WIRELESS SET NO. 46

GENERAL DESCRIPTION

PRELIMINARY DESCRIPTION

1. The Wireless set No. 46 is a portable man-pack set for transmission and reception of R/T and M.C.W. signals over any of three pre-set crystal-controlled channels. The sender output is 1·5W.

2. The set is designed to cover the following bands by means of plug-in coils:—

Range 1: 7·9—9·1Mc/s Range 3: 5·0—6·0Mc/s
Range 2: 6·4—7·6Mc/s Range 4: 3·6—4·3Mc/s

Any three frequencies in the band chosen may be obtained by plugging in the appropriate crystals and adjusting three pre-set trimmers. Two crystals (one for send and one for receive) are required for each of the three frequency channels used on the set. The set is thus limited to those frequencies for which crystals are actually avaiiable, and the frequency allotment requires to be planned in advance. The operator may change instantly from one to another of the three channels by merely switching over, no readjustment of the aerial trimming being normally required.

3. The range of transmission is approximately 10 miles in day-time over flat country.

4. The set is designed for use with rod aerials 2 to 16 ft. in length. The power supplies are from 162/3V batteries, as used in the No. 18 set.

Brief electrical description

5. The receiver section of this crystal-controlled transceiver consists of four valve stages. V1A (ARTP 2) is the frequency changer, V2A (ARP 12) is the first I.F. amplifier, V2B (ARP 12) is the second I.F. and reflex A.F. amplifier, and the diode sections of V3A (AR 8) are used as the detector and A.V.C. rectifier. The triode section of V3A is used as the sender modulation amplifier. V4A (ATP 4) is the sender crystal-controlled oscillator, and V5A (ARP 37), a double pentode, is a push-pull modulator. The I.F. is 1,550kc/s.

Brief mechanical description

6. The set is in a waterproofed carrying case. The batteries are carried separately in a haversack and the whole is a one-man load. The weight of the complete station is 24 lb. with one battery and the phone assembly. For a fixed station 16 ft. aerial rods weighing 6½ lb. are used.

7. Connections from the battery haversack to the D.L.R. phones and throat microphone are made by means of a snatch plug, those between the set and battery haversack being made by means of a six-point screw plug and multi-core screened cable.

Panel controls

8. All the controls are situated on the top panel of the set. The controls are as follows:—

(*a*) The ON/OFF switch (S3A) with indicator, which shows clearly at a distance.
(*b*) The PRESS TO SEND-PRESS TO RECEIVE control (K1A-B), which switches the set from send to receive. It may be used if necessary for M.C.W. morse transmission up to 12 w.p.m.
(*c*) The CHANNELS switch (S1A-C), which selects the desired channels of the three provided.
(*d*) The R/T—M.C.W. switch (S2A-B).
(*e*) The TRIM AERIAL control (C4A), which is adjusted to tune the aerial circuit.

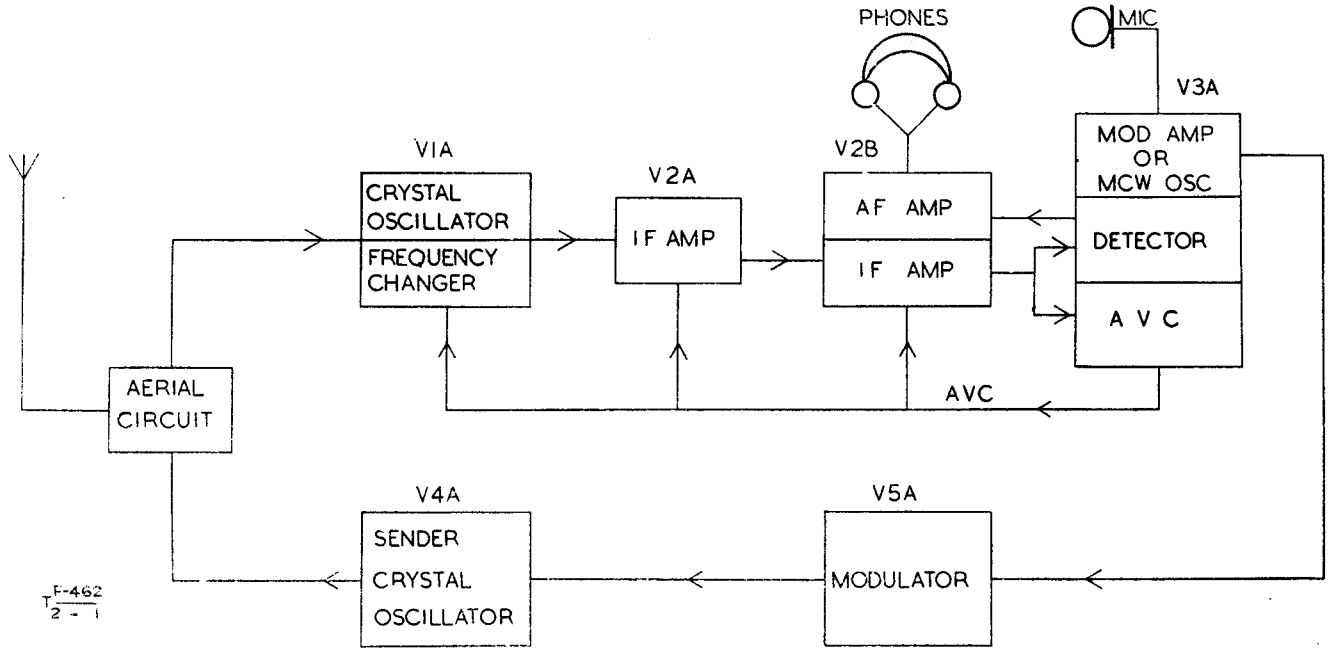

Fig. 1—Block diagram

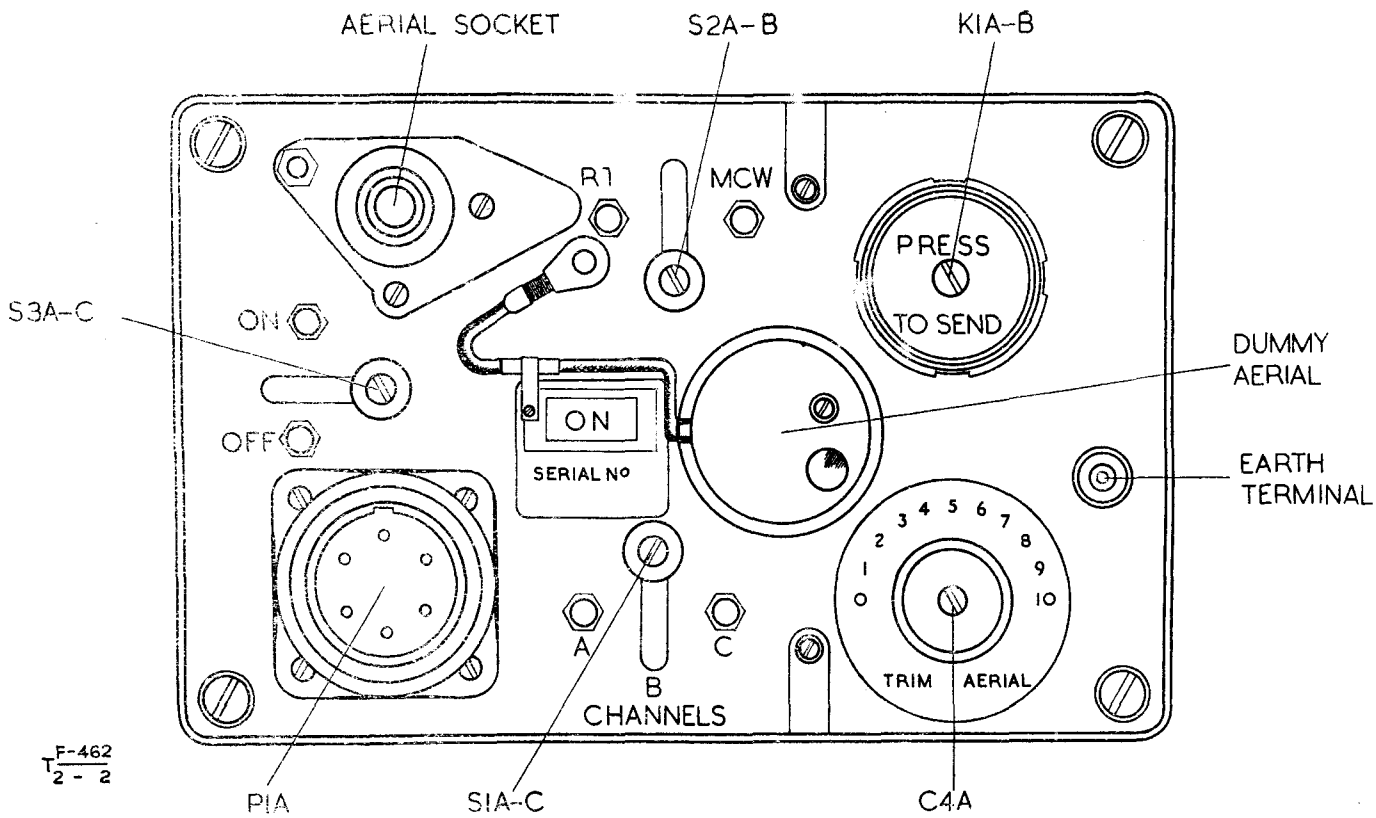

Fig. 2—Front panel

9. The following additional items are on the top panel:—
   (*a*) The aerial socket into which the aerial rods are plugged. The aerial adaptor is plugged into this socket when a 16 ft. rod aerial is used.
   (*b*) The six-way plug for connections to batteries, headphones and microphone.
   (*c*) The dummy aerial may be plugged into the aerial socket in place of the aerial. The lamp B1A indicates the sender output into the dummy aerial.

10. The panel is held to the base by means of four screws. A rubber gasket is provided to make a waterproof joint between the set and its case.

TECHNICAL DESCRIPTION

11. All valves have 2V heaters, with which resistors are inserted in series to permit the valves to be run from the 3V L.T. battery.

Receiver

12. The aerial circuit (which is also used as the aerial circuit of the sender) is tuned by C4A, the external AERIAL TRIM knob of the set. In order to avoid having to retune this external trimmer every time the set is changed from one channel to another, an additional internal trimmer is switched in by the CHANNELS switch; there are three trimmers (C20A, C20B and C20C), pre-set to make the aerial tuning correct for the particular crystals in use. The condenser C9A, in series with the aerial coil, is chosen so that the additional combination acts as an I.F. filter, to prevent direct reception from any interfering station on or near a frequency of 1,550kc/s.

13. The first valve is the frequency changer V1A (ARTP 2). The frequency of the triode oscillator portion is fixed by the receiver crystal; the oscillator anode coil is so arranged that any crystal within the given waveband will oscillate when plugged in, and no retuning of the anode circuit is necessary. The frequency of the oscillator (and of the crystal) is not the same as that of the signals which it is desired to receive, being 1,550kc/s lower than the signal frequency on the three higher frequency bands, and 1,550kc/s higher than the signal frequency on the lowest frequency band.

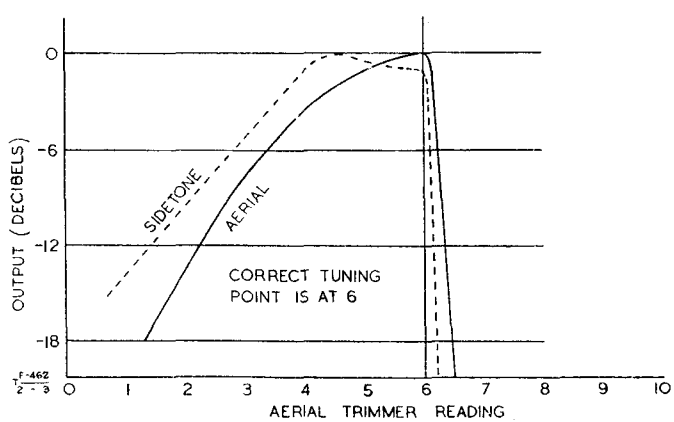

Fig. 3—Graph, aerial trimmer reading/output

This issue replaces and cancels pages 3 and 4 of Issue 2. Paras marked ● are additional.

14. The first I.F. transformer follows the frequency changer and feeds the first I.F. valve V2A (ARP12). This is followed by the second I.F. transformer feeding the second I.F. valve V2B (ARP12); these transformers each employ two tuned circuits and are tuned by adjustment of the position of the iron-dust cores in the moulded coil formers. The I.F. is 1,550kc/s, and it is essential that the transformers should be tuned accurately to this frequency since the signal they are required to amplify is fixed at exactly 1,550kc/s, this being the difference between the frequency crystal in the set and the sender crystal at the distant station. The third I.F. transformer is close-coupled, only one of the circuits being tuned; its screening box is arranged to screen also several other components. This transformer feeds the detector and A.V.C. diodes, which are part of V3A.

15. The detector output is fed to the grid of V2B through R13B, C3B and R6C. V2B acts as a reflex A.F. amplifier and feeds the headphones through the output transformer T1A. Due to the presence of the components R12A and C12A, the anode load of V2B at audio frequencies primarily consists of T1A, that at the intermediate frequency being L5A.

16. The A.V.C. diode feeds bias to the grid of V1A and V2B through the resistors R3A and R10A. C15B is the A.V.C. decoupling condenser.

Sender

17. V4A (ATP4) acts as a crystal-controlled oscillator with a tuned anode circuit. The output transformer T1A is connected to the V4A grid circuit through R7B. Sidetone may thus be heard in the headphones and this gives an indication of the output of the sender oscillator. If C4A is turned down from maximum capacity, the sidetone suddenly becomes loud. This point is the setting of C4A for maximum sender output (see Fig. 1).

18. The small audio-frequency voltage produced by the throat microphone is applied to the triode section of V3A through the 100 : 1 ratio microphone transformer T3A. The output of V3A is applied to the push-pull amplifier V5A through the modulator input transformer T2A. The audio output voltage from V5A is developed across the centre-tapped modulator output auto-transformer T4A and is applied to anode and screen of V4A in series with the H.T. feed.

19. The sender is switched for M.C.W. operation by S2A-B The primary of T3A is then connected into the anode circuit of V3A. This valve stage then acts as an oscillator operating between 1,000c/s and 1,500c/s. The voltage developed across R20A is applied to V5A through T2A, as for R/T working. R20A is chosen to give nearly 100% modulation without over-running V5A, by applying an excessive A.F. input. The modulation wave form on M.C.W. is made non-sinusoidal in order to give a rough note.

Send-receive switching

20. Send-receive switching is carried out by means of K1A-B. With S2A at R/T, both H.T. and filament circuits are changed by K1A and K1B respectively. On M.C.W., morse keying is required; therefore only the H.T. is switched, the heater supply to the sender being permanently left on to allow for rapid switching from send to receive.

Batteries

21. The L.T. current taken is 350mA for the receiver valves and 550mA for the sender valves. The H.T. current taken is 10mA on receive, 28mA on send R/T, and 37mA on send M.C.W.

22. The circuit is arranged so that the bias section of the battery is run down at the same average rate as the H.T. section, by means of the resistors R15A, R16A and R17A. The bias value is very important, and non-standard batteries, or batteries which have been in use on other sets, should never be used on the No. 46 set.

23. The point marked +12V on the battery is connected to the chassis and the L.T. −, while the point marked 0V is used to supply the − 12V grid bias.

24. The life of the battery depends upon a number of factors. For example, a battery which has been in stock for six months will usually have a shorter working life.

Telephones and microphones

25. The phones used (type D.L.R. 2) are considerably more sensitive than normal types, and are 500-1,000 Ω impedance at middle audio frequencies. The throat microphone is 30-100 Ω impedance, and gives an output of 1 to 5mV on speech.

Aerial coupling

26. The aerial circuit is primarily designed for matching to a rod aerial about 8 ft. in length, having a capacity of about 20*p*F and a resistance of 20-60 Ω. Larger aerials are accommodated by inserting a series aerial condenser (in the AERIAL ADAPTOR) which reduces the effective capacity of the larger aerial to about 20*p*F and also maintains the correct resistive loading on the circuit.

Alterations in positions of R15A and R16A

●27. In sets of serial numbers given below in para. 28 the positions of R15A and R16A have been reversed. This has been made necessary by a change in the valve characteristics of the later productions of the AR8 used in position V3A. This change necessitates an altered grid bias, which is brought about by the above circuit changes, in order that the correct M.C.W. note may be obtained.

Serial numbers affected

●28. All sets of serial number above 21489 and

8440	17430	19094	19310	19493	19786	20183
9935	17597	19113	19318	19502	19794	20225
9958	17673	19131	19323	19521	19807	20228
10017	17705	19136	19327	19522	19837	20231
11229	17714	19142	19331	19540	19870	20233
12871	17743	19155	19335	19544	19881	20234
12995	17820	19163	19347	19551	19882	20242
13518	17975	19183	19375	19558	19440	20243
13608	18310	19197	19378	19571	19998	20248
16385	18312	19201	19379	19576	20001	20282
16447	18411	19202	19394	19596	20003	20283
16842	18492	19206	19397	19598	20012	20287
16952	18602	19217	19403	19622	20017	20288
16953	18946	19235	19409	19626	20023	20289
16975	19016	19248	19418	19630	20025	20272
16993	19018	19252	19433	19633	20027	20293
17019	19043	19260	19434	19667	20029	20294
17059	19049	19261	19435	19688	20030	20295
17172	19057	19265	19436	19694	20031	20296
17213	19065	19273	19456	19715	20032	20376
17295	19077	19279	19460	19717	20033	20379
17296	19079	19280	19464	19720	20034	20858
17348	19084	19283	19487	19731	20181	
17374	19088	19303	19488	19750	20182	

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Circuit reference	*Remarks*
	INDUCTORS
L1A	Aerial tuning inductance
L2A	Frequency changer, oscillator, anode inductance
L3A	First I.F. transformer, primary
L3B	„ „ „ secondary
L3C	Second I.F. transformer, secondary
L4A	„ „ „ primary
L5A	Third I.F. transformer, primary (untuned)
L6A	„ „ „ secondary
L7A	Filament choke, V3A
L8A	R.F. choke, sender oscillator anode
L9A	Filament choke, V1A
	TRANSFORMERS
T1A	Output transformer
T2A	Modulator input transformer
T3A	Microphone transformer
T4A	Modulator output transformer
	SWITCHES
S1A-C	3-pole, 3-way, crystal channel, switch
S2A and S2B	3-pole, 2-way, R/T—M.C.W., switch
S3A-C	3-pole, ON/OFF, switch
	VALVES
V1A	ARTP 2, triode-pentode
V2A and V2B	ARP 12, pentode
V3A	AR 8, double-diode-triode
V4A	ATP 4, R.F. pentode
V5A	ARP 37, double pentode
	PLUGS
P1A	6-point battery plug
	KEYS
K1A and K1B	Morse key, send-receive, switch

Circuit reference	*Value*	*Tolerance*	*Wattage*
RESISTORS			
R1A	27kΩ	±10%	¼W
R2A: Range 1	39kΩ		
„ 2	33kΩ	±10%	
„ 3	15kΩ		
„ 4	15kΩ		
R3A-D	1MΩ	±10%	¼W
R4A	3MΩ		
R5A-B	2·2kΩ	±10%	
R6A-F	100kΩ	±10%	¼W
R7A-C	47kΩ	±10%	¼W
R8A	100kΩ	±10%	¼W
R9A-C	12kΩ	± 5%	¼W
R10A	2·2MΩ	±10%	¼W
R11A	150kΩ	±10%	¼W
R12A	1kΩ	±10%	¼W
R13A-B	330kΩ	±10%	¼W
R14A	100Ω	±10%	
R15A-C	100Ω	±10%	½W
R16A	68Ω	±10%	½W
R17A	680Ω	±10%	½W
R18A	1Ω		
R19A	10kΩ	±10%	¼W
R20A	1·8kΩ	±10%	¼W

Circuit reference	*Capacity*	*Tolerance*	*Working voltage*	*Remarks*
CONDENSERS				
C1A-B	20pF	±2½%		Ceramic
C2A	40pF	± 5%		
C3A-B	0·001μF			
C4A	40pF			Variable
C5A-F	0·01μF			
C6A-D	40pF			
C7A	2pF			
C8A-B	30pF	±10%	500V	
C9A: Range 1	0·0029μF			
„ 2	0·0018μF			
„ 3	0·0011μF			
„ 4	0·530pF			
C10A-D	0·1μF		250V	
C11A-B	0·0003μF			
C12A	0·001μF		350V	
C13A-D	0·002μF			
C14A	50pF			
C15A-B	0·05μF			
C16A	0·0001μF	±10%	350V	
C17A	15pF	± 5%		Ceramic
C18A	8μF		500V	Electrolytic
C19A	1pF			
C20A-C	40pF			

Table 1001—Details of components (Fig. 1001)

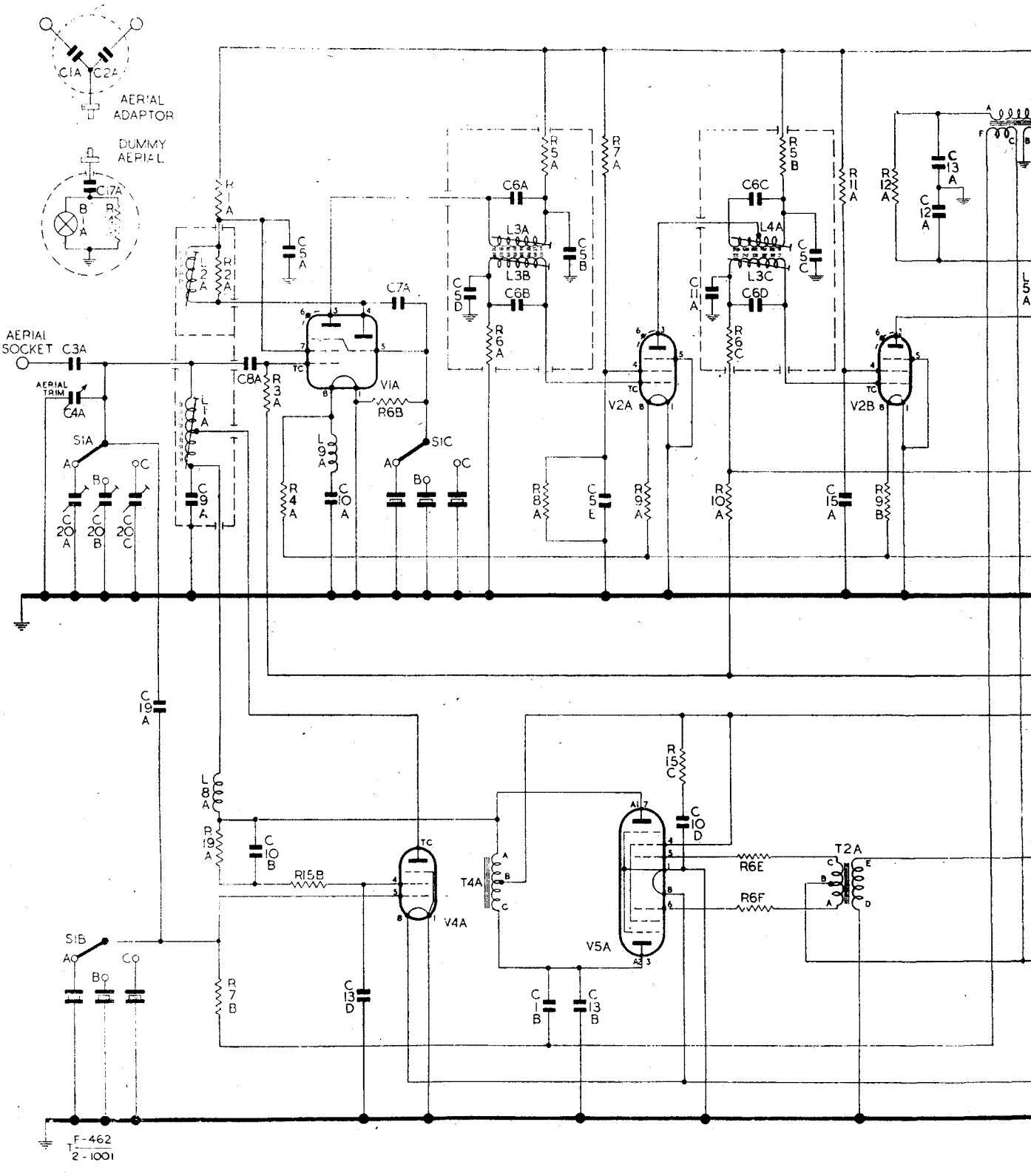

Fig. 1001—Circuit

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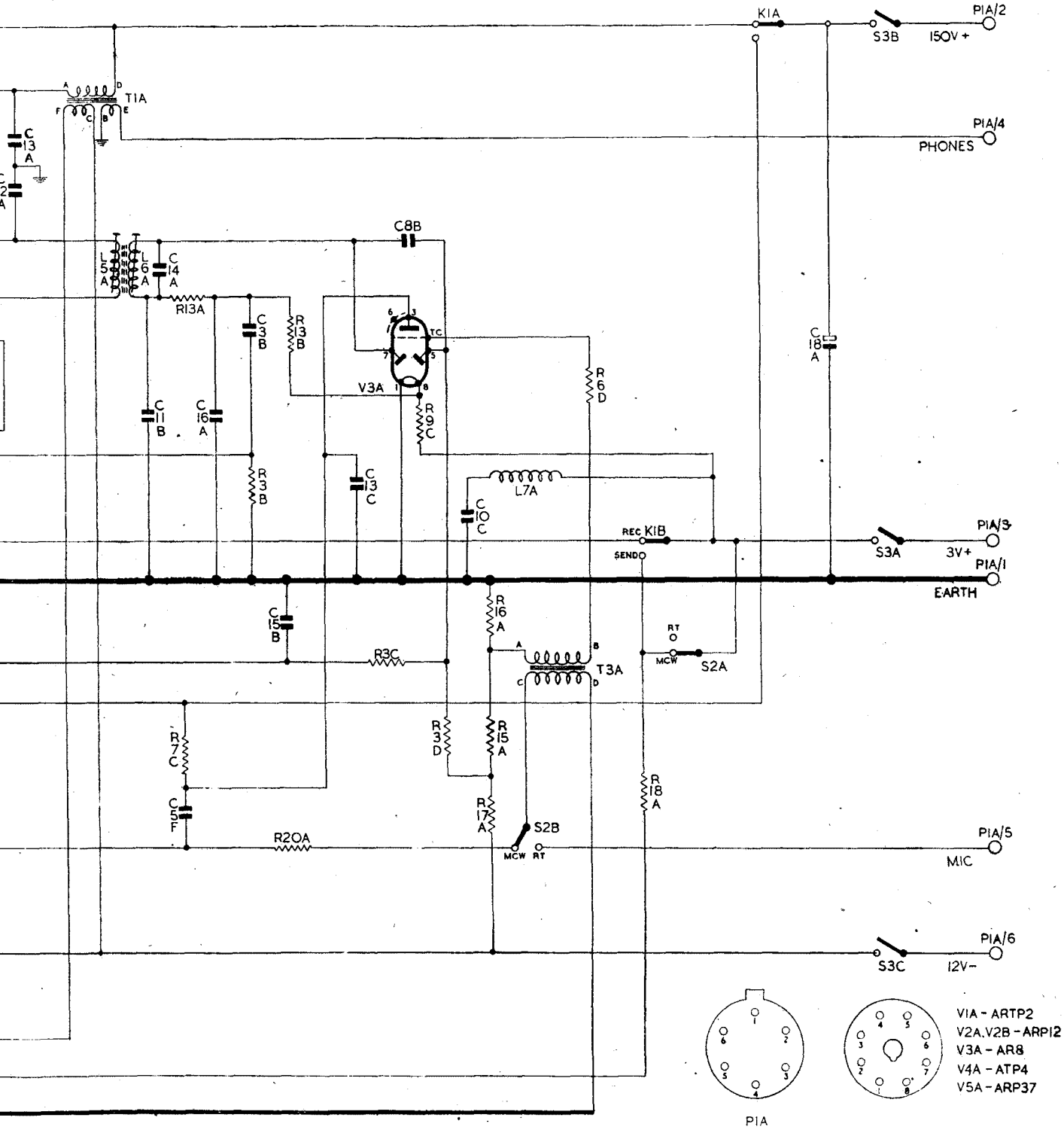

001—Circuit diagram

END

ated 5 Apr. 1944, which has been amended throughout.

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