STATION, RADIO, A43R, Mk 2

TECHNICAL HANDBOOK - TECHNICAL DESCRIPTION

This EMER must be read in conjunction with Tels F 532 Part 2 which contains figures and tables to which reference is made.

Note: **These Pages 1 to 4 and 25 to 29, Issue 2, supersede Pages 1 to 4 and 25 to 28, Issue 1, dated 24 Sep 64. Pages 1 to 4 and 26 to 29 have been revised throughout. Page 4a, Issue 2, will be filed immediately after Page 4, Issue 2, dated 6 Jun 67. It contains information previously on Page 4, Issue 1, dated 24 Sep 64.**

LIST OF CONTENTS

Note: These Pages 1 to 4 and 25 to 29, Issue 2, supersede Pages 1 to 4 and 25 to 28, Issue 1, dated 24 Sep 64. Pages 1 to 4 and 26 to 29 have been revised throughout. Page 4a, Issue 2, will be filed immediately after Page 4, Issue 2, dated 6 Jun 67. It contains information previously on Page 4, Issue 1, dated 24 Sep 64.

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Warning

1. The case of the equipment and the antenna are connected electrically to the positive side of the supply. Care must be taken to isolate the case and the antenna from earth when the battery adaptor is connected to an external supply with its negative side earthed.

GENERAL

Role and purpose of equipment

2. The SRA43 is a lightweight manpack v.h.f. radio set which can also be used as a static station. The set is normally used for ground-to-air communications, but it may also be used in a ground-to-ground role.

3. Early models of the A43R Mk 2 suffered long receive to send delay ie, the time taken, after operation of the pressel switch, for the r.f. output to reach 2W. A modification was introduced (Tels F 537 Mod Instr No 2) to reduce this delay to a limit of 4 secs.

4. To reduce this time further, later models of the A43R Mk 2, having the figure 3 on the modification record plate struck through, have design changes incorporated by the manufacturer. Details of these models are given in para 105 onwards.

Main parameters
(Fig 1)

5. The station operates in the frequency band 240 to 300Mc/s and has the following facilities: amplitude modulated telephony, or beacon service modulated c.w. unkeyed,

or beacon service c.w. unkeyed. The station items are listed in Table 1 and illustrated in Fig 1.

6. The transmitter-receiver unit produces a minimum of 2W of r.f. power. Six crystal channels are fitted; the minimum channel spacing is 100kc/s. Twenty-four alternative channels, each consisting of four tuners, radio frequency, are carried in the cases, stowage. The tuners are aligned for each equipment and no loss of performance should result when a channel frequency is changed.

7. Two types of antenna are supplied for either the manpack role or static role. These operate without adjustment throughout the frequency band of 240-300Mc/s. They consist of:-

(a) Flexible 15 in. steel whip with a loop top for manpack operation.

(b) Discone type antenna that can be mounted on an 8 ft collapsible mast for operation as a static station.

Note: In the static role a 20 ft coaxial connector permits a wider choice of sites for the antenna.

8. The transmitter-receiver is powered by a 12V secondary portable battery externally connected to the bottom of the case by quick release dzus fasteners. Two types of battery, the Magnatex lead acid and the Nife nickel cadmium are in use. They are identical in size and sealed, without vents.

9. The station equipment includes a Charger, battery, transistor type, input 12V or 24V d.c. A preset adjustment sets the regulated charging potential so that it can be used to charge either the Magnatex or the Nife battery. The battery under charge is clipped by dzus fasteners to the rear of the charger.

10. Alternatively the A43R, Mk 2 may be operated from an external 12V supply. The normal battery is replaced by the battery adaptor which is then coupled by the battery connector cable to the external supply. Correct polarity is ensured by the protection relay in the battery adaptor and the polarized connectors of the connector cable.

11. The A43R, Mk 2 may also be operated from the Charger, battery, transistor type in the 'float' charge condition. Instead of using the external 12V supply, as in para 10, the cable is connected to the front panel 2-pole socket of the charger which is charging a battery. It must be noted that if the equipment is operated continually on transmit ie, beacon service, the battery will gradually discharge and the output power will fall off.

12. Two types of audio equipment are provided, these being:-

(a) A nylon handset, SI type.

(b) A microphone and twin receiver headgear assembly, SI type.

13. The tuners, radio frequency providing alternative frequency channels are carried in a case which also provides storage facilities for small ancillaries. The tuners, radio frequency are stowed as shown in Fig 2518.

Note: These Pages 1 to 4 and 25 to 29, Issue 2, supersede Pages 1 to 4 and 25 to 28, Issue 1, dated 24 Sep 64. Pages 1 to 4 and 26 to 29 have been revised throughout. Page 4a, Issue 2, will be filed immediately after Page 4, Issue 2, dated 6 Jun 67. It contains information previously on Page 4, Issue 1, dated 24 Sep 64.

Testing and repair facilities

14. Removal of the front panel desiccator gives access to a B7G test socket. Using the adaptor, test provided, the following voltages may be measured:-

Pin 1	Sidetone (-V)
Pin 3	+3.2V
Pin 4	-12V
Pin 5	+150V
Pin 6	+75V
Pin 7	A.G.C. (-V)

(Pin 2 is a receiver earth point)

15. The receiver and the transmitter chassis are mounted on hinges and can be swung out for servicing purposes. To allow either assembly to be tested clips are fitted to hold a set of tuners, radio frequency as a substitute for the tuners fitted to the turret drum.

16. With the exception of the power amplifier valve in the transmitter, all transistors and valves are wired in. The semi-conductors in the receiver i.f. stages are mounted within the actual i.f. transformers. As these stages are dipped in transparent resin, a faulty stage will normally be completely replaced. I.F. cores are sealed and cannot be adjusted.

17. To aid identification of components and test points, the circuit diagrams, layouts and component tables in Tels F 532 Part 2 use the following code which is added to the component number marked on the assembly:-

Receiver	-	100
Front panel	-	200
Transmitter	-	300
Power supply unit	-	400
Battery charger	-	500

Unit codes are marked on a flange of each assembly.

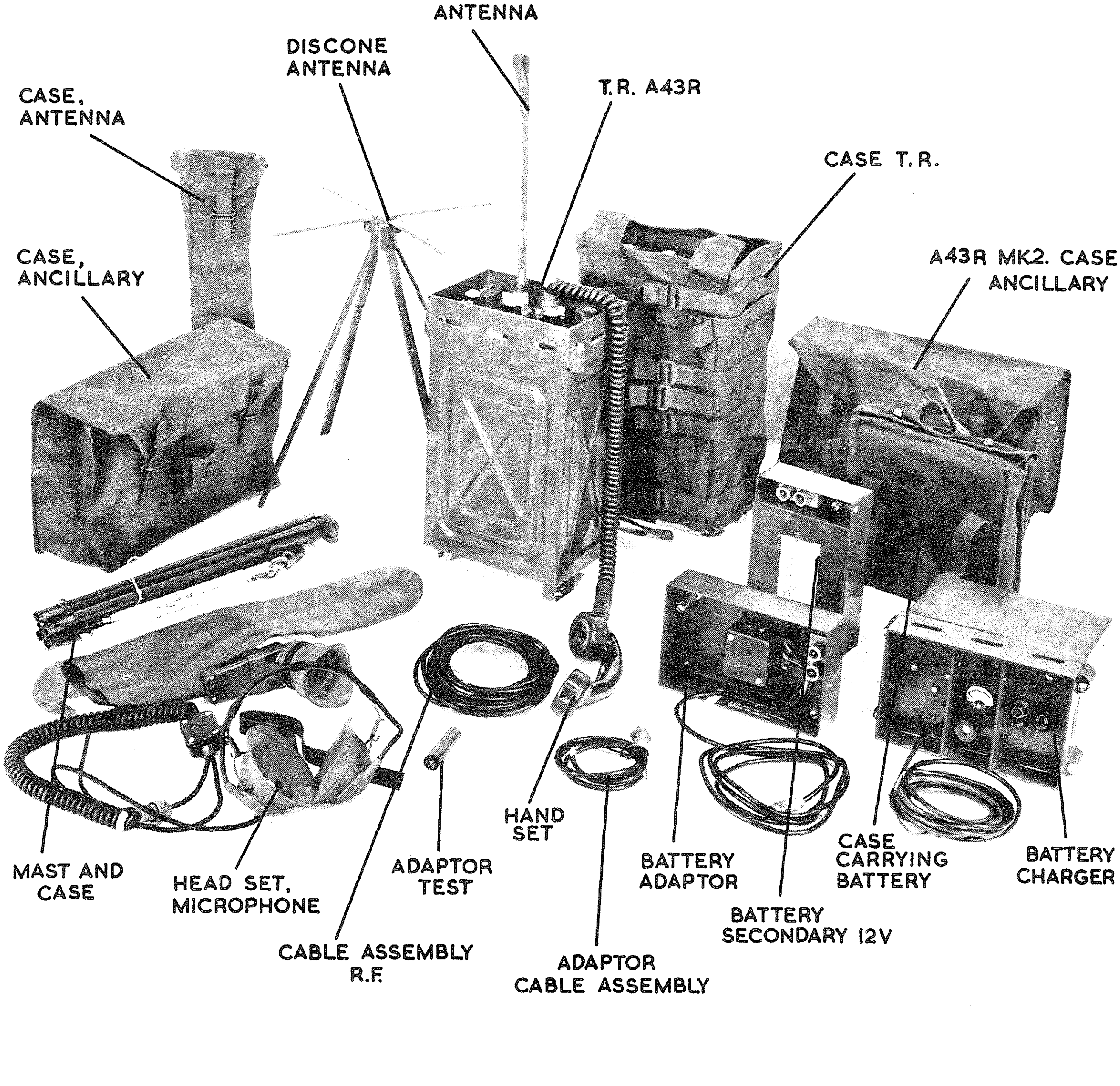

Fig 1 - Complete station

Table 1 - Station equipment list

Item No	Description
1	Transmitter-receiver, radio, A43R, including:- *Desiccator *Indicator, humidity *Tuner, r.f., channel frequency, transmitter A43R (qty 6) *Tuner, r.f., channel frequency, crystallized, transmitter A43R (qty 6) *Tuner, r.f., channel frequency, receiver A43R (qty 6) *Tuner, r.f., channel frequency, crystallized, receiver A43R (qty 6)
2	Microphone and receiver headgear assembly, Redifon A 6258/s.Ed.A
3	Handset, Redifon A 6257/s.Ed.A
4	**Tuner, r.f., channel frequency, transmitter A43R (qty Army 18, RAF 10)
5	**Tuner, r.f., channel frequency, crystallized, transmitter A43R (qty Army 18, RAF 10)
6	**Tuner, r.f., channel frequency, receiver A43R (qty Army 18, RAF 10)
7	**Tuner, r.f., channel frequency, crystallized, receiver A43R (qty Army 18, RAF 10)
8	Antenna, Redifon, A 6256/s.Ed.A
9	Antenna, remote and mast assembly, comprising:- Antenna, Redifon A 6267/s.Ed.A Cable assembly, r.f., Redifon A 6274/s.Ed.A Mast, Redifon A 6255 Ed.A (including stay and peg assembly)
10	Adaptor and cable assembly, Redifon A 6245/s.Ed.A
11	Case, antenna, Redifon OP.5120/S
12	Case, transmitter-receiver, OP.5121/S
13	Plate, instruction, operating, Transmitter-receiver, radio, A43R
14	Plate, extension platform, Harness, electrical equipment
15	Cable assembly, special purpose, electrical, Redifon A 6272/s.Ed.A
16	Case, carrying, battery
17	**Case, stowage, tuning units, r.f.
18	Adaptor, test, Redifon A 6259/s.Ed.A
19	Charger, battery, input 12V/24V, Mk 2, Redifon A 6249/Ed.B
20	User Handbook, Transmitter-receiver, radio, A43R W.O. Code No 12790
21	Carrier, radio station, manpack kit, No 1 comprising:- Case, radio station ancillaries, web, 5 in. x 8 in. deep x 14.1/2 in. Harness, electrical equipment
22	Battery, secondary, Redifon A 6227/M Edn B (Magnatex) or Battery, secondary, 12V, Redifon A 6227 Edn C (Nickel cadmium) } (qty 3)

*This item is fitted in transmitter-receiver, radio
**RN and RM equipment is limited to 6 channels

TRANSMITTER-RECEIVER, RADIO, A43R, MK 2

BRIEF TECHNICAL DESCRIPTION

Transmitter
(Fig 2001)

18. The transmitter frequency is crystal controlled on each of the six channels in the frequency range 240-300Mc/s and uses valves in the v.f. stages. A crystal oscillator doubler V301, fundamental crystal frequency of fs/16, is followed by three class C frequency doublers, V302, V303, V304 and V305. The final doubler uses two valves in parallel to provide the necessary drive for the push pull power amplifier V306, which is a high efficiency indirectly heated double tetrode. To contribute to battery economy and operating efficiency heater voltage is reduced to a low level on receive and given an initial heater boost when switched to phone transmit. This action reduces the transmit warm-up time to a minimum. The modulator uses transistors throughout and includes a speech clipper to prevent over modulation and a low pass filter to limit the bandwidth. The speech clipper functions as a tone generator when the set is switched to BEACON TONE. A condition indicator on the front panel provides a visual display of r.f. output and modulation level.

Receiver
(Fig 2001)

19. The receiver is a six channel crystal controlled double superheterodyne in the frequency range 200-300Mc/s and uses transistors throughout. Crystal oscillator doubler VT108, fundamental crystal frequency of fs-19.05/16, is followed by three frequency doubler stages VT109, VT110, VT111 and VT112. The 1st mixer VT103 is fed by the signal fs, from amplifiers VT101 and VT102 and the crystal controlled frequency, fs-19.05. The resultant 1st i.f., 19.05Mc/s, is amplified by VT104 and fed to 2nd mixer VT105 together with the 19.98Mc/s output from 2nd oscillator VT113. The 2nd i.f. of 930kc/s is amplified by VT106 and VT107 before rectification by the detector MR102. The a.f. output is fed to the audio amplifiers VT116 and VT117 and also to the a.g.c. amplifiers VT114 and VT115. A.G.C. is applied to the first mixer and also to the 1st i.f. and 2nd mixer stages.

Power unit

20. The power unit is a double transistor convertor. It provides transmitter h.t. supplies of +150V and +75V d.c., and a +3.2V d.c. supply for transistor emitter bias and transmitter valve filaments. The transistor collectors and carbon microphone energizing supplies are taken direct from the -12V input. The transistor convertor circuits operate at high efficiency on a short time constant to provide power for immediate reception, and the minimum delay when transmitting.

Batteries

21. Two types of battery have been developed for A43R, Mk 2:-

(a) The Magnatex battery contains 42 miniature Magnatex sealed lead acid cells connected in series banks of seven cells in parallel to give a nominal

12V supply. These cells are set in epoxy resin within a metal case to form a fully enclosed battery unit which is secured by dzus type fasteners to the back of the transmitter-receiver case. The battery should not be discharged below 10V on load.

(b) The Nife battery is of nickel cadmium type and consists of 10 cells of sintered plate construction. The cell assembly is set in epoxy resin within a metal case to form a fully enclosed battery unit of identical shape and fixing as the lead acid battery. In manufacture (after the final conditioning charge) the cells are each permanently plugged to prevent the loss of electrolyte.

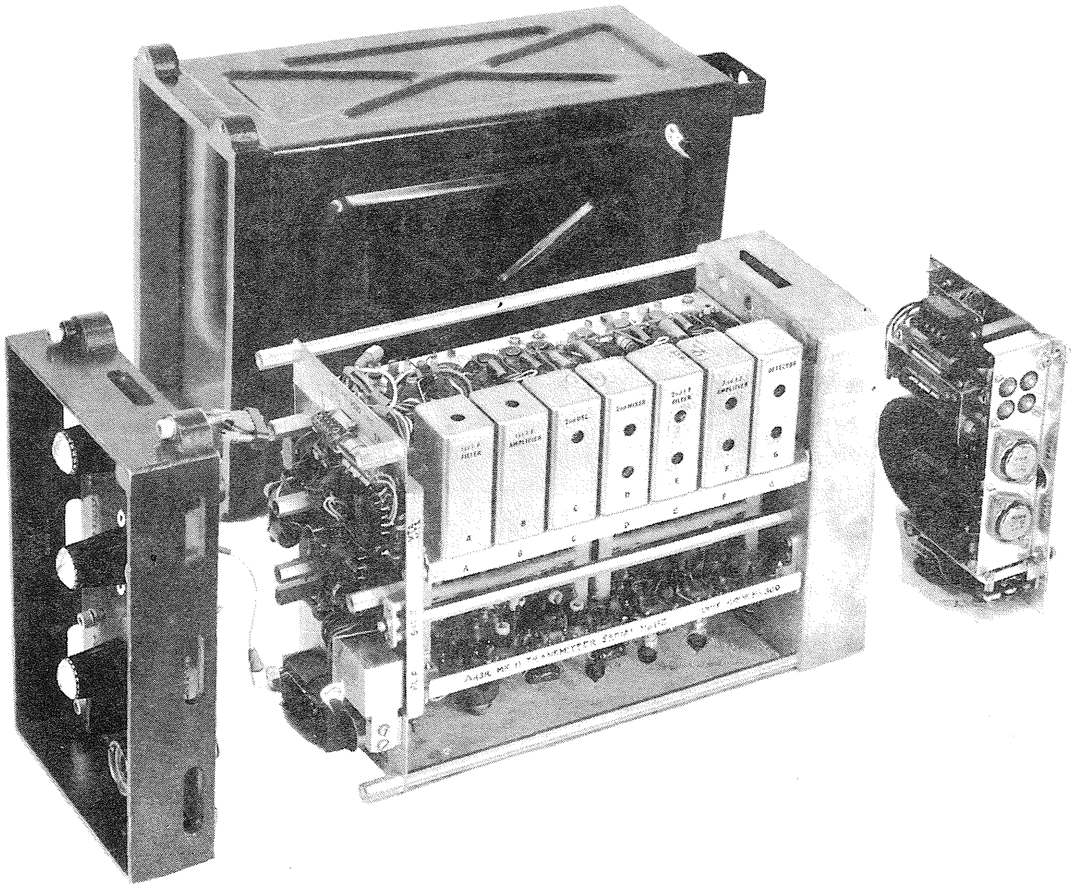

Fig 2 - Transmitter-receiver, radio, A43R, Mk 2 - main items

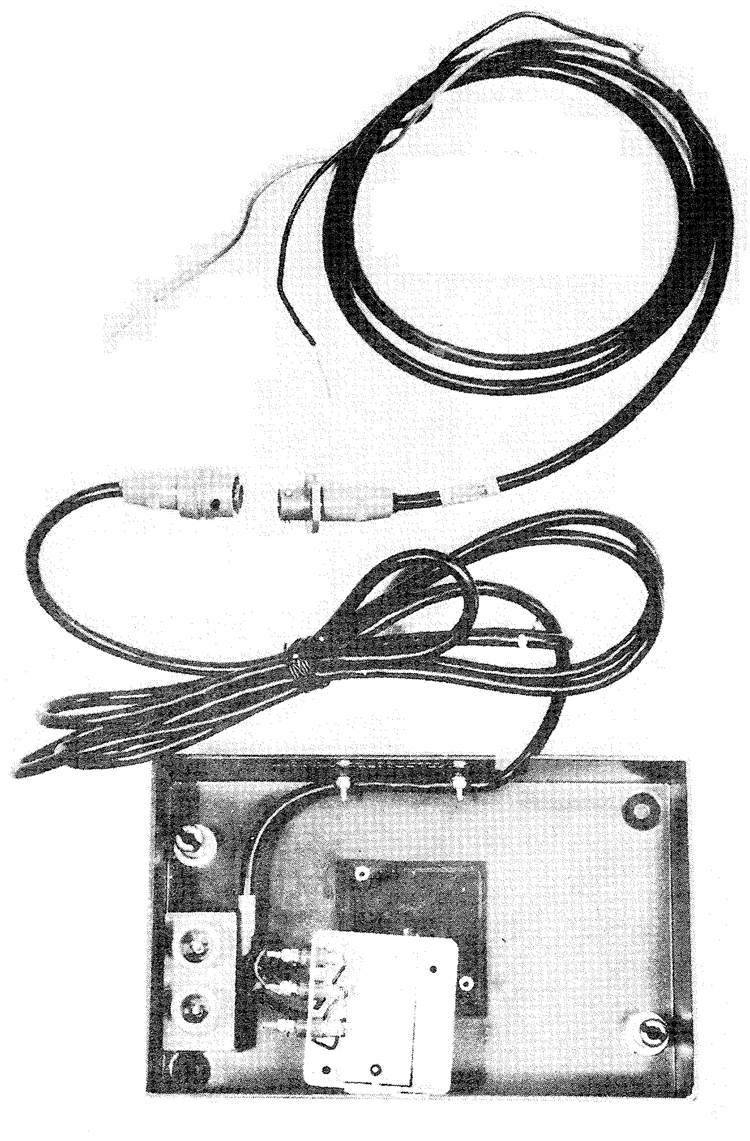

Fig 3 - Battery adaptor and cable assembly

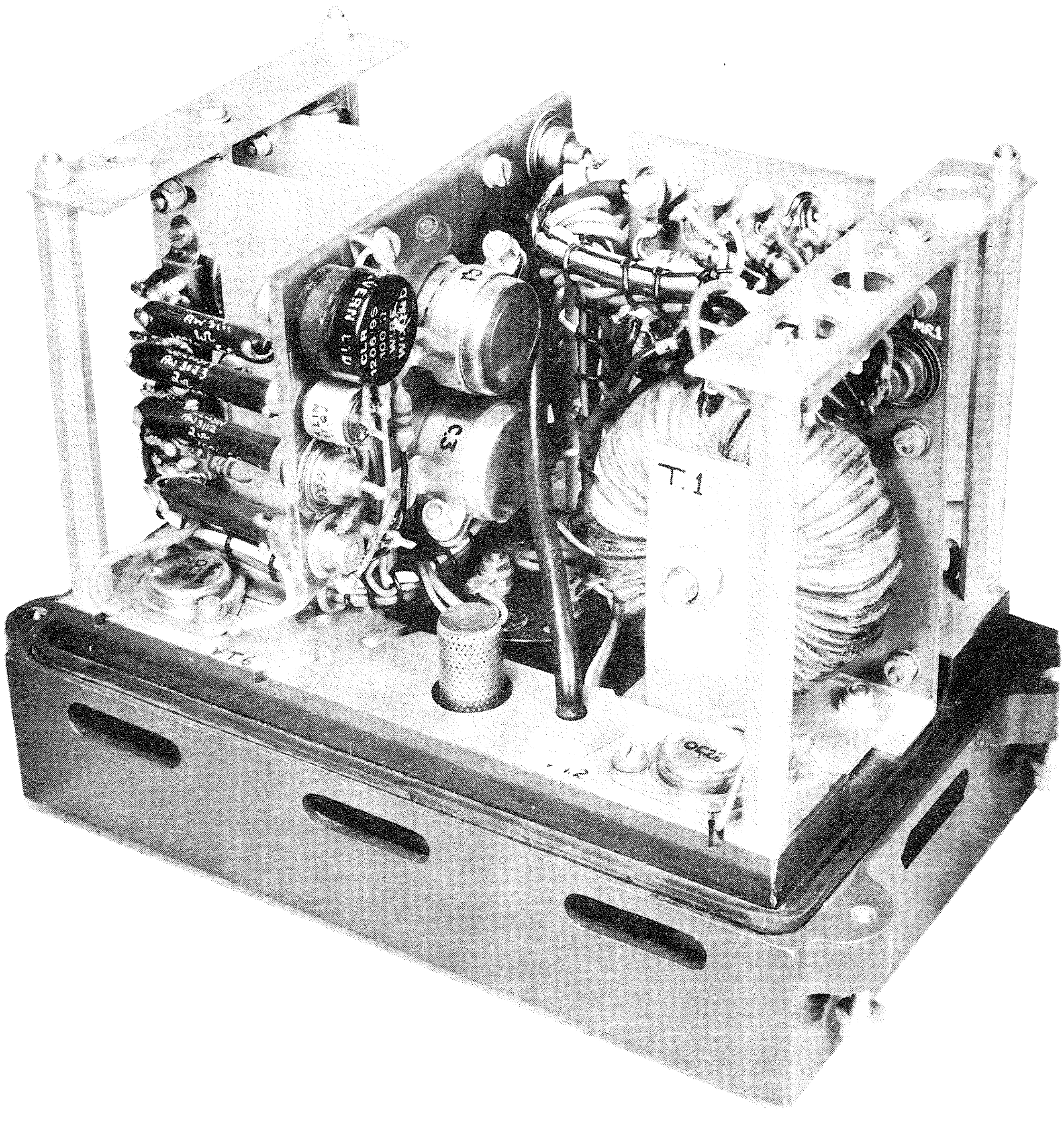

Fig 4 - Charger, battery, transistor type, input 12V or 24V d.c.
(A 6249/L Ed B)

Battery adaptor

22. The battery adaptor is used when the A43R, Mk 2 is connected to an external supply. To prevent damage to the equipment, the adaptor contains a relay whose operation is dependent on the polarity of the applied voltage. The relay's operating coil is connected in series with a diode across the external supply.

Battery charger

23. The battery charger is designed to operate from a d.c. supply of either 12 or 24V nominal, eg a vehicle or aircraft battery or electrical system. The input voltage selection is effected automatically by means of a voltage sensitive relay. The charger provides a constant voltage output at 13.2V for a Magnatex lead acid battery or 14.6V for a Nife nickel cadmium battery. It can deliver sufficient current to float charge one normal battery unit at the correct rate whilst simultaneously operating one equipment in the receive condition via the battery adaptor. The mean charging current for the lead acid battery is 350mA, and the nickel cadmium battery 1A. The input circuits are protected by a diode MR501 to prevent damage to the transistors VT501 and VT502 by reversed supply polarity. The unit is fitted with a meter which indicates the charge condition of the battery to which the charger has been adjusted. The charging supply must not fall below 11V or 22V or the indication of meter M501 may be inaccurate and show the battery to be fully charged, even though this is not so.

Antenna

24. For manpack use a whip antenna of 15 in. length and 50Ω impedance is used, this is made of steel tape and has a loop at the top. This increases the capacitance slightly which helps to nullify the stray capacitance due to the fixing plug by reflecting a small inductance at the feed point. The standing wave ratio of the whip antenna when working against the set case is approximately 1.8:1 over the frequency range of the set. For static operation of the A43R, Mk 2 a wideband discone antenna and short mast is provided. The discone type of antenna for A43R, Mk 2 is of skeleton construction and uses elements made of steel tape. It is completely collapsible and the centre section is moulded in epoxy resin. The A43R, Mk 2 is connected to the antenna by a 20 ft coaxial cable assembly of 50Ω impedance, and is terminated at either end by v.h.f. plugs. The discone antenna functions as an elementary form of horn radiator and operates by matching the characteristic impedance of the feeder to that of free space. As such the antenna is non-resonant and the band of operation is governed at the lower end by the length of the sloping elements. These have to be somewhat greater than $\lambda/4$ long at the lowest frequency of operation. The impedance presented by the antenna depends on the disc to cone spacing, the length of the upper or disc elements and the angle of the lower elements, and the combination which gives the best results over the required band is best found empirically. The upper operating frequency of the antenna is dependent on the number of radial elements, the bandwidth increasing with a greater number of radials. The A43R, Mk 2 discone covers the frequency range of 240-300Mc/s with a standing wave ratio of approximately 2:1, and over the frequencies of 240-258 and 272-278Mc/s better than 1.5:1. The height of the mast is 8 ft, when erected, and is made up of seven sections of 16.1/2 in.

Construction

25. The transmitter-receiver is housed in a corosion-resistant case which is ribbed and stressed for strength and sealed against the ingress of moisture. The controls are positioned on the top panel and protected by a deep surrounding flange. A silica-gel desiccator capsule is fitted and a humidity indicator is attached to the top of the desiccator. The complete equipment may be withdrawn from the case after removing four Allen-headed screws.

26. The equipment can be dismantled into five main assemblies.

(a) The front panel assembly secured by seven Allen screws and two countersunk Allen screws under the channel selector knob.

(b) The main chassis containing the speech clipper, low pass filter and turret switch. This chassis is mounted behind the front panel.

(c) The power unit attached to the lower end of the turret switch.

(d) The transmitter assembly.

(e) The receiver assembly.

27. The receiver and the transmitter chassis are mounted on hinges and can be swung out for servicing. These chassis can be tested in the servicing position by fitting tuners, radio frequency in the clips provided.

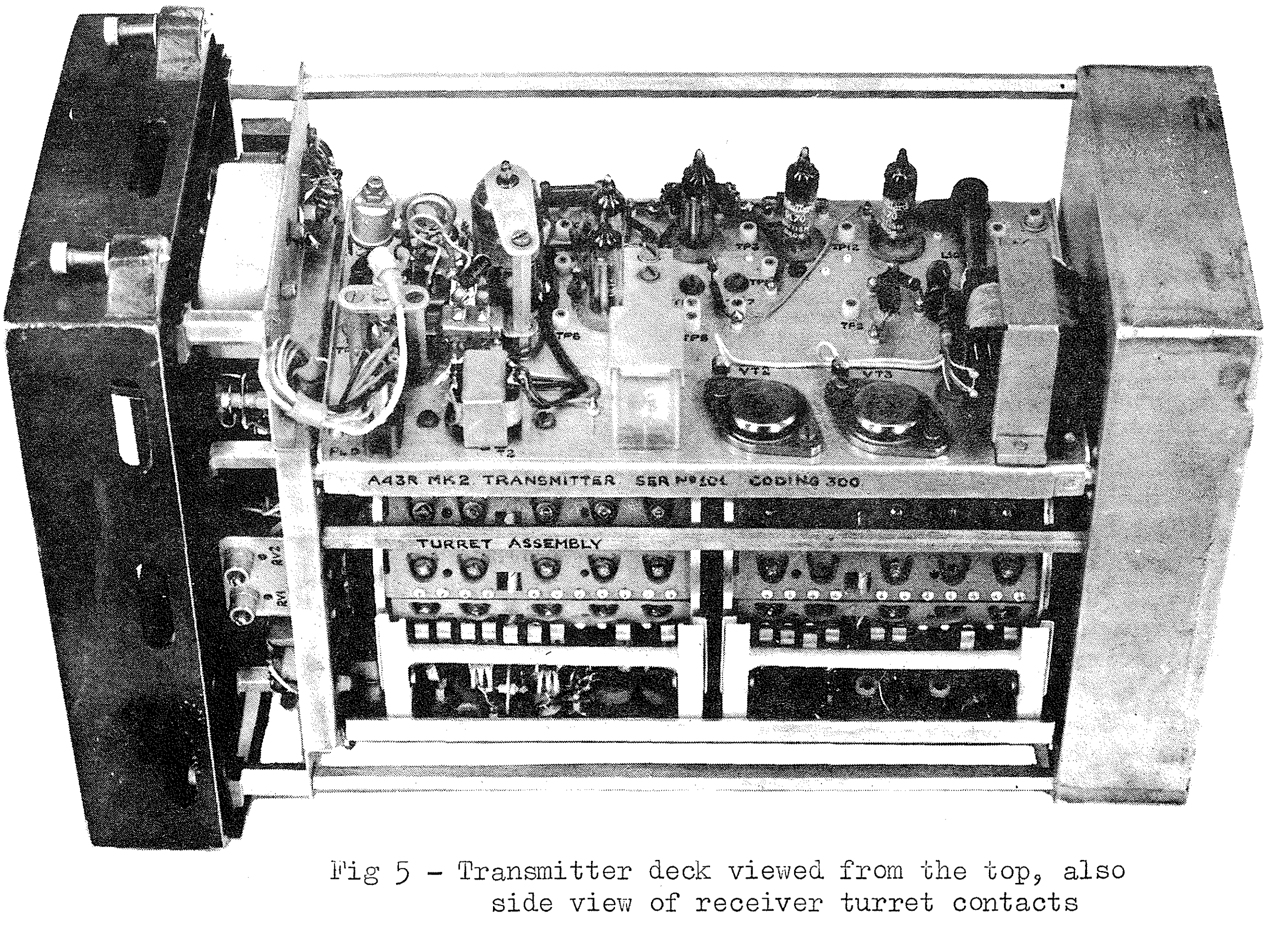

Fig 5 - Transmitter deck viewed from the top, also side view of receiver turret contacts

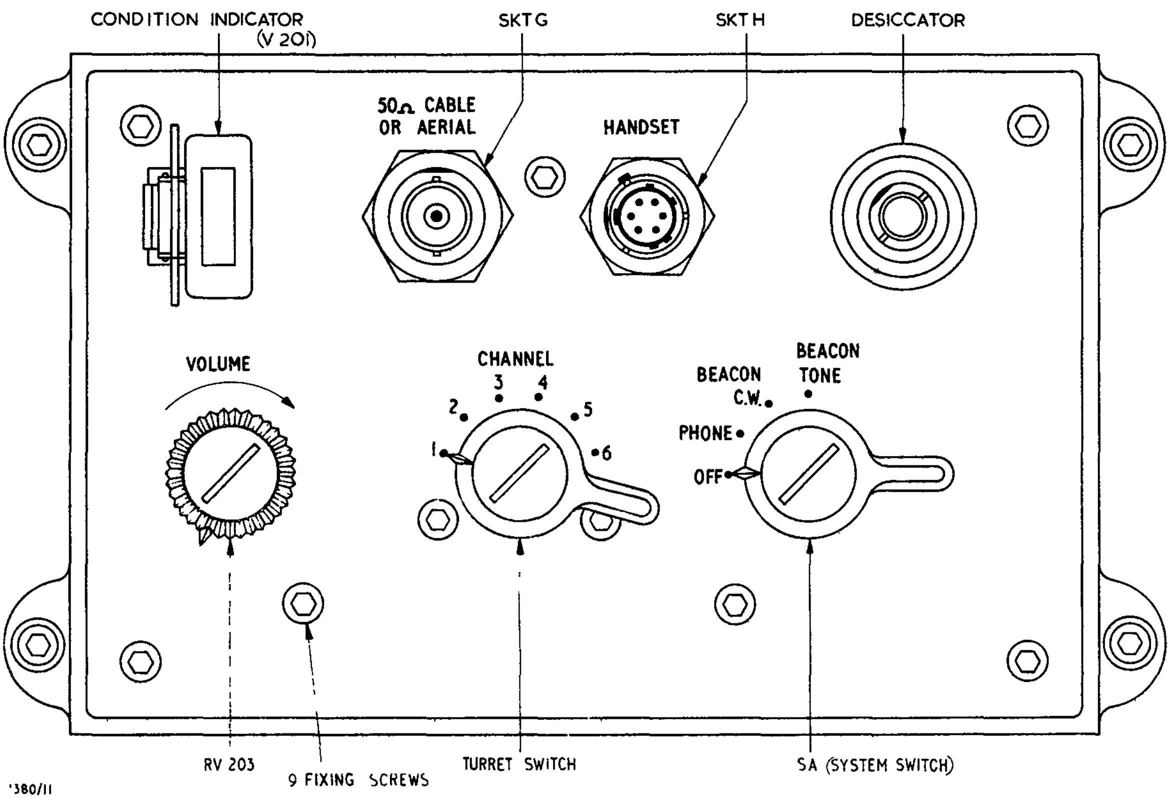

Fig 6 - Front panel layout

Controls

28. The front panel controls are shown in Fig 6 and details are given below:-

Switch SA	OFF	
(SYSTEM SWITCH)	PHONE	- The set is switched for use on telephony amplitude modulation
	BEACON CW	- The set is switched to transmit, output is unmodulated c.w.
	BEACON TONE	- The set is switched to transmit, output is modulated c.w. at approximately 1000c/s
Turret switch	1 to 6	- Selects one of six channel frequencies
RV203	VOLUME	- Sets receiver volume
Plug G	50Ω CABLE OR AERIAL	- Connection to antenna
Socket SKTH	HANDSET	- Connections to Microphone and receiver headgear assembly or handset
Condition indicator (V201)		- Visual indication of battery charge, transmitter output and modulation

DETAILED TECHNICAL DESCRIPTION

Transmitter

General

29. The transmitter operates in the frequency band 240 to 300Mc/s. Frequency selection is by means of a six position turret switch and two tuners, radio frequency are used in each position. Crystals and capacitors mounted on these tuners are underlined in the text.

Crystal oscillator doubler stage V301 (CV2105)

30. A directly heated pentode operates in a crystal doubler circuit. Crystal XL301 in the grid circuit is trimmed by C302, (C301 may also be connected), fundamental crystal frequency is fs/16. The anode circuit, L301 and C307 is tuned to twice the crystal frequency fs/8. A semi-conductor diode MR302 is connected between V301 grid and the filament dropper resistor R327. Its function is to limit the grid voltage to a safe operating level and so protect crystal XL301. The diode, which is back biased from the potential divider across the +3.2V supply, conducts and limits the grid voltage swing if it rises above 1.1V. The screen grid is fed from the 75V line via R304 and is decoupled by C310. Test point TP301 is connected to the junction of grid resistors R301 and R302. The output is fed via C312 to the doubler (V302) grid.

Doubler stage V302 (CV2105)

31. This stage is operated in Class C and is biased directly from the -12V supply via contacts 9 and 10 of relay RLA3. The anode circuit, L302 and C313 is tuned to fs/4. The screen grid is fed from the 75V line via R308 and decoupled by C315. Test point TP302 is connected to the junction of grid resistors R305 and R306. The output is fed via C317 to the doubler (V303) grid.

Doubler stage V303 (CV2299)

32. This stage is also operated in Class C and is biased from the -12V supply. The anode load, untuned r.f. choke L303, is coupled via C321 to the tuned push-pull grid circuit of the next doubler stage V304 and V305. This circuit is tuned to fs/2.

Doubler stage V304, V305 (CV2299)

33. This stage is operated as a push-pull doubler with the anodes connected in parallel. V304 and V305 grids are fed from opposite ends of tuned circuit L304 and C322 and the centre tap of L304 is connected to earth via R313 and C323. Preset capacitor C324 is connected between V305 grid and chassis and is adjusted to equalize the drive to V304 and V305.

34. The anodes are connected to the +150V line via r.f. choke L305 and R316 decoupled by C327. The output circuit is T301 primary tuned by C328 and C329. Note that C329 is omitted for frequencies above 250Mc/s. Test points TP305, TP306 and TP308 are connected to the screen resistors R316 and R317. These test points are used when the valve currents are equalized by adjustment of C324.

Power amplifier V306 (CV2466)

35. The input to the grids of V306, an indirectly heated double tetrode, is from T301 secondary which is tuned by C330 to the final frequency (fs). Grid bias is fed to the centre tap of T301 secondary from the -12V line via R319, R321 and R320. Test points TP309 and TP310 are connected to each side of R321.

36. The anode and screen supplies are fed from the +150V line via the operating coil of relay RLB/2 and the secondary of the modulating transformer T303 to the junction of R323 and R324. R323 decoupled by C334 is connected to the screens and R324 decoupled by C340 is connected via the r.f. choke L306 to the centre tap of the tank coil L307.

37. Tank coil L307 is tuned by C333 and C335. These capacitors are connected in parallel for frequencies below 265Mc/s and in series for frequencies above 265Mc/s. During manufacture the wiring is arranged so that the output stage is neutralized and it should not normally require readjustment when V306 is replaced.

38. The series tuned circuit, L308 and C341, is inductively coupled to the tank coil L307 and is designed to give an output impedance of 50Ω. The adjustment of L308 and C341 is made at the band edge frequencies, 240 and 300Mc/s, and is set for optimum performance during manufacture.

39. V306 heater is centre tapped and each half requires 6V for normal operation. When the equipment is switched to PHONE and is in the receive condition, +2.9V derived from the +3.2V supply is applied to the two halves of the heater connected in parallel. On switching to transmit relay RLA/4 operates and 12V is applied to each half of the heater. The valve quickly warms up and the combined anode and screen current operates relay RLB/2 connecting the 12V to the two halves of the heater in series ie, normal operation. These circuits are described in more detail in para 49-52.

Condition indicator V201 (DM70)

40. V201 is an electronic indicator valve and consists of a triode assembly with a fluorescent coated target anode which shows a column of light when the indicator is conducting. The height of the column is controlled by the grid potential, as the grid voltage becomes more positive the column increases in height.

41. The r.f. voltage developed across L309, which is inductively coupled to the tank coil L307, is rectified by the crystal diode MR301. The positive voltage across the diode load R337 is applied to V201 grid. This voltage is normally greater than the negative bias from the fixed potentiometer R326 and R325 between the -12V line and earth and the valve conducts. The anode is connected directly to the 75V line. The height of the light column is dependent on the carrier output, the modulation and the battery charge.

Sidetone

42. The demodulated signal which is fed to V201, is also applied to the base of VT116, the receiver a.f. amplifier via C208 and R213 and true sidetone is heard in the earphones.

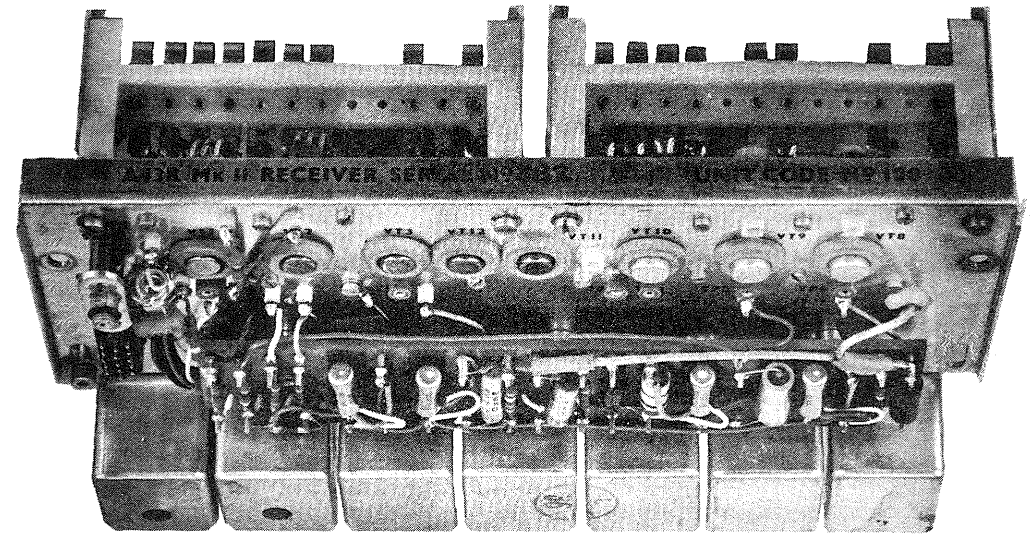

Fig 7 - Top view of the receiver assembly

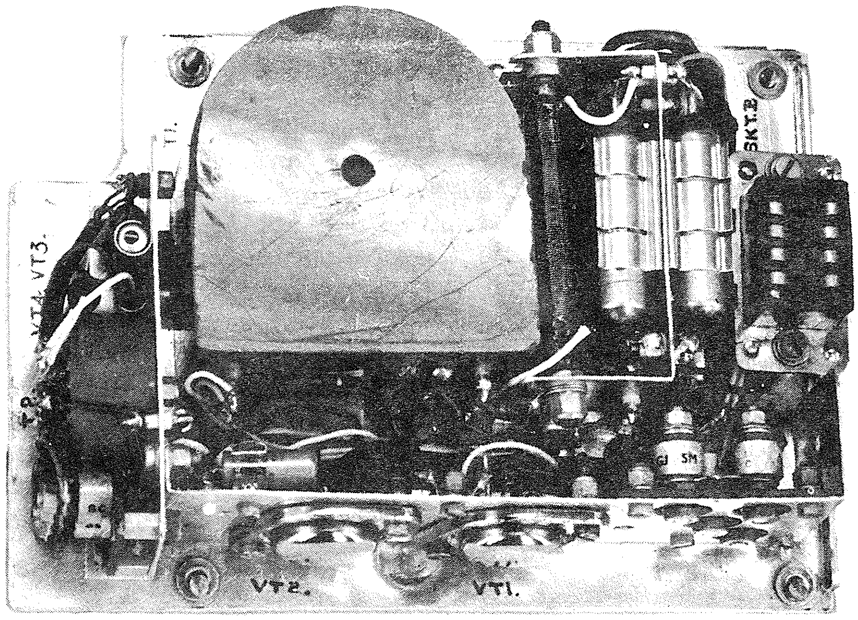

Fig 8 - Top view of the power unit assembly

Speech clipper VT201 and VT202 (CV5439 type)

43. The speech clipper is a two stage directly coupled amplifier which prevents over-modulation with changes of voice level. VT202 operates as an emitter follower and VT201 operates in the common base mode. The emitters of both transistors are thermally stabilized.

44. A.F. signals from the microphone are applied to the base of VT202 via RV202 and C206. Positive going signals above amplitude governed by the base bias conditions, set by R209 and R210, cause VT202 to cut off. The signal, with positive peaks clipped is developed across common emitter resistor R206. VT201 is now cut off by negative peaks exceeding the base bias conditions set by R203 and R204. Symmetry of clipping action is governed by RV202 and the amplitude of the output by RV201. Correct adjustment of these controls gives an output which will produce 90% modulation before the clipping threshold level is reached. When clipping takes place it will handle an increase in amplitude of four times above threshold level for an increase in output of less than 26%.

45. When the service switch is set to BEACON TONE the clipper circuit operates as an audio oscillator, thus providing tone modulation for radio beacon (A2) transmission. The frequency of the tone is governed by the value of C205 switched into circuit by contacts 22 and 23 of SABc. The tone frequency is preset within the range 300-3000c/s. A sample set was found to be generating a tone at approximately 800c/s. This was produced by a nominal capacitance value for C205 of 0.1μF (made up of 2 x 0.05μF ±20% capacitors in parallel).

Low pass filter

46. The output from the speech clipper is fed to the double π section low pass filter via the blocking capacitor C204. The filter is designed to pass frequencies between 300c/s and 3kc/s with an attenuation factor of less than 3.5dB. Above 3.5kc/s the rate of attenuation is at least 20dB per octave. The filter components are inductors L201 and L202, shunt capacitors C201, C202 and C203, and series resistor R202.

Modulator unit VT301 (CV7363) VT302 and VT303 (CV7084)

47. The modulator is a three stage amplifier with a 5W push-pull output stage providing anode and screen modulation of the transmitter power amplifier. The frequency response has been cut below 300c/s to reduce the size of the driver and output transformers.

48. The modulator input from the low pass filter is fed to VT301 base, fixed bias being provided by R332, R330 and R331 across the -12V supply. The emitter is thermally stabilized by R333. The collector output is fed to the bases of VT302 and VT303 by T302 secondary; fixed bias is applied to the secondary centre tap from the junction of R325 and R336 connected across the -12V supply. Negative feedback from VT302 collector is fed via C354 and R329 to VT301 base to ensure crossover distortion is kept at a low level. The modulating signal is developed across T303 secondary which is the anode and screen supply to the power amplifier.

Receive/transmit switching and relay operation

Phone receive

49. The -12V supply is connected via PLB6 to:-

(a) Power supply unit section supplying +3.2V.

(b) Receiver via RLA3, smoothing choke L203 and SKTF-C.

(c) 2nd a.f. amplifier via RLA2-13, R212, T201 primary and SKTF-J.

(d) Operating coil RLA/4, this will of course not operate until the earth return is completed by the microphone pressel switch.

(e) Test socket pin 4.

50. The +3.2V from the power supply unit is connected to:-

(a) Receiver via RLA4 and SKTF-E (emitter supply).

(b) Receiver via SKTF-A, protective antenna circuit which operates when switched to transmit.

(c) Test socket pin 3.

(d) Power amplifier V306, pre-heat filament supply via RLA4, R216, RLA2, SKTD-F, RLB2 and L312. This voltage, approximately +2.9V to the centre tap of V306 filament allows the power amplifier to warm up rapidly when the set is switched to transmit. The two halves of the filament winding are connected in parallel as pin 4 is strapped to chassis and pin 5 is connected to chassis via L311 and RLB1. Each half of V306 filament has a nominal rated voltage rating of 6V. All the other transmitting valves are disconnected on receive as they are the directly heated type and have a quick warm up time.

Phone transmit

51. Closing the pressel switch completes the earth return to the operating coil of RLA/4 and the relay contacts changeover. The -12V supply is connected via SAFa and PLB6 to:-

(a) Power supply unit section supplying +3.2V as 49(a).

(b) Test socket pin 4 as 49(e).

(c) RLA2-13, R212, SKTF-J to 2nd a.f. amplifier.

(d) Power supply unit +150V and +75V via RLA3 thus disconnecting the receiver supply.

(e) Transmitter bias and operating coil RLC/1 via SKTD-H.

(f) Microphone polarizing voltage via RLA3, PLK-J, SABb, R211, R215 and RV202, PLK-H and SKTH-A.

(g) Modulator via RLA3, PLK-J, SAFb, PLK-H, SKTD-D.

(h) Speech clipper via RLA3, PLK-J, SAFb, PLK-H, SKTD-D, R332 and SKTD-J.

(j) Power amplifier filament pre-heat via RLA2, SKTD-F, RLB2 and L312. Therefore the 2.9V applied to the two halves of the filament during the receive condition has been replaced by a 12V, boost voltage. This results in a rapid heating and the combined anode and screen current rises quickly and operates RLB/2 in the 150V feed line. The two halves of the filament are not put in series across the -12V supply by RLB2 disconnecting the boost voltage to the centre tap and RLB1 connecting the 12V via the line detailed in (d) and L311.

52. The +3.2V is connected to:-

(a) Receiver SKTF-A, protective antenna circuit operating as described in para 56.

(b) Transmitter filament supply via RLA4 and SKTD-C.

(c) Test socket pin 3.

Beacon c.w. transmit

53. The earth return for RLA/4 is completed by SAFc and the set is at permanent transmit. The -12V supplies are as detailed in para 51 except that SABb and SAFb are open and therefore the microphone modulation and speech clipper are inoperative.

Beacon tone transmit

54. The earth return for RLA/4 is completed by SAFc as for Beacon c.w. transmit. The -12V supplies are as detailed in para 51 with the exception of the microphone energizing supply as SABb is not made. The speech clipper operates as tone generator as C205 is connected from VT201 base via PLK-D, SABc, and PLK-E to VT202 collector.

Antenna circuits

55. When the operating coil of RLA/4 is energized as described in para 51, change over contact RLA1 transfers the receiver input circuit from the antenna to muting capacitor C211 during transmission. As previously described in para 51(e) RLC/1 will be energized and its contacts will open to remove the damping capacitor C356 from across the transmitter r.f. circuit during transmission.

Receiver

Antenna circuits

56. The incoming signal from the 50Ω antenna is fed to a tap on L101 tuned by C101. To prevent damage to the input transistor by r.f. energy from the transmitter, germanium diodes MR106 and MR107 (of the OA70 type) are connected across L101. On transmit the diodes are forward biased by the +3.2V fed through R160 and they heavily damp the tuned circuit. When the set is switched to receive the -12V supply is connected to the diodes which are then reversed biased and so have a negligible effect on the antenna circuits. The input to the receiver is also disconnected from the antenna by RLA1 (as shown in para 55 describing relay operation) and short circuited by C211 when the set is switched to transmit.

First r.f. amplifier VT101 (T1832)

57. This stage operates in the grounded base mode. Signals from L101 are coupled to the emitter by C102, fixed emitter bias derived from the +3.2V line is applied via R103, R101 and r.f. choke L102 decoupled by C105. The collector tuned circuit L103 and C104 is coupled to the next stage by C107.

Second r.f. amplifier VT102 (T1832)

58. This stage also operates in the grounded base mode and emitter bias is applied from the +3.2V line via R104 and r.f. choke L104, shunted by R161 and decoupled by C109. The collector tuned circuit L105 and C108 is coupled to the first emitter by C111.

First mixer stage VT103 (T1832)

59. The mixer stage is operated in a hybrid configuration r.f. input to emitter, oscillator to base, and the output is taken from the collector coupled into a tapped i.f. coil L107. It performs the function of accepting signals at channel frequencies of 240-300Mc/s, from the r.f. stages, and the local oscillator, combining these and amplifying the resultant frequency to be passed on to the first 19.05Mc/s i.f. amplifier. The emitter of VT103 is fed with input signal by C111 and is provided with a.g.c. control by the a.g.c. 1 line derived from the a.g.c. amplifiers VT114 and VT115. The standing current present through R106 is determined by R108 and R109 which provide the base potential of transistor VT103. The current is prevented from passing into the a.g.c. amplifier through R131 by MR101 (OA70) a germanium diode. However when the signal exceeds the designed level, the negative a.g.c.1 output from the a.g.c. amplifier is fed to the cathode of MR101. Providing the potential derived from the a.g.c. amplifier exceeds the standing potential across R106, MR101 will conduct and further increments of a.g.c. output current will be subtracted from the available emitter current of VT103. Hence the forward gain and attenuation of VT103 can be controlled.

60. The mixer a.g.c. system provides a wide range of control due to the high degree of loop gain available via the intermediate frequency stages, and the setting of the a.g.c. amplifier output.

61. The local oscillator output is injected into the base of VT103 via the secondary of T106. Emitter r.f. filtering is provided by the network L106, R162 and C112. C113 and C114 are used to decouple the -12V line, and the base potential divider respectively.

Oscillator and oscillator doubler stages
(VT108, 109, 110 (OC170), 111 and 112 (T1832))

62. To allow channel setting crystals to be used in a receiver operating in the v.h.f. band, it is necessary to use relatively low frequency crystals and employ multiplier amplifiers to step up the required mixer injection frequency, which is 19.05Mc/s below the signal frequency. In the A43R, Mk 2 the crystals are situated in the tuners, radio frequency and are of the style J type with a temperature coefficient of -40°C +70°C ±0.003% and are marked with the final channel frequency and symbol R.

63. The first oscillator transistor VT108 (OC170) is operated in the common emitter mode. The circuit is a modified Colpitts, which depends upon the relative low impedance of the collector load to allow it to function as a frequency multiplier. The base is operated with a back biased diode MR104 (OA70) which limits the amplitude of the oscillator as a safety circuit, if the crystal selected is of higher than average activity.

64. The oscillator VT108 is tuned by C147 and C148 together with XL101. C147 may be linked to C148 to suit the crystal fitted, and is not required for all channels. As the stage operates as a doubler oscillator the crystals are ground to operate between 13.8 and 17.6Mc/s. The collector circuit is tuned to twice this frequency 27.6 to 35.2Mc/s by T103 and C150. Bias for the stage is derived from the +3.2V line decoupled by R159 and choke L118. C149, C151 form the feedback circuit between the emitter and the base, and R128 provides d.c. bias to the base.

65. T103 is an h.f. transformer and the matched secondary coupling winding supplies drive to the base of the frequency multiplier stage VT109. The primary of T103 is tapped down to optimum coupling from the collector of VT108. A diode MR103 (OA70) is connected as a forward limiter to prevent over-drive of this stage. The emitter is directly biased from the +3.2V line via R132 decoupled by C154. The collector tuned circuit is formed by T104 and C153, is tuned to operate over the range of 55.2 to 70.4Mc/s and the matched secondary feeds into the base circuit of VT110 which operates as a further frequency multiplier stage.

66. VT110 stage is electrically similar to VT109 and it is transformer coupled to VT111 and VT112 by T105. It is operated as a frequency multiplier over the range 110.4 to 140.8Mc/s. The tuning capacitor of the collector circuit is C156. MR105 (OA70) is connected as a forward limiter to prevent over-drive to the stage.

67. The final frequency multiplier consists of a push-pull input transistor stage, VT111 and VT112. These transistors are of the germanium micro-alloy diffused base type, designed to provide adequate v.h.f. oscillator power, and are interchangeable with the r.f. transistors used elsewhere in the receiver. The mode of operation is grounded base and they are operated in Class B. The drive is applied to the emitters of VT111 and VT112 from the parallel connected secondary of T105, which is a close coupled bifilar winding.

68. The bases of this stage are grounded. Bias is applied to the emitters by connecting the bifilar coupling windings to R138 from the +3.2V line. Emitter stabilization is provided by R137 which in conjunction with R138 constitutes a potential divider across the +3.2V supply, decoupled by C159.

69. The collectors are connected in parallel to provide single ended output, the primary of T106, tuned by capacitor C161 forming part of the common collector load. The frequency coverage is 220.8 to 281.6Mc/s. The collectors are supplied from the -12V supply by R139 and decoupled by r.f. choke L117 and C162. The secondary winding of T106 provides drive to the base circuit of the first mixer stage VT103 and is matched for best overall performance over the frequency coverage of the receiver.

First i.f. amplifier stage VT104 (OC170) and first i.f. filter

70. The 19.05Mc/s signal produced in the collector circuit of VT103 is fed to the i.f. coil L107 which is coupled by C116, C117 and C118 top capacitance coupling, to the transformer T101 producing a bandpass i.f. response. R110 is the VT105 collector supply resistor from the -12V line and decoupled by C115. The output of the i.f. filter is shunted by R111 to ground and coupled to the emitter of the first i.f. amplifier VT104 by C119. VT104 is operated in the common base configuration although in fact the base is fed with a.g.c. 2 supply. Emitter stabilizing is provided by R111 which is grounded. The collector is connected to a tap on coil L308, the tap being arranged for optimum coupling and i.f. gain. The collector coil and T102 and associated coupling components C123, C124 and C125 constitute a bandpass filter of similar design to the first i.f. filter.

71. The first i.f. filter and the first i.f. amplifier stages have been constructed as separate assemblies each with its own screening can. In the case of the first i.f. amplifier the transistor VT104 is incorporated on the sub-assembly within the screening can.

Second mixer stage VT105 (OC170)

72. Second mixer stage VT105 is constructed as a screened unit and in conjunction with second oscillator VT113 functions to convert the first i.f. frequency of 19.05Mc/s down to the second i.f. frequency of 930kc/s.

73. The second mixer stage consists of VT105 which is operated as a hybrid mixer, r.f. input to base, oscillator to emitter, and the 930kc/s second i.f. output is taken from the collector. The input from the second oscillator VT113 is at a frequency of 19.98CMc/s which when mixed with the first i.f. of 19.05Mc/s produces a second i.f. of 930kc/s.

74. The 19.05Mc/s i.f. output from T102 secondary is fed to the base of VT105, the secondary being matched into the base impedance of VT105 and is connected to the a.g.c. 2 line. The output from the second oscillator VT113 is fed to the emitter of VT105 via C126, from the transformer T107, the emitter being stabilized by R113. The secondary of T107 has been designed to match the emitter impedance of VT105. The collector circuit consists of a tuned winding L109, damped by R115 and tuned to 930kc/s by the iron dust core and C127. This circuit including L110 tuned by its core and C129, forms, with L109 a bandpass circuit with capacitance coupling across C128.

Second oscillator stage VT113 (OC170)

75. The second oscillator stage is crystal controlled and has been designed for high stability operation. The specification calling for a tolerance of ±10c/s over the operating frequency of 19.98CMc/s. The transistor is operated as a modified Colpitts oscillator and the output being taken from the emitter via T107 which is adjusted for maximum amplitude of signal. The collector is fed from the -12V line by R143, and from this point R140 is fed to the base for bias and d.c. stabilization with R141 forming the end component of a potential divider. The 19.98CMc/s crystal is parallel tuned by the air spaced preset capacitor C163 and the tuned circuit is between base and chassis earth. The emitter is stabilized by the resistor R142

which is in series with the primary of the output transformer T107. C164, C165 and coupling capacitor C166 together form the feedback circuit from emitter to base. Output is taken from the high impedance point at the junction of C164 and C165 to the primary of T107 which is critically coupled by the secondary winding to the emitter coupling capacitor C126 in the second mixer VT105.

Second i.f. filter stage (930kc/s)

76. This stage is a screened assembly consisting of two tuned circuits, L111, C131 and L112, C133, coupled by the bottom capacitor C132 thus forming a bandpass network operating at 930kc/s. The input signal is fed by series capacitor C130 and damped by R117. The output from L112 is taken at low impedance and shunted to chassis earth by R118. External to the screening can and fitted between the filter and the next stage is an attenuator matching network consisting of R155 and R156.

Second i.f. amplifier stage VT106 (OC170) (930kc/s)

77. This stage contains VT106, operated in the common emitter configuration with the input from the previous stage taken directly to the base. Bias is applied to the emitter via R210 which is connected to the +3.2V line. The collector circuit consists of L113, C137, and L114, C139, which together constitute a bandpass filter. Top capacitance coupling by C138; L113 is tuned by C137 and damped by R119 to provide optimum matching for VT106 collector and output to VT107. The collector supply is taken from the -12V line via R121. Resistor R157 is in series with the collector to limit the gain of VT106 at 930kc/s and to maintain the output impedance. The stage is neutralized by a series circuit consisting of the overwind on L113 and C135.

Detector stage including third i.f. amplifier VT107 (OC170) (930kc/s)

78. This stage is a screened assembly containing the third i.f. amplifier stage VT107 and the crystal diode detector MR102. The signal from the previous stage is fed directly to the base of VT107 which is operated in the common emitter mode. The stage is similar to that of VT106 in that it uses two tuned circuits L115, C143 and L116, C145 top coupled by C144 to form a bandpass filter.

79. A portion of L115 and C141 form a series neutralizing circuit connected between the base of VT107 and the collector circuit. L115 tuned circuit is damped by R124. R123 is connected between the tuned circuit L115, C143 and the collector of VT107 to limit the gain at 930kc/s, and maintain output impedance to the detector. The signal is coupled directly to the cathode (equivalent) element of the detector MR102, and the negative going output is developed across R127 and the filter capacitor C146. The output of the detector is fed in parallel to the first a.g.c. amplifier VT115 and to the first audio frequency amplifier VT117.

A.G.C. amplifier VT115 and VT114 (CV7363)

80. The impedances in transistor a.g.c. circuits are much lower than in those of conventional valve receivers. This introduces a new problem with transistors because the a.g.c. system has to supply significant power and not just voltage as with valves. To prevent excessive loading of the detector stage, some form of d.c. amplifier stage is required to be inserted between the detector stage and the

controlled stages. Direct coupling is most suitable in the a.g.c. line because it ensures that blocking cannot occur when the receiver experiences sudden strong input signals.

81. The transistors are in the common emitter mode with the collectors connected in parallel directly to the -12V line. The negative going input from the detector stage is fed to the base of VT115 via R148. The base is connected to chassis earth by C168, a large capacitor to provide a long time constant to the input circuit. The base of VT114 is directly coupled to the emitter of VT115 which is operated as an emitter follower. The emitter is stabilized by R147 which has been given a high ohmic value to increase the gain and also by reducing the emitter current assists the stability of the stage. VT114 also operates as an emitter follower stage with the emitter potential being set by the network R144, R145 and R146. The collector and upper end of R144 are fed from the -12V line. The a.g.c. 1 and a.g.c. 2 voltages are in the order of -1V and -2.6V respectively, these being tapped off the junctions of R146, R145 and R144, R145.

Forward a.g.c. to stages VT104 and VT105

82. The initial a.g.c. action in the A43R Mk 2 takes place at the mixer VT103, and for this purpose reverse a.g.c. is used (para 59 refers), if however the range of the mixer a.g.c. is exceeded by a large reduction in signal, the second a.g.c. comes into action thus giving the set a wider range of control. The second a.g.c. system controls VT103 and VT105, and operates on the forward control. Transistor a.g.c. systems depend on the fact that the output level of a transistor varies with both collector voltage and collector current. In forward a.g.c., gain is reduced by reducing the collector voltage, usually by increasing the collector current and thus the voltage drop across the decoupled resistor in the collector circuit. This is a simplified account of the action of a.g.c. circuits because gain is also affected by the variations in transistor input and output impedance with the bias voltage and current.

83. Negative going supply a.g.c. 2 is fed to the base of VT104 via R154 to increase the forward current of VT104 and a variation of collector current produced, this causes the voltage across R112 to drop and a reduction in collector to emitter voltage, and hence the gain of the stage. A similar method is used in the case of VT105 except the input is fed through the secondary of T102 to the base of VT105 and the current variation of R114 alters the applied voltage to the collector and thus the gain.

First a.f. amplifier stage VT117 (CV7363)

84. The signal from the detector is fed by C171 to the base, which is connected to the potential divider R151, R152 is connected from the -12V line to chassis earth. The stage operates in an emitter follower configuration, the output being coupled to RV203 by C170. The collector is fed directly from the -12V line.

Second a.f. amplifier VT116 (CV7363)

85. The stage is operated in the common emitter mode with the amplified audio signal from VT117 being fed from the slider of RV203, the emitter stabilizing resistor for VT117. The input point is also used to introduce the sidetone audio voltage derived from MR301 via C208 and R213. The negative 12V supply line is fed through R212 and primary of T201 to the collector of VT116. The emitter is

Note: These Pages 1 to 4 and 25 to 29, Issue 2, supersede Pages 1 to 4 and 25 to 28, Issue 1, dated 24 Sep 64. Pages 1 to 4 and 26 to 29 have been revised throughout. Page 4a, Issue 2, will be filed immediately after Page 4, Issue 2, dated 6 Jun 67. It contains information previously on Page 4, Issue 1, dated 24 Sep 64.

connected to chassis earth. The collector is connected to the base by R149 which is shunted by C169 for response purposes. The secondary of T201 is matched to the impedance of the 300Ω electro-magnetic earphone.

Handset or headset circuit

86. The pressel switch fitted to either the handset (or headset) assemblies operates the coil of RLA/4 by earthing the -12V supply from RLA2-13. This facility is confined to the PHONE setting of the system switch SA.

87. The microphone is connected via pin A SKTH of the Bendix-Thorn connector to the input of the low pass filter via PLK-M. The earphone is connected to PLK-N, and on to the output transformer T201.

Smoothing circuit

88. An iron cored inductance is connected from the -12V supply line RLA3-8 and functions as a filter circuit to ensure the receiver power is free from ripple. The receiver side of the inductance is also connected to C210 to provide capacitive smoothing.

Power supply unit VT401, VT402 (CV7084), VT403 and VT404 (CV5416)

89. The power supply consists of two transistor d.c./d.c. convertors. One part of the convertor uses a pair of CV5416 (VT403 and VT404) to provide the +3.2V supply and operates continuously. On receive it supplies the emitter bias chain and the 'pre-heat' voltage for the p.a. valve heater. On transmit the oscillator and multiplier valves also obtain their filament voltage from this source.

90. The second part of the transistor convertor which operates only on transmit uses a pair of CV7084 transistors (VT401 and VT402) to provide +150V and +75V for the transmitter.

91. Both power supplies perform the same basic function as a vibrator type convertor in that d.c. from the supply battery is applied to a high speed switch (in this case the transistors). The interrupted primary voltage is then stepped up by the transformer secondary windings, rectified and smoothed.

92. The circuit providing the +150V and +75V supplies operates in the following manner. On switching to transmit the -12V supply is applied to the collectors of VT401 and VT402 via the centre tapped collector winding on T401. Also connected across the supply is the biasing network R401 and R402 and the junction of these two resistors is connected to the centre tap of the base winding on T401. This potential provides a small forward bias to VT401 and VT402 to ensure starting. Due to differences in the characteristics of the two transistors, one will conduct more heavily than the other (Assume this is VT401), the resultant voltages developed across the transformer windings will cause VT401 to 'bottom' (conduct heavily) whilst due to the opposite phasing of the windings VT402 will be cut off. This action will continue until the transformer core reaches saturation; the voltages then collapse, switching off VT401 and the overswing biases VT402 on. Regeneration

causes VT402 to bottom and it remains so until the transformer core once again reaches saturation in the opposite direction. The voltage collapses, VT402 switches off, VT401 switches on and so the cycle repeats itself.

93. On the secondary side of T401 full wave bridge rectification takes place via MR401, MR402, MR403 and MR404 (CV7039). The full winding is used to provide the +150V supply which is smoothed by C402, L402 and C403. Half the secondary winding is used for the +75V supply which is additionally smoothed by L401 and C401.

94. The action of the +3.2V supply circuit consisting of VT403, VT404 and T402 is basically similar to the previous one except that forward bias is provided from the junction of R403 and MR405 (OA70). R405 and R406 provide current limiting during initial operation as the supply starts on load. Full wave rectification by MR406 and MR407 (CV7036) is used and the +3.2V output is smoothed by C403, L403, C407 and C409.

Test points

95. Several test points are placed throughout the set to assist in fault tracing. To gain access to these points the set must be unsealed; test point information is given in Tels F 532 Part 2 Table 2504.

A43R Mk 2. Later models.

96. In the following paragraphs and tables details are given of the circuits and component changes between the earlier and later models. Table 2 lists component changes.

97. The principal difference between the two models is in the p.a. section of the transmitter and minor alterations have been incorporated in both the receiver section and the power supply unit.

98. The p.a. valve V306 is now a directly heated high efficiency double tetrode type QQZ02/6 and its heater volts are applied through contacts RLA2 operated by the pressel switch. Screen voltage on V304 and V305 is now raised to 150V d.c.

99. The relay RLA/4 has been changed for a type having heavy duty contacts to carry the p.a. valve heater current (RLA-2). Relay RLB/2 has been removed from circuit.

100. The resistors R313, R315 and R322 in the transmitter have been changed either in value or rating, R216 has been removed. Capacitor C321 is changed in value and C343, C352 and C358 together with L312 have been removed.

101. In the power supply unit, R403 is changed in value and the toroid transformer T402 is changed for one having an additional secondary winding giving 2.2V off load for the p.a. valve heater. This connection is made from pin 10 of T402 to pin 1 of SK B and thence to pin P of SK D via RLA-2.

102. In the receiver section (Fig 2526), R153 is changed in value and resistor R163 and diode MR108 added to the a.g.c. amplifier.

103. The technical description given in Tels F 532 Part 1 Issue 1 applies in the main to the later models with the exception of the details resulting from the circuit changes. In the following paragraphs the corresponding paragraphs of the Issue 1 are given in parenthesis to enable cross reference to be made.

Note: These Pages 1 to 4 and 25 to 29, Issue 2, supersede Pages 1 to 4 and 25 to 28, Issue 1, dated 24 Sep 64. Pages 1 to 4 and 26 to 29 have been revised throughout. Page 4a, Issue 2, will be filed immediately after Page 4, Issue 2, dated 6 Jun 67. It contains information previously on Page 4, Issue 1, dated 24 Sep 64.

Table 2 - Component additions/changes

Cct ref	Component location		Value Ω	Rating W	Type	Tolerance ±%
	Fig 2502	Fig 2503				
RESISTORS						
R313	E2		6.8K	1/8	comp	10
R315	G1		4.7K	1	comp	5
R322	H3		3.9K	1/8	comp	10
R403	G8		680	1/8	comp	10
R216	N8		Removed from circuit			
R153		AA6	56	1/8	comp	10
R163		AA4	330K	1/8	comp	10
CAPACITORS						
C321	E2		56pF	750V	cer tub	5
C343	L1		Removed from circuit			
C352	D5		Removed from circuit			

Cct ref	Component location		Description
	Fig 2502	Fig 2503	
MISCELLANEOUS			
RLA		AA8	Relay, armature 4 contacts
RLB	M1		Removed from circuit
L312	D5		Removed from circuit
V306	J2		QQZ02/6 Double tetrode
MR108		AA4	Semi-conductor diode OA70

Transmitter

P.A. stage
(Fig 2025)

104. The p.a. valve (V306) is a directly heated durable tetrode (para 18, 35). Heater volts are applied via RLA-2, operated by the pressel switch, and pre-heat voltages are not necessary (para 39).

Phone transmit

105. The -12V supply (para 51(c)) is re-routed from RLA2-13 to RLA3-9. The p.a. filament pre-heat (para 51(j)) operation does not apply.

Receiver

A.G.C.
(Fig 2026)

106. The addition of R163 and MR108 to the base circuit of VT115 reduces the time constant of R148 and C168 thus reducing the a.g.c. attack time (para 81).

Power supply unit
(Fig 2525)

107. The toroid transformer T402 is changed for one having an additional secondary winding giving 2.2V a.c. off load (para 94).

108. The output voltages of the converter T402, VT403 and VT404 are +3.2V and 2.2V a.c. On receive, the +3.2V supplies the emitter bias chain. On transmit this voltage is fed to the oscillator and multiplier valves as filament voltage and the 2.2V is fed to the p.a. valve heater.

BATTERY CHARGER

109. The battery charger is designed to operate from a d.c. supply of either 12 or 24V nominal, eg a vehicle or aircraft battery or electrical system. The input voltage selection is effected entirely automatically by means of a voltage-sensitive relay. The charger provides a constant voltage output at either 13.2V for lead-acid batteries or 14.6V for use with the nickel cadmium batteries. It can deliver sufficient current to float-charge one normal battery unit at the correct rate whilst simultaneously operating one equipment in the receive condition via the battery adaptor.

110. Rectifier MR501 (CV7122) presents a low resistance to normal current flow when the supply voltage is connected in the correct polarity, but a very high resistance to a reverse current in the event of the supply voltage being inadvertently reversed. This arrangement prevents the possibility of damage to transistors VT501 and VT502 (CV7085) being caused by reversed polarity.

111. The value of R501 is selected so that relay RLA/2 will operate at 19 ±1V, so that for input voltages below this figure RLA/2 will remain de-energized and so in turn will relay RLB/2. The transistor oscillator VT501, VT502, will therefore operate using the inner taps on the main primary winding of T501, to give 17V nominal output from the secondary.

112. To ensure that the oscillator will start, it is necessary for a large forward bias to be applied initially to the bases of VT501 and VT502 to establish base-emitter current. A diode, MR502 (CV7039) is included in the circuit for this purpose. Under starting conditions, MR502 is biased in the reverse direction and so has a very high d.c. resistance. A large bias is therefore applied to the bases of VT501 and VT502. As oscillation builds up, the base potential of the transistors becomes positive with respect to that of the emitters owing to the rectifying action of the base-emitter junctions. Therefore, MR502 then becomes biased in the forward direction, and so its d.c. resistance is reduced; this allows the base current to assume an appropriate value for the continuously operating condition.

Note: These Pages 1 to 4 and 25 to 29, Issue 2, supersede Pages 1 to 4 and 25 to 28, Issue 1, dated 24 Sep 64. Pages 1 to 4 and 26 to 29 have been revised throughout. Page 4a, Issue 2, will be filed immediately after Page 4, Issue 2, dated 6 Jun 67. It contains information previously on Page 4, Issue 1 Dated 24 Sep 64.

113. For input voltages above 19 ±1V, RLA/2 will be energized and contacts RLA1 will close to energize RLB/2 whose contacts will change over to the end connections of the main primary winding of T501, thereby adjusting the turns ratio so that the same nominal output of 17V will be available from the secondary. Contacts RLA2 will change over to substitute R502 for R503, thereby adjusting the potential divider ratio so that the same biasing condition is maintained.

114. The output from T501 is rectified by the bridge rectifier MR503-506 (CV7122) and reservoir capacitor C503.

115. Transistors VT506 and VT507 (both of CV7084 type) operate in parallel as a series voltage regulator giving a substantially constant output voltage. A Zener diode (CV7069) with R507 in series, forms a potential divider across the output to provide a reference voltage across MR507. This voltage is fed to the base of VT504 (CV5416) which operates with VT505 as a long-tailed pair. A sample of the output voltage is fed to the base of VT505 (CV5416) via a potential divider with adjustment provided by RV501 to obtain the required stabilized output of 13.2V. In the event of the output voltage tending to increase, the base of VT505 will tend to become more negative. The collector of VT505 will therefore go more positive. This change is fed to the base of VT503 (CV5416) which operates as an emitter follower to provide a low-impedance output as the controlling base bias for VT506 and VT507 which will now go more positive. This results in an increased effective regulating resistance to restore the output voltage to the required stabilized value.

116. The meter M501 has a rectifier MR508 (CV7122) connected in parallel in order to make it non-linear so that a useful deflection is obtained over the significant range of output current. Rectifier MR509 (CV7122) prevents a battery discharging back through the charger in the event of the removal or failure of the supply voltage.

104. The charging supply must not fall below 11V or 22V or the indication of meter M501 may be inaccurate and show the battery to be fully charged, even though this is not so.

EME8c/1380

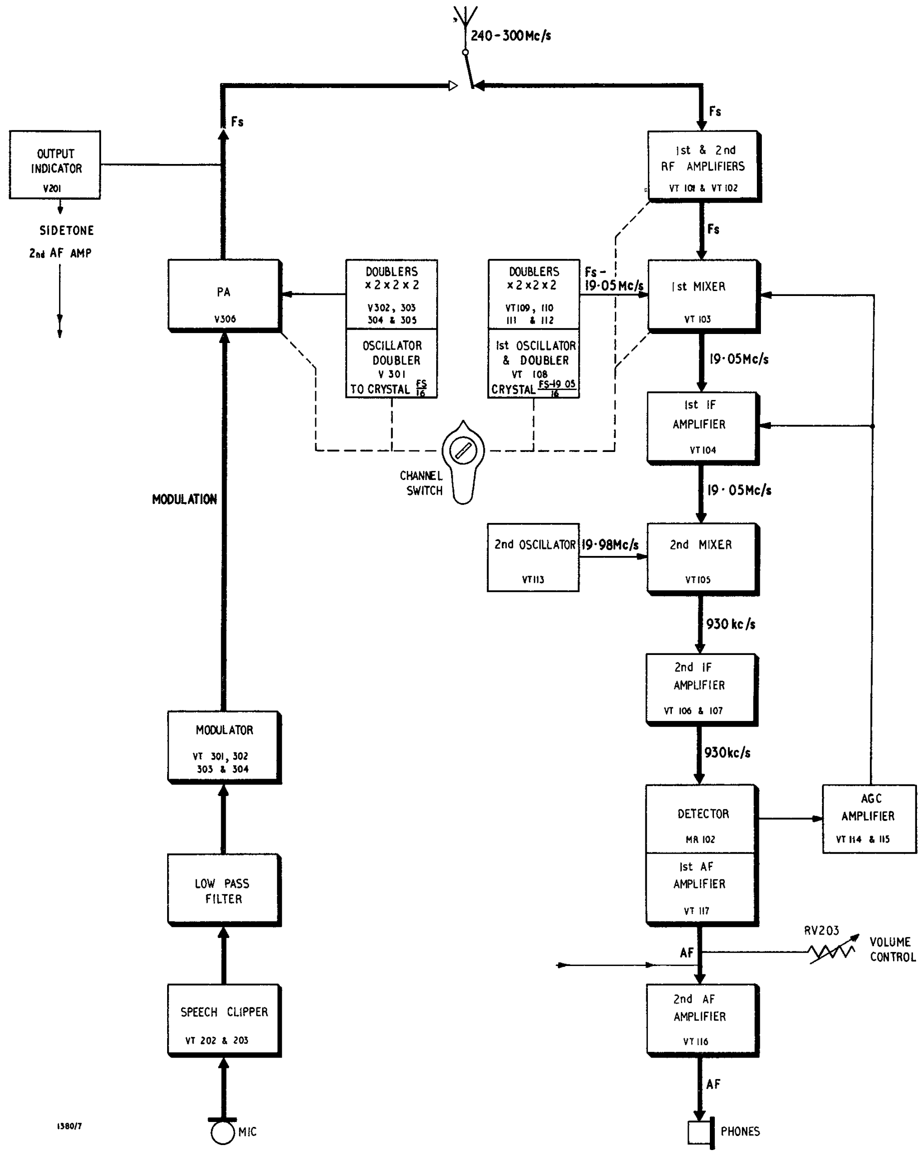

Fig 9 - Block diagram

END OF PART 1