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INSTRUCTIONS

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BY RAKERS ON 23 Aug 8

RADIO RECEIVING EQUIPMENT

MODEL RBH SERIAL [redacted]

FREQUENCY RANGE: 300-1200 KCS. AND 1700-16,000 KCS.

SUPPLY: 115 VOLTS, 50 TO 60 CYCLES, SINGLE PHASE

EQUIPMENT CONSISTS OF FOLLOWING UNITS

CNA-46144 RADIO FREQUENCY TUNER

CNA-49106 LOUD SPEAKER

SEE LICENSE NOTICE INSIDE

NAVY DEPARTMENT

BUREAU OF SHIPS

CONTRACTOR

GENERAL ELECTRIC SUPPLY CORPORATION

WASHINGTON, D.C.

CONTRACT NOs 87668 CONTRACT DATE: JUNE 28, 1941

D-270

NATIONAL COMPANY, Inc.

MALDEN, MASS.

U. S. A.

UNCLASSIFIED

RESTRICTED

INSTRUCTION BOOK

FOR

RADIO RECEIVING EQUIPMENT

MODEL RBH

Frequency Range	300 to 1200 Kcs. and 1700 to 16,000 Kcs.
Supply 115 Volts	50/62 Cycles one Phase

NAVY DEPARTMENT

Bureau of Engineering

CONTRACTOR

General Electric Supply Corp.

Washington, D. C.

MANUFACTURED BY

NATIONAL COMPANY, Inc. MALDEN, MASS., U. S. A.

Contract NOs 87668 Dated June 28, 1941 Schedule 500-2923

RESTRICTED

This instruction book is furnished for the information of commissioned, warrant, enlisted and civilian personnel of the Navy whose duties involve design, instruction, operation and installation of radio and sound equipment. The word "RESTRICTED" as applied to this instruction book signifies that this instruction book is to be read only by the above personnel, and that the contents of it should not be made known to persons not connected with the Navy.

GUARANTEE

All items used in this equipment, except vacuum tubes, will be guaranteed by the contractor for a period extending one year from the installation date of the equipment, provided that in no case will the guarantee extend longer than two years after the date of acceptance. This guarantee will cover items failing in normal operation and the contractor will replace these at no cost to the Government and with transportation charges prepaid to destination. If the contractor elects to have the defective unit returned to his plant for examination, he will be required to pay the transportation charges.

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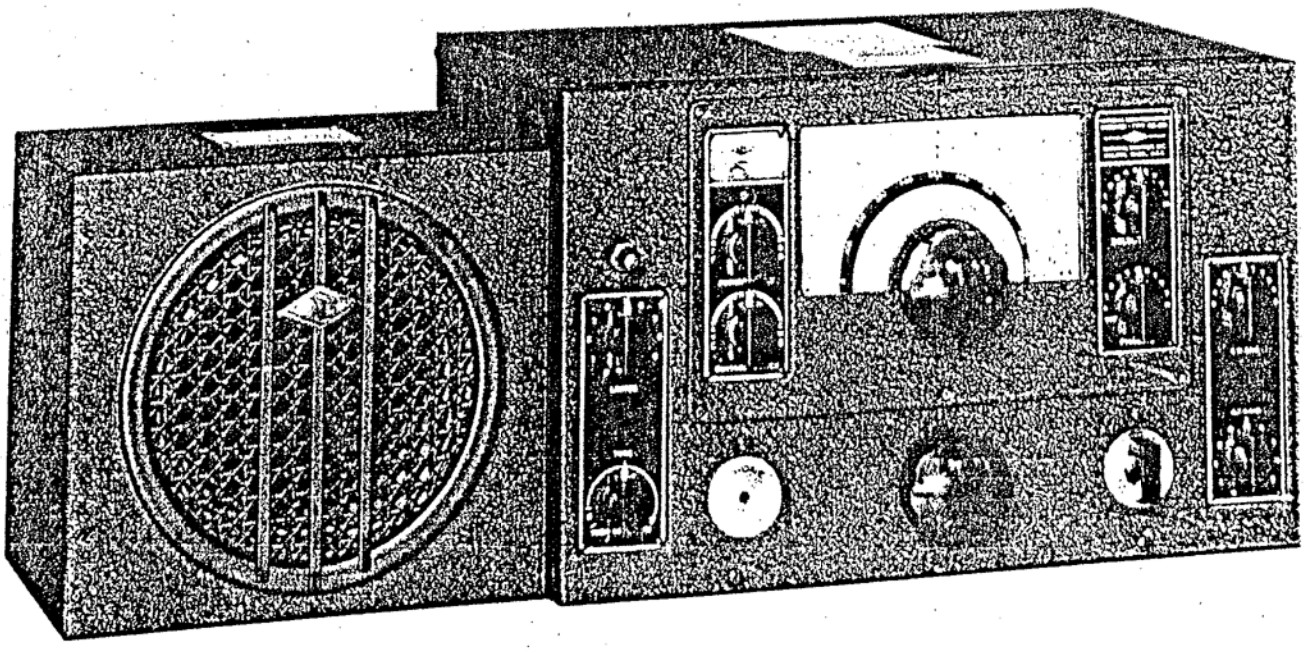


PHOTO NO. 1 MODEL RAO-1 EQUIPMENT

Date of Acceptance by INM Boston, Mass. .....

Date of Installation .....

Guaranteed 2 Years from Acceptance, 1 Year from Installation

FAILURE REPORTS AND REPLACEMENT DATA

Form N. Eng 183		Part Failing Symbol No. from Instruction Book	Date Replacement Received	Remarks
Date	Serial No.			

Reports of failures of Component Parts of the Model RBH Radio Receiving Equipment shall be made in accordance with Bureau of Engineering CIRCULAR LETTER 40b, dated January 16, 1939.

1. GENERAL DESCRIPTION

1.1 The Model RBH Equipment is a complete radio receiving equipment suitable for use on U. S. Naval vessels and at Naval radio shore stations.

1.2 The equipment is suitable for the reception of radio telephone and telegraph signals (either CW or MCW) by either headphone or loud speaker methods.

1.3 Each equipment consists of the following major items:

Type CNA-46144 Radio Receiver
Type CNA-49106 Loud Speaker
One Set Spare Parts
Instruction Books

2. DESCRIPTION OF MAJOR UNITS

2.1 The Type CNA-46144 Radio Receiver

2.11 The Type CNA-46144 Radio Receiver is a ten tube, table mounting, superheterodyne covering a continuous frequency range of from 300 to 1200 kilocycles and 1700 to 16,000 kilocycles in five bands. Weights and overall dimensions are listed in Section 7.

2.12 The circuit of the receiver is shown in Dwg. No. 15.1. It consists of one stage of radio frequency amplification, first detector (or mixer), high frequency oscillator, two stages of intermediate frequency amplification operating at 1560 kilocycles, an "infinite impedance" diode detector, a noise peak limiter and two resistance coupled audio stages. A CW oscillator is provided for beat note reception for CW signals. An amplified and delayed automatic volume control system is provided. Associated with the automatic volume control system is a signal strength meter, calibrated in S-units from 1 to 9 and in db. above S-9 from 0 to 40 db. A crystal filter, having both selectivity and phasing adjustments, is connected between the first detector and first I.F. amplifier tubes. A built-in power supply designed for operation from a 115 volt (± 10%) 50/62 cycle AC power source supplies all voltages required by the receiver.

2.13 Two audio output circuits are provided:

(1) A headphone jack is mounted on the front panel. The correct load impedance for the headphone output circuit is 600 ohms. Maximum audio power output at the headphone jack is approximately 12 milliwatts. The headphone jack is so wired that a loud speaker circuit is opened when the phone plug is inserted.

(2) A pair of loud speaker output terminals (pin jacks) are located at the rear of the chassis. The proper load impedance of the loud speaker output circuit is 5000 ohms. The maximum undistorted audio power available is 2 watts.

2.14 Antenna input terminals are located at the rear of the chassis near the center. The input circuit is suitable for operation with a single wire antenna or with a low impedance transmission line.

2.15 The frequency range of the Type CNA-46144 Radio Receiver is from 300 to 1200 kilocycles and 1700 to 16,000 kilocycles. This range is covered in five working bands as follows:

300	to	600 Kilocycles
600	to	1,200 Kilocycles
1,700	to	3,900 Kilocycles
3,900	to	8,000 Kilocycles
8,000	to	16,000 Kilocycles

All radio frequency transformers and their associated trimmer capacitors are mounted in a cast aluminum catacomb having fifteen shielding compartments. Each R.F. transformer and its associated trimmer capacitor is mounted on a low-loss bakelite base fitted with contact pins which protrude from the coil catacomb. Manipulation of the band change knob slides the coil catacomb across the width of the chassis causing the contact pins of each set of R.F. transformers to engage, in turn, with contact springs mounted on the receiver chassis.

2.16 The Type CNA-46144 Radio Receiver has a dial with five scales calibrated in accordance with the frequency response of the five bands. The particular band in use is indicated by the tip of the pointer which moves radially as the band selector knob is

turned. In addition to the frequency calibrated scales, an auxiliary numerical dial is employed. This dial has 100 divisions and makes 10 revolutions while the tuning capacitor rotates 180 degrees; it is direct reading to one part in one thousand.

2.17 The power supply circuits provide 6.3 volts at 3.15 amperes for the heater circuit of the receiver and 240 volts at 70 milliamperes for the receiver B supply. A two-section filter is employed.

2.2 THE TYPE CNA-49106 LOUD SPEAKER

2.21 The Type CNA-49106 Loud Speaker is of the cabinet mounted type. The circuit is shown in Dwg. No. 15.1; weights and overall dimensions are listed in Sec. 7.

2.22 The loud speaker chassis has a nominal diameter of eight inches.

2.23 A coupling transformer having an input impedance of 5000 ohms is provided to match the voice coil and receiver output impedances.

3. TUBE COMPLEMENT

3.1 The tubes employed in the Type CNA-46144 Radio Receiver are as follows:

Symbol (Dwg.)	*Navy or Commercial Type*	*Function*
V-101	-6K7	R.F. Amplifier
V-102	-6J7	First Detector
V-103	-6J5	H.F. Oscillator
V-104	-6K7	First I.F. Amplifier
V-105	-6K7	Second I.F. Amplifier
V-106A	-6F8G	First Audio Amplifier
V-106B		Automatic Volume Control
V-107A	-6C8G	Second Detector
V-107B		Limiter
V-108	-6J7	C.W. Oscillator
V-109	-6V6GT/G	Second Audio Amplifier
V-110	-5Z3	Rectifier

4. POWER REQUIREMENTS

4.1 The Model RBH Radio Receiving Equipment is built for operation from a 115 volt (± 10%) 50/62 cycle AC power source. Normal power consumption is approximately 70 watts.

5. ANTENNA REQUIREMENTS

5.1 The antenna input circuit of the Type CNA-46144 Radio Receiver is suitable for use with a single wire antenna, a balanced feed-line or a low impedance concentric transmission line. The impedance of the antenna or transmission line at the receiver input terminals should not be less than 70 ohms.

5.2 The antenna input terminals E-101 are located at the rear of the chassis near the center. Two insulated binding posts are provided together with a short length of flexible lead permanently attached to the receiver chassis. By means of this lead, either input terminal may be grounded to the chassis if required.

5.3 In an installation having a simple antenna-ground combination, connect the single wire lead-in to either of the two input terminals, and ground the other terminal to the chassis by means of the flexible lead, referred to in Par. 5.2. It is recommended that the Model RBH Equipment be permanently grounded; the ground lead may be attached directly to the input terminal which is connected to the chassis or the terminal E-104. The dimensions of the single wire antenna system are not at all critical: The recommended minimum overall length of antenna and lead-in is fifty feet; the recommended maximum overall length is two hundred feet.

5.4 In an installation having a balanced feed-line, connect the two leads directly to the two input terminals. The chassis grounding lead, referred to in Par. 5.2, is not used.

5.5 In an installation having a concentric feed-line, connect the inner conductor to one of the input terminals and the outer conductor to the other input terminal. Connect the latter to the chassis by means of the flexible lead.

6. INSTALLATION

6.1 Each major unit and the spare parts of the Model RBH Radio Receiving Equipment is packed in a separate container.

6.2 After unpacking, make interconnections between the Type CNA-46144 Radio Receiver and the Type CNA-49106 Loud Speaker in accordance with Dwg. No. 15.3. Connect the shielded leads W-201 of the loud speaker to the speaker terminals E-102 of the receiver; screw the shield grounding lug to the chassis terminal E-104.

6.3 Connect the power supply plug P-101 to a 115 volt 50/62 cycle AC power source. See Par. 9.13.

6.4 Make antenna connections in accordance with Section 5 "Antenna Requirements".

6.5 Before putting the receiver in operation, remove machine screw at the left-hand end of the chassis to release the band changing mechanism. This screw clamps the coil catacomb to the end of the chassis during shipment and should be saved if the equipment is to be repacked and reshipped.

6.6 If the installation is such that the Type CNA-49106 Loud Speaker will be placed close to the receiver, the most desirable position is at the left-hand side. Placing the Loud Speaker on top of the receiver cabinet is the least desirable position since vibration from the speaker may introduce microphonic noises which would not otherwise be noticeable. Microphonic noise or "mechanical feed-back" can often be eliminated by reversing the speaker leads at the speaker output terminals of the receiver.

6.7 A pair of terminals E-103 at the rear of the receiver chassis is wired to the B+ switch S-101B. These terminals provide a convenient means of connecting a relay or switch for remote control.

7. NET WEIGHTS AND OVERALL DIMENSIONS

7.1 Net Weights

Type CNA-46144 Radio Rec'v'r	55 lbs.
Type CNA-49106 Loud Speaker	11 lbs.
Spare Parts, packed	19 lbs.
Total Weight of Equipment	85 lbs.

7.2 Overall dimensions of the Type CNA-46144 Radio Receiver.

Depth, including panel controls	13 inches
Height	11 inches
Width	17½ inches

7.3 Overall dimensions of the Type CNA-49106 Loud Speaker.

Depth	7⅜ inches
Height	9½ inches
Width	10¼ inches

8. OPERATING INSTRUCTIONS

8.1 CONTROLS

8.101 All switches and controls (with the exception of the main tuning dial and the band selector knob) of the Type CNA-46144 Radio Receiver are identified by etched panel plates or dial scales. The symbol numbers in the following paragraphs of this Section refer to Dwg. No. 15.1 and to all Parts Lists.

8.102 The main tuning dial is located at the center of the front panel of the receiver. The dial scale and pointer arrangement are described in Par. 2.16. The dial drive is so arranged that the frequency to which the receiver tunes increases with clockwise rotation of the tuning knob. The accuracy of calibration can be relied upon to plus or minus 3%.

8.103 The band selector knob is located near the bottom of the front panel at the center. The knob must be rotated approximately one turn to change from one band to an adjacent band. In addition to the radial movement of the dial pointer (see Par. 2.16) a positive detent is provided to insure proper positioning of the coil contact pins in the contact springs.

8.104 The LIMITER control R-144, at the left-hand side of the receiver panel, is used to adjust the DC potential applied to the elements of the limiter tube V-107B. The limiter circuit is thus provided with an adjustable threshold at which limiting action starts. Any audio voltages, or noise peaks, in excess of this threshold are prevented from reaching the audio amplifier. With the LIMITER control set at 0, the limiter circuits will pass all but the strongest audio peak voltages; when the control is set at 10, the threshold is lowered to a point where the audio signal will be distorted due to suppression of the positive peaks of the audio signal.

8.105 The TONE control R-115, at the lower left-hand corner of the front panel, is used to vary the frequency characteristic of the audio amplifier. When the control is set at the position marked "N", the full audio frequency range of the receiver is available; in the HIGH position, audio frequencies below 100 cycles are attenuated; as the control is turned clockwise towards the LOW position, audio frequencies above 1000 cycles are increasingly attenuated.

8.106 At the left of the dial scale is located the POWER SUPPLY switch S-101A—S-101B. In the counterclockwise position, OFF, the receiver is turned off, the primary circuit being opened by switch S-101A; in the mid-position, B+ OFF, switch S-101A is turned on but the B supply circuits are incomplete since switch S-101B is open; in the clockwise position, B+ ON, switch S-101B is closed, completing the B supply circuit. The B+ OFF position may thus be used for rendering the receiver inoperative, as may be required during periods of transmission, unless the B supply circuits are completed through terminals E-103.

8.107 A three-position CONTROL SWITCH S-102A—S-102B is located at the left of the dial below the POWER SUPPLY switch. In the AVC position, the automatic volume control circuits are in operation; in the MVC position, automatic volume control is turned off; in the CWO position, the CW oscillator is turned on and automatic volume control turned off.

8.108 At the right-hand side of the front panel is located the C.W. OSC. control C-129, used for varying the frequency of the CW oscillator over a range of approximately 10 kilocycles. The CW oscillator is tuned to the intermediate frequency at 0 on the C.W. OSC. scale.

8.109 The A.F. GAIN control R-116 is located at the lower right-hand corner of the front panel. It is used to control the audio amplification of the receiver. Audio amplification increases as the control is turned clockwise towards 10 on the scale.

8.110 The R.F. GAIN control R-121 is located at the lower right center of the front panel. It controls the amplification of R.F. amplifier tube V-101 and the two I.F. amplifier tubes V-104 and V-105. Amplification increases as the control is turned clockwise towards 10 on the scale.

8.111 At the right of the main tuning dial scale are located the crystal filter SELECTIVITY and PHASING controls C-147 and C-148 respectively. When the PHASING control is set at OFF, the crystal filter is disconnected. Turning the PHASING control from the OFF to the 0 position switches in the filter by means of switch S-105. The PHASING control is used pri-

marily for balancing the crystal bridge circuit and eliminating heterodynes, as explained under Par. 8.27.

8.112 The SELECTIVITY control is used primarily for adjusting the selectivity of the crystal filter after the filter has been switched into the circuit by means of the PHASING control. See Pars. 8.26 and 8.35. With the crystal filter disconnected, the SELECTIVITY control functions as a simple I.F. transformer tuning adjustment and should be set to provide maximum I.F. amplification, as explained in Par. 8.21.

8.113 At the upper left-hand side of the front panel is located the S-METER switch S-103. This switch must be pushed in when S-meter readings are to be made, as explained in Par. 8.41. At all other times, the S-meter should be disconnected by pulling the switch button out.

8.2 MCW OR PHONE RECEPTION

8.21 After the Model RBH Equipment is properly installed, in accordance with Section 6, it is put into operation by turning the POWER SUPPLY switch to the B+ ON position. The LIMITER control should be set at 0; the TONE control set at "N"; the R.F. GAIN control should be advanced to some position between 8 and 10, depending upon receiving conditions; the A.F. GAIN control should be set at the point providing the desired audio volume; the PHASING control should be set at the OFF position; the SELECTIVITY control should be adjusted to the setting which provides maximum back-ground noise; the CONTROL SWITCH may be set either at the AVC or MVC positions. The receiver is now adjusted for stand-by or monitor service. Operated in this manner, the receiver will respond to signals over a band width of about 15 kilocycles. For general communications use see Par. 8.26.

8.22 With the CONTROL SWITCH in the MVC position, the operator must be careful not to advance the R.F. GAIN control to a point where I.F. or audio amplifier overload occurs. Such overload is indicated by excessive distortion. In general, it is recommended that the A.F. GAIN control be set about halfway on, *i.e.*, at 5 and audio output adjusted by means of the R.F. GAIN control.

8.23 With the CONTROL SWITCH in the AVC position, the R.F. GAIN control should be advanced as far as receiving conditions permit, or until background noise becomes objectionably loud. Audio output should be adjusted entirely by means of the A.F. GAIN control. The operator must remember that automatic volume control action will be restricted unless the R.F. GAIN control is fully advanced.

8.24 If a signal is weak and partially obscured by background noise and static, best signal-to-noise ratio will be obtained by turning the TONE control towards the LOW position. The most effective setting must be determined by trial as too much attenuation of high audio frequencies will impair the intelligibility of the signal.

8.25 When a signal is accompanied by static peaks or noise pulses of high intensity and short duration, the best signal-to-noise ratio will be obtained by advancing the LIMITER control towards 10. The best setting must be determined by trial as too much limiter action will impair audio quality. If static peaks and noise pulses are extremely strong or if they are of fairly long duration, the effectiveness of the limiter will be best with the CONTROL SWITCH in the MVC position. In such cases both R.F. GAIN and LIMITER controls must be carefully adjusted for optimum signal-to-noise ratio.

8.26 In general communications reception, it is recommended that the selectivity of the receiver be increased by use of the crystal filter. The filter is switched into the circuit by setting the PHASING control at any position other than 0. The normal setting of the PHASING control in MCW reception is at 5 on the scale. The normal setting of the SELECTIVITY control in MCW reception is at the position affording minimum selectivity. This position is near the middle of the selectivity scale and is that at which background noise is maximum. Selectivity may be further increased by turning the SELECTIVITY control in either direction from the minimum selectivity position.

8.27 The PHASING control is used to eliminate or attenuate heterodynes. If, after a signal has been tuned in, an interfering signal causes a heterodyne or whistle, the PHASING control should be adjusted until the heterodyne is reduced to a minimum. The setting of the PHASING control which provides maximum attenuation of the heterodyne will depend upon the pitch of the heterodyne whistle. If the heterodyne beat note is above 1000 cycles, the optimum PHASING control setting will be near midscale; if the beat note is 300 or 400 cycles, the optimum PHASING control setting will be near one end of the scale or the other, de-

pending upon whether the interfering signal has a higher or lower frequency than the desired signal.

8.28 It is recommended that the TONE control be set in the HIGH position when using the crystal filter in MCW reception. The resulting attenuation of low audio frequencies tends to compensate for the sideband cutting action of the crystal filter and is helpful in eliminating low frequency flutter or "motor-boating" which may be present when the receiver is not accurately tuned to the signal.

8.3 CW RECEPTION

8.31 The initial adjustment of the Type CNA-46144 Radio Receiver for CW reception is as described in Par. 8.21, except that the CONTROL SWITCH must be in the CWO position. The C.W. OSC. control should be set at mid-scale.

8.32 The sensitivity of the receiver should be adjusted by means of the R.F. GAIN control, care being taken not to advance the control to the point where strong signals will cause I.F. or audio amplifier overload. Such overload is indicated by excessive distortion and by a change in pitch over the duration of a code character (dot or dash).

8.33 The action of the TONE and LIMITER controls will be similar to that described under Pars. 8.24 and 8.25. When receiving CW signals, it will be possible to advance both TONE and LIMITER controls considerably further than is possible in MCW reception, since audio distortion is relatively unimportant.

8.34 Turning the C.W. OSC. control will change the characteristic pitch of the receiver background noise. The pitch will become higher as the CW oscillator is detuned from the I.F. amplifier. With the C.W. OSC. control set at 2 or 3 (on either side of 0), the characteristic pitch of the receiver background noise will be in the neighborhood of 2000 cycles. Under these conditions, the audio beat note of any CW signal will show a broad peak in output at approximately 2000 cycles. This peak will appear on "one side of the carrier" only but on the other side, where the audio beat note is around 2000 cycles, it will be considerably weaker. This characteristic is helpful in receiving weak signals through interference.

8.35 As stated in Par. 8.26 the selectivity of the receiver may be increased by means of the crystal filter. The action of the SELECTIVITY and PHASING controls will be similar to that described in Pars. 8.26 and 8.27. It may be desirable, however, to utilize the full range of crystal filter selectivity in CW reception. Maximum selectivity is obtained with the SELECTIVITY control set at 0. With this setting the single-signal effect, outlined in Par. 8.34, becomes very pronounced; in other words, the audio beat note is very sharply peaked at a definite audio frequency which is determined by the setting of the C.W. OSC. control. The operator may have difficulty in finding the audio peak when first attempting to use the crystal filter. After a signal has been accurately tuned to give peak response, it is usually necessary to retard the R.F. GAIN control to prevent I.F. or audio overloading.

8.4 MEASUREMENT OF SIGNAL STRENGTH

8.41 To make a measurement of signal strength by means of the S-meter, the R.F. GAIN control must be fully advanced, the CONTROL SWITCH in the AVC position and the S-meter switch S-103 depressed to complete the meter circuit. The crystal filter should be turned off by means of the PHASING control, and the SELECTIVITY control set at maximum gain, as described in Par. 8.21. The adjustment of the TONE, LIMITER and A.F. GAIN controls is unimportant.

8.42 With no R.F. input to the receiver, or with the antenna disconnected, the S-meter should read 0, plus or minus 1 S-unit. If it does not, the S-meter circuit requires adjustment. See Par. 11.5.

8.43 Measurement of the signal strength of CW signals cannot be made with the CW oscillator in operation.

9. CIRCUIT DESCRIPTION

9.01 The actual wiring diagrams of the Type CNA-46144 Radio Receiver and the Type CNA-49106 Loud Speaker are shown in Dwg. No. 15.1. The actual wiring diagram of the coil catacomb assembly is shown in Dwg. No. 15.2.

9.02 For purposes of illustration, in the following description it will be assumed that transformers covering the 300 to 600 kilocycle band are connected in the circuit. Signal input to the receiver through antenna terminals E-101 is coupled to the R.F. amplifier tube V-101 by R.F. amplifier transformer T-116. The secondary of transformer T-116 is tuned by trimmer capacitor C-171 and by the R.F. amplifier section of the main tuning capacitor C-105C. The output of tube V-101 is coupled by transformer T-111 to the first detector tube V-102. The secondary of transformer T-111 is tuned by trimmer capacitor C-166 and the first detector section of the main tuning capacitor C-105B.

9.03 The H.F. oscillator tuned circuit consists of transformer T-106, trimmer capacitor C-161 and the H.F. oscillator section of the main tuning capacitor C-105A with series padding capacitor C-142 in series with the latter. The series padding capacitor is used to modify the tuning of the H.F. oscillator circuit so that it will maintain a fixed frequency difference of 1560 kilocycles with the R.F. amplifier circuits when the main tuning capacitor C-105 is varied from minimum to maximum capacity. H.F. oscillator potential obtained from the cathode of tube V-103 is coupled by means of capacitor C-128 to the screen grid of first detector tube V-102.

9.04 The plate voltage of first detector tube V-102 is normal (approximately 180 volts) but the screen voltage is considerably lower than the value applied in an amplifier application. The voltage reduction is obtained through the combination of resistors R-128 and R-129. Bias on the first detector tube V-102 is obtained from resistor R-103 and is considerably higher than the value applied in an amplifier application. The combination of low screen voltage and high bias causes tube V-102 to operate on a non-linear portion of its grid-voltage-plate-current characteristic with the result that R.F. signal voltage, applied to the control grid, heterodynes with the high frequency oscillator potential applied to the screen grid, producing a third R.F. potential the frequency of which is equal to the difference between signal and H.F. oscillator frequencies. This third potential is the intermediate frequency of the receiver, *i.e.*, 1560 kilocycles.

9.05 I.F. potential from tube V-102 is coupled by the crystal filter CF-101 to the first I.F. amplifier tube V-104. The I.F. signal then progresses through transformer T-103, second I.F. amplifier tube V-105 and I.F. transformer T-102 to the control grid of the second detector tube V-107A. The characteristics of the crystal filter CF-101 and I.F. amplifier transformers T-102 and T-103 determine the minimum overall selectivity of the receiver in the frequency range of 1700 to 16,000 kilocycles as shown in Dwg. No. 10.3. The characteristics of first R.F. and first detector transformers in the 1,700 to 16,000 kilocycle range do not noticeably alter overall selectivity although their presence in the circuit tends to decrease band width slightly. The characteristics of first R.F. and first detector transformers in the 300 to 1200 kilocycle range do produce a noticeable narrowing of the overall selectivity. The crystal filter CF-101 provides a wide range of band width as shown in Dwg. No. 10.3.

9.051 With switch S-105 closed, crystal filter CF-101 functions as an I.F. transformer, with capacitors C-155, C-156, C-148 and C-147 tuning the primary, and capacitor C-150 tuning the secondary. Coupling between the primary and secondary is capacitative, and is effected by capacitor C-149.

9.052 With switch S-105 open, crystal resonator Y-101 is connected in a capacity bridge circuit, three legs of which are capacitors C-155, C-156 and C-148, the fourth leg being the capacity of the electrodes (or plates) of Y-101. Phasing capacitor C-148 is normally adjusted for capacity bridge balance and consequently no signal voltage will appear between capacitor C-149 and ground, unless the signal has exactly the same frequency as crystal resonator Y-101. In this case, crystal resonator Y-101, which constitutes a series resonant circuit, exhibits low impedance to the signal, and the bridge is unbalanced, allowing the signal to pass.

9.053 The selectivity of crystal filter CF-101 is adjustable (with switch S-105 open) by means of selectivity control capacitor C-147. This capacitor, in combination with capacitors C-155 and C-156, tunes the input circuit of the filter. When the input circuit is tuned exactly to the frequency of crystal Y-101, the latter is loaded, or damped, by the high effective resistance of the input circuit, and selectivity is consequently reduced to a minimum. When the input circuit is detuned, its effective resistance decreases and damping is greatly reduced, producing maximum selectivity. Detuning the input circuit does not materially affect the amplification of the receiver at the resonant frequency of crystal resonator Y-101 since the

series impedance of the circuit becomes very low when damping is reduced.

9.054 The phasing capacitor C-148 provides an adjustment for obtaining exact balance of the capacity bridge circuit described in Par. 9.052. Capacitor C-148 may, however, be adjusted so that the bridge is in exact balance for signals differing slightly in frequency from the resonant frequency of crystal resonator Y-101, and such signals will then be completely suppressed. Under this condition, the bridge circuit will be only slightly unbalanced to signals of the resonant frequency of Y-101.

9.055 The output of the bridge circuit described in Par. 9.052 is coupled to a tapped tuned circuit by means of capacitor C-149. This capacitor, in addition to the function described in Par. 9.051, provides for properly terminating the crystal filter network, and will therefore determine, to a considerable extent, the selectivity characteristics of the filter as a whole.

9.06 The elements of the second detector tube V-107A are those of one triode of a dual triode tube Type 6C8G. The circuit of the second detector is the "infinite impedance" diode type wherein audio voltage is developed across cathode load resistor R-113. Capacitor C-109 and resistor R-112 comprise a filter circuit which suppresses the 1560 kilocycle component of the second detector output.

9.07 Associated with the second detector circuits is the CW oscillator tube V-108. The CW oscillator circuit operates at or near the 1560 kilocycle intermediate frequency. It provides an R.F. potential with which an unmodulated I.F. signal (CW) at the second detector can heterodyne to produce an audible CW beat note. The CW oscillator circuit is tuned by transformer T-104; a panel control C-129 provides a vernier frequency adjustment. CW oscillator excitation from the plate of tube V-108 is coupled to the grid of tube V-107A by means of capacitor C-140.

9.08 Automatic volume control action is provided by tube V-106B. The elements of V-106B are those of one triode of a dual triode type -6F8G (Navy Type -38768F). Bias for tube V-106B is furnished by resistors R-137, R-138 and R-139 which are connected between the receiver chassis and B—. The action of the AVC circuit is as follows: I.F. signal potential from transformer T-102 is impressed upon the grid of tube V-106B through a coupling capacitor C-141. The tube V-106B is normally biased beyond cut-off but when the I.F. signal potential is sufficiently strong, plate current will flow through resistor R-136. The voltage drop across this resistor is impressed through filter resistors R-133, R-107, R-105, R-123 and R-101 upon the control grids of I.F. and R.F. amplifier tubes V-105, V-104 and V-101. Inasmuch as the voltage drop across resistor R-136 varies in proportion to the I.F. signal on the grid of tube V-106B, and since the amplification of tubes V-101, V-104 and V-105 decreases with increasing negative bias, the AVC system tends to maintain constant I.F. potential at the output of transformer T-102. See Dwg. No. 10.6.

9.09 A meter M-101 is connected in a bridge circuit associated with the plate supply of tube V-105. Two legs of the bridge are resistors R-134 and R-135. A third leg is the plate cathode circuit of tube V-105, and cathode resistor R-108. The fourth leg is made up of voltage divider resistors R-124 and R-104 together with the various circuits which are supplied from the junction between them. With the R.F. gain control R-121 fully advanced and with resistor R-135 properly set, the bridge is balanced and no current will flow through meter M-101 when switch S-103 is closed. When the receiver is tuned to a signal, AVC voltage developed by tube V-106B is applied to the control grid of tube V-105 causing an increase in its plate-cathode resistance. This increase in resistance unbalances the bridge circuit and produces a current through meter M-101. The meter reading will increase with the amount by which the bridge is unbalanced and since this unbalance varies with the strength of the received signal, the meter scale is calibrated directly in terms of the signal input at the antenna terminals E-101.

9.10 The audio output of the second detector tube V-107A is coupled through capacitor C-108 to the input of noise limiter tube V-107B, the latter being one set of elements of a dual triode type 6C8G. The D.C. potential impressed upon the elements of tube V-107B is adjustable by means of the limiter control R-144. The circuit is so arranged that the limiter will pass only audio voltages which have a peak value less than the adjustable D.C. potential.

9.11 The tone control system is connected at the output of limiter tube V-107B. The variable tone control resistor R-115 is connected in series with capacitor C-107 and provides an adjustable by-pass circuit for high audio frequencies. Maximum high frequency attenuation occurs when resistor

R-115 is adjusted for zero resistance (LOW position), capacitor C-107 then being connected directly across the output of limiter tube V-107B. With the TONE CONTROL in the HIGH position, switch S-104 is open, connecting capacitor C-104 in series with audio coupling capacitor C-138. Capacitor C-104 has a value of .001 mfd., and in combination with resistor R-116 attenuates low audio frequencies.

9.12 The output of limiter tube V-107B is coupled to the A.F. GAIN control R-116 by capacitor C-138; the movable arm of the A.F. GAIN control is connected to the grid of audio amplifier tube V-106A. The audio tube V-106A is coupled to the output audio amplifier tube V-109 by capacitor C-102. The output tube V-109 is coupled to the loud speaker terminals E-102 and to the phone jack J-101 by transformer T-101. The phone jack J-101 is so wired that the speaker circuit is opened when the phone plug is inserted. A resistor network R-119 and R-120 is associated with the phone jack to provide the necessary reduction in power for headphone operation while maintaining the proper plate load for tube V-109.

9.13 A.C. power (115 volt 50/62 cycle) is supplied to the receiver through connector plug P-101 and connector cord W-101. The primary power circuit includes a one ampere fuse F-101, primary switch S-101A, the primary of power transformer T-105 and a primary tap connector block X-101. Either of two primary connections may be selected by connector plug P-102. With plug P-102 in the "H" position in block X-101, the whole primary of transformer T-105 is available for operation from a power source of 115 to 126.5 volts, 50/62 cycles; with plug P-102 in the "L" position, a primary tap is connected for operation from a power source of 103.5 to 115 volts 50/62 cycles. The secondary power supply circuit provides full wave rectification by means of rectifier tube V-110. A two-section filter is used to attenuate the alternating current components delivered by the rectifier tube.

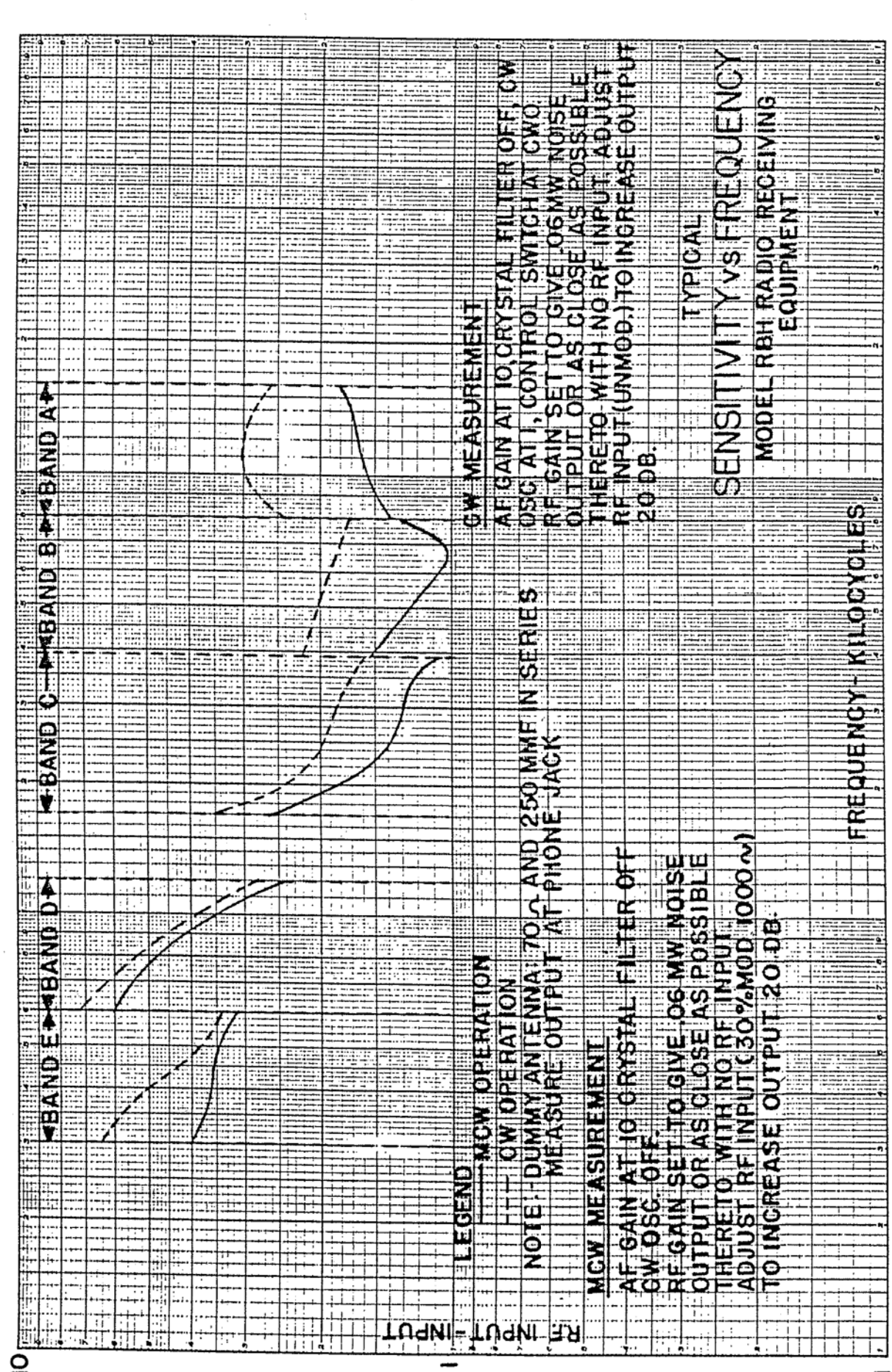
9.14 Connection between the loud speaker terminals E-102 and the Type CNA-49106 Loud Speaker is made by shielded cable W-201. The cable shield provides a bond between the loud speaker chassis and the chassis of the radio receiver thus maintaining them both at the same (ground) potential. Coupling transformer T-201 matches the voice coil impedance of loud speaker LS-201 to the output impedance of transformer T-101. In other words, the input impedance of transformer T-201 is 5000 ohms.

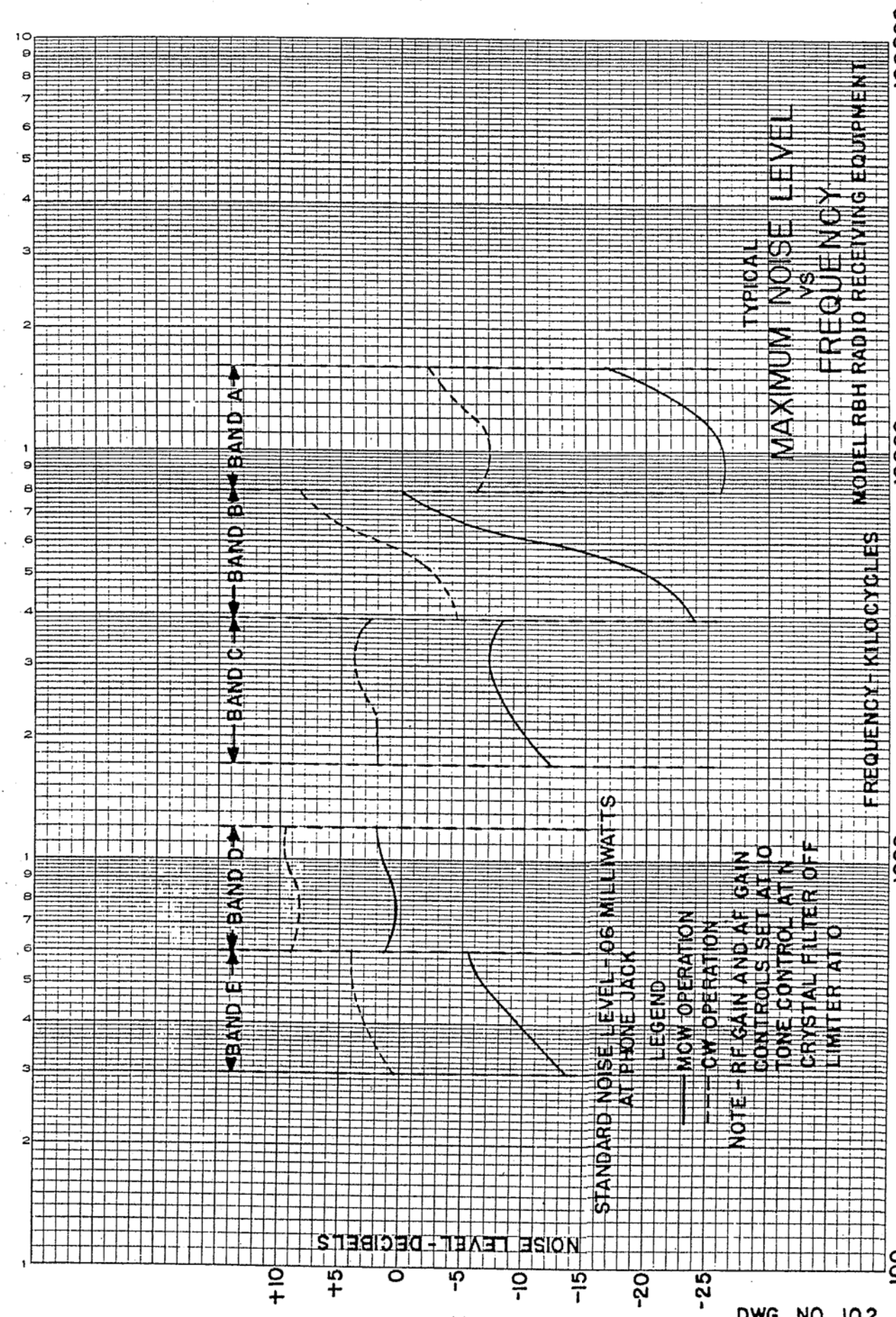
9.15 The construction of the coil catacomb is illustrated in Photo. No. 16.5. The wiring of the individual transformers T-106 to T-120 inclusive is shown in Dwg. No. 15.2. Trimmer capacitors C-161 to C-175 inclusive are used to adjust the minimum capacity of the tuned circuits to which they are connected and thus serve to compensate for unavoidable variations in wiring and tube capacities.

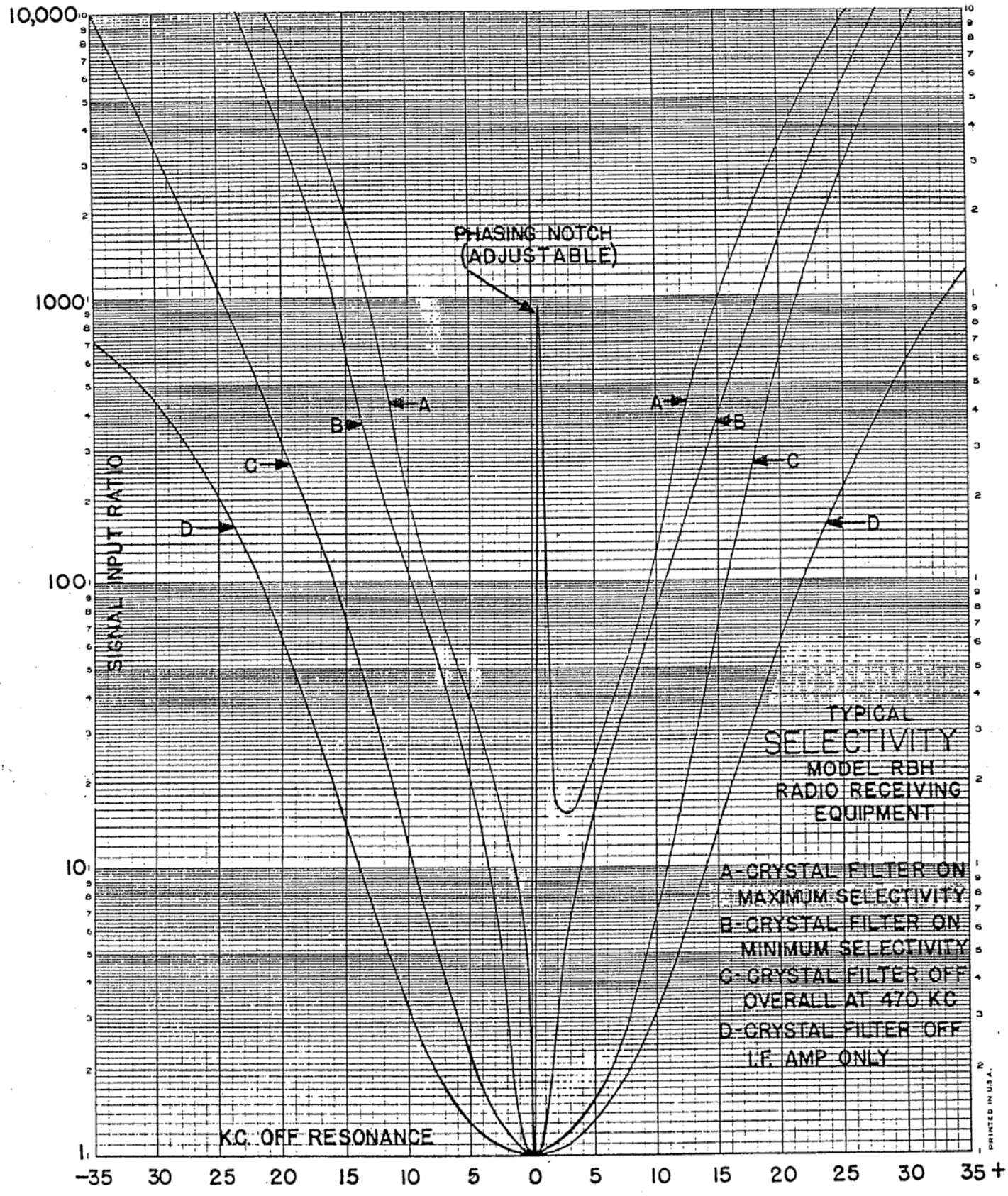
10. PERFORMANCE DATA

The SENSITIVITY vs. FREQUENCY curves of Dwg. No. 10.1 indicate the overall sensitivity of the Model RBH Radio Receiving Equipment. These curves, together with the MAXIMUM NOISE LEVEL curves of Dwg. No. 10.2, provide data for definitely checking the Type CNA-46144 Radio Receiver to determine if repairs or realignment are necessary, since the majority of circuit element failures, or any misalignment, will reduce both sensitivity and maximum noise level of the Equipment. The data referred to above will, therefore, also serve to show the efficacy of repairs or realignment.

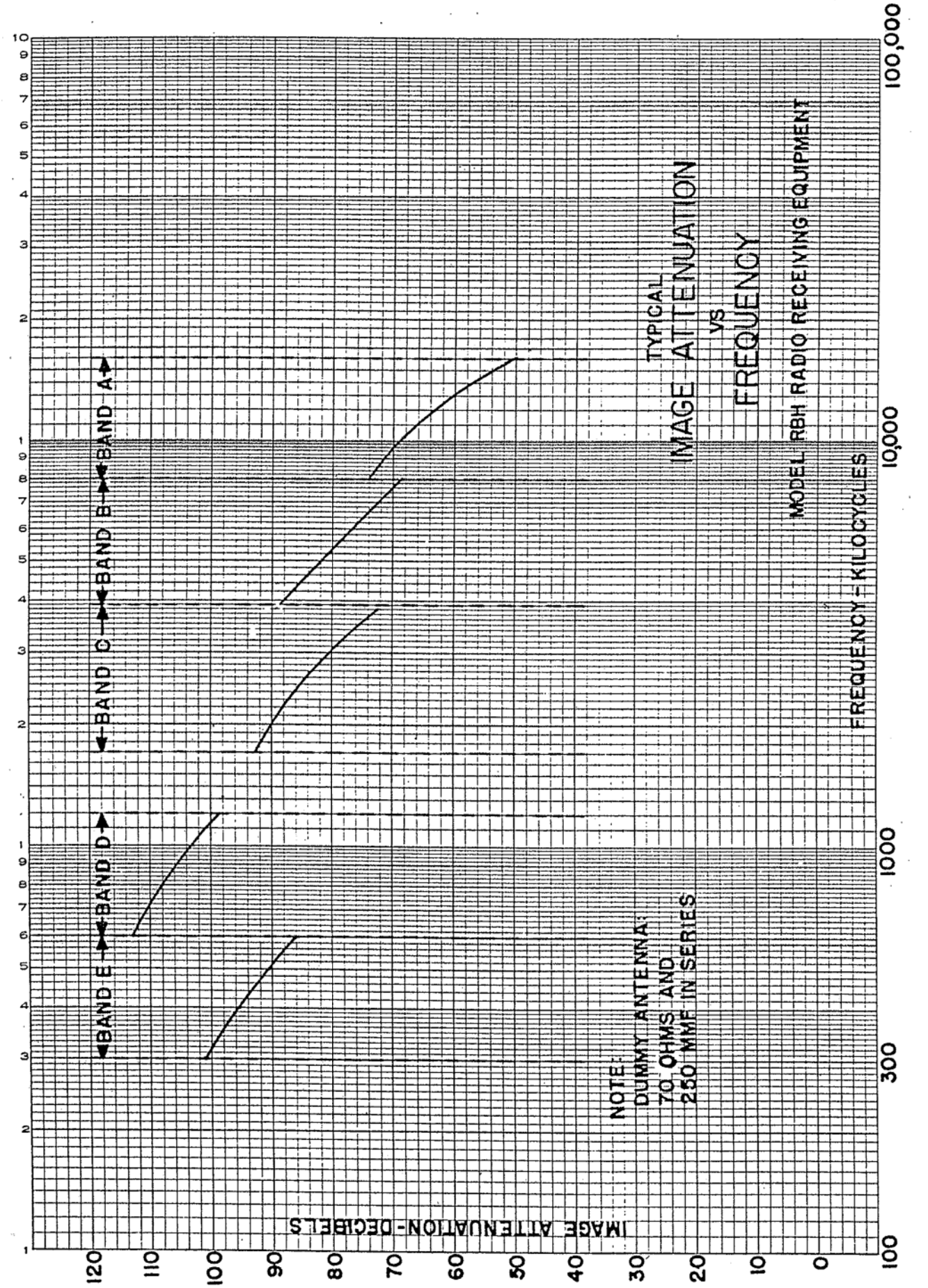
The SELECTIVITY, IMAGE ATTENUATION, FIDELITY and AVC characteristics of Dwg. Nos. 10.3 to 10.6 inclusive are necessary where a particular performance check is desired, but are of secondary importance in most cases, since an Equipment having normal SENSITIVITY and MAXIMUM NOISE characteristics will, in all probability, be normal in all other respects.


SENSITIVITY Vs FREQUENCY
TYPICAL
MODEL RBH RADIO RECEIVING EQUIPMENT
FREQUENCY - KILOCYCLES
100,000
10,000
1000
100
10
1
.1
RF INPUT - INPUT
BAND E
BAND D
BAND C
BAND B
BAND A
LEGEND — MCW OPERATION
--- CW OPERATION
NOTE: DUMMY ANTENNA 70Ω AND 250 MMF IN SERIES
MEASURE OUTPUT AT PHONE JACK
MCW MEASUREMENT
AF GAIN AT 10, CRYSTAL FILTER OFF
CW OSC. OFF.
RF GAIN SET TO GIVE .06 MW NOISE
OUTPUT OR AS CLOSE AS POSSIBLE
THERETO WITH NO RF INPUT.
ADJUST RF INPUT (30% MOD 1000~)
TO INCREASE OUTPUT 20 DB.
CW MEASUREMENT
AF GAIN AT 10, CRYSTAL FILTER OFF, CW
OSC AT 1, CONTROL SWITCH AT CWO.
RF GAIN SET TO GIVE .06 MW NOISE
OUTPUT OR AS CLOSE AS POSSIBLE
THERETO WITH NO RF INPUT. ADJUST
RF INPUT (UNMOD.) TO INCREASE OUTPUT
20 DB.

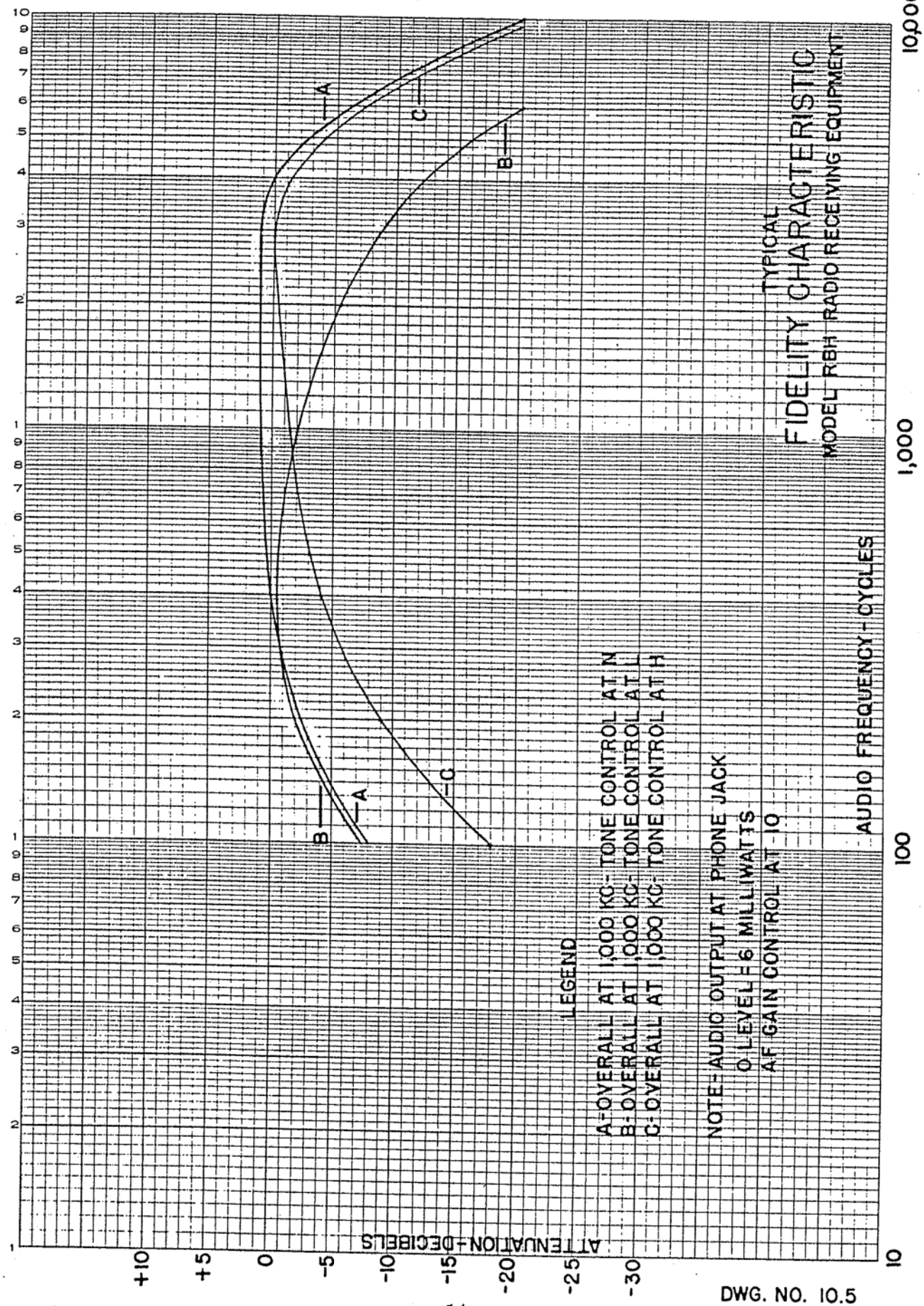

TYPICAL
MAXIMUM NOISE LEVEL
VS
FREQUENCY
MODEL RBH RADIO RECEIVING EQUIPMENT
FREQUENCY - KILOCYCLES
100,000
10,000
1000
100
BAND A
BAND B
BAND C
BAND D
BAND E
STANDARD NOISE LEVEL-06 MILLIWATTS
AT PHONE JACK
LEGEND
MCW OPERATION
CW OPERATION
NOTE - RF GAIN AND AF GAIN
CONTROLS SET AT 10
TONE CONTROL AT N
CRYSTAL FILTER OFF
LIMITER AT 0
NOISE LEVEL - DECIBELS
+10
+5
0
-5
-10
-15
-20
-25
DWG. NO. 10.2

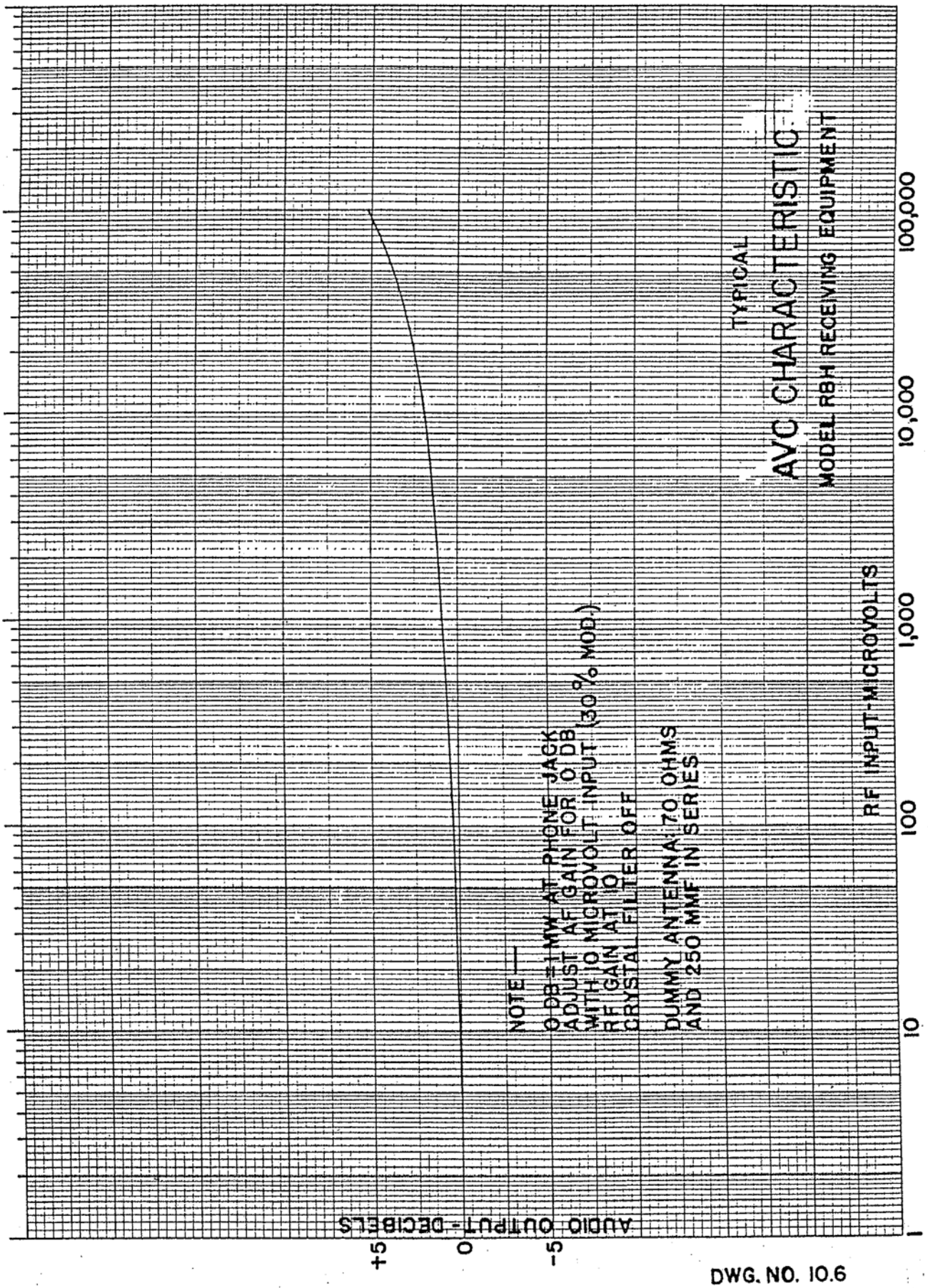

10,000
1000
100
10
1
SIGNAL INPUT RATIO
PHASING NOTCH
(ADJUSTABLE)
A
B
C
D
A
B
C
D
TYPICAL
SELECTIVITY
MODEL RBH
RADIO RECEIVING
EQUIPMENT
A-CRYSTAL FILTER ON
MAXIMUM SELECTIVITY
B-CRYSTAL FILTER ON
MINIMUM SELECTIVITY
C-CRYSTAL FILTER OFF
OVERALL AT 470 KC
D-CRYSTAL FILTER OFF
I.F. AMP ONLY
PRINTED IN U.S.A.
KC. OFF RESONANCE
-35 30 25 20 15 10 5 0 5 10 15 20 25 30 35+

DWG. NO. 10.3


TYPICAL
IMAGE ATTENUATION
VS
FREQUENCY
MODEL RBH RADIO RECEIVING EQUIPMENT
NOTE:
DUMMY ANTENNA:
70 OHMS AND
250 MMF IN SERIES
BAND A
BAND B
BAND C
BAND D
BAND E
IMAGE ATTENUATION-DECIBELS
FREQUENCY-KILOCYCLES
120
110
100
90
80
70
60
50
40
30
20
10
0
100,000
10,000
1000
300
100

DWG. NO. 10.4


TYPICAL
FIDELITY CHARACTERISTIC
MODEL RBH RADIO RECEIVING EQUIPMENT
AUDIO FREQUENCY-CYCLES
10,000
1,000
100
10
ATTENUATION-DECIBELS
+10
+5
0
-5
-10
-15
-20
-25
-30
A
B
C
LEGEND
A-OVERALL AT 1,000 KC- TONE CONTROL AT N
B-OVERALL AT 1,000 KC- TONE CONTROL AT L
C-OVERALL AT 1,000 KC- TONE CONTROL AT H
NOTE-AUDIO OUTPUT AT PHONE JACK
0 LEVEL 6 MILLIWATTS
AF GAIN CONTROL AT 10
DWG. NO. 10.5


AVC CHARACTERISTIC
TYPICAL
MODEL RBH RECEIVING EQUIPMENT
RF INPUT-MICROVOLTS
1
10
100
1,000
10,000
100,000
AUDIO OUTPUT-DECIBELS
+5
0
-5
NOTE — 6 DB = 1 MW AT PHONE JACK
ADJUST AF GAIN FOR 0 DB
WITH 10 MICROVOLT INPUT (30% MOD.)
RF GAIN AT 0
CRYSTAL FILTER OFF
DUMMY ANTENNA: 70 OHMS
AND 250 MMF IN SERIES
DWG. NO. 10.6

11. MAINTENANCE — FAILURES AND REMEDIES

11.1 GENERAL

11.11 Adequate test equipment for maintenance of the Model RBH radio receiving equipment should include the following items:

(1) A Model LP Radio Frequency Standard Signal Generator Equipment, or equivalent.

(2) An audio output meter, General Radio Company Type 583A, or equivalent.

(3) A resistance bridge or ohmmeter capable of measuring resistance from a fraction of an ohm to about 10 megohms.

(4) An analyzer of the type designed for testing vacuum tubes and measuring the D.C. potentials and currents in the circuits with which the tube under test is associated.

The performance and test data of Sections 10 and 12 were determined with equipment as listed above.

11.12 In making any tests or adjustments, it is essential that the operator consider the influence that any one circuit element may have upon other associated circuits. The test data of Section 12 will be particularly helpful in determining the extent of such influence and the necessity for making further replacements after a fault in one particular circuit element has been located and repaired.

11.2 TUBE REPLACEMENTS

11.21 ALL TUBES SUPPLIED WITH THE EQUIPMENT OR AS SPARES ON THE EQUIPMENT CONTRACT SHALL BE USED IN THE EQUIPMENT PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

11.22 All tubes in the Type CNA-46144 Radio Receiver are listed with Navy Type numbers in Section 3. Navy Type and Commercial Type numbers are identical except for prefixes.

11.23 Failure of a vacuum tube in the receiver may reduce the sensitivity of the equipment to radio signals, produce intermittent operation, or cause the equipment to be completely inoperative. In such cases, all tubes should be checked either in an analyzer or similar tube testing equipment, or by replacement with tubes of proven quality. When any tube is tested, it should be tapped or jarred to make sure that it has no internal loose connection or intermittent short-circuit.

11.24 When tube replacements become necessary, substitution of new tubes may alter the alignment of the R.F. or I.F. circuits inasmuch as the replacement tubes may not be identical with those originally employed. The necessity for realignment as well as alignment procedure is discussed in Section 13.

11.25 A replacement high frequency oscillator tube V-103 should be checked in the receiver as follows: apply a 15 to 16 megacycle unmodulated test signal of at least 10 microvolts at the antenna input terminals E-101. Tune in the signal with the receiver adjusted for MCW reception (see Par. 8.21) with the CONTROL SWITCH in the AVC position. Tap the replacement tube V-103 with a piece of insulating material or jar the receiver as a whole: this should not produce persistent microphonic noise in the loud speaker. Turn the CONTROL SWITCH to the CWO position and adjust the receiver to give an audio beat note. A poor replacement tube V-103 may cause "modulation hum" or 60 cycle modulation of the beat note. The tube should be tapped to make sure that its characteristics will not change if the receiver is subjected to vibration.

11.3 FAILURE OF THE RADIO RECEIVER

11.31 In case of breakdown or failure of the Type CNA-46144 Radio Receiver, the fault must first be localized in one portion of the circuit. This can be accomplished by observation of some peculiar action of one of the controls or by checking the receiver against the test data tabulated in Section 12. Reference to the circuit diagram Dwgs. Nos. 15.1 and 15.2 and Photos. Nos. 16.1 to 16.8 inclusive will show the location of any component part of the receiver. Functions and ratings of component parts are given in the Parts List, Section 14.

11.32 It must be remembered that the test data of Section 12 will not positively locate certain faults. For instance, an open-circuited by-pass capacitor will not appear in point to point resistance tests and may introduce regeneration or oscillation in certain circuits which affect the stage gain of other circuits. Similarly, a short-circuit occurring in a low resistance inductor will not appear in point to point resistance tests and if the short appears in an R.F. coil, a false indication for the necessity for realignment may result.

11.33 By-pass or filter capacitors which develop poor connections internally or which become open-circuited will cause decreased sensitivity and/or poor stability. The defective unit can be located by temporarily connecting a good capacitor in par-

14.3 TABLE I (*Continued*)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RBH RADIO RECEIVING EQUIPMENT (See Par. 14.2)

SECTION 1

TYPE CNA-46144 RADIO RECEIVER UNIT (101-199)

Symbol Desig.	#	FUNCTION	DESCRIPTION	Navy Type Desig. for Replacement	Navy Dwg.-Spec. Number	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	National Co. Dwg. and Part No.
			TRANSFORMERS (*Continued*)						
T-119		R.F. Amplifier Coil Assembly	3.9 to 8.0 mc. Band	.....	.....	8	RBH-B1		
T-120		R.F. Amplifier Coil Assembly	8.0 to 16.0 mc. Band	.....	.....	8	RBH-A1		
			VACUUM TUBES						
*V-101		R.F. Amplifier	R.F. Pentode	CRC-6K7	.....	9	6K7		
*V-102		First Detector	R.F. Pentode	CRC-6J7	.....	9	6J7		
*V-103		H.F. Oscillator	R.F. Triode	CRC-6J5	.....	9	6J5		
*V-104		First I.F. Amplifier	Same as V-101	CRC-6K7	.....				
*V-105		Second I.F. Amplifier	Same as V-101	CRC-6K7	.....				
*V-106			Dual Triode	CRC-6F8G	.....	9	6F8G		
	A	First Audio Amplifier	Part of V-106						
	B	Automatic Volume Control	Part of V-106						
*V-107			Dual Triode	CRC-6C8G	.....	9	6C8G		
	A	Second Detector	Part of V-107						
	B	Noise Limiter	Part of V-107						
*V-108		C.W. Oscillator	Same as V-102	CRC-6J7	.....				
*V-109		Second Audio Amplifier	Beam Audio Output	CRC-6V6GT/G	.....	9	6V6GT/G		
*V-110		Rectifier	Full Wave Rectifier	CRC-5Z3	.....	9	5Z3		
			INTERCONNECTING CABLES						
W-101		AC Power Supply	2 Wire Rubber Covered	.....	.....	15	POSJ	8'-18/2	
			SOCKETS						
X-102		Fuse Holder	Extractor Post	.....	.....	6	1075		
X-103		Socket for V-101	8 Prong Ceramic	CNA-38358	.....	8	CIR-8		C-268
X-104		Socket for V-102	Same as X-103	CNA-38358	.....				
X-105		Socket for V-103	Same as X-103	CNA-38358	.....				
X-106		Socket for V-104	Same as X-103	CNA-38358	.....				

* SPARE PARTS FURNISHED refer to TABLE III for quantities.

\# Symbol part designation, if any.

14.3 TABLE I (*Continued*)

PARTS LIST BY SYMBOL DESIGNATIONS FOR MODEL RBH RADIO RECEIVING EQUIPMENT (See Par. 14.2)

SECTION 1

TYPE CNA-46144 RADIO RECEIVER UNIT (101-199)

Symbol Desig.	#	FUNCTION	DESCRIPTION	Navy Type Desig. for Replacement	Navy Dwg.-Spec. Number	MFR.	MFR. Desig.	Special Tolerance Rating or Modification	National Co. Dwg. and Part No.
			SOCKETS (*Continued*)						
X-107		Socket for V-105	Same as X-103	CNA-38358	.....				
X-108		Socket for V-107	Same as X-103	CNA-38358	.....				
X-109		Socket for V-106	Same as X-103	CNA-38358	.....				
X-110		Socket for V-108	Same as X-103	CNA-38358	.....				
X-111		Socket for V-109	Same as X-103	CNA-38358	.....				
X-112		Socket for V-110	4 Prong Ceramic	.....	.....	8	CIR-4		C-266
X-113		"S" Meter Lamp Mtg.	Miniature Screw	.....	.....	8	HDL-28		
X-114		Main Dial Lamp Mtg.	Dual Socket Mtg. Assembly	.....	.....	8	MDL-100		
			CRYSTALS						
Y-101		Crystal Resonator, Part of CF-101	1560 KC. ± 8 KC.	.....	.....	8	CFR-RBH		
			FILTERS						
CF-101		Crystal Filter Unit	1560 KC.	.....	.....	8	CF-RBH		

SECTION 2

TYPE CNA-49106 LOUD SPEAKER UNIT (201-299)

			TRANSFORMERS						
*T-201		Matching Transformer	5000/2.8 Ohm Matching	CNA-30501	.....	8	5537C		C-295
			INTERCONNECTING CABLES						
W-201		Speaker Cable	2 Wire Shielded	.....	.....	8	PM8-SC		
			LOUD SPEAKERS						
LS-201		Loud Speaker Chassis	8" P. M. Field	.....	.....	12	PM-K-8		LS-301

* SPARE PARTS FURNISHED refer to TABLE III for quantities.
\# Symbol part designation, if any.

14.4 TABLE II

PARTS LIST BY NAVY TYPE NUMBERS (See Par. 14.2)

FOR MODEL RBH RADIO RECEIVING EQUIPMENT
LOUD SPEAKER UNIT (201-299)

Quantity	Navy Type Number	All Symbol Designations Involved	Description
		TRANSFORMERS AND INDUCTORS (CLASS 30)	
1	—30501	T-201	
		MISCELLANEOUS	
1	None	W-201	2 Wire Shielded Cable
1	None	LS-201	8" P. M. Speaker Chassis

14.5 TABLE III

SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS (See Par. 14.2)
FOR MODEL RBH RADIO RECEIVING EQUIPMENT

Navy Type	Name	Symbol Group
CNA-46144	Radio Receiver	101-199
CNA-49106	Loud Speaker	201-299

Quantity	Navy Type Desig. For Replacement	All Symbol Designations Involved	Description	NationalCo. Dwg. and Part No.
		TRANSFORMERS AND INDUCTORS (CLASS 30)		
1	CNA-30501	T-201	5000/2.8 Ohm Audio Trans. *5537C	C-295
1		T-101	5000/5000 Ohm Audio Trans. *6001C	
1		T-105	100 Watt Power Trans., 115 Volt, ±10%, 50/62 Cycles *11028	
1		L-101, 102	17 Henry, ±20%, .08 Amp. 300 Ohm ±10% *80	
		VACUUM TUBES (CLASS 38)		
2	CRC-6J7	V-102, 108	R.F. Pentode *6J7	
3	CRC-6K7	V-101, 104, 105	R.F. Pentode *6K7	
1	CRC-5Z3	V-110	Full Wave Rectifier *5Z3	
1	CRC-6F8G	V-106	Dual Triode *6F8G	
1	CRC-6C8G	V-107	Dual Triode *6C8G	
1	CRC-6J5	V-103	R.F. Triode *6J5	
1	CRC-6V6GT/G	V-109	Beam Audio Output *6V6GT/G	
		CAPACITORS (CLASS 48)		
1		C-140, 178	Bakelite: 1 mmf., 400 V DC W *B21	C-765
1		C-177	Bakelite: 2 mmf., 400 V DC W *B-22	C-765
1		C-127	Ceramic: 10 mmf. ±10% −.0007 Temp. Coeff., 500 V DC W *813N	
1		C-149	Mica: .00001 mfd. ±10% 500 V DC W *1468	
1		C-162A	Ceramic: 50 mmf. ±10% 500 V DC W *813Z	
1		C-141	Mica: .00005 mfd. ±10% 500 V DC W *1468	
2		C-151A, 152A, 153A, 154A	Ceramic: 75 mmf. ±10% 500 V DC W *810Z	
1		C-161A	Ceramic: 100 mmf. ±10% 500 V DC W *810Z	
1		C-130	Mica: .0001 mfd. ±10% 500 V DC W *1460	
1		C-142A	Mica: .00012 mfd. ±3% 500 V DC W *1468	
1	CAW-481042-10	C-155, 156	Mica: .000145 mfd. ±10% 500 V DC W *1468	
1		C-143A	Mica: .00016 mfd. ±3% 500 V DC W *1468	

*Manufacturer's Type.

14.5 TABLE III (*Continued*)

SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS (See Par. 14.2)
FOR MODEL RBH RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Desig. For Replacement	All Symbol Designations Involved	Description	National Co. Dwg. and Part No.
		CAPACITORS (CLASS 48) (*Continued*)		
2	CAW-48090-10	C-106, 109, 110, 125	Mica: .00025 mfd. ±10% 500 V DC W *1468	
1		C-144	Mica: .00036 mfd. ±3% 500 V DC W *1468	
1		C-145	Mica: .00074 mfd. ±3% 500 V DC W *1467	
1		C-104	Mica: .001 mfd. ±10% 500 V DC W *1467	
1		C-146	Mica: .00125 mfd. ±3% 500 V DC W *1467	
1		C-160	Mica: .0038 mfd. ±3% 500 V DC W *1467	
1	CAW-481037-10	C-123	Mica: .005 mfd. ±10% 300 V DC W *1467	
1		C-158	Mica: .0085 mfd. ±10% 500 V DC W *1467	
1		C-126	Mica: .01 mfd. ±10% 300 V DC W *1467	
3		C-107, 114, 117, 124, 128, , 138	Paper: .01 mfd. +20−10% 600 V DC W *G116AB	
1		C-159	Paper: .05 mfd. +20−10% 600 V DC W *G156AB	
5		C-112, 113, 116, 119, 121, 122, 131, 132, 133, 139	Paper: .1 mfd. +20−10% 400 V DC W *014AB	
3		C-102, 111, 115, 118, 120	Paper: .1 mfd. +20−10% 600 V DC W *G016AB	
1		C-101	Paper: .25 mfd. +20−10% 200 V DC W *0252AA	
1		C-108	Paper: 1 mfd. +20−10% 200 V DC W	
2	CD-481080	C-134, 135, 136, 137	Oil: 4 mfd., 600 V DC W *610N2-4, *TLAD-6040, *P8211, or *NAT-104	
1	CD-481045	C-103	Elec.: 25 mfd., 50 V DC W *FA-10062	
		RESISTORS (CLASS 63)		
1	CBN-63360	R-148	200 Ohm ±10%, ½ Watt *310	
1	CBN-63474	R-118	250 Ohm ±10%, 2 Watts *316	
1	CBN-63360	R-120	300 Ohm ±10%, ½ Watt *310	
1	CBN-63360	R-102	350 Ohm ±10%, ½ Watt *310	
1	CBN-63360	R-106, 108	500 Ohm ±10%, ½ Watt *310	
1	CBN-63474	R-139	500 Ohm ±10%, 2 Watts *316	
1	CBN-63360	R-134	1000 Ohm ±10%, ½ Watt *310	
2	CBN-63360	R-111, 117, 126, 141	2000 Ohm ±10%, ½ Watt *310	
1	CBN-63474	R-137, 138	2000 Ohm ±10%, 2 Watts *316	
1	CBN-63360	R-103, 112	5000 Ohm ±10%, ½ Watt *310	
1		R-119	5000 Ohm ±10%, 5 Watts *5K	

*Manufacturer's Type.

14.5 TABLE III (*Continued*)

SPARE PARTS LIST BY NAVY TYPE DESIGNATIONS (See Par. 14.2)
FOR MODEL RBH RADIO RECEIVING EQUIPMENT

Quantity	Navy Type Desig. For Replacement	All Symbol Designations Involved	Description	National Co. Dwg. and Part No.
		RESISTORS (CLASS 63) (*Continued*)		
1	CBN-63474	R-104, 124	20,000 Ohm ±10%, 2 Watts *316	
3	CBN-63360	R-113, 122, 125, 127, 131, 147	50,000 Ohm ±10%, ½ Watt *310	
1	CBN-63360	R-109	70,000 Ohm ±10%, ½ Watt *310	
4	CBN-63360	R-110, 114, 128, 129, 132, 142, 145	100,000 Ohm ±10%, ½ Watt *310	
1	CBN-63360	R-130, 146	250,000 Ohm ±10%, ½ Watt *310	
4	CBN-63360	R-101, 105, 107, 123, 133, 136, 143	500,000 Ohm ±10%, ½ Watt *310	
1	CBN-63360	R-140	5 megohm ±10%, ½ Watt *310	
1		R-135	1,000 Ohm, W.W. Variable *MH-1000	
1		R-121, 144	10,000 Ohm, 1.5 Watt W.W. Variable *P58-10,000U	
1		R-115	500,000 Ohm, 1 Watt Comp. Variable *62-106	
1	CBN-63757	R-116	500,000 Ohm, 1 Watt Comp. Variable *72-105	

Prefix letters on items indicate the exact types *originally* furnished as spare parts.
Replacements of these spares need not carry same prefix letters.
*Manufacturer's Type.

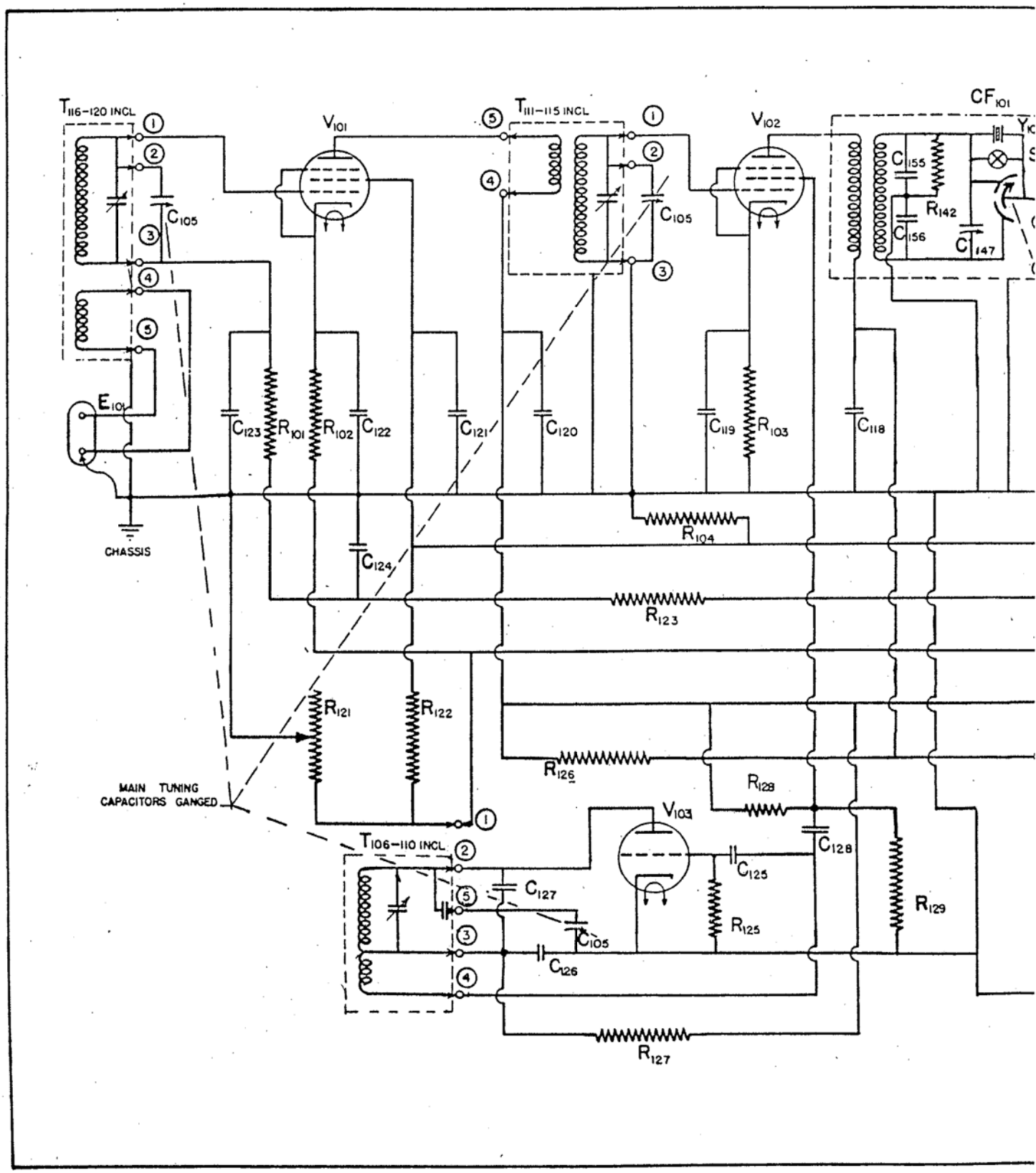
RMA COLOR CODE FOR RESISTORS

Color	*Body*	*End*	*Dot*
Black	—	0	.0
Brown	1	1	0
Red	2	2	00
Orange	3	3	000
Yellow	4	4	0000
Green	5	5	00000
Blue	6	6	000000
Purple	7	7	0000000
Gray	8	8	00000000
White	9	9	—

Body color denotes first numeral in resistance value.
End color denotes second numeral.
Dot color denotes number of ciphers following first two numerals.
Gold color bronze end dip indicates 20% tolerance.
Silver color bronze end dip indicates 5% tolerance.
Other resistors 10% tolerance.

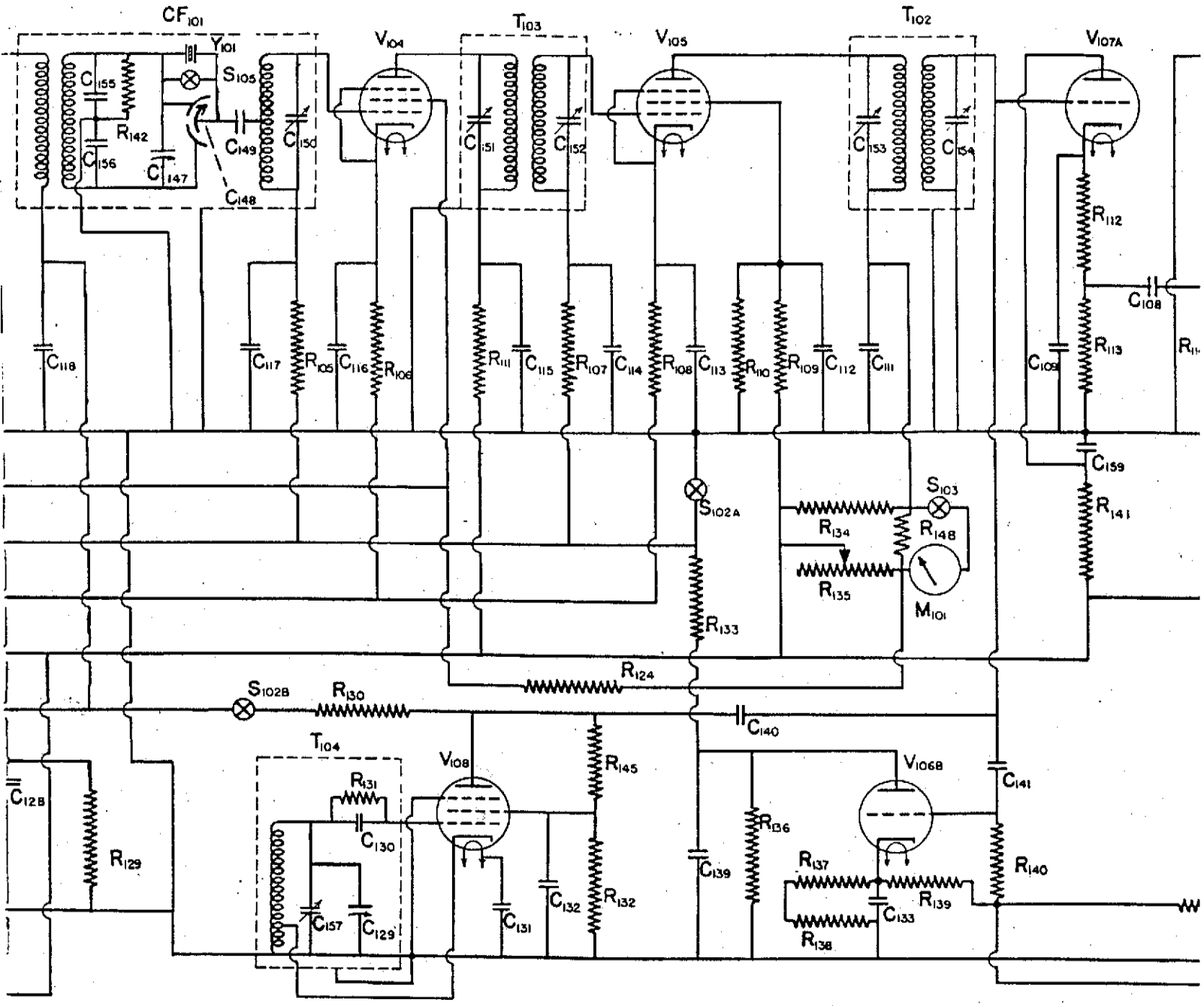
14.6 LIST OF MANUFACTURERS

CODE NO.	MFR. PREFIX	NAME	ADDRESS
1	CAW	Aerovox Corporation	New Bedford, Mass.
2	CBN	Central Radio Labs.	Milwaukee, Wisconsin
3	CD	Cornell Dubilier Elec. Corp.	So. Plainfield, N. J.
4	CG	General Electric (Mazda)	Cleveland, Ohio
5	CHH	Arrow-Hart & Hegeman	Hartford, Conn.
6	CLF	Littlefuse Laboratories	Chicago, Illinois
7	CMC	Clarostat Mfg. Co. Inc.	Brooklyn, N. Y.
8	CNA	National Company, Inc.	Malden, Mass.
9	CRC	RCA Manufacturing Company RCA Radiotron Division	Harrison, N. J.
10	CYM	Yaxley Division of P. R. Mallory & Co., Inc.	Indianapolis, Ind.
11		Sprague Products Co.	North Adams, Mass.
12		The Rola Co. Inc.	Cleveland, Ohio
13		Marion Elec. Inst. Co.	Manchester, N. H.
14		Cinch Mfg. Co.	Chicago, Illinois
15		Cornish Wire Company	New York, N. Y.
16		E. F. Johnson	Waseca, Minnesota
17	CTD	Tobe Deutschmann	Canton, Mass.

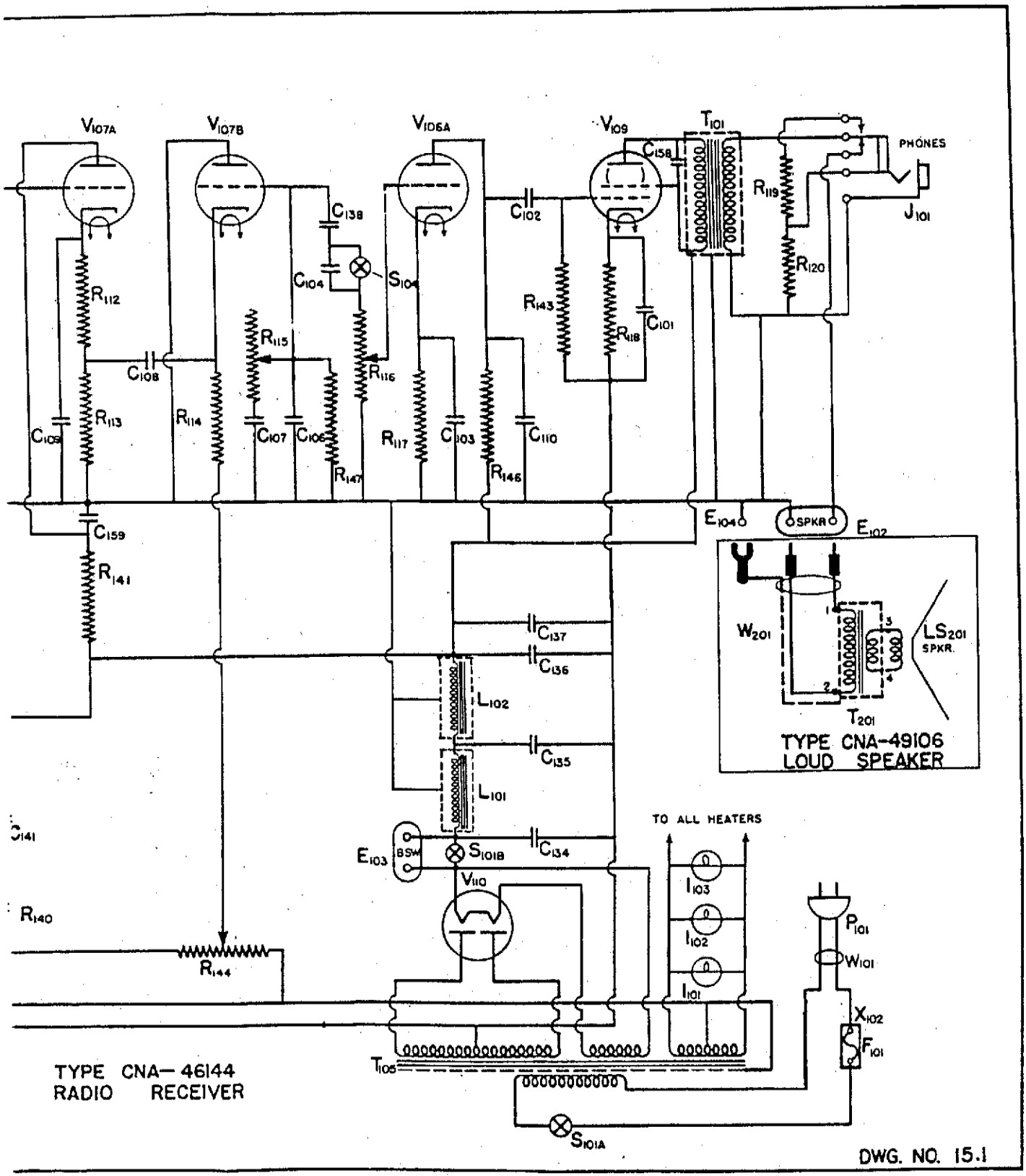


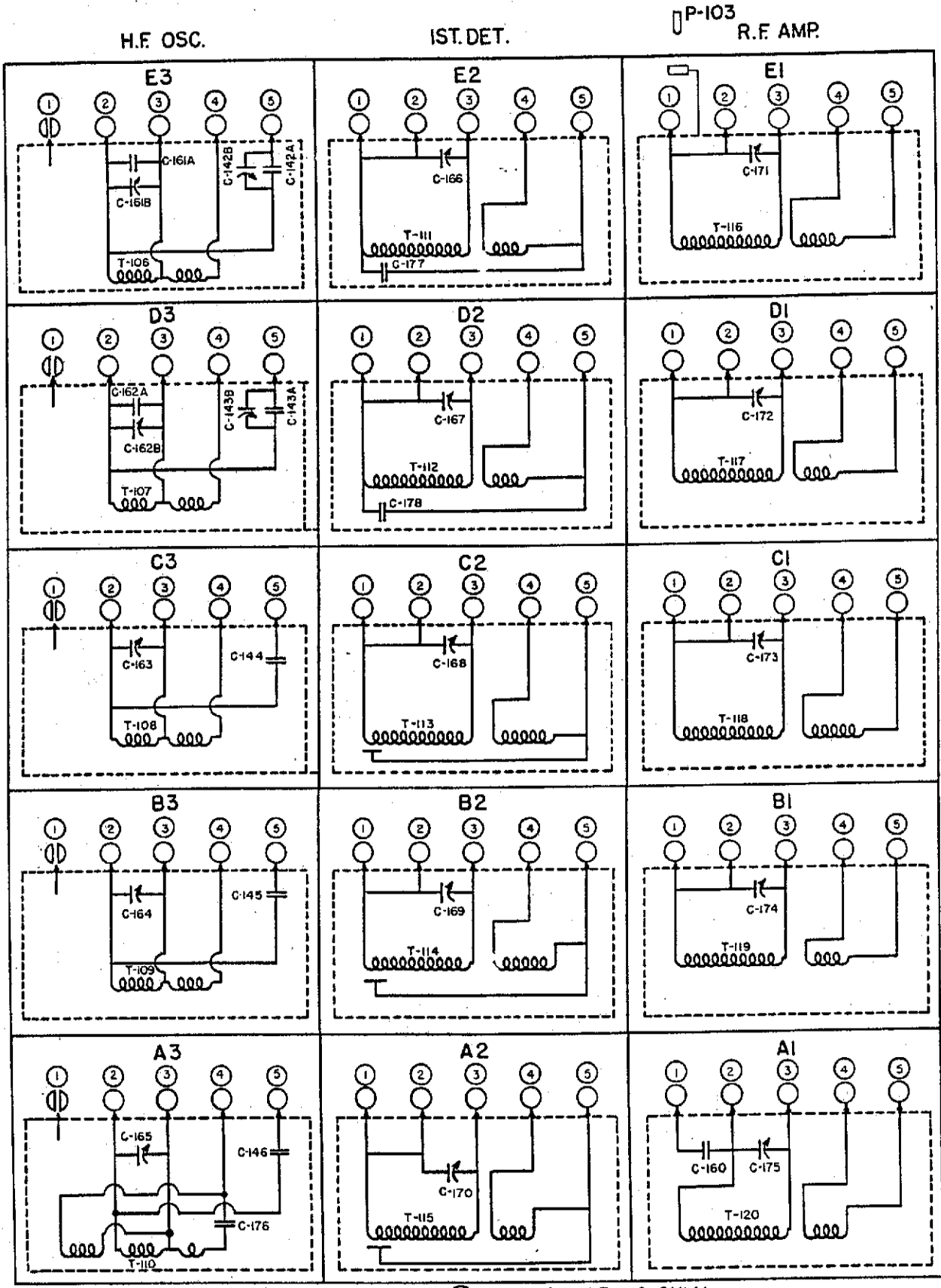
(1) REFERENCE NUMBERS ONLY

ACTUAL WIRING DIAGRAM
MODEL RBH EQUIPMENT



TYPE CNA-- 4(
RADIO RECE


V107A
V107B
V106A
V109
T101
PHONES
J101
C158
C102
C138
C104
S104
R119
R120
R112
R115
R116
R143
R118
C101
C108
R113
R114
C107
C106
R147
R117
C103
R146
C110
C105
C159
R141
E104
SPKR
E102
W201
LS201
SPKR.
T201
TYPE CNA-49106
LOUD SPEAKER
C137
C136
L102
C135
L101
C134
E103
BSW
S101B
V110
TO ALL HEATERS
I103
I102
I101
P101
W101
X102
F101
R140
R144
T105
S101A
TYPE CNA-46144
RADIO RECEIVER
DWG. NO. 15.1



ACTUAL WIRING DIAGRAM

(1) = REFERENCE NO. ONLY

RF TRANSFORMERS T-106 TO T-120 INCLUSIVE

DWG. NO. 15.2

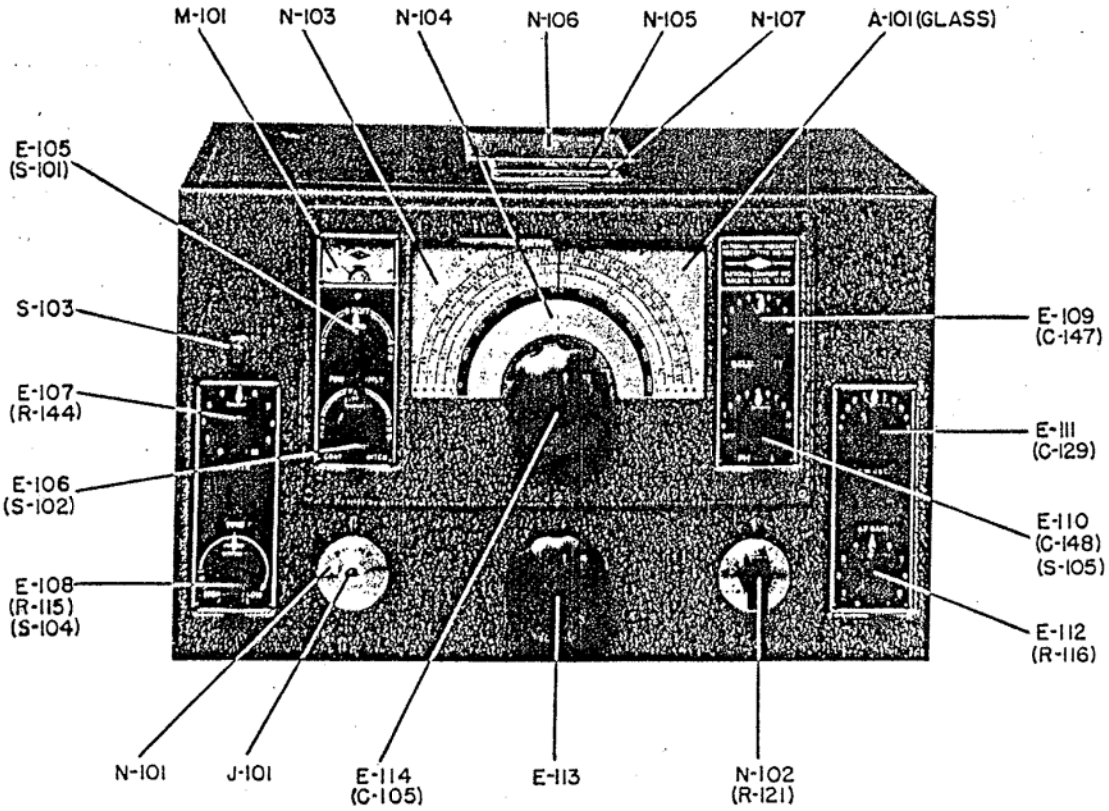


PHOTO NO. 16.1 FRONT VIEW OF RECEIVER

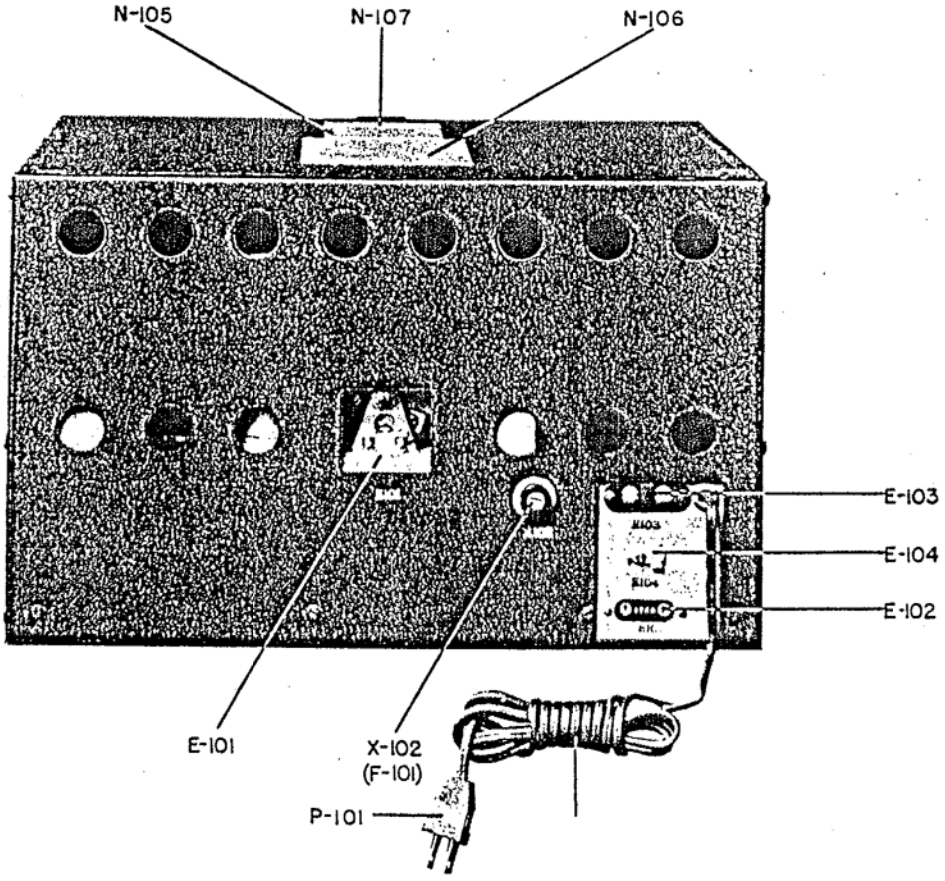


PHOTO NO. 16.2 REAR VIEW OF RECEIVER

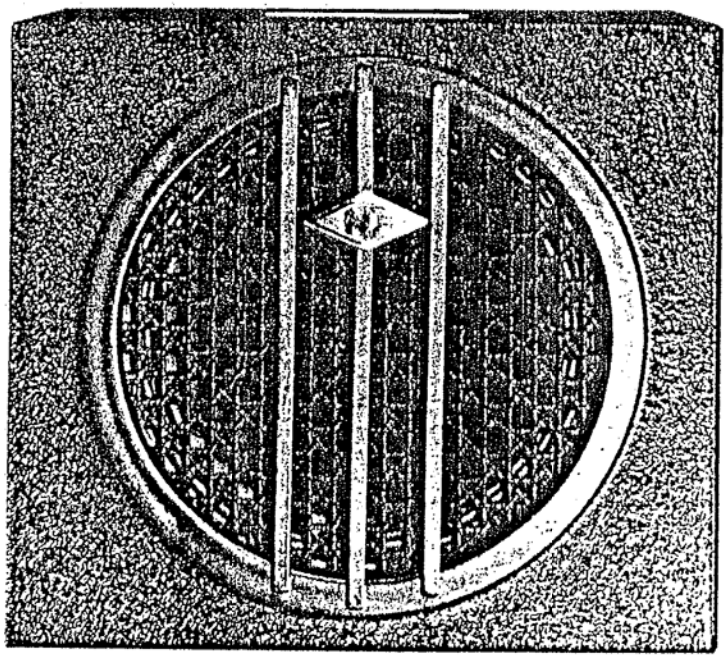


PHOTO NO. 16.3 FRONT VIEW OF LOUDSPEAKER

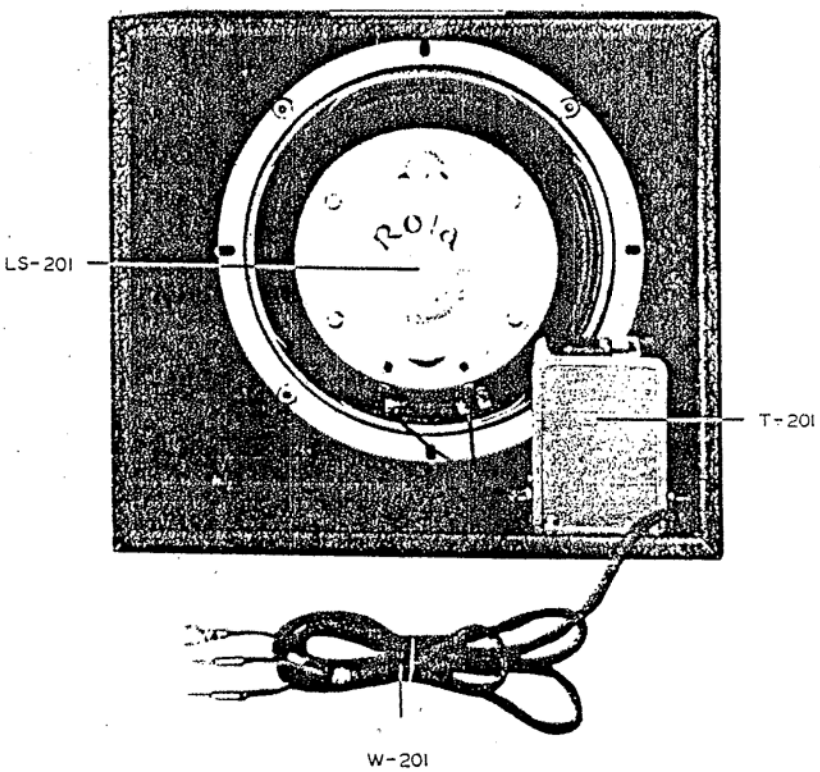


PHOTO NO. 16.4 REAR VIEW OF LOUDSPEAKER

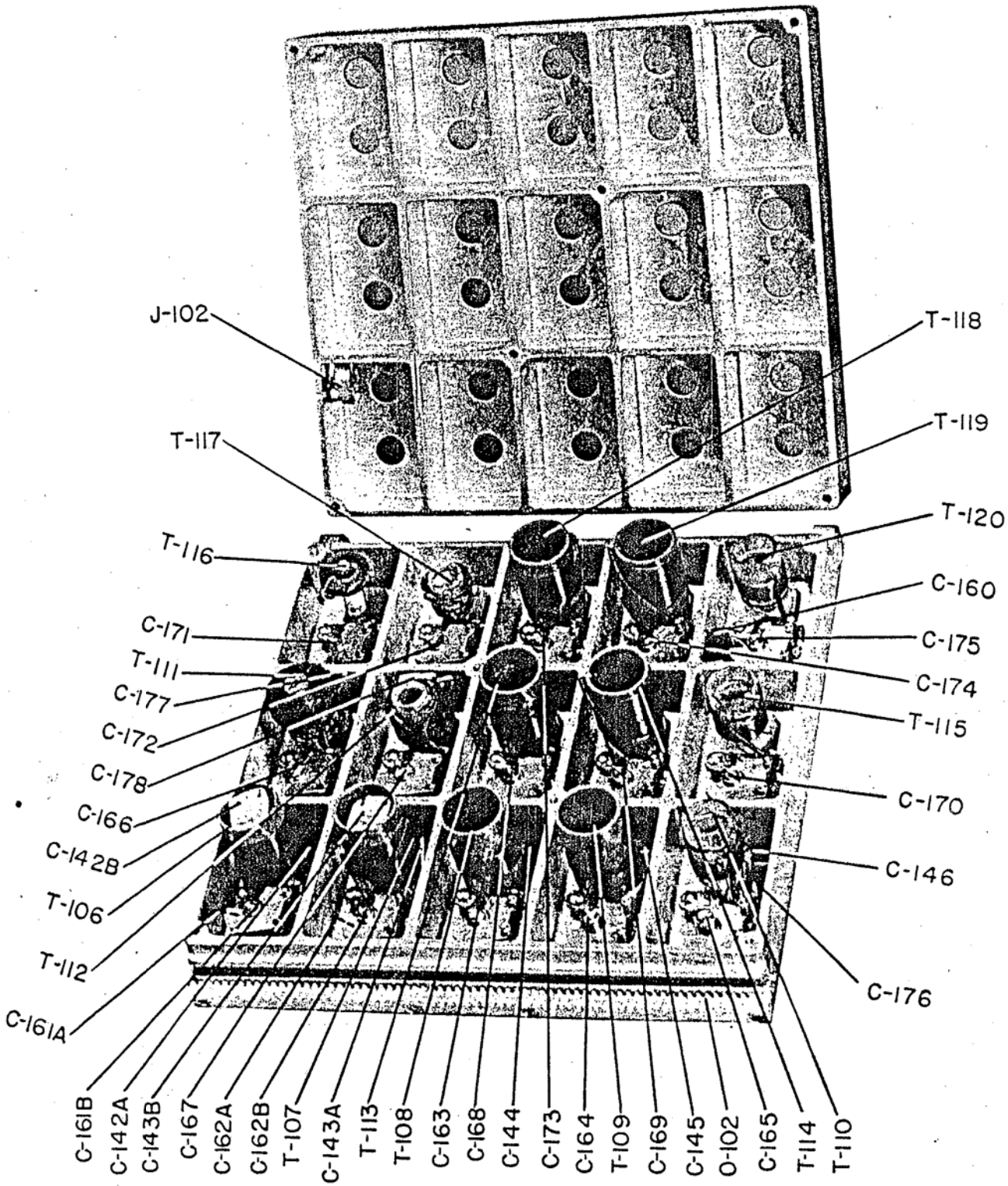


PHOTO NO. 16.5 COIL CATACOMB

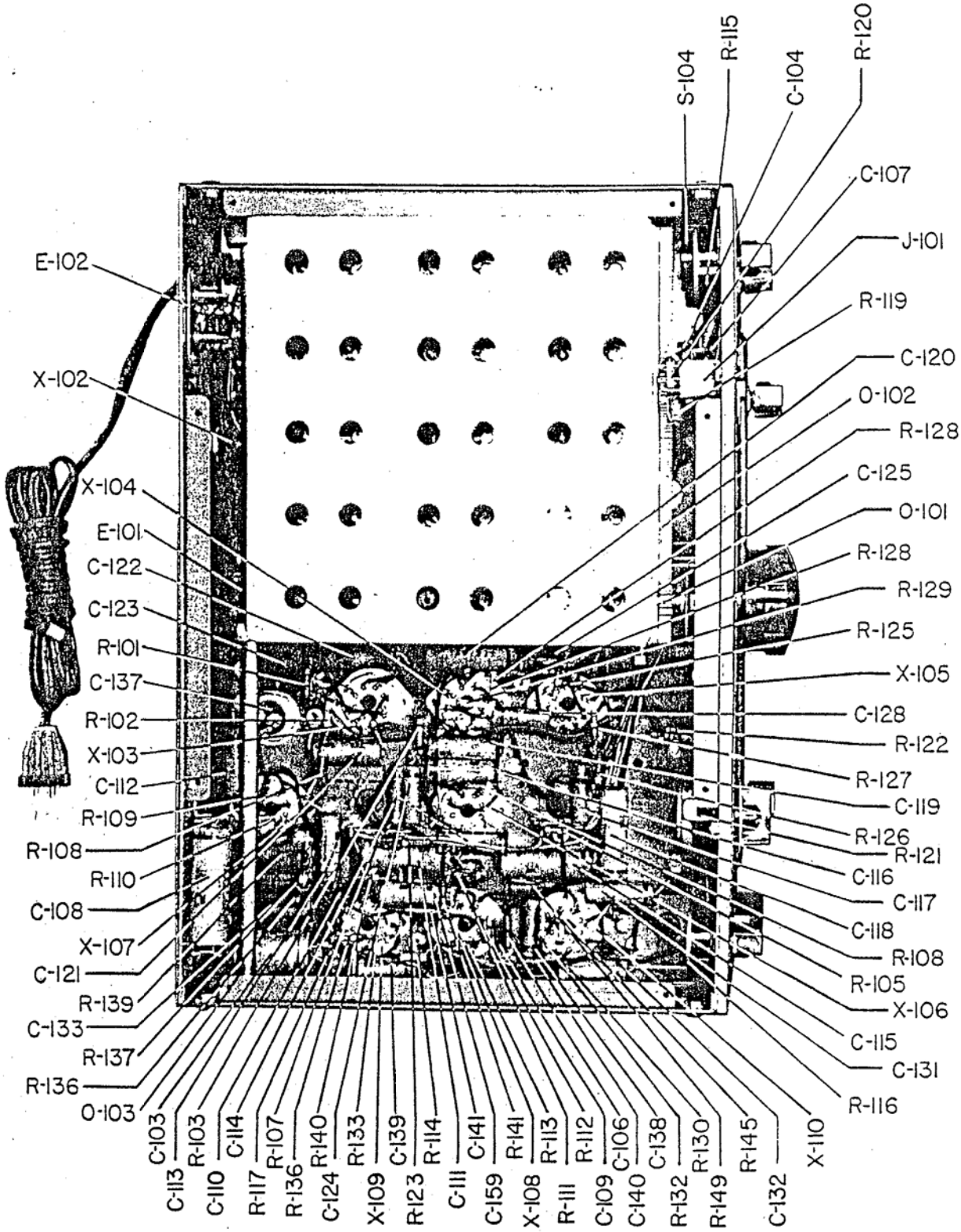


PHOTO NO. 16.6 BOTTOM VIEW OF RECEIVER

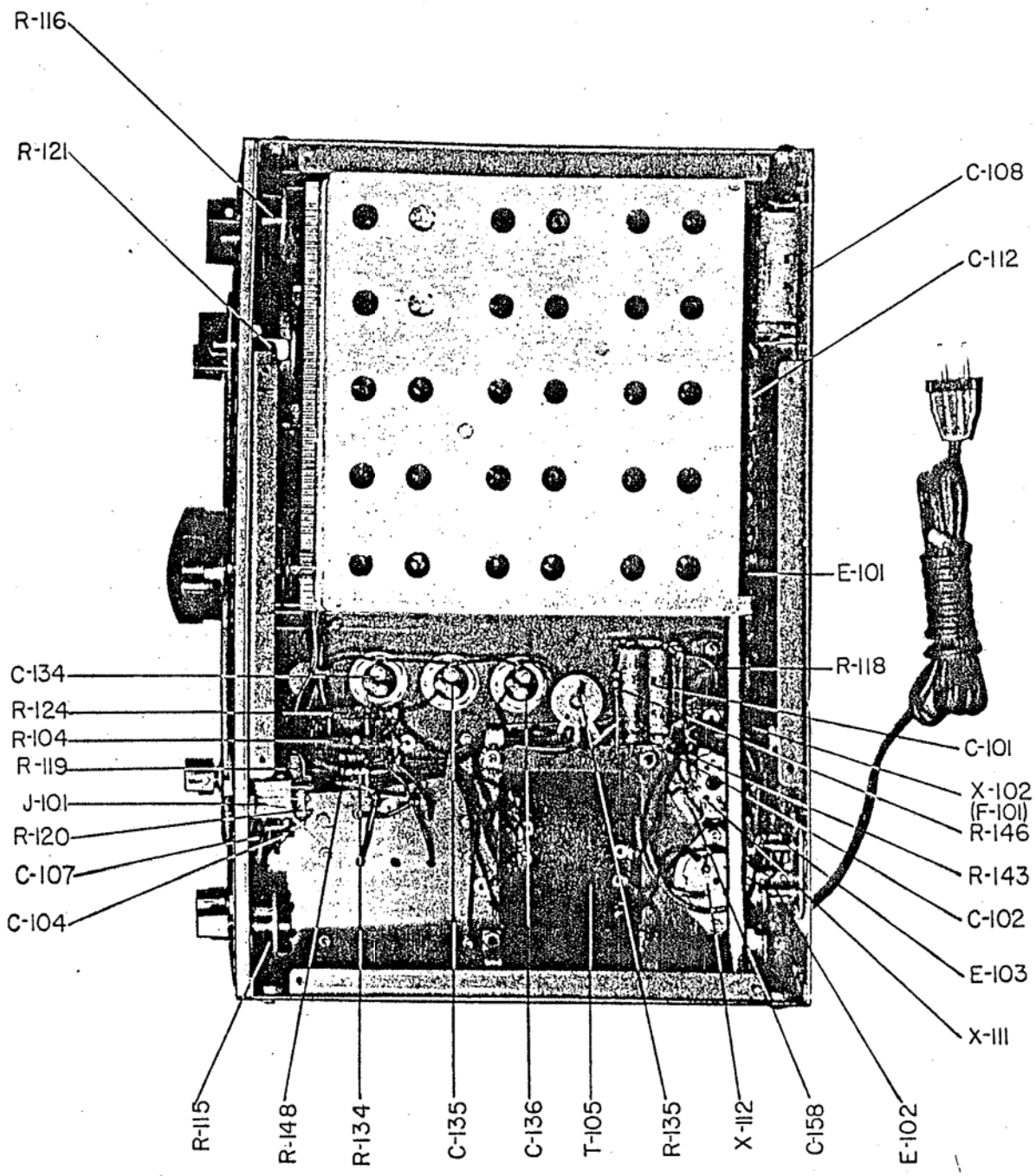


PHOTO NO. 16.7 BOTTOM VIEW OF RECEIVER

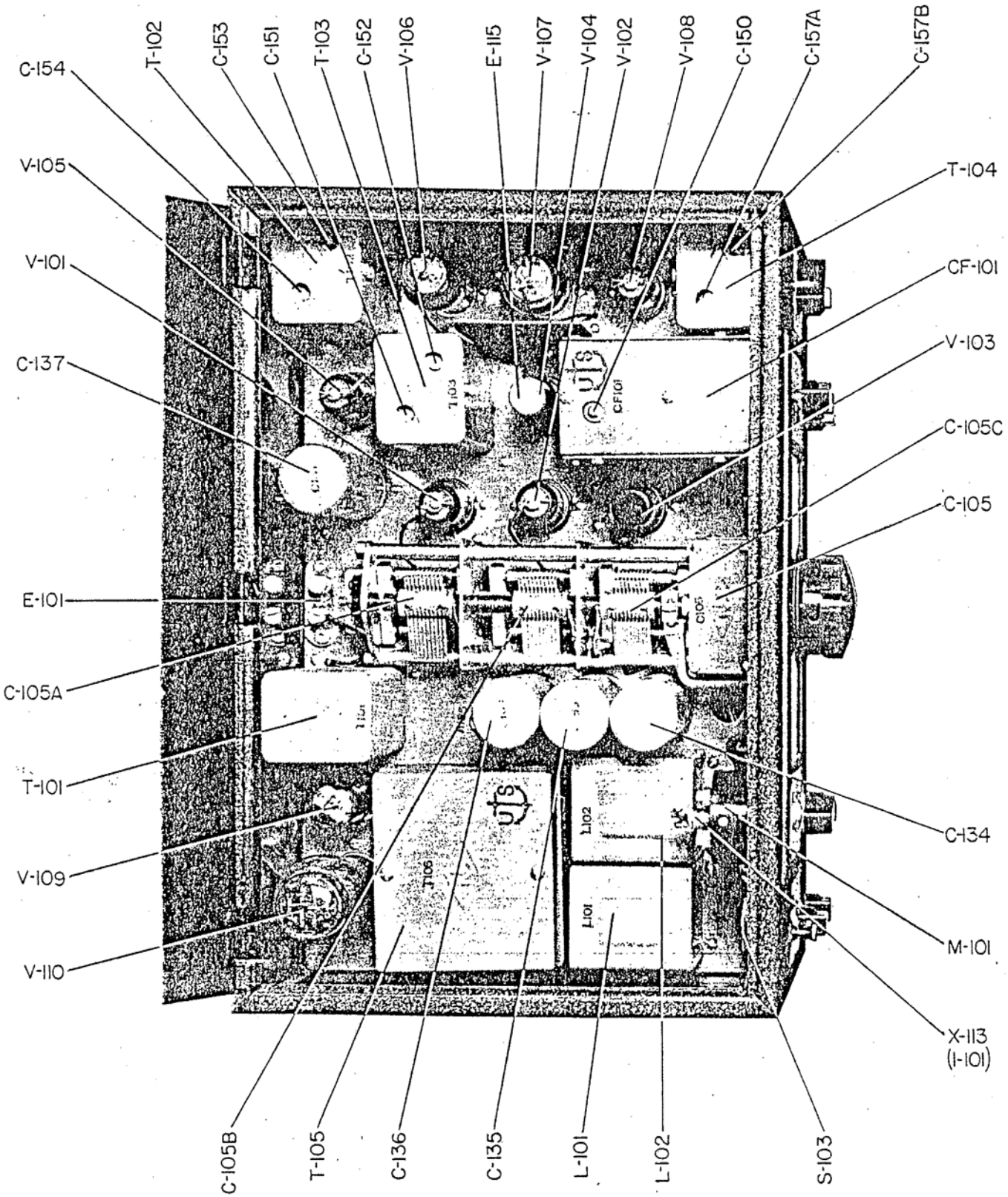


PHOTO NO. 16.8 TOP VIEW OF RECEIVER