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SIGNAL MANUAL PART IV

Section 152

FREQUENCY INDICATOR - TYPE C2

FOR OFFICIAL USE ONLY

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FREQUENCY INDICATOR, TYPE C - 2.

STORES REF. NO. 10D/3789

FREQUENCY INDICATOR

TYPE C-2

STORES REF. NO. 10D/3789

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FREQUENCY INDICATOR

TYPE C-2

STORES REF. NO. 10D/3789

1.0. GENERAL

1.1. Description

The Frequency Indicator type C2 is a direct reading heterodyne type of frequency measuring instrument, the accuracy of which is based on a built-in secondary frequency standard. (Calibrator).

1.2. Frequency Range

The fundamental frequency range over which the instrument is direct reading is 5 to 10 mc. divided into five ranges as follows:-

Range 5	5 to 6 megacycles
" 6	6 to 7 "
" 7	7 to 8 "
" 8	8 to 9 "
" 9	9 to 10 "

By the use of harmonics, the overall frequency range may be extended depending on the strength of signal being measured.

1.3. Application

The instrument is intended for use in aircraft, fixed , ground and mobile stations under wide ranges of atmospheric conditions.

1.4. Compensation

To eliminate errors due to temperature and/or battery voltage change, it is necessary to compensate the heterodyne oscillator. This correction, which should be made prior to each measurement, is made by an adjustment of the vernier dial scale with respect to its index line, no calculations being involved. Later designs have a moveable index line adjusted by a thumb wheel, and are numbered serially 788 and above. See Figure 1B.

1.5. Dimensions and Weight.

When mounted in aircraft or other mobile equipment, the unit is suspended on a shock-absorber mounting, as described in Table 1, and shown in Figures 2 and 10.

When in portable use, or on fixed station location, the shock absorber is not used, and dimensions and weights are as shown in Table 1.

When in transit between sites of operation, the unit is mounted in a transit case, dimensions and weight of which are shown in Table 1. The transit case does not provide space for the shock mounting.

TABLE 1

<u>Stores Ref.</u> <u>No.</u>	<u>UNIT</u>	<u>Weight</u>	<u>Maximum</u> <u>Dimensions</u>
10D/3789	Type C2 Frequency Indicator	15 lbs.	12" x 10 3/8" x 7 11/16"
5J/725	Battery (GENERAL 60A-2L)	4 lbs. 10 ozs	7" x 5 7/16" x 2 5/8"
10D/2644	Shock Absorber Mount	1 lb 6 ozs	12" x 11" x 3 1/2"
10D/2506	Transit case	10 lbs. 8 ozs.	15 1/4" x 12 1/2" x 10 3/8"

1.6. Shock Absorber Mount

The mounting tray into which the unit fits is equipped with four Lord shock absorbers. Each shock absorber is fitted with washers to limit its travel and safe-guard the unit in event of failure of the rubber. Quick release fasteners are employed which permit the easy removal of the unit from the mounting tray. Fig. 2 is a photograph showing the arrangement of the shock absorber assembly and the unit mounted thereon. Fig. 10 is a drawing showing the layout of the shock absorber mounting holes and the overall dimensions of the unit mounted on the shock absorber.

1.7. Controls

All operational controls are mounted on the top panel of the instrument. These comprise:-

- (a) RANGE selector switch.
- (b) COUPLING-GROUND terminals.
- (c) ANTENNA terminal.
- (d) Main dial
- (e) Vernier dial "Corrector" (main dial drive)
- (f) Main dial lock
- (g) Battery ON-OFF switch
- (h) Calibrator ON-OFF switch
- (j) Receiver headset jack for Plug Type 1
- (k) Micro-telephone jack for Plug Type 58

All controls are enclosed, and the Battery ON-OFF switch automatically operates to the "OFF" position when the top cover is put in place. Fig. 1 (B) is a photograph showing the general layout of the Control Panel.

1.8. Antenna

A plug-in whip-type telescopic antenna is provided, in addition to "COUPLING" terminals, for obtaining coupling with equipment under measurement. The antenna when extended measures 24 inches overall and when contracted measures $8\frac{1}{2}$ inches. The antenna when not in use and contracted, fits into spring holding clips in the top cover, see Fig. 1 (B).

1.9. Coupling

When the instrument under measurement is well shielded, it is necessary to use very close coupling and in the case of receivers fitted with shielded antenna leads it is necessary to provide a physical connection between the antenna of the receiver under test and the COUPLING terminal of the frequency indicator.

1.10. Valves.

Five 1.4 volt filament type valves are used. The 1st and 2nd audio valve (in a single envelope) is rubber-suspended to reduce microphonics. The valve sockets are positioned so as to eliminate effects of "valve filament sag" in either of two planes of operation of the unit. Consequently, the unit is suitable for continuous operation with the unit mounted in either of the two following planes.

- (a) CONTROL panel horizontal.
- (b) " " vertical and upright.
(RANGE switch at top - PHONE jacks at bottom)

See Fig. 1 (a) and (b).

1.11. Power Supply

The normal power supply for the unit is 90 volts H.T. and 1.4 volts L.T. This is obtained from a combined H.T. - L.T. battery located in a detachable tray at the base of the unit. The life of the battery under intermittent operation is approximately 1000 hours. This figure is based on the "end-point" of the battery which is 75 volts H.T. and 1.17 volts L.T. After the battery voltage has dropped below these values, the battery should be replaced, as the sensitivity and performance of the unit on lower voltages than these is unsatisfactory for service use. The battery drain under normal conditions is as follows:-

<u>VOLTAGE</u>	<u>CURRENT</u>
H.T.90	10 milliamps.
L.T.1.4	350 "

Fig. 3 is a photograph showing the battery in place with the bottom tray detached.

2. CONSTRUCTION

2.1 Description

The unit consists of a two-section chassis, and a control panel carrying all the operational controls of the unit. One section of the chassis carries all the tubes and associated components, the other section of the chassis carries all the Heterodyne Oscillator coils and associated components. Figs. 4 and 5 are photographs showing the general construction and wiring of the unit. Fig. 11 shows the overall dimensions.

2.2 Material

Tube chassis and overall case:- 1/16" aluminium. Coil chassis:- Aluminium alloy casting. All exposed aluminium has been anti-corrosion treated. Insulation on all covered wire is 1/64" heat resisting rubber, slow burning acetate braid and flame-proof lacquer.

3. THEORY OF OPERATION

3.1 Circuit Description

Refer to Fig. 6. The essential elements of the circuit consist of a Heterodyne Oscillator (V1) covering the frequency range of 5 to 10 mc.; a 1 mc. crystal-controlled oscillator (V5) controlling a 100 kc multivibrator CALIBRATOR, (V4); a grid-leak Detector-Mixer (V2) and a two stage audio amplifier (V3). the R.F. output from the Heterodyne oscillator, and the 100 kc harmonic series from the CALIBRATOR, appears on the ANTENNA and COUPLING terminals which are wired in parallel. The audio beat note resulting from the signal voltages applied to the Detector grid, appears at the two jacks J1 and J2 wired in parallel.

3.2 Heterodyne Oscillator

This is an electron-coupled, Feedback oscillator covering a frequency band from 5 to 10 megacycles in five ranges. Each range covers a frequency band of one megacycle. The transformers T1, T2, T3, T4, and T5 are the oscillator coils for Ranges 5, 6, 7, 8, and 9 respectively. The secondary or grid winding of each transformer is trimmed with an air dielectric trimmer C1, C2, C3, C4, or C5, and tuned with the Straight Line Frequency variable condenser C18. C17 is a special S.L.F. curve correcting condenser integral with C18. Across each grid coil is connected a parallel temperature compensating condenser C6, C7, C8, C9, and C10. The temperature compensating condensers produce a slight negative or positive capacity change depending respectively upon whether the ambient temperature rises or falls and thereby neutralizes the normal change in circuit capacity, which is in the opposite direction to that of the compensators. Also connected across each coil is one of the parallel Temperature Compensating condensers C36, C37, C38, C39 and C40. The function of these condensers is to raise the circuit minimum capacity to the required value, while still maintaining the variable trimmers at a small capacity. This opens out the adjustment of the trimmers and provides greater stability and less critical adjustment.

The plates of C18, are shaped to provide S.L.F. characteristic on range 5. Ranges 6, 7, 8 and 9 use C18 for tuning, and the required S.L.F. characteristic is obtained by "Tracking" each of these ranges by means of the tracking condensers C32, C16, C11 and C12 respectively. The inductance of each grid winding is adjusted to the correct value by means of iron dust cores which are labelled on the outside of the coil chassis casting as T1, T2, T3, T4, and T5, corresponding to the grid windings of Ranges 5, 6, 7, 8, and 9 respectively. Switch S1 selects the appropriate grid coil and connects it to the oscillator grid condenser C14. Switch S2 shorts the unused grid coils to chassis. Switch S3 is a double pole switch. One pole connects the S.L.F. condenser C17-C18 directly to the grid coil on RANGE 5, or via the trackers, to the grid coils on RANGES 6, 7, 8 and 9. The other pole selects the appropriate reaction coil and connects it to the screen grid of V1. L1 and the bypass C13 is an H.T. filter, isolating the Heterodyne Oscillator H.T. from the other H.T. supplies to the unit. The plate of V1 is "electron-Coupled" to the oscillatory circuit of this valve, and is further coupled through C15 and C20 to the ANTENNA and COUPLING terminals and also through C15 and C21 to grid of the Detector - Mixer Valve V2.

The function of the Heterodyne Oscillator is to supply an R.F. Voltage of known frequency to the ANTENNA or COUPLING terminals, or to beat with signals of unknown frequency, applied to the ANTENNA or COUPLING terminals, the resultant beats being passed on to the Detector - Mixer V2 for rectification.

3.3. Crystal Oscillator

The Crystal Oscillator consists of the Valve V5, with the CRYSTAL connected between grid and ground and the permeability tuned anode tank L2 connected to the screen grid which is used as the oscillator anode. The oscillatory circuit of the valve V5 is electron-coupled to the plate, which via C34 supplies control voltage to the Multivibrator. The condenser C35, connected across the crystal, provides for the precise adjustment of the crystal oscillator frequency to exactly 1000 kc. Increasing the capacity decreases the oscillator frequency and vice-versa. C35 is capable of changing the frequency approximately plus or minus 30 c.p.s. from a mean value. The anode coil L2 is resonated by virtue of its self-capacity and by adjustment of the iron dust core, over which the coil L2 is wound.

The function of the Crystal oscillator is to supply an R.F. voltage at exactly 1000 kc to the Multivibrator for the purpose of controlling it.

3.4 Multivibrator (CALIBRATOR)

The multivibrator is a relaxation type of oscillator consisting of a twin triode valve V4; the plate resistors R4, R5; the control

voltage coupling resistor R18; the two grid resistors R3, R6, and the two grid-plate coupling condensers C22, C23. The function of the multivibrator circuit is two-fold:-

- (1) To generate a highly irregular wave-form which is essentially rich in harmonics.
- (2) To divide the CRYSTAL oscillator frequency by the factor 10; which means that the multivibrator operates at the 10th sub-harmonic of 1000 kc which is 100 kc.

The multivibrator in its uncontrolled state is a very unstable form of oscillator, and it is therefore "controlled" or pulled into step (at the 10th sub-harmonic of the Crystal oscillator frequency) by injecting a small controlling voltage from the Crystal Oscillator via C34. The fundamental frequency of the multivibrator is therefore 100 kc and the accuracy and stability of the 100 kc harmonic series is identical with that of the Crystal Oscillator.

Since the fundamental frequency of the uncontrolled multivibrator is increased by the injection of control voltage, the fundamental frequency of the multivibrator in the uncontrolled state is lower than 100 kc. The uncontrolled fundamental frequency is dependent primarily upon the time constants of the two grid circuits according to the following relation:-

$$f = \frac{1}{R.3 \ C23 + R.6 \ C}$$

Where f is the fundamental frequency, which in our case is 80 kc approximately. The main purpose of the multivibrator is to supply a calibrating point at every 100 kc over the fundamental range of the Heterodyne Oscillator, thereby supplying a calibration check at every division of the MAIN TUNING DIAL, i.e. 11 points in each band.

3.5 Detector - Mixer

This is a grid-leak detector consisting of the Valve V2; the grid leak R11 and grid condenser C21; the plate load R12 and coupling condenser C27; the R.F. by-pass C25, and the plate filter R13, C26.

The function of the detector is to mix the R.F. voltages appearing on its grid, to rectify them and pass the resultant beats on to the audio amplifier. Hence when calibrating, (using the CALIBRATOR) the R.F. voltage from the Heterodyne Oscillator is mixed with the R.F. voltage from one of the multivibrator harmonics, the resultant beats are rectified and the audio

component passed on to the audio amplifier. When measuring the frequency of a transmitter, the R.F. voltage from the latter appearing at the ANTENNA or COUPLING terminal is fed to the detector grid where it is mixed with the R.F. voltage from the Heterodyne Oscillator; the resultant beats are rectified and the audio component is passed on to the audio amplifier.

3.6 Audio Amplifier

This is a two-stage resistance coupled audio amplifier consisting of a triode driver and a pentode output. The elements of both the triode and pentode are contained in the single envelope of V3. The amplifier components consist of the triode grid leak R14; the triode plate load R15 and coupling condenser C28; the pentode grid leak R16, and the output transformer T6. The condensers C29 and C33 are by-passes which attenuate the high audio frequencies in the beat note. The output transformer is matched to a load of 500 ohms across either PHONE jack J1 or J2.

3.7 Battery ON-OFF Switch

This is a double pole single throw push-pull type of switch. Pulling the switch outward connects the L.T. and H.T. supply to the unit; pushing the switch inwards disconnects both supplies. A device inside the control panel cover automatically pushes the switch inwards, thus disconnecting the power supply from the unit, when the cover is put into place.

3.8 Miscellaneous

C30 and C31 are by-pass condensers across the positive and negative H.T. supplies respectively. R17 is a bias resistor connected between negative H.T. and chassis. The I.R. drop across this resistor (which is negative with respect to the chassis) is used to bias the pentode control grid of V3 to the correct operating point.

4. OUTPUT

4.1 Heterodyne Oscillator

The R.F. output from the Heterodyne Oscillator (available at the COUPLING and / or ANTENNA terminals) is approximately 25,000 microvolts at any frequency in the fundamental range of 5 to 10 megacycles. The R.F. output outside of the fundamental range of the instrument will depend upon the frequency under consideration.

4.2 Audio

The audio amplifier will deliver 30 milliwatts of power at approx. 500 c.p.s. when the Heterodyne Oscillator is beating against an R.F. signal of approximately 1 volt injected at the COUPLING or ANTENNA terminal.

The audio output available from the resultant beats

between the CALIBRATOR and each 100 kc check point of the Heterodyne Oscillator, varies between 4 milliwatts @ 5 Mc and 0.25 milliwatts @ 10 Mc.

5. OPERATING INSTRUCTIONS

5.1 To Read the Frequency

Frequencies are read from the instrument by a system of three scales, which indicates the frequency to which the Heterodyne Oscillator is tuned. This system of scales breaks the frequency reading down into four digits - thousandths, hundredths, tenths and units. The scales allow the frequency reading to be directly read to within 1,000 cycles and estimates to within 250 cycles. The three scales and their functions are as follows:-

SCALE	FUNCTION
RANGE switch	Indicates thousands of kilocycles
Main Dial	Indicates hundreds of kilocycles
Vernier Dial	Main divisions indicate tens of kilocycles sub-divided into kilocycles.

The Vernier dial scale is engraved with 100 dividing lines. The 10 large divisions with the indicating numerals 0, 1, 2, etc. up to 9 reads tens of kilocycles, while the small dividing lines read units or kilocycles - hence one complete rotation of the Vernier dial corresponds to a frequency change of 100 kc.

Example:-

RANGE switch	@	5
Main Dial	@	4 (approx.)
Vernier dial	@	0

Frequency reading:- 5,400 kc.

Example:-

RANGE switch	@	6
Main dial	@	5 (approx.)
Vernier dial	@	35

Frequency reading:- 6,535 kc.

5.2 Adjustment of Vernier Dial

The CALIBRATOR furnishes a calibrating check at every 100 kc over the Heterodyne Oscillator RANGE from 5 to 10 Mc. Hence, with the CALIBRATOR "ON", a "ZERO BEAT" should be obtained at every 100 kc, as the Heterodyne Oscillator is tuned from 5 up to 10 megacycles. i.e. "ZERO BEATS" should be heard at each complete rotation of the Vernier dial from its "0" mark; thus corresponding to a "ZERO BEATS" at each main dial division. Assuming the RANGE switch to be set at 5, the frequency reading at each of these

"ZERO BEATS" would have been exactly 5,000 kc, 5,100 kc, 5,300 kc, etc., the Vernier dial in each case reading "0".

Due to changes in the frequency of the Heterodyne Oscillator, the Vernier dial reading for "ZERO BEAT" in each of the above cases may not read exactly "0", but may read for example 03, so that the indicated frequency at each of the "ZERO BEATS" would be 5003, 5103, 5203, 5303, etc. In order to correct for these drifts, the Vernier dial is constructed so that it may be rotated with respect to its drive shaft and index. Hence, when zero beat is obtained at any one of the above points, the main dial is then locked and the Vernier dial knob held while the Vernier dial scale is moved so that it reads exactly "0". This adjustment is to be made prior to each frequency measurement on the nearest audible 100 kc calibrator frequency to the frequency to be measured.

Example: Required Frequency 9515 kc.

Set the RANGE switch to 9. Turn the CALIBRATOR "ON". Set the main dial at approximately 5 and Vernier dial at approximately "0" and turn Vernier dial knob slowly back and forth until "ZERO BEAT" is obtained. Lock the main dial. Hold the Vernier dial drive knob, and by means of the Vernier dial pin rotate the Vernier dial scale to "0". The calibration of the instrument is then set to within the accuracy of the CALIBRATOR. To make the measurement, unlock the main dial, turn the CALIBRATOR "OFF", and rotate the Vernier dial knob until the Vernier dial reads 15, at which setting the frequency setting will be 9515 kc.

When the required frequency is midway or nearly midway between two calibrating points (i.e. near 50 on Vernier dial) the procedure is to equalize the errors at each calibrating point.

The point to remember when making frequency measurements at settings approximately midway between two calibrating points (i.e. between any two main dial divisions) is:-

Adjust Vernier dial disc so that the errors at the two calibrating points (adjacent to the desired frequency) are equal and opposite.

5.3 Beat Notes:- Although "ZERO BEATS" are heard at every 100 kc, there are also weaker beats heard at every 50 kc., 25 kc., etc., the strength of these beats decreasing rapidly as the frequency interval decreases. No trouble should be found in identifying the 100 kc series however, since the strength of these are much stronger than the 50 and 25 series.

5.4 Measuring Frequencies

The procedure in measuring frequencies is to match (i.e. ZERO BEAT) the Heterodyne Oscillator of the Frequency Indicator, with the

frequency under measurement. The latter should be coupled to the Frequency Indicator either via the COUPLING terminal or the ANTENNA.

CAUTION

Always use as weak a coupling as possible and never under any circumstances connect the COUPLING terminal directly to, or bring the ANTENNA in close proximity to high voltage circuits.

When the frequency under measurement is within the fundamental range (5 to 10 Mc) of the frequency Indicator, the dial of the latter will indicate the frequency directly. When frequencies higher or lower than the fundamental range are being measured the dial of the Frequency Indicator will indicate a sub-harmonic or a harmonic respectively of the frequency under measurement. In these cases, the frequency is found by multiplying or dividing the dial reading by the harmonic or sub-harmonic number as explained in paragraphs 5.6 and 5.10.

5.5. Measurement of Frequencies in the fundamental Range

If the frequency is known to be within the coverage of any one RANGE, the procedure should be as follows:-

- (1) Switch to the appropriate RANGE.
- (2) Switch CALIBRATOR "ON" and check calibration as described in para. 5.2.
- (3) Switch CALIBRATOR "OFF" and tune to ZERO BEAT with frequency under measurement.
- (4) Read dial which gives the frequency directly in kc.

If the frequency is known to be between 5 and 10 Mc but not known on which range it is, the procedure should be as follows:-

Start from the low frequency end of the Heterodyne Oscillator (RANGE switch at 5; main dial at "0") and slowly increase frequency - covering the full range on RANGE 5, then switching to RANGE 6,7,8, 9 and doing likewise. If the coupling is not too strong, only one loud beat should be obtained. If the coupling is too strong then more than one beat will be obtained, but there should be one beat louder than the others, this beat being the correct one. If the frequency under measurement happens to be an exact multiple of 1,000 kc then two loud beats will be obtained - one at the high frequency end of one RANGE and one at the low frequency end of the next higher RANGE.

Example:- Frequency under measurement :- 7,000 kc
 Zero Beats will be found at:-
 RANGE 6 Main dial at END DIV.
 RANGE 7 " " " "0" "

In such a case as this either one of the two RANGES may be chosen for the actual frequency measurement. Having found the RANGE to use, the actual frequency measurement should be made as outlined at the beginning of para. 5.5.

5.6 Extension to Higher Frequencies:

In Fig. 7 are shown on a logarithmic scale, the frequencies covered by each Harmonic Range of the instrument, using the Harmonics from 1 to 10. Each range is shown as a horizontal line, the length of each line being constant, since the percentage frequency coverage of each range is the same.

On each line are marked five intervals corresponding to the five coil ranges of the instrument. The interpretation of these coil range marks will agree with the engraving of the coil switch if the first is called r, the second 6, the third 7 etc., up to 9, the last mark is then 10, which represents the highest frequency which can be reached on coil 9. Each line is marked with its harmonic number, i.e., the line marked 1 shows the frequencies obtainable on each range using the fundamental frequencies of all the frequencies of the Heterodyne Oscillator. The line marked 2 shows the frequencies obtainable by using the 2nd Harmonic of all the frequencies of the Heterodyne Oscillator. The line marked 3 shows the frequencies obtainable using the 3rd Harmonic, etc.

5.7 To match or radiate a known harmonic frequency:

Look for the frequency along the abscissa of the curve Fig. 7 and move up the ordinate to the point where it crosses the lowest harmonic range line. This intersecting point indicates the order of harmonic which is to be used, the coil range, and approximate main dial setting. The exact dial setting is found by dividing the known frequency by the harmonic number.

Examples:

Required to set the instrument to 48,735 kc.

On Fig. 7 enter the abscissa at the ordinate 48.7 Mc. Move upwards along this ordinate until the lowest harmonic line is intersected, which in this case will be 5. At this intersection the following data should be apparent:

The harmonic number to be used would be 5

The coil range to be used would be 9

The main dial would be approximately $3/4$ (i.e. somewhere between 6 and 8)

The exact dial setting will be obtained by dividing the known frequency by the harmonic number, i.e.:-

$$48,735 \div 5 = 9747$$

Hence the Range switch would be set at 9.

The Vernier dial would be set at 47.

The main dial would be set at 7 approximately.

5.8 To measure an approximately known frequency:

Suppose a frequency near 62 Mc is to be measured exactly. Find 62 Mc on the Abscissa of Fig. 7 and follow the ordinate up until it intersects the lowest harmonic line which in this case would be 7. The coil Range would be indicated as 8 with the main dial approximately full scale. Hence it will be known that on Range 8, with the main dial at approximately full scale, the 7th harmonic of the Heterodyne Oscillator will be near 62 Mc. Therefore, with the coil switch on Range 8, tune the Heterodyne Oscillator in the vicinity of full scale until ZERO BEAT with the unknown signal is obtained. When ZERO BEAT is obtained, suppose the dial reading is:-

Main dial 9
Vernier dial 23

then the indicated frequency would be 8923 kc. And since it is known that the 7th harmonic of this frequency beats with the unknown frequency, the unknown frequency is:-

$$8923 \times 7 : 62,461 \text{ kc.}$$

5.9 To measure an unknown frequency:

For the sake of simplicity it will be assumed that the frequency is either within or higher than the fundamental frequency Range of the Heterodyne Oscillator. The method to use in this case is to start from the highest frequency end of the Heterodyne Oscillator and note the successive settings of the harmonic ZERO BEATS as the frequency of the Heterodyne Oscillator is progressively reduced. If only one ZERO BEAT is obtained, this indicates that the frequency is within the fundamental frequency range of the instrument, and the indicated frequency of the instrument at this ZERO BEAT is the unknown frequency. If more than one ZERO BEAT is obtained, this may indicate that the unknown frequency is outside the fundamental frequency range of the instrument, (see however, para. 5.5.). In order to determine the frequency in this latter case, note the settings of any two or more successive ZERO BEATS. By reference to Fig. 7, locate the approximate condenser settings on any two or more successive harmonic lines. When this ordinate has been located, follow it down to the point where it crosses the abscissa; this point is the approximate frequency of the unknown frequency. When this stage has been reached, the coil range of each ZERO BEAT is known and also its harmonic number. Hence the exact frequency will be the frequency reading of each ZERO BEAT multiplied by their respective harmonic numbers, the answer in each case being the same.

Example:

Starting from the high frequency end of the Heterodyne Oscillator (Range 9, Main dial at END DIV.) ZERO BEATS were found at:-

Range 9 Dial reading 9093 kc.

Range 7 Dial reading 7274.4 kc.
(decimal estimated)

Range 6 Dial reading 6062 kc.

Range 5 Dial reading 5196 kc.

Searching for an ordinate which will cross through these coil range dial reading points, we find the ordinate corresponding to approximately 36.5 Mc. It would also be noted that the ordinate crossed the 4th harmonic line on Range 9, the 5th harmonic line on Range 7, the 6th harmonic line on Range 6 and the 7th harmonic line on Range 5. Hence the ZERO BEAT on Range 9 was obtained by using the 4th harmonic; the ZERO BEAT on Range 7 was obtained by using the 5th harmonic; the BEAT on Range 6 was obtained by using the 6th harmonic and the ZERO BEAT on Range 5 was obtained by using the 7th harmonic. Therefore the exact frequency would be:-

$$9093 \times 4 : 36372 \text{ kc.}$$

$$\text{or } 7274.4 \times 5 : 36372 \text{ kc.}$$

$$\text{or } 6062 \times 6 : 36372 \text{ kc.}$$

$$\text{or } 5196 \times 7 : 36372 \text{ kc.}$$

5.10 Extension to lower frequencies:

When measuring frequencies below the fundamental range of the Heterodyne Oscillator the actual measurement is made at a harmonic of the unknown frequency. If the unknown frequency is sufficiently strong, and is applied to the COUPLING terminals, harmonics will be generated in the detector itself, and these harmonics may then be matched against the fundamental of the Heterodyne Oscillator, from which by the use of the Sub-Harmonic chart Fig. 8 the actual frequency of the unknown frequency may be obtained.

In Fig. 8 are shown the sub-harmonic ranges of the Heterodyne Oscillator, The general description follows that already given in Fig. 7, on the higher harmonic ranges. From this chart the appropriate sub-harmonic number and the coil switch setting may be found. From this data, and the frequency reading of the scale at each ZERO BEAT, the exact frequency of the unknown signal may be found.

5.11 Measurement of frequencies below 5,000 kc.

The procedure is to start from the low frequency end of the Heterodyne Oscillator range and note the settings of the successive

ZERO BEATS, as the frequency of the Heterodyne Oscillator is increased. When the range settings and the frequency readings of each of the ZERO BEATS are known, enter these on the sub-harmonic chart and search for a common ordinate as described under paras. 5.8 and 5.9. The sub-harmonic numbers for each coil range on which a ZERO BEAT was obtained may then be found. The exact frequency will then be divided by the sub-harmonic number for that coil range, as determined from the sub-harmonic chart.

5.12 Setting receivers to known frequencies:

Two different methods are used in this operation depending upon whether the frequency to which the receiver is to be set lies above or below the lowest frequency of the Frequency Indicator, i.e., above or below 5,000 kc. The receiver calibration will serve as a guide to the approximate tuning of the Frequency Indicator, which will be used for the final adjustment. The 100 kc harmonic series from the CALIBRATOR may also be used for a general check on the receiver calibration. With the COUPLING terminal coupled to the receiver antenna and CALIBRATOR switched "ON", check points will be heard at every 100 kc over the receiver range.

5.13 Setting receiver to frequency between 5 and 10 Mc.

The procedure is to set the Frequency Indicator to the required frequency, couple it to the receiver aerial and tune in the signal on the receiver, as follows:-

Set RANGE switch to the appropriate range, switch "ON" CALIBRATOR and check calibration as described in para. 5.5 switch "OFF" CALIBRATOR and set the Frequency Indicator dial to the required frequency. Connect the COUPLING terminal to the receiver aerial and tune in the signal from the Frequency Indicator on the receiver. If the receiver is fitted with a B.F.O., switch this on while making the measurement as this will facilitate picking up the signal. On regenerative receivers set the regenerative control so that the detector is just oscillating.

5.14 Setting receiver to frequency above 10 Mc.

The procedure is to set the Frequency Indicator to the highest available sub-harmonic frequency of the desired frequency, and tune in the correct harmonic of the Frequency Indicator on the receiver.

Example:- Required to set receiver to 21624 kc.

It is seen that the 4th sub-harmonic would be $\frac{21624}{4} : 5406$ which would be obtained on RANGE 5. But the highest available sub-harmonic, is the 3rd which gives $\frac{21624}{3} : 7208$ which is obtained on RANGE 7, with the main dial set at approximately 2 and the Vernier dial at 08. The next higher sub-harmonic is the 2nd, which gives $\frac{21624}{2} : 10812$ which is not available as it is outside the fundamental range of the

instrument. Hence with the RANGE switch at 7 this band would first be calibrated as described in para. 5.5, and then the Frequency Indicator set to read 7208. Tuning the receiver in the vicinity of 21.6 Mc the 3rd harmonic of this signal would be picked up. The reason for always using the highest available sub-harmonic frequency is, that the strength of the harmonics from the Frequency Indicator decreases as the harmonic number increases.

CAUTION

When making these measurements always keep the coupling from the Frequency Indicator as loose as possible to prevent saturation of the receiver, which in some cases will cause errors in the receiver setting.

5.15 Setting Receiver to frequency below 5,000 kc.

The procedure in this case depends upon the type of receiver, whether of the regenerative type or of the super-heterodyne type.

Regenerative receiver: The procedure is to set the Frequency Indicator dial to the lowest harmonic (of the desired frequency) which will fall within the band of 5 to 10 Mc. Then with the regenerative detector of the receiver just oscillating, the detector tuning is slowly altered back and forth until the beat is heard on the Frequency Indicator. On these measurements, if the COUPLING terminal of the Frequency Indicator is connected to the receiver antenna terminal, the input to the frequency indicator will usually be strong enough, on frequencies between 1 to 5 megacycles, to give satisfactory beats, but for frequencies below 1,000 kc it may be necessary to get very tight coupling between the Frequency Indicator and the regenerative detector of the receiver. This can usually be obtained by bringing a lead from the Frequency Indicator coupling terminal close to the grid of the regenerative detector in the receiver.

Example: Required to set regenerative receiver to 1853 kc.

The lowest harmonic of 1853 which will fall within the band of 5 to 10 Mc is obviously the 3rd or 5559 kc. Hence with RANGE switch set at 5 this range would be calibrated as described in para. 5.5. The dial would then be set to read 5559. Then with the regenerative detector just oscillating and tuned in the vicinity of 1,800 kc, slowly alter the detector tuning back and forth until a beat is heard from the Frequency Indicator. At "ZERO BEAT" on the Frequency Indicator, the receiver will be tuned to the 3rd Sub-harmonic of 5559 or 1853 kc.

Superheterodyne Receiver: There is no direct method of setting a superheterodyne receiver on frequencies lower than 5,000 kc with this instrument. For service purposes, this is best accomplished by setting the associated transmitter on frequency by methods previously described and then tuning the receiver to the transmitter.

Another method, which makes use of the fact that the difference between the frequency of the conversion oscillator and the intermediate frequency is equal to the received frequency, can be used, but is not recommended for service use; the objection being the possibility of inaccurate adjustment of the intermediate frequency amplifier and the difficulty in obtaining a sufficiently strong signal from the conversion oscillator.

5.16 Simplified Harmonic and Sub-Harmonic Chart

Fig. 9 is a chart combining Fig. 8 and Fig. 9 in a more simplified and less detailed form.

Example: Required to set Frequency Indicator to "ZERO BEAT" a frequency at 1300 kc.

Referring to Fig. 9 and following up the ordinate, corresponding to 1300 kc, to where it crosses the range line, it would be found that the RANGE to use would be 5, and the sub-harmonic number 4. Hence it would be known that the 4th harmonic of 1300 kc (i.e. $1300 \times 4 : 5200$) would be found on RANGE 5. Hence the RANGE switch would be set at 5 and the dial set so that the instrument reads 5200 kc. This setting would then be calibrated as explained in para. 5.5, and the frequency measurement made. It will be noted that the 5th harmonic of 1300 kc could still be used, on RANGE 6 ($1300 \times 5 : 6500$), but inasmuch as the 5th harmonic would, in general, be weaker than the 4th, then this setting would not be as satisfactory as the previous one. For this reason, the use of the 5th harmonic is not shown on Fig. 9. Fig. 9 thus indicates the best combination to use for any given frequency.

6. ALIGNMENT INSTRUCTIONS

6.1 Crystal Oscillator Alignment

Remove chassis from case and connect battery. Adjust Crystal tank coil (L2 see Fig. 4) as follows:- Turn the iron core screw (adjacent to the CRYSTAL) all the way out. With a valve voltmeter connected across the grid of the Crystal Oscillator Valve (V5) and ground, turn the iron core screw "in" until the maximum voltage reading is obtained on valve voltmeter. Then turn iron core screw "out" until Voltmeter reading drops approximately 15%. The Crystal trimmer C35 (see Fig. 4) should then be adjusted to bring the Crystal Oscillator frequency to 1,000 K.C. plus or minus 1 C.P.S. For this purpose it will be necessary to compare the CRYSTAL frequency against a primary frequency standard, or a highly stable source of frequency which has been recently calibrated against a primary frequency standard.

6.2 Multivibrator (Calibrator)

After the Crystal circuit has been adjusted, it should

be found that the multivibrator is oscillating (under control of the CRYSTAL) at exactly 100 K.C. In order to check that this condition obtains, the multivibrator 100 K.C. harmonic series, appearing at the COUPLING and ANTENNA terminals should be checked on a receiver as follows:-

(a) With the Frequency Indicator Coupling Terminal connected to the receiver antenna, and with the crystal alone oscillating (the multivibrator not operating) tune the receiver, noting the points 1 Megacycle apart where beats with the crystal harmonics are heard.

(b) With the multivibrator turned on, note the new beats between the 1 Megacycle beats.

(c) Tune the receiver across any available band, such as 200 to 500 K.C., or 1500 to 2000 K.C., and note that the beats are obtained at every 100 K.C. interval.

This check should be made at two conditions of battery voltage, i.e., H.T. 90 V, L.T. 1.50 V; and H.T. 75 V, L.T. 1.17 V. The low battery voltage condition being obtained by a method such as shown in Fig. 13.

At each multivibrator harmonic, tuned in on the receiver, and at each of the two conditions of battery voltage, the signal from the multivibrator should be a pure C.W. note and an exact multiple of 100 K.C.

If the multivibrator is not being controlled by the Crystal, the frequency of the multivibrator will be approximately 80 K.C. and very unstable (see para. 3.4). If the multivibrator is being controlled by the CRYSTAL, but on some other sub-multiple than the 10th (i.e. 100 K.C.), beats will be found on the receiver at intervals lower or higher than 100 K.C.

In each of the above cases the trouble will most probably be due to a poor valve. The twin triode multivibrator valve V4 (1G6GT) should be replaced. The two triode elements of V4 should be fairly evenly matched, and a satisfactory valve can usually be found by trying several valves in this position. If this is not the remedy, the CRYSTAL Oscillator Valve V5 (1N5GT) should be replaced, and several valves tried in this position. Providing the rest of the circuit is normal, this procedure should clear up any trouble of poor control of the multivibrator. In some cases it will be found that a slight adjustment of the iron core L2 will clear the trouble. If this is the case, the iron core should be left in this new position and C35 re-adjusted to bring Crystal Oscillator back to 1,000 K.C. plus or minus 1 C.P.S.

6.3 Heterodyne Oscillator

Before alignment of the Heterodyne Oscillator can be undertaken, the chassis should be installed in its case, and the Vernier dial indexed properly. Access to the Heterodyne Trimmers and Trackers (C1, T1; C2, T2; etc.) is obtained by removing the cover on the right hand side of the case. If the Heterodyne Oscillator is adjusted outside the case, the trimmers will have to be slightly re-adjusted when the unit is installed in its case.

The method of indexing the Vernier dial is as follows:-

Set main dial at INDEX MARK and "slip" the Vernier dial around until it reads 57. The Vernier dial is then indexed and adjustment of Heterodyne Oscillator may be undertaken. The main dial INDEX MARK is the line on the main dial before (i.e. to the left of) the division "0".

In order to adjust the Heterodyne Oscillator to the dial calibration, a signal generator accurate to plus or minus 0.1% or better is necessary. The procedure is as follows:

Calibrator OFF. Sig. Gen. 0.1 volt input direct to COUPLING and GROUND.

N.B. The line on the main dial after the division "9" is known as the "End Division".

- | | | | |
|----------------|---|---|----------------|
| <u>Range 5</u> | Sig. Gen. @ 5,000 kc. |) | Adjust T1 to |
| (1) | Main dial @ 0 div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (2) | Sig. Gen. @ 6,000 kc. |) | Adjust C1 to |
| | Main dial @ End div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (3) | Repeat steps (1) and (2) until adjustment at one end of the dial makes little or no difference at the other. | | |
| (4) | Disconnect Sig. Gen. Switch CALIBRATOR "ON". Repeat steps (1) (2) and (3) using the CALIBRATOR instead of the Sig. Gen. to set the two end points to zero beat. | | |

Het. Osc. Condenser Curve Adjustment

The condenser is adjusted by means of the compensating screws protruding through the bottom of the tube base. These adjustments are made only on RANGE 5, after this band has been trimmed and tracked as outlined previously.

The method of adjusting the compensating screws should be as follows:-

(a) With the range switch at 5, and the calibrator on, check that trimmer, C-1 is adjusted for zero beat at the end division, with the vernier at 0, and that the iron core of T-1 is adjusted for zero beat when the main and vernier are set at zero.

Rotate the main dial to 9.5, vernier to 50. Adjust the compensator screw corresponding to this position for zero beat, or as near zero beat as possible. (See Fig. 12).

Rotate the main dial to 9.0, vernier to 0. Adjust the compensator screw corresponding to this position for zero beat or as near zero beat as possible.

Continue as above, for each half rotation of the vernier dial, i.e., each half division of main dial, until all points have been adjusted.

(b) When this preliminary adjustment has been finished (0 on main and vernier dials is last adjustment), repeat the procedure, starting at the end division of the main dial, but now instead of using the trimmer, C-1, to obtain zero beat at this point, the compensating screw corresponding to this position is to be adjusted to obtain zero beat. Do not alter the trimmer after step above has been completed. Continue on down the dial as before, adjusting the corresponding compensating screw at each half revolution of the vernier dial. When this step has been completed, it should be found that the vernier dial is within half a division of 0 or 50 at each of the calibration points in the range.

If this tolerance is not obtained, step b should be repeated. Ranges 6, 7, 8, and 9 may now be trimmed and tracked as follows, no further adjustment of the heterodyne oscillator being necessary.

6.4 Tracking

Range 6

- | | | | |
|-----|--|---|----------------|
| (1) | Sig. Gen. @ 6,000 kc. |) | Adjust T2 to |
| | Main dial @ 0 div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (2) | Sig. Gen. @ 7,000 kc. |) | Adjust C2 to |
| | Main dial @ End div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (3) | Repeat steps 1 and 2 until adjustment at one end of the dial makes little or no difference at the other end. | | |

- (4) Disconnect Sig. Gen. Switch CALIBRATOR "ON". Repeat steps (1) (2) and (3), using the CALIBRATOR instead of the Sig. Gen. to set the two end points to zero beat.

Range 7

- | | | | |
|-----|-----------------------|---|----------------|
| (1) | Sig. Gen. @ 7,000 kc. |) | Adjust T3 to |
| | Main dial @ 0 div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (2) | Sig. Gen. @ 8,000 kc. |) | Adjust C3 to |
| | Main dial @ End Div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
- (3) Repeat steps (1) and (2) until adjustment at one end of the dial makes little or no difference at the other.
- (4) Disconnect Sig. Gen. Switch CALIBRATOR "ON". Repeat steps (1) (2) and (3), using the CALIBRATOR instead of the Sig. Gen. to set the two end points to zero beat.

Range 8

- | | | | |
|-----|-----------------------|---|----------------|
| (1) | Sig. Gen. @ 8,000 kc. |) | Adjust T4 to |
| | Main dial @ 0 div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (2) | Sig. Gen. @ 9,000 kc. |) | Adjust C4 to |
| | Main dial @ End Div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
- (3) Repeat steps (1) and (2) until adjustment at one end of the dial makes little or no difference at the other.
- (4) Disconnect Sig. Gen. Switch CALIBRATOR "ON". Repeat steps (1) (2) and (3) using the CALIBRATOR instead of the Sig. Gen. to set the two end points to zero beat.

Range 9

- | | | | |
|-----|------------------------|---|----------------|
| (1) | Sig. Gen. @ 9,000 kc. |) | Adjust T5 to |
| | Main dial @ 0 div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
| (2) | Sig. Gen. @ 10,000 kc. |) | Adjust C5 to |
| | Main dial @ End div. |) | zero beat with |
| | Vernier " @ 0 " |) | Sig. Gen. |
- (3) Repeat steps (1) and (2) until adjustment at one end of the dial makes little or no difference at the other.
- (4) Disconnect Sig. Gen. Switch CALIBRATOR "ON". Repeat steps (1) (2) and (3), using the CALIBRATOR instead of the Sig. Gen. to set the two end points to zero beat.

With the CALIBRATOR "ON", check that in each of ranges 6, 7, 8 and 9, zero beat is obtained when the vernier dial is within $3/4$ division of the calibration points 0 and 50 across each range.

7. SENSITIVITY

Calibrator "OFF". Output meter 500 ohms plugged into phone jack. Range switch on 5. Main dial on 0. Connect Sig. Gen. (at 5,000 kc) direct to COUPLING and GROUND. Sig. Gen. adjusted to give beat note which gives max. output.

Adjust Sig. Gen. input to 80,000 uv.

Output of Frequency Indicator should be 1 M/W-10%±20%.

Turn Sig. Gen. "OFF". Switch Calibrator "ON". At dial reading 5,000 kc. (approx.) adjust beat note for max. output. Output should be 3.0 M/W±50%-20%. Failure of unit to meet these specifications will usually be caused by poor valves in the Detector (V2) 1H5GT or in the audio amplifier (V3) 1D8GT.

8. POWER OUTPUT

Apparatus as under Sensitivity. Sig. Gen. input 1 volt. Monitor output to be not less than 30 M/W.

9. LOWER VOLTAGE TEST (Operational Test)

Reduce H.T. supply to 75 volts. The method of doing this should be such that 1,000 ohms resistance unbypassed be inserted in series with the H.T. supply (see Fig. 13).

Reduce L.T. to 1.17 volts.

Check operation of unit on all bands, using internal calibrator. The calibrator beats should be heard in the vicinity of each main dial division on every band. If this condition is not obtained, a new valve should be substituted for V1 (1N5GT).

CAUTION

The calibration will be found to be slightly displaced, (approximately 1 to 5 Vernier divisions). This is normal and no adjustment should be made at this time to correct for this error, but the frequency interval between each loud beat should correspond to one complete rotation of the Vernier dial (plus or minus 2 Vernier divisions approximately).

10. VOLTAGES

Voltages at various terminal points in the circuit are shown below. The voltages shown are measured between the point indicated and chassis, with a 1,000 ohms per volt voltmeter, unless otherwise specified. The symbol (V/V) underneath some of the figures indicates that these voltages are to be measured with a valve-voltmeter.

H.T. @ S-5 90 V - 2% + 5% (Between S4 and - H.T.)
 - H.T. @ C31-7 V plus or minus 10%
 L.T. @ S-6 - 5% + 10%
 Ll @ No. 1 terminal 90V - 2% + 5%

VALVE SOCKET PIN NO.	VALVE					CRYSTAL SOCKET.
	V1	V2	V3	V4	V5	
1.	0	0	0	0	0	0
2.	1.5-5+10%	1.5-5+10%	1.5-5+10%	1.5-5+10%	1.5-5+10%	0
3.	4.5±10% (V/V)	4.5±10% (V/V)	85±10%	43±2%	43±2%	0
4.	85±10%	0	85±10%	0	85±10%	0
5.	0	0	7±10% (V/V)	0	0	0
6.	0	0	55±10%	43±2%	85±10%	0
7.	0	0	0	0	0	0
8.	0	0	0	0	0	0

11. PARTS LIST

CONDENSERS			
Ref. No.	Sch. Des.	Nomenclature	Description
10C/6441	C1	Het. Osc. Trimmer, Range 5	Marconi, Type #106-111
10C/6441	C2	Het. Osc. Trimmer, Range 6.	Effective Cap. 15 mmf. Identical with C1.
10C/6441	C3	Het. Osc. Trimmer, Range 7.	" " "
10C/6441	C4	Het. Osc. Trimmer, Range 8.	" " "

Ref. No.	Sch. Des.	Nomenclature	Description
10C/6441	C5	Het. Osc. Trimmer, Range 9	Identical with C1.
10C/6442	C6	Het. Osc. Temp. Compensating Condenser, Range 5.	Centralab, Type "D" 24.5 mmf. plus or minus 0.5 mmf. Coeff. minus 75×10^{-5}
10C/6443	C7	Het. Osc. Temp. Compensating Condenser, Range 6.	Centralab, Type "D" 28 mmf. plus or minus 0.5 mmf. Coeff. minus 75×10^{-5}
10C/6443	C8	Het. Osc. Temp. Compensating Condenser, Range 7.	Identical with C7.
10C/6444	C9	Het. Osc. Temp. Compensating Condenser, Range 8.	Centralab, Type "D" 27 mmf. plus or minus 75×10^{-5}
10C/6444	C10	Het. Osc. Temp. Compensating Condenser, Range 9.	Identical with C9.
10C/6482	C11	Het. Osc. Tracker, Range 8	Solar, Type MOSCW- .5-3412-1 412 mmf. plus or minus 1%
10C/6483	C12	Het. Osc. Tracker, Range 9	Solar, Type MOSCW- .5-33-1 330 mmf plus or minus 1%
10C/6484	C13	Het. Osc. H.T. Bypass	Aerovox, Type 1467-S 0.01 mfd plus or minus 10%
10C/6485	C14	Het. Osc. Grid Condenser	Aerovox, Type 1469-S 250 mmf plus or minus 2-1/2%
10C/6486	C15	Het. Osc. Plat coupling	Aerovox, Type 1468-L-S 100 mmf. plus or minus 10%
10C/6487	C16	Het. Osc. Tracker, Range 7	Solar, Type MWSCW- .5-3595-1 595 mmf plus or minus 1%.
10C/6488	C17	Het. Osc. Condenser Curve Corrector	Marconi, Type 106-501 Details A and B.
10C/6488	C18	Het. Osc. Tuning Condenser	Identical with C17.

Ref. No.	Sch. Des.	Nomenclature	Description
10C/6489	C19	Multivibrator coupling	Aerovox, type 1469-S 15 mmf, plus or minus 0.5 mmf.
10C/6489	C20	"COUPLING" terminal, and "ANTENNA" coupling Condenser	Identical with C19
10C/6486	C21	V2 Detector Grid Condenser	Identical with C15
10C/6490	C22	V4 Multivibrator 2nd Triode grid coupling condenser	Aerovox, Type 1469-S 170 mmf plus or minus 2-1/2%.
10C/6513	C23	V4 Multivibrator 1st Triode	Aerovox, Type 1469-S 100 mmf plus or minus 2-1/2%.
10C/6484	C24	Calibrator H.T. Bypass	Identical with C13.
10C/6514	C25	V2 Detector plate RF Bypass	Aerovox, Type 1468-S 350 mmf plus or minus 10%
10C/6515	C26	V2 Detector plate audio filter	Aerovox, type 1467-S 0.01 mfd, plus or minus 10%
10C/6484	C27	V3 1st Audio Grid Coupling Condenser	Identical with C13
10C/6484	C28	V3 2nd Audio Grid Coupling Condenser	Identical with C13
10C/6516	C29	V3 2nd Audio Grid - H.F. audio bypass	Aerovox, type 1467-S 0.002 mfd, plus or minus 10%
10C/2791	C30	Positive - H.T. Battery Bypass	Aerovox, Type 284, 0.5 mfd, plus or minus 20%
10C/2791	C31	Negative - H.T. Battery Bypass	Identical with C30
10C/6517	C32	Het. Osc. Tracker, Range 6	Solar, Type MWSCW- .5-21095-1, 1095 mmf, plus or minus 1%
10C/6484	C33	V3 2nd Audio plate H.F. Bypass	Identical with C13

Ref. No.	Sch. Des.	Nomenclature	Description
10C/6441	C5	Het. Osc. Trimmer, Range 9	Identical with C1.
10C/6442	C6	Het. Osc. Temp. Compensating Condenser, Range 5.	Centralab, Type "D" 24.5 mmf. plus or minus 0.5 mmf. Coeff. minus 75 x 10 ⁻⁵
10C/6443	C7	Het. Osc. Temp. Compensating Condenser, Range 6.	Centralab, Type "D" 28 mmf. plus or minus 0.5 mmf. Coeff. minus 75 x 10 ⁻⁵
10C/6443	C8	Het. Osc. Temp. Compensating Condenser, Range 7.	Identical with C7.
10C/6444	C9	Het. Osc. Temp. Compensating Condenser, Range 8.	Centralab, Type "D" 27 mmf. plus or minus 75 x 10 ⁻⁵
10C/6444	C10	Het. Osc. Temp. Compensating Condenser, Range 9.	Identical with C9.
10C/6482	C11	Het. Osc. Tracker, Range 8	Solar, Type MOSCW-.5-3412-1 412 mmf. plus or minus 1%
10C/6483	C12	Het. Osc. Tracker, Range 9	Solar, Type MOSCW-.5-33-1 330 mmf plus or minus 1%
10C/6484	C13	Het. Osc. H.T. Bypass	Aerovox, Type 1467-S 0.01 mfd plus or minus 10%
10C/6485	C14	Het. Osc. Grid Condenser	Aerovox, Type 1469-S 250 mmf plus or minus 2-1/2%
10C/6486	C15	Het. Osc. Plat coupling	Aerovox, Type 1468-L-S 100 mmf. plus or minus 10%
10C/6487	C16	Het. Osc. Tracker, Range 7	Solar, Type MWSCW-.5-3595-1 595 mmf plus or minus 1%.
10C/6488	C17	Het. Osc. Condenser Curve Corrector	Marconi, Type 106-501 Details A and B.
10C/6488	C18	Het. Osc. Tuning Condenser	Identical with C17.

Ref. No.	Sch. Des.	Nomenclature	Description
10C/6489	C19	Multivibrator coupling	Aerovox, type 1469-S 15 mmf, plus or minus 0.5 mmf.
10C/6489	C20	"COUPLING" terminal, and "ANTENNA" coupling Condenser	Identical with C19
10C/6486	C21	V2 Detector Grid Condenser	Identical with C15
10C/6490	C22	V4 Multivibrator 2nd Triode grid coupling condenser	Aerovox, Type 1469-S 170 mmf plus or minus 2-1/2%.
10C/6513	C23	V4 Multivibrator 1st Triode	Aerovox, Type 1469-S 100 mmf plus or minus 2-1/2%.
10C/6484	C24	Calibrator H.T. Bypass	Identical with C13.
10C/6514	C25	V2 Detector plate RF Bypass	Aerovox, Type 1468-S 350 mmf plus or minus 10%
10C/6515	C26	V2 Detector plate audio filter	Aerovox, type 1467-S 0.01 mfd, plus or minus 10%
10C/6484	C27	V3 1st Audio Grid Coupling Condenser	Identical with C13
10C/6484	C28	V3 2nd Audio Grid Coupling Condenser	Identical with C13
10C/6516	C29	V3 2nd Audio Grid - H.F. audio bypass	Aerovox, type 1467-S 0.002 mfd, plus or minus 10%
10C/2791	C30	Positive - H.T. Battery Bypass	Aerovox, Type 284, 0.5 mfd, plus or minus 20%
10C/2791	C31	Negative - H.T. Battery Bypass	Identical with C30
10C/6517	C32	Het. Osc. Tracker, Range 6	Solar, Type MTSCW- .5-21095-1, 1095 mmf, plus or minus 1%
10C/6484	C33	V3 2nd Audio plate H.F. Bypass	Identical with C13

Ref. No.	Sch. Des.	Nomenclature	Description
10C/2876	C35	Crystal Oscillator Calibrating Condenser	Centralab Ceramic Trimmer with mounting bracket 6.5 - 35 mmf, Marconi, Type 100-477.
10C/6451	C36	Het. Osc. Parallel Padder, Range 5, Temp. Compensating	Centralab Class "D" 34 mmf - plus or minus 2-1/2% Temp. Coeff. Zero
10C/6452	C37	Het. Osc. Parallel Padder, Range 6, Temp. Compensating	Centralab Class "D" 42 mmf, plus or minus 2-1/2% Temp. Coeff. Zero
10C/6453	C38	Het. Osc. Parallel Padder, Range 7, Temp. Compensating	Centralab Class "C" 55 mmf, plus or minus 2-1/2% Temp. Coeff. Zero
10C/6454	C39	Het. Osc. Parallel Padder, Range 8, Temp. Compensating	Centralab Class "C" 72 mmf, plus or minus 2-1/2% Temp. Coeff. Zero
10C/6455	C40	Het. Osc. Parallel Padder,	Centralab Class "C" 87 mmf, plus or minus 2-1/2% Temp. Coeff. Zero

RESISTORS

10C/3281	R1	V1 Het. Osc. Grid Leak	100,000 ohms plus or minus 10% I.R.C. type BT 1/2
10C/1924	R2	V1 Het. Osc. Plate load	500,000 ohms plus or minus 10% I.R.C. type BT 1/2.
10C/2792	R3	V4 Multivibrator 1st Triode	50,000 ohms plus or minus 2% I.R.C. type BT 1/2.
10C/2793	R4	V4 Multivibrator 1st Triode Plate Load	10,000 ohms plus or minus 2% I.R.C. type BT 1/2.
10C/2793	R5	V4 Multivibrator 2nd Triode Plate Load	Identical with R4

Ref. No.	Sch. Des.	Nomenclature	Description
10C/2792	R6	V4 Multivibrator 2nd Triode Grid Leak.	Identical with R3
10C/2792	R7	V5 Crystal Osc. Plate Load	Identical with R3
10C/7386	R8	"Equivalent" H.T. load of Calibrator	50,000 ohms plus or minus 10% I.R.C. type BT 1/2.
10C/3281	R9	V5 Crystal Osc. Grid Leak	Identical with R1
10C/7387	R10	Antenna Discharge Resistor	10,000 ohms plus or minus 10% I.R.C. type BT 1/2
10C/1686	R11	V2 Detector Grid Leak	3 megohms plus or minus 10% I.R.C. type BT 1/2
10C/1700	R12	V2 Detector Plate Load	2 megohms plus or minus 10% I.R.C. type BT 1/2
10C/1700	R13	V2 Detector Plate Filter	Identical with R12
10C/1924	R14	V3 1st Audio Grid Leak	Identical with R2
10C/7386	R15	V3 1st Audio Plate Load	Identical with R8
10C/1924	R16	V3 2nd Audio Grid Leak	Identical with R2
10C/2794	R17	H.T. Negative Bias Resistor	650 ohms plus or minus 10% I.R.C. type BT 1/2
10C/2792	R18	Multivibrator Control Resistor	Identical with R3

 TRANSFORMERS

10A/6446	T1	Het. Osc. Coil, Range 5	Marconi, Type 106-104
10A/6447	T2	" " " " 6	" " 106-105
10A/6448	T3	" " " " 7	" " 106-106
10A/6449	T4	" " " " 8	" " 106-107
10A/6450	T5	" " " " 9	" " 106-108
10A/2800	T6	Audio Output Transformer	" " 89383

INDUCTANCES

Ref. No.	Sch. Des.	Nomenclature	Description
10A/6479	L1	Het. Osc. H.T. Decoupling	Marconi Type 106-130
10C/6480	L2	Crystal Osc. Coil Ass'y	" " 106-129
10C/6481	L3	Antenna R.F. Choke	" " 106-200

SWITCHES

	(S1	Het. Osc. Grid Coil and	Marconi, Type 106-901 Sect.1
	(	Tracker Selector Switch	
	(		
10F/5457	(S2	Het. Osc. Grid Coil and	Marconi, Type 106-901 Sect.2
	(	Tracker Selector Switch	
	(		
	(S3	Het. Osc. Plate Coil	Marconi, Type 106-901, Sect.3
	(	Selector Switch	
	(		
	(S1)		
	(S2)	Switch Assembly	Marconi, Type 106-901
	(S3)		
10F/2805	S4	Calibrator "ON-OFF" Switch	Arrow H.&H. S.P.D.T. Bat handle - with lugs
10F/1829	S5	Battery "ON-OFF" Switch,) H.T. Section)	Arrow H.&H No. 3581
10F/1829	S6	Battery "ON-OFF" Switch,) L.T. Section)	D.P.S.T. Circuit made on pull.

VALVES

10E/2373	V1	Het. Osc. Valve	Type 1N5GT
10E/2372	V2	Detector Valve	Type 1H5GT
10E/2806	V3	1st Audio and Output Valve	Type 1D8GT
10E/2807	V4	Multivibrator Osc. Valve	Type 1G6GT
10E/2373	V5	Crystal Osc. Valve	Type 1N5GT

VALVE SOCKETS

Ref. No.	Sch. Des.	Nomenclature	Description
10H/1750	V1	Valve Socket (V1)	Amphenol, Type RSS8
10H/2808	V2	Valve Socket (V2)	Marconi, Type 68087
10H/2809	V3	Valve Socket (V3)	Amphenol, " S8
10H/2808	V4	V4 Valve Socket	Marconi, " 68087
10H/2808	V5	V5 Valve Socket	" " 68087
10H/2809	CRYSTAL	Crystal holder socket	Amphenol, " S8

MISCELLANEOUS

10X/1000	CRYSTAL	Crystal Oscillator with holder	Marconi, Type 111-505
10H/2816	J1	Headphone jack, Standard	Carter - Short No. 1
10H/2817	J2	Headphone jack, Special	Marconi, Type 93519
10A/2818	COUPLING	Terminal Post	G.R. Type 138 V.D.
10A/2821	GROUND	Terminal Post	G.R. Type 138 V.D.
10B/2822		Insulator for "GROUND-COUPLING" Terminal	G.R. Type 274-Y
10B/2823	ANTENNA	Whip Type - Telescopic	Marconi, Type 88920
10H/2824		Receptacle for Antenna	" " 88753
10A/6456		Iron Cores for T1 to T5 inclusive	" " 120-301
10H/2826		Grid Clips for V1, V2, V3 and V5	United Carr Fastener Type 6005
5J/725	BATTERY	Combined H.T. and L.T. Unit	General, Type 60A-2L
10H/2830		Plug for Battery Cable	Eby, Type 30-4
10H/2814		Conductors for Battery Cable	Marconi, Type 88733
10H/2815		Battery Cable, complete	" " 88732

Ref. No.	Sch. Des.	Nomenclature	Description
10A/2863		Lead-thru Bushings Ass'y (on castings.)	Marconi Type 91457
10A/6457		Condenser - Resistor Panel, Assembly - Mounting R8, R14, C27, C25, etc.	" " 106-136
10A/6458		Condenser - Resistor Panel Assembly, Mounting C21, C15, C20 and C19.	" " 106-133
10A/6459		Condenser - Resistor Panel Assembly - Mounting C30, C31, R17, R16, C29, etc.	" " 106-139
10A/6460		Cover Ass'y, Top	" " 106-511
10D/2833		Cover Ass'y, Bottom	" " 88741
10D/2865		Strap, Leather Carrying	" " 88943
10D/2834		(Cover, Trimmers - Coils) (& Cond. Het. Osc.)	" " 89164
10A/6461		Pad, Felt, Support, Chassis	" " 106-209
10D/2836		Pad, Felt, Support, Battery	" " 93739
10A/2877		Grommet, Rubber, Battery Switch, Actuating	Lavelle Rubber Co. #1105 - Pure Gum
10D/2838		Cover, Base, Osc. Section	Marconi Type 88744
10A/6462		Cover, Base, Tube Section	" " 106-508
10A/2871		Grommet, Rubber, large	Lavelle Rubber Co. #911, black.
10A/2872		Grommet, rubber, medium	Lavelle Rubber Co. #909, pure gum.
10A/2873		Grommet, rubber, small (x)	" " " #901, pure gum.
10A/1835		Knob, switch, range	G.R. Co. #637A, with pointer.
10A/6463		Clamp, Lead, Coupling	Marconi, Type 106-191

Ref. No.	Sch. Des.	Nomenclature	Description
10A/6464		Nut, Lock, Trimmer, T-1 to T-5 inclusive	Marconi, Type 106-177
10A/6465		Spring, Trimmer - L2.	" " 106-202
5K/41		Clamp, Cable Battery	" " 93671
10A/6466		Dial, Main tuning, including gear	" " 106-173
10A/6467		Gear, Spring Loaded, Main tuning	" " 106-151
10A/6468		Spring, Tension, Gear,	" " 106-454
10A/6469		Disc, Locking, Main tuning	" " 106-154
10A/6470		Hub, Gear, Main Tuning	" " 106-153
10A/6471		Spacer, Disc, Locking Main Tuning	" " 106-204
10A/5458		Dial, Main Tuning, Complete	" " 106-180
10A/5459		Indicator Ass'y, Dial, Main tuning (x).	" " 106-165
10A/5460		Dial Ass'y, Vernier tuning(x)	" " 106-170
10A/5461		Indicator Ass'y, Dial, Vernier tuning. (x).	" " 106-126
10A/5462		Knob, Vernier tuning.(x)	G.R. Co. #637G. less pointer & 2 set screws OR Marconi, type 106-250
10A/2845		Washer, Spring, Knob, (x)	" " 94582
10A/6472		Pinion Ass'y, Vernier tuning(x)	" " 106-155
10A/6473		Spacer, Thrust, Pinion Ass'y Vernier tuning.(x).	" " 106-461
10A/6474		Plate Ass'y, Support, Dial and drive. (x)	" " 106-160
28C/374		Washer, Double Coil, Friction Pinion Ass'y, Vernier tuning (x).	Wallace Barnes Type AGS- 1583A OR "S/P" #3502-16-1

Ref. No.	Sch. Des.	Nomenclature	Description
10A/6475		Collar, Pinion Ass'y, Vernier tuning	Marconi, Type 106-163
10A/6476		Bracket, Bearing, Pinion Ass'y Vernier tuning (x)	" " 106-158
10A/6477		Clamp, dial locking	" " 106-168
10A/6278		Washer, Spring, Dial Locking	Shakeproof #3502-10
10A/2869		Nut, thumb, dial locking	Marconi, Type 88801
10A/5463		Screw, Dial Locking	" " 106-176
10A/5464		Stop, retaining, nut thumb, dial locking	" " 96512
28/4863		Nut, Stop, Elastic, Gang Condenser	Elastic Stop Nut #22M82
10H/2810	V3	Spacer, Rubber, Bushing	Marconi, Type 94159
10H/2811	V3	Plate, Socket, Suspension	" " 106-181
10H/2812	V3	Bushing, rubber, Plate suspension	Lavelle Rubber Co. Type #1105 - Pure Gum
10A/2819		Washer, Insulating "COUPLING" Terminal	Marconi, Type 88895
10A/2820		Washer, Metal "COUPLING" Terminal	" " 29695
10D/2506		Transit Case	" " 93806
10D/2644		Tray, Mounting, Shockproof	" " 90761
(x) following the nomenclature of some 11 parts above indicates same are used only in instruments with serial numbers from 101 to 787.			
The following parts are used only in instruments with serial numbers above 787.			
10A/9637		Indicator Ass'y Dial, Main tuning	Marconi, Type 116-575
10A/9638		Dial Ass'y, Vernier tuning	" " 116-568
10A/9639		Indicator, Dial, Vernier tuning	" " 116-581

Ref. No.	Sch. Des.	Nomenclature	Description
10A/9640		Gears Ass'y, Indicator Adjustment, Vernier tuning	Marconi, Type 116-580
10A/9641		Spring, Compression, Gear loading Indicator Adjustment Vernier tuning	" " 110-175
10A/9642		Washer, Spring Gear Ass'y Vernier tuning	" " 116-594
10A/9643		Pinion Ass'y, Vernier Tuning	" " 116-595
10A/9644		Bearing Ass'y, Pinion Ass'y Vernier tuning	" " 116-582
10A/9645		Washer, thrust, Pinion Ass'y Vernier tuning	" " 60706
28C/17912		Washer, Spring, Friction, Pinion Ass'y Vernier tuning	Shakeproof #3502-16-1
10A/9647		Drive, Worm, Indicator Adjustment, Vernier tuning	Marconi, Type 116-585
10A/9648		Knob Ass'y, Drive, Worm Indicator Adjustment, Vernier tuning	" " 116-590
10A/9649		Washer, Spring, Drive, Worm Indicator Adjustment Vernier tuning	" " 116-589
10A/9650		Collar, Drive, Worm, Indicator Adjustment, Vernier tuning	" " 116-588
10A/9651		Plate Ass'y, Support, Dial and Drive	" " 116-577

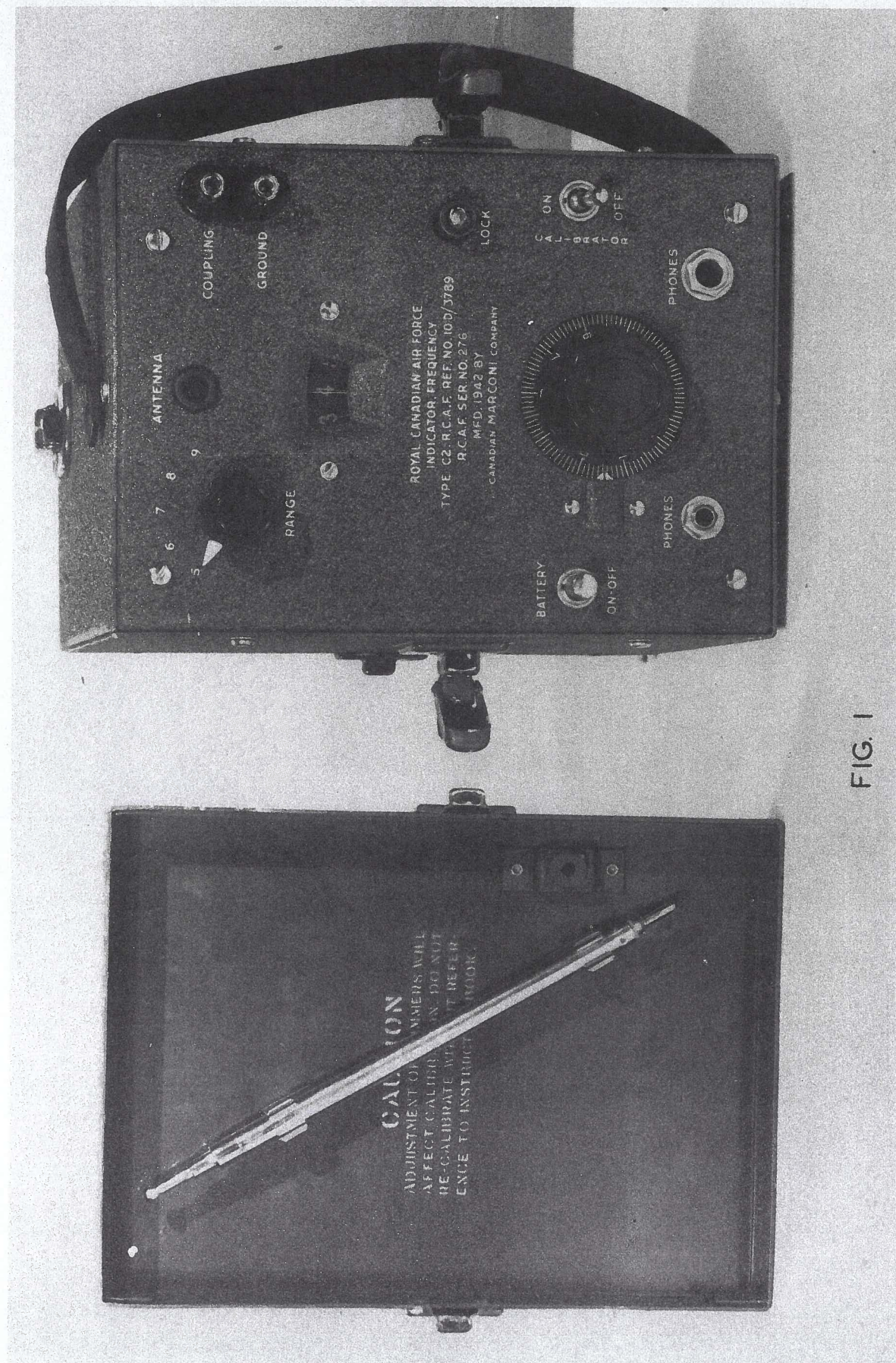


FIG. 1

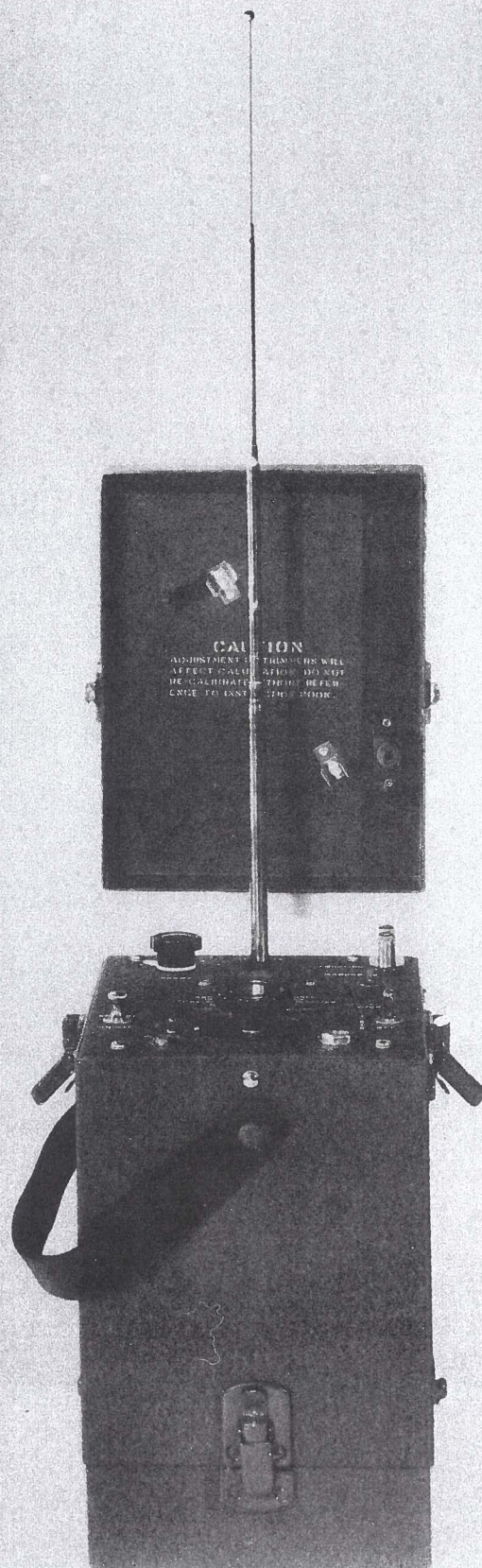


FIG 1A

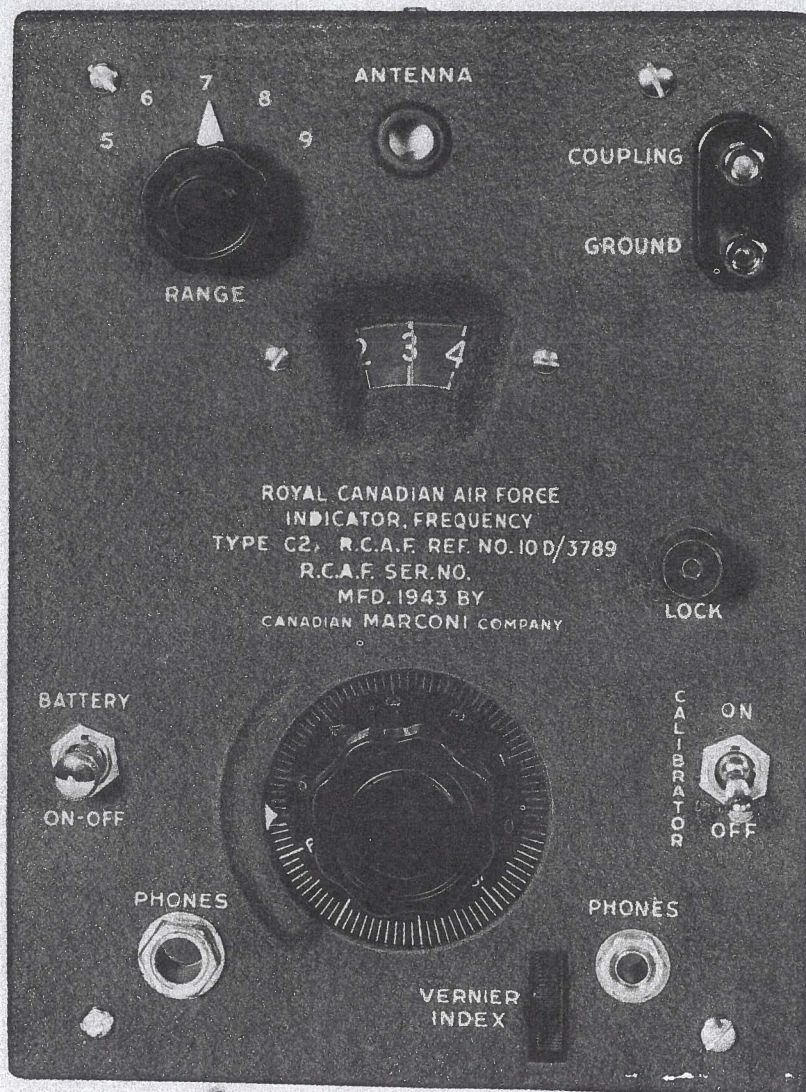


FIG. 1B
FREQUENCY INDICATOR
TYPE C2

STORES REF. N^o. 10D/3789 - SER. N^o 788 & ABOVE

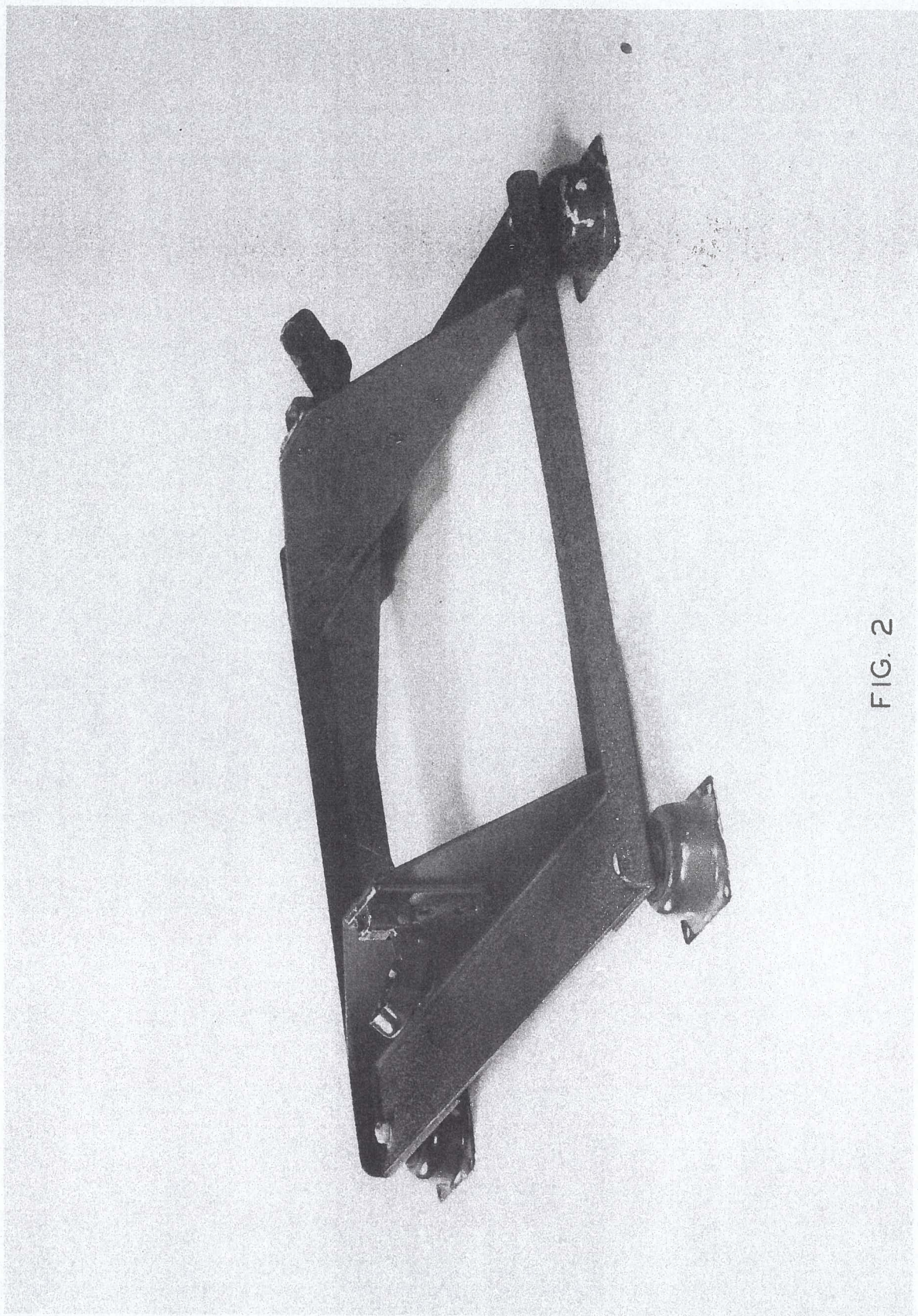


FIG. 2

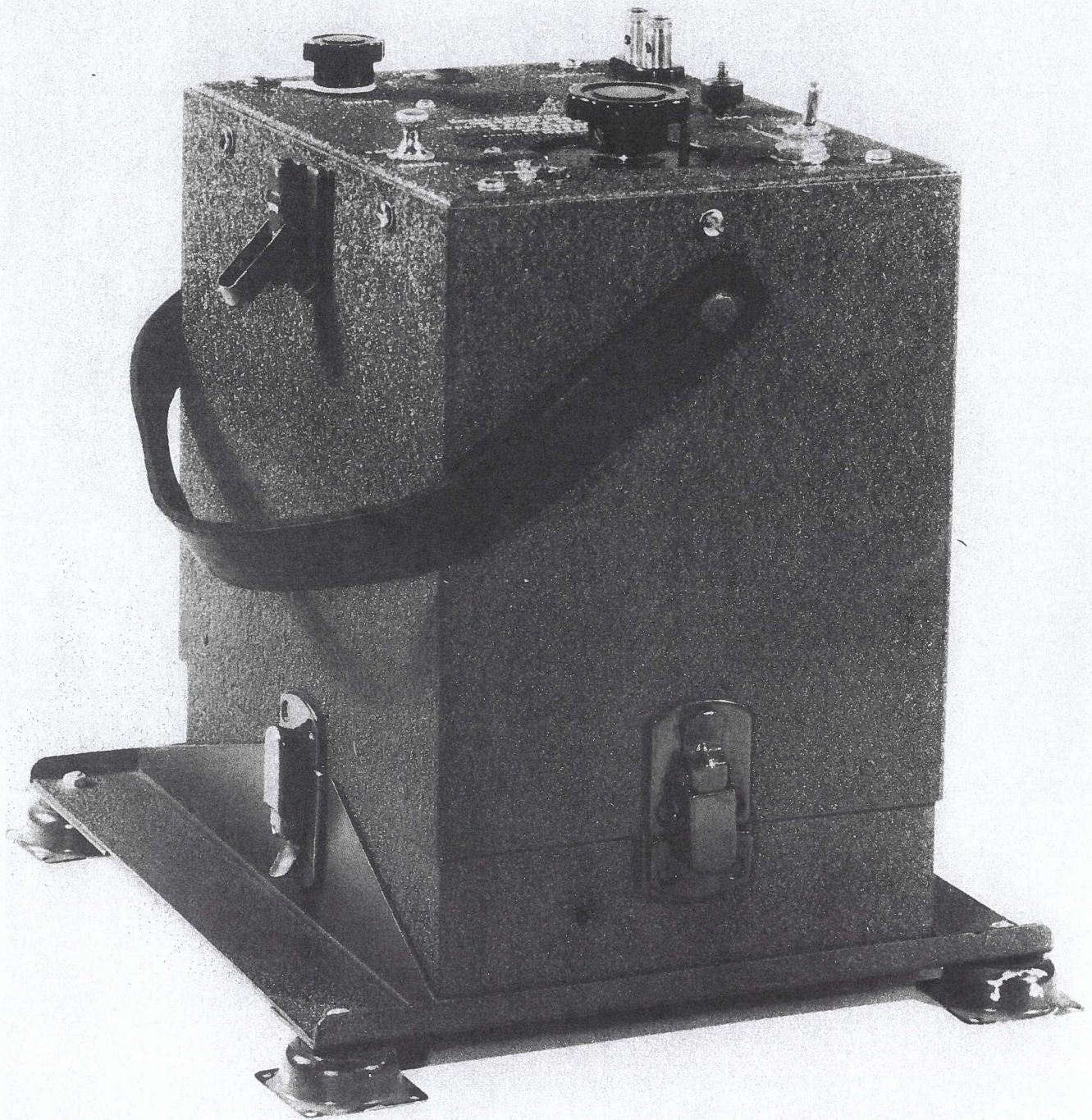


FIG. 2A

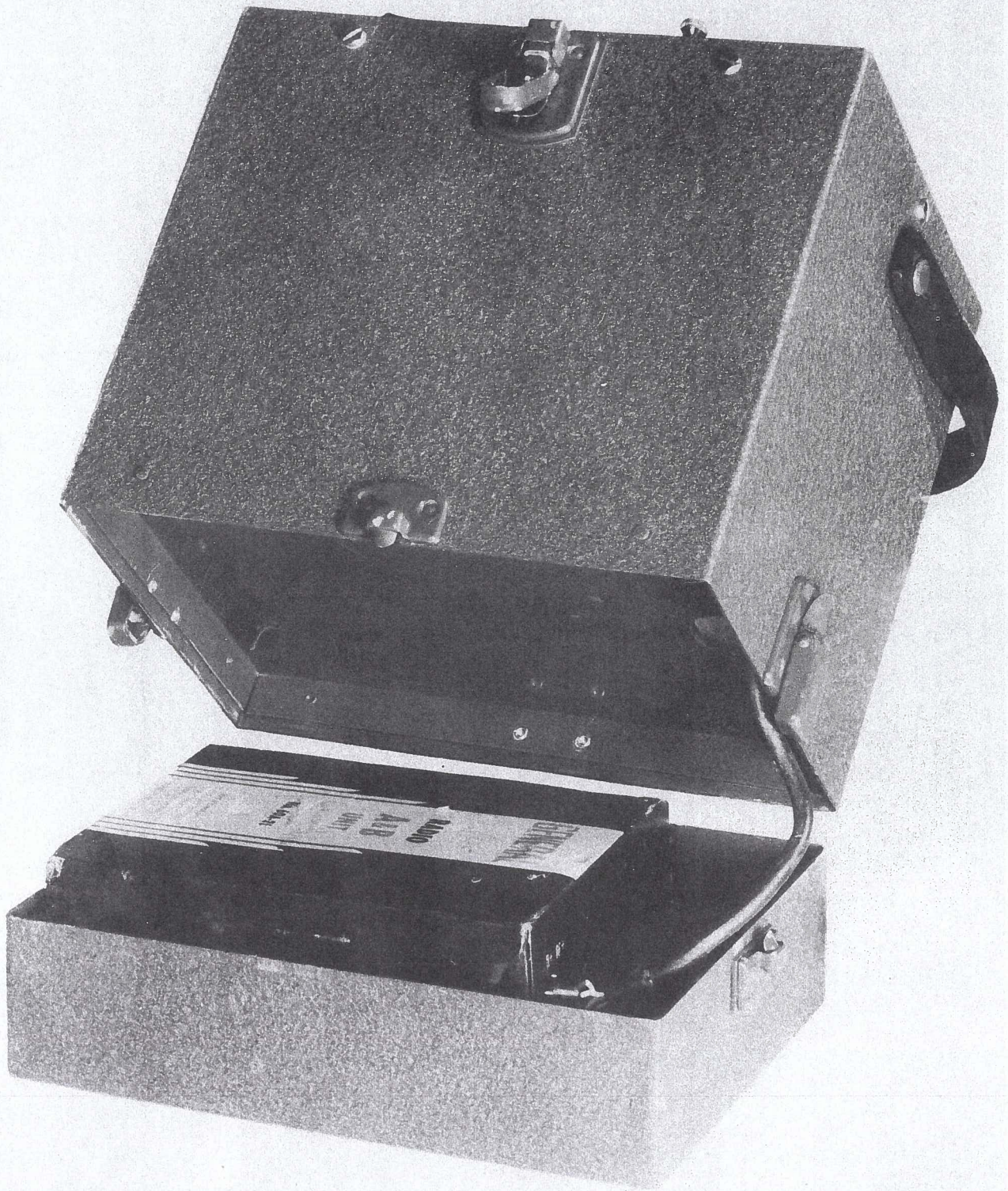


FIG. 3

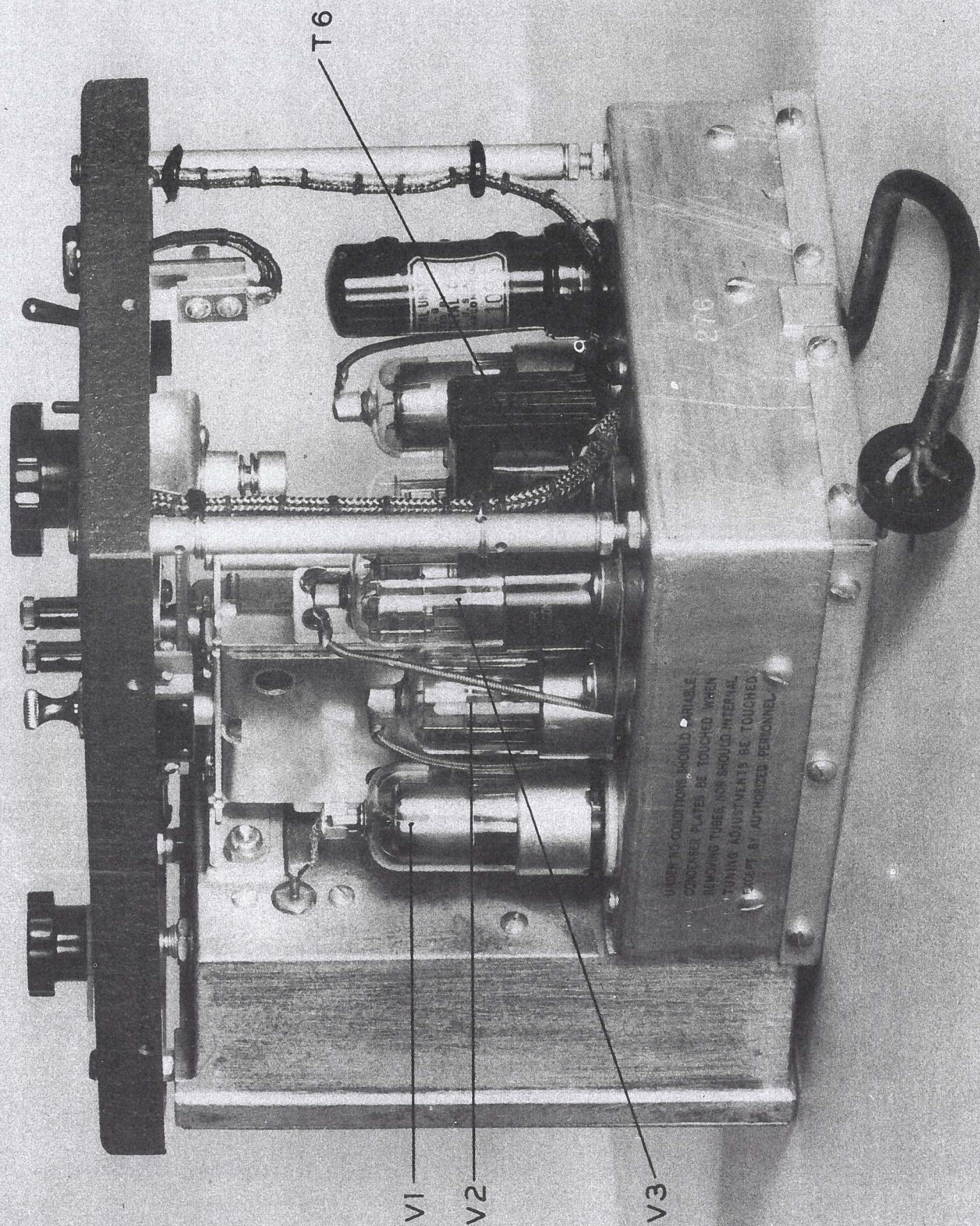


FIG. 4

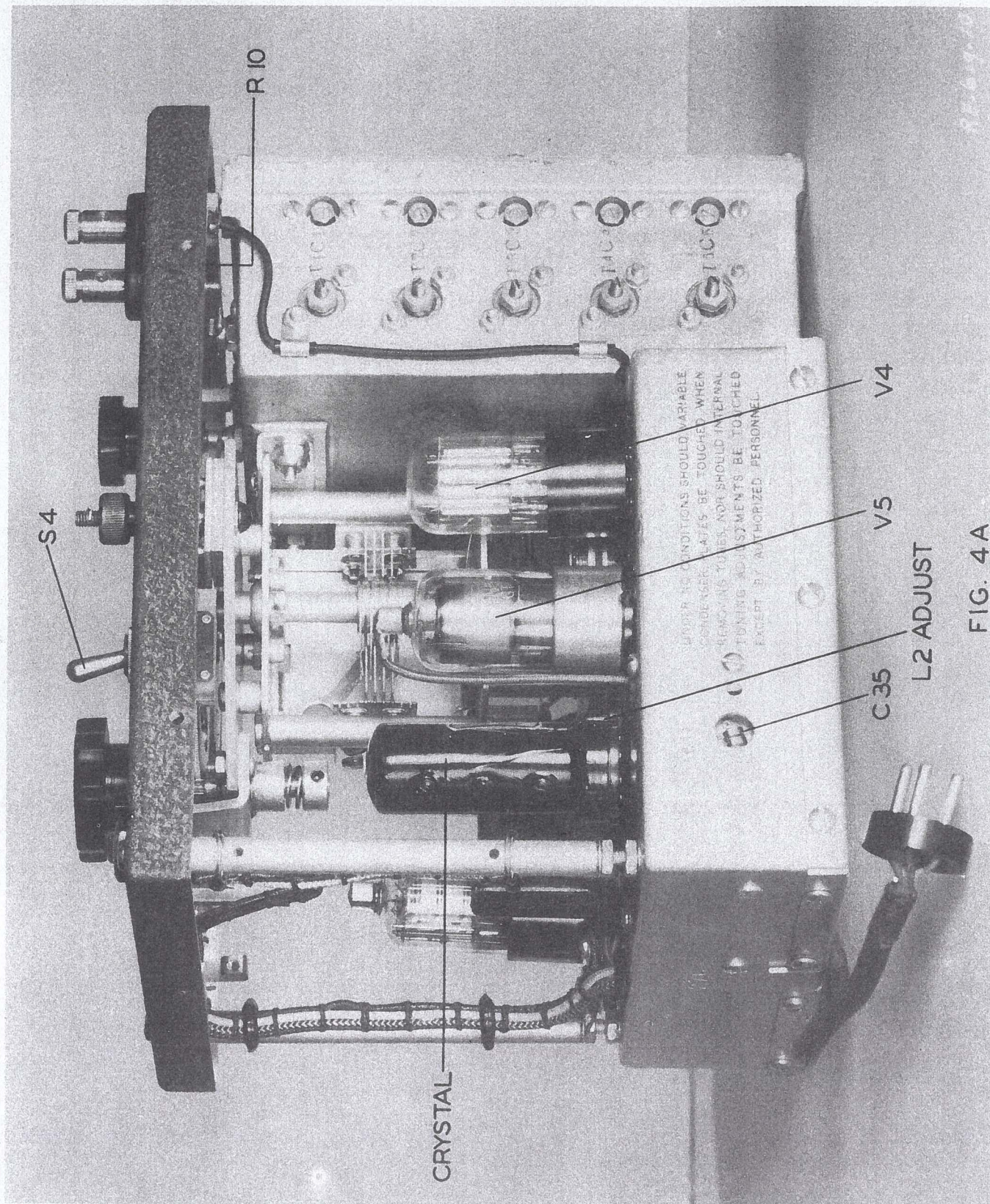


FIG. 4A

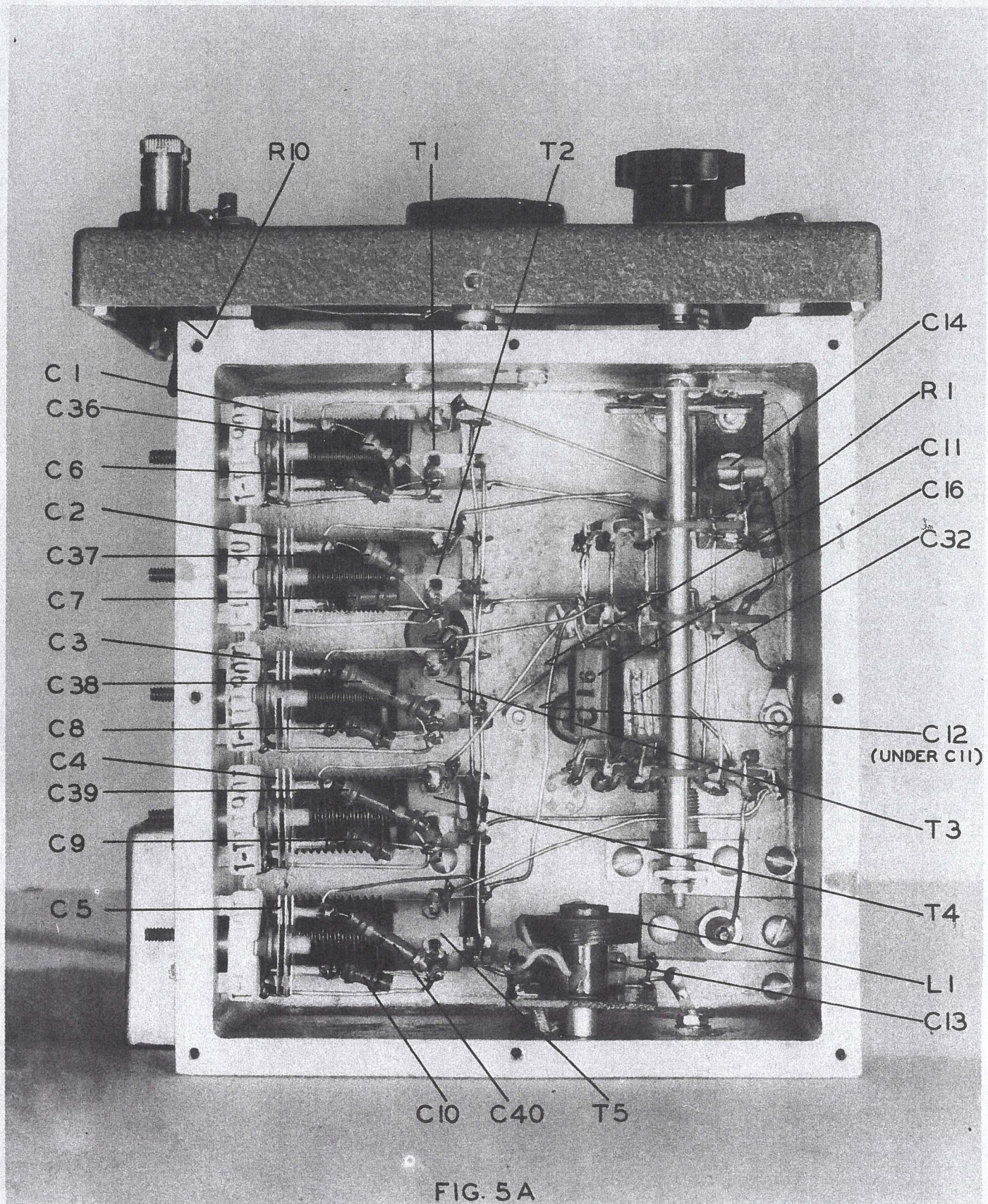


FIG. 5A

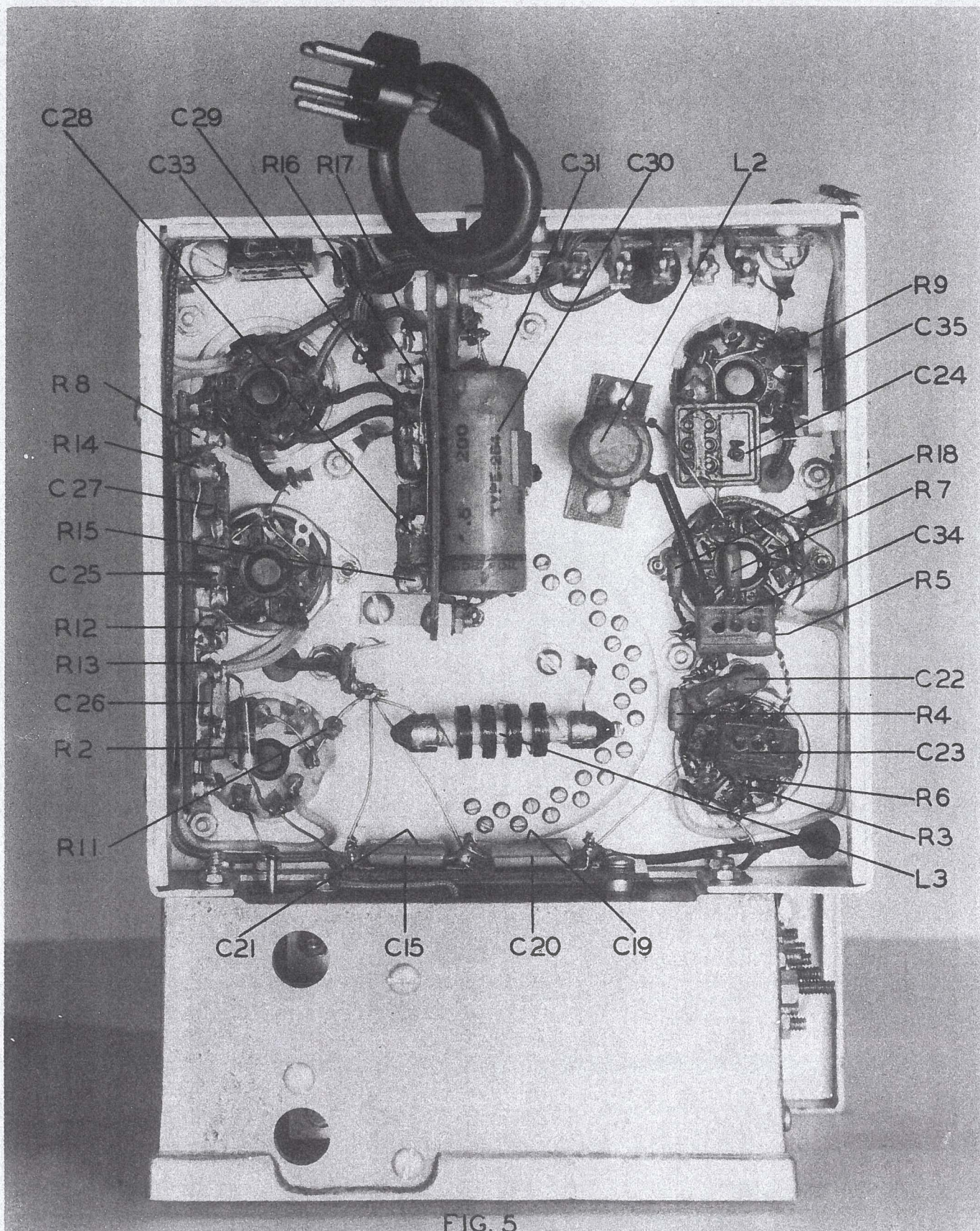


FIG. 5

Crystal and Calibrator

- (1) Calibrator 'ON' adjust L2 iron core for maximum crystal drive as indicated by V.T.V.M. across V5 control grid and ground, then back off iron core (turning iron core out) until drive drops 15 %.
- (2) Adjust crystal trimmer C35 to bring crystal oscillator frequency to 1000 kilocycles, plus or minus 1 C.P.S. When this condition has been achieved it should be found that C35 is neither all 'in' nor all 'out' but has sufficient adjustment remaining to swing the frequency plus 5 C.P.S. on one side of 1000 kilocycles and minus 5 C.P.S. on the other side.
- (3) The multi-vibrator 100 kilocycles series (appearing at the coupling and ground terminals) should now be checked to insure that the crystal is controlling the M/V. This check may be in the nature of an aural test such as tuning in the M/V harmonics on a receiver, and as the receiver is tuned across a given band (e.g. 100 to 200 kc's ; 200 to 400 kc's , 400 to 1000 kc's ; 1000 to 3000 kc's ; etc.) noting that the frequency interval between each M/V harmonic is 100 kc's. as indicated by the receiver dial. When making this test the RX B.F.O. should be switched on and the gain control kept as low as possible. This check is to be made on both high and low battery voltage ie 90 volts, minus 2%, plus 5%, H.T. 1.4 volts minus 5%, plus 10% L.T. and 75 volts plus or minus 2%, H.T. 1.17 volts plus or minus 2%, L.T. respectively. The method of obtaining the low battery voltage being as shown in figure 2. For both cases of battery voltages the M/V harmonics should be pure cw carriers and the frequency interval between adjacent harmonics should be 100 kc's.

Adjustment of Vernier Dial for type C2.

Serial # 101/ 787 set main dial at its index mark, slip vernier dial disc to 57. # 787 upwards set main dial at its index , set vernier indicator approx. at its mid-point of travel , vernier dial should read 57

Adjustment of Het- Oscillator.

Calibrator 'off'. Signal Generator 0.1 volt input direct to coupling and ground.

N.B. The line on the main dial after the division '9' is known as the End Division.

Range 5

- | | |
|---------------------------|----------------|
| (1) Sig.Gen. @ 5000 kc's. | Adjust T1 to |
| Main dial @ 0 division | zero beat with |
| Vernier @ 0 " | Sig. Gen. |
| (2) Sig.Gen. @ 6000 kc's. | Adjust C1 to |
| Main dial @ End div. | zero beat with |
| Vernier @ 0 div. | Sig.Gen. |
- (3) Repeat steps 1 & 2 until adjustments at one end of the dial makes little or no difference at the other
 - (4) Disconnect Sig.Gen. and switch calibrator 'ON'. Repeat steps 1,2,&3 using the calibrator to obtain the two end setting points instead of Sig.Gen.

Battery voltages measured with 1000 ohm per volt meter

Net-Oscillator Condenser Curve Adjustment

The condenser is adjusted by means of the compensating screws protruding through the bottom of the tube base.

These adjustments are made only on Range 5, after this band has been trimmed and tracked as previously outlined.

Method of adjusting compensating screws

- (a) Range switch at 5, Calibrator 'ON'. Check that trimmer (C1) is adjusted for zero beat at End Division (Vernier at 0) and that iron core (T1) is adjusted for zero beat at 0 (Vernier at 0).

(1) Rotate main dial to 9.5, Vernier at 50, adjust compensator screw corresponding to that position for zero beat, or as near as possible.

(2) Main dial at 9, Vernier at 0, adjust compensator screw corresponding to this position for zero beat, or as near as possible.

Continue as above for each half rotation of the vernier dial (i.e. each half division of main dial) until all points have been adjusted.

- (b) When this preliminary adjustment has been finished (0 on main dial is last adjustment) repeat the procedure starting at main dial End Division; but now instead of using trimmer (C1) to obtain zero beat at this point the compensating screw corresponding to this position is to be adjusted to zero beat. Do not alter the trimmer after step (a) above has been completed. Continue on down the dial as before, adjusting the compensation screws at each half Vernier dial revolution. When this step has been completed it should be found that the calibration points are within the following tolerances.

Main Dial	0	.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5
Vernier	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50	0	50

Vernier Tol.	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
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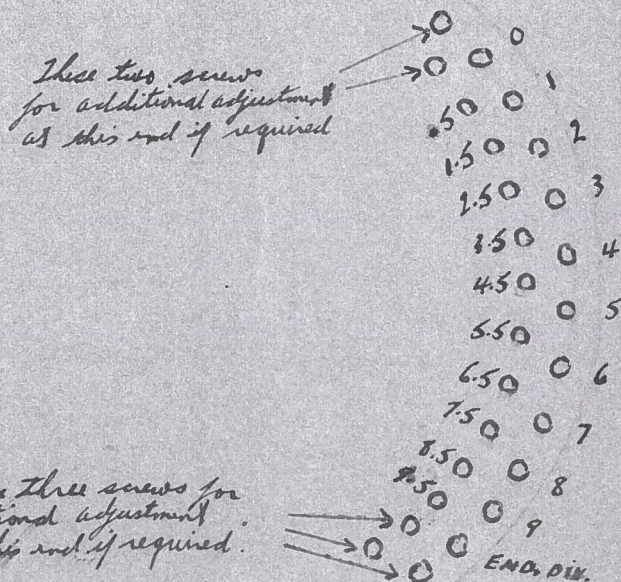
Main Dial	9	9.5	End Division
-----------	---	-----	--------------

(Vernier Tolerance is $\frac{1}{2}$ division)

Vernier	0	50	0
---------	---	----	---

Vernier Tol.	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
--------------	---------------	---------------	---------------

If tolerances not obtained repeat step (b).



Tracking Ranges 6,7,8 & 9
(Het- Oscillator Condenser no further adjustment)

Range 6

- | | |
|--|--|
| (1) Sig.Gen @ 6000 kc's.
Main Dial @ 0 division
Vernier @ 0 " | Adjust T 2 to
zero beat with
Sig Gen |
| (2) Sig.Gen @ 7000 kc s.
Main Dial @ End division
Vernier @ 0 " | Adjust C2 to
zero beat with
Sig.GEN. |
| (3) Repeat steps (1) & (2) until adjustment at one end of the dial makes little or no difference at the other end. | |
| (4) Disconnect Sig Gen Sw't h Calibrator 'ON' . Repeat steps (1),(2),(3) using calibrat r instead of Sig.Gen to obtain the two end settings. | |

Range 7

- | | |
|--|--|
| (1) Sig.Gen @ 7 00 kc's.
Main Dial @ End division
Vernier @ 0 " | Adjust T3 to
zero beat with
Sig.Gen. |
| (2) Sig.Gen @ 8000 kc s
Main Dial @ End division
Vernier @ 0 " | Adjust C3 to
zer beat with
Sig.Gen |
| (3) Repea 1) & () until adju tment at one end of the dial makes little or no difference at th other | |
| (4) Disconnec Sig Gen Swit h Calibrator 'ON' Rep at steps (1),(2) (3) using cal brator in teed of Sig Gen. o obta n the two end settings | |

Range 8

- | | |
|---|--|
| (1) Sig.Gen @ 8000 k 's
Main Dial @ 0 d v sion
Vernier @ 0 " | Adjust T4 to
zero eat with
Sig Gen |
| (2) Sig Gen. @ 9000 k 's
Main Dial @ End division
Ver ier @ 0 " | Ad ust C4 to
zero beat with
Sig.Gen. |
| (3) Repeat (1 & (2) n il adjustment at one nd of the dial makes little or no difference at the other | |
| (4) Disc nnect Sig Ge . Swi ch Cal brator 'ON' Repeat steps (1), 2) (3) sing calibrator in ead of Sig,Gen. to obtain the two end settings | |

Range 9

- | | |
|---|--|
| (1) Sig.Gen @ 9000 kc'
Main Dia @ E d divis on
Vernier @ " | Adjust T5 to
zero beat with
Sig.Ge |
| (2) Sig.Gen. @ 10 000 k 's.
Main D al @ End d vision
Vernier @ 0 " | Adjust C5 to
zero beat with
Sig Gen. |
| (3) Repeat s eps 1) & 2) unti adjustment at one end of the dial makes little or no difference at th other.. | |

over.

Tracking Chart
(With Calibrator 'ON' zero beats at following points)

Main Dial	0	.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5
Vernier	0	50	0	50	0	50	0	50	0	50	0	50

Main Dial	6	6.5	7	7.5	8	8.5	9	9.5	End Division
Vernier	0	50	0	50	0	50	0	50	0

Tolerance of Vernier dial on ranges 6,7,8 & 9 should be $\frac{1}{2}$ division on all points.

Range Switch

The range switch is to be checked for frequency re-setability on each range. The maximum allowable frequency change from a given frequency setting during 24 switching operations on each range (ie. 12 anti-clockwise and 12 clockwise operations except range 5 make 24 anti-clockwise, and in range 9 make 24 clockwise operations) should not be more than 1000 C.P.S.

Sensitivity.

Calibrator 'OFF'. Output meter 400 ohm plugged into phone jack. Range switch on 5. Main dial at 0. Connect a Sig.Gen. at 5000 kc's. direct to coupling and ground. Sig Gen adjusted to give beat note which gives maximum output. Adjust Sig Gen input to 80,000 u/v. Output of Freq. Meter should be 1 MW, minus 10% plus 20%. Turn Sig.Gen. 'OFF'. Switch Calibrator 'ON'. At dial reading 5000kc's. adjust beat note for max. output. Output should not be less than 2.5 M/W.

Power Output

Apparatus as under sensitivity. Sig Gen input 1 volt. Monitor output to be not less than 30 M/W.

Lower Voltage Test

Reduce HT. to 75 volts (insert 1000 ohm unbypassed resistor in series with HT. Reduce LT. to 117 volts. Test unit on all bands, using calibrator. Beats should be heard in vicinity of each main dial division on each band. **Caution** - Calibrator slightly displaced - DO NOT ALTER. Frequency interval between beats should correspond to one full vernier dial rotation. (plus or minus 1 division).

After foregoing tests have been made the Main Dial should be turned to Index Mark and the unit carefully assembled in the overcase. Each range should then be re-trimmed and tracking (using calibrator) by means of the trimmers C1, C2, C3, C4, C5 and the iron cores T1, T2, T3, T4 and T5. The iron core adjustments should then be locked.

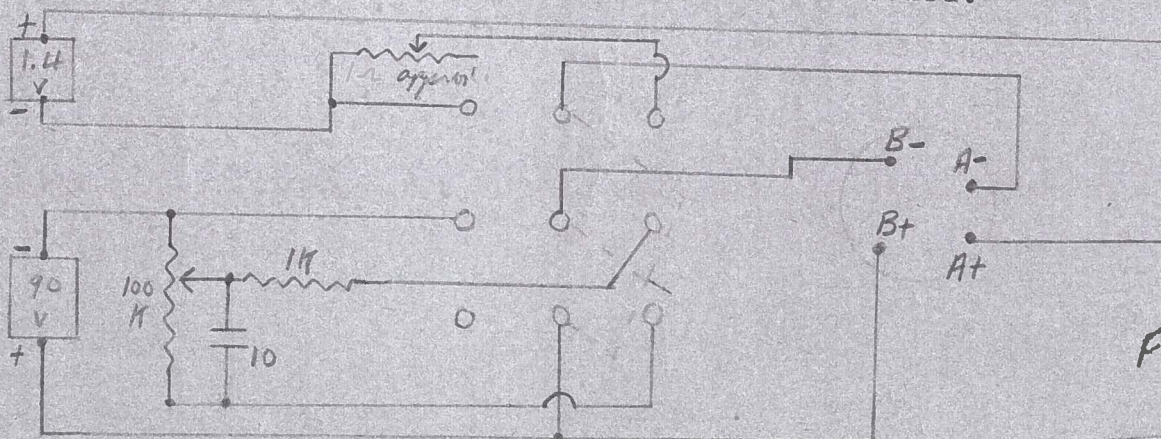
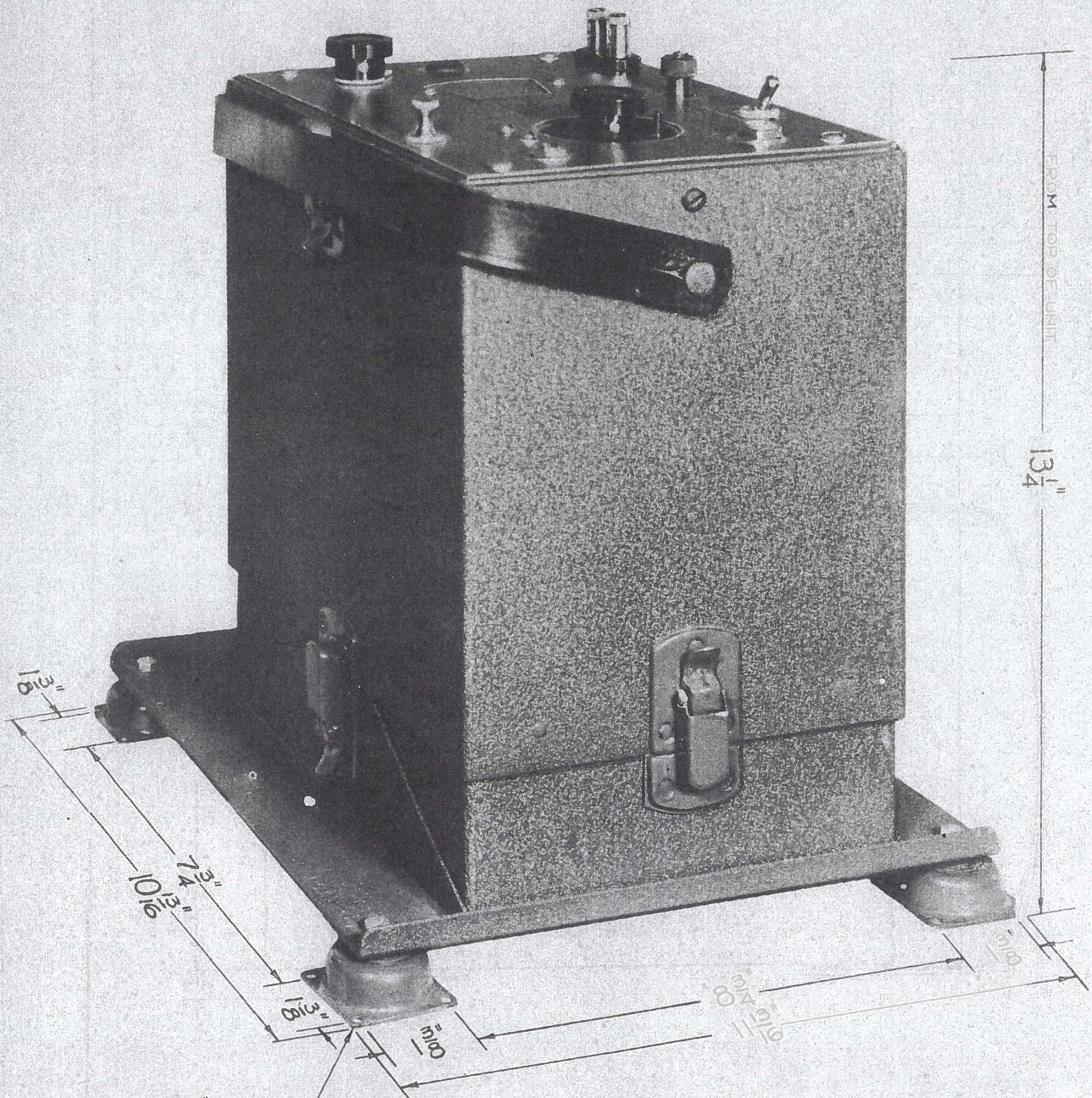


Fig. 2

FREQUENCY INDICATOR
TYPE C2
R.C.A.F. REF. N°10D/3789



4 HOLES $\frac{9}{64}$ " DIA. IN EACH
(OF 4) MOUNTING FOR N°6 SCREWS.

FIG. 10

Technical drawing of a rectangular metal box, likely a component of a machine. The drawing shows the front and side views with dimensions and assembly details.

Dimensions:

- Overall width: 11 7/8"
- Overall height: 9 1/2"
- Top flange width: 3 1/4" (max)
- Top flange thickness: 1/2"
- Bottom flange thickness: 1/2"
- Side flange thickness: 1/2"
- Internal compartment width: 9 1/2"
- Internal compartment height: 9 1/2"

Assembly Details:

- The box is constructed from metal plates, with a top flange, a bottom flange, and a side flange.
- The top flange is secured by a bolt and nut assembly.
- The bottom flange is secured by a bolt and nut assembly.
- The side flange is secured by a bolt and nut assembly.
- The internal compartment is secured by a bolt and nut assembly.
- The box is shown with a handle on the left side.

REC TYPE M

60545

FREQUENCY
INDICATOR

R.C.A.F

OVERALL DIMENSIONS

USED ON

CANADIAN MARCONI COMPANY
LIMITED

DR. M.C. CK. 27 AP

DATE:- JAN 23/43.

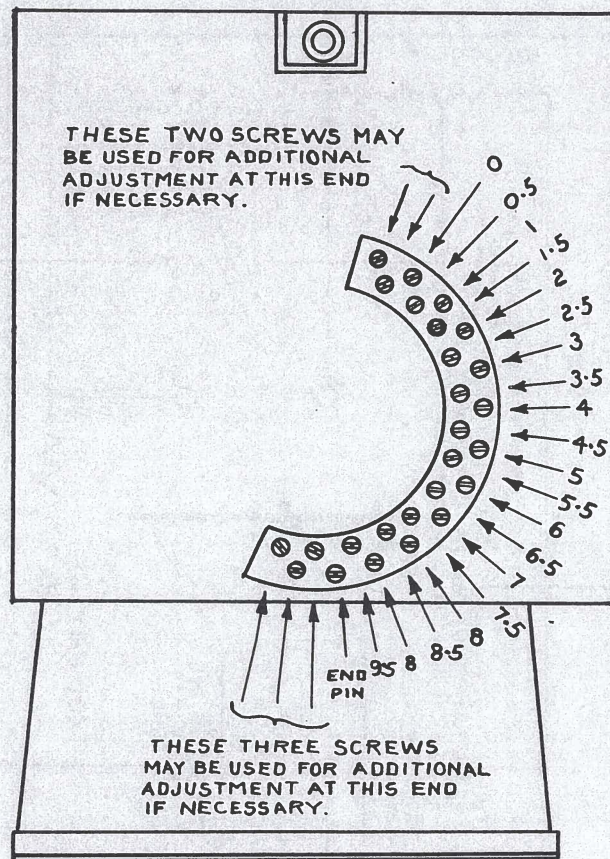


FIG. 12.
ALIGNMENT
FREQUENCY INDICATOR
TYPE C 2
STORES REF. N° 10D /3789.

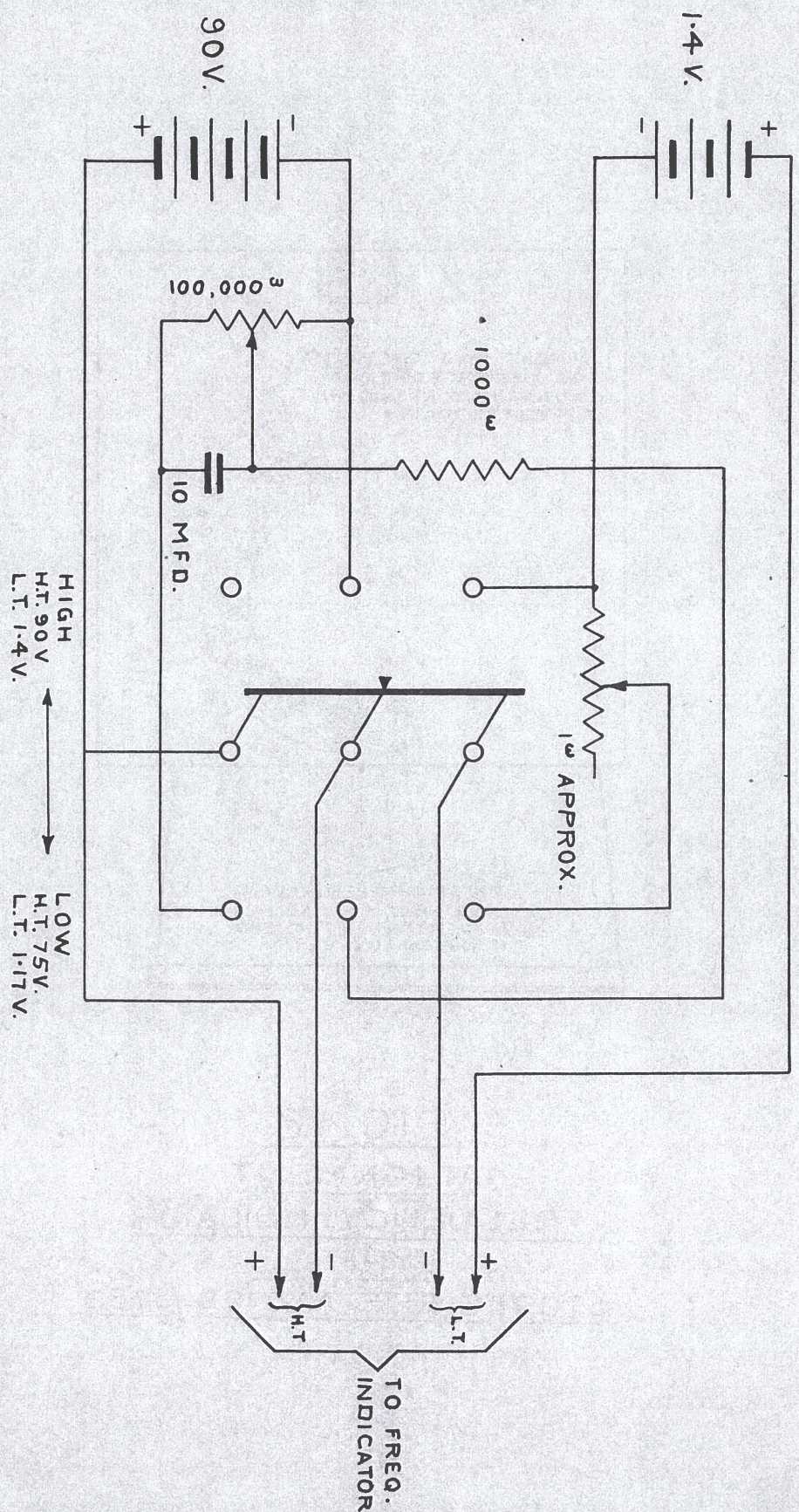


FIG. 13

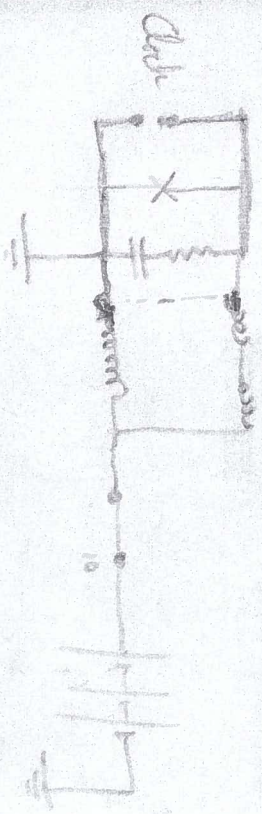
ALIGNMENT

FREQUENCY INDICATOR

TYPE C2

STORES REF. N° 10D/3789.

Should I see how



BATTERIES
Type

Date when installed

Condition

USE

I have checked the transmitter meter readings and they approximate the specimen readings on file.

(Officer-in-charge).

(Back of form may be used if necessary) .