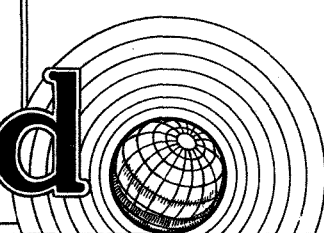
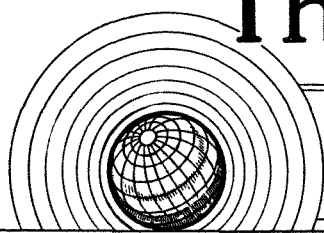


# The Wireless World

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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

### Broadcasting by Telephone

#### Necessity for Assurances

THE announcement last week of the Government's decision to renew the licences of the broadcast relay companies by a further term of ten years was coupled with a statement that the Post Office will also participate in the relay business by means of the wires now connecting telephone subscribers.

Some time ago, it will be remembered, the Post Office made known their intention to enter this field and proposed to start with a relay service for Southampton. That project was abandoned, at least for the time being, because of the strong opposition which it called forth from the radio industry, which quite naturally feared that a competitive means of receiving broadcasting run under the auspices and with the resources of the Post Office would be the kind of competition which the private enterprise of the radio firms could not hope to survive.

So here the matter ended for a time, but now A.R.P. has been called to the aid of the Post Office to provide the excuse apparently for obtaining authority for a policy which a democratic Parliament would probably not have sanctioned in normal times.

The nature of the new proposals suggests, however, that there has been some recognition of the devastating effect which a national Post Office relay system would have upon the radio industry, for the proposal is now to supply programmes by "wired wireless" on the telephone wire and for the reception to be carried out on the listener's own receiving set which he will tune to the programme he selects ;

he will also be able to tune in other programmes received through the medium of his aerial as at present.

Now, if the legitimate activities of the radio industry are not to be unfairly hampered and if the listener is to continue to have a free choice of programmes it is essential that an assurance should be forthcoming from the Post Office that they will not at any time compete with the radio industry by themselves supplying receivers or other reproducing apparatus to their subscribers or listeners. Such an assurance is vitally necessary if the goodwill of the radio industry, both manufacturers' and local dealers', is to be retained, and it should contribute a great deal towards helping in the A.R.P. aim which the Post Office have made the justification for their present autocratic action.

There is another important assurance which is required from the Post Office. This is that their adoption of a relay service should not result in a lessening of their zeal in fighting the problem of electrical interference. It is easy to appreciate that with a relay system of this kind, less prone to interference than ordinary reception, the Post Office may be tempted to make this fact an argument to persuade listeners to adopt the system. As we have pointed out before, relay services thrive where interference is particularly bad.

Given these assurances that the Post Office will never compete with the Industry in the supply and maintenance of receivers and that their efforts to reduce electrical interference will not slacken, we see no reason why the new proposals should not proceed with the approval and even with the active support of the radio industry. But these assurances must come first.

# COMPACT THREE-VALVE BATTERY RECEIVER

(Concluded from page 293  
of last week's issue)

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World

## Stand-by Three

CONSTRUCTION AND  
TESTING

**T**HE receiver is built as a unit on a metal chassis which can be of steel or aluminium as preferred. Unless the chassis is bought ready-made, aluminium is to be preferred to steel, since it is easier to work. The gang condenser is bolted to the top of the chassis, but wires should first be attached to the soldering tags on its underside, since these are rather difficult to reach when it is in position.

The coils must be mounted after most of the wiring has been done. This is readily carried out in spite of the small space available, but care must be taken to keep wires, condensers and resistances close to the chassis, so that they do not foul the coils when these are put in.

The cross-screen does not extend up to

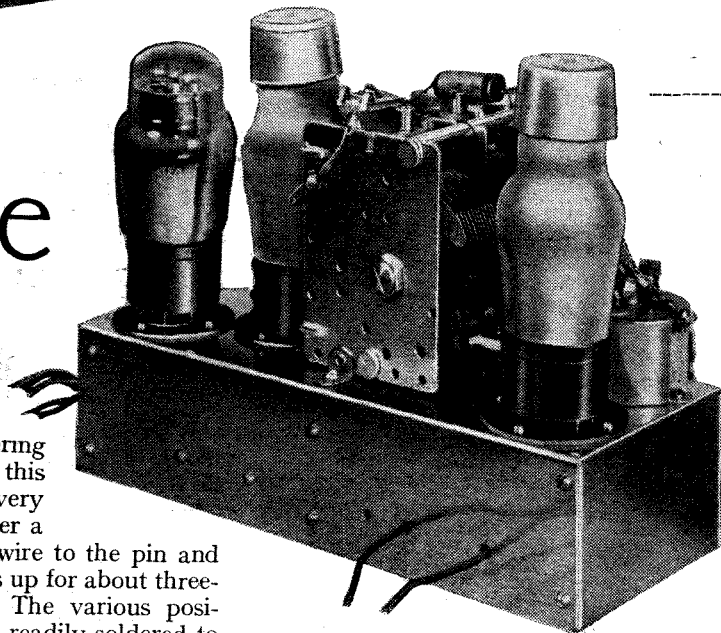
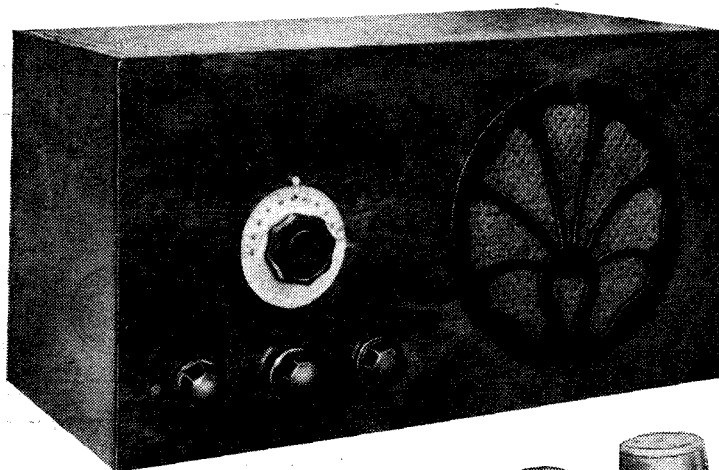
HT. To avoid soldering many wires directly to this pin, which is not very easy, it is best to solder a length of fairly thick wire to the pin and bend it so that it stands up for about three-quarters of an inch. The various positive HT leads are then readily soldered to points along this wire.

The most awkward connections are some of those on the switch, and the easiest course is to attach wires to the least accessible lugs before mounting it in the set. The connections to the volume control should also be made before the switch is mounted.

The switch may be a little confusing at first, for it has so many contacts. If in doubt, the best way of identifying the con-

tacts is by a continuity test. For this an ohmmeter can be used, a voltmeter and battery, or a battery and a flash-lamp bulb. Set the switch in the middle one of its three positions and connect the coils to the contacts which show continuity. The battery and chassis connections must also be made to a pair showing continuity, and a further

***T**HE construction and adjustment of the receiver are dealt with in this article and the performance obtained from the original model is described. Notes on the LT supply are also given.*



The back of the cabinet removed, showing how the batteries are stored.



the chassis top. There is a gap through which the cross-wires pass. The centre-pin (screen) of the output pentode is used as a general junction point for positive

which show continuity. The battery and chassis connections must also be made to a pair showing continuity, and a further

lug connected so that there is again continuity when the switch rod is rotated clockwise. These notes, together with the drawings, should obviate any difficulty here.

The two intervalve coils are identified by their carrying a red spot on the former. The medium-wave coils are the ones with the tuned winding in several sections; incidentally, the coil numbers are stamped on the brass mounting strips.

In every case the pair of long solder tags is for the tuned winding, and the short pair for the primary or reaction. On the medium-wave coils the grid end of the winding is remote from the primary or reaction coil. This lead can readily be traced to its tag. Once the grid tag is found, all other connections follow automatically from the drawings. On the long waveband it does not matter which of the long tags is made the grid lead. The coils are multilayer side-by-side, and it is only their relative connections that matter.

### Preliminary Tests

The receiver should be tried out before being fitted to its cabinet, since it is then easier to adjust the trimmers. The controls all operate logically; that is, minimum volume and reaction are obtained with the knobs turned anti-clockwise. The three positions of the switch are: left, off; centre, on, medium waves; right, on,

**Stand-by Three—**

long waves. A direct drive is used for the tuning condenser, since it is quite easy to tune with it, and it occupies less space and costs less than a dial with a reduction ratio.

**Adjustment and Operation**

The trimmer C3 is included because the trimmers fitted to the gang condenser have insufficient capacity for this receiver. With tuned grid coupling, the stray capacity on the intervalve circuit is rather high, so an unusually large amount of trimming capacity must be added to the first circuit. The gang condenser trimmer on C1 should be screwed up and forgotten, adjustments being made to C3 and the trimmer on the other section. Set this latter about half-way in, tune in a station on the lower end of the medium wave-band, using reaction, and then adjust C3 for maximum response. A rough adjustment can be made on a strong signal, but afterwards a weak one should be found upon which precise adjustments of the two trimmers can be carried out.

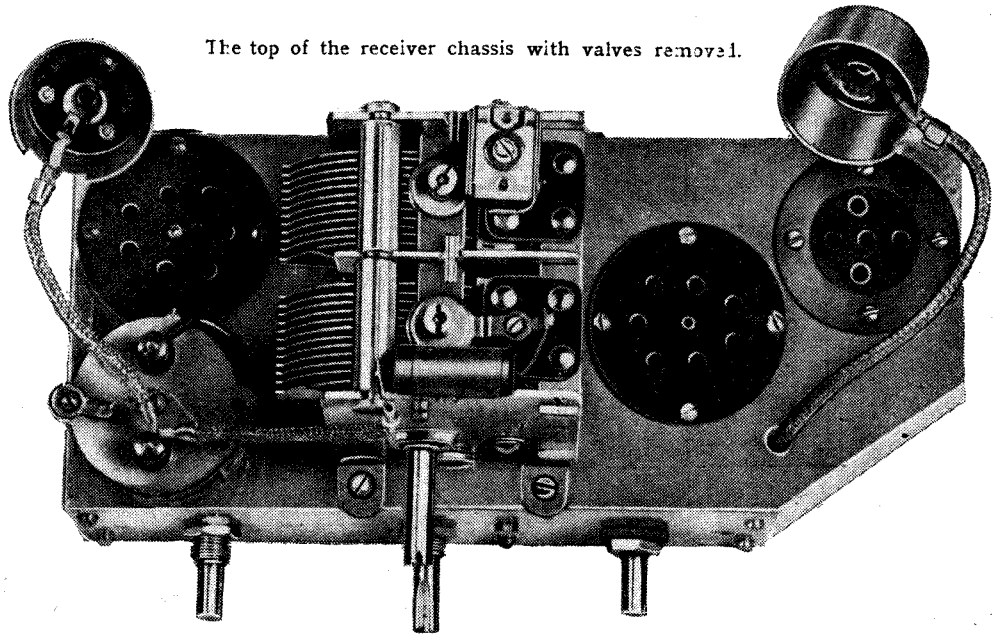
When satisfactory results have been secured, the set can be fitted to the cabinet. It is held in place by two wood-screws through the front; if the holes in

the chassis are small, the screws bite their way into the metal quite well and hold the chassis firmly.

The LT batteries fit behind the receiver and the HT behind the set and loud speaker. In connecting the LT batteries

door, or, better, outdoor aerial. An earth is advised wherever possible. It is not essential, but it improves stability. Without an earth there may be some instability, which can be corrected by the volume control.

The top of the receiver chassis with valves removed.

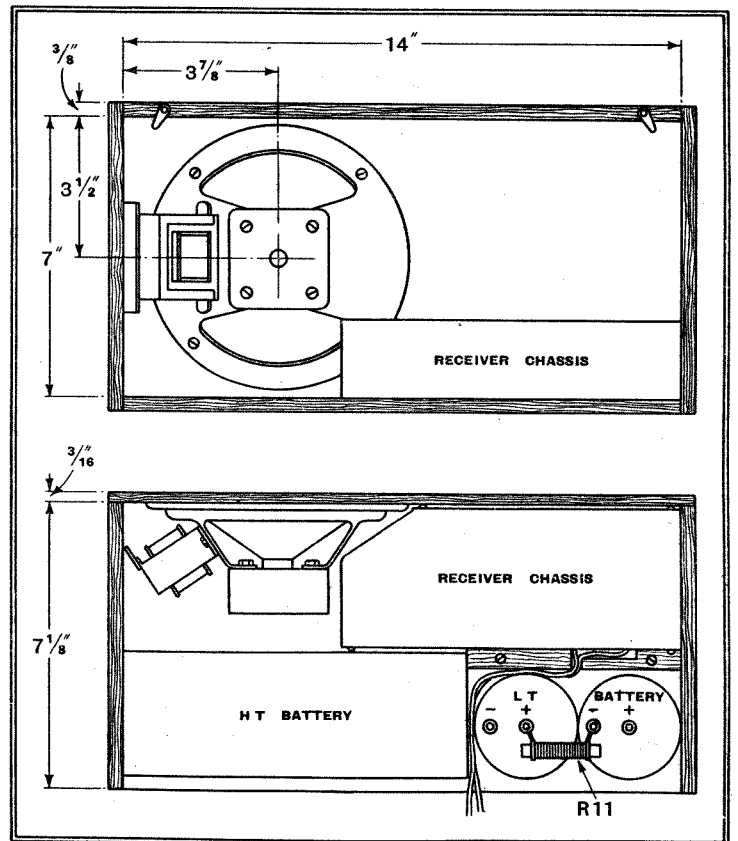


it is convenient to join the battery leads one-to each battery and to place the resistance R11 to join the two batteries. The batteries then support the resistance at each end. The centre terminal of the battery is the positive.

The value of 10 ohms specified for R11 is correct for a new LT battery giving 6 volts, since the drop in it at the current of 0.2 ampere is 2 volts. If a high-resistance voltmeter is available, the voltage applied to the set should be checked occasionally so that R11 can be reduced in

Tested in London with a fifteen-foot length of wire for an aerial in a steel-framed building, both local stations were well received. By hanging the wire out of a window, these two, as well as Droitwich, provided a terrific signal, and at good strength many other stations could be

The cabinet dimensions and how the receiver, speaker and batteries are accommodated.



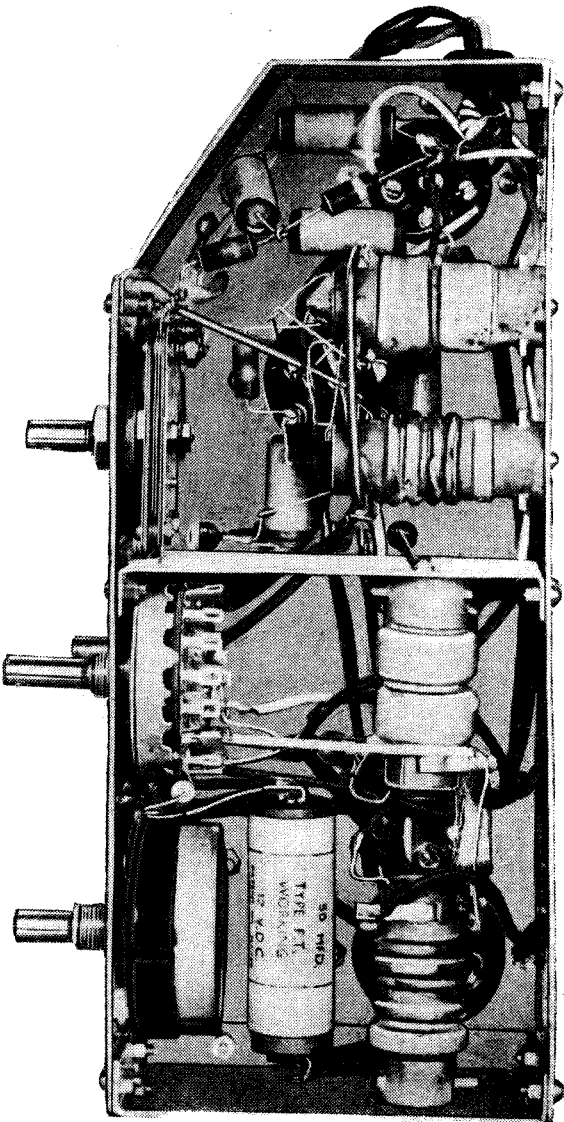
received in daylight. These included Fécamp, North Regional, Cologne, Brussels, Weather London, Radio-Paris.

The quality and volume proved surprisingly good in view of the low-current drain on the battery, and, in fact, considerably surpassed expectations. Selectivity is not high, but is adequate for the purpose for which the set is intended.

The set is not designed for use with a large aerial, and with one the selectivity is too low. It is intended for a short in-

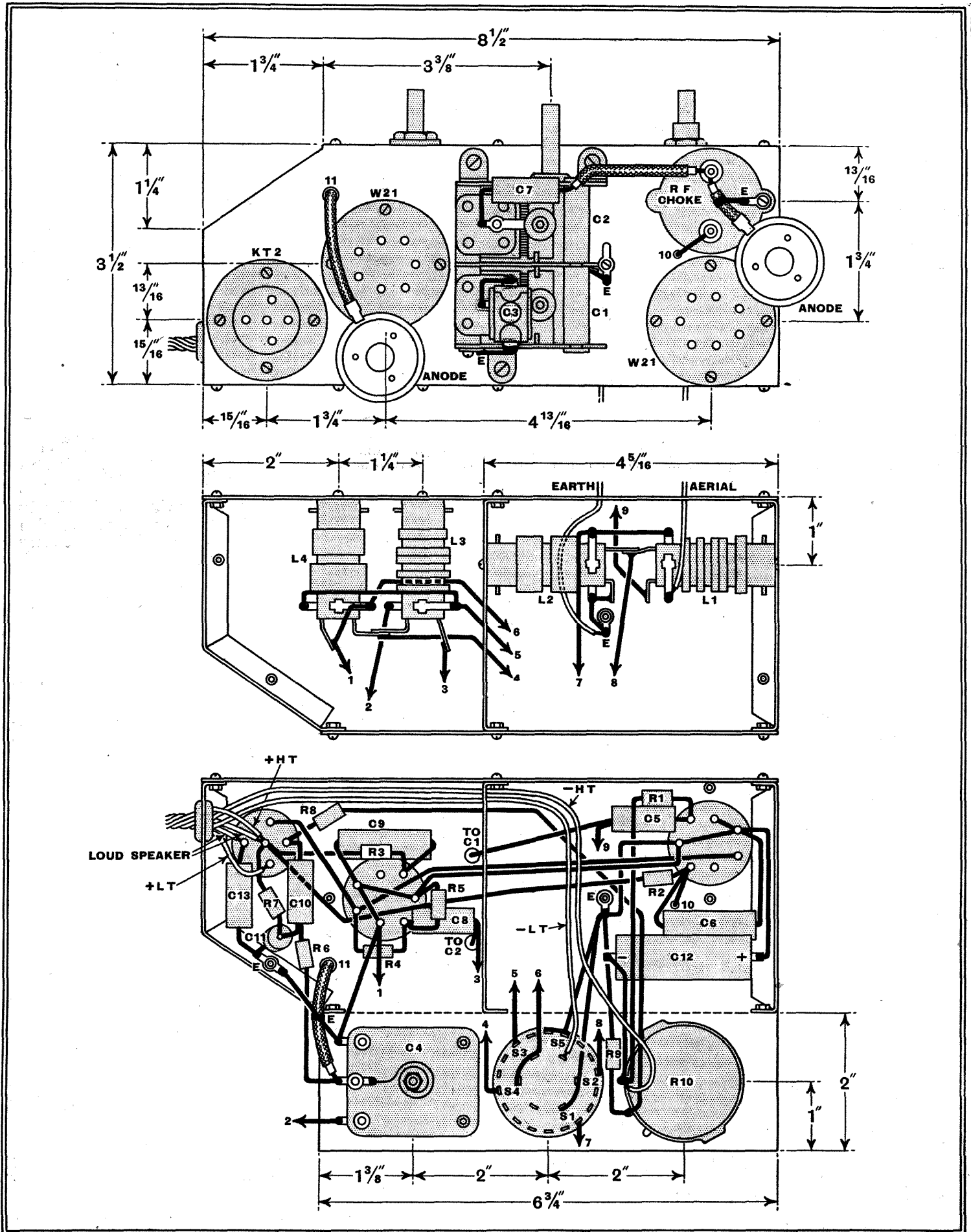
value when it falls appreciably. Alternatively, an ammeter of low resistance can be inserted in series with the battery to check the current.

If no meter is available, the only course is to reduce the resistance arbitrarily when



Underside of the receiver chassis.

The Wireless World STAND-BY BATTERY THREE. Wiring Diagram



Full assembly and constructional details of the receiver chassis. The reference letters will make easy the identification of components when compared with the full circuit diagram included in last week's instalment of this article.

Stand-by Three—

the performance falls off. A drop of 0.5 volt in the battery will probably pass unnoticed, so that one can assume that the battery voltage is down by nearly one volt when the performance falls off. A value of 5 ohms is then indicated for R<sub>11</sub>.

In conclusion it should be pointed out that a receiver of this nature is not only extremely useful, but its construction is of value. The beginner will find the construction instructive, and this applies also to those who lack practical experience but have yet a good theoretical knowledge.

*THE triangulated mast described in this article is easy to assemble from steel conduit tube, which is readily obtainable. As the structure is light in weight and has considerable inherent rigidity it can be erected with a minimum of trouble.*

# Steel Aerial Mast

**A**BOUT four years ago the writer had the need to erect an aerial, at that time intended as a temporary measure, and did not wish to expend much money, or to have to obtain assistance with the erection. Now even the simplest scaffold pole, if of any height, is heavy, and not very cheap to buy. Thin steel masts require to be lashed to a ladder during erection, as otherwise they are inclined to buckle, and they can be quite difficult to erect, particularly in windy weather. A very satisfactory arrangement for a temporary or even permanent mast is a framed structure consisting of bamboo poles fixed end to end and braced by means of cross-pieces and tensional wires. Poles of this kind, however, are not obtainable everywhere, and it was in the absence of these that the mast which is to be described was evolved.

## EASY CONSTRUCTION IN CONDUIT TUBE

tions between the two tripods would each consist of six members, which number of members is the minimum with which triangulation producing complete stability is possible.

The method of construction was as follows: Three 15ft. lengths of  $\frac{1}{2}$ in. diameter steel conduit of the cheapest quality were placed side by side and temporarily tied round with string. They were then drilled through near the end two at a time, and three  $\frac{3}{16}$ in. eyebolts passed through and nuts lightly screwed on. This end was intended to be the top of the mast, and eyebolts were used to facilitate connection of guy wires. These bolts had to be placed at slightly different distances from the ends of the tubes so as not to foul one another (see Fig. 1.). Three lengths of  $\frac{3}{8}$ in. diameter steel conduit, 15ft. long, were then treated in a similar manner, but plain bolts were used in place of eyebolts. The other ends of the three  $\frac{1}{2}$ in. tubes were inserted for a few inches into the ends of the  $\frac{3}{8}$ in. tubes and a hole was drilled through the junction of each tube and a  $\frac{3}{16}$ in. bolt passed through the hole. Thus, an approximate 30ft. length of triple tube was produced.

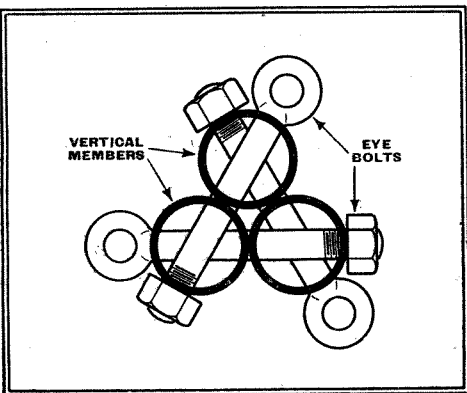
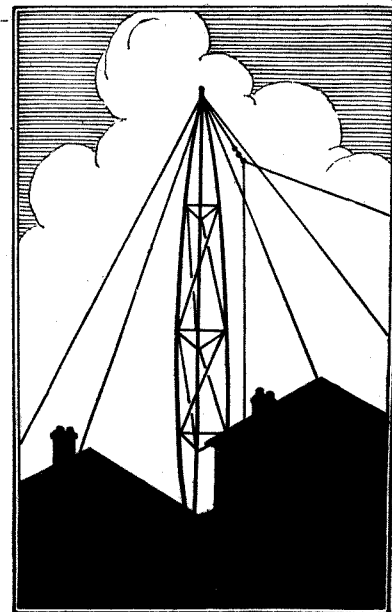


Fig. 1.—Method of bolting together the three vertical members at the top of the mast.

Steel electric-light conduit is inexpensive to buy and may be obtained anywhere, and for this reason it was selected as the material for construction. The method decided on was that used at Lisburn—that is, the mast would be purely a compressional strut held in position by guys reaching from the top to the ground. This would mean that the two ends would be pointed and the thickest part of the mast would be at the centre. To make erection easy, and to economise so far as possible in material, it was decided to make the strength as low as reasonably possible and to use the minimum number of individual members. This meant that the top section would be a tripod, the legs of which would be as long as they could possibly be without buckling. The bottom would be an inverted tripod, and the intermediate sec-

A piece of  $\frac{1}{2}$ in. diameter steel conduit was then flattened with a hammer at 2ft. intervals and also at the ends, and bent into an equilateral triangle. This was drilled through the flattened portions at the angles of the triangle. The three main steel tubes were then sprung apart and the triangle inserted in the centre and secured to the main tubes by the bolts which fastened the tubes together at the centres (see Fig. 2).



By A STRUCTURAL ENGINEER

The members of the mast then took up a curved form.

At approximately quarter intervals the

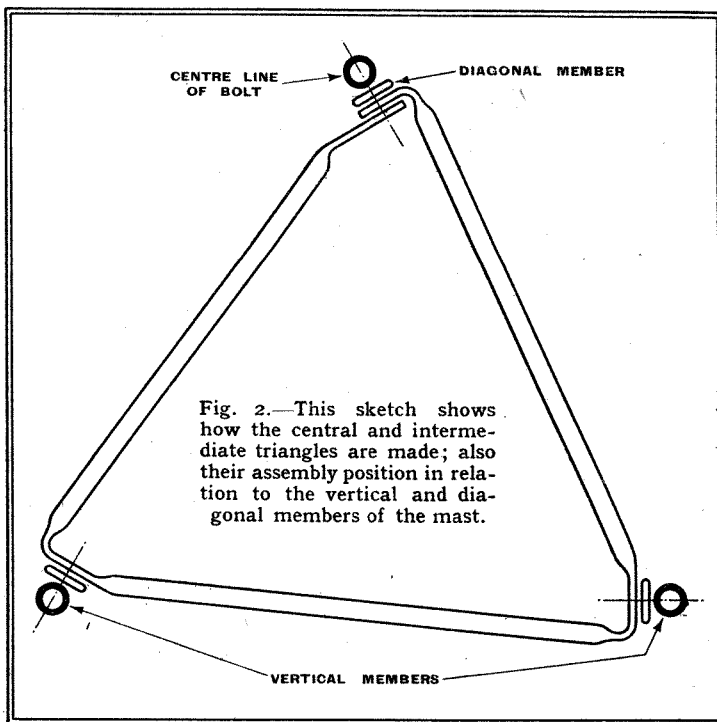
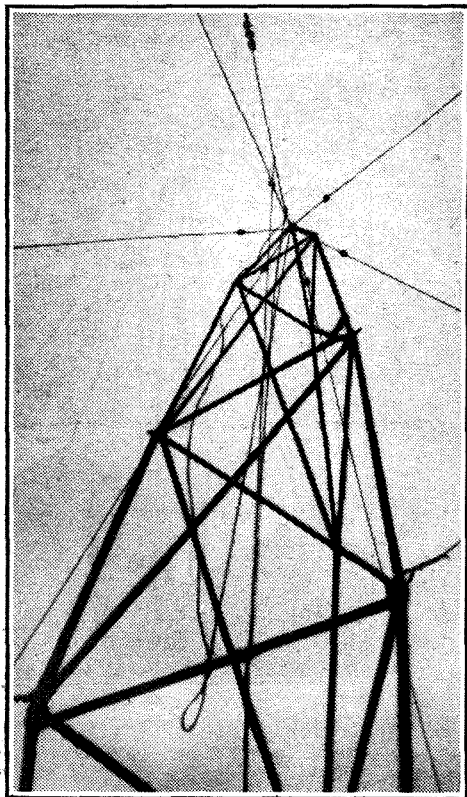


Fig. 2.—This sketch shows how the central and intermediate triangles are made; also their assembly position in relation to the vertical and diagonal members of the mast.

distances apart of the members were measured, and two triangles, similar to that previously mentioned, were made to fit, and the main members and the triangles were drilled and bolted together. The exact positions of these intermediate

**Steel Aerial Mast—**

triangles were determined when the diagonal members (to be described) were bent to shape and measured. The resultant structure was unstable in that it was not completely triangulated. To overcome this, three lengths of tube were taken and flattened at the centres and the ends so as



Although the mast—seen from below in this photograph—was set up as a temporary structure four year ago, it is still standing.

to form diagonal members. These were then drilled and bolted in position with the bolts that secured the triangles to the vertical members. Fig. 3 illustrates the side elevation of the mast during assembly; all three sides of the mast are similar.

**Alternative Assembly**

It was found that the diagonal members fitted into position better if placed between the triangles and the vertical members when bolting up. There are two ways in which these diagonal members may be placed. First, as shown in Fig. 3, a bent

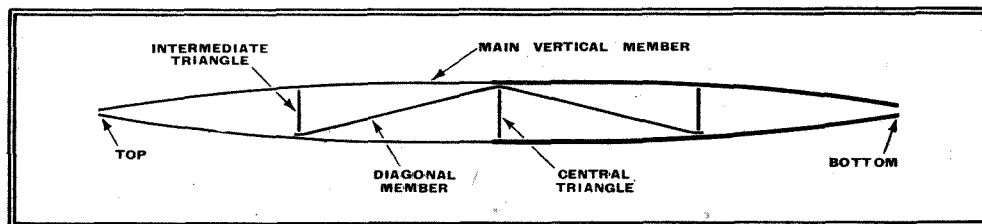


Fig. 3.—Side elevation of mast during assembly; all three sides are similar.

member may pass from one vertical tube to another and back to the first tube. Secondly, the diagonal member may be passed from the first tube to the second and then across another side of the mast to connect to the third vertical member.

This latter method was the one actually used during construction, although there is no particular advantage in one method over the other.

It was found to be important that during the drilling and bolting together of the members the ends and intermediate portions of the mast should be propped up at the correct distances from the floor, and kept propped up in this manner until the whole of the structure is completed and all bolts tightened up. If this is not observed, the mast may be visibly crooked or twisted on completion. When the bolts were tightened up the projecting ends were cut off and burred over.

Finally, to protect the structure from rust, the lower end—that is, the section constructed of  $\frac{5}{8}$ in. tube—was placed in a small tin and set in molten lead and the top end similarly protected by a tin filled with putty. The joints were stopped thoroughly with putty, which was rubbed over all bolts and nuts, and afterwards bound with insulating tape. This method, although rough, did not give a bad appearance after painting. The whole structure was painted with two coats of grey paint.

To erect the structure it was necessary first to drive a central pin for the mast to rest on, to drive six  $1\frac{1}{2}$ in. angle iron stakes 30in. long, spread well out, for securing the six guys, and to connect the guys, which consisted of stranded galvanised steel wire. The mast was then seized by the centre, being held at the junctions of the members, and the bottom was placed on the central pin and tied to the pin to prevent the lower end from lifting. It was then lifted vertically, hand over hand, one of the distant guy ropes being pulled gently by an assistant until the mast was brought into a vertical position. The near guy ropes were previously temporarily fastened to their stakes at approximately the correct length. Aeroplane strainers had been fitted in the guy ropes, together with insulators, to break up the lengths, but the strainers were found to be unnecessary, as the required degree of adjustment could be made easily without them. The true vertical of the mast was found by using a cotton thread plumb line hung down the centre. The mast was provided with a permanent halyard, consisting of stranded wire passing through a pulley fastened to the mast, and supporting a

pulley through which was passed a plaited cord halyard. The idea of the metal halyard was to make possible easy renewal of the halyard normally in use. Incidentally, the use of two halyards doubled the load on the mast due to the pull of the aerial.

The mast when finally erected was found to be sufficiently strong to take the pull of a normal aerial in all weather conditions. Storms had no effect on it owing to its low wind resistance. It has now been standing four years, during which period two nearby trees have been blown down during a heavy gale. Nevertheless, slightly heavier members (say, about  $\frac{3}{4}$ in. and  $\frac{5}{8}$ in., in place of  $\frac{5}{8}$ in. and  $\frac{1}{2}$ in.) are perhaps to be recommended for general use, as the smaller sections require careful handling during erection. Proportionately larger sections should be used for higher masts.

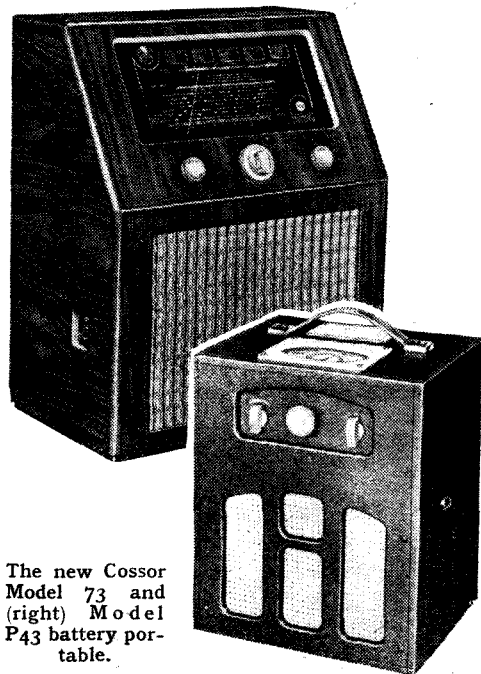
Additional guys may be connected to the lower triangle of the mast in order to prevent a rotating motion that may occur during strong winds.

**TWO NEW COSSOR SETS**

A Table Model Superheterodyne and a Battery Portable

IN the Model 73 superheterodyne there are five valves excluding the rectifier and cathode-ray tuning indicator. A radio-frequency amplifier functions on all three wavebands, the lowest of which covers 16 to 52.5 metres. The output valve is a large triode and the controls include a combined selectivity and tone control. The set is for manual tuning only and a large easily read dial has been provided. The price of the Model 73 is  $12\frac{1}{2}$  guineas.

The new Model P43 battery portable makes use of a "straight" circuit with a



The new Cossor Model 73 and (right) Model P43 battery portable.

pentode RF amplifier, pentode detector, triode first AF amplifier and either a pentode or tetrode output valve. An interesting feature is that the detector is an indirectly heated valve. The price of £6 15s. includes a 120-volt HT battery and an 18 ampere-hour accumulator which is easily removed through a door in the side of the cabinet. Controls are on the front panel and the tuning scale is on top. It is calibrated in metres and a replacable list of station names is fitted in a frame behind the dial. The set is finished in blue leatherette with grey-moulded knobs and escutcheon.