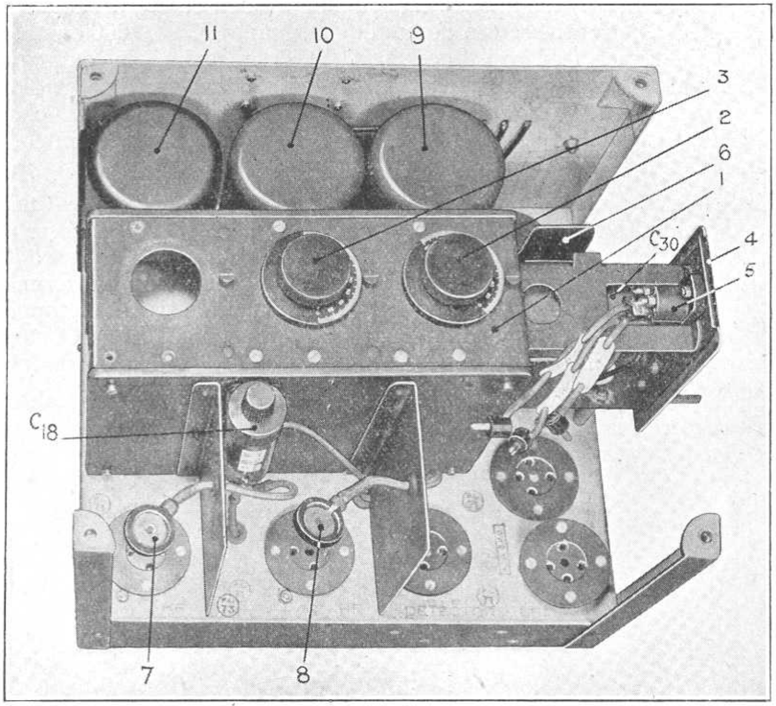

FIG. 11. Receiver R.1120, front view.

amplifier valves, are in the adjacent compartment, separated from the second R/F valve by another metal partition. The tuned anode inductances are enclosed in the screening cans (9), (10), the can (11) being empty.

47. The remainder of the components are fitted below the main panel, the space being about 2 in. deep. It is divided into four bays by means of screening partitions, as shown in fig. 12. For descriptive purposes these will be numbered from right to left, when the contact bar connections are at the top. A bench wiring diagram of the instrument is shown in fig. 13.

48. Referring to fig. 12, the first bay contains the condenser (C_{35}) with a 0·5 megohm resistance (R_2) in parallel. Near these, but mounted upon the inter-bay partition, is the R/F choke (L_9). An insulating platform, fitted to the underside of the main panel, carries two resistances. The first resistance (R_{21}), is of 10,000 ohms. All the above-named components are in the grid circuit of the first R/F valve. The second resistance (R_7), is of 20,000 ohms, and is the screen decoupling resistance for the first R/F valve. The corresponding screen by-pass condenser (C_9), of 0·5μ F, is mounted on the inter-bay partition. The valve-holder (1) carries the first R/F valve, and adjacent thereto is its filament resistance (R_6).

49. In the second bay, the connections for the anode tuning inductance (L_6) of the first R/F valve are brought through a circular orifice. Adjacent thereto, but mounted on the inter-bay partition, is the 0·5μ F condenser (C_{20}), which acts as a decoupling condenser in the first R/F anode circuit. Two other condensers are also mounted on the inter-bay partition, one on each side. On the left is the 0·5μ F condenser (C_{16}), which is the screen decoupling condenser for the second R/F valve, and on the right is a 0·5μ F condenser (C_{15}), which maintains the amplitude of the oscillatory component of screen potential at a low value.

50. An insulating platform (2) in the middle of the bay, and mounted on the underside of the panel, carries the following components, *viz.*, (i) the isolating condenser C_{10}, 0·01μ F, in the

second tuned-anode circuit ; (ii) the anode-grid coupling condenser C_{17}, 0·003μ F ; (iii) the grid leak resistance R_9, 1 M Ω ; (iv) the screen decoupling resistance R_{11}, 20,000 ohms, for the second R/F valve, and (v) the screen feed resistance R_8, 20,000 ohms which is common to the screen circuits of both R/F valves. Below this platform is a 0·01μ F condenser (C_{21}) which is connected across the L.T. supply leads. In the illustration this condenser is partly obscured by the condenser (C_{15}). The valve-holder (3) for the second R/F valve can be seen in the lower part of the bay, with its filament resistance (R_{10}) in proximity.

51. The third bay contains the connections to the base of the second anode-tuning inductance (L_7) and above this, mounted on the right-hand partition, is a 0·5μ F condenser (C_{26}) which, in conjunction with the resistance (R_{12}), of 2,000 ohms, serves to decouple the second tuned-anode circuit from the first. This resistance is carried on a small mounting platform. The 0·5μ F condenser (C_{23}) which is also mounted on the right-hand partition, is the decoupling condenser of the detector valve. The corresponding decoupling resistance (R_{14}), of 20,000 ohms, is suspended by its own wiring in proximity.

52. A small platform (4) near the middle of the bay carries the grid leak resistance R_{13}, 0·25 M Ω, for the detector valve, and also the condenser C_{22}, 0·0001μ F, which couples the anode of the second R/F valve to the detector grid. The valve-holder (5) for the detector valve is also

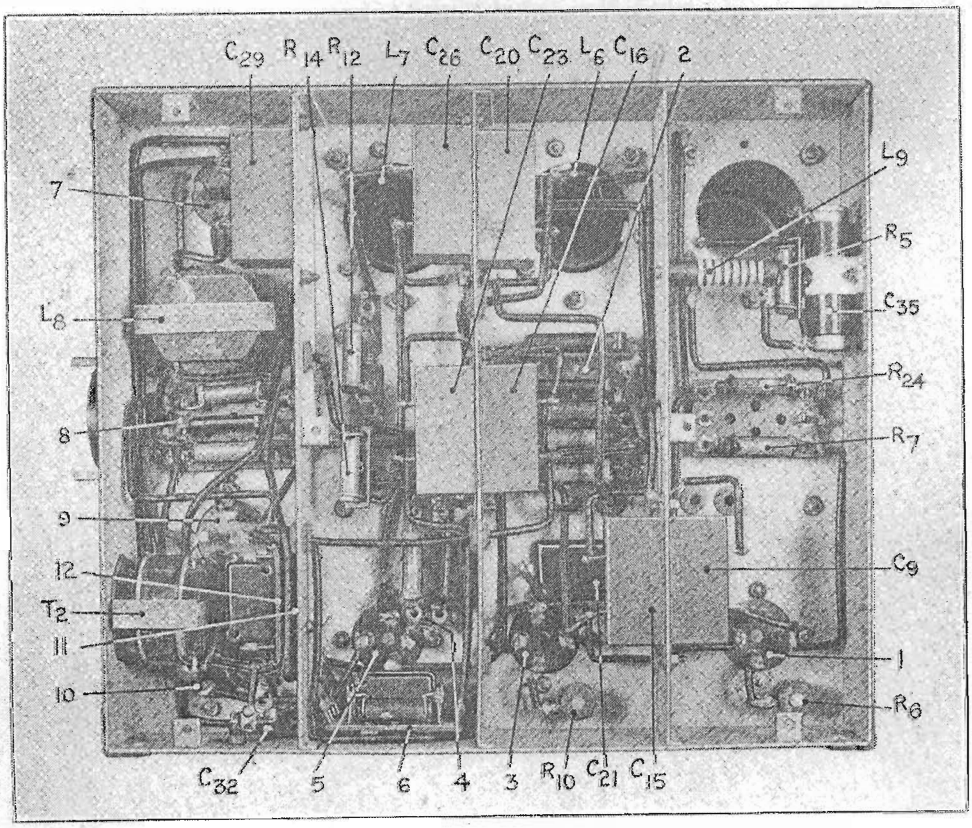

FIG. 12. Receiver R.1120, rear view.

fitted in this bay. On the inside of the case, an insulated platform (6) is fitted, in order to carry a bank of three resistances and four condensers. The components fitted here are (i) the grid leak

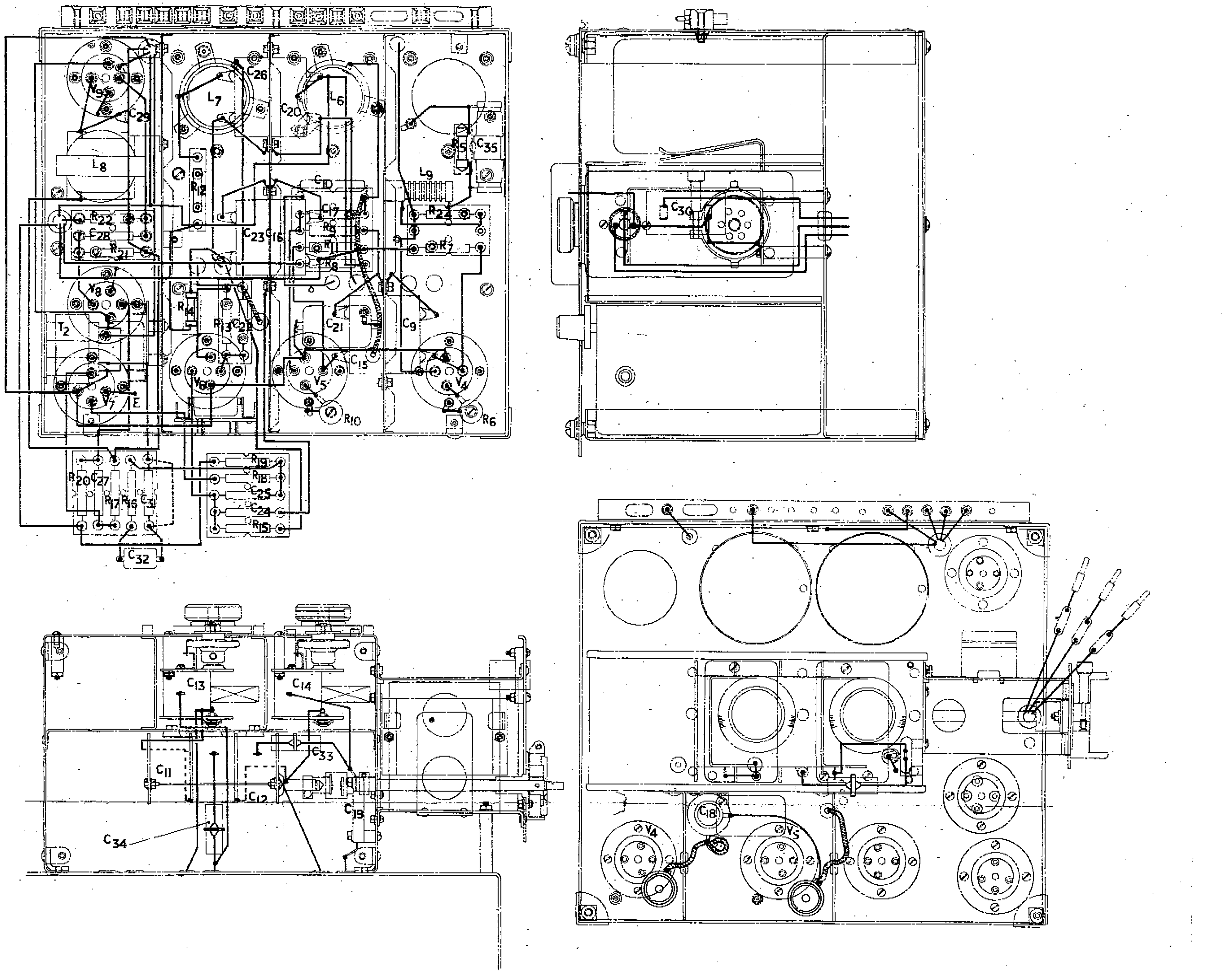

FIG. 13 BENCH WIRING DIAGRAM OF R.1120

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R_{19}, 1 M Ω, for the detector valve; (ii) the grid stopper resistance R_{18}, of 2 M Ω; (iii) the condenser C_{25}, $0{\cdot}001\mu$ F, which is the grid coupling condenser between detector and first A/F valve; (iv) the condenser C_{24}, $0{\cdot}001\mu$ F, which serves as a radio-frequency by-pass in the detector anode circuit, and (v) the anode load resistance R_{15}, 100,000 ohms, in the detector circuit. Only the two upper components can be seen in the diagram.

53. In the fourth bay, in line with the bases of the anode tuning inductances, is the valve-holder (7) for the output valve. On the right-hand partition is a $0{\cdot}5\mu$ F condenser (C_{29}), which forms part of the choke-filter output circuit of the output valve. Closely adjacent is the output choke (L_8). A mounting plate (8) near the middle of the bay carries (i) the resistance R_{22}, 1 M Ω, which is the grid leak for the output valve, (ii) the grid coupling condenser C_{28}, $0{\cdot}001\mu$ F, and (iii) the resistance R_{21}, 200,000 ohms, which is the anode load resistance of the second A/F valve. The valve-holder (9) for the latter is in close proximity to the mounting plate, and below this is the valve-holder (10) for the first A/F valve. The microphone transformer (T_2) is mounted on the side of the case and partly obscures the two lower valve-holders.

54. Between the latter valve-holders, fitted on a mounting plate (11) attached to the right-hand partition, is a group of resistances and condensers, arranged horizontally one above the other. In succession from the lower one upwards, these are as follows :—(i) the resistance R_{20}, 1 M Ω, which is the grid leak for the valve V_8; (ii) the grid coupling condenser C_{27}; (iii) the resistance R_{17}, 20,000 ohms, in the anode circuit of the valve V_7; (iv) the resistance R_{16}, $0{\cdot}5$ M Ω, in series with the secondary winding of the microphone transformer, and (v) the condenser C_{31}, $30\mu\mu$ F also in series with the secondary winding of the microphone transformer. This condenser is, however, normally short-circuited by a link (12) of copper wire.

55. It is most important to observe that the receiver is supplied with this link in position, for use with an electro-magnetic microphone. If a carbon microphone is to be used, this link must be removed, taking care not to reduce the electrical efficiency of the remaining connections to the condenser (*see* para. 111). On the inside of the case, near this bank of components, the $0{\cdot}0002\mu$ F condenser (C_{32}), is mounted upon a separate support, and it is also in series with the secondary winding of the microphone transformer.

Case

56. The transmitter and receiver units are housed together in a special case. They are shown in position in fig. 7 and in fig. 14 the case of the T.R.9D is shown with the units removed. The case is of metal and is painted grey. A main contact bar (1) as shown in fig. 14 is fitted in the case, and from the underside of the contacts flexible connections are taken out through a bush. When the units are in position, spring-jaw contacts on each unit engage with the knife contacts on the bar. One end of the case is cut away and a tray (2) is slid in, occupying a position under the transmitter unit. This tray carries the common H.T. battery for the transmitter and receiver and the grid bias battery for the transmitter. By means of four flexible leads (3) terminating in plugs the batteries are connected up to three spring-jaw contacts (4) on the tray, and when the tray is in position these three contacts engage with three knife contacts on the underside of the main contact bar.

Transit case

57. A transit case is provided for carrying the transmitter-receiver. It is constructed of yellow deal and is painted grey. The dimensions are approximately 1 ft. 9 in. by 1 ft. 3⅝ in. by 10¾ in., and the case accommodates the complete instrument. The hinged lid is fastened with screw catches, and two metal carrying handles are provided.

REMOTE CONTROLS

58. The T.R.9D transmitter-receiver is intended for operation by remote controls, and three different adjustments are made by these controls. The send-receive switch and the fine tuning condensers are each operated by a flexible shaft running in a casing and actuated by a

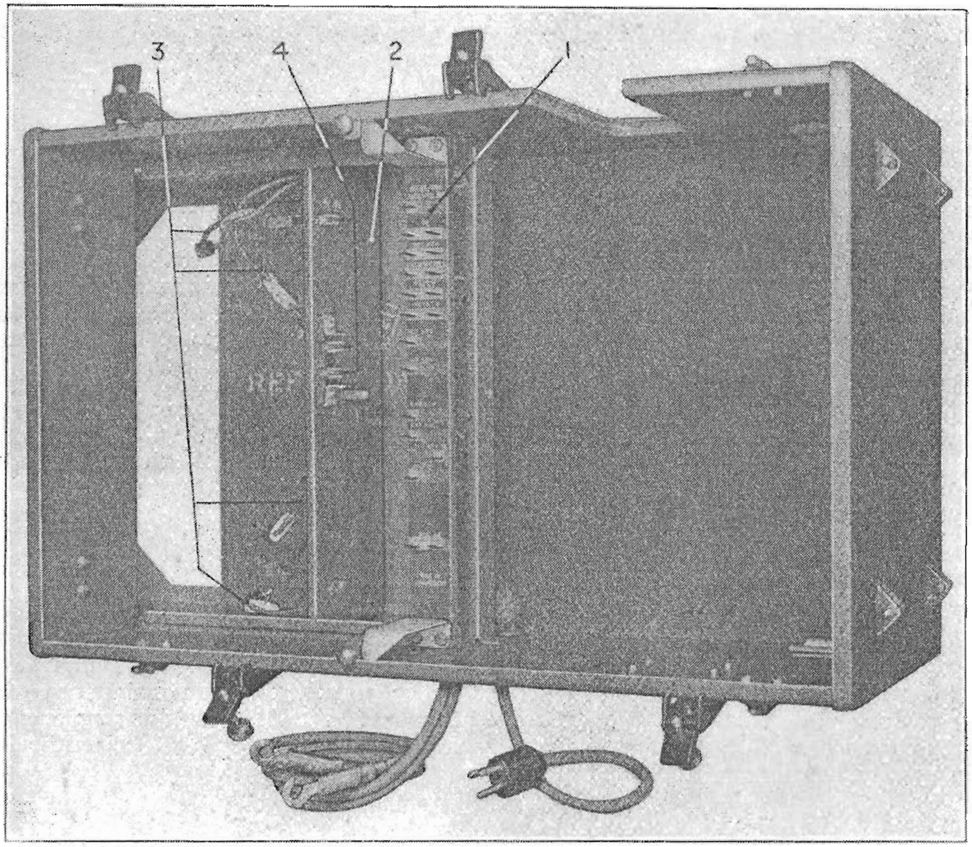

FIG. 14. Case for T.R.9D.

wheel and handle. The volume is regulated by means of a potentiometer connected by a cable to the receiver in such a manner as to vary the potential applied to the screening grids of the two radio-frequency amplifiers. The three controlling handles are mounted in one unit known as the controller.

59. Two types of remote control, the type C and the type D are standardised. The type C remote controls have a flexible shaft of diameter $\frac{5}{32}$ in. for both the switch control and the tuning control. The type D remote controls are intended for installations where the shafting is 15 ft. long or more, and in this type the flexible shafting for the switch control is $\frac{3}{16}$ in. in diameter, the tuning control using the $\frac{5}{32}$ in. shafting as in the type C remote controls. Larger casing is therefore used for the type D controls, and the controller and switch coupling are modified to accommodate the larger shafting.

60. Two types C and D remote controls, as applied to the T.R.9D, are shown in fig. 15. The controller (11) is mounted in the pilot's cockpit; the switch coupling (23), condenser unit (control) (29) and the plug (26) are fitted to the transmitter-receiver. The flexible shafting (1) runs in a casing, part of which (2) is rigid and part flexible, (16) and (30). The shafting consists of a stranded core of steel wire on which is wound a helical tooth wire making about ten turns to the inch.

61. The controller consists of two parts fitted together. One part, known as the control, switch and tuning, consists of the mechanism for operating the two flexible shafts for the SEND-RECEIVE switch and the tuning condensers. The other part, the volume control, is mounted in

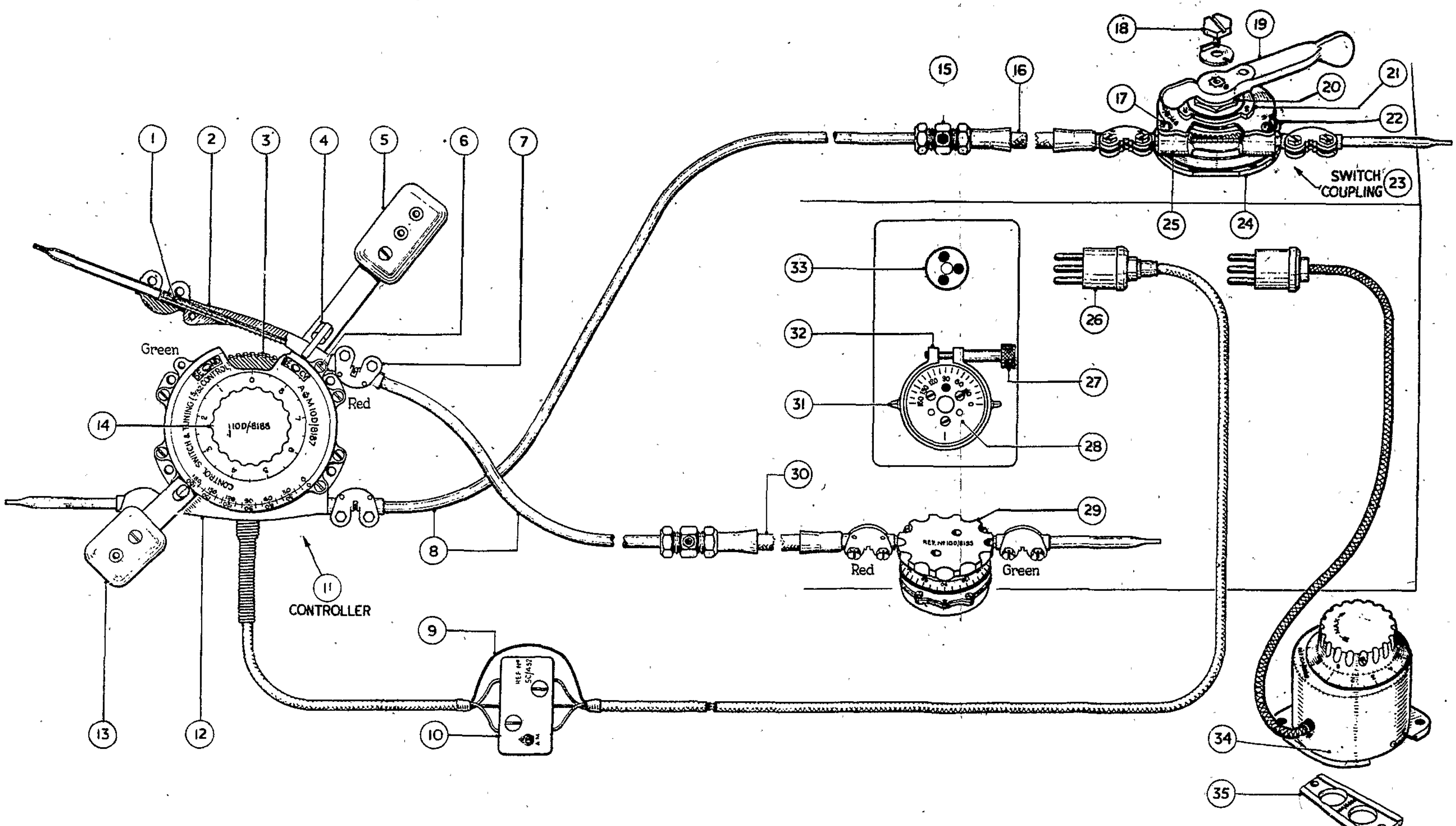

FIG.15. REMOTE CONTROLS. TYPES C & D, FOR T.R.9D

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the centre of the switch and tuning control and consists of a high resistance potentiometer operated by a knob.

62. The control, switch and tuning, consists of a case containing two wheels (3) with teeth specially shaped to engage with the helical tooth on the flexible shafting, so that rotation of the wheel moves the shafting in one direction or the other. The longer handle (5) is connected to the wheel which engages with the flexible shafting in the guide tube (12) and is the control for the SEND-RECEIVE switch. The other handle (13) is connected to the other wheel, and this meshes with the flexible shafting in the guide tube (2). This shafting is connected to the tuning condensers, and the handle (13) thus forms the tuning control.

63. The handles are attached to the levers by a single screw each. Three holes are provided in the switch control handle, and two in the tuning control handle, so that adjustment of the effective length of the levers is available. A spring-loaded catch (4) is fitted on the switch control handle. The central position of this handle is the OFF position, and it can be locked in this position by engaging the catch with a notch in the frame.

64. The guide tubes are attached to the body of the controller by two screws each (6), and are arranged so that if one screw is removed and the other loosened the guide tube may be swung away from the toothed wheel and the flexible shaft thus disengaged. The controller may be mounted with either of the handles uppermost, and the engraving is duplicated so that it can be read in either position. The flexible shaft may be arranged to enter either side of the controller, and the two extreme positions of the handle may be allotted for send and receive to suit the installation. The words SEND and RECV. are engraved on detachable plates which can be interchanged and turned upright to show the positions of the handle for the corresponding positions of the switch in the instrument.

65. The switch coupling (23) also contains a wheel with teeth to engage in the helical winding on the flexible shaft. On the lower end of the spindle carrying this wheel is a dog, which fits over the crossbar attached to the switch spindle on the instrument. A handle (19) is fitted on to the outer end of the shaft for local operation of the switch and as a local indicator of the switch position. As in the controller, the guide tube (25) is fixed by two screws (17) either of which may be removed to disengage the flexible shaft from the wheel.

66. The switch coupling fits on to a ring adaptor (24) which is attached to the transmitter panel by two ¼ in. by 2 B.A. countersunk screws. The sleeve and flange of the coupling are slit and are clamped to the adaptor ring by tightening the screw (22) which draws the band around the sleeve. A key inside the sleeve engages in a keyway in the upper edge of the adaptor ring. The ring has eight keyways equally spaced so that the coupling can be secured in any of eight positions on it, to allow the casing and flexible shaft to be led up to the instruments at the most convenient angle. The shaft may be led off from either end of the guide tube provided that the controller is arranged accordingly.

67. The handle (19) may be fitted on to the square end of the spindle in any of eight positions, and is secured by the screw (18) with a locking washer. The plate (21) is cut away to form a stop plate and also carries the designations S and R to indicate the send and receive positions. This plate can also be fixed in eight different positions to suit the position chosen for the handle. It is located by a dowel pin and secured by the nut (20) with its locking washer. The reverse side of the stop plate is also engraved S and R, but in the reverse positions. The reverse engraving will not, however, be required when the coupling is fitted to this transmitter.

68. The condenser unit (control) (29) consists of a knob fixed to a spindle turning in the body. A disc is fixed on the other end of the spindle inside the body and carries a single eccentric pin which engages in the largest of the three holes in the index wheel (28) attached to the operating spindle of the ganged fine tuning condensers. The guide tube for the flexible shaft is attached to the body by two screws, in the same way as in the switch coupling, and the flexible shaft meshes with a wheel on the spindle. The sleeve of the body fits inside the split ring (32) fixed to the receiver, and is clamped by the screw (27). The condenser unit control can be fixed in any position in the ring. A dial engraved with a scale of 0—180° on each half, forms part of the knob.

One scale is marked in white and the other in orange, and the two indices (31) register with them. Whichever scale is more easily visible may thus be used. One end of the guide tube is coloured red and the other green, and the ends of the guide tube on the controller are also marked with these colours. The flexible shaft must be led off from the red end of both or the green end of both in order to obtain the correct direction of the rotation of the condenser.

69. The rigid casing (8) for the flexible shaft consists of solid-drawn light-alloy tubing. The flexible case (16) and (30) is built up of a helix of brass strip over which is a winding of steel wire and another of phosphor-bronze or spring steel wire and, finally, a waterproof covering of varnished cotton braid. The junctions between the casing and the components and between two lengths of casing are made by means of casing unions (7). The free ends of the shafting at the controller, the switch coupling, and condenser unit handle are protected by short lengths of rigid casing fitted to the free ends of the guide tubes by casing unions, and pinched up at the ends.

70. The union consists of two split clips made in one piece, and each clip is clamped up on the casing by means of a screw. A hole is drilled through the union at each end to take a key pin for increased security. These pins are not fitted, however, in the unions at the free ends. Special unions (15) to allow of lubrication are fitted between the flexible and the rigid casing, and along the run of the rigid casing when necessary. These lubricator unions carry a standard grease nipple, and have a union nut at each end. The union nut is tightened up on to a cupped washer inside the body, which is thus flattened out and bites into the tubing.

71. The volume control consists of a high-resistance potentiometer operated by the knob (14). Two different methods of construction are used for the potentiometers in service. One type is built up as an ordinary strip-wound resistance with a contact arm moving over it. The other type consists of a number of resistances connected to contacts on a multiple-contact rotary switch. This type is shown diagrammatically in fig. 16. Forty-four resistances of 1,250 ohms, each with a centre tapping, are mounted round the spindle and connected to the contacts as shown. The ends of this circuit are connected to the H.T. supply with a further resistance of 20,000 ohms in the positive lead, and the contact arm is connected to the screening grids of the valves. The 20,000 ohms resistance connected in series with the potentiometer has the effect of limiting the range of variation of the screen-grid voltage to that required for smooth control of the amplification from a minimum to a maximum.

72. A 2-ft. length of screened three-core cable is supplied with the controller and is connected, on installation, to a 3-way terminal block (10). The connections are taken from the terminal block to the three-pin plug (26) for connection to the socket (33) in the side of the receiver. The screening conductors of the two lengths of cable are connected by the bonding wire (9), which is bound to the metal braiding by 30 s.w.g. tinned copper wire soldered in position.

73. As the receiver will not function without the potentiometer connected to the socket (33), a type B volume control (34) is provided for use by an observer having access to the transmitter-receiver in a two-seater aeroplane, or for operation of the receiver on the test bench. The type B volume control consists of the potentiometer forming the type A volume control, as used in the controller, fitted into a metal case and having a lead and three-pin plug connected to it. It may be fixed in any convenient position by two screws through a flange ; or the wedge plate (35) may be attached to the airframe and the volume control supported on it when easy detachment is required.

74. A key diagram showing the components required for remote control of the T.R.9D transmitter-receiver is given in fig. 17. The upper sketch shows the type C controls, and the second sketch, the type D controls as used with these instruments. In the bottom sketch the type B controls are shown. The switch coupling can be attached directly to the plate on the receiver to which the ring adaptor is otherwise fixed. The ring adaptor will not be required, and must be removed. The condenser unit handle requires an adaptor for the type B controls. This adaptor consists of a sleeve to fit into the clamp ring, (32) on fig. 15, with a spindle carrying two discs. The inner disc has an eccentric pin to engage in the largest hole in the index plate (28), and the other is arranged to fit the condenser unit handle of the type B controls.

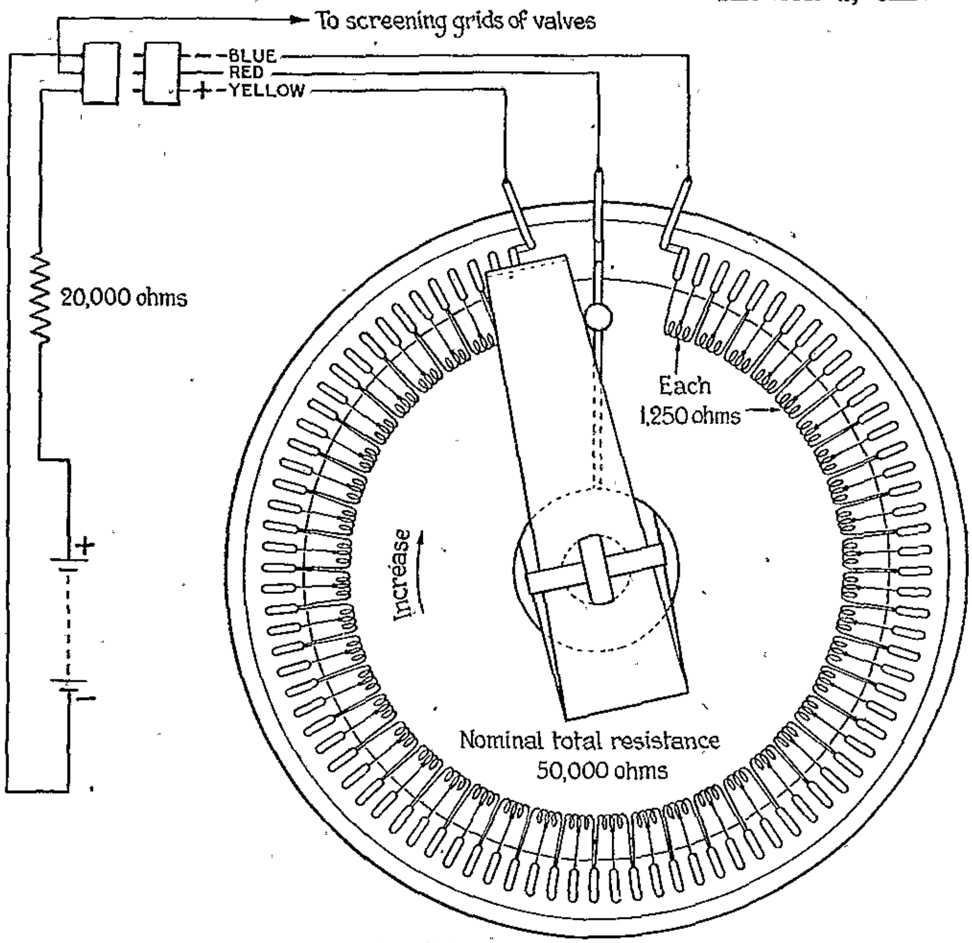


FIG. 16. Volume control circuit.

VALVES AND BATTERIES

75. The valves used in the transmitter are as follows:—In the oscillator stage, a valve V.T.50 is employed. This is a directly-heated triode having a filament rating of 0·1 amperes at 2 volts. It is non-metallized and is fitted with a standard 4-pin base. The maximum H.T. voltage is 150 and it is capable of dissipating 1 watt continuously. The normal anode current is about 3·0 mA. In both modulator and power amplifier stages, the valve is a V.T.51 (Stores Ref. 10E/10946). This is a directly-heated pentode having a filament rating of 0·2 amperes at 2 volts. The maximum H.T. voltage is 150 and it is capable of dissipating 3 watts continuously. The normal anode current is about 9 mA and the screen current about 2·5 mA.

76. The receiver employs two tetrodes, V.R.18, each having a filament current of 0·2 amperes at 2 volts, a detector valve V.R.27 (0·1 ampere, 2 volts), two audio-frequency amplifier valves V.R.21 (0·1 ampere, 2 volts) and a power amplifier valve V.R.22 (0·2 amperes, 2 volts).

77. Since all the valve filaments are heated during transmission, the total load on the L.T. battery is about 1·4 amperes. To this must be added the operating current for the frequency changing delays, and the microphone current, making the total current about 1·6 amperes.

78. The current for the transmitter and receiver valve filaments is supplied by a 2-volt lead-acid accumulator. If a 14 Ah. type B accumulator is fitted, it will serve for about six hours

continuous use, when on the border line of serviceability as defined in R.A.F. Form 480, para. 33. In its earlier life it should of course provide a longer service, but as a precaution, the accumulator should be changed after every operational flight of approximately full duration. Where a 20 Ah. Type B accumulator is fitted, and is on the border line of serviceability, it should provide for 8½ hours continuous flight, but should be changed after every second flight of approximately full duration. The 20 Ah. accumulator will eventually be standardized for use with this installation. The H.T. supply for both transmitter and receiver is obtained from a 120-volt dry battery housed in a tray which is part of the case.

79. A 15-volt dry battery supplies the grid bias voltage for the modulator valve, and a 4½-volt dry battery provides the grid bias voltage for the sub-modulator stage. The former is housed in the transmitter battery tray but the latter is accommodated in the receiver itself.

80. During transmission, the H.T. battery is called upon to give an input current to the transmitter and sub-modulator, amounting in all to about 28 milliamperes. The H.T. battery will therefore require replacement more frequently than in the transmitter-receiver type T.R.9.B. It should be tested frequently, and replaced if the terminal voltage falls below 100 volts on the load.

Installation

81. A typical installation diagram is given in fig. 18. It will be seen that the transmitter-receiver is fitted in a specially designed crate by means of the usual type of suspension. The crate also carries the master contactor and the 2-volt L.T. accumulator. The latter is connected to the transmitter by leads supplied as a part of the transmitter-receiver. The master contactor is fitted with three leads 15 in. long, enveloped in a woven cover and terminating in a plug, type 33. This has 4 pins, marked —, +, 3 AND 4, 1 AND 5. The latter is internally connected to the — pin. The fixed wiring of the master contactor consists of a pair of supply leads from the general service accumulator, which terminates upon the + and — pins of a socket, type 12, into which the plug, type 33, of the master contactor is fitted. The marking of the sockets corresponds to that of the plug. From the terminals 1 AND 5 and 3 AND 4 a pair of leads is carried to a socket, type 19. The input leads of the remote contactor are connected to this socket by a plug, type 51.

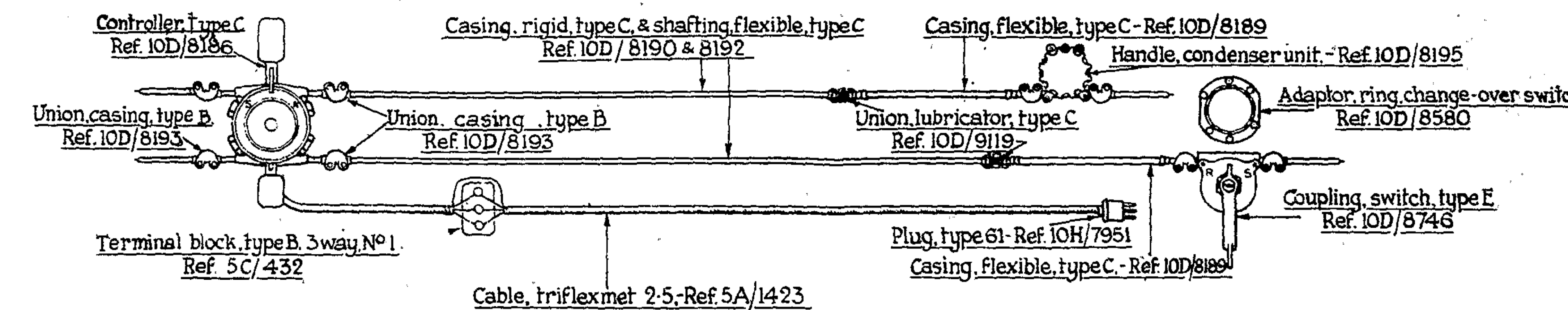
82. The output leads of the contactor are fitted to a plug type 62 which is plugged into a socket, type 19. The fixed wiring of the installation is then carried to a point near the crate and terminates in a plug, type 34, which fits the control socket on the transmitter. A switchbox, type B, is fitted in a convenient position in order that the radiation of the special frequency may be suspended when necessary, without switching off the remote controller and so throwing it out of synchronism.

83. The microphone and telephone leads of the transmitter-receiver terminate in a plug, type 48, which connects up to the fixed wiring *via* a socket, type 17. The fixed wiring, both of the microphone and the telephone circuits, is of metal braided cable (duflexmet 2·5) the braiding being earthed at the ends of each run. Standard sockets, type 29, are fitted for the accommodation of the plug, type 119, fitted to the cord of the mask microphone. The remote controls are also shown in this diagram.

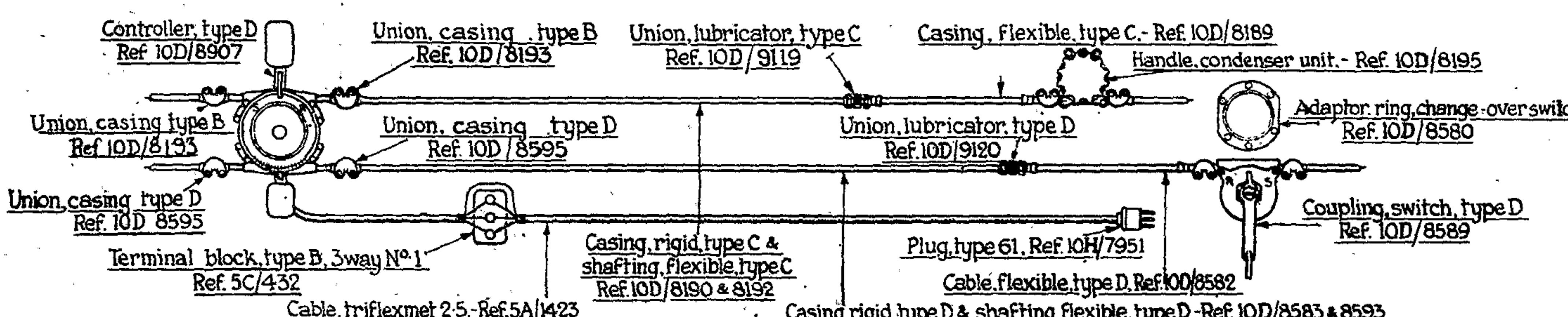
TUNING

Transmitter

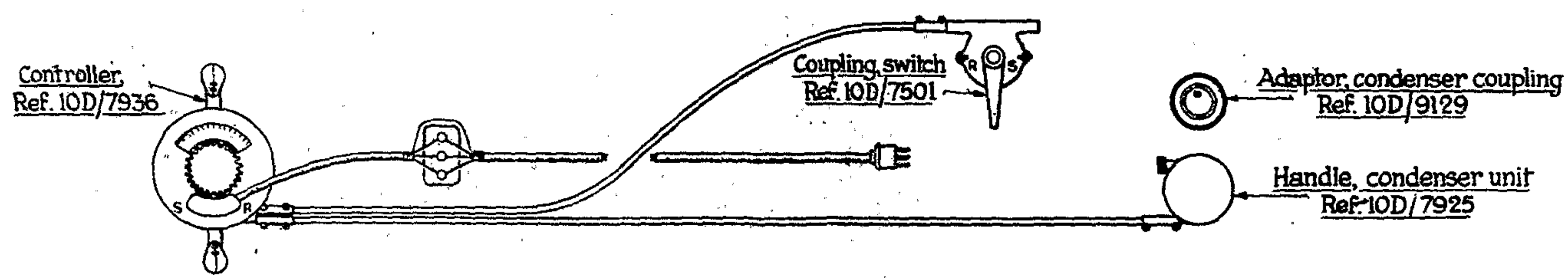
84. Since the oscillator is crystal controlled, no wavemeter is necessary for the tuning of the transmitter. Frequency-control crystals, complete in mountings, have been allocated a separate section in Air Publication 1086 (Priced Vocabulary of Royal Air Force Equipment), to be known as Section 10X. The stores reference number of a crystal is identical with that of its frequency in kilocycles per second. The nomenclature of a crystal complete in mounting, consists of the word " crystal " followed by its frequency expressed verbally, thus 10X/5320, crystal, five three



TYPE C (Condenser & change-over switch shafting 5/32" dia.)



TYPE D (Condenser shafting 5/32" dia., change-over switch shafting 3/16" dia. for long runs - 15 ft. or over)



TYPE B (When T.R.9D is fitted in an aeroplane where type B controls are installed, the adaptor, condenser coupling, is required)

FIG. 17. REMOTE CONTROL COMPONENTS

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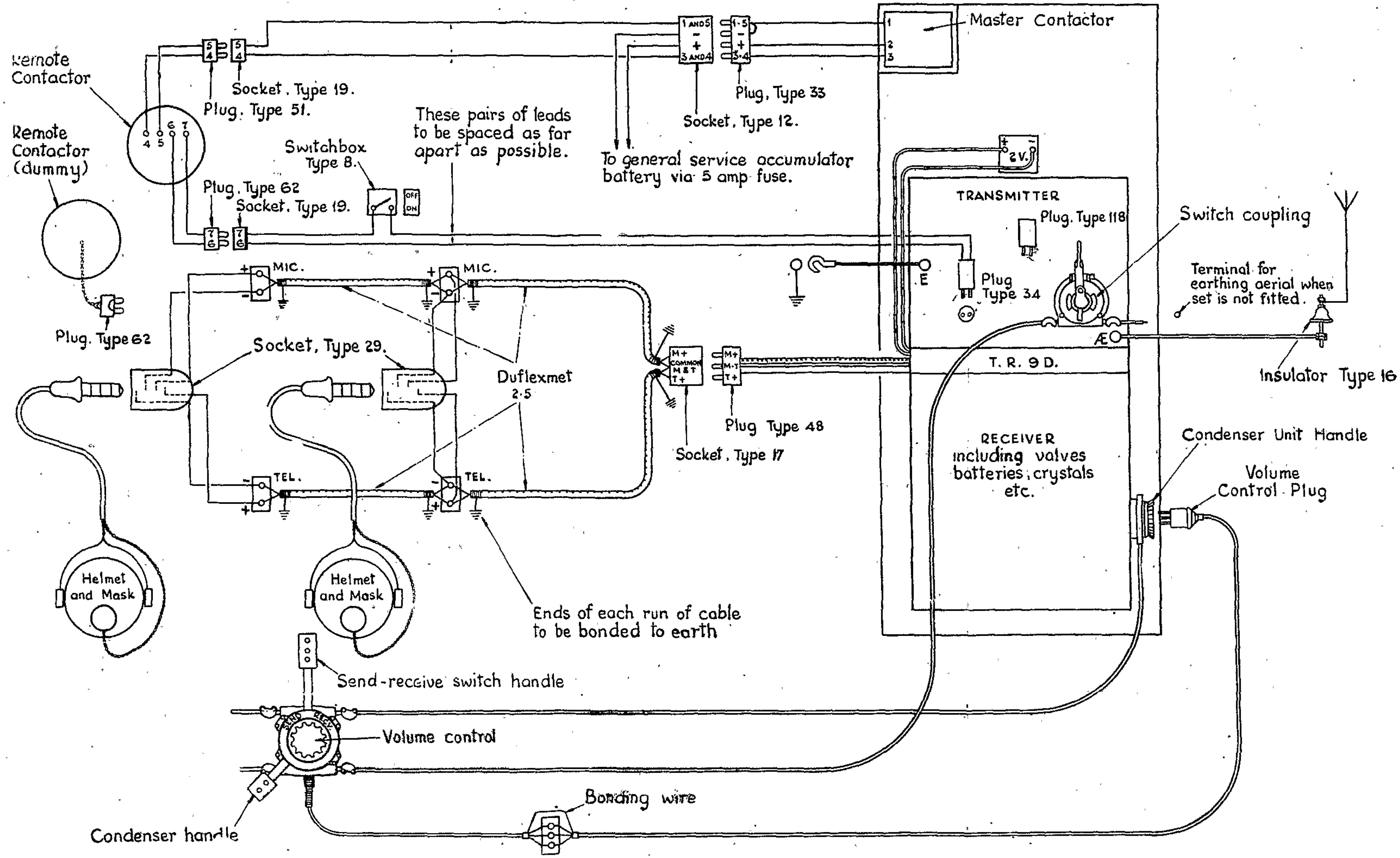

FIG. 18 INSTALLATION DIAGRAM OF T.R. 9D.

two zero, indicates a crystal having a natural frequency of 5320 kc/s. On no account are crystal mountings to be opened up or repaired by service units or by depots.

85. The procedure for tuning the transmitter to a pair of predetermined (i.e., normal and special) frequencies, is as follows :—

(i) Remove the transmitter from the instrument case.

(ii) Insert a 120-volt H.T. battery and a 15-volt grid bias battery in the battery tray and connect the appropriate plugs. Take particular care that the grid bias is set to —10·5 volts.

(iii) Insert the crystal oscillator valve V.T.50 and replace the transmitter in the case, ensuring that the SEND-RECEIVE switch is in the OFF position and the limiting resistance switch to TUNE.

(iv) Select a pair of crystals of the desired frequencies, ensuring that the "normal" crystal is plugged into the holder N and the "special" crystal into the holder S.

(v) Connect the L.T. leads to the 2-volt accumulator.

(vi) Connect the aerial and earth to the appropriate terminals of the transmitter.

(vii) See that the control socket is unoccupied, so that the relays are in the "normal" position. Ensure that the short-circuited plug, type 118 (red top), is available for use when required.

(viii) Set SEND-RECEIVE switch to SEND. Since the amplifier and modulator valves are not yet in position, only the sub-modulator and oscillator valves will take current. The milliammeter should indicate a feed current of not more than 4·5 mA.

(ix) Insert the short-circuited plug, type 118, in the control socket. This should cause the relays to operate, changing to the "special" position ; observe the feed current. This should not exceed 4·5 mA.

(x) Set SEND-RECEIVE switch to OFF, and remove the short-circuited plug, type 118.

(xi) Insert the amplifier and modulator valves V.T.51.

(xii) Set the SEND-RECEIVE switch to SEND.

(xiii) Adjust the normal aerial tuning inductance to obtain minimum input current. It will be found that the aerial current is very nearly a maximum at this point. The input current should be of the order of 13 mA, and the aerial current should be about 0·13 amperes.

(xiv) Set the limiting resistance switch to TRANSMIT.

(xv) Trim aerial inductance for minimum input as before.

(xvi) Set SEND-RECEIVE switch to OFF.

This completes the tuning of the normal frequency. The special frequency is tuned as follows :—

(xvii) Select a suitable tapping on the aerial coil by means of the control marked S.AE COARSE, and adjust the condenser S.AE FINE to about 4.

(xviii) Return the limiting resistance switch to TUNE.

(xix) Insert red-topped plug, type 118, in the control socket.

(xx) Set SEND-RECEIVE switch to SEND.

(xxi) Adjust S.AE FINE control for minimum input. Unless a definite minimum is obtainable,

- (*a*) Put SEND-RECEIVE switch to OFF and
- (*b*) try an adjacent tapping on the S.AE COARSE control. The input current should be of the order of 13 mA, and the aerial current should be about 0·13 amperes.
- (*c*) When a definite minimum input is observed.

(xxii) Set limiting resistance switch to TRANSMIT and re-adjust S.AE FINE control for minimum input as before.

The special frequency is now correctly adjusted.

(xxiii) Put SEND–RECEIVE switch to OFF and remove red-topped plug, type 118, from control socket.

Note.—When tuning on the bench before installation, an artificial aerial type 3 may be used instead of an aerial and earth. The capacitance should be set to 100μμ F. When re-tuning a transmitter which has been in use previously, the stages (i) to (xi) are omitted, except that appropriate crystals must be inserted as in (iv) if the frequency allocation has been altered.

86. The following table may be used as a guide for preliminary settings of the aerial tuning for both normal and special frequencies.

Crystal frequency kc/s.	Crystal in socket.	Red-topped plug.	N aerial tuning.		S aerial tuning.		Input MA.	Output amperes.
			Turns.	Degrees.	Coarse.	Fine.		
6·6	N	out	5	330	—	—	24	0·25
6·0	N	out	7	100	—	—	24	0·25
5·75	N	out	7	310	—	—	24	0·25
5·3	N	out	9	40	—	—	24	0·25
4·75	N	out	11	20	—	—	24	0·25
4·25	N	out	13	200	—	—	24	0·25
6·66	S	in	—	—	4	2·0	25	0·23
6·0	S	in	—	—	5	2·5	25	0·23
5·75	S	in	—	—	5	8·0	25	0·23
5·3	S	in	—	—	6	8·0	25	0·23
4·75	S	in	—	—	8	5·0	25	0·23
4·25	S	in	—	—	10	5·0	25	0·23

Receiver

87. Since the aerial circuit of the transmitter is the input circuit of the receiver, the transmitter must invariably be tuned to the desired frequency before attempting to tune the receiver. Until a suitable type of crystal monitor is generally available, the receiver may be tuned by means of an R/T tester, Unit A, which has previously been modified in accordance with the instructions contained in A.P.1186/E.36. This modification consists of the introduction of a crystal for stablizing the frequency of the modulated oscillation generated by the R/T tester; when used in this manner, a valve V.R.21 is used as a modulator and a valve V.T.20 as an oscillator. The R/T tester, Unit A, is set up to the desired frequency as follows. Insert a crystal of the required frequency into the crystal adaptor. Using the telephone plug and lead supplied with the R/T tester, connect a testmeter, type C, to the jack on the instrument panel. Set the testmeter to the 0—30 mA. range, and the R/T tester to transmit T.T. The latter operation completes the filament circuit of both valves and the oscillations will then be initiated. Adjust the variable condenser until the reading of the testmeter is a minimum. This adjustment is critical, but is facilitated by the fact that the setting of the condenser dial in kc/s should agree approximately with the frequency of the crystal. Having determined the condenser setting giving minimum input, increase the condenser reading by 15 kc/s., lock the condenser dial and withdraw the plug of the testmeter. The R/T tester, Unit A, is now radiating a modulated crystal-controlled oscillation.

88. The following instructions are generally applicable, no matter what form of signal generator is used to produce the tuning signal, except where specific reference is made to the R/T tester Unit A.

(i) Turn the volume control potentiometer in the pilot's cockpit to the maximum volume position. Except, as stated in sub-para. (viii), it must be maintained in this position during the whole of the operation of tuning.

(ii) Set the fine tuning control to 90 degrees, *i.e.*, to the middle of its range of movement.

(iii) Place the signal generator near the tail plane. Where a modified R/T tester, Unit A, is used for this purpose, the screening lid should not be securely closed during the preliminary tuning.

(iv) Put SEND–RECEIVE switch to RECEIVE, and adjust the two main tuning condensers until the modulated signal is heard at maximum strength.

(v) Progressively weaken the field strength at the receiver, first by closing and securing the screening cover of the Unit A where used and, if necessary, by removing the unit further from the receiver. In no circumstances should the signal strength be decreased by adjustment of the receiver volume control. Where crystal monitors are available, an attenuator is fitted as an integral component, and this control is used to reduce the field strength instead of the somewhat haphazard method which must be adopted with the R/T tester, Unit A.

(vi) Having attenuated the field at the receiving aerial until signals are barely audible when the receiver is exactly in tune, turn the regeneration control in the direction of the arrow until the receiver commences to oscillate, then turn back one complete turn.

(vii) Re-adjust the two main tuning condensers for maximum signal strength.

(viii) Operate the volume control, ensuring that the strength of signals decreases and increases over the entire range of variation and that oscillation does not set in at any point in the range. Return the control to the maximum position.

(ix) Rotate the fine tuning control over the whole of the range, ensuring that the instrument is stable, and return it to the original position, by observation of maximum signal strength.

(x) Should oscillations set in during the operations described in (viii) or (ix), repeat the whole tuning operation up to (v). In operation (vi) the regeneration control should be turned back $1\frac{1}{2}$ turns from oscillation point instead of 1 turn, then proceed as in (vii), (viii) and (ix).

OPERATION AND MAINTENANCE

General

89. When the aeroplane is on the ground, the switch handle of the controller should be locked in the OFF position as a safeguard against battery wastage. Immediately before leaving the ground the handle should be moved to the RECEIVE position and continuously maintained in this position except when transmission is in progress on the " normal " frequency, so that it is always possible to receive a call.

90. Immediately before each flight a test of transmission and reception should be made. During flight, the SEND–RECEIVE control and volume control are operated as required. If the receiver has been tuned in accordance with the preceding instructions the receiver fine tuning control should not require adjustment during the flight. It is again emphasized that a carbon microphone must not be used unless the shorting link across the attenuating condenser (C_{31} fig. 2), is previously removed (*see* para. 111).

91. Since the aerial circuit of the transmitter also functions, during reception, as the input circuit to the first R/F stage, it is essential that all inter-communicating transmitters shall be

on exactly the same frequency. If this is not the case, the input circuit of the receiver may not be in resonance with a received signal, and the signal strength may be poor.

92. The L.T. accumulator must be removed and charged at frequent intervals. If a 14 Ah. accumulator is fitted, a newly charged one should be installed before each flight in which the wireless apparatus is to be used. Where the 20 Ah. type is fitted, the accumulator should be replaced by a newly charged one after each two flights of approximately full duration.

93. The H.T. battery voltage should be tested periodically. This may be done either by withdrawing the battery tray, or by removing the cover of the contact bar and connecting the voltmeter between H.T. + and H.T. — contacts. If the voltage on load falls below 100 volts the battery must be renewed. The plugs should be secure in the battery sockets and care must be taken not to dislodge them in replacing the battery tray. As already stated the H.T. battery is called upon to supply a total current of about 28 milliamperes.

94. The voltage of the transmitter and receiver grid bias batteries should also be checked periodically, and the security of the plugs attended to. If the voltage of either is low, the modulator or sub-modulator, as the case may be, will take a heavy anode current and transmitted speech will be distorted. A defective receiver grid bias battery will also give rise to distorted speech during reception.

95. On no account should any attempt be made to remove or replace any plug or valve, unless the SEND-RECEIVE switch is in the OFF position, except that the relays may be operated for testing and tuning by the insertion and withdrawal of the plug, type 118, supplied for this purpose.

96. The relays themselves should seldom, if ever, require adjustment, but if this should become necessary it is not to be attempted except by means of the proper tools, which are contained in the kit specified in Section V, Chapter XVI (Ground Station Remote Controls, Table I), of this Air Publication. The relays should operate on the closure of the circuit, *e.g.* by the insertion of the plug, type 118, into the control socket, provided that the terminal P.D. of the L.T. battery is above 1·8 volts. The minimum "break" between any two pairs of contacts should be 0·04 in. On "making" in either direction the contacts should "follow through" for at least 0·02 in.

Master Contactor

97. If any doubt arises as to the accuracy of the master contactor, its regulation should be checked by means of a stop watch Mark VI, which is available for use with this installation. It is not necessary to remove any apparatus from the aeroplane, but the remote contactor must be installed and not the dummy one. The master contactor is fully wound and started by means of the starting knob. At least ten minutes should be allowed for the interior of the clock to attain its working temperature (75° to 80° F.) and for the balance wheel oscillation to settle down to a steady rate. See that the switch of the master contactor is OFF and set the adjustable index to 0°, aligning the pointer to it. Fully wind the stop watch and set it to zero.

98. When ready to take the first or rough check, start the stop watch and simultaneously start the remote contactor by moving the switch to ON. Take the time of 15 complete revolutions. This should take 15 minutes exactly. If, however, it actually takes 15 minutes 0·5 second the master contactor is obviously losing 2 seconds per hour. It is unlikely that the rate of the clock will be so high as this. If it is considerably less, however, it is not possible to check it with accuracy over such a short period as 15 minutes. The remote contactor and the stop watch should therefore be left running for six hours. Suppose that at the end of six hours run, the hand of the remote contactor is 1/10th of a revolution past the index; then the master contactor has gained 1/10th of a minute in six hours, *i.e.* is gaining one second per hour. If the master contactor gains or loses more than this, the accuracy is below the operational requirements of the installation. The object of the preliminary check is to guard against the remote possibility that this is actually a gain of 1, 1/10th minute or a loss of 9/10th minute per six hours.

99. For simplicity it has been assumed that the stop watch Mark VI has no rate of gain or loss. The actual rate of the watch should be checked by comparison with a watch of known rate or by wireless time signals. In the latter case, however, it must be remembered that the watch runs for six hours only on a single winding. Since under certain conditions the pilot will use the clock on the instrument panel in conjunction with the radio installation, it is convenient to obtain the relative rates between this clock and the master contactor during the above test. After performing a six-hour test, the L.T. battery should always be replaced by a fully charged one.

Remote controls

100. When the remote controls are to be disconnected for removal of the transmitter-receiver from the aeroplane the switch coupling is removed by loosening the clamp screw and pulling the coupling off the adaptor ring attached to the panel, and the condenser unit handle is removed in a similar manner. The positions at which each of these has been fitted should be noted before they are removed. The volume control plug must also be taken out.

101. When the transmitter-receiver is replaced, the switch coupling and condenser unit handle should be fitted in the same position as before unless there is particular reason for changing them. The correct position for the switch coupling may be determined, if it is not known, by putting both the switch and the handle of the coupling in the OFF position and engaging the dog with the switch cross bar. The key should then fit into the appropriate keyway. The condenser unit handle is not keyed and the correct position must be found by trial.

102. If the shafting has been disengaged from the wheels, or if the position of the switch coupling or condenser unit handle changed, the shafting must be re-adjusted. When the switch coupling has been fitted in the new position and fixed by tightening the clamp screw the most convenient position for the handle is then decided on and the OFF position noted. The stop plate is moved if necessary to correspond with the range of movement decided on for the handle and the handle then fitted. The condenser unit handle is fixed as required and clamped up.

103. The flexible shafting must then be re-adjusted. The following method is observed in the initial fitting and should be repeated if the shafting has been disturbed. It is assumed that the casing and components are completely assembled.

(i) Disconnect the short closed lengths of tubing from the controller and coupling by disengaging the casing unions from the guide tubes.

(ii) Remove one of the screws fixing each guide tube, slacken the others and swing the tube away from the wheel.

(iii) Thread the required length of shafting into the casing and push it through until the end is just flush with the free end of the guide tube on the coupling.

(iv) Turn the handle on the coupling to the position that it would occupy if the shafting were engaged with the wheel and then pulled from the far end. Push the guide tube back into place, meshing the shafting and wheel to the nearest tooth, and screw up the guide tube.

(v) Pull the end of the shafting projecting from the controller so as to take up all slack. Turn the handle of the controller to the position it would occupy to pull the shafting as far as possible from the other end and refix the guide tube, meshing the shafting and wheel to the nearest tooth. It should now be possible to operate the coupling to either extreme position by movement of the controller handle. When the shafting is pushed away from the controller to its extreme position, the end should be flush with the free end of the guide tube.

(vi) If there is an intermediate switch coupling for operation of the SEND-RECEIVE switch by the observer, the switch handle of the controller should be placed in the OFF position and locked. The handle of the intermediate coupling should then be turned to the central position and the guide tube pushed into place and screwed up. With the controller handle unlocked, it should then be possible to operate the switch to either extreme position by movement of the intermediate handle.

(vii) Replace the short closed lengths of rigid casing on the free ends of the guide tubes.

104. If in the repair or modification of remote controls, it is required to bend the rigid casing, the bending tool supplied for the purpose must be used. The bending tool is of wood and is in the shape of a segment of a circle, with a U-section slot round the edge in which the casing is to be fitted for bending. For the type C rigid casing the tool, bending, type C, is used, and for the type D rigid casing the tool, bending, type D and the following precautions must be observed.

(i) The cross-section of the casing must not be distorted from the circular form. The appropriate flexible shafting must therefore always be threaded through the casing before the casing is bent.

(ii) The straight casing adjacent to a bend must be tangential to the bend. The bending tool is to be placed against the casing where the bend is required and the casing bent by hand to the shape of the tool. The bending must be done slowly and without jerks.

Electro-magnetic microphone

105. Periodic inspection of the electro-magnetic microphone should be carried out. The front cover and diaphragm should be removed and any moisture which has condensed on the wax filling or on the diaphragm should be removed with a clean soft white cloth. Before reassembly a thin layer of petroleum jelly should be applied to the rim of the body of the instrument.

106. Tests of microphone resistance, lead screen resistance, insulation resistance and microphone efficiency may be carried out with the following apparatus :—Insulation Resistance Tester, Testmeter, Type A or D, Noise Generator, No. 1, and Condenser, Type 112 or 330. All microphone and telephone connections should be carefully checked before carrying out the tests.

107. Microphone resistance test. Withdraw the microphone-telephone plug and connect the testmeter, on ohmmeter scale, across the microphone contacts on the plug, rings 2 and 3 (counting the tip as ring 1). With the microphone switch at ON, the ohmmeter should read approximately 60 ohms. A faulty microphone will be indicated by a reading which is over 75 or under 45 ohms.

108. Lead screen resistance test. Connect the testmeter between Tel.— (ring 4 of the plug) and the earthing terminal on the back of the microphone. The meter should indicate a very low resistance, less than 1 ohm. A higher resistance indicates a defective screen on the microphone lead.

109. Insulation resistance test. The insulation resistance tester should give a reading of greater than 40 megohms when connected between the following pairs of plug contacts, the microphone switch being in the OFF position :—(i) Mic.+ and Tel.— (rings 2 and 4), (ii) Mic.— and Tel.— (rings 3 and 4), (iii) Mic.+ and Mic.— (rings 2 and 3). If the reading is less than 40 megohms in any of these tests, repeat them after disconnecting the microphone. If these latter tests are satisfactory the fault lies in the microphone which should be tested by connecting the meter in turn between each of the microphone terminals and the earth terminal on the casing. In this way it will be possible to isolate the fault and make any necessary replacements.

110. Microphone efficiency test. Set up the transmitter-receiver T.R.9.D with a condenser, type 112 or 330, connected between the aerial and earth terminals, other connections being removed from these terminals. Insert the microphone plug in its socket, and, with a suitable crystal inserted in the "normal frequency" holder, switch on the transmitter. Tune for minimum anode current. Set the microphone switch to ON and place the front cover of the microphone against the rubber guard strips round the aperture in the noise generator. Note

the current on the aerial ammeter. Switch on the noise generator. The aerial ammeter current should increase by approximately 0·06 amps. If this current does not rise by at least 0·04 amps. the output from the microphone is unsatisfactory.

111. The transmitter-receiver, type T.R.9D, has been designed primarily for use with electro-magnetic microphones, such as microphones, type 19, but when necessary carbon capsule microphones, such as mask microphones, type E, may be used. Since the output voltage from a carbon capsule microphone is considerably greater than that from an electro-magnetic microphone, it is necessary to attenuate the gain of the common amplifier in the receiver portion of the transmitter-receiver. This attenuation is obtained by transferring the grid lead from the secondary to the primary of the microphone transformer, using the primary winding as a choke and dispensing with the transformer as such. Any transmitter-receivers T.R.9D which have been modified as above, cannot be used in conjunction with electro-magnetic microphones.

112. Any instability which may be experienced when using carbon capsule microphones, can be eliminated in the following manner. A lead should be soldered to the common negative terminal of the socket, type 17, and the other end of the lead should be connected to the nearest convenient point on the aeroplane earth system. Any instruments which have been modified, should have the original wiring restored before they are returned to Store.

APPENDIX

NOMENCLATURE OF PARTS

The following list of parts is issued for information only. In ordering spares for this transmitter-receiver, the appropriate section of AIR PUBLICATION 1086 must be used.

Ref. No.	Nomenclature.	Quantity.	Ref. in Fig. 2.	Remarks.
10D/10470 ..	Transmitter-receiver T.R.9D	—	—	
	Consisting of :—			
10D/10531 ..	Case	1	—	Fitted with contact bar Ref. No. 10A/10477, leads and plug type 48.
10A/10477 ..	Bar, contact	—	—	
10A/9172 ..	Cover, contact bar	1	—	
10D/10472 ..	Receiver, type R.1120	1	—	For details, *see* below.
10D/10471 ..	Transmitter, type T.1119	1	—	For details, *see* below.
10A/9175 ..	Tray, battery	1	—	
	Principal components :—			
10A/7818 ..	Ammeter, thermo 0—0·5	1	A	
10A/10474 ..	Bar, contact, type 8	1	—	
10H/9227 ..	Base, terminal	1	—	
10C/9206 ..	Choke, H/F, type 34	1	L_2	
10C/10117 ..	Choke, H/F, type 37	1	L_4	
10C/7912 ..	Choke, L/F, type G	1	L_5	
10D/10473 ..	Coil, aerial	1	L_3	
10C/8009 ..	Condenser, type 132	1	C_3	0·0005 μF.
10C/9179 ..	Condenser, type 280	1	C_5	0·001 μF.
10C/9185 ..	Condenser, type 286	1	C_4	0·01 μF.
10C/9208 ..	Condenser, type 289	1	C_7	0·002 μF.
10C/10394 ..	Condenser, type 404	1	C_2	10 μμF.
10C/10568 ..	Condenser, type 410	2	C_1, C_8	50 μμF, ceramic disc.
10C/10476 ..	Condenser, type 411	1	C_6	Variable, air dielectric.
10F/10111 ..	Head, switch	1	—	
10H/10478 ..	Holder, crystal	1	—	
10H/9615 ..	Holder, valve, type S	2	V_2, V_3	5-pin.
10H/9195 ..	Plate, guard	2	—	For valve-holders.
10H/10479 ..	Holder, valve, type X	1	V_1	4-pin.
10A/7820 ..	Milliameter 0—30	1	—	
10F/10112 ..	Plate, stop	1	—	
10F/10480 ..	Relay, magnetic, type 42	2	REL_1, REL_2.	Telephone type, 2 makes, 2 breaks.
10C/7956 ..	Resistance, type 103	1	R_4	5,000 ohms.
10C/8020 ..	Resistance, type 112	1	R_2	30,000 ohms.
10C/8021 ..	Resistance, type 113	2	R_1, R_3	20,000 ohms.
10H/7276 ..	Socket, type 11	1	—	
10F/10113 ..	Switch, type 137	1	SR_1, SR_2, SR_3, SR_4.	
10F/10338 ..	Switch, type 152	1	S_5	
10A/10497 ..	Transformer, L/F, type 19	1	T_1	
10D/10472 ..	Receiver, type R.1120	1	—	
	Principal components :—			
10A/10475 ..	Bar, contact	1	—	Fitted with 7 contacts.
10H/9190 ..	Base, terminal, 1-way, type A ..	1	—	Engraved 16.
10H/9191 ..	Base, terminal, 2-way	1	—	Engraved 14 and 15.
10H/9192 ..	Base, terminal, 3-way, type A ..	1	—	Engraved 1, 2 and 3.
10H/9224 ..	Base, terminal, 3-way, type B ..	1	—	Engraved 22, 23 and 24.
10H/9193 ..	Base, terminal, 5-way, type A ..	1	—	Engraved 4, 5, 6, 7 and 8.
10H/9225 ..	Base, terminal, 5-way, type B ..	1	—	Engraved 9, 10, 11, 12 and 13.
10H/9226 ..	Base, terminal, 5-way, type C ..	1	—	Engraved 17, 18, 19, 20 and 21.

Ref. No.	Nomenclature.	Quantity.	Ref. in Fig. 2.	Remarks.
10D/9189	Can, coil	3	—	
10C/10117	Choke, H/F, type 37	1	L_9	
10C/7384	Choke, L/F, type B	1	L_8	
10D/9187	Coil, anode	2	L_6, L_7	
10C/7902	Condenser, type 121	1	C_{22}	0·0001 μF.
10C/7906	Condenser, type 125	2	C_{10}, C_{19}	0·01 μF.
10C/8388	Condenser, type 178	1	C_{32}	0·0002 μF.
10C/9178	Condenser, type 279	1	C_{17}	0·0003 μF.
10C/9179	Condenser, type 280	4	C_{24}, C_{25}, C_{27}, C_{38}	0·001 μF.
10C/9180	Condenser, type 281	1	C_{30}	2 μF.
10C/9181	Condenser, type 282	7	C_9, C_{15}, C_{16}, C_{20}, C_{23}, C_{26}, C_{29}.	0·5 μF.
10C/9182	Condenser, type 283	1	C_{18}	Variable.
10C/9184	Condenser, type 285	1	C_{31}	0·00003 μF.
10C/9185	Condenser, type 286	1	C_{21}	0·01 μF.
10C/9197	Condenser, type 287	1	$C_{11}+C_{12}$	Variable.
10C/9198	Condenser, type 288	2	C_{13}, C_{14}	Variable.
10C/10554	Condenser, type 423	1	C_{35}	0·1 μF.
10C/10948	Condenser, type 429	2	C_{33}, C_{34}	20 μμ F, ceramic disc.
10H/9194	Holder, valve, type R	6	V_1, V_5, V_6, V_7, V_8	4-pin.
10H/9195	Plate, guard	6	—	For valve-holders.
10H/9196	Plate, guide	6	—	For valve-holders.
10A/9202	Knob, type 1	2	—	
10A/9201	Knob, type 2	2	—	
10H/9176	Plug, type 76	3	—	For grid bias battery.
10C/7955	Resistance, type 102	1	R_{12}	2,000 ohms.
10C/7957	Resistance, type 104	1	R_{24}	10,000 ohms.
10C/8016	Resistance, type 108	2	R_5, R_{16}	0·5 megohm.
10C/8017	Resistance, type 109	1	R_{18}	2 megohms.
10C/8018	Resistance, type 110	1	R_{13}	0·25 megohm.
10C/7910	Resistance, type 130	2	R_6, R_{10}	1·5 ohms.
10C/8019	Resistance, type 111	1	R_{15}	100,000 ohms.
10C/8021	Resistance, type 113	5	R_7, R_8, R_{11}, R_{14}, R_{17}	20,000 ohms.
10C/8117	Resistance, type 123	4	R_9, R_{19}, R_{20}, R_{22}.	1 megohm.
10C/8519	Resistance, type 145	1	R_{21}	200,000 ohms.
10A/9199	Ring, clamp	1	—	For remote control attachment.
10A/9200	Screw, clamp.	1	—	For Ref. No. 9199.
10A/7394	Socket, type 17	1	—	For remote volume control.
10A/7916	Transformer, microphone, type 51	1	T_2	
10A/9203	Wheel, index	1	—	For remote control attachment.
	Accessories			
5A/1386	Accumulator, lead-acid, 2 V., 14 Ah., type B.	1	—	For L.T. supply, according to operational requirements.
5A/1387	Accumulator, lead-acid, 2 V., 20 Ah., type B.	1		
5A/1383	*Battery, dry, 4½-V.	1	—	G.B. for receiver.
5A/1338	*Battery, dry, 15-V.	1	—	G.B. for transmitter.
5A/1333	*Battery, dry, 120-V.	1	—	H.T. for transmitter and receiver.

* *or appropriate overseas pattern*

Ref. No.	Nomenclature.	Quantity.	Ref. in Fig. 2.	Remarks.
10D/10993 ..	Case, transit	1	—	For complete transmitter-receiver.
10A/10984 ..	Contactor, type 1 .. .. .. *or*	1	—	12-volt, master.
10A/10994 ..	Contactor, type 2	–	—	24-volt, master
10A/10985 ..	Contactor, type 3 .. .. .. *or*	–	—	12-volt, remote.
10A/10995 ..	Contactor, type 4	–	—	24-volt, remote.
10A/10988 ..	Contactor, dummy	1	—	Fitted with plug, type 62.
10X/.... ..	Crystals—units (Quantities and frequencies as required by W/T organisation.)			
10H/10969 ..	Plug, type 118	1	—	2-pole, shorted for ground testing.
5C/543 ..	Switchbox, type B, 1-unit	1	—	
10E/7607 ..	Valve, V.R.18	2	V_1, V_5	R/F. amplifier.
10E/7738 ..	Valve, V.R.21	2	V_7, V_8	A/F. amplifier.
10E/7958 ..	Valve, V.R.22	1	V_9	Receiver output.
10E/8239 ..	Valve, V.R.27	1	V_6	Detector.
10E/10945 ..	Valve, V.T.50	1	V_1	Oscillator.
10E/10946 ..	Valve, V.T.51	2	V_3, V_2	Modulator and R/F. power amplifier.
10A/10989 ..	Microphone, type 19, consisting of:—			
10A/10990 ..	Microphone, type 18	1	—	Electro-magnetic.
10H/10353 ..	Cord, instrument, type Q	1	—	
10H/10991 ..	Plug, type 119	1	—	
—	Remote controls	–	—	*See* Appendix of A.P. 1186, Sect. 2, Chap. 2.

CONCISE DETAILS OF
TRANSMITTER-RECEIVER, TYPE T.R.9D

PURPOSE OF EQUIPMENT	Air-borne transmitter-receiver for single seater aircraft
TYPE OF WAVE	R/T
FREQUENCY RANGE	4·3 M/cs to 6·6 Mc/s.
FREQUENCY STABILITY	Quartz crystal controlled
CRYSTAL MULT. FACTOR	Fundamental
PERCENTAGE MODULATION	90 per cent.
MAXIMUM SENSITIVITY	5 milli-watts output into 20,000 ohm load with 10 micro-volts input at 400 cycles modulated 25 per cent.
SELECTIVITY	—
OUTPUT IMPEDANCE	20,000 ohm, receiver ; variable for transmitter
AMPLIFIER CLASS	Transmitter, Class C ; Receiver, Class A
MICROPHONE TYPE	Carbon or electro-magnetic
VALVES	*Transmitter, T.1119* Oscillator, V.T.50 (Stores Ref. 10E/10945) Modulator, V.T.51 (Stores Ref. 10E/10946) Power-amplifier, V.T.51 (Stores Ref. 10E/10946) *Receiver, R. 1120* R/F (2) V.R.18 (Stores Ref. 10E/7607) Detector, V.R.27 (Stores Ref. 10E/8239) A/F amplifier (2), V.R.21 (Stores Ref. 10E/7738) Power amplifier, V.R.22 (Stores Ref. 10E/7958)
POWER INPUT	28 mA. at 120 volts, H.T. Transmitter L.T. 0·5 amp. at 2 volts Receiver L.T. 0·9 amp. at 2 volts Total operating current, including relays and microphones, 1·6 amp.
POWER OUTPUT	0·27 amp. to 0·29 amp. into average aircraft aerial
STORES REF. NO.	10D/10470
APPROXIMATE OVERALL DIMENSIONS	LENGTH 19½ in. — WIDTH 13¼ in. — HEIGHT 9½ in.
WEIGHT	Excluding batteries 28 lb. With valves and dry batteries, 40 lb. With remote control equipment, 67 lb.
ASSOCIATED EQUIPMENT	Remote control, type C or D (Stores Ref. 10J/8186 and 10J/8907) Accumulators, 2 v., 20 Ah (Stores Ref. 5A/1387) Battery, dry, 120 v. (Stores Ref. 5A/1333 or Stores Ref. 5A/1615). Battery, dry, 15 v. (Stores Ref. 5A/1338) Battery, dry, 4½ v. (Stores Ref. 5A/1383) Crystal monitor or R.T. Tester, unit A (modified) (Stores Ref. 10S/7185) or R.T. Tester, Type 1, Unit C (Stores Ref. 10S/35)