S.S.218

MARCONI

TYPE CR. 100 SERIES OF RECEIVERS

Admiralty Type B. 28 Series Receivers

Patterns W2835A—E.

DESCRIPTION

OPERATING and SERVICING INSTRUCTIONS

Ref. No. T 1868

This Handbook supersedes Admiralty patterns S.S. 90 and S.S. 90A Handbooks.

MARCONI'S WIRELESS TELEGRAPH COMPANY, LTD.

LONDON, W.C.2

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MARCONI OFFICES, ELECTRA HOUSE,

VICTORIA EMBANKMENT, LONDON, W.C.2

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DATA SUMMARY.

TYPE	Self-contained Communications Receiver of superheterodyne type with A.V.C. for use on CW or Phone reception.
FREQUENCY RANGE ..	60 kc/s to 420 kc/s .. } in 6 bands. 500 kc/s to 30 Mc/s .. }
SUPPLY REQUIREMENTS ..	(A) *D.C. Supplies.* (1) H.T. and L.T. Batteries. H.T. 250 volts 100 mA. reduced to 160 volts 60 mA. if desired. L.T. 6 volts 4 Amps. or (2) Battery and Rotary Converter. 6 volts 8 Amps. total supply. (B) *A.C. Supplies.* 200/250 volts 50 c/s. 85 watts.
RECEIVER INPUT	100 ohms. balanced or unbalanced, or high impedance aerial.
SENSITIVITY .. .. .. (Average Receiver)	For 20 db signal-to-noise ratio on C.W. 60 kc/s to 11 Mc/s. 1 to 2 µV. 11 Mc/s to 30 Mc/s. 1.5 to 4 µV.
VALVES	See page 9.
RECEIVER OUTPUTS ..	Loudspeaker (3 ohms or 1,000 ohms) 2 watts maximum, approx Line (600 ohms) of the order of 2 mW. Phones (high or low resistance) depending on impedance of Phones and Receiver Edition.
MODIFIED EDITIONS ..	A number of Editions exist carrying modifications to suit the needs of various Services, the principal models being CR. 100, CR. 100/2, CR. 100/4 and CR. 100/5. CR100/7, CR100/8 & CR100/8 Mod.
WEIGHT AND DIMENSIONS ..	Dimensions overall : Width 16 in. : Depth 16½ in. : Height 12¼ in., Weight 82 lbs.

RECEIVER TYPE CR. 100/2.

A. Fine and Coarse Tuning Controls.

B. Band-Change Switch.

C. Aerial Trimmer.

D. Pass-band Switch.

E. H.F. Gain Control.

F. L.F. Gain Control.

G. Beat Frequency Oscillator Control.

H. Operational Switch.

MARCONI
TYPE CR. 100 SERIES
OF RECEIVERS

SECTION 1.

GENERAL CHARACTERISTICS.

The receiver when operated from an A.C. supply is self-contained. It combines extreme flexibility with high sensitivity and selectivity, and is equally suitable for providing good quality speech output at loudspeaker level as for the reception of C.W. signals under difficult conditions. It may be operated from Batteries or Rotary Converter if desired.

SALIENT FEATURES.

(1) Sensitivity and Image Protection.

By the use of two stages of high frequency amplification preceding the mixer, great sensitivity and protection against interference on image frequencies are obtained. Image protection is of the order of 30 db. (30 to 1) at 28 Mc/s, and is greater than 60 db. (1,000 to 1) on frequencies below 11 Mc/s.

(2) Selectivity (Variable).

Protection against adjacent channel interference is made high by the use of a crystal gate and three stages of Intermediate Frequency Amplification employing coupling circuits of high Q. A low frequency filter preceding the output valve can be used to reduce further the pass-band width to 100 cycles if desired.

(3) Automatic Volume Control.

A.V.C. may be used on both phone and C.W. reception, and a suitable delay voltage and time constants have been provided.

(4) Calibration and Logging Scales.

Easy tuning and accurate re-setting to any known frequency are ensured by the illuminated scale calibrated directly in frequency, and the separate Logging Scale which has a high discrimination and is driven from the same control spindle.

(5) Side-Tone Facility.

Facilities are provided on certain models for muting the receiver during transmissions from associated equipment.

OPERATION.

Assuming that the receiver has been correctly installed the following instructions give all the information essential for its correct use. Most of this information is also to be found in concise form on a bound card supplied with later receivers.

Fig. 1. The numbered controls correspond to the numbers in brackets below.

PRELIMINARY ADJUSTMENTS FOR OPERATING THE RECEIVER.

(1) MAINS SWITCH to ON. Dial lamps should light up. Allow a few minutes for warming up, and longer if possible. This switch is not in circuit if operating the receiver from batteries.

(2) OPERATIONAL SWITCH to "C.W.—A.V.C."

(3) PASS-BAND SWITCH to "3,000 c/s."

(4) H.F. GAIN at or near maximum clockwise.

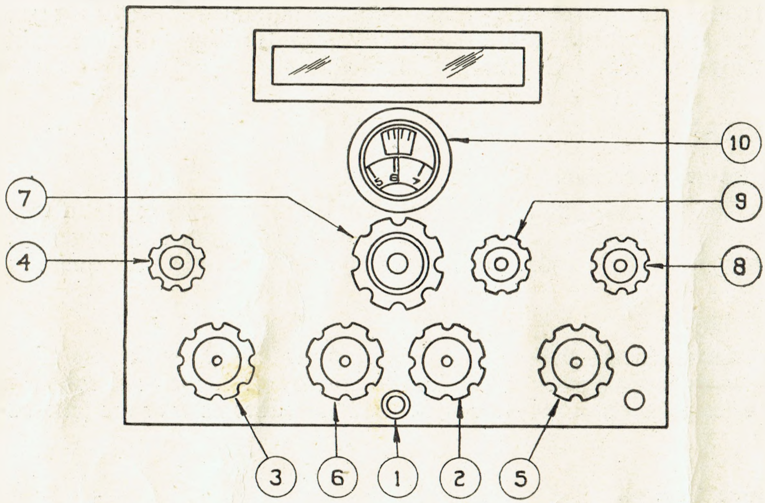


Fig. 1. Panel Controls.

(5) L.F. GAIN adjusted to give a comfortable level of noise in phones or loudspeaker.

(6) BAND-CHANGE SWITCH to the frequency band required.

(7) TUNING. Adjust the pointer on the calibration scale to the desired frequency by the larger tuning knob, and rock the smaller knob *slowly*, about one revolution on either side, until the carrier of the wanted station is heard. If R/T (telephone) is to be received change the Operational Switch (2) to "MOD—A.V.C." and retune slightly if necessary.

(8) B.F.O. Do not use the B.F.O. for fine tuning. When the receiver has warmed up (15 minutes or longer if convenient) this should be adjusted and thereafter not varied, except for occasional checking. See General Notes below.

(9) AERIAL TRIMMER. If signals are weak this should be adjusted for best results. The optimum setting for any frequency in use is found by reducing the H.F. Gain to a level at which strong incoming signals do not swamp the amplifiers or work the A.V.C., and then adjust for maximum signal strength or maximum 1st circuit noise. The setting is more critical and important at the high frequency end of the band in use.

GENERAL NOTES ON OPERATING THE RECEIVER.

Adjustment of Beat Frequency Oscillator.

To enable full use to be made of the selectivity of the receiver the B.F.O. must be accurately set to give the optimum beat note of about 1 kc/s in the phones when the receiver is accurately tuned to the signal. A convenient method of finding this setting is to make use of the characteristics of the L.F. Filter, which is adjusted to have maximum response at this frequency. Proceed as follows : After the preliminary warming up period put the Pass-band switch to 100 c/s, the Operational switch to C.W.—MAN and both gain controls at or near maximum so as to have a high level of receiver noise. Adjust to a frequency where no signals are received, or disconnect the aerial. For maximum receiver noise choose the high frequency end of Band 4. Rotate the B.F.O. Control knob to one of the points at which the maximum ringing noise is heard, and leave it in this position. Checks should rarely be necessary if the receiver is left switched on for long periods.

Use of Pass-Band Switch.

Once the wanted signal has been found the operator should endeavour to use a narrower pass-band so as to get greater protection from interference. A very slight and careful readjustment of tuning may be necessary when switching to the narrower pass-bands.

6,000 c/s Pass-band. Gives best intelligibility of speech, and makes tuning broader, but can only be used when signals are strong and there is little interference. Used for C.W. signals only in exceptional circumstances.

3,000 c/s Pass-band. Better selectivity and less background noise. Recommended for use on speech and when searching.

1,200 c/s Pass-band. High selectivity. Not used on speech. Useful chiefly on Bands 4, 5 and 6.

300 c/s Pass-band. Higher selectivity. Used on C.W. only, chiefly on Bands 1, 2, 3 and 4. Can be used with care on Band 5, but not recommended for use on Band 6.

100 c/s Pass-band. Highest possible selectivity. For use on C.W. only, chiefly on Bands 1 and 2. If used on Bands 3 and 4 greater care in tuning is demanded and the correct setting of B.F.O. becomes increasingly important. Not recommended on Bands 5 and 6.

The narrowest pass-bands can only be employed where the frequency of the transmitted signal is reasonably constant, and the speed of signalling relatively low.

When receiving C.W. on the broad pass-bands and tuning through zero beat it will be found that the signal is equally strong on both sides, but on narrower pass-bands one side will give a stronger note than the other. The weaker signal may even be inaudible. Always tune to the stronger of the two.

Should a signal be tuned-in on a wide pass-band and the wrong side of zero beat be selected, the signal will probably be lost if the operator decides to change to a narrow pass-band. Because of this and the difficulty of distinguishing the stronger signal it is recommended that the 6 kc/s pass-band should not normally be used when tuning-in or searching for a C.W. signal.

Use of AVC.

The use of A.V.C. will be determined chiefly by the conditions prevailing and the skill of the operator. It is given as a general rule, however, that A.V.C. should always be used except where the wanted signal is weak and in danger of being lost because the gain has been reduced by the action of a strong interference on the A.V.C. diode. Examples of this are peaky types of static, and pulse transmissions.

The H.F. Gain must be controlled manually when transmitting on the same frequency, unless the receiver is being muted by the Side Tone Facility (as in the Type CR. 100/2 receiver) or other effective device.

On C.W. the A.V.C. is given an increased recovery time-constant. This will tend to broaden the apparent selectivity when searching through strong signals, and thus make tuning slower. To switch off A.V.C. put the Operational Switch to MAN :

Use of Gain Controls.

The relative positions of H.F. and L.F. gain controls will depend largely on whether the operator is controlling the gain manually to prevent overloading of the H.F. and I.F. amplifiers or relying on the A.V.C. to do it. The rule laid down for general guidance is

On C.W.—A.V.C. } H.F. Gain Control at maximum, except for very strong signals.
or MOD.—A.V.C. } L.F. Gain Control as desired.

On C.W.—MAN. } H.F. Gain Control as desired.
or MOD.—MAN. } L.F. ,, ,, at approximately mid position.

" Off " Position of Operational Switch.

Frequency drift of the oscillator due to temperature fluctuation is reduced to a minimum if the receiver is left switched on for long periods.

During short stand-by periods the H.T. to certain stages may be cut off by putting the Operational switch to the OFF position.

Use of Logging Scale.

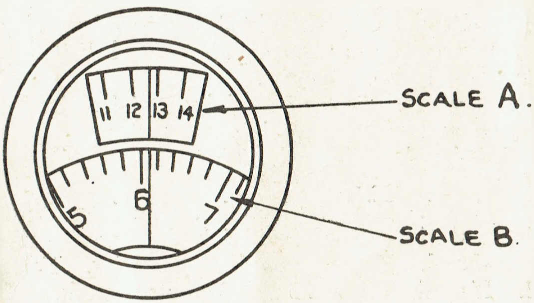


Fig. 2. Logging Scale.

This scale is not for reading frequency directly but for noting how to reset the tuning control to a station which has once been found. Some slight allowance for initial drift should be made if the receiver has not been running for 2 hours or more.

The main divisions 0 to 25 are read on scale " A " and sub-divisions on scale " B." The example shows a reading of 12—61.

" **AERIAL FILTER UNIT** (*See* Fig. 26)

When the receiver aerial is not connected through an aerial exchange, protection against Radar transmissions, particularly Radar Type 79, 279, 281, 960 and variants, is provided by fitting Filter Unit Design 12 in series with the aerial lead to the receiver. When the receiver aerial is connected through an aerial exchange the filter unit forms part of the aerial exchange outfit.

Filter Unit Design 12 is a low pass R.F. filter and provides protection against transmissions on frequencies above 30 Mc/s.

When the source of interference is inoperative and where maximum receiver sensitivity can usefully be employed the filter can be taken out of circuit by means of a " through connector " arrangement."

NOISE LIMITER DESIGN 1, PATTERN 56703

Noise Limiter Design 1 is fitted to minimise the interference experienced from Radar Pulses. Its effectiveness depends fundamentally on the duration of the pulse and its repetition frequency. The shorter the pulse and the lower the repetition frequency, the less is the interference.

The limiter valve is connected between the second detector stage and the first stage of L.F. amplification, because the L.F. stages of the receiver tend to prolong the duration of the pulse to a much greater degree than the wide-band HF stages, so the widest pass band position should always be used. Any interference which passes the limiter is increased in strength by the L.F. amplification, so the L.F. gain is kept as low as possible. The HF gain is kept at a maximum so that the signal reaching the limiter is as large as possible. So for the best results the following adjustments should be used :—

(A) Limiter ON
(B) A.V.C. ON
(C) HF gain control at MAX
(D) 6,000 cycle pass band position
(E) L.F. gain control as low as possible.

Note.—Sometimes with MAX HF gains and A.V.C. on, when receiving local or very strong transmissions blocking of the receiver may occur and HF gain should then be reduced.

The function of the noise limiter is as follows. After the coupling capacitor C91 (*see* Fig. A) an M.C.W. signal gives rise to an alternating voltage at the modulation frequency. A pulse transmission at this point is responsible for pulses of D.C. in a negative direction. These voltages are applied to the anode of the limiter valve (CV 1054). The characteristic of this valve is that when a D.C. voltage is applied to its anode, current flows until this voltage falls to about 0·5 volts. Thus an M.C.W. signal whose maximum value (controlled by HF gain and A.V.C.) is 0·5 volts, is not distorted by the diode valve. On the other hand, the large negative D.C. pulses are limited to a value only slightly greater than the M.C.W. signal, the excess being mainly due to capacitive effects which by-pass the limiter. As the pulse is of short duration compared with the signal, the interference caused is small (*see* Fig. B).

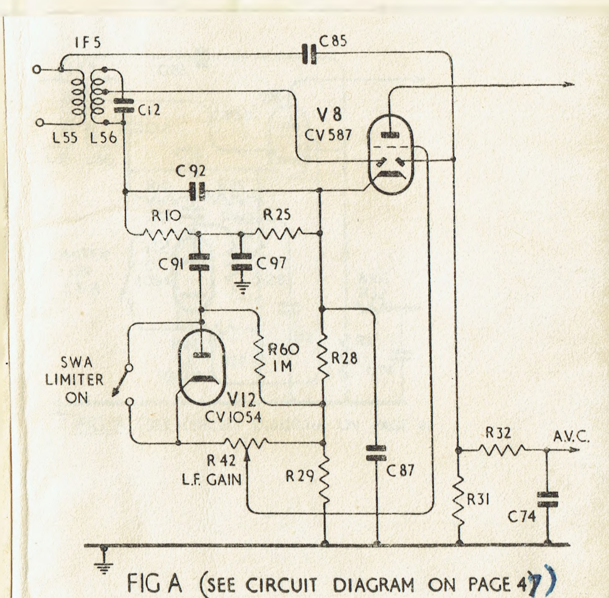


FIG A (SEE CIRCUIT DIAGRAM ON PAGE 47)

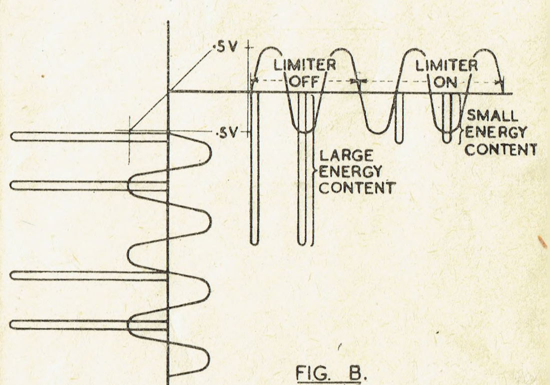


FIG. B.

TECHNICAL DESCRIPTION.

(A) ELECTRICAL.

CIRCUIT ARRANGEMENT. (See Drg. WZ.1943, page 47.)

Two signal frequency stages of amplification employing variable-mu valves are used before the mixer valve, which is of the triode hexode type. The triode section is not used, and the frequency change oscillator is a separate valve. The mixer output voltage at the intermediate frequency of 465 kc/s $\pm$ 2 kc/s is applied to the I.F. amplifier embodying three stages, with suitable couplings and a crystal gate for varying the band width. The third I.F. amplifier operates a double-diode-triode incorporating the signal detector, the automatic volume control rectifier and the 1st audio frequency amplifier. An independent beat frequency oscillator is provided for continuous wave reception and is coupled to the signal detector.

An output stage and the mains rectifier valve and associated circuits complete the circuit plan.

Aerial Input, Signal Frequency Circuits and Mixer.

The overall gain of the signal frequency stages does not vary greatly between bands, and is sufficient to make shot noise from the first valve greater than that generated by the mixer valve. Up to a frequency of about 11 Mc/s the dynamic impedance of the first tuned circuit is high enough to ensure that thermal agitation noise from this circuit exceeds valve noise, but on Band 6 the circuit noise has fallen below valve noise, and the sensitivity is then limited by the first valve noise alone.

The feeder or dipole connections are taken via double-pole contacts on the aerial section of the Band-change switch to the low impedance winding of the aerial coupling coil. In the case of the Types CR. 100 and CR. 100/4 receivers the input is suitable for a balanced input if desired, there being two terminals marked " D." For the Types CR. 100/2 and CR. 100/5 receivers, one end of the coupling coil is earthed and the other connected to a coaxial socket marked " D." The coupling is designed to present an impedance of approximately 100 ohms on all bands. The secondary winding with the rear section of the main tuning condenser and the aerial trimmer condenser in parallel form the grid circuit of the first amplifier.

The aerial socket or terminal " A " is connected to the top of this circuit through a capacity of 10 pf, and a static leak of 2 megohms to earth is provided.

The grid connections of signal frequency and 1st Oscillator valves contain stabilizing resistances, the value being 10 ohms for V1, V2 and V3, and 50 ohms for V4.

The rear plate of the rotor of the grid circuit Band-change switch short-circuits the idle inductances while the front plate selects the active one.

The foot of the grid circuit of the two Signal Frequency Amplifiers and the first two Intermediate Frequency Amplifiers is joined to the A.V.C. line through a 50,000 ohms resistance, the top end of which is decoupled by a condenser of 0.1 μF to earth. The decoupling condensers, both for grid and anode circuits of Signal Frequency Stages are situated in the H.F. Coil Assembly.

The cathodes of all signal frequency and intermediate frequency valves have series resistances of 400 ohms or the " preferred value " of 390 ohms $\pm$ 20 per cent., and are decoupled by 0.1 μF condensers to chassis.

The screen grid voltage of signal frequency amplifiers and other valves is taken from a line fed from a voltage divider and is of the order of 80 volts. Each valve has its own screen grid decoupling resistance and condenser.

The coupling from the first to second amplifier is by the conventional untuned anode—tuned grid transformer, the anode being decoupled from the H.T. supply by a resistance of 2,000 ohms and 0.1 μF condenser.

Each grid circuit inductance is fitted with a trimmer condenser. All inductances in the coil pack have adjustable iron dust cores. The second signal frequency stage is similar to the first and drives the 1st grid of the mixer. The mixer cathode resistance is connected to earth and the bottom of grid circuit is also earthed ; there is therefore no manual or automatic control of bias on this valve. The triode anode of the X66 is earthed.

Oscillator and Intermediate Frequency Circuits.

A KTW.62 valve connected as a triode and having a tuned grid circuit mutually coupled to an untuned anode coil serves as the frequency change oscillator. The oscillator operates at a frequency higher than the signal frequency on all bands. Series tracker condensers are contained in the coil pack in addition to the usual decoupling condensers. On the three lowest frequency bands variable trimmer condensers are fitted to the oscillator inductances, but on Bands 4, 5 and 6, where very small values of capacity are required, fixed capacitors are connected instead, the required value being determined on test.

The tuned anode circuit of the mixer is decoupled from the H.T. supply and forms the first side circuit of the crystal resonator. The second side circuit is also tuned and is coupled to the 1st intermediate frequency valve. The crystal whose frequency may be between 463 kc/s and 467 kc/s, is neutralised, a fraction of the voltage present in the 2nd side circuit being fed back into the 1st side circuit in the correct phase. The neutralising condenser is situated in I.F.1 assembly and the crystal is mounted in I.F.2 assembly. The crystal is not in circuit when using the 3,000 c/s and 6,000 c/s positions of the Pass-band switch.

The normal band-width with the crystal in circuit is 1,200 c/s. By switching the condenser C.43 (value 7 pF) from the first to the second side-circuit and altering the phase and impedance the band-width is reduced to 300 c/s.

The couplings between the three intermediate frequency amplifiers consist of loosely coupled tuned transformers of high Q, both primary and secondary coils having variable permeability tuning and fixed value capacitors. A small, tightly coupled auxiliary coil is introduced in series with the secondary of the I.F. transformers, I.F.3 and I.F.4, when the Pass-band switch is placed to 6,000 c/s.

The gain of the I.F. amplifiers is of the order of 28 db per stage (25 to 1). The conversion gain of the mixer is about 16 db (6 to 1).

I.F. Sensitivity figures will be found in Section 5, page 30.

The selectivity switches S.10, S.11, S.12 and S.15 in Diagram WZ.1943, page 47, are all operated by a common spindle.

All switches are shown on the diagram in the counter-clockwise position.

Signal Detector and A.V.C. Rectifier.

The signal detector is driven from the secondary of the last I.F. circuit, and works into a series connected load of 0.3 MΩ with suitable low-pass filtering components, a portion of the rectified voltage being applied to the L.F. gain control potentiometer via a capacity of 0.1 μF. The slider of the potentiometer is connected to the grid of the triode section of the DH.63 valve and the bottom is tapped on to a suitable biasing point of the cathode resistance, giving a voltage of 1.8 volts negative with respect to the cathode.

The auto-gain voltage is derived from the second diode of the DH.63 driven from the anode of the 3rd I.F. valve via a capacitor of 100 pF. The A.V.C. diode load of 0.5 MΩ is in shunt with the valve. In order to have the necessary delay the cathode is biased positive by about 16.8 volts relative to the anode. Suitable decoupling is provided, and an additional capacity of 1 μF for increasing the recovery time constant is introduced when the Operational switch is placed to C.W.

The time constant is 0.1 sec. on MOD, and 1.0 sec. on C.W.

Beat Frequency Oscillator.

The B.F.O. is of the electron-coupled Colpitts type, and is coupled to the signal detector through a capacity of 30 pF. The core of the inductance is adjustable as in the I.F. circuits, and a variation of several kilocycles above and below the intermediate frequency is obtained by the variable condenser which is under the control of the operator. The correct adjustment of the B.F.O. condenser is a matter of importance when using narrow pass-bands and is dealt with in Section 2, page 3.

Audio Frequency Amplifier.

The triode section of the DH.63 is resistance capacity coupled to the grid of the output tetrode, KT.63. A band-pass filter having maximum response at a frequency of about 1 kc/s and a total bandwidth of 100 c/s is inserted here when the Pass-band switch is put to " 100 c/s."

The gain of the amplifier at 1 kc/s is not reduced by the insertion of the filter. Suppression of high-frequency voltages is attained by the use of capacitors in shunt with the two audio frequency amplifier valves. Low frequency stability is ensured by adequate decoupling in the H.T. supply to the DH.63 stage.

The various outputs are obtained through a multi-ratio transformer. The slope of the load line, which should be of the order of 5,000 ohms, is determined by the loudspeaker, the line and phone outputs having negligible effect. Other details of outputs are given elsewhere in this Handbook.

Power Supplies.

The power supply circuits are arranged so that either A.C. mains or D.C. supplies can be used, a change-over being effected by merely plugging in a differently connected supply socket, and changing the position of a D.C./A.C. Heater Link in the receiver. The mains on-off switch is not in circuit when using D.C. supplies. A 2 amps. fuse is used as a link on the primary of the transformer for selecting the appropriate mains voltage tapping.

When using batteries an economy in H.T. current may be effected by reducing to 160 volts, and at this value a further economy can be made by replacing the KT.63 by an L.63 if using receiver for phone reception only. A suitable arrangement of supplies when using batteries and rotary converter is shown on Drg. WZ.1960, page 45.

The rectifying and smoothing circuits are of conventional design.

In later models a 500 mA fuse is fitted in the earth connection of the high voltage winding of the transformer, and a spare fuse housed in the lid of receiver.

Controls.

The receiver controls, as shown in Fig. 1, page 2, are :—

1. On-Off Mains Switch.
2. Operational Switch (control of A.V.C. and B.F.O.).
3. Pass-band Switch. (Variable Selectivity).
4. H.F. Gain Control Potentiometer.
5. L.F. Gain Control Potentiometer.
6. Band Change Switch.
7. Main Tuning Control (coarse and fine controls).
8. Beat Frequency Oscillator Tuning.
9. Aerial Trimmer Condenser.

Frequency Band.

The overall frequency band, 60 kc/s to 30 Mc/s, with a gap between 420 kc/s and 500 kc/s, is covered by six positions of the Band-change switch. The bands are

1. 60 kc/s to 160 kc/s.
2. 160 kc/s to 420 kc/s.
3. 500 kc/s to 1.4 Mc/s.
4. 1.4 Mc/s to 4 Mc/s.
5. 4 Mc/s to 11 Mc/s.
6. 11 Mc/s to 30 Mc/s.

Tuning and Calibration.

The main tuning control has a driving ratio of 25 to 1 and is fitted with a slow motion epicyclic drive having a reduction ratio of about 170 to 1. This control, besides operating the logging scale, moves a pointer across a scale calibrated directly in frequency. The frequency scale is brought into view by the action of the Band-change switch.

Logging Scale. (See Fig. 2, page 4.)

The logging scale provides a method of retuning to a station already located with rapidity and accuracy. It has a scale length for each frequency band equivalent to 18 feet, and carries 1,250 divisions large enough to allow accurate estimation to the nearest quarter of a division. At the highest frequency of 30 Mc/s this corresponds to only 5,000 c/s in frequency change, so that readjustment to a given reading will bring a desired C.W. station into sufficiently close adjustment to give a beat note within the audio band.

Selectivity Control.

The width of the intermediate frequency pass-band is controlled by the pass-band switch having 5 positions. At the 100 cycles position a low frequency filter tuned to approximately 1 kc/s is introduced following the 2nd detector.

The pass-bands available are

6,000 cycles total width at half peak amplitude.
3,000 ,, ,, ,, ,,
1,200 ,, ,, ,, ,,
300 ,, ,, ,, ,,
100 ,, ,, ,, ,,

The gain of the intermediate audio frequency stages does not vary more than a few decibels between any two positions of the pass-band switch.

H.F. Gain Control.

The gain of the two signal frequency stages and the first two I.F. stages is controlled by varying the positive voltage applied to the cathodes in excess of the normal self-bias developed across the cathode resistance. The range of control is of the order of 100 db.

L.F. Gain Control.

The amplitude of the signal applied to the grid of the first audio frequency valve is varied by a potentiometer of 0.5 M Ω, there being a reduction of approximately 50 db when the control is fully counter-clockwise.

Outputs.

Three levels of output are available.

(A) Loudspeaker. Approximately 2 watts maximum power.
CR.100/4 and CR.100/5 to match 1,000 ohms.
Other models ; to match 3 ohms.
On these latter models the loudspeaker is disconnected when the phone plug is inserted.

(B) Line. For 600 ohms line or amplifier ; 2 mW, unaffected by connecting phones.

(C) Phones. Two phone jacks on front panel. Phones of any convenient impedance may be used. Output of the order of 0.3 mW for high impedance phones on standard models, but considerably higher on CR.100/4 and CR.100/5 models.

Operational Switch.

This is a 5-position switch controlling the use of A.V.C. and the B.F.O. The centre position marked OFF breaks the anode supply to all stages except the L.F. and Output Valves. Its use is to keep heaters alight during short stand-by periods, thus reducing to a minimum any frequency drift caused by temperature variations.

The other points of the switch are

MOD — MAN ; that is, B.F.O. off, A.V.C. off.
MOD — A.V.C. ; that is, B.F.O. off, A.V.C. on.
C.W. — A.V.C. ; that is, B.F.O. on, A.V.C. on.
C.W. — MAN ; that is, B.F.O. on, A.V.C. off.

Side-tone Facility.

On the Type CR.100/2 receiver facilities are provided for desensitizing the receiver when an associated transmitter is emitting. This consists in raising the cathode line voltage of the receiver when the transmitting key is pressed by introducing all or part of a 2,000 ohms resistance at the earth end of the H.F. gain control potentiometer. The resistance is mounted on the top deck inside the receiver, and should be adjusted so that the operator hears his own transmitted signal at the desired amplitude. The connection to the insulated back contacts of the morse key or relay is made by a length of shielded twin cable, terminated by a plug. When not in use the side-tone socket on the rear of the receiver chassis should be shorted, using the special shorting plug provided.

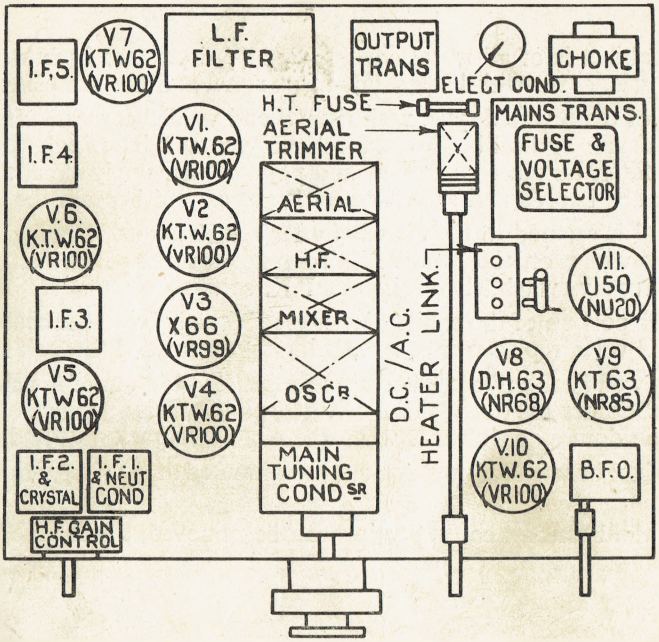


Fig. 3. Plan showing Valve Positions.

Valve Complement.

The valve complement of the receiver is here shown with equivalent types and substitutes. The valve number refers to that shown on Circuit Diagram WZ.1943, page 47. The substitutes shown in brackets should be used only in an emergency.

Valve No.	*Type*	*Use*	*Service Type No.*	*Possible Substitute.*
V1	KTW.62	1st Signal Frequency Amplifier	VR.100 CV1100	KTW.61 = NR.64. (6K7G) (6J7G)
V2	KTW.62	2nd Signal Frequency Amplifier		
V3	X.66	Mixer	VR.99 CV1099	X.65 = NR.82. (6K8G)
V4	KTW.62	Frequency-change Oscillator	VR.100 CV1100	KTW.61 = NR.64. (6J7G) (6K7G)
V5	KTW.62	1st I.F. Amplifier	VR.100 CV1100	KTW.61 = NR.64. (6K7G) (6J7G)
V6	KTW.62	2nd ,, ,,		
V7	KTW.62	3rd ,, ,,		
V8	DH.63	Combined Signal Detector A.V.C. Diode and L.F. Amplifier	NR.68 CV587.	(6Q7G)
V9	KT.63	Output Tetrode	NR.85 ARP.17 CV1186	(6F6G) (6V6G)
V10	KTW.62	Beat Frequency Oscillator	VR.100 CV1100	KTW.61 = NR.64. (6J7G) (6K7G)
V11	U.50	Full Wave Rectifier	NU.20 CV1268. CV1071	5Y3G 5Z4G (U.52)

For plan of Chassis showing position of valves see Fig. 3.

V12. VR54. Noise Limiter valve. (not shown in fig 3 above). CV1054.

(B) MECHANICAL.

The receiver cabinet is of all metal construction ($\frac{1}{16}$-in. motor body steel) and comprises four main members ; chassis, cover with hinged lid, front panel and bottom plate.

The chassis is of the inverted type, with riveted and welded corners. It carries on top the high frequency tuning condenser and calibration sub-assembly, valves, intermediate frequency transformers, crystal circuits, L.F. filter, output transformer and parts of the supply circuit. The H.F. coil pack, condenser and resistance boards and switch controls are carried beneath the chassis.

The front panel is secured to the chassis by Parker Kalon self-tapping screws (which are used whenever possible elsewhere on the receiver). To remove front panel, first remove control knobs and locking ring on supply switch, then take out P.K. screws.

The main cover portion of the cabinet is screwed directly on to the chassis, access to the upper part of the chassis for valve replacements, etc., being then provided through the hinged lid.

The base is screwed flush on to recessed brackets at the bottom of the chassis, and has holes to assist ventilation, and domes on which the receiver rests if bench mounted. The bottom plate may be reversed so that the domes are inwards when the receiver is rack mounted.

The main terminal board and input sockets are mounted at the rear of the chassis, and telephone jacks at the front.

For servicing, the base and cover portion can be removed, leaving the receiver complete with front panel intact.

SECTION 7.

COMPONENT PARTS LIST FOR RECEIVER.

For References in Column 1, page 47, see Drawing WZ.1943.

CONDENSERS

Ref.	*Nominal Values*
C.1	Special 4 Gang
C.2	Tuning Condenser 437.5pF Sweep
C.3	Dwg. W.Q. 3240 Sh. 1
C.4	
C.5	350pF Dubilier Type S.690W ± 2%
C.6	As C.5
C.7	,,
C.8	,,
C.9	,,
C.10	,,
C.11	,,
C.12	,,
C.13	20pF W.I.S.1540 Neut. Cond.
C.14	25pF ± 2 Erie P.120M.
C.21	H.F. Circuit Trimmers Wright & Weaire 5-50 pF
C.22	As C.21
C.23	,,
C.24	,,
C.25	,,
C.26	,,
C.27	,,
C.28	,,
C.29	,,
C.30	,,
C.31	,,
C.32	,,
C.33	Osc. Circuit Trimmers Wright & Weare 5-50 pF
C.34	As C.33
C.35	,,
C.36	P.120K. Value to be determined on Test
C.37	P.120K. Value as determined on Test
C.38	25 pF Wingrove & Rogers Type C.802 Aerial Trimmer
C.39	P.120K. Value to be determined on Test
C.40	10 pF Wingrove & Rogers Type C.802 B.F.O. Cond.
C.41	2,000 pF Dubilier Type S.691W
C.42	420 pF Dubilier Type S.690W
C.43	7 pF ± 1 Erie P.120K
C.44	55 pF ± 1 Erie P.120D
C.45	150 pF ± 1% Dubilier Type S.690W
C.46	460 pF ± 1% Dubilier Type S.690W
C.47	1,190 pF ± 2% Dubilier Type S.691W
C.48	3,400 ± 2% Dubilier Type S.691W
C.49	10,000 pF ± 2% Dubilier Type S.691W
C.50	
C.51	10 pF ± 1 Erie P.120K
C.52	0.1 μF Dubilier Type 24901/1A
C.53	As C.52
C.54	0.1 μF Dubilier Type P.991W
C.55	As C.52
C.56	,,
C.57	As C.54
C.58	As C.52
C.59	,,
C.60	,,
C.61	,,
C.62	,,
C.63	,,
C.64	,,
C.65	,,

CONDENSERS *(contd.)*

Ref.	*Nominal Values*
C.66	As C.52.
C.67	,,
C.68	,,
C.69	,,
C.70	,,
C.71	,,
C.72	,,
C.73	,,
C.74	,,
C.75	,,
C.76	,,
C.77	,,
C.78	1 μF Muirhead Type 134JA
C.79	As C.78
C.80	0.1 μF T.C.C. Type 545
C.81	As C.80
C.82	0.01 μF Dubilier Type 24901/4A
C.83	500 pF Dubilier Type 690W
C.84	0.01 μF Dubilier Type 691 W
C.85	100 pF Dubilier Type 635
C.86	30 pF ± 2 Erie P.120M
C.87	25 μF 25v. Wkg. Dubilier Type 4001
C.88	As C.87
C.89	8-8-8 μF T.C.C. Electrolytic 400 v.
C.90	
C.91	0.1 μF Dubilier Type 24901/4A
C.92	As C.85
C.93	,,
C.94	,,
C.95	500 pF Dubilier Type 635
C.96	2,000 pF 500 v. D.C. Wkg. A.H. Hunt Type L.6/4
C.97	As C.95
C.103	Plessey Mica Trimmer Type 1760/7
C.104	As C.103
C.105	3,100 pF ± 2% Dubilier Type S.691W
C.106	As C.105
C.110	.01 μF T.C.C. Type M.4 } Replacing C.90 tubular type
C.111	As C.110 } Suppressor Condenser

RESISTANCES

Ref.	*Preferred Value in Ohms*	*Original Specified Value in Ohms*
R.1	47,000 Erie RMA No. 9	50,000
R.2	As R.1	50,000
R.3	22,000 Erie RMA No. 9	20,000
R.4	As R.1	50,000
R.5	,,	50,000
R.6	47 Erie RMA No. 9	50
R.7	22,000 Erie RMA No. 1	20,000
R.8	As R.1	50,000
R.9	20,000 Painton Type P.301	20,000
R.10	220,000 Erie RMA No. 9	200,000
R.11	On CR.100 & CR.100/2 470,000 RMA 9	500,000
	On CR.100/4 & CR.100/5, CR100/7 & CR100/8 47,000 RMA No. 9	50,000
R.12	10,000 Erie RMA No. 9	10,000
R.13	2,200 Erie RMA No. 9	2,000
R.14	As R.13	2,000
R.15	,,	2,000
R.16	,,	2,000
R.17	,,	2,000
R.18	4,700 Erie RMA No. 9	5,000
R.19	As R.18	5,000
R.20	39,000 Erie RMA No. 9	40,000

RESISTANCES (*contd.*)

Ref.	*Preferred Value in Ohms*	*Original Specified Value in Ohms*
R.21	As R.18	5,000
R.22	,,	5,000
R.23	,,	5,000
R.24	As R.3	20,000
R.25	100,000 Erie RMA No. 9	100,000
R.26	As R.25	100,000
R.27	1 Megohm Erie RMA No. 9	1 Megohm
R.28	1,200 Erie RMA No. 9	1,200
R.29	As R.12	10,000
R.30	470 Erie RMA No. 2	500
R.31	470,000 Erie RMA No. 9	500,000
R.32	As R.27	1 Megohm
R.33	390 Erie RMA No. 9	400
R.34	As R.33	400
R.35	,,	400
R.36	,,	400
R.37	,,	400
R.38	,,	400
R.39	10,000 Dubilier Type A.B.	10,000
R.40	As R.39	10,000
R.41	2,000 Potentiometer	2,000
R.42	500,000 Potentiometer	500,000
R.43	As R.25	100,000
R.44	As R.13	2,000
R.45	As R.3	20,000
R.46	,,	20,000
R.47	3,300 Erie RMA No. 9	3,000
R.48	560 Erie RMA No. 9	600
R.49	As R.10	200,000
R.50	,,	200,000
R.51	10 Erie RMA No. 9	10
R.52	As R.51	10
R.53	,,	10
R.54	As R.25	100,000
R.55	2.2 Megohms Erie RMA No. 9	2 Megohms
R.56	As R.25	100,000
R.57	2,000 Potentiometer (CR.100/2 only)	2,000

TRANSFORMERS.

T.1	Mains Transformers W.Q.3244 Sh. 1
T.2	Output Transformer W.I.S.2578

CRYSTAL

Q.	Crystal. W.Q.3244/C Sh. 14

SWITCHES.

S.1, S.2, S.3, S.4, S.5, S.6, S.7, S.8	H.F. Switch W.I.S.1197 Sh. 131
S.10, S.11, S.12, S.15	I.F. Switch W.I.S.1197 Sh. 133
S.13	Operational Switch W.I.S.1197 Sh. 132
S.14	Mains Switch { Bulgin Type S.80T Fitted with Insulated Ring

INDUCTANCES.

L1-L.48.	High Frequency Coils W.Q.3241 Sh. 1
L.49-L.60	I.F. Coils W.Q.3242 Sh. 1
L.61	1 μH Choke W.Q.3244 Sh. 3
L.62	Special Iron Core Inductance W.Q.3244 Sh. 13
L.63	As L.62
L.64	L.F. Choke 8 H 120 mA 225 Ω W.Q.3244 Sh. 4
L.65	As L.64

VALVES.

V.1 to V.11 See page 9.

ILLUMINATING LAMPS.

IL.1	6.5 v.—.3A O.S.75 MES 12 mm. Round
IL.2	6.5 v.—.3A O.S.75 MES 12 mm. Round

FUSES.

F.1	2 Amps. W.Q.3244 Sh. 1
F.2.	L.338/500mA

MISCELLANEOUS ITEMS.

Description.	*Drg. No.*
Cord for Pointer and Cylinder, No. 9 Cord (No. 5289 Allcock)	—
Dial-lamp Holder	W.I.S.2769
Grid Lead, screened	W.Q.3244/C Sh. 7 Ed.A
„ „ „ for V8	W.7646/C Sh. 1 Ed.A
„ „ unscreened, for Oscillator	W.Q.3244/C Sh. 7 Ed.B
Handle and Pointer for Band-change Switch	W.Sk.13620 Ed.B
Knob, small	W.Sk.13613 Sh. 1 Ed.L
„ medium	W.Sk.13619 Sh. 1 Ed.B
„ large. Tuning	W.8277C Sh. 1, Ed.A
„ medium. Tuning	W.Sk.14312 Sh. 1 Ed.B
Mains Socket 5 point, side entry	W.Sk.1904
„ Plug „ „	W.C.P.393
Plug, Heater-Link	W.Q.3244/C Sh. 18
Screws, P.K. self-tapping No. 4 × $\frac{3}{16}$ B.H.	—
Screws, P.K. self-tapping No. 8 × $\frac{1}{4}$ B.H.	—
Telephone Jack	W.I.S.3150/C Sh. 1 Ref. 1
Valve Holder (Amphenol)	W.I.S.1894
„ Screening Can.	W.I.S.2345
Wire flexible "Hamofil," 14/.0076	—
Wire flexible "Telcothene" screened 23/.004	—

"NOISE LIMITER, PATTERN 56702

Ref.	*Pattern No.*	*Description*
R60	W2261	Resistor, 1 megohm ± 10 per cent. ½ watt.
SW.A	W2996A	Switch, 3 amps, 250V, 1 pole, 1 way.
V12	CV1054	Valve, wireless, VR54.
—	W2999	Valveholder, 8-pin ".

COMPONENT PARTS LIST FOR ROTARY CONVERTER.

For references in Column 1 see Drawing below.

CONDENSERS.

Ref.	*Description*
C.1	4 μF Dubilier 24681 Non-inductive
C.2	,, ,, ,, ,,
C.3	1 μF Muirhead 134J
C.4	,, ,, ,,
C.5	,, ,, ,,

CHOKES.

CH.1	Ferranti RD.1472
CH.2	,, ,,
CH.3	,, RD.1470
CH.4	WSK.3203 Edn.G.
CH.5	,, ,,

FUSE.

F.1 Slydlock 15A 1533 F.W.

SWITCH.

S.1 Arrow 10A D.P. WIS 2220

RESISTANCE.

R.1 Erie 5.Ω R.M.A.9

ROTARY CONVERTER.

Elect. Dyn. Con. WIS.1571 Sht.3. Input 6 V., Output 190 V., 80 mA.

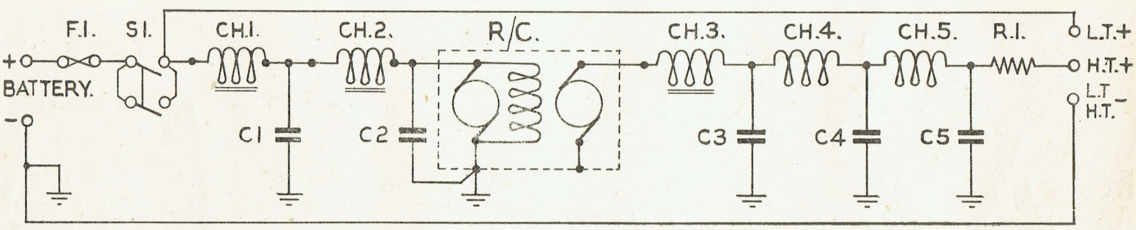


Diagram of Connections, Rotary Converter and Battery. WZ1960/C

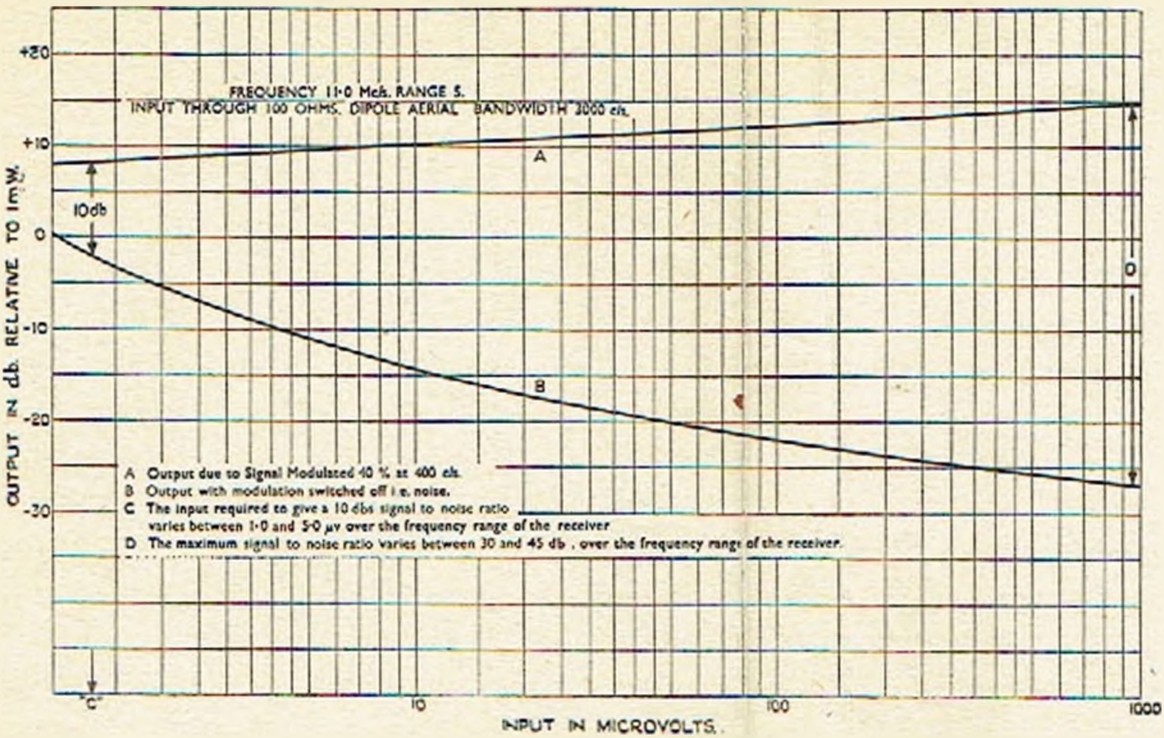


Fig. 4. A.V.C. Response Curves.

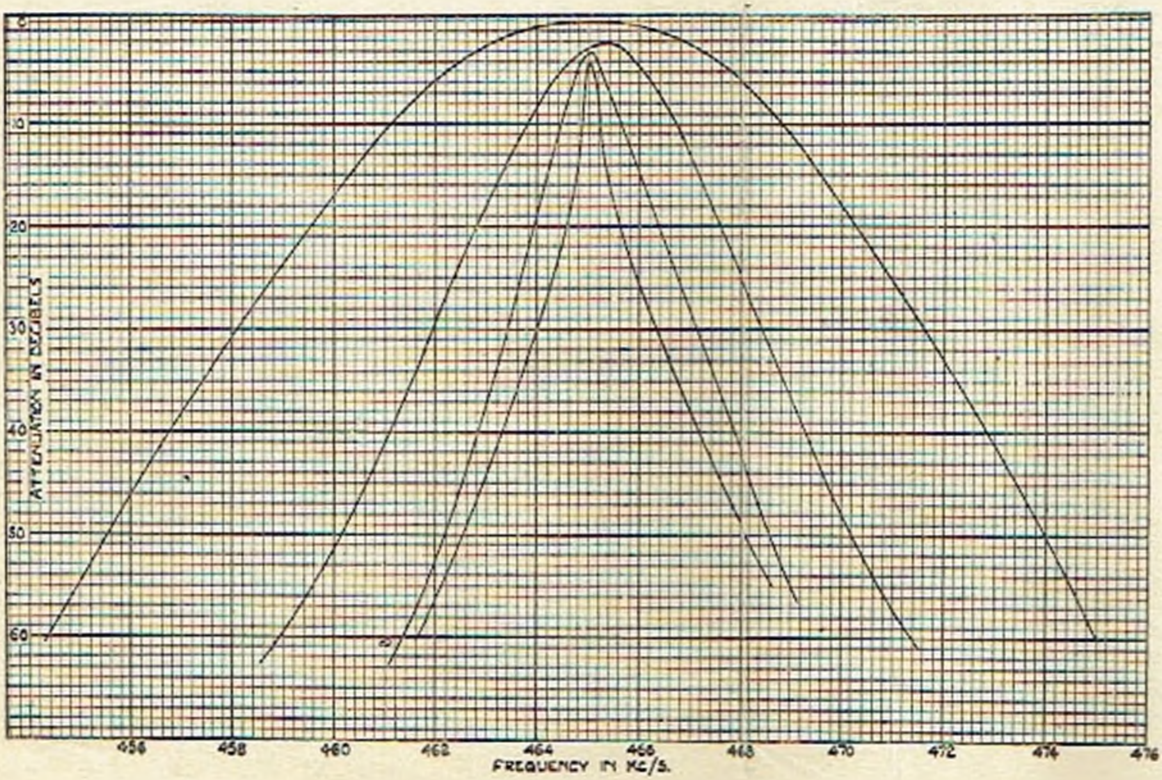


Fig. 5. I.F. Response Curves.

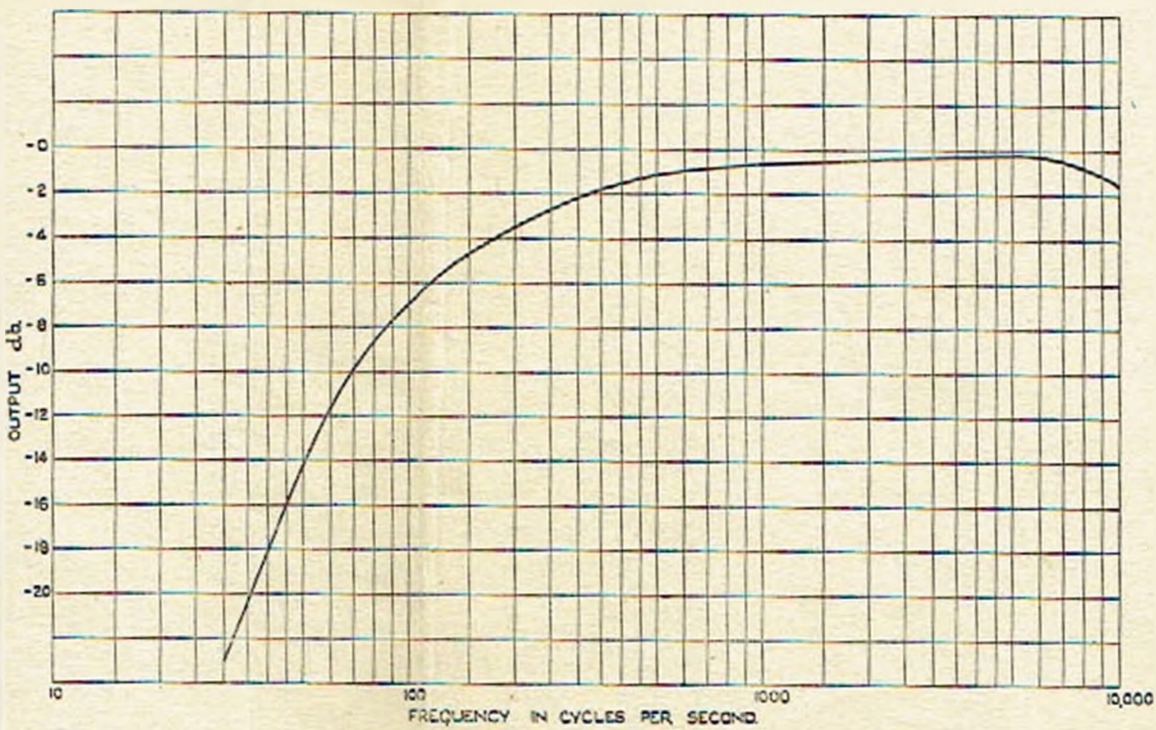


Fig. 6. Audio-frequency Response Curve.

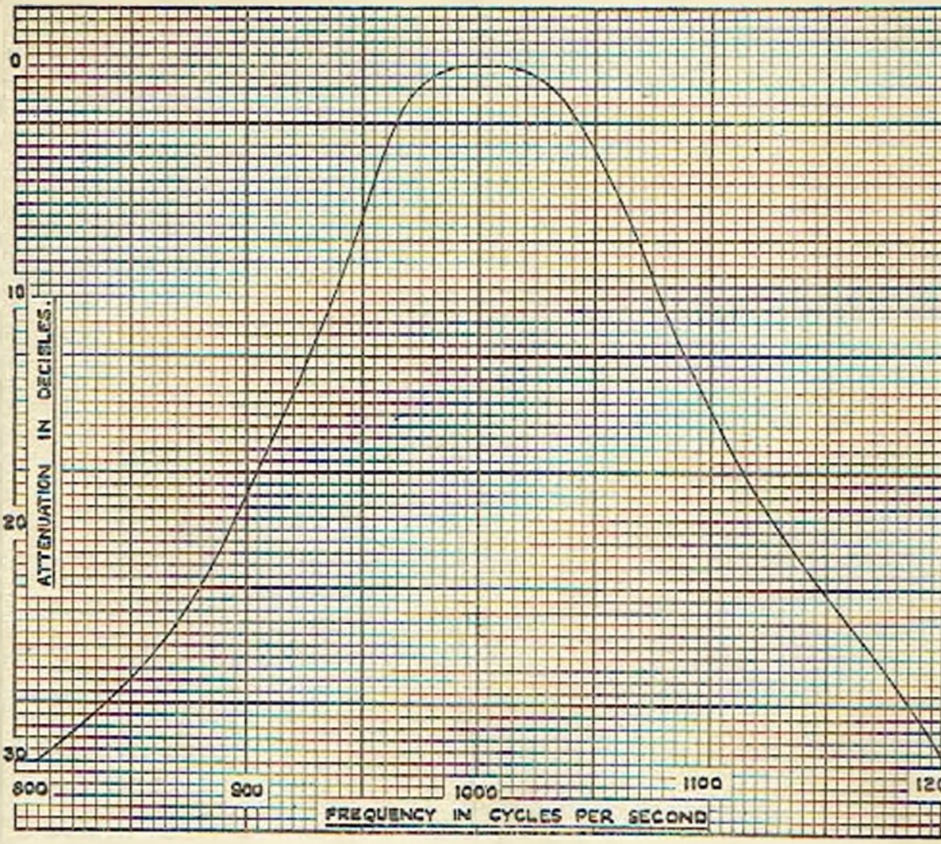


Fig. 7. L.F. Filter Response Curve.

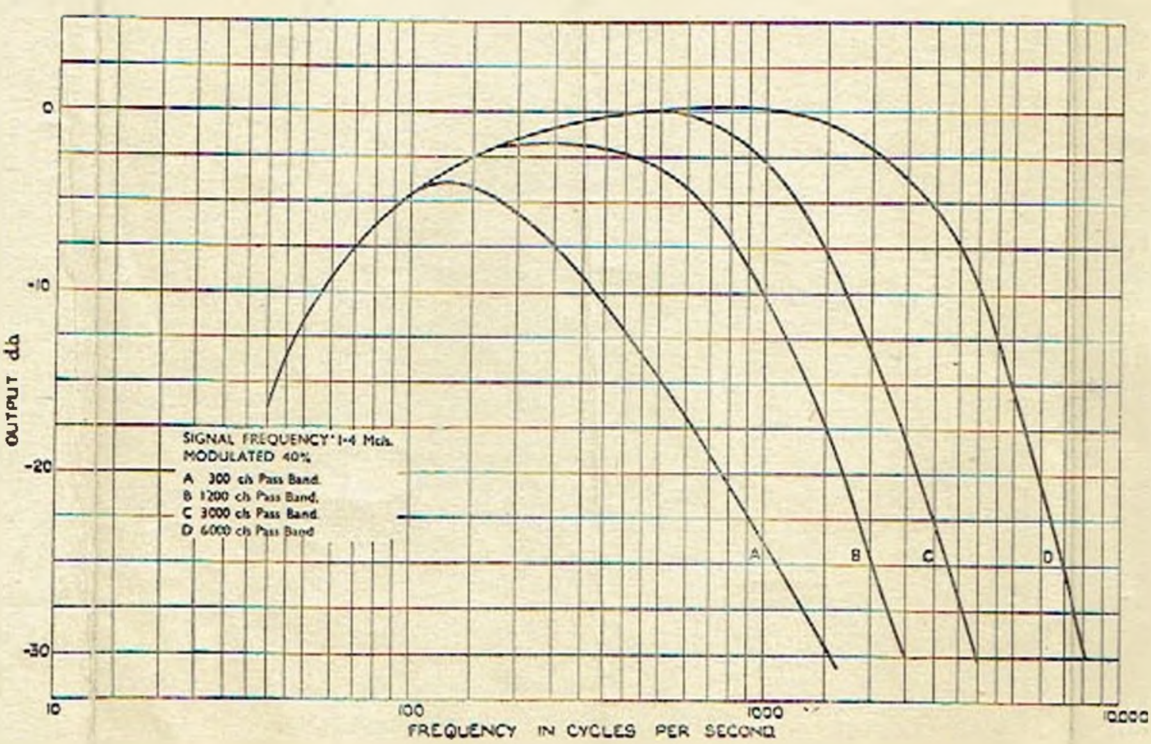


Fig. 8. Overall Fidelity Response Curves.

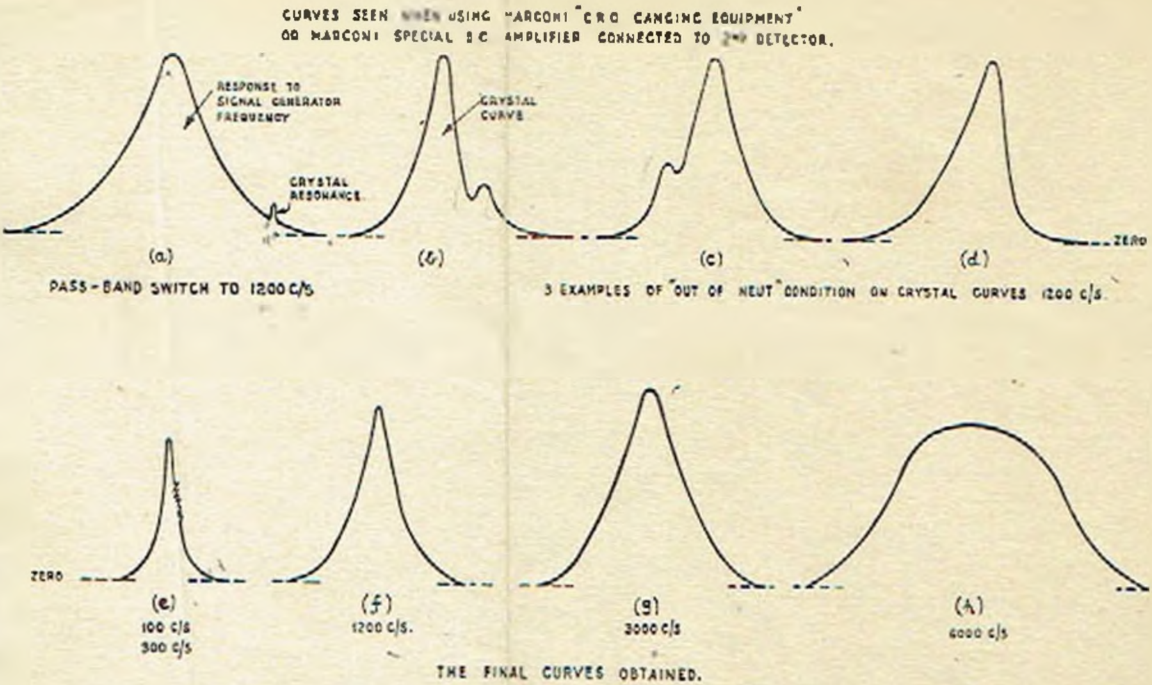


Fig. 13.

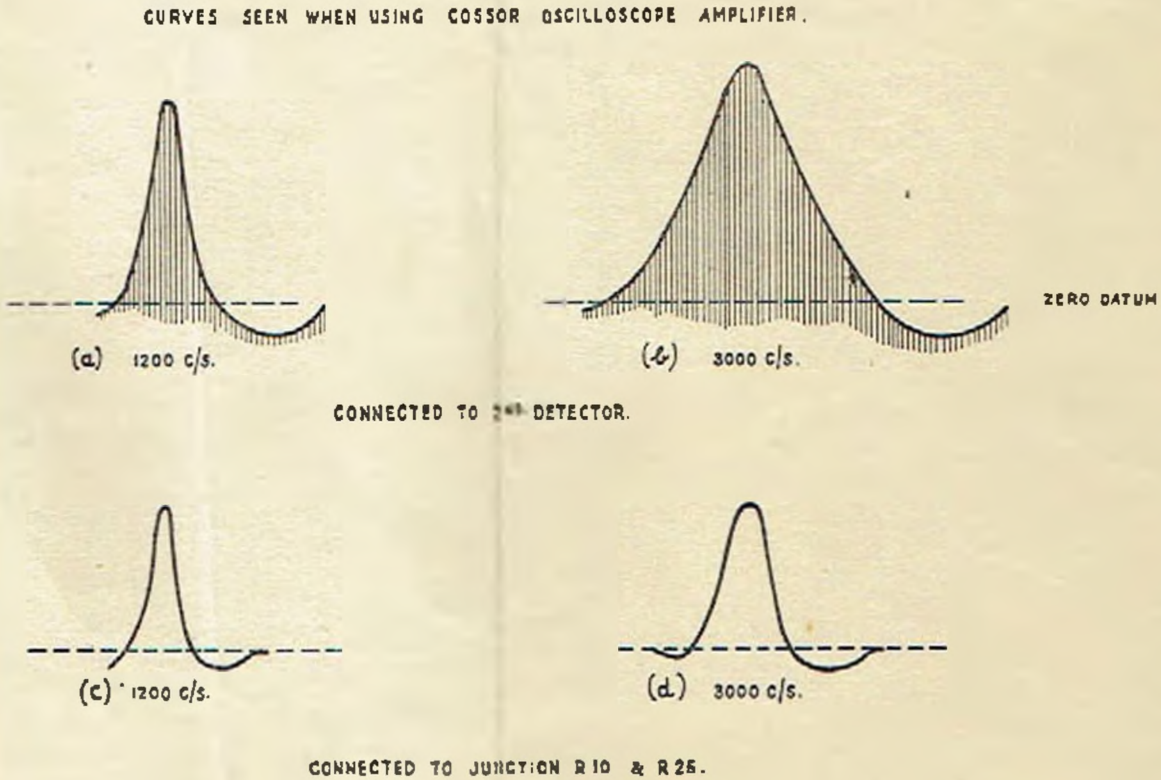


Fig. 14.

I.F. Response Curves (Oscilloscope).

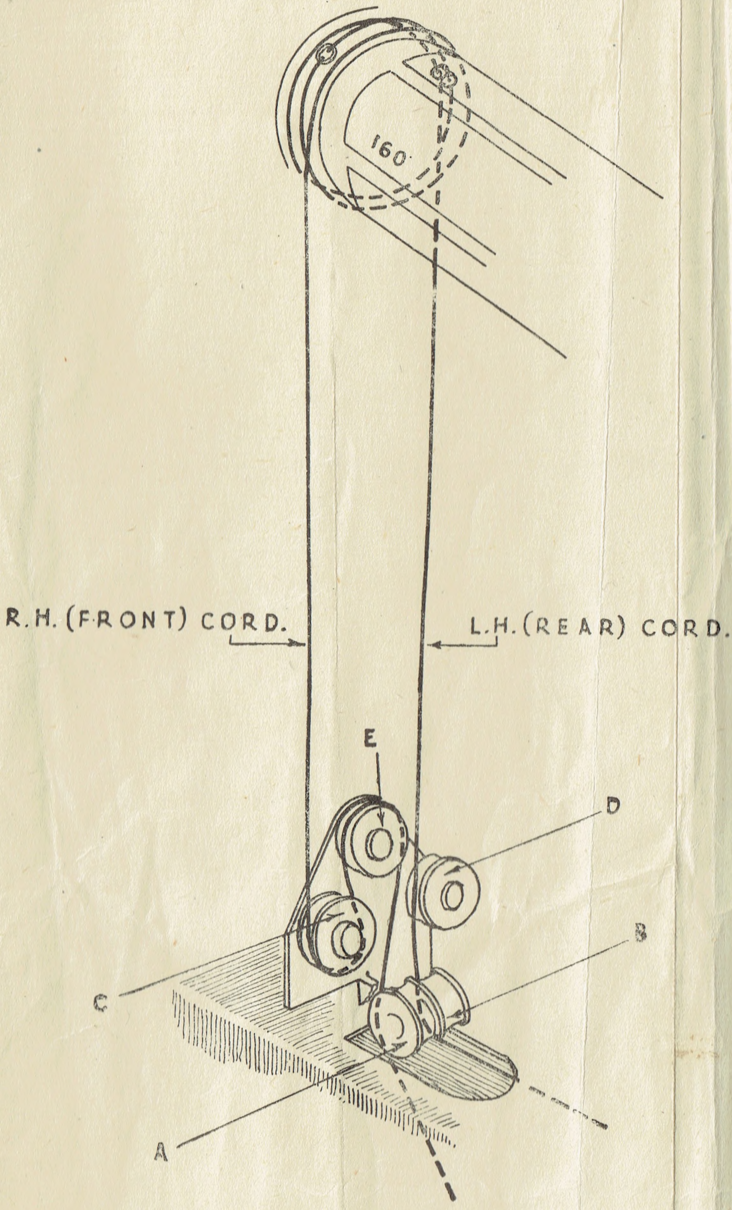
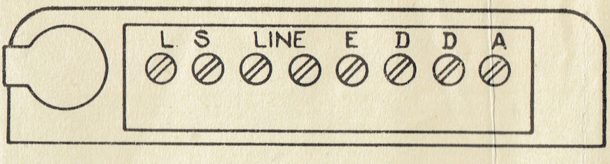


Fig. 11. Band-change Cord.



OTHER D TERMINAL TO BE EARTHED IF USING ONE D TERMINAL FOR AERIAL OR UNBALANCED FEEDER.

Fig. 17. CR100/7.

Rear Terminals of Types C.R.100 and CR.100/4 ^ Receivers.

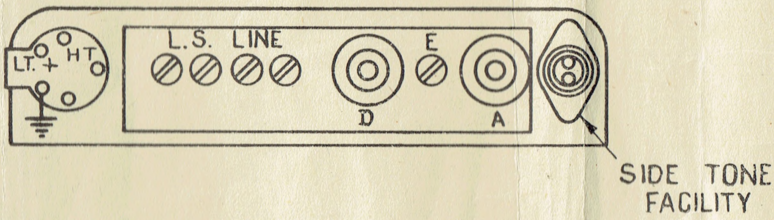


Fig. 18.

Rear Terminals of Type CR.100/2 Receiver.

Side tone, short circuited when not in use.

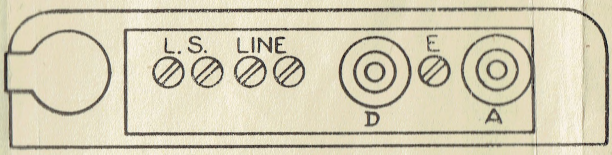
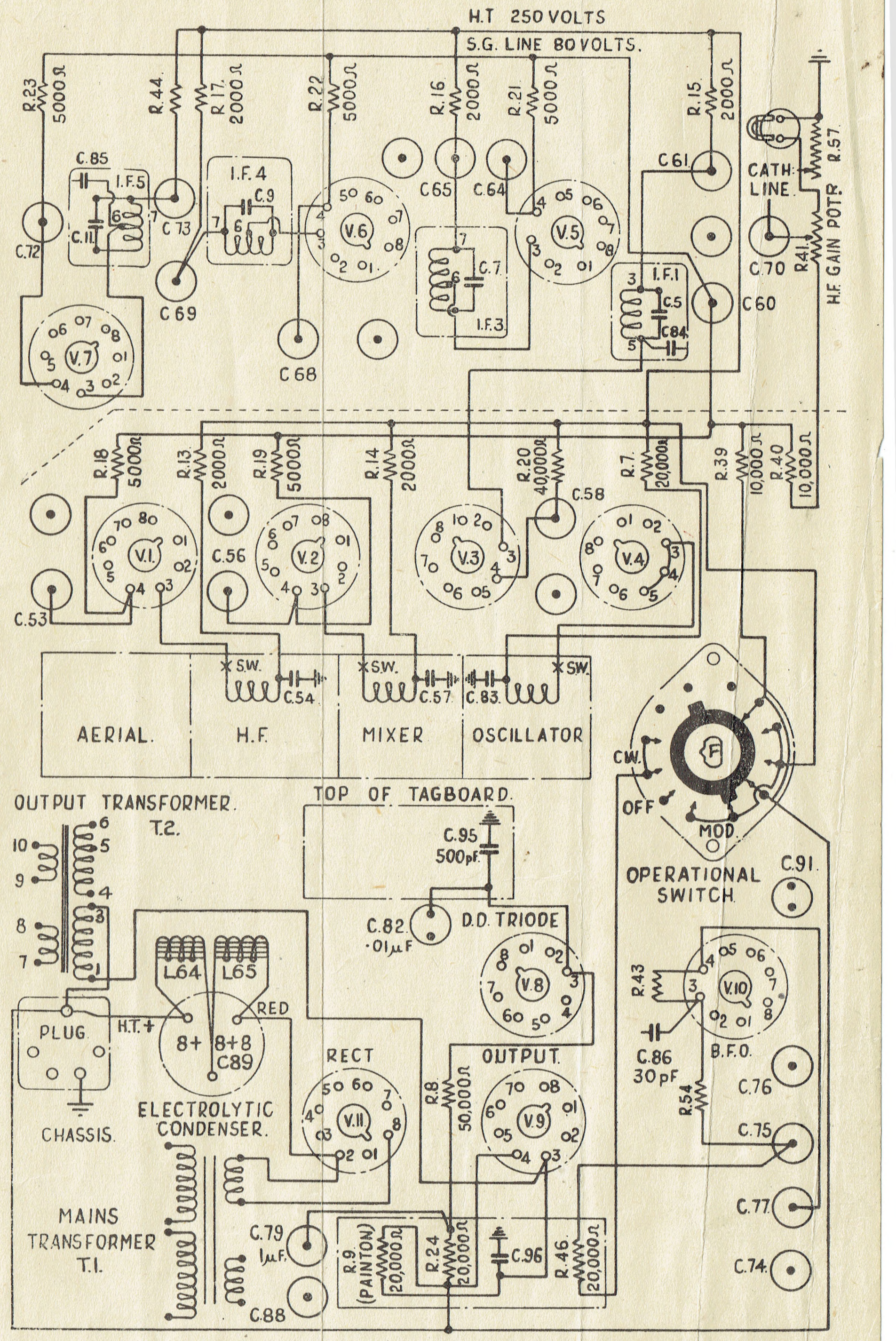


Fig. 19.

Rear Terminals Type CR.100/5 Receiver.

CR100/8.

CR100/8 Mod.



WZ1948/C

H.T. Circuits.

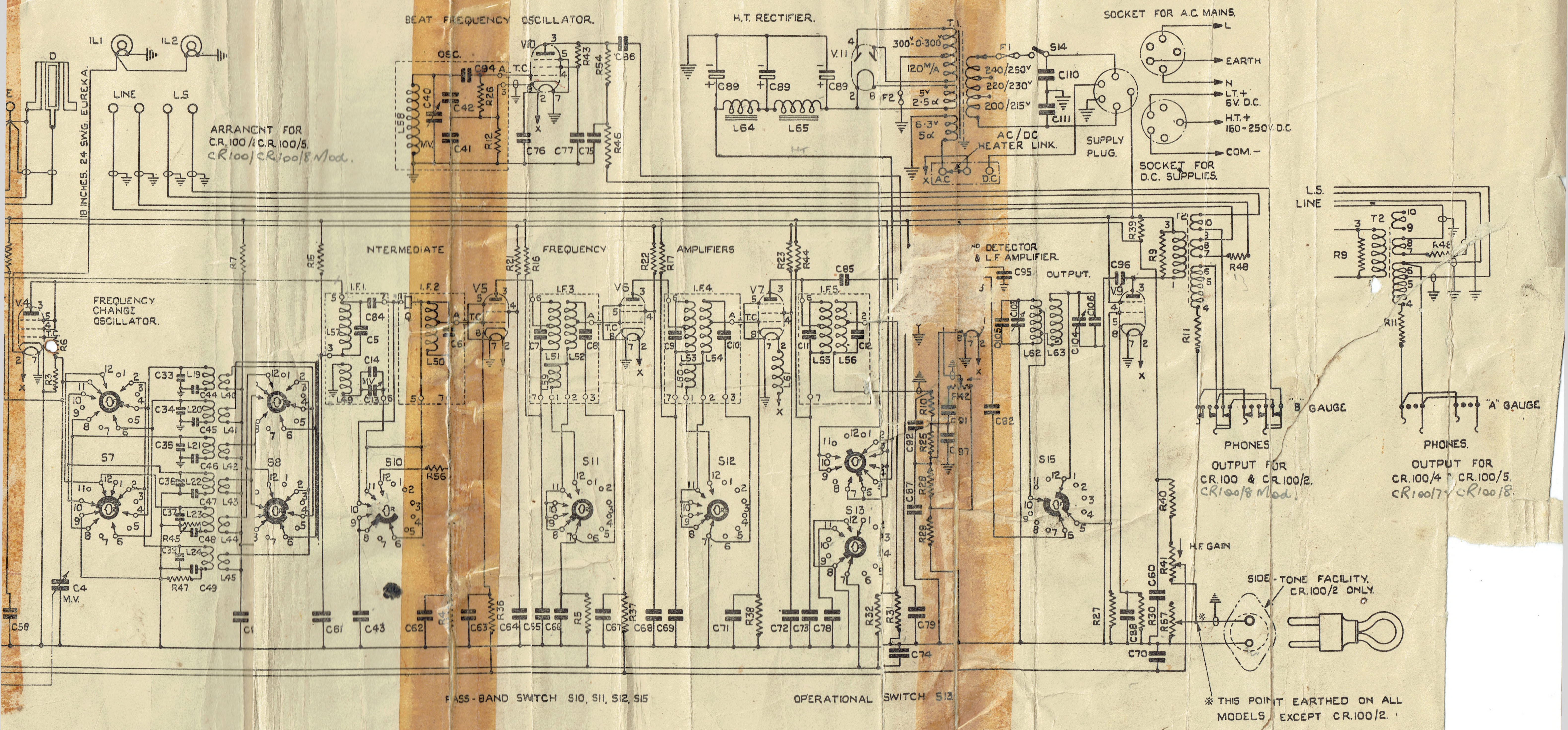
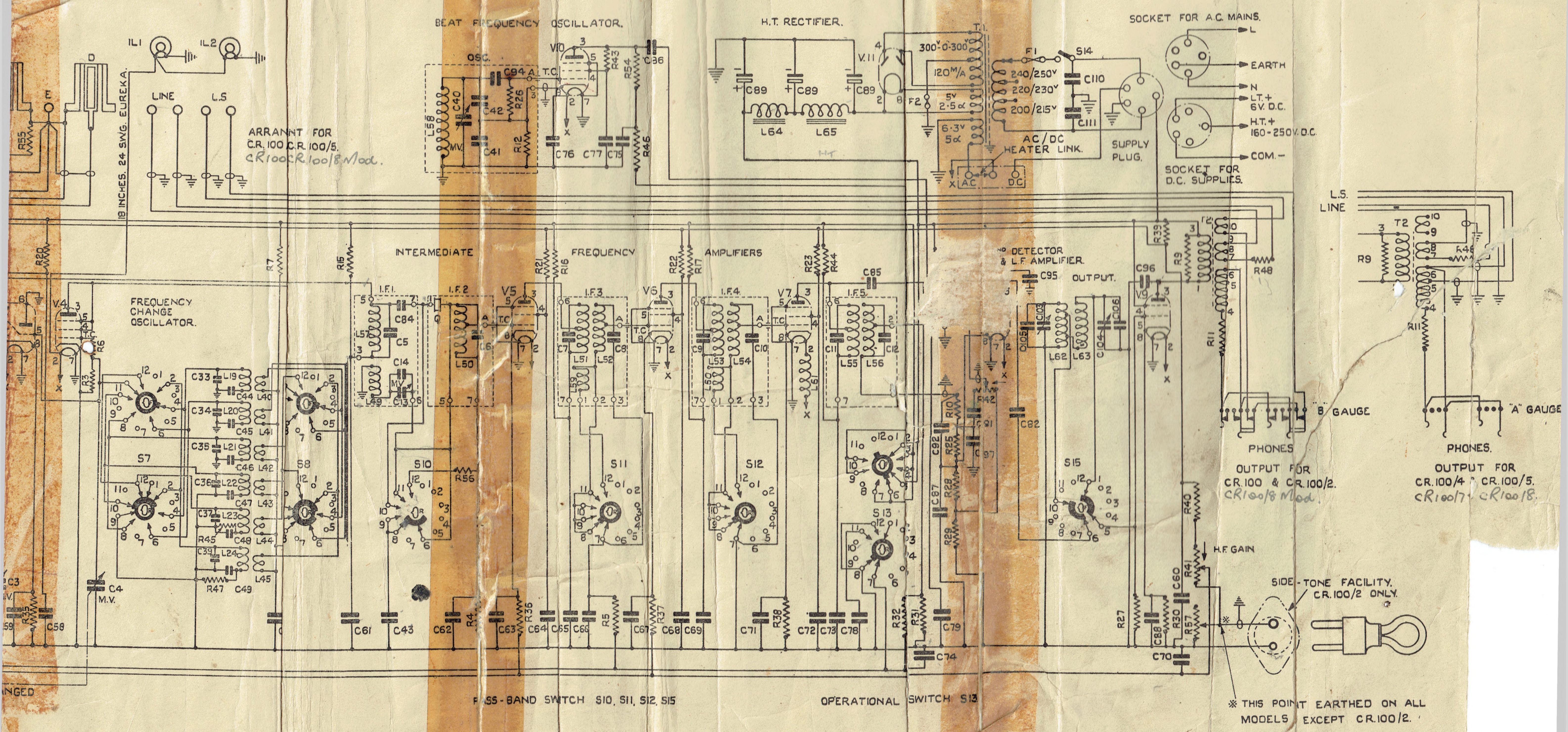


DIAGRAM OF CONECTIONS OF RECEIVER.



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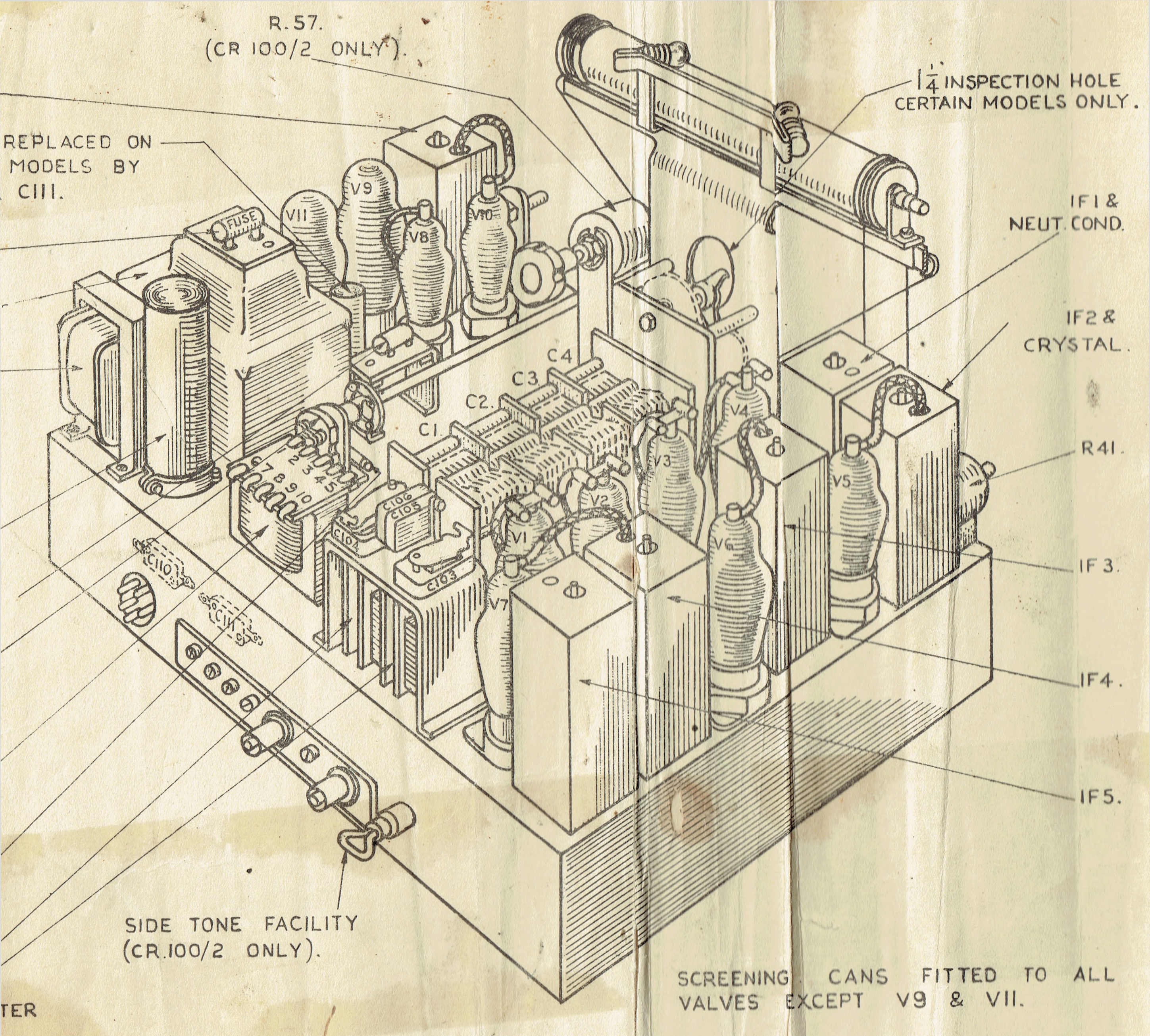


Fig. 20. TOP OF CHASSIS.

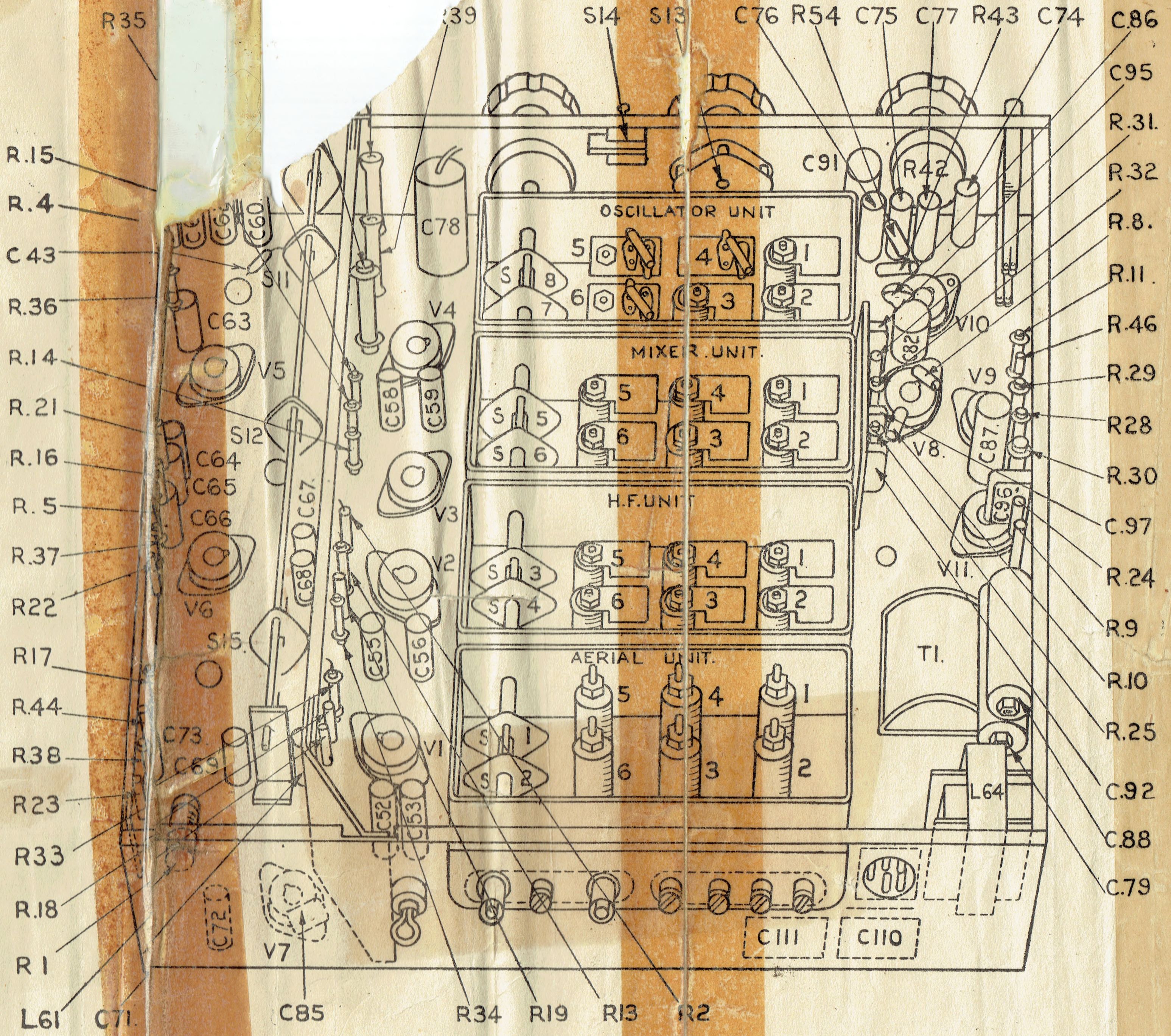


Fig. 21. UNDERNEATH OF CHASSIS.

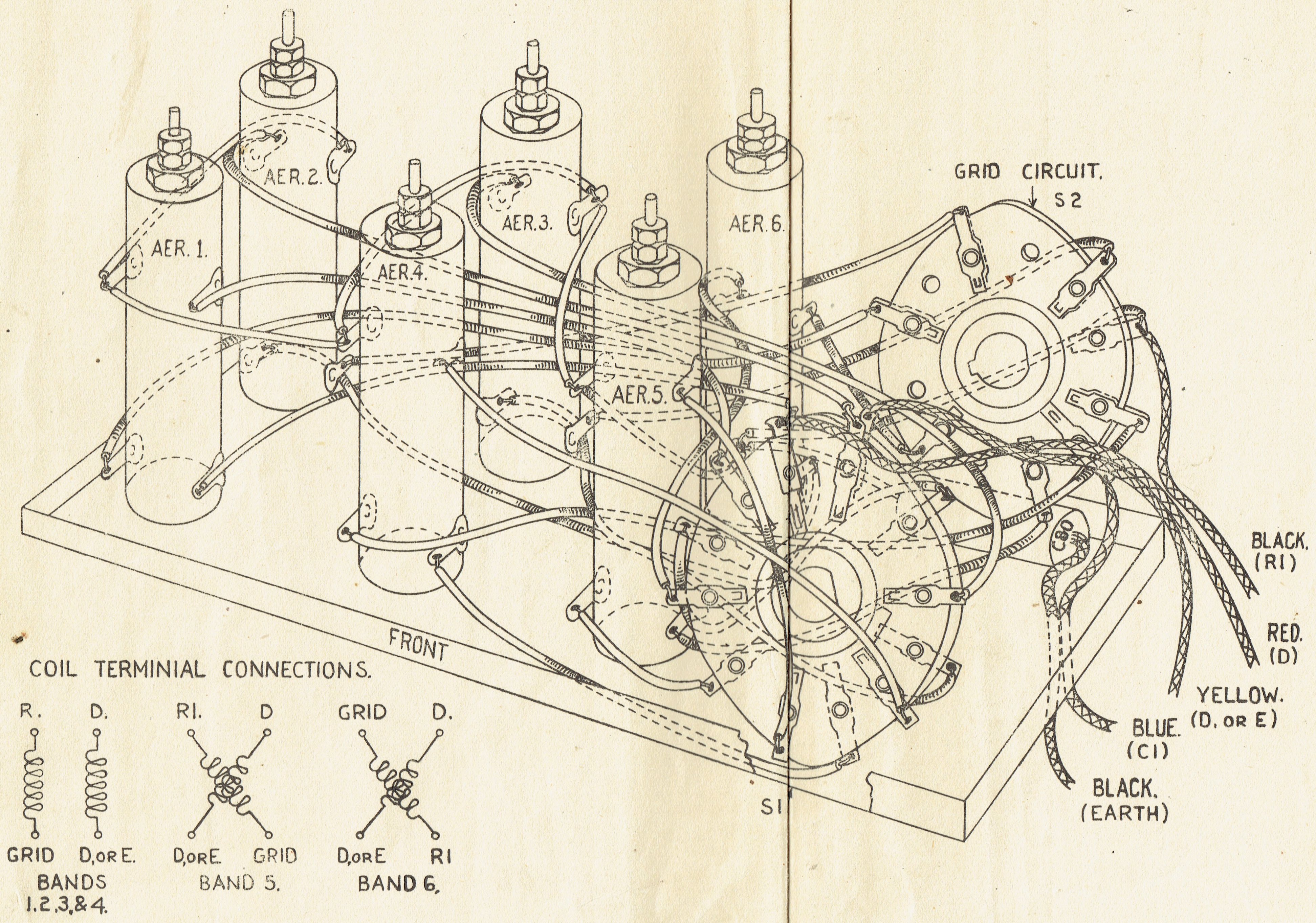


Fig. 22. COIL ASSEMBLY. AERIAL SECTION.

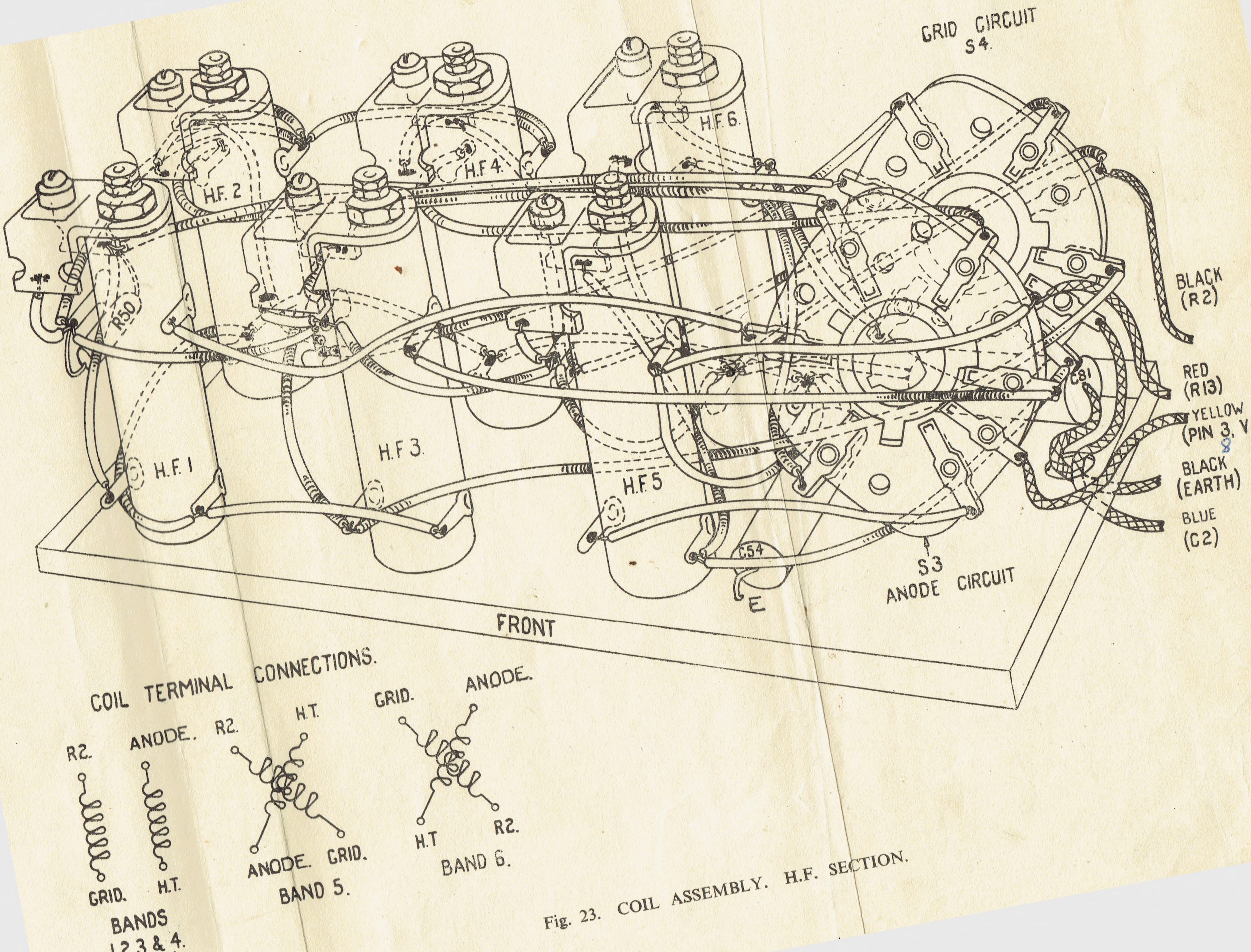


Fig. 23. COIL ASSEMBLY. H.F. SECTION.

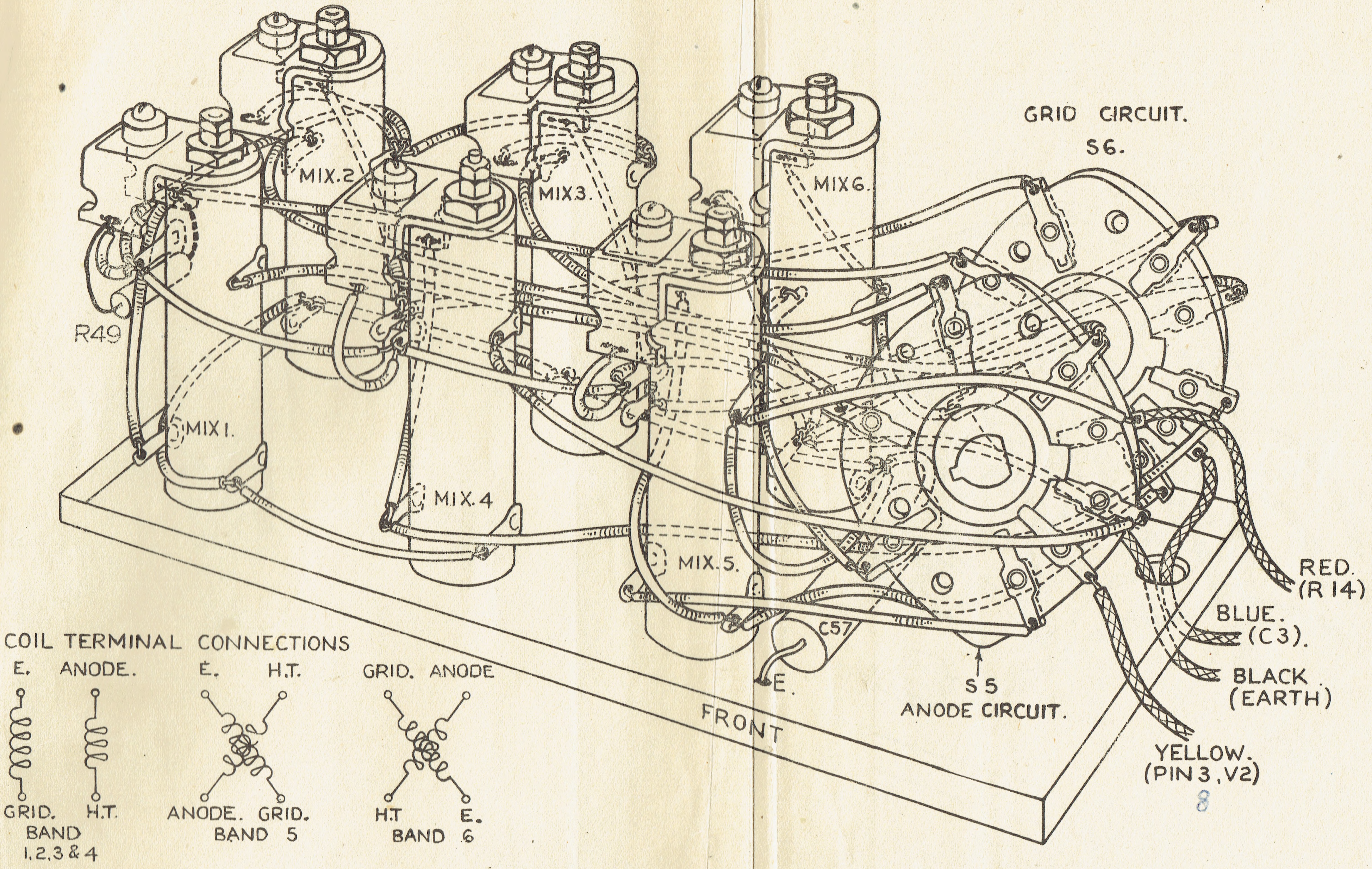


Fig. 24. COIL ASSEMBLY. MIXER SECTION.

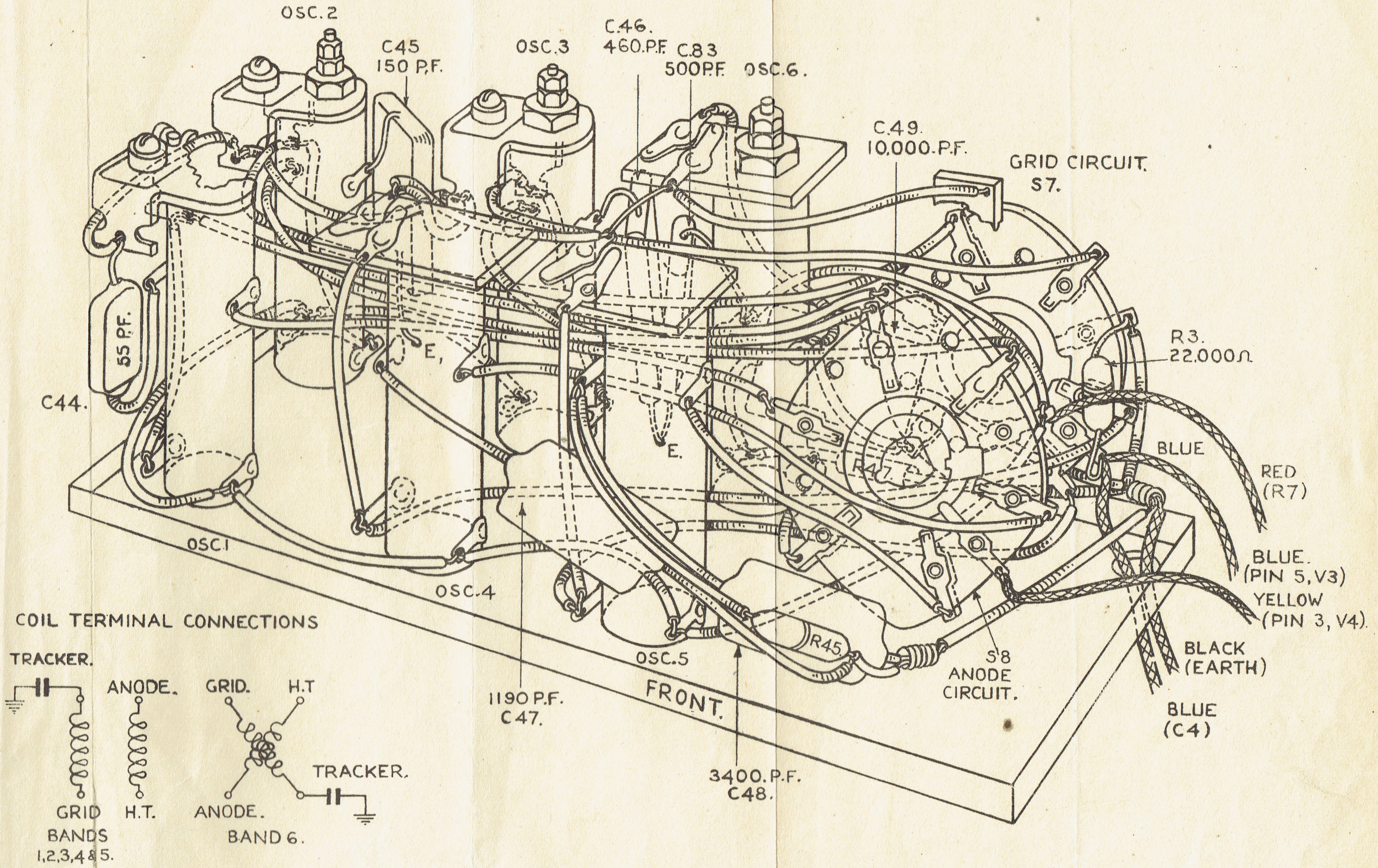
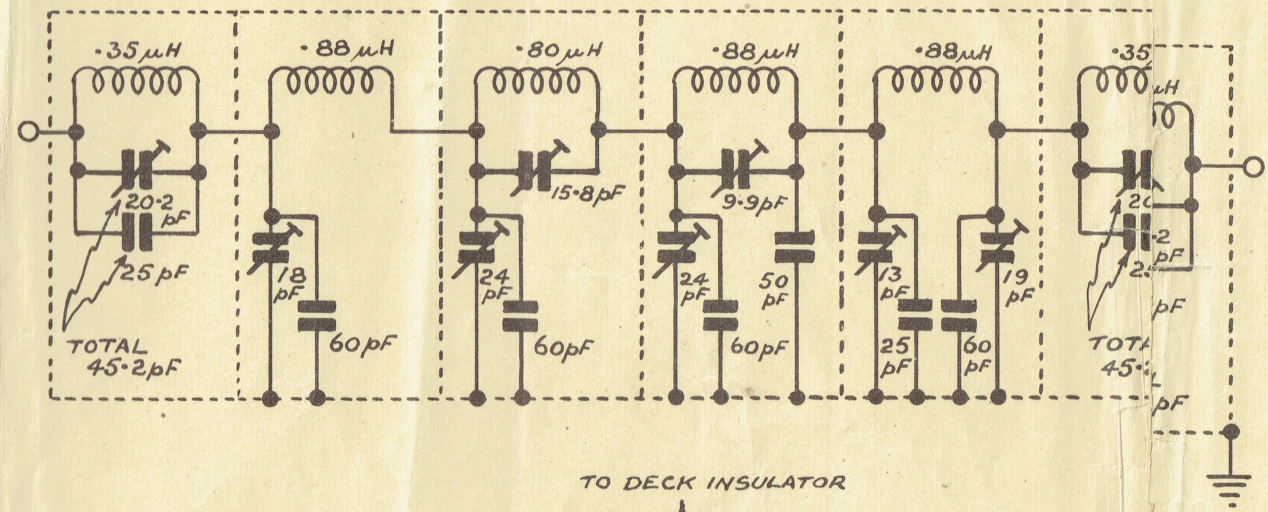


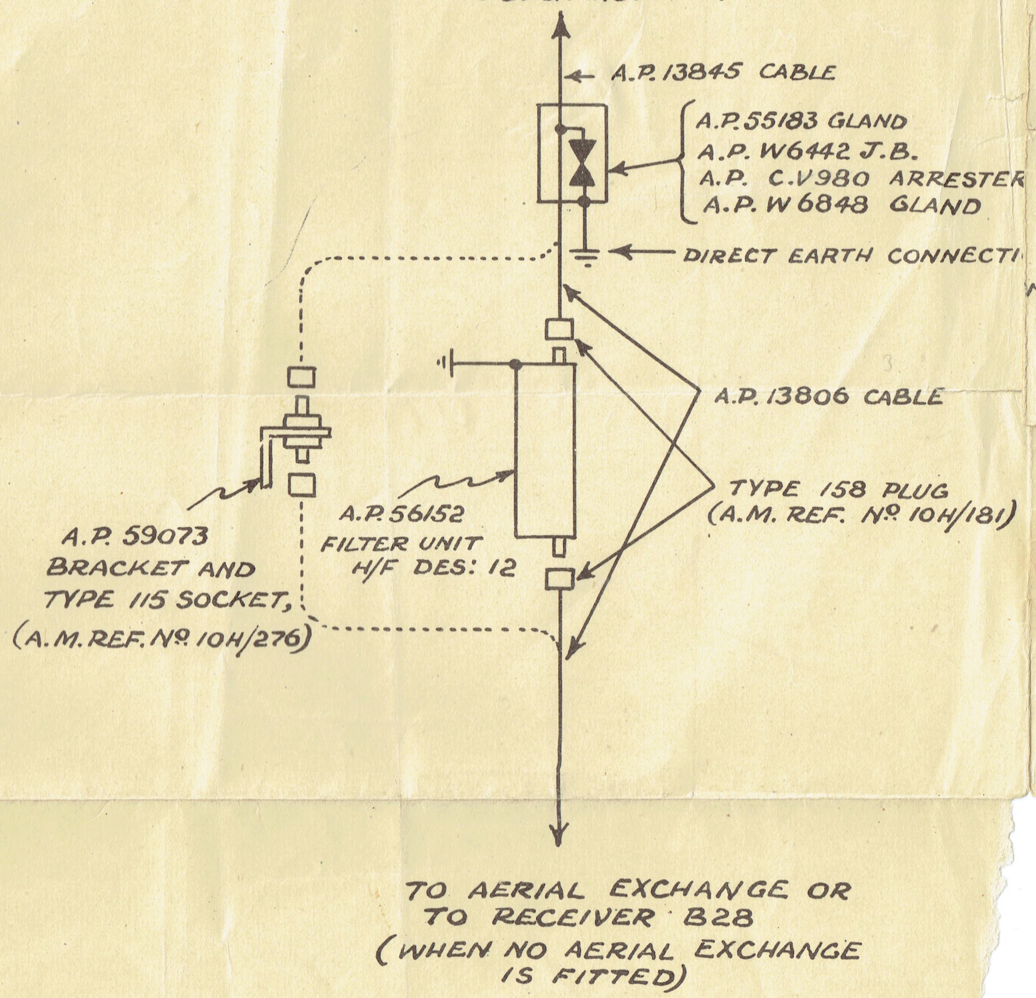
Fig. 25. COIL ASSEMBLY. OSCILLATOR SECTION.

A.P. 56152

FILTER UNIT DES: 12.

CIRCUIT DIAGRAM





A.F.O. "P" SERIES DIAGRAM 39/48

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