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*As many of the circuits and apparatus described in these
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EDITORIAL COMMENT

The Gramophone Record

*Present Recording System
Obsolete*

A REVOLUTION in the gramophone industry took place when electrical methods of recording and reproduction were introduced.

We are all of us familiar with the restrictions which purely mechanical means of reproducing from records imposed and the improvements which came within the reach of the general public at once when the modern electrical pick-up and valve amplifier superseded the sound box and the horn, and, startling as the effect on the reproducing side has been, the improvements brought about by the introduction of electrical methods to the original recording are even more remarkable.

The system of recording now in general use has been brought to such a state of perfection that it seems unlikely that any considerable further improvement can be expected ; yet it is common knowledge that the gramophone record to-day is a long way behind in quality the best results which can be received from broadcasting.

The reason for this state of affairs is that the present recording and reproducing system has inherent limitations and the quality of gramophone records must be expected to stand still unless another system is adopted. But the system need not be new—it can be a system introduced in the earliest days of recording but neglected because greater energy for cutting in the recording process was needed, and before the advent of the valve and amplifiers this consideration was so serious that the system had perforce to be shelved.

But the advantages of the "hill and

dale" system, as it is called, are so outstanding that it is probably safe to say that the present system would never have made progress except for this one objection. By the time the valve and amplifiers arrived the present types of records and gramophones were so universally distributed that no manufacturer had the courage to make the change-over. If a change-over to "hill and dale" recording on disc were made our new records would be capable of far greater contrast because at present the spacing of adjacent grooves limits the amplitude of the cut, and, therefore, correct proportioning of amplitudes is impossible ; needle scratch would practically disappear ; records would have a longer playing time because the width of grooves would be uniform and could, therefore, be brought closer together ; the moving-coil pick-up would become available for the first time, since pivoted pick-ups would no longer be necessary, and the reproducing needle could be permanent.

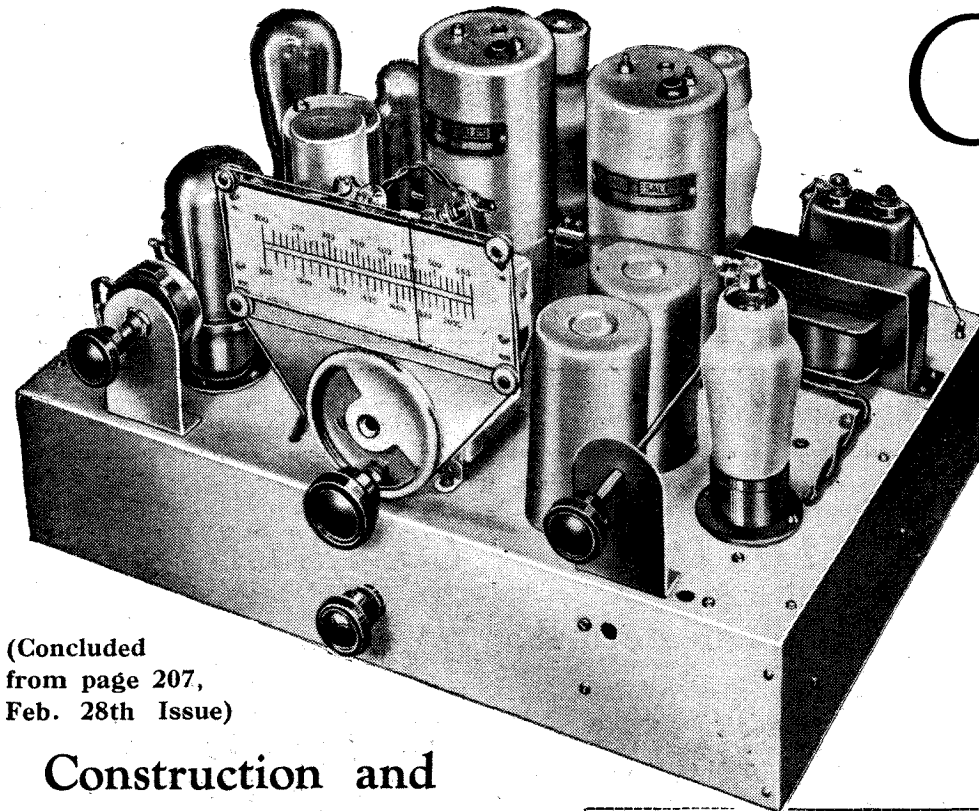
We have not, we believe, exhausted the advantages, but sufficient has been said to show that the change-over is prevented not by any technical considerations but solely because we are so committed to the present types of records and gramophones. For years now a perfected "hill and dale" system has been in existence and for special purposes this form of recording and reproduction is in use. It is regrettable that records on this principle should not yet be available to the public at a time when there is so much clamour for better quality. The question is now entirely a commercial one depending upon whether a sufficient increase in sales of records would result. We have to remember, of course, that the change would be most appreciated by a minority and not by the purchasers of the bulk of "popular" records.

QA Super

By W. T. COCKING

The second departure from ordinary practice lies in the erection of screens around the valveholders of the two IF valves, and this has an important bearing not only upon the stability, but also upon the uniformity of different models. Stray couplings are greatly reduced because all leads carrying IF currents are screened from one another, including the so-called "dead" HT leads which are often nearly as live as anode leads. All by-pass and decoupling condensers are included within the screening, and all leads passing from one compartment to another do so through definitely placed holes in the screens which necessarily fix their positions.

The amount of screening incorporated



(Concluded
from page 207,
Feb. 28th Issue)

Construction and Operation

SEVERAL minor departures from the usual have been made in the constructional details of this receiver in order to obtain a more convenient assembly and a greater degree of uniformity between different receivers. The use of a metal chassis with all holes correctly drilled for mounting the components has for long ensured that variations due to changes in layout cannot accidentally occur. With modern screened components, however, their relative position is often quite unimportant as far as interaction between the components themselves is concerned, and their position is only of importance in so far as it determines the positions of the various connecting wires.

Most sets nowadays contain a large number of resistances and condensers which are so small that they are usually supported in the wiring. This course is entirely satisfactory electrically provided that they are placed with due regard to the possibilities of stray couplings, but there is no doubt that it leads to a considerable chance of error. To take only one example, resistances are commonly fitted with a lead of about $1\frac{1}{2}$ in. for the connection; now a resistance is sometimes connected to the grid of an HF valve and the designer naturally intends the lead to be cut short to perhaps $\frac{1}{4}$ in. so that the resistance can be soldered almost directly to the valve socket with the shortest possible lead. It is not uncommon, however, to find receivers in which the full length of wire is retained, and the constructor is surprised to find that instability is present!

In an endeavour to overcome possible troubles of this nature, therefore, definite mountings have been adopted for such

small components in cases where it is advantageous to do so. Paxolin boards carrying double-ended soldering tags are employed and each resistance or condenser is soldered to the appropriate pair of tags as shown in the constructional drawings. In most cases it is necessary to cut short the wire end or soldering tag fitted to the component.

Mechanical Considerations

It is recommended that all the parts concerned be mounted on the boards before they are fixed to the chassis, and all the necessary cross-connections made. The tags which come next to the chassis should all be bent out to give a greater clearance from the chassis and to render them more readily accessible should it be necessary at any time to make a connection to them. Moreover, it is easiest to attach long leads to the appropriate tags for the connections to other parts before mounting them; this is advisable, of course, only in the case of those tags which come next to the chassis.

It will be observed that all resistances and condensers are not supported by these boards. In particular, C8, C9, R2, and R3 in the oscillator circuit are included in the wiring because the use of a board would here involve absurdly long leads. The components are, however, connected directly from point to point with the shortest possible leads.

has been found to be much greater than is necessary for the maintenance of stability, but in such an important item a large factor of safety is very desirable when it can be obtained. Even if actual oscillation does not occur, incipient instability usually spoils the performance, leading to excessive background noise and an unsymmetrical resonance curve.

The order in which the various components are assembled is not a matter of great importance, for none is difficult of access. When wiring, those leads which come nearest the chassis will naturally be placed in position first, and it is as well to start with the heater leads. To avoid an excessive voltage drop, No. 16 gauge wire must be used, and in view of the screening it is not feasible to use single lengths for joining together all valves. It is recommended that the frequency-changer be wired to the first IF valve; then straight lengths can be used and easily passed through the screening, for joining the two IF valves and the detector. The connections of this valve with the phase-changer and AVC valves are then quite straightforward. All wires are naturally sleeved to prevent short-circuits.

The inter-unit cable is of the five-way type, although only four wires are actually used. The heavy leads are for the heater connections, and those joined to the "cathode" and "anode" pins of the plug for negative and positive HT respectively. The cable is terminated by solder-

PRECEDING issues of "The Wireless World" have contained full details of the theoretical considerations underlying the design of the QA Super as well as a complete description of the set. In this article, the construction and initial adjustments are dealt with and the performance described.

ing the leads to the appropriate points in the receiver, and the fifth lead, to the "grid" pin, should be cut short.

When the construction of the receiver is done there remain only the initial adjustments to perform. If a calibrated test oscillator is available, these can be done

frequency-changer, and the trimmers on T1 adjusted.

The IF amplifier is now approximately adjusted to 465 kc/s, but to ensure precise trimming it is necessary to go over it again and adjust each trimmer exactly for the maximum response. Unless the

input be very small, it will be impossible to judge the optimum settings by ear, or even by means of an output meter owing to the

effect of AVC. This is so much more effective than usual that it is impossible to trim properly, using an output meter as an indicator, unless the detector input be kept small enough for AVC to be inoperative.

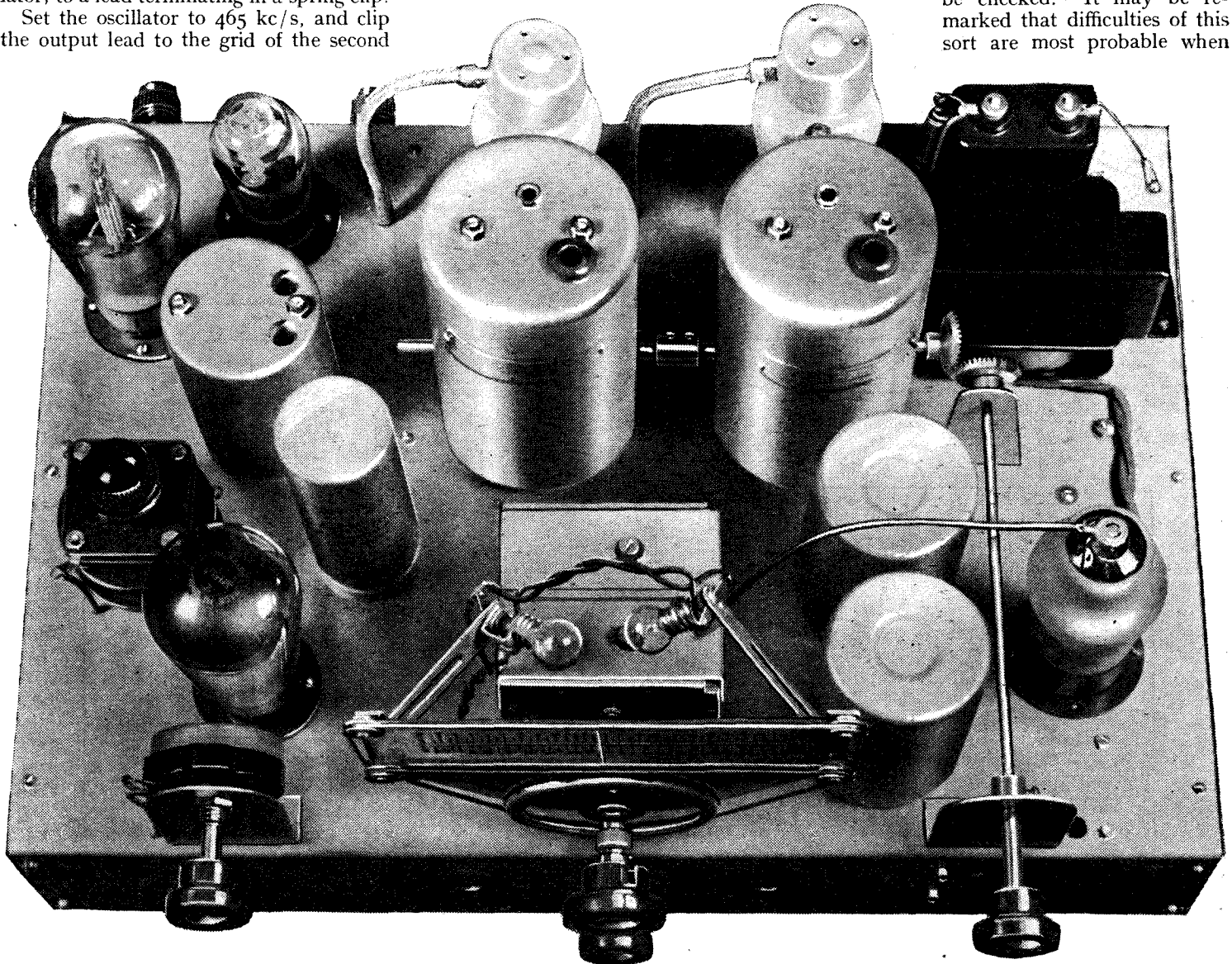
a millimeter-type tuning indicator wired in the same position. The input must then be great enough for AVC to be operative, and maximum response coincides with a minimum indication on the meter.

Particular care should be taken to see that each trimmer is adjusted correctly, otherwise the adjacent channel selectivity will be below normal. It is just as important to make sure that the frequency to which the circuits are adjusted is the correct one, for although this will not affect the selectivity or amplification, it will have a large effect upon the accuracy of ganging of the signal and oscillator circuits. Should any difficulty be found in adjusting the ganging, an incorrect intermediate frequency is the most probable cause, and the calibration of the test oscillator should be checked. It may be remarked that difficulties of this sort are most probable when

A SPECIAL RECEIVER FOR THE PUSH-PULL QUALITY AMPLIFIER

very rapidly and certainly. The "earthy" side of the oscillator output should be joined to chassis, and the live output lead taken through an artificial aerial or a 0.0002 mfd. condenser, if this is not already incorporated in the oscillator, to a lead terminating in a spring clip.

Set the oscillator to 465 kc/s, and clip the output lead to the grid of the second



The layout of components is well shown in this illustration. The variable-selectivity IF transformers with their bevel-drive can be seen in the centre with the two IF valves behind them. The transformer for the AVC HT supply is on the extreme right at the rear.

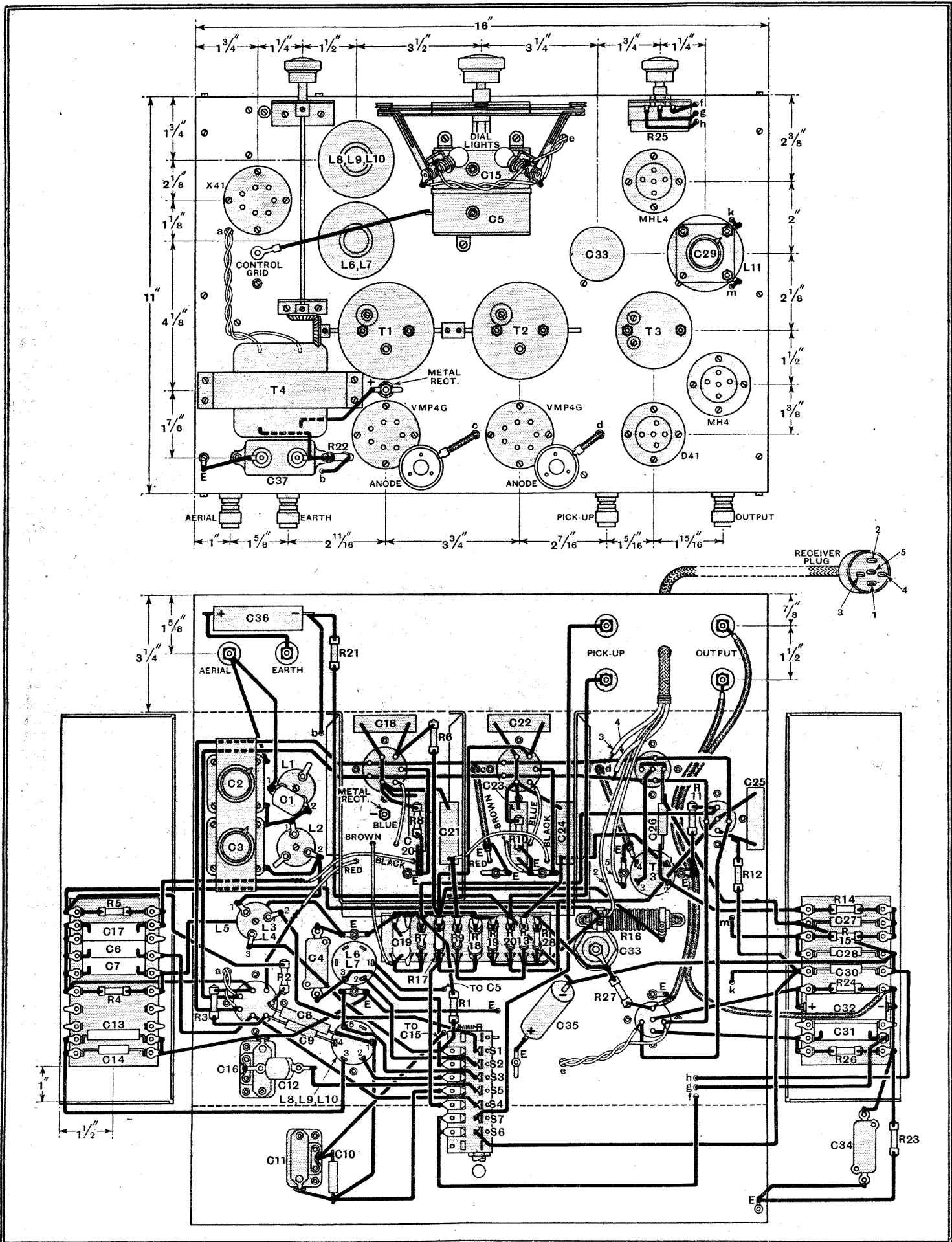
IF valve, and adjust the trimmers on T3 for maximum response. Then transfer the oscillator lead to the grid of the first IF valve and adjust the two trimmers on T2 for maximum response, the selectivity control on the panel being fully rotated in an anti-clockwise direction (maximum selectivity). The oscillator output must next be connected to the grid of the fre-

quency-changer, and the trimmers on T1 adjusted. The IF amplifier is now approximately adjusted to 465 kc/s, but to ensure precise trimming it is necessary to go over it again and adjust each trimmer exactly for the maximum response. Unless the input be very small, it will be impossible to judge the optimum settings by ear, or even by means of an output meter owing to the effect of AVC. This is so much more effective than usual that it is impossible to trim properly, using an output meter as an indicator, unless the detector input be kept small enough for AVC to be inoperative.

An output meter is by no means necessary, however, and it is just as easy to employ a millimeter connected in the anode circuit of the first IF valve in series with R9 and on the HT side, or, alternatively, to use a voltmeter connected across R8. Incidentally, the milliammeter can be left in circuit permanently to act as a tuning indicator, if desired, or

the oscillator is of the type using harmonics for the IF range. Any error in the calibration is then multiplied by the degree of harmonic. Thus, suppose that the second harmonic is used, and the oscillator is accordingly adjusted to what is believed to be 232.5 kc/s, but that the fundamental is actually 242.5 kc/s—an error of 10 kc/s. The second harmonic will be 485 kc/s, and

PRACTICAL WIRING DIAGRAM



Complete details of the construction and wiring are given in these drawings. It should be noted that the wires shown as passing over the IF screen partition are actually bunched together between the screen and resistance board.