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Richard Hankins, VMARS Archivist, Spring 2004

RESTRICTED

AIR PUBLICATION
2914Y
VOLUME 1
(Second Edition)

ARI.5610
Rebecca Mk. 4

Prepared by direction of
the Minister of Aviation

W. Shatti

Promulgated by Command
of the Air Council

W. J. Dean

AIR MINISTRY

THE PATENT 'LOXON' LOOSE-LEAF BINDER

Patent Nos. 700547 and 802577

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REF. F 3447

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AMENDMENT RECORD SHEET

To record the incorporation of an Amendment List in this publication, sign against the appropriate A.L. No. and insert the date of incorporation.

A.L. No.	Amended by	Date
1 to 7	Incorporated in this reprint	May 1963
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NOTE TO READERS

The subject matter of this publication may be affected by Air Ministry Orders, or by "General Orders and Modifications" leaflets in this A.P., or even in some others. If possible, Amendment Lists are issued to correct this publication accordingly, but it is not always practicable to do so. When an Order or leaflet contradicts any portion of this publication, the Order or leaflet is to be taken as the overriding authority.

The inclusion of references to items of equipment does not constitute authority for demanding the items.

Each leaf, except the original issue of preliminaries, bears the date of issue and the number of the Amendment List with which it was issued. When this Volume is amended by the insertion of new or replacement leaves in an existing chapter, the new or amended technical information will be indicated by triangles, positioned in the text thus: —◀------▶ to show the extent of amended text, and thus: — ▶◀ to show where text has been deleted. When a Part, Section, or Chapter is issued in a completely revised form, the triangles will not appear.

LAYOUT OF A.P.2914Y

A.R.I.5610 - REBECCA Mk.4

VOLUME 1
General and technical information

- PART 1 — Technical information
- PART 2 — First and second line servicing
- PART 3 — Fault diagnosis
  ▶ See Vol.6 (2nd Edn.) Part 2, Sect.1, Chap.10 ◀
- PART 4 — (Not applicable)

Information which would normally be applicable to Part 3 is included in Part 2

VOLUME 2
General orders and modifications

VOLUME 3
Equipment schedules and scales

- PART 1 — Schedule of spare parts
- PART 2 — Schedule of airframe equipment (Appendix A)
- PART 3 — Scales of unit equipment
- PART 4 — Scales of servicing spares

VOLUME 4
Planned servicing schedules

- PART 6 — Bay servicing schedules

Applicability of other Parts to be determined later

VOLUME 5
Basic servicing schedules

Applicability to be determined later

VOLUME 6
Repair and reconditioning instructions

- PART 1 — Minor repairs
- PART 2 — Repair and reconditioning instructions (Major repairs)
- PART 3 — Fits, clearances and repair tolerances

Information which would normally be applicable to Parts 1 and 3 is included in Part 2

Notes . . .

(1) *A list of chapters, where applicable, is given in each Part.*

(2) *Availability of Volumes is indicated in A.P.2463.*

LEADING PARTICULARS OF ARI.5610

Frequency of operation

Using control unit 526 — six preset spot frequencies—

Transmitter	185-238 *Mc/s*
Receiver	175-236 *Mc/s*

Using control unit 526A — six preset spot frequencies—

Transmitter and receiver	212-236 *Mc/s*
Intermediate frequency	45 *Mc/s*
Transmitter peak power output	*not less than* 212 *watts at fundamental frequency, into a* 50*-ohm load*
Pulse duration	*between* 4·5 *and* 6·5 *microseconds*
Pulse repetition frequency	*between* 95 *and* 110 *pulses per second*
Receiver sensitivity	*not less than* 78*dB* down on* 0·1*V*, *for a signal-to-noise ratio of* 2 : 1
Bandwidth	*between* 2·4 *and* 3·6 *Mc/s*
Second channel rejection	*not less than* −46*dB**
I.F. rejection	*not less than* −50*dB**

* *Includes matching pad, approx.* 26*dB*

Range scales	6, 12, 60, 120 *and* 240 *nautical miles*
Power consumption	200 *watts* (80*V*, 1000-2000 *c/s*) 30 *watts* (24*V d.c.*)
Voltages	*H.T. positive* 250*V*, 300*mA* (*including anti-jitter line*) *Anti-jitter line* +220*V*, 50*mA* *E.H.T. positive* 1·5*kV*, 3*mA* *E.H.T. negative* 1·5*kV*, 5*mA*

Weights

*Transmitter-receiver Type TR.*3624	37 *lb*
Control unit Type 526 *or* 526*A*	4 *lb*
Indicating unit Type 208	3 *lb*

Overall dimensions

*Transmitter-receiver Type TR.*3624	19 *in. long* × 10½ *in. dia.*
Control unit Type 526 *or* 526*A*	8½ *in.* × 4 *in.* × 4 *in.*
Indicating unit Type 208	13¾ *in. long* × 4¼ *in. dia.*

PART 1

TECHNICAL INFORMATION

PART I

RESTRICTED

PART 1

LIST OF CHAPTERS

CHAPTER 1

MAIN UNITS

Chapter 1

MAIN UNITS

LIST OF CONTENTS

CIRCUIT DESCRIPTION

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LIST OF ILLUSTRATIONS

* *Also issued in the A.D. 6277/MIN series*

INTRODUCTION

1. Rebecca Mk. 4 is a lightweight miniature airborne interrogator operating over the frequency band 185-240 Mc/s. It is a general-purpose equipment providing for the interrogation of all types of British homing and re-supply beacons operating within the above frequency range. It is also used as a blind approach system in conjunction with BABS Mk. 2.

2. The principle of operation is exactly the same as employed in other interrogators, in that the pulses radiated from the Rebecca transmitter interrogate the ground beacon, which responds on a different frequency. These responses, after amplification and detection in a superheterodyne receiver, are displayed as an L 'scope presentation on a small cathode-ray tube indicator.

3. The installation has been designed for remote control operation, all necessary controls being situated in a small panel-mounted control unit. The indicating unit is also designed for panel mounting.

4. Six transmitting and six receiving frequencies are available for selection through the control unit.

OUTLINE DESCRIPTION

General

5. Rebecca Mk. 4 installation consists of:

(1) Transmitter-receiver TR.3624 (Ref. No. 10DB/8118)

(2) Control unit Type 526 (Ref. No. 10LB/6239) or Control unit Type 526A (Ref. No. 10L/16745)

(3) Indicating unit Type 208 (Ref. No. 10QB/6130)

(4) Visor Type 43 (Ref. No. 10AT/41)

(5) Mounting Type 814 (Ref. No. 10AB/5819) or Mounting Type 6832 (Ref. No. 10AJ/631)

(6) Mounting assembly Type 212B/2 (Ref. No. 10AJ/81)

(7) Wedge plate (Ref. No. 14A/540)

(8) Aerial installation (Chapter 3 of this part refers to the aerial systems applicable to various aircraft).

(9) Connector set (Chapter 2 of this part gives cabling information without reference to any particular aircraft. Details of the connector set are given in the aircraft A.P.).

A general view of the main units is given in fig. 1.

Brief description of operation

6. The master oscillator valve, V108, produces a 50-volt pre-pulse which is applied to the grid of the modulator drive valve, V110. This causes a 400-volt positive-going pulse at V110 anode, which is used to drive the modulator valve V201, series modulating the final valve V202. This is *L-C* coupled, via a simple harmonic filter, to the transmitting aerial. At the instant of peak transmitter current, a positive pulse is developed which is used to suppress the receiver, lest it be overloaded, for the duration of the transmitter pulse. There is also developed, simultaneously, a negative-going pulse which is used to trigger the timebase.

7. V7, V8, V9 and V10 generate the timebase and V12 is connected in paraphase with V10 to supply balanced sawtooth waveforms to the c.r.t. 'X' plates. A brightening pulse is also produced in conjunction with the timebase and is applied to the c.r.t. grid.

8. Signals from the beacon energize the port and starboard aerials, which are connected to an electro-mechanical switch, S101, passing information from each aerial alternately to the receiver r.f. unit, the 45 Mc/s output of which is amplified in the six-stage i.f. amplifier, which also includes the second detector and a video cathode-follower stage.

9. The form of presentation of the information on the c.r.t. screen requires the video signals to be fed alternately to the Y1 and Y2 plates, in synchronism with reception from the port and starboard aerials. This is accomplished by means of the aerial switch S101 in conjunction with suitable filters to separate video and aerial signals. Calibration signals are also provided and may be injected into the video amplifier or not, as required.

PHYSICAL DESCRIPTION

Transmitter-receiver TR.3624 (*fig.* 25)

10. Transmitter-receiver TR.3624 is the main unit of the installation and contains the following sub-assemblies:

(1) Chassis assembly Type 6450 (Ref. No. 10D/20385), which includes:

(a) Chassis No. 1 (not referenced)

(b) Chassis No. 2 (not referenced) including switch unit Type 273 (Ref. No. 10FB/6249).

(2) Transmitter unit Type 127 (Ref. No. 10DB/8665), which has a filter unit Type 6834 (Ref. No. 10P/16226) attached to the underside cover.

(3) Receiving unit Type 6449 (Ref. No. 10P/16222), which includes:

(a) R.F. unit Type 147 (Ref. No. 10DB/8858)

(b) I.F. unit Type 123 (Ref. No. 10DB/8508)

(c) Gearbox and motor assembly Type 55 (Ref. No. 10KB/6346).

The complete transmitter-receiver TR.3624 is a cylindrical unit enclosed in a sealed dust cover, overall dimensions 19 in. long by 10½ in. diameter and weight 37 lb. The unit is pressurized to 5 lb/in^2 by means of a Schrader valve and external pump. A desiccator is fitted to give visual indication, by change of colour of the desiccant when moisture is present inside the unit. The TR.3624 does not include any mounting arrangements and must therefore be fitted with a mounting Type 814 or mounting Type 6832 (para. 17). There are no operator's controls on the TR.3624, all functions being remotely controlled by the manual controls on the control unit Type 526 or 526A (para 18).

11. Chassis assembly Type 6450 consists of a front and rear panel with two main bulkheads fitted between. These bulkheads effectively divide it into three longitudinal sections The outer side of each bulkhead supports a chassis mounted at right angles, these are chassis No. 1 and chassis No. 2. All interconnections with other main units of the installation are made through plugs and sockets mounted on the front panel.

12. The inner section between the two bulkheads houses the transmitter unit Type 127 and the receiving unit Type 6449. The transmitter unit Type 127 is mounted below the receiving unit Type 6449, leaving a central duct between the two units.

13. Views of both the transmitter and receiving units are given in fig. 27. In the two views of the transmitter unit both the top and bottom covers are removed and the filter unit Type 6834 is not shown. The construction of the filter unit Type 6834 is given in fig. 13. All connections to the transmitter unit Type 127 are made through a fixed plug PL210 which is mounted at the rear end of the transmitter unit.

14. The receiving unit Type 6449 consists of a chassis fitted with a blower unit. Fitted on the chassis are three sub-units: r.f. unit Type 147, i.f. unit Type 123, and the gearbox and motor assembly Type 55. A fixed plug PL228 mounted at an angle on the chassis carries interconnections for the blower unit and the gearbox and motor assembly Type 55. On the r.f. unit Type 147 there are two fixed plugs, PL227 interconnects with chassis 1 and 2, and PL226 connects directly into a fixed socket SKT426 on the i.f. unit Type 123. The remaining interconnections between chassis No. 1 and 2 and the i.f. unit Type 123 are made through a fixed plug PL427.

15. To enable the equipment to operate at high altitudes and in tropical climates, the complete TR.3624 is enclosed in a sealed cylindrical dust cover which is held in position by two clamps

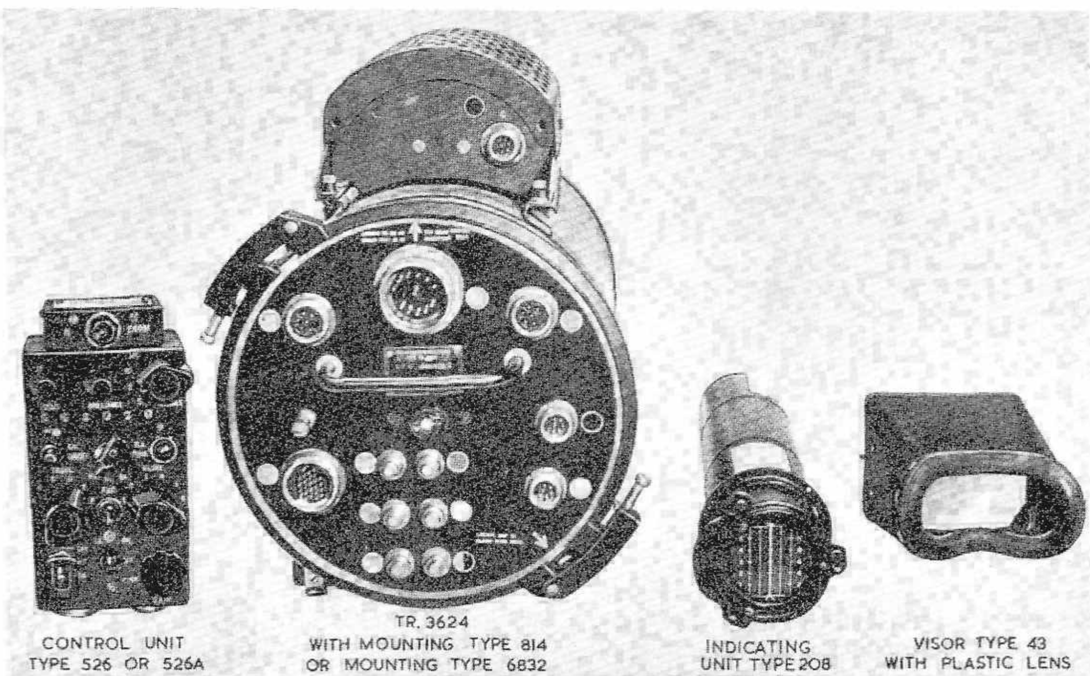

Fig. 1. Rebecca Mk. 4—general view

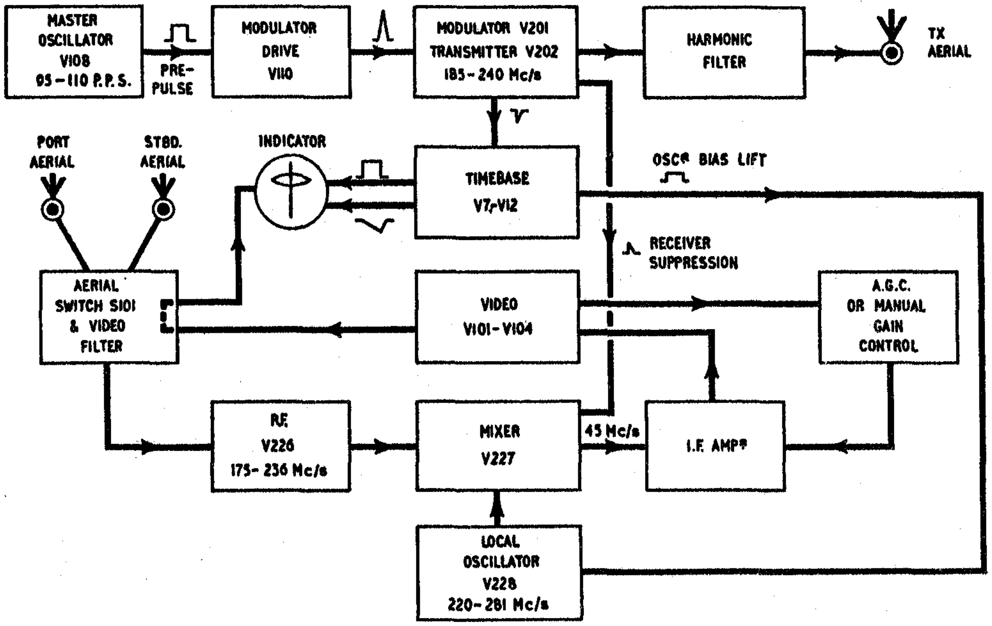

Fig. 2. Rebecca Mk. 4—block diagram

attached to the front flange of the dust cover and the front panel. A Schrader valve is fitted in the front panel to facilitate the pressurizing of the TR.3624 to 5 lb/in^2. This pressurizing, whilst affording protection at high altitudes, causes a considerable increase in the internal temperature rise, thus it is essential to maintain a good air circulation both inside and outside the dust cover. To this end both internal and external blowing systems are used.

16. The blower unit fitted to the receiving unit Type 6449 provides the internal air circulation. As most of the heat is generated in the i.f. unit Type 123, the internal air blower system is arranged to concentrate on this position. The internal air circulation is consequently as follows. Relatively cool air, drawn in by the fan from the rear of the unit, is blown direct on to the valves of the i.f. unit and into the transmitter Type 127 and the central air duct. As a result hot air is forced down the central duct and along the upper deck, escaping through large holes cut in the bulkhead to the main valve decks, chassis No. 1 and 2, where it flows back along the cylinder to the rear of the unit to be drawn up by the blower unit for the air circulation cycle to recommence. To ensure that the air recirculated is cooled, an external blower is used.

17. The transmitter-receiver TR.3624 is fitted with either a mounting Type 814 (Ref. No. 10AB/5819) or a mounting Type 6832 (Ref. No. 10AJ/631). The mounting Type 814 consists of a cradle mounting with a box containing the external blower. The mounting Type 814 is fitted to the dust cover by two bands which clamp around the circumference of the dust cover. Mounting Type 6832 is a strengthened version of the mounting Type 814 using the same external blower unit. The external blower concentrates cool air on to the top and sides of the dust cover, which are the hottest parts. By this means the hot spots are externally cooled and the maximum heat dissipation is effected, thus cooling the air before recirculation by the internal blower. The use of both an internal and external blower limits the highest air temperature rise inside the transmitter-receiver TR.3624 to 35°C. The TR.3624, with a mounting Type 814 or 6832 fitted, is in turn mounted in the aircraft on a mounting assembly Type 212B/2 (Ref. No. 10AJ/81).

Control units Type 526 and 526A

18. A control unit Type 526 or 526A may be used in a Rebecca Mk. 4 installation. Both control units contain all the manual and preset controls necessary for the operation of the installation. Manual controls are grouped so as to render their identification and operation as easy as possible without direct observation on the part of the operator. The two versions of the control unit are identical externally. The control unit Type 526A includes a modification (R.M.C. Mod. No. 5387/8) enabling the transmitter and receiver frequencies of the transmitter-receiver TR.3624 to be changed to frequencies spaced by 4 Mc/s without any modification being carried out on the transmitter-receiver TR.3624.

19. Views of the control unit Type 526 are given in fig. 26. The unit is a rectangular box with an additional box, containing the extended range unit, fitted on to the top end. The unit case is constructed in hard aluminium, the rear panel (not shown in fig. 26) including a dovetail plate arrangement for mounting the unit on to a wedge plate (Ref. No. 14A/540). This type of mounting makes the control unit readily detachable, allowing adjustment of all the preset controls through access holes in the rear cover, also giving access for the replacement of the h.t. fuse which is located at the rear of the extended range unit box. The overall dimensions of the control unit are 8½ in. long by 4 in. wide by 4 in. deep and the unit weighs 4 lb. The control unit is not pressurized, but adequate precautions have been taken to prevent flash-over or failure up to altitudes of 35000 feet.

20. The following manual controls are available to the operator:

(1) C.R.T. FOCUS and BRILLIANCE

(2) Timebase RANGE selector switch

(3) Calibrator push-button switch, CAL. ON/OFF

(4) Receiver frequency fine tuning control, RX. TUNE

(5) Receiver frequency selector switch, RX. SEL.

(6) Transmitter frequency selector switch, TX. SEL.

(7) Function switch, H_0–H_1–BA.

(8) HT ON/OFF switch

(9) Transmitter switch, TX. ON–OFF–CODE

(10) Receiver GAIN control

(11) Manual/a.g.c. switch, AVC/M.

(12) Normal—240m switch, N–240M.

21. The receiver frequency fine tuning control consists of a spring-loaded switch which, when operated, causes the receiver tuning to sweep 2-3 Mc/s about the selected frequency. When the desired beacon signal is seen to reach maximum amplitude, releasing the switch causes the tuning system to stop. By this means the operator can tune to beacon signals off frequency. A second operation of the switch re-starts the sweep tuning and so on. Selection of another frequency channel automatically disengages the tuning system until such time as it is reintroduced, if required, by operation of the switch. A particular advantage of this arrangement is that an aircraft operating just outside the maximum range of a ground beacon can have the receiver sweeping and will be certain to pick up the beacon signal at the maximum possible range.

22. The six preset transmitter frequencies are coded A to F and the six receiver frequencies 1 to 6. This arrangement precludes the possibility of ambiguity on the part of the operator in selecting the appropriate beacon code.

23. The receiver manual gain control operates normally on all ranges, without a.g.c., but serves as an override control when the AVC/M switch is set to the AVC position.

24. In addition to the other manual controls, which are self-explanatory, a number of preset controls necessary for daily servicing is embodied in the unit. These are adjustable from the rear when the unit is lifted off its wedge mounting. Setting-up of the transmitter and receiver frequencies, timebase velocity and timebase delay are all accomplished within the control unit. By this means any adjustments to compensate for day-to-day variations in the equipment may easily be made without having to open the main TR. unit. The h.t. fuse is also located in the control unit.

25. The physical differences between the control unit Type 526 and 526A are:

(1) Changes in value and circuit references of the six receiver, six transmitter preset frequency controls and the associated resistors

(2) The tagstrip housing the X and Y shorting points and the X and Y resistors are not fitted (para. 27).

26. The transmitting and receiving frequencies of the TR.3624 are electronically controlled from the control unit. The frequency ranges, when using a control unit Type 526 are given in Table 1 and the ranges when using a control unit Type 526A are given in Table 2.

27. When using control unit Type 526 (Table 1) X and Y refer to four resistors, the connections to which are brought out to the tagstrip mounted above the potentiometer panel. Short-circuiting

TABLE 1

Transmitter and receiver frequencies when using control unit Type 526

TRANSMITTER		RECEIVER	
TX. SEL.	Min. freq. coverage	RX. SEL.	Min. freq. coverage
A (X shorted)	185-195 Mc/s	1 (X shorted)	175-178 Mc/s
A (Y shorted)	200-210 Mc/s	1 (Y shorted)	195-204 Mc/s
B	208-216 Mc/s	2 and 3	202-220 Mc/s
C	214-222 Mc/s		
D	221-228 Mc/s	4 and 5	217-236 Mc/s
E	225-233 Mc/s	6	232-236 Mc/s

TABLE 2
Transmitter and receiver frequencies when using control unit Type 526A

TRANSMITTER		RECEIVER	
TX. SEL.	Min. freq. coverage	RX. SEL.	Min. freq. coverage
A	212-216 Mc/s	1	212-216 Mc/s
B	216-220 Mc/s	2	216-220 Mc/s
C	220-224 Mc/s	3	220-224 Mc/s
D	224-228 Mc/s	4	224-228 Mc/s
E	228-232 Mc/s	5	228-232 Mc/s
F	232-236 Mc/s	6	232-236 Mc/s

of one pair X or Y tags (one each for transmitter and receiver) changes the frequency range of channels A and 1 as indicated.

Indicating unit Type 208 (*fig.* 26)

28. This unit consists solely of a cathode-ray tube Type CV1526, enclosed in a duralumin cylinder suitable for direct mounting on the instrument panel. It is 4¼ in. diameter, 13¾ in. long and weighs 3 lb. A valuable feature is that the cathode-ray tube can be extracted from the front of the indicating unit without having to remove the unit from its mounting. The indicating unit is not pressurized since it contains nothing but the cathode-ray tube and its associated wiring.

29. The effective display area of the c.r.t. is approximately 2 in. by 1½ in. A visor Type 43 (Ref. No. 10AT/41) may be attached to the indicating unit for viewing under bright lighting conditions. The visor Type 43 has a plastic magnifying lens, with a magnification of 2½ times, fitted into the aperture which mates with the c.r.t. face.

Power supplies

30. Rebecca Mk. 4 equipment is designed to operate from the standard 80-volt, 1000-2000 c/s a.c. supply and consumes 200 watts. If a supply is not available in the aircraft, a small motor generator Type 7 is installed, which provides a regulated 80-volt, 1600 c/s supply at 240 watts from the 24-volt d.c. supply. The equipment also requires 30 watts at 24 volts d.c. for operation of the blower motors and relays. The negative pole of the d.c. supply is earthed to the equipment.

CIRCUIT DESCRIPTION

TRANSMITTER-RECEIVER TYPE TR.3624

General

31. The circuit description of the TR.3624 is sub-divided so as to describe each of the sub-assemblies listed in para. 10.

(1) Chassis assembly Type 6450—the circuit diagram is divided into two illustrations: chassis No. 1 (fig. 23) and chassis No. 2 (fig. 24). The circuits include the appropriate poles of the front panel plugs and sockets. There are several interconnections between the two chassis, which do not pass through plugs or sockets, but are carried via the cableforms. These interconnections are arrowed and cross-identified on both chassis. Chassis No. 1 includes the calibrator, delay, timebase and h.t. power supplies for the whole equipment. Chassis No. 2 includes the video, a.g.c., master oscillator, IFF, modulator drive, transmitter and receiver frequency selector circuits, together with the heater supplies for chassis No. 1 and 2, and the receiving unit Type 6449.

(2) Transmitter unit Type 127—the complete circuit diagram is given in fig. 18 and that of the filter unit Type 6834 is given in fig. 13. The transmitter unit Type 127 includes the transmitter valve, modulator, a heater transformer and the transmitter tuning system, consisting of a lecher line with a motor driven aerial coupling unit. The filter unit Type 6834 is the harmonic filter inserted between the transmitter output and the aerial system to suppress harmonics.

(3) Receiving unit Type 6449—the circuit diagram is split into two illustrations, r.f. unit Type 147 (fig. 19) and i.f. unit Type 123 (fig. 20). The interconnections to the internal blower unit and the tuning motor are also given in fig. 16. The r.f. unit Type 147 includes an r.f. mixer and oscillator stage. The i.f. unit Type 123 includes six band-pass coupled amplifying stages, the second detector and the video cathode-follower.

CHASSIS No. 1

(*complete circuit fig.* 23)

Power supplies

32. The power supplies for the equipment, 80 volts, 1600 c/s a.c. and 24 volts d.c., are connected to the black 6-way plug PL.L6 on the right-hand side of the front panel. Transformers T1 and T2 provide h.t. and rectifier heater voltages. They are sealed and so designed as to permit separate switching of the heater and high voltage circuits. Heater voltages are applied to all valves whenever the 80-volt supply is connected to the equipment, but the h.t. and e.h.t. voltages are not available until the h.t. switch on the control unit is operated.

33. The +1·5kV and −1·5kV supplies for the transmitter and indicator are obtained from the half-wave rectifier valves V15 and V16, and smoothed by the capacitors C31 and C32 (fig. 23).

34. The main h.t. supply of 250 volts at 300mA is provided by a pair of mercury vapour rectifiers V14 and V17 (CV338), each of which has its anodes connected in parallel, via limiting resistors R24-R25 and R51-R52 respectively. The supply is smoothed by the choke input filter CK1 and C30.

35. To protect the rectifiers V14 and V17, a thermal delay switch Type CV342 (RL1) and a relay RL2 are operated in conjunction with the H.T. ON/OFF switch, fig. 16, so that a delay of 60 seconds is introduced between the application of the heater voltage to the rectifiers and the switching of the h.t. circuits from the control unit. After the h.t. voltage has been applied, contacts 1/2 of RL2 insert R74 in series with the heater of the delay valve. This ensures that the thermal contact breaks but reduces the delay time to 20 seconds in the event of the h.t. being switched off accidentally, and immediately switched on again.

36. V13 is a conventional ripple eliminator valve and provides a 220-volt line substantially free

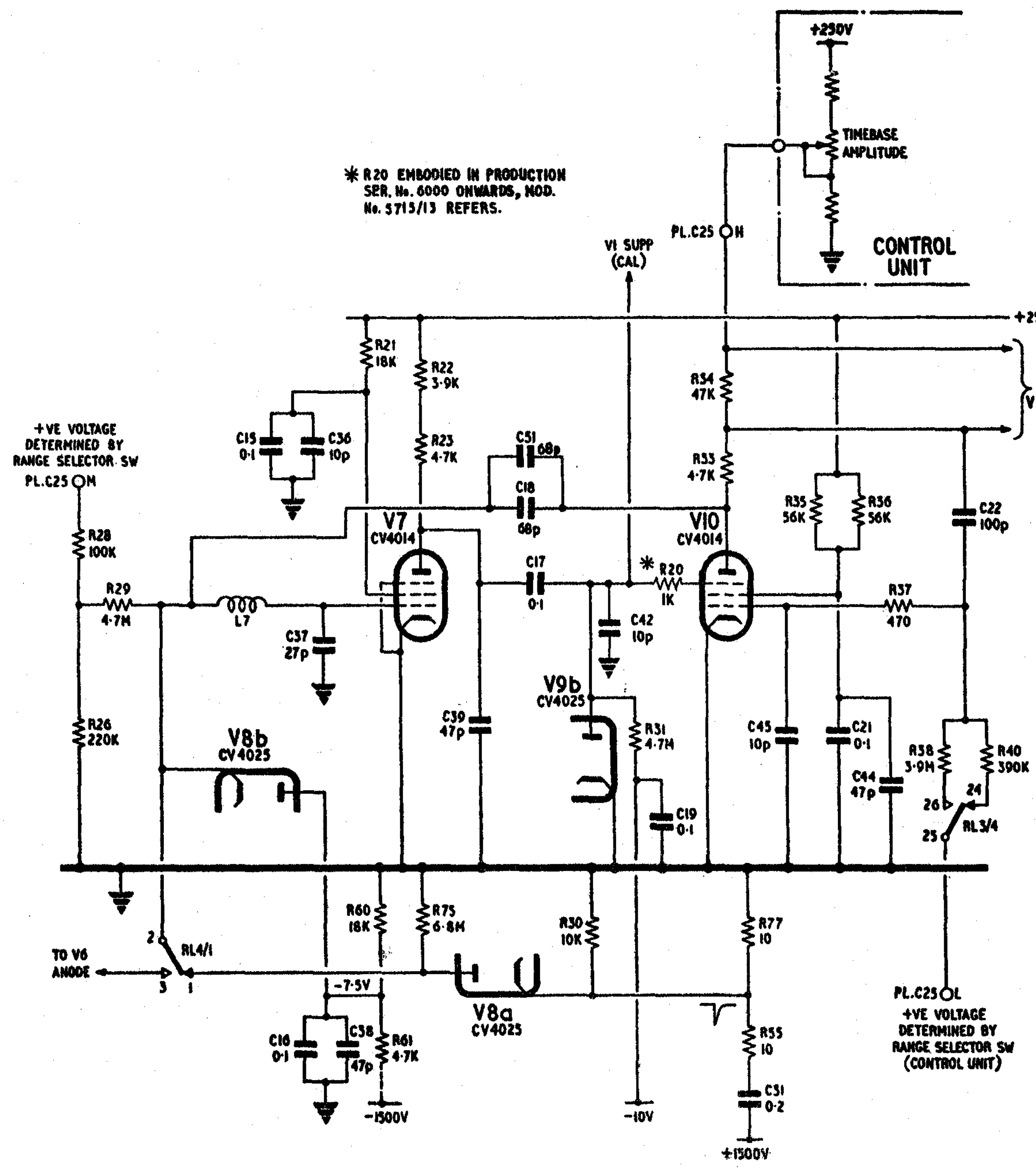

Fig. 3. Timebase—circuit

from ripple for the i.f. unit and the a.g.c. valve V106.

Timebase

37. The timebase circuit consists of the valves V7, V8, V9 and V10 connected in a Sanatron circuit, as shown in fig. 3. The waveforms associated with the timebase are shown in fig. 4. In the quiescent condition, V10 is cut off by the 10-volt negative potential applied to its suppressor grid. V7 is fully conducting. When the negative-going trigger pulse, developed across R77 at the instant of peak transmitter current (para. 72), is applied to the grid of V7, via V8a and RL4/1, the anode current of this valve falls and the anode potential rises, thereby raising the potential of the suppressor grid of V10. V10 is thus caused to conduct, and its anode potential falls linearly at a rate dependent upon the time constant C22, R38 or R40 and the voltage to which these resistors are taken. This voltage is selected by the RANGE switch in the control unit. At the same time the falling anode potential is communicated, via C18 and C51 in parallel, to the grid of V7, keeping that valve cut off.

38. At the end of the run-down the anode potential of V10 'bottoms', C18 and C51 discharge and the grid voltage of V7 rises. As this voltage passes through the cut-off point, V7 commences to re-conduct. V7 anode potential therefore falls, taking with it the suppressor of V10 and the circuit returns to the quiescent condition to await the next triggering pulse. An additional resistor R20, may be inserted in the suppressor grid of V10 on certain models. This resistor has been inserted to check any tendency to self-oscillation in the Sanatron circuit.

39. The diode V9b prevents the suppressor grid of V10 rising above earth potential. The purpose of V8b is to limit the negative excursions of the grid of V7 to a value −7·5 volts, just sufficient to ensure that V7 is cut off. This reduces the interval between the end of the timebase run-down and the instant at which V7 reconducts. V8a prevents the trailing edge of the triggering pulse from causing V7 to re-conduct prematurely. A full description of the theory of operation of the basic Sanatron circuit may be found in A.P.1093E, Sect. 10, Chap. 10.

40. V12 is connected in paraphase with V10, and the sawtooth waveforms derived at the anode of each valve are fed to the X plates of the cathode-ray tube, which are d.c. restored to earth potential by the double-diode V11 (fig. 23). Thus is provided, in the indicating unit, a linear timebase of 6, 12, 60, 120 or 240 nautical miles according to the positions of the timebase RANGE and Normal-240 Miles switches. A preset capacitor C52, in parallel with C26, provides feedback variation between the anode and grid of V12. C52 is used as a preset coarse control of the timebase amplitude. A preset fine control is provided by the timebase amplitude control RV315, in the control unit, which is used to select the voltage applied to the anode of V10 (para. 37). The V10 grid resistor R40 is connected in circuit on the two short ranges and R38 on the three long ranges.

41. The positive square wave appearing at the anode of V7 for the duration of the timebase is fed to the cathode-follower valve V5 (fig. 6), and, in conjunction with the d.c. restoration diode V4, is used as a brightening waveform for the cathode-ray tube.

Calibrator

42. Consider the simplified circuit diagram fig. 5, V1 functions as a tuned anode oscillator whose frequency is determined by L1 and C6. Since the suppressor grid of V1 is connected in parallel with that of V10, oscillation can only occur during the conduction period of V10, i.e. for the duration of the timebase.

43. Immediately the suppressor of V1 is driven positive, a sinusoidal waveform is developed across the oscillatory circuit. The first half-cycle of this waveform follows the direction of the falling anode potential of V1 and a voltage in antiphase to this is taken from the end of L3 to the grid of V2. Since the amplitude of the sine wave applied to grid of V2 exceeds the grid bias of the valve, a square waveform is obtained at the anode of V2, the periodicity of which corresponds to the oscillator frequency. This waveform is differentiated by C8 and T3 to provide negative-going calibration pips limited by V3b to an amplitude of 10 volts. The positive-going pips resulting from the differentiation are removed by V3a. (The waveform shown at the junction of C8 and T3, in fig. 5, is for explanatory purposes only, and could not, in fact, be monitored without first disconnecting the anode of V3a.) The calibration markers are injected into the suppressor grid of the video amplifier V104 and subsequently appear on the Y deflection plates of the cathode-ray tube.

44. Calibration markers appear at intervals of one nautical mile on the 6 and 12 mile ranges, and at intervals of ten nautical miles on the 60, 120 and 240 mile ranges. The components shown in fig. 5 are those in circuit on the two short ranges. The long range components, relay switching and screen circuits for V1 and V2 are shown on the complete circuit diagram for chassis No. 1 —fig. 23. Note that the phase-adjusting components RV1, R69 and C5 do not appear on the long ranges. The calibrator is switched on and off by applying the h.t. voltage to V1 and V2 from the calibrator switch (CAL. ON/OFF) on the control unit.

Delay circuit (*fig.* 6)

45. As stated in para. 37, the timebase is triggered by the application of a negative-going pulse to the grid of V7. In the normal homing (H_0) position of the function switch on the control unit, this pulse is obtained across R77 coincident with the transmitter r.f. pulse and is injected into the grid circuit of V7 via the relay RL4/1 contacts 1/2, and V8a. When interrogating the Eureka Mk. 4 and 5 beacons or using the BABS system, however, the start of the timebase is delayed with respect to the transmitter pulse. This is necessary since the Eureka beacons incorporate a fixed delay of one nautical mile whilst the BABS beacon has a variable delay which is adjusted so that the runway always appears to be 10000 feet in length. The range on the BABS function is thus the range to the touch down point.

46. When the function switch is set to either the H_1 or BA position, the grid of V7 is connected via the relay RL4/1 to C14; the anode circuit of the delay valve V6, which is now conducting, since its grid previously taken to –10 volts through RL4/2 is now taken, via pin K on PL.C25 through one of two variable delay controls, RV316 or RV322, to 250 volts positive.

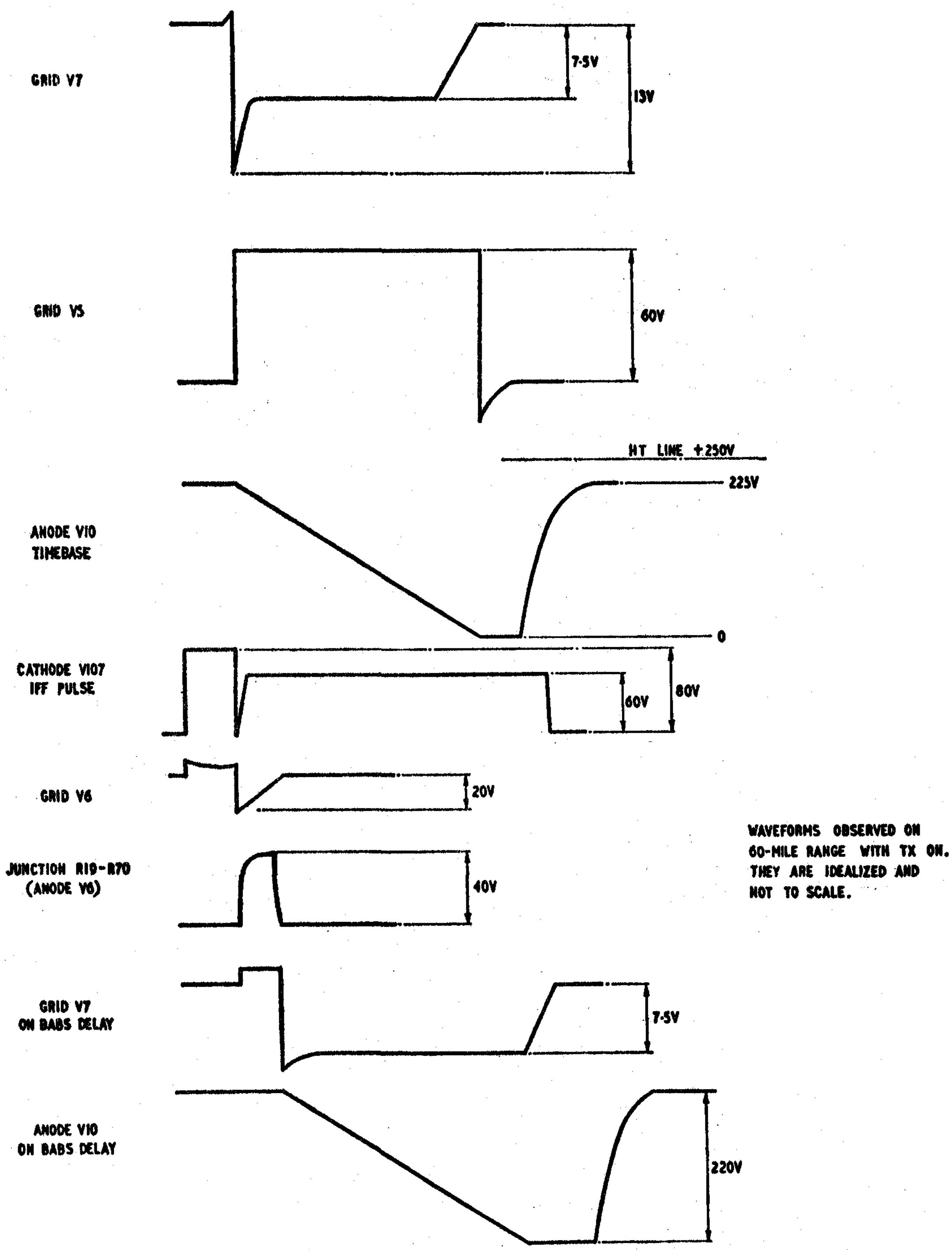

Fig. 4. Timebase—waveforms

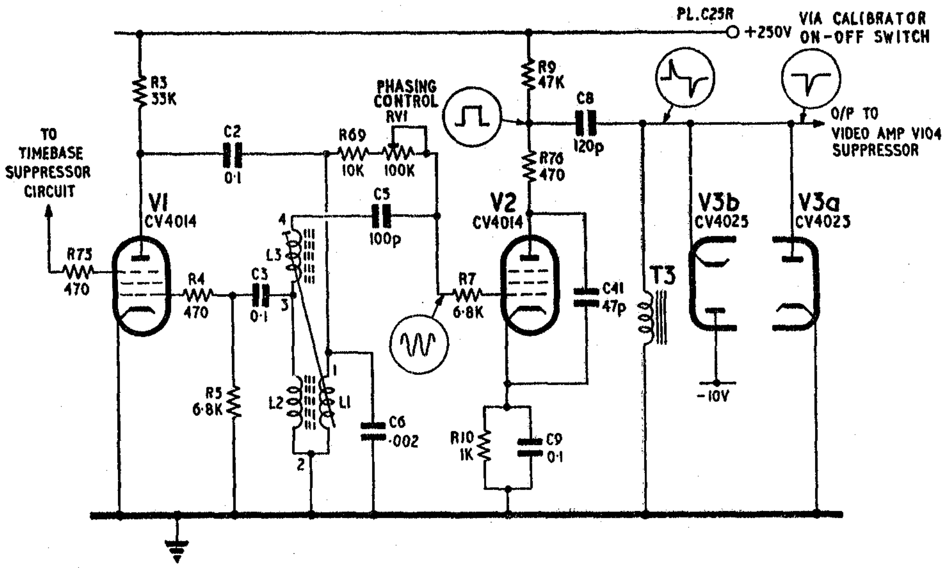

Fig. 5. Calibrator—simplified circuit

47. The recurrence frequency of the Rebecca transmitter is controlled by a master oscillator generating a standard positive pre-pulse, the back edge of which triggers the transmitter. The pre-pulse is differentiated by C12, the resistive network R17 and the delay control. The leading edge thus produces a positive-going pulse which drives V6 into grid current. The negative-going pulse coincident with the trailing edge of the pre-pulse cuts off V6 so that its anode rises. C12 now discharges until the cut-off point of V6 is passed, conduction then takes place and the anode potential falls again. The discharge rate of C12 is determined by the setting of the delay control, so that the time taken to reach V6 cut-off, and hence the duration of the square wave appearing at V6 anode, is variable. Since V7 is fully conducting, the leading edge of the square wave produces a small rise in grid potential before the negative-going edge triggers the timebase. This small rise, however, is sufficient to ensure that r.f. which may be present at the instant of the transmitter pulse does not trigger the timebase before the end of the delay period. It may be remembered that in the case of the H_0 function, the timebase is triggered by a pulse which is caused by, and coincident with, the transmitter pulse; the possibility of the timebase being prematurely triggered by r.f. does not therefore arise. The delay in initiation of the timebase on the H_1 and BA functions can consequently be controlled by preset adjustments within the control unit. The delay is variable from ½ to 1½ nautical miles in the H_1 position and 1½ to 2½ nautical miles for the BA setting.

Reference potentials

48. The resistors R57 to R68 and R78 in fig. 23 form a potential divider chain across the e.h.t. positive and e.h.t. negative supplies to provide bias and other reference potentials required by the equipment.

CHASSIS No. 2

(*complete circuit fig.* 24)

Master oscillator (*fig.* 7 *and* 8)

49. V108 is a blocking oscillator which generates a positive 60-volt pulse of between 32 and 45

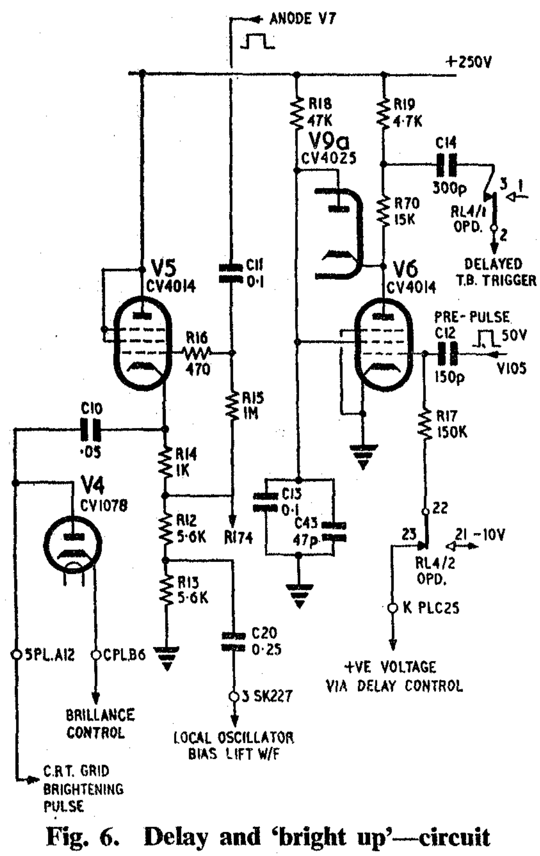

Fig. 6. Delay and 'bright up'—circuit

microseconds duration at a recurrence frequency of the order of 100 p.p.s., controllable by adjustment of RV101. The squegg grid drive for the oscillator is derived from the pulse transformer T103, and the recurrence is determined by the time constants of C115, R126, R173 and RV101. The pre-pulse is obtained from another pulse transformer T104, limited and squared by the diode V109, and fed to two cathode-follower valves V105a and V107, for the modulator drive valve V110 and IFF purposes respectively (fig. 24). Normally V108 operates in a self-running condition, but, by removing the connection between C116 and C118 and joining C116 to the junction of R130 and the suppressor of V108, an input pre-pulse waveform can be used to synchronize the master oscillator to an external unit. The master oscillator waveforms are shown in fig. 8.

50. The pre-pulse, of the order of 50 volts, from the cathode of V105a, is fed to the drive valve V110 (fig. 9), which has variable inductance L102 as the anode load. The 400-volt positive ring obtained at the anode of V110 at the termination of the pre-pulse is used to drive the modulator valve in the transmitter unit, thereby operating the transmitter. The length of the transmitted pulse is a function of the inductance of L102 and is set to be between 4·5 and 6·5 microseconds duration. The transmitter is switched on from the control unit by connecting the lower end of R134 to chassis, thereby reducing the bias applied to the grid of V110.

51. The double-triode V107 provides a suppression pulse for IFF sets, since the pre-pulse and a waveform from the cathode of V5 (fig. 6) are fed to the grids of the triodes and the mixed output appearing at the cathode is suitable for shutting down an IFF set during the operative period of the Rebecca equipment. This waveform is fed to the orange coaxial socket 'F', and the pre-pulse to the yellow/black coaxial socket 'J', on the front panel where they may be monitored. The external synchronizing pulse referred to in para. 49 is also fed into SKT. 'J' when required.

Receiver video circuit (*fig.* 10)

52. The video circuits for the receiver consist of a video amplifier V104 which converts the low-

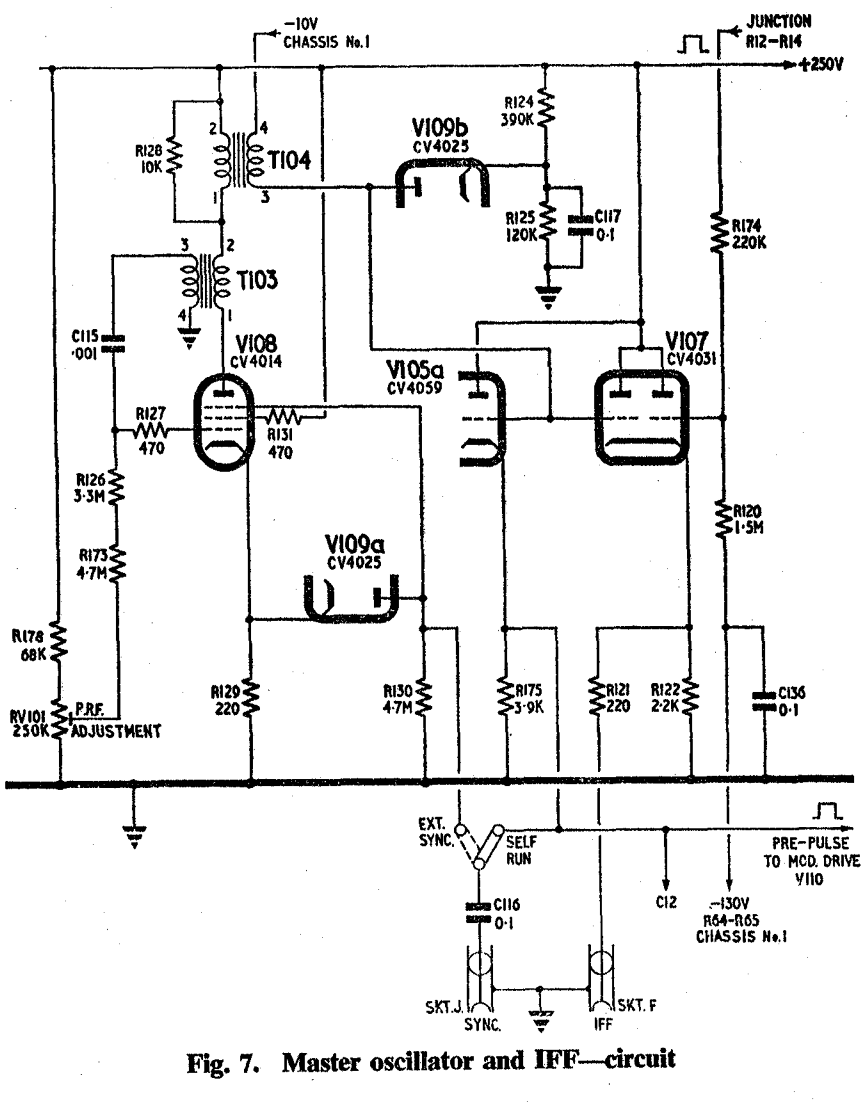

Fig. 7. Master oscillator and IFF—circuit

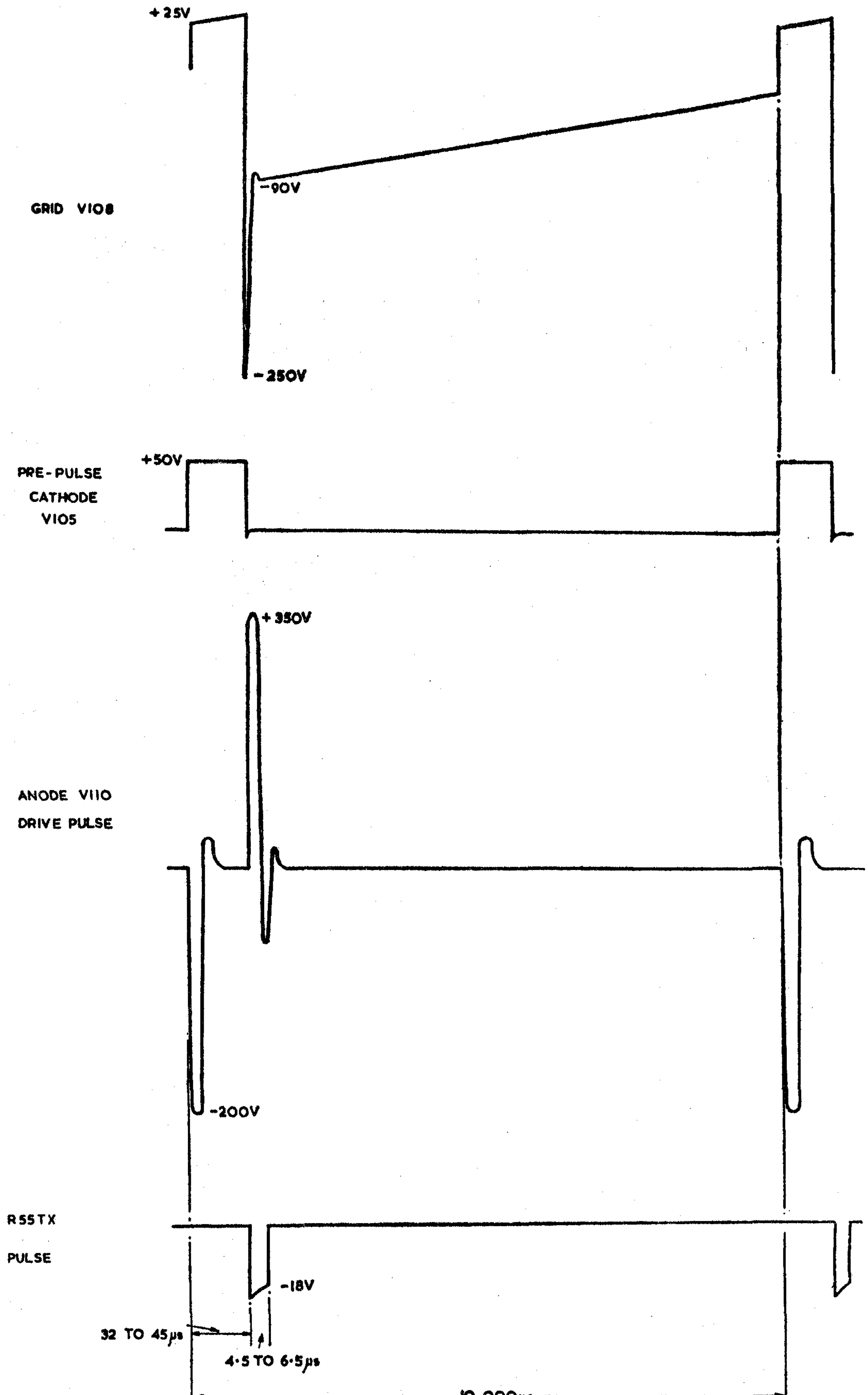

Fig. 8. Master oscillator—waveforms

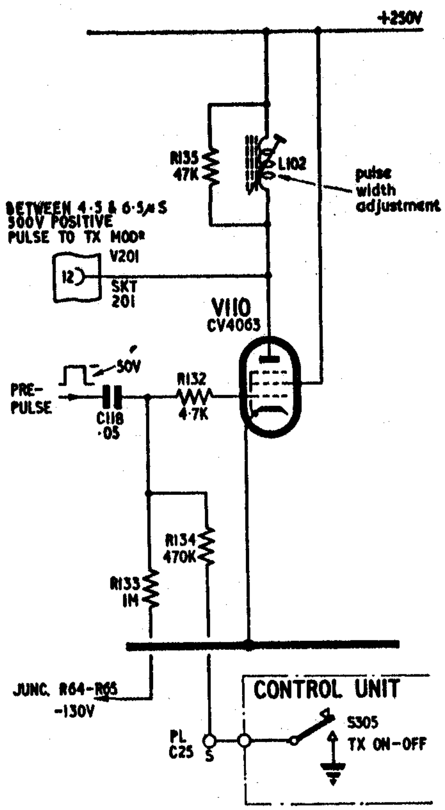

Fig. 9. Modulator drive—circuit

level negative-going signals from the i.f. unit into high-level positive-going signals for display on the cathode-ray tube. Since, however, the capacitance of the cable to the indicating unit is 30 pF per foot, it is necessary to pass the video signals through a low-impedance cathode-follower system to preserve the wavefront of the signals. V103 is a cathode-follower driving the main cathode-follower output valves V101 and V102.

53. As previously explained in para. 43, the negative calibration pips are injected into the suppressor grid of V104 and appear at the anode as positive-going pips superimposed on the video display.

54. The final video output is then switched by the aerial switch unit Type 273 (S101) to the left and right Y plates of the cathode-ray tube in synchronism with the switching of the port and starboard receiving aerials.

55. The switch unit Type 273 differs from the Rebecca Mk. 2 aerial switch in one important feature. R.F. signals and video signals are switched on the same contact, a simple capacitor/choke filter serving to discriminate between them. A detailed description of this unit is given in para. 70 to 86.

56. V105b and V106 form an a.g.c. control for the receiver. When using the 6 or 12 mile range, this helps in reducing the work of the operator at a time when he is most occupied. The operation of the a.g.c. circuit is described in para. 106.

Frequency selector circuits

57. The selection of the transmitter and receiver frequencies is controlled by electronic bridge circuits operating permanent-magnet motors driving the r.f. tuning mechanisms.

58. V111 and V112 form the transmitter selector and V113 and V114 the receiver selector circuits. As the operation of both circuits is identical, only one need be described in detail.

59. Consider the receiver selector circuit, fig. 11. The two triodes of V114 form a long-tailed pair bridge circuit; in the balanced state each valve takes approximately the same anode current (5-6mA) which energizes the relay in each anode circuit. These relays control the direction of rotation of the tuning motor and when both relays are energized the motor armature is short-circuited and the motor is at rest.

60. The grid of V114b is taken to a constant potential (90 volts), whilst the potential on the grid of V114a is determined by the anode potential of the d.c. amplifier V113, which is fixed by its own grid potential. The bridge circuit is balanced only when the potentials of the two grids of V114 are equal; since one of these is fixed, it is obvious that the bridge is balanced only for a particular value for the grid potential of V113. Now the grid potential of V113 is the mean of the two voltages applied to PL.C25/F and PL.227/2. The former is supplied from a potentiometer in the control unit and is the control voltage. The latter is obtained from a potentiometer ganged to the motor tuning system and is called the slave potential. Consequently when $\frac{1}{2}(C+S)=K$, where K is the critical balance voltage, C the control voltage and S the slave potential, the selector system is at rest. If, therefore, voltage C is increased to C_1 the voltage at the anode of V113 falls and the current flowing through V114a is reduced. Relay RL104 is thus de-energized, causing the motor to rotate in such a direction that the slave potential S is reduced. When the slave potentiometer has been rotated to a degree such that $(C_1+S_1)=2K$, the system is again balanced, RL104 is energized and the motor stops. It will be evident, therefore, that the position of the slave potentiometer, and hence the setting of the tuning system, can be accurately controlled by adjustment of the control voltage from the control unit. Should failure of any part of the system cause the motor to continue to rotate in either direction, the mechanism is protected by the overshoot contacts (fig. 11) which remove the negative supply connection from the motor armature when the slave potentiometer reaches the end of its effective travel.

61. To cater for slight variations in the frequency of the beacon responder and of the r.f. unit Type

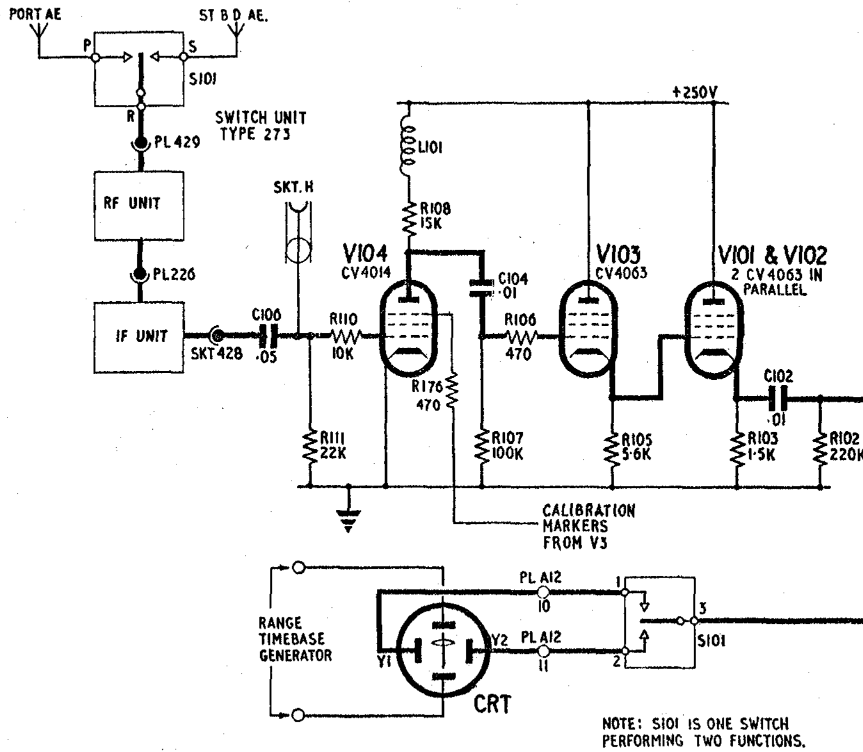

Fig. 10. Video—simplified system diagram

147, the selector system can be made to sweep the receiver ±2 Mc/s about the selected frequency. This is accomplished by energizing RL106 through operation of the switch S306, RX.TUNE on the control unit. RL106 is self-locking through contacts 2 and 3, and therefore remains energized after S306 is released. When RL106 is energized, the lower end of C128, which is normally floating, is connected to the grid of V113 by RL106/3. C128 therefore charges up and lifts the grid potential of V113. The cathode of V113 also rises and increases the grid potential of V114b. Since the anode of V113 falls, so does the grid of V114a. The action is cumulative until V114a is cut off and all the current through the valve is taken by V114b. Under these conditions the bridge circuit is unbalanced, RL104 is de-energized and the motor rotates.

62. The direction of rotation of the motor is such that the slave potential is reduced and the potential at the grid of V113 falls. The anode of V113 therefore rises, and this rising potential, fed back to the grid through C128, slows down the rate of change due to the falling slave potential. The anode of V113 continues to rise, taking with it the grid of V114a, while the grid of V114b falls with the cathode of V113. Eventually V114a passes sufficient current to energize RL104, and at this point the motor stops.

63. C128 now discharges, so that the anode of V113 rises still further and the grid falls. Corresponding changes are produced in the grid potentials of V114a and V114b until V114b is cut off and all the current is taken by V114a. RL105 is then de-energized and the motor rotates in the opposite direction.

64. The slave potential is now increasing and the grid voltage of V113 rises. The anode begins to fall, and this fall, fed back to the grid through C128, opposes the rising grid potential and slows down the rate of change caused by the increasing slave potential. The grid continues to rise, and the anode to fall until V114b passes sufficient current to energize RL105, then the motor stops again. C128 now charges up, producing a further fall in anode potential and a rise in the grid potential of V113. Corresponding changes occur at the grids of V114 until V114a is cut off, RL104 is de-energized and the whole cycle recommences. The waveforms associated with the receiver frequency selector circuit are shown in fig. 12.

65. When the sweep facility is in operation, the negative feed-back path is modified by the action of the changeover contacts RL106/4. Normally, R181 and C127 are connected in parallel and taken to the anode of V114a. Energizing RL106 causes contacts 24/25 to break and 25/26 to make so that one end of R181 is connected to the anode of V114b. This arrangement prevents the sweep circuit overshooting in either direction.

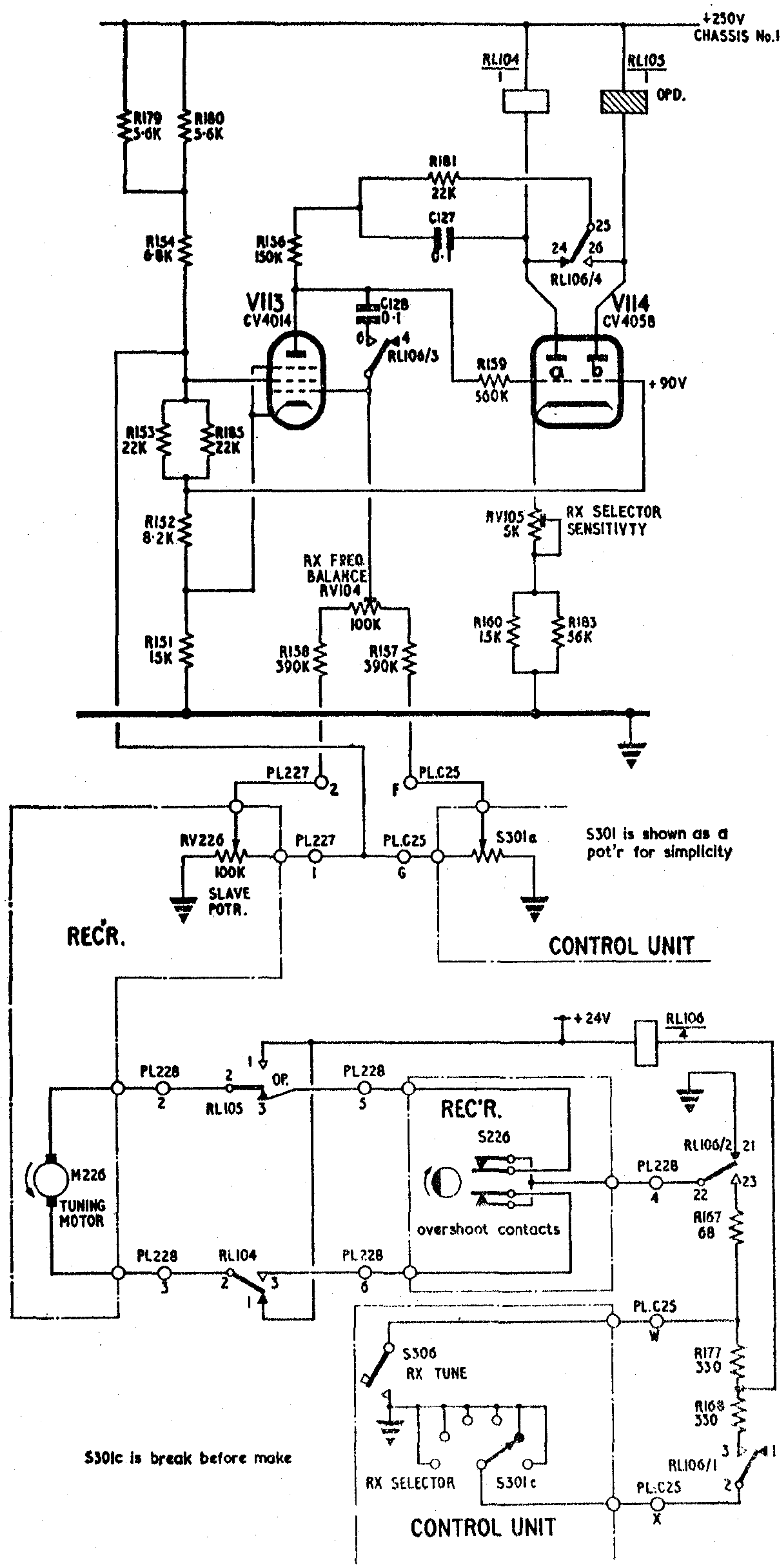

Fig. 11. Receiver frequency selector—circuit

66. The tuning motor armature normally returns directly to earth via RL106/2 (fig. 11), but when the sweep facility is in use, the earth return is made through the switch S306 and a 68-ohm resistor R167. The motor, therefore, runs at a somewhat reduced speed. Now, when S306 is released, since RL106 is self-holding, the motor earth circuit is through S301c and R167, R177 and R168, together equal to 728 ohms. This value of resistance is more than will allow the motor to continue to operate.

67. The time constants selected provide a sweep of ±2 Mc/s at a period of 3½ seconds. The operator can observe the peak of the desired signal as the receiver sweeps through the beacon frequency and, by releasing the switch, stop the motor. If he overshoots at the first attempt, further manipulation of the switch will again start the sweep.

68. As the holding circuit of RL106 is taken via PL.C25/X to one bank of the frequency selector switch in the control unit, the bridge remains in an unbalanced state until a new frequency channel is selected. When the selector switch is rotated to another frequency, the earth connection to PL.C25/X is momentarily broken and RL106 reverts to its de-energized condition.

Thermal cut-out

69. The thermal cut-out switch S102, mounted above the i.f. unit, is connected in series with the main HT switch, and shuts off the h.t. in the event of the equipment becoming overheated due to a breakdown of the blower system. It is designed to operate at approximately 90 deg. C.

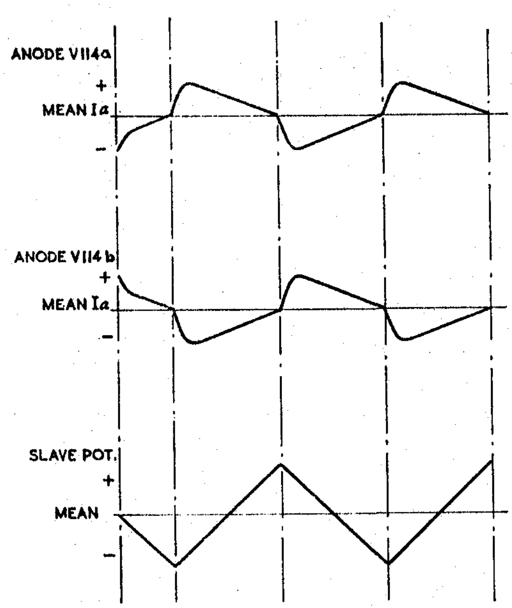

Fig. 12. Receiver frequency selector—waveforms

Switch unit Type 273

General

70. Reference has already been made to this unit in the section describing the receiver video circuit, para. 54 and 55. Pictorial and diagrammatic illustrations of the switch unit are given in 'b' and 'c' of fig. 17 while 'a' of fig. 17 shows the circuit in which the switch operates.

71. The switch unit Type 273 is a lightweight miniature aerial switch designed primarily for use with the Rebecca Mk. 4 interrogator. To provide a double-sided presentation it is necessary to switch the receiver video output to each deflection plate of the c.r.t. in turn and, since the receiver is unable to discriminate between signals picked up by the port aerial and those coming from the starboard aerial, it is essential to switch the aerials simultaneously with the video output, so that the port aerial only is connected when the output is taken to the left deflection plate and vice versa. By this means the amplitudes of the signals from the directional aerials can be compared, and the aircraft heading, with respect to the beacon or responder, determined (fig. 10).

72. The unit has the following features:—

(1) R.F. and video signals are switched by the same contact to ensure perfect synchronization.

(2) The performance is satisfactory over a wide frequency range, 174-236 Mc/s.

(3) The switching sequence is fast and stable.

(4) The power consumption is very small (0·7 watt at 26V d.c.).

(5) The switch can be locked on the port contact for BABS Mk. 2 or single aerial operation.

73. In the following description it will be convenient to regard the functions of this switch as consisting of two distinct operations:—

(1) The major operation for which the unit has been designed, namely, the simultaneous switching of the r.f. and video signals.

(2) The operation of the mechanism to drive the springsets required to perform operation (1).

R.F. switch

74. The main switch assembly consists of a relay type changeover springset with suitably interposed screening blades to maintain the line impedance at 50 ohms and to reduce the cross-talk.

75. Video and r.f. signals are switched on the same contact, not only to ensure good synchronization, but also to reduce the bulk of the switch. A simple, but effective, r.f. choke and capacitor filter serves to discriminate between the signals. The contacts are connected to the Uniradio 43 aerial feeders through small capacitors, and by r.f. chokes to the video output. The standing wave ratio introduced indicates that the impedance mismatch varies over the frequency band from 1·2 : 1 to 1·4 : 1.

76. The overall crosstalk ratio varies slightly over the frequency band and increases towards the high-frequency end. The video crosstalk contribution is small (about 5% of the r.f.). The west probable crosstalk ratio is of the order of 20 : 1.

77. The aerial switch sequence consists in connecting the central springset *C* in turn to *U* and *L* ('c' of fig. 17). Thus, the port and starboard aerials, which are effectively connected to the outer springsets, are switched in turn to the input of the Rebecca receiver. Simultaneously, the receiver video output is switched to the Y deflection plates of the cathode-ray tube.

78. The CV1526 cathode-ray tube has a steep brilliance/rate-of-writing characteristic, so that the central line displayed appears, due to its slower writing speed, brighter than the video signals. This contrast has been reduced as far as possible by keeping the switch transit time to a minimum.

Driving mechanism

79. The motive power for the main springset is produced by a drive system consisting essentially of an oscillating wheel, maintained in motion by a magnetic circuit driving the central blade of the springset.

80. By referring to b and c of fig. 17 it will be seen that the wheel *W* carries a soft-iron magnetic link *M*, which, in the unenergized condition, is slightly asymmetrical with respect to the poles of an electromaget. When the magnet is energized, the link *M* moves into the magnetic field, causing the wheel to rotate in a counter-clockwise direction. The wheel, in rotating, moves the centre contact *C* upwards to make contact with the upper spring *U*.

81. Shortly after the wheel commences to move, a spigot opens the contact *S*, which is connected in series with the coil *H*, thereby de-energizing the electromagnet. The wheel, however, continues to rotate by virtue of its own inertia until it is brought to rest and then reversed by the tension of the springset blades *C* and *U*, which have been maintained in contact.

82. The wheel rotates, now in a clockwise direction, until the coil *H* is re-energized by the closing of contact *S*. The wheel movement, however, is too rapid for the re-activated field to retard its progress until the contacts *C* and *L* close and finally reverse the wheel. In reverting to the counter-clockwise direction, the wheel is now accelerated by the combined energy of the electromagnet and the contacts *C* and *L*. Thus the motion is maintained by the alternate application of electromagnetic energy and the energy imparted to the springset by the inertia of the wheel.

83. The frequency of oscillation is almost entirely dependent on the moment of inertia of the wheel, the springset tensions and the magnetic air gap. Since these parameters are constant for any one switch, the oscillatory period is very nearly constant for a wide range of d.c. potential, a typical variation being 3% in frequency for a voltage change of 20%. The nominal frequency is 22-23 c/s for a mean voltage of 25V. The change in frequency arises mainly from the increase in amplitude of oscillation due to the stronger magnetic field created by a rise in supply voltage.

84. The rotation of the wheel approximates to a simple harmonic motion and the switch changeover is arranged to occur when the wheel is moving at its fastest speed. Since the maintenance of oscillation is partly dependent on the potential energy imparted to the springset, the contact pressures are somewhat higher than usual. Counter-clockwise rotation of the wheel is faster because motion in this direction results from the combined energy of the magnet and springset, whereas clockwise rotation is due solely to the springset. A slight but insignificant contact bounce may occur, usually more noticeable in the counter-clockwise direction due to the greater velocity just mentioned.

85. Ideally, the make and break of contacts should occur within the changeover period of the main springset, in order to avoid the appearance of interference on the display. Assembly tolerances, however, preclude this condition, and reliance is placed upon the low peak coil current of 40mA together with partial screening by the wheel, to keep interference pulses to a minimum.

86. Normal power consumption of the switch unit is approximately 0·6 watts at 25 volts. It is possible, however, to lock the switch in the upper, or port, position by short circuiting the contact *S*, so that the coil is permanently energized. In this condition the coil current is some 60mA and the coil is therefore designed to withstand a mean power dissipation of 2 watts.

TRANSMITTER UNIT TYPE 127

(*complete circuit fig.* 18)

87. The transmitter consists of a CV1759 valve, V202, operating with a tuned anode-grid lecher line circuit. The frequency is varied over the band 185-240 Mc/s by adjustment of the coupling unit, which is moved up and down the line by a motor-driven lead screw. The motor also rotates the slave potentiometer. The operation of the frequency selector system is described in para. 59 and 60. Sweep tuning is not provided in the transmitter.

88. The transmitter is series-modulated by V201. In the quiescent state, V201 is biased to virtual cut-off, so that a current of approximately 500 microamps flows through V201 and V202. In this non-conducting condition V202 acts as a diode of constant impedance which is low compared with the high impedance of V201, therefore, for practical purposes it may be said that a potential of 3kV exists across V201. When the +400V positive pulse from the drive valve V110 is applied to V201 grid, this valve conducts very heavily, the peak current being of the order of 1·5A; V201 anode, and hence V202 cathode, falls and the 3kV supply voltage is now effectively switched across the transmitter circuit, giving rise to an r.f. pulse of between 4·5 and 6·5 microseconds duration.

89. The peak transmitter current is drawn from the charge built up across the main smoothing capacitors C31 and C32 on chassis No. 1 and, in consequence, negative pulses are obtained across R55 and R77 (fig. 8), whilst a positive pulse is developed across R56. The negative pulse from R77 is used to trigger the timebase on the H_0 function and the positive pulse from R56 is employed to suppress the receiver mixer for the duration of the transmitter pulse.

90. The mean peak power output at the fundamental frequency is not less than 210 watts. This energy is taken out by means of the coupling unit, mentioned in para. 87, which consists of a single turn loop L205, which, together with lead inductances and capacitors C203, C208 is in series-resonance at the lower end of the frequency range, that is, approximately 190 Mc/s.

91. Since the dimensions of the coil and the connections made to it are somewhat critical, the coil is formed with silver-plated brass wire. To maintain the accuracy of the dimensions, and at the same time to provide a unit suitable for mechanically traversing the lecher bars, the coupling unit is encapsulated in an 'Epikote' resin block, allowance having been made for the increase in the dielectric constant.

Note . . .
Pins 1 and 6 on the base of V202 are connected to the cathode although there are no electrodes connected to them. This has been done to prevent the building up of any r.f. potentials across these pins.

Filter unit Type 6834 (*fig.* 13)

92. Since the coupling unit described in the preceding paragraphs tends to favour the fundamental frequency, it requires only a simple filter unit between the transmitter unit Type 127 and the aircraft aerial system to provide adequate suppression of harmonics. The filter consists of four low-pass π sections and one half π section in cascade. The first low-pass π section is variable, this facilitates selection of transmitter frequencies over the specified frequency range. The cut-off frequency is approximately 300 Mc/s and the attenuation in the stop band is 30dB at the lowest harmonic frequency. A typical attenuation/frequency characteristic is shown in fig. 13. The insertion loss over the range 180-250 Mc/s is not greater than 1·5dB. In order to ensure uniformity in production, the coils are wound on a slotted former. Similarly, a locating frame is used to control the capacitor lead lengths.

RECEIVING UNIT TYPE 6449

General

93. The receiver consists of three sections mounted on a removable chassis. These consist of the r.f. unit Type 147, the tuning gearbox and motor for the receiver, together with the internal blower unit and the i.f. unit Type 123, all of which, when assembled together, form the receiving unit Type 6449.

R.F. unit Type 147

94. The circuit diagram and mechanical layout of the r.f. unit Type 147 are given in 'a' and 'b' of fig. 19. The r.f. unit Type 147 consists of a grounded-grid triode input stage V226, local oscillator V228 and the mixer V227. The following characteristics are required in the receiver:—

(1) Rapid tuning over a relatively wide range of frequencies.

(2) Adequate sensitivity and r.f. bandwidth.

(3) Suitable selectivity against image interference and direct pick-up of i.f.

The sensitivity and selectivity requirements make the use of an r.f. amplifier essential, but owing to the difficulties which would be encountered in tracking three ganged tuning circuits, an almost flat input circuit has been employed.

95. The receiving aerial system is coupled to the r.f. stage via an i.f. rejector circuit, L226-C226, tuned to 45 Mc/s. The tuned circuit for this stage consists of the half-turn loop L227 and the grid-cathode capacitance of V226, which is approximately 8 pF. The 50-ohm aerial source, together with the low input impedance of the grounded-grid triode, make the response of this stage substantially flat, even over the range of 70 Mc/s. Amplified r.f. signals are fed to the mixer tuned circuit by C229.

96. The mixer tuned circuit consists of L229, the preset padding capacitor C247 and the tuning capacitor C246, together with wiring and valve capacitances. Since it is impracticable to ensure perfect tracking of the oscillator and r.f. sections throughout the tuning range, the r.f. circuit response cannot be made as narrow as pulse requirements permit, and the bandwidth is therefore approximately 3 Mc/s. The use of capacitance tuning, if a simple tuned circuit were employed, would give a considerable variation in the bandwidth which would increase at the high frequency end of the tuning range, thus reducing selectivity against second channel interference. The circuit

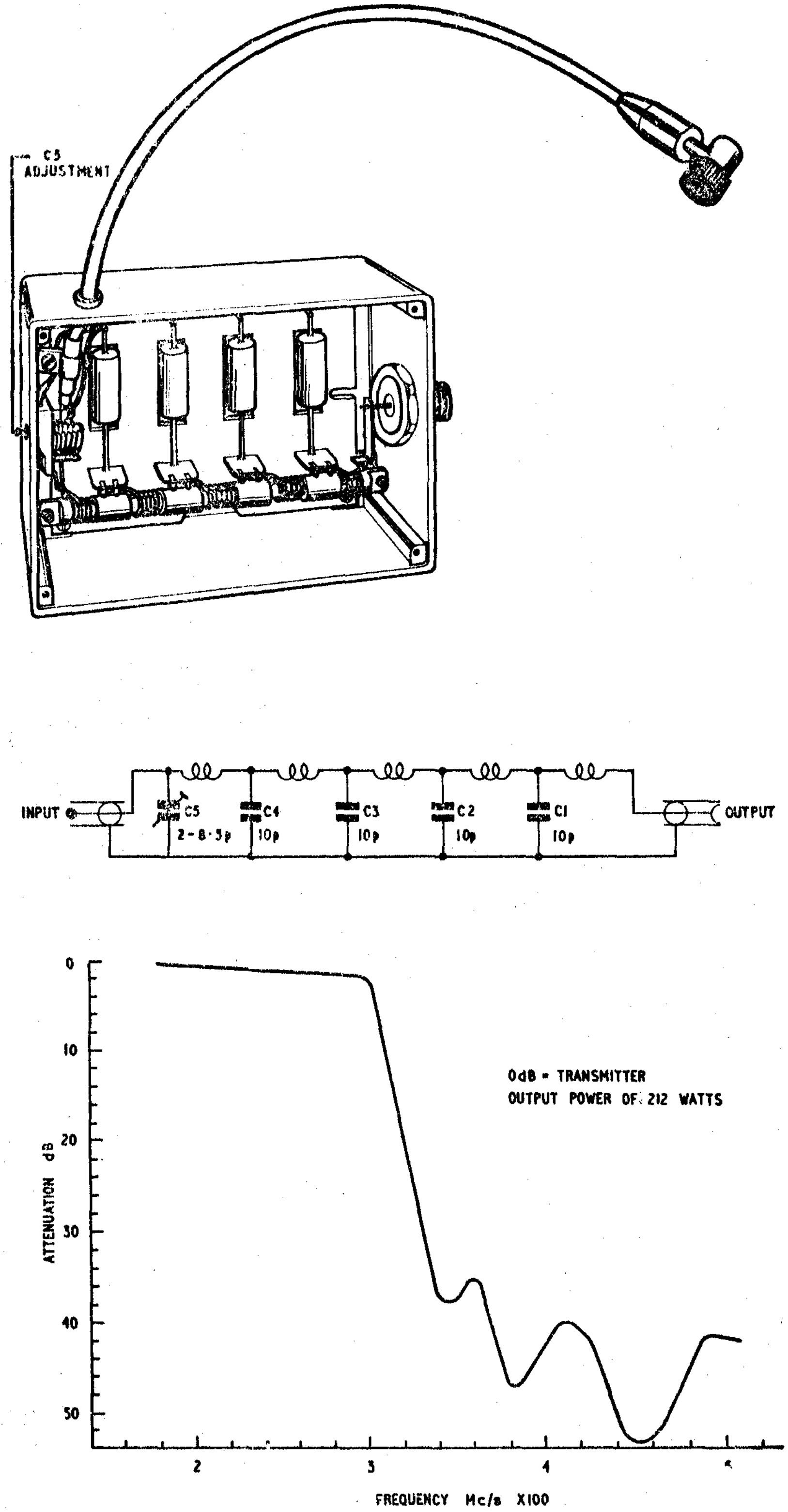

Fig. 13. Filter unit 6834—general view, circuit and typical frequency characteristic

of the r.f. unit is designed to avoid this difficulty. In practice the desired constancy of bandwidth has not been entirely achieved, due to feedback effects, and an r.f. choke L241 has been included in the anode circuit of the CV4014 mixer valve V227. This choke has a modifying influence on the input conductance of the valve due to the Miller effect, and reduces the variations in bandwidth. The operating conditions of the mixer are such that maximum conversion efficiency together with relatively constant conversion volts are obtained.

Note . . .

In serial No. 6001 onwards the value of C228 has been changed to improve stability of the r.f. unit. This increases the bandwidth to between 3 and 12·5 Mc/s for the r.f. unit only. However, the overall bandwidth of the receiving unit Type 6449 is between 2·4 and 3·6 Mc/s.

97. Since L229 consists of a one-and-a-half turn loop without a former, tuning is effected by means of a single closed loop, so mounted that its coupling with L229 may be varied. L230, in the anode of the mixer, is tuned to 45 Mc/s, and i.f. signals are fed via L241 and C233 to the primary of the input transformer in the i.f. unit Type 123.

98. The oscillator valve is a CV4058 connected in a conventional Colpitts circuit. Tuning is effected by the main capacitor C248, together with the padding capacitor C249 and the trimmer C250. The oscillator tuning coil L231 consists of two silver-plated copper strips connected at the upper ends by a screwed rod, also silver-plated. Trimming of L231 is accomplished by altering the effective length of the screwed rod. This is shown in 'b' of fig. 19. The oscillator frequency is 45 Mc/s higher than the signal frequency. This is advantageous because the frequency dependence of the input conductance of the CV4014 mixer gives a response which is not strictly the same as a single tuned circuit, but has a greater selectivity on the high frequency side of resonance.

99. The r.f. and oscillator tuning capacitors C246 and C248 are mechanically coupled to the slave potentiometer RV226 and the whole assembly is rotated by the tuning motor M227 via the gear train shown in 'c' of fig. 19. The operation of the tuning motor M227, the overshoot contacts S226 and the receiver frequency selection circuit is given in para. 57 to 68.

100. Since the longest timebase required is 240 miles, i.e. approximately 1·3 milliseconds, and the transmitter p.r.f. is 100 p.p.s., the smallest mark-space ratio is 1 : 8. The local oscillator, therefore, is only required for a maximum of 12½% of the time. To reduce possible radiations to a minimum, the oscillator valve V228 is normally biased off, and a positive-going waveform, equal in length to the timebase in use, is taken from the cathode of V5 and used to lift this bias for the duration of the timebase. This waveform is designated the "local oscillator bias lift waveform". As mentioned in para. 89, the positive pulse developed across R56 in chassis No. 1 is applied to the cathode of the mixer V227 so that the receiver cannot operate during the transmission period, thereby avoiding damage due to overloading.

101. The voltage supplies for the r.f. unit are obtained via the i.f. unit. The i.f. output from the mixer valve passes into the i.f. unit through the same 4-way plug PL226. The suppressor units 226 and 227 prevent r.f. radiation from the receiver tuning motor and the blower motor.

I.F. unit Type 123

102. The i.f. unit consists of six bandpass coupled amplifying stages, a second detector, and video cathode-follower. A circuit diagram is provided in fig. 20. The mid-band intermediate frequency is 45 Mc/s, and the nominal bandwidth is ±1·5 Mc/s at 3dB down. The wide response curve is obtained by staggered tuning of alternate stages, the first, third and fifth stages being peaked at 47·1 Mc/s, whilst the second, fourth and sixth stages are peaked at 43 Mc/s. A steep-sided

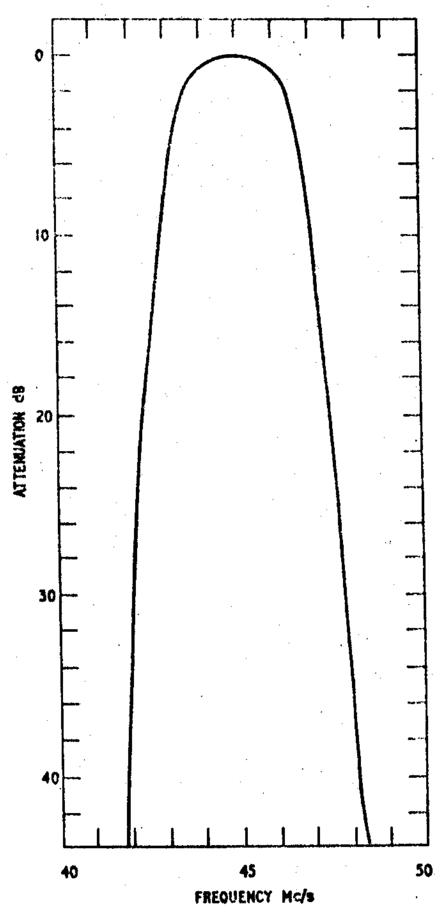

Fig. 14. I.F. unit 123—typical i.f. characteristic

response curve is achieved by inserting a double π section filter between the last i.f. stage and the second detector. The three parallel circuits L437, L439 and L442 are peaked at 45 Mc/s. L438 is tuned to reject at 41·6 Mc/s and L441 at 48·7 Mc/s. The overall i.f. response curve is then approximately as shown in fig. 14.

103. The screen voltage for all valves is obtained from the 220-volt anti-jitter line to ensure that the video output is free from ripple. Gain control is applied to the grid circuits of the first five stages. The second detector provides a negative-going signal which is delivered as a low impedance output from the CV4063 cathode-follower V433. This video output is amplified by the main video amplifier valves in chassis No. 2 and is also taken to the white coaxial socket H on the front panel of the TR.3624 to facilitate the monitoring of the receiving system without having to break the pressure seal.

Gain control circuit (*fig.* 15)

104. A manual GAIN control is provided by RV321 in the control unit and a.g.c. is incorporated for use if required. The grid control line is taken via PL427/3 to the capacitor C111 on chassis No. 2 and the potential developed across C111 is the mean of the two potentials derived through R137 and R146 at the sliders of RV2 and RV321 respectively.

105. When using manual control, RL101 is de-energized and V106 is cut off. The gain control RV321 is then part of a divider chain consisting of R117, R118, RV321 and R327, the slider potential being variable from +7 to +14 volts. The slider potential of RV2 is variable from 0 to –28 volts so that the gain control potential can be varied by adjustment of either RV2 or RV321. This practice has been adopted to overcome the variation in gain control characteristic of individual i.f. amplifier units. In setting up, RV321 is rotated fully clockwise and RV2 is adjusted until the amplitude of the noise output on the cathode-ray tube is about half full scale. RV2 is then locked in this position so that the maximum possible variation in gain is now provided by the manual gain control.

106. In the AVC position of the AVC/M switch, S309, the relay RL101 on chassis No. 2 is energized, thereby applying the positive-going video output signals to the diode peak rectifier V105b. The a.g.c. valve is V106, connected in a Miller feedback circuit. Normally V106 is cut off, since its cathode is taken to +15 volts, whilst the anode potential of V105b is held at –35 volts. In consequence, the diode cannot conduct until the signal amplitude exceeds 35 volts, and no change in the grid potential of V106 can occur until the amplitude has increased by a further 10 volts. When the signal amplitude is greater than 45 volts, V106 starts to conduct and the anode and grid then run

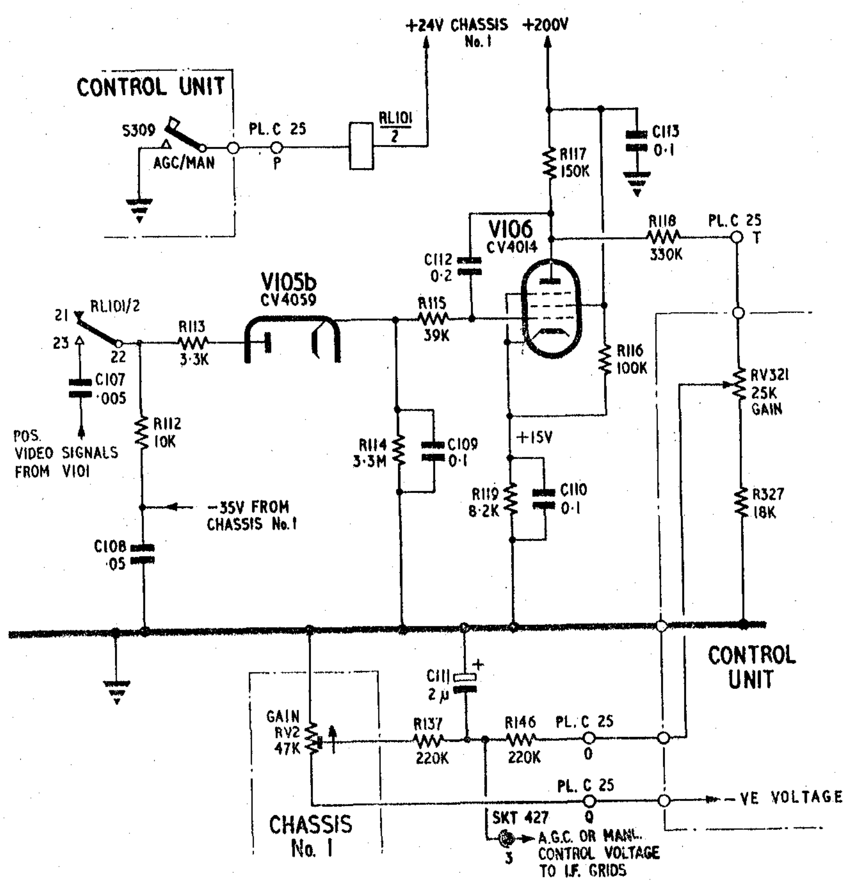

Fig. 15. A.G.C.—circuit

down together, at a rate determined by the time constant of the feedback circuit. This fall in anode potential reduces the voltage across RV321, thereby reducing the gain of the i.f. unit and decreasing the potential at the grid of V106 until the valve is once more cut off. The a.g.c. circuit, therefore, continuously adjusts the gain of the i.f. unit so that the signal amplitude is maintained at a level of 45 volts.

107. The video signals are differentiated by C107 and R112, to ensure that the a.g.c. level is not affected by variations in pulse length or by long pulses of interference. Due to the presence of the resistor R113, in series with the rectifier V105b, the charge on C109 does not reach the peak value of the signal voltage until five pulses have been received. This reduces the effect of intermittent interference pulses having an amplitude greater than that of the beacon signal.

108. When the a.g.c. system is in operation, the manual control is normally left in the position of maximum gain. It can, however, be used as an overriding control to reduce the signal amplitude, should the a.g.c. level be unsuitable for a particular observation.

CONTROL UNIT TYPE 526

109. All the functional and calibration controls for the equipment are housed in the control unit. The circuit diagram is shown in fig. 21, from which, together with fig. 26, the control unit front panel, it will be seen that the various manual controls are as follows:—

Extended range switch (N–240M)—S310

Cathode-ray tube FOCUS—RV324 and BRILLIANCE—RV323

Timebase RANGE selector switch—S307

Calibrator switch (CAL. ON–OFF)—S308

Function switch (H_0–H_1–BA)—S304

Receiver sweep frequency control (RX.TUNE)—S306

Transmitter frequency selector (TX.SEL)—S302

Manual—a.g.c. switch (AVC–M)—S309

Receiver frequency selector (RX.SEL)—S301

H.T. switch (HT ON–OFF)—S303

Transmitter ON–OFF–CODE switch—S305

Receiver manual GAIN control—RV321.

110. As described in para. 57 to 60, the frequency of the transmitter or receiver is determined by adjusting the control potential of the bridge circuit in the selector system. The control voltage is obtained from one of six preset potentiometers, each of which covers a predetermined portion of the frequency band. The frequency selector switch selects each potentiometer in turn, and this can then be adjusted so that the tuning system is set to the appropriate frequency. The resistors, referred to in para. 27 as X and Y, are respectively R302 and R304 for the receiver selector, and R346 and R335 for the transmitter selector.

111. The timebase amplitude is preset by RV315 which controls the voltage applied to the anode of V10. Due to wide variations in sensitivity of cathode-ray tubes CV1526, used in indicating unit Type 208, the range of adjustment of RV315 has been found to be inadequate. The timebase amplitude has been increased by the addition of a preset capacitor C52 in parallel with C26, which controls feedback between the anode and grid of V12. C52 is used as the coarse timebase amplitude control while RV315 is used as the fine timebase amplitude control.

112. The velocity controls for the timebase ranges are RV313, RV317, RV314 and RV318. On the two short ranges, the V10 grid resistor R40, on chassis No. 1, is connected through S310 to the RANGE switch S307c, by relay RL3/4, also on chassis No. 1. On the three long ranges RL3 is energized by S307b and R38 becomes the grid resistor for V10. RV318 is the velocity control for the 120-mile range. The 240-mile range is selected by the toggle switch S310, mounted in the extended range box on top of the control unit. No separate velocity control is provided for this range.

113. The timebase delay, to which reference was made in para. 45 to 47, is adjusted by means of two preset controls RV316 and RV322, which provide ½ to 1½ and 1½ to 2½ nautical mile delays respectively. The former controls the H_1 delay and the latter the BA delay.

114. RV319 and RV320 are respectively the X and Y shift controls.

115. In fig. 16, assuming that the 80V, 1600 cycle and, therefore, the 6·3 volt supplies are present, so that the 60 second thermal delay relay RL1 is energized, the HT ON–OFF switch S303 energizes RL2, which is self-holding through contacts 23/24. Contacts 3/4 close and the 80V supply is applied to the primary winding of T2. At the same time contacts 1/2 open, inserting R74 in series with the heating element of RL1. The heater current is thus reduced to a value which opens RL1 contacts but decreases the re-make time to 20 seconds should the HT switch be inadvertently turned off, and immediately switched on again. S102 is a second thermal switch which is situated over the i.f. unit, since this is the hottest point in the equipment, and it is designed to open should the ambient temperature rise above 90 deg. C.

CONTROL UNIT TYPE 526A

116. Control unit Type 526A, which is a modified version of the control unit Type 526, provides the same manual controls as used in the control unit Type 526, but includes circuit and component changes to enable the transmitter-receiver TR.3624 to be operated at frequencies separated by 4 Mc/s. To avoid repetition of information given for the control unit Type 526 (para. 109 to 115), only the differences between the control units Type 526A and 526 are given in para. 117 and 118. The circuit diagram of the control unit Type 526A is given in fig. 22.

117. The transmitter and receiver frequency ranges, when using control unit Type 526A, are given in Table 2. To operate the transmitter and receiver at these frequencies, it is necessary to provide a range of preset control voltages which is different from that provided by the control unit Type 526. To achieve this, the resistor networks associated with the preset potentiometers in the transmitter and receiver frequency selection circuits have been modified. The X and Y resistors (para. 27) are not fitted in the control unit Type 526A.

118. In certain production models of the control unit Type 526A or when a replacement switch is required for earlier models, the switch used for S308 CAL ON–OFF will be of a different type. The old switch Type 1795 (Ref. No. 10FB/1509) was operated both ON and OFF by pushing the switch knob. The replacement switch (Ref. No. 10F/21353) is push-pull operated and the switch knob is engraved PULL ON.

INDICATING UNIT TYPE 208

119. No circuit diagram is included for this unit because, as has already been stated in para. 29, it contains nothing but the cathode-ray tube and its associated wiring.

120. The cathode-ray tube Type CV1526 used in this indicator is of the post accelerator type and operates with –1·5kV on its cathode and +1·5kV on the post-accelerator anode. These voltages, timebase waveforms and the video signals are all conveyed to the indicating unit from the TR.3624 by a twelve-corvinmet No. 3 cable.

121. Sufficient brilliance can be achieved, with reasonable focus, for most observations, except when the face of the tube is directly exposed to sunlight. A special visor Type 43, embodying a magnifying lens, can be attached when a larger picture is desired. The magnification is 2½ times.

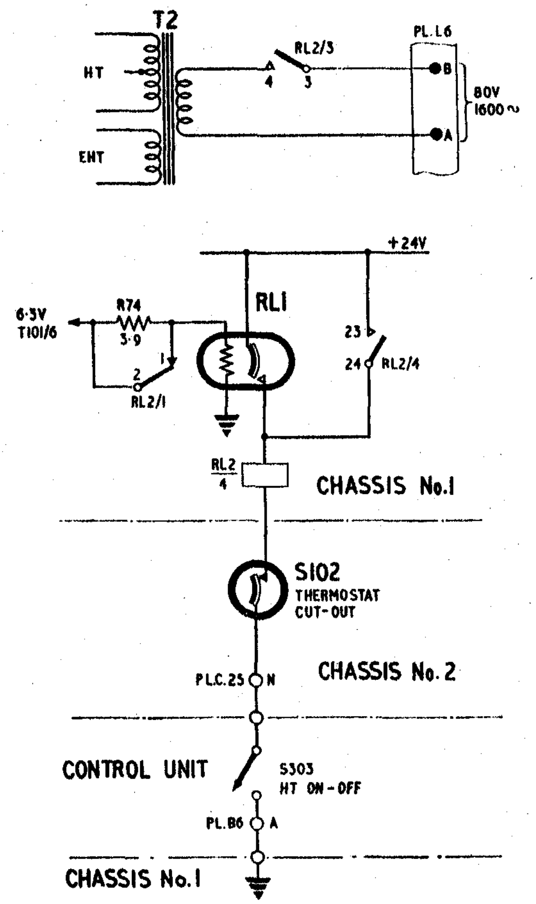

Fig. 16. Switching-on sequence

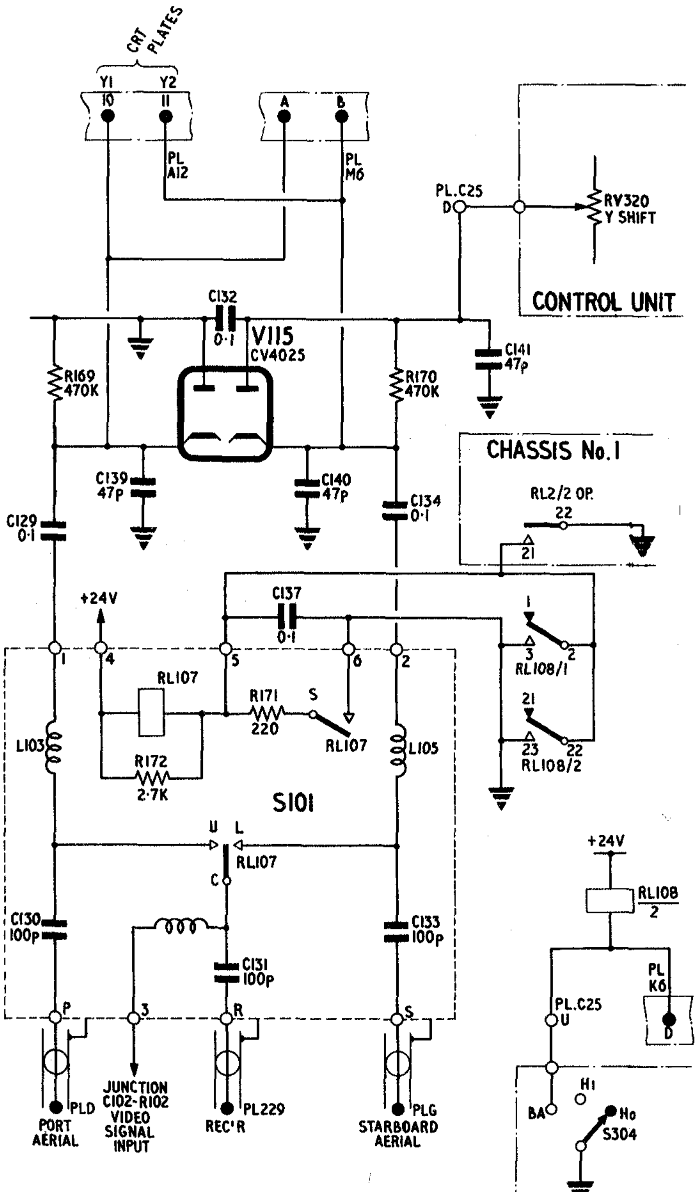

FIG. 17a

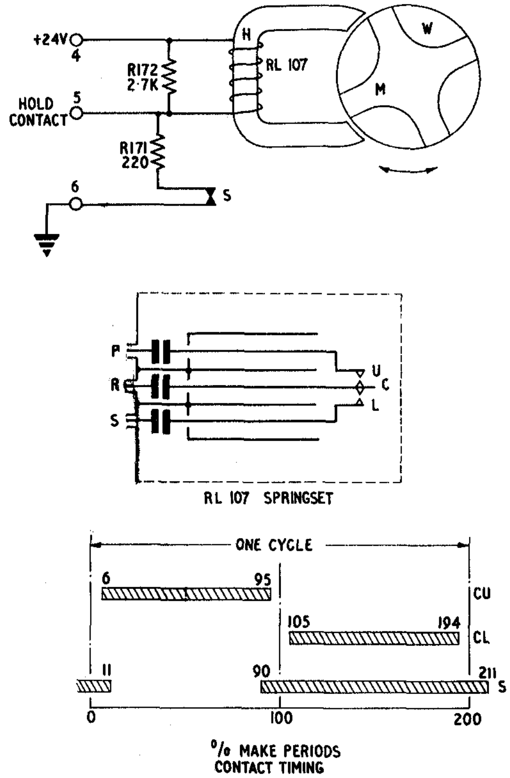

FIG. 17c

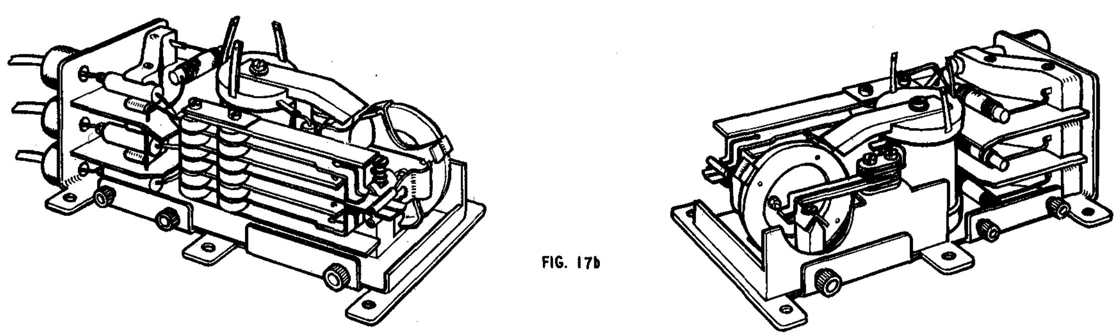

FIG. 17b

AIR DIAGRAM 6277E/MIN.	
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ARI.5610 – TR.3624 – switch unit 273 Fig.17

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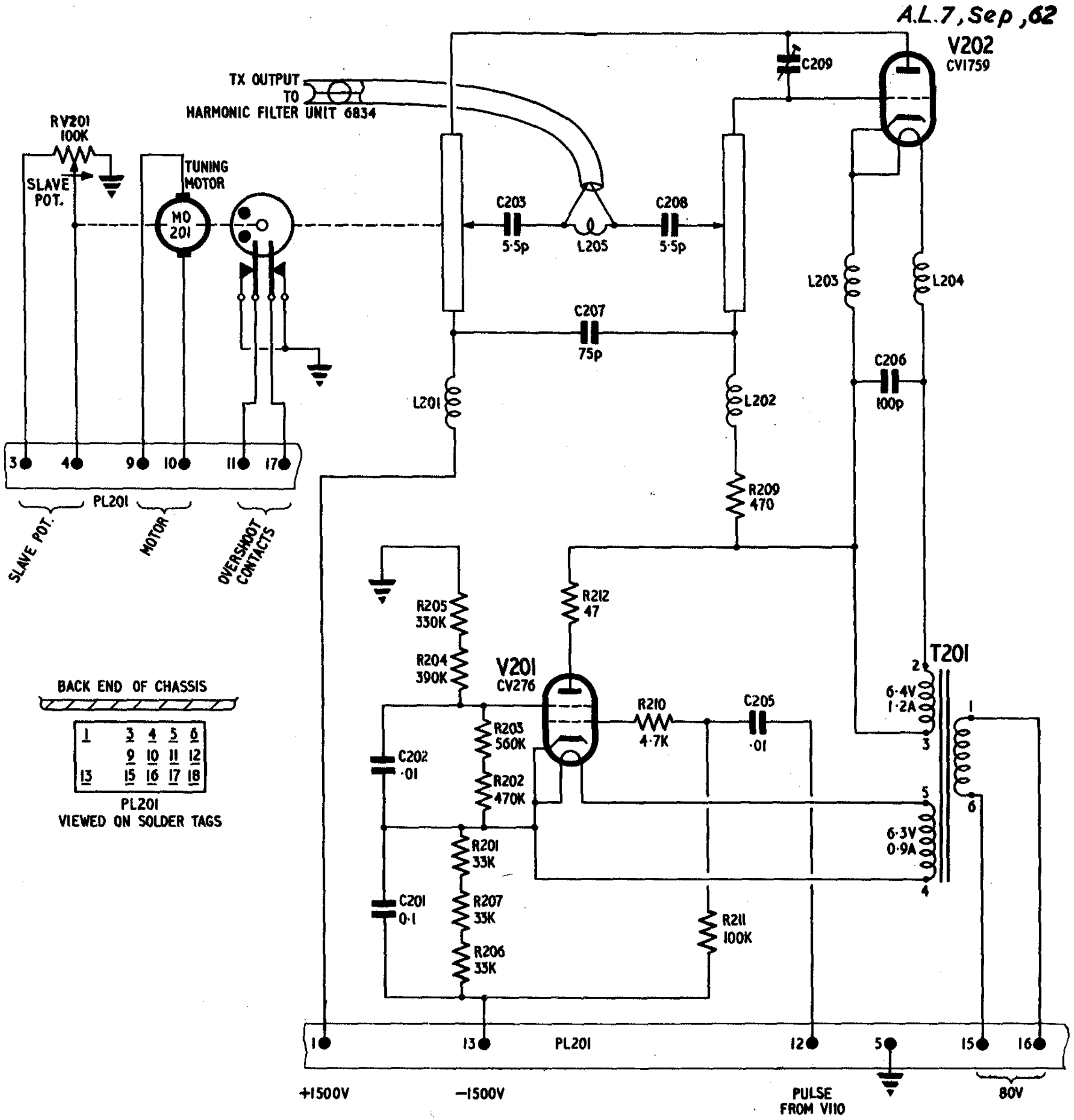

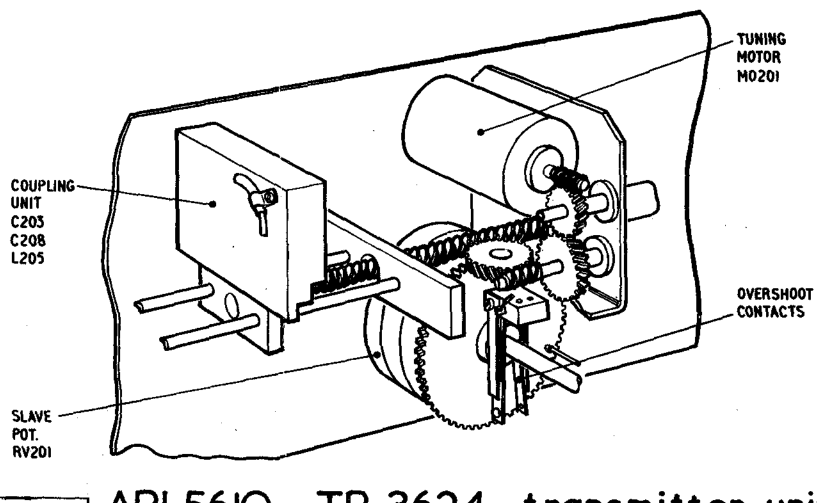

AIR DIAGRAM 6277A/MIN.
ISSUE 3 — PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

ARI. 5610 – TR. 3624 – transmitter unit 127 – circuit diagram & tuning mechanism Fig. 18

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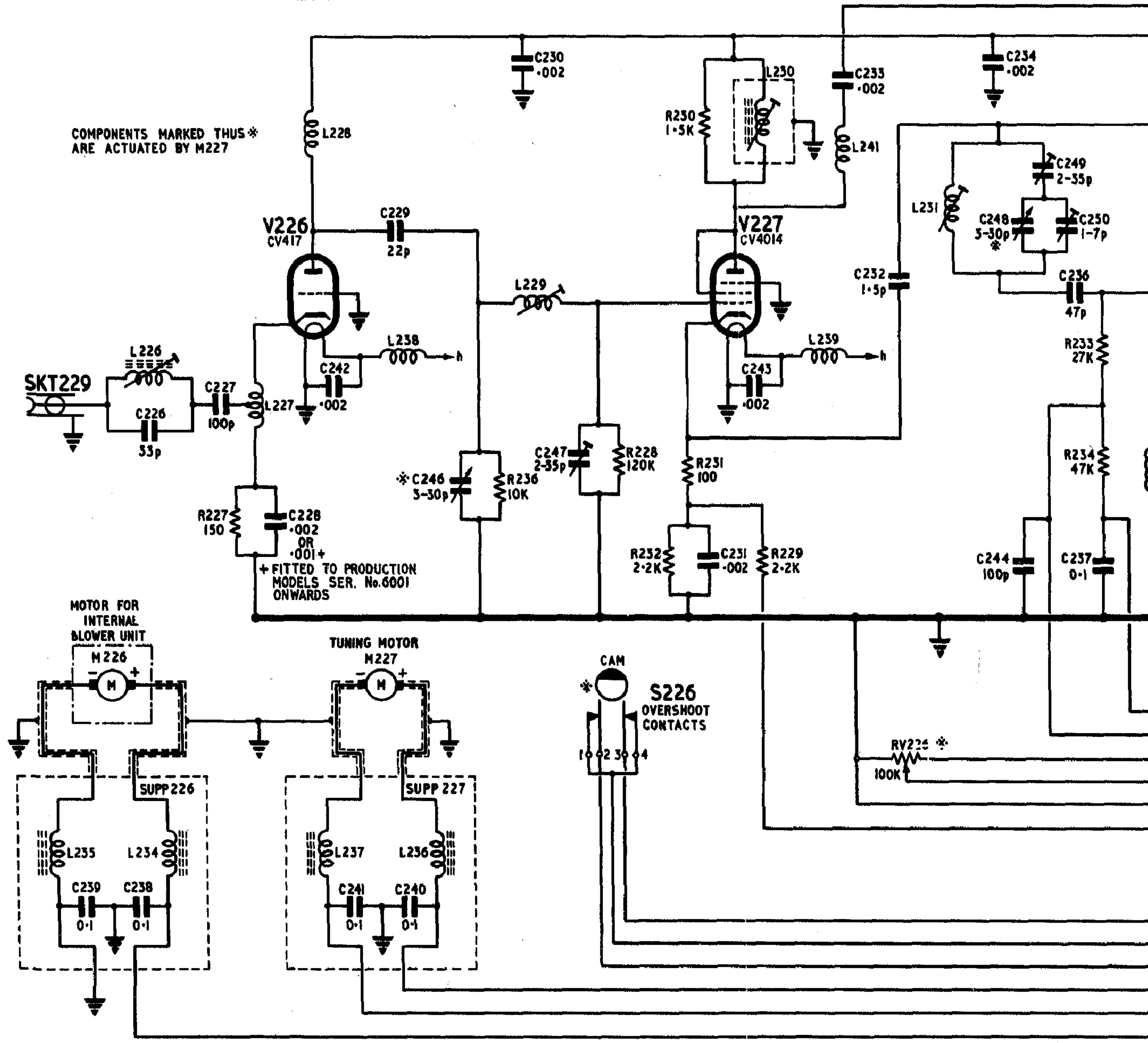


FIG. 19 a

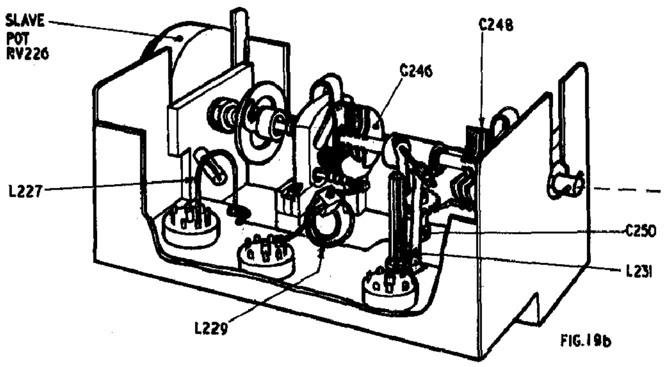
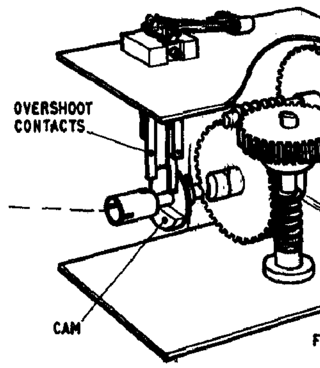


FIG.19b



AIR DIAGRAM
6277B/*MIN.*

ISSUE 2 | PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

ARI. 5610-TR.3624-R.F. unit 147-
circuit diagram & mechanical layout

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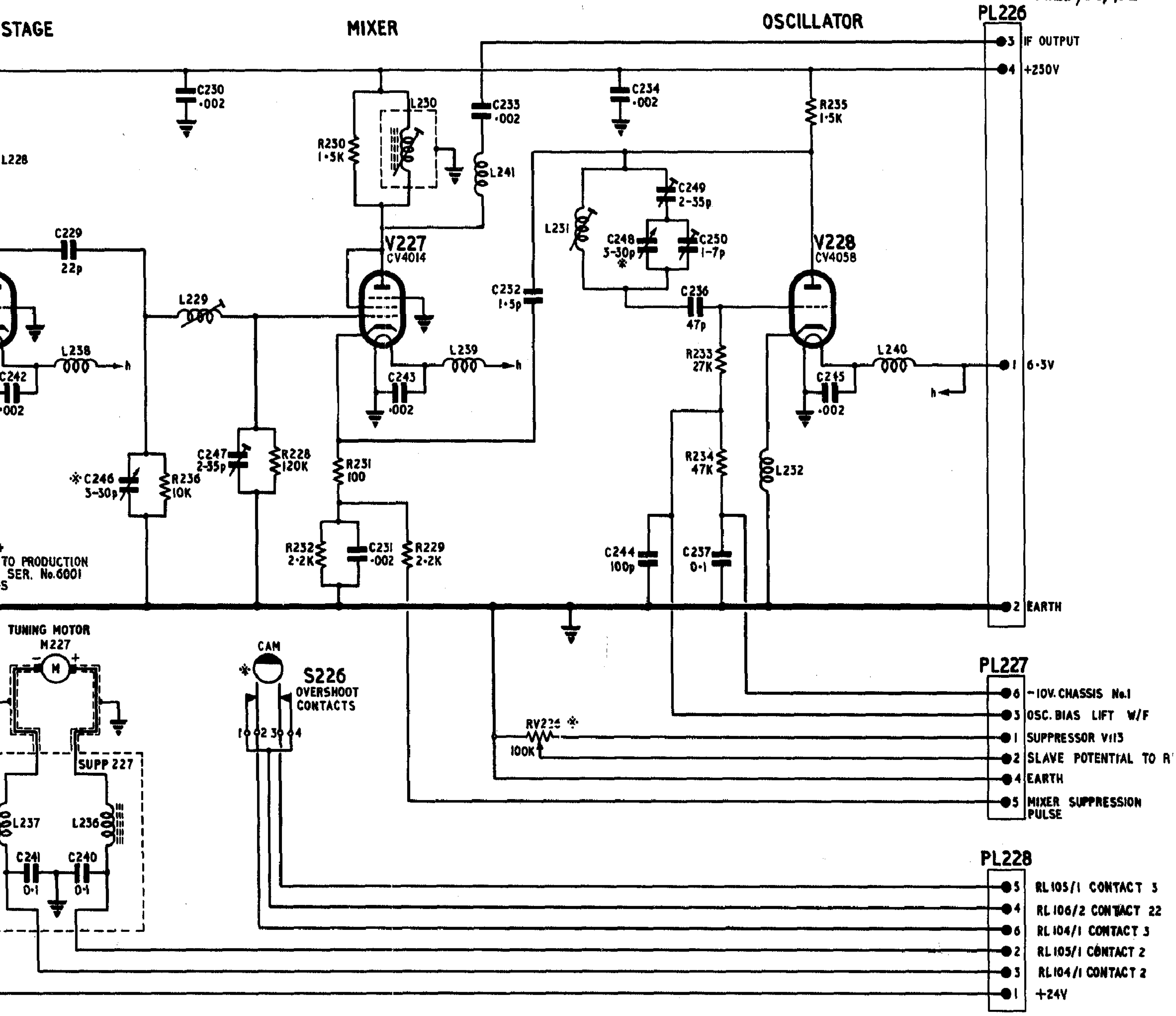


FIG. 19a

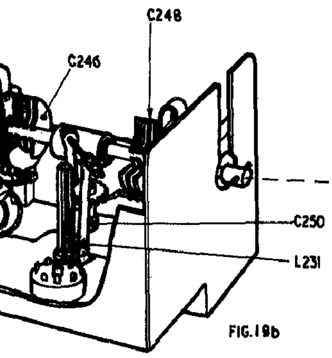


FIG.19b

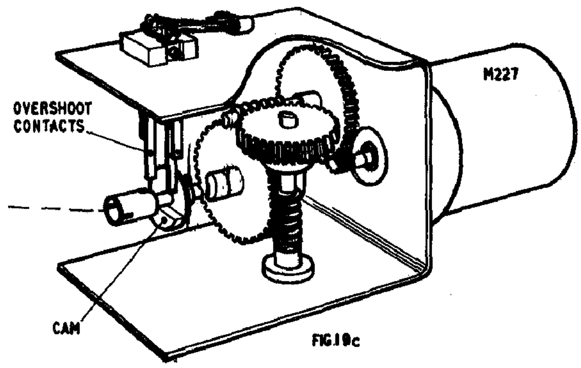
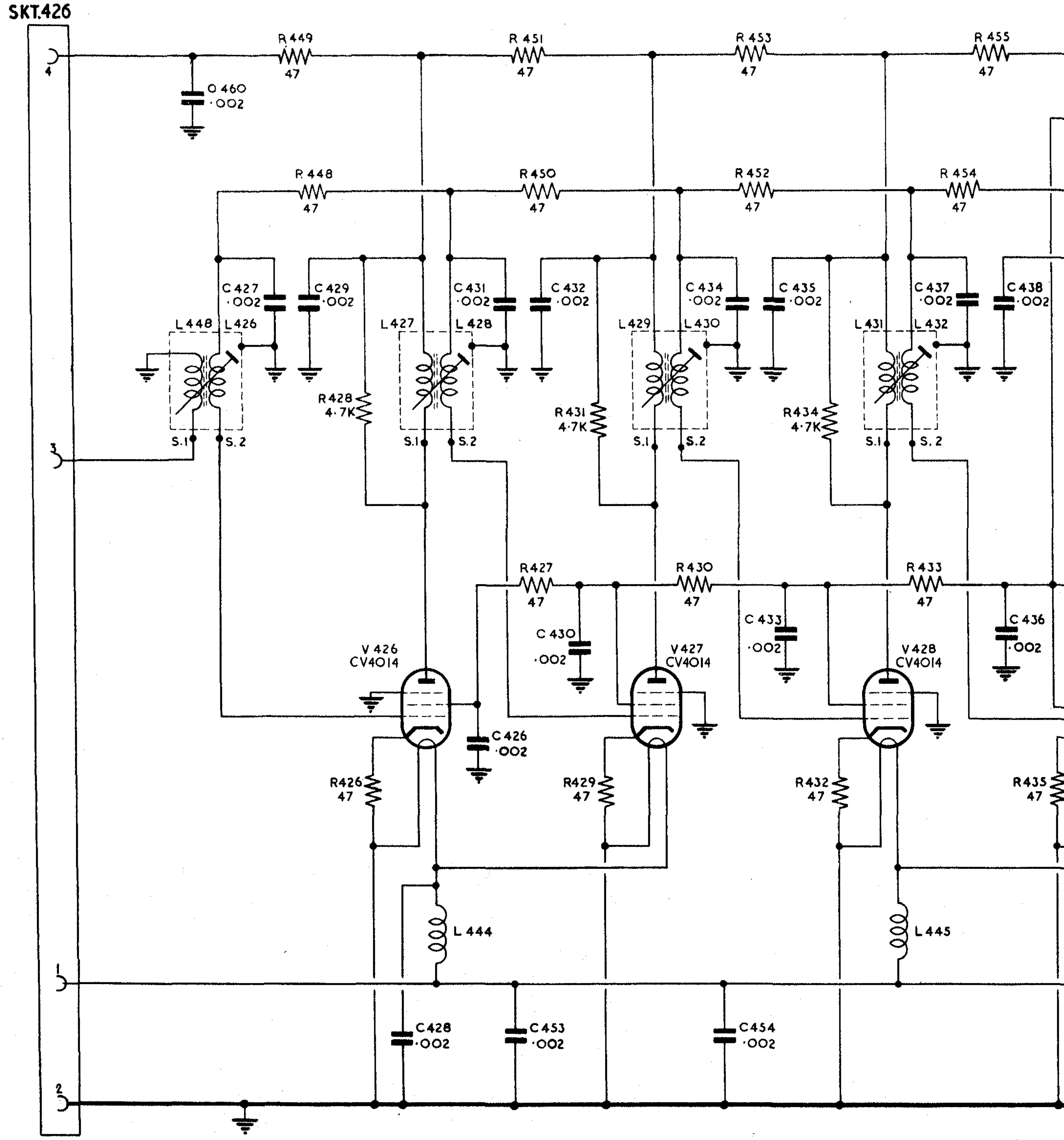


FIG.19c

ARI.5610-TR.3624-R.F. unit 147-circuit diagram & mechanical layout

Fig.19



AIR DIAGRAM

6277C/MIN.

ISSUE 2 | PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

D.2322. 0.281807. 5/63. S.W.Ltd.

ARI. 5610

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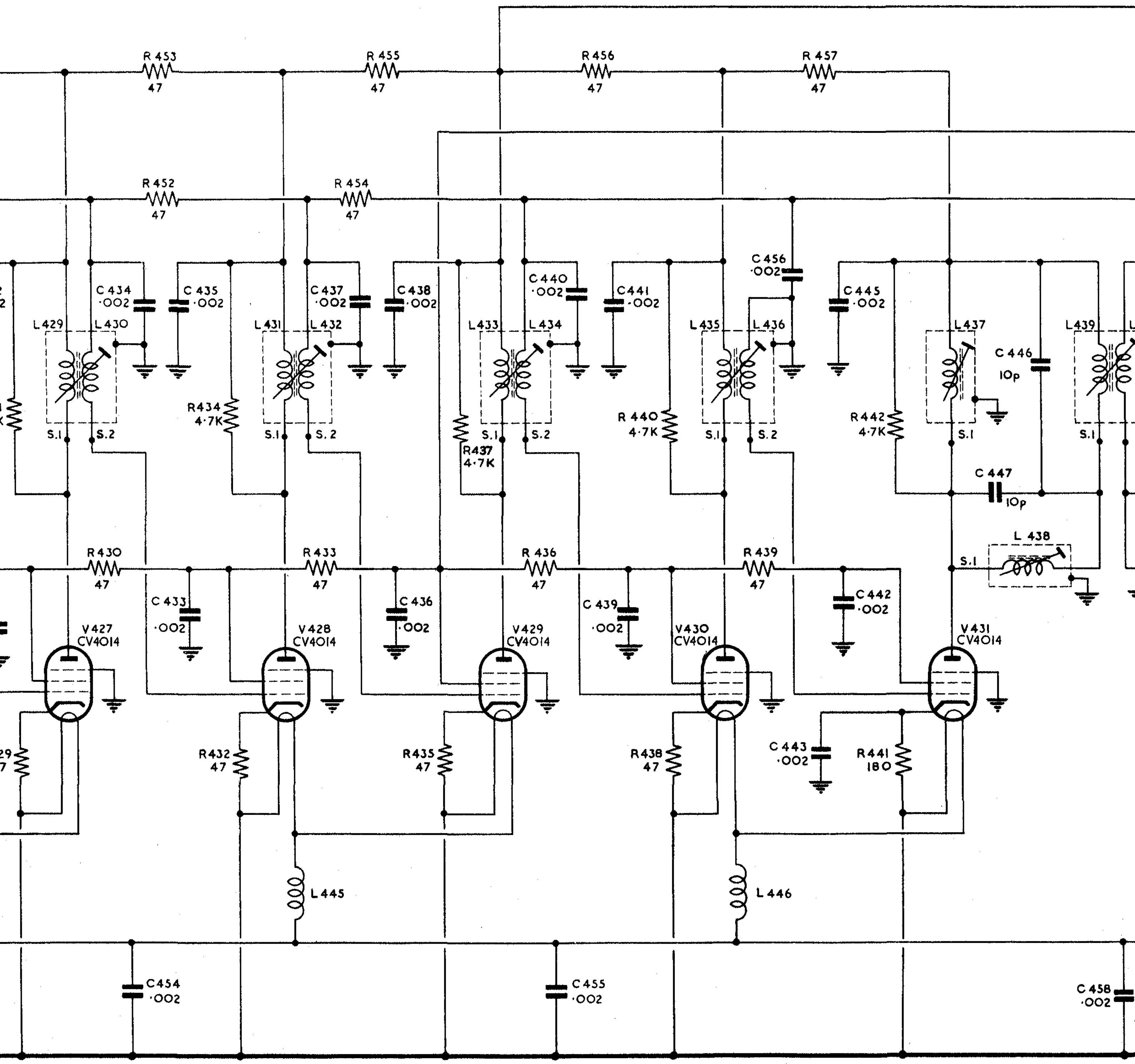

ARI. 5610 – TR.3624 – I.F. unit 123-circuit

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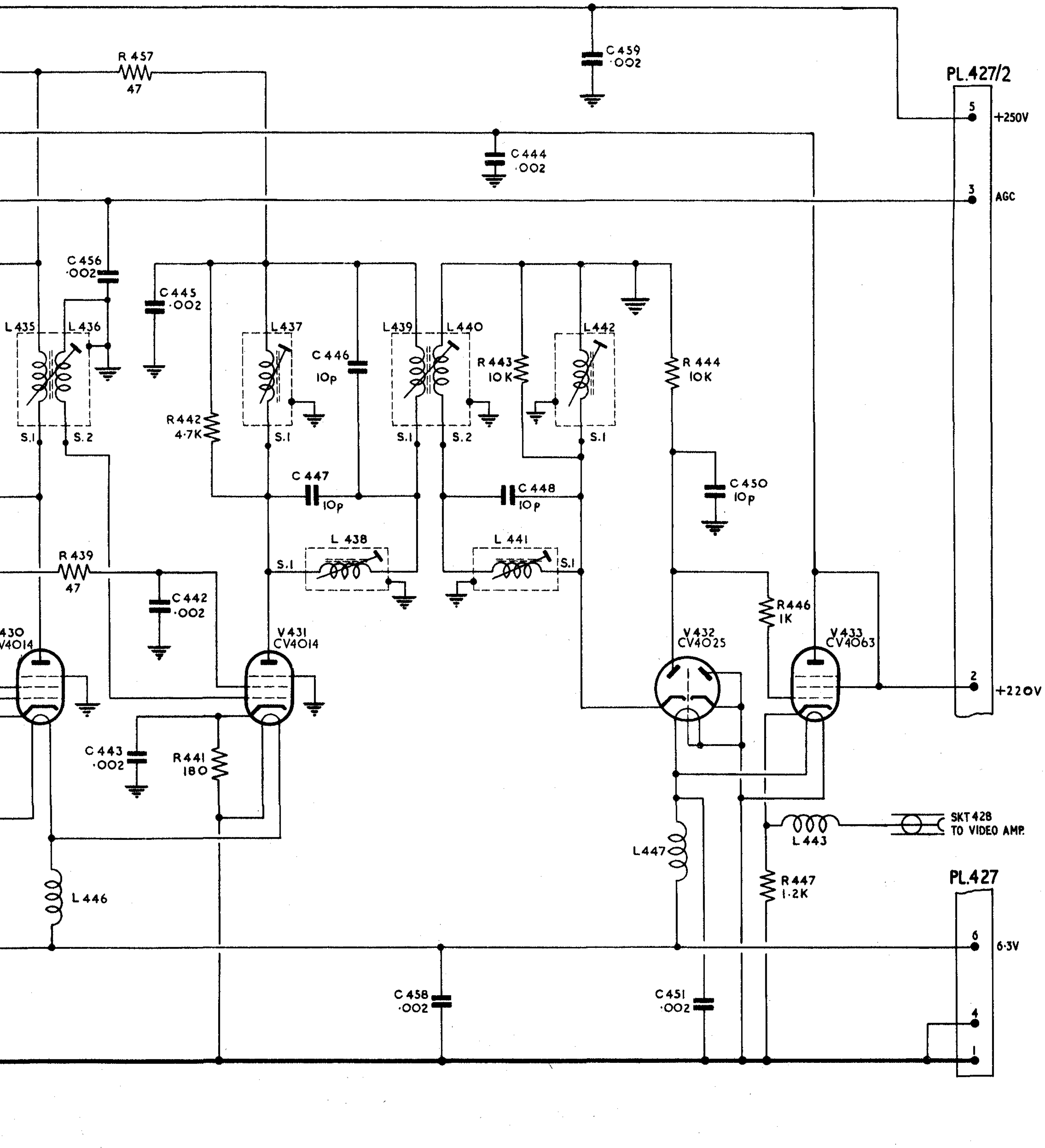
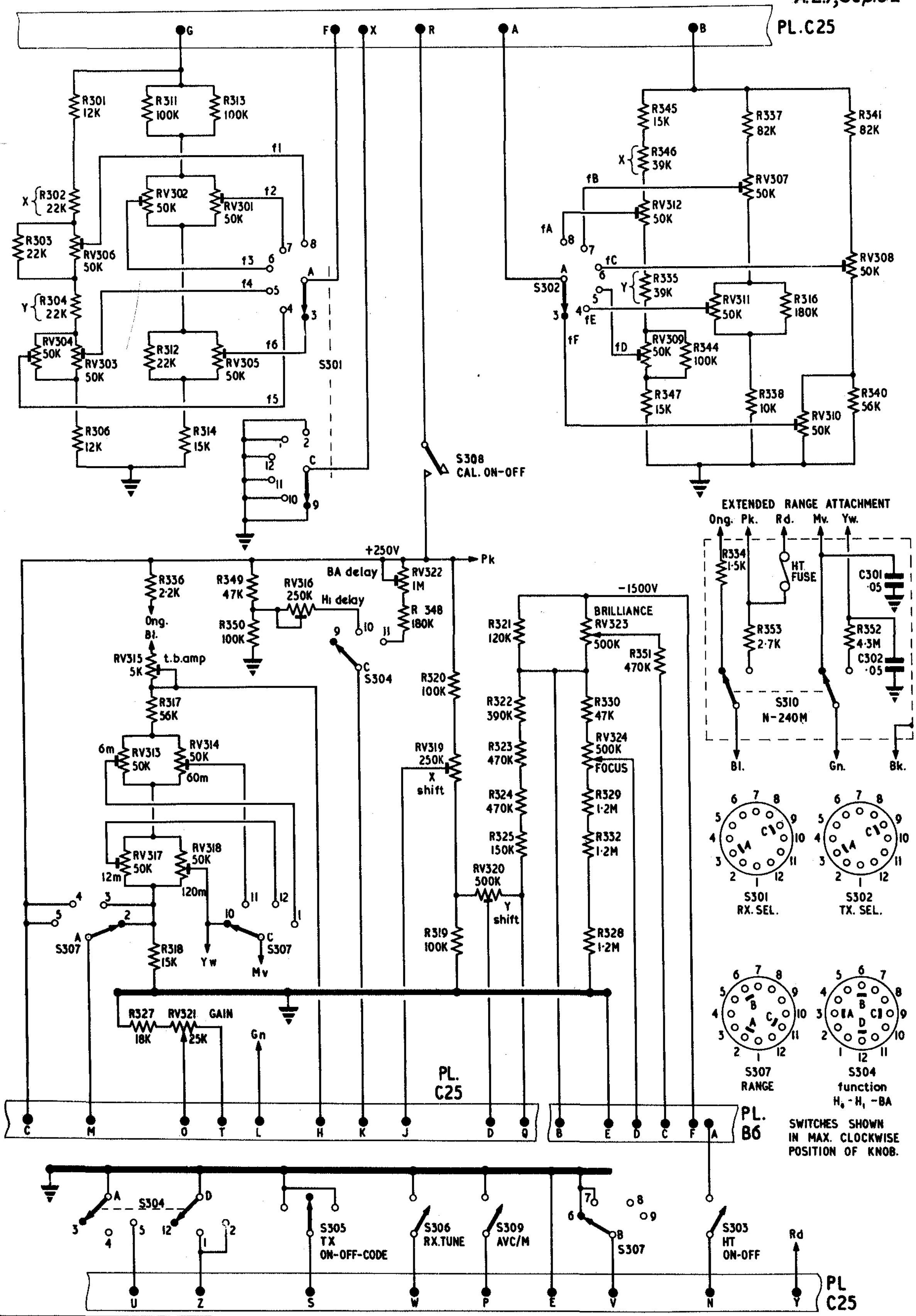


unit 123-circuit

T E D

Fig.20



AIR DIAGRAM 6277D/MIN.	
ISSUE 2	PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

ARI. 5610- control unit 526-circuit

Fig. 21

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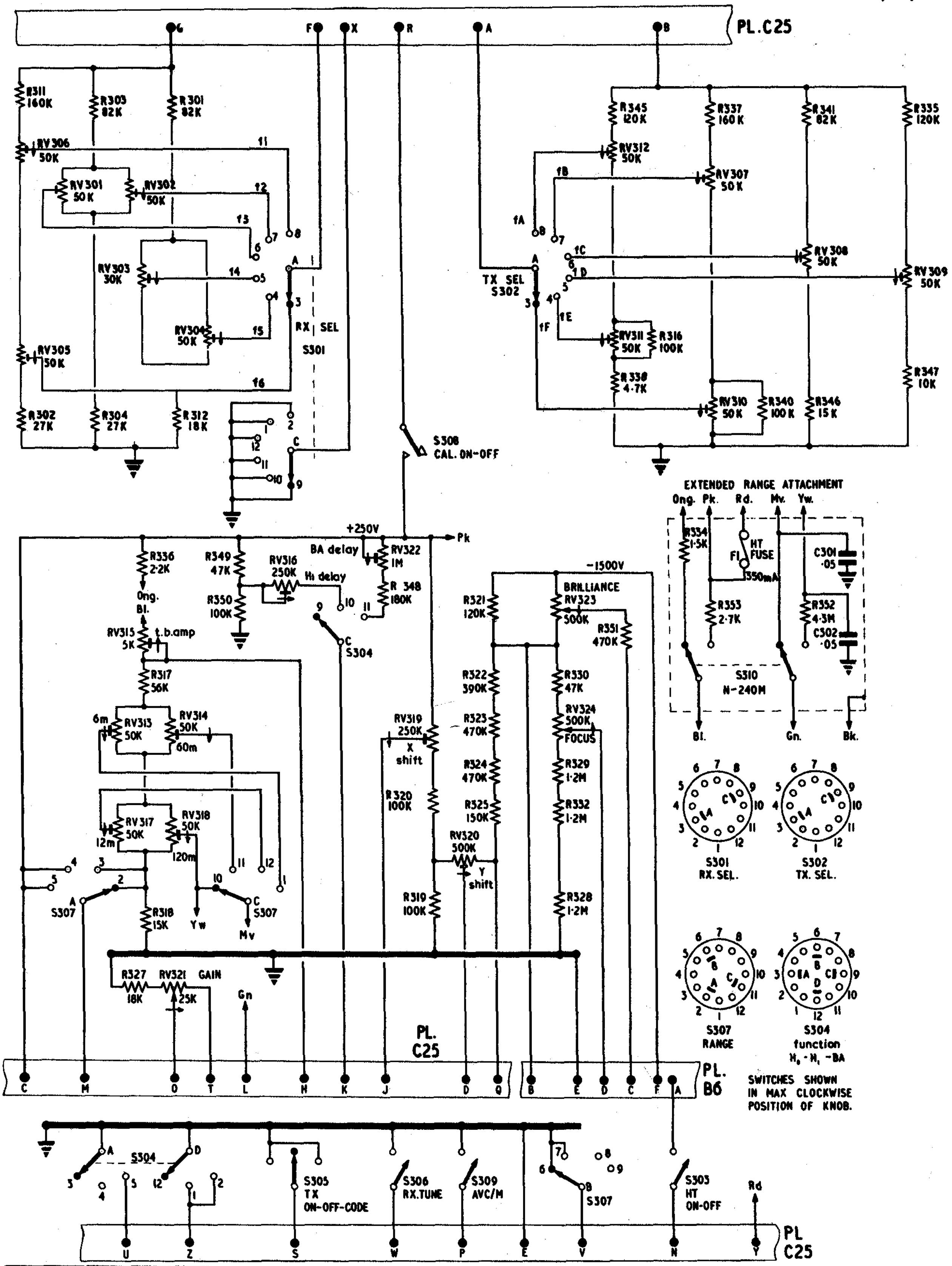


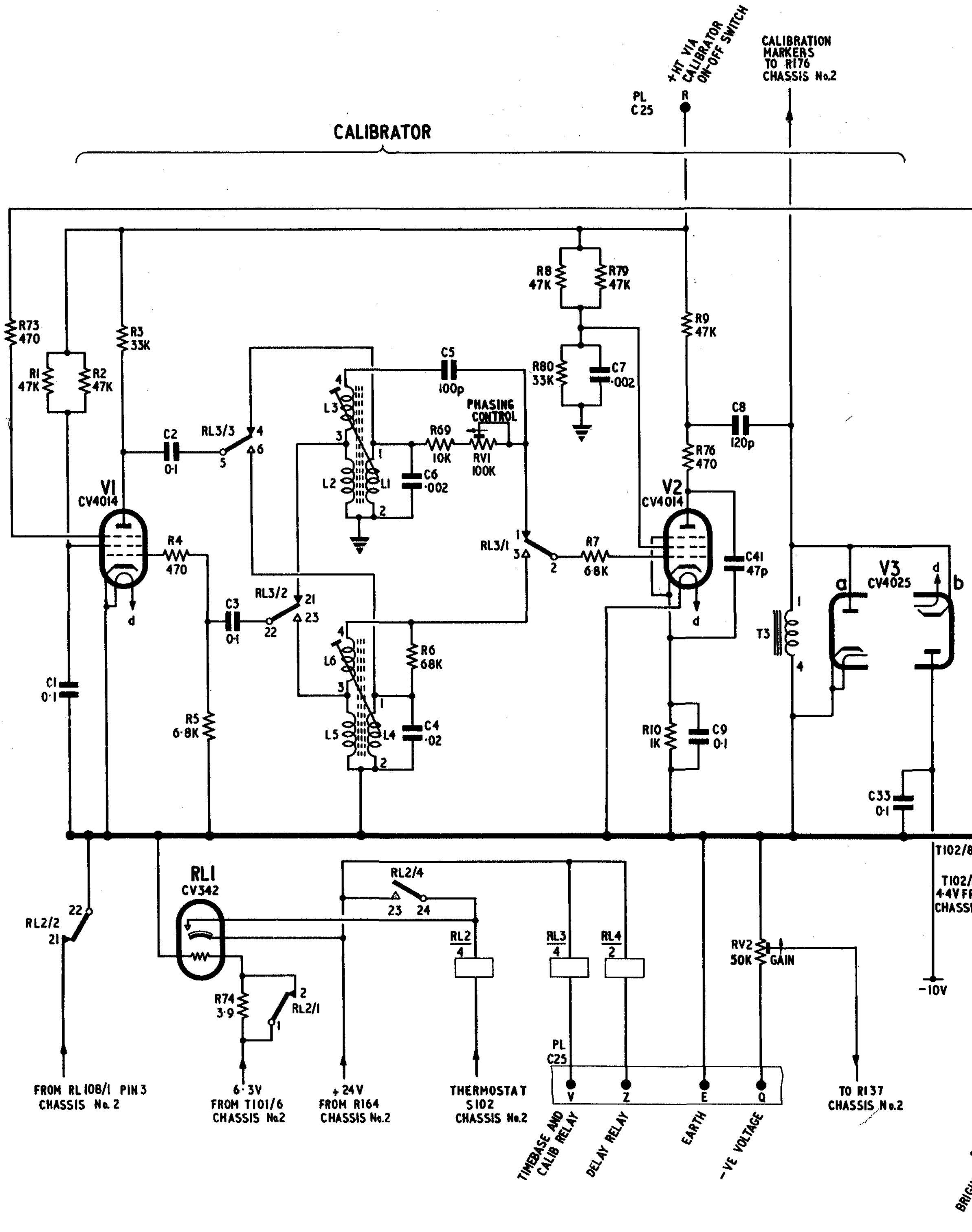
AIR DIAGRAM

6277AB/*MIN.*

ISSUE 1 — PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

ARI.5610 - control unit 526A-circuit

Fig.22



AIR DIAGRAM 6277F/ *MIN.*	
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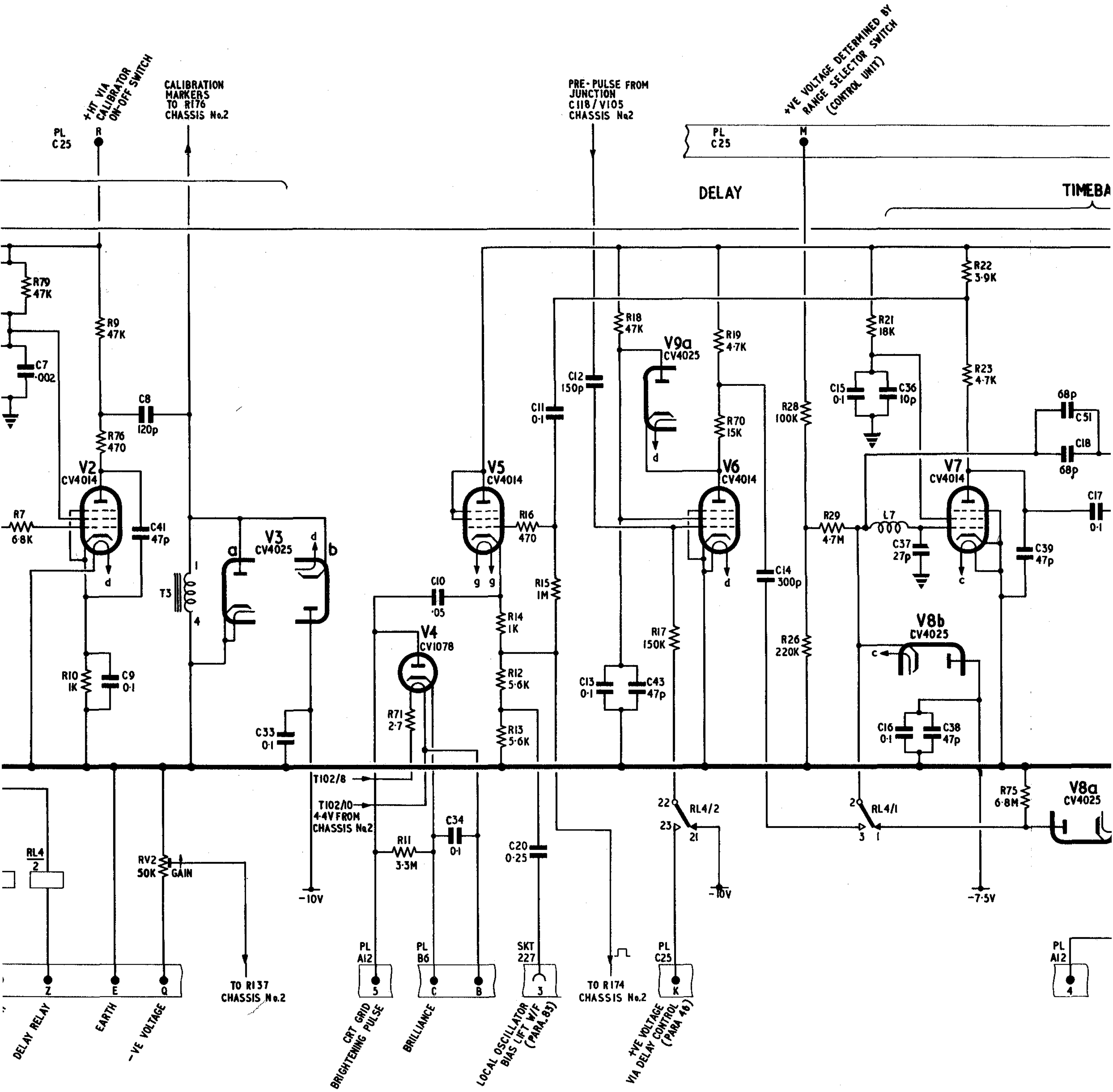

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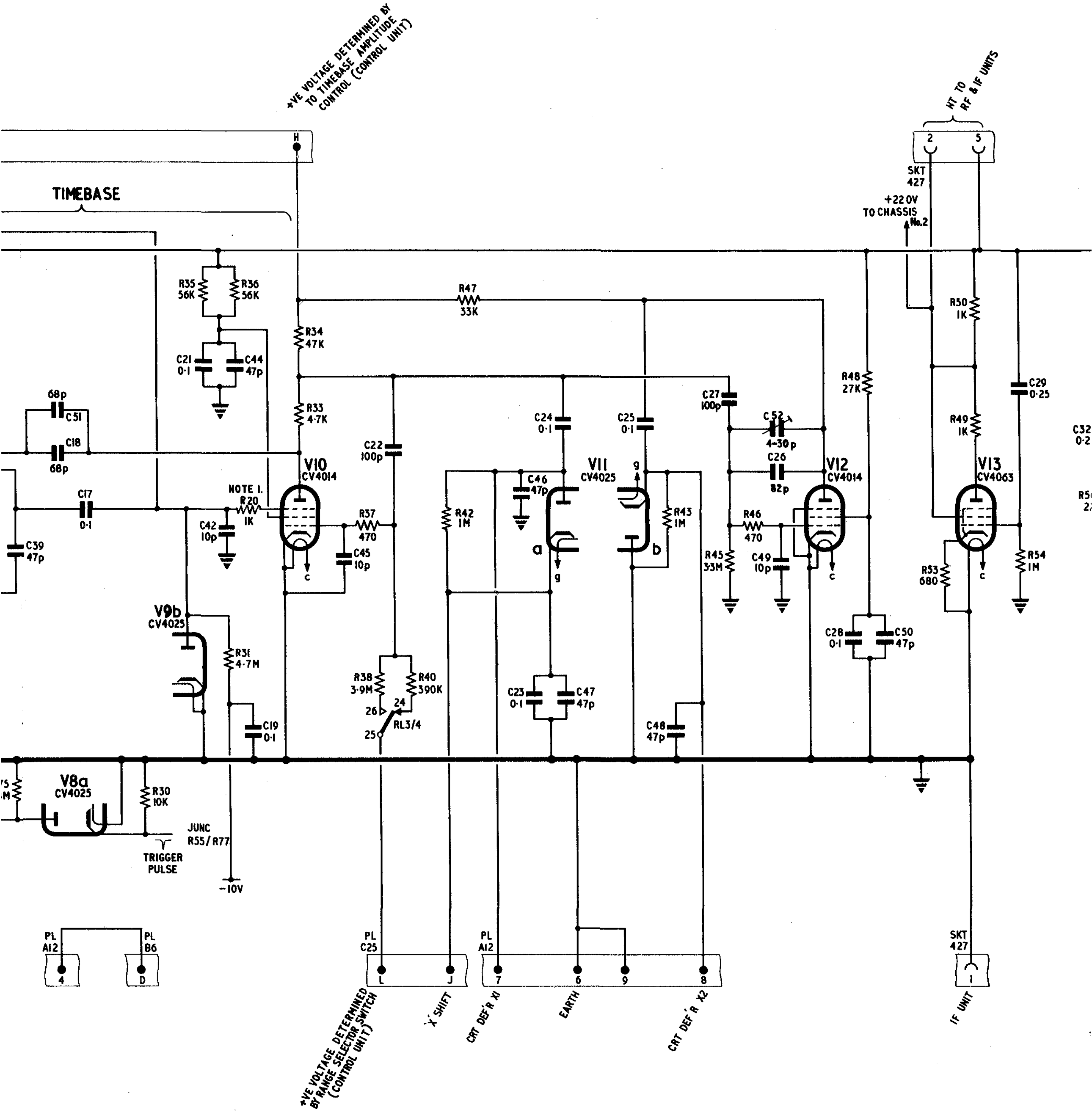
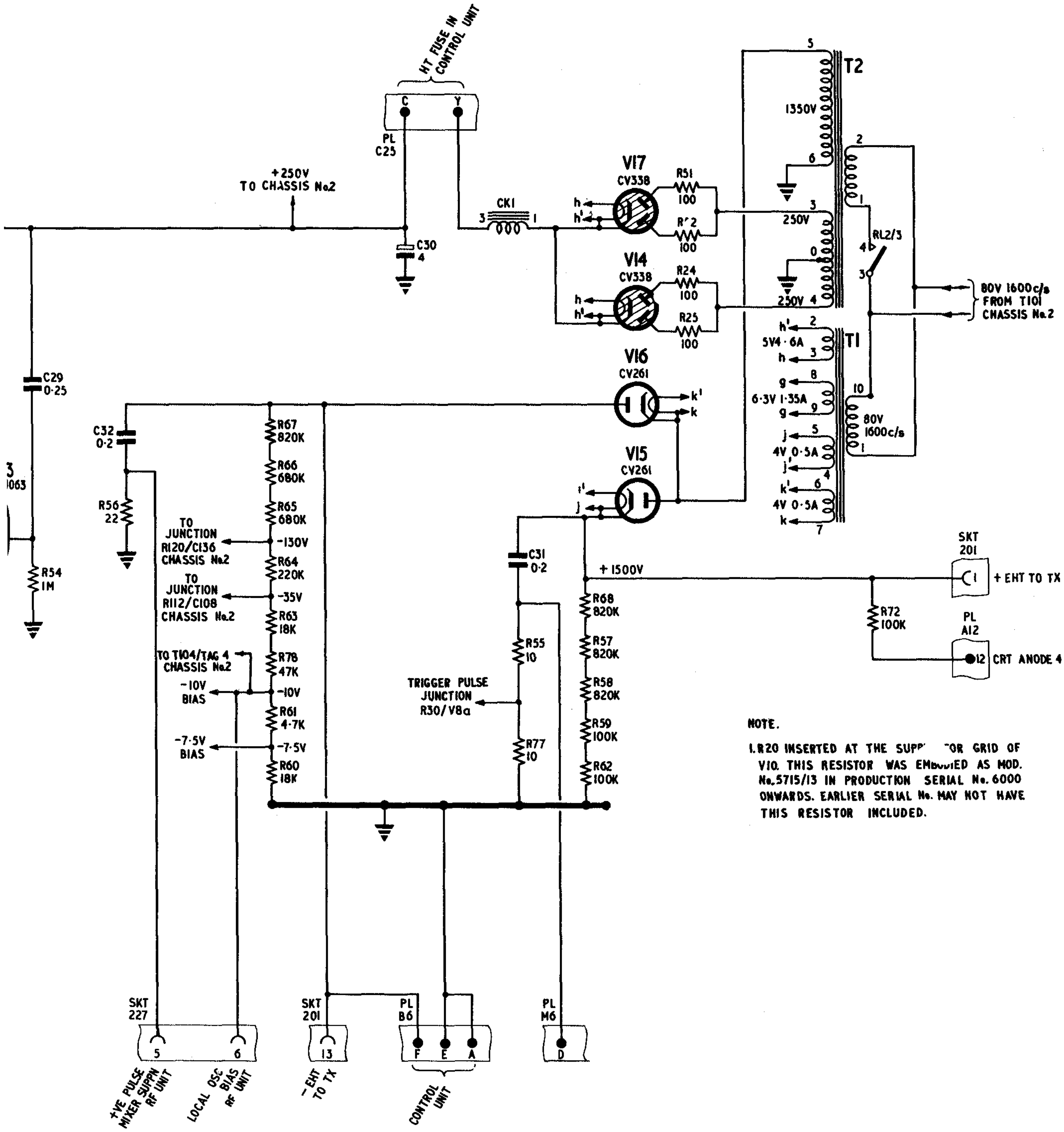


.5610- TR.3624- chassis assembly 6450-
chassis No.1-complete circuit

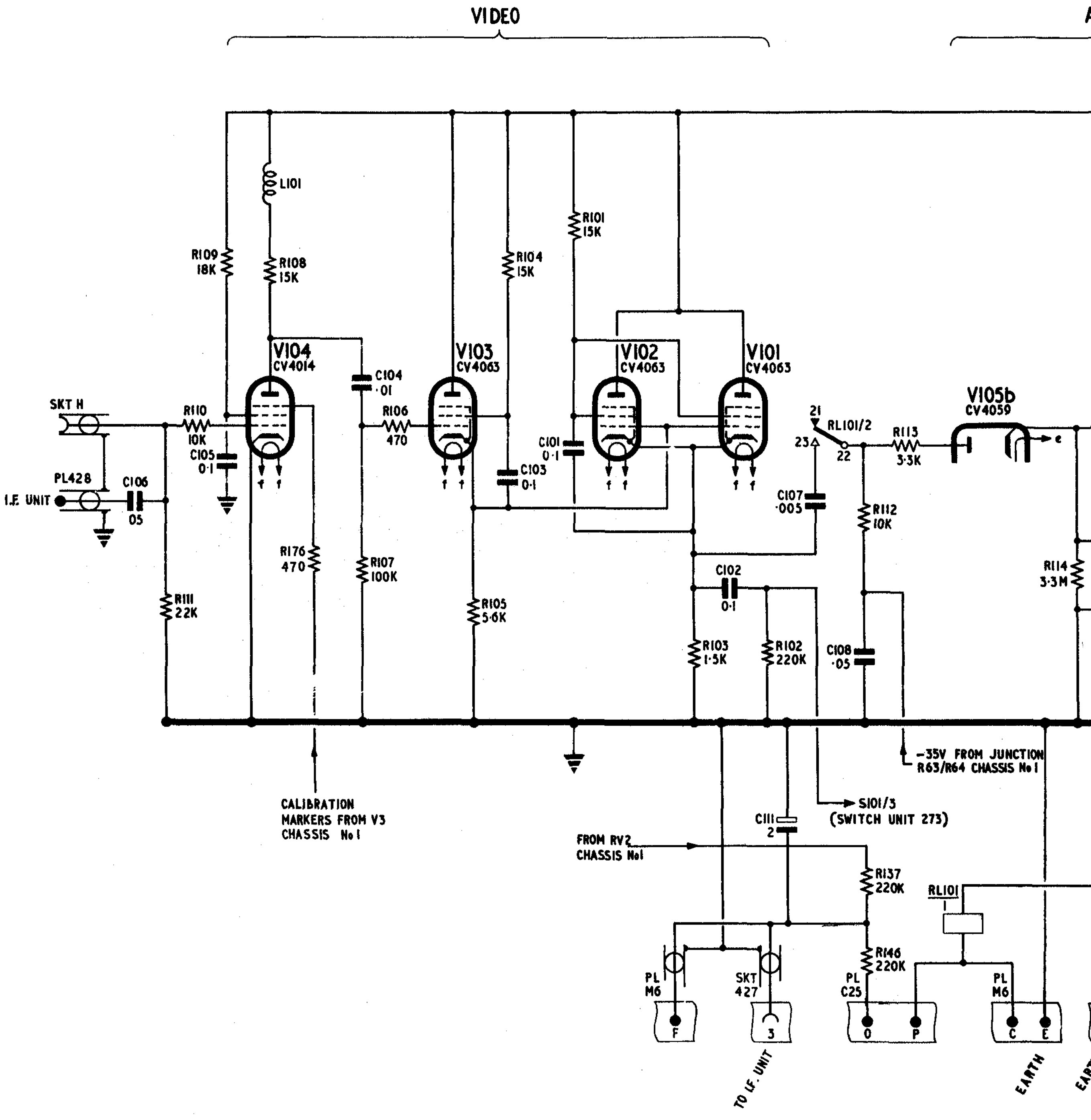
RESTRICTED



NOTE.

1. R20 INSERTED AT THE SUPP' 'OR GRID OF V10. THIS RESISTOR WAS EMBODIED AS MOD. No.5715/13 IN PRODUCTION SERIAL No. 6000 ONWARDS. EARLIER SERIAL No. MAY NOT HAVE THIS RESISTOR INCLUDED.

Fig.23



AIR DIAGRAM

6277G/*MIN.*

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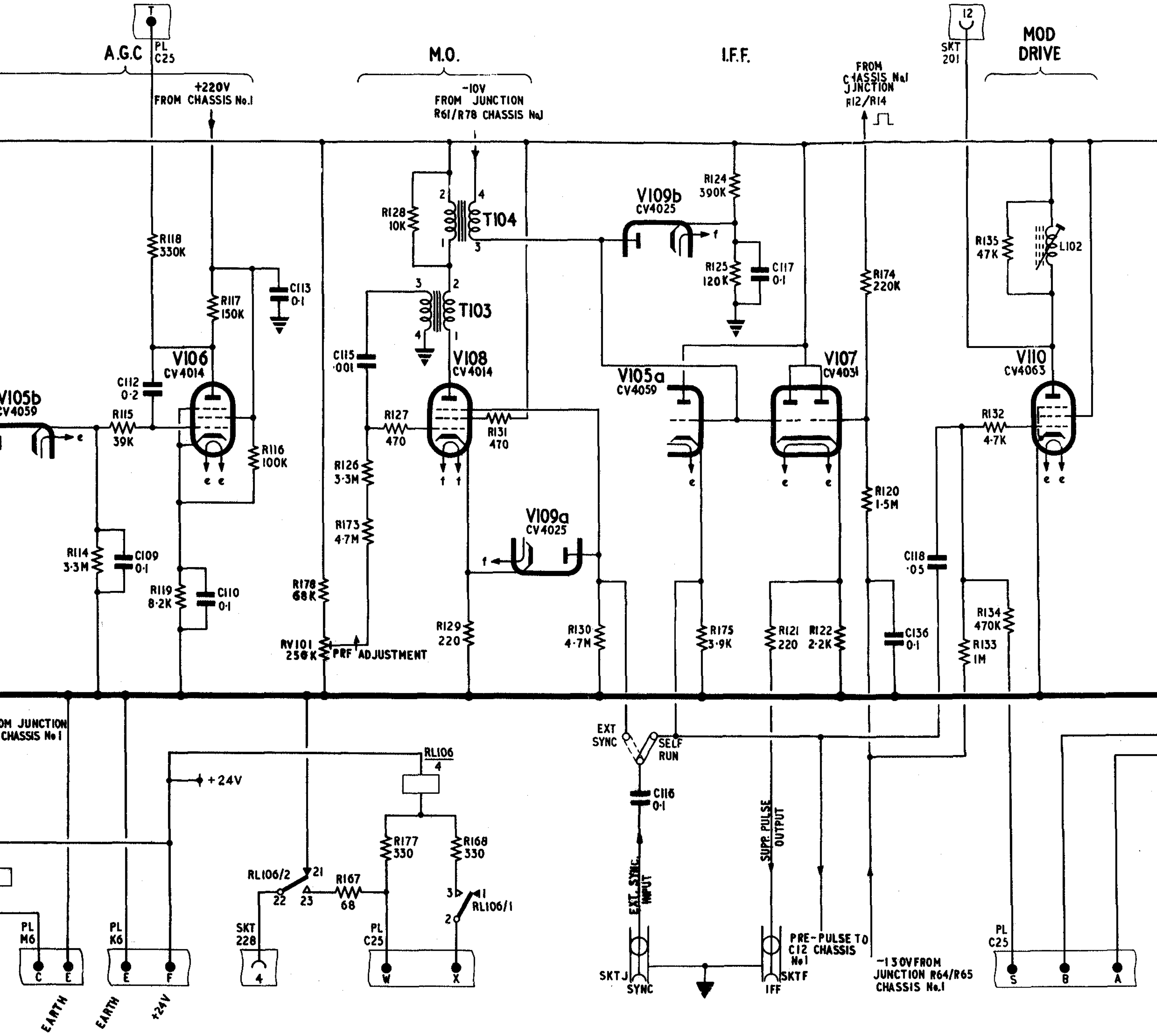
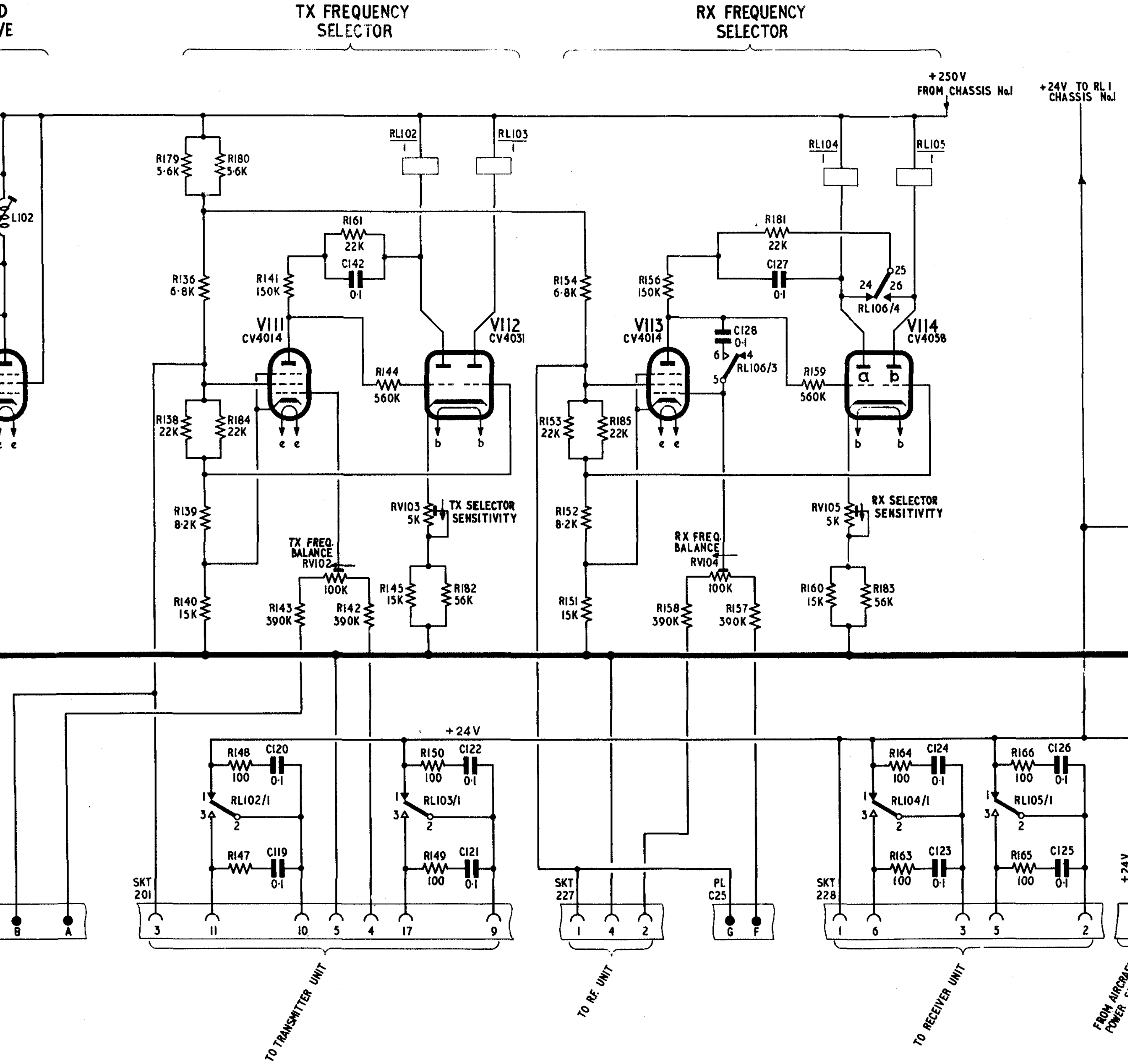


A R1.5610- TR3624-c

chassis No.2 c

R E S T R



3624-chassis assembly 6450-
No.2 complete circuit

STRICTED

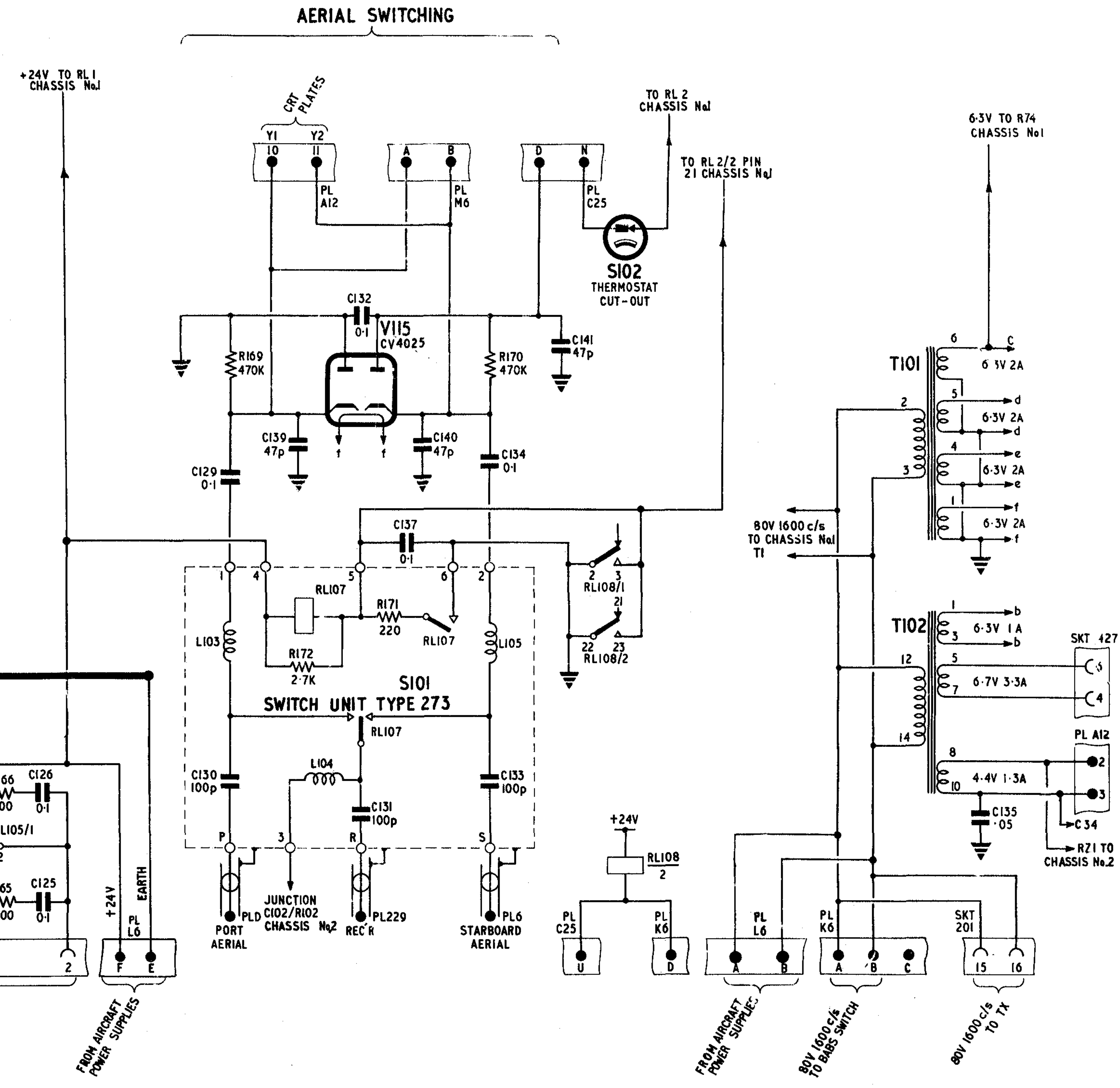
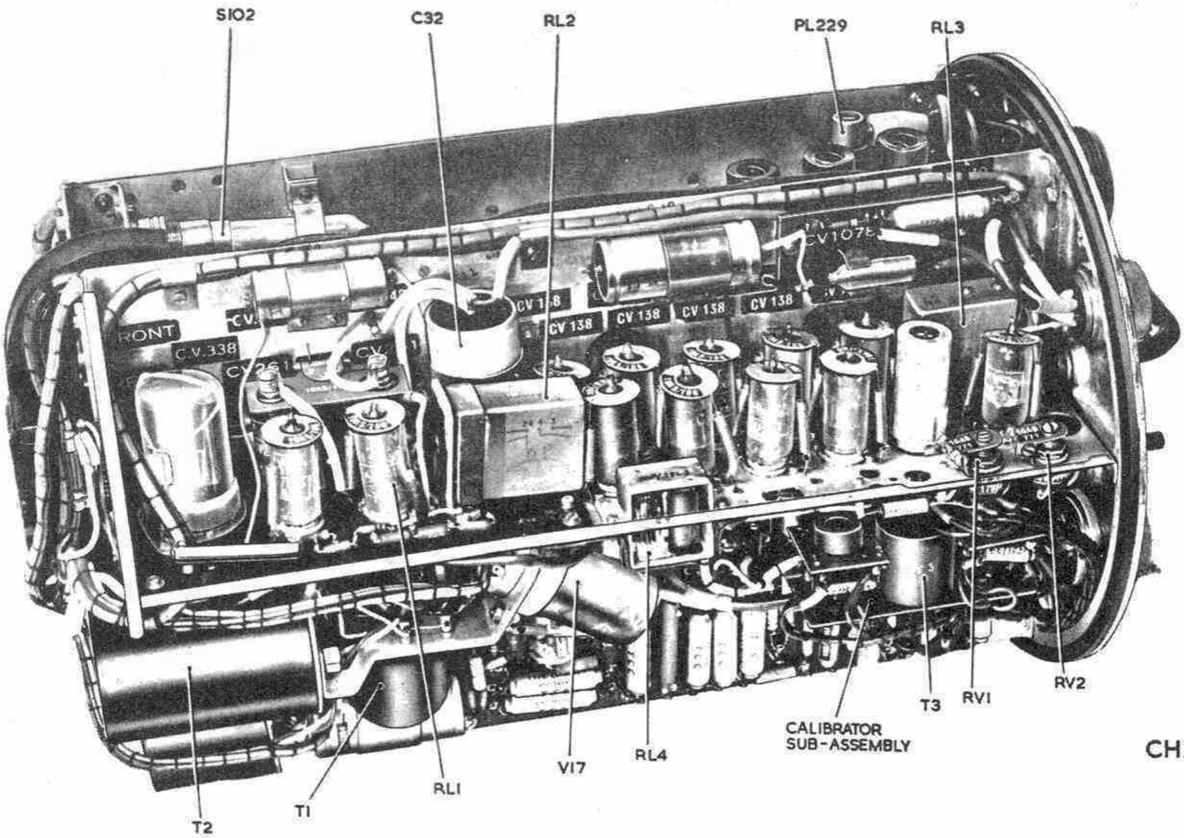
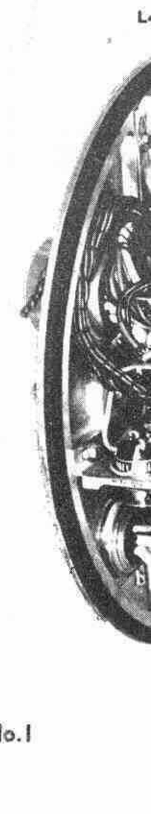
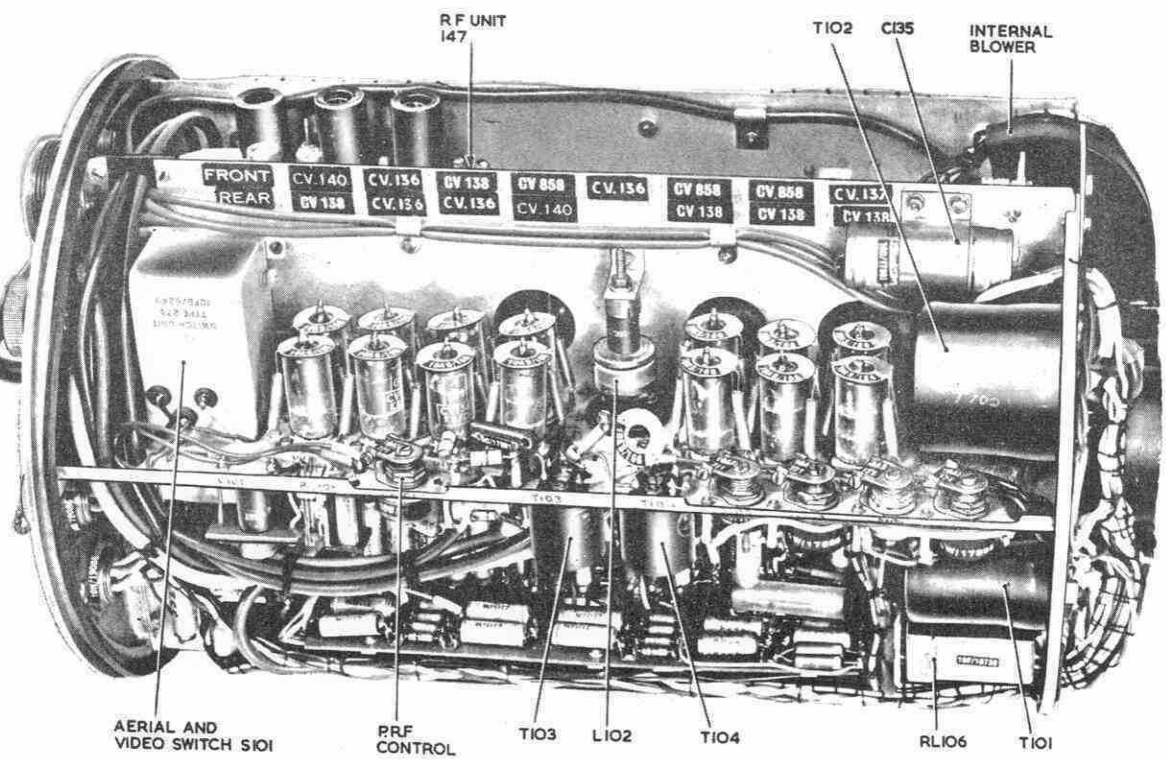

AERIAL SWITCHING
+24V TO RL I CHASSIS No.I
CRT PLATES
TO RL 2 CHASSIS No.I
TO RL 2/2 PIN 21 CHASSIS No.I
6·3V TO R74 CHASSIS No.I
S102
THERMOSTAT CUT-OUT
V115
CV4025
S101
SWITCH UNIT TYPE 273
80V 1600 c/s TO CHASSIS No.I T1
T101
T102
SKT 427
PL A12
RZ1 TO CHASSIS No.2
JUNCTION C102/R102 CHASSIS No.2
PORT AERIAL
REC'R
STARBOARD AERIAL
FROM AIRCRAFT POWER SUPPLIES
80V 1600 c/s TO BABS SWITCH
80V 1600 c/s TO TX

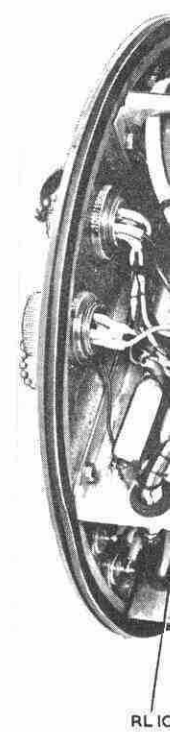
Fig. 24





CHASSIS No.1





CHASSIS No. 2

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ARI.5610 Internal views

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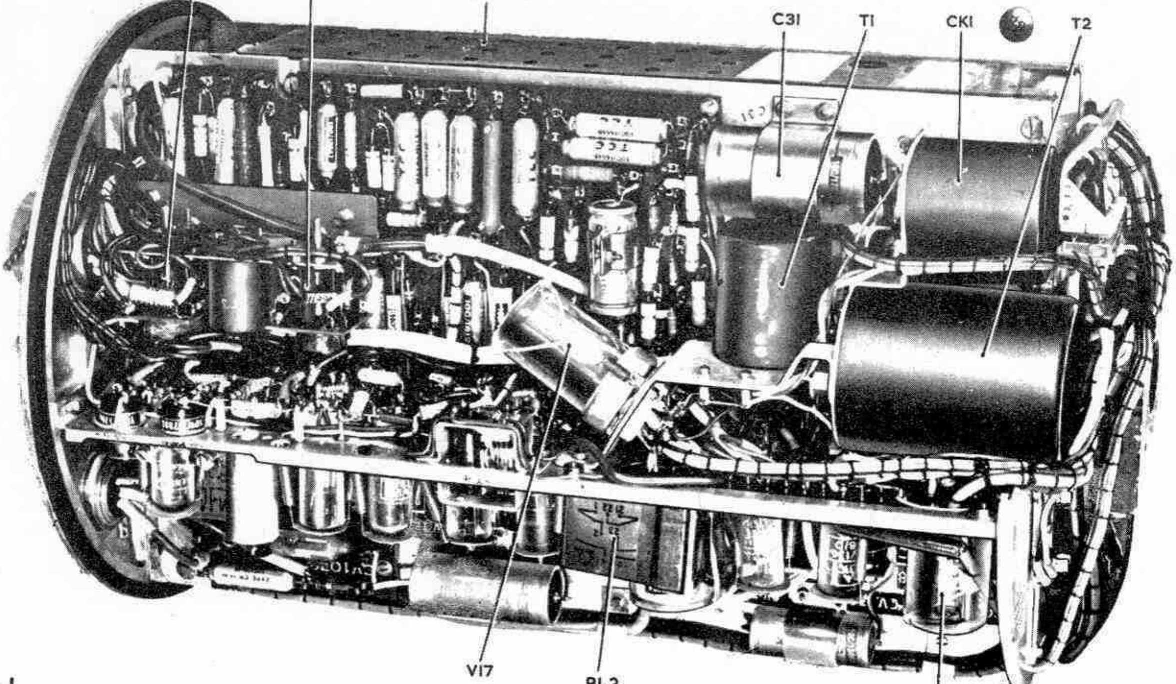
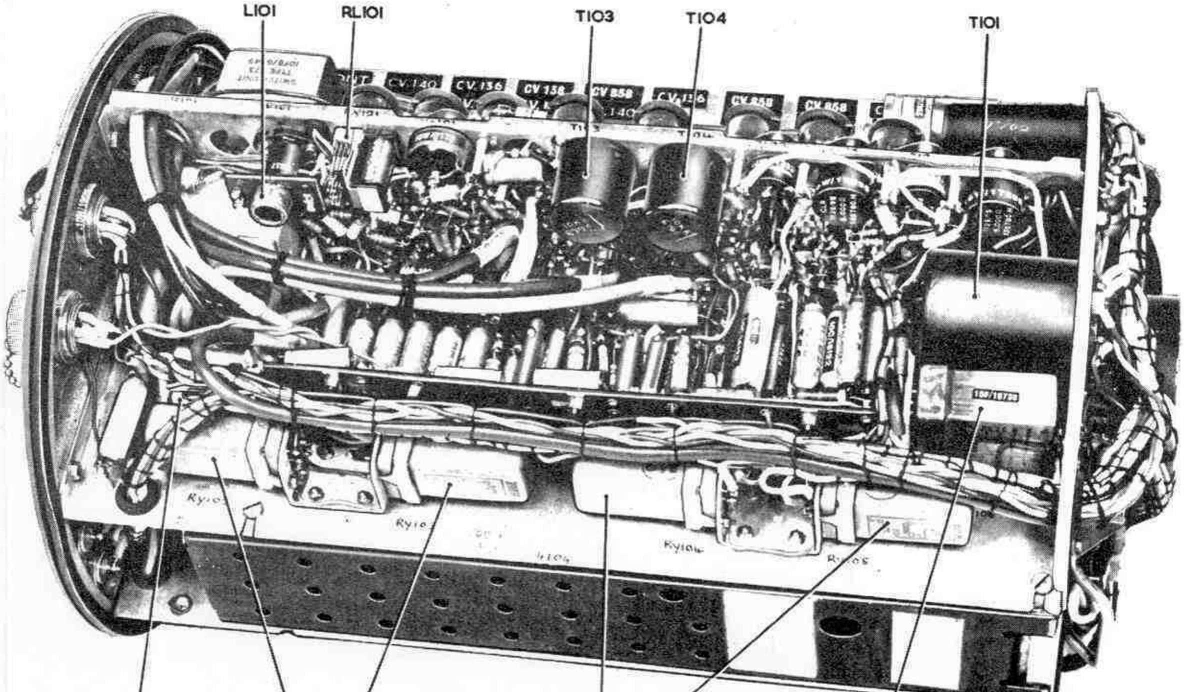


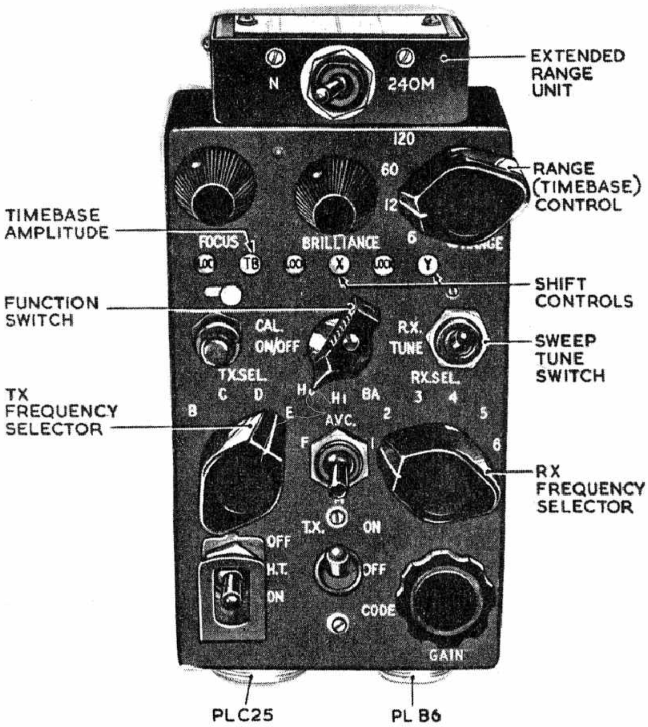
CHASSIS No. 1

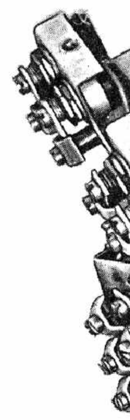


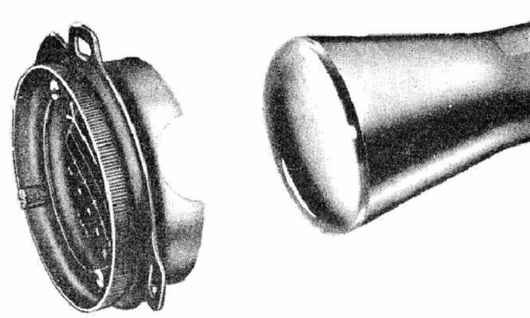
CHASSIS No. 2

5610 Internal views of TR.3624

Fig. 25







AIR DIAGRAM 6277J /MIN.	
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A.R.I 5610 Views of C

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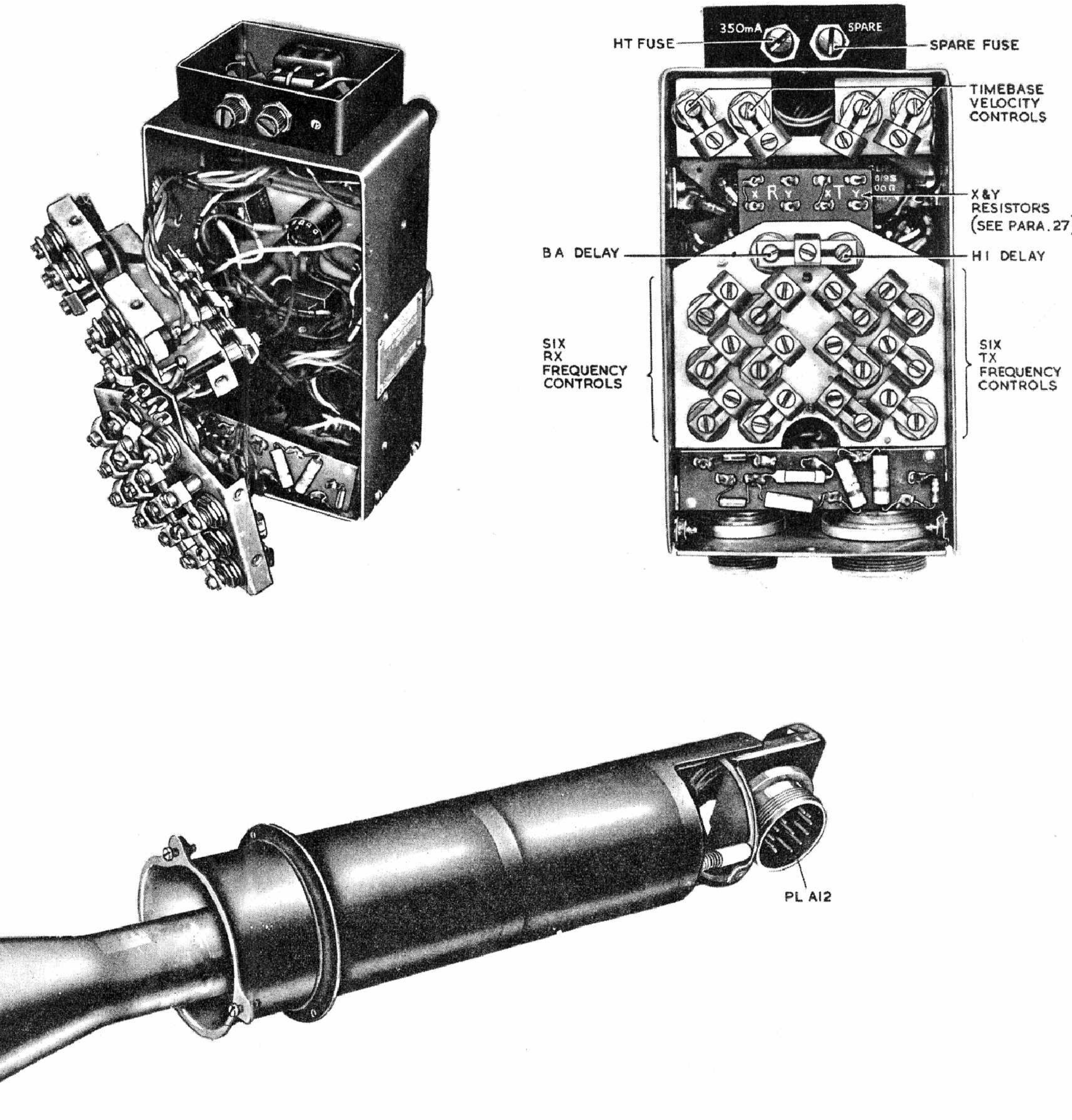
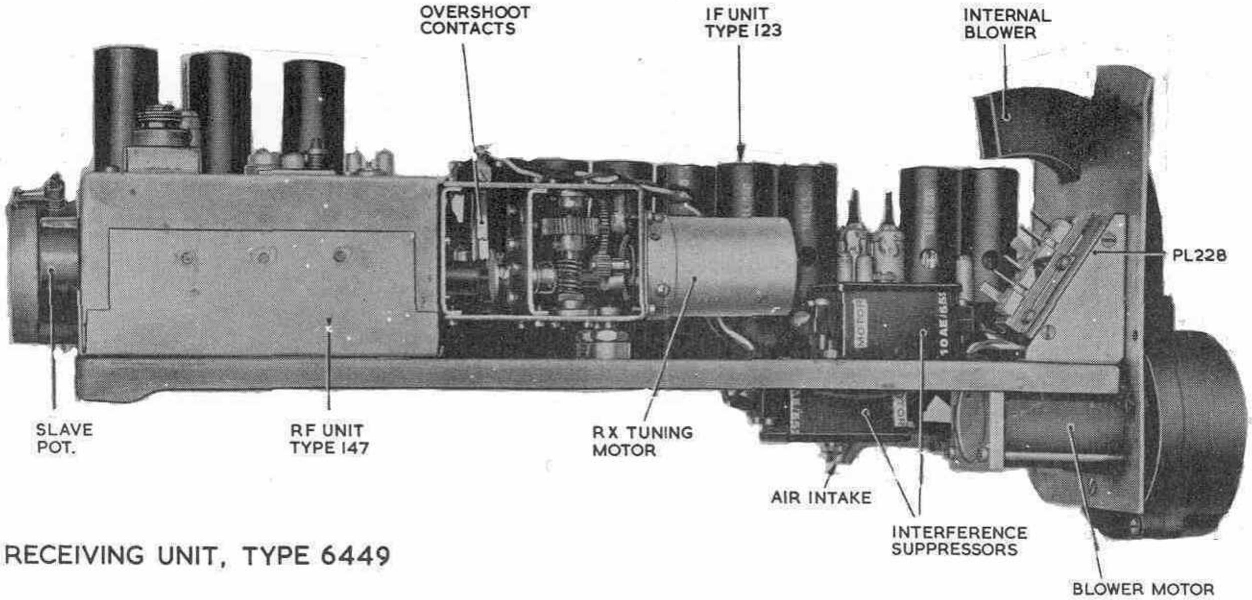
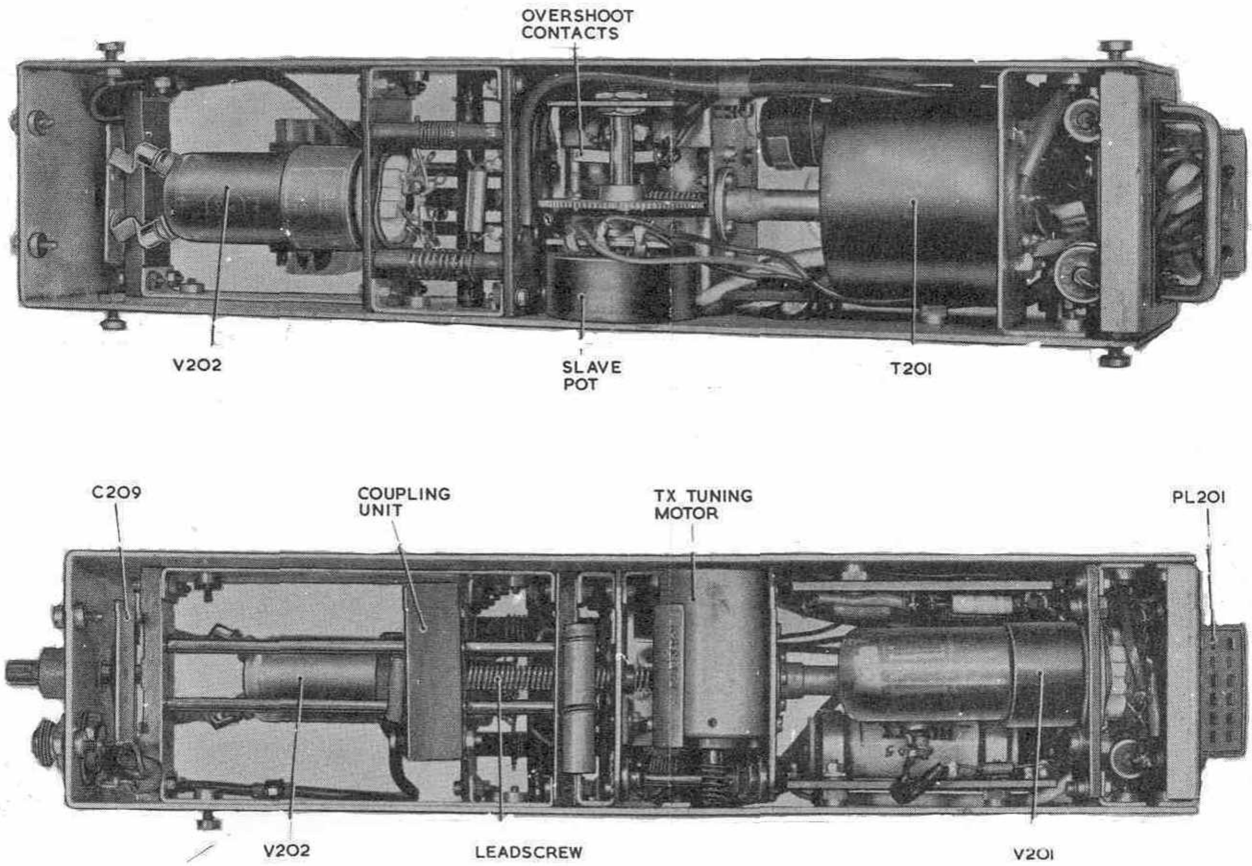


Views of Control Unit, Type 526 & Indicating Unit, Type 208 Fig. 26



RECEIVING UNIT, TYPE 6449



TRANSMITTER UNIT, TYPE 127

AIR DIAGRAM
6277K/MIN.
ISSUE 1 | PREPARED BY MINISTRY OF SUPPLY FOR PROMULGATION BY AIR MINISTRY

ARI. 5610 Views of Transmitter & Receiving Units

Fig. 27

07. 5/63. S.W.Ltd.

CHAPTER 2

CABLING

CHAPTER [illegible]

TED

Chapter 2.—CABLING

LIST OF TABLES

LIST OF ILLUSTRATIONS

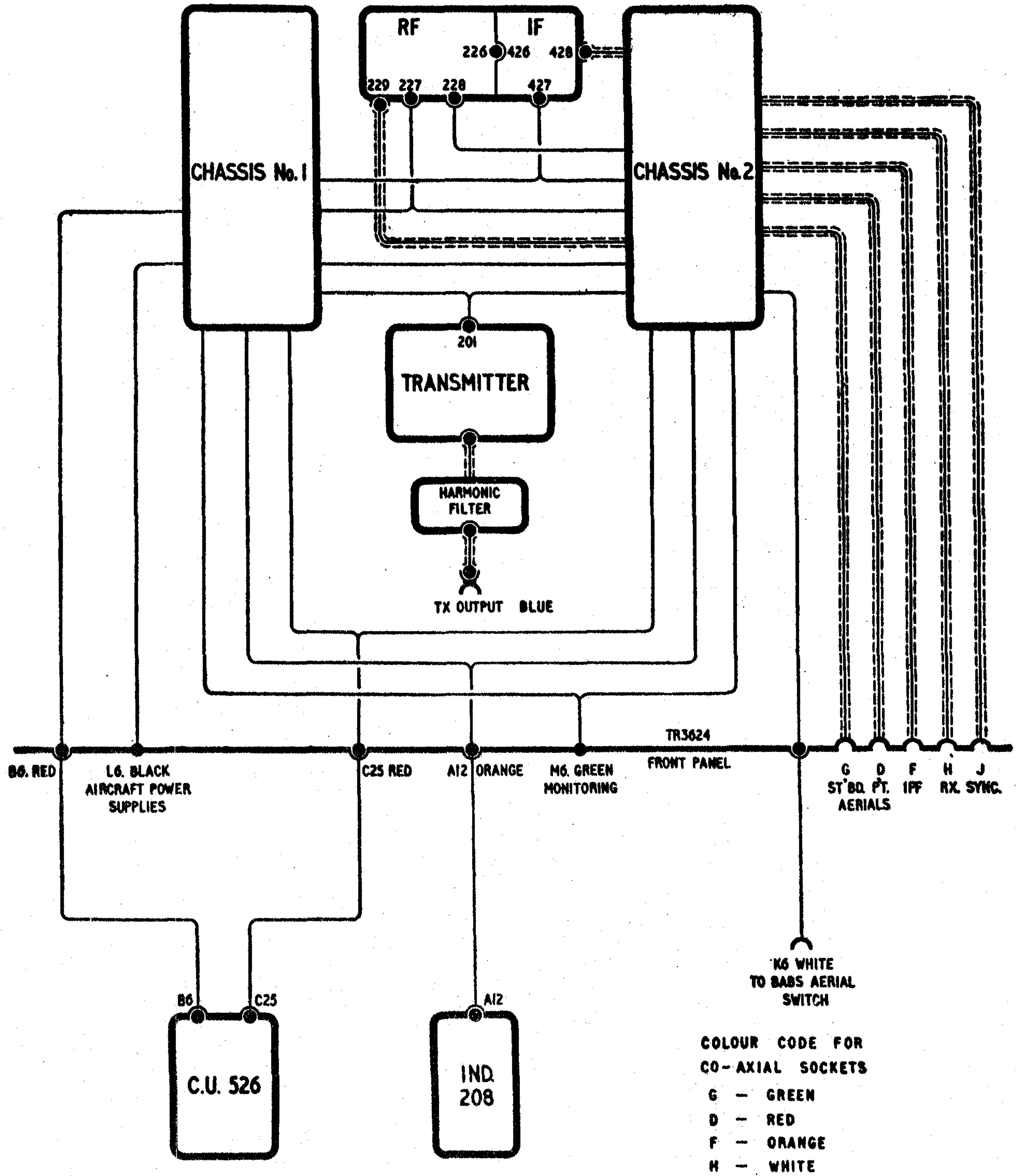


Fig. 1. Interconnecting diagram

Introduction

1. The cable diagram, fig. 1, shows the interconnections between the units contained in TR.3624 and also the connections to control unit 526, indicating unit 208 and the aircraft power supplies. The diagram is intended to supplement the following Tables and should be used in conjunction with them.

EXTERNAL CABLES

Table 1

Plug C25 (red) TR3624 to control unit 526

Pin	From	To	Function
A	R143	S302/A	TX frequency selector
B	Junc. R136, R138	Junc. R337, R341, R345	TX freq. selector ref. voltage
C	+250V.	+250V.	HT + ve
D	Junc. C132, R170	Slider RV320	Y shift
E	Earth	Earth	Earth
F	R157	S301/A	RX frequency selector
G	Junc. R153, R154	Junc. R301, R311, R313	RX freq. selector ref. voltage
H	Junc. R34, R47	Junc. RV315, R317	Timebase voltage
J	Junc. R42, C47	Slider RV319	X shift
K	RL4/23	S304/C	Delay voltage
L	RL3/25	S310	Timebase grid voltage
M	R28	S307/A	V7 grid voltage
N	S102	S303	HT ON/OFF
O	R146	Slider RV321	Gain control
P	RL101	S309	AGC
Q	RV2	Junc. R325, RV320	Gain pre-set pot. voltage
R	Junc. R8, R9	S308	Calibrator HT
S	R134	S305	Transmitter ON/OFF
T	R118	RV321	AGC voltage to gain control
U	RL108	S304/5	Operation of RL108
V	RL3/A	S307/B	Operation of RL3
W	Junc. R177, R167	S306	RX tune
X	RL106	S301	RX tune hold-on switch
Y	CK1/3	HT fuse	HT fuse
Z	RL4/A	S304/1	Operation of delay relay RL4

Table 2

Plug B6 (red) TR.3624 to control unit 526

Pin	From	To	Function
A	Earth	S303	HT ON/OFF
B	Junc. C34, R71	Junc. R321, R322, R330, RV323	CRT cathode
C	Junc. C34, R11	R351	Brilliance
D	A12/4	RV324	Focus
E	Earth	Earth	Earth
F	Junc. R67, C32	Junc. R321, RV323	—1500V

Table 3

Plug A12 (orange) TR.3624 to indicating unit 208

Pin	From	To	Function
1	Not used	—	—
2	T102/8	Heater	
3	T102/10	Heater cathode	
4	Plug B6/D	Anode 2	Focus
5	Junc. V4 anode, R11	Grid	Brightening pulse
6	Earth	Anodes 1 and 3	
7	V11/2	X1 plate	
8	V11/1	X2 plate	
9	Earth	Earth	
10	Junc. C129, C139	Y1 plate	
11	V115/5	Y2 plate	
12	R72	Anode 4	+1500V.EHT

Table 4
Plug K6 (white) TR.3624 to BABS aerial switch

Pin	From	To	Function
A	T101/2	BABS aerial switch	80V 1600 c/s.
B	T101/3	BABS aerial switch	80V 1600 c/s.
C	Not used	BABS aerial switch	
D	RL108	BABS aerial switch	
E	Earth	BABS aerial switch	
F	+24V.	BABS aerial switch	

Table 5
Plug L6 (black) aircraft power supplies to TR.3624

Pin	From	To	Function
A	Aircraft power supplies	T1/1	80 1600 c/s.
B	Aircraft power supplies	T1/10	80 1600 c/s.
C	Aircraft power supplies	Not used	
D	Aircraft power supplies	Not used	
E	Aircraft power supplies	Earth	
F	Aircraft power supplies	RL1/4	+24V.

INTERNAL CABLES

Table 6
Plug 227 chassis 1 and 2 to RF unit 147

Pin	From	To	Function
1	Junc. R153, R154	RV226	Slave pot. reference voltage
2	R158	Slider of RV226	Slave pot. slider
3	C20	Junc. R233, R234	Oscillator bias lift
4	Earth	Earth	Earth
5	Junc. C32, R56	R229	Mixer suppression pulse
6	Junc. R61, R78	Junc. R234, C237	—10V. bias

Table 7
Plug 228 chassis No. 2 to RF unit 147

Pin	From	To	Function
1	+24V.	Junc. C238, L234	24V. to blower motor
2	RL105/2	Junc. C240, L236	24V. to tuning motor
3	RL104/2	Junc. C241, L237	24V. to tuning motor
4	RL106/22	S226/1 and 4	Overshoot contacts
5	RL105/3	S226/3	Overshoot contacts
6	RL104/3	S226/2	Overshoot contacts

Table 8
Plug 427 chassis 1 and 2 to IF unit 123

Pin	From	To	Function
1	Chassis 1 earth	Earth	
2	V13 screen	+200V ripple free	Screen grid voltage
3	C111	Grid return line	Gain control voltage to IF grids
4	Earth	Earth	
5	+250V. HT	+250V. HT.	Anode voltage
6	T102/5	Valve heaters	

Table 9

Plug 201 chassis 1 and 2 to transmitter unit 127

Pin	From	To	Function
1	V15 cathode	L201	+1500V. EHT supply
2	Pin removed	—	—
3	V111 screen	RV201	Slave pot. reference voltage
4	R142	Slider of RV201	Slave pot. slider
5	Earth	Earth	—
6	Not used	—	—
7	Pin removed	—	—
8	Pin removed	—	—
9	RL103/2 }	Tuning motor	
10	RL102/2 }		
11	RL102/3	Overshoot contact	
12	V110 anode	C205	TX drive pulse
13	V16 anode	Junc. R206, R211, C201	—1500V. EHT supply
14	Pin removed	—	—
15	T102/12	T201/6 }	80V. 1600 c/s.
16	T102/14	T201/1 }	
17	RL103/3	Overshoot contact	
18	Not used	—	—

Table 10

Coaxial cables

Pin	From	To	Function
D	Port aerial	Chassis 2 S101/D	Input to aerial switch
F	Socket F	R121	IFF
G	Starboard aerial	S101/G	Input to aerial switch
H	Socket H	R110	Video signal monitoring point
J	Socket J	C116	External sync. input
PL229	SKT229 RF unit	Chassis 2, S101/R	Aerial switch output
PL428	SKT428 IF unit	Chassis 2, C106	IF output to video stages

CHAPTER 3

AERIAL INSTALLATIONS

Chapter 3

AERIAL INSTALLATIONS

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

1. In all the various Rebecca Mk. 4 installations separate transmitting and receiving aerials are employed. The receiving aerials, two in number, are installed either near the wing tips or on the port and starboard sides of the fuselage and are alternately connected to the receiver by an electro-mechanical switch. A switched lobe system is thus obtained, giving a sharp cross-over in the dead ahead direction. The transmitting aerial can be either forward-looking or omnidirectional.

2. The complete aerial system may take one of two forms, namely, blade aerials such as dipoles, unipoles, etc., or suppressed aerials such as the slot type, which are, in fact, slots cut in the skin of the aircraft. At the present time the Canberra is the only aircraft using Rebecca Mk. 4 with suppressed aerials, descriptions of which are given under the appropriate headings. The subject of suppressed aerials is treated completely in A.P.1093H, Vol. 1, to which reference should be made.

3. The frequency range covered by a particular aerial system and also the type of transmitting aerial are dependent upon Service requirements. The frequency range covered by the Rebecca equipment is 174-240 Mc/s. and the various aerial systems are designed to operate over the whole or part of this band.

4. Table 1 shows the different aerial systems used in aircraft fitted with Rebecca Mk. 4 and Table 2 gives details of the component parts of each aerial system.

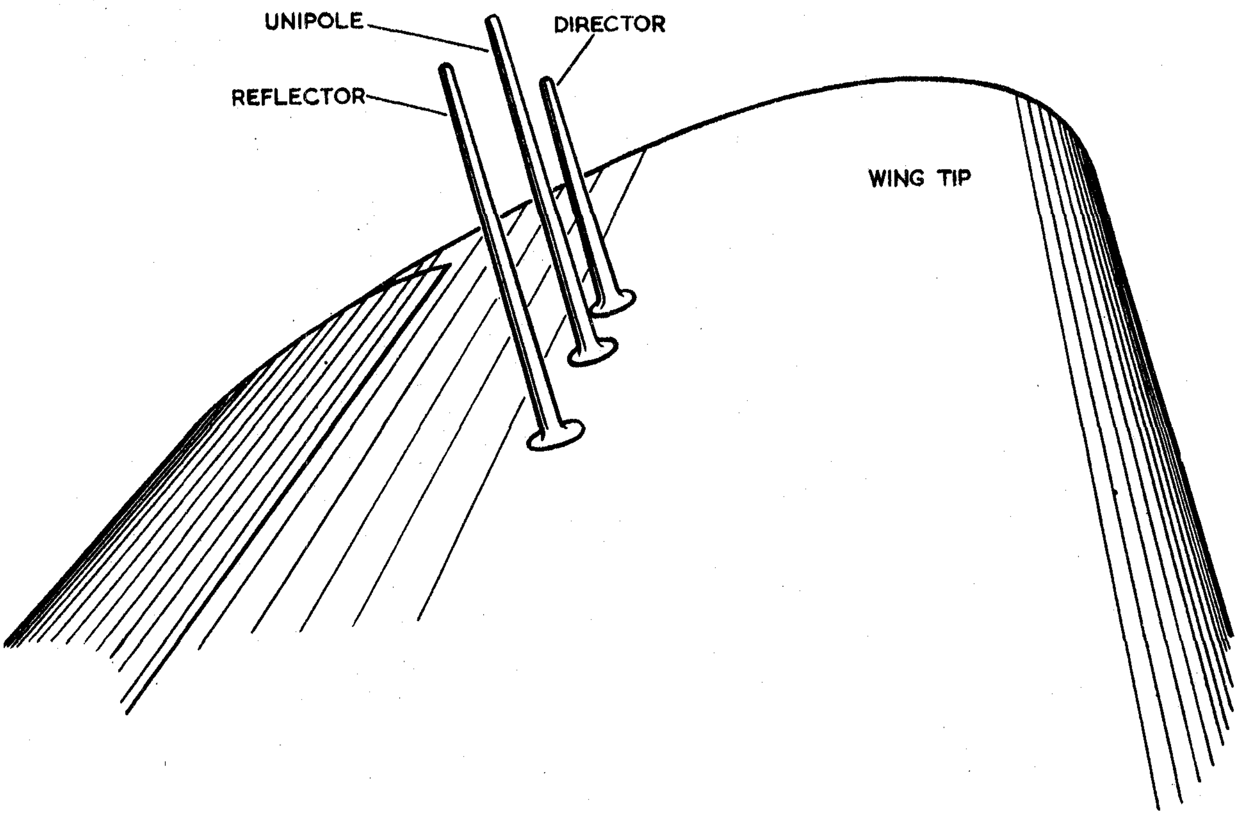


Fig. 1. Aerial system, Type 370

GENERAL DESCRIPTION

RECEIVING AERIALS

General

5. Three types of receiving aerials are in use and these have been designed to operate:

(1) as wing tip unipoles } blade type,

(2) as nose mounted unipoles } blade type,

(3) as nose slots—suppressed type.

Wing tip unipoles (Type 370 and 370A)

6. These aerials each consist of three light alloy elements, a director, a driven unipole and a reflector. The elements are mounted vertically along a line athwart the line of flight of the aircraft and in the order:

(1) director,

(2) unipole, and

(3) reflector,

the director being nearest to the wing tip. They are orientated so that the streamlining is in the line of flight. Fig. 1 and 2 show the aerials mounted on the wing of an aircraft. In these illustrations the elements are mounted on the top surface of the wing, but they can equally well be mounted on the underside.

7. Aerial systems, Type 370 and 370A, cover a frequency range of 176-234 Mc/s and are used on metal aircraft with small wing spans such as the Anson.

8. The radiation pattern of one of these aerials consists of a principal lobe which has its maximum at right-angles to the line of flight of the aircraft. The signal along the line of flight in both a forward and a backward direction is between 0·4 and 0·5 of the maximum. Fig. 3 shows a typical radiation pattern for this aerial system, from which it will be observed that beacon signals can be received from astern as well as from ahead of the aircraft.

Nose mounted aerials (aerial system, Type 184)

9. This type of receiving aerial is fitted to large aircraft such as the Beverley, Hastings and Valetta. It is directional in azimuth and consists of one dipole and director mounted on each side of the nose of the aircraft as shown in fig. 4. Such a system provides overlapping lobes ahead of the aircraft, the radiation pattern being illustrated in fig. 5.

10. Aerial system, Type 184, consists of a dipole unit, Type 13, and a steel assembly incorporating the director unit. The frequency range is 214-234 Mc/s, but frequencies down to 200 Mc/s can be used with no great loss in efficiency. The system is designed mainly for low speed aircraft.

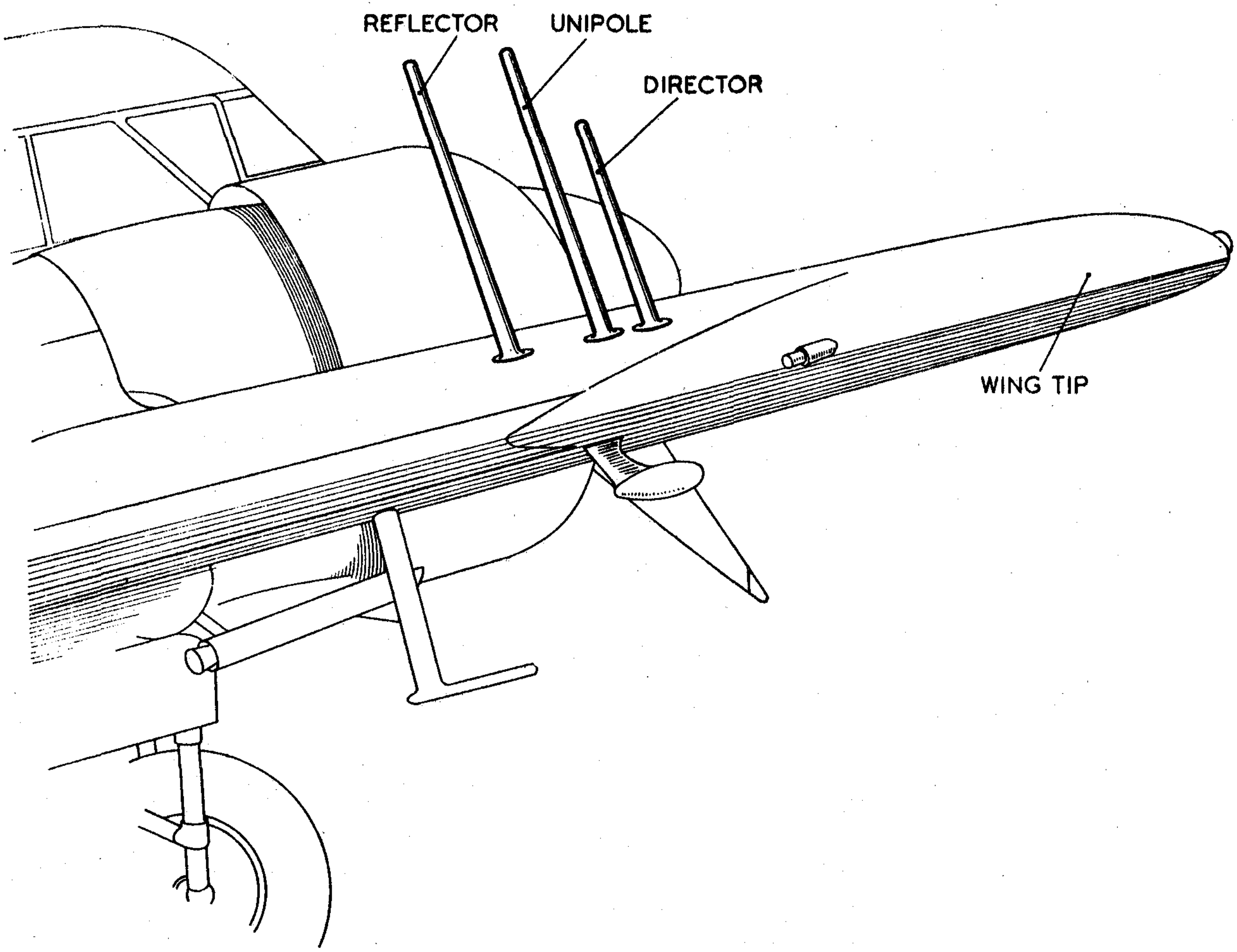


Fig. 2. Aerial system, Type 370A

Suppressed aerials

11. The relatively high speed of the Canberra and the consequent requirement for the greatest possible reduction in drag necessitates the use of suppressed aerials in this aircraft. The two receiving aerials are in the form of horizontal slots located one on each side of the nose as shown in fig. 6. They are therefore equivalent to vertically polarized dipoles.

12. The slots are a half-wavelength long and are backed by a suitably shaped piece of dielectric material which serves to seal and strengthen the aircraft skin at these points (*see fig.* 7). In the polar diagram for the receiving aerials, shown in fig. 8, the small backward lobes are due to diffraction over and under the nose of the aircraft. Some Marks of the Canberra are fitted with a plastic nose section, in which case the receiving aerial slots are situated farther aft along the fuselage. This brings the axes of the slots and the aircraft nearer to the parallel, resulting in some loss of signal strength in the forward direction.

TRANSMITTING AERIALS

General

13. Two types of transmitting aerial are employed with Rebecca Mk. 4—omnidirectional and forward-looking. The type which is fitted to any particular aircraft is governed by Service requirements.

Omnidirectional aerials

14. Since the main requirement of this type of aerial is that it shall radiate equally well in all directions, no directivity is necessary, and hence a simple unipole is adequate.

Aerial, aircraft, Type 386

15. This is the unipole element of the aerial system Type 370, and is used as the transmitting aerial on the Anson, Shackleton and Beverley. It may be fitted under the fuselage or on one of the wing tips on the opposite side to the receiving aerial. See fig. 9.

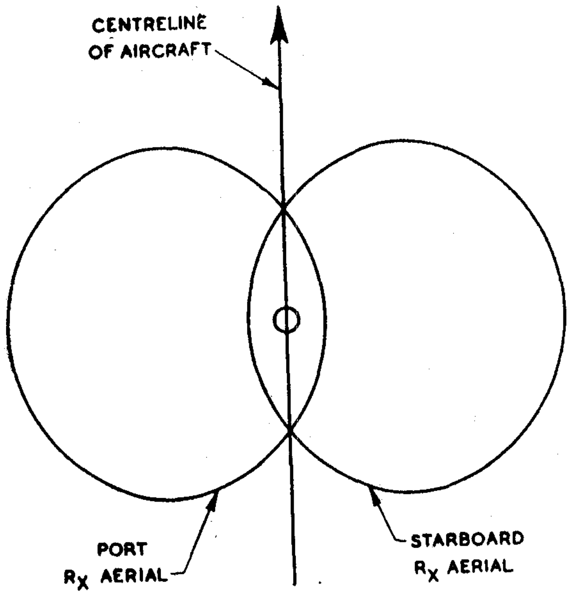


Fig. 3. Radiation pattern of aerial systems, Type 370 and 370A

Aerial, aircraft, Type 312

16. This aerial is similar in appearance to the Type 386 and may be used in the Valetta in place of the directional system Type 308.

Forward-looking aerials

Aerial system, Type 308

17. For forward-looking, maximum radiation is required ahead of the aircraft and therefore additional elements have to be provided in order to produce the necessary directivity. Aerial system Type 308, whose frequency coverage is 214-234 Mc/s, employs a unipole and director mounted in the line of flight of the aircraft as shown in fig. 4.

Suppressed aerial (Canberra)

18. This is a probe-fed cavity-backed aerial with a director slot for increased radiation in the forward direction. The general form of the system is shown in fig. 10. The horizontal radiation pattern of a transverse slot under the fuselage is approximately of cosine form, that is, with zero radiation at 90° and 270° as shown in fig. 11a.

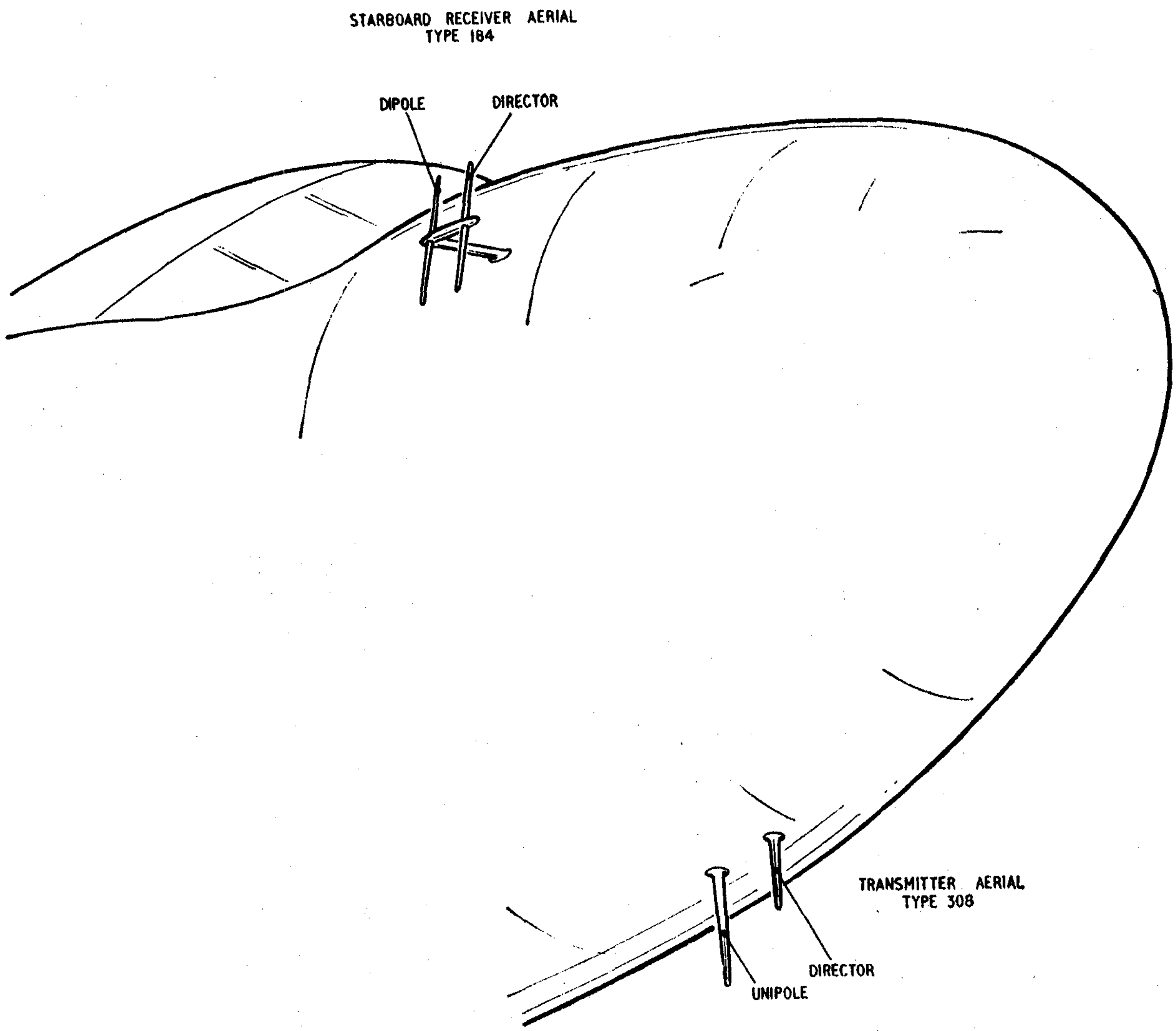


Fig. 4. Aerial system, Type 184

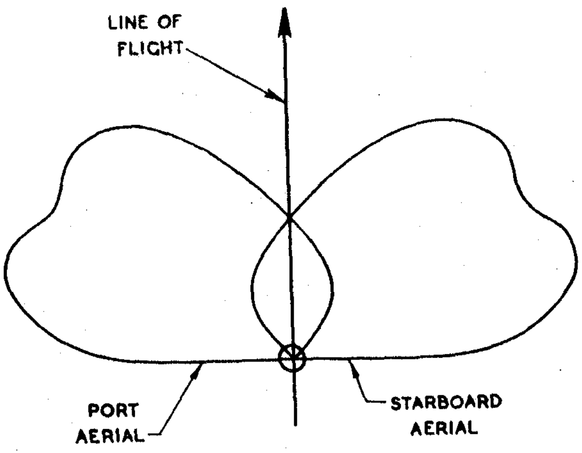


Fig. 5. Radiation pattern of aerial system, Type 184

This is partially remedied by bending the radiating slot into a V shape giving a pattern as in fig. 11b. The addition of the director slot increases the forward-looking lobe producing a final radiation pattern as in fig. 11c.

19. The purpose of the cavity is to prevent radiation inside the aircraft, where it might set up unwanted resonances and alter the impedance of the aerial by producing varying reactive components. The dimensions of the cavity are such as to make it approximately resonant for maximum efficiency.

B.A. AERIALS

General

20. The two main requirements for the operation of Rebecca Mk. 4 with the Babs Mk. 2 equipment are:

(1) the transmitting aerial should radiate equally well both ahead and astern of the aircraft, and

(2) the receiving aerial should be mounted in such a position that propeller modulation is reduced to a minimum.

21. In those aircraft which have the receiving aerials mounted on the nose, an independent beam approach receiving aerial is installed and, to facilitate switching from this to the main receiving aerials, a switch unit Type 78A is added to the Rebecca installation. The B.A. aerial, which is usually a Type 312, is mounted under the fuselage and near the tail of the aircraft as shown in fig. 12. Propeller modulation is thus considerably reduced.

22. Where wing tip aerials are fitted, a separate B.A. aerial is unnecessary since wing tip aerials are not appreciably affected by propeller modulation.

23. The B.A. aerial installation in the Canberra is similar in all respects to the transmitting aerial described in para. 18 and 19. Its location is shown in fig. 6.

SWITCH UNIT, TYPE 78A

Connection to TR.3624

24. Provision has been made for connecting the switch unit 78A to the Rebecca equipment, the white six-way plug on the front panel of the TR.3624 being included for this purpose. The switch unit, which is illustrated in fig. 13, is a double-pole double-throw switch designed for operation with coaxial aerial feeders. The changeover of the switch may be made either directly by moving a plunger, or remotely by applying 24V DC to a solenoid which actuates the switch. A small cover plate gives easy access to the switch contacts for inspection purposes.

25. A simplified diagram of the switch unit is given in fig. 14, from which it will be seen that, when the switch operates, a pair of contacts open to insert a small resistance in series with the solenoid, thus economizing in holding current.

26. The aerial terminals of the TR.3624 are normally connected to the directional receiving aerials via contacts on the switch unit 78A. When the solenoid is energized these contacts disconnect the directional Rebecca aerials from the receiver and substitute the BABS aerial.

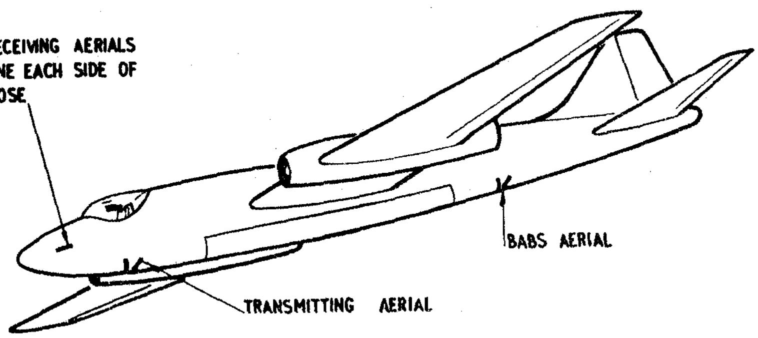


Fig. 6. Location of Rebecca aerials in the Canberra

Aerial installations

27. Fig. 15 and 16 are schematic diagrams of the Rebecca systems in the Anson and the Canberra respectively, these being considered as typical of the blade and suppressed types of aerial.

Table 1

Type numbers of aerial systems in aircraft fitted with Rebecca Mk. 4

Aircraft	Receiving aerial Port	Receiving aerial Starboard	Transmitting aerial	BABS aerial
Anson	370	370A	386	—
Hastings	184	184	308	312
Valetta	184	184	308 or 312	308
Shackleton	370	370A	386	312
Beverley	184	184	386	308
Canberra	Horizontal slots		Probe excited slots	
Varsity	184	184	308	—

Table 2

Component parts of aerial systems

Aerial type	Stores Reference
Aerial, aircraft, Type 184	10BB/2171
Aerial system, Type 308	10BB/2172
Aerial, aircraft, Type 312	10BB/1696
Switch unit, Type 78A	10FB/366
Aerial system, Type 370, port—comprising	
Aerial, aircraft, Type 386	10BB/6713
Blade aerial, Type 346	10BB/6714
Blade aerial, Type 347	10BB/6715
Aerial system, Type 370A, starboard—comprising	
Aerial, aircraft, Type 386	10BB/6713
Blade aerial, Type 346	10BB/6714
Blade aerial, Type 347	10BB/6715
Socket assembly, Type 369	10H/18707

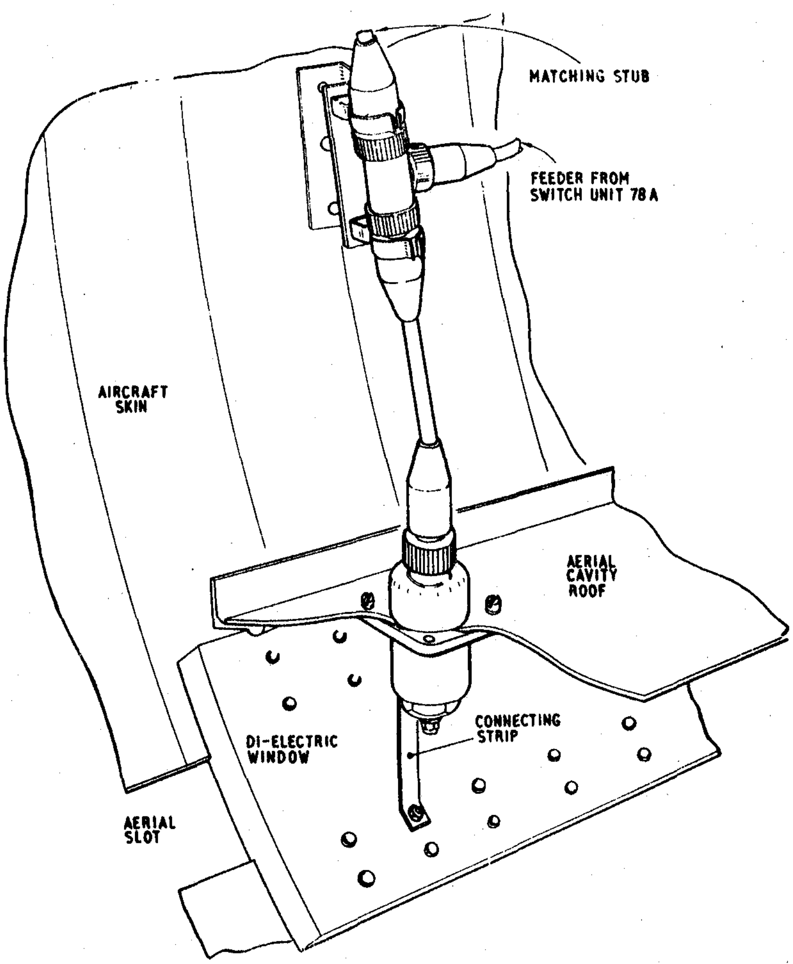


Fig. 7. Connection of feeder to receiving aerial in the Canberra

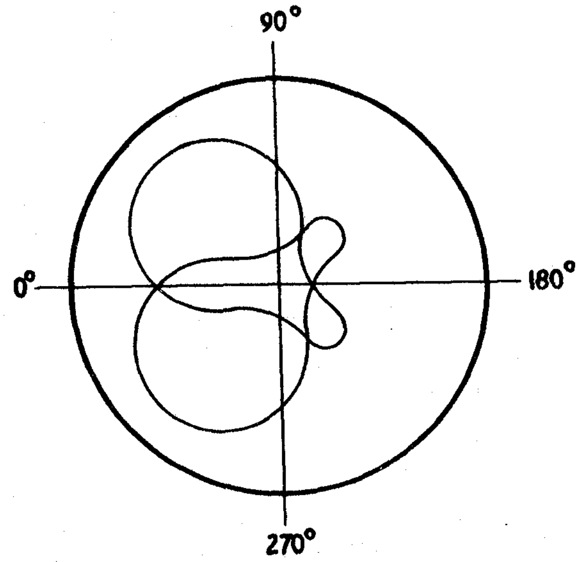


Fig. 8. Polar diagram for receiving slot aerials

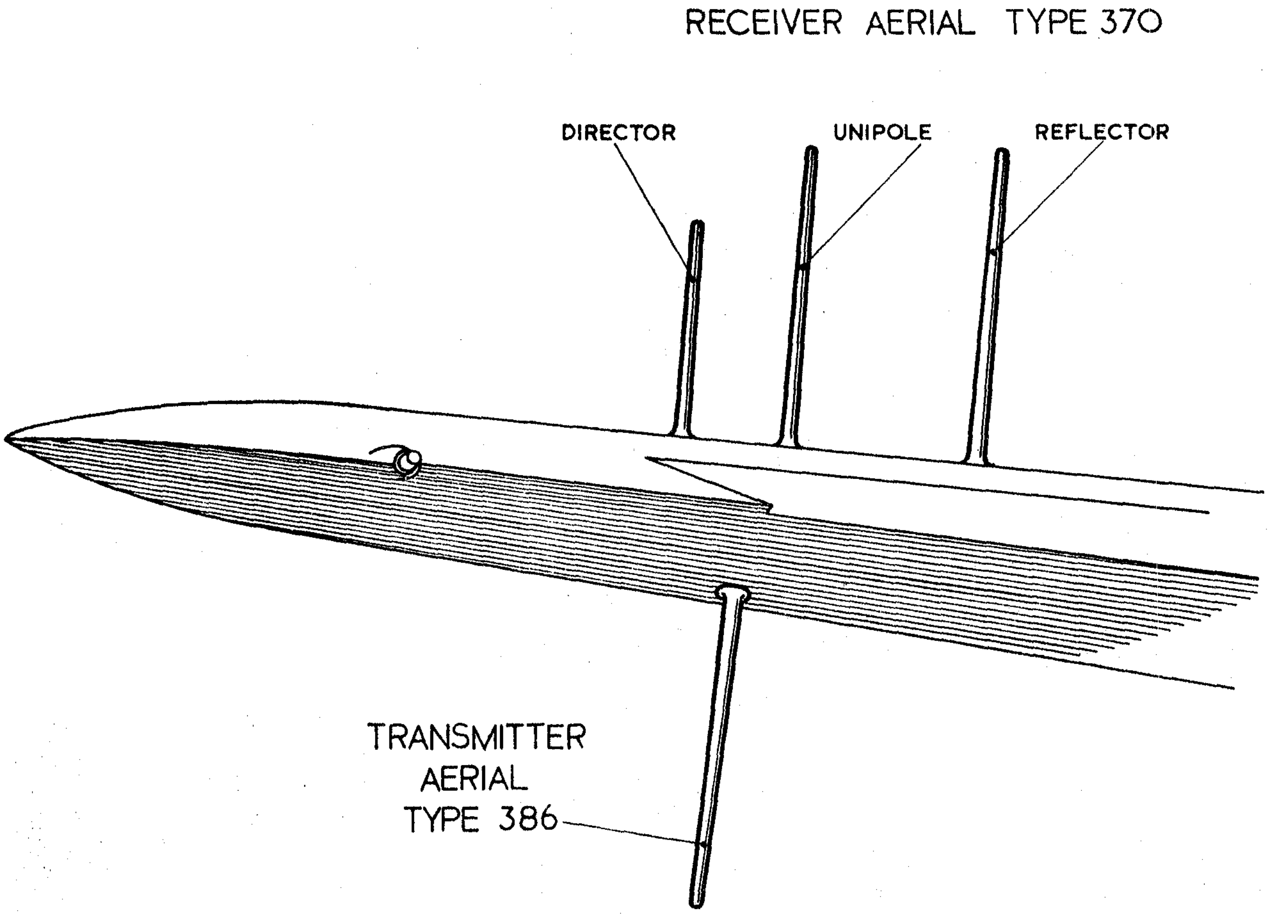


Fig. 9. Aerial, aircraft, Type 386

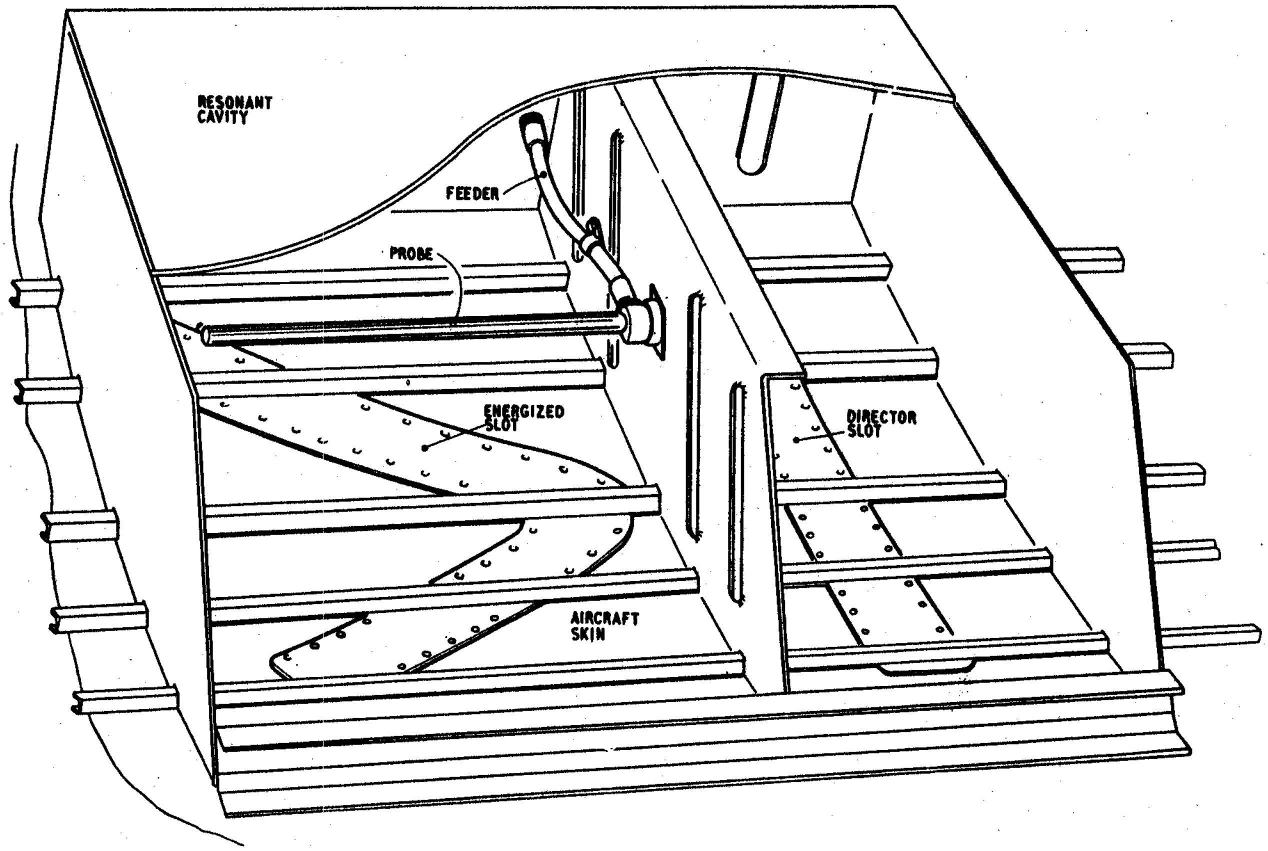


Fig. 10. Canberra transmitting aerial system

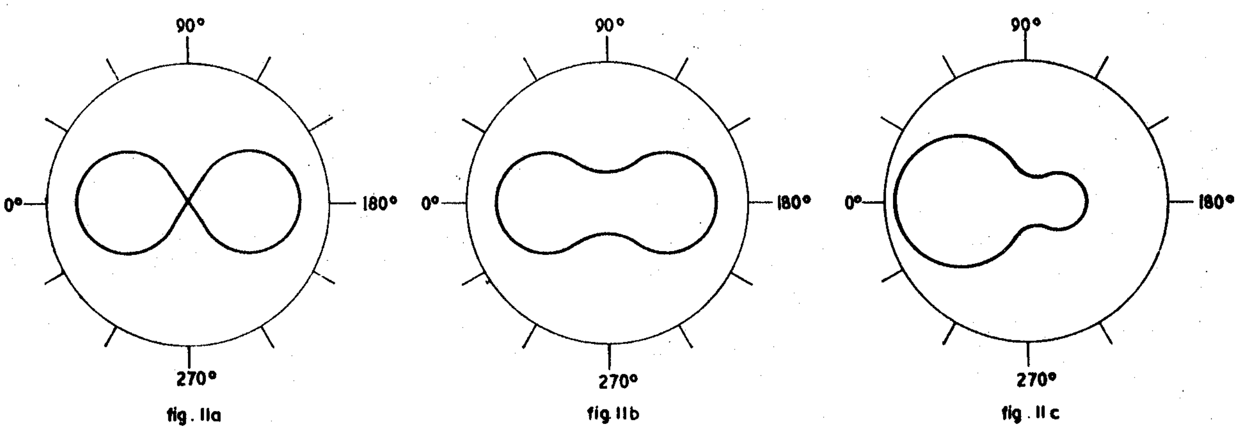


Fig. 11. Canberra transmitting aerial radiation pattern

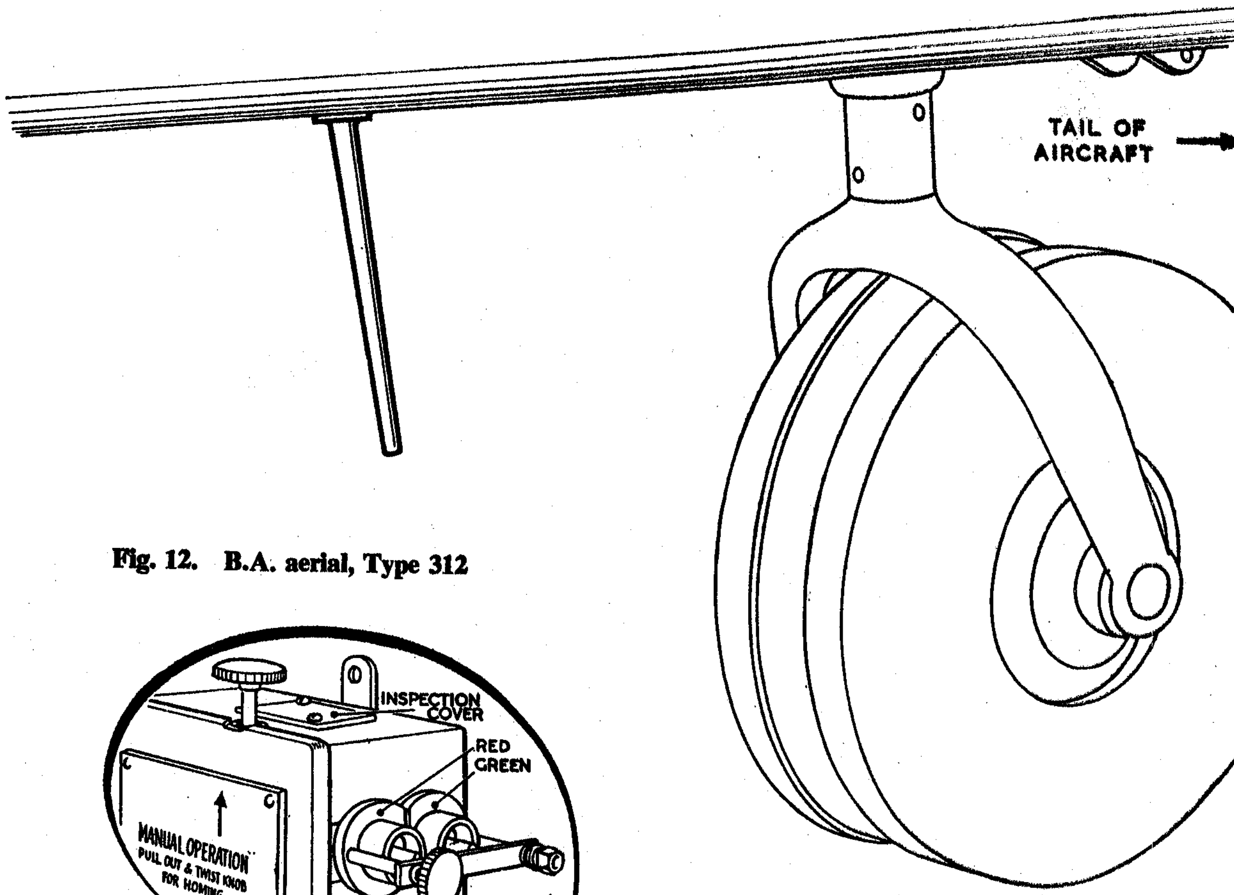


Fig. 12. B.A. aerial, Type 312

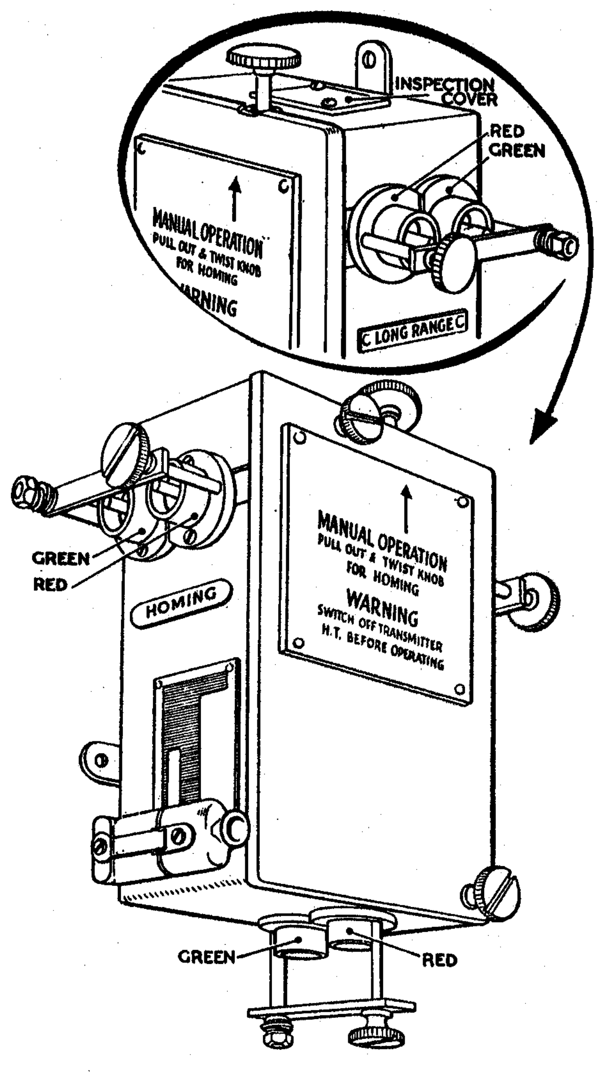


Fig. 13. Switch unit, Type 78A

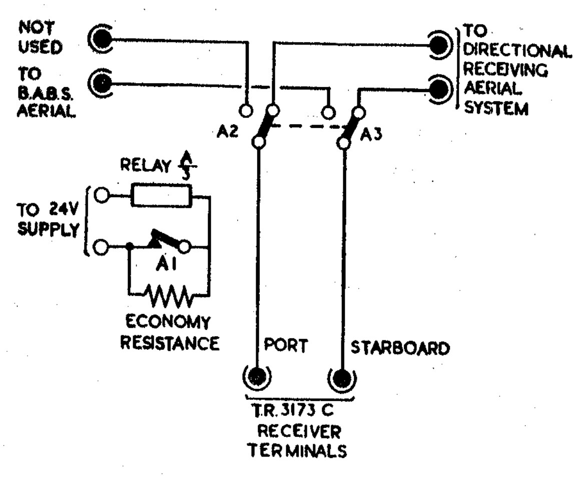


Fig. 14. Switch unit, Type 78A: simplified circuit diagram

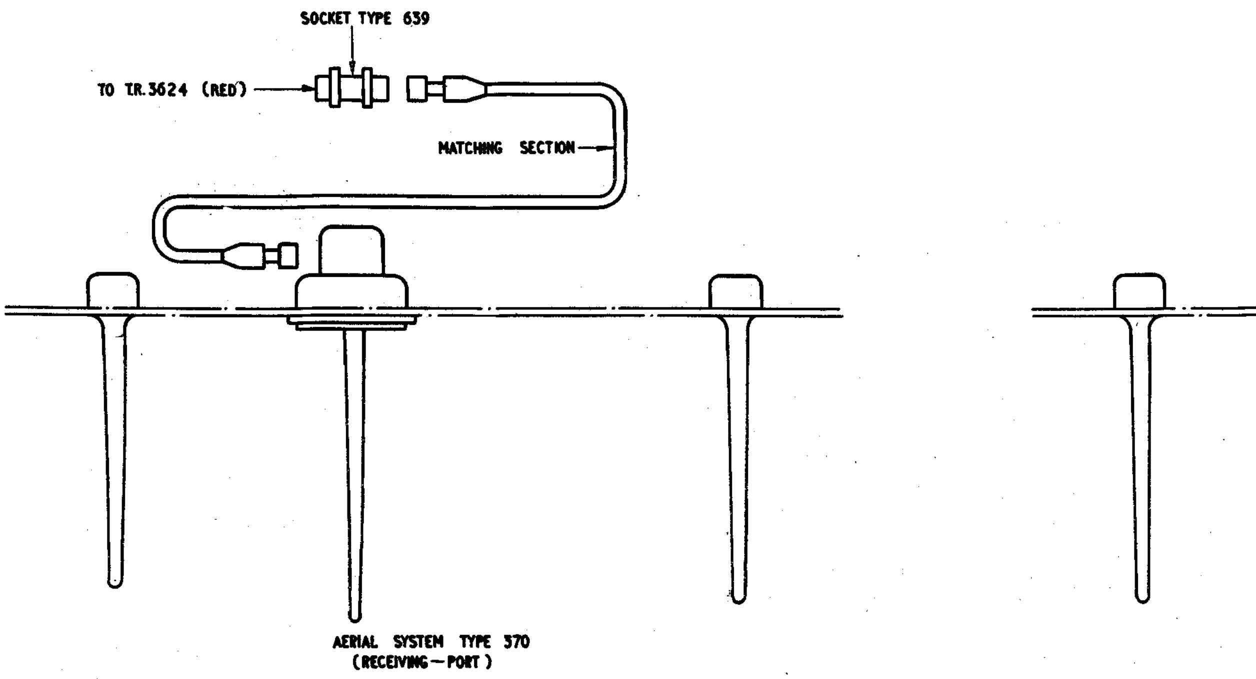


Fig. 15 Aerial installation

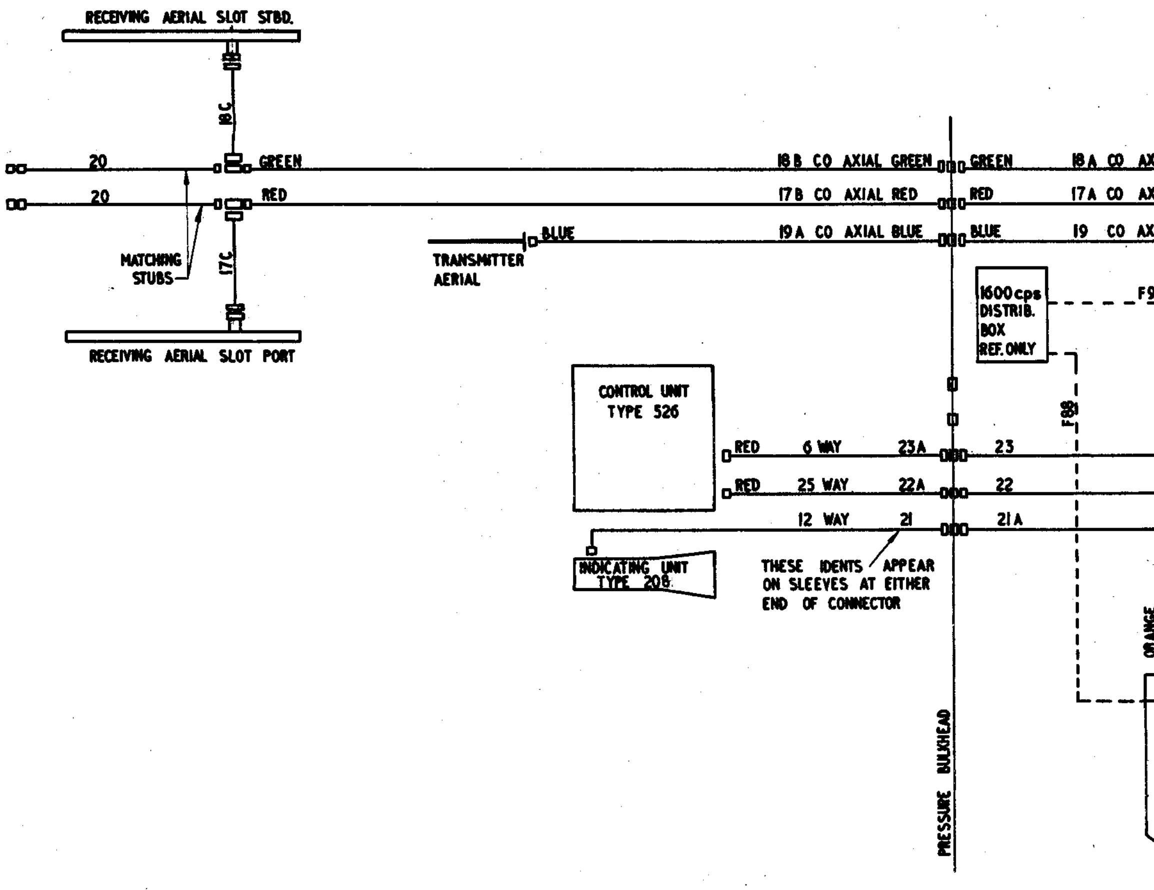


Fig. 16 Aerial installation,

Fig. 15 & 16

Typical aerial installations

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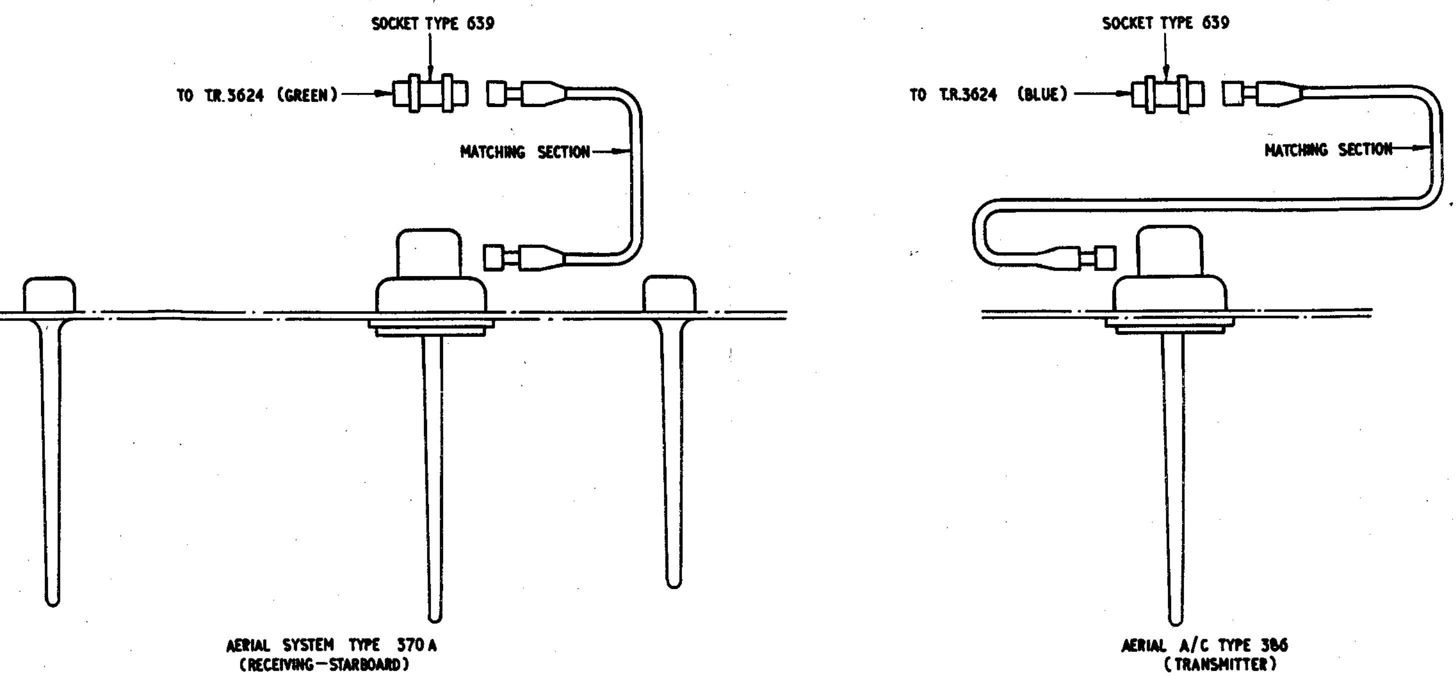
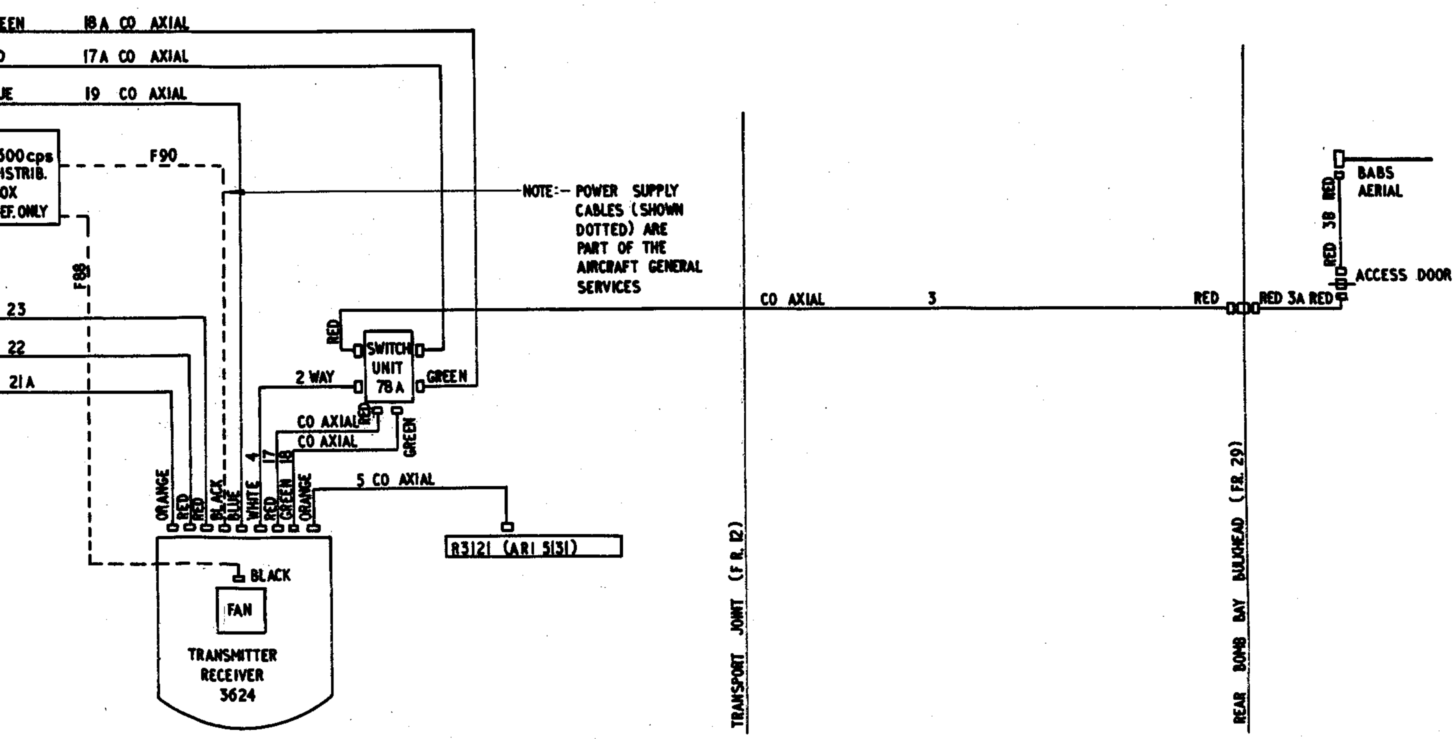


al installation, Anson: schematic diagram.



l installation, Canberra: schematic diagram.

stallations: blade & suppressed types

Fig. 15 & 16

CHAPTER 4

OPERATING INSTRUCTIONS

Chapter 4.—OPERATING INSTRUCTIONS

1. When the aircraft is airborne ensure that the TX and HT switches on the control unit, Type 526, are in the OFF position; switch on the power supplies to the equipment by depressing the switches marked REBECCA or ARI.5610.

2. Wait one minute, then set the HT switch on the control unit to the ON position. When the trace appears, set the TX switch to ON and adjust the FOCUS and BRILLIANCE controls as required. The BRILLIANCE control should not be turned fully clockwise to maximum as it would then be difficult or impossible to focus the trace.

3. If normal homing facilities are required, set the function switch to the H_0 position and the TX. SEL. and RX. SEL. switches to the appropriate positions for the frequencies of the beacon on which it is proposed to home. The RANGE switch should be adjusted to the position covering the estimated distance of the beacon from the aircraft.

4. Set the AVC/M switch to the M position and observe the trace for signs of the beacon signal, adjusting the GAIN control as required. When the signal appears, wait for the coding period to ensure that the received signal has the same coding as that laid down for the required beacon.

5. If the expected signal does not appear on the display, or is of very small amplitude, depress the RX. TUNE switch and hold it down. The receiver tuning will now sweep about the preselected frequency. If the frequencies chosen are correct and the beacon is within range, the signal on the display will increase and decrease in amplitude as the receiver sweeps through the beacon frequency. Just before the signal reaches its peak, release the switch, when the tuning motor will stop. If the receiver overshoots the signal, depress the RX. TUNE switch again and release it so that the sweep ceases at the point of maximum signal amplitude.

6. To measure the range of the aircraft from the beacon depress the CAL. ON-OFF push button (unless the calibration markers are already displayed) and use the markers to estimate the distance from the timebase origin to the leading edge of the signal. The markings on the indicator scale may be used, if desired, until a short range is reached, when greater accuracy will be derived from the markers. On the 6 and 12 mile ranges the markers appear at intervals of one nautical mile and on the 60, 120 and 240 mile ranges, at intervals of ten nautical miles.

7. Heading information is obtained by comparing the amplitudes of the right- and left-hand signals displayed on the trace. When the aircraft is flying directly towards the beacon the two signals will have the same amplitude. If the beacon is to the left or port side of the aircraft then the left-hand signal will be greater in amplitude than the right. Conversely, if the beacon is to the right of the aircraft the right-hand signal will have the greater amplitude.

8. To home on to the beacon after it has been identified, alter the heading of the aircraft until the left- and right-hand signals are equal in amplitude and set the aircraft course to maintain this condition. The indicated range will decrease if flying towards the beacon and increase when flying away from it. When homing from long range it is not necessary to keep the transmitter running continuously. It should only be switched on when required, until the aircraft is within a few miles of the beacon.

9. For operation in conjunction with the BABS beacon, the function switch should be set to BA and the TX. SEL. and RX. SEL. switches set to the channels giving the frequencies of the required BABS beacon. A single-sided display will now appear on the indicating unit, all signals, noise and calibration markers being shown as port deflections. The BABS aerial is also automatically connected to the receiver. Where a separate BABS aerial is not fitted, the port receiving aerial is used. In addition, the start of the timebase is delayed and the range now measured on the display will be the range from the touchdown point. The TX switch is left in the ON position and the standard procedure for a BABS approach is followed.

10. The H_1 position of the function switch is only for use with certain types of high-powered Eureka beacons which incorporate a fixed delay. In the H_1 position the start of the timebase is delayed by one nautical mile and, therefore, if this setting is used when homing on to normal types of beacons, a one mile range error will be introduced.

11. The third position of the TX switch, marked CODE, is provided to enable the train of transmitter pulses to be started and stopped for long or short periods at will. In the CODE position, the transmitter is on, and when the switch is released a spring returns it to the OFF position. By depressing and releasing the switch, the train of pulses radiated by the transmitter can be broken up to simulate Morse characters which may be received aurally on the ground beacon.

12. To avoid frequent adjustment of the GAIN control on homing or when making a BABS approach, the AVC/M switch may be set to the AVC position. This limits the signals to a predetermined level, thus rendering adjustment of the manual gain control unnecessary.

13. When the operation is completed, or on touchdown, return the TX and HT switches on the control unit to the OFF position and switch off the power supplies for the Rebecca equipment.

14. Ensure that any observed faults in the equipment are reported to the appropriate maintenance authority.

PART 2

FIRST AND SECOND LINE SERVICING

Chapter 1

SERVICING INSTRUCTIONS

LIST OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

TEST GEAR

1. For setting-up and general servicing of Rebecca Mk. 4 the test gear listed in Tables 1 and 2 is required. Table 1 lists items normally held in station workshops whilst Table 2 lists special items.

Table 1
Standard test gear

Ref. No.	Title
10S/16160	Signal generator CT53 (where available) or
10SB/189	Signal generator 53 or
10SB/150	Signal generator 51
10T/6045	Wavemeter W1649 with } or
10KB/6205	Power unit 633 }
110S/256	Frequency meter BC906E
10AH/141	Headset, Type 9
10T/6157	Monitor 101 (where available) or
10T/6100	Monitor 56 or
10T/6026	Monitor 52 or
10T/500	Monitor 28
10S/16411	Multimeter Type 1 or
10S/1	Testmeter Type F or
10S/10610	Testmeter Type D1
*5Q/25256	Voltmeter, a.c., 0-150V
5G/152	Tester, insulation resistance, Type C
*5Q/12248	Voltmeter, electrostatic, Type A, 0-3·5kV
5A/1901	Blower, air, portable

* These items are not required when multimeter Type 1 (*Ref. No.* 10S/16411) is available.

Table 2
Special test gear

Ref No.	Title
10SB/6246	Test set 302
10SB/6235	Test set 296
10S/16143	Calibrator, timebase, Type 1
10SB/6120	Output tester 57 with
10SB/6574	Detector unit 75
10DB/8853	Junction box 351
10A/16129	Attenuator Type 70 (where available) or
10WZ/221064	Resistor, fixed, 47 ohms
10HA/7095	Bench connector set for ARI.5610
14A/540	Plate, wedge
1B/4490	Iron, soldering, electric
10H/19395	Spanner kit (for miniature plugs and sockets)
4G/5435	Pump, pressurizing
4G/2595	Gauges, pressure, 2-20 lb/in.^{2}
10AG/20	Tool, valve pin alignment
Locally manufactured	Bench jig for TR.3624 (*fig.* 14)
Locally manufactured	Bench jig for CU.526 and Ind. unit 208 (*fig.* 15)
Locally manufactured	Desiccator spanner (*fig.* 13)

2. For first line servicing, and to facilitate checking the operation of Rebecca Mk. 4 in an aircraft, either test set 31 (*Ref. No.* 10S/16553) or test set 31A (*Ref. No.* 10S/16856) together with junction box 383 (*Ref. No.* 10D/18597) is required. These are special units, the uses of which are detailed in para. 48 to 53, and they do not form part of the normal bench testing equipment. For complete information on test sets 31 and 31A see A.P.2914AE.

Warning . . .

When Rebecca Mk. 4 is used in a non-pressurized aircraft equipment bay, the plugs on the front panel of TR.3624 are liable to collect moisture; this causes the plugs to arc over at the low atmospheric pressures encountered at altitudes in excess of 30,000 feet. It is recommended, therefore, that before being used at such altitudes certain plugs on the TR.3624, together with the associated interconnecting bulkhead plugs and sockets, should be treated with sealing compound MS4 (Ref. No. 33C/942829). The plugs most affected are the 12-way orange plug to indicating unit 208 and the 6-way red plug to CU.526, both of which carry e.h.t. voltages. These plugs should be dried thoroughly and packed with the compound so that the insertion of the mating socket will force the compound into the spaces between the pins. Any surplus compound should be removed. In storage, the TR.3624 plugs are protected from contamination by the plug protection covers forming part of the plug assembly.

SETTING-UP PROCEDURE

General

3. A block diagram of Rebecca Mk. 4 is provided in Part 1, Chap. 1. Reference should be made to the interconnection diagram shown in Part 1, Chapter 2; fig. 1 of this chapter shows a typical bench set-up as used at a second-line servicing unit.

Warning . . .

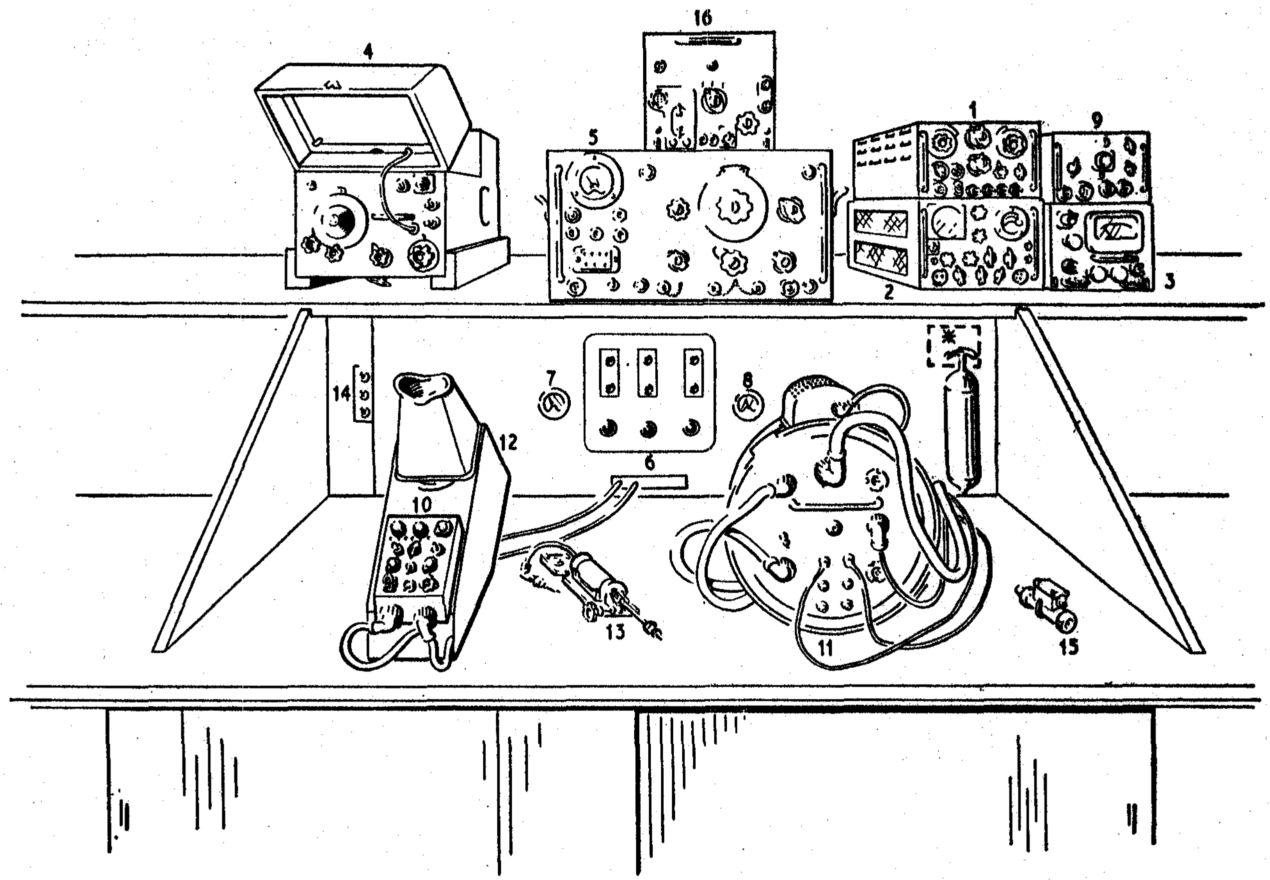
TR.3624 is a pressurized unit and must, therefore, be depressurized before attempting to remove the case. If this is not done serious damage to the equipment will result and may also lead to injury of personnel. The case, when removed, is to be stowed in a place of safety. It is not in any circumstances to be used as a receptacle or support for other equipment since any damage will almost certainly ruin the sealing of the unit.

Junction box 351

4. This unit is illustrated in fig. 2 and a wiring diagram is provided in fig 3. It is used for all interconnections between Rebecca Mk. 4 equipment, the test gear and power supplies when carrying out the setting-up procedure or when bay servicing.

Setting up the signal generator

5. To ensure that the frequency measuring equipment is set up correctly it is first of all necessary to check the calibration of the signal



1	WAVEFORM GENERATOR 51—PART OF TEST SET 302	**9**	CALIBRATOR UNIT 123—PART OF TEST SET 296
2	INDICATOR UNIT 221—PART OF MONITOR 52	**10**	CONTROL UNIT 526
3	INDICATOR UNIT 247—PART OF OUTPUT TESTER 57	**11**	TR.3624
4	WAVEMETER W1649	**12**	BENCH JIG CARRYING IND. UNIT 208 AND CU.526
5	SIGNAL GENERATOR CT53	**13**	ATTENUATOR TYPE 70
6	POWER SUPPLY SWITCHES	**14**	AERIAL PLUGS
7	E.H.T. METER 0-3·5KV	**15**	DETECTOR UNIT 75
8	VOLTMETER 0-500V	**16**	TIMEBASE CALIBRATOR TYPE 1

Fig. 1. Typical bench set-up for second-line servicing of Rebecca Mk. 4

generator against that of the wavemeter W.1649 in which is incorporated a crystal-controlled oscillator. The method to be adopted is outlined in the following sub-paragraphs:—

(1) Set the signal generator function switch to CW-ON and the OUTPUT LEVEL switch to NORMAL. Adjust the SET CARRIER control until the meter needle registers against the red NORMAL mark. Set the ATTENUATOR dial to 'O' and the frequency to correspond with the receiver channel 1 as in Command Instructions.

(2) Set the wavemeter W1649 control switch to XTAL and allow a period of 30 minutes for the equipment to reach thermal stability. With the incremental dial at 'O', set the frequency to the crystal checkpoint nearest to the receiver channel 1 and tune until a note is heard in the headphones. Set the control switch to ON and the wavemeter frequency exactly to that of receiver channel 1 by means of the incremental dial (adding to or subtracting from the frequency set on the main tuning dial).

(3) Connect the signal generator output to the WAVEMETER socket on W1649. Set the signal generator modulation switch to INT. MOD. SQUARE and adjust the signal generator tuning dial until the note is heard in the 'phones. This position of the tuning dial should be marked to indicate the receiver channel 1 frequency. The procedure must be repeated for each receiver frequency.

Setting up the frequency meter BC.906E

6. Connect the output from the signal generator 53 to the frequency meter input socket. Set the signal generator frequency dial to the transmitter channel A frequency; then adjust the frequency

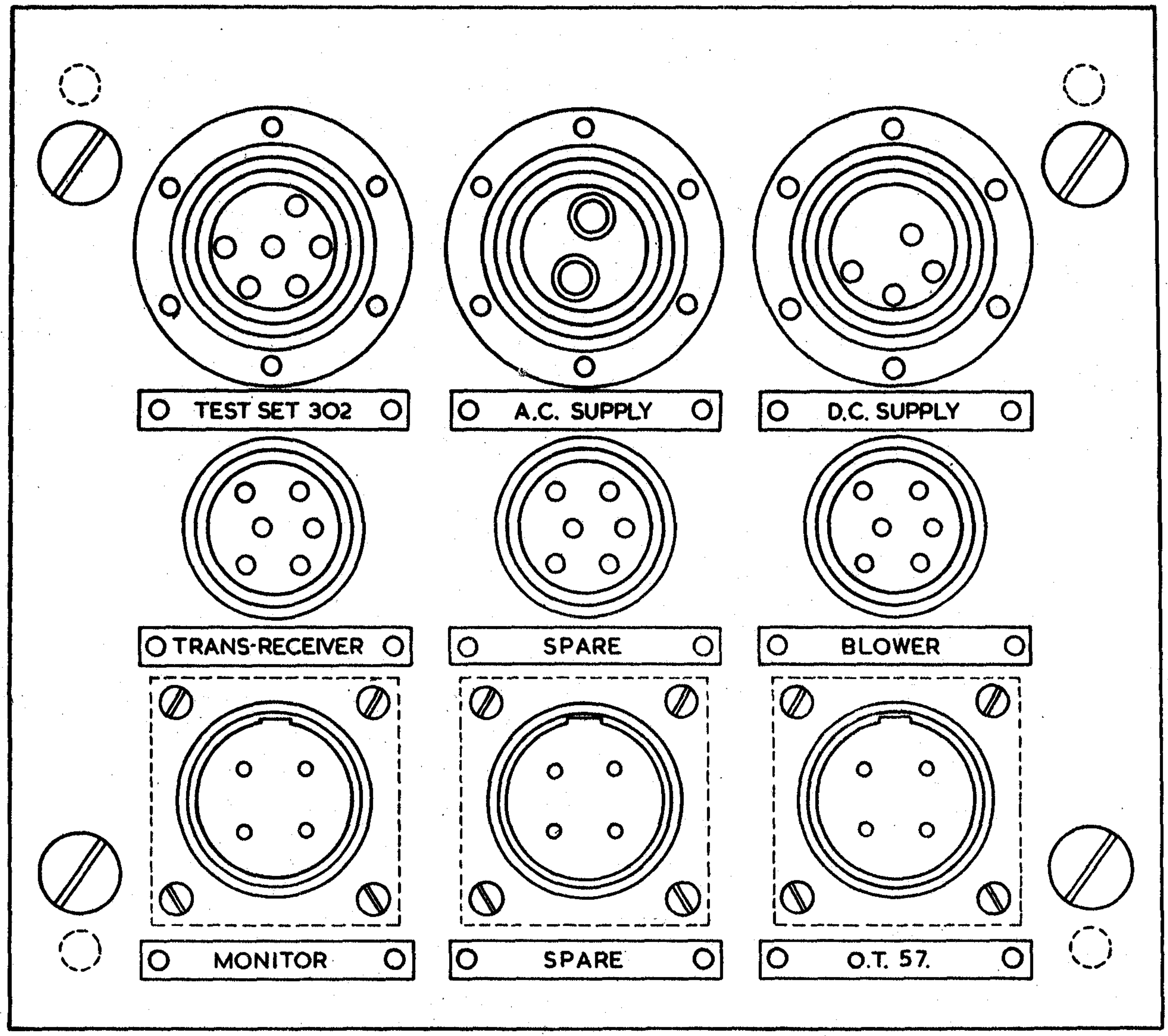


Fig. 2. Junction box 351

meter tuning dial for minimum meter reading. Note this dial reading. Repeat the above procedure for each transmitter channel.

Voltage control panel

7. Using multimeter Type 1 (*Ref. No.* 10S/16411) or an a.c. voltmeter (*Ref. No.* 5Q/25256), the voltage output from the control panel should be checked. This must be 80 volts$\pm$2 volts. If the voltage is not within these limits it is probable that the regulator within the control panel requires adjustment. The control panel is described in A.P.1186E, Vol. 1, Sect. 5, Chap. 7, whilst the setting up procedure for the regulator Type E5 or Type EU is given in A.P.1186D, Vol. 1, Sect. 2, Chap. 2. The d.c. supply should be between 24 and 28 volts.

Timebase

8. Having ensured that either an aerial or attenuator Type 70 (*Ref. No.* 10A/16129) or a 47 ohm resistor (*Ref. No.* 10WZ/221064) is connected to the transmitter output socket (blue coaxial), switch on the equipment and allow the required amount of time for the thermal delay switch and the mercury rectifiers to operate. Set the RANGE switch to the 6-mile position; function switch to H_0; AVC/M switch to AVC; N-240M switch to N and, with the transmitter on and the calibration pips displayed, adjust the FOCUS and BRILLIANCE controls until a clear trace of suitable brightness is obtained.

9. Ensure that the trace is vertical and adjust the X and Y shift controls until the trace is central, with the start at zero. Adjust the timebase amplitude preset control so that the bright spot at the end of the trace is at the top of the blacked-out portion of the graticule on the indicating unit. On the other ranges this bright spot may not be visible, but provided the 6-mile range is used for setting the amplitude, the other ranges will be correct.

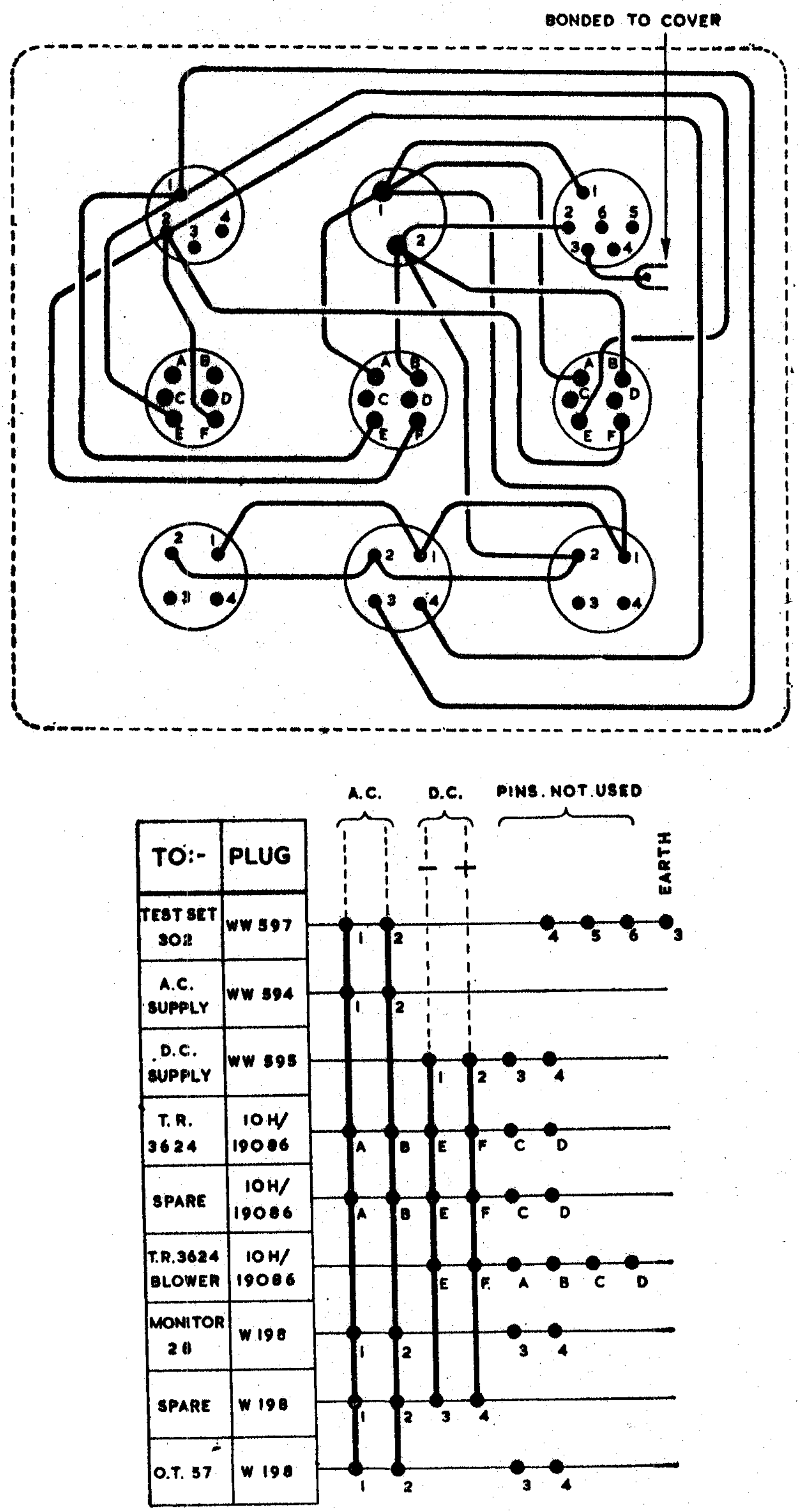


Fig. 3. Junction box 351 : wiring diagram

10. If the sensitivity of the cathode ray tube is such that the amplitude preset control does not adjust the trace to its correct length, either of the resistors R334 or R336 (connected in series with the variable control) BUT NOT BOTH must be short-circuited. R334 is situated in the extended range unit while R336 is mounted between RV319 and RV320 (X and Y shift controls).

Range timebase calibration (*fig.* 4)

11. Having set the timebase amplitude—remember that its length is constant for all ranges—the various ranges are given by altering the speed at which the timebase is accomplished. This is done by having a separate preset speed control for each range, the appropriate one being selected by one section of the RANGE switch.

12. The individual range controls are set up as detailed in the following sub-paragraphs: —

(1) Set up the calibrator unit 123 as follows: —

(a) TRIG switch to +VE.

(b) Function switch to TUNE.

(c) HT switch to ON.

(d) Adjust the preset control TUNE until the 'magic eye' visual indicator just closes.

(e) Function switch to OPERATE.

(f) AMPLITUDE control fully clockwise.

(2) Set up the timebase calibrator Type 1 as follows: —

(a) RANGE switch to ½ NAUTICAL MILES.

(b) AMPLITUDE control fully clockwise.

(c) ½ MILE MARKERS switch to IN (on some units this switch is not fitted, in which case the ½M markers are permanently in circuit).

(d) HT switch to ON.

(3) Connect the yellow/black coaxial socket on the TR.3624 to

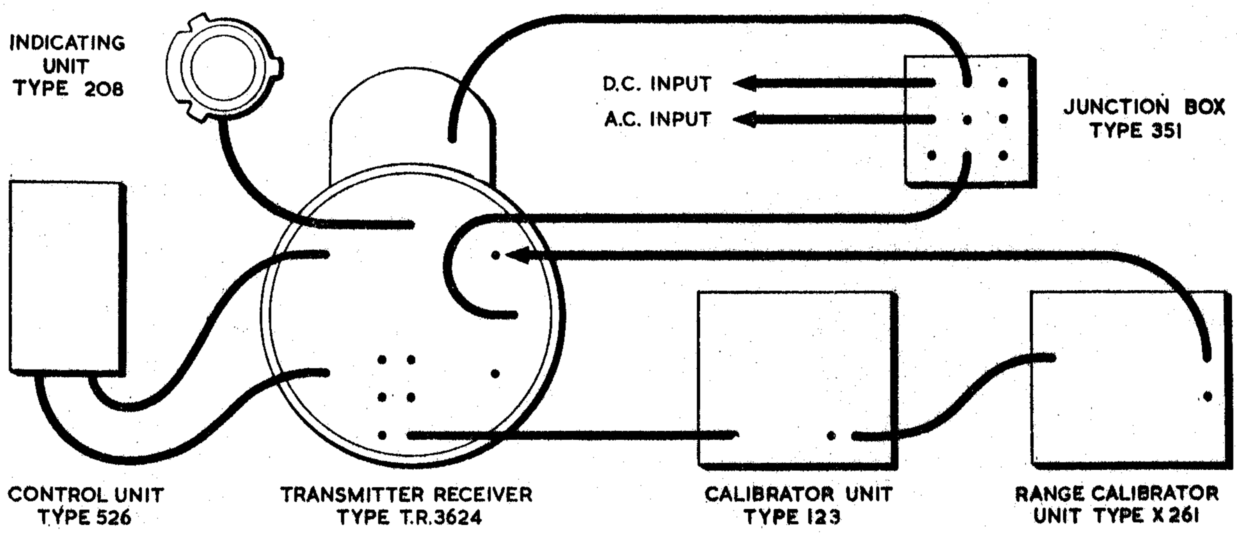


Fig. 4. Range timebase calibration : block diagram

the TRIG plug on calibrator unit 123 and the '+40V' output from that unit to TRIGGER socket on the timebase calibrator, Type 1. Now connect the +40V OUTPUT on the timebase calibrator to pin B of the green 6-way plug—having first removed its blanking cap—on TR.3624. These connections are shown diagrammatically in fig. 4.

(4) Set the CU.526 function switch to BA, RANGE switch to 6, extended range switch to N and switch off the internal calibrator. Adjust the AMPLITUDE control on the timebase calibrator, Type 1 until the external calibration markers are approximately half an inch in amplitude.

(5) Adjust the X shift on CU.526 until the second ½-mile marker is aligned with the 1-mile graticule mark on the ind. unit 208. Adjust the 6M preset control, at the back of CU.526, until each alternate external calibration marker is aligned with a graticule mark. Since these two operations are, to some extent, interacting, they will need repeating several times for the best result.

(6) Set the CU.526 RANGE switch to 12 and the timebase calibrator Type 1 RANGE switch to 2. The ½ MILE MARKERS switch (if fitted) should be turned to OUT. Now adjust the 12M preset control until the first and sixth markers are aligned with the 2 and 12-mile graticule marks respectively.

(7) Set the CU.526 RANGE switch to 60 and the timebase calibrator RANGE to 10. Align the first and sixth markers with the 10 and 60-mile graticule marks by adjustment of the 60M preset control.

(8) Set the CU.526 RANGE switch to 120 and depress the PUSH FOR LONG RANGE switch on the timebase calibrator. Set the second and twelfth markers to coincide with the 20 and 120-mile graticule marks by means of the 120M preset control.

(9) The accuracy to which the injected calibration pips should be set with respect to the graticule marks must lie within the tolerance set out in Table 3. Check this with the aid of a suitable lens and visor, for example, the visor Type 43.

(10) Perform the foregoing procedure with the brilliance of the indicating unit 208 adjusted to a normal level; then check that it is possible to focus the trace on all settings of the RANGE switch and that at full brilliance it is not unduly defocused.

13. Table 3 lists the scale tolerances related to range. The first figure in each column refers to the range in miles whilst the second figure is the tolerance in mm to which the injected cal. pip must be set.

Table 3
Scale tolerances

6-mile range		12-mile range		60-mile range		120-mile range	
m	mm	m	mm	m	mm	m	mm
0	±1·0	0	±1·5	0	±1·5	0	±1·5
1	±0	2	±1·0	10	±1·5	20	±1·5
2	±1·0	4	±1·0	20	±1·0	40	±1·0
3	±1·0	6	±1·0	30	±1·0	60	±1·0
4	±1·0	8	±1·0	40	±1·0	80	±1·0
5	±1·5	10	±1·0	50	±1·0	100	±1·0
6	±2·0	12	±2·0	60	±2·0	120	±2·0

No adjustment is provided for the 240-mile range as this is automatically correct when the 120-mile range is correctly adjusted.

Calibrator

14. It now remains to cause the range markers to appear at their correct positions on the timebase; this is done by altering the frequency of the calibration oscillator as follows:—

(1) Set the CU.526 RANGE switch to '6' and depress the CAL. ON-OFF button to display the internal calibration markers.

(2) Adjust the phasing control, RV1, until the first calibration marker is coincident with the 1-mile graticule mark. Adjust the calibrator frequency control, L1, until the second to the sixth markers are accurately aligned with the graticule marks. Repeat these two adjustments until no further improvement can be effected. Switch the RANGE control to '12' and check that the markers remain coincident with the 12-mile graticule scale.

(3) Set the CU.526 RANGE switch to '60' and adjust the frequency control, L4, until the markers are aligned with the 60-mile scale. Check the 120-mile range as for the 12-mile range. Finally, with the RANGE switch still at '120', set the extended range switch to '240M', check that twenty-four markers are displayed and that every fourth marker is coincident with a graticule mark.

IFF pulse

15. This is dealt with in para. 40 (2) under the general heading "Master oscillator".

Pulse repetition frequency

16. The block diagram in fig. 5 shows the layout, and the procedure to be adopted is as follows:—

(1) Connect the 60V POS. output of the test set 302 to the INPUT of the monitor 52. Set the TRIGGER switch on the test set to the +VE INT. position, the FREQ. SCALE FACTOR switch to '÷10' and the frequency scale to '2·0'. Rotate the SYNC control on the monitor to its minimum setting (fully anti-clockwise).

(2) Set the monitor timebase switch to VARIABLE and adjust the timebase speed until a fixed number of pulses appear on the trace.

(3) Disconnect the test set 302 and connect the Rebecca sync. output (yellow/black coaxial socket) to the INPUT plug of the monitor 52. Rotate the preset control, RV101, until the same number of pulses per trace is obtained. Lock the control after adjustment.

BA and H_1 delays

17. The BA delay is incorporated to delay the start of the timebase so that the operator reads the range to the touchdown point. The controls for the BA and H_1 delays are RV322 and RV316 respectively and are located at the back of the control unit. The test gear connections are shown in fig. 6 and the procedure for setting up the delay controls is as follows:—

(1) Connect the signal generator to the port aerial socket. Connect the 60V positive output from the test set 302 to the signal generator input and set the switch on the signal generator to the EXT. MOD. position. Set the function switch on the control unit to H_0 and the RANGE selector to 6 miles.

(2) Tune the signal generator to the appropriate receiver frequency and adjust the controls

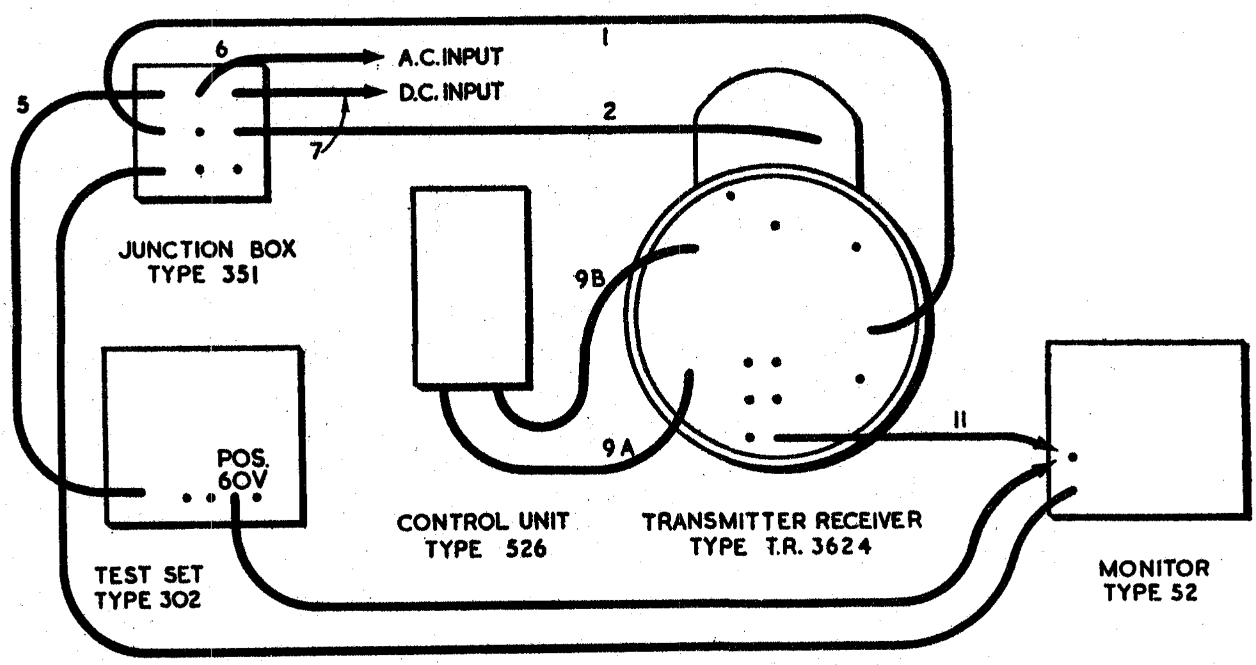


Fig. 5. Setting up pulse repetition frequency : block diagram

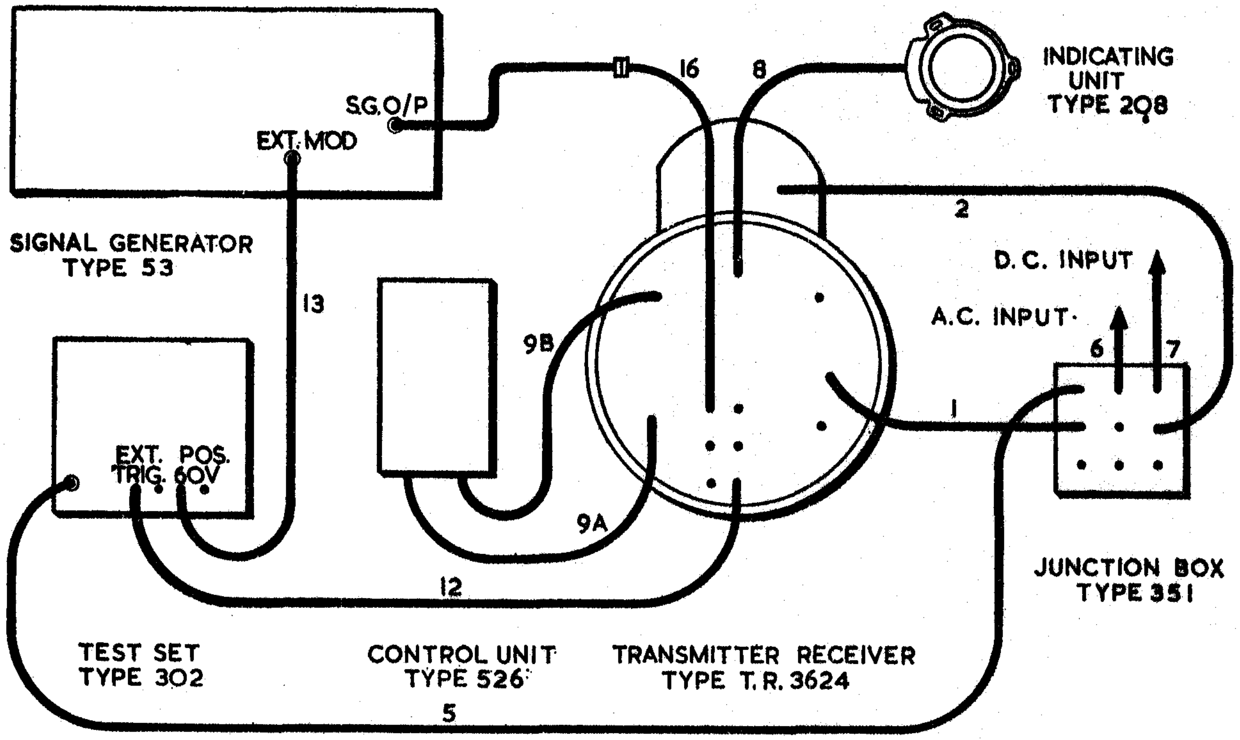


Fig. 6. Setting up BA and H_1 delays : block diagram

on the test set until the leading edge of the video signal appears on the indicating unit at the 5-mile point.

(3) Change the function switch to H_1 when the pulse should appear at a range of 4 miles. If necessary, rotate the delay control RV316 until this range is obtained.

(4) Now set the function switch to BA, when the video pulse should appear at a new range of 3 miles. If it does not, rotate the delay control RV322 until the range is 3 miles.

(5) Return the function switch to H_0 and check that the undelayed pulse is still at 5 miles. If not, the process must be carried out again, and repeated as necessary, until the video signal remains constant at 5, 4 and 3 nautical miles as the function switch is set at H_0, H_1 and BA respectively.

Receiver gain control

18. Adjustment of the preset gain control is carried out in the following manner:—

(1) Set the RANGE selector switch to 60 miles and the AVC/M switch to M, then rotate the manual GAIN control fully clockwise. Switch on the transmitter.

(2) Adjust the preset control RV2, until the peak amplitude of the noise output observed on the indicating unit 208 reaches the outer line on the graticule. Lock the control after adjustment.

Automatic gain control

19. The correct functioning of the AGC system may be checked as set out below:—

(1) Set the ATTENUATOR on the signal generator to give an output of 1 mV.

(2) Turn the GAIN control on CU.526 fully clockwise. The pulse should then be at full scale amplitude of the indicating unit 208.

(3) Set the AVC-M switch on CU.526 to AVC at which the pulse amplitude should decrease to approximately one inch.

(4) Slowly rotate the ATTENUATOR on the signal generator until its output is 32 mV. The pulse amplitude should remain constant.

Frequency selector sensitivity

20. The sensitivity of the transmitter and receiver frequency selector circuits is controlled by the potentiometers RV103 and RV105 respectively; these are located on chassis No. 2. These controls should be adjusted only if the selector systems hunt (sensitivity too high) or the blacklash is excessive (sensitivity too low). If it is necessary to adjust either of the controls, it should be set to a position such that the system just fails to hunt when a new frequency channel is selected.

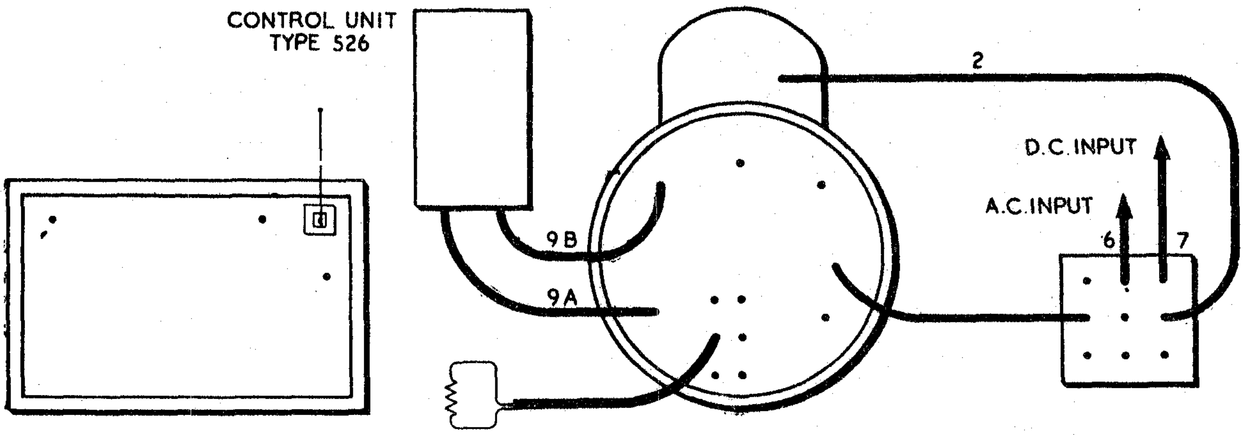


Fig. 7. Measurement of transmitter frequency

Frequency selector circuits

Receiver

21. The bench set-up for the adjustment of the receiver frequency selector circuits is as shown in fig. 6. The signal generator is tuned until the pulse appearing on the indicating unit 208 reaches maximum amplitude. If the frequency thus shown on the signal generator tuning scale differs from that required, slacken the locking screw on the appropriate preset potentiometer in the control unit. Having set the signal generator to the correct frequency, rotate the preset control until the signal viewed on the indicating unit reaches maximum amplitude. Lock all the preset controls after adjustment.

Transmitter

22. The set-up for the adjustment of the transmitter frequency selector circuit is shown in fig. 7. The attenuator Type 70 (*Ref. No.* 10A/16129) or a 47 ohm resistor (*Ref. No.* 10WZ/221064) must be connected to the transmitter output socket (blue) while this adjustment is being carried out.

23. To measure the frequency of the transmitter, set the selector switch to the appropriate position and tune the wavemeter W1649, using the main tuning dial, until the signal is audible in the headphones. Note this setting. The incremental dial should be set to O.

24. Now set the wavemeter control switch to X-TAL and readjust the main tuning dial of the wavemeter until the crystal beat note nearest to the setting previously noted is audible. Lock the main tuning dial and return the control switch to ON. Retune the signal to maximum by means of the incremental tuning control only. The transmitter frequency is given by adding or subtracting the incremental dial reading from that of the main tuning dial.

25. If the frequency is not correct, locate in the control unit 526, the preset potentiometer controlling that channel and, having first slackened the locking screw, adjust the potentiometer until the frequency is correct. Clockwise rotation increases the frequency.

26. It should be realised that the tuning system will move in incremental steps as the preset control is rotated, also that some backlash may be experienced. To overcome backlash troubles, it is advisable to turn the preset control back by half the last incremental rotation if the frequency is overshot and then reselect the code frequency to reset the bridge circuit to its central position. After a little practice it should be possible to set the frequencies accurately to $\pm\frac{1}{4}$ Mc/s. Lock all preset controls after final adjustment.

27. No actual frequencies are specified in this publication since these will depend on Command Instructions.

Setting the transmitter frequency using frequency meter BC.906E

28. When the frequency meter BC906E is available, its use enables the transmitter frequencies to be set to a slightly greater degree of accuracy due to the fact that maxima and minima are more easily determined visually—by a meter reading—than aurally by a note in a headset. The procedure then is as follows:—

(1) Set the CU.526 TX ON-OFF switch to OFF.

(2) Position the frequency meter adjacent to the transmitter dummy load, and extend the rod aerial.

(3) Set the frequency meter dial to the transmitter channel 'A' frequency.

(4) Set the CU.526 TX ON-OFF switch to ON and the TX-SEL switch to 'A'.

(5) Locate and adjust (*as in para.* 25) the pre-set control for minimum meter reading. The procedure must be repeated at each transmitter frequency.

Receiver sensitivity

29. For this test, a matching network, as shown in fig. 8, will be required. This is to match the 75 ohm generator impedance to the 50 ohm receiver impedance and will introduce an attenuation of 20dB in the signal generator voltage applied to TR.3624.

30. Connect the equipment as shown in fig. 9 and proceed as follows:—

(1) Set the RANGE selector switch to 60 miles and the function switch to BA. Adjust the receiver gain control until the noise amplitude displayed on indicating unit 208 is approximately ½ cm.

(2) Tune the signal generator to peak to the receiver frequency and adjust the controls on test set 302 until the video signal is delayed approximately 20 miles.

(3) With the signal generator switch at CW, set the carrier level indicator on the signal generator to the position for normal output. Return the switch to the EXT. MOD. position and adjust the attenuator until the signal pulse amplitude is equal to the peak noise amplitude. The display should now appear as illustrated in fig. 10.

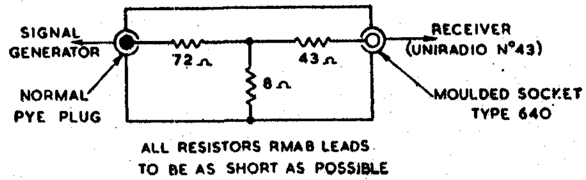


Fig. 8. Matching network

(4) The receiver sensitivity for a signal/noise ratio of 2 : 1 at each of the six receiver spot frequencies should not be less than 78dB down on 0·1 volt, this figure being made up of the actual attenuator reading plus a 20dB allowance for the matching network. A receiver which does not exactly comply with this test need not necessarily be rejected, but any unit having a sensitivity of less than 72dB down on 0·1 volt must be regarded as faulty and returned for fourth-line servicing.

Receiver bandwidth

31. The overall bandwidth of the receiver should be measured at Channels 1 and 5. The bench connections are shown in fig. 6 and the procedure is as follows:—

(1) Adjust the signal generator attenuator to give a convenient video output when the receiver gain control is set to a position such that noise is just visible on the indicating unit, using the 60-mile timebase range.

(2) Increase the signal input by 6dB and note the frequencies to which the signal generator must be retuned so that the output falls to its original level.

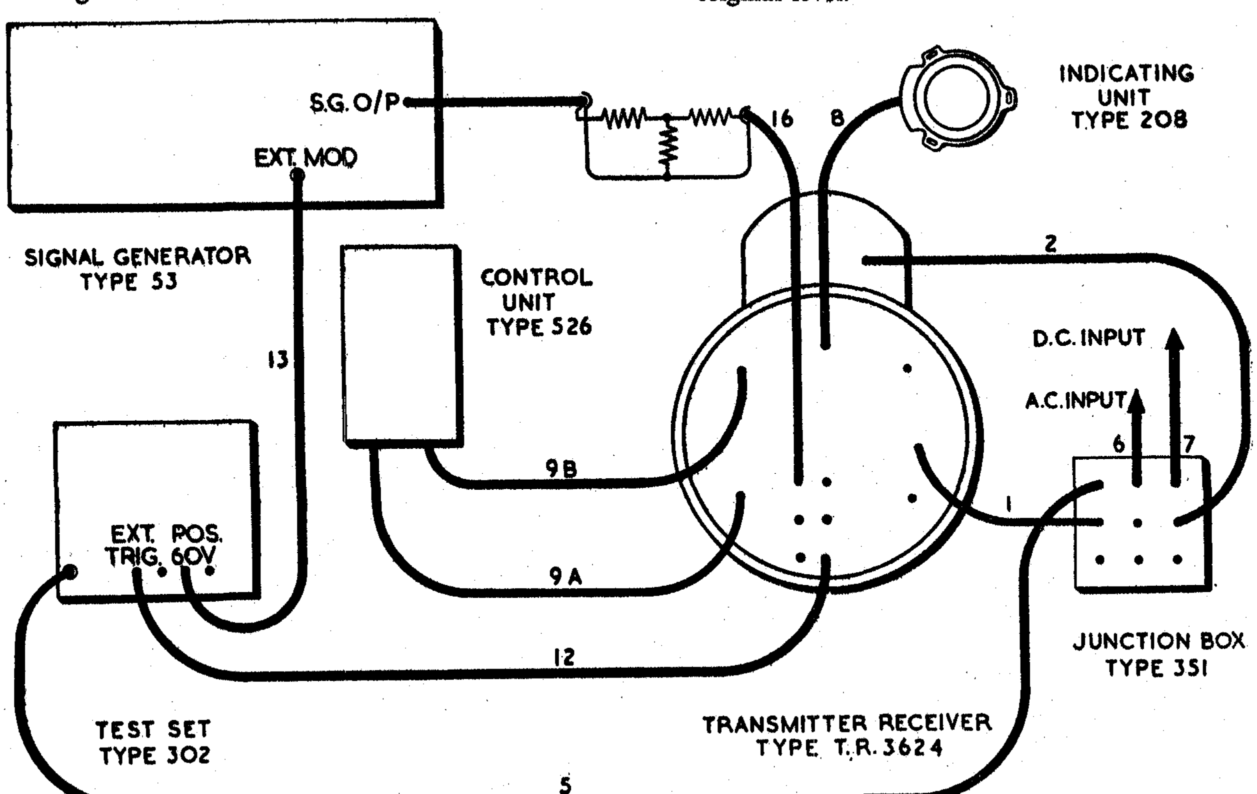


Fig. 9. Measurement of receiver sensitivity : block diagram

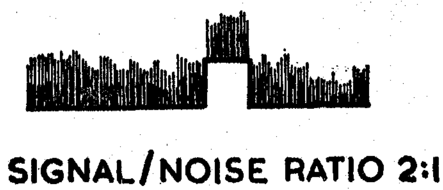


Fig. 10. Receiver presentation of signal/noise ratio

(3) The difference between the new frequencies should lie between 2·4 and 3·6 Mc/s.

Receiver video characteristics

32. Check that the positive video pulse output is greater than 90 volts in amplitude and contains no perceptible ripple on the signal.

33. Check that the maximum positive output with the AGC in operation is between 60 and 80 volts when a 5-10 microsecond pulse is viewed on the 12-mile range BA display. This level should be maintained for input signal levels of 10dB down and 40dB down on 0·1 volt with the receiver GAIN control rotated fully clockwise.

34. Connect the signal generator 53, test set 302 and the TR.3624 as shown in fig. 6. Set the PULSE WIDTH switch on the test set to the MOD. position and check that the AGC level of the broad and narrow pulses on the BA display remains unchanged.

Receiver alignment

35. When the r.f. head or i.f. unit require re-alignment they must be replaced by serviceable units. No attempt whatever should be made by unskilled personnel to interfere with the alignment of either of these units and tests must be confined to those specified in the preceding paragraphs. Special test equipment for Rebecca Mk. 4 has been provided at certain third and fourth line maintenance units to which unserviceable r.f. and i.f. units should be returned.

Transmitter power output

36. Fig. 11 shows the bench connections for this measurement. The output from the Rebecca transmitter aerial socket (blue) is fed to the output tester 57 via detector unit 75.

37. With the RANGE selector switch on the OUTPUT TESTER set to 1500, adjust the NULL SET control until the meter reads approximately full scale. Now turn the NULL SET control slowly in an anti-clockwise direction until the "magic eye" indicator just begins to close. The red scale of the meter now shows directly the peak power output of the transmitter. Complete information on the output tester 57 is contained in A.P.2563AB.

38. The power output should be measured at each setting of the transmitter frequency selector switch. The peak power indicated on the meter of the output tester should not be less than 210 watts at each spot frequency.

Transmitter output waveform

39. The shape of the r.f. pulse should be observed on the cathode ray tube of a suitable monitor,

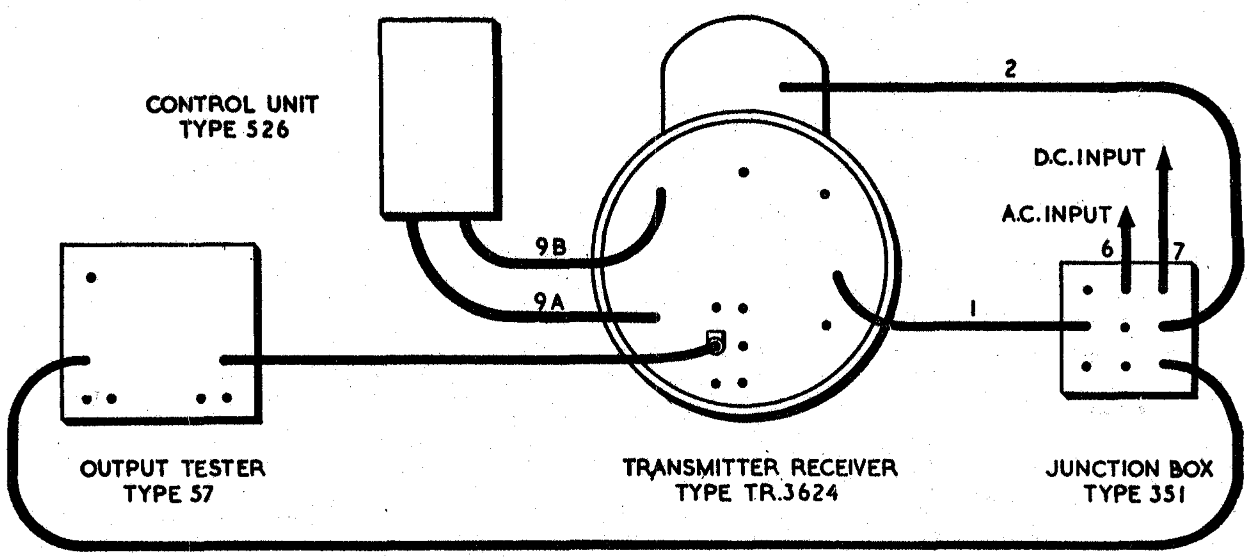


Fig. 11. Measurement of transmitter power output : block diagram

via the output tester 57. The width of the pulse, measured at half amplitude, should be between 4·5 and 5·5 microseconds at each position of the frequency selector switch.

Master oscillator

40. The waveforms associated with the master oscillator are as shown in fig. 12. These should be examined and their amplitudes and widths should be between the values indicated below:—

(1) The pre-pulse developed at the cathode of V105a should be between 50 and 80 volts positive in amplitude, and between 22 and 35 microseconds in width at half amplitude.

(2) The IFF suppression pulse derived at the cathode of V107, and appearing at the orange coaxial socket on the front panel of TR.3624, is a positive pulse coincident with the pre-pulse and is followed by a positive pulse of 25 to 40 volts in amplitude, and width equal to the time-base brightening pulse. The amplitude of the IFF suppression pulse should be from 45 to 65 volts.

(3) Check that the amplitude of the timebase brightening pulse which is developed across the cathode load of V5 is between 45 and 60 volts positive.

(4) The amplitude of the negative-going transmitter triggering pulse, appearing across the resistor R55, should be at least 18 volts.

(5) The transmitter drive pulse is developed at the anode of V110. With the transmitter unit connected, the amplitude of the drive pulse should be at least 400 volts positive when its width is adjusted (by means of L102) such that the width of the transmitter triggering pulse is 5·5 microseconds. If the monitor 52 is used for this measurement it will be found that only a portion of the drive pulse is visible when the trace is centred on the cathode ray tube. Since adjustment of the shift control may still not permit observation of the entire pulse, the amplitude of the negative-going portion should be measured; if this is 150 volts or more it may be assumed that the amplitude of the positive-going pulse is adequate.

General notes

41. Care should be taken when connecting the coaxial plugs to ensure that the plug pin enters the socket hole and not the polythene. Make certain that the plug is screwed firmly home but do not use undue force.

42. Check that the polarity of the d.c. supply is correct before connecting the power supply to the equipment, otherwise the tuning motors will not stop. Pin E should be negative and pin F positive. Similarly, if it is necessary to disconnect the leads to either tuning motor ensure that the leads are correctly reconnected.

43. Remember to lock all preset controls, particularly those controlling the transmitter and receiver frequencies, after adjustment.

Warning . . .

Certain preset controls in the TR.3624 unit are sealed and painted red. In no circumstances must these controls be touched as the test gear required to set them up is only available at fourth-line stations.

Desiccator

44. Before carrying out the leakage test detailed in para. 45 and 46 the desiccator must be examined to ensure that the indicating paper—seen through the window in the centre of the desiccator—is coloured blue. Should there be any trace of pink or white discolouration, the desiccator must be removed with the spanner illustrated in fig. 13 and a fresh one substituted. When replacing the desiccator unit, care must be taken to ensure that the sealing ring is not damaged. If the ring should be damaged it must be replaced by a new one.

Leakage test

45. After the conclusion of the bench tests, the TR.3624 unit is to be replaced in its pressure cover and the following leakage test made.

46. The internal air pressure is to be raised to 12 lb/in.^{2} above atmospheric pressure, the pressure source removed, and the unit allowed to stand at normal room temperature for a period of 24 hours. The leakage of the cover must not be sufficient to allow the internal air pressure to fall below

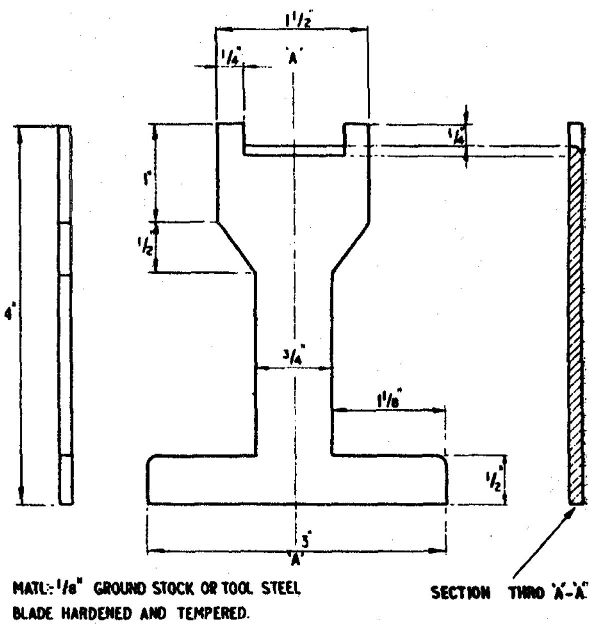


Fig. 13. Desiccator spanner

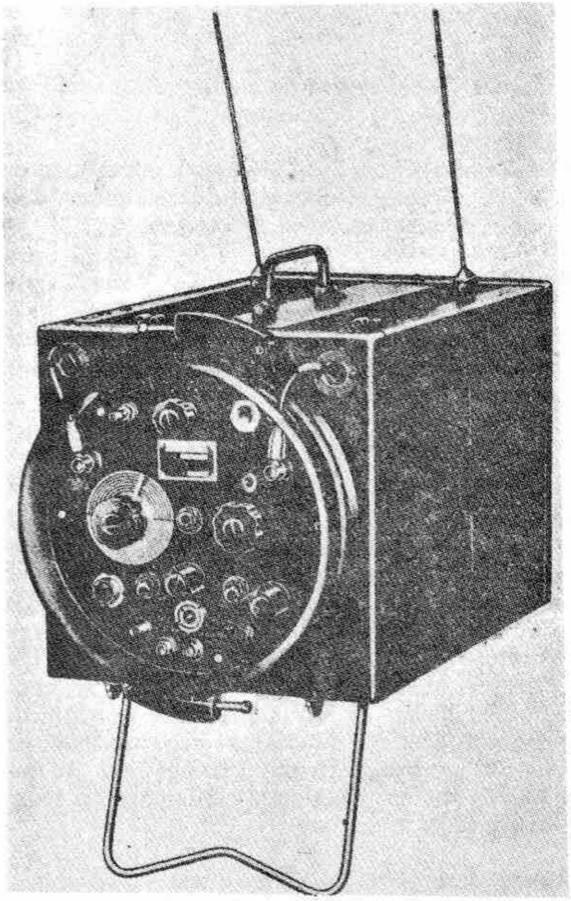


Fig. 16. Performance tester Type 102 : general view

7 lb/in.^{2} above atmospheric pressure by the end of this period.

Bench jigs

47. The cylindrical construction of the TR.3624 and the small physical dimensions of the control and indicating units render it difficult to handle the equipment conveniently on a test bench. Two jigs have therefore been designed, one to accommodate the TR.3624 and the other for mounting the control unit 526 and indicating unit 208. General arrangement diagrams are shown in fig. 14 and 15. These jigs are not provisioned as part of the test equipment but are relatively simple in design and the illustrations include sufficient detail to enable construction to be undertaken where normal workshop facilities exist. The wedge mounting plate (*Ref. No.* 14A/540) should be screwed to the CU.526 jig.

TEST SETS 31 AND 31A

General

48. As mentioned in para. 2, test sets 31 and 31A are provided to enable overall performance checks to be made on Rebecca Mk. 4 equipment. Test set 31 requires an a.c. supply of 80V at 1000-2000 c/s, whereas test set 31A operates from 28V d.c. Both test sets are basically similar and may be used for tests on Rebecca Mk. 4, but test set 31A includes additional facilities for use on Rebecca Mk. 7 and 8 equipments. Complete information on these test sets may be found in A.P.2914AE. A general view of performance tester Type 102—the main item of test set 31—is shown in fig. 16.

Field application

49. When used to check the operational performance of an aircraft installation, the performance tester is placed in front of the aircraft and connected to the 80V supply to the TR.3624. For this purpose a connector of adequate length is provided with the test set together with a junction box Type 392 which clips on to the handle on the panel of the TR.3624 as shown in fig. 17. The following information may then be derived by relatively unskilled personnel:—

(1) That the Rebecca transmitter is operating at the correct pre-selected frequencies.

(2) That the receiver is operating and displaying normal responses at the correct frequencies.

(3) That the receiver sweep facility is operative.

(4) That the H_1 and BA delays are correct, by observing the displacement of the response with respect to the calibration markers.

(5) The measurement, in some degree, of the directive properties of the aerial system by locating the performance tester first to port, and then to starboard of the aircraft and observing the change in ratio of the response on the indicator 208.

50. It is more convenient if two operators can conduct the test, one to manipulate the performance tester and the other the Rebecca equipment. Since some form of communication between the two is desirable, a headset is provided with the test kit, and this may be connected to the socket

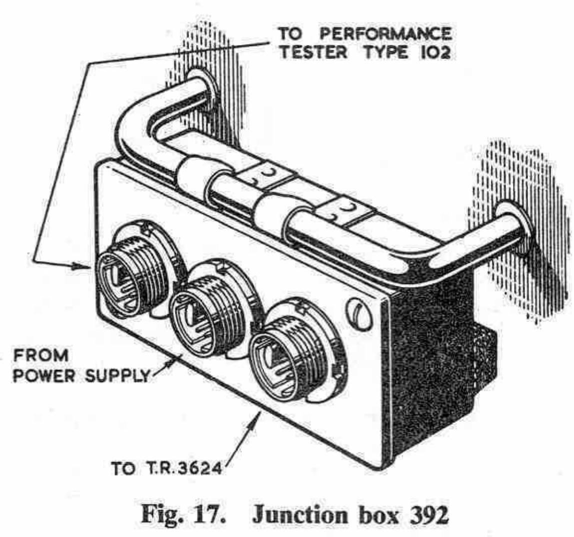


Fig. 17. Junction box 392

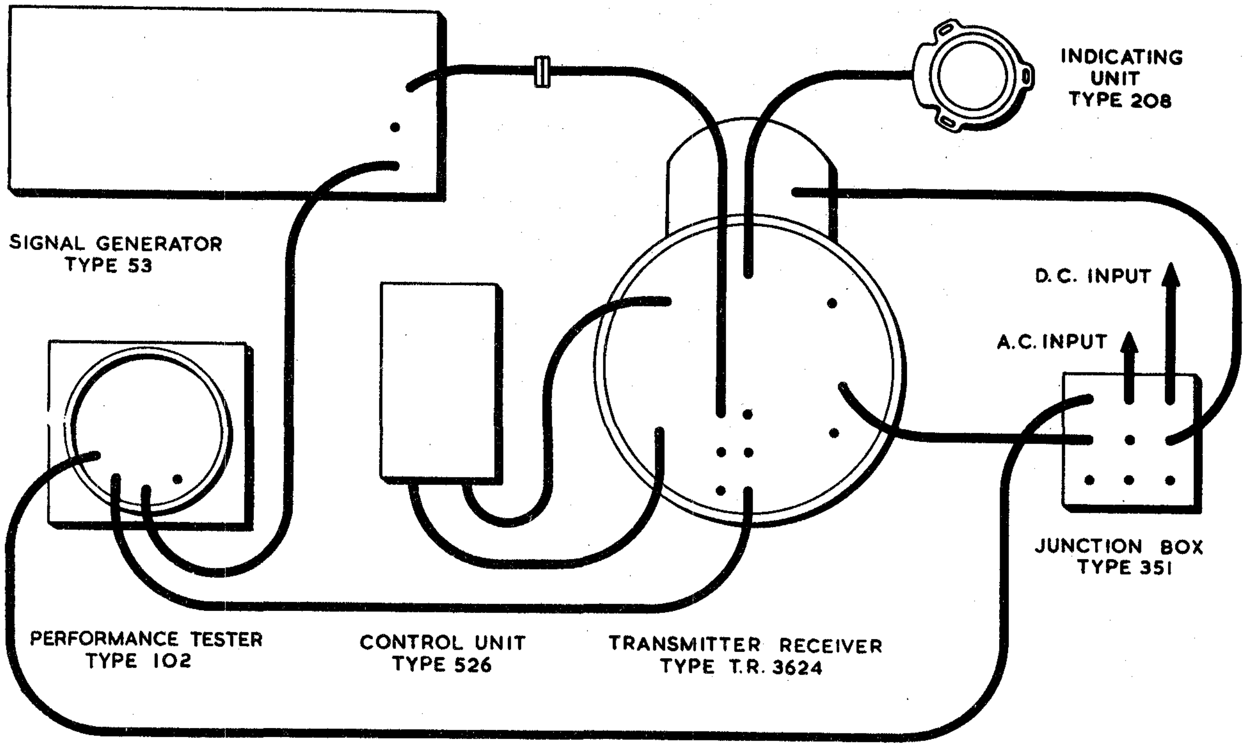


Fig. 18. Performance tester Type 102 in bench layout

marked DELAYED PULSE OUT on the performance tester. By using the TX ON/OFF/CODE switches, on both the performance tester and the Rebecca control unit, as morse keys, communication can readily be established; the aircraft signals will be audible in the earphones and the performance tester signals will be displayed on indicating unit 208 in the aircraft.

Bench application

51. All the facilities of test set 302 required for the Rebecca application are provided by the performance tester 102 and the latter can therefore be used in setting up and testing Rebecca Mk. 4 on the bench. The block diagram of fig. 18 shows how the performance tester fits into the bench layout in place of test set 302.

52. It will be observed that the first two settings of both the transmitter and receiver tuning controls are marked X and Y. This is done to enable the performance tester to be set up so that the first two spot frequencies correspond with the coverage of the TR.3624 when the X or Y resistor is short-circuited as described in Part 1, Chap. 1, of this volume.

JUNCTION BOX TYPE 383

53. This unit, which is illustrated in fig. 19, is not part of test sets 31 or 31A, but is provided to facilitate tests on indicating unit 208. As will be observed, it consists merely of a box in which is mounted a double-sided tag strip. Opposite tags are joined by sliding connector bars. The tags on one side are connected to a 12-way plug while those on the other side are connected to a short length of Twelvecorevinmet No. 3 cable. In use, the 12-way socket, with which the cable is terminated, is connected to the 12-way orange plug on the front panel of the TR.3624; the socket at the end of the cable attached to indicating unit 208 engages with the plug on the side of the junction box. Voltage and current measurements and examination of all the waveforms fed to the indicating unit may then easily be made.

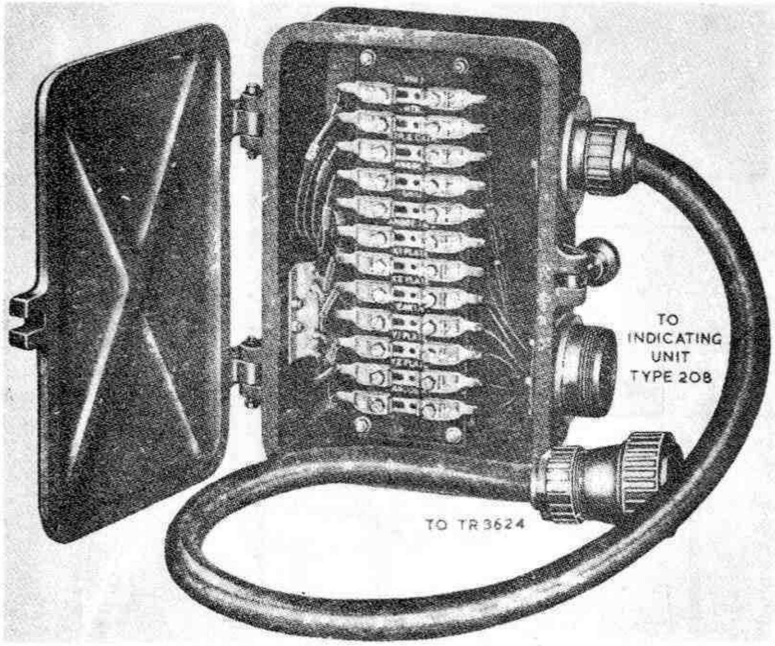


Fig. 19. Junction box 383

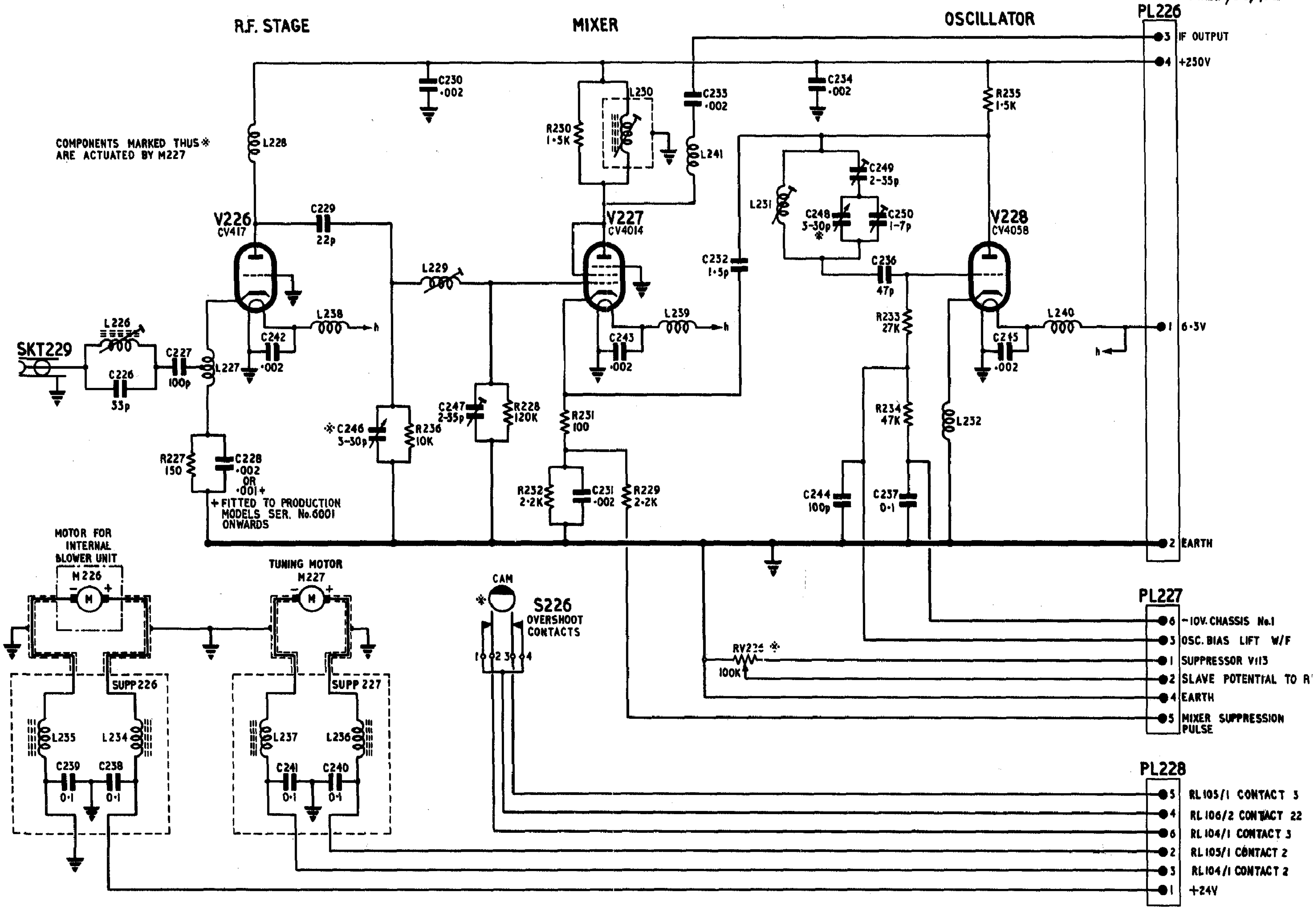


FIG. 19 a

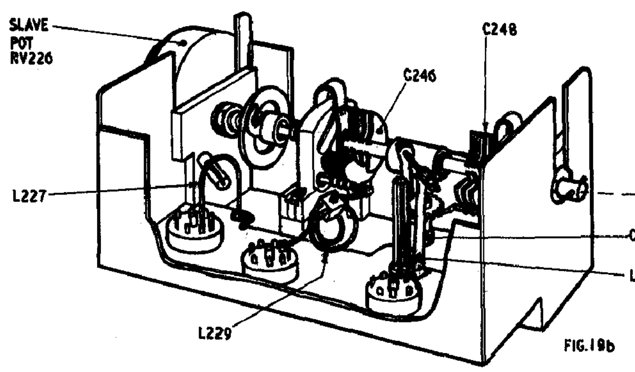


FIG.19b

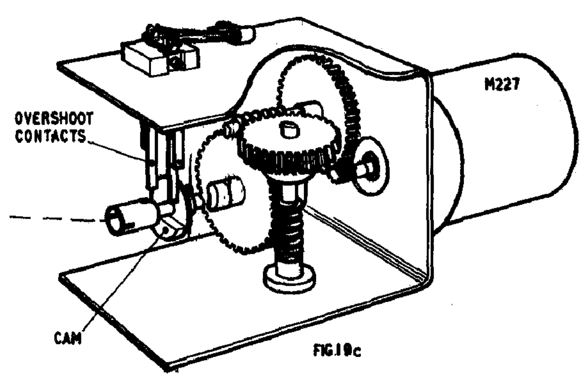
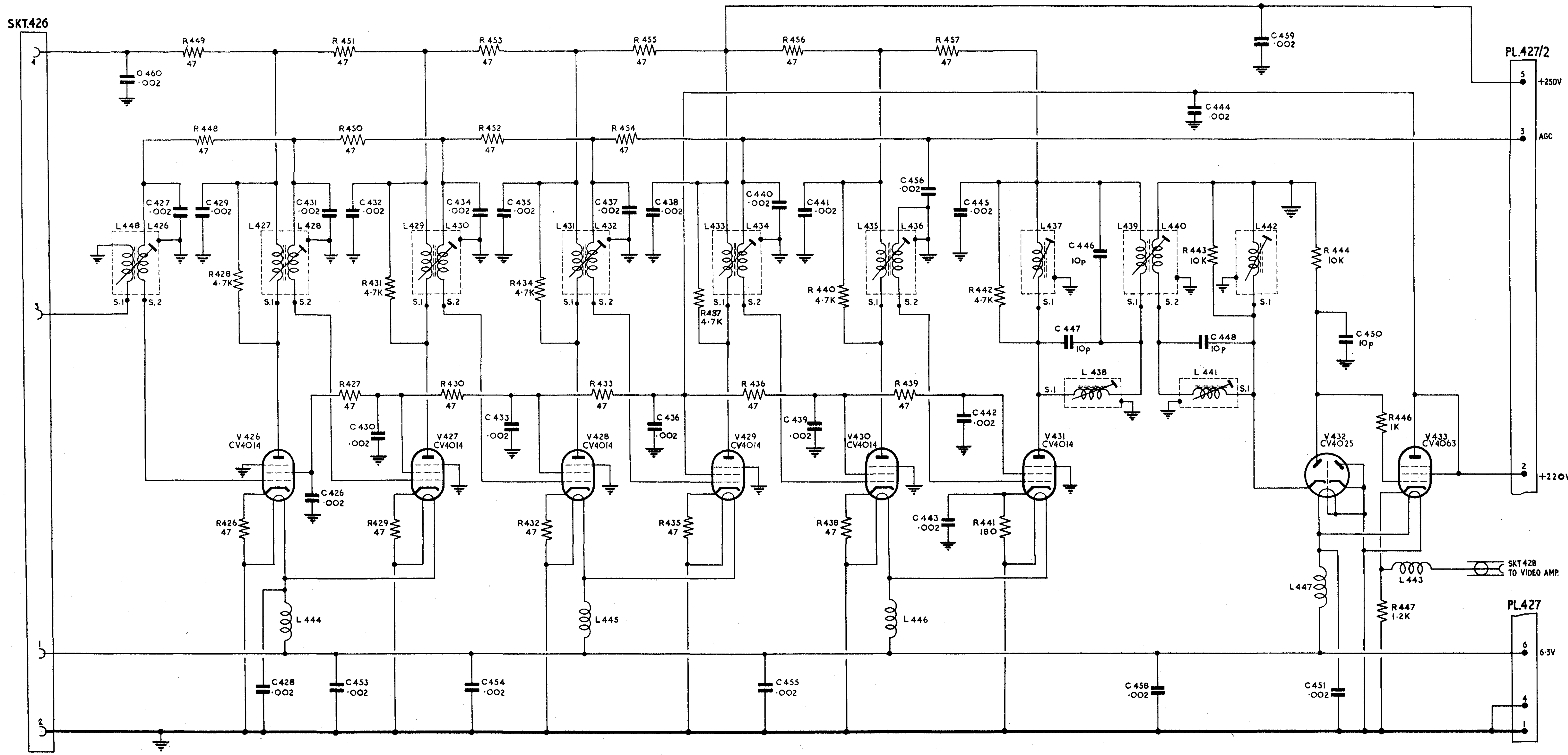


FIG.19c

AIR DIAGRAM
6277B/*MIN.*
ISSUE 2 PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

ARI. 5610-TR.3624-R.F. unit 147-circuit diagram & mechanical layout

Fig.19



AIR DIAGRAM
6277C/MIN.
ISSUE 2 — PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

D.2322. 0.281807. 5/63. S.W.Ltd.

ARI. 5610 - TR.3624 - I.F. unit 123-circuit

Fig.20

RESTRICTED

AIR DIAGRAM
6277F/MIN.
ISSUE 3 PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

D.2322. 0.281807. 5/63. S.W.Ltd.

ARI.5610-TR.3624- chassis assembly 6450-
chassis No.1-complete circuit

RESTRICTED

Fig.23

AIR DIAGRAM 6277G/MIN.

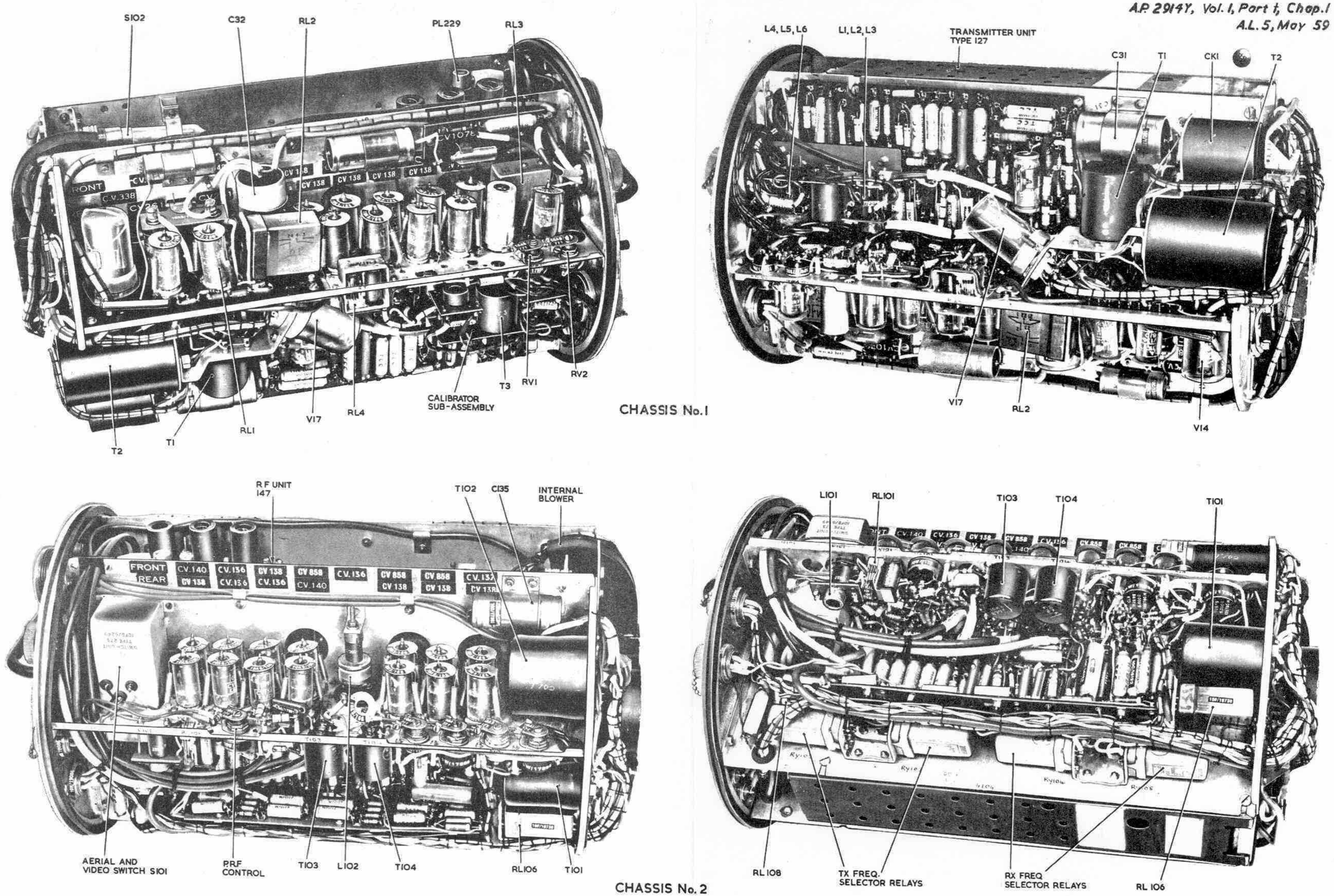
ISSUE 2 PREPARED BY MINISTRY OF AVIATION FOR PROMULGATION BY AIR MINISTRY

D.2322. 0.261807. 5/63. S.W.Ltd.

A R1.5610 - TR3624 - chassis assembly 6450 - chassis No.2 complete circuit

RESTRICTED

Fig. 24

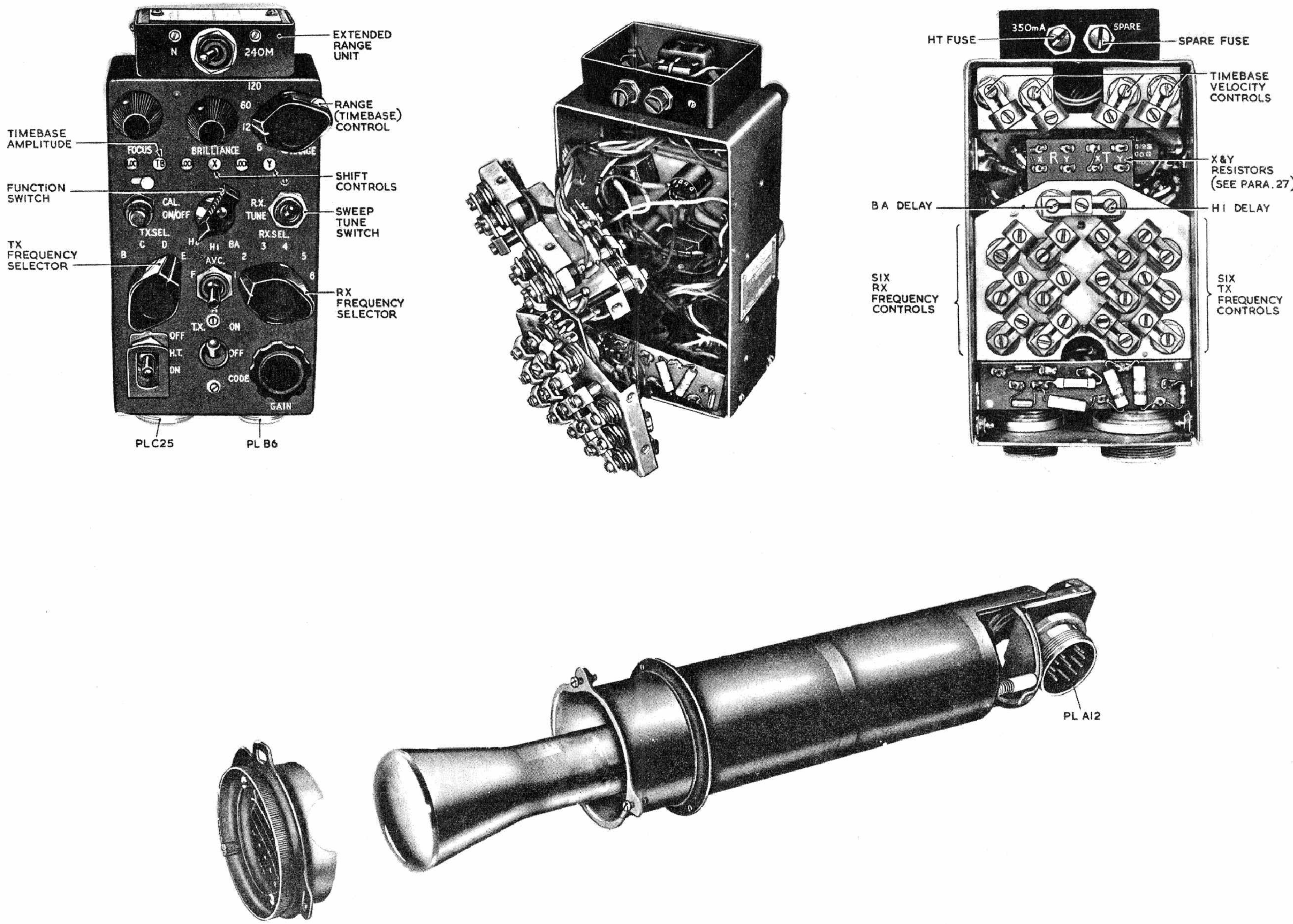


AIR DIAGRAM
6277H / MIN.
ISSUE 2 — PREPARED BY MINISTRY OF SUPPLY FOR PROMULGATION BY AIR MINISTRY

ARI.5610 Internal views of TR.3624

Fig. 25

D.2322. 0.281807. 5/63. S.W.Ltd.



AIR DIAGRAM 6277J/MIN.	
ISSUE 2	PREPARED BY MINISTRY OF SUPPLY FOR PROMULGATION BY AIR MINISTRY

A.R.I 5610 Views of Control Unit, Type 526 & Indicating Unit, Type 208

Fig. 26

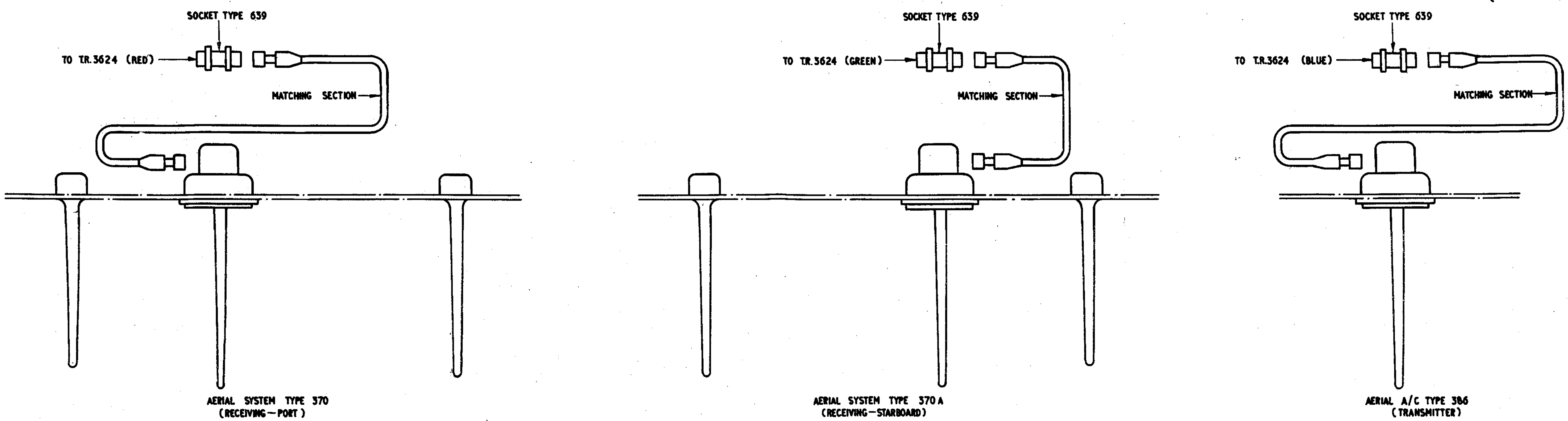


Fig. 15 Aerial installation, Anson: schematic diagram.

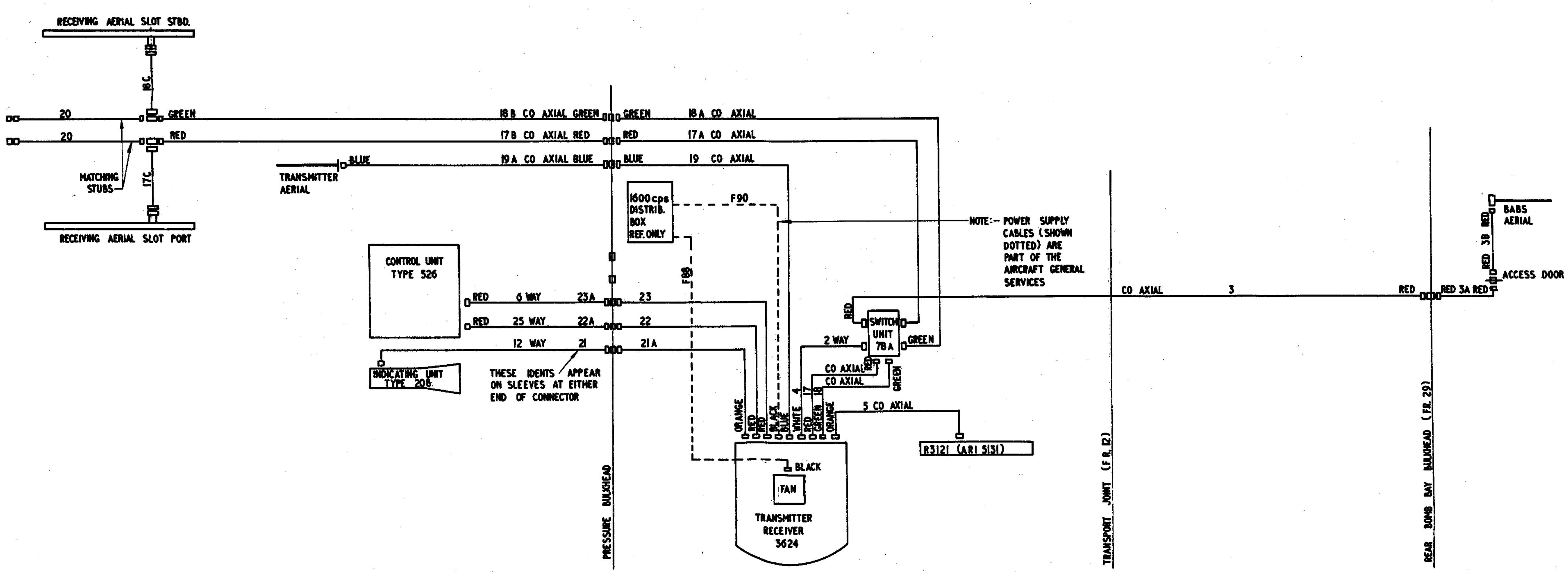


Fig.16 Aerial installation, Canberra: schematic diagram.

Fig. 15 & 16

Typical aerial installations: blade & suppressed types

Fig. 15 & 16