Aerial switch position

69. The aerial switching unit, type J, or the aerial plug board, which may be used as an alternative to the switching unit, is positioned between the transmitter and the aerial lead-in points so that the "run" of the aerial leads is clean and short. Instructions on the switch unit, the aerial plug board, internal aerial leads and other relevant details are given in Chap. 1.

D.F. loop aerial and impedance matching

70. The D.F. circuits of the receiver have been designed to work with a D.F. loop, type 3, which has a nominal inductance of 100 μH 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.

71. Two small condensers C_{108} and C_{104}, the latter adjustable, are contained within the plug type 209 which connects the D.F. loop to the receiver. The condenser C_{104} should be adjusted for maximum sensitivity. The fixed condenser C_{108} 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.

72. The procedure for matching the receiver input to the capacitance of the loop aerial lead is as follows:—

(i) Set the aerial switch, type J, to D.F. (If the aerial plug board is in use set the plug marked FIXED AE to the group marked H.F.) As no D.F. interlock is provided by the aerial plug board care must be taken to avoid transmission when the receiver master switch is in the D.F. positions. Set the receiver master switch MS to FIGURE-OF-EIGHT.

(ii) Tune receiver to suitable signal on range 3 at the 1,500 kc/s end of the scale, and turn the loop to a position giving *maximum* signals in the telephones.

(iii) Adjust the trimmer condenser C_{104} 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_{104}. If it is found that the plates are in a position between maximum and minimum capacitance the adjustment is satisfactory and the plug should be replaced.

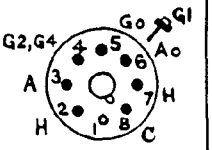
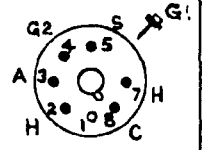
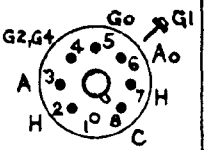
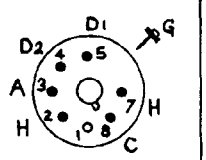
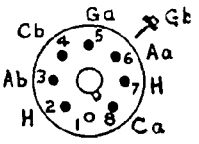
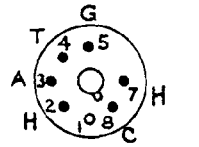
Circuit Ref.	*Valve Type*	*Base Connections*
V_1, V_2	VR99A	
V_3, V_5, V_6	VR100	
V_4	VR99	
V_7, V_8	VR101	
V_9	VR102	
V_{10}	VI 103	

FIG. 20.—VALVE CONNECTIONS

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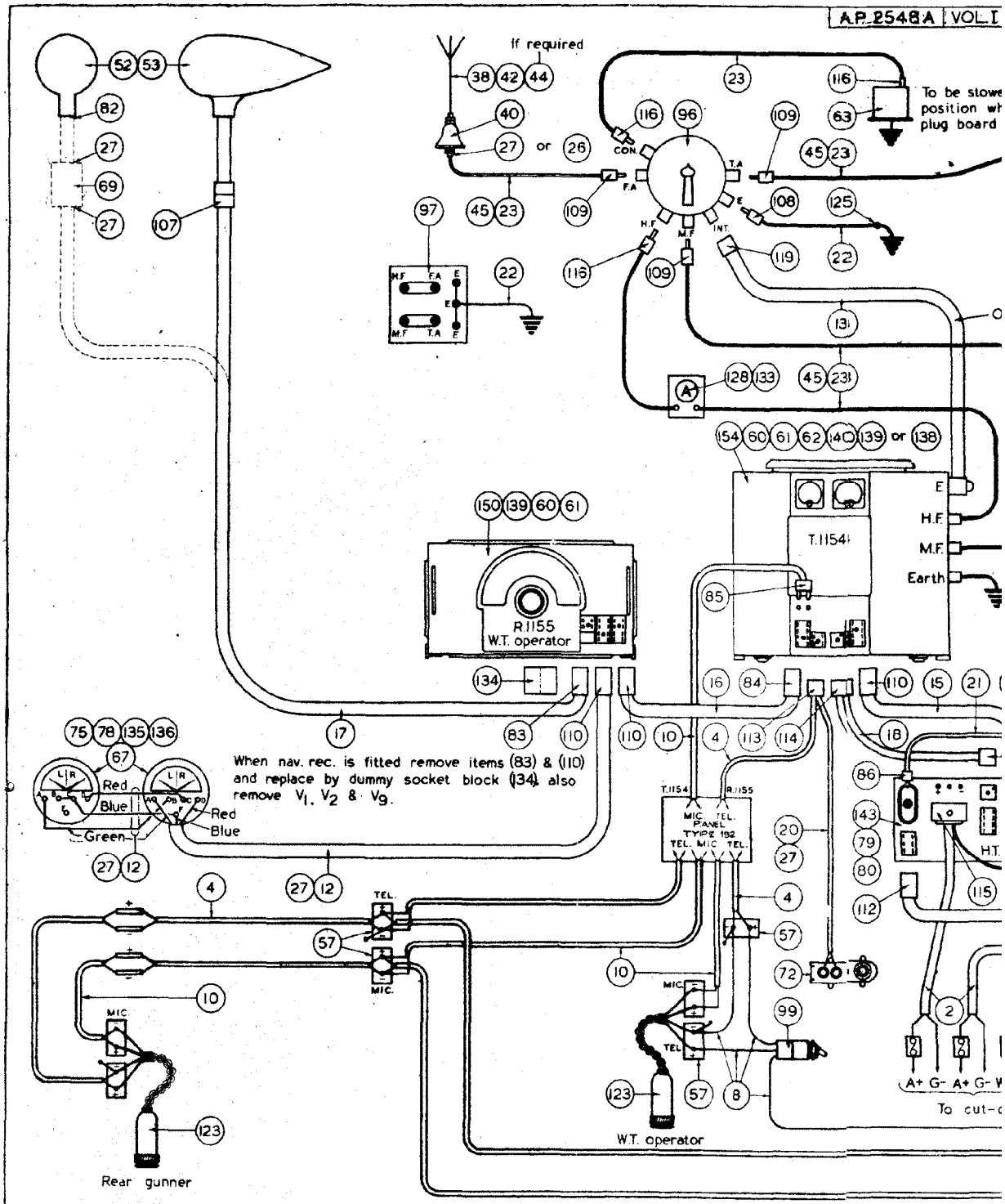
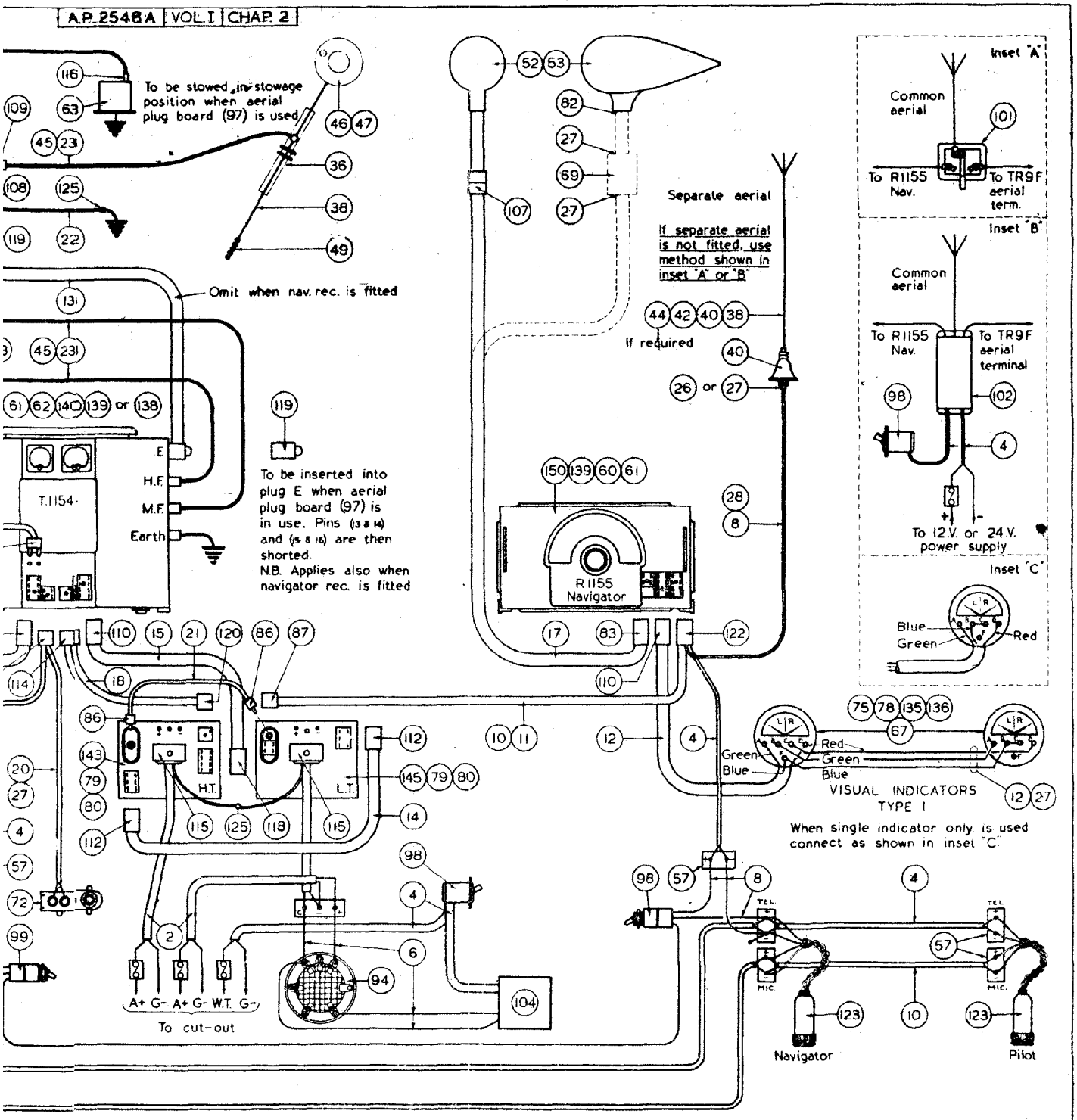


FIG. 21

TYPICAL INSTALLA



ICAL INSTALLATION DIAGRAM

FIG. 21

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(v) If it is found that the rotor 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 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_{106} 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.

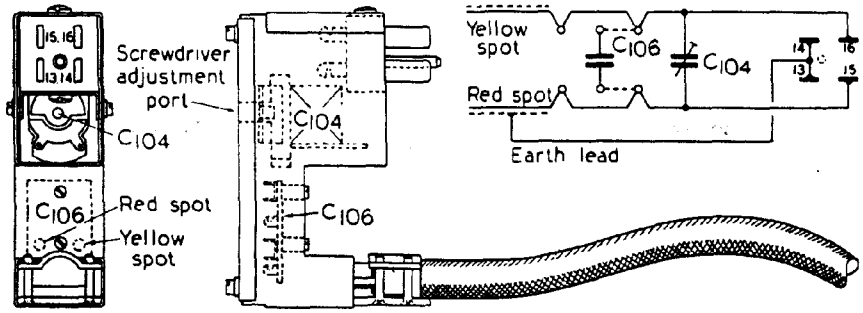

FIG. 22.—PLUG, TYPE 209

73. When a 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. The position of the impedance matching unit, with the maximum permissible length of cable between the loop and the receiver, is indicated in the installation schedules. 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. In paras. 74 and 75 general principles governing the position are given.

74. On installations using the loop aerial, type 3, the length of cable connector Duradio No. 20 fitted with plug, type 209, and socket, type 83, should not be less than 6 ft. nor more than 20 ft. On installations using the loop aerial, type 1, the length of cable connector Duradio No. 20 should not be less than 5 ft. nor more than 18 ft. The matching unit should, preferably, be as near to the loop as possible. The position of the matching unit, when the Hampden retractable loop is used, should be as near the loop as possible and the position of the unit affects the maximum permissible length of cable. The length of Duradio No. 20 between the loop and the receiver should not be less than 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.

75. When the Bendix loop is installed the matching unit, type 15, should be, preferably, as near as possible to the receiver. The length of Duradio No. 20 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

76. The fixed aerial input to the switching valves V_1 and V_2 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. The procedure is as follows:—

(i) Set the aerial switch, type J, to D.F. (If plug board in use set the plug marked FIXED AE to group marked H.F.) Set the meter deflection switch S_2 to HIGH and receiver master switch to FIGURE-OF-EIGHT.

(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 to VISUAL and noting that the needles of the visual indicator remain steady. 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 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 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 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

77. 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 their 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.

78. The mounting, 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

79. 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 connections from the receiver to the D.F. loop must 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. The following procedure should be adopted to ensure that the sense is correct:—

(i) Turn the master switch to FIGURE-OF-EIGHT. Tune the receiver to a suitable signal in range 3 or 5. This signal should be definitely identified and the relative position of the transmitting station, 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 bearing.

(iii) Turn the meter deflection sensitivity switch S_2 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 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 connections are correct. It is necessary to check on a station the position of which relative to the aircraft is known.

Loop centre tap

80. 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 not 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. 81 should be taken in these circumstances.

(iv) Adjust the loop lead capacitance (*see* para. 72).

81. The following is the sequence of operations for the removal of the loop centre tap:—

(i) Remove the fabric 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 connection from one winding termination, inner, to the metal centre piece.

(v) Remove the connection 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 not show a deflection.

(*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 cotton tape (Stores Ref. 32B/409), approximately 10 ft. long, and special adhesive, Boscolyn lacquer (Stores Ref. 33C/590).

Navigator-operated receivers

82. In certain aircraft an additional receiver is installed for the exclusive use of the navigator for D.F. purposes. The D.F. loop which is normally connected to the communications receiver is now connected to the navigator-operated receiver. The existing loop connector is dispensed with and a new connector fitted, the length of this varying to suit individual installations. The typical installation diagram of fig. 21 includes this navigator-operated receiver.

83. 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/1838) is provided for the purpose of blanking out the D.F. loop and visual indicator connections on the communications receiver. Existing remote controls may have to be repositioned or removed and where no remote controls exist these may have to be provided.

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

85. In order to overcome any difficulty which might arise over signal identification, means are 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 intercommunication facilities are established when the switches are set to the I/C position.

86. 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 Chap. 1 of this publication. It is recommended that V_1, V_2, and V_3 be removed from the *wireless operator's* receiver to reduce the load on the L.T. power units when two receivers are installed.

87. 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 following procedure should be adopted:—

(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.

Power units

88. Installation instructions in connection with the airborne power units and the procedure for adjustment of the resistance unit, type 47 (12-volt) or type 52 or 52A (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, Chap. 1 of this publication. Any of the L.T. power units listed in the concise details sheet at the beginning of this chapter may be in use, those bearing the suffix letter A being for use when a navigator-operated receiver is installed. Details of types 34A and 35A are as follows:—

Type	Stores Ref.	Input		Outputs				Rated Watts
				L.T.		H.T.		
		Volts	Amps.	Volts	Amps.	Volts	mA.	
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 to 69 mA or more at BALANCE or VISUAL with maximum setting of volume control.

OPERATION

89. The operation of the receiver will be facilitated by reference to fig. 1 which shows the front panel controls, plugs, and socket. The operator should first satisfy himself that all valve top cap connectors are making secure contact. The plugs and sockets should be securely engaged and the retaining bar should be in position on the posts provided. The receiver socket and plugs are grouped at the bottom right-hand corner and, from left to right, they are:—Socket SK_3, FROM LOOP AERIAL; plug P_3, TO VISUAL INDICATOR; plug P_1 FROM TRANSMITTER.

90. For communications reception the fixed aerial is normally used on the H.F. ranges 1, 2, and 2A, and the trailing aerial on the M.F. ranges 3, 4, and 5. By operating 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 and 2 A. (In the R.1155C only, range 1 may also be used for D.F. purposes.) The operator should ensure that the correct matching unit, for the type of loop aerial being used, is installed, as specified in para. 73.

Controls

91. The receiver has three main communications controls:—

(i) The tuning control with frequency-calibrated scales, the frequency being indicated by a pointer on the scale. The exact point of resonance is shown by a minimum shadow 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, but see para. 56.

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

(iii) The master switch MS has five positions which perform the following functions:—

• (OMNI). The R.F. and I.F. gain is manually controlled by the volume control, which actuates the ganged potentiometers $R_{8(1)}$ and $R_{8(2)}$. In this position of the master switch the potentiometer $R_{8(1)}$ is in circuit. This position is used for W.T. reception and for back-tuning between the transmitter and the receiver.

A.V.C. The R.F. and I.F. gain is automatically controlled. In this position of the master switch the potentiometer $R_{8(2)}$ is in circuit giving manual control over the A.F. gain. This position is used for R.T. reception.

BALANCE. This position is used in conjunction with the meter balance control R_{11} for balancing the visual indicator before D.F. is carried out.

VISUAL. For homing by visual means. This position may also be used for taking bearings by visual means in lieu of the normal aural method.

∞ (FIGURE-OF-EIGHT). For aural D.F. reception, using the switch S_3 for sense discrimination.

92. 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 R.F. and I.F. stages when MS is at OMNI and FIGURE-OF-EIGHT.

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

(iii) METER AMPLITUDE (R_{12})—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_{11})—Adjusted with MS at BALANCE and must not be adjusted with MS at any other position. Balance is indicated when two needles of the visual indicator intersect on 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 and also to reduce background noises when listening to R.T. transmissions from aircraft.

Setting up heterodyne oscillator

93. To bring the B.F.O. valve V_7 into operation for receiving C.W. 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 an aerial plug board, connect the fixed aerial to M.F.

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

(iii) Switch on the B.F.O., using S_4.

(iv) The frequency range switch FS should be at range 3 and a convenient R.T. transmitting station tuned in until the minimum shadow is seen in the tuning indicator V_{10}.

(v) Insert a screwdriver into the HET.ADJ. port giving access to C_{13} and slowly adjust the condenser until a suitable note is heard in the telephones. A variation of approximately 3 kc/s can be effected.

Back-tuning

94. 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 the volume control R_8 about half-way. 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}.

95. It will be realised 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 first be independently tuned to the required 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 the key, and adjust the receiver tuning for minimum shadow in V_{10}.

Note.—If the edges of light on the tuning indicator overlap during tuning operations, reduce the volume control. If the shadow cannot be reduced, increase volume control.

Normal communication

96. The aerial switching unit, type J, is turned to NORMAL (when using aerial plug board the fixed aerial is connected to H.F. and the trailing aerial 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. 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.

Note.—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 connect the plugs of both aerials to the EARTH sockets provided). 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.

D.F. bearings using visual indicator

97. Frequency ranges 3, 4, and 5 (occasionally 2) are used. On the R.1155C all ranges, including range 1, may be 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 connect the trailing aerial to M.F. and the fixed aerial to 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.

98. Tune in the signal as for normal communication and adjust the volume to a low level. Turn the receiver master switch to BALANCE. Adjust the visual indicator needles by the 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. Turn the switch S_1 to HIGH for W.T. or LOW for R.T. and the filter switch S_5 to IN. Readjust balance by the meter balance control R_{51}. Turn the master switch MS to VISUAL. The indicator needles should now operate. Turn the loop aerial until the indicator needles intersect along the centre line on the dial face.

99. 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 bearing. The routine may be easily remembered by the "RRR rule":—Reduce reading; Right deflection; Right sense.

Homing, using visual indicator

100. The sequence of operations detailed in paras. 97 and 98, 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 master switch 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 in the next paragraph.

101. 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 by 180 degrees. This sense discrimination may, if desired, be carried out by reducing the loop scale reading by, say, 10 deg. instead of altering the aircraft's course. Sense will be indicated in the same manner. Care should be taken to ensure that the loop is restored to zero after sense determination. During "homing," balance should be checked every ten minutes. If necessary, make adjustments to the meter amplitude R_{23} and re-check the balance after this operation.

102. 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 aircraft 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.

103. 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 if 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 symmetrically down the centre scale as the distant transmitter is keyed. If the needles do not collapse symmetrically 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.

104. When using the aural method of D.F. the fixed aerial is disconnected, the loop being the sole source of signal pick-up. The meter switching circuits of V_9 are inoperative. Volume control is effected manually, the A.V.C. system being out of circuit.

105. The routine for aural D.F. is as follows:—The aerial selector switching unit is turned to D.F. or, when using the aerial plug board the trailing aerial is connected to M.F. and the fixed aerial to H.F. The range switch FS is turned to the required range and the master switch MS to OMNI. The meter deflection switch S_3 is placed at LOW and the required signal tuned in. The volume control is then readjusted and the tuning re-checked on the tuning indicator V_{10}.

106. 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 SERVICING

Ground testing

107. The following procedure should be adopted for ground testing the R.1155. Having set the aerial switching unit to the NORMAL position the frequency range switch should be placed at either range 1, 2, or 2A. The master switch 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.

108. To receive on 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.

109. 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, 2, and 2A. To receive on ranges 3, 4, and 5, the fixed aerial socket should be connected to the M.F. plug. When using visual D.F., it should

D.C. RESISTANCE TABLE

Component	Test Points	Resistance in ohms	Component	Test Points	Resistance in ohms
I.F. Coils					
L_{18} prim.	V_4 anode to R_{34}, C_{32}	2 approx.	Range 4 input	FS xr1 to C_{40}, R_{45}	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	FS xr1 to C_{40}, R_{45}	57
sec.	V_6 grid to R_{29}, C_{30}	2 approx.			
L_{21} prim.	V_6 anode to R_{58}, C_{27}	2 approx.	Aerial circuits		Less than 1 to earth
sec.	V_7 diode to R_{20}, C_{11}	2 approx.			
B.F.O. Coil			*V_4 input circuits*		
L_{22}	Fixed plates C_{12} to R_{18}, C_{17} or C_{15}	5			
A.F. oscillator trans.				V_4 grid to C_{37}, R_{38} junction	
L_{23}, prim.	V_1 osc. anode to V_2 osc. anode	7,970	Range 1	Switch to Range 1	Less than 1
			Range 2	Switch to Range 2	Less than 1
L_{23}, sec.	V_1 osc. grid to V_2 osc. grid	355	Range 2A	Switch to Range 2A	Less than 1
			Range 3	Switch to Range 3	3·5
L_{23}, 2nd sec.	P_2 pins 7 and 8	331	Range 4	Switch to Range 4	11·0
Anode chokes V_1, V_2			Range 5	Switch to Range 5	78·0
			V_4 osc. circuit		
L_{24}	V_1 anode to R_{46}, C_{41}	550		V_4 osc. grid C_{35} (zf contact 12) to joint R_{35}, C_{34}	
L_{24}	V_2 anode to R_{46}, C_{41}	550			
A.V.C. choke					
L_{25}	V_7 diode to C_{108}, R_{68}	135	Range 1	Switch to Range 1	Infinity
Visual meter chokes			Range 2	Switch to Range 2	Infinity
			Range 2A	Switch to Range 2A	500
L_{26}	V_3 anode to C_3, R_{25}	135	Range 3	Switch to R_3	1,600
L_{27}	V_3 anode to C_5, R_{24}	135	Range 4	Switch to R_4	1,650
Limiter diode choke			Range 5	Switch to R_5	0.5
			H.F. Ranges 1 and 2		
L_{28}	R_{70}, C_{20} to C_4, R_{22}	135		FS zf12 to zf6	0·5
L.F. filter choke			*Ranges 2A, 3, 4, 5*		
L_{29}	S_5 to earth	2,020		FS zf12 to zf6	Infinity
Output transformer			*Oscillator anode coil*		
L_{30}, prim.	V_8 anode to pin 5, power plug P_1	1,528	Range 3	C_{34}, R_{35} to C_{75}	2·5
			Range 4	C_{34}, R_{35} to C_{74}	4·5
L_{30}, sec.	P_1 pin 6 to earth	1,063	Range 5	C_{34}, R_{35} to C_{73}	8·5
Aerial circuit			*Oscillator anode coils tap check*		
Range 1 input	FS xr1 to C_{40}, R_{45}	Less than 1			
Range 2 input	FS xr1 to C_{40}, R_{45}	Less than 1	Range 1	FS zr6 to C_{35} or zf12	Infinity
			Range 2	FS zr6 to C_{35} or zf12	Infinity
Range 2A input	FS xr1 to C_{40}, R_{45}	Less than 1	Range 2A	FS zr6 to C_{35} or zf12	500
			Range 3	FS zr6 to C_{35} or zf12	1,600
Range 3	FS xr1 to C_{40}, R_{45}	2	Range 4	FS zr6 to C_{35} or zf12	1,600
			Range 5	FS zr6 to C_{35} or zf12	1·5

VOLTAGE TESTS, ETC.

Measure	Test Points	Voltage and Resistance
L.T. volts	Withdraw meter plug P_2 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 Vol. control to OMNI max. position	−3 v. M.F.
	Remote end of R_{12} and chassis Vol. control to OMNI max. position	−1·5 v. H.F.
D.C. resistance between H.T.+ and H.T.−	Withdraw P_1 from chassis Measure between pin 5 and pin 8	9,500 ohms.
A.F. oscillator	Withdraw plug P_2 Measure between pins 7 and 8 using A.C. range of Testmeter	28 v. at 30 c/s 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
y is anode V_3
z is grid and osc. V_4

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.

110. When the aircraft 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. 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 and 6 volts, the frequency changer valve V_4 should be renewed.

Starter trolley batteries

111. 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

112. Should either of the visual indicators, type 1, be rendered unserviceable, operation can be carried out with a single instrument. The windings are connected in series, and connections A and B, C and D on the unserviceable indicator should be short-circuited to enable the serviceable one to operate.

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

Trouble location

114. Trouble location charts, figs. 23 and 23A, are included and these should assist in the rapid localizing of faults. 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 assisted by the location diagram, fig. 17.

Test apparatus

115. Ground tests of the R.1155 are normally carried out by means of the test rigs, types 22 or 22A. For the use of civilian repair organizations and Maintenance Units a special test set, type 65, is provided for bench testing. This, however, is 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 test rig, type 22, comprises a single panel carrying a 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 connection of a signal generator, output meter, and telephones. The test set, type 65, is described in Sect. 5, Chap. 18 of A.P.1186, Vol. I.

Valve data

116. The following table gives the type and function of each valve. All the valves are fitted with international octal bases. A diagram of the base connections is given in fig. 20.

Figure Ref.	Function	Type
V_1, V_2	Visual D.F. switching	Triode-hexode, V.R.99A
V_3	R.F. amplifier	Variable-mu H.F. pentode, V.R.100
V_4	Frequency-changer	Triode-hexode, V.R.99
V_5, V_6	I.F. amplifiers	Variable-mu H.F. pentode, V.R.100
V_7	A.V.C. and B.F.O.	Double diode triode, V.R.101
V_8	Second detector, visual meter limiter and output	
V_9	Visual meter switching	Double triode, V.R.102
V_{10}	Tuning indicator	V.I.103

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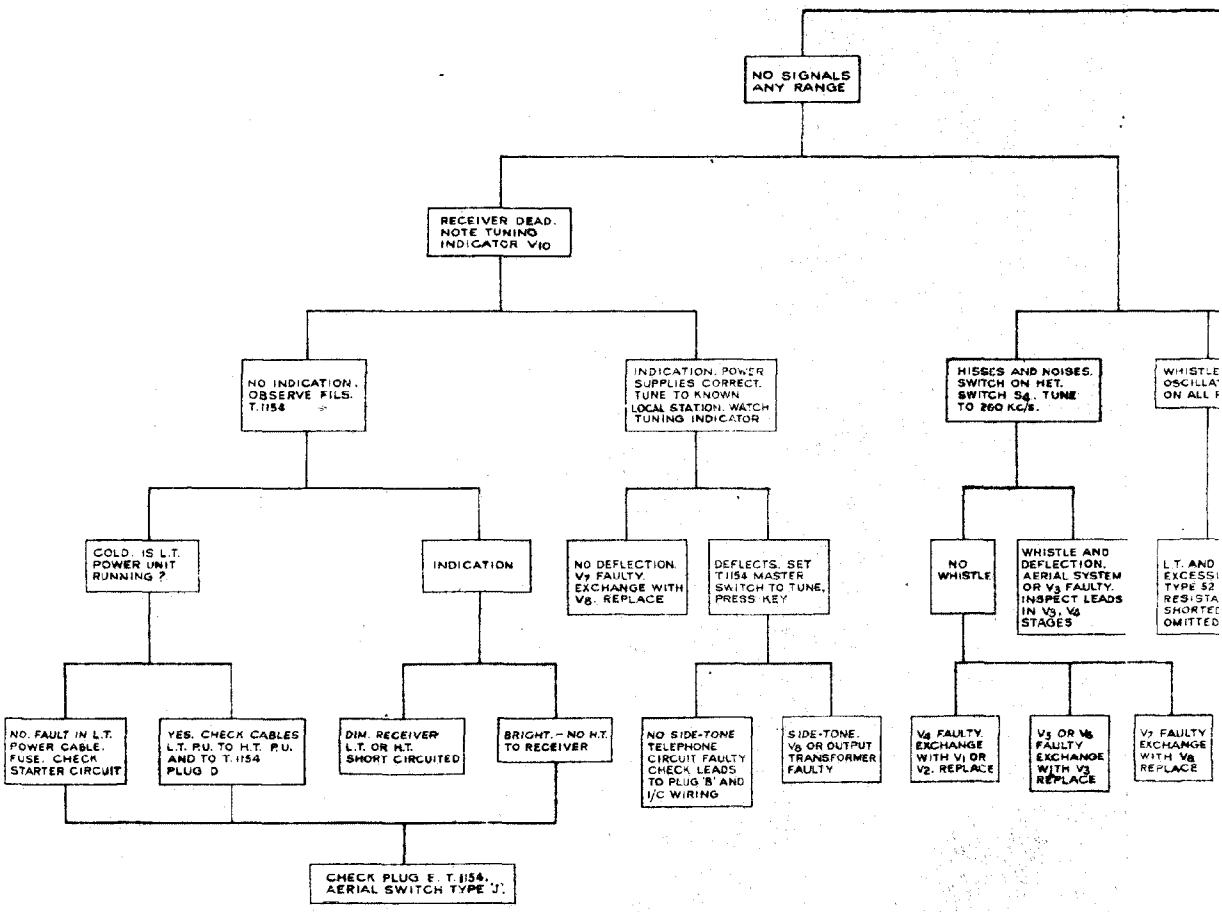
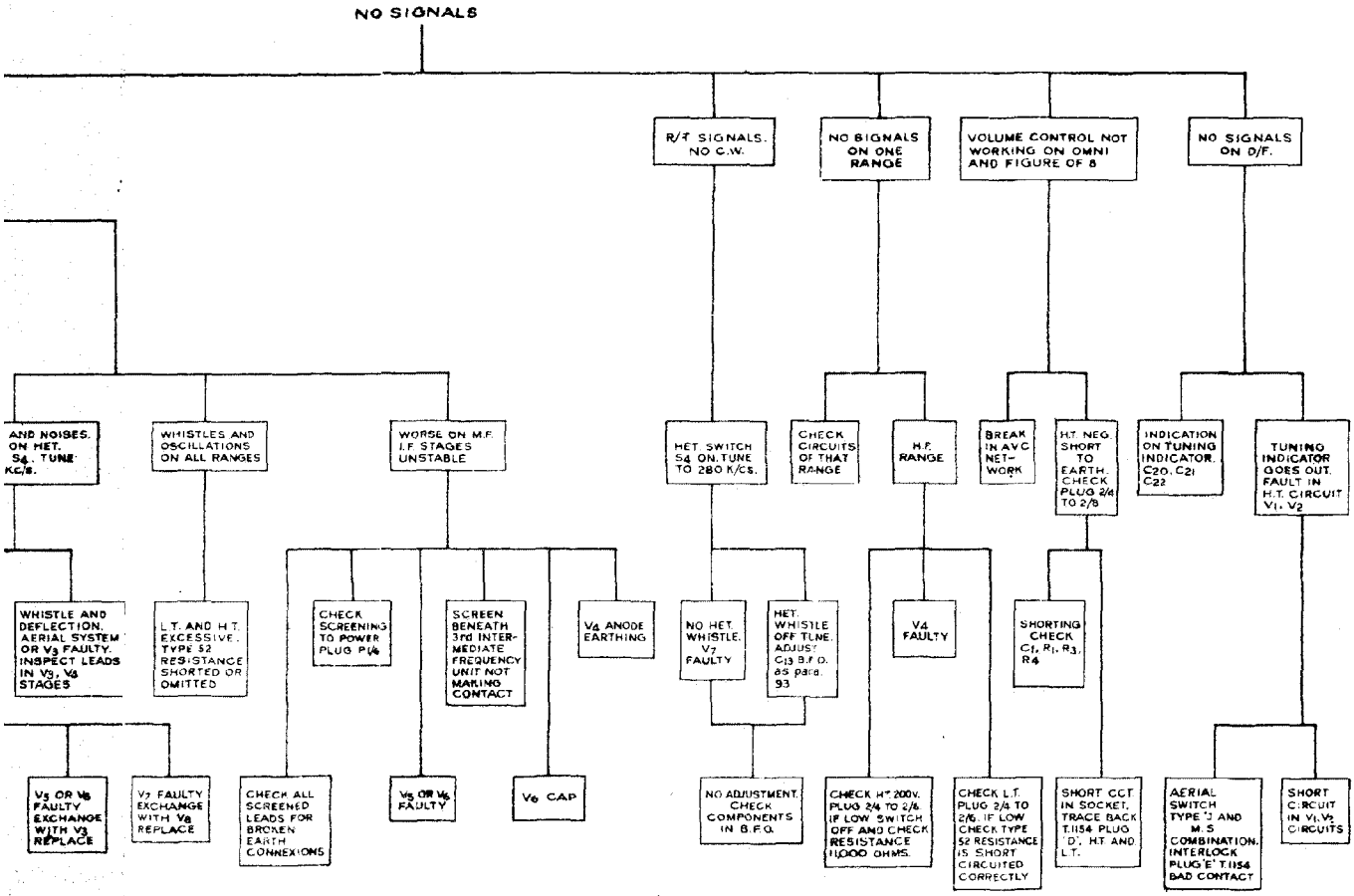


COMMUNICATION CIRCUITS

FIG. 23



ON CIRCUITS — TROUBLE LOCATION CHART

FIG. 23

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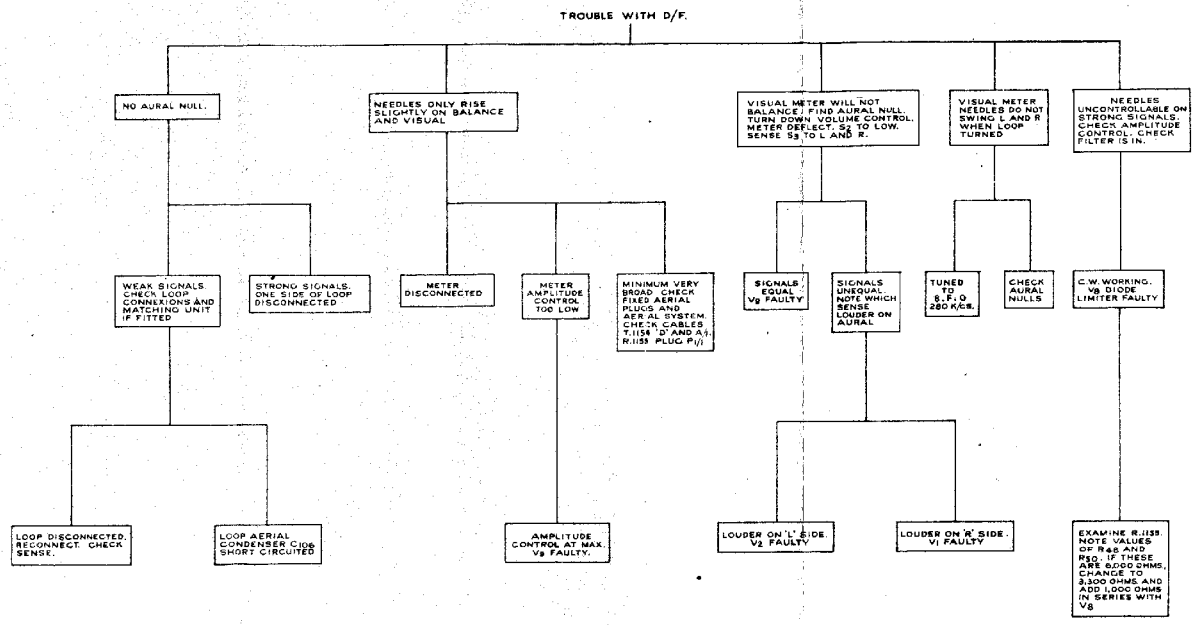

D. F. SWITCHING CIRCUITS — TROUBLE LOCATION CHART

FIG. 23a

FIG. 23a

Valve identification

117. 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 numbers as indicated in col. 3 of the table in para. 116. 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. The sequence of operations for affixing the valve label is as follows:—

(i) Remove the receiver from its case.

(ii) Identify the flat screening box immediately behind the front panel and adjacent to the tuning condensers.

(iii) Use shellac varnish (Stores Ref. 33A/511) to fix the valve identification label on to the top screening plate so that it can be read from the front of the instrument, and so that it does not cover either the remaining four screws or the ventilation hole.

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

(v) Replace the receiver in its case.

Valve replacements

118. Certain valves, supplied as spares for this receiver, are too large in diameter to go into the screening cans as originally supplied. To overcome this difficulty the cans are now being manufactured without the longitudinal stiffening ribs. Where, however, it is found that the original cans remain, Units are to remove the ribs on all valve screening cans so that in the event of oversize valves being issued the cans may be ready to accommodate them. The method to be adopted is to remove the can from the receiver and, placing it on a round bar or pipe of suitable diameter, gently beat out the ribs from the outside. Should renewal of the valve V_4 be necessary, or should it be exchanged when pairing V_1 and V_2 (see para. 51) care must be taken that no valve having a metallised envelope is placed in the V_4 socket. The socket for the pin connected to the valve metallising is used to anchor a H.T. line, and the insertion of a metallised valve would short the H.T. supply via the earthed screen of the grid lead.

Removal of B.F.O. valve

119. 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 in later models by a type 1525 and no difficulty will be experienced in removing, or inserting, the valve V_7 where this replacement has been made. The procedure to be followed when removing V_7 is as follows:—

(i) Remove the receiver from its outer case.

(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.

(v) Set up the B.F.O. as described in para. 93.

Prevention of frequency drift

120. Cases have occurred of excessive frequency drift in the beat frequency oscillator. 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 together with renewal, if necessary, of the valve identification label. The procedure 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 $1\frac{1}{4}$ 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 $1\frac{7}{8}$ in. from the short edge of the lid.

(v) Refit and secure the lid to the compartment.