WAVEMETER CLASS D No. I
Mk. I, Mk. II and Mk. II*

WORKING INSTRUCTIONS

ZA 21346

CONTENTS

CONTENTS—continued

DIAGRAMS.

WAVEMETER CLASS D. No. 1
MK I, MK II and MK II*

CHAPTER I—GENERAL DESCRIPTION.

1. Purpose and facilities.

The Wavemeter Class D. No. 1, Mk. I, Mk, II and Mk. II* (see Fig. 3) is a portable heterodyne wavemeter similar to the instrument previously known as Corrector Frequency.

NOTE.—The Wavemeter Class D. No. 1, Mk. I is the original Corrector Frequency with minor circuit changes. It has a detachable lid.

The Wavemeter Class D. No. 1, Mk. II is the same as the Mk. I instrument except for minor circuit changes. It has a hinged lid.

The Wavemeter Class D. No. 1, Mk. II* is the same as the Mk. II instrument except for component changes.

It is designed for adjusting senders and receivers to particular frequencies, for checking frequency calibration of these sets, and for determining the frequency of a received signal.

The accuracy of the wavemeter can be expected to be within ±2 kcs. over ranges 1 and 2.

The frequency band covered is 1900 kcs to 8000 kcs (158—37·5 m.) in two ranges, 1900 kcs—4000 kcs and 4000 kcs—8000 kcs. The instrument also provides check frequencies, spaced apart by 1 mcs (1000 kcs), up to 25 mcs (25,000 kcs). These check frequencies are used for verifying gross errors of calibration.

2. Weights and dimensions.

The approximate overall weights and dimensions are as follows :—

TABLE I.—WEIGHTS AND DIMENSIONS.

	Weight.	Width.	Height.	Depth.
In metal case ...	11 lb.	8½ in.	7½ in.	6¼ in.
In metal case carried in Cases, Transit, No. 7	20½ lb.	10½ in.	11¼ in.	9¾ in.

3. Power supply.

The power supply for the wavemeter is normally a 6-volt accumulator external to the instrument. A Clip Battery Special No. 1 is also issued with the wavemeter which enables 6 volts to be tapped from a higher voltage accumulator. This provides filament heating for the valve and dial lamp and also supplies a vibrator which is housed in the instrument for H.T. through a bridge-connected metal rectifier system. The total current consumption is 1·1 amp. at 6 volts.

4. Technical description.

(1) Principle of operation.

The principle of operation of the wavemeter is based on the fact that when a carrier wave is modulated, upper and lower sideband frequencies are produced. The number of sideband frequencies depends upon the number of harmonics generated by the modulating signal

For example, suppose the carrier frequency of 3400 kcs is modulated by 100 kcs signal, then three frequencies are produced, viz.: 3300 kcs, 3400 kcs and 3500 kcs, the 3500 kcs and 3300 kcs being the upper and lower sidebands respectively. The sidebands produced by any frequency which is modulated by another frequency can therefore be found simply as follows :—

$$f_1 = f_0 + fm. \qquad f_2 = f_0 - fm.$$

Where : f_0 is the carrier frequency.
fm the modulating frequency.
f_1 the upper sideband frequency.
f_2 the lower sideband frequency.

Taking another example, assume that the carrier frequency f_0 is 6100 kcs and that fm is 200 kcs, then by substituting these values in the above formulæ the upper sideband frequency f_1=6100 kcs+200 kcs=6300 kcs, and the lower sideband frequency f_2=6100 kcs—200 kcs=5900 kcs.

As has already been stated above, where fm contains a large number of harmonics as in the Wavemeter Class D. No. 1, then obviously these will have to be added to, or subtracted from, the carrier frequency and thereby further upper and lower sideband frequencies are obtained.

Now in the Wavemeter Class D. No. 1 a triodehexode valve is used. The hexode portion of the valve is arranged to generate the carrier frequency and is tuned by a variable condenser (known as the frequency control).

The triode portion of the valve is connected into a crystal oscillator circuit working at a 100 kcs and generates copious harmonics. The crystal oscillator modulates the hexode circuit which is the carrier oscillator.

Suppose for example the carrier frequency is set at 3400 kcs and that the modulating wave has a frequency of 100 kcs (see Fig. 2(A)).

If the modulating wave has harmonics (as in the wavemeter) the frequencies of these harmonics will be 200 kcs, 300 kcs, 400 kcs, 500 kcs, etc. Then from the statements given above the modulated carrier wave will be equivalent to a series of waves having frequencies of :—

3400 kcs (carrier frequency).
3500 kcs, 3600 kcs, 3700 kcs, 3800 kcs, etc. (upper sideband).
3300 kcs, 3200 kcs, 3100 kcs, 3000 kcs, etc. (lower sideband).

But the hexode or carrier portion of the valve in the wavemeter is tuned by a variable condenser (frequency control) which is calibrated from 0 to 100 kcs, so that the carrier frequency itself can be shifted any amount up to 100 kcs. Fig. 2(A) shows the carrier frequency with its sidebands when the wavemeter is set at a carrier frequency of 3400 kcs. At this setting of frequency a sideband signal of 3700 kcs will also be produced owing to modulation as shown above.

Assume now that it is required to generate a signal frequency of 3779 kcs (see fig. 2(B)) then the carrier frequency must be increased from 3400 kcs to 3479 kcs (this is done on the actual wavemeter by rotating the tuning condenser knob so that the scale shows 79 kcs). The carrier now being 3479 kcs, it is obvious that when the carrier is modulated by the 300 kcs harmonic of the crystal oscillator, a sideband frequency of 3779 kcs is produced.

(2) The wavemeter circuit (see Figs. 1, 1A, 1B and 1C. See also Figs 3, 4, and 5).

The circuit of the wavemeter Class D, No. 1, employs a triode-hexode valve V1A. The hexode portion of the valve operates as a carrier oscillator the frequency of which can be varied by the tuning condenser C14A.

When the RANGE switch S1A is in the position 2 (see Fig. 1) the carrier frequency generated by the grid circuit L6A, C8A, †C10B, C9A, C12A, C15A, C16A, and C14A, lies between 3400 kcs and 3500 kcs according to the position of the tuning condenser, the oscillation being maintained by the reaction coil L4A.

† C10B in Mk. I model only.

When the RANGE switch S1A is in the position 1 (see Fig. 1). the carrier frequency generated by the grid circuit L5A, C7A, ††C17A, C12B, C9A, C15A, C16A and C14A lies between 6100 kcs and 6200 kcs according to the position of the tuning condenser C14A, the oscillations being maintained in this case by the reaction coil L3A.

The tuning condenser C14A covers 100 kcs exactly on both ranges. In order that this condition may obtain, the grid circuit coils are pre-set and in addition are provided with trimming condensers.

Since the condenser C14A covers 100 kcs the carrier frequency can thus be varied continuously any amount up to 100 kcs. The last two figures only of the required frequency in kcs are read off the condenser scale of C14A, the scale being calibrated from 0 to 100 kcs.

The condenser C15A enables the zero error on the scale to be corrected. The pre-set condenser C13A controls the amplitude of the oscillations.

The condenser C9A is for temperature compensation.

With RANGE switch S1A in position 3 (see Fig. 1) the hexode portion of the valve V1A functions purely as an amplifier, amplifying the oscillations generated by the 1 mcs crystal X2A in the grid/anode circuit of the valve V1A.

The triode portion of the valve generates oscillations of such amplitude that copious harmonics are produced. These harmonics are of such strength that 1 mcs check points are obtained up to 25 mcs.

With RANGE switch S1A in positions 1 or 2 (see Fig. 1) the triode portion of the valve V1A generates copious harmonics, the fundamental frequency of which is obtained from the 100 kcs crystal X1A, the tuned circuit being the coil L2A and condenser C5A. These harmonics modulate the carrier frequency. The carrier modulated by the 100 kcs crystal and its harmonics produces a spectrum of frequencies comprising the carrier and the associated upper and lower sideband frequencies 100 kcs apart, which extend sufficiently to cover the working range of the instrument. Actually two spectra of frequencies are produced, one on range 2 (see Fig. 1) of the RANGE switch covering 1900 to 4000 kcs and the other on range 1 of the RANGE switch covering 4000 kcs to 8000 kcs.

The third and fourth figures (tens and units) of the frequency in kcs are read off the scale marked KCS. The first two figures (thousandths and hundreds) are taken from the dial of the set under test. If the dial is out by more than ±50 kcs the result will, of course, be wrong ; the steps described in Sec. 12, Chapter II must then be taken.

††C17A not fitted in MK II*

If an external signal is introduced into the wavemeter and its frequency is close to the carrier or sideband frequency produced by the circuit, the audible beats will be heard in the wavemeter phones. In this way the frequency of an external signal is measured.

Oscillations generated by the crystal oscillator also beat with the oscillations generated by the carrier oscillator and produce audible beat notes near the "0" and "100" points on the dial. These are used to check the 0 and 100 kcs points on the wavemeter tuning scale.

In order to avoid using a false beat note, which may be obtained by a signal to be measured beating with one of the harmonics of the crystal oscillations, the frequency of the carrier oscillator may be altered slightly; by pressing the CHECK button on the left hand side of the instrument.

This CHECK button varies slightly the capacity of a small condenser C16A in the tuned circuit of the carrier oscillator. If the beat note changes frequency when this button is pressed the true beat note has been selected. If on the other hand the beat note does not change in frequency when the button is pressed, then a false indication has been obtained by the beating of a harmonic of the crystal oscillator or of an external signal with the signal being checked, in this case it is clear that changing the frequency of the carrier oscillator will have no effect on the frequency of the crystal oscillator or on any external signal and hence the beat note is unchanged in frequency.

The output from the hexode anode is developed across the resistance R5A and fed to the COUPLING terminal through the condenser C10A.

The condenser C6A is a bypass condenser.

The pre-set resistance R9A is initially set for the optimum value of the oscillations generated by the triode anode circuit.

The resistances and condensers R6A, R4A, C3B and C3C are for voltage dropping and decoupling purposes.

The resistances R1A and R3A form the grid leak for the triode grid of V1A, R3A being used simply for measuring purposes in the initial checking of the instrument.

The condenser C11A connected between the grid of the triode and the coupling terminal is used in checking senders and provides sufficient coupling to ensure the resulting beat notes to be heard in the telephones. The triode anode is connected to the telephones through the transformer T2A.

A false beat note may in some cases be obtained from the harmonics of the carrier oscillator modulated by the crystal oscillator, but the instrument is so designed that these harmonics are very weak compared with the fundamental frequency, and the heterodyne notes arising from them should be readily distinguished by their relative feebleness.

(3) The power-supply circuit (see Figs. 1 and 1D).

The power-supply circuit for L.T. and H.T. is contained in the instrument. A pilot lamp P1A not only functions as a dial lamp but also indicates when the L.T. is switched on.

Filtering for the heater V1A is provided by the condensers C3A, C2A and the choke coil L1A.

The vibrator circuit which supplies the H.T. comprises the vibrator VR1A with its transformer T1A and suppressor resistances R8A and R8B. The output from the transformer is filtered by the condenser C3D. This A.C. output is rectified by the bridge-connected rectifier W1A and the D.C. output is fed via the reservoir condenser C1B, smoothing resistance R6B and smoothing condenser C1A to the valve V1A.

(4) Construction (see Figs. 3, 4 and 5).

The Wavemeter Class D. No. 1 is enclosed in a metal case with a lid. For transport purposes it is housed in a wooden carrying case. A spare valve and a spare vibrator are carried on the chassis of the instrument.

The chassis slides into the case and is held in position by two coin slot screws.

The L.T. is supplied through a cable coming from the lower left-hand corner of the front panel.

Phones (L.R.) are plugged into the socket at the lower right-hand corner of the panel.

The range-switch is mounted just above the phone plug and is engraved RANGE SWITCH.

A coupling (input or output) terminal, marked COUPLING, is mounted on the top right hand corner of the panel. The frequency control is mounted in the middle of the panel and a small trimming condenser (SET ZERO) for setting the zero of the scale is mounted at the top left hand corner of the panel. Immediately below the set zero control is a press-button switch (marked CHECK) which varies the capacity of a small condenser in the tuning circuit of the carrier oscillator and thus slightly alters the frequency.

In the Mk. II and Mk. II* models two spare pilot lamp bulbs are carried inside the metal containing case at the right-hand top corner.

NOTES

CHAPTER II—WORKING INSTRUCTIONS.

5. Preliminary.

(1) Remove the instrument from its wooden carrying case.

IMPORTANT NOTE.—The instrument must be always carried in its wooden transport case. (Case Transit No. 7). It should also be used in the transport case whenever possible.

(2) Unscrew the coin slot screws at the back of the wavemeter and withdraw it from its metal case by means of the handle on the front panel.

(3) See that valve and vibrator are in the working position.

(4) Replace and screw wavemeter into case.

(5) Connect the L.T. lead of the wavemeter to a 6-volt accumulator, the red lead being connected to the positive pole of the battery.

The supply for the wavemeter may be taken from a battery supplying other equipment provided that the black lead is connected to the earth terminal and the red lead to a terminal 6-volts positive to this.
(The black lead is connected internally to the case of the wavemeter).

(6) Switch the instrument ON, and plug a pair of L.R. phones into the phone socket marked L.R. PHONES.

(7) Select the appropriate frequency range by the RANGE SWITCH on the right hand side of the panel.

(8) Adjust the frequency control (marked 0 to 100 kcs) in the centre of the panel until the cross line is on the zero (0 position) of the calibrated scale.

(9) Adjust the SET ZERO control at the upper left hand corner of the panel until an audible note is heard in the headphones, and adjust to zero frequency.

(10) The frequency control is then moved so that the cross line is on the other end of the scale (100 kcs position) and in approaching this position a beat note should be heard, the frequency of the note becoming zero when the cross line is on the end of the scale. If this is not the case, the instrument requires further internal adjustment as described in Chapter III Maintenance.

6. To set the wavemeter to a given frequency.

(1) After the preliminary adjustments described above, adjust the frequency control until the reading on the scale corresponds with the third and fourth figures of the desired frequency in kilocycles. For example, if it is required to set the wavemeter to a frequency of 7254 kcs the RANGE SWITCH is adjusted to the range 4000—8000 kcs. and the frequency control is adjusted until the scale reading is 54 kcs. It should be noted that when the instrument is adjusted as in this example signals of frequency 7154, 7054, 6954 . . . . 7254, 7354 kcs. and so on are generated and for this reason it is necessary that the calibration of the instrument to be checked by the wavemeter should not be in error by more than ±50 kcs. This may be ensured by a preliminary check described in Sec. 12.

7. To couple the wavemeter to a sender or receiver aerial.

(1) Connect about 2 feet of insulated wire to the " COUPLING " terminal of the wavemeter and carry it near to the aerial of the sender or receiver. The aerial circuits should be correctly tuned.

(2) In the case of a sender, listen to the wavemeter phones and tune the sender in the neighbourhood of the required frequency. Move the wavemeter frequency control over the whole range and find the strongest beat note. While listening to that note, move the coupling wire towards or away from the aerial until the note is about as loud as the one heard when setting zero as in Sec. 5 para. (10). If the coupling is too tight some additional beat notes may be found due to the harmonics of the carrier oscillator being modulated by the crystal oscillator. These beat notes will cease to be noticeable when the coupling is correctly adjusted. The amount of coupling required will vary at different frequencies.

(3) In the case of a receiver, listen for the beat note on the receiver headphones and use the weakest coupling between wavemeter and receiver which will produce a beat note. The amount of coupling required will vary at different frequencies.

With certain superheterodyne receivers, a strong and a weak beat note may be heard at two settings of the wavemeter dial. Use only that setting which gives the strong signal.

With Wireless Set No. 19 (after this has been correctly tuned) the amount of coupling should not be so great that a "dip" is observed on the meter with the meter switch in position "A.V.C."

8. To set a sender to a given frequency.

(1) Couple the wavemeter to the sender aerial as in Sec. 7.

(2) Set the wavemeter to the given frequency according to Sec. 6.

(3) While listening in the wavemeter headphones adjust the sender frequency until the beat note is obtained in the headphones, then adjust to zero frequency.

(4) Press the CHECK button on the left-hand side of the panel. The frequency of the beat note should change, confirming that it is derived from the signal under test produced by the carrier oscillator side bands and not by the crystal oscillator harmonics. If the beat note does not change, adjust the sender frequency until the correct beat is obtained.

9. To set a receiver to a given frequency.

(1) Set the wavemeter to the required frequency as described in Sec. 6.

(2) Couple the wavemeter to the receiver aerial as in Sec. 7.

(3) Adjust the receiver for C.W. reception (B.F.O. in the correct working position) and while listening in the receiver headphones tune the receiver to the strongest beat note obtained due to the wavemeter.

Important Note.—The aerial circuit must be properly tuned otherwise spurious beat notes may occur (second channel of receiver).

(4) Press the CHECK button on the left-hand side of the panel. The frequency of the beat note should change, confirming that this is the required frequency derived from the wavemeter. If the beat note does not change, adjust the receiver tuning control until the correct beat is obtained.

Note.—As stated above, the calibration of the receiver should be correct within ±50 kcs. In the case of certain superheterodyne receivers a strong and a weak note may be heard at two settings of the dial. Use only that setting which gives the strong signal.

10. Netting.

When using the wavemeter with wireless sets which are provided with netting facilities (e.g. Wireless Sets No. 19 and No. 22) always use the netting drill given in the working instructions for these sets.

11. To determine the frequency of a received signal.

(1) Couple the wavemeter to the receiver aerial as in Sec. 7.

(2) Make the preliminary adjustments described in Sec. 5, leaving the cross line on the zero frequency reading.

(3) Tune in the signal accurately on the receiver and then if C.W. telegraphy is being received switch off the B.F.O.

(4) While listening to the receiver adjust the frequency control of the wavemeter to give zero beat on the signal.

(5) Press the CHECK button on the left-hand side of the panel. The frequency of the beat note should change, confirming that this is derived from the signal beating with the wavemeter.

(6) Note the wavemeter reading. This reading gives the third and fourth figures of the required frequency. The first two figures are determined by the calibration of the receiver (see Sec. 6).

Example: If according to the receiver calibration the signal is between 5300 and 5400 kcs and the reading on the wavemeter dial is 27, then the true frequency of the signal is 5327 kcs.

12. Preliminary check on calibration of receiver or sender.

As was stated above, the first two figures of the frequency to be determined are obtained from the calibration of the sender or receiver under test, and this calibration should not have an error greater than ±50 kcs. If such an error is suspected, a preliminary check on the calibration may be made as follows :—

(1) Switch the RANGE SWITCH to the position marked MCS. In this position the wavemeter generates signals, the frequencies of which are 1 mcs and multiples of 1 mcs (1000 kcs). These signals are used to check the megacycle points on the sender or receiver calibration.

(2) To check the 1/10 mcs (100 kcs) point on the calibration of a sender or receiver, set the instrument according to Sec. 5,

leaving the cross line on zero of the calibrated scale. The wavemeter now generates signals every 100 kcs from which the calibration may be checked.

NOTE.—In the case of a receiver, the aerial circuit must be properly tuned otherwise spurious beat notes may occur (second channel of receiver).

IMPORTANT NOTE.

If the 100 kcs crystal fails to oscillate, then the wavemeter will not function on the 1900—4000 kcs and the 4000—8000 kcs ranges. An indication that the crystal is not oscillating is an abnormal hum in the phones.

This may occur also on the 1 mcs crystal (mcs check points).

Any small amount of hum heard in the phones should be the same in both the above cases if the crystals are oscillating.

NOTES

CHAPTER III—MAINTENANCE.

13. Scale alignment.

IMPORTANT NOTE.

(1) *On no account should the split vanes of the condenser C14A be tampered with.*

(2) *If it is necessary to change the tuning condenser C14A this must be done in a REME workshop.*

(1) The adjustment of scale alignment is made by varying the inductances and capacitances of the tuning circuit associated with the carrier oscillator. The inductances, which are situated on a sub-panel on top of the chassis, are varied by inductance trimmers which can be moved into or out of the inductance solenoid by means of a screw adjustment which must be locked when the desired inductance is obtained. The capacity trimmers are situated above the corresponding inductance coil. If the scale alignment is known to be incorrect as determined in Chapter II. Sec. 5 (10) proceed as follows :—

(*a*) Switch to the range 1900—4000 kcs.

(*b*) Adjust the frequency control until the cross line is on the zero of the scale.

(*c*) Adjust the SET ZERO control at the top left-hand corner of the panel until the beat note becomes zero frequency.

(*d*) Rotate the frequency control until a zero frequency beat note is heard in the neighbourhood of the reading 100 kcs on the calibrated dial. If the cross line is exactly on 100, the calibrated " fits " the calibration on this range. Otherwise instrument continue as follows :—

(*e*) Unscrew the coin slot screws at the back of the wavemeter and withdraw by means of the handle on the front panel.

(*f*) If the beat note of zero frequency is obtained before the cross line reaches the reading 100 (e.g. the beat note of zero frequency may be obtained at the reading 96) slightly increase the capacity of the capacity trimmer on the internal top panel corresponding with the range being adjusted (Fig. 4).

(*g*) Adjust the frequency control until the scale reading is zero.

(*h*) Adjust the inductance of the range being aligned until the zero frequency beat note is reached.

(*j*) Adjust the frequency control until the zero frequency beat note is heard when the reading is in the neighbourhood of 100. It will now be found that the reading is nearer 100 than before.

(*k*) Continue the process described above until the zero frequency beat note is obtained on the end mark at each end of the scale. It will be understood, of course, that with reference to sub-para. (*f*) above that if the second zero frequency beat note is obtained when the cross line has *passed* the reading 100 then the capacity trimmer on the internal sub-panel should be slightly *decreased* in capacity.

(*m*) Switch to the range 4000—8000 kcs and repeat the process described above.

14. To adjust the grid condenser C.13A.

If the carrier oscillator is not oscillating (no set-zero beats) or is oscillating very strongly (beats on 50 kcs division too pronounced) the grid condenser C13A (Fig. 4) needs re-adjustment :—

(1) Unscrew the coin slot screws at the back of the wavemeter and withdraw by means of the handle on the front panel.

(2) Set the RANGE SWITCH to 1900—4000 kcs range.

(3) Set the grid condenser C13A (orange ceramic pre-fixed condenser on the sub-panel inside the top part of the unit) to maximum, i.e. with the black line on the disc pointing upwards.

(4) Set the frequency control (marked 0 to 100 kcs) dial at the 100 kcs point.

(5) Rotate the SET ZERO control until the best note is obtained.

(6) Turn the grid condenser centre adjusting screw anti-clockwise a small amount with a screw-driver, remove the screw-driver from the screw slot and well away from the wavemeter. If the beat note is still there, continue to adjust the screw, little by little, until the note only just disappears. During this operation the SET ZERO control should be re-adjusted from time to time in order to make sure that the note has disappeared since the adjustment of the grid condenser alters the tuning slightly.

(7) Turn the grid condenser from this position clockwise until the black line has moved ⅜ in.

15. To re-set the crystal oscillator output resistance control.

If the crystal or valve has been changed, it may be necessary to re-set the pre-set damping resistance R9A (Fig. 4), but it is essential that the R.F. grid condenser C13A be first adjusted as above if the valve has been changed.

To re-set the damping resistance, proceed as follows :—

(1) Unscrew the coin slot screws at the back of the wavemeter and withdraw by means of the handle on the front panel.

(2) Set the RANGE SWITCH to 1900—4000 kcs range.

(3) Set the frequency control to 0 on the dial.

(4) Adjust the SET ZERO control for the beat note.

(5) Set the frequency control near to 50 kcs (centre of dial) so as to hear the faint beat note existing there.

(6) Adjust the pre-set damping resistance (this resistance is mounted on the crystal sub-panel and is adjusted by means of a screw-driver) little by little, so that a beat note as weak as possible is obtained in the 50 kcs position of the dial.

> NOTE.—The pre-set resistance has the maximum value when its adjusting screw is turned fully clockwise and a minimum value when turned fully anti-clockwise. Owing to the circuit characteristics in which it is used, however, the crystal oscillations weaken and reach a minimum on nearing the extreme anti-clockwise position and then increase slightly again as the extreme position is reached.

(7) Set the frequency control dial to 0.

(8) Set the RANGE SWITCH to the 4000—8000 kcs position and check using the SET ZERO control that the beat note is sufficiently strong. If there is no beat note or if it is not sufficiently strong, then a compromise will have to be made, i.e. the note made weak in operation (6) will have to be made stronger.

NOTES

APPENDIX I—LIST OF MAIN COMPONENTS.

W.D. Cat. No.	Designation.	Reference. Symbol.	Reference. Fig.	Value.	Remarks.
W.B. 0071	Bulbs, 6 volt, J.	P1A	1 & 4	6 volt, 0·06 amp.	Dial and Indicator Lamp.
ZA 17121	Chokes, R.F. No. 114 ...	L1A	1 & 5	—	Smoothing in vibrator circuit.
ZA 1946	Condensers, 8, M.	C1A	1, 4, 5	8 μF.	Electrolytic H.T. Smoothing reservoir.
"	" "	C1B	1, 4, 5	8 μF.	" " " "
ZA 11331	" 50, J ...	C2A	1 & 5	‡50 μF.	Vibrator filter Reversible electrolytic 12 volt working.
§ZA 22248	" 50, T				
ZA 0913	" P.1.AC. ...	C3A	1 & 5	0·1 μF.	Vibrator filter.
"	" " ...	C3B	1 & 4	"	Hexode screen decoupling.
"	" " ...	C3C	1 & 4	"	" " "
"	" " ...	C3D	1 & 5	"	H.T. filter.
XA 1622	" Q.1.M.	C4A	1 & 5	0·01 μF.	Bias by-pass.
ZA 17113	" R.1.BC. ...	C6A	1 & 5	0·001 μF.	Crystal tuning by-pass.
ZA 1507	" R.1.X. ...	C5A	1 & 4	0·001 μF.	100 kcs triode tuning.
ZA 14779	" X.3.S. ...	C7A	1 & 4	300 μμF.	Hexode grid tuning. Range 4000/8000 kcs.
ZA 14669	" X.135A. ...	C8A	1 & 4	135 μμF.	Hexode grid tuning. Range 1900/4000 kcs.
ZA 21172	" Y.25.P.	††C17A	1 & 4	25 μμF. (Mk. I)	Hexode grid tuning. Range 4000/8000 kcs.
ZA 21173	" Y.2.AD			20 μμF. (Mk. II)	
ZA 14667	" Y.5.Z. ...	C9A	1 & 4	50 μμF.	Temperature compensating condenser
ZA 13324	" Z.5.K. ...	C10A	1 & 4	5 μμF.	Hexode anode aerial coupling.
ZA 13324	" " ...	†C10B	1 & 4	" "	Hexode grid tuning. Range 1900/4000 kcs.
ZA 11427	" Z.1.A. ...	C11A	1 & 4	1 μμF.	Triode grid aerial coupling.
	Condensers, Semi-Fixed :—				
ZA 1968	Y.2.B.	C12A	1 & 4	20μμF. (Mk. I)	Grid trimming for hexode for ranges 1900/4000 kcs. and 4000/8000 kcs.
ZA 1971	Y.5.A.			50μμF. (Mk. II)	
ZA 0968	Y.25.B.			25μμF. (Mk. II*	" " "
ZA 1968	Y.2.B.	C12B	1 & 4	20μμF. (Mk. I)	
ZA 1971	Y.5.A.			50μμF. (Mk. II)	" " "
ZA 0968	Y.25.B.			25μμF. (Mk. II)*	

‡ Mk. I model was fitted with 0·5 μF paper condenser. For replacement purposes a ZA 11331 shall be fitted in lieu.
† Fitted in Mk. I model only.
†† Fitted in Mk. I and Mk. II models only.
§ Fitted in Mk. II* model only.

APPENDIX I.—LIST OF MAIN COMPONENTS.

W.D. Cat. No.	Designation.	Reference. Symbol.	Reference. Fig.	Value.	Remarks.
ZA 13520	Y.6.B.	C13A	1 & 4	15–60 μμF.	Grid condenser of hexode.
ZA 13325	Y.35.D.	C16A	1, 3, 4	35 μμF.	Press check condenser. Fitted to Switches. Push button S.P. No. 5 (ZA 13333).
	Condensers, Variable :—				
ZA 13521	Y.2.E.	C14A	1, 3, 4	20 μμF.	Hexode grid tuning condenser for both ranges.
ZA 13522	Z.8.B.	C15A	1, 3, 4	8 μμF.	Set-Zero condensers.
	Inductances :—				
ZA 13326	R.F. 4-mH, No. 1 ...	L2A	1 & 4	4mH	100 kcs tuning in triode anode.
ZA 17122	Oscillator No. 16 ...	L3A	1 & 4	—	Reaction coil on hexode range. 4000/8000 kcs wound on same former as L5A.
†ZA 21365	" No. 50 ...	L5A	1 & 4		Tuning grid hexode range 4000/8000 kcs.
ZA 17123	Oscillator No. 17 ...	L4A	1 & 4	—	Reaction coil of hexode range 1900/4000 kcs wound on same former as L6A.
†ZA 21362	" No. 51 ...	L6A	1 & 4	—	Tuning grid hexode range 1900/4000 kcs.
ZA 4394	Jacks, Microphone, No. 2...	J1A	1, 3, 5	—	Phone jack.
ZA 13327	Oscillators, Quartz, 100 kcs +1000 kcs.	X1A	1 & 4	100 kcs	
		X2A	1 & 4	1 Mcs	
ZA 13328	Rectifiers, Selenium, No. 23	W1A	1 & 5	—	Comprising four rectifiers in bridge-connected circuit.
	Resistors, No. 2A, ½-W.—				
ZA 13332	2-meg-ohms	R1A	1 & 4	2 megohms	Triode grid leak.
ZA 7323	500,000 ohms	R2A	1 & 4	500,000 ohms	Hexode grid leak.
ZA 7322	100,000 "	R3A	1 & 4	100,000 "	Triode grid leak circuit.
ZA 7309	20,000 "	R4A	1 & 4	20,000 "	Screen decoupling for hexode amplifier circuit.
ZA 6497	2,000 "	R5A	1 & 5	2,000 "	Anode hexode.
ZA 7307	1,000 "	R6A	1 & 4	1,000 "	Screen hexode.
		R6B	1 & 5	1,000 "	Series with H.T. and smoothing.

†Fitted in Mk. II* only.

APPENDIX I—LIST OF MAIN COMPONENTS.

W.D. Cat. No.	Designation.	Reference. Symbol.	Reference. Fig.	Value.	Remarks.
	Resistor —				
ZA 13331	No. 2B, ½-W, 820 ohms	R7A	1 & 5	820 ohms	Cathode bias for V1A.
ZA 13330	No. 2A, ½-W, 150 ohms	R8A	1, 4, 5	150 ,,	Across primary of vibrator transformer.
		R8B	1, 4, 5	150 ,,	
	Resistances, Variable—				
ZA 13390	50,000 ohms, No. 15 ...	R9A	1 & 4	50,000 ,,	Across 100 kcs tuned circuit. Pre-set.
	Switches, rotary disc—				
ZA 14666	4-pole, 3-position, 2-bank No. 2	S1A	1, 3, 4	—	Wafer type range switch.
ZA 4949	Switches, on-off, S.P. No. 8	S2A	1, 3, 5	—	On-off L.T.
ZA13333	Switches Push button S.P. No. 5	—	1, 3, 4		Designated Press check C16A.
ZA 13336	Transformers, vibrator, No.6	T1A	1, 4, 5	—	Vibrator transformer.
ZA 13391	,, telephone, No. 23	T2A	1 & 5	—	Phone transformer.
ZA 2985	Valves, W.T. type ARTH 2	V1A	1 & 4	—	Triode-hexode.
ZA 6779	Vibrators, No. 2	VR1A	1 & 4	—	
	NOTE.—Alternative resistors for R1A to R8B are :—				
	Resistors—				
ZA 6471	No. 3A, ½-W, 2-megohms	R1A			
ZA 6437	,, 500,000 ohms	R2A			
ZA 6434	,, 100,000 ohms	R3A			
ZA 6427	,, 20,000 ohms	R4A			
ZA 6516	,, 2,000 ohms	R5A			
ZA 6424	,, 1,000 ohms	R6A			
		R6B			
ZA 18138	No. 3B, ½-W. 820 ohms	R7A			
ZA 3699	No. 3A, ½-W. 150 ohms	R8A			
		R8B			

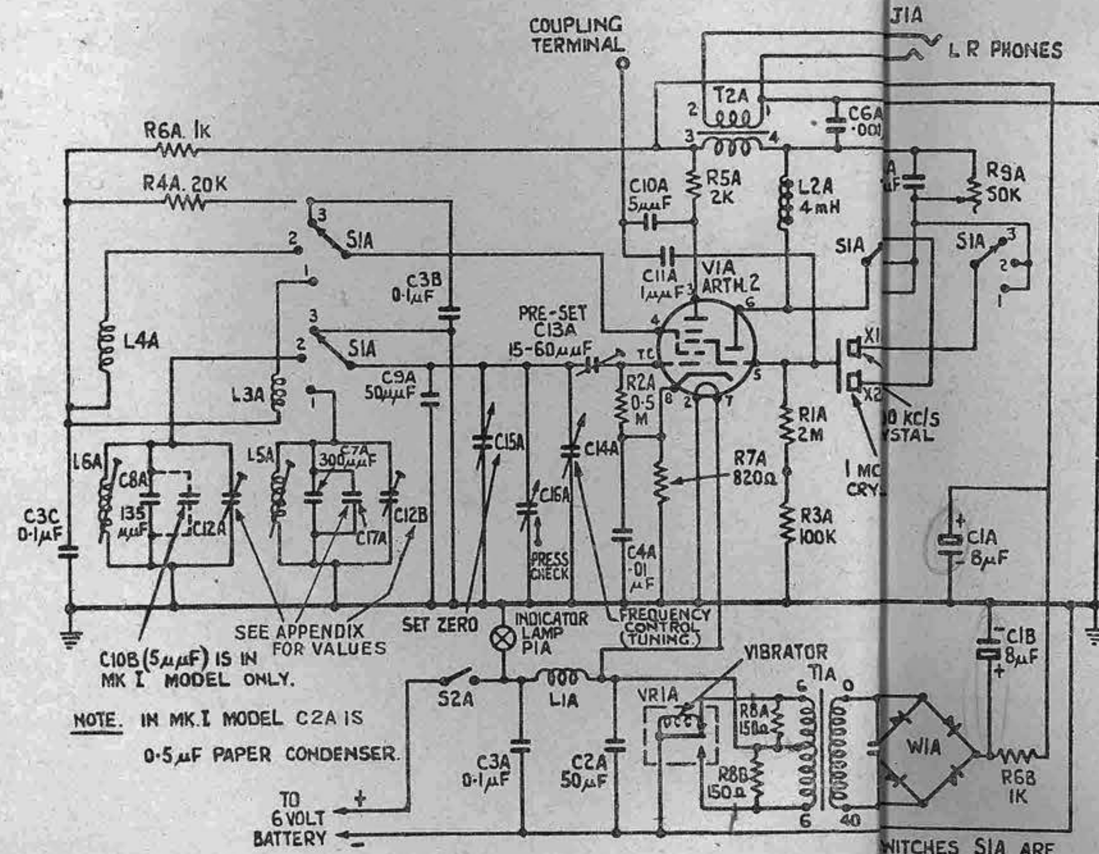

FIG. 1

WAVEMETER CLASS D No. 1, CIRCUIT DIAGRAM.

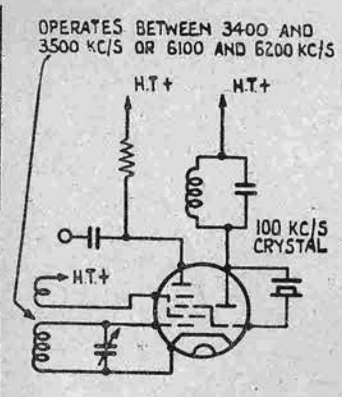

FIG. 1A

SIMPLIFIED DIAGRAM OF WAVEMETER CLASS D, No. 1

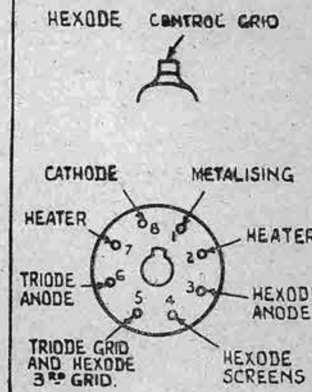

FIG. 1B

VALVE CONNECTIONS VIEWED FROM BELOW

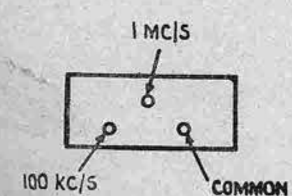

FIG. 1C

CRYSTAL CONNECTIONS VIEWED FROM BELOW.

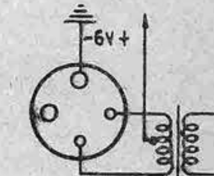

FIG. 1D.

VIBRATOR CONNECTIONS VIEWED FROM BELOW

FIG. 2

WAVEMETER CLASS D No 1

DIAGRAM SHOWING PRINCIPLE OF OPERATION

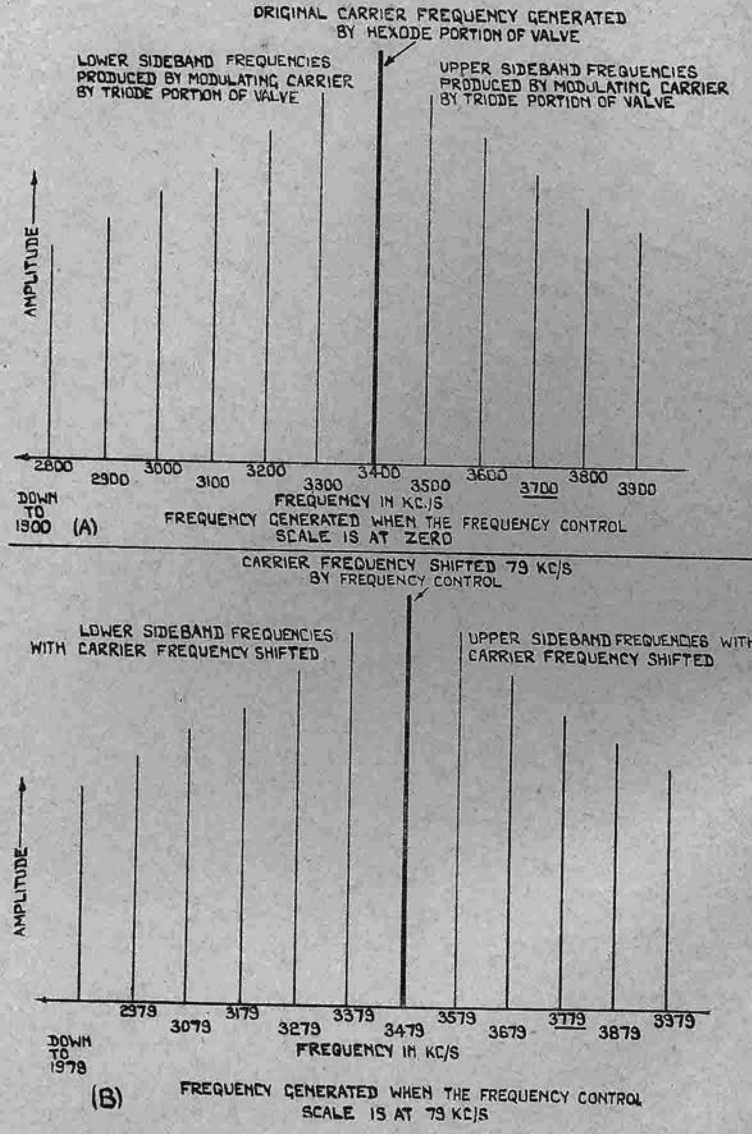

Fig. 2

NOTE. THE MARK I MODEL HAS A DETACHABLE AND NOT A HINGED LID.

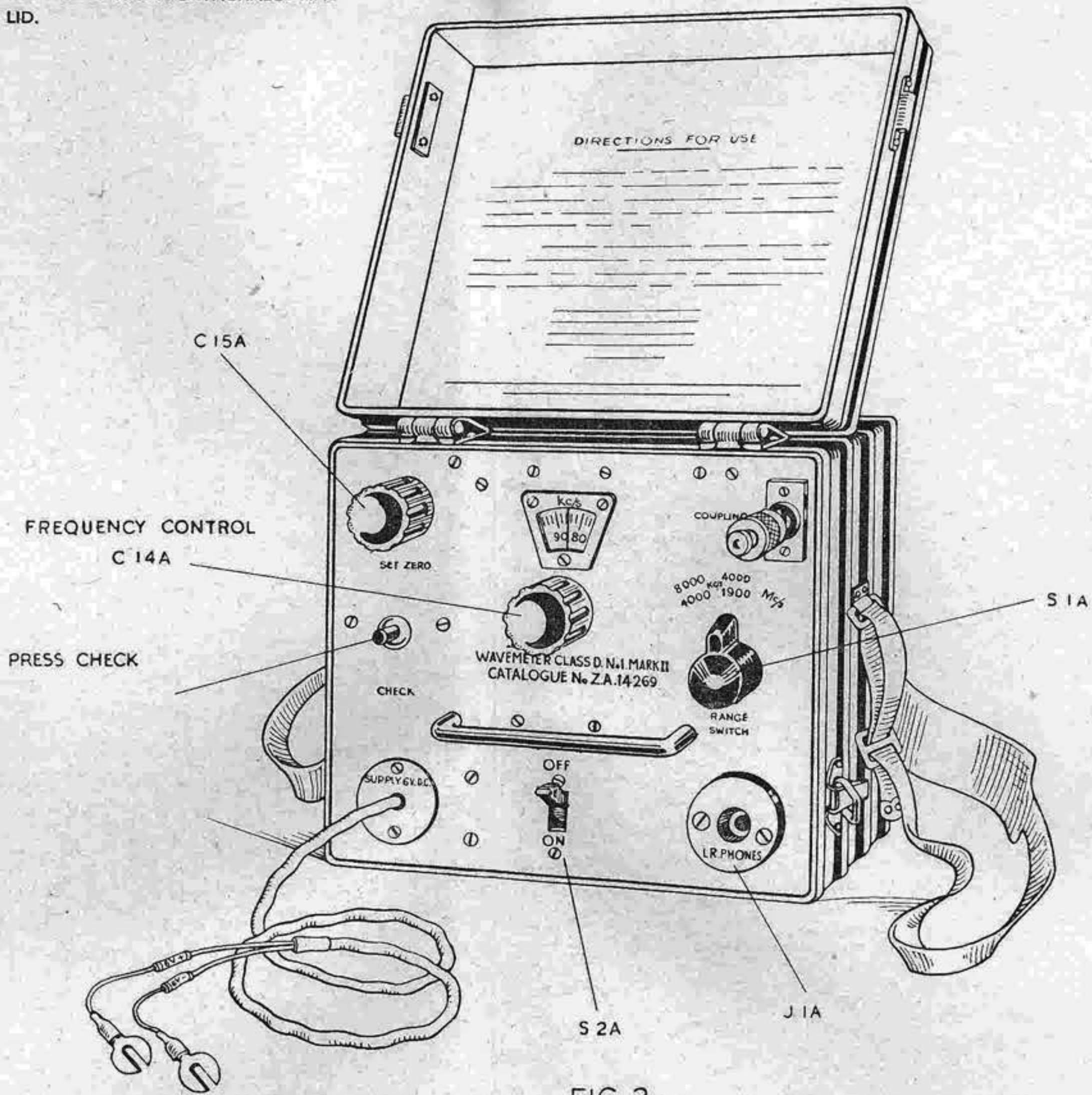

FIG. 3.

WAVEMETER CLASS D. No.1.

FRONT VIEW.

NOTE. THIS DRAWING HAS BEEN MADE FROM THE MARK II MODEL, THE MARK I AND MARK II* BEING ONLY SLIGHTLY DIFFERENT IN LAYOUT.

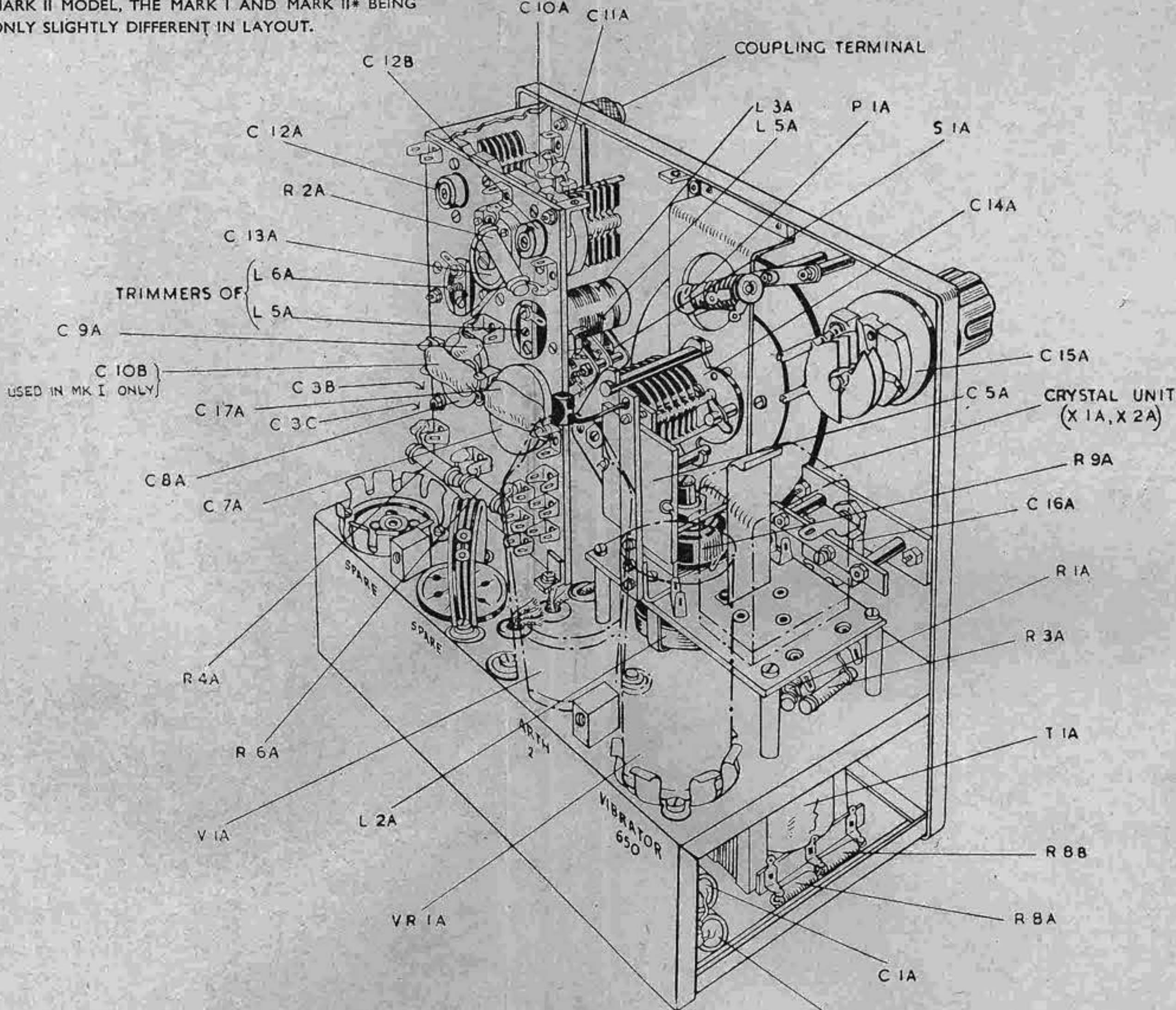

FIG. 4.

WAVEMETER CLASS D. No. 1.

INTERNAL VIEW FROM ABOVE.

Fig. 4

NOTE. THIS DRAWING HAS BEEN MADE FROM THE MARK II MODEL, THE MARK I AND MARK II* BEING ONLY SLIGHTLY DIFFERENT IN LAYOUT.

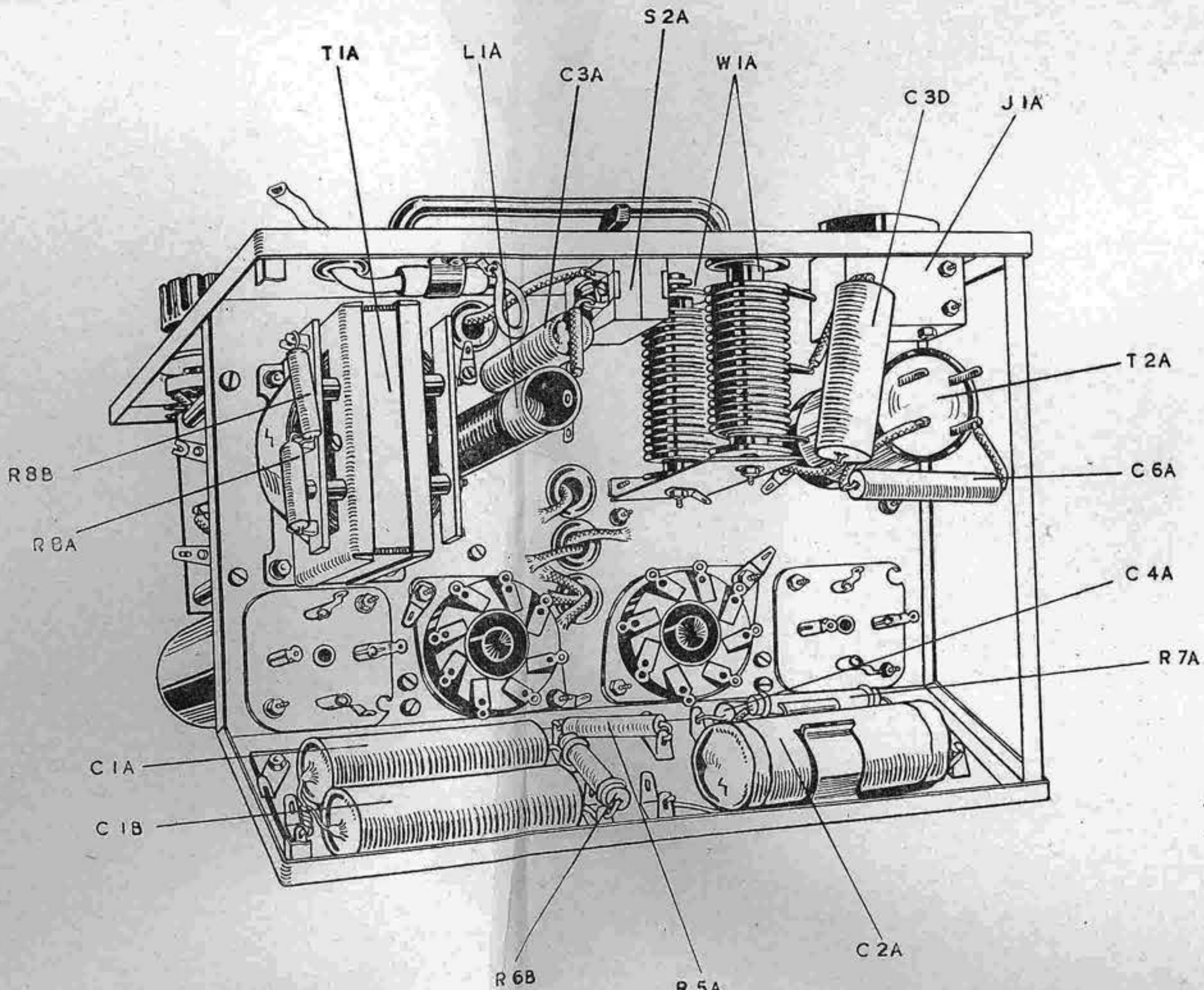

FIG. 5.

WAVEMETER CLASS D. No.1.

INTERNAL VIEW FROM BELOW.