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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Valve Developments

Are Multiple Types Worth While?

VALVE development of recent years has taken two distinct trends. On the one hand we have the tendency towards the production of multi-electrode valves as exemplified by the screen-grid, the pentode, and the heptode or pentagrid, while on the other we have the trend towards the multiple valve, of which the Class "B" valve and the multiple diode types are good examples.

No one can have anything to say against the development of *multi-electrode* valves, since these represent a definite advance in technique, and function in a manner which cannot be duplicated by any other valve or combination of valves. The same cannot be said, however, of *multiple* valves, for their equivalent can always be obtained by a combination of existing valves of simple types.

The multi-electrode valve represents a definite contribution to the advance of radio, but the multiple valve has no technical merit, and it may even be argued that it is a retrograde step, except in so far as it serves as an exercise for the ingenuity of the valve manufacturer.

The characteristics of the individual sections of a multiple valve are usually inferior to those of their equivalents built as separate valves, and the common cathode to the sections renders such valves less convenient to use. It is the experience of most receiver designers that the grouping of so many connections in a single valve base leads to such a serious congestion of components and wiring around the valve holder that efficiency and stability are impaired.

Perhaps the strongest argument which can be advanced against the

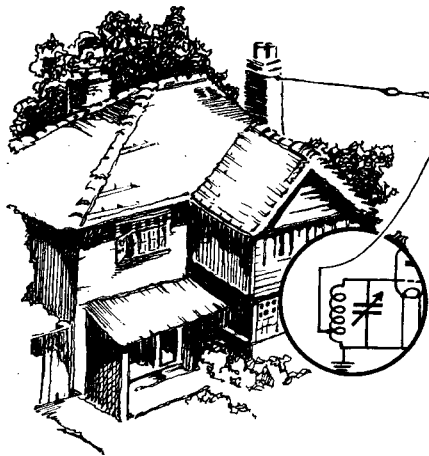
multiple valve, however, is the infinite variety of combinations possible. Valves to-day are quite numerous enough, and it is easy to visualise the difficulties which would be brought about by still further increases in the numbers of the multiple types. If we use a duo-diode-triode, it is but a step farther to a combination of two triodes for an L.F. stage and the output valve and, indeed, such a valve has already appeared in America. A logical development would be to incorporate all the valves of a set in a single glass envelope, and the absurdity of this will be readily apparent. Not only would the whole multiple valve have to be replaced when only a single section had failed, but the manufacturer would have to provide, and the dealer to stock, innumerable types to suit the infinite combinations of sections required by different receivers.

Need for Prompt Action

If such an unnecessary and technically indefensible situation is to be avoided it is obviously necessary that some action be taken at once, so that manufacturers may reach agreement before they have committed themselves too far.

The ordinary type of full-wave rectifier valve for mains equipment, which is really a double diode, would, of course, be retained, and a double or triple diode type for signal detection and A.V.C. purposes would be satisfactory, but there can be no real justification for combinations of diodes and other types in the same bulb.

We are not suggesting, in fact, that any existing valve types should be discontinued. Such a course is obviously impracticable on account of the large number of sets now embodying them for which replacements will be needed in the future.



The Best Aerial Coupling

The First Link in the Chain

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

A SUPERFICIAL study of contemporary technique might lead one to suppose that by this time every detail of a receiving system has been minutely investigated and raised to a very high degree of efficiency. The truth of the matter is rather that pure efficiency is falling into neglect.

Modern transmitters provide such strong signals, and modern valves make possible so much amplification of them, that efficiency is squandered right and left. Perhaps it is to the extreme left (of the usual circuit diagram) that there is the most striking example of haphazardness, leading to wholesale waste of what the good broadcasters have given us.

Definite Data Needed

There seems to be no agreement as to how the aerial should be coupled to the receiver, or knowledge of which of the several methods in use is the right one. Even if in these days we can afford to give away signal strength, we are still in no position to do the same with selectivity. The aerial coupling affects both. Yet many designers, when they come to this part of the work, make a hopeful guess; or buy an aerial coil unit from somebody else, which usually amounts to the same thing.

The two commonest systems are the capacity or series condenser method, and the inductive method (Fig. 1). The latter appears in two variations—the transformer and the tapped coil. These two are essentially the same; it is mainly a matter of convenience whether the coils are separate or combined.

The first step in settling the question of which of these methods is the right one is to decide what we expect the ideal aerial coupling system to do. The aerial picks up small voltages from all the wireless waves that are splashing up against it. These voltages cause corresponding currents to flow up and down in it. The object of the game is to cause all or part of these aerial currents to flow through a tuning circuit (coil and condenser) in such a way as to make one set of them deliver a magnified voltage to the grid of the first valve.

Now it should be quite clear that there are two distinct considerations here. If it were not for the magnifying effect of the coil on signal voltages of one particular wavelength—in a word: *tuning*—all the sets of voltages, due to all the transmitters “on the air,” would be reproduced in proportion to their original strengths.

Of course, that would be quite hopeless. Unless there were some means of select-

THIS article clears up many popular misconceptions on the subject of aerial coupling, and gives valuable data on choosing the most satisfactory operating conditions. The theory that small aerials increase true selectivity is exploded.

ing the desired wavelength, all interest in broadcasting would cease forthwith. The tuned circuit performs its function by causing aerial currents of one wavelength to build up a much bigger voltage across the input to the valve than those due to any other wavelength. The smaller the “losses” of the tuned circuit, the sharper the response to the desired wavelength.

Now, while it may sound very thrilling

an m of about 100. The thing that must be understood quite clearly is that this magnification is not at all the same sort of thing as the amplification factor of a valve. Although it is quite useful to have the desired signal voltage made bigger, that in itself is not the most valuable asset. It is the fact that it is made bigger *relative to interfering signals* that gives significance to m . A tuned circuit with an m of 120 magnifies the desired signal 120 times, and other signals less and less as the wavelength differs more and more, until at very remote wavelengths the relative strength is only about 1.

When an aerial is coupled to the tuned circuit it brings the programmes to it, but it also inevitably introduces a certain amount of loss. The more completely it is coupled the more the tuned circuit magnification is pulled down, or damped; and the poorer the selectivity becomes. If the coil is very good to start with, the aerial has a correspondingly large damping effect. If in the interests of selectivity the aerial is very loosely coupled, it fails to communicate a large enough proportion of the signal strength. That is the dilemma.

Selectivity and Sensitivity

Present-day conditions bias one heavily in favour of loose coupling. Mere signal strength can be made up by the wonderful valves we have now. But selectivity is very precious. At the same time, we don't want to throw away a shilling's worth of signal strength to gain a ha'p'orth of selectivity. The increased amplification needed to put things right is only too apt to bring in a noisy background. And, anyway, it costs money.

That is why a good deal of space has already been taken up in trying to make clear just exactly why the aerial coupling is important. We want it, first of all, to injure the selectivity of the tuned circuit as little as possible. Secondly, we want it, subject to this, to pass as large a proportion as possible of the signal strength picked up. Thirdly (and very decidedly if the tuning is ganged), the coupling ought to be such as to disturb the tuning as little as possible; the capacity it puts in parallel with the tuning condenser should

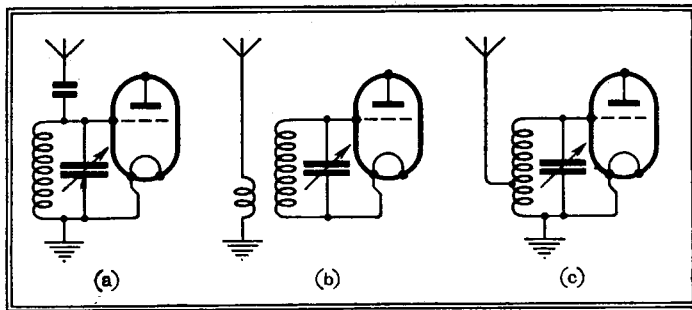


Fig. 1.—Simple capacity coupling compared with alternative systems of inductive coupling.

to talk about “knife-edge” selectivity, which presumably is a stage inferior to “razor-edge” selectivity, a more informative method of comparison is the statement of actual figures. And because the tuning circuit functions by virtue of magnifying signals of the desired wavelength above its fellows, the best basis of comparison is the so-called *magnification*, m . A fair average coil (the losses are supposed to be concentrated mainly in the coil) has

The Best Aerial Coupling—

be reduced to the lowest possible value.

The first requirement has already been fitted with a numerical standard—*m*.

The second we can express in terms of the number of volts (or millivolts, or microvolts) produced across the tuned circuit by a desired signal for each volt (etc., etc.) picked up by the aerial, and call it *v*. Assuming, for example, an *m* of 120, and a coup-

Here they are:—

Wavelengths.—One in the medium band (375 metres) and one in the long band (1,500 metres).

Coils.—Two for each waveband. Medium wave—160 microhenries. Coil G (good), *m* 200; Coil B (bad), *m* 64. Long wave—2,000 microhenries. Coil G, *m* 100; Coil B, *m* 32.

Aerials.— Three representative types.

(1) Large outdoor aerial; with a rather high capacity, such as might be due to a screened down-lead, but no excessive losses. A good aerial. Equivalent capacity, 500 m.mfd.; and resistance, 20 ohms on medium wave, 36 ohms on long wave.

(2) Rather poor outdoor aerial. Lower capacity; but higher losses, such as might be caused by buildings

ances. Actually (2) is the least efficient.

The curves in Figs. 2 to 9 show how *m* and *v* are affected by the closeness of coupling. The figures attached to the individual curves refer, of course, to the aerials.

In the case of series-condenser coupling, the coupling is least when the capacity is smallest; and, in the inductive system, when the proportion of coil turns that are included between aerial and earth is least.

A Limiting Factor

The third basis of comparison—the capacity thrown into the tuned circuit by the aerial—is presented by emphasising the parts of the curves corresponding to adjustments in which this capacity does not exceed 25 m.mfds. The dotted lines may be regarded as “out of bounds” on this count.

If these curves are carefully studied they show up some useful facts.

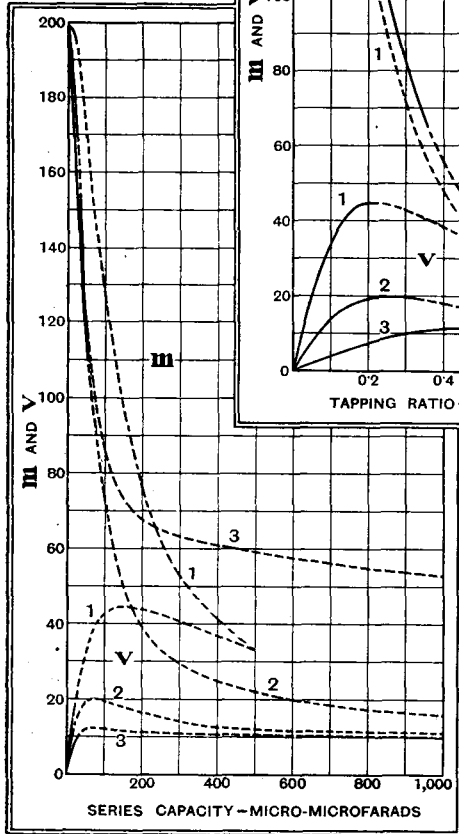


Fig. 2.—The effects of variations in aerial coupling capacity on selectivity (*m*) and sensitivity (*V*). These curves relate to the medium-wave coil G in conjunction with aerials Nos. 1, 2 and 3, as described in the text.

ling efficiency of 20 per cent., it follows that *v* is 24. The third requirement—which later on we shall find has the casting vote—may be brought in by fixing a limit of, say, 25 micro-microfarads for the maximum allowable increase in tuning capacity due to the aerial.

A Basis for Comparison

Now we are ready to start. The first difficulty (and this is probably the reason for the prevailing vagueness on the subject) is that there are endless combinations of conditions—good coils, bad coils, lots of wavelengths (long, short and medium), long aerials, outdoor aerials, bad aerials, frame aerials—and so on. All we can do here is to look at a few typical examples.

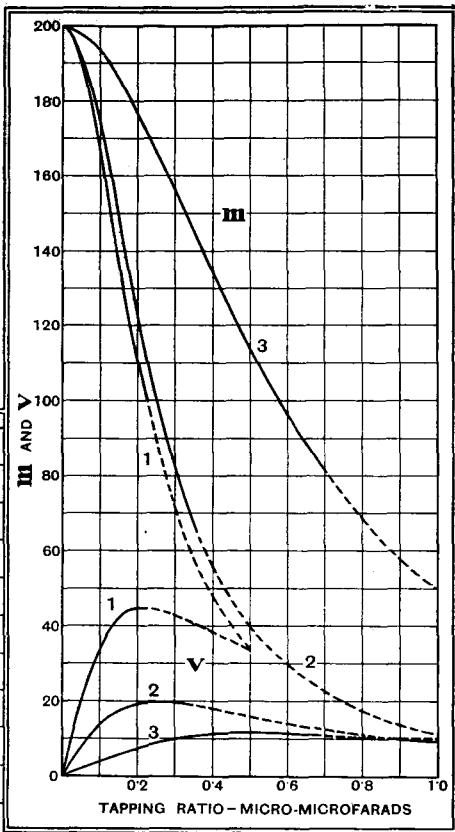


Fig. 3.—Effects of variations in inductive coupling; conditions otherwise as in Fig. 2.

or trees between it and the ground, or by an inferior earth connection. Capacity 200 m.mfds.; resistance 100 ohms on medium wave, 200 on long.

(3) Indoor aerial; with fairly high losses, as are usual when the wire is carried along walls. Capacity, 50 m.mfds.; resistance 300 ohms on medium wave, 800 on long.

It is a mistake to judge the inefficiency of the aerials in proportion to the resist-

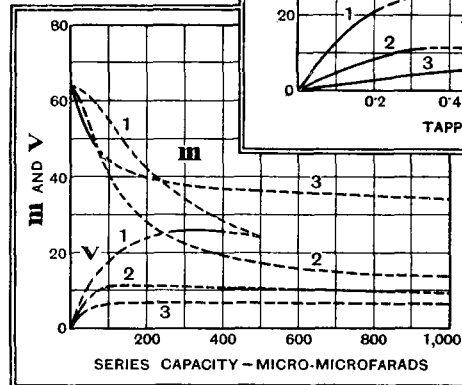


Fig. 5.—(Above) Inductive coupling with coil B on medium waves.

Fig. 4.—(Left) Conditions as for Fig. 2, but with medium-wave coil 3 condenser-coupled to the aerial.

(1) The closer the aerial is coupled, the more it reduces selectivity; and the best tuning circuits are hardest hit.

(2) The efficiency of reception, or “receptivity,” *v*, at first increases rapidly when the coupling is increased, but unless the aerial is small there is an optimum

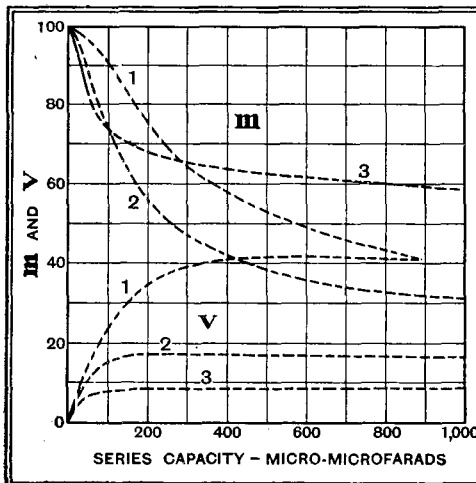


Fig. 6.—Long-wave coil G with condenser coupling.

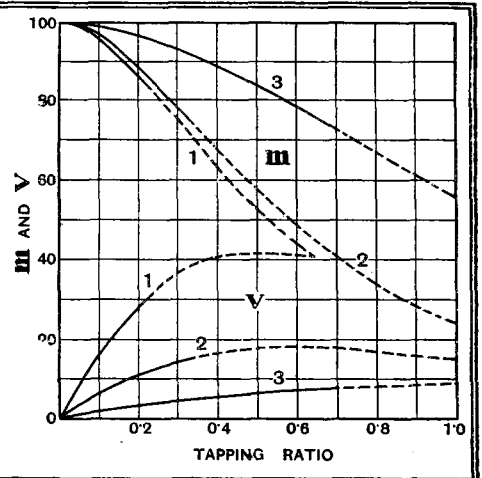


Fig. 7.—Long-wave coil G with inductive coupling.

The Best Aerial Coupling—

point, beyond which v slowly falls. As selectivity is falling, too, this is a very bad state of affairs. Under-coupling, though it sacrifices some signal strength, at least gives compensation in the form of better selectivity. But if a poor coil is used the

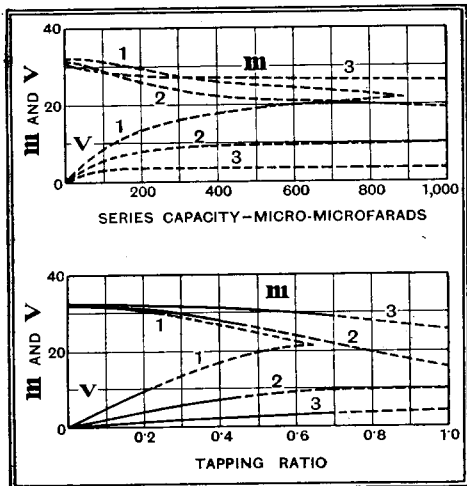


Fig 8.—(Above) Long-wave coil B with condenser coupling.
Fig. 9.—(Below) Long-wave coil B with inductive coupling.

improvement in selectivity may not be worth it.

(3) For a given receptivity, a large aerial gives most selectivity. Thus, in Fig. 3, when aerial (2) gives a v of 20, the m is 100. But with aerial (1) the m is 192 for the same v . Added to that, the large aerial picks up more signal, so if desired the coupling can be made still looser without sacrificing any signal strength. This explodes the theory that a small aerial is more selective.

(4) Within the range of coupling possible to both systems, there is nothing to choose between them as regards the best compromise between receptivity and selectivity. Comparing Figs. 2 and 3, for example, each system gives the same maximum receptivity, and for any given receptivity neither can offer a superior selectivity.

Where Inductive Coupling Scores

(5) But the capacity effect of the aerial on the tuned circuit is less with the inductive coupling. If, then, a capacity limit is fixed, such as the 25 m.mfds. here chosen, the inductive system offers a wider range of adjustment, and therefore may well give better results. In Fig. 3, aerial (1) permits a receptivity of 45 without exceeding the 25 m.mfd. limit. The capacity coupling (Fig. 2) allows only 20. The necessity for limiting the capacity effect is not only because too high a minimum capacity makes it impossible to tune low enough in wavelength, but also because the effective capacity due to the aerial is not absolutely constant at all wavelengths, and even if "trimmed" at one point on the scale it throws the ganging out elsewhere.

This point is further illustrated in Fig. 10, which shows the measured voltage

across the tuned circuit due to London Regional, and the corresponding change in tuning capacity due to the aerial coupling. This shows clearly how much stronger reception can be obtained with inductive coupling for a restricted amount of capacity disturbance.

(6) When receptivity reaches its maximum, selectivity is reduced to one half that due to the tuned circuit alone. In practice it is nearly always better to work with a lower coupling than this, so as to get better selectivity.

In addition to these interesting conclusions, which favour inductive coupling, there are some practical points that the curves do not reveal.

It is easier and more convenient to arrange to get continuous control over the coupling by means of the variable series condenser. A rotating coupling coil is a little less easy to contrive, and in any case one is usually limited by it to rather low values of coupling. On the other hand, it does reduce the coupling right down to zero, whereas it is difficult to get a series condenser with sufficiently low minimum capacity:

Double-acting Volume Control

And the coil tapped low down has two more advantages. It lends itself to a useful method of volume control, using an ordinary type of potentiometer of moderate resistance. This is a particularly good arrangement in battery-driven sets, where a "short-base" variable- μ valve has to be used, which can handle most degrees of signal strength but is liable to be overloaded by the local station. In that case some form of aerial volume control puts matters right, and one can buy ganged volume controls that serve the purpose nicely.

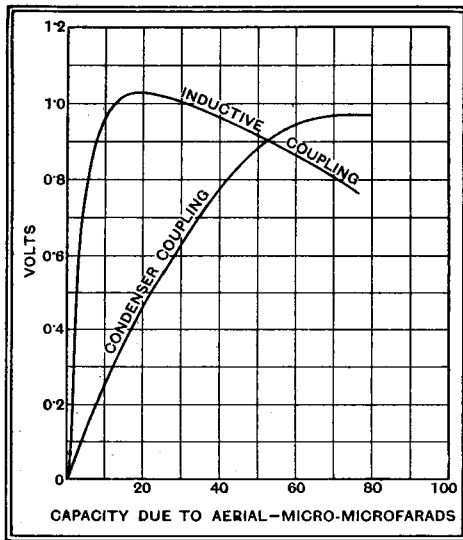


Fig. 10.—Showing how inductive coupling provides greater signal strength for a given transference of aerial capacity to the tuned circuit.

Fig. 11 illustrates this little piece of work. It is estimated that a tap including 10 per cent. of the coil turns is sufficient in most cases; and as a resistance across the aerial turns is equivalent to one across

the whole coil which is larger by the square of the tapping ratio, a 5,000 ohm volume control in this circuit damps the coil no more than 500,000 ohms across the whole coil.

Secondly, when the aerial is tapped low down it is curiously immune from most of the things that one has been brought up to avoid. It can be grasped firmly in the hand, or used with surprisingly slight insulation, or run around the house in a lead covering, or taken through a tubular metal screen in accordance with the latest anti-interference schemes; all without noticeable mistuning or loss of efficiency.

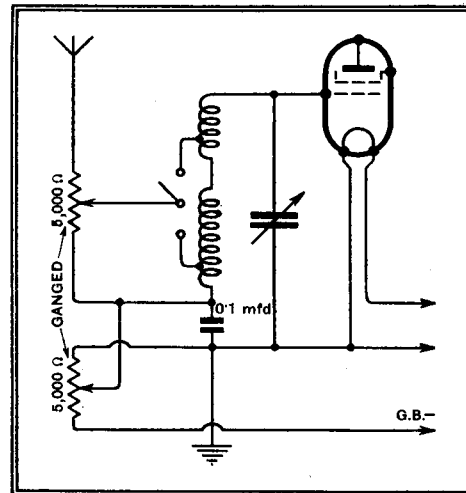


Fig. 11.—Double-acting volume control; negative bias is progressively increased and at the same time a resistance of decreasing value is shunted across the aerial input.

The conclusion of the whole matter, therefore, can be summed up thus briefly: Use a good coil, a large aerial, and a low tapping.

Twenty Years Ago
Extracts from *The Wireless World* of February, 1914

A Time-Signal Receiver.

"It will come as welcome news to a great many readers that there is now available a complete Time-Signal receiving set which is manufactured in the Marconi Works at Chelmsford. . . . These signals (from the Eiffel Tower) will be of great value to clock and watchmakers, while it is hoped that an apparatus for receiving them will become part of the equipment of every village and of many country houses."

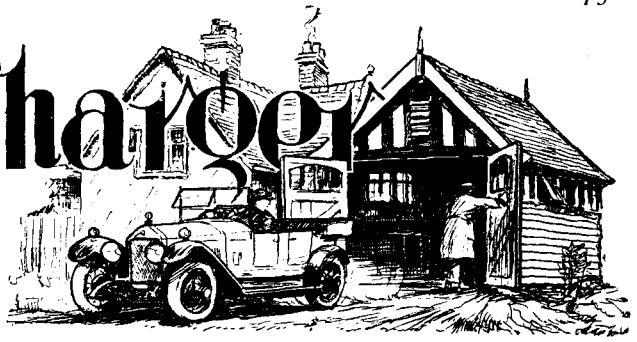
From "Questions and Answers":—

"W. V. H. (Shoeburyness).—I have constructed a small wireless station for receiving, the dimensions of which are as follows:—The aerial is a 4-wire, 35 yards long, with an average height of 30 feet above ground, with leads from centre. The earth wire is soldered to the water pipe. The apparatus is a variable inductance, jigger, variable condensers, silicon-gold detector and single 1,000-ohm telephone. I get Paris, Norddeich and Cleethorpes loud, especially Paris, but cannot get Poldhu quite loud enough to read. Can you suggest any additions to my apparatus to make Poldhu readable? It is practically impossible to either lengthen or heighten my aerial. Would adding more wires be of much use?"

Extract from answer:—

"We cannot be sure that you are in the habit of getting accurate tuning; can you so adjust to Poldhu that any change—either increasing or decreasing the wavelengths of your receiving circuits will cause a corresponding decrease in the signals?"

Garage Battery Charger

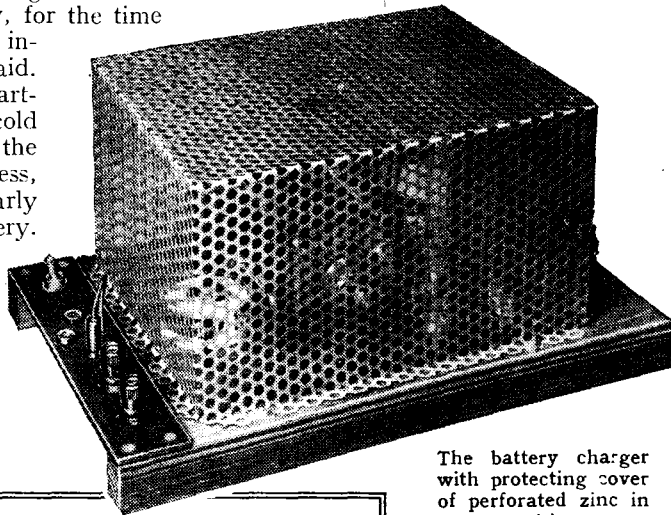


An A.C. Unit for Charging Two-, Six- and Twelve-Volt Batteries

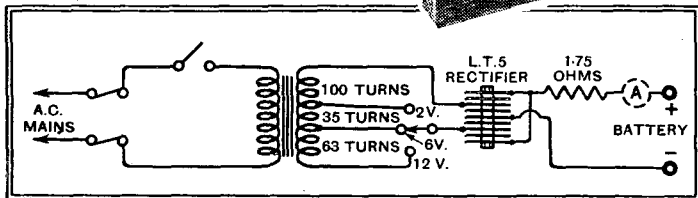
By H. B. DENT

WIRELESS listeners who are also motorists might profitably turn their electrical knowledge to good account at this time of the year and give a little attention to the car battery, for the time and any small expense involved will be well repaid. The greater difficulty in starting the engine on these cold mornings, coupled with the extra long hours of darkness, combine to impose particularly heavy loads on the battery. Yet the opportunities for charging at the full rate are less frequent than during the summer months, when the battery is not required to do such heavy work. It is quite understandable,

build himself; the initial cost is small and the work not difficult. Furthermore, there is no reason why the unit should not be made to serve for wireless batteries as well,



The battery charger with protecting cover of perforated zinc in position.



Circuit diagram of the three-purpose battery charger.

therefore, that without some additional help in the way of occasional charging on the bench the battery can hardly be expected to perform its allotted functions in a really satisfactory manner. That many succeed in struggling through the winter is a credit indeed to the battery makers, but the result is an undue strain, and consequently a shortened life of this all-important unit.

Those who have an A.C. electric supply in the garage might with advantage consider installing a small trickle charger, for even one giving a D.C. output of but one ampere will prove adequate to maintain the battery in good order. An over-night charge at this rate will revive the battery sufficiently to enable it to turn over the engine quite vigorously on the following morning. It is even possible to bring the battery up to full charge, although this may take from three to four days, yet it will prove economical, as the charger consumes only about 30 watts per hour, which allows some 33 hours' working on one kW., or unit, of electricity.

The charger illustrated here is one that the home constructor can quite easily

and 20, either two-, six- or twelve-volt batteries can be charged merely by selecting the appropriate A.C. voltage for the Westinghouse rectifier, which, incidentally, is the type L.T.5 rated for 12 volts 1 amp. output. For this purpose a special mains transformer would be needed, but its

for it entails no extra expense.

By using a mains transformer with several tappings on its secondary winding, and giving A.C. output voltages of 10, 14,

could be employed. The secondary A.C. output from these is 15, 18 and 22 volts, these voltages being suitable for charging six-, ten- and twelve-volt batteries. If a resistance of about four ohms is joined in series with the six-volt charging circuit then two-volt wireless batteries would be dealt with as well.

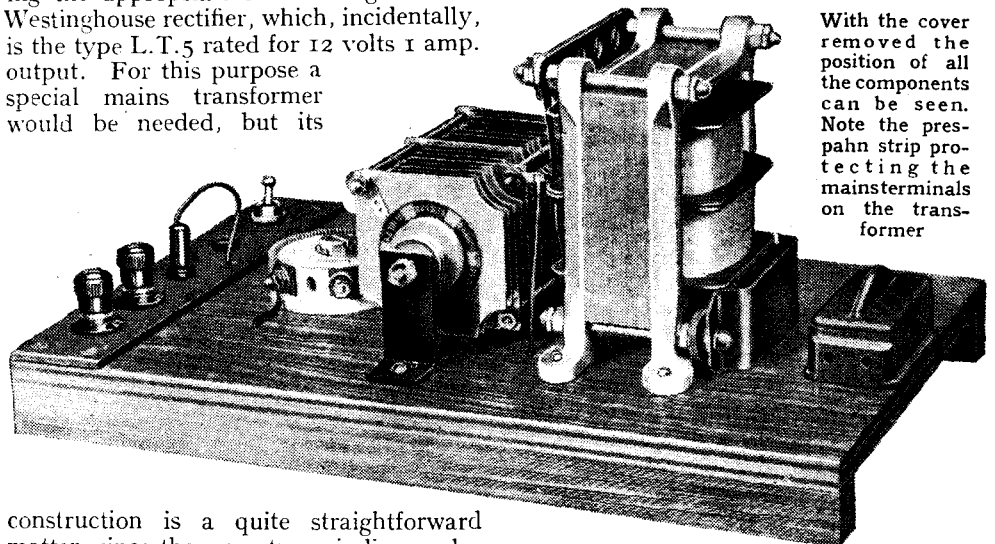
For the benefit of those desiring to construct the transformer themselves the following brief details of the windings may be helpful.

The primary and secondary windings are wound on separate bobbins assembled on Stalloy No. 4 stampings with a core approximately one inch square— $1\frac{1}{8}$ in. x 1 in. to be exact. If the supply is 240 volts 50 cycles, the primary bobbin should be wound with 2,160 turns of No. 30 S.W.G. D.S.C. wire, while for the secondary 198 turns of No. 20 S.W.G. D.C.C. are required. This winding is tapped at the 100th and 135th turns. The correct primary winding for any electric supply of 50 cycles can be found by multiplying the voltage by nine; the gauge of wire specified being suitable for all supplies of from 200 to 250 volts.

The following material is required for the construction of the mains transformer:—

- 60 pairs of No. 4 "Stalloy" stampings.
- 2 half-size No. 4 bobbins, with a 1 in. x 1 in. centre hole.
- 1 pair of aluminium end-clamps, with nuts and bolts.
- 10 oz. of No. 30 S.W.G. D.S.C. wire.
- 10 oz. of No. 20 S.W.G. D.C.C. wire.

With the exception of the wire all this



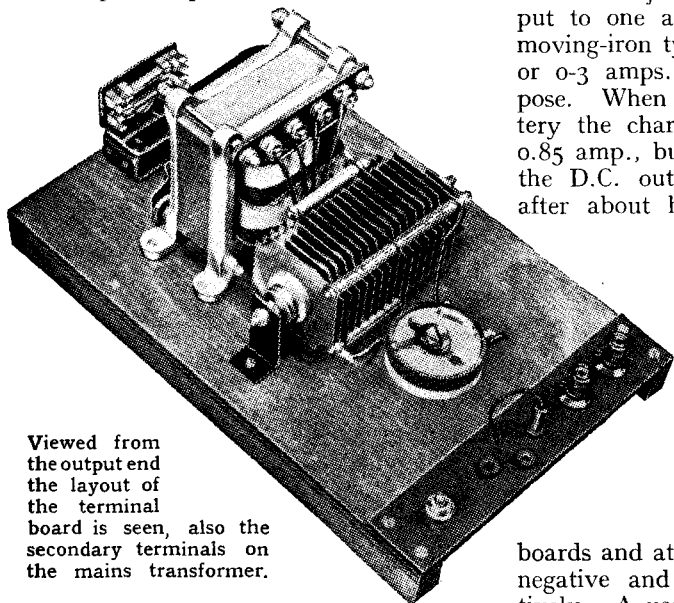
With the cover removed the position of all the components can be seen. Note the brass strip protecting the main terminals on the transformer.

construction is a quite straightforward matter, since there are two windings only, and these are arranged on separate bobbins. Alternatively, a standard commercial transformer, such as the Heayberd, R.I., or Regentone models, for example,

material is obtainable from Sound Sales, Ltd., and possibly this firm would supply the transformer made to specification if required.

Garage Battery Charger—

The stampings are assembled in the usual manner for mains transformers; that is to say, with the "T" and the "U" pairs inserted alternatively from opposite sides. Cast-aluminium end-plates are employed to clamp the core, and the leads from the coils may be brought out to terminals mounted on ebonite or Paxolin strip clamped under the core bolts, or they can be left sufficiently long to join direct to their respective points.

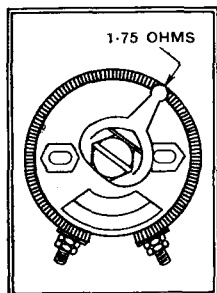


Viewed from the output end the layout of the terminal board is seen, also the secondary terminals on the mains transformer.

When the transformer is finished attention can be given to the assembly of the components on the baseboard. This measures 10½ in. long and 7½ in. wide, and can be cut from ¾ in. plywood. It is mounted on battens each 12½ in. long by ¾ in. deep by ½ in. wide. These extend two inches beyond the baseboard and on them is then screwed a small ebonite, or Paxolin, panel, measuring 7½ in. by 2 in. This carries a mains on-off toggle switch, three sockets for adjusting the A.C. input to the rectifier and two terminals for the battery leads.

The other components required consist of a Westinghouse L.T.5 rectifier, a two-ohm pre-set resistance, and a twin fuse-holder. The inclusion of a small resistance—1.75 ohms is the value recommended—is a precautionary measure advised by the makers of the rectifier to safeguard the unit against damage in the event of the battery being connected accidentally with the wrong polarity. The approximate position of the contact arm on the Igranic resistance used to give 1.75 ohms is shown in one of the drawings.

Since some protection is obviously needed for the components, a cover made from perforated zinc would serve as well as any, but there is no objection to



Approximate position of the slider on the 2-ohm resistance to give 1.75 ohms.

fitting a wooden one, provided some ventilation holes are drilled along the lower and upper edges. If a zinc cover is fitted, and there are terminals on the transformer on the side nearest the cover, these should be protected by a strip of thin prespahn, or other suitable insulating material, as shown in the illustration.

It would be exceedingly helpful if an ammeter were available the first time the charger is used, as it would then be possible to adjust accurately the D.C. output to one ampere. One of the cheap moving-iron type having a range of 0-1.5 or 0-3 amps. would serve for this purpose. When first connected to the battery the charging rate should be about 0.85 amp., but as the rectifier warms up the D.C. output will rise slightly, and after about half an hour the ammeter should read about one ampere. If the output does not quite reach this figure, then an adjustment should be made to the 2-ohm resistance to give the correct output.

It is quite unnecessary, of course, to remove the battery from the car, and it can be charged *in situ* by lifting the floorboards and attaching the two leads to the negative and positive terminals respectively. A useful clip for this purpose is the Goltone Bull-Dog spring connector, made by Ward and Goldstone, Ltd., of Manchester.

Since preparing this article the writer has learnt that there is available a Parmeko transformer giving 11, 15, 18 and 22 volts output, and this model might quite well be regarded as an alternative to the one described in the text. For the voltages 11, 15 and 22 are so near to those specified that only a slight adjustment of the variable resistance would be needed to compensate for the difference.

LIST OF PARTS

- 1 Mains transformer, see text
- 1 L.T. rectifier, 12 volts 1 amp. output
Westinghouse type L.T.5
- 1 2-ohm pre-set resistor Igranic 2241/13
- 1 Mains on-off switch Igranic 2296/61
- 2 Terminals, L.T., L.T.— Igranic 2297/30
- 3 Insulated-headed sockets
- 1 Wander plug. Clix Parallel Socket No. 9
- 1 Twin fuse-holder with 1 amp. fuses Belling-Lee 1033
- Wood for baseboard and battens
- Perforated zinc for cover
- 1 Paxolin or ebonite panel, 7½ in. x 2 in. x ¼ in.
- Quantity of No. 18 S.W.G. tinned copper wire, screws and insulating sleeving

THE RADIO INDUSTRY

IN the recent article on "Q.A.V.C.," the use of a Weston relay was considered; readers may be interested to know that Electradix Radios, of 218, Upper Thames Street, London, E.C.4, still have a stock of these highly sensitive instruments. Other types of electro-magnetic relays as well are described in a special leaflet.

The new Corsor Station Identification Chart (price 2d.) gives useful information about the Lucerne wavelength allocation, a list of identification signals, and also has spaces for recording dial settings.

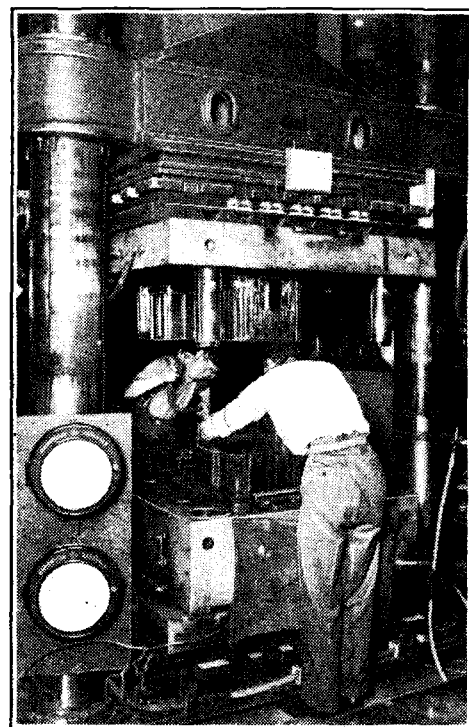
A new style of receiver, essentially designed for remote control, is about to be introduced by Radio Furniture and Fittings, Ltd., of 106, Victoria Street, London, S.W.1. From each

of three remote points the set may be switched on or off, any one of three stations selected, and volume regulated to taste.

Lissen announce that all their receivers and kits will work satisfactorily under the new wavelength plan without any alteration.

Mullard's emphasise the fact that the low-consumption pentode Type PM22A can still be obtained either with a five-pin or a four-pin base, the latter having a side terminal for the auxiliary grid connection. This valve may therefore be used to replace an out-of-date triode in the simplest possible manner, and without disturbing the existing connections of the receiver.

The loose-leaf Dubilier list, No. 933G, contains full details of their condensers and resistances, and is published solely for those professionally or commercially interested in wireless engineering. Apart from information on dimensions, etc., a great deal of useful technical data is included.



MOULDING EKCO CABINETS.—One of the 1,500-ton presses installed at the new bakelite factory of Messrs E. K. Cole Ltd., at Southend. The operator in the foreground is removing a Model 75 cabinet from the mould, which is electrically heated.

Ferranti's method of solving the Lucerne wave-change problem is to supply users of the "Arcadia" and 7-valve models with conversion charts, showing the old and new adjustments side by side. This is a temporary measure; when the stations have "settled down," replacement scales will be issued.

Wright and Weaire are manufacturing a commercial version of the second-channel interference suppressor, described in last week's issue.

The latest Trix Amplifier, Model TP.144, is a three-stage instrument giving 10 watts output, and designed primarily for talking-picture reproduction, but can be used for many other purposes where exceptionally high gain and large output are needed.

Changes of Address

Atrow Electric Switches, Ltd., from Newton Works, Whitfield Place, London, W.1, to Hanger Lane, Ealing, London, W.5.

Technical and Commercial Radio College, from Lloyd's Place, Blackheath, to Cromwell House, High Holborn, London, W.C.1

Practical HINTS AND TIPS

THERE is a right and a wrong way of connecting the two terminals of even such a simple device as a semi-variable compression condenser. To avoid disturbing hand-capacity effects while making adjustments, it is necessary that the plate

Compression Condensers

(or set of plates) which make contact internally with the adjusting screw should be joined to the "earthy" side of the circuit.

When dealing with an unshrouded condenser, the correct connections are easily found by inspection, but the bakelite-cased components bear no indication, and so it is advisable to make a continuity test between the shank of the screw and each terminal, to find which should be earthed.

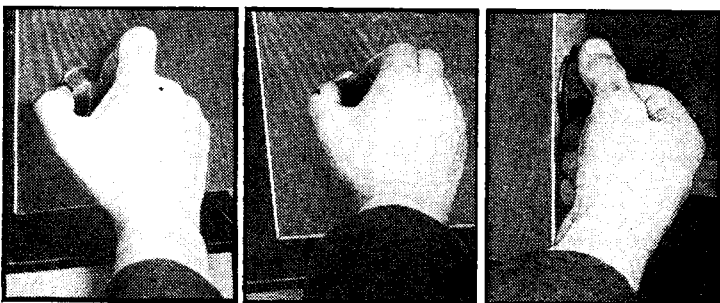
This does not apply to series aerial condensers, in which both sides are at high potential. Such condensers should therefore be adjusted with a long insulated screwdriver.

A GREAT deal of interest has been shown by readers in the question of "the receiver in outward form," particularly from the point of view of convenience in operation. In particular, it seems to be generally agreed that no effort

"Function-alism"

should be spared to enable the critical and somewhat delicate operation of tuning to be carried out as easily as possible. Criticism directed against the conventional arrangement of the tuning knob—with its spindle at right angles to a vertical panel—has been generally accepted.

The weakness of the ordinary arrangement is that the user's wrist and fore-arm must be in an unnatural position. It may be pointed out, however, that this objection may be largely overcome by setting the control panel at an angle with the vertical—say 45 degrees. With a control panel mounted at this angle, experience shows that the most critical adjustments



The knob controversy: three different positions compared.

may be made with ease and certainty, especially if the fore-arm or under-side of the wrist is supported during the process of tuning.

In spite of the advantages of the sloping

AIDS TO BETTER RECEPTION

panel, it would seem certain that the best position of all for the tuning knob is at the side of the cabinet, but there is some difficulty in finding suitable condenser drive mechanism for installation in this manner. Of course, the side control must be combined with an indicating scale visible from the front.

ELECTROLYTIC condensers are never perfectly insulated; nor, for that matter, is the average paper condenser. But the point is that the leakage current which flows through an electrolytic condenser is quite considerable, and can be detected easily with ordinary measuring instruments.

Condenser Leakage

Accordingly, it should be remembered when testing a receiver in which electrolytic smoothing or by-pass condensers are included it will sometimes happen that quite a large fraction of a milliampere is found to be flowing in circuits where normally one would expect to find virtually perfect insulation.

Of course, the small leakage current which normally flows does no harm in a mains-operated receiver, but it is as well to be on one's guard to avoid false conclusions when checking insulation resistance, etc.

WHILE on the subject of electrolytic condensers, it is perhaps wise to point out that the use of this type of condenser for grid-circuit decoupling and by-pass purposes should generally be restricted to true self-bias arrangements,

Automatic Bias Circuits

where the bias resistor is inserted in the cathode lead. This matter was recently discussed in the "Hints and Tips" section, and we are indebted to a reader who reminds us that, in a circuit like that shown in Fig. 1, the use of an electrolytic by-pass condenser C would probably have harmful effects.

The diagram re-

presents an output stage in which bias voltage is developed across a speaker field winding inserted in the negative H.T. lead. The condenser C, if it has a leakage in any way comparable

with the other resistances in the circuit, will act as one limb of a potentiometer across the source of voltage, and so the voltage actually applied to the grid will not have the value estimated. It may be very much less than calculation would show, and if this point be ignored, there is a real risk of over-running the output valve.

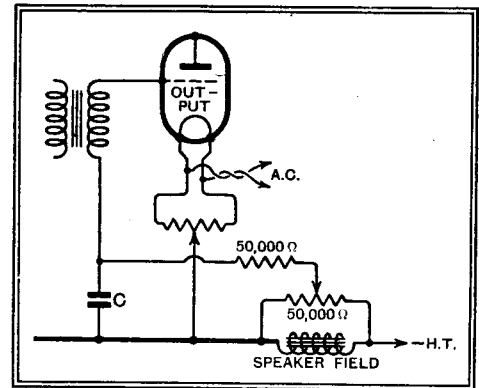


Fig. 1.—It is risky to use an electrolytic decoupling condenser in special bias circuits of this type.

UNCONTROLLABLE instability in H.F. receivers is not nearly so common as it used to be, but, nevertheless, it is a trouble that sometimes arises. In a surprisingly large number of cases it is finally traced to an incorrect method of

Well Earthed

earthing the metal framework of a ganged tuning condenser. The rule to be remembered here is that a single connection should never be depended upon; at least two connections should be made, preferably from opposite ends of the frame, to the earth line. Similarly, with metal chassis construction, care should be taken to see that a good and clean contact is made between the condenser frame and the metal base-plate at more than one point.

IT would seem that solid valve pins are being largely displaced by those of the split "banana" type; in this matter manufacturers show a tendency to revert to an earlier practice, and it is probable that experience shows that, to ensure good connections, a certain amount of springiness in the valve pin is desirable.

Badly Fitting Valves

It will be obvious that, after long use, the diameter of a banana valve pin will tend to decrease, and so it may fit loosely in its holder. The best way of putting matters right is to insert the point of a penknife in each of the slots in turn, and then to give the knife a slight twist. This will have the effect of opening out the slots, and so restoring springiness to the pin.

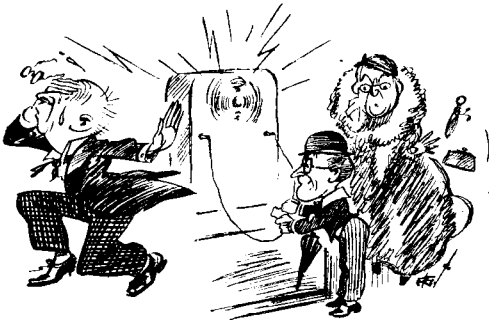
Jeopardising Ohm's Law

I HAVE never been one to make pretence to knowledge which I do not possess.

It was, therefore, with a due sense of my own inferiority the other day that I took the little Grid Leaks into the tents of an electrical wizard that they might learn from the lips of the savant himself how each of our bodies was an electric battery—or primary cell, as I suppose the pedants would have me say—and have the fact proved by actual demonstration.

Upon entering the booth of the seer we were bidden to be seated among a large and varied assortment of our fellow creatures, both male and female. Before us was an impressive contraption rather reminiscent of Joanna Southcott's box, the leading feature of which was a healthy looking microammeter and a pair of electrodes dangling at the end of a piece of flex.

We were first treated to a highly technical lecture of a medico-legal nature, liberally besprinkled with words and phrases calculated to impress the non-technical members of the audience. The electrodes were then handed to a portly dame, who promptly scored a fifty on the meter. She was quickly outstripped, however, by a clammy handed youth, who sent the needle up to 150.



Broke all the laws of nature.

Even he was put into the shade, however, by a sturdy son of toil who had the foresight to spit on his hands before grasping the electrodes, a fact which seemed to pour cold water on the audience's desire for further experiment. Their ardour was damped to such an extent, in fact, that the lecturer was quite relieved when I nudged one of the little Grid Leaks in the back as a signal for him to get into action.

He scored a modest 100, and all would have gone well had not the lecturer made the fundamental mistake of patronising him with a pat on the head and the sickly look generally described by novelists as an indulgent smile. This, I regret to say, raised in my boy the worst of the instincts which he has inherited from his mother, and he promptly joined the electrodes together, thus short-circuiting not only the meter but himself also. Instead of the meter falling back to zero as might have been expected, it broke all the laws of nature by taking a sudden leap forward.

I immediately rose and called attention to this truly remarkable defiance of Ohm's law, but to my utter astonishment the

UNBIASED by FREE GRID

lecturer, so far from being abashed by his unexpected unmasking, immediately turned to the audience and pointed out that this happening furnished yet one more proof of the old proverb about strength in unity, and explained that the joining together of the hands increased the strength of the current.

My expostulations were immediately drowned by an indignant clamour from the assembled females who, with their customary readiness to defend anything that appears orthodox and respectable, rushed to the defence of the lecturer. After an unequal battle of words I deemed it wise to withdraw my troops while the going was good, and fall back on the weapon of the pen.

Something New in A.V.C.

EVERYBODY is familiar with that peculiarly noxious kind of distortion associated with night-fading, from the curse of which A.V.C. does nothing to deliver us. It is, of course, due to the fact that the various musical frequencies are not refracted to the same extent by the Heaviside layer. Thus, at any given moment, we may get the high C of an outsize in sopranos hitting our aerials fair and square, while her accompaniment may miss the mark altogether.

I have long thought that the only way to combat this successfully was to use an entirely separate A.V.C. valve for every frequency, and my recent experiments have been along these lines. Since I have had to use over four thousand valves to cover even the fundamentals of a piano, it can be seen that my A.V.C. attachment will undoubtedly rank as an invention of the first magnitude.

An unexpected difficulty has now delayed publication of my little unit, and the valve manufacturers, who are, of course, financing me, are getting a little petulant about it. The trouble is due to the fact that a wretched colleague, in his efforts to throw cold water on my whole idea, has at last succeeded in getting into my mind a little scintilla of doubt.

Briefly his theory is that the distortion associated with fading is not entirely due to the cause I mentioned; in fact, he alleges that fully ninety-nine per cent. of it is due to unequal refraction, which causes certain notes to lag behind the others.

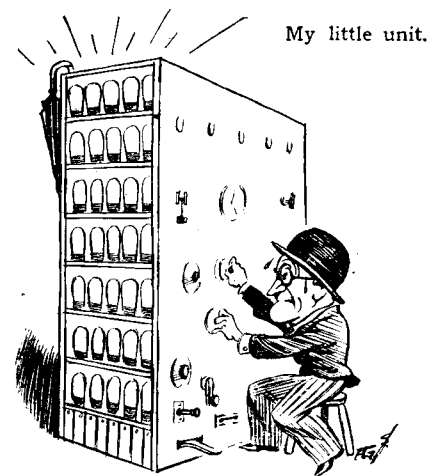
I must, therefore, design an additional unit which will retard the eager first arrivals until their more laggard brethren have caught up. Then, when all are neatly lined up, it must release the lot like horses at the starting gate in the Derby.

What worries me is not so much the designing of the unit as the fact that I am not sure whether my colleague's contentions are true. Perhaps my readers can help? If they decide that the theory is correct perhaps they will suggest some lines along which I ought to work to evolve this delayed action device?

If the problem cannot be solved I shall have several thousand valves to dispose of cheaply.

Television's Opportunity

THE subject of *pulex irritans* is not one which I altogether care to discuss in my columns, but its appearance in one of the television programmes of a certain continental station the other day leaves me no option. It was perhaps unfortunate that on the particular evening in question I had invited a somewhat select



company to have a look-in through my home-made radioscope, and still more unfortunate, perhaps, that on that occasion the television transmission was unusually clear.

However, it is not about the reactions of people to the efforts of these intelligent little creatures that I wish to speak. No matter if they had searched the whole earth for it, the broadcasting station in question could not have found any entertainment so suited to the technique of television as that of performing fleas. To people unarmed with powerful field glasses, for instance, these miniature antics are invisible in music hall, theatre, or circus. But television makes every detail clear.

I trust, therefore, the B.B.C. will not be content to lag behind their Continental contemporaries in this respect, and that we shall both see and hear more of this kind of performance, which should do more to popularise television than a half a dozen prize fights from the Albert Hall.

In time people would get accustomed to such events and would feel more comfortable in their minds as well as their bodies. At present, the whole thing is a novelty, and so great is the power of suggestion that, on the morning after the recent broadcast, laundry managers in the Continental country concerned were, I hear, at their wits' end to know how to cope with the sudden rush of work.

How Europe Listens

The Most Popular Stations on the Continent

By HANS W. PRIWIN

SOME years ago a well-known German wireless journal invited its readers to decide which foreign broadcast programmes were best received and most popular in Germany. The result of the voting was very interesting, particularly to English listeners; for, from the many tens of thousands of replies received, *London* occupied the first place.

One reason for this lies in the fact that the English stations can be received very well—not only in Germany but all over Central Europe. But a significant feature of this result was that it revealed that not merely one type of item contributed to the choice of the English programmes, but three: dance music, military bands, and the "Proms." This means that three quite different categories of listener combined in selecting the same station as their most popular choice.

Travelling around Europe and investigating not merely the official statistics, but also public opinion, I have come to the conclusion that the popularity of various stations and their programmes depends on several factors—technical and psychological.

In the first place, naturally, comes the technical criterion. Only those stations are listened to regularly which are strong enough to be counted on for fairly undisturbed reception. (The "fans" who carry on "DX-reception" merely as a "thrill" are here excepted.)

Temperamental Factors

To-day there are large numbers of stations which can be well received in every European country. These are the big stations erected in the last two years in England, Germany, France, Czechoslovakia, Poland, Belgium, Holland, Switzerland, Italy, Denmark, Austria and Sweden. Warsaw, for instance, is just as loud in France as in Italy or Austria. Naturally each country has certain stations in neighbouring countries which, from their geographical positions, are particularly clearly heard; and these stations, of course, come in for specially sharp public criticism.

Then comes the psychological factor. To a temperamental Southerner the music of Scandinavian composers has little appeal, while, on the other hand, a Russian has little appreciation for German or English military music.

These two factors, the technical and the psychological, must be taken into account in considering the following opinions which I have collected from the listening public of all the European countries.

Of Germany we have already spoken;

apart from the English stations, the Warsaw station is the most popular,



Peasants in East Prussia enjoying an alfresco concert. Listeners throughout Germany favour the programmes of the Northern European countries.

chiefly owing to the excellent music which the Polish stations transmit. One item in particular finds enthusiastic friends in Germany—the Chopin recitals every Saturday from Warsaw Radio. Foreign dance music is only popular among the young city dwellers; the older people can raise little enthusiasm for this kind of item, preferring—according to their type—either classical or military music. Little interest is felt in essentially French music, which—particularly in South Germany—can be very well received from the Strasbourg station. In recent months, too, Germany has become very "self-supporting" in the matter of broadcasting. The German stations are the most popular, which is very important from the political point of view.

Now for a very different country. Greece, which still has no broadcasting service of its own and depends on foreign transmissions, is geographically situated for the favourable reception of Italian and other South-European stations. While Bucharest can be well received there, Greek listeners do not attach much value to this station, which relies largely on gramophone records. It suits their temperament much better to hear the Italian operatic transmissions, which are, in fact, of very high quality, some of them—such

BRITISH stations come high in the list of most popular "foreigners" in the eyes of Continental listeners, according to this interesting article by a journalist who has scoured Europe for radio impressions and opinions. The conclusion he draws is that no formula can be found for predicting the likes and dislikes of individual listeners.

as those from the "Scala" in Milan—being unsurpassable. Classical music interests the Greek listener very little. I may mention that this fact is vouched for by Athenian dock labourers, omnibus conductors, University professors, and even the Greek Postmaster-General; so that here we have an unusual unanimity as regards the public taste. English and North-European stations are little heard in Greece, so that their programmes receive little criticism.

In France comparatively little interest is taken in foreign transmissions, although reception conditions there are excellent and would permit the reception of almost all the big European stations. This is probably connected with the fact that France

has a very pronounced national feeling which readily extends itself into the fields of culture. Added to this, France has a definite folk-music of her own, which is honoured equally by Frenchmen of all grades and is fostered by all the French stations. When foreign stations are received at all they are for the most part limited to those of kindred Latin nations. In South France, for instance, it is the natural thing to listen to Milan and Rome, while in Marseilles the favourably situated Barcelona station, with its folk-song choirs, similar to those of the Southern French, is much listened to.

What Italy Prefers

Italian opinion is somewhat similar. Only Youth, endowed by travel with an international outlook, troubles about the reception of modern music, coming chiefly from England, France and Germany. Otherwise, the great interest of Italians is for folk and operatic music. In Trieste I myself heard a young Italian dock worker whistle, without a flaw, a whole act of "Madame Butterfly." When I asked him which was his favourite broadcasting station, he replied that he only listened to the Italian stations, as these provided the best operas. The same reply was given me by a well-known Italian architect; while a young student, greatly interested in politics, was most interested in German political pro-

How Europe Listens—

grammes, of which there are many.

An old Danish peasant in the Island of Fünen sat at his "radio" as I passed his cottage, listening devoutly to the Zigeuner (gipsy) music from Budapest. On my asking him why he was so fond of this type of music, he replied that it was the strangeness of it that attracted him; it was so different from the cold Scandinavian music. Otherwise I found throughout Scandinavia that the most popular stations were those of Teutonic countries—England, Holland and Germany; no

doubt partly because these are the languages most easily understood in Scandinavia, and partly because these stations are best received there.

In Hungary there is a special enthusiasm for English dance music, perhaps based on Hungary's great interest in dancing. Hungarian gipsy music, after all, is only a kind of dance music.

Each country has its own special type of music—each has its well-defined groups of listeners. A rule or formula for working out their predilections will never, I think, be found.

DISTANT RECEPTION NOTES

Transatlantic Surprises : Hunting Europe's Heterodynes

READERS may have been somewhat surprised on certain recent days and nights at not being able to pick up the big Berlin Tegel station. Lest they should blame their sets, let me immediately reassure them: Tegel is not yet quite in full running order, and breakdowns have been of fairly frequent occurrence.

The wavelength of 240.2 metres is allotted under the Lucerne Plan to Luxembourg, but this big station is still working on 1,304

Time, which corresponds to 6 a.m. and 11 a.m. G.M.T.

As several reports have been received of early morning reception of the experimental transmissions of the 500-kilowatt WLW on a wavelength of 428.3 metres, it is more than likely that the early bird at the wireless set will secure another fat worm in the shape of KDKA.

Stations under the Lucerne Plan now seem to be settling down much more happily than

On the medium waveband Budapest is now one of the most strongly received stations. It is lucky in having as neighbours Bero-münster and Athlone, both of which keep strictly to their wavelength. Mühlacker is quite clear from interference, but Vienna has a very slight heterodyne. Similar small heterodynes affect both Brussels No. 1 and Lyons PTT. Paris PTT comes through well, but both Stockholm and Rome suffer intermittently from small interference.

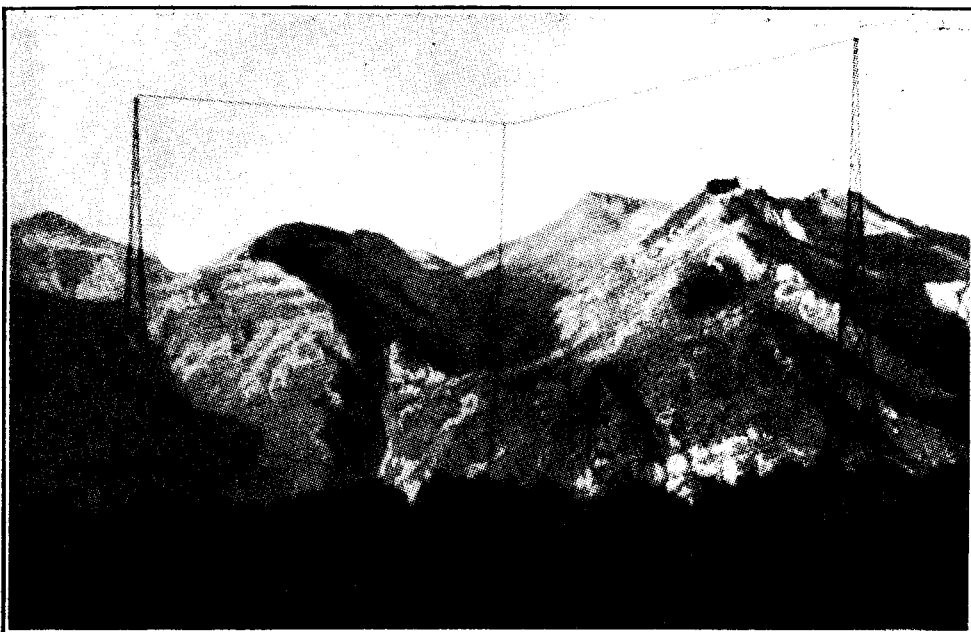
Long Wave Improvements

To begin with, Leipzig was very badly heterodyned by a station which I have not been able to identify, but there has been a very great improvement recently, and it seems probable that Leipzig will soon be altogether clear.

Well-received stations lower down in the waveband at the present time are Hamburg, Brussels No. 2, Breslau, Hilversum, and Nürnberg. Berlin generally comes in well, but is occasionally affected by slight interference, and there has been some background to the transmissions of Radio Toulouse on certain evenings. The Poste Parisien is not a certainty at the moment, being heterodyned as a rule on two or three evenings a week. Both Frankfurt and Gleiwitz come in strongly, but there is naturally a background from the smaller stations which share their wavelengths.

Though I cannot at present speak in very glowing terms of long-distance reception conditions, they are by no means so bad as some would have us believe. On most nights there are fifteen or sixteen good alternative programmes at least from abroad, and the number is steadily growing. Within a week or two we should find little to complain of.

D. EXER.



IN MOUNTAIN FASTNESSES. No station in Europe is less easily accessible than Monte Ceneri (Tessin) which relays the programmes of Sötters on 257.1 metres. The transmitter is surrounded by mountains.

metres. You will find, though, that its medium-wave channel is occupied by a German station which comes in strongly and well. Though it is exceedingly difficult to identify the station, since it is generally relaying a programme taken simultaneously by two or three others, it appears to be Nürnberg.

A reader from Stoke very kindly sends me a communication that he has received from the Westinghouse Electric Company, of Pittsburgh, U.S.A. This is to the effect that permission has been granted by the Federal Radio Board for experimental transmissions with a power of 400 kilowatts. These transmissions are being made on a wavelength of 305.9 metres between the hours of 1 a.m. and 6 a.m. Eastern Standard

at one time seemed likely. After a pretty good beginning matters became worse and worse for some days, culminating in one particularly gloomy evening when on the long waves there were but two unheterodyned Continental stations, and on the medium waveband a bare half-dozen.

Where Heterodynes Linger

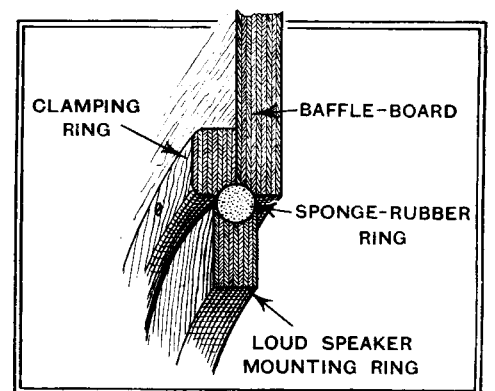
Since then many of the slight heterodynes have been cleared up altogether, whilst some of those that were at one time nothing short of poisonous are now barely noticeable.

Huizen still suffers from background interference, though not on every night. Radio-Paris is sometimes heterodyned, but Zeesen, Warsaw, Luxembourg, Kalundborg and Oslo are nearly always clear.

Freestone Insulated Baffle

AN ingenious method of providing mechanical insulation between loud speaker and baffle-board has been devised by V. E. Freestone and Co., Ltd., of 102, Wembley Hill Road, Wembley, Middlesex. The object, of course, is to prevent direct transference of vibration from the speaker to the cabinet or any components that may be rigidly secured to it.

The accompanying sketch shows clearly how this object has been achieved. Between the circular mounting ring of stout plywood and the main baffle there is interposed a ring of sponge rubber, which pro-



A "floating" loud speaker mounting.

vides a freely floating support but yet affords ample strength. Freestone baffles are made in various sizes, at prices of from 12s. 6d. upwards.

BROADCAST BREVITIES

By Our Special Correspondent

Nation Shall Speak . . .

IS it true that, in broadcasting, nations speak peace unto nations? During the last few weeks this joyful sentiment has had little or no foundation in fact, but most of the turmoil has centred around the Continental stations in their fight for wavelengths and, to a lesser extent, over the question of propaganda.

But the scene is shifting westwards.

American "Distortion"

On Wednesday (January 31st) *The Listener*—the B.B.C.'s talks journal—started a counter-attack on American criticism of the British broadcasting system. The criticism is launched in a new book, "Broadcasting in the United States," just issued by the American National Association of Broadcasters. It is offered, says *The Listener*, as "a full and fair discussion of the issues involved," but the B.B.C. journal goes on to suggest that the Corporation's system of control and method of operation are subjected to distortion.

There then follows a minute description of the B.B.C.'s constitution and its attitude to questions of censorship and controversy.

Tub-thumping Contest

No doubt the provocation has been considerable, but I cannot help thinking, with Hamlet, that "the lady doth protest too much." However, this is for readers to judge. Only one or two copies of the American book are at present available in this country. When the full facts are disclosed it will be time for the British public to decide whether America has been guilty of distortion.

Whatever the issues involved, there is something spectacular, suggestive of a Wellsian novel, in the great tub-thumping contest which now appears to be only beginning.

820 Feet Up with the Microphone

TRANSATLANTIC conversations, scrambled for purposes of secrecy, will be heard by listeners who tune in the Rugby Radio Ramble on Saturday, February 17th. The affair, to which I referred a fortnight ago, promises to be quite exciting, as Midland Regional "O.B.'s" usually are. Fortunately, it will be relayed by London Regional.

If giddiness is communicable over the ether, there may be some tense moments in the homes of England when the microphone is taken to the top of one of the 820ft. masts. But I hear that the commentator will venture thus far only if weather permits.

Talking to a Liner

This microphone tour is to be very thorough. The commentator will talk to listeners as if he were actually conducting them round the station. In addition to the transatlantic talks, listeners will hear conversations with a liner at sea and also some interesting telephony records, including Cape Town calling Adelaide and a broadcast from Bombay.

Broadcasting from Battersea!

Although Midland Regional holds the palm for outside broadcasts, the London

Regional is now showing more enterprise in this respect. The transmission from the Battersea power station on February 23rd should be almost as thrilling as the Rugby event.

Although the output at Battersea is not more than 100,000 kilowatts at the moment, there will be an ultimate capacity of 360,000 kilowatts. The station constitutes a small town, with its large buildings, coal sidings and wharves covering an area of fifteen acres.

The Battersea power station comes under the South-East England electricity scheme, and serves the West London area.

Television from West End Drawing Room

EUSTACE ROBB, the B.B.C. television chief, is now on the last round-up at Broadcasting House preparatory to shifting all the studio and projector paraphernalia—lock, stock and barrel—into No. 16, Portland Place.

Actually, the new studio will occupy what was originally the drawing-room of this elegant town house.

Mid-February Start

The television programmes will begin in their new surroundings on or about February 16th.

The ultra-short-wave transmitter as used for television will, of course, remain on the roof of Broadcasting House. The engineers are now busy on the connecting cables.

Satisfied Engineers

ALTHOUGH the Continental stations are still jostling each other, the B.B.C. has every reason to be satisfied with the great change-over. After the first few days Daventry National was saved from the annoying whistle caused by Eiffel Tower by the amicable decision of the latter station to exchange wavelengths with Warsaw.

An Elusive Whistle

The other stations in the B.B.C. family are practically all clear of interference, though I have noticed a slight whistle on London National in the past few days. Tatsfield is still hunting for the elusive cause of this trouble.

Anonymity: Good or Bad?

THE old warfare on the question of anonymity in British broadcasting is breaking out again. There are two violently opposed schools of thought in Portland Place. The one contends that members of the staff are cogs in a machine, while their opponents, on the other hand, consider that self-expression must be encouraged if the best creative results are to be obtained.

Publicity for All

Thus there is a perpetual bickering between those who would suppress the names of play producers and everyone connected with a production except the players and the author, and those who believe that everyone, from Producer to the Balance and Control officials, should receive their share of publicity.



"O.B." À LA FRANÇAISE. Outside broadcasting vans have not yet made their appearance in France. This is how Marseilles staged a running commentary on the sea front.

Daring to Talk to Henry

To show to what absurd lengths this policy of anonymity may go, I may say that official chits are exchanged before an inoffensive journalist may ask Henry Hall for an opinion on the modern girl.

The truth is, of course, that Fleet Street is well able to look after itself in these matters, and enterprising journalists will not be discouraged no matter how much red tape they have to struggle through to reach their goal.

Maurice Winnick's Return

MAURICE WINNICK, who made a broadcasting reputation with his relays from the Piccadilly Hotel and Carlton Hotel, returns to the microphone on February 12th, when his *Ciro's Club Band* is to be relayed from *Ciro's Club*.

Some years ago Winnick undertook a series of engagements on several liners, making more than a score of trips between England and America. Those were the days when jazz music was in great demand; and he decided to stay in America to study this medium and at the same time to take saxophone and clarinet lessons. He returned to England in 1927 and began film work at Elstree simultaneously with the advent of the first talking pictures made in this country. His was the first dance orchestra to be featured in a British film.

Jack Payne on Tuesday

Jack Payne's Band, fresh from another successful tour of Northern England, will return to the microphone on Tuesday next, February 5th, to give an hour's entertainment in the London Regional programme. The band has a new vocalist co-operating with Billy Scott-Comber, whose voice was familiar to listeners during Jack Payne's four years with the B.B.C. The new singer is Ralph Silvester, who is already earning high opinions among public audiences.

News of the Week

Current Events in Brief Review

A Late Starter

HAMBURG'S new 100-kW. station is not yet working on full time. Until February 11th the station will not open transmissions until noon each day. This is due to certain technical adjustments which are not yet completed.

"Crampless" Tuning Knobs

MR. RICHARD HAIGH, English manager of the Gramophone Co., Ltd., stated last week that in designing the two new H.M.V. sets, "Superhet. Four-Forty" and the "Superhet. Five-Forty Radiogram," the research engineers consulted anatomical experts in their search for the best type of tuning knob. "We consider," said Mr. Haigh, "that our new knobs are practically crampless."

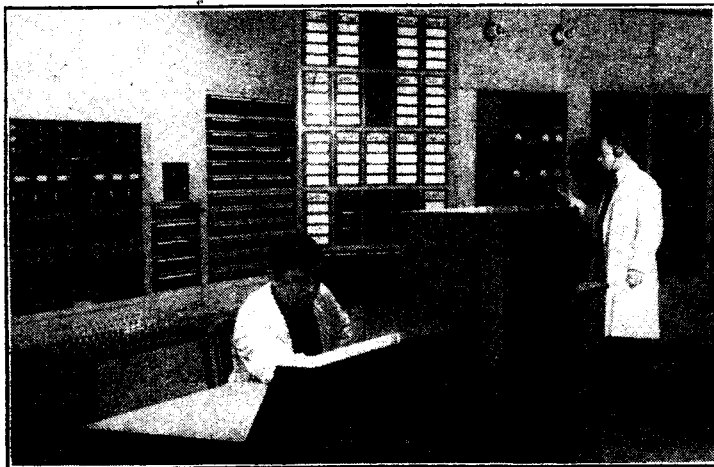
We are gratified at this tribute to *The Wireless World* campaign for more comfortable tuning.

German Station Announcements

A NEW form of announcement is now used by the German broadcasting stations, the opening call being "Hier ist der deutsche Rundfunk," followed by "Mit dem Ursender . . ." and the name of the station of origin. But as many of the German programmes are interchanged, it is often difficult to identify the transmitter from the announcement.

Wireless Pioneers' Society

THE formation of a "Wireless Pioneers' Society" is now being considered by the International DX'ers Alliance. Membership will be open only to 'phone-men, short-wave listeners and rabid experimenters who can furnish suitable proof of having been interested in short-wave work for ten years." The secretary is Mr. Mickelson, 3229, Bloomington Avenue, Minneapolis, Minnesota, U.S.A.



CONTROL: THE LAST WORD. The very latest in broadcast control equipment has just been put into service at the Berlin station. The photograph depicts the main control desk, and, in the background, the indicator which shows studios in use for broadcasting or rehearsals. The interval signal cabinet is on the extreme right.

Unity in Morocco

A MATEURS in French Morocco have just formed themselves into a society known as the Reseau des Emetteurs du Maroc—or R.E.M., for short.

"O.B." Van for Denmark

THE Danish broadcasting authorities have just equipped a motor van for outside broadcasting. The vehicle contains a miniature studio and a short-wave transmitter.

Sweden Buys British

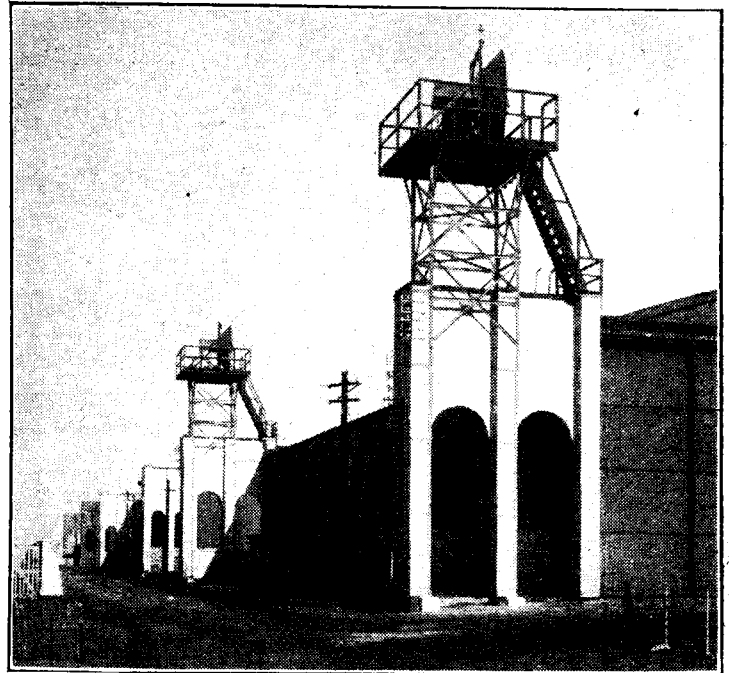
THE MARCONI CO. is to build the equipment for a super-power broadcasting station to replace the existing long-wave transmitter at Motala. The apparatus will be constructed entirely at the Chelmsford works.

Television at the I.E.E.

A VELOCITY-MODULATION TELEVISION SYSTEM will be described by Mr. L. H. Bedford, M.A., and Mr. O. S. Puckle at a meeting of the Wireless Section of the Institution of Electrical Engineers on Wednesday next, February 7th, at 6 p.m. The meeting will be held at the Institution, Savoy Place, Victoria Embankment, London, W.C.2.

Radio-therapy Congress

THE effect of ether waves of varying frequencies on the human body is seriously interesting the medical profession. In September next the first International Congress on Electro-Radio-Biology is to be held in the Ducal Palace, Venice, under the presidency of H.E. Count Volpi di Misurata, Minister of State. Representatives from colleges and institutions in all parts of the world will discuss electric waves, infra-red, ultra-violet, radium and other manifestations of etheric oscillations. The secretary of the Congress is Dr. Giocondo Protti, Canal Grande, S. Gregorio 173, Venice.



RAYS ACROSS THE CHANNEL. Transmitting and receiving reflectors at the new "micro-ray" station at Lympne aerodrome.

Ether Conquerors

THE International DX'ers Alliance has inaugurated a "Goodwill Campaign" in South America. The campaign was opened by Sr. George Vargas, of Peru, with the motto "The conquerors of the ether are destined to be ambassadors of international friendship."

"The Wireless World" Index and Binding Cases

THE index for Vol. XXXIII., July to December, 1933, is now ready and may be obtained from the publishers at Dorset House, Stamford Street, London, S.E.1, price 4d. post free, or with binding case, 3s. 1d. post free.

English Talks from Warsaw

CONTINUING his series of talks in English from the Warsaw station, Mr. Thad Ordon will respond to requests from British listeners by speaking on "The Old Customs of Poland" to-morrow evening (Saturday) at 9.40 p.m.

Mr. Ordon welcomes correspondence from listeners in this country. Letters may be addressed to him c/o *The Wireless World*, Dorset House, Stamford Street, S.E.1.

Local Sets for Germans

ACCORDING to the Munich correspondent of the *Times*, a severe warning has been issued by the Baden and Württemberg Office for Propaganda and Enlightenment to wireless dealers to make no attempt to dissuade their customers from purchasing the popular sets officially recommended by the Nazis with which foreign stations cannot be received.

The reference is to the Volksempfänger, first described in *The Wireless World* of July 7th last. Actually, it is not correct to say that this set is incapable of foreign reception, though it is intended for nearby stations.

17-cm. Radio Link

THE inauguration last Friday of a regular "micro-ray" service between the aerodromes at Lympne and St. Inglevert (near Calais) may well be considered as an important landmark in the history of wireless communication. Wavelengths of 17 and 17.5 cms., as employed by the new stations, it is believed, have never previously been put to commercial use.

Micro-ray telephony may become a serious competitor of the wired telephone; communication is not affected by ordinary forms of outside interference, and the mutual interference problem is, apart from other considerations, almost completely solved by the fact that the radiation is concentrated into an extremely narrow beam, and is confined to an optical range.

The Lympne station, constructed for the Air Ministry by Standard Telephones and Cables, Ltd., is fitted with apparatus that is basically similar to that described in *The Wireless World* of April 15th, 1931, but which has been improved and "cleaned up" in many directions. Both transmitting and receiving reflectors are raised on 40ft. towers, and a special "micro-radion" valve, which functions as an "electronic" oscillator, is now mounted behind the large roft. paraboloidal reflector, being connected to a tiny aerial inside the smaller hemispherical reflector by a short transmission line. Communication is effected by Morse, Creed Teletypewriter, and ordinary telephony.

The Tatsfield Wavemeter

IN the description of the photograph on page 57 of our issue of last week (January 26th) reference was made to the "Brussels" wavemeter. The instrument shown, however, is the well-known Sullivan-Griffiths wavemeter, which is in regular use by the B.B.C.

The Photo-Electric Gramophone

A New System of Electro-magnetic Recording on Film

By ANDRÉ L. J. BERNAERT

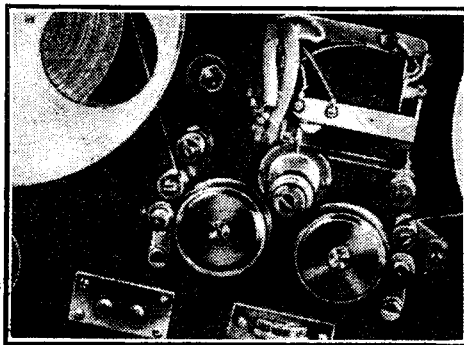
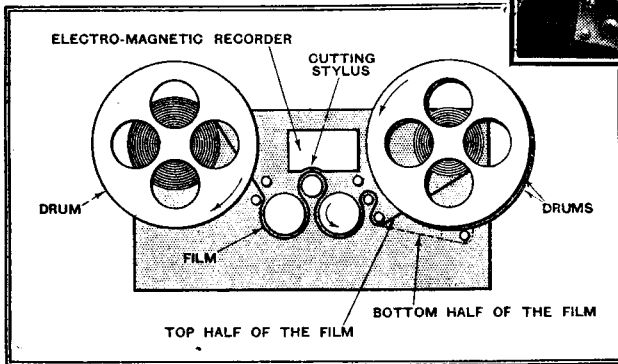
IT seems more than likely that compact spools of film, or even of paper tape, will eventually be used in domestic gramophones, either in place of, or as an alternative to, the present-day type of disc records. A promising method of recording sound on film is here described by a Continental contributor.

THE opinion is growing that, despite progress made in sound-on-disc recording and reproducing, the "sound-on-film" process will probably, as time proceeds, supersede all other methods so far as the domestic gramophone is concerned. The lowest frequencies are easily recorded on film, but the recording of the higher frequencies above, say, 5,000 or 6,000 hertz is still difficult at film speeds determined with regard to photographic considerations—

that it is not a photographic film, therefore it is cheap and easy to handle. Full

reproduction the jagged edge of one of these is interposed between a photo-electric cell and a narrow beam of light. Hence the amount of light on the photo-electric cell will depend on the modulation recorded on the edge of the strip. The resulting variations in electric current will, after suitable amplification, feed the loud speakers.

Good monitoring of the recorded sound is possible, as the reproducing instrument can be fitted alongside the recorder; there is no delay while waiting for developing and printing of the film. Another advantage is that, as the mass of the film is entirely opaque, no scratches will show up and cause "clicks" and background noise, as is the case with the photographic film. In the mechanical recording on film the amplitudes do not exceed $1/10$ mm., and so a slit of light of that length will be sufficient, and the background noise due to the photo-electric cell will be considerably reduced.



The recording apparatus, with diagrammatic sketch to show how the film is divided into two lengths.

advantage can be taken of the fact that at present it is possible to design a recording movement which will have a practically level frequency characteristic up to about 8,000 kc/s. For sound-on-disc work the usual limit

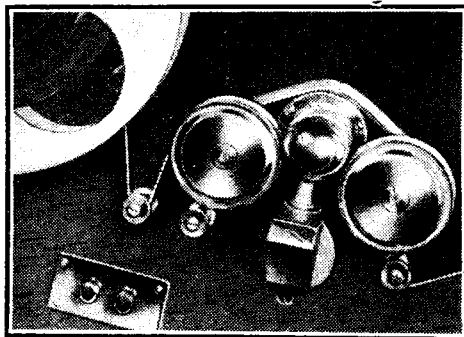
(due to surface noise, etc.) is 5,500 kc/s.

The film is passed at constant speed between a drum and a diamond cutting stylus actuated by an electro-magnetic recorder. When no modulation is applied to the recorder movement, the film is cut in two strips, the edges being straight. When modulation is applied, the cutting point

such as the number of frames per second. But for purely sound recording no such limitation exists, and matters can be so arranged that the upper limit of recorded frequencies lies in the region of 10,000 kc/s.

Up till now the recording of sound-on-film has been practically ruled out for the amateur owing to the costly apparatus involved in the recording process and in the developing and making of prints. The mechanical recording on discs (by the amateur) requires a minimum of special apparatus, and has been instrumental in making home recording a practical proposition. So it is probable that the new system of sound recording on film, recently developed on the Continent, will appeal both to the musician who appreciates extended frequency range and long playing time, and to all those interested in the fascinating hobby of home recording.

The new film recording is electro-mechanical, and so is basically similar to the sound-on-disc method, but reproduction is obtained on lines similar to those followed in the ordinary "talkies" in which the variable-area system is employed. The film used is 16 mm. wide and very thin ($5/100$ mm.), is not influenced by light, and the mass of it is absolutely opaque. A point to be stressed is

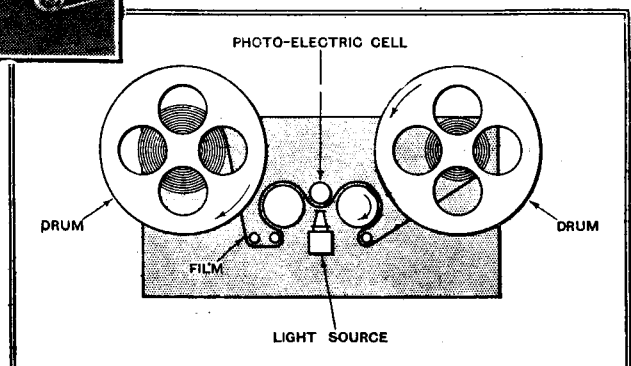


The reproducing apparatus is basically similar to that dealing with ordinary variable-area sound films.

is given a lateral motion while cutting the film; thus, the two strips show undulations on the inner edges corresponding to the modulation, and two copies are obtained at one operation. For

Output and Frequency Range

It is obvious that in sound films in which the variable area system is employed, the maximum output will be obtained when the difference between the opaque part of the sound track and the transparent part is at a maximum. The above condition for maximum output is fulfilled with the system now described, as the film is absolutely opaque and no transparent part exists, while with normal recording the opaque part is never entirely opaque, while the transparent part is never entirely transparent. So far as frequency range is concerned, the new system, while being superior to the sound-on-disc method, is inferior to what can be done in sound recording on photographic film. Another disadvantage is the greater amplification required, owing to the small am-



The Photo-Electric Gramophone—

plitudes of the mechanically recorded sound on film.

When it is desired to make a great number of copies, they are produced photographically from the original jagged strip. It is understood that during the printing process use is made of an optical system to enlarge the amplitudes ten times, while the length of the cycle is not altered. Thus, the copies obtained are nearly equivalent to those which would be obtained from a photographically recorded sound film.

A roll of film, 30 cm. diameter, represents a playing time of about 45 minutes. Another model is being developed which will provide an uninterrupted programme

for several hours. For reproduction, a photographic film will be used, carrying eight separate sound tracks, which are automatically switched-in one after the other.

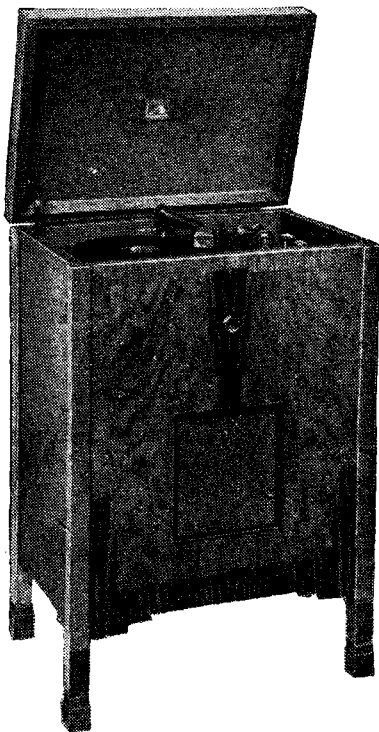
The writer has not yet had an opportunity of carrying out measurements on the instrument, nor of putting it through severe tests. But, after close examination of its special features, and as far as could be judged aurally, the conclusion was reached that it is superior to the ordinary disc. There is no doubt that it will open up a new field, and, while providing the amateur with a practical home recorder, will offer him plenty of scope for experiment.

Two New H.M.V. Models

Table Model and Radio-gramophone

THE two new H.M.V. receivers which were officially released yesterday are remarkably good value for money. The Model 440 for A.C. mains is priced at 12 guineas, and the Model 540, a radio-gramophone, at 20 guineas. There are additional models for D.C. mains at an extra cost of one guinea in each case.

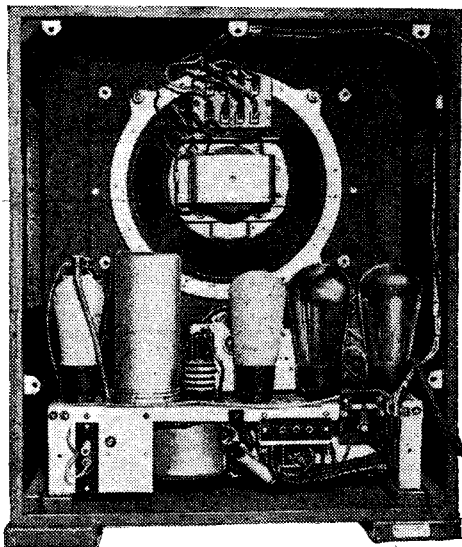
The receiver chassis in both instruments is a superheterodyne employing five valves (including rectifier) with a band-pass input circuit and whistle suppressor circuit. An illuminated horizontal scale is calibrated in wavelengths and each instrument is provided with a tuning chart showing the new positions of the principal European stations. A special disc representative of the latest electrical recordings will accompany each radio-gramophone in order that the purchaser may be in a position to appreciate the full capabilities of the instrument.



An H.M.V. radio-gramophone for 20 guineas—
—the Model 540.

From an examination of the sets it is obvious that no sacrifice in the quality of the cabinet work or the circuit specification has been made. The reduction in price has

been effected by installing new machinery, so that 95 per cent. of the parts used in the



Back view of the "Superhet Four-Forty"
table-model.

finished instrument are now manufactured at Hayes. It is also anticipated that the large numbers of employees who would normally be dismissed during the "slack" summer months will be kept on and that the overhead costs of training new operatives will be eliminated.

THE SHORT-WAVE WORLD

A Great Empire Contest

DURING the next four week-ends everyone who listens on the short-wave amateur bands will hear "Test B.E.R.U." at frequent intervals from practically every active British station. If conditions are as good as they usually are during February, the listener versed in the art of holding weak amateur signals may also expect to receive quite a record number of Empire stations.

The R.S.G.B.'s annual British Empire Radio Union Contest is the one event during the year which brings into action practically every amateur in the Empire who has a transmitter and the requisite enthusiasm for putting it into service, and it is usually favoured by excellent radio conditions.

As a rough guide, which may serve

equally well for interested listeners and transmitters who have lost touch with the short waves, but are thinking of "coming back," some indication is given herewith of the best times at which to listen on the 20- and 40-metre bands.

Logs for the last three years during February have been carefully compared during the compiling of this information.

The 20-metre band should be good for contacts with Australia and New Zealand between 8 a.m. and 2 p.m., with "peaks" for Australia about midday, and New Zealand about 10 a.m. Canada should be heard from midday until 5 p.m. or after; South Africa may possibly come through in the late afternoon, but seems rather doubtful.

During the morning it may also be possible to hear stations in Hong Kong, India, and probably the West Indies. The pure "locals"—Iraq, Egypt, and Nigeria—should be audible nearly all day.

The 40-metre band will probably be more useful than the 20 for consistent DX work, since the Antipodes are usually outstandingly good both in the mornings and evenings. The early period extends from 6.30 a.m. till 9 a.m. or after. From that time onwards the band is not of much use until 3.30 or 4 p.m., when the Antipodes start coming in again—presumably "the other way round."

Last year the writer logged Australia, New Zealand, India, several South and Central African countries, Hong Kong, Singapore, Canada and Barbados between 6 and 7 p.m.

The Antipodes have generally faded out soon after 8 p.m., after which very little remains except South Africa and Canada. Every reader of these notes who is interested in amateur work and can copy Morse should make a point of spending an hour or so on the 20- and 40-metre bands for at least one week-end in February.

Wavelength Muddle

Short-wave broadcast has been fairly consistent during the past fortnight, although the time seems overdue for a rearrangement of wavelengths similar to that which has just been successfully carried out on the normal broadcast bands.

So many short-wave stations seem to be a law unto themselves that the interference problem is becoming more acute each month. Broadcast stations and commercial stations work in the amateur bands; commercials work in the broadcast bands (although, be it said, there is no trace of amateurs working outside *their* own preserves!).

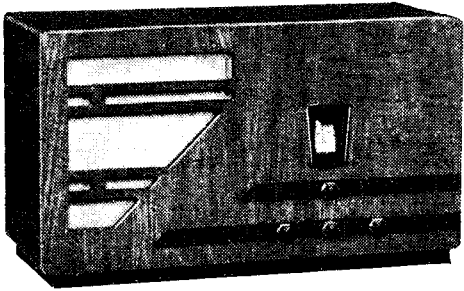
The 19-metre band is more free from interference than any of the others, although unfortunately it is less reliable than either the 25-, 31-, or 49-metre groups. W2XAD, W8XK and W2XE have all been good, as has W3XAL on 16.87 metres. Just at present, however, these stations have little interest to the man who is not free in the afternoons, since they have generally faded right out by 5 p.m.

All the Americans listed between 46 and 50 metres may be heard on a good night, and Nairobi on 49.5 metres is also worth listening for between 4.30 and 7 p.m.

It is also worth while to remember that there are several interesting transmissions to be found *between* the 31- and 49-metre bands, mostly in the region of 37 metres. Two Brazilian stations, PRDA and PSK, may often be heard before midnight.

MEGACYCLE.

Standard "60" Superheterodyne



Exceptionally Good Tone in a Table Model

BETWEEN the popular four-stage superhet. at 14 or 15 guineas, and the six- or seven-stage type at 20 or 25 guineas, there is a gap which has been rather neglected by designers and manufacturers. The receiver under review will, therefore, appeal to those who cannot afford to buy the more expensive type, but who require a performance somewhat above the average of the cheaper superheterodynes.

There are six valves, including the rectifier, and the five amplifying stages are made up as follows: An H.F. amplifier working at radio frequency is coupled to the detector-oscillator valve through a tuned transformer. Both these valves and the I.F. amplifier which follows are of the H.F. pentode type. Four tuned circuits are associated with the I.F. stage, and the voltage across the secondary of the I.F. output transformer is connected to the diodes of a duo-diode triode second detector valve. Full-wave rectification is employed, and automatic bias is applied to the input H.F. and the I.F. amplifier. The full bias voltage is applied to the first valve, and a potentiometer arrangement supplies a reduced voltage to the I.F. valve. The volume control preceding the triode amplifier portion of the second detector valve is interesting, as a tuned acceptor circuit is connected across the lower half of the resistance to give automatic tone compensation in the bass and treble when the volume is reduced.

Resistance coupling is employed between the detector and pentode output stages, and the manual tone control consists of a variable capacity across the input circuit of the latter valve. The moving-coil loud speaker is of "Standard" design and manu-

facture, and the diaphragm is fitted with a flexible surround material which gives a much lower response in the bass than is customary in units of this size.

The chassis is well constructed, and the tuning condenser is mounted on rubber supports. All valves carrying H.F. currents are screened in metal containers specially designed to give adequate ventilation. The controls are well placed, and from a mechanical point of view are smooth and precise in operation. Sockets are provided

done to facilitate the use of anti-interference lead-in systems if desired.

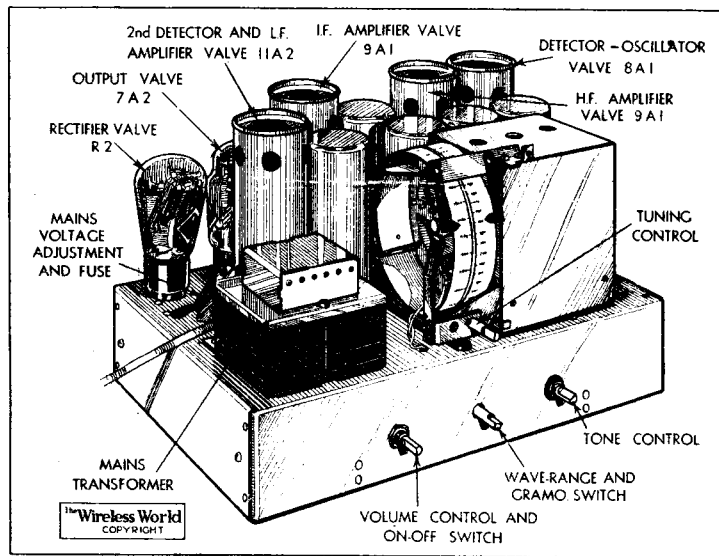
We have no hesitation in saying that the performance of this set will give satisfaction from whatever standpoint it is judged. It is extremely lively, and the distant reception enthusiast will have no cause to wish for greater range. The selectivity is sufficient to cut out the Brookmans Park stations in Central London within two channels of their normal settings, while on long waves Daventry, Königswusterhausen and Moscow

No. 1 are easily separated. The automatic volume control works well, and there is remarkable freedom from second channel whistles and background noise generally. Finally, the tone is of a quality which is rarely to be found in table model receivers, and the depth of bass response would do credit to a cabinet radio-gramophone. By this we do not wish to infer that the quality is "boomy"; on the contrary, the balance of tone is excellent and the automatic tone control ensures that this

balance is maintained at low volume levels. The bass is obtained, as it should be, by diaphragm amplitude and not by cabinet resonance.

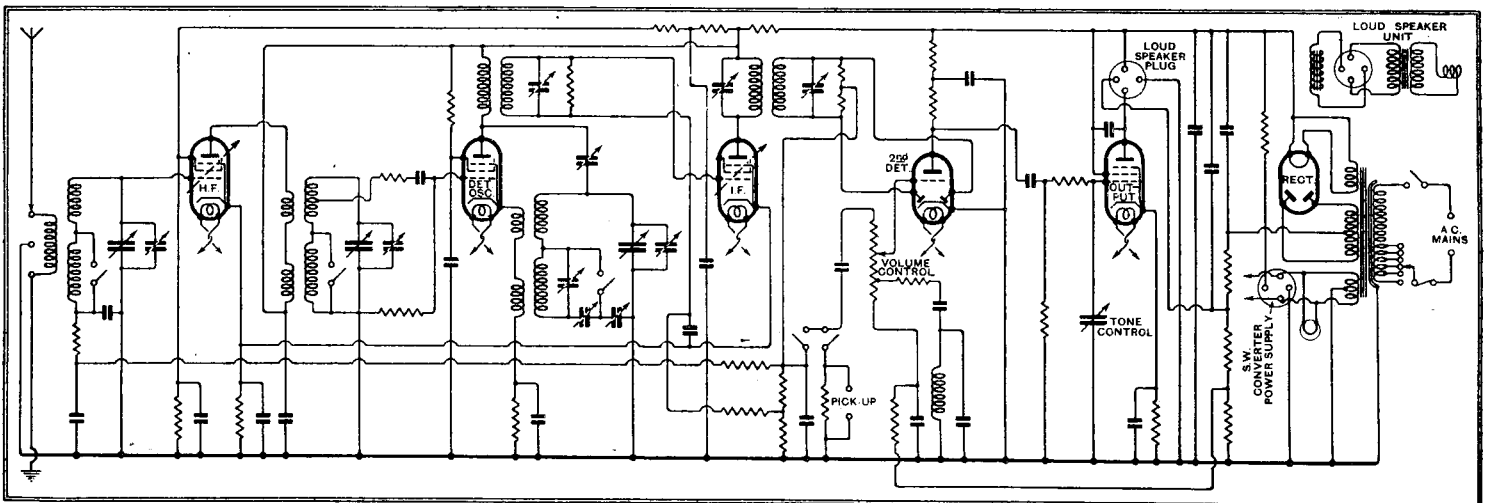
From every point of view a "thoroughbred," and excellent value for money.

FEATURES.—**Type:** Table model superheterodyne receiver for A.C. mains. Automatic volume control. Moving-coil loud speaker. Provision for pick-up and short-wave converter. **Circuit:** Pentode H.F. amplifier—pentode frequency changer—pentode I.F.—duo-diode triode 2nd det.—pentode output valve. Full-wave valve rectifier. **Controls:** (1) Tuning, with illuminated drum dial calibrated in wavelengths. (2) Volume control and on-off switch. (3) Waverange and gramo. switch. (4) Tone control. **Price:** £16 17s. 6d. **Makers:** Standard Telephones & Cables Ltd., St. Chad's Place, 364, Gray's Inn Road, London, W.C.



With the exception of the rectifier and output stages, the valves are enclosed in well-ventilated screening cans.

at the back of the chassis for a gramophone pick-up and also for a short-wave converter. It will be seen from the circuit diagram that the chassis is not connected to earth internally but is brought out to a separate socket on the terminal strip. This has been



Complete circuit diagram. Provision is made for the addition of a short-wave converter unit.

Letters to the Editor :—

Standard Practice in Nomenclature

Tuning Scales : Who Will Pay? : "Ten Years Ago" : Do Transmitters Tire?

The Editor does not hold himself responsible for the opinions of his correspondents

Nomenclature

I AM in complete agreement with Mr. E. M. Lee when he suggests that *The Wireless World* would be performing a service to radio in endeavouring to secure standard practice in nomenclature. There is a good etymological and scientific case for confining the word "interference" to a clashing between wave motions. But "disturbance" does not seem an entirely satisfactory description for the interruptions of electrical noises. In fact, it seems that for a really definitive and expressive term we are going to have a laborious hunt. There is never any doubt what Americans mean when they talk about "static" and "man-made static," but preserve us from a "man-made static suppressor"!

"Interruption" itself suggests a complete break, and may therefore be rejected. Let us be bold and call a spade a spade and a noise a noise. The word "noise" itself is too vague and general, but what about "racket" and "racket suppressor"? It is a word that might well be claimed for the special meaning of electrical interference as reproduced in the loud speaker. It is sharp and concise, better far than the somewhat nebulous "disturbance." The only objection that I can see is the shady significance that the word has taken on in America, which prejudices the mind of the hearer against it. However, I would be very willing to accept "disturbance" rather than allow the present confusion to continue.

May I, therefore, suggest that *The Wireless World* begins publication of recommended nomenclature? This correspondence merely touches the fringe of the subject. When we find that there is still doubt as to what is meant by "short waves," the situation becomes impossible.

L. MARSLAND GANDER.

London, W.11.

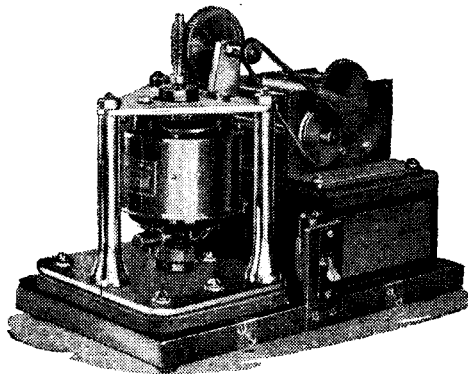
Tuning Scales

YOUR recent editorial on the subject of tuning scales and clear visibility is, for the non-technical user, of more than ordinary importance. In South Africa programmes are broadcast from three stations only—at Johannesburg, Cape Town, and Durban; if something different is desired we must try for Europe or U.S.A. The average user twisting the knob or knobs on the average tuning scale discovers he is hopelessly handicapped even with a ten-valve super-het. because the marking divisions are too close together on the absurdly small half-circle dial with its tiny opening through a pretty-pretty escutcheon.

Some three years ago a British set manufacturer produced a full-circle dial surrounding, and larger than, the loud-speaker opening it enclosed. This was so great an improvement that it is surprising the company seem to have discarded that device. Recent advertisements in *The Wireless World* indicate some progress; I refer to the full-vision horizontal scales, yet these are nothing more than the ancient half-circle transformed to a straight line and still retaining all the inherent defects of divisions or degrees too

closely spaced in the available length. On my set I find that each dial would need exactly six inches if transposed to the horizontal line.

Is there any vital objection to the following rough idea? Horizontal full-vision opening in panel, minimum length 15 inches, split up into the conventional ten main divisions and sub-divided as closely as the main divisions permit. Thus each main division would occupy $1\frac{1}{2}$ inches, and, if sub-spaced by thirty-seconds of one inch, would permit of forty-eight sub-section markings, or a total of 480 in the 15 inches. But by utilising a metric scale of half-millimetres for the sub-division marks, then the total would be, approximately, 750 on a 15-inch horizontal dial. I notice that on one commercial straight-line dial the vertical cursor line from a slide rule has been utilised; why not go the logical step forward and copy the cursor square-shape magnifying lens at additional cost of about 2s.? With this aid, on a horizontal 15-inch dial divided by half-millimetre marks, fitted to a modern super-het. set, one could read to quarter-millimetre divisions. To complete the scheme, use two concentric knobs, one with direct drive for quick general location, and the other with a re-



OSLO'S INTERVAL SIGNAL, the motif from Grieg's "Sigurd Jersalfar," is provided by this new drum device, specially supplied by the engineers of Radio Budapest.

duction drive of at least 50 to 1, or even 100 to 1 for short waves.

Johannesburg.

VEEAITCH.

Who Will Pay?

YOUR special correspondent in "Broadcast Brevities" in *The Wireless World* of January 19th discusses the economics of interference.

His argument concerning the refusal of a manufacturer to pay for an anti-interference device is quite sound, but in answer to his query, "Who will pay" to avoid disturbance of honest neighbours? May I suggest that the B.B.C. might easily divert a little of its enormous income to such a worthy channel?

A small grant given to the manufacturers of electrical machinery liable to cause interference would allow the introduction of smoothing devices at the source.

L. K. G. CARTER.

London, S.E.6.

"Ten Years Ago"

IN the very interesting review of "Ten Years Ago" on page 480 of your issue of December 22nd, I am improperly credited with being the first American amateur to establish two-way Transatlantic communication—with Mr. Leon Deloy, of Nice, France. The work on this end was done by station 1MO, as stated, but that station belonged to, and was operated at the time by, my brother officer in the A.R.R.L., Mr. Fred H. Schnell, then our traffic manager.

I did have the honour of being the first American amateur to establish contact with a British amateur, operating Mr. Schnell's station, 1MO, upon the first exchange with 2KF, Mr. J. A. Partridge, as also reported by you.

Schnell and I were often mistaken for each other in those days, the more particularly as we lived together at the time.

K. B. WARNER,

General Manager,

The American Radio Relay League.

Do Transmitters Tire?

THE interesting correspondence from Messrs. Dinsdale, Croft, and Jolly prompts the following:—

I recommend reference to the papers of Barfield, on the attenuation of wireless waves over land, before the Institute of Electrical Engineers in 1928, and again in collaboration with Munro in January, 1929, for support of the suggestion put forward by Mr. Croft.

I am sure Mr. Croft will permit me to correct him on one point; it is incorrect, in my opinion, to say that a receiver, even assuming stability, will re-radiate a signal in anti-phase to the received signal, or to say that an aerial does not absorb power. Reference to Barfield will show that an aerial does absorb power, and this alone causes a re-radiation of energy in anti-phase; it is not a function of the receiver.

This point allowed, I agree that Mr. Croft's suggestion is probably the correct one. The presence of an increasing number of antennas tuned to the broadcast band, and the erection of steel buildings, etc., in the line of reception of the true ground wave, would account for progressive loss of field strength from any particular transmitter.

I also agree with Mr. Jolly that electrolytic action at the earthing system of a transmitter is likely to have a small bearing on the performance, and I must point out to Mr. Dinsdale that, even if this occurred, the performance of a transmitter can be checked—periodical field strength measurements would indicate immediately to the operating staff that a loss of efficiency was occurring. It is more likely that a variation in efficiency occurs on the receiving plant due to a lack of periodical maintenance.

Lastly, in regard to the consistency of ships' transmitters, I suggest that the small attenuation offered to the signal on its passage over open sea is the reason for the consistency of performance.

L. F. ODELL.

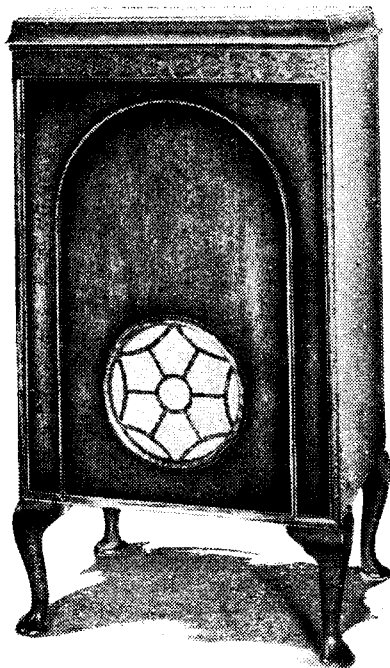
Harrow Weald, Middlesex.

New Apparatus Reviewed

Latest Products of the Manufacturers

PICKETT'S CABINETS

THE specimen cabinet submitted for examination by Pickett's Cabinets, Albion Road, Bexley Heath, Kent, is that described as the Royal-Grand radio-gramophone model. It is an attractive piece of furniture and measures 41in. high, 22in. wide, and 16½in. deep. The gramophone compartment provides ample space for the customary fittings, the head-room allowed for the pick-up arm being 3½in., including the recess in the lid.



Pickett's Royal-Grand radio-gramophone cabinet.

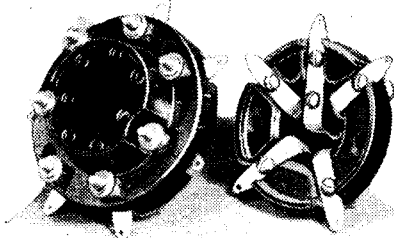
Accommodation is provided for a receiver chassis up to 18in. x 15in., and the height of this compartment is about 12in. The loud speaker compartment, which forms the lower half of the cabinet, is approximately 20in. wide, 14½in. deep, and 14½in. high, so there is ample space here for a power pack or batteries as well as the loud speaker. There is a removable back of thin wood, with a large circular opening fabric covered to exclude dust, so that the acoustic properties should be good and, but for a slight accentuation of the bass, this was found to be so when a test was made with a loud speaker in position.

Finished in polished oak the price is £5 5s., or in walnut £6 6s. A baffle board is included, and the cabinet can be supplied with a plain front, as illustrated, or with an opening cut for a panel to suit individual needs.

BENJAMIN VALVE HOLDERS

IN the latest style of valve holder made by Benjamin Electric, Ltd., Tariff Road, Tottenham, London, N.17, a very thin shell of moulded bakelite is used to support the one-piece nickel-silver contact springs which

in this type are fitted in place of the customary sockets. Contact is made with the sides of the valve pins, and as the springs



Benjamin five- and seven-pin valve holders; note the fixing and the formation of the one-piece contact springs.

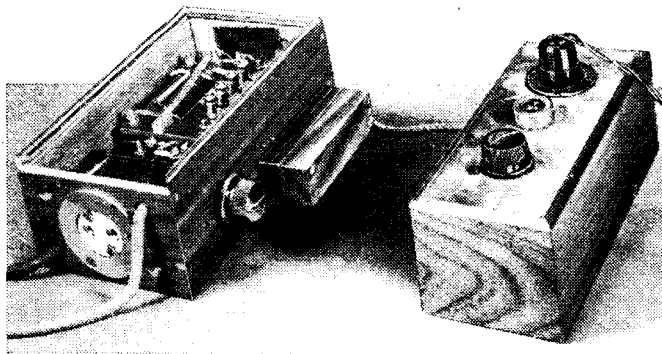
are very stout and securely anchored there is little likelihood of them becoming displaced and failing to make contact. The terminals can be reversed quite easily for under-deck wiring if necessary.

With the seven-pin type the electrical contact was found to be entirely satisfactory at every point; furthermore, the valve can be inserted without undue pressure.

They are available in five- and seven-pin models, and the prices are 10d. and 2s. respectively.

REMOTE CONTROL INSTALLATION

WITH the remote control system evolved by Radio Furniture and Fittings, Ltd., 106, Victoria Street, London, S.W.1, the broadcast programme can be listened to in any room in the house fitted with a control panel and an additional loud speaker. The whole idea of this system, however, is not merely to provide an extension point, but it enables the volume to be adjusted and the receiver to be switched on or off at any remote control panel; and each has an indicator lamp which remains alight at all control points until the set is switched off. The number of loud speakers in use simultaneously depends, of course, on the power rating of the output valve, but in most mains sets it should be possible to operate two extension loud speakers, or the speaker



Radio Furniture and Fittings remote control installation comprising master unit and remote control panel.

in the set and one at the distant point, quite satisfactorily. For with this system the loud speaker embodied in the set need not be always in action.

The equipment consists of a master control unit, which is installed near the set or preferably inside the cabinet if space allows, remote control panels for the distant points, and distribution boxes for interconnecting

the remote panels. Only one master controller is needed for each installation and any number of remote panels can be employed, but a loud speaker need not be provided for each, as it can be carried from room to room and plugged into the control panel there installed.

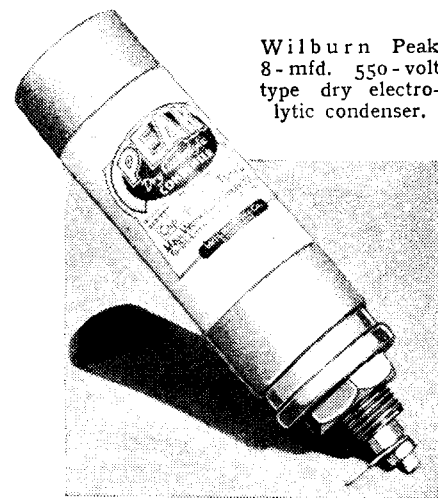
The equipment is entirely A.C. operated, but only low potentials, derived from a secondary winding on the transformer in the master unit, are employed for control.

The installation has been tested and has proved entirely satisfactory. It is exceptionally well made, is very robust and should not require attention, since there are no moving parts likely to wear out. The relay in the master control is thermal-operated, and no adjustment is required, or, indeed, allowed for. On the whole, it seems a very sound system, and can be recommended.

For a single extension without a volume control attachment the remote control relay alone would suffice, and this costs 30s. The master unit complete costs 52s. 6d., and the remote control panels 23s. 6d. each, while distribution boxes are available at 7s. 6d. each. The special six-wire cable provided costs 3d. per foot.

PEAK DRY ELECTROLYTIC CONDENSERS

WILBURN AND CO., Wheatsheaf House, Carmelite Street, London, E.C.4, recently introduced a range of dry electrolytic condensers, which includes high-



Wilburn Peak 8-mfd. 550-volt type dry electrolytic condenser.

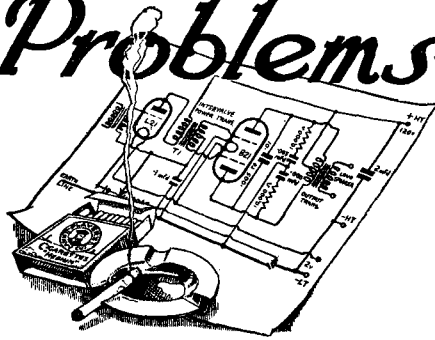
and low-voltage types, and some large capacity models for use in grid bias circuits.

The specimen tested was an 8-mfd. size rated at 550 volts D.C. working, this being the maximum voltage the condenser is designed to withstand under working conditions. At a potential of 500 volts our specimen showed the very small leakage of 0.25 mA. It successfully withstood a potential of 600 volts, but an increase of 20 volts gave indications that the safe limit was passed. For the leakage current fluctuated considerably, and slight internal sparking was audible.

The working value of 550 volts peak allows an adequate margin of safety, but it would be unwise to exceed the rated maximum given, for any considerable increase would undoubtedly cause serious damage to the condenser.

The price of the 8-mfd. size is 5s.

Readers' Problems



THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

Two Fuses for Safety

ALTHOUGH a single fuse inserted in one pole of the mains supply to the receiver will confer a measure of protection, it is better in this matter to follow convention and to fit a fuse in each lead.

For instance, a querist, in spite of the fact that a fuse—but only a single one—is fitted, tells us that he has twice "blown" the house fuses by making an accidental internal short-circuit, but the fuse built into the receiver remains intact. This he cannot understand, and asks us to give an explanation.

Assuming that the receiver fuse is of suitable gauge, there can be no doubt that it is wired on the earthed side of the mains supply. This is wrong; a single fuse should always be in the "live" mains lead.

Calibrated by Hand

REFERRING to the 1934 Station Finder, described in *The Wireless World* of January 12th, a correspondent asks for advice on how to use a variable condenser already in his possession, of a type other than that described in the constructional article. It is realised that, as a result of this alteration, the published calibration scale can no longer be expected to hold good.

Probably the best plan to be adopted in these circumstances is to fit the Station Finder temporarily with an ordinary 0-180 degree dial, and then to note the readings corresponding to a number of known stations (that can be depended upon to work on their allotted wavelengths) at points well distributed round the scale. A graph, in which these points are plotted against frequency, is next prepared, and, lastly, the allotted frequencies are transferred to a station-name scale.

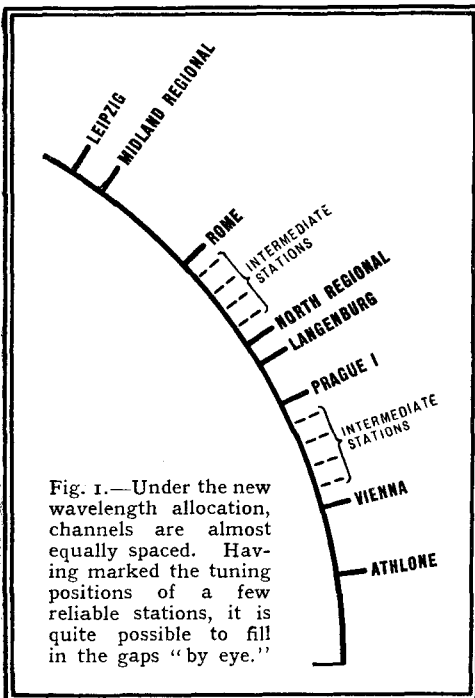


Fig. 1.—Under the new wavelength allocation, channels are almost equally spaced. Having marked the tuning positions of a few reliable stations, it is quite possible to fill in the gaps "by eye."

Another way is to fit a pointer and blank scale on which tuning positions may be marked temporarily with a pencil, and finally with ink, working in the manner suggested in Fig. 1. Having obtained the tuning positions of as many known stations as possible, intermediate stations may be added "by eye" or with the help of a pair of dividers. Although modern condensers

do not give a perfect "straight-line-frequency" tuning curve, it is quite safe and permissible to assume that the spacing between channels will be equal over perhaps as much as 20 degrees of the scale. The intermediate stations are, of course, filled in by referring to a list of stations, such as that published frequently in the programme section of *The Wireless World*. Before doing so, the number of channels between adjacent "key" stations must be counted.

These remarks apply to the calibration of both wavemeters and receivers. Direct calibration by the second method is attractive because it involves no intermediate processes.

Loss and Gain

THE user of a straightforward "I-H.F." receiver with band-pass input finds that the tuning range of his receiver is somewhat restricted, and so he is unable to receive two or three stations at the upper end of the medium broadcast band. The question asked is whether it will be advisable to make an attempt to increase the upper limit of wavelength by re-trimming with more capacity in all three circuits.

If there is sufficient latitude of trimming adjustment, it will certainly be possible to do this, but it is questionable whether such a course is always to be recommended. In order to gain, say, three channels at the upper end of the wavelength scale, it will be necessary to sacrifice a much greater number at the lower end. However, in view of the fact that most of the low wavelengths are

The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

allotted to "common" channels, it is quite possible that the plan will suit our correspondent's needs. The only other way out of the difficulty would be to obtain new coils with higher inductance, or to add turns to the existing coils, and, of course, to "re-match" them.

The Light that Wouldn't Fail

A CORRESPONDENT tells us that he has recently connected an anti-interference filter (consisting merely of a pair of condensers in series with the junction point earthed) to the mains input of his A.C. receiver. So far as background noises are concerned, the addition has proved eminently satisfactory, but a minor trouble has arisen; a table lamp, wired across the mains leads which feed the receiver, cannot now be switched off. On opening the switch built into the wall socket fitting through which current is obtained, the lamp is dimmed, but still continues to glow with fair brilliancy until the wall-plug is removed.

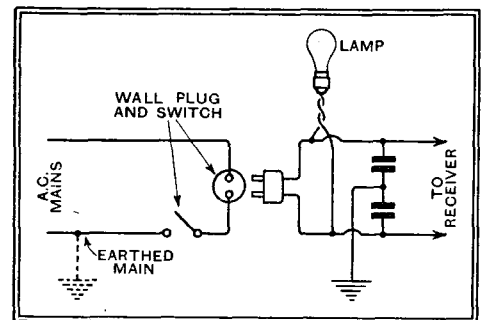


Fig. 2.—Illustrating a common fault in electrical wiring. As the switch is in the earthed lead, there is an alternative path for A.C. current through the condenser filter.

We expect that matters are arranged as in Fig. 2; the switch in the wall-plug fitting has been wrongly installed in the earthed main lead instead of in the "live" lead, as it should be. A consideration of the diagram will show that even when the switch is open a path for current exists from the unearthed main through the lamp and back to earth through one of the filter condensers.

The right thing to do would be to have the switch changed over to the other lead. A second switch, in series with the lamp, seems also to be indicated.

Finally, it would appear that the condensers used in the filter are unnecessarily large.

Changing Loud Speakers

A CORRESPONDENT has found that his receiver is quite stable when a moving-iron loud speaker is employed, although it goes into a state of violent self-oscillation on substituting a moving-coil instrument.

Effects of this nature are by no means unknown, and are often to be ascribed to differences in capacity to earth between the two loud speakers and to other physical peculiarities. Very probably a good deal of H.F. energy is filtering through to the output stage, and a greater proportion of it is fed back to the aerial end of the set with the moving-coil loud speaker.

Again, it is possible that the trouble is not of an "H.F." nature; maybe it is due to microphonic feed-back at a fairly low frequency, which is reproduced at greater strength by one speaker than by the other. In either case the remedies will be fairly obvious.

The Wireless World

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*As many of the circuits and apparatus described in these
pages are covered by patents, readers are advised, before
making use of them, to satisfy themselves that they would
not be infringing patents.*

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EDITORIAL COMMENT

Adherence to Wavelengths

Is Compulsion Possible?

WHAT will be the future trend in European broadcasting development? The Lucerne Plan has probably succeeded as well as its sponsors anticipated, but in the process of the change-over it must have brought home to every listener in Europe how near we came to a traffic jam, out of which it might have been extremely difficult to extricate ourselves.

There are still stations which are giving trouble, and others which, while accepting the position and working on channels left free for them, are by no means satisfied and are only adhering to the wavelengths under protest.

Wild Suggestions

Recently some very foolish rumours were started which suggested that some stations of Europe of high power would be detailed to jam the transmissions of those stations which declined to fall in with the Lucerne Plan wavelength allocations. It was even implied that the British Foreign Office countenanced the proposal.

It is more than a pity that such rumours should be permitted to get about. Nothing is more calculated to break up any endeavours to organise European broadcasting on the lines attempted by the Conference which produced the Lucerne Plan than a suggestion that compulsion will be exercised where stations are unwilling to fall in with any plan adopted by the majority. There is a vast difference between organisation by agreement and organisation by compulsion. If once the idea that stations can justify the

principle of elbowing one another out of position to make more room for themselves is accepted, we may just as well say good-bye at once to any hopes for an amicable agreement on wavelength allocations in Europe.

The B.B.C. and Advertising

Is There a Formula?

IT has been laid down that the B.B.C. must not be guilty of permitting the microphone to be used to give publicity to individual commercial undertakings, although by a curious contradiction some unwritten law has been interpreted as exempting their own commercial enterprises from such a ban.

When it comes to the censorship of talks we have often been left in a state of bewilderment after trying to construct for ourselves the formula, if any, employed by the B.B.C. censor in deciding what is, and what is not, advertising. During a broadcast talk the other evening a reference was made to a feature now being conducted in a certain daily paper; the speaker explained that he could not name the paper, but that listeners could probably find out its identity for themselves. Continuing almost in the same breath, the speaker referred to types of articles which would be found helpful to his listeners, and gave the names of two particular daily papers which, he said, would be found to contain articles of this character.

The B.B.C. would be conferring a favour on many inquisitive minds if they would disclose how these differentiations are arrived at and justified.

So much ingenuity in discrimination suggests that it is no ordinary common-sense decision on the part of the B.B.C. censor.

New Television System

Velocity and Intensity Modulation Combined

VARIOUS articles in this journal during the last months of 1933 were devoted to the subject of television, including the general use of the cathode-ray tube for this purpose, and including, also (December 15), an account of a cathode-ray method known as variable speed scanning. This system, which is also frequently described as that of velocity-modulation, has not previously featured in British television practice.

This method of television reproduction is actually by no means new, and appears to have been suggested first in 1911. From then, however (due fairly certainly to the total absence of suitable oscillograph tubes), it appears to have been completely shelved, until it was revived a few years ago in Germany by Thun and von Ardenne.

A new British system, using this method of modulation, has recently been developed in the laboratories of the Cossor Valve Works, and was described by Messrs. Bedford and Puckle, of the Cossor

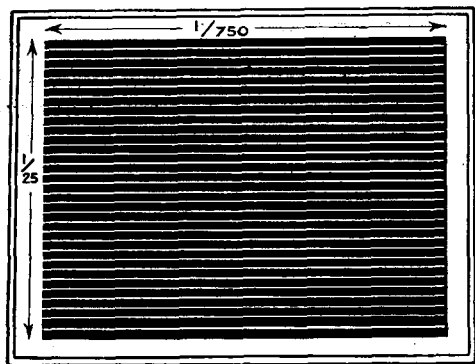


Fig. 1.—Two dimensional scanning for cathode-ray television.

Company, in a paper read before the Wireless Section of the Institution of Electrical Engineers on Wednesday last. In addition to using the system of modulation by variable velocity as its chief means of picture reproduction, the Cossor system employs ordinary cathode-ray intensity modulation as an auxiliary to "intensify" the received image.

Having had an opportunity of witnessing a demonstration of the Cossor apparatus in laboratory operation, the results were found to be very pleasing, particularly in view of the fact that it has been developed in a space of only eighteen months. So far, it has been worked entirely with ordinary commercial type oscillographs, not well suited to the purpose. Hard vacuum tubes, better suited for television, are now in the course of development, and may be expected to effect a substantial improvement on the already good results obtainable.

In the previous article on variable speed scanning, it was pointed out that the



An untouched reproduction of a picture (of about 120 lines) from the receiver tube.

system led to a more complicated type of transmitter than that necessary for the usual intensity modulation method. This appears to be true of the Cossor system, but it undoubtedly appears also to lead to considerable simplification at the receiver. As a guiding principle this must be conceded as a good one.

Although the general principles of cathode-ray television have been previously described, it may be well just briefly to recapitulate them. The typical feature is the use of scanning voltages of the "linear saw-tooth" type for the framing and line scanning motions of the light source, which is, in this case, the fluorescent spot produced on the screen of the oscillograph. Generating circuits for the production of such voltages were described in previous articles. A simple impression of the result is given in Fig. 1, which shows the path of the spot in a 30-line scan, and at the rate of 25 frames per second. During $\frac{30}{750} = \frac{1}{25}$ second the spot moves horizontally, with a sharp return, during which it is also moved down in a sort of ratchet movement, so that it traces its next path in a slightly lower position. At the end of

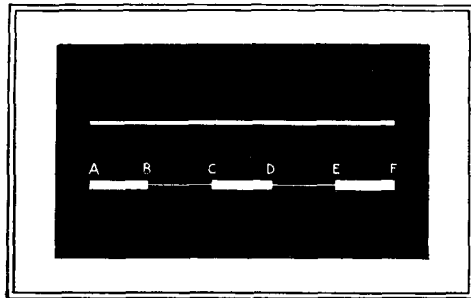


Fig. 2.—Principle of velocity modulation. The top line, is scanned at uniform speed. The bottom line is scanned with a slow movement from A to B, a quick movement B to C, and so on.

$\frac{30}{750} = \frac{1}{25}$ second it has travelled to the bottom, and is abruptly returned to its original position, so that it repeats the course shown every $\frac{1}{25}$ second.

This is the condition in the absence of a picture and the eye. Watching the tube gives the impression of a streaky oblong of fluorescence. Actually it is less streaky than Fig. 1, since the scanning lines used with cathode-ray television are at least 120 per frame, this being the number employed in the Cossor system.

During each line movement (Fig. 1) the brightness of the light produced by the spot is caused to vary in accordance with the impulses from the transmitter scanning. In cathode-ray television practice this is usually done by some form of "intensity control" electrode, which varies the instantaneous intensity of the electron beam, and, therefore, also the brightness of the fluorescent spot in accordance with the picture voltages. The ordinary type of cathode ray tube gives a very small range of intensity control without being accompanied by a defocusing effect on the spot, and special electrode systems have to be arranged for good intensity modulation.

The Cossor system, as already stated, therefore uses this "intensity" effect only as an auxiliary, and does its main picture formation by means of the velocity modulation system.

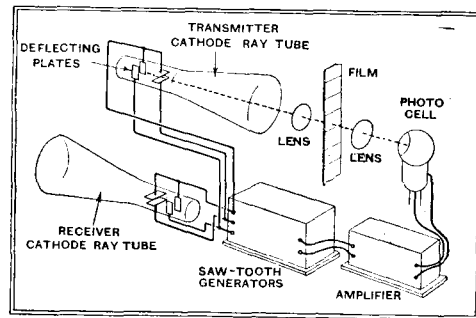


Fig. 3.—The essential layout for velocity modulation television.

This method of modulation uses a scanning system exactly similar to that already described, but is based on the fact that the brightness of the light produced by the moving spot is proportional to the time taken by the spot to travel any particular length along the scanning line. For example, in Fig. 2 the top line represents the effect of a scanning line which takes a certain time to travel from A to F, doing so in a uniform manner. The lower line takes exactly the same total time to travel the distance A to F, but does so in an erratic manner, moving slowly from A to B, producing a bright response, very quickly from B to C, producing a very feeble response, then slowly from C to D. The impression of brightness conveyed to the eye thus varies with the speed, and

New Television System—

it will be seen that dark patches on the reproduction correspond to places where the spot is moving rapidly, and light patches to places where it is moving slowly.

One of the advantages claimed for the Cossor system is the absence of the synchronising problem in the line scanning direction, and that it gives a simple solution of the synchronising problem in the picture traversing dimension, includ-

tube of standard dimensions, the size of picture on the transmitting tube is 6 cm. x 8 cm., the tube working with an anode voltage of 500. In the velocity modulation system each scanning line must be produced by the same total deflecting voltage, that is to say, the length of each scanning line on the tube must be the same even although they need not all take the same time to sweep this distance (according to the amount of light and dark encountered in the scan). It is thus possible to

express the size of picture in terms of deflecting voltages, these being 380 for the horizontal line scan and 285 for the framing scan. The rate of picture presentation is 25 per second, which is governed by an extra timing control circuit which is not shown in Fig. 4. This circuit is controlled from the 50 cycles mains, to which, being a sub-multiple, it is very easily locked at 25 per second.

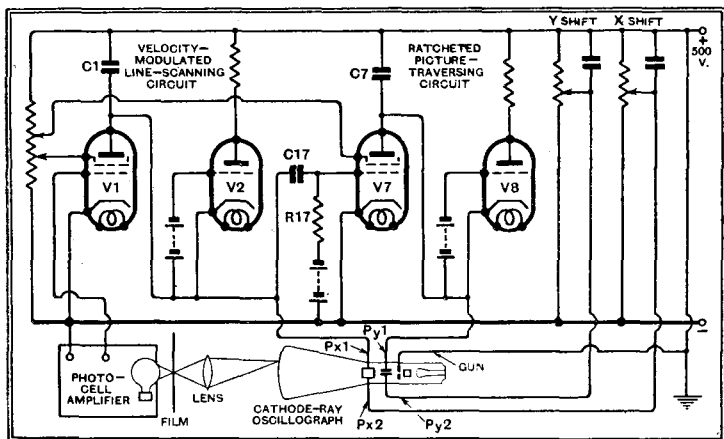


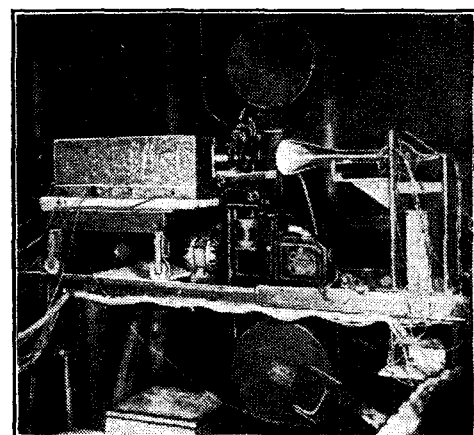
Fig. 4.—Skeleton circuits of Cossor transmitter, V1, C1 and V2 form the line-scanning saw-tooth generator, V7, C7 and V8 the framing saw-tooth generator.

ing the imposition of automatic framing. The lack of a need for synchronising of the line scan is due to the fact that a cathode-ray oscillograph is actually used as the scanning device, and the picture is formed on this tube itself. In the simplest case it is then only necessary to common together the plates of the transmitting and receiving tubes by means of a wire or radio link.

This is schematically illustrated in Fig. 3, but it will be seen that this, in practice, involves two transmission channels. This has been avoided by using one channel to connect the horizontal deflections of both tubes for line-synchronisation, while the framing-synchronisation is effected by a signal impressed on the scanning.

In the Cossor system, using their own

bases with cathode-ray tubes. The principle is that the valve V1 operates under constant-current conditions and allows the relatively slow building up of a charge on C1. This builds up until it reaches a voltage sufficient to trigger V2, which abruptly discharges the condenser. The rate of building up the charge on C1 is governed by the voltage on V1, which is applied from the output of the photocell amplifier, and therefore on the amount of light passed in any scan line. The frame-scanning is also derived from a similar saw-tooth generator comprising the valve V7, condenser C7 and thyatron V8. The building up of the voltage across C7 is controlled by the receipt of impulses from V2 via the condenser C17. This condenser receives an impulse on the abrupt discharge of C1 through V2. The valve V7 is oper-



The transmitting equipment used for the experiments described in this article.

For the transmission of a television picture the film is moved continuously (not in jumps as in ordinary cinema projection) between the transmitting oscillograph and the photo-cell lenses focusing the spot (in its instantaneous position) on to the cell, as shown schematically in Fig. 3.

The complete practical transmitting circuit contains a considerable number of

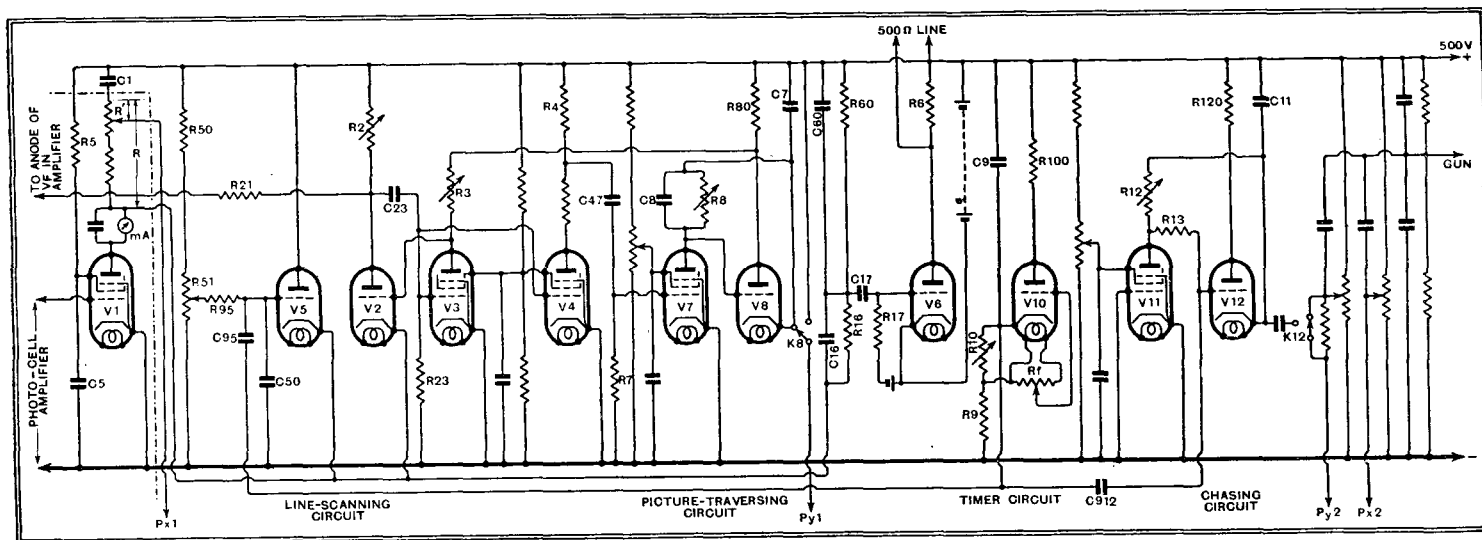


Fig. 5.—The complete scanning circuits of the transmitter system. The valve V1 is located in the photo-cell amplifier to minimise stray capacities.

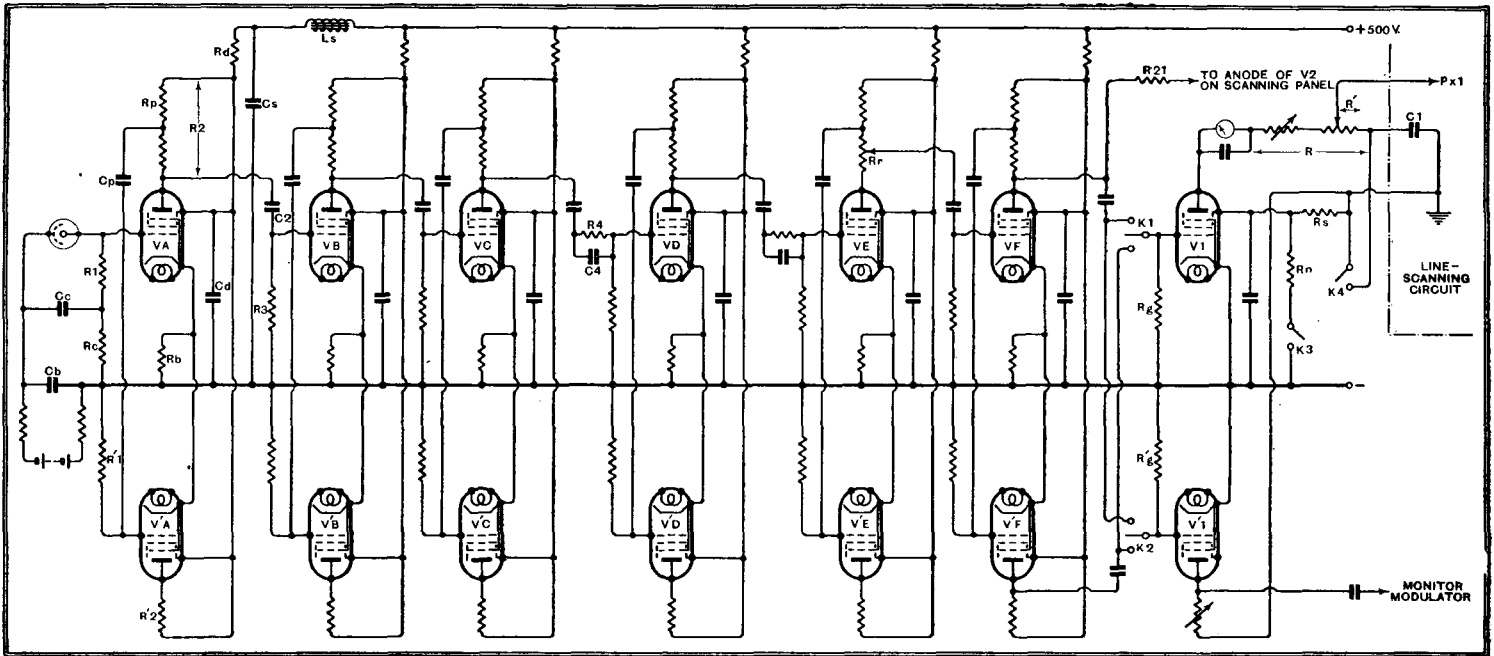
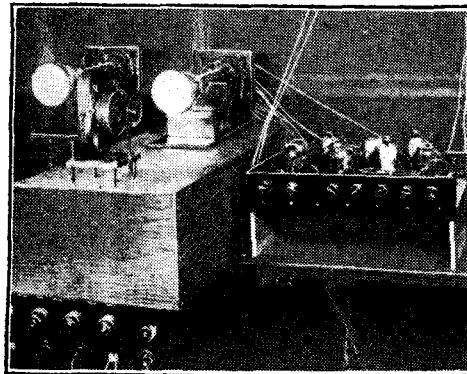


Fig. 6.—The circuits of the "paraphase" photo-cell amplifier.

additions to the simplified scheme shown in Fig. 4. The complete circuit is thus distinctly complicated, but the apparent complications are devised to place all the difficulties on the transmitter and make the operation of the receiver as simple as possible.

The complete transmitter circuit is shown in Fig. 5, but it is impossible in this short account to discuss its operation in detail. The various sections are indicated below the diagram. The line-scanning system is similar to that already described, except that a pair of hard valves, V2 and V3, replace the thyatron V2 of Fig. 4, this giving a more stable circuit for operation at the relatively high-scanning frequency. The picture-traversing circuit is also similar to that already described. The "timer" circuit is another saw-tooth generator (non-linear), operating, as stated, to impress the recurrence of 25 per second on the picture framing, the film being "phased" by means of a take-

up roller, so that the picture-change point coincides with the timer pulse. The "chaser" circuit performs an auxiliary



The apparatus associated with the receiver.

operation in scanning, which need not be considered in this short account.

The photo-cell amplifier is illustrated in full in Fig. 6, and contains an immense

amount of circuit detail, the discussion of which would call for a lengthy article of its own. The essential features can, however, be indicated. These are: (1) A voltage gain of the order of 5,000; (2) effectively flat response characteristics from 25 to 240,000 cycles; (3) a minimum of phase distortion; (4) minimum phase delay; (5) low valve and set noise; (6) low level of microphonic noise; (7) freedom from any form of instability; (8) freedom from pick-up, e.g., of the scanning voltages; (9) preferably mains-operated.

The Cossor system as so far developed has only been operated over a short wire channel. The output of Fig. 5 could, of course, be applied to modulate a radio transmitter, although in the present conditions it has been joined directly to the receiver. The receiver is intended to be operated by signals of low level such as could easily be obtained from a detector.

The circuit of the television receiver after such a detector is shown in Fig. 7. The "size" of the picture is approximately that of 440 volts x 330 volts, the former being that of the line-scan and the

latter that of the ratched frame time-base. The main incoming signal is the line-scanning, which receives two stages of push-pull or "paraphase" amplification before being passed on to the horizontal deflection plates (Px1, Px2, of Fig. 7). A part of the same output is also applied to a valve V3, and through it to V4, which controls a picture-framing, saw-tooth generator V7, C8, and V8 (thyatron)

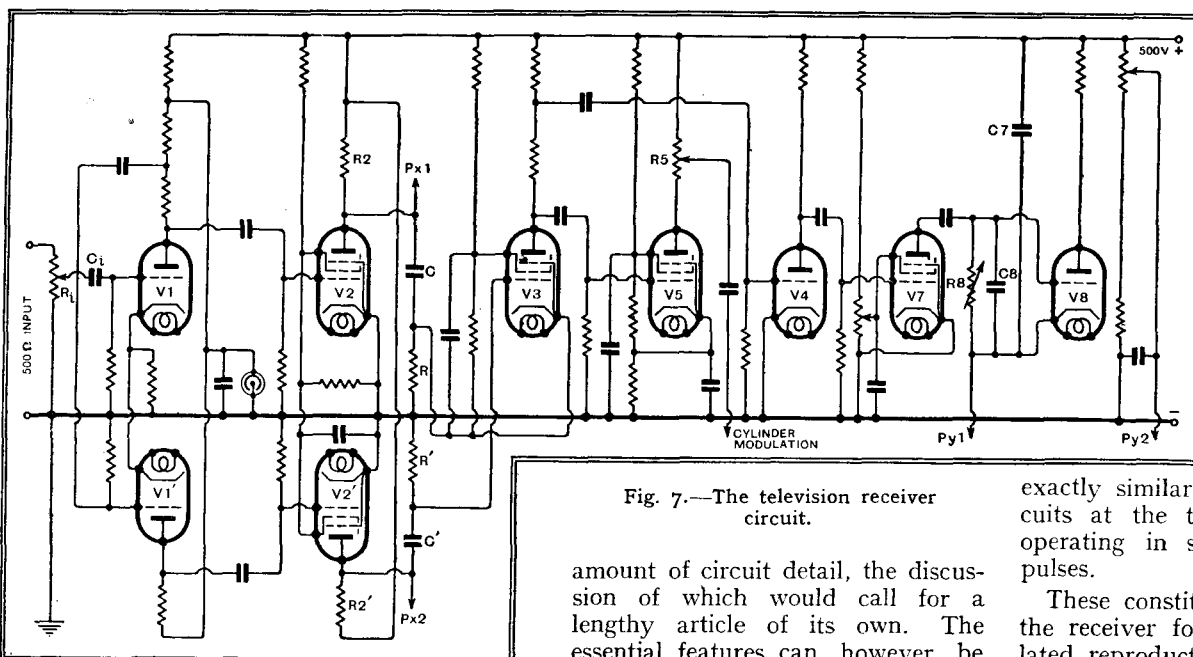


Fig. 7.—The television receiver circuit.

amount of circuit detail, the discussion of which would call for a lengthy article of its own. The essential features can, however, be

exactly similar to the corresponding circuits at the transmitter, and therefore operating in synchronism with its impulses.

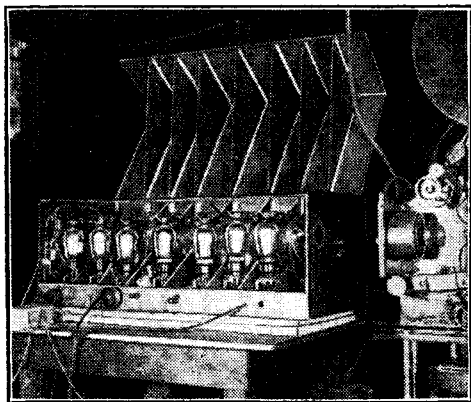
These constitute the essential parts of the receiver for the pure velocity-modulated reproduction of the picture. The

Practical Hints and Tips

Aids to Better Reception

New Television System—

valve V5 controls the "intensification" process, which is obtained by combining an auxiliary contribution of intensity modulation with the chief action of velocity modulation. It has already been stated that the ordinary type of oscillograph is not suitable for use on intensity modulation as its chief work, but it gives a reasonable degree of control of the intensity of the beam which can profitably be utilised. While the main output of the television transmitter (Fig. 5) is the line-scanning impulses of velocity modulation, it can be shown, both by theoretical reasoning and by analysis, that it also contains a component which is similar in nature, although possibly not so great in magnitude, as would exist in a transmitter



The cathode ray amplifier.

using intensity modulation. It can also be shown that the circuits CR and C'R' in the anodes of the valves V2 and V2' act as differentiating circuits, using the word in both its mathematical and physical meanings. This permits that component which is equivalent to intensity modulation to be handed on to V5, from the anode circuit of which it controls the potential of the oscillograph cylinder in order to obtain the intensifying effect in reception.

The operating controls of the receiver are extremely simple, due to the inherent nature of the system and the arrangement of the transmitter. The input potentiometer R1 is adjusted to give the required breadth of picture, and the screen voltage of V7 is set to give the required depth. There is no synchronising adjustment, even for framing, because R8 and C8 are fixed at the correct values. The remaining controls are the intensification volume control R5, and, of course, the focusing of the cathode-ray tube by the usual methods. The above adjustments can only be made while the signal is actually being transmitted and received.

Future possibilities which are envisaged in the improvement of the system lie in the direction of tube design and manufacture. For example, in the receiver tube a 9 inch screen appears a satisfactory compromise, and the design of a tube of this size, also of hard tubes, is in progress. So far as the transmitter is concerned there appears no doubt that the scanning lines could be raised to 150 or 200 at which the theoretical detail approaches that of the home cinema.

WHEN checking the operation of an A.C. mains receiver by the usual method of measuring individual anode currents of the various valves there is always liable to be some uncertainty as to whether low current readings are due to failing emission of the receiver valves or to some defect (also possibly failing emission) of the H.T. rectifier or of associated apparatus.

Anode Current and Rectified Voltage

If it is found that there is an all-round and more or less proportional decrease of current, it is at least possible that the rectifier is at fault. But if some of the anode currents are abnormally low and others abnormally high, one can generally rest assured that the H.T. supply system is free from blame.

This points to the desirability of keeping a record, not only of anode currents, but of the voltage output of the rectifier. Fortunately, a sufficiently accurate measurement may be made with an ordinary moving-coil voltmeter, although, as is well known, one cannot accurately measure the individual anode voltages of the receiver valves themselves without special precautions, and the use of apparatus that is not generally available.

AN important and highly practical contribution to the art of adjusting band-pass circuits was made when it was recently suggested, in the pages of this journal, that band-width should be temporarily narrowed down by shunting each

Shunting Band-pass Circuits

of the component circuits of the filter with a resistance. In the absence of elaborate laboratory equipment there is no other way in which preliminary ganging adjustments may be made with such a high degree of accuracy and certainty. Although the method is nowadays particularly applicable to the band-pass circuits of super-heterodynes, it still has its uses in the signal-frequency circuits of "straight" sets.

As a footnote to what has already been said

A standard slow-motion drive mechanism, modified for use on a calibrated condenser.

on the subject, it is worth while emphasising the fact that the resistance used must be of the composition or metalised type, and not wire-wound; the latter are likely to have an excessively high self-capacity. Further, it is advisable to take

some care that the resistances are mounted as close as possible to the coils, and that the capacity of their connecting leads should be as low as possible. Lastly, the length and the capacity of the connecting leads used in each individual circuit should be sensibly the same, in order to avoid all risk of mis-alignment in ganging.

AS receivers improve, both with regard to selectivity and quality of reproduction, the need for accurate tuning becomes more and more apparent. Users of sets which are not fitted with visual tuning indicators sometimes find real difficulty in

A Tuning Tip

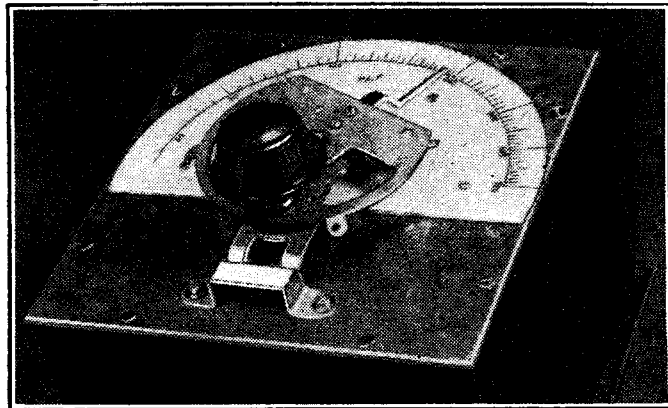
determining whether the circuits are quite accurately tuned; their difficulties will largely disappear if the rule is made always to tune for the lowest-toned reproduction—in other words, "tune to the "bass." Tuning to the lowest pitch is often more accurate than tuning for maximum signal strength.

In any other position the circuits will be tuned more or less to the sidebands, and the best possible quality of reproduction cannot then be attained.

ATTENTION has lately been focused on the question of improved tuning dials, and it would appear that many readers have devoted thought to the subject. Those who are trying to devise better arrangements, or to make large-diameter station-calibrated dials for

Tuning Dials

receivers or wave-meters, may be reminded that many of the slow-motion drive mechanisms that are obtainable commercially may be modified for use in a manner other than that intended by their designers. Most of these drives are intended for



mounting behind a panel fitted with a viewing aperture. It is quite easy to adapt the dial for external fitting in the manner shown in the accompanying photograph. The long pointer is screwed to the rotating arc in place of the usual indicator.

"Ultra-Shorts" for the Police

Two-way Working on American Patrol Cars

NO more practical use could be found for the so-called "optical" waves than the pursuit of gangsters within a confined city area. Here is an interesting account of a two-way ultra-short-wave system which has been put to the test by the police of Bayonne, New Jersey

By WILLIAM W. MACDONALD

IN a land of saints an ultra-short-wave wireless-equipped police patrol car would be a white elephant, so it was fortunate, in a way, that there was still some crime left in New Jersey when the Bayonne police took to radio. Very soon after the first two-way police radio equipment in the United States had been installed, patrol car No. 7 happened upon a large deserted touring car, lights out and motor running at midnight. And at that moment two cracksmen raced out of a

into Main." A mile away patrol car No. 3 intercepted the message to headquarters and in a twinkling was able to round up the thieves.

The new equipment, which has been manufactured by Radio Engineering Laboratories, of Long Island, New York, operates on 8.6 metres. As the City is contained within an area of two by four miles it is adequately served by these "optical" waves. Previously, orthodox long-wave police transmitters hundreds of miles apart have been heterodyned so badly that the police officers welcome the freedom from interference which the new equipment affords.

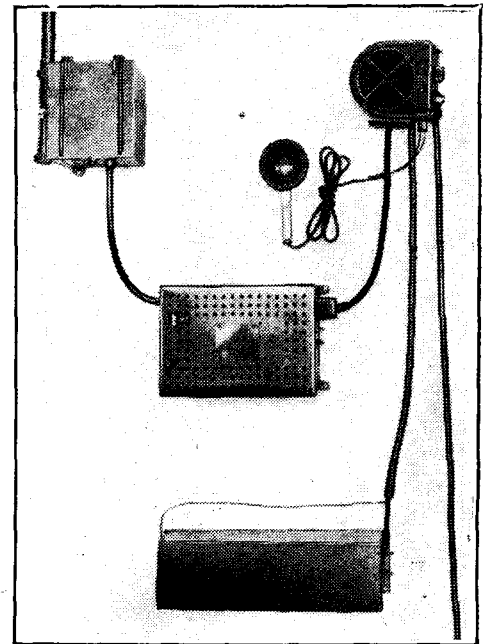
Again, the power required is approximately half that necessary with the long-wave transmitters. The total cost of the Bayonne installation has been less than 5,000 dollars, covering the equipment at headquarters and in ten patrol cars, while a long-wave one-way system suitable for the area would cost nearly double.

Transmission is uniform irrespective of hour, season, or atmospheric conditions.

The headquarters installation comprises a super-regenerative receiver and a master oscillator - power amplifier - phone transmitter permanently tuned to 8.6 metres. The output of the Class "B" stage is carried in shielded cables through three floors to the roof, where a push-pull high-frequency oscillator and push-pull 25-watt (output) high-frequency amplifier are mounted in a water-tight metal case. The aerial is a half-wave horizontal radiator in the form of a vertical brass

rod supported 70 feet above the roof by a wooden tower. It is fed from the high-frequency equipment on the roof by a three-quarter wavelength tuned feeder system of the two-wire "zeppelin" variety.

The car transmitters are equipped with 4.5-watt push-pull H.F. oscillators also permanently tuned to 8.6 metres. The system employed is known as "Simplex," only one transmitter at a time being used, thus enabling one wavelength to serve the entire system without materially slowing



Complete patrol car outfit. At the base of the antenna rod is the high-frequency oscillator case. The moving-coil loud speaker and associated microphone can be clearly seen. In the centre is the super-regenerative receiver and transmitter modulator unit. Beneath is the battery eliminator.

down the service. Microphones plug in to the speaker case mounted on the steering column; on the side of this case is a send-receive switch. Each patrol man has his own personal microphone.

Super-regenerative Receivers

The motor generator and pentode modulator are mounted in the rear luggage compartment, and the output of the pentode is carried to the separate metal unit containing a high-frequency oscillator, which is mounted under the metal of the body in the rear compartment in such a manner that the quarter-wave vertical aerial may be plugged directly into the high-frequency unit, eliminating transmission lines. The aerial rod itself is telescopic and can be extended as much as 8ft. 6in. It is possible to transmit one mile, even when the rod is telescoped to about four feet.

The super-regenerative receivers are extremely interesting. Power for the filaments is obtained directly from the car battery while plate potential is supplied by a vibrator-type battery eliminator driven from the same source. The receiver draws 3.5 amperes from the car-starting battery when in use. All car



A typical patrol car. Note the plug-in microphone and antenna rod. (Inset) Bayonne's police chief at the headquarters transmitter.

neighbouring building and tore down the street. The driver of the police car sat still at his wheel. He switched on his transmitter and shouted into the microphone: "Two thieves running north on Ash Street. They have just turned west

"Ultra-Shorts" for the Police—

receiving and transmitting equipment draws approximately 5 amperes, increasing to 10 amperes when the transmitter is in use. To date the transmitters have been used for only 1 per cent. of the total driving time.

In operation this new police system has worked well. The 25-watt transmitter at headquarters can broadcast a signal which is comfortably audible in the speakers of all patrol cars so long as they are within the city limits. It is interesting to note that sparks created by car ignition systems and other electrical devices are quite inaudible.

At three miles communication can be comfortably maintained between the cars themselves. The car receivers do not heterodyne until they approach within a

few hundred yards of each other, at which point a "squeal" results. This is not, however, sufficiently strong to prevent reception of the headquarters' station unless two cars are parked side by side. Improved receivers are now in production with tuned high-frequency stages which should reduce receiver radiation almost to zero level.

Strangely enough, the peculiar "rush" experienced with super-regenerative receivers prior to the reception of a modulated signal is an advantage rather than a disadvantage in the police installation at Bayonne. It not only indicates that the receivers are in good working order, but its disappearance serves as a warning signal that announcements are about to be made. And when these announcements do come, it is the gangsters who "rush."

Next Week's Issue

SPECIAL COMPONENTS NUMBER

Wireless components will form the subject of special articles. Essential features of good coils, transformers, loud speakers, etc., will be discussed.

The issue will also include hints on testing components and set building.

Signal Indicator Lamp

A Visual Aid to Accurate Tuning

By J. J. E. ASPIN

WITH modern sensitive and highly selective receivers, it is a great advantage to be able to determine visually the correct

point on the dial at which a station tunes. A meter connected in the anode circuit of the detector valve, or, in the case of A.V.C. receivers, in the anode circuit of the controlled H.F. and I.F. valves, will give visual indication, but hardly adds to the appearance of a receiver. During some recent experiments, the writer had occasion to try out a form of indicator which has found some favour in American receiver design, and was struck with the extremely satisfactory operation of the device.

Fig. 1 shows the arrangement in its simplest form. One of the windings of a double choke is connected in the anode circuit of the detector valve and the other in series with a flash-lamp bulb and the four-volt A.C. filament supply of the receiver. The bias battery normally maintains the steady anode current of the anode bend rectifier at a low value. This current has little effect on the choke, of which the winding B offers a high impedance to the alternating current through it; consequently, the lamp glows but dimly. When signals are applied to the grid, a comparatively large current flows through the winding A of the choke, the magnetic core becomes saturated, and the inductance of winding B falls considerably, with the result that more current flows through the lamp and it glows brightly.

One or two precautions have to be taken, however, before the device can be incorporated successfully in a receiver design. The choke cannot usually be connected in

the anode circuit of the valve without additional smoothing, since the fluctuations in voltage induced into the anode circuit by the alternating current in the lamp circuit will cause variations in the voltage at the anode of the valve, at supply frequency, and the

resistance of about 30 ohms. It should be adjusted so that the lamp just fails glow with no signal.

The operation of the method with anode-bend detection is easy to understand, but is of little practical value; it will be more useful to consider the tuning lamp indicator in relation to sets with A.V.C. Fig. 3 shows an arrangement suitable for a receiver where the anode current of the controlled H.F. and I.F. valves passes through the winding A. In this case the current falls in the presence of a signal, and the indicating lamp behaves in the opposite sense, becoming dark when the receiver is in tune. The variation in anode current will also usually be larger, and the inductance L may have a lower value than that necessary for the circuit of Fig. 2.

Operating Hints.

Now a word as to the double choke. This should be designed specifically for the receiver in which it is to operate, but a small A.C. transformer of the type used for bell ringing or filament heating may often be pressed into service.¹

For a number of his experiments the writer employed a small 250-volt A.C. bell transformer. This had a tapping on the L.T. side, which allowed of some adjustment, and for anode currents having a maximum value of 4 to 6 mA, this was

found to be eminently suitable when used with a 4-volt 0.15 amp. bulb and a 30 ohm resistance. For anode currents of other values, the L.T. winding (winding B) may remain the same, but the H.T. winding (winding A, and the primary winding in

the case of a bell transformer) must be altered, keeping the ampere-turns constant.

¹ A special double choke suitable for this purpose is made by Rich and Bundy, Ltd.—ED.

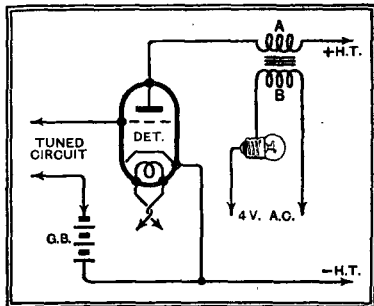


Fig. 1.—Principle of the tuning lamp.

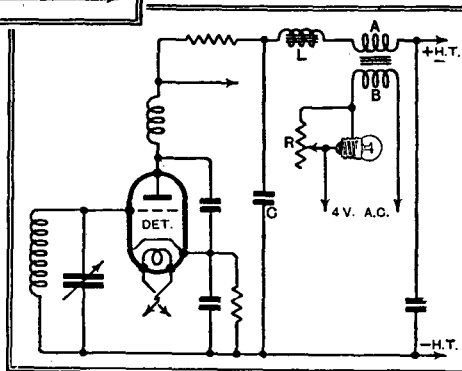
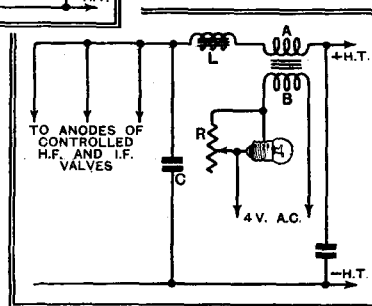


Fig. 2.—A practical arrangement, with smoothing added.

Fig. 3.—(Right) Tuning lamp connected to an A.V.C. set.



receiver will hum badly. A separate smoothing circuit should therefore be employed, and Fig. 2 shows an arrangement suitable for an anode-bend detector. The choke L is, in effect, in parallel with the winding A and must have a high inductance. The condenser C may have a capacity of 2 to 4 mfd. The resistance R is a filament

Tuning Made Easy

Visual and Mechanical Aspects

UNDER present broadcasting conditions, the ability to pick and choose a programme at will calls for something more than a highly selective receiver. One must possess in addition a certain cunning in manipulation and a deft hand on the controls in order to get the most out of a set—even if all the high-frequency circuits are controlled by a single ganged condenser. The task of pinning down one of the more remote stations remains something of a fine art.

Automatic volume control is another factor which tends to simplify control in one direction but to complicate it in another, since one can no longer depend upon the ear for an indication of exact resonance.

Auxiliary aids to tuning go back to the days of the single-circuit receiver when vernier condensers and slow-motion gears

It is safe enough to prophesy that it will be possible for the least skilful listener to tune the broadcast receiver of the future to any desired transmission, or at any rate to any desired "channel," with complete ease and certainty. Meanwhile, we are progressing towards that ideal, and the tuning system is assuming increasing importance.



The clock-dial method of tuning is mainly attractive on account of the ease of memorising station settings and the "openness" of the scale.

angular movements of the control knob. The logarithmic condenser—a later development on these lines—was primarily designed to offset the effects of stray capacity, and so to facilitate the simultaneous tuning of a number of circuits by a series of mechanically linked condensers.

Attention next shifts to the shape and marking of the dial itself, and to the provision of separate scales for the long and medium wavelengths. The original Ekco arrangement shown in Fig. 1 had an exceptionally large dial—conveniently

arranged round the periphery of the loud speaker diaphragm—which was marked by station names instead of in degrees. The medium-wave stations occupied the top half of the scale, and the long-wave stations the lower half. The top half was illuminated by a lamp L, and the lower by a lamp L1, a contact C, linked to the wave-range switch, automatically bringing the appropriate lamp into circuit on changing from one band to the other.

Fig. 2 illustrates another arrangement; here the dial markings are engraved on three transparent zones, 1, 2, 3, on an otherwise opaque disc D, located at the back of the cabinet. The appropriate scale reading is projected by means of a lamp S, through a lens L, on to a viewing window set in the front panel. When

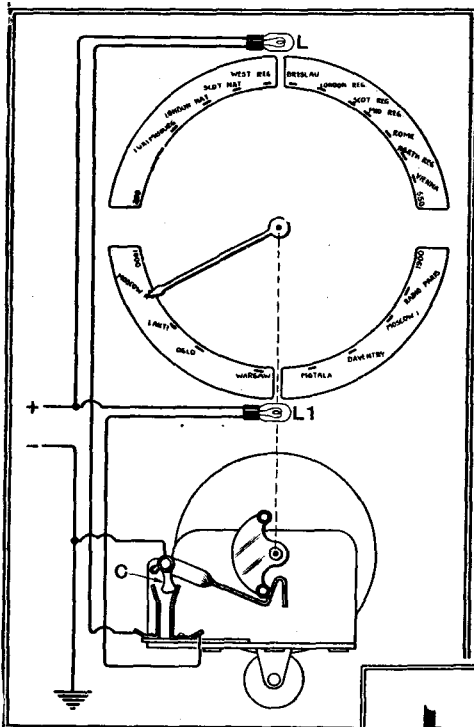


Fig. 1.—The original Ekco dial; one of the first and most practical station-calibrated tuning systems.

for the tuning condenser drive first came into favour. There followed various attempts to relieve congestion at the low-wavelength end of the tuning scale by replacing the earlier semi-circular condenser vanes by more complex shapes designed to give a straight-line wavelength or a straight-line frequency response for equal

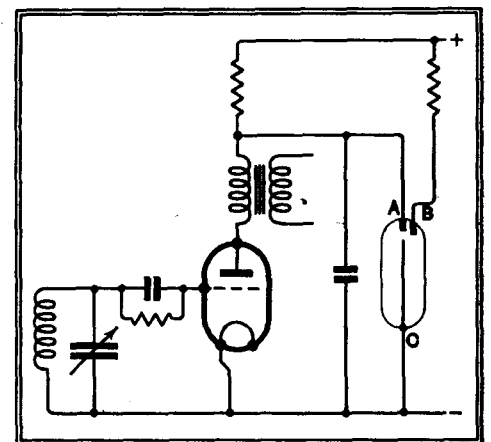


Fig. 3.—The "thermometer" type of neon tuning indicator.

switching from one waveband to another, the lamp S is automatically raised or lowered to bring it into line with the new scale marked 1 or 3, and a second lens, L1 or L2, deflects the light through the main lens L on to the front window.

Tuning is often facilitated by the more convenient grouping of the different scale readings. For instance, the long-wave scale is arranged vertically on the front panel in line with the right-hand side of the speaker diaphragm, while the medium-wave scale similarly occupies the left-hand side. Or the different scales are engraved in sloping lines at the top of the panel; various other arrangements naturally suggest themselves.

Reverting to those systems which make use of numbered scales, it is natural enough that users find difficulty in memorising the precise numerical reading corresponding to particular stations. A successful variant to the usual system is found

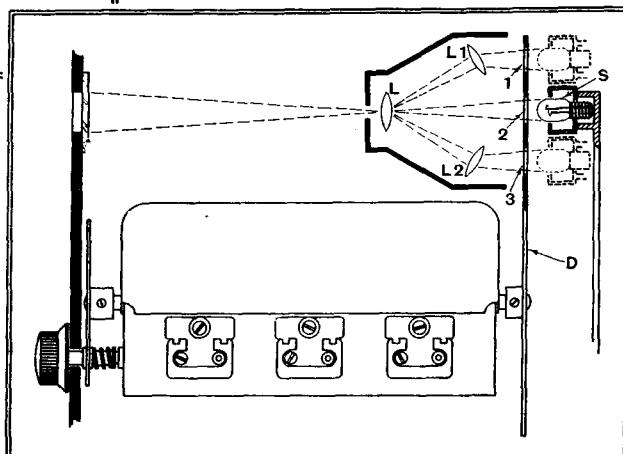


Fig. 2.—An optical method of obtaining the effect of a large easily-read dial in a small space.

Tuning Made Easy—

in the Philips Superinductance receivers, which are provided with a secondary scale marked with letters, so that one can memorise Toulouse as coming in, say, at H.22, instead of at 67.5 degrees. Another expedient is to mark the tuning dial as a clock face, and to identify the setting for a particular station with a certain time; for example, Toulouse might be recorded at 25 minutes past three. These may be small points, but they make an appeal to those who value mnemonics.

A further development on these lines was shown at the recent Berlin Exhibition, where a receiver was shown fitted with a "geographical" scale; all the German transmitters are grouped together, as are the English, French, Spanish, and other stations. In tuning one first turns the dial to a particular country, and then selects the particular station of that nationality to which it is desired to listen.

Perhaps the most elaborate "easy tuning" notion is to arrange banks of pre-set condensers and inductances, so that certain pre-determined stations are selected by the single movement of a throw-over switch or press button. In other cases the necessary combination of inductance and capacity are selected by a dialling operation similar to that used on

an automatic telephone, or it may be done by plugging in a selector jack which acts like a yale key, to operate a series of contacts. In theory, such arrangements solve the tuning problem completely, since nothing is left to the skill of the operator. But in practice they seem too expensive to make a wide appeal, and often the initial adjustments have proved difficult and unreliable.

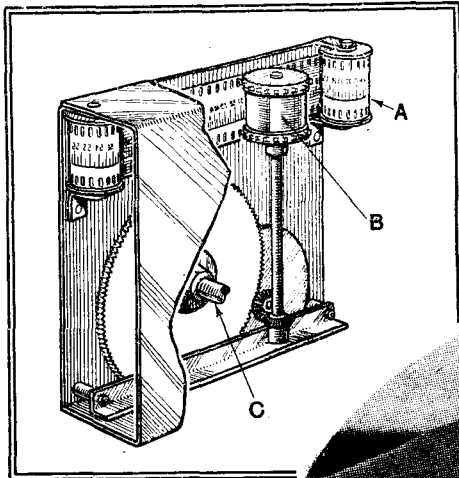
A set fitted with A.V.C. can hardly be tuned accurately by ear, and so some form of visual indicator is therefore desirable to show when the cir-

broadside-on to a lamp so as to overshadow a viewing aperture in the front panel. As signal strength increases the screen is rotated about its own axis so that its shadow contracts, until, at maximum signal strength, it has turned through a complete right-angle, and shows only a single line of shadow.

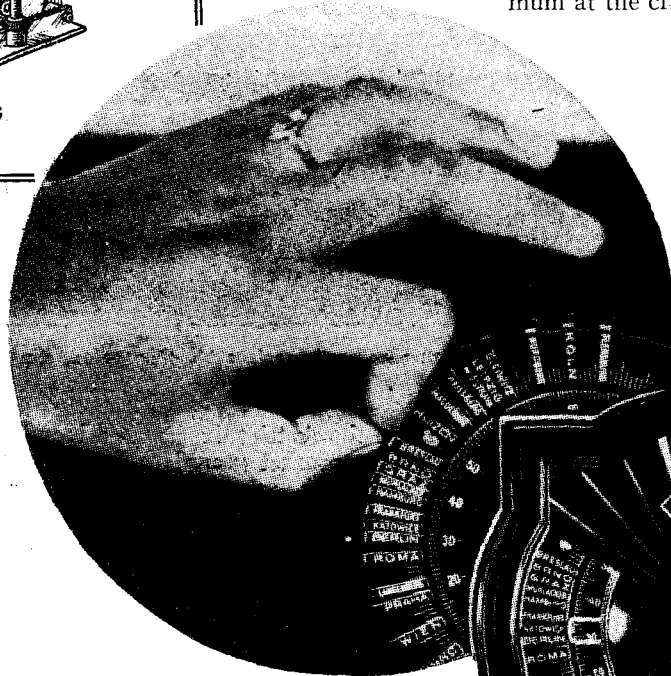
Variable-area Tuning Lamps

A neon tube or glow discharge device may take the place of the milliammeter. In one such arrangement the tube is fitted with a long cathode C (Fig. 3), a short anode A, and a "priming grid" B. Here increase in signal strength causes the discharge to lengthen out along the cathode, so that the line of light increases to a maximum at the critical point of resonance.

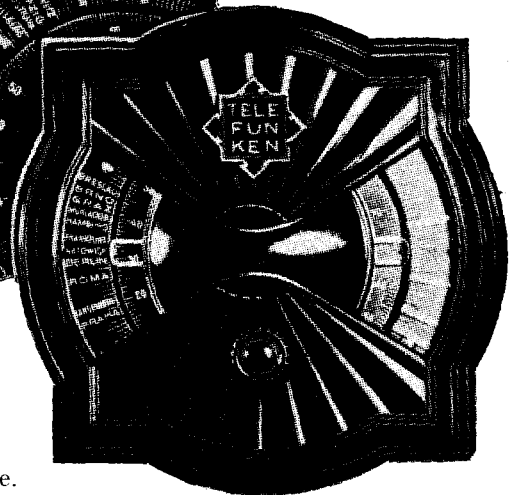
A somewhat similar idea is utilised in the well-known Tunograph. Here the neon tube is replaced by a small cathode ray tube with one pair of deflector plates which may be shunted across the resistance in the plate circuit of the last H.F. amplifier. The cathode ray is normally focused



The McGloin tuning system; an exceptionally open scale is made possible by the use of a roll of perforated film. A, film spool; B, driving sprocket; C, condenser spindle.



A German station-calibrated scale. Station names are printed on springy metal strips, which may be clipped securely into the right positions.



cuits are in resonance.

In receivers where an independent volume control is fitted for the low-frequency circuits, visual tuning has the further advantage that it allows a station to be tuned in accurately even while the volume control is set at zero.

The simplest type of visual tuner is a milliammeter inserted either in the plate circuit of the detector, or, in an A.V.C. set, in the anode circuit of one or more of the controlled valves. Exact resonance is indicated by maximum change of current of the meter.

In "shadow" tuning, the milliammeter needle is replaced by a small disc or screen, which, when no signal is being received, lies

so that it appears as a bright spot in the centre of the screen. As the applied signal increases in strength the spot is swung to and fro, creating a line of light which attains its maximum strength as the H.F. circuits are brought accurately into tune.

The arrangements so far described are located in or on the set itself. There are, however, occasions when it would be preferred to manage the set from a distance—to change the programme at will, control the volume, and to switch on and off, all without leaving one's comfortable seat by the fireside.

Armchair control, though quite a practicable proposition, is, of course, a somewhat expensive luxury. Among the various possible schemes, that shown in Fig. 4 involves the use of grid-glow relays, V and V1, and the small motor M, geared to the shaft of the tuning condenser C. The remote control casing K, fitted to

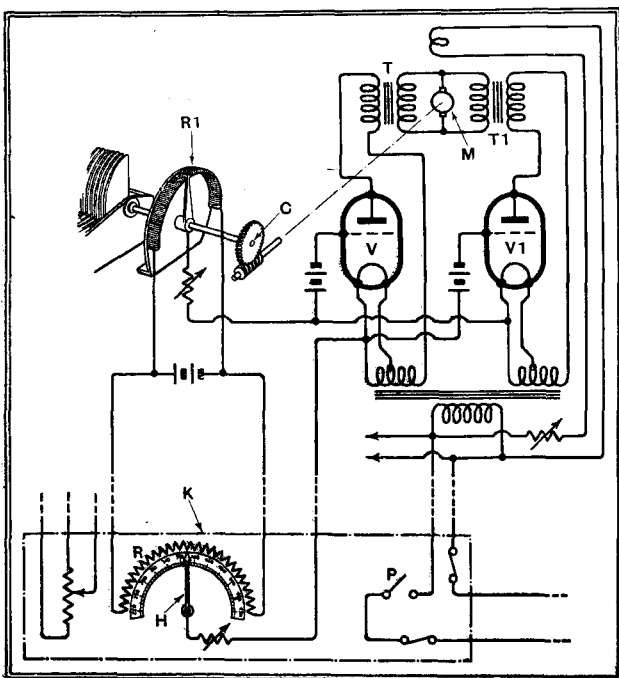


Fig. 4.—A motor-driven remote-control system with valve relays.

Tuning Made Easy—

the arm of an easy chair, contains a replica of the tuning dial and the selector hand H, together with an on-off switch P. The mains supply of the receiver also energises the two relay valves V and VI.

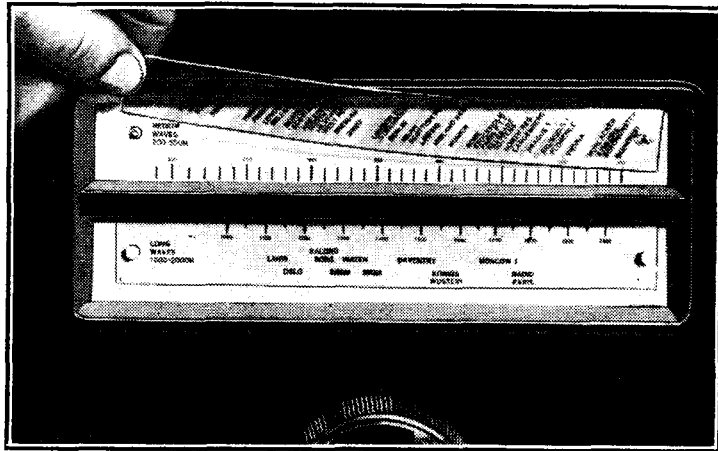
As the selector hand H is moved over the remote dial it varies the tapping point of a potentiometer resistance R, which is included in the cathode circuit of the valve V, and in the grid circuit of the valve VI. A similar resistance R1 is tapped off by an arm attached to the spindle of the tuning condenser C of the set; this resistance is included in the grid circuit of the valve V, and also in the cathode circuit of the valve VI.

Movement of the remote control hand H to the right or left causes more or less current to flow from the valve VI through the transformer T1 to the armature windings of the motor M, which in turn rotates the shaft of the tuning condenser C through the gearing shown.

The "follow-up" movement of the condenser shaft C continues until the alteration in the resistance R1 causes the current fed by the valve V to the motor M through the transformer T to balance that fed from the valve VI. In other words, each movement of the remote selector hand H is repeated by the tuning condenser shaft under conditions which ensure strict coincidence between the two.

Reverting to directly controlled tuning systems, a little thought will show that much of the ingenuity of designers has

been expended in devising methods of getting the effect of a large-diameter dial, but without its bulk and unsightliness. A small scale of conventional dimensions cannot possibly carry a clear and easily read station-name calibration; hence the various expedients, both optical and mechanical, that have been adopted. A promising idea, with the same object in view, has recently been produced by Mr. James McGloin, and shown at the last Exhibition of Inventions in London. Instead of a dial, there is a long length of film, carried on spring-loaded spools, as



The latest Ekco tuning scale; an easily replaceable transparent slip marked directly in station settings.

shown in the sketch; the film is driven by a toothed sprocket geared to the normal condenser-drive mechanism. Other arrangements, including one embodying an edgewise disc drive, have been evolved.

Of course, the electrical side of tuning cannot be divorced entirely from the mechanical and optical aspects. When extremely accurate station-calibrated scales come into general use it may be necessary to provide means for retrimming to compensate for the more-or-less inevitable "drift" that takes place.

NEWS FROM THE CLUBS

Invitation to Manchester Readers

Members of the Manchester Chapter of the International Short Wave Club will shortly visit Broadcasting House, Manchester. At a recent meeting Mr. F. Fielding, of Allied Newspapers, described and demonstrated a new short-wave three-valve receiver. The Club extends an invitation to all *Wireless World* readers in the district. Hon. Secretary: Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

Television Success

By arrangement with the Edison Swan Electric Co., Ltd., the Exeter and District Wireless Society recently staged the first public demonstration of television in the district. Clear images were obtained on a cathode ray tube from the B.B.C. transmissions and synchronisation was remarkably good. There was an audience of over two hundred people. Hon. Secretary: Mr. W. J. Ching, 9, Sivell Place, Heavitree.

Radio Facts

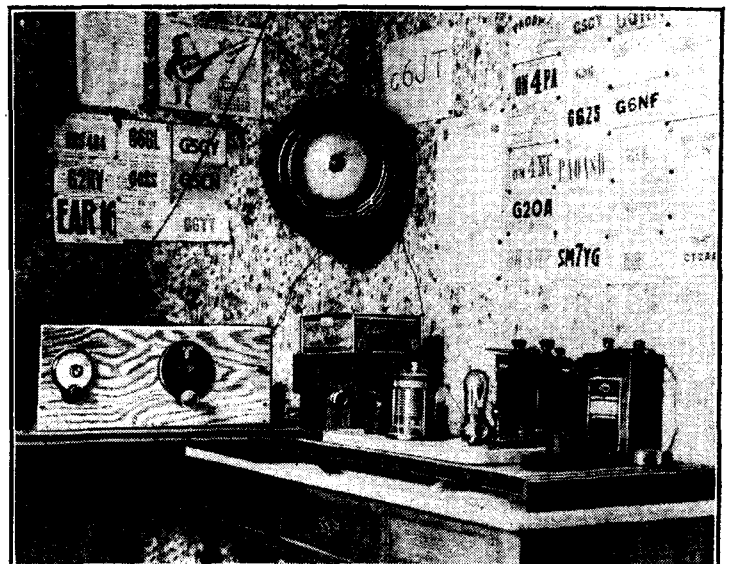
"The Truth About Wireless" was the intriguing title of a lecture recently given before the Golders Green and Hendon Radio Scientific Society by Mr. D. N. Corfield. He gave some

significant facts concerning the range of frequencies transmitted and those provided for in certain commercial receivers. All communications should be addressed to 55, Ebury Street, London, S.W.1.

Electric Condensers

At a recent meeting of the Smethwick Wireless Society, Mr. C. D. Gwinn, B.Sc., of the Telegraph Condenser Co., Ltd., lectured on "Electric Condensers," dealing with the construction and properties of the

BREAD-BOARD TRANSMITTER. G6JT, Liverpool, which cost its owner, Mr. J. T. Shrouder, a few shillings, including 6d. for the valve. The set is built on a bread-board, operates on 3 watts with battery H.T., and has "worked" SPIDT, Lwow, and many other European stations.



paper, mica and electrolytic types. Hon. Secretary: Mr. E. Fisher, 33, Freeth Street, Oldbury, near Birmingham.

Catkin on the Films

Valve manufacture from the earliest days to the present time was interestingly described by Mr. W. G. J. Nixon, of the General Electric Co., Ltd., at the last meeting of the Sidcup and District Radio and Television Club. The new Catkin film was watched with great interest. Full particulars of the Club's activities can be obtained from the Hon. Secretary: Mr. W. F. Smith, 4, Rowley Avenue, Sidcup, Kent.

THE RADIO INDUSTRY

THE Marconiphone Model 285 battery set is one of the new "Lucerne Special" series; it embodies Ferrocart coils and a special form of Q.P.P. output circuit. Marconiphone also announces the introduction of a canvas cover for the Model 269 portable.

Work is beginning on the erection of a third Philips factory at Mitcham.

A new Pertrix H.T. battery, specially designed for the Ekco receiver, and with a higher capacity than that ordinarily supplied, has just been introduced.

F. W. Lechner and Co., of 61, Spencer Street, London, E.C.1, undertake repairs to N. and K. Farrand inductor speakers.

Belling and Lee now supply suitably marked terminals for use in conjunction with cathode ray tubes.

The new Ever Ready battery, Type W.1250, is specially made for the G.E.C. BC3446 Super-heterodyne, and is suitably tapped. It includes a 9-volt grid bias battery in the case.

Change of Address

Manchester depot of Fuller Accumulator Co., Ltd., to 53, Back George Street, Princess Street, Manchester. Tel.: Central 6356.

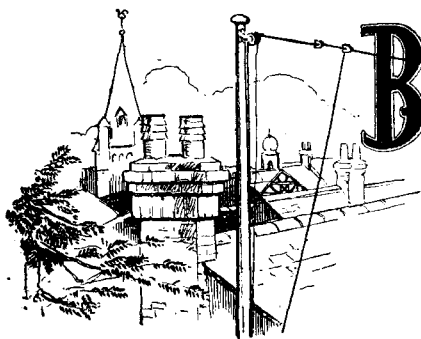
Catalogues Received

A. C. Cossor, Ltd., Highbury Grove, London, N.5.—Cossor radio accessories.

James McMillan and Co., Clun House, Surrey Street, Strand, London, W.C.2.—Electrical measuring instruments.

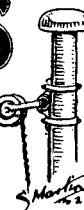
Mullard Wireless Service Co., Ltd., 111, Charing Cross Road, London, W.C.2.—H.F. pentodes; leaflet with technical data.

Ferranti, Ltd., Hollinwood, Lancs.—New receiver catalogues, including the latest radio-gramophones.



Broadcast Brevities

By Our Special
Correspondent



Another "Lucerne Conference"

THE B.B.C. will be represented at a newly arranged miniature "Lucerne Conference" which is to be held in Brussels to clear up the muddle which still exists in the European ether, especially on the long waves.

It has been argued that the B.B.C. need not bother itself with such an affair, having secured virtual tranquillity on its own waves, but this point of view suggests ignorance of the B.B.C.'s moral responsibilities in the matter.

B.B.C.'s Obligations

It was the British Broadcasting Company, predecessor of the existing organisation, that was largely responsible for the formation of the International Broadcasting Union; indeed, the first meetings were held at Savoy Hill. So it is not mere grandmotherly concern that prompts the B.B.C. to exert every effort to straighten out the present tangle.

But, putting aside the question of moral obligation to help, it should be remembered that, so long as there are stations still seeking a place in the ether, so long will there be a risk of interlopers butting in on the British wavelengths.

New Plan for Long Waves?

The medium-wave stations appear to be working out their own salvation. Not so the long-wave transmitters. But as there are only twenty of these the B.B.C. might, it seems to me, be safe in suggesting an entirely new plan for the long waves. Is there any reason why the two wavebands—long and medium—should be treated on an equal basis? Each is a water-tight compartment; they are as remotely related as two solar systems.

The Two Main Factors

Surely it should not be difficult to reshuffle the long waves with a closer eye on those two main factors, power and geographical position? What is needed is the practical realisation that the Lucerne Plan, as it affects the long waves, is not a success.

Programme Poaching

A NEW problem in broadcasting has cropped up if it be true, as reported, that Luxembourg is giving "colourable imitations" of the B.B.C. dance band performances by the skilful manipulation of gramophone records. It is said that the programmes even conclude with Henry Hall's signature tune.

Whether or not the British manufacturers of the records in question have any copyright claim on Luxembourg territory is beside the point. If the gramophone company were able to take action it would still be possible for the foreign station to record Henry Hall's numbers as received by wireless and to rebroadcast them on another occasion.

Tit for Tat

Tremendous and disturbing possibilities are opened up by such an action. What is to prevent any station from picking up and recording the programmes of another for future use? This habit of taking in each others' washing might extend indefinitely until—the mind reels at the thought—the whole broadcasting world would be subsisting on one programme.

Vicious Circle

In the wild hunt for material, recording officials at each station would comb the wavelengths for something new, something that their own station had not originated many months before. In the end one could imagine the B.B.C. broadcasting a "Prom" concert picked up from Algiers, which had picked it up from Bratislava, which had recorded it from the Queen's Hall three months previously.

Really a vicious circle.



CHOOSING THE RECORDS is not the least arduous part of Christopher Stone's labours. The popular gramophone compère is here seen in the B.B.C. record library with one of the new "H.M.V." Superhet Five Forty Radiograms.

Crooners

ALTHOUGH dance band crooning is sometimes less objectionable than heterodyne whistles, I was glad to hear that the dance band leaders, in a little Lucerne Conference of their own, had agreed to cut out some of this man-made static. So far, however, I have seen no diminution of the nuisance, but I am assured at B.B.C. headquarters that eventually not more than 25 per cent. of broadcast dance numbers will call upon the crooner.

Apparently the extermination of crooning must be carried out gradually, as in the case of the drug habit.

Strange Noises at Battersea

"FROM Coal to Grid" is the title of the broadcast from the Battersea Power Station on February 23rd. The commen-

tary will be given by Howard Marshall, who will take the microphone round this Robot building, as he calls it, and bring us the sound of the mighty turbines, the swirl of the condensing water drawn in from the Thames, and the almost ceaseless hum of the power house.

B.B.C. Engineers Test for a Week

One of the most interesting "visits" will be to the control room, which somewhat resembles the captain's bridge on an Atlantic liner. From this the controller can view almost the entire plant and be in telephonic touch with every corner in it.

The "O.B." engineers have done some prospecting already, and wire tests will be carried out for a whole week before the broadcast.

Research in an Orchard

WHILE, I believe, no special significance attaches to the fact that it is in Nightingale Square that the B.B.C. has bought its new Balham property, it is interesting to know that, whether next summer's bird noises are to be manufactured here or not, the engineers will henceforth be prosecuting their researches amid fruit trees. This twenty-acre property, which has been purchased from the Convent of Perpetual Adoration, is larger than the premises which are being vacated next Quarter Day, and includes a very prolific orchard.

Potted Film at the Microphone

LESLIE FULLER, the film artist of "Not So Quiet on the Western Front," gives his first broadcast on February 24th in "Music Hall." He will bring a condensed version of "Not So Quiet" to the microphone, and will have with him a cast of four or five artists.

Leslie's enterprise should be encouraged. The B.B.C. has now adapted many stage plays for the microphone but very few films, although in many ways film technique lends itself to microphone treatment.

Denmark "Drops a Brick"

RADIO play producers throughout Europe should be warned by an incident in Denmark. Recently the Danish stations broadcast a playlet entitled "Mozart's Piano."

The drama told how the composer's widow permitted the sale of her husband's little square piano in Copenhagen and how the instrument got into the hands of a furniture dealer who wanted the beautiful birchwood for decoration purposes. The play concluded with the sound of the saw cutting through the old piano.

A High Court lawyer has now come forward with unassailable evidence that the said piano is still standing intact in his flat. It has been in his family ever since the auction sale.

UNBIASED

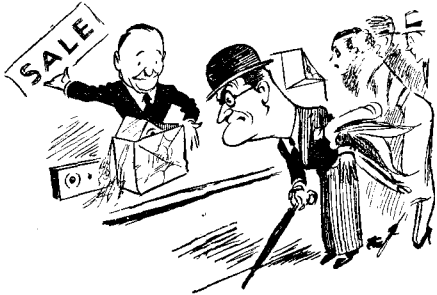
BY FREE GRID

Cracked Piano Notes

I HAVE for a long period suffered from a plague of dithering piano notes, and have from time to time spent much cash and energy in disembowelling my set and trying out devious dodges in an endeavour to overcome the trouble. In spite of all that I have done, however, I have never succeeded in curing it.

Recently, however, my interest in the matter was reawakened by a letter from a reader who complained that his set showed a predilection for foreign pianos, as it seemed to reproduce these correctly at all times, although producing the familiar cracked noises on B.B.C. transmissions. He was impious enough to suggest that the trouble might be in the B.B.C. transmissions.

I have always set my face against heresy in any form, and so, in order to confound my correspondent, I immediately betook myself to the listening halls at Broadcasting House which the B.B.C. provide for the benefit of music critics and other hangers-on of our great journals. You can imagine my horror, therefore, when, after settling myself comfortably in a voluptuous armchair in order to listen to a piano-forte recital, my ear-drums were almost split by a horrible cracked tincanniness accompanying the opening chords of "Did Tosti raise his bowler hat when he said Goodbye?"



Sure to fetch 'em.

It is quite obvious, of course, that, since the loud speakers in these listening halls are fed directly from the control room and not from wireless receivers, the fault does, after all, arise in the B.B.C.'s transmissions. It is of little use our attempting to seek after perfect quality in our receivers if the B.B.C. permits distortion to arise at the source, and I, for one, should like to know what they are going to do about it.

The Original Carton

THE other day, when wandering through one of our great departmental stores in an endeavour to study human nature in roar as well as in the raw, I witnessed a mass of my fellow creatures

struggling for possession of a few yards of coloured calico which an enterprising, but unscrupulous, departmental manager had advertised as being specially manufactured for use in loud speaker frets and being sold off at the usual enormous sacrifice.

This tasty morsel was, I saw, merely groundbait to lead the uninitiated into wasting their money on a lot of years'-old junk in the shape of once-costly sets that had been reduced to a humble fiver.

This sort of thing nearly always attracts buyers; perhaps a student of psychology can tell me why. The fact that a set sold at seventy guineas years ago and is still "in the makers' original carton" (that bit is sure to fetch them) is no guarantee that it is worth seventy pence now. It is not necessarily even worth while buying for its components, which are probably quite unsuited for modern conditions. Would anybody give good money for a 1904 car even if it was "in the makers' original carton"?

The Night Club Affair

THE request for help in devising the perfect night club alarm which I made in the January 26th issue has been far from unfruitful, as I have received many valuable suggestions, for which I now take this opportunity of returning thanks.

One suggestion was to take advantage of the size of a policeman's feet by studding the vestibule floor with sunken photoelectric cells so spaced that two of them could just be bridged by a policeman's feet, ordinary sized feet being too small.

The idea reminds me very much of a mousetrap which I patented several years ago, consisting of several strips of meccano screwed down to a bread-board, with a clearance of about an eighth of an inch between each strip. Alternate strips were connected up to each other and to the electric light mains, so that when a mouse made for the piece of cheese in the middle it was bound to bridge the mains with its body and so be electrocuted. I recollect this incident well, as I later improved it so that it combined the functions of electrocution and cremation. This was done by stepping up the voltage by means of several mains transformers (primaries in parallel and secondaries in series) so that immediately the animal stepped on the trap it simply blew like a fuse.

But we digress, as the Editor says when he wants time to think. Yet another idea which a kind reader has put to me is that the principles of television be used, reliance being placed on the fact that different faces televise with a different note in the musical scale when 'phones or loud speakers are used instead of a radioviewer.

Another Problem

AT last a suggestion which I made in these columns some time ago has been adopted. I refer to the idea of placing a glass panel between the studio audience and the performers in order to prevent listeners being annoyed by the excessive efforts of the subsidised claque.



Unfair to the audience.

Actually a theatre in New York has put the idea into use, the glass panel being lowered like a safety curtain whenever an act is to be broadcast. The theatre audience are, of course, supplied with the aural portion of the entertainment by loud speakers suitably disposed about the auditorium just as I suggested.

The one remaining difficulty is to enable the artistes to hear the applause from the auditorium and so get the "atmosphere" to which they are accustomed. Obviously it would not do to put a microphone in the auditorium and a loud speaker on the stage; one might just as well raise the glass panel a bit. My suggestion of a microphone in the auditorium and headphones for all the actors has not met with approval because, so it is stated, the sight of the actors on the stage wearing headphones is unfair to the theatre audience as it would deprive them of their "atmosphere." This little problem is, therefore, still awaiting a solution, but no prizes are offered.

These Sibilants

I AM surprised to note that in spite of the protest which I made some time ago, the B.B.C. still continue to permit the broadcasting of songs with an excessive number of sibilants.

They little heed the tremendous harm they do to people suffering from hydrophobia. After "Songs from the Shows" the other night when the B.B.C. broadcast that old Drury Lane favourite, "Does this shop stock shot socks with spots?" even I felt the impulse to fetch both mac and umbrella.

How much more baneful must be the effect on people of a refined nature.

NEW APPARATUS REVIEWED

Latest Products of the Manufacturers

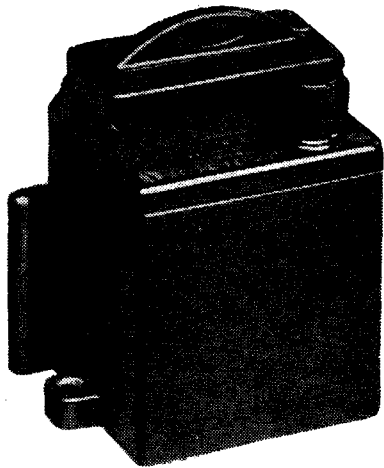
T.C.C. ANTI-INTERFERENCE UNIT

DOMESTIC electric appliances, flashing signs, motors, and the many other electrical devices now in common use for one purpose or another are a very prevalent cause of the bad background noises in receivers. In the majority of cases these electric disturbances can be suppressed by joining a pair of large-capacity condensers across the mains supplying these devices, but this is not always convenient, or even possible, since the interference is often conveyed along the supply mains from some distant source, and therefore difficult to trace.

A filter unit installed at the point where the electric cable enters the building will, however, prevent these disturbances getting into the house wiring and so reaching the set, and a very convenient device for this purpose is the T.C.C. Anti-interference Unit. It consists of two 2-mfd. condensers and a pair of one-amp. fuses mounted in a moulded bakelite case. The fuses do not carry the household supply, but serve only as a safeguard in the unlikely event of the condensers developing a fault.

A test made with one of these units fitted as described gave a most marked improvement where hitherto the interference was particularly troublesome. It is simple to install, perfectly safe, and the price is ros. 6d. The units can be fitted to any local apparatus known to be a source of interference, and will effect a cure, providing the mains are free from electrical disturbances, when one fitted at the point of entry would be needed as well.

The makers are the Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W.3.



T.C.C. anti-interference unit fitted with protecting fuses.

T.M.C. HYDRA CONDENSERS

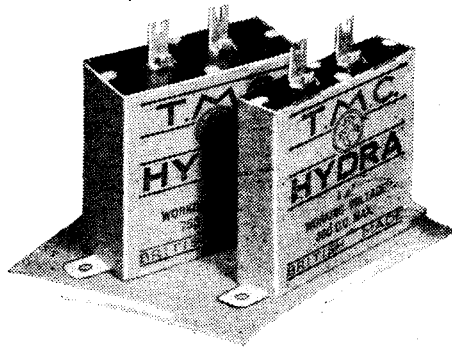
HYDRA condensers are now made in this country by the Telephone Manufacturing Co., Ltd., Hollingsworth Works, West Dulwich, London, S.E.21, under the name of T.M.C. Hydra condensers. A comparatively wide range is available, and this is being added to from time to time. The present types include all the usual sizes from 0.1 mfd. to 10 mfd. in working voltages of 250, 300, 400 and 500 volts D.C., while a series of 750-volt D.C. working are made from 0.1 mfd. to 6 mfd.

They are assembled in metal containers,

and can be obtained with either soldering tags or screw terminals, the price for either pattern being the same.

Several specimens were tested and found entirely satisfactory; the measured capacities are all well within the maker's tolerance of ± 10 per cent., and a large margin of safety is allowed in all models. For example, a 300-volt D.C. working type was subjected to a potential of 800 volts D.C., and showed no signs of erratic behaviour, leakage, or gave any indication of breakdown. The insulation of the condenser is also exceedingly good.

A 1-mfd. 300-volt D.C. working type costs 2s. 5d.; a 2-mfd. 3s. 3d., and a 4-mfd. 5s. 6d. In the 750-volt series, tested at 2,000 volts D.C., 1-mfd. costs 5s., 2-mfd. 7s. 6d., and 4-mfd. 13s. 6d. Hydra con-



T.M.C. Hydra condensers; both are of 1 mfd., the larger being for 750 volts D.C. working.

densers are distributed through Harwell, Ltd., The Sessions House, Clerkenwell Green, London, E.C.1.

WEARITE UNIVERSAL COIL

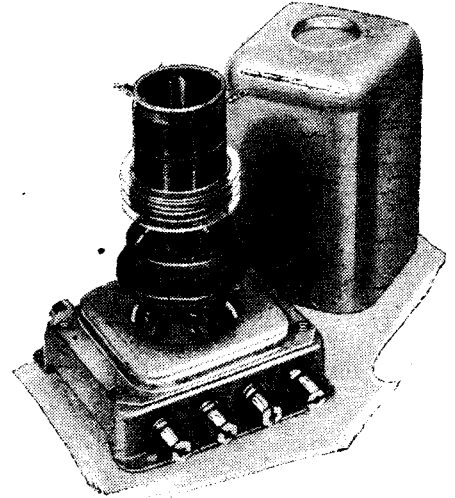
THIS new Wearite component is a general purpose coil designed for use either in the aerial circuit or as an H.F. transformer, or wherever a screened dual-range coil is needed. It consists of a one-inch Paxolin tube on which is wound primary, secondary and reaction coils, each being brought out to terminals with the exception of one end of the reaction winding which is joined to the low potential end of the secondary.

Two tappings are provided on the secondary winding; one is about one-third down from the grid end of the medium-wave section and the other is at the junction of medium-wave portion and the long-wave loading coil. The former is the grid connection to the following valve, while the latter joins to the wavechange switch, as the coil does not include switching.

With an average 0.0005 mfd. condenser the tuning ranges are from about 154 to 540 metres and from 660 to 1,870 metres. In a set fitted with a gang condenser, and where the stray capacities will be fairly high, the lowest ranges covered will be raised to about 190 and 670 metres respectively.

The measured inductance of the total secondary winding is 1,800 mH., the medium-wave portion being 155 mH. In efficiency the coil com-

pares very favourably indeed with the best of the air cored types. The makers are



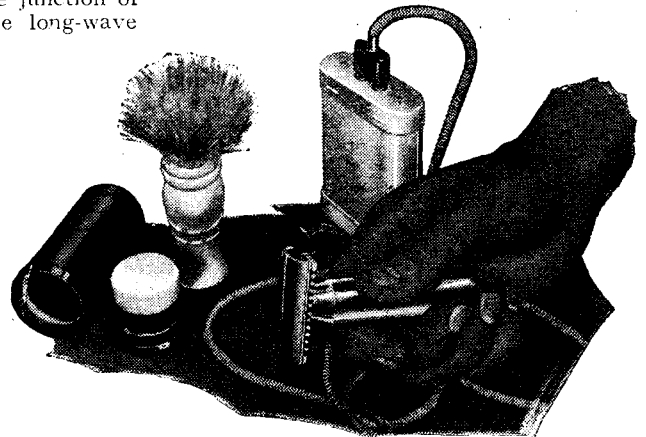
Wearite screened dual range Universal coil.

Wright and Weaire, Ltd., 740, High Road, Tottenham, London, N.17. The price is 5s.

SIRAMA ELECTRIC SAFETY RAZOR

OF the many electrical devices that come under our notice occasionally we meet with some that, although having no connection with wireless, are of general interest. The Sirama Electric Safety Razor, marketed by Siemens-Schuckert (Great Britain), Ltd., New Bridge Street House, 30/34, New Bridge Street, London, E.C.4, is a case in point. It is operated by a standard 4½-volt flash-lamp battery, with the battery and the razor as separate units and joined by a length of flexible cable.

A small electric motor in the handle of the razor causes the blade to vibrate, with a shuttle motion, about 100 times per second, and it is this motion that is responsible for the exceptionally good cutting qualities. Yet the razor is just as easy to manipulate as any of the safety pattern and very close shaving is given with the minimum of effort. Special blades are not required as the three-hole double-edged type fit the Sirama razor; it is economical to operate, and the price is 25s. Incidentally, there is not the slightest risk of obtaining a shock for the battery voltage is far too



Sirama electric safety razor and battery container.

low, and the razor can be handled with the same confidence as any other style.

NEWS of the WEEK

Current Events in Brief Review

Anti-static Law in Germany

AN Anti-interference Bill is now being prepared by the German broadcasting authorities in conjunction with the Post Office.

Broadcast Appetisers

OUR trenchant French contemporary, *Haut-Parleur*, has congratulated the Paris PTT station for "only playing the 'Danse Macabre' (dance of death) between meals now." At the same time, criticism is levelled at the station for permitting talks during meal times on intestinal troubles.

The Country Listener

EVERY second radio listener in Germany lives in a town of over 100,000 inhabitants, according to recently published statistics. Now, however, there are signs that the country listener is taking a greater interest. The total increase in German listeners during the past year was approximately 750,000, or 17.2 per cent. of the previous total.

Oh, Luxembourg!

THE Grand Duchy of Luxembourg, besides confounding the radio stations of Europe, appears to have offended the laws of philately by the multiplicity of its stamp designs.

If the postal authorities at Luxembourg (says Peter Simple in the *Morning Post*) are at a loss for a new stamp design, might I suggest a wireless mast rampant?

U.S. Theatre as Studio

AMERICA now has its own "St. George's Hall"—the old Hudson Theatre, which has been converted into a radio playhouse by the Columbia Broadcasting System. The radio playhouse opened on Saturday last, February 3rd, and admission is free by special invitation. This is the first move in America towards the cultivation of the studio audience.

Radio Esperantists' Contest

ESPERANTIST listeners are now competing for the "Guerrilla" Silver Trophy. This trophy is held for one year by the Esperantist who submits the best log of reception during a given month, and the test is held under the auspices of the British Esperanto Association, Inc., 142, High Holborn, London, W.C.1. The test period this year is the whole of the month of February.

Shakespeare or Marconi?

SHAKESPEARE is to be represented as the "Father of Wireless" in a pageant of British industries which is to take place at the British Industries Fair Dinner Ball at the Dorchester Hotel, London, on Tuesday, February 27th. Miss Gwenn Lally, the pageant master, justifies her choice of Shakespeare on the grounds of the many prophetic allusions to wireless in "The Tempest."

40,000 Radio Dealers

THE compulsory registration of all professions and trades in Germany has revealed the fact that there are now 40,000 radio dealers. In addition, there are between 500 and 600 wholesalers.

The New Static

A NEW form of interference is reported from France, a listener having complained that the programmes of Radio PTT Nord are marred by "uninterrupted whistling and intermittent snoring."

Hitherto, snoring has been confined to the receiving end.

Radio on Mount Everest

AN illustrated lecture entitled "Radio Communications with the 1933 Mount Everest Expedition" will be delivered by Mr. David S. Richards at a meeting of the Incorporated Radio Society of Great Britain on February 23rd at 6.15 p.m. at the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

R.M.A. President

LT.-COL. J. T. C. MOORE-BRABAZON, M.P., has been elected President of the Radio Manufacturers' Association for the third time.

"Passports" for Service Men

TO avert the possibility of false representation, each service engineer of the Gramophone Company is to carry an identification card bearing his portrait. The identification cards will be about the size of driving licences.

"P.O." in Print

RED tape is a conspicuous absentee in the new "Post Office Magazine," the second number of which, dated February, 1934, has just been published. Wireless has a large share of the thickly illustrated pages. An interesting account of the Empire broadcasts at Christmas is given, and there is a page discussing the personality of that famous broadcaster, Christopher Stone.

Through French Ears

FRENCH engineers seem as satisfied as their English colleagues with the success of the Lymgne and Saint-Inglevert micro-wave service which was opened on January 27th. A correspondent who attended the opening demonstration at the French end of the beam states that the signals received from England were as clear and powerful as those on the best local telephone circuit.

Radio Research at the Vatican

SHORT-WAVE tests are being conducted between the Vatican station and VK2ME, Sydney, operated by Amalgamated Wireless of Australia. The tests are of an unusual character. The Vatican station transmits a signal for a fraction of a second. This is picked up in Sydney on a relay device and simultaneously retransmitted. The Vatican engineers are preparing records to show the time taken by the signal to complete its world trip.

Short Waves from Buenos Aires

TWICE-DAILY short-wave transmissions on 10,350 kilocycles are now given from Station LSX, "Radio Splendid," Buenos Aires, under the auspices of the *Compania Transradio Internacional*. From 20.00 to 21.00 (G.M.T.) a European programme is broadcast, while a transmission for North America is given between 01.00 and 02.00 (G.M.T.) daily.

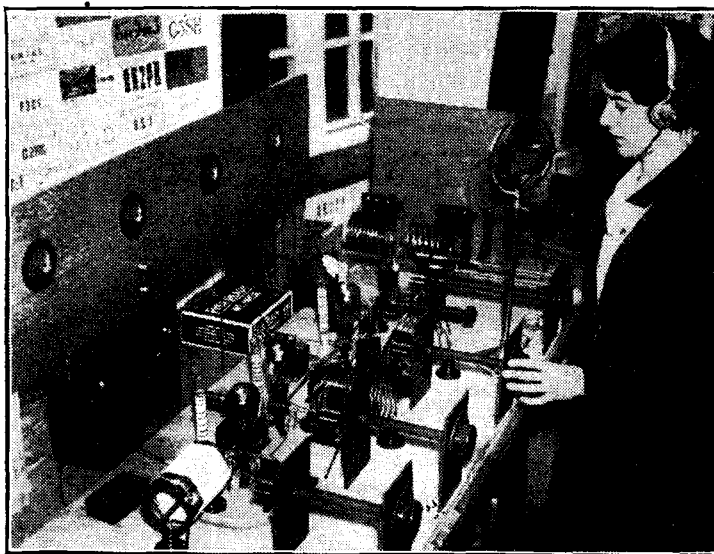
We shall be glad to forward reports to Radio Splendid.

Turkish Radio

LICENSED listeners in the Republic of Turkey number about 5,000, the majority being in and around Istanbul. The penalty for piracy is confiscation of the receiver and a fine of 125 piastas, but this regulation is honoured more in the breach than in the observance. At present the broadcasting company receives the whole of the licence revenue plus 25 per cent. of the Customs duties, but the State coffers will benefit when the licence figure reaches 6,000.

500 Kilowatts from America

AN opportunity to tune in a special transmission by the new 500-kilowatt station, WLW, at Cincinnati occurs at 6 a.m. (G.M.T.) on Sunday, February 18th. A special programme will be broadcast under the auspices of the International DX'ers Alliance. The transmission, on a frequency of 700 kilocycles, will go out under the call-sign W8XO, though the WLW transmitter will be in use on full power. Reports are requested by the I.D.A., Bloomington, Illinois, and the Crosley Radio Corporation, Cincinnati, Ohio.



R.S.G.B. BRITISH EMPIRE TESTS. Miss N. Corry (G2YL) of Walton Heath, Surrey, a lady competitor in the DX tests now taking place. Miss Corry, who constructed the transmitter herself, has been in two-way communication with stations in fifty-six countries, including over thirty in Australasia.

Iceland's Radio Fans

PRACTICALLY 72 per cent. of the population of Iceland are radio listeners. The total number of registered listeners on December 31st last was 8,030, showing an increase of 2,612, or 48 per cent. in twelve months.

Radio Inquisition

A MINOR storm is raging in France over the new regulation under which a listener discarding his wireless set or presenting it to a friend must sign a form empowering the Post Office officials to search his premises to confirm that the transaction has been carried out.

Questions are being asked in the Chamber concerning several cases in which this ruling has been put into effect.

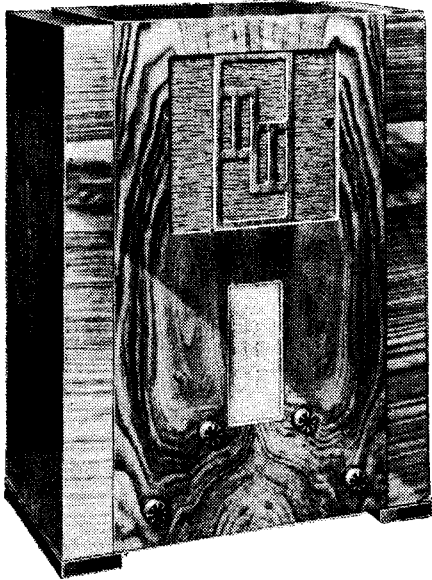
Without a Station

ALBANIA is the only country in Europe without a broadcasting station of any description, the inhabitants relying on the transmissions of the Italian station at Bari on the opposite side of the Adriatic, which are well received. The programmes include talks in the Albanian dialect.

Taxi Radio Comes Back

TAXI radio is now "okeyed," according to our Washington correspondent, who states that Police Commissioner O'Ryan, of New York City, has reversed the ruling of his predecessor and will permit New York taxicabs to be radio-equipped. The volume of sound must be limited, and the sets are to be kept mute at parking places.

G.E.C. Superhet 8



FEATURES. *Type.*—Table-model superheterodyne receiver for A.C. mains. *Circuit.*—H.F. amplifier—1st detector—oscillator—I.F. amplifier—duo-diode triode 2nd detector—noise suppressor—pentode output valve. *Full-wave valve rectifier.* *Controls.*—(1) Tuning. (2) Volume control and on-off switch. (3) Waverange and gramo. switch. (4) Tone control. (5) Noise suppressor control. *Price.*—21 guineas. *Makers.*—The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Delayed A.V.C. with Noise Suppression

THE general trend of superheterodyne receiver design of late has been in the direction of combining as many functions as possible in each stage with a view to reducing the number of valves and, consequently, the cost of the complete receiver. It cannot be denied, however, that greater freedom of action is permitted to the designer when separate valves can be allotted for each amplifying process between the aerial and the loud speaker, and those who are prepared to pay the little extra price involved can be assured of obtaining a corresponding return in performance.

The set under consideration employs seven stages, and with the exception of the second detector, which is of the duo-diode triode type, each valve has only one duty to perform. It will be seen from the circuit diagram that the first stage amplifies the incoming signal at radio frequency and is connected to the aerial through a tuned transformer which incorporates a cathode feedback coil designed to reduce second-channel interference. The coupling between the H.F. and first detector stages takes the form

of a tuned transformer with both magnetic and electrostatic coupling between primary and secondary. The method of injecting the output from the separate local oscillator valve into the grid circuit of the first detector is unusual, the coupling coils forming part of the long- and medium-wave sections of the tuned grid circuit.

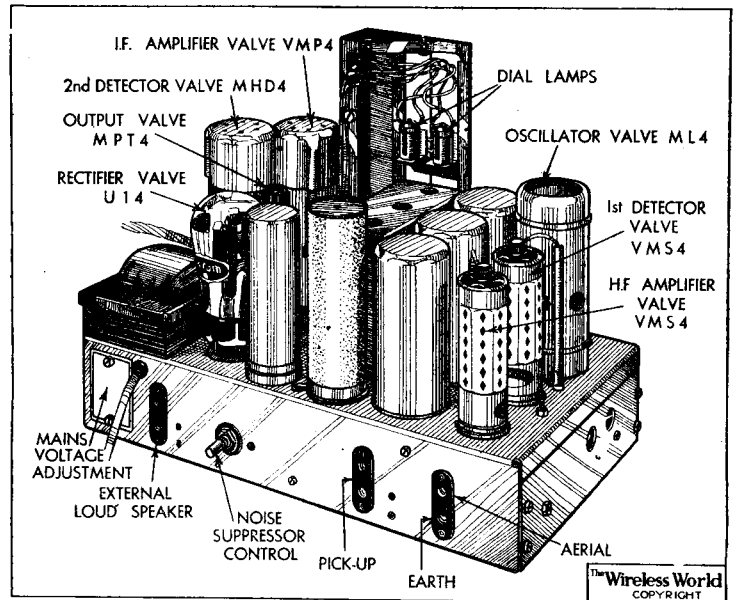
Four tuned circuits are associated with the I.F. amplifier, and the output is taken directly from the anode for the A.V.C. diode and from a tapping on the secondary tuned output transformer for the signal rectification diode. A tuned acceptor circuit is connected across the diode load to eliminate all traces of the intermediate frequency in the subsequent stages.

A separate triode valve is employed to suppress background noise between stations and performs this function by over-biasing the triode amplifying part of the second detector valve when the A.V.C. bias, which is applied to its grid, is at its lowest value.

Resistance-capacity coupling precedes the power pentode output valve. The moving-coil loud speaker is provided with a silencing key, which places a resistive load across the transformer secondary in place of the

speech coil when it is desired to use the extension loud speaker only.

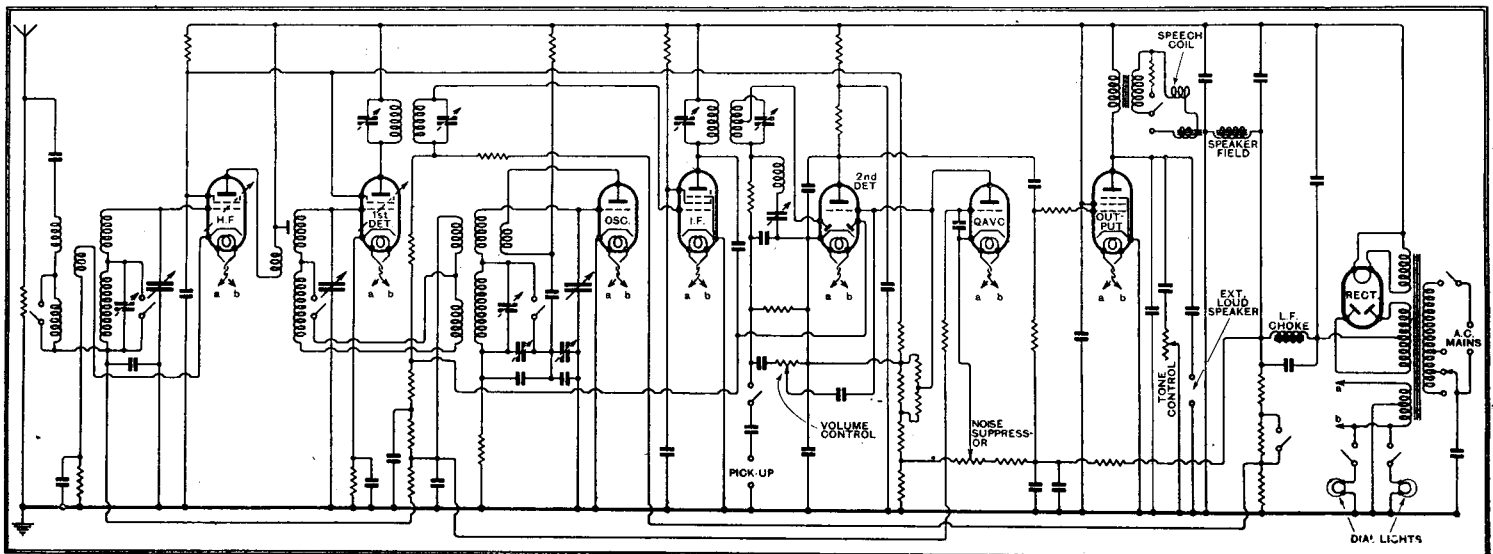
The chassis is strongly made from heavy-gauge steel and is cadmium-plated. As is usual in G.E.C. sets the soldered joints are particularly clean, and all mechanical details such as the wave-range switch are of sound engineering design. The screened grid valves, together with their anode leads, are thoroughly screened by metal cylinders with



The noise suppressor valve, which is not visible in this view of the chassis, is mounted behind the I.F. and second detector valves.

close-fitting caps of special design. A vertical tuning scale of good length is illuminated by coloured pilot lamps, which travel up and down on the indicator carriage.

The controls handle easily, and in the



Complete circuit diagram. The A.V.C. bias controls the H.F., first detector and I.F. stages.

G.E.C. Superhet 8—

matter of range and selectivity the set is capable of a high performance. In daylight it was found possible to receive Strasbourg, which is separated from London Regional by two channels, at good programme strength and without the slightest trace of interference from the latter station. The automatic volume control is fully effective, and the noise suppressor control, which is situated at the back of the chassis, can be adjusted to cut off background noise at any desired level of sensitivity. The noise suppressor valve showed some tendency to become intermittent in action near the threshold input, but this is mentioned only as a matter of technical interest, and in the course of normal use the threshold is passed before this effect has time to establish itself.

The noise control has a wide range of operation, and can be set to receive only the local stations or it may be cut out of action altogether, when the set will operate at full sensitivity over the whole waverange.

The quality in general is clean and crisp and speech is particularly well reproduced. The tone control is useful, but for most purposes it will be found that best results are obtained with the control set a short distance back from the high-note position.

From the service man's point of view, the assembly of the chassis in the cabinet is ideal, a seven-pin plug being employed to connect the set with the loud speaker and smoothing equipment in the top of the cabinet. A spare pilot lamp is provided, and is carried in a dummy lampholder mounted on the inside of the cabinet.

Oscillator Coupling

A RATHER interesting effect is described by the user of a fairly straightforward superheterodyne of his own design. Briefly, it is found that signal strength increases appreciably when the voltage of the L.T. battery drops towards the figure corresponding to complete discharge. This is contrary to the usual experience, and we are asked to suggest a possible cause.

It is reasonable to suppose that this unusual effect may be due to the fact that the first detector valve is normally overloaded seriously by energy fed to it from the oscillator valve. As battery voltage falls, oscillator output will be reduced, and so operating conditions will become more favourable.

It is suggested that our correspondent should try an experimental reduction in the coupling between the oscillator circuit and the grid circuit of the detector. It would also be worth while to make sure that the oscillator coil is sufficiently screened to prevent the transference of an undue amount of energy through incidental couplings.

Readers' Problems

H.F. Resistances

WE are asked to say whether it is safe to assume that the H.F. resistance of commercially made fixed resistors will be the same as their rated D.C. resistance.

The modern type of composition or metalised resistor is non-inductive, and has an almost negligible self-capacity; it therefore follows that, within the usual tolerances as to accuracy, the resistance value will for most purposes be independent of frequency.

This does not apply, of course, to wire-wound resistors.

Valve Makers' Benefit

EVER since the thermionic valve came into general use it has been necessary from time to time to issue warnings in these pages against dangerous and incorrect forms of H.T.-L.T. inter-connection and switching, which may easily result in the accidental burning-out of all the valve filaments in a receiver.

And now, in spite of these repeated warnings, the old trouble has cropped up again,

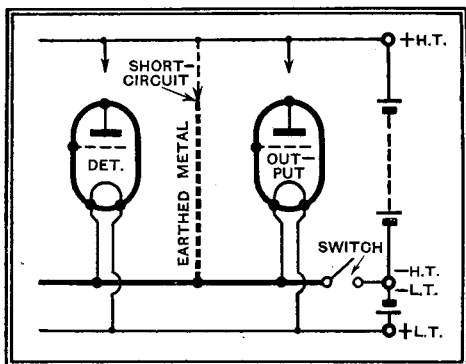


Fig. 1.—How valves are liable to be destroyed through incorrect connections of the on-off switch.

and the mystified sufferer asks us both to explain how the accident occurred, and to say how it may be prevented in the future.

The incorrect form of connection that led to the accident is that shown diagrammatically in the skeleton diagram reproduced in Fig. 1. A common terminal is used for H.T. negative and L.T. negative, and the on-off switch is interposed in the lead which connects this terminal to the receiver circuits. An equally objectionable variant is the arrangement in which L.T. positive is joined to H.T. negative in a misguided effort to obtain a volt or two extra of

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page

"free" high tension, the switch being again inserted in the common lead.

Consideration of Fig. 1 will show that, as a result of making accidental contact between the H.T. positive line and any earthed metal work (screening, condenser frames, etc.), the H.T. battery will be virtually connected across the filaments of all valves—generally with disastrous results. The L.T. battery, of course, remains in circuit, but will have a negligible effect when the on-off switch is "open."

The standard form of connection, with H.T. negative joined to L.T. negative, the switch in the positive L.T. lead, and all metal work connected to the common negative, is the safest and simplest.

Extended Waverange

THERE are quite a number of receivers which cannot be tuned to a wavelength of as low as 200 metres; very often this is not considered to be of much importance, but occasionally it is especially desired to listen to transmissions at the extreme lower end of the medium broadcast band.

A reader who is in this position asks if it is correct to assume that the inductance of his tuning coils might be reduced to a sufficient extent by inserting inside them small metal tubes. The position of the tubes would be adjusted by means of screws passing through the top of the screening cover, and in this way inductance values, which would obviously be disturbed, could be re-matched.

It is certainly true that the waverange of a receiver could be extended in a downward direction by this plan, and it is also agreed that no great difficulty should be encountered in re-matching the inductance values of the coils. But the plan is hardly one that can be advocated, as losses would be increased and the wave-range at the other end of the scale would be reduced.

It would seem much better to make a determined effort to reduce incidental stray capacities across the tuned circuits.

Old-fashioned Condensers

WE often have requests for information as to the suitability of components removed from out-of-date receivers for use in modern circuits. The subject is hardly one that can be treated briefly in general terms, but with regard to fixed paper-dielectric condensers of high capacity, the position may be summed up quite definitely.

Any condensers of adequate working voltage and good insulation may safely be employed for smoothing purposes and for decoupling low-frequency circuits. But for high-frequency circuits, old types of condensers are likely to prove unsatisfactory for by-pass purposes, as they will probably be inductive, and so will offer a considerable impedance to the passage of H.F. currents.

A Sporting Chance

A QUESTION that cannot be answered definitely is propounded by a reader who asks whether American broadcasting could be received with a three-valve receiver.

No details are given as to the circuit arrangement, etc., but this hardly affects the answer. Given sufficiently favourable conditions, American broadcasts can be—and often are—received on extremely simple sets, even with reacting detector-L.F. combinations. When conditions are unfavourable, the most sensitive of sets will fail to give the desired results. But the point is that the chance of receiving the American broadcasts at any given time increases in proportion to the sensitivity of the receiver.

**The Wireless World
INFORMATION BUREAU**

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

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making use of them, to satisfy themselves that they would
not be infringing patents.*

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EDITORIAL COMMENT

Components

The Importance of Careful Selection

A WIRELESS set never breaks down; it is always an individual component which is the root of the trouble. Just as a chain is no stronger than the weakest link, so the efficiency of a wireless set depends upon the performance of the poorest component. A wireless set is, in fact, very much like a chain, because it is composed of a circuit, or series of circuits, and failure on the part of any one of the components produces a breakdown of the receiver.

It is small wonder then that the choice of components for building a set, whether in commercial production or for the home builder, is so important. Not only must we be sure that the components selected are of a quality and reliability up to the standard we have set for the receiver as a whole, but the components must be carefully chosen as regards their electrical characteristics, and usually the choice of each component has to be considered bearing in mind the properties of other components which have to work in harness with it.

In this issue we have endeavoured to discuss the characteristics of components and give advice on their selection, and we hope that the information imparted will be of value to our readers. No attempt has been made to deal individually with the great variety of articles from which the reader can select, but essential points characteristic of the various types have been discussed.

In the early days the constructor had very few components available ready-made for his use, and consequently he had to set about making

nearly every part himself. Many components to-day are really too complicated to be within the scope of the ordinary constructor to build up, whilst others require such careful matching as to necessitate the use of special apparatus. There are still, however, a number of components which it is both interesting and instructive to make, and materials can be bought cheaply for the purpose. An article in this issue indicates what material of this kind is available and where it can be procured.

500 kW.

Listen to America

IS there any limit to the power to which broadcasting stations aspire? In Europe we have felt concerned at the increasing number of stations designed to work on power of the order of 100 kW., and it has been suggested that this should be regarded as the utmost limit to which stations should be allowed to go. America evidently does not consider 100 kW. to be sufficiently imposing.

It will probably be worth while for those who are prepared for early rising next Sunday to listen-in at 6 a.m. for the transmissions from the new 500 kW. broadcasting station at Cincinnati. A special programme is being transmitted with the object of discovering what is the range of the station. The wavelength to be used is 428.5 metres and the call-sign will be W8XO. It has been suggested that this station may be heard regularly in Europe, provided that times of transmission are suitable. It is the first of a number of 500 kW. transmitters projected in the States.

Reports on reception from listeners in this country next Sunday morning are invited.

Modern Tuning Coils

Up-to-date Practice in Coil Design

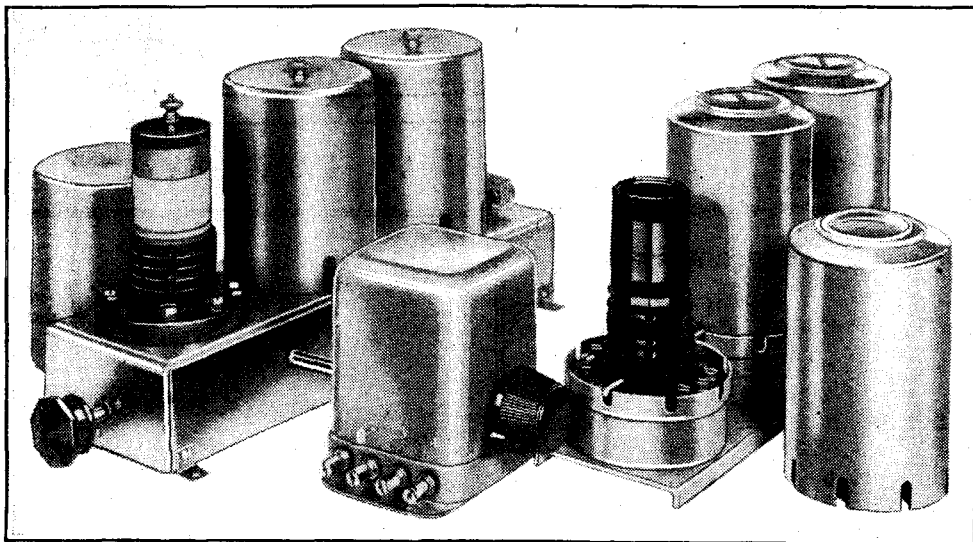
IN a receiver with any pretensions to sensitivity and selectivity the tuning coils are of paramount importance. Selectivity is affected more than sensitivity by any inefficiency in the tuned circuits, for in these days of valves with high values of mutual conductance, quite a large degree of amplification can be secured with relatively poor coils. Selectivity, however, is an extremely important attribute of a receiver, and one upon which its success or failure may depend.

The selectivity of a tuned circuit depends upon the frequency to which it is tuned and upon the coil magnification under working conditions. Since the frequency is fixed by that of the stations to be received and the coil inductance by the wavelength range to be covered with the usual capacity values, we find in practice that we need only consider the resistance of the circuit. The lower the effective resistance the higher the magnification, and the greater the selectivity and, incidentally, the efficiency.

From the point of view of amplification it is the dynamic resistance which is important, and the higher the figure which can be obtained the greater is the stage gain. With fixed values of coil inductance and wavelength range, however, the dynamic resistance increases as the H.F. resistance decreases, so that here again we find that low resistance is desirable.

In their general mechanical construction modern screened coils differ very little from one another. They nearly all take the general form illustrated, and their physical sizes are also of the same order. Electrically, the coils of different makes are also alike as regards their inductance values, and variations are to be found chiefly in the arrangement of the various tapping points or coupling coils, methods of coupling in band-pass filters, and in their efficiency. An inductance value of 157 mH. for the medium waveband and 2,200 mH. for the long waveband is practically standard for straight sets and for the preselector coils of superheterodynes.

The medium-wave coil is usually of the single-layer type, but the former upon which it is wound may vary considerably.



A selection of screened air-cored tuning coils.

In some cases a Paxolin or similar tube is used, whereas in others a ribbed bakelite moulding is employed, but from the efficiency point of view there is probably little to choose between the different types. The actual winding, however, is important, for the gauge of wire and the shape of the coil affect the resistance appreciably. In general, for a given coil diameter, the longer the winding the better, provided that the size of wire is correctly chosen. With

the most commonly employed dimensions a wire gauge of from No. 28 to No. 32 leads to the lowest H.F. resistance, and it is now rare to find coils wound with heavier wire. The long-wave coil is usually wound slab fashion in slots, which may vary in number from one to three, the latter being the more usual. In this coil the wire is considerably finer, as befits the different inductance and type of winding.

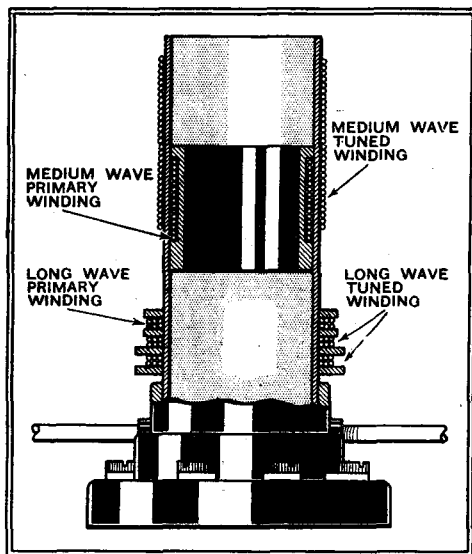
As regards the efficiency of the coil itself, there is rarely any great difference between makes of air-cored types, but in the provision for connecting the coil in a receiver there may lie a very great difference indeed. It must be remembered that the selectivity and amplification do not depend only upon the resistance of the coil itself *but upon its effective resistance*

when connected in circuit. The connection of any component to a tuned circuit inevitably increases its losses and reduces selectivity, so it will readily be seen that the best coil is not necessarily the one of the lowest H.F. resistance in itself, but the one which is so arranged that it has the lowest resistance when connected in circuit. In this connection, of course, it should be made clear that the lowest resistance coil will still be the best when connected in circuit if the same care be taken in the choice of its connecting points. Of two coils which are equally well designed as regards the positioning of tapping points, that with the lower resistance is the better. If the higher resistance coil is properly tapped, however, and the more efficient coil is poorly designed in this respect, the former will probably be the better to use and lead to the greater degree of selectivity.

The Tapping Points

This question of tapping points, therefore, is one of very great importance, and is one which merits careful consideration. It is the general practice to connect the anode of an H.F. valve to a tapping point on a tuned anode or tuned grid coil, or, in the case of an H.F. transformer, to use fewer turns on the primary than on the secondary. Since modern H.F. valves have very high A.C. resistances, this inevitably means a loss of amplification, but the practice is advisable to maintain stability with even one H.F. stage, and it is essential with two. Owing to the high valve resistance selectivity is not greatly affected by the position of the tapping point.

The case of the detector, however, is very important. The usual grid detector



The disposition of the windings of a typical air-cored H.F. transformer is clearly shown in this drawing.

Modern Tuning Coils—

or diode has a fairly low input impedance, and if it be connected across the whole tuned circuit the effective H.F. resistance is greatly increased. It is becoming common, therefore, to connect the detector to a tapping point, and in order to save complication in the switching the same tapping is usually employed for the detector as for the H.F. valve anode. The fewer the number of turns between the tapping and earth the less will the tuned circuit be damped by external components, and the greater will be the selectivity. On the other hand, the lower the tapping the smaller will be the amplification, so that a compromise is necessary. In general, a tapping point should be so placed that from one-half to one-third the total number of turns are between the tapping and earth. A point of particular importance in a coil for use in a ganged receiver is to see that the long-wave coil is tapped so that the effective ratio is the same on both wavebands, and that switching is included to effect the changeover, otherwise the ganging will not hold properly on both wavebands. This point applies with even greater force to the aerial coil.

It is now common to use a band-pass filter to precede the first valve in the set. The tuned coils, of course, are identical with the others in order that ganging may be maintained, but there are many different methods whereby the circuits are coupled. Some coils include no provision for coupling, and it is then necessary to use a common capacity or a very small condenser connected between their high-potential ends, or a combination of both. Although good results are obtainable with this arrangement it is not so convenient for general use as inductive coupling, since the capacity required in the case of "top-end" coupling is extremely small.

In general, therefore, coils which include a method of coupling are the easiest to use, and it is a common practice to fit a small winding to each of the filter coils, the interconnection of which forms a link circuit. This type of coupling has the merit of avoiding any additions to the waveband switching, for the correct linkage on both bands can be secured by the simple process of coupling the link coils tightly to the long waveband tuned coils and loosely to the medium-waveband coils. This method of avoiding switching with coupling coils is one which is often adopted in the case of a reaction winding. Here, however, it is becoming more and more common to find that two coils are employed, and that

a switch short-circuits one of them on the medium waveband. This additional switching is being introduced because it leads to somewhat more reliable reaction effects.

The superheterodyne has led to the introduction of a new type of coil for the oscillator circuit. It is, of course, essentially the same as the others, and differs chiefly in the arrangements for coupling and in its inductance. The medium-waveband coil has almost invariably an inductance of 126.5 mH. and the long-wave coil an inductance of 1,056 mH. Provision should be made in the design for the switching to short-circuit the long-wave padding condenser, and in a coil for use with a two-valve frequency changer in a mains set there should be a coupling coil to permit cathode injection to the first detector. This is unnecessary in a coil for use with a Heptode or Pentagrid.

Most oscillator coils are intended for use with one of the special superheterodyne type gang condensers, and when purchasing these components care should be taken to see that they are designed to work together. Complete standardisation has not yet been obtained, and a few gang condensers need different inductance values from the usual. The value of the intermediate frequency is also important, and it should be remembered that most components are designed for use with a frequency of 110 kc/s.

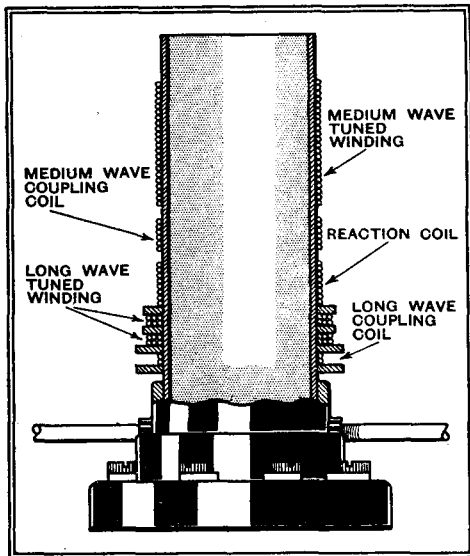
A good quality iron-cored screened coil has a lower H.F. resistance than a screened air-cored coil of similar or even somewhat larger dimensions. If its tapping points or coupling coils be correctly designed for the circuit in which it is to be used, therefore, it will undoubtedly give increased selectivity. Even if it is a good coil, however, it will not appreciably improve the performance of a set if its tapings are not correctly placed.

All iron-cored coils, moreover, are not equally good. Some have higher resistances than air-cored types! Others are little better than air-cored coils, but are so tapped that they give better selectivity than the usual air-cored type; this selectivity, however, is obtained at the expense of amplification, and the same results could be obtained with an air-core coil designed on the same lines.

Iron-cored Coils

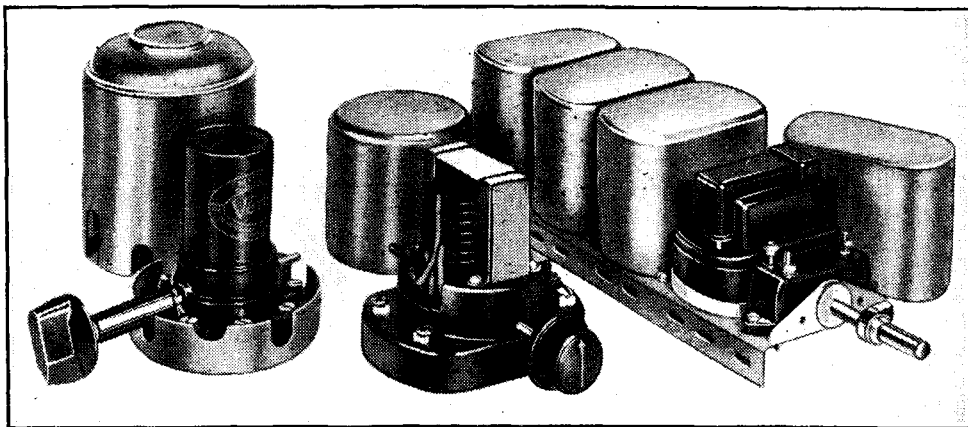
The best iron-cored coils are undoubtedly a vast improvement over the usual air-cored coils, and they find their chief application in the straight set. Their higher selectivity is often unnecessary, and may prove embarrassing, in the signal frequency circuits of a superheterodyne. In this type of receiver it must be remembered that the adjacent channel selectivity is obtained chiefly at the intermediate frequency. Excessive selectivity in the pre-selector may lead to difficulties because it may be accompanied by a degree of side-band cutting which varies with the wavelength to which the receiver is tuned, and which cannot be easily compensated for by a tone-correction circuit.

Enough has been said to show that discrimination should be shown in the choice of iron-cored coils, and the points for which to watch are in the main the same as for air-cored types. Their use is now fashionable, but although a good coil may lead to a greatly improved performance, a poor one can be very much worse than



The arrangement of the oscillator windings of a superheterodyne is shown here.

for use with one of the special superheterodyne type gang condensers, and when purchasing these components care should be taken to see that they are designed to work together. Complete standardisation has not yet been obtained, and a few gang condensers need different inductance values from the usual. The value of the intermediate frequency is also important, and it should be remembered that most components are designed for use with a frequency of 110 kc/s.



A group of modern iron-cored coils.

Some mention should be made of the latest development in tuning systems, namely, iron-cored coils. The idea is widespread that their use will necessarily lead to a great improvement in selectivity. This is by no means the case, and a few remarks on the subject may help in clarifying the situation.

the average air-cored type, and lead to a reduction in selectivity.

Whatever coils be used, accuracy of matching is of great importance if ganging is to prove satisfactory. In general, the inductance values should be within at least plus or minus 1 per cent. of their rated figure, and 0.5 per cent. is better.

L.F. Transformers and Chokes

A Guide to the Choice of Good Components and Proper Ratios

THE past few years has seen some decided changes in the design of L.F. intervalve transformers, and whereas hitherto but two styles only were in general use, to-day there are no fewer than five distinct varieties, and in each category are several models of different ratio.

Transformers for direct connection in the anode circuit of a valve are very nearly as old as the thermionic valve itself, and were in use long before broadcasting became an established fact. The other early type was the push-pull model, and to complete the five modern styles may be added parallel-feed transformers, Class "B" driver transformers and Q.P.P. intervalve models. Some may say, perhaps rightly so, that the last two mentioned are really push-pull transformers, and the writer will not enter the lists against this contention as, strictly speaking, that is so, yet in each instance the method of operation is markedly different, so there is every justification for

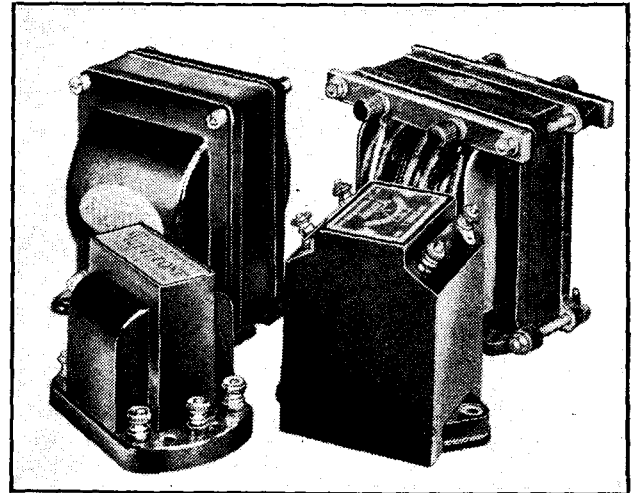
and this method of construction is usually adopted in the higher grade components.

That attention to these details is most essential is illustrated by the curves in Fig. 1. Curve A relates to a transformer in which the primary inductance is too small, as a result of which the reproduction is lacking in bass. In curve B we have a transformer possessing an adequate primary inductance, yet showing a marked failing in the upper register. A large leakage inductance, coupled with high self-capacity of the secondary, are the main factors responsible for this failing. By careful design a good approximation to the ideal is obtainable, as shown by curve C.

These curves take into account the characteristics of the preceding valve, so it is most essential that the transformer maker's recommendation as to the manner of its use should be followed faithfully. A considerable latitude is usually allowed and most conditions can be complied with by one component or another.

The primary inductance will be maintained at an adequate value only by keeping within the limits prescribed for the steady D.C.

current that can be passed through the winding. In some transformers currents up to eight or ten milliamperes are permissible, while in others a limit may be set at but two milliamperes. The former type



A few typical L.F. transformers for direct connection in the anode circuit of valves.

are often of fairly large dimensions, being wound on a core of normal transformer iron, and the inductance of the winding is not influenced to anything like the same extent by the D.C. current as it is in transformers embodying the high permeability alloys. These, however, are of much smaller size, since fewer turns of wire are needed to obtain an equivalent inductance, consequently the secondary winding is smaller and a good characteristic is possible without undue constructional complications.

As a rule, however, this style is employed in a parallel-feed circuit so that the steady anode current does not pass through the transformer's primary and magnetisation of the core is thereby avoided. The anode feed resistance, which with the decoupling resistance may amount to about 50,000 ohms, will account for a certain voltage drop, and the available H.T. voltage must be high enough to cope with this and yet allow the normal working potential to reach the anode of the valve.

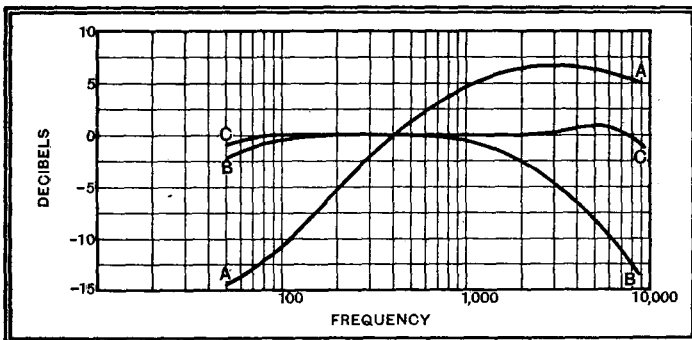


Fig. 1.—Curves showing effect on performance of transformers with A, very small primary inductance, and B, high leakage inductance. Curve C is for a high-grade component.

classifying them under separate headings.

In practically every case the transformer actually contributes to the amplification of the stage by providing a voltage step-up between its windings, but there is a limit to the step-up that can be employed in practice. For, in the first case, the primary winding should offer a reasonably high impedance to the lowest audible frequency reproduced, consequently its inductance must be large; on the other hand, high self-capacity in the secondary winding must be avoided, which with large primaries and big step-up ratios is not easy to achieve.

This is a potential cause of high note loss in L.F. transformers, but as a rule it is not the most serious, and when deficiencies in the upper register do occur they are more likely to be due to the leakage inductance, a factor brought about by imperfect coupling between the windings. If the windings are arranged in several sections with primary and secondary portions interleaved the leakage inductance can be kept small,

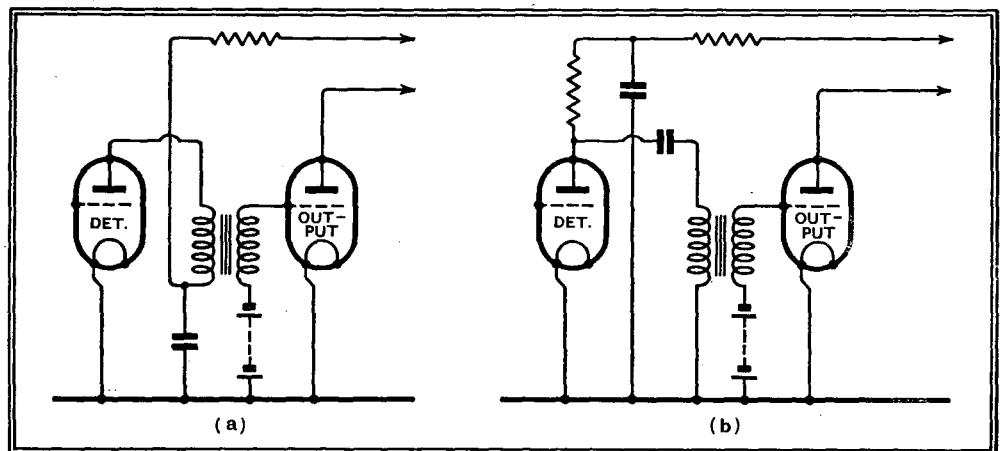


Fig. 2.—Two methods of connecting an intervalve transformer. In (a) the primary carries the valve's anode current, while in (b) only the A.C. component is passed through the winding. This is described as parallel-feed connection.

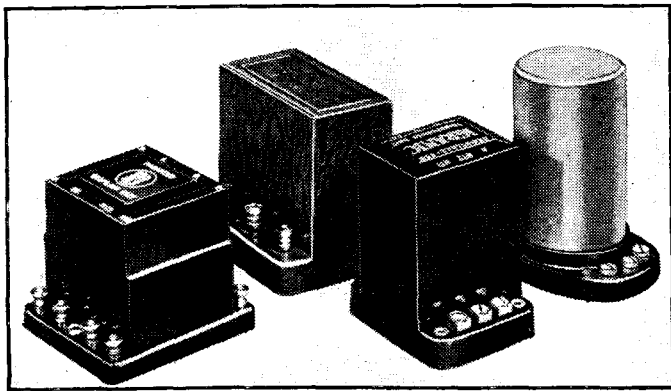
L.F. Transformers and Chokes—

Intervalve transformers may, therefore, be divided broadly into two classes: in the one we have those designed for direct connection in the anode circuit of the valve and capable of carrying reasonable amounts of D.C. yet maintaining its inductance at a high level, while under the other heading may be included the miniature style embodying high permeability cores and suitable for use in parallel-feed circuits only. Their connections are shown diagrammatically in Fig. 2.

In battery sets operated at a comparatively low voltage the former type might prove the more convenient, for some decoupling will be needed, and the resistance in the H.T. path must be kept as small as possible. The parallel-feed type being as a rule of small size are particularly well suited for use where space is limited. Furthermore, they give a fairly uniform amplification, but at a slightly lower level, than a straight-connected transformer of the same ratio, owing to the influence of the anode feed resistance.

Choosing the Ratio

While it would be very convenient if we could calculate by some simpler formula the best ratio to employ for any particular case, it would afford little advantage if having arrived at a satisfactory answer the only transformer satisfying this condition proved to be unsuitable in other respects. Thus, it would seem that no hard and fast rule can be laid down, but a rough and ready one is to decide what primary inductance is most likely to give the best all-round results with the valve fitted in the preceding



It is now common practice to embody all the components associated with the parallel-feed transformer in a single container, several examples of which are shown here.

stage and let the ratio be governed by the output valve. For it is assumed that only one L.F. amplifier is employed and this follows the detector.

If the detector has an A.C. resistance of between 10,000 and 15,000 ohms, at least 50 henrys would be needed to ensure a good low note response, while for a valve of less than 10,000 ohms the minimum inductance could be set at 30 henrys. Of course, these are minimum values, and by employing larger inductances the lower register will be improved.

Where the output valve is of the small power type or one of the high-efficiency pentodes not capable of handling a large input, it might be unwise to exceed a 1 to 3 or a 1 to 3½ voltage step-up, as this valve will be easily overloaded; otherwise the highest ratio obtainable, provided the other conditions are complied with, would be a perfectly safe choice.

The possibility of overloading the smaller output valves can be shown by a simple formula. It gives an approximate answer only, but will serve our purpose. Let us take for example a detector valve with an amplification of 15 and a signal voltage of 0.25 applied to its grid. The approximate stage gain with a 1 to 3.5 ratio transformer connected in its anode circuit can be found by multiplying all these factors and taking fifty per cent. of the result as a correction for the average depth of modulation. We thus write $0.25 \times 15 \times 3.5 \times 0.5 = 6.5$ volts, and this will bear a reasonable approximation to the voltage output of the detector stage at a frequency of about 2,000 cycles and serves to show whether the voltage passed to the grid of the output valve is within or beyond its capacity to handle.

It should be remembered that this is an R.M.S. voltage, and the grid bias needed for the power valve to take care of the peak value is $1.4 \times 6.5 = 9.1$ volts, the nearest value obtainable in a battery operated set being minus 9 volts.

With small power valves we cannot always avoid occasional overload, since otherwise the general level of the output would be too low for ordinary occasions, and in the example taken this has been assumed, for the maximum modulation may attain 70 to 80 per cent., and the overall amplification will be increased proportionately.

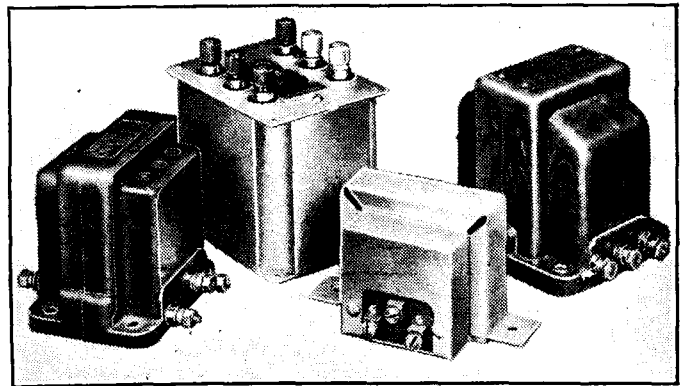
With a Q.P.P. output stage, intervalve transformers giving a voltage step-up of from 1 to 7 to 10 to 10 are usually employed, for it must be remembered

that so far as each individual output valve is concerned, only half this ratio is effective, since the secondary winding is centre tapped.

Another variation of push-pull amplification, of which Q.P.P. is, of course, but one, is that in which the two output valves are biased to the mid-point of their characteristic curves, or put in another form, given the same bias as for one valve used as a single output stage, and as the secondary winding is centre tapped the overall step-up ratio may be twice that of

a transformer that would serve for the same combination of detector and one output valve of the type used.

In Class "B" amplification an entirely different state of affairs exists, and it is not uncommon to find *step-down* ratio transformers specified. This valve is always preceded by a driver valve, and the whole has to be regarded more in the nature of a power stage than as an ordinary intervalve coupling. For the input impedance of the Class "B" valve is low



A group of Class "B" driver transformers; some offer the choice of several ratios.

compared with that of alternative arrangements, as the input voltages actually swing into the region of *positive grid bias*, and grid current flows during each half cycle.

This resistance is reflected back into the anode circuit of the preceding valve as the square of the transformer ratio, and as a certain amount of power is needed to operate the output stage the reflected load must be approximately equal to the optimum working load for the particular driver valve employed. The power demanded is not large and varies from about 40 to 80 milliwatts or so, according to the combination of valves.

This input impedance varies with the operating voltages and also to some extent with the characteristics of the driver valve, all of which complicates the process of calculating the optimum transformer ratio. By far the best course is to follow the valve maker's advice with regard to the transformer ratio and fit one of the driver valves recommended for that particular Class "B" valve.

The driver and output transformers need to be designed with care if the best results are to be obtained, but this matter has already been dealt with at some length in a recent article.¹

L.F. Chokes

Iron-cored inductances play an important part in the working of a receiver, for whenever low-frequency currents are required to be deflected from one path to another or their passage blocked, yet still leaving a path of comparatively low resistance for the D.C. component, an inductance of this type serves the purpose best. In the majority of cases the coil

¹ "High Quality Class 'B' Amplification." *The Wireless World*, December 15th, 1933.

L.F. Transformers and Chokes—

has to carry reasonably large values of D.C., and unless the iron core is of adequate size, this may lead to considerable changes in its inductance. For the inductance of any iron-cored structure is governed by the permeability of the iron, and this factor varies with the magnetisation of the core.

With chokes designed for one particular purpose it is of little consequence if the inductance changes with variation of the D.C. component, provided the inductance available under the condition it is used is adequate for the purpose, and that normally the D.C. component is not subject to fluctuation, or changes only by small amounts above and below a steady value.

This condition rarely obtains, however, in a wireless receiver, although the current fluctuations may be far too rapid for any normal measuring instrument to follow. It applies particularly to output chokes, since its function depends solely upon changes in the steady current to produce the difference in potential across its ends.

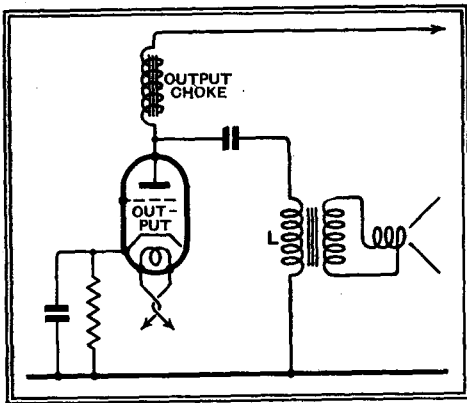


Fig. 3.—An L.F. choke is often used to avoid passing heavy anode currents through loud speaker input transformers; but its inductance must be large compared with L.

Yet no milliammeter will record these changes. But the instantaneous inductance of the choke may vary quite widely, and if it falls below a certain value could conceivably give rise to distortion.

There is little likelihood of this occurring if the choke is of the constant inductance type, that is to say, its inductance is independent of the value of the D.C. flowing through its windings. This applies, of course, to intervalve transformers as well, but the current changes are usually too small to be worth considering.

Sometimes an output circuit, as shown in Fig. 3, is adopted to isolate the loud speaker from the H.T. supply, this precaution being taken usually when the loud speaker is located some distance from the set. Or again, it enables loud speakers fitted with transformers not capable of carrying the anode current of the last valve to be operated under more favourable conditions.

The choke for this purpose should have an inductance many times that of the transformer primary winding, but this is not always practicable, since it is not

unlikely for L (Fig. 3) to be 30 to 40 henrys with no D.C. flowing. This would bring the choke inductance to an unwieldy figure, so that the only course to follow is to use the highest inductance choke that circumstances will allow, always remembering it must possess this inductance when passing the anode current of the output valve, and further, preference might be given to those designed to

have a reasonably constant inductance.

There are many different styles of output chokes in every-day use, some are tapped for matching Q.P.P. operated output valves and Class "B" valves to existing loud speakers, others for matching pentodes and triodes to loud speakers. Yet all serve the same purpose, so that the essential points to watch when making a choice is very much the same for all kinds.

DISTANT RECEPTION NOTES

"Magnificent" Transmissions, and Some Others

THERE have been rumours that Luxembourg had suffered a change of heart and had been working on its Lucerne wavelength of 240.2 metres, at certain times, at any rate. I cannot say for certain whether this is so or not, but I have never myself found the station working anywhere but on the long waves. Possibly some listeners have mistaken Nürnberg, which is coming in very powerfully just now, for Luxembourg.

Readers have probably noticed that the German stations are no longer working in three big groups for programme purposes, as they were up to the coming of the Lucerne Plan. Actually, the exchanges of programmes between German stations are very frequent, and, as often as not, one seems to find a number of stations relaying the same concert or sporting running commentary.

The old Copenhagen transmitter, which was rated at only .8 kilowatt, has now closed down and its place has been taken by a new 10-kilowatt plant that has been erected some miles outside the city. It is now at work on 255.1 metres, but I cannot yet record reception of it, since there has been so much interference in that part of the medium waveband.

It is stated authoritatively that a fresh conference is to be called to consider the position of the long-wave stations. Something will certainly have to be done, and

that right soon. At the moment a dozen stations are working according to the Lucerne Plan whilst the remainder are not. The result is that conditions, though better than they were a week or two ago, are still not too good. Order cannot be evolved until the Eiffel Tower closes down and certain other stations cease to use wavelengths to which they have no "Lucerne" right.

Reception conditions are definitely improving, and the improvement was especially marked during the three days preceding the writing of these notes. On the long waves, for instance, Huizen has been coming in clear of heterodyne interference, and I can report good reception from Motala. Radio-Paris, however, is still heterodyned.

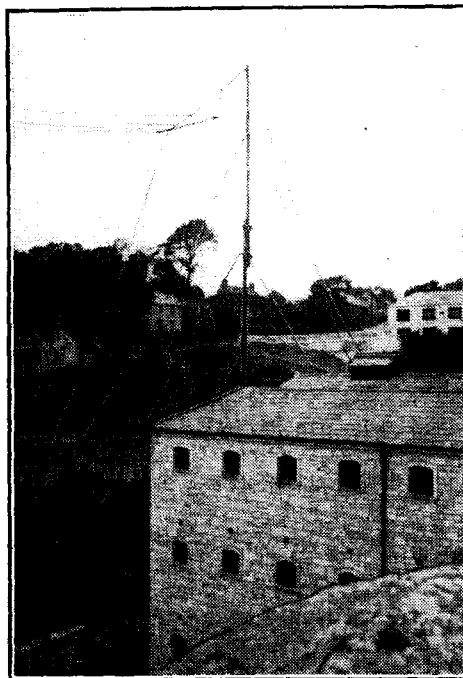
Of the medium-wave stations Budapest is magnificent, and Beromünster comes in well, though this station has taken to closing down rather early in the evening. Mühlacker was jammed some time ago, but is now coming in well. Vienna, Florence, Brussels No. 1, Prague, Lyons PTT, Langenberg, and Söttens all provide good reception clear of interference.

Paris PTT is now one of the best of Continental stations. Munich is very well heard. Marseilles and Katowice are receivable, though usually they are rather weak. Leipzig is still badly heterodyned. Milan is not yet completely clear of a heterodyne, though the interference is becoming sensibly less. Berlin is, unfortunately, heterodyned. Hamburg, Brussels No. 2, and Breslau all come through well, but the Poste Parisien and Hilversum suffer from interference. Heilsberg has never been well heard since the Lucerne Plan came into operation.

Owing probably to better synchronisation Frankfurt is now often receivable, though sharing a wavelength with other stations. Trieste comes in clearly and strongly on most evenings, and Nürnberg, as already mentioned, gives excellent reception. Bordeaux PTT is amongst the best received of Continental stations.

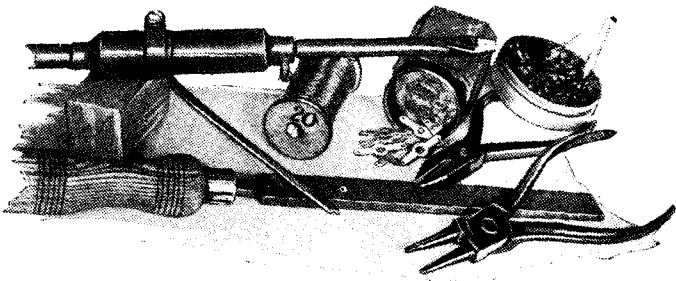
I have seen it stated that conditions on the medium waveband are still very much worse than they were before the coming of the Lucerne Plan. With this I am not in complete agreement, for so many good stations are now providing reception of real entertainment value. On a recent evening a rapid traverse of the medium waveband showed that Budapest, Beromünster, Athlone, Mühlacker, Vienna, Florence, Brussels No. 1, Prague, Lyons PTT, Langenberg, Söttens, Paris PTT, Munich, Milan, Strasbourg, Hamburg, Brussels No. 2, Breslau, Frankfurt, Trieste, and Bordeaux were all available as genuine alternatives. There seems little to grumble at when such a wide choice of programmes is open to the listener.

D. EXER.



PRISON BARS TO MUSICAL BARS. The Cork broadcasting station is situated in a building previously used as the local gaol.

TO SOLDER : *Yes or No ?*



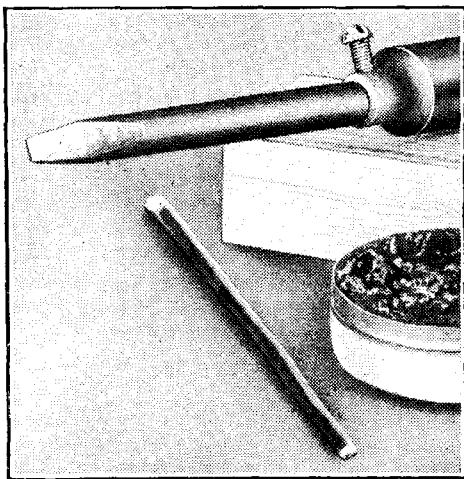
A Problem with an Easy Solution

HOME constructors can be divided into two groups: those who use solder and those who hope for the best.

There are arguments in favour of hoping for the best. A set can be made to work and may give good service when its wire connections depend upon the tightness of hand-screwed terminals, but its owner is never free from the fear that the worst may happen; and the more he and his friends are enjoying a particular programme the more insistent this dread becomes.

A knock, or even the vibration of a passing bus, may wreck the efficiency of a receiver until the offending terminal is located; and more especially is this so in the high-frequency stages, where sound electrical, as distinct from mere mechanical, contacts are the prime essential.

Why, then, is there a single solderless set in the country? The answer is simple. Soldering, like rose-pruning and egg-boiling, demands a little elementary technique. Nobody is a born solderer, and it is this fact that deters many intelligent human beings from attempting to acquire what is nothing more than a simple knack.



With the iron tinned we can face our first soldering job with equanimity.

The materials required are a soldering iron, procurable for 1s. 3d., six pennyworth of resin-cored solder and a sal ammoniac block, price about 4d. If the iron is not already "tinned," i.e., if its tip is not coated with a solder base, this is the first job to be undertaken. The iron is warmed in a flame and then rubbed on the sal ammoniac block, which prepares

NEARLY every constructor has had to decide whether to rely upon screw terminals for his electrical connections or master the art of soldering. This article shows that the "art" is nothing more than a little knack which can be acquired in a few minutes.

the copper surface to receive its thin layer of solder. Just a touch of solder on the warm iron will wander all over the tip, and, as the iron cools, will form a bright surface. Do not raise the iron to red heat or the solder will fail to grip, and it will be necessary to cool the iron, file it, and begin again.

With the iron tinned we can face our first soldering job with equanimity. We will assume that this is to consist of joining a length of copper wire to a tag. *The golden rule is to tin both surfaces.*

Run a small quantity of solder on to the iron, which, if it is well tinned, will hold solder even when it is inverted, with the solder on the underside. Apply the heated iron to the tag. The solder will then run on, and as the iron is withdrawn will harden. Treat the end of the wire in the same way. And now that both surfaces are tinned it is a simple matter to place the wire on the tag in the position required and apply the warm iron. Immediately the iron is withdrawn the solder will harden into a firm electrical joint.

The Use of Flux

If ordinary solder is used, i.e., not resin-cored, it is necessary to supplement the outfit with soldering flux, which prevents oxidation of the metal before the solder has had time to adhere. The flux, which should always be used in very small quantities, is applied to the surfaces before running on the solder. Otherwise the soldering process is the same as already outlined.

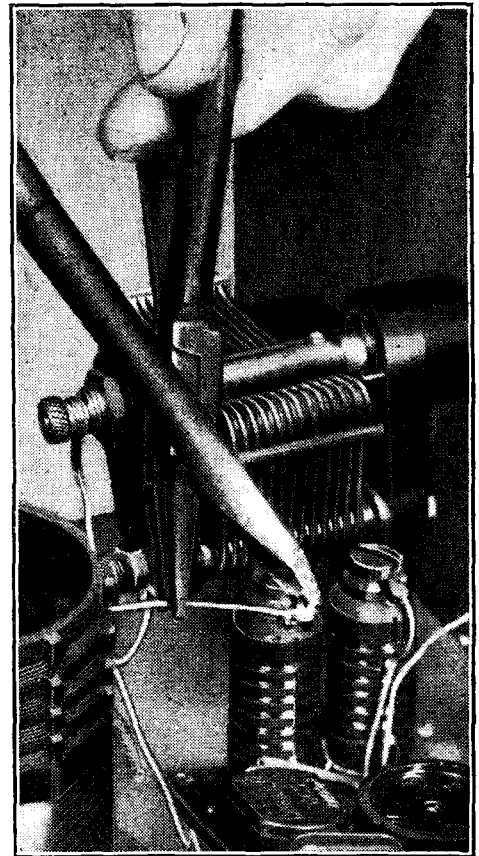
Like everything else, soldering has its little snags. Lucky the man with an electric iron, which may be maintained at an even temperature; the flame-heated iron needs a certain amount of watching, for if it gets too hot (this is denoted by the gas flame turning yellow) the solder will run off the tinning. If it is too cold the solder will split into separate lumps and be unworkable. Only experience will teach

the amateur to keep his iron at just the right temperature.

Do not hold the hot iron too long on the soldering tag if this is attached to a delicate component. Heat travels fast and will often melt the insulation or loosen an associated screw before the handyman realises the harm that has been done.

It is important to see that the surfaces to be soldered are quite clean, and in some cases it may be necessary to scrape them.

In joining two wires it is preferable to make a lap joint. Any attempt at a butt joint, in which the ends are fitted together and solder is run in between, should be left to experts with exceptionally steady hands and supreme self-confidence. Much the better plan is to overlap the wires to the extent of half an inch or more. Besides making a much easier job the joint is superior electrically and mechanic-



A small pair of pliers is useful to hold the shorter lengths of wire in position whilst the joint is being made.

ally to the more "pretty" butt joint. When joining wires at right angles the lap joint is still to be preferred; there is nothing to commend the very popular practice of twisting one wire in a small loop round the other and letting the solder run in between.

Occasionally the iron should be scraped, rubbed on the sal ammoniac block and re-tinned.

To solder or not to solder: that is the question. If any reader is still wavering on the point, let him remember one other important consideration: terminal-fitted components are much more expensive.

UNBIASED

By
FREE GRID

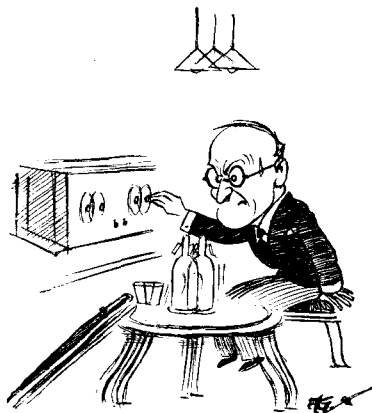
Blurred Vision

I RECEIVED a remarkable demonstration the other day of the growing intelligence of certain Harley Street medicos brought about entirely, I believe, by the spread of electrical knowledge engendered by the reading of this journal.

I recently received an S.O.S. from a distant relative with whom, to say the least, I have never been on the best of terms. His trouble was that an all-mains set which he had recently built was plagued by an ineradicable hum. My interest in the set overcame my baser feelings, and accordingly I agreed to journey down and spend a week or so in his seaside residence.

After several days of fruitless work I was suddenly alarmed to find myself suffering from blurred vision which, from much reading of police court reports, I knew to be one of the symptoms of arsenical poisoning. Since there were reasons, which I do not propose to enter into here, leading me to suspect that an attempt was being made on my life by certain interested parties, I lost no time in making tracks for the consulting room of a well-known Harley Street poisons-expert. After a careful examination he was able to disabuse my mind of my fears, but urged me strongly to consult a fellow fee-snatcher further along the street who has won some renown as an oculist.

This worthy, in whom I had not had much faith, completely astounded me when, after some smart work with a stethoscope, he announced that it was quite obvious that I had been staying in a house where the electric lighting supply was A.C. of exceedingly low periodicity.



Blurred vision.

A hasty trunk call not only confirmed the correctness of his diagnosis, but revealed to me at once why I had been unable to cure the hum, since I had foolishly assumed the periodicity to be standard, as the district was a modern one in every sense of the word.

Apart from the fact that this low

periodicity caused me to waste many days of fruitless labour, to suspect innocent people of crime, to undergo eyestrain, and sustain a nasty shock, there remains grave danger to the eyesight of those unfortunate enough to dwell in areas still served by A.C. of this archaic periodicity.

Speeding Up the Loud Speakers

A WELL-KNOWN Northern journal, in criticising the efforts of a celebrated talker whom the B.B.C. inflict upon us every week, suggests that his delivery is much too rapid and that "a radio talker should always remember people whose sets are not very good."



Speeded up for

This only shows how careful we inventors have to be not to breathe a word to a soul about our brain children during the period of gestation. I have not mentioned a word about an impending invention of mine outside my immediate family circle, and yet, as you see, those keen fellows up North have already got wind of it. The only thing for me to do now is to silence all chatter by disclosing vital details.

The invention is really quite a simple one and enables anyone to speed up or slow down a broadcast talk or musical excerpt according to his taste. Thus, it should prove especially useful to fourth formers who desire to follow the Parisian news bulletin, or jazz fanatics who desire to speed up chamber music for dancing purposes.

The output of the set is taken not to a loud speaker, but to an ordinary electromagnetic recorder associated with a dictaphone. Now, as you will agree, it is possible, by using a pick-up immediately following the recording stylus, to reproduce the programme from the wax cylinder immediately after it is recorded, but the speed of reproduction will be the same as that of recording. I have, however, fitted the pick-up on a revolving arm, the connections to it being made by the usual slip rings and brushes.

This revolving arm is driven by a separ-

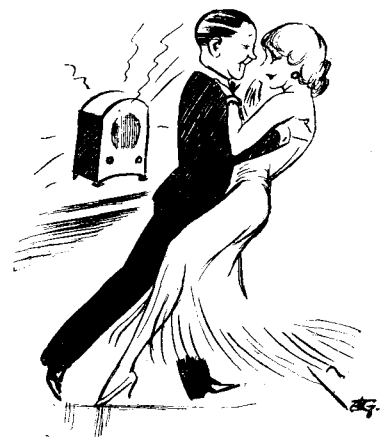
ately reversible and variable speed motor. By driving it in the same direction as the cylinder, but at half-speed, the record is reproduced at half the rate at which it is recorded. If, however, the arm is rotated in the opposite direction to that of the cylinder and at the same speed, then the rate of reproduction is double that of recording. In fact, any rate of reproduction can be obtained by merely adjusting the speed and direction of the motor driving the revolving pick-up arm.

I am now busily engaged in trying to apply the same idea to the Blatterphone and the photographic film methods of recording, but frankly I am up against a brick wall. It will be a test of your intelligence to say why.

A Cabinet Question

I WAS delighted to observe the high degree of ingenuity and originality displayed by certain readers in the cabinet designs which were illustrated and described in recent issues of *The Wireless World*. On the other hand, some of the designs were so stodgy that they scarcely merited the attention of even a set manufacturer.

None, I noticed, seemed suitable for the inhabitant of the modern small flat; and it seemed evident that the majority of competitors, at any rate among those who sent in radiogram designs, dwelt in marble halls.

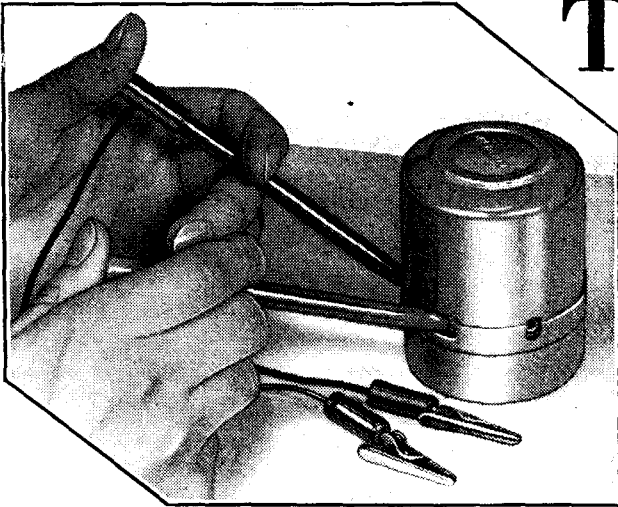


. dancing purposes.

I am still of the opinion that no design can equal that of the compactum type washhand stand to be found in ships, gaols and other confined spaces, with the loud speaker in the place of the mirror, the tuning dials just underneath, and the turntable in the let-down portion usually occupied by the basin. The set itself would, of course, be in the space behind the mirror which is usually occupied by the fresh water tank. The records would naturally be stored in the space usually taken up by the receptacle for waste water, which is, in my opinion, a highly suitable place for many of them.

Testing Components

Methods Requiring a Minimum of Apparatus



A SINGLE faulty component, after it has once been mounted and wired in the receiver, may be difficult to locate; and worse, its presence may cause quite a considerable amount of damage before the fault is detected. It may seem unkind to suggest that even brand-new parts might well be tested before they are fitted, but accidents *do* happen, and a fault may have developed since the component left the manufacturer's test room. It may be taken as an axiom that the means for making an electrical test are always necessary; even such a simple thing as a length of insulated wire can be tested very much more easily electrically than by visual means.

Three simple testers that can be improvised easily and cheaply enough are shown diagrammatically in Fig. 1. The first (diagram (a)) provides a lamp test for circuits of low resistance and for the detection of complete short-circuits, while headphones are useful for testing through circuits of high resistance. The unit is so wired that both indicating appliances come into operation when the test leads are connected across the circuit or component under suspicion. Another form

The value of the limiting resistance should be just high enough to pass a current corresponding to full-scale deflection of the milliammeter, and is ascertained by dividing the voltage of the test battery by "full-scale reading" (expressed as a fraction of an amp.).

In addition to this apparatus, it will be advisable to have some testing clips or "prods" with insulated handles for making contact with the terminals of the component under test. Incidentally, most of the excellent multi-range measuring instruments which are available are fitted with clips; amateurs who take their hobby seriously should realise that one of these instruments is an excellent investment, and will do much more than the extemporised testers already described.

For the benefit of those who have not previously considered the subject, the simplest possible methods of testing individual components in a wireless receiver may be put on record as briefly as possible.

Condensers, Fixed and Variable

In at least nine cases out of ten a fixed condenser that shows a lack of con-

tinuity and resistance tests are made by joining test leads to the common negative terminal and to the lower terminal.

A milliammeter may be wired as in diagram (c), a resistance being inserted in order to prevent risk of damage if the test leads should be connected across a path of very low resistance.

Various methods of detecting the presence of capacity in the condenser and of making a rough estimate of its value have been described from time to time; it will be sufficient to say that when testing with the phone method (Fig. 1 (a)) a "click" should be heard on completing the test circuit, but nothing should be heard when disconnecting the test leads. There is little to go wrong with variable condensers that cannot be detected by inspection, but continuity of "pigtail" connections may be checked, and the presence of a complete short-circuit between fixed and moving vanes may be detected by apply-

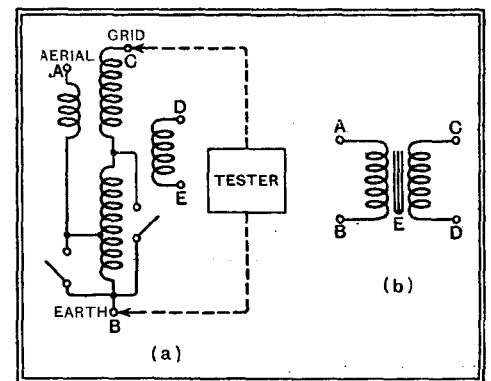


Fig. 2.—Testing coils and L.F. transformers.

ing a continuity test across the appropriate points while turning the rotor.

H.F. and I.F. Coils

A test for standard coils is indicated in Fig. 2 (a). The tester is first applied across the whole of the medium- and long-wave section; there should be a through circuit with the wave-range switch in the "open" or long-wave position. On closing this switch, a slightly increased flow of current should be detectable, at any rate with a lamp tester. The reaction winding may be checked by applying the test leads between points D and E, and the aerial circuit between points A and B. Complete insulation should exist between terminals D or E and any other terminal of the coil assembly. A similar course of procedure is applicable to I.F. transformers and H.F. chokes, although it should be remembered that the resistance may be too high for a lamp test.

L.F. Transformers and Chokes

Primary and secondary windings of L.F. transformers may be tested for continuity between points A, B and C, D (Fig. 2 (b)). There should be complete insulation between each of these windings, and also between either winding and the earthing terminal E joined internally to the core or metal shroud. Essentially the

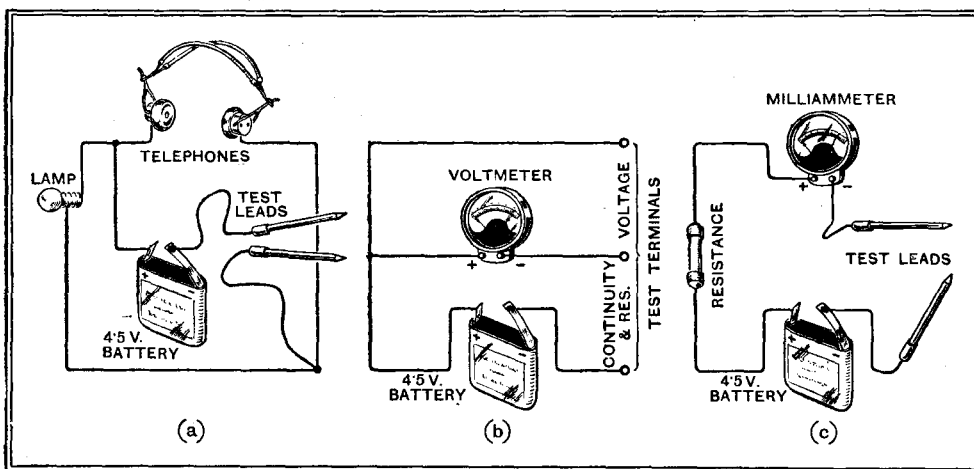


Fig. 1.—Three simple devices for checking continuity and insulation.

of tester, for which a voltmeter is necessary, is shown in diagram (b); it is wired in such a way that by using the middle and upper terminals, the voltmeter may be used for its normal purpose, while

continuity when tested by means of any of the devices shown in Fig. 1 will be in order. In the tenth—or perhaps one should say the hundredth—case there may be an internal disconnection.

Testing Components—

same procedure in testing is applied to power transformers or chokes, but it should be remembered that low-tension secondaries will have a very low resistance, while primaries and high-tension secondaries will be of much higher resistance.

Resistances and Potentiometers

Continuity can be checked and a rough test of resistance value can be made with the testing appliances described. For instance, a test lamp will glow when connected to the battery through a resistance of perhaps 30 or 40 ohms—more or less—while an indication of continuity through a resistance in the order of megohms can only be obtained with such sensitive devices as telephones or a micro-ammeter. Continuity through resistances up to 50,000 ohms or so is generally detectable with the help of a voltmeter or milliammeter (Fig. 1 (b) or (c)). The greater the deflection of the meter, the lower the value of the resistance. In the lack of suitable measuring devices a good deal can be done by making comparisons between different resistances in the receiver; all of them cannot be wrong. Variable resistances and potentiometers are tested by connecting the indicator between one of the fixed terminals and that joined to the movable contact, and then noting whether a gradual change in resistance occurs as the arm is rotated.

Valves

Except by the method of substitution, it is impossible to make conclusive tests of the condition of a valve, but something at least may be done by testing through the filament for continuity. In addition, there should be complete insulation between the filament and all other electrodes (plate, grid, etc.) in the valve. With a milliammeter connected in the anode circuit, one can say that it is at least functioning as a valve if anode current varies when grid bias is varied.

Loud Speakers

Continuity tests through the windings of the loud speaker and of its built-in transformer again apply, but are not quite

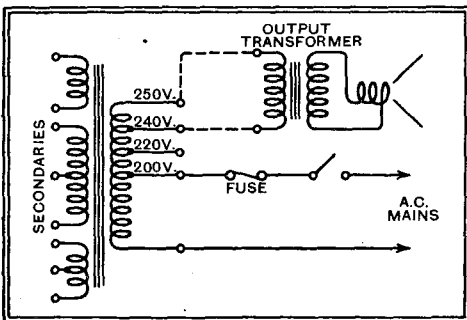


Fig. 3.—Loud speaker tests.

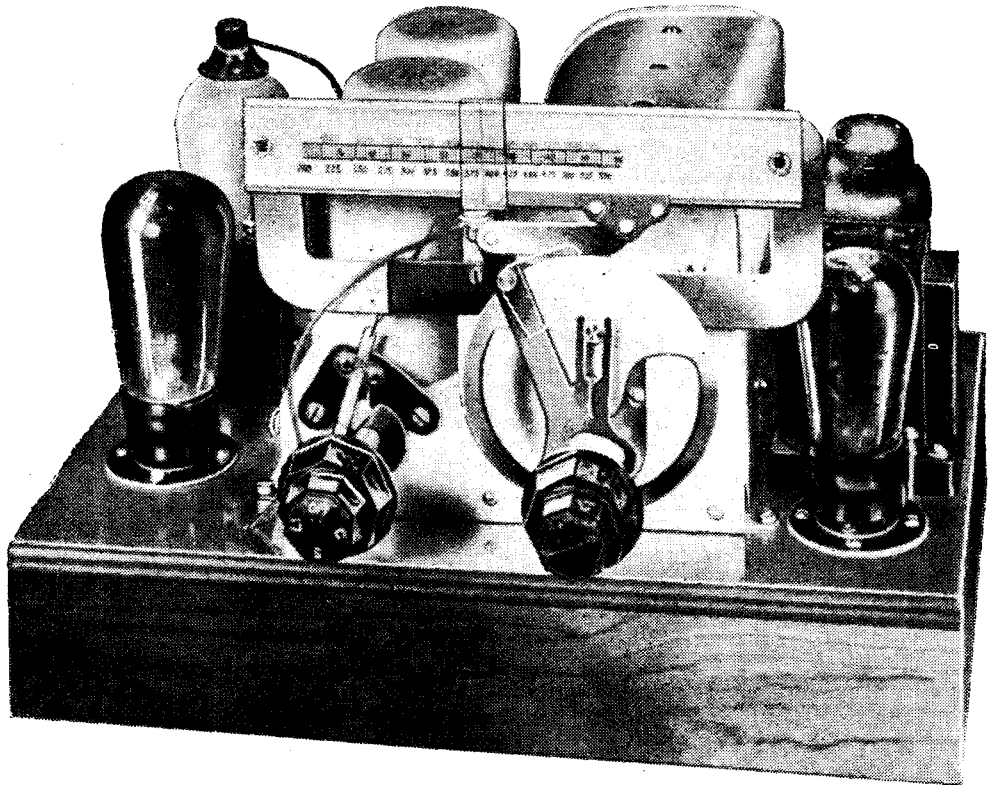
conclusive. In dealing with an A.C. set it is useful to remember that a source of low-voltage alternating current for testing purposes is available across theappings of the power transformer primary (see Fig. 3).

In Next Week's Issue**The Battery H.F. Pentode IV**

A Selective and Economical Receiver Embodying the New H.F. Pentode

In a battery-operated receiver, adequate volume in conjunction with economical operation can only be obtained with the aid of one of the quiescent output systems, of which Q.P.P. and Class "B" are the best known. Each of these

coil loud speaker is sufficient for normal purposes, and the quality of reproduction reaches a high standard, while both the sensitivity and selectivity are adequate for good reception of many foreign stations under average conditions.

**LIST OF PARTS**

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- | | |
|--------------------------------------------------------------------------------------------------------------|-------------------------------------|
| 1 Linacore Bandpass Tuner | J.B. Type BPB |
| 1 Bulb, 2 volts, 0.06 amp. | Bulgin Type H |
| 1 H.F. Choke | Kinva |
| (Bulgin, Wearite.) | |
| 2 Fixed Condensers, 0.1 mfd., 200 v. D.C. working | T.C.C. 50 |
| 1 Fixed Condenser, 1 mfd., ditto | T.C.C. 50 |
| 1 Fixed Condenser, 2 mfd., ditto | T.C.C. 50 |
| 1 Fixed Condenser, 0.005 mfd. | T.C.C. Type M |
| 1 Fixed Condenser, 0.0065 mfd. | T.C.C. Type M |
| (Dubilier, Peak, T.M.C. Hydra, Telsen.) | |
| 1 Metallised Resistance, 500 ohms, 1 watt | Dubilier |
| 1 Metallised Resistance, 10,000 ohms, 1 watt | Dubilier |
| 1 Metallised Resistance, 20,000 ohms, 1 watt | Dubilier |
| 1 Metallised Resistance, 250,000 ohms, 1 watt | Dubilier |
| (Claude Lyons, Erie, Graham Parish, Seradex, Watmel.) | |
| 1 L.F. Transformer | R.I. Parafead |
| 1 Drivermu Transformer, 1:1 | R.I. |
| (Multitone, Varley.) | |
| 3 5-pin Valve Holders | Clix Chassis Mounting Standard Type |
| 2 7-pin Valve Holders | Clix Chassis Mounting Type |
| 1 C.B. Battery, 9 volts | Siemens |
| 1 5-way Battery Cable, 30in., with wander plugs and spade ends | Belling-Lee |
| 3 Wander Plugs | Clix Type B |
| 4 Ebonite Shrouded Terminals, A. E., Pick-up (2) | Belling-Lee Type B |
| Plymax Baseboard, 8 in. x 12 in. x 1/2 in. | Peto-Scott |
| 2 oz. No. 20 tinned copper wire, 3 lengths | |
| Systoflex, wood, flex, etc. | |
| Screws:— | |
| 28 1/4 in. No. 4 R/hd., 10 1/2 in. No. 4 R/hd., 4 1/2 in. No. 4 B.A. with metal thread and nuts and washers. | |
| Valves:—1 Osram or Marconi HL2; 1 Osram or Marconi L21; 1 Osram or Marconi VP21; 1 Osram or Marconi B21. | |
| 1 Microfode Loud Speaker | W.B. Type PM4A |

methods has its own particular advantages, and the Q.P.P. circuit seems best adapted for reproduction at moderate volume, but Class "B" is better suited to a larger output.

In the Battery H.F. Pentode IV an H.F. stage is used to precede the grid detector, and one of the new variable-mu H.F. pentodes is employed in conjunction with iron-cored tuning coils. A band-pass filter is fitted between the aerial and the first valve, and the coupling to the detector is by means of an H.F. transformer to which reaction is applied.

The receiver is unusually simple to operate, there being only the tuning control, the combined volume and reaction control, and a multi-way switch for wave-changing, gramophone, and "On-off." A neat panel appearance is obtained with the aid of concentric knobs for these controls, and the set will be found to be economical to run.

In the L.F. circuits, the detector is coupled to the driver valve by a resistance-fed transformer, and this stage feeds the Class "B" valve through a driver transformer. The output to the moving-

Practical HINTS AND TIPS

SIMPLIFIED AIDS TO BETTER RECEPTION

BEFORE making a systematic search for the sources of excessive hum in the receiver itself, it is wise to begin with the field current supply of the moving-coil loud speaker. If serious irregularities be present in this circuit, a noise-free background can hardly be expected.

Hum Tests

The usual method of procedure is illustrated diagrammatically in Fig. 1 (a). Both leads are disconnected from the primary winding of the output transformer, and then joined together. Across this winding is then connected a resistance R, roughly equal to the rated impedance of the output valve. If hum can still be heard in the loud speaker it is fairly safe to assume that it must be due to ripple superimposed on the field supply, and that extra smoothing will be necessary. So far as older sets are concerned, it is worth while remembering that a high-capacity, high-voltage electrolytic condenser may afford an inexpensive cure, although occasionally an extra choke will be needed.

An alternative method of making a test, which in certain circumstances may prove rather more definite, is that illustrated in Fig. 1 (b). Here the speech coil is disconnected from the secondary of the output transformer, and resistances R₁ and R₂, with values roughly equal to the rated impedance of the speech coil, are connected temporarily as shown. Again, if hum still persists, we know that the field supply system is to blame.

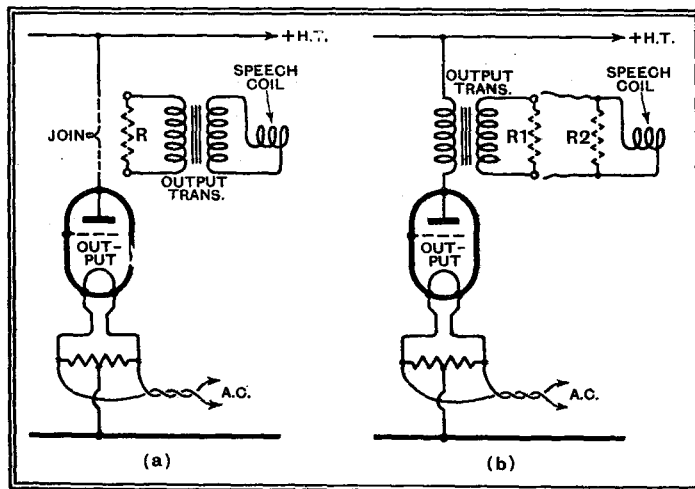


Fig. 1.—Two methods of localising the source of hum. Resistances shown in dotted lines are temporarily connected.

IF the full benefit of the metal-coated bulbs of modern valves is to be obtained it is necessary that the metallic coating should be properly earthed. For instance, it is a sign that this condition has not been complied with if any noticeable effect on signals can be produced by touching the bulb.

Metallised Valves

So far as the older type of 5-pin mains valves are concerned, the metallic coating is connected internally to the cathode pin, and so, with conventional methods of biasing, it is not possible to make a direct earth connection; a resistance must be

interposed in the cathode lead for bias purposes. Accordingly, it is necessary to "tie down" the cathode, so far as signal frequency impulses are concerned, by joining it to earth through a large condenser which, in H.F. circuits at any rate, must be non-inductive.

In some of the latest 7-pin and 9-pin valves the metallic coating is connected internally, not to the cathode but to its own pin, which must accordingly be earthed directly.

IT was recently pointed out in the "Hints and Tips" Section that, by making use of the directional properties of a frame aerial, certain forms of interference could be either avoided or mitigated in a way beyond the capabilities of any other anti-interference device.

Improving Directional Reception

For instance, it would be possible, at any rate theoretically, to select the programme of either one of two stations normally receivable at identical strength, and on

coupling coil through which the frame is linked to the secondary circuit has a centre-point tapping which is earthed. In this detail lies the chief merit of the arrangement suggested; ordinarily, directional effects are not so sharply marked as they might be, for the reason that the frame acts to some extent as an ordinary aerial,

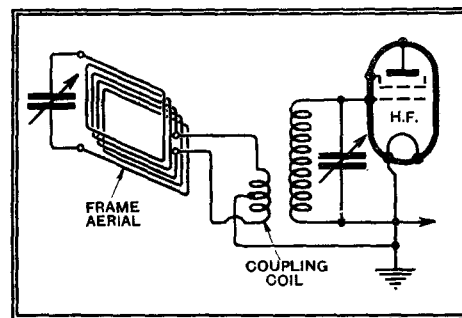


Fig. 2.—Avoiding "vertical aerial" effects; a split-frame aerial with balanced coupling.

and so there is no position giving a zero signal. By adding the centre-tapped coupling coil, however, signals received in this way are balanced out and are not transferred to the secondary circuit.

The coupling coil may have, roughly, a dozen turns and should be enclosed in the same screening "can" as the tuned secondary coil. There should be no direct interaction between the frame and the latter coil.

WHEN measuring, or even attempting to check roughly, the resistance value of any device that operates at a high temperature (let alone in a state of incandescence), it is well to be prepared for the influence of temperature on ohmic value.

Hot Filaments

The metal filament of an ordinary electric lamp, or instance, may have a resistance of some 2,000 ohms when working at the normal temperature, but when cold may be found to have a value of only a few hundred ohms. The same applies to valve filaments, heaters, and to the protective "barretter" devices used in series with the heating elements of D.C. or universal mains sets.

To a lesser extent the same applies to resistance wire, and, of course, to wire-wound resistances used in a receiver. But the effect may generally be neglected unless it is proposed to run the resistance at a very high temperature.

What is known as a "positive temperature coefficient" is a property of metallic substances. Moulded or composition resistances with a carbon base have a negative coefficient, and thus show a higher resistance when cold than hot.

exactly the same wavelength, provided only that they lie in different planes.

In spite of these advantages, it is highly doubtful whether the frame aerial will ever regain any of its lost popularity for ordinary domestic reception. But so far as the keen amateur is concerned the field of directional reception seems to be somewhat neglected, and it is the purpose of this note to draw attention to a method of connection which "sharpens up" directional effects to a more-than-acceptable extent.

Instead of connecting the frame directly to the valve, it is coupled through a tuned secondary circuit in the manner indicated in Fig. 2. It will be observed that the

I.F. Transformers

The Modern Trend in Design

THE adjacent channel selectivity of a superheterodyne depends almost entirely upon the intermediate frequency tuned circuits, and it is usually much higher than can be obtained on the higher signal frequencies. It has been pointed out in an article dealing with coils for the latter frequencies, which appears elsewhere in this issue, that the greater the coil magnification and the lower the frequency at which it functions the greater the selectivity. The gain in selectivity in the superheterodyne is thus due partly to the lower operating frequency, and partly to the larger number of tuned circuits which can be economically employed.

An intermediate frequency of 110 kc/s is now practically standard; a higher frequency is usually inconvenient, since it approaches too closely the frequencies used on the long waveband, and a lower frequency leads to excessive second channel interference. In general, an I.F. transformer consists of two tuned circuits coupled together, one tuned circuit being connected in the anode circuit of a valve and the other in the grid circuit of the following valve. The selectivity obtainable depends upon the coil magnification (the reactance divided by the resistance) and upon the degree of coupling between the two circuits, while the amplification depends upon the dynamic resistance (the square of the reactance divided by the resistance) and upon the coupling.

In a signal frequency circuit, the coil inductance is determined by the wavelength range which must be covered, but an I.F. circuit is tuned once and for all to a single frequency, so that there is an almost infinite number of combinations of inductance and capacity which might be used. If we have two coils, therefore, one of which has twice the inductance and twice the H.F. resistance of the other, their magnifications are the same, and they will give the same selectivity. The dynamic resistance of the higher inductance coil, however, is twice that of the other, so that much higher amplification will be obtained.

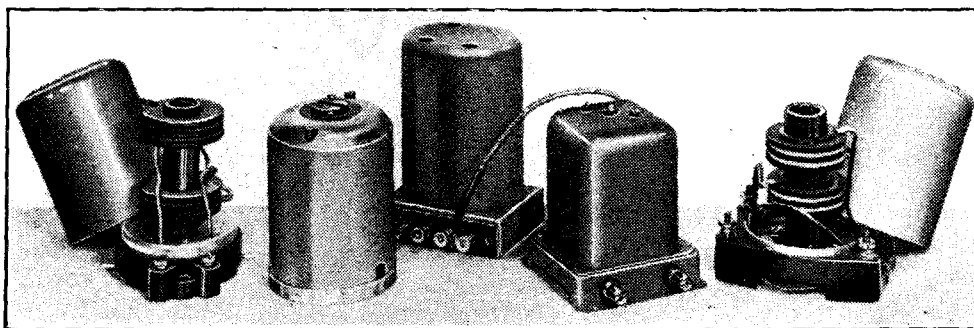
In practice, the H.F. resistance is not proportional to the coil inductance, and it will usually be found that where the overall dimensions of the screen are kept constant there is an optimum value from the point of view of selectivity and a different optimum as regards amplification. Although one may be tempted to employ a

high inductance coil to obtain high amplification, this is not always a wise practice, for the losses introduced by external components, in particular the damping of the second detector, become greatly increased. A value of about 10,000 mH. is usual for air-cored transformers and this gives a satisfactory compromise between conflicting factors.

It might be thought that since the circuits have all to be tuned to the same frequency they could be set accurately by the manufacturers. This is not the case, however, for the external stray capacities vary considerably in the different circuits, and, just as in the case of ganging the signal-frequency circuits, it is necessary to equalise the stray capacities. The only exception is in the case of transformers fitted with coils of such a high resistance that the tuning is very flat.

The Trimmers

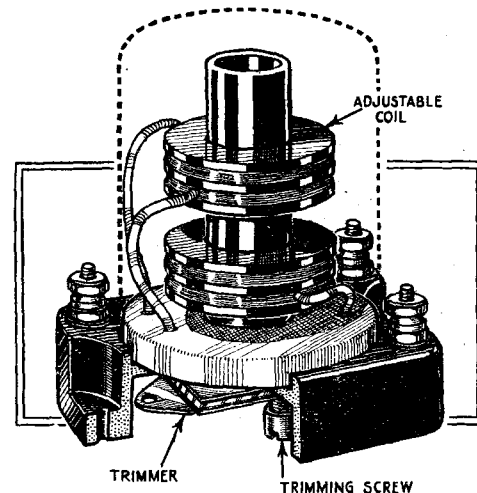
Modern I.F. transformers, therefore, are fitted with a trimmer for each circuit. In some types the capacity range of the trimmer is mechanically limited, so that it is possible to tune the circuits over a range of only some 115-108 kc/s, and it is consequently impossible to adjust them far from the correct frequency of 110 kc/s. The disadvantage of this, however, is that one sometimes meets with a set in which the stray capacities on one circuit are quite



A group of typical modern I.F. transformers.

low, while those on another are high, and it is not always then possible to bring the circuits into resonance with one another. Quite a large number of transformers have no special limitation to the capacity range, however, and will often tune over a band as wide as 130-100 kc/s. Accurate trimming can then always be obtained, but care must be taken not to adjust them to the wrong frequency, otherwise the signal frequency ganging will be affected. This usually necessitates checking the intermediate frequency, which need not be done with the other type.

The selectivity obtainable with I.F. transformers is so high that a large degree of sideband cutting is present unless use is



The construction of an air-core transformer, showing the disposition of the terminals.

made of the band-pass principle. Perhaps the majority of modern I.F. transformers are fitted with adjustable coupling between the circuits, in order that the band-width may be readily adjusted. The range of coupling provided is usually sufficient to permit the transformer being operated at optimum or sub-optimum coupling, with which no band-pass effect is obtained. This permits the attainment of the highest selectivity in cases where quality of reproduction is not of the first importance, and it meets the requirements of many sets embodying tone-correction for sideband cutting. The variation in coupling is obtained in practice by sliding the upper coil of the pair nearer to or farther away from the lower coil.

Iron-cored I.F. transformers have recently made their appearance, and if well designed give higher selectivity and have a much greater dynamic resistance than air-cored types. The dynamic resistance may reach the high figure of 600,000 ohms, as compared with the 100,000 ohms to 300,000 ohms found with the usual air-cored models. On account of this high dynamic resistance, the amplification is

greater, and instability is sometimes felt. Most iron-cored coils, therefore, have one winding tapped for the anode or grid connection. Amplification is reduced by this means, and stability assured, without adversely affecting the selectivity.

Transformers of this type can be recommended for general use in sets employing band-pass type couplings, and they lead to a considerable improvement in selectivity. They cannot be easily substituted for air-cored types in sets designed to operate with critically coupled coils and fitted with tone-correction for the preservation of the upper register, for the increase in side-band cutting would necessitate a complete redesign of the tone-corrector.

Choosing a Loud Speaker

Faults the Pessimist Will Look For Before Buying

IT cannot be denied that the improvements in loud speaker design—that is, of the types which are within the reach of the average purse—have not kept pace with recent advances in other component parts of the broadcast receiver. Competition in prices has resulted in the standardisation of a type of performance which varies very little from make to make. There are several faults, however, which are common to the majority, and the problem is to find the unit in which they are least obtrusive. A simple test with an oscillator throughout the musical range would soon separate the sheep from the goats; but how many retailers are prepared to demonstrate their wares in this way? Is the proportion of mutton so small?

OF all the components contributing to good quality of reproduction the loud speaker is the weakest. A knowledge of the more obvious defects, however, will enable the purchaser to select for himself a unit which will give very pleasing, if not perfect, reception.

of music, together with a good range at the top for the reproduction of harmonics to give the characteristic tone quality of different instruments. Any serious defect in quality will almost certainly be due to the presence of peaks or troughs in the output at well-defined frequencies, and in choosing a unit this is the first point to look for.

A typical response curve for a permanent magnet moving-coil unit in the 50s. class is shown in Fig. 1. It is reasonably uniform in the middle register between 250 and 1,000 cycles, and shows a well-defined peak at (A) due to the principal resonance of the diaphragm on its surround, and a general increase of output between 2,000 and 4,000

ciated with the resonance will be accentuated on account of the comparatively subdued approach. Finally, the tail-off in the region (D) above 6,000 cycles can make an appreciable difference to the timbre. In some units the cut-off is too sudden, and although this may be an ad-

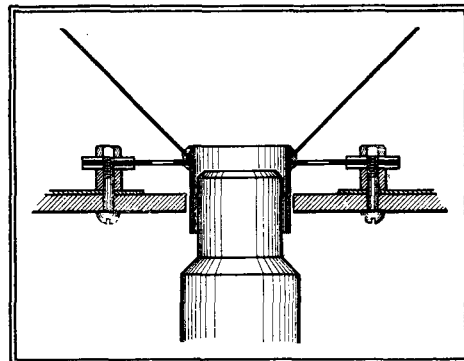
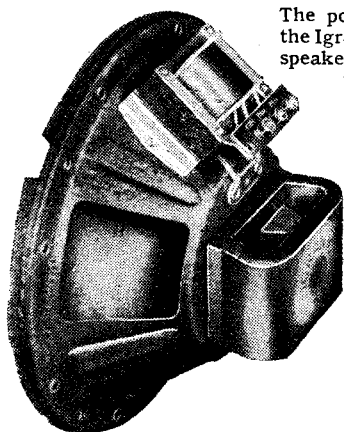


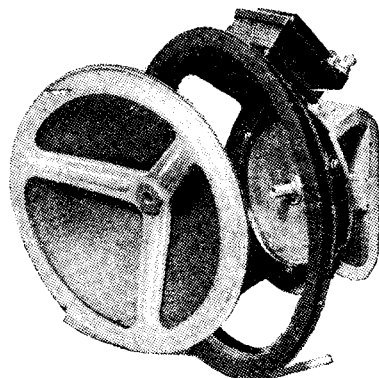
Fig 2.—A projecting centre pole-piece is employed in the Hartley-Turner loud speaker to obtain a symmetrical distribution of the field outside the gap.

vantage in reducing extraneous noises due to mush and heterodyne whistles, it is better to arrange for this in the receiver by means of a tone control in order that the best possible quality may be obtained on the local station.

If a loud speaker passes inspection on the score of freedom from pronounced resonances it should next be examined from the point of view of amplitude distortion. This is primarily determined by the distribution of the field on each side of the air gap in re-



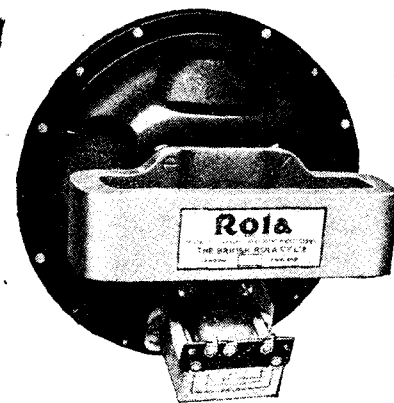
The pole-pieces in the Igranic D9 loud speaker are shaped to minimise amplitude distortion.



Reliability is assured in the R & A "Alpha" unit by precise centring and a separate housing for the diaphragm assembly.



In the Celestion permanent-magnet loud speaker a wide air gap combined with an increased size of magnet gives freedom from fouling without reducing efficiency.



Efficiency in a permanent-magnet unit can often be judged from the size and shape of the magnet system.

Uniformity of output with frequency is by no means the only criterion by which a loud speaker should be judged, but it is by far the most important, and a loud speaker which gives a uniform output over a limited frequency band is more pleasant to listen to than one which covers all the musical frequencies but is marred by one or more serious resonances. Unless a high price is paid the purchaser cannot expect to get very much response in the extreme bass or top, and the useful frequency range of the average commercial moving-coil unit lies between 75

cycles at (B) caused by the diaphragm breaking up into a complicated series of subsidiary resonances. The resonance at (A), provided it is not too prominent, is useful in strengthening the bass, which is deficient in frequencies below 75 cycles. A very pronounced bass resonance is frequently accompanied by a dip at (E), and as this is in the region of greatest sound energy the general tone will be lacking in "body," and the monotone of the bass will be very prominent. A similar effect is often noticeable in the upper register where a prominent peak at about 2,500 cycles (C) is preceded by a trough at 1,000 cycles (F). This can be detected by listening to ascending scale passages, when the stridency of certain notes asso-

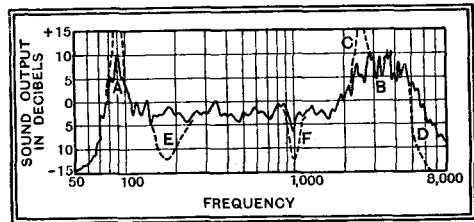


Fig. 1.—Response curve of a typical commercial moving-coil unit.

and 6,000 cycles per second. This covers all the frequencies necessary for clear articulation in speech and also the fundamental notes commonly used by composers

lation to the travel permitted to the speech coil. If a part of the coil passes into a region of reduced field strength, or if the suspension of the diaphragm causes a sudden restriction of movement at the end of each excursion from the mean position, harmonic distortion will be introduced and there will be modulation of high notes by the lower notes of large amplitude. It

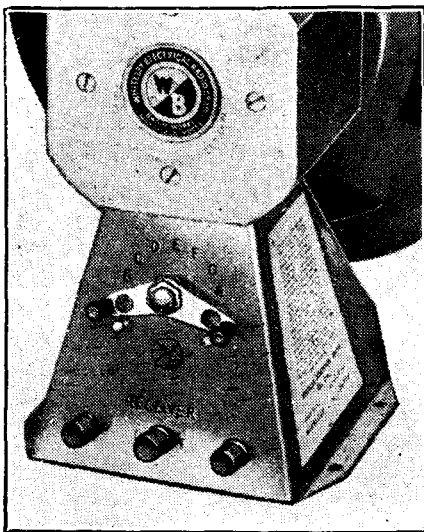
Choosing a Loud Speaker—

is difficult to describe the type of distortion resulting from these defects, but it is generally characterised by a confusion of sound during passages for the full orchestra. If the individual instruments stand out from one another it is reasonable to assume that the loud speaker is free from serious amplitude distortion.

The unit should next be examined from the point of view of reliability. With modern moulded seamless diaphragms the only probable sources of rattles or buzzing noises will be misalignment of the coil or the accumulation of dust in the air gap. Lateral rigidity can be tested by carefully holding the diaphragm on both sides and moving it gently up and down with a bias towards the sides, at the same time listening for any signs of rubbing. Preference will naturally be given to those makers who have gone to the trouble of providing felt dust seals for the air gap or who completely enclose the unit in a dust-proof bag.

Lastly, the question of efficiency must not be overlooked. This can only be judged by a comparative test, but in the case of permanent magnet units a very shrewd guess can often be made from the weight of the magnet and the length of the magnetic path from the centre pole round to the outer edge of the gap in relation to the width of the gap itself. Correct matching with the output valve

will determine not only the apparent efficiency but also the frequency response and the power which the output valve will



Accurate matching with the output valve is rapidly obtained with a multi-ratio output transformer.

handle without introducing distortion. It is, therefore, a wise plan to select one of the many excellent makes which are now fitted with multiple-ratio transformers and switches or plugs and sockets. The optimum ratio can then be found by judging the volume and quality by ear.

there is a sufficient number of stations "on the air." On the Friday night one would have described the outlook as decidedly poor, yet early on the Saturday morning the Australians and New Zealanders in the 40-metre band were stronger and more numerous than ever before.

When one reflects on the unsatisfactory reception that is frequently obtained from 50 kW. broadcasting stations across the Atlantic, one is forced to marvel at the carrying-power of some of the amateur 50-watt and 100-watt transmitters.

Improvement in Working Conditions

Short-wave conditions, on the whole, are certainly improving. One expects, naturally, with the lengthening days, to hear more of the 19 and 16-metre stations, but the improvement is also apparent among the 49-metre group. The South Americans have been very much in evidence, especially the stations located in the northern parts of that continent—Venezuela and Colombia.

Most consistent of all is HJ3ABF (Bogota) on 47.97 metres, although the Venezuelan YV3BC on 48.78 metres is a good second. There appears to be a set of conditions in force at present that is exceptionally favourable for this region, since the best stations are usually those in the north of South America, the whole of Central America, and the southern part of the U.S.A. W4XB at Miami, for instance, is frequently much stronger than the more familiar stations in the New York region.

Even this is reflected in the amateur 40-metre band, where VP4AA (British Honduras), VP5PZ (Jamaica) and VP6MR (Barbados) have been heard at greater strength than the majority of the U.S.

The Pye "Cambridge" Receiver

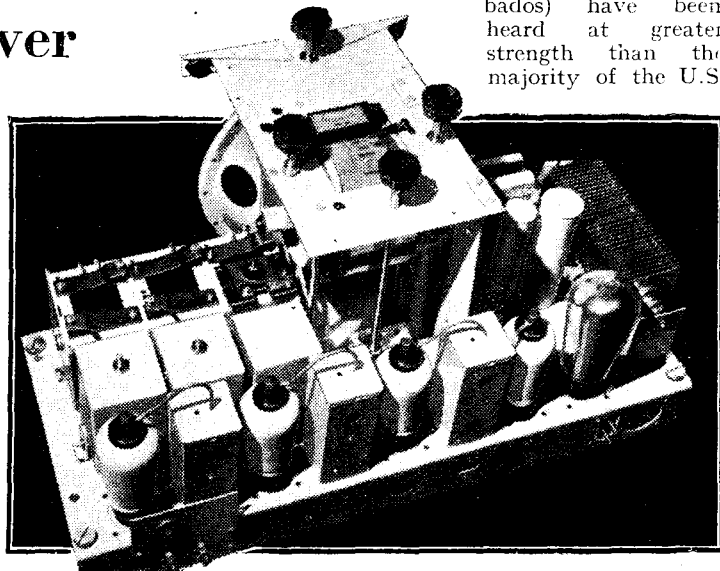
IN introducing this new receiver to the public the makers have deliberately avoided competition with the cheaper makes, and have catered for those who are willing to pay a little more for a radio set which is distinguished in appearance as well as in performance.

The cabinet is a piece of furniture which has been specially designed to blend with tasteful decorations of all periods, and its simplicity is not marred by visible tuning controls. These, together with the wavelengths scale and visual tuning indicator, are mounted in the top panel under a hinged lid.

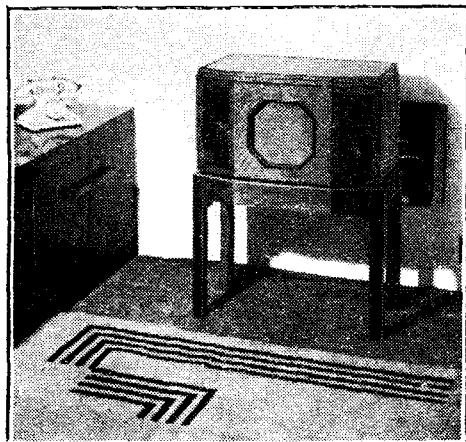
The chassis bears the stamp of Pye workmanship throughout, and is finished in Cambridge blue. It is a superheterodyne

circuit employing five valves with a Westinghouse metal rectifier. A variable-mu H.F. stage is followed by a pentode frequency changer and a variable-mu I.F. amplifier leading to a double-diode-triode second detector from which automatic volume is derived. The output valve is a super-power triode, and, of course, a moving-coil loud speaker is employed.

The price of the new model is 20 guineas, and with a stand as illustrated 22 guineas.



The chassis of the Pye CR/AC superheterodyne is finished in pale blue and is notable for high-grade workmanship.



The new Pye "Cambridge" receiver in a modern setting.

SHORT-WAVE WORLD

Are Conditions Ever Uniformly Bad?

THE R.S.G.B.'s Annual "B.E.R.U. Contest," briefly alluded to in these notes a fortnight ago, is now well under way. The first two week-ends in February are allotted to the high-power stations, and the last two to the "Juniors," who have to use inputs that do not exceed 25 watts.

The first week-end of the tests amply proved the writer's contention that conditions are never really bad, provided that

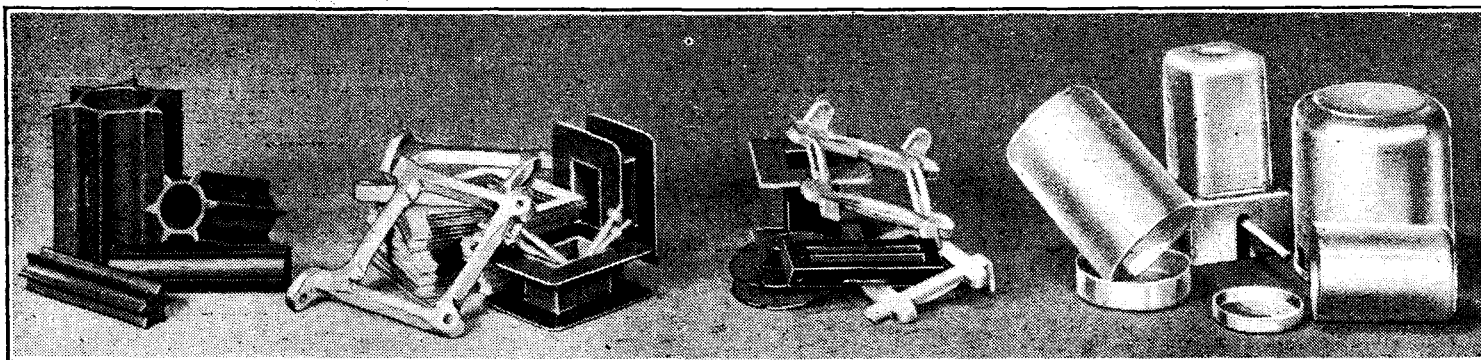
amateurs, although the latter, on the average, probably use far more power.

During the next month or so we may reasonably expect a continuation of good conditions, if the loggings of previous years are any criterion. The international societies who organise their tests in February and March seem to have had experience of this, and it is certainly a fact that long-distance reception below 50 metres is usually at its best between February and May.

The somewhat neglected 31-metre broadcast band, too, should be coming into its own once more, as the fade-out period for U.S.A. is already as late as 1 or 2 a.m.

MEGACYCLE.

Home Construction of Components



A Brief Guide to Material Available

THE enthusiastic home constructor who likes to turn his hand to the making of as many parts as possible when building a receiver may occasionally be tempted to draw comparisons between present-day practice and those obtaining a decade ago. At that period it was common practice to give constructional details of some of the components employed, for the very good reason that in practically every case these parts had to be designed specially for the set. But components of every description are now so readily obtainable that the necessity to build them no longer arises. Yet the amateur mechanic can still find much to interest him in this direction if he so desires, for ample material is available and opportunities can be found to exercise one's skill. It is advisable, however, to restrict activities to the making of those parts that can be built to a specification and then put into use without elaborate measurements and adjustments to ensure their electrical constants being correct.

Parts to Make

The components that come under this heading are coils, preferably for use in sets fitted with separate tuning condensers, as the accurate matching of inductances for gang tuning is a tedious business unless a fair amount of apparatus is available. We might include, also, H.F. chokes, as these are comparatively easy to make, mains transformers, output transformers, and L.F. chokes. Intervalve transformers might even be attempted, as their construction is well within the abilities of the amateur, though the design should be correct. To these can be added short-wave parts, so that, all told, it is quite comprehensive, and covers many present-day requirements. It provides the practical man with enough to exercise his skill and adaptability, and offers a little diversion from the more orthodox set construction.

Out-of-date components stripped down will often provide much useful material which can be augmented where necessary by new parts, as coil screens, formers, transformer material, and the sundry small items needed are readily obtainable.

THERE are no particular difficulties in the home construction of certain simple components where quite ordinary tools will suffice, so that their making offers a pleasant diversion for spare time. The novice is advised to commence with the easiest parts and a few suggestions are given regarding those most suitable, together with a brief description of the materials now available

Colvern, Ltd., market an aluminium screening cover described as the type C.C.S., that measures 3 $\frac{5}{8}$ in. in diameter and 3 $\frac{7}{8}$ in. high. Coils up to 2 $\frac{1}{4}$ in. diameter can be housed in this container, so enabling various home-made coils to be compared for efficiency. Complete with a base piece the price is 3s. 6d.

From Wright and Weaire can be obtained a rectangular case similar to those used for their latest coils. One model is 2in. square and 2 $\frac{3}{4}$ in. high inside; the other measures 2 $\frac{1}{2}$ in. square and 2 $\frac{3}{8}$ in. high. In the base of the container is fitted a double-pole, single-way switch of low capacity design for wave-band switching, also eight terminals are provided. The prices are 3s. 6d. and 4s. 6d. each, complete. This firm supply Paxolin tube for coil winding in sizes up to 4 $\frac{1}{2}$ in. in diameter, and also a wide range of ribbed ebonite formers.

A further source from which coil screens can be obtained is White Bros and Jacobs, Ltd., makers of Stella aluminium ware. The stock sizes are 2in. and 2 $\frac{3}{8}$ in. diameter in any height up to 3 $\frac{1}{2}$ in., and they cost 1s. each for either type, including a base.

The British Ebonite Co., Ltd., supply ebonite formers in sizes ranging from $\frac{3}{4}$ in. to 4in. diameter. These are the well-known Becol formers, and the smaller-diameter type are ideal for winding H.F. chokes.

Ribbed ebonite formers, ebonite rod, tube and sheet can be used to good advantage in components, and this material is obtainable from the above firm, also from Redfern's Rubber Works, Ltd., and

Trelleborg's Ebonite Works, Ltd. Stratton and Co., Ltd., have a range of moulded bakelite formers on which H.F. chokes and coils can be wound; and, although intended mainly for short-wave components, they will answer for other purposes as well.

Pirtoid tube, which is obtainable from H. Clarke and Co. (M/c), Ltd., being a type of bakelised material, is very useful for this type of work, as it is tough, yet not difficult to handle, and it can be drilled easily. The wall is about $\frac{1}{16}$ in. thick and tubes up to 4in. in diameter and in any length are available.

Iron-cored components, such as mains transformers, output transformers, and chokes, are comparatively easy to make, the work is not difficult, and the skilful constructor can produce home-made articles which compare very favourably in appearance, and, incidentally, in performance, with any factory-made article. All the material is readily obtainable, and these components can be attempted with every confidence by the novice with very little previous experience in making electrical apparatus, and satisfactory results can be assured provided the design is correct.

Transformer Material

In these components the core consists of thin laminations cut from a special grade of iron covered on one side with a thin layer of insulating material. In the case of Stalloy stampings made by Jos. Sankey & Sons, Ltd., the iron is 0.014 in. thick and laminations of every conceivable size and shape are made. For amateur use possibly the No. 4, measuring 3 $\frac{9}{16}$ in. by 3 $\frac{3}{16}$ in. outside; the No. 30—3 $\frac{1}{16}$ in. by 2in.—and the No. 33—4 $\frac{1}{2}$ in. by 4in.—are the most suitable as bobbins for these stampings are kept in stock by several firms specialising in material of this kind.

They are obtainable from Sound Sales, Ltd., who also supply cast aluminium end-plates, core bolts, varnished tape for insulating the windings, terminal strips, bakelised sheet for making bobbins and the various other odds and ends needed for transformer construction. This firm supply also transformer stampings.

Home Construction of Components—

Geo. L. Scott & Co., Ltd., market a range of stampings in two qualities known respectively as the Stantranis and Standynis series. The former quality is possibly the best for mains transformers and chokes, and the standard thickness is 0.014 in. There is a very wide range to choose from, but the No. 4, the No. 34 and the No. 76 might best meet our requirements as they are a convenient size and bobbins are readily obtainable. Incidentally, Stantranis No. 4 and No. 34 are the same size as Stalloy No. 4 and No. 30 stampings.

Magnetic & Electrical Alloys, Ltd., make silicon iron stampings in several grades. The Silcor I grade has a high permeability in weak magnetic fields and is well suited for use in intervalve transformers. For mains components and heavy-duty chokes the Silcor II grade is generally used, as this quality is more suitable for this class of component.

Stampings made of a nickel-iron material which is one of the high perme-

ability alloys are a speciality of this firm. It is known as Laminic, and is used for the cores of intervalve transformers and L.F. chokes. These stampings are somewhat more expensive than the Silicon iron variety, but their use leads to a saving in other directions as the component can be made very much smaller.

The constructor's requirements are also well catered for by the Lumen Electric Company, who supply stampings, aluminium core clamps, presspahn sheet and a full range of bobbins, to mention but a small part only of the material stocked by this firm.

Metal is used to a large extent in the construction of modern components, particularly aluminium, as it is ductile and easy to handle. This can be obtained in sheet of any thickness from the British Aluminium Company. Copper and brass are good substitutes and often more suitable for amateur work, as solder takes well on these materials. Of the two, brass is possibly the better as it can be drilled and tapped without difficulty.

described be made impossible. It surely is essential that the manufacturer be taught, if he will not learn the fact for himself, that as a radio receiver is expected to work he must ensure that it does before it is passed out of the factory. I further suggest that a little additional care in the individual manufacture will more than repay the cost of the time thus lost. If I may venture to be slightly facetious on a matter that is obviously of importance, some well-known receivers have been delivered to me in such condition that I have been tempted to examine the container to see if they had been constructed by an Infant Welfare clinic.

L. J. LOWEN.
Twickenham.

The New Monodial

I AM writing primarily to express my appreciation of your "New Monodial Superhet," which I completed a month or so ago.

A truly remarkable set in all respects, and easily the best set I have ever handled.

The instructions in *The Wireless World* have my admiration for conciseness and clarity of exposition, and the set is simple to build for any amateur, and all the adjustments being definite alignment without ambiguity or backlash, the hall-mark of good design.

C. A. FOUNTAINE
King's Lynn. (Vice-Admiral).

I HAVE yet to hear any trade set which will vie with the Monodial for station getting, selectivity and quality combined. It is difficult to determine whether one has found a foreign or British station apart from the tuning or the type of programme.

C. B. COLLINS.
Croydon.

MY successive *Wireless World* receivers have been the "1930 Everyman Four," "Wireless World Four," "Monodial," and now the "New Monodial," each receiver being without a rival in its class. I am still running the 1930 Everyman Four, and even now very few of the modern battery receivers can better it. It is still capable of coping with the difficult prevailing reception conditions. To be able to say this about a receiver designed more than four years ago is a very great tribute indeed.

H. W. ALLBROOKE.
Smethwick.

The Wavelength of Luxembourg

YOUR contributor, "Wandering Wave," is able to disclose why Luxembourg took the wavelength of 1,304 metres. The implication appears to be that the authorities at that station only decided to appropriate this wavelength after waiting for twenty-four hours; then, finding the position free, they stepped in, and apparently hope to remain there.

On Sunday evening, the 14th ult., the English announcer at Radio Luxembourg, just before closing down, invited his listeners to tune in to that station at 7 o'clock on Tuesday "on our new wavelength of 1,304 metres, 230 kc." This announcement was given twice. It would therefore seem that the authorities at that station had decided already that they were going to appropriate "our new wavelength" as above.

It will be interesting to see whether the priority claim will hold good. If it is not accepted, presumably nation will speak peace unto nation in attempts to dislodge Radio Luxembourg.

M. H. ATKINSON.
Ewell, Surrey.

Letters to the Editor :—**Factory Built Sets****The New Monodial : Luxembourg's Wavelength**

The Editor does not hold himself responsible for the opinions of his correspondents

AS a regular reader of THE WIRELESS WORLD I am, of course, aware that your journal concerns itself primarily with matters of interest to the listener, who, for the purposes of this letter, I will term the consumer, but I crave the courtesy of your columns to enable me to air a matter which has been causing grave concern among the distributors, or retailers, of radio.

For some weeks past there has been considerable correspondence in the radio trade journals anent the truly extraordinary number of defective receivers delivered direct from the manufacturers, and this correspondence serves to confirm that my personal experience in this direction is by no means uncommon. Out of forty-three receivers delivered to the firm of which I am a member, no less than thirty-one had major defects, necessitating their return. In another instance, out of sixteen receivers sold of one particular model no less than fifteen have had to have new volume controls fitted within periods varying from one to eight weeks after installation. I would at this juncture state that I refer only to receivers manufactured by what we have been led to believe are firms of repute, and of whom the public in general have been educated to expect reliability and quality.

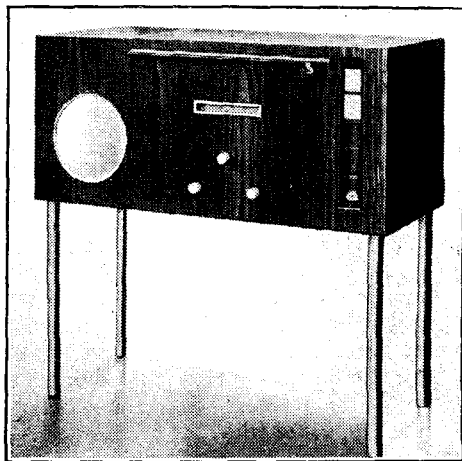
Faulty switches, condensers, resistances, and valves—particularly valves of the new multi-electrode types—are the rule rather than the exception, and all point to the supposition that the manufacturers are at fault in not conducting their tests more rigorously.

This state of affairs, I submit, is a disgrace to an industry that may rightly term itself scientific and to the British manufacturers; they (the manufacturers) have in the past been accustomed to let us down in the matter of deliveries, service, and the like, but this latest lack of foresight on their part

is likely to have such far-reaching results as will imperil the industry as a whole, since it must undoubtedly prejudice the consumer against the reliability and/or the value of radio receivers in general.

An actual instance in support of this contention is given in a letter published this week in a trade journal. The writer, a dealer, relates how he collected a receiver from the manufacturer and then took it direct to his customer. On connecting the receiver it caught fire. Imagine, then, the reaction of his customer. Is it any wonder that he now refuses to have anything to do with all-mains receivers?

I therefore beg of you in all sincerity to lend the valuable influence of your journal to the end that such matters as I have



Without comment! This radio-gramophone design won the first prize in a national competition organised in Italy. Our correspondent says "it was accorded a mixed reception." Note the metal legs and record album.

BROADCAST BREVITIES

By Our Special Correspondent

Fewer Television Programmes

THE B.B.C.'s television audience, whoever he may be, will be disappointed to learn that the half-hour transmission periods will probably be cut down to two a week as from April 1st next. The ostensible reason for this policy, so far as I can gather from B.B.C. headquarters, is that more energy must be devoted to the 120-line transmissions on the ultra-short-waves which, incidentally, very few, if any, ordinary listeners can hope to pick up.

Do You Know a Televisionist ?

The vast majority of listeners will not quarrel with the Corporation for cutting down the time spent by a couple of high-power broadcasting stations in sending out television programmes which, at a generous estimate, cannot interest more than a handful of people. How many readers of these notes are acquainted with, or even know of, an individual who tunes in the 30-line tests?

A Last Stand

If television enthusiasts have just that extra amount of enthusiasm needed to send a postcard, I should be very glad to hear from them. Only a very determined stand on their part can possibly lead the B.B.C. to modify its decision. If a sufficient number of pleas for more frequent television programmes were received, it would at least be possible to present an arguable case to the authorities.

Mark your postcard "Brevities" and state whether you are actually picking up the present 30-line transmissions or are merely considering the purchase of television gear if the transmissions warrant it.

Alternatively . . .

If the postcards are few they will furnish a good argument for the complete cessation of 30-line tests.

Changing Quarters

In the meantime, Mr. Eustace Robb, the B.B.C.'s television producer, is moving his quarters from Studio Bb to No. 16, Portland Place. There will, therefore, be no television transmissions on Monday, Tuesday, Wednesday and Friday of next week.

The first programme from the new studios will be transmitted on Monday, February 26th, at 11 p.m.

A Programme Ballot

WHATEVER the B.B.C.'s opinion of the American system of broadcasting, the Corporation watches any new move on the part of the American organisation with feline intentness. They are now talking at Broadcasting House about the latest experiment of the American National Broadcasting Company in initiating a special series of half-hour test programmes upon the merits of which listeners will be asked to express their opinion.



LOUD SPEAKERS IN THE STUDIO. The 150-man orchestra during rehearsal in the world's largest broadcasting studio, Radio City, New York. Note the loud speakers above.

Listeners as Voters

The idea is to compile short programmes with the best talent available and to label them A, B, C, etc. Listeners all over the American continent will be asked to show their preferences by postcard. The results of this referendum will be made use of in compiling future programmes.

Such an idea has been flirted with at Portland Place for some time, but the nearest that the B.B.C. has ever got to it has been with "First Time Here"—the Saturday afternoon broadcasts which have exploited artistes entirely new to the microphone.

A thoroughly bad programme will occasionally provoke correspondence, but the only real method of securing votes in this country is to offer monetary inducement. When I recently hinted this at headquarters the B.B.C. "was not amused."

Twenty-five Years Back

THE year 1909, when Shackleton was conquering Antarctic wastes, when Blieriot flew the Channel, and when the Suffragettes were launching their campaign, will be recreated in Leslie Baily's "Scrap Book" programme to be broadcast on February 19th (Regional) and 20th (National). Mr. Baily's new presentation is a sequel to his recent successful "Scrap Book of 1913."

An Official Jamming Station

THE wish may have been father to the thought in the case of an extraordinary story which reached me last week. It was stated that as Luxembourg refused to descend to the medium waveband, the B.B.C., by special arrangement with the Foreign Office, had decided to retain the Daventry transmitter after the opening of Droitwich for the express purpose of "jamming" the Delectable Duchy.

The B.B.C. repudiates the idea of resorting to "jamming" in any circumstances as a method of settling questions of wavelength and power. It would be pleasant to think that all the broadcasting organisations of Europe shared the same view.

"Big Business"

MR. JOHN GREEN, the American composer of "I-Cover-the-Waterfront" fame, is paying a compliment to the B.B.C. by supplying the music for a burlesque, "Big Business," to be broadcast during the second week in March. The story, which is to be furnished by John Watt and Henrik Ege, deals with the vexed questions of hours and wages in a roller-skate factory.

Clergy in the Canteen

TEATIME in the Broadcasting House canteen is usually the occasion for a dazzling assembly of broadcasting stars, producers and staff. The place wore a different aspect, however, on Thursday of last week, when the "Cloth" was present in force. The visitors were the delegates to the conference of the clergy of the chief denominations which was held in the Council Chamber to discuss the recent Sunday evening talks and to outline arrangements for religious programmes during the autumn of 1934.

The Cup that Cheers

For half an hour the B.B.C. staff were banished from the canteen while the eminent ecclesiastics partook of the refreshment which was their just due after a day of concentrated colloquy.

Listeners at the Microphone

A CORRESPONDENT writes: "It seems a pity that listeners are denied access to the microphone. Would any real harm be caused if the B.B.C. were to devote half an hour each week to airing the views of licenceholders in the same manner that an editor offers the hospitality of his Correspondence columns to readers? Listeners would, of course, furnish their remarks in advance for censorship, if necessary, and would be limited to one minute each at the microphone. I cannot imagine a more interesting half-hour."

NEWS of the WEEK

Current Events in Brief Review

Homehunters, Beware !

IN new flats to be built at Winchmore Hill, London, N., wireless aerials will be barred. Radio lovers seeking a home in North London will bear this fact in mind.

Heath Robinson Radio

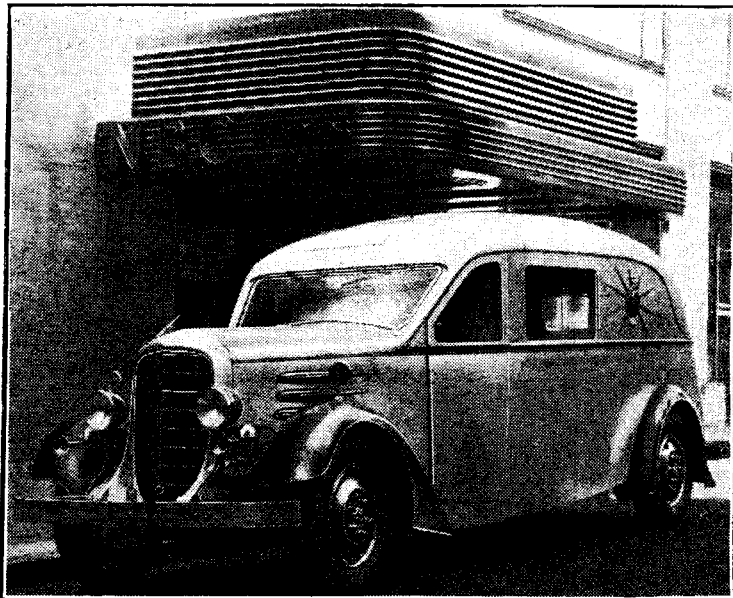
WIRELESS will figure in the "Heath Robinson House" which the famous inventor-engineer-artist-humorist is designing for the Ideal Home Exhibition at Olympia, opening on April 3rd. One device to be shown will be a gadget for automatically tuning in the fat stock prices as one sits down to dinner.

Rumania Buys British

AS forecast in *The Wireless World* of January 5th last, the Rumanian Broadcasting Company is now proceeding with the erection of a 150-kilowatt broadcasting station. The transmitter is being built by the British Marconi Company, who will also supply a smaller plan of 20 kilowatts. The high-power station will work on a wavelength of 1,875 metres.

Florida Calling

A SPECIAL invitation to British listeners comes from WRUF, the State and University of Florida radio station, Gainesville, which will present a special programme on Thursday next, February 22nd, at 8 a.m. (G.M.T.), on a wavelength of 361.2 metres. WRUF is usually limited to daytime transmissions, but this programme (at 3 a.m. E.S.T.) is specially intended for world-wide reception, and reports from British listeners will be welcome.



A MOBILE STUDIO. The new transmitting car of the American National Broadcasting Company at the entrance to Radio City, New York. The 150-watt transmitter, which is used for running commentaries, is stated to have a range of 100 miles when the car is stationary or 50 miles when travelling.

The Explanation

FROM our Vienna correspondent:—

"Why does your husband speak German in such whistling tones?"

"He has learnt the language on the radio since the Lucerne Plan came into action."

Most Westerly Station

THE most westerly broadcasting station in Europe is now testing on 291 metres. This is the transmitter of the Portuguese Radio Club at Parede, sixteen miles west of Lisbon. The Portuguese Club will welcome reports from British listeners, and these should be addressed to the Radio Club Portugues, Parede (Cascais), Portugal.

500 Kilowatts from America

A UNIQUE opportunity to pick up America's most powerful broadcasting station occurs at 6 a.m. on Sunday next, when WLW, the 500-kilowatt station at Cincinnati, will transmit a special programme under the auspices of the International DX'ers Alliance. The transmission, which will be on a wavelength of 428.5 metres, will go out under the call sign of W8XO. Reports are requested by the I.D.A., Bloomington, Illinois, and the Crosley Radio Corporation, Cincinnati, Ohio.

Television Demonstrations

CATHODE RAY television is being demonstrated every Friday at 11 p.m. by Haynes Radio at Queensway, Enfield, Middlesex. All *Wireless World* readers who are interested are invited to attend.

Ventriloquist Announcer

BARCELONA Radio has the honour of possessing the world's only ventriloquist announcer, Senor Toresky. According to unconfirmed reports, the Senor can throw his voice into the studio for the late night bulletin while enjoying his supper at home.

A Wireless Pioneer

THE Edison Medal, regarded as one of the highest awards open to the electrical engineering profession, has been presented to Professor Arthur E. Kennelly, of Harvard, for pioneering work in radio research. It was in 1902 that Dr. Kennelly, almost simultaneously with Oliver Heaviside in Great Britain, discovered what is known in America as the Kennelly-Heaviside Layer.

Germany's New Aerial Masts

ALL German broadcasting stations will shortly be equipped with new anti-fading aerials of the type introduced with great success at the Breslau transmitter. These aerials employ wooden masts, the antenna itself consisting of a vertical wire. By adding inductance to the top of the aerial it is possible to increase the local range of the station by 20 to 30 per cent. The highest wooden aerial tower, at Muhlacker, has just been completed and is 623 feet high. The second highest will be that at Langenberg, which will be 542 feet.

Crystal Sets are Dangerous !

THAT crystal sets are prejudicial to health is the contention of Mr. Fode, former Chairman of Denmark's Wireless Trade Association, who hails with satisfaction the removal of the Copenhagen station to a point outside the town, this having apparently reduced the number of crystal listeners. Supporting his contention, a well-known Danish doctor states that the tight pressure of 'phones on the ears threatens circulation, particularly in older listeners. Other medical authorities are now contradicting this point of view and a lively dispute is raging.

Radio on the Landing

THE Sheffield Recorder last week allowed, with costs, the appeal of an hotel licensee against a conviction and fine of ten pounds for allowing music and singing at the Millhouses Hotel, Abbeydale, without a licence.

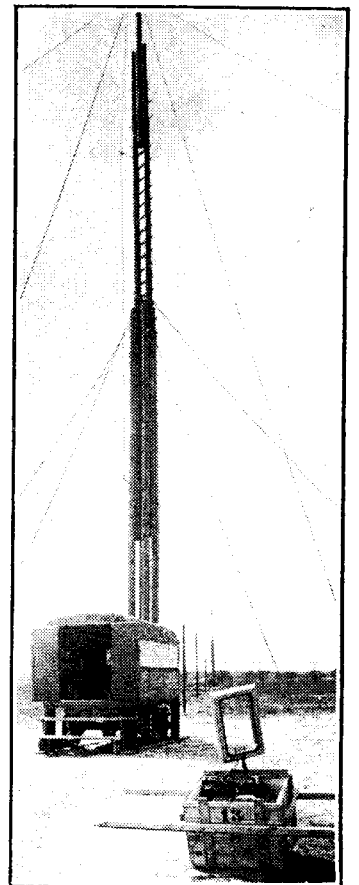
The licensee, Mr. T. A. Badger, contended that the eight-valve wireless set in question was installed on the landing in the private quarters of the hotel for the entertainment of his family and employees. The Recorder said that the fact that customers could hear the music and singing was, in his opinion, just incidental.

Short-waves from Iceland

IT is learned that the British and Danish Post Office administrations have been negotiating with the object of establishing a short-wave service at Reykjavik for broadcasting and telephone purposes. The new station will probably be erected this year.

Trouble in Denmark

DANISH listeners are protesting against a subsidy of 500,000 kroner which the Royal Theatre at Copenhagen is to receive annually from the State Broadcasting System. Provincial listeners contend that the money should be expended on alternative programmes.



USEFUL, IF NOT ORNAMENTAL. Apparatus in use at Berlin for testing a new anti-space wave aerial.

Home Newspapers by Wireless ?

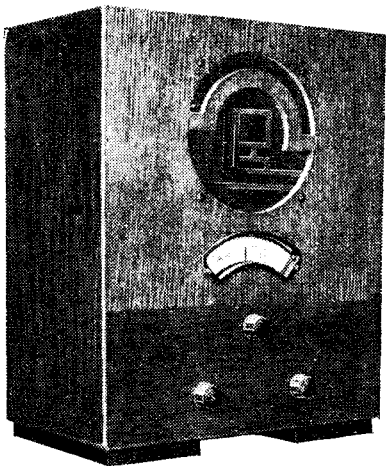
A "RADIO NEWSPAPER" printed on the wireless receiver and disgorged in the early hours of the morning is the latest vision of Mr. O. H. Caldwell, ex-member of the American Federal Radio Commission.

"Instead of turning off the family radio as in the old days," says Mr. Caldwell, "father switches to a point on the dial labelled 'facsimile.' And then, while the family is sleeping, the radio set is busy feeding to its printing apparatus an exact reproduction of a little newspaper which falls into a basket.

"For the usual loud speaker an electro-magnetic stylus is substituted. This stylus goes back and forth across the paper to draw a series of parallel lines." The apparatus appears to be almost a replica of the Fultograph.

Bush Battery Superheterodyne

TYPE S.B.1



An Ingenious Circuit Employing Only Three Valves

ALTHOUGH there are only three valves in this receiver the number of stages is four, as a metal oxide rectifier performs the function of a second detector. There is no signal-frequency H.F. stage, but the necessary selectivity is obtained by an inductively coupled band-pass circuit preceding the frequency-changer valve, which is of the H.F. pentode type. Cathode coupling is employed in the oscillator circuit, with balanced coupling coils in both filament leads. A variable-mu H.F. pentode is assigned the function of I.F. amplification and four tuned circuits are associated with this stage.

The metal oxide second detector feeds directly into the pentode output valve, and a very ingenious circuit has been adopted to combine the functions of automatic volume control and battery economy. The bias is derived partly from cells at the negative end of the H.T. battery and partly from the volt drop in a resistance in the negative H.T. lead. With no signal on the aerial the I.F. valve receives its normal working bias and the output stage is over-biased negatively; but when a station is tuned-in, the D.C. component of the second detector output applies a positive potential to the grid of the output valve in opposition to the standing bias, and brings that valve to its correct working point. The resulting increase in anode current in the last valve

passes through the bias resistance and increases the negative bias on the variable-mu I.F. valve.

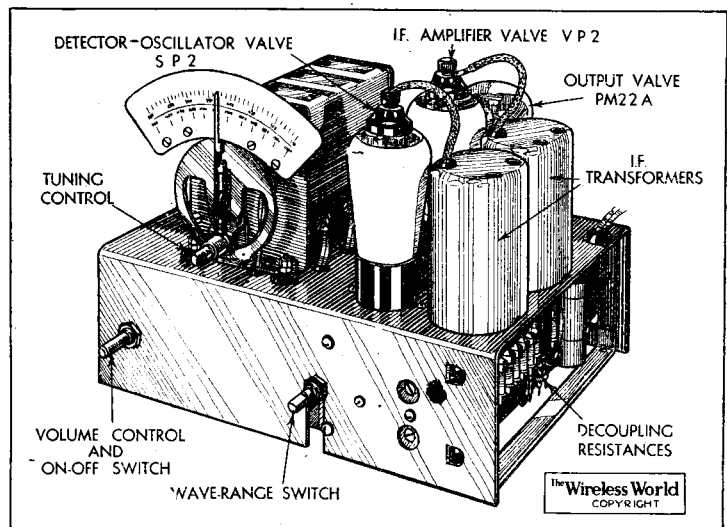
Thus it will be seen that the designers have virtually obtained amplified A.V.C. through the output stage and noise suppression between stations, due to the fact that under these conditions the output valve is over-biased. With three valves this is no mean achievement, and the performance of the set leaves no doubt of the practicability of such a scheme.

At first the set gave the impression of being rather insensitive, but this was due to the entire absence of background noise between stations, and when a distant station was tuned-in it was at once realised that the range is very little different from that of a good four-valve superheterodyne. The noise-to-signal ratio is certainly the lowest we have encountered in sets other than those provided with a special noise suppressor valve and relay. Seven or eight foreign programmes were received in daylight on the medium waveband and the set proved to be exceptionally sensitive on long waves. In Central London the band-width occupied by the Brookmans Park transmitters did not exceed 30 kc/s in

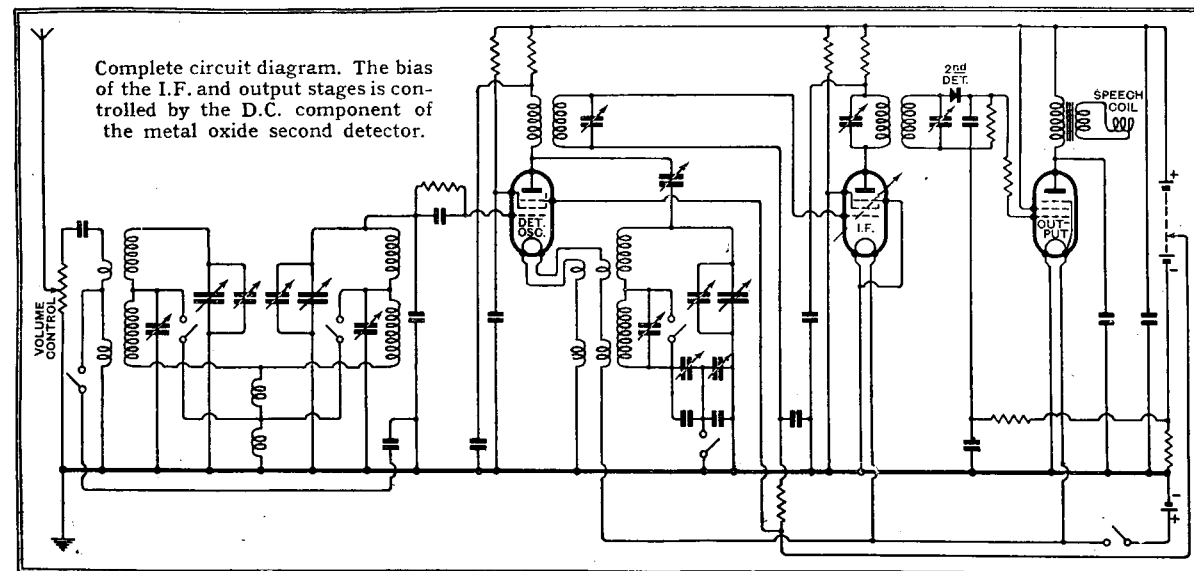
either case, and on long waves no difficulty was experienced in receiving Zeesen quite clear of Daventry. Second-channel interference was negligible.

The manual volume control consists of a high-resistance potentiometer connected across the input circuit. It is quiet in operation, and as it precedes the second detector the H.T. current consumption is more or less proportional to the setting of

FEATURES. *Type.*—Table model battery superheterodyne receiver with moving-coil loud speaker. *Circuit.*—Band-pass tuner preceding pentode frequency-changer valve—variable-mu pentode I.F. amplifier—metal oxide second detector—pentode output valve. *Controls.*—(1) Tuning with illuminated scale calibrated in wavelengths. (2) Volume control and on-off switch. (3) Wave-range switch. *Price.*—£10 19s. 6d. *Makers.*—Bush Radio Ltd., Woodger Road, Shepherd's Bush, London, W.12.



The compact three-valve chassis leaves ample room in the cabinet for batteries.



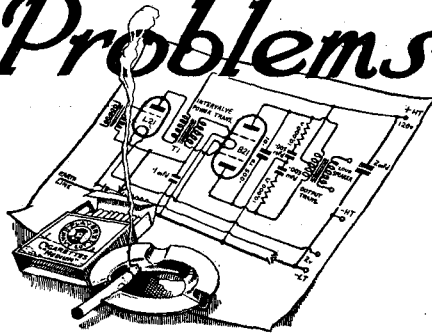
Complete circuit diagram. The bias of the I.F. and output stages is controlled by the D.C. component of the metal oxide second detector.

this control. The measured standing current for the receiver under test was 5.4 mA., and at maximum volume the current did not exceed 10 mA.

A Magnavox permanent-magnet moving-coil loud speaker is fitted and there is ample volume for the average living room (about 400 mW.). The balance of tone in relation to the volume level is good, and the excellent response in the extreme top probably accounts to some extent for the unusually good reproduction of transients. The cabinet is well built of solid wood and a separate compartment has been provided for the L.T. battery.

There is nothing in the receiver or its performance to suggest that a three-valve circuit has been adopted with the object of price reduction, and it is gratifying to find so much evidence of originality in view of the present-day tendency towards standardisation of design.

Readers' Problems



THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page

A "Passenger" Circuit

A READER asks what may be deduced from the fact that no audible difference to signal strength is made by disconnecting one section of the ganged condenser which tunes the circuits of his "2 H.F." receiver. Actually the section in question is that shunted across the detector grid coil. In spite of the fact that this circuit is clearly inoperative, the receiver is stated to work "quite well."

It is perhaps rather a pity that a modern receiver often will give results of a sort even when most serious faults exist. We can assure our correspondent that, in the circumstances described, he is not getting anything like the results of which the set should be capable, either with regard to sensitivity or selectivity. It seems highly probable that there is a disconnection in the tuning coil, or possibly some simple misconnection that should be easily traceable.

Series-connected Valve Heaters

ALTHOUGH the question of joining a number of battery-fed valve filaments in series does not often arise, it is still standard practice in D.C. and "universal" mains sets to connect the heaters in this way. Usually the problem is simplified by the fact that all valves take the same heating current, and so may be connected in series without any precautions.

But complications will ensue when different types of valves are to be mixed in the same receiver. For instance, a reader wishes to replace an existing valve, rated at 16 volts 0.25 amp. by one designed to work at 20 volts 0.18 amp. In this case it will become necessary to shunt the heater having the lower current rating with a resistance, and we are asked to say how the value of this resistance should be estimated.

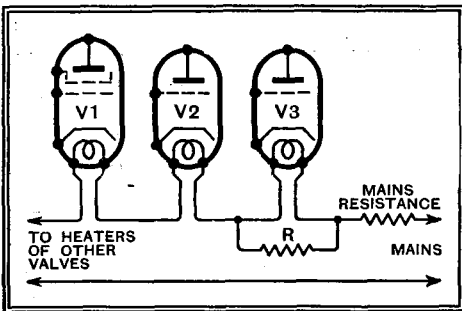


Fig. 1.—Illustrating the use of a "by-pass" resistance; in the example given in the text it is assumed that V1, V2 and remaining valves (if any) are rated at 16 volts, 0.25 amp., while V3 takes 0.18 amp. at 20 volts.

It will be convenient to consider that the resistance (R in Fig. 1) will have the task of carrying the surplus current; that is to say, the difference in current between that at which the low-consumption valve is rated and that which must flow through the chain of series-connected heaters. The right value is then easily ascertained by dividing the voltage at which the shunted valve heater is rated by surplus current, expressed as a fraction of an ampere.

In the present case "surplus current" is $0.25 - 0.18 = 0.07$ amp., while the valve is rated at 20 volts; the value of the shunt will therefore be approximately 286 ohms.

In making this change one is apt to forget that a slight alteration will theoretically be

necessary in the value of the series-connected main resistance; in the present case the voltage to be absorbed by it will be 4 volts less than before the new valve was substituted.

Leaky Paper Condensers

WITH the help of a sensitive milliammeter and an H.T. battery, a reader has been making a systematic test of the insulation resistance of the various high-capacity condensers in his A.C. mains receiver. He is apparently rather perturbed to find that in nearly every one there is a slight trace of leakage, and asks whether the performance of the set is likely to be affected.

It is a fact that all paper condensers tend to leak slightly; the leakage is usually more or less proportional to capacity. Provided it is only just perceptible, no harm should result, except that grid bias might be upset by a leaky coupling condenser in a resistance- or choke-coupled amplifier. But one usually chooses mica condensers for such purposes. A slight leakage does not greatly matter in a coupling condenser used with a parallel-fed transformer or auto-transformer.

Wave-range Switch Wiring

READY-MADE tuning coils are generally fitted nowadays with a built-in wave-change switch and so the question of wiring an external switch does not generally arise. However, a reader who has just built a set with home-made coils has found it necessary, in order to obtain complete stability,

The Wireless World

INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

to make the connections to the wave-range switches by means of leads shielded in metallic braiding. Since the screening was added, no difficulty has been experienced, but it is thought that the bands of wavelengths covered by the set seems to be unduly restricted; it is suspected that the additional self-capacity of the screened wiring is responsible. We are asked to say how matters might be improved in this respect.

If it can be assumed that the wave-change system is arranged on conventional lines, our correspondent must be mistaken in thinking that shielding of the switch leads adds anything to stray capacity on the medium-wave side. This will be made clear if we draw out the circuit as in Fig. 1 (a).

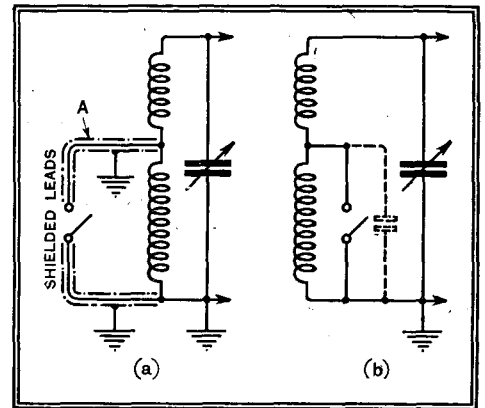


Fig. 2.—Screened connections to a wave-range switch add to the stray capacity across the long-wave section of a tuning coil, but do not affect the medium-wave section.

The capacity between the lead marked A and its shield will admittedly be additive to that existing across the long-wave section of the coil, but it will not in any way affect the circuit when the switch is closed for medium-wave reception. Further, the self-capacity of the lower screened lead being at the "earthy" end of the circuit will in no way affect matters on either waveband. Accordingly, ordinary metal-braided rubber-covered wire might be used for this lead, but the high-potential wire A should be of low capacity.

What actually happens is shown in diagram (b), where the capacity of the "live" switch lead is indicated by dotted lines.

Partial A.V.C.

NORMALLY, it is most unlikely that a set with A.V.C. should be "over-controlled." The effect would, of course, manifest itself by the fact that weak and distant stations would be received at greater strength than would be a powerful near-by transmitter.

The New Monodial is rather different from the general run of sets in that it has a post-detection A.V.C. stage operating on the double-diode-pentode second detector. It is therefore possible—though far from probable—that over-control should occur, and to a reader who suspects the presence of this effect we suggest the following test.

The post-detection control stage may be temporarily eliminated by the simple expedient of connecting R15 to the earth line instead of to the junction of R14 and S2. It will then be easy to determine whether over-control is taking place.

The Wireless World

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As many of the circuits and apparatus described in these
pages are covered by patents, readers are advised, before
making use of them, to satisfy themselves that they would
not be infringing patents.

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EDITORIAL COMMENT

Wireless Receivers

Importance of Reliability

AT no time in the history of broadcasting has it been more important that the public should be able to regard a wireless receiver as a dependable instrument. The correction of any fault which may develop is to-day more difficult by reason of the increasing compactness of receivers and their complication. In earlier designs every part in a receiver was conveniently accessible and a defective component could easily be removed and replaced.

If receivers were beyond reproach in the matter of reliability there could be no objections to compactness, even in spite of the additional complications in the receiver, but we find to-day that public confidence in sets is being badly shaken because of the high proportion of breakdowns occurring.

We have not far to look for the causes which have contributed to bringing about this state of affairs. The component parts of the receiver are not inherently unreliable in themselves. Unreliability results from two principal causes—haste and cheapening of the product.

We should be the very last to discourage a reduction in price which would bring better receiving sets within the means of the majority to purchase, but most emphatically do we consider that reliability should be the first consideration of the manufacturer, and only when he has established a reputation in this respect can he turn his attention to reduction in price. It would seem as if the British name for reliability is being sacrificed in order to follow the fashion for mass production. Mass production undoubtedly has its proper place in

the wireless industry, but it should be the servant of the manufacturer and not the master. Unfortunately, mass production will produce a bad article with just the same despatch as it will a sound one, and the process is, therefore, a dangerous aid to employ until you are entirely satisfied with the product you wish to repeat.

Until sets can be made more reliable and less subject to breakdowns, "fewer sets and better" might well be adopted as the slogan of the industry, even though for the time being this might result in a slight increase in prices.

B.B.C. and Talks

The Question of Responsibility

B.B.C. talks, in particular those having a bearing on international politics, have recently been in the news. If broadcast talks were interpreted abroad merely as the expressions of opinion of individuals, they would not be taken so seriously; but, as Sir John Simon pointed out recently, they are generally regarded abroad as official pronouncements of the British Government.

With the present constitution of the B.B.C. it is difficult to imagine how this impression abroad can be corrected. The B.B.C. accepts responsibility for censoring talks, and in doing so must surely approve the talks as censored. The B.B.C. is responsible to the Postmaster-General under the terms of its licence, and it is the Postmaster-General who is the mouth-piece of the B.B.C. in the House. With this chain of responsibility direct to the Government, is it to be wondered at if, not only abroad, but in this country also, the majority of listeners regard B.B.C. talks as "official" or at least "officially approved"?

H.F. Pentode Four

An Economical Battery Straight Set with a Class "B" Output Stage

DEVELOPMENT in battery receivers has of recent years been largely confined to the output stage, and great strides have been taken in the production of systems capable of combining good quality reproduction with extreme economy of battery power. The appearance of the battery H.F. pentode, however, is by no means unimportant, and it is likely to lead to a considerable improvement in the performance of the H.F. amplifier.

There is rarely any difficulty attached to the attainment of an adequate stage gain, and in the interests of economy it is the common practice to sacrifice a certain

The difficulty is occasioned largely by the negative resistance kink in the characteristic of the screen-grid tetrode. The addition of an extra electrode to the valve, in the form of a suppressor grid situated between the screen-grid and the anode, removes this negative resistance kink, and

quired, and since this lessens the possibility of stray couplings between the different parts it is likely to promote stability.

The detector is of the grid rectifying type and reaction is obtained from its anode circuit, the control being arranged in the usual way by means of a variable condenser, a resistance R₂ of 500 ohms being connected in circuit to prevent any possibility of parasitic oscillation. The detector is coupled to the driver valve through a resistance-capacity fed auto-transformer, and its anode circuit is decoupled by the 10,000 ohms resistance R₃ and the 2 mfd. condenser C₄. The driver valve is an L₂₁ and is coupled

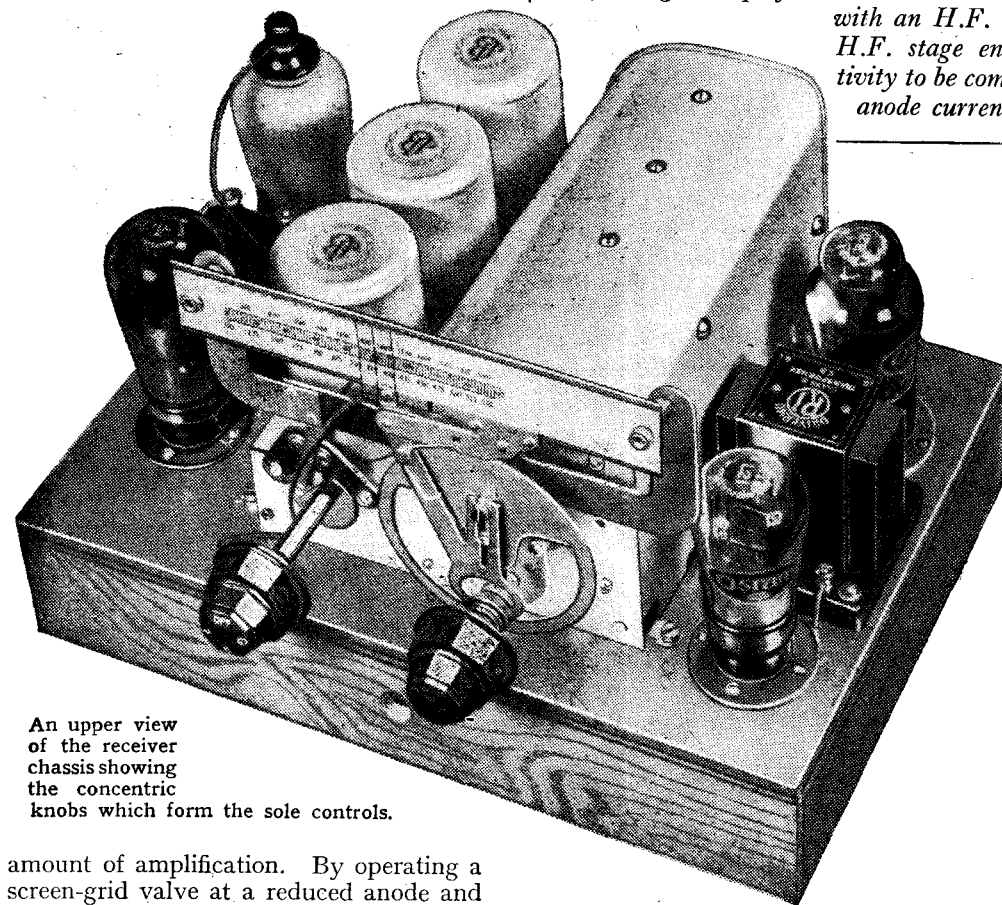
THE quiescent output systems developed during recent years have so greatly reduced the drain on the H.T. battery that the attainment of good quality reproduction at pleasing volume has become economically possible. Various methods can be used to achieve the desired end, and in the Battery H.F. Pentode IV a Class "B" output stage is employed. Iron-cored tuning coils together with an H.F. pentode for the H.F. stage enable high selectivity to be combined with a low anode current consumption.

to the B₂₁ output Class "B" valve through a 1-1 ratio driver transformer with a secondary of low d.c. resistance. With an H.T. supply of some 120 volts, the output valve required a negative grid bias of 4.5 volts, and the same value is applied to the driver valve, since this arrangement has been found to give good quality reproduction with highly economical working. The output transformer is of the multi-ratio type and is mounted on the loud speaker itself; as a result, a three-way connector and plug are used for the connection to the receiver. To prevent undue accentuation of the upper register by the output valve, a 0.005 mfd. condenser C₅ is connected across the output transformer primary.

The Controls

Practically the whole of the H.F. equipment is obtained ready assembled in a single unit, and this leads to an extremely easy construction. This unit contains the tuning coils, gang condenser, reaction condenser, volume control, wave-change switch, radio-gramophone switch, on-off switch, and dial light switch. The switches are grouped and operated by two concentric knobs, while the tuning, reaction, and volume controls are also grouped and operated by another pair of concentric knobs. A very neat panel appearance is thus preserved.

The tuning is carried out by the section of the right-hand knob which is nearest the panel, and this controls only the variable condenser. The front section of the same knob, however, operates both the reaction and volume controls. When the knob is fully rotated in an anti-clockwise direction, both reaction and volume are at minimum. Rotating the knob in a



An upper view of the receiver chassis showing the concentric knobs which form the sole controls.

amount of amplification. By operating a screen-grid valve at a reduced anode and screen potential a considerable saving in the current drain upon the H.T. battery can be made for quite a small loss in amplification. There is, however, one disadvantage attendant upon operation at moderate voltages—the maximum undistorted output of the valve is reduced. The output of a battery-type valve is never of a very high order, and the use of voltages lower than the maximum rated values may sometimes lead to difficulty in obtaining sufficient undistorted output from the H.F. valve fully to load the detector. This is likely to occur chiefly when receiving a local station, for then the valve is operated at a high bias voltage, and its output is still further restricted.

considerably increases the output obtainable. The valve is then an H.F. pentode.

A valve of this type is employed in the H.F. stage of the H.F. Pentode IV, and it is operated with an anode potential of some 120 volts, and a screen supply of about 70 volts. The circuit diagram of Fig. 1 shows that it is preceded by a two-stage band-pass filter for which iron-cored tuning coils are employed, and that it is coupled to the detector by means of an H.F. transformer to which reaction is applied. The use of an H.F. transformer in preference to the tuned grid or tuned anode coupling is advantageous in that it reduces the number of components re-

The Battery H.F. Pentode IV—clockwise direction from this position affects only the volume control for about three-quarters of its travel; when the volume control has reached maximum, however, a further rotation of the knob ceases to affect it but increases reaction. The control is actually a potentiometer ganged to a variable condenser. The potentiometer controls the negative grid bias applied to the H.F. valve and the condenser is in the reaction circuit. The components, however, are specially designed so that the potentiometer is inoperative over that portion of its travel during which reaction is being applied, and the condenser ceases to function over the other portion where volume is being controlled. In this way the number of controls is reduced without affecting the performance of the receiver.

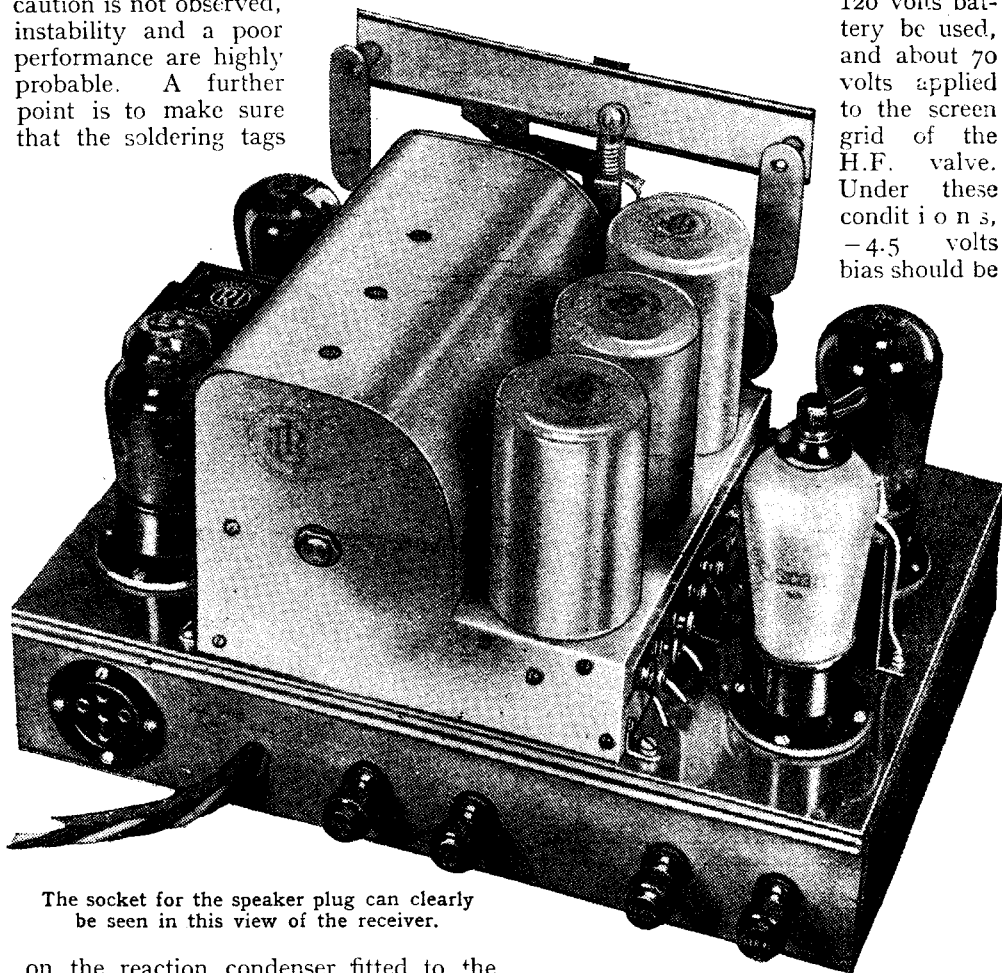
The Construction

The outer of the left-hand pair of concentric knobs controls a multi-way switch which performs the operations of wave-band switching, changing over to gramophone, and switching the set on and off. The other knob operates a switch which controls only the dial light. Since the current drain in a battery receiver is likely to be an appreciable item in the running costs, it seems wasteful to leave the dial light always in circuit, for it is required only during the process of tuning. This switch is included, therefore, to permit it being switched off when tuning has been carried out. If it be considered, of course, that the most valuable feature of a dial light is to serve as a reminder that the set is switched on when the station to which it is tuned has closed down, the dial light switch may be left permanently in the "on" position.

The receiver is assembled on a metal covered ply-wood chassis, and the components required are quite few in number. The assembly will be found quite straightforward; the diagrams are self-explanatory and need little comment here. It should

be noted, however, that it is important to make sound connections between the chassis of the tuning unit and negative L.T. at more than one point. If this precaution is not observed, instability and a poor performance are highly probable. A further point is to make sure that the soldering tags

a.h. (actual) be employed. Some flexibility is permissible with regard to the H.T. supply. Where a maximum of economy is desired, it is advised that a 120 volts battery be used, and about 70 volts applied to the screen grid of the H.F. valve. Under these conditions, -4.5 volts bias should be



The socket for the speaker plug can clearly be seen in this view of the receiver.

on the reaction condenser fitted to the tuning unit do not make contact with the metal covered receiver chassis when the unit is screwed down.

The receiver consumes 0.5 ampere at 2 volts for the L.T. supply to the valves and an additional 0.06 ampere for the dial light, or a total of 0.56 ampere. Although a small accumulator may be used satisfactorily, it is recommended that one with a capacity of at least 20

used for the Class "B" and driver valves and -1.5 for the HL2 on gramophone. The total current consumption in the absence of a signal and with the volume control at maximum is then 10.3 mA. With the correct ratio on the output transformer, and this is best chosen by experiment, since the switching device enables the optimum ratio to be easily determined, an output of some 900 milliwatts is then

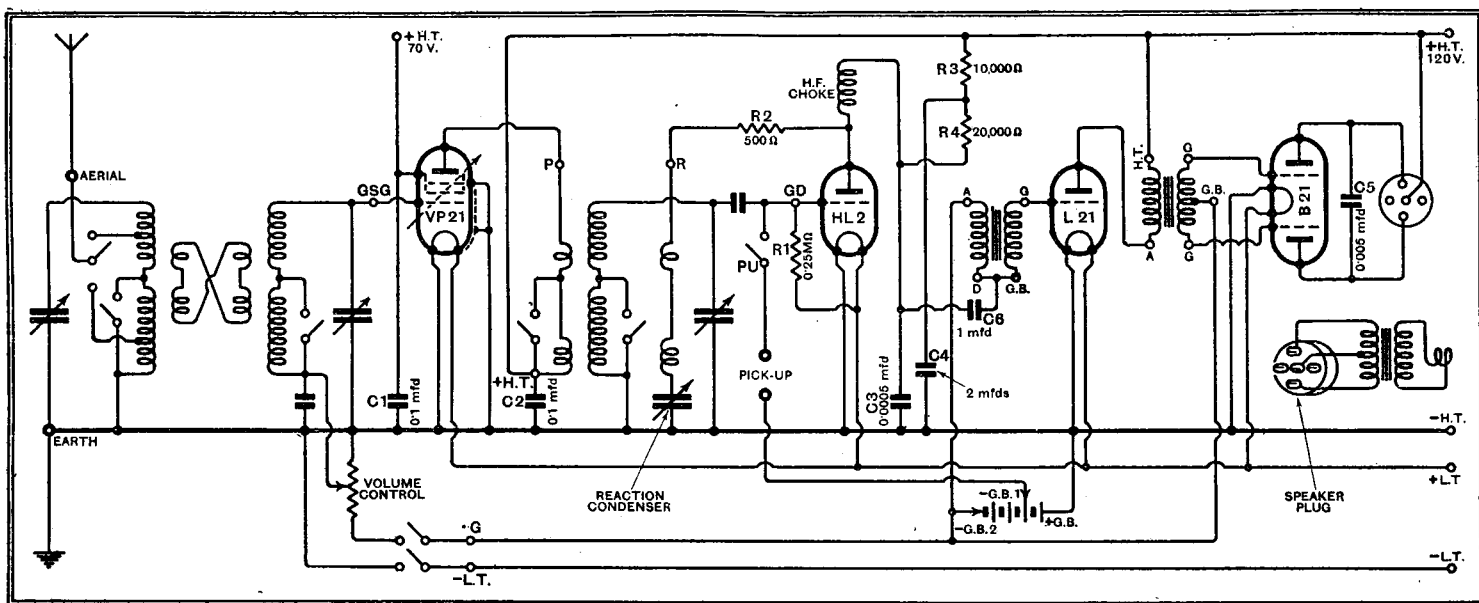
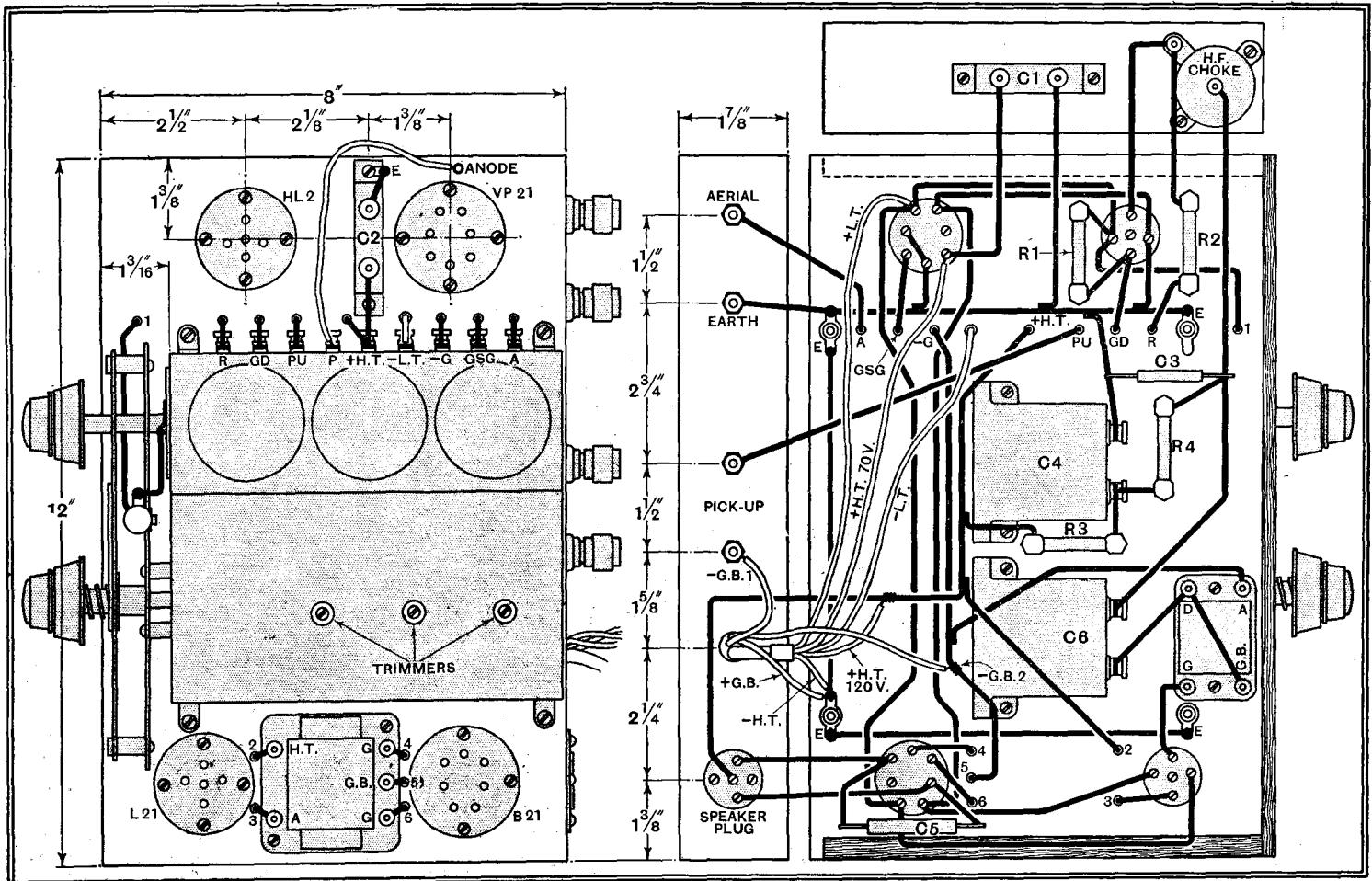


Fig. 1.—The complete circuit diagram of the set is shown here. The majority of the H.F. components are included in the "pack."

PRACTICAL WIRING DIAGRAM



The construction and wiring are clearly shown in these drawings.

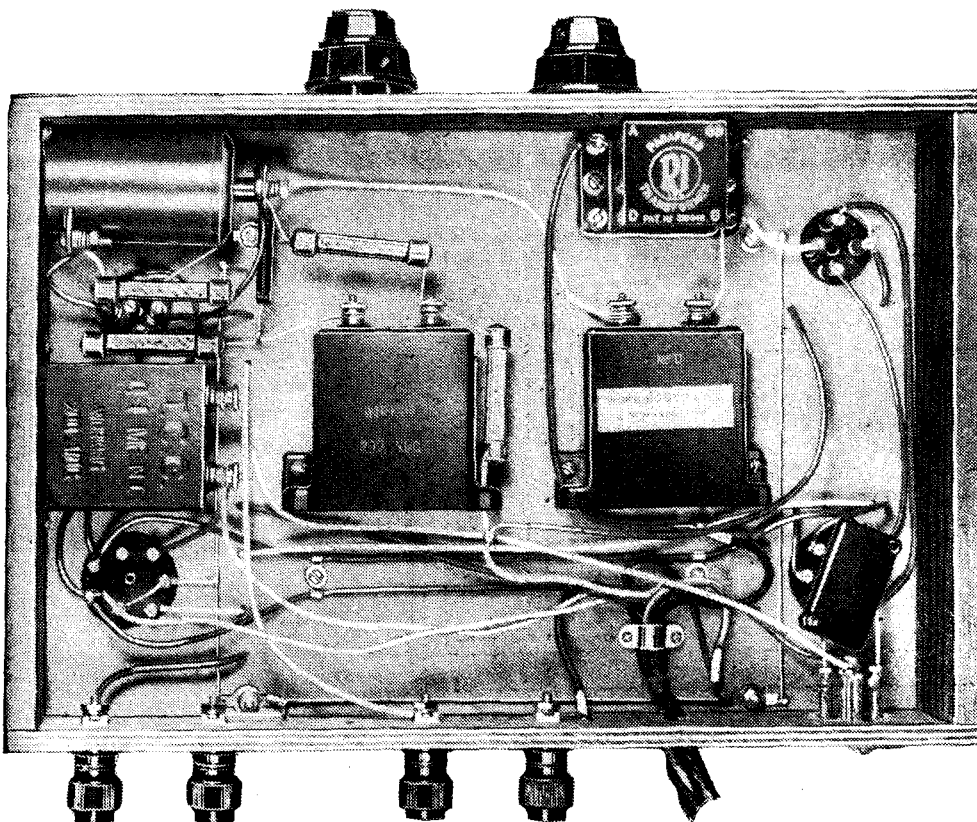
obtainable. Where a larger output is required, it may be obtained at the expense of an increased current consumption by using a 150 volts H.T. battery, and with the L21 driver the output rises to some

1,500 milliwatts; the bias on the output and driver valves should be increased to -6 volts with 150 volts H.T. supply. The output may be increased still further when using 150 volts by employing the P2

valve as a driver, but there is a still further increase in current consumption; the output, however, rises to about 2,000 milliwatts. It will be seen, therefore, that there is considerable latitude in the choice of operating conditions.

The only initial adjustments required are to the ganging, and these will be dealt with later. In the meantime some notes on the performance to be expected may prove interesting. In the matter of sensitivity, the set is well up to the usual standard of its class, and in judging it it must be remembered that the Class "B" valve and the driver are really a single stage, the purpose of which is to provide power output and not amplification. The

A full-size blue print of the wiring diagram is available from the Publishers, Dorset House, Stamford Street, London, S.E. 1. Price 1s. 6d. post free.



An under-baseboard view of the receiver chassis showing the modest number of components employed.

Class "B" valve and driver are thus roughly equivalent to the single output pentode of an older type of receiver. In sensitivity, therefore, the set is comparable to the older three-valve type, the additional valve being provided for economical operation and not to increase the amplification to any great extent. The set, therefore, should be used with a reasonably good aerial, and it will then be found to give good reception of all the chief Continental stations under average conditions.

The selectivity provided by the iron-cored tuning coils is sufficient to permit good reception of distant stations, even

The Battery H.F. Pentode IV—

when the set is used close to a powerful local. Mutual interference between distant stations reaches quite small proportions, and the blanketing effect of the locals is entirely removed, their spread being confined to remarkably few channels. The quality of reproduction reaches a high standard, and is unusually good for an inexpensive battery-operated receiver, while the volume obtainable with a 120 volts H.T. supply is adequate for the average small room.

The volume obtainable, it should be noted, is dependent upon the type of output stage and its precise operating conditions, and three alternatives have already been given. The appearance of the new quiescent push-pull valve, the QP21, leads to still another possible arrangement. The system is somewhat better adapted to low-volume reproduction than Class "B," and, where a smaller output is required, it is recommended that it be adopted in preference. In next week's issue of *The Wireless World*, therefore, it is proposed to describe the set with an output stage of this type. The single Q.P.P. valve, of course, replaces both the Class "B" valve and the driver. The ganging of the receiver will also be treated in that article, which will be actually an extension of the present one.

LIST OF PARTS

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- | | |
|----------------------------------------------------------------------------------------------------------------|----------------------------|
| 1 Linacore Bandpass Tuner | J.B. Type BPB |
| 1 Bulb, 2 volts, 0.06 amp. | Bulgin Type H |
| 1 H.F. Choke | Kinva |
| (Bulgin, Wearite.) | |
| 2 Fixed Condensers, 0.1 mfd., 200 v. D.C. | working, T.C.C.50 |
| C1, C2 | T.C.C.50 |
| 1 Fixed Condenser, 1 mfd., ditto, C5 | T.C.C.50 |
| 1 Fixed Condenser, 2 mfd., ditto, C4 | T.C.C.50 |
| 1 Fixed Condenser, 0.005 mfd., C5 | T.C.C. Type M |
| 1 Fixed Condenser, 0.005 mfd., C3 | T.C.C. Type M |
| (Dubilier, Peak, T.M.C. Hydra, Telsen.) | |
| 1 Metallised Resistance, 500 ohms, 1 watt, R2 | Dubilier |
| 1 Metallised Resistance, 10,000 ohms, 1 watt, R3 | Dubilier |
| 1 Metallised Resistance, 20,000 ohms, 1 watt, R4 | Dubilier |
| 1 Metallised Resistance, 250,000 ohms, 1 watt, R1 | Dubilier |
| (Claude Lyons, Erie, Graham Farish, Seradex, Watmel.) | |
| 1 L.F. Transformer | R.I. Parafeed |
| 1 Drivermu Transformer, 1:1 | R.I. |
| (Multitone, Varley.) | |
| 3 5-pin Valve Holders | |
| Clix Chassis Mounting Standard Type | |
| 2 7-pin Valve Holders | Clix Chassis Mounting Type |
| 1 G.B. Battery, 9 volts | |
| 1 5-way Battery Cable, 30in., with wander plugs and spade ends | Belling-Lee |
| 3 Wander Plugs | Clix Type B |
| 4 Ebonite Shrouded Terminals, A., E., Pick-up (2) | Belling-Lee Type B |
| Plymax Baseboard, 8 in. x 12 in. x 3/8 in. | Peto-Scott |
| 2 oz. No. 20 tinned copper wire, 3 lengths | |
| Systoflex, wood, flex, etc. | |
| Screws:— | |
| 28 3/16 in. No. 4 R/hd., 10 1/2 in. No. 4 R/hd., 4 3/16 in. No. 4 B.A. with metal thread and nuts and washers. | |
| Valves:—1 Osram or Marconi HL2; 1 Osram or Marconi L21; 1 Osram or Marconi VP21; 1 Osram or Marconi B21. | |
| 1 Microloide Loud Speaker | W.B. Type PM4A |

Muirhead Service Oscillator

THIS instrument has been designed for the use of the service man, and consists of a radio-frequency oscillator modulated internally by a fixed audio frequency or externally from a gramophone pick-up. It is provided with a screened output lead and dummy aerial unit, and the price complete is £9 15s. It is hoped shortly to produce an output meter specially for use with this set.

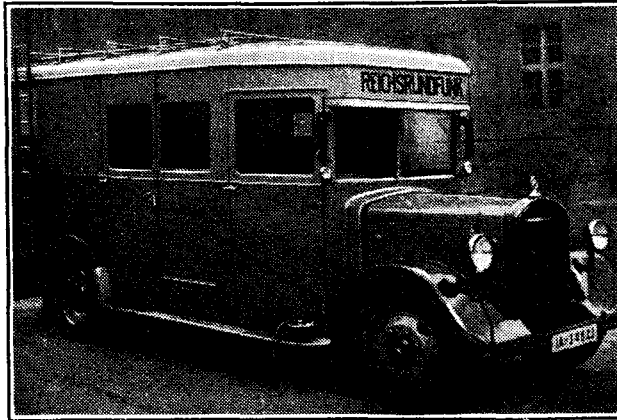
A Busy Day

On Tour With an "O.B." Van

A DAY'S tour with the German outside broadcasting van is an exciting experience. A few days ago, through the kind invitation of Herr Eduard Dietze, the Funkstunde "O.B." specialist, a number of Press representatives set out at 9 a.m. for the Berlin District Railway. We wit-

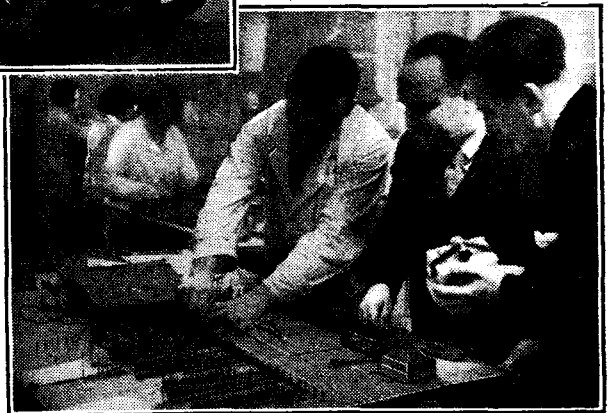
whole recording is boiled down to a twenty-five minutes' programme described as "The Echo of the Week."

The technical procedure is as follows. The reporter, Herr Dietze, talks straight into a microphone. The current is passed to the mixing panel, which also gathers up the sound effects associated with each broadcast, and then to the amplifiers. From these a cable runs to the broadcasting van in which the recording machines are installed. The recording engineer must be careful to overlap from one disc to another, numbering each as he goes along. The reporter sometimes speaks his part two or three times for the purpose of obtaining the best recording. This is often an advantage, because in one



An outside broadcasting van ready for its day's tour. Running commentaries are sometimes given from the roof, hence the ladder.

A visit to a telephone factory. The popular announcer, Herr E. Dietze (centre), is giving a microphone description of what he sees.



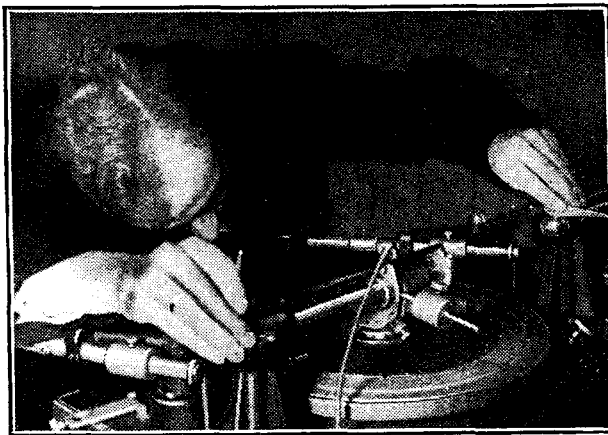
nessed Herr Dietze giving his microphone account of the special precautions taken by the railway authorities on foggy days. Then we were transported to the "winter relief" kitchen for an account of the catering methods. Then the scene changed to a huge telephone factory, where Dietze took his hearers in imagination through the workshops. Tea-time saw us without tea at the UFA film studios. Here, after some persuasion, Herr Dietze was permitted to interview such great "stars" as Brigitte Helm and Hans Albers. Then we were rushed twenty miles back into town for a swift recording of the "Wintergarten" festivi-

record the accompanying sounds may be less successful than in others. Again, he is speaking spontaneously without any manuscript, and therefore the talk may be better on one record than on another.

Immediately the van returns to headquarters the reporter has the discs played over to him and he then selects the most interesting portions. The final choice is re-recorded to provide one continuous programme complete with announcements.

A few facts regarding the technical arrangements in the "O.B." vans may be interesting. Each car is fitted with three microphone cables, two approximately six hundred yards in length, and one half that length. A further cable connects the van to the nearest A.C. supply of any voltage. These cables are rolled on drums in a special compartment. Where no A.C. supply is available the amplifiers and other electric equipment can be driven off a motor set working from 12-volt starting batteries providing current for twelve hours.

The recorder in the van. Metal discs are used, these being less expensive than the wax types.



ties, and, finally, for a few minutes' talk at the National Socialist Kreisrundfunkstelle, where prospective listeners are given advice on the choice of a receiver.

Rather a big day, considering that the

The recording is carried out on metal discs covered with a special varnish. Reproduction is good, though the more expensive wax discs give superior results.

WANDERING WAVE.

Valves v. Cost

IT is usually assumed that the cost of a receiver is proportional to the number of valves employed in it. Whilst this argument might hold good with mass produced commercial receivers it is by no means the case with sets for individual construction, and in this article it is shown that it may often happen that the use of an additional valve will prove truly economical as well as leading to an improved performance

CONTRARY to the generally accepted belief, the cost of a receiver bears no direct relationship with the number of valves employed, and an increase in the number may actually prove true economy as well as leading to a better performance! The belief that each additional valve must increase the cost seems obvious and unassailable, but in reality it is based upon a fallacy.

At first sight it appears that an extra valve must necessarily involve an increased expenditure, for the valve must be provided with additional components, the cost of which must be allowed for as well as that of the valve. This is perfectly true, but the point which is often overlooked is that the increased amplification obtained with the aid of the additional valve and components may permit us to use fewer or cheaper components in other parts of the receiver, so that the saving effected may more than offset the cost of the extra stage.

This point is well brought out by the modern small superheterodyne. A three-valve superheterodyne is well within the bounds of possibility, and has been so for a long time. There are many possible arrangements of the valves, but the most obvious and generally satisfactory is to use a Heptode as a frequency-changer followed by an H.F. pentode as a single I.F. stage. Westectors could act as the second

detector and provide A.V.C. if necessary, while the output valve would almost certainly be of the pentode type. Alternatively, a duo-diode-output pentode could be used. In order to obtain a reasonable degree of sensitivity great care would have to be taken throughout to maintain a maximum of efficiency, and a transformer coupling between the second detector and the output valve would usually be deemed necessary.

Three-valve Superheterodyne

Critically coupled I.F. transformers of high dynamic resistance would be needed, with the result that sideband cutting would be evident, and the loss of amplification incidental to tone correction systems would be too great to permit its inclusion. Quality, therefore, would have to be sacrificed to some degree, and this would be still further affected by the use of a transformer coupling after a diode or Westector, for such an arrangement can hardly be defended from the quality viewpoint, however advantageous it may be from the standpoint of amplification. The transformer used would be unlikely to have a ratio of less than 1:6 or cost less than 15s.

Now, even a small superheterodyne of this nature would have two signal frequency tuned circuits, otherwise second channel interference would prove prohibitive, and these would be arranged as

The Economics of Receiver Design

an input band-pass filter. Suppose we consider the addition of an H.F. stage, making the set into a four-valve type. Apart from the valve we shall need only



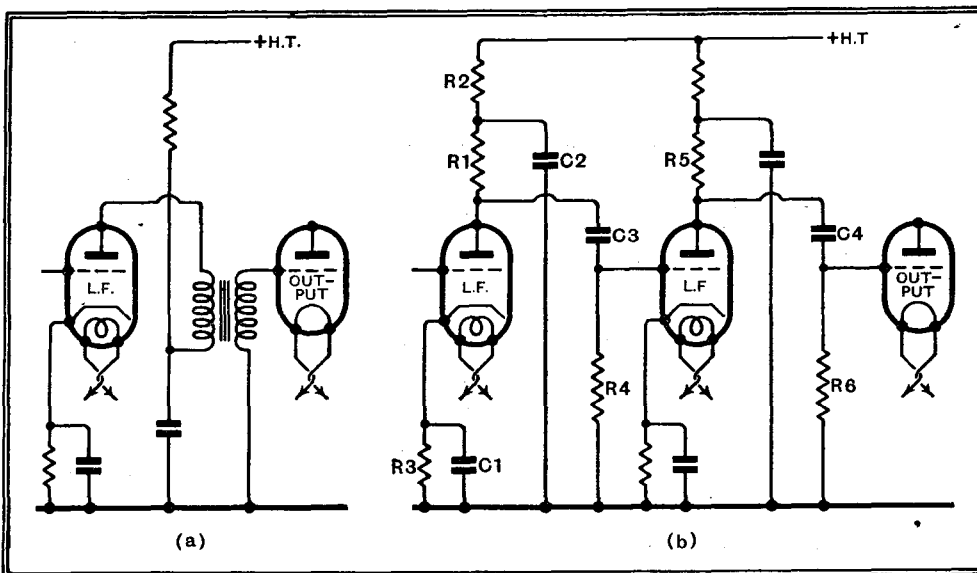
The H.F. and frequency-changer stages of a typical modern four-valve superheterodyne.

a valve-holder in the way of extra components, for it is unnecessary to increase the number of tuned circuits. For the band-pass input we substitute a single tuned aerial circuit, and we use a tuned H.F. transformer for the coupling between the H.F. valve and the frequency-changer. Thus, there are still only two signal frequency tuned circuits, and although the coils are of different kinds, they need cost no more than the band-pass type employed in a three-valve superheterodyne.

An H.F. Stage

The H.F. stage will give an amplification of from 30 to 100 times, according to the coil design, and, in addition, the efficiency will be doubled by the absence of the band-pass filter. The sensitivity, therefore, will be increased from 60 to 200 times by the change, which will have cost 17s. 6d. for the valve, and, say, 9d. for the valve-holder, or a total of 18s. 3d.

With such a large increase in amplification we can well afford to use a cheaper L.F. coupling, and one, moreover, which will give improved quality of reproduction. After a diode detector or Westector a transformer would be resistance-capacity fed, so that we have to substitute for it only a grid leak at a cost of 1s. If the transformer costs 15s. we thus save 14s. in the



When changing a transformer-coupled amplifier (a) to a resistance-capacity coupled (b) the only component in the former which will not be used is the L.F. transformer. The additional parts needed for resistance coupling comprise the resistances R5 and R6 and the condenser C4 to replace the transformer. The extra valve necessitates R1, R2, R3, and R4 with C1, C2 and C3 and a valve-holder. It is explained in the article that the total cost of all these components and the valve may actually be less than that of the transformer.

Valves v. Cost—

coupling, so that the additional valve increases the total cost of the set by only 4s. 3d., and leads to an increase of amplification, even after the removal of the transformer, of from ten to thirty times, gives better quality of reproduction, and improves the action of A.V.C. if this be incorporated. If desired, more amplification can be thrown away by using I.F. transformers with increased coil couplings, and a still further improvement in the reproduction obtained.

In this particular case the extra valve has led to some increase in the total cost of the receiver, but the increase (4s. 3d.) is trivial when compared with the figure of £2-£3 which many would expect. The increase is quite negligible when it is remembered that the performance is greatly improved. The exact figure for the increase in cost in this case naturally depends on the price of the L.F. transformer which would be used in a three-valve set. If a very cheap component be employed, the additional valve will certainly represent an appreciable increase in the cost, but to compensate for this the change would result in a much greater improvement in the quality. On the other hand, if an expensive transformer costing 30s. or so were to be used, the extra valve would actually lead to a reduction of some 11s. 9d. in the total cost, and a better performance in regard to sensitivity and quality would still be found.

Resistance Coupling

It is largely for reasons of this nature that no constructional three-valve superheterodyne has been described in *The Wireless World*. A good three-valve set could have been made long ago, and there is no question of it having only recently become possible. It has been felt, however, that such a receiver was not worth while when with little or no increase in total cost a four-valve set could be built which would be capable of a vastly superior performance. The smallest superheterodynes described in *The Wireless World*, therefore, have been of the four-valve type, and those interested in the details of design are referred to *The Wireless World* D.C. Superhet.¹ and the Everyman A.C. Super.²

A similar chain of reasoning is applicable to other types of receiver, but space does not permit all cases to be discussed in such detail. A point of particular interest, however, lies in the L.F. amplifier, where the relative merits of transformer and resistance coupling come up for consideration. In high quality apparatus a single L.F. stage will probably be sufficient with a transformer, but it will probably be necessary to use a very high quality component, which may cost as much as 30s. If we substitute resistance-capacity coupling we shall certainly need an extra valve with its associated equipment.

The transformer will be the only apparatus dispensed with, and it must be

¹ *The Wireless World*, Sept. 29th and Oct. 6th, 1933.
² *The Wireless World*, Dec. 22nd and 29th, 1933

replaced by two resistances and a condenser costing about 4s., so that we save 26s. on this coupling. The additional stage will comprise a valve at 13s. 6d., a valve-holder at 9d., four resistances costing 4s., one condenser at 2s., another at 2s. 6d., and a third at about 3s.; a total cost of 25s. 9d. The use of an extra valve in this case, therefore, leads to a reduction of 3d. in the total cost; it is important to notice, however, that the amplification will almost certainly be considerably increased, and that the quality of reproduction is likely to be slightly improved.

In many other parts of the set an additional valve will prove either an economy or will greatly improve the performance without increasing the cost. In a straight set, for instance, two low-gain H.F. stages will provide much higher amplification than a single high-gain stage, and are likely to be more reliable in operation. Although an additional valve is needed the cost may be offset by savings in decoupling and screening, for additional tuned circuits would be unnecessary if an increase in selectivity were not aimed at.

It will thus be apparent that additional valves do not necessarily mean additional cost, and they usually confer the benefits of higher amplification, better quality, and greater reliability. This last point is important. When a minimum of valves is used it is necessary to obtain the last ounce from each if an adequate performance is to be secured, with the result that the slightest defect in construction or adjustment makes the set very unsatisfactory. An extra valve would permit a much greater factor of safety in the design, and the results would be affected to a much smaller degree by errors on the part of the constructor.

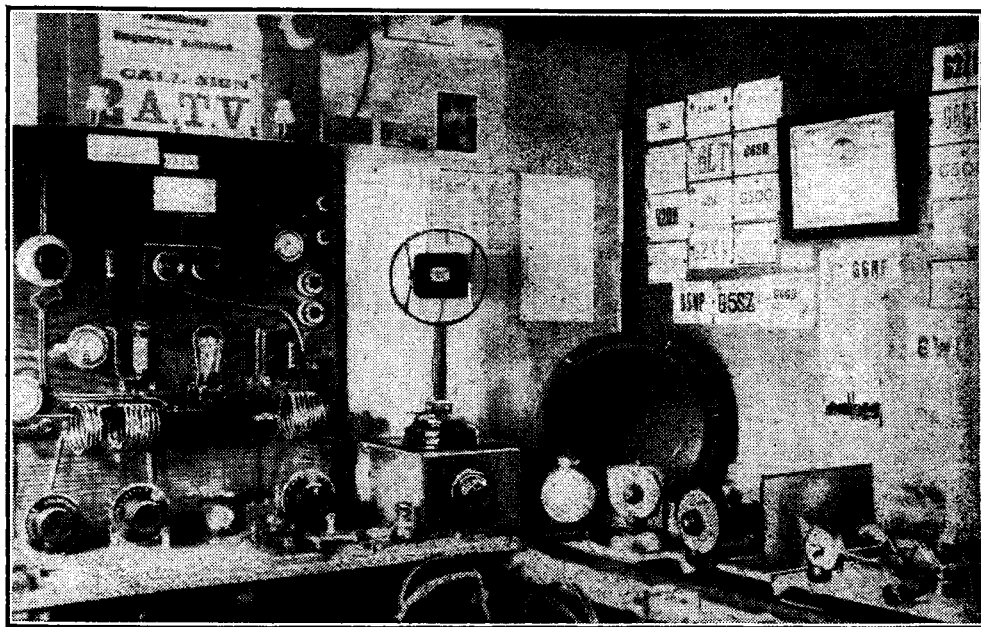
A disadvantage inherent in a multi-valve set might be thought to be an increased expenditure on valve replacements, even although the initial cost is no more. Here

again, this is not necessarily the case. The set with a few valves is critically dependent upon the full efficiency of all being maintained, and valves need replacing as soon as their emission commences to fall. In a multi-valve set, however, the reserve of amplification permits a much greater drop in efficiency before the results are seriously affected. Thus, although there are more valves to replace, they do not need replacing so often. The total cost of replacements, therefore, may not be increased, and the writer would not be surprised to find that it is actually smaller.

Commercial Sets

It should be understood, of course, that most of the remarks in this article apply to home-constructed receivers, and are not necessarily true of manufactured sets. With the latter, the total cost does not depend only on the cost of parts, for labour in assembly has to be taken into consideration. Each extra connection on a set means some increase in cost, and an extra valve must involve many additional leads, so that the extra valve may cost relatively more in a factory built set than in one constructed at home.

Enough has been said to show the fallacy of supposing that the set with the smallest number of valves is necessarily the cheapest, either in first cost or in running costs, and there can be no doubt that of two sets of the same price that with the greater number of valves will give the better performance, particularly with regard to quality of reproduction. It is, of course, necessary to make sure that the sets are equally well designed, and are not like many of the early portable receivers in which the aperiodic H.F. stages contributed little to performance, and where their chief function was to consume current from the batteries! Fortunately, such designs are now rarely to be found.



2ATV, the experimental station owned by Mr. C. Smith, at Whittlesey, near Peterborough. The T.P., T.G. transmitter takes its power from a Parmeko transformer with Westinghouse rectifier, which can work up to 1,000 volts.

Practical HINTS AND TIPS

AIDS TO BETTER RECEPTION

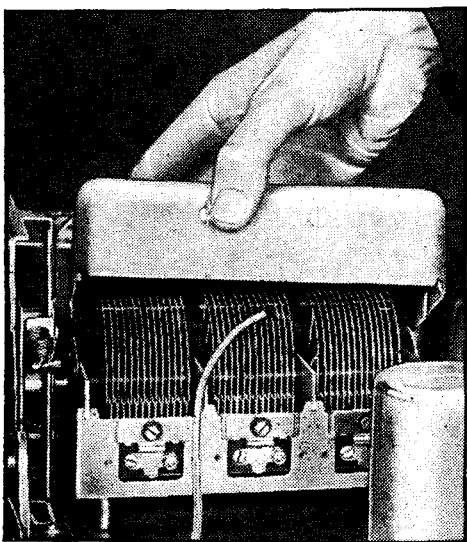
AS most readers are aware, the purpose of the delay-action switch is to safeguard by-pass and smoothing condensers; it is arranged in such a way that the output of the H.T. rectifier is not applied until the receiver valves have been given time to warm up and so to consume anode current. If this precaution were not observed, an excessively high voltage would be applied for a period of many seconds; this is because the filaments of the earlier rectifier valves attain their working temperature very much more quickly than do the heaters of ordinary indirectly heated receiver valves.

The Delay-action Switch

Users of sets fitted with a delay-action switch should realise that, if the rectifier valve be replaced by a modern indirectly heated type, the switch will no longer serve any useful purpose, and so its contacts may be short-circuited if desired.

AT one time valves were undoubtedly the most fragile components in our receivers, and so most of us have acquired the habit of treating them with due care and gentleness. Nowadays they are more robust, and although it is not suggested for a moment that the glass-envelope type should be handled roughly, it is urged that some of our care should be spared for the ganged variable condenser, which must be regarded as an instrument of precision, and a fragile one

Care of Ganged Condensers



How *not* to do it: projecting rotor sections of a ganged condenser may be injured when removing or replacing the cover.

at that. It is fatally easy to impair the matching of the sections by bending the rotor vanes, or to cause the same trouble

by displacing them bodily through dropping the condenser.

Damage may easily be done through carelessly removing the cover with which many condensers are provided. These covers are sometimes fitted with transverse partitions which, if the cover be taken off carelessly, may foul the end-plates of one or more of the rotor elements. It is wise, before removing the cover, to set the condenser at maximum capacity (rotors and stators fully enmeshed) in order to avoid the possibility of such accidents.

ALTHOUGH it is none too easy to make a definite test of the condition of a fixed condenser, there are an almost innumerable number of ways of making a rough check. Many methods have been described from time to time in these pages, and now a reader points out still another which he has found to be effective.

A Quick Condenser Test

The condenser under test is connected momentarily across the loud-speaker terminals; with a little experience, the resulting alteration in tone and volume will convey a good indication as to the capacity; with regard to insulation, it will at least be proved that there is not a complete short-circuit. A large condenser will attenuate the high notes and also reduce the average level to a greater extent than a small one.

Of course, this test is only applicable to capacities greater than, say, 0.001 mfd.; even with that value the alteration in tone may be barely perceptible.

TO avoid all risk of impairing the performance of the receiver or of introducing instability, it is wise to make an attempt to fit the radio-gramophone change-over switch as close as possible to the valve (generally the detector) with which it is associated.

Fitting a Pick-up

But it is not always practicable to observe this counsel of perfection, and in such cases a scheme suggested by the Cossor Technical Department may be borne in mind. It is particularly applicable where the change-over switch (if used) is mounted at some distance from the detector grid terminal, or, alternatively, where the pick-up volume control is connected by long leads.

In order to prevent all risk of the added pick-up wiring causing undesirable interaction, and so provoking instability, it is suggested that an H.F. choke should be interposed in the position indicated in Fig. 1. This choke should, of course, be

mounted as close as possible to the valve, and some care should be taken in choosing a type that is efficient but compact; it is usually desirable that it should be screened.

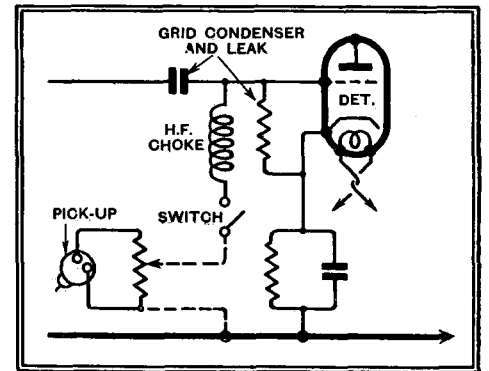


Fig. 1.—An H.F. choke for deflecting H.F. energy from the pick-up wiring.

IT is not always realised that the gramophone pick-up terminal with which most receivers are fitted affords a handy "break-in" point for testing purposes. For instance, it is possible to determine in a moment whether a failure to receive signals is due, say, to a breakdown in the power supply equipment, or to a fault in the H.F. section, by

Handy for Testing

noting whether the set is still operative as a gramophone amplifier.

Even if one does not use a pick-up, an equally definite test may be made by connecting a single dry-cell or a flash-lamp battery intermittently across the pick-up terminals. At each "make" or "break" of the contact a click should be heard in the loud speaker; if it is, we have fairly clear proof that the receiver is operative from the detector onwards.

The Radio Industry

BOTH the keen amateur and the service man will be interested in the new Ferranti circuit tester, a versatile instrument which reads A.C. and D.C. volts (up to 600), A.C. and D.C. milliamps., and is also a self-contained ohmmeter and continuity tester. The instrument is fully described in a pamphlet recently issued.

Leslie Dixon Switch Gear Co., of 218, Upper Thames Street, London, E.C.4, issue a list describing battery chargers of various capacities and associated equipment.

Rich and Bundy, Ltd., of 13, New Road, Ponders End, Middlesex, tell us that their Dimmer Tuner unit, which is suitable for use in visual tuning systems like that described in our issue of February 9th, will operate adequately on a change of anode current of 3 milliamps. Used in controlled H.F. or I.F. stages, no hum is introduced, and smoothing is not required.

A well-prepared brochure describing the activities of the National Institute of Radio Engineering, 55, Guildhall Street, Preston, is now available. The technical training offered by the Institute appears to be very complete and up to date.

An Osram A.C. heptode frequency-changer valve is to appear shortly, as well as a double pentode for Q.P.P. output circuits.

Conversion Conductance

The Stage Gain of the Frequency-changer

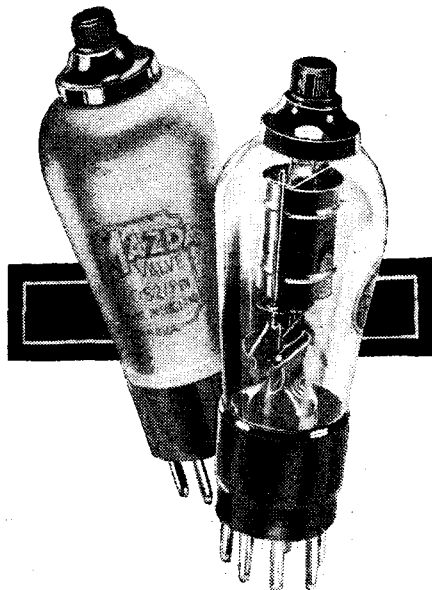
IT is often very useful to be able to predict the overall sensitivity of a receiver from a study of the circuit diagram. This is fairly easy with a straight set, for quite simple rules govern the calculation of the gain of each valve stage. A single high-frequency amplifier, for instance, will provide a stage gain which is approximately the product of the mutual conductance of the valve and the dynamic resistance of the tuned circuit which follows it.

Whilst it is admitted that this method must not be applied indiscriminately, it can be relied upon to give accurate enough results if the A.C. resistance of the valve is high compared with that of the tuned circuit. Fortunately, with modern screened H.F. pentodes and tetrodes, this condition almost invariably exists and nothing more elaborate than the formula referred to is needed.

For stage-gain figures for the simple detector, reference must be made to curves connecting the L.F. output for a given H.F. input, taken at different modulation percentages. These have been given from time to time in this journal.¹

The low-frequency amplifier also responds to simple treatment, the gain being calculated from the formula, $A. (gain) = \mu \times R / (R + R_a)$ where μ is the effective amplification factor of the valve, R the external anode impedance, and R_a the working A.C. resistance of the valve. This is a reasonably good approximation for resistance coupling. If transformer coupling is employed, the formula is slightly different.

In a superheterodyne the stage gains of the ordinary H.F. or L.F. amplifiers



Typical frequency-changers. (Left) The Mazda AC/S2Pen., with the remarkably high conversion conductance of 2,400 micromhos, and (right) the Ferranti Heptode using electronic coupling.

the I.F. valve for every volt applied to the frequency-changer at signal frequency. These voltages can be expressed either in R.M.S. or peak values.

Valve manufacturers in this country are now supplying data in respect of frequency-changers which enable the designer to make the necessary calculation. The amplitude of the intermediate frequency component of the anode current in microamps divided by the signal volts input expresses the efficiency of the valve as a frequency-changer and represents a new unit to be added to our valve data known as "Conversion Conductance." It is very similar to the mutual conductance of a valve where the input and output components are measured at the same frequency.

Optimum Heterodyne

To work out the gain of the frequency-changer valve together with a tuned anode coupling, it is necessary only to multiply the conversion conductance by the dynamic resistance of the tuned circuit, and then to divide by one million, because the

dynamic resistance is expressed in ohms and the conversion conductance in microamps per volt. Actually, an I.F. transformer is normally used so that the figure obtained above must be multiplied by 0.5 for optimum coupling; it is usually safer to multiply by 0.4 instead of 0.5, for the coupling may not be optimum.

The accompanying table gives the conversion conductance in microamps per volt, or micromhos, for a number of valves which can be used as frequency-changers. The working voltages and currents are given and a column is included for optimum heterodyne, which requires some explanation.

It has been found that maximum signal strength and the highest conversion conductance (i.e., efficiency) are obtained when a certain fixed value of oscillator voltage is developed between grid and cathode of the first detector valve. This voltage is called the optimum heterodyne, and it is important that the signal voltages should always be small in comparison. Should

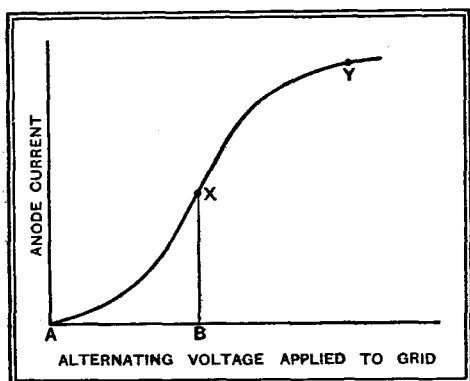


Fig. 1.—The optimum heterodyne is at the point X where the characteristic is steep and straight.

lend themselves to the same formulæ, but when we come to consider the frequency-changer the problem of stage amplification is not quite so simple. We have to find out how many volts at the intermediate frequency are developed at the grid of

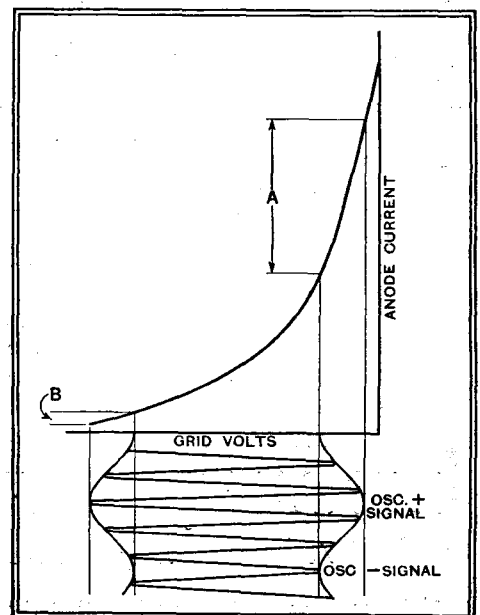


Fig. 2.—The oscillator voltage should be made large and the signal voltage small, so that the anode current change A, due to the positive half cycles of beat frequency, is small compared with the change B.

HITHERTO there has been little quantitative data published concerning the frequency-changer of the superheterodyne receiver. In the accompanying article the meanings of Conversion Conductance and Optimum Heterodyne are explained and a table is given which should assist in the accurate design of the frequency-changer stage

these two become equal the amplification may drop tremendously.²

This can be seen by examining a curve (Fig. 1) showing the relation between alternating voltage applied to the grid of an anode-bend detector and the resultant anode current. The point X is at the steepest and most linear part of the characteristic and AB would be the optimum heterodyne voltage. A small signal applied simultaneously would only shift the working point X very slightly, but a

¹ See *The Wireless World*, February 10th, 1932, and March 19th, 1933.

² See article on "Optimum Heterodyne" by J. F. Herd. *The Wireless Engineer*, Sept., 1930.

Conversion Conductance—

signal equal to the optimum heterodyne (the two being additive) would bring the working point to Y where the amplification is much reduced and the characteristic non-linear.

The mechanism of the detection of a composite wave consisting of a separate oscillator voltage combined with a signal carrier voltage to form a beat frequency is shown in Fig. 2. Obviously the distance A, representing the anode current change for the positive half of the I.F. component, should be as great as possible, whereas B should be as small as possible. Thus the optimum heterodyne voltage is obtained when the first detector is swung just short of grid current on positive cycle and sufficiently near the cut-off on negative cycle.

With a self-oscillating frequency changer, the valve is run into grid current, and although the optimum heterodyne and conversion conductance are a little higher than with the separate oscillator, the effect of this is to some extent offset by the damping of the input circuit, due to the low effective grid-cathode resistance.

An example of the use of the conversion conductance column may not be out of place. Let us suppose that a Mazda AC/S2Pen is employed as a first detector having a separate oscillator and that in the anode circuit is an air-cored I.F. transformer of 200,000 ohms primary

other hand, Fécamp, which spent some days in wandering aimlessly over the lower part of the medium waveband and heterodyning every station within reach, has now settled down on the French common wavelength of 206 metres, where it is doing nobody any harm.

A particularly bad "jam" occurs in the neighbourhood of 222.6 and 224 metres. There is a double reason for this. Some of the stations working on the international common wavelength of 222.6 metres are not keeping strictly to their wavelengths, and Milan No. 2 is for some reason trying to fit itself in between this channel and Montpellier on 224 metres. The result has to be heard to be believed. To make matters still worse Lodz has been transmitting almost but not quite on top of Montpellier!

"Star" American Stations

At the time of writing transatlantic reception is possible at a surprisingly early hour. The best band of wavelengths at the moment is that between about 220 and 320 metres, and if some of the European stations happen to have closed down one can sometimes hear Americans as early as 11 p.m. By midnight half a dozen or more may be received within these wavelength limits at such strength that one can easily mistake them for European stations and pass them over on that account. The star American transmissions at the moment are WIOD, WPG, WCAU, WTIC, WHAM and KDKA. I have never heard American stations better, for on many nights there is absolutely no fading.

The number of European medium-wave stations receivable clear of interference continues to increase. The list now includes

CONVERSION CONDUCTANCE AND OPTIMUM HETERODYNE DATA FOR FREQUENCY-CHANGERS.

Valve Type.	Anode Volt- age.	Screen Volt- age.	Grid Volt- age.	Anode Current (mA.).	Optimum Hetero- dyne (Peak Volts).	Conversion Conductance (Micro- mhos).
Mazda.						
SG 215 ..	15	80	5.0	1.4	4.5	480
S 215A ..	150	90	3.8	1.3	3.3	480
S 215B ..	150	80	3.75	1.3	3.25	650
S 215 VM ..	150	80	3.5	1.3	3.0	650
Pen 220 ..	150	100	1.5	3.8	6.25	725
Pen 220A ..	150	60	5.0	5.2	7.0	400
AC/SG ..	200	100	5.5	3.7	4.0	800
AC/S 2 ..	200	100	5.0	4.4	3.5	1,200
AC/S 1 VM ..	200	100	6.0	5.2	5.0	300
AC/SG VM ..	200	80	5.0	5.0	4.0	750
AC/S 2 Pen ..	250	120	4.0	5.5	3.0	2,400
AC/Pen ..	200	90	9.0	5.2	7.0	600
DC 2/SG ..	200	60	5.2	1.75	3.5	525
DC 2/SG VM ..	200	90	8.2	4.5	6.5	525
Ferranti.						
VHT 4* ..	20	100	3.0	4.0	—	650
Osram.						
MSP 4 ..	200	100	2.3	2.5	1.5	940
MSP 4 ..	200	140	2.9	1.8	2.1	1,070
MS 4B ..	200	100	2.7	0.75	1.9	600
Mullard.						
SP 4 ..	200	100	6.0	3.0	4.5	1,100
PM 12A ..	150	80	3.0	2.0	2.5	600

The figures given are for cathode injection from separate oscillator source and are supplied by the valve makers. * Heptode.

dynamic resistance, what will be the stage gain? We must multiply together the conversion conductance, the dynamic resistance and 0.4 and divide by a million to convert microamps. to amps. $2,400 \times 200,000 \times 0.4 / 1,000,000 = 192$.

DISTANT RECEPTION NOTES**A Temporary Truce on the Long Waves**

THE reader may have noticed that the Stuttgart programmes have not been receivable recently in the daytime. The reason is that work is still going forward on the great aerial mast, and on this account the 100-kilowatt transmitter is not used in daylight hours, the service being undertaken by the old low-powered transmitter.

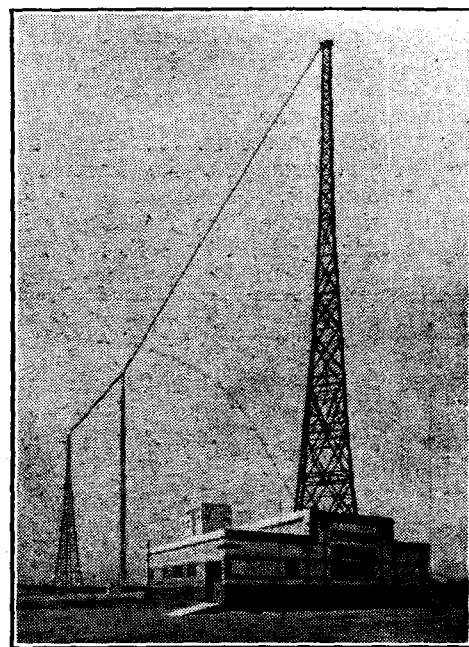
The tangle on the long waveband appears to be straightening out, though there is still a certain amount of interference. Kootwijk suffers from background interference about twice a week on the average. I believe that the culprit really is Brasov now. Radio-Paris is trying to share 1,796 metres with Lahti, but the two stations do not yet appear to be synchronised, for there is invariably a bad heterodyne whistle on Radio-Paris. Otherwise most of the important stations are coming in clear of interference. Zeesem, Motala, Warsaw and Oslo are generally well received, but Kalundborg has

occasionally a heterodyne, probably due to Leningrad.

Since satisfactory working has been so nearly achieved it should be possible to arrive at an agreement at the forthcoming long-wave conference. It must, though, be remembered that peace on the long waves can be but temporary. Before many months have passed Madrid and other new stations will be coming along to claim the wavelengths that have been assigned to them. At the moment Luxembourg and the Eiffel Tower seem to be the two greatest obstacles to a proper settlement of affairs.

Fécamp Settles Down

One or two stations on the medium waveband are also causing trouble by using wavelengths that do not belong to them. One of these is Kharkov, which is working nominally on 304.3 metres, but actually a little below that wavelength. The result is that it is heterodyning Hilversum. On the



The masts and aerial system of the new Marconi 10-kW. broadcasting station at Milnerton, near Cape Town, which replaces the former station, dating from 1924.

Budapest, Beromünster, Athlone, Stuttgart, Vienna, Florence, Brussels No. 1, Prague, Langenberg, Sottens, Paris PTT, Stockholm, Rome, Munich, Marseilles PTT, Milan (usually), Berlin, Hamburg, Brno, Breslau, Frankfurt, and Bordeaux PTT.

In addition Lyons PTT, Strasbourg, Brussels No. 2, Trieste and Nürnberg are frequently, though by no means always, free from interference. D. EXER.

Broadcast Brevities

By Our Special Correspondent

Cutting Out the Crackle

LET us join with the Post Office and the B.B.C. in a hymn of praise to the London Passenger Transport Board. The Board, it seems, is one of the few transport organisations in the country to recognise that, by eliminating the interference which vehicles cause to radio reception, they are not merely doing the listener a good turn, but are earning the goodwill of the public.

An Example to Others

Reading between the lines in an official report on anti-interference tests carried out on January 30th, one can hear the sighs of the engineers regarding the attitude of some similar organisations in the provinces.

Double-hump Chokes

On the date mentioned, special tests in the use of double-hump chokes were carried out with trolley-buses from the Fulwell Depot. These flat-resistance chokes peak at about 800 metres, and the tests revealed that this was a more suitable value than those formerly used in South London peaking at 300 metres. The new chokes are a compromise intended to prevent interference on both the medium and long wavebands.

It has been found that interference is less easily suppressed on the long waves, but the L.P.T.B. hopes the new arrangement will please all parties.

Public Good Will

The Transport Board is wise in recognising the importance of public good will. Rather than ride, many a man would walk a mile to wreak his vengeance on the disturbers of his evening enjoyment.

Steeplechase Broadcast

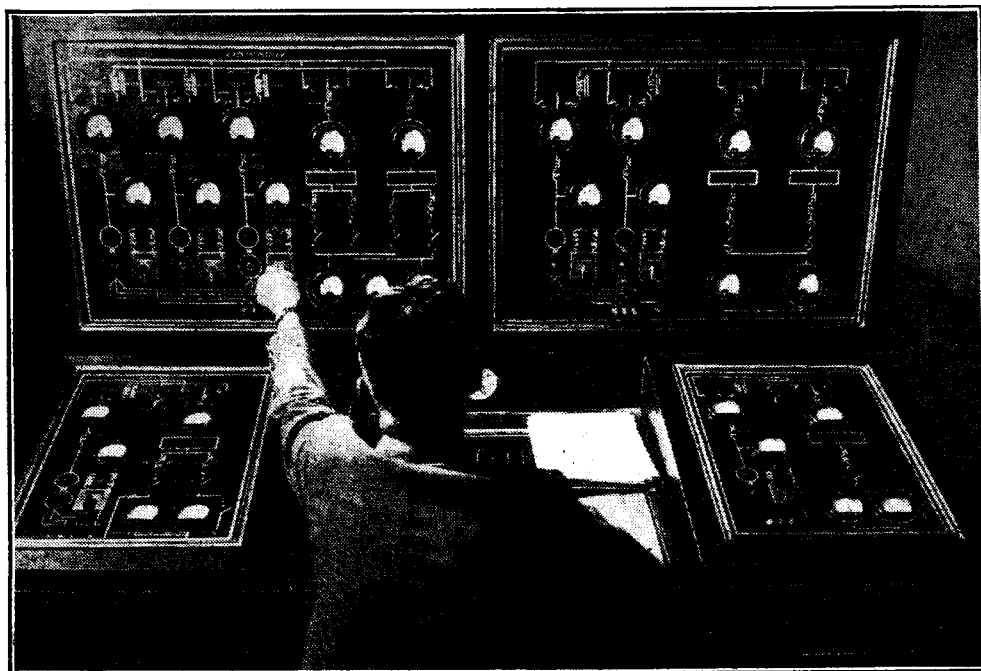
MIDLAND Regional—famous for its O.B.s—has never yet originated a racing commentary! The omission will be atoned for on Wednesday, March 7th, when a description of the National Hunt Steeplechase at Cheltenham will be broadcast by Mr. R. C. Lyle and Mr. W. E. Hobbiss via Midland Regional and thence to the London and other Regionals.

The steeplechase covers a course of four miles and is only less thrilling than the Grand National itself.

Owt About Owt

INFORMALITY at the microphone is a habit worth encouraging, and I am glad to see that the North Region is following London in this respect.

Saturday, March 10th, will see the inauguration of a new feature, "Owt About Owt," which, being interpreted, stands for "Anything About Anything." The feature will consist of a commentary on the news of the North delivered by one who views existence not through rose-coloured spectacles but with the good-humoured downrightness of the typical North-countryman.



IN RADIO CITY. The power control desk at the American National Broadcasting Company's headquarters in New York. Meters in every circuit simplify the task of locating faults.

Site of "North Scottish"

ARDIVOT, near Elgin, is almost certain to be the site of the "North Scottish" high-power station. Despite rumours that the mobile transmitting van has been seen in Thurso, Oban, Inverness, Fort William, and a dozen other places, I can state that it has been immobile at Ardivot for the last three months.

I cannot imagine that the engineers have required ninety days to discover that Ardivot is unsuitable.

Dick Sheppard's Seven Days

THE "Whither Britain?" series is proving to be one of the most successful in B.B.C. talks history and is thus tending to overshadow "Seven Days Hard"—those pleasant weekly reviews now given on Saturday evenings by distinguished people who tell us how they have employed themselves during the past week. There is great play for individualism here, as has been shown by G. K. Chesterton and Hilaire Belloc.

On Saturday, March 10th, the seven days will be described by the Rev. Dick Sheppard.

Marble Halls in the Provinces

BROADCASTING HOUSE is being swiftly outdated by some of the new provincial centres. The Manchester studios are to be redecorated within the next six months; Cardiff's redecorations are completed, as also those at Edinburgh.

Much work is still in progress at Birmingham, and when the redecorations are finished the Midland Regional studios will be the finest in the country.

The designers of all the new provincial studios are Mr. Chermayeff and Mr. Wells Coates, who had a large share in studio design at Portland Place.

The Real Truth

THE merciless searchlight of truth is to be turned on the mechanism of broadcasting on March 5th (National) and 6th (Regional) in "This Radio Racket." The authors of this rather "different" form of light entertainment are Godfrey M. Hayes

and F. Keston Clarke, who will not hesitate to tell the world all about what goes on in the Effects Department and in those dealing with talks, Children's Hour, music, and productions.

The cast for "This Radio Racket" will include Doris Gilmour, Lawrence Baskcomb, Harry Hemsley, Phillip Wade, John Rorke, and Fred Hartley.

A Goosly on the Air

THE export of gooslys from Russia having been stopped, Walford Hyden will borrow one from M. Leontieff, of the old Moscow Balalaika Orchestra, for his Katchska ("Katinka") programme on March 5th. As you know, a goosly is a big brother of the zither, standing on four legs. The player uses a plectrum in the right hand to pluck the strings while the left hand plays the keyboard.

Television

AT the moment of going to press letters and postcards are coming in at a brisk rate on the suggested limitation of the B.B.C. 30-line television transmissions to two a week as from April 1st next.

There is still time to swell the volume of "votes" in favour of the continuance of the existing arrangements. Mark your postcard "Brevities," and state whether you are actually receiving the transmissions or just considering the purchase of television gear if future transmissions warrant it.

Our Helpless B.B.C.

TO save the B.B.C. from the superiority complex engendered by the news that there were 6,124,000 licence holders on January 31st, a wise Providence ordained that the mailbags should carry this letter from the West of Scotland:—

"Dear Sirs,—I wish to inform you about this musick every night the same old thing it is getting *Dud*. . . . Pepal are getting disgusted. . . . Give yourselves a shake for you getting Helpless the will Be less wire-less sets Bought if this carries on much longer time your musick to let the singer Be heard the Singer and the musick is do worth listening to.—Cherrio."

NEWS of the WEEK

Current Events in Brief Review

A Geneva Conference

ON Monday next, February 26th, a Conference of the International Broadcasting Union will open at Geneva to discuss, among other things, the long-wave situation arising out of the Lucerne Plan.

For Short-wave Enthusiasts

A WORLD-WIDE broadcast for all short-wave enthusiasts has been arranged for Sunday next, February 25th, by the International Short-Wave Club. From 0300 to 0500 (G.M.T.) a musical programme will be broadcast from the Dutch station PAOASD, 3,770 kilocycles, 79.51 metres. The interval signal will consist of a bugle call. Reports should be sent to Radio PAOASD, Nassaukade 93, Amsterdam, Holland.

Prize for Invention

WIRELESS experimenters may find scope for their ingenuity in the competition organised by the Royal Society of Arts in connection with the Thomas Gray Memorial Trust. The Council offers a prize of £100 to any person who may bring to their notice an invention, publication, diagram, etc., which, in the opinion of the judges, is considered to be an advancement in the science or practice of navigation, proposed or invented by himself in the period January 1st, 1929, to December

No Flowers, by Request

FROM an advertisement in the *Chasseur Français*: "Will exchange mains set of first quality for fruit and early vegetables."

Radio on Everest

RADIO communications on the 1933 Mount Everest Expedition will be described in an illustrated lecture to be given this evening (Friday) before the Incorporated Radio Society of Great Britain at 6.15 at the Institution of Electrical Engineers, Savoy Place, London, W.C.2. The lecturer is Mr. David S. Richards.

Radio During Paris Riots

POSTE PARISIEN gave first news of the trouble in Paris on the night of February 6th, writes our Paris correspondent, while Radio-Paris was busy distributing the story of the millions that were being won in the State Lottery. During the riots P.T.T. played light music, and the Eiffel Tower was eloquently silent. Poste Parisien broadcast a summary of the situation at 11 p.m.

Man-made Static Analysed

A GREAT anti-interference campaign in Baden-Baden has resulted in the elimination of 94 per cent. of the man-made static. A correspondent gives us an exact

Still They Come

BRITAIN is now ahead of all other European countries in the number of receiving licences, 6,124,000 being current at the end of January. The increase during twelve months amounted to 758,000.

120 kW. from Lithuania?

KAUNAS, the station with the longest wavelength in Europe, will shortly build a new 100-kilowatt transmitter to be erected at Kleipada. A British firm has already offered tenders for the construction of the station.

Searchlight on Canadian Broadcasting

MR. BENNETT, the Prime Minister of Canada, has given notice of a Motion for the appointment of a Committee of seven members of the House of Commons to investigate the work of the Canadian Radio Broadcasting Corporation and to suggest improvements in the present system.

The Radio Premier

M. GASTON DOUMERGUE, the new French Premier, won the special esteem of all radio enthusiasts in France during his Presidency on account of his interest in wireless. M. Doumergue did not disguise the fact that he was an inveterate "knob-twiddler," and many of his leisure hours at the Elysee were spent in operating his long-distance receivers.

Radio Tasties?

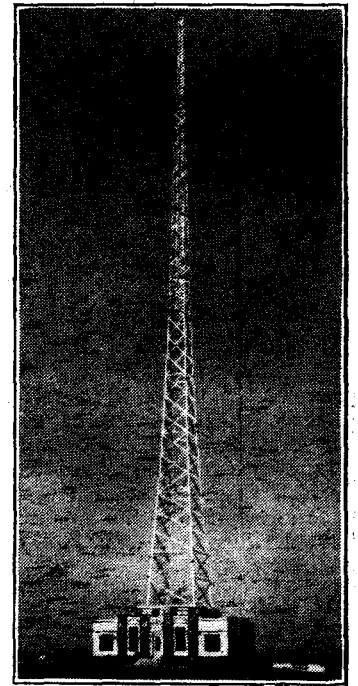
CAPTAIN H. DE A. DONISTHORPE, of the G.E.C., was in prophetic mood in a recent speech before the Notts Radio Luncheon Club. He foresaw when scientific development would reach such a pitch that those unable to attend a public dinner would switch on their home talkie and have it televised, not only hearing and seeing but, by putting something on the tongue, tasting also.

South Pole Calling

AN Antarctic broadcasting station made its debut a few days ago when Station KFZ, Little America, owned and operated by the Byrd Antarctic Expedition, relayed a programme over the Columbia Broadcasting System which had been picked up from the Byrd flagship, "Jacob Rupert."

For two years KFZ will supply Saturday night broadcasts for American listeners describing the work of the Expedition. A variety of frequency channels is used from 3,000 to 21,625 kilocycles. The station is actually situated 400 miles from the South Pole.

Some of the transmissions from the Expedition to the station will be made by little one-watt transmitter-receiver sets only five inches square, mounted on sledges and operated with dry batteries.



VERTICAL RADIATORS IN U.S. The 300-ft. mast of Station KMBC, which has just been opened at Johnson City, Kansas. The aerial is one of the first vertical radiator types to be erected in America.

150 Kilowatts from Paris

WE learn that Radio-Paris may shortly increase its power from 75 to 150 kilowatts. This will make the station the most powerful in France, the maximum power for other stations in the Ferrié system being 120 kilowatts.

Radio "Disarmament"

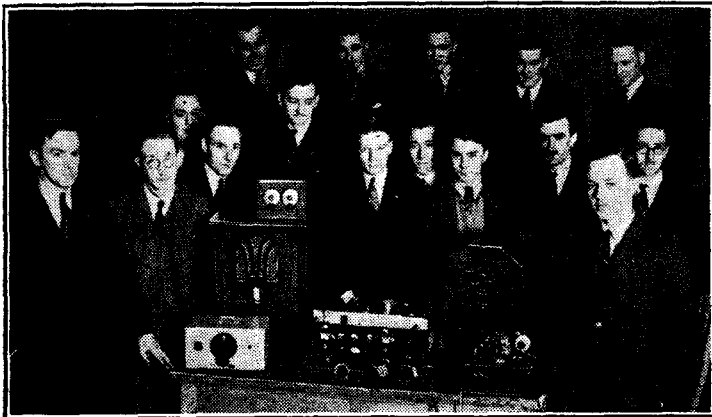
THE first anti-radio-propaganda pact has been concluded between Austria, Switzerland, and Czechoslovakia, the signatories undertaking to avoid all transmissions likely to hurt the susceptibilities of their respective populations.

Cave Canem

BERLIN lawyers have refused to take up the case of a listener wishing to sue the broadcasting organisation for damages on account of his dog having destroyed his loud speaker. It seems that a talker in the studio brought his dog to the microphone, and when the animal barked, the listener's dog, actuated by the best motives, flew at the loud speaker and tore it to pieces.

"Elijah"

IN the performances of the oratorio "Elijah" at the Royal Albert Hall loud speakers are used for relaying hidden choirs and the voice of the "angel." The public address equipment has been installed by Mr. R. Waldo Emerson, in collaboration with Voigt Patents, Ltd. It is interesting to note that the majority of the music critics failed to notice that the voices relayed from back-stage were not heard direct. The "angel" addressed a microphone in a room beneath the platform.



INTERNATIONAL SHORT-WAVE CLUB. A special world-wide transmission on short waves from Holland has been arranged by the "I.S.W.C." for Sunday next, and particulars are given on this page. The photograph shows members of the London Chapter with receivers of their own construction.

31st, 1934. Full particulars can be obtained from the Secretary, Royal Society of Arts, John Street, Adelphi, London, W.C.2.

Free Gift from Warsaw

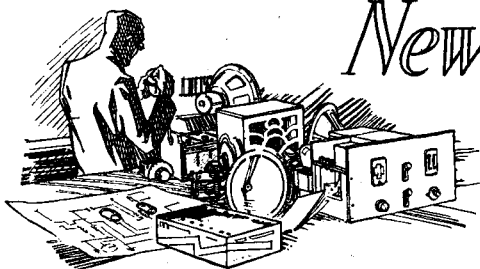
A SPECIAL book gift is being offered by Mr. Thad Ordon in his English talk from the Warsaw studio on Wednesday next, February 28th, at 9.40 p.m. (G.M.T.). To indicate that they have heard the broadcast applicants for the gift should mention the name of the book. Letters can be addressed to Mr. Thad Ordon, c/o *The Wireless World*, Dorset House, Stamford Street, London, S.E.1.

list of the sources of interference which were traced and quelled. It is as follows:—

- 1,316 vacuum cleaners,
- 784 sewing machines,
- 258 small household motors,
- 285 electric fans,
- 56 hair-cutting machines and dentists' drills,
- 18 X-ray equipments,
- 197 high-frequency massage plants,
- 20 diathermy equipments,
- 58 violet-ray equipments,
- 8 neon tube installations,
- 24 electric alarms,
- 37 office machines,
- 63 lifts,
- 1,670 workshop motors,
- 27 refrigerators.

Baden-Baden has a population of about 30,000.

New Radio Products Reviewed



Latest Products of the Manufacturers

CENTRALAB RADIOHM AND OCTAVE TONE CONTROL

THESE two components, which might be said to represent recent developments in America, have now been introduced in the market here by R. A. Rothermel, Ltd., Rothermel House, 1, Willesden Lane, London, N.W.6.

The Radiohm volume control measures 1 1/2 in. in diameter and about 3/8 in. deep. If fitted with a mains switch the depth is increased to just under one inch.

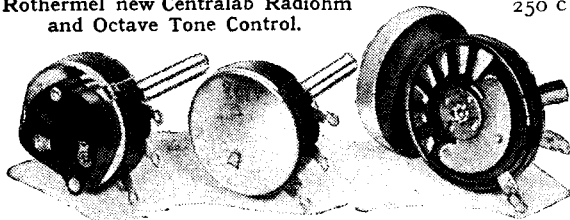
The resistance element is enclosed in a bakelite case and contact is made with it by means of a flexible metal band which is pressed into the element by a stud on the rotating arm. A flat strip 1/8 in. wide and coated with a special compound comprises the resistance element.

These volume controls are available in resistance values of from 5,000 ohms to 3 megohms, the price being 3s. 9d. each, or with a mains switch incorporated, 4s. 6d. each. They are fitted with a 1/2 in. spindle measuring 2 1/2 in. long.

Tone control is often effected by means of a variable resistance and a fixed condenser, the former providing the adjustment. Condensers alone would serve a similar purpose, but they must be variable, and a variable type of the capacity required has not hitherto been available.

In the Filtermatic Octave Tone Control provision is made for varying the capacity in steps from about 50 m-mfds. to 0.006 mfd. It is a very compact unit and measures only 1 1/2 in. in diameter and 1/2 in. deep. It is actually a tapped condenser, the sections being joined in parallel by a semi-circular plate which, however, is insulated from the spindle. There are seven contact springs and the capacity changes approximately as follows: 0.00005 mfd., 0.0003 mfd., 0.0005 mfd., 0.002 mfd., 0.003 mfd., 0.0044 mfd., and 0.0056 mfd. The circuit is not broken between changes and the control gives a smooth and gradual change in tone.

Rothermel new Centralab Radiohm and Octave Tone Control.



Mica is used for the dielectric and the condenser is housed in a bakelite case fitted with a metal dust cover. The price is 5s.

A ONE-MILLIAMP FUSE

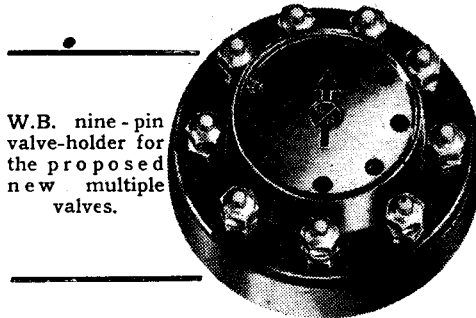
MICROFUSES, Ltd., 36, Clerkenwell Road, London, E.C.1, announce that as the result of recent research they are now able to supply from stock fuses rated to carry 1 mA. and 2 mA. Hitherto, the lowest stock rating was 3 mA., and the new fuses, which make use of the same principle of an extremely thin gold film, will be wel-

comed by those engaged in electrical research involving delicate and expensive instruments. A specimen 1 mA. fuse submitted for test had a resistance of 550 ohms, and carried its rated current indefinitely without showing any change of resistance. The average fusing current varies from 150 to 250 per cent. of the rating, and the time interval from the application of the overload currents met with in practice is of the order of milliseconds.

The price of the new ratings is 4s. for the 2 mA. and 4s. 6d. for the 1 mA. fuse.

W.B. NINE-PIN VALVE-HOLDER

THE Whiteley Electrical Radio Co., Ltd., Radio Works, Victoria Street, Mansfield, Notts, has introduced a nine-pin valve-holder for the proposed new multiple valves that should now soon be available for general use. The body of the valve-holder is a moulded bakelite shell having a centre boss on the inside against which one side of the spring contacts lightly rest.



W.B. nine-pin valve-holder for the proposed new multiple valves.

They are anchored at the other end by the screws which form the shanks of the outside terminals.

This extra support ensures that the springs do not become displaced or fail to make contact with their respective pins on the valve cap. The springs have sufficient resilience to permit the valve to be inserted without undue pressure, yet rigid enough to retain their shape and make unflinching contact with all the pins. The price is 2s. 3d.

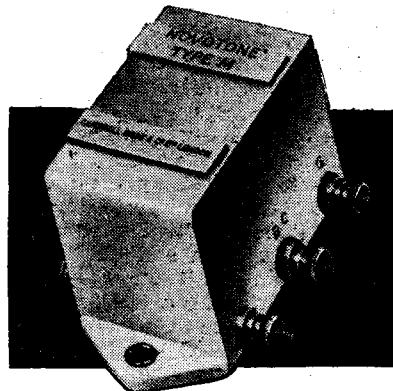
NEW MODEL NOVOTONE TYPE M

THE Novotone was introduced some years ago to compensate for the falling characteristic of gramophone recording below 250 c.s.; it also afforded a correction at the upper end of the audible scale, provision being made to vary the amount of high-note correction to suit individual needs. These units were relatively expensive, but a new model has now been developed which has similar characteristics but costs only 27s. 6d.

Known as the type M, it is suitable for use with gramophone pick-ups of between 1,000 and 2,000 ohms D.C. resistance. It is simple to install, being inserted in the leads between the pick-up and the amplifier, and provision is made for varying both the low- and the high-note corrections. Bass control is effected by joining a 0.5 megohm resistance across the two output terminals marked BC and GB, while for upper register adjustments one of 50 ohms is connected between two of the input terminals.

Without these control resistances our specimen gave sensibly constant amplifica-

tion from 300 c.s. to about 4,500 c.s.; above this upper limit the amplification gradually tailed off. Below 300 c.s. it has a rising characteristic which reaches a maximum



New model type M Gambrell Novotone.

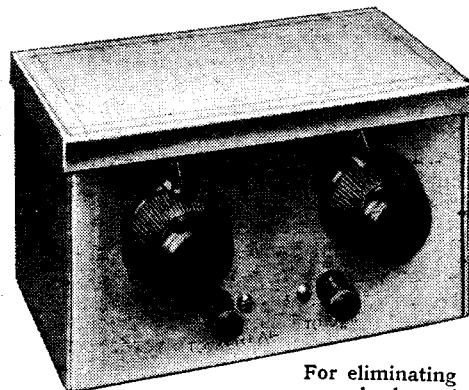
just below 100 c.s., where the gain was approximately 14 decibels above the average level. At 50 c.s. the amplification had fallen to 3 decibels above the 250-cycle level.

By joining a 0.5 megohm variable resistance across terminals BC and GB, and adjusting it to 100,000 ohms, the peak was lowered by 3 decibels, and it is possible to smooth it out completely with this control.

The new model is quite small, measuring only 4 in. x 1 1/2 in. x 2 1/2 in. high, and, being enclosed in a thick screening case, can be mounted inside the cabinet without the slightest risk of picking up mains hum. The makers are Gambrell Bros. and Co., Ltd., Merton Road, Southfields, London, S.W.18.

WEARITE WHISTLE SUPPRESSOR

IT was recently announced briefly that Wright and Weaire, Ltd., of 740, High Road, Tottenham, London, N.17, were producing a commercial version of *The Wireless World* superheterodyne whistle suppressor, described in our issue of January 26th. It will be recalled that this device is designed to eliminate second-channel whistles at two distinct points, and is connected externally in the aerial circuit of any superheterodyne.



For eliminating second-channel whistles in superheterodynes: the new Wearite unit.

Thanks to the use of Nucleon iron-cored coils, the Wearite unit is very compact, measuring only 3 in. by 5 1/4 in. by 3 1/4 in., and is housed in a neat metal case. We have now had an opportunity of testing it, and find that performance is in every way equal to that of the original instrument.

Letters to the Editor:—

Reliability or Cheapness?

Alternatives to the Disc Record: Service Engineers

The Editor does not hold himself responsible for the opinions of his correspondents

Reliability Must Come First

YOUR Editorials on price of sets and on new valves touch two very essential points which are important both to the public and manufacturer.

In order to survive competition, reliability must come first. In the end the trouble and extra expense entailed by the sacrifice of quality in order to achieve the momentary attraction of a low price will certainly create general dissatisfaction and disgust with a particular make.

Recommendation by a satisfied customer is of far greater value than any by a dealer; while the harm caused by dissatisfied ones will soon have a permanent effect on sales—avoid so-and-so's sets; they give a lot of trouble!

With regard to new valves, it is to be hoped that manufacturers will not bring them out after the style of new season's "Paris creations."

Wireless instruments are a scientific product as opposed to art. Therefore, the main considerations must be technical advantage and usefulness. If the public's point of view is to be considered in the design of a set, it should be kept in mind that the layout and construction be conducive to ease of manipulation in use and in servicing, so that repairs may be quickly effected.

Maintenance cost can be kept down through the use of new types of valves which reduce their number for a given type of circuit, *consistent with quality*.

When will the example of motor car manufacturers be followed in the issue of a comprehensive manual to foster interest in their goods? Whether it is advisable to leave it to a dealer or to do one's own servicing is surely a matter to be decided by the one who has ultimately to pay for the repairs. When a fully descriptive and servicing manual is issued one has the *option* to do either. Even a circuit diagram is often not provided.

Liverpool, I.

Alternatives to the Disc Record

ON the subject of alternatives to disc records, the majority of your correspondents show a commendable keenness on the improvement of sound reproduction coupled with a lamentable ignorance of the practical problems involved.

These gentlemen, with the exception of Mr. Arbib and one other who doesn't wish to spend any money, all plead for sound on film records, and their reasons may be briefly enumerated as follows:—

- (1) Better high-frequency response.
- (2) Reduction of surface noise.
- (3) Ability to play for long periods without interruption.

Now, theoretically, a photo-electric device is infinitely superior to a mechanical method that causes a chunk of iron to wobble between the poles of a magnet, and recordings of remarkable fidelity have been made on film in the laboratories, but there are several factors which mitigate against their production commercially; in fact, such quality is

rarely attained in the talking films exhibited in theatres.

"Wide range" or "high fidelity" recording calls for accurate exposure, coupled with the highest grade (fine grain) negative stock perfectly developed. From this a positive print is taken, but in development a certain amount of shrinkage of the negative occurs, and this shrinkage is repeated in the positive which will contribute perhaps a negligible distortion. But a single negative can print satisfactorily only a few positives and it is necessary, even to supply the world's theatres, to make several "duped" negatives by reprinting from first positives, and each process of duping causes a further shrinkage, and, more important, a coarsening of the grain, with consequent loss of high notes and increase of surface noise.

It is my experience that bad sound in a theatre is often directly attributable to duped stock; imagine, then, the quality of a record that had survived thousands and thousands of printings to meet the demands of mass production.

Again, supposing one is lucky enough to secure an original print, what of the reproducing equipment? High quality being the main consideration, a very expensive optical system would have to be employed in order to secure the coveted "highs." Mechanically, too, the apparatus would have to be of the highest order to run the film without flutter past the light gate, and the problem of silencing the mechanism to an extent where it is absolutely inaudible, even during *pianissimo* passages is not to be disposed of lightly or cheaply. Some of your correspondents should visit their local cinema and listen to the noise made not only by the projector mechanism but by the film itself, when it is old and brittle, engaging on the sprockets.

I do not say the problem could not be solved, but it would be an expensive apparatus far in excess of the figure suggested by Mr. Arbib.

In spite of this adverse criticism I do agree that there exists a need for high-quality reproduction, particularly of reproduction free from mechanical effects like surface scratch and the agonising thud of a record-changer doing its stuff, and it might interest your readers to know that recent developments in the Bell Laboratories in America show signs of doing much to alleviate the sufferings of Flt.-Lt. King* and others, provided the gramophone companies take them up commercially.

In the journal of The Society of Motion Picture Engineers for February, 1932, is an article dealing with the results obtained from records cut by the hill and dale method, and also a very instructive lecture by the famous conductor of the Philadelphia Orchestra, Leopold Stockowski, on the musical aspect of this system.

Briefly, the Bell Laboratories claim:—

- (1) To have increased the recording range to 10,000 C.P.S.
- (2) Reduced the surface noise to such an

* See letter published in issue of October 20th, 1933.

extent that at 10,000 cycles it is 5 db. below that experienced on ordinary records at 5,000 cycles.

(3) Increased the playing life of the record to several thousand times without deterioration.

(4) Increased the playing time of 12in. records to twenty minutes.

(5) Increased the intensity range by 5 db.

Since, provided one has a high-quality amplifier, the only changes necessary would be in the pick-up and turn-table, this system promises to be a very satisfactory solution to the present problem, and it is to be hoped that the gramophone companies will be willing and able to do something about it.

H. L. CARTER.

Singapore.

Service Engineers

IN view of the past discussions, and also, I believe, Editorials on the subject of paramount importance both to the public and the radio manufacturer, *Service* before and after sales, a recent advertisement under "Situations Vacant" invited applications for the post of "Service Engineer" at a salary of 35s. per week!

How many receivers are returned to the manufacturer per year after being mauled by "Service Engineers"?

F. L. C.
London, E.C.1.

CLUB NEWS

Members Test Service

Component testing night was observed by the Catford Radio and Television Society on January 31, when members were able to bring along their components for testing on the Society's instruments. The Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23, will be pleased to give full information concerning the Society's activities.

Television in Uxbridge

On Wednesday next, February 28, the Uxbridge branch of the Anglo-American Radio and Television Society will give a second television demonstration. Admission is free to everyone interested, and full particulars can be obtained from the Hon. Secretary, Mr. Leslie W. Orton, "Kingsthorpe," Willowbank, Uxbridge.

Cathode-ray Television in Exeter

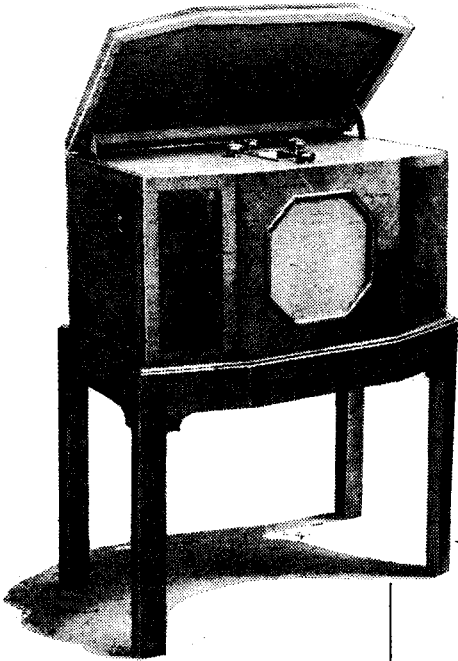
Cathode-ray television is to be demonstrated before the Exeter and District Wireless Society at the Washington Singer Laboratories on Friday, March 2, by Mr. T. D. Humphreys, of the Edison Swan Electric Co., Ltd. As accommodation will be strictly limited, admittance will be by ticket (free) only. All applications should be made at once to the Programme Secretary, Mr. E. H. Ware, "The Beeches," Woodbury.

New Lancashire Radio Society

"The Chatburn and District Radio Society" has just been formed at Chatburn, Lancashire. Meetings are held every Friday at 7.30 p.m., and many interesting lectures have been arranged. All interested are invited to apply for particulars to the Hon. Secretary, Mr. J. Holden, Downham Road, Chatburn, Lancs.

Pye "Cambridge" Superheterodyne

High-grade Workmanship in a Receiver of Modern Design



BOTH inside and out this receiver is more than usually attractive to the eye. The cabinet, which is the work of an eminent furniture designer, is beautifully proportional, and the matt-finished walnut surface provides a tasteful decorative effect. Clean workmanship has always been a characteristic of Pye receiver chassis, and this quality is further enhanced in the present model by the pale blue enamel finish.

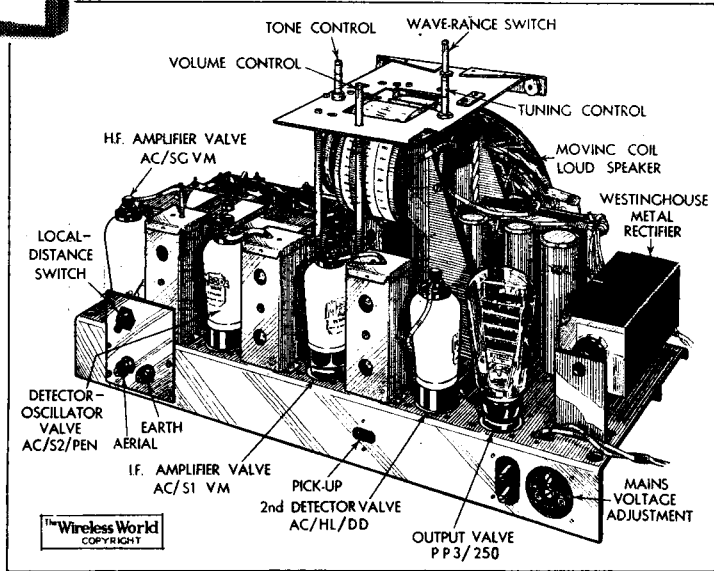
The circuit, which employs five valves and a Westinghouse metal rectifier for the H.T. supply, includes automatic volume control and tone control. The single-circuit aerial tuner is provided with a local-distance switch, and is designed to minimise second-channel interference. The variable-mu screen grid H.F. stage is coupled by a second tuned R.F. circuit to the pentode frequency-changer which employs the conventional cathode mixing circuit. The I.F. valve is of the variable-

mu screen grid type, and, together with the signal frequency amplifier, is controlled by the A.V.C. bias. Included in the anode circuit of both valves is a small moving-iron meter which is used as a tuning indicator, and is mounted adjacent to the drum tuning dial.

The second detector is of the double-diode-triode type, and one diode and the amplifying portion of the valve deal both with the audio-frequency output and the A.V.C. bias. The remaining diode is used to control the delay voltage so that the set

FEATURES.

Type.—Five-valve superheterodyne for A.C. mains with delayed amplified A.V.C. **Circuit.**—Variable-mu H.F. amplifier—pentode frequency-changer—variable-mu I.F. amplifier—duo-diode-triode second detector—triode output valve. Westinghouse metal rectifier. **Controls.**—(1) Tuning control with visual tuning indicator. (2) Volume control. (3) Tone control. (4) Wave-range switch. (5) Local-distance switch. (6) Mains on-off switch. **Price.**—22 gns. (without stand 20 gns.). **Makers.**—Pye Radio Limited, Radio Works, Cambridge.



All metal parts in the chassis are finished in Cambridge blue.

is working at full magnification until the incoming signal reaches 14 micro-volts per metre. The control is effective up to 200,000 micro-volts per metre, and the change in watts output over this range is only 1:1.4.

A 2½-watt triode output valve supplies the moving-coil loud speaker which is fitted with a jack switch so that the external loud

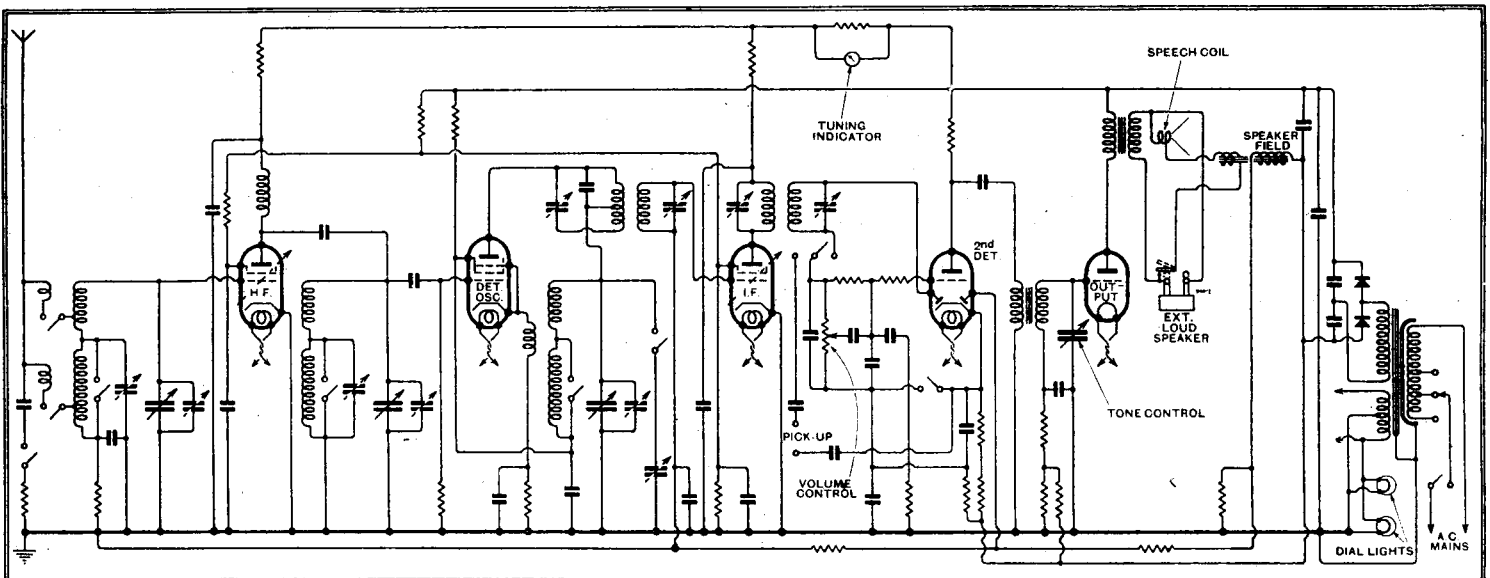
speaker may be used with or without the unit in the set. Sockets are provided for a gramophone pick-up.

Access to the controls is obtained by lifting the hinged lid of the cabinet. The top panel is 29in. from the floor level, so that the set can be worked equally well from a sitting or standing position. The mains on-off switch is fitted flush in the left-hand side of the cabinet, while the local-distant switch is at the back. This is useful in giving a wider range of manual volume control on the local station.

The loud speaker is at just the right height for listening from an easy chair, and although the receiver is arranged to cut off at 5,000 cycles the reproduction is bright and the balance of tone is good. The tone control is

hardly necessary when a station is accurately tuned by the indicator as this tends to bring up the bass slightly. There is a fair amount of noise between stations owing to the fact that the set is working at full sensitivity, but the automatic volume control reduces the background on all worthwhile stations. Mains hum is entirely absent.

The range on medium waves gives eight



Circuit diagram of the Pye CR/AC receiver. The A.V.C. delay bias is controlled by one of the diode elements.

Pye "Cambridge" Superheterodyne.

or ten foreign stations at programme strength in daylight, and the sensitivity on long waves is exceptionally good for the number of valves employed. In Central London, Strasbourg and Hamburg could be tuned in clear of the Regional transmitter, and two channels were lost on either side of the National. The aerial rejector system

does not entirely eliminate second channel interference, the whistles due to the two local transmitters being fairly prominent at 324 and 460 metres if the manual volume control is tuned to maximum. However, the image rejector is probably working as well as any that have so far been produced, but the slight leakage is magnified owing to the high sensitivity of the set.

extent, but nevertheless our correspondent feels that it ought to do so by all the rules of the game, and he asks whether the condenser is really too large.

After all, the ear is the final judge, and we are tempted to say that if the condenser does not bring about any evident high-note loss it cannot possibly be doing any harm in this direction. It should therefore be retained, as it effects noticeable improvements in other directions. If, for example, the loud speaker in use happens to have an early "cut-off" and does not reproduce high notes at all, it is clearly a mistake in this case to sacrifice anything for the sake of feeding them to it.

Readers' Problems

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

Almost Hopeless

WE do not like to admit defeat, but cannot claim to offer very much in the way of helpful advice to sufferers from interference from tramways or electric railways. Many forms of "man-made static" can be mitigated, if not eliminated, at the receiver end, but interference of this nature can seldom be reduced to a worth-while extent by anything that the listener can do. It is hoped that the fitting of suppressors at the source will become more general, but this matter must be regarded as *sub judice* until the findings of the I.E.E. Anti-Interference Committee are made public.

In the meanwhile, we can do little but suggest that an experimental alteration in the position of the aerial should be tried; the guiding principle should be to keep it as far away from, and as nearly as possible at right angles to, the tramway or railway line. In a few instances the use of a different earth connection, or even a counterpoise, has been found to improve matters. Similarly, the fitting of a screened aerial down-lead may confer some benefit.

100 volts D.C.

WIRELESS users with a low-voltage D.C. supply (in the order of 100 volts) are not in a particularly enviable position. Ready-made D.C. sets for such low voltages are not available, and even if one were specially designed, the output, and indeed the general performance, would be much below the usual accepted standards.

A querist, who has a 100-volt house-lighting plant of ample capacity, asks us to enumerate some of the possible methods of using this supply system to the best advantage. His present receiver is a somewhat unsatisfactory arrangement, which takes H.T. supply direct from the household mains, but requires a separate L.T. battery for the filaments. It is suggested that our correspondent should consider one or other of the schemes given below:—

(a) A rotary converter fed from the D.C. supply, but giving an A.C. output. Any standard A.C. set, not excepting one of the most ambitious type, could then be used.

(b) A standard D.C. receiver (such as the superheterodyne described in our issues of September 29th and October 6th, 1933), with the circuit suitably modified in such a

way that the heaters would be fed from the supply system, and the voltage from the same source would be supplemented for feeding the anodes by an H.T. accumulator battery. The supplementary battery would, of course, be charged from the household supply, and arrangements could be made for putting it on charge through a suitable change-over switch, which might even be incorporated with the on-off switch of the receiver.

(c) An arrangement similar to (b), but with a rotary converter for H.T., which would "step-up" the voltage of the supply system.

An Important Condenser

THE detector anode by-pass condenser has an important bearing on the performance of the receiver: not only does it influence selectivity and sensitivity by reducing anti-reaction feedback through the internal capacity of the valve, but it also helps to filter out H.F. impulses which would otherwise be applied to the succeeding L.F. amplifier.

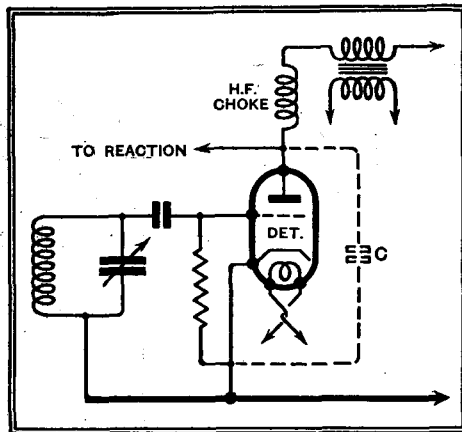


Fig. 1.—The rule for choosing the detector by-pass condenser C is to use largest capacity possible without impairing high-note reproduction or reaction control.

The larger the condenser, the greater are the benefits conferred by it in all these directions, but—never a rose without a thorn—the more serious will be the effect of the by-pass condenser in causing high-note loss. Here, clearly, is a case for striking a judicious balance, and in making a decision we must retain our sense of proportion.

These remarks are prompted by a letter from a reader who has found that the performance of his set is greatly improved by using a detector anode by-pass condenser (C in Fig. 1) with the relatively high value of 0.001 mfd. So far as can be judged without making a careful comparative test, the fitting of this large condenser does not reduce brilliancy of reproduction to an appreciable

Mains or Battery ?

SEVERAL readers seem to be puzzled by the fact that the symbols for indirectly heated mains valves or directly heated battery valves are used more or less indifferently to illustrate articles discussing general principles. There is uncertainty in some cases whether a particular arrangement, for which a battery valve is taken as an illustration, may be considered equally applicable to a mains-fed receiver—and *vice-versa*.

When discussing general principles, it is perhaps most usual to show the application of the principle at issue to a battery valve, partly because the circuit diagram tends to be simpler. But unless some statement to the contrary appears in the text, or unless there is some fairly obvious reason, it may be assumed that the arrangement in question is applicable to either type of valve.

BOOK RECEIVED

The Dictionary of Photography and Reference Book for Amateur and Professional Photographers, by E. J. Wall, F.R.P.S., edited and largely rewritten by F. J. Mortimer, Hon. F.R.P.S., editor of *The Amateur Photographer and Cinematographer* and *Photograms of the Year*.—This book has long been recognised as the standard reference book on the subject, and its popularity may be gauged by the fact that this new edition is the thirteenth.

All interested in camera work will find it a practical book of general reference for every phase of photographic work. The present edition has been brought up to date as regards colour photography, amateur cinematography, and the latest processes and formulae.

The contents are arranged in dictionary form with cross-references to facilitate the finding of any item of information on co-related subjects.

Pp. 645 with numerous diagrams. Published by Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 7s. 6d.

**The Wireless World
INFORMATION BUREAU**

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.