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SECTION 4, CHAPTER 3

AMPLIFIER, TYPE A.1219

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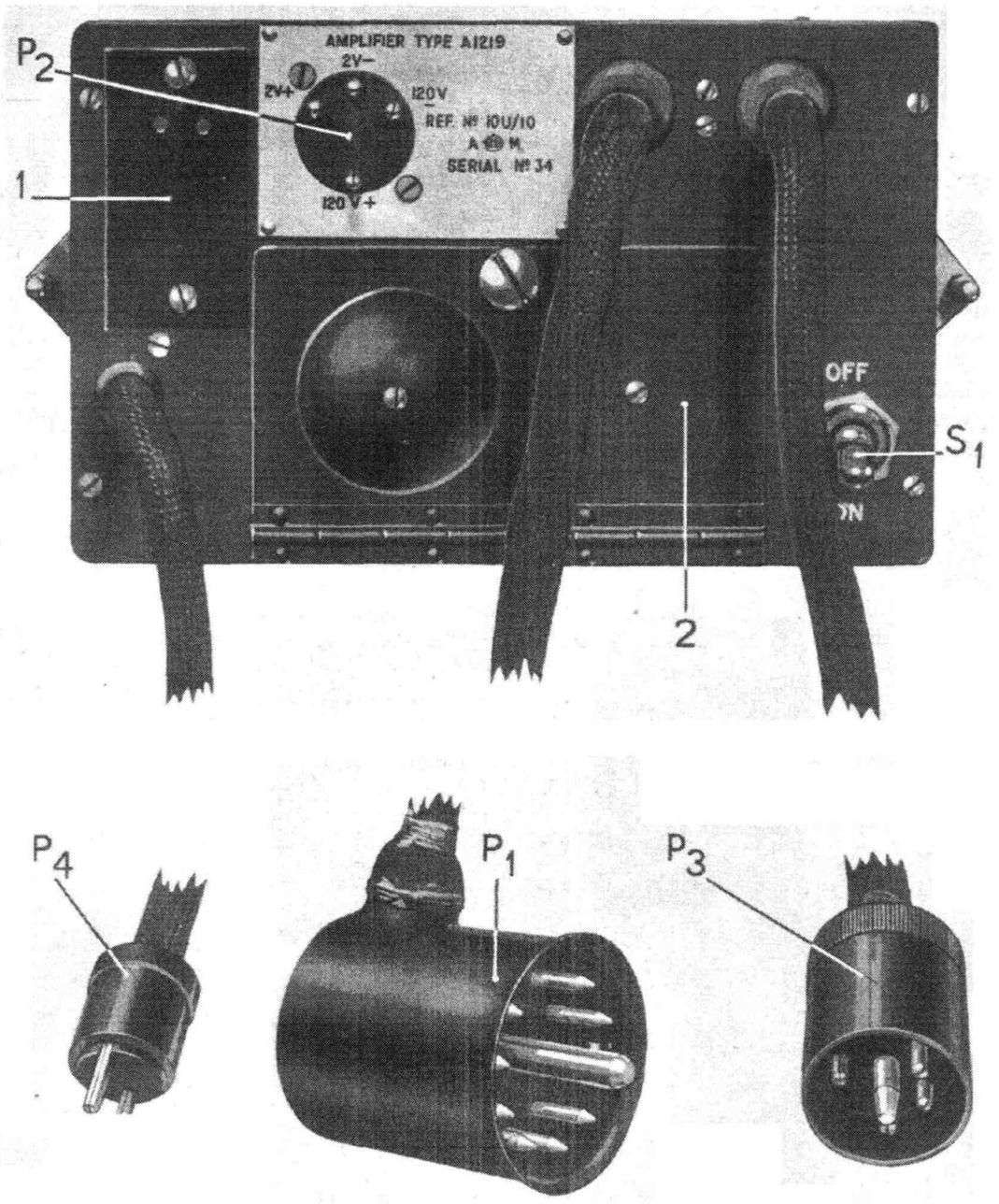


FIG. 1.—FRONT VIEW

AMPLIFIER, TYPE A.1219

(Stores Ref. 10H/10)

INTRODUCTION

1. The amplifier, type A.1219, has been designed to be used in place of the amplifier, type A.1134, to provide intercommunication between members of the crew of multi-seater aeroplanes, in cases where a transmitter-receiver, type T.R.1133 is installed together with a transmitter, type T.3065 and receivers, types R.3066, R.3080 or R.3085.

2. In addition to acting as an inter-communication amplifier, the A.1219 will act as a speech-input amplifier for transmitter modulation for use with electro-magnetic microphones. Up to seven pairs of phones may be connected to the output circuit.

3. The I/C circuits of the amplifier, A.1219 are adapted for push-button operation by means of a relay, which can be operated automatically, if desired, from the contactor mechanism of the transmitter-receiver T.R.1133, yielding I/C facilities during contactor periods. The push-button controls of the relay disconnect the transmitter-receiver as well as connecting the I/C amplifier in circuit.

4. The amplifier circuits are so designed that though the observer can overhear all incoming and outgoing R/T signals, only the pilot's microphone is capable of being connected to the transmitter, so that communications from the observer to the pilot cannot be radiated.

5. The dimensions of the amplifier, A.1219 are identical with those of the A.1134, namely, approximately 7⅞ in. long by 6⅛ in. deep by 4¼ in. high, and its weight, including valves and grid bias battery, 5 lb. 2 oz. The weight, inclusive of all associated supplies, but exclusive of fixed aircraft wiring, is 19 lb. 6 oz. A general view of the amplifier is given in fig. 1.

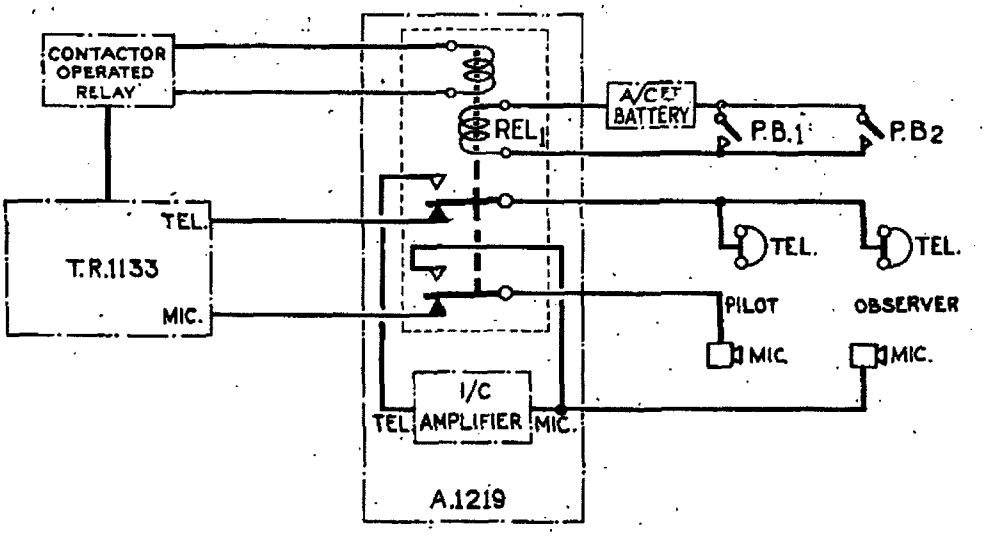


FIG. 2.—FUNCTIONAL DIAGRAM

GENERAL DESCRIPTION

6. From the schematic diagram, fig. 2, showing the interconnection of the amplifier A.1219 with the transmitter-receiver T.R.1133, it will be seen that in the normal position of the relay REL_1, the pilot's microphone is connected to the microphone terminals of the T.R.1133, and the phones of all members of the crew are connected in parallel to the output circuit of the A.F. amplifier of this instrument.

7. When the transmitter of the T.R.1133 is in operation, its amplifier acts as a speech input amplifier, and the outgoing speech is therefore audible in all the phones. Conversely, when the instrument is receiving, the amplifier is connected to the receiver output terminals and therefore the phones will in this case monitor the incoming speech. The observer's microphone, and the amplifier A.1219 are seen to be disconnected.

8. The relay REL_1 may be energised either automatically *via* a contactor-operated relay, actuated by the T.R.1133, or manually by push buttons under the control of members of the crew. When a relay is in the energised condition, the pilot's microphone is connected, in parallel with that of the observer, to the input of the amplifier A.1219, and the phones are all connected across the output of the amplifier, thus providing full I/C facilities. The transmitter/receiver is then disconnected from both the microphone and telephone circuits.

9. Referring to the theoretical circuit diagram, fig. 3, it will be seen that the input circuit to the amplifier is connected *via* a screened twin cable to the primary winding of the transformer T_1, and is balanced with reference to earth by the resistances R_1 and R_2.

10. The secondary winding of the transformer T_1 is connected to the grid-filament circuit of the triode amplifier valve V_1 through the coupling condenser C_1, the grid resistance R_4 being provided to make the necessary connection to the 3-volt tapping of the grid bias battery $BATT_1$ while maintaining the requisite value of grid-filament impedance at the input circuit of the valve. The values of the resistance R_4 and of the condenser C_1 are selected so as to provide attenuation of frequencies below 500 c/s, and thus to reduce noise interference.

11. The low potential terminal of the secondary winding of the transformer T_1 is connected to earth through a resistance R_3 which forms part of a negative feedback circuit designed to stabilise the performance of the amplifier. The operation of this circuit will be fully described in a later paragraph.

12. The anode of the valve V_1 is connected *via* a screened lead to the primary winding of the transformer T_2 and thence to the H.T. supply. The secondary winding of this transformer is centre tapped, and connected to the 6-volt terminals of the grid bias battery $BATT_1$ through the resistance R_5, while the high potential extremities of the winding feed the grid-filament circuits of the quiescent push pull duo-pentode output valve V_2.

13. The two anodes of this valve are connected to the primary winding of the output transformer T_3, and also, through the condensers C_2 and C_3 to the control grids of the two halves of the valve. The condensers C_2 and C_3 produce a restriction of the frequency response band, due to a degenerative action which becomes effective above a frequency of 2,500 c/s.

14. Four secondary windings are provided in the transformer T_3. Two of these are unused, while the third is connected through two resistances R_{10} and R_{11} in parallel, to provide an output similar in characteristic to that obtained from a carbon microphone, which may be used for transmitter modulation, if required.

15. The fourth output winding provides the telephone output, and is loaded by the resistance R_7, whose action is to ensure that the load impedance of the valve does not exceed a predetermined value, even if all the phone circuits are disconnected.

16. One end of this winding is earthed, and the other is connected through the resistance R_6 to the low potential end of the secondary winding of the transformer T_1. The fraction of the output voltage developed across the potentiometer comprising the resistances R_3 and R_6 is thus applied to the grid circuit of the valve V_1, yielding a negative feedback effect which renders the overall gain of the amplifier substantially independent of battery voltage changes and output impedance changes, and also reduces the distortion introduced by the amplifier circuits.

17. The H.T. and L.T. battery connections of the amplifier are connected to the plug P_3, the latter *via* the switch S_1. The remaining external connections of the amplifier are made through a connection panel; to the plugs P_1, P_2 and P_4. The terminals 6 and 18 are intended for use when the aircraft battery has a voltage of 12, while the terminals 20 and 17, which are intended for use with 24-volt aircraft batteries, feed the windings of the relay through the resistances R_9 and R_8 which reduce the operating circuit of the relay to a suitable value when the higher battery voltage is employed.

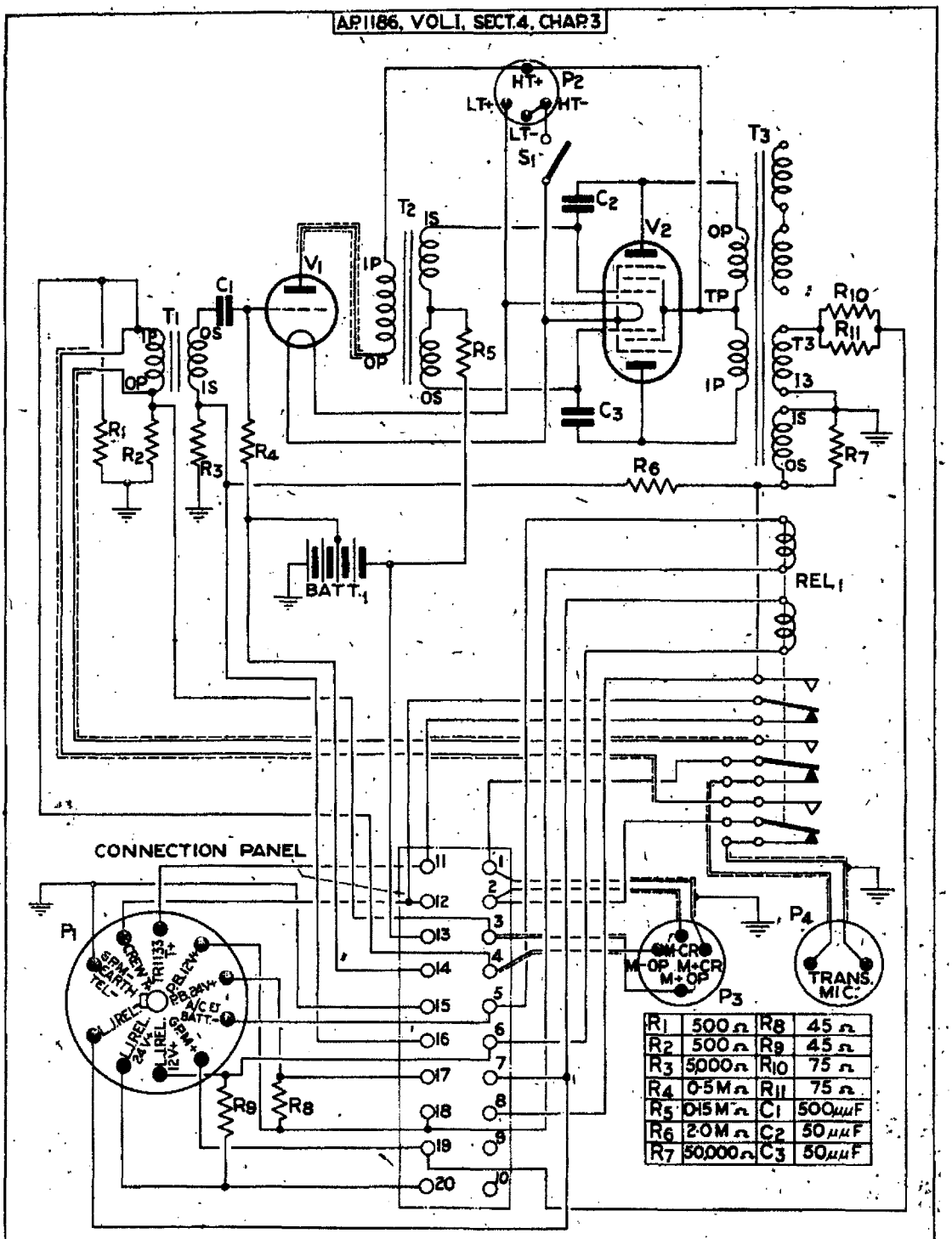
CONSTRUCTIONAL DETAILS

18. Three views of the amplifier, type A.1219, are given in figs. 1, 4 and 5 of which the two latter show the underside and the topside of the chassis respectively, with the cover removed.

19. Referring to fig. 1, it will be seen that all the plugs which provide the external connections of the amplifier, with the exception of the plug P_3, which is mounted on the front panel of the chassis, are connected *via* flexible multi-core cables which are shown broken in the illustration.

20. The screw-on cover (1) gives access to the relay REL_1, while the hinged door (2) which is retained by a coin-headed screw, protects, and gives access to the valves mounted beneath it.

21. From fig. 5, it will be observed that the connections to the grid-bias battery, $BATT_1$, which is mounted within the amplifier chassis, are effected by means of wander plugs.



R1	500 Ω	R8	45 Ω
R2	500 Ω	R9	45 Ω
R3	5000 Ω	R10	75 Ω
R4	0·5 MΩ	R11	75 Ω
R5	0·15 MΩ	C1	500 μμF
R6	2·0 MΩ	C2	50 μμF
R7	50,000 Ω	C3	50 μμF

FIG. 3 THEORETICAL CIRCUIT DIAGRAM FIG. 3

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VALVES AND POWER SUPPLY

22. The amplifier, type A.1219, employs one valve, type V.R.21, as voltage amplifier and a valve, type V.R.35 in the output stage. As has previously been explained, a 6-volt grid bias battery is carried within the chassis; the remaining power supplies comprise one 2-volt, 20-amp-hour capacity L.T. battery, and one 120-volt battery, type A.

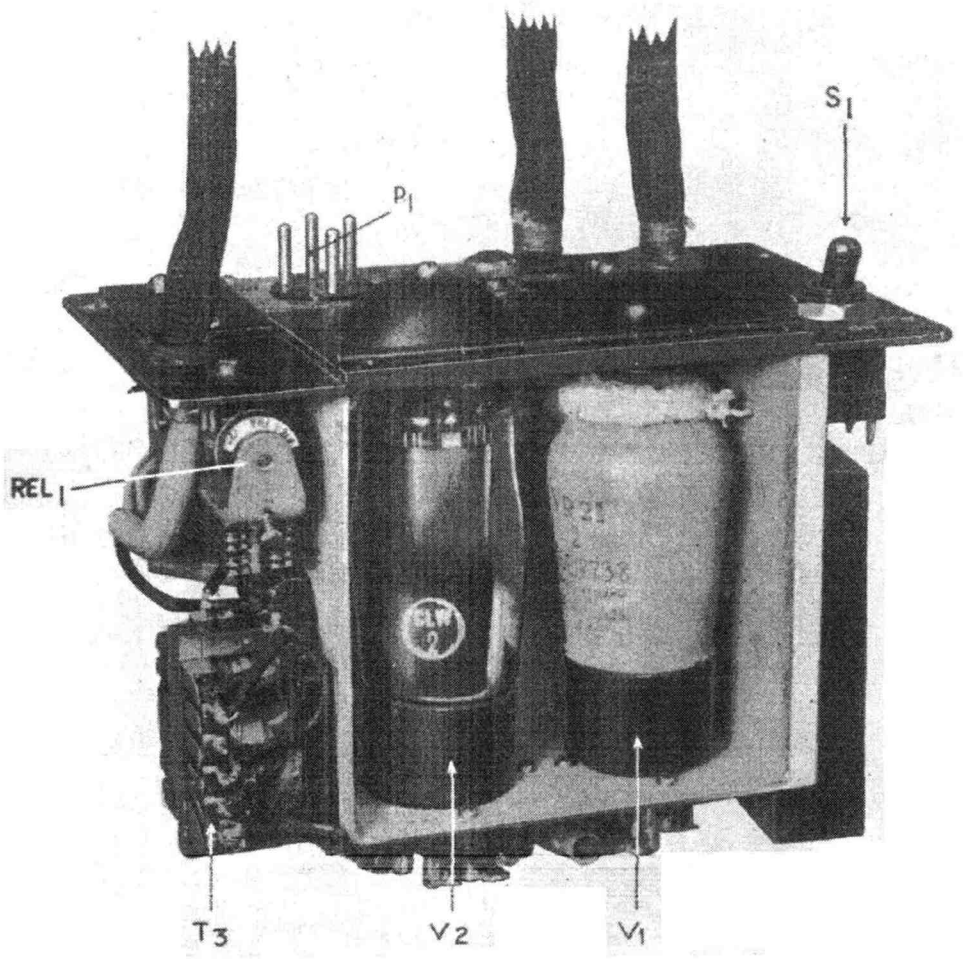

FIG. 4.—UNDERSIDE OF CHASSIS

INSTALLATION AND OPERATION

23. Care should be taken when installing the amplifier, type A.1219, that all the screened leads of the microphone circuits are bonded together, the continuity of the bonding being continued across any necessary junction main earth connexion of the amplifier. The bonding should be joined to the aeroplane earth, or to some point connected to it. It is essential that corresponding leads of all microphones are connected together, namely MIC+ to MIC+, and MIC— to MIC—.

24. The amplifier should be switched on throughout the time that the aircraft is in operation. No further adjustments should be necessary, provided that the necessary battery and other connections have been made, and that the valves and connection plugs are firmly inserted in position.

25. The I/C circuit may be set in operation at any time by depression of one of the push buttons, even should the transmitter/receiver be in operation. The I/C circuit will remain set up only so long as the push button is depressed.

PRECAUTIONS AND MAINTENANCE

26. The voltage of the L.T., H.T., and grid bias battery should be checked at regular intervals. The L.T. battery should be recharged if its voltage, measured under load conditions, is less than 1·8 volts. The H.T. battery should be renewed when the voltage falls below 90, or if the amplifier appears noisy in operation. The grid-bias voltages should not fall below the values 3 and 6 volts, at the points of connection to the circuits of the valves V_1 and V_2 respectively.

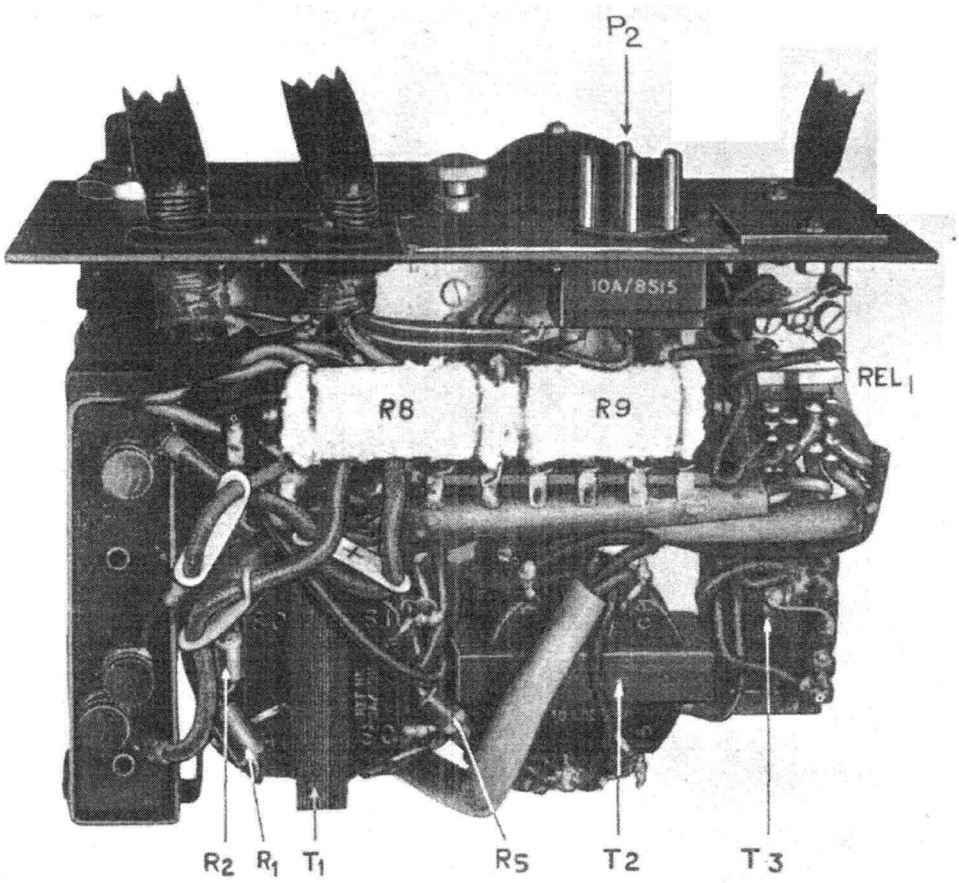

FIG. 5.—TOP SIDE OF CHASSIS

27. If the amplifier becomes unstable in operation, as demonstrated by "howling" or apparent loss of gain, a thorough check should be made to ensure that the bonding of all screened cable is satisfactory, and that all necessary earth connections have been effected in an efficient manner.

28. Especial care should be taken to ensure that leakage does not take place across the microphone-telephone plugs, as such leakage is a frequent cause of instability. The plugs should periodically be lubricated with a small quantity of vaseline, and a little transformer oil may also be injected into the sockets with advantageous results.

29. If L.T. leakage is suspected, the retaining spring over the valve V, should have 1·5 mm. H.T. insulating tube, grade E, threaded over the three last turns, below the asbestos binding. This eliminates the earthing of the valve metallizing, which short-circuits the L.T. switch S_1.

APPENDIX

NOMENCLATURE OF PARTS

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

Ref. No.	Nomenclature	Qty.	Ref. in Fig. 3	Remarks
10U/10	Amplifier, type A.1219			
	Principal components			
10U/12	Case	1		
	Condenser			
10C/10552	Type 421	2	C_2 C_3	50 $\mu\mu$ F
10C/11511	Type 543	1	C_1	500 $\mu\mu$ F
	Disc, indicating			
10H/11510	Type F	1		
10H/1168	Type P/129/J	1		
	Holder, valve			
10H/9615	Type S	1		7-pin
10H/9756	Type U	1		5-pin
10U/11507	Panel, connection	1		
	Plug			
10H/7280	Type 33	1		4-pole
10H/7274	Type 34	1		2-pin
10H/8515	Type 67	1		4-pole
10H/9112	Type 82	1		Red
10H/9113	Type 83	2		Black
10H/11505	Type 129	1		10-pole
10F/535	Relay, magnetic, type 231	1	REL_1	G.P.O. No. 616
	Resistance			
10C/11381	Type 477	1	R_7	50,000 ohms
10C/11382	Type 478	1	R_5	150,000 ohms
10C/11385	Type 481	1	R_6	2·0 megohms
10C/11670	Type 504	1	R_3	15,000 ohms
10C/11674	Type 508	1	R_4	0·5 megohm
10C/6	Type 540	2	R_1, R_2	500 ohms
10C/1751	Type 1,751	2	R_8, R_9	45 ohms
10C/	Type	2	R_{10} , R_{11}	75 ohms
10F/10338	Switch, type 152	1		
	Transformer			
10K/10280	Type 16	1	T_1	
10K/11503	Type 100	1	T_3	
10K/7916	Type 51	1	T_2	
	Accessories			
5A/1387	Accumulator, 2V., 20 A.H., Type B	1		L.T.
5A/1251	Battery			
	Dry, 6V	1	$BATT_1$	G.B.
	Dry, 120V			
5A/1333	Type A	1		Home
	or			
5A/1615	Type B	1		Overseas
10U/11730	Case, transit	1		
	Disc, indicating			
10H/11511	Type F	1		
10H/1169	Type S/67/J			
	Plug			
10H/8261	Type 64	1		
10H/8262	Type 65	1		
	Socket			
10H/7283	Type 12	1		
10H/8529	Type 39	1		
10H/11506	Type 67	1		
	Valve			
10E/7739	Type V.R.21	1	V_1	
10E/9779	Type V.R.35	1	V_2	