Chapter 1

TEST OSCILLATOR TYPE 9784

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

Function	A crystal controlled transmitter of very small r.f. power, designed to check the operation of homing systems installed in aircraft.
Frequencies	Two fixed frequencies 172 MHz and 344 MHz crystal controlled.
Output power	Approximately ◄200► µW at 172 MHz ◄20► µW at 344 MHz
Modulation	Approximately 800 Hz amplitude modulation not less than 15 per cent at 344 MHz. Approximately 800 Hz frequency modulation, frequency deviation being not less than 2 kHz and not greater than 20 kHz at 172 MHz.
Power supplies	Self-contained h.t. and l.t. battery (Ref.No. 5J/3474) HT 67.5V, LT 1.3V.
Dimensions	Cylindrical Length 9 in. Diameter 4 in.
Weight	4 lb (including battery).

Introduction (fig.1)

1. This is a crystal-controlled transmitter of very small r.f. power, used to check the operation of homing systems installed in aircraft.

2. It is a hand-held battery-operated unit which provides an amplitude modulated signal at 344 MHz and a frequency modulated signal at 172 MHz. The required frequency is selected by a switch near the collapsible aerial.

3. One crystal only, a wired-in Type 10XAC/40, operating at 21.5 MHz, is used in the oscillator.

4. Power is supplied from a self-contained cylindrical battery containing both h.t. and l.t. sources. The h.t. is derived from a Leclanche battery of 67.5V (nominal) and the l.t. from a single 1.3V Kalium cell. The oscillator operates satisfactorily with the h.t. down to 50V and the l.t. down to 1.2V. The battery is not supplied with the oscillator but must be requisitioned separately. It is known as a battery 67.5V, 1.34V (Ref.No. 5J/3474).

5. Two controls are provided:

(1) A three-position switch adjacent to the aerial. One position is for the 344 MHz output, one for the 172 MHz output and the middle position, marked TEST, is used for initial setting-up.

(2) A spring-loaded plunger in the handle operates the microswitch connected in series with the l.t. supply.

Construction (fig. 1 and 2)

6. The test oscillator is housed in a cylindrical metal case which is fully sealed and contains a desiccator fitted with a visible indicator. It may be held by the handle in either hand and operated with the thumb on the spring-loaded on-off switch. A two-section telescopic rod aerial is incorporated.

7. The selector switch, telescopic aerial and desiccator are on a circular metal plate fitted to the top of the chassis. A second circular plate, fitted to the lower end of the chassis, is provided with three off-set spigots which engage with corresponding slots on the main housing. The slots and spigots ensure that the microswitch is correctly aligned with the spring-loaded plunger when the oscillator is reassembled.

8. To prevent the ingress of moisture, a rubber gasket is placed between the top circular plate and a lip on the inside of the housing. The switch, aerial and plunger are also sealed.

9. The battery is in a cylindrical compartment clamped to the end of the main housing by a knurled screw-on clamping ring. Slots in the top flange of the compartment engage with the spigots on the chassis assembly. Additional gaskets fitted between the battery compartment and the main housing complete the sealing of the oscillator.

10. The battery is held in position by a coil spring in the bottom of the battery compartment. Connections from the battery to the chassis assembly are through a 4-pin plug.

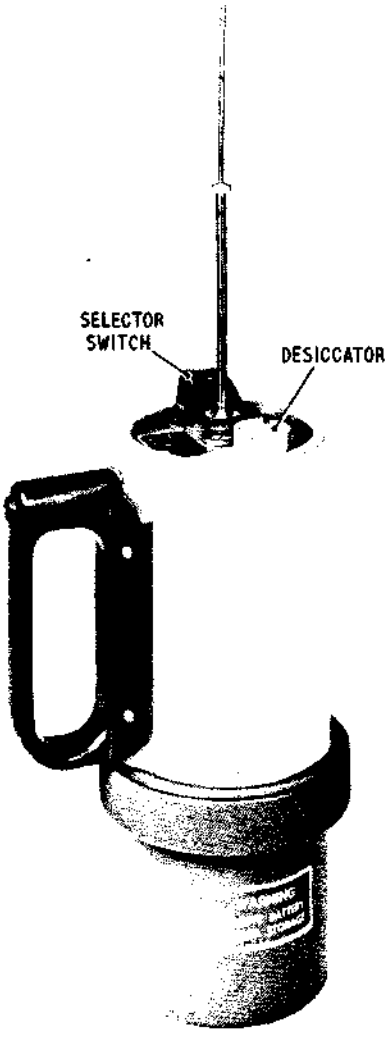


Fig.1 Test oscillator Type 9784 - general view

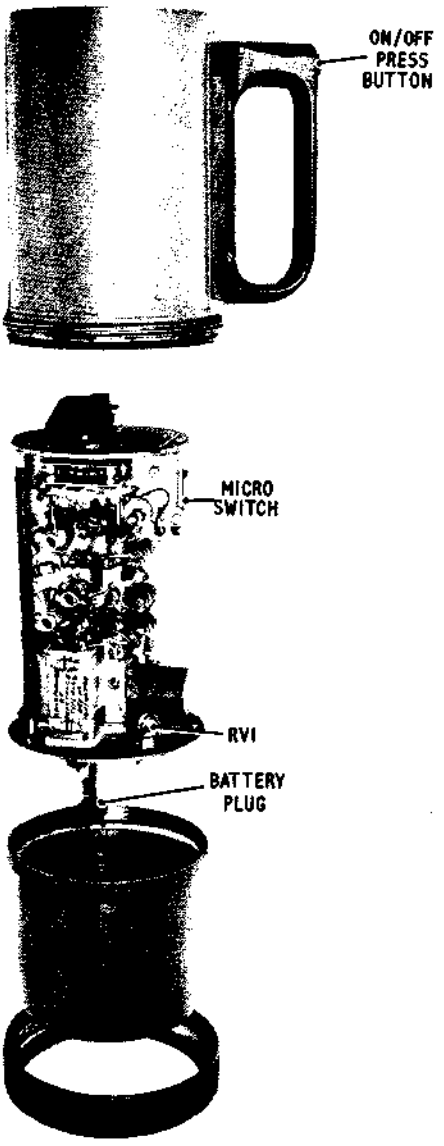


Fig.2 Test oscillator Type 9784 - exploded view

Circuit description (fig.3)

11. The pentode V6 is used as a triode, crystal-controlled, Pierce oscillator operating at the crystal fundamental frequency of 21.5 MHz. C29 and C36 are used to obtain the correct circuit constants for the crystal unit. Self-bias is provided by R14 and R15. To check oscillation of V6 test point TP5 is provided at the junction of R14 and R15, which gives a negative voltage with respect to chassis due to grid current through R15.

12. The voltage across the anode load of V6 is fed by C33 to the grid of V1. The anode load of V1, L2B (part of the reactor assembly L2) and L3 in series, is tuned by the dust-iron core of L3 to the crystal frequency, i.e. 21.5 MHz. Grid current flows through R2 and R3 and the voltage across R3 is brought out to TP1 to indicate the drive from V6.

13. The voltage across the anode load of V1 is fed by C5 to the grid of V2. Grid current flows through R4 and R5 and the voltage across R5 is brought out to TP2. This test voltage indicates the drive obtained from V1 and is used to obtain the correct tuning point of L3.

14. V2 is a frequency doubler. The anode load L4 has an adjustable dust-iron core and is tuned to 43 MHz. The voltage across the anode load of V2 is fed by C8 to the grid of V3. Grid current flows through R6 and R7 and the voltage across R7 is brought out to TP3 to indicate the drive from V2 and is used to obtain the correct tuning point of L4.

15. L5 forms the anode load of V3 and has an adjustable dust-iron core. With S1 in the 344 MHz position the whole of L5 is used and tuned to 86 MHz by trimmer C10. With S1 set to the 172 MHz, part of L5 is short-circuited and the remainder is tuned by C12 to 172 MHz. Thus V3 acts either as a doubler, with the switch at 344 MHz, or a quadrupler with the switch at 172 MHz.

16. Inductively coupled to L5 is L11. When S1 is set to 172 MHz the signal induced in L11 is fed to the aerial.

17. The voltage across the anode load of V3 is fed by C14 to the grid of V4, which acts as a quadrupler when the switch is at 344 MHz. The anode load of V4 consists of L8 tuned by trimmer C17 to 344 MHz. Inductively coupled to L8 is L10. When S1 is at 344 MHz, the signal induced in L10 is fed to the aerial.

18. In the 172 MHz position V4 is not required so to conserve the battery, the filament of V4 is switched out of circuit. MR1 rectifies the drive from V3 so that the voltage at TP4 can be used to enable L5 to be tuned in the 172 MHz position.

19. A modulation frequency of approximately 800 Hz is obtained from V5. A Hartley oscillator circuit is used, the frequency of which is controlled by the inductance of the tapped l.f. choke L9 and C24 and C31. Self-bias is provided by R11.

20. With S1 at 344 MHz, the output of the audio oscillator is fed by C22, R9 and r.f. choke L6 to grid-modulate quadrupler V4.

21. With the switch at 172 MHz the output of the audio oscillator is fed to coil L2A of the reactor assembly L2 which phase-modulates the oscillator voltage across the whole anode load of V1. Some control of the frequency deviation is afforded by RV1.

22. Since V4 is grid-modulated in the 344 MHz position, the drive voltage from L5 (as indicated at TP4) would be swamped by the audio modulating voltage. To enable L5 to be tuned correctly a TEST position is provided on the selector switch. In this position the modulation voltage is disconnected from V4 grid and L5 can be tuned using a meter connected to TP4.

Magnetic reactor assembly

23. A ferrite core carrying an r.f. winding is placed in the gap of a nickel iron core carrying an l.f. winding. The permeability of the ferrite core and therefore the inductance of the r.f. winding is affected by audio currents flowing in the l.f. winding. A permanent magnet is included in the magnetic circuit and it is arranged so that the ferrite core is working at the correct point on the hysteresis loop.

Servicing

Battery replacement

24. To fit the battery proceed as follows:

(1) Hold unit, with aerial pushed in, with battery compartment uppermost.

(2) Unscrew knurled clamping ring and remove battery compartment.

(3) Insert battery in compartment. Plug-in 4-pin plug and replace compartment, taking care that the locating spigots engage in the slots in both main housing and battery box.

(4) Ensure that the gaskets are retained in position.

(5) Replace clamping ring and tighten by hand.

(6) Change the desiccator.

Setting-up

25. Proceed as follows:

(1) Unscrew the knurled clamping ring and remove the battery compartment.

(2) Remove the chassis assembly from the main housing.

(3) Connect the battery.

(4) Set the selector switch to TEST and variable resistor RV1 fully counterclockwise.

(5) Connect the positive lead of a multimeter Type 1, set to the 250 µA d.c. range, to chassis, and the negative lead to test point TP5.

(6) Depress the microswitch and wait a few seconds for the oscillator to stabilize. The reading on the multimeter should be not less than 40 µA.

(7) Connect the meter negative lead to test point TP1 and depress the microswitch. The reading on the multimeter should be not less than 60 µA.

(8) Connect the meter negative lead to test point TP2. Depress the microswitch and adjust the core of L3 for maximum reading on the multimeter. This should be not less than 200 µA.

(9) Connect the negative lead to test point TP3, adjust the core of L4 for maximum reading on the multimeter. This should be not less than 270 µA.

(10) Connect the negative lead to test point TP4. Set trimmers C10 and C12 to midway. Adjust the core of L5 for maximum reading on the multimeter.

(11) Set the selector switch on the test oscillator to 172 MHz. Adjust C12 for maximum reading on the multimeter.

(12) Set the selector switch to TEST. Adjust C10 for maximum reading on the multimeter.

(13) Repeat (11) and (12) until no further adjustment is required for C10 and C12. The multimeter readings should be as follows:

Selector switch position	Multimeter reading
172 MHz	20 µA min
TEST	150 µA min
344 MHz	0.4 mA min

(14) Disconnect the multimeter.

(15) Set the selector switch to 344 MHz and extend the telescopic aerial. Using a u.h.f. transmitter-receiver ARC 52 set to 344 MHz, adjust C17 on the test oscillator for maximum modulated signal in the receiver headphones.

(16) Disconnect the battery.

(17) Unsolder the aerial wire from the feedthrough terminal adjacent to C10 and solder this wire to earth. Connect a tester, carrier deviation CT219 to the feedthrough terminal.

(18) Check that RV1 is still set fully counterclockwise and connect the battery to the test set.

(19) Set the selector switch to 172 MHz and depress the microswitch.

(20) Set the CT219 to 172 MHz and observe the deviation which shall be not less than 2 kHz and shall not exceed 20 kHz. If necessary adjust RV1 to bring the deviation within these limits.

(21) Disconnect the battery and the CT219. Reconnect the aerial wire to the terminal from which it was removed in sub-para (17).

(22) Reassemble the test oscillator ensuring that the rubber gaskets are in position.

(23) Renew the visible desiccator.

Operation

26. The proposed method of using the test oscillator to check the ARI.18120 homing equipment in the aircraft requires two operators. One to operate the test oscillator and the other to operate the ARC52 control unit and to act as an observer in the aircraft cockpit.

Note...

The test oscillator is not suitable for checking the elevation indication, as multiple path propagation may cause erroneous readings.

27. The operating procedure is as follows:

(1) Set the selector switch on the ARC52 control unit to ADF and the channel selector switch to 'M'.

(2) Select 344.0 MHz on the manual selector.

(3) Set AZIMUTH/ELEVATION to AZIMUTH and the meter sensitivity switch to MAX.

(4) With the telescopic aerial fully extended, the test oscillator should be held vertically about 10 ft to the port of the port aerial and to the starboard of the starboard aerial in turn. The observer in the cockpit should note that when the test oscillator switch is depressed:

(a) the vertical pointer moves to the left when the oscillator is on the port side of the aircraft, and conversely to the right with oscillator on the starboard side;

(b) the 800 Hz modulation note is present in the headphones.

28. Incorrect bearing indications may be obtained if the aircraft is in a hangar or on an aircraft carrier or near to large masses of metal.

Faultfinding

29. The following typical voltages and currents were made with a multimeter Type 1 (20,000 ohms/V). Variations of up to ±20% are not necessarily indicative of faults.

30. Battery voltages and currents:

	Handle switch OFF	Handle switch ON	
		344 MHz	172 MHz
HT volts	66	62	62
HT current	-	28 mA	27 mA
LT volts	1.35	1.23	1.25
LT current	-	0.55A	0.46A

31. Voltages on valve electrodes: (Handle switch ON)

	Anode	Screen
V1	60	59
V2	61.5	61.5
V3	61.5	61.5
V4	61.5	-
V5	53	37
V6	61.5	61.5

32. Audio volts r.m.s. measured on the 25V a.c. range of multimeter Type 1:

(1) TEST position - voltage between the junction C22/S1 and chassis = 20V.

(2) 172 MHz position - voltage between the junction of C22/S1 and chassis = 8V.

(3) 344 MHz position - voltage between the junction of L6/R9 and chassis = 3.0V.

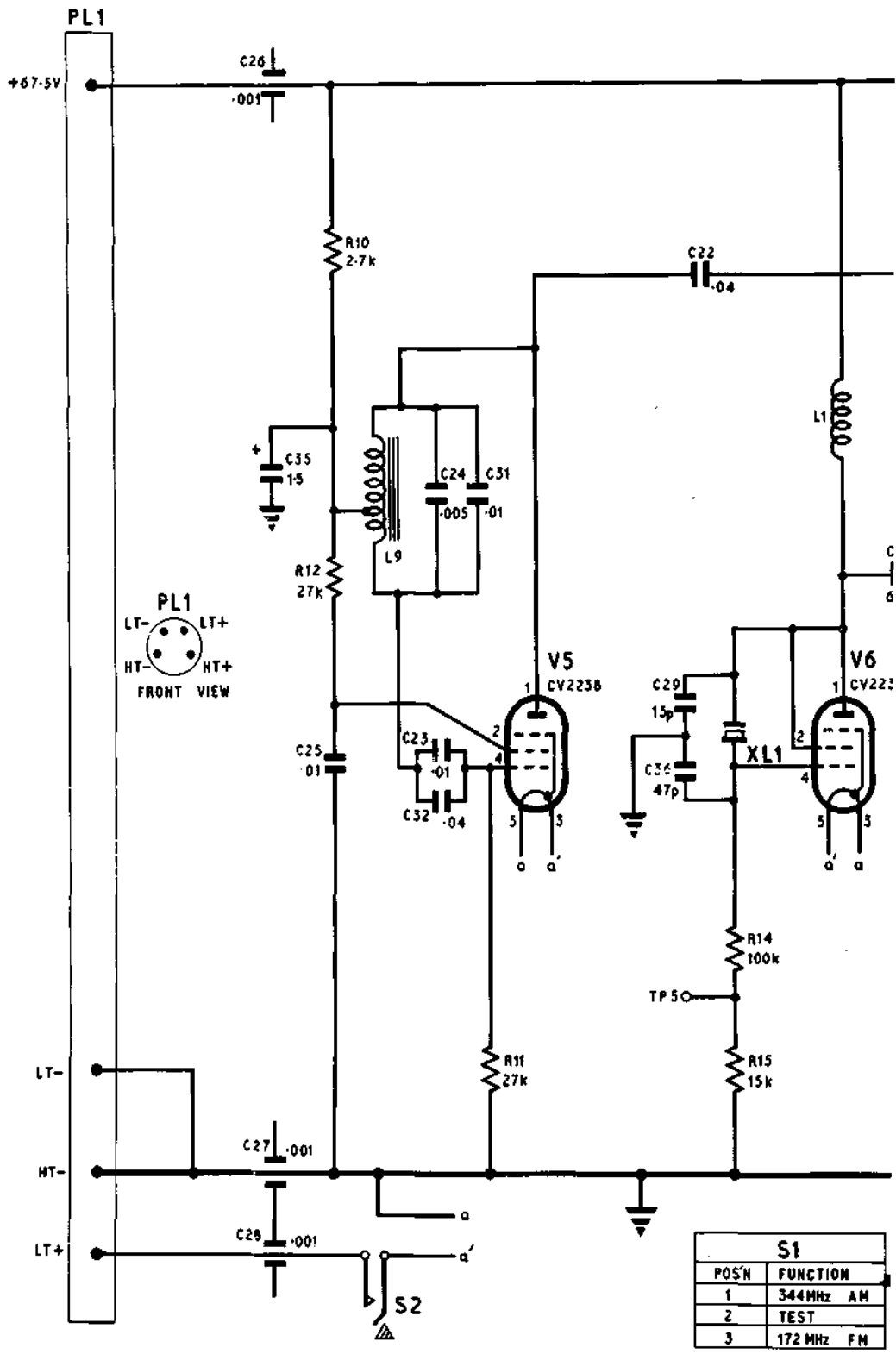
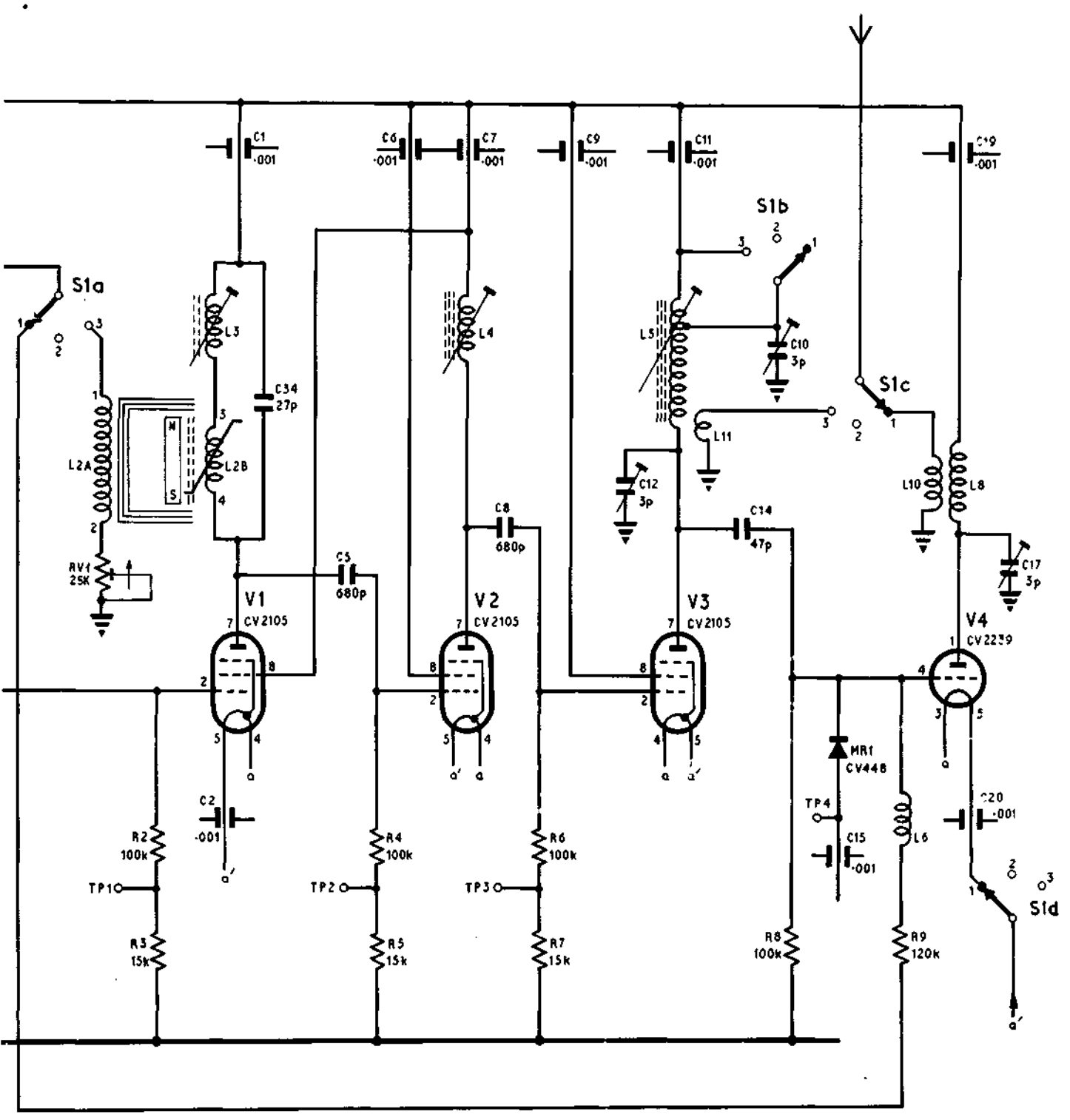

PL1
+67·5V
C26
·001
R10
2·7k
C22
·04
L1
C35
1·5
C24
·005
C31
·01
L9
R12
27k
PL1
LT-
LT+
HT-
HT+
FRONT VIEW
V5
CV2238
V6
C29
15p
C36
47p
XL1
C25
·01
C23
·01
C32
·04
R14
100k
TP5
R11
27k
R15
15k
LT-
HT-
LT+
C27
·001
C28
·001
S2
S1
POS'N
FUNCTION
1
344MHz AM
2
TEST
3
172 MHz FM

Fig. 3

Test



* MODS. INCORPORATED IN THIS DIAGRAM

MOD. No.	5586	6212	A3460
STRIKE OFF	2	3	4

cillator Type 9784: circuit.

Fig. 3