# R101
# TYPE "C"
# RECEIVER

# SPECIFICATION.

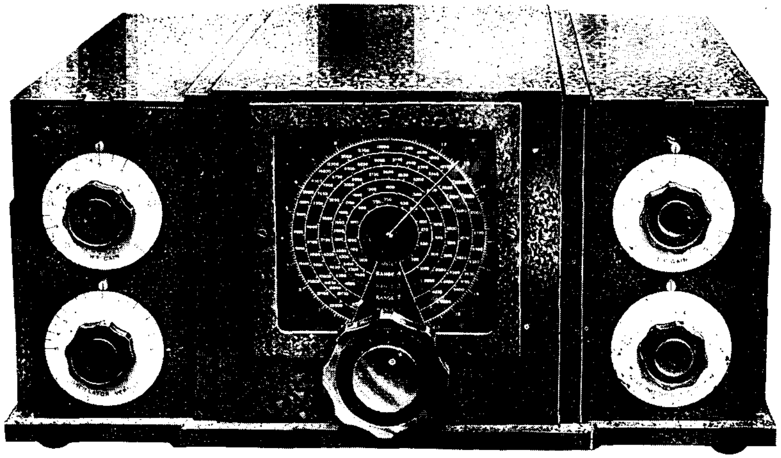


Plate 1.

## GENERAL.

This receiver is a battery operated superheterodyne, utilises eight valves, is built for use with separate loud speaker and has plug-in coil units. Its circuit arrangement and rigid construction provide for consistent and reliable performance in any climate.

The cabinet, chassis and coil unit boxes are aluminium base castings finished dark brown, and efficient screening is effected by integrally casted shields. A spring loaded, tufnol geared condenser drive, having a ratio of approximately 80 to 1 and fitted with a flywheel, permits smooth and rapid operation of the tuning control. The drive is free from backlash and is quite noiseless mechanically and electrically.

## CIRCUIT ARRANGEMENT.

A variable pentode R.F. amplifier stage followed by a pentode mixer into which a separate R.F. oscillator is electron coupled. Then follow two I.F. amplifier stages operating at 465 Kc/s ; these precede a double diode triode which supplies A.V.C. and operates as 2nd detector and 1st L.F. amplifier. The 2nd L.F. amplifier, which forms the output stage, is a beam power tetrode. To these is added an electron coupled beat frequency oscillator.

## SPECIFICATION—continued.

### OPERATING RANGE.

The total range of the instrument is from 31·5 Mc/s to 150 Kc/s. This is covered by eight coil units, five of which are calibrated on the tuning dial, which also has an outer arbitrary scale for use with the remaining three units. The five units are :—

| | | | |
|---|---|---|---|
| Range 1 | 9,000 | — | 22,000 Kc/s. |
| Range 2 | 4,500 | — | 11,000 Kc/s. |
| Range 3 | 2,100 | — | 4,600 Kc/s. |
| Range 4 | 1,000 | — | 2,500 Kc/s. |
| Range 5 | 530 | — | 1,200 Kc/s. |

Of these, ranges 1, 2, and 5 are supplied as standard equipment with the receiver.

The remaining three units are :—

| | | | |
|---|---|---|---|
| Range 1A | 11,500 | — | 30,000 Kc/s. |
| Range 6 | 375 | — | 600 Kc/s. |
| Range 7 | 150 | — | 375 Kc/s. |

With each of these is supplied a graph Frequency/dial reading, referred to the outer scale on the dial.

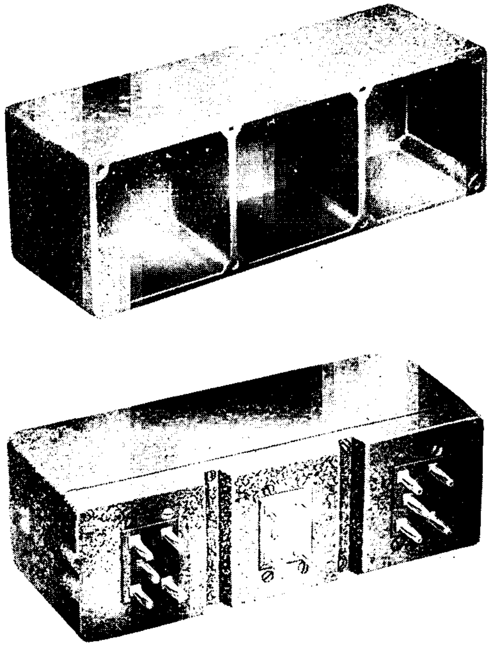


**Plate 2**—*COIL UNITS* (*Note internal screening*).



## SPECIFICATION—continued.

**Plate 3.**

### CONTROLS.

In addition to main tuning there is H.F. Gain, L.F. Gain, Oscillator Vernier, Beat Frequency Pitch, A.V.C. On-off switch, B.F.O. On-off switch and main supply On-off switch.

There are two jacks in parallel on the right hand side of the cabinet for phones or loud speaker.

### SUPPLY.

H.T. battery of 135 volts, and L.T. accumulator of 2 volts, via two 2-way cables.

### DIMENSIONS.

15½″ long × 7¼″ high × 12¼″ deep, excluding projections.

### WEIGHT.

Receiver, 28¾ lbs. Coil Units, 1 lb. 10 ozs.

### PERFORMANCE.

| | |
|---|---|
| Average Sensitivity : | Better than 7 microvolts for 50 milliwatts output. |
| Selectivity : | 9 Kc/s at 20 db down. 16 Kc/s at 40 db down. |
| Consumption : | 16 M/A at 135v. H.T. 0·9A at 2v. L.T. |
| Output Impedance : | Suitable for 2,000 ohms or 120 ohms. Adjusted by changing a lead inside cabinet. |

# INSTALLATION.

These instructions are intended as a guide to the methods for obtaining the best results, and we recommend that the following procedure is adopted.

**VALVES.**

A set of valves is supplied and checked in the receiver at the final bench test in the works, and it is essential that only the specified types should be used. These are :—

| *Position.* | *Function.* | *Type.* |
|---|---|---|
| V.1. | H.F. Amplifier. | Mazda VP210. |
| V.2. | Mixer. | Mazda SP210. |
| V.3. | H.F. Oscillator. | Mazda SP210. |
| V.4. | 1st I.F. Amplifier. | Mazda VP210. |
| V.5. | 2nd I.F. Amplifier. | Mazda VP210. |
| V.6. | Detector A.V.C. and L.F. Amplifier. | Mazda L21 DD. |
| V.7. | Output. | Osram KT2. |
| V.8. | B.F.O. | Mazda SP210. |

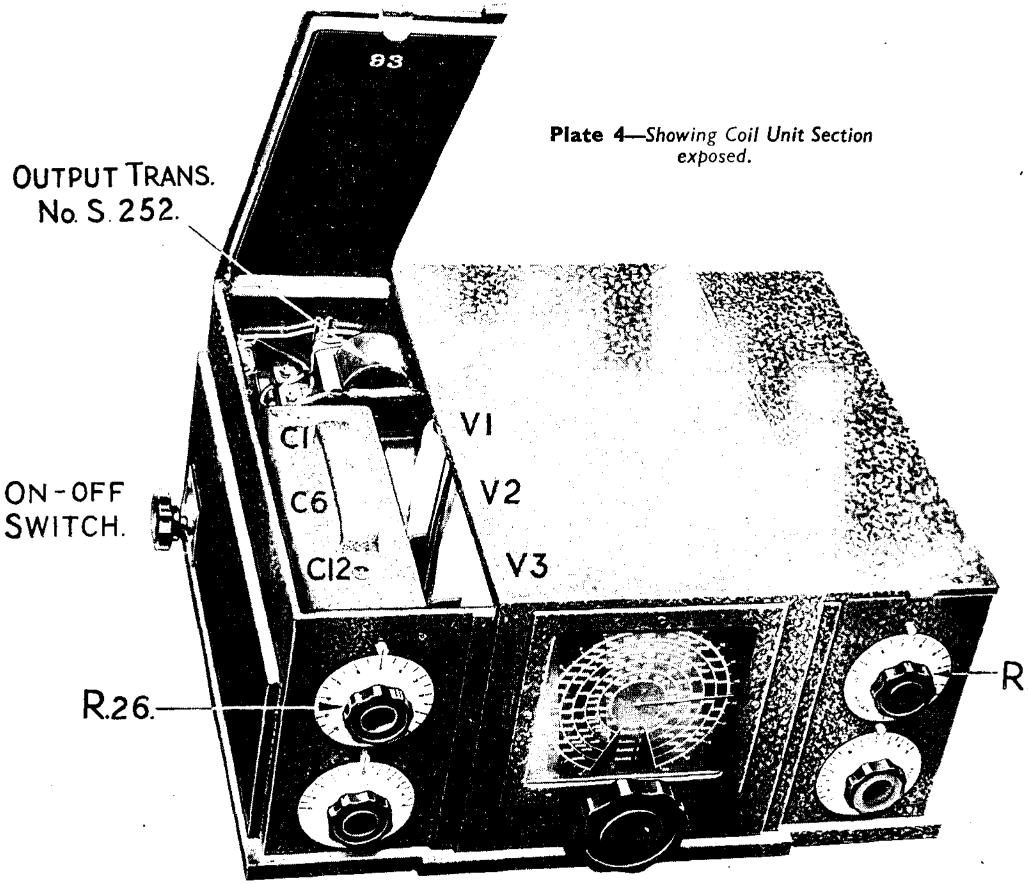



**Plate 4**—*Showing Coil Unit Section exposed.*



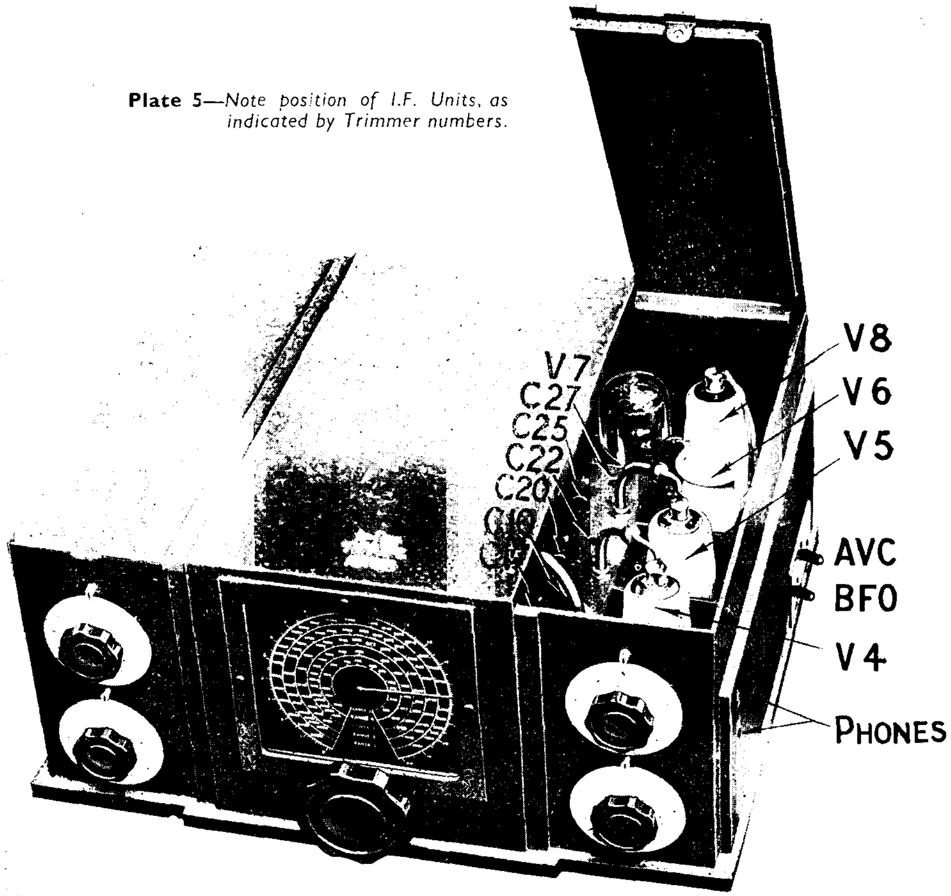
**INSTALLATION—continued.**

All valves must be inserted in their holders in the positions shown on plates 4 and 5 before batteries are connected to the receiver ; further, at any time when changing valves, always make sure that the receiver is switched off. With the exception of V.7, a flexible lead with spring clip is fitted for the top connection ; this should be firmly pressed on the metal plug at the top of the appropriate valve. Care should be taken to ensure that all valves are pushed well home into their respective sockets.

**HEADPHONES OR LOUD SPEAKER.**

Either should be provided with a P40 type jack plug. Insert the plug into either of the sockets located at the right hand side of the receiver. (Terminals are also fitted in some cases). High or low impedance output can be selected by means of a change-over connecting lead on the output transformer which is at the back of the coil platform. The lead should be adjusted to the appropriate terminal.

**Plate 5**—*Note position of I.F. Units, as indicated by Trimmer numbers.*



## INSTALLATION—continued.

### BATTERIES.

The filament supply should be obtained from a 2 volt accumulator and since the valves have 2 volt filaments, no higher voltage should be used, otherwise their efficiency will be destroyed. If any other form of low tension supply be used, and the initial voltage is more than two, a voltmeter should always be connected across the low tension leads to the receiver, and a regulator resistance used to maintain the voltage at exactly two.

The high tension supply should not exceed 135 volts, and when dry batteries are used these should be of the large capacity type. Cheap batteries of the ordinary standard capacity type are not recommended as they run down very quickly and are also a source of unwanted noise.

Batteries are connected to the receiver with the cables at the rear of the cabinet. The red and black " spade " type connectors are taken respectively to the positive and negative terminals of a charged 2 volt accumulator. The red and black " wander plugs " are respectively connected to the positive and negative terminals of the high tension battery.

### AERIAL AND EARTH.

The receiver is arranged for use with an ordinary single wire aerial or a doublet type. When a single wire aerial is used it should be connected to the " A1 " terminal shown on plate 6, whilst the shorting strip should be connected across terminals " A2 " and " E " as shown.

If a doublet aerial is used, then the shorting strip should be removed from " A2 " and the two leads from the doublet should be connected, one to each of the terminals " A1 " and " A2." A direct earth wire, which should be well insulated, is then connected to the earth terminal. For further information refer to the aerial section of these instructions.



## OPERATING THE RECEIVER.

Positions of the controls are indicated in the various photographs, and their purposes will now be dealt with.

### ON-OFF SWITCH.

This is for bringing the receiver into use. Always place this in the " off " position when changing coil units.

### L.F. GAIN.

This is set from time to time at a position which allows reception at the desired strength. To decrease volume, turn the knob anti-clockwise.

### H.F. GAIN.

This controls the actual gain of the high frequency amplifier, and its regulation is connected with the type of signal being received and the use or not of the A.V.C. circuit. Rotation in a clockwise direction increases the gain of the receiver. For more detailed application see notes under " Reception of C.W. and Telephony Signals."

### OSCILLATOR VERNIER.

A fine tuning device which allows perfect tracking of the H.F. oscillator tuning circuit, throughout the frequency coverage of the receiver. It should be adjusted to give maximum signal strength, after the main tuning control has been suitably adjusted to the desired signal.

### B.F.O. ON-OFF SWITCH.

The beat frequency oscillator valve circuit is made to oscillate when this switch is placed in the " on " position, and is used when it is desired to receive a C.W. station. The B.F.O. may also be switched on when searching for a weak telephony station in order to locate the carrier wave.

OPERATING THE RECEIVER—continued.

**BEAT FREQUENCY OSCILLATOR.**

Only when the B.F.O. switch is on may this control be used, when the pitch of the note produced by interaction with an incoming C.W. signal may be adjusted. Its application is fully covered in the notes on the reception of C.W. and Telephony signals.

**TUNING CONTROL.**

The large centre knob is the tuning control ; this operates the three gang condenser and also causes a hair-line pointer to traverse the tuning dial, which has five directly calibrated scales for use with the coil units named on the dial. The outer scale is for use with additional coil units with which graphs are supplied.

**A.V.C. ON-OFF SWITCH.**

Situated at the right hand side of the receiver this switch is used to put A.V.C. in or out of the circuit, and A.V.C. is rendered inoperative when the switch is off.

When searching for a very weak station, A.V.C. should be switched off and the H.F. gain control fully advanced in a clockwise direction. A.V.C. should also be switched off when using the B.F.O., as otherwise the local oscillations will cause the receiver to become insensitive. For all C.W. reception the A.V.C. should be switched off.



OPERATING THE RECEIVER—continued.

# THE RECEPTION OF C.W. AND TELEPHONY SIGNALS.

**C.W.**

Some care in the use of the controls for C.W. reception is necessary, especially if the signal being received is weak, and the B.F.O. control is not the least important.

When its dial is set to " O," the frequency generated by the B.F.O. is the same as the intermediate frequency of the receiver. Therefore, if the receiver is correctly tuned to the desired signal, the beat note produced will then be zero ; further, by turning the control on either side of zero, the frequency of oscillations of the B.F.O. is increased or decreased, resulting in an increase of pitch of the audible beat note.

It will be seen that an audio difference frequency or " Beat note " can be produced by an incoming signal, if the B.F.O. is set at zero, which is the I.F. frequency (465 Kc s). This is the result of detuning of the signal, and should not be resorted to, as sensitivity and selectivity are thus impaired—obtain zero beat with B.F.O. dial at " O " by tuning, and then adjust for pitch by means of the B.F.O. control.

By discriminate use of the B.F.O. control, the effect of an interfering signal may be reduced. Refer to figure 1 (a) and consider an unwanted signal producing an audible beat note of 5 Kc s when the wanted signal is correctly tuned ; then if the B.F.O. is adjusted nearer to the former to produce a 1,000 cycle note, the difference in the audio frequency between the two signals will be only 4,000 cycles. Now referring to figure 1 (b), with the same signal conditions, if the B.F.O. control is moved to the corresponding dial position beyond

## OPERATING THE RECEIVER—continued.

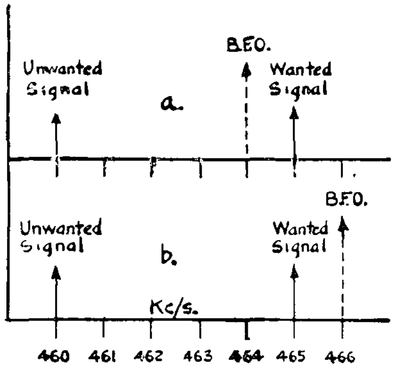



*FIG. 1*

zero, so that the B.F.O. frequency is 466 Kc s, a 1,000 cycle note is still produced by the wanted signal, but the unwanted signal is 6,000 cycles away from this; so that conditions for reception of the wanted signal are very much improved.

If the unwanted signal was only a few Kc/s more remote, then its beat note would be beyond audibility and interference would be eliminated altogether. The same considerations apply if the unwanted signal produces a frequency higher than 465 Kc s.

Should the wanted C.W. signal be of a strong character it will tend to overload the input circuit of the receiver, causing blocking and other troubles. To avoid this, the H.F. gain should be reduced and the L.F. gain adjusted so that the receiver functions at a volume level, suited to the strength of the incoming signal and amount of audio output favoured by the individual operator.

In connection with A.V.C., it will be obvious that with the B.F.O. operating and producing local oscillations, the A.V.C. will have to be switched off as otherwise it would be considerably affected by the oscillations (which can be likened to those from a local transmitter), reducing the gain of the receiver and making it extremely insensitive.



## OPERATING THE RECEIVER—continued.

### TELEPHONY.

For the reception of telephony signals the B.F.O. is not required and should be switched off.

The A.V.C. Circuit becomes of greater importance and should be switched on since it minimises fading and consequent distortion, automatically adjusting the gain of the Receiver input circuits so that a constant input level is maintained. The H.F. Gain still functions, but more as a fine control, and normally should be left in the maximum gain position.

If the wanted signal is very weak and difficult to locate, it can sometimes be found by switching on the B.F.O. with the dial set at "O," and tuning to the null point of the carrier wave and then switching off the B.F.O.

Care in the correct handling of the controls of the Receiver will more than repay, as correct operation will allow signals to be received at readable strength ; which incorrect operation would render difficult if not impossible.

# ALIGNMENT INSTRUCTIONS.

These instructions should be carried out with great care since, with correct operation of the receiver, performance depends entirely upon adjustment of the various parts of the circuit.

The following apparatus is necessary :—

A signal generator having modulation control and a frequency range sufficient to produce the extreme frequencies of the coil units.

An output meter of 1,500 ohms load.

A short wave dummy aerial or 400 ohms non-inductive resistor.

A standard dummy aerial, as normally supplied with signal generators.

Before commencing alignment, one should make quite certain that the receiver is otherwise in the same condition as it will be when operated. All valves should be tightly in place ; the earth connected and the chassis in the cabinet.

## I.F. AMPLIFIER.

The first procedure is to align the I.F. amplifier and in this, a signal generator and output meter only are required.



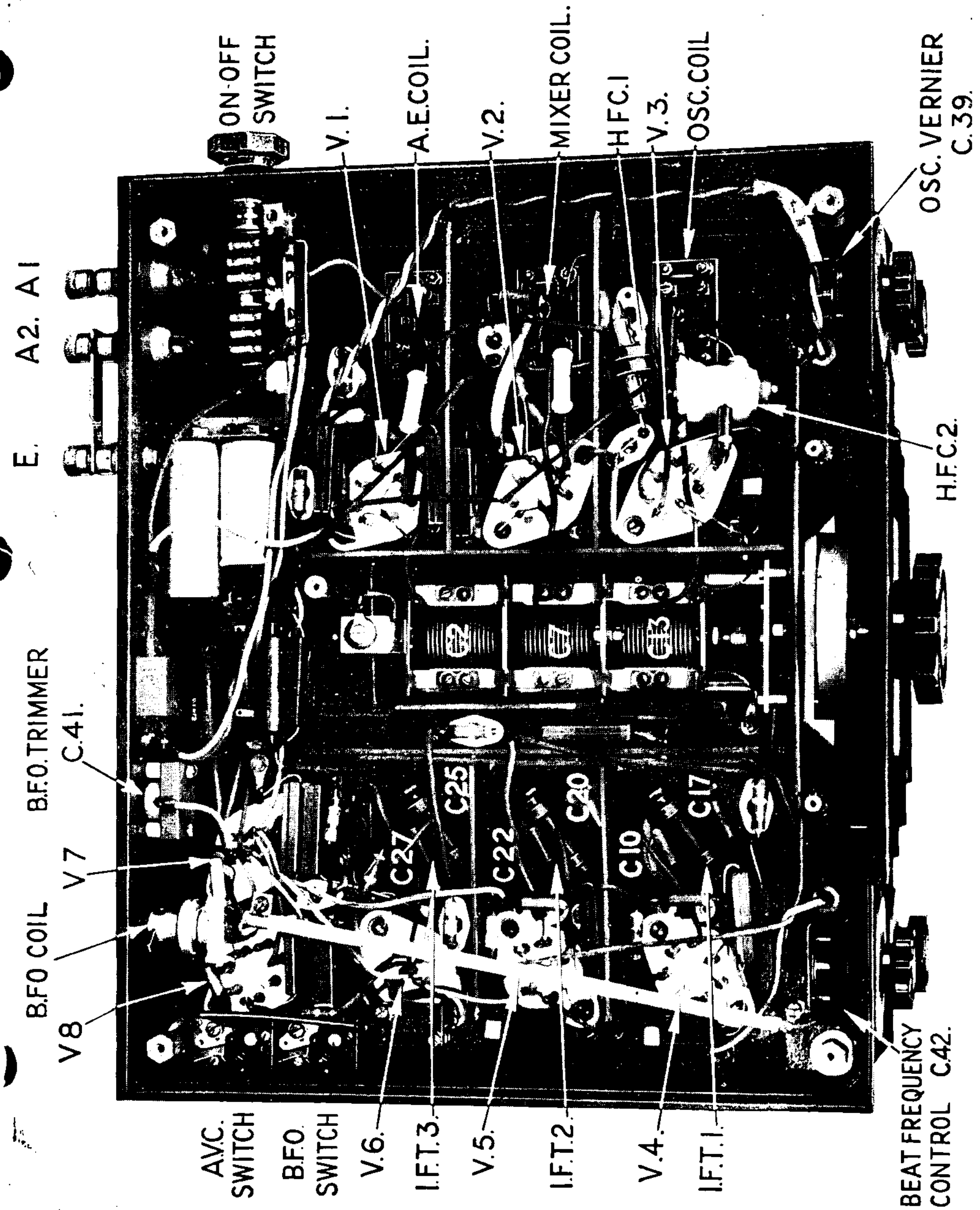



Plate 6.

## ALIGNMENT INSTRUCTIONS—continued.

Remove the coil unit from the receiver. Connect the output meter to one of the output jacks at the right hand side of the receiver, and if necessary adjust the flexible lead on the output transformer, connecting it to the terminal marked "H." Now referring to figure 2, connect the high potential lead from the generator to socket No. 2 on the receiver chassis, and the low potential lead to socket No. 4. Short circuit sockets Nos. 1 and 5, thus allowing the high tension to reach the anode of the H.F. valve V1, and so preventing damage to the valve when the receiver is switched on. Set the generator at 465 Kc/s (the I.F. frequency) to modulate at 30%, and switch on the receiver. Set H.F. and L.F. gain controls at maximum and switch off both A.V.C. and B.F.O.

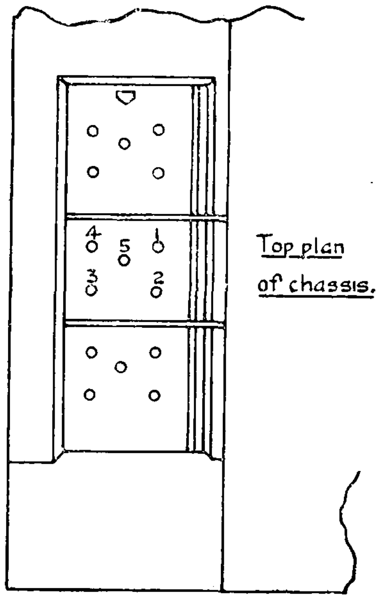



*FIG. 2*

The six I.F. trimmers are now to be adjusted ; these may be found by reference to plate 5. Commencing from the output end and working towards the input end, adjust C27, C25, C22, C20, C10, and C.17 in this order, to produce maximum deflection on the output meter. The injected signal should be maintained to give about a mid-scale reading on the meter.

After careful adjustment, the I.F. amplifier should give 50mW output for not more than 10uV input from the generator. Should the sensitivity be down however, and substitution of the valves fail to improve matters, the resistor R25 may be substituted for a higher value, and this should bring the performance of the receiver up to the required standard.

At this point A.V.C. and the B.F.O. may be checked if necessary.



## ALIGNMENT INSTRUCTIONS—continued.

### A.V.C.

Switch this on and increase the input from the generator to 100 micro-volts, reducing the L.F. gain to keep the output meter reading fairly low. Now switch off the A.V.C. and if the circuit is functioning correctly, a sharp rise will be indicated on the output meter.

### B.F.O.

With the signal still being injected, set the B.F.O. control at "O" ; switch on the B.F.O. and adjust the trimmer C41 (located at the back of the receiver) to zero beat.

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### COIL UNITS.

The coil units are very carefully adjusted before leaving the factory and the trimmers set to give the greatest possible efficiency. If however, it is found necessary to readjust these units, the methods which follow should be carried out systematically.

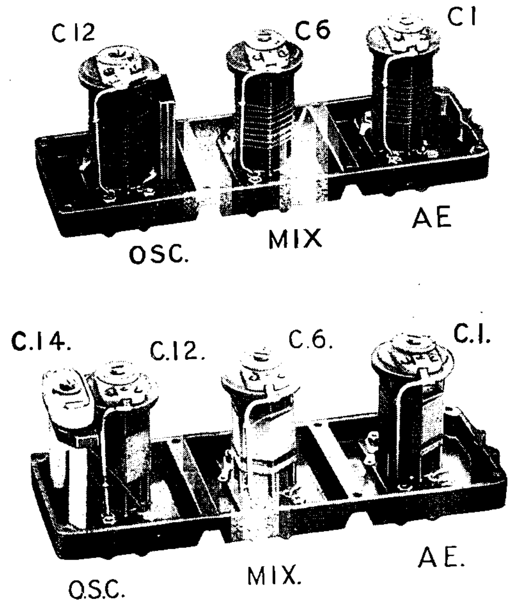


**Plate 7.**

### ALIGNMENT INSTRUCTIONS—continued.

Reference to the photographs of the coil units will show that in some cases a variable oscillator tracking condenser C14 is fitted ; this applies to ranges 4, 5, 6 and 7. In ranges 1, 2 and 3, C14 is a fixed condenser. Adjustment is made through the holes in the tops of the covers, by means of a non-metallic trimming tool ; this is insulated to prevent short circuiting to chassis, of the high potential which is present on the trimmers.

For ranges 1, 2 and 3 the short wave dummy aerial must be used, connected in the high potential lead from the generator ; for other ranges the standard dummy aerial is used.

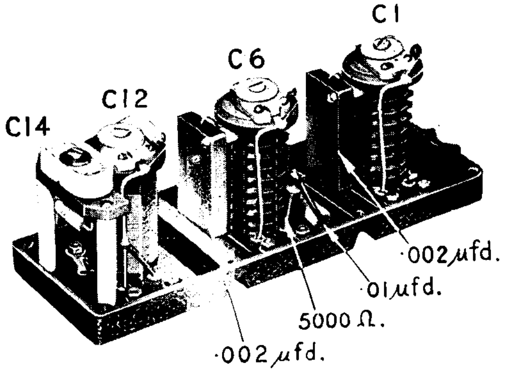


**Plate 8.**

For the location of trimmers refer to illustrations of the coil units. The oscillator vernier control must be set at " O" throughout these operations, also the shorting strip should be connected to the " A2 " and " E " terminals.

**RANGES 1, 2 and 3.**

Set the tuning pointer of the receiver on to the aligning frequency, and inject this frequency from the generator. The aligning frequencies to be used are :

| | |
|---|---|
| Range 1 | 21,000 Kc s. |
| Range 2 | 10,000 Kc s. |
| Range 3 | 4,500 Kc s. |

Adjust the oscillator trimmer C12 until the signal is indicated with maximum deflection on the output meter. A deflection on the meter can be produced at two frequency readings on the generator dial. The trimmer should be adjusted to bring the deflection at the lower frequency up to the correct aligning frequency setting of the generator dial ; that is until the reading on the generator is the same as the reading on the receiver tuning dial.



### ALIGNMENT INSTRUCTIONS—continued.

Now adjust aerial and mixer trimmers C1 and C6 to give maximum deflection on the output meter, overloading of which must be avoided by reducing the generator output as necessary.

Provided that coil inductances have not been altered, calibrations at all points on the tuning dial should now be correct.

**RANGES 4, 5, 6 and 7.**

On these ranges, a variable oscillator tracking condenser C14 is fitted, for the purpose of correcting calibrations at the L.F. end of the tuning scale.

Align with trimmers C1, C6, and C12, as for ranges 1, 2, and 3, using the aligning frequencies given here.

| *Range.* | *Aligning Frequency.* | *Tracking Frequency.* |
|---|---|---|
| 4 | 2,300 Kc s. | 1,100 Kc s. |
| 5 | 1,200 Kc s. | 550 Kc s. |
| 6 | 600 Kc s. | 300 Kc s. |
| 7 | 300 Kc s. | 150 Kc s. |

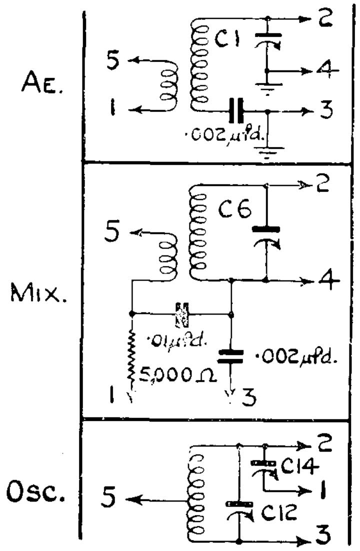


*FIG. 3.—Showing circuit arrangement of RANGE 6 coil unit, which may be seen to differ from other ranges as it encompasses the I.F. frequency.*

Now turn the tuning pointer to the tracking frequency. Inject this frequency from the generator and adjust the tracking condenser C14, so that the meter deflection occurs when the frequency reading of the generator is the same as that on the receiver tuning dial.

The adjustment of the two oscillator trimmers C12 and C14 mutually affect each other, therefore they should be readjusted in turn until the change in frequency becomes negligible, when C1 and C6 may finally be checked for any consequent misalignment.

For ranges 6 and 7 reference will have to be made to the appropriate graph supplied, and the outer scale on the tuning dial used. The aligning and tracking frequencies will be found to occur at about 2° and 18 respectively on the outer scale.

# COMPONENT VALUES.

R.1 —50,000 ohms.
R.2 —40,000 ohms.
R.3 —·5 megohm.
R.4 —1,000 ohms.
R.5— 1,000 ohms.
R.6 —1 megohm.
R.7 —·1 megohn.
R.8 —·25 megohm.
R.9 —20,000 ohms.
R.10—70,000 ohms.
R.11—·5 megohm.
R.12—1,000 ohms.
R.13—50,000 ohms.
R.14—40,000 ohms.
R.15—1,000 ohms.
R.16—·25 megohm Pot. (L.F. Gain).
R.17—·5 megohm.
R.18—2 megohms.
R.19—·5 megohm.
R.20—60,000 ohms.
R.21—Not used.
R.22—Not used.
R.23—Not used.
R.24—2 megohms.
R.25—15,000 ohms.
R.26—50,000 ohms Pot. (H.F. Gain).
R.27—1·0 megohm.
R.28—·1 megohm.
R.29—80 ohms.
R.30—250 ohms.
R.31—·1 megohm.
R.32—30,000 ohms.
R.33—1 megohm.
R.34—·5 megohm.

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C.1 —See Coil Unit List.
C.2 —236 m.mfd. Gang (H.F.)
C.3 —·01 mfd.
C.4 —·1 mfd.
C.5 —·1 mfd.
C.6 —See Coil Unit List.
C.7 —236 m.mfd Gang (Mixer).
C.8 —·0005 mfd.
C.9 —3pF.
C.10—100pF + 75pF.
C.11—·1 mfd.
C.12—See Coil Unit List.
C.13—236 m.mfd. Gang (Osc.).
C.14—See Coil Unit List.
C.15—100 pF.
C.16—·1 mfd.
C.17—100pF + 75pF.
C.18—·01 mfd.
C.19—·1 mfd.
C.20—100pF + 75pF.
C.21—·1 mfd.
C.22—100pF + 75pF.
C.23—·01 mfd.
C.24—·1 mfd.
C.25—100pF + 75pF.
C.26—·1 mfd.
C.27—100pF + 75pF.
C.28—·0003 mfd.
C.29—·006 mfd. (Screened).
C.30—·0003 mfd.
C.31—2 + 1 + 1 mfd.
C.32—Not used.
C.33—·001 mfd.
C.34—·002 mfd.
C.35—100pF.
C.36—100pF.
C.37—·1 mfd.
C.38—1 mfd.
C.39—4 m.mfd approx. Osc. Vernier.
C.40—100pF.
C.41—15-45pF, B.F.O. Trimmer.
C.42—12½ m.mfd., B.F.O. Pitch.
C.43—·0003 mfd.
C.44—75pF.
C.45—·1 mfd.
C.46—·1 mfd.
C.47—50 mfd. 12v. Elect.
C.48—16 mfd. 250v. Elect.

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# R101 Receiver Type C.

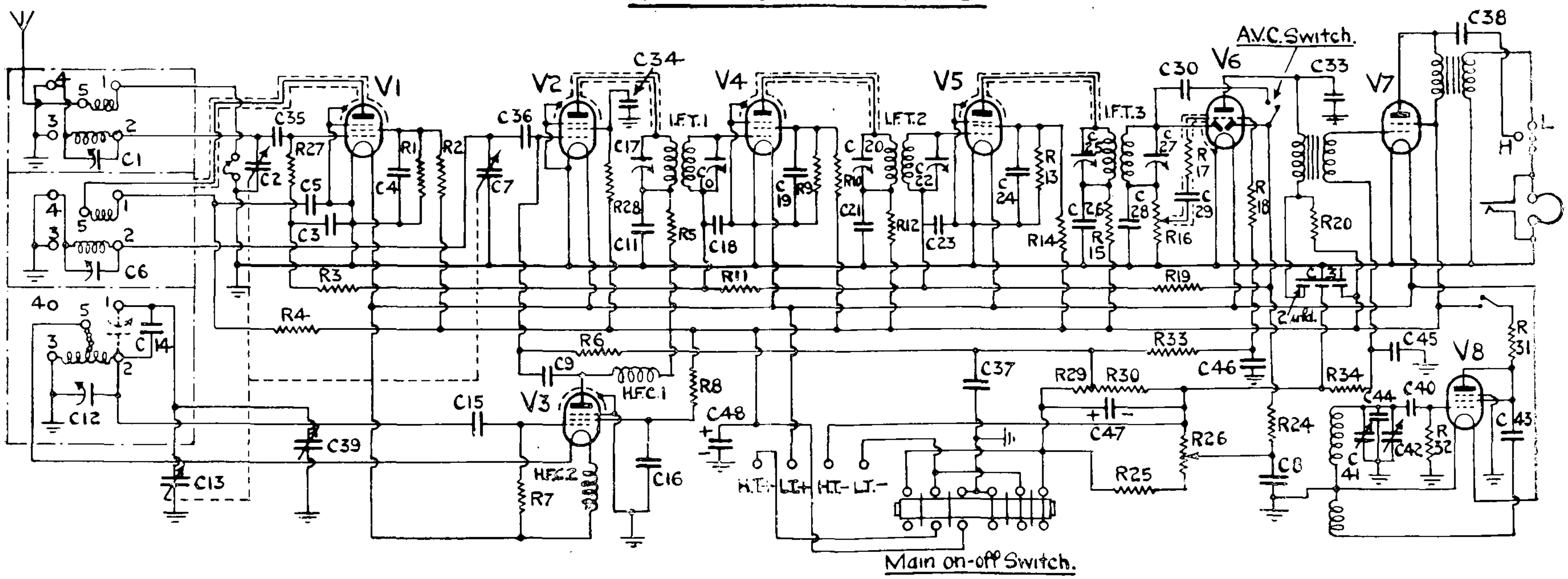


FIG. 4

COMPONENT VALUES—continued.

# COIL RANGES.

| | | |
|---|---|---|
| **C.1** | Range 1A. | |
| | Range 1 | 3-20pF. |
| | Range 2 | |
| | Range 3 | 3-20pF. |
| | Range 4 | 3-20pF. |
| | Range 5 | 3-20pF. |
| | Range 6 | 15-45pF + **40pF.** |
| | Range 7 | 3-20pF. |
| | Range 8 | |

| | | |
|---|---|---|
| **C.6** | Range 1A | |
| | Range 1 | 3-20pF. |
| | Range 2 | |
| | Range 3 | 3-20pF. |
| | Range 4 | 3-20pF. |
| | Range 5 | 3-20pF. |
| | Range 6 | 15-45pF. + **40pF.** |
| | Range 7 | 3-20pF. |
| | Range 8 | |

| | | |
|---|---|---|
| **C.12** | Range 1A | |
| | Range 1 | 1·5-6pF. |
| | Range 2 | |
| | Range 3 | 3-20pF. |
| | Range 4 | 1·5-6pF. |
| | Range 5 | 3-20pF. |
| | Range 6 | 15-45pF + 100pF. |
| | Range 7 | 15-45pF. |
| | Range 8 | |

| | | |
|---|---|---|
| **C.14** | Range 1A | |
| | Range 1 | ·006 mfd. |
| | Range 2 | |
| | Range 3 | 1,000 m.mfd. + 300pF. |
| | Range 4 | 1,000 m.mfd. |
| | Range 5 | 1,000 m.mfd. |
| | Range 6 | 250 m.mfd. + 100pF. |
| | Range 7 | 1,000 m.mfd. |
| | Range 8 | |

## COMPONENT TYPES.

| | | |
|---|---|---|
| **C.1** | Range 1A | |
| | Range 1 | U.I.C. No. 2496. |
| | Range 2 | |
| | Range 3 | U.I.C. No. 2496. |
| | Range 4 | U.I.C. No. 2496. |
| | Range 5 | U.I.C. No. 2496. |
| | Range 6 | U.I.C. No. 2502. |
| | Range 7 | U.I.C. No. 2496. |
| | Range 8 | |
| **C.6** | Range 1A | |
| | Range 1 | U.I.C. No. 2496. |
| | Range 2 | |
| | Range 3 | U.I.C. No. 2496. |
| | Range 4 | U.I.C. No. 2496. |
| | Range 5 | U.I.C. No. 2496. |
| | Range 6 | U.I.C. No. 2502. |
| | Range 7 | U.I.C. No. 2496. |
| | Range 8. | |
| **C.12.** | Range 1A | |
| | Range 1 | U.I.C. No. 2509. |
| | Range 2 | |
| | Range 3 | U.I.C. No. 2496. |
| | Range 4 | U.I.C. No. 2509. |
| | Range 5 | U.I.C. No. 2496. |
| | Range 6 | U.I.C. No. 2502. |
| | Range 7 | U.I.C. No. 2502. |
| | Range 8. | |
| **C.14.** | Range 1A. | |
| | Range 1 | Dub. 691. |
| | Range 2 | |
| | Range 3 | Cyldon ST14. |
| | Range 4 | Cyldon ST14. |
| | Range 5 | Cyldon ST14. |
| | Range 6 | Cyldon ST14. |
| | Range 7 | Cyldon ST14. |
| | Range 8 | |

| | |
|---|---|
| **C.38** | T.C.C. type 62 T.F.C. |
| **C.39.** | Spec. No. 404 modified. |
| **C.41.** | U.I.C. No. 2502. |
| **C.42.** | Spec. No. 404 modified. |
| **C.47.** | Dub. 50 mfd., 12v., Elect., **type** 401B. |
| **C.48.** | Dub. 16 mfd., 250v., Elect., **type** 4021. |



## SHORT WAVE AERIALS.

An efficient short wave aerial should **have the following** characteri**stics :**

(a). Good pick-up.

(b). High signal to noise ratio.

(c). Resonate on certain desired frequencies and be semi-aperiodic on other frequencies.

(d). Its impedance must be matched to the input impedance of the Receiver.

### PICK-UP.

The first condition is easily attainable provided high conductivity copper wire is used in the installation and the aerial is erected in a position where dielectric losses are at a minimum, i.e., well away from buildings and trees and particularly metal objects, such as drainpipes, gutters, metal roofs, and telephone and power lines. Since the current induced in an aerial is directly proportional to the effective height of the latter, it is essential to erect the aerial as high as circumstances permit.

### HIGH SIGNAL NOISE RATIO.

The signal to noise ratio is one of the most important factors to be considered in the design of an aerial. Due to thermal agitation, shot effect and Johnson noise, there is always a considerable amount of noise present in a radio receiver, and it is a problem to reduce this to a minimum. It is in the first stage that these effects are troublesome since the noise level developed is amplified by each succeeding valve. Therefore, no radio signal of less intensity than this noise level will be reproduced in the loud speaker, and if the strength of the weak signals can be increased BEFORE they reach the Receiver input then many more stations will be heard.

In practice the strength of the weak signals is increased by the use of resonant aerials, and the man-made static present in densely populated areas is reduced by using transposed lead-in wires.

### RESONANT AERIALS.

The use of resonant aerials on short waves is a practical proposition, since the wavelengths are small and aerials whose physical dimensions are $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, or a full wavelength long, do not occupy too much space. For example, a half-wave doublet tuned to 30 metres only requires a top span of 45 feet.

## SHORT WAVE AERIALS—continued.

### IMPEDANCE MATCH.

If an aerial of 400 ohms impedance is connected to a feeder line of equal value, no voltages will be impressed in the feeders. The maximum output from any generator is obtained when the impedance of the load equals the internal impedance of the generator. If an inverted "V" aerial has a terminating impedance of 400 ohms, the feeder line should have a corresponding value. Half-wave aerials have an extremely high impedance when measured across their ends, but by feeding the line near the centre the impedance is reduced to a few hundred ohms and maximum transference of energy will take place. The Receiver type R101, is so arranged that the aerials mentioned here can be successfully used.

### TYPES OF AERIALS.

There are two types of short **wave aerials :—**

(1) Non-resonant.

(2) Resonant.

In the first category there is the conventional Inverted L and T aerials, which are quite efficient, particularly in districts where little interference is present. Small space is required for their erection.

Where plenty of ground space is available and interference is negligible, the "Inverted V" aerial is suggested. This aerial has to be resonant on the desired wavelengths if maximum efficiency is desired.

For town and general use the Crossfeeder type of aerial with transposed lead-in is recommended, since not only is an improved short wave performance obtained, but interference due to man-made static is reduced.

### 1. "INVERTED L" OR "T" AERIAL.

This type of non-resonant aerial for general short wave reception is made about 60 feet long from the free end of the aerial to the set. The down-lead is kept well away from buildings and not allowed to run close to the wall of the house. In the case of the "T" aerial the down-lead should be taken from the centre and soldered. The best method of obtaining the down-lead for the "Inverted L" aerial is to continue the horizontal portion by securely twisting it at the insulator and so avoiding the necessity of making a soldered joint.



## SHORT WAVE AERIALS—continued.

### 2. CROSSFEEDER DOUBLET AERIAL.

The Crossfeeder Doublet is a static-free, large signal to noise ratio aerial. Basically, it is a form of Hertz aerial, and as such, the two top sections can be cut to a definite length to give maximum response at certain frequencies. The top section is cut to the length corresponding to a half-wavelength of the station which it is desired to receive consistently.

To cut the lengths A and B of figure 1 for any given frequency or wavelength, their combined length should be approximately one half of the wavelength of the desired station.

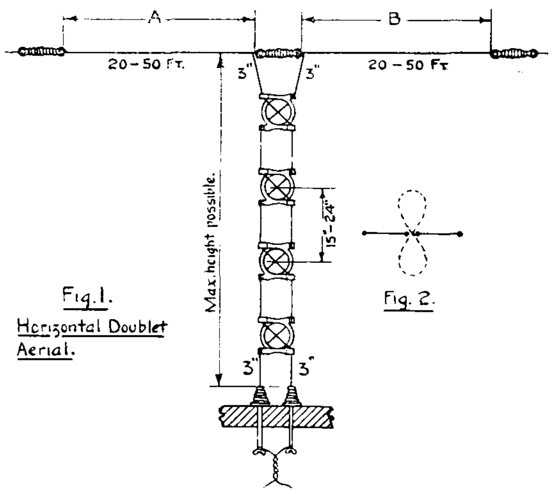


Fig. 1.
Horizontal Doublet Aerial.

Fig. 2.

**The formula for working out the length A + B for any given frequency is :**

$$(A + B) \text{ ft.} = \frac{468,000}{\text{kc/s.}}$$

Remembering that Frequency in kc/s. = Wavelength in metres × 300,000, it is easy to work out the length **required for** any given wavelength.

The length of feeder line from the receiver to the aerial should be not less than a quarter of a wavelength, i.e., greater than half (A + B). The inset, Fig. 2, shows the directional property of the doublet, the aerial receiving the most energy from a direction at right angles to its own plane.

## SHORT WAVE AERIALS—continued.

### 3. "INVERTED V" AERIAL.

When used on wavelengths above 25 metres the physical dimensions of this aerial become large and it has, therefore, become popular on lower wavelengths. It has the advantage of being semi-resonant over a wide waveband either side of the resonant frequency. For example, an aerial designed for 15 metres will give five times the performance of an ordinary aerial on this wavelength, on 20 metres a gain of three times, falling off gradually until about 40 metres, when no gain is obtained over the standard aerial systems.

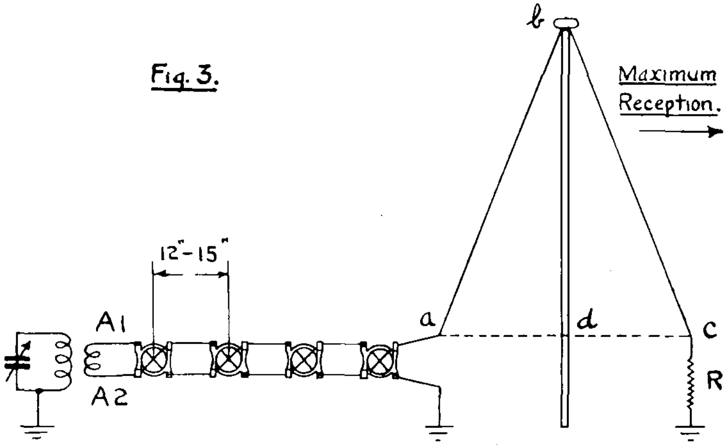


Fig. 3.

Figure 3 illustrates the aerial, which consists of a wooden pole (bd) with the aerial wires (ab) and (bc) forming two sides of an isosceles triangle (abc). The length (abc) is one continuous wire and the aerial is directional, receiving signals which are arriving parallel to the line joining the feeder and aerial in the direction nearest the matching resistance R. Resistance R should be about 400 ohms and of the non-inductive type. A metallised composition resistance is perfectly satisfactory but should be enclosed in a glass tube or waterproof box since it will be exposed to all kinds of weather. The earth lead should be fitted to the earth terminal of the receiver and the far end of the feeder line also earthed to the nearest point. 16 gauge wire is advised for the feeder line.



## SHORT WAVE AERIALS—continued.

**The length of wire (abc) should equal the length ac plus I wavelength, i.e.:**

$$abc = ac + \lambda$$

It is not advisable to make ab a wavelength long, as maximum signal to noise ratio occurs when ab or bc are an odd number of quarter wavelengths long. The correct length of the aerial wires for ab = bc = 3 quarter wavelengths as this enables the installation to be erected in a reasonably small space.

A simple all wave aerial, which can be coupled to the receiver without any form of matching transformer, is shown in figure 4. The dimensions given are for general short wave use.

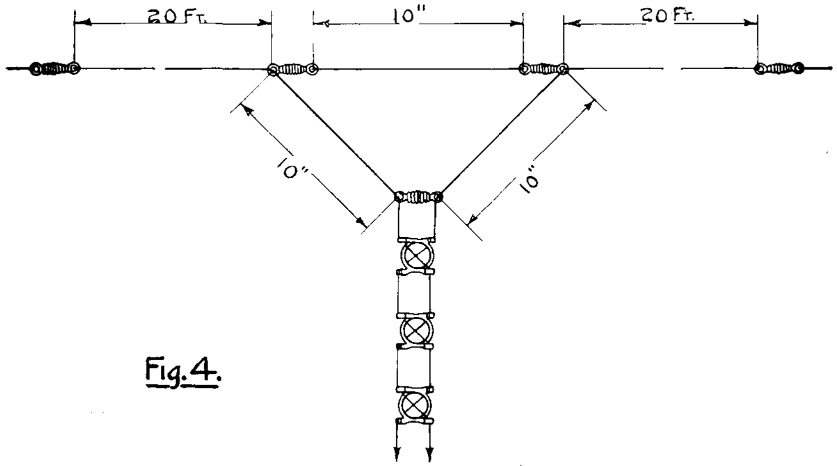


Fig. 4.

Both the "Inverted V" and *Doublet aerials are coupled magnetically* to the receiver by means of the coupling coil provided in each range, and the earth terminal of the receiver taken to earth proper. The lead-in must be duplicated in order to connect both the feeder lines to the receiver.