the bi-millenary, six on "Virgil and His Times," by Dr. T. R. Glover. The latter seems rather in the nature of an overdose. The bi-millenary of Virgil is, of course, definitely interesting—an event, no doubt. But does it call for *six* talks?

The Reviewers

International affairs are well represented with five talks on "World Finance," by Mr. Denis Robertson; six talks on "Contact between Peoples To-day," by Dr. Delisle Burns; and a series called "Whither Mankind?" We hope the talks on finance will have some practical bearing on the economic problems of the average man-in-the-street. Learned discoveries on the evils of inflation, etc., will undoubtedly not prove popular; but talks on how to make the most of one's available cash would prove interesting and valuable.

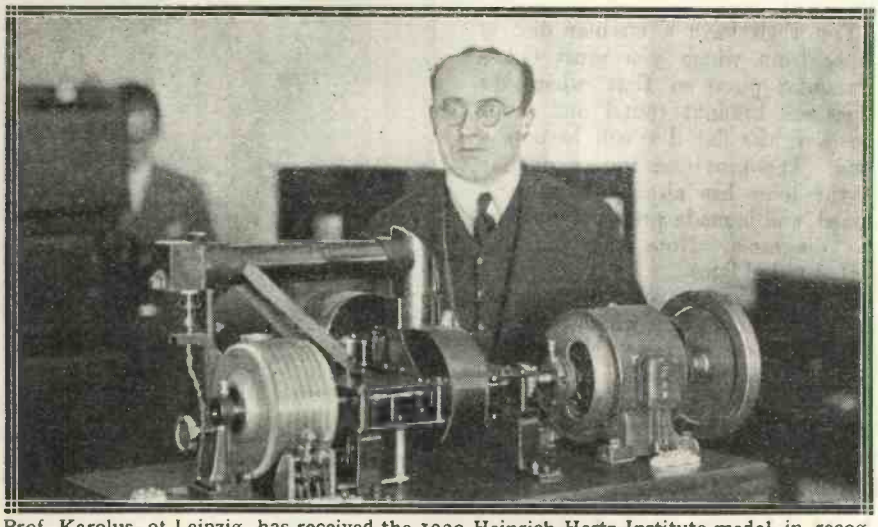
On Fridays, the survey of current Imperial problems moves from Africa to "British Mandates."

The 7 o'clock talks are as usual devoted chiefly to the reviewers of books and plays, to films, etc., discovery and other developments, and these will again be given by Mr. Desmond MacCarthy, Miss V. Sackville West, Mr. James Agate, Mr. Francis Birrell, Mr. Michael Sadleir, Mr. Duff Cooper, Mr. Gerald Heard, Mr. Ernest Newman, and Dr. Boult.

On Fridays a series of reminiscences will be given by well-known women, including Mrs. Margaret Woods, Miss

(*Continued on page* 250.)

HE GETS A MEDAL FOR TELEVISION



Prof. Karolus, of Leipzig, has received the 1930 Heinrich Hertz Institute medal in recognition of his work in the development of television. He is seen with a Telefunken-Karolus transmitter.

THE WORLD'S PROGRAMMES

WHEN WHERE AND HOW TO HEAR THOSE FOREIGNERS

CONDUCTED by "D.X."

SUPER-SENSITIVITY

Have you ever wondered why it is that sometimes a set seems far, far better than at other times? More sensitive, livelier, better for DX results?

* * *

It may be outside conditions, or it may be something under your control. Here are some suggestions:

* * *

Wet insulators of outdoor aerials and wet roofs above indoor aerials will often weaken signals. The latter may be unavoidable, but when an outdoor insulator is ineffective it should be "strengthened" by another insulator placed in series with it.

* * *

Both L.T. and H.T. batteries obviously need watching. If you use a screened-grid valve try different values of H.T. on the screen, and on the plate; voltage-drops here being the likeliest cause of poor long-distance results.

* * *

The detector's H.T. is another important factor. Try fairly low voltages as well as high—often 20 volts will be found better for DX reception than 60 volts.

* *

Then in many sets there is the potentiometer adjustment. This may need "resetting," as explained elsewhere on this page.

* *

If you have a selectivity control this will affect strength. Generally speaking, the higher the degree of selectivity (separation) the lower the strength. So use this control sparingly.

* *

There are several other likely causes, but one deserves special mention. That is the loud-speaker adjustment. Very easy to overlook.

* * *

Another very easily forgotten cause of weakened signals is an old grid-bias battery for the H.F. valve. Six months is a good "life," and variations in bias may greatly affect sensitivity.

* * *

And, of course, there is always "lost emission," which is simply senile decay of the filament. An old detector filament will spoil the best set.

ICELAND'S NEW STATION

The Iceland Government has just installed a new station at Reykjavik. It uses a power of about 16 kw. and—at the time of going to press—is testing on wave-lengths about 1,200 metres.

* * *

This station is also equipped to work telegraphy with ships, on 600 metres. Heard it?

THAT GRID RETURN

Nearly all detector valves employ the leaky-grid system, with a grid condenser and a grid leak. And in a great many long-distance sets the grid-leak's connection to filament is not made direct, but via a potentiometer.

* * *

Often such a potentiometer is mounted on the baseboard, because once set it seldom requires readjustment. Not every listener, however, knows how to set it for best results.

* * *

The best method is to give the detector valve its recommended H.T. (and L.T.), and then adjust the potentiometer in conjunction with the reaction. One end of the potentiometer goes to the L.T.+ wiring, and the other end to L.T.—, so mark it accordingly.

* * *

Then turn the slider right up to the positive end, and try the reaction control. Probably it will prove to be a little "fierce" or "ploppy."

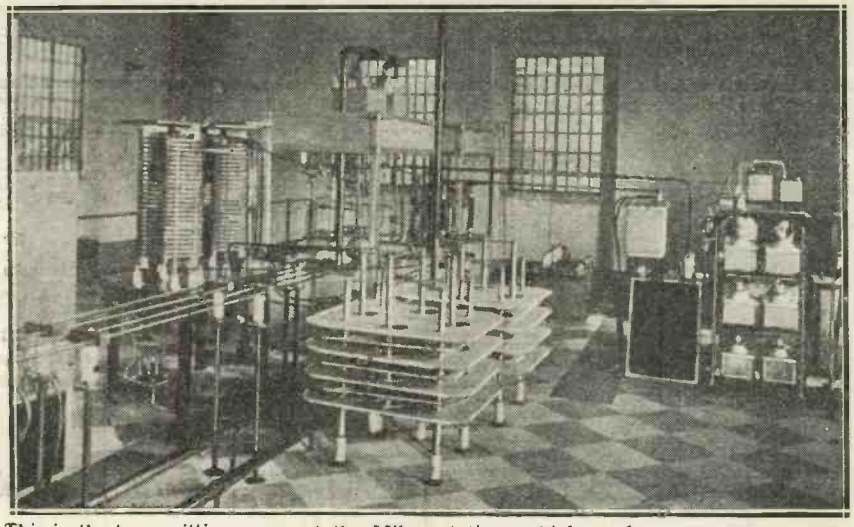
* *

To overcome this, bring the slider a little way round towards the negative, at the same time readjusting H.T. to get smooth reaction. Don't go too far towards negative with the slider—the nearer it can stay to positive the better.

* *

With care you should soon find a slider position where reaction control is perfectly smooth, and tests on a weak station will show the set to be very sensitive. Leave the slider in this position, and you will find long-distance work is now much easier.

"FINE DELLA TRANSMISSIONE"



This is the transmitting room at the Milan station, which works on 501 metres. The station works in conjunction with Genoa and Turin, and closes down with the words "Fine Della Transmissione." followed by the Royal Italian March and Fascist Hymn.

From 2,000 to 200 Metres

The Principal Stations of Europe arranged in order of wave-lengths.

Wave-length in Metres	Name of Station
1961	Ankara (Turkey)
1935	Kaunas (Lithuania)
1875	Huizen (Holland) (Hilversum programme and announcements).
1796	Lahti (Finland) (relays Helsinki)
1725	Radio Paris
1635	Königswusterhausen (Zeesen)(Germany). Relays Berlin
1554	Daventry National Station
1481	Moscow (Old Komintern) (Russia)
1445·7	Eiffel Tower
1411	Warsaw (Poland)
1350	Kasbah (Tunis)
1348	Motala (Sweden) (relays Stockholm)
1304	Moscow (Trades Unions)
1200	Kharkov (Russia), Istanbul (Turkey), Boden (Sweden)
1153	Kalundborg (Denmark) (relays Copenhagen)
1116	Novosibirsk (Russia)
1103	Moscow, Popoff (Russia)
1073	Rostov-Don (Russia)
1071	Oslo (Norway)
1000	Leningrad (Russia)
937·5	Kharkov (Russia)
870	Tiflis (Russia)
840	Nijni Novgorod (Russia)
800	Kiev (Russia)
778	Petrozavodsk (Russia)
770	Ostersund (Sweden)
760	Geneva (Switzerland)
720	Moscow (Experimental)
700	Minsk (Russia)
680	Lausanne (Switzerland)
587	Hamar (Norway)
574·7	Ljubljana (Yugoslavia)
570	Freiburg-im-Breisgau (Germany)
566	Hanover (Germany)
565	Smolensk (Russia)
560	Augsburg (Germany)
550	Budapest (Hungary)
542	Sundsvall (Sweden)
533	Munich (Germany)
525	Riga (Latvia)
517	Vienna (Austria)
511	Archangel (Russia)
509	Brussels No. 1 (Belgium)
501	Milan (Italy)
497	Moscow (Russia)
487	Prague (Czechoslovakia)
479.2	Midland Regional Station
476	Simferopol (Russia)
473	Langenberg (Germany)
466	Lyons (La Doua), France
459	San Sebastian (Spain), Zürich (Switzerland)
453·2	Porsgrund (Norway), Salamanca (Spain), Bolzano (Italy), Danzig (Free City), Klagenfurt (Austria), Tromsö (Norway), Uppsala (Sweden)
450·2	Tampere (Tammerfors) (Finland), Nidaros (Norway)
450	Moscow (Russia)
447.1	Paris (P T T) (Ecole Supérieure), France, Aalesund (Norway), Notodden (Norway), Rjukan (Norway)
441	Rome (1 R O) (Italy)
436	Stockholm (Sweden), Malmberget (Sweden)
432·3	Belgrade (Yugoslavia)
424	Madrid (Union Radio) (Spain)
418	Berlin (Witzleben) (Germany)
416	Rabat (Morocco)
413	Dublin (2 R N) (Ireland)
408	Katowice (Poland)
406	Kharkov (Russia)
403	Berne (Switzerland)
401	Tallinn (Estonia)
398·9	Glasgow (5 S C)
394	Bucharest (Rumania)
390	Frankfurt (Germany)
385	Toulouse (Radio) (France)
381	Lwów (Poland)
376·4	Manchester (2 Z Y)
372	Hamburg (Germany)
370·4	Radio L L (France)
368	Fredriksstad (Norway), Seville (Union Radio) (Spain)
364	Bergen (Norway)
363·4	Algiers (N. Africa)
360	Mühlacker (Germany)
356·3	London Regional Station
352	Graz (Austria)
351	Leningrad (Russia)
349	Barcelona (Radio Barcelona) (Spain)
345	Strasbourg-Brumath (France)
342	Brno (Czechoslovakia)
338·2	Brussels No. 2 (Belgium)
335	Cadiz (Spain), Poznan (Poland)
332	Naples (1 N A) (Italy)
328·2	Grenoble (P T T) (France), Paris—Poste Parisien (France)
325	Breslau (Germany)
322	Göteborg (Sweden)
319	Dresden (Germany), Basle (Switzerland)
316	Bremen (Germany), Marseilles (P T T) (France)
313·2	Genoa (Italy)
312·8	Wilno (Poland)
309·9	Cardiff (5 W A)
307	Zagreb (Yugoslavia)
304	Bordeaux-Lafayette (France)
301	Aberdeen (2 B D)
298·8	Falun (Sweden), Hilversum (Holland) (Huizen programme and announcements)
293	Kosice (Czechoslovakia), Limoges (P T T) (France)
291	Viipuri (Viborg) (Finland)
288·5	Bournemouth (6 B M), Bradford (2 L S), Dundee (2 D E), Edinburgh (2 E H), Hull (6 K H), Liverpool (6 L V), Newcastle (5 N O), Plymouth (5 P Y), Sheffield (6 F L), Stoke-on-Trent (6 S T), Swansea (5 S X)
287·2	Lyons (Radio) (France)
286	Montpellier (France)
283	Berlin Relay (Germany), Magdeburg (Germany), Stettin (Germany), Innsbruck (Austria), Uddevala (Sweden), Varberg (Sweden)
281	Copenhagen (Denmark)
280	Radio Liège (Belgium)
279	Bratislava (Czechoslovakia)
276.5	Heilsberg (Germany) Relays Königsberg
273·2	Turin (Italy)
272	Rennes (France)
270	Trollhätten (relays Göteborg), Hudiksvall (relays Sundsvall), Norrköping (Sweden), Kaiserslautern (Germany)
268	Barcelona (Radio Catalana) (Spain), Oviedo (Spain)
265·4	Lille (P T T) (France)
263	Moravská-Ostrava (Czechoslovakia)
261·3	London National Station
259	Leipzig (Germany)
257	Hörby (Sweden)
255	Toulouse (P T T) (France)
253	Gleiwitz (Germany)
252	Almeria (Spain)
249	Juan-les-Pins (France)
247·7	Kalmar (Sweden)
246·2	Schaerbeck (Brussels) (Belgium)
246	Turku (Åbo) (Finland), Säffle (Sweden), Eskilstuna (Sweden), Pietersaari (Jacobstad) (Finland), Linz (Austria), Cassell (Germany), Kiruna (Sweden), Cartagena (Spain)
244	Cracow (Poland)
242	Belfast (2 B E)
240	Radio-Beziers (France)
239	Nimes (France), Nürnberg (Germany)
238	Bordeaux (Sud Ouest)
237	Orebro (Sweden)
234	Lodz (Poland)
232·2	Kiel (Germany)
231	Borås (Sweden), Umeå (Sweden), Malmö (Sweden), Hälsingborg (Sweden)
227	Cologne (Germany), Aachen (Germany)
227	Münster (Germany)
224·4	Cork (6 C K)
222·9	Fécamp (France)
221	Helsinki (Finland)
218	Karlstadt (Sweden), Flensburg (Germany), Ornskoldsvik (Sweden), Björneborg (Finland)
216.3	Königsberg (Germany)
216	Halmstad (Sweden), Radio Chatelineau (Belgium)
214·2	Warsaw, No. 2 (Poland)
204	Gävle (Sweden)
203	Kristinehamn (Sweden)
202	Jönköping (Sweden)
200	Leeds (2 L S)

HOW MAST-LESS MUNICH CARRIED ON

The famous wooden masts of Munich failed to withstand the recent winter gales and came down with a run one night. Fortunately, no one was injured, and the temporary aerial shown enabled the station to carry on as usual with its programmes on 533 metres.

NEXT MONTH

The March "M.W." will be on sale FEB. 28th. Price 1/-.

Order Now.

COUNTRIES YOU HAVE HEARD— FRANCE

Broadcasting in France is run on totally different lines from the broadcasting in this country. There is no central authority similar to our B.B.C., and consequently the stations are not as evenly distributed as those in Britain.

Some of the programmes contain advertising matter, and Radio Toulouse, for instance, announces an advertising programme to British listeners on alternate Sundays at 10.45 p.m. (February 1st, 15th, etc.).

The following is a complete list of the French (and French North African) broadcasting stations, in alphabetical order:

	Wave-length in metres.
Agen. Works Tues. and Fri., 9–10.15 p.m.	30·75
Algiers (North Africa)	363·4
Bordeaux - Lafayette (P.T.T.). Power of 35 kw.	304
Bordeaux-sud-Ouest	238
Eiffel Tower (Paris). Power 15 kw.	1445·7
Eiffel Tower (Paris). Call-sign F L J. Time signal at 8.56 a.m. and 8.56 p.m.	32·5
Fecamp	222·9
Grenoble (P.T.T.). Power 1·2 kw.	328·2
Juan-les-Pins. (Near Nice)	249
Lille (P.T.T.). Power of 1 kw.	265·4
Limoges (P.T.T.). Power 0·08 kw.	293
Lyons, La Doua. Relays Ecole Superieure. Power 2·3 kw.	466
Lyons (Radio)	287·2
Lyons. Call-sign Y R. Week-days only, 4.30–5.30 p.m.	40·2
Marseilles (P.T.T.). Power 1·5 kw.	316
Montpellier. Power 1·2 kw.	286
Nancy. (9 p.m.–10 p.m.)	15·5
Nimes	239
Paris, Ecole Superieure (P.T.T.). Power 1 kw.	447·1
Paris, Poste Parisien. Power 1·2 kw.	328·2
Rabat, (Morocco)	416
Rabat, (Morocco). Short-wave relay	23
Radio Beziers	240
Radio L.L. (Paris)	370·4
Radio L.L. (Paris). Short-wave relay	61
Radio Paris. Call-sign C F R. Power 17 kw. (Sometimes announces under its old name "Radiola")	1725
Radio Toulouse	385
Radio Vitus (Paris). Testing	41
Rennes. Power 1·2 kw.	272
St. Quentin	175
Strasbourg-Brumath	345
***Toulouse** (P.T.T.). Power 1 kw.	255

*See also under Radio Toulouse.

Of all the countries of Europe, France secured the largest allocation of wave-lengths under the "Prague Plan." (This latter was a plan whereby virtually all countries combined unofficially to share by agreement the available wave-lengths, so that interference should not be increased by lack of co-operation.)

Under the Prague Plan France is entitled to thirteen "medium wave-lengths," as against the twelve allowed to Germany and nine to Great Britain. This is in addition to "long" waves. France also has a share in one of Europe's "common" wave-lengths. (On these low power may be used, the same wave-length being employed by several different stations in different countries.)

Which Station?

Confusion often arises in the minds of listeners when receiving a long-wave French station because of the slight wave-length separation between the two Paris long-wavers. There is often doubt as to whether the programme in question is coming from Radio-Paris or from the Eiffel Tower station.

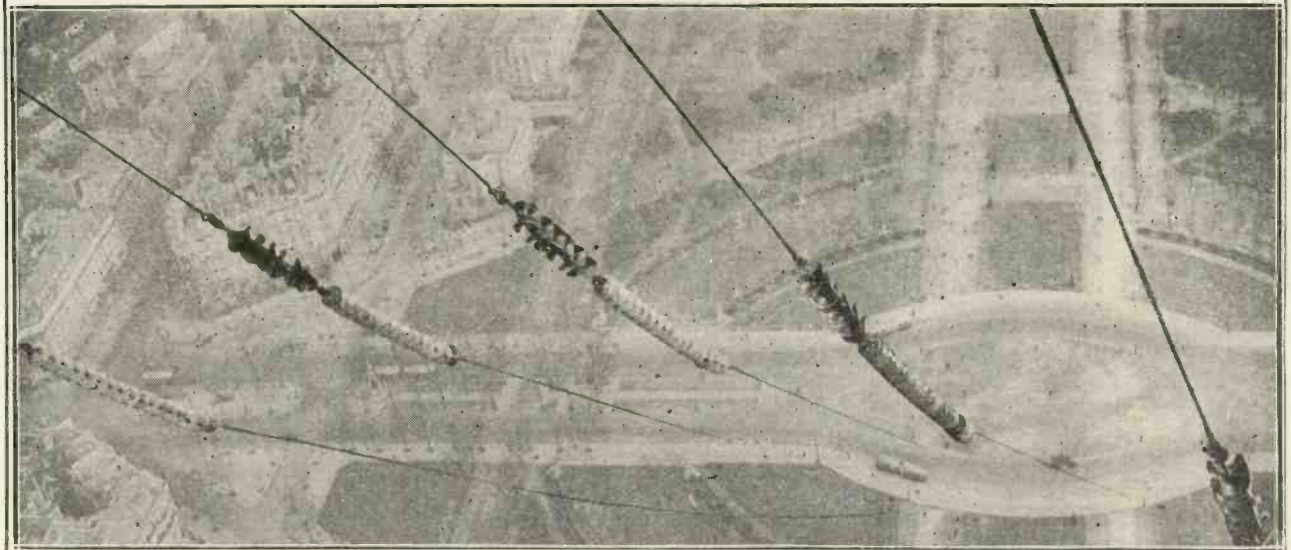
One way of clearly distinguishing between these two is to remember that Radio-Paris (1,725 metres) is *above* the setting for Daventry 5 X X, while Eiffel Tower's reading is to be found below it (1,445·7 metres).

The fact that Radio-Paris sometimes calls itself "Radiola" should be borne in mind, as a further aid to identification.

The French language is often used for announcements by stations not situated in or near France, such as the Swiss or Polish stations. Stamboul (or Istanbul), Turkey, on 1,200 metres, and Zagreb (Jugo-Slavia), on 307 metres, are examples of other European stations often heard announcing in French.

Owing to its situation near the Rhine, the new French station Strasbourg-Brumath announces in German as well as in French.

From the Top of the Eiffel Tower!



A wonderful view of Paris and the surrounding country is obtained from the top of the Eiffel Tower, where the aerials of the famous station are suspended. The actual transmitting apparatus is housed underground in the gardens surrounding the tower.

News from the Stations

REYKJAVIK (Iceland) now has a new broadcasting station.

RADIO BELGIQUE is arranging for both French and Flemish programmes from the Velthem stations. Starting early in February, they will begin about 5 p.m.

SOTTENS AND BEROMUNSTER, the new Swiss stations, are due on the air with tests this month.

ATHLONE has now been definitely decided upon as the site for Ireland's new high-power station.

RADIO VITUS (Paris) recently debarred from transmitting from its new premises at Romainville, has resumed its activities at the old address in Paris.

BORDEAUX SUD-OUEST and **RADIO BEZIERS** have both applied to be allowed to use increased power.

LEOBEN (Austria) is to have a relay station.

THE SCOTTISH REGIONAL STATION is to be erected at Westerglen, three miles south of Falkirk. It will be similar to Brookmans Park and Moorside Edge.

THE NORTH REGIONAL STATION will take over the Midland Regional (5 G B) wave-length of 479·2 metres, so

THE MIDLAND REGIONAL STATION will use Glasgow's wave-length (398·9 metres) and Glasgow will take 376·4 metres.

RADIO PARIS is contemplating the use of a power of 60 kw.

PRAGUE is to have a new high-power station, to give an alternative service.

MADRID broadcasts a "spoken newspaper" every morning at 8 a.m., the news being read out three times in succession.

TOKIO listeners heard the Hon. Mrs. Victor Bruce speak through the microphone of J O A K after her solo flight from England to Japan.

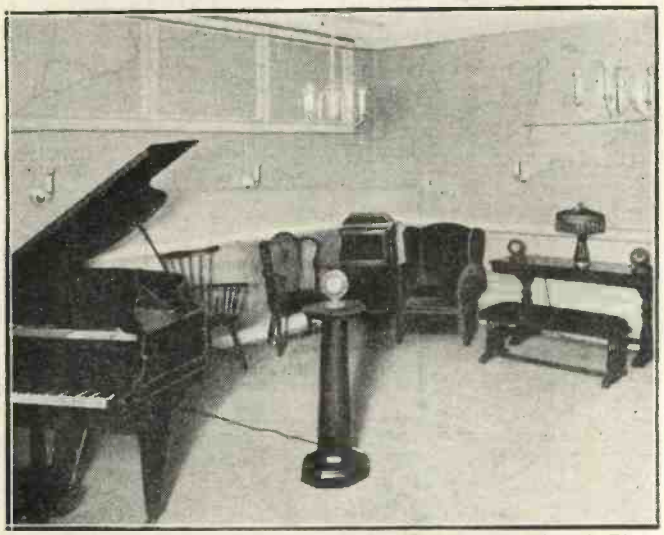
EAST PITTSBURG (K D K A) is to have a new transmitter erected at Saxonburg, Penn.

WINNIPEG (C J R X) recently changed its wave-length from 25·6 to 49·5 metres. Call-sign, V E 9 C L.

BODEN (Sweden) and **ISTANBUL** (Turkey) have both been working off their allotted wave-length (1,200 metres) owing to heterodyne interference.

KONIGSBERG is now working on 216·3 metres, its old wave-length of 276·5 has been confiscated for **HEILSBERG,** Germany's newest Regional station.

IN THE WORLD'S PLAYGROUND



A studio in the famous American station W P G—the World's Playground, near New York. This station was recently heard on 272.6 metres in this country. (See below.)

STRASBOURG-BRUMATH announces in German as well as in French, because it serves a large part of the Rhineland area.

SAIGON (French Indo-China) now broadcasts news bulletins in English, on short waves.

OSLO has been getting over rather better since its wave-length was altered from 1,060 to 1,071 metres.

ST. QUENTIN is the European station with the lowest "ordinary" wave-length I⁴ works on 175 metres.

ANKARA (Turkey), which works on 1,961 metres, has the longest broadcasting wave-length in Europe.

STUTTGART is now used only as an emergency stand-by station, all the programmes being handled by Mühlacker.

THE VATICAN STATION will probably use two wave-lengths, one about 19 and the other about 50 metres.

America on Medium Wave-Lengths

A reader's remarkable results.

ALTHOUGH the *short-wave* reception of American stations is common enough, many people do not believe that stations in the States can sometimes be heard here on ordinary wave-lengths. But one Uxbridge reader of "M.W." could tell them something startling about that.

In a letter to the Editor, recounting his experiences during 1930, he says:

"I had very little hope of anything exciting when I turned on at 2.5 a.m., January 26th. Yet I was not merely surprised, but astounded at what I received.

"W M C (Memphis, Tennessee), W B B C (Brooklyn, N.Y.), a station at Havana, W T I C, W P G, W G P, W I O D (Florida) and many others! W M C and W B B C made the loud speaker fill the room well with music and nasal resonance!

More Than 3,000 Miles Away!

"Many times since then I received one or other American station, but not until November 13th did I beat it. On this occasion I received W T I C, W P G (World's Playground New Jersey), W G Y (Schenectady, N.Y.), X D A (Mexico City), W G B B (New York), and many others of which calls were not heard.

Again, on November 23rd, I received C W O W (Montevideo), WPG, WTIC, W G Y, etc. I made a gramophone record of selections from W T I C—a record made over 3,200 miles!"

For this remarkable reception the set used was an S.G., detector, 1 R.C.C. stage, and 1 push-pull L.F. And the reader in question—Mr. L. W. Orton—has sent for verification from some of the stations heard. It is probable that he will have received confirmation by the time these words are in print.

The Best Time to Try

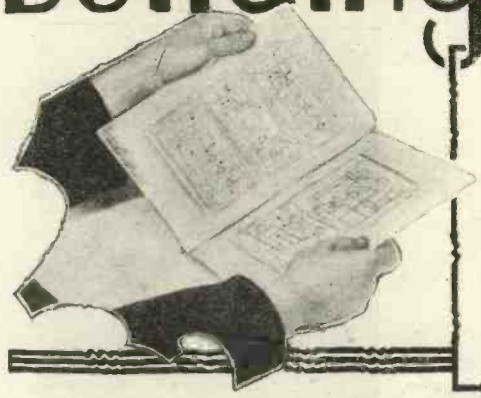
Although not many people in this country could claim such a startling series of successes as this, it is a well-established fact that when conditions happen to be suitable the American stations *can* be heard on ordinary wave-lengths.

But it generally means sitting up till 1 or 2 a.m. to try for them, and several complete failures at this hour are apt to damp even the most ardent long-distance enthusiast.

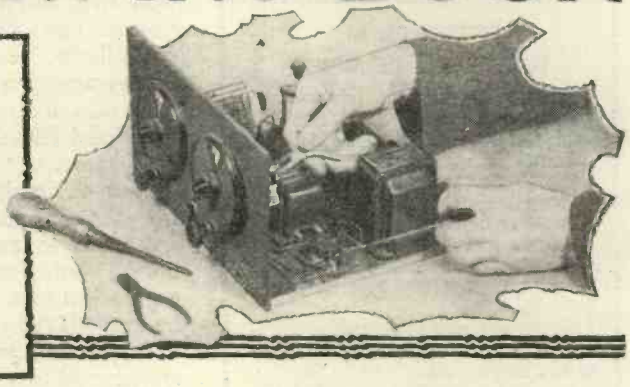
All the more honour to Mr. Orton!

OUR FREE GIFT

Building from the Book



Some practical hints on how to use the Circuit Gift Book presented with this copy of "Modern Wireless"



WITH every copy of this issue of MODERN WIRELESS we are giving away a book containing fifty more guaranteed circuits, providing sufficient data for the construction of another fifty sets of first-class quality.

A Wealth of Designs

Naturally, in a book of this description it is impossible to give dimensional drawings showing every step in the construction of these receivers, but the circuits have all been constructed (sometimes in more than one form) and the sets have been thoroughly tested under very stringent conditions.

Whether or not you want to build a receiver now you will find this book extremely interesting, for to the home constructor it offers a wealth of possible designs for his next set, while to the ordinary reader it provides an invaluable insight into the way wireless receivers are designed, for the theoretical circuit is the first step in the design of a modern radio set.

Gone are the days when one used to take some components and sling them together and try all sorts of methods in order to get the best results out of even the simplest type of set. Nowadays the receiver is planned in theoretical form, a form such as you see in this booklet, and the values of the components are worked out and are marked on the theoretical diagram and then the layout is designed in accordance with the data which the theoretical circuit provides.

100 Tip-Toppers

So that you have in this book the essential data for the building of fifty sets, all of which are up-to-date designs, and we have tried to give in the circuits themselves and in the captions underneath sufficient data about the components to enable the

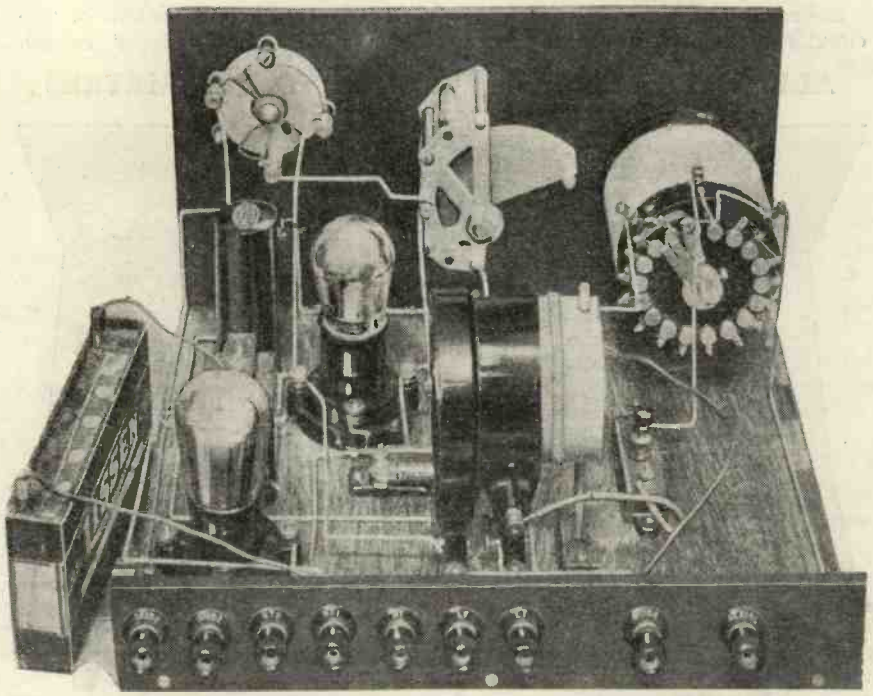
CIRCUIT No. 12

THE PARTS YOU NEED

- 1 Panel, 12 in. × 7 in.
- 1 Baseboard, 12 in. × 10 in.
- 1 "Star-Turn" Selector coil.
- 1 H.F. choke.
- 1 ·0003-mfd. max. compression type condenser.
- 1 ·0005-mfd. variable, with slow-motion dial.
- 1 ·0001–·00015-mfd. differential reaction condenser.
- 2 Sprung valve holders.
- 1 On-off switch.
- 1 2-meg. grid leak and holder.
- 1 ·0003-mfd. fixed condenser.
- 1 L.F. transformer.
- 2 Baseboard-mounting coil holders.
- 1 Terminal strip, 12 in. × 2 in., with 9 terminals. Wire, screws, G.B. plugs, etc.

(The coupling coil consists of 5 turns of 24 D.C.C. tapped at 3 and 4 on a 2½ in. diameter × 1 in. long Pirtoid or Paxolin tube.)

A SELECTIVE ALL-ROUND TWO-VALVER



The practical form of Circuit No. 12. As you will see, it contains an "M.W." "Star-Turn" Selector coil and a special form of "Star-Turn" coupling. It is ideal for the man who wants not only local, but distant radio reception.

experienced set-builder to go straight ahead on construction.

But if you do not want to build a set just now, these circuits will provide excellent reference for the future, and if you have also got the book which we gave away last month you will be in possession of a hundred tip-top circuits in embryo form.

CIRCUIT No. 48

COMPONENTS REQUIRED

- 1 Panel, about 7 in. × 7 in.
- 1 Baseboard, 7 in. × 9 in. (should be of metal to fit in metal covering box).
- 1 25,000-ohm power resistance, potentiometer type.
- 1 0-250 or 0-300 voltmeter.
- 4 Engraved insulated terminals.
- 1 Heavy-duty smoothing choke.
- 1 4-mfd. high-voltage type condenser.
- 1 2-mfd. ditto.
- 1 2-mfd. ordinary condenser.
- 1 20,000-ohm potential divider.
- Wires, screws, etc.

The first thing to do when choosing a circuit from which to build a set is to decide exactly what you want the set to do. If you want only local reception you will not choose a set using more than one high-frequency stage, and probably if living quite close to the local station you will not choose a set using H.F. at all. On the other hand, if you want long-distance reception as well as the local on the same set you will probably choose a receiver having two H.F. stages, so as to get plenty of selectivity.

Sufficient details are given with the circuits in the book to enable you to decide exactly what the sets will do, and whether or not they will suit certain cases, or meet your individual requirements. But let us take one or two of the circuits as examples to show exactly what we mean.

A Typical Case

Let us consider the case of the man who lives fairly close to the local station and who likes a receiver specially for local station listening on an average type of loud speaker, but who also likes to use the set for occasional listening to other stations on 'phones.

Now obviously this man (who for the sake of argument we will say does not want to run his set from the mains) wants a receiver which is fairly economical to run. At the same time he wants it to be sufficiently selective, to enable him to get rid of his local station and to pick up other transmissions on neighbouring wave-lengths.

Probably the detector and one L.F. set will do for him very well in the circumstances. He will get very good volume on a detector and transformer-coupled low-frequency stage if he is fairly near the local station, but, of course, he will be in danger of being swamped out by that station.

Selecting a "Two"

Having decided that a detector and L.F. will do him as well as anything, what is the next step? Naturally, it is to decide whether the aerial circuit and the tuned grid circuit of the detector valve are sharply enough tuned to enable him to get rid of his local transmissions when he wants to hear distant stations.

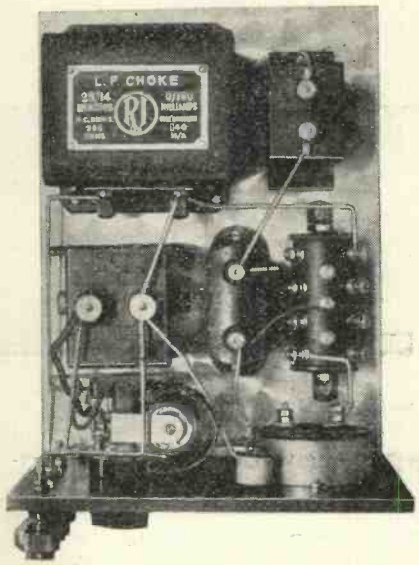
We have several detector and transformer-coupled L.F. circuits in the book, all of which will probably come under consideration when trying to pick out a receiver for the particular purposes we have in mind.

Let us consider four of them.

No. 10 circuit is an ordinary plain reaction circuit with the aerial tapped straight on to the end of the grid coil and the earth to the other end of it. Reaction is coupled and controlled through a variable condenser of ·0001 capacity, and the detector goes to an L.F. transformer in the usual way.

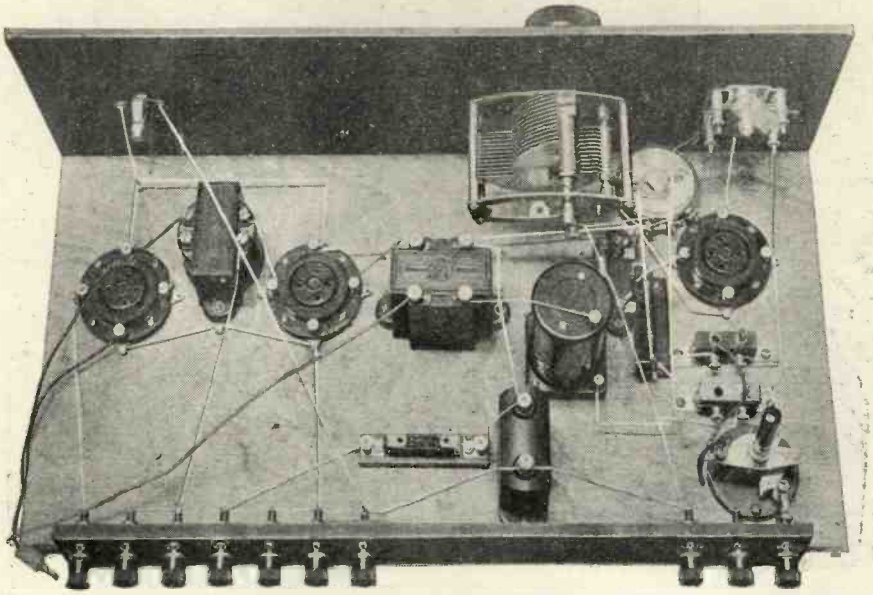
This circuit, while very good for

ECONOMICAL H.T. SUPPLY



Circuit No. 48 is a simple D.C. mains unit which is very simple to build and will provide perfect H.T. supply for small sets.

ALL WAVE-LENGTHS FROM 20 TO 2,000 METRES



A simple but amazingly effective all-wave receiver is that shown above and described in the book as Circuit No. 27. By means of plug-in coils all wave-lengths between 20 and 2,000 metres can be covered.

CIRCUIT No. 27

WHAT YOU WILL REQUIRE

- 1 Panel, 18 in. × 7 in.
- 1 Baseboard, 10 in. × 18 in.
- 1 ·0005-mfd. variable condenser.
- 1 Vernier dial.
- 1 ·0001-·00015-mfd. differential reaction condenser.
- 1 L.T. on-off switch.
- 3 Sprung valve holders.
- 2 Single-coil sockets.
- 1 200- or 400-ohm baseboard-mounting potentiometer.
- 1 Baseboard-mounting neutrodyne type condenser.
- 1 H.F. choke (all-wave type).
- 2 L.F. transformers.
- 1 ·0003-mfd. fixed condenser.
- 1 2-mfd. Mansbridge condenser.
- 1 2-meg. grid leak and holder.
- 1 25,000-ohm resistance and holder.
- 1 Terminal strip, 16 in. × 2 in. × ¼ in.
- 10 Terminals.
- Wire, screws, G.B. plugs, etc.

Plenty of Programmes and Plenty of Punch

long-distance work, would be absolutely hopeless for the man who wants to listen close to a powerful station, especially if that station were of the Brookmans Park or Moorside Edge type having two transmitters. It would be incapable by itself of picking out one or other of the two transmissions, let alone getting any distant stations when the local was on. We are assuming, of course, that the situation of the listener is within about twelve or fifteen miles of the local station.

"What About Wave Traps?"

He might add a wave-trap for cutting out one or other, or both, of the locals, or he might alter the circuit. The best thing to do as we are considering the building of a new set is to alter the circuit. So we will transfer our attentions to Circuit No. 11. Here we see that the aerial, if desired, can be tapped through a neutralising type of condenser to an "X" coil, and differential reaction can be applied.

This is a distinct gain in selectivity and would probably enable quite a number of distant stations to be picked up clear of the local, but the neutralising type condenser, though giving selectivity and enabling one to decide between two local stations, will cut down the sensitivity of the set very badly, and when distant transmissions are required the volume would be too small. So this is not what we require.

Now, Circuit No. 14 is roughly the same circuit, with a wave-trap enabling one or other of the locals to be cut out and enabling distant stations round about the wave-length of the local to be brought in at better strength. But the other local may still trouble a bit unless we use a second rejector, or unless we sharpen up the tuning of the circuit still farther.

Still Greater Selectivity

After all, we are asking rather a lot of a two-valve set when we demand that it shall enable us to separate completely the two local stations (as this Circuit No. 14 would do quite easily) *and* to get distant stations as well. We must remember that we have only one tuned circuit to deal with if we do not count the rejector circuit. So that we must pass on to another circuit.

No. 12 seems more hopeful, for here we find the "Star-Turn" Selector coil employed in the aerial circuit, and this is coupled via a variable condenser and an "X" coil for long waves, and through a hank coil tied to the "X" coil for short waves. Now this definitely would do the job that we want.

It cuts out the local station by virtue of the very great selectivity provided, by tuning the aerial by means of the "Star-Turn" Selector, and by the small coupling between the hank coil and the ordinary "X" coil, and yet the very fact that we tune the aerial enables us to *increase* sensitivity at the same time.

So, then, in this particular case, we decide on circuit No. 12 and get not only the most selective two for general purposes, but also one of the most sensitive of the circuits we have under consideration.

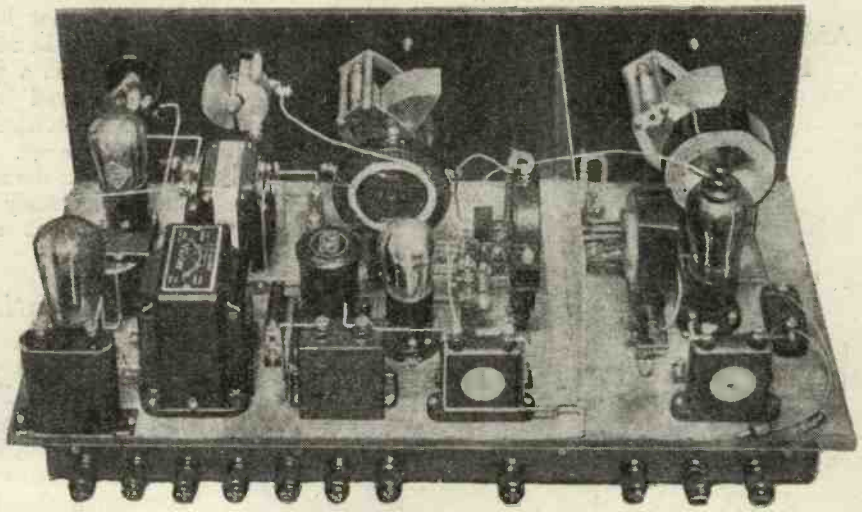
Circuit Comparisons

For the man who does not want distant stations, but only wants to listen to his local, there would be no sense in building this circuit, for he could get his requirements from the previous circuit just as well; but we have chosen a difficult problem to solve, because if we can solve the difficult problems it is obvious we can solve the little ones.

We have not considered Circuit No. 13, however, which is a wave-change set having equal selectivity to Circuit No. 12, and generally even greater sensitivity. It is, in fact, a sort of "de luxe" model to Circuit No. 12, and could be substituted for that circuit if desired.

We have seen how to go about the choice of a circuit, balancing the capabilities of one against those of another. Now let

FOR LONG-RANGE LOUD-SPEAKER RECEPTION



Circuit No. 36. In this set under-baseboard wiring of filament and H.T. leads has been carried out. Hence the narrow terminal strip is used to raise the back of the baseboard.

CIRCUIT No. 36

COMPONENTS NEEDED FOR BUILDING THIS SET

- 1 Panel, 21 in. × 7 in., and baseboard 10 in. deep.
- 2 ·0005-mfd. variable condensers, with slow-motion dials.
- 1 ·0002-mfd. reaction condenser.
- 1 ·5-meg. pot. type volume control.
- 1 L.T. switch.
- 2 Baseboard - mounting D. P. D. T. switches for panel control.
- 1 Standard 10 in. × 6 in. metal screen.
- 4 Sprung valve holders.
- 4 Single-coil mounts.
- 2 600-ohm fixed resistances and holders.
- 1 25,000-ohm fixed resistance and holder.
- 1 ·0001-mfd. fixed condenser.
- 1 ·01 ditto.
- 2 2-mfd. ditto.
- 2 1-mfd. ditto.
- 1 ·002-mfd. ditto.
- 1 2-meg. grid leak and holder.
- 1 Three-terminal ·0003 fixed condenser with grid-leak clip.
- 1 H.F. choke.
- 2 L.F. transformers.
- 1 Output choke.
- 1 Terminal strip, 19 in. × 1 in.
- 11 Terminals.
- Wire, screws, plugs, etc.

us consider the actual turning of the theoretical into its practical form.

To aid readers in this we have photographed in set form several of the circuits that are likely to prove most popular, and with the photos have provided the lists of components as guides to the prospective constructor.

In the building of receivers from theoretical circuits the layout should be very carefully considered before construction is commenced. It is impossible in theoretical circuits to give any more than a rough idea of the set; layouts cannot be described, though we do endeavour to give a clear impression of the screening when it comes to H.F. amplification.

Arranging the Screen

For instance, you will see in some of the circuits that the screening goes straight up past the screened-grid valve, the connection from the anode going through a hole in the screen to the anode coil or detector grid circuit, and in others that the screen bends so that it cuts through the valve itself in a line with the screening grid. This latter method denotes that the valve should be placed projecting through the screen, while the former shows that the valve need not go through the screen, but that it can be placed vertically alongside it.

In regard to layout of coils, components, etc., it is impossible to give any sort of instructions. It must be left to the reader's previous experience to decide exactly how he should place his parts.

We will assume he has chosen his circuit and is now deciding how to lay it out. While a set does not want to be spread out too much, it is better to be on the lavish side than to make it too cramped; especially is this true at the H.F. end, particularly if wave-change switching is incorporated, which usually takes up a fair amount of room. A mains set also has to be very carefully thought out, and very painstakingly spaced, if satisfactory operation is to be obtained.

Starting at the H.F. end, the first thing to remember in the construction of the set is that all grid and plate leads should be as short as possible, and should not run close to each other. The next thing to remember is that the tuning coils should not be placed too near the panel or hand-capacity effects may occur, and they should not be run right up against the screen so that losses due to the proximity of large earthed metal masses are met with.

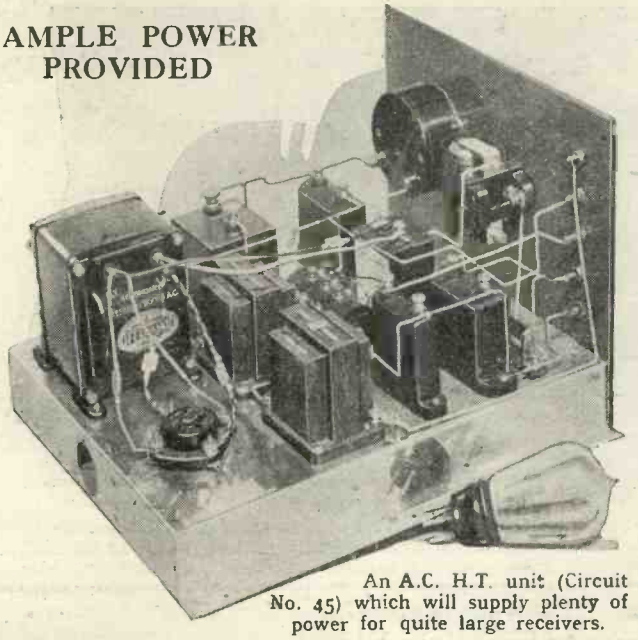
Condenser Connections

Moving vanes of condensers should go to earth wherever possible, the fixed vanes going to grid and high potential end. In the case of an aerial series condenser it does not much matter which way round the condenser is wired up.

CIRCUIT No. 45

THE PARTS THAT GO TO MAKE IT

- 1 Panel, 10 in. × 8 in.
- 1 Metal baseboard and metal cover, the former about 12 in. deep.
- 5 Terminals.
- 1 10,000-ohm variable resistance.
- 1 Voltmeter, 0—250 or 0—300 volts.
- 2 Smoothing chokes (about 20 henries).
- 1 Mains transformer to suit rectifier valve.
- 1 Sprung valve holder.
- 3 2-mfd. fixed condensers.
- 1 4-mfd. ditto.
- 1 1-mfd. ditto.
- 1 20,000 or 15,000 potential divider.
- 1 25,000-ohm resistance.
- Wire, screws, etc.



An A.C. H.T. unit (Circuit No. 45) which will supply plenty of power for quite large receivers.

On the L.F. end the same precautions as regards grid and plate wiring must be carried out; and where by-passing or de-coupling components are used, these should be placed close up against the components to be de-coupled, and not at the H.T. end of the lead. Also in the case of an S.G. valve the de-coupling resistance of 600 ohms and the 1-mfd. condenser, which are often used to de-couple the grid circuit, should be placed close up to the valve holder and not at the H.T.+1 terminal on the receiver.

When building a large set, especially a mains set, it is not a bad idea to test all the condensers before placing them in circuit. Charge them up by means of an H.T. battery and leave them for several minutes. Then try a piece of wire or a screwdriver across each of the large ones to see if they still have their power. This will prove if the condenser is likely to be faulty or not.

If no spark is obtained, then one can feel sure that the condenser is faulty. In the case of a small one, such as ·0001 to ·002, etc., a pair of 'phones should be placed across it and a definite click should be heard. If this is not heard then the condenser can be reckoned to be faulty.

Very often a great deal of trouble can be saved by testing out such things as condensers before placing them in the set. There are not many "duds" on the market, but even the most rigorously organised factory can turn out a faulty condenser occasionally.

Differential Reaction

In all the diagrams in this book the differential reaction condensers are labelled F_1, F_2, and M. You will not find this labelling on this type of condenser itself, but it has been done on the diagrams for the purposes of correlating the theoretical with any wiring diagrams which you may care to draw out, and it is our practice always to consider that a differential reaction condenser provides reaction by means of coupling the moving vanes to the F_1 vanes, while F_2 is the by-pass side to earth.

And talking about wiring diagrams, it is not a bad plan when you have got your set laid out to take a copy of your baseboard and panel layout and mark in the terminals and the various components, joining them up in accordance with the connections

Work Your Receiver from the Mains

in the theoretical circuit. This will give you a very good idea how best to place the leads when you come to the actual wiring up of the set. Incidentally, you will be able to check up the theoretical and your wiring diagram before you *start* wiring the set, and then give the set another check up when the wiring is completed, thus greatly minimising any chances of error in construction.

Portable Sets

You will find in this booklet one or two circuits for portable sets, and there are one or two little points in the construction of these receivers which it might be useful to bring forward.

In the two-valve portable circuit in which a Loewe valve type R.N.F.7 is employed (Circuit No. 18), screening can be carried out in the usual way between the screened-grid valve and the rest of the circuit, though it has been found that such screening in this set is not absolutely necessary. But what is essential is that the frame aerial, which is wound round the case, should not be allowed to couple with the loud-speaker wires. Consequently, on no account should the output leads be allowed to trail round inside the case. They must be taken as directly as possible to the loud speaker.

In the instance of the four-valve portable set (Circuit No. 37), it may be necessary to shield the inside of the frame aerial in order to prevent coupling due to transference of energy from the loud-speaker end to the frame aerial, and thus affording back-coupling and causing instability.

The Mains Units

Finally, we come to the mains units. Several of these, both D.C. and A.C., are provided in this book, but we should like to impress upon constructors that one of the greatest errors which he can make is to use second-rate condensers. Condensers in mains circuits *must* be of good make and capable of withstanding the voltages to which they will be subjected.

You will find in most of the mains circuits condensers right across the maximum voltage—sometimes of the mains and sometimes of the A.C. rectifier. It may be upwards of 200 or 250 volts. These condensers must be able to stand the full voltage of the mains circuit, and thus should have a *working* voltage of somewhat more than the voltage to which they are to be subjected.

Remember to test your components, for it is very much more difficult to trace a fault after you have built a set than to decide whether a component is faulty before it is incorporated in the receiver.

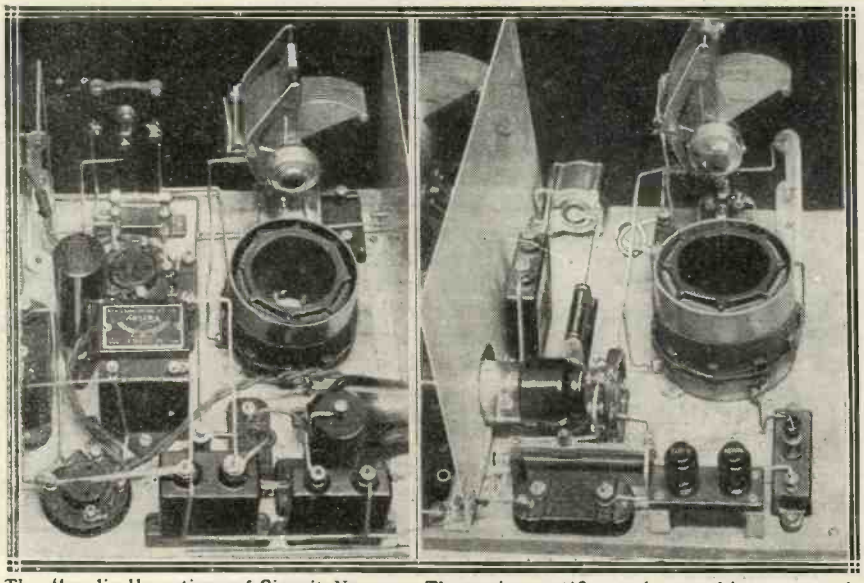
For Your Guidance

The illustrations of a few of the circuits (given in the Fifty More Guaranteed Circuits book) which are provided in these pages will act as guides and give an idea of how the layouts are carried out and what the original sets looked like when the circuits were built up for test.

They will act as models not only for themselves, but also for other circuits of a similar character which you may choose to build.

Of course, in this issue of MODERN WIRELESS there are also a number of other complete sets fully described, and these, too, will help you when you are deciding on a layout for one or other of the circuits given in "Fifty More Guaranteed Circuits."

ALL-FROM-THE-MAINS THREE



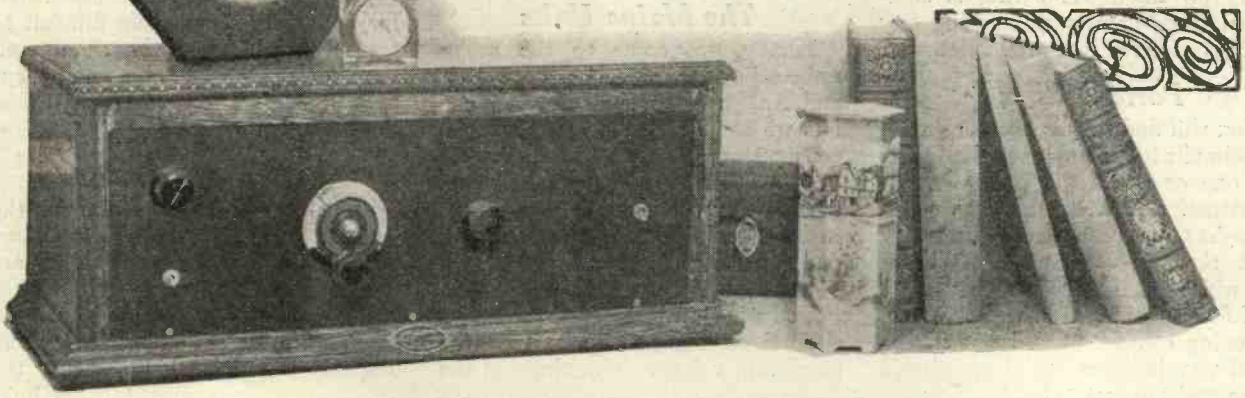
The "radio" sections of Circuit No. 31. The mains rectifier and smoothing system is situated off the picture to the left of the photo.

CIRCUIT No. 31

WHAT YOU WILL REQUIRE TO BUILD IT

1 Panel, 21 in. × 7 in., baseboard 10 in. deep.
2 ·0005-mfd. variable condensers with slow-motion dials.
1 ·0001 differential reaction condenser.
1 Compression type condenser, ·001 max.
2 3-point on-off wave-change switches.
1 Mains on-off switch.
2 25,000-ohm "Spaghetti" resistances.
1 1,000-ohm ditto.
2 600 de-coupling type resistances.
1 Panel-mounting variable resistance, C-2 megohms.
1 1,000-ohm potentiometer.
1 2-meg. grid leak and holder.
2 5-pin valve holders.
1 Horizontal 5-pin valve holder.
1 4-pin valve holder.
5 2-mfd. 200-volt "working" condensers.
1 4-mfd. ditto.
2 1-mfd. ordinary condensers.
1 ·01-mfd. ditto.
1 ·001-mfd. ditto.
2 ·002-mfd. ditto.
1 ·0003-mfd. ditto.
2 H.F. chokes.
2 Smoothing L.F. chokes.
1 Output filter choke.
1 Intervalve L.F. transformer.
1 Power transformer for half-wave rectifier.
2 "M.W." dual-range coil units.
1 "M.W." standard screen, 10 × 6 in.
Panel brackets, terminals, etc.
(Mains section can be mounted edgewise on a 6 in. × 10 in. baseboard at L.F. end of set.)

The "STAR-



OUR presentation last month of the "Triple" Two seems to have aroused an extraordinary amount of interest, even among readers who had no intention of building so small a receiver. Indeed, it rather looks as though we have set a new fashion in radio journalism, and ere long practically all important sets will be presented in this "three model" form.

In Three Forms

Certainly any journal which aims at making its designs available to every section of its readers will have to give serious consideration to this method of presentation. The idea, as the reader will probably remember, is to design the receiver in three different forms embodying the same basic circuit.

There is first the fundamental battery-operation model, then one for D.C. mains in which H.T., L.T. and grid bias are all obtained from the mains-drive circuit, but employing battery-type valves. Finally, a third model for all-mains operation from an A.C. supply, using indirectly-heated-cathode mains valves.

We had decided some time ago to try out this idea pretty thoroughly, and we prepared our plans for a three-valve experiment long before the "Triple" Two went to press. It has been most encouraging, however, to observe the keen interest aroused by the "Two," and it has confirmed us in our intention to explore the possibilities of the scheme fully.

This month comes the three-valve design, and here we have adopted a slightly different scheme. We found that exactly the battery model we wanted had recently been published (the "M.W." Three, December issue), and so we felt there was no point in repeating the design.

Completely Mains-Operated

Accordingly, we have prepared just the direct current and alternating current mains models, and it is these which we are about to describe.

Before we go into details there is just one point we want to emphasise once again. We want to make it clear right away that these are "all-mains" sets in the fullest sense of the

WHAT YOU WILL WANT TO MAKE THE A.C. MODEL

PANEL
1 21 × 7 in. (Goltone).

CABINET
Panel space 21 × 7 in., baseboard 10 in. deep (Pickett).

VARIABLE CONDENSERS
1 ·0005-mfd. (Lissen).
1 ·0001-mfd. or over (up to ·0002 mfd.) differential reaction condenser (Ormond).
1 "neut"-type (Bulgin).

SWITCHES
2 mains-type on-off (one used for wave-changing can be an ordinary L.T. type if desired) (Igranic).

RESISTANCES
2 25,000-ohm "Spaghetti" type (Magnum).
1 50,000-ohm ditto.
2 1,000-ohm ditto.
1 1-meg. grid leak and vertical holder (Dubilier).
1 ·5-meg. grid leak and holder (Dubilier).

VALVE HOLDERS
3 5-pin-type (Lotus, or Bulgin, W.B., etc.)
1 ordinary 4-pin type (W.B.).

FIXED CONDENSERS
6 2-mfd. (Lissen, T.C.C., and Dubilier in set). (See text re working voltage rating of these.)
2 4-mfd., 200 working voltage rating (T.C.C.).
1 ·002-mfd. (Lissen).
1 ·0003-mfd. (Lissen).
1 ·01-mfd. (T.C.C.).

CHOKES
1 H.F. (Ready Radio).
2 smoothing-type, about 20 henries, to carry up to about 20 milliamps, resistance not to exceed 500 ohms (R.I. "Hypercore," or other compact type).
1 output filter type (Wearite).

TRANSFORMERS
1 L.F. (Ferranti or Varley, Telsen, Igranic, Lissen, R.I., Mullard, Lotus, Lewcos, etc.).
1 power, with primary to suit mains voltage and periodicity, giving the following outputs: 150 volts and up to 30 milliamps. (H.T.), 4 volts 1 amp. (rectifier filament or heater), 4 volts and up to 3 or 4 amps. (heaters of valves) (Atlas, or Wearite, R.I., etc.).

COILS
1 dual-range (Parex).
1 "Star-Turn" Selector (Ready Radio).

MISCELLANEOUS
1 slow-motion dial (Lotus).
4 terminals (Belling & Lee).
2 terminal blocks (Belling & Lee) (or two strips about 3 × 2 in.).
Glazite, screws, flex, mains plug or adaptor, etc.).

NOTE.—In this list the makes and types of the parts in the original set are given. For suitable alternatives (where not quoted) refer to the list for the D.C. model of this receiver on a subsequent page.

"STAR-POWER" THREE

Here is a magnificent set with an overwhelming appeal to the man with mains, whether D.C. or A.C. There is not one single battery to bother about—no grid bias, no high-tension renewals, and, best of all, no accumulator charging.

Just think what that means in constancy and in convenience! And, remember, it is coupled with first-quality reproduction and a wonderful range of loud-speaker reception.

By THE "M.W." RESEARCH & CONSTRUCTION DEPARTMENT.

word. They use no batteries whatever, not even the humble G.B. unit, for every volt and every milliamp is derived from the mains-drive circuits. Only in this way can the delightful freedom from maintenance troubles and constancy of results associated with true all-mains operation be achieved.

We begin with what is perhaps the most interesting of the group.

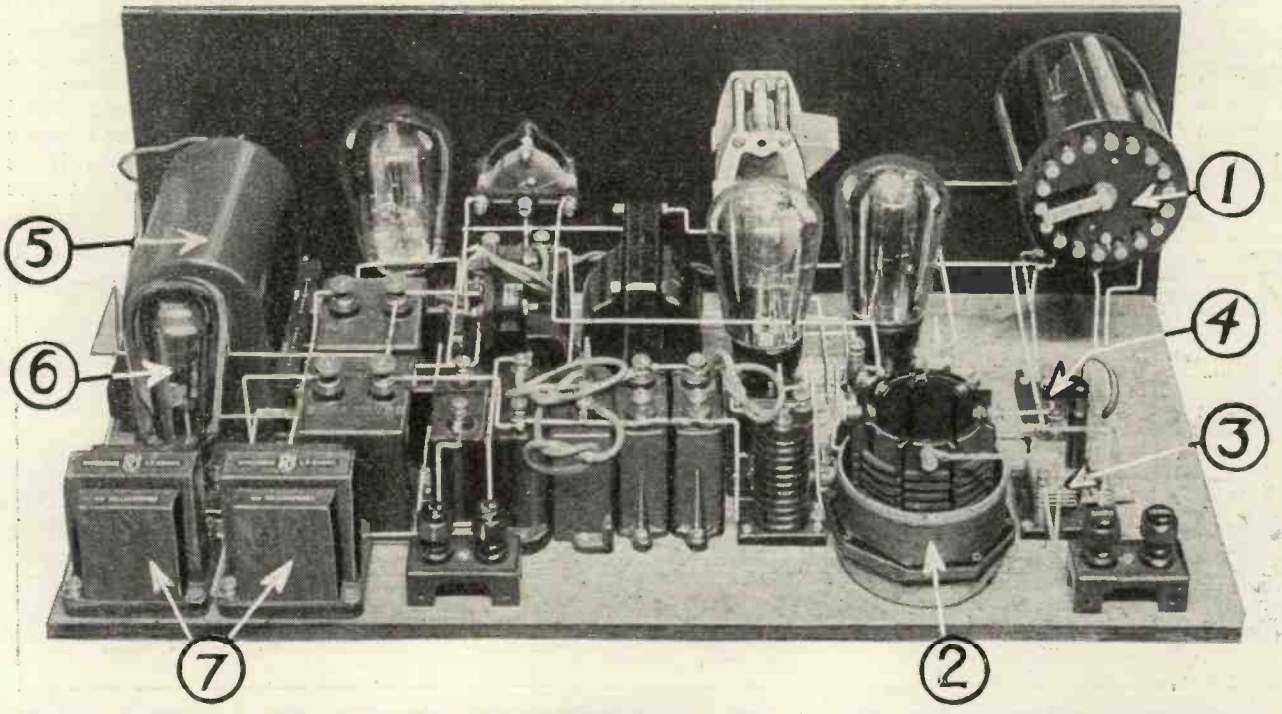
Readers who have an alternating current supply will probably have realised by now that they are extremely fortunate, for whenever we produce one of these "three model" designs they will notice that the A.C. version is always perceptibly ahead in performance of the other two.

Superior Characteristics

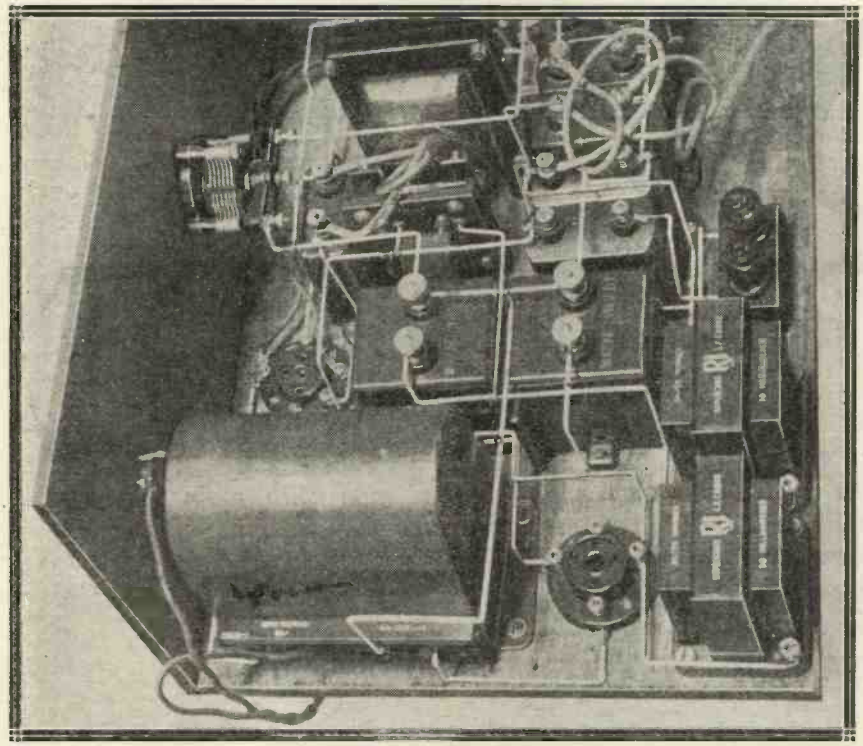
The reason is to be found in the superior characteristics of the special mains valves which it is possible to employ in an A.C. receiver. These valves (the indirectly-heated type) are very definitely better than the corresponding battery types, and so they render possible a receiver whose performance is strikingly impressive when judged by "battery" standards.

They bring with them problems of their own, of course, arising out of

OUTSTANDING FEATURES OF THE ALL-WAVE "STAR-POWER" DESIGN



The set's remarkable selectivity is due to the famous "M.W." Selector system (1), and to the dual-range coil, capacity coupling, and Interwave system respectively denoted at (2), (3), and (4). The power transformer is shown at (5), while (6) indicates the rectifier valve, and (7) the two smoothing chokes.



Here we see the power supply end of the "Star-Power" Three, with the mains transformer in the foreground. Note the adequate smoothing provided by chokes and large condensers, and also the flexible resistances attached to certain of the condenser terminals.

their very virtues, and they are most decidedly valves with which no liberties may be taken. The amount of amplification they give is so great that the normal risks of instability due to coupling effects in the H.T. source, etc., are much intensified.

Don't Alter the Circuit!

The design of a receiver employing them is therefore a matter of some nicety, especially when two low-frequency stages are to be used. Considerable care is called for in the layout of the H.T. de-coupling circuits and in deciding the amount of amplification each valve shall be permitted to give.

Hence it is risky for the constructor to make any serious modifications in such design unless he has had a good deal of experience of A.C. work.

We do not want to alarm anyone needlessly, but our A.C. "Star-Power" Three has been worked out very carefully in all its details and we do most earnestly advise the prospective constructor to take it as it stands or else wait for some future set which will suit his needs more closely.

After which (we fear) rather long-winded preamble we can proceed to business and tell you about the design, construction and use of this interesting A.C. mains instrument.

The basic receiving circuit is exactly the same as that of the battery and D.C. models. There is a detector valve with the latest form of the "Star-Turn" and "Interwave" systems, wave-change switching, and, of course, differential reaction.

The Mag. Question

Following the detector there come two low-frequency amplifying stages, carefully arranged to give a suitable amount of magnification for the best results. That probably looks a curiously vague statement, so let us explain. You see, with two L.F. stages using A.C. valves it is quite easy to get TOO MUCH amplification for practical purposes.

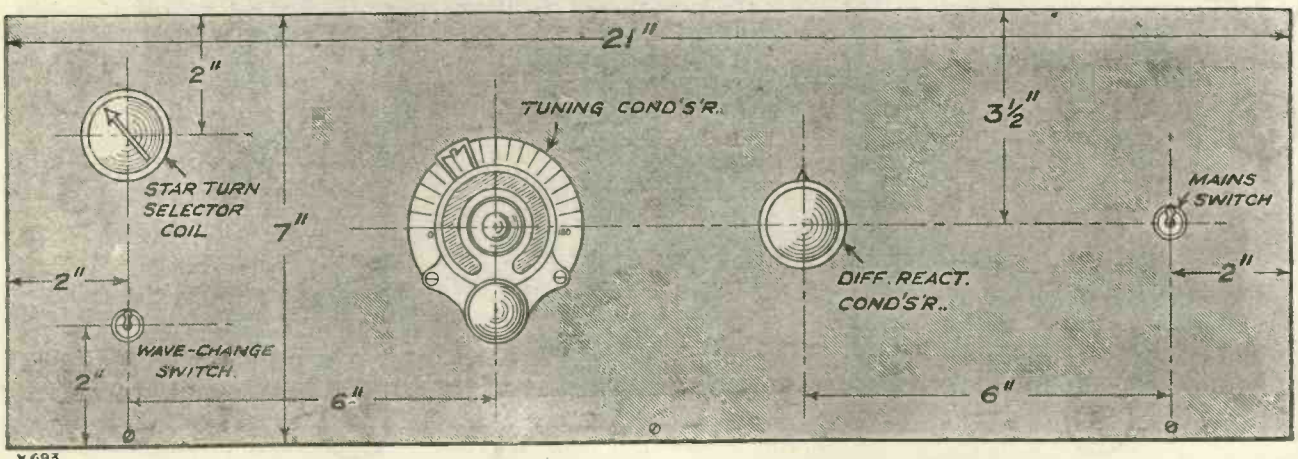
If an attempt is made to extract the full possible "mag." from two "indirectly-heated" L.F. stages, several acute difficulties are at once encountered. There is, for example, the question of stability, and extraordinarily elaborate (and expensive) de-coupling precautions are needed to prevent howling or motor-boating.

Avoiding Hum

Again, there is a great risk of an annoying amount of hum even when stability has been achieved. A very minute amount of hum in the detector circuit will be brought right up to an objectionable level by so tremendously powerful a low-frequency amplifier, whereas under more normal conditions it would be inaudible.

These difficulties might be regarded merely as a spur to urge the designer on to overcome them, but that is not the end of the story. Suppose we got

AS EASY TO CONTROL AS THE BATTERY MODEL



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Many people seem to think that because a set is mains-driven there must be a whole host of controls on the panel. That this is not so is shown by this diagram of the panel of the A.C. "Star-Power" Three.

The Logical Way is to Work All Off the Mains

this tremendous "mag." out of the L.F. side, would it be a desirable achievement? For practical purposes it would not, because it would merely land us in fresh difficulties with constant overloading of the output valve.

For this there would be only two remedies, the most obvious one being to fit a volume control and so keep the magnification well cut down most of the time. The absurdity of this cure is sufficiently obvious!

The Best Expedient

A more scientific but still unpractical way of meeting the difficulty would be to provide a very large output valve capable of accepting the very big grid swings delivered to it without overloading. The objections here are that the cost of the set would be greatly increased (such valves drink a lot of current and require a high anode voltage), and that on the stronger stations it would deliver volume far in excess of the level desirable for domestic conditions.

Experience with A.C. sets with two L.F. stages has brought us to the conclusion that the best expedient is to adjust the L.F. mag. to a more suitable amount. This, we have found, can be set with advantage to something well above that obtained from the normal battery receiver, and so a very fine performance can be obtained without encountering the difficulties we have mentioned to any serious degree.

It is just a matter of a little finesse in fixing the amount of magnification to be given by each L.F. stage, and to this part of the design we have devoted a good deal of time. We are explaining this point in some little detail because we think it will increase the prospective constructor's interest in the receiver to understand some of the main principles of its design.

Controlling Amplification

The actual methods of controlling the amount of L.F. amplification can be followed in the main from the circuit diagram. Note the use of a stage of resistance-capacity coupling in the first stage with carefully chosen resistance values. The final adjustment is made by correct choice of valve types, as to which important matter we shall naturally have more to say later on.

Now let us just run over the circuit diagram and see how the various power supply circuits are arranged. First note the power transformer (right-hand extremity of the diagram), which supplies the whole of the "juice" used by the set.

Observe that it has a winding which provides the necessary supply of alternating current at 4 volts for the heaters of the valves. This winding is actually marked "2—0—2," because it has a centre-tap (which is not normally used in the present receiver); but that means 4 volts, of course.

Then there is another winding which also supplies alternating current at 4 volts for the heater or filament of the power rectifier valve. This is of the half-wave type, because such valves give a sufficient supply of current for a set of this kind and their output is more easily smoothed than that of the full-wave type, paradoxical as that may seem.

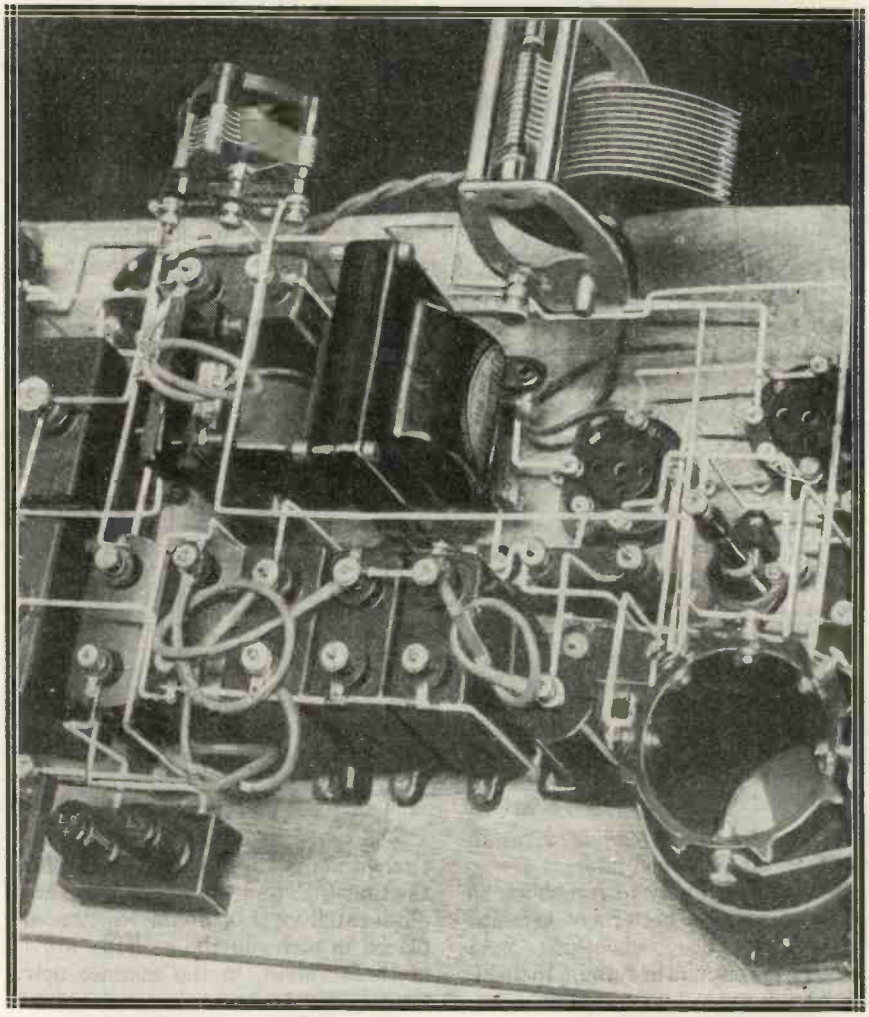
A third and last secondary winding provides alternating current at about 150 volts to the rectifier for conversion into the H.T. supply for the receiving valves. This supply after smoothing not merely provides the anode current of these valves, but the automatic grid bias as well, so completing our supply of all the necessary current and voltage.

The smoothing and de-coupling circuits are very similar to those of a D.C. receiver, as might be expected, but there are some significant differences in the detector de-coupling filter.

Obtaining Grid Bias

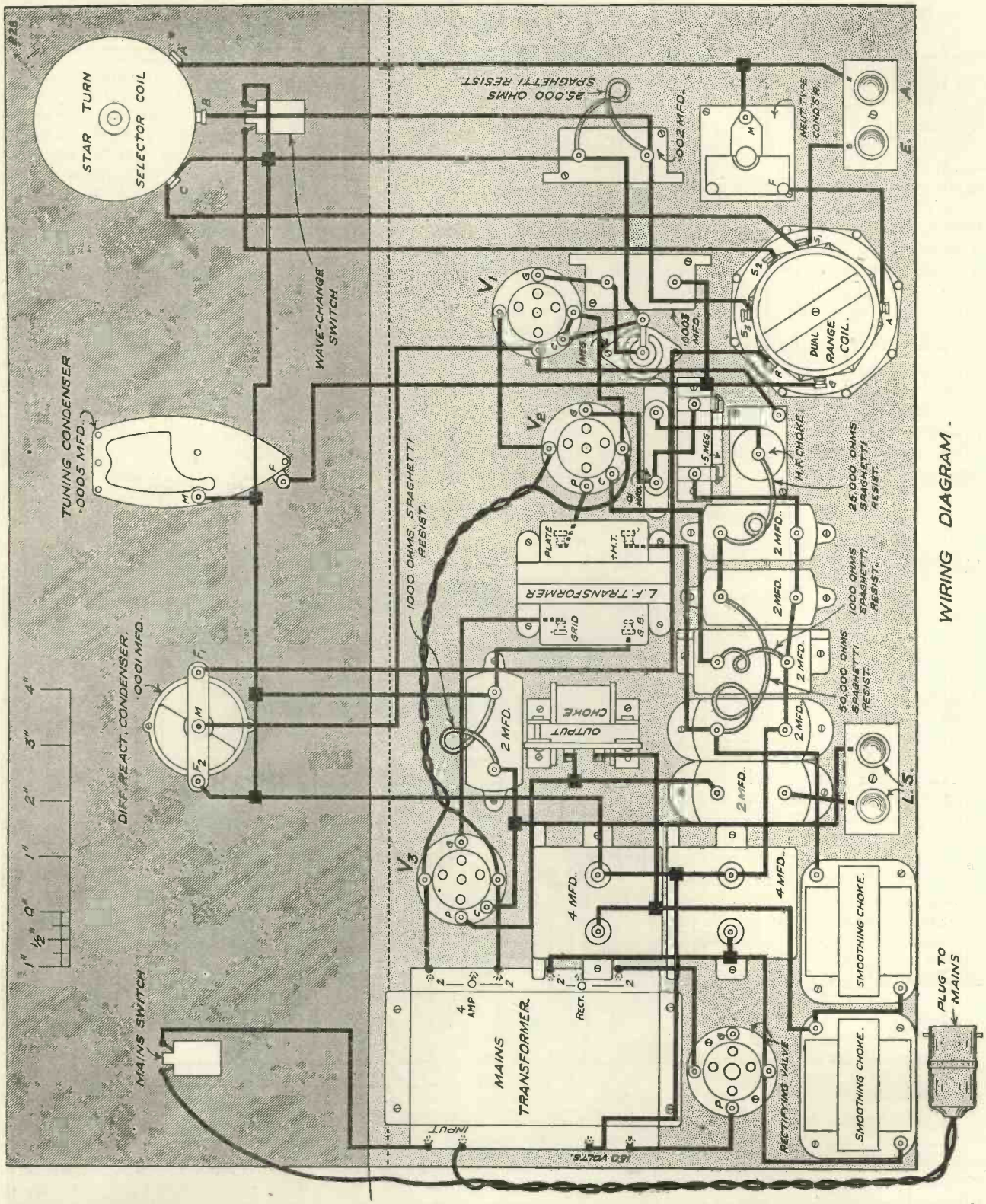
These differences are in the direction of still more drastic de-coupling to ensure stability with the much more "lively" A.C. mains. Note that the capacity in the detector filter

AMPLE VOLTAGE VARIATION AND DE-COUPLING



This close-up of the detector stage shows in detail some of the de-coupling arrangements and voltage-adjusting resistances. Note the two loud-speaker terminals on the left, ready mounted on a little base of their own.

THE LAYOUT AND WIRING OF THE A.C. MODEL



is 4 microfarads instead of 2, as in the D.C. set described later.

Space is beginning to run short, so we think we had better not attempt to explain the smoothing and de-coupling circuits in detail. Instead, we would suggest you read the explanation of the equivalent portion of the D.C. set.

The grid-bias arrangements are entirely different. The bias voltages for the first L.F. and the power valve are obtained from 1,000-ohm resistances placed in series in the cathode leads of these valves, in the manner now almost universally used.

The anode current of each valve flows through its appropriate cathode lead resistor, and so sets up across the latter a voltage drop in the proportion of one volt for every milliampere of current. This voltage becomes the grid bias for the valve, and undesirable back-coupling effects are prevented by shunting a 2-mfd. condenser across each of the bias resistors.

Those A.C. Valves Do Hand It Out!

The construction of the receiver you will find is a very straightforward task, although there is quite a lot of work involved. After all, you are really building the equivalent of a three-valve set of an advanced type plus an " all-power " mains unit.

An Interesting Point

The diagrams and photos make the actual work quite clear, but there are still some practical matters which would probably be the clearer for a little explanation. Note, for example, the two 2-mfd. condensers nearest to the H.F. choke.

These, as you will see, are connected in parallel to give a capacity of 4 mfd., and they could obviously be replaced if desired by a single condenser of that capacity.

"Working" Voltages

While we are mentioning the voltage ratings of condensers, perhaps we might as well clear up the whole question and explain the working voltages of the various condensers. In addition to the two just mentioned, the following 2-mfd. condensers are of the ordinary " receiving " or low voltage type : the middle one in the row of five, and the one near the reaction condenser. The remaining two of 2 mfd. and those of 4 mfd. should be of the 200 volts ("working") rating.

In the illustrations of the tuning circuits it is to be noted that the dual-range coil differs slightly from our usual standard " M.W." type. The actual difference is purely mechanical, not electrical, and is chiefly a matter of placing the terminals at the top of the unit instead of at the bottom.

This departure we have found makes no difference to the functioning of the coil, and therefore we have approved this make of unit as complying electrically with our specification. At the same time, we do not advise this position for the terminals for *home-made* versions of the coil.

The Heater Circuit

The rest of the practical matters we believe you will be able to follow out quite easily upon the wiring diagram, except that perhaps we should draw your attention to the wiring of the heater circuits. This is done in part with the usual twisted twin flex and in part with ordinary stiff wire (Glazite or other covered material here, and for all other wiring in the set). It is important to see that these leads are well spaced out from those to the grids of the valves.

There is just one possible little adjustment to make for the best results when the set is first tried, concerning the method of earthing the heater circuit. If you examine the wiring diagram you will see that one heater terminal on the detector socket (V_1) is wired to the cathode terminal and so to earth. On some mains you may get better results by wiring the other heater to the cathode instead of the one shown.

Valves to Use

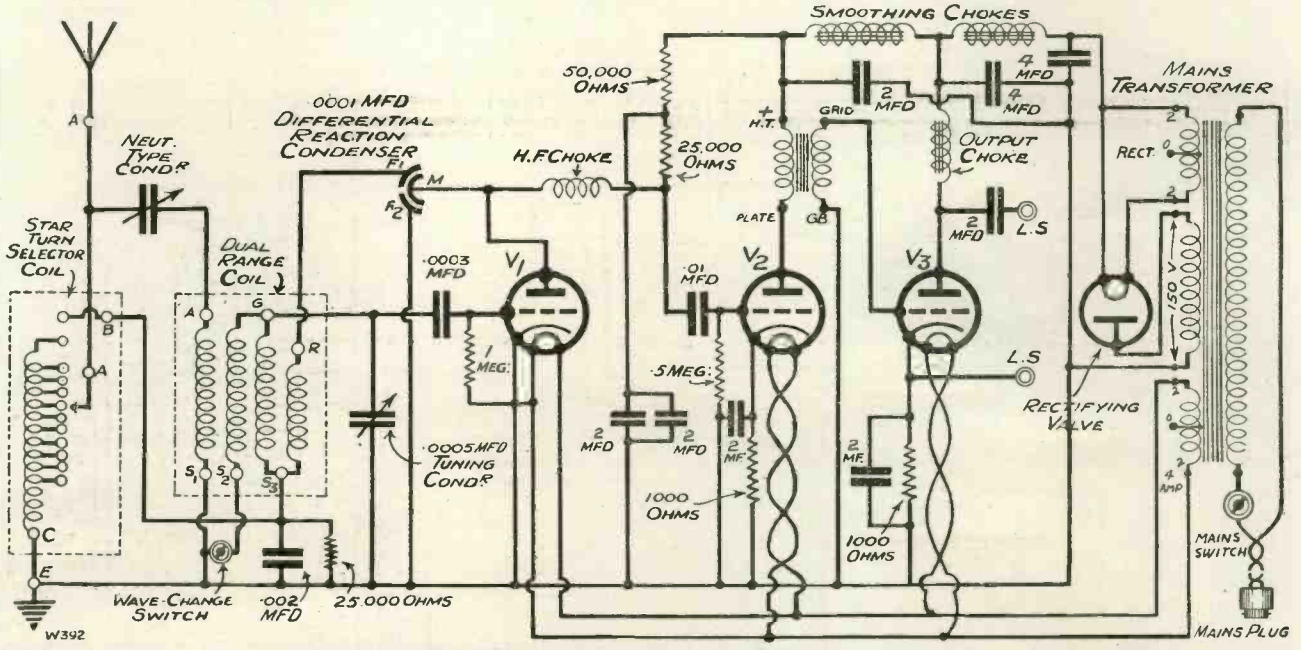
In very exceptional cases, again, it may be better to earth neither of these heater terminals, but instead to earth the centre-tap terminal of the heater winding on the transformer.

Now you just want the valve types, and we have done. For the first two sockets (V_1 and V_2) you require valves (indirectly heated) of the " H.L." class, and here are a few examples : Osram and Marconi M.H.L.4, Mazda A.C./H.L., Mullard 354V. (164V somewhat to be preferred for first L.F. stage), Cossor 41M.H.L., etc. For the output valve (V_3), a Mullard 104V., Marconi and Osram M.L.4, or other indirectly-heated power type.

In the course of our tests, by the way, we obtained particularly good results with a Mazda A.C./H.L. as detector, Mullard 164V. in the first L.F. position, and a Marconi M.L.4 as the output valve.

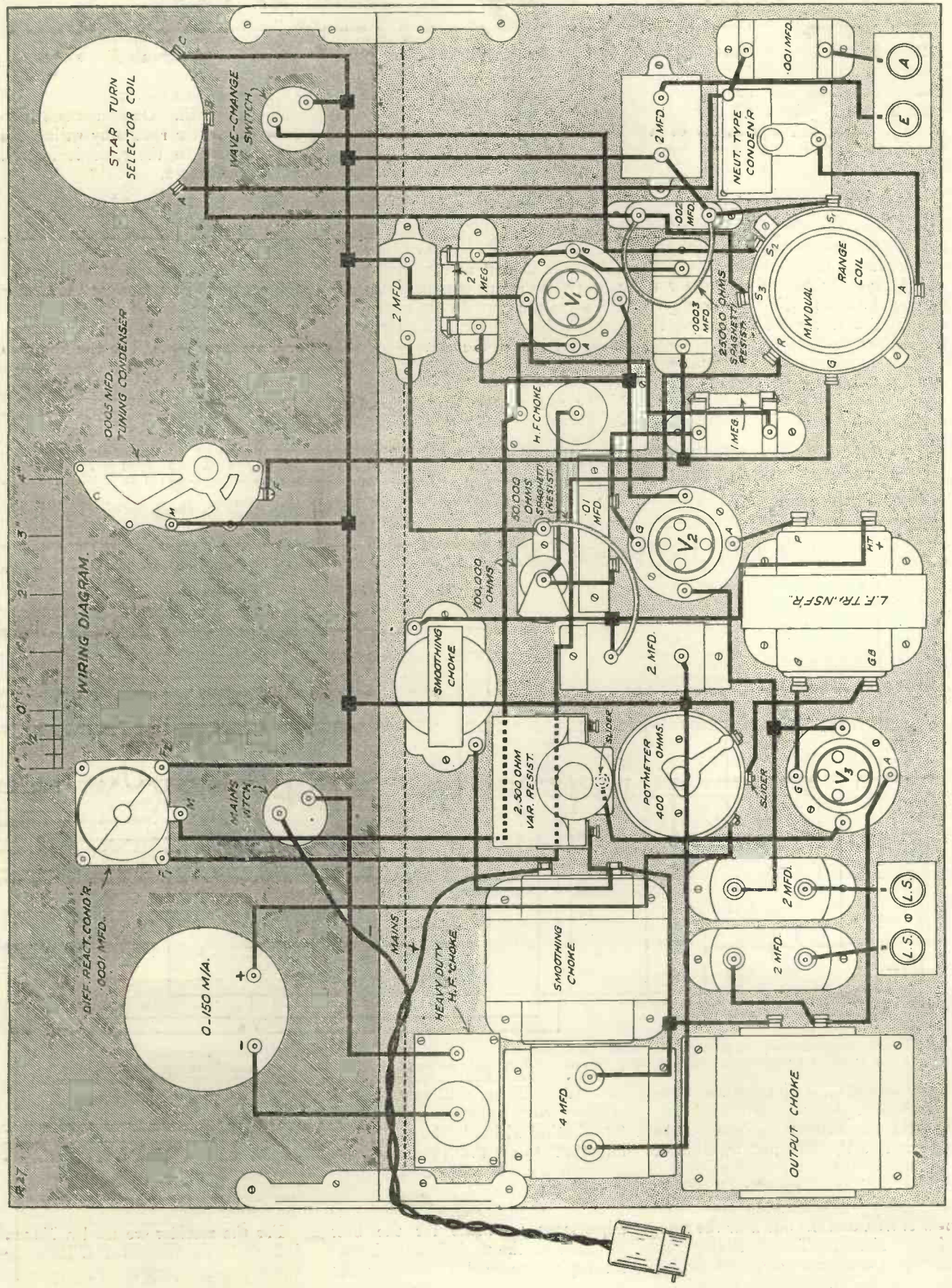
For the rectifier we used a Mazda U.30/250, the Mullard D.U.10 being another example of the correct type.

A REALLY MODERN WAVE-CHANGE MAINS CIRCUIT

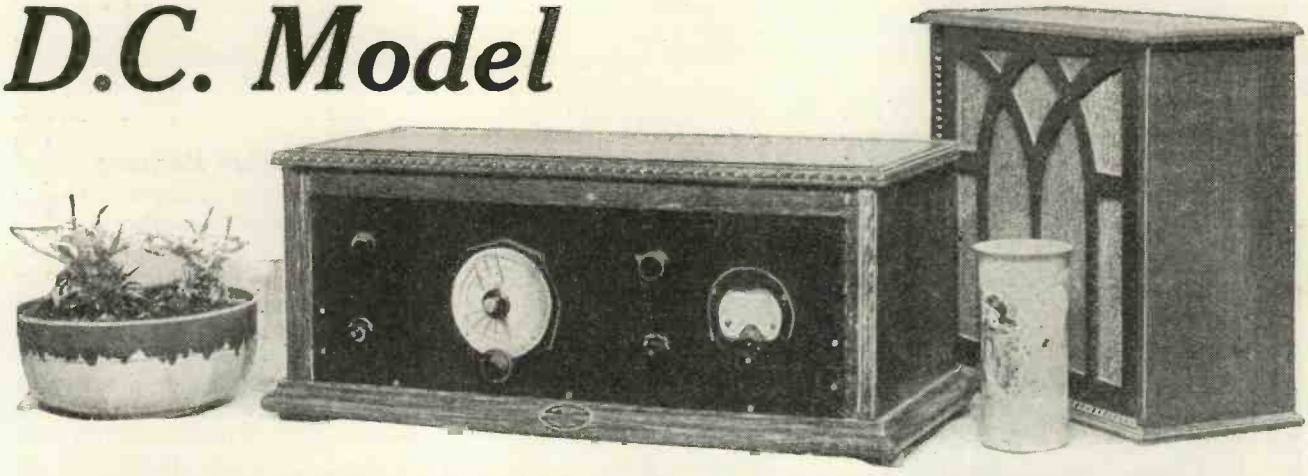


The Selector connections in front of the dual-range coil ensure strength and selectivity, while Interwave coupling gives volume and freedom from interference on long waves. Differential reaction is employed, and the results are exceptionally fine.

THE WIRING FOR DIRECT-CURRENT OPERATION



The "Star-Power" Three D.C. Model



FOR USE WHERE THE MAINS SUPPLY DIRECT CURRENT

Now let us make a start on the model for direct current mains. Just as in the D.C. model of the "Triple" Two, this set is arranged for "series filament" working, i.e. all the valve filaments are connected in series and the mains current through them is adjusted to 100 milliamps. with a variable resistance, checked by means of a meter on the panel.

A limitation as to valve types is imposed by this system, but it is more apparent than real. In practice it is quite simple to comply with, for it just means that you must use three valves of types taking ·1 amp. filament current. It is comparatively easy to find suitable valves of suitable types with this characteristic, remembering that they can be of any filament voltage.

The Best Method

A good deal of experimental work has been done to find the best method of connecting the filaments in series, but in the end we came back to the simple scheme you see in the circuit diagram. Here the mains current from the positive side of the circuit passes first through the power valve filament, then the first L.F., and finally the detector, and so back to negative.

Alternative methods were found to possess advantages of their own, but the one illustrated was found definitely superior in the all-important matter of hum-prevention. It has certain drawbacks, but these we have found it possible to overcome by the adoption of some simple precautions in the design.

Let us look at this series filament

THE PARTS REQUIRED TO MAKE THIS FINE NO-BATTERY RECEIVER

PANEL
21 × 7 in. (Red Seal, or Goltone, Lissen, etc.).

CABINET
Panel space 21 × 7 in., baseboard 10 in. deep (Camco, or Pickett, Osborn, Kay, Lock, etc.).

VARIABLE CONDENSERS
1 ·0005-mfd. (Lotus, or Lissen, J.B., Polar, Ormond, Igranic, Ready Radio, Dubilier, Formo, Burton, etc.).
1 ·0001-mfd., or over (up to ·0002) differential reaction (Lotus, or Ready Radio, J.B., Igranic, Dubilier, Ormond, Formo, Polar, Lissen, Magnum, Wearite, Parex, Burton, etc.).
1 "neut."-type (Bulgin, or Magnum, etc.).

SWITCHES
2 on-off mains-type (one is used for wave-change) (Bulgin, or Igranic).

RESISTANCES
1 25,000-ohm "Spaghetti"-type (Bulgin, or Magnum, Ready Radio, etc.).
1 50,000-ohm "Spaghetti"-type (Magnum, or Ready Radio, Bulgin, etc.).
1 100,000-ohm, and holder (Varley, or Dubilier, Igranic, Mullard, Lissen, etc.).
1 2-meg. grid-leak and holder (Lissen, or Ediswan, Ferranti, Dubilier, Igranic, Mullard, etc.).
1 1-meg. ditto (Lissen, or Dubilier, etc.).
1 400-ohm baseboard-mounting potentiometer to carry about 100 milliamps (Igranic).
1 2,500-ohm "power potentiometer" (used as variable resistance) (Varley).

VALVE HOLDERS
3 ordinary 4-pin (W.B., or Telsen, Lotus, Igranic, Lissen, Clix, Bulgin, Dario, Formo, Magnum, Wearite, Junit, etc.).

FIXED CONDENSERS
1 2-mfd. of ordinary low-voltage "receiving" type (placed against panel) (Dubilier, or Lissen, Ferranti, Igranic, T.C.C., Mullard, Hydra, Filta, etc.).
1 2-mfd. of 250 volts "working" rating or over (placed beside neutralising-type condenser (Igranic, etc.).
3 2-mfd. of 200 volts "working" rating or over (Lissen and T.C.C., or other good makes as above).
1 4-mfd. of 250 volts "working" rating or over (T.C.C., etc.).
1 ·001-mfd. (Dubilier, or Telsen, T.C.C., Igranic, Ediswan, Ferranti, Ready Radio, Watmel, etc.).
1 ·002-mfd. (T.C.C., etc.).
1 ·0003-mfd. (Dubilier, etc.).
1 ·01-mfd. (Lissen, etc.).

CHOKES
1 heavy-duty smoothing type, about 20 henries, resistance about 200 to 250 ohms (Varley, or R.I., etc.).
1 smaller smoothing-type about 20 henries, resistance immaterial (Igranic, or R.I., Wearite, Atlas, Bulgin, etc.).
1 output filter type (Atlas, or Ferranti, Igranic, Lissen, R.I., Wearite, Varley, Magnum, Bulgin, etc.).
1 H.F. (Lewcos, or Telsen, Ready Radio, Keystone, Lotus, Dubilier, Varley, Igranic, R.I., Magnum, Wearite, Watmel, etc.).
1 heavy-duty H.F. (Wearite).

TRANSFORMER
1 L.F. (Lissen, or Telsen, Ferranti, R.I., Igranic, Varley, Mullard, Lewcos, Lotus, etc.).

COILS
1 "Star Turn" Selector (Ready Radio, or Wearite, Magnum, Parex, Goltone, etc.).
1 "M.W." dual-range (R.I., or Goltone, Ready Radio, Wearite, Magnum, Tunewell, Keystone, Parex).

MISCELLANEOUS
2 small panel brackets (Magnum, or Camco, Keystone, etc.).
4 terminals (Belling & Lee, or Igranic, Eelex, Clix, etc.).
2 terminal blocks (Belling & Lee) (or two small strips about 3 × 2 in.).
1 0–150 or 0–200 milliammeter (Ferranti, or Bulgin, Weston, etc.).
1 slow-motion dial (Ormond, or Igranic, Ready Radio, J.B., Lissen, Lotus, Brownie, Formo, etc.).
Glazite, screws, flex, mains plug or adaptor, etc.

circuit a little more closely, for in so doing we shall come across a number of the most important features of the set.

The circuit diagram will be the easiest in which to follow these matters, and we will adopt, for simplicity's sake, the old convention that current flows from the positive to the negative side of the mains circuit.

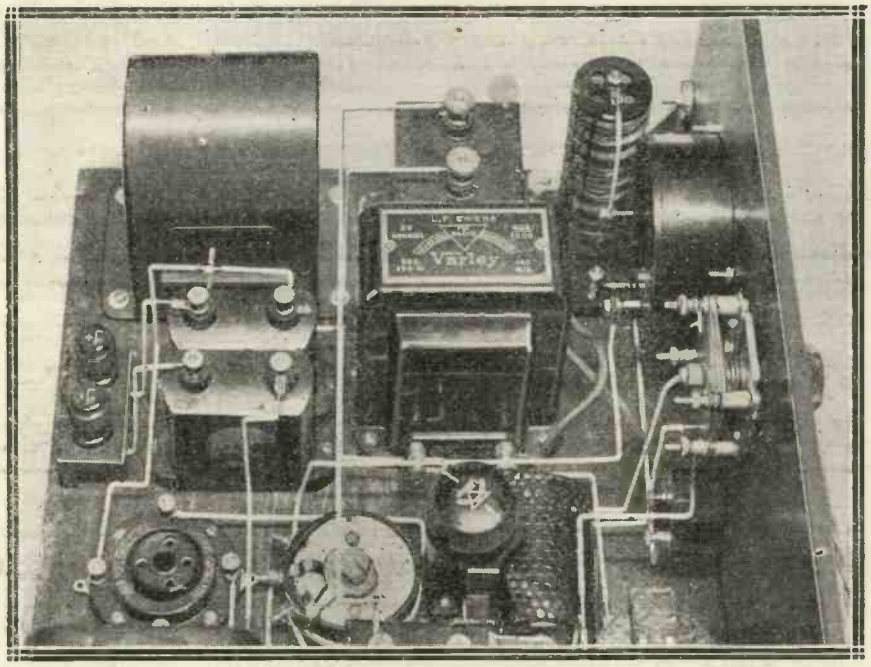
Very well, then; suppose current enters the set from the positive mains lead. It first passes through a heavy-duty L.F. choke, which suppresses the bulk of the "ripple" with the aid of a 4-microfarad condenser shunted across to the earth side of the circuit.

On emerging from the choke the current divides up. The anode currents of the three valves pass along the line, going off to the left, while the 100 milliamps. or so of filament current follow the line going downwards to the 2,500-ohm variable resistance.

This latter component is the one which is adjusted to give the correct filament current to the valves, the actual operation being a very simple one to perform with the aid of the meter on the panel.

After passing through this resistance the current goes through the three valve filaments in succession, then arriving at the "earthed" side of the circuit. From this point it makes its way back to the negative mains lead, passing on its way through a 400-ohm potentiometer, the milliammeter, a heavy-duty H.F. choke, and the on-off switch.

WHERE THE POWER IS DEVELOPED



The potentiometer in the left foreground controls the grid bias on the last valve, and is "set" as explained in the article when the receiver is first put into use, after which it requires no more attention.

A Double Purpose

The functions of these latter parts are rather interesting. The potentiometer serves a double purpose. First, it helps to get rid of some of the excessive mains voltage and ensures that the valves get only the correct 120 to 140 volts H.T. Secondly, part of the voltage drop across it is picked off by means of the slider and used to provide the grid bias for the power valve. (Note the G.B. terminal of the L.F. transformer is wired to the slider.)

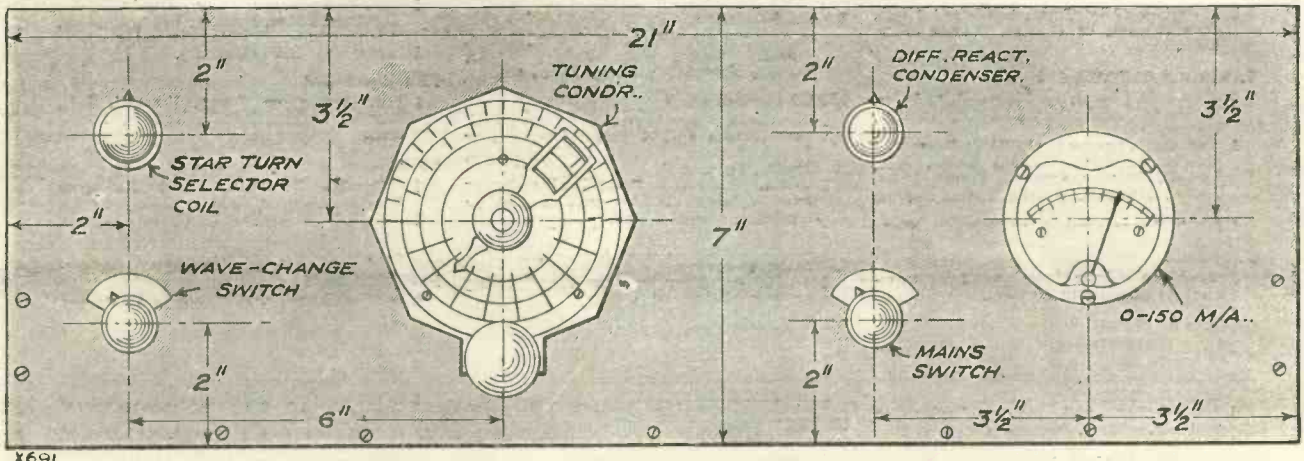
The purpose of the milliammeter you will already have gathered, and that of the on-off switch is obvious. The heavy-duty H.F. choke has been found very valuable in stopping hum and crackle on those mains which carry a considerable semi-H.F. component.

Provided by Filament

This is often present to some extent, and appears to arise from sparking at the commutators of machinery in the neighbourhood and possibly in the main generators themselves.

We have just mentioned the method of getting grid bias for the power valve, so it is perhaps an opportune moment to mention the equivalent provision for the first L.F.

EVERYTHING IS AT YOUR FINGER TIPS



X691

PANEL LAYOUT.

All the parts on the panel are accessibly arranged, and the milliammeter enables you to provide perfect regulation of the filament current, and to keep a constant check on this supply.

Switch On and Then Forget It!

stage. The bias for this valve is obtained in a very simple fashion by utilising the voltage drop across the filament of the detector valve.

Thus if a 2-volt valve is used for the detector, there will be 2 volts grid bias applied to the first L.F. valve, 4 volts from a 4-volt detector, and so on.

It has been found that the average L.F. valve works best in this circuit with 4 volts bias, and therefore a 4-volt detector is recommended; but more will be said about the choice of valve types later on.

Before we go any farther, let us just mention the mains voltages for which the receiver is designed, for this is important. It is expressly intended for mains of voltages from 200 to 240. It will *not* work properly on lower voltages.

Perfectly Safe

On those mentioned it will give excellent results, with very good volume and as near complete absence of hum as can be obtained without squandering a lot of money on ultra-elaborate smoothing filters. On any ordinary mains there should be practically no hum at all, and only on the worst should it be just faintly audible close up to the loud speaker.

Another important point concerns the question of safety. Emphatically, then, it is impossible to get a shock off any of the external leads of this receiver, for proper devices are included in the loud speaker, aerial, and earth circuits to ensure perfect safety.

A Final Precaution

Under some special conditions it is possible to get shocks from the fixing grub screws of some types of tuning condenser, reaction condenser, and selector coil knobs. To be on the safe side, therefore, cover the heads of these screws with sealing wax, Chatterton's compound, or a spot of enamel, if they project.

Continuing our survey of the circuit, we come next to the H.T. feed arrangements. The power valve derives its anode supply straight from the main smoothing circuit, and it has the usual type of "safety" output filter.

The feed for the detector and first L.F. valve is taken through another filter choke (of the light- or medium-duty type) with a 2-mfd. smoothing condenser. In this way these valves are de-coupled from the output stage, and provided with the desirable little bit of extra smoothing. (Any hum here would be amplified up and might become objectionable.)

The detector valve is again de-coupled from the first L.F. by a filter consisting of a 50,000-ohm resistance and another 2-mfd. condenser. This filter also serves to drop the H.T. on the detector to a suitable value.

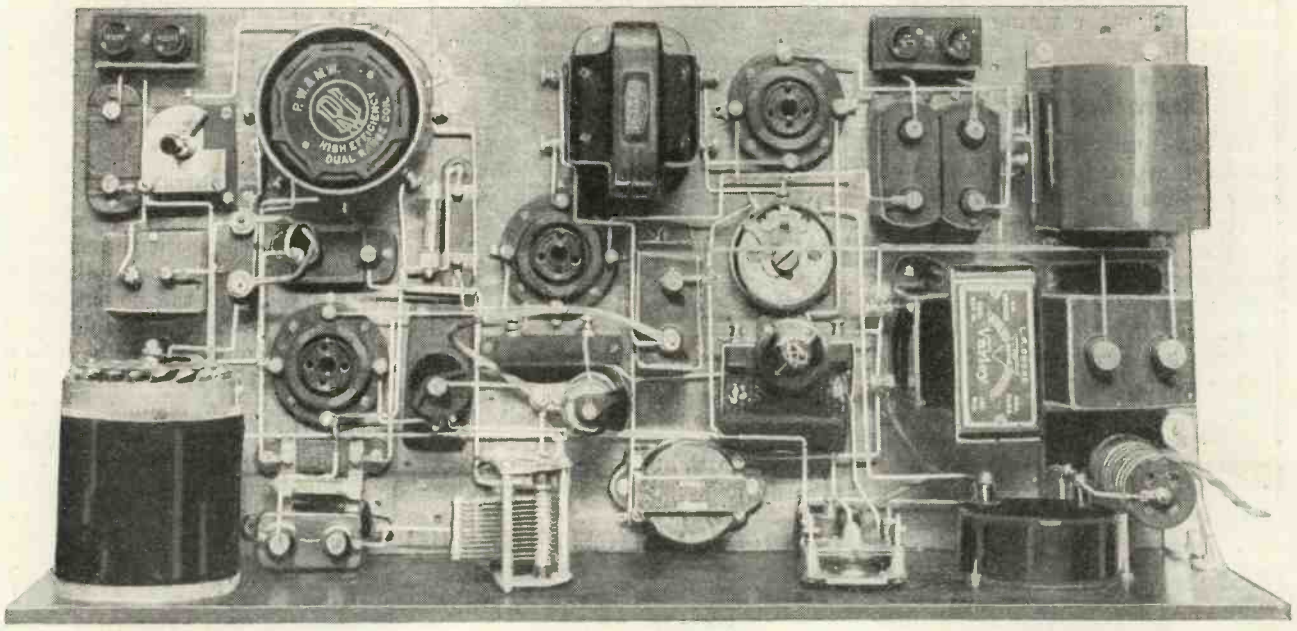
Turning to the receiving circuits proper, you will see they are on the latest "M.W." lines, with "Star Turn" aerial tuning and coupling for high sensitivity and selectivity on the medium waves and "Interwave" aerial coupling to give a similar fine performance on long waves. The "M.W." dual-range coil is used as a matter of course, and so a really high standard of excellence is naturally forthcoming, with really simple and efficient wave-change switching and wonderful results on the most distant foreign stations.

Now we have given you a general idea of the features of the set let us look it over as a constructional job. Much of the information you want will be found in the list of components, and, of course, the wiring diagram really shows you how to make it, but there are just a few other points which might be mentioned with advantage.

Wire the Set Carefully

First, there is the question of wiring. Here we would urge you to make a really sound job, with carefully made joints, for it is of vital importance in a mains set. The material should certainly be of the insulated type, either Glazite or bare tinned wire encased in Systoflex sleeving. Always remember that a short-circuit in a mains receiver may cause a lot of damage.

HOW THE SET APPEARS WHEN THE WIRING IS FINISHED



This illustration gives you an excellent idea of layout and spacing, and will prove of value in the mounting on the baseboard and wiring-up process if compared with the large diagram on a preceding page.

In placing and wiring up the 2,500-ohm resistance (of which one terminal is not used) and the 400-ohm potentiometer, be careful to do it *exactly* as shown upon the wiring diagram. This is most important, in order that our adjusting instructions may apply correctly.

Be careful, too, to wire up your milliammeter with due regard to its positive and negative markings, so that it may read in the right direction.

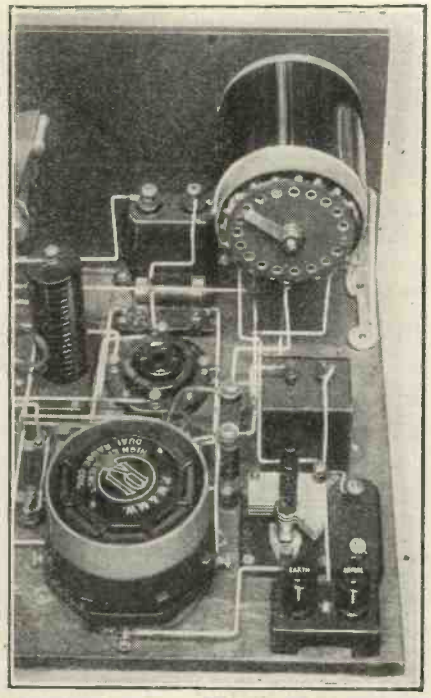
A final hint about the wiring: A good deal of it is more easily done if the Selector coil and tuning condenser are not in place. Therefore, leave the fitting of these two parts until the last and all other wiring has been completed.

Operating Details

We have just had a final look over the diagrams, and it appears that all other points are made quite clear thereon, so now we have just to give you the operating instructions for the finished set.

First you want to know something about suitable valves, in which connection we must remind you that only those types taking ·1 amp. for their filaments may be used. For the detector a 4-volt specimen is advised, examples being the Mullard P.M.4D.X., Marconi and Osram H.L.410, Cossor 410H.F., Six-Sixty SS.410D., etc.

A WARM WELCOME!



Foreigners are assured a warm welcome at this end of the set, where they are picked out by the Selector before being passed to the dual-range coil.

For the first L.F. valve you can use a 2-, 4-, or 6-volt one, so long as its filament consumption is ·1 amp. Examples are the Marconi and Osram L.210 and L.410, Mazda L.210, Mullard P.M.1L.F., etc., the general type required being that usually designated "L." or "L.F."

For the last socket (V_3) a 4- or 6-volt power valve is recommended, and here there is a pretty wide range to choose from. Here are a few: Mullard P.M.6 and P.M.4, Marconi and Osram D.E.P.410 and D.E.P.610, etc.

So much for valves. Now we come to the important matter of preliminary adjustments.

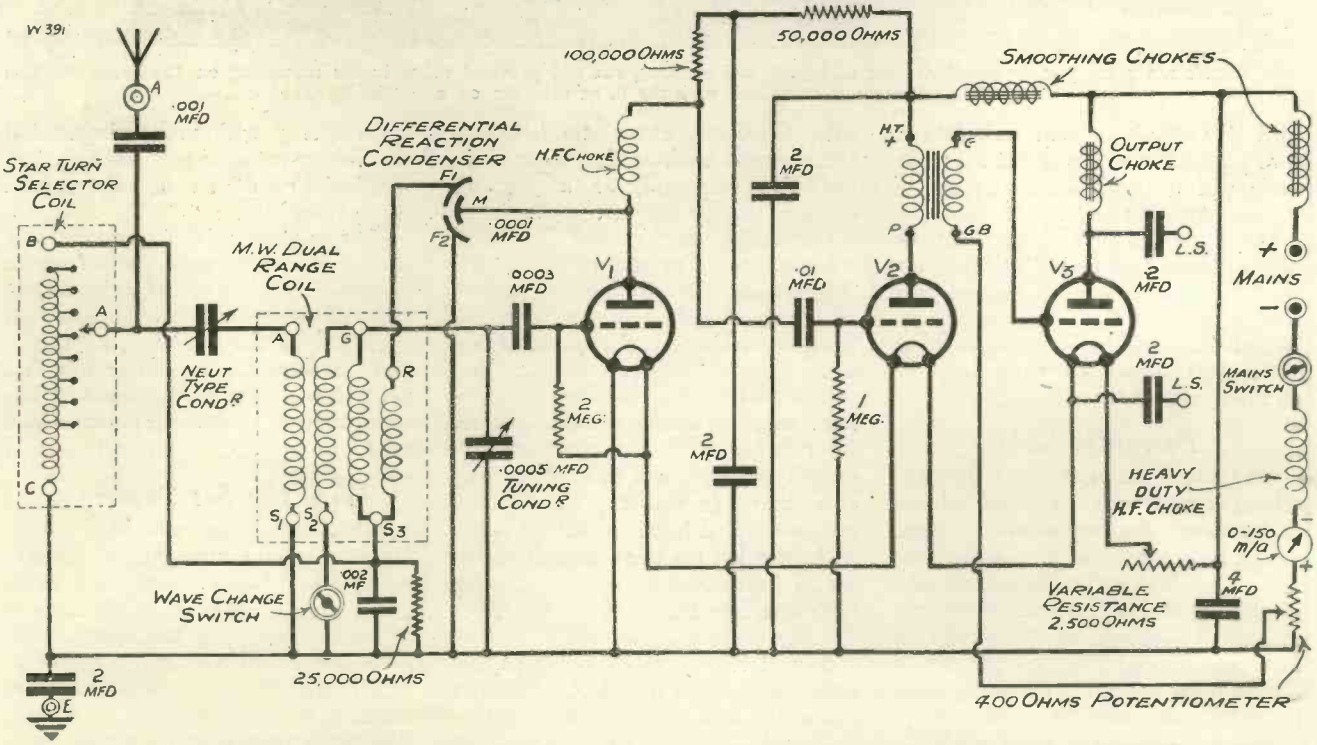
Getting the set going is chiefly a matter of adjusting it to suit the voltage of your mains, and this is how you should set about it. Connect everything up and insert the valves, but do not switch on.

"Most Important"

First see that the knob of the 2,500-ohm resistance is turned as far as it will go in a clockwise direction, and the slider of the potentiometer (400 ohms) in the opposite direction. This is most important, so be careful.

Now switch on and see if the milliammeter gives a reading. If not, reverse the plug or adaptor in the mains point feeding the set. Next turn the knob of the 2,500-ohm

THE CIRCUIT FROM WHICH THE SET IS BUILT



Many of the fine features of this receiver will be apparent at a glance, but note that special precautions have been taken to ensure no shocks from external leads. Earth, aerial, and loud-speaker leads all have fixed condensers in series with them, before they emerge from the set, thus giving complete protection.

The Set that Doesn't "Run Down" nor "Play Up"

resistance until the milliammeter reads 95 m.a. Be careful not to touch anything except the insulated knob while doing this.

Next take a screwdriver with a wooden or otherwise insulated handle and gradually turn the 400-ohm potentiometer slider (the spindle has a slot for the screwdriver) until you see the meter reading increase to about 105 milliamps. (The difference is the anode current of the power valve.)

Now about the use of the controls. We have described the handling of "Star Turn" sets so many times that the reader will probably know how it is done, but some brief notes may be helpful.

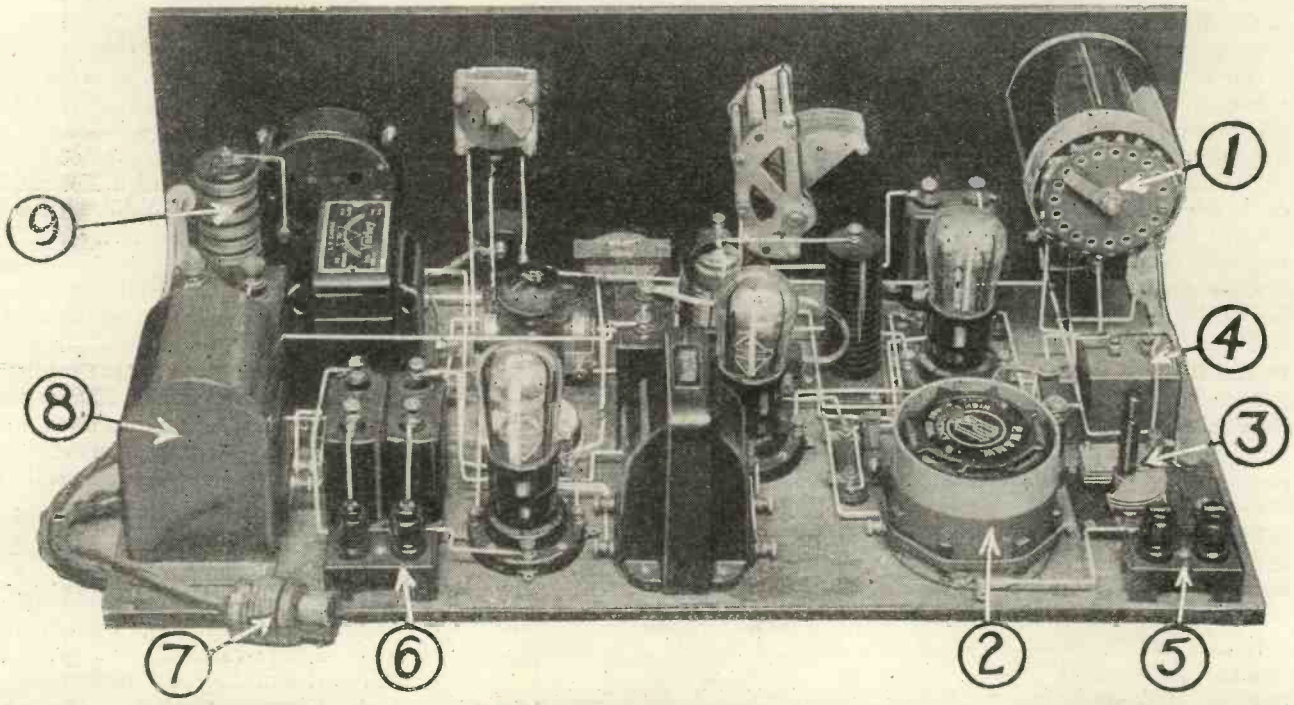
For medium waves, then, see that the neutralising type condenser on the baseboard is set to maximum (reduce it a little later if ultra-selectivity is needed), put the wave-change switch to "on," tune on the variable condenser, and then, having got your station, bring up strength and selectivity by adjusting the Selector coil switch to the last stud. Searching, as you will see, is thus delightfully simple, yet the selectivity obtained is far above that of any ordinary "single circuit" receiver.

For long waves, put wave-change switch to "off," turn Selector knob fully round to the right, and tune on the variable condenser alone. That's all!

A final hint. Tune in your local and adjust volume (by de-tuning a trifle) until it is just as loud as you can get without distortion.

Then have another shot at the 400-ohm potentiometer, turning it back farther still until the milliammeter reads perhaps 102 or 103. Go as far as you can without spoiling quality, and that is the final adjustment. Thereafter all you have to do is work the receiver controls proper and enjoy the fine results you will get.

JUST A FEW OF THE POINTS TO PONDER ON



The Selector and dual-range coils will be recognised at (1) and (2) respectively; (3) being a selectivity condenser that can also be used to control volume. The special earth-lead condenser is shown at (4), and its *working* voltage should not be less than 250; (5) indicates the A, E terminals; (6) those for loud speaker, and (7) is the plug that goes into your house-wiring socket; (8) and (9) respectively denote the output and heavy-duty H.F. choke.

Even if insulated wire is used for the aerial at least one insulator should be employed at each end of the horizontal portion.

* * *

The directional effects of the average broadcast reception aerial are negligible.

* * *

If you use directly-heated A.C. valves of the '8 type, remember that the filament voltage should be maintained very accurately, as small variations even of a fraction of a volt mean a very large percentage variation in the filament voltage.

* * *

Owing to the very high magnification provided by screened-grid valves, and especially those of the A.C. types, it is essential that the circuit should provide for adequate screening between the input and output circuits of this class of valve.

* * *

It should not be assumed that variations in the voltage output of a rectifying valve can be made by dimming the filament, as often the manufacturers specifically state that this should under no circumstances be done.

HINTS FOR THE HANDYMAN

QUESTIONS ANSWERED

An I.F. Howl

B. R. C. (Kensington.)—" I have a detector and two transformer-coupled set which I am trying to work from an H.T. eliminator. Unfortunately I get a low moan which no adjustment of the H.T. will eliminate. Can you suggest a remedy ? "

One of the best schemes is to insert a de-coupling device in series with the detector valve. The procedure is as follows :

The lead which goes from the detector valve H.T. + terminal on the set to the primary of the L.F. transformer should be broken.

A resistance of 25,000 ohms is now inserted between this H.T.+ terminal and the L.F. transformer primary terminal.

A lead is taken from that side of the resistance which is joined to the primary terminal to a 4-mfd. condenser. The other side of the condenser is connected to H.T.—.

This scheme can be employed externally to the set by those who do not wish to interfere with the wiring of the receiver.

In this case the resistance would be inserted between the H.T.+ lead from the H.T. supply and the H.T.+ terminal on the baseboard terminal strip. The condenser would then be connected between the H.T.+ and H.T.— terminals on the set.

Adding a Third Stage

F. S. (Malvern).—" Will you please say whether you think it advisable to add a further H.F. stage to the " Olympia " Five, which, as you know, already possesses two H.F. stages ? Could a separate H.F. unit be used ? "

No, we do not advise this, since it is highly probable that instability would occur, the H.F. side becoming uncontrollable. In order to stabilise the set you would have to cut down the amplification, and you would then be where you were before, except for the fact that the extra tuned circuit might improve selectivity. But how difficult it would be to adjust four tuning controls satisfactorily!

Some form of " ganged " tuning would be essential.

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 can be obtained direct from the MODERN WIRELESS Technical Queries Department, 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.

Threshold Howling

W. E. H. (Torquay) is troubled with threshold howl on his short-wave receiver. The set is of the transformer-coupled type and the threshold effect makes it impossible to take full advantage of the reaction build-up. He asks us if there is any remedy we can suggest.

Try a potentiometer across the L.T. battery, joining the grid-leak return to the moving arm. Vary the potentiometer until you get the smoothest reaction control. In addition, reverse the leads to the primary of the 1st L.F. transformer. If this has no effect, place the second transformer in the first position and vice versa.

A different value grid leak is sometimes beneficial, and we have heard of cases in which the use of a 1- or 2-megohm resistance across the first transformer secondary has improved matters.

Plug-In Coils

L. C. (London) asks us what size " X " coils are usually employed for the medium and long wave-bands.

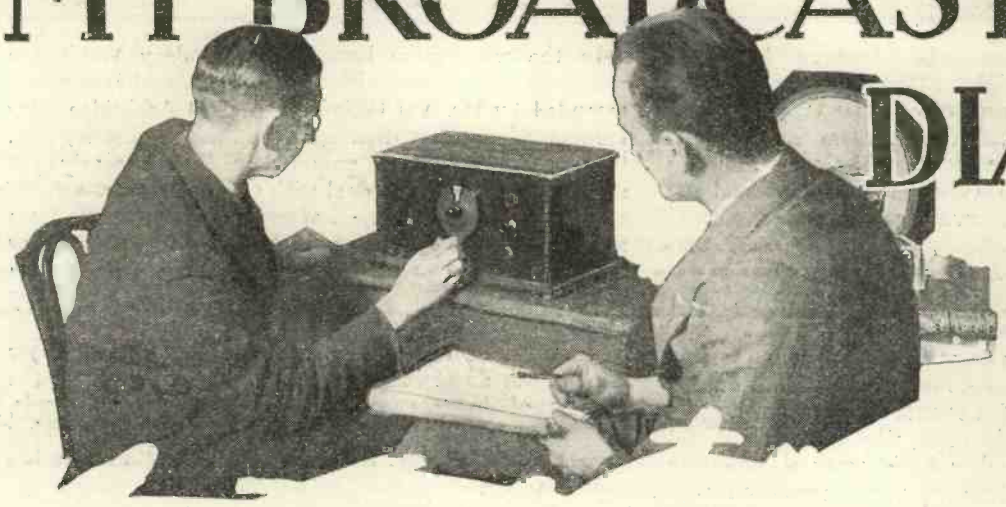
The usual sizes are a No. 60X for the medium waves and a No. 250X for the long waves. A No. 50X will give a little more selectivity on the medium waves, owing to the fewer coupling turns and the greater tuning capacity needed for a given wavelength. For reaction a No. 50 or even a No. 40 is adequate for the medium waves, and a No. 100 or 150 for the long waves. These coil sizes are based on the assumption that a ·0005-mfd. tuning condenser and a ·0001-mfd. reaction condenser are employed.

Regional Station Jamming

M. L. (Richmond).—" I intend to make a two-valve set to get the National and Regional transmissions from Brookmans Park. Do you think that I shall have any difficulty in separating these two stations with such a simple receiver ?"

None whatever, if you insert a condenser of the compression type in series with the aerial lead. The capacity required is ·0002–·001 mfd. Tune in one of the transmissions with the adjusting knob screwed down. Then gradually unscrew it until all signs of interference disappears. Of course, this procedure only holds good for those listeners who are situated at 20 miles or over from a Regional transmitter, and assumes a reasonably selective tuning device. At short ranges a rejector may be necessary.

MY BROADCASTING DIARY



Our own Broadcasting Correspondent records the progress of the British Broadcasting Corporation, and frankly comments on the policies in force at B.B.C. headquarters.

Broadcasting House

DESPITE official reassurance, it is now fairly obvious to all close students of broadcasting that the new "B.B.C. Palace" in Portland Place will be hopelessly inadequate for the purpose for which it was intended.

What a pity the British broadcasting headquarters should be behind the corresponding centres in Germany and the United States! There is this to be said in mitigation: the studios in the new building in Portland Place are definitely better and reveal more vision than is the case with the studios in New York and Berlin.

This is all to the good, but it does not clear the B.B.C. from blame in respect of lack of courage and foresight in other matters. If the real "long view" had been taken, Broadcasting House would have been twice its present size. As things stand, and despite however numerous and angry official "denials," I say quite advisedly that a considerable proportion of B.B.C. officials will have to be lodged outside the new building in Portland Place, if the present standard of efficiency is maintained.

I still have a misgiving about some influence at Savoy Hill, the influence that rather specialises in "façades." But perhaps this is a weakness it is better to tolerate.

The South Coast on Trial

The B.B.C. has not had an entirely smooth career of negotiation with the various coast resorts who happen to possess bands and orchestras good enough to relay. There have been "ructions" with Brighton, Hastings, and Folkestone.

As a lay listener myself, I have never been able to understand why the B.B.C. did not manage somehow to "ring the changes" so that the inevitable advertisement should be spread over the widest possible meritorious field.

It is good news, therefore, that Savoy Hill has decided to send qualified representatives to examine the musical products of Bournemouth, Hastings, Margate, Folkestone, Brighton, Eastbourne, and Torquay.

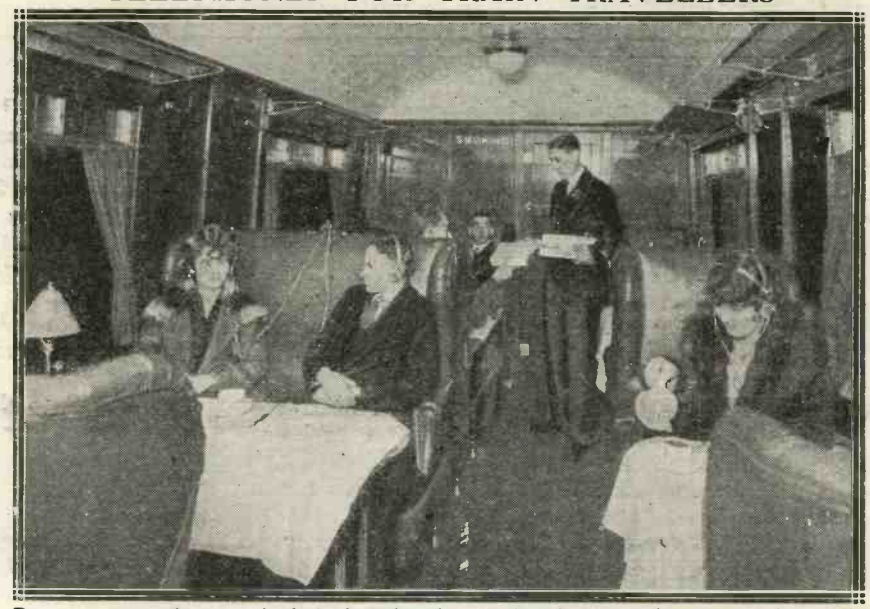
The visits will take place during March and April, and will not be notified to the places concerned; hence the "resultant" should be accurate. If I were a "betting man" I would place Bournemouth to be a "snip winner," because of old-time association. And I think quite rightly. But what will happen to the others? That *is* a pretty problem.

The National Orchestra of Wales

It looks as if the "National Orchestra of Wales," which the B.B.C. has been running and paying for during the last two years, is about to sink into oblivion. Somehow B.B.C. affairs in Wales seem to be in a specially difficult tangle.

In point of fact, the people who have a real grievance about the B.B.C. are those who live in the far West of

TELEPHONES FOR TRAIN TRAVELLERS



Passengers eagerly patronised the broadcasting service that recently was experimentally initiated by the L.N.E.R. on certain of their long-distance trains. Here you see the attendant handing out telephone receivers on loan at 1s. per time.

Latest News Items for the Listener

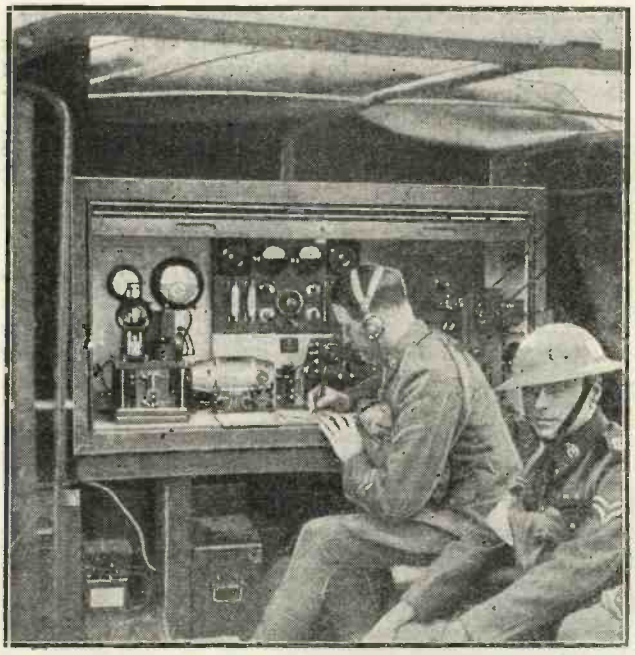
England, and have been hoping that sooner or later they would find themselves inside a "service area."

The truth is that the paucity of ether channels gives them not "an earthly"; similarly, there is no better chance for the perpetuation of "The National Orchestra of Wales," though no doubt there will be the usual run of consultation and negotiation and so on.

British and Foreign Artistes

The B.B.C. deserves credit for taking a new and firm line on behalf of British artistes. This is involved in a new set of rules which lays down *inter alia* that no foreign artistes shall be engaged except for special work with which they are identified and which cannot be done equally well by British artistes. Furthermore, the B.B.C. will not engage foreign artistes unless their work, if unknown to the B.B.C., has the strongest recommendation of a reliable authority abroad.

THE ARMY OF TO-DAY . . .



The latest portable radio outfit used by the Royal Corps of Signallers. It is a 120-watt affair and is installed on a special motor lorry.

B.B.C. Personalities

In the rise and fall of personal affairs at the B.B.C. there have been some singularly consistent records. For instance, Mr. Ralph Judson, the newly appointed "advertisement executive," has moved forward steadily under the sympathetic encouragement of his chief, Major Guy V. Rice, the General Manager of Publications.

I have heard it said that comradeship on service on the Murman Coast had sealed the devoted friendship of Major Rice and Mr. Judson long before they met in the B.B.C.

In the programme branch, Mr. Lindsay Wellington continues to gain ground by sheer merit, and is worthily seconded by Mr. Val Gielgud. Mr. Noel Ashbridge adds more laurels for competent service in the engineering line. Commander Goldsmith goes on in his pleasantly yet strictly efficient way to deal with administration.

And while on the subject of gossip, it reaches me from an unquestionable source that Major Gladstone Murray is being tempted to go either to Washington or Ottawa at a figure which literally dwarfs his present monetary rewards from broadcasting.

I confess to a feeling of curiosity about what Major Murray will do in this connection. The subject was the keenest of those engaged in by three good friends, the editors of London's three great "penny" morning papers, the other day, but it would not be "playing the game" to give even the "consensus."

The Ysaye Opera

Radio Belgique has advised the B.B.C. that the contemplated Ysaye Opera on the Continent is unlikely to be of any interest to the B.B.C.

Hugo Johnston

Hugo Johnston, the "anonymous" preacher and conductor of the daily morning service at Savoy Hill, has recently come very much to the fore in broadcasting. Mr. Johnston certainly brings more calm and comfort to homes in Britain than any other person.

He is a resolutely "sound" fellow; an excellent balance of the "hefty" and the really "sympathetic." If the B.B.C. allows Mr. Johnston to take on one of the several good "livings" coming his way now at Oxford and elsewhere they will regret it. More than that: I would ask my readers to write to Sir John Reith suggesting two things, namely, that Mr. Johnston of St. Martin-in-the-Field should be taken on as permanent Chaplain to the B.B.C. and relieved of all parochial duties, and that Sir John Reith should consider recommending to the Prime Minister that Dean Sheppard be placed high up on the list of those who might be candidates for the "interim" B.B.C. Board.

Lord Clarendon and the B.B.C.

The Earl of Clarendon left on January 9th for South Africa to take up the Vice-Regal appointment. I saw him about a fortnight before his departure, and he told me, perhaps inadvertently, that the B.B.C. had done rather less than nothing to say "Good-bye" or wish him "God-speed" in his new enterprise.

Lord Clarendon is, of course, much too much of a "diplomat" to allow any suggestion of malice or discomfort to intervene in a conversation of this kind; but I thought it a bad break in the customary regulated policy of the B.B.C. to allow one such as Lord Clarendon to go to a high post abroad without even so much as a "good luck" token. The first Chairman of the Corporation simply "faded out" of broadcasting. No doubt this mystery will be cleared up some day in someone's memoirs.

AT YOUR SERVICE

by OUR TRADE COMMISSIONER

Here is some varied news of the trade that should interest all readers, whether or not they are connected with the radio industry. Manufacturers, dealers, home constructors and general readers are invited to send items of interest to be included under this heading.

AN interesting exhibit amongst the many Mullard articles on show at the recent Physical Society and Optical Society Exhibition was an amplifier designed to demonstrate the effect of stray H.F. in amplifiers, and a method of avoiding damage to valves and apparatus due to these "transients."

Interesting Exhibits

A low-frequency amplifier with two large power valves in parallel in the output stage was shown, and all precautions obviating high-frequency oscillation were omitted. The circuit was made to fall into oscillation by applying a transient voltage to the input, and the oscillation was indicated by a small lamp connected to an exploring coil consisting of a single turn of wire and shunted by a small variable condenser.

In addition, this firm showed a comprehensive display of rectifying and modulating valves, and also a very interesting exhibit indicating ten years' progress in high-frequency amplification. At one end of the scale was shown a receiver with two stages of resistance-coupled H.F., and the other a single stage of screened-grid amplification with an efficient tuned circuit, and it was possible to compare the voltage amplification obtainable with the two arrangements.

Keep in Touch

Celestion loud speakers have become household names, and it is always with interest that we look at anything which emanates from this enterprising firm.

So many good things have been brought out by Celestions that it is rather difficult to keep in touch with all the latest developments, but if you want to know what is happening, and care to drop a line to their address at London Road, Kingston-on-Thames, they will be pleased to send you their new coloured folder describing the whole range of speakers, pick-ups, etc., which are now on the market.

The "Tiltatone," the Celestion-Woodruffe pick-up, the new pick-up, and the new dynamic loud speaker, are all described in this brochure, together with the full range of other types of Celestion loud speakers at present on the market.

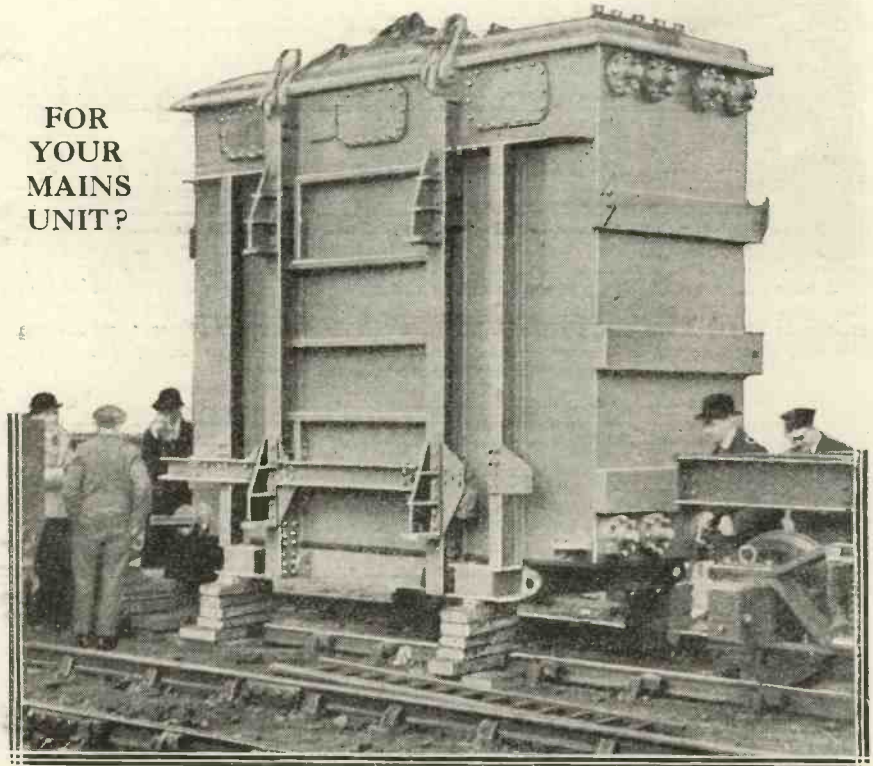
Better H.T.

Users of H.T. batteries, especially of the accumulator type, will be interested in the new Tungstone accumulator, which has many special features, one of which is that the internal resistance of the battery has been reduced to a negligible proportion.

The new Tungstone battery has plates only about 2 in. square, but has an actual ampere-hour capacity of three.

Each 2-volt unit is insulated from the next by a rubber band round the container, and it rests on a rubber band in the battery box, being thoroughly insulated and proof against vibration. No wood separators are

FOR YOUR MAINS UNIT?



A giant 32-ton transformer en route from Walthamstow to Lincoln for the Central Electricity Board.

Useful Catalogues and Components

employed, and it is claimed that negligible voltage drop over long periods occurs, while the battery will not give rise to noises in the 'phones or loud speaker.

Finally, and this perhaps is one of the most important features, it is claimed that the battery will not sulphate.

A Good Text-Book

I am often asked by readers for the name of a good text-book on radio which will enable them to get a grasp of the principles of broadcasting without going too deeply into the mathematical aspects of the subject.

The new "Bangay" should suit all those looking for a text-book of this description. "The Elementary Principles of Wireless Telephony and Telegraphy," by R. D. Bangay, third edition, published by Iliffe & Sons, Ltd. (price 10s. 6d.), contains over 250 pages closely packed with diagrams and illustrations, and it begins right at the very beginning, assuming that only the most elementary knowledge of electricity and mathematics is possessed by the reader.

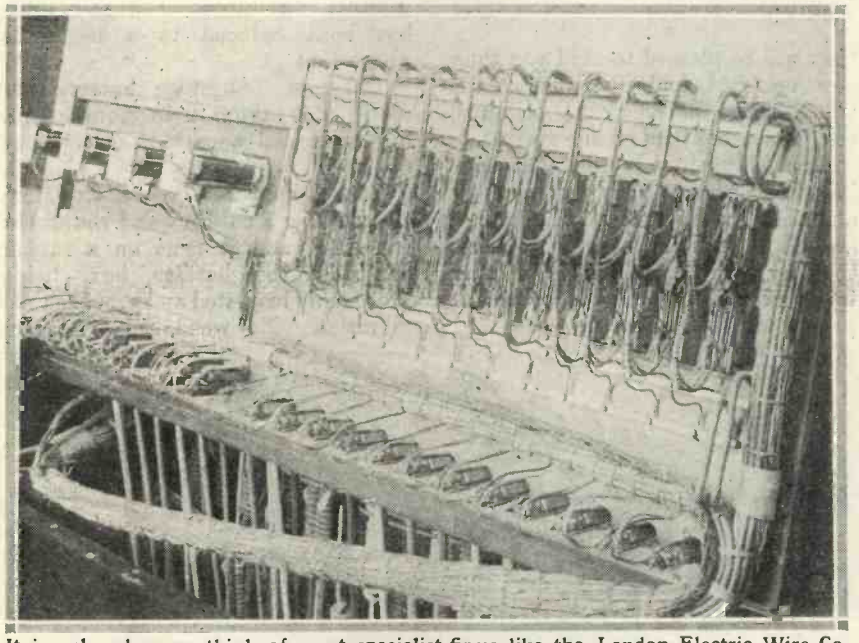
It should form a very valuable book for a great number of readers in the construction of their sets, for there is nothing like knowing *why* when you are doing anything connected with a radio circuit.

Benjamin Switches

All types of the famous Benjamin switches, including the double-pole rotary switch, are fully described, and circuits in which these switches can be used are provided in the new illustrated 1931 catalogue just issued by Messrs. Benjamin Electric, Ltd., of Tottenham.

Every switch is described in detail, with instructions for mounting, and in addition all the other numerous Benjamin lines are described very fully. The booklet can be had on request from the makers, the address being Tariff Road, Tottenham, London, N.17.

"A VIEW OF THE BACK-OF-PANEL WIRING"



It is only when we think of great specialist firms like the London Electric Wire Co., that we begin to realise how much wire must be used in the electrical and radio trades. Hundreds of miles are used by the B.B.C. (not counting their land lines); and though this may be a staggering statement, this photo of the back of one of the Savoy Hill control boards will show where much of it goes.

Varley Components

Messrs. Oliver-Pell Control, the manufacturers of Varley components, are using a very interesting method of catalogue publication. The Varley catalogue is divided into sections, and you can get *all* the sections, or any that you require, according to the various types of components of which you want details.

Section A, for instance, contains all the details of receivers and radio-gramophones, pedestal loud speakers, gramophone pick-ups, tone-arms, and volume controls. Sections B and C are devoted to the H.F. choke, coils, potentiometers, resistances, R.C. couplers, and anti-motor-boating devices.

Section D deals with the L.F. chokes and L.F. transformers of various types, while the final section, E, is devoted to mains transformers and details of mains chokes, resistances, potentiometers, etc.

A New Unit

Have you seen the new L.F. coupling unit designed to give high-quality coupling between L.F. stages?

The values of the anode resistance and coupling condenser incorporated have been carefully selected so as to offer, in conjunction with the auto-transformer incorporated, a good balance over the audio-frequency range. This unit and a number of other new components are described in the Wearite illustrated list, which can be obtained from the makers, Messrs Wright & Weaire, Ltd., 740, High Road, Tottenham, London, N.17.

The "Tub" Condenser

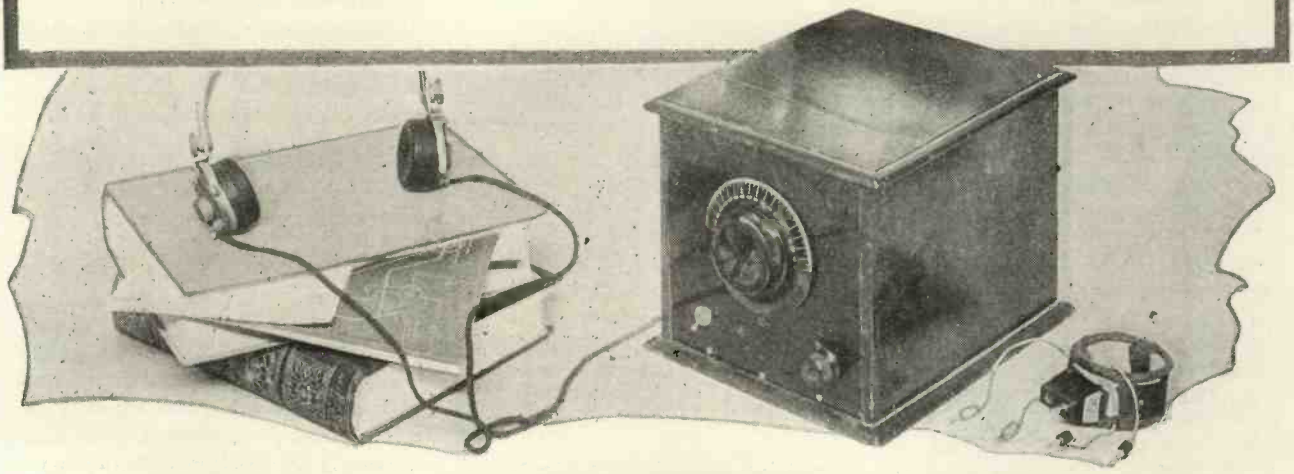
In the modern radio component section of "M.W." this month there is an illustration of the new Polar "Tub" condenser, a triple-ganged, fully-screened condenser carefully designed to meet the needs of the modern multi-stage triple-control set. The separate condensers are mounted on a common spindle, and are accurately matched within 1 m/mfd. up to ·0001, and over that figure to within 1 per cent.

Trimmers are provided, and full details can be obtained in the 24-page catalogue which will be sent free on request. The address is: Wingrove & Rogers, Ltd., 188–9, Strand, London, W.C.2.

Six-Sixty Equipment

Another interesting booklet is that issued by the Six-Sixty Radio Co., Ltd., and describes the Six-Sixty A.C. all-mains equipment. This is a complete unit containing a power section for H.T., L.T., and G.B., and is provided with adaptors and Six-Sixty A.C. valves to suit your own circuit. It can be obtained complete for about £8 5s. 0d., or the power unit only is obtainable for about six guineas.

THE "M.W." "TRI-COIL" ONE



It uses only one ordinary plug-in coil for each wave-band, in conjunction with easy-to-wind home-made coils. This little set is one of the most inexpensive and most effective one-valvers ever described.

Designed and Described by

The "M.W." Research and Construction Dept.

EVERY MODERN WIRELESS set is designed specifically to meet the needs of some particular group of readers, and we always like to explain in the course of our description exactly what we had in mind in producing each one.

We make rather a point of this, because we find that in this way we make it easier for our readers to pick out exactly the set they want. It becomes just a matter of looking out for a reference to the needs of the class of constructor to which any particular reader knows he belongs, and there he finds the right set for his purpose.

The Correct Type

We have referred to this matter before, but we believe its importance warrants a reminder now and again. Experience has shown us that one of the most vital factors in ensuring satisfactory service from a receiver lies in the choice of the correct type for one's requirements, and that is why we always try to explain very clearly just what sort of service each of our designs is intended to give.

In the receiver we are about to describe in this article our aim has been to please those readers who want a sensitive small set for long-distance headphone work, low cost and compactness being among the features which we assumed that they desired.

More specifically, we have sought to comply with the demands of those who call for a set in which they can really *make* some part or parts.

In other words, we had in mind those constructors who like the work for its own sake, and are not satisfied to string together a collection of bought components. Many of us find that sort of assembly rather uninteresting in the case of a small set, and prefer to turn out something with special features of its own which cannot be achieved with the aid of bought parts alone.

Attractive Characteristics

To them this little receiver should appeal strongly, for it has some very attractive characteristics of a kind rarely encountered in designs for so simple a type. They will find that its construction and adjustment to their requirements proves a most interesting piece of work, more akin to the development of a new receiver under commercial conditions than anything they are likely to have tackled before.

Even the member of the "M.W." constructional staff who built the original model succumbed to the interest of the job, and wanted to spend far more time over it than his schedule really permitted! That it aroused his keen interest is something of a testimonial when it is known that his previous job had been the making of a highly developed high-power instrument with two screened-grid H.F. stages!

THIS IS ALL YOU WANT

PANEL
7 in. × 7 in. (Goltone, or Lissen, Red Seal, etc.).

CABINET
7 in. × 7 in. panel space, baseboard 7 in. deep (Pickett, or Camco, Lock, Kay, Osborn, etc.).

VARIABLE CONDENSERS
·0005 mfd., plain or slow-motion (J.B., or Lissen, Lotus, Dubilier, Ormond, Polar, Igranic, Ready Radio, Burton, Formo, etc.).
·0001-, ·00013-, or ·00015-mfd. differential reaction condenser (Lotus, or Ready Radio, Dubilier, Lissen, Polar, Ormond, Igranic, J.B., etc.).

FIXED CONDENSERS
·0003 mfd. (Lissen, or Telsen, Ediswan, Dubilier, Ferranti, T.C.C., Mullard, Watmel, Ready Radio, Goltone, Magnum, Formo, Igranic, etc.).
·001 mfd. (Telsen, etc. See above).

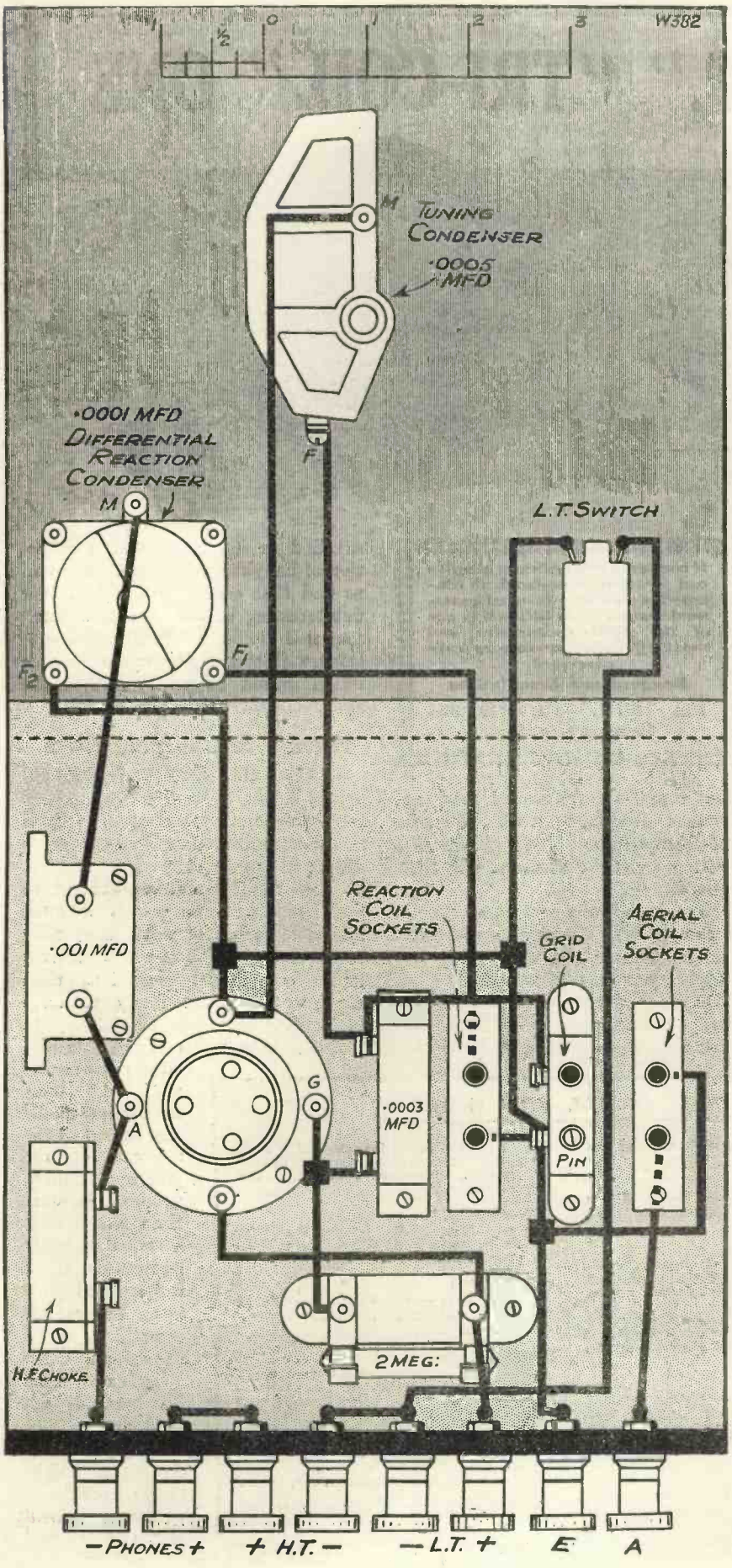
GRID LEAK
2 meg. with holder (Lissen, or Igranic, Dubilier, Ferranti, Ediswan, Mullard, etc.).

H.F. CHOKE
(Telsen, or Lissen, Lewcos, R.I., Ready Radio, Varley, Lotus, Igranic, Dubilier, Magnum, Keystone, Watmel Parex, Wearite, etc.).

VALVE HOLDER
Sprung type (W.B. or Igranic, Telsen, Lotus, Dario, Junit, Clix, Bulgin, Benjamin, Wearite, Formo, Magnum, etc.).

COIL HOLDER
Baseboard mounting (Lotus, or Bulgin, Igranic, Red Diamond, Wearite, Keystone, Magnum, etc.).

MISCELLANEOUS
1 slow-motion dial (optional if condenser of plain type) (Igranic, or Ready Radio Lissen, Formo, J.B., Lotus, Ormond, etc.).
1 on-off switch (Igranic, or Goltone, Keystone, Lotus, Ready Radio, Benjamin, Bulgin, Magnum, Wearite, Junit, Red Diamond, Ormond, etc.).
1 terminal strip, 7 in. × 2 in.
8 terminals (Eelex, or Belling & Lee, Igranic, Clix, etc.).
4 small sockets (Eelex, or Clix, etc.).
Screws, wire, flex, plugs, etc.



Wherein, then, is the interest in the little receiver we are discussing? Just in the fact that the two most important factors in a simple set are made adjustable by the constructor to suit his exact conditions. In "hotting them up" to the highest possible pitch of perfection he will have quite a fascinating time.

These two important, and in this set adjustable, factors are the two couplings which are the key to success in any simple receiver, i.e. the aerial and reaction couplings.

Strength and Selectivity

The first, of course, decides the exact balance between signal strength and selectivity with any given aerial, and it is so important that some provision for varying it is often made in even quite large receivers. The customary method is a variable or adjustable series aerial condenser, and this device gives quite satisfactory results for general purposes.

The simplest method of all, however, is just to vary the number of turns in use in the aerial coupling, or primary winding. Alternative taps are sometimes provided on this winding, but unless they are very numerous they scarcely give sufficiently close adjustment, and so the series condenser type of control is more commonly employed where a really "close fit" is required.

To get just the right conditions without the aid of the series condenser really demands the adjustment of the aerial winding turn by turn if particular circumstances are to be met exactly.

We are thinking, by the by, of those localities where it is necessary to get the best possible selectivity without serious loss of strength. In less difficult positions quite a rough adjustment is all that is needed, and perfectly standard couplings, such as those in the various dual-range coil units, will serve.

"Turn by Turn"

Most of us, however, need all the selectivity we can get, and so the series aerial condenser is seen in a large proportion of "M.W." designs. Now what about the "turn by turn" adjustment of the coupling winding which we mentioned just a few lines back? It is not as a rule a permissible expedient, because of the use of standard coils, and it is always a little troublesome.

In the present case neither objection applies. We are not going to use a standard coil unit, and we are assuming that anyone who builds the set will be of the type who not merely

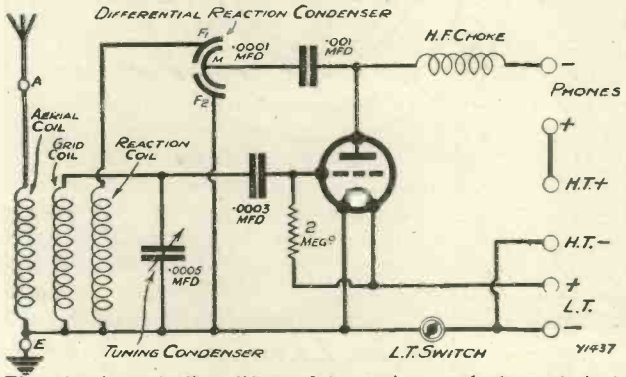
Brings in Those Long-Wavers Really Strongly

doesn't mind a little trouble, but actually likes it if he gets something good at the finish to reward him.

In building our model, therefore, we so arranged matters that while a standard plug-in coil is used for the tuned secondary circuit, a specially wound primary is employed. This little winding is very simply made, and as simply adjusted to match up exactly to the needs of the particular locality in which the set will be used.

By so doing you can get the most perfect balance obtainable between selectivity, and so be sure of very excellent results indeed. The actual process does not take very long, and you will find it quite a fascinating little bit of experimental work which is likely to teach you a lot about the exact effect of variations in aerial coupling.

PERFECTLY STRAIGHTFORWARD



The circuit embodies differential reaction, and, although it is up-to-the-minute in every way, there are no complications.

The Last Ounce

The importance of a nicely proportioned reaction winding is not often fully appreciated by the modern constructor. He is so accustomed to the excellent behaviour of present-day dual-range coil units that he does not realise the amount of hard work put into the job by the designer in striking a balance to suit as perfectly as possible the reaction requirements of the average detector valve.

Most plug-in coil sets, on the other hand, could be improved, if only slightly, by a closer adjustment of the size of the reaction winding than is possible by trying different standard sizes. This is probably a rather minor matter, but it will appeal to the constructor who wants the last ounce out of his receiver.

It was of him that we thought chiefly in producing this little design, so we adopted a similar adjustable scheme for the reaction winding to that employed for the primary. Again a little trouble and time will be required, but the adjustment is quite straightforward and ensures the best possible results from the circuit and the particular valve employed.

Now we have given you a general idea of the special features of the receiver, so let us next explain more in detail how they are arranged.

Our mention of a plug-in coil and a glance at the photos will probably have given you a clue. Briefly, the scheme is this: The plug-in coil forms the tuned secondary circuit, and it is fitted in just the ordinary baseboard-mounting holder. To one side of it is bound or tied a small "hank" winding to form the aerial or primary coil, and to the other side another shank for reaction.

To each end of these hank windings a short piece (about 3 inches) of flex is soldered, its other end bearing a plug (the battery type will do). Thus when the "unit" is finished you have a plug-in coil with a hank winding bound to each side, and four dangling leads ending up in four plugs, these being the connections of the hank coils.

The plug-in coil fits into the ordinary holder on the baseboard, while the plugs go into four little sockets in two small strips of ebonite. One of these strips is fixed on either side of the coil holder, and they should be raised up a little with small blocks of wood or other supports to allow space for the shanks of the sockets beneath.

Winding the Coils

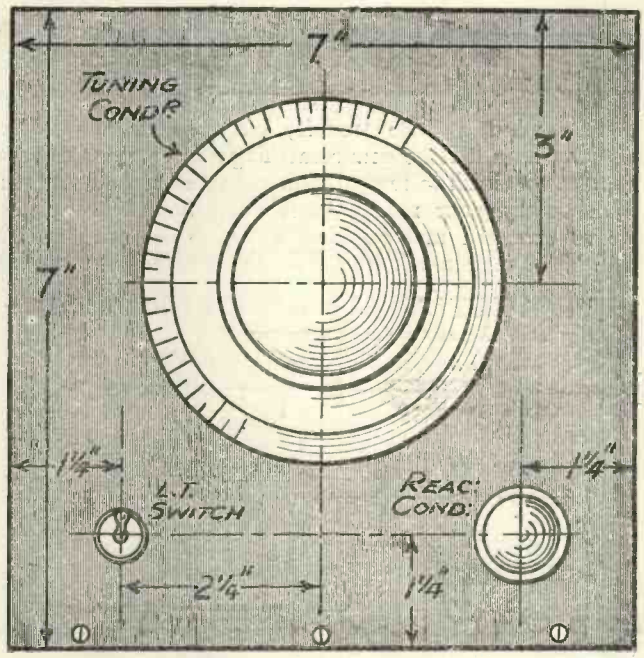
Now some practical details. The hank coils should be of some 2½ inches diameter, and can be wound quite roughly round the fingers, afterwards being squeezed to a more or less circular shape. To attach them to the plug-in coil a sixpenny roll of adhesive surgical tape is convenient as a binding material.

For the plug-in coil you want a No. 60 for the medium-wave "unit" and a No. 250 for long waves. (The

COIL UNITS YOU MAKE YOURSELF

Here you see the two coil units—one for each wave-band. The plugs are inserted in the sockets provided on the baseboard, each side of the coil holder.

A Virile One-Valver



PANEL LAYOUT Y1435

Only the one tuning dial, a reaction control, and an on-off switch figure on the front panel.

open-centre type of coil like the Lissen is the most convenient.)

For the bank coils No. 24 D.C.C. wire is suitable for the medium and No. 26 D.C.C. for long waves, although any gauge from 26 to 28 will do at a pinch for either.

The direction of the windings does not matter. The primary is immaterial in any case, and if the reaction happens to come wrong, all you have to do is to reverse its plugs in their sockets (those to the left of the coil holder as you look at the wiring diagram).

Final Adjustments

Now the turn numbers. Aerial, 15 for medium and 80 for long waves; reaction, 30 for medium and 75 for long.

At first only attach the banks temporarily, don't trouble to solder on the bits of flex. Put a medium-wave unit in the set and see that it will oscillate (reverse reaction as above if it won't). Now pull turns off the reaction, two at a time, until the set only just oscillates with the condenser nearly right in (to the right) at the top of the tuning range, with 60 volts H.T.

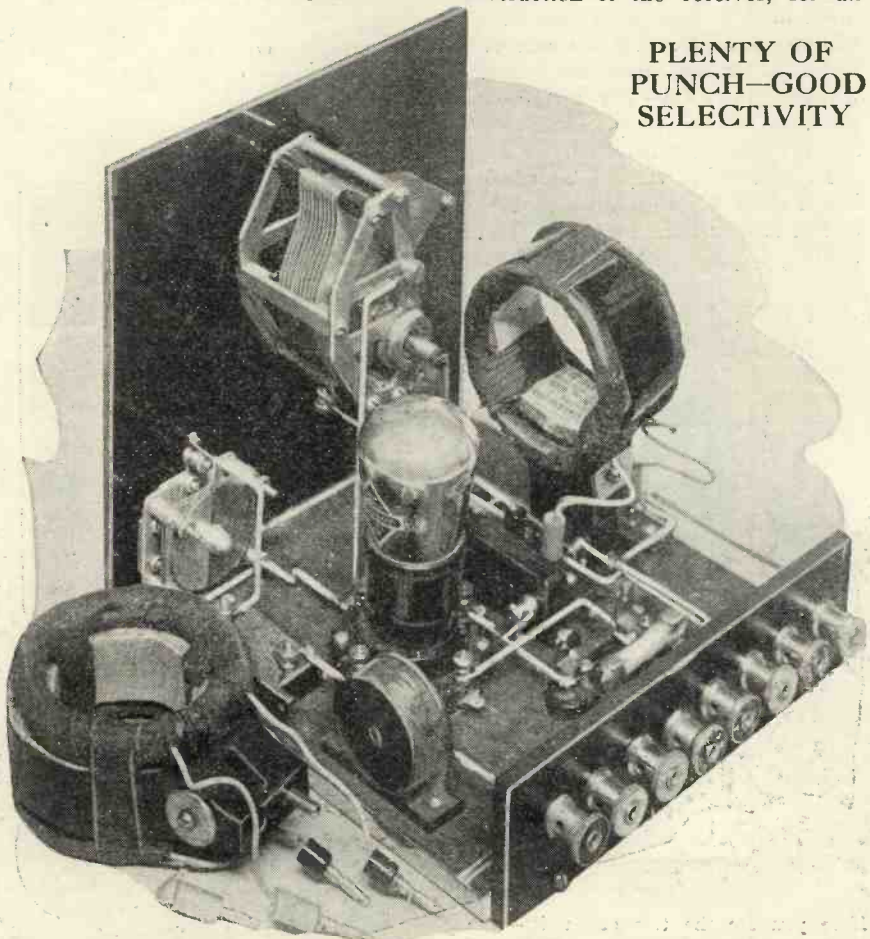
That done, turn to the primary and remove one turn at a time until you just, and only just, get the selectivity you need. Pretty simple, isn't it?

Finish off the medium-wave unit, and turn to the long-wave one. Repeat the process here, but you can now remove five turns at a time.

This is really all there is in the construction of the receiver, for all the rest is quite clear in the photos and diagrams. To conclude, therefore, we will just give you the remaining working data for the finished set.

The valve will normally be of the H.F. type, but those classed as "special detectors" are very good in this type of circuit.

The H.T. requirements are very simple: Apply 60 volts, and with these carefully adjusted reaction windings you will get beautifully smooth control.



PLENTY OF PUNCH—GOOD SELECTIVITY

The "Tri-Coil" One is a particularly powerful little outfit, but it is not hyper-selective. On the other hand, it has adequate selectivity for all situations barring the real "swamp areas."

DO YOU KNOW THAT—

The modern broadcast station transmits a range of musical frequencies from about 30 cycles per second to 8,000 cycles per second?

* * *

With the average broadcast receiver a large tuning condenser and small coil increase selectivity, while a large coil and a smaller condenser give greater sensitivity?

* * *

Metal Screening

It is not good practice to run the active portion of the aerial wire among the branches of a tree, so the insulator should come at a good distance from the trunk.

MODERN RADIO —COMPONENTS AND ACCESSORIES

A REVIEW of present-day wireless technique prepared with the two objects of interesting and assisting "M.W." readers.

The section gives many fascinating comparisons between modern radio products and those in common use five or so years ago, and enables you to obtain a clear idea of the astounding progress that has been made.

It is shown that the cumulative effects of a series of steady improvements, which in themselves may have been of minor importance, have resulted in cases in almost revolutionary changes of design.

On the other hand, constructors will find in this special section a great deal of invaluable information concerning current practice, which will help them to choose successfully the best available components and accessories.

A large, number of photographs illustrate the radio products of the various periods, and we trust that readers will find these, too, both interesting and informative.

We do not claim that this section constitutes a completely comprehensive review of the subject, for it would take several whole issues of "M.W." to give that, but we do consider that we have achieved our objective—that of providing a readable, useful summary of the development of the more widely used radio devices.

THE Great War has been blamed for many things—and quite rightly so—but it should never be forgotten that it is probable that this generation would not have had broadcasting had the Great War never happened.

Indeed, it provided a stimulus to many other things as well as radio. It was, in fact, four years of intensive scientific development. Radio was (and still is) one of the most useful arms of war, and therefore money was burned, and all available manpower concentrated on it so that it should become more effective.

Became Vital

Before the war considerable progress in wireless had been made, but 1914 saw it leap to the front as a national need. In the times of peace its importance as a means of communication between ships at sea and between ships and land was great, and commerce welcomed it as a new means of rapid communication over sea and continent. Nevertheless, apart from its maritime applications, wireless was, after all, merely an auxiliary to the cable.

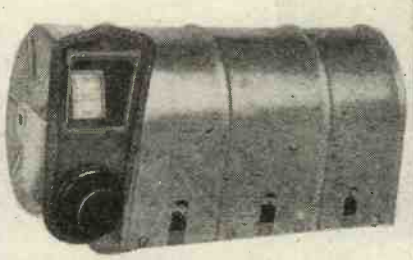
War certainly did give wireless a mighty fillip. It would take many pages of "M.W." to enumerate its vital uses during those years. But here are a few examples. Some countries found themselves cut off from outlying parts of their own territories, or from their allies in every way, with the exception of radio links.

Four Years' Progress

Radio completely revolutionised army "Lines of Communication," and enabled desert campaigns to be speeded up and land and sea forces to be co-ordinated in miraculous manners. It created a liaison between artillery and aircraft that changed the whole trend of the war on many fronts.

Remembering that we started the war with radio in a half-baked stage of development, it is easy to see the reason for the world-wide

FIVE YEARS OF CONDENSER PROGRESS



Left and right you see two variable condensers dating back about five years. With their ebonite end plates and straight-line-capacity vanes they look very crude as compared with the Polar "Tub," a very recent shielded gang assembly due to Messrs. Wingrove and Rogers.

Modern Components and Accessories—continued

and intense research that was devoted to it.

We commenced the war with spark transmitters and crystal receivers, and ended it with radio telephony good enough for a broadcasting service. That is progress!

It must not be thought that the valve was a war invention—it wasn't; but the pre-war valve was a very shaky affair and hardly suited to the rigours of naval and military service.

There was a fair amount of amateur radio activity before 1914, although one had to be a keen enthusiast before one could find wireless a satisfactory hobby. You see, there was no telephony in the ether to be picked up. Also, one was restricted to the crystal detector, and that did not enable much in the way of sensitivity to be achieved.

The Early Experimenter

The Morse from ships and land stations was not a quarter as profuse as it is to-day. The radio enthusiast had to learn Morse, or all he could do was to pick up and listen to meaningless dots. That is, excepting those Eiffel Tower time signals that came along every day rather late in the evening. These signals were easily recognised and formed a central attraction. Their reception constituted the height of ambition for many radio amateurs.

Transmitting licences were few and far between, and the lucky ones who had them used little else but large spark coils with which to communicate with their near-at-hand friends.

The average amateur receiver comprised a huge coil of wire with a clip or slide adjustment, an ordinary telephone earpiece, and a silicon and steel detector.

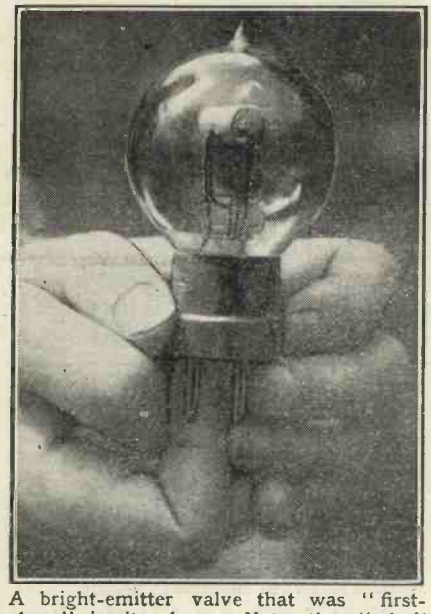
H.F. and L.F. Amplification

Valves, with their accompanying H.F. and L.F. amplification processes and reaction, first came into prominence during the war.

But let us leave those early days and come forward nearer to the present. Many people find history dull and uninteresting, and to these we must apologise. But it is difficult to appraise and criticise modern radio without drawing on the past for comparisons. The future lies in the hands of prophets, and we do not wish to transgress on their ground!

The 51R, a compact Blue Spot loud speaker in which an excellent example of up-to-date electro-magnetic unit design is to be found.

A REAL "OLD-TIMER"



A bright-emitter valve that was "first-class" in its day. Note the "pip" on the bulb.

A group of modern valves illustrated with Six-Sixty mains conversion equipment.

VALVES OF TO-DAY

However, we cannot help pointing out that if we made a habit of looking back a little more we should be able to add to our appreciation of the things we do and the things we use to-day. But time seems to have speeded up so much, and the years whip by so fast, that there is little time for meditation of the happenings of yesterday.

No doubt radio has much to answer for in this respect. If fills up many of those odd moments of leisure!

But let us make this the occasion of just one tiny look back over a space of five or six years; 1924 and 1925 do not lie in the dusty pages of history—they are years that belong to us in a very vital manner, though "*tempus fugits*" so rapidly that either year might in many ways just as easily belong to the last century!

No More Groping

However, turning back the leaves four or five years we cannot fail to note the increasing pace of radio progress. In 1924 anyone could have been forgiven for saying dogmatically: "Well, we have made such strides in radio during and since the war that a slowing-up is surely inevitable; we cannot possibly continue to improve and improve in this way—a saturation point must be at hand."

Such a belief is held by lots of people to-day, but another four or five years will assuredly prove its falseness.

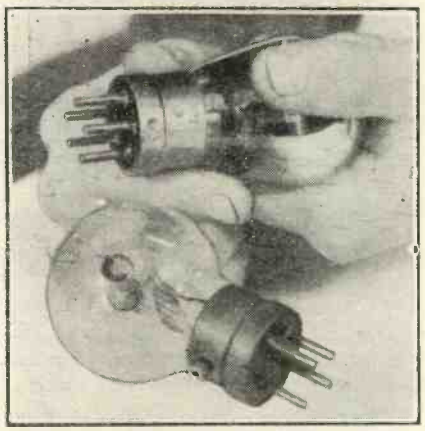
Progress will continue, that is certain, but it is going to be a steady progress on scientific, well-ordered

"Nobody Questions the Reality of H.F. Amplification Now!"

lines. You see, we have now got our radio theory fairly well lined up with radio practice; we aren't groping about in the dark.

Vast steps forward have been

THE FIRST TETRODES



Two of those four-electrode bright-emitters that were once quite popular. One you will see has a five-pin base, while the extra grid connection to the other is via a terminal on the side of the base.

taken in the last four or five years, but there is one significant fact that stands out, and this is that revolutionary inventions and discoveries no longer happen.

Very Little Different

Fundamentally, the set of to-day differs little from the set of 1924. Of course, the H.F. amplifiers are more efficient, components are better and the valves greatly improved. And

DYNAMIC SPEAKER

The moving-coil principle in loud-speaker design is being more and more widely adopted, especially in the more ambitious outfits. Here is a Philips loud speaker incorporating the dynamic system.

on the L.F. side quality is astoundingly superior. However, the progress has been more a progress in detail than in principles.

It is, however, a queer thought that there were many radio engineers in 1924 to support the idea that H.F. amplification was more a pious hope than an accomplished fact! When we turn to our mains S.G.'s, with their colossal amplification, there doesn't seem any room for a question such as: "Is H.F. amplification worth while?" And, remember, this query was often asked very seriously indeed four or five years ago.

"On the Map"

It can safely be said that Professor Haseltine and his neutralisation definitely placed H.F. amplification "on the map," and the screened-grid valve has confirmed its claim for serious consideration—and use.

Nobody questions the reality of H.F. amplification these days.

FILAMENT RESISTANCES

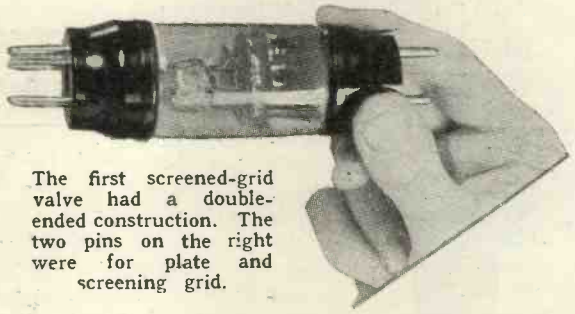
A group of fixed resistances for filaments. These were once widely used, more particularly for those 2·8–3-volt valves. Remember them?

But even in this enlightened age there is a surprising amount of sheer radio heresy spoken, written and practised. This is due to the presence of a weak link in the chain-armour of radio engineering. Its practitioners have few universally recognised qualifications. You might almost say that it has none at all. It seems that anyone who has sufficient radio learning glibly to talk about "impedances" and "couplings" can set himself up as a wireless expert.

The result is that there are wireless firms who, through the clever use of advertisement and finance and salesmanship, force themselves into the van with products bearing 1931 claims but having 1924 efficiencies.

"M.W." readers would assuredly

THE S.G. ARRIVES



The first screened-grid valve had a double-ended construction. The two pins on the right were for plate and screening grid.

do well to cleave to "M.W." advertisers and apparatus reported upon by our technical department, for although there is less junk abroad than there was a few years ago, there is still far too much for the peace of mind of those who have the best interests of radio at heart.

Much to be Learnt

We have indicated that there is much to be learnt from the past if you will only take its lessons to heart, and this platitude has a direct application to this "M.W." review. Supposing we trace the development of a number of the most widely-used components and accessories from, say, 1924 or thereabouts, up to the present, taking as our examples of modern radio productions those that reach a fairly high standard of efficiency.

That will enable you to judge where to place any one definite article of a certain make. If it represents history you won't want it except as a museum product, will you?

MAGNIFICENT!

A little horn loud-speaker that once enjoyed great popularity. It was excellent for its time, and fully deserved the praise poured on it.

Modern Components and Accessories—continued

You may find that technical details concerning a number of components and accessories are not supplied or cannot be obtained. In these cases, if suspicion is aroused in your mind, it will be perfectly justifiable, although we must make it clear that that in itself must not be allowed to lead you to condemn the article altogether.

PLUG IN

One of the earliest plug-in coils. Plug-in coils have changed little in design, and are now tending towards obsolescence.

It is the practice of a number of quite reliable, quite honest concerns not to publish full technical specifications of their products. It is their considered policy. They apparently think that to do so would frighten the non-technical purchaser.

An Admirable Compromise

On the other hand, there are manufacturers who ban all technicalities from their advertisements, but who include all the vital data in leaflets inserted in the various cartons. This appears to be an admirable compromise, and it is one that is being more and more widely adopted.

There is just one further point that we must mention in connection with the specifications of components and accessories, and that is that those circulated by manufacturers of unknown standing should be taken only at their face value.

In cases you will be able to see at once the changes a few years has made possible, but often the improvements are much greater than those of mere form.

Let us be specific.

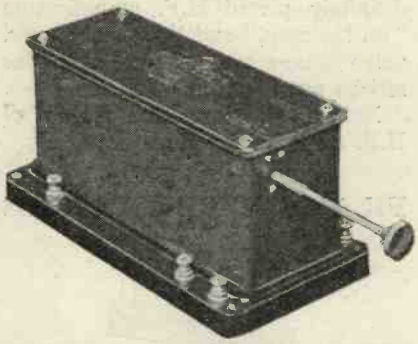
BATTERIES

A fascinating survey of H.T. and L.T. types.

The dry H.T. battery once suffered from the "what the eye doesn't see the heart doesn't grieve over" disease. But the modern battery has just as much care and attention paid to its internal structure as to its attractive label.

Perhaps it would be fairer to say that a great deal more trouble is taken

COIL DEVELOPMENT



A Lewcos dual-coil unit, embodying wave-changing, which covers a wide wave-range.

with its "innards." Scientists have been hard at work evolving paste electrolytes able to withstand temperature changes over long periods,

The Varley impedance matching output transformer, a splendid example of modern radio component design.

and arranging cell assemblies that are leak-free and robust.

And to-day you do not have to use match-sticks in order to make fairly satisfactory tap connections—that is, if you buy a battery made by a reputable, conscientious concern.

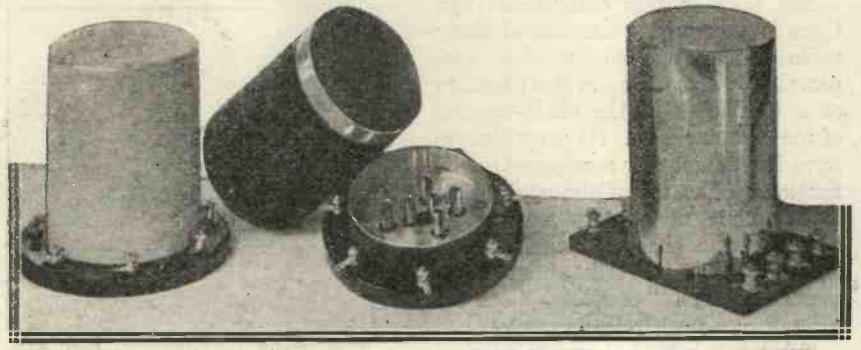
But that is a detail and does not affect the life of a battery Nevertheless, the fitting of properly designed sockets greatly facilitates the use of such an accessory and contributes much to easier radio.

Why They Failed

In the light of modern knowledge it is easy enough to see how those early H.T. batteries failed. They were really only outsizes in flashlamp batteries! Much the same principle of construction was applied, except instead of three cells giving 4½ volts you might have as many as 60.

But a flashlamp battery is not called upon to give a particularly extended service. If it deteriorates of itself within two or three months it is seldom regarded as a complete failure. In an H.T. battery, however, you meet greater voltages, and inter-cell resistance becomes an important factor. Reputable manufacturers soon found that special assemblies would be necessary to ensure long shelf and long working lives, and they eventually entirely abandoned the practice of using flashlamp cell constructions embedded in wax material.

REMEMBER THESE "JAM-JARS"?



Disrespectfully styled "jam-jars" and "tin hats" by some amateurs, shielded coils of the above design were right in the van four or so years back, though they are now practically obsolete.

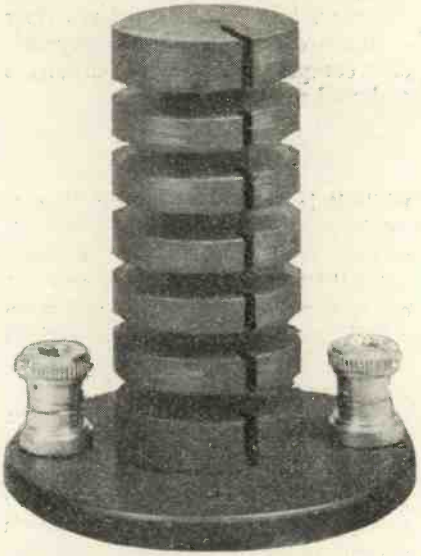
Choose Your Accumulators Very Carefully

There is another thing to notice, and that is that the cells in modern H.T. batteries are generally built on more ample lines. That is so even in the case of the small capacity types.

A casual examination of an accumulator reveals little, but here there has also been considerable improvement and advance. The formation of modern accumulator plates is such that we are no longer troubled by early decay and loosening of paste. This was once a very troublesome factor in accumulators, and tended considerably to shorten their lives.

Bits of paste would become dislodged and perhaps cause internal short-circuit between the plates. Sulphation—the deadly enemy of all lead and sulphuric acid batteries—is still frequently met with, although if a modern battery is carefully maintained the disease can be practically suppressed.

SECTIONALISED



One of the earliest sectionalised formers for an H.F. choke. This pattern is retained in principle to this very day. The winding is divided up into sections in order to reduce its capacity.

Inferior Casings

The celluloid casings, and indeed the casings of other materials employed for accumulators a few years back sometimes exuded impurities that mingled with the electrolyte and impeded the action of the cells. The separators used between the plates often gave rise to similar troubles, but these failings are now well under control. But there is still encountered in many cells one nasty fault. This is the sulphation or corrosion of the positive terminal. Frequent cleaning and greasing helps to keep this under and the annoyance does not assume the same proportions in a radio battery as it does with those used in cars. You see, car accumulators are not so accessible and seldom receive the attention they should.

Unspillable Batteries

The greatest progress in accumulator design is to be found in the unspillable varieties. There are two types of these. There is, first of all, the free acid kind, the construction of which is something on the lines of the unspillable inkwell. You have the ordinary fluid electrolyte, but the accumulator cases are so constructed that, however you tip them, the acid cannot pour out.

The other kind makes use of a semi-solid acid electrolyte. A paste material takes the place of the fluid acid. In view of the complete success of the unspillable accumulator it would seem highly probable that the ordinary kind will sooner or later decline into obsolescence, if not become completely obsolete, as far as home radio is concerned.

Sulphuric acid is corrosive, and when spilt over carpets and so on can cause considerable damage. Certainly, spillable containers of it seem more suited to the laboratory than to the drawing-room.

There is not the slightest doubt but that the portable set must be given credit for the development of the unspillable accumulator; indeed this is obvious, for such accessories are made primarily for portables, although it would be a pity if their application stopped at that.

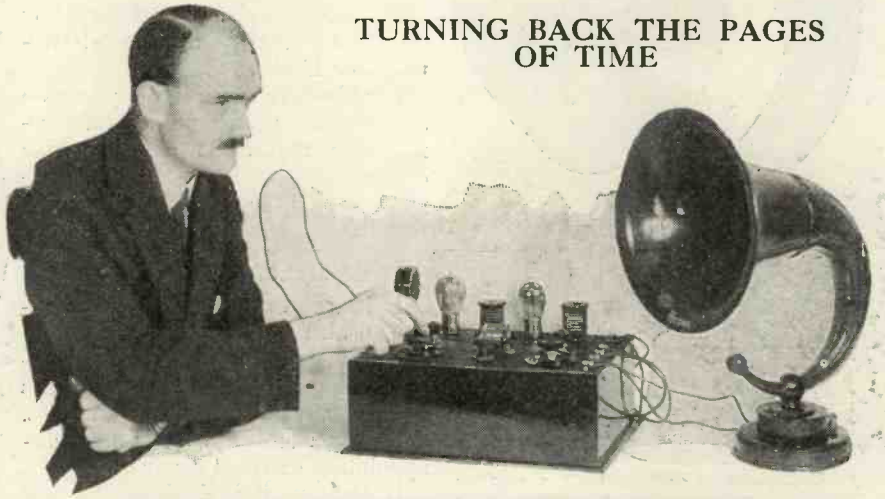
A SOLID DIELECTRIC

Compactness is achieved in this modern Dubilier variable condenser by the use of solid insulation between the vanes.

The Vital Factor

Technical specifications of radio batteries are available, but only with a few of the many makes on the market. Of course, voltage and ampere-hour capacity, etc., are nearly always stated, but these do not tell the whole story. For example, the ampere-hour capacity of an accumulator indicates the number of hours of output at a certain current the accumulator will give, but it cannot tell you how long an accumulator will last in months or in years, providing it is properly maintained.

TURNING BACK THE PAGES OF TIME



Here you have one of those "flat panel" sets that were once so popular. And it is a dual-amplification reflex outfit using a crystal detector!

Modern Components and Accessories—continued

A Clarke's " Atlas " mains unit.

We are afraid that there is nothing to indicate that. Clearly, then, it is imperative that an accumulator should be purchased with discrimination. Here, more than with almost anything else, the importance of the maker's name and reputation are paramount.

An H.T. Fallacy

Much the same sort of thing applies to a " dry " H.T. battery. A continuous discharge curve is of little use. Assuredly it shows you the number of hours for which the battery will deliver a current if run continuously. But there is a snag: no ordinary radio amateur runs his set continuously.

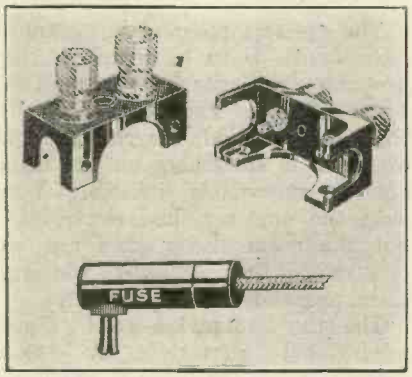
He uses it for a few hours at a time only. His hundred hours, far from being continuous, may spread over two or three months. The battery might be quite capable of giving the necessary current for a hundred continuous hours and yet fail to do so in the other circumstances.

It is a widespread belief that a battery has a greater aggregate output if used for short periods of time and given long periods of rest. Probably it would, but for one very important thing, and this is that while it is standing idle its paste may be drying up.

Good paste does not dry up in years, but bad paste may dry up in a matter of a few weeks.

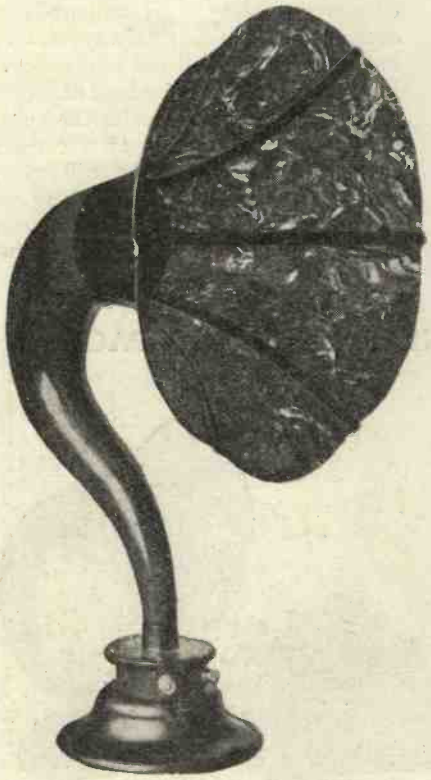
Clearly, then, the H.T. battery must bear the name of a maker widely known to produce long-life batteries. Failing this, there seems to be nothing else that will completely guarantee reliability.

MODERN GADGETS



Two items that make for easier radio. The Belling-Lee terminal mount and the Belling-Lee wander fuse.

AN ARISTOCRAT OF THE OLD REGIME



A horn-type loud speaker with a wooden flare that was once considered a very " classy " affair.

LOUD SPEAKERS

Some notes on present-day models.

Moving-coil loud speakers are often styled the aristocrats of radio reproduction. However, we must not let this moving-coil complex of many enthusiasts blind us to the sterling worth of many of the electro-magnetic kinds available.

For £2 or so it is possible to purchase a cone loud speaker with an electro-magnetic movement of either the compensated reed or balanced armature type that will give first-class results.

Distinctly Superior

It is true that a first-class moving-coil speaker is distinctly superior to a simple instrument of the kind mentioned, but moving-coil loud speakers are generally heavy, expensive articles, and sometimes apt to prove disappointing on small receivers.

In any case, it is doubtful whether the moving-coil speaker will retain its proud position as leader of all the reproducers for very much longer. At this very moment it is being actively challenged by the " inductor."

The inductor must not be classified as electro-magnetic, although by rights it should come under that category, but precedence has firmly established that the electro-magnetic class comprises the balanced-armature and reed movements.

A Breakaway

The inductor is a breakaway, and while it is not revolutionary it certainly is novel. This principle comprises the employment of a magnetically restored armature, and not one that relies upon a spring reaction for this purpose. It is true that springs are used, but these are employed more as guides than anything else.

Even as we write we learn of a further inductor development. One of the best known of the loud-speaker manufacturers has, after long research, developed its own application of the inductor principle, and has placed a reasonably priced loud speaker incorporating this on the market.

With an inductor loud speaker you do get an excellent bass response, while the preserve of the moving-coil

AN ARISTOCRAT OF TO-DAY

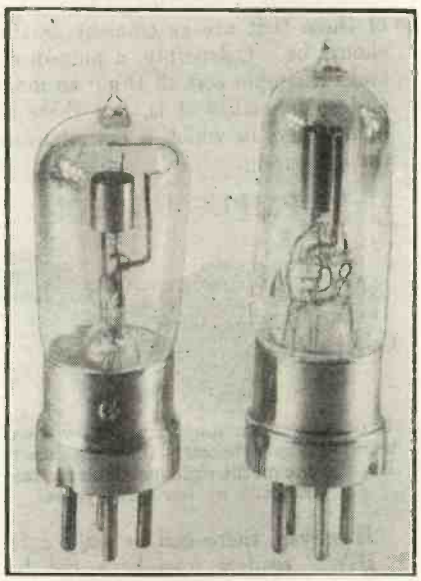
One of the very latest of moving-coil loud-speaker units—the Ferranti Magno-Dynamic.

Mechanical Design of Paramount Importance

speaker in respect of definition and attack are certainly transgressed upon.

But as yet it would not be right to say that the inductor has proved its complete equality, let alone superiority, over the moving-coil speaker. Nevertheless, it must be remembered that the inductor principle calls for a less expensive instrument and is altogether a proposition well within the scope of the average amateur.

MIND THOSE SPIKES!



Two old-time tubes, both bright-emitters, and both very crude as compared with modern valves, which incidentally are much cheaper.

CONDENSERS

A survey of progress made.

The variable condenser of 1923–4 compares extremely unfavourably with that of to-day. In the first place, it has straight-line capacity action. Its vanes were semi-circular, and the variation of capacity was directly proportional with the movement of the control knob.

Stations Crowded Together

Roughly speaking, if you had half the vanes "in" you had half the capacity, and when they were three-quarters of the way "in" you had three-quarters of the maximum capacity. The effect of this was that the stations were crowded together at the lower dial readings, while they widened out towards the upper.

Eventually a correction was applied to the vanes and these were shaped so that something of a straight-line wave-length control was possible. That is to say, the wave-lengths were evened out over the dials. It was soon realised, however, that this was not the ideal method, and further corrections were applied to the shape of the vanes in order to achieve "straight-line frequency" so that the stations were separated in frequency and not wave-length.

Well-Built Instrument

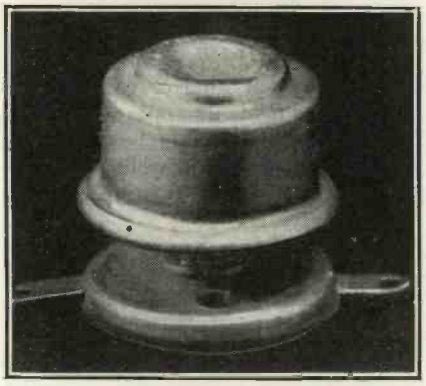
The final step—the one which brings us to the present day—was the introduction of compensation for circuit and other added capacity effects, so that straight-line frequency could really be attained in practice.

The usual modern variable condenser has a skeletonised metal frame to which the moving vanes are connected, and there is a minimum of solid insulating material. In this way dielectric losses are reduced to the lowest possible level.

The old-time variable was built up with separate vanes, separated by innumerable spacing washers, and often a little usage would tend to lock the vanes or make them scrape. Solid precision assemblies have now eliminated these annoyances.

Many variables have combined in them forms of gearing to enable slow-motion movements to be obtained. In this regard some excellent engineering is to be seen. Particularly with two or three prominent makes velvety smooth adjustments

A "COMPRESSION" RESISTANCE



A filament rheostat of the compression variety for baseboard mounting.

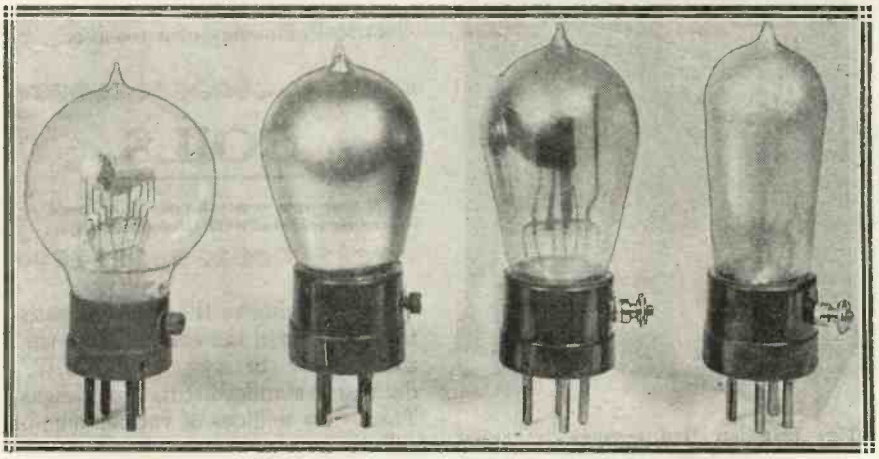
are possible without the slightest backlash, and when the direct drive as well is also very smooth, high marks can be given to the manufacturer concerned.

A Mechanical Proposition

It is true to say that the variable condenser is primarily a mechanical proposition. After all, it has only to impart a varying capacity to a circuit, and any two pieces of metal or two metal structures closing together and separating again can do that.

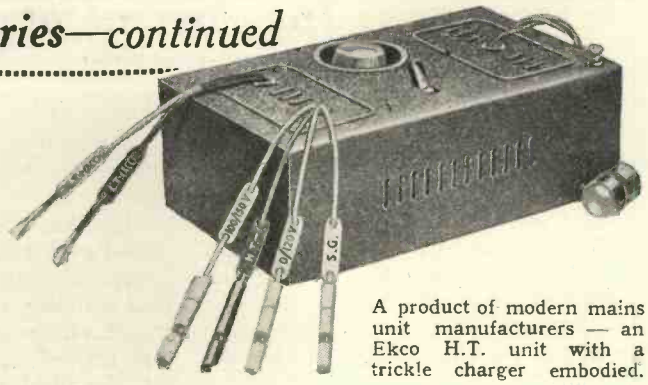
Certainly a variable must act up to its maximum capacity and must be able to provide a minimum of about a tenth of that maximum and no more, and it must have low dielectric losses

A TEAM OF FOUR-ELECTRODE TUBES



One bright- and three dull-emitter tetrodes. The main purpose of the extra grid was to enable results to be achieved with very low H.T. voltages—not for screening, as with the S.G.

Modern Components and Accessories—continued



A product of modern mains unit manufacturers — an Ekco H.T. unit with a trickle charger embodied.

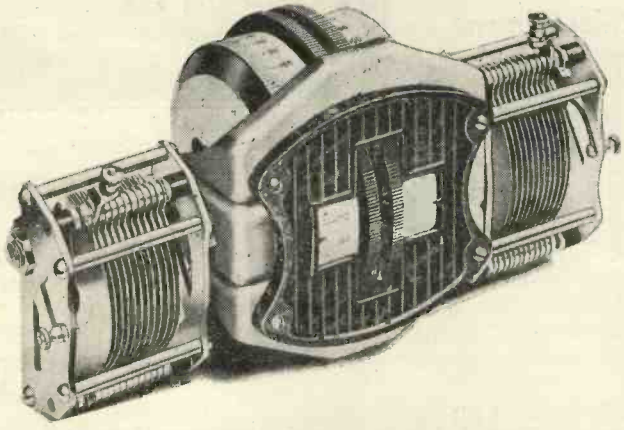
and a high insulation resistance. But these are not particularly difficult qualities, to obtain. It is with its smoothness and its consistency of action, and its ease of operation that the average amateur is more closely brought into direct contact.

A New Kind

A quite new kind of variable condenser has made its appearance in the last year or so. This is the differential reaction condenser in which there are two sets of fixed vanes and one moving. Many of the differential reaction condensers are given a solid dielectric; that is, instead of air in between the vanes you have thin sheets of insulating material such as bakelite.

In some receivers it is vital that such dielectric should be of the highest quality; if it is not, a partial or even complete short-circuit may be the cause of H.T. wandering around the filaments of the valves. This indicates the advisability of a safety condenser—i.e. a fixed condenser joined in series with the differential—if any suspicions are entertained regarding the ability of the variable to withstand high voltages.

THE VARIABLE EMERGES



A wonderful illustration of the best present-day practice in variable condenser design and construction. It is a Lotus drum vernier dial fitted with two ·0005-mfd. condensers.

Ganged condenser assemblies are by no means new, for ganging was first used as far back as 1917. Maybe it was even earlier. But the modern ganged condenser is a different product from its early brother.

Some really beautiful pieces of engineering are to be seen in some of the 1930–31 drum-drive gangs, but although they contribute vastly to the ease of operation of certain types of sets, it cannot be said that they necessarily add anything to the overall electrical efficiency of a receiver.

A NEW PRINCIPLE!

This Celestion D50 employs a special inductor type of movement which Celestions themselves have evolved and patented.

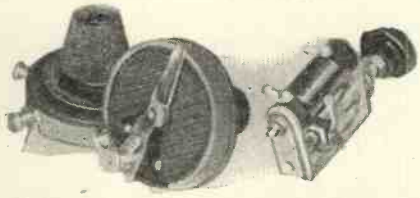
COILS

These are components that need to be selected with discrimination.

It was owing to the rather unsatisfactory state of the coil situation that some year or two ago "M.W." decided to standardise its own designs. There were millions of various plug-in coils in existence, but they were not completely satisfying in modern conditions.

It is possible to design a first-class receiver for which plug-in coils can be used, but it is not a large percentage of these that are as efficient as they should be. Ostensibly, a plug-in coil looks a simple sort of thing to make, and so in reality it is, but there are many ways in which a manufacturer can go wrong.

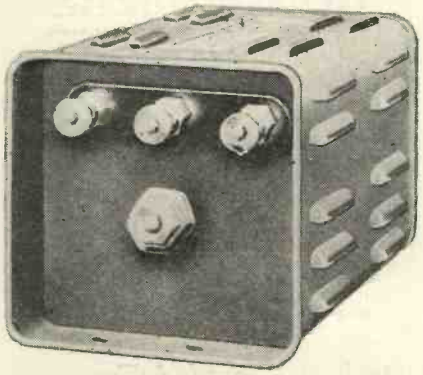
TEMPUS FUGIT!



It doesn't seem long ago that we were using filament rheostats like this, does it? But the one on the right, particularly, takes you back at least five years.

However, there can be only a few "M.W." readers who have not had actual experience of the vast differences that obtain between the badly-made plug-in coil and one that is accurately and scientifically constructed.

REAL NOVELTY



The metal rectifier was a real novelty, and has since gained great popularity. Here is one of the very latest Westinghouse productions.

At present "M.W." sets are mostly designed around the "M.W." dual-range and the "Star-Turn" coils.

The Arrival of Dull-Emitter Valves

These are entirely modern products, but despite the care with which the specifications were drawn up, quite a few commercial versions that were definitely faulty got on the market.

No words are too strong with which to condemn the slipshod methods practised by the concerns to whom these are due. We can only reiterate—choose your manufacturers as carefully as you choose your circuits.

VALVES

You can run twenty modern 2-volters on the filament power consumed by one of those early bright-emitters!

It does not seem long ago that the "pipless" valve was an innovation, but yet it must be at least four or five years. And there are no doubt many readers of "M.W." who do not realise that at one time every valve had a little glass spike on the top of its glass bulb, as still do quite a few electric lamps. But those early radio valves were little else except modified electric lamps. They had the same kind of brightly glowing filament, although this was, of course, surrounded by grid and plate electrodes.

THOSE GRACEFUL "TRUMPETS"

It must be admitted that the horn loud speaker developed distinctly graceful lines.

The real development of the receiving valve did not begin until the arrival of dull-emitter filaments. Or, perhaps we should say, until the wide adoption of such, for dull-emitter filaments were in experimental use well over ten years ago.

Vastly More Efficient

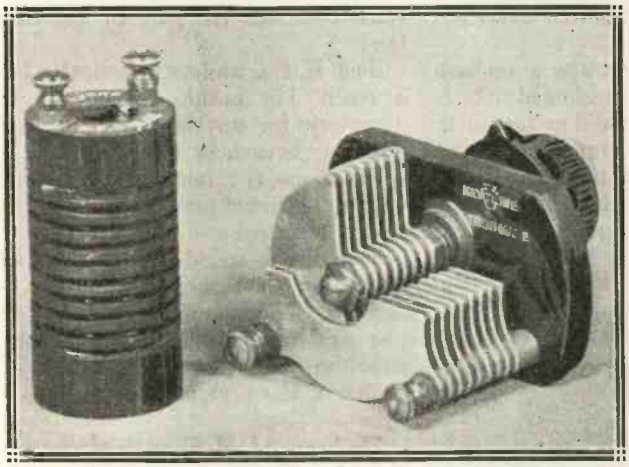
The average "bright-emitter" consumed some 4 watts of power in its filament, as against the ·2 watt of some of the vastly more efficient valves of to-day. You could work twenty modern two-volters on the power demanded by one bright-emitter!

Practically all valves used to have filaments comprising short, straight lengths of wire, but eventually zigzag and "V" formations were introduced. Dull-emitters using the short, straight filament had been made, but, as many readers will remember, these were of rather fragile character.

You see, the specially treated filament wires were able to give all the necessary electron emission at a very much lower temperature; in its turn this meant that a much smaller current was necessary.

Initially the current was cut down by making the filament thinner and in this way increasing the resistance. But the same effect was soon achieved with far greater robustness of structure by lengthening the filament and retaining the original thickness.

THE PROGRESS OF PETO-SCOTT



Two of the modern products of the Peto-Scott Co.—one of the earliest component makers in the field which is still "going strong."

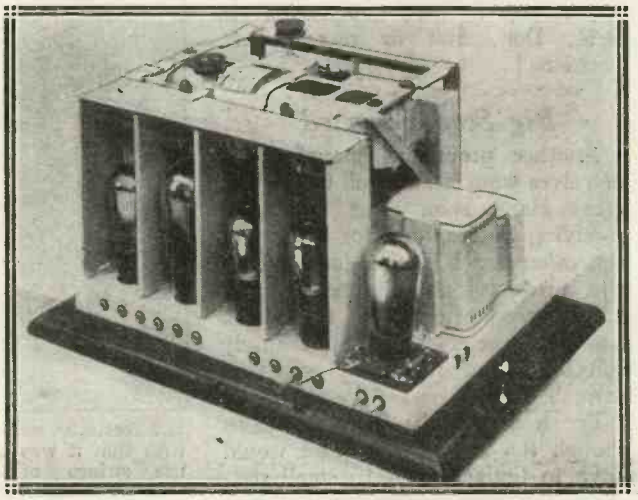
The "Slope"

Incidentally, this greatly added to the effective electron emission, and by the employment of a grid of necessarily greater area and an anode in similar proportion the all-round efficiency of the valve was increased in a manner far from being purely theoretical.

You prove this by taking the "goodness factor."

The "goodness factor" is the "slope," or "mutual conductance" as it is sometimes called. It indicates approximately the anode current variation in milliamperes that accompanies every volt of grid potential variation.

THE SCIENCE OF SET DESIGN



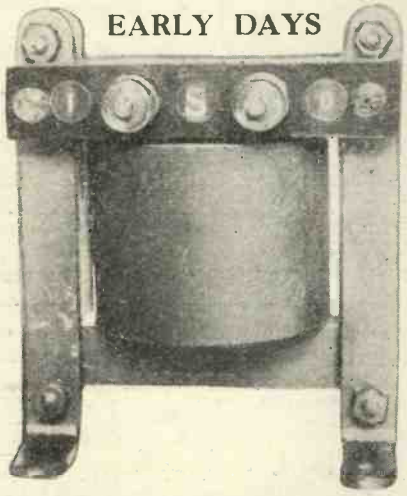
A beautiful piece of radio engineering—the vital parts of a current Marconiphone receiver.

Modern Components and Accessories—continued

You can arrive at the "slope" fairly closely by taking one thousandth of the impedance value and dividing this into the amplification factor. Thus a valve with an impedance of 2,000 ohms and an amplification factor of 4, has a mutual conductance of 2.

Not so many years ago a mutual conductance of 1 was reckoned to be a kind of ideal, and you did not consider a valve that had a mutual conductance of only ·5 to be a bad valve. On the contrary, it would have been classified as of good average efficiency.

EARLY DAYS



The L.F. transformer, like most of its contemporaries, had no casing at all.

Nowadays, a mutual conductance of 3 is by no means a record. One of the greatest of our valve manufacturers had only one receiving valve in production seven or eight years ago. They did not call it a "general purpose" valve; it was taken for granted that you could use it wherever a valve was needed—in H.F., Det., first or second L.F. positions!

Big Step Forward

Another prominent manufacturer of valves who is still well in the van came along soon after with two receiving valves, one for H.F. and the other for L.F. positions. That was progress! Both concerns now have dozens of types in their lists, and whatever your set an absolutely suitable valve for every stage is available.

For a long while it did look as though the 2-volt valve user would have to limit himself to small outputs, but now super-power 2-volt valves capable of delivering sufficient power for moving-coil speakers are freely obtainable.

Further, H.T. volts are coming down. It is only a year or so ago that if you could not raise at least 350 or 400 volts H.T. you were considered outside the pale by the real fan!

Such H.T.'s, while still desirable for a really big outfit, are no longer necessary for anything suitable for ordinary household reception.

There are, too, innumerable special valves. Pride of place must be given to the screened-grid. It started by being a double-ended affair, and it was something of a bombshell to set-designers and manufacturers when it was first announced that this construction would be abandoned in favour of the present pattern.

Universal H.F. Amplifier

It is safe to say that the screened-grid valve has become the universal H.F. amplifier, while the pentode has enjoyed only limited success; that is, in comparison with the S.G.

But the popularity of the pentode is increasing, and who is there to say that it will not eventually supersede the ordinary three-electrode variety on the L.F. side of the set?

The screened-grid valve has an extra grid inserted between the control grid and the anode in order to reduce the electro-static capacity between those electrodes.

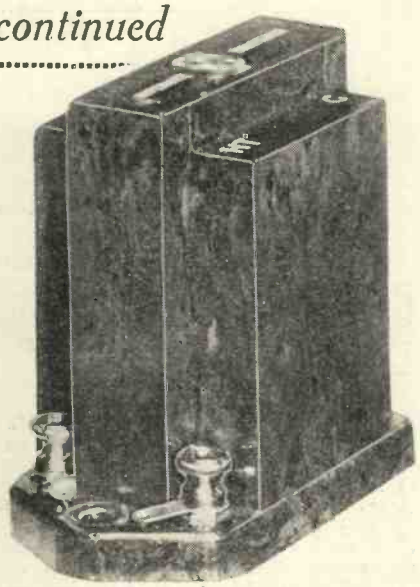
The pentode is an L.F. development of the S.G., and has a third grid, and is therefore a five-electrode valve.

Practically all valve types are now duplicated by mains versions. And yet it is less than four or five years ago that the K.L. valves first made their appearance!

Mains valves divide themselves into two groups. In the one you have those that are indirectly heated, while the other class comprises the directly heated.

H.T. BY INSTALMENTS!

H.T. batteries were so expensive to begin with that it was a common practice to use strings of flashlamp batteries. Connecting devices to facilitate the linking were widely sold. A group of these links can be seen above.



The R.I. "Hypermite" L.F. transformer has a nickel-iron core and a primary inductance of 50 henries.

Indirectly-Heated Valves

An indirectly-heated valve embodies a heater element, and the heat from this small "electric fire" is communicated to an electron-emitting cathode by conduction. There is no direct metallic connection. The idea is, of course, to isolate the working parts of the valve from the mains and so eliminate hum.

The construction of a directly-heated mains valve is, fundamentally, similar to that of a battery valve, except that it has a short, thick filament, a filament which takes a heavy current—the usual consumption is ·8 ampere—and which requires only small voltage across it.

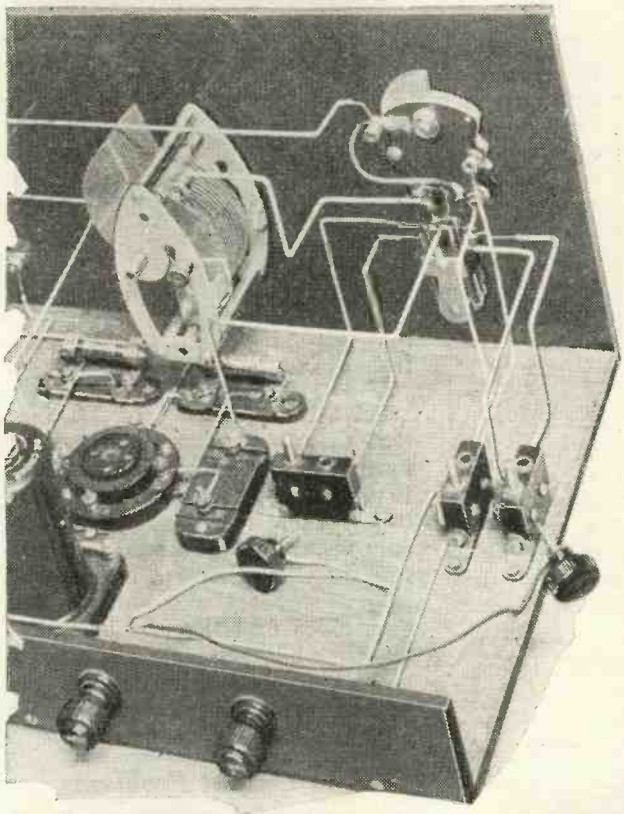
The characteristics of mains valves vary considerably from those of battery types, and in reading an article in which impedances and amplification factors, etc., are discussed in relation to mains or battery receiver circuits, you should always

A Few Timely Words of Warning

ascertain whether or not specific mention is made of mains valves.

Generally speaking, mains valves are more effective than battery types.

Modern Variable Condensers



Note the practically all-metal construction of the tuning condenser and its cut-away end plates and compensating shaped vanes. On the right you will see a ·0005-mfd. variable made much more compact through the use of a solid dielectric.

An all-mains set comprising an S.G. det. and an A.C. pentode valve, if properly designed, will give results practically as good as anything that can be obtained with four battery valves however arranged. Some mains valves are so good that it can be said they represent the peak of progress in modern valve development.

MAINS UNITS

Some invaluable hints concerning the selection of these devices are embodied in this section.

The Institution of Electrical Engineers has done many great things, but none of its works can be of greater practical value to the radio enthusiast than the framing of recommendations for the construction of radio mains devices. These recommendations are specific, and cover every vital point relating to making mains units and receivers safe for home use. It will be noted that the I.E.E. can only "recommend"; they cannot enforce, as can the Board of Trade, which is, of course, possessed of statutory powers.

Nevertheless, no reputable manufacturer makes mains apparatus that does not run closely parallel with the I.E.E. schedule.

Any device directly connected to the power mains can be a potential source of danger, and listeners should, for their own safety, insist on obtaining a maker's guarantee that an H.T. unit, or such-like article, conforms with the I.E.E. recommendations.

We should also like to point out, too, that it is distinctly unwise for complete tyros to attempt the design of mains apparatus, and only qualified engineers should take it upon themselves to plan their own mains outfits.

Safety Measures

The Institution of Electrical Engineers' recommendations refer only to safety measures, and have nothing to do with the actual operation of H.T. units, etc. A mains unit may conform to I.E.E. recommendations and have this fact printed or stamped on it, but yet that is no guarantee that it is an efficient unit. It indicates that it is safe to use, but not that it will necessarily give good results.

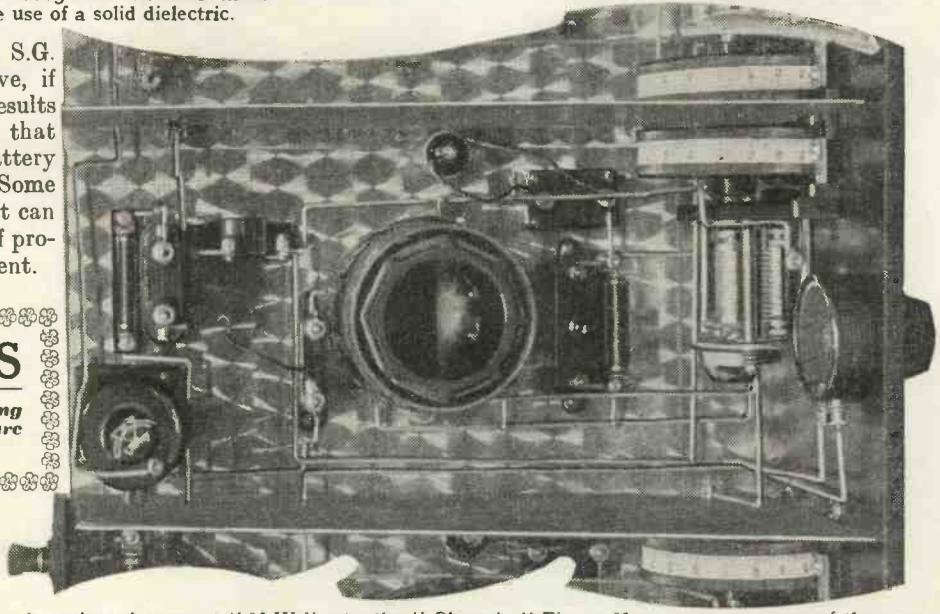
Mains units can be regarded as the younger members of the radio family. It is only during the last year or two that they have come into real prominence; certainly it is during this period that they have developed from very crude, unsafe articles to their present average good standard.

Many Mediocre Makes

We use those last three words advisedly, because it is a fact that there are many makes on the market of but doubtful quality. As yet there seems to be no clearly defined standard of values for these devices.

Quite a number of people seem

An Example of Present-Day Design



A section of a recent "M.W." set—the "Olympia" Five. Here you can see one of the new "M.W." dual-coil units and a double-drum variable condenser with "thumb controls." Note also the thorough metal screening employed electrically to "isolate" this H.F. stage of the receiver.

Modern Components and Accessories—continued

to be completely hazy as to what should be expected from a mains unit costing this or that amount of money, and that is not to be wondered at, for H.T. mains units are particularly difficult objects to classify.

They divide easily enough into the two main groups, D.C. and A.C., but a wide range of different outputs is met. Nevertheless, there is an automatic kind of sorting out in process, and no doubt in due course complete standardisation will result.

At present, however, prospective purchasers of H.T. units must find themselves very perplexed as they are faced by the long lists of different models offered by different manufacturers.

A Wide Assortment

But it must be said, in fairness to the trade, that there is this in favour of a wide assortment of types: with growing competition prices are naturally being cut down to the lowest possible minimums, and the fact that many different models are available makes it possible for you to choose a unit capable of giving just the output necessary in your immediate circumstances.

This accumulator cell is some years old. The physical appearances of batteries change little, although great improvements in their plate structure, etc., have been made.

You see, roughly speaking, the greater the output the higher the price. Some concerns concentrate on the production of but two or three models, and this right away means that they can reduce their cost of manufacture. And you do not have to pay so very much more if you have to buy a unit that is really considerably bigger than you need. It is in this direction that we are moving towards standardisation, for you find even those firms having the widest ranges, while retaining the greater proportion of their models for the present, are tending to give greater prominence to just the one or two.

A recent T.C.C. condenser arranged for either vertical or horizontal mounting. It has a bakelite case and a non-inductive plate assembly.

The Output Problem

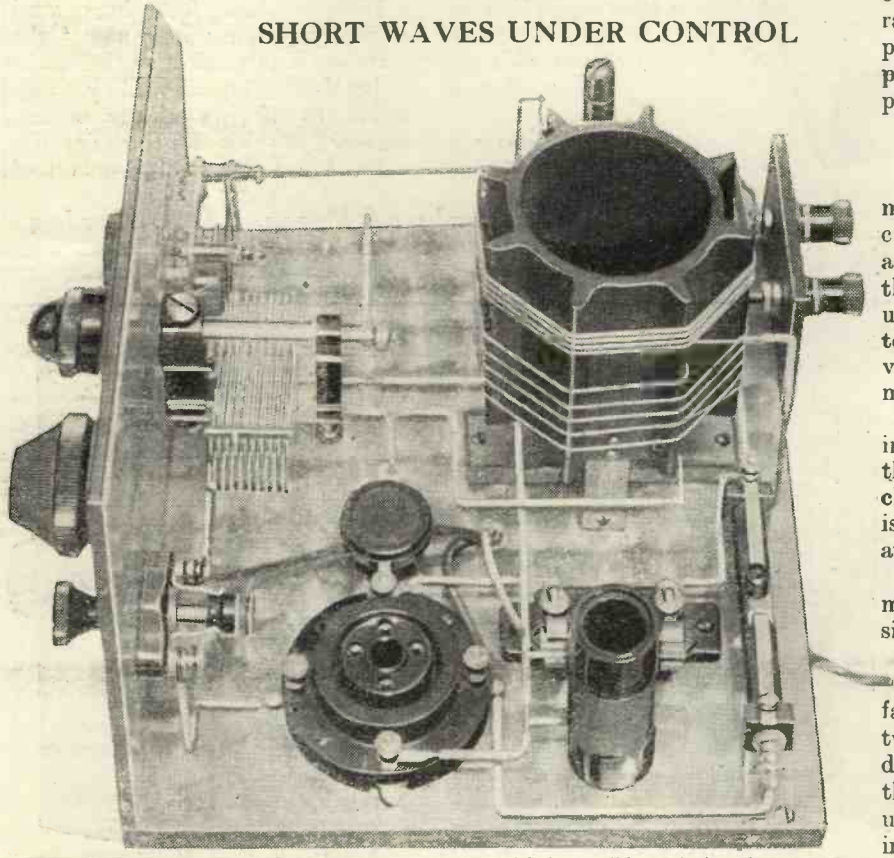
When we refer to output we do not mean only aggregate voltage and current outputs, but the number and kinds of tappings into which these are divided. A very simple unit may have only two H.T. + terminals, one giving a variable voltage and the other a fixed, or there may be only three fixed terminals.

A more complicated outfit perhaps includes as many as five H.T. taps, three of which are of a variable character; so you see, the problem is not such a simple one as might at first sight be thought.

Every additional terminal on a mains unit carries with it the necessity for additional "separation," and it is in regard to separation that so many otherwise good units fail. It is easy enough to provide twenty H.T.+'s merely by tapping down a potentiometer device, but the modern high-amplification set, unless it has very efficient separation in its own construction, would not take kindly to such a unit unless each tap were adequately de-coupled.

But we are rather wandering away

SHORT WAVES UNDER CONTROL



With vastly improved components at our command it is possible to design short-wave sets that can be handled by more or less unskilled operators. The short waves were once the exclusive preserves of the real "fan." But above you see an adaptor that converts practically any ordinary broadcast set into a short-waver.

There Are Very Few Technical Controversies Raging Nowadays

from the main points. Let us summarise the requirements, or the qualities that should be looked for in a mains unit. First of all comes safety, and when a unit conforms with the I.E.E. regulations safety is assured.

Next, it must have at least as many output terminals as there are H.T. terminals on the set to be supplied, and each terminal must be capable of delivering the required current with a little to spare.

The unit's output terminals should be adequately " separated " ; that is, the A.C. resistance obtaining between any two of them should be extremely low. It might be advantageous for one or other of the positive tappings to be able to provide a variable voltage.

Practical Advice

There should be sufficient smoothing to prevent any hum creeping through. Some radio salesman may try and convince you that a certain amount of hum is inevitable, but that is not the case, for a completely silent background is possible with efficient apparatus.

In conclusion, we advise the purchase of a larger mains unit than

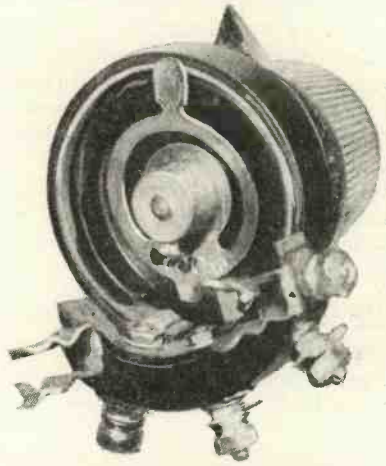
THE NEW IDEA

H.T. batteries are now designed and manufactured on special lines suited to the special work they have to do. Here is the latest of the famous Siemens' family of radio batteries.

may be immediately needed. If your set has only two H.T. positive terminals, it is wise to purchase a unit that has at least three ; while if the total H.T. current consumption of your present valve set is 20 milliamps, buy a unit capable of delivering at least 30, at rather greater voltages than are specified for your valves.

You do not want to render a new unit completely useless soon after you have bought it merely because you fancy using a bigger set or rather more greedy power valves. And if you can actually try the unit on your set before you pay the money, so much the better.

A NEAT DEVICE



This new product of Messrs. Wright and Weaire is a potentiometer fitted with a grid-leak clip.

LOW-FREQUENCY TRANSFORMERS

A particularly interesting section, which, although in itself complete, constitutes an astonishingly up-to-date supplement to the "M.W." Transformer Review published last year.

Time often provides a very full answer to " burning questions of the hour." We have already referred to one such. This was : " Is H.F. amplification worth while ? " A query that was raised with perfect seriousness and which embraced doubts nursed by even fully qualified radio engineers.

PANEL PROGRESS

The Brownie S.G. Three strikes a decidedly modern note with its tastefully and conveniently disposed tuning controls.

There is an old saying that " it is easy to be wise after the event," and somehow that seems to fit in very well in regard to another question that was a never-failing source of discussion in radio circles a mere three or four years ago.

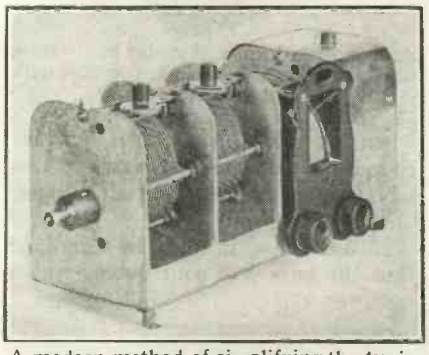
An Old Controversy

It was usually raised in this manner : " Transformers versus Resistance Capacity Coupling "—and long and fascinating were the arguments invoked by the protagonists of each method.

But radio has grown up from the contentious stage. There are very few technical controversies raging nowadays ; but, then, there is no room for controversy when the theory and practice of the time tend to run parallel pretty closely nearly the whole way.

It is true that there is a minor struggle in process even as we write,

TUNING TECHNIQUE



A modern method of simplifying the tuning of a multi-valve set—a " Formo " gang condenser.

which can be summed up as : " Are there such things as side-bands ? " However, this is almost entirely academic and fails to move the average home-constructor.

But such things as Transformer v. R.C.C. strike right at the root of amateur radio. You see, practically every set has one or more L.F. amplifying stages.

There were, and are still, two widely used methods of coupling L.F. amplifiers, viz., by means of an L.F. transformer and by the resistance capacity method.

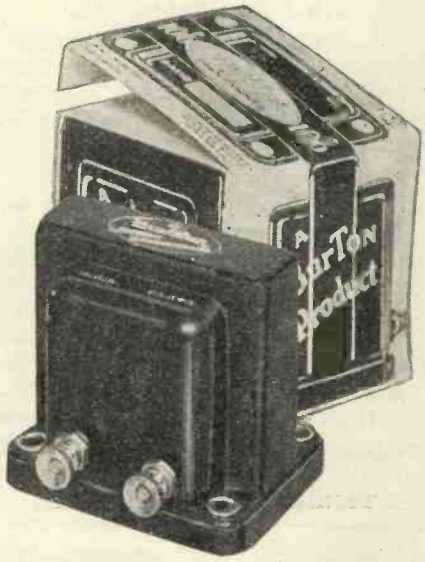
When the case for each of the two was evenly balanced, and experts quarrelled among themselves as to the advantage and disadvantages of the two systems, the home constructor

Modern Components and Accessories—continued

will be forgiven if he seemed perplexed in the selection of his circuits.

We can afford to laugh at such things to-day, because we are in the happy position that we can say for certain that this or that will happen

NEATLY CASED



An L.F. transformer of to-day built into a neatly moulded case and provided with substantial terminals.

when we do that or this, or that so-and-so scheme possesses these advantages or those disadvantages, etc., etc., etc.

Nevertheless, it must be admitted that the bumps of controversy which now have been smoothed away were the spice of life itself.

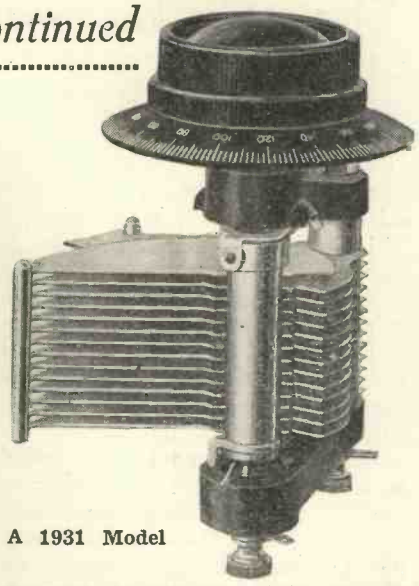
However, we have ample compensation in our more exact knowledge of the science of radio. Mystery may be intriguing, but too much of it is apt to be disturbing. Anyhow, we know which *we* would choose between the admittedly glamorous uncertainty of early radio and the fascinatingly logical outcome of theoretically determined course of action in the design and operation of radio receivers. But we must not let ourselves fall into the habit of looking down at past practices. Anyway, most of us were engaged in them!

Radio's "Growing Pains"

Also, it would not be fair to accuse manufacturers of exploiting the public with badly-made apparatus in the first boom days of radio immediately following the inception of broadcasting, which created, almost overnight, as it were, an enormous demand for all kinds of components.

Of course, there were plenty of concerns with no qualifications other than experiences of small and general engineering works only too ready to leap in with well-shielded cases of absolute "tripe" disguised as radio apparatus.

Some of these concerns eventually "grew up" and settled down to do their job properly, while others failed to stay the pace. In either event,



A 1931 Model

Note the clamped edges of the vanes, the cut-away end-supports, the "stop" device, and other features of this new Ormond No. 4 log slow-motion variable.

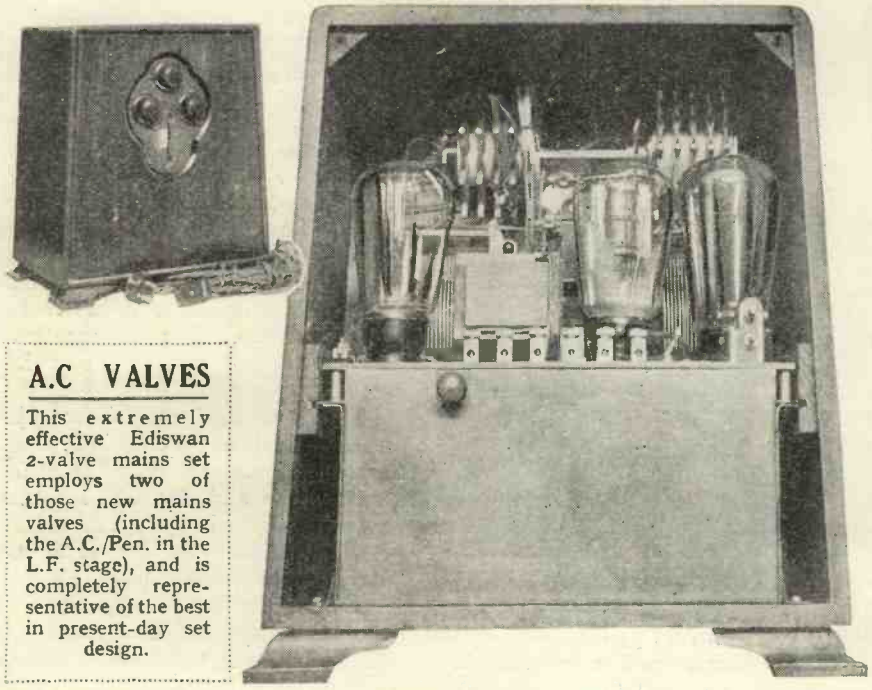
the fortunate outcome is that there is not an alarming proportion of wireless rubbish marketed to-day.

But no industry can commence at perfection. Everything must grow, and the growing pains of radio were, after all, not very serious. The L.F. transformer of four or five years ago was a crude affair, but so, with but few exceptions, were all the other radio components. You may safely say that the early transformers were adequate for their time. A 1931 L.F. transformer would have been distinctly out of place in a 1925 set. There is very little doubt but that it would have been regarded by not a few as a "poor specimen"; it is possible in such a business as radio for things to be "too good."

What a Difference!

In 1924 there was selling an L.F. transformer at 25s. that was an aristocrat in its class. It was miles ahead of many of its contemporaries, yet its primary inductance was a mere 15 henries! The same concern nowadays produces an L.F. transformer at half the price with a primary winding inductance of 50 henries!

And for the figure of 25s., or so, you can purchase L.F. transformers whose primary inductances range up to 200 henries. This is really astounding progress when it is remembered that this vast improvement in regard to one quality has been accompanied by great improvements in other technical characteristics of this particular component.



A.C VALVES

This extremely effective Ediswan 2-valve mains set employs two of those new mains valves (including the A.C./Pen. in the L.F. stage), and is completely representative of the best in present-day set design.

What to Look for in L.F. Transformers

There are still L.F. transformers obtainable with primary inductances as low as 15 henries.; one or two do not scrape up much more than 10 or 11 henries, and where these are concerned there is still point in the question: "transformer or resistance capacity?" But the figures of primary inductance of most L.F. transformers are freely available, so that the constructor is easily able to avoid those that are not up to standard.

What Do We Need?

We must make it clear that we are dealing in this article with components for normal home-constructed receivers. There are special considerations attaching to higher power apparatus that may make it difficult to decide upon the dispositions of the various elements in an L.F. circuit.

But that does not mean that we are unable to plan with precision for a definite purpose. Particular conditions will always call for varied treatment.

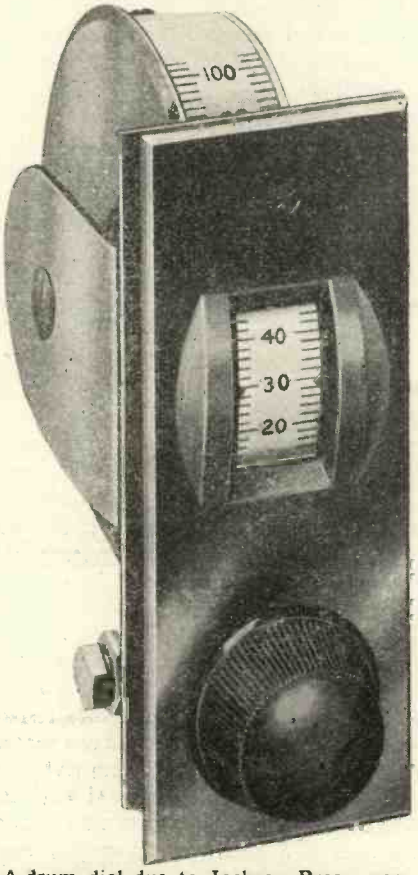
Now what are the definite requirements of a good modern transformer, according to modern standards? First of all, it should have a high primary winding inductance; 50 henries is good, 200 henries is magnificent, always providing the resistance of the primary winding does not run into too many hundreds of ohms, and that the capacity of the secondary winding remains extremely low.

Now supposing we located a number of makes, all more or less of the same price, and all said to be of good standard in respect to the foregoing qualities. What further efficiency factor should we look for? Well, there is the frequency amplification curve.

BRITISH BATTERIES

At one time foreign countries had a firm grip on the battery market of this country, but Ever Ready have increased, not merely maintained, their popularity.

MAKES TUNING EASIER



A drum dial due to Jackson Bros.—very old-established makers of first-class variable condensers.

Several manufacturers send their transformers to the National Physical Laboratory and freely advertise the curve drawn up by this authority. N.P.L. reports are absolutely impartial and their accuracy cannot be questioned.

An Excellent Curve

A curve of this nature would show you exactly just how evenly the particular transformer deals with the various frequencies in the audio range. If the curve is a practically straight line from 30 or 40 cycles up to 4,000 or so, the component reaches a high standard.

You do not want a big bump in the curve at the higher frequencies, although a rising characteristic here will be advantageous, for it will provide compensation for the inevitable losses in the higher frequencies that will occur at other points in the receiver.

It is not likely that you will get a bump in the bass part of the curve. On the other hand, a transformer should not be classified as poor if there is a falling off at about 100 cycles.

There are two things to remember in this connection. Firstly, you have got to have about a 25 per cent drop before the effect will be audibly appreciable, and, secondly, there will probably be in any case a far greater bass failure in the loud speaker or other sections of the set.

Shunt or Direct Feed?

It should be noted whether the transformer primary winding inductance or the frequency amplification curve is taken when current is being passed through the component greater, or at least as much, as will be taken when you use it.

Maybe the characteristics were arrived at with a shunt H.T. supply. This necessitates the use of a resistance and condenser. There is nothing against shunt H.T. It is often very advantageous, but there are instances when you may not desire to employ it.

For example, a simple Det.-L.F. set of a quite satisfactory nature can be designed without the recruitment of those additional two components. However, it is not likely that the anode

CAUSED GREAT INTEREST

The introduction of the Amplion Lion loud speakers, with their specially compensated reed movements, was a notable event of not-so-very-long ago.

Modern Components and Accessories—continued

circuit of a detector valve of such an outfit would raise sufficient grid current appreciably to affect the operation of any modern L.F. transformer.

Constructors often ask whether there are any advantages in metal casings, having noticed that while some have these, other L.F. transformers are built into bakelite or cases of other insulating material.

Shielding Not Necessary

It can be said that, generally speaking, it matters little of what substance the casing of the component is, provided it gives ample protection to the windings against mechanical shock and atmospheric conditions.

A NICKEL-IRON CORE

This tiny Igranic L.F. transformer achieves its efficiency through the use of a nickel-iron alloy core.

The core of the modern L.F. transformer of good construction and design will be a very efficient magnetic circuit, and there will be little external magnetic dissipation.

Those old-time L.F. transformers radiated quite a bit, and shielding of metal may have been necessary in the somewhat unstable amplifiers of the time.

In modern conditions, and with modern design, it can be said that shielding in an L.F. transformer is mostly quite unnecessary. A designer of a set is able to provide sufficient separation of stages without that.

Nickel-Iron Alloys

No article dealing with L.F. transformers would be complete without mention of the new nickel-iron alloys. These are now widely used for the construction of cores, since they enable high primary inductances and low secondary self-capacities to be obtained in small compact constructions.

Characteristic curves of some of these nickel-iron instruments are very near perfection. Nevertheless, there is not quite complete unanimity among the transformer manufacturers in regard to the use of nickel-iron cores. However, there can be no doubt as to the real merits achieved both by nickel-iron and other special constructions.

To hark back to the past again, it was once said that you could get greater amplification with transformer coupling, but for purity it was essential to go to the resistance capacity method.

The L.F. transformer has retained its superior amplifying powers, while it has crept up almost into line with resistance capacity coupling in regard to purity.

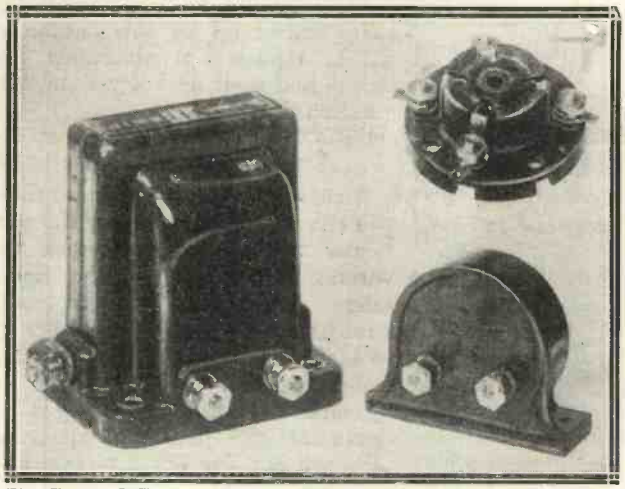
Quite Grown Up

Resistance capacity coupling can have distinctly useful application, more particularly where it is desired to provide frequency compensation in the transaction between the anode circuit of one valve and the grid circuit of another.

And there are instances where it does not matter particularly if you do drop volts through an anode resistance, but where H.T. volts are scarce the L.F. transformer has no rival.

Indeed, it can now be said that the L.F. transformer has grown up to the status of a quality component. And its growth has been rapid, for it is only a matter of two or three years since it was a kind of poor man's alternative!

THREE POPULAR COMPONENTS



The Telsen L.F. transformer, Telsen valve holder, and Telsen H.F. choke.

A very latest product of a great accumulator-making concern—an Exide unspillable cell.

It was sneered at by the ambitious amateur able to command plenty of apparatus and plenty of H.T.

There is no standardisation in the manufacture of L.F. transformers, but then there is little standardisation of many other popular radio components. One of these days, no doubt the radio trade will organise a bureau to frame definite specifications for various radio products.

There have been attempts to do this, but, of course, such a project is fraught with difficulties; however, it will be a great day for the buying public when this great step towards radio rationalisation is taken.

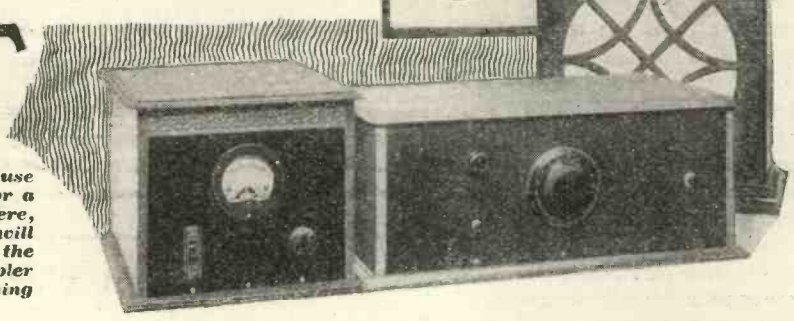
A National Bureau?

At present it is widely known that there are both extremely good and extremely poor pieces of apparatus on the market, but if anybody not too well up in radio learning is suddenly in urgent need of a radio component or accessory, he has little to guide him in his choice of goods.

He has the fairly certain safeguard of a well-known name, but the names of many quite reputable manufacturers of certain lines may not be well known to him.

The indication of a national bureau would be a sound guide. That, however, has to do more with the future than with the present, which is the period with which this article is concerned.

THE "ALL-POWER" UNIT



If you have D.C. mains, why not make full use of them? With a simple trickle-charger, or a mains L.T. supply, and the unit prescribed here, you have an all-power supply which will enable you to run your set entirely from the electric light supply. Nothing could be simpler or more free from trouble, and the running costs are negligible.

THE greatest sources of trouble in the maintenance of a modern radio receiver are undoubtedly dry batteries. The modern accumulator rarely gives any trouble, and it is easy enough to tell almost at a glance whether it is in good condition or not. But when one considers the H.T. and grid-bias batteries, one is to a certain extent fumbling in the dark.

ALL YOU NEED TO BUILD IT

PANEL
9 in. × 7 in. (Red Seal, or Lissen, Goltone, etc.).

CABINET
Panel space 9 in. × 7 in., baseboard 12 in. deep (Camco, or Pickett, Kay, Osborn, Lock, etc.).

RESISTANCES
1 10,000-ohm panel-mounting potentiometer (Varley).
1 1,000-ohm baseboard-mounting potentiometer (Ready Radio).
1 400-ohm baseboard-mounting potentiometer (used as variable resistance) (Igranic, or Lissen, Wearite, Ready Radio, etc.).
2 ·25-meg. grid-leak type resistances and vertical holders (Dubilier, etc.).
1 potential divider, 15,000 or 20,000 ohms (Igranic, or Bulgin, Wearite, Climax, etc.).
1 25,000-ohm fixed resistance and holder (Ready Radio, or Ferraoti, Lissen, etc.).

CHOKES
2 smoothing type about 20 henries, one heavy duty, one medium (Varley and Lissen, or R.I., Ferranti, Igranic, Wearite, etc.).

FIXED CONDENSERS
1 4 mfd., "working" rating not less than 250 volts (T.C.C., or Dubilier, Igranic, Lissen, etc.).
2 2 mfd. ditto (T.C.C. and Ferranti, or Lissen, Hydra, Dubilier, Igranic, Mullard, Formo, Filta, etc.).
2 2 mfd., of usual low voltage "receiving" type (Dubilier and Lissen, or other good makes).
1 1 mfd., and 1 2 mfd., working rating not less than 200 volts (Lissen, or Igranic, etc.).

MISCELLANEOUS
1 mains double-pole on-off switch for panel mounting (Bulgio).
1 0–250 or 0–300 voltmeter (Ferranti, or Bulgio, Weston, etc.).
8 safety sockets and plugs (Clix, or Belling & Lee).
1 terminal strip, 9 in. × 2 in.
Flex, wire, plugs, etc.

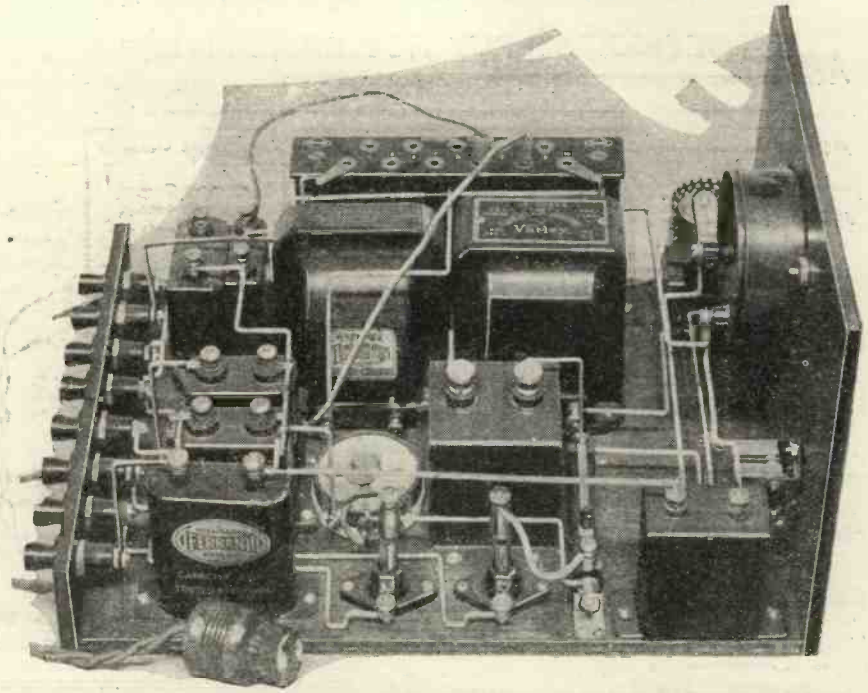
Both are liable to be left connected to the set for so long a period of time that the high-tension battery has largely lost its voltage and become unreliable, causing all sorts of coupling troubles, while the G.B. battery has practically faded out. We have often forgotten this battery until it has hardly half its voltage left. Then comes the replacement of the two batteries, and in many cases, especially where large sets are concerned, this necessitates quite a large outlay of money.

The Question of L.T.

We have come across many cases of instability in receivers due to dying and dead grid-bias batteries. One of the cells may dry up, causing high resistance in the grid circuit of one or more valves, with the consequence that back-coupling occurs. The voltage drops and the valves do not get enough, the H.T. consumption goes up, having a further bad effect upon the H.T. battery, and while we may be tolerably sure of a constant filament supply from the accumulator without frequent tests and careful examination, we can never be absolutely sure that neither dry battery—the H.T. nor the G.B.—is leading us up the garden.

The obvious thing to do, therefore, is to do away with these batteries and use the mains wherever possible. There is no need to scrap the L.T. battery, that can probably be relied upon to give years of faithful service, but it is an undoubted advantage to obtain both anode and grid voltages from the electric light supply.

GIVES H.T. AND G.B. FROM THE MAINS



This compact unit provides plenty of H.T. and up to about 30 volts grid bias from the mains. It is suitable for any ordinary set having up to four or five valves, and including two L.F. stages.

That is the reason we are placing before you this simple all-power D.C. mains unit. We call it "all-power" because by the addition of a simple trickle-charger, or a simple L.T. supply unit, you can derive complete power for your set from the electric light supply if you so desire.

The L.T. unit itself has not been incorporated in the main unit, because we also feel that a large number, while wishing to change over to mains H.T. and G.B., will not yet wish to scrap their accumulators. Many will probably have trickle-chargers in their possession, but others will prefer to use their accumulators till they are worn out—which may be many years hence—before thinking about changing the filament supply to the mains.

Very Easy to Build

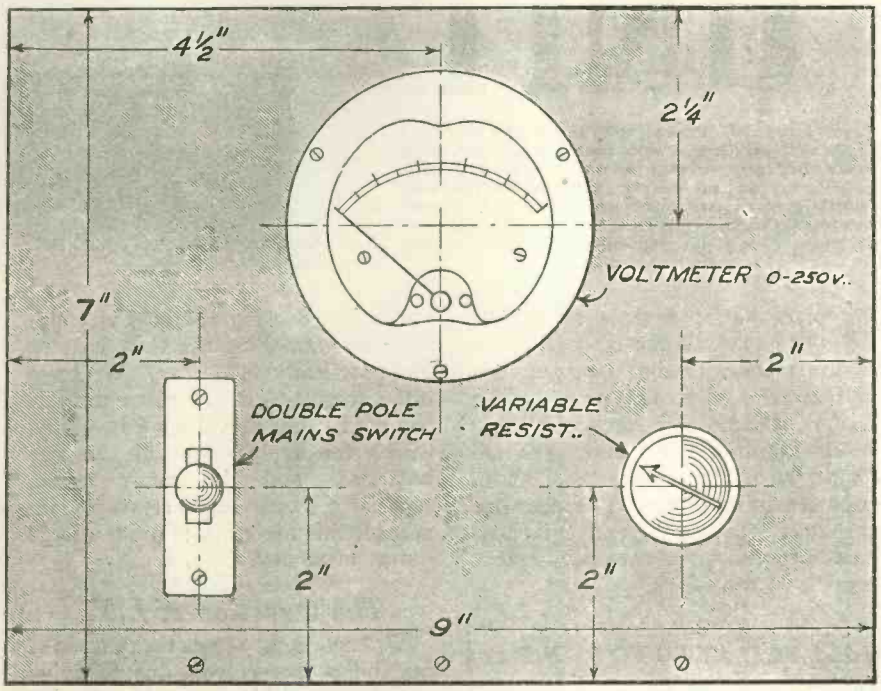
But to the man possessing D.C. mains a change over from battery to electric supply for H.T. and G.B. will come as an undoubted boon, and so, as we said before, we present this all-power mains unit in the sure knowledge that it will prove an extremely valuable proposition to a very large number of our readers.

A glance at the photographs will show that it is a compact and extremely simple unit to build; there is nothing very much in it in the way of components, and all the connections are perfectly easy to carry out; but it will remove once and for all that uncertainty as to whether the set is giving of its best, or whether one of those batteries is not letting you down again.

Here let us state that we have nothing against the dry battery as such. We are merely putting forward a scheme of power supply which we—and we are sure you also—consider is highly preferable. Where mains are not available, then, of course, batteries have to be used, and the modern high-tension battery is really a wonderful piece of work. It is far and away more reliable than its brother of a few years ago.

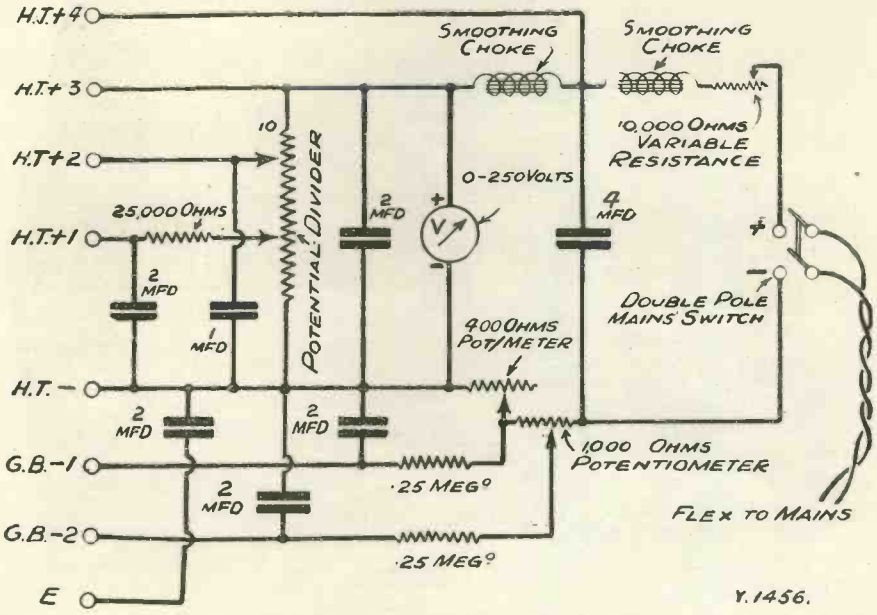
But even the best battery needs replacing, whereas a mains unit does not. There are no rectifiers to wear out in the "M.W." all-power unit, and provided care is taken in its construction, and good components are used, there is no reason why you should not get constant service without the slightest trouble; if second-class components are used, however, and especially does this apply to the high-voltage condensers which are necessary, then you may expect trouble!

COMPLETE VOLTAGE CONTROL



The meter on the panel and the variable resistance (combined with the potential divider inside) provide smooth and accurate control for the H.T. voltage.

EFFICIENT BUT NOT EXPENSIVE



The system of H.T. and G.B. tappings and the de-coupling devices employed in the unit enable perfectly smooth power to be obtained without a mass of apparatus that necessitates large initial expense.

Some Circuit Features

And now, having had a brief glance at the photographs and at the list of components, let us examine the unit more closely by means of the theoretical circuit. You will see that very simple smoothing has been employed, with the idea of keeping down the price as far as possible, though no efficiency has been lost on that account.

There is one heavy-duty choke and one medium-type choke, *all* the anode current going through the heavy choke and all except that via one tapping (H.T.+4) through the second smoothing choke. But let us begin at the mains end.

Across the mains, controlling the supply to the unit, is a special double-pole mains switch. This is situated on

Special Safety Switch Controls the Power Supply

the panel of the unit. It is an ideal component, for it enables one to cut the mains right off, so that one can make alterations inside the unit without the slightest fear of a shock.

So many mains units are controlled by a single-pole switch, which only breaks one side of the mains. Consequently, it is quite possible to get a severe shock from the mains unit, although you may think that it has been switched off. In reality, of course, in this event one pole of the mains is still connected to the unit, and in such cases it is necessary to remove the mains plug itself before complete immunity from shock is achieved.

Smoothing the Supply

With the "M.W." "All-Power" Unit, however, complete safety is achieved, and there is no need to run to the adaptor plug and remove that before you carry out such things as voltage adjustment inside the unit.

From the switch we go along the positive side, and we find a 10,000-ohm variable resistance. This is situated so that it is controlled from the panel, and is set so that the maximum voltage of your valves (and no more) is obtained. But we will discuss that a little later.

On the set side of the larger smoothing choke (the first one) we find the tapping H.T.+4 and a 4-mfd. condenser, which is placed right across the unit. This condenser must be capable of working at not less than 250 volts, for it may have to resist the full mains voltage on occasions when the filaments of the valves are off and the mains unit is on. Therefore, it must be of first-class manufacture.

The second smoothing choke feeds the three H.T.+ tappings: H.T.+1, H.T.+2 and H.T.+3. H.T.+2 has its voltage varied by means of taps on the potentiometer divider, while H.T.+1 has its voltage varied in the same way, and, in addition, this tapping has a de-coupling unit of 25,000 ohms and a 2-mfd. (200 volts working type) condenser between it and H.T.—.

Careful De-Coupling

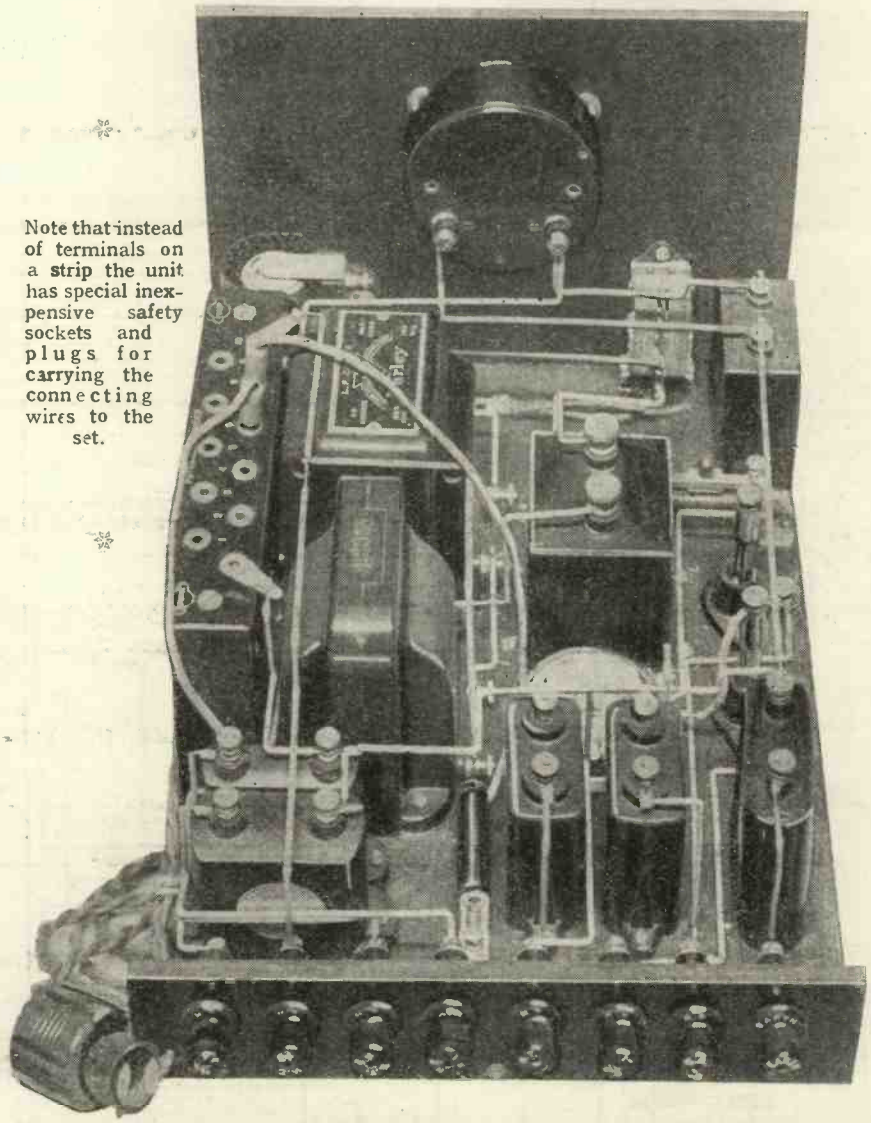
You should also note the 2-mfd. condenser (also high-voltage type) between H.T.— and the E terminal of the unit. This is in case your mains have the positive side earthed. Were this condenser omitted and H.T. negative taken straight to earth on the set, you would short your mains; so in connecting up the unit (switch "off," of course) you take H.T.— to H.T.— on the set, *remove the earth lead from the earth terminal on your set*, and connect it to E on the mains unit.

And now let us turn our attention to the grid-bias terminals. Grid bias —1 is carefully de-coupled by the ·25-meg. grid leak and the 2-mfd. condenser between G.B.—1 and H.T.—; this condenser and that condenser from G.B.—2 need not be of the high-voltage type.

The voltage of G.B.—1 is controlled by means of the slider of the 400-ohm potentiometer, which, by the way, is used as a variable resistance. The reason for this will be explained later. G.B.—2 is controlled by means of the slider of the potentiometer of 1,000 ohms, and both these potentiometers, you will notice, are connected in series with the H.T. negative.

That is, both the total anode and the "waste" current through the potential divider flow through the potentiometers. This, of course, causes voltage drops across the potentiometers, and it is by means of these drops that the grid bias is obtained. Naturally, this deducts from your H.T. available the value in volts of the total grid bias

PERFECTLY SAFE TO HANDLE



Note that instead of terminals on a strip the unit has special inexpensive safety sockets and plugs for carrying the connecting wires to the set.

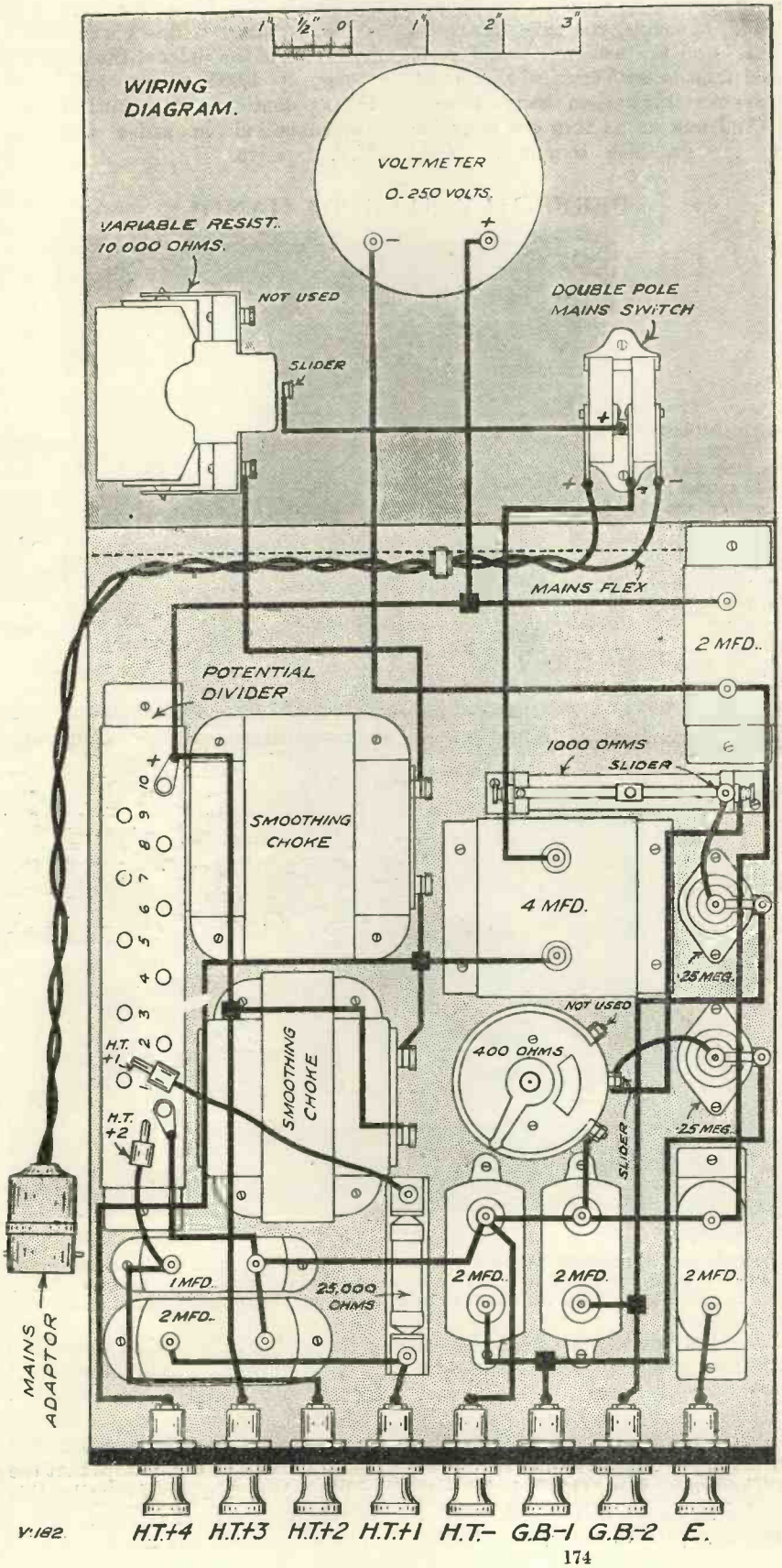
The lead from the mains plug should be tacked, by means of insulated staples, neatly round the baseboard to the on-off switch, seen on the right of the meter. The switch enables a complete break from the mains to be achieved, eliminating any risk of shock.

available, but this is allowed for in the design.

There is nothing in the construction which requires us to go into details other than, perhaps, to mention one or two small points. One is that the voltmeter used should be of a type having a resistance of not less than 200 ohms per volt, and it should read to 250 or 300 volts. If a Ferranti meter is employed, one can get a cutting tool from the makers to cut the necessary hole in the panel, thus making it a very easy job, otherwise a fretsaw can be applied with success.

The second point is that we would like to emphasise the importance of keeping to the types of fixed condensers mentioned in the list of components; when it is stated a condenser must be of high-voltage WORKING type it is absolutely essential that you get the type of condenser specified, otherwise you will get trouble from breakdown, and breakdown may mean shorting across the mains, and the possibility of damaging the smoothing chokes.

HOW THE UNIT IS WIRED



Connecting the Set

Of course, the unit should be kept in its cabinet, and should on no account be tampered with while the switch on the panel is in the ON position. This must always be switched off before any parts of the unit are touched.

Now let us assume that all the connections have been made and carefully soldered together and we are going to connect the unit up to a three- or four-valve set which has a screened-grid valve, detector and one or two note-magnifiers.

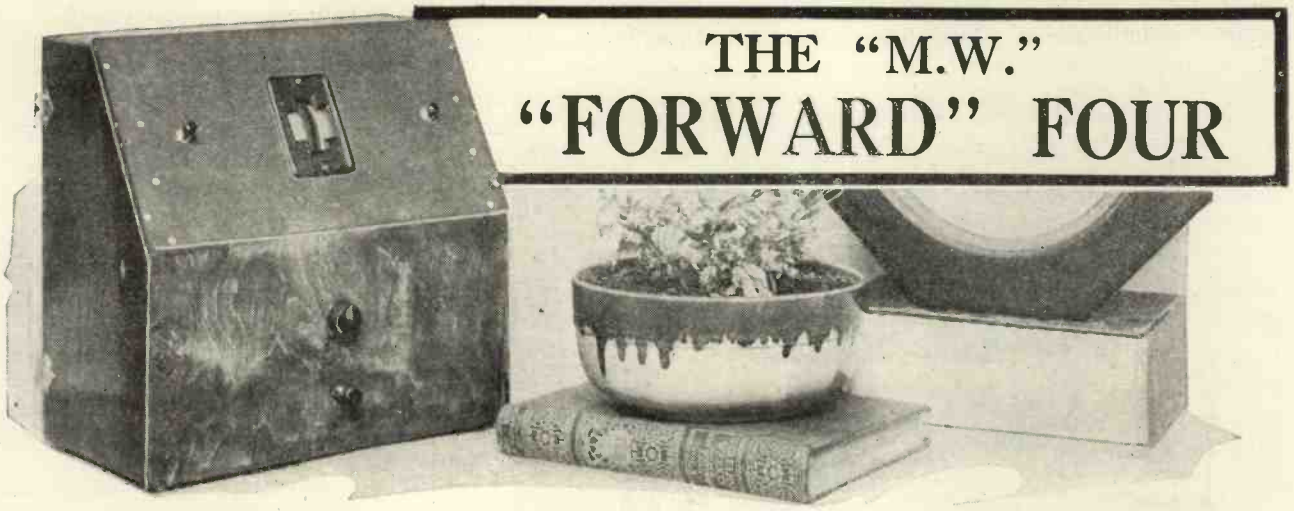
The first thing to do before switching on the unit, or connecting it to the set, is to place the 10,000-ohm resistance at the *maximum* position, with the resistance all in circuit. Then switch on the unit and note the reading on the voltmeter. If no reading is seen then you have the polarity of the mains wrong, and must reverse the plug, which is put into the electric light socket. It is advisable to mark the plug in some way after you have found the right way round, to make sure in future.

Before Switching On

Now switch off the unit and connect up to the set. H.T.+1 should go to the detector; H.T.+2 is intended for the screening grid of the S.G. valve; H.T.+3 is intended for the anode of the screened-grid valve and also for the first L.F. valve, and H.T.+4 can be used for the output valve; or you can use H.T.+3 for this stage and neglect H.T.+4.

Now, *before* switching on the filaments of your set, switch on the mains unit and adjust the variable resistance 10,000 ohms until the voltmeter

(*Continued on page* 248.)



THE "M.W." "FORWARD" FOUR

An up-to-the-minute set designed on novel lines. Incorporating one of "M.W.'s" most modern, efficient and reliable combinations of circuit developments, it makes a fine compact outfit with an appearance that is distinctly competitive with the best commercial productions.

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

THERE are those who, while admitting that progress in circuits has been very great during the last few years, consider that design, so far as physical arrangement and appearance are concerned, has not kept pace with it. And, of course, there is quite a lot in what they say.

The upright panel screwed to a baseboard at right-angles to it has been with us for quite a long time now. This type of construction dates back almost to the period when the horizontal panel with the valves and half the innards of the set mounted on top of it was employed.

A Real Advance

The vertical panel style (originally termed "American") has very much to recommend it, particularly from the point of view of the average home-constructor. Also, it is doubtful whether any other fundamentally different scheme will ever succeed in completely displacing it.

Among the chief advantages of sets using vertical panels are simplicity of construction and accessibility. They are easy to wire, and when any back-of-panel adjustment is necessitated no difficulties of access are encountered. All these appeal greatly to the average constructor.

But what about the advanced enthusiast, of whom there are quite a large number, particularly among readers of MODERN WIRELESS? They are probably prepared to tackle something requiring a little more patience and constructional skill.

It is primarily for these that we are presenting the "Forward" Four, which is a real step forward in the way discussed in the opening paragraphs of this article. At the same time, the set is so full of novel points that those with little constructional experience, and those who have no desire to build such a receiver, will find much to interest them in the following description.

Avoiding Monotony

Over those who have built or handled many sets of the standard vertical pattern type there comes at some time or another a kind of fed-up feeling with the monotonous sameness of the general appearance of these sets. A feeling which is not lessened by the fascinating appearance of many of the present-day commercial sets, with their drum-drive condensers and neat little panels.

Of course, compactness is one of the chief reasons for the neat appearance of such sets, and in this connection the designer of commercial

THESE ARE THE PARTS YOU WILL REQUIRE

PANEL
12½ × 7 in. (Red Seal, or Goltone, Lissen, Permcol, etc.).

CABINET
See text for constructional details. Can be home-made, or the data given can be handed to one of the usual cabinet-making firms.

VARIABLE CONDENSERS
1 Double-thumb-drive with 2 ·0005-mfd. variables (J.B.).
1 ·0001-, ·00013-, ·00015-mfd. differential reaction (Lotus, or other good make, e.g. J.B., Ready Radio, Lissen, Magnum, Igranic, Wearite, Ormond, Polar, Parex Burton etc.).

ADJUSTABLE CONDENSER
1 ·001-mfd. max. compression type (R.I. Varicap, or equivalent in such makes as Formo, Lissen, Polar, Lewcos, etc.).

SWITCHES
2 3-point on-off wave-change (Red Diamond, or Ready Radio, Bulgin, Wearite, Magnum, etc.).
1 on-off switch (Ormond, or Lissen, Igranic, Ready Radio, Goltone, Lotus, Keystone, Wearite, Bulgin, Junit, Benjamin, Magnum, Red Diamond, etc.).

RESISTANCES
1 25,000-ohm Spaghetti type (Magnum, or Ready Radio, Bulgin, etc.).
1 600-ohm ditto.
1 2-meg. grid leak and holder (Igranic, or Ferranti, Dubilier, Ediswan, Lissen, Graham-Farish, Mullard, etc.).
1 1-meg. grid leak and holder (Dubilier, etc.).
1 100,000-ohm and holder (Varley, or Igranic, Dubilier, Lissen, Mullard, etc.).

VALVE HOLDERS
4 horizontal type (W.B., or Bulgin, Junit, etc.).

FIXED CONDENSERS
1 1-mfd. (Filta, special type with extra terminal to hold de-coupling resistance).
1 2-mfd. (Lissen, or Ferranti, Igranic, Lissen, Dubilier, Hydra, T.C.C., Mullard, Filta, etc.).
1 ·0003-mfd. (Ormond, or Telsen, Lissen, T.C.C., Dubilier, Ready Radio, Ediswan, Ferranti, Mullard, Watmel, etc.).
2 ·01-mfd. (T.C.C., and Lissen, or other good makes).
2 ·002-mfd. (Lissen, etc.).
1 ·001-mfd. (Telsen, etc.).

CHOKES
2 H.F. (Magnum, and Ready Radio, or other compact types of good manufacture).
1 output (R.I. Hypercore, or other very compact type).

TRANSFORMER
1 L. F. (R.I. Hypermite, or other very compact type of good make).

COILS
2 "M.W." dual-range (R.I., or Wearite Ready Radio, Goltone, Magnum, Tunewell, Parex, Keystone, etc.).

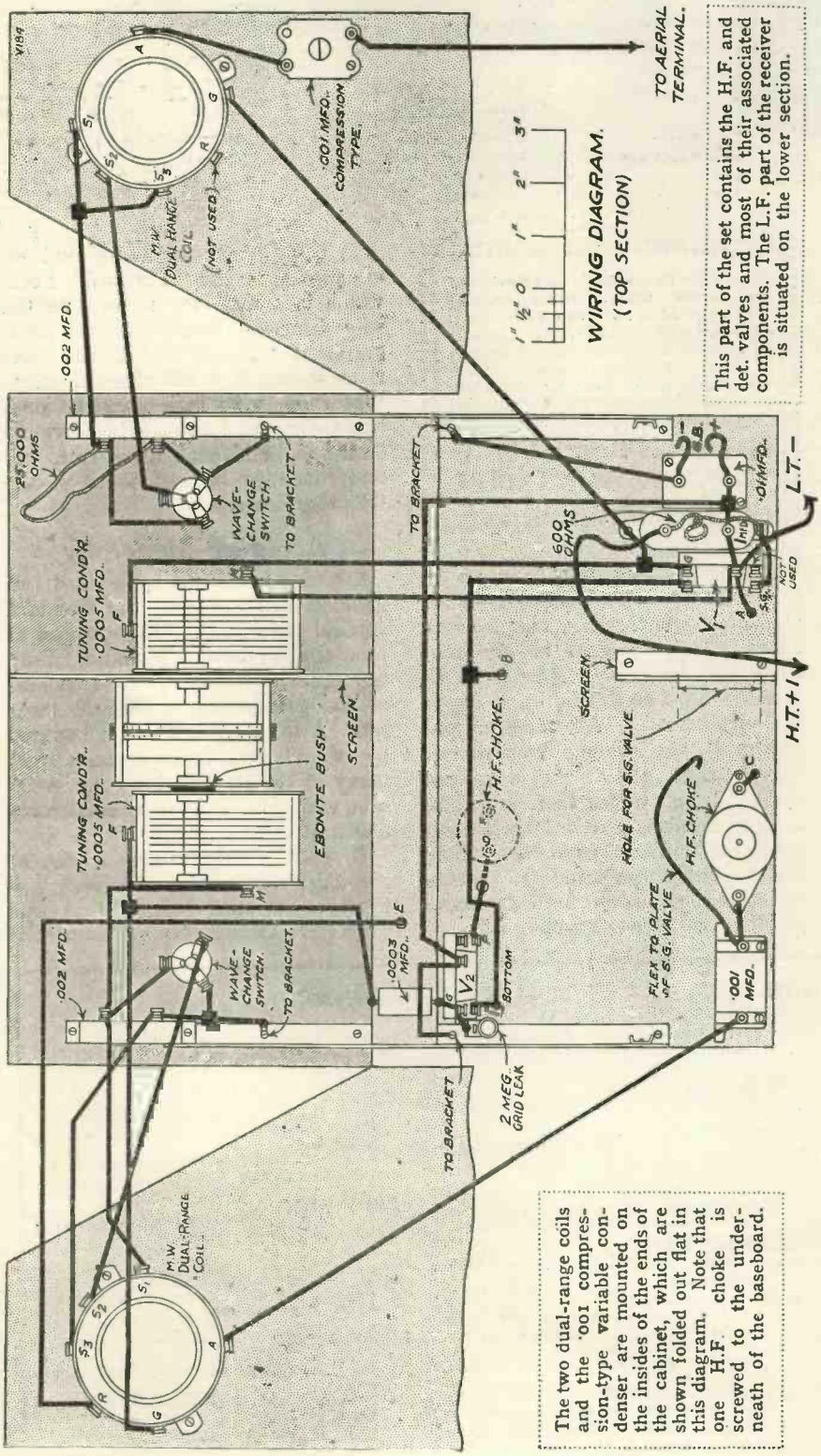
MISCELLANEOUS
1 screen, 7 × 3 in.
2 panel brackets (Collett, or similar hinged type).
4 plugs and sockets (Belling-Lee, or Clix, Eelex, etc.).
2 terminal blocks (Belling-Lee). Wire, etc.

sets has an advantage over the producer of sets for the home-constructor. The former is able to have special parts made to fit into little corners, and also can introduce constructional work requiring complicated tools to carry it out.

But although we started with this handicap, we can truthfully say it has been more than made up. A more compact and efficient general-purpose four-valver would be difficult to produce, and its appeal to the eye and its comfortably placed controls are certainly hard to beat.

When we tell you that its dimensions are little over 12 in. square and 7 in. deep you will begin to wonder what sort of arrangement has been employed to make it possible to get all the components in; and you may be surprised to learn that the circuit is quite a normal, efficient type of "M.W." scheme, and employs some of our latest and best ideas.

To appreciate this to the full you have only to look at the theoretical circuit diagram. Among other things, you will immediately spot the "M.W." dual-range coils and the "Interwave" system of coupling for long waves.



High Degree of Selectivity

The use of two of the efficient wave-change coils gives the set a high degree of selectivity, both on the medium and long broadcast wave-bands, and enables a very simple wave-change switching scheme to be utilised. The set will be found quite selective enough for all but the most intense "swamp" conditions.

The "Interwave" method of coupling, as you may know, gives immunity from medium-wave interference when working on the long waves. Also, when used in conjunction with the somewhat similar combined capacity-inductance long-wave coupling on the second dual-range coil, provides just the right degree of selectivity and efficiency over the whole long-wave band.

Interesting Volume Control

A component which requires a little explanation is the ·001 compression type variable condenser in series with the aerial lead. This is primarily for the purpose of controlling volume.

The ideal place to control volume is before the first valve of the set, because one is then able to feel that there is not much likelihood of an early valve being overloaded.

There is also another interesting advantage which accrues by having a volume control of this type.

The advantage we have in mind is that as the control is brought into use the selectivity of the set is increased. The control can, therefore, be used for increasing selectivity should this be found necessary to separate two stations.

A Valuable Control

With such a control it is often possible to receive a station free from another one which is interfering with it, and at the desired strength, by reducing the capacity of the aerial series condenser and using a little more reaction.

Since the set is a general-purpose receiver, and therefore will be used largely for local reception, it was not considered necessary to have the volume-control condenser mounted on the panel. It is quite a simple matter to slip the door at the back of

Its Systematic Layout Provides Perfect Control

the set open a little way and turn the volume control to maximum when it is desired to tune-in distant transmissions.

There is one other point requiring mention before leaving the circuit diagram. You will note that the output valve and the plate of the screened-grid valve are both supplied from the same H.T. tap, whereas the first L.F. valve has an H.T. lead all to itself.

Battery or Mains Unit

When working from ordinary H.T. batteries, the H.T.+3 and +4 taps can be joined and taken to 120 volts or so, and when the set is used with a mains unit separate tappings can be used (if they are available) for +3 and +4. The great advantage of doing this is that the two L.F. stages are much better separated and thus there will be less tendency for L.F. instability.

The difference in the anode current variations of the power valve and the H.F. valve's anode circuit, and the difference in the frequencies with which they occur are so large that there is no question of possible trouble by coupling them to the same tapping.

And now a few words about the general design of the receiver. It is built in two sections, arranged one above the other, and there are consequently two separate baseboards.

The top one has the sloping ebonite panel attached to it by means of special brackets. These brackets, one at either end, are hinged so that the panel can be placed at any angle, and then held rigid in that position by tightening up the small thumb-screws on the brackets.

Two Sections

This panel and baseboard carries the majority of the components for the H.F. valve and the detector. The piece of wood below the ebonite panel is attached to another baseboard, which carries the L.F. components.

You will thus see that the set is made in two sections, which are more or less completed before being fitted into the cabinet. The two dual-range coils are screwed, one to either side-piece of the cabinet, which can easily be assembled at home.

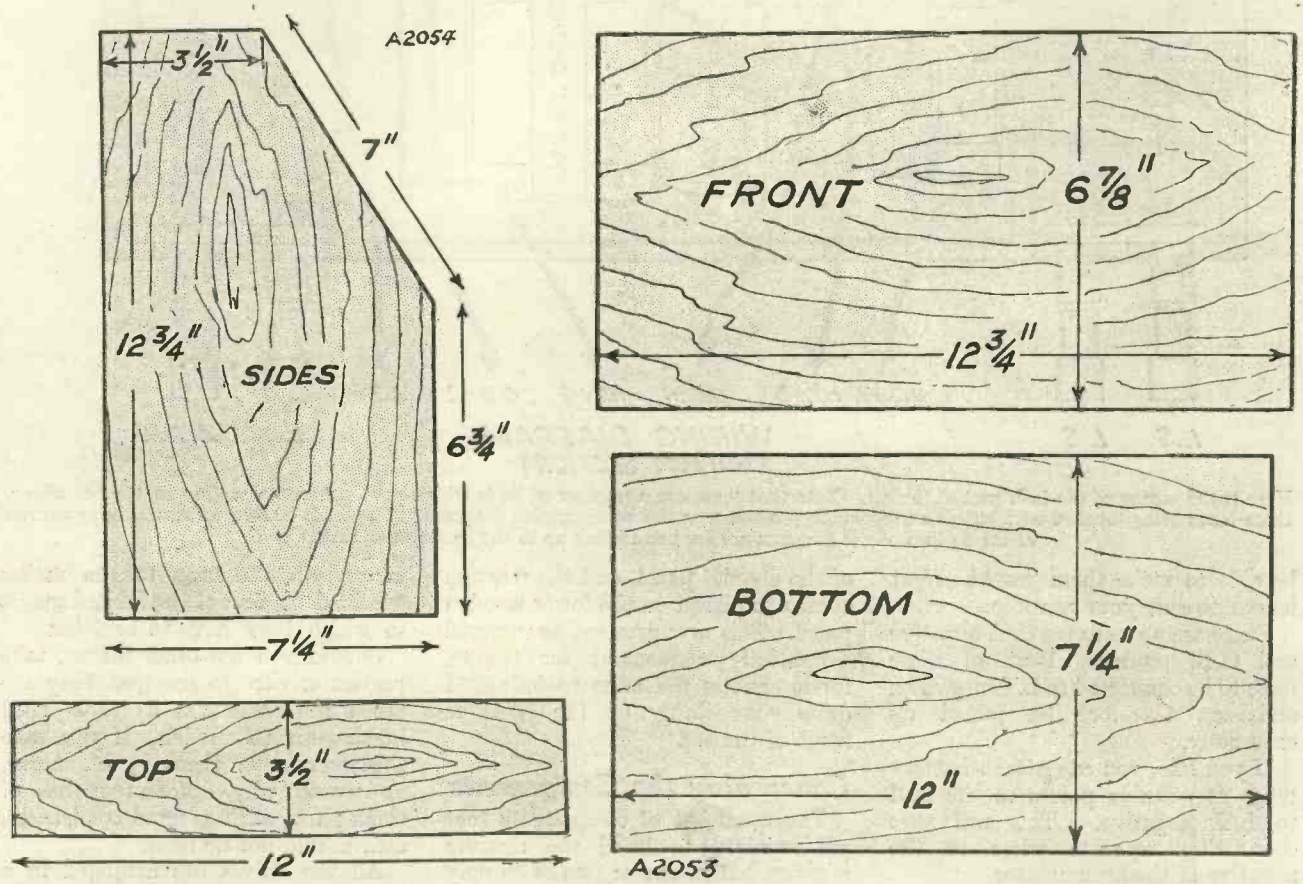
The back of it consists of a door which is hinged at one side, so that easy access is obtained to the interior of the receiver. Five holes have to be made along the bottom of the door—four for the plugs for aerial, earth and loud speaker, and one large one through which the battery leads are brought.

The External Connections

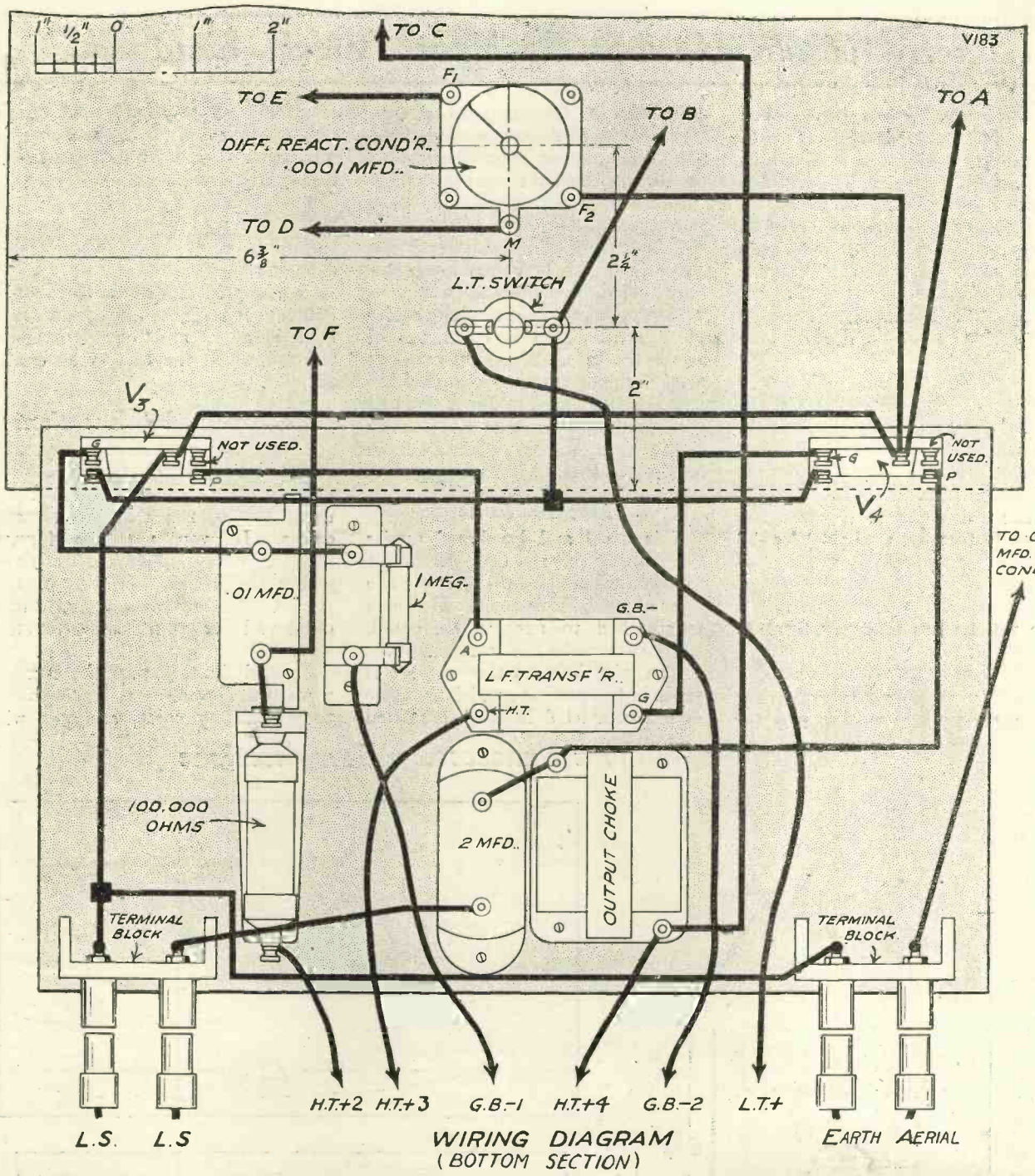
These leads can either be separate lengths of ordinary rubber-covered flex, or they can be combined by using one of the multiple battery cables. If you use the former method you can plait the leads together and secure the ends of the plait by binding with a few turns of thread or thin cotton-covered wire.

Treated in this way the flexible wires will be as serviceable as a proper battery cable, and you will

Compactness Without Unnecessary Complications



The construction is not as simple as that of many "M.W." productions, but if you follow the various diagrams closely you will find it quite straightforward, and well within your powers, even if you have had only slight previous experience of set building.



Here is the wiring of the L.F. part of the set. Note that there are a number of leads which pass up to the section of the set above, these leads being labelled with letters corresponding to those on the other wiring diagram. The leads shown terminating in arrows at the bottom of the diagram are for connecting up to the batteries or mains unit.

be able to make them just the right length to suit your purpose.

There are no leads for H.T. negative and G.B. positive. Both of these have to be connected to L.T. negative, and can therefore be joined up externally.

If you like, you can attach battery plugs at suitable points in the lead to L.T. negative. This will save connecting separate wires to the negative of the accumulator.

The drum-drive for the two tuning condensers is mounted in the centre of the ebonite panel, and the reaction control is placed on the lower wooden panel. This arrangement has proved delightfully convenient for tuning, for it enables the arms to be rested quite comfortably on the table in front of the set.

Concerning the Components

The usual list of components that are required to build the receiver is given, but in one or two cases only the makes of the parts actually used in the original are mentioned. It is advisable to keep to the makes specified, because of the limited spaces in which they have to be fitted.

Should you use other makes, take particular care to see that they are much the same size as those used in the original model. If you take this precaution there is, of course, no reason why different makes of small parts, such as fixed condensers, etc., should not be used.

All the valves are arranged in a horizontal position, and consequently it is necessary to have valve holders

There is No Hard-to-Fit Metal Work Included

which are fixed in a vertical plane. Valve holders of this type are normally of the 5-pin type, and this is the reason why such holders are used in the set. They must in no way be taken as a suggestion that the set is adaptable for A.C. indirectly-heated valves.

The 1-mfd. by-pass condenser for the 600-ohm de-coupling resistance in the H.T. supply circuit of the screening grid is of a special three-terminal type. Two of the terminals are across the actual condenser, and the third is a spare terminal provided specially for a resistance of the Spaghetti type.

Simple Screening

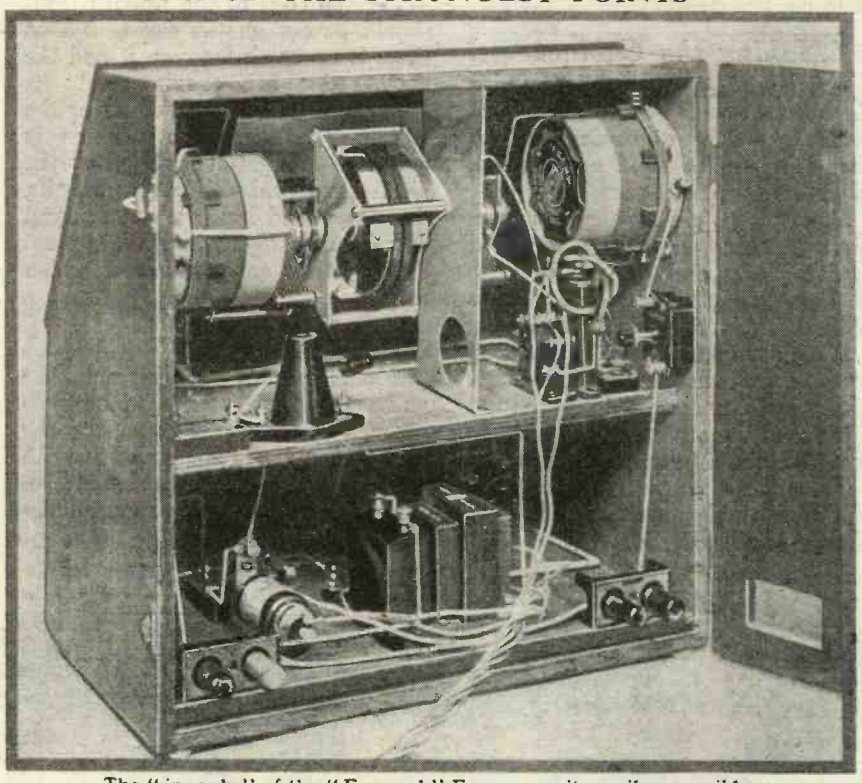
The condenser itself is not connected across the usual two terminals, but between the terminal on the side and the top terminal nearer to it. The other top terminal is the blank one.

Very little screening is necessary, chiefly because the two coils are so well spaced. However, a small vertical screen is attached to the metal of the drum tuning frame.

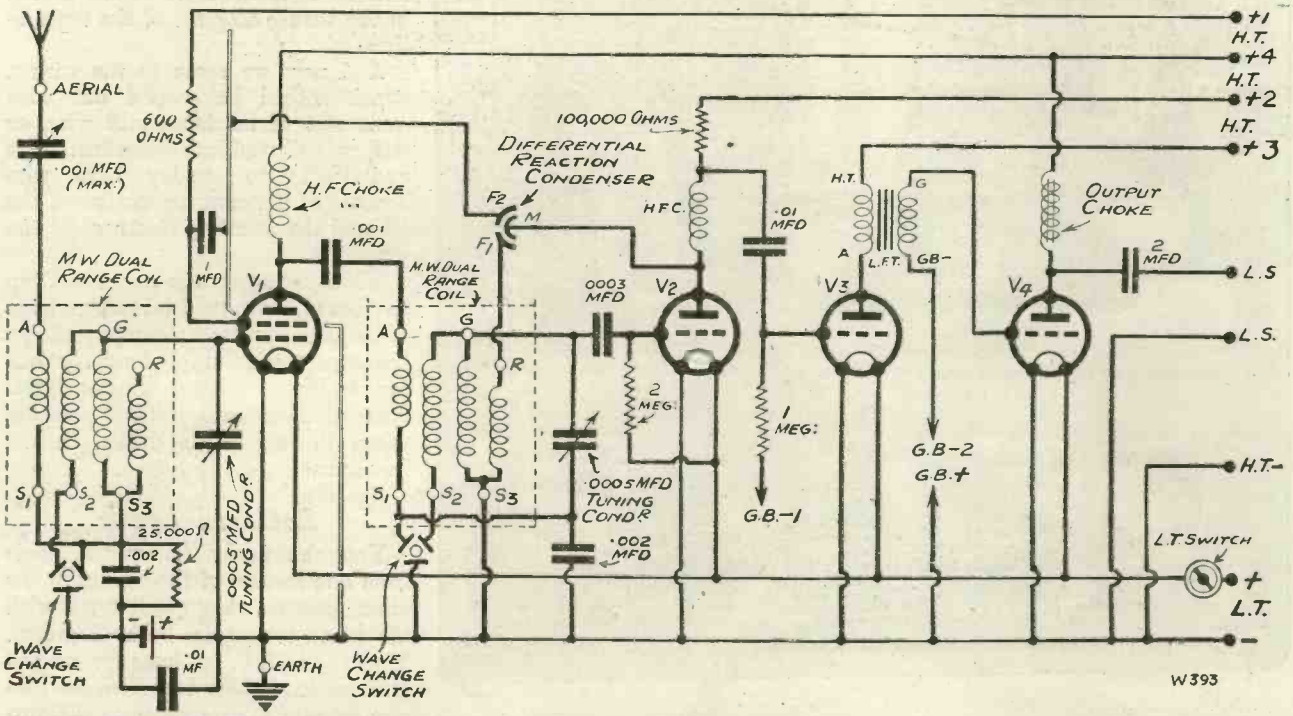
There is a fair amount of metal in this frame assembly, so that adequate screening is thus provided. Just behind the panel, near to the drum control, is a small sheet of aluminium. This is part of the complete condenser assembly, and has been omitted from the wiring diagram for the sake of simplicity.

So far as the constructional work is concerned, there is no need to go into details about drilling the panel, wiring up, etc., in the usual way,

ONE OF THE STRONGEST POINTS



The "innards" of the "Forward" Four are quite easily accessible.



You will note that the main features of this effective circuit are two "M.W." dual-range coils, which together give great selectivity, and comprehensive precautions against battery coupling have been taken, while many other modern schemes, such as aerial input volume control, differential reaction, etc., all assist in making the set a hot-stuff instrument.

The main part of the constructional work is carried out in quite a normal manner, with the exception that perhaps a little more patience is required when wiring up.

We will therefore confine the remarks so far as constructional work is concerned to enlarging upon the various points which call for special mention.

Making the Cabinet

First of all, you should assemble the cabinet; or, if you prefer, have it made up. The dimensions of the various pieces of wood required are given on a previous page.

You will note that the two side-pieces overlap both the top and bottom pieces, and the back overlaps all four. The front piece of wood is of three-ply, as it serves for a panel.

If you have the cabinet made up for you, you should make sure that the front is just screwed on, and not dovetailed in any way, as it has to come off like a panel with the lower baseboard. A couple of small fillets will be required on the sides to support the top baseboard.

The bottom baseboard is 7 in. deep, and the top one 6½ in. The latter is made smaller to allow room for the wires which pass down between it and the door. Incidentally, the door need be opened only a little way in order to give access to the volume-control condenser which is mounted on the side of the cabinet.

The top edge of the wooden front should be cut on the slope, so that there is no crack between it and the bottom edge of the ebonite panel.

In the main the work of fixing the various components in position is normally straightforward. But the ·0003 fixed grid condenser and its associated grid leak are not screwed down in any way, being held in place by the wires or terminals to which they are attached.

The Panel Brackets

When you are working out the positions of the screws which pass through the ebonite panel for the panel brackets, do not forget that the brackets are ⅜ in. from the ends of the panel, and not close up to the edges.

The vertical screen is linked up with the framework of the drum condenser by being bolted on to the end of the main drum frame by means of one of the bolts which pass through this frame. A hole for the valve is, of course, required in this screen, which may need cutting about a little so far as the edge next to the variable condenser is concerned, in order to make it fit fairly close to the framework.

Coils and Condensers

If you are doubtful whether you will manage to connect up the coils while they are screwed to the cabinet sides, you can wire them up with pieces of flex about the right length, and screw them in place when all the wiring is completed. Otherwise they should be screwed in place right away.

The variable condenser assembly will be supplied complete with insulating bushes for both sections, to insulate them from the main framework. Only one section has to be insulated, namely, the right-hand one. (Once again as you look at the set from the front.) The other has to be clamped up so that it makes contact with the framework and so joins the latter to L.T. negative.

Under the Baseboard

One of the H.F. chokes is mounted on the underneath of the top baseboard. It is therefore shown dotted in the wiring diagram of the top section.

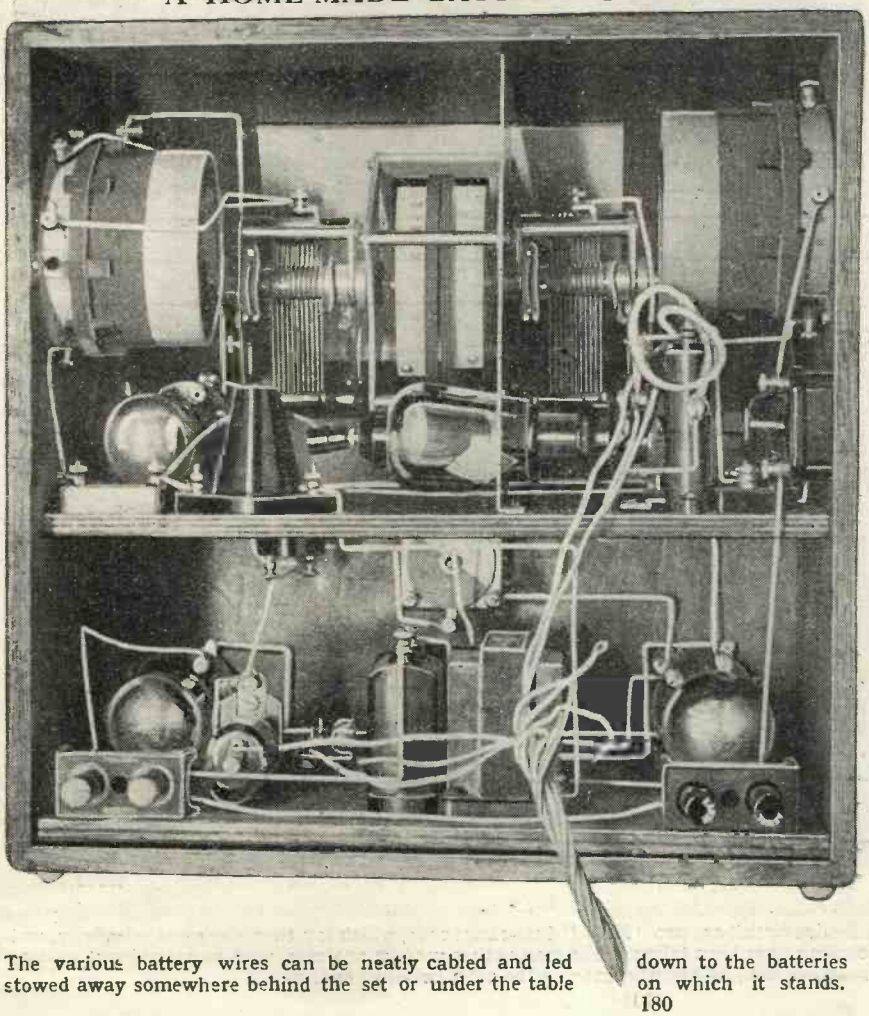
And now we come to the wiring, which should be carried out with some sort of insulated stiff wire, or stiff wire slipped into Systoflex. It is undesirable to employ bare wire because of the compact nature of the set and the resulting closeness of the wires.

When wiring up the panel and top baseboard, leave the leads which have to be joined up to the components on the lower section amply long, for they can easily be nipped shorter later. Some of these leads you will note are taken through holes drilled in the baseboard.

Lettered Leads

You can easily follow the leads from one section of the wiring to the other, because they are lettered with the same letters in both diagrams. Thus the lead C, for instance, on one H.F. choke, is joined up with the lead also labelled C running from the output choke in the lower section of the receiver.

A HOME-MADE BATTERY CABLE



The various battery wires can be neatly cabled and led down to the batteries stowed away somewhere behind the set or under the table on which it stands.

Powerful Loud-Speaker Results From Many Stations

If you intend to wire the two wave-change coils up while screwed in place, you should cut the wires as near as possible to the exact lengths required. Then when all the other components on this section are connected, join up the wires which go to the coil terminals on the panel side of the coils. You will have to do this with the panel forward and not sloping back in its final position.

The remaining coil connections can be made from the back of the set. It is as well to connect up the 1½-volt cell for grid bias to the H.F. valve, and place it in position before putting the top section in place.

Simplifying the Wiring

Note that for convenience the brackets supporting the panel are used to make certain connections. There is no objection to this, for quite good contact is ensured by the clamping screws which hold the bracket rigid and thus make the contacts sound.

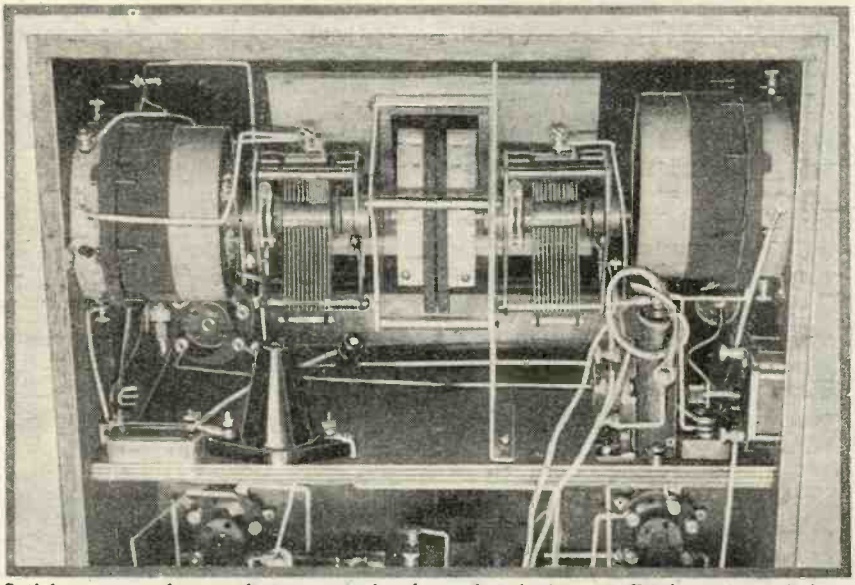
The left-hand bracket, which is connected up to grid bias, is not at earth potential, and must not be earthed on any account.

The particular make of grid leak employed for the detector valve is supplied with two short lengths of tinned wire permanently fixed to its ends. These are clamped direct under the grid and positive filament terminals of the detector valve holder.

It merely remains to discuss the operation of the receiver, though it has quite a normal circuit, and those who build it will no doubt have had some experience in tuning with two tuned circuits. Actually you will find that the two condensers keep largely in step, and therefore can both be moved together with one thumb.

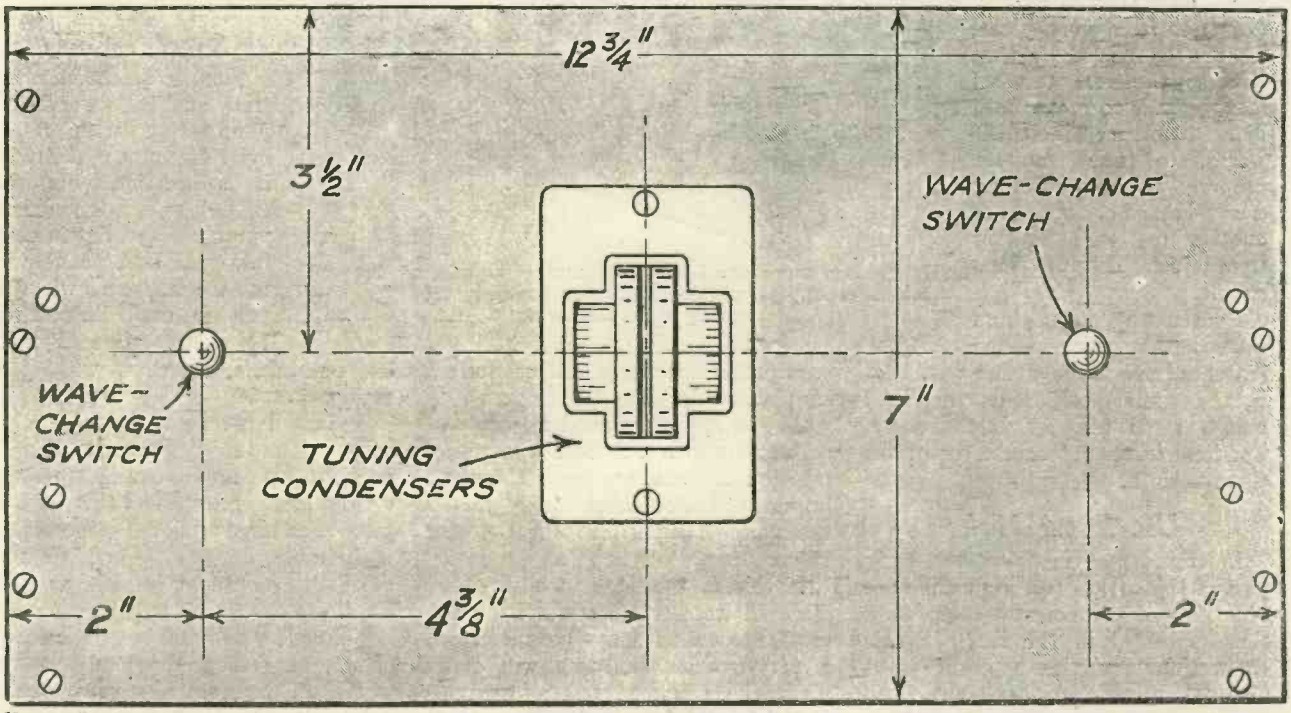
The set is suitable for 2-, 4- or 6-volt valves, and will give excellent loud-

IT USES TWO OF OUR NEW COIL UNITS



Satisfactory panel wave-change control and complete dual-wave effectiveness result from the use of two "M W." dual-range coil units.

The Control of the Set is Remarkably Simple



Unusually clean lines and symmetry of appearance characterise the "Forward" Four, of which the dimensions of the panel are provided in the above diagram. The two drums of the condensers can be rotated individually or together, so that very accurate tuning can be obtained, though the advantages of ganging are retained.

It is Selective as Well as Very Sensitive

speaker results on many stations. It is also quite suitable for use with either a mains H.T. unit or with H.T. batteries.

The first valve is naturally an S.G. type, the second being either an H.F. or special detector type, the third an L.F. type and the last a power or super-power valve. With dry H.T. batteries it is advisable to use a small power valve, unless you have very large capacity cells.

The statement that the condensers will most likely keep in step for the greater part of the tuning range does not necessarily mean that both dials will have exactly the same reading.

Correct Tuning

What is meant is that once they are put in step at a certain point searching can be largely carried out simply by moving both thumb-drives at the same time and the same amount. The best way to get them in step at first is to tune in a local or other loud transmission.

Incidentally, you may find that if when tuned to a powerful station you move one drive only a small way that selectivity does not seem very great. Do not be misled by this, because the real test of selectivity is to move both dials together; in other words, to tune the set properly to a quite near wave-length. This is another matter altogether from just detuning one circuit.

By the way, for medium waves both the wave-change switches have to be pulled out, that is, the same position as the L.T. switch when the set is tuned on. For long waves, of course, you push them both in.

Use Same Make

Reference was made in the early part of this article to the possible use of makes of components other than those specified in the list. In this connection there is a small point about the wave-change coils which we ought to mention.

To obtain the "in-stepness" of the tuning just mentioned, the coils must be more or less balanced. Without actually deviating from the proper specification in any way, it is possible for two different makes of "M.W." dual-range coils to tune to a certain wave-length at quite different readings of a given condenser, and so make single-thumb tuning over a wide range impossible.

Smooth Reaction

For this reason we strongly advise you to obtain two coils of the same make, whatever it is. You will thus ensure that searching will be quite a simple matter.

As you know, for good reception of distant stations a smooth control of reaction is necessary, and the most important factor in obtaining this is the voltage applied to the detector valve.

If this is too high, whilst signal strength from stations which do not require reaction may be increased, a very sudden build-up will occur when the reaction condenser is adjusted to give feed-back. The actual voltage on the plate of the detector valve needs to be as low as 20 or 30 sometimes for best results.

The Detector Voltage

So that adjustment of H.T. voltage on the detector valve of the "Forward" Four can be made without upsetting the H.T. for another stage, it is given an H.T. terminal all to itself.

But don't forget when adjusting the voltage to this terminal (which is H.T. +2), that the detector valve is fed with H.T. via the 100,000-ohm resistance.

Therefore, the voltage applied will be considerably higher than that reaching the plate of the valve, and you may quite likely find that 80 volts or so can be used satisfactorily.

The detector valve H.T. is not the only voltage which requires proper adjustment. The grid-bias voltage to the screened-grid valve needs a little attention.

As a general rule it is quite O.K. to apply 1½ volts irrespective of the filament rating of the valve. But sometimes for best results—and who does not want them?—it can be higher.

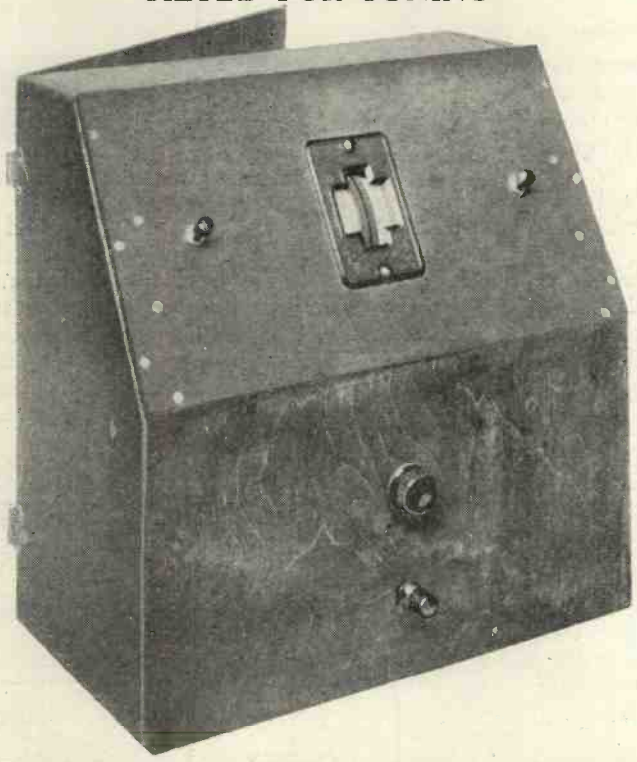
Special Cells

This is a matter for trial, and it is worth experimenting with 3 or even 4½ volts. Actually it is occasionally stated that ·9 volt is the correct voltage to use, but in very few cases is it possible to tell the difference when ·9 volt is used instead of 1½ volts. Special cells are obtainable, however, with this rating.

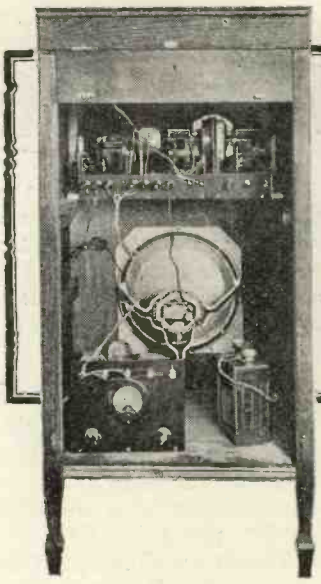
A very large aerial is not necessary with the "Forward Four," which will give quite excellent results on an indoor aerial round the picture-rail. Too large an aerial is almost as undesirable as a tiny one, so use a smallish outdoor aerial as the ideal.

You will find quality particularly good, therefore use a loud speaker worthy of the set. If a super-power valve is employed there will be ample power for a moving-coil speaker.

TILTED FOR TUNING



By "raking" the panel back the tuning controls are brought into a beautiful position, both for handling and for easy reading of the dial numbers.



RECORD RADIO RECEIVERS

SOME MORE SPECIAL NEWS FOR HOME-CONSTRUCTORS

THE modern radio set is a source of complete entertainment. At least two programmes are within the reach of anyone, wherever he may be in the country, and even if he has only quite modest apparatus. But a gramophone pick-up adds still further to any set's possibility.

It is quite wrong to suppose that successful electrical reproduction of records can be accomplished only with powerful, intricate, and expensive amplifiers. Very pleasing results are possible with pick-ups used in conjunction with straightforward, simple radio receivers.

But only if you go the right way about it. During the past months a number of articles have appeared in MODERN WIRELESS giving full details for the conversion of existing sets, and the designing of new outfits so that records can be reproduced on loud speakers.

Tone Adjustment

And it has been pointed out that the mechanical method can be beaten without difficulty by anyone who cares to take just a little trouble. Obviously, the ordinary gramophone has to take the records more or less as it finds them. But the electrical system enables compensation to be provided for the inherent failings of all recordings. Any good modern pick-up will be designed to that end. And it is possible to arrange the L.F. portion of a set so that further "balance" can be introduced.

These facts are being more widely appreciated, and it is because of the ever-increasing popularity of the pick-up that the MODERN WIRELESS Research Dept. has of late concentrated on the problem of obtaining this adequate treatment of pick-up impulses in the L.F. section of a set without in any way sacrificing the effectiveness of the radio side.

THE MARCH ISSUE OF "M.W." WILL BE ON SALE FEBRUARY 28th. PRICE ONE SHILLING.

We have frequently referred to this problem in the past, and have, indeed, indicated methods of arriving at its successful solution; but next month we propose to give additional prominence to this.

Practically all the sets to be described have been designed specifically to deal efficiently both with radio and records.

We must make it plain that we do not claim this to be a revolutionary development. Many previous "M.W." sets have been able to take a pick-up without any interference being caused with their radio reception abilities. Nevertheless, we will show you next month that there still remained much to be done in the development of the technique of radio-gram design.

Perfect Control

Hitherto it has been thought, rightly or wrongly, that the radio-gram had a limited appeal; but whatever its status in the past, it is obvious that this is far from the case to-day. No doubt the improvement in the quality of radio reproduction has done much to make listeners dissatisfied with their mechanical gramophones.

Not that the quality given by up-to-date gramophones is poor, but many have old machines; and, in any case, there is no comparison between the mechanical and the electrical in point of volume control; a pick-up output can be modulated from anything from a mere whisper up to full strength,

(*Continued on page* 246.)

By the Technical Editor

On the

"M.W." Dual-Range Coil

WE have now had an opportunity of testing "M.W." dual-range coils made by Radio Instruments. Our test, although thorough, was of a formal character. That is to say, we tested them because it is the practice of the Research Department to make scrupulously close examinations of everything submitted to it.

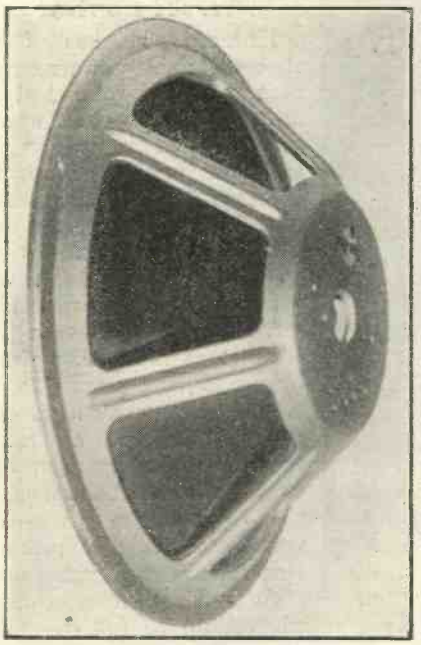
But, as was anticipated, we found that the R.I. coils reached the highest possible standard. They are every bit as good as those original coils from which the specification was drawn up. Additionally, the R.I. coils are of particularly substantial construction.

The windings are tight—there is none of that "give" such as is to be found in some versions, and the material throughout is of the highest possible quality.

The terminals, too, are clearly marked with neat little tabs, and this makes it much easier to carry out the various connections when the coil unit is mounted on a baseboard.

While it has nothing at all to do with the operation of the coil, there is another feature of the R.I. that deserves commendation. This is the round, engraved label that is fixed on the top. It gives a finish to the component, makes it look a thoroughly professional job.

It may be argued that appearance in a device intended for behind-panel accommodation is of little moment. We do not agree with that, for we are sure that every conscientious constructor likes his set to look as neat behind the panel as in front.



The Blue Spot Special Chassis.

Precision Components

By the way, every "M.W." dual-range coil made by R.I. is tested both for inductance and wave-length.

Practical proof of their close adherence to standard was afforded us when we connected three of these R.I. "M.W." dual-range coils in a special wave-change band-pass we were experimenting with.

The matching was astoundingly precise.

In conclusion, we cannot refrain from mentioning that this is the first time Radio Instruments have made, for wide circulation, any coil or coil unit other than one of their own design. From this one is able to infer two things. First, that R.I.'s consider it a good coil unit; secondly, that they anticipate a wide demand for it.

All those who have used a set employing the "M.W." dual-range coil will be able to endorse the first remark; it remains for those who know a good thing when they see it to ensure that the second develops into a concrete reality!

Ferranti Radio Testing Leads

Messrs. Ferranti, Ltd., are making radio testing leads that should prove particularly useful for experimenters and dealers. These leads are sold in pairs at 5s. per pair. Each lead comprises about a yard of high quality flex, terminating at the one end with a substantial spade, and at the other with a sharp-pointed prong fitted with a bakelite-moulded handle.

The colour scheme is red for the one lead and black for the other. Now Ferranti's are people who frequently experiment with millions of volts, and, remembering this, it will be unnecessary for us to refer to the robust lines on which these leads are constructed.

Acid Resisting

But a point that needs special reference is that the prongs are made of Eureka, in order that they shall have good acid-resisting properties. This makes them able to stand up to the job of measuring accumulator voltages in garages, etc.

Even more compact, although the photo doesn't do it justice for this, is the 28P Blue Spot Chassis.

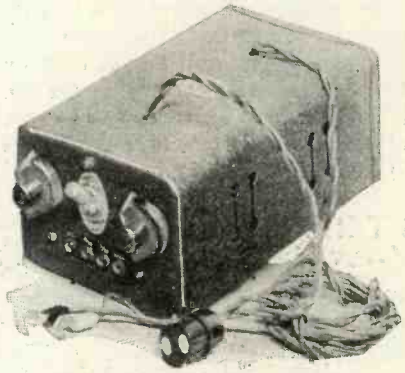
Test Bench

Impartial and critical comments concerning new products due to Radio Instruments, Ferranti, British Blue Spot, Tannoy, and Burndept.

As a further preventative of corrosion the prongs are treated with an anti-sulphuric enamel. Finally, it may interest readers to learn that the sample leads sent us are being retained by the Research Department, where they will prove exceptionally useful.

New Blue Spot Products

The Major Blue Spot chassis embodies a large diaphragm, and many constructors must have found it



This is the C.P.2. Tannoy unit.

difficult to incorporate this very efficient article in the smaller kinds of cases and cabinets.

Realising this, the British Blue Spot Co., Ltd., has now introduced a Special Chassis which is quite a bit more compact than the Major. The Special Chassis retails at 10s. 6d., and will take any Blue Spot unit.

Gives Good Results

Constructors who have to employ this smaller chassis need not fear that they are losing much. Careful comparative tests convince us that the "Special" falls very little short of the "Major" in performance. Indeed, it takes a very critical ear to tell that the "Major" is superior. The human ear is tolerant, and one loud speaker has to be quite a deal better than another before the first is appreciable.

Where there is sufficient room to accommodate it, we would advise the use of the Major, but, as we have indicated, a constructor who perforce has to employ the smaller chassis will still be in possession of a goodly quota of Blue Spot quality.

There is an even smaller Blue Spot chassis making its appearance coincident with the Special. This smallest one of the whole Blue Spot family is known as the 28P. It has been designed in two models, one for the 66P and the other for the 66K unit; it is not considered that justice is done to the R unit by using any smaller chassis than the Special.

The 28P chassis in combination with its appropriate unit operates excellently.

It forms a very bright little speaker that has quite respectable bass, and which has that pleasing definition that makes Blue Spots stand so far above many other electro-magnetic assemblies.

Mains Units for Portables

Portable sets do not always take kindly to mains units. For one thing, when used on the mains they often tend towards instability. Successful mains operation on *ordinary* sets demands fairly efficient separation in any H.T. unit used, but in the case of the portable this is even more vital.

The new portable unit C.P.2, made by Tannoy Products, is perfectly satisfactory. It is a combined H.T. and trickle-charger device, and thus provides a complete solution to the power problem for portables. The trickle charging for the L.T. accumulator is automatically controlled—when you switch the H.T. off the L.T. accumulator is put on charge.

The Tannoy C.P.2 employs a Westinghouse full-wave metal rectifier for both H.T. and L.T., and there are two variable output tappings in addition to one fixed maximum.

The unit is remarkably compact and occupies no more space than a standard 108-volt battery. Nevertheless, the smoothing is adequate and the H.T. output ample for any ordinary portable set. It is supplied for A.C. mains of from 200–250 volts. The price is £5 10s.

A Burndept A.C. Set

The Burndept A.C. receiver de-luxe illustrated on this page includes one

The "M.W." Dual-Range coil as made by Messrs. R.I.

stage of screened-grid H.F. amplification and one of those new A.C. pentode valves. There is a valve rectifier. A pre-detector volume control, friction-coupled tuning drums and an indicator lamp are other features.

As can be imagined, it is a particularly powerful set for its moderately limited number of valves, and with a proper outdoor aerial it is capable of providing many programmes at full loud-speaker strength.

Its two wave-bands are 210-560 and 900–2,100 metres, and it retains its smoothness of control over the whole of both ranges. In a quite short test we were able to receive some 18 or 19 stations, all of which were well worth listening to.

In regard to selectivity, this Burndept receiver is also first-class. A table model of the same set is now available.

The Burndept A.C. receiver is an excellent example of the way modern sets are built as pieces of furniture rather than purely as scientific devices.

A NEW TELEVISION SYSTEM

Some brief details of the H.M.V. method of televising cinematograph films.

JUST prior to the opening of the Physical Society's exhibition I had an opportunity of seeing the H.M.V. system of television. This system appears to differ in some respects from anything seen previously in this country, and though it is by no means in a condition to be placed before the public, yet as a scientific achievement it cannot be overlooked.

Entertainment Possibilities

In their researches the H.M.V. engineers have kept one goal in view, that of entertainment, for they argue that television can be no real good unless it provides real entertainment. So they set out to develop a scheme by which films could be transmitted by television from one place to another, and projected upon a screen with sufficient illumination for a large crowd of people to witness

in the ether, and this fact completely prohibits the use of "detailed" television on ordinary broadcast wave-lengths.

So H.M.V.'s have cut down the frequency band as much as possible by using five separate channels; this in broadcasting terms would mean five separate wave-lengths, and in terms of land-line it means five separate land-lines.

You will see better what happens from the diagram which shows the transmitter on the left, the photo-electric cells and amplifier in the middle, and the receiver on the right-hand side.

The light from the revolving lenses is thrown on to five photo-electric cells in the panels shown in the centre of the diagram. After amplification, five lines take their respective sections across to the receiver. The

synchronised by means of a special motor controlled by a special synchronising device coupled to the shaft of the projector, and the mirrors move in place at exactly the right time, and reflect the modulated light through a lens on to a translucent screen.

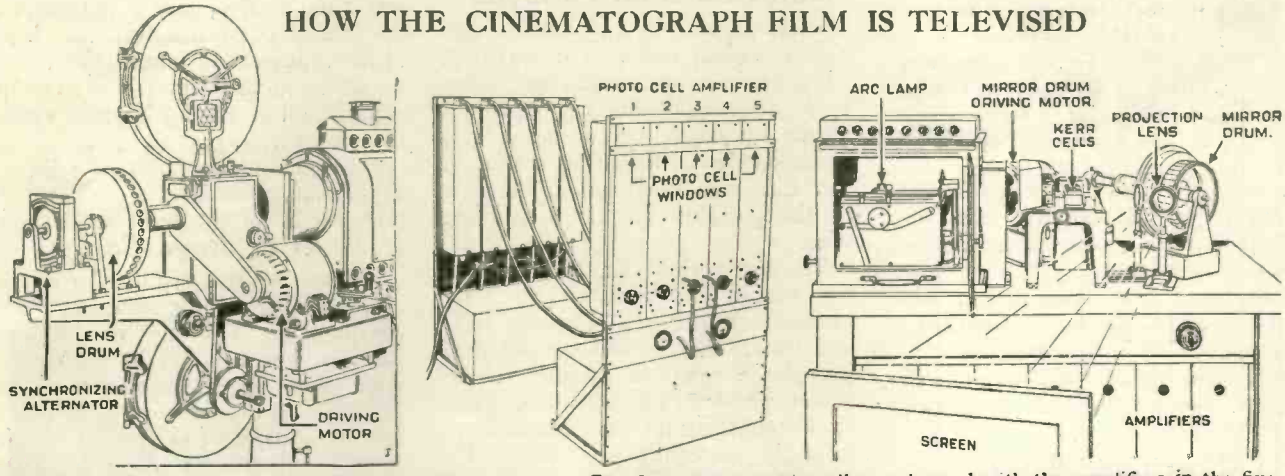
The scanning of the picture is rather slow for really comfortable watching; it is rather trying to the eyes in that there is not complete blending of the five sections on the screen.

Combining the Sections

Each section, however, taken by itself, is practically perfect, so that in a view of London in which there is a policeman directing traffic, and contained completely in one section, the figure of the policeman and his actions would come out just as well as they do on the ordinary cinematograph screen. It is where the other sections of the picture join up that the trouble seems to occur.

No doubt this will be got over by further modifications, but, even so, it is difficult to see where the exact value of this system of television is to lie. If it cannot be "radioed"

HOW THE CINEMATOGRAPH FILM IS TELEVISED



The three main sections of the H.M.V. television scheme. The five photo-electric cells are housed with the amplifiers in the five-sectioned panel shown in the centre. On the right is the receiver with its arc lamp and revolving mirror drum.

nearly. This is no small task, but from a laboratory point of view they have undoubtedly achieved a good deal.

In order to get sufficient detail in a televised image a very large number of scanning points must be transmitted, and this is where a very big snag lies, because you very soon get into really high frequencies, and to send high-frequency impulses over either radio or land-line is a difficult business. If you have a very high modulation frequency and try to transmit it over radio you will take up a tremendous band of frequencies

source of light here is an ordinary arc lamp. This shines on to five Kerr cells, which are connected through further amplification with the impulses coming from the transmitter.

Revolving Mirrors

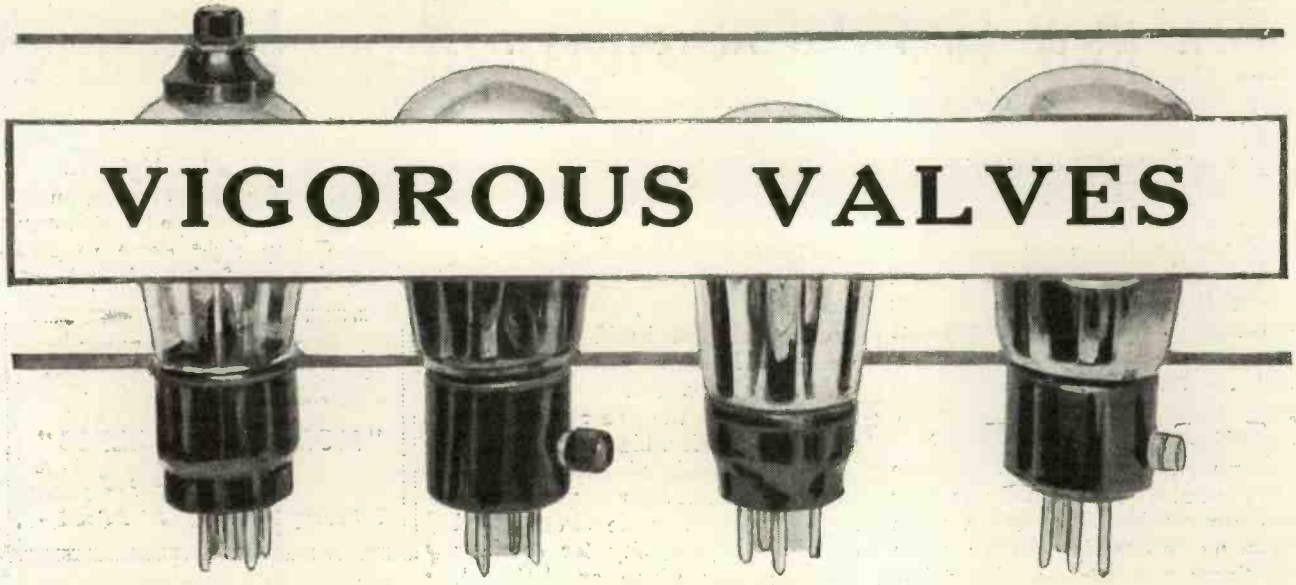
These Kerr cells vary the amount of light they pass according to the strength of the impulses received, so that the light from the arc lamp is varied before it strikes the revolving drum shown on the right-hand side of the diagram.

This revolving drum of mirrors is

with any degree of ease, in my opinion fully 80 per cent of the value is lost.

From a laboratory point of view (and, in all fairness to H.M.V., it is as an experiment that the designers look at it) it is extremely interesting, and it is to be hoped that H.M.V. will push forward in their experiments.

It will be a long time before we have television in our homes, but it *will* come, and large concerns like the Gramophone Company have the best chance of successfully solving the problem. K. R.



VIGOROUS VALVES

More magnification is the motto of the British valve manufacturers, who, as will be seen, are improving their valves by leaps and bounds. A brief review of some of the latest "models."

By K. D. ROGERS

AN unusual title, perhaps, but I think it is justified, for I want to discuss quite briefly some of the latest valves that I have had under test. And very vigorous they are, too! Especially the latest two-volters I have come across.

As a matter of fact, quite a large number of valves have been released during the last few weeks; valves that will be valuable additions to the ordinary series. For instance, there is the Mullard P.M.2A. and the new Marconi "P" and "C" series, to mention only two makes concerned.

Low Current Consumption

The Mullard P.M.2A. is a two-volt valve having a filament consumption of ·2 amp. Designed for an output stage, it has an anode impedance of 3,600 ohms, and the remarkably high magnification factor of 12·5, giving it a mutual conductance of 3·5. It is thus pretty well on a par with the mains type of valve using an indirectly heated cathode.

It will be found that the L.T. current consumption is extremely moderate, and at 100 volts H.T. and normal grid bias the anode current consumption is only 5 milliamps. The valve is therefore ideal for use in the output stage of a portable receiver in which economy of both high- and low-tension supply is of vital importance.

Input and Output

But it will not be for only portable receivers that this valve will be welcomed by the average constructor and set user, for economy of H.T. is of vital importance whatever the set used, unless the anode supply is being taken from the mains, so it is assured popularity among a very large number of our readers. As a matter of fact, we understand it has already been specified by a number of the leading set makers for use in their receivers.

The maximum H.T. permissible with the valve is 150 volts, and at this voltage it needs somewhere about 6 volts grid bias. It will therefore not carry a very great grid swing, but it will give a big output for a small input and so is extremely valuable for all ordinary sets.

THE LATEST S.G. MAINS VALVE

LOW IMPEDANCE AND HIGH MAG.

This is the most recent addition to the ranks of S.G. A.C. valves. It has an impedance of only 257,000 ohms and a mag. factor of 900.

Now let us turn to the Marconi L.P.2 and the P.2, which belong to the new series of two-volters which have been recently brought out and which promise to become very popular.

The L.P.2 and the P.2 are more or less logical sequences of the original P.2 valve which some time ago set a new standard of efficiency in the two-volt range. The L.P.2 is a small power valve with a 2-volt ·2-amp. filament, and has an amplification factor of 15 with an impedance of 3,900 ohms.

High-Stage Gain

These characteristics render it capable of providing sufficient power output for domestic requirements with an unusually low H.T. consumption, combined, of course, with a stage gain comparable almost to that of a small pentode. The grid bias advisable is 4½ volts for 150 volts on the anode for all ordinary cases, but Marconi's recommend 6 volts for such cases as portable receivers where special economy is necessary. At −4½ the anode consumption is 11·5 milliamps, and at grid bias −3 and 100 volts anode the current is 5·2.

Real Economy

The Marconi P.2 is a super-power valve consuming something like 17 milliamps at maximum anode voltage, and having an amplification factor of 7·5 and an impedance of 2,150 ohms. It is capable of sufficient output for driving a large cone or moving-coil loud speaker at quite good volume, though it is remarkably economical, and with careful biasing is suitable

The Race for Valve Supremacy is Keener than Ever

for use in the last stage of portable or other small receivers.

The grid bias is $-10\frac{1}{2}$ with 150 volts H.T. In the case of the P.2 the special " economy setting " of the bias is advised by the makers at the same $-10\frac{1}{2}$ volts, with 125 H.T. instead of the 150, giving an anode current consumption of 9 ; nearly 50 per cent reduction on the total anode current with 150 volts H.T.

Two Remarkable Types

These are two very remarkable valves, and should certainly be very carefully considered by readers when replacing valves in sets or when building a new receiver. The prices are 10s. 6d. for the L.P.2 and 13s. 6d. for the P.2.

Messrs. Tungsram have recently added to an already interesting list of A.C. valves the P.430, which is a directly-heated valve having a short filament and taking only ·3 of an amp, at 4 volts. It is designed for anode voltages of 150 to 250 volts, and has a high amplification factor. The anode current consumption at maximum H.T. and proper grid bias, which is 32 volts, is about 45 milliamperes.

The valve is certainly a very interesting and useful output valve for A.C. sets. It will carry quite a sufficient grid swing and give sufficient power for operating moving-coil speakers, and is sure to find a home in many listeners' sets.

Remember the Screening

And now I want to mention the Mullard S.4V.B., the fairly recently marketed screened-grid A.C. valve using an indirectly-heated cathode. This valve has a remarkably low A.C. impedance (of the order of 257,000 ohms), but with a high magnification factor. It thus is suitable to be used in sets which have not particularly high impedance anode circuits, and obviates the necessity for specially designed coils where an A.C.-S.G. valve is used, though, of course, the extra high magnification means that better screening must be used. This S.G. valve is probably the most useful for general purposes of the three Mullard A.C. S.G.'s, and it can be confidently recommended to home constructors looking for a really good A.C. valve.

The Mazda valves have also been altered somewhat, the S.G. Mazda A.C. has an amplification factor of 12,000 and a mutual conductance of 3. It is capable of giving wonderful results provided it is properly screened. The next on the list is the A.C./H.L., which has an impedance of 11,700 ohms with an amplification factor of 35. This is a highly efficient detector or first L.F., having an exceedingly steep slope. Following this we drop right down to 2,650 ohms, where we find the A.C./P.

NEXT MONTH

The March

"MODERN WIRELESS"

will be on sale

February 28th. **Price 1 -**

It is a small output or second L.F. valve, having an amplification factor of 10 and carrying a grid swing of 12 to 15 volts either way. It has a maximum anode dissipation of about 5 watts.

The "Big Noise"

Next to this, where larger loud-speaker results are required, we have the A.C./P.1, with an amplification factor of 5 and an impedance of 2,000 ohms. This valve will dissipate 6 watts and takes a grid bias (at 200 volts H.T.) of 30 volts.

They are very high-efficiency valves, the A.C./H.L. being a most remarkable product.

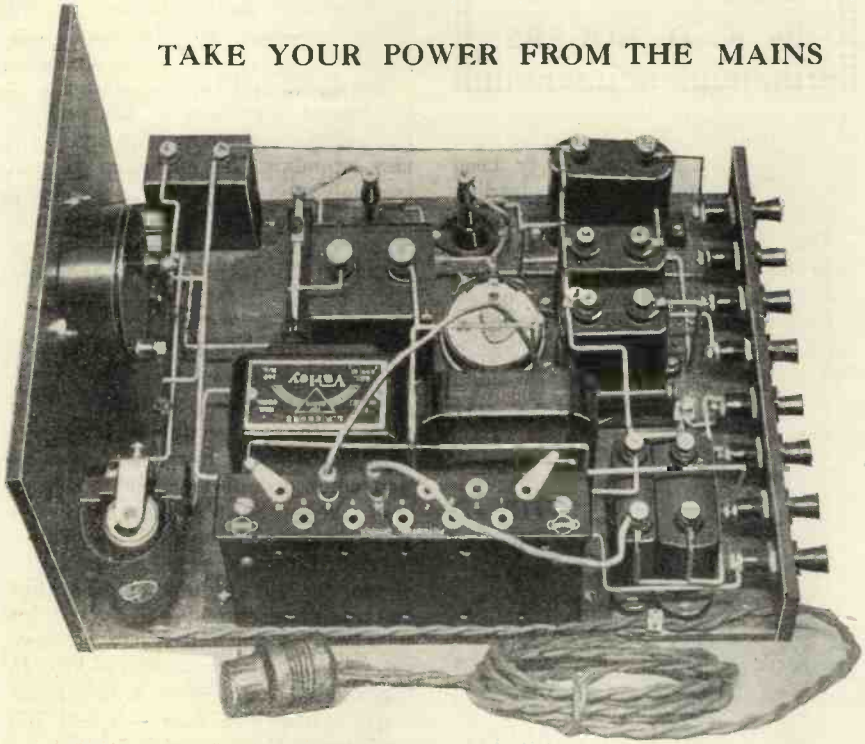
The " big noise " of the Mazda A.C. valves, however, we have not yet mentioned. It is the A.C./Pen. This has an amplification factor of about 95 on an H.T. voltage of 250 for the anode and 200 for the screen grid. It is a really remarkable valve, and is capable of giving a tremendous output.

" Valve Facts and Figures "

By the way, in conclusion, I should like to correct a misprint that occurred in my article " Valve Facts and Figures" in the December "M.W."

The calculation of applied anode voltage on page 636, centre column, should have concluded with the equation $\frac{37,500}{87,500} \times V = 150$, which would give the answer as 350 volts. This is the correct solution, as can be verified by uisng another method of solution. We know that $R \times C = V$, therefore if the total circuit resistance=87,500 ohms, and the current we know is 4 milliamps (·004 amp.), therefore the applied voltage will have to be $87,500 \times ·004 = 350$ volts.

TAKE YOUR POWER FROM THE MAINS



This is the "All-Power" mains unit, described elsewhere in this number, by means of which H.T. and G.B. can be obtained from the electric light supply.

THE "M.W." KIT SET REVIEW

For years the set built from a kit of parts has enjoyed great popularity, and many of the leading radio firms devote a large part of their energies to the production of these home-construction receivers. But though much has been said in various quarters of the marvellous results that can be obtained from this or that receiver, little has been said about the technical aspects of the different kit sets, and of the circuits involved.

Therefore, we have devoted a section of "Modern Wireless" this month to a special review of a number of leading kit receivers, dealing with the technical side only, and we feel that this will provide a long-awaited opportunity for the average listener and home-constructor to judge for himself how these receivers work.

THE "kit" set was originally conceived by a well-known manufacturer as a method of creating a new market among the great army of home-constructors. It met with instant success, for the man who likes to build his own set responded enthusiastically to this new easy style of building his receiver.

He had no longer to go and buy the required components for his set separately; he could get the whole lot en bloc, and go right ahead and build.

From this first success all sorts and sizes of kit sets have sprung, and now there are several firms prominent in the world of radio who specially cater for the home-constructor by the provision of complete sets of parts for certain receiver designs of their own devising.

The BROWN S.G. THREE

A neat little set that can be built in ordinary or in portable form.

A FINE S.G. SET

This is the Brown home-constructor three-valve S.G. receiver in the ordinary cabinet. It can be had in portable form as shown in the other photograph on this page.

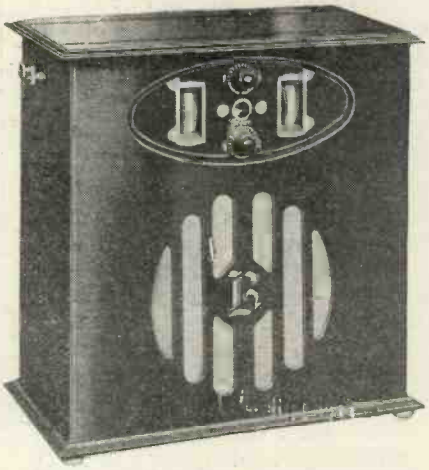
The Technical Side

Many other firms sell complete kits for receivers designed by the radio journals, but it is not with these that we are concerned in this section of MODERN WIRELESS. We want instead to have a look at some of the outstanding proprietary kit sets, and to see wherein their merits lie, and perhaps in what respects they differ from one another.

Naturally, in order to have a large appeal to the average man they must be alike in many respects, but in others they are often widely different in conception.

Of results we do not intend to speak—it is our present business to review the receivers from a technical and utilitarian standpoint, and not to discourse on the range of reception or loudness of the reproduction.

IN PORTABLE FORM



This is the S.G. Three reviewed above, with loud speaker, batteries and all except aerial-earth connections on board.

The "M.W." Kit Set Review—Cont.

Let us first consider the Brown receiver, which can be obtained in three versions—for battery use, for D.C. mains, and for A.C. mains operation.

The Battery Model

We will take the battery model to start with.

It can be obtained as an ordinary set, or complete, having the speaker on board and all batteries tucked away inside the cabinet. The latter model, except for the fact that it needs an outdoor aerial and an earth, one might easily mistake for a portable set.

The circuit consists of a screened-grid stage followed by a detector and a transformer-coupled L.F. The instructions are unusually easy to follow, and Messrs. Brown provide five life-size diagrams showing the various stages of construction of the set.

First we have the mounting of components on the baseboard, and then wiring-up; after that we have assembling the front panel and wiring up; then completing the front panel, and finally attaching the coloured flex leads, which are for the external connections.

Cannot Go Wrong

You cannot go wrong in building this set if you follow the instructions, as these are extremely easy to understand.

A tapped aerial coil with three tappings on it comprises the grid circuit of the screened-grid valve, which itself is controlled by means of a rheostat acting as a volume control. From the anode of the screened-grid valve we go to the anode coil, which is of the usual plain untapped type acting as a tuned anode with reaction.

The two tuning condensers are separate, being drum-controlled at either end of the panel, while the reaction and filament control and the on-off switch are placed at the centre. No H.F. choke is employed, the inductance of the transformer primary being sufficient to give good reaction control over all wave-lengths.

Instead of using wave-change switching (though we believe different wave-change coils can be obtained), the standard receiver employs plug-in coils of special design, which cover wave-lengths from 200 to 600 metres, and 900 to 2,000 metres. The coils supplied with the kit are those for the medium wave-band, and the long-wave pair can be obtained from any wireless dealer at a price of 17s.

The whole of the set is mounted on the baseboard and panel, and fits well up in the cabinet, and in the case of the complete portable receiver the batteries—H.T., L.T., and G.B.—and the loud speaker are housed below. An ordinary aluminium screen provides separation between H.F. grid circuit and the anode circuit, and the famous Brown transformer is used for coupling the detector valve to the power stage, this transformer undoubtedly being one of the best on the market.

THIS SIMPLE SET—

You commence the construction of the Brown S.G. Three by tackling the mounting of the components on the baseboard.

—CAN BE BUILT—

The next step is the wiring-up of the components and a check over by means of the diagrams.

—IN A FEW HOURS

When the panel components are in position and wired up the set is ready for test, and the whole job need not occupy more than three or four hours.

There are remarkably few components in the set, which fact, of course, makes it one of the easiest kits to build; in fact, the baseboard components only number nine and on the panel there are only the two tuning condensers, the reaction condenser, on-and-off switch, and the resistance controlling the filament of the H.F. valve.

Protection from Shorts

The screened-grid valve is mounted vertically, and not protruding through the screen, which helps to make things simple for the constructor, while the anode lead is taken through the screen by means of an ebonite bush, thus obviating any danger of an H.T. short due to faulty wires through the screen. One filament wire goes round the screen, and the other makes contact with the screen.

So rough-edged holes cannot possibly cause abrasions on any of the wires and thereby cause battery shorts.

From the battery model we will now go on to the mains set, models of which can be obtained either for D.C. or A.C. operation. The parts are very similar to those in the battery model, but there are one or two additional components. For instance, in the D.C. model a special mica condenser is mounted between the tapped coil and earth, that is, between the aerial coil and earth; and, in addition to the instructions and the diagrams for the set itself, there is another series showing how to build the Brown D.C. mains unit for use with the set.

When Mains are Used

This is a comprehensive mains arrangement carrying the necessary components for grid bias and L.T. as well as H.T., and it contains the necessary anti-motor-boating units, so that stability is assured. Regulation of the screened-grid valve is again obtained by means of a filament rheostat, and the valve filaments are connected in parallel, not in series as is so often done in D.C. mains sets.

The mains unit is designed to stand in the horizontal position in the cabinet where no loud speaker is provided, but in the type A set, where the Brown loud speaker is fitted, the D.C. mains unit can be stood on end

A Famous Series of Sets

provided you do not allow it to foul the adjusting screw on the loud speaker.

The A.C. Set

The A.C. model, of course, varies quite considerably from both the D.C. and the battery types, in that it requires five-pin valve holders, and the unit used with it has to have a rectifier.

The baseboard layout is very much the same, however, and the screened-grid valve is still held vertically; but special bias resistances for biasing the S.G. valve and the output valve are included in the layout.

As in the case of the D.C. model, the A.C. mains unit is so designed that it will fit quite easily into the back of the set.

THE EMPIRE MELODY MAKER

THE Cossor Melody Maker, in its various forms, is too well known to need much introduction, but readers may be interested in technical details of the latest of the famous series, which goes under the name of the Empire Melody Maker.

This is a kit set which has quite a usual combination of valves, taking the form of a three-valve receiver, comprising one stage of screened-grid high-frequency amplification followed by a detector and power valve.

Great Flexibility

The outstanding feature of the set, which we believe has proved very popular, is the great flexibility which can be obtained with the controls provided, and a glance at the circuit which we reproduce here will show that in addition to the normal tuning control there are two devices which give control of selectivity.

First of these is the pre-set variable condenser which is in series with the aerial, and the second is the filament rheostat in the screened-grid valve's circuit. This resistance allows the impedance of the screened-grid valve to be varied at will, and thus gives a further small control of selectivity as well as permitting the volume to be adjusted.

Wave-Change Coils

Naturally, a certain loss of sensitivity is experienced when the filament rheostat is used to increase selectivity, so that one of the best ways of using this control is to cut down the filament supply of the screened-grid valve, and, at the same time, make up what loss of signal does occur by increasing the reaction. In many cases this is quite a useful method of increasing the selectivity of the receiver when listening to distant stations.

The aerial coil comprises a long- and medium-wave winding, and allows medium waves to be received when the two coils are connected in parallel by means of a switch; the long waves being used when the switch is open. The long- and short-wave coils are astatically wound to prevent interaction between the grid and anode circuits of the H.F. stage, and they thus enable screening to be carried out in a simple manner.

The set is quite self-contained, and batteries or mains units can be attached as desired. The controls are extremely simple, consisting of just the aerial and anode condensers, on-off switch, reaction condenser, and the rheostat which controls the filament of the S.G. valve.

In the Cossor EmpireMelody Maker the S.G. valve is mounted through the vertical screen, the valve, of course, being in a horizontal position, and a metal panel is employed. The aerial and earth terminals are on the left-hand side of the set as you look at it from the front, and the loud-

Mounting one of the variable condensers on the panel.

speaker terminals are on the right-hand side. These will be clearly seen in the photographs illustrating this article.

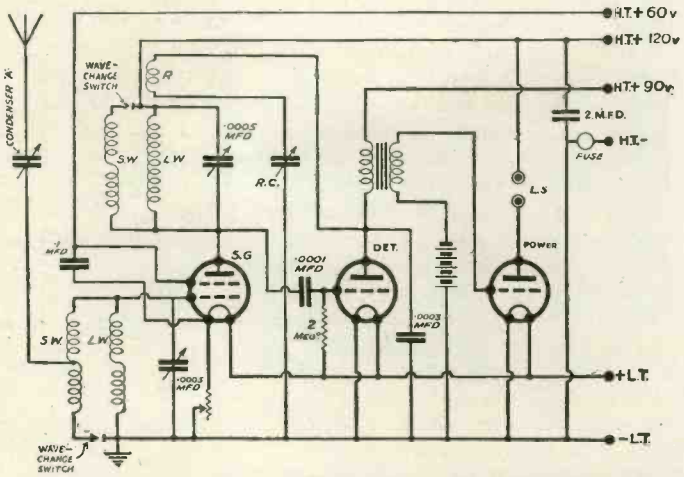
As in the Brown receiver, no choke is employed in the anode circuit of the detector valve, the impedance of the transformer primary being relied upon to allow sufficient reaction to be obtained. The set employs the usual leaky-grid rectification, and capacity-controlled reaction.

Back-Coupling Countered

Every precaution has been taken to ensure that the set can be built easily, and to make sure it will give efficient working, and by-pass condensers have been included to minimise the likelihood of back-coupling if batteries are used, while a fuse is also included against the danger of the batteries being connected up wrongly.

As pioneers of the home-constructors' kit sets, Messrs. Cossors understand the necessity for making

HOW THE MELODY MAKER IS WIRED



The circuit of the Empire Melody Maker. It will be noticed that the screen between the H.F. valve and the detector stage has been omitted, but its position is clearly shown in the photograph overleaf.

The "M.W." Kit Set Review—Cont.

all constructional work as easy as possible, and the parts that they supply with the Empire Melody Maker could not very well be simpler.

Detailed Instructions

Detailed instructions are given for fixing the various components, especially the panel components, which are mounted through ebonite bushes in the metal panel to prevent unwanted earthing.

The cabinet is supplied in sections, and details of how to assemble it are given on the chart. The wiring is done on the point-to-point system, but the cutting of the leads is left for the constructor to decide. Some systems state the lengths of various connections in inches.

Which plan is the better it is difficult to decide, and in our opinion it does not much matter whether the length is given in inches or whether one measures off the wire between the two terminals to be connected and then cuts it. It certainly makes little difference to the time in which the receiver can be completed, and as no solder is used in the course of construction it is a very simple business.

The Battery Connections

The grid-bias battery is fixed on the baseboard on the right-hand side of the set (between the L.F. valve holder and the panel). This obviates any trailing grid-bias leads, and the only external connections are for the aerial and earth, loud speaker and the H.T. and L.T. batteries. Further charts show how the batteries are connected, and the assembly of this receiver is really a very easy matter.

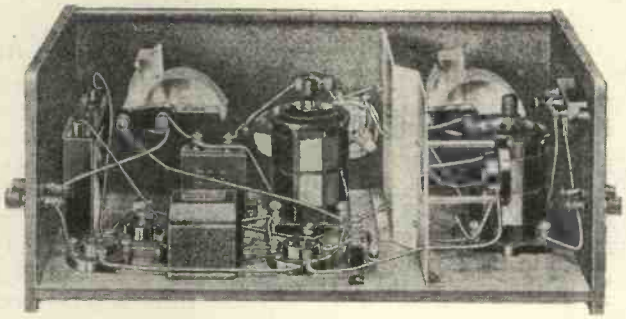
The Cossor Empire Melody Maker makes a very attractive outfit, and the finished receiver has quite a distinguished appearance. The whole thing is easily built in an evening, and the kit as purchased includes everything (except batteries) right down to the wire, Systoflex, and the wood screws.

If you want this set for mains work, to operate with an A.C. or D.C. mains eliminator, it is advisable to employ an output filter choke, and, of course, a special condenser in the case of the D.C. unit between the earth and the earth terminal of the set and between the aerial and the aerial terminal. This prevents any possibility of shorting the mains to earth and of allowing the aerial to become alive should the positive main be earthed.

It is also quite a good plan to incorporate an anti-motor-boating device in the H.T. lead to the detector valve, as this will prevent coupling between that circuit and the other circuits in the receiver through the potential divider or other voltage distributing system in the mains unit.

With batteries the output filter is not necessary, though the addition of the de-coupler is not a bad scheme if you are using rather doubtful batteries. In all ordinary cases, however, it is quite unnecessary.

INSIDE THE EMPIRE MELODY MAKER

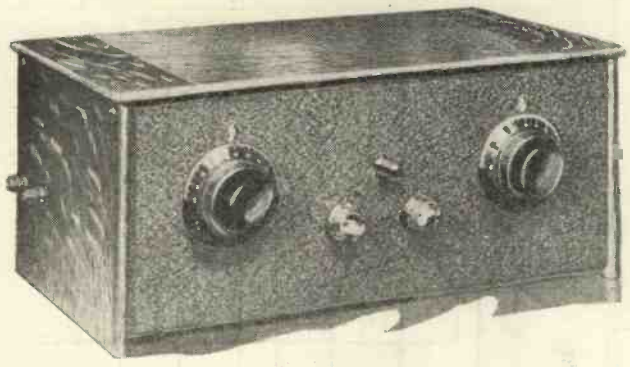


One of the Melody Makers built from the instructions given with the kit of parts. Note the bent screen between the two tuned circuits. The S.G. valve protrudes through the screen when in position

NEARLY FINISHED

A happy constructor who has nearly completed his set, and is smiling in anticipation of the results he will get.

A BUSINESS-LIKE APPEARANCE



The panel is of metal with the well-known crystalline finish. Besides the two tuning condensers we have the volume control resistance, and reaction condenser, and the on-off switch mounted on the panel.

The FERRANTI TWO- AND THREE-VALVERS.

Ingenious battery or mains receivers.

When Messrs. Ferranti go in for anything in the way of set building or kit design they go into the matter extremely thoroughly, and evidence of their thoroughness is to be found in every section of the sets we have picked out for this review—the Ferranti Two, and the Screened-Grid Three.

A Simple Circuit

Let us consider the Ferranti Two first. We will take the battery model to begin with. This is a pure detector and L.F. with a series aerial condenser and aerial coil coupled to the grid coil, which is of the usual wave-change variety, tuned with a ·0005-mfd. condenser, and enabling a wide band of wave-lengths to be covered.

The first thing to notice about this set is that the grid leak is not only of a low value, being only 1 megohm, but is parallel across the grid condenser, and that it is taken to the *negative* L.T. This, of course, enables

A Wave-Change Radio-Gram Circuit

very smooth reaction to be obtained, and is somewhat a breakaway from the ordinary standard practice.

No H.F. choke is included in the outfit, but a very effective anti-motor-boating system is employed in the detector lead in the form of a 20,000-ohm resistance and a 2-mfd. condenser taken to earth.

A condenser is also placed across the H.T. battery.

The Reaction Control

A peculiar feature, perhaps, is the condenser across the primary of the L.F. transformer. This, of course, is included in the A.F.6, which is recommended, but if another make of transformer is used Ferranti's advise that this condenser be placed in circuit. This strikes one as rather unusual, especially in view of the fact that no H.F. choke is employed for reaction, though it seems to work well, reaction being very smooth.

The transformer recommended is the new 1 to 7, giving a very large step-up, and an output choke or output transformer has been omitted in order to cut down the cost, though Ferranti's state in their directions that the performance from the reproduction point of view can still further be improved if such is added, and suggest one of their output transformers as being suitable for all ordinary types of speakers.

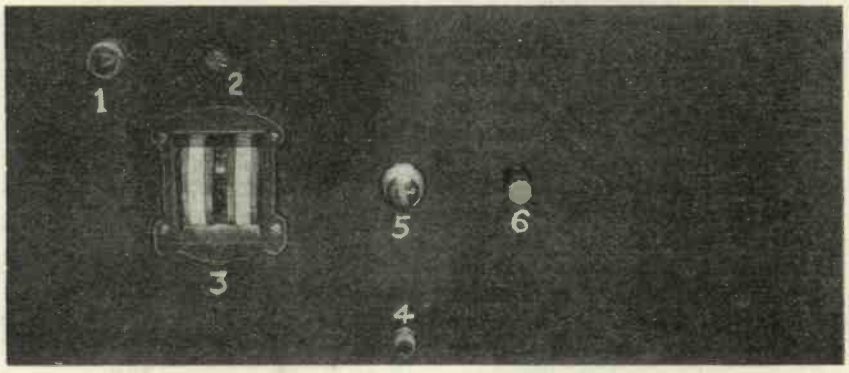
The receiver is suitable for the reception of long-wave stations like 5 X X, and any of the medium-wave English stations, its range under average conditions being about 55 miles from 5 X X and 50 from the more powerful stations such as Brookmans Park, 5 G B, and the new Northern Regional station.

The tuning coil, type R.F.5, is rather unusual in that this has a wave-change switch included in it, and also variable rotor reaction control by Bowden wire.

Altogether it is an extremely easy receiver to construct, but Ferranti also put out a special A.C. mains two-valver, including complete A.C. mains all-power equipment. This receiver should preferably be built in a suitable cabinet with the special Ferranti safety switch, which automatically turns off the mains as soon as the cabinet lid is lifted. Naturally the price of the A.C. model is somewhat higher than that of the battery model, the latter costing only £4 13s. 1d., while the A.C. model costs £13 8s. 7d.

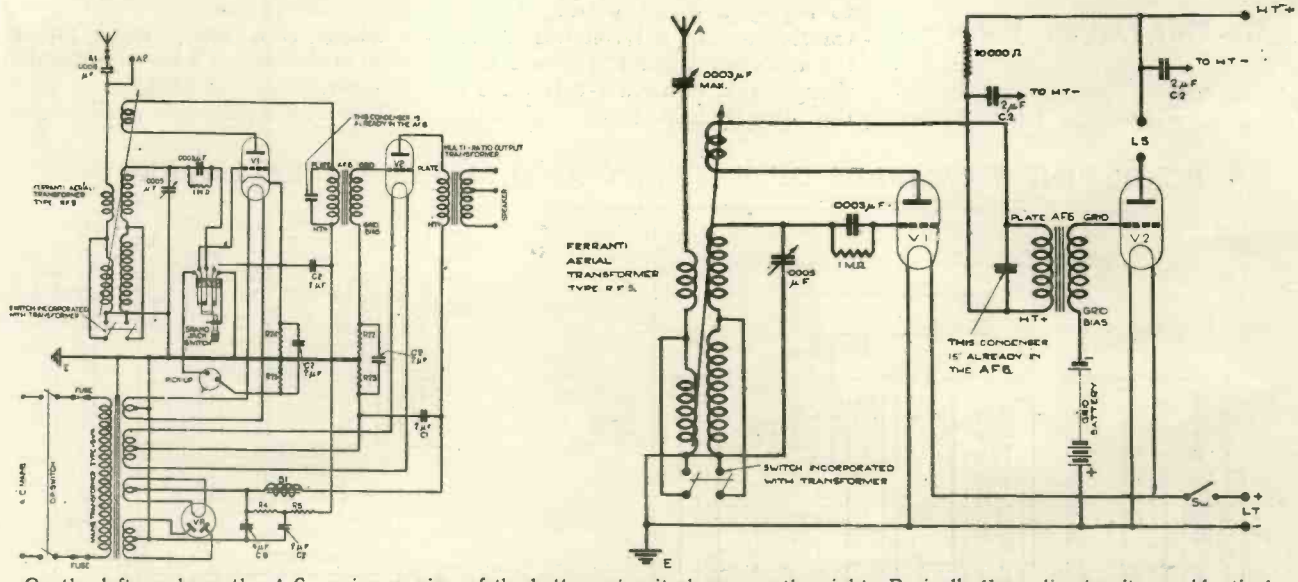
One or two little differences in the circuit itself, apart from the mains side, are included, there being a super-power output valve, and a multi-ratio output transformer in order to suit the impedance of this output valve to the speaker being used.

A VERY SUCCESSFUL RECEIVER



The Ferranti Three panel controls are clearly seen in this photograph. (1) is the series aerial condenser; (2) wave-change switch; (3) tuning control; (4) pick-up jack switch (5) reaction control; (6) on-off switch.

A.C. MAINS AND BATTERY VERSIONS OF THE FERRANTI TWO



On the left we have the A.C. mains version of the battery circuit shown on the right. Basically the radio circuits are identical, and only slight differences have been made in the battery circuit to make it suitable for A.C. mains operation.

The "M.W." Kit Set Review—Cont.

The receiver also has a switch to enable it to be used with a gramophone pick-up, any ordinary high-impedance pick-up being suitable. The output power is given as 600 milliwatts, with only 3½ per cent distortion, and as much more than this is generally considered permissible it will be seen that the performance is well within the required limits. The power of the set is adequate for working a moving-coil loud speaker.

Now let us consider the A.C. circuit a little more closely. It will be noticed that the whole of the A.C. kit has been made as simple as possible consistent with keeping it efficient. For instance, there is only one smoothing choke (labelled B_1) in the positive lead, which feeds the output valve.

The positive feed to the detector valve is through the resistances R_4 and R_5, which are de-coupling and smoothing resistances, while grid bias is applied automatically through the resistances R_{24} in the case of the detector valve when the pick-up is used, and R_{23} in the case of the output valve itself

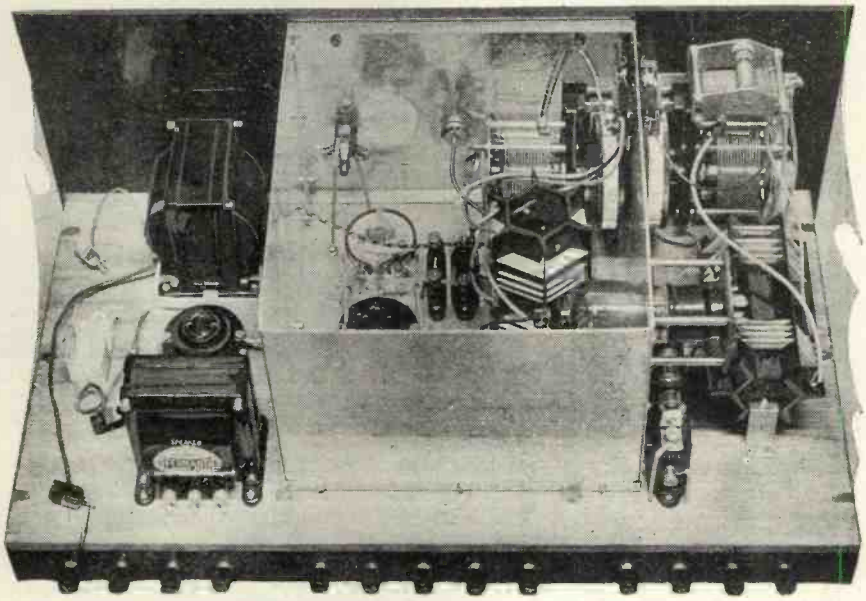
Six-Volt Output Valve

The whole circuit is very well by-passed, and a specially interesting fact is that whereas the detector valve is of the indirectly-heated cathode variety, the output valve is directly heated, the valve recommended by the designers of the set being the Osram P.625, or the Mullard D.F.A.9. Why Messrs. Ferranti have used a directly-heated output valve is not quite clear, especially as they have had to supply a 6-volt winding on the transformer and a 4-volt winding for the detector, when one would have thought that either a 4-volt valve of the directly-heated or indirectly-heated type would have suited their purpose better.

A special warning note is included on the A.C. Mains Two chart, drawing attention of constructors to the fact that every care must be taken to see that the possibility of contact with the mains by any of the internal parts is impossible while the receiver is alive, especially as the mains transformer provides a pressure of something like 600 volts for the rectifiing valve, and the power available is naturally much greater than in the case of a battery-operated receiver.

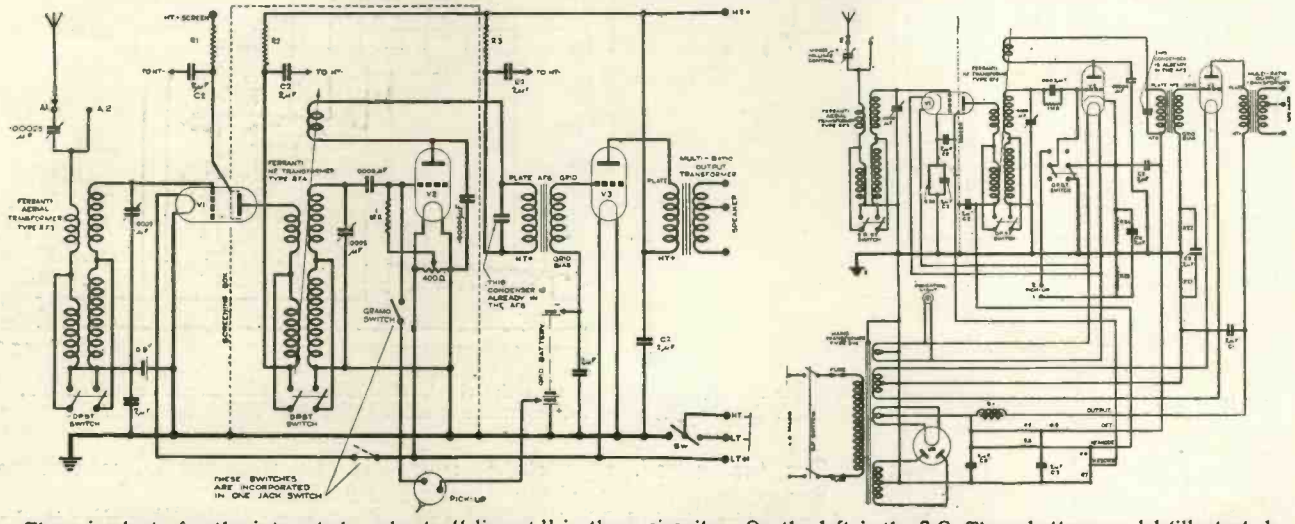
Now we will pass on to the Screened Grid Three. This is a fairly straightforward circuit, well de-coupled, and provided with a pick-up switch and potentiometer control of the grid

FULL OF NOVEL FEATURES



An interior view of the battery S.G. Three, the circuit of which is shown below. Note the efficient screening and the Bowden-controlled reaction.

SOME FINE EXAMPLES OF BATTERY AND MAINS KIT RECEIVERS



There is plenty for the interested reader to "dig out" in these circuits. On the left is the S.G. Three battery model (illustrated in the photograph above), and to the right is the same circuit modified for A.C. mains working. The wave-change switches are arranged to form a composite switch on the edge of the screen, and the two sections operate from one plunger.

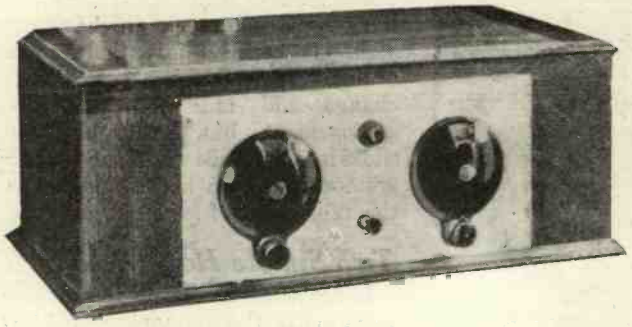
A Cunningly Arranged Radio-Gram Receiver

for the detector valve. A special Ferranti aerial transformer (type R.F.3) is employed, and the H.F. transformer (type R.F.4) couples the screened-grid valve to the detector.

A special screening box is supplied which includes the whole of the detector H.F. circuits, but, as before, no choke is included in the detector anode circuit. One jack switch controls the pick-up arrangements, enabling the H.F. valve to be switched off, and the pick-up switched in, or vice versa at will.

De-coupling for the screened grid circuit, the S.G. anode circuit, and the detector circuit is efficiently carried out, and a multi-ratio output transformer is supplied for the last valve. De-coupling has been carried out very thoroughly, even the grid-bias battery for the last valve being by-passed by a 2-mfd. condenser.

ALL BATTERIES ON BOARD!



The Lissen S.G. Three, which has room on either side of the panel for the H.T., G.B. and L.T. batteries.

Bowden Reaction Control

As in the two-valve model, the reaction is controlled by means of a Bowden wire scheme on a rotating reaction coil, operated from the panel, and enabling ordinary or reversed reaction to be obtained. The makers state that the use of the reversed reaction enables the high-frequency resistance of the intervalve high-frequency transformer to be increased from ten to fifteen times, with the result that the receiver reproduces adequately above 5,000 cycles, which the average similar receiver would not reproduce at all, or only very slightly.

Effect on High Notes

This reversed reaction naturally decreases the selectivity, but when listening to local stations it is obviously a great help in enabling the receiver to cover a wider band of audio-frequencies and therefore gives better reproduction of the high notes. The total price of this receiver, excluding cabinet and batteries, is £12 19s. 0d.

This A.C. model is based upon exactly the same circuit as the battery model, and uses very largely the same components. Instead of a jack switch, however, a double-pole double-throw switch of the rotary variety is employed for the pick-up. Indirectly-heated A.C. valves are used for the screened-grid stage and detector, while a directly-heated valve is used for the last stage.

Volume control is obtained by means of a small variable condenser connected in series with the primary of the aerial high-frequency transformer, and has the additional advantage of providing in certain circumstances a degree of increased selectivity.

Under-Baseboard Wiring

Automatic bias is obtained in a way similar to that on the A.C. two-valver, and once again a special 6-volt winding on the A.C. transformer is used to supply the filament of the last valve.

Unfortunately we have no space to deal with a later Ferranti kit, that of the battery "four-valver" which has been recently released. Briefly, however, it consists of an S.G., Det., L.F., and two valves in push-pull, being, as you see, a five-valve receiver, though it is designated a "four." At present it is available as a battery set, but possibly an A.C. version would be even more popular.

THREE LISSEN SETS

The S.G. Three, Instanter Two, and the Table Grand Radio-Gramophone.

The Lissen kit receivers number three: The S.G. Three, The Instanter Two, and the Table Grand Radio-

AN INGENIOUS AND EFFECTIVE RADIO-GRAMOPHONE

This illustration of the Table Grand Radio-Gramophone gives a very clear idea of how the set is housed in the table type of gramophone cabinet. Batteries also are stowed away inside.

The "M.W." Kit Set Review—Cont.

Gramophone, which latter is an extremely novel design. We will take these in order. First let us discuss the S.G. Three.

Costing £7 14s. 3d., the S.G. Three receiver consists of a conventional screened grid, detector and L.F., complete with a cabinet, which also has room in it for grid bias, L.T. and H.T. batteries. A metal panel is employed in the centre of the cabinet, and with the battery compartments on either side enables a very neat and effective-looking receiver to be constructed.

Minute Details Provided

In the construction of the Lissen receivers not only are the lead lengths given, but also the lengths of the pieces of Systoflex to be placed on the leads, and the gaps where connections have to be made to terminals are clearly shown. No soldering, of course, is employed and the receiver is extremely easy to wire up.

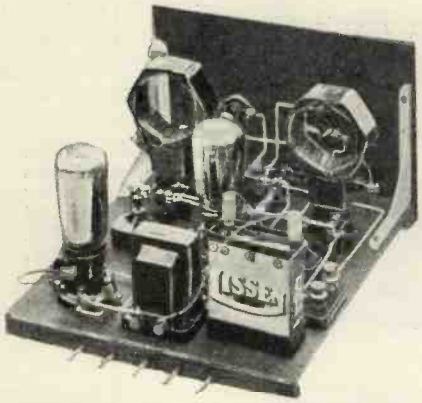
A vertical screen separates the S.G. valve from the detector circuit, special plug-in coils fitting into valve holders being used for tuning. The variable condensers are insulated from the panel by means of ebonite washers, and, of course, the whole of the panel and the screen—which, by the way, is continued *underneath* the H.F. section of the set—are earthed.

city, the aerial being coupled to the "X" tappings of the coils through separate ·0003 condensers.

Ideal Family Receiver

A change-over switch enables either one station or the other to be obtained, and thus the receiver makes an ideal

FOR THE FAMILY



The Instanter Two gives instant change-over from one alternative programme to the other.

household set. No reaction is used, and there is nothing on the panel with which any non-technical member of the household can fiddle and so upset the receiver.

It will be noted that no output choke system or pentode transformer is employed, the pentode being taken direct to the loud speaker. Another notable feature is the ·001-mfd. fixed condenser from the anode of the detector valve to earth, which enables a fairly mellow tone to be obtained in spite of the fact that a pentode is used without any special output transformer.

It will be also seen from the theoretical circuit that there is absolutely nothing to go wrong with the receiver, and no reason why anyone who builds it should not have complete success from the moment they finish the wiring. The price is remarkably low, while the construction is simplicity itself.

A number of the leads are taken underneath the baseboard, so that no battery leads (which consist of flex) have to wander about among the component connections. They come out through holes in the back and can be connected straight up to the battery.

The Table Grand Radio-Gramophone receiver is one of the most novel home-constructor sets we have ever seen. It consists essentially of an ordinary two-valve set with a wave-change and radio-gram switching arrangement, but the whole thing slides into the place where the ordinary gramophone horn has its position in the table type of gramophone.

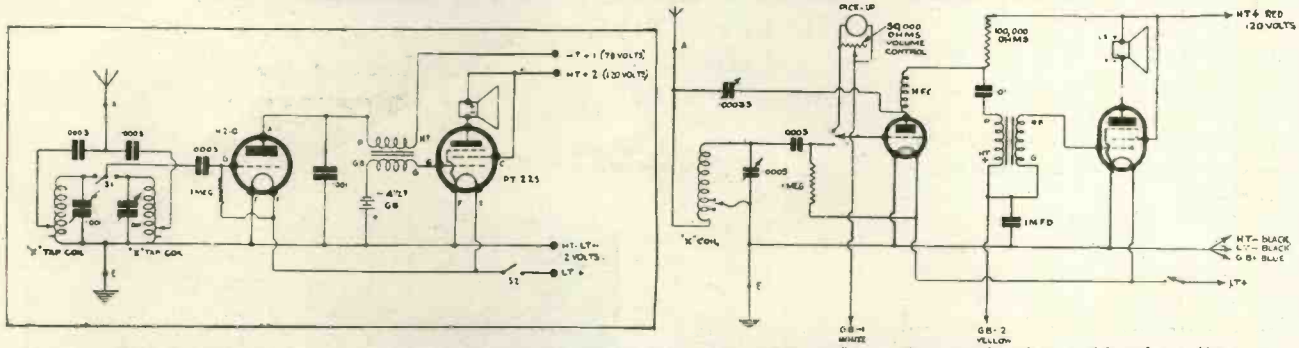
Two Simple Household Sets

Instructions are given for the construction of the gramophone cabinet, which contains an ordinary spring motor and turntable and a pick-up and pick-up arm. A volume control is situated on the gramophone motor board and the set simply slides into the front of the cabinet.

The set itself is a two-valver, detector and pentode, using plain "X" coil tuning (which limits its usefulness, of course) and capacity reaction on to the aerial. The ordinary type of pick-up switch, single-pole change-over, is employed, and the detector is transformer-coupled by a shunt scheme to the pentode valve.

It should be noted in the theoretical diagrams of both this receiver and of the Lissen Two on the constructional charts that the internal arrangements of the pentodes are not quite accurately drawn, though this, of course, makes no difference to the arrangement

TWO SIMPLE CIRCUITS FOR "LOCAL" LISTENING



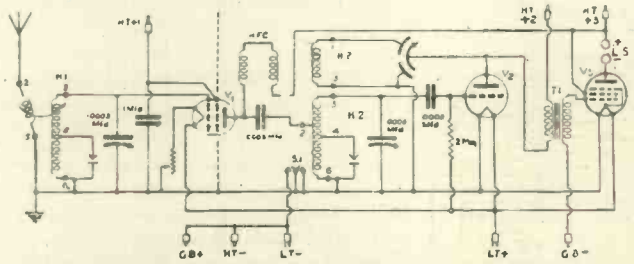
The circuit of the "Instanter" is shown above. Its simplicity proves that Messrs. Lissen have seriously considered the "household" when designing these receivers. The circuit to the right is that of the Table Grand Radio-Gramophone. Both sets are ideal for family use on the Regional stations.

The Lissen Instanter Two is an exceedingly neat little two-valver using ordinary "X" type plug-in coils and a very conventional circuit employing a pentode in the last stage. It is intended as an alternative programme receiver, for the coils are fairly accurately tuned either to the National or Regional by means of pre-set condensers of ·001 mfd. capa-

Two Famous Screened-Grid Sets

of the set. It is a little error on the part of the draughtsman which could easily occur, and he has joined the extra grid and the control grid together in each case, whereas the extra grid should go the the filament inside the valve itself.

PENTODE OR POWER OUTPUT



The circuit of the famous 1931 "Orgola," which made its appearance on the market a short time ago. A pentode or power valve can be used in the last stage.

The tuning of the Table Grand Radio-Gramophone kit is done by an ordinary ·0005-mfd. condenser, and it will be noticed that the "X" coil is used in rather an unusual way in order to obtain reaction. The earth is tapped up the coil, the aerial coming to the end of the coil. The tappings, therefore, enable a certain amount of preliminary setting of reaction to be obtained, variation of control being carried out by means of the ·00035 variable condenser between the plate of the detector and the aerial.

Compact Design

The valves are placed horizontally in this receiver in order to clear the base of the gramophone motor. This motor is also the reason for the aerial coil being placed up against the variable condensers, and the set being packed in as tightly as possible on the baseboard.

The H.T. batteries are arranged so that we have 60 volts on either side of the set and these are connected in series. They are placed *inside* the cabinet, and so is the two-volt accumulator and the grid-bias battery. This enables an extremely compact receiver to be obtained, and the set really is one of the most interesting and novel of the kit sets we have come across.

The loud speaker is connected externally and can be placed in any position that may be desired. This is a very good way of working a radio-gramophone, because the scratch of the needle which usually is heard to a certain extent through the lid is quite inaudible when one is listening to a loud speaker which is not too near the gramophone itself.

In many radio-gramophone receivers which incorporate the speaker a certain amount of this direct scratch is heard, and it gives the impression that there is a certain roughness in the high notes from the speaker, whereas in reality nothing of the sort is taking place.

The Lissen radio-gramophone therefore scores heavily from this point of view, and though it may not seem a big point, yet it is one that is decidedly in its favour, for more harm is done by that pick-up noise than is commonly imagined.

The MULLARD ORGOLAS

The 1931 and the four-valve models

The 1931 "Orgola," as you will see from the theoretical circuit diagram, consists of a screened-grid, detector and pentode circuit. As a matter of fact, a power valve is supplied in the standard kit, but a pentode can be substituted if required.

This unique receiver is comparable with the average five-valve set of a few seasons ago, and its neatly compact appearance can be seen from the photograph.

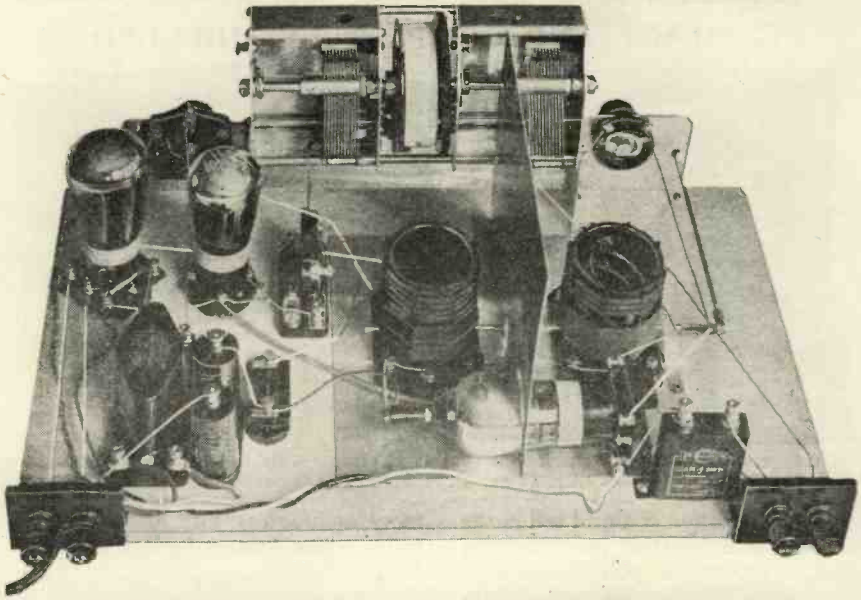
The chief features are the special loose-coupled aerial system, the coupling of which can be varied; a shunt-fed anode supply for the screened-grid valve, which isolates the tuning condensers from H.T. voltage; reaction control by differential condenser, and provision for either a triode or pentode output valve.

Volume Control

Volume control is carried out by means of the rheostat in the filament circuit of the screened-grid valve, which is placed horizontally through the screen at one end of the receiver. An entirely new design of coil giving better selectivity than heretofore has been included in the kit, and the aerial coil has a rotor for loose coupling adjustments.

The detector has a stationary reaction winding (marked H_2 in the theoretical diagram), while wave-changing is obtained by separate switches on each coil, operated by a single push knob with link motion. The tuning condensers are ganged,

NO PANEL IS USED IN THIS SET



Note the unusual method of mounting the drum condensers and the other controls. The tuning coils are mounted on metal sheets and are separated by the vertical screen. The rest of the baseboard is uncovered wood. The front of the cabinet forms the "panel."

The "M.W." Kit Set Review—Cont.

and although they are operated simultaneously by one slow-motion knob, a thumb-control permits separate adjustment of the aerial tuning condenser, and thus the advantages of ganging and separate control are combined.

Screened from Underneath

No panel is used in this set, the controls passing through the front of the cabinet, which gives the set an unusual but rather pleasing appearance. Sub-panels of aluminium support the reaction and volume controls, and also the battery switch. The H.F. circuits are screened from underneath by aluminium sheet as well as from each other by the usual aluminium screen. The famous Mullard Permacore L.F. transformer, which employs a silver alloy and nickel iron core, is employed. There are altogether only about thirty wires in the whole of the set, and these are given in the wiring diagram extremely clearly.

A.C. Modifications

Both of the tuning coils are mounted on the baseboard, and all external connections except aerial, earth and loud speaker are made by means of multiple cord, so that one does not have to have a whole host of terminals behind the back, or in some other position on the set.

The A.C. model is a very slight modification of the battery model, the layout and wiring having to be altered slightly. Briefly, the alterations consist of the addition of a grid cell in the cathode lead of the screened-grid valve, a screen-grid potentiometer in the place of the filament rheostat for volume control, and twisted leads for the heater circuit.

The A.C. "Orgola" is not, of course, an all-power model in itself, in that it requires an external source of power and does not consist of a completely integral all-mains outfit. There is, however, available the Mullard "Orgola Junior Power Unit," which will supply 160 volts output at 30 milliamps, and power for the heaters of the indirectly-heated A.C. valves.

The unit consumes roughly from 25 to 30 watts, and is quite simple, as will be seen from the photograph. Only one smoothing choke is employed and the potential is broken down for the various tapping points in one case by a series resistance of 50,000 ohms, and in the case of H.T.+1 by a 50,000-ohm potentiometer placed across the whole of the output from the rectifier, which is a double-wave D.W.1 valve.

Smoothing and De-coupling

Grid bias is not taken from the power unit, it being considered more satisfactory for various reasons to use a bias battery for the "Orgola" Three.

A Climax power transformer is employed in this unit, with a tapped primary for adjustment to the various mains voltages, and a centre-tapped 4-volt secondary winding for the heater current. A further 4-volt centre-tapped winding is included for the rectifier filament.

The smoothing and de-coupling condensers are standard Mullard components, and the resistances are wire-wound. The case supplied in the kit fully complies with the Institution of Electrical Engineers' recommendations, and when in position completes all earth connections. H.T. cannot be switched on unless the case is in position and closed, nor can the case be removed until the H.T. is switched off.

And now for the "Orgola" Four. This receiver is designed to meet the needs of those requiring still greater selectivity and sensitivity for long-distance work. It employs two screened-grid H.F. stages, a detector, and power or pentode output.

The "Orgola" Four

It is designed primarily for use with A.C. valves, but a battery model is also produced for those who have no electric supply and wish to take advantage of the design. Due to careful spacing, the four-valver takes up no more room than the 1931 "Orgola" Three. The cabinets are, in fact, identical except for the positions of the controls.

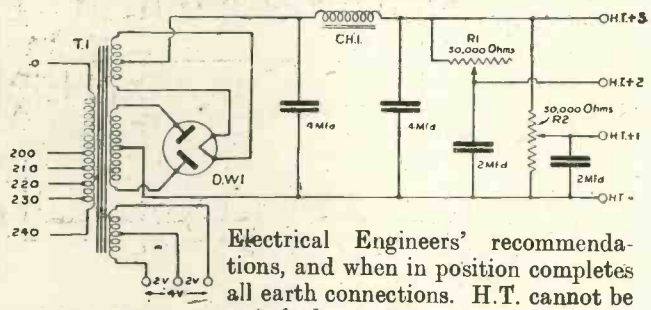
Three tuned circuits are employed, and a trimming condenser in parallel with aerial tuning enables the last ounce to be got out of the set in the matter of selectivity. The coils are transformer type, with tuned secondaries, and are separately screened, thus greatly simplifying the construction and eliminating the risk of faulty screening due to imperfect joints.

Uses Power Detector

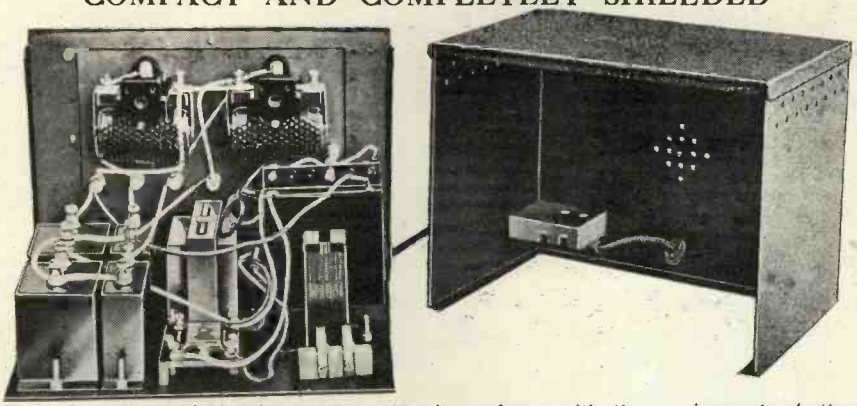
Power grid detection, an unusual feature of a kit set, is included in the "Orgola" Four, and no reaction is employed. If a pentode is used as the output valve it is recommended that the P.M.24A. be employed, with 300 volts on the anode and 200 on the auxiliary grid; though a large power output valve can be used if desired.

WHY NOT USE THE MAINS?

This is the circuit of the Mullard Orgola Junior Power Unit, by means of which the "Orgola" Three can be made an A.C. mains receiver.



COMPACT AND COMPLETELY SHIELDED



The A.C. unit is shielded by metal so that it conforms with the requirements of the I.E.E. regulations. It costs only £6 4s. 3d. to build, and is perfectly safe in operation.

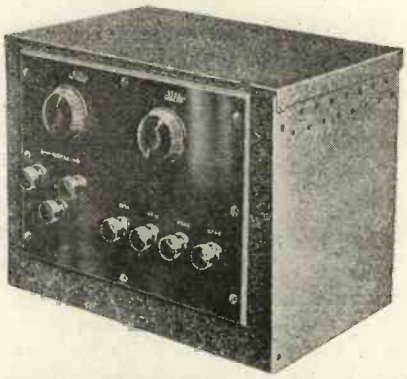
An S.G. A.C. Mains Four

Slightly different coils are employed when the set is used with the battery type of valves, the Colvern transformer coils with special screening being used. Anti-motor-boating decoupling devices are placed in the anodes of the screened-grid valves, and the screening grid of the pentode is also carefully de-coupled. The transformer is shunt-fed, the detector valve having a 20,000-ohm resistance in series with the anode and H.T. +, and the L.F. impulses being passed on to the transformer through a 1-mfd. condenser.

Methods of Grid Bias

The remaining side of the primary of the transformer is earthed, and the secondary goes between the grid of the pentode and the grid bias negative. An interesting point about the grid bias supplied to the screened-grid valves is that the cathode potential is above earth, the grids being taken to earth.

EASY VOLTAGE CONTROL



The two intermediate voltages on the "Orgola" power unit are controlled by means of a series resistance in one case and a potentiometer in the other.

A ·001-mfd. condenser between the anode of the pentode and H.T.— acts as a useful tone filter, and it will be noticed that no output-choke system or transformer is used.

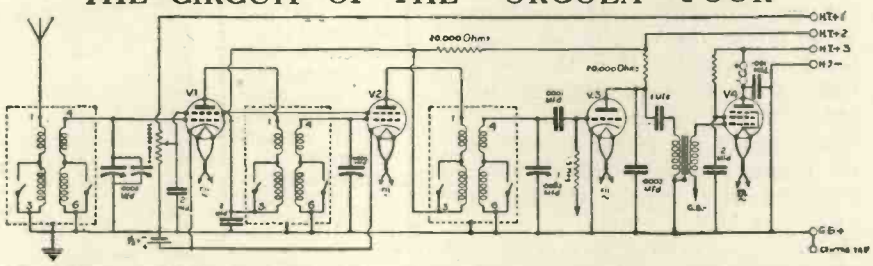
The "MUSIC MAGNET" 4

A popular Osram receiver.

The first thing that meets one's eye when one glances over the chart and instructions for building the Osram "Music Magnet" Four is the following sentence: "There is no drilling and no soldering—no carpentering—cabinet and components almost fall into place." And if any of our readers have built this receiver they will realise that such is indeed the case.

The ganged condenser is enclosed so that stray capacities cannot possibly cause any trouble. The tuned circuits, as before remarked, are assembled on trays, the screened-grid valves being in the first two trays and the detector in the last tray. This makes for very easy assembly, and these trays are denoted in the theoretical diagram by the parallel dotted lines.

THE CIRCUIT OF THE "ORGOLA" FOUR



The four-valve Mullard kit set is designed for mains operation, though parts for a battery model can be supplied if desired. The mains rectifier, smoothing and L.T. section is provided by a separate unit.

The set is extremely easy to build, and there is absolutely nothing in the circuit which will cause trouble of any description. Step by step the instructions for building this receiver are presented with most meticulous care, as will be seen from the following quotation from Step 1, which states: "Remove all the packages from the box and lay them on the table without, however, removing any of the components or screws from their packets or envelopes."

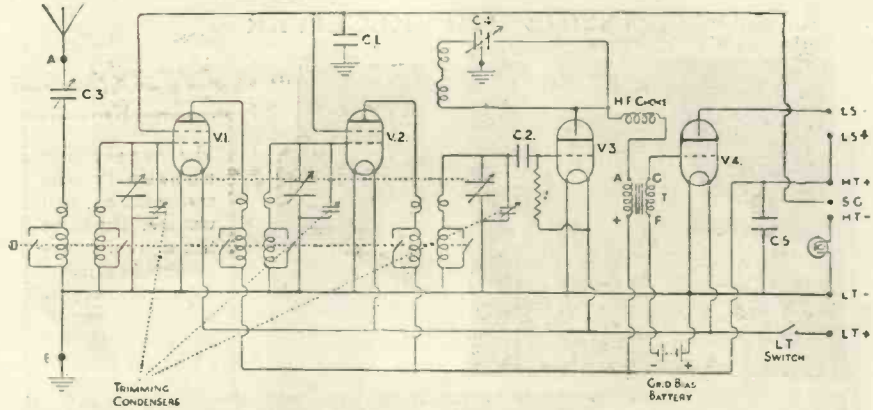
Some Unusual Features

After this we commence assembling the metal base plate, which is the bottom of the receiver, and takes the place of the ordinary baseboard. In fact, a great deal of the receiver is metal, for we have a metal panel and the H.F. sections are shielded with metal lids on metal trays.

A valuable feature of this receiver is the trimming condensers, which are placed in parallel across *each* of the ganged tuning condensers, and a ganged wave-change switch enables wave-changing to be carried out. Differential reaction is provided.

The operation of the "Music Magnet" Four is somewhat different from that of the other sets, for although a panel is used, and drum indicator is shown on the panel, the control of the receiver takes place from the knob projecting at left-hand side. On this side also is the volume-control knob, controlling a series condenser in the aerial lead. On the other side of the set are the reaction control and the wave-change switch.

THIS IS THE OSRAM "MUSIC MAGNET" FOUR



Note the ganged wave-change switching and tuning condensers used in this circuit. The set is illustrated on the next page.

The "M.W." Kit Set Review—Cont.

It is interesting to note that no grid bias is provided for the screened-grid valve, and with the valves recommended by the makers the anode current of the whole set varies from 14 to 18 milliamps in the case of two-volt valves, 22 to 28 milliamps in the case of four-volt valves, and from 30 to 35 in the case of six-volters being employed. It is thus essentially a job for super-capacity batteries or H.T. accumulators, if you cannot make use of the mains, and the Osram people provide details of a suitable H.T. supply, whether dry battery or H.T.B. eliminator be employed.

Very Valuable Refinement

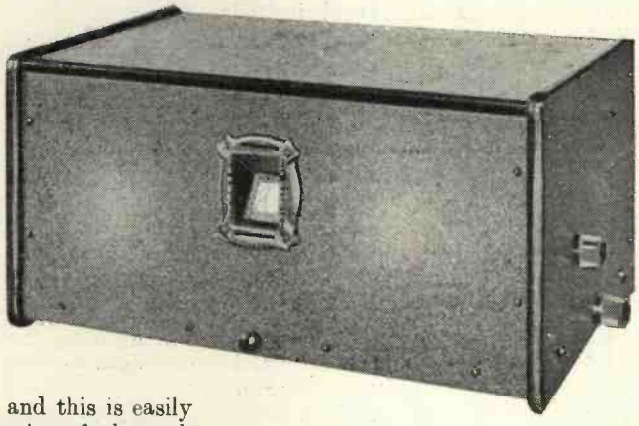
We said earlier on in this "Music Magnet" review that it employed trimming condensers. These are incorporated in the ganged condenser assembly, and are what might be termed semi-fixed trimmers, in that they cannot easily be varied while the set is actually in use, and should be set during the preliminary testing of the set. The trimming condensers are adjusted by means of three brass strips which project through slots on the top of the ganged condenser fitting, and enable extremely fine ganging to be obtained.

A very valuable refinement in the Osram "Music Magnet" Four is the specially calibrated drum dial, which enables the set to be rapidly tuned to any wave-length desired. The wave-lengths are to be found on the large drum projecting through the escutcheon plate, and are approximately correct on assembly.

A slight adjustment is usually necessary, however, and this is easily carried out by slackening of the grub screw which fixes the metal drum to the spindle, and turning the tuning control on the side of the set until the loudest station is heard. Then one merely reduces volume by the aerial series condenser until the station is heard without distortion when fully tuned in. The wave-length of the station is looked up and the large drum is rotated until this wave-length comes opposite the pointer on the escutcheon plate. After this has been done it is found that the calibration is particularly accurate throughout the wav engtli band.

The tuning coils cover a range of 240-550 metres on the medium band, and 900 to 2,000 metres on the upper band; the one switch automatically changing the wave-length of each of the three coils simultaneously.

PLAIN BUT BUSINESS-LIKE

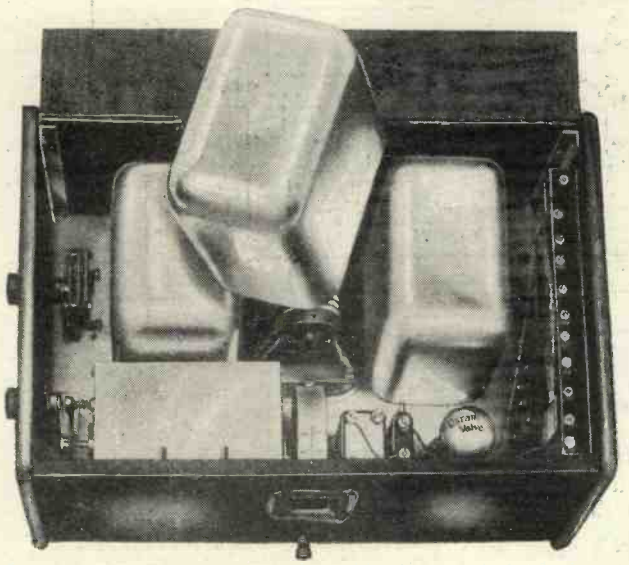


The controls of the "Music Magnet" Four are on the ends of the cabinet, the little window in front enabling the setting of the ganged condenser to be seen at a glance.

THE KIT ARRIVES!

How the components reach you, neatly packed in boxes, with everything necessary for the construction of the set, even down to the last screw.

INSIDE THE RECEIVER



The receiver is unusually well screened, as you will see. The three tuning coils are mounted on metal trays and are completely screened, as also are the ganged condensers. Calibration in wave-lengths is provided for by a rotating drum showing through the window in the panel.

Safe Working from Mains

It is not our purpose in this review to discuss the results obtainable with any of the sets under consideration, but a study of the circuits and the remarks we have made will show fairly clearly what can be expected from each receiver, and it will be realised that the Osram "Music Magnet" Four is a really good DX loud-speaker set.

Warning about the use of power units with the set is given, it being stated that if you have D.C. with the *positive* main earthed a D.C. power unit should not on any account be employed, as it would render all the metal parts of the set "alive."

This is a very timely warning, and we must congratulate the G.E.C. on their frankness. So many people are content to let you use a metal-enclosed, metal-panel set without any regard to possible danger from D.C. mains units.

Many nasty shocks could have been averted if people would only realise

From 15 to 2,000 Metres!

the possible danger of a metal panel connected to L.T.

The voltage difference between such a panel and the person operating the set may be equal to the full voltage of the mains.

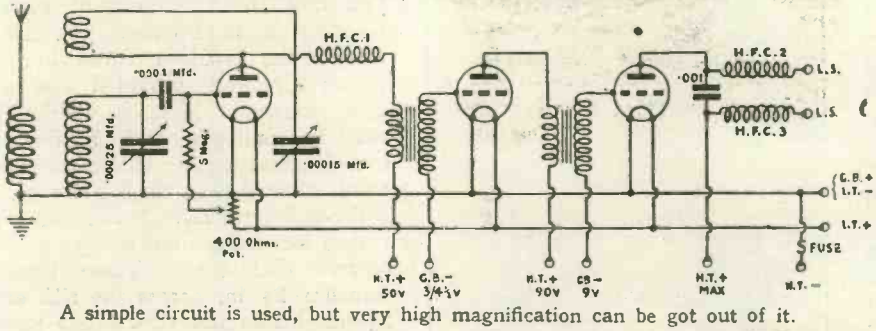
The "EMPIRE LINK" KIT

An all-wave Ready Radio set of distinction.

A set which is becoming increasingly popular is the new Ready Radio "Empire Link" receiver. It covers all wave-lengths from 15 to 2,000 metres and is, we believe, the only kit set which has such a tremendous range.

It consists essentially of an aperiodic aerial coupled to an ordinary grid coil tuned with a ·00025-mfd. condenser, the grid tuning system being connected via a ·0001-mfd. condenser to the grid of the detector valve and a 5-megohm grid leak.

SHORT, MEDIUM, OR LONG WAVES



A simple circuit is used, but very high magnification can be got out of it.

Reaction is carried out on the throttle principle, control being by a ·00015-mfd. condenser, and the biasing of the detector is controlled by means of a 400-ohm potentiometer.

Avoiding Hand-Capacity

Two transformer stages are employed in the set, which has a filter output scheme in which H.F. chokes are employed. This, of course, is to keep any H.F. from getting through into the loud speaker when listening on the ultra-short waves and causing capacity effects which can very well upset the operation of the whole set.

The cabinet is of metal, as also is the panel, and the baseboard also is of the same material. Thus the set is well screened, and hand-capacity should be at a minimum. Slow-motion dials are fitted to both the tuning and reaction condensers, and potentiometer control of the grid of the detector valve is placed on the panel just below the filament rheostat, which also acts as the on-off switch.

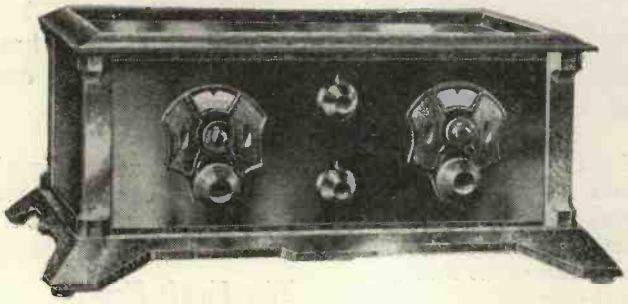
There is nothing at all tricky in the wiring or construction of the set, and by means of the six-pin plug-in coil units wave-lengths up to 2,000 metres can be covered.

A fuse is included and the wiring is carried out by means of "Jiffilinx," which is provided in different lengths so that it can be readily seen which length can be used for any particular position.

The price of the "Empire Link" receiver is eleven guineas in kit form, and can be obtained under the hire purchase system. It is also available at £14, wired up and ready for working.

No anti-motor-boating devices are included, and transformers of a ratio of 5 to 1 are supplied with the set.

A PLEASING PANEL APPEARANCE



A very pleasing panel appearance is obtained in this receiver. The controls are suitably placed and tuning is extremely simple.

Very Simple to Assemble

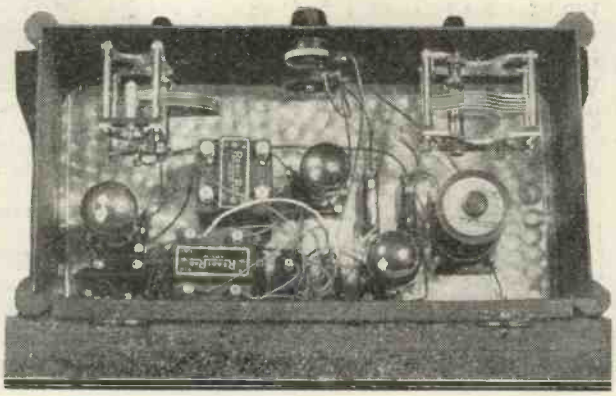
The assembly of the receiver is really so simple that there is little else we can say except that in operation it is perhaps advisable to use batteries for the H.T. rather than a mains unit when listening on very short waves.

(Many mains-unit-driven sets do not take kindly to the ultra-high frequencies and an unnecessary background of noise might be encountered when using such a unit to hear stations on wave-lengths of 50 metres or lower.)

Unfortunately, it has not been possible owing to lack of space to go very fully into the various kit sets now on the market, but the few remarks we have made concerning some of the most popular of these receivers may serve to give you an idea of the variation in kit receivers available to the constructor.

COVERS A WIDE RANGE

By means of plug-in six-pin coils practically any band of wave-lengths from 15 to 2,000 metres can be covered by this interesting three-valver. The detector bias is controllable from the panel.



TROUBLE TRACKING

On this page the Chief of the "M.W." Query Dept. discusses, month by month, some of those common difficulties and troubles which can be so perplexing. This month he deals with two faults which caused the constructors much anxiety.

JUST recently I had a rather interesting case of a set that wouldn't work properly. It was a straight three, consisting of a detector and 2 L.F. stages, the first L.F. being resistance-coupled.

The owner complained that he could not get any reaction effects. The receiver simply would not oscillate, no matter how much H.T. he put on the detector valve.

Oh, yes, he had tried all the usual remedies, such as reversing the leads to the reaction coil, larger coil, etc. An "expert" had seen the set and had not been able to locate the trouble.

A Bad Point!

I endeavoured to diagnose the fault from the details he gave in his letter, but it was hopeless. Everything had been tried and "tested," so in desperation I asked him to let me see the receiver.

The trouble was obvious at first glance. He was using a grid-leak type anode resistance which he stated was ·2 megohm. Actually it was a standard 2-megohm grid leak (let me whisper, it measured 2·8 megohms) and of course, he could not hope to get a single "squeal" with such a high value.

I tried a ·25-megohm resistance in its place and the set worked perfectly, oscillating freely all round the tuning scale. Then I had another similar instance—I did not find the fault this time. The reader lived in Wales and he said that he could not get any signals at all.

Tested Everything

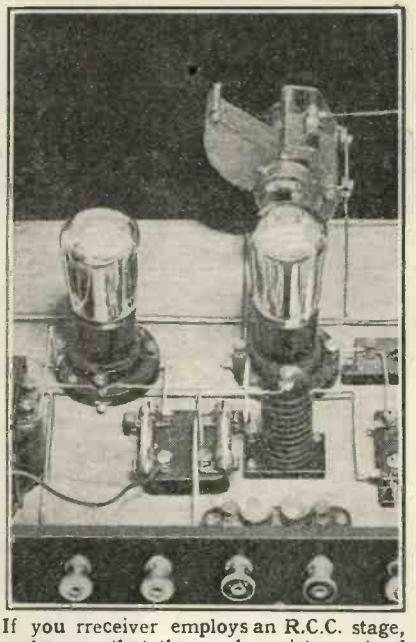
He also had "tested" every component, and he was inclined to blame our design. I insisted that either the wiring or one of the components or accessories *must* be defective.

There was a period of silence. Our reader was probably feeling somewhat annoyed because, not possessing magical powers, I had not spotted the fault from the information he gave in his letters.

The Fault Found

However, he persevered, and finally wrote us a letter of appreciation. I forget how many stations he logged in a single evening, but there was ample proof of the set working satisfactorily. And what do you think the trouble was? It was simply a "dud" grid condenser, in which one of the terminals was not connected to its appropriate plates.

WATCH THIS POINT!



If you rreceiver employs an R.C.C. stage, make sure that the anode resistance is of the correct value. Too high a value will prevent satisfactory reaction from being obtained, and in consequence the set will not give its maximum results.

My correspondent had "tested" this component with a voltmeter and dry cell, a method which told him absolutely nothing, and which was useless as a test for a condenser.

I have commented on these two cases in order to show how very necessary it is to make quite sure that the components are O.K., and that the correct values are used throughout. Only a practical test by a competent dealer or electrician will reveal such faults.

Our Dual-Range Coil

Next I would like to say a few words about the "M.W." dual-range coil. We have had a certain amount of trouble through readers not winding the coil correctly, and owing to formers of incorrect size being used.

First, the reaction. If you have made up one of these coil units and you find that you cannot obtain reaction it is because you have wound the reaction turns in the wrong direction—provided you are using adequate H.T., a ·0001-mfd. reaction condenser, and transformer or resistance coupling, with a low value anode resistance in the latter case.

Secondly, we have found that the ribbed formers are not always of the correct diameter. These should measure $2\frac{5}{8}$ in. across the ribs and $2\frac{1}{8}$ in. inside the ribs. Too small a diameter will mean too small a winding and insufficient coupling between the reaction and medium-wave secondary windings.

Don't Use Dope

One reader sent his coil to us. He said that it was thoroughly inefficient and would not tune correctly. No wonder! He had doped the windings with paraffin wax and *spoilt the coil.*

The greater distributed capacity of a doped coil increases its minimum wave-length enormously, and moreover reduces the signal voltage applied to the grid of the valve.

Please don't use paraffin wax or shellac varnish on any of our coils unless we tell you to.

THE "M.W." SPECIAL SHORT-WAVER

By The "M.W." Research and Construction Department.

A super two-valver of remarkable range. It was designed expressly for the discriminating explorer of the higher frequencies, and yet nearly all the parts are of types in everyday use.

IT seems rather curious that the great increase in popularity of short-wave work has not led to a more rapid development in short-wave receivers of specialised types. Interesting and effective as many of these sets are, it cannot be denied that they have not progressed nearly so fast as the broadcast type in the course of the last twelve months or so.

Operating Skill Unnecessary

It may be argued that this has been because the specialised short-wave receiver was not in such urgent need of improvement as the broadcast set of a year or so ago, and there is probably a good deal of truth in this explanation. The best short-wave receivers of a year ago certainly did their job extremely well, performing remarkable feats of long-distance reception with very few valves, and so on, and so perhaps it has been thought that there was little need to seek for revolutionary improvements.

An excusable attitude it may be, but not a healthy one to adopt in so essentially progressive a subject as radio. That is how it struck us recently anyway, and we set to work to do something about it.

Reviewing the position, it seemed to us that a very satisfactory standard of performance had already been achieved, bearing in mind the fact that the most generally useful type of receiver for short-wave work is the detector and one or two low-frequency stages.

After much consideration and a certain amount of experimental work we came to the conclusion that what was really needed was a determined attempt to make the typical short-wave receiver easier and pleasanter to operate, ruling out as far as possible the factor of operating skill.

What Has Been Overcome

Those readers who have had any experience of short-wave work will readily agree that even the best of normal short-wave receivers is definitely very much more difficult to operate than an equivalent broadcast set. Tuning is very much sharper, so that quite a delicate touch must be cultivated upon the tuning controls, reaction requires to be set in a similar accurate manner, and besides these matters there is always a tendency to hand-capacity effects, and the risk of threshold howling, "flat spots" etc.

A Real Step Forward

The experienced short-wave operator unconsciously allows for all these things and probably thinks very little of them, but to everyone else they

A LIST OF THE PARTS REQUIRED FOR THIS RECEIVER

PANEL
12 in. × 7 in. (Lissen, or Red Seal, Goltone, etc.).

CABINET
Panel space as above, baseboard 9 or 10 in. deep (Camco, or Lock, Keystone, Pickett, Kay, Osborn, etc.).

VARIABLE CONDENSERS
1 double condenser, ·0001 mfd. and ·00002 mfd. (Polar).
1 ·00025 or ·0003 mfd. (Formo, or J.B., Igranic, Lotus, Ormond, Dubilier, etc.).
1 baseboard-mounting "neutralising" type (J.B., or Bulgin, Igranic, Magnum, etc.).

SWITCH
1 ordinary on-off type (Ready Radio, or Lissen, Bulgin, Lotus, Igranic, Benjamin, Keystone, Goltone, Junit, etc.).

COIL HOLDERS
2 (Igranic, or Lotus, Lissen, Magnum, Bulgin, Wearite, Red Diamond, etc.).

VALVE HOLDERS
2 ordinary 4-pin type (Clix, or Benjamin, Igranic, Lotus, Junit, W.B., Lissen, Bulgin, Formo, etc.).

FIXED CONDENSERS
1 ·0001 mfd. (T.C.C., or Lissen, Telsen, Dubilier, Ready Radio, Ediswan, Ferranti, Watmel, Formo, Ormond, Mullard, etc.).
1 ·001 mfd. (Lissen, or Telsen, etc.).
1 ·006 mfd. (Ormond, or Formo, etc.).
1 2 mfd. (Dubilier, or Igranic, T.C.C., Lissen, Ferranti, Mullard, Hydra, etc.).

GRID LEAK
2 meg. with holder (Ediswan, or Lissen, Dubilier, Ferranti, Igranic, Mullard, etc.).

L.F. TRANSFORMER
Low or medium ratio (Telsen, or Igranic, Lissen, R.I., Ferranti, Varley, Lotus, Mullard, Lewcos, etc.).

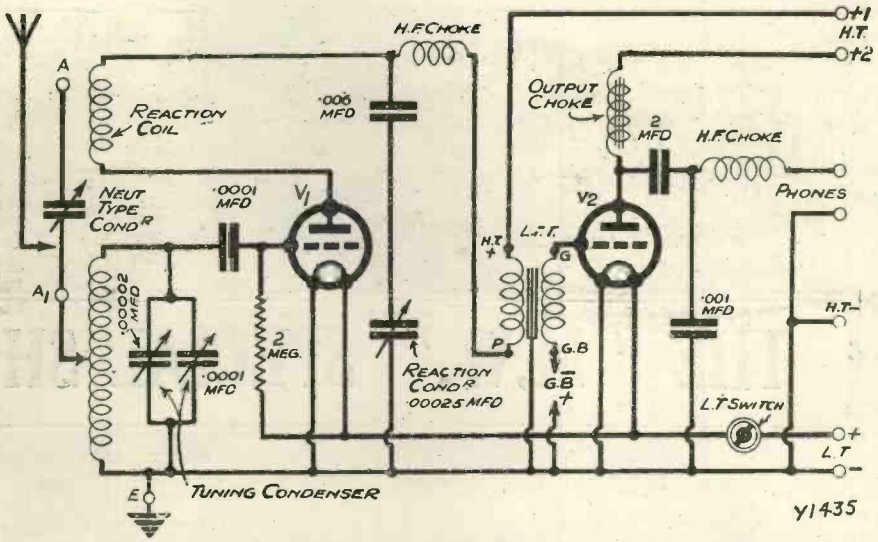
CHOKES
2 H.F. (Bulgin and Magnum in set. Any other good specimens of the special short-wave type, e.g. Igranic, Wearite, etc.).
1 output filter (Varley, or Lissen, R.I., Igranic, Ferranti, Atlas, Magnum, etc.).

MISCELLANEOUS
2 vernier dials (Igranic, or other good make giving a really smooth motion free from backlash).
1 terminal strip, 12 in. × 2 in.
10 terminals (Belling-Lee, or Igranic, Eelex, Clix, etc.).
Wire, flex, screws, G.B. plugs, clip, etc.

are very real stumbling blocks indeed. Our conclusion was that if they could be removed, or at any rate cut down to much smaller proportions, this would mark a very real step forward in short-wave progress.

The short-wave receiver which we are about to introduce to you was the outcome of these deliberations, and we think that our readers will agree that in it the desired step forward has been achieved. In many ways it is indistinguishable in behaviour and operation from a broadcast receiver of equivalent type. It conforms to the highest standard of actual performance, and it puts that performance within the reach of those who have had little or no previous experience of short-wave reception.

A DET.-L.F. WITH A DIFFERENCE



Note the H.F. choke and ·001 fixed condenser in the output circuit, which free the set from hand-capacity complications. The "reservoir" tuning condenser is another invaluable feature.

Removing Threshold Howls

We tackled first the question of avoiding body-capacity effects and the allied nuisance of threshold howl. Here we found that two comparatively simple precautions sufficed to ensure adequate elimination of these previously troublesome effects.

So far as threshold howl is concerned in a simple receiver of the detector and one L.F. type, we have obtained adequate freedom by such a simple remedy as a slight rearrangement of the reaction circuit, in conjunction with the use of a preventive circuit to deal with body-capacity effects. These latter, it has developed, are definitely interconnected with the threshold-howl trouble, and when they are removed the latter is likewise rendered far less troublesome.

These body effects, it has been found, are due very largely to the presence of wandering H.F. currents in the leads of the headphones worn by the operator. Accordingly the provision of a really effective H.F. filter in the 'phone output circuit can be trusted to ensure trouble-free operation, so long as a little care is taken with the actual layout of the parts.

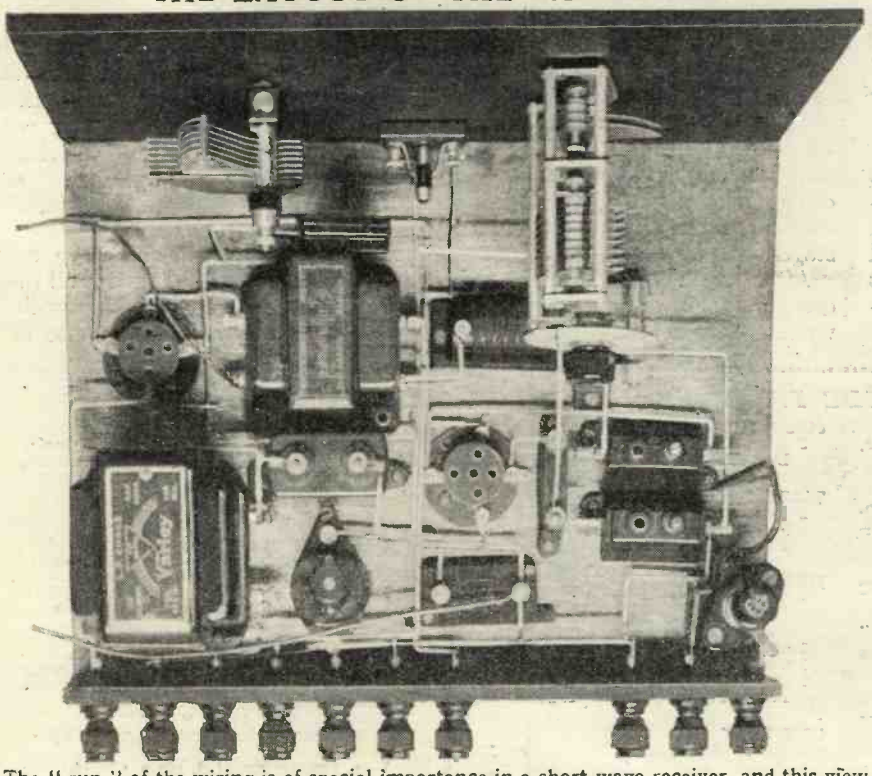
The H.F. Filter

While we are mentioning this matter of the exclusion of H.F. currents from the 'phones we may perhaps as well explain exactly what has been done in the present instance. If you will refer to the circuit diagram you will see that there is first of all an ordinary type of output filter for the 'phones. Then note that in series with the high-potential lead to the 'phones there is an H.F. choke, and shunted from the valve side of this choke down to earth there is a ·001-mfd. bypass condenser. This device has been found quite adequate for the purpose and very effectively prevents stray H.F. currents from getting into the 'phone leads.

Easily Handled Reaction

Next comes the question of obtaining much easier tuning and reaction adjustments, and upon this a considerable amount of experimental work has been carried out. As regards reaction, we gained the idea that only quite a simple expedient was needed. The main difficulty has been found to lie in the manipulation of the small and direct-acting knob of the ordinary type of reaction condenser, and we have found that all that was needed here was to use an ordinary type of variable condenser of suitably small capacity for reaction purposes, so that a good vernier dial can be fitted. With the aid of the slow-motion drive of this scheme reaction becomes quite simple to handle.

THE LAYOUT OF THE BASEBOARD



The "run" of the wiring is of special importance in a short-wave receiver, and this view of the set will help the constructor to make a close copy of the original.

LISSEN

FIXED CONDENSERS

Deliver all their stored up energy

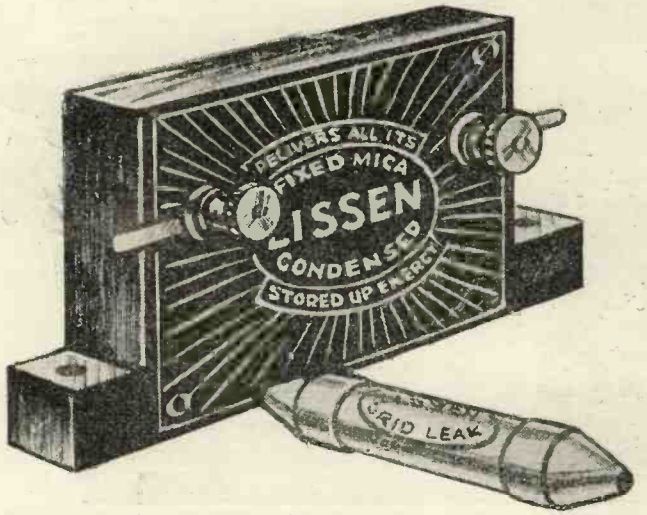
Because you are using bigger H.T. voltage—because you are seeking always more power and more purity from your set—because you are going out for ever more distant stations—your need for condensers that will stand up to all demands without leakage and without breakdown is more urgent now than ever.

Lissen fixed condensers have become the standard fixed condensers in almost every published circuit. Accurate to within 5 per cent of stated capacity.

·0001 to ·001 mfd., **1/-** each

·002 to ·006 mfd., **1/6** each

INSIST UPON LISSEN PARTS ALWAYS



MOULDED CASES MADE of INSULATING MATERIAL—HEAVY "CAB TYRE" FLEX LEADS

The current you get from Lissen Batteries is the purest form of current you *can* get for radio. But if you want to use an eliminator, use a Lissen Eliminator. You'll then get H.T. current from your mains smoother, steadier better than before. There are four types of Lissen Eliminators; one of them will almost certainly be just right for your set. Tell your dealer what voltage your mains supply is, and whether it is A.C. or D.C.; tell him what output you require, or what valves you are using, and he will demonstrate for you the Lissen Eliminator to suit your needs.

TYPES AND PRICES.

D.C. MODEL "A"
(100-150 volts and 200-250 volts).
Employs 3 H.T.+ tappings: H.T.+1 giving 80 volts for S.G. valves; H.T.+2 giving 60 volts at approx. 2 mA. for detector valves; H.T. +3 giving *120/150 volts at 20 mA.
Price **27/6**

D.C. MODEL "B"
(100-150 volts and 200-250 volts).
Employs 3 H.T. + tappings: H.T.+1 and H.T.+2 are continuously variable (by means of two control knobs) and capable of giving any desired voltage up to *120/150 volts at approx. 2 mA.: H.T. + 3 giving *120/150 volts at 20 mA. for power valves.
Price **39/6**

*(The output voltages given from D.C. models operating from 100/150 volt mains are approximately 75 per cent. of those quoted).

A.C. MODEL "A"
Tappings as in D.C. Model "A"
(100-125 volts and 200-250 volts).
Price **£3-0-0**

A.C. MODEL "B"
Tappings as in D.C. Model "B"
(100-125 volts and 200-250 volts)
Price **£3-15-0**

LISSEN ELIMINATORS

LISSEN LIMITED, WORPLE ROAD, ISLEWORTH, MIDDLESEX

A Set Built Specially for Short Waves

The problem of easier tuning proved much more difficult of solution. A common expedient is to employ only a very small capacity tuning condenser, say of ·00005 mfd., with a very low ratio slow-motion dial, but there are certain practical drawbacks. Chiefly, there is the nuisance of constant coil-changing produced by the fact that the tuning condenser only enables one to cover a very small range of wave-lengths.

Really Simple Tuning

While we were investigating various means of overcoming the difficulties associated with the tuning control, we came across a component which seemed likely to fill the bill very completely. This is the special type of tuning condenser actually incorporated in our final receiver, and a very few tests showed that it did precisely what was required.

This new short-wave condenser consists actually of two parts, namely, a true variable condenser with a maximum capacity of only ·00002 mfd. controlled by the usual spindle passing through the panel, and carrying a slow-motion dial, with a " reservoir " portion having a maximum capacity of ·0001 mfd. This portion is controlled by a simple knob at the rear of the condenser, this knob carrying a pointer indicating upon a small scale.

How the Condenser is Used

The method of using this double arrangement is extremely simple. Suppose it is desired to cover the wave range given by a particular set of coils, you start by placing both the condensers at their minimum setting. You then sweep over the tuning range of the panel control with the slow-motion dial, and if you have not found your station you advance the knob and pointer of the " reservoir " capacity to the first division on the scale, and proceed to search upon the tuning portion again.

A Revelation

After traversing the next portion of the tuning range you advance the reservoir capacity pointer to the second division on the scale and again search over the range. In this way you can cover the complete tuning range, which can be quite considerable, and yet all the while you are tuning with a small capacity.

This latter, with the aid of a good slow-motion dial, makes searching and actual tuning just about as simple as the operation of tuning-in a distant broadcast station. What that really means in convenience in short-wave work will come as something of a revelation to those who have been accustomed to the earlier types of short-wave receivers.

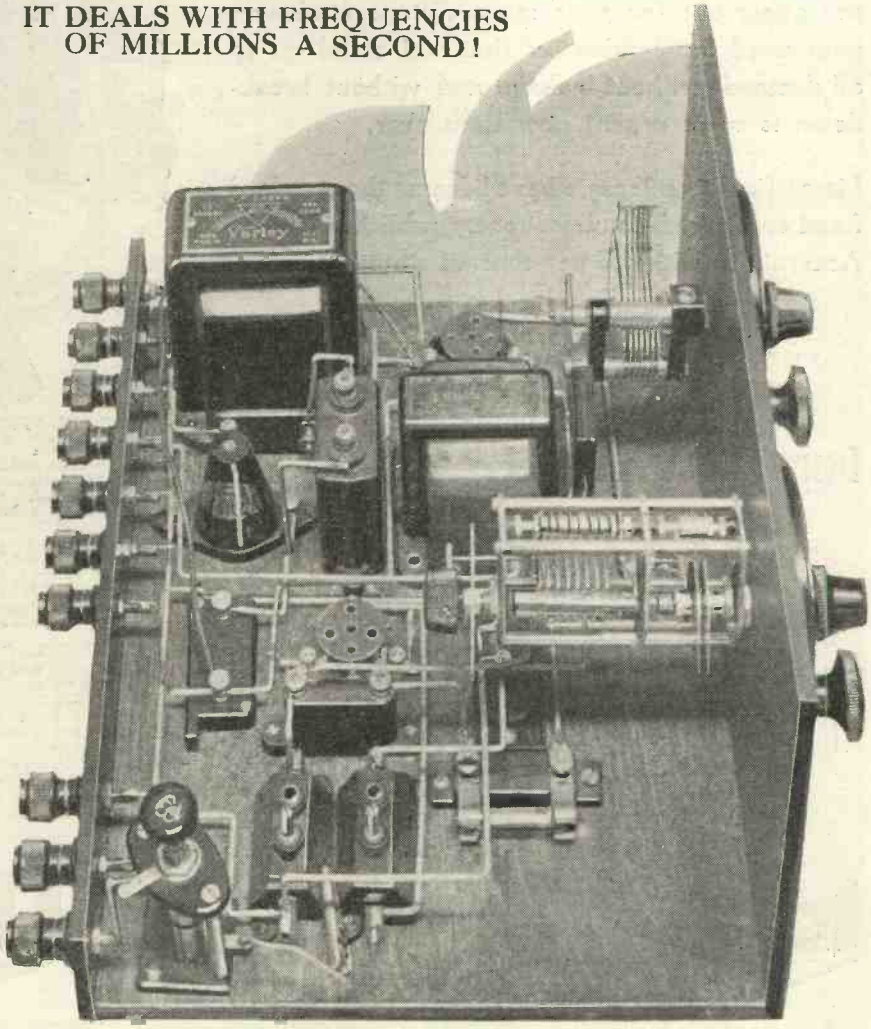
So much for the general ideas underlying the design of the receiver. A glance over the circuit diagram will make clear the other main features of its arrangement, notably the layout of the reaction circuit, and the method of tuning and aerial coupling employed.

You will observe that there are two aerial terminals, one marked A_1 taking the aerial straight through to a tapping point on the grid coil, and the other bringing in the customary small neutralising type of condenser in series for the removal of flat spots.

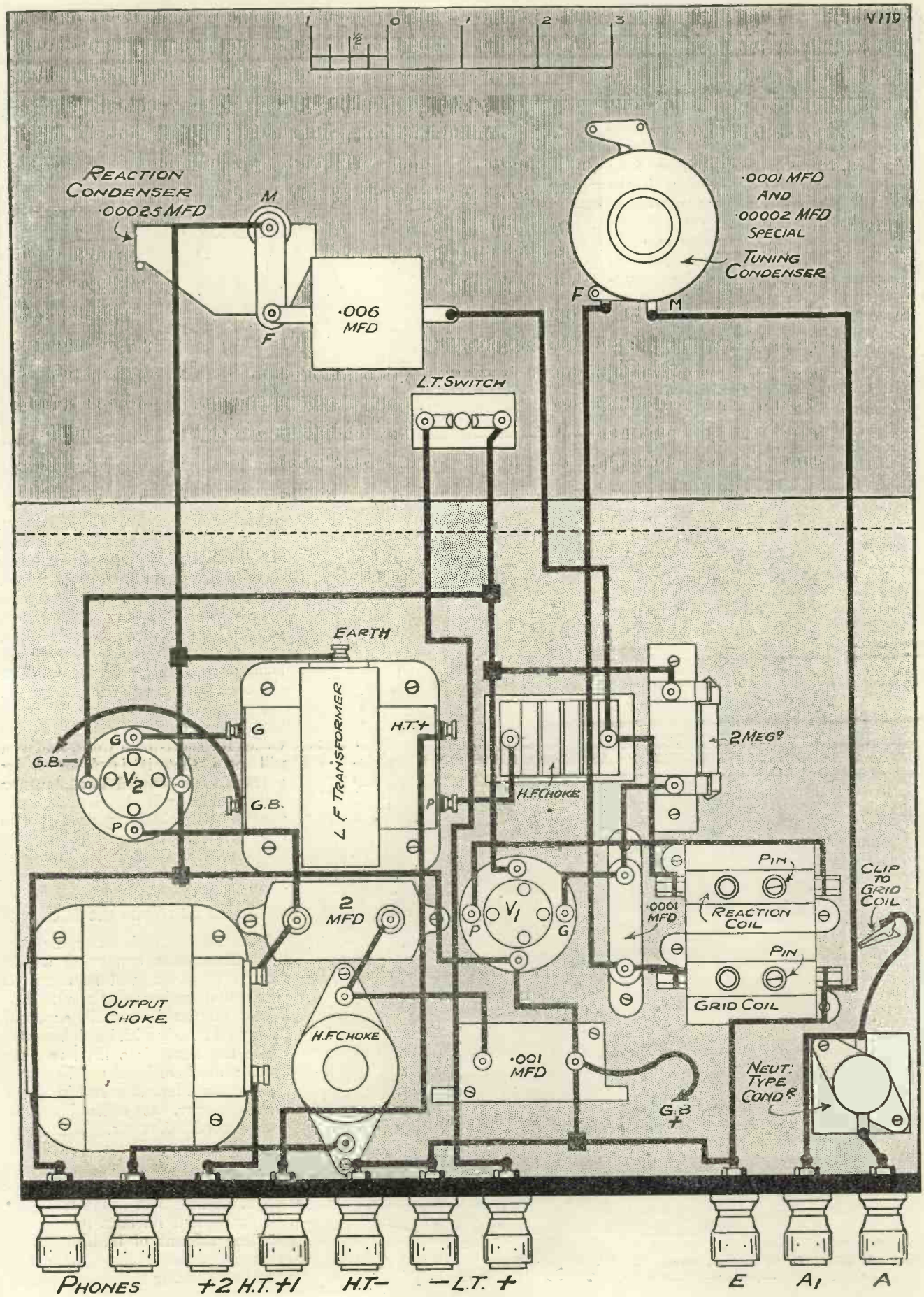
The Tapping Clip

The coils employed are of the standard bare wire spaced type, with a plug-in mounting, and the necessary tapping point is obtained on the grid coil by means of a flex lead terminating in a small crocodile clip. As a practical point, it is to be noted that this clip must never make contact with more than one turn at a time, and so it is rather a good scheme to bend outwards those turns with which it is most likely to engage. A little judicious bending this way and that will make it easy to obtain access to any desired turn and the coil will not be injured in any way by this treatment.

IT DEALS WITH FREQUENCIES OF MILLIONS A SECOND!



Even on 30 metres the H.F. end of the set—seen in the foreground—has to deal with a frequency of 10,000,000 per second, so the wiring and spacing need to be carried out with care.

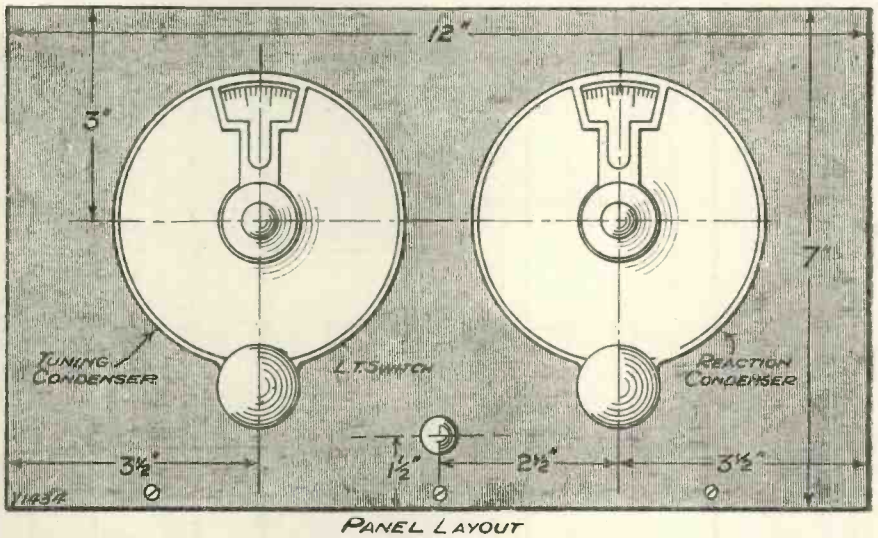

V179
REACTION CONDENSER ·00025 MFD
M
F
·006 MFD
·0001 MFD AND ·00002 MFD SPECIAL TUNING CONDENSER
F
M
L.T. SWITCH
EARTH
G.B.−
G
V2
P
G
G.B.
L F TRANSFORMER
H.T.+
P
H.F.CHOKE
2 MEG?
2 MFD
V1
P
G
·0001 MFD
PIN
REACTION COIL
PIN
GRID COIL
CLIP TO GRID COIL
OUTPUT CHOKE
H.F.CHOKE
·001 MFD
G.B.+
NEUT. TYPE COND.R
PHONES
+2 H.T.+1
H.T.−
−L.T.+
E
A1
A

It Is Unusually Easy to Handle and to Build

The reaction circuit is of the "throttle control" type, which we have found particularly favourable from the point of view of getting a really smooth control free from threshold-howl effects and with the least possible effect upon tuning, The reaction condenser you will note is of ·00025 mfd. capacity (a ·0003 mfd. will also serve), this form of rather large condenser being recommended in view of the fact that the reaction demands of a short-wave set commonly vary very considerably at different points on the tuning scale.

Use of Safety Condenser

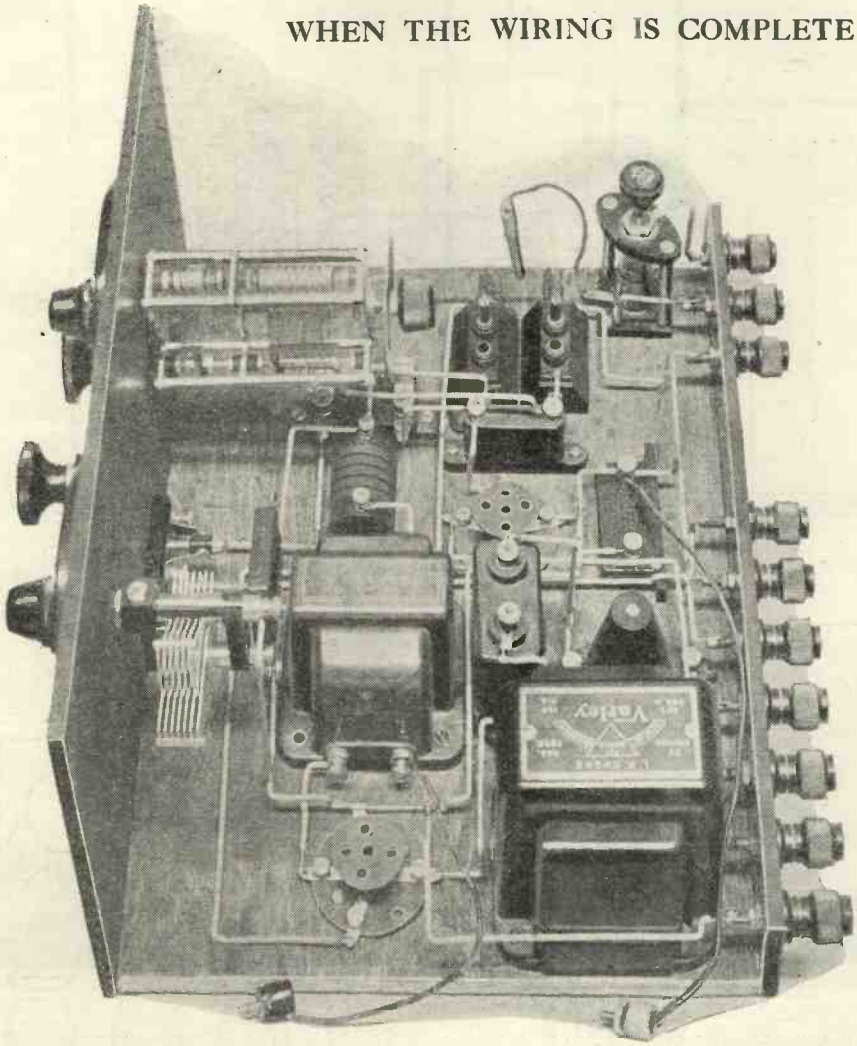
Since the reaction condenser is of the air-dielectric type, there is always a risk of damage to this component, resulting in the moving plates touching the fixed, and so producing a partial short of the H.T. battery.



PANEL LAYOUT

Symmetrically placed slow-motion dials for tuning and reaction make the set a very "slick" one to handle. The only other panel component is the L.T. switch.

WHEN THE WIRING IS COMPLETE



Here is a view of the finished wiring, taken from the L.F. end, and clearly showing the disposition of the wires to the L.F. valve holder.

You will therefore see in series with the reaction condenser the customary safety or stopping fixed condenser of fairly large capacity. In passing, it may be noted that any capacity here from ·001 mfd. upwards will serve, the one actually employed in the set being of ·006 mfd., is an indication of the order of capacity called for here.

The detector valve is provided with a grid condenser and leak of suitable values for short-wave work, and you will note that it is followed by a transformer-coupled low-frequency stage which will be found quite adequate for obtaining good 'phone strength from the majority of the short-wave stations which are normally received.

Some Stations on L.S.

Some of them, of course, notably those Europeans employing a fair amount of power, will be found to give actual loud-speaker results, but a set of this sort is naturally expected to be used mostly with headphones.

The net result is a little receiver which we feel confident will be found to set quite a new standard in short-wave efficiency, ease of handling and general good behaviour. When first put on test it rather surprised the operator by immediately bringing in a comparatively small commercial station in California in broad daylight, and throughout its tests it gave an excellent account of itself, bringing in many of the really distant low-wave broadcasting stations, including

Build Your Receiver with a "Ready Radio" Complete Kit of Guaranteed Parts

"STAR-POWER" THREE

RADIO OUT OF INCOME

A.C. MODEL

	£	s.	d.
1 Polished ebonite panel, drilled to specification, 21 × 7 × 3/16 in.		7	0
1 Hand-polished cabinet, with 10 in. baseboard	1	10	0
1 ReadiRad ·0005-mfd. variable condenser		4	6
1 Igranic Indigraph S.M. dial		6	0
1 ReadiRad ·00015-mfd. differential reaction condenser		5	0
1 Bulgin N.7 neutralising condenser		4	9
1 ReadiRad on-and-off switch			10
1 Igranic mains type on-and-off switch (Midget)		1	8
2 Link resistances, 25,000 ohms		3	0
1 Link resistance, 50,000 ohms		1	9
2 Link resistances, 1,000 ohms		1	6
1 Dubilier 1-meg. grid leak and vertical holder		2	9
1 ReadiRad ·5-meg. grid leak and holder		1	4
3 Telsen 5-pin valve holders		3	9
1 Telsen 4-pin valve holder		1	0
6 Dubilier 2-mfd. fixed condensers	1	1	0
2 T.C.C. 4-mfd. fixed condensers		12	6
1 Telsen ·002 fixed condenser		1	0
1 ReadiRad ·0003 fixed condenser			10
1 Dubilier ·01-mfd. fixed condenser		3	0
1 ReadiRad "Hilo" H.F. choke		4	6
2 R.I. Hypercore L.F. chokes	1	15	0
1 Wearite output filter choke, H.T.5		12	6
1 Telsen "Radiogrand" L.F. transformer, 3-1		12	6
1 Atlas half-wave transformer, to specification	1	5	0
1 ReadiRad "M.W." dual-range coil		12	6
1 ReadiRad "Star-Turn" selector coil		12	6
2 Belling-Lee terminal blocks		1	4
4 Belling-Lee terminals, type "B"		2	0
1 Pkt. Jiffilinx, for wiring		2	6
3 A.C. mains valves to specification, 2 H.L. and 1 L types	2	7	6
1 Half-wave rectifier valve, to specification		15	0
Wire, flex, screws, plug, adaptor, etc.		1	6
TOTAL (including Valves and Cabinet)	£14	17	6

KIT A. Cash Price, £11:0:0, or 12 equal monthly payments of 20/2

KIT B. Cash Price, £13:7:6, or 12 equal monthly payments of 24/6

KIT C. Cash Price, £14:17:6, or 12 equal monthly payments of 27/3

D.C. MODEL

	£	s.	d.
1 Polished ebonite panel, drilled to specification, 21 × 7 × 3/16 in.		7	0
1 Hand-polished cabinet, with 10-in. baseboard	1	10	0
1 ReadiRad ·0005-mfd. variable condenser		4	6
1 Igranic Indigraph S.M. Dial		6	0
1 ReadiRad ·00015 differential reaction condenser		5	0
1 Bulgin N.7 neutralising condenser		4	9
1 Igranic mains type on-and-off switch (Midget)		1	8
1 ReadiRad on-and-off switch			10
1 Link resistance, 25,000 ohms		1	6
1 Link resistance, 50,000 ohms		1	9
1 Varley 100,000-ohm resistance holder		7	0
1 ReadiRad 2-meg. grid leak and holder		1	4
1 ReadiRad 1-megohm grid leak and holder		1	4
1 Igranic Pre-Set 400-ohm potentiometer		1	8
1 Varley 2,500-ohm power potentiometer		9	6
3 Telsen 4-pin valve holders		3	0
1 Dubilier 2-mfd. fixed condenser		3	6
1 Igranic 2-mfd. fixed condenser (250 volts working type)		3	0
3 Dubilier 2-mfd. fixed condensers, type B.C.		11	0
1 Dubilier 4-mfd. fixed condenser, type B.C.		6	0
1 Telsen ·001-mfd. fixed condenser		1	0
1 Telsen ·002-mfd. fixed condenser		1	0
1 ReadiRad ·0003-mfd. fixed condenser			10
1 Dubilier ·01-mfd. fixed condenser		3	0
1 Varley L.F. choke, 20-henry	1	0	0
1 Igranic L.F. smoothing choke, 20-henry, C.30		15	6
1 Atlas output filter choke	1	5	0
1 ReadiRad "Hilo" H.F. choke		4	6
1 Wearite H.F.8 heavy-duty H.F. choke		10	6
1 Telsen "Radiogrand" L.F. transformer, 3-1		12	6
1 ReadiRad "M.W." dual-range coil		12	6
1 ReadiRad "Star-Turn" selector coil		12	6
1 Pair ReadiRad panel brackets			10
4 Belling-Lee terminals, type "B"		2	0
2 Belling-Lee terminal blocks		1	4
1 Ferranti 0-150 flush-mounting milliammeter, 4.F.	1	15	0
1 Pkt. Jiffilinx, for wiring		2	6
3 Valves to specification: detector, L.F. and power (4-volt ·1-amp. class)	1	7	6
Flex, screws, plug adaptor, etc.		1	8
TOTAL (including Valves and Cabinet)	£15	0	0

KIT A. Cash Price, £12:2:6, or 12 equal monthly payments of 22/3

KIT B. Cash Price, £13:10:0, or 12 equal monthly payments of 24/9

KIT C. Cash Price, £15:0:0, or 12 equal monthly payments of 27/6

RADIO OUT OF INCOME

"M.W." SPECIAL SHORT-WAVER

	£	s.	d.
1 Polished ebonite panel, 12 × 7 × 3/16 in., drilled to specification		4	0
1 Cabinet, with 10-in. baseboard		19	0
1 Polar short-wave condenser, ·0001 and ·00002 mfd.		15	0
1 Formo ·00025 log condenser		4	6
1 J.B. neutralising condenser, B.M.		3	6
1 ReadiRad on-and-off switch			10
2 ReadiRad single-coil holders		1	8
2 Telsen 4-pin valve holders		2	0
1 ReadiRad ·0003-mfd. fixed condenser			10
1 Telsen ·001-mfd. fixed condenser		1	0
1 Ormond ·006-mfd. fixed condenser, R/443		1	6
1 Dubilier 2-mfd. fixed condenser		3	6
1 ReadiRad 2-meg. grid leak and holder		1	4
1 Telsen "Radiogrand" L.F. transformers, 3-1 ratio		12	6
1 Bulgin short-wave H.F. choke		3	0
1 Igranic short-wave H.F. choke		2	0
1 Varley 20-henry L.F. choke	1	0	0
2 Igranic "Indigraph" S.M. dials		12	0
1 Terminal strip, 12 × 2 × 3/16 in.		1	6
10 Belling-Lee "B" terminals		5	0
1 Set Atlas short-wave coils		10	0
2 Valves, to specification (detector and power)		19	0
1 Pkt. Jiffilinx, for wiring		2	6
Flex, screws, crocodile clip, plugs, etc.		1	7
TOTAL (including valves and cabinet)	£7	7	9

KIT A. Cash Price, £5:9:9, or 12 equal monthly payments of 10/0

KIT B. Cash Price, £6:8:9, or 12 equal monthly payments of 11/9

KIT C. Cash Price, £7:7:9, or 12 equal monthly payments of 13/6

"ALL-POWER" UNIT

	£	s.	d.
1 Polished ebonite panel, drilled to specification, 9 × 7 × 3/16 in.		3	6
1 Oak cabinet, with 12-in. baseboard		19	0
1 Varley power potentiometer, 10,000 ohms		10	0
1 ReadiRad 1,000 potentiometer, B.M.		3	6
1 Igranic "Pre-Set" potentiometer, 400 ohms		1	8
2 Dubilier ·25-megohm grid leaks and vertical holder		5	6
1 Igranic potential divider, 20,000 ohms		12	6
1 ReadiRad 25,000 resistance and holder		2	6
1 Varley L.F. choke, 20-henry	1	0	0
1 R.I. Hypercore L.F. choke, 20-henry		17	6
1 Dubilier 4-mfd. fixed condenser, type BC.		6	0
2 Dubilier 2-mfd. fixed condensers, type BC.		7	4
3 Dubilier 2-mfd. fixed condensers		10	6
1 Dubilier 1-mfd. fixed condenser		2	6
1 Bulgin double-pole mains switch		3	9
1 Ferranti voltmeter, 0-250 volts (Flush)	2	4	0
8 Belling-Lee insulated plugs and sockets		6	0
1 Terminal strip, 9 × 2 × 3/16 in.		1	2
1 Pkt. Jiffilinx, for wiring		2	6
Flex, screws, plug adaptor, plugs, etc.		1	4
TOTAL (including cabinet)	£9	0	9

or 12 equal monthly payments of 16/6

THE "M.W." "TRI-COIL" ONE

	£	s.	d.
1 Polished ebonite panel, 7 × 7 × 3/16 in., drilled to specification		2	6
1 Cabinet, with 7-in. baseboard		12	6
1 ReadiRad ·0005-mfd. variable condenser		4	6
1 Igranic "Indigraph" S.M. dial		6	0
1 ReadiRad ·00015-mfd. differential reaction condenser		5	0
1 ReadiRad ·0003-mfd. fixed condenser			10
1 Telsen ·001-mfd. fixed condenser		1	0
1 ReadiRad 2-meg. grid leak and holder		1	4
1 ReadiRad "Hilo" choke		4	6
1 Telsen 4-pin valve holder		1	0
1 ReadiRad single-coil holder			10
1 ReadiRad on-and-off switch			10
1 Terminal strip, 7 × 2 × 3/16 in.			10
8 Belling-Lee "M" terminals		3	0
4 Clix sockets			4
2 Small ebonite strips, 2 × ½ × 3/16 in.			3
1 Pkt. Jiffilinx, for wiring		2	6
1 Valve to specification (detector)		8	6
2 Atlas coils, 60 and 250		8	0
¼ lb. each No. 24 gauge and No. 26 gauge D.C.C. wire		2	4
Flex, wander plugs, screws, etc.		1	2
TOTAL (including valves and cabinet)	£3	7	9

KIT A. Cash Price, £2:6:9, or 6 equal monthly payments of 8/6

KIT B. Cash Price, £2:15:3, or 6 equal monthly payments of 10/-

KIT C. Cash Price, £3:7:9, or 6 equal monthly payments of 12/6

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The First Station Picked Up was a Californian!

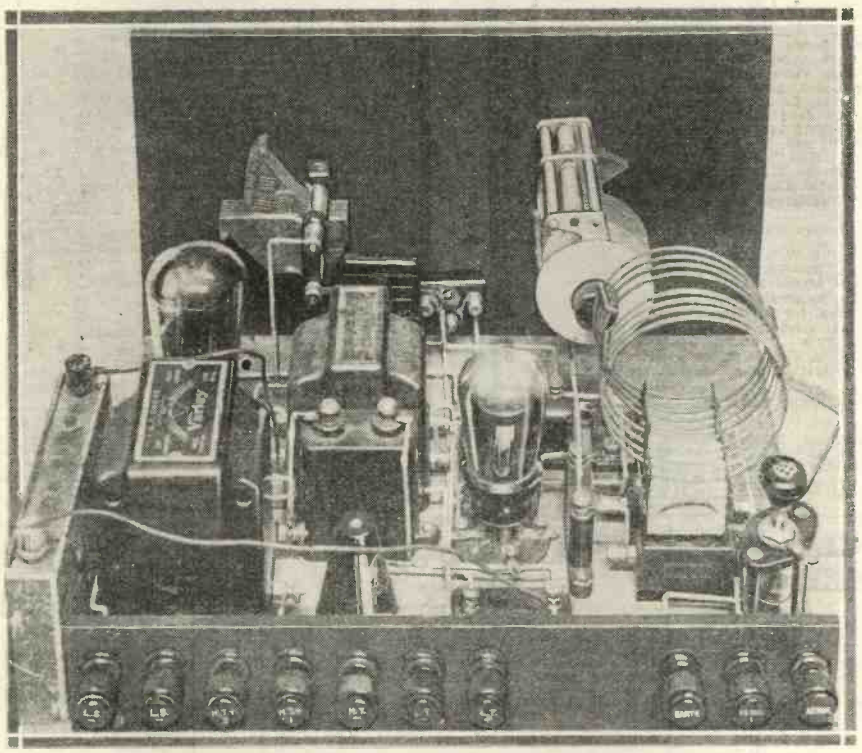
two in America, at quite respectable 'phone strength.

The receiver is one which will appeal definitely to the more advanced constructor, and so we do not feel it will be necessary to give any detailed constructional hints. The diagrams and photographs will assuredly make everything quite clear to the type of constructor for whom it is intended.

We do not wish to imply, by the way, that it is not a suitable beginner's short-wave set, but the point we have in mind is that anybody who builds the instrument will almost certainly have previously constructed at least a broadcast set, and so will be conversant with general constructional methods.

Probably some fairly detailed operating notes will be helpful, particularly in view of the fact that the tuning control is of a type which is not likely to be familiar to many readers. First of all there is the question of coil sizes. For the interesting band of waves from about 19 or 20 metres up to some 35 metres you should use a No. 4 coil for the grid position, and another No. 4 or 6 in the reaction socket.

IT WILL REACH RIGHT ROUND THE GLOBE



This view shows the set with coils and valves inserted, and with the grid-bias battery connected. Note how the crocodile-clip (right) joins the neutralising-type condenser to the grid coil by means of a flexible lead.

Down to 15 Metres

For general purposes you will find that the aerial clip can be attached to a turn somewhere near the middle of the grid coil, but a little adjustment here for the best results is to be recommended.

To cover the tuning range you will understand that you start with the reservoir capacity control set to minimum, and then tune over the range on the slow-motion dial. Then advance the reservoir capacity pointer to the first division and again sweep over the dial. Progress in this way until the whole range has been covered. If any "flat spots" are encountered on the reaction control in the course of searching, the aerial can be transferred to the "A" terminal and a suitable adjustment made upon the neutralising-type condenser.

For the next wave range higher up, namely, from about 30 to 45 metres, a No. 6 coil should be used in the grid position and a No. 4 or No. 6 for reaction. The procedure here is exactly the same as before.

We ourselves found that the receiver would go down to a wavelength which must have been in the neighbourhood of 15 or 16 metres, and this lower range is obtained with a No. 2 coil in the grid position and a No. 4 or No. 6 for reaction. The majority of short-wave sets will not oscillate with this combination, but the present one did so with very little persuasion when a suitable, fairly freely oscillating detector valve was used, such as one of the modern "special detector" types of comparatively low impedance.

These valves will be found quite suitable, as also will be the majority of those "H.F." or "H.L." types with an impedance of some 20,000 ohms. In the second socket, of course, one of the usual L.F. or small power types should be employed.

The H.T. voltage adjustment is naturally a matter of considerable importance in such a receiver, where everything depends upon getting a really perfect control of reaction. Accordingly, you should adjust the H.T. voltage on terminal H.T. + 1 with a certain amount of care, voltages ranging from perhaps 40 to some 70 or 80 volts being tried until one is found which suits your particular detector valve as perfectly as possible. On terminal H.T. + 2, on the other hand, just the conventional 100 or 120 volts can be applied without adjustment. (This feeds the output valve.)

One concluding hint. The design of this receiver is such that body capacities are cut down to somewhere about the lowest possible level, but it is sometimes found, even with a receiver of this nature, that a long earth lead or a bad earth will lead to a certain amount of trouble.

Working Without Earth

In such cases it is well worth trying the experiment of dispensing with the earth altogether. It will often be found in this way that decidedly better results can be obtained because more accurate adjustments can be made.

Incidentally it may be as well to mention here that a fairly small aerial (a horizontal span of about 35 to 40 feet) is better than a very large one.

IN PASSING

A Warning to Wives of Radio Men

I HAVE had a revelation which is going to be reflected in this magazine before I am a day older—lest I miss the bus. It's an extraordinary thing that an acute fellow like me can go on writing, month after month, brilliantly, yet overlook a fact of the greatest importance; namely, the reader. You can hardly believe that I have failed to consider thee, O fellow-fans, brothers of the dial and the coil!

THE NEW JOURNALISM

"I am not in on it," I said.

Nevertheless, I am convinced that I have been guilty of gross negligence, for which I shall pay a bitter price unless I can make up all the leeway in this month's offering.

A Soused Mackerel

The angel who appeared unto me and showed me the true vision came in the guise of a soused mackerel. At least, that is the name which he gave himself, aloud, crying mightily into the fog as he staggered forth from Carlatts'—under the arches—where freemen of London sit amongst the casks and drink sherry. He was not a mackerel; only a sprat amongst the whales of his profession. But he most assuredly was soused; that is, lit up.

"Laddie," he muttered, as I steered him to a dark alley nearby, out of sight of the police, "'smi hup-pinion tha' jinnel—jennel—er—*junnelism*—zash word! *zjunnelism!*—ish nee's be revised; 'sall based on anniquated noshunce."

Sobering Up!

"I, too, believe that, Mac," I said. (Ah, that was where he got the mackerel from, then!) "I venture to inoculate all my editors with that gospel, but up to date not one has 'taken.' Come in here and sober up with a bite of sausage and a strong coffee."

I did manage to bring him into a state verging upon sobriety, when he passed his hand over his brow and announced that I had saved him from being kicked out permanently from the finest "diggings" in London. Then he pulled a handful of filthy "galley proofs" from his trousers pocket and shoved them under my nose.

The New Journalism

"Some of your tripe?" I asked, knowing full well that editors bought his tripe to the tune of a thousand per annum.

"Laddie," he replied, "it's the new journalism being born before your eyes. Ye are lucky to be in on it."

"Am I in on it, then?" I queried; and, picking out the clearest strip, I observed that my friend had apparently tried his hand at an article for "Home Jottings."

Here and there I noticed references to "woman's fine-spun intuition," "the delicate feminine touch which no male can counterfeit," and "the power behind the cradle."

"I am *not* in on it," I added. "This cookery-cleaning-cradle racket is quite out of my line. And what's the matter with the 'Weekly Review,' that you give it the chuck in favour of 'Little Toddlers'?"

SHE MARRIED BERT

Everyone was agreed that it was an ideal match.

"Eh? Ha, ha!" he chuckled. "But this *is* for the 'Review.' I have—*hup!*—that's nothing; that's coffee! I have discovered that man is a waning force. It is *wumman* that is 'the public.' The dailies found out the same for their particular channel, but I tell you that we have got to reckon with and write down to the gals—er—*wumman*—in well-nigh every branch of journalistic activity.

Hence this feminine appeal in my weekly outpouring on the gold standard and its repercussion on the frozen meat carriers' trade!"

"But," I said, "I can't carry out your theory in *my* line; it's radio! The boys would resent it. So would

Doing Radio Work in the Drawing Room

my editor—with his thick, steel-studded Alpine boots. Dash it, I couldn't treat the lads so scurvily, especially after my January article, which made them feel so bucked! Ah, no, Mr. Mackerel!"

He rose and restored his unspeakable "galleys" to his pocket.

Words of Warning

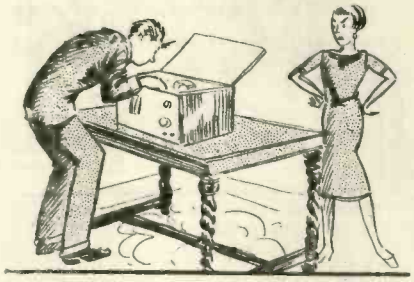
"I'm a man that doesn't waste words; and, moreover, I've an appointment somewhere with somebody I can't think of at the moment. So I will leave you with a wurrud of warning. Lave the lassies go by and ye'll miss the bus."

Thereupon he shambled out and caught an East-bound bus with the agility of an orang-outang. So, boys, this is ladies' day, for weal or woe, bitter or burton, salmon or gluckstein.

This month my wisdom is laid at the feet of *wummun*, the Power behind the Powder. Oh, Ethel, lend me thine ear!

Now, this is the story of Lucinda Pennycomequick, who was formerly Lucy Madle of Cowkimble's Perfect Laundry. When she wedded her Bert a kind providence had rarely smiled upon a more perfect match. As Lucy's ma said, "Our gal's a match

ON THE VENEER



Trouble began to brew, but he did not notice it.

for 'im, all right and no mistook." Bert was an engineer's fitter, though he never explained exactly what he obliged engineers by fitting. A home-loving man, he was seldom absent from No. 3, Daisy Villas, Romerton, after working hours. He had a little shed, half workshop, half old curiosity shop, in which he used to spend the greater part of his evenings in the summer, making motor-cycles behave, mostly. At the close of play he would enter the wigwam and consume quantities of beer and the more esoteric parts of pigs and sheep, sometimes varied by the homely "faggot" or the nourishing hake fried in nut-oil. Eden!

Through all these scenes of humble domestic felicity Lucinda came and went; came home with the pig's trotters or went to the "pickshers" with her Bert. But Marconi was at work in his laboratory and already the serpent was being hatched for the undoing of her Eden, and in May, 1923, the serpent raised his head in No. 3, Daisy Villas, and said: "Connect the positive terminal of the whatsitsname to the end of the secondary of the thingummy," and a whole lot more balderdash of a similar kind.

Confiding in Ma

Bert lapped it up like a good 'un and panted for more. He ate and drank radio; breathed it, lived by and for it.

As the long winter evenings came in, Bert transferred his radio-museum workshop to the parlour, and left shavings and shameful ebonite dust on the polished veneer of the table. When the parlour looked like a ship-chandler's attic, Lucinda went and wept into her ma's bodice (is that word correct, Ethel?) and cried her wrongs aloud.

"After all, it do keep 'im 'ome, dearie, don't they? Not like your pore pa, hallways takin' the cheer at 'is bufferloes. Howsomedever, what I say is, a foot put down proper before the 'arm's gone too far makes 'em mind out."

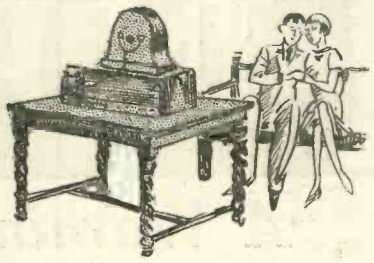
Search Parties Out!

With this in her mind, Lucinda returned to her home, and that very night, when Bert crept up to bed at 1.30, happy in the belief that he had heard Australia and that Lucinda was asleep, and sawing wood, as usual, he was met with a fierce-eyed woman who took from him the power of speech, so innocent did he conceive himself to be, so sinful did wummun paint him. Being a man, he did not understand the stammering caterwauling, dishevelled fury which sat on the bed and rocked itself to and fro, back and forth; he just said, "Yuh! All right!" and fell asleep.

On the following evening Bert sat in the parlour with his evening paper and fags. From half-past seven it was pretty fair for an hour, after that his fingers began to feel fidgety and things were plainly awful. He saved himself by mending the clock. Let us never forget, Ethel, that Bert was a man with skilled hands.

Bert was in the habit of giving up fitting for engineers at about 6 p.m., and he generally arrived home at seven, a little earlier if it was a special night for radio bugs. There came a

JACK PAYNE'S BAND



He got the set out and let her listen to dance music.

night when he had not arrived at Daisy Villas the Third by eleven p.m. Lucinda thought (a) she was a deceived wife, or (b) she was, or was about to be, a widow. Search parties speedily located him in the Dove and Dewdrop, playing darts and about nine and sixpence to the good—for he was a man of his hands—but his hands were being wasted!

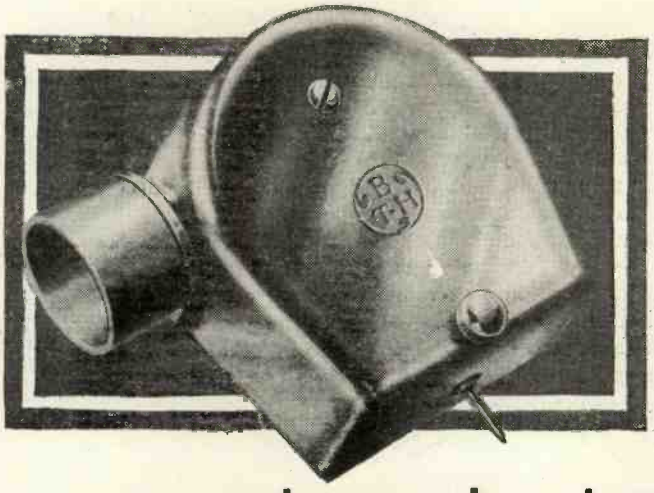
A week later Bert stayed out all night. He was with his sister in the Mile End Road, telling her about radio till the fog closed down and there was no getting home. Lucinda passed through seven-and-twenty assorted perditions until the "old body" next door took her in hand and with the aid of tea and the wisdom of eighty years showed her that ebonite dust and gluepots are the least of the world's evils, so long as a man is content to stay in his home and use the skill the Lord has vouchsafed to him. (Here the "old body" had to weep and be comforted in her turn.)

The Happy Ending

So, when Bert turned up ready for breakfast the next morning, and with a cake baked by his sister, he was met with tears and incoherent nonsense, which, being a man, he did not understand. But he got out his accumulator and dials and things and let her listen to Jack Payne's dance band in the evening.

Ethel, I have pitched this homily in a low key, because perchance the tale were better told thus. Lucinda was a wummun, and so art thou!

Here's why you should use this PICK-UP—



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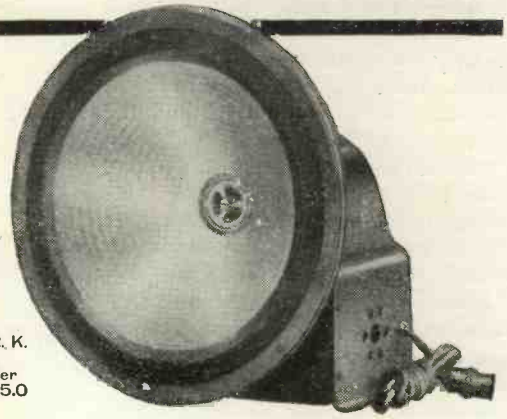

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Without rectifier
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JUNIOR R.K. UNIT
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SENIOR R.K. UNIT (illustrated) with built-in rectifier for A.C. Mains Field Excitation. Price - 10 Gns.

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FROM OUR READERS

A selection from the letters we have received about the "Plus-X" Four and other popular "M.W." sets and features.

The "Plus-X" Four

Sir,—I really must write you this letter of appreciation. Having previously constructed several sets at times from circuits described in various wireless journals, I had the good fortune this month to study your "Plus-X" Four circuit. You state in your description all the nice things usual in these instances (but not always realised), the outcome was a decision by me to construct the "Plus-X" Four, correct to every detail outlined by you. Now I must thank you for supplying me with the data enabling me to possess, in my opinion, a set incorporating everything that is to be desired, even by the most critical. The set accomplishes everything you have said for it. I have crowned it by using a "Grassmann" moving-coil loudspeaker, and the reproduction is perfect, and in thanking you once more I wish you the compliments of the season, and every success for your MODERN WIRELESS journal.

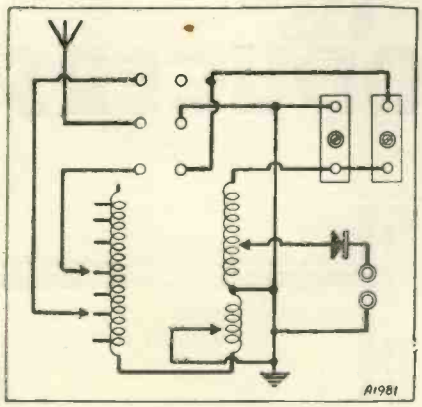
I am,
Yours truly,
O. F. CATT.

Woolwich, S.E.18.

A "Star-Turn" Variation

Sir,—With reference to your "Star-Turn" crystal set, I wish to submit to you the attached improvement which will make it possible for the blind to enjoy an alternative programme.

FOR THE BLIND



Mr. Garnet's scheme permits of very simple switching for alternative programmes.

In place of the ·0005 condenser I have put two Formodensors, type J, and arranged a double-pole double-throw switch to bring in either one or both of them. The switch also varies the position of the tapping on the Selector coil, and this enables two programmes to be at the command of the user of the set.

With the switch in up position only one Formodensor is in use, and the tapping on Selector is adjusted to receive the National 261-metre programme by means of one Formodensor. With the switch down the second Formodensor is placed in parallel with the first and adjusted to receive the Regional programme, at the same time the tapping to the Selector coil from point on switch is adjusted to receive that station, 365 metres.

Having been once fixed, the position of the switch will determine which programme is being listened to. Since only a switch is used to provide an alternative programme it would be useful to the blind.

Perhaps you have already had this idea submitted to you, in which case a repetition will cause no harm.

You may, of course, make any use of my idea which you think fit.

Yours sincerely,
WALTER GARNET.

London, W.6.

The "Conqueror" Five

Sir,—I expect you have already had a number of letters of congratulation on your recently published "Conqueror" set. I hope, because my letter may not be the first, it will at least be of interest, because it is based on a "good try-out."

The set is absolutely first-class—volume that positively staggers one, extreme range, selectivity, and last, but not least, magnificent quality. The latter is so fine that I propose to get a new speaker, a thing I have previously never thought of!

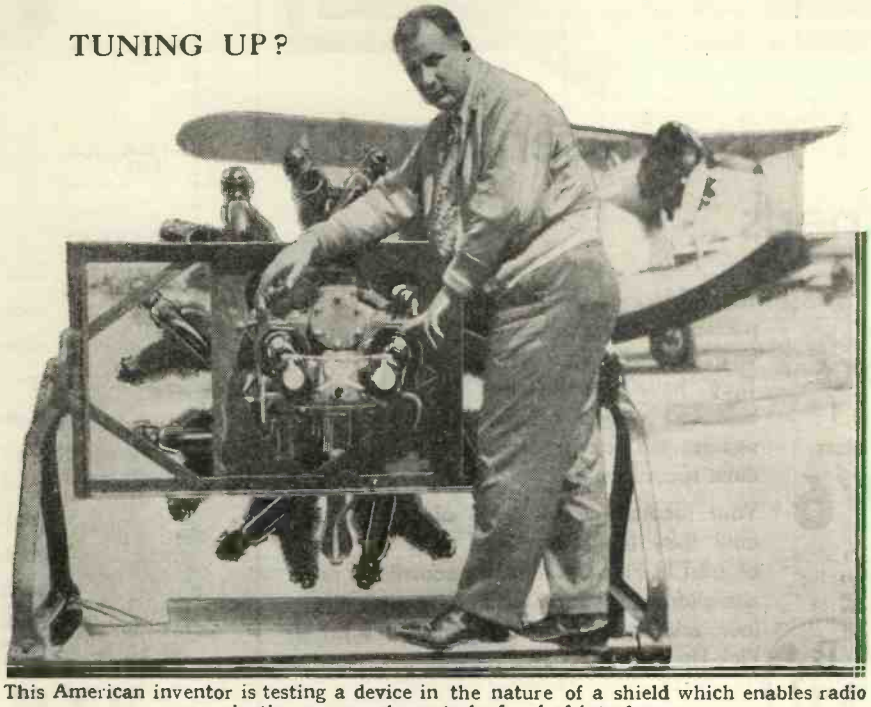
Sometimes I "open the lid" and look inside, just to be assured that four valves really do the marvels that they do. I don't propose to append a list of stations, as I have too much respect for your space, as I hope that this letter may see its way into the pages of MODERN WIRELESS, so that any readers who have not already constructed this set may get busy!

They will then be as enthusiastic as I am.

Yours faithfully,
C. H. TOWNSON.

Guildford.

TUNING UP?



This American inventor is testing a device in the nature of a shield which enables radio communication on aeroplanes to be freed of interference.

A RADIO RECKONER

By W. A. BARCLAY M.A.

Here is a valuable time-saver which takes all the sting out of tedious calculations, and enables you to read off ohms, amps., or volts without putting pencil to paper. Read all about the new N-Diagrams below.

MODERN radio, like most other useful hobbies, is becoming more and more an "exact" science. Many of us remember the days when one used to slap together a miscellaneous assortment of components on a baseboard, and trust to providence to hear something. The perpetual miracle of wireless in those days was that we heard anything at all!

Nowadays it is quite different, and each component of a modern receiver is carefully selected with a single eye to its efficiency for its particular job.

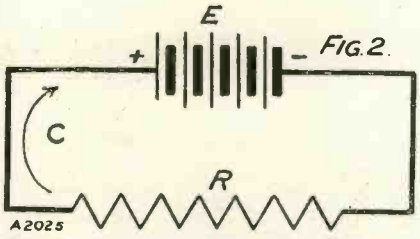
When to-day a given size of condenser is specified for a certain position, it is ten to one that the whole performance of the set would be jeopardised if one of a different size were substituted.

Calculations Necessary

This tendency towards precision means, of course, that more and more "figuring" is becoming necessary on the part of those who design sets. The constructor, too, is finding it increasingly necessary to understand the simple arithmetical principles which underlie the selection of the components he uses.

For the great majority of people, however, the word "arithmetic" is as a red rag to a bull; be the reason what it may, multiplication and division sums have never been exactly popular as a recreation.

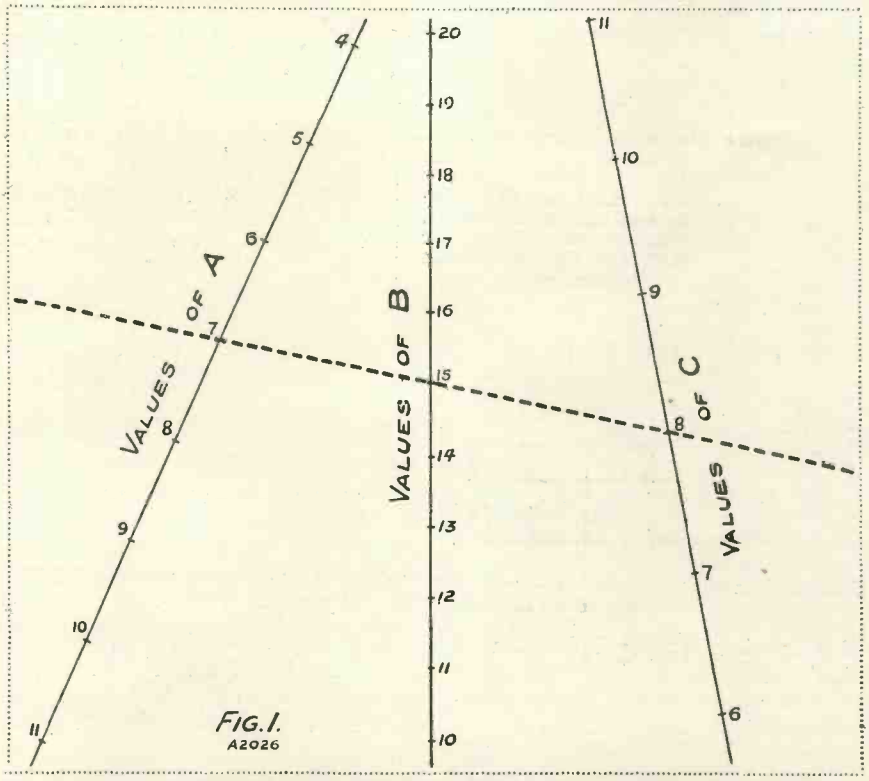
It is not surprising, therefore, that the average wireless enthusiast is content as far as possible to "give them a miss." It might as well be frankly admitted, too, that there is a certain amount of quite legitimate support for this attitude. For it is a sad but incontestable fact that many of the little calculations which crop up in radio science are quite needlessly complicated!



This fundamental circuit illustrates the application of Ohm's Law. The voltage (E), Resistance (R), and Current (C) are strictly interdependent.

Avoid Exasperating Sums

As an instance one need only take the reactance of a condenser. Anyone who has to calculate the reactances of even a single condenser at



The line joining 7, 15, and 8 shows how a ruler or other straight edge can be placed across the two known quantities to indicate the third (unknown) quantity.

Values Worked Out Without Mathematics

different wave-lengths knows what a tedious business it is, often involving considerable " jugglery " with decimal points.

Within the last few years, however, a means has been found of doing away altogether with these exasperating sums. This new process is called " Alignment," and consists in the use of a specially prepared diagram or chart on which is simply placed a ruler or other straight line in a certain position.

The chart is quite self-contained and combines in itself all that is necessary for the solution of the problem.

In its simplest form the alignment chart consists of three straight lines, or " scales," upon which are marked numerical values for three different quantities. When the values of two of the quantities are known and it is desired to find the value of the third, all that one has to do is to place a ruler to pass through the two known values on their respective scales.

PUT A RULER ACROSS THIS ONE!

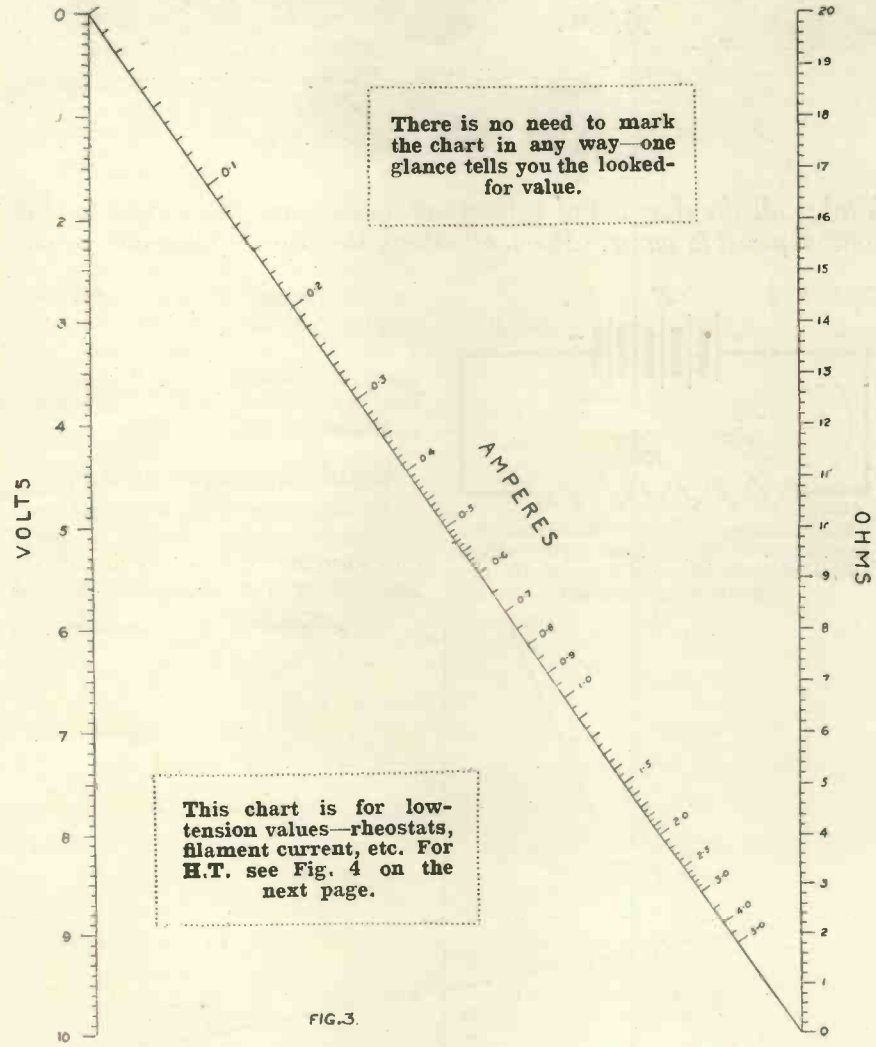


FIG. 3.

N - DIAGRAM FOR OHM'S LAW (IN L.T. CIRCUITS)

There is no need for calculation—just line up the rule to join the two known values and it will cut across the exact value that you want to know.

In this position the ruler will now meet the third scale in the required value. Thus in Fig. 1, if A is 7 and B is 15, the value of C is seen to be 8.

The present series of alignment charts has been specially prepared to illustrate some of the simpler arithmetical problems with which the home constructor may from time to time be faced.

Apart from their actual use in assisting the man who is " not very good at figures," the charts will be found of great value in bringing out clearly the manner in which the various concepts dealt with are related to one another. It is hoped to emphasise this aspect from time to time as the series proceeds.

Most readers of MODERN WIRELESS will be familiar with Ohm's law in its application to direct current. This law has been called the " Pons Asinorum " or " Asses' Bridge " of electricity, and it is not too much to say that a working acquaintance with it is essential to any proper understanding of wireless.

Ohm's Law Calculations

Indeed, the most frequently occurring calculations in radio science are merely simple applications of Ohm's law. It will be appropriate, therefore, if we commence with two charts designed to facilitate the use of this important law.

Put briefly, Ohm's law states that in any closed circuit, such as that of Fig. 2, the current flowing is directly proportional to the electro-motive force applied, and is inversely proportional to the resistance in the circuit. In symbols:

$$C = \frac{E}{R}, \text{ or } E = C \times R,$$

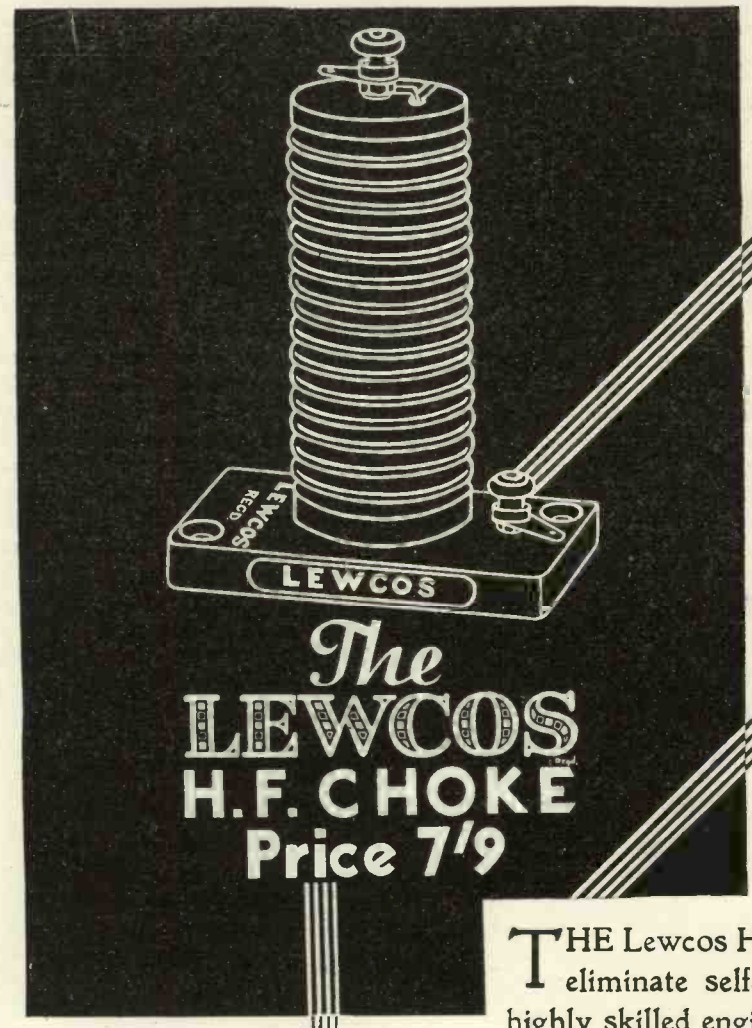
where C is the current in amperes, E is the E.M.F. in volts, and R is the resistance in ohms.

L.T. Considerations

The first alignment chart, Fig. 3, is designed to illustrate this relation for comparatively large currents, such as those used to operate valve filaments. This chart and the following are known as " N-diagrams," on account of their resemblance to the letter " N."

The two uprights and the diagonal of the " N " are each made to carry a scale of values, those for currents appearing on the sloping diagonal. Let us take for example an E.M.F. of 5·4 volts and a resistance of 6·8 ohms.

By joining the points corresponding to these values on the outer scales it is easily found that the resulting current is a minute fraction under 0·8 amp. In using this chart it is important to notice that each small division on the left-hand



MADE BY MASTER-CRAFTSMEN

THE Lewcos H.F. Choke is specially constructed to eliminate self-oscillation. Scientific research by highly skilled engineers shows that this choke can be used with complete confidence in its efficient performance on all wavelengths from 20 to 2,000 metres.

The following are extracts taken from an appreciation by Industrial Progress (International) Limited, Bristol. "... the Lewcos H.F. Choke is, in our opinion, ***the most efficient choke we have tested*** ... and ***its design places it in the front rank of high-class components.***"

In short, the Lewcos H.F. Choke fulfils its purpose because it is constructed on a scientific basis with the best materials by master craftsmen.

Write to-day for a fully descriptive leaflet Ref. RM33, which shows the choke curves and gives tested values.

THE LEWCOS H. F. CHOKE IS SPECIFIED FOR THE "STAR-POWER" 3 RECEIVER DESCRIBED IN THIS ISSUE.

We respectfully request the public to order through their local radio dealer, as we only supply direct to the trade.

LEWCOS RADIO PRODUCTS FOR BETTER RECEPTION

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED, CHURCH ROAD, LEYTON, LONDON, E.10

You Can Apply the N-Diagrams to Your Own H.T. and L.T.

scale represents 0·1 volt, while each small division on the right-hand scale represents 0·2 ohm. The value 6·8 ohms is thus four small divisions above the 6-ohm mark.

Since the diagram is so constructed that a straight line placed across it in any position will always meet the three scales in corresponding values according to the formula $C = \frac{E}{R}$, *we may use it to find the value of any of the three quantities C, E and R, when those of the other two are known.*

Filament Resistance Values

If, for instance, the filament of a valve is stated to require 0·4 ampere, the rated filament volts being given as 6, it is easy to see by joining these values on Fig. 3 that the resistance of the valve's filament is 15 ohms.

We can use the chart further to find what extra resistance would be required in series with the filament if the voltage at our disposal happened to be greater than that specified by the maker.

Let us suppose that instead of the 6 volts recommended for the above valve our available supply was 8 volts. Here we should require to include a certain amount of extra resistance in the filament circuit in order to use up the excess voltage.

Now, we know that the filament when properly lit requires 0·4 amp., and that our available voltage is 8. Using these values, the total amount of resistance in the circuit is found from the chart to be 20 ohms, and, since the resistance of the filament was found above to be 15 ohms, the extra resistance which is required is obviously 20 — 15, or 5 ohms.

H.T. Circuit Measurements

Let us now turn to the second chart, given in Fig. 4. This diagram is constructed on the same general lines as the preceding one, but deals with much smaller currents.

The currents passing in the H.T. circuits of modern valves are very much less than those taken by the filaments, and are usually measured in milliamperes, the milliampere being the one-thousandth part of an ampere.

The resistance offered to the current in the H.T. circuit is, however, very much greater, being of the order of thousands of ohms. The result is that even if the E.M.F. or high-tension voltage amounts to some hundreds of volts, the current is still very small.

Let us now find the resistance of an H.T. circuit in which a current of 8 milliamperes is flowing, the H.T. employed being 140 volts. The resistance of this circuit is read from Fig. 4 as 17,500 ohms.

This figure is called the "D.C." resistance of the anode circuit, as we are here dealing solely with direct currents. It must not be confused with the "A.C." resistance of the same circuit, or resistance to alternating currents. This latter is of even more importance, and is usually quoted by the makers, but does not concern us just now.

It must not be supposed, of course, that the use of the diagrams Figs. 3 and 4 is restricted to valve circuits. On the contrary, they may be applied directly to any instance of Ohm's law for direct currents.

Another Useful Figure

Let us suppose, for instance, that it were required to estimate the current taken by a high-resistance voltmeter reading 200 volts at full-scale deflection, the resistance of the instrument being 25,000 ohms. Joining these values on Fig. 4, the current taken is shown as 8 milliamperes.

ALL THE CALCULATION IS DONE FOR YOU!

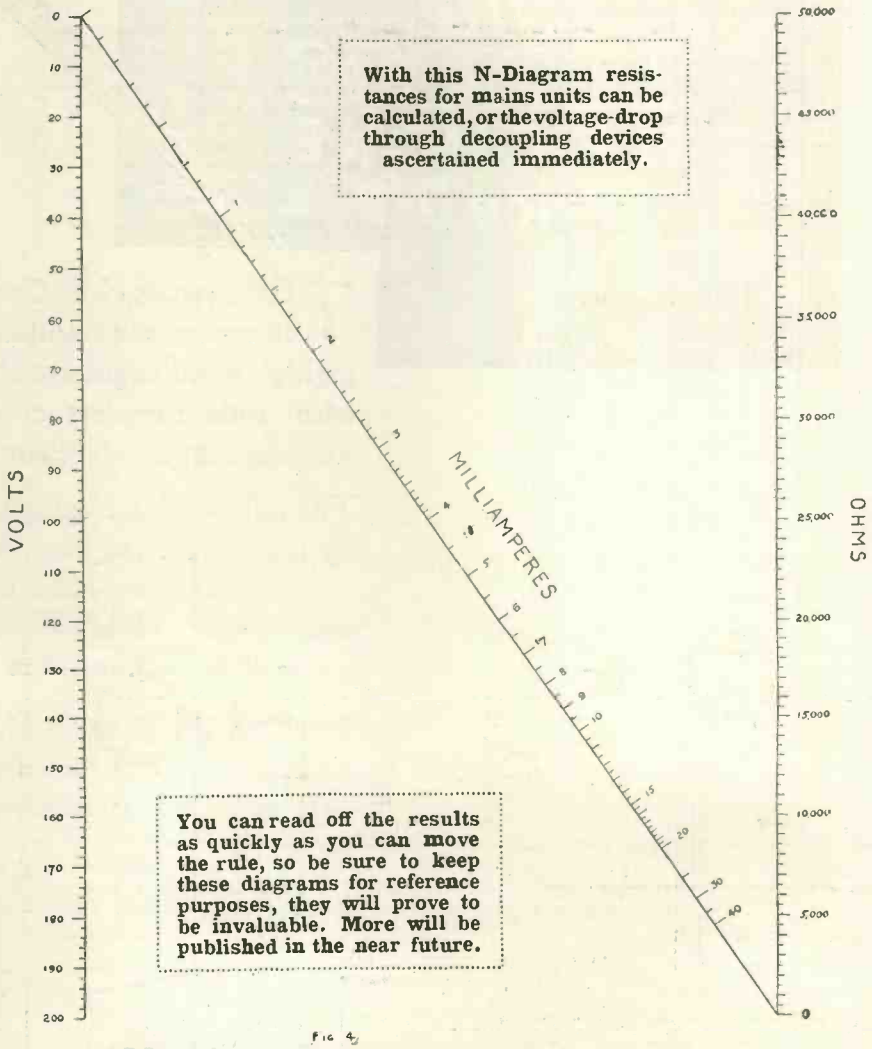
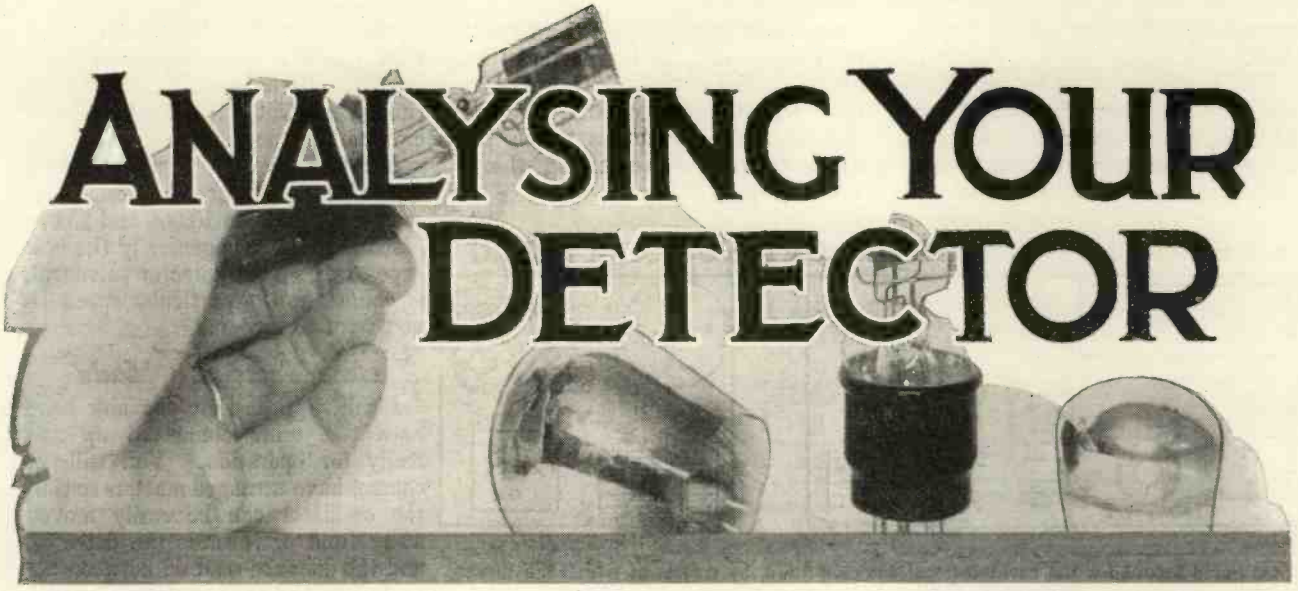


FIG 4.

N-DIAGRAM FOR OHM'S LAW (IN H.T CIRCUITS)

Suppose you get a current of 5 milliamps when 150 volts are applied. The rule laid across these values tells you instantly that the circuit's resistance is 30,000 ohms.

ANALYSING YOUR DETECTOR



Which is your best detector valve? This appears to be an easy question to answer, but close investigation may prove that it is not necessarily the valve that "sounds" best. The ear is a poor judge of detector efficiency, and the easiest way to check your opinion on the matter is the method described below.

By J. ENGLISH.

THE radio detector, one of the earliest of wireless inventions, has seen many startling changes since communication through the ether was first achieved. The remarkable efficiency of our modern valve detectors surpasses the wildest hopes of the early pioneers, but even to-day it has not yet settled down to such a standard type as the valve L.F. amplifier.

A Vital Link

Besides a conflict of opinion as to the respective merits and limitations of grid and anode-bend methods of rectification we now have the early promise of even more efficient and powerful valve detectors.

The detector stage is a vital part of any receiver because of its unique function of changing the inaudible radio-frequency signals into the audible frequencies of speech and music. Consequently it has a considerable effect upon the quality and volume of the sounds reproduced by the loud speaker.

Nowadays we compare the efficiency of our valve detectors not by audible comparisons but by measuring the amount of distortionless audio-frequency output we can obtain for a given radio-frequency input.

This study of detector performance can be a most interesting and useful one if carried out on a scientific basis, and offers opportunity for many new and fascinating experiments which you can easily carry out without expensive apparatus. Farther on in this article I will show you how to make simple experiments for analysing the performance of your detector stage upon which so much depends.

The Two Methods

As you know, a valve can be used as a detector in two ways, as a grid or anode detector. The former is the more popular, of course, because of its greater sensitivity to weak signals, but strong inputs produce overloading and distortion. On the other hand, the anode detector is relatively insensitive to weak signals, but a much larger H.F. input can be

A SIMPLE METHOD OF MEASURING EFFICIENCY

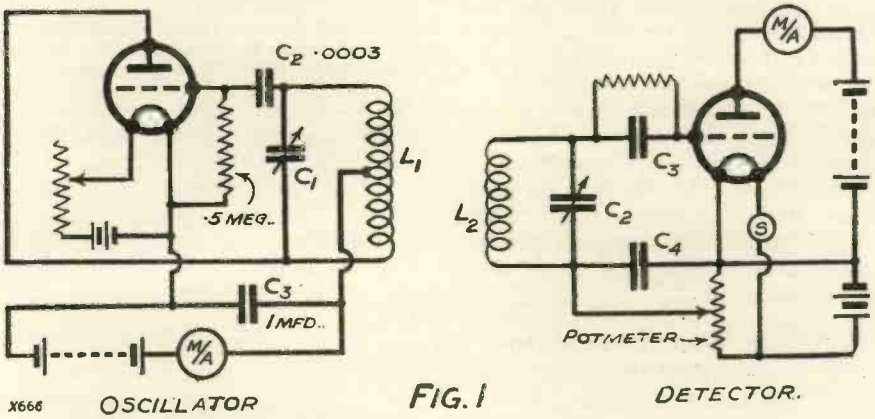
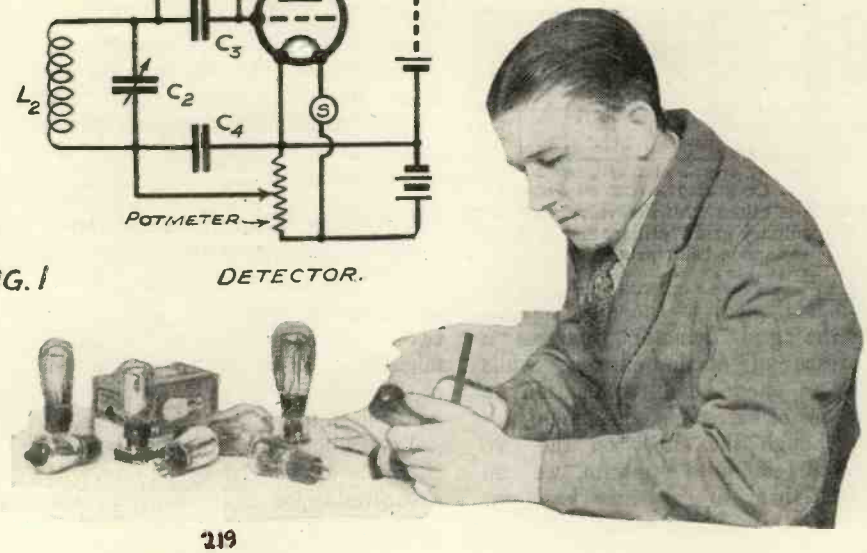


FIG. 1



(Above) The two units required for detector testing. The distance of the oscillator from the detector must be variable, so that the strength of "reception" can be changed at will. (Right) Examining and tabulating the characteristics of a group of two-volt detectors.

accommodated before the valve overloads.

Now if you attempt to get a true idea of the relative efficiency of your detector valves under different conditions of operation by audible comparison of the L.F. outputs, you will be sadly misled. The human ear is not critical enough, in spite of its marvellous mechanism, so that we have to use a more exact method, such as the comparison of the change of anode current for small increases in the radio-frequency input to the detector valve. This is the method of test we invariably use when exact data are required.

GUESS-WORK WILL NEVER GET YOU ANYWHERE

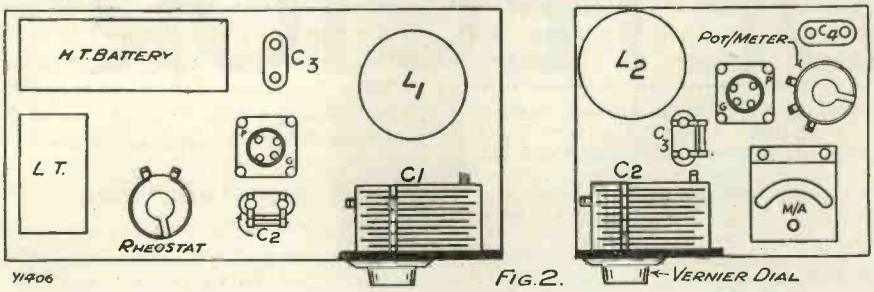


FIG. 2.

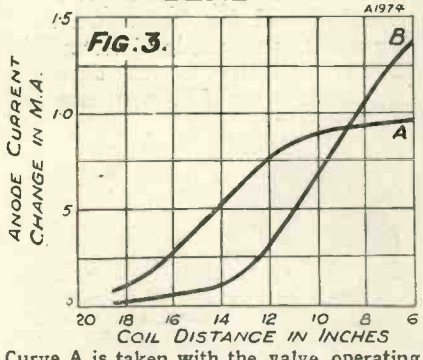
A suggested layout for the oscillator and detector units, by means of which the curves shown in Figs. 3 and 4 were taken.

The Effect of Signals

If at any time you have had a milliammeter in the anode circuit of your detector you will be sure to have noticed that as soon as a station is tuned-in the anode current immediately changes. An H.F. voltage applied to the input circuit of the grid detector produces a decrease of anode current, while with an anode-bend rectification an increase of current is observed.

Although the effect on the two detectors is quite opposite, we can reduce them to the same basis for comparison by measuring the amount of *change* of anode current for different H.F. inputs. If we make these measurements carefully we can plot performance curves which tell us a variety of interesting things about the two detectors.

GRID LEAK v. ANODE BEND



Curve A is taken with the valve operating as an ordinary grid rectifier, and B on the anode-bend principle.

In the same way we can find out exactly the effect on detector efficiency of using different valves, grid resistances, condensers, coils, etc., as well as the best combination of detector valve and its associated components to suit a particular receiver.

All you require for these experiments is a few ordinary components and one or two meters, the most essential one being a good moving-coil milliammeter reading 0 to 5 milliamps, to measure anode current changes. From your components you will make up a simple one-valve oscillator unit to provide a constant H.F. signal, and a simple detector unit to pick up this artificial transmission.

Varying the Input

As the amount of H.F. energy picked up by the detector grid coil depends upon the proximity to it of the oscillator coil, we can get a nice graduation of detector input; small when the two units are some distance apart and large when they are quite close together. In this way we can easily find out how a particular detector valve handles weak or strong signals as regards sensitivity and distortionless rectification.

Practical Details of Units

Fig. 1 shows the theoretical circuits of the oscillator and detector units, which can be temporary hook-ups on two small baseboards. The layout might well be similar to that shown in the diagram of Fig. 2, which is the one I often use.

You will notice that a Hartley circuit is used for the oscillator with a centre-tapped coil. Both L_1 and L_2 are normal broadcast coils, tuned with whatever condensers you have handy; all that you require is just enough capacity to bring the two circuits into tune.

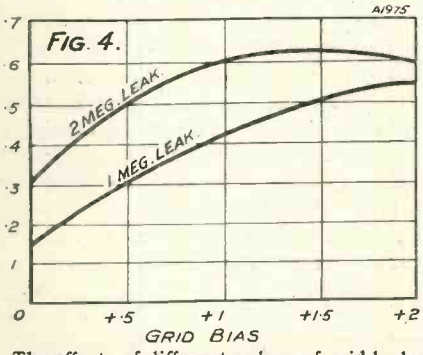
You can use almost any general-purpose valve for the oscillator, something between 10,000 and 20,000 ohms impedance is generally the best type to use. Your detector valve will, of course, be the particular specimen you want to examine.

How Tests are Made

I will suppose that you now have both test units connected up and ready for operation. You will, of course, have arranged matters so that the oscillator can be easily moved away from or towards the detector, and the distance read off between the centres of the coils, mounted on end with their axes parallel.

The two units are then placed some 2 ft. apart and the detector set for grid rectification with the potentiometer slider fully positive. The steady detector anode current is then noted for a normal H.T. voltage, say, 60 volts.

WHAT VALUE GRID LEAK?



The effects of different values of grid leaks can be recorded by means of the two simple units described in this article.

The oscillator is then switched on and its rheostat adjusted until the milliammeter in the detector anode circuit just gives a readable change when both units are in tune. Another low-reading milliammeter in the oscillator H.T.+ lead is useful, although not essential, as a visual indication that the H.F. output remains constant throughout each experiment.

Readings to Take

The first experiment can now be commenced in earnest, and with the position of the two units unchanged the detector tuning is adjusted to give the maximum deflection of the meter needle. Note the reading of detector anode current, and then take further

Find Out What Your Valves are Doing

readings for oscillator positions each two inches nearer to the detector, slightly retuning the detector each time for maximum meter response.

I find that a slow-motion dial on the detector condenser is certainly worth while, because tuning is rather critical when the units are some distance apart, getting broader as they approach one another. Incidentally, the coil separation should not be less than six inches.

A detector arrangement that gives the loudest results on distant stations may not necessarily be the best for local reception. In fact, it is very likely that on powerful transmissions the valve will be overloaded, and distortion will take place.

It is difficult to judge the efficiency of a rectifying system by ear alone, it is necessary to take measurements if we are to obtain a true picture of what happens in the circuit.

But as you will see by this article, these measurements are not difficult to make, and, indeed, the task is a most fascinating one.

What the Curves Show

If you now subtract each reading of detector anode current from the steady reading found to begin with, you will get the amount of current change for each oscillator position. These figures are then plotted against the coil distances, giving a curve like A of Fig. 3.

The corresponding curve B for anode detection, using the same valve, is obtained in just the same way, with the exception that the grid return lead is changed over to a grid-bias battery.

Having obtained two curves of anode current change for both methods of rectification, we can now begin to analyse this particular valve's behaviour. The first thing you will notice on examining the curves of Fig. 3 is that the output of the grid detector is greater than that of the anode detector for weak H.F. inputs.

Comparison of Sensitivity

At fourteen inches the curve A shows a current change of ·5 m.a., almost five times that of curve B. Between seventeen and twelve inches the curve A is practically a straight line, indicating that anode current changes are proportional to the change of input voltage, which is absolutely essential for distortionless detection.

As regards the curve B, for anode detection we find that although the valve is relatively insensitive to weak signals, we get a good straight portion above twelve inches. This indicates ample capabilities for handling strong signals without distortion, but you must not forget that in practice the peak H.F. input voltage must not exceed the negative grid bias, otherwise grid current will flow with disastrous effect on quality.

I expect you will now be rather keen to carry out some more experiments with your oscillator and detector testing set. A simple but very striking experiment is finding the effect on efficiency of the positive bias of the grid detector.

You use the same arrangement of oscillator and detector, but in this case the distance between the coils is fixed at a suitable value to give a small but readable current change. The grid return lead is connected to the slider on the potentiometer and readings taken of the anode current change for different settings of the slider between negative and positive ends.

You must first note the steady anode current at each change of bias voltage. The negative end of the potentiometer will correspond to zero grid volts, and moving the contact arm over each quarter of the resistance element corresponds to a bias change of ·5 volt, when a 2-volt accumulator is used.

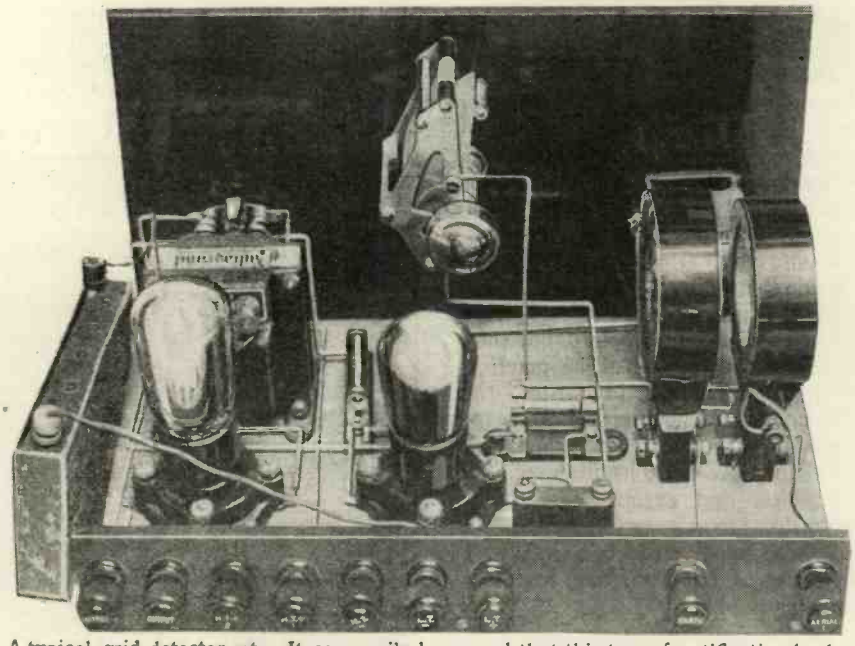
The Best Value Shown

You can then plot current changes against bias volts. The resulting curve, which should be similar to that of Fig. 4, will show you quite clearly that there is a best value of positive bias.

At some time or another you have probably had arguments with your friends about the best value of grid leak to use. You can easily settle any such doubts by a further simple experiment.

You proceed in just the same way as in the last one, but change only the grid leak and note the anode current change for each resistance value between ·25 megohm and 5 megohms. Then plot these readings against resistance in megohms and the resultant curve will show you how the detector output increases rapidly up to 1 megohm, and then gradually to 5 megohms.

A POPULAR METHOD OF RECTIFICATION



A typical grid-detector set. It can easily be proved that this type of rectification leads from the point of view of sensitivity.

Have you tried the "Talkie" needles?—A new pick-up—Should we use hard or soft needles if we want to preserve our records?—And some further interesting notes on choosing records.

By "TONE ARM."

I HAVE just tried the new Parlophone pick-up. It is rather more like the old style than a modern design to look at, but gives very good results. Bass reproduction is adequate, and the high notes are quite well reproduced. It is rather rigidly damped and is sensitive.

Light on the Record

The wear on the record caused by the rigid damping is not excessive, and the pick-up should appeal to many radio-gramophone owners. It is marketed by the famous Parlophone record people.

* * *

Have you tried the Columbia "talkie" needles? They are longer than the normal needle, and have rather hard, thinnish points, but they are very good; almost as good, if not quite, as my favourites—the spearpoint. Although they are supposed to be used for "one side only," I find they are quite hard enough for two sides, and except where very favourite records are concerned I use these needles for two sides. I ought not to, but I am lazy, and hate changing needles.

The Scratch Problem

And that brings me to the everlasting "scratch" problem. Ought we to cut out surface noise or to bear it! I prefer to bear a large portion of it, because I know that if present-day methods are employed to cut it out, or reduce it considerably, away go the high notes too.

* * *

Talking about scratch, I wonder how many of my readers realise that a great deal of the "surface noise" that used to mar the pre-electrical recordings was due to noises in the recording mechanism itself.

Hard or Soft Needles?

"Should a needle be hard or soft?" asks a correspondent. He is querying which causes the most wear. It is a difficult question to answer, but the needle should either be really soft, when it will wear more rapidly than the record, and thus save the latter's surface; or it should be really hard, when it will wear chisel-shaped much more slowly, and initially it can be manufactured with a finer and truer point.

But if a hard needle is used it should not be assumed it is suitable for a "two-side" run. The "one-side-only" motto should still hold good.

Warped Records

Have you ever had a record warp? I have just found one of my favourite discs in a horribly distorted condition. I have managed to cure the trouble, however, and the method employed is one that was recommended to me by an old gramophone enthusiast.

* * *

The record is first warmed gently on both sides, and then pressed between two sheets of glass which have been thoroughly polished with french chalk. The heating should be carried out by rotating the record in front of the fire, moving it constantly, and as soon as one side is warm the other side should be done. After being pressed for some days between the glass sheets, with a pile of books on top, the record will be found to be quite "true" again.

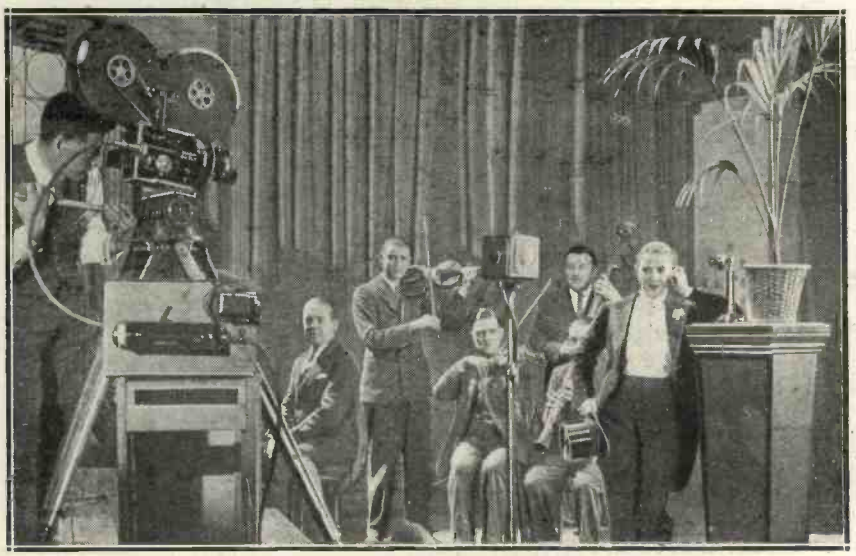
Those Pin-holes

When choosing a record examine it carefully; if it appears to have bubbles or pin holes on its surface it should be rejected and another copy chosen. Sometimes a record seems to have a "watered" silk appearance. This means very often that it is a faulty stamping, the process having been carried out with the stamper too warm, causing a sort of sheen on the surface of the wax. This record is faulty and should be discarded.

* * *

It is possible to store 1,000 records in a space of 12 ft. by 13 in.

"IF I HAD A TALKING PICTURE . . ."



Miss Ella Shields, the famous male impersonator, singing one of her latest hits at the telephone, while the talkie machine records her.

PRECISION CONDENSERS

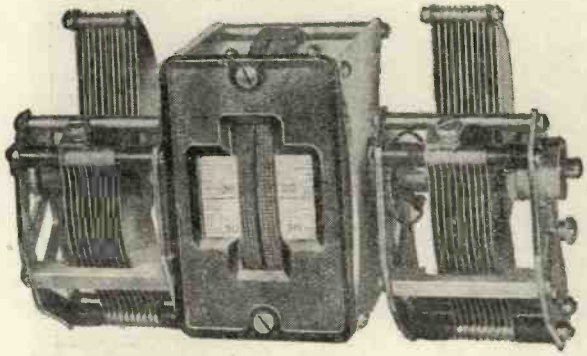
For the "Forward" Four

Set-designers appreciate the many points of superiority of J.B. Precision Condensers and Dials—their extreme accuracy, low-loss construction and careful finish.

For the "Forward" Four a J.B. Dual Thumb Control and two J.B. Universal Log Condensers are specified.

The J.B. Dual Thumb Control has an exceptionally rigid frame, and forms with the two condensers specified a gang Unit. Both Thumb Controls can be revolved together, and when the desired station is heard a slight separate movement brings it up to full strength—an easy tuning method.

In the well-known J.B. Universal Log Condenser all surplus material is cut away, giving an extremely low-loss yet rigid construction. An adjustable and detachable spindle and a reversible panel-bush enable this condenser to be mounted in a variety of ways.



J.B. Double Thumb Gang Condensers.
·0005 Dual - 28/6
·0003 ,, - 27/6
The ·0005 model is specified for the "Forward" Four, described in this issue.

PRECISION INSTRUMENTS

Advertisement of Jackson Bros., 72 St. Thomas' Street, London, S.E.1. Telephone: Hop 1837

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The goodness of FERRANTI components is reflected in the performance of FERRANTI All-electric Radio. Experienced constructors know that nothing less than the best satisfies Ferranti, and in every detail the range of All-electric Radio maintains the traditions Ferranti have established.

2-VALVE SETS for the REGIONAL Twin Transmissions. No tuning. Either programme at the turn of a switch. Good radio in its simplest form. £16

2-VALVE SETS for the Local Station. Long and medium waves. Dial illuminated and scaled in wavelengths. £16

3-VALVE SETS. Capable of superb reproduction, ample volume, and sufficient selectivity to ensure variety. £25 to £28

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From 28 guineas to £55

RADIO-GRAMOPHONES providing magnificent reproduction of gramophone records and the broadcast programmes.
75 guineas.

All these Sets have plug and socket for gramophone pick-up. All are fitted with fuses and safety switch, and dual ratio (1–1 and 15–1) output transformer.

Easy Hire Purchase Terms are available.

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What the Small Orchestra is Doing for

The author of the article discusses a piece of music with his fellow artistes.

Why is it that, while all other musical combinations have come in for a great deal of criticism from listeners, the small orchestra has practically escaped such discussion?

This important question is answered by the leader of one of our most popular broadcast music providers.

ANY man connected with that most difficult of all tasks—the provision of fare which will please the huge radio audience—would not be human if he did not take an interest in the reaction of that audience to the fare provided.

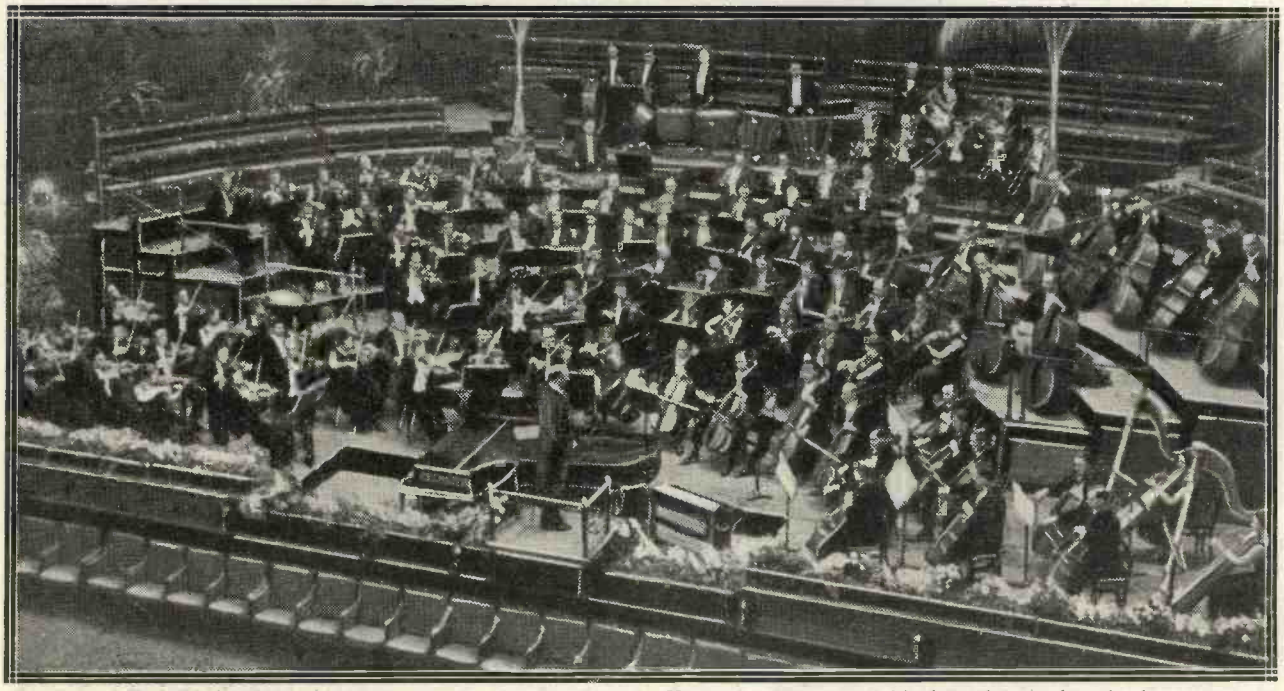
At once he comes up against one of the difficulties in connection with broadcasting—the fact that it is hard to gauge with any real degree of accuracy just what the public does like! But he has one guide which shows him roughly which way the current of public taste is flowing, and this is the letters of complaint from listeners.

Five Years of Broadcasting

These, if they are not very positive in indicating what people like, at least tell him fairly definitely what people do not like.

I have been connected with the broadcasting of music by a small orchestra since the very early days; in fact, my sextet celebrates its fifth radio birthday this year. It is only natural therefore that I should be interested in

IT IS ESSENTIAL TO HAVE THE RIGHT ATMOSPHERE



Can we get the Queen's Hall atmosphere into the drawing-room? Upon the answer to this depends very largely the success or failure of the really large orchestra.

Orchestra is Music

By VICTOR OLOF

Leader of the famous Sextet

comparing the popularity of a musical combination, such as my own, with other forms of broadcast music. I am accordingly a student of listeners' letters.

Letters appear complaining of almost every item broadcast. Symphony concerts, jazz music, language lessons, radio drama; all these, deservedly or undeservedly, seem at some time or another to have roused the spleen of at least one listener.

Escaped Adverse Criticism

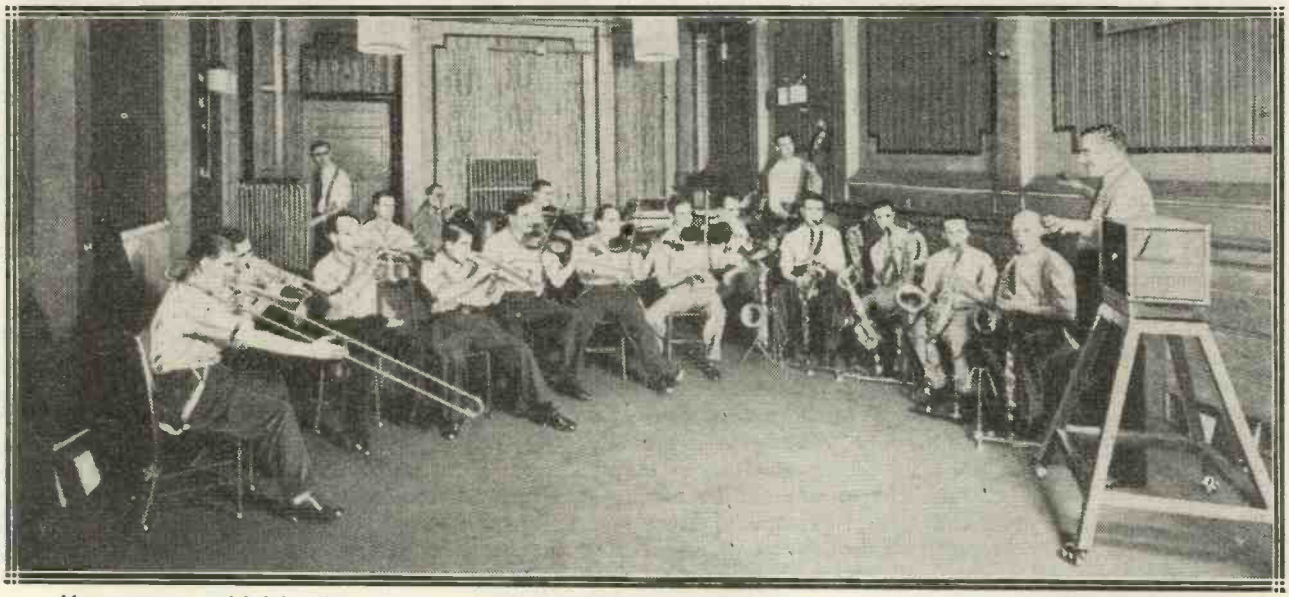
Only small orchestral combinations broadcasting more or less light music seem to have escaped almost any adverse criticism. People may at times complain about a particular programme provided, but they do not complain about the small orchestra as such.

Why is this? Broadly, it is, I suppose, that the music commonly performed by a sextet, or any other small orchestral combination, appeals to people who cannot conveniently be classified under either of the two most popular modern categories—highbrow and lowbrow! I think perhaps that in our passion for black and white, no matter what we are discussing, we are apt to argue from extremes rather than from representative examples.

Wrangles about music, as far as broadcasting is concerned, seem invariably to be between the lowbrow who

Mr. J. H. Squire, who also runs a very successful small chamber orchestra.

They Can Give Themselves a "Pat on the Back"



Always merry and bright, these seventeen "boys" Jack Payne is conducting have given thousands of listeners pleasure.

The Small Orchestra Leads the Way

has no time for anything but a dance orchestra playing jazz the whole time, and the highbrow whose soul is hurt by anything other than the latest work of some ultra-modern composer. And the truth is that these are by no means representative types ; I doubt, in fact, if more than 10 per cent. of the total listening population could correctly be put into either category, for all the publicity they receive.

Popularity of Light Music

I am rather disposed to doubt if nine wireless listeners out of ten call themselves any sort of " brow " at all. They are just ordinary men and women who, if they are

TESTING THE TRUMPETS

Jack Payne and John Ireland, the composer, deciding the merits of muted trumpets before a Queen's Hall concert, in which these instruments were used for the first time.

not completely tone-deaf, like listening to music which is creditably performed, which is not too exacting to the lay ear, and which is melodious. They are middlebrows, and they are the staunch but silent supporters of the small orchestral combination such as my own.

Suppose they could be persuaded to state the qualities they look for in their broadcast music—what would be their stipulations ? In the first place they are, most of them at any rate, busy men who work most of the day and have many odd things to do when they arrive home from their work, tired and not ready to exert themselves too much in the business of listening-in.

Short Items are Preferred

Consequently, their first demand would be for musical items which are not too long ; music which they can listen to for spells of a quarter of an hour, without losing the thread, so that if they are interrupted they can resume their listening later without having missed anything important. The small orchestra gives them what they want from this point of view. The pieces played are fairly short and varied.

At the same time, the middlebrows are not by any means satisfied by a never-changing programme of dance music. Nor are they prepared to devote the time and study necessary in order to appreciate a lengthy symphony lasting forty minutes.

Their appeal is for tuneful, understandable music which strikes the happy medium, in their estimation, between the two undesirable extremes—undiluted mechanical dance music, and long classical compositions which, generally speaking, they cannot understand and for which they cannot, as a rule, spare the time. The small orchestra can and does satisfy their demand for music of quality which is nevertheless not too heavy.

Finally, they are naturally attracted by the music which comes to them via their loud speaker in a form most like a real performance. They find, as I find, that with the average set the reproduction of a large orchestra from a great hall is apt to be blurred.

A Psychological Point

And, apart from this matter of fidelity of reproduction, there is the psychological angle to be taken into consideration. Most people listen in small rooms ; the day of the public hall radio concert has not yet dawned.

Which sounds more fitting in a small room—the music of an orchestra of a hundred performers, or the music from an orchestra of six ? Actually, I suppose, it cannot be denied that the latter must instinctively be given the preference by the average mind. Until we have trained our minds to evoke the atmosphere of the Queen's Hall in our sitting-rooms, the music of the small orchestra will continue to sound more congruous therein.

Again, it must not be forgotten that large numbers of listeners are themselves amateur performers on one musical instrument or the other. I understand that the numbers

POPULAR PROGRAMME PROVIDERS

The Gershom Parkington Quintet, one of our best-known broadcasting combinations.

of students at the principal musical colleges are as steady as ever, and mechanical music has not stopped people from yearning to play the violin or the piano in spite of the many other attractions which modern life has to offer !

What is the effect upon these amateurs of the huge volume of music which wireless has made possible for them at the mere twiddling of a knob ?

I imagine that they must have a particularly warm corner in their hearts for the small orchestra, which performs the kind of music which they themselves attempt.

MULLARD ORGOLA KITS

Mullard Orgola components are conveniently kitted in one carton containing complete parts including cabinet and valves. Purchase has thus been reduced to one single transaction only. The Mullard Orgola 3 (either A.C. or battery operated) can be built in an evening by even the most amateur constructors. A full description of assembly and operation in the current issue of "Radio for the Million."

P. M. 12

1931 Orgola Battery Model	£8. 0. 0
1931 Orgola A.C. Model -	£9. 15. 0

P.M.2DX

Orgola 4 Battery Model -	£13. 12. 6
Orgola 4 A.C. Model -	£15. 0. 0
Orgola Junior Power Unit	£6. 15. 0

P.M. 252

Mullard

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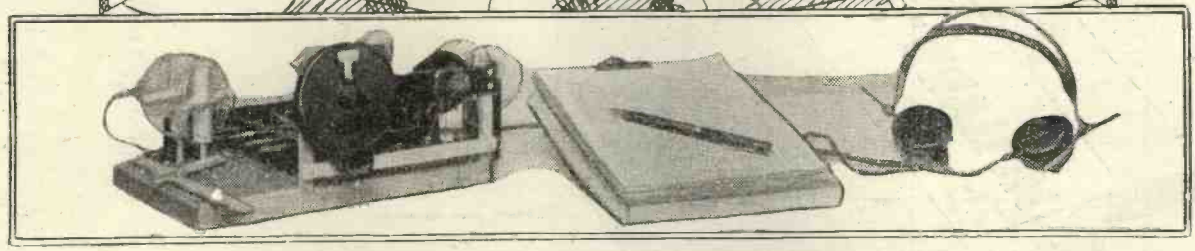
ON THE SHORT WAVES



A talk about matters of particular interest to the short-wave enthusiast, including some interesting things revealed by a log extending over the whole of 1930.

By W. L. S.

I HAVE a distinct feeling that 1931 is going to be an interesting year for the short-wave enthusiast. In fact, with unpardonable optimism, I might even say that I do not think receiving conditions, on the whole, are going to be too bad.

Fine Day—Fine DX

For the whole of 1930 I kept a log of any notable stations heard, days or nights that appeared to be particularly good from the "DX" point of view (I only struck ten of them in the whole year !), and a rough note on the weather conditions for each day.

From this log one fact stands out a mile—that an abnormally good "DX" day is either cold and clear (and dry) or warm and sunny. This for 1930, at any rate. There was not one day during the year that was both wet *and* good for DX. In general, then, high pressure locally appears to improve things.

Now I am quite prepared for another short-waver to come along and squash this on the spot, but that will not alter the fact that in my particular part of the world, with *my* barometer and *my* receiver, high pressure means high signal-strength.

Rome Rolls In

The next point is this. As you may have noticed—I certainly have myself—1931 has been somewhat cold up to the present. As I write it is snowing merrily and the barometer is quite high. Now I have already logged eight abnormally good days for DX work this year ! So we appear to be eclipsing 1930, the "Black Year of Radio," already. As a matter of interest I should like to hear other readers' views on this "WX-DX" business, and I propose to give a brief summary of conditions each month on these pages.

Quite the outstanding short-wave broadcast station at the moment is Rome. 3 R O, on 80 metres. He certainly does occupy a share of the ether as far as the average inselective receiver (like mine) is concerned, but if one uses many kilowatts on that wave-length one is bound to make a noise. Incidentally, 80 metres is again showing up as an excellent amateur wave-length for inter-European work and, thanks to the enthusiasm of various amateurs who now go up there for their European contacts, the 40-metre wave is not quite so congested. Listen on 80 metres if you have not already done so, particularly on Saturdays and Sundays, and you will be surprised at the great strength of some of the signals, and, more important, at the high quality of most of the transmissions.

A.C. Valves on S.W.

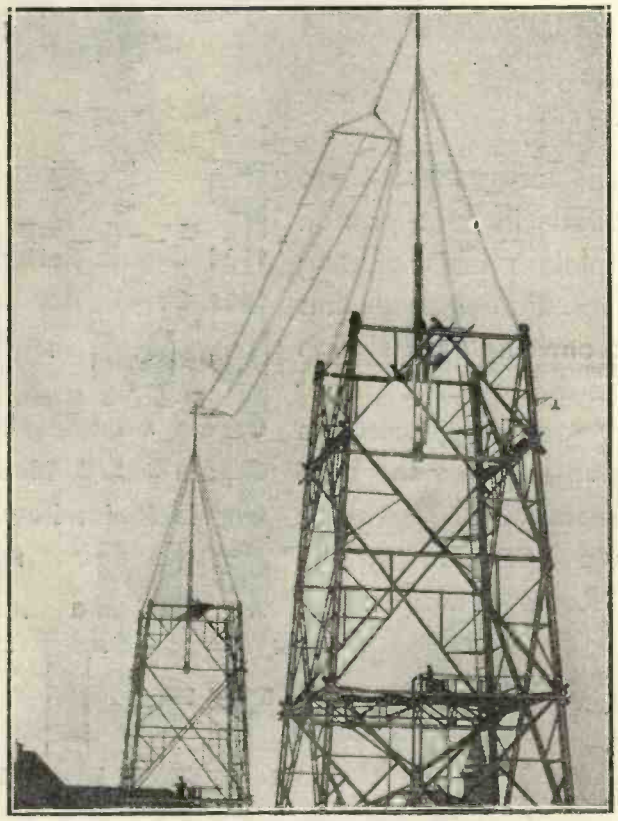
I have again been using an all-A.C. short-waver, and it certainly is a perfect gem to handle. I must confess, however, that I have *never* yet succeeded in reducing the ripple to *zero*.

It is down to 0·1 per cent, perhaps, but it is still there, and is sufficient to make me jumpy about receiving really weak DX signals on the very short waves. For 80 and 40 metres the set is perfect, but on 20 and 10 I go back to the battery-operated set to make sure that I am not missing anything.

The A.C. job uses a screened-grid stage, detector and pentode.

Incidentally, I see the opinion expressed in an American magazine that the short-waver of the future will have more valves, chassis construction throughout, single-control, and a neat little mains plug.

A USE FOR BROKEN MASTS



The bottom parts of the wooden masts at the Munich station have been used as mounts for small masts which carry the temporary aerial now in use.

A VERY HIGH FREQUENCY

JOHN DARE, the famous radio consulting engineer of Regent Street, spends much of his time examining and preparing expert reports on radio inventions that will never appear on the market. He once told a close friend that he reckoned only one-tenth of 1 per cent of the new patents that came his way were commercial propositions.

Certainly the one we find him standing before on the summer morning upon which this particular narrative opens seemed far removed from the realm of practical radio. It had the appearance of a very large cabinet gramophone, except that a small black funnel projected from it.

This is the second of an unusual series of narratives that we feel sure will arouse considerable interest. They deal with the experiences of a radio consulting engineer, and, of course, all the characters are entirely fictitious. Nevertheless the stories are founded on fact to a large extent, and none of the situations lies outside the bounds of strict possibility.

The Machine Echoed Him

"Just a miserable mechanical parrot," disgustedly exclaimed Dare aloud.

"Just a miserable mechanical parrot," agreed the machine—even more loudly.

Dare laughed, and the machine rather stridently echoed him.

"You want a little more bass," said the radio consultant.

"You want a little more bass," responded the machine.

There was a tap at the door, and Dare's office-boy entered bearing a card.

Dare glanced at it with some surprise, for it bore the inscription, "Inspector Blazer, New Scotland Yard."

"Show him in immediately," he ordered, switching off the gramophone-like instrument before it could repeat his words.

The Dope Gang

The police officer was soon in evidence, and it was seen that he was in plain clothes. That is, at least, plain clothes in the sense that they did not constitute the regulation uniform. But the red-brown lounge suit, black shoes and spats and bright red tie were rather at variance with the inspector's military cast of features and clipped moustache!

Coming straight to the point, after the usual salutations, the inspector said:

"We want your help in tracing the means of communication used by a dope gang."

"That sounds horribly dramatic," smiled Dare. "Dope gangs are, I am afraid, a little out of the line of my usual business."

Mysterious Messages

"It is quite a straightforward commission," explained the police officer. "and I can place it before you in quite a few words. No, I won't smoke, thank you. There's a gang running dope from the Continent, and we've got them pretty well lined up mainly owing to the receipt of information from one of their own men who we ran in a few weeks back.

"Now this man knows that the gang has some means of communicating from somewhere in East England with the big motor-boat that is generally used for bringing over the

LORD ARLINGTHAME'S INVENTION

"Just a miserable mechanical parrot!" exclaimed Dare.

It Nearly Made the Inspector Drop His Notebook!

dope cargoes. As it nears the coast, various messages are sent directing where the landing should take place, and so on.

"Now this is the point. We've got a fair idea when they are running their next lot, and we also know that they will bring it in not so very far away from Mersea Island, Essex. But if we could tap their messages we might get a line on the remaining big men behind this gang, and so make a clean sweep of the whole blooming lot.

Can You Track Them?

"We know it is not visual signalling with lights, and we know that they aren't using radio on any of the ordinarily used wave-lengths, but, and this is where you come in, Mister Dare, we've been told that it is a possibility that they are using a wireless wave-length that is outside the range of any standard receiver. Do you think you could track the messages down even if the wave-length were extremely small, or very big? It is a Home Office commission, and you will be well paid for your work—successful or not."

Dare leant back in the swivel chair in which he was then sitting, and tapped his blotting pad with a letter opener.

Far-Fetched Theory

"Well," he commenced carefully, "it seems to me that it is a very far-fetched theory, for there are few wave-lengths that are at all workable on which someone isn't working—and listening—most of the time these days. You have your big commercial stations on the very long wave-lengths, and goodness hows how low those amateur transmitters go! It appears to me most improbable that anyone could transmit anything on any wave-length without someone hearing it, unless——" he paused, as a thought struck him, "unless they are using a very low power. Power so low, in fact, that it would only barely radiate as far as the motor-boat from a point fairly near it on the land.

"I suppose you people have done some listening somewhere in the neighbourhood, because they could work any wave on very low power and so confine the messages to a restricted area. Any wave, that is, except those below about one hundred metres, for those short waves are apt to be erratic in their effects in the immediate neighbourhood of their origin—indeed, they are mostly erratic altogether."

"We've had men listening with radio sets under their very noses," explained Inspector Blazer.

"Aren't you taking a lot of chances of losing most of the gang just for the chance—and, so it seems to me, a pretty poor chance—of learning the names of one or two more who may or may not exist?"

"Bless you, no," chuckled the inspector, "the bunch that's running that boat are as lively as a lot of logs of wood. We could pick 'em up any time. People often criticise the police for being slow, but we're forked lightning in comparison with most of the criminal classes.

Got Them Nailed

"We're running them in by the dozen every day—you look at the police court reports—it's only the *very* mysterious and *very* tough cases that get prominence in the papers. Why? Because they *are* tough and they *are* mysterious! Obvious, isn't it? No, the gang we're talking about is nailed—most of their names are as good as on the charge sheet—some of 'em already are—but there's one or two slippery customers right behind that are worth all the rest put together.

"They are your mysterious cases and they are the tough guys who often manage to slip away, while the small fry get carted off to the station. However, the job's a clear one from your angle. Will you take it?"

"Will you take it?"

The metallic repetition of his own words nearly made the inspector drop his notebook. Dare had absent-mindedly switched on the "parrot."

"Bless my soul, what was that?" queried the police officer amazedly.

"Oh, that? Sorry, inspector," apologised Dare, "that is a patent set-tester I have had sent me for expert criticism by a titled inventor." He rose, and invited Blazer to examine the thing at close quarters.

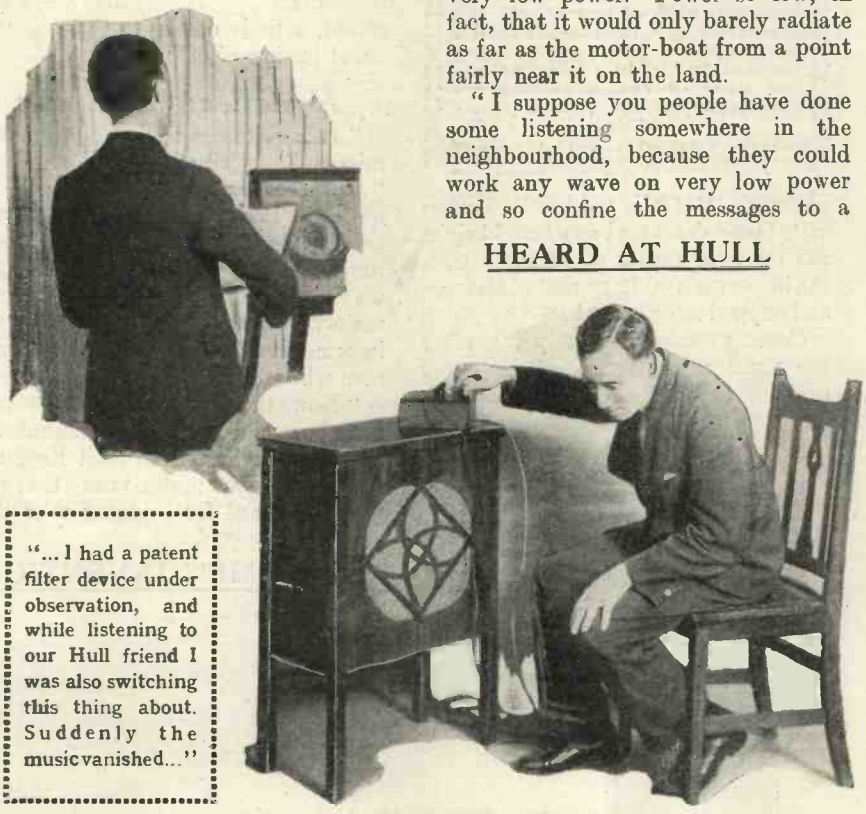
"Gets on My Nerves"

"You open this metal-lined chamber," he said, suiting his actions to his words, "and place the set in it. You see, there is one already there. You connect up the various leads and then shut the door. You are now ready to test the set. I will switch on again. Now it will repeat my words."

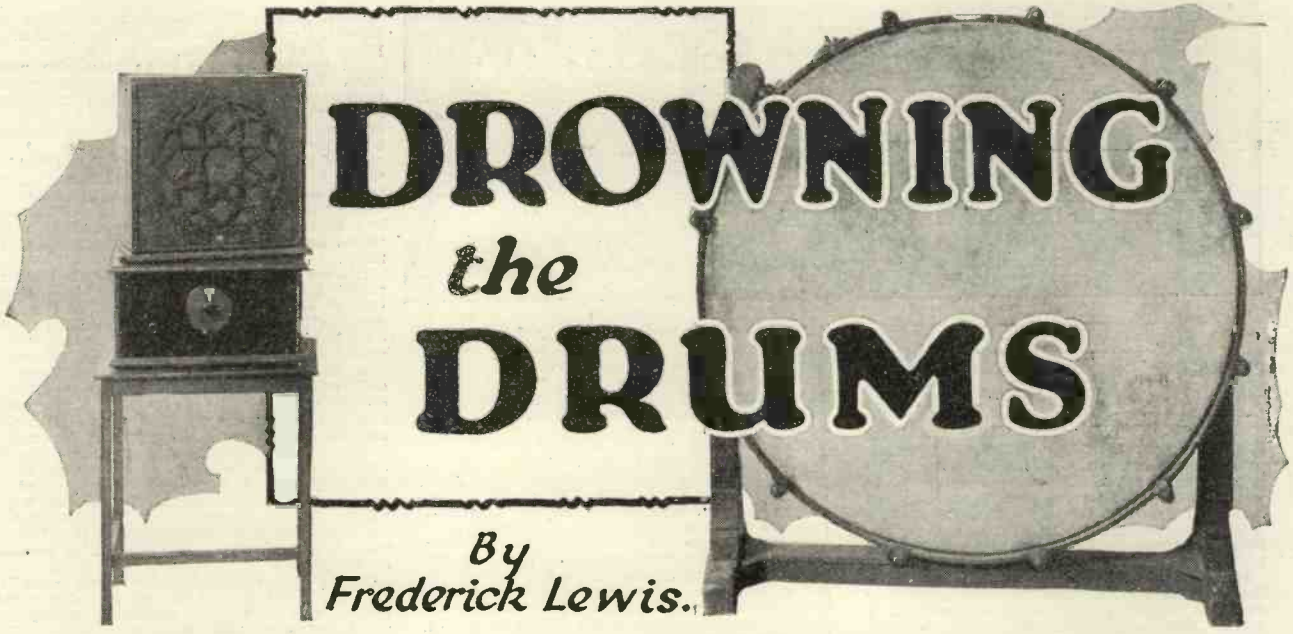
"Now it will repeat my words," agreed the mechanism.

"I will switch it off—and it gets on my nerves. Don't wonder you jumped! It is apparently a fairly complicated machine, but I don't think it has anything novel in it. The inventor states that there is a sort of

(*Continued on page* 250.)



"... I had a patent filter device under observation, and while listening to our Hull friend I was also switching this thing about. Suddenly the music vanished..."



DROWNING the DRUMS

By Frederick Lewis.

IN a recent number of MODERN WIRELESS I wrote an article called "Neglected Notes," in which I pointed out the danger of the cut-off of the high-frequencies in radio-gram receivers. But because I mentioned the necessity of having all the high-frequency in radio-gram reproduction, and in radio reproduction, it should not be taken that the other end of the musical scale, viz., the bass, can be disregarded.

Musical Balance

No doubt you are all familiar with the loud speaker which gives beautiful brilliance of the high notes, but which nevertheless often sounds shrieky and harsh. That may be due to a certain amount of peak in the upper register, but it is also very largely due to the fact that there is no musical balance.

The high and medium notes may be reproduced very well, but the bass is practically absent. The bass that is being reproduced in the *set* is being overwhelmed in the loud speaker, so that the preponderance one hears consists of the middle and high notes.

What are we going to do about it? Obviously, it is quite insufficient to listen to a reproduction of a brass band in which all the rhythm is left to the upper notes of the piano and the banjo, and the deep rhythmic beating of the drums and the double bass is absent.

We Want Poise

For proper reproduction and pleasant listening we must have those low notes. The danger is, however, that in trying to get the low notes we lose the high.

What sort of bass reproduction do you get from your radio-gram receiver? Do you hear the drums, or are they drowned in a medley of middle and high notes?

One of the biggest enemies to good low-note reproduction is the badly-made home-constructed loud speaker. This very often has in it a reed mechanism which has several resonant points in the upper portion of the scale, and is often subject to the most strident "paper noises," while frequently it is so suspended that it has nothing like a hope of doing justice to the impulses passed on to it from the set.

BANGING THE BIG BASS

When they give the big drum a good whack does it sound on your set like a tennis ball hitting cardboard, or does it give you the true impression and timbre?

In this month's MODERN WIRELESS there is a special loud-speaker supplement in which various types of home-made coil loud speakers are described, and details are given for their construction. These speakers are not expensive to make, but they are scientifically designed, and will give a good balance of reproduction.

I use the term "balance" because it is *balance* that we require more than anything. It is difficult to get a loud speaker to go down to 50 (or fewer) cycles per second. Similarly, it is difficult to get good reproduction above 5,000 cycles, and for balanced listening it is no good having the very top without the bottom notes, or the bottom notes without the top ones. We want musical poise. If the speaker goes up well, then it should also go down well.

"Absolute Realism"

This is where some of the moving-coil speakers fail. They go down well without going up properly, and I have heard others which go up better than they go down. A speaker with too much bass may not be as unpleasant to listen to as that with too much treble, but from the reproduction point of view it is just as wrong—it is giving an untrue picture; and although absolute realism may not always be desirable, I do think that we require proper balance in order to make listening really pleasurable.

It is no advertisement for our sets and speakers if every band sounds the same, and every orchestra is

(*Continued on page* 246.)

BROADCAST

THREE of the most interesting Broadcast Twelves released during the last month are Nos. 5202, 5203 and 5205. The former is the Grand Opera recording of **The Soldiers' Chorus** from "Faust," and the **Pilgrims' Chorus** from "Tannhauser," sung by the Grand Opera Chorus, with full orchestra, conducted by Stanley Chapple. The second record is the Gilbert and Sullivan vocal gems recording from **H.M.S. "Pinafore."** The third outstanding record is the Band of H.M. Welsh Guards, playing the **Hungarian Rhapsody No. 2**, by Liszt. These three are all very good recordings.

In a Monastery Garden and **Sanctuary of the Heart**, by Ketelby, on 5206, form an interesting couple of recordings by string orchestra and organ, while Sophie Tucker scores another great hit with Ted Shapiro and Orchestra in 5208, when she sings **Washin' the Blues from My Soul** and **That Man of My Dreams**. These are two true Sophie numbers.

Now let us consider the Broadcast Super Dance Records. Here we find that Marius B. Winter and his Dance Orchestra have been hard at work again to provide **What a Perfect Night For Love** and **Oh, Donna Clara**, on 2599, and **Soldier on the Shelf** and **Beware of Love**, on 2600. This band, which broadcasts fairly regularly and is very popular, is an ideal combination for recording purposes. **Rollin' Down the River** and **Where Can You Be?** will be a popular record (No. 2604), played by the New York Night-Birds with good effect. These dance numbers are very well recorded, and the improvement noticeable in the Broadcast recordings some little time ago seems to be very consistently maintained.

Among the "Tens" we find Sophie Tucker again in **Too Much Lovin'** and **Hollywood Will Never be the Same**, on 657. The Stoll Picture Theatre Organ (650) provides a "**Chu Chin Chow**" selection which is worth hearing, and so are Bob and Alf Pearson in **Little White Lies**, on 648.

The rest of the "Tens" are mainly dance numbers by Hal Swain and his Band, and the Midnight Merrymakers. Most noteworthy amongst these are **My Baby Just Cares for Me** and **Go Home and Tell Your Mother**, on 653, by the former band, and **The King's Horses**, on 656, by the latter; though coupled with these, perhaps, should be placed **Don't Tell Her What's Happened to Me**, on 655. All these dance records have vocal refrains.

COLUMBIA

Of the very large number of Columbia records released this month we have chosen some representative ones for discussion in this month's review. The first of these is a band record by H.M. Royal Horse Guards playing **Knights of the King**, a grand processional, by Ketelby, on one side, and **Gallantry**, also by Ketelby, on the other. This is on DX192, and is recorded in the Central Hall, Westminster. It is a fine example of military band recording, the valuable "hall atmosphere" having been caught almost perfectly.

Running close in popularity will probably be **DX193**, on which Quentin M. MacLean plays **Hungarian Rhapsody No. 2** on the organ. This, of course, is a cinema organ. The record is particularly notable for the excellent piano recording by means of the piano stop on the organ, and though the Rhapsody is played rather slowly the record is well worth getting if only for the deep pedal notes, which are really excellently recorded.

Finally, the third 12-in. we have selected is that of the Milan Symphony Orchestra, playing the **Overture from Masaniello**, on DX187. This is an extremely fine recording, being full-bodied and perfectly clean-cut throughout. We should like to recommend this disc to everyone who has a radio-gramophone, as not only is it a fine test of the qualities of the instrument, but it is also a very enjoyable record and the overture is extremely well executed.

And now for some of the 10-in. records. We will take, first, DB334, Hubert Eisdell singing some of Roger Quilter's compositions. Two are Shakespearean ballads: **Take, Oh, Take Those Lips Away** and **Heigh Ho, the Wind and the Rain**, and on the reverse side is **Go, Lovely Rose**. This is evenly recorded, the only fault we can find being that the consonants do not seem to come out as well as they might, and unless one knows the words some are rather difficult to catch. Otherwise the recording leaves little to be desired.

Then we come to the J. H. Squire Celeste Octette, playing two simple but attractive compositions by the leader himself: **The Fly's Courtship** and **The Ant's Antics**. Both are delightful little descriptive pieces, and the record provides six or seven minutes of very pleasant musical relaxation. Clapham and Dwyer break out again in a shortened version of the broadcast sketch, **Buying a House**. It suffers a little by having to be cut down to 10-in. size, and some of the more subtle jokes have had to be omitted, but the record is excellent entertainment and the personality of these popular broadcasting entertainers comes over exceedingly well. This is recorded on DB338.

Finally, we have yet another Layton and Johnstone record. This time they give **Little White Lies**, and **Horatio Nichol's Gipsy Melody**, on DB347. Nothing further need be said about this record except that it is a typical Layton and Johnstone number.

DECCA

The Hastings Municipal Orchestra is still busy recording for the Decca Gramophone Company, and this month they have produced the **Dance of the Hours**, from "La Gioconda," on K551. This is a particularly spectacular waltz, and exhibits to the full the powers of the Hastings Orchestra. George Morris, on the banjo, playing **The Drum Major** and **Fun on the Wabash**, is exceedingly good on both these numbers, and the latter particularly will be sure to win a large number of admirers. These two numbers are recorded on F2069.

A brief selection of outstanding records that have been released during the month. They are chosen because of their special value to the pick-up user.

F2065 provides a revival of two fine songs which were considerable favourites a few years ago. These are: **Cloze Props** and **Old Barty**, both of which Roy Henderson sings with his well-known artistry. **Dancing With Tears in My Eyes** we have heard a great deal on records lately, but it is undoubtedly one of the most popular dance hits at the moment, and Billy Milton has chosen it to make his début on Decca Records. Both this and **My Description of You** are sung with remarkable individuality on F2115. It may be of interest to readers to know that Billy Milton is starring in Noel Coward's "Bitter Sweet" at His Majesty's Theatre.

The Million-Airs are still hard at it, and their **Pantomime Favourites for 1931** and the selection of "**Evergreen**" are delightful recordings. Finally, we must not forget the Decca Special issue of Carl Brisson, singing **Wonder Bar** and **Tell Me I'm Forgiven**, and other numbers from the popular musical comedy, "Wonder Bar."

H.M.V.

One of the most interesting records we have had from the Gramophone Company this month is the special demonstration record which is being supplied to music dealers to assist them in the marketing of the new radio-gramophone, model 521. This "salesman" record tells in simple language exactly what the instrument will do, and how it is tuned and adjusted for various purposes, radio or gramophone reception, etc. In fact, the record is a concise description of the possibilities of the outfit.

On the reverse side is an attractive march tune, **Victory**, which fully demonstrates the musical quality of the 521. Such instruments as the violin, piccolo, grand organ, are heard in turn, and a vocal chorus with a full orchestra winds up the record.

If we may criticise it we think the talk side is rather too stilted and is on the long side, but the musical side of the disc is excellent. The full orchestral music is wonderfully recorded, and it is a delight to listen to the reproduction of this record on any radio-gramophone worthy of the name.

Among the ordinary H.M.V. records there are several most entertaining and novel productions. One of these is a recording of **Dancing With Tears in My Eyes** and **Lover Come Back to Me**, on The Theremin Oscillator, with a piano accompaniment. Readers will probably remember that some time ago a special "music-from-the-air" oscillating valve instrument was brought over to this country by the inventor, M. Theremin, and H.M.V. have used this instrument or an adaptation of it in the production of this record. It is extremely interesting for anybody connected or interested in radio, as it gives a peculiarly pure violin type of toue, and is not at all of the wailing class of instrument which one would expect. It is somewhat weird, but rather fascinating, and should certainly be heard by all readers of MODERN WIRELESS. It is recorded on B3726.

Marek Weber and his Orchestra, recording on C1941, give us **Old Vienna** and **Amorettentanze**. This is a light orchestral record well worth hearing. Nellie Wallace, on B3683, gives us **Mother's Pie-Crust** and **Cuckoo**, two comedy numbers which will be dear to the hearts of her followers; while W. P. Lipscomb and Alex. Fields, in **Tit For Tat** (which gives us the barber in the dentist's chair and the dentist in the barber's chair), on B3650, is another record very full of humour.

Medleys of "**Evergreen**" and "**Little Tommy Tucker,**" played by Raie da Costa, on B3689, are two pianoforte selections which are excellent radio-gramophone tests; while Peter Dawson, singing **The Blind Ploughman** and **The Menin Gate**, with organ accompaniment, on B3691, should be as popular as Paul Robeson's **High Water** and **Mammy is Gone**, on B3663. Both these are excellent recordings, and can be recommended to those who want a couple of good bass or baritone records.

Finally, we should like to put before the notice of readers the piano duet, **Waltz from the First Suite**, by Arensky, and the **Slavonic Dance No. 15**, by Dvorak. These are played by Ethel Bartlett and Rae Robertson, on B3634, and are both excellently recorded.

PICCADILLY

Piccadilly records are largely devoted to dance music, and we have chosen six numbers deserving special attention this month. All are by Jack MacDermott and his New Carlton players, and they provide **Dear Dear**, a haunting foxtrot from "Evergreen," and **Dancing on the Ceiling**, from the same show (No. 690). Then we have **My Heart Belongs to the Girl Who Belongs to Somebody Else**, an old favourite, which, coupled with **Go Home and Tell Your Mother**, should make a popular appeal (691), and **Roamin' Through the Roses** and **Absence Makes the Heart Grow Fonder**, on 692, another pair of numbers of decided interest.

ZONOPHONE

A very large selection of Zonophone records is available this month, including discs by artistes such as Foster Richardson, Esther Coleman, Herbert Thorpe, Solemn and Gay (the famous duettists), Maurice Elwin and, of course, the Rhythmic Eight, the International Novelty Quartette and the London Orchestra.

The latter provides very good **Paramount on Parade** selections from the well-known film, and this is coupled with **Honey**, another selection, on 5742. Solemn and Gay give us **The King's Horses** and **The Chum Song**, a couple of very jolly numbers; while Maurice Elwin, that sentimental baritone, provides two discs, the better of which we thiuk is the one containing **You'll Never Realise** and **The Same As We Used To Do**, on 5749. Herbert Thorpe has recorded two old favourites, if we may call them such: the famous tenor solos from Handel's great oratio, "The Messiah," **Comfort Ye My People** and **Every Valley Shall Be Exalted** (5745).

And now we come to a new dance combination, the Orpheus Dance Band. This group of instrumentalists will probably create great interest. The band is made up of some of the leading players in the world, and provides snappy syncopation and an interesting crispness in all their recording. **Little White Lies** and **That's Where the South Begins**, on 5758, is a recording well worth hearing, and if they continue their recordings for Zonophone as they have begun, there will be no gainsaying their popularity.

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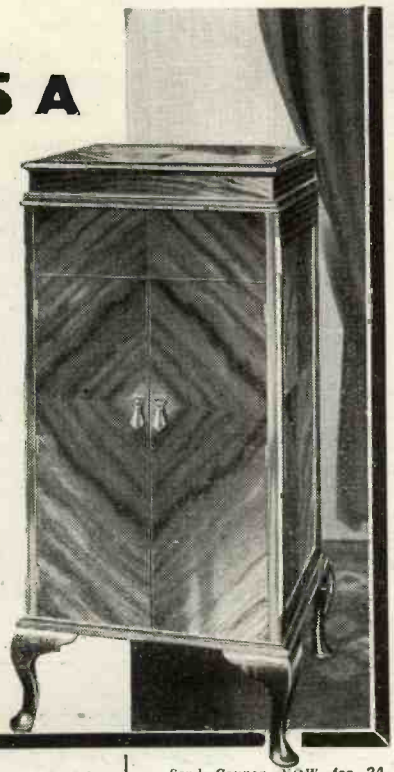

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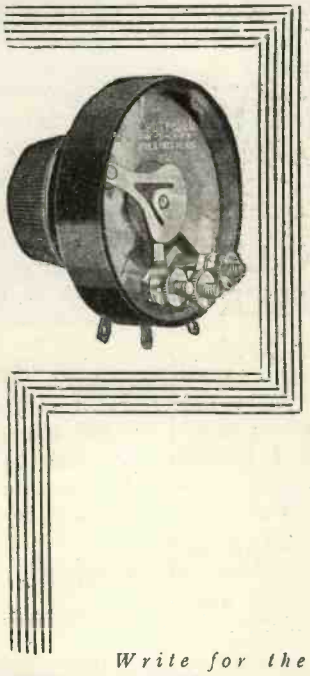

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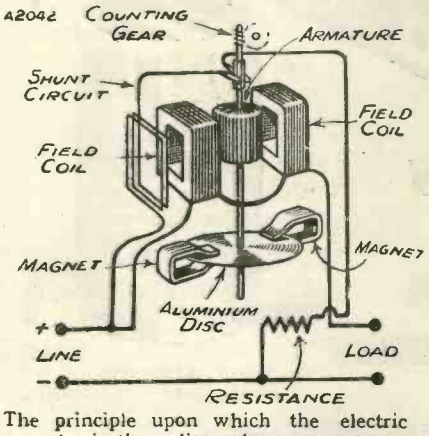
I HAVE more than once been asked by radio experimenters what is the principle of the electricity meter by which not merely ampere-hours but watt-hours are measured. Obviously, if the voltage is constant the ampere-hours enable the watt-hours to be calculated readily, but at the same time it is an advantage to have a meter which actually reads watt-hours.

THE WATT-HOUR METER



The principle upon which the electric meter in the ordinary house operates.

How It Works

In the accompanying figure you will see a diagram which explains the working of a direct-current watt-hour meter, which is really a simple compound-wound motor which rotates more rapidly for an increase either of the current or of the electro-motive force.

One of the best-known supply meters is based on the Thomson principle, and it operates roughly as follows: If a current passes through the armature of a small motor which has a constant field, the speed being controlled purely by eddy current reaction in an aluminium disc revolving between magnet poles, then the speed will at any instant be proportional to the current. If a suitable train of gear wheels is connected to the rotor it is easy to arrange for these to operate a counter or indicator which will serve as a meter of the ampere-hours.

Now, if the revolving armature is wound with fine wire and has a high resistance and is connected as a shunt, whilst the fixed field-coils pass the main load, the meter can be made to record watt-hours.

The Brake Effect

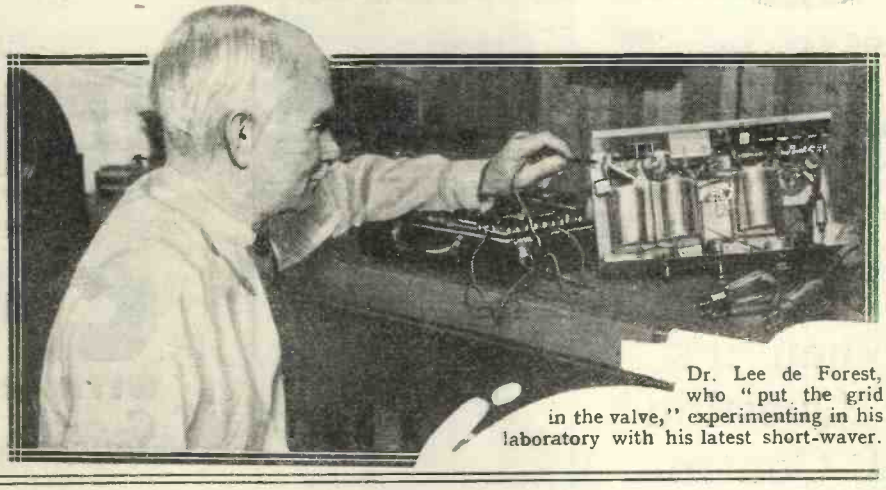
The torque produced by the revolving armature is proportional to the watts, and at the same time an aluminium disc revolving between the permanent-magnet poles acts as a brake and keeps the speed proportional to the torque.

A small auxiliary field coil may be connected into the shunt circuit, in order to compensate for the small losses by friction of the moving parts.

In a good meter the proportion of the total load which is required to operate the meter is very small, less than 1 per cent.

J. H. T.

THE INVENTOR OF THE TRIODE



Dr. Lee de Forest, who "put the grid in the valve," experimenting in his laboratory with his latest short-waver.

RADIO WRINKLES TO REMEMBER

It is always better to run an aerial wire at right angles to other wires than to have it parallel with them.

* * *

If a metal screen is placed too close to a coil the inductance of this may be lowered and consequently calibration may be thrown out.

Crowded Cabinets

Often insufficient de-coupling is suspected of causing hum when the real trouble is the crowding into a cabinet of unsmoothed mains apparatus.

* * *

For their gramophone work the gramophone pick-ups used by the B.B.C. are of the needle-armature type.

* * *

A high resistance in series with the output, or tappings of the transformer secondary, are usually the methods recommended by the makers for variations in the output voltage of a rectifying valve, which should not be run at a reduced filament voltage for this purpose.

* * *

It is not advisable to use a variable resistance in series with the loud speaker for controlling volume, as the effect on quality is detrimental.

* * *

When fixing an aerial to a tall tree remember that it is unwise to anchor the wire so high up the tree that it swings unduly in the wind.

* * *

When using indirectly-heated cathode valves, the cathode return (except in the case of the S.G.) is generally taken either to a potentiometer connected across the heater circuit or else to the centre of the filament winding on the transformer.

An Aerial Tip

Where the best aerial support is a tree that cannot be prevented from swaying in the wind, springs or balanced weights may enable the aerial to be safely supported by it.

* * *

When a pentode valve employing 200 volts on the screened grid and 250 on the plate is used, a convenient method of obtaining the lower voltage rating from an H.T. supply is to join a resistance of approximately 7,000 ohms in series with the screened-grid lead. (This resistance should be by-passed by a 2-mfd. condenser to the negative end of filament.)

AMPLIFIERS IN HARNESS

APART from its use as a detector, the main purpose of the valve is to amplify signals either before or after rectification. As an amplifier it should reproduce exactly, but on a larger scale, every impulse applied to it.

Judged by this definition, the thermionic valve is not a true amplifier, because the response to an input *voltage* takes the form of a change in plate *current*. The effect of applying signal voltage to the grid is simply to increase or diminish the number of electrons which can pass from the filament to the plate. In other words, it controls the value of the current passing through the valve into the external circuits.

True, the change in plate current is proportional to the input voltage, but it is not the same thing. Before the valve can be said to act strictly as an amplifier, the plate current must be converted into a magnified "voltage image" of the applied grid impulse.

H.F. and L.F.

Each valve is essentially voltage-operated, and its business is to pass voltage variations on to the next stage for further amplification. This holds good both on the high- and low-frequency sides, with the single exception of the output valve, which is specially designed to deliver power, i.e. current as well as voltage, to the loud speaker.

"Although the problem of converting plate current into voltage may not appear at first sight to present any particular difficulty, it is amazing how much controversy it has provided"—says

J. C. JEVONS.

Although the problem of converting plate current into voltage may not appear at first sight to present any particular difficulty, it is amazing how much controversy it has provoked. Mathematicians, for instance, have written reams on the subject, whilst certain lucky inventors have made their fortunes. In fact, some of the most valuable patents in the radio industry are—or have been—based on tuned-anode, transformer, and choke and resistance-capacity intervalve couplings.

Bearing in mind that the object of any intervalve coupling is to convert current into voltage variations for transfer to the next valve, let us first consider the case where there is nothing in the external plate circuit except the H.T. battery.

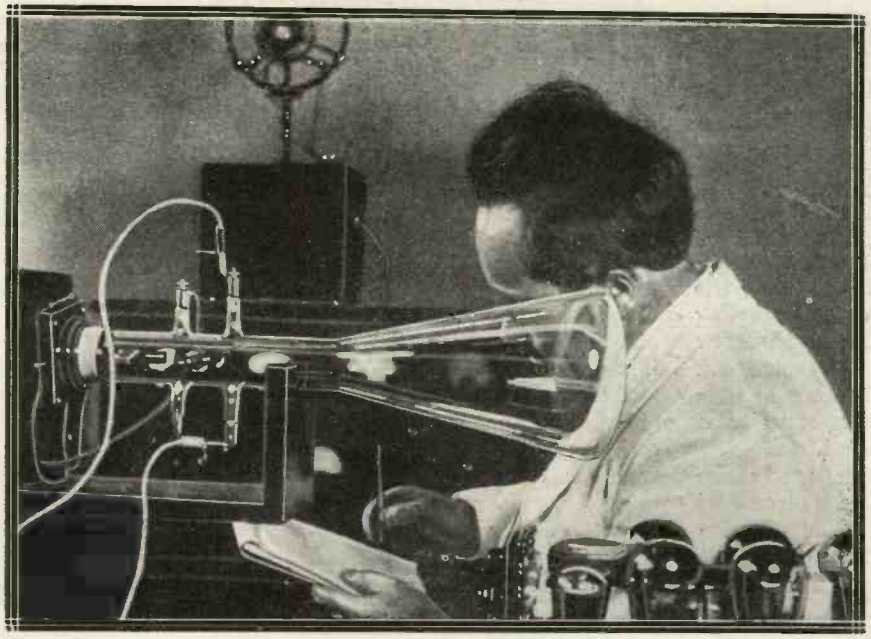
The Anode Load

This is equivalent, so far as any high-frequency currents are concerned, to a simple short-circuit. The H.T. battery should offer neither resistance nor impedance, so that there is no means for converting current into voltage; nor, in fact, for passing on energy to the next stage in any shape or form.

It is clear, then, that the plate circuit must contain some form of impedance or "load," and since there is a direct-current component to be considered, as well as an alternating current, we are necessarily restricted to using either a resistance or an inductance. Capacity will transfer the alternating component but will not carry D.C.

Resistance produces a voltage

TESTING A NEW LOUD SPEAKER



Hans Vogt, the German radio engineer and talkie pioneer, in his private laboratory. He is using a microphone and a large cathode tube to investigate the tonal qualities of his new loud speaker

Where and Why Transformers are Used

drop as a plate current passes through it, whilst inductance, either in the form of a choke or transformer winding, reacts by setting up a back-voltage. The larger the resistance or inductance, the greater will be the resultant back-voltage.

Limiting Factors

But there is an obvious limit. If the load is made infinitely large, no current can force its way through, and the main object of the coupling is therefore frustrated. One is accordingly forced to compromise by choosing the highest resistance or inductance, consistent with other circuit conditions.

A NOTABLE JAPANESE FAMILY

A photograph recently received from Japan. It shows Mrs. Hamagushi, the wife of the Japanese Prime Minister (who was injured in an attempted assassination a month or two ago), listening together with her family to the broadcast from London of the speeches in connection with the Japanese ratification of the London Naval Pact.

For instance, with resistance coupling one limit is reached when the D.C. voltage-drop across the coupling element reduces the H.T. supply below the point at which the valve can operate efficiently. Another limit is set by the effect of shunt capacity as the resistance is increased.

In the case of transformer and choke couplings not only does the cost of manufacture rise with the effective inductance, but a point is soon reached where the capacity losses across the windings more than offset the advantage of increased impedance.

In modern practice the tendency is to use only transformer coupling on the high-frequency side, the effective impedance of the primary winding being made at least as high as that of the valve. It must be borne in mind that the secondary winding of the transformer is practically open-circuited, since it is connected across the grid filament circuit of the next valve. This increases the impedance of the primary and cuts down the current-flow to small proportions, giving practically a pure voltage response.

On the low-frequency side one has a wider choice between transformer, resistance, and choke couplings, though the same general considerations still hold good. With high-mu transformers it is advisable to use a parallel feed from the H.T. supply to the plate of the valve, in order to keep the D.C. component out of the transformer windings.

If the core is saturated the effective inductance is diminished, and some of the lower notes are lost. Incidentally this type of transformer is particularly susceptible to stray fields, so that it should be well screened.

From what has been said it is clear that plate current should be kept down in every stage of amplification except the last, where power or wattage, i.e. the product of current and voltage, must be delivered to operate the loud speaker. Even in an L.F. valve preceding the output stage excessive plate current is detrimental, since it tends to saturate the core of the next coupling choke or transformer.

The Power Output

For the low-impedance type of power valve, giving a large current output, the impedance of the valve should match that of the loud-speaker windings for maximum efficiency. The pentode stands in a class by itself. Although its internal impedance is high, so also is its amplification factor and mutual conductance—the two last factors tending to offset the first so far as output is concerned.

On account of its high impedance, it is necessary to use a step-down transformer-coupling between a pentode and the loud speaker, so that the impedance of the primary winding may match that of the valve. The resulting step-up in current from primary to secondary provides a liberal flow through the speaker windings. This is necessary, since a loud speaker, unlike the valve, is essentially a current-operated device.

INTERFERENCE

Some hints about "humming."

A hum from the mains may be introduced into a set in several different ways, such as via a mains unit, by pick-up in aerial or earth leads, or by pick-up in a long battery or loud-speaker lead.

* * *

When tracing a hum try the effect of switching off your mains altogether to see if the house wiring is responsible for the trouble.

* * *

For locating electrical interference there is much to be said for the simple plan of disconnecting the aerial and earth wires to see if this affects it.

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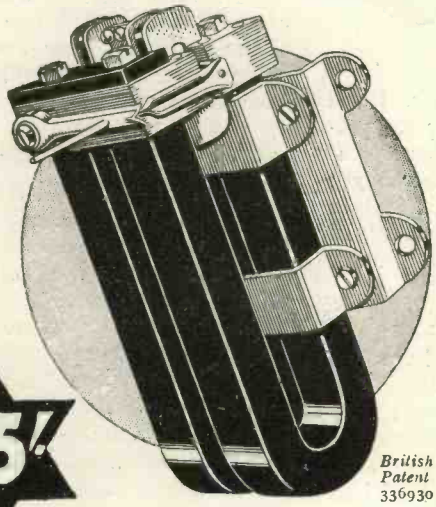

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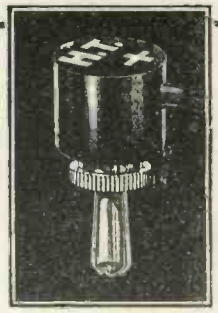

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RADIO NOTES and NEWS of the MONTH

Still Going Strong

ACCORDING to the B.B.C., the fact that the number of licences issued during 1930 showed an increase of 409,000 must be an unanswerable proof of the rapidity with which broadcasting has "sloughed the skins of novelty and luxury and taken its place in contemporary life as a fully-fledged necessity."

Well, there's no argument against that. An increase of very nearly half a million in one year is a full and certain indication of how the general public is at last realising that radio is as necessary as electric light or gas.

Wait and See

It was rather interesting the other day at the Imperial College of Science when the H.M.V. Co. demonstrated their television system. Mr. Baird was there, eagerly watching the progress of the demonstration; but when he was asked what he thought of the system, he smiled rather cryptically and said: "Wait awhile!"

We are, with considerable interest.

A Station for Mecca

The Marconi Company have got rather a difficult problem to handle in supplying the King of Arabia with fifteen wireless stations, plus experts.

One of these stations will be at Mecca, and, of course, no infidel is allowed to enter the Sacred City; so the station must be erected and operated by Mohammedans. Some of these Arabian students are now busy at Chelmsford, learning all they can about radio.

Telegraphy, Too

These stations are not entirely for broadcasting, although they will be able to broadcast entertainment. Thirteen of them are going to be used specifically for telegraphic communication.

There are four Arabs at the moment at the Marconi's Wireless College in Chelmsford, and they are probably going to take a course which will last from four to six months.

No Luck for Listeners

It has been proposed that a statue should be put up in honour of Schonberg, and possibly one in honour of Bela Bartok, in the B.B.C.'s new Broadcasting House.

We don't know where this suggestion came from—probably as a humorous idea from "Ariel" in our contemporary "Popular Wireless"—but we think most MODERN WIRELESS readers will agree, after hearing "Ewartung," for example, that there's not much chance of listeners subscribing to these two statues.

(*Continued on page* 240.)

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1 Oak Cabinet, 21" × 7", and baseboard	1	8	0
1 Ebonite Panel, 21" × 7", ready drilled		9	0
1 Lissen ·0005 Variable Condenser		6	6
1 Magnum ·0001 Differential Condenser		6	0
1 Magnum Neutralising Condenser		5	0
2 On-off Mains Type Switches		3	6
1 Magnum Spaghetti Resistance, 25,000 ohms		1	6
1 Magnum Spaghetti Resistance, 50,000 ohms		1	6
1 100,000-ohm Resistance and Holder		5	6
1 Lissen 2-meg. Leak and Holder		1	6
1 Lissen 1-meg. Leak and Holder		1	6
1 400-ohm Potentiometer, B/B		1	6
1 Varley Power Potentiometer, 2,500 ohms		10	0
3 Magnum 4-pin Valve Holders		5	0
1 Dubilier 2-mfd. Condenser		3	6
1 Dubilier 2-mfd. Condenser, 250 volt type		3	8
3 Dubilier 2-mfd. Condensers, 200 volt type		10	6
1 Dubilier 4-mfd. Condenser, 250 volt type		6	0
1 Magnum ·001 Fixed Condenser		1	6
1 Magnum ·002 Fixed Condenser		2	0
1 Magnum ·0003 Fixed Condenser		1	6
1 Magnum ·01 Fixed Condenser		2	6
1 Varley Heavy Duty Choke, 20 henries	1	0	0
1 Smoothing Choke, 20 henries		15	0
1 Magnum Output Filter Choke		15	0
1 Magnum H.F. Choke		7	6
1 Wearite Heavy Duty H.F. Choke		10	6
1 Varley L.F. Transformer, Nicore II		15	0
1 Magnum Star Turn Selector Coil		12	6
1 Magnum Dual Range Coil		12	6
2 Magnum Small Panel Brackets		1	6
4 Belling-Lee Terminals		2	0
2 Belling-Lee Terminal Blocks		1	4
1 Bulgin Milliammeter, 0-200 m/a		8	6
1 Ormond Slow-Motion Dial		5	0
Connecting Wire, Screws, Flex and Adaptor		2	6
	£12	6	0

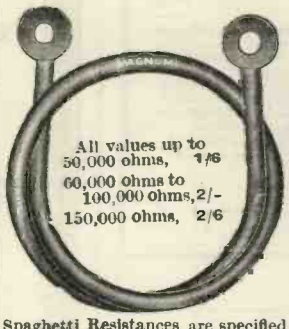
Any of the above parts supplied separately as required.

1 Set of Valves, as specified ... £1 7 6

The "Star-Power" Three, as above, ready wired and tested, including Coils, Valves, and Cabinet. Royalty paid ... £15 15 0

BURNE-JONES & CO., LTD.,
"MAGNUM" HOUSE, 296, BOROUGH HIGH STREET, LONDON, S.E.1.
Telephone: HOP 6257 & 6258.
Scottish Agent: Mr. ROSS WALLACE, 54, Gordon St., Glasgow, C.1

MAGNUM SPAGHETTI RESISTANCES



Spaghetti Resistances are specified for the "Star-Power" Three, and hosts of other modern circuits.

"M.W." DUAL-RANGE COIL

Every coil is individually tested. Specified for all "M.W." and "P.W." sets. 12/6

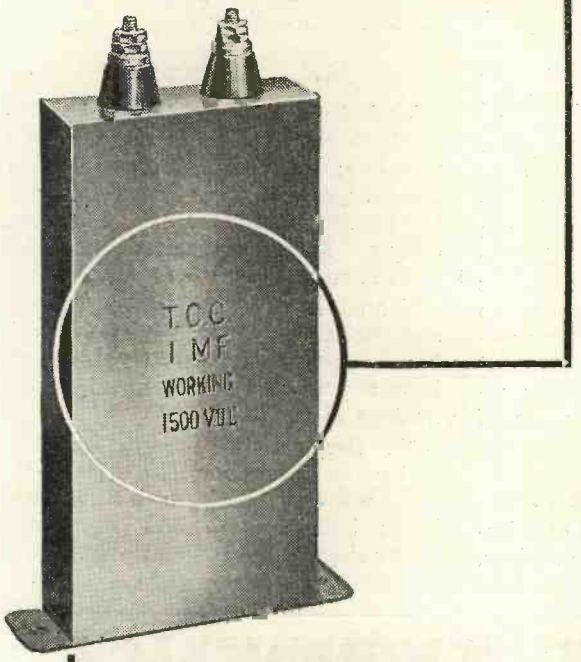
UNIVERSAL THREE
(15-2,000 METRES)

Owing to the increased demand for this receiver of exclusive design, we are pleased to announce a reduction in price, from £18 to £15, inclusive of valves, coils and royalty.

The most versatile set yet designed.

Comprehensive lists, dealing with this, and other Magnum Sets and Components, including a list of leading short-wave stations, Free on request.

TELLING THE TRUTH ON A CONDENSER



Test Voltages or Working Voltages?

SOME condensers are marked in a misleading manner. They indicate *test* voltages, which are obviously so much higher than actual *working* voltages, you may believe you are buying more efficient and better insulated condensers. This is not necessarily the case. The old idea that the continuous working voltage of a condenser was half its stated test voltage cannot now be relied upon, for Condensers of similar capacity and size have been sold stamped with varying test voltages, but with no indication of the working voltage. Do not take risks, therefore. See that the condensers you buy are definitely marked with their maximum **working** voltage. You will always find this on

T.C.C. CONDENSERS

TELEGRAPH CONDENSER CO. LTD. N. ACTON, W.3

♡ 7438

METAL RECTIFIERS FOR ALL-MAINS RADIO

WESTINGHOUSE

Why have the trouble—the worry—the expense of batteries and accumulators if your house is on the mains? Why risk missing a specially good programme because the "battery's down again"?

Our booklet, "The All Metal Way, 1931," gives complete information as to the most suitable type of rectifier for converting any battery-run set into an all-mains set.

If you are buying a mains set, make sure that it incorporates the Westinghouse Metal Rectifier—most of the good makes now do. If you are building such a set, send for the forty-page booklet, "The All Metal Way, 1931." It is written by our technical staff and contains informative sections on radio sets, eliminators, battery chargers, moving-coil loud speakers, etc. (Please enclose 3d. for your copy.)

Prices of the Westinghouse Metal Rectifier are from 15/-.

USE YOUR A.C. MAINS AND A WESTINGHOUSE RECTIFIER

THE WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD., 82, YORK ROAD, KING'S CROSS, N.1.

'Phone: North 2415.

COUPON

Please send me your forty-page booklet, "The All Metal Way, 1931," for which I enclose 3d. in stamps.

PLEASE WRITE IN BLOCK LETTERS.

NAME.....

ADDRESS.....

..... M.W. 2/31

The **CLIX**

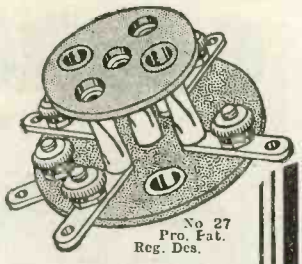
"Built for Efficiency"

VALVEHOLDER

is gaining the highest praise from everyone.

The Head of a Municipal Physical Laboratory writes:— "The two samples of the 5-pin type I have examined both show an insulation resistance of **over 100 megohms**, and, as the amount of dielectric used is very small, the dielectric losses must be a minimum. It is a pleasure to see a valve holder in which a great chunk of bakelite giving large dielectric losses is not used."

Because of the Resilient Sockets used in the Clix Valveholder, it is the only one giving perfect contact with SOLID as well as all other types of valve pins.



No 27 Pro. Pat. Reg. Des.

Type B: Baseboard mounting.

5 PIN MODEL with screw terminals 1/-

5 PIN MODEL without screw terminals 9d.

4 PIN MODEL with screw terminals 10d.

4 PIN MODEL without screw terminals 8d.

Fully descriptive folder on application.

Lectro Linx, Ltd., 254, Vauxhall Bridge Rd., S.W.1

CHEAPER ELECTRIC RADIO by REGENTONE

Three new Regentone models at lower prices. A.C. Combined Unit Model W.5.A. (H.T. with L.T. Charger) £4:15:0. D.C. Combined Unit Model II (H.T. with L.T. Charger) £2:12:6. A.C. Mains Unit (H.T. only—3 fixed tappings) £3:7:6. Write for FREE Art Booklet with colour supplement "Cheaper Electric Radio by Regentone"—or get it from your dealer.

Regentone Ltd., Regentone House, 21, Bartlett's Bldgs., Holborn Circus, London. Tel: Central 8745 (5 lines). *Irish Free State Distributors: Kel'y & Shiel Ltd., 47, Fleet Street, Dublin.*

RADIO NOTES AND NEWS OF THE MONTH

—*continued from page 238*

The Ether Tangle

The newspapers are waking up to the fact that the problem of the congestion of the ether is becoming more and more serious. This is all to the good, because something will certainly have to be done—from the Government point of view, at any rate—very shortly; otherwise the situation will get into such a tangle that the whole broadcasting system will suffer.

"A Guid Time Coming"

It must be remembered that Germany has seven high-power stations in hand, some of which will use as much as 75 kilowatts. Switzerland, Belgium and France also are providing new stations, and at the back of them all is Russia, which is occupied with a big series of eleven high-power stations—one of which, it is reputed, will have a force of 500 kw.

Government Intervention?

In an interview, Captain Mullard says it is possible that Government intervention will be necessary. It seems pretty clear that it will have to be necessary. The International Broadcasting Union at Geneva has very limited powers, and we mustn't look there for any real solution to the problem.

The Alternatives

This reminds us of Warsaw, where there is a new station going up of 158 kw., and again a 120-kw. one is being built for Prague.

As Captain Mullard has pointed out, even with a good modern receiver the situation will be too much for the average listener. Despite all the research and concentration on selectivity, designers of sets cannot be expected to work miracles day after day, and if the various authorities in Europe are going to allow an indefinite number of super-broadcasting stations to spring up, there are only two alternatives left: (1) widen the available broadcasting wave-bands, or (2) an international agreement for restriction of power and number of stations.

Is It Mercury's Fault?

The American Association of Scientists, at one of their recent meetings, were informed by a speaker that Mercury and Venus were sometimes responsible for bad radio reception. It appears that they sort of shower the sun with electrons, and produce sun-spots. Under such an electrical attack the sun in turn produces electrical storms in the earth; and these electrical storms, or assaults, are the cause of atmospherics.

According to the speaker, the moon is also a disturber of wireless reception, more especially when our satellite is directly overhead.

B.B.C. Finance

Little has been heard lately of the £400,000 which the Treasury will take from the B.B.C.'s licence money this year, and little has been heard of the rumour that the B.B.C. was in danger of bankruptcy unless they got more money.

Nevertheless, the situation is serious, and probably before this issue has been out very long listeners will hear a good deal more about the finances of the B.B.C.

The Regional stations are going to cost a lot of money yet, and something will definitely have to be done about letting the B.B.C. have a bigger share of the licence revenue.

(*Continued on page 242.*)

CORROBORATIVE EVIDENCE

of the superiority of Telsen Components is to be found in the fact that, apart from their continual inclusion in the most popular sets of the day, they are being bought by wireless enthusiasts in ever increasing quantities.

Components may look alike, but there IS a difference—a very big difference—in Telsen! MANY FEATURES OF TELSEN COMPONENTS ARE PATENTED, hence the remarkable improvement in performance when they are incorporated.

TELSEN H.F. CHOKES. Designed to cover the whole wave-band range from 18 to 4,000 metres. Extremely low self-capacity, shrouded in Genuine Bakelite. Inductance 150,000 microhenries. Resistance 400 ohms. Price 2/6 each.

TELSEN FOUR-PIN VALVE HOLDERS. Price 1/- each.

TELSEN GRID LEAKS. Absolutely silent and non-microphonic, practically unbreakable, cannot be burnt out and are unaffected by atmospheric changes. Not being wire wound, there are no capacity effects. Made in capacities of ¼, ½, 1, 2 3, 4 and 5 megohms. Price 1/- each.

TELSEN VALVE HOLDERS. Pro. Pat. No. 20286/30. An entirely new design in Valve Holders, embodying patent metal spring contacts, which are designed to provide the most efficient contact with the valve legs, whether split or *Non-Split*. Low capacity, self-locating, supplied with patent soldering tags and hexagon terminal nuts.

TELSEN FIXED (MICA) CONDENSERS. Shrouded in Genuine Bakelite, made in capacities up to ·002 mfd. Pro. Pat. No. 20287/30. ·0003 supplied complete with patent Grid Leak Clips to facilitate series or parallel connection. Can be mounted upright or flat. Tested on 500 volts. Price 1/- each.

TELSEN COMPONENTS

TELSEN FIVE-PIN VALVE HOLDERS. Price 1/3 each.

Advt. of Telsen Electric Co., Ltd., Birmingham.

Dubilier mica condensers are encased in a nice, clean, moulded box—but that doesn't mean a thing. Anyone can put up a product in a nice clean moulded bakelite box. What does count is what's inside.

Dubilier built condensers long before broadcasting began—condensers for scientific labs., condensers for high power radio stations, and what Dubilier's don't know about condensers isn't worth knowing.

Dubilier mica condensers ensure uniformity and permanence of results. If you buy a condenser bearing the name "Dubilier" you can be sure that inside is the finest condenser of its type obtainable.

PRICES

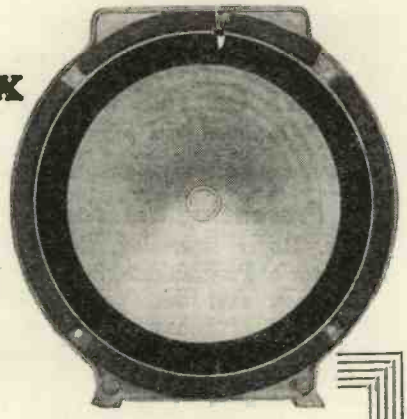
Types 610 and 620		Types B 775, 776 and 777	
·00005 to ·0009	each 1/8	·01	each 3/-
·001 and ·002	,, 2/-	·02	,, 3/6
·003, ·004 and ·005	,, 2/3	·05	,, 5/6
006	,, 2/6	·1	,, 8/-
·01	,, 3/-	·2	,, 14/6
		·25	,, 18/-
		·5	,, 37/6

DUBILIER CONDENSERS

Dubilier Condenser Co. (1925) Ltd.,
Ducon Works, Victoria Rd., N. Acton, London, W.3

Now Magnavox Little Giant—

A Moving Coil Speaker for 57/6



Everyone can now afford to buy a genuine Magnavox Moving-Coil speaker. The new Little Giant model, equipped with 6½" cone and input transformer, gives a remarkable performance comparable only with that of instruments selling at considerably higher prices.

6-volt, 110-volt, and 220-volt D.C. models .. .. 57/6 each
110-volt or 220-volt A.C. models, £5 10s. each

THE ROTHERMEL CORPORATION LTD.
24, Maddox Street, London, W.1.
'Phone: MAYFAIR 0578/9.
Continental Office:
27, QUAI DU COMMERCE, BRUSSELS, BELGIUM.

A Guaranteed
PILOT RADIO KIT
for every
"M.W." CIRCUIT

Success guaranteed. Every part down to the last screw, in an attractive carton, including **Free Pilot "Test" Meter**, without which no set is complete. No delay—immediate dispatch service. Immediate delivery to all approved orders. Carriage paid.

"P.W." DOUBLE TRAPPER.
(See "P.W." 13/12/1930)

Assembled, Wired & Tested
C. O. D.
Send no Money
Pay the Postman **11/6**
Post Free.

"M.W." SPECIAL SHORT-WAVER

	Cash Price	or 12 Monthly Payments of
Kit "A"	£4 12 0	8/5
,, "B"	£5 11 0	10/2
,, "C"	£6 4 9	11/5

"STAR-POWER" THREE (D.C. Model)

Kit "A"	£13 6 3	24/5
,, "B"	£14 13 9	26 11
,, "C"	£16 11 3	30 5

"STAR-POWER" THREE (A.C. Model)

Kit "A"	£11 18 4	21/10
,, "B"	£15 0 10	27/7
,, "C"	£16 18 4	31/-

PETO-SCOTT CO. LTD.

77 CITY ROAD, LONDON, E.C.1. 'Phone: Clerkenwell 9406-7-8

62 High Holborn, London, W.C.1. 'Phone: Chancery 8266. 33 Whitelow Road, Chorlton-cum-Hardy, Manchester. 'Phone: Chorlton-cum-Hardy 2028. 7 Albany Road, Newcastle, Staffs.

PLEASE SEND ME FREE YOUR FAMOUS PILOT RADIO CHART BY RETURN OF POST.

NAME .....

ADDRESS .....

.....

M.W. 2/31.

RADIO NOTES AND NEWS OF THE MONTH

—*continued from page 240*

Presenting the Talks

Mr. Roger Eckersley, the B.B.C. Director of Programmes, in his recent broadcast, said that periodically a good deal of nonsense is said and written about the abolition of talks from programmes.

"We propose to broadcast in the future," he went on, "as in the past, a carefully-thought-out number of interesting talks judged on their merits as programme items."

This is all very well, but won't Mr. Eckersley pay more attention to the psychology of the presentation of these talks, and the engagement of people who have more interesting and charming broadcasting personalities than is the case with the majority of talkers to-day?

Good Talks and Bad Titles

It's no good having a first-class subject matter talk unless it can be put over with charm and character, in such a way as to arrest and hold the attention of the average listener, and it's no good announcing such a talk in a dull and dry-as-dust academic fashion.

Mr. Eckersley should really come round to a newspaper office and learn a little of the art of the psychology of sub-editing, and that includes learning how to give attractive titles to subjects which, even if they aren't attractive, can in more ways than one be made so.

NEXT MONTH

A Special Radio - Gram Number of "M.W." is now in preparation and will be **On Sale Feb. 28th. Price 1/-**

ORDER YOURS NOW

Mr. Mark Hambourg

In the December issue of MODERN WIRELESS, under a picture of Mr. Mark Hambourg (on page 620), he was described as having broadcast several times. Mr. Hambourg wishes us to point out that he has *not* broadcast, and has no intention of doing so until the authorities pay what he considers is a proper fee.

A Striking Forecast

Mr. Baird has been interviewed again, and, according to the "Evening Sentinel," prophesied that in 1931 improved, cheaper, and portable televisor sets will be produced, a new television transmitting station will be opened, moving pictures of speakers and actors will be transmitted, and stage plays may be televised complete.

This is a very striking forecast of television, when one compares it with the modest claims made by the H.M.V. television system; and yet some of those who saw the H.M.V. system were undoubtedly more impressed with the results than they were with the Baird system.

Going Some!

By the way, here's another extract from one of Mr. Baird's forecasts, which appeared in the form of an interview with Alan Warwick in the January number of "Pearson's Magazine": "The day is not far distant when the housewife who wants a joint of meat from the local butcher will demand a sight of the joint on the television screen."

Will she be able to smell it and so ascertain whether it is fresh?

V.P. 14

One after the other new programmes come crowding in as your dial revolves. Stations you could not get before—programmes coming to life in your home from every part of Europe. TUNGSRAM VALVES have made the difference. TUNGSRAM VALVES give longer range to your set, give better selectivity, too, and mighty volume. And though they cost less than any other valves of similar quality, yet they have longer life and economy in use. TUNGSRAM VALVES will give you better radio at less cost.

2-v. and 4-v. Screened Grid Valves, 13/-; 4-v. A.C. Screened Grid Valves, 16/-; L.F., 5/6; H.F., 5/6; R.C., 5/6; Power, 7/3; Super Power, 8/-; A.C. Indirectly Heated H.F. and L.F., 9/6 each; A.C. Directly Heated Power, 9/6 each; A.C. Directly Heated H.F. and L.F., 7/9; Rectifying Valves, 10/- each; Tungsram Photo-Electric Cell, Nava E., £2 : 17 : 6; Nava R., £3 : 3 : 0.

*For full details of Tungsram range write to Dept. V.*108.

TUNGSRAM ELECTRIC LAMP WORKS (GT. BRITAIN), LTD.,

Radio Dept., Commerce House, 72, Oxford Street, London, W.1.

Branches: Belfast, Birmingham, Bristol, Cardiff, Glasgow, Leeds, Manchester, Newcastle, Nottingham and Southampton.

I.F.S. Organisation: Tungsram Lamps and Radio, Ltd., 11, Burgh Quay, Dublin. *Telephone No.: Dublin 45049. Telegrams: Tungsram, Dublin.*

Lamp, Valve and Glass Factories: Austria, Czechoslovakia, Hungary, Italy and Poland.

TUNGSRAM BARIUM VALVES

REPLACE YOUR OLD CONDENSER

with –

POLAR IDEAL

Here is a unique opportunity for you to save 2/- and to modernise your set. Substitute your old type condenser with a Polar "Ideal" or a Polar "Ideal" Drum Control. These condensers have the finest Fast and Slow Motion Drive on the market to-day and are regarded as *the standard* of high-class design.

OUR OFFER. Take your old condenser, any make or type, to your Dealer and he will supply you with one of the Polar "Ideal" condensers listed below and allow you **2/-** from the list prices quoted.

POLAR "IDEAL" with knob dial, ·0005, 12/6; ·0003, 12/-.

POLAR "IDEAL" Drum Control, right or left hand, ·0005, 15/-; ·0003, 14/6.

SPECIAL EXCHANGE OFFER

This offer holds good for January and February. Take advantage of it now. Put new life into your set.

Scrap the ancient— use the modern
POLAR CONDENSERS

WINGROVE & ROGERS, Ltd.
188-9, STRAND, LONDON, W.C.2
POLAR WORKS, OLD SWAN, LIVERPOOL

Well-Written Baffling Dynamic

MYSTERY STORIES

Built round an entirely fresh figure in crime fiction—INSPECTOR EGO—created by G. R. MALLOCH. Meet this NEW detective to-day in the February issue of

CASSELL'S

MAGAZINE *Now on Sale* **1/-**

MAKING CHARGING TRANSFORMERS

Some practical information for experimenting on the construction of a useful mains component.

By Dr. J. H. T. ROBERTS, F.Inst.P.

IN making a transformer for stepping-down the voltage of the alternating-current mains so as to provide charging-current for low-tension batteries, there is a fair amount of latitude available, and it is not necessary in these small transformers to keep particularly closely to the precise figures for windings, size of core, and so on, which are usually given.

Of course, if the core or the windings are *very* deficient in amount it will mean that the transformer will run hot, but this is a matter of degree and, provided the running temperature is not too high, it may not be serious. On the other hand, if you are very generous with the core and the windings you will get a cool-running transformer, capable of carrying considerable overloads for short periods, but the cost will be correspondingly higher, as well, of course, as the bulk and weight.

In passing, I should say that although amateurs often seem to have a predilection for "hedgehog" type transformers, these are not really so easy to make up as they appear, and it is more satisfactory, from the constructional point of view, as well as for other reasons, to use laminations.

A Practical Case

It is impossible to give a sort of rule-of-thumb formula by which the core and windings can readily be calculated for any particular requirements, but I will take a fairly general case and assume that the voltage of the mains is 240 volts (the usual 50-cycle frequency), also that you require a charging rate of, say, 3 amps. for a 6-volt battery.

The actual output low-tension A.C. voltage required will naturally depend upon the resistance of the rectifier which is used. If this is a very low-resistance rectifier, such as the copper-oxide type, the voltage-drop in the rectifier will be very small and a total output voltage of, perhaps, 10 volts for a 6-volt battery will be sufficient.

Output Requirements

A tantalum rectifier will require a somewhat higher voltage (although still not very high), whilst certain other kinds of chemical rectifier may require a considerable excess voltage in order to overcome their internal resistance. Naturally, it is very desirable to use a low-resistance rectifier if you can, as the forcing of the current through the resistance of the rectifier results in the production of heat, which all means so much waste of the power drawn from the mains.

If our transformer is to have a voltage output of, say, 20 volts, this will mean an output capacity in watts of 20 × 3, that is, 60 watts (taking watts as volts × amps.).

The core may consist of strips about 1 in. wide, arranged to form a 6 in. square. The strips should be of stalloy, about 0·02 in. thick. The current in the primary winding arranged on one side of the core, the secondary being on the opposite side, is, theoretically, about 0·25 amp.; but owing to losses in the transformer it is better to assume that the current will be about 50 per cent greater.

The Turns To Use

In fact, if a current of 0·5 amp. in these circumstances is allowed for in the primary winding, this will be on the safe side. You have then to choose a wire of the proper gauge, No. 26 or 28 S.W.G., D.C.C. wire will be suitable for the primary and about 2,000 turns will be ample.

The number of turns in the secondary or low-tension winding can be calculated very roughly by taking it as proportional to the output voltage. As this has to be about 20 volts, the turns will be about $\frac{1}{12}$th of the turns in the primary, or, say, roughly, to be on the safe side, about 200 turns.

The foregoing figures for core and windings are intentionally on the generous side, as one never knows what quality of material amateurs will use.

NEW "STATIC" LOUD SPEAKER

Hans Vogt, the German radio engineer and physicist, with his new capacity-type loud speaker—he calls it the Oscilloplan. It is said to give very promising results

THE FERRANTI SCREENED GRID 4

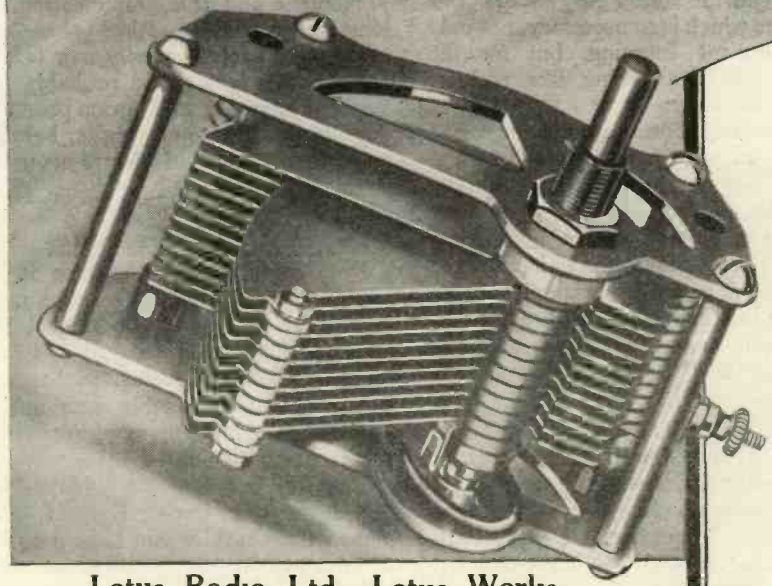
A battery-operated Receiver employing one H.F. and two L.F. stages with push-pull output. Incorporating the finest components throughout and capable of providing as good reproduction as can be obtained at the present day.

Free constructional chart will be sent on request. It would facilitate supply if application could be made on ***postcards only*** *— saving labour and delay.*

FERRANTI

Ask your dealer for a Chart or write to:
FERRANTI LTD., Constructors' Dept., HOLLINWOOD, LANCASHIRE.

LOTUS CONDENSERS



Lotus Radio Ltd., Lotus Works, Mill Lane, Liverpool.

Specially recommended for the "Star Power" Three for D.C. Mains, the Lotus ·0005 Variable Logarithmic Condenser will materially increase the efficiency of your set. Perfectly smooth, firm tuning is assured by its ball-bearing action.

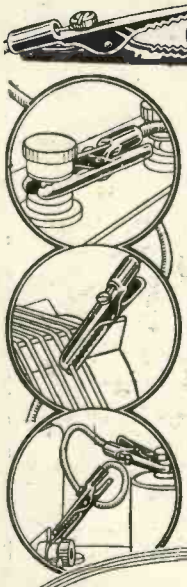
Available in the following capacities:

·0005 ..	5/9	·0003 ..	5/6
·00035 ..	5/7	·00025 ..	5/3
		·00015 ..	5/-

Another Lotus Component of equal merit is the Lotus ·00013 Differential Reaction Condenser, which is specified in the "M.W." Forward Four. Price 5/6

Available in other capacities from 5/3.

All Lotus Condensers are obtainable from any Wireless Dealer.



GRIPS THE ATTENTION

AND now YOU can buy superior quality British Made Crocodile Clips at most competitive prices. They are clean-cut, well-made articles with a special wire-grip feature, indispensable to constructors and short-wave enthusiasts. They make perfect contact, under all conditions.

BRIGHT COPPERED NICKEL PLATED OR LEAD COATED.

PRICE, 1½d. EACH. or 3 in a carton, 4½d.

SEND FOR OUR NEW 60-page CATALOGUE. Enclose 2d. Postage.

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The Choice of Critics

CROCODILE CLIPS

Rgd. Design No. 753747.

A. F. BULGIN & CO., LTD.,

9, 10, 11, CURSITOR STREET, CHANCERY LANE, LONDON, E.C.4.

Telephones: HOLBORN 1072 & 2072.

A Home for your SET! or RADIO-GRAM

The sort that people desire to possess and keep. Sound construction—graceful design—piano finish.

DE-LUXE RADIO FURNITURE.

Famed for its Excellence.

PIANO TONE Baffle and Tone Chamber improves your Speaker—yields an amazing body of tone—without distortion.

Sent ON APPROVAL—direct from the *makers*.

A NEW PORTABLE RADIO-GRAM UNIT. 35/- to £5/5/0.

List and Photographs of Cabinets FREE.

PICKETT'S, RADIO FURNITURE MAKERS,

WORKS "M.W.", BEXLEYHEATH, KENT.

Established at the beginning of Broadcasting.

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DROWNING THE DRUMS

—continued from page 231

identical with every other orchestra. Those differences in the composition of orchestras and bands are not mere haphazard differences; they are deliberately introduced because the "designer of the band," so to speak, requires a certain effect. If the man with the big drum gives it three or four big whacks, all by itself, the other instruments remaining silent, it is neither complimentary to the band or to ourselves if we put up with those whacks sounding like a tennis ball hitting a sheet of cardboard. And yet how often this occurs, or else the big drum and the tympani are drowned by the other instruments in the reproduced version of the band.

Tilting Tone

We find with pick-up work that the danger of losing a low note is even greater than with broadcasting, because the bass instruments are not reproduced on the gramophone record as much as they are broadcast from the transmitter of the average B.B.C. station.

That is why we use such things as "Novotones," "Tiltatones" and the like in order to boost up the bass part. And that is why so many pick-ups have rising characteristics down at the bass end, in order to restore this balance which is so necessary, not only for pleasant listening, but for the obtaining of anything like realistic reproduction.

Obviously it would not be pleasant to get *complete* realism in a drawing-room, any more than it would be feasible to have a full symphony orchestra playing in the house, but we can get a miniature which has the same balance as the original, and, in fact, gives the effect of hearing the orchestra as one would at, say, the back of the Queen's Hall.

Go To It

But if we drown the drums in a welter of middle and upper register frequencies we shall never get a true picture, and reproduction will be hard and unpleasant.

The best way to start a criticism of your own receiver, of course, is to hear the band "in the flesh," and then go home and listen to it when it is broadcast, or listen to it on a gramophone record. Then try and get the reproduction as a true miniature of the original band.

In some cases, when you are listening to chamber music played by a quartette or an octette, you can bring the volume up to pretty well "life size" without it being unpleasantly loud, but as a rule "life size" reproduction is not desirable. It is only by careful comparison that we can hope even to approach perfection, and constant listening first to the real and then to the "canned," or radio, version is the ideal way to gain our goal.

RECORD RADIO RECEIVERS

—continued from page 183

smoothly and without muffling effects.

Further, radio amateurs are discovering that they can get first-class results with anything in the way of a turntable, providing they use a good pick-up and a good set.

Therefore, as we have already said, the Research Department, which has recently been extended in size, decided to detail certain of its members to make an intensive investigation into radio-gram practice and possibilities. Mr. G. P. Kendall, Director of Research, himself actively engaged in the work and had the close co-operation of Mr. K. D. Rogers, who is "M.W.'s" radio-gram expert.

Their main aim has been the improvement and the simplification of existing methods rather than to attempt to evolve entirely new ideas. Indeed, this last would probably be waste of time, for radio-gram practice does not, on the whole, lag far behind any other branch of electro-acoustic engineering.

A Steady Search

But, as is always the case in a young science, this close research into a particular phase of the subject by men fully qualified to pursue it to logical, scientific conclusions has resulted in much valuable data being accumulated and many interesting points being elucidated.

You will find concrete evidence of this in our next issue. Even if you, personally, consider you have a completely satisfactory radio-gram, we are sure you will discover a great deal of fascinating reading in the March MODERN WIRELESS, for development is never at a standstill and the accepted practice of to-day may be an anachronism to-morrow.

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3. Filaments of valves, 4 volts, 3 amp.
4. Filament of output power valve, 4 or 6 volts, 1 amp.

Price 37/6

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The Picture Paper with the MOST News

SUNDAY GRAPHIC

THE "ALL-POWER" UNIT

—continued from page 174

reading is at the maximum required for the screened-grid valve. Probably this will be something from 120 to 150 volts.

Switch off the unit again and place the grid-bias potentiometers in their *maximum* positions. On no account must they be put to minimum. The maximum positions, looking down at the unit, are in the case of the 400-ohm potentiometer a full turn round to the right (this should be varied by means of a screwdriver placed down into the slotted nut on the top of the potentiometer), and in the case of the 1,000-ohm potentiometer the slider should be at the end on the *inside* of the unit; that is, nearest the smoothing choke.

When you know you have got these right adjust the tappings on H.T.+1 and H.T.+2, so that H.T.+1 is in about No. 5 of the potential divider, and H.T.+2 is in Nos. 6, 7 or 8. The other tappings, of course, are not adjustable. Now switch on the set.

You will not get good results straight away probably, but you may find that the voltmeter reading has fallen below its maximum. You can increase the voltage by decreasing the variable resistance till the voltmeter again reads the 120 or 150 volts which is required.

The First Adjustments

We must next adjust the grid bias, and to do this it is best to switch off the unit again and insert, if possible, a milliammeter in the anode circuit of the last valve. We know the voltage applied by means of the voltmeter on the unit, and we can adjust the 1,000-ohm bias resistance (switching off the unit while each adjustment is made) until one gets the right milliammeter reading according to the valve-maker's figures for the plate voltage applied.

The voltage to the intermediate L.F. valve can be checked in the same way, if desired. In the event of a milliammeter not being available, a convenient way is to use an ordinary L.T. voltmeter (borrowing it if necessary) reading to a maximum voltage as much as the maximum bias voltage required on the valve, and to connect it first of all between the slider of the 1,000-ohm potentiometer and H.T.—.

With the set switched on and the mains unit also on, this voltmeter will give you the voltage of bias that you are obtaining on the valve controlled by G.B.—2, and, of course, the slider of the 1,000-ohm potentiometer must be varied until the voltage is correct.

Next connect the voltmeter from the slider of the 400-ohm potentiometer to H.T.—. Vary the 400-ohm potentiometer by means of a screwdriver until you get the G.B. voltage right on the first L.F. valve. This adjustment will have slightly upset the voltage on the last valve, and a slight readjustment here should now be made.

Varying the Volts

The reason for adjusting the voltages by taking the second valve first is that the 400-ohm potentiometer remains at maximum, and no matter how long you are adjusting the grid bias of the last valve no harm can come to the intermediate valve. If the potentiometer were placed at the minimum the first L.F. valve would be getting no bias, and would consequently be subjected to a heavy strain.

The total voltage variation across the 400-ohm potentiometer will be found in most cases to be only about six volts, and so the variation in the bias of the last valve, while the first valve is being altered, will be under six volts.

We mentioned earlier in the article that the 400-ohm potentiometer is being used as a resistance and not as a potentiometer. That is because if this potentiometer were used as such then the 400 ohms would *always* be in series with the 1,000 ohms and H.T.+, and would cause the grid-bias voltage available for the last valve always to be at least 6 volts negative. In certain cases this might not be convenient.

One Volt per Milliamp

The bias obtainable, of course, depends on the current flowing through the whole unit, and the maximum bias on the G.B.—2 tapping will be 1 volt per milliamp. flowing through the unit, including all the anode current of the valves plus the waste current passing through the 15,000-ohm potential divider.

You will see from the foregoing that there is nothing at all difficult in the operation of this unit. In conclusion, however, there are one or two little points we should like to mention regarding the tappings H.T. + 3 and H.T. + 4.

It will depend largely on the circuit employed in your receiver as to

(*Continued on page* 249.)

for every circuit

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THE "ALL-POWER" UNIT

—continued from page 248

whether it is advisable to use H.T.+4 for your last valve and H.T. + 3 for the intermediate L.F. and the screened-grid valve, or whether it would be better to place the two L.F. valves on H.T. + 4 and the screened-grid alone on H.T. + 3. Another alternative is to have H.T.+3 feeding the last valve and the screened-grid valve, and the intermediate L.F. valve going on H.T. + 4.

You can reckon that H.T. + 4 and H.T. + 3 have pretty well the same anode voltage; the drop of voltage through the second smoothing choke, which is in series with H.T. + 3, being very small. This choke does, however, act as a valuable de-coupling choke, and so it is advisable to try the change over of H.T. + 3 and H.T. + 4 as suggested, if you should experience any instability or motor-boating.

The Detector's H.T.

We have said nothing about the variation of H.T. + 1, which is the detector feed. This should be varied up and down the potential divider until best reaction results and best overall running of the set are obtained.

It is easy to calculate roughly the voltage the detector is getting, because the potential divider used is divided into ten equal sections of 1,500 ohms each. So that if placed at tapping No. 5 the H.T. + 1 voltage would be about half that available across the whole of the potentiometer; that is, half that shown by the voltmeter on the unit. Let us end with a warning note to those who are not used to mains working. (1) *Do not touch anything in the mains unit without making sure that the mains switch is off*, and (2) do not switch on your receiving set when first testing the all-power unit unless you have made sure that the grid-bias resistances have their sliders at the maximum bias setting.

A G.B. Warning

If you neglect to do this you will find that you have got your anode voltages on the receiving valves, but that the L.F. valves have no grid bias, a condition of things which is extremely bad for their health. But if you remember the few facts we have brought forward in this article, there is no reason why you should have the slightest trouble.

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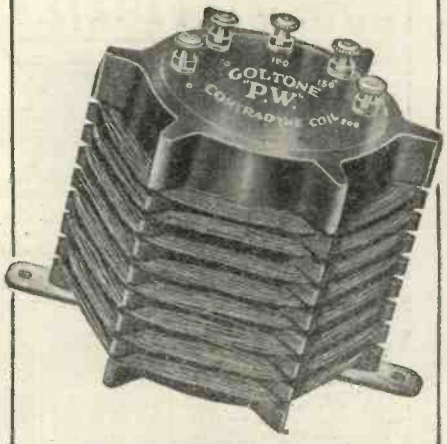

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THE NEW TALKS

—continued from page 124

Gertrude Kingston, and Mme. Karsavina. There will also be gardening talks, and three talks on "The Art of Cookery," by an expert, M. Boulestin, and two amateurs, Mr. Evelyn Wrench and Mr. Wickham Steed. On Mondays Mr. John Sparrow is arranging a selection of readings from English religious poetry, and on Thursdays Mr. Clinton Baddeley will read a representative selection from the English essayists.

Science in the Making

New features will be found in the morning talks at 10.45, which were introduced by Lady Diana Cooper in a preliminary talk on January 2nd. A weekly "Housewives' News" will contain information of the arrival of foodstuffs or of surplus stocks. This feature is designed to help listeners to buy at the most advantageous moments. On Wednesdays the usual talks on "The Week in Westminster" will be given, and on Thursdays Mrs. Barbara Holmes's series on "Germs and How to Avoid Them" will be succeeded by Mrs. H. A. L. Fisher's talks on "Other People's Standpoints." The usual talk in the National programme (1,554·4 metres only) will be given at 8 p.m. on Tuesdays. Philosophy has already reappeared in the shape of a series called "Thinking Ahead," by Professor A. E. Heath, followed by "Science in the Making," which looks like proving an interesting series.

How I Would Spend £1,000,000!

Enough has been written about the new talks season to show that, despite some unattractive titles, there is plenty of varied matter—a good deal of it indicative of interest. But the programme wants lightening a little. A touch of the unconventional would do no harm. Fantasy might be given a place—even to the degree of inviting representative people to give their views on such old topics as "What I would do if I were Dictator," or "How I would spend a million pounds." After all—why not?

Two of the most interesting things in this material world are Power and Money. And I'd like to hear a bank clerk tell us how he would spend a million. Properly handled these two subjects could be made psychologically and humorously interesting.

A VERY HIGH FREQUENCY

—continued from page 230

gramophone recorder and that when you speak the instrument begins to make a record; this record is played back to you the moment you stop speaking. The sounds are passed through the set, the idea being that you can in that way gauge the amplifying properties and tonal qualities of the receiver. But the test is really a very rough one, for the human ear is too crude a measuring instrument, both qualitatively and quantitatively, to enable it to give anything but rough approximations."

"A lot of ingenuity for nothing!" commented Blazer.

A Complete Case

"Quite so," agreed Dare, "and yet it seems to have the elements of a good idea in it, although I admit that they might be hard to find. It only arrived this morning, so I have not had time to give it much attention. But about your dope gang; I'll certainly investigate the possibilities of an illicit radio communication, though it seems a somewhat wild-cat affair to me."

* * *

Some three weeks passed before the inspector and Dare again met, and this time it was Dare who adopted the rôle of visitor. He was shown into the inspector's private office at New Scotland Yard, and he found that policeman busily engaged with a pile of documents.

"Good morning, Inspector," he said, "I think I have a pretty complete case for you."

"Complete case?" echoed the inspector a little vaguely. "Oh, yes, of course." He smiled, throwing down his pen. "Send in your account as soon as you like."

Not Ordinary Radio

"I have had a summary of the facts typed," explained Dare, placing an envelope on the desk, "but I'll run over the main points in case you have any special questions to ask. Shall I carry on?"

"Do," invited the inspector politely.

"Well, after a great deal of preliminary work in the areas you had mapped out I came to the conclusion that if there were any communication between the land and the dope gang's boat it could not be by *ordinary* radio.

(*Continued on page* 251.)

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Obtainable from all the best dealers.

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This famous author is at his best in handling a powerful human theme, which is also a fresh version of the eternal triangle.

STORY-TELLER 1/-

For FEBRUARY. *Now on Sale*

A VERY HIGH FREQUENCY

—continued from page 250

I therefore racked my brains to see if I could think of any *extraordinary* method they might employ. Quite by chance I came across a most significant piece of evidence.

"I saw, in one of the papers, that a man named Winterthrogton had been committed to prison for distributing opium. Now, I happened to know that another man of a similar name regularly broadcasts as a vocalist from the Hull station. I therefore made a point of investigating all the circumstances connected with his performances.

"Just Like Morse"

"I soon found that he had no contact at all with the engineering staff—never spoke to or even went near any of them. But the name was too uncommon to suggest a mere coincidence, so I again gave the matter much consideration, and eventually asked myself whether it were possible that this broadcasting singer was passing messages on during his performance by some sort of code."

He paused, somewhat dramatically.

"Go on, this is most intriguing," encouraged the inspector.

"I very carefully listened to this man singing, and I listened particularly for stressed words, but it all seemed very hopeless until I had another stroke of luck.

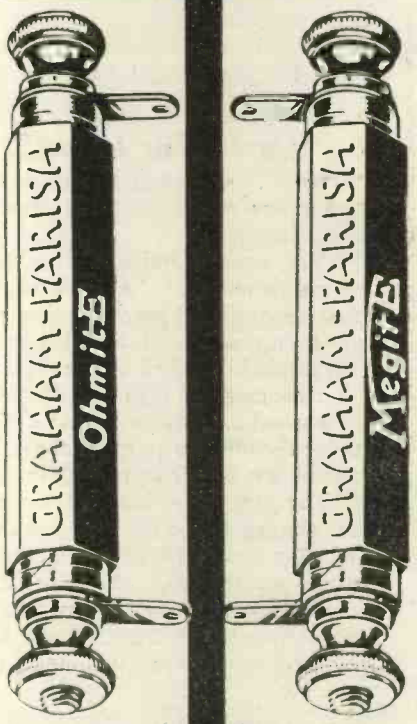
"One evening I was killing two birds with one stone—or with one set, to be more exact. I had a patent filter device under observation, and while listening to our Hull friend I was also switching this thing about. Suddenly the music vanished—and there was nothing to be heard but hissing sounds just like Morse. I had cut out all the musical notes except the very high ones, and what I was hearing was a high, sibilated hissing that the singer made as he drew in his breath.

One of Their Spies

"The cunning hound! He knew that only the very best of sets would reproduce sibilants properly. Doubtless, the gang's motor boat is fitted with a first-class set able to handle those frequencies. As you no doubt know, inspector, one of the first things a radio engineer looks for in a good

(*Continued on page 252.*)

YOU can make this test in your own home



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A VERY HIGH FREQUENCY

—continued from page 251

set is a proper balance of sibilants—S's and Z's—if they don't come out he knows that the set is not up to a possible standard."

"Could you decipher the signals?" queried Blazer, leaning forward in his chair.

"No, that is where I have failed, but it is now up to your code experts. Get them to listen on a first-rate outfit and they'll soon dig it out. Oh! By the way, I can now ask you to collect one of the gang's spies."

"Small Man Inside"

"Spies!" repeated the inspector, with every evidence of the greatest astonishment.

"Yes, again a quite lucky chance led me to unscrew the back of the great set-testing 'parrot' thing you saw in my office. I found a small man inside! He had been supplying the responses through the funnel—the whole thing was a fraud planted on me for the obvious purpose of getting information of our conversation.

"The gang must have known you were coming to see me that morning. And they must have known all about my movements, too. The little fellow actually had the sauce to say he was Lord Arlingthame, the man who was supposed to have invented the machine."

A Shock for Dare

Dare laughed heartily, although, for some reason, the inspector did not share his merriment.

"You have had this—er spy, er—"

"Yes, had him locked up in one of my Queen Street rooms all the time. Fed him well and kept him pretty quiet, although he raved a good deal at first. Thought it best to keep right away from the police until I had my case complete, as that gang is obviously so well organised."

"Were," corrected Inspector Blazer gently, rising to his feet. "Mister Dare, I am afraid you've been just a trifle too scientific. We've had the whole gang—every man-jack of it—under lock and key for over a week. I must apologise for not notifying you, but I've been so mighty busy with the framing up of the case."

He waved a hand over the pile of papers on his desk.

"But the messages—Winterthrogton?" cried Dare.

"I don't know much about those sibilants you mentioned," said Blazer. "I'm no scientist, I'm only a policeman, but I did spot their submarine signalling."

"Submarine signalling?"

"Yes, a simple enough stunt, something like they use on submarines for communicating with each other under the water. But as for Lord Arlingthame, that's going to be a bit difficult for you, Mister Dare—unlawful detention's rather serious, you know."

Dare sank back in his chair and mopped his forehead with his handkerchief.

"You don't mean to say he really is Lord——"

"A Bit Funny"

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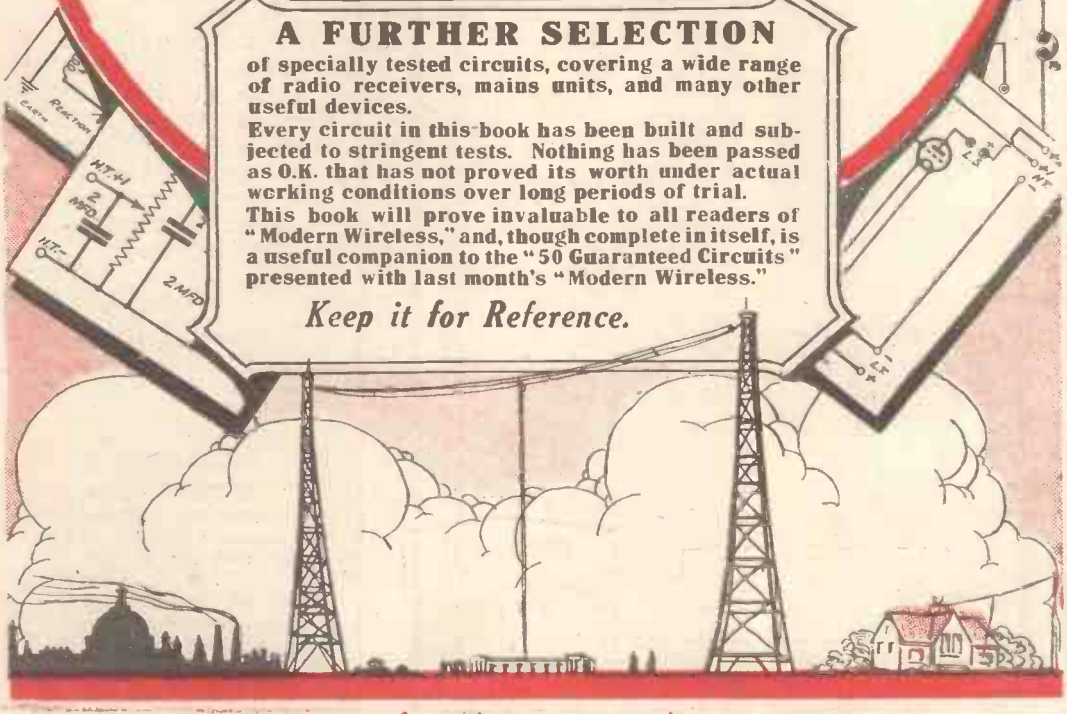

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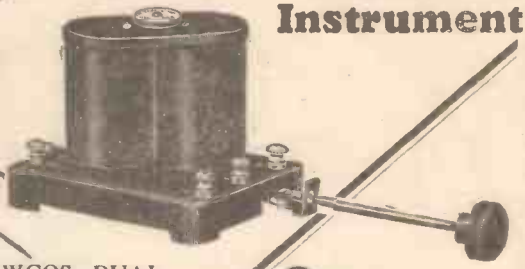

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FIFTY MORE GUARANTEED CIRCUITS

A further specially chosen selection of circuits representing practically every type of modern radio broadcast receiver. No circuit that has not passed exhaustive tests has been included in this book.

CONTENTS

PICKING YOUR CIRCUIT

Every one of the following circuits has been thoroughly tested, so you can set to and choose one of them for your next set with the full assurance that it will give you every satisfaction. Some hints on the building of sets from theoretical circuits are given below.

WE are presenting another fifty guaranteed circuits this month, and as many of our readers will be making up sets from them, perhaps a few remarks about the choice and use of the circuits will be useful.

SATISFYING MODERN CONDITIONS

In the first place, before you pick on any one circuit it is best to have quite definite ideas as to what you want to do with it—what results you are to expect from it.

For instance, if you want quality reception, and are not going to bother about distant stations, you do not need two stages of S.G., even though the set containing them is described as a "powerful circuit."

Such a circuit would be very trying on the local station, and overloading of H.F. and detector valves, to say nothing of the L.F., would be likely to occur. In such circumstances you would do far better with a moderately selective Det. and 2 L.F., or an H.F., Det., and L.F., dependent upon the type of loud speaker and the "loudness" required.

Carefully considered and properly read, the theoretical circuit should give you all the information you require to turn the set it represents into practical form.

A certain amount of selectivity is essential these days, even if you live some distance away from a "local," and so you will find the majority of circuits in this book are well up to standard in this respect; they have been designed with a view to satisfying modern conditions, and that takes a bit of doing.

But the design of a circuit is one thing, and the building of the set is another. So before any circuit can be placed before readers in the manner in which these fifty have, it has to be built and the set thoroughly tested. Every circuit in this book has been tried over long periods in all sorts of conditions, and it is with full confidence that we place the final circuits before you.

CHOOSE COMPONENTS CAREFULLY

In the rebuilding, so to speak, it is, of course, essential that as much care as possible be taken that the layout and the components used be carefully considered. You cannot get the maximum results from any circuit unless the components are suitable and of good manufacture. It would be useless to try and get a four- or five-valver using S.G. valves to give really satisfactory results if the screening were imperfectly carried out, and if the wrong sorts of tuning circuits were used.

As far as possible we give details of such vital things as tuning coils, resistances and [illegible] in the brief descriptions under each circuit, but naturally a certain amount must be left to the commonsense of the reader, and we feel we can trust him not to try out any of these circuits unless he uses good-class parts—the substitute type of component, the "just as good," is not always satisfactory; in fact, it very often is most unsatisfactory.

THE QUESTION OF SCREENING

We mentioned the screening just now because it is still being brought to our notice that numbers of constructors seem to forget how very important screening is. The relative positions of the screens in the circuits are shown as closely as possible by means of dotted lines, and these should be followed when building the circuit into set form.

In some cases it will be seen that the screen is to the right of the S.G. valve, and in others that it goes right through the valve in line with the screening grid. This variation is intentional, and in the first case the position of the screen shows that the H.F. valve is mounted vertically to one side of the partition, and the other denotes that the valve is horizontally placed with the bulb projecting through the screen.

Dotted lines round components, such as the "Star-Turn" Selector Unit, or a wave-change coil, denote that the whole of the parts inside the boundary line can be obtained in one unit form.

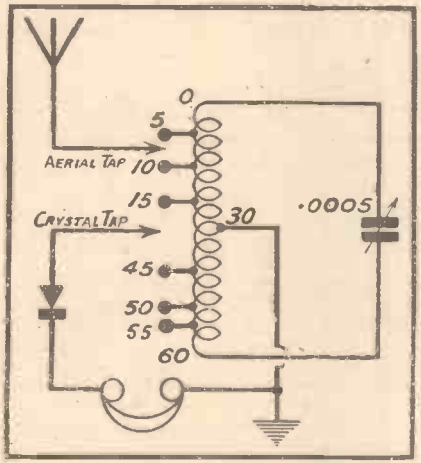
DATA FOR SET-BUILDERS

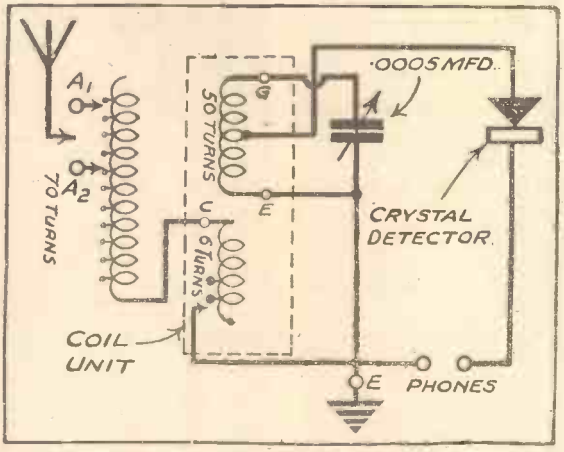
Of course, in cases of tuning coils it is impossible to give the correct relative sizes of the windings in theoretical diagram form, and so if one winding seems to have more turns than another adjacent to it, it must not necessarily be assumed that that coil is really larger than the other. Necessary data as to coil sizes or the makes of commercial coils are given in the text with the circuits.

There is nothing in the way of snags in the circuits shown, Any one can be made up, and success is assured if sufficient care in layout and choice of components is taken. And so we will leave you to contemplation of the various tempting sets represented in the following pages, which illustrate the last word in modern radio receiver design.

Fifty More Guaranteed Circuits

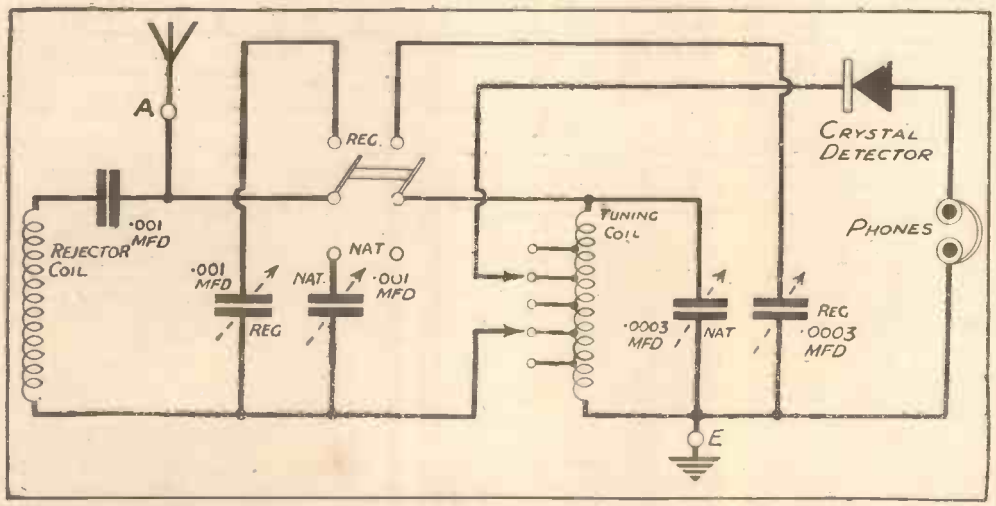
Every One Tried and Tested



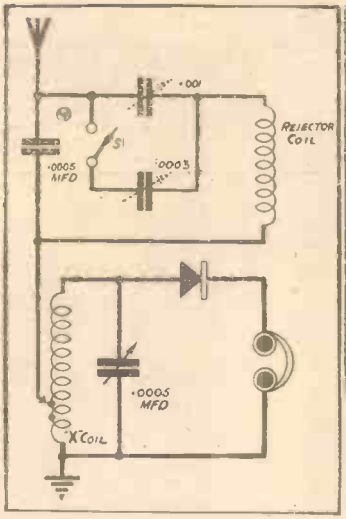


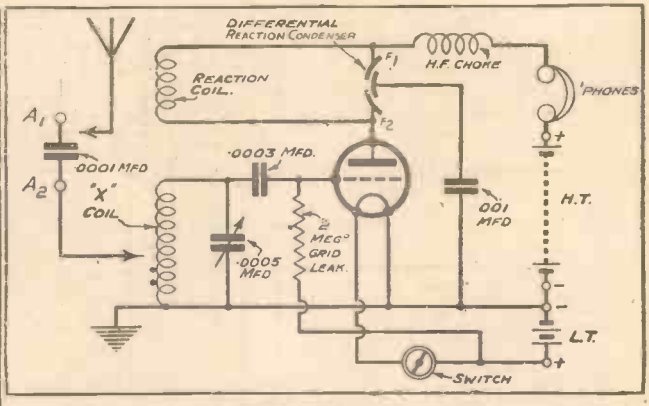
CIRCUIT No. 1 (left) shows a very simple way of getting good selectivity with a crystal receiver. The coil is wound on a 3-in. diameter tube, which will require to be about three inches long, with No. 24 double silk-covered wire. The crystal tap should be tried on points 45, 50 and 55, and the aerial on 15, 10 and 5 in turn to find the best adjustments.

CIRCUIT No. 2, on the right, shows how "Star Turn" aerial tuning may be applied to a crystal circuit to get still higher selectivity. A_1 and A_2 are two sockets into which the aerial lead can be plugged to tune it to either of two stations. Flex leads from these sockets terminate in clips attached to suitable points on the aerial coil, which is tapped at every 3 or 4 turns and wound with No. 24 D.S.C. wire on a 3-in. former. The same size of wire and former is used for the other coil unit.



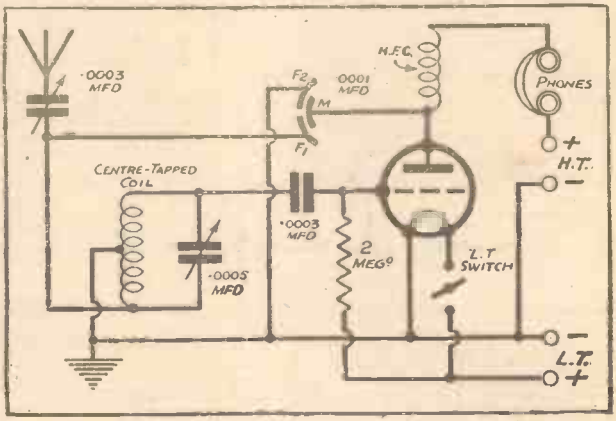
CIRCUIT No. 3, illustrating a very effective way of adapting the "Kendall" Rejector to a crystal receiver with a switching change-over between two stations, e.g. the London "Regional" and "National" transmissions. Compression type adjustable condensers are used, set so that with the double-pole change-over switch in one position the "National" is tuned in on the receiver circuit, the "Regional" being rejected, and vice versa.

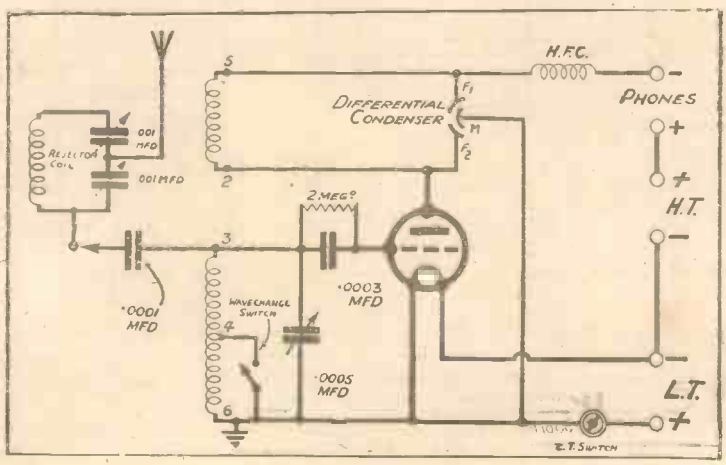




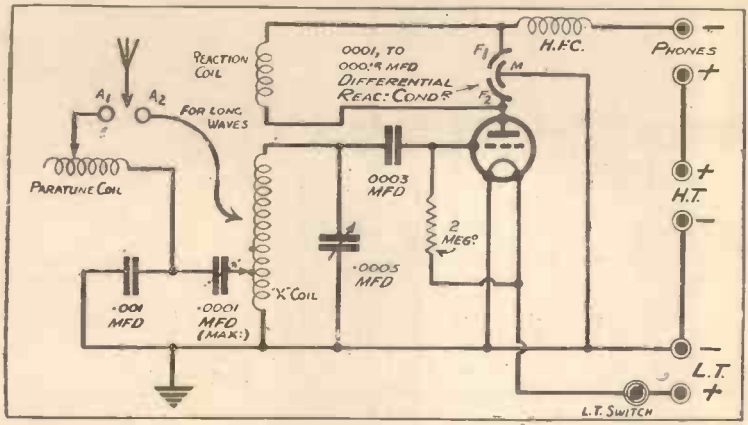
CIRCUIT No. 5. One of the simplest and best ways of arranging a single-valve receiver for plug-in coils. The "X" coil should be of size 60 for medium and 250 for long waves, corresponding reaction sizes being 50 and 100. By connecting the aerial to A_1 instead of A_2 a series condenser is brought into circuit and higher selectivity is obtained.

CIRCUIT No. 4 (above) shows how a rejector can be applied to a very simple type of crystal circuit to enable it to meet the requirements of Regional conditions. The switch S permits the two compression type adjustable condensers to be set so that one or other transmission is rejected according to the position of the switch. **CIRCUIT No. 6** (on the right) is really a modernised version of the famous Hartley circuit. Using only a single (centre-tapped) plug-in coil (60 for medium, 250 for long waves) it is extremely simple to assemble. Selectivity on medium waves is good, but on long waves the local tends to "break through" at short distances. A valuable circuit for the outer areas.

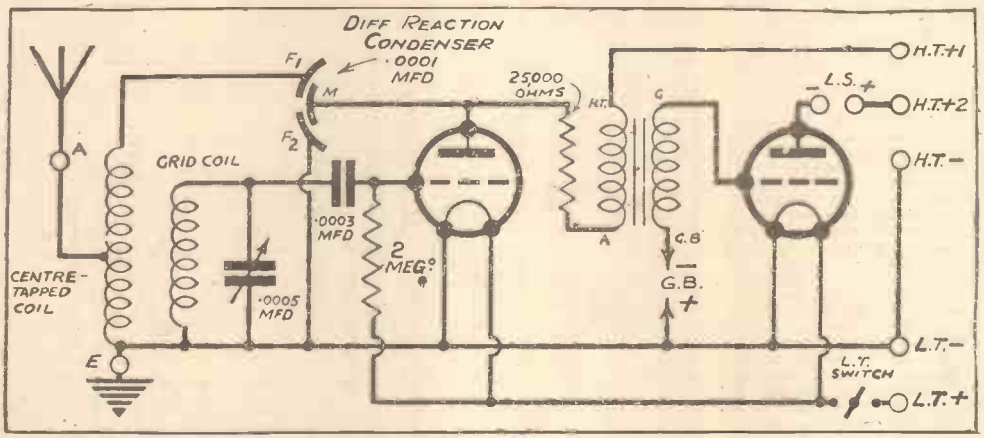




On the left, **CIRCUIT No. 7**, illustrates the application of a simple form of "Kendall" Rejector to a single-valver using a commercial dual-range coil unit. The arrow to the left of the ·0001-mfd. fixed condenser denotes the lead which previously went to the aerial and now goes to the rejector. The two condensers of ·001 mfd. in the rejector circuit should be of the adjustable compression type. The rejector coil sizes should be as follows (plug-in type): For medium waves, No. 50; for long waves (i.e. elimination of Daventry 5 X X), No. 250.

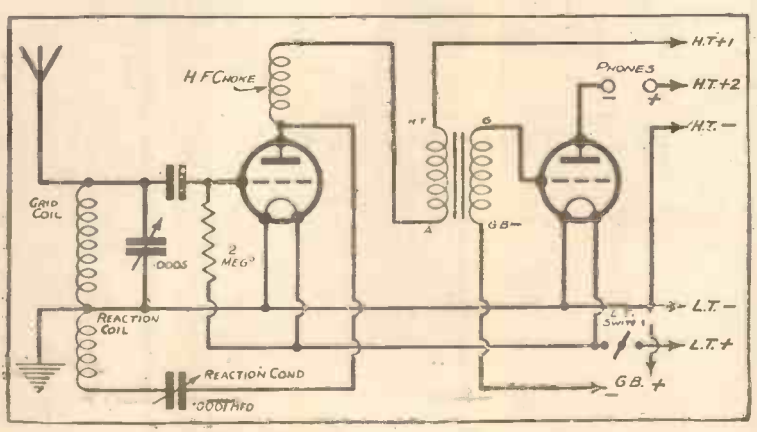


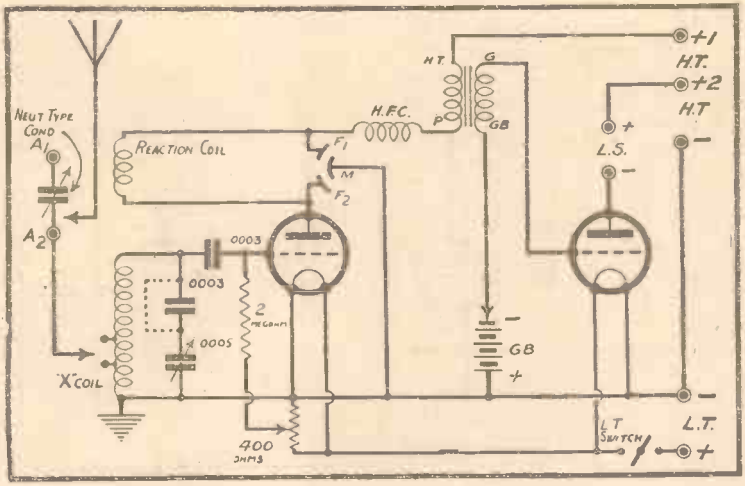
CIRCUIT No. 8. A single-valve receiver of very high selectivity obtained by the use of the "Paratune" system of aerial tuning and coupling (similar in its general functioning to the "M.W." "Star Turn" system). The ·0001-mfd. (max.) compression type condenser controls the coupling of the aerial to the secondary circuit and so provides an adjustment of selectivity. The "X" coil will be of size 60 for medium, and 250 for long waves. Note that the flex from A_1 goes direct to the "X" coil tap on long waves.



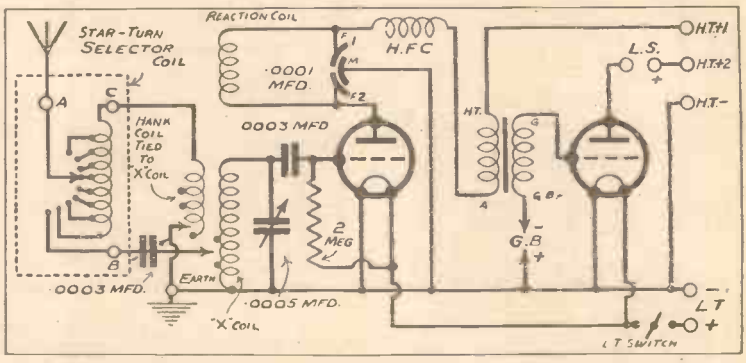
CIRCUIT No. 9, showing an interesting method of using a centre-tapped coil to provide both aerial and reaction coupling. Another feature is the use of a resistance of 25,000 ohms for reaction purposes (instead of an H.F. choke). This can be of the inexpensive "Spaghetti" type. The H.T. voltage applied to the detector should be a little higher than usual, say, 70 or 80, to compensate for the drop in the resistance. Coil sizes should be these: Centre-tapped, 50 or 60 (150 or 200 for long waves); grid coil, 60 (250 for long waves).

To the right is CIRCUIT No. 10, intended for use in a receiver of the compact "attaché case" type. It requires a small aerial, which can be a few yards of rubber-covered wire fixed to any convenient elevated object, and an earth. The latter can be a metal pin driven into the ground, or a few yards of wire to act as a counterpoise. Plug-in coils, No. 35 or 50, for grid (150 or 200 for long waves), and No. 50 (100 for long waves) for reaction.

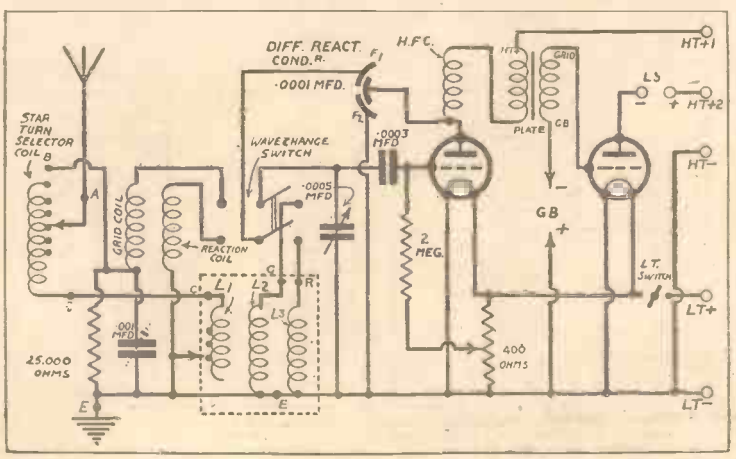




CIRCUIT No. 11. A very simple but efficient type of two-valver for both short-wave and normal reception, using standard plug-in coils. For broadcast reception place the aerial lead on A_2 and use No. 60X coil (250X for long waves) and No. 50 (100 for long waves) for reaction. Short-circuit ·0003-mfd. fixed condenser seen in series with tuning condenser. For short waves "unshort" this, transfer aerial to A_1 and adjust "neut." as required to remove flat spots. Flex lead previously going to "X" coil tap now to engage by means of clip with suitable turn on grid coil (bare wire type plug-in).

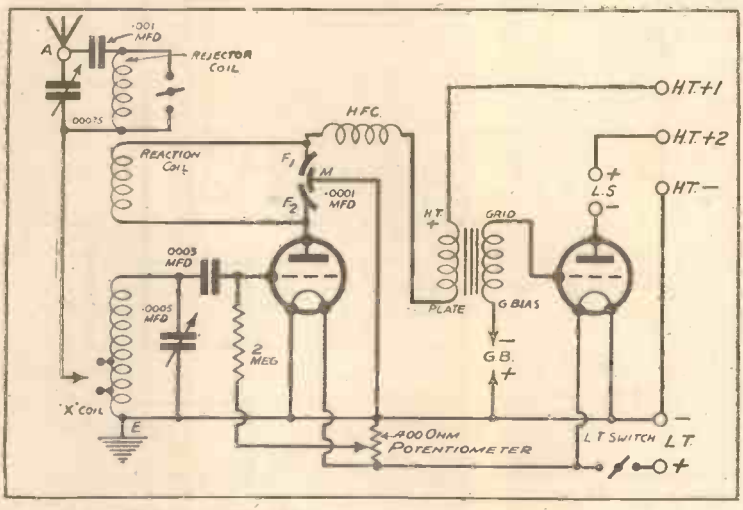


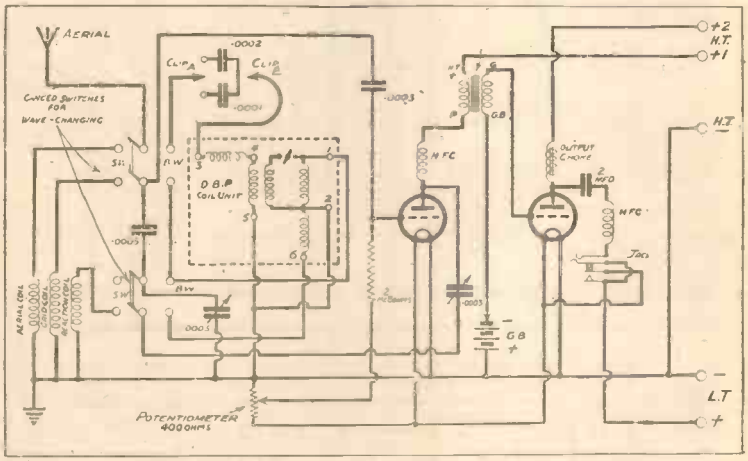
CIRCUIT No. 12 (to the right) illustrates a simple method of adding "Star Turn" aerial tuning to an existing set of the plug-in coil type. The Selector coil is mounted in a vacant space on the panel, well away from the other coils in the set, and a small coupling winding is tied against the side of the existing tuning coil. This consists of a hank coil of about 5 turns of No. 24 D.C.C. wire, tapped at 3 and 4 turns, so that the coupling may be adjusted by means of a clip. The necessary alterations to the wiring are then made in accordance with the diagram. For long-wave work the Selector coil switch knob is turned round to the right-hand limit of its travel, so switching the aerial through to point "B." From there it passes through the customary compression type series condenser to the usual tapping on the long-wave "X" coil. This tapping lead is, of course, left disconnected when working on medium waves.



CIRCUIT No. 13 (left). A two-valve wave-change version of the "Star Turn" circuit arranged with standard components. A pair of plug-in coils (No. 250 grid, 100 reaction) is used for long waves, and the original "Star Turn" grid coil unit for medium waves. This unit is represented in the diagram by the windings L_1, L_2 and L_3, enclosed within a dotted outline. A double-pole change-over switch of the low-capacity type gives the necessary wave-changing action, and a standard form of "Interwave" device serves for aerial coupling on long waves.

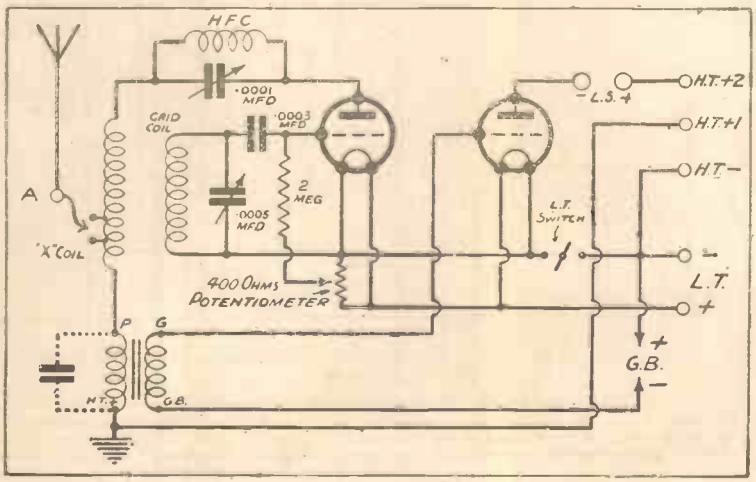
CIRCUIT No. 14 (to the right) shows how a "Kendall" Rejector can be used to enable a very simple type of two-valve circuit to cope with the interference produced by a powerful local station. The coil in the rejector should be a No. 50 plug-in for the elimination of a station of wave-length up to 400 metres, and a No. 60 for one of any wave from about 400 to 550 metres. The ·00075 rejector condenser should be of the inexpensive solid-dielectric type, mounted on the panel of the set (the rejector is built in), and the switch puts the rejector out of action when it is desired to hear the local station. The "X" coil should be a No. 60 for medium waves and No. 250 for long waves. Reaction sizes: No. 50 and 100 or 150.

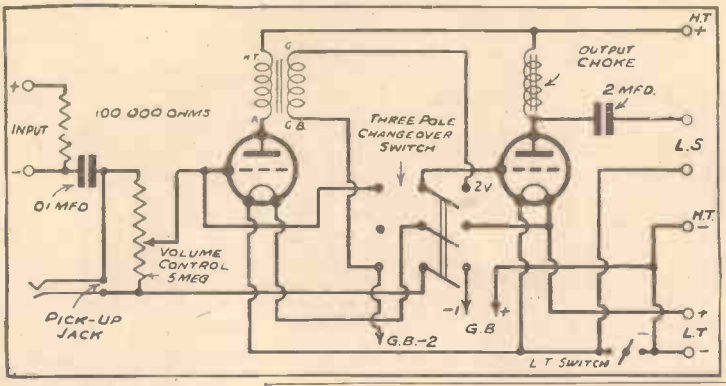




CIRCUIT No. 15 (left). An interesting arrangement in which the convenience of wave-change switching is extended to short waves as well as the usual medium and long ranges. The latter wave-bands are covered by a commercial type of dual-range coil unit (marked D.B.P.), which has its own built-in range switch. A pair of ganged low-capacity type double-pole change-over switches takes the receiver over to short waves when desired, making certain small modifications in the circuit in doing so.

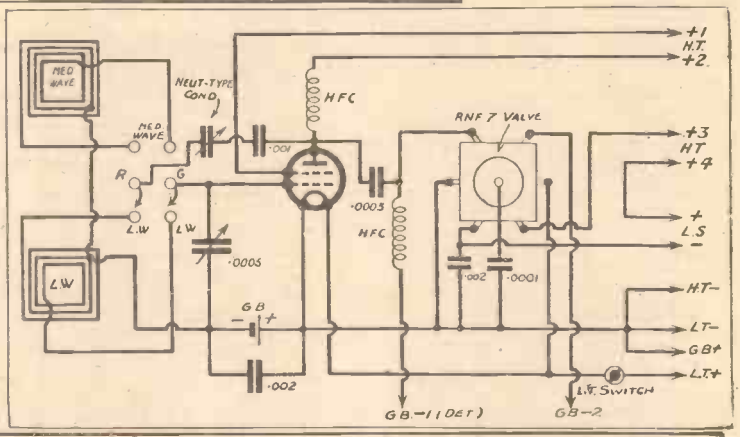
To the right is **CIRCUIT No. 16**, a modernised version of the "anode input" arrangement which will look rather strange to those accustomed to the more conventional circuits of today. It is capable of very good results, and very simple to assemble. The "X" coil should be of size 60 or 75 for medium waves, and is replaced by a centre-tapped 100 or 150 for long waves. The grid coil sizes are No. 60 (medium) and 250 (long). It is to be noted that the low-frequency transformer used in this circuit must be of one of those types which incorporate a fixed condenser in parallel with the primary winding.

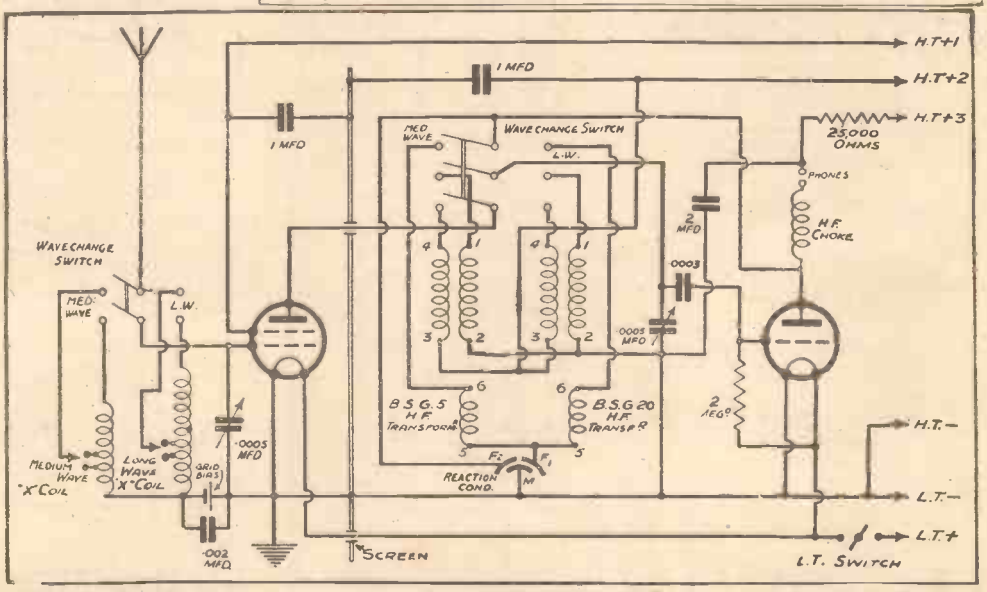




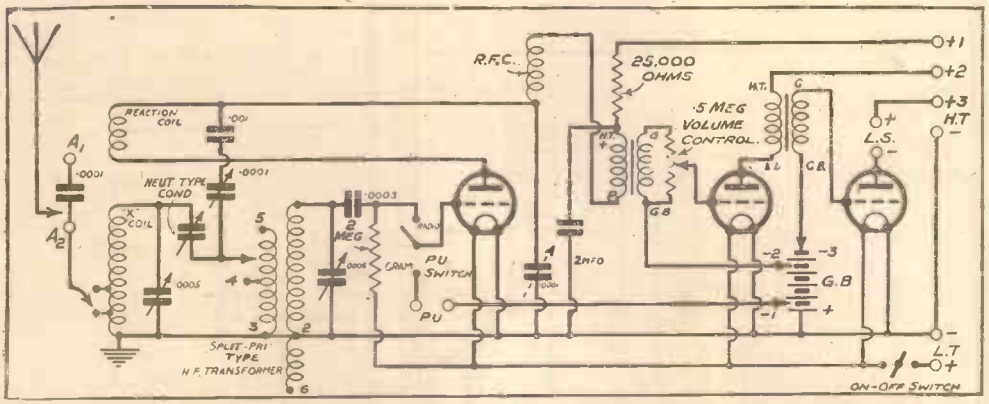
CIRCUIT No. 17 (left) illustrates a simple two-stage low-frequency amplifier for radio and gramophone pick-up work. With good components, suitable valves and adequate H.T., this will give very fine quality. The three-pole change-over switch enables the intermediate L.F. stage to be cut out, leaving the second valve alone at work for reception of the programmes from a local station.

CIRCUIT No. 18 (on the right) is intended to form the basis of a specially compact portable set with built-in frame-aerial windings. Its main features are the use of a screened-grid valve as an aperiodic H.F. amplifier, reaction being taken from the anode of this valve and applied to the frame windings, and a "three-in-one" valve to provide the detector and two low-frequency stages. An interesting feature of this circuit is that it will function successfully with considerably less screening than is usually required in portable receivers.



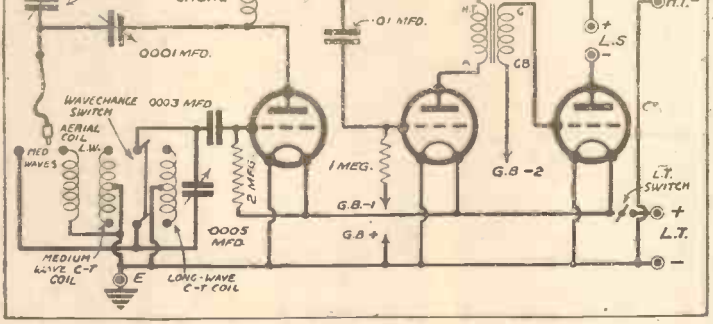


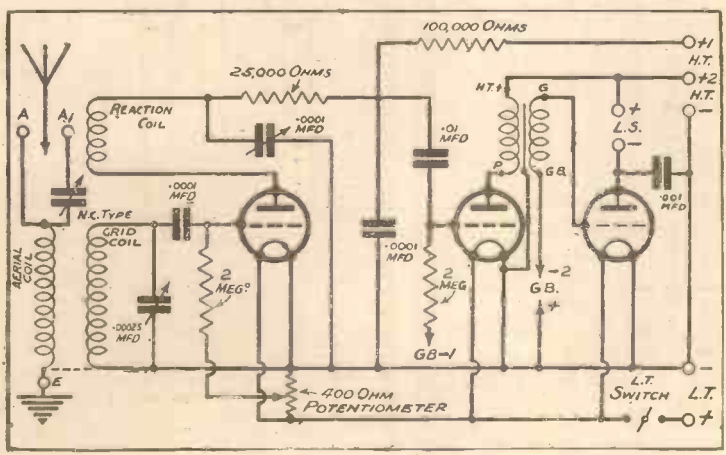
CIRCUIT No. 19. A two-valve receiver of the H.F. and detector type designed to enable the benefits of wave-change switching to be obtained with such coils as many constructors will have available. This is quite a suitable circuit to use in conjunction with No. 17 above, to form a complete four-valve outfit of excellent performance.



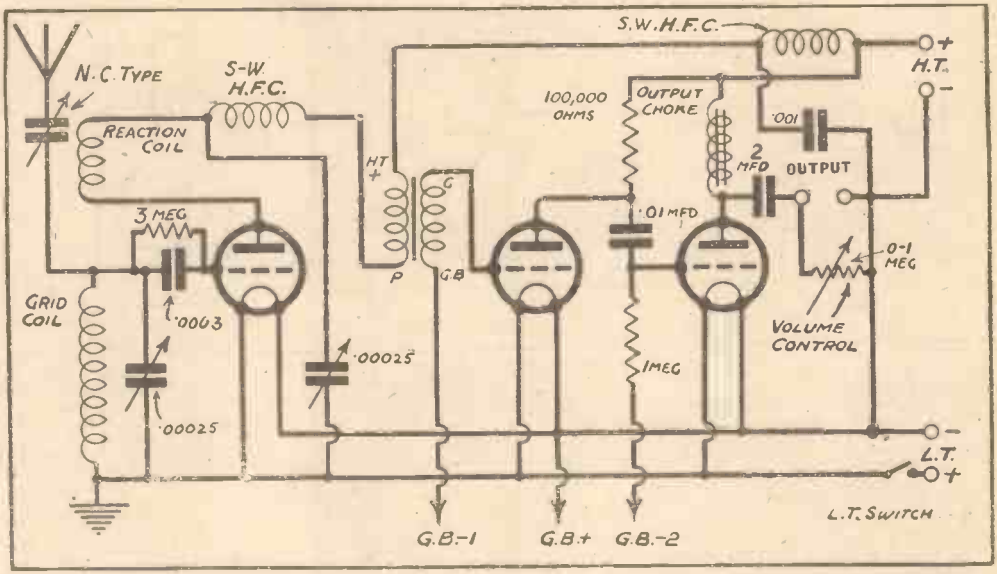
CIRCUIT No. 20, illustrating the use of band-pass filter tuning in a receiver of the detector and 2 L.F. type in such a way as to maintain its sensitivity for long-distance work. Used in this way, band-pass filter tuning yields good selectivity and provides quality of reproduction hard to equal with normal circuits of equal selectivity, with the exception of the "Star Turn" type, of course. In the example shown above, standard types of coils are used in the assembly of the tuning circuits, those marked "X" coil and reaction coil being of the plug-in type (placed side by side as usual). The other windings are provided by a 6-pin coil of a type many constructors possess. An important point in arranging a receiver of this type so that it shall perform well on weak signals concerns the reaction circuit. It is desirable to apply reaction to both the tuned circuits which compose the filter, and it will be seen how this is arranged in the diagram above. Reaction into the first circuit is set to a suitable moderate value by means of a compression condenser inside the receiver, and the actual operating control provides reaction for the second circuit.

CIRCUIT No. 21 (to the right) shows how that old favourite, the Hartley circuit, can be adapted to the requirements of a modern wave-change receiver. A double-pole double-throw switch changes over from the medium-wave centre-tapped coil (No. 60 size) to the long-wave one (No. 250). The aerial lead plug can be kept in the socket marked "med. waves," but if interference from the local is experienced on long waves it should be transferred to the socket at the upper end of the aerial coil (No. 100 or thereabouts).

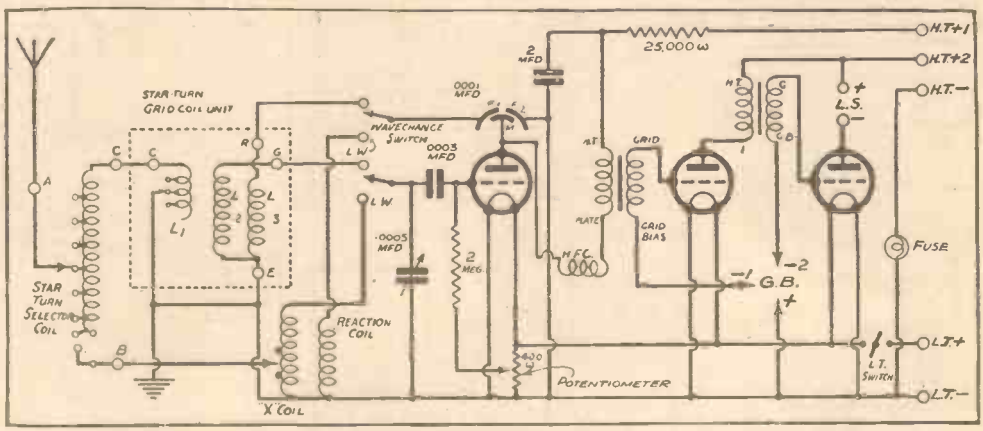




CIRCUIT No. 22 (left) is one of the best and most straightforward three-valve arrangements for short-wave work. Alternative aerial terminals permit the neutralising type series condenser to be brought into play (to remove "dead spots") or cut out when not required. Note the use of a resistance of 25,000 ohms (or any similar value, e.g. 20,000 or 30,000) in place of the usual H.F. choke. It is somewhat easier to ensure the absence of "threshold howl" in this way. Note, too, the bypass condensers of ·0001 and ·001 mfd. at strategic points in the L.F. circuits. These prevent wandering H.F. currents from making themselves a nuisance.

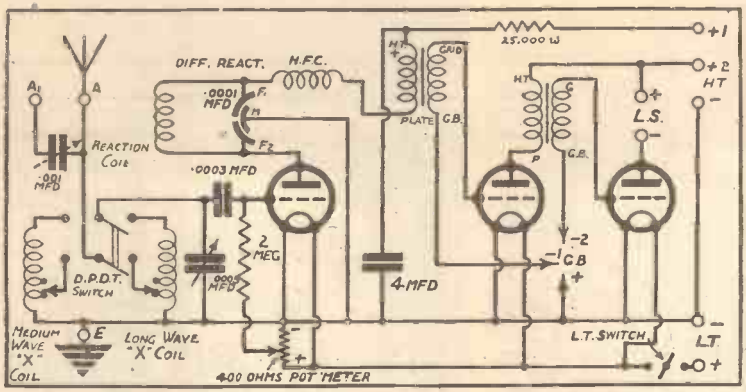


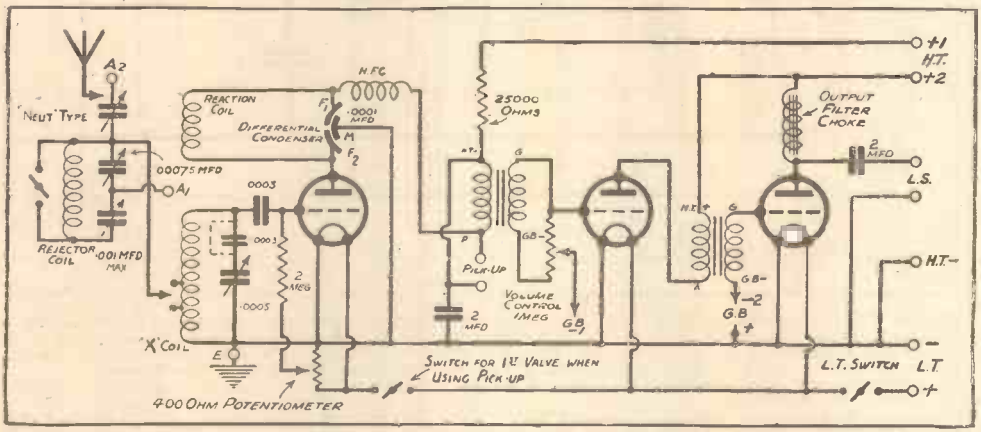
CIRCUIT No. 23 illustrates a method o. rearranging Circuit No. 22 so as to improve its performance on short waves, sacrificing its powers of usefulness for broadcast reception. This is therefore essentially a receiver for short waves alone. The aerial series condenser is kept in circuit permanently, being set to maximum at such times as it is not required to remove "flat spots." The low-frequency side is rearranged to secure slightly better functioning when dealing with very short wave-length signals, but at some sacrifice of quality when handling very powerful signals, such as would be encountered in ordinary broadcast work. A simple form of volume control permits headphones to be used with comfort when searching. Note also the H.F. filter in the H.T. feed lead to the detector.



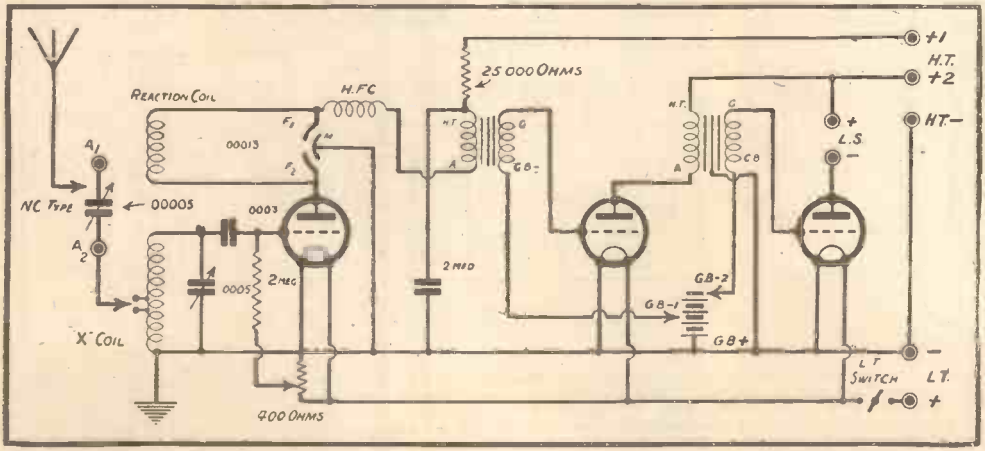
CIRCUIT No. 24. A "Star Turn" type of three-valve receiver in which wave-change switching is provided and plug-in coils are used for the long-wave portion of the circuit. This is a much simplified arrangement, specially devised to permit of the use of existing materials. A standard "Star Turn" Selector coil will be required, and a "Star Turn" Grid Coil unit, but the double-pole change-over switch used for wave-changing and the two plug-in coils for long waves will probably be in the possession of most constructors. The L.F. amplifying circuits are of particularly powerful type, with two stages of transformer coupling. A decoupling filter of the usual type is included in the detector H.T. feed lead to prevent L.F. instability due to coupling effects in the H.T. battery. (If an H.T. mains unit is used an output filter for the loud speaker will also be desirable.)

CIRCUIT No. 25 (to the right) illustrates one of the simplest efficient methods of arranging a wave-change circuit with plug-in coils. The three coils are placed side by side in a group with the reaction coil in the middle, then the medium-wave "X" coil is gradually turned outwards at an angle to the others until satisfactory reaction effects are obtained on the medium-wave band. Coil sizes: 60X and 250X, 100 or 150 for reaction.

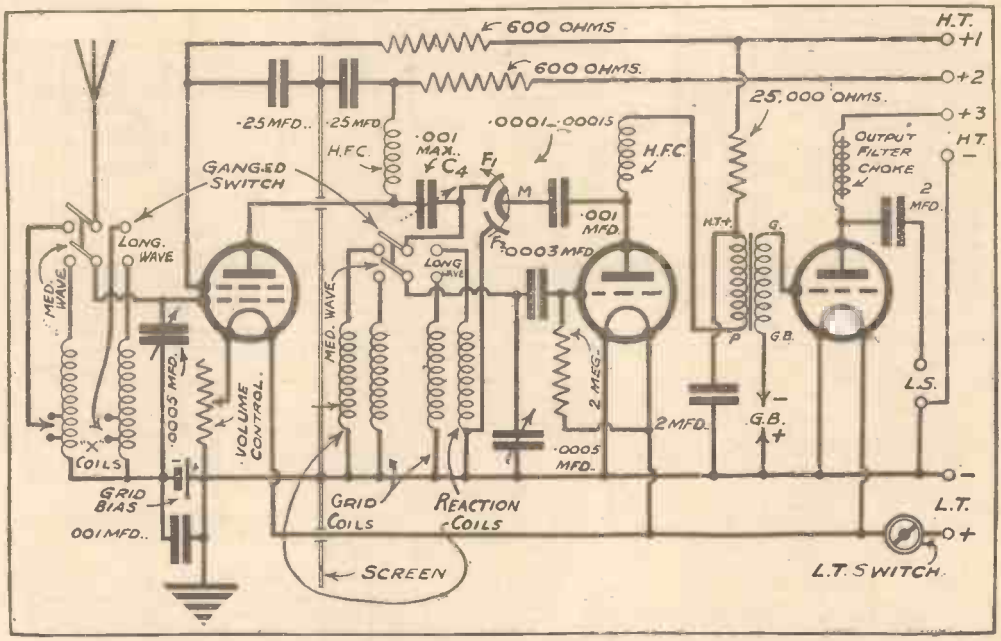




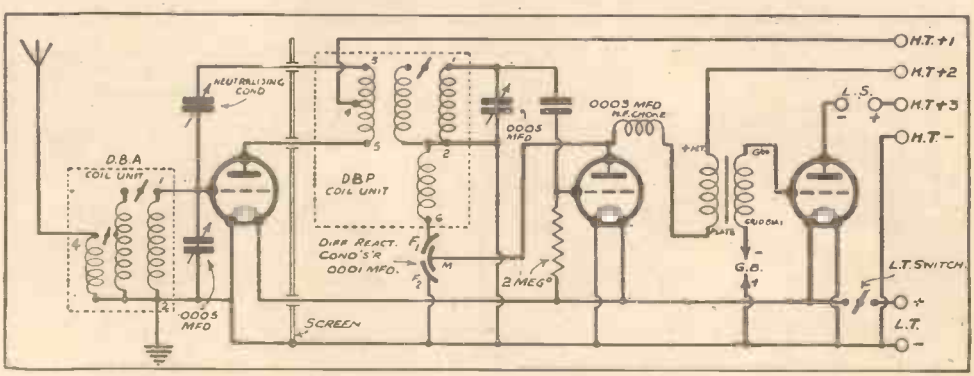
CIRCUIT No. 26 (above) is an essentially simple three-valver with powerful L.F. circuits and the addition of a "Kendall" Rejector to enable it to cope with severe interference from a high-power local station. An alternative aerial terminal (A_3) brings in a series condenser for short-wave work, and there are various refinements which will be recognised.



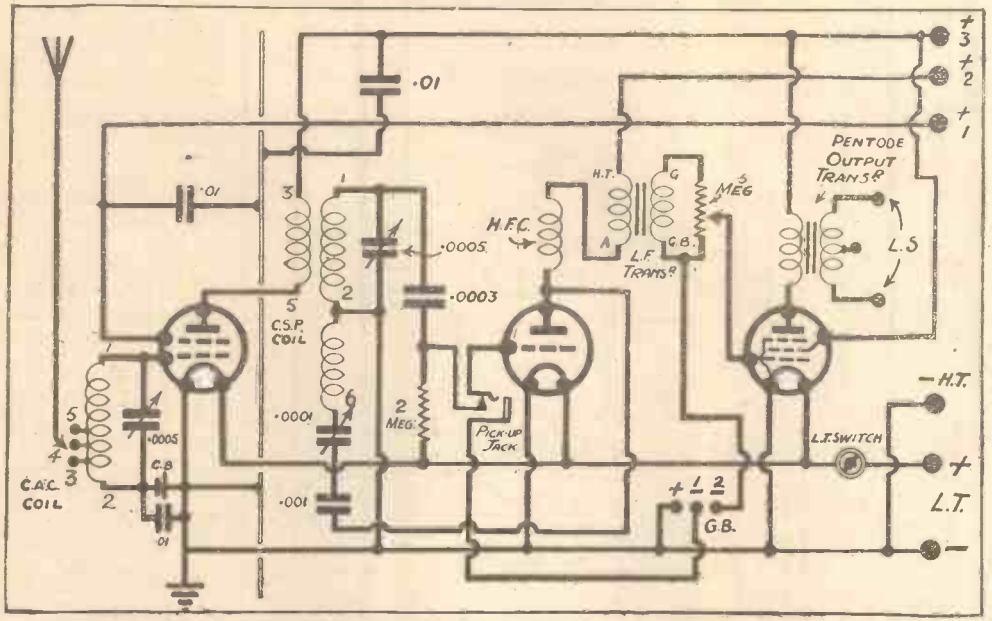
CIRCUIT No. 27 reproduces the basic portion of No. 26, stripped of its refinements and reduced to the severely practical essentials. An excellent combination for use in localities where the problem of interference from the local station is not a serious one, giving excellent sensitivity and range. Selectivity is quite good, but scarcely adequate for the more severe Regional conditions. Coil sizes: No. 60X (250 for long waves), No. 50 or No. 60 (100 or 150) for reaction.



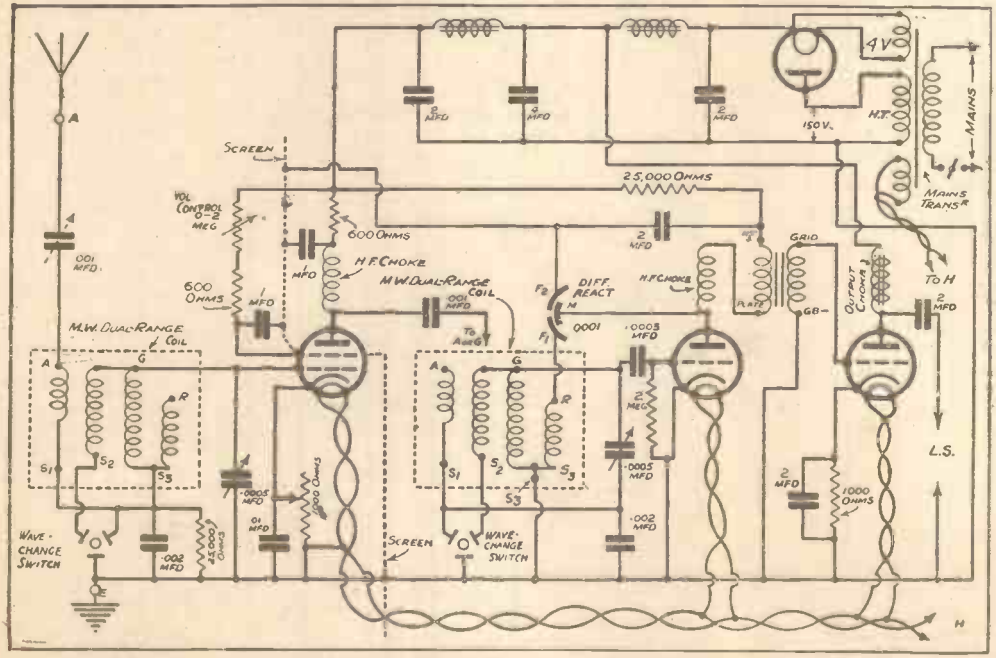
CIRCUIT No. 28. Special features of this three-valve combination are the use of plug-in coils throughout, ganged wave-change switches and very lavish decoupling. By virtue of the latter feature it is particularly suitable for use with mains H.T. units, and can be expected to work satisfactorily and without motor-boating with almost any unit. The wave-change switching is of the efficient "complete change-over" type, but adequate spacing must be provided between the medium and long-wave coils. Note the pre-detector volume control, in the form of a filament rheostat for the screened-grid valve, and the differential reaction circuit which makes the primary coils serve a double function. The "X" coils should be of sizes 60 and 250, likewise the grid coils in the intervalve circuit. The reaction coils should be of sizes 35 or 40, and 150.



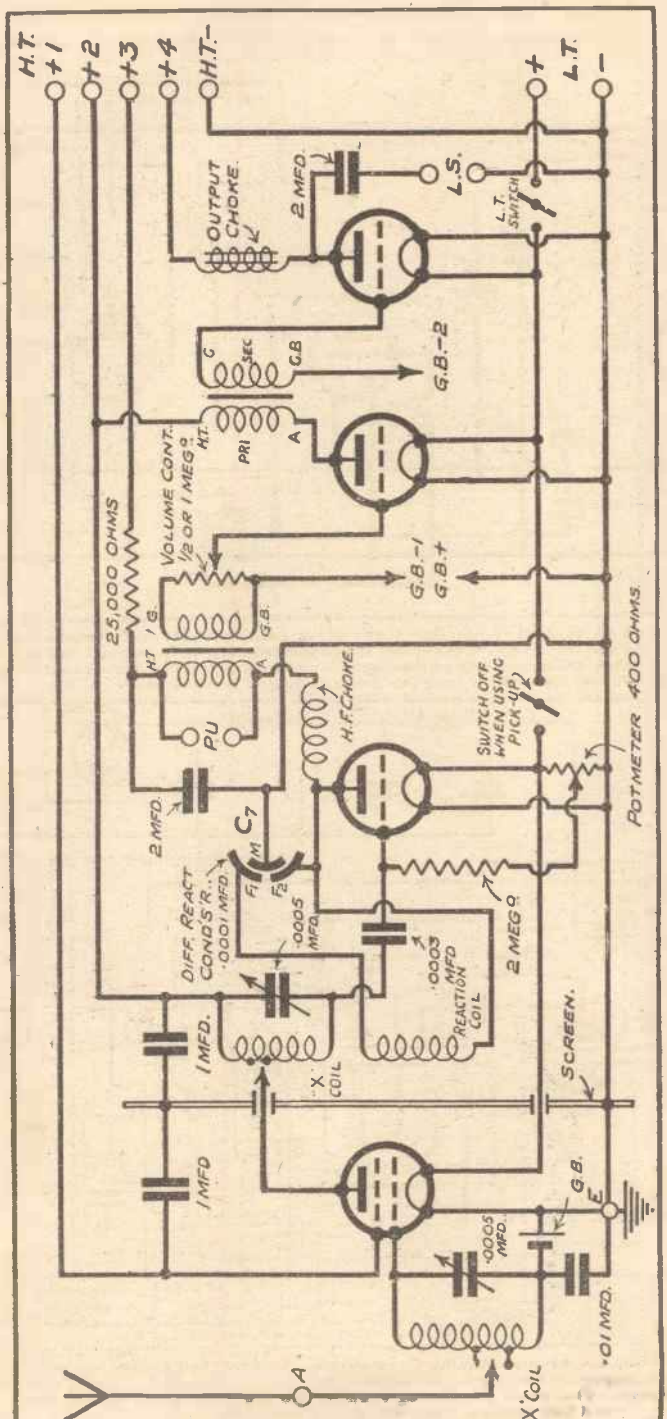
CIRCUIT No. 29. The neutralised three-electrode valve as an H.F. amplifier still has many adherents who value its quiet background, low initial and running costs, and the high selectivity characteristic of the circuits in which it is used. In situations where reception conditions are good and an efficient aerial is available a very satisfactory performance can be obtained from such a circuit as the one illustrated above. It uses commercial dual-range coil units and the split-primary method of neutralising the H.F. valve's inter-electrode capacity to obtain stability of operation. The circuit is shown in severely simplified form, since this type appeals as a rule most strongly to those who value just this quality. Refinements are easily added, e.g. a pick-up jack and a volume control, as in Circuit No. 30.



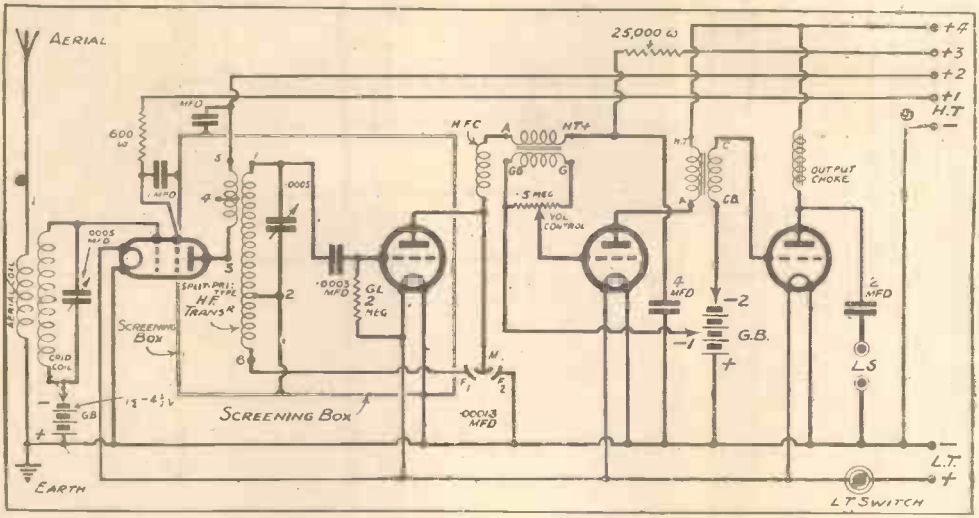
CIRCUIT No. 30, illustrating that very popular three-valve combination, the screened-grid H.F. stage, detector and pentode output valve. The tuning arrangements are very simple, using standard types of 6-pin coils, but there are numerous refinements in the L.F. circuits. Note the pick-up jack, the L.F. volume control, and the pentode output transformer.



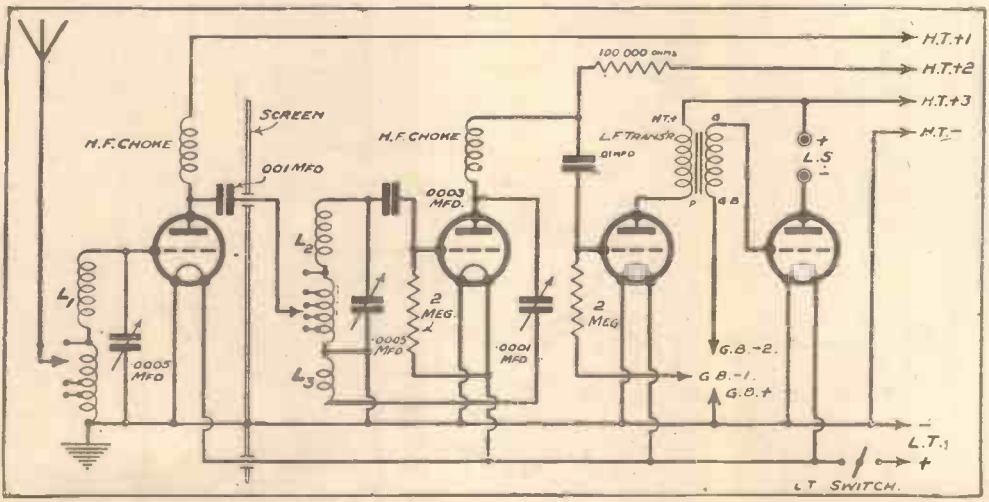
CIRCUIT No. 31. A simple but highly efficient three-valve all-mains receiver for use on alternating current. Employing indirectly heated valves and an up-to-date circuit incorporating the "M.W." dual-range coil, it gives a performance of an extremely high standard. Half-wave rectification is used in the power circuit and very simple but efficient smoothing and decoupling arrangements. Note the "automatic" grid-bias devices and the use of twisted flex for the wiring of the valve heater circuits. The ·001-mfd. compression condenser in series in the aerial lead provides the usual control of selectivity.



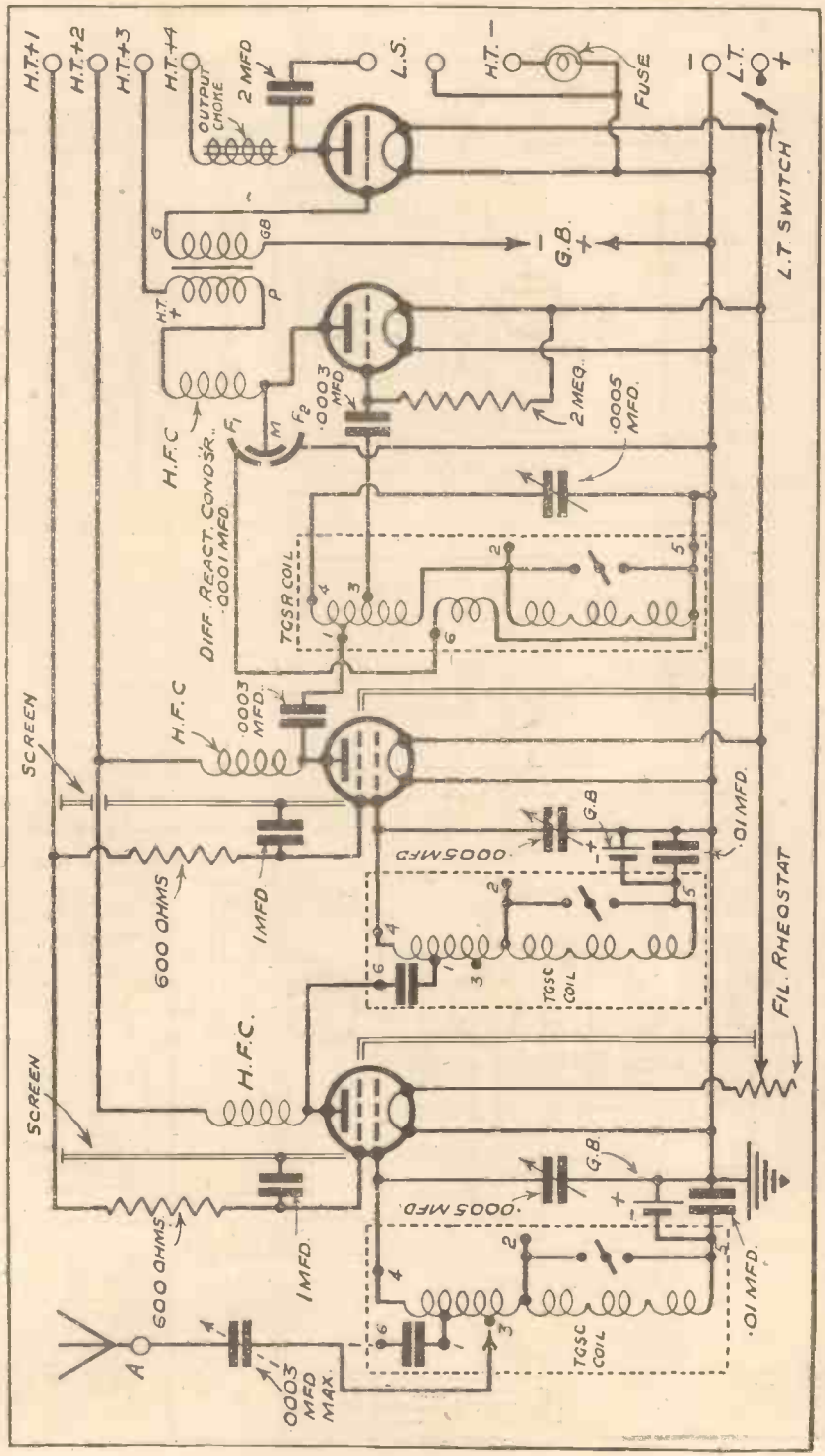
CIRCUIT No. 32. A powerful and selective four-valve circuit for plug-in coils, without wave-change switching. Coils of the "X" type are used for the grid circuit of the S.G. valve, and for the intervalve coupling circuit. The latter is of the tapped tuned-anode type, which gives an excellent balance between selectivity and amplification. Differential reaction of the improved modern type is provided, and following the detector is a powerful L.F. amplifying circuit with two transformer-coupled stages. Full precautions are included for the prevention of motor-boating and other H.T. coupling troubles, and provision is made for the use of a gramophone pick-up. This is plugged into the two sockets marked "P.U.," and the S.G. and detector valves are then turned off, the necessary amplification being performed by the two L.F. valves. The two "X" coils should be of size 60 for medium and 250 for long waves. Corresponding reaction sizes are 50 and 100.



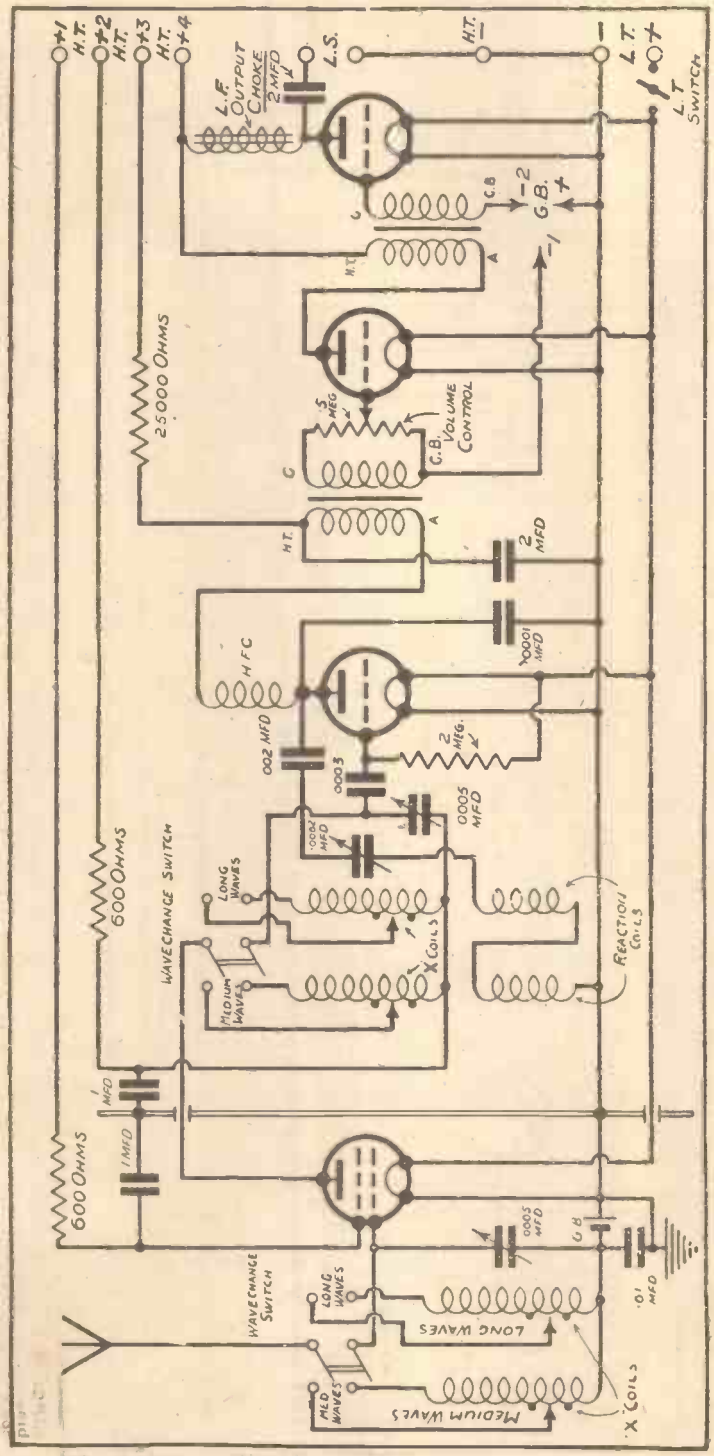
CIRCUIT No. 33 illustrates the use of certain standard types of coils to form an efficient system of tuning and intervalve coupling for a screened-grid H.F. stage. The aerial and grid circuits of the S.G. valve are made up with two plug-in coils, giving a primary and secondary arrangement, the sizes being 25 or 35 (aerial primary), and 60 (grid), and 75 and 250 on long waves. The H.F. intervalve coupling is arranged with a 6-pin coil of a type which is usually found in neutralised circuits. By placing both neutralising and primary windings in series in the anode circuit of the S.G. valve a sufficient degree of coupling is obtained to utilise a good measure of the possible amplification of the valve. The low-frequency circuits are of a straightforward type, transformer coupled, with well-provided anti-battery-coupling arrangements.



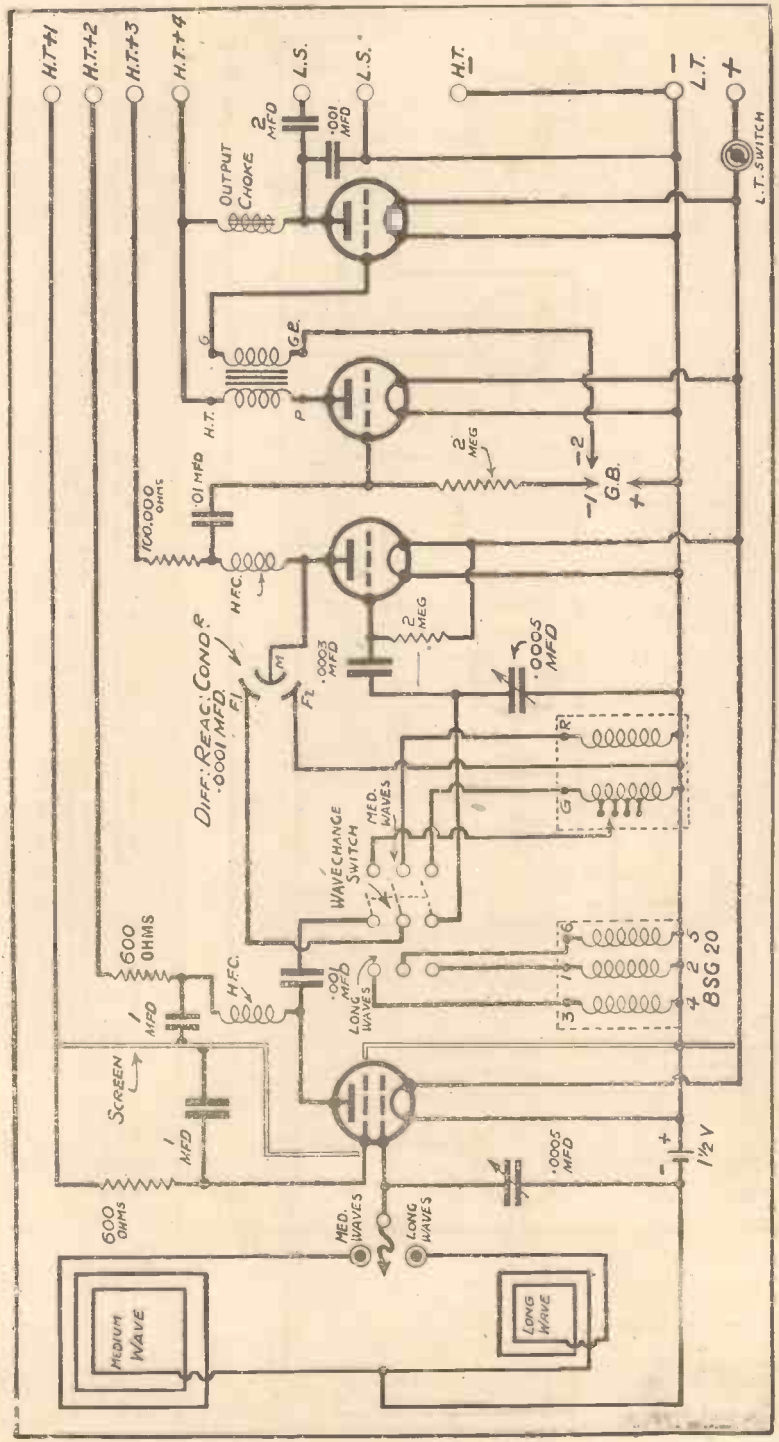
CIRCUIT No. 34, designed to appeal to those who are interested in coil winding. Astatic home-wound coils are used, and thus only a modest amount of screening is required. The coils are wound on 3-in. diameter tubes, each main winding (L_1 and L_2) being in two sections in opposite directions. The first one has 40 turns of No. 24 D.C.C. in each section, and the aerial taps are at 20 and 30 turns (from outer end) and at the junction point (i.e. centre). For long waves this unit has 150 turns of No. 34 enamelled in each section, tapped at 50 and 100 turns. The H.F. unit main winding is exactly the same except that it is tapped at 10, 20, 30 and 35 turns (medium waves), and 30, 50, 70, 90, 110, and 130 turns (long waves). The reaction winding (L_3) is of 25 turns of No. 30 D.C.C. (med. waves) and 100 turns of No. 34 enamelled (long).



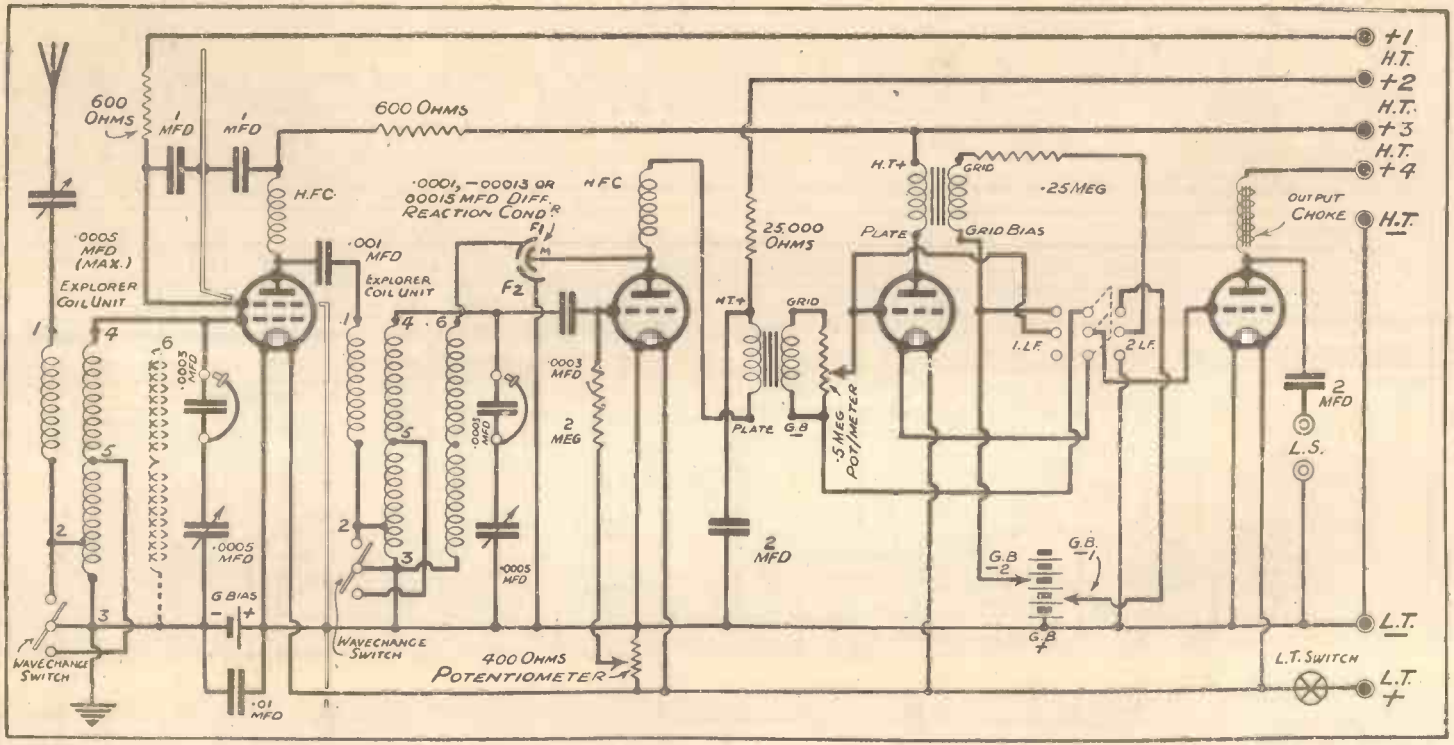
CIRCUIT No. 35. A powerful and selective four-valve circuit with two screened-grid H.F. stages, detector, and one L.F. valve. A very good combination for general long-distance work. A standard commercial make of dual-range coils is used in which built-in wave-change switches are provided, controlled by extension rods passing through the panel. A considerable amount of screening is necessary with a circuit of this type, and a sheet of copper foil covering the upper surface of the baseboard is advised in addition to the usual vertical partition screens through holes in which the S.G. valves are fitted. A selectivity control is provided in the form of a .0003-mfd. compression condenser in the aerial lead. This can be employed advantageously as a supplementary volume control on the local station to back up the main volume control, which is a filament rheostat operating on the first screened-grid valve.



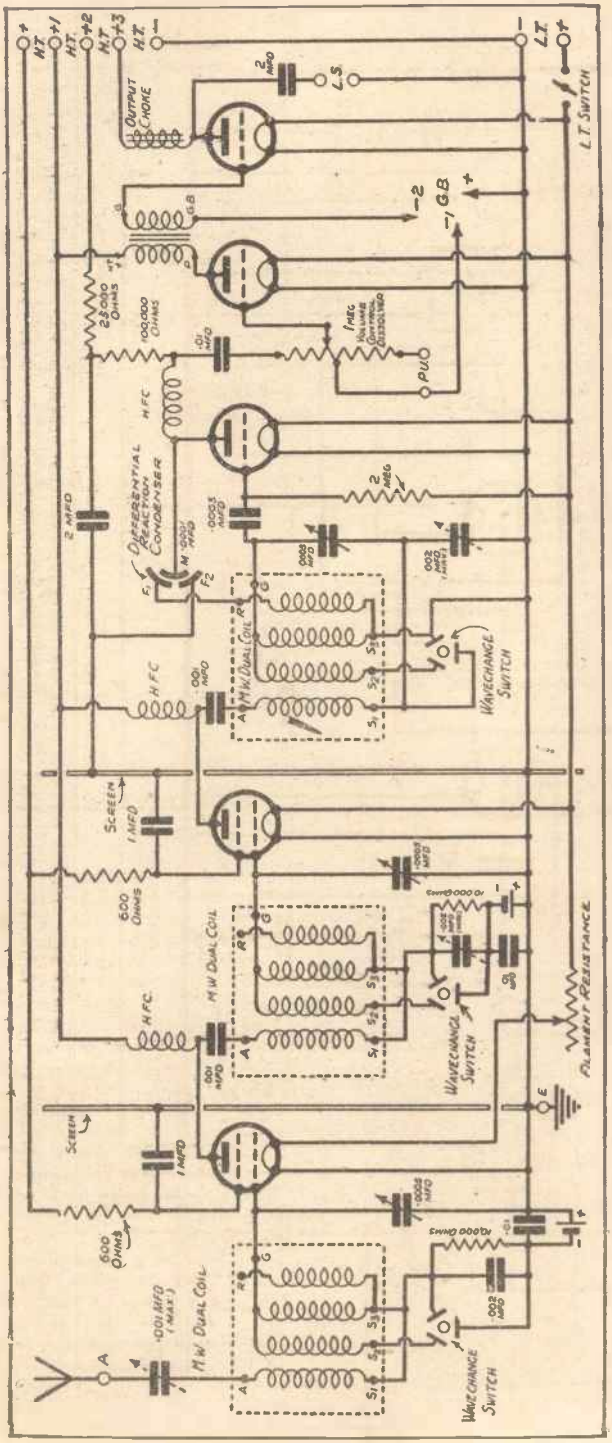
CIRCUIT No. 36. A high selectivity circuit which can be easily assembled with plug-in coils for the tuned circuits. Wave-change switching of the "complete change-over" type is used calling for two double-pole double-throw switches of the low capacity type. By suitable mechanical design these can be ganged for operation by a single knob or lever. An interesting feature is the reaction circuit, with the medium- and long-wave windings permanently in series. These are "hank" coils tied against the corresponding "X" coils, of diameter about 2½ inches. The medium-wave one has 20 turns of No. 26 D.S.C. wire, and the long-wave winding contains 50 turns of No. 32 D.S.C. The direction of winding is immaterial, since correct reaction effects can be obtained by reversing the connections to each hank if necessary. The "X" coils which form the tuned circuits should be of size 60 for medium waves and 250 for long.



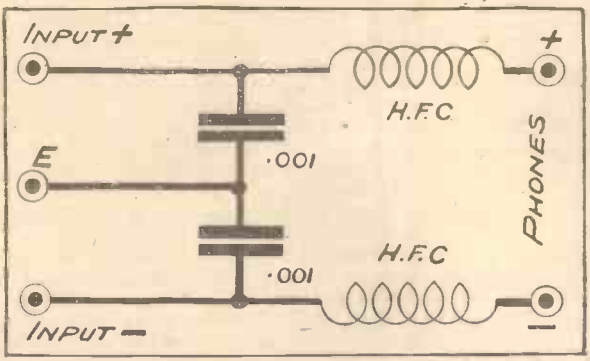
CIRCUIT No. 37. The basis of a sensitive long-range portable receiver. A simple plug and socket gives the necessary wave-change switching for the two frame-aerial windings and a double-pole double-throw switch performs a like function in the H.F. intervalve circuit. Contrary to the usual "portable" practice the intervalve circuit is tuned, and so a very high degree of selectivity and sensitivity is obtained. Very thorough screening and careful layout here are called for in order to maintain stability. The physical arrangement of the parts of a receiver of this type is of extreme importance, and particular care must be taken to prevent interaction between the frame windings and the set itself, or the loud speaker which will presumably be built in. At the same time a sparing use of actual metal screening is advisable to limit loss effects in the frame windings.



CIRCUIT No. 38. A powerful and sensitive long-distance receiver of the four-valve type, with one screened-grid valve employed for H.F. amplification. Very simple wave-change switching is obtained by the use of the "Explorer" dual-range coil unit, the actual type of switch required being the "three-point on-off" variety. Provision is made for short-wave reception, for which purpose the dual-range coil units are removed from their 6-pin sockets and equivalent short-wave types are put in their places. To ensure easy tuning on short waves fixed condensers of ·0003 mfd. are connected in series with the tuning condensers. These are short-circuited for medium and long waves. A three-pole change-over switch in the L.F. circuits gives the choice of one or two low-frequency amplifying stages, according to the strength of the signals desired. Other refinements to be noted are the volume control and the potentiometer for the detector valve.

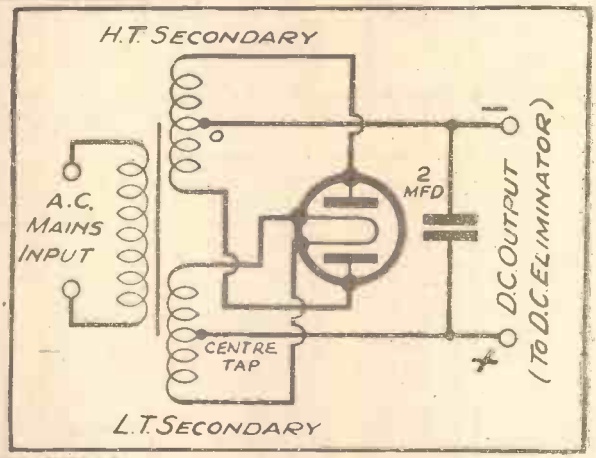


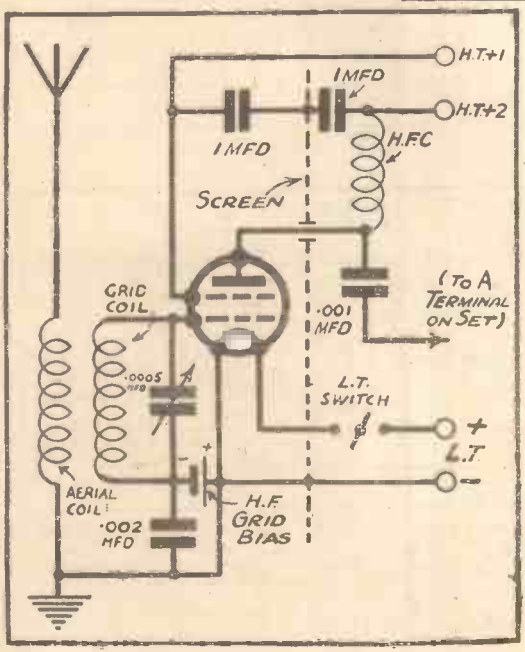
CIRCUIT No. 39. A high-power five-valve combination capable of very fine results even under adverse conditions. It employs two screened-grid H.F. stages with the "M.W." high-efficiency dual-range coil unit, and so provides very high sensitivity and selectivity. The latter quality can be enhanced still further by a suitable adjustment of the .001-mfd. compression-type series aerial condenser. When this is set to a fairly small value selectivity becomes fully adequate to even the severe "Regional" conditions. A considerable amount of screening is required for the best results, and the baseboard should be covered with copper foil, in addition to the partition screens indicated on the diagram. The coil units should then be mounted up about ½ in. above the copper on blocks of wood. Note the "fader" type volume control in the first L.F. stage, which gives a change-over action to a gramophone pick-up connected to the "P U" terminals. Considerable de-couplings provided, and should not be omitted, since the over-all amplification is very high. Note, also, the supplementary volume control acting on the first H.F. stage.



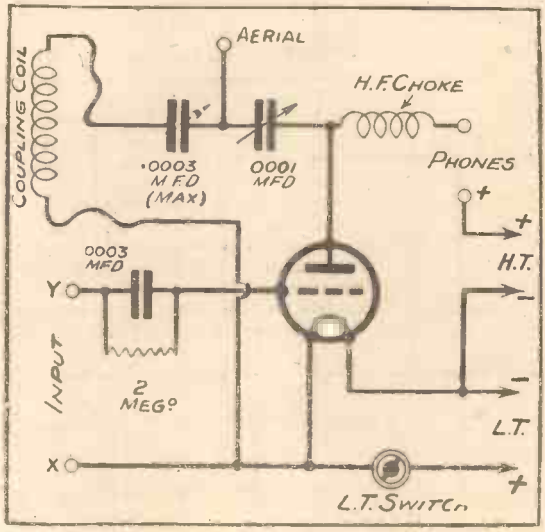
CIRCUIT No. 40 (on the left). An interesting little device for use with short-wave receivers in which body-capacity effects are troublesome. When interposed between headphones and set it prevents H.F. currents from getting into the 'phone cords, and so removes one of the main causes of such effects. Use short-wave H.F. chokes and wire "input" terminals to "'phone" terminals on the set. Other connections are obvious from the marking of the terminals.

CIRCUIT No. 41 (to the right). A converter unit for use where a D.C. mains unit has been put out of service by the changing of the mains to A.C. It then serves to rectify the A.C. and deliver it to the old "mains" terminals of the D.C. unit for smoothing, as usual. A full-wave rectifier is indicated, and the H.T. winding on the transformer should give about 180-0-180 or 200-0-200 volts. The primary winding on this transformer must be of the correct rating for the voltage of the A.C. supply. Note particularly the polarity of the output terminals. Check this up when connecting across to the D.C. unit. The A.C. mains input terminals naturally have no polarity and can be joined up either way round.



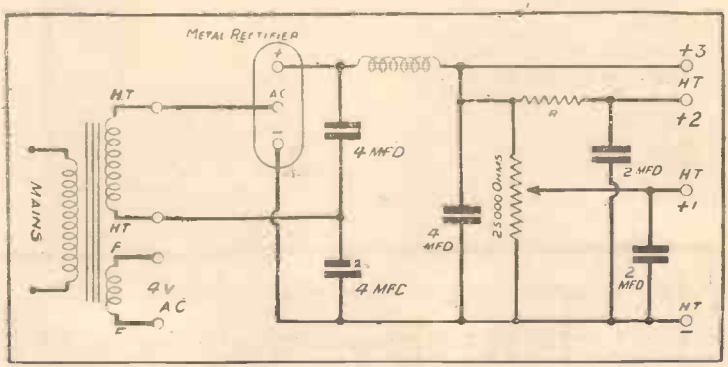


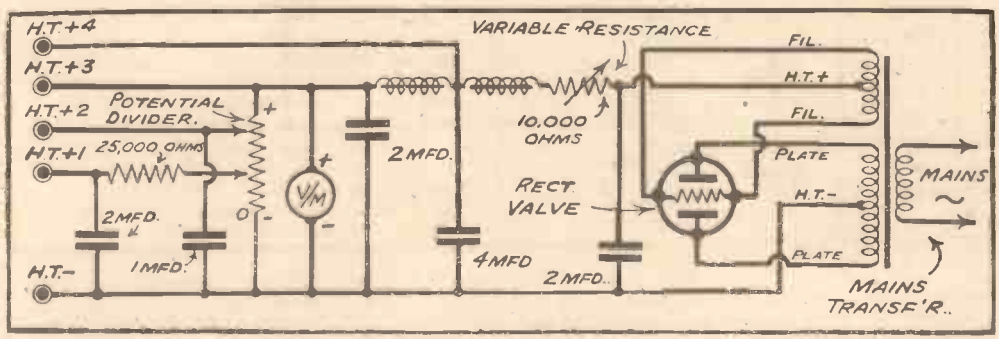
CIRCUIT No. 42 (left). A very simple but quite efficient little H.F. unit. An inexpensive way of increasing the range and selectivity of a receiver of the "detector and low-frequency" type by adding a stage of screened-grid H.F. amplification without alteration to the receiver itself. Not to be advised where the set already contains a stage of H.F. Uses plug-in coils and a very simple type of circuit, and requires to be run from same batteries as those which supply the receiver. Coil sizes: aerial, Nos. 25 or 35 (75 or 100 for long waves); grid, 60 (250 for long waves). A few simple precautions mus be taken to ensure the best results. For example, the lead marked "to A terminal on set" should be kept very short and dirsct and well away from all other leads. If the receiver has a choice of aerial couplings, the one now to be used should be that normally giving the greatest volume and least selectivity.



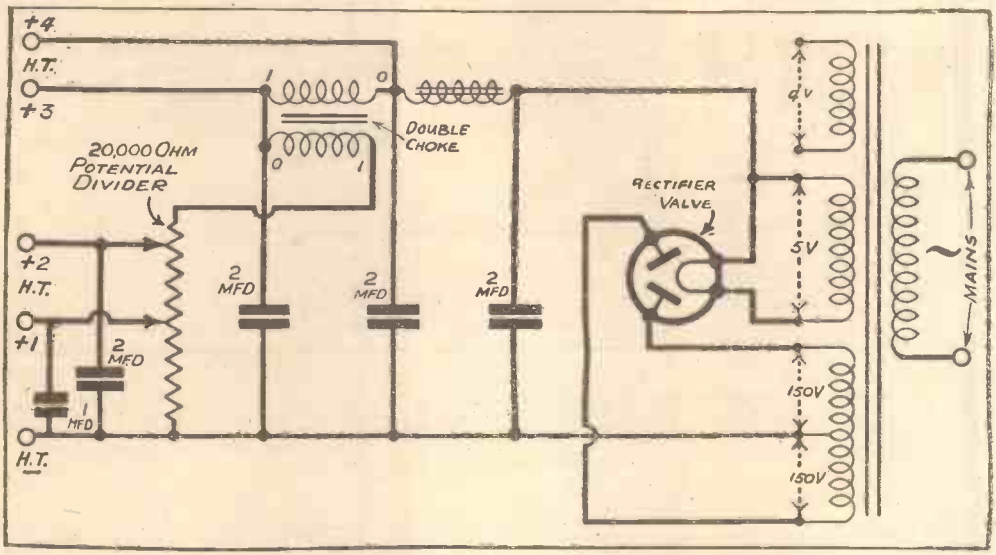
CIRCUIT No. 43 (left). An interesting unit for the conversion of a crystal receiver into a single-valve set of greatly increased selectivity to meet the needs of the Regional conditions. Connect X and Y to 'phone terminals on crystal set and short-circuit crystal detector. If no results at first, reverse X and Y connections. Coupling coil can be a hank of about 20 or 30 turns of No. 24 D.C.C. tied to side of coil in crystal set, or otherwise closely coupled thereto. Adjust ·0003-mfd. (max.) compression condenser to give the desired degree of selectivity. The best way of making this adjustment is to begin with the condenser at maximum and then gradually reduce it until just the necessary selectivity is obtained. In this manner the best balance between volume on the one hand and selectivity on the other will be achieved. The larger the working capacity here the better the volume, but the lower the selectivity.

CIRCUIT No. 44 (right) illustrates the use of a metal (or "dry") rectifier in a "voltage doubling" mains H.T. circuit. (Note the two 4-mfd. condensers in series.) Enables quite a high output voltage to be obtained from a low-voltage (input) type of rectifier. Suitable for comparatively simple receivers requiring a high voltage for the "output" valve. Terminal H.T. +1 may be used for the detector valve, H.T. +2 for the first L.F. stage and H.T. +3 for the "outfit" valve. The single smoothing choke must be of the high inductance, heavy duty type.

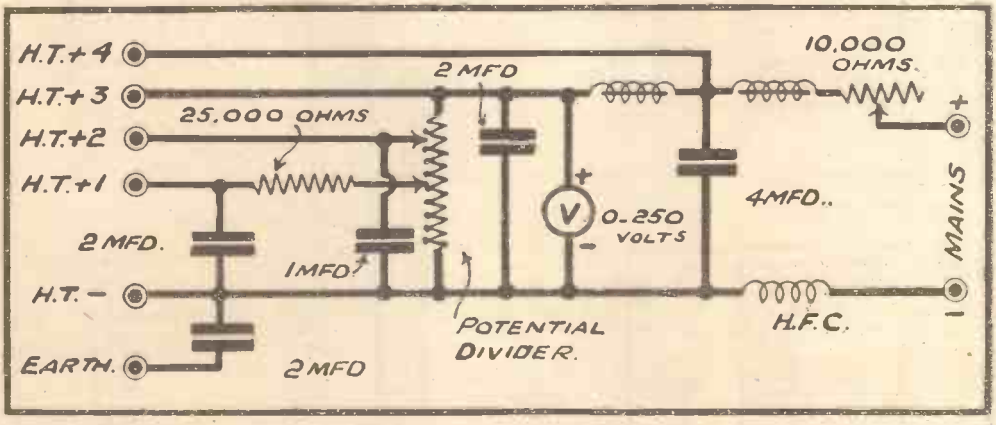




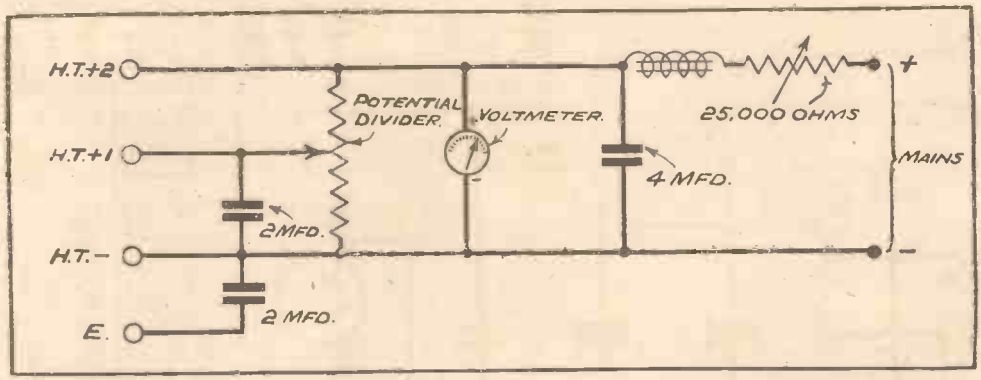
CIRCUIT No. 45. An elaborate type of A.C. mains H.T. unit suitable for quite large receivers. Very well smoothed and "de-coupled," and employing a full-wave valve rectifier. Terminal H.T. + 1 is intended for the detector valve, H.T. + 2 for the screening electrode of the S.G. valve, H.T. + 3 for the anode of the valve, and H.T. + 4 for the L.F. and power stages. In some cases it will be found best to run the first L.F. stage from H.T. + 3 and the power stage from H.T. + 4. Better "separation" is often obtainable in this way, and hence more complete prevention of motor-boating with rather unstable sets.



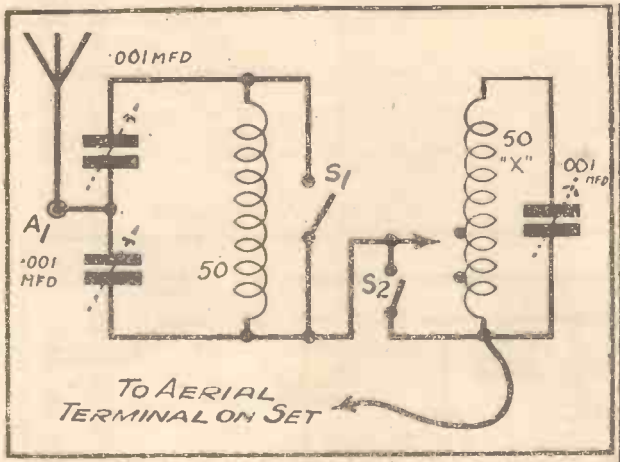
CIRCUIT No. 46, showing a simple type of A.C. mains H.T. unit for use with three-valve sets of the screened-grid, detector and L.F. type in which the screened-grid valve anode and screening electrode are already provided with de-coupling devices. Terminal H.T. + 1 is for the screening electrode, H.T. + 2 for the detector, H.T. + 3 for the S.G. anode, and H.T. + 4 for the L.F. or power valve. Note the double-winding type smoothing choke used at one point and the 4-volt winding in the transformer for the heaters of A.C. valves.



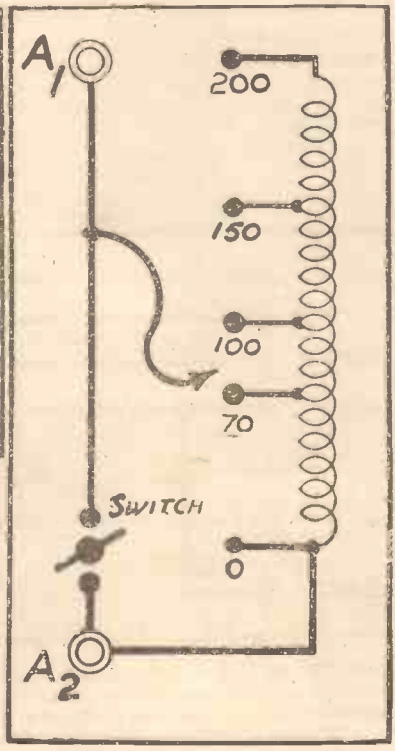
CIRCUIT No. 47. A D.C. mains H.T. unit of a particularly well-smoothed and de-coupled type, with a special voltage-control device. This is the 10,000-ohm variable resistance which is adjusted when the unit is actually working until the voltmeter reads the correct figure for the L.F. and output valves (i.e. 120, 140 or 150 volts, according to the rating of the valves). The various output terminals should be used exactly as in Circuit No. 45, which incorporates the same voltage-control scheme.



CIRCUIT No. 48. A very much simplified D.C. mains H.T. unit for running sets of the detector and low-frequency type. Incorporates the same voltage control and measuring method as No. 47, but has only two output tappings. Of these, H.T. + 1 is for the detector valve and H.T. + 2 for the L.F. On very bad mains place a heavy-duty H.F. choke in series in the negative lead, as in Circuit No. 47. Note the special terminal in both these circuits to which the earth lead must be transferred. (Leave earth terminal on set blank.)



CIRCUIT No. 49 (above) illustrates a double rejector device for the elimination of either or both of two interfering transmissions specially designed for the Regional areas. The coil sizes are indicated in the diagram, and the condensers are of the adjustable compression type. Switches put one or other of the rejectors out of action when not required.



CIRCUIT No. 50 (right). The "Contradyne" device, which will prevent local station interference on long waves with practically any set. Switch "shorts" coil to put it out of action when working on medium wave-band. Coil is wound in sections on 2 or 2½ in. diameter ribbed former, in which ten sets of slots have been filed. Usually increases volume of long-wave stations perceptibly, as well as stopping "local" interference.

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