L A O school

WIRELESS SET. No. 46.

General Description.

(Based on E. M. E. R. F. 262 Issue I, dated 5th April, 1943.)

Note.—This information is provisional and is supplied for the use of R./I.E.M.E. and Signals personnel concerned pending the issue of more complete instructions. All errors of a technical nature should, therefore, be notified through the usual channels, to the Director of Mechanical Engineering (MG. ME-12) G. H. Q. (I).

1. **General Data.**—Type of set :— Sender-receiver.

Frequency range :—Three crystal-controlled frequencies in one of four bands :—

3·6 — 4·3 Mc. (red)
5·0 — 6·0 Mc. (blue)
6·4 — 7·6 Mc. (white)
7·9 — 9·1 Mc. (yellow)

Intermediate frequency :—1550 kc.

Power supply :—Battery, dry, 162/3 V, No. 1.

Power consumption :—

	L. T.	H. T.
Receive R/T	350 mA	10 mA
Receive M. C. W.	900 „	10 „
Send R/T	550 „	28 „
Send M. C. W.	550 „	37 „

3. **Frequency channels.**—The set is designed to cover the following bands by means of plug-in coils :—

3·6 — 4·3 Mc. 6·4 — 7·6 Mc.
5·0 — 6·0 Mc. 7·9 — 9·1 Mc.

Any three frequencies in the band chosen may be obtained by plugging in the appropriate crystals, and adjusting three pre-set trimmers. The transmitter frequency is stable and accurate to approximately 0·01% and receiver to approximately ± 3 kc. 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 available, 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.

Valves :—			
V 1A	ARTP 2	Triode-pentode	Frequency-changer.
V 2A	ARP 12	R. F. pentode	First I. F. amplifier.
V 2B	ARP 12	R. F. pentode	Second I. F. and reflexed A. F. amplifier.
V 3A	AR 8	Double-diode-triode	Diodes only used on receiver as detector and A. V. C. rectifier. Triode used as sender modulation amplifier.
V 4A	ATP 4	R. F. pentode	Sender oscillator.
V 5A	ARP 37	Double pentode	Push-pull modulator.

Weight and dimensions :—

	Weight. lbs.	Width. ins.	Height. ins.	Depth. ins.
No. 46 set	9	6½	12	4
Set carrier with aerial B	2	7½	12½	4½
Battery carrier with junction box and leads	4	10	13	5½
Battery, 162/3 V in bag	7½	9	5	5
Phones assembly, No. 5	1½—	leads 4 ft. 6 ins.		
Complete station as carried	24—33	allowing for two batteries and phone assembly		
Antenna rods F 16 ft. (fixed station)	6½	..	..	..

2. **General.**—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 complete set comprises a crystal-controlled waterproofed transceiver in a carrying case, with No. 18 set type batteries carried separately in a haversack. It is a one-man load and is designed for use with rod aerials 2 to 16 ft. in length. Connections from the battery haversack to the D. L. R. phones and throat microphones are made by means of a snatch plug, those between the set and battery haversack by means of a six point screw plug and multicore screened cable.

4. **Controls.**—All the controls are situated on the top panel of the sender-receiver unit. The controls are as follows (see also fig. 1) :—

(a) ON-OFF switch with indicator to show clearly at a distance.

(b) PRESS TO SEND—RELEASE TO RECEIVE—arranged so that this control can be used if necessary for Morse transmission up to 12 w.p.m.

(c) CHANNELS switch—selecting the desired channel of the three provided.

(d) R/T—M.C.W. switch—selecting the type of transmission.

(e) TRIM AERIAL control—adjusts for aerials of different capacities.

Remaining items on the panel are :—

(f) Aerial socket into which aerial rods B are plugged. When an F aerial or other larger aerial is used, the aerial adaptor is plugged in to the socket and the aerial connected to a terminal on the adaptor.

(g) Six-way plug to batteries, headphones and microphone.

(h) Dummy aerial. Bulb glow indicates sender output when lead (J) is plugged into socket (F) in place of aerial.

(k) Four screws holding panel to case: waterproof joint is provided by a rubber gasket.

TECHNICAL DESCRIPTION

5. The following description should be read in conjunction with figs. 2, 3, 4 and 6. Note that all valves are of the 2 V filament type with resistances inserted to allow of their being run from the 3V. L.T. battery.

6. **Receiver (Fig. 3).**—The aerial circuit (which is also used as the aerial circuit for the sender), is tuned by C 4A, controlled by the external AERIAL TRIM knob on the top of the set.

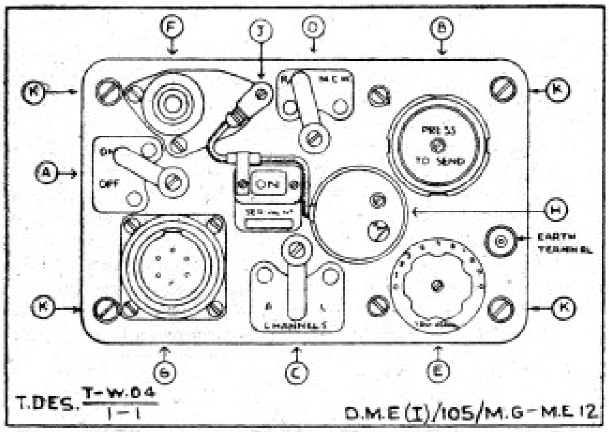


Fig. 1.—Control panel.

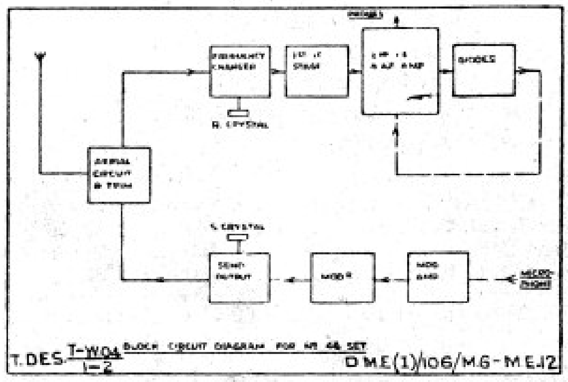


Fig. 2.—Block schematic diagram.

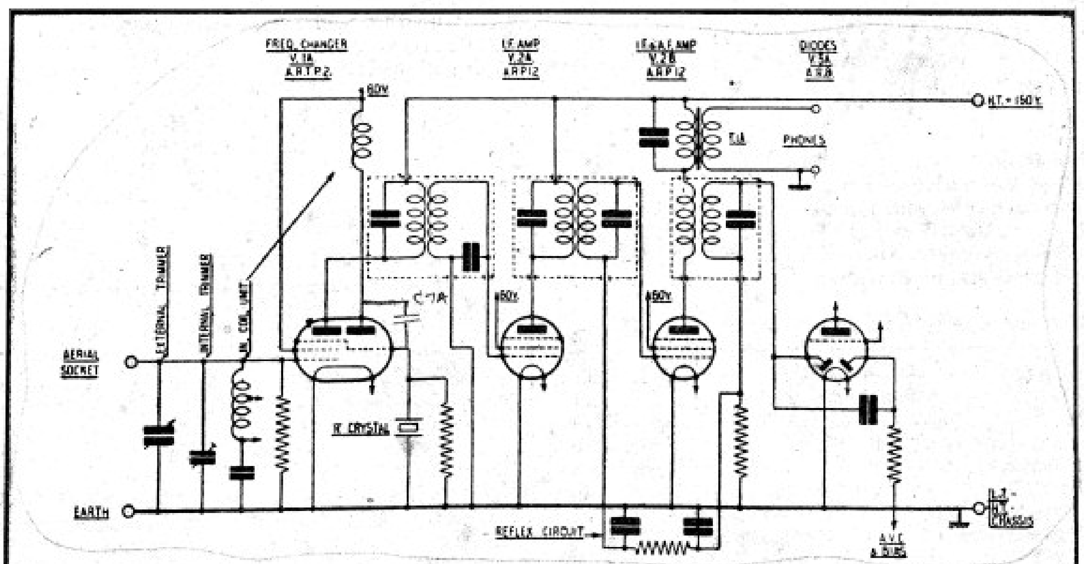


Fig. 3.—Simplified circuit diagram of receiver, omitting switch, de-coupling, A. V. C., etc.

W/Set No 46 (ENG)
Simplified Diagrams
W/3D

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 of these trimmers (C20A, C20B, C20C), pre-set to make the aerial tuning correct for the particular crystals in use. The condenser C 9A in series with the serial coil is chosen so that the combination acts as an I. F. filter, to prevent direct reception from any interfering station on or near a frequency of 1550 kc.

7. The first valve is the frequency changer (V 1A). 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 1550 kc. lower than the signal frequency on the 7·9—9·1, 6·4—7·6, and 5·0—6·0 Mc. bands, and 1550 kc. higher than the signal frequency on the 3·6—4·3 Mc. band.

8. The first I.F. transformer follows the frequency changer and feeds the first I. F. valve (V 2A). This is followed by the second I. F. transformer feeding the second I.F. valve (V2B); these transformers each employ two tuned circuits, and are adjusted by screwing the iron dust cores in the moulded coil formers. The I. F. is 1550 kc. 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 1550 kc., this being the difference between the frequency of the receiver 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: the third I.F. transformer screening box is arranged to screen also several other components, some of which are involved in amplification at I.F. This transformer feeds the diodes, which are part of V 3A; the A. V. C. diode feeds bias to V 1A and V 2B through a network of resistances and condensers.

9. The rectified (audio frequency) signals from the detector diode are then fed back to the grid of V 2B through a filter and the second I. F. transformer; in this way V 2B acts as an audio amplifier and feeds the phones through a transformer connected in the anode circuit. The A. V. C. voltage applied to the grid of V 2B reduces the audio amplification on strong signals, giving a practically level A. V. C. curve.

10. **Sender (Fig. 4).**—The ATP 4 (V 4A) acts both as oscillator and as output valve; the crystal, connected between its grid and earth, controls the frequency, but the anode (*i.e.*, aerial) circuit requires to be tuned to the crystal (or to a slightly higher frequency) if the valve is to oscillate. For sidetone, the phones transformer T 1A is connected in V 4A grid circuit, thus permitting the modulation to be made audible. Fig. 5 shows the variation in sender R. F. output and in loudness of sidetone as the aerial trimmer is rotated. Note that the loudness of this sidetone remains fairly constant as the trimmer is tuned below the correct tuning point; this peculiarity makes it important to follow carefully the instructions given for tuning (as the trimmer is turned down from maximum capacity, the first point is chosen at which the tuning note becomes loud).

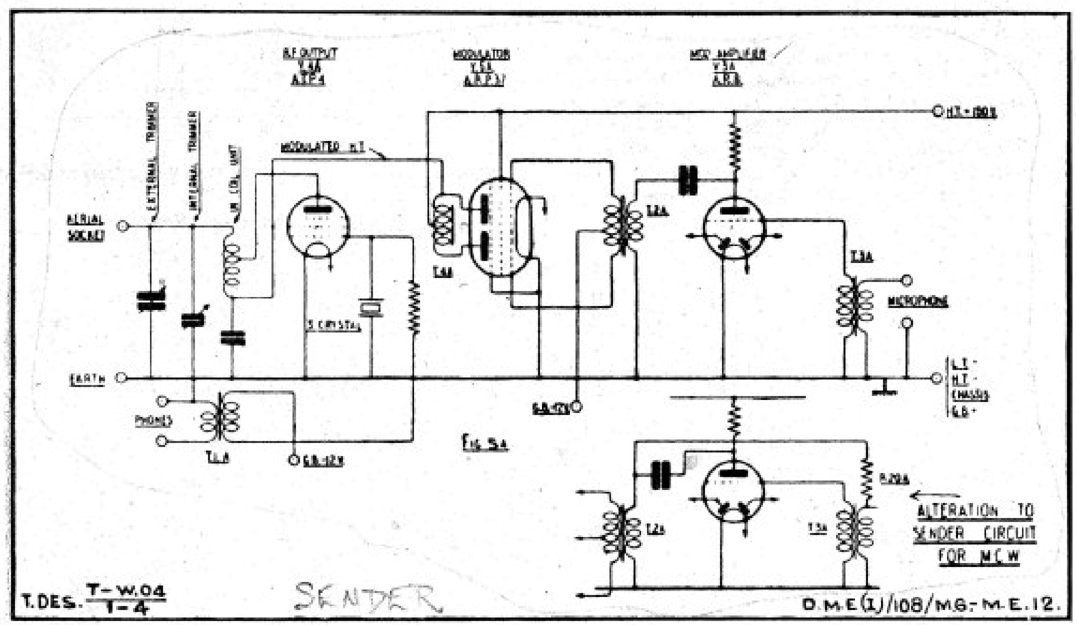


Fig. 4. Simplified circuit diagram of sender switched to R/T omitting switching, de-coupling, A. V. C., etc.

11. The small audio voltage (a few mV) produced by the throat microphone is magnified successively by the 100/1 ratio microphone transformer (T 3A), by the triode section of V 3A, and by the Q.P.P. intervalve transformer (T 2A). This feeds the modulator valve V 5A, which works as an overbiassed push-pull (Q.P.P.) amplifier; the anode current here is normally about 5 mA, rising to about 15 mA on M. C. W. or even more on modulation peaks. The audio output voltage from V 5A is developed across the centre-tapped modulation autotransformer (T 4A) and applied in series with the H. T. feed to the anode and screen of the ATP 4.

12. On M. C. W. the circuit is modified as shown in fig. 4. V 3 A is made to oscillate at a frequency between 1000 and 1500 cyc. by connecting the microphone transformer primary into its anode circuit. The voltage developed by the anode current across 1800Ω resistance R 20A (the transformer primary has a very low impedance) is then applied to the intervalve transformer and modulator as before; the value of the resistance is chosen to give nearly 100% modulation but also to avoid the overrunning of V 5A which would occur if an excessive input were applied. The M.C.W. modulation waveform is intentionally made non-sinusoidal in order to give a rough note.

13. Send-receive switching and morse keying is carried out by means of K 1A and B. With S 2A at R/T, both H. T. and filament circuits are changed by K 1A and B respectively. On M. C. W., however, only the H. T. is switched, the filament supply to the sender being left on all the time to allow of the rapid switching needed for morse transmission.

14. **Battery.**—The current consumption has been given in para. 1. In this connection the following points should be noted :—

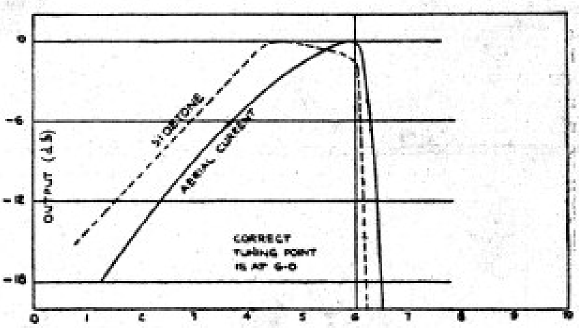
(a) The circuit is arranged so that the bias section of the battery is run down at the same average rate as the H. T. section, by means of the resistors R 15A, R 16A, R 17A. The bias value is very important, and non-standard batteries, or batteries which have been in use on other sets, should never be connected to the No. 46 set.

(b) The point marked + 12 V on the battery is connected to chassis and to L.T.—, while the point marked O V is used to supply the —12 V grid bias.

(c) 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.

15. **Telephones and microphones.**—The phones used (type D.L.R.2) are considerably more sensitive than normal types, and are 500-1000 Ω impedance at middle audio frequencies. The throat microphone is 30-100 Ω impedance, and gives an output of 1 to 5 mV on speech.

16. **Aerial Coupling.**—The aerial circuit is primarily designed for matching to a rod aerial of about 8 ft. in length, having a capacity of about 20 μμF 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 μμF and also maintains the correct resistive loading on the circuit.



T.DES. $\frac{T-W.04}{1-5}$ D.M.E(I)/109/M.G.-M.E.12.

Fig. 5.—Aerial Trimmer Reading.

Table 1.—Junction box internal connections (Fig. 6).

No. of terminal in junction box.	Marking on top plate.	6-way cable.	5-way cable.	Operator's 3-way cable.	Extra 3-way cable.
1. L. T. + . . .	+3 V .	Blue .	Green .		
2. Phones . . .		Yellow .		White (green end) .	White (green end).
3. H. T.+set . .		Red .			
4. H. T. +Batt. .	+150V .		Red		
5. Mic . . .		Green .		White (red end) .	White (red end).
6. G. B.— . . .	—12 V .	White .	Yellow		
7. Case . . .		Black	White		
8. Case . . .			Blue		White (blue end)
9. Case . . .				White (blue end)	

Notes on Table 1.—

(1) On preproduction models, serial nos. 1—32, the yellow wire of the 6-way cable was connected to terminal 5 in the junction box, and the green wire to terminal 2. Correspondingly the connections from phones and microphones to the male snatch plug were interchanged.

(2) The socket marked +12 V on battery is connected through to case of set and junction box, and to L. T.—.

(3) The socket marked H. T.— on battery is used to supply grid bias (—12 V) to set.

Table 2. Circuit component references

Inductances.

Circuit reference	Function
L 1A	Aerial tuning inductance
L 2A	Frequency changer, oscillator, anode inductance.
L 3A	First I. F. transformer, primary
L 3B	First I. F. transformer, secondary
L 3C	Second I. F. transformer, secondary
L 4A	Second I. F. transformer, primary
L 5A	Third I. F. transformer, primary (untuned)
L 6A	Third I. F. transformer, secondary
L 7A	Filament choke, V 3A
L 8A	R. F. choke, sender oscillator anode
L 9A	Filament choke, V 1A

Transformers

T 1A	Output transformer
T 2A	Modulator input transformer
T 3A	Microphone transformer
T 4A	Modulator output transformer

Switches

S 1A-C	3-pole, 3-way crystal channel switch
S 2A & B	3-pole, 2-way R/T—M.C.W. switch
S 3A-C	3-pole, on-off switch

Valves

V 1A	ARTP 2, Triode-pentode
V 2A & B	ARP 12, R. F. pentode
V 3A	A. R. 8, Double-diode-triode
V 4A	ATP 4, R. F. pentode
V 5A	ARP 37, Double pentode

Plugs

P 1A	6-point battery plug

Keys

K 1A & B	Morse key send-receive switch

Condensers.

Circuit reference.	Value in F.
C 1A & B	20 p.
C 2A	40 p.
C 3A & B	.001 μ
C 4A	40 p variable
C-5A-F	.01 μ
C-6A-D	40 p
C 7A	2 p
C 8A & B	30 p
C 9A	.0029 μ
C 10A-D	.1 μ
C 11A & B	.0003 μ
C 12A	.001 μ
C 13A-D	.002 μ
C 14A	50 p
C 15A & B	.05 μ
C 16A	.0001 μ
C 17A	15 p
C 18A	8 μ
C 19A	1 p
C 20A-C	40 p trimmers

Resistances

Circuit reference.	Value in
R 1A	27 k, ¼ W
R 2A	39 k
R 3A-D	1 M, ¼ W
R 4A	3
R-5A & B	2200
R-6A-F	100-K, ¼ W
R 7A-C	47-K, ¼ W
R 8A	100-K, ¼ W
R 9A-C	12, ¼ W
R 10A	2.2 M, ¼ W
R 11A	150-K, ¼ W
R 12A	1000, ¼ W
R 13A & B	330-K, ¼ W
R 14A	100
R 15A-C	100, ¼ W
R 16A	68, ¼ W
R 17A	680, ¼ W
R 18A	1
R 19A	10-K, ¼ W
R 20A	1800, ¼ W

Note.—Condensers and resistances corresponding to C 9A and R 2A have the following values in the different coil units :—

7·9—9·1 Mc	·0029 μF	39 k Ω
6·4—7·6 Mc	·0018 μF	33 ,,
5·0—6·0 Mc	·0011 μF	15 ,,
3·6—4·3 Mc	·00053 μF	15 ,,

Slightly different values for C 9A (·0025, ·001, and ·0005 μF) will be found in serial nos. 1—1000.

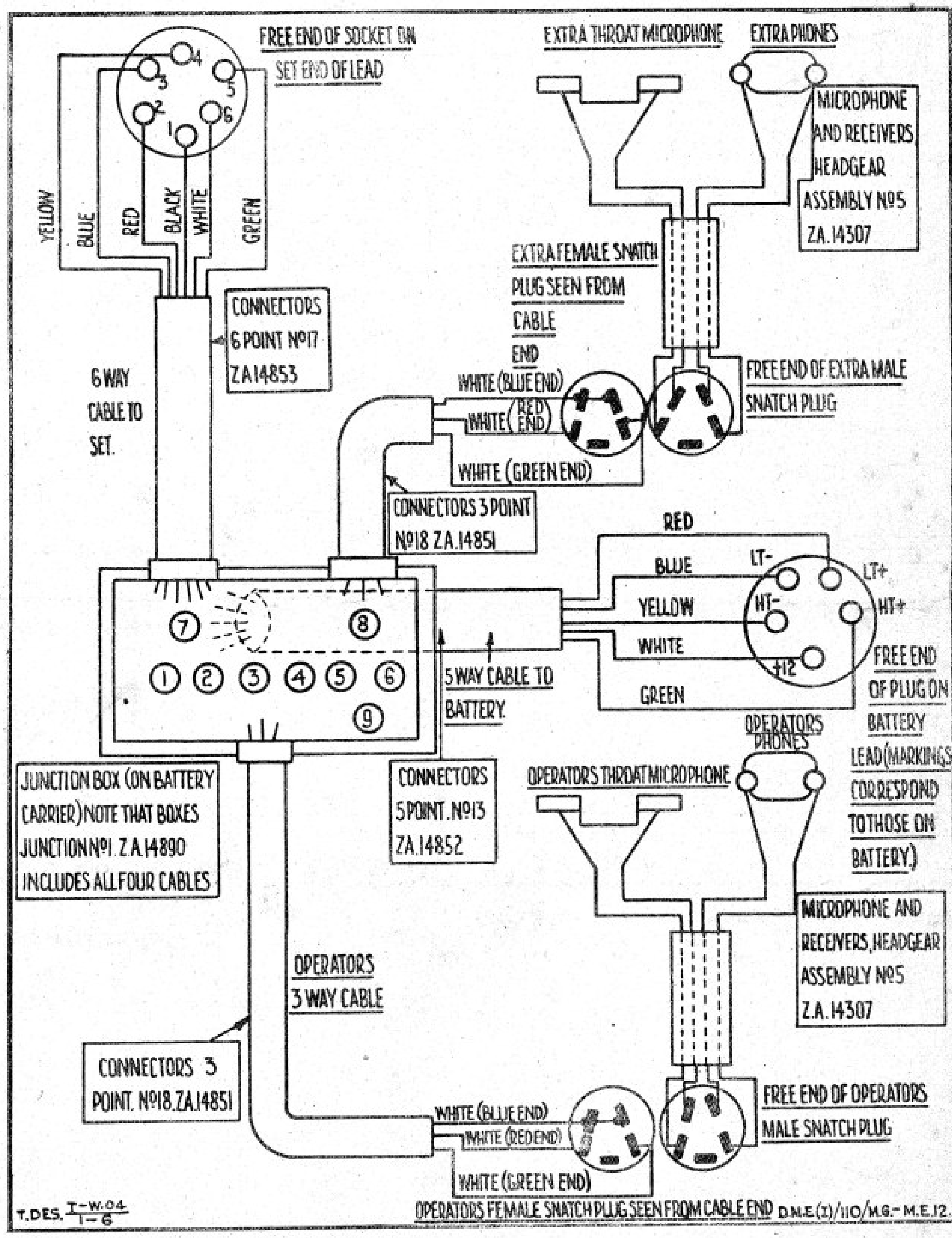
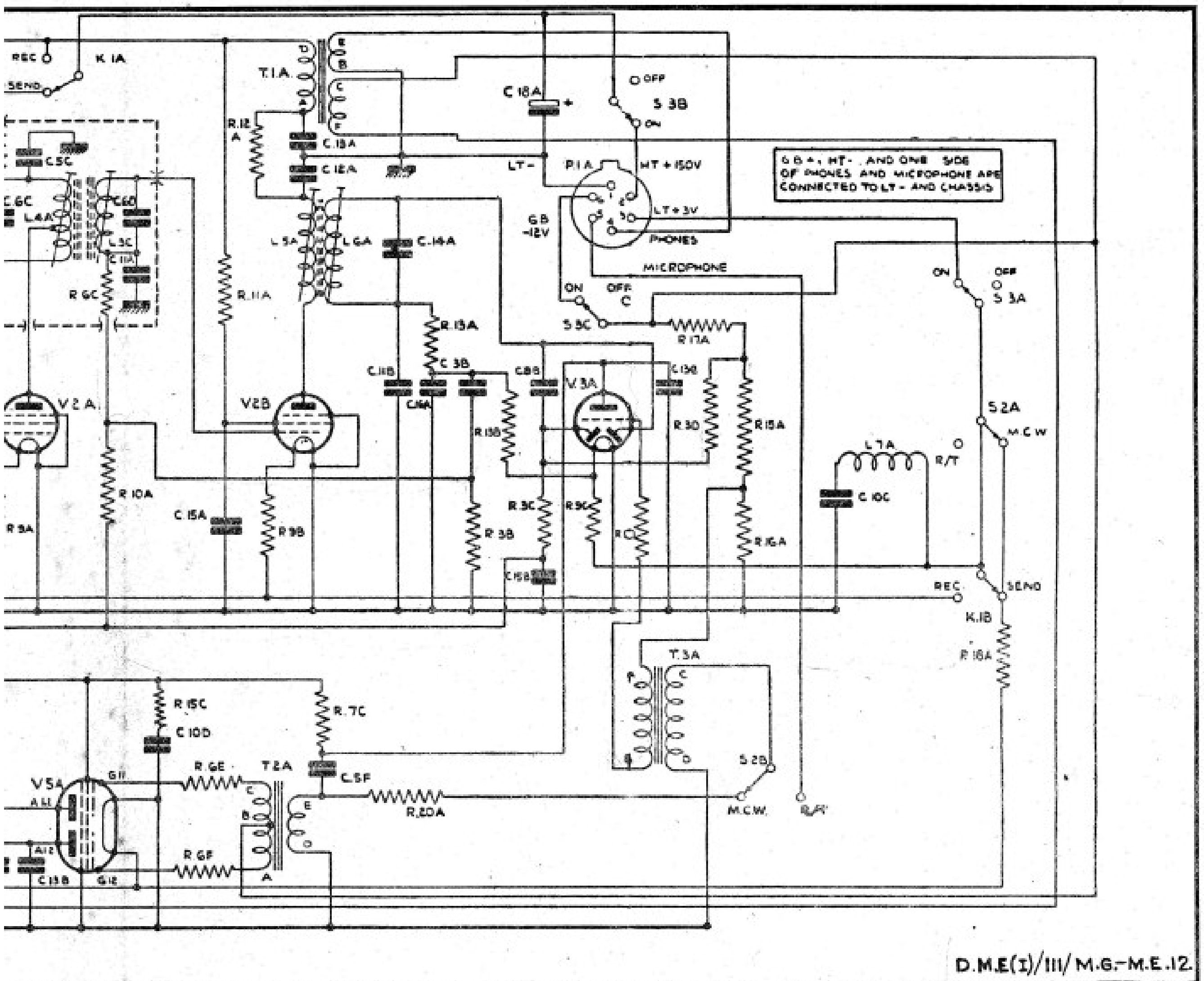


Fig. 6.—Circuit diagram for junction box and leads.



g. 7.—Circuit diagram of Wireless Set, No. 46.

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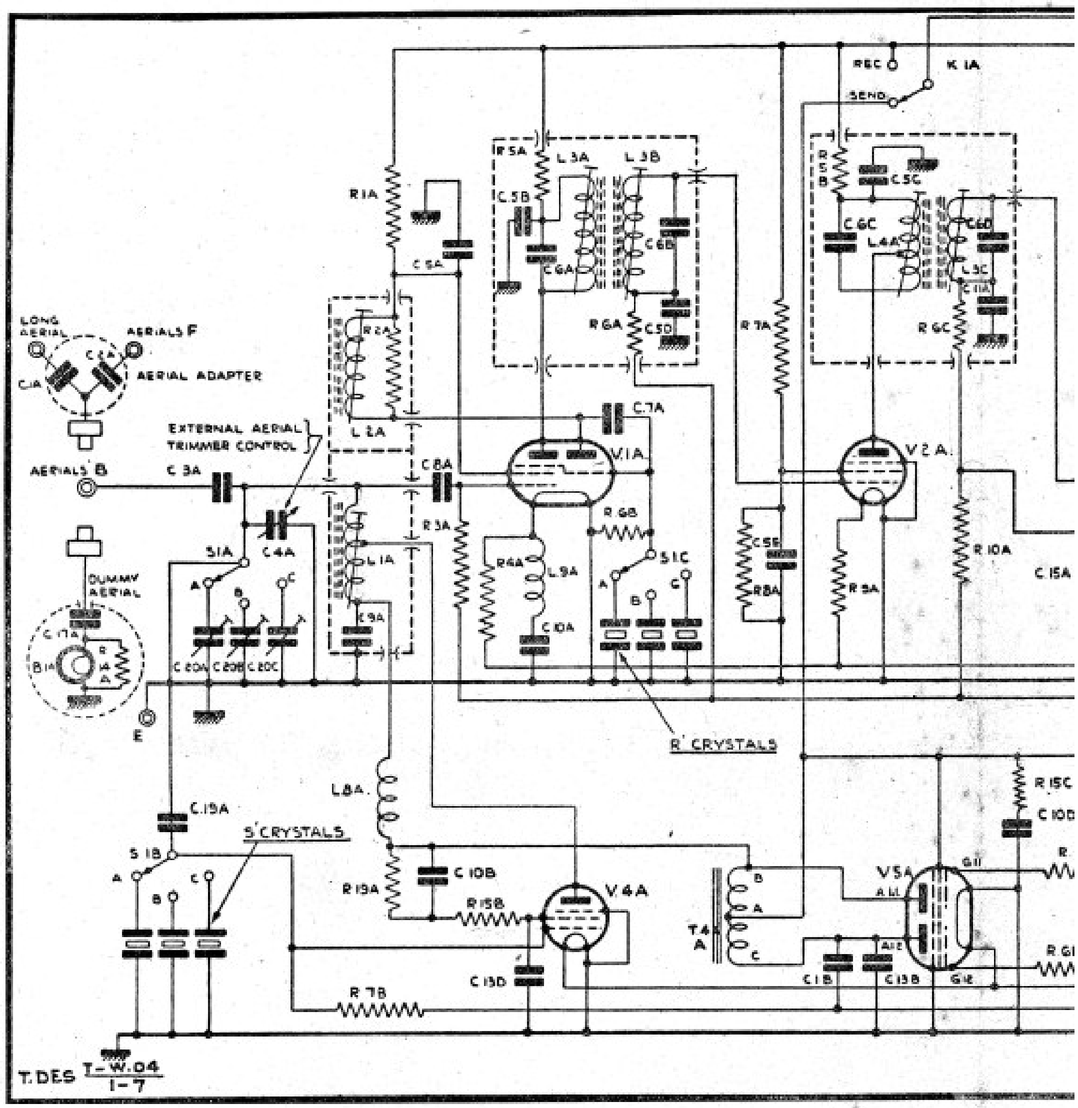

Fig. 7.—Circuit diagram

LH Q school

D. M. E. (INDIA)
TECHNICAL INSTRUCTIONS
(I. A. O. 1398/43)

WORKSHOP
TELS. W-11

WIRELESS SET No. 46

Instructions for testing

1. This information is provisional and is supplied for the use of R/I. E. M. E. personnel pending the issue of more complete instructions. All errors should, therefore, be notified through the usual channels to D. M. E. (I), M. E. 12/G. H. Q., New Delhi.

NORMAL SENDER CHECK TESTS.

Aerial Current.

2. Connect a 0-200 mA aerial ammeter (Thermoammeter) between the aerial socket and the dummy aerial plug, taking care to minimise stray capacity by using very short leads and keeping the meter well clear of earthed objects. When tuned in the usual way, by side tone, the normal reading ranges from about 140 mA at 9 Mc to 80 mA at 3·6 Mc. (*N. B.* The above figures also hold roughly for current into the actual 8 section aerial). Reading should rise slightly (about 5 per cent.) when switched to M. C. W., and should rise by 20-25 per cent. on R/T with loud sounds at the microphone. The H. T. current when the sender is accurately tuned should not exceed 35 mA on R/T or 45 mA on M. C. W ; the rise in current (which should be 8-11 mA) on switching to M. C. W. provides a check on the percentage modulation.

3. If readings are not normal, the first points to examine (by replacement or otherwise) are :—

Low R/T output	ATP. 4 valve.
Low M. C. W. or R/T modulation	ARP. 37 and AR. 8.
High H. T. current	Bias battery and circuits.

Modulator circuits.

4. Faults in the modulator circuit can best be tested for with an A. F. generator with attenuator, as in Table 1. In each case the aerial current reading should rise with the input given, by between 15 per cent, and 25 per cent, indicating 80-100 per cent. modulation.

5. The modulation may also be examined by feeding a C. R. O. from the aerial socket through 20 μμF, with a resistance of about 1,000 ohms shunted across the input terminals of the oscillograph. The M. C. W. waveform is not sinusoidal, and the peak-to-peak modulation is normally 80-90 per cent.

NORMAL RECEIVER CHECK TESTS.

6. An audio output meter, capable of reading 0·1 mW and having an impedance of about 500 ohms, is required. (N. B. If a large output were used for the tests, some A. V. C. action might be present and give rise to false results. As an alternative, 0·5 mW could be used if the generator will provide 70 per cent modulation). The R. F. signal generator is connected through a 20 μμF condenser to the aerial socket ; the generator is tuned in to the set, and the aerial trimmer must also be adjusted for maximum output. With the usual 30 per cent. modulation at 400 cyc. the input required for 0·1 mW output should be about 5 μV on all bands ; if the generator is fully modulated with speech, signals should be intelligible at about 1 μV. If the input is increased to 1 or 10 mV the output should be between about 0·25 mW and 2 mW.

7. Faults can best be located by testing each stage as in Table 2. In each case the generator (A. F., I. F. or R. F.) is to be connected to the point through the condenser specified ; the input figure given is that for 0·1 mW output.

TABLE 1. A. F. GENERATOR TESTS.

Points of injection.	Frequency in cyc.	Input in V.
In place of microphone*	1,000	4 m
In place of microphone*	400 or 4,000	8 m
To hot end of T 3A secondary	1,000	300 m
To hot end of T 2A primary	1,000	3 m
To either grid of ARP 37	1,000	7 m

*Generator output impedance must be approx. 300 hms for this test.

TABLE 2. FAULT LOCATION TESTS.

Frequency in cyc.	Applied to :—	Through capacity in F off	Input in V.
1000	Hot end of C 11B	0·1μ	0·25
400 or 3000	Hot end of C 11B	0·1μ	0·5
1000	V 2B grid	0·1μ	75 m
1550 k	V 2B grid	0·001μ	70 m

Frequency in cyc.	Applied to :—	Through capacity in F off.	Input in V.
1550 k	V 2A grid	0·1 μ	700 μ
1550 k	V 1A grid	0·1 μ	20 μ
1550 k	Aerial socket	20 μμ	10-100 m
R. F. signal.	V 1A grid	0·1 μ	30 μ

VOLTAGE AND CURRENT ANALYSIS.

8. Detailed examination for faulty components is facilitated by comparing voltages and currents with those given in Table 3. Tests Nos. 3 to 15 were measured on Avometer Model 7 on the 400 V range, and Tests Nos. 16 to 25 on the 10 V range of the same instrument. If a voltmeter taking a greater current is used, readings will be rather lower in some cases. The battery voltages were exactly 150 V 3·0 V, and 12·0 V. Provided that the H. T. and G. B. are reduced in the same proportion, figures may be reduced proportionately when checking on a slightly lower voltage. Figures were taken with the aerial tuned accurately and the set under normal working conditions ; figures for Tests Nos. 1 and 4 will vary considerably under the conditions on send. All voltages are measured relative to chassis.

TABLE 3. VOLTAGE AND CURRENT TEST FIGURES.

Test No.	R/T		M. C. W.	
	Send	Rec.	Send	Rec.
1. Total HT current	30	11	40	11
2. Total LT current	·62	·38	·62	·93
3. V 4A anode voltage in V	147	0	144	0
4. V 4A screen (pin 4) in V	85	0	80	0
5. V 1A screen (pin 7) in V	0	60	0	60
6. V 1A pentode anode in V	0	145	0	145
7. V 1A screen (pin 4) in V	0	60	0	60
8. V 2A screen (pin 4) in V	0	70	0	70
9. V 2A anode (pin 3) in V	0	145	0	145
10. V 2B screen (pin 4) in V	0	50	0	50
11. V 2B anode (pin 3) in V	0	145	0	145
12. V 3A anode (pin 3) in V	90	0	75	0
13. V 5A screen (pin 4) in V	150	0	150	0
14. V 5A anode (pin 3) in V	148	0	145	0
15. V 5A anode (pin 7) in V	148	0	145	0
16. T 2A sec. No. 1 (hot) in V	—10·5	—10·5	—10·5	—10·5
17. T 2A sec. No. 2 (hot) in V	—10·5	—10·5	—10·5	—10·5
18. Junction of R 15A and R 17A in V	—2·2	—2·2	—2·2	—2·2
19. T 3A sec. (hot) in V	—1·0	—1·0	—1·0	—1·0
20. V 1A filament (pin 8) in V	0	2·25	0	2·20
21. V 2A filament (pin 8) in V	0	2·25	0	2·20
22. V 2B filament (pin 8) in V	0	2·25	0	2·20
23. V 3A filament (pin 8) in V	2·22	2·25	2·22	2·20
24. V 5A filament (pin 8) in V	2·35	0	2·35	2·32
25. V 4A filament (pin 8) in V	2·35	0	2·35	2·32

CHANGING THE FREQUENCY CHANNELS, FITTING CRYSTALS AND COIL UNITS.

9. Coil units are available to cover the following frequency bands.

7·9—9·1Mc.	(yellow).	5·0—6·0Mc.	(blue).
6·4—7·6Mc.	(white).	3·6—4·3Mc.	(red).

Any three frequency channels in any one of the above bands may be allocated for a given set. Two crystals are required for each frequency channel ; one is for the sender, and is marked on the side with an S followed by the channel frequency in kc.; the other is for the receiver oscillator and is marked with an R followed by the channel frequency in kc. The crystal is also marked with a coloured dot corresponding with that on the coil units, and with the ZA number. The actual frequency of the crystal itself is also shown in small figures on the top of the crystal.

Changing Frequency Channels.

10. The procedure for changing frequency channels is as follows :—

Operation·

(*a*) Remove chassis from case after loosening evenly, a few turns at a time, the four slotted screws at the corners of the top panel. This must be done very carefully, to avoid damage to the set or the rubber gasket on the case.

(*b*) Remove crystal retainer and crystals ; also remove plug-in coil if new channels are in a different band (different colour spots). Crystals and coil unit should be carefully eased out with the aid of a screwdriver.

(*c*) Plug in the new crystals and coil unit, making sure that the former are all in the correct positions (for sender and receiver and for channels A, B and C) as marked on the chassis, and that the colour of the spot is the same on all crystals and on the coil unit.

(*d*) Plug in dummy aerial and set external aerial trimmer knob accurately to 2·5 on scale, unless the 7·9—9·1 Mc. band is in use, when set to 3·0 on scale. Switch to M. C. W., put on headphones, switch on set and keep send-receive switch depressed.

(*e*) Switch CHANNELS switch to A, and adjust pre-set aerial trimmer for channel A (front one) with a screwdriver very slowly and very carefully ; start at maximum (line or rotor pointing down towards coil unit) and turn until the loud tuning note just comes in.

(*f*) Repeat the procedure of (*e*) very carefully on the other two channels in turn.

(*g*) Check that no readjustment of the AERIAL TRIM is required when switching over from one channel to another.

(*h*) Make sure that the receiver oscillator is working on all channels as follows :—on touching a screwdriver on and off the aerial socket, loud clicks should be heard, but these should be nearly inaudible when the crystal for the channel in use is removed from its socket.

(*i*) Mark the new frequencies on the frequency record disc attached to the set.

(*j*) Switch off, replace crystal retainer, and replace set carefully in case. Finally screw up the four case retaining screws, going round each in turn several times, and making sure that the panel is bedding down evenly all round.

During the above process, certain difficulties may occasionally arise. Thus, the correct tuning point in operation (*e*) or (*f*) above may appear to be slightly outside the range of the internal trimmer in question ; this can usually be corrected by a very slight adjustment of the AERIAL TRIM knob. It is advisable to check output and sensitivity after changing crystals.

Aerial tuning and coil units.

11. Apart from ordinary faults in wiring, pin contact to socket, switches, etc., the only difficulty likely to be encountered here is a possible failure to tune with crystals at the extreme limits of the band, or with special aerials.

12. Some difficulty may occur in tuning in with the F aerial, especially at the highest frequencies (near 9 Mc.) : first shorten the lead-in as far as possible, but if this is still not enough, the L terminal on the aerial adaptor may be used in place of the F terminal.

13. When setting up new crystals, it might be found that, with a crystal at the high frequency end of the band, even with the internal trimmer set to zero, the tuning point comes below 2·0 on the AERIAL TRIM adjustment. After checking all other possible causes of the trouble (*e.g.*, trying another crystal and dummy aerial), break the paper seal (over the hole nearer to the control panel of the set) on the coil unit and turn the core slightly anti-clockwise until tuning is obtained.

14. If a reading greater than 2·5 is required to tune to a crystal at the extreme low frequency end of the band (with internal trimmer at maximum), this can be accepted, provided the other crystals can be trimmed.

15. If it is found that a receiver crystal near the highest frequency in the band will not oscillate, while others of lower frequency do oscillate, it is possible that L 2A (or other oscillator coil) is tuning to too low a frequency. After checking all other possible causes of the trouble, such as trying another valve and crystal of the same or adjacent frequency, and trying the crystal in another channel, break the paper seal over the hole farthest from the control panel and turn the iron-dust core adjustment slightly anti-clockwise until oscillation is obtained.

I. F. ALIGNMENT.

16. When testing I. F. alignment, it is *essential* to adjust the signal generator to within ±1 kc. of 1550 kc. The generator must be connected to the set and tuned carefully for zero beat with a crystal controlled oscillator, which may be either :—

(*a*) a special oscillator for 1550 kc. ±0·01 per cent.;
or (*b*) another No. 46 set switched to the same channel as the set on test, and fixed at send R/T, which will cause an I. F. signal to be generated by V **1A**, and will give a squeak, when the strength of signal is suitable. Usually no aerial is required if the second set is in the same room.

The I. F. cores can then be adjusted for maximum output, care being taken always to keep the input from the generator low (output around 0·1 mW). The bandwidth for—6db. (*i.e.*, generator input doubled) is about 10 kc. and that for —40 db. is about 60 kc.; the peak of the curve must be symmetrical about the 1550 kc. point.

END

(51552/2/MG/ME 12)