INSTRUCTION AND MAINTENANCE MANUAL

FOR

AM/FM SIGNAL GENERATOR

MODEL 61A

Fig. 1.

TAYLOR ELECTRICAL INSTRUMENTS LIMITED
419/424 MONTROSE AVENUE, SLOUGH, BUCKS, ENGLAND
Telephone: SLOUGH 21381 Telegrams: TAYLINS, SLOUGH

MEMBER OF THE METAL INDUSTRIES GROUP OF COMPANIES

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ABBREVIATIONS

A.M. = amplitude modulation
F.M. = frequency modulation
I.F. = intermediate frequency
C.W. = continuous (unmodulated) wave
A.C. = alternating current
D.C. = direct current
R.M.S. = root-mean-square
R.F. = radio frequency
signal = adjusted output of signal generator.
A.F. = audio frequency
P.-P. = peak-to-peak
C.R.O. = cathode-ray oscilloscope
c/s = cycles per second
Kc/s = kilocycles per second
Mc/s = megacycles per second
V = volt
mV = millivolt
dB = decibel

1. INTRODUCTION

61A

This instrument is designed mainly for the servicing of A.M. and F.M. high-frequency receivers and the intercarrier I.F. stages of television receivers, but has wide applications in development laboratories and test-rooms; it can also be used in the field if A.C. mains is available. It provides, in conjunction with an oscilloscope (such as the Taylor 31A or 32A), complete facilities for the sweep alignment of the R.F., I.F., and discriminator or ratio detector stages of A.M. and F.M. receivers. The speedy and accurate method of ratio detector alignment, using simultaneous A.M. and SWEEP signals, is available.

The A.M. generator covers the range 4-120 Mc/s in 5 bands, all on fundamentals. The F.M. and sweep section also operates on fundamentals, avoiding the confusion and poor frequency-accuracy inherent in the frequency-difference method. The F.M. and sweep bands cover the frequencies 4-12 Mc/s and 70-120 Mc/s in 3 bands. The A.M. generator may be used as a marker during sweep alignment. A variable-phasing network is incorporated, and retrace blanking of deflection is provided.

The audio modulation is at 400 c/s. A separate output for this is provided, so that tests with this frequency can be performed on audio circuits.

Deviation on F.M. is variable up to 100 kc/s from the mean carrier frequency at a modulation rate of 400 c/s. The sweep covers a total band width of 1 Mc/s at power line frequency, 40 to 60 c/s. A crystal calibrator circuit, with switch selection of any one of three internally-mounted crystals, is incorporated. A 5 Mc/s crystal can be normally supplied at extra cost, but other crystals, which may be selected in the frequency range 1-11 Mc/s, can be fitted easily.

All the facilities offered in the 61A model are selected by switching, no cross-connections external to the instrument being necessary. There is choice of C.W., A.M., F.M., SWEEP plus C.W., or SWEEP plus A.M. by internal switching. When using the SWEEP facility, the marker amplitude may be continuously varied.

A five-section attenuator with a non-inductive potentiometer ensures accurate attenuation over the whole frequency range. Radio frequency leakage has been reduced to a minimum by careful shielding of both the attenuator sections and both oscillator sections.

2. FUNCTION OF INSTRUMENT

2.1 General

This instrument supplies test signals for radio-frequency equipment of all kinds, and covers the range 4 to 120 Mc/s when amplitude-modulated (A.M.), and 4 to 12 and 70 to 120 Mc/s when frequency modulated (F.M.). The A.M. can be used as a marker to the sweep. The return deflection (flyback) can be blanked when a C.R.O. is used for display, for which the necessary time-base voltage is provided.

2.2 Amplitude-modulation

Radio-frequency receivers for A.M. signals are in wide use, and must be tested for performance with signals having frequency and waveform similar to those that form the normal input of such receivers. Ideally, amplitude-modulation leaves the steady carrier-frequency unchanged, but two bands of side-frequencies are added; each of these bands represents exactly the original audio or video signal conveyed by the carrier. In the receiver, the modulated carrier is rectified and the audio or video frequencies filtered from the carrier and other high frequencies, which are no longer wanted.

Alternatively, the incoming modulated-carrier signal can be mixed with a signal from a local oscillator, as in every supersonic-heterodyne receiver (" superhet "). The oscillation frequency is so adjusted that the difference between the frequencies of the local oscillator and the modulated-carrier falls into the pass-band of the intermediate-frequency amplifier of the receiver. The newly modulated carrier is finally demodulated by the second rectifier, and the audio-frequencies are filtered from the higher frequencies, which are no longer wanted.

2.3 Frequency-modulation

In this system of radio transmission, now also widely used, the carrier is maintained constant in amplitude, and the frequency is varied from its steady or mean value to a new frequency, which depends on the amplitude of the audio waveform at every instant. There is a maximum deviation of the carrier frequency from its steady value, both above and below, when modulated. The side-bands added to the original carrier are many times wider than the maximum in the original modulating waveform, and thus extend considerably above and below the unmodulated carrier.

During transmission, there are usually spurious changes in the relation between the unmodulated carrier and the side-frequencies, and it is the function of the *limiter* in the receiver to restore the received modulated carrier to a constant amplitude. A *discriminator* in the receiver converts the frequency-modulated carrier into the desired audio waveform.

2.4 Range of performance

The present instrument uses the standard audio-frequency of 400 c/s for both A.M. and F.M. With A.M., the depth of modulation is approx. 35% and with F.M. the maximum deviation can be varied between zero and 100 kc/s.

A feature of the equipment is the provision for the addition of the A.M. signal to the F.M. signal. When the demodulated output is observed as an S-curve (Fig. 7.5) on a C.R.O., using the sweep, the trace shows the amplitude-modulation marking the S-curve, to show the exact division of the frequency scale.

2.5 Crystal verification

A separate crystal oscillator provides a frequency standard for verifying the calibration. One crystal is supplied as an extra, but there is provision for two further crystals, the selection being by a switch on the front panel. The beat-note can be monitored at the A.F. OUT jack.

2.6 50 c/s X-deflection voltage

From the mains transformer there is available a deflection voltage for C.R.O. display. It has a phase-shifting control that enables the S-curve display to be adjusted to give two closely-positioned traces (Fig. 7.2). The BLANKING control is a push-button switch that, when depressed, eliminates one of these two traces, and a single trace, as in Fig. 7.3, is displayed.

3. DESCRIPTION OF INSTRUMENT

3.1 Front panel. (See Fig. 1)

All the controls and sockets (except S6 and S8) are on the front panel and are arranged as follows:

(*a*) *Mains Switch ON* (near bottom right) when raised switches on the entire apparatus, and lights the adjacent neon lamp. About five minutes should be allowed for the circuits to stabilize.

(*b*) *A.F. OUT* (bottom left) is the audio 400 c/s jack output for general audio testing. The output impedance is approx. 100 ohms. and unbalanced.

(*c*) *X OUT* is the jack for mains-frequency time-base voltage for the oscilloscope.

(*d*) *R.F. OUT* is the coaxial output socket for the radio-frequency test signals. The output impedance is 75 ohms.

(*e*) *R.F. LEVEL.* This control (V.R.4) is at the extreme left of the lowest row and adjusts the voltage to a datum level as indicated on the meter, which is connected across V.R.5, the potentiometer that feeds the switched output attenuator.

(*f*) *DEVIATION.* This control (V.R.1) pre-determines the deviation, from zero to 100 kc/s, in the frequency-modulated wave.

(*g*) *Attenuator* (*X.E.o.*). This control varies the output voltage in steps of ratio 10:1, *i.e.*, 20 decibels (dB) each, below 100 mV.

(*h*) *Attenuator* (*E.o.*). This control varies the output voltage continuously: its scale is marked in unit steps from 1 to 10.

(*i*) *XTAL.* The control (S3) on the right of the front panel switches any one of three crystals to determine the verifying frequency generated by a separate internal oscillator.

(*j*) *F.M. BAND.* This control (S1) at the left of the upper row, determines which of three frequency bands is in use for frequency modulation.

(*k*) *FUNCTION.* This central control (S2) selects one of the following functions:

(i) Continuous wave (C.W.)
(ii) Amplitude-modulated wave (A.M.)
(iii) Frequency-modulated wave (F.M.)
(iv) Sweep and continuous wave (SWEEP & C.W.)
(v) Sweep and amplitude modulation (SWEEP & A.M.)

(*l*) *A.M. BAND.* The control (S4) on the right of the panel selects for amplitude-modulation one of the five bands available.

(*m*) *F.M. DIAL.* This is the left-hand dial on which, by a Perspex pointer, the frequency of the carrier for frequency-modulation is indicated.

(*n*) *A.M. DIAL.* This is the right-hand dial on which, by a Perspex pointer, the frequency of the carrier for amplitude-modulation is indicated.

(*o*) *OUTPUT LEVEL.* In the top centre is a meter for indicating that the setting of the R.F. LEVEL control gives the datum voltage of 100mV of the R.F. output.

3.2 Back of Instrument

A three-core cable brings mains to the back of the instrument. Here the termination includes series inductors, capacitor shunts, a switch (S8) for accepting 240, 210, or 115 volt, 40-60 c/s, and one of two fuses 0·5 A for the higher and 1·0 A for the lower voltage, both being provided. From this termination is a lead to the mains transformer on the chassis attached to the front panel, which is detachable from the case.

4. SPECIFICATION

4.1 A.M. Generator

R.F. Frequency Ranges:	(1) 4 – 8 Mc/s. (2) 8 – 16 Mc/s. (3) 16 – 32 Mc/s. (4) 32 – 60 Mc/s. (5) 60–120 Mc/s.
Calibration Accuracy:	±1%.
Modulation:	Approx. 35% at 400 c/s.
Envelope Distortion:	Not greater than 5%.
R.F. Output:	100 mV. ± 10% unbalanced (coaxial) to ground. Monitored by crystal diode voltmeter.
R.F. Attenuation:	Coarse: 5 steps of 20 dB. Fine: Variable from 1–10 (linear).
Audio:	Up to approx. 1 V. R.M.S. at 400 c/s.

4.2 F.M. Generator

Frequency Ranges:	(A) 4 – 7 Mc/s. (B) 7 – 12 Mc/s. (C) 70–120 Mc/s.
Calibration Accuracy:	± 2%.
Deviation:	Variable from substantially zero to ± 100 Kc/s at 400 c/s.
Deviation Accuracy:	± 5 kc/s or ± 10%, whichever is the greater deviation.
Distortion:	Less than 3% at 100 Kc/s deviation.
Noise:	Not greater than −40dB relative to 100 Kc/s deviation.
Attendant A.M.:	Adds less than 1 dB at 100 Kc/s deviation.
R.F. Output:	100 mV. ± 10% unbalanced to ground. Monitored by crystal diode voltmeter.
R.F. Attenuation:	Coarse: 5 steps of 20 dB. Fine: Variable from 1–10 (linear).

4.3 Sweep Generator

Frequency Ranges:	(A) 4 – 7 Mc/s. (B) 7 – 12 Mc/s. (C) 70–120 Mc/s.
Bandwidth:	Variable up to 1 Mc/s total at power line frequency.
Carrier Shift:	Not greater than 2%.
Blanking:	An internal switch is provided to allow blanked or unblanked operation. An internal phase control allows variation of external sweep phase over approximately 165° with an output level of 8V. peak-to-peak.

Attendant A.M.:	Adds less than 2 dB.
R.F. Output:	Adjustable to 100 mV. ± 30%. Unbalanced to ground.
R.F. Attenuation:	Coarse: 5 steps of 20 dB. Fine: Variable from 1–10 (linear).
4.4 Crystal Calibrator: (See Note below)	Three sockets for mounting quartz crystals are provided within the instrument, selected by a front-panel switch to allow the C.W. or A.M. generator section to be monitored; crystals within the frequency range 1–11 Mc/s (with certain restrictions) can be supplied at extra cost.
4.5 Power Supply:	105–125, 200–250 V., 40–60 c/s.
4.6 Weight:	Approx. 21 lb. (9·5 kg.).
4.7 Dimensions:	13″ × 9″ × 8″ (33 cm × 23 cm × 20 cm).
4.8 Accessories:	1 Model 480 minimum-loss pad, 75–300 ohms. 1 Model 485 terminated 75-ohm coaxial cable with terminals giving choice of isolated or unisolated live lead. 1 Audio output jack plug. 1 Horizontal deflection output jack plug.
4.9 Optional Accessories: (at extra cost)	Model 481: Standard " All-Wave " dummy antenna. Model 482: Unterminated 75-ohm coaxial cable. Model 483: Terminated 75-ohm coaxial cable with isolated earth and live leads (for use with A.C./D.C. receivers). Model 484: Terminated 75-ohm coaxial cable with isolated live lead. (To protect generator from receiver high-tension supply).

Note: The above crystal units can be obtained at extra cost. The crystals are Standard Telephones and Cables Ltd., London, type 4044. The frequency recommended is 5 Mc/s.

5. DESCRIPTION OF CIRCUIT

5.1 Block diagram

Because the units of the instrument are used in several different ways, they will the more easily be understood from the block diagram. Fig. 2, than from the main circuit, Fig. 10, which is detailed later. The way in which the units are switched to co-operate will be made clear from the applications of the instrument. The functional parts are:

(*a*) *Mains Supply*, which provides the voltages for all the units, including low-voltage at mains frequency for the X-deflection voltage.

(*b*) *Audio-frequency oscillator* at 400 c/s for amplitude-modulating or frequency-modulating the appropriate radio-frequency oscillator.

(*c*) *Frequency-modulation section* in which a reactance is varied at 400 c/s or mains frequency, and so controls the frequency-modulation of a radio frequency oscillator.

(*d*) *Radio-frequency oscillator*, the frequency of which is determined by preset tuned circuits and the reactance circuit of (*c*) above.

(*e*) *Radio-frequency oscillator*, the frequency of which is determined by preset tuned circuits, with available amplitude-modulation at 400 c/s.

(*f*) *Crystal oscillator*, which verifies the frequencies of the oscillator above by heterodyning, the beat-note being amplified by the valves which normally oscillate at 400 c/s.

(*g*) *Attenuator*, which is in two parts, one continuously variable over a decade of amplitude, the other in decade steps, the output being a known loss on an adjusted level set by reference to a meter.

5.2 Mains supply

Single-phase 40-60 c/s mains supply is brought in from a three-core cable. In the live leads are chokes L14 and L15 and capacitors C49 and C50 to earth, which form a filter to reject high-frequency currents from the mains. The live lead most remote from earth has the mains fuse F1 and the mains switch S7; the other live lead passes through a mains voltage selector switch S8 to tappings on the mains transformer T2, which has an earthed screen between the windings. Across the primary winding is an indicating neon lamp.

5.3 High-tension supply

This is taken from a secondary winding through a bridge-rectifier RT4 and a resistor-capacitor filter C46 – R36 – C45.

5.4 Low-tension supply

This is taken from a centre-tapped secondary, half the voltage A going to V2 and V3, half the voltage B going to V1, both returning to the centre tap, which picks up the earth from the mains and extends it throughout the circuit and chassis.

5.5 Phasing circuit

This is a resistor-capacitor network to alter the phase of the mains supply when used as a time-base. The low voltage is taken from the AB secondary of the mains transformer. Phasing is controlled by one variable resistor VR6 at the base of the instrument, and extended to X OUT jack J2. The output impedance of this mains time-base voltage is high.

5.6 Audio oscillator, 400 c/s

The pentode section of valve V3 sustains oscillations in a resistor-capacitor phase-shift network with a fine adjustment in the capacitor C34. This network drives the grid of the pentode, the anode of which drives the triode section through C35. Positive feedback for the network is taken from the cathode of the triode.

The anode of the triode V3b drives the output transformer T1, which has two output windings. One output winding leads to three contacts on the switch S2 and then to a potentiometer VR2. The current passes through the split controlling winding L1 of the reactor L2. Tapped off this circuit is an AF OUT jack on the front panel, which can supply 400 c/s or 50 c/s, depending on the position of S2. The other output winding leads to one contact on switch S2 (above) and then to S3 and S4, to modulate the A.M. oscillator.

5.7 Crystal oscillator

The triode V2a is a Pierce-type oscillator. S3 selects the crystal inserted between the anode and grid of V2A.

5.8 A.M. oscillator

The triode V2b acts as a high-frequency Colpitts-type oscillator, the frequency of which is determined by the inductors L6, etc., in series with the capacitors C24, etc., switched through S4, all of which are preset. The exact frequency of oscillation is determined by the variable split-stator capacitor C23, which is driven by a reduction gear from the right-hand knob on the front panel, which also indicates the calibrated frequency on the appropriate A.M. scale.

5.9 Crystal verification

When a crystal is switched into circuit, V2a and V2b triodes are coupled through C16 between the cathodes. The audio beat-note is filtered from the high-frequency components in the anode circuit by C21, and fed, via C14, to the grid of V3B, which stops oscillating and forms, with the accompanying triode, an amplifier for the beat-note through the A.F. OUT jack J1. Adjustment of the right-hand knob on the front panel, indicating the frequency on the appropriate A.M. scale, determines the beat-note.

5.10 F.M. oscillator

The triode V1a acts as a Colpitts-type oscillator, the frequency being determined by the preset inductors L3, etc, and the sections " A ", etc, of the reactor L2, switched by S1, and the preset capacitors C3, etc. The exact frequency of oscillation is determined by the variable capacitor C6 which is driven by a reduction gear from the left-hand knob on the front panel, which also indicates the frequency on the appropriate F.M. scale. Frequency modulation is effected by varying the inductance " A ", etc, by the current (at 400 c/s) in L1 when this is switched in by S2 from V3. Thus, at constant amplitude, the frequency of oscillation is varied at 400 c/s about a steady value, which is indicated on the appropriate F.M. scale on the front panel. The preset permanent magnet N. is to linearize the performance of L2, and under no circumstances should any attempt be made to re-adjust it. The output of this oscillator is taken from the cathode resistor R13 via capacitor C41 and coaxial lead to the switch S2.

5.11 Blanking

When the switch S2 is in either of two positions and S6 (operated through the base of the case) closed, high-tension is applied to V1b. Low mains voltage from B is applied to the grid of this valve, but only the negative half-cycle is effective, because the positive half-cycle is short-circuited (clamped) to earth by rectifier RT2. The negative pulse on the grid results in a large positive pulse on the anode of V1b. In V1a, the grid is held negative by grid oscillatory current integrated by C7, so that RT1 is ineffective until a pulse passes to C8. The impulse passed on to the grid of V1a makes it so negative that the valve ceases to maintain oscillation. On alternate half cycles there is therefore no output of the oscillator, and therefore a horizontal line is displayed on a C.R.O. It follows that closing the blanking switch S6 permits oscillation only during alternate half cycles of the mains supply; there is correspondingly no deflection vertically on the cathode-ray oscilloscope display but a horizontal *zero* or *reference line*, to which the vertical deflection, effective during the alternate half cycles, can be referred. See Figs. 7.1 and 7.2.

5.12 Meter

This has a red calibration mark and is for setting a reference level to be applied to the attenuator. The rectifier RT3 and integrating capacitor C43 are in shunt with the meter.

5.13 Attenuator

This is in two parts, a potentiometer VR5 and a number of fixed pads switched by S5.

The potentiometer is continuously variable by the front panel knob, which reduces the datum maximum of ten down to nearly zero in unit steps. The pads diminish the datum maximum in the ratio of 10 (20 dB) through each step, as clearly marked on the scale.

5.14 Output cable

The attenuator is connected to a coaxial socket (R.F. OUT) on the front panel for a plug at the end of a flexible cable. At the end of this is a terminating unit from which a balanced or unbalanced output can be obtained, the impedance level being 75 ohms.

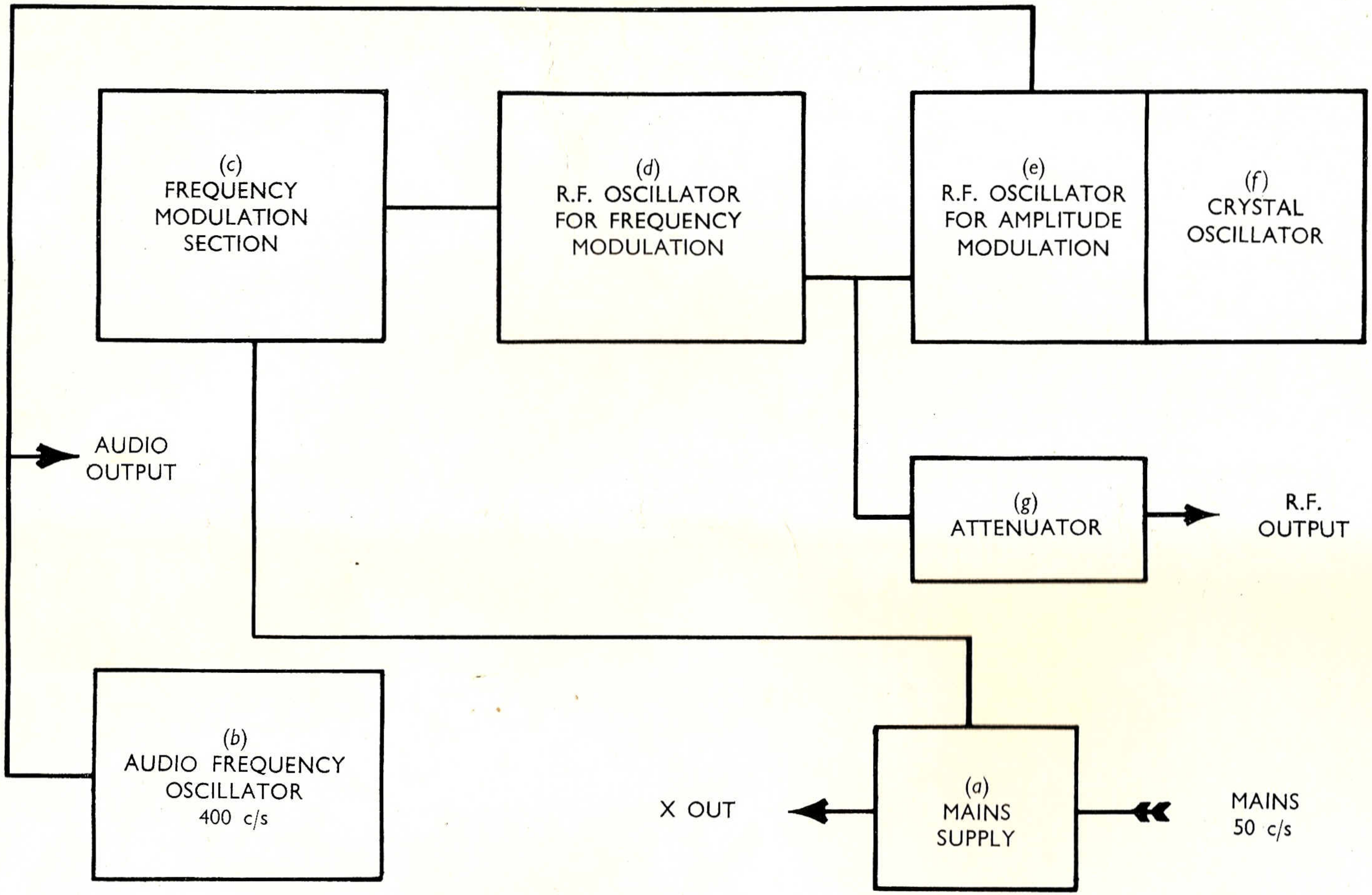


Fig. 2. Block diagram of Instrument

For explanation of diagram, refer to Section 5

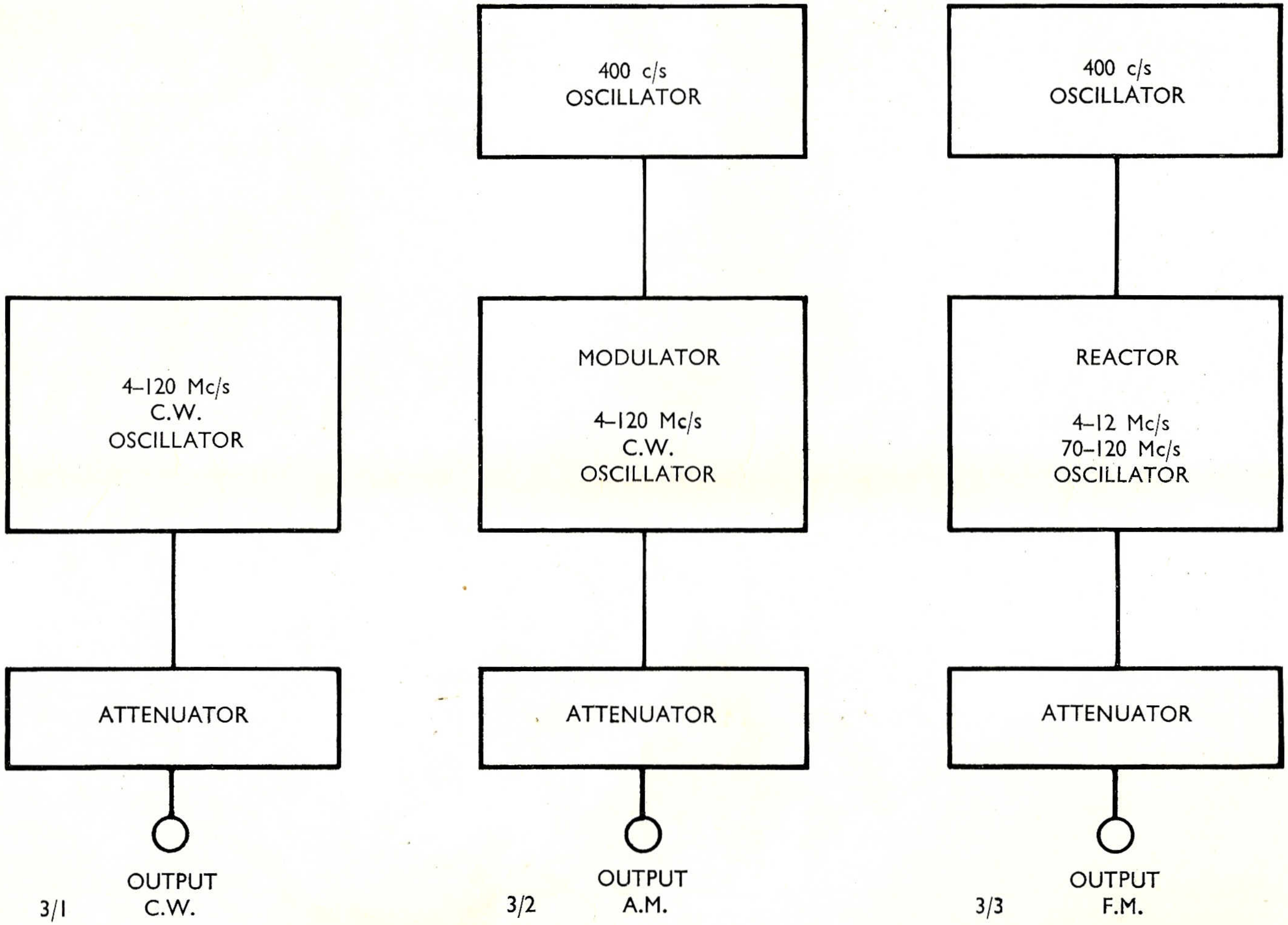


Fig. 3. Functions without Sweep

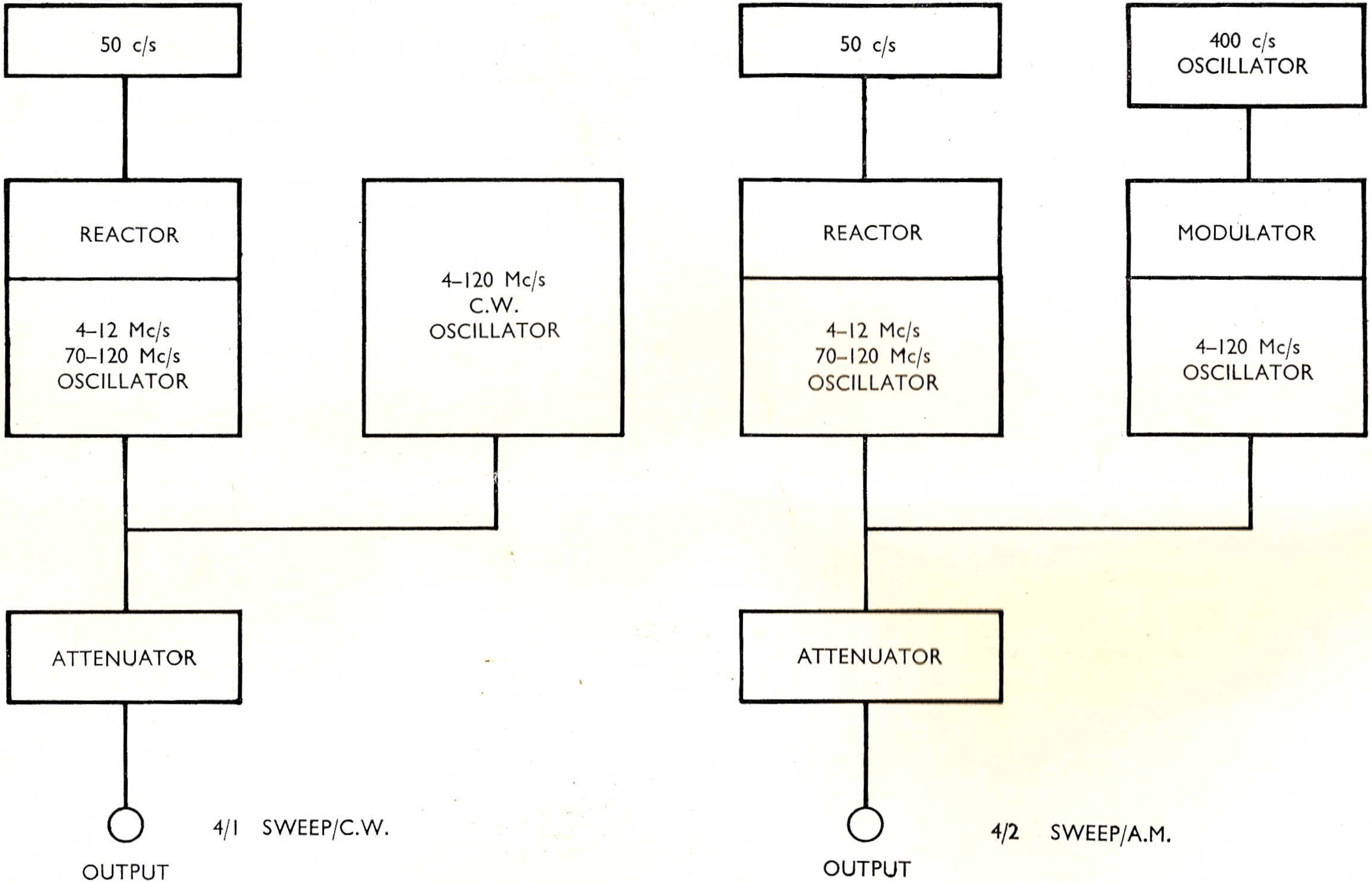


Fig. 4. Functions with Sweep

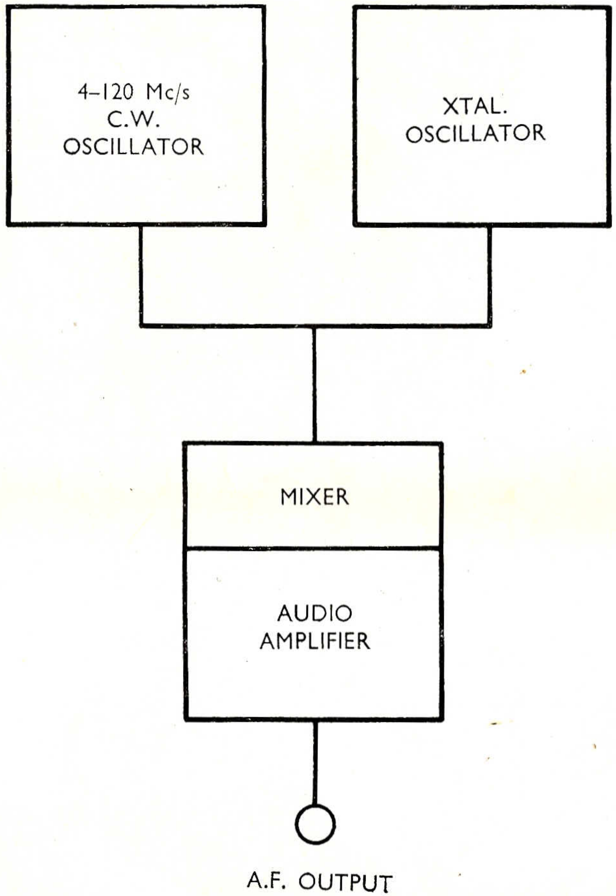


Fig. 5. Crystal Calibration

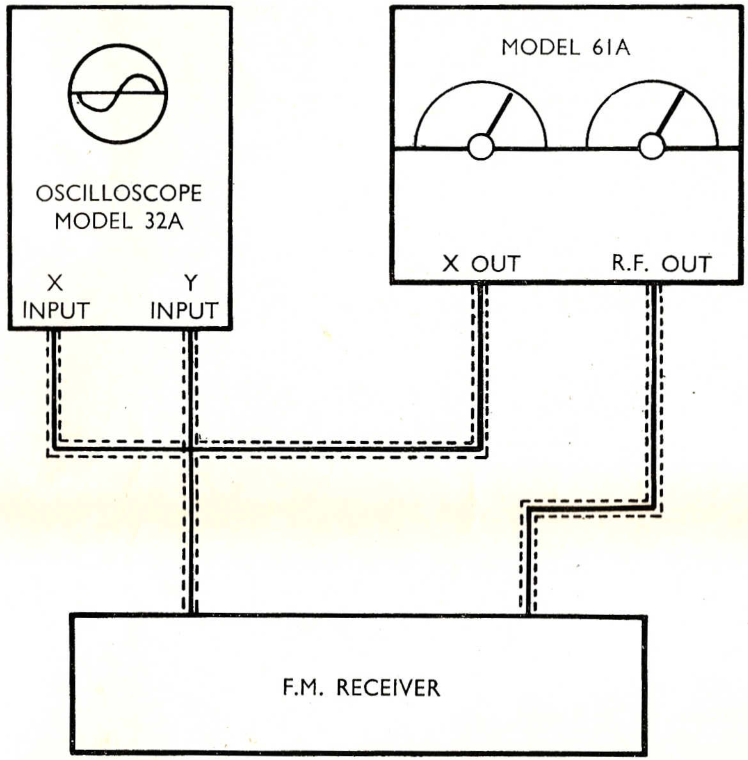


Fig. 6. Testing F.M. Receiver

6. OPERATING INSTRUCTIONS

6.1 General

Note: Not all models of this instrument are fitted with the OUTPUT LEVEL meter. If your model is without this meter, ignore all references to the meter that appear in the following paragraphs.

As a source of high-frequency signal voltage, at adjustable and known level, the instrument can be used for a wide variety of tests, particularly of the frequency-response and sensitivity of receivers of all kinds (with A.G.C. temporarily disconnected) and of filters and transformers.

6.2 Receiver alignment

The instrument is specially designed for the display of frequency responses on a C.R.O., for which the time-base voltages are provided. It thereby facilitates visual observation of the result of the adjustment of any of the components which can be varied in a receiver under test. It enables responses to be adjusted to within a prescribed standard.

6.3 Continuous wave (Fig. 3.1)

The instrument can be used as a simple source of known voltage, which can be attenuated in known steps, for determining sensitivity and high-frequency responses of radio-receivers, filters, transformers, antennae, etc. The operation is performed as follows:

(*a*) Set the FUNCTION control to C.W.
(*b*) Select the frequency-range to be covered on the A.M. BAND switch.
(*c*) Set the frequency on the A.M. dial (right-hand).
(*d*) Adjust the R.F. LEVEL control so as to bring the pointer on the OUTPUT LEVEL meter to the red line; full output voltage is then 100 mV. at 75 ohms impedance level.
(*e*) Adjust the output voltage range on the step-attenuator $X.E._o$.
(*f*) Adjust the output voltage on the variable attenuator $E._o$.
(*g*) Take the signal output from the R.F. OUT socket.

6.4 Amplitude-modulated wave (Fig. 3.2)

The continuous wave is amplitude-modulated with 400 c/s, which is useful in determining the overall sensitivity of receivers, up to a loudspeaker or other load, the audio output power being measured by any suitable means. The adjustments are as follows:

(*a*) Set the FUNCTION control to A.M.
(*b*) Select the frequency range on the A.M. BAND switch.
(*c*) Set the frequency on the A.M. dial (right-hand).
(*d*) Adjust the R.F. LEVEL control as described in para. 6.3(*d*).
(*e*) Adjust the output voltage as described in para. 6.3 (*e*) and (*f*).
(*f*) Take the signal output from the R.F. OUT socket.

Note: The XTAL control must be set to the OFF position while the A.M. facility is being used. If the control is set to another position, the audio oscillator is put out of action and there is no A.M. output.

6.5 Frequency-modulated wave (Fig. 3.3 and 7.7 to 7.9)

The continuous wave is frequency-modulated by any adjustable amplitude of 400 c/s up to the calibrated $\pm$ 100 kc/s deviation. The accompanying amplitude-modulation is very low, being less than one decibel relative to the F.M. wave. To obtain this F.M. facility:

(*a*) Set the FUNCTION control to F.M.
(*b*) Select the frequency range on the F.M. BAND switch.
(*c*) Set the frequency on the F.M. dial (left-hand).
(*d*) Adjust the R.F. LEVEL control as described in para. 6.3 (*d*).
(*e*) Adjust the output voltage as described in para 6.3 (*e*) and (*f*).
(*f*) Set the deviation on the DEVIATION control, which is marked in steps of 5 kc/s up to a maximum of 100 kc/s.
(*g*) Take the signal output from the R.F. OUT socket.

6.6 Sweep with continuous wave (Fig. 4.1 and 7.1 to 7.6)

Here 50 c/s is used for time-base, and the frequency-modulated output has an adjustable amplitude of continuous wave added. The purpose is to give marking blips on the C.R.O. display, so that the latter can be interpreted in terms of frequency. In this setting the carrier signal is frequency-modulated at 50 c/s with a deviation up to $\pm$ 500 kc/s, *i.e.*, a sweep of 1 Mc/s, and the C.W. oscillator imposes a marker pip on to any part of the S-curve (Fig. 7.3 and 7.4); this provides an accurate calibration of the frequency to which the receiver I.F. amplifiers are tuned. To do this:

(*a*) Set the FUNCTION control to SWEEP & C.W.
(*b*) Select the frequency-range on the F.M. BAND switch.
(*c*) Set the frequency on the F.M. dial (left-hand).
(*d*) Any indication on the OUTPUT LEVEL meter is to be disregarded.
(*e*) Adjust the output voltage as described in para. 6.3 (*e*) and (*f*).
(*f*) Set the sweep on the DEVIATION control, which now provides a sweep of up to 1 Mc/s and is therefore marked in steps of 50 kc/s.
(*g*) Take the signal output from the R.F. OUT socket.
(*h*) Connect the X-OUT socket of the instrument to the horizontal deflection input of the C.R.O.

The phase of the X-deflection voltage can be adjusted to display two closely-positioned traces; this control is accessible through the underside of the instrument. A further control on the underside, the push-button BLANKING control, is then depressed to eliminate one of these two traces. (Fig. 7.2 and 7.3).

6.7 Sweep with amplitude-modulation (Fig. 4.2 and 7.5)

This is the same as 6.6 above, but with the steady carrier modulated with 400 c/s, the purpose being to observe the effectiveness of the limiter in reducing to the minimum any spurious amplitude-modulation in the output of the equipment being tested. To effect this:

(*a*) Set the FUNCTION control to SWEEP & A.M.
(*b*) Select the frequency range on the F.M. BAND switch.
(*c*) Set the frequency on the F.M. dial (left-hand).
(*d*) Any indication in the OUTPUT LEVEL meter is to be disregarded.
(*e*) Adjust the output voltage as described in para. 6.3 (*e*) and (*f*).
(*f*) Set the sweep on the DEVIATION control as described in para. 6.6 (*f*).
(*g*) Take the signal output from the R.F. OUT socket.
(*h*) Connect the X OUT socket to the C.R.O. as described in para. 6.6 (*h*).

Note: The XTAL control must be set in the OFF position.

6.8 Crystal verification (Fig. 5)

For this the crystal oscillator and the high-frequency continuous wave oscillator are coupled. The audio oscillator of V3 is stopped from oscillating and is used as an amplifier, the low frequency beat-note being available from the A.F. OUT socket, J1.

This crystal calibration should be made regularly. When measuring receivers, verification of calibrations, using reception of known carriers from local transmitting stations, can be routine. The calibration by crystal, when the latter is fitted, is performed as follows:

(*a*) Set the FUNCTION switch to C.W.
(*b*) Select the crystal by the XTAL switch.
(*c*) Set the A.M. dial and the A.M. BAND switch to select frequencies in the region of the fundamental or the harmonics of the crystal. The audio beat-note is taken from the A.F. OUT socket and, by adjustment of the A.M. dial, the frequency calibration of the A.M. dial can be accurately verified.

6.9 F.M. receiver alignment (Fig. 6)

This instrument has been primarily designed for this application, using a C.R.O. display. The R.F. OUT socket is connected to the aerial input of the F.M. receiver under test, and the discriminator output of this is applied to the Y-amplifier of the oscilloscope. The X OUT socket of the instrument gives the time-base voltage, and is therefore applied to the X-amplifier of the oscilloscope. Curves similar to those in Fig. 7.1 and 7.2 can then be obtained.

The feature is the marking of the displayed response curve by the A.M. oscillator and the blanking of the amplitude during the return sweep, so that a *reference* or *base line* is given for the accurate measurement of the trace, as indicated in Fig. 7.3 to 7.5.

6.10 General Audio Testing

A 400 c/s signal is available at the A.F. OUT jack socket for general audio testing. The output impedance is approximately 100 ohms, unbalanced, and the maximum output voltage is approximately 1v. R.M.S. To use this facility, set up as follows:

(*a*) Set the FUNCTION switch to C.W. or A.M.

(*b*) Set the XTAL switch to the OFF position.

(*c*) Adjust the output voltage by means of the DEVIATION control.

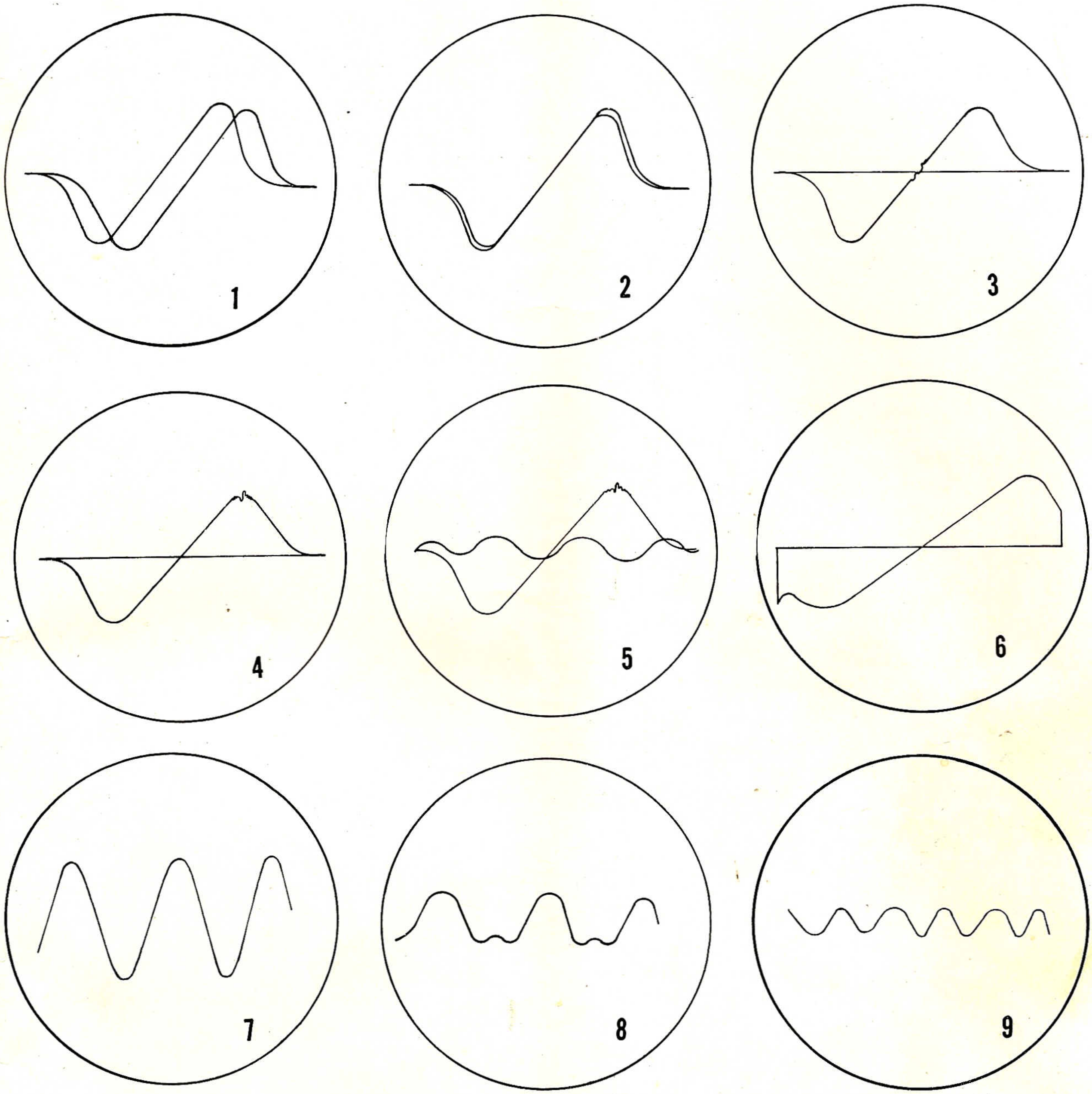


Fig. 7. Typical oscilloscope displays

Key to Fig. 7

7.1 S-curve unblanked and X-sweep out of phase.

7.2 S-curve unblanked and X-sweep in phase.

7.3 S-curve with blanking and marker in centre of curve.

7.4 S-curve with blanking and marker on top of curve.

7.5 S-curve with blanking with marker modulated at top of curve.

7.6 S-curve with deviation reduced to 0·05 Mc/s.

7.7 400 c/s F.M. signal correctly tuned.

7.8 F.M. signal slightly out of tune.

7.9 400 c/s F.M. signal incorrectly tuned.

7. MAINTENANCE

7.1 General

The apparatus is intended for service department and test-room use, and must be handled with reasonable care, because of the necessity for maintaining the high-frequency calibration. The calibration is valid only with the front panel and chassis in the case.

7.2 Failure

If the apparatus fails to deliver the correct outputs, the setting of all dials should be verified, as well as power-supply. Alteration of the setting of the controls for a different function may direct attention to a fault, particularly if this is on a switch-contact. Visual inspection can reveal foreign matter, which may cause a short-circuit or an open contact.

7.3 Procedure

Components should not be disturbed until a fault is located by measuring circuit voltages with a high-resistance meter. Insulation should not be measured with a high voltage megohm-meter, because of the danger of damaging capacitors. The greatest care should be exercised in removing valve shields and valves, to avoid causing further faults.

Fault-finding should be systematic and follow recommendations of Table 1, which refers to the test-points indicated on the main circuit Fig. 10.

7.4 Replacement of parts

Having located by systematic testing a faulty component, the correct replacement should be fitted. Particulars of all replaceable components are given in Table 4. Those components requiring special consideration are additionally listed in Table 2. A list of replaceable subassemblies is given in Table 3.

7.5 Operations

When wires are unsoldered the minimum heat should be applied, using tweezers and a miniature soldering tool. When rectifiers are inserted into circuit, a heat shunt should be used, e.g., narrow notched pliers to fit the leads, which should not be shortened to less than $\frac{3}{4}$ inch.

Where maintenance beyond the replacement of simple components is required, and technicians skilled in the testing and maintenance of specialised electronic equipment are not available, the apparatus should be returned to the supplier for overhaul.

7.6 Warning

The mains plug should be withdrawn from its socket before any maintenance work is attempted. When withdrawn from its case for testing, the chassis should be kept clear of any metal that might cause a short-circuit. All test-points are available without removing inside covers and can be identified by colours of wire-covering.

A short-circuit will not damage the circuit except on the capacitor C46, when the rectifier RT4 will be irreparably damaged.

7.7 Auxiliary apparatus

For locating faults and for maintenance, the following apparatus is recommended:

(1) Multirange test meter, preferably Taylor Model 88A or 127A, or any similar multimeter having a resistance of at least 20,000 ohms/volt for D.C.

(2) Oscilloscope, preferably Taylor Model 31A or 32A, or similar equipment having X and Y amplifiers of high input impedance.

(3) Laboratory tools, including miniature electric soldering tool, tweezers, heat-shunt pliers, resin-cored solder.

8. PARTS LIST

Table 2 Components, special requirements

Component	Reference	Remarks
Resistors Resistors	R20, 21, 23 R2 R3 R48	High stability Selected for particular instrument
Capacitors	C6 C23	Identical to maintain calibration
Meter	Edgwise	Taylor No. 830142
Fuses	Belling-Lee No. L 562	0·5 A. for 210-240 V. A.C. 1·0 A. for 110 V. A.C.
Escutcheon Pointers		Perspex Perspex
Mains cable		No. 730019
R.F. cable	No. 480 No. 485	Optional See Specification
Resistors, variable	VR 1 VR 3 VR 5	Wire wound carbon carbon, for attenuator
Rectifier	RT 1 RT 2 RT 3 RT 4	GEX 34 } determines GEX 34 } performance GEX 66 frequency sensitive 16 R.D. 2-2-8-1
Transformer	T1 T2	No. 310004 No. 300020
Switch	S5	Part of Subassembly No. 700074
Valve bases		B9G
Output jack plug	Bulgin P 38	
Crystal No. 1, etc.	S.T.C. type 4044, 5 Mc/s (tolerance) suitable for 61A.	

TABLE 1. TEST POINTS FOR MAINTENANCE (See Fig. 10)

Test-point to earth	Voltage
(A) & (B)	6·3 A.C.
(C)	300 D.C.
(D)	175–200 D.C.
(E)	115–145 D.C.
(F)	1 at 50 c/s
(F)	1 at 400 c/s
BRN (G) (F.M.)	50–100 D.C.
(G) SWEEP	100–110 D.C.
(H)	160 D.C.
(I) C.W.	50–150 D.C.
(I) A.M.	50–150 D.C.
(K) SWEEP	13–14 –ve D.C.
(X)	8 P–P

Note:—Voltages within these wide ranges are controlled by the lowest left hand control on front panel.

Table 3 Subassemblies

Subassembly		Remarks
Switches	S1	F.M. range
	S2	Function
	S4	A.M. range
	S5	Attenuator
	S6	Blanking
(No. 720046)	S8	Mains adjuster
Flexible couplings		No. 660389
Capacitor ball-drive		No. 660531

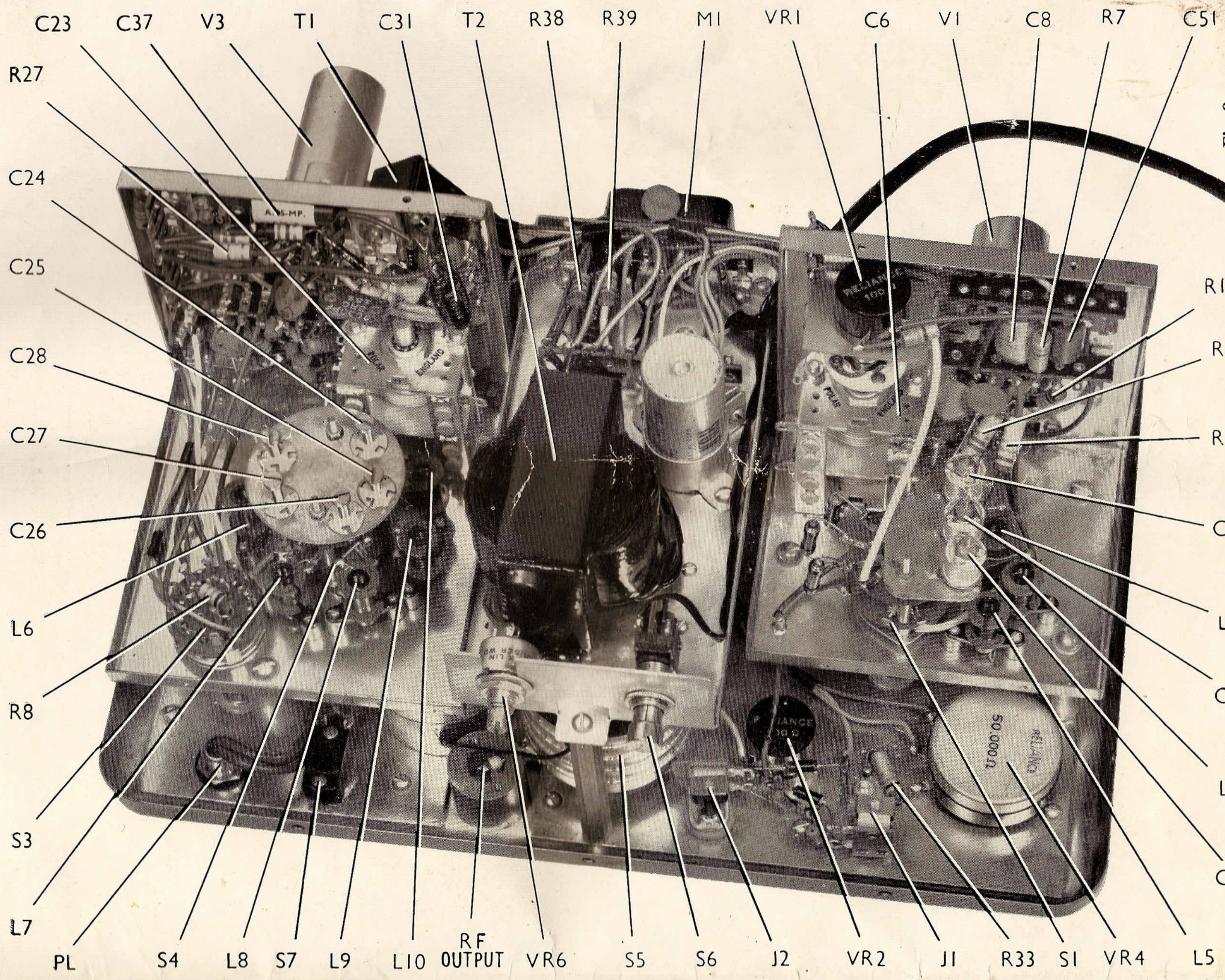

C23
C37
V3
T1
C31
T2
R38
R39
M1
VR1
C6
V1
C8
R7
C51
R27
C24
C25
C28
C27
C26
L6
R8
S3
L7
PL
S4
L8
S7
L9
L10
RF OUTPUT
VR6
S5
S6
J2
VR2
J1
R33
S1
VR4
L5
R14
R5
R4
C3
L3
C4
L4
C5

Fig. 8.

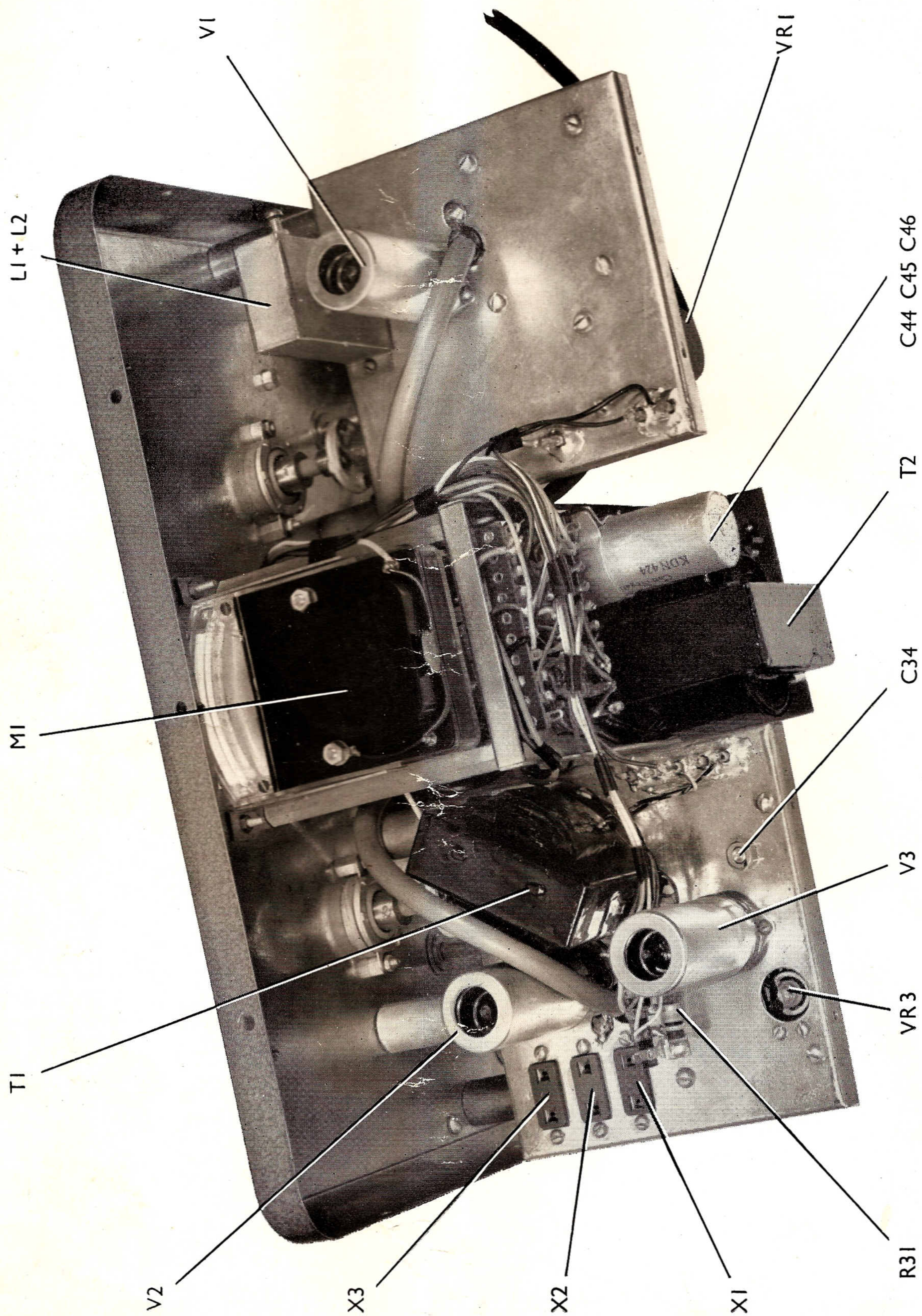
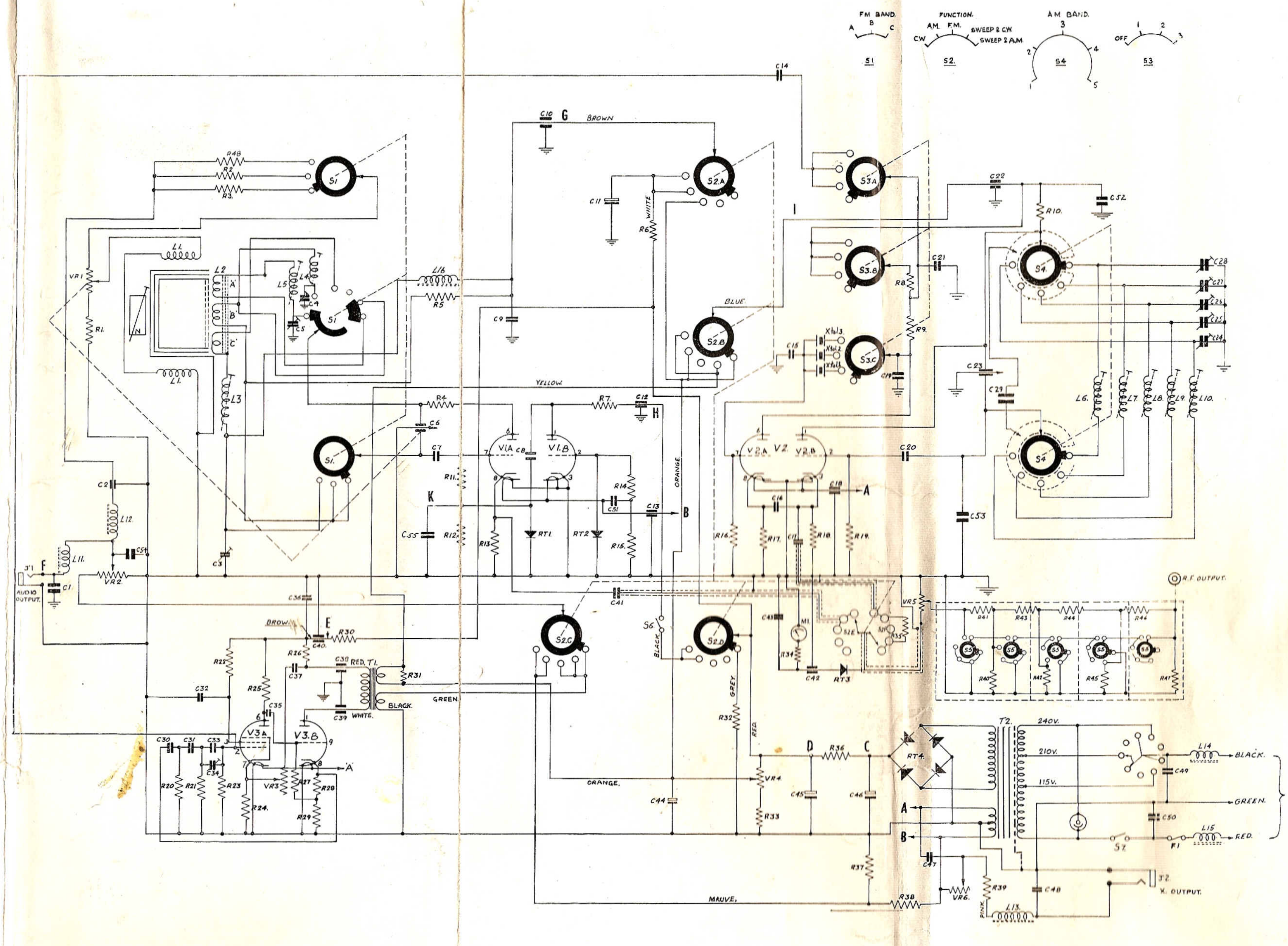


Fig. 9.



CIRCUIT DIAGRAM

Fig. 10. AM/FM SIGNAL GENERATOR MODEL 61A — COMPLETE CIRCUIT DIAGRAM

C	CAPACITOR	TOL. %	RATING V	TYPE
1	1000pF	—	350	Cer
2	1000pF	—	350	Cer
3	30pF	—	—	Trim
4	30pF	—	—	Trim
5	30pF	—	—	Trim
6	75-0-75pF	—	—	Var
7	27pF	—	350	S.M.
8	4µF	—	350	Elec
9	0.01µF	—	350	Cer
10	1000pF	—	350	Cer
11	4µF	—	350	Elec
12	1000pF	—	350	Cer
13	1000pF	—	350	Cer
14	0.01µF	—	350	Cer
15	50pF	5	350	S.M.
16	10pF	10	350	Cer
17	1000pF	—	350	Cer
18	1000pF	—	350	Cer
19	50pF	5	350	S.M.
20	27pF	5	350	S.M.
21	0.01µF	—	350	Cer
22	1000pF	—	350	Cer
23	75-0-75pF	—	—	Var
24	9pF	—	—	Trim
25	9pF	—	—	Trim
26	9pF	—	—	Trim
27	9pF	—	—	Trim
28	9pF	—	—	Trim
29	.01	—	350	Cer
30	0.25µF	10	350	Pap
31	0.02µF	10	250	Pap
32	0.05µF	10	250	Pap
33	2000pF	2	350	S.M.
34	750pF	—	—	Trim
35	0.01µF	—	350	Cer
36	4µF	—	350	Elec
37	0.05µF	10	250	Pap
38	1000pF	—	350	Cer
39	1000pF	—	350	Cer
40	1000pF	—	350	Cer
41	1000pF	—	350	Cer
42	1000pF	—	350	Cer
43	0.01µF	—	350	Cer
44	20µF	—	350	Elec
45	20µF	—		
46	20µF	—		
47	0.5µF	25	150	Pap
48	0.02µF	10	—	Cer
49	0.01µF	—	1400	Cer
50	0.01µF	—	1400	Cer
51	0.25µF	10	350	Pap
52	.05µF	10	250	Pap
53	2pF	—	250	Cer
54	1000pF	20	400	Cer

1			
4			
5			
6	4		
7	4.7k		
8	10k		
9	22k	[illegible]	
10	4.7k	5	
11	4.7k	10	1/8
12	10k	10	1/4
13	91	10	1/4
14	4.7k	10	1/8
15	10k	5	1/4
16	22k	10	1/4
17	470	5	1/4
18	68	10	1/4
19	4.7k	10	1/8
20	600	1	1/4
21	6k	1	1/4
22	470k	5	1/4
23	60k	1	1/4
24	560	10	1/4
25	100k	10	1/8
26	470	5	1/4
27	470k	5	1/4
28	270	5	1/4
29	2.2k	10	1/4
30	8.2k	5	1
31	22k	5	1/4
32	68k	5	1
33	20k	5	/2
34	2k	2	1/4
35	680	5	1/8
36	7k	5	6
37	75	5	1/8
38	110	5	1/4
39	270k	5	1/4
40	82	5	1/8
41	680	5	1/8
42	82	5	1/8
43	680	5	1/8
44	680	5	1/8
45	82	5	1/8
46	680	5	1/8
47	75	5	1/8

Table 4 Parts List

VR	POTENTIOMETER ohms	
1	100	
2	100	
3	20k	
4	50k	
5	100	
6	50k	
RT	**RECTIFIERS**	
1	GEX34	
2	GEX34	
3	GEX66	
4	WESTALITE	
	Type 16RD2-2-8-1	
T	**TRANSFORMERS**	
1	MOD.	
2	MAINS	
L	**COILS PT. NO.**	
1	830398	
2	389	
3	390	
4	391	
5	392	
6	250	
7	157	
8	251	
9	252	
10	388	
11-15	254	
16	830427	
S	**SWITCHES**	
1	FM RANGE	
2	FUNCTION	
3	XTAL	
4	AM RANGE	
5	ATTENUATOR	
6	BLANKING	
7	MAINS ON/OFF	
8	MAINS ADJUSTER	
V	**VALVES**	**BASE**
1	12AT7	B9A
2	ECC85	,,
3	ECF80	,,
X	**CRYSTAL**	**BASE**
1		
2		
3		

Service Guarantee

We hereby guarantee each new instrument manufactured by us to be free from defective materials and workmanship and agree to rectify any such defects free of charge for a period of six months from date of registered purchase. This guarantee is subject to the following conditions:—

1. That the instrument has had, at all times, normal use and has not been tampered with.
2. That the registration card has been correctly completed and returned to us within seven days of purchase.
3. That in cases of complaint the instrument is returned to us with seals intact, securely packed and carriage paid.
4. That any faulty parts of our manufacture are returned to us for inspection if required.
5. That any Valves, Rectifiers or other components of proprietary make are definitely excluded and are covered by the respective manufacturers' guarantee.
6. In the event of repairs being carried out by the purchaser, the Company cannot be held liable for any expenses incurred.
7. Under no circumstances can the Company be held responsible for indirect damage caused by any defect. Our liability in all cases is limited to making good any defective part.
8. In the event of any dispute arising as to the interpretation of this guarantee, the decision of the Company must be accepted as final.

TAYLOR ELECTRICAL INSTRUMENTS LIMITED

419/424 MONTROSE AVENUE . SLOUGH . BUCKS . ENGLAND

INSTRUCTION AND MAINTENANCE MANUAL

Taylor

MODEL 61A

AM/FM SIGNAL GENERATOR

TAYLOR ELECTRICAL INSTRUMENTS LTD

MONTROSE AVENUE · SLOUGH · BUCKS · ENGLAND

Telephone: SLOUGH 21381 **Telegrams: TAYLINS, SLOUGH**

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