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# PART IV

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**COVER B**

# SECTION 3

# SECTION 3

## RECEIVERS

# SECTION 3

## RECEIVERS

LIST OF CHAPTERS

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## SECTION 3, CHAPTER 6

# RECEIVERS, TYPES R.1155. R.1155A. AND R.1155B

## Contents

## List of illustrations

| | |
|---|---|
| TYPE OF WAVE | C.W., M.C.W., and R.T. |
| FREQUENCY RANGE | 18 Mc/s. to 3 Mc/s. and 1·500 kc/s. to 75 kc/s. with gap between 600 kc/s. and 500 kc/s. |
| FREQUENCY STABILITY | Not applicable |
| CRYSTAL MULT. FACTOR | Not applicable |
| PERCENTAGE MODULATION | Not applicable |
| MAXIMUM SENSITIVITY | Input of 12 micro-volts at 210 kc/s. gives output in excess of 50 milliwatts Input of 6 micro-volts at 16 Mc/s. gives an equivalent output |
| SELECTIVITY | Approximately 4 kc/s. to 6 kc/s. total bandwidth for 6 db attenuation |
| OUTPUT IMPEDANCE | 5,000 ohms |
| AMPLIFIER CLASS | Not applicable |
| MICROPHONE TYPE | Not applicable |
| VALVES | Visual D/F switching, triode-hexodes, two V.R.99 (Stores Ref. 10E/277). |

Supplied by L.T. power unit used for T.1154 L.T. Input to unit, type 34, 10·8 v., 24 amp. D.C.; output, 7 v., 13 amp. D.C. and 217 v., 110 mA.

(Stores Ref. 10A/12245) or type 15 (Stores Ref. 10A/12247)

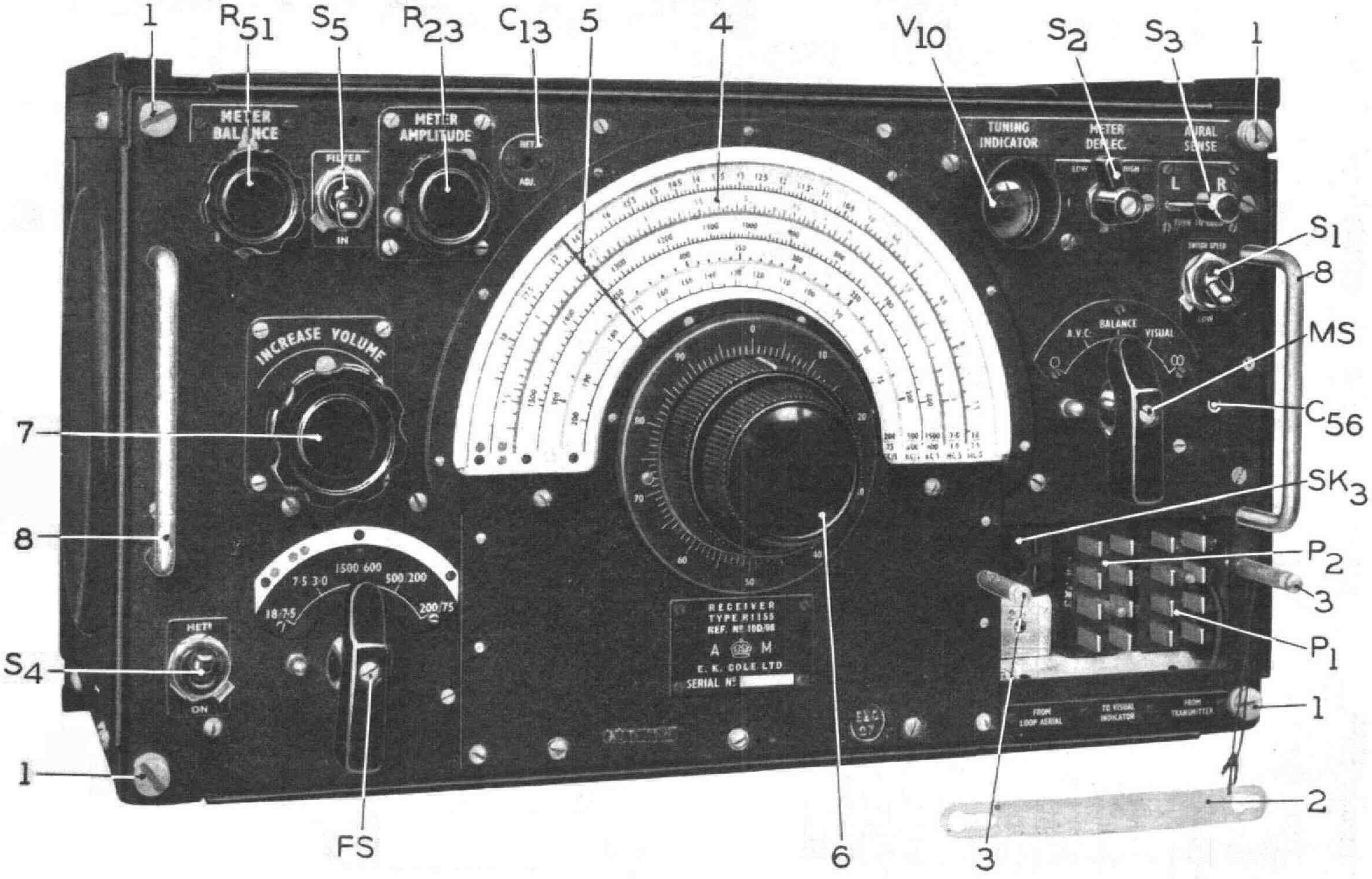



FIG. 1.—THE RECEIVER R.1155

# RECEIVERS, TYPES R.1155, R.1155A AND R.1155B

## INTRODUCTION

1. The receivers of the type R.1155 have been designed for use in aircraft in conjunction with transmitters of the T.1154 group described in Sect. 1, Chap. 7 of this publication. The receiver, type R.1155 (Stores Ref. 10D/98) is the parent type; the R.1155A (Stores Ref. 10D/820) and R.1155B (Stores Ref. 10D/13045) are equipped for employment in circumstances in which R.F. interference may be experienced. It is expected that, ultimately, the type R.1155A will become standardised and will incorporate the additional filter circuits of the R.1155B.

2. The receiver covers the bands of frequencies from 18·5 Mc/s to 3 Mc/s. and from 1,500 kc/s to 75 kc/s with a gap between 600 kc/s and 500 kc/s. The coverage is effected in five ranges:—

| | |
|---|---|
| RANGE 1 (H.F.) | 18·5 Mc/s to 7·5 Mc/s. |
| RANGE 2 (H.F.) | 7·5 Mc/s to 3·0 Mc/s. |
| RANGE 3 (M.F.) | 1,500 kc/s to 600 kc/s. |
| RANGE 4 (M.F.) | 500 kc/s to 200 kc/s. |
| RANGE 5 (M.F.) | 200 kc/s to 75 kc/s. |

Tuning is of the uni-control type, the scales appropriate to the RANGES being colour coded and, where applicable, the colour coding of the T.1154 RANGES is adopted. It should be noted that the term RANGES is used in this Chapter as a convenient method of avoiding repetition of the frequency bands. The receiver controls are not engraved with the term.

3. Provision is made for the reception of modulated and of unmodulated signals and, on D/F, or, in certain circumstances for communications, for direction-finding. The receiver is a D/F or communications receiver on the M.F. RANGES 3, 4 and 5 and a communications receiver on the H.F. RANGES 1 and 2. The determination of bearings in D/F and of "homing" course are made in conjunction with a visual indicator, type 1. Bearings may be taken aurally. Sense of bearings can be determined aurally or visually.

4. The receivers may be worked on either fixed or trailing aerials for communications and on a suitable loop aerial, such as the loop aerial, type 3, for D/F. Aerial switching is, however, interlocked with that of the associated transmitter, and an exterior common switching device, such as the aerial switching unit, type J, or an aerial plug board, is used. The fixed aerial is normally between 25 ft. and 65 ft. long overall, including the lead-in, 45 ft. being, approximately the optimum length. The trailing aerial is 200 ft. long. The D/F loop aerial, type 3, has a nominal inductance of 100 $\mu$ H and self-capacitance of 20 $\mu\mu$ F

5. The receiver uses ten valves and is based on a super-heterodyne circuit. The communications circuit has one R.F. stage, a frequency-changer stage, two intermediate frequency amplifier stages, a combined beat frequency oscillator (B.F.O.) and automatic volume control (A.V.C.) stage, with a combined second detector, visual meter limiter and output stage. The I.F. is 560 kc/s and the B.F.O. oscillator frequency is about 280 kc/s. A visual tuning indicator shows correct tuning. The D/F circuit arrangements incorporate a visual direction-finding system in which two triode hexode valves electronically switch the fixed aerial into phase and anti-phase, or 90 deg. lead or lag, relationship to the loop aerial at a pre-determined frequency. A meter switching valve synchronously switches the rectified output to a visual indicator, type 1. A limiter valve, already mentioned, automatically controls the input to the visual indicating meter.

6. The I.F. selectivity of the receiver is, approximately, 4 kc/s to 6 kc/s band width for an attenuation of 6 db. The two I.F. stages have either A.V.C. or manual gain control according to the position of a master switch. The sensitivity is such that the input of 12 microvolts at 210 kc/s gives an output in excess of 50 milliwatts and at 16 Mc/s an input of 6 microvolts has an equivalent output. A maximum working output of approximately 100 milliwatts is obtainable when working into a 5,000-ohm impedance.

7. The L.T. and H.T. power for the receiver, when airborne, is obtained from a rotary transformer power unit driven from the aircraft general electrical system. This power unit is also used for the supply of L.T. to the associated transmitter and may be the power unit, type 34 (nominal input D.C. 12 volts) or type 35 (nominal input D.C. 24 volts). Derived types of these units such as the type 34A, 34X and 35A may also be used. When utilized for ground training purposes it is customary to employ power units, type 114 or type 115 in conjunction with the 230-volt, 50 c/s A.C. mains. These units are described in Sect. 6, Chap. 18 of this publication.

8. The overall dimensions of the receiver are, approximately, 16$\frac{7}{16}$ in. by 9$\frac{3}{8}$ in. by 11$\frac{3}{8}$ in. The weight of the instrument, with valves, is 25 lb. 14 oz. The receiver R.1155 is shown in the illustration of fig. 1.

## GENERAL DESCRIPTION

9. A schematic diagram of the receiver is shown in fig. 2. A complete theoretical circuit diagram of the receivers R.1155, R.1155A, and R.1155B is given in fig. 3. The simplified communications circuit diagram in fig. 4, a simplified visual D/F circuit diagram in fig. 10 with the switching diagrams of figs. 11, 12 and 13, should materially assist towards an understanding of the circuits. The annotational references of fig. 3 have, as far as possible, been-preserved throughout the simplified diagrams.

10. Both the fixed aerial, F.Ae., and the trailing aerial T.Ae. are connected to the receiver *via* an exterior aerial switching device and the transmitter. The aerial switching is described in Sect. 1, Chap. 7, of this publication, in connexion with the transmitter T.1154. The correct aerials for reception on the H.T., M.F. or D/F RANGES are selected by a frequency range switch and a master selector switch. The trailing aerial is used on all M.F. RANGES, the fixed aerial being used for the H F. RANGES and also for SENSE determination on D/F. When the aerial selector switch is in the D/F position, ordinary reception may be obtained if desired.

11. The frequency range switch selects the five frequency RANGES. In this chapter it is designated as FS. The wafers associated with this switch are, for the purpose of clarity, dispersed on the theoretical circuit diagram of fig. 2 and for easier identification the annotation FS prefixes each wafer. The individual wafers are shown as "wf," "wr," "xf," "xr, "yf," "yr," "zf," and "zr," these references being included as subscripts to FS. Thus, the section "wr" of FS is annotated as "$FS_{wr}$." The "f" and "r" subscripts refer to "front" and "rear," respectively, of the wafer sections.

12. The general functions of the switch FS are to select the appropriate aerial (*see* para. 10), to select the correct RANGE coils of the grid and anode circuits, to select the correct grid and anode circuit oscillator coils and to regulate the grid bias for the R.F. amplifier, frequency-changer and I.F. stages on the H F. RANGES in order to preserve constant amplification. The individual wafers are "w," loop aerial input, "x," aerial to grid of R.F. valve, "y," anode of R.F. valve and "z," grid and anode coils of the oscillator of the frequency changer valve. These are shown, with contact details, on fig. 2.

13. The master selector, functional, or operational switch, is a five-position switch and is designated in this chapter as MS. The wafers are annotated in a manner similar to that described for the switch FS. These are the sections "af," "ar," "bf," "br," "cf," "cr," "df," "ef" and "er," shown on fig. 2. The section "a" controls visual meter, manual and A.V.C. volume control switching, section "b" switches the fixed and trailing aerial circuits with M.F. biasing, section "c" is associated with the L.F. switching valve used for D/F, section "d" deals with the communications aerial input and section "e" switches loop and dummy aerial, the latter for circuit balancing purposes.

14. The five positions of the switch MS are:—

(i) OMNI (⊙) or plain reception. The gain of the R.F. amplifier, frequency-changer and I.F. stages is controlled, manually, by a potentiometer $R_{8(1)}$, the A.V.C. being out of circuit.

(ii) A.V.C. This position gives A.V.C. with the manual control of the A.F. input to the output stage by means of a potentiometer $R_{8(2)}$.

(iii) BALANCE (for visual D/F). This is for the purpose of matching the circuits and valves $V_1$ and $V_2$ associated with the visual indicator.

(iv) VISUAL D/F. The twin needle indicator and associated circuits, including valves $V_1$, $V_2$ and $V_9$ are switched into circuit. In this position A.V.C. is provided.

(v) FIGURE-OF-EIGHT (∞) which represents aural D/F. In this position bearings can be taken on aural "nulls" (zero signals), using a hand-switch $S_3$ for the determination of sense. The R.F. gain is manually controlled, A.V.C. being disconnected.

### The communications circuit, R.1155

15. Referring to the schematic diagram of fig. 2, it will be seen that the communications circuit commences at the R.F. amplifier valve $V_3$, the valves $V_1$ and $V_2$ being used for visual switching in the D/F circuit. The valve $V_3$ is an aligned grid variable-mu pentode and, in the simplified communications circuit diagram of fig. 4, it is shown as the basis of a R.F. amplifier stage.

16. Before studying the main circuit in fig. 3, it is desirable to understand the plug and socket arrangements of the receiver and the connexions to the various points. Looking at the front panel of the instrument, the socket $P_3$ is engraved FROM LOOP AERIAL, the central plug $P_2$ TO VISUAL INDICATOR and the right-hand plug $P_1$ FROM TRANSMITTER.

17. The Table A overleaf gives the connexions to the individual points of the plugs and socket. The style of connector cable with its end connexions, is also set out. The first plug, or socket, mentioned is that which is connected to the receiver.

18. The aerial is capacitatively coupled to the grid circuit of the R.F. amplifier valve $V_3$. A condenser $C_{100}$ is in the trailing aerial (T.Ae) circuit and a condenser $C_{102}$ does similar service in the fixed aerial (F.Ae) circuit.

19. For convenience in studying the theoretical circuit diagram of fig. 3, a complete coil and choke table is given as an Appendix I to this chapter. The inductance values of the various components are included in this Appendix.

20. The trailing aerial is connected through the switch section $MS_{bf}$, the condenser $C_{100}$, switch sections $MS_{df}$ and $FS_{xr}$ to the coils $L_4$, $L_5$ or $L_6$, the aerial coils for the M.F. RANGES 3, 4 or 5, whence *via* the switch section $FS_{xr}$ connexion is made to a variable condenser $C_{84}$ and the control grid of the variable-mu pentode valve $V_3$. The variable-mu characteristic permits control of volume by means of grid bias variation and full automatic volume control can be applied without distortion on normal signals. The valve $V_3$ is actually tetrode connected.

21. The fixed aerial is connected through the switch section $MS_{bf}$, condenser $C_{102}$, sections $MS_{df}$, $FS_{xf}$ and the H.F. RANGES 1 or 2, coils $L_2$ and $L_3$, through switch $FS_{xr}$ to the control grid of $V_3$. These coils are also tuned by the condenser $C_{84}$ which forms part of a ganged assembly including an anode circuit tuning condenser $C_{83}$ and an oscillator circuit condenser $C_{82}$.

22. The resistances $R_{62}$ and $R_{63}$ in series across the fixed and trailing aerials, are joined to earth at their junction. These resistances afford a drain path for static charges. A condenser $C_{40}$ is a blocking condenser enabling the moving vanes of the tuning condenser $C_{84}$ to be earthed and is, together with a resistance $R_{45}$, part of the A.V.C. system (*see* paras. 43 to 49). Small trimmer condensers are connected across the coils and their tuning condenser $C_{84}$. These are the condensers $C_{61}$ (with a fixed condenser $C_{110}$ in parallel) for $L_2$, $C_{60}$ for $L_3$, $C_{59}$ for $L_4$, $C_{58}$ for $L_5$ and $C_{57}$ for $L_6$.

23. The screen grid voltage for $V_3$ is decoupled by a resistance $R_{43}$ forming part of a virtual potentiometer composed of $R_{43}$, $R_{44}$ and $R_1$. A condenser $C_{95}$, in conjunction with another condenser $C_{39}$, by-passes the circuit to earth. The resistance $R_1$ is by-passed by a condenser $C_1$. The earth is tapped in at a positive point across the H.T. supply. Bias for the control grid of the valve $V_3$ is obtained from a resistance network in the A.V.C. circuit (*see* paras. 43 to 49). The cathode is not automatically biased by a resistance but the A.V.C. resistance network is returned to a point 3·6 volts negative with respect to the cathode. This point is taken from the junction of resistances $R_3$ and $R_4$ in series and parallel with $R_1$ and it provides for standing bias on $V_3$ during no-signal periods.

| VALVE TYPES | | | | | | | |
|---|---|---|---|---|---|---|---|
| V1 | VR 99 | V4 | VR 99 | V7 | VR.101 | V10 | VI 103 |
| V2 | VR 99 | V5 | VR.100 | V8 | VR.101 | | |
| V3 | VR 100 | V6 | VR 100 | V9 | VR 102 | | |

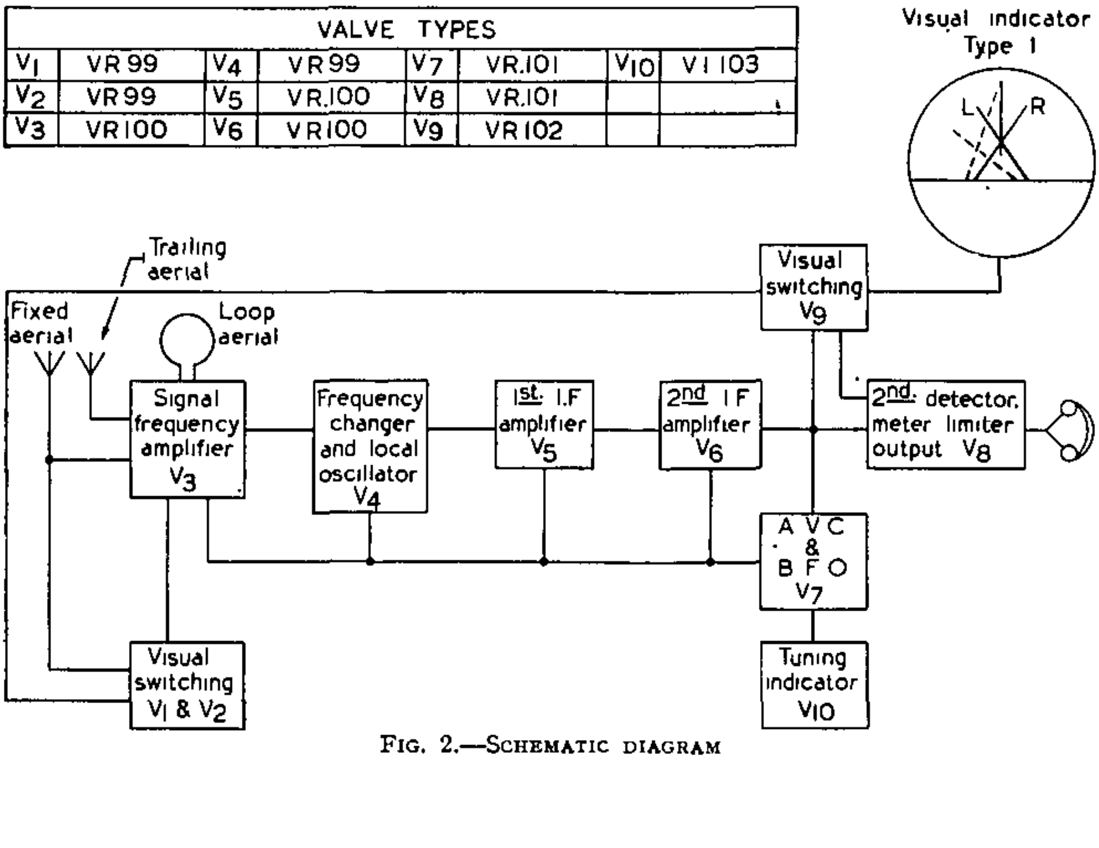



FIG. 2.—SCHEMATIC DIAGRAM

TABLE A

## PLUGS, SOCKET AND CONNECTORS FOR R.1155

### SINGLE RECEIVER WITH VISUAL INDICATOR, TYPE 1

| Points | SOCKET $P_3$ FROM LOOP AERIAL | | PLUG $P_2$ TO VISUAL INDICATOR | PLUG $P_1$ FROM TRANSMITTER |
|---|---|---|---|---|
| 1 | — | | To V.I. terminal A (GREEN) | F.Ae. (H.F. RANGES) |
| 2 | — | | To V.I. terminal D (RED) | T.Ae. (H.F. RANGES) |
| 3 | — | | To V.I. terminals B, C (BLUE) | L.T.+ |
| 4 | — | | To V.I. screening earth | L T — and screen earth |
| 5 | — | | | H.T.+ through interlock |
| 6 | — | | | Telephone+ |
| 7 | — | | WHEN TWO INDICATORS FITTED | H.T.+ 220–v. |
| 8 | — | Points | | H.T.– |
| 13 | Earth | 1 | To V.I. terminal A (Green) | — |
| 14 | Earth | 2 | To V.I. terminal D (Red) | — |
| 15 | $MS_{ef}$ contact 5 and loop | 3 | To V.I. terminal F (Blue) | — |
| 16 | $MS_{ef}$ contact 11 and loop | 4 | To V.I. screening earth | — |
| | CONNECTOR<br>Plug, type 209<br>Dulocapmet No. 1<br>Socket, type 63 or Cable end eye (to matching unit). | | CONNECTOR<br>Socket, type 137<br>Trimet 4<br>Cable end eye | CONNECTOR<br>Socket, type 137<br>Octocoremet No. 2<br>Plug, type 210 |

### SINGLE RECEIVER WITH TWO VISUAL INDICATORS

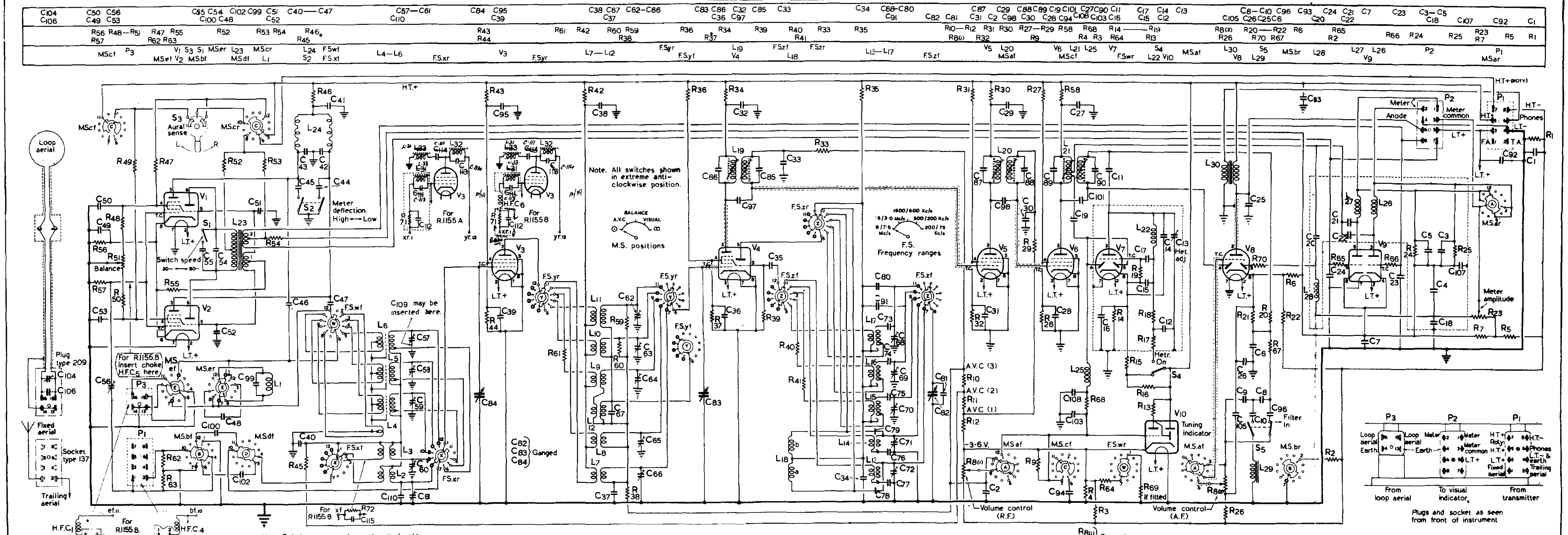
As above

As above but with, additionally:
CONNECTOR
Between visual indicators
Cable end eye,
Trimet 4,
Cable end eye
TERMINAL CONNEXIONS

| First V.I. | Colour | Second V.I. |
|---|---|---|
| B | Green | A |
| C | Red | D |
| F | Blue | BC |

### TWO RECEIVERS (ONE NAVIGATOR-OPERATED) WITH 2 INDICATORS
### W.T. OPERATOR RECEIVER

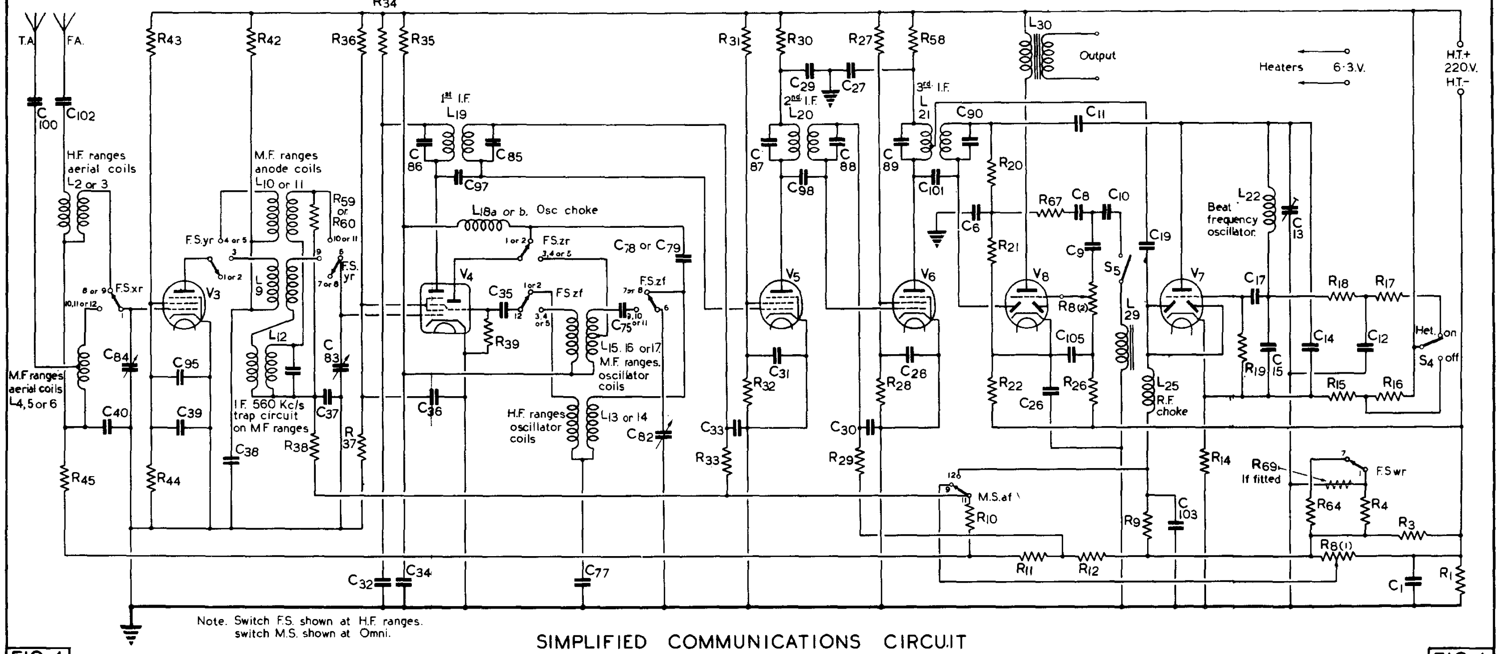
| Socket $P_3$ | Plug $P_2$ | Plug $P_1$ |
|---|---|---|
| DUMMY SOCKET BLOCK INSERTED | | As above |
| | | CONNECTOR<br>As above |




Note. Switch contacts shown thus o, denote front (f) & rear (r) contacts connected
Important. In order to avoid excessive crossing of connecting wires certain switch wafers have been duplicated.

# R.1155, R.1155A AND R.1155B, CIRCUIT DIAGRAM

FIG. 3




Note. Switch F.S. shown at H.F. ranges, switch M.S. shown at Omni.

SIMPLIFIED COMMUNICATIONS CIRCUIT

FIG. 4

This table should be read in conjunction with fig. 3

COMPONENT LIST FOR R.1155, R.1155A AND R.1155B

CONDENSERS

| Annotation | Value | Stores Ref | Type |
|---|---|---|---|
| $C_{1}$* | 2·5μF | 10C/960 | 892 |
| $C_{2}$ | 2 × 0·1μF | 10C/961 or | 893 |
| | | 10C/3399 | 1662 |
| $C_{3}$† | 2·5μF | 10C/962 | 894 |
| $C_{4}$† | 10μF | | |
| $C_{5}$† | 25μF | | |
| $C_{6}$ | 0·0001μF | 10C/963 or | 895 |
| | | 10C/2155 | 995 |
| $C_{7}$ | 0·005μF | 10C/964 | 896 |
| | | 10C/4256 | 2201 |
| $C_{8}$ | 0·001μF | 10C/965 | 897 |
| $C_{9}$ | 0·001μF | 10C/965 | 897 |
| $C_{10}$ | 0·004μF | 10C/966 | 898 |
| $C_{11}$ | 0·0001μF | 10C/963 or | 895 |
| | | 10C/2155 | 995 |
| $C_{12}$ | 0·1μF | 10C/967 | 899 |
| $C_{13}$ | 75μμF | 10C/968 | 900 |
| | | (1st 1,000) | |
| | 60μμF | 10C/3129 | 1525 |
| | | (after) | |
| $C_{14}$ | 1,600μμF | 10C/969 | 901 |
| | | (2 off) | |
| $C_{15}$ | 4,550μμF | 10C/2005 | 917 |
| $C_{16}$ | 0·5μF | 10C/970 or | 902 |
| | | 10C/3401 | 1664 |
| $C_{17}$ | 0·0001μF | 10C/2006 | 918 |
| $C_{18}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{19}$ | 0·001μF | 10C/651 | 782 |
| $C_{20}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{21}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{22}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{23}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{24}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{25}$ | 0·001μF | 10C/651 | 782 |
| $C_{26}$ | 0·1μF | 10C/961 | 893 |
| $C_{27}$ | 0·1μF | or | |
| $C_{28}$ | 0·1μF | 10C/3399 | 1662 |
| $C_{29}$ | 0·1μF | 10C/961 | 893 |
| $C_{30}$ | 0·1μF | or | |
| $C_{31}$ | 0·1μF | 10C/3399 | 1662 |
| $C_{32}$ | 0·1μF | 10C/961 or | 893 |
| $C_{33}$ | 0·1μF | 10C/3399 | 1662 |
| | | with $C_{36}$ | |
| $C_{34}$ | 0·1μF | 10C/967 | 899 |
| $C_{35}$ | 0·0002μF | 10C/972 or | 904 |
| | | 10C/2719 | 1322 |
| $C_{36}$ | 0·1μF | with $C_{32}$, $C_{33}$ | |
| $C_{37}$ | 0·1μF | 10C/967 | 899 |
| $C_{38}$ | 0·1μF | 10C/967 | 899 |
| $C_{39}$ | 0·1μF | 10C/3399 | 893 |
| $C_{40}$ | 0·1μF | 10C/967 | 899 |
| $C_{41}$ | 0·1μF | with $C_{49}$, $C_{50}$ | |
| $C_{42}$ | 25μμF | 10C/2007 | 919 |
| $C_{43}$ | 25μμF | 10C/2007 | 919 |
| $C_{44}$ | 240μμF | 10C/2008 | 920 |
| $C_{45}$ | 240μμF | 10C/2008 | 920 |
| $C_{46}$ | 80μμF | 10C/2009 | 921 |
| $C_{47}$ | 80μμF | 10C/2009 | 921 |
| $C_{48}$ | 200μμF | 10C/2010 | 922 |
| $C_{49}$ | 0·1μF | 10C/961 or | 893 |
| $C_{50}$ | 0·1μF | 10C/3399 | 1662 |
| | | with $C_{41}$ | |

| Annotation | Value | Stores Ref. | Type |
|---|---|---|---|
| $C_{51}$ | 0·1μF | 10C/961 | 893 |
| $C_{52}$ | 0·1μF | or | |
| $C_{53}$ | 0·1μF | 10C/3399 | 1662 |
| $C_{54}$ | 0·04μF | 10C/973 or | 905 |
| | | 10C/4257 | 2202 |
| $C_{55}$ | 0·5μF | 10C/970 or | 902 |
| | | 10C/3401 | 1664 |
| | max. | | |
| $C_{56}$ | 8–115μμF or | 10C/974 or | 906 |
| | 8–105μμF | 10C/3402 | 1665 |
| $C_{57}$ | 4–40μμF | | |
| $C_{58}$ | 4–40μμF | | |
| $C_{59}$ | 4–40μμF | 10C/3173 | Unit |
| $C_{60}$ | 4–40μμF | | type 34 |
| $C_{61}$ | 4–40μμF | | |
| $C_{62}$ | 4–40μμF | | |
| $C_{63}$ | 4–40μμF | | |
| $C_{64}$ | 4–40μμF | 10C/3173 | Unit |
| $C_{65}$ | 4–40μμF | | type 34 |
| $C_{66}$ | 4–40μμF | | |
| $C_{67}$ | 2,000μμF | 10C/2011 | 923 |
| $C_{68}$ | | | Unit |
| $C_{69}$ | 4–40μμF | 10C/3174 | type 35 |
| $C_{70}$ | | | |
| $C_{71}$ | 5–40μμF | 10C/976 | 908 |
| $C_{72}$ | 5–40μμF | 10C/976 | 908 |
| $C_{73}$ | 93μμF | 10C/2012 | 924 |
| $C_{74}$ | 255μμF | 10C/2013 | 925 |
| $C_{75}$ | 537μμF | 10C/2014 | 926 |
| $C_{76}$ | 1,670μμF | 10C/2015 | 927 |
| $C_{77}$ | 6,170μμF | 10C/2016 | 928 |
| $C_{78}$ | 20μμF | 10C/10948 | 429 |
| $C_{79}$ | 15μμF | 10C/978 | 910 |
| | 10μμF | 10C/977 | 909 |
| $C_{80}$ | | (1st 1,000) | |
| | 25μμF | 10C/3027 | 1439 |
| | | (after) | |
| $C_{81}$ | 15-cms. | 10C/978 | 910 |
| $C_{82}$ | Ganged | 10C 584 | 770 |
| $C_{83}$ | tuner | (1st 1,000) | |
| $C_{84}$ | | 10C/3028 | 1440 |
| | | (after) | |
| $C_{85}$ | 300μμF | 10C/2017 | 929 |
| $C_{86}$ | 300μμF | 10C/2017 | 929 |
| $C_{87}$ | 300μμF | 10C/2017 | 929 |
| $C_{88}$ | 300μμF | 10C/2017 | 929 |
| $C_{89}$ | 600μμF | 10C/971 | 903 |
| $C_{90}$ | 300μμF | 10C/2017 | 929 |
| $C_{91}$ | 40μμF | 10C/853 | 858 |
| $C_{92}$* | 2·5μF | 10C/960 | 892 |
| $C_{93}$ | 4·0μF | 10C/979 | 911 |
| $C_{94}$* | 1·0μF | 10C/960 | 892 |
| $C_{95}$ | 0·5μF | 10C/970 or | 902 |
| | | 10C/3401 | 1664 |
| $C_{96}$ | 0·02μF | 10C/2000 or | 912 |
| | | 10C/4258 | 2203 |
| $C_{97}$ | 2μμF | 10C/2001 | 913 |
| $C_{98}$ | 2μμF | 10C/2001 | 913 |
| $C_{99}$ | 100μμF | 10C/2006 | 918 |
| $C_{100}$ | 200μμF | 10C/2010 | 922 |
| $C_{101}$ | 4μμF | 10C/2002 | 914 |
| $C_{102}$ | 0·001μF | 10C/651 | 782 |
| $C_{103}$ | 0·005μF | 10C/964 or | 896 |
| | | 10C/4256 | 2201 |
| $C_{104}$ | 75μμF. var. | 10C/968 | 900 |
| $C_{105}$ | 0·1μF. | 10C/2003 | 915 |
| $C_{106}$ | 65μμF | 10C/2649 | 1265 |
| $C_{107}$ | 0·1μF | 10C/2003 | 915 |

| Annotation | Value | Stores Ref. | Type | Annotation | Value | Stores Ref. | Type |
|---|---|---|---|---|---|---|---|
| $C_{108}$ | 0·0002µF | 10C/972 or | 904 | $C_{111}$‖ | 160µµF | 10C/4923 | 2613 |
| | | 10C/2719 | 1322 | $C_{112}$‖ | 30µµF | 10C/4922 | 2612 |
| $C_{109}$‡ | 10 cms. | | | $C_{113}$‖ | 160µµF | 10C/4923 | 2613 |
| $C_{110}$ | 40µµF | 10C/853 | 858 | $C_{114}$‖ | 8µµF | 10C/3860 | 1949 |

NOTES

* $C_1 + C_{92} + C_{94}$ Block    † $C_3 + C_4 + C_5$ Block    ‡ In early receivers    ‖ In R.1155A and R.1155B

RESISTANCES

| Annotation | Value in ohms | Stores Ref. No. | Type | Annotation | Value in ohms | Stores Ref. No. | Type |
|---|---|---|---|---|---|---|---|
| $R_1$ | 2,000 or | 10C/1001 | 1,001 | $R_{37}$ | 22,000 | 10C/1010 | 1,010 |
| | 4,700 | | | $R_{38}$ | 100,000 | 10C/993 | 993 |
| $R_2$ | 1,200 | 10C/1002 | 1,002 | $R_{39}$ | 56,000 | 10C/1008 | 1,008 |
| $R_3$ | 1,200 | 10C/1002 | 1,002 | $R_{40}$ | 1,500 | 10C/1082 | 1,082 |
| $R_4$ | 120 | 10C/1003 | 1,003 | $R_{41}$ | 1,500 | 10C/1082 | 1,082 |
| $R_5$ | 1,000 | 10C/11667 | 500 | $R_{42}$ | 2,200 | 10C/691 | 875 |
| $R_6$ | 1,500 | 10C/124 | 592 | $R_{43}$ | 27,000 | 10C/1006 | 1,006 |
| $R_7$ | 270 | 10C/1505 | 1,505 | $R_{44}$ | 22,000 | 10C/1010 | 1,010 |
| $R_8(1)$ | 50,000 | 10C/1000 | 1,000 | $R_{45}$ | 100,000 | 10C/993 | 993 |
| $R_8(2)$ | 500,000 | dual pot. | | $R_{46}$ | 1,500 | 10C/1082 | 1,082 |
| $R_9$ | 2 M | 10C/1004 | 1,004 | $R_{47}$ | 27,000 | 10C/1006 | 1,006 |
| $R_{10}$ | 150,000 | 10C/11382 | 478 | $R_{48}$ | 6,800 or | 10C/991 | 991 |
| $R_{11}$ | 150,000 | 10C/11382 | 478 | | 3,300 | 10C/1464 | 1,464 |
| $R_{12}$ | 27,000 | 10C/1005 | 1,005 | $R_{49}$ | 27,000 | 10C/1006 | 1,006 |
| $R_{13}$ | 1 M | 10C/11384 | 480 | $R_{50}$ | 6,800 or | 10C/991 | 991 |
| $R_{14}$ | 1,000 | 10C/11667 | 500 | | 3,300 | 10C/1464 | 1,464 |
| $R_{15}$ | 30,000 | 10C/1007 | 1,007 | $R_{51}$ | 20,000 pot | 10C/999 | 999 |
| $R_{16}$ | 27,000 | 10C/1006 | 1,006 | $R_{52}$ | 6,800 | 10C/991 | 991 |
| $R_{17}$ | 1,500 | 10C/1082 | 1,082 | $R_{53}$ | 560,000 | 10C/992 | 992 |
| $R_{18}$ | 10,000 | 10C/777 | 906 | $R_{54}$ | 56,000 | 10C/1008 | 1,008 |
| $R_{19}$ | 56,000 | 10C/1008 | 1,008 | $R_{55}$ | 56,000 | 10C/1008 | 1,008 |
| $R_{20}$ | 56,000 | 10C/1008 | 1,008 | $R_{56}$ | 240 | 10C/995 | 995 |
| $R_{21}$ | 470,000 | 10C/989 | 989 | $R_{57}$ | 560,000 | 10C/992 | 992 |
| $R_{22}$ | 1,000 | 10C/11667 | 500 | $R_{58}$ | 2,200 | 10C/691 | 875 |
| $R_{23}$ | 20,000 | 10C/998 | 998 | $R_{59}$ | 220,000 | 10C/648 | 855 |
| | (min. 6,000) | | | $R_{60}$ | 220,000 | 10C/648 | 855 |
| $R_{24}$ | 22,000 | 10C/1010 | 1,010 | $R_{61}$ | 1,200 | 10C/1081 | 1,081 |
| $R_{25}$ | 22,000 | 10C/1010 | 1,010 | $R_{62}$ | 2·2 M | 10C/996 | 996 |
| $R_{26}$ | 100,000 | 10C/993 | 993 | $R_{63}$ | 2·2 M | 10C/996 | 996 |
| $R_{27}$ | 27,000 | 10C/1006 | 1,006 | $R_{64}$ | 200 or | 10C/1634 | 1,634 |
| $R_{28}$ | 22,000 | 10C/1010 | 1,010 | | 100 | 10C/2006 | 918 |
| $R_{29}$ | 100,000 | 10C/993 | 993 | $R_{65}$ | 10,000 | 10C/11671 | 505 |
| $R_{30}$ | 2,200 | 10C/691 | 875 | $R_{66}$ | 10,000 | 10C/11671 | 505 |
| $R_{31}$ | 27,000 | 10C/1006 | 1,006 | $R_{67}$ | 22,000 | 10C/1278 or | 1,278 |
| $R_{32}$ | 22,000 | 10C/1010 | 1,010 | | | 10C/1010 | 1,010 |
| $R_{33}$ | 100,000 | 10C/993 | 993 | $R_{68}$ | 56,000 | 10C/1008 | 1,008 |
| $R_{34}$ | 2,200 | 10C/691 | 875 | $R_{69}$ | 100 | 10C/2006 | 918 |
| $R_{35}$ | 22,000 | 10C/1010 | 1,010 | $R_{70}$ | 1,000 | 10C/11667 | 500 |
| $R_{36}$ | 27,000 | 10C/1006 | 1,006 | $R_{71}$* | 150,000 | | |

NOTES

$R_1$ normally 2,000 ohms but in certain receivers 4,700 ohms.

$R_{64}$ is 100 ohms if $R_{69}$ (100 ohms) fitted.

$R_{48}$, $R_{50}$ are 6,800 ohms but in certain receivers 3,300 ohms.

* In R.1155A and R.1155B.

TABLE A—(*Contd.*)

NAVIGATOR-OPERATED RECEIVER

| SOCKET $P_3$ | PLUG $P_2$ | PLUG $P_1$ |
|---|---|---|
| Points and connector detail as for single receiver (above) | | CONNECTOR<br>Socket, type 299<br>Dumet 7 (to power unit)<br>Plug, type 336<br>Ducel 4 (to telephones)<br>Terminal block B (2-way)<br>Unicel 4 (to aerial)<br>Cable end eye |

The connexion points are numbered in accordance with the above table and are shown, as viewed from the back, in fig. 3.

24. The incorporation, before the frequency-changer, of the R.F. amplifier stage, represented by the valve $V_3$ and its associated circuits, leads to an increase in the signal-to-noise ratio and to an improved image ratio or suppression of second channel interference. It also prevents the frequency-changer from overloading and obviates any tendency to cross modulation which would otherwise develop.

25. The anode circuit of the valve $V_3$ is inductively coupled to the grid circuit of a frequency-changer valve $V_4$. Operation of the switch FS, through its section $FS_{yr}$, brings into the anode circuit of $V_3$ and the grid circuit of the valve $V_4$, one of the RANGE coils $L_7$, $L_8$, $L_9$, $L_{10}$ or $L_{11}$, which are R.F. transformers tuned in their secondary circuits by a condenser $C_{83}$ forming part of the three-ganged assembly with $C_{82}$ and $C_{84}$. The use of a tuned secondary circuit brings about a greater stage gain with increased stability and is generally preferred to a circuit in which a tuned primary is used.

26. The grid circuit coils of the assemblies $L_7$, $L_8$, $L_9$, $L_{10}$ and $L_{11}$ are, further, "trimmed" by variable condensers $C_{66}$, $C_{65}$, $C_{64}$, $C_{63}$ and $C_{62}$. The M.F. RANGES 3, 4 and 5 are also equipped with an accurately adjusted common rejector circuit consisting of a coil $L_{12}$ and a fixed condenser $C_{67}$. This combination constitutes a frequency filter tuned to the I.F. of 560 kc/s. The circuit eliminates the possibility of instability due to I.F. feedback *via* the circuits of $V_3$ either at the low frequency end of RANGE 3 or at the high frequency end of RANGE 4.

27. In the absence of the filter circuit $L_{12}$ and $C_{67}$, should the impedance of the tuned grid circuits of $L_9$, $L_{10}$ or $L_{11}$ become appreciably near, or actually equal to, that of the I.F., feedback might occur, either due to the direct influence of the stray field in the circuit itself, or by the amplification of the valve $V_3$. The inclusion of the circuit of $L_{12}$ and $C_{67}$ causes the impedance of the grid circuit of the valve $V_4$ to fall very sharply at the I.F. thereby preventing feedback due to either of the causes mentioned above.

28. The valve $V_4$ is a triode hexode and combines the functions of a first detector and a R.F. oscillator. The incoming signal frequency, amplified by the stage $V_3$, is admitted at the signal grid of the hexode portion of $V_4$. The screen grids are internally joined and form a screening electrode for the internal injector grid which is directly connected to the grid of the triode portion of $V_4$. The triode portion is the R.F. oscillator and this functions at a frequency which is, at all times, greater than the signal frequency by 560 kc/s. The signal and oscillator frequencies are "mixed" electronically within the valve $V_4$ and the resultant differeuce frequency of 560 kc/s appears in the anode circuit of the hexode portion. A complete theoretical discussion of the super-heterodyne principles can be found in Chapter XI of A.P.*1093*.

29. The screen grid of the valve $V_4$ derives its H.T. voltage through a resistance $R_{36}$ which forms part of a potentiometer composed of $R_{36}$, $R_{37}$ and $R_1$ across the supply. The condenser $C_{36}$ serves to decouple the circuit from the common cathode; which is at earth potential. A grid condenser for the triode, or oscillator portion, is $C_{35}$ and a resistance $R_{39}$ is a grid leak. The oscillator circuit consists of a tuned anode circuit loosely coupled to an untuned grid circuit. The grid circuit is switched, according to the RANGE, by the switch section $FS_{zf}$ and embraces the primary windings of the transformers $L_{13}$, $L_{14}$, $L_{15}$, $L_{16}$ or $L_{17}$. A condenser $C_{37}$ is a blocking condenser and a resistance $R_{38}$ a decoupler. These components are the counterpart of $C_{40}$ and $R_{45}$ mentioned in para. 22.

30. The oscillator anode circuit, switched by the switch sections $FS_{zr}$ and $FS_{zf}$, consists of the secondary windings of $L_{13}$ $L_{14}$, $L_{15}$, $L_{16}$ or $L_{17}$, all of which are tuned by a condenser $C_{82}$. On the RANGES 3, 4 and 5 the anode is tap connected, through the switch section $FS_{zr}$, from the secondary of the coil $L_{15}$, $L_{16}$ or $L_{17}$ whilst on RANGES 1 and 2 the anode is coupled through separate small R.F. choke coils $L_{18a}$ or $L_{18b}$. The choke coils are of such a value and arrangement that, with the stray capacitance across them, they resonate at a frequency just below the lowest frequency in their respective bands.

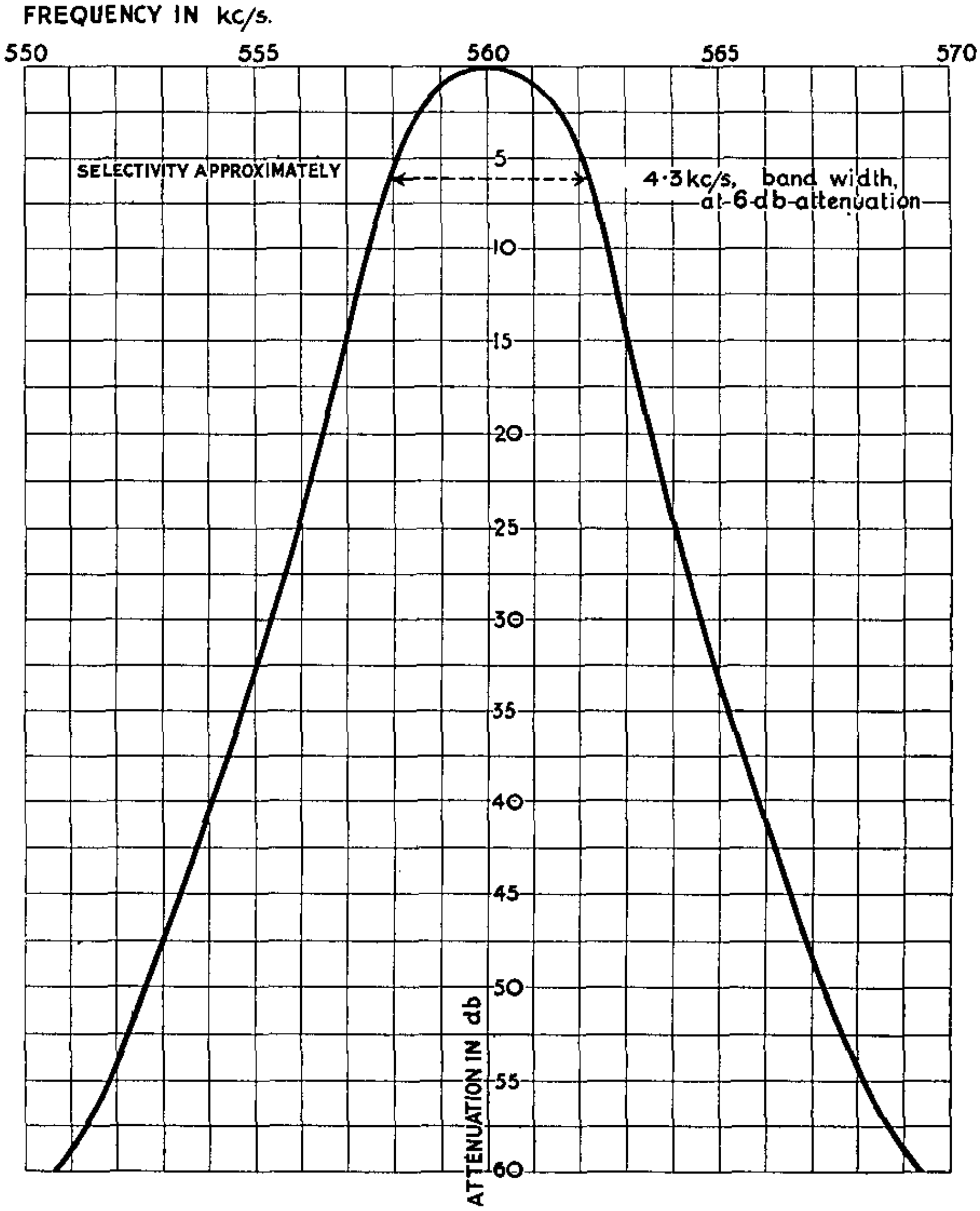



FIG. 5.—I.F. RESPONSE CURVE

31. The combination of $L_{18a}$ or $L_{18b}$, with the condensers $C_{78}$ or $C_{79}$, provides for the maintenance of the correct coupling between the anode and the tuned circuit throughout the frequency band. The design of the circuit is calculated to give a high degree of frequency stability on the H.F. RANGES, particularly in the obviation of initial frequency drift due to changes in valve constants either during the heating-up process or caused by replacements. There is, in consequence, a greater retention of calibration accuracy than in more conventional circuit arrangements.

32. Stability is materially assisted in the oscillator circuits also, by the incorporation of fixed condensers, which, in conjunction with trimmer condensers, keep the oscillator tuning at a constant difference from the incoming signal tuning circuits. These condensers are identified as $C_{77}$, $C_{78}$,

$C_{75}$, $C_{74}$ and $C_{73}$ and they decrease the maximum capacitance of the tuning condenser $C_{82}$. The absolute minimum capacitance of $C_{82}$ is determined by the small fixed condenser $C_{81}$ which is effective over all RANGES; pre-set trimmer condensers $C_{68}$ to $C_{72}$ determine the lower limits for each RANGE. A condenser $C_{34}$ is a R.F. by-pass or decoupler for all RANGES.

33. The receiver includes two stages of I.F. amplification employing three band-pass coupling units. The peaked nature of these coupling units is shown in the response curve of fig. 5, the selectivity of the I.F. circuits being of the order of a bandwidth of from 4 kc/s to 6 kc/s for an attenuation of 6 db, and about 8·5 kc/s bandwidth for an attenuation of 20 db. Very little mutual inductive coupling exists between the tuned circuits of the band-pass units, the coupling being effected by the small condensers $C_{97}$, $C_{98}$ and $C_{101}$. The coils are adjusted to the I.F. of 560 kc/s by means of dust-iron cores, there being no adjustable capacitance across the coils.

34. The anode of the hexode portion of the valve $V_4$ is joined to the primary of the 1st I.F. transformer $L_{19}$, the connexion to the H.T. positive being made from the opposite end of the primary winding through a decoupler resistance $R_{34}$. The circuit is decoupled by a condenser $C_{32}$. A fixed condenser $C_{86}$ is across the primary winding of $L_{19}$, $C_{85}$ occupying a similar position for the secondary winding. The I.F. transformer is by-passed to earth through a condenser $C_{33}$ and decoupled for biasing purposes, by a resistance $R_{33}$.

35. The I.F. amplifier valves $V_5$ and $V_6$ are aligned grid variable-mu pentodes. The I.F. transformer units between $V_5$ and $V_6$ and between $V_6$ and the subsequent stage $V_8$ are similar to that of the $V_4$–$V_5$ stage. The second I.F. unit comprises the primary and secondary windings of $L_{20}$ with the coupling condenser $C_{98}$ and the fixed condensers $C_{87}$ and $C_{88}$. The third I.F. unit is composed of $L_{21}$, a coupling condenser $C_{101}$ and the fixed condensers $C_{89}$ and $C_{90}$.

36. The output from the I.F. amplifier valve $V_6$ which passes through the I.F. transformer unit $L_{21}$, is taken to one diode of an indirectly-heated double diode triode common cathode valve $V_8$. The diode acts as a second detector, the triode section functioning as the output valve. Another function of the valve $V_8$ will be dealt with later in this chapter (*see* para. 59).

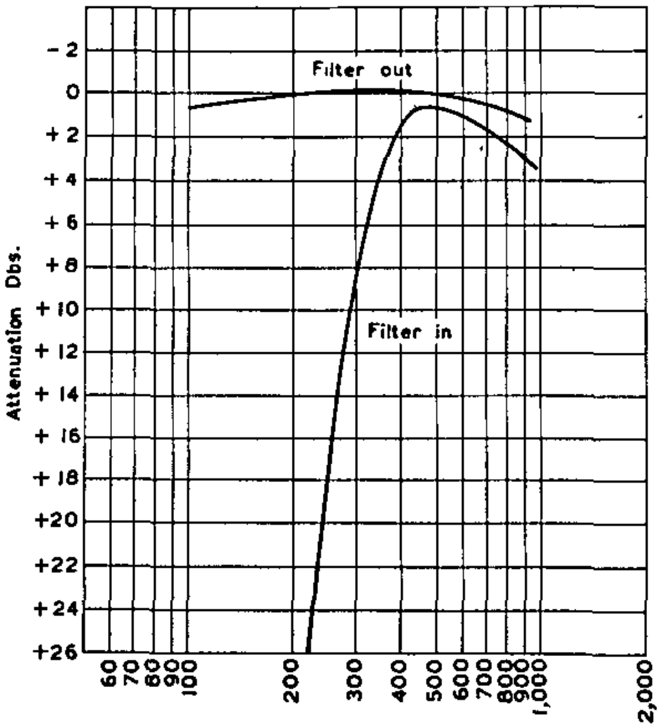



FIG. 6.—L.F. FILTER CHARACTERISTICS.

37. The rectified voltage from the diode detector is developed across a resistance $R_{21}$. A resistance $R_{20}$, in conjunction with a condenser $C_6$, forms part of a R.F. filter system to prevent R.F. being passed to the A.F. circuit. A condenser $C_{28}$ with $C_1$ decouples the cathode. The A.F. passes through a network comprising $R_{67}$ and two series condensers $C_8$ and $C_9$ to a potentiometer $R_{8(2)}$, the variable contact of which is connected to the grid of the valve $V_8$ Before the potentiometer $R_{8(2)}$ there is a L.F. filter "T" network composed of the condensers $C_8$ and $C_9$ with a condenser $C_{10}$, passing from their junction, to an A.F. choke coil $L_{29}$ and earth.

38. The A.F. filter network, which may be switched in or out of circuit by a switch $S_5$, prevents the greater proportion of the frequencies below 300 c/s from reaching the volume control $R_{8(2)}$ and the output stage. The filter removes part of the aircraft electrical and ignition noises. The diagram of fig. 6 gives the A.F. filter characteristics. The attenuation of 300 c/s is approximately 9 db and below that frequency the curve drops 1 db, for, approximately, every 5 c/s. It is a test requirement for this filter that not less than 21 db attenuation takes place at 200 c/s.

39. The voltage developed across $R_{8(2)}$ is admitted *via* the grid of $V_8$, the anode impedance of which is the primary of an output transformer $L_{30}$, by-passed to earth by a condenser $C_{25}$ and connected directly to the H.T. positive input terminal. A condenser $C_{105}$ and resistance $R_{28}$ decouple the cathode bias resistance $R_{22}$ in the triode section of $V_8$.

**Gain control of communications receiver (manual)**

40. The R.F. gain of the valves $V_3$, $V_4$, $V_5$ and $V_6$ is controlled by the application of varying degrees of grid bias to their respective grids and is manually effected by the potentiometer $R_{8(1)}$ When the master switch MS is in the OMNI position the grid of the output valve $V_8$ is joined through section $MS_{af}$ to the top end, that is, further from the H.T. negative, of the A.F. volume control $R_{8(2)}$ and the variable slider is out of circuit. The full A.F. voltage is therefore applied to the grid of $V_8$. The automatic volume control (A.V.C.) system is inoperative.

41. With the switch at OMNI the circuits are:—

(i) A fixed potentiometer $R_{10}$, $R_{11}$ and $R_{12}$ is connected, through the switch contacts $MS_{af}$, to the slider of the manual gain control $R_{8(1)}$.

(ii) The A.V.C. diodes (strapped together) of $V_7$ are connected, through the load resistance $R_9$, to a point 3·6 volts negative along the resistances $R_3$ and $R_4$, the rectified voltage across $R_9$ operating the tuning indicator $V_{10}$.

(iii) On RANGES 1 and 2 the switch $FS_{wr}$ connects $R_{64}$ and $R_{69}$ (if fitted) across $R_4$ to reduce the minimum bias voltage and also the delay on the operating voltage of the indicator $V_{10}$.

42. The chassis is, approximately, 30 volts positive with respect to H.T. negative. The method by which this figure and that of the 3·6 volts negative, previously mentioned, are assessed may be rendered less obscure by the diagram of fig. 7. It is convenient to consider potentiometer networks across the supply, an example of which is $R_{43}$, $R_{44}$, chassis and $R_1$. The effective resistance of these circuits, having regard to the switch positions, gives a basis for calculation. Effective resistance should not be confused with the values appearing on the component table shown on fig. 3.

43. The resistance $R_1$ has, at a minimum, $R_3 + R_4$ in parallel with it and these form a potential divider so that 26·4 volts are across $R_3$ and 3·6 volts across $R_4$. The manual volume control $R_{8(1)}$ is connected across $R_3$ and any voltage between — 3·6 and — 30 can be applied to $V_5$ and $V_4$ for grid bias. This voltage is broken down by means of the fixed potentiometer $R_{10}$, $R_{11}$ and $R_{12}$ for connexion to $V_6$ and $V_3$ (*see* fig. 7).

**Automatic volume control**

44. Automatic control of the gain of the valves $V_3$, $V_4$, $V_5$ and $V_6$ is effected by the strength of the received signals when the master switch MS is in the A.V.C. position. Manual control of the A.F. from the second detector diode of $V_8$ to the output valve, that is, the triode of $V_8$, is also provided from the potentiometer $R_{8(2)}$. The controls of $R_{8(1)}$ and $R_{8(2)}$ are ganged for simplification of operation and the joint front panel control is labelled VOLUME CONTROL. The position of the master switch MS determines which of the potentiometers is operative:—OMNI for $R_{8(1)}$, A.V.C. for $R_{8(2)}$.

45. The received signal which is applied to the grid of the R.F. amplifier valve $V_3$, detected and frequency-changed at $V_4$, is amplified at I.F. by $V_5$ and $V_6$. The amplified I.F. voltage appears across the primary winding of the third I.F. transformer $L_{21}$. This primary winding is tapped and a proportion of the R F. voltage is led to the strapped diodes of the indirectly-heated double diode triode valve $V_7$. Rectification takes place and the rectified current flows through a series R.F. choke coil $L_{23}$, a resistance capacitance filter and decoupling circuit composed of $R_{68}$ and the condensers $C_{108}$ and $C_{103}$.

46. At A.V.C., BALANCE and VISUAL, the switch $MS_{af}$ disconnects the slider of $R_{8(1)}$ and connects the fixed potentiometer network $R_{10}$, $R_{11}$ and $R_{12}$ across $R_9$, the A.V.C. diode ($V_7$) load which has a delay of –3·6–V due to the drop across $R_4$ in series with $R_3$. On RANGES 1 and 2 this delay is reduced to — 2·4–V by switching $R_{64}$ (and $R_{69}$, if fitted) across $R_4$. The rectified current flows through $R_{10}$, $R_{11}$ and $R_{12}$, with $R_9$ in parallel, back to the cathode *via* $R_4$. The

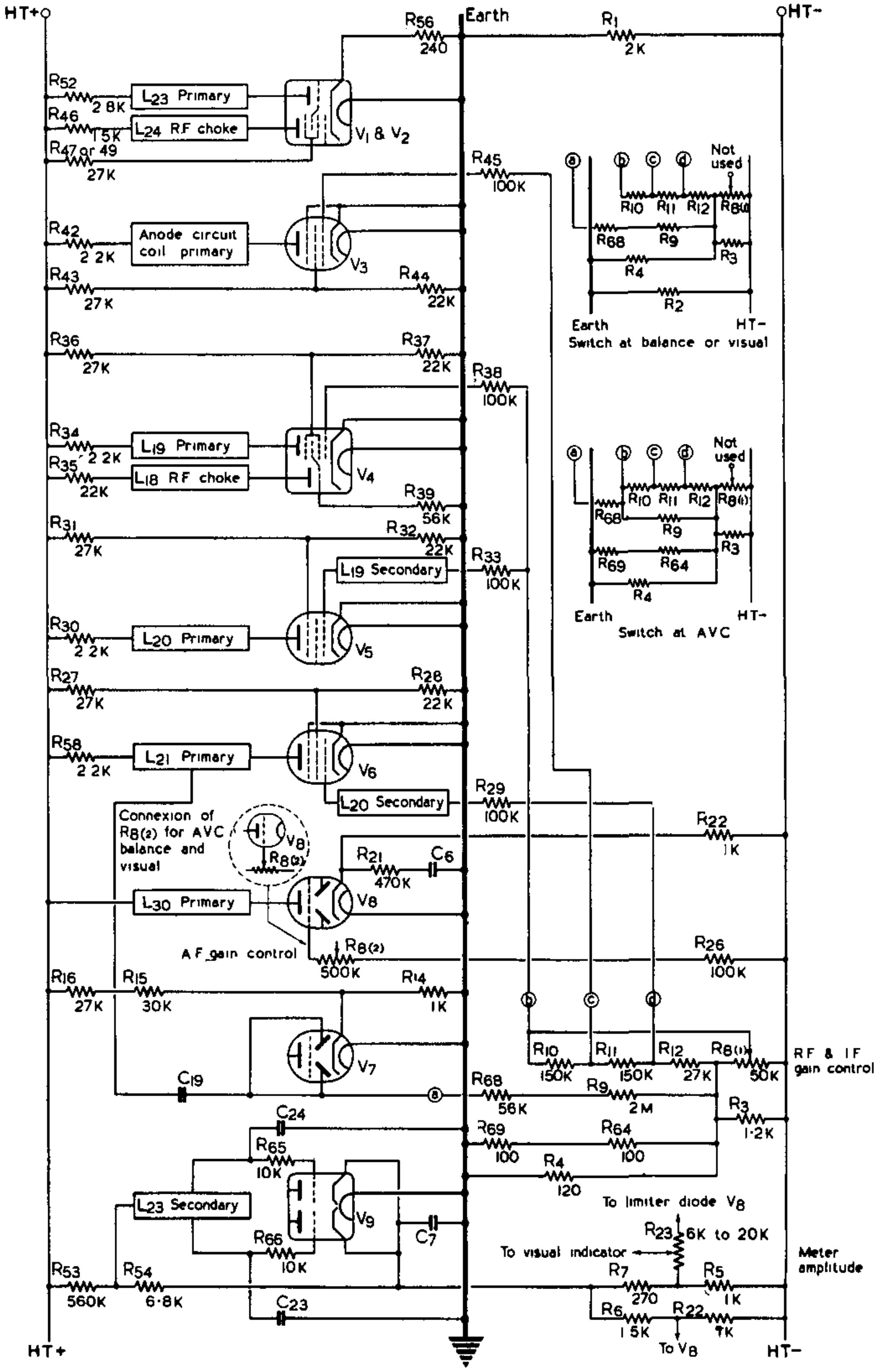



**FIG. 7** BIASING AND FEED ARRANGEMENTS **FIG. 7**

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voltage developed across $R_9$ and the network $R_{10}$, $R_{11}$ and $R_{12}$ is divided to suit $V_3$ and $V_6$. On BALANCE and VISUAL, $C_{94}$ is shunted across $R_9$ to give a longer time constant and reduce the flicker of $V_{10}$.

47. The R.F. amplifier valve $V_3$ receives approximately one half the full value of the biasing voltage, through the line A.V.C.2, tapping the junction of $R_{10}$ and $R_{11}$, and the grid-return circuit includes the resistance-capacitance circuit of $R_{45}$ and $C_{40}$ preventing back-coupling between $V_3$ and $V_4$, $V_5$ and $V_6$ and has a time-constant which is much longer than the lowest incoming signal frequency and which has been previously mentioned. The frequency changer $V_4$ and the first I.F. amplifier $V_5$ receive full A.V.C. bias voltage from the top end of the resistance $R_{10}$ through the line A.V.C.3 and decoupling combinations $R_{38}$–$C_{37}$ and $R_{33}$–$C_{33}$ respectively. The second I.F. valve $V_6$ receives approximately one-tenth of the bias volts through the circuit $R_{29}$–$C_{30}$.

48. The A.V.C is subjected to a voltage delay of approximately 13 volts, that is, it does not come into operation until the received carrier reaches the pre-determined level of strength, represented by the 13 volts. This delay is partially accomplished by running the cathode of $V_7$ positive with respect to its diode by means of resistances $R_{14}$ and $R_{15}$ which are connected with $R_{16}$ between H.T. positive and earth. An additional resistance $R_{16}$ is introduced on C.W. to reduce this delay voltage. The full delay voltage is a composition of the voltage produced here and the standing bias on the R.F. valves (*see* para. 50). The voltage delay assists in giving an A.V.C. characteristic which, for a change in input signal of 80 db results in a change in output of approximately 8 db.

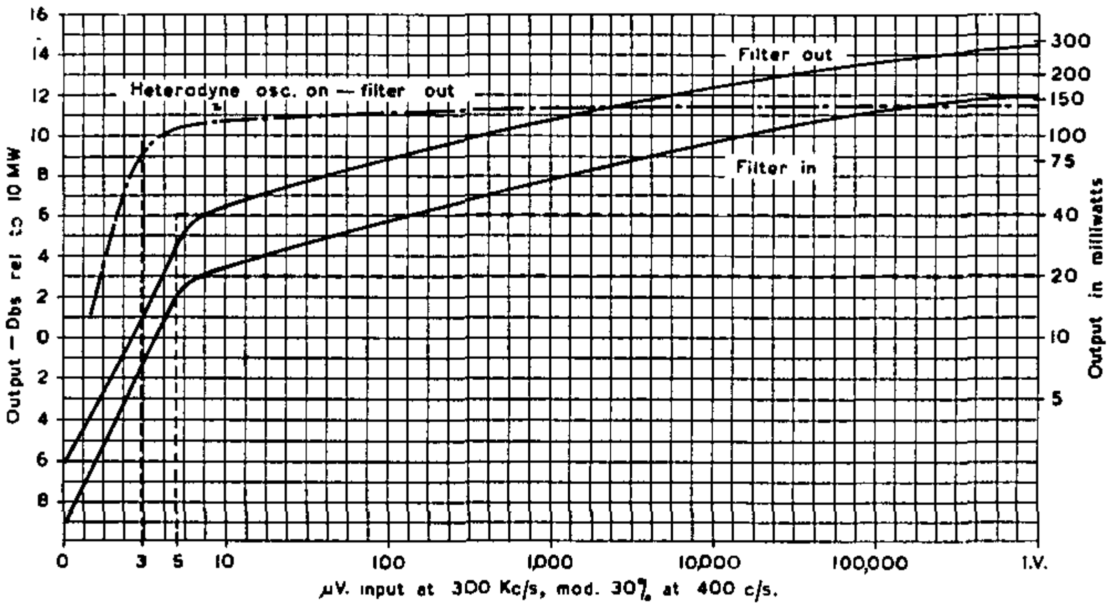



FIG. 8.—A.V.C. CHARACTERISTICS

49. The A.V.C. characteristic curves of fig. 8 are taken on an input of from 1 $\mu$ volt to 1 volt ($10^6$ $\mu$ volt) and show an output in decibels with an arbitrary zero at 10 milliwatts. The curves show the output plotted against input voltages at 300 kc/s, modulated 30 per cent. at 400 c/s. No curve is given for a "no control" condition, that is, with A.V.C. removed, but it is indicated by the steep straight portions of the curves which show a slope of approximately 16 db for 10 times the voltage. The effect of the A.V.C. is to level off the curves, at inputs above 5 $\mu$ volt, to a slope of approximately the same input voltage as with the filter IN but the slope is a trifle less steep. The heterodyne oscillator ON curve, with filter OUT, is practically level and comes into operation at a lower input voltage. The A.V.C. action is clearly defined by the sharp bend in all curves. There is nowhere any indication of excessive modulation rise. The input/output characteristics of the receiver are shown in fig. 9. These are taken for R.F. sensitivity, with or without the L.F. filter in circuit, and the carrier input of 300 kc/s is modulated 30 per cent. at 400 c/s. Since this description was written a fresh specification provides for 210 kc/s, 10 mW at 100 $\mu$V and 32 mW at 104 $\mu$V.

50. As mentioned in para. 22 in connexion with the R.F. amplifier valve $V_3$ none of the A.V.C. controlled valves are automatically biased by cathode resistances. To preserve a standing bias on the cathode during no-signal periods, therefore, the resistance network of $R_{12}$, $R_{11}$ and $R_{10}$ is returned to a point ($R_8$) which is 3·6 volts negative with respect to the cathodes. On RANGES 1 and 2 (H.F.)

this standing bias is reduced to approximately 2·5 volts in order to preserve reasonably constant amplification over the five RANGES. On these RANGES the resistances $R_{64}$ and $R_{69}$ are included in the circuit.

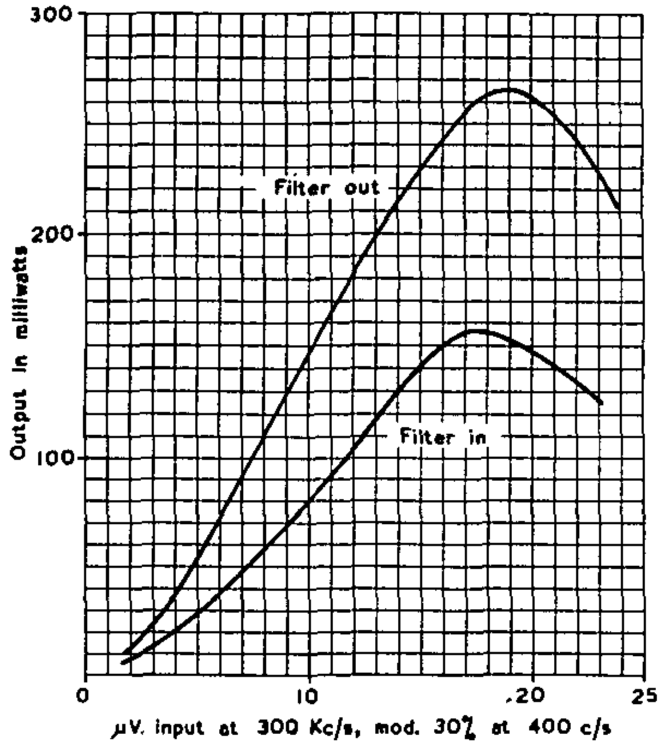



FIG. 9.—INPUT/OUTPUT CHARACTERISTICS

### Beat frequency oscillator

51. In addition to providing the A.V.C. the valve $V_7$ also acts as a beat frequency oscillator, the triode section of the valve being used for this purpose. The oscillatory circuit consists of a coil $L_{22}$ and the condensers $C_{14}$ and $C_{16}$ in the Colpitt's arrangement, the anode and grid circuits being capacitance coupled. A variable pre-set condenser $C_{13}$ enables the beat frequency to be adjusted by means of screwdriver control to a variation of approximately 3 kc/s. The grid condenser is $C_{17}$ and a grid-leak resistance $R_{19}$ gives the grid its correct negative potential. The oscillatory circuit is tuned to approximately half the I.F., that is, to 280 kc/s and the second harmonic is used to heterodyne the incoming signal. The use of second harmonic prevents "pulling" of the two oscillations into synchrony which would give no resultant A.F. note. A peak voltage of, approximately, 42 volts is produced and this gives optimum heterodyne.

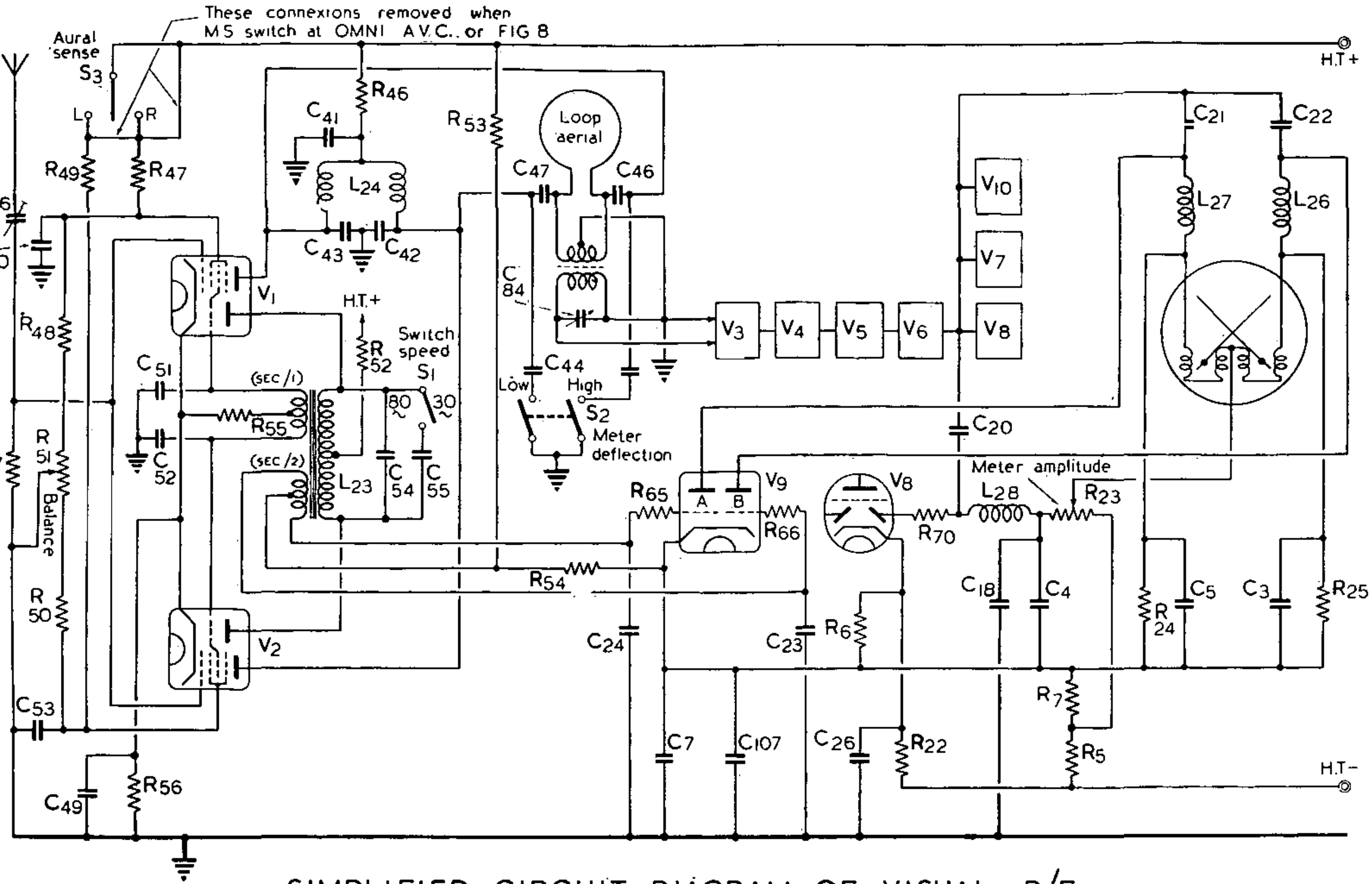
52. The H.T. for the oscillatory circuit is fed in series with the tuning coil $L_{22}$, $R_{17}$ and $C_{12}$, forming a decoupling circuit, and $R_{18}$ a choke to R.F. The condenser $C_{15}$ provides for the 180 degrees out-of-phase grid/cathode voltage. The output from the oscillator is coupled *via* $C_{11}$ to the signal diode of $V_8$ where it mixes with the I.F. signals, the resultant A.F. beat being produced across the diode load $R_{21}$–$C_6$.

### The tuning indicator

53. Correct tuning of the receiver is indicated by means of a cathode ray indicator $V_{10}$. The indicator gives a varying shadow angle on a fluorescent anode, the angle of light being dependent upon the voltage developed across the resistance $R_9$ which is the diode load on OMNI (*see* paras. 41 to 43). The anode of the triode portion of $V_{10}$ is connected to H.T. positive through a resistance $R_{13}$ the grid being fed from the voltage developed across $R_9$. A potential difference thus exists between the fluorescent anode and the triode anode. The greater the difference in potential between these anodes, the greater the deflection of the electronic stream.

54. The deflection of the electronic stream is brought about by a wire which is in the direct path of the stream. This wire is adjacent to the fluorescent anode but slightly off-centre from it, and is joined to the anode of the triode section. In the absence of a signal the voltage drop through $R_{13}$ makes the wire negative with respect to the fluorescent anode repelling the electronic stream and producing a V-section. When a strong signal is received, the control grid becomes more negative with consequent reduction in the triode anode current and of the voltage across $R_{13}$. This

FIG. 10




SIMPLIFIED CIRCUIT DIAGRAM OF VISUAL D/F



FIG. 10

in turn causes a smaller potential difference between the two anodes, and the electron stream will be repelled less, giving a smaller V. The direct bombardment illuminates a greater part of the fluorescent anode and a greater part of the indicator will be coloured green.

## The D/F circuits

55. The frequency ranges covered by the R.1155 for D/F purposes are primarily the RANGES 3, 4 and 5, covering from 1,500 kc/s to 75 kc/s. Provision is also made for D/F reception on the RANGE 2, from 7·5 Mc/s to 3 Mc/s. The change from the communication circuit to the D/F circuit is made by means of the switch MS, the OMNI or plain reception and A.V.C. positions of which have already been described. A simplified circuit diagram of the visual D/F system is shown in fig. 10.

56. The following operations can be performed with the receiver when coupled to a suitable D/F loop:—

(i) Determination of bearings of a selected transmitting station either visually or aurally with sense discrimination.

(ii) Homing on to a transmitter by the visual method, in which the loop is set athwartship (except in special circumstances) and the course determined by the point of intersection of the twin needles on the centre line of the scale.

57. Primarily, the receiver has been designed to work in conjunction with the loop aerial, type 3, which has a nominal inductance of 100 $\mu$ H and self-capacitance, when installed, of 20 $\mu\mu$ F. In order to effect a match between this aerial and the receiver, that is, to adjust the total impedance of loop and lead to the receiver adjustment, a small pre-set condenser $C_{104}$ is provided, built into the loop lead terminating plug, parallel, in certain conditions, to the fixed condenser $C_{106}$ shunting the loop. The condenser $C_{106}$ is of small capacitance (65 $\mu\mu$ F) and is included in circuit only when the total loop and lead capacitance is too small to enable tuning by $C_{104}$ alone to be effected. Referring to fig. 3, it will be seen that the loop is connected through the switch sections $MS_{ef}$, $MS_{er}$ and the frequency range switch section $FS_{wf}$ to the input circuit of $V_3$.

58. Suitable impedance matching units are provided for use with types of loop aerial other than the type 3, to enable the input tuned circuits to gang correctly with the other tuned circuits. These, are, normally, the impedance matching units, types 12, 13 or 15 and the application will be dealt with later in this chapter (paras. 136 to 142).

59. A general picture of the electron switching system should be obtained before commencing a study of the details of the circuits. D/F is accomplished by using:—

(i) Signals received on a loop aerial.

(ii) Signals received on a vertical aerial, and

(iii) A twin-needle visual indicator meter or

(iv) Aural methods.

60. The use of a loop aerial, or its electrical equivalent, is a fundamental feature of D/F and depends upon the fact that the E.M.F.'s induced in the vertical sides and, consequently, the resultant E.M.F. from the loop, is determined by the angle of the plane of the loop relative to the path of the transmitted wave. When the plane of the loop is at right-angles to the direction of the distant transmitter no signal is heard. The signals received upon the vertical aerial are unaffected by direction so that when the two aerial systems are operated together it will be seen that the resultant produces a cardioid polar diagram of reception.

61. The vertical aerial E.M.F.'s are injected into the loop aerial E.M.F. and, dependent upon whether they are in phase or in anti-phase with the instantaneous voltages of the loop, become additive to or subtractive from the loop voltages. This phasing process is brought about by a system of electronic switching which may occur either at a frequency of 30 c/s or of 80 c/s. The conjoint loop and vertical aerial E.M.F.'s are amplified and, finally, rectified. The rectified D.C. is then applied, synchronously with the original switching, by another electronic switch, alternately to the two moving coils of a visual indicator and drives the indicator needles up or down in accordance with the greater or lesser E.M.F.'s determined by the proportion of the loop aerial E.M.F.'s (resulting from the orientation of the loop) to the practically constant E.M.F.'s of the vertical aerial.

62. The twin needle indicator is a positive method of providing ON COURSE direction through the action of the differential currents upon the needles. The aural D/F methods are standard practice and are not complicated by the electronic switching processes referred to in the previous paragraph.

63. The switching of the visual indicator is accomplished by electronic means on what is known as the "switched heart" principle. The indirectly-heated triode hexode valves $V_1$ and $V_2$ switch the fixed aerial with relation to the loop at a predetermined frequency. A double triode valve,

referred to as the meter switching valve, switches the rectified output to the visual indicator. The two operations are synchronized. A limiter valve automatically controls the input to the indicating meter. The simplified diagrams of figs. 10, 11, 12 and 13 will assist in an understanding of the operations.

64. The expression "switched heart" is based on the typical cardioid reception polar diagram arising from a conjoint vertical aerial and loop aerial system. For convenience, polar diagrams of a loop aerial (A) system ("figure of eight") alone, a vertical aerial system (B) alone ("circle") and resultants from differing proportions in amplitude of the received waves (C), (D) and (E) are shown in the diagram of fig. 14.

65. Upon the reception of signals the E.M.F.'s of the fixed and loop aerial systems are 90 deg. out-of-phase. The application of the fixed aerial voltages to those of the loop aerial must, ultimately, however, be either in phase or in anti-phase. The essential phase-opposition is brought about by the valves $V_1$ and $V_2$ operating according to the well-known push-pull procedure. The necessary switching of $V_1$ and $V_2$ is controlled by a L.F. oscillatory system which is described in paras. 69 to 73.

66. Whilst the fixed aerial original signal is subjected to a phase-splitting process in $V_1$ and $V_2$, the original angular difference $\pm$ 90 deg. between the voltage and that of the loop aerial, would still persist were the phase-restoring condensers $C_{46}$ and $C_{47}$ not incorporated in the circuit to bring the signals into phase and anti-phase.

67. The resultant potentials, that is, fixed aerial with loop aerial, ultimately appear across the variable condenser $C_{84}$, which is part of the tuned aerial circuit, and are amplified and finally rectified in the normal manner.

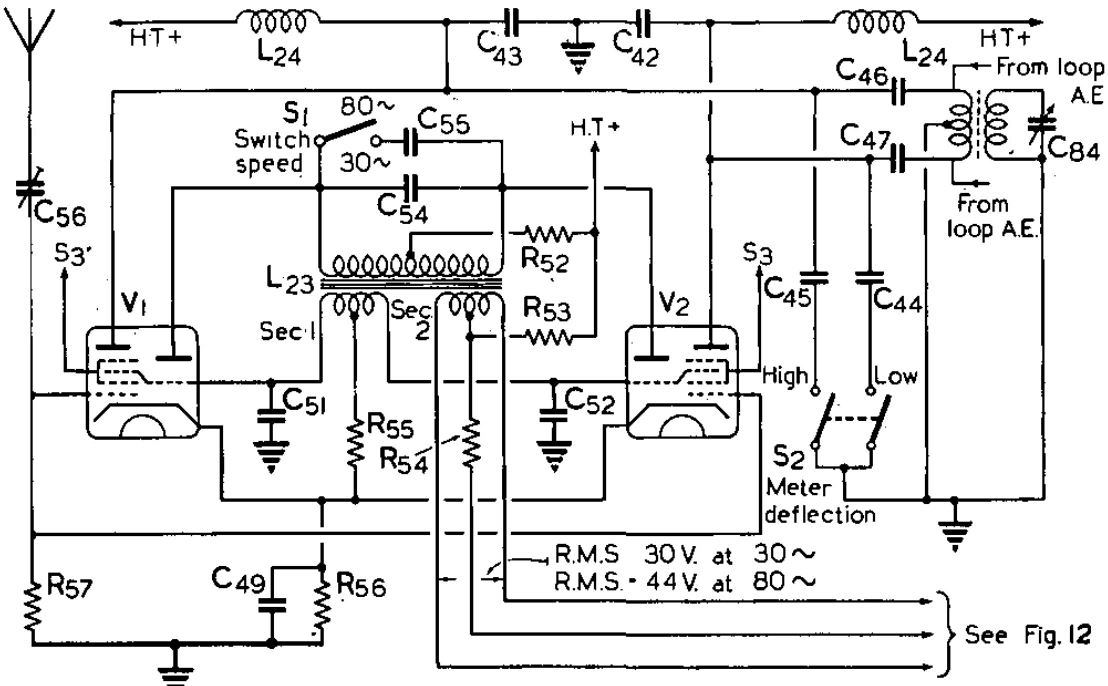



FIG. 11.—L.F. OSCILLATOR SWITCHING CIRCUIT

68. The visual circuit of the receiver consists of three principal valves, $V_1$, $V_2$ and $V_9$, together with one of the diodes of the valve $V_8$. The fixed aerial component is capacitance coupled to the joined input grids of the hexode portions of the indirectly heated triode-hexode valves $V_1$ and $V_2$. The coupling condenser is the pre-set variable condenser $C_{56}$ which provides for an initial installation, adjustment of the amount of fixed aerial input to the switching valves. The resistance $R_{57}$ is the grid return of $V_1$ and $V_2$.

**L.F. switching oscillator for D/F**

69. The triode portions of the valves $V_1$ and $V_2$ are connected to form a push-pull L.F. oscillator the frequency of which is internally injected into the hexode section of the valves. The oscillator frequency is determined by the inductance of the primary winding of a L.F. transformer $L_{23}$ directly connected between the anodes of the triodes in conjunction with two condensers $C_{54}$ and $C_{55}$. Switching

is provided, by means of $S_1$, to incorporate either $C_{54}$ alone, in the oscillatory circuit, giving a frequency of 80 c/s, or to include $C_{54}$ and $C_{55}$ in parallel, giving a frequency of 30 c/s. The necessity for the two frequencies is explained in paras. 75 and 76.

70. The push-pull oscillator circuit brings about a condition in which the mutual inductive excited oscillator grids of $V_1$ and $V_2$ are in anti-phase. This is brought about by the phase-splitting process rendered possible by the centre-tapped secondary winding $SEC_1$ of $L_{23}$. Two equal voltages, 180 deg. out-of-phase are fed to the triode grids of $V_1$ and $V_2$. The hexode anodes are connected differentially to the loop aerial circuit through the condensers $C_{47}$ and $C_{46}$. Thus, when $V_1$ is amplifying and $V_2$ is not amplifying, anode current flows in one sense with respect to the loop whilst if $V_2$ is amplifying and $V_1$ not amplifying the current flows in the opposite sense.

71. At each valve, during the positive half-cycle, the oscillator grids are held at a uniform and slightly positive value. Grid current through the resistance $R_{58}$ causes the oscillator grid to become only slightly positive due to the injector connexion and this positive voltage holds the hexode gain practically constant. During the negative half-cycle the full secondary voltage is applied to the oscillator grids. Due to the reservoir condenser $C_{52}$ or $C_{51}$ the negative volts block the hexode portions, rendering them inoperative for a longer period than would, normally, be the case during the negative half-cycles, thus bringing about a sharp cut-off.

72. Two condensers $C_{51}$ and $C_{52}$ have a value of capacitance which does not permit an appreciable negative charge to be built up due to rectifying action by the grids. These condensers by-pass to earth any R.F. voltages which might appear on the grids. The H.T. positive is series fed *via* the centre-point of the primary winding of $L_{23}$, $R_{52}$ acting as a R.F. choke and voltage dropper for the anode. The voltages to the screens are dropped by the potentiometers $R_{47}$, $R_{48}$ and $R_{51}$ and $R_{49}$, $R_{50}$ and $R_{51}$. The screens are by-passed to earth by $C_{50}$ and $C_{53}$.

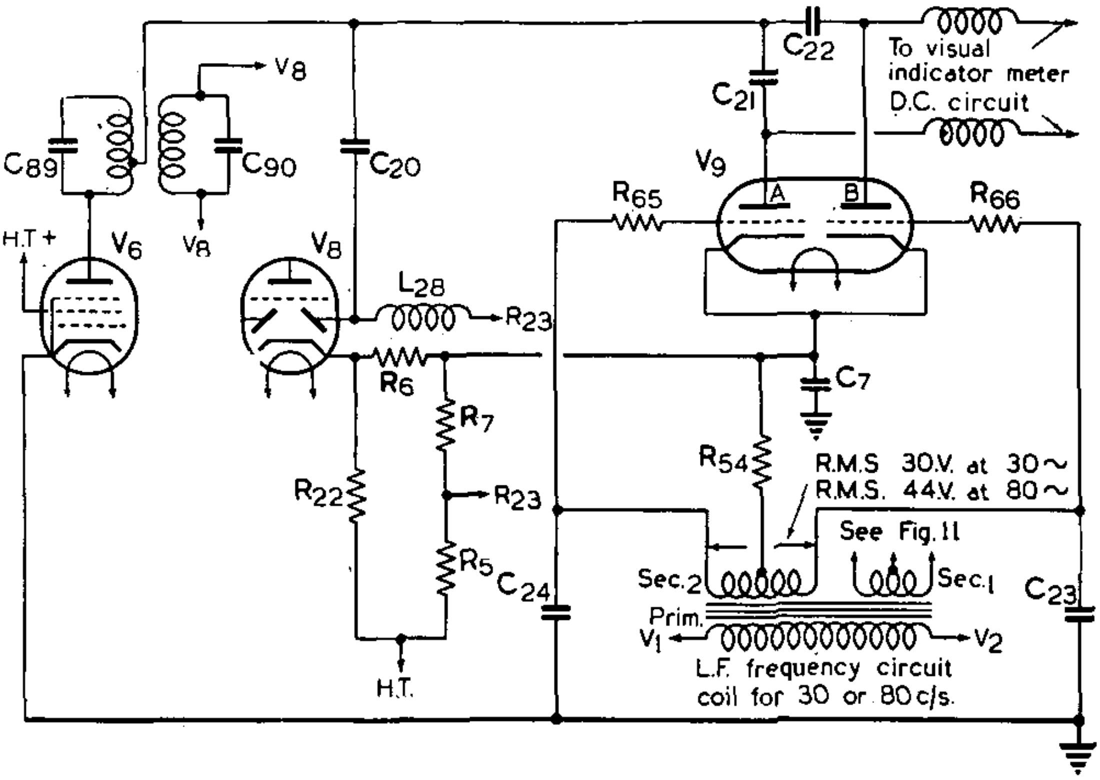



FIG. 12.—THE VISUAL METER SWITCHING CIRCUIT

73. A resistance $R_{56}$ is a cathode biasing resistance for the valves $V_1$ and $V_2$ and is by-passed by a condenser $C_{49}$. The resistance $R_{57}$ affords a grid return for the mixer valves. The potentiometer $R_{51}$, having two equal resistances $R_{48}$ and $R_{50}$, one on either side of it, in the screen circuit of $V_1$ and $V_2$, is used to balance the screens to earth. The potentiometer $R_{51}$ is referred to later in this chapter (para. 94).

74. The combined potential differences (loop and fixed) across the condenser $C_{84}$ are taken to the control grid of the valve $V_3$ and, following the sequence of the communications circuit, through the valves $V_4$, $V_5$ and $V_6$, are ultimately applied to the anodes of an indirectly-heated double-triode valve $V_9$ from a tapping on $L_{21}$ *via* $C_{21}$ or $C_{22}$. The anodes A and B (fig. 10) of $V_9$ act as diode

anodes and the valve functions as an electronic switching device by means of which the L.F. switching voltage from a second secondary winding $SEC_2$ of the oscillator transformer $L_{23}$ is utilized to provide simultaneous switching of the receiver output to the visual indicator.

75. As indicated in fig. 12, the voltage from $L_{23}$ which may be approximately 30 volts R.M.S. at 30 c/s or 44 volts peak at 80 c/s is applied to the two grids of the valve $V_9$. The resistances $R_{54}$ and $R_{53}$ form a potentiometer to put a positive voltage between the grid and cathode of $V_9$, reducing the valve impedance and increasing its sensitivity.

76. Whenever the fixed aerial voltage is switched by the action of the valves $V_1$ and $V_2$ there must, necessarily, be some interruption of the received signal at the time of phase reversal. The process of switching actually implies a condition in the valves $V_1$ and $V_2$ analogous to Class C amplifier operation, that is, that the valve working point is considerably beyond cut off. The negative pulses of grid voltages are high and the sudden phase reversal, causing cessation in the individual valves, tends to produce momentarily excessive harmonics with consequent wave distortion. This is reflected in the received signal as a "wobble" which is least noticeable when the axis of the loop is pointing in the direction of the transmission, that is, when the amplitude of the loop received signal is sufficiently high to tend to override the fixed aerial signal at the moment of phase reversal.

77. Interference with intelligibility of R.T. signals is negligible when the switching frequency is 30 c/s. For telegraphy, however, 30 c/s is too low a switching frequency and arrangements have, therefore, been made to provide an oscillator frequency of 80 c/s. As mentioned in para. 69, the L.F. oscillator frequency is determined by the primary winding of the transformer $L_{23}$ and either the condenser $C_{54}$ alone, for 80 c/s, or the condensers $C_{54}$ and $C_{55}$ in parallel, for 30 c/s. The frequency change is accomplished by the switch $S_1$.

**Meter deflection sensitivity**

78. The "sharpness" of D/F bearing is determined by the relative amplitude of the fixed aerial voltage to that of the loop aerial. Variation of the fixed aerial voltage with respect to that of the loop will therefore make it possible to adjust for a high degree of sensitivity to change of direction. As will be seen from the polar graph D of fig. 14, a displacement of a few degrees in the loop direction brings about a given change from maximum to minimum signals whereas, from graph E it will be appreciated that a considerably greater angular displacement is required to bring about the same change from maximum to minimum signals.

79. The valves $V_1$ and $V_2$, with their associated circuits, are electrically balanced to provide for equal gain during their respective operative half cycles. Variation of the fixed aerial voltage input to the valve grids would result in a reduction in the gain of the valves but would also reduce the signal to valve noise ratio. The amplitude of the fixed aerial voltage introduced into the loop aerial circuit has therefore been reduced by the introduction of two condensers $C_{43}$ and $C_{42}$ which may be switched between the anodes of $V_1$ and $V_2$ and earth by means of the ON–OFF switch $S_2$ which is the METER SENSITIVITY SWITCH. The sensitivity is HIGH when the switch $S_2$ is ON.

80. When the switch $S_2$ is ON and the two condensers $C_{44}$ and $C_{45}$ are in circuit, maximum deflection of the visual indicator occurs when the loop aerial is offset from the true bearing by a small amount. When taking bearings by the visual method therefore, the switch $S_2$ should be closed. When the switch $S_2$ is open and $C_{44}$ and $C_{45}$ are out of circuit, maximum deflection does not take place until the loop is off-set by a considerably greater number of degrees. This condition is used for "homing" as the "blunting" of direction sensitivity enables an approximate COURSE to be maintained without the strain of constant search and correction imposed by the sharper indication obtaining when the switch $S_2$ is open.

**The visual indicator, type 1**

81. The visual indicating meter is of the twin needle type giving an ON COURSE indication by the intersection of two needles on the centre line of a scale. The position of the point of intersection is dependent upon the amount of current passing through the circuits associated with each needle. The presence of signal voltages automatically ensures that the point of intersection of the two needles lies on the working part of the scale. The no-signal condition is shown by a complete collapse of the needles. The indicator is dealt with in greater detail in paras. 195 to 198.

82. A certain advantage attaches to the use of a twin-needle indicator when compared with the single needle indicating instrument. In the latter type the ON COURSE signal is indicated when the needle is at the central position, that is, no current is flowing through the meter. There is, in consequence, no means of determining, visually, whether the needle is actually giving the ON COURSE indication or whether its condition arises from failure of current through cessation of the signal or failure to receive. A simplified visual meter switching diagram is shown in fig. 13.

83. Referring to fig 13 the combined diode and switch action of the valve $V_9$ is presented in simplified form. Rectification of the signal impulses takes place at the anodes of $V_9$ and, as previously indicated, these may be regarded as diode anodes. The grids of $V_9$ alternately accept the L.F. oscillator switching voltage and the diodes are rendered conducting, or non-conducting, accordingly as the grids pass through positive or negative half cycles.

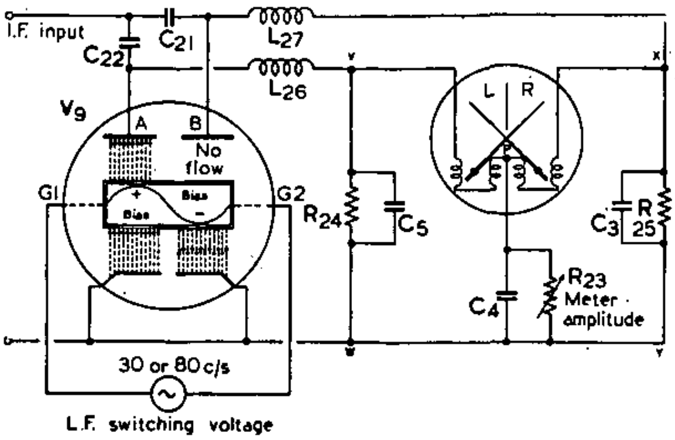



FIG. 13.—SIMPLIFIED VISUAL METER SWITCHING CIRCUIT

84. The grids of $V_9$ are represented as $G_1$ and $G_2$ and an idealized waveform is attached to them. This is, of course, merely conventional and does not represent the true condition. It will be seen that when the grid wave is in the positive half cycle the electronic flow is maintained between anode and cathode of the valve $V_9$. When $G_1$ or $G_2$ is biased strongly negative the through current flow ceases. When either of these grids is biased slightly positive the current flow exists and the diode is operative. In synchronization with the reversal of phase in $V_1$ and $V_2$ so the application of the L.F. switching voltages to the grids $G_1$ and $G_2$ takes place.

85. The I.F. voltage from the secondary winding of $L_{21}$ is applied to the anodes A and B of the valve $V_9$ and, according to the condition of $G_1$ and $G_2$, it is rectified by the unilateral conductivity of the diode action. The effect of this rectified voltage upon the circuits associated with the visual indicator meter is described in the subsequent paragraphs.

86. The sections A and B of the valve $V_9$ pass current in quick succession (either 30 or 80 c/s) at values which are dependent upon the voltages resulting from the switched heart mentioned in para. 63. The condensers $C_5$ and $C_3$ become charged through the voltages developed across the anode load resistances $R_{24}$ and $R_{25}$ to values proportional to the mean currents in the sections A and B respectively.

87. The condensers $C_5$ and $C_3$ will tend to discharge through the coils of the visual indicator meter *via* the variable resistance $R_{23}$. When the charges are equal, that is when the current in sections A and B is equal, the indicator needles rise by an equal amount and intersect on the centre scale of the meter. If the charges in $C_5$ and $C_3$ are unequal, the needles rise to different heights giving intersection to left or right according to which section is passing the greater current.

88. Additionally, however, when the charges are unequal, current will pass from the point of greater charge to that of lesser charge in such a manner as to emphasize the deflection of the needle, bringing about a greater differential movement. As the resistance $R_{23}$ is variable, the values of the currents can also be varied with the result that the height at which the needles intersect is controllable.

89. In the diagram of fig. 13 the potential points are indicated by V, X, Y, W and P. When $C_3$ and $C_5$ charges are equal, the potentials between XY and VW are equal. The potential at P is equal to those of X and V. The potential at P remains practically constant under all conditions and it is this fact which assists the condition mentioned in para. 88.

90. The necessity for the variable resistance $R_{23}$ is imposed by the potential action of the A.V.C. system. It follows that, due to A.V.C. when the loop aerial is rotated from the ON COURSE position, one needle of the visual indicator would remain steady whilst the other would move downwards. The output from $V_1$ and $V_2$ always affects the same section of $V_9$, that is $V_1$ supplies section A of $V_9$, and $V_2$ supplies section B. If the loop aerial is rotated OFF COURSE, therefore, $V_1$ supplies a larger signal to section A than $V_2$ supplies to section B. The A.V.C. will hold the larger signal but cannot control the weaker signal. One needle therefore would remain in its original position whilst the other would fall.

### The diode limiter valve $V_9$

91. That the sections A and B of valve $V_9$ operate alternately and in synchronization with the L.F. oscillator switch of $V_1$ and $V_2$ has already been explained. Through the condensers $C_{21}$ and $C_{22}$ the I.F. is fed to the valve $V_9$ and the D.C. switched-output flows through the R.F. chokes $L_{27}$ and $L_{26}$ to the meter indicating circuit. A delay bias is applied between the cathode and the anodes of $V_9$ in order to prevent them from delivering a current and raising the meter needles, due to noise output of the receiver in the absence of a signal.

92. Through a condenser $C_{20}$ from the secondary winding of $L_{21}$ a proportion of the L.F. voltage is taken to one diode of the double-diode triode $V_8$, the second detector and output valve already dealt with in its communications circuit application. The rectified output from $V_8$ flows *via* a "swamp" resistance $R_{70}$, and a R.F. choke $L_{28}$ to the variable resistance $R_{23}$. The circuit is decoupled by the condensers $C_{18}$ and $C_4$ in parallel and by-passed from R.F. by $C_{18}$. The cathode of $V_8$ is biased through a resistance $R_{22}$. Any current injected at $R_{23}$ tends to drive both needles downwards without interfering with the differential action of the circuit. The normal A.V.C. arrangements of the receiver are not sufficient to keep the iutersection point of the needles on the scale for the possible range of signal variation.

93. The limiter delay voltage is supplied across the resistances $R_6$ and $R_7$ in series and is adjusted to be approximately 4 volts. It does not come into action until the peak voltage applied to the common points $C_{20}$, $C_{21}$ and $C_{22}$ exceeds the delay voltage. This limiter deals with input changes up to 80 db and is so adjusted as to make it impossible, given correct setting of $R_{23}$, for the point of intersection of the needles to move off the scale. A small positive bias potential is given to the grids of $V_9$ by the resistances $R_{53}$ aud $R_{54}$ and this, by lowering the working impedance of the anode circuit, greatly increases sensitivity. This positive bias also reduces the effect of any difference in impedance between the diodes A and B circuits of $V_9$.

94. Accuracy of indication depends upon the balance of the two input switching valves $V_1$ and $V_2$ and all associated circuits throughout the receiver. Between the screens of $V_1$, $V_2$ and earth there is a balancing circuit consisting of the potentiometer formed by $R_{47}$, $R_{48}$ and $R_{51}$, $R_{49}$, $R_{50}$ and $R_{51}$. The variable portion of this is $R_{51}$. When the meter switch MS is in the BALANCE position the loop aerial is disconnected and is earthed by $MS_{ef}$. A suitably matched dummy loop consisting of a coil $L_1$ with a condenser $C_{99}$ is connected in place of the loop aerial.

95. As the dummy loop does not pick up signals any side deflection of the visual indicator needles, when the dummy is in circuit, is due to lack of symmetry in the circuit. In order to balance out this lack of symmetry the potentiometer $R_{51}$ is adjusted until the point of intersection of the indicator needle coincides with the centre scale line.

### Visual sense

96. The direction of movement of the visual indicator needle reflects the angle of the plane of the loop aerial relative to the path of the incident wave. Now, orientation of the loop so that one side of it is nearer to the distant transmitter than is the opposite side brings about a current condition (due to phase difference in the two sides) in which increased current is indicated in the needle corresponding to the nearer side. Supposing the loop to be swung off course to the RIGHT. The aircraft must go to the left to return to its course and the increased current is indicated by the LEFT movement of the needles because the LEFT side of the loop is nearer to the transmitter *if the aircraft is travelling towards the transmitter.* If the transmitter is astern the iudication is, of course, reversed.

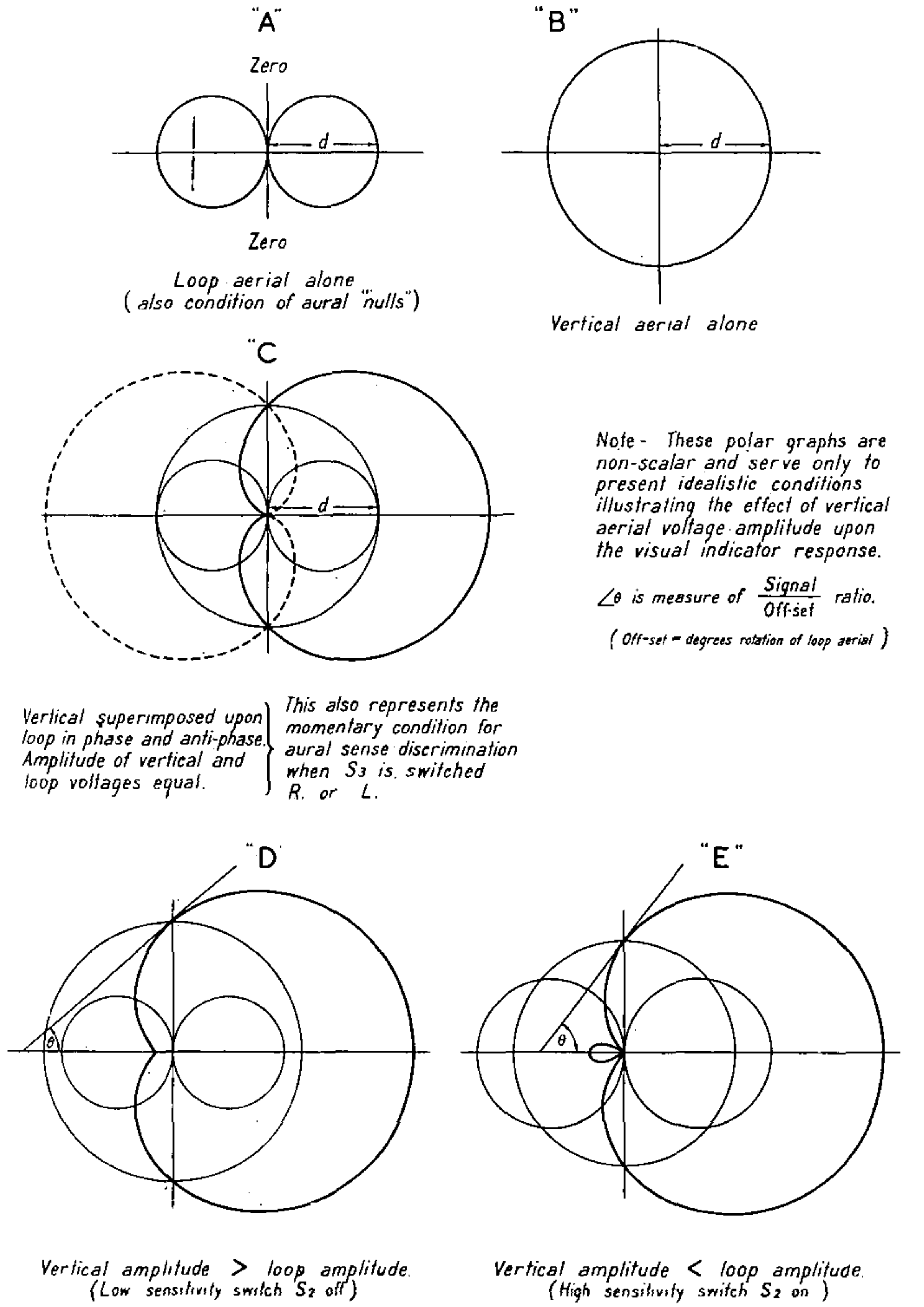
### Aural D/F "figure-of-eight"

97. For aural D/F using the conventional "figure-of-eight" polar reception diagram shown, in fig. 14, for the loop aerial, the fixed aerial is disconnected in the FIGURE-OF-EIGHT position of the master switch $MS_{bf}$. The H.T. to the L.F. oscillator $L_{23}$ is disconnected by the switch $MS_{cr}$ rendering the meter switching circuits of $V_9$ inoperative. The A.V.C. system is changed to manual control by $MS_{af}$ and $MS_{cf}$ (*see* paras. 41 to 43).

98. Consideration of the polar diagram will show that two aural "nulls" exist for any given station, resulting in an ambiguity of 180 degrees. Application of fixed aerial voltage by means of a three-position switch $S_3$ gives a cardioid polar graph and enables the correct minimum to be selected. The spring-loaded switch $S_3$ applies H.T. to the screens of one or the other of the hexode portions of $V_1$ or $V_2$ thus coupling the fixed aerial through to the loop circuit. Sense determination is described in para. 182.

### Receiver R.1155A

99. The receiver, type R.1155A, is a modified form of the R.1155 with which it is interchangeable. It incorporates arrangements designed to prevent interference from certain M.F. broadcasting stations the carrier frequency of which approximates to the receiver I.F. of *560 kc/s. It is possible*




## POLAR DIAGRAMS

FIG. 14

FIG. 14

that this instrument will eventually become the standard receiver and will incorporate the suppression units at present associated with the R.1155B (paras. 103 and 104). These notes describe the R.1155A in its existing limited form.

100. The arrangement comprises three assemblies which are the grid rejector circuit, the anode rejector circuit and the anode acceptor circuit. These three assemblies are shown inset in the theoretical circuit diagram of fig. 3 which gives only that portion of the R.1155 circuit affected by their inclusion.

101. The grid rejector circuit is included in the grid circuit of the R.F. valve $V_3$ from the top end of the variable condenser $C_{84}$ and the aerial circuit coils to the grid of $V_3$. The circuit consists of a coil $L_{31}$ with a parallel fixed condenser $C_{113}$. In series with the rejector circuit there is the added impedance of a condenser $C_{112}$ having a resistance $R_{71}$ of 150,000 ohms in parallel. This circuit minimises the additional capacitance to earth produced by the addition of the filter and associated wiring.

102. The anode rejector circuit between the anode of $V_3$ and the switch section $FS_{yr}$, which switches the anode coil primaries of this stage, consists of a coil $L_{32}$ with a parallel fixed condenser $C_{116}$. The anode acceptor circuit consists of a condenser $C_{114}$ and a coil $L_{33}$ in series between the anode of $V_3$ and the chassis earth.

**Receiver R.1155B**

103. The receiver, type R.1155B is a modified form of the R.1155 and whilst incorporating the arrangements designed to prevent interference by broadcast transmitters whose carrier frequencies approximate to the I.F. of 560 kc/s it has, in addition, six R.F. choke coils all introduced at the points indicated in the inset in fig. 3. These chokes are designed to filter the unwanted frequencies from transmitters utilizing a V.H.F.

104. In order to bring about a condition of maximum impedance in respect of the R.F. chokes they have been designed to represent an electrical $\frac{\lambda}{2}$. In the circuit diagram of fig. 16 they are annotated generally, as HFC. The choke $HFC_4$ is in series with the trailing aerial and the choke $HFC_3$ is in series with the fixed aerial. The chokes $HFC_1$ and $HFC_2$ are in series with the loop aerial leads. In the common grid circuit of the L.F. switching valves $V_2$ and $V_1$, the choke $HFC_5$ is inserted. The choke $HFC_6$ is incorporated in the grid circuit of the valve $V_3$ and is, in series with the grid M.F. rejector circuit and the resistance-condenser combinations $C_{112}$–$R_{71}$. A condenser $C_{115}$ shunted by a resistance $R_{72}$ is connected between the switch contact 3 of $FS_{xf}$ section and the primary of $L_3$.

## CONSTRUCTIONAL DETAILS

**Receiver R.1155**

105. The control panel of the receiver, type R.1155 is shown in fig. 1. Other illustrations of the R.1155 are given in fig. 15, which is a view of the upper deck of the chassis, and fig. 16 which shows the chassis underside view. The composite diagram of fig. 17 gives the location of components. To facilitate search this diagram has been "gridded" and a reference table is provided.

106. The containing box of the receiver is easily removed by loosening the four screws indicated as (1) on fig. 1 and by pulling on the handles (8). The box is mounted on special rubber anti-vibrational suspension units, which are known as the mounting, type 54. This method of mounting is also used when the receiver is back mounted. All cable connexions to the receiver are terminated in plugs and sockets which are non-reversible and non-interchangeable. Cables are, wherever possible, metal braided, the braiding being earthed to reduce interference from external sources. The receiver containing box and chassis and panel are of metal construction, being earthed to the main bonding system of the aircraft.

107. Referring to fig. 1, the metal strip (2) is a retaining strip by means of which the cable connector plug and sockets are secured to the receiver by means of the metal posts (3). The calibrated tuning dial (4) which differs as to type in certain models (*see* Appendix 2) shows the frequency to which the receiver is tuned by a pointer (5). The tuning control (6) has two speeds, direct drive (outer knob) and 100 : 1 slow-motion gearing (inner knob) for vernier tuning. The exact point of resonance is indicated on the tuning indicator $V_{10}$, located to the right-hand side of the tuning scale. The tuning control (6) is coupled to a three-gang condenser comprising $C_{82}$, $C_{83}$ and $C_{84}$.

108. The tuning scale is divided as follows:—

RANGE 1 18·5 Mc/s to 7·5 Mc/s. The scale colouring refers to the dial colouring on the transmitter of the T.1154 group. Ranges not covered by the transmitter are engraved BLACK. The part of the scale marked 10 Mc/s to 7·5 Mc/s refers to RANGE 1 on the transmitters T.1154, T.1154A and T.1154B, and is coloured BLUE. The scale is marked in divisions of 100 kc/s.

RANGE 2 7·5 Mc/s to 3 Mc/s. From 7·5 Mc/s to 5·5 Mc/s the scale is coloured BLUE referring to RANGE 1 on the T.1154. The portion coloured RED corresponds to the transmitter RANGE 2. Scale divisions are marked every 50 kc/s.

RANGE 3 From 1,500 kc/s to 600 kc/s This is engraved BLACK and marked every 10 kc/s.

RANGE 4 From 500 kc/s to 200 kc/s. This is coloured YELLOW corresponding to RANGE 3 on the transmitter Scale divisions are marked every 10 kc/s.

RANGE 5 From 200 kc/s to 75 kc/s. This is engraved BLACK and marked every 5 kc/s.

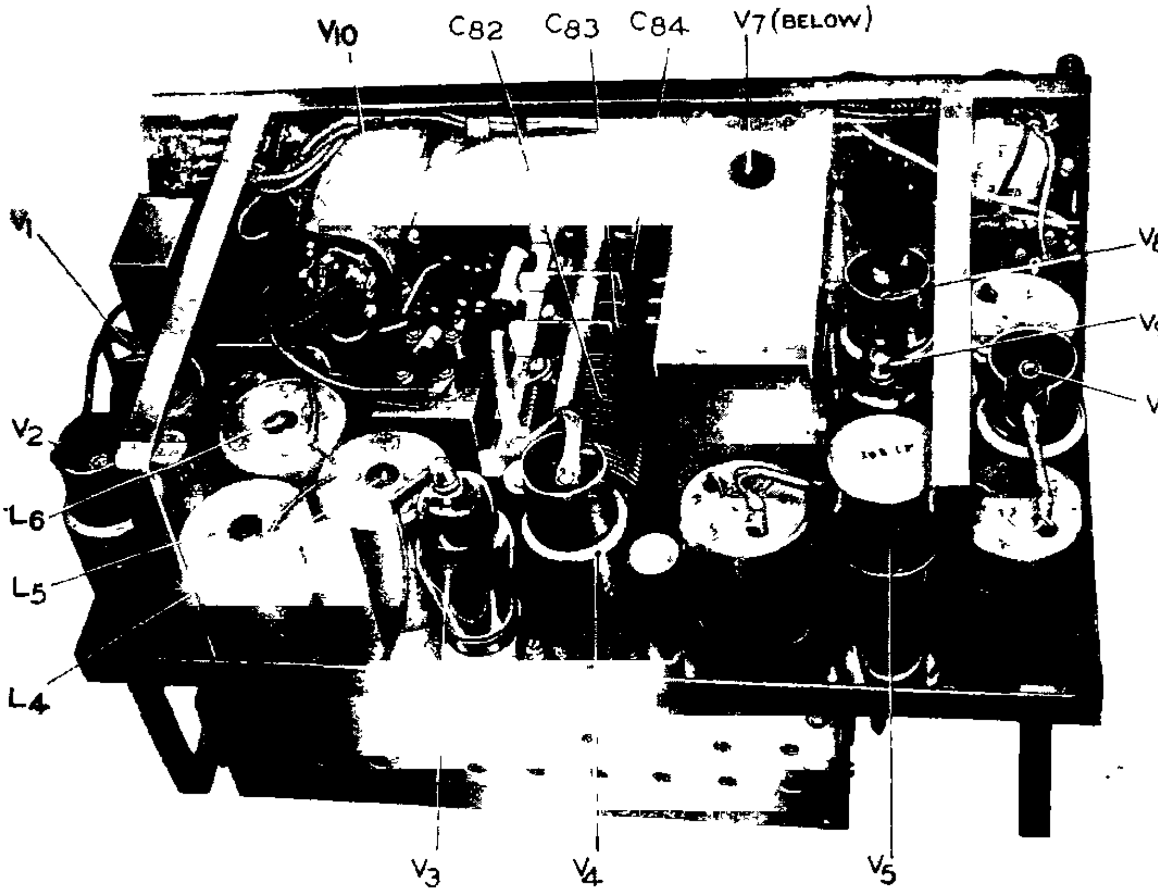



FIG. 15—R 1155 CHASSIS UPPER DECK

109. The five-wafer master switch (MS), type 234, has five positions which are as follows:—

OMNI ( )—The R.F. and I.F. gain is manually controlled by $R_{8(1)}$ which is represented by the control (7). The control (7) actuates $R_{8(1)}$ in this position of the master switch but brings a ganged potentiometer $R_{8(2)}$ into circuit in the A.V.C. position (*see* below). The knob (7) is rotated clockwise and is engraved INCREASE VOLUME.

A.V.C.—The R.F. and I F gain is automatically controlled. This position is used for W.T. reception and for back-tuning between transmitter and receiver.

BALANCE—For balancing the visual indicator before using D/F. This position is used *in conjunction* with the adjustment of the meter balance control $R_{51}$.

VISUAL—For visual D/F "homing" by the pilot.

FIGURE-OF-EIGHT—For aural D/F reception on "null" signals, using the switch $S_3$ (L–R) for sense discrimination.

110. The frequency range switch FS is at the lower left-hand side of the tuning scale and selects the five frequency RANGES. Its five positions are engraved with the numerical band coverage and there is a supplementary colour-coded scale. It is composed of one switch, type 368 for oscillator wafer, one switch, type 369 for anode wafer, one switch, type 370 for aerial wafer, and one switch, type 371 for the loop aerial wafer.

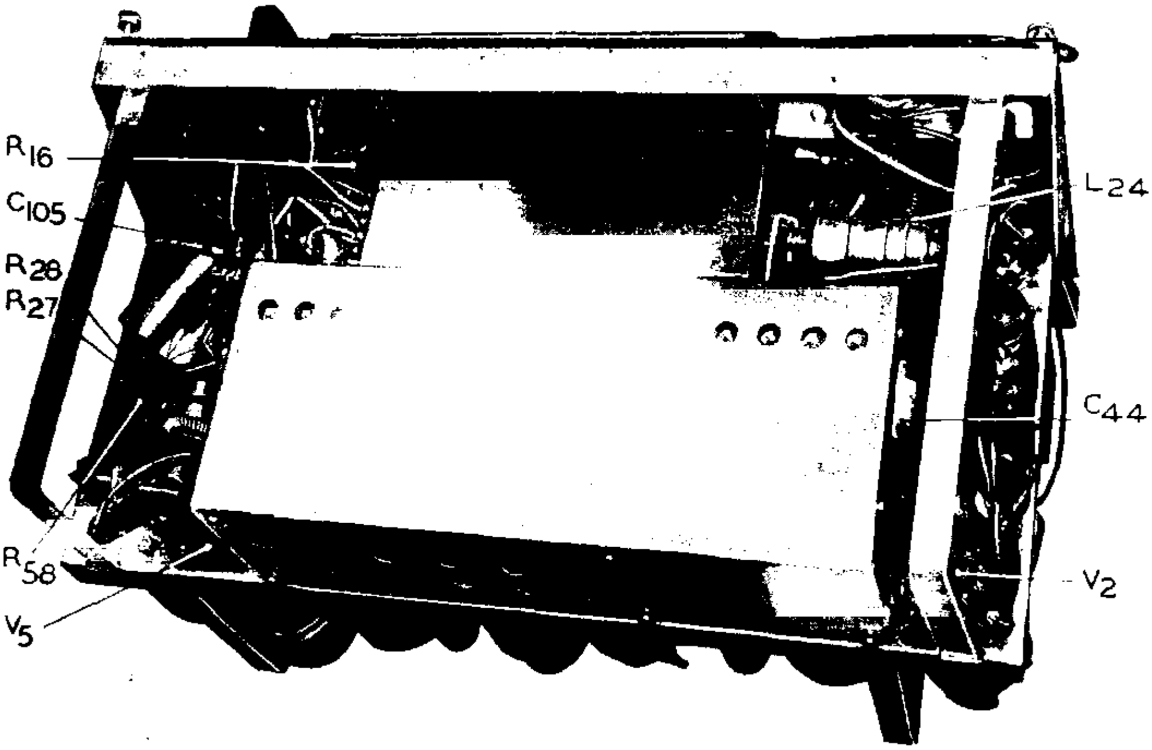



FIG. 16.—R.1155 CHASSIS, UNDERSIDE

111. The remaining front panel controls include the L.F. filter switch $S_5$, the meter amplitude control of $R_{23}$, the heterodyne switch $S_4$, the meter sensitivity switch $S_2$, type 235, and the meter frequency switch $S_1$. The switches $S_1$, $S_4$ and $S_5$ are single-pole switches of the type 152.

112. The aural sense switch $S_3$ has three positions and is spring-loaded to allow it to revert to the centre position when not normally held to the left or to the right. It is of the type 239. Screwdriver adjustment is provided, on the panel, for the B.F.O. circuit of $V_7$ by $C_{13}$ which is of the type 1525. The condenser $C_{18}$ near to the meter amplitude control $R_{23}$ is adjustable between capacitance limits of from 5 $\mu\mu$ F to 60 $\mu\mu$ F.

113. The degrees of fixed aerial input to the switching valves $V_1$ and $V_2$ and thence to the loop aerial, are adjusted, when the receiver is installed, by means of $C_{56}$ which is found below $S_1$ and is of the screwdriver, adjustable, type 906, from 8 $\mu\mu$ F to 115 $\mu\mu$ F.

114. The panel is attached to a metal tray, braced top and bottom, by right-angle strips returned to the panel upper and lower edges. The strips provide an equalising fit into the receiver container. The upper deck plan view in fig. 15 shows the chassis with valves in position. For the purposes of this illustration the screening container of the valve $V_3$ has been removed. The disposition of the components can be seen in the location diagram of fig. 17.

115. An underside view of the chassis is given in fig. 16. The aerial circuit, anode circuit and local oscillator coils, associated condensers, resistances, and the wafers, wr–wf, xr–xf, yr–yf and zr–zf of the frequency range switch FS are contained inside the large screening case at the bottom of fig. 16. Fifteen ports can be seen near the top edge of this container and, reading from left to right, they are the adjustment ports for the trimmer condensers $C_{69}$, $C_{70}$, $C_{68}$, $C_{71}$, $C_{72}$, $C_{63}$, $C_{64}$, $C_{65}$, $C_{62}$, $C_{66}$, $C_{59}$, $C_{60}$, $C_{61}$, $C_{58}$ and $C_{57}$.

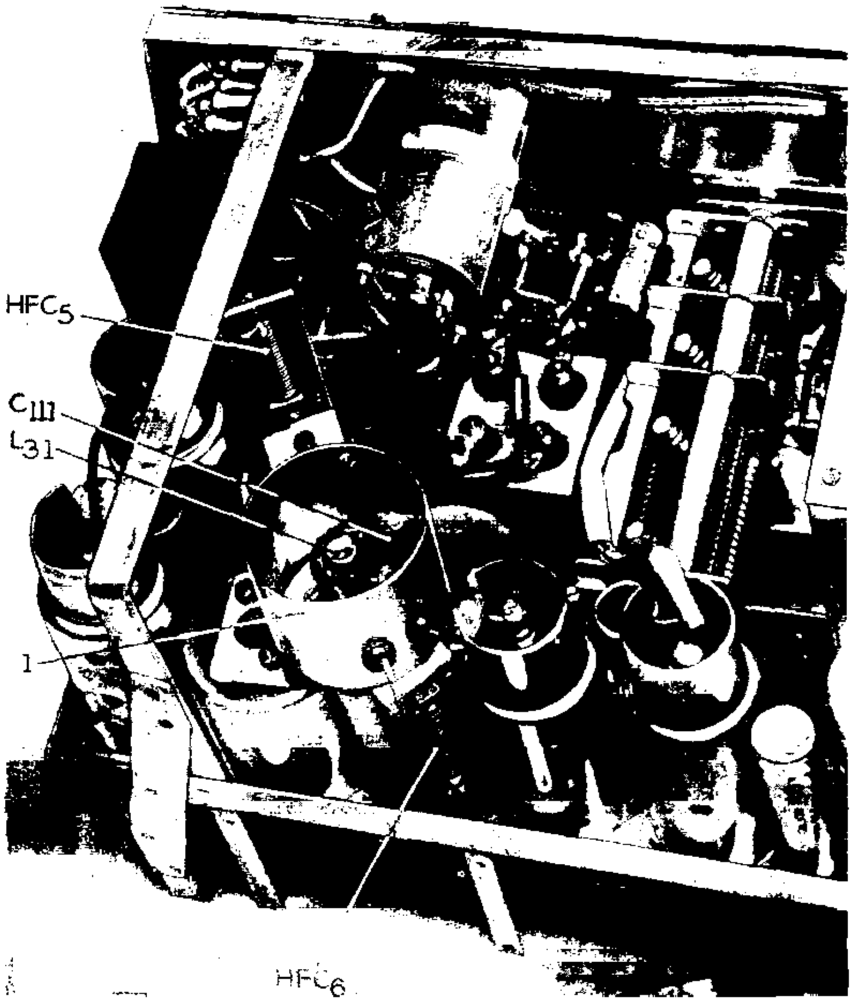
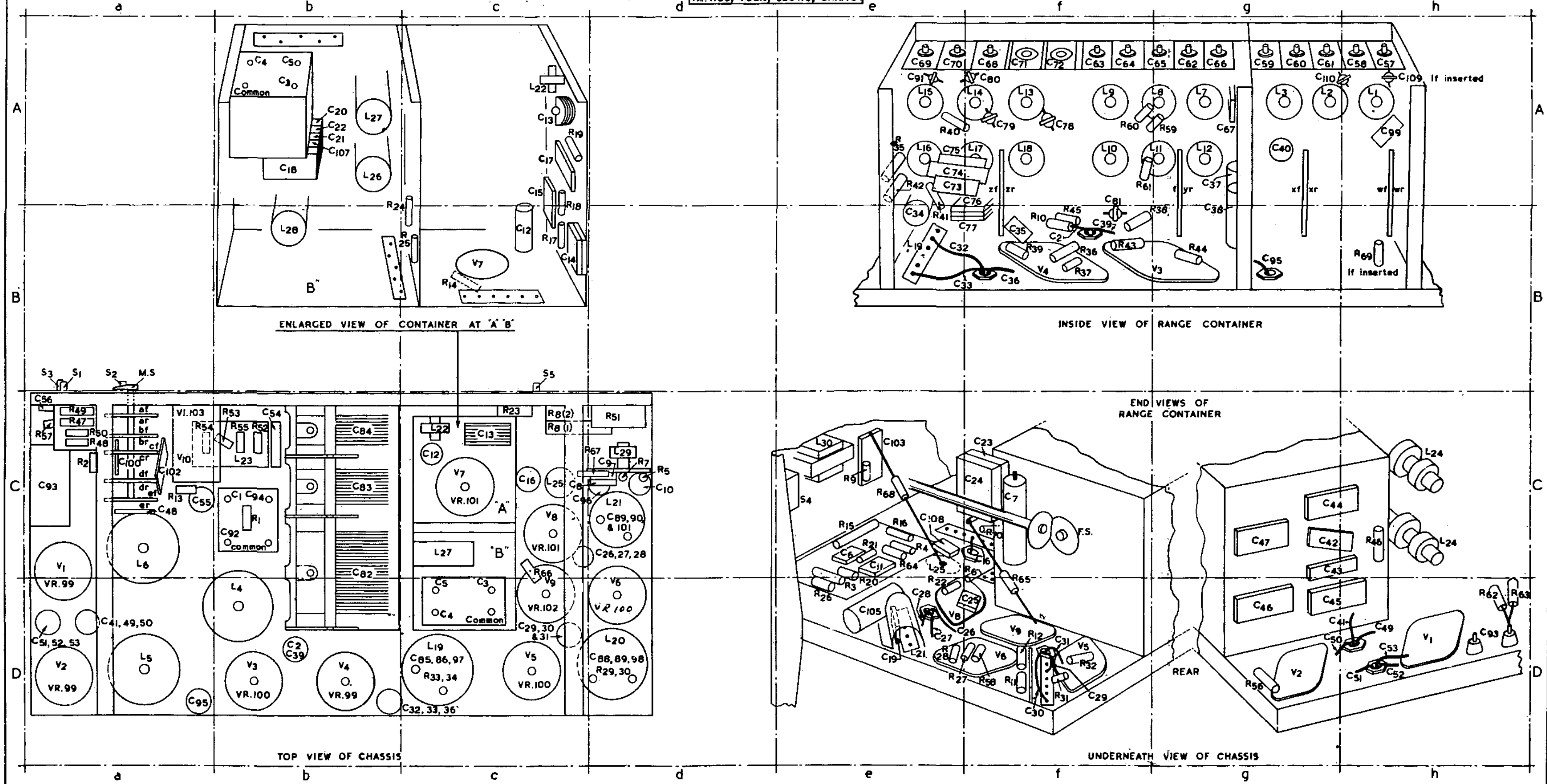



FIG. 18.—R.1155B CHASSIS UPPER DECK

**Receivers R.1155A and R.1155B**

118. Referring to fig. 18 the screening can (1), mounted over the three D/F aerial coil assemblies on the upper side of the deck, contains the rejector filter unit, type 44, comprising a coil $L_{31}$, type 393, with a condenser $C_{111}$, type 2,613. In the R.1155A this can also contains a condenser $C_{112}$, type 2,612 and a resistance $R_{71}$, type 7373. In the R.1155B these two components are located in the H.F. coil box under the deck and are connected between the choke $HFC_6$ and the switch section xr. The choke $HFC_5$ connected between the vertical aerial tuning condenser $C_{56}$ and the control grids of $V_1$ and $V_2$ is mounted on a bracket adjacent to the top caps of $V_1$ and $V_2$. The illustration of fig. 19 shows the H.F. coil box removed. The positions of the suppressor components are indicated.




COMPONENTS LOCATION DIAGRAM

FIG. 17

REPRINT PP2150 M28881/2459 4/43 4250 C & P Gp. 959(4)

This table should be read in conjunction with fig. 17

COMPONENTS LOCATION (GRID REFERENCES)

| Component | G. R. | Component | G. R. | Component | G. R. | Component | G. R. |
|---|---|---|---|---|---|---|---|
| $C_1$ | Cb | $C_{29}$ | Dc | $C_{57}$ | Ah | $C_{85}$ | Dc |
| $C_2$ | Db | $C_{30}$ | Dc | $C_{58}$ | Ah | $C_{86}$ | Dc |
| $C_3$ | Ab, Dc | $C_{31}$ | Dc | $C_{59}$ | Ag | $C_{87}$ | Dd |
| $C_4$ | Ab, Dc | $C_{32}$ | Db | $C_{60}$ | Ag | $C_{88}$ | Dd |
| $C_5$ | Ab, Dc | $C_{33}$ | Db | $C_{61}$ | Ag, Ah | $C_{89}$ | Cd |
| $C_6$ | Ce | $C_{34}$ | Be | $C_{62}$ | Ag | $C_{90}$ | Cd |
| $C_7$ | Cf | $C_{35}$ | Bf | $C_{63}$ | Af | $C_{91}$ | Ac |
| $C_8$ | Cd | $C_{36}$ | Db | $C_{64}$ | Af | $C_{92}$ | Cb |
| $C_9$ | Cd | $C_{37}$ | Ag, Bg | $C_{65}$ | Af, Ag | $C_{93}$ | Ca, Dh |
| $C_{10}$ | Cd | $C_{38}$ | Ag, Bg | $C_{66}$ | Ag | $C_{94}$ | Ch |
| $C_{11}$ | Ce | $C_{39}$ | Bf, Db | $C_{67}$ | Ag | $C_{95}$ | Da |
| $C_{12}$ | Bc | $C_{40}$ | Ag | $C_{68}$ | Af | $C_{96}$ | Cd |
| $C_{13}$ | Ac, Cc | $C_{41}$ | Da | $C_{69}$ | Ae | $C_{97}$ | Dc |
| $C_{14}$ | Bc | $C_{42}$ | Cg, Ch | $C_{70}$ | Ac, Af | $C_{98}$ | Dd |
| $C_{15}$ | Ac | $C_{43}$ | Cg, Ch | $C_{71}$ | Af | $C_{99}$ | Ah |
| $C_{16}$ | Cc | $C_{44}$ | Cg, Ch | $C_{72}$ | Af | $C_{100}$ | Ca |
| $C_{17}$ | Ac | $C_{45}$ | Dg, Dh | $C_{73}$ | Ae, Af | $C_{101}$ | Cd |
| $C_{18}$ | Ab | $C_{46}$ | Dg | $C_{74}$ | Ae, Af | $C_{102}$ | Ca |
| $C_{19}$ | De | $C_{47}$ | Cg | $C_{75}$ | Ae, Af | $C_{103}$ | Ce |
| $C_{20}$ | Ab | $C_{48}$ | Ca | $C_{76}$ | Bc, Bf, Af | $C_{104}$ | Plug type 209 |
| $C_{21}$ | Ab | $C_{49}$ | Da | $C_{77}$ | Be, Bf | | |
| $C_{22}$ | Ab | $C_{50}$ | Da | $C_{78}$ | Af | $C_{105}$ | De |
| $C_{23}$ | Ce, Cf | $C_{51}$ | Da | $C_{79}$ | Af | $C_{106}$ | Plug type 209 |
| $C_{24}$ | Ce, Cf | $C_{52}$ | Da | $C_{80}$ | Af | | |
| $C_{25}$ | De, Df | $C_{53}$ | Da | $C_{81}$ | Bf | $C_{107}$ | Ab |
| $C_{26}$ | Cd, Cc | $C_{54}$ | Cb | $C_{82}$ | Db, Cb | $C_{108}$ | Ce |
| $C_{27}$ | Cd, Cc | $C_{55}$ | Ca | $C_{83}$ | Cb | $C_{109}$ | Ah |
| $C_{28}$ | Cd, Cc | $C_{56}$ | Ca | $C_{84}$ | Cb | $C_{110}$ | Ag |

RESISTANCES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $R_1$ | Cb | $R_{19}$ | Ac | $R_{37}$ | Bf | $R_{55}$ | Cb |
| $R_2$ | Ca | $R_{20}$ | Ce, Dc | $R_{38}$ | Bf | $R_{56}$ | Dg |
| $R_3$ | Ce, De | $R_{21}$ | Ce | $R_{39}$ | Bf | $R_{57}$ | Ca |
| $R_4$ | Ce | $R_{22}$ | De | $R_{40}$ | Ae | $R_{58}$ | Df |
| $R_5$ | Cd | $R_{23}$ | Cc | $R_{41}$ | Ae | $R_{59}$ | Af, Ag |
| $R_6$ | Cf, Df | $R_{24}$ | Ac, Bc | $R_{42}$ | Ae | $R_{60}$ | Af |
| $R_7$ | Cd | $R_{25}$ | Bc | $R_{43}$ | Bf | $R_{61}$ | Af |
| $R_8$ | Cc | $R_{26}$ | De | $R_{44}$ | Bg | $R_{62}$ | Dh |
| $R_9$ | Ce | $R_{27}$ | Df | $R_{45}$ | Bf | $R_{63}$ | Dh |
| $R_{10}$ | Bf | $R_{28}$ | De | $R_{46}$ | Bf | $R_{64}$ | Ce |
| $R_{11}$ | Df | $R_{29}$ | Dd | $R_{47}$ | Ca | $R_{65}$ | Cf, Df |
| $R_{12}$ | Df | $R_{30}$ | Dd | $R_{48}$ | Ca | $R_{66}$ | Cc |
| $R_{13}$ | Ca | $R_{31}$ | Df | $R_{49}$ | Ca | $R_{67}$ | Cd |
| $R_{14}$ | Bc | $R_{32}$ | Df | $R_{50}$ | Ca | $R_{68}$ | Ce |
| $R_{15}$ | Ce | $R_{33}$ | Dc | $R_{51}$ | Cd | $R_{69}$ | Bh (if used) |
| $R_{16}$ | Ce | $R_{34}$ | Dc | $R_{52}$ | Cb | $R_{70}$ | Cf |
| $R_{17}$ | Bc | $R_{35}$ | Ae | $R_{53}$ | Cb | | |
| $R_{18}$ | Ac, Bc | $R_{36}$ | Bf | $R_{54}$ | Ca | | |

COILS AND CHOKES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $L_1$ | Ah | $L_9$ | Af | $L_{17}$ | Ae, Af | $L_{25}$ | Ce, Cd |
| $L_2$ | Ag, Ah | $L_{10}$ | Af | $L_{18}$ | Af | $L_{26}$ | Ab |
| $L_3$ | Ag | $L_{11}$ | Af, Ag | $L_{19}$ | Dc, Be | $L_{27}$ | Ab, Ce |
| $L_4$ | Db | $L_{12}$ | Ag | $L_{20}$ | Dc, Dd | $L_{28}$ | Bb |
| $L_5$ | Da | $L_{13}$ | Af | $L_{21}$ | Ce, De | $L_{29}$ | Cd, Cc |
| $L_6$ | Ca | $L_{14}$ | Af, Ae | $L_{22}$ | Ac | $L_{30}$ | Ce |
| $L_7$ | Ag | $L_{15}$ | Ae | $L_{23}$ | Cb | | |
| $L_8$ | Af, Ag | $L_{16}$ | Ae | $L_{24}$ | Ch | | |

VALVES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $V_1$ | Ca, Da, Dh | $V_4$ | Db; Bf | $V_6$ | Dd, Cd, Dc, Df | $V_8$ | Cc |
| $V_2$ | Da, Dg | $V_5$ | Dc; Df | | | $V_9$ | Cc, Dc, Df |
| $V_3$ | Dd, Bf, Bg | | | $V_7$ | Bc, Cc' | $V_{10}$ | Ca |

SWITCHES

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $S_1$ | Ca | $S_3$ | Ba | $S_5$ | Bc | F.S. | Af to Ah |
| $S_2$ | Ba | $S_4$ | Ce | M.S. | Ca | | |

## VALVES AND POWER SUPPLIES

119. The accompanying TABLE B gives a list of the valves used in the receivers, types R.1155, R.1155A and R.1155B, showing their respective function, type and Stores Reference number.

TABLE B

### R.1155 VALVE LIST

| Ref. in fig. 2 | Function | Type | Stores Ref. No. |
|---|---|---|---|
| $V_1$, $V_2$ | Visual D/F switching | Triode-hexode, V.R.99 | 10E/277 |
| $V_3$ | R.F. amplifier | Aligned grid variable-mu pentode V.R.100 (tetrode connexion) | 10E/278 |
| $V_4$ | Frequency-changer | Triode-hexode, V.R.99 | 10E/277 |
| $V_5$, $V_6$ | I.F. amplifiers | Aligned grid variable-mu pentode, V.R.100 (tetrode connexion) | 10E/278 |
| $V_7$<br>$V_8$ | A.V.C. and B.F.O.<br>Second detector, visual meter limiter and output | Double diode triode, V.R.101 | 10E/280 |
| $V_9$ | Visual meter switching | Double triode, V.R.102 | 10E/279 |
| $V_{10}$ | Tuning indicator | V.I.103 | 10E/305 |

All the above valves are fitted with international octal bases. A diagram of the base connexions is given in fig. 20.

120. The receivers R.1155 were originally issued with the valve positions marked with trade nomenclatures. Later issues of the receivers are marked with the standard A.M. V.R. numbers as indicated in the table of para. 119. To remove the difficulty arising when it is necessary to fit spare valves marked in one system into a receiver marked in the other system a valve identification label (Stores Ref. 10D/580) has been prepared. Instructions for affixing this label to the screening box of the valve $V_7$ and its associated components are contained in the leaflet A.P.1186/B.48–W.

121. The sequence of operations for affixing the valve label is as follows:—

(i) Remove the receiver from its outer screening case.

(ii) Identify the flat screening box immediately behind the front panel and adjacent to the tuning condensers. Remove the four fixing screws in the centre of the top screening plate.

(iii) Use shellac varnish (Stores Ref. 33A/511) to fix the label to the rear inside face of the receiver can in the most suitable position for reading.

(iv) Apply a thin coat of shellac varnish over the label.

(v) Replace the receiver in its outer screening case.

122. Due to restricted space in early issues of the receiver, difficulty may be experienced in removing the B.F.O. valve $V_7$ without altering the adjustment of the B.F.O. tuning condenser $C_{13}$. Originally this condenser was a type 900 but this has been replaced by a type 1525 and no difficulty will be experienced in removing, or inserting, the valve $V_7$.

123. The procedure to be followed when removing $V_7$ is as follows:—

(i) Remove the receiver from its outer case by withdrawing the four screws from the front panel.

(ii) Remove the top cover of the oscillator unit, type 18, by withdrawing the six screws securing it. The valve $V_7$ and condenser, type 900, $C_{13}$ will now be exposed.

(iii) Using a suitable screwdriver, rotate the condenser, type 900, until the moving vanes are fully engaged with the fixed vanes. The valve can now be readily removed and replaced without fouling the condenser.

(iv) Replace the top cover of the oscillator unit and place the receiver in its outer case.

The procedure for setting up the B.F.O. is laid down in para. 165.

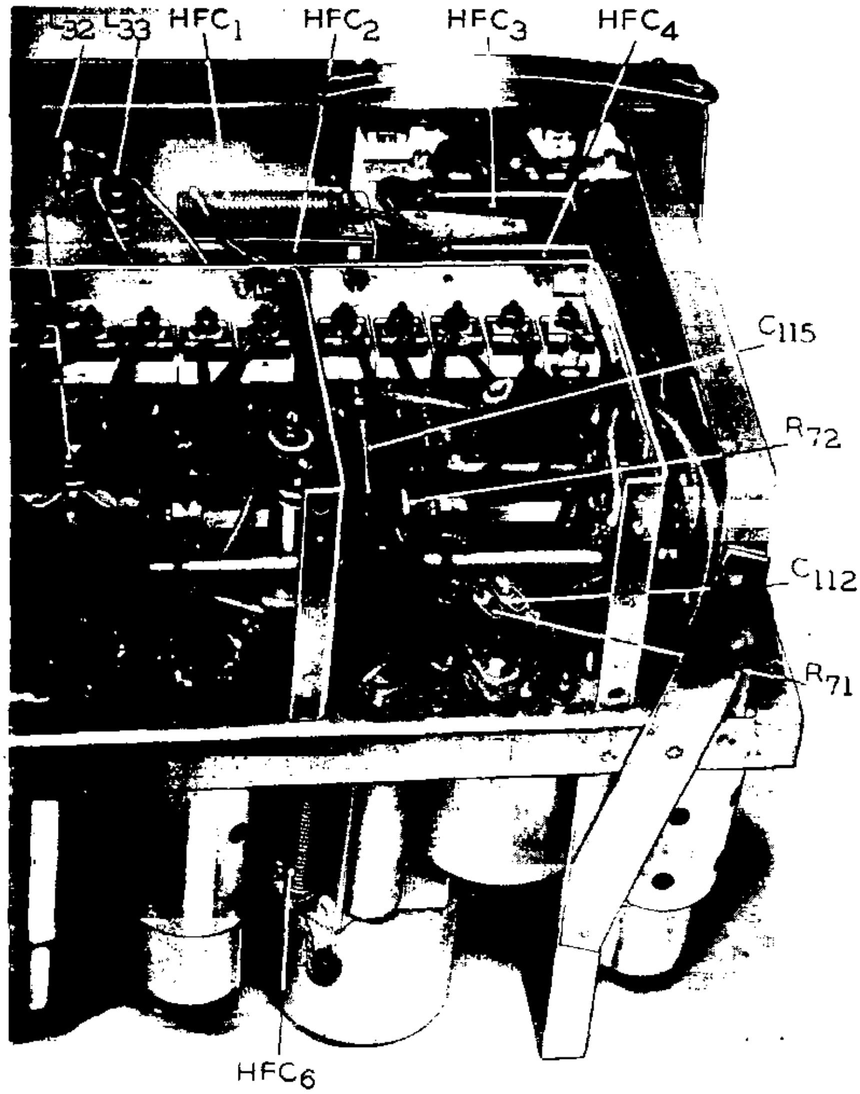



FIG. 19.—R.1155B CHASSIS UNDERSIDE

When the R.1155 is used solely as a communications receiver, the visual D/F switching and meter valves $V_1$, $V_2$ and $V_9$ are removed to conserve power. Whilst the valves $V_1$, $V_2$ and $V_4$

126. A small padded valve stowage box (Stores Ref. 10E/542) is provided for use, where necessary, for carrying spare valves and it is desirable to carry one V.R.101, and one V.R.100 for the receiver.

127. The power supplies for both L.T. and H.T. of this receiver are derived from a power unit incorporating a three-commutator compound wound rotary transformer driven off the aircraft general electrical system. The power unit, which may be either the type 34 (Stores Ref. 10K/19) of the type 35 (Stores Ref. 10K/20), is described in detail in Sect. 1, Chap. 7 of this publication. The power units, types 34A and 35A which are improved versions of these units are also described therein.

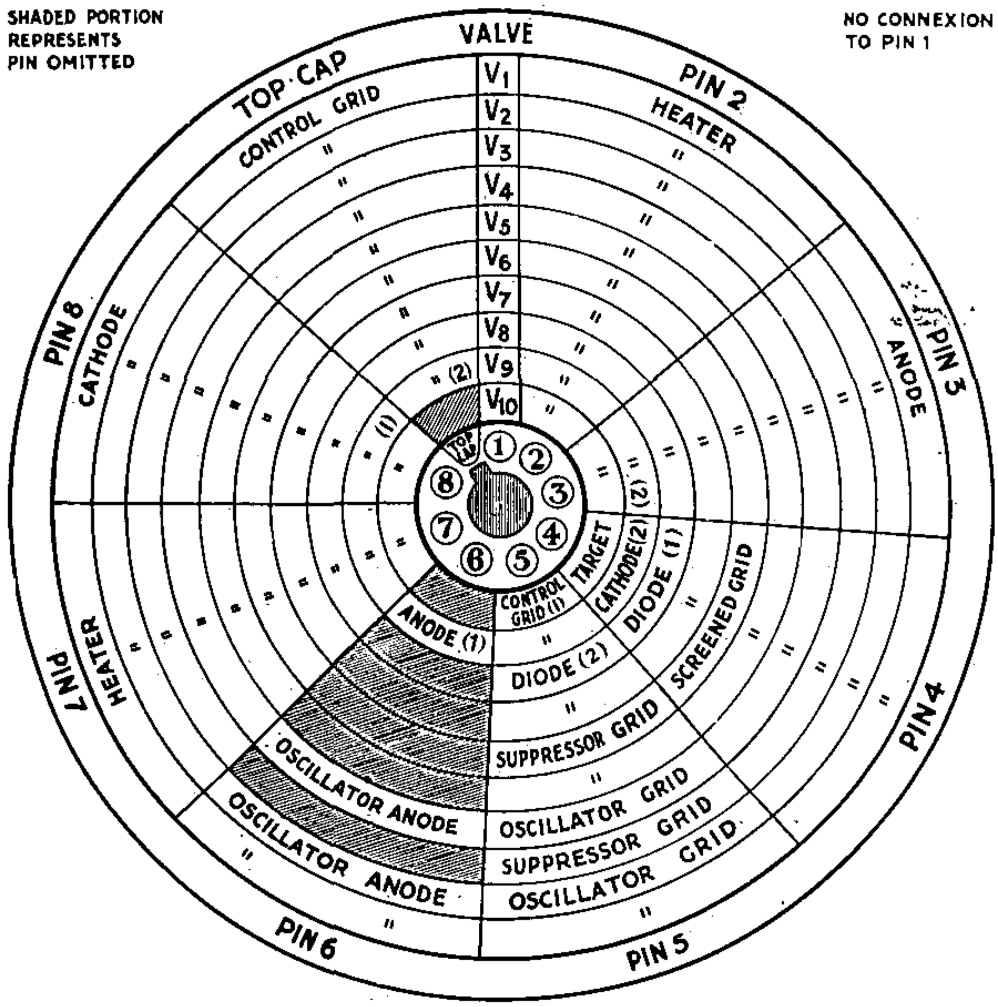



FIG. 20.—VALVE CONNEXIONS

128. The power unit is used in common with the transmitter and supplies the L.T. for that instrument. The accompanying TABLE C gives the power unit types and details.

TABLE C

**R.1155 ASSOCIATED POWER UNITS**

| Type | Stores Ref. No. | Input D.C. | | L.T. — Outputs | | — H.T. | | Rated Watts |
|---|---|---|---|---|---|---|---|---|
| | | Volts | Amps. | Volts | Amps. | Volts | mA. | |
| 34 | 10K/19 | 10·3 | 24 | 7 | 13 | 217 | 110 | 115 |
| 35 | 10K/20 | 18·5 | 12 | 7 | 13 | 217 | 110 | 115 |
| 34A | 10K/13065 | 10·3 | 24 | 7 | 13 | ~~217~~ | 110 | ~~115~~ |
| 35A | 10K/13066 | 18·5 | 12 | 7 | 13 | 217 | 110 | 115 |

The receiver D.C. feed varies according to the master switch position ranging from 48 mA at OMNI with volume control at a minimum tc 69 mA or more at BALANCE or VISUAL with maximum setting of volume control.

129. The aircraft electrical supply is connected to the L.T. power unit through a resistance unit, type 47 (Stores Ref. 10C/2221), or type 52 (Stores Ref. 10C/2295), for the type 34 and type 35 respectively. This resistance unit is adjusted to maintain the filament voltage between 6 volts and 7·8 volts and to compensate for the voltage alteration between the charge and no-charge condition of the aircraft batteries. It is dealt with in detail in Sect. 1, Chap. 7 of this AIR PUBLICATION.

## INSTALLATION

### General

130. The following notes upon the installation of the receiver duplicate, to some extent, the installation paragraphs included in Sect. 1, Chap. 7, of this AIR PUBLICATION upon the transmitter T.1154. This is unavoidable due to the interdependence of the transmitter and receiver when used as airborne equipment. A typical installation diagram is given in fig. 21. When it is realized that the transmitter is the main focal point of the wiring any initial confusion is dispelled. The power unit connectors plug into the transmitter, also the fixed and trailing aerials and connexions from the receiver.

131. In laying out the equipment in the aircraft the receiver is placed in the most convenient position for operation and where possible it is at desk level. The transmitter is mounted above, or to one side of the receiver. The tuning scales of the receiver are easily visible and the controls are accessible to the operator. The coloured click-stop dials on the transmitter are in an accessible position and visible without effort on the part of the operator.

### Receiver position

132. The receiver is normally positioned horizontally. If space is limited it may be mounted vertically. The receiver is mounted on suspension fittings, mounting, type 54, and as these fittings will be 90 deg. out when the receiver is mounted vertically, a sponge rubber pad, mounting, type 55, may be positioned between the table and the bottom of the receiver. The receiver may be either table mounted or back mounted depending upon the aircraft layout.

133. From 1½ in. to 2 in. is left between the receiver and the table or between the transmitter and the receiver (if mounted one above the other) to permit freedom of movement for the suspension fittings. Clearance around the receiver and transmitter should be sufficient to allow for removal and replacement of plugs and sockets and of the chasses themselves. The transmitter case retaining screws will also be accessible. The equipment is not provided with internal illumination and is put in such a position that the natural illumination is good. For night work artificial illumination is provided and this is easily adjustable for direction and intensity.

### Power unit position

134. The H.T. and L.T. power units, the latter of which is used to supply the receiver, are positioned in an accessible position. Complete instructions on the installation of the power units power cables and fuses, the L.T. dropping resistances, types 47 and 52, and the positioning of apparatus with respect to the aircraft compass, are given in Sect. 1, Chap. 7 of the AIR PUBLICATION dealing with the transmitter T.1154 group. The receiver should be at least 24 in. from the compass and the visual indicator at least 18 in. to guarantee negligible interference.

### Aerial switch position

135. The aerial switching unit, type J or the aerial plug board, which is the temporary alternative to the switch unit, is positioned between the transmitter and the aerial lead-in points so that the "run" of the aerial leads is clean and short, but accessible for easy operation. Complete instructions upon the switch unit, the aerial plug board, internal aerial leads and other relevant detail are given in the transmitter chapter previously mentioned.

### D/F loop aerial and impedance matching units

136. The D/F circuits of the receiver have been arranged to work with a D/F loop, type 3, which has a nominal inductance of 100 $\mu$ H and a self-capacitance, when installed, of 20 $\mu\mu$ F. When loops, having constants widely differing from these figures, are used, it is necessary to use an impedance matching unit with a series or shunt coil between receiver and loop.

137. Two small condensers $C_{106}$ and $C_{104}$, the latter adjustable, are contained within the plug, type 209 (Stores Ref. 10H/433) which connects the D/F loop to the receiver. The condenser $C_{104}$ should be adjusted for maximum sensitivity. The fixed condenser $C_{106}$ should be wired in circuit only if the length of low-loss cable between loop and receiver is less than 12 ft. The position of the adjustment of $C_{104}$ can be seen on the diagram of the plug, type 209, in fig. 22. The screwdriver used for adjusting $C_{104}$ should have an insulated shaft to prevent short circuiting to the receiver metal casing. A suitable tool is the tool, tuning (Stores Ref. 10A/11421).

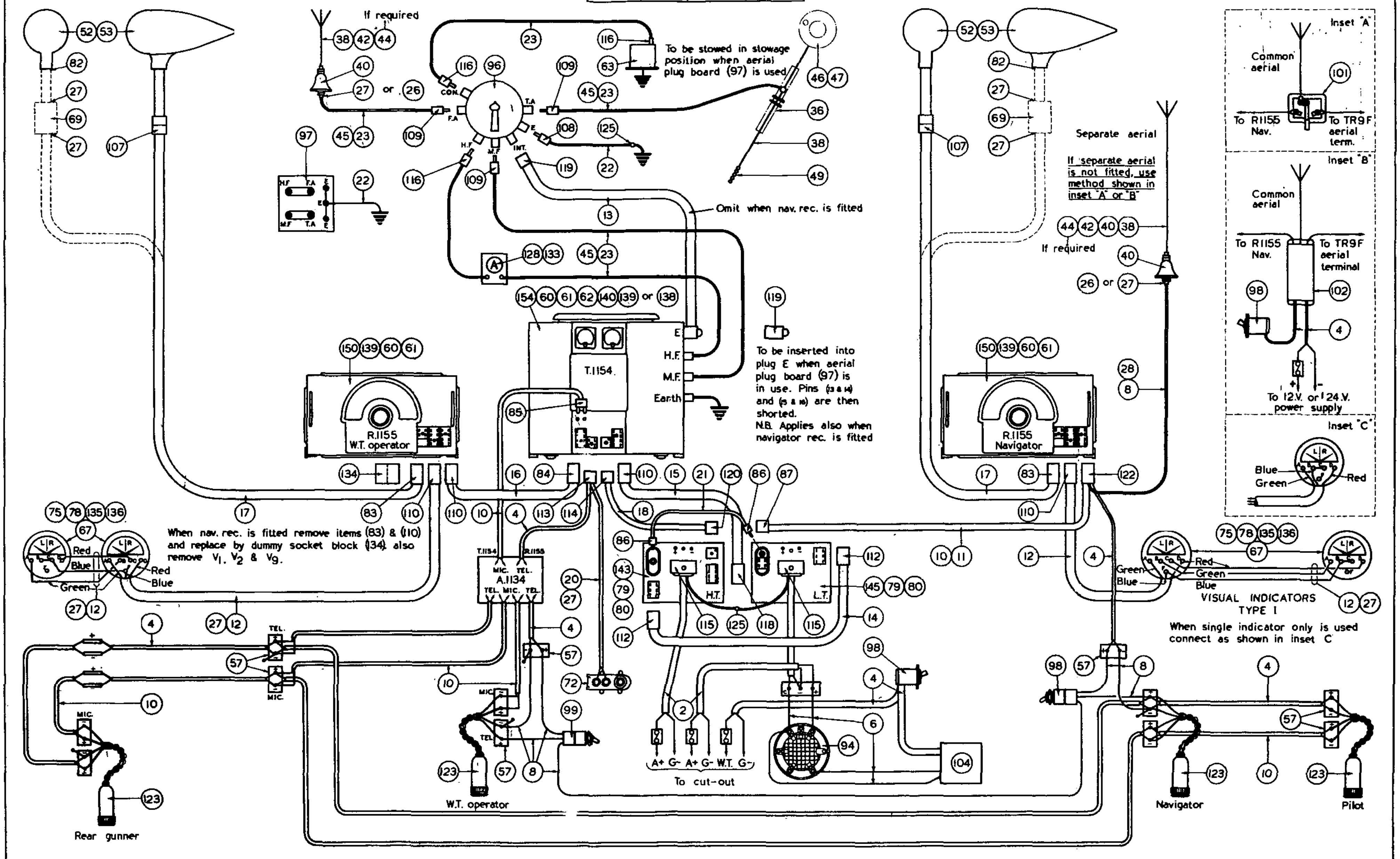



**FIG. 21** TYPICAL INSTALLATION DIAGRAM **FIG. 21**

| Item No. | Stores Ref. No. | Description |
|---|---|---|
| | | GENERAL WIRING |
| 2A | 5E/1364 | Cable L.T. Ducel 19 Cellse. braided or |
| 2B | 5E/1365 | Cable L.T. Ducel 37 metal braided |
| 4 | 5E/1362 | Cable L.T. Ducel 4 Cellse. braided |
| 6A | 5E/1360 | Cable electric L.T. Unicel 19 Cellse. braided or |
| 6B | 5E/1361 | Cable electric L.T. Unicel 37 Cellse. braided |
| 8 | 5E/1358 | ...ectric L.T Unicel 4 Cellse braided |
| 10 | 5E/1328 | Cable electric L.T. Dumet 4 metal braided |
| 11 | 5E/1348 | Cable electric L.T. Dumet 7 metal braided |
| 12 | 5E/1351 | Cable L.T. Trimet 4 metal braided |
| 13 | 5E/1353 | Cable L.T. Quad- |
| 14 | 5E/2069 | |
| 15 | 5E/2067 | |
| 16 | 5E/2068 | |
| 17 | 5E/2033 | Cable electric H.F. Dulocapmet No. 1 |
| 18 | 5E/758 | Cable H.T. Uni-plugmet No. 1 |
| 20 | 5E/916 | Cable L.T. , Uni- |
| 21 | 5E/130 | |
| 22 | 5E/ | |
| 23 | 5E/82 | |
| 26 | 5A/912 | |

| Item No. | Stores Ref. No. | Description |
|---|---|---|
| 27 | 5A/911 | Cable end eye type 4 B.A. |
| 28 | 5A/910 | Cable end eye type 6 B.A. |
| 31 | 5A/1810 | Cable end hook type crimping Uniflex cable |
| 34 | 5A/1073 | Sleeve identification Uniflex cable |
| | | .T. FIXED EQUIPMENT |
| 36 | Special | Ae. frld. com. with lghtn. arrt. type C |
| 38 | 10B/8235 | Ae. wire stainless steel |
| | 10B/8093 | Ae. insulator type 16 (lead in) or |
| 40B | 10B/11457 | ... insulator type .9 (lead in) |
| 42 | 10B/8097 | Ae. insulator type 17 (strain) or |
| 42B | 10B/8994 | Ae. insulator type 18 (strain) |
| 44 | 10B/9121 | Ae. insulator type 8 (shroud) |
| 45 | 10B/468 | Ae. insulator type |
| 52 | | Ae. loop type 1 or |
| 53 | | Ae. loop type 3. Group to suit a/c |
| 57 | | Block terminal type B 2 way No. 1 |
| | | Block terminal type B 3 way No. 1 |
| | | Block mounting |

| Item No. | Stores Ref. No. | Description |
|---|---|---|
| 69 | 10A/12148 | Impedance match-ing unit type 12 or |
| 69A | 10A/12247 | Impedance match-ing unit type 15 |
| 72 | 10A/7741 | Key morse type F |
| 73 | Special | Label |
| 75A | Special | Lamp holder or |
| 75B | 10A/13078 | Lamp holder type 61 |
| 78 | 10A/12954 | Mounting anti vibration type 119 |
| 79 | 10A/12421 | Mounting type 51 |
| 80 | 10A/12422 | Mounting type 52 |
| 82 | 10H/9872 | Plug type 101 |
| 83 | 10H/433 | Plug type 209 |
| 84 | 10H/434 | Plug type 210 |
| 85 | 10H/451 | Plug type 217 |
| 86 | 10H/8516 | Plug type 68 |
| 87 | 10H/1518 | Plug type 358 |
| 92 | 10A/12436 | Plate anchorage type 1 |
| 94A | 10C/2221 | Resistance uni type 47 |
| 94B | 10C/2295 | Resistance uni type 52 |
| 96 | 10F/126 | Switch unit type J or |
| 97 | | |
| 101 | | |
| 102A | | (12-v.) or |
| 102B | | |
| 104A | | |
| 104B | | |
| 106 | | |

| Item No. | Stores Ref. No. | Description |
|---|---|---|
| 112 | 10H/427 | Socket type 168 |
| 113 | 10H/428 | Socket type 169 |
| 114 | 10H/429 | Socket type 170 |
| 115 | 10H/431 | Socket type 171 |
| 116 | 10H/422 | Socket type 172 |
| 117 | 10H/423 | Socket type 173 |
| 118 | 10H/424 | Socket type 174 |
| 119 | 10H/425 | Socket type 175 |
| 120 | 10H/435 | Socket type 176 |
| 122 | 10H/1498 | Socket type 299 |
| 123 | 10H/2206 | Socket type 359 |
| 125 | 5A/1058 | Terminal 2 B.A. type A spring type |
| | | W.T. REMOVABLE EQUIPMENT |
| 128A | 10A/12227 | Ammeter H.W. 0–4 amps. type A or |
| 128B | 10A/12667 | Ammeter thermo 0–4 amps. type C |
| 131 | 10E/542 | Box valve stowage |
| 133 | 10A/12674 | Cover protective |
| 134 | 10H/1938 | Dummy sockets block |
| 135 | 5C/462 | Lamp instrument |
| 136A | 5L/1150 | [illegible]mp filament 12-v. or |
| 136B | 5L/1898 | Lamp filament 24-v. |
| 138 | 10A/12423 | Mounting type 53 |
| 139 | 10A/12424 | Mounting type 54 |
| 140 | 10A/12425 | Mounting type 55 |
| 143A | 10K/13063 | Power unit H.T. type 32A or |
| 143B | 10K/13064 | Power unit H.T. type 33A |
| 145A | 10K/13065 | Power unit L.T. type 34A or |
| 145B | 10K/13066 | Power unit L.T. type 34B |
| 150 | 10D/98 | Receiver R.1155 (or |
| 154A | 10D/97 | |
| 154B | 10D/99 | |
| 154C | 10D/196 | |
| 154D | 10D/198 | |

## TYPICAL CONNECTOR SET INSTALLATION

(*Note.*—This installation is typical and refers only to the SUNDERLAND type aircraft)

KEY TO BASIC TYPE NOS. AND FUNCTION

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 541 | Power Unit H.T. to Power Unit L.T. | 543 | Power Unit H.T. to Transmitter | 545 | Switch Unit, type J to Transmitter "D/F" | 547 | Receiver (Nav.) to Power Unit L.T. Only required when 2 Receivers fitted |
| 542 | Transmitter to Receiver | 544 | Power Unit H.T. to Transmitter | 546 | Loop Aerial, type 3 to Receiver | 548 | Used in place of Switch Unit, type J and also when 2 Receivers are installed |

| Aircraft Type Indentification Letter and Connector Set | Comprising Connector Set | | Fitted with | | | | | | | | | References in Figure |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Socket | | | Plug | | | |
| | Stores Ref. No. | Type | Stores Ref. No. | Cable type | Length | Stores Ref. No. | Type | Qty. | Stores Ref. No. | Type | Qty. | |
| Sunderland Mk. II and Mk. III | 10H/1634 | 541/1 | 5E/2069 | Sextocoremet | 1′ 3″ | 10H/427 | 168 | 2 | | | | 14, 112 |
| "A" | 10H/1635 | 542/1 | 5E/2068 | Octocoremet No. 2 | 3′ 2″ | 10H/322 | 137 | 1 | 10H/434 | 210 | 1 | 16,110, 84 |
| Fitted with single receiver | 10H/1636 | 543/1 | 5E/2067 | Octocoremet No. 1 | 3′ 0″ | 10H/322 | 137 | 1 | | | | 15, 110 |
| Connector Set | | | | | | 10H/424 | 174 | 1 | | | | 118 |
| Type T.1154/R1155 | 10H/1637 | 544/1 | 5E/758 | Uniplugmet No. 1 | 3′ 6″ | 10H/429 | 170 | 1 | | | | 18, 114 |
| (Stores Ref. | | | | | | 10H/435 | 176 | 1 | | | | 120 |
| 10H/1556) | 10H/1638 | 545/1 | 5E/1353 | Quadramet 4 | 1′ 10″ | 10H/425 | 175 | 2 | | | | 13, 119 |
| | 10H/1639 | 546/1 | 5E/2033 | Dulocapmet No. 1 | 13′ 8″ | 10H/11051 | 63 | 1 | 10H/433 | 209 | 1 | 17, 107, 83 |
| | 10H/1718 | 548/1 | 5E/1362 | Ducel 4 | 6′ 0″ | 10H/425 | 175 | 1 | | | | 119 |
| Fitted with extra | Items 10H/1634, 10H/1635, 10H/1636 and 10H/1718 as above. Item 10H/1637 is 4′ 0″ not 3′ 6″ | | | | | | | | | | | |
| Receiver R.1155 for D/F. | 10H/2317 | 545/3 | 5E/2033 | Dulocapmet No. 1 | 6′ 6″ | 10H/11051 | 63 | 1 | 10H/433 | 209 | 1 | 17, 107, 83 |
| Connector Set Type T.1154/2 R.1155/A (Stores Ref. 10H/1735) | 10H/1640 | 547/1 | 5E/1348<br>1328<br>1362 | Dumet 7<br>Dumet 4<br>Ducel 4 | 25′ 0″<br>25′ 0″<br>9′ 6″ | 10H/1498 | 299 | 1 | 10H/1518 | 358 | 1 | 11, 122, 87<br>10<br>4 |
| Conversion of Single Recr. Instn. | Item 10H/2317 (below) replaces Item 10H/1639 when converting to two Receiver installation | | | | | | | | | | | |
| To Two Recr. Instn. | 10H/2317 | 545/3 | 5E/2033 | Dulocapmet | 6′ 6″ | 10H/11051 | 63 | 1 | 10H/433 | 209 | 1 | 17, 107, 83 |
| Connector Set Type T.1154/R. 1155/Convn./A (Stores Ref. 10H/1986) | 10H/1640 | 545/3 | 5E/1328<br>5E/1328<br>5E/1362 | Dumet 4<br>Dumet 7<br>Ducel 4 | 25′ 0″<br>25′ 0″<br>9′ 6″ | 10H/1498 | 299 | 1 | 10H/1518 | 358 | 1 | 10, 122, 87<br>11<br>4 |

The following items refer to 14 connectors without reference Nos.:—

| Stores Ref. No. | Cable | Approx. length | Ref. in fig. | Sockets | | | Ref. in fig. | Plugs | | | Ref. in fig. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Stores Ref. No. | Type | Qty. | | Stores Ref. No. | Type | Qty. | |
| 5E/82 | Unispark 7 | 21′ 0″ | 23 | 10H/8531 | 40 | 1 | 106 | 10H/451 | 217 | 1 | 85 |
| 5E/86 | Uniflex 19 | 6′ 0″ | 22 | 10H/319 | 135 | 2 | 108 | | | | |
| 5E/916 | Unisheath 4 | 6′ 0″ | 20 | 10H/320 | 136 | 4 | 109 | | | | |
| 5E/1328 | Dumet 4 | 4′ 0″ | 10 | 10H/322 | 137 | 1 | 110 | | | | |
| 5E/1349 | Ducel 19 | 5′ 0″ | 2 | 10H/428 | 169 | 1 | 113 | | | | |
| 5E/1351 | Trimet 4 | 14′ 0″ | 12 | 10H/431 | 171 | 2 | 115 | | | | |
| 5E/1362 | Ducel 4 | 4′ 0″ | 4 | 10H/422 | 172 | 4 | 116 | | | | |
| | | | | 10H/423 | 173 | 2 | 117 | | | | |

The following items refer to 15 connectors without reference Nos.:—

| Stores Ref. No. | Cable | Approx. length | Ref. in fig. | Sockets Stores Ref. No. | Type | Qty. | Ref. in fig. | Plugs Stores Ref. No. | Type | Qty. | Ref. in fig. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5E/82 | Unispark 7 | 19′ 0″ | 23 | 10H/8531 | 40 | 1 | 106 | 10H/8531 | 68 | 2 | 86 |
| 5E/86 | Uniflex 19 | 6′ 0″ | 22 | 10H/319 | 135 | 2 | 108 | 10H/451 | 217 | 1 | 85 |
| 5E/916 | Unisheath 4 | 7′ 0″ | 20 | 10H/320 | 136 | 4 | 109 | | | | |
| 5E/1328 | Dumet 4 | 9′ 0″ | 10 | 10H/322 | 137 | 1 | 110 | | | | |
| 5E/1349 | Ducel 19 | 4′ 0″ | 2 | 10H/428 | 169 | 1 | 113 | | | | |
| 5E/1362 | Ducel 4 | 10′ 0″ | 4 | 10H/431 | 171 | 2 | 115 | | | | |
| 5E/1351 | Trimet 4 | 28′ 0″ | 4 | 10H/422 | 172 | 4 | 116 | | | | |
| 5E/130 | Unisheath 7 | 3′ 0″ | 21 | 10H/423 | 173 | 2 | 117 | | | | |

The following items refer to 2 connectors without reference Nos.:—

| Stores Ref. No. | Cable | Approx. length | Ref. in fig. | Sockets Stores Ref. No. | Type | Qty. | Ref. in fig. | |
|---|---|---|---|---|---|---|---|---|
| 5E/1351 | Trimet 4 | 18′ 0″ | 4 | 10H/322 | 137 | 1 | | Replaces Receiver to Indicator connector |
| 5E/130 | Unisheath 7 | 3′ 0″ | 21 | 10H/8531 | 68 | 2 | | Connector between power units |

(iii) Adjust the trimmer condenser $C_{106}$ to the position which gives maximum signals. Observe the tuning indicator $V_{10}$ for minimum shadow during this operation.

(iv) Remove the loop plug, type 209, from the receiver and note the position of the rotor plates in the condenser $C_{106}$. If it is found that the plates are in a position between maximum and minimum capacitance, that is, at about 90 deg., the adjustment is satisfactory and the plug should be replaced.

(v) If it is found that the rotary plates are fully meshed it is an indication that insufficient capacitance adjustment is obtainable and additional capacitance should be added by removing the insulated covering from the leads, running the insulated covering from the leads across the paxolin strips from the lower pair of tags to the top pair of tags and by soldering the leads to the middle pair of tags adjacent to the leads.

(vi) If examination shows that the rotor plates are in the position of minimum capacitance it is an indication that too much capacitance is in circuit. The additional capacitance of the fixed condenser $C_{104}$ should be removed by reversing the procedure outlined in (v) above. Unsolder the connecting wires from the middle pair of tags and cover the wires with suitable insulation to prevent contact with the middle pair of tags.

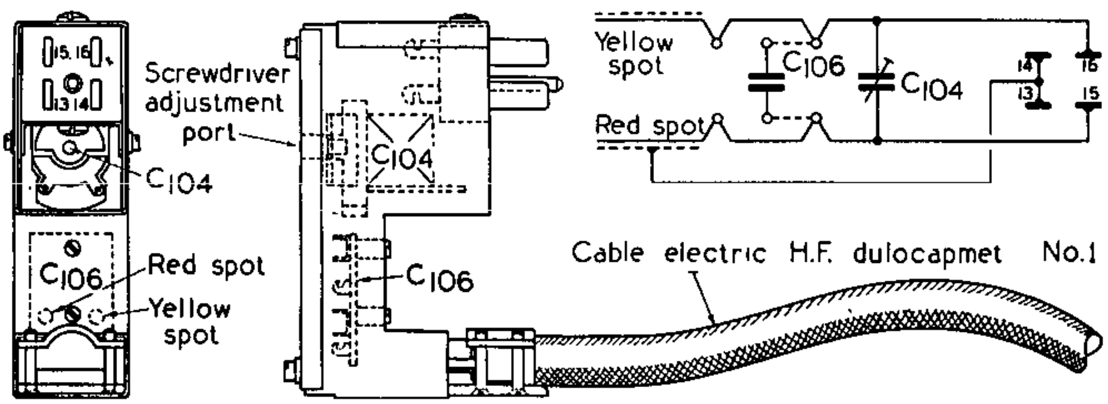



Fig. 22.—The plug, type 209

139. When the loop aerial, type 1, is installed, an impedance matching unit, type 12, is used. When the receiver is installed on Hampden aircraft fitted with the retractable loop, an impedance matching unit, type 13, is used. When installed in aircraft fitted with the Bendix type loop, a matching unit, type 15, is used.

140. The position of the impedance matching unit, with the maximum permissible length of cable between the loop and the receiver, is clearly indicated in the installation schedules, a typical specimen of which is included in the diagram fig. 21. The lengths between loop and matching unit, when installed, and between matching unit and receiver must, naturally, depend upon the position of the matching unit.

4 ft. If the matching unit is not more than 7 ft. from the receiver a maximum total length of 22 ft. from loop to receiver is permissible. If the unit is not more than 3 ft. from the loop, the cable should not exceed 18 ft., total length, from loop to receiver.

143. When the Bendix loop is installed the matching unit, type 15, should be, preferably, as near as possible to the receiver. The length of dulocapmet between loop and receiver should not be less than 4 ft. If the matching unit is not more than 6 ft. away from the receiver, the total length of cable from receiver to loop should not exceed 20 ft. If the unit is not more than 2 ft. from the loop, the total length of cable between receiver and loop should not exceed 17 ft.

### Fixed aerial input

144. The amount of fixed aerial input to the switching valves $V_1$ and $V_2$ and hence to the loop aerial circuit, is adjusted, on installation, by inserting a screwdriver into the small port on the right-hand side of the master switch MS. This is indicated on fig. 1 as $C_{56}$. Once adjusted, the condenser needs no further attention. An insulated screwdriver should be used in order to avoid the possibility of short-circuiting the trimmer to earth.

145. The following procedure should be followed:—

(i) Set the aerial switch, type J, to D/F. (If plug board in use set plug marked FIXED AE to group marked HF, *see* para. 138(i).) Set the Meter deflection sensitivity $S_2$ to HIGH.

(ii) Tune the receiver to a suitable signal on RANGE 4 and rotate the loop to a position which gives the MINIMUM signals in the telephones. The signal selected should be one the bearing of which remains constant. This may be checked by turning the master switch MS to VISUAL and noting that the needles of the visual indicator remain steady on the bearing. It is advisable, also, that the volume control $R_8$ should be adjusted to give the lowest possible signal strength, consistent with accurate observation, during this and other adjustments.

(iii) Set the receiver master switch to BALANCE and adjust balance control of $R_{51}$ and meter amplitude control $R_{23}$ to a position which causes the visual indicator needles to intersect along the white centre line on the dial face.

(iv) Return the receiver master switch MS to FIGURE-OF-EIGHT and rotate the loop 30 deg. from the position previously obtained for (ii) above.

(v) Operate the aural sense switch $S_3$ to L and R and hold the switch to the side which gives the weaker signal.

(vi) With the aural sense switch held in the position selected as at (v) adjust the trimmer $C_{56}$ so that zero or minimum signals are obtained. Observe the tuning indicator $V_{10}$ during this operation as correct adjustment is indicated by maximum shadow.

### The visual indicator, type 1

146. It is usual to install two visual indicators, type 1, one on the pilot's instrument panel for "homing" purposes and the other in a convenient position for the operator of the receiver and D/F loop. These indicators are provided with a dim, but independent, illumination so that they may be used at night. The indicators are mounted on a sprung panel, or otherwise protected against jars and vibrations, as the movements are extremely fragile. The methods of wiring to the visual indicator when either one or two of these instruments is installed are shown as part of the typical installation diagram, fig. 21.

147. The mounting, anti-vibration, type 119, is used with the visual indicators, and filament lamps, jack, type G.P.O. No. 3 (12-volts) or G.P.O. No. 3 (24 volts) with lampholders, type 61, are provided when required. The following points should be noted when fitting the visual indicators:—

(i) The instruments are mounted in the retaining strap so that they are suspended horizontally. The side brackets of the mounting, type 119, are adjusted as necessary. A minimum clearance of $\frac{1}{32}$ inch is allowed between the face of the instrument and the rubber cushion of the mounting.

(ii) Not less than 9 in. of loose cable is left between the indicator and the first cable fixing point.

(iii) The instrument retaining strap is tightened by means of a screw.

### Setting up the D/F loop

148. The polarity of the leads connecting the visual indicators to the receiver must be correct as indicated in fig. 21. This must be carefully checked. Similarly, the connexions from the receiver to the D/F loop should be checked. If the loop, type 3, is used and has been installed with the

red end of the cradle toward the rear and the cursor reading at 180 deg. on the black marking of the scale ring, then the sense of the visual indicators should be correct. If a D/F loop, other than the type 3, is used it should be stated quite clearly on a label in the aircraft how the loop scale must be adjusted so that the sense is correct.

149. The following procedure should be adopted to ensure that the sense is correct:—

(i) Turn the master switch MS to FIGURE-OF-EIGHT. Tune the receiver to any signal in RANGES 3 or 5. This signal should be definitely identified and its relative position, with respect to the aircraft, known.

(ii) Set the loop to the approximate bearing of the station and finally adjust for minimum or zero signal to give the exact relative bearing.

(iii) Turn the meter deflection sensitivity switch $S_8$ to LOW. Hold the aural sense switch $S_3$ to R and reduce the loop scale reading. The signals should rise in strength.

(iv) If the signals decrease in strength it will indicate that the installation has been incorrectly made and the loop and associated circuits should be checked.

(v) The above test should be repeated with the master switch MS at VISUAL. If sense is correct, the visual indicator meter needles will swing to the right.

After installation of a new apparatus, when making a test flight, the routine for visual D/F sense discrimination should be carried out in order to determine whether the loop connexions are actually correct. It is necessary to check on a station, the position of which, relative to the aeroplane, is known.

## Loop centre tap

150. The receiver is designed to work on loops having no centre tap. As the receiver aerial coils are centre-tapped to earth, the loop centre tap is unnecessary. Since it is possible that the tap may have been removed with new installations a check should be made as follows:—

(i) Remove loop plug at receiver and connect a test meter, type E across contacts 15 and 16 using the OHMS range. This should give a low resistance reading.

(ii) A reading should then be taken from contact 15 or 16 to 14 and 13. Open circuit should be indicated.

(iii) If a reading is obtained at (ii) it indicates that the loop has not had the centre tap removed, or that one side is earthed. The necessary action as indicated in para. 151, should be taken in these circumstances.

(iv) Adjust the loop lead capacitance (*see* para. 138).

Checks of sense, vertical aerial input and loop lead capacitance should always be applied as a matter of routine after any repair or replacement of items in the loop aerial or visual meter circuits.

151. The following is the sequence of operation, as laid down in the leaflet A.P.1186/E.62-W, for the removal of the loop centre tap:—

(i) Remove the fabric seating strips from around the centre seam of the streamlined housing.

(ii) Remove and retain the six screws securing the tail and centre section of the housing.

(iii) Withdraw the tail portion of the housing. The loop winding will now be exposed.

(iv) Identify the loop winding inner terminations and remove the connexion from one winding termination, inner, to the metal centre piece.

(v) Remove the connexion from the other winding termination, inner, to the spill on the corner fixing screw

(vi) Connect the winding terminations, inner, by a short length of 18 s.w.g. tinned copper wire (Stores Ref. 5E/1779) encased in insulating tubing, grade E (Stores Ref. 5F/1910).

(vii) Disconnect the loop plug from the receiver and using a test meter, type E, check the loop circuit as follows:—

(*a*) Plug the negative lead into the OHMS socket and connect the test meter between the loop winding and earth. The test meter should remain undeflected.

(*b*) Connect the test meter across the loop winding outer terminations and it should register full-scale deflection.

(viii) Replace the tail piece of the loop housing and secure it by the six screws.

(ix) Re-seal the centre seam, using 2-in. wide tape (Stores Ref. 32B/409), approximately 10 ft. and special adhesive, bostik No. 103 (Stores Ref. 10C/590)

### Navigator-operated receivers

152. In certain aircraft an additional receiver is installed for the exclusive use of the navigator for D/F purposes. The D/F loop is then connected to the navigator-operated instrument and the existing loop connector is deleted and a new connector fitted, the length varying to suit individual installations. The typical installation diagram of fig. 21 includes this navigator-operated receiver.

153. The D/F loop which is normally connected to the communications receiver is now connected to the navigator-operated receiver and the D/F valves are removed from the communications receiver in order to conserve the electrical supply. The existing loop connector is dispensed with and a new connector fitted, the length of this varying to suit individual installations.

154. The visual indicator, previously located and wired in a position accessible to the W/T operator, is removed and mounted at the navigator's station, a suitable connector being used. The visual indicator is connected to the navigator-operated receiver. The visual indicator provided for the use of the pilot will remain. A dummy socket, Stores Ref. 10H/1938, is provided for the purpose of blanking out the D/F loop and visual indicator connexions on the communications receiver. Existing remote controls may have to be repositioned or deleted and where no remote controls exist these may have to be provided.

155. To provide for sense indication a fixed aerial is required for use with the navigator-operated installation. For this purpose it is necessary to employ a separate fixed aerial. In certain circumstances it may be necessary to utilise one of the existing fixed aerials and a change-over switch.

156. In order to provide for any difficulty which might arise over signal identification, means is provided to enable signals to be switched from the navigator back to the W/T operator. This is accomplished by means of two switches, type 170, suitably wired. One switch is controlled by the navigator whilst the other is controlled by the W/T operator. When the navigator's switch is set to the D/F position his telephones are connected to the output of the additional receiver. Should it be necessary for the W/T operator to identify the signal, the operator's switch is set also to the D/F position. Normal I/C facilities are established when the switches are set to the I/C position.

157. The modifications to the power unit, to enable the additional power for the navigator operated receiver, entail the fitting of a relay unit to the L.T. power unit and a single pole socket to the H.T. power unit. These modifications are described in the appropriate sub-section of Sect. 1, Chap. 7 of this publication.

158. It has been found that in certain navigator-operated receivers, type R.1155, some valves are not connected to the H.T. supply. This is due to the omission of a lead between pins Nos. 5 and 7 of the socket, type 299, which is fitted at the receiver end of the cable between the L.T. power unit and the receiver. If, upon examination, the socket, type 299, is found deficient in this respect, the procedure as laid down in the leaflet A.P.1186/B.58.W should be followed:—

- (i) Withdraw the socket, type 299, from the receiver and remove its cover.
- (ii) Connect a 1 in. length of 18 s.w.g. tinned copper wire, encased in grade E insulating tubing, between pins No. 5 and No. 7.
- (iii) Replace the cover of the socket.
- (iv) Replace the socket in the receiver.

### Prevention of frequency drift

159. Cases have occurred of excessive frequency drift in the beat frequency oscillator of the R.1155. This has been traced to (i) the overheating of the fixed silver mica condensers in the B.F.O. compartment causing alteration of capacitance and (ii) the presence of sulphur from the sorbo pad used to prevent the valve $V_7$ from touching the lid. The modification consists of drilling a ventilation hole in the B.F.O. compartment lid with replacement of the valve identification label. The procedure detailed in the leaflet A.P.1186/B.54.W is as follows:—

- (i) Withdraw the receiver from its case.
- (ii) Remove the lid of the B.F.O. compartment situated immediately behind the front panel, by withdrawing the six securing screws.
- (iii) Remove the sorbo pad from the inside of the lid.
- (iv) Cut a hole 1¼ in. dia. in the B.F.O. compartment lid, the centre of the hole being directly above the valve top cap, that is, approximately 1 in. from the long edge and 1⅞ in. from the short edge of the lid.
- (v) Refit and secure the lid to the compartment.
- (vi) Readjust, if necessary, the frequency of the trimmers as described in para. 165.

(vii) Use shellac varnish to fix the valve identification label to the rear inside face of the receiver case in the most suitable position for reading.

(viii) Apply a thin coat of shellac varnish over the label.

(ix) Replace the receiver in its case.

**Power units**

160. Installation instructions in connexion with the power units and the full procedure for adjustment of the resistance unit, type 47 (12-volt) or type 52 (24-volt) which is connected between the aircraft electrical supply and the L.T. power unit, supplying the receiver L.T. and H.T., can be found in the chapter on the transmitter, type T.1154, Sect. 1, Chap. 7 of this publication.

## OPERATION

**General**

161. The operation of the R.1155 will be facilitated by reference to fig. 1 which shows the front panel controls, plugs and socket. An initial necessity is that the operator should satisfy himself that all valve top cap connectors are making secure contact. The plugs and socket should be securely engaged and the retaining bar (2) should be in position on the posts (3) provided. The receiver socket and plugs are grouped at the bottom right-hand corner and, from left to right, they are:—Socket $P_3$, "FROM LOOP AERIAL"; plug $P_2$, "TO VISUAL INDICATOR"; plug $P_1$ "FROM TRANSMITTER."

162. For communications reception the fixed aerial is normally used on the H.F. RANGES 1, 18·5 Mc/s to 7·5 Mc/s, and 2, 7·5 Mc/s to 3·0 Mc/s; the trailing aerial is used for the M.F. RANGES 3, 1,500 Mc/s to 600 Mc/s, 4, 500 Mc/s to 200 Mc/s and 5, 200 Mc/s to 75 Mc/s. By operation of the aerial selector switching unit, type J, or the aerial plug board, the fixed or trailing aerial can be used on all RANGES. This ensures continuity of communication should one of the aerials become unserviceable. For D/F the fixed aerial and loop aerial are used. D/F reception, using visual and aural methods, is available on all RANGES except RANGE 1. The operator should ensure that the correct matching unit, for the type of loop aerial being used, is installed, as specified in paras. 133 to 136. He should be familiar with the RANGE coverage and colour code associated with it. The sequence of RANGES 1 to 5 corresponds to the five positions of the frequency switch reading from left to right.

**Main controls**

163. The receiver has three main communication controls:—

(i) The tuning control (6) with direct frequency calibrated dial (4), the frequency being indicated by a pointer (5) on the full-vision scale. The front knob has direct drive and the inner knob is the vernier adjustment. The exact point of resonance is shown by the narrowest shadow indicated on the tuning indicator $V_{10}$. The scale colour code is based on that of the transmitter, type T.1154, frequencies outside the transmitter RANGES being indicated in BLACK (*see* para. 108).

(ii) The frequency range switch FS selects the desired RANGE 1 to 5.

(iii) The master switch MS has five positions:—

"OMNI"—(⊚) Manual control of H.F. and I.F. ($R_{8(1)}$). Used for W/T reception and transmitter-receiver inter-tuning, that is, using receiver as a monitor.

A.V.C.—Automatic control of H.F. and I.F. gain. Manual control of L.F. gain ($R_{8(2)}$). Used for R.T.

BALANCE—For balancing visual indicator before using D/F.

VISUAL—For visual D/F and "homing."

FIGURE-OF-EIGHT (∞) For aural D/F.

164. The receiver secondary controls are:—

(i) INCREASE VOLUME ($R_8$)—Adjusts input to grid of $V_8$ when MS is at A.V.C. and adjusts bias of H.F. and I.F. when MS is at OMNI and FIGURE-OF-EIGHT. The knob is rotated clockwise.

(ii) HETERODYNE SWITCH ($S_4$)—Switches in the B.F.O. valve $V_7$ for W/T reception.

(iii) METER AMPLITUDE ($R_{23}$)—Varies height of visual indicator needles when setting up to D/F balance. May also be used for occasional adjustment of the needles on weak signals.

(iv) METER BALANCE ($R_{51}$)—Adjusted with MS at BALANCE and must not be adjusted with MS at any other position. Balance is indicated when the two needles of the visual indicator intersect along the centre line.

(v) METER SENSITIVITY SWITCH ($S_2$)—Effects maximum deflection of visual indicator needles at 25 deg. off course for "homing" purposes (LOW) or maximum deflection of 10 deg. off minimum when taking bearings by visual indicator (HIGH).

(vi) METER FREQUENCY SWITCH ($S_1$)—Causes L.F. switching oscillator ($V_1$ and $V_2$) frequency to be either 80 c/s (HIGH) for W/T, or 30 c/s (LOW) for R.T.

(vii) AURAL SENSE SWITCH ($S_3$)—Spring loaded. Used for sense determination when aural D/F reception is employed.

(viii) FILTER SWITCH ($S_5$)—Used to eliminate the switching frequency when monitoring visual D/F and for elimination of aircraft electrical noises.

**Setting up heterodyne oscillator**

165. To bring the B.F.O. valve $V_7$ into operation when receiving W/T the switch $S_4$ is used. It is first necessary to set up the heterodyne oscillator and this is accomplished as follows:—

(i) Turn the aerial selector switching unit, type J, to the position M/F on FIXED or, if using and aerial plug board, FIXED AE. TO M/F.

(ii) Put the transmitter master switch to STAND BI and the receiver master switch MS to A.V.C.

(iii) The frequency range switch FS should be at RANGE 3 and a convenient C.W. transmitting station tuned in until the minimum shadow is seen in the tuning indicator $V_{10}$

(iv) Now switch on the heterodyne, using $S_4$.

(v) Insert a screwdriver into the HET.ADJ. port of $C_{13}$ and slowly adjust the condenser until an audible note is heard in the telephones. A variation of approximately 3 kc/s can be effected and the note should be adjusted to the required frequency.

**Back-tuning**

166. In the absence of a crystal monitor the back-tune method can be used to facilitate the setting up of the transmitter "spot" frequencies. The receiver frequency range switch FS is set to the RANGE in which the required transmitter frequency occurs. Set the receiver to the required frequency and set the master switch to OMNI. Set volume control $R_8$ about half-way.

167. With the transmitter master switch at TUNE, press the morse key and swing the master oscillator dial until maximum signal strength, that is minimum shadow, is indicated in the tuning indicator $V_{10}$, adjusting the receiver volume control $R_8$ as necessary. Adjust the transmitter output in the normal manner and recheck the M.O. tuning by reference to the receiver tuning indicator $V_{10}$. Send a series of dots and observe flicker in $V_{10}$.

168. It will be realized that it is possible to set up the receiver exactly to a click-stopped "spot" frequency on the transmitter by means of back-tuning. The transmitter should be tuned, using the M.O. calibration, to the correct frequency. Set the receiver FREQUENCY RANGE switch to the required RANGE in which transmitter frequency occurs. Set the receiver master switch to OMNI with volume control half-way. Set the transmitter master switch to TUNE, press key and adjust receiver, tuning for minimum shadow as shown in $V_{10}$: N.B.—If the edges of light on the tuning indicator overlap during tuning operations, reduce the volume control. If shadow cannot be reduced, increase volume control.

**Normal communication**

169. The aerial switching unit, type J, is turned to NORMAL (when using aerial plug board FIXED AE. to H/F, TRAILING AE. to M/F). The transmitter master switch is at STAND BI. Turn up the receiver volume control until background noise is heard. Put the receiver master switch MS to OMNI and $V_{10}$ should show a green light. Turn the receiver frequency range switch FS to the required RANGE and adjust the receiver frequency, first by the outer tuning knob (6) and finally by the inner fine-tuning knob. If working C.W., switch ON the heterodyne by $S_4$. Whilst sending signals a 1,200 c/s side-tone should be heard in the telephones. Listening-through can be tested, with the morse key up, by listening for signals or receiver background noise. The tuning indicator $V_{10}$ will flicker to dots and dashes when transmission is taking place if the receiver is tuned to the same frequency as the transmitter.

**Heavy atmospheric interference**

170. In heavy static, or thunder conditions, the fixed and trailing aerials should be earthed. This condition is met by turning the aerial selector switching unit, type J, to EARTH (when using an aerial plug board, FIXED and TRAILING AE. TO EARTH). Reception is still possible.

using RANGES 2 to 5, in conjunction with the loop aerial. Turn the frequency range switch FS to the required RANGE. Turn the master switch MS to FIGURE-OF-EIGHT and tune in the signal. Rotate the loop aerial to the position of maximum strength, noting the $V_{10}$ shadow. Adjust the volume control (7).

**D/F bearings with visual indicator**

171. Frequency RANGES 3, 4 and 5 (occasionally 2) are used. Only the BLACK scale on the *loop should be used. First, turn the aerial selector switch to D/F or, if using aerial plug board* TRAILING AE. on M/F and FIXED AE. on H/F. If an aerial plug board is fitted, care must be taken by the operator to see that the transmitter switch is at STAND-BI and that the key is not pressed. Turn the transmitter master switch to STAND-BI and the receiver frequency range switch FS to the required RANGE. Turn the receiver master switch to OMNI.

172. Tune in the signal as for normal communication and adjust volume (7) to a low level. Turn the receiver master switch to BALANCE. Adjust the visual indicator needles by METER BALANCE control $R_{51}$ so that they intersect exactly along the centre line on the dial face. If necessary, adjust the needles to a suitable working height by rotating the METER AMPLITUDE control $R_{23}$. Turn the METER SENSITIVITY switch $S_2$ to HIGH.

173. Turn the METER FREQUENCY switch $S_1$ to HIGH for W/T or LOW for R.T. Switch FILTER $S_5$ to IN. Readjust balance by METER BALANCE control $R_{51}$. Turn the master switch MS to VISUAL. The indicator needles should now operate. Turn the loop aerial to position at which the indicator needles intersect along the centre line on the dial face.

174. Check for sense by reducing the scale reading of loop. If indicator needles swing to the RIGHT, sense is correct. If to the LEFT, sense is incorrect. When sense is correct, turn the loop back to the position on BLACK SCALE to which needles intersect along the centre line on the dial face, and note reading. If sense is incorrect, rotate through 180 deg. to determine bearings. The routine may be easily remembered by the RRR rule:—Reduce reading; Right deflection; Right sense.

**"Homing," using visual indicator**

175. The sequence of operations detailed in paras. 171 to 173, up to that in which the master switch MS is turned to VISUAL, should be carried out prior to the following. The loop is then set to loop scale reading zero, that is, athwartship. The meter deflection sensitivity switch $S_2$ is positioned at LOW and the master switch MS to BALANCE. The balance is readjusted by $R_{51}$ and the switch MS put to VISUAL. The pilot should now be asked to alter course until the needles intersect along the centre line on the visual indicator dial face. There may be occasions when it is not known whether the "homing" transmitter lies ahead or astern of the aircraft, and sense discrimination must then be carried out as described herein.

176. After the aircraft has been set to a course which causes the needles to intersect on the centre line the course is off-set a few degrees to the left; if the station is ahead, the needles will intersect on the right; if the station is astern, the needles will intersect on the left and the course should be altered to 180 degrees. This sense discrimination may, if desired, be carried out by reducing the scale reading by, say, 10 deg. instead of altering the aircraft's course. Sense will be indicated in the same manner.

177. Care should be taken to ensure that the loop is restored to zero after sense determination. During "homing," balance should be checked every ten minntes. If necessary, make adjustments to the meter amplitude by $R_{23}$ and re-check the balance after this operation.

178. It should be remembered that "homing" by visual indication is only in the nature of an "aid to navigation" and that normal navigation should not be neglected whilst it is being used. The aircraft should, for example, be prevented from drifting if there is a cross wind. The homing method, when properly used, will always bring the aeroplane to the source of transmission, but unless the standard navigational methods are observed, the course flown may be increased beyond the point-to-point distance due to wind, speed and direction.

179. A method of off-setting the loop to the fore-and-aft line of the aircraft in order to traverse a true point-to-point course is possible, but this is dependent upon very accurate information as to cross wind, speed and direction. When flying over the home station the indicator needles will collapse for a few seconds indicating that the station is directly below. After passing the station the sense will reverse and if the instructions given are observed the course of the aircraft can be reversed until the station is again directly below. When homing on a keyed transmitter, it is necessary to note that the indicator needles collapse symetrically down the centre scale as the distant transmitter is keyed. If the needles collapse assymetrically it will indicate that signals are being received with

interference and resulting false indication of course. When homing, signals should be monitored from time to time to ensure that the desired frequency is not subject to interference.

### Aural D/F

180. When using the aural method of D/F the fixed aerial is disconnected, the loop being the sole source of signal pick-up. The L.F. oscillator, incorporated in $V_1$ and $V_2$ and the meter switching circuits of $V_9$, are inoperative. Volume control is effected manually, the A.V.C. system being out of circuit.

181. The operational routine is as follows:—The aerial selector switching unit is turned to D/F or, when using the aerial plug board, the positions TRAILING AE. on M.F. and FIXED AE. ON H.F. should be used. The range switch FS is turned to the required range and the master switch MS to OMNI. The meter deflection switch $S_2$ is placed at LOW and the required signal tuned in. The volume control (7) is then readjusted and the tuning re-checked on the tuning indicator $V_{10}$.

182. The master switch MS is then turned to the FIGURE-OF-EIGHT position, the loop is swung to the position of MINIMUM signal and the volume control adjusted to obtain a zero. The loop scale reading for this zero signal should be observed. To check for sense, reduce the scale reading of the loop, putting the sense switch $S_3$ to the R position. If the signal strength rises the sense is correct. If the signal strength decreases the sense is wrong, and the loop should be turned through 180 deg. and the zero signal setting noted. The L and R positions of $S_3$ permit the operation of $V_1$ or $V_2$ by applying H.T. to the screens. This, of course, brings in the fixed aerial signals for application to the loop aerial circuit.

## PRECAUTIONS AND MAINTENANCE

### Ground testing

183. The following procedure should be adopted for ground testing the R.1155. Having set the aerial switching unit to the NORMAL position the range switch FS should be placed at either RANGE 1 or RANGE 2. The master switch MS is then positioned at either OMNI or A.V.C. Having turned the transmitter master switch to STAND-BI the L.T. power unit should start up and, in a few seconds, the tuning indicator should glow. The telephones are then inserted and the reception of signals checked.

184. To receive in the M.F. RANGES 3, 4 and 5 the aerial switching unit is set to the position engraved M.F. ON FIXED AERIAL. If a check of D/F reception is made the aircraft should be clear of all metal obstructions such as hangars, before verifying sense of bearings. To carry out this test the aerial switching unit should be placed to D/F. With the aerial switching unit in this position or in the EARTH position, the H.T. power unit should remain inoperative in all positions of the transmitter master switch.

185. On installations fitted with the aerial plug board, the fixed aerial socket must be connected to the H/F plug in order to receive on the H.F. RANGES 1 and 2. To receive on the RANGES 3, 4 or 5, the fixed aerial socket should be connected to the M.F. plug. When using visual D/F, it should be remembered that the aerial plug board does not break the H.T. power unit relay circuit in any position and therefore the transmitter master switch MUST be kept at STAND-BI.

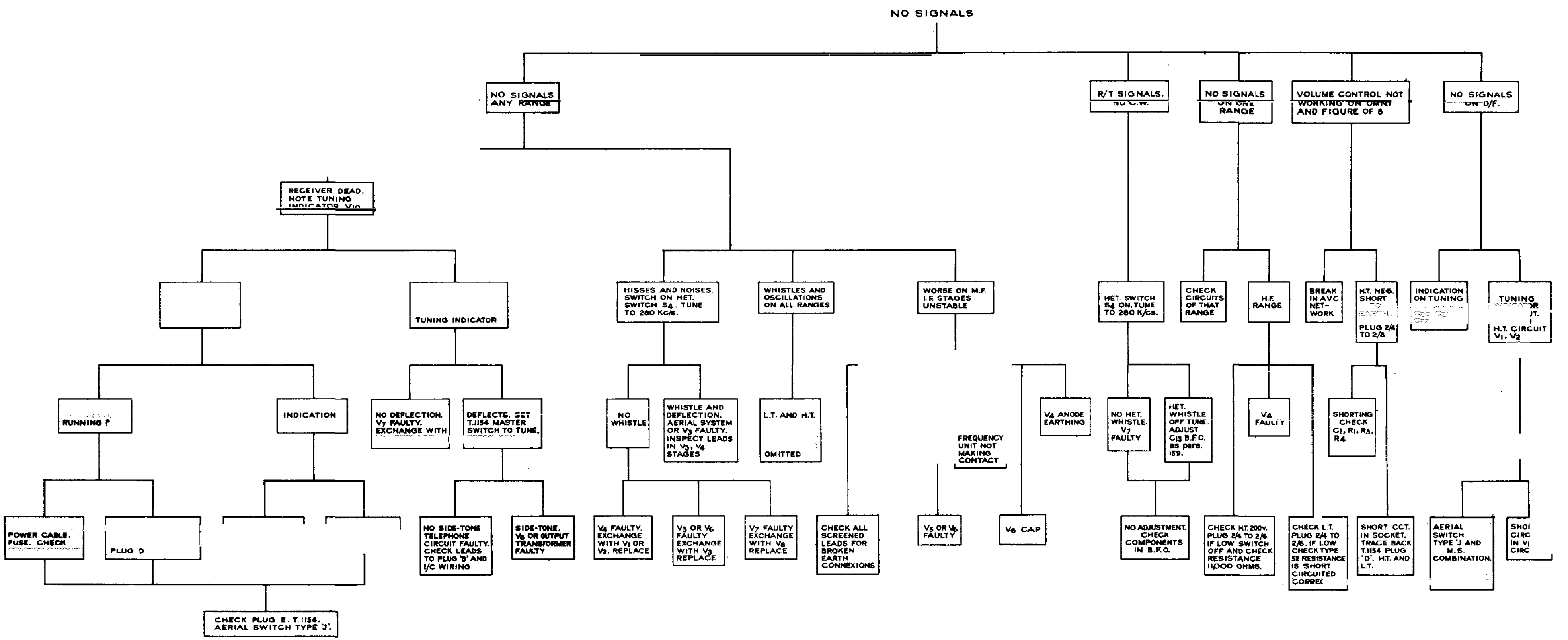
186. When the aeroplane nominal supply is 12 volts the minimum permissible voltage with the L.T. power unit running is 10·5 volts. When the aircraft supply is 24 volts the minimum permissible voltage with the L.T. power unit running is 21 volts. A high resistance voltmeter should be used to check these figures. The minimum filament voltage permissible for normal functioning of the receiver is 5·7 volts. If reception fails or signals are weak, when the filament voltage is between 5·7 volts and 6 volts, the frequency changer valve $V_4$ should be replaced.

### Starter trolley batteries

187. As the current drawn by the T.1154–R.1155 equipment will discharge the aircraft batteries very rapidly, ground tests are to be carried out using the larger batteries on a starter trolley. It is usual for equipment to be so arranged that plugging in the trolley starter service leads to the normal point, automatically isolates the aircraft starter accumulator and connects the W/T equipment to the trolley accumulator.

### Visual indicator meter unserviceable

188. Should either of the visual meters be rendered unserviceable, operation can be carried out with a single instrument. The windings are connected in series and connexions A, B, C and D on the unserviceable meter should be short-circuited to enable the serviceable meter to operate.

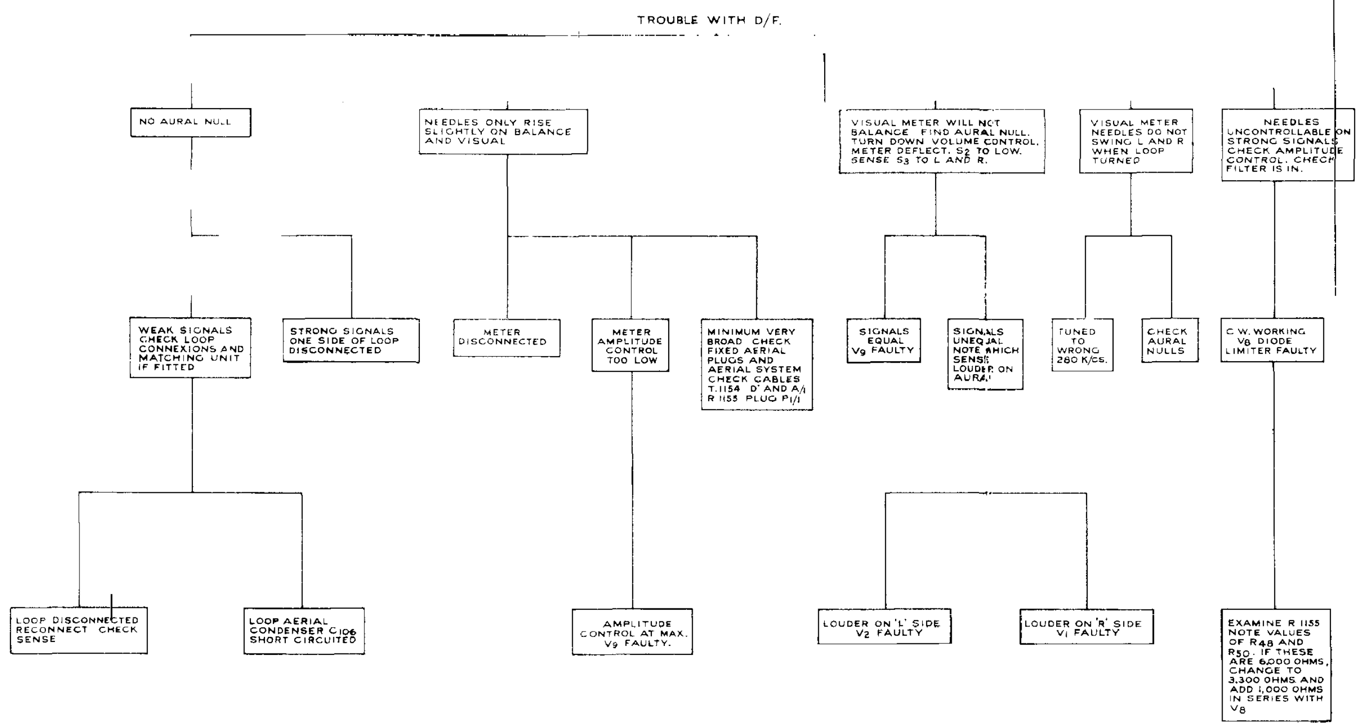



# COMMUNICATION CIRCUITS — TROUBLE LOCATION CHART

FIG. 23

FIG. 23

REPRINT PP2150 M28881/2459 4/43 4250 C & P Gp. 959(4)




D/F SWITCHING CIRCUITS — TROUBLE LOCATION CHART

FIG. 23a

FIG. 23a

## D.C. RESISTANCE TABLE

| Component | Test Points | Resistance ohms | Component | Test Points | Resistance ohms |
|---|---|---|---|---|---|
| *I.F. Coils* | | | | | |
| $L_{19}$ prim. | $V_4$ anode to $R_{34}$, $C_{32}$ | 2 approx. | Range 4 input | $V_3$ grid to $C_{40}$ junction | 6 |
| sec. | $V_5$ grid to $R_{33}$, $C_{33}$ | 2 approx. | | | |
| $L_{20}$ prim. | $V_5$ anode to $R_{30}$, $C_{29}$ | 2 approx. | Range 5 input | $V_3$ grid to $C_{40}$ junction | 57 |
| sec. | $V_6$ grid to $R_{29}$, $C_{30}$ | 2 approx. | | | |
| $L_{21}$ prim. | $V_6$ anode to $R_{53}$, $C_{27}$ | 2 approx. | Loop input circuit | Tested between $C_{46}$ (switch end) and $C_{47}$ (switch end) | |
| sec. | $V_7$ diode to $R_{20}$, $C_{11}$ | 2 approx. | | | |
| *B.F.O. Coil* | | | | | |
| $L_{22}$ | Fixed plates $C_{13}$ to $R_{18}$ | 5 | Aerial circuits | | Less than 1 to earth |
| *Anode chokes* | | | | | |
| $V_1$, $V_2$ | | | *$V_4$ input circuits* | | |
| $L_{24}$ | $V_1$ anode to $R_{46}$, $C_{41}$ | 550 | | | |
| $L_{24}$ | $V_2$ anode to $R_{46}$, $C_{41}$ | 550 | | $V_4$ grid to $C_{37}$, $R_{38}$ junction | |
| *Visual meter chokes* | | | Range 1 | Switch to $R_1$ | Less than 1 |
| | | | Range 2 | Switch to $R_2$ | Less than 1 |
| $L_{26}$ | $V_9$ diode to $C_3$, $R_{25}$ | 130 | Range 3 | Switch to $R_3$ | 3·5 |
| $L_{27}$ | $V_9$ diode to $C_5$, $R_{24}$ | 130 | Range 4 | Switch to $R_4$ | 11·0 |
| *Limiter diode choke* | | | Range 5 | Switch to $R_5$ | 78·0 |
| $L_{28}$ | $V_8$ limiter diode to $C_4$, $R_{28}$ | 130 | *$V_4$ osc circuit* | | |
| *A.V.C. choke* | | | | $V_4$ osc. grid $C_{35}$ (zf contact 12) to joint $R_{35}$, $C_{34}$ | |
| $L_{25}$ | $V_7$ diode to $C_{108}$, $R_{68}$ | 130 | | | |
| | | | Range 1 | Switch to $R_1$ | Infinity |
| *L.F. filter choke* | | | Range 2 | Switch to $R_2$ | Infinity |
| | | | Range 3 | Switch to $R_3$ | 1,600 |
| $L_{29}$ | $S_5$ to earth | 2020 | Range 4 | Switch to $R_4$ | 1,650 |
| *Output transformer* | | | Range 5 | Switch to $R_5$ | 0·5 |
| $L_{30}$, prim. | $V_8$ anode to pin 5, power plug $P_1$ | 1528 | *H.F. Ranges 1 and 2* | FS zf12 to zf6 | 0·5 |
| $L_{30}$, sec. | $P_1$ pin 6 to earth | 1063 | *Ranges 3, 4, 5* | FS zf12 to zf6 | Infinity |
| *A.F. oscillator trans.* | | | | | |
| $L_{23}$, prim. | $V_1$ osc. grid to $V_2$ osc. grid | 800 | *Oscillator anode coil* | | |
| $L_{23}$, sec. | $V_1$ osc. grid to $V_2$ osc. grid | 355 | Range 3 | $C_{34}$, $R_{35}$ to $C_{75}$ | 2·5 |
| | | | Range 4 | $C_{34}$, $R_{35}$ to $C_{74}$ | 4·5 |
| $L_{23}$, 2nd sec. | $R_{65}$, $C_{29}$ to $R_{66}$, $C_{23}$ or across $P_2$ pins 7 and 8 | 331 | Range 5 | $C_{34}$, $R_{35}$ to $C_{73}$ | 8·5 |
| *Aerial circuit* | | | *Oscillator anode coils tap check* | | |
| Range 1 input | $V_3$ grid to $C_{40}$ junction | Less than 1 | Range 1 | FS zr6 to $C_{35}$ or zr.12 | Infinity |
| Range 2 input | $V_3$ grid to $C_{40}$ junction | Less than 1 | Range 2 | FS zr6 to $C_{35}$ or zr.12 | Infinity |
| Range 3 input | $V_3$ grid to $C_{40}$ junction | 2 | Range 3 | FS zr6 to $C_{35}$ or zr.12 | 1,600 |
| | | | Range 4 | FS zr6 to $C_{35}$ or zr.12 | 1,600 |
| | | | Range 5 | FS zr6 to $C_{35}$ or zr.12 | 1·5 |

## VOLTAGE TESTS, ETC

| Measure | Test Points | Voltage and Resistance |
|---|---|---|
| L.T. volts | Withdraw meter plug $P_2$<br>Measure across contacts 4 and 5 | 6 to 7·5 v. |
| H.T. volts | Measure across contacts 4 and 6 | 200 v. approx |
| *Standing bias on* $V_3$, $V_4$, $V_5$ and $V_6$ | Remote end of $R_{12}$ and chassis<br>Vol. control to OMNI max position | —3 v. M.F. |
| | Remote end of $R_{12}$ and chassis<br>Vol. control to OMNI max position | —1·5 v. H.F. |
| *Output transf.* $L_{30}$ | Withdraw meter plug $P_2$<br>Measure between pin 6 and $C_{93}$ | 1,528 ohms |
| *D.C. resistance* across H.T.+ across H.T.— | Withdraw meter plug $P_2$<br>Measure between pin 6 and chassis | 11,000 ohms |
| A.F. oscillator | Withdraw plug $P_2$<br>Measure between pins 7 and 8 using A.C range of AVOMETER | 28 v. at 30 c/s<br>35 v. at 80 c/s |

*COLOUR CODE*

*Wiring* Red, H.T. positive; Yellow, H.T. negative; Blue, L.T. positive; Black, earth; Green grids

*SWITCHES*

w is aerial input
x is grid $V_3$
y is anode $V_3$
z is grid and osc. $V_4$

189. Water or dampness will affect the readings on the visual meters if allowed to remain on the terminals of the instrument. The back of the meters should therefore be wiped dry before use. Periodical observations should be made to check that the pilot's and operator's visual meters are giving approximately equal readings If not approximately equal the pair should be tested against a known serviceable meter and the faulty instrument replaced. When carrying out these checks the receiver master switch MS should be in the BALANCE position.

### Trouble location

190. Simple trouble location charts, figs. 23 and 23A, are included and these should be of assistance in the rapid localizing of faults. They are given as indicative only. Various circuit continuity tests are also included for the checking of burnt-out or deteriorated components. A necessary preliminary to the rapid solution of difficulties is a familiarity with the location of the various components and this will be materially assisted by the location diagram of fig. 17.

### Test apparatus

191. Ground tests of the R.1155 are normally carried out by means of the test rig, type 22. For the use of civilian repair organizations and maintenance units for bench testing, a special test set, type 65, is provided. This is, however, not a normal service issue. By means of this unit all the test conditions necessary for communications and D/F reception can be simulated and are easily selected for each particular test by means of switches. The unit, type 22, comprises a single panel carrying the visual indicator, four switches for selecting the test conditions, four plugs for connecting the unit to the receiver and power supplies, and terminals for the connexion of the signal generator, output meter and telephones. The test set, type 65, is described in Sect. 5, Chap. 18 of this publication.

## THE IMPEDANCE MATCHING UNITS, TYPE 12, TYPE 13, AND TYPE 15

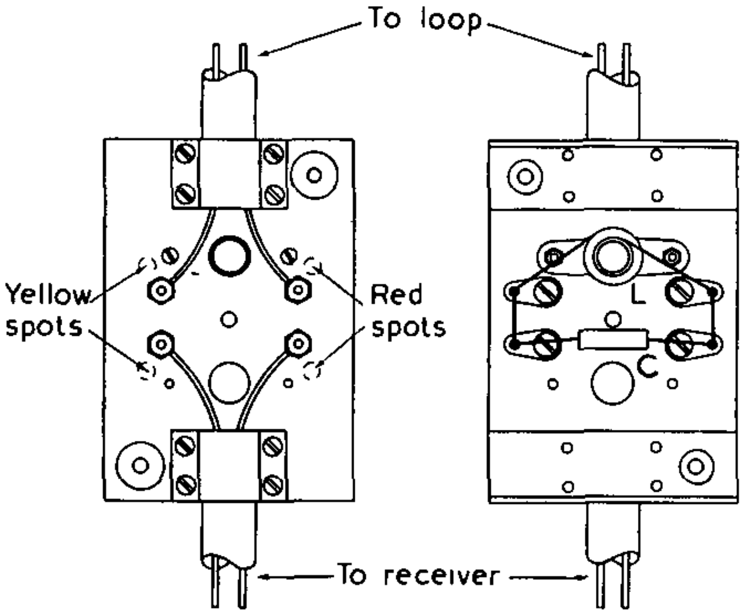
192. The R.1155 is designed for use with the D/F loop aerial, type 3, which has an inductance value of approximately 100 $\mu$ H and a self-capacitance of 20 $\mu\mu$ F. Should the inductance placed across the loop terminals differ appreciably from this value, the input tuned circuit will not gang correctly with the other tuned circuits. As the receiver is required for use with loop aerials of widely differing values of inductance from the type 3, a matching unit is necessary with these loops. The impedance matching units, type 12 (Stores Ref. 10A/12248), type 13 (Stores Ref. 10A/12245) and type 15 (Stores Ref. 10A/12247) have been designed for application as indicated in para. 139. The matching unit consists of a small metal box containing a panel of bakelized liner carrying four terminals to which are connected the dulocapmet No. 1 screened cables from the loop and to the receiver. The matching coils and condensers are also mounted on this panel. The unit weighs 11¾ oz.

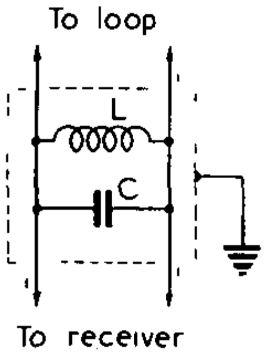
193. The theoretical circuits and constructional details of the matching units are shown in fig. 24. The matching unit circuit depends upon whether it is required to reduce the inductance of the loop or to increase it. If a reduction in value is required a shunt unit (type 12) is used. This consists of one matching coil L with a condenser C both in shunt across the twin leads of the loop. If an increase in value is necessary the series units (types 13 and 15) are used. To preserve the symmetry of the loop two series coils $L_1$ and $L_2$, of equal inductance, are connected, one to each lead from the loop to the receiver. A condenser $C_1$ is connected in shunt across the receiver leads. The condenser brings the total capacitance of the circuit to the correct value.

194. The unit condenser C, type 12, has a capacitance of 40 $\mu\mu$ F and the coil L consists of 150 turns of 38 d.s.c. wire on a former and is adjusted by a dust iron screwed core to 410 $\mu$ H. The unit condenser $C_1$, type 13, is 70 $\mu\mu$ F and the coils $L_1$ and $L_2$ each consist of 29 turns of 30/48 litz wire adjusted to 20 $\mu$ H. The corresponding values for components of the unit, type 15, are 70 $\mu\mu$ F and 8·25 $\mu$ H. The four terminals are colour-coded by indicator spots of red and yellow and it is essential that due regard should be paid to these when fixing the cable ends.

## THE VISUAL INDICATOR, TYPE 1

195. The visual indicator, type 1 (Stores Ref. 10Q/2) consists essentially of two D.C. milliammeter movements mounted side by side. The windings, which are connected in series, each have a resistance of 500 ohms. The current sources applied to opposite ends of the conjoint winding produce deflection of heavily damped indicator needles in opposite sense. The intersection of the indicator needles follows a straight line between zero and 90 microamps current. Approximately 2·4 microamps are required to produce one degree scale deflection. The visual indicator is shown in the diagram of fig. 25.

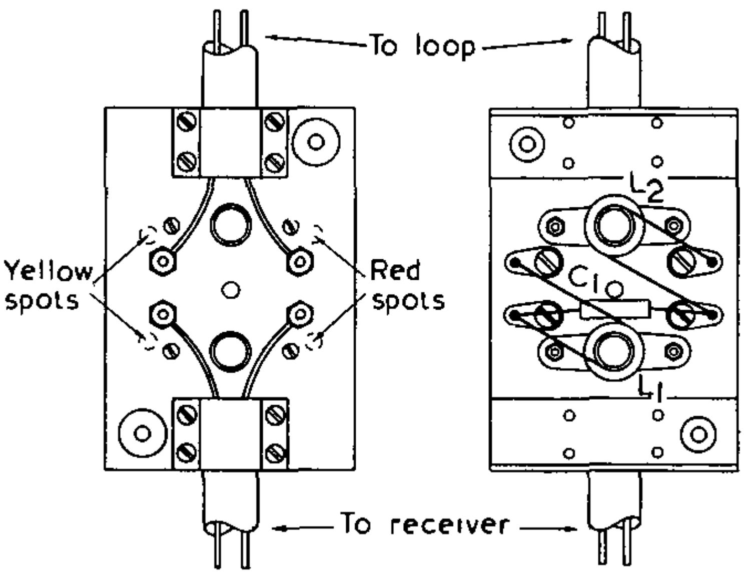


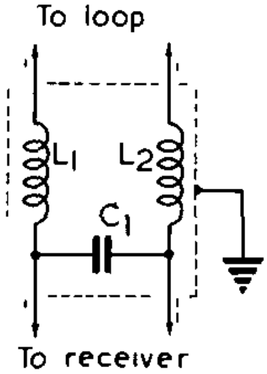




| TYPE 12 | |
|---|---|
| C | 40 µµF |
| L | 410 µH |

TYPE 12

TYPES 13 & 15




| TYPE 13 | |
|---|---|
| C1 | 70 µµF |
| L1 | 20 µH |
| [illegible] | [illegible] µH |
| [illegible] 15 | |
| [illegible] | [illegible] µF |
| [illegible] | [illegible] µH |
| L2 | 8 25 µH |

THE IMPEDANCE MATCHING UNITS,
TYPES 12, 13 & 15

FIG 24 | FIG 24

196. The visual indicator is contained in a circular metal screening case of, approximately, 3¼ in. diameter. The depth of the casing may vary in different models but the overall maximum depth is 3⅜ in. The instrument weighs 1 lb. 7 oz. Its general appearance is shown in the drawings of fig. 25 and a theoretical circuit forms part of fig. 13.

197. The indicator is fixed in position through four fixing lugs of 0·187 in. dia. and a space of 4·12 in. dia. by 4 in. deep shonld be allowed behind the panel for an anti-vibrational mounting. Five terminals, nominated A., B., C., D. and F., are mounted on the rear of the indicator. The terminal F. is a binding post for securing the cable. The connexions of terminals A., B., C. and D. differ according to the number of indicators installed. The normal connexions are shown in the installation diagram of fig. 21.

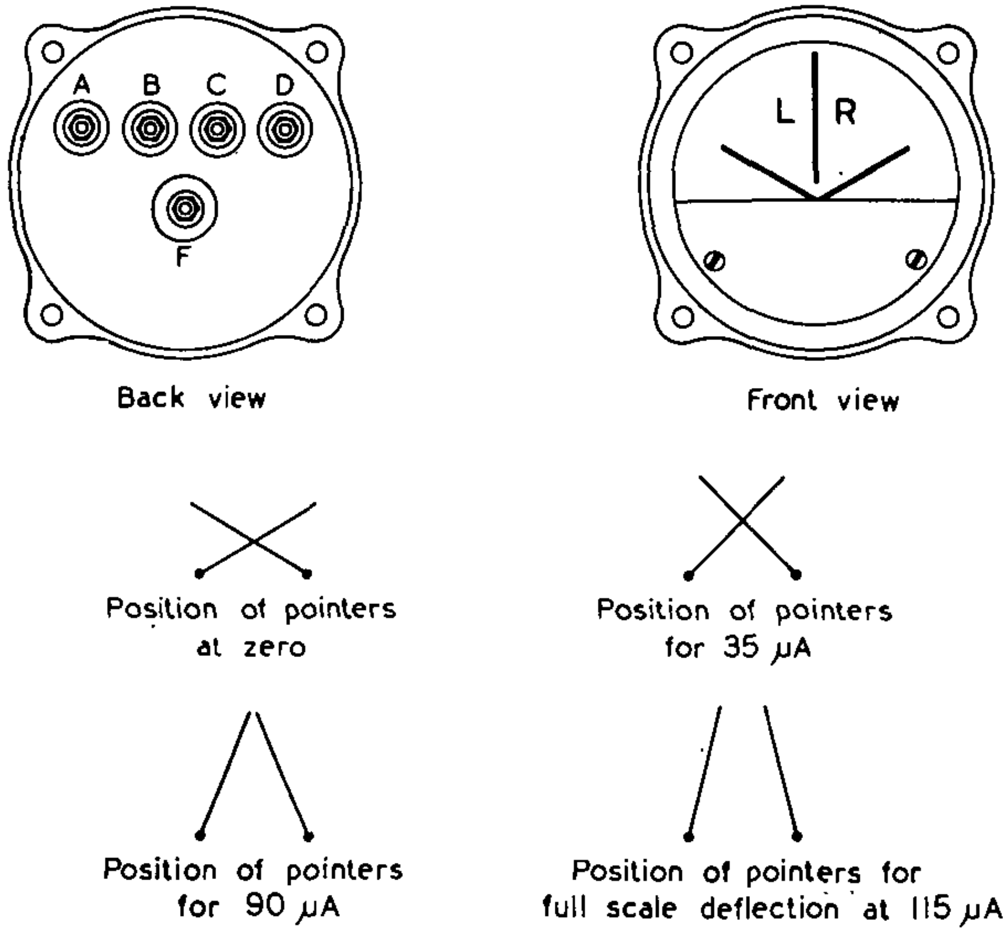



FIG. 25.—THE VISUAL INDICATOR, TYPE 1

198. The mounting, anti-vibrational, type 119 (Stores Ref. 10A/12954) has been introduced for use with the visual indicator. The lampholder, type 61 (Stores Ref. 10A/13078), lamp, filament, 12 volts, jack type, G.P.O. No. 3 (Stores Ref. 5L/1150) and lamp, filament, 24 volts, jack type, G.P.O. No. 3 (Stores Ref. 5L/1898) are also used when required. The equipment required and the installation procedure are detailed in para. 147 and is the subject of leaflet A.P.1186/E entitled Indicators, visual, type 1 (Stores Ref. 10Q/2)—Mounting, type 119 (Stores Ref. 10A/12954)—Introduction.

APPENDIX 1

## R.1155 COILS AND CHOKES

| Ref. in fig. 3 | Function | Value *in situ* |
|---|---|---|
| $L_1$ | Dummy loop coil | 109μH |
| $L_2$ | Aerial coil, RANGE 1 | Sec. 0·74 μ H |
| $L_3$ | Aerial coil, RANGE 2 | Sec. 5·64 μ H |
| $L_4$ | D/F coil, RANGE 3 | Sec. 158 μ H |
| $L_5$ | D/F coil, RANGE 4 | Sec. 1462 μ H |
| $L_6$ | D/F coil, RANGE 5 | Sec. 11, 426 m H |
| $L_7$ | Anode coil, RANGE 1 | Sec. 0·77 μ H |
| $L_8$ | Anode coil, RANGE 2 | Sec. 6·21 μ H |
| $L_9$ | Anode coil, RANGE 3 | Sec. 163 μ H |
| $L_{10}$ | Anode coil, RANGE 4 | Sec. 1374 μ H |
| $L_{11}$ | Anode coil, RANGE 5 | Sec. 10·5 m H |
| $L_{12}$ | I.F. trap or filter coil | Sec. 40 μ H |
| $L_{13}$ | Oscillator coil, RANGE 1 | Sec. 0·7 μ H |
| $L_{14}$ | Oscillator coil, RANGE 2 | Sec. 5·83 μ H |
| $L_{15}$ | Oscillator coil, RANGE 3 | Sec. 70·6 μ H |
| $L_{16}$ | Oscillator coil, RANGE 4 | Sec. 248 μ H |
| $L_{17}$ | Oscillator coil, RANGE 5 | Sec. 699·2 μ H |
| $L_{18}$ | Oscillator choke coil | (*a*) RANGE 1, 18·8 μ H† <br> (*b*) RANGE 2, 102·3 μ H† |
| $L_{19}$ | 1st I.F. coil assembly | Pri. 244·5 μ H <br> Sec. 251·0 μ H |
| $L_{20}$ | 2nd I.F. coil assembly | Pri. 250·5 μ H <br> Sec. 251·5 μ H |
| $L_{21}$ | 3rd I.F. coil assembly | Pri. 132 μ H <br> Sec. 254·5 μ H |
| $L_{22}$ | Beat frequency—oscillator coil | 272 μ H |
| $L_{23}$ | Switching oscillator transformer assembly | Pri. 27 μ H <br> Sec. 1, 1·82 μ H <br> Sec. 2, 1·44 μ H |
| $L_{24}$ | R.F. choke assembly | 290 m H |
| $L_{25}$ | R.F. choke assembly (screened) | 6·7 m H |
| $L_{26}$ | R.F. choke assembly (screened) | 6·7 m H |
| $L_{27}$ | R.F. choke assembly (screened) | 6·7 m H |
| $L_{28}$ | R.F. choke assembly (screened) | 6·7 m H |
| $L_{29}$ | A.F. choke assembly | 200 H** |
| $L_{30}$ | Output transformer (1·75 : 1) | Pri. 14 H <br> Sec. 4·5 H |

† Measured off chassis.

* Measured at 1,000 c/s, with no D.C.

** Measured at 150 c/s.

## APPENDIX 2

## NOMENCLATURE OF PARTS

The following list of parts is issued for information only. When ordering spares for these *receivers the appropriate section of AIR PUBLICATION 1086 must be used.*

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| 10D/98 | Receivers, types R.1155, R.1155A and R.1155B | | | |
| | Principal components | | | |
| 10D/508 | Case | 1 | | |
| | Choke, H.F. | | | |
| 10C/583 | Type 71 | 1 | $L_{24}$ | 250 $\mu$ H, 637 ohms, D.C. |
| 10C/2019 | Type 83 | 3 | $L_{26}$, $L_{27}$, $L_{28}$ | 250 $\mu$ H, 637 ohms, D.C. |
| 10C/2186 | Type 94 | 1 | $L_{35}$ | 250 $\mu$ H, 637 ohms, D.C. |
| 10D/157 | Coil unit, R.F. | 1 | | For first 1,000 receivers only |
| | Fitted with:— | | | |
| | Coil | | | |
| | Aerial | 3 | $L_1$ to $L_3$ | RANGES 1 to 2 and "dummy" |
| | Anode | 6 | $L_7$ to $L_{12}$ | RANGES 1 to 5 and I.F. trap |
| | Oscillator | 6 | $L_{13}$ to $L_{18}$ | RANGES 1 to 5 and anode choke |
| | Condenser unit | | | |
| 10C/3173 | Type 34 | 2 | $C_{57}$ to $C_{61}$, $C_{62}$ to $C_{66}$ | 4 to 40 $\mu\mu$ F trimmer |
| 10C/3174 | Type 35 | 1 | $C_{68}$ to $C_{70}$ | 4 to 40 $\mu\mu$ F trimmer |
| | Condenser | | | |
| 10C/10948 | Type 429 | 1 | $C_{78}$ | 20 $\mu\mu$ F |
| 10C/853 | Type 858 | 1 | $C_{91}$ | 40 $\mu\mu$ F |
| 10C/965 | Type 896 or | 2 | $C_7$, $C_{16}$ | 0·005 $\mu$ F |
| 10C/4256 | Type 2201 | | | |
| 10C/967 | Type 899 | 4 | $C_{37}$, $C_{38}$, $C_{34}$, $C_{40}$ | 0·1 $\mu$ F |
| 10C/972 | Type 904 | 1 | $C_{35}$ | 0·0002 $\mu$ F |
| 10C/976 | Type 908 | 2 | $C_{71}$, $C_{72}$ | 5 to 40 $\mu\mu$ F trimmer |
| 10C/977 | Type 909 | 1 | $C_{80}$ | 10 $\mu\mu$ F |
| 10C/978 | Type 910 | 1 | $C_{79}$ | 15 $\mu\mu$ F |
| 10C/2003 | Type 915 | 1 | $C_{105}$ | 0·1 $\mu$ F |
| 10C/2006 | Type 918 | 1 | $C_{99}$ | 100 $\mu\mu$ F |
| 10C/2007 | Type 919 | 2 | $C_{42}$, $C_{43}$ | 25 $\mu\mu$ F |
| 10C/2008 | Type 920 | 2 | $C_{44}$, $C_{45}$ | 240 $\mu\mu$ F |
| 10C/2009 | Type 921 | 2 | $C_{46}$, $C_{47}$ | 80 $\mu\mu$ F |
| 10C/2011 | Type 923 | 1 | $C_{67}$ | 2,000 $\mu\mu$ F |
| 10C/2012 | Type 924 | 1 | $C_{73}$ | 93 $\mu\mu$ F |
| 10C/2013 | Type 925 | 1 | $C_{74}$ | 255 $\mu\mu$ F |
| 10C/2014 | Type 926 | 1 | $C_{75}$ | 537 $\mu\mu$ F |
| 10C/2015 | Type 927 | 1 | $C_{76}$ | 1,670 $\mu\mu$ F |
| 10C/2016 | Type 928 | 1 | $C_{77}$ | 6,170 $\mu\mu$ F |
| | Resistance | | | |
| 10C/648 | Type 855 | 2 | $R_{59}$, $R_{60}$ | 220,000 ohms |
| 10C/691 | Type 875 | 1 | $R_{42}$ | 2,200 ohms |
| 10C/993 | Type 993 | 1 | $R_{38}$ | 100,000 ohms |
| 10C/1081 | Type 1,081 | 1 | $R_{61}$ | 1,200 ohms |
| 10C/1082 | Type 1,082 | 3 | $R_{17}$, $R_{40}$, $R_{41}$ | 1,500 ohms |
| 10C/1278 | Type 1,278 | 1 | $R_{35}$ | 22,000 ohms |
| | Switch | | | |
| 10F/154 | Type 368 | 1 | $FS_{zf}$, $FS_{zr}$ | Oscillator wafer |
| 10F/155 | Type 369 | 1 | $FS_{yf}$, $FS_{yr}$ | Anode wafer |
| 10F/156 | Type 370 | 1 | $FS_{wf}$, $FS_{wr}$ | Aerial wafer |
| 10F/157 | Type 371 | 1 | $FS_{xf}$, $FS_{xr}$ | Loop aerial wafer |
| 10D/380 | Coil unit, R.F. | 1 | | After 1st 1,000 receivers |
| | Fitted with:— | | | |
| | Coil | | | |
| | Aerial | 3 | $L_1$ to $L_3$ | RANGES 1, 2 and "dummy" |
| | Anode | 6 | $L_7$ to $L_{12}$ | RANGES 1 to 5 and I.F. trap |
| | Oscillator | 6 | $L_{13}$ to $L_{18}$ | RANGES 1 to 5 and anode choke |

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | Principal components (*contd.*) | | | |
| | Coil unit, R.F. (*contd.*) | | | |
| | Fitted with (*contd.*) | | | |
| | Condenser unit | | | |
| 10C/3173 | Type 34 | 2 | $C_{57}$ to $C_{61}$, $C_{62}$ to $C_{66}$ | 4 to 40 $\mu\mu$ F trimmer |
| 10C/3174 | Type 35 | 1 | $C_{68}$ to $C_{70}$ | 4 to 40 $\mu\mu$ F trimmer |
| | Condenser | | | |
| 10C/10948 | Type 429 | 1 | $C_{78}$ | 20 $\mu\mu$ F |
| 10C/853 | Type 858 | 1 | $C_{91}$ | 40 $\mu\mu$ F |
| 10C/965 | Type 896 | 2 | $C_7$, $C_{18}$ | 0·005 $\mu$ F |
| | or | | | |
| 10C/4256 | Type 2201 | | | |
| 10C/967 | Type 899 | 4 | $C_{37}$, $C_{38}$, $C_{34}$, $C_{40}$ | 0·1 $\mu$ F |
| 10C/972 | Type 904 | 2 | $C_{35}$, $C_{108}$ | 0·0002 $\mu$ F |
| 10C/976 | Type 908 | 2 | $C_{71}$, $C_{72}$ | 5 to 40 $\mu\mu$ F trimmer |
| 10C/978 | Type 910 | 1 | $C_{79}$ | 15 $\mu\mu$ F |
| 10C/2003 | Type 915 | 1 | $C_{105}$ | 0·1 $\mu$ F. |
| 10C/2006 | Type 918 | 1 | $C_{99}$ | 100 $\mu\mu$ F |
| 10C/2007 | Type 919 | 2 | $C_{42}$, $C_{43}$ | 25 $\mu\mu$ F |
| 10C/2008 | Type 920 | 2 | $C_{44}$, $C_{45}$ | 240 $\mu\mu$ F |
| 10C/2009 | Type 921 | 2 | $C_{46}$, $C_{47}$ | 80 $\mu\mu$ F |
| 10C/2011 | Type 923 | 1 | $C_{67}$ | 2,000 $\mu\mu$ F |
| 10C/2012 | Type 924 | 1 | $C_{73}$ | 93 $\mu\mu$ F |
| 10C/2013 | Type 925 | 1 | $C_{74}$ | 255 $\mu\mu$ F |
| 10C/2014 | Type 926 | 1 | $C_{75}$ | 537 $\mu\mu$ F |
| 10C/2015 | Type 927 | 1 | $C_{76}$ | 1,670 $\mu\mu$ F |
| 10C/2016 | Type 928 | 1 | $C_{77}$ | 6,170 $\mu\mu$ F |
| 10C/3027 | Type 1,439 | 1 | $C_{80}$ | 25 $\mu\mu$ F |
| | Resistance | | | |
| 10C/648 | Type 855 | 2 | $R_{59}$, $R_{60}$ | 220,000 ohms |
| 10C/691 | Type 875 | 1 | $R_{42}$ | 2,200 ohms |
| 10C/993 | Type 993 | 1 | $R_{38}$ | 100,000 ohms |
| 10C/1081 | Type 1,081 | 1 | $R_{61}$ | 1,200 ohms |
| 10C/1082 | Type 1,082 | 3 | $R_{17}$, $R_{40}$, $R_{41}$ | 1,500 ohms |
| 10C/1278 | Type 1,278 | 1 | $R_{35}$ | 22,000 ohms |
| | Switch | | | |
| 10F/154 | Type 368 | 1 | $FS_{zf}$, $FS_{zr}$ | Oscillator wafer |
| 10F/155 | Type 369 | 1 | $FS_{yf}$, $FS_{yr}$ | Anode wafer |
| 10F/156 | Type 370 | 1 | $FS_{wf}$, $FS_{wr}$ | Aerial wafer |
| 10F/157 | Type 371 | 1 | $FS_{xf}$, $FS_{xr}$ | Loop aerial wafer |
| | Coil, D/F. | | | |
| 10D/161 | Range 3 | 1 | $L_4$ | 1,515 kc/s. to 600 kc/s. |
| 10D/162 | Range 4 | 1 | $L_5$ | 502 kc/s. to 198 kc/s. |
| 10D/163 | Range 5 | 1 | $L_6$ | 202 kc/s. to 74 kc/s. |
| | Condenser | | | |
| 10C/10948 | Type 429 | 1 | $C_{78}$ | 20 $\mu\mu$ F |
| 10C/584 | Type 770 | 1 | $C_{82}$, $C_{83}$, $C_{84}$ | Var. 3-ganged (1st 1,000 receivers) |
| 10C/651 | Type 782 | 3 | $C_{19}$, $C_{25}$, $C_{102}$ | 0·001 $\mu$ F |
| 10C/853 | Type 858 | 1 | $C_{91}$ | 40 $\mu\mu$ F |
| 10C/760 | Type 892 | 1 | $C_1$ | 2·5 + 2·5 + 1·0 $\mu$ F (or 10C/3399) |
| 10C/961 | Type 893 | 6 | $C_{26}$ to $C_{28}$; $C_{29}$ to $C_{31}$; $C_{32}$ + $C_{33}$ + $C_{36}$; $C_{41}$ + $C_{49}$ + $C_{50}$; $C_{51}$ to $C_{53}$; $C_2$ + $C_{39}$ | 0·1 + 0·1 + 0·1 $\mu$ F |
| | or | | | |
| 10C/3399 | Type 1662 | | | |
| 10C/962 | Type 894 | 1 | $C_3$ + $C_4$ + $C_5$ | 2·5 + 2·5 + 1·0 $\mu$ F |
| 10C/963 | Type 895 | 2 | $C_6$, $C_{11}$ | 0·0001 $\mu$ F |
| | or | | | |
| 10C/2155 | Type 995 | | | |
| 10C/964 | Type 896 | 8 | $C_7$, $C_{18}$, $C_{20}$ to $C_{24}$, $C_{103}$ | 0·005 $\mu$ F |
| | or | | | |
| 10C/4256 | Type 2201 | | | |
| 10C/965 | Type 897 | 2 | $C_8$, $C_9$ | 0·001 $\mu$ F |
| 10C/966 | Type 898 | 1 | $C_{10}$ | 0·004 $\mu$ F |
| 10C/967 | Type 899 | 5 | $C_{12}$, $C_{34}$, $C_{37}$, $C_{38}$, $C_{40}$ | 0·1 $\mu$ F |
| 10C/968 | Type 900 | 1 | $C_{104}$ | 75 $\mu\mu$ F, trimmer |
| 10C/969 | Type 901 | 2 | $C_{14}$ | 800 $\mu\mu$ F (2 off) = 1,600 $\mu\mu$ F |

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | Principal components (*contd.*) | | | |
| | Condenser (*contd.*) | | | |
| 10C/970 | Type 902 | | | |
| | or | 3 | $C_{16}$, $C_{55}$, $C_{95}$ | 0·5 $\mu$ F |
| 10C/3401 | Type 1664 | | | |
| 10C/971 | Type 903 | 1 | $C_{89}$ | 600 $\mu\mu$ F |
| 10C/972 | Type 904 | | | |
| | or | 2 | $C_{35}$, $C_{108}$ | 0·0002 $\mu$ F |
| 10C/2719 | Type 1322 | | | |
| 10C/973 | Type 905 | | | |
| | or | 1 | $C_{54}$ | 0·04 $\mu$ F |
| 10C/4257 | Type 2202 | | | |
| 10C/974 | Type 906 | | | |
| | or | 1 | $C_{56}$ | 8 to 115 $\mu\mu$ F, trimmer |
| 10C/3402 | Type 1665 | | | |
| 10C/976 | Type 908 | 2 | $C_{71}$, $C_{72}$ | 5 to 40 $\mu\mu$ F, trimmer |
| 10C/977 | Type 909 | 1 | $C_{80}$ | 10 $\mu\mu$ F (1st 1,000 receivers) |
| 10C/978 | Type 910 | 1 | $C_{79}$ | 15 $\mu\mu$ F |
| 10C/979 | Type 911 | 1 | $C_{93}$ | 4 $\mu$ F |
| 10C/2000 | Type 912 | | | |
| | or | 1 | $C_{96}$ | 0·02 $\mu$ F |
| 10C/4258 | Type 2203 | | | |
| 10C/2001 | Type 913 | 2 | $C_{97}$, $C_{98}$ | 2 $\mu\mu$ F |
| 10C/2002 | Type 914 | 1 | $C_{101}$ | 4 $\mu\mu$ F |
| 10C/2003 | Type 915 | 2 | $C_{105}$, $C_{107}$ | 0·1 $\mu$ F |
| 10C/2005 | Type 917 | 1 | $C_{15}$ | 4,550 $\mu\mu$ F |
| 10C/2006 | Type 918 | 2 | $C_{17}$, $C_{99}$ | 100 $\mu\mu$ F |
| 10C/2007 | Type 919 | 2 | $C_{42}$, $C_{43}$ | 25 $\mu\mu$ F |
| 10C/2008 | Type 920 | 2 | $C_{44}$, $C_{45}$ | 240 $\mu\mu$ F |
| 10C/2009 | Type 921 | 2 | $C_{46}$, $C_{47}$ | 80 $\mu\mu$ F |
| 10C/2010 | Type 922 | 2 | $C_{48}$, $C_{100}$ | 200 $\mu\mu$ F |
| 10C/2011 | Type 923 | 1 | $C_{67}$ | 2,000 $\mu\mu$ F |
| 10C/2012 | Type 924 | 1 | $C_{73}$ | 93 $\mu\mu$ F |
| 10C/2013 | Type 925 | 1 | $C_{74}$ | 255 $\mu\mu$ F |
| 10C/2014 | Type 926 | 1 | $C_{75}$ | 537 $\mu\mu$ F |
| 10C/2015 | Type 927 | 1 | $C_{76}$ | 1,670 $\mu\mu$ F |
| 10C/2016 | Type 928 | 1 | $C_{77}$ | 6,170 $\mu\mu$ F |
| 10C/2017 | Type 929 | 5 | $C_{85}$, $C_{86}$, $C_{87}$, $C_{88}$, $C_{90}$ | 300 $\mu\mu$ F |
| 10C/3027 | Type 1,439 | 1 | $C_{80}$ | 25 $\mu\mu$ F after 1st 1,000 |
| 10C/3028 | Type 1,440 | 1 | $C_{82}$, $C_{83}$, $C_{84}$ | Var. 3 ganged after 1st 1,000 |
| 10C/3129 | Type 1,525 | 1 | $C_{13}$ | 5 to 60 $\mu\mu$ F var. |
| 10C/3860 | Type 1,949 | 1 | $C_{114}$ | 8 $\mu\mu$ F (R.1155A and R.1155B) |
| 10C/4922 | Type 2,612 | 1 | $C_{112}$ | 30 $\mu\mu$ F (R.1155A and R.1155B) |
| 10C/4923 | Type 2,613 | 2 | $C_{111}$ $C_{113}$ | 160 $\mu\mu$ F (R.1155A and R.1155B) |
| | Condenser unit | | | |
| 10C/3173 | Type 34 | 2 | $C_{57}$ to $C_{61}$, $C_{62}$ to $C_{66}$ | 4 to 40 $\mu\mu$ F trimmer |
| 10C/3174 | Type 35 | 1 | $C_{68}$ to $C_{70}$ | 4 to 40 $\mu\mu$ F trimmer |
| 10A/12684 | Drive, slow-motion, type 13 | 1 | | |
| | Holder, valve | | | |
| 10H/326 | Type 51 | 10 | | American octal (1st 1,200 receivers) |
| 10H/326 | Type 51 | 9 | | After 1st 1,200 receivers |
| 10H/493 | Type 73 | 1 | | After 1st 1,200 receivers |
| 10P/13005 | Filter unit, type 44 | 1 | | Grid rejector (R.1155A) |
| | *Fitted with:—* | | | |
| 10C/4838 | Coil, type 393 | 1 | $L_{31}$ | |
| | Condenser | | | |
| 10C/4922 | Type 2,612 | 1 | $C_{112}$ | 30 $\mu\mu$ F.* In H.F. coil box, R.1155B |
| 10C/4923 | Type 2,613 | 1 | $C_{111}$ | 160 $\mu\mu$ F |
| 10C/7373 | Resistance, type 7373 | 1 | $R_{71}$ | 150,000 ohms. In H.F. coil box R.1155B |

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | Principal components (*contd.*) | | | |
| 10P/13006 | Filter unit, type 45 | 1 | | Anode rejector (R.1155A and B) |
| | *Fitted with*:— | | | |
| 10C/4839 | Coil, type 394 | 1 | $L_{32}$ | |
| 10C/4923 | Condenser, type 2,613 | 1 | $C_{113}$ | 160 $\mu\mu$ F |
| 10P/13007 | Filter unit, type 46 | 1 | | Anode acceptor (R.1155A and R.1155B) |
| | *Fitted with*:— | | | |
| N.I.V. | Coil | 1 | $L_{33}$ | |
| 10C/3860 | Condenser, type 1,949 | 1 | $C_{114}$ | 8 $\mu\mu$ F |
| 10D/164 | Output unit, type 4 | 1 | | |
| | *Fitted with*:— | | | |
| | Choke L.F. | 1 | $L_{29}$ | |
| | Condenser | | | |
| 10C/965 | Type 897 | 2 | $C_8$, $C_9$ | 0·001 $\mu$ F |
| 10C/966 | Type 898 | 1 | $C_{10}$ | 0·004 $\mu$ F |
| 10C/2000 | Type 912 or | 1 | $C_{96}$ | 0·02 $\mu$ F |
| 10C/4258 | Type 2,203 | | | |
| | Resistance | | | |
| 10C/11667 | Type 500 | 1 | $R_5$ | 1,000 ohms |
| 10C/1505 | Type 1,505 | 1 | $R_7$ | 270 ohms |
| 10V/1 | Oscillator unit, type 18 | 1 | | |
| | *Fitted with*:— | | | |
| 10C/2019 | Choke, R.F., type 83 | 3 | $L_{26}$ $L_{27}$, $L_{28}$ | |
| | Condenser | | | |
| 10C/962 | Type 894 | 1 | $C_3$, $C_4$, $C_5$ | 2·5 + 2·5 + 1·0 $\mu$ F |
| 10C/964 | Type 896 or | 5 | $C_{20}$, $C_{21}$, $C_{22}$, $C_{23}$, $C_{24}$ | 0·005 $\mu$ F |
| 10C/4256 | Type 2201 | | | |
| 10C/967 | Type 899 | 1 | $C_{12}$ | 0·1 $\mu$ F |
| 10C/968 | Type 900 | 1 | $C_{13}$ | 75 $\mu\mu$ F (1st 1,000 receivers) |
| 10C/969 | Type 901 | 2 | $C_{14}$ | 800 $\mu\mu$ F (2 off) = 1,600 $\mu\mu$ F |
| 10C/2005 | Type 917 | 1 | $C_{15}$ | 4,550 $\mu\mu$ F |
| 10C/2006 | Type 918 | 1 | $C_{17}$ | 100 $\mu\mu$ F |
| 10C/3129 | Type 1,525 | 1 | $C_{13}$ | 5 to 60 $\mu\mu$ F (after 1st 1,000 receivers) |
| 10C/3129 | Holder, valve, type 51 | 1 | | |
| | Resistance | | | |
| 10C/11667 | Type 500 | 1 | $R_{14}$ | 1,000 ohms |
| 10C/777 | Type 906 | 1 | $R_{18}$ | 10,000 ohms |
| 10C/1008 | Type 1,008 | 1 | $R_{19}$ | 56,000 ohms |
| 10C/1010 | Type 1,010 | 1 | $R_{32}$ | 22,000 ohms |
| 10C/1082 | Type 1,082 | 1 | $R_{17}$ | 1,500 ohms |
| 10H/323 | Plug, type 194 | 2 | $P_1$, $P_2$ | Power and meter |
| | Resistance | | | |
| 10C/11382 | Type 478 | 2 | $R_{10}$, $R_{11}$ | 150,000 ohms |
| 10C/11384 | Type 480 | 1 | $R_{13}$ | 1 megohm |
| 10C/11667 | Type 500 | 3 | $R_5$, $R_{14}$, $R_{22}$ | 1,000 ohms |
| 10C/1505 | Type 505 | 2 | $R_{65}$, $R_{66}$ | 10,000 ohms |
| 10C/124 | Type 592 | 1 | $R_6$ | 1,500 ohms |
| 10C/648 | Type 855 | 2 | $R_{59}$, $R_{60}$ | 220,000 ohms |
| 10C/691 | Type 875 | 4 | $R_{30}$, $R_{34}$, $R_{42}$, $R_{58}$ | 2,200 ohms |
| 10C/777 | Type 906 | 1 | $R_{18}$ | 10,000 ohms |
| 10C/989 | Type 989 | 1 | $R_{21}$ | 470,000 ohms |
| 10C/991 | Type 991 | 3 | $R_{48}$, $R_{50}$, $R_{52}$ | 6,800 ohms (or 10C/1464) |
| 10C/992 | Type 992 | 2 | $R_{53}$, $R_{57}$ | 560,000 ohms |
| 10C/993 | Type 993 | 5 | $R_{26}$, $R_{29}$, $R_{33}$, $R_{38}$, $R_{45}$ | 100,000 ohms |
| 10C/995 | Type 995 | 1 | $R_{56}$ | 240 ohms |
| 10C/996 | Type 996 | 2 | $R_{62}$, $R_{63}$ | 2·2 megohms |
| 10C/998 | Type 998 | 1 | $R_{23}$ | 20,000 ohms, var. |
| 10C/999 | Type 999 | 1 | $R_{51}$ | 20,000 ohms, pot. |
| 10C/1000 | Type 1,000 | 1 | $R_{8(1)}$ and $R_{8(2)}$ | 0·5 megohm + 50,000 ohms |
| 10C/1001 | Type 1,001 | 1 | $R_1$ | 2,000 ohms |
| 10C/1002 | Type 1,002 | 2 | $R_2$, $R_3$ | 1,200 ohms |
| 10C/1003 | Type 1,003 | 1 | $R_4$ | 120 ohms |
| 10C/1004 | Type 1,004 | 1 | $R_9$ | 2 megohms |

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | Principal components (*contd.*) | | | |
| | Oscillator unit, type 18 (*contd.*) | | | |
| | Resistance (*Contd.*) | | | |
| 10C/1005 | Type 1,005 | 1 | $R_{12}$ | 27,000 ohms |
| 10C/1006 | Type 1,006 | 6 | $R_{16}$, $R_{27}$, $R_{31}$, $R_{36}$, $R_{43}$, $R_{47}$ | 27,000 ohms |
| 10C/1007 | Type 1,007 | 1 | $R_{15}$ | 30,000 ohms |
| 10C/1008 | Type 1,008 | 6 | $R_{19}$, $R_{20}$, $R_{39}$, $R_{54}$, $R_{55}$, $R_{68}$ | 56,000 ohms |
| 10C/1010 | Type 1,010 | 7 | $R_{24}$, $R_{25}$, $R_{28}$, $R_{32}$, $R_{35}$, $R_{37}$, $R_{44}$ | 22,000 ohms |
| 10C/1081 | Type 1,081 | 1 | $R_{61}$ | 1,200 ohms |
| 10C/1082 | Type 1,082 | 4 | $R_{17}$, $R_{40}$, $R_{41}$, $R_{46}$ | 1,500 ohms |
| 10C/1278 | Type 1,278 | 1 | $R_{67}$ | 22,000 ohms |
| 10C/1464<br>10C/991 | Type 1,464<br>or<br>Type 991 | 2 | $R'_{48}$, $R_{50}$ | 3,300 ohms |
| 10C/1505 | Type 1,505 | 1 | $R_7$ | 270 ohms |
| 10C/1634 | Type 1,634 | 1 | $R_{64}$ | 200 ohms |
| 10C/7373 | Type 7,373 | 1 | $R_{71}$ | 150,000 ohms |
| 10H/327 | Socket, type 138 | 1 | $Sk_3$ | Loop socket |
| | Switch | | | |
| 10F/10338 | Type 152 | 3 | $S_4$, $S_1$, $S_5$ | S.P. c/o. Het.; speed, filter |
| 10F/158 | Type 234 | 1 | MS | 5 wafer, 5 position |
| 10F/159 | Type 235 | 1 | $S_2$ | D.P. c/o. meter deflection |
| 10F/163 | Type 239 | 1 | $S_3$ | S.P. D.T. aural sense |
| 10F/154 | Type 368 | 1 | $FS_{zf}$, $FS_{zr}$ | Oscillator wafer |
| 10F/155 | Type 369 | 1 | $FS_{yf}$ $FS_{yr}$ | Anode wafer |
| 10F/156 | Type 370 | 1 | $FS_{xf}$, $FS_{xr}$ | Aerial wafer |
| 10F/157 | Type 371 | 1 | $FS_{wf}$, $FS_{wr}$ | Loop aerial wafer |
| 10K/12136 | Transformer, type 130 | 2 | | I.F. |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/2001 | Type 913 | 1 | $C_{97}$ or $C_{98}$ | 2 $\mu\mu$ F |
| 10C/2017 | Type 929 | 2 | $C_{85}$, $C_{86}$ or $C_{87}$, $C_{88}$ | 300 $\mu\mu$ F |
| | Resistance | | | |
| 10C/691 | Type 875 | 1 | $R_{34}$ or $R_{30}$ | 2,200 ohms |
| 10C/993 | Type 993 | 1 | $R_{33}$ or $R_{29}$ | 100,000 ohms |
| | or, as alternative | | | |
| | Transformer | | | |
| 10K/12136<br>10K/251 | Type 130<br>and<br>Type 366 | 1 | | As above |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/2001 | Type 913 | 1 | $C_{97}$ | 2 $\mu\mu$ F |
| 10C/2017 | Type 929 | 2 | $C_{85}$, $C_{86}$ | 300 $\mu\mu$ F |
| | Resistance | | | |
| 10C/691 | Type 875 | 1 | $R_{34}$ | 2,200 ohms |
| 10C/993 | Type 993 | 1 | $R_{33}$ | 100,000 ohms |
| 10K/12137 | Transformer, type 131 | 1 | | 3rd I.F. coil assembly |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/971 | Type 903 | 1 | $C_{89}$ | 600 $\mu\mu$ F |
| 10C/2002 | Type 914 | 1 | $C_{101}$ | 4 $\mu\mu$ F |
| 10C/2017 | Type 929 | 1 | $C_{90}$ | 300 $\mu\mu$F |
| 10K/12138 | Transformer, type 132 | 1 | $L_{23}$ | 30 c/s. transformer assembly |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/973<br>10C/4237 | Type 905<br>o.<br>Type 2202 | 1 | $C_{54}$ | 0·04 $\mu$F |
| | Resistance | | | |
| 10C/991 | Type 991 | 1 | $R_{52}$ | 6,800 ohms |
| 10C/992 | Type 992 | 1 | $R_{53}$ | 560,000 ohms |
| 10C/1008 | Type 1,008 | 2 | $R_{54}$, $R_{55}$ | 56,000 ohms |
| 10K/12139 | Transformer, type 133 | 1 | | |

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | *Accessories* | | | |
| 10D/315 | Case, transit | 1 | | |
| | Valve : | | | |
| 10E/277 | Type V.R.99 | 3 | $V_1$, $V_2$, $V_4$ | |
| 10E/278 | Type V.R.100 | 3 | $V_3$, $V_5$, $V_6$ | |
| 10E/280 | Type V.R.101 | 2 | $V_7$, $V_8$ | |
| 10E/279 | Type V.R.102 | 1 | $V_9$ | |
| 10E/305 | Type V.I.103 | 1 | $V_{10}$ | |
| 10Q/2 | Indicator, visual, type 1 | 2 | | |

*A complete installation schedule is included in Sect. 1, Chap. 7 of this AIR PUBLICATION*

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | Principal components (*contd.*) | | | |
| | Oscillator unit, type 18 (*contd.*) | | | |
| | Resistance (*Contd.*) | | | |
| 10C/1005 | Type 1,005 | 1 | $R_{11}$ | 27,000 ohms |
| 10C/1006 | Type 1,006 | 6 | $R_{16}$, $R_{27}$, $R_{31}$, $R_{36}$, $R_{43}$, $R_{47}$ | 27,000 ohms |
| 10C/1007 | Type 1,007 | 1 | $R_{13}$ | 30,000 ohms |
| 10C/1008 | Type 1,008 | 6 | $R_{19}$, $R_{20}$, $R_{39}$, $R_{54}$, $R_{55}$, $R_{68}$ | 56,000 ohms |
| 10C/1010 | Type 1,010 | 7 | $R_{24}$, $R_{25}$, $R_{28}$, $R_{32}$, $R_{35}$, $R_{37}$, $R_{44}$ | 22,000 ohms |
| 10C/1081 | Type 1,081 | 1 | $R_{61}$ | 1,200 ohms |
| 10C/1082 | Type 1,082 | 4 | $R_{17}$, $R_{40}$, $R_{41}$, $R_{46}$ | 1,500 ohms |
| 10C/1278 | Type 1,278 | 1 | $R_{67}$ | 22,000 ohms |
| 10C/1464 | Type 1,464 | | | |
| | or | 2 | $R_{48}$, $R_{50}$ | 3,300 ohms |
| 10C/991 | Type 991 | | | |
| 10C/1505 | Type 1,505 | 1 | $R_7$ | 270 ohms |
| 10C/1634 | Type 1,634 | 1 | $R_{64}$ | 200 ohms |
| 10C/7373 | Type 7,373 | 1 | $R_{71}$ | 150,000 ohms |
| 10H/327 | Socket, type 138 | 1 | $Sk_8$ | Loop socket |
| | Switch | | | |
| 10F/10338 | Type 152 | 3 | $S_4$, $S_1$, $S_5$ | S.P. c/o. Het., speed, filter |
| 10F/158 | Type 234 | 1 | MS | 5 wafer, 5 position |
| 10F/159 | Type 235 | 1 | $S_2$ | D.P. c/o. meter deflection |
| 10F/163 | Type 239 | 1 | $S_3$ | S.P. D.T. aural sense |
| 10F/154 | Type 368 | 1 | $FS_{zf}$, $FS_{zr}$ | Oscillator wafer |
| 10F/155 | Type 369 | 1 | $FS_{yf}$ $FS_{yr}$ | Anode wafer |
| 10F/156 | Type 370 | 1 | $FS_{xf}$, $FS_{xr}$ | Aerial wafer |
| 10F/157 | Type 371 | 1 | $FS_{wf}$, $FS_{wr}$ | Loop aerial wafer |
| 10K/12136 | Transformer, type 130 | 2 | | I.F. |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/2001 | Type 913 | 1 | $C_{97}$ or $C_{98}$ | 2 $\mu\mu$ F |
| 10C/2017 | Type 929 | 2 | $C_{85}$, $C_{88}$ or $C_{87}$, $C_{89}$ | 300 $\mu\mu$ F |
| | Resistance | | | |
| 10C/691 | Type 875 | 1 | $R_{34}$ or $R_{30}$ | 2,200 ohms |
| 10C/993 | Type 993 | 1 | $R_{33}$ or $R_{29}$ | 100,000 ohms |
| | or, as alternative | | | |
| | Transformer | | | |
| 10K/12136 | Type 130 | | | |
| | and | 1 | | As above |
| 10K/251 | Type 366 | | | |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/2001 | Type 913 | 1 | $C_{97}$ | 2 $\mu\mu$ F |
| 10C/2017 | Type 929 | 2 | $C_{85}$, $C_{86}$ | 300 $\mu\mu$ F |
| | Resistance | | | |
| 10C/691 | Type 875 | 1 | $R_{34}$ | 2,200 ohms |
| 10C/993 | Type 993 | 1 | $R_{33}$ | 100,000 ohms |
| 10K/12137 | Transformer, type 131 | 1 | | 3rd I.F. coil assembly |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/971 | Type 903 | 1 | $C_{89}$ | 600 $\mu\mu$ F |
| 10C/2002 | Type 914 | 1 | $C_{101}$ | 4 $\mu\mu$ F |
| 10C/2017 | Type 929 | 1 | $C_{90}$ | 300 $\mu\mu$F |
| 10K/12138 | Transformer, type 132 | 1 | $L_{23}$ | 30 c/s. transformer assembly |
| | *Fitted with*:— | | | |
| | Condenser | | | |
| 10C/973 | Type 905 | | | |
| | or | 1 | $C_{64}$ | 0·04 $\mu$F |
| 10C/4237 | Type 2202 | | | |
| | Resistance | | | |
| 10C/991 | Type 991 | 1 | $R_{52}$ | 6,800 ohms |
| 10C/992 | Type 992 | 1 | $R_{53}$ | 560,000 ohms |
| 10C/1008 | Type 1,008 | 2 | $R_{54}$, $R_{55}$ | 56,000 ohms |
| 10K/12139 | Transformer, type 133 | 1 | | |

| Ref. No. | Nomenclature | Qty. | Ref. in fig. 3 | Remarks |
|---|---|---|---|---|
| | Receivers, types R.1155, R.1155A and R.1155B (*contd.*) | | | |
| | *Accessories* | | | |
| 10D/315 | Case, transit | 1 | | |
| | Valve | | | |
| 10E/277 | Type V.R.99 | 3 | $V_1$, $V_2$, $V_4$ | |
| 10E/278 | Type V.R.100 | 3 | $V_3$, $V_5$, $V_6$ | |
| 10E/280 | Type V.R.101 | 2 | $V_7$, $V_8$ | |
| 10E/279 | Type V.R.102 | 1 | $V_9$ | |
| 10E/305 | Type V.I.103 | 1 | $V_{10}$ | |
| 10Q/2 | Indicator, visual, type 1 | 2 | | |

*A complete installation schedule is included in Sect. 1, Chap. 7 of this AIR PUBLICATION*

APPENDIX 3.

## RECEIVERS, Types R.1155C, D, E, F, L, M, and N

1. The above-mentioned receivers are all variants of the basic R.1155 series. The receivers R.1155C and L have certain circuit modifications which will be promulgated in due course. The remaining receivers, with the exception of R.1155M, differ from the basic type only so far as the casing material is concerned.

2. The following list of receivers, stores reference numbers and basic types from which developed, is supplied for reference:—

| *Receiver type* | *Stores Ref. No.* | *Basic type* | *Comments* |
|---|---|---|---|
| R.1155C | 10D/1105 | R.1155B | Modified for H.F.D/F. Primarily intended for Coastal Command: |
| R.1155D | 10D/1331 | R.1155 | Steel case. |
| R.1155E | 10D/1332 | R.1155A | Steel case. |
| R.1155F | 10D/1333 | R.1155B | Steel case. |
| R.1155L | 10D/1477 | R.1155B | 75–200 Kc/s range replaced by 1·5–3·3 Mc/s range for A.S.R. launches. Aluminium case. |
| R.1155M | 10D/1597 | R.1155A | For use in ground schools only. These are R.1155A receivers which, for certain reasons, have been rejected as unfit for other use. |
| R.1155N | 10D/1667 | R.1155L | Steel case. With modified extended ranges for A.S.R. launches as in R.1155L. |

P4264 M /137 6/44 13000 C & P Gp. 1