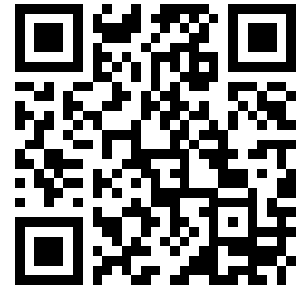

TM11-861

WAR DEPARTMENT

TECHNICAL MANUAL

RADIO SET SCR-255 (DIRECTION FINDING)

AUGUST 28, 1942

Pending the final printing and distribution of TM11-861, the matter contained herein is published for the information and guidance of all concerned.

DESTRUCTION OF ABANDONED MATERIEL IN THE COMBAT ZONE

In case it should become necessary to destroy this equipment because of imminent danger of capture by the enemy, or when ordered to do so, proceed as follows:

a. **Destruction of equipment by explosives, when provided, is described in appropriate instructions.**

b. **All radio sets may be destroyed in the following manner:**

(1) Shear off all panel knobs, dials, etc., with an axe head, break open set compartment by smashing in panel face, then knock off top, bottom, and sides. The object is to destroy the panel and expose the chassis. On the top of the chassis strike all tubes and circuit elements with the axe head. On the under side of the chassis the axe head should be used for shearing and tearing off wires and small circuit units. Socket bases should be broken and circuit units and wires cut. Tubes, coils, crystals and holders, microphones and batteries should be smashed or cut, the treatment and tool being the same as for chassis parts. Masts and poles should be broken at the joints by bending. The variable gang tuning capacitor is the most difficult part to replace and should therefore be destroyed.

(2) The following supplementary means of destruction should be employed whenever possible:

(a) **Pile up equipment already smashed as outlined above, and pour on gasoline or oil and set on fire. If other inflammable material such as wood, sawdust, cloth, straw, etc., is available pile up this material and place equipment on it before pouring on gasoline or oil.**

(b) **Smashed parts should be buried in earth or stream beds.**

c. **Instruction books, circuit and wiring diagrams, records of all kinds for all types of Signal Corps equipment, and code books and registered documents should be destroyed by burning.**

TECHNICAL MANUAL

FOR

RADIO SET SCR-255
(DIRECTION FINDING)

Prepared under direction of the
Chief Signal Officer

RESTRICTED

NOTICE: —This document contains information affecting the national defense of the United States within the meaning of the Espionage Act (U.S.C. 50:31, 32). The transmission of this document or the revelation of its contents in any manner to any unauthorized person is prohibited.

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WAR DEPARTMENT
WASHINGTON

This Technical Manual, published by Wilcox-Gay Corp. on order Numbers 2465-CHI-41, 1210-CHI-42, 5073-CHI-42 and 5077-CHI-42, is furnished for the information and guidance of all concerned.

By order of the Secretary of War:

G. C. MARSHALL,
Chief of Staff.

Official:
J. A. ULIO,
Major General,
The Adjutant General.

SAFETY NOTICE

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH CAN CAUSE SEVERE SHOCK. THE HIGH POTENTIAL POINTS, WHICH ARE INACCESSIBLE DURING NORMAL OPERATION, SHOULD BE AVOIDED DURING SERVICING PROCEDURES.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

ADDENDUM

The majority of the direction finder units, each designated as Radio Set SCR-255 (Direction Finding) have been furnished with pilot lights for illuminating the frequency dial and the azimuth scale at the control position.

Units bearing serial numbers from 2 to 45 inclusive (Order No. 2465-CHI-41) are equipped with pilot lights which derive their lighting source from the storage battery circuit of the radio receiver installed within the cabinet at the top of the tower. A connection is also provided at the control position of these units, for use of headphones.

Because of the magnification of terrain effect errors, resulting from the use of wires for connecting the pilot lights and headphones to the radio receiver, it was deemed advisable to eliminate these features from further production until a satisfactory method for their adaption could be incorporated. For this reason, units bearing serial number 1 and numbers from 46 to 79 inclusive (Order No. 2465-CHI-41) are furnished without pilot lights and associated connections, and without provision for use of headphones. The illustrations shown in Figures 35 and 46 apply to these units.

All units produced on Order Nos. 1210-CHI-42, 5073-CHI-42 and 5077-CHI-42 are furnished with pilot lights which derive their lighting source from flashlight cells contained within the control box at the control position. Figures 35-A and 46-A apply to these units. Inasmuch as this arrangement does not require the use of connecting wires placed between the control position and the equipment at the top of the tower, operation of the direction finder is not impaired. As the use of headphones at the control position necessitates the placement of connecting wires between the control box and the radio receiver, probable error resulting from such arrangement has been eliminated by complete omission of the headphone feature. For this reason, headphones have been omitted from these units.

CAUTION: Under no condition should connecting wires be placed between the control position and the equipment installed at the top of the tower, in those units in which such connections have been omitted in manufacture.

FIGURE 1

RADIO SET SCR-255 (DIRECTION FINDING),—TYPICAL INSTALLATION

SECTION I

DESCRIPTION

1. GENERAL.—

a. The complete Radio Set SCR-255 (Direction Finding) illustrated in Figure 1 is a semi-portable, ground-station, radio direction finder, covering the frequency range of 550. kilocycles to 30. megacycles. The equipment is designed to operate as an aural null direction finder employing a rotating Adcock antenna system. The radio receiver, together with its power supply consisting of two 6 volt storage batteries connected in parallel, and the loudspeaker, are contained within the aluminum cabinet at the top of the wooden supporting tower. Hinged doors at opposite ends of the cabinet permit access to the receiver and battery compartments. A wooden platform that surrounds the tower, slightly above the middle, provides a means for installation and maintenance of the equipment at the top of the direction finder. The antenna system is secured to a central shaft extending through the cabinet and terminating at the control position within the lower section of the tower. From this position rotation of the antenna and all operating adjustments of the radio receiver are accomplished. The control position is at a convenient height for manipulating the controls from either a standing or sitting position. An operator's stool is included with the equipment. Two 12-foot ladders are furnished for use in equipment installation and maintenance. The tower is completely enclosed by detachable wooden panels that provide a weatherproof shelter. A door is incorporated in the lower front panel to permit entry into the tower, and a window of shatterproof material is located in the lower panel adjacent to the door.

b. The direction finder tower may be guyed by tying the four 30-foot guying ropes, furnished with the equipment, to the platform support rails. Holes are provided in the rails for this purpose.

2. COMPONENT UNIT DIMENSIONS AND WEIGHTS.—

Refer to group illustrations, Figures 2 to 24 inclusive.

Quantity	*Name*	*Dimensions*	*Unit Weight (lbs.)*
3	***Box BX-35-A***	37⅞" x 10½" x 14¾", empty	66.00
		with contents	181.00
	Contents:		
	2 Storage Batteries (249)	11 1/16" x 7 1/16" x 10½"	57.50
1	***Chest CH-81-A***	86⅜" x 18⅛" x 13⅜", empty	112.00
		with contents	302.00
	Contents:		
	2 Anchor Plate Support Rails (114) 5PJ-110-48	55 1/32" x 4" x 1⅛"	5.50
	2 Base Rails 5PJ-110-12 (112)	72-39/64" x 4" x 1⅛"	7.00
	2 Base Rails 5PJ-110-13 (113)	72-39/64" x 4" x 1⅛"	7.00
	2 Lower Uprights 5PJ-110-3 (110)	80" x 3" x 3"	16.00
	2 Lower Uprights 5PJ-110-4 (111)	80" x 3" x 3"	16.00
	2 Top Uprights 5PJ-110-6 (102) with End Casting (100) and		

Quantity	Name	Dimensions	Unit Weight (lbs.)
	Splice Casting (102) attached.	74" x 3" x 3"	16.50
	2 Top Uprights 5PJ-110-7 (103) with End Casting (100) and Splice Casting (102) attached.	74" x 3" x 3"	16.50
1	***Chest CH-82-A***	85" x 21" x 19⅜", empty	137.00
		with contents	337.00
	Contents:		
	1 Anchor Assembly (117) including Anchor Base (118), and Anchor Plate Cleats (115) attached to Anchor Plate (116), 5PJ-110-16	50 3/32" x 16" x 6½"	35.00
	2 Platforms 5PJ-110-21 (125)	79" x 15¾" x 2⅛"	41.75
	2 Platforms 5PJ-110-22 (126)	75" x 15¾" x 2⅛"	39.50
	2 Platform Support Rails (104)	74" x 4" x 4"	7.50
1	***Chest CH-83-A***	151¼" x 22¾" x 13⅛", empty	160.00
		with contents	332.00
	Contents:		
	2 Beams M-264-A	144 9/16" x 7⅛"	24.50
	1 Beam Socket MC-263-A	24-49/64" x 7⅛" x 8⅝"	31.50
	2 Dipole Collectors AN-63-A including:		
	2 Dipole Mtg. Bases Assem. (168)	37⅞" x 4⅝" x 2 5/16"	3.25
	2 Fixed Dipoles (175)	96⅜" x ¾"	.77
	2 Telescoping Dipoles (174)	96⅜" x ¾"	.72
1	***Chest CH-84-A***	40⅝" x 31" x 31", empty	167.00
		with contents	264.00
	Contents:		
	1 Cabinet CS-95-A with loudspeaker (242) mounted in place, and protective cap (194) attached	34½" x 26⅛" x 26⅞"	83.00
	4 Guying Ropes (240)	360" x ¾"	4.75
1	***Chest CH-85-A***	100¾" x 18 1/16" x 7⅛", empty	115.00
		with contents	277.00
	Contents:		
	4 Cross Braces 5PJ-110-8 (108)	94 31/32" x 4" x 1⅛"	10.00

Quantity	Name	Dimensions	Unit Weight (lbs.)
	2 Cross Braces 5PJ-110-11 (109)	95-63/64" x 4" x 1⅛"	10.50
	1 Front Center Brace 5PJ-110-14 (107)	42$\frac{3}{16}$" x 4" x 1⅛"	4.25
	4 Ground Stakes GP25 (239)		8.00
	2 Platform Cross Rails (105) 5PJ-110-10	43$\frac{5}{16}$" x 4" x 1⅛"	4.00
	4 Top Rungs 5PJ-110-19 (101)	28" x 2" x 1"	1.00
	1 Set of Hand Tools, as follows:		
	1 Adjustable End Wrench	Part No. 70-2059	.28
	1 Hammer	Part No. 70-2064	1.50
	2 Open-end Wrenches ½"-$\frac{9}{16}$"	Part No. 70-2057	.56
	2 Open-end Wrenches $\frac{13}{32}$" x $\frac{11}{16}$"	Part No. 70-2058	.66
	1 Pliers (slip jaw)	Part No. 70-2063	.53
	1 Screwdriver ⅛"	Part No. 70-2060	.063
	1 Screwdriver ⅜"	Part No. 70-2061	.16
	1 Screwdriver $\frac{7}{32}$"	Part No. 70-2062	.50
	1 Set of standard Bolts, Nuts and Washers, including spares		19.56
	4 Hook Bolts (127)	6$\frac{13}{32}$" x ⅜"—16 thd.	.21
	4 Coupling Links (236)	4¼" x ¾"	.45
	31 Panel Clamps (137)	3½" x 1½" x 1⅛"	.18
	5 Panel Clamps (138)	3¼" x 1½" x 1⅛"	.21
1	***Chest CH-86-A***	81¼" x 54¼" x 17¼", empty	196.00
		with contents	349.00
	Contents:		
	2 Bottom Panels (130)	39½"h x 69½"w x 55$\frac{5}{16}$" x 1$\frac{5}{16}$" thick	14.50
	1 Bottom Panel (134)	39¾"h x 69$\frac{1}{16}$"w x 57½"w x 1$\frac{5}{16}$" thick	15.00
	1 Bottom Panel (135)	71¾"h x 36"w x 25⅛"w x 1$\frac{5}{16}$" thick	Joined by Hinges
	1 Door (136)	71$\frac{9}{16}$"h x 33⅝"w x 22⅝"w x 1$\frac{5}{16}$" thick	29.00
	1 Center Panel (133)	16"h x 47$\frac{25}{32}$"w x 42¾"w x 1$\frac{5}{16}$" thick	4.50
	1 Center Panel (132)	48"h x 57½"w x 42¾"w x 1$\frac{5}{16}$" thick	13.25
	2 Center Panels (129)	48"h x 55¼"w x 37⅞"w x 1$\frac{5}{16}$" thick	13.50
	2 Top Panels (128)	47⅞"h x 36½"w x 19$\frac{13}{32}$"w x 1$\frac{5}{16}$" thick	8.75
	2 Top Panels (131)	45⅞"h x 41½"w x 27$\frac{13}{32}$"w x 1$\frac{5}{16}$" thick	9.00
1	***Chest CH-90-A***	48¾" x 26⅛" x 24¼", empty	210.00
		with contents	295.00
	Contents:		
	1 Headset (241)		1.13
	1 Preliminary Instructions for Radio Set SCR-255 (Direction Finding)		

Quantity	Name	Dimensions	Unit Weight (lbs.)
	2 Jumper Leads (250)	19¼" x 5/16"	.13
	1 Magnetic Compass (245)	3⅝" x 3⅜" x ¾"	.50
	1 Radio Receiver BC-903-A with 3 Shaft Couplings (237) and 1 Shaft Coupling (238) attached.		51.00
	1 Radio Transmitter BC-904-A including 4 "B" batteries (81), and 1 "A" battery (82)		21.50
	1 Transmitter Antenna (80)	96" x 5/16"	.50
	1 Spare Vibrator	3¾" x 1½"	.28
	1 Spirit Level (248)		1.56
	1 Telescope (246)	16" x ¾"	.69
	1 Telescope and Compass Mount (247)	5⅛" x 5" x 7½"	1.18
	1 Vacuum Tube Kit including:	7" x 7" x 6¾"	1.63
	1 Tube VT-163		
	1 Tube VT-66A	**For Units under Order No. 1210-CHI-42**	
	1 Tube VT-198A	**(see name plate) add:**	
	3 Tubes VT-91		
	3 Tubes VT-86	2 Spare Pilot Bulbs	
	1 Tube VT-126	6 Flashlight Cells	
	1 Spare Fuse		
1	***Chest CH-91-A***	105¼" x 26¾" x 23⅛", empty	225.00
		with contents	275.00
	Contents:		
	1 Control Unit MC-265-A	99" x 23" x 20"	50.00

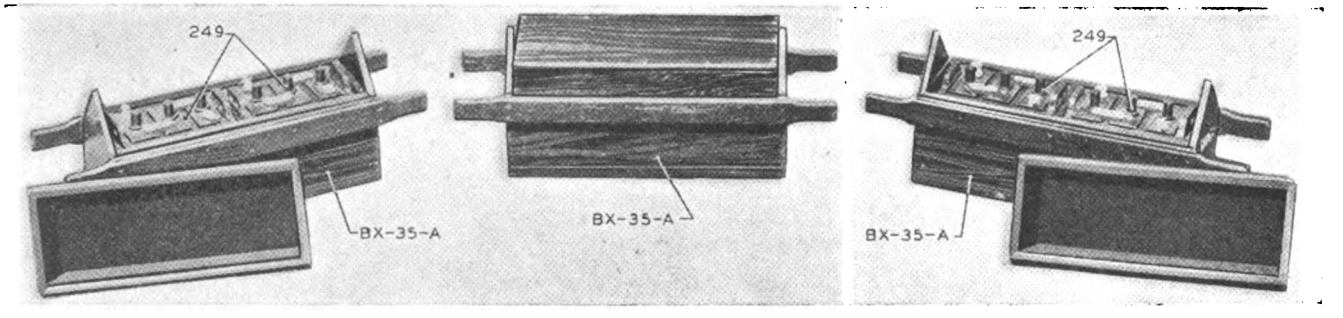


FIGURE 2

BATTERY BOXES BX-35-A AND BATTERIES

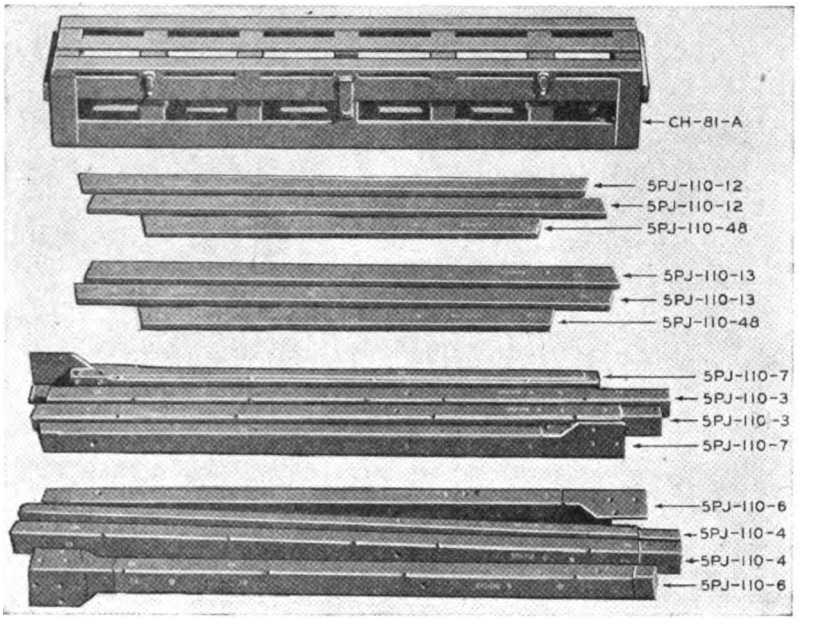


FIGURE 3

CHEST CH-81-A WITH CONTENTS

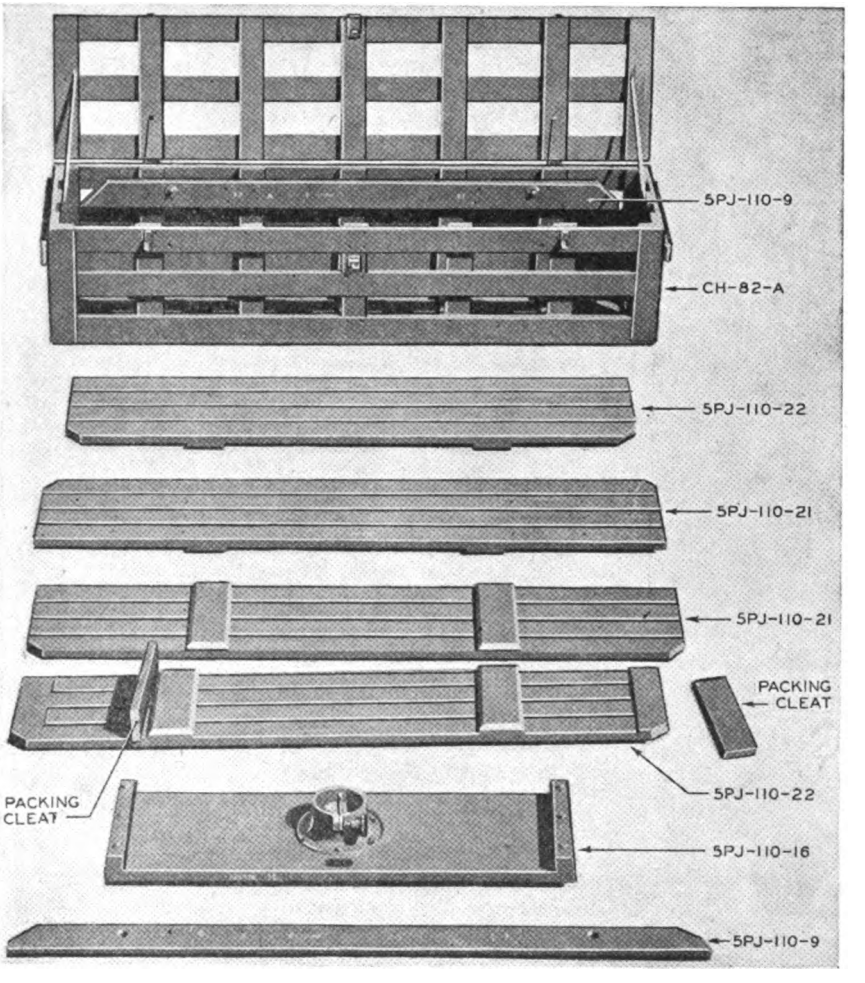


FIGURE 4

CHEST CH-82-A WITH CONTENTS

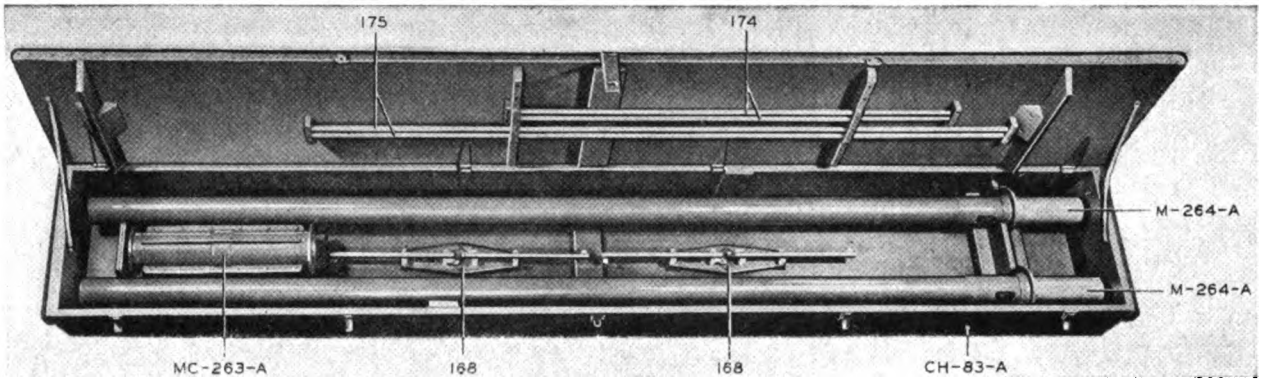


FIGURE 5
CHEST CH-83-A WITH CONTENTS

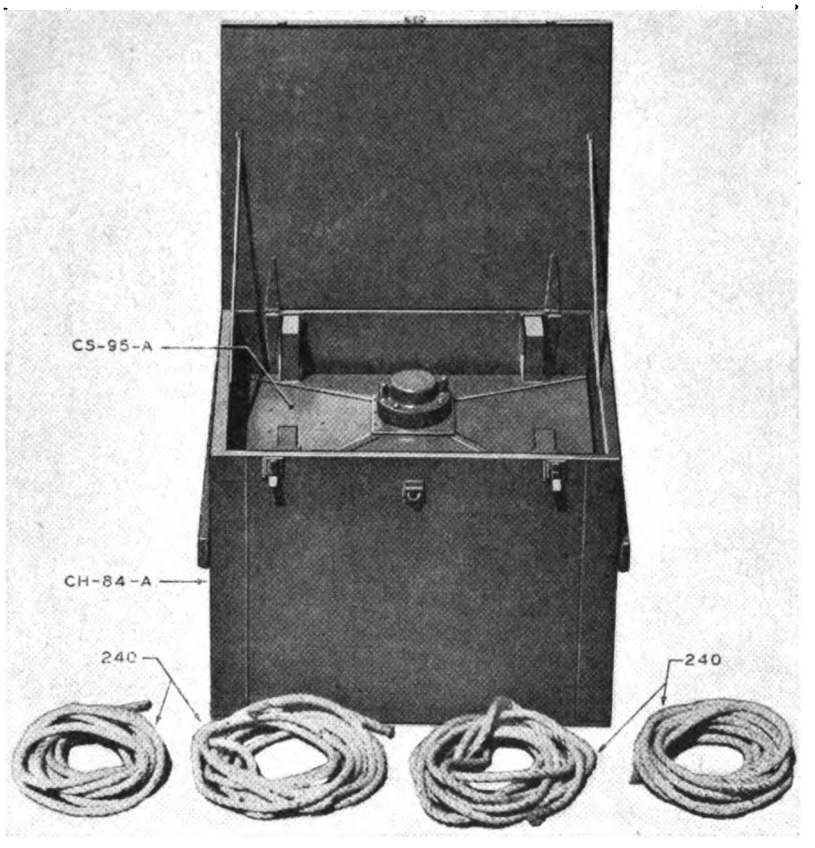


FIGURE 6
CHEST CH-84-A WITH CONTENTS

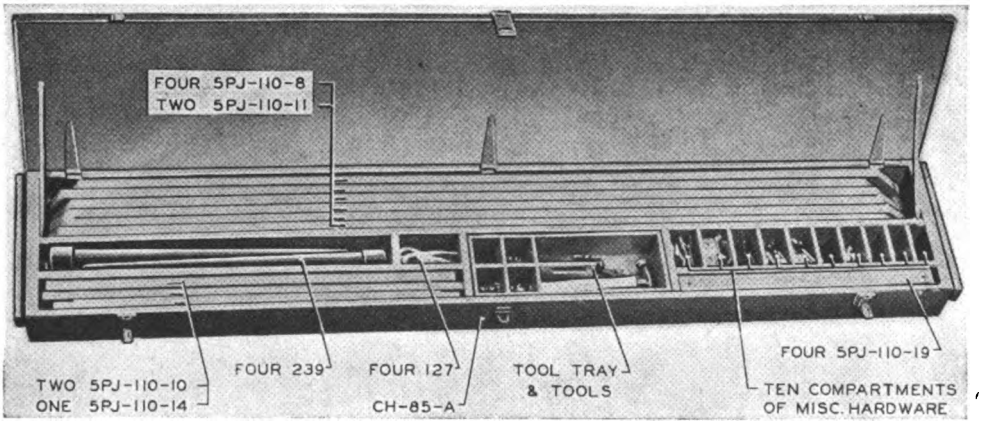


FIGURE 7
CHEST CH-85-A WITH CONTENTS

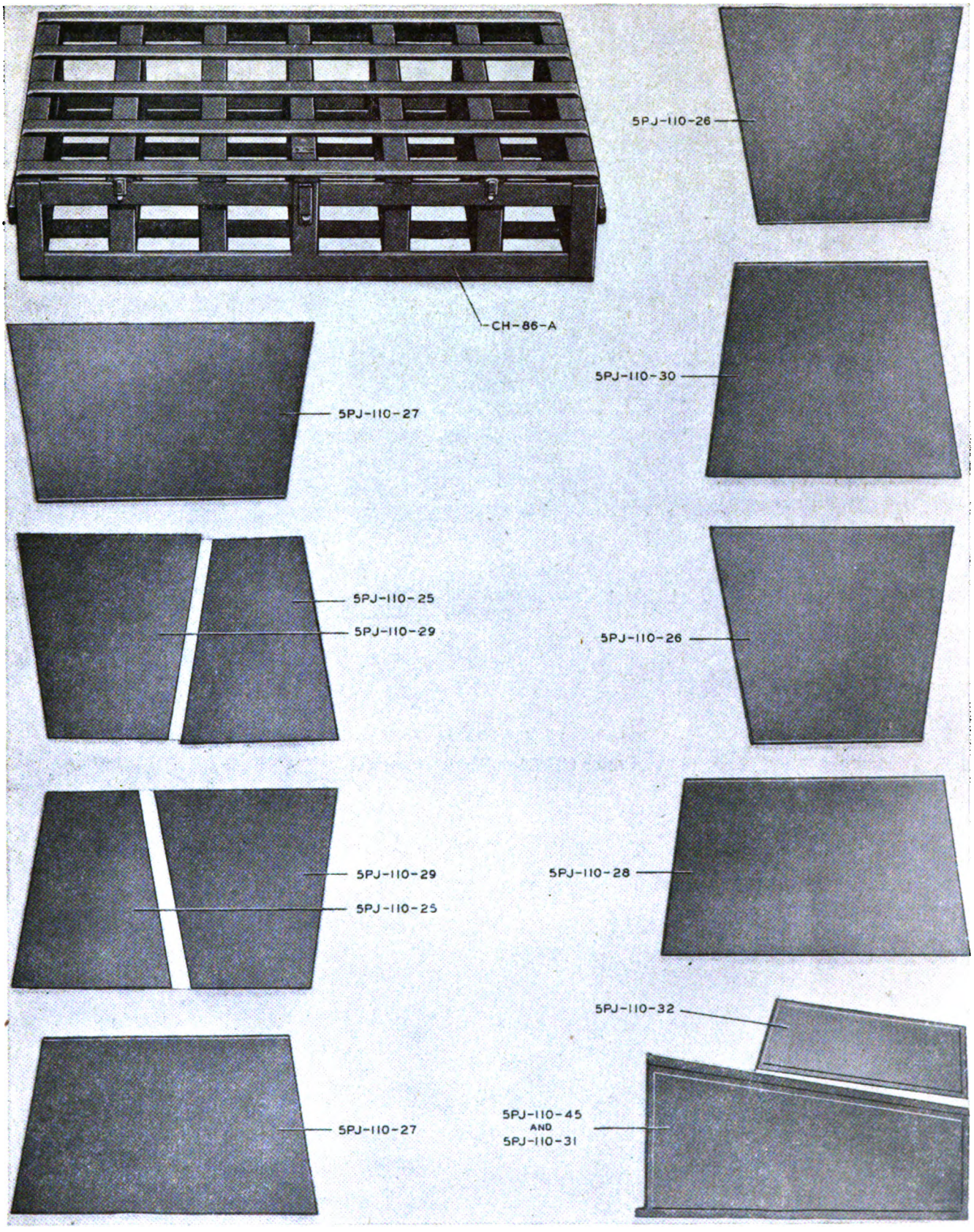


FIGURE 8

CHEST CH-86-A WITH CONTENTS

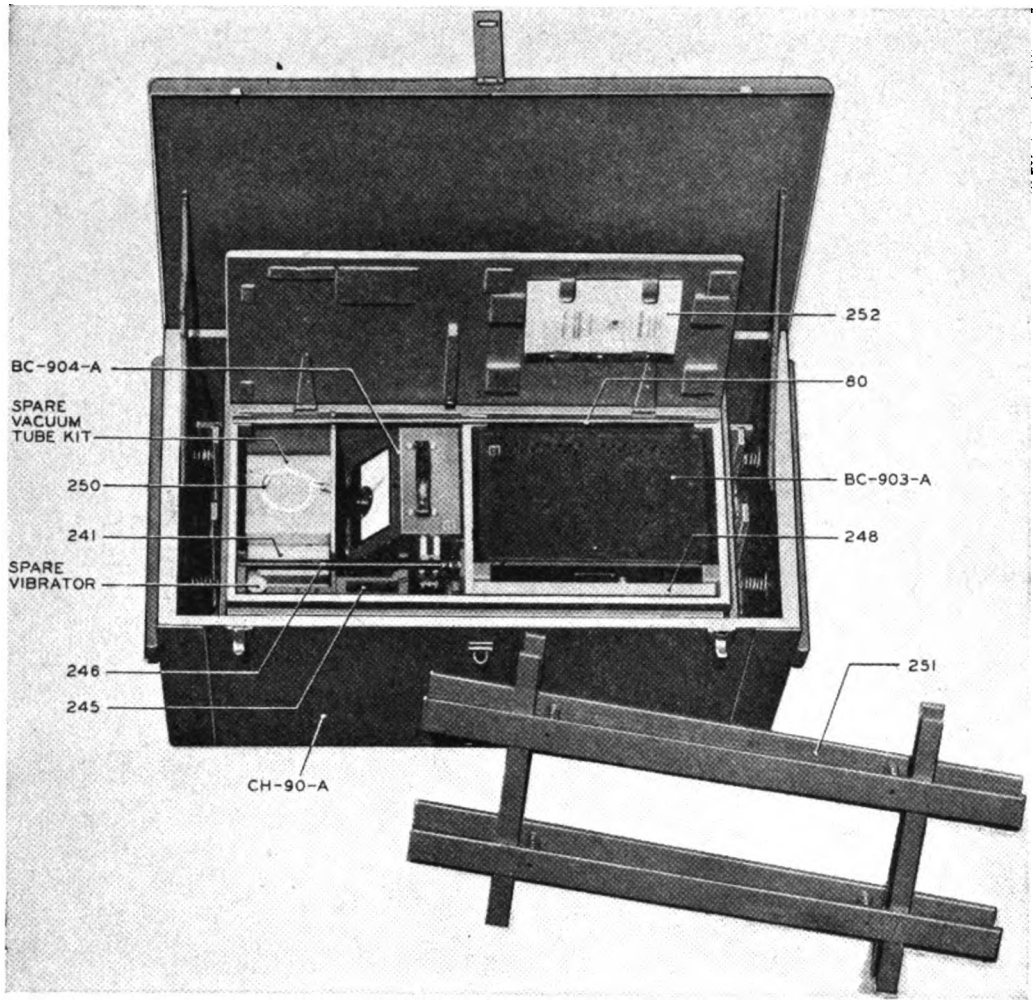


FIGURE 9

CHEST CH-90-A WITH CONTENTS

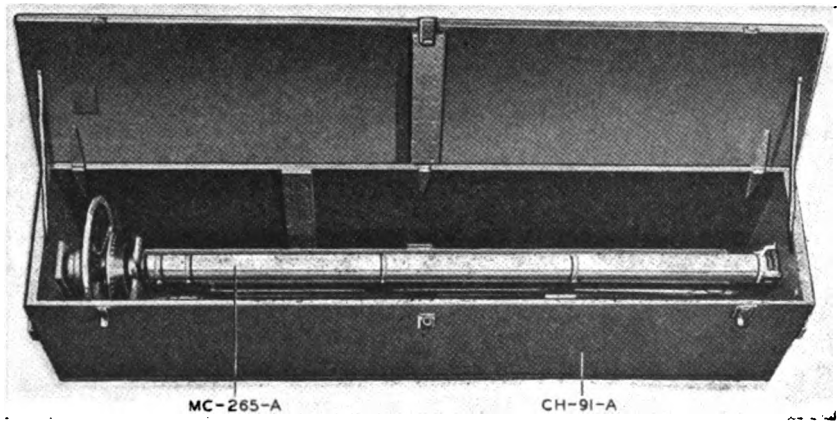


FIGURE 10

CHEST CH-91-A WITH CONTENTS

3. OVERALL DIMENSIONS,— EQUIPMENT INSTALLED,—

Height (at dipoles)	22½ ft.
Height (at center)	15 ft.
Beam spread (between dipoles)	24¾ ft.
Base	6 ft. x 6 ft.
Platform	6 ft. x 6⅛ ft.
Height of platform	8¼ ft.

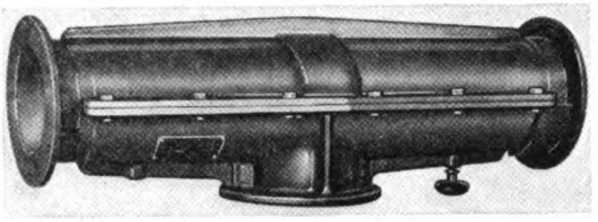


FIGURE 11
BEAM SOCKET MC-263-A

4. MAJOR COMPONENTS.

a. Tower TR-19-A

(1) The tower members are made of red oak. None of the disassembled portions of the tower exceeds 8 feet in length or 4 feet in width. Aluminum splice-castings and end castings are attached to the top upright members.

(2) The four platforms are made of red oak, and are supplied individually assembled. Two platforms (5PJ-110-21) and two platforms (5PJ-110-22) are supplied.

(3) The tower shelter consists of three plywood panels attached to heavy wooden frames for each of the two sides and back of the tower, and three panels and a door for the front of the tower. The door, and the panel containing the window are fastened together by means of hinges.

FIGURE 12
BEAM M-264-A

b. Rotating Beam and Transmission Line

The rotating beam houses and shields the antenna transmission line. The beam unit is made in three sections for convenience in transportation. The two Beams M-264-A slide into the center section of Beam Socket MC-263-A when the unit is assembled.

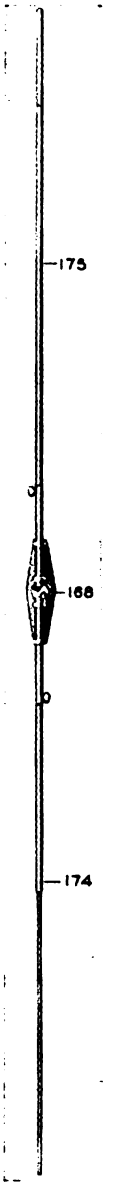


FIGURE 13
DIPOLE COLLECTOR AN-63-A

c. Dipole Collector AN-63-A

Each dipole collector consists of one fixed dipole element (175) and one adjustable dipole element (174), and a center mounting section (168).

d. Cabinet CS-95-A

The cabinet is made of aluminum. When mounted in position at the top of the tower, and with the cabinet doors closed and the protective cap (194) or rotating beam in place, the unit is weatherproof. Two handles are provided, one on each of two opposite sides, for carrying the

cabinet. A loudspeaker (242) is mounted under a protective cover on the floor of the cabinet.

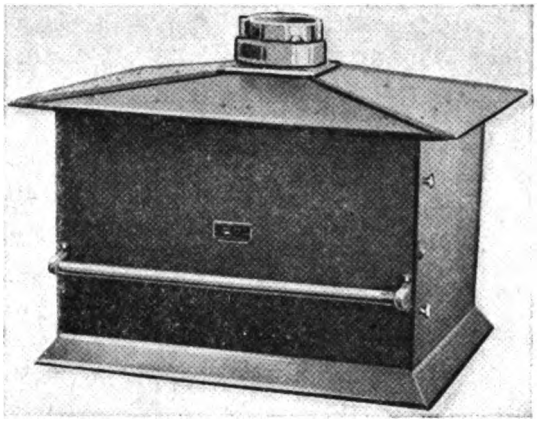


FIGURE 14
CABINET CS-95-A

e. Radio Receiver BC-903-A

The radio receiver is designed to operate from a 6-volt storage battery supply. The receiver is housed in a metal case having a hinged top cover and a detachable bottom cover. Remote operation of the controls marked TUNING, RANGE SELECTOR, VOLUME, and OPR. SWITCH is accomplished by means of shafts attached to the controls. To the shafts of these four controls extending from the front panel of the receiver are attached fittings (237 and 238) for coupling to the control shafts of Control Unit MC-265-A. Large threaded studs are attached to the four bottom corners of the receiver

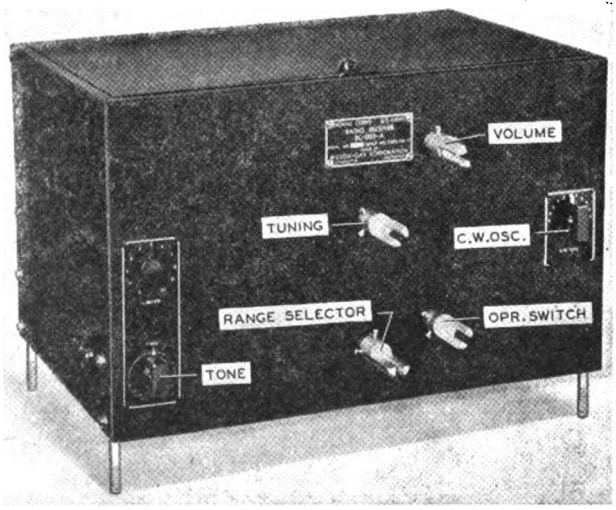


FIGURE 15
RADIO RECEIVER BC-903-A

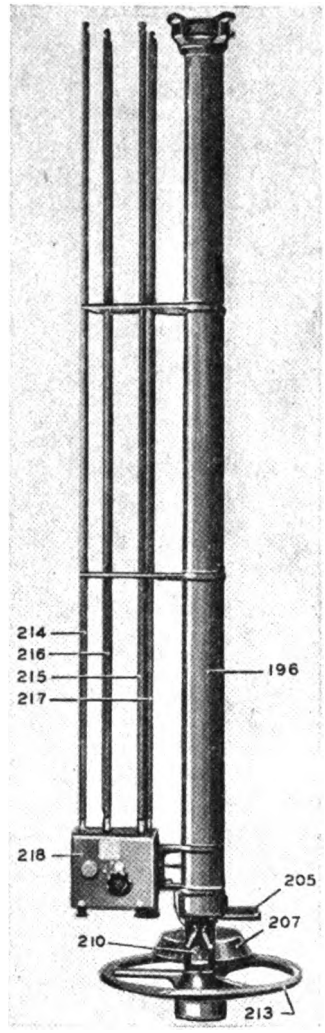


FIGURE 16
CONTROL UNIT MC-265-A

for mounting within the cabinet at the top of the tower.

f. Control Unit MC-265-A

The control unit is an assembly consisting mainly of a group of four phenolic control shaft extensions (214, 215, 216 and 217) for coupling to the controls of Radio Receiver BC-903-A; and an antenna control extension, including a central shaft (195), handwheel (213), azimuth scale (207), azimuth scale pointer (210) and compass mount (205). The central shaft housing (196), to which the control box (218) is attached, encloses the central shaft (195).

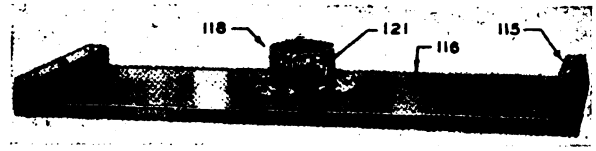


FIGURE 17
ANCHOR ASSEMBLY

g. Anchor Assembly

The anchor base (118) of the assembly serves as a bearing for the lower end of the control unit central shaft, as well as a brake control for the whole rotating antenna system. The anchor base is permanently attached to the anchor plate (116) member of the tower structure, the anchor plate serving as a bearing-support table.

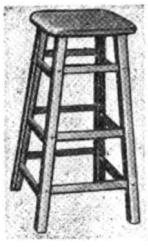


FIGURE 18
OPERATOR'S STOOL

h. Operator's Stool

The operator's stool (244) is constructed of wood. The glued tenon joints between the rungs and posts are reinforced with wood screws for rigidity.

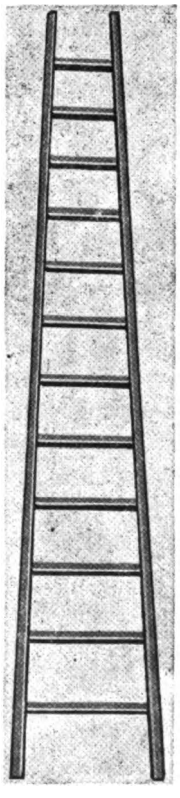


FIGURE 19
LADDER LC-55-A

i. Ladder LC-55-A

These ladders are constructed of wood, and are reinforced by means of brass tie-rods.

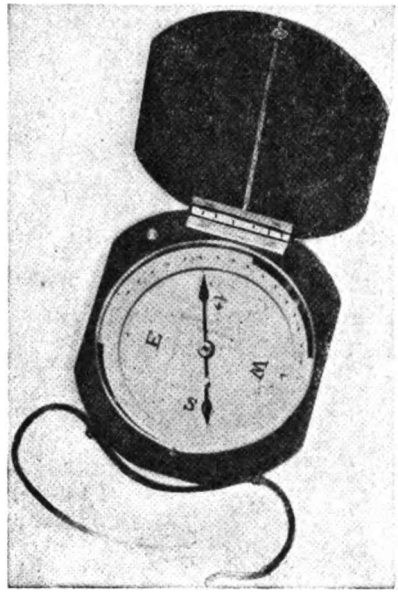


FIGURE 20
MAGNETIC COMPASS

j. Magnetic Compass

The scale of the magnetic compass (245) is graduated in degrees, counter-clockwise from 0 to 360, and is equipped with a jeweled center needle 2½ inches long. The compass is housed in an aluminum case having a hinged lid, and is equipped with an automatic needle stop so that with the lid closed the needle is held in a fixed position.

FIGURE 21
TELESCOPE

k. Telescope

The telescope (246) employs a five lens optical system, having a universal focus and a magnifying power of 4 diameters. The telescope is equipped with medium fine cross hairs .001" in diameter. The field of view is approximately 27 feet at 100 yards.

FIGURE 22

TELESCOPE AND COMPASS MOUNT

l. Telescope and Compass Mount

The telescope and compass mount (247) is made of aluminum, with a provision for clamping to one of the antenna beams.

FIGURE 23

SPIRIT LEVEL

m. Spirit Level

The spirit level (248) has an aluminum frame which embodies truss construction, and the top and bottom are milled parallel surfaces. Four glass-cover-protected "cat's eye" glasses are employed in the level, two of these constitute the double level at the center, and the other two are single plumbs at either end.

FIGURE 24

STORAGE BATTERY

n. Storage Battery

The 6-volt storage battery (249) is provided with non-spillable vent plugs. Wing-nut type terminals are provided for connection to the battery leads of the receiver. Two jumper leads (250) are furnished for connections between the two batteries.

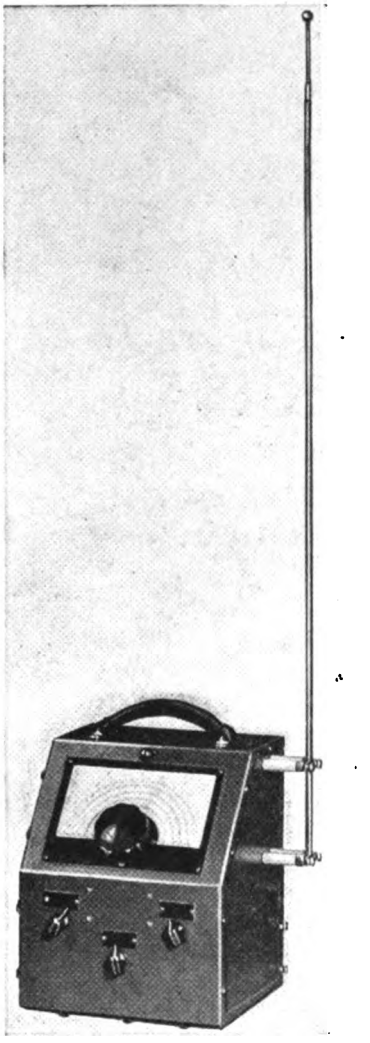


FIGURE 25

RADIO TRANSMITTER BC-904-A

o. Radio Transmitter BC-904-A

The radio transmitter is portable and is designed to be used as the Target Transmitter component of this equipment. It operates from a contained dry-battery voltage supply. The transmitter is housed in a metal case equipped with a leather carrying handle, and all controls are located on the front of the instrument. The battery compartment is located in the bottom of the instrument, and may be easily removed after the four knurled screws at the back of the case have been extracted. The telescoping type antenna (80) which is 36 inches long when collapsed and has a fully extended length of 8 feet, is supported on the stand-off insulators at the side of the transmitter case, and is secured to the supporting insulators by means of metal clamp bars and knurled screws.

p. Box BX-35-A (Refer to Figure 2)

(1) This box is used for transporting and storing two storage batteries (249). The three boxes, for accommodating the six batteries furnished with the equipment, are non-invertible types made from ¾" plywood, and are protected with acid-proof paint, inside and outside.

(2) Each box contains two lead-lined compartments, and is provided with a removable lead-lined cover. Carrying handles are provided at each end of the box.

q. Chest CH-81-A

(1) This chest is used for transporting and storing the disassembled parts of Tower TR-19-A listed in paragraph *2* and illustrated in Figure 3. The chest is in the form of a crate to minimize weight, and is constructed of hardwood. A hinged lid is provided with catches and a locking means, for use with a standard padlock.

(2) The various tower members are illustrated in groups, in the order in which they are contained within the chest. In repacking, the group shown nearest the chest is placed in the bottom, in the exact order illustrated. The group shown second from the chest is placed on top of the first group, and the remaining groups follow in a similar order.

r. Chest CH-82-A

(1) This chest is used for transporting and storing the disassembled parts of Tower TR-19-A listed in paragraph *2* and illustrated in Figure 4. The chest is a crate type, with a hinged lid provided with catches and padlock hasp.

(2) The contents of the chest are shown in the illustration in the order in which they are contained within the chest. In repacking the chest, one of the Platforms 5PJ-110-22 is placed in the bottom, in the exact position shown. The two Platforms 5PJ-110-21 are next placed in the chest in the order and positions shown. The remaining Platform 5PJ-110-22 is next placed in the chest with the two packing cleats positioned as shown at the left of the platform.

(3) The anchor plate 5PJ-110-16 with anchor base and mounting cleats attached is placed within the chest between the packing cleats. The contents of the chest are prevented from shifting by means of the method used for placing the two Platform Rails 5PJ-110-9 within the chest. One of these rails is shown attached to the back of the chest by means of bolts. The remaining Platform Rail 5PJ-110-9 is attached to the inside front of the chest in a similar manner.

s. Chest CH-83-A

(1) This chest is used for transporting and storing parts of the rotating antenna system listed in paragraph *2* and illustrated in Figure 5. The chest is a completely enclosed type constructed of hardwood and weatherproof plywood, and is provided with a hinged lid with catches and a padlock hasp. Carrying handles are provided at the opposite ends of the chest.

(2) The various antenna parts are shown in position within the chest. The Beam Socket MC-263-A and the two dipole mounting bases (168) are secured to the bottom of the chest by means of threaded studs and nuts. Provision is made in the lid of the chest, for storing the telescoping dipoles (174) and the fixed dipoles (175). The two Beams M-264-A fit into recessed partitions in the base of the chest, and with the lid closed, are held securely in position.

t. Chest CH-84-A

(1) This chest is used for transporting and storing Cabinet CS-95-A and the four guying ropes (240) listed in paragraph *2* and illustrated in Figure 6. The chest is a completely enclosed type, constructed of hardwood and weatherproof plywood. The hinged lid is provided with catches and a padlock hasp. Carrying handles are provided at the opposite ends of the chest.

(2) Padded packing frames, the upper ends of which may be seen in the illustration, are placed on the opposite sides of the cabinet to hold it securely within the chest. The cabinet is secured to a bottom shipping frame by means of threaded studs and wing-nuts. The wing-nuts used for this purpose are of the same type as are used to hold Radio Receiver BC-903-A in position in

Cabinet CS-95-A during normal use of the equipment.

(3) In repacking Cabinet CS-95-A, the bottom shipping frame should be secured to the cabinet bottom, the side frames placed in position on the cabinet, and the unit as a whole lowered into the chest.

(4) The four guying ropes (240), arranged in coils as illustrated, should be placed on top of the cabinet within the chest.

u. Chest CH-85-A

(1) This chest is used for transporting and storing parts of Tower TR-19-A, and the set of hand tools listed in paragraph 2, and illustrated in Figure 7. The chest is a completed enclosed type, constructed of hardwood and weatherproof plywood. The hinged lid is provided with catches and a padlock hasp. Carrying handles are provided at the ends of the chest.

(2) The portable tool tray, contained within the chest, is removable and is provided with a carrying handle.

(3) The large compartment at the rear of the chest is for accommodating the various tower members indicated in the illustration. As these parts are of nearly the same dimensions, no specified order for placement within the chest compartment need be followed. Other tower members, as indicated, are stored in the forward compartments at the left and right ends of the chest. Miscellaneous bolts, nuts, washers, etc., are contained within the ten small compartments near the right end of the chest. Separate compartments are provided for the hook bolts (127) and the ground stakes (239).

v. Chest CH-86-A

(1) This chest is used for transporting and storing the wooden panels which constitute the tower shelter. The various panels are listed in paragraph 2 and are illustrated in Figure 8. The chest is of crate type construction, and is provided with a hinged lid having clasps and a padlock hasp. Carrying handles are provided at opposite ends of the chest.

(2) The panels are shown in the illustration in the order in which they are contained within the chest. In repacking the chest, Panel 5PJ-110-27 shown immediately under the chest illustration is placed in the bottom in the exact position shown. The remaining panels are placed within the chest, singly or in groups as the case may be, in the order shown, progressing downward in each row of panels illustrated.

w. Chest CH-90-A

(1) This chest is used for transporting and storing the component and spare parts listed in paragraph 2 and illustrated in Figure 9. The chest is a completely enclosed type provided with a hinged lid having clasps and a padlock hasp. Carrying handles are provided at the opposite ends of the chest.

(2) An inner chest, suspended within Chest CH-90-A by means of shock absorbing packing frames, provides the actual housing for the various parts listed. A shock absorbing top packing frame (251), shown in the illustration, is placed between the lids of the inner and outer chests, so that with the outer lid securely closed the sensitive instruments contained within the inner chest are protected against damage which may be caused by rough handling.

(3) The large compartment at the right is for accommodating Radio Receiver BC-903-A. Radio Transmitter BC-904-A is placed just to the left of the center partition of the chest. The compartment at the left contains the spare tube kit, on top of which may be seen the two battery jumper leads (250). The headset (241), packed in a cardboard container, is placed in the same compartment with the spare tube kit. The telescope-compass mount (247) is shown in the illustration, as it is placed in the bottom of the chest just forward of Radio Transmitter BC-904-A. The telescope (246), transmitter antenna (80), magnetic compass (245), spirit level (248) and the spare vibrator, are placed in recesses provided in the chest, as shown in the illustration. Clips are provided on the inside of the inner lid for storing two instruction books (252).

x. Chest CH-91-A

(1) This chest is used for transporting and storing Control Unit MC-265-A listed in paragraph 2 and illustrated in Figure 10. The chest is a completely enclosed type provided with a hinged lid having clasps and a padlock hasp. Carrying handles are provided at the opposite ends of the chest.

(2) Control Unit MC-265-A is placed in the chest with the control end of the unit toward the left as illustrated.

SECTION II

EMPLOYMENT

5. INITIAL PROCEDURE,—

a. Location of Radio Direction Finder

(1) In selecting a site for the erection of the Radio Set SCR-255 (Direction Finding), it should be realized that the nature of the area in the immediate vicinity of the equipment has a definite relation to the accuracy of the bearings to be taken. Locate the radio set as far as conveniently possible and at least 300 feet from surrounding objects such as buildings, trees, wire fences, overhead wires, etc., also from roads or other passageways which are subject to travel, and areas used for accommodating other personnel or equipment. **The ground immediately surrounding the installation must be level for a distance of at least 15 to 20 feet from the base of the tower.**

(2) The tower, when erected, should be so positioned that the entrance side faces South. General directions may be determined by use of the magnetic compass (245) furnished with this equipment.

(3) Set the tower squarely upon a **firm and solid foundation.** Regardless of terrain, the central shaft (176) extending through Cabinet CS-95-A must be truly vertical. (See par. *7a).* In order for this condition to exist, points of contact between the tower and the ground or other foundation should be in a level plane. For a permanent installation particularly, use a cement foundation of adequate proportions, to prevent uneven settling of the tower under all conditions. If separate foundations are used at the four corners of the tower, arrange these to form the corners of a square and space them 5 ft. 9 in. between their centers.

b. Unpacking

(1) Place Chest CH-85-A near the site selected for erection of the direction finder. This chest contains the hand tools and hardware that will be used in assembly of the equipment.

(2) Remove all of the wooden tower parts from Chests CH-81-A, CH-82-A and CH-85-A, separating the various parts into four groups as marked, E. for East, W. for West, N. for North, and S. for South.

(3) Unpack the parts contained in the remaining chests and boxes, as required in the process of equipment assembly, or remove them from their respective chests at this time. In unpacking Chest CH-90-A, however, only Radio Receiver BC-903-A will be required for the initial equipment installation. **Important:** Upon removing the radio receiver from the chest, remove the wing-nut from the left end of the receiver case. The movable coil rack within the receiver is held in place during transportation by this wing-nut. Retain the wing-nut for future use by placing it on the threaded stud provided on one of the partitions of Chest CH-90-A, in which the receiver is contained during transportation.

(4) Unpacking Chest CH-86-A. Separate the tower panels into four groups as marked for the four sides of the tower, i.e., E. for East, W. for West, N. for North and S. for South.

6. INSTALLATION,—

a. Assemble EAST and WEST Sides of Tower

(1) Refer to Figure 26. Assemble the East and West sides of the tower as individual units, in a horizontal position on the ground. Observe that all of the tower members are labeled with part numbers as well as other numbers which designate junction points for two or more of the members. Select bolt sizes in accord with the bolt legend accompanying the illustrations. **Place a flat washer under the head of each hex bolt only,** also under each nut for all bolts. Turn the nuts snugly against the washers, but do not tighten them securely until after the tower has been completely assembled, and Cabinet CS-95-A has been mounted on top of the tower.

(2) The anchor assembly (117) is shown in the illustrations only to clarify its position in the completed tower. Do not attach this part until called for in paragraph *6g.*

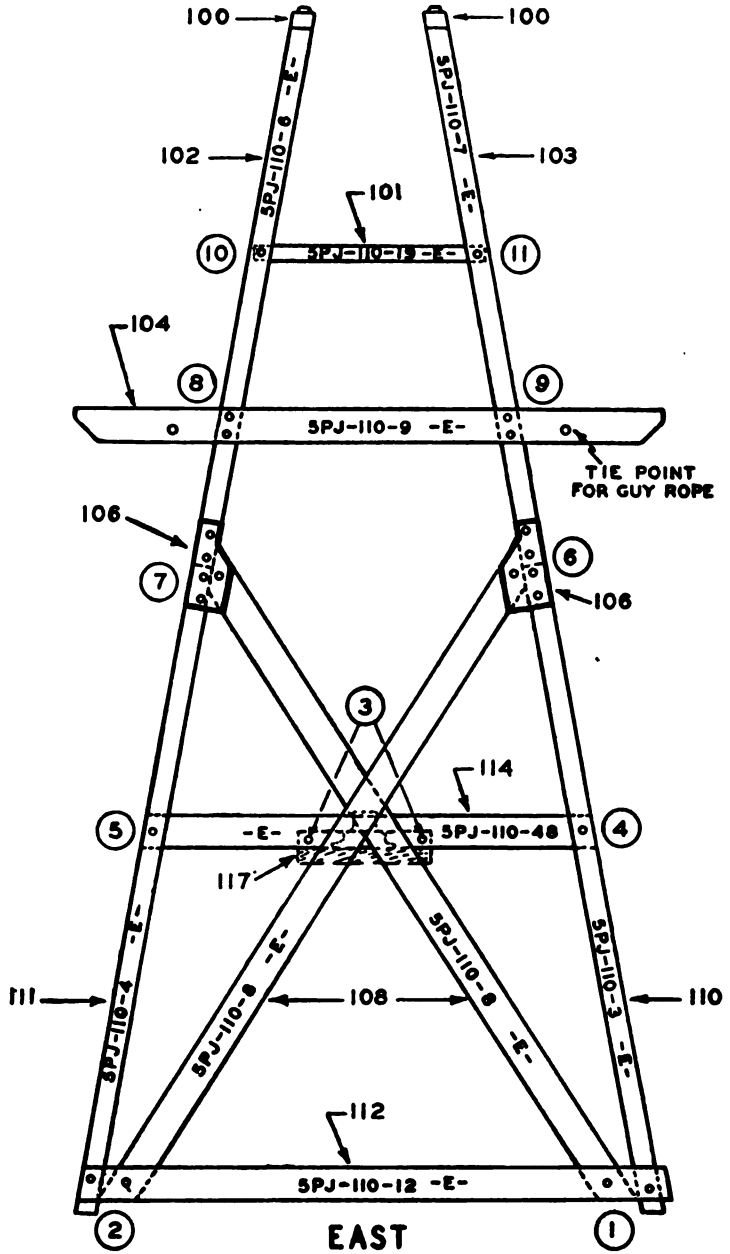


FIGURE 26

ASSEMBLY OF TOWER TR-19-A,—EAST AND WEST SIDES

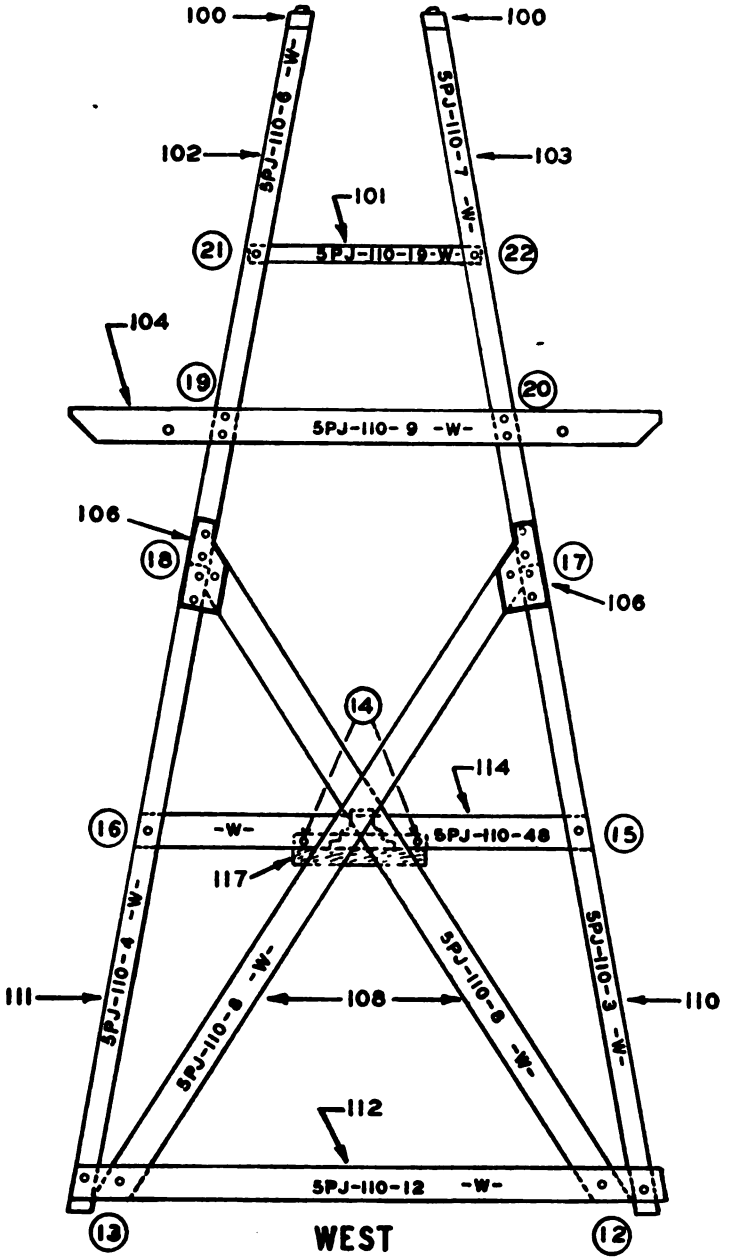
BOLT LEGEND

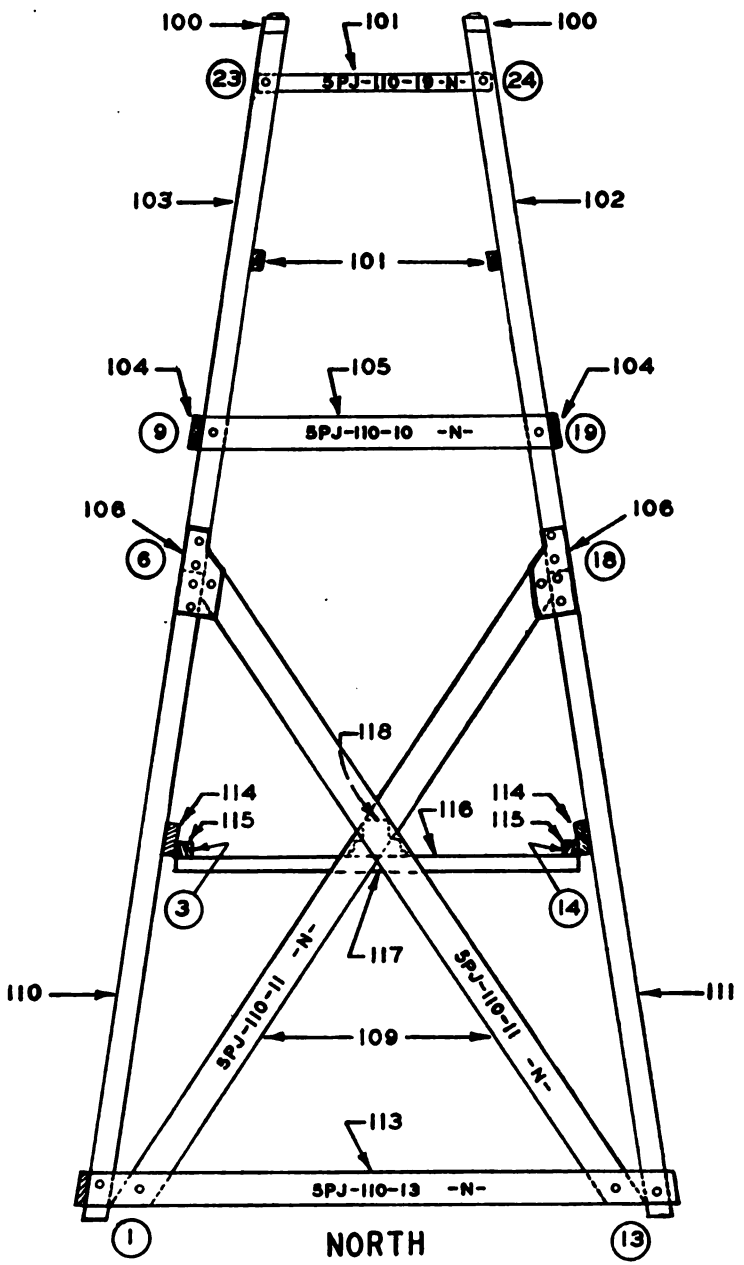
F.H. —Flat Head

HEX.—Hex. Head

C.B. —Carriage Bolt

Junction	*Bolt*
1	4¾" HEX. 2¾" HEX.
2	4¾" HEX. 2¾" HEX.
3	3¾" HEX.
4	4¾" F.H.
5	4¾" F.H.
6	3½" F.H. 1¾" F.H.
7	3½" F.H. 1¾" F.H.
8	4¾" HEX.
9	4¾" HEX.
10	4½" F.H.
11	4½" F.H.
12	4¾" HEX. 2¾" HEX.
13	4¾" HEX. 2¾" HEX.





BOLT LEGEND

F.H. —Flat Head
HEX.—Hex. Head
C.B. —Carriage Bolt

Junction	*Bolt*
14	3¾" HEX.
15	4¾" HEX.
16	4¾" F.H.
17	3½" F.H. 1¾" F.H.
18	3½" F.H. 1¾" F.H.
19	4¾" HEX.
20	4¾" HEX.
21	4½" HEX.
22	4½" F.H.
23	4½" F.H.
24	4½" F.H.
25	4½" F.H.
26	4½" F.H.

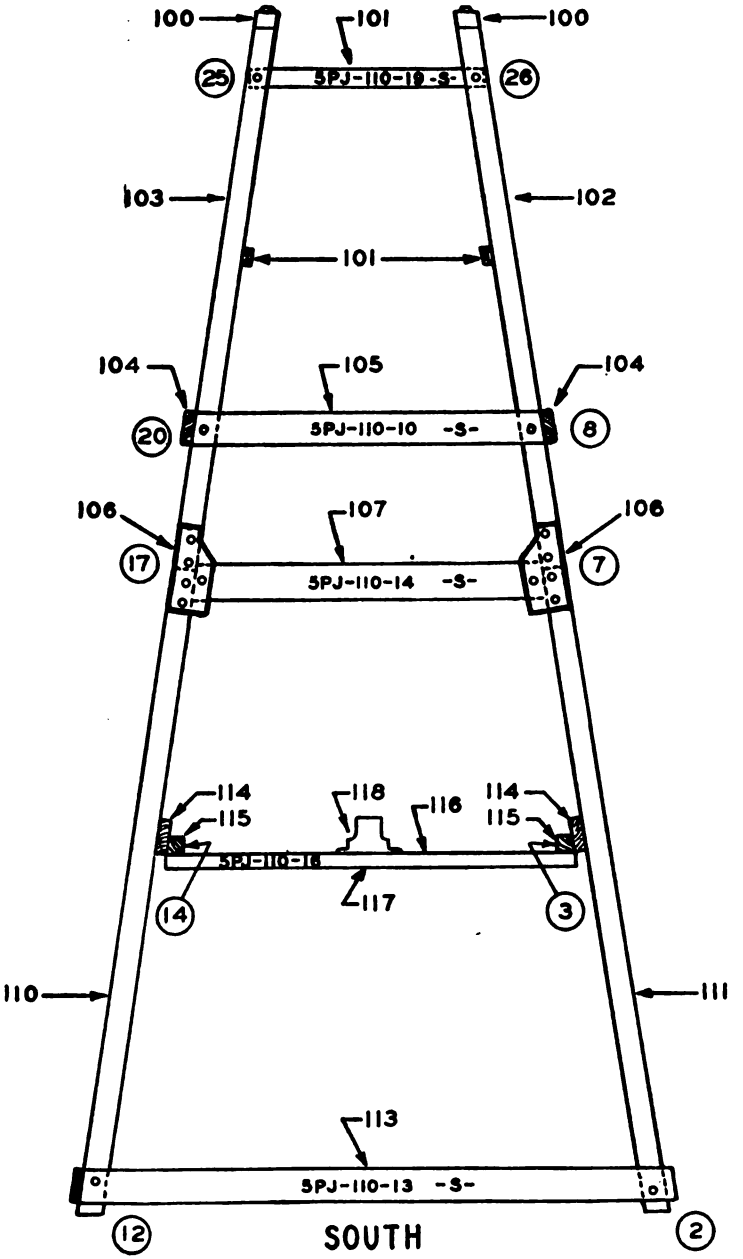


FIGURE 27
ASSEMBLY OF TOWER TR-19-A,—NORTH AND SOUTH SIDES

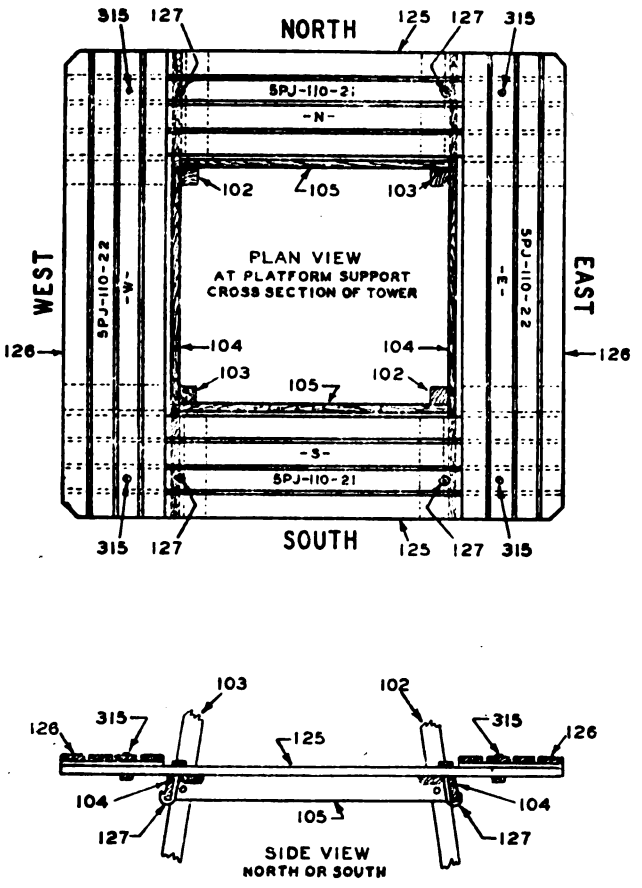


FIGURE 28

PLATFORM ASSEMBLY

b. Join EAST and WEST Sides of Tower. (Refer to Figure 27).

(1) Raise the two tower sides to a vertical position with their bases parallel and separated by approximately six feet.

(2) Attach the base rails (113).

(3) Attach the cross braces (109).

(4) At this point in its assembly, the structure is sufficiently rigid and self-supporting so that assembly crew members may climb up the tower to attach platform cross rails (105) and top rungs (101).

c. Attach Platform

(1) The platform is composed of four sections, as illustrated in the "plan view," see Figure 28.

(2) Place the platforms (5PJ-110-21) across the support rails (104) extending from the North and South sides of the tower.

(3) Place the platforms (5PJ-110-22) across the ends of platforms (5PJ-110-21) extending from the East and West sides of the tower.

(4) Join the platform sections by means of four carriage bolts (315) and secure the platform to the tower support rails with hook-bolts (127) shown in Figure 28.

(5) Before tightening the nuts on the hook-bolts, make sure that the clearance between the platform and tower is about equal on all four sides, otherwise, the shelter panels to be attached later may not fit properly.

d. Mount Cabinet CS-95-A

(1) Place the Cabinet CS-95-A on top of the tower, in the position illustrated in Figure 29, observing the correct orientation marked on the cabinet.

(2) Use four machine screws (100-1), and four countersunk flat washers (100-2) for mounting the cabinet.

(3) Now tighten all tower assembly bolts, securely.

e. Mount Radio Receiver in Cabinet CS-95-A

(1) Make sure the wing-nut has been removed from the left end of the receiver case. Refer to paragraph 5*b* (3).

(2) Open the hinged door on the west side of the cabinet and place Radio Receiver BC-903-A in position, as illustrated in Figure 29.

(3) Hold the receiver in this position. Have an assistant secure the receiver to its mount by means of four wing-nuts (313). These wing-nuts were used in shipping, to secure Cabinet CS-95-A to the bottom shipping form of Chest CH-84-A.

f. Install Control Unit

(1) Carry Control Unit MC-265-A upper end foremost into the tower, entering the South side of the tower.

(2) Raise the control unit perpendicularly so that the control shafts (214, 215, 216 and 217) are in line with the controls on the radio receiver. In this position, the control box panel and the azimuth scale window will face the South side of the tower.

(3) Attach the central shaft housing of the control unit to the bottom of the cabinet, by use of four nuts (305) and lockwashers (321). Refer to Figure 29.

(4) Couple the central shaft of the control unit to the central shaft of the cabinet by

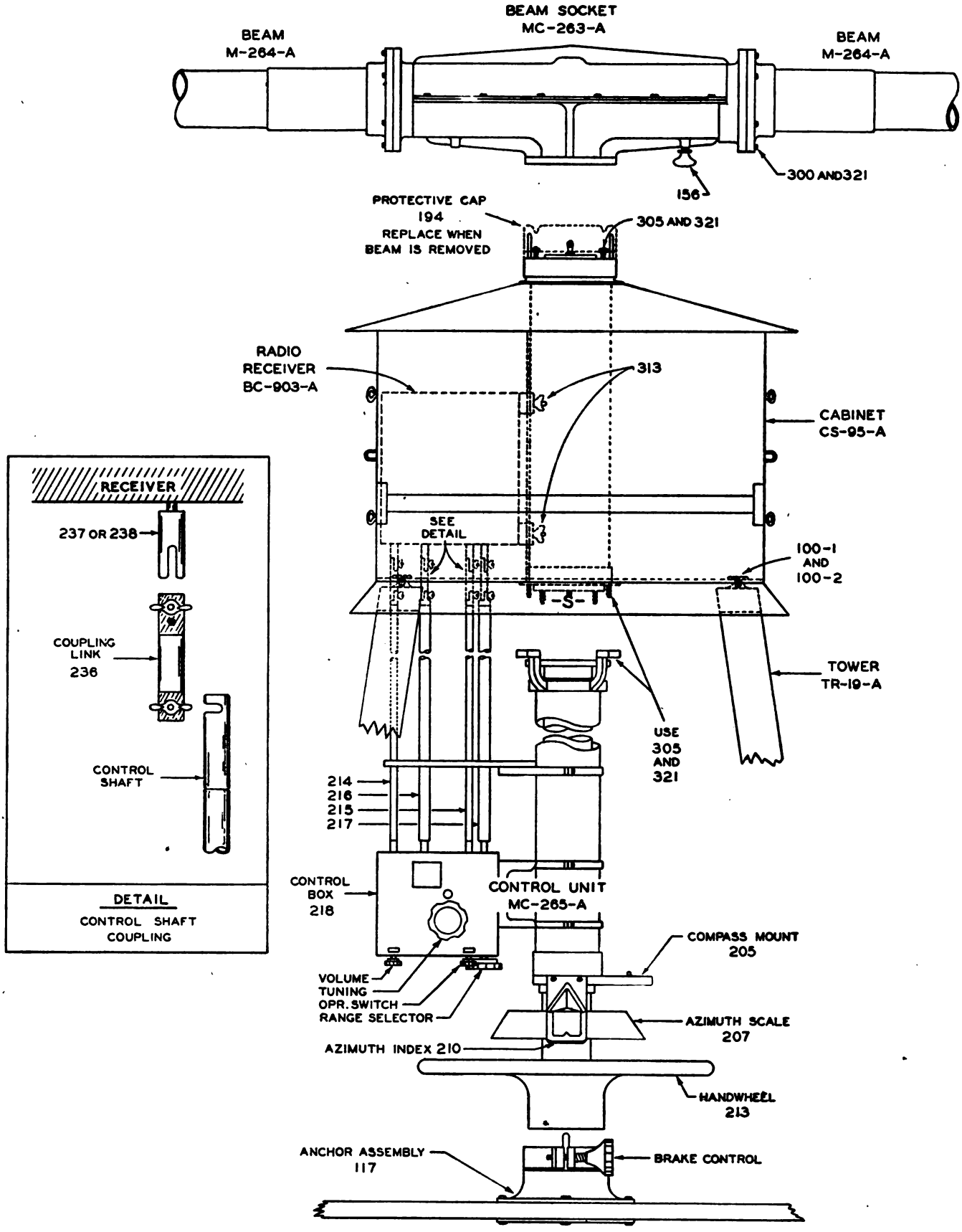


FIGURE 29

GENERAL ASSEMBLY OF COMPONENTS

means of four hex nuts (305) and lockwashers (321). Refer to Figure 29. Observe that the alignment pin and hole are properly engaged before tightening nuts.

g. Install Anchor Assembly

(1) Expand the brake-shoe of the anchor base (118) by turning the brake control (121) counter-clockwise. Refer to Figure 29.

(2) Install the anchor assembly (117) in the position illustrated in Figures 26 and 27, observing that the brake drum properly engages the brake-shoe.

h. Attach Control Shafts to Receiver Controls

(1) The detail drawing in Figure 29 illustrates the means by which the control shafts (214, 215, 216 and 217) of Control Unit MC-265-A are coupled to the control extensions of Radio Receiver BC-903-A.

(2) Attach coupling links (236) to each of the receiver control extensions (237) and (238). Loosen the wing-nut at the long flat end of the coupling link, and inserting this end of the link through the opening in the bottom of Cabinet CS-95-A, so that the coupling link engages the receiver control extensions with their flat sides together. Then, with the door open on the West side of the cabinet, tighten the wing-nut by reaching the hand under the receiver.

(3) Turn the volume control of the receiver (Refer to Figure 15) to minimum volume position, (extreme counter-clockwise position). Coordinate the setting of the volume control on the control box (Refer to Figure 29) and attach the volume control shaft (214) to the coupling link.

(4) Turn the operating switch of the receiver (Refer to Figure 15) **off** (extreme counter-clockwise position). Coordinate the setting of the operating switch on the control box (Refer to Figure 29) and attach the switch control shaft (215) to the coupling link.

(5) Observe the indexed setting of the range selector mechanism in the radio receiver. This may be accomplished by raising the lid of the radio receiver and viewing the index letter A, B, C, D or E which appears in one of the two large openings, one on either side of the variable tuning capacitor (C1, C2, C3) in the receiver chassis as shown in Figure 48. **Make sure that the range selector mechanism in the receiver is positively engaged in one of its five operating positions, under which condition the index letter will appear to be well centered in the viewing hole. This may be determined by "feel" when rotating the range selector control extension of the receiver, by hand.**

(a) Coordinate the setting of the range selector control (231) on the control box (Refer to Figure 29) so that the corresponding index letter is indicated by the range selector pointer (225) on the dial (226), and attach the range selector control shaft (217) to the coupling link.

(6) Turn the rotor of the variable tuning capacitor (C1, C2, C3) in the receiver so that the index (600) finger is in line with the index pointer mounted on the front frame of the variable capacitor unit as illustrated in Figure 48. Then, coordinate the setting of the tuning control on the control box (Refer to Figure 29) so that the 0-1000 scale reads 600, and attach the tuning shaft (218) to the coupling link.

i. Assemble the Antenna

(1) Lay out the component parts for the beam and dipole antenna assembly on the ground, in the relative positions shown in Figure 30.

(2) Loosen the clamp screw (156) on Beam Socket MC-263-A, and rotate the inner sleeve (154) of the beam socket so that the key-ways in either end of the sleeve are in line with the keys on the beams. Then tighten the clamp screw.

(3) Assemble the two beams M-264-A to the Beam Socket MC-263-A.

(4) Elevate the assembled beams and beam socket in a horizontal position above the ground (not less than 24 inches) using any means of substantial support available. Place the supports under the beams about 24 inches from either end of the beam socket. **Do not allow the flanged base of the beam socket to rest upon the ground. Make sure that all flanged fittings and electrical plugs and socket connections are clean, and free from dirt or other foreign particles, before completing the assembly.**

(5) Assemble the dipole mounting bases (168) to the two Beams M-264-A, then rotate the whole assembly so that the dipole sockets (170) are vertical.

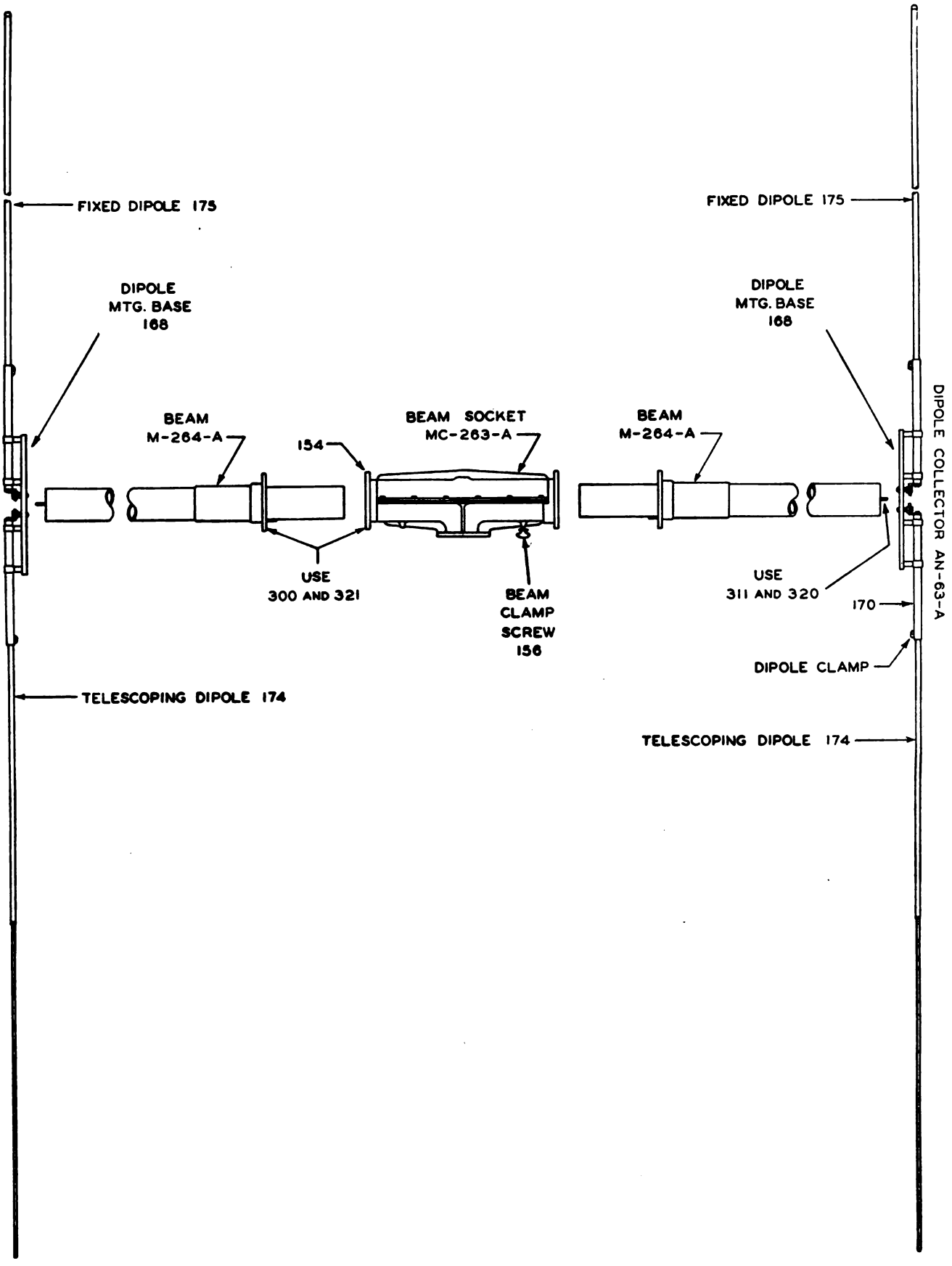


FIGURE 30

ANTENNA SYSTEM ASSEMBLY

(6) Insert the fixed dipoles (175) in the upper sockets (170) of each mounting base. Make sure that the dipoles go to the bottom of the sockets. Then tighten the dipole clamp wing-screws.

(7) After the two fixed dipoles (175) are in place, retire to a distance of about fifty feet, in line with the dipoles, and give directions to an assistant for the alignment of the dipoles so that both fixed dipoles are in the same plane. Alignment adjustments may be made by loosening the wing-nuts (311) which secure the dipole mounting bases (168) to the beams. **Vertical alignment of the dipoles, viewed from a position off the ends of the beams as described above, is important.** Vertical positions of the dipoles, viewed from a position broadside to the beams, however, is not of such great importance.

(8) Rotate the whole assembly so that the upper dipoles are horizontal and insert the telescoping dipoles (174) in the lower dipole sockets of the mounting bases (168). Tighten the clamp screws and extend the adjustable dipole elements to full length.

j. Mount Antenna Assembly on Cabinet CS-95-A

(1) Remove Protective Cap (194) from the cabinet top.

(2) By means of two ladders (243) placed against the East tower platform, two men (one on each ladder) carry the assembled antenna to the top of the tower, and attach the assembly to the top of the cabinet. Use the same nuts and lockwashers which were used to hold the protective cap in place.

(3) It may be found desirable to position the dipoles horizontally, to get them "out of the way" while completing the tower assembly. This may be done by loosening the beam clamp screw (156) and turning the beams in the beam socket.

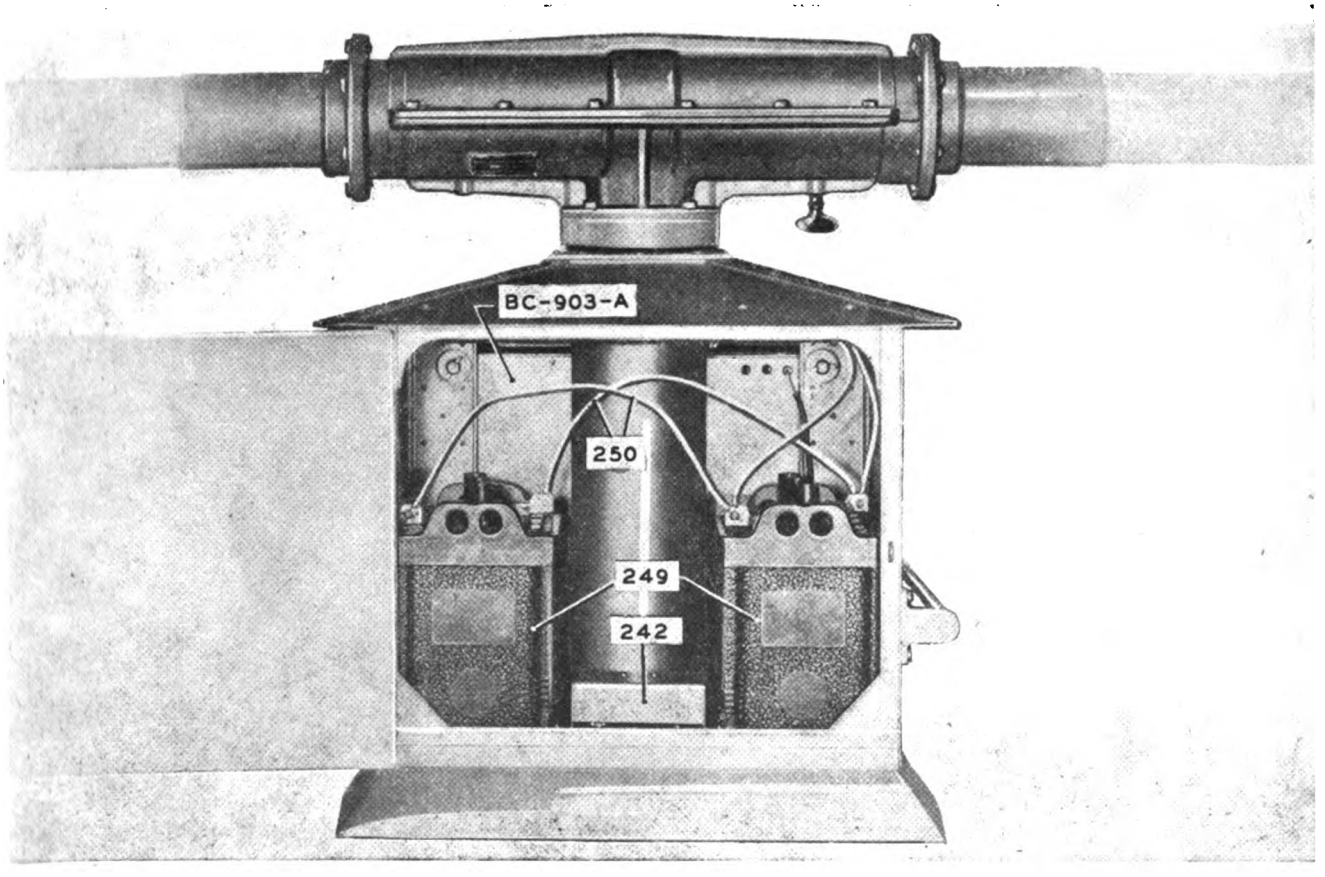


FIGURE 31

INTERIOR VIEW OF CABINET CS-95-A

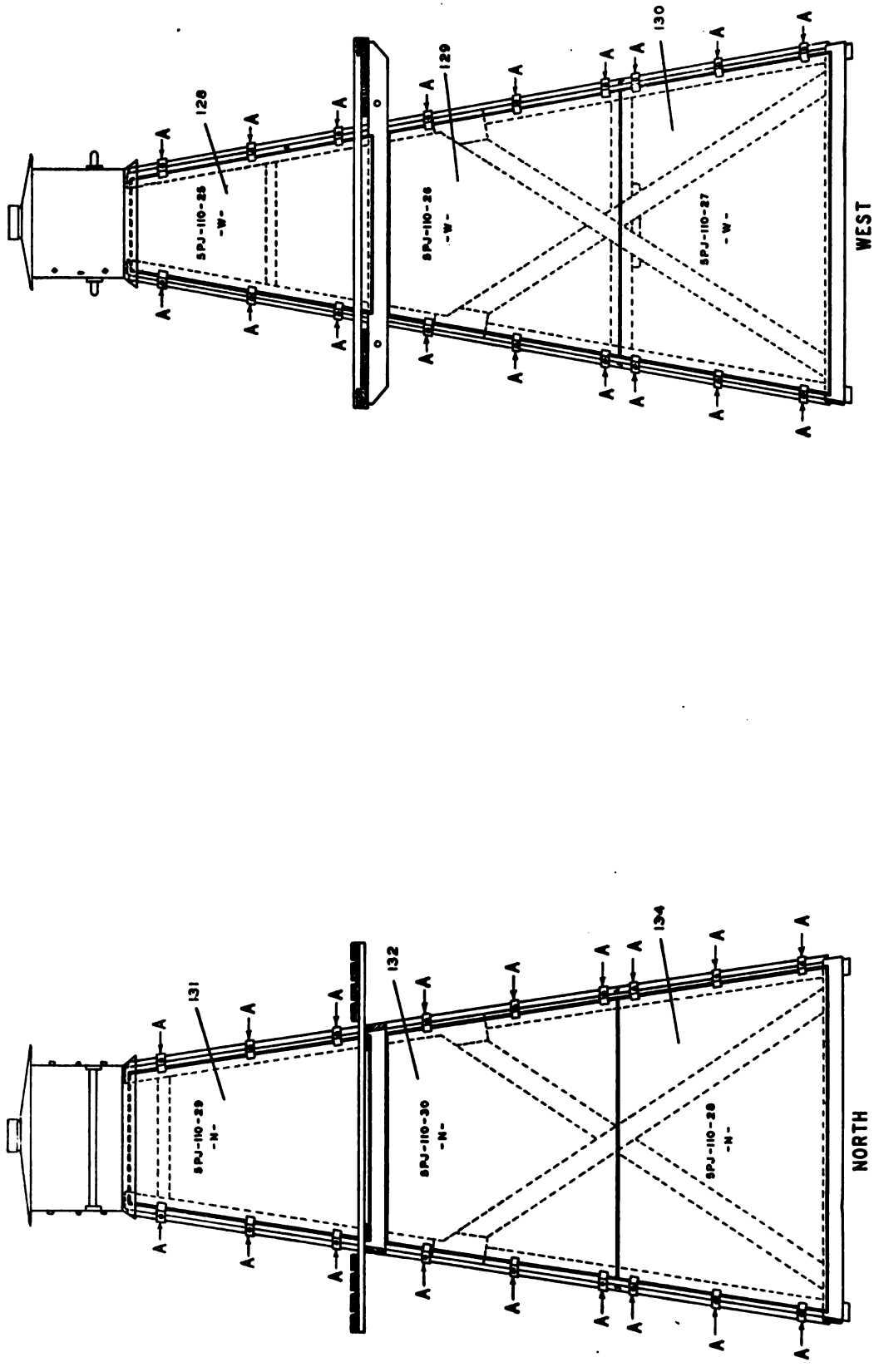


FIGURE 32

INSTALLATION OF TOWER PANELS,—NORTH AND WEST SIDES

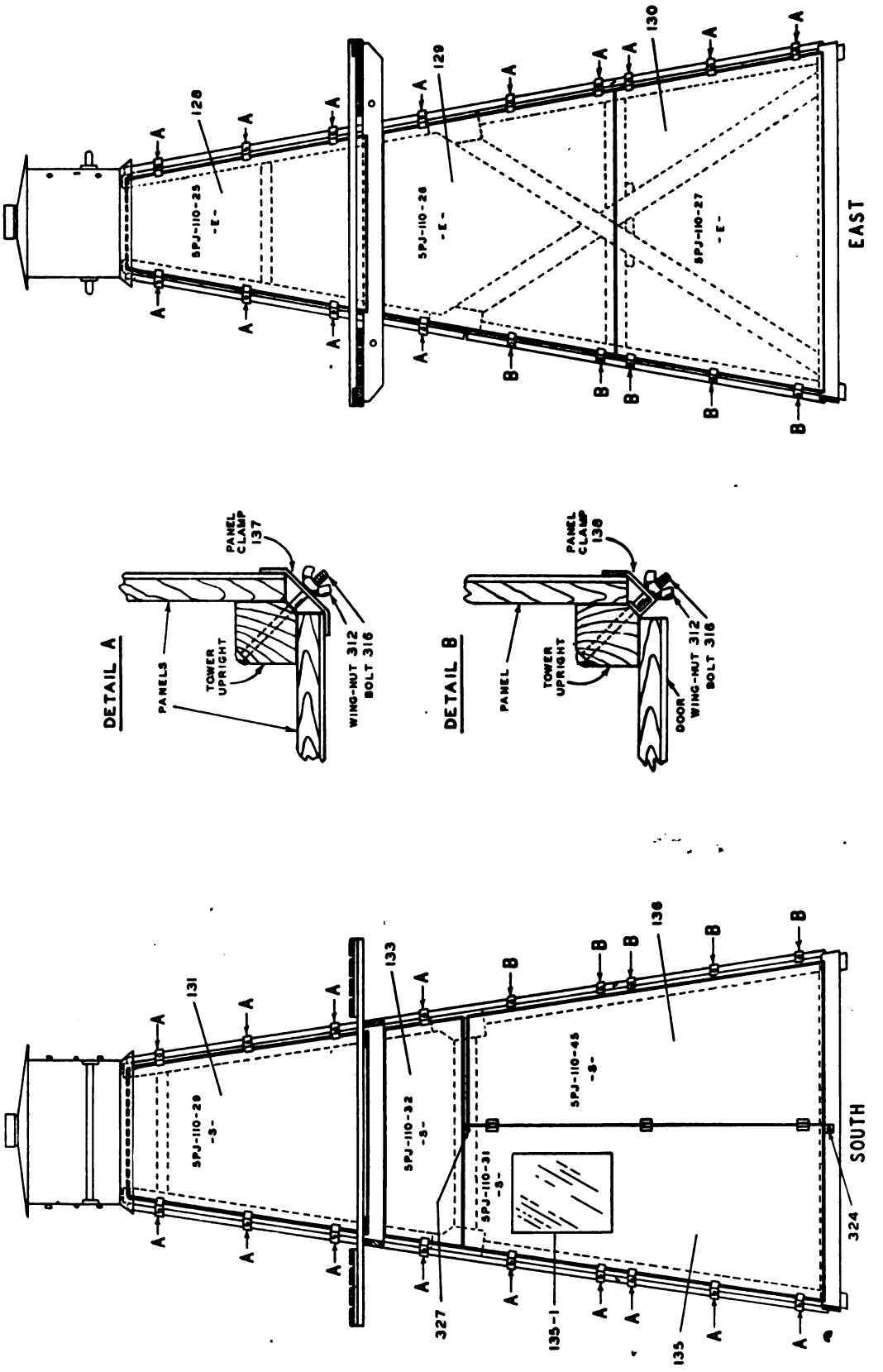


FIGURE 38

INSTALLATION OF TOWER PANELS,—SOUTH AND EAST SIDES

k. Complete All Electrical Connections.

(1) **Antenna to Radio Receiver.** Two flexible leads (190) (Figure 45) are attached to the terminals at the opening in the West side of the vertical column within Cabinet CS-95-A. Connect them to the antenna binding posts on the radio receiver chassis. Open the East cabinet door, and reach around the central column to place the leads in the binding posts.

(2) **Batteries to Radio Receiver.** Open the East cabinet door of Cabinet CS-95-A and install two 6 volt storage batteries (249) in the spaces provided for them on either side of the loudspeaker (242) as illustrated in Figure 31. Connect the two batteries in parallel (+ to + and — to —) by means of battery jumper leads (250). Battery connections to Radio Receiver BC-903-A may be of either polarity.

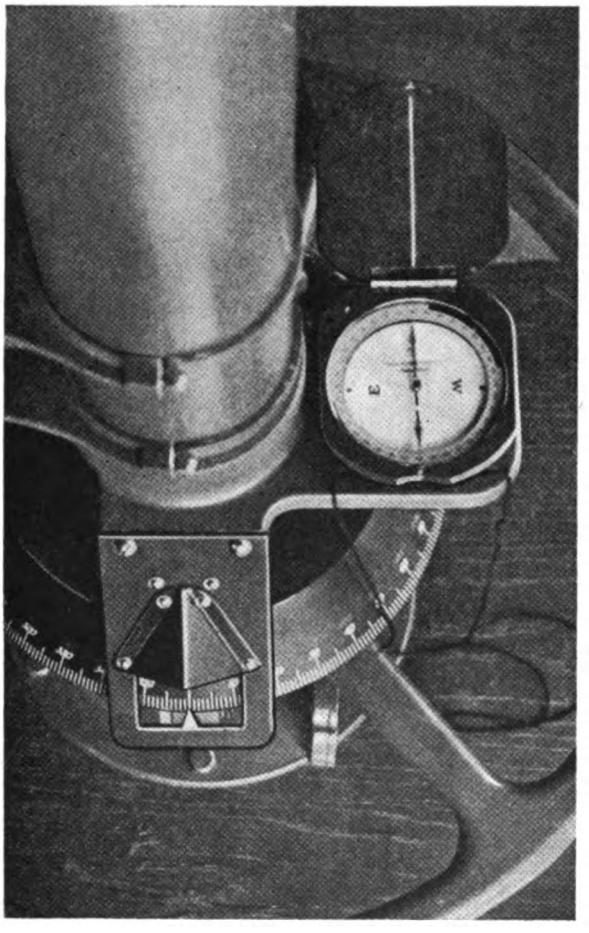


FIGURE 34

CONTROL POSITION
Showing Use of Magnetic Compass

(3) **Connecting the Loudspeaker to the Radio Receiver.**

(a) Insert Plug PL-55 (200) of the loudspeaker into the jack labeled SPEAKER on the radio receiver.

l. Attach Tower Panels.

(1) All panels are labeled with their respective part numbers indicated in Figures 32 and 33, as well as the letter N, S, E or W for proper orientation. Thirty-one panel clamps (137) illustrated in Detail A of the drawings and five panel clamps (138) illustrated in Detail B are required. A total of thirty-six carriage bolts (316) and wing-nuts (312) are used in attaching the panels.

(2) All the top panels should be attached first. Stand on the tower platform, and have an assistant on the ground raise the panel up along the side of the tower, so that the upper end of the panel is inserted in the clearance space between the tower and the platform. Then, raise the panel into position, so that the bottom of the panel frame rests on the platform support rail (104) or the platform cross rail (105) of the tower. The lower edge of the top panels will overlap the platform rails about ¼ inch.

(3) The bottom panels should be attached next. Allow the bottom of the panel frame to rest on the base rail of the tower. The lower edge of the bottom panels will overlap the base rails about ¼ inch.

(4) Attach the center panels last. The top edge of the center panels will overlap the inside of the platform rails about ¼ inch, and the lower edge of the center panels will slightly overlap the top frame of the bottom panels.

7. PREPARATION FOR USE,—

a. Check Vertical Alignment of the Central Shaft

(1) The central shaft (176) in Cabinet CS-95-A is secured perpendicularly to the rotating beam assembly at the beam center. In order for the beam to rotate in a truly horizontal plane, the central shaft must be truly vertical or plumb. This condition may be checked by placing the spirit level (248) lengthwise against the central shaft housing (177). (Refer to Figure 45). Vertical align-

ment of the central shaft may be attained by placing blocks or shims under the tower legs indicated as being low, or by removing earth from under the tower legs indicated as being high.

b. Frequency Dial Adjustment

(1) Any slippage of the frequency dial (221) on its shaft, due to vibration or other causes, may be corrected by releasing the two set screws (352) on the dial drum hub, illustrated in Figure 35. If such correction is found necessary, proceed as follows:

(a) Loosen set screws on dial drum hub.

(b) Rotate the tuning control knob (230) (See Figure 29) so that the index finger secured to the rotor of the variable tuning capacitor (C1, C2, C3) in the receiver, is in line with the index pointer mounted on the front frame of the tuning capacitor unit. Refer to Figure 48.

(c) Position the frequency dial on its shaft, so that the dial graduation 600 on the 0-1000 scale is in line with the dial index.

(d) Tighten the set screws on the dial drum hub.

c. Check Azimuth Scale Position on the Central Control Shaft.

(1) The position of the azimuth scale (207) relative to the rotating antenna system, is accurately adjusted. The scale is secured to the central shaft of Control Unit MC-265-A by means of three set screws (212), located on the azimuth scale hub as illustrated in Figure 45-A. At the time this adjustment is made, a reference mark is placed on the top of the scale casting, and on the central shaft as shown in Figure 35. These reference marks should always coincide. In the event of any slippage due to vibration or other causes, the set screws on the azimuth scale hub should be loosened, so that the scale may be correctly positioned. Before tightening the set screws make sure that the azimuth scale is seated firmly against the azimuth-scale-bearing collar (209), otherwise the scale will likely rub against the scale pointer as the scale is rotated.

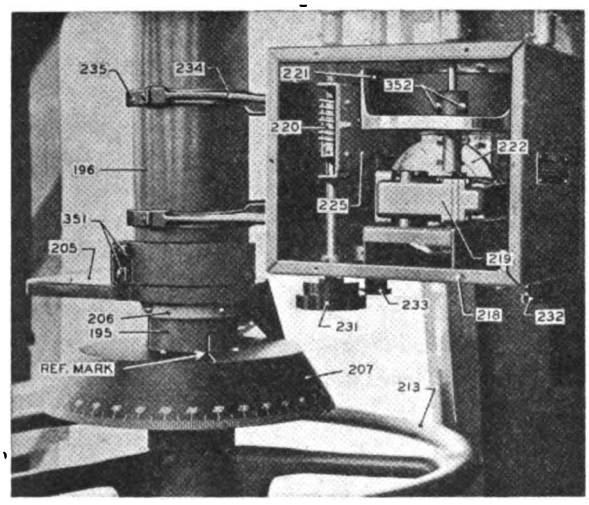


FIGURE 35

CONTROL POSITION

Showing Interior View of Control Box

Note: This illustration applies only to Serial Numbers 46 through 79. (Order No. 2465-CHI-41.)

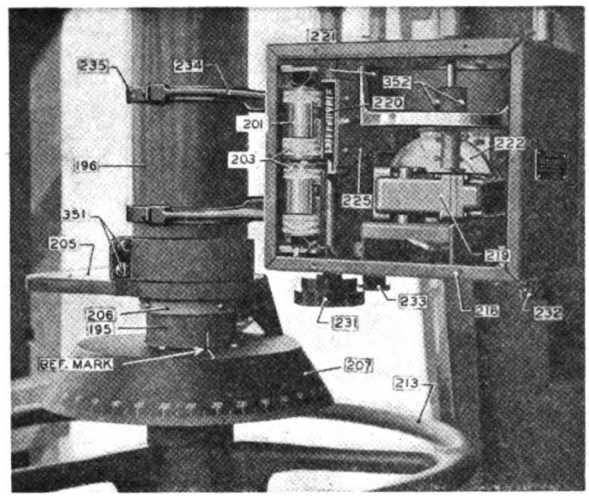


FIGURE 35-A

CONTROL POSITION

Showing Interior View of Control Box

Note: This illustration applies only to Order Nos. 1210-CHI-42, 5073-CHI-42 and 5077-CHI-42.

d. Set Azimuth Index with Respect to True North.

(1) Place the magnetic compass (245) on the compass mount (205) directly above the azimuth scale, as illustrated in Figure 34, so that the north point of the compass is toward the North. Holes are provided on the bottom of the compass to engage the locating pins on the compass mount.

(2) Loosen the two clamping screws (351) on the back of the compass mount collar illustrated in Figure 35, so that the compass mount may be rotated. Before tightening

the clamping screws, observe that the vertical position of the unit has not shifted during the adjustment process. It should be as low as possible on the central shaft housing so that there is minimum clearance between the azimuth scale and the tip of the pointer.

(3) **Before proceeding, remove all tools and other magnetic material from the proximity of the tower, otherwise compass readings will be inaccurate.** Pocket knives and other items including spectacle frames, that may be carried on the person, are sometimes made from magnetic materials, and the effect such items may have upon the accuracy of the compass requires that they be removed from the person whenever the compass is used.

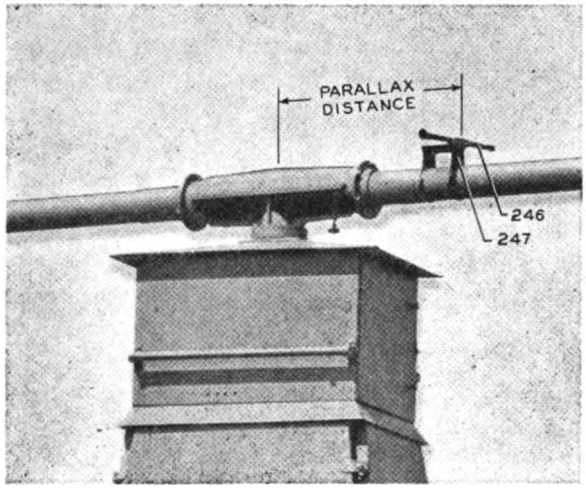


FIGURE 36

TELESCOPE AND MOUNT EMPLOYMENT

(4) Rotate the position of the compass mount so that the compass reads 360° plus or minus the magnetic variation for the particular locality in which the radio direction finder is used. The magnetic variation may be determined by referring to an Isogonic map which embraces the territory in which the equipment is used. For east variation rotate the compass mount so that the compass reads 360° minus the variation. For west variation make the adjustment so that the compass reads 360° plus the variation. In the latter instance, the compass reading will be a figure equal to the variation itself, inasmuch as the compass scale is not graduated beyond 360°.

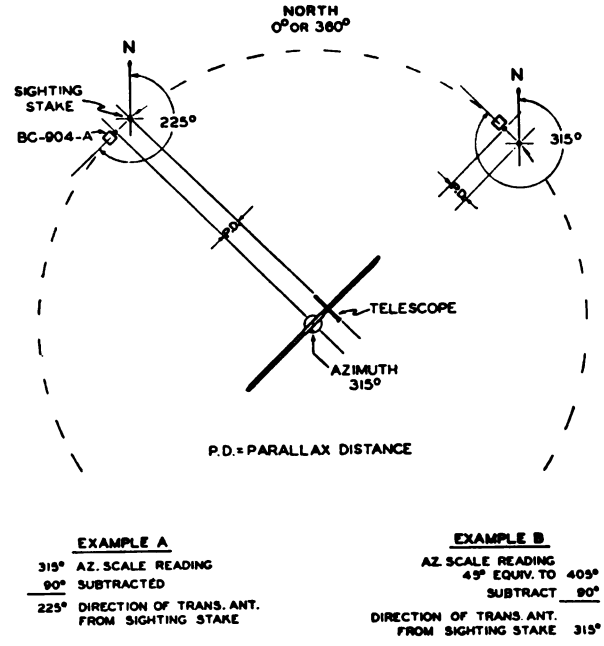


FIGURE 37

DIAGRAM FOR CHECKING SITE ERROR

EXAMPLES:

(a) East variation 16°—Compass reading 344°.

(b) West variation 12°—Compass reading 372°, or an actual reading of 12° on the compass.

(5) Tighten the clamping screws on the compass mount collar, and again check the compass reading to make sure that the position of the compass mount remained unchanged during the action of tightening the clamp.

e. Check for Site Error

(1) The probability of error in radio bearings, resulting from the effect of surface obstructions in the vicinity of the direction finder, will be negligible provided the site has been carefully selected as directed in paragraph 5*a*. A site error may exist, however, originating in unsuspected causes such as uneven soil conductivity, and buried pipes or cables. Pools of water, or uneven patches, or mounds, of snow, in the immediate vicinity of the direction finder may constitute unsuspected causes for site error. Reliable radio bearings can be taken only after local conditions at the site of the direction finder have been analyzed. It is suggested that a check for site error be made two or three

times each day the direction finder is in service, so that any change in the conductivity of the ground at the site, which may affect the operation of the equipment, may be compensated for in computing true bearings. The use of a calibration curve for site error would be very advantageous. (See paragraph *9c* (3).)

(2) Checking for site error is accomplished by comparing aural (radio) bearings, and sight bearings, by use of the telescope (246) mounted as illustrated in Figure 36. This procedure also requires the use of Radio Transmitter BC-904-A, and the operation of the direction finder, and a general understanding of their operation will be necessary. Refer to par. 8 for operation of these units.

(3) Attach the telescope-compass mount (247) in the position shown in Figure 36, on the beam, which is directed toward the East, when the azimuth scale reads 0 on the white scale.

(4) Secure the telescope (246) behind the spring clips on the mount, so that an object toward the North may be viewed through the telescope. Sight through it and rotate it in its mounting, so that one of the crosshairs is vertical.

Note: The magnetic compass will not be required for this operation. Because of the proximity of the steel transmission wires within the beam, compass readings may be found to be inaccurate in some degree when positioned on the mount beside the telescope.

(5) Establish three or four equally spaced operating (target) positions for Radio Transmitter BC-904-A, each position being approximately 100 feet from the direction finder for frequencies between .55 megacycles and 4.0 megacycles, and approximately 200 to 250 feet for frequencies between 4.0 megacycles and 30 megacycles. The transmitter positions are established by employing the rotating beam and azimuth scale of the direction finder, in conjunction with the use of the telescope, as a transit.

(a) Rotate the direction finder antenna to such a position so that the angle of incidence from true North, on which it is desired to position the transmitter, is indicated on the white azimuth scale. Lock the antenna in this position by tightening the brake control (121).

(b) Sight through the telescope, and have an assistant drive sighting stakes (of wood) at the required distances from the direction finder, so that the stakes are in the direct line of sight through the telescope.

(c) Place Radio Transmitter BC-904-A at the operating position, so that its antenna is positioned at a distance from the sighting stake equal to the parallax distance, indicated in Figure 36. Sight along a line through the vertical axis of the antenna of Transmitter BC-904-A and the center of Beam Socket MC-263-A, to achieve correct target position. (Refer to Figure 37.)

(6) An aural bearing (see (a) below) both direct and reciprocal taken on the signal from the target transmitter, should correspond to the sight bearing taken on the sighting stake, provided that a site error does not exist.

(a) The area in the immediate vicinity of the transmitter, and between the transmitter and the direction finder, should be free from surface obstructions. After adjusting the transmitter to the desired frequency and output, the operator attending the transmitter should retire to a distance of not less than 10 feet to the rear of, and in line with, the transmitter and direction finder, so that his presence will not distort the wave form of the transmitted signal.

(b) Unlock direction finder antenna system and take bearing on target transmitter.

(c) In order to avoid misinterpretation of an error which occurs in the region of 11.3 megacycles, when taking aural bearings with the telescoping dipoles of the direction finder antenna system fully extended, using personnel should familiarize themselves with the information and instructions outlined in paragraph *9c*, **Adjustment of Telescoping Dipoles.**

f. For normal operation, the dipoles should be in a vertical plane. Under other conditions of operation, it may be desirable to incline the dipoles toward the vertical. (See par. *10d.*)

(1) To rotate the dipoles, loosen the beam clamp screw (156) on the underside of Beam Socket MC-263-A, and tighten the clamp screw after having positioned the dipoles as desired.

g. Storage Battery Voltage

(1) At the time of initial installation of the storage batteries, the two batteries used should be fully charged. The voltage of each battery, checked separately, with connections between batteries removed, should be of the order of 6.0 volts. If the battery voltage is only 5.6 to 5.7 volts, prolonged satisfactory performance of the equipment can not be expected.

8. OPERATION,—

a. Normal Procedure

(1) Turn the radio receiver on, and allow about 30 seconds for the tubes to reach operating temperature; then, tune in the signal from which a bearing is to be taken. The c-w oscillator should be used for reception of unmodulated radiotelegraph signals, and for reception of modulated signals, whenever its use is found to result in a received signal of greater dependability.

(2) Two 360° scales are indicated on the azimuth scale (207). The direct bearing scale is the white scale, and the reciprocal bearing scale is the red scale. Both the direct bearing and reciprocal bearing should be taken, as indicated hereafter, and then rechecked, to reduce personal error to the lowest possible minimum.

(3) Release the brake (121) beneath the handwheel (213), and rotate the antenna by turning the handwheel, until the strength of the received signal disappears or reaches a minimum. The position of the antenna at which the signal is at a minimum or completely disappears, is called the **null** position. In rotating the antenna through one complete rotation of 360 degrees, two null positions of equal definition, approximately 180 degrees apart should be observed. One of the null positions will be the **direct** bearing, while the other will be the **reciprocal** bearing. The direct bearing can be distinguished from the reciprocal bearing only if the general direction of the incoming signal is known. Otherwise, a condition of so-called 180 degrees ambiguity exists, in which it is impossible to determine which is the true bearing. However, this difficulty is automatically resolved when cross bearings are taken with two or more direction finders erected and operated on a base line, and the bearings plotted.

(4) Provided the site for the radio direction finder has been carefully chosen, and the equipment set up in accordance with the instructions, the direct bearing reading (white scale) and the red scale reading of the reciprocal bearing will, ordinarily, be approximately equal. In extreme cases this condition may not be possible to attain, and in such cases **the average of the two readings may be taken as the ultimate bearing reading.**

b. General Information

(1) Exercise care in tuning the radio receiver to the desired station, and in regulating the volume control of the receiver. Unless the amplitude of the received signal is extremely great, a high degree of accuracy in tuning the receiver to the center of the signal is usually attained, by first rotating the antenna to the approximate position that affords maximum strength of the received signal with a fixed setting of the volume control. Doing this increases the signal to noise ratio advantageously. The recommended procedure, then, is to regulate the volume of the signal issuing from the loudspeaker, concurrently with the manipulation of tuning control, thus enabling the operator to recognize a change in the general character of the signal. In this manner it is possible to center the tuning of the receiver on the exact frequency of the signal.

(2) As the antenna is rotated back and forth through null, the volume of the received signal will be noticed to diminish as the null position is approached from either direction, and in many instances a sharp and well-defined vanishing point will be found at the null position, and this, in the 360° rotation of the antenna, should be separated approximately 180° from the other equally sharp vanishing point. The azimuth scale readings, at these sharply defined null points, may be taken as the required bearings. However, it is considered preferable to take **swing bearings** in addition to these **spot bearings.**

(3) The swing bearing method requires the matching of characteristics of the received signal each side of the null, by turning the handwheel to and fro past the null position to points of equal signal intensity. The human ear is extremely sensitive, and is remarkably reliable in discriminating between dissimilar sounds. If the received signal is extremely weak, the no-signal null may be fairly broad on the azimuth scale. Although it may be possible to lessen the width of the no-signal null, in some degree, by increasing the sensitivity of the receiver (advancing the volume control setting) the attendant increase in background noise usually off-sets any advantage gained in narrowing the width of the null. As the true vanishing point is rarely well-defined in the case of weak signals, the necessity for, and the advantage of, taking swing bearings is readily apparent.

(a) The mean (or average) of the two azimuth scale readings, which coincide with the two matched signals each side of null, is taken as the correct null reading.

(b) The use of the swing bearing method offers an excellent check on the accuracy of spot bearings taken from strong signals, and may be accomplished by decreasing the sensitivity of the receiver, so that a no-signal null is produced, or, simply by swinging the rotating antenna back and forth between two signals of equivalent characteristics, each side of the minimum signal. If the received signal is exceptionally strong, however, care should be exercised to prevent tube overload in the receiver, as the antenna is swung away from null. It is possible for the signal volume to reach a value beyond which a change in the characteristic of the signal will not be perceptible.

(c) If a discrepancy exists between the direct and reciprocal bearing readings, and a recheck of the process reveals no error having been made, the average between the two bearing readings may be taken as the ultimate bearing. If a site error is known to exist for the particular frequency and angle of incidence from true North involved, this must be considered in computing the true bearing. (Refer to paragraph *7e).*

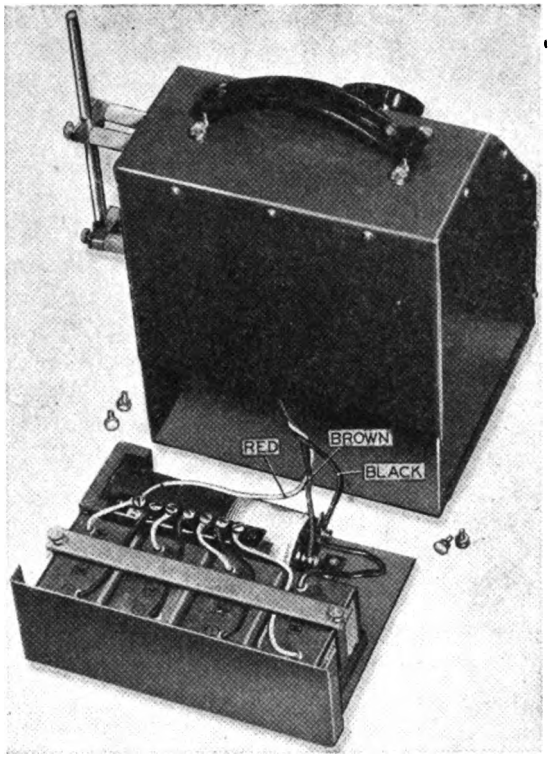


FIGURE 38
RADIO TRANSMITTER BC-904-A
BATTERY CONNECTIONS

c. Operation of Radio Transmitter BC-904-A

(1) Explanation of Controls. Refer to Figure 25.

(a) **Tuning Control.** The tuning control is the large central knob, and actuates the dial pointer which moves over the frequency calibrated dial. The four frequency ranges are indexed by the letters A, B, C, and D which appear at the ends of each range on the dial, and correspond to the respectively indexed positions of the range selector. In addition to the four frequency calibrated ranges, the tuning dial includes a 0-100 scale graduated in equally spaced divisions, which is the scale nearest the tuning knob. Reference to this scale provides a convenient means for accurately logging any previously determined frequency setting of the dial pointer.

(b) **Range Selector.** The range selector is the lower central knob labeled RANGE. The desired range as indexed on the dial is selected by turning the knob to the correspondingly indexed position.

(c) **Operating Switch.** The knob on the right has three positions marked OFF, CW

and MCW. At OFF the transmitter is completely turned off. At CW the unmodulated radio frequency signal is turned on. At MCW the radio frequency signal is on, and is tone-modulated.

(d) **Output Control.** The knob on the left controls the output of the transmitter. Full output is available at the knob position indexed MAX, and minimum output is obtained at MIN. The knob position between MAX and MIN provides medium output of the transmitter.

(2) Other Features.

(a) **Telescoping Antenna**

To attach the antenna (80) to its insulated support on the side of the transmitter case, release the knurled screws on the supports and insert the large end of the antenna into the two metal clamps and then tighten the knurled screws. The antenna may be used at any desired extension with little effect on frequency.

(b) **Indicator**

At the top of the transmitter case is mounted a small neon lamp (N1). The lamp flashes to indicate that the transmitter is turned on. If the lamp does not flash when the operating switch is turned to CW or MCW, this is an indication that the B battery voltage has dropped below its useful terminal voltage (approximately 70 volts).

(c) **Batteries**

The battery complement contained in the battery compartment of the transmitter consists of four 22½ Batteries BA-2 (81) and one type No. 6 1½-volt dry-cell A battery (82). The batteries are connected as shown in Figure 38.

(d) **Vacuum Tubes**

Two tubes (type 1LB4) are employed in the transmitter. One for radio frequency oscillator, and one for audio oscillator-modulator.

(3) Normal Procedure.

(a) To turn the transmitter on, turn the operating switch to MCW.

(b) To tune the transmitter, first rotate the range selector knob to the indexed position which indicates coverage of the desired frequency channel. Then, rotate the tuning knob to a position where the hair-line index of the transparent pointer is directly over the desired frequency calibration on the dial.

(c) Adjust the output control to the one of its three positions which provides the desired signal intensity at the receiver of the direction finder. The output of the transmitter may be further regulated, in some degree, by adjusting the length of the telescoping antenna (80).

9. PRECAUTIONS DURING OPERATION,—

a. Vertical Alignment of Central Shaft

As the tower may settle unevenly, especially if the ground upon which it rests does not provide a firm and solid foundation, frequent checks of the vertical alignment of the central shaft should be made as explained in paragrapn *7a*. This precautionary measure should be taken to insure that the beams always rotate in a truly horizontal plane.

b. Wave Form Distortion Due to Surface Obstructions

While taking bearings the area in the immediate vicinity of the radio direction finder should be maintained free of all surface obstructions, in order to assure constant uniformity in the signal wave form approaching the rotating antenna system. **Note: So much as the presence of one person, standing under or near one of the dipole elements will cause sufficient unbalance in the electrical characteristics of the antenna to introduce considerable error in bearing readings.**

c. Adjustment of Telescoping Dipoles

(1) Both of the lower dipoles (174) are telescoping, and may be adjusted for the purpose of counteracting electrical unbalance in the antenna system. Normal operation of Radio Set SCR-255 (Direction Finding) usually results with the dipoles fully extended, excepting for frequencies in the immediate vicinity of, and slightly below 11.3 mc. Because of an inherent characteristic of the system, which is associated with the dimensions of the beams and dipoles, as related to this particular frequency, a pronounced error will be introduced in taking bearings at this frequency with the dipoles fully extended. When frequencies of 11.3 megacycles and slightly below are used, adjust the equipment for substantially no error by fully collapsing the telescoping dipoles.

(2) The operation outlined in the foregoing paragraph effects a remedy for the error referred to, simply because the mechanical dimensions of the equipment are changed, resulting in a different frequency being affected. For this reason it is important that the dipoles be fully extended for use on all frequencies other than those in the immediate vicinity of 11.3 megacycles.

(3) Exercise care in adjusting the telescoping dipoles, in order to retain electrical symmetry in the antenna system. Both dipoles should be maintained at the same length, whether extended or collapsed, as a difference of one graduated section in the lengths of the two dipoles will introduce a noticeable error in aural bearings.

(4) Do not adjust the dipoles in an endeavor to correct for site error, since these errors will depend on the azimuth position of the transmitter. (See par. *7e.*) A site calibration chart or curve may be prepared by placing the target transmitter at eight equally spaced points around the direction finder and determining the site error for each position.

(*a*) Bearings should be corrected for calibration curve.

d. As indicated in paragraph *7g*, the storage batteries should be removed from service for the purpose of recharging, when the useful terminal voltage has dropped to a value of 5.6 to 5.7 volts. Due to variance in radio tube characteristics, some equipments will function satisfactorily at a lower battery voltage. However, the above values represent a conservative lower end-point in battery voltage, beyond which consistently satisfactory performance should not be expected. In order to avoid failure of equipment operation because of this, the storage battery voltage should be checked frequently, and the batteries replaced with fully charged batteries as required.

e. Regulating the sensitivity of the radio receiver by manipulation of the volume control, which operation is closely associated with rotating or swinging the antenna through null, plays an important part in promoting a high degree of accuracy in taking bearings. This procedure is fully covered in paragraphs *8b* (1) and *8b* (3).

f. If the receiver ceases to function, or functions intermittently, in the high frequency ranges, interchange Tube VT-91 (h-f oscillator) with one of the other similar type tubes in the receiver.

g. Radio Transmitter BC-904-A should not be jarred, especially when operated in the higher frequency ranges, as an unstable condition of the transmitted signal may result. Likewise, if the transmitter antenna sways abnormally, a similar condition of instability may exist.

h. Always release the brake control (121) when leaving the direction finder unattended. In the event that extremely high winds are encountered, considerably less strain is imposed upon the rotating mechanism when the antenna is free to rotate with changing wind directions.

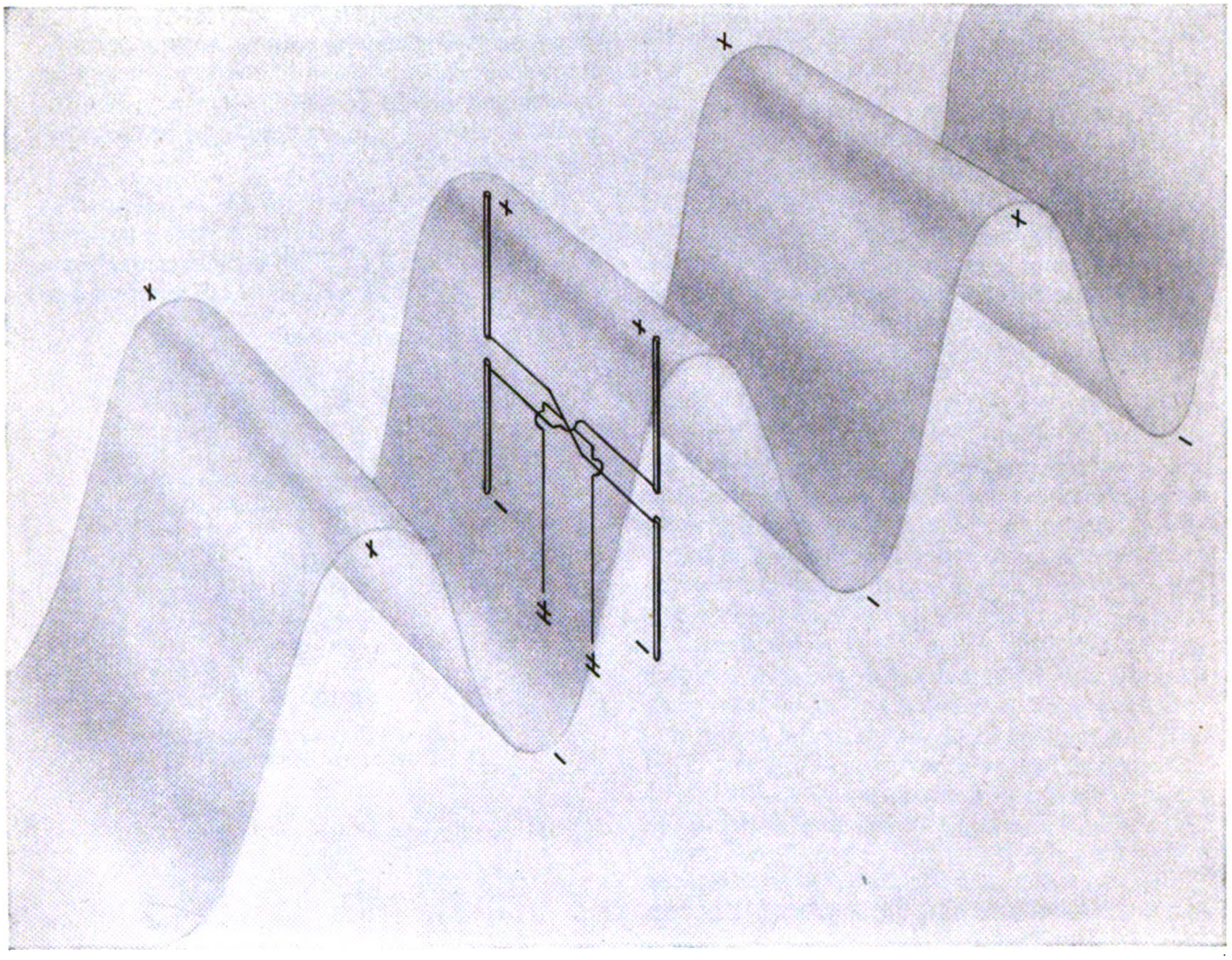


FIGURE 39

DIAGRAM SHOWING EFFECT OF WAVE APPROACHING ANTENNA SYSTEM AT NULL POSITION OF ANTENNA

SECTION III

FUNCTIONING OF PARTS

10. THEORY OF OPERATION,—

a. Radio Set SCR-255 (Direction Finding) operates on the principle of comparing the signals received by each of two antennae mounted at opposite ends of a rotatable supporting beam. Each of these antennae are in the form of Dipole Collectors AN-63-A.

b. By making reference to Figure 39, it can be seen that when the supporting beam is perpendicular to the travel of the received signal, each Dipole Collector AN-63-A receives exactly the same signal at the same instant of time. Since the two dipole collectors are connected to the receiver with reverse polarities, these two signal inputs will exactly cancel each other and there will be no input to the receiver.

c. When the supporting beam is rotated toward the position where it is in the line of travel of the received signal, the two dipole collectors receive signals which are not instantaneous duplicates of each other. Cancellation is therefore incomplete and the uncancelled difference between the two signal inputs becomes the input to the receiver. The dissimilarity between the two signal inputs is primarily a difference in phase, not in amplitude. When one dipole collector is closer to the transmitting station, the signal it receives will be advanced in phase compared to the signal received by the other dipole collector. This phase difference is a maximum when the line of travel of the incoming wave coincides with the plane of the dipoles—that is when the difference in distance from each dipole to the transmitter is a maximum, resulting in maximum input to the receiver. Rotating the whole antenna system is primarily a means of changing the phase difference between the two signals received by each of the dipole collectors. It can be seen that anything in the vicinity of the direction finder which might affect the amplitude balance between the two dipoles, even minutely, should be avoided.

d. Radio Set SCR-255 is so designed as to utilize only the vertical polarized component of the received signal. With the dipoles in a vertical position, the maximum pickup will be obtained when the line of travel of the incoming signal is horizontal. For maximum reception of waves arriving at an angle to the ground (waves reflected from the Heaviside Layer, or sky waves, or signals being received from an airplane transmitter) the dipoles should be inclined so that the plane of the dipoles is perpendicular to the direction of arrival of the signal. If time permits, the best angular position of the dipoles may be determined experimentally; otherwise, the dipoles should be inclined at an angle of about 30° with the vertical.

e. Although the antenna system is intended to exclude radio signals when in its null position it may be responsive to these signals under some conditions, by virtue of the whole antenna sys-

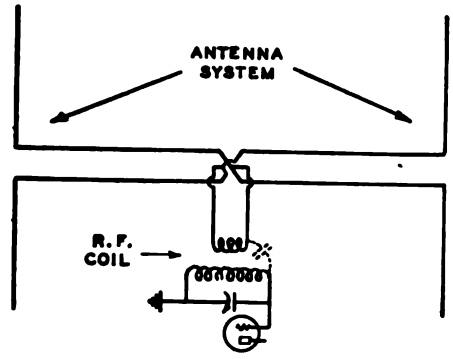


FIGURE 40

DIAGRAM SHOWING CAPACITY EFFECT OF ANTENNA

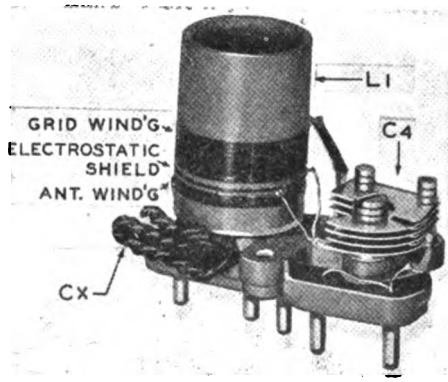


FIGURE 41

R-F COIL WITH TRIMMER CAPACITOR

Note positions of electrostatic shield between antenna and grid windings.

tem working against ground. If special precautions are not taken in the receiver circuit design, it is possible for signals picked up in this manner to be impressed on the r-f grid, through capacity existing between the antenna winding and the grid winding of the r-f coil, as illustrated in Figure 40.

(1) In the design of the receiver input circuit means have been provided:

(*a*) To eliminate the capacity between these windings an electrostatic shield has been placed between the antenna and grid windings of the r-f coils, as illustrated in Figure 41. The shield breaks up any capacity existing between windings, into individual capacities from each winding to ground, as illustrated in Figure 42.

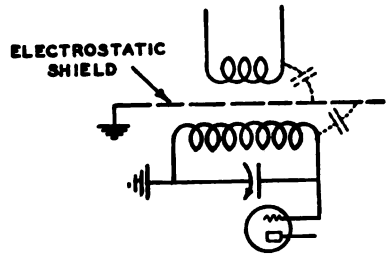


FIGURE 42

DIAGRAM SHOWING EFFECT OF ELECTROSTATIC SHIELD

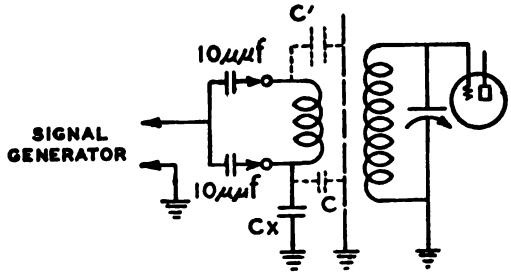


FIGURE 43

RADIO RECEIVER BC-903-A,—

DIAGRAM SHOWING USE OF SIGNAL GENERATOR FOR BALANCING ANTENNA CIRCUIT

C represents the low capacitance to ground on one side of the antenna winding, while C' represents the high capacitance to ground on the opposite side of the winding. Cx represents the balancing capacitance and when correctly adjusted, the combined values of C and Cx is equal to the value of C'.

(*b*) To establish an electrical capacity balance. This has been accomplished, **first,** by dressing other connecting leads, in the proximity of the antenna terminals in the receiver, so that they are removed as far as possible from the antenna input circuit; **second,** by adding capacitance-to-ground to the lower capacitance side of the antenna input circuit, so that a balance-of-capacity condition is effected, as illustrated in Figure 43. The added capacitance is in the form of a short length of insulated twisted wires, represented by the symbol Cx in Figure 41. An arrangement employing a signal generator, the output voltage of which is applied in phase through identical capacities of about 10 μμf each, to both of the antenna input terminals, as illustrated in Figure 43, is used to determine the correct adjustment of capacitance Cx in establishing the electrical balance in the receiver input circuit.

f. By referring to Figure 44, which represents the bridge circuit equivalent of the input circuit of Figure 43, it is seen that signal voltage E across antenna inductance L will be a minimum, when a balance has been established in the bridge. An electrical balance has been effected in the antenna system, especially with regard to the transmission line, and the electrical balance of the whole antenna system with the receiver input circuit connected, is therefore a maximum. A signal voltage across the antenna winding of the r-f coil will be a minimum at the null position of the antenna, thus resulting in a high degree of directional sensitivity when the antenna is rotated.

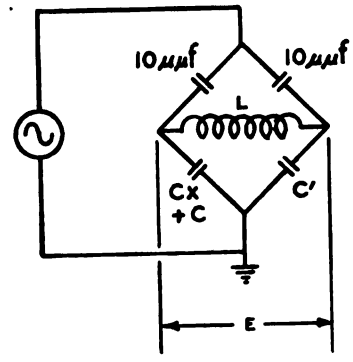


FIGURE 44

BRIDGE ARRANGEMENT OF INPUT CIRCUIT SHOWN IN FIGURE 43

11. DIPOLE COLLECTOR AN-63-A,—(Refer to Figure 45)

a. Each Dipole Collector AN-63-A consists of one fixed dipole element (175), one telescoping

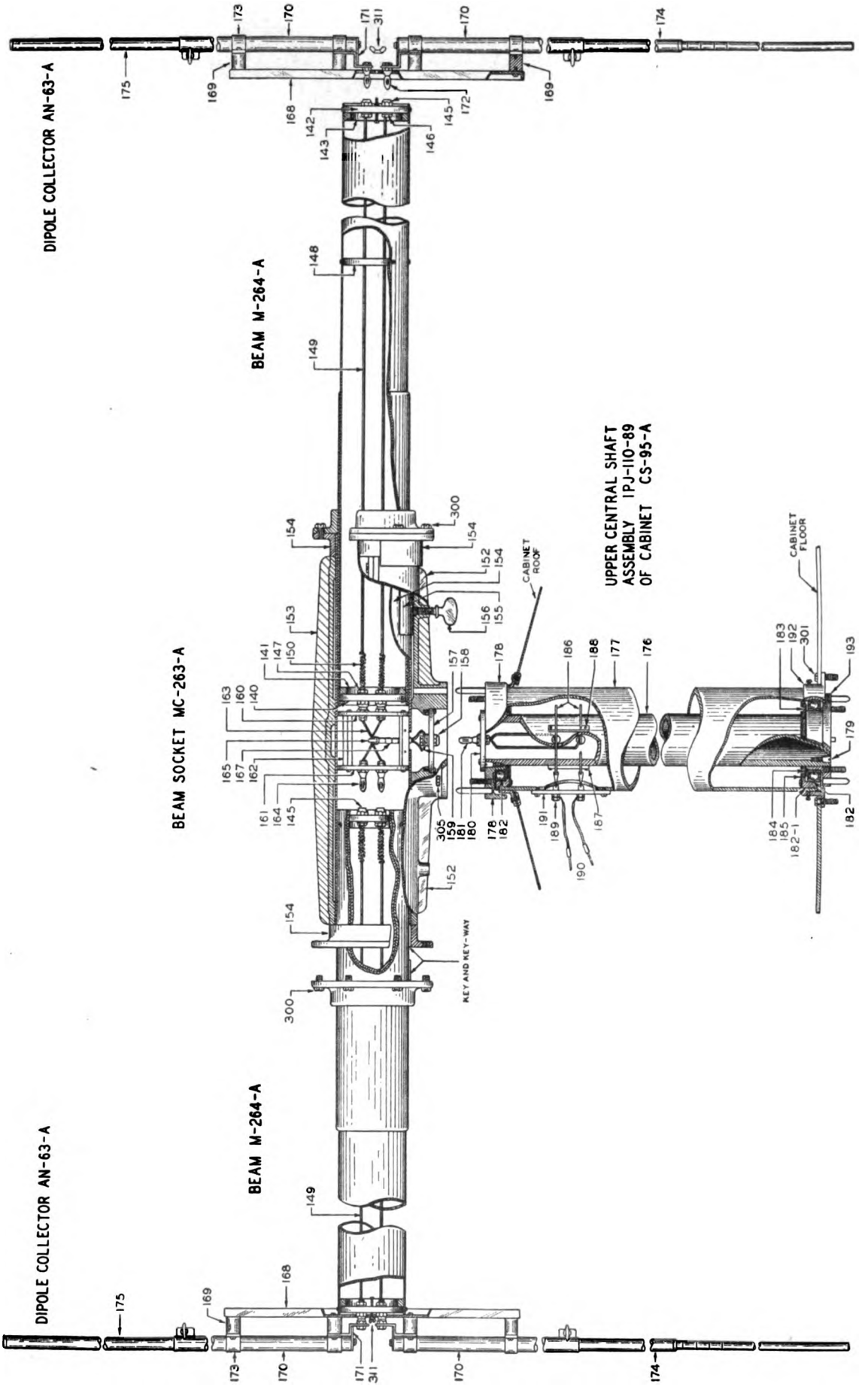


FIGURE 45
ANTENNA SYSTEM,—DETAIL DRAWING

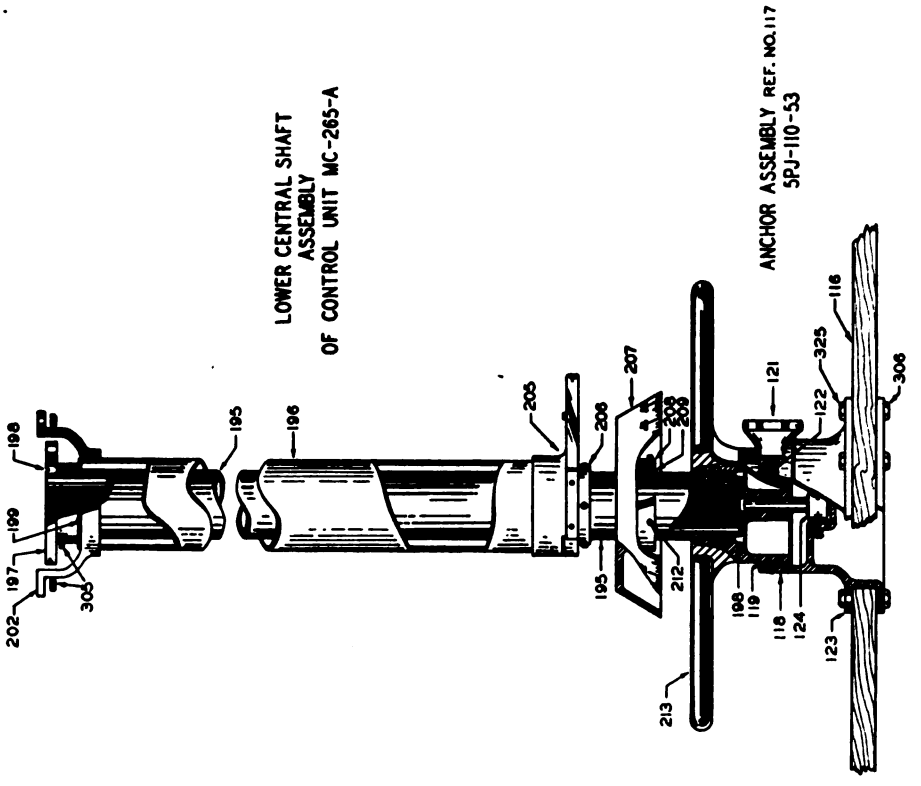


FIGURE 45-A

ANTENNA ROTATING MECHANISM,—DETAIL DRAWING

dipole element (174), and a mounting base (168) to which two dipole sockets (170) are attached by means of stand-off insulators (169). Each dipole socket is provided with a wing-screw clamp to hold the dipoles securely in the sockets, and is connected to a banana spring plug (172). Holes are provided in the mounting base for attaching to the end of Beam M-264-A.

b. Because of the combined length of the dipoles and beams, the system becomes resonant at one-quarter wave length in the region of 11.3 megacycles. All effects of slight unbalances of inductance and capacitance are multiplied many times at one-quarter wave resonance. This phenomenon results in a pronounced error in aural bearings taken in this frequency region. The lower dipoles are made adjustable so that they may be collapsed to a length that will shift the quarter wave resonance sufficiently so as to counteract its effect. Obviously, the adjustable dipoles should be used in the fully extended position on all frequencies other than in the 11.3 megacycle region, to avoid recurrence of the error at the resonant frequency to which the system is shifted by collapsing the dipoles, and to provide insofar as possible, a well balanced antenna system in all respects for the frequencies covered by the direction finder.

12. BEAM M-264-A,— (Refer to Figure 45)

Beam M-264-A, two of which are used, houses and shields the antenna transmission lines (149). The transmission lines comprise two steel wires, plated with silver over a copper plating, to provide a conducting surface having a low radio frequency electrical resistance. These wires are suspended within the beams so that the distance from each wire to the inside surface of the beam is equal to the spacing between the wires. The wires are supported in this position by means of insulating discs (148) evenly spaced within the beam, and are kept taut by means of a spring (150) attached to one end of each wire. This spring exerts a two-pound pull upon the wire. The wires terminate in jacks (145), which are mounted on insulating discs (140 and 142) at the opposite ends of the beams. The two beams have matched electrical and physical characteristics, and are directly interchangeable.

13. BEAM SOCKET MC-263-A, — (Refer to Figure 45)

a. The Beam Socket MC-263-A consists of an inner rotating brass sleeve (154), incased in a cast aluminum housing. The sleeve housing comprises two sections, namely, an upper cap casting (153) and a lower T-casting (152). The flanged base of the lower section provides a means for mounting at the top of Cabinet CS-95-A.

b. The inner sleeve (154) of the beam socket houses a center section of transmission line, that forms a junction for the transmission lines of the two beams. The transmission line within the beam socket is constructed and supported similarly to that of the beams, excepting that the relative positions of the two wires (163) are transposed at the center of the inner sleeve, so that with the two beams assembled to the beam socket, the transmission lines are connected in phase opposition, resulting in a condition of phase equality at the dipoles. Connection between the transmission line junction center, and the jacks (158) at the base of the beam socket is made by means of flexible leads, to permit rotation of the beam assembly about a horizontal axis parallel with the beam axis.

c. A large wing-screw (156) through the bottom of the T-casting, when tightened, bears against a clamping plate (155), shaped to conform to the contour of the inner sleeve surface, and locks the sleeve in any desired position with respect to its 90 degree rotation.

14. CABINET CS-95-A,— (Refer to Figure 45)

The upper central shaft (176) for rotating the beam assembly mounted at the top of Cabinet CS-95-A, is positioned vertically through the center of the cabinet, and is enclosed within an aluminum housing (177). Two like bearing assemblies, each consisting of a ball bearing unit (182), grease retainer (183), and grease shields (184 and 185), assembled within the bearing socket (182-1), are placed at the upper and lower ends of the shaft, to provide a minimum of friction in the rotation of the antenna system. The aluminum housing (177) also serves to shield the transmission line terminating section connected between the banana spring plugs (181) and the collector rings (186). Two double wiping contact brushes (189) mounted on an insulating panel (191) attached to the central shaft housing at the large opening in the side of the housing, make continuous contact with the collector rings. Flexible leads (190) attached to the brush terminals are provided to make connection to the antenna terminals of Radio Receiver BC-903-A. The banana spring plugs (181) engage the jacks (158) at the base of

Beam Socket MC-263-A when the beam assembly is mounted at the top of the cabinet, thus completing the electrical circuit of the transmission line from the dipole collectors to the radio receiver. Top and bottom flanges (178 and 193) are secured to the central shaft by means of three taper screw pins (179) at each end.

15. CONTROL UNIT MC-265-A, — (Refer to Figure 45-A)

a. This unit affords control of the various functions of the equipment. All of the principal controls for the entire direction finder are included, and these are grouped at the lower end of the unit which constitutes the control position within the base of the tower. (Refer to Figure 46).

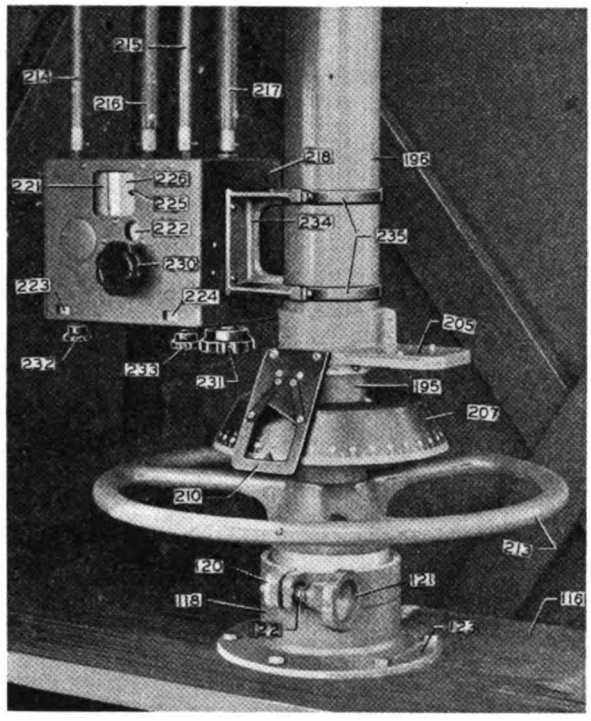


FIGURE 46

CONTROL POSITION,—FRONT VIEW

Note: This illustration applies only to Serial Numbers 46 through 79 (Order No. 2465-CHI-41.)

b. The lower central shaft (195) is enclosed in a tubular phenolic housing (196), to which the control box (218) is attached, that houses the remote controls for Radio Receiver BC-903-A, and in which the control shaft extensions (214, 215, 216 and 217) terminate. Coupling links (236) are furnished for coupling the four shaft extensions to the receiver controls. An aluminum flange (197) is attached to the upper end of the central shaft (195), by means of three taper screw pins (198) that are used for coupling to the upper central shaft (176) in Cabinet CS-95-A. The flange (202), attached to the central shaft housing (196) is for suspending the whole control unit from the bottom of the cabinet. An aluminum handwheel (213) is secured to the lower end of the central shaft (195) by means of three taper screw pins (198). The brake-drum on the under side of the handwheel fits into the adjustable brake-shoe of the anchor base (118), when the unit is assembled into the tower. The azimuth scale (207) is secured to the central shaft directly above the handwheel, and the combined azimuth scale pointer (210) and compass mount (205), directly above the azimuth scale, is secured to the shaft housing (196).

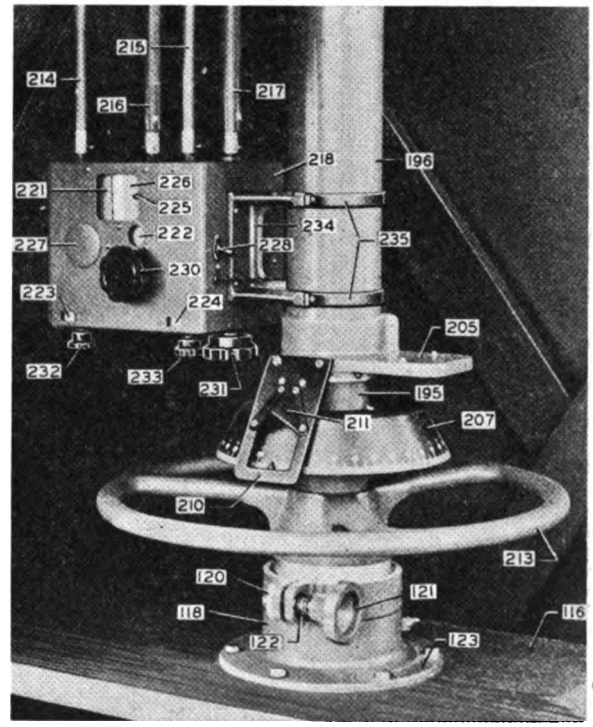


FIGURE 46-A

CONTROL POSITION,—FRONT VIEW

Note: This illustration applies only to Order Nos. 1210-CHI-42, 5073-CHI-42 and 5077-CHI-42.

c. Control Functions (Refer to Figure 45-A)

(1) **Handwheel** (Ref. No. 213)

Controls the continuous rotation of the antenna system in either direction.

(2) **Brake Control** (Ref. No. 121)

Locks the antenna in any desired position with respect to its 360 degree rotation, and may be used to control the effects of high winds while the antenna is being rotated.

(3) **Compass Mount and Azimuth Index**

The compass mount (205) and azimuth index (210) assembly is secured to the central shaft housing (196) by means of two clamping screws (351), and is adjustable as an integral unit for the purpose of correct orientation with respect to the direction of true North.

(4) **Tuning Control**

The tuning control (230) is located on the front of control box (218), and actuates the direct-reading frequency calibrated dial (221) on which also appears a 0-1000 reference scale, viewed through the rectangular window above the knob. This knob also actuates the reference scale vernier dial (222) that is viewed through the round window directly above the knob.

(5) **Range Selector**

The range selector is actuated by manipulation of the large knob (231) on the bottom of the control box (218), and actuates the coil changing mechanism of the radio receiver. The five frequency ranges are marked to the right of the main tuning dial. The pointer (225) which moves perpendicularly along the right edge of the window as the knob is turned, indicates the frequency range in use. Approximately one complete turn of the knob is required to shift the mechanism between adjacent ranges.

(6) **Operating Switch**

The operating switch is controlled by the small knob (233) to the right on the bottom of control box (218). Turning the knob in a clockwise direction (to the right) to MVC, in the small window directly above the knob, turns the radio receiver on, and places the equipment in operation for reception of radiotelephone or other modulated signals. Turning the knob to CW in the window, turns on the beat frequency oscillator in the radio receiver, for the reception of radiotelegraph or other continuous wave signals. The beat frequency oscillator may also be used for locating carriers of radiotelephone or broadcasting stations. The beat frequency oscillator is also referred to in this manual as the c-w oscillator.

(7) **Volume Control**

The volume control is actuated by the small knob (232) to the left, on the bottom of the control box (218). Turning the knob in a clockwise direction (to the right) increases volume, and turning the knob counter-clockwise (to the left) decreases volume.

16. RADIO RECEIVER BC-903-A

a. Circuit of the Receiver

(1) The radio receiver employs ten tubes in a superheterodyne circuit, covering all frequencies from 550 k-c to 30,000 k-c in five ranges.

(2) The complete circuit, which is shown in Figure 57, consists of one stage of r-f amplification, first detector, two i-f amplifier stages tuned to a frequency of 456 k-c, an infinite impedance second detector, a resistance-coupled first audio amplifier stage, a resistance-coupled pentode output stage, a high frequency oscillator, and a beat frequency oscillator. The high frequency oscillator is coupled to the first detector through the .01 μf capacitor (C33). Its frequency is always equal to the sum of the frequency of the received signal, and the intermediate frequency (i-f). The beat frequency oscillator is coupled to the second detector through the 2 $\mu\mu$f capacitor (C41), and is tuneable over a narrow range of frequencies centered around 456 k-c by means of the variable capacitor (C37), the control for which is located on the front panel of the receiver, and is labeled C.W. OSC.

(3) Provision is made, by means of a jack, mounted on the bottom of the receiver, for connecting the output stage to a permanent-magnet dynamic type loudspeaker (242).

(4) The principal circuit modification is associated with the removal of the functions of the limiter, and the automatic volume control features originally incorporated in the receiver, and relates to the portions of the circuit indicated by dotted lines in the circuit diagram.

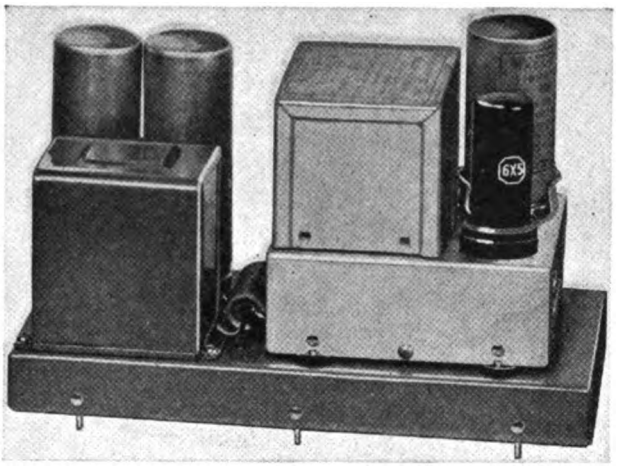


FIGURE 47

POWER SUPPLY UNIT
Part of Radio Receiver BC-903-A

(5) A battery operated vibrator type power supply, illustrated in Figure 47, employing full-wave tube rectification, provides operating voltages for the vacuum tubes in the receiver. Battery connections may be of either polarity. The power supply unit is built on a separate chassis which is attached to the receiver chassis, and is represented by the dashed lines in the circuit diagram. This high voltage power supply is protected by a fuse connected in the primary circuit of the power transformer (T1).

(6) As all of the vacuum tubes employed in the receiver are of the 6.3 volt heater type, the heater voltage is taken directly from the 6-volt battery input to the receiver.

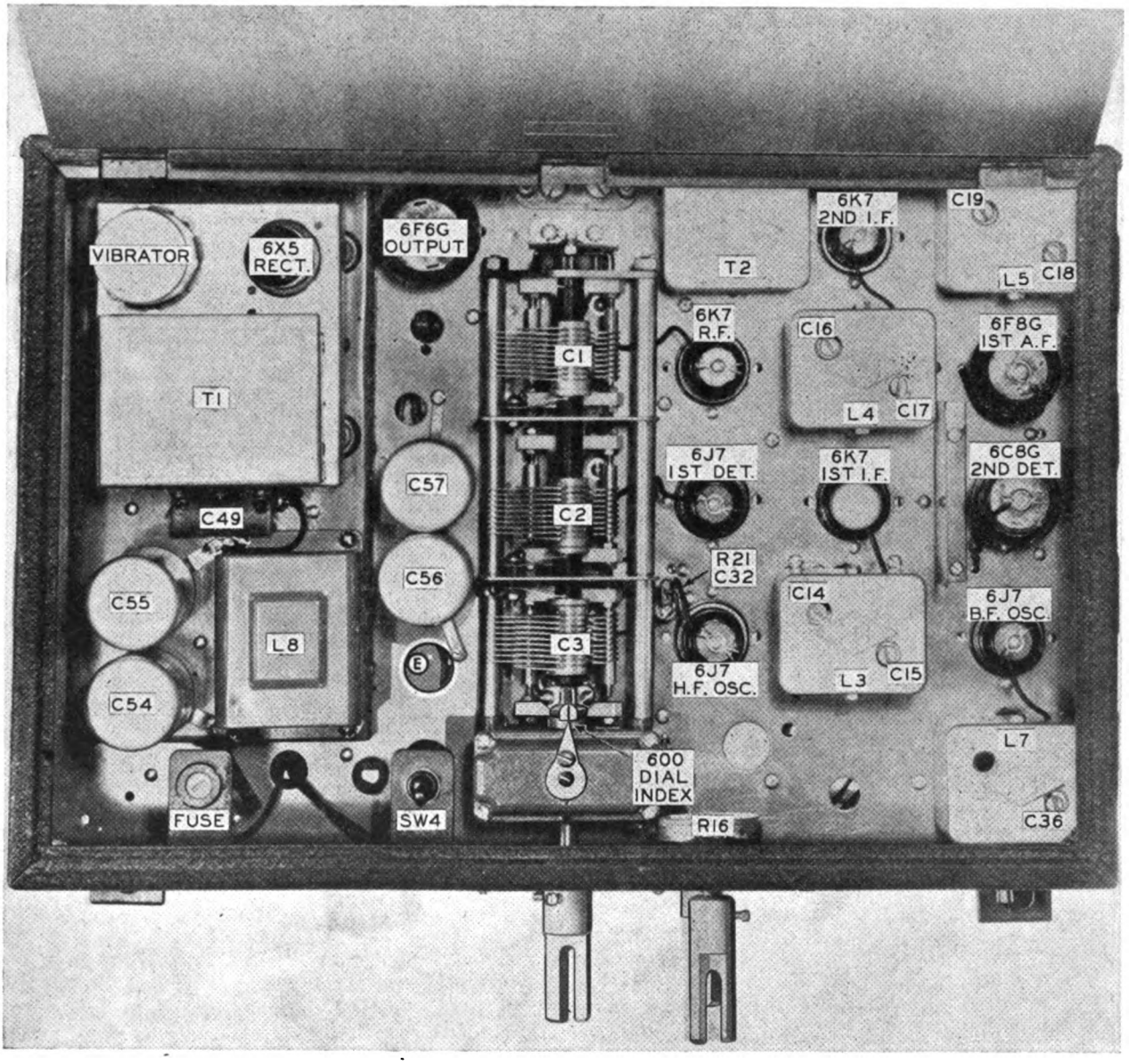


FIGURE 48
RADIO RECEIVER BC-903-A,—TOP VIEW
Showing Tube Positions and Chassis Layout

b. *Vacuum Tubes Employed in Radio Receiver BC-903-A*

Stage	Signal Corps Type	Commercial Type	
R. F.	VT-86	6K7	
First Detector	VT-91	6J7	
First I.F.	VT-86	6K7	
Second I.F.	VT-86	6K7	
Second Detector (1)	VT-163	6C8G	Tube Positions are shown in Figure 48.
First Audio (2)	VT-198A	6F8G	
Output	VT-66A	6F6G	
High Frequency Oscillator	VT-91	6J7	
Beat Frequency Oscillator	VT-91	6J7	
Rectifier	VT-126	6X5	

Note (1) Tube VT-163 is a twin triode type. One triode section only functions in this application, this being the second detector stage.

Note (2) Tube VT-198A is a twin triode type. One triode section only functions in this application, this being the first audio stage.

c. *Vacuum Tube Characteristics*

TUBE	VT-163	VT-66-A	VT-198-A	VT-91	VT-86	VT-126
HEATER VOLTAGE	6.3	6.3	6.3	6.3	6.3	6.3
HEATER CURRENT (amps)	0.3	0.7	0.6	0.3	0.3	0.6
PLATE VOLTAGE	250	250	250	250	250	325
PLATE CURRENT (ma)	3.2	34	9.0	2.0	10.5	
GRID VOLTAGE	—4.5	—16.5	—8.0	—3.0	—3.0	Total Output
SCREEN VOLTAGE	——	250	——	100	125	Current
SCREEN CURRENT (ma)	——	6.5	——	.05 Above	2.6	20 ma. MAX.
PLATE RESISTANCE (ohms)	22,500	80,000	7,700	1,000,000	600,000	
TRANSCONDUCTANCE (micromhos)	1,600	2,500	2,600	1,225	1,650	
AMPLIFICATION FACTOR	36	——	20	——	——	
LOAD RESISTANCE (ohms)	——	7,000	——	——	——	
TOTAL HARMONIC DISTORTION (percent)	——	8	——	——	——	
POWER OUTPUT (watts)	——	3.2	——	——	——	

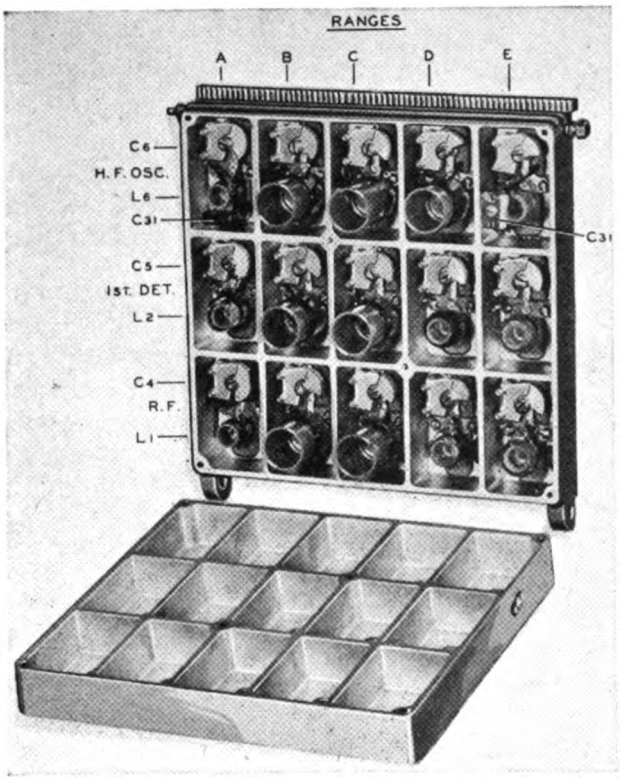


FIGURE 49

RADIO RECEIVER BC-903-A,—COIL BOX
Showing all high frequency inductances and trimmer capacitances

d. Controls

(1) The front view of Radio Receiver BC-903-A is illustrated in Figure 15.

(2) The control marked TUNING on the receiver is actuated by rotation of the tuning control (230) on the remote control box (218), (Figure 46). This operates the rotor plates of the 3-gang variable tuning capacitor in the receiver. The three sections of the tuning capacitor are represented by symbols C1, C2 and C3 in the circuit diagram, and are identified by the same symbols in the illustration in Figure 48. C1 is the r-f section; C2 is the first detector section; and C3 is the h-f oscillator section.

(3) The RANGE SELECTOR (coil changing mechanism) of the receiver is actuated by manipulation of the range selector control (231) on the remote control box.

(*a*) The complete coil arrangement employed in the receiver is illustrated in Figure 49. With the coil box cover in place, the coils are individually shielded. The coils are arranged in five groups, one group for each of the five frequency ranges of the receiver. Each coil group consists of an r-f coil, first detector coil, and h-f oscillator coil for its respective range. The coil nearest the front of the receiver is the h-f oscillator represented by L6 in the circuit diagram. The middle coil (L2) is the first detector and the coil (L1) nearest the rear of the receiver is the r-f.

(*b*) Manipulation of the range selector control causes the complete coil unit to be moved, transversely, underneath the receiver chassis. Only the coil group actually in use is in any way connected in the circuit, the coil group in use being the one directly underneath the 3-gang tuning capacitor at the center of the chassis. It may be seen that the coils are thus literally "plugged" into the circuit, and the necessity for a coil switching circuit and long connecting leads between the coils and their respective tuning capacitor sections has been eliminated.

(*c*) In order to preclude the possibility of damage to the coils and the associated mechanism during transportation, provision is made for securing the coil rack against one end of the receiver chassis by means of a wing-nut attached to the threaded stud, that protrudes through a small hole in the left end of the receiver case, when the coil rack is moved to the extreme position at the left end of the receiver chassis.

(4) The VOLUME CONTROL, identified by the symbol R16 in the circuit diagram, Figure 57, is connected in the common cathode to ground circuit of the r-f and i-f stages. It is essentially a sensitivity control because it determines the operating grid bias of these stages.

(5) The OPERATING SWITCH comprises two single circuit toggle switches which are respectively identified by the symbols SW1 and SW3 in the circuit diagram. The switches are actuated, in sequence, by rotation of the operating switch control on the remote control box. Beginning with the control at OFF, turning the control to MVC, at the remote control box, closes switch SW3 and connects the vacuum tube heaters and the primary circuit of the high voltage power supply to the external 6-volt storage battery voltage supply. Further clockwise rotation of the con-

trol to CW at the remote control box, closes switch SW1, and applies plate and screen voltages to the beat frequency oscillator tube.

(6) The TONE CONTROL (R41) is located near the lower left corner on the receiver panel, and does not extend to the remote control box, since once adjusted to meet with the requirements of the operator it need not be readjusted. The normal audio range, indicated by N on the tone control plate, is near the extreme counter-clockwise position. As the control is turned to the right, high audio frequencies are attenuated. When the control is turned from the N position to the left, switch SW2 in the circuit diagram is **opened.** This operates to limit the extreme low audio frequency response, by reason of the series arrangement of the .01 μf capacitor (C47) and the .001 μf capacitor (C48) which provide the coupling media between the second detector and first audio stages.

(7) The C. W. OSCILLATOR tuning is controlled by the knob located near the upper right corner of the receiver panel. This control does not extend to the remote control box, because, once it is adjusted to produce the desired beat note, it need not be reset.

SECTION IV

MAINTENANCE

SERVICE NOTICE — Radio Set SCR-255 (Direction Finding) embraces certain design features which make servicing impracticable excepting by properly equipped and trained personnel.

Servicing of Radio Receiver BC-903-A should be accomplished only by personnel possessing an experienced knowledge of the technicalities involved, and adequate tools and equipment.

17. INSPECTION,—

Radio Set SCR-255 should be visually inspected after each installation, and at least once every month during continued use at a fixed location or as frequently as may be considered necessary depending upon prevailing conditions of service which may have an effect upon the operation of the equipment, the components of Radio Set SCR-255 (Direction Finding) should be inspected as follows:

Part	Inspect For
Radio Receiver BC-903-A	Vacuum tubes insecurely inserted in sockets. Vibrator insecurely inserted in socket. Loose grid clips on vacuum tubes. Loose fuse retainer cap. Loose antenna terminal screws. Loose volume control lock-nut. Loose set-screws on control shaft couplings. Plug for speaker circuit insecurely inserted in jack. Accumulation of dust or dirt, above and below chassis.
Antenna System Beam M-264-A Beam Socket MC-263-A Dipole Collectors AN-63-A **Cabinet CS-95-A**	Loose dipole socket clamp screws. Loose dipole collector mtg. wing-nut (311). Loose or damaged banana spring plugs (172). Damaged or bent dipole elements (174), (175). **Insufficient tension on transmission line wires (149).** **Loose jacks (145).** **Loose jacks (158).** **Loose or damaged banana spring plugs (164).** **Loose or damaged banana spring plugs (181).** **Loose connection on transmission line termination point, on collector rings (186).** **Loose or damaged collector brushes (189).** **Loose connection between receiver leads (190) and brushes (189).**
Antenna Rotating System **Cabinet CS-95-A** **Control Unit MC-265-A** **Anchor Base (118)**	**Lost motion or binding during rotation.** **Loose clamp screws on compass mount (205).** **Loose set-screws on sleeve-bearing (206).** **Loose set-screws on azimuth scale hub (208).** **Loose set screw, holding lower bearing and spindle unit (124) to the anchor base (118).** **Worn or damaged threads on brake nut (120) and brake control (121).**

Part	Inspect For
Receiver Remote Controls	Loose coupling links (236).
Control Unit MC-265-A	Loose set-screws on the control shafts (214), (215), (216) and (217).
	Loose set-screws on the control knobs (230), (231), (232) and (233).
	Loose set screws on the frequency dial (221), vernier dial (222), volume index dial (223), and switch index dial (224).

18. SERVICE AND LUBRICATION,—

a. In rendering service of any nature, to Radio Set SCR-255 (Direction Finding), it is important that any alteration of critical characteristics of the system be avoided, unless such characteristics can be duplicated, within permissible limits, during or following the servicing procedure.

b. Little if any lubrication of the equipment will be required. It may be found desirable, however, to occasionally make a careful application of light lubricating oil to the various shaft bearings associated with the radio receiver remote controls. One or two drops of oil will, in most cases, be sufficient to relieve friction. Use oil sparingly, as any excess amount will tend to "creep" to other parts, where it may collect dust or dirt particles, and aggravate an otherwise harmless condition.

c. White petroleum is useful in preventing rust on bolts, and terminal screws on batteries, and can also be used sparingly to prevent scale from collecting on the dipoles. Do not use abrasives on dipoles. (See par. 18e).

d. The main bearings (182) of the antenna rotating system, located at the upper and lower ends of the upper central shaft assembly in Cabinet CS-95-A, and the lower central shaft support bearing (124) in the anchor base (118), are ball bearing units which are packed with grease and sealed to provide permanent lubrication.

e. Accumulation of dust or dirt should be cleaned from exposed and easily accessible parts, during inspection, using a cloth dampened with carbon-tetrachloride. The transmission line collector rings and banana spring plugs may be cleaned in a similar manner. **Emery cloth, crocus cloth, or other abrasive should not be used for cleaning contact surfaces as doing so would remove the plating of these parts.**

f. Dust which may accumulate in Radio Receiver BC-903-A should be blown out with dry compressed air from time to time. When doing this, do not alter any critical adjustment of the instrument. A small diameter pipe-cleaner, dampened with carbon-tetrachloride, may be used to remove dust or dirt particles from between the tuning capacitor plates, however this should be done carefully, so that the plates will not be bent.

(1) **Note: Radio Receiver BC-903-A should always be removed to the repair shop or depot for servicing. Before removing the receiver from the direction finder, make sure that the 0-1000 dial, at the remote control position, reads 600 with the index finger of the tuning capacitor, in the receiver, in line with the index pointer. Refer to Figure 48.**

19. VOLTAGE AND CURRENT MEASUREMENTS,—RADIO RECEIVER BC-903-A,—

Note: The following table of voltage and current measurements presents typical readings which represent average values taken on several receivers of this type, using Model 665 Analyzer of SIGNAL CORPS TEST SET I-56-A as outlined under Section III—"Detailed Tests on Radio Sets" in the instruction book covering this test equipment.

(Any Signal Corps Test Set I-56-( ) may be employed, using the corresponding analyzer units.)

a. One fully charged 6-volt storage battery is used as the power source for the receiver under test. (Polarity observance unnecessary).

b. Meter readings within ±10% of the tabulated values will, in most cases, indicate correct operation of the receiver.

c. To obtain the various readings, connect jumper leads from the analyzer socket selector block Model 666, type 1B, to the analyzer pin jacks, in accordance with the instructions given on the next page, opposite the heading bearing the title of the required measurement.

Test	Block Terminal Number	to	Analyzer Jacks
Plate Voltage r-f, 1st det., 1st i-f, 2nd i-f, Output, h-f-o, and b-f-o stages	3 gnd.		250 volts ±
Plate Voltage 2nd det. and 1st a-f stages	6 gnd.		250 volts ±
Plate Voltage Rectifier	3 and 5 gnd.		250 volts ±
Screen Voltage	4 gnd.		250 volts ±
Filament Voltage	2 7		10 volts ±
Plate Current (Max. and Min. volume) r-f, 1st det., 1st i-f, 2nd i-f, h-f-o, and b-f-o stages	3 Outside 3 Inside		5 Ma. —Ma.
Plate Current (Max. and Min. volume) Output stage	3 Outside 3 Inside		25 Ma. —Ma.
Plate Current (Max. and Min. volume) 2nd det. and 1st a-f stages	6 Outside 6 Inside		5 Ma. —Ma.
Plate Current (Max. and Min. volume) Rectifier	3 Outside and 6 Outside 3 Inside and 6 Inside		25 Ma. —Ma.
Screen Current (Max. and Min. volume) r-f, 1st det., 1st i-f, 2nd i-f, h-f-o, and b-f-o stages	4 Outside 4 Inside		1 Ma. —Ma.
Screen Current (Max. and Min. volume) Output stage	4 Outside 4 Inside		5 Ma. —Ma.

d. Procedure:

(1) Rotate the volume control to the minimum volume position unless otherwise specified.

(2) Be sure the analyzer plug and vacuum tube grid caps are connected to the grid leads. It may be necessary to extend the receiver grid cap leads in order to make connection to the analyzer plug grid cap.

(3) Be sure the analyzer AC-DC switch is at DC, excepting for measuring rectifier plate voltage, for which purpose the switch should be at AC.

(4) Be sure the VOLTS - MA - OHMS switch is at VOLTS-MA.

(5) When checking the filament voltage of the first and second i-f stages, the output stage, and the rectifier, it will be necessary to transpose the connections to selector Block Terminals-2-and-7 in order to obtain a correct voltmeter reading.

(6) When checking the beat frequency oscillator plate and screen voltages, the C.W. OSC. switch should be on. All other voltage measurements should be made with the C.W. OSC. switch off.

Stage	Tube Type	Plate Volts	Screen Volts	Cathode Volts Volume Control Max.	Cathode Volts Volume Control Min.	Fil. Volts	(Ma.) Plate Current Volume Control Max.	(Ma.) Plate Current Volume Control Min.	(Ma.) Screen Current Volume Control Max.	(Ma.) Screen Current Volume Control Min.
r-f	VT-86	210	90	2.5	16	5.8	4	0.2	1	.02
1st det.	VT-31	200	55	3	3	5.8	.45	.45	0.1	0.1
1st i-f	VT-86	210	90	1	16	5.8	1.6	0.1	0.6	.02
2nd i-f	VT-86	210	100	6	18	5.8	1.6	0.25	0.7	0.1
2nd det.	VT-163	210	——	7	7	5.8	1	1	—	—
1st a-f	VT-198A	105	——	3.3	3.3	5.8	2	2	—	—
Output	VT-66A	205	215	13	14	5.8	21.5	23	4	4.1
H F Osc.	VT-91	195	85	0	0	5.8	4.85	5	1.4	1.5
B F Osc.	VT-91	40	17	0	0	5.8	.35	.35	0.1	0.1
Rectifier	VT-126	250 ac	—	220	220	5.8	25	22	—	—

e. A tube socket voltage diagram is shown in Figure 50. The bottom view of the tube sockets relative to the chassis in indicated.

(1) All voltages indicated are measured against ground, using Model 564 Volt-Ohmmeter, or Model 665 Analyzer with external test lead and prod connections.

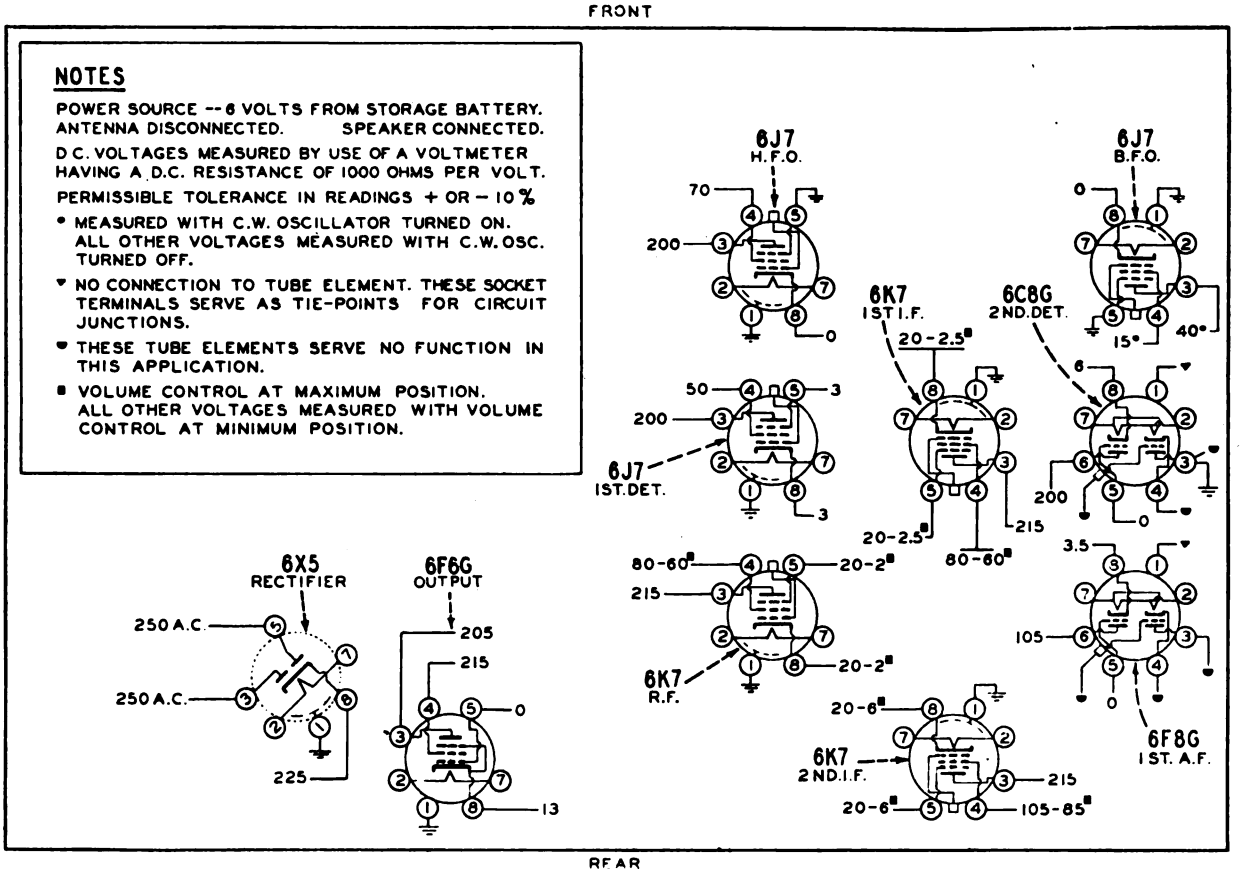


FIGURE 50

TUBE SOCKET VOLTAGE DIAGRAM

(2) As the socket for Tube VT-126 is mounted on the vibrator unit chassis, a bottom view of it can be had only by removing the power supply unit from the receiver, and then removing the vibrator unit from the power supply chassis. For this reason, the socket for Tube VT-126 is represented by a dotted outline in the diagram. **It is not necessary, however, to remove the power supply unit in order to make voltage measurements as this may be accomplished simply by use of analyzer selector block Model 666 type 1B, which affords access to the circuits connected to the tube socket.**

20. RESISTANCE AND CONTINUITY MEASUREMENTS,—RADIO RECEIVER BC-903-A,—

Note: The following table of resistance and continuity measurements presents typical readings which represent average values taken on several receivers of this type, using Model 665 Analyzer of SIGNAL CORPS TEST SET I-56-A as outlined under Section III—"Detailed Tests on Radio Sets" in the instruction book covering this test equipment.

a. Resistance and continuity measurements of the receiver should be made with the storage battery disconnected. This will allow the manipulation of all switches without causing voltages to be built up across resistors and condensers. Any voltages set up in the receiver may cause serious errors in reading on the ohmmeter ranges and they may damage the test instrument.

b. Ohmmeter readings will generally be most accurate when taken on the upper 2/3 of the scale, and whenever possible, the range should be chosen that will give indications on this part of the meter dial. Meter readings within ±10% of the tabulated values will, in most cases, indicate correct operation of the receiver.

c. Procedure:

(1) Disconnect both sides of the storage battery from the receiver.

(2) Disconnect the loudspeaker.

(3) Rotate the volume control to the minimum volume position unless otherwise specified.

(4) Turn the OPR switch to the full "Off" position.

(5) Be sure the analyzer plug and tube grid caps are connected to grid leads.

(6) Before taking a resistance reading on any range, short the two jumper leads plugged into the ohmmeter pin jacks and rotate the battery adjustment knob until the instrument pointer reads exactly full scale.

21. TROUBLE SHOOTING REFERENCE,—RADIO RECEIVER BC-903-A,—

a. Most of the defects in the receiver will be indicated by erratic plate or screen voltage readings. For this reason reference tables are given indicating the individual parts that will cause low readings in each stage.

RESISTANCE TO GROUND (OHMS)

Stage	Tube Type	Cathode Volume Control Max.	Cathode Volume Control Min.	Plate	Screen	Grid
r-f	VT-86	500	9,000	24,000	13,000	1 MEG.
1st det.	VT-41	5,000	5,000	26,000	135,000	0
1st i-f	VT-86	500	9,000	25,000	13,000	500,000
2nd i-f	VT-86	2,700	11,000	25,000	50,000	500,000
2nd det.	VT-163	55,000	55,000	26,000	——	0
1st a-f	VT-198A	2,000	2,000	75,000	——	500,000
Output	VT-66A	500	500	25,000	24,500	500,000
H F Osc.	VT-91	0	0	26,000	45,000	21,000
B F Osc.	VT-91	0	0	200,000	110,000	50,000

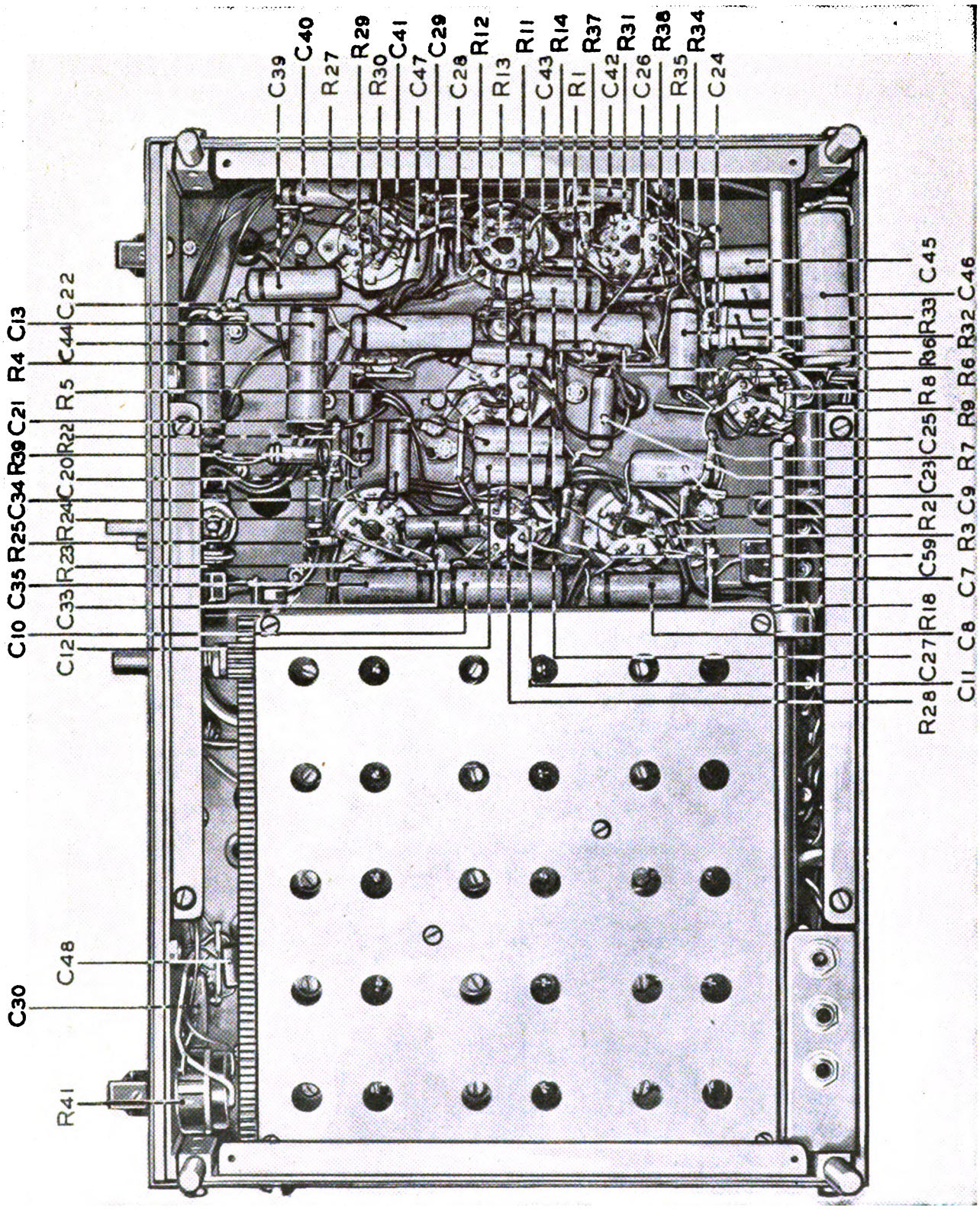


FIGURE 51

RADIO RECEIVER BC-903-A,—BOTTOM VIEW
With Coil Rack at Extreme Left

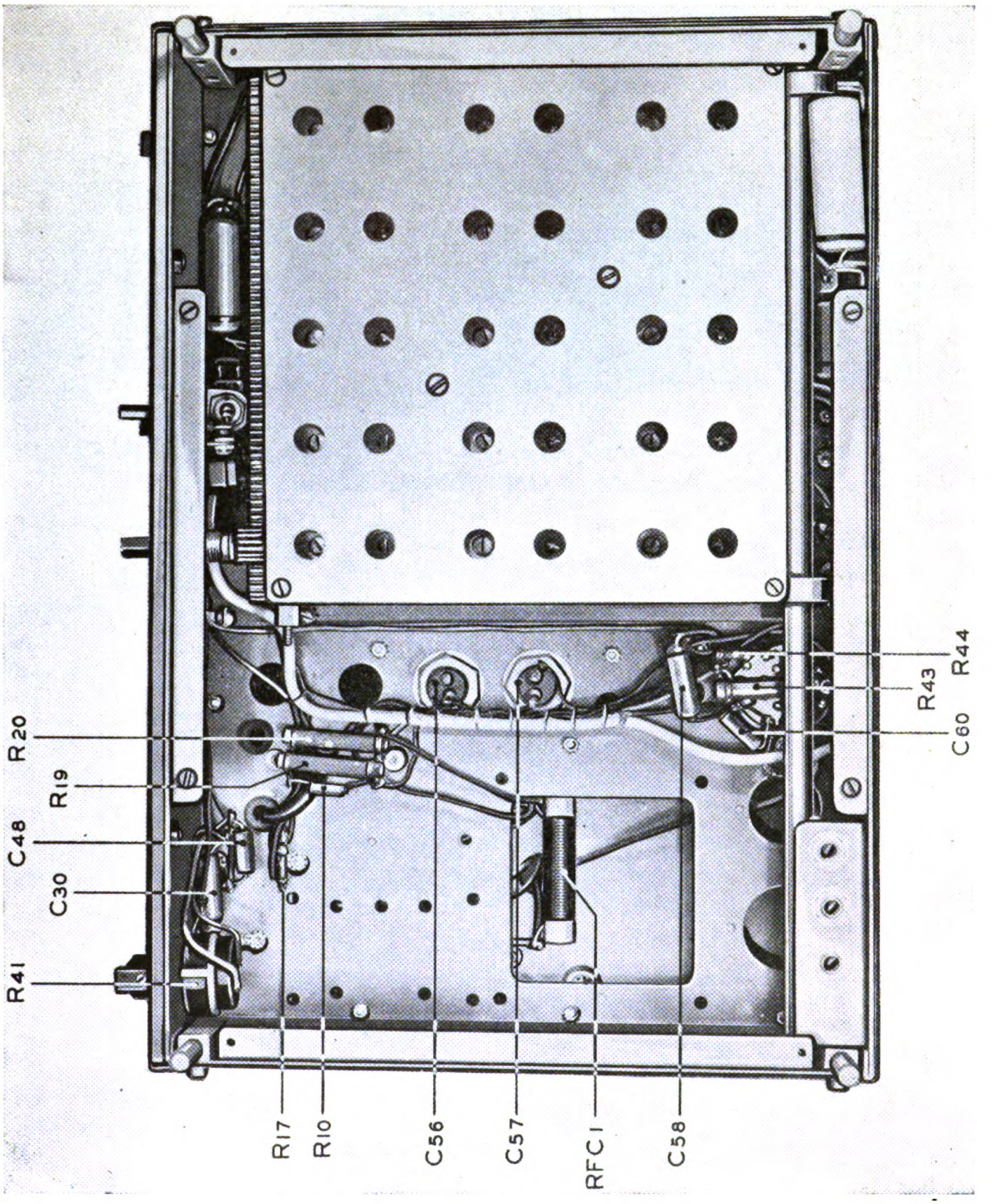


FIGURE 52

RADIO RECEIVER BC-903-A,—BOTTOM VIEW
With Coil Rack at Extreme Right

b. The reference numbers in the tables refer to parts indicated by corresponding numbers shown in the circuit diagram (Figure 57), and in the chassis layout illustrations (Figures 51, 52, 53 and 54).

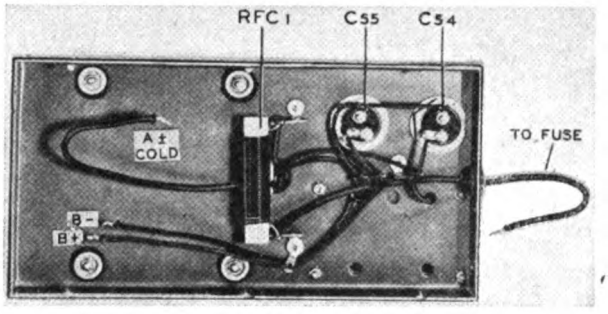


FIGURE 53
POWER SUPPLY UNIT,—BOTTOM VIEW

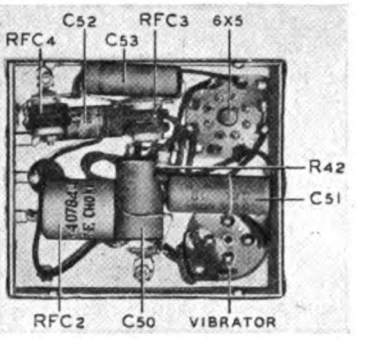


FIGURE 54
VIBRATOR PACK,—BOTTOM VIEW

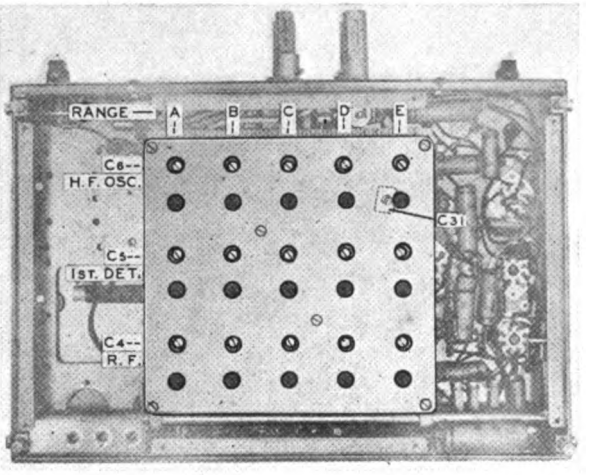


FIGURE 55
RADIO RECEIVER BC-903-A,—BOTTOM VIEW
Showing High Frequency Trimmers

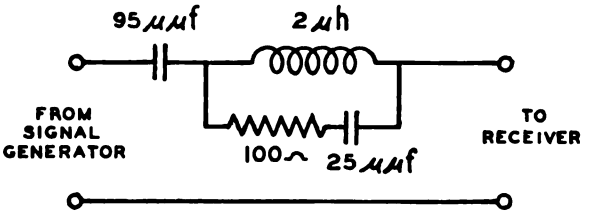


FIGURE 56
DUMMY ANTENNA DIAGRAM

ZERO PLATE VOLTAGE OR LOW METER READINGS

Stage	Check Value of Resistor	Check Transformer for Continuity	Check Condenser for Breakdown
r-f	R19	L2—Pri.	C10
1st det.	R22	L3—Pri.	C13
1st i-f	R26	L4—Pri.	C22
2nd i-f	R10	L5—Pri.	C26
2nd det.	R11		C27
1st a-f	R39		C44
Output		T2—Pri.	C58
H F Osc.	R22		C13
B F Osc.	R22		C13 and C41
Rectifier		T1—Sec.	C52, C53, C54 and C55

ZERO SCREEN VOLTAGE OR LOW METER READINGS

Stage	Check Value of Resistor	Check Condenser for Breakdown
r-f	R19 and R20	C9
1st det.	R23 and R24	C33
1st i-f	R19 and R20	C9
2nd i-f	R8 and R9	C25
H F Osc.	R22 and R24	C35
B F Osc.	R22, R27, R29 and R30	C40

Note: Low screen voltage in the output stage, in all probability, would also be evidenced by low plate and screen voltages in all other stages, and may usually be attributed to failure of some part of the power supply. In this event, condensers C50, C51, C52, C53, C54 and C55 should be checked for breakdown.

22. ALIGNMENT,—

a. The following paragraphs contain important information relating to certain precautionary measures, which should be taken into consideration, before any attempt is made at alignment of the radio receiver circuit.

b. Do not attempt to make any realignment adjustments unless it is apparent that such procedure is necessary to bring about correct performance of the receiver. Do not attempt to make any adjustments without first determining the exact function of each trimmer capacitor, and the effect that it will have upon performance.

c. Removal of the receiver remote control from the direction finder will **not** be required in order to align the receiver circuit. The high frequency trimmer adjustments for the various ranges will be made at the 600 dial reference setting of the 3-gang tuning capacitor (C1, C2, C3) while the low frequency adjustments will be made with the rotors of the tuning capacitor plates fully meshed at the extreme tip ends of the rotor plates. Meshing of the rotor plates as occasion requires during the alignment procedure may be accomplished with repeated accuracy, by placing the squared end of a large screwdriver bit, or other tool having a straight edge, across the capacitor plates at the extreme outer end.

d. Listed in the following table are the high and low frequencies respectively related to the 600 dial reference and maximum tuning capacitor capacity for the five tuning ranges.

Frequency Range (megacycles)	600 Dial Reference (k-c)	Tuning Capacitor Max. Cap. (k-c)
.55 to 1.3	974	552
1.3 to 2.8	2163	1265
2.8 to 6.4	4770	2700
6.4 to 14.5	10605	6100
14.5 to 30	22410	13300

e. In aligning the circuit, an accurately calibrated test oscillator should be used in conjunction with output meter contained in Signal Corps Test Set I-56-A. The loudspeaker should be removed from the direction finder cabinet, and connected to the receiver undergoing test. The ± and VM pin jacks of the output meter should be connected to the voice coil terminals of the loudspeaker. In making the final circuit alignment adjustments, use of the lowest range on the voltmeter will afford greatest accuracy in scale readings; it may be found desirable, however, to use one of the higher ranges on the meter in making preliminary adjustments, and doing so will also protect the instrument against damage in the event of possible signal voltage overload in the receiver. **Care should be exercised in regulating the receiver volume during circuit alignment procedure, as too much volume may result in an overload in the receiver which will seriously affect the accuracy of alignment adjustments.**

f. The aluminum coil box cover in the receiver should always be in place and attached to the coil box, as illustrated in Figure 55, when making alignment adjustments. A screwdriver having a metal shaft may be used for adjusting the trimmers, but the shaft should not touch the coil box cover. Similarly, in adjusting the i-f trimmers, the metal screwdriver shaft should not touch the coil shield.

g. The r-f, 1st detector, and h-f oscillator coil group, which is connected into the circuit at any time, is the one directly underneath the 3-gang tuning capacitor at the center of the chassis. The coil nearest the front of the receiver is the h-f oscillator, the middle coil is the 1st detector, and the coil nearest the rear of the receiver is the r-f.

h. As shown in Figure 55, there are two holes in each coil compartment; of each pair, the one nearest the front of the receiver is directly over the trimmer capacitor.

i. Correction for calibration of the receiver is made by adjustment of the h-f oscillator trimmer. Refer to the table on this page and set the test oscillator frequency as indicated in the "600 Dial Reference" column, for the range to undergo alignment. Tune in the test oscillator signal on the receiver, and observe the position of the tuning capacitor rotors. If the capacitance of the tuning capacitor is found to be too great, more trimmer capacitance is needed and vice versa. On the two highest frequency ranges, it may be possible to make the initial oscillator adjustment incorrectly. There are two settings of the oscillator trimmer which will tune in the desired signal at the 600 dial reference setting of the 3-gang capacitor. Of these, the higher frequency setting (least trimmer capacitance) is correct.

j. In adjusting the r-f and 1st detector trimmer, the **approximately** correct alignment may be indicated by maximum background noise without using the test oscillator; however, **critical alignment of these trimmers should always be made, using the signal from the test oscillator.** The background noise should be fairly loud when the volume control is fully advanced, although the strength of background noise may be of a somewhat different order for the different ranges. The 1st detector trimmer will have a much greater effect upon the amplitude of this noise than does the r-f trimmer, but actually the setting of each is equally important. This importance should also be considered when making precise adjustments of these trimmers through the use of the test oscillator.

k. With the alignment correct at the high frequency end of the range (600 dial reference) the 3-gang tuning capacitor rotors should be turned to the fully meshed position. The back-

ground noise may vary slightly over the range but should not become appreciably weaker except in the case of range E (.55 to 1.3 megacycles). Low frequency calibration of this range is accomplished by adjustment of the oscillator padder (C31), which is a compression type capacitor located inside the oscillator coil compartment, and is accessible through one of the holes in the coil compartment. The calibration may first be checked by use of a radio servicing tool commonly known as a "tuning wand." Inserting either end of the tuning wand into the coil will decrease the receiver output only if the coil in question is in correct alignment at the test frequency. In the four higher frequency ranges (D), (C), (B) and (A), the oscillator padder is a fixed capacitor, and therefore, low frequency calibration of these ranges is accomplished by shifting the physical position of the half-turn oscillator inductance loop inside the coil form. **Care should be exercised in inserting the tuning wand into the receiver coils, so as not to alter the position of the half-turn inductance loops.**

l. The low frequency alignment of the r-f and 1st detector stages for all ranges is also checked by use of the tuning wand, and alignment is corrected by shifting the inductance half-turn loop, as previously explained for adjusting the oscillator alignment. However, with reference to the lowest frequency range (range E), shifting the half-turn inductance loop will have little, if any, effect upon low frequency alignment, because of the high inductance ratio between the half-turn loop and the total number of turns in the coil. Should any error in tracking be found at the low frequency end of range E, it is probable that the same error may be present on all ranges. Capacitor plates having become bent accidentally may be suspected as the cause for such error, and correction may be made by bending the outside rotor plates of the capacitor section in question.

NOTE: With respect to the use of the tuning wand, **the shorted turn end of the wand lowers the inductance** of the coil into which it is inserted, **and the opposite end of the wand, in which is enclosed an iron slug, raises the inductance of the coil.** Some error in checking the alignment may occur at extremely high frequencies when using the iron slug end of the tuning wand, because of certain frequency characteristics of the iron slug. For this reason it may be found desirable to use a strip of celluloid inserted between the meshed plates of the tuning capacitor section involved, when checking circuit alignment at high frequencies. This has the effect of raising the capacitance, resulting in an attendant lowering of the tuned circuit frequency.

m. I-F Alignment (Refer to Figure 48 for trimmer positions)

(1) Remove the h-f oscillator Tube VT-91 from the receiver.

(2) Connect the test oscillator output to the control grid of the 1st detector Tube VT-91.

n. R-F Alignment (Refer to Figure 55 for trimmer positions)

(1) Replace the h-f oscillator Tube VT-91 in the receiver.

(2) Turn the C. W. OSC. switch to off.

Test Oscillator Frequency (k-c)	C.W. OSC. Switch	Stage	Trimmer Capacitor
456	Off	3rd i-f	C19
456	Off	3rd i-f	C18
456	Off	2nd i-f	C17
456	Off	2nd i-f	C16
456	Off	1st i-f	C15
456	Off	1st i-f	C14
456	On	b-f-o	C36*

*First, set the C. W. OSC. control knob to zero (0) on the receiver panel. Then adjust C36 for zero beat with the test oscillator signal.

(3) Connect the test oscillator output to the antenna terminals of the receiver.

(a) The correct alignment of the r-f stage tuned circuits requires the use of a dummy antenna connected in series with

the high side of the signal generator output, **at the receiver antenna input.** Ordinarily, a 100 $\mu\mu$f fixed capacitance connected in this manner will serve satisfactorily for use on the three lower frequency ranges (C), (D) and (E).

(b) A dummy antenna comprising the components illustrated in Figure 56 is recommended for use in r-f tuned circuit alignment for all frequency ranges of the receiver. The use of this preferred type provides a simulated antenna capacitance equivalent to that of the antenna system of the direction finder.

Test Oscillator Frequency (k-c)	3-Gang Tuning Capacitor Position	Receiver Range (Megacycles)				Trimmer Capacitor
974	600 dial reference	(E)	.55	to	1.3	h-f osc. C6
974	600 dial reference	(E)	.55	to	1.3	1st det. C5
974	600 dial reference	(E)	.55	to	1.3	r-f C4
552	Plates fully meshed*	(E)	.55	to	1.3	h-f osc. C31 (pad)
2163	600 dial reference	(D)	1.3	to	2.8	h-f osc. C6
2163	600 dial reference	(D)	1.3	to	2.8	1st det. C5
2163	600 dial reference	(D)	1.3	to	2.8	r-f C4
1265	Plates fully meshed*	(D)	1.3	to	2.8	h-f osc. ind. loop
1265	Plates fully meshed*	(D)	1.3	to	2.8	1st det. ind. loop
1265	Plates fully meshed*	(D)	1.3	to	2.8	r-f ind. loop
4770	600 dial reference	(C)	2.8	to	6.4	h-f osc. C6
4770	600 dial reference	(C)	2.8	to	6.4	1st det. C5
4770	600 dial reference	(C)	2.8	to	6.4	r-f C4
2700	Plates fully meshed*	(C)	2.8	to	6.4	h-f osc. ind. loop
2700	Plates fully meshed*	(C)	2.8	to	6.4	1st det. ind. loop
2700	Plates fully meshed*	(C)	2.8	to	6.4	r-f ind. loop
10605	600 dial reference	(B)	6.4	to	14.5	h-f osc. C6
10605	600 dial reference	(B)	6.4	to	14.5	1st det. C5
10605	600 dial reference	(B)	6.4	to	14.5	r-f C4
6100	Plates fully meshed*	(B)	6.4	to	14.5	h-f osc. ind. loop
6100	Plates fully meshed*	(B)	6.4	to	14.5	1st det. ind. loop
6100	Plates fully meshed*	(B)	6.4	to	14.5	r-f ind. loop
22410	600 dial reference	(A)	14.5	to	30	h-f osc. C6
22410	600 dial reference	(A)	14.5	to	30	1st det. C5
22410	600 dial reference	(A)	14.5	to	30	r-f C4
13300	Plates fully meshed*	(A)	14.5	to	30	h-f osc. ind. loop
13300	Plates fully meshed*	(A)	14.5	to	30	1st det. ind. loop
13300	Plates fully meshed*	(A)	14.5	to	30	r-f ind. loop

Note: Upon completing the alignment of any one range, it is advisable to repeat the alignment procedure to correct the slight effect one adjustment may have upon the other.

*The fully meshed position of the tuning capacitor plates is explained in paragraphs 22c and 22d.

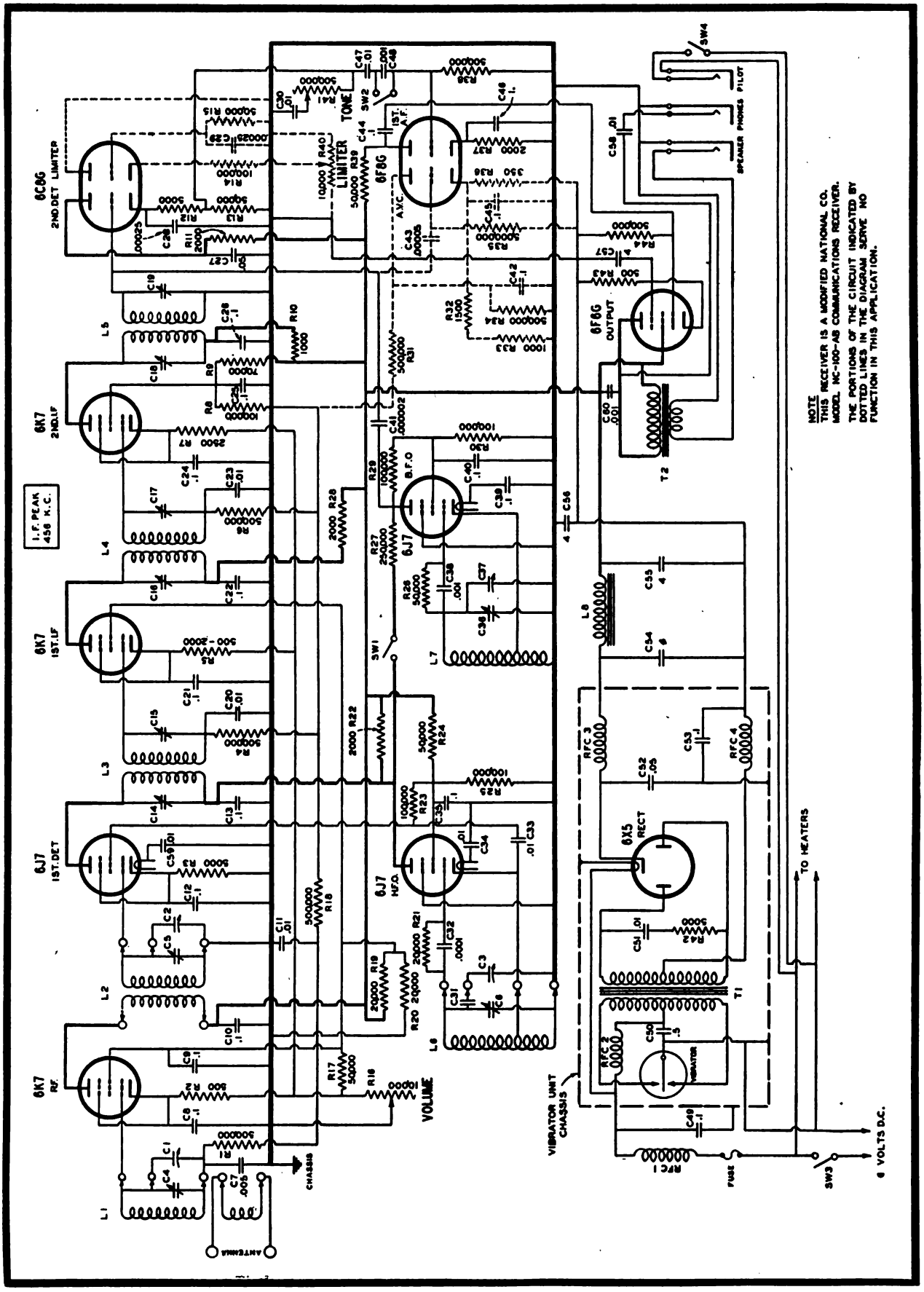


FIGURE 57
RADIO RECEIVER BC-903-A,—SCHEMATIC DIAGRAM

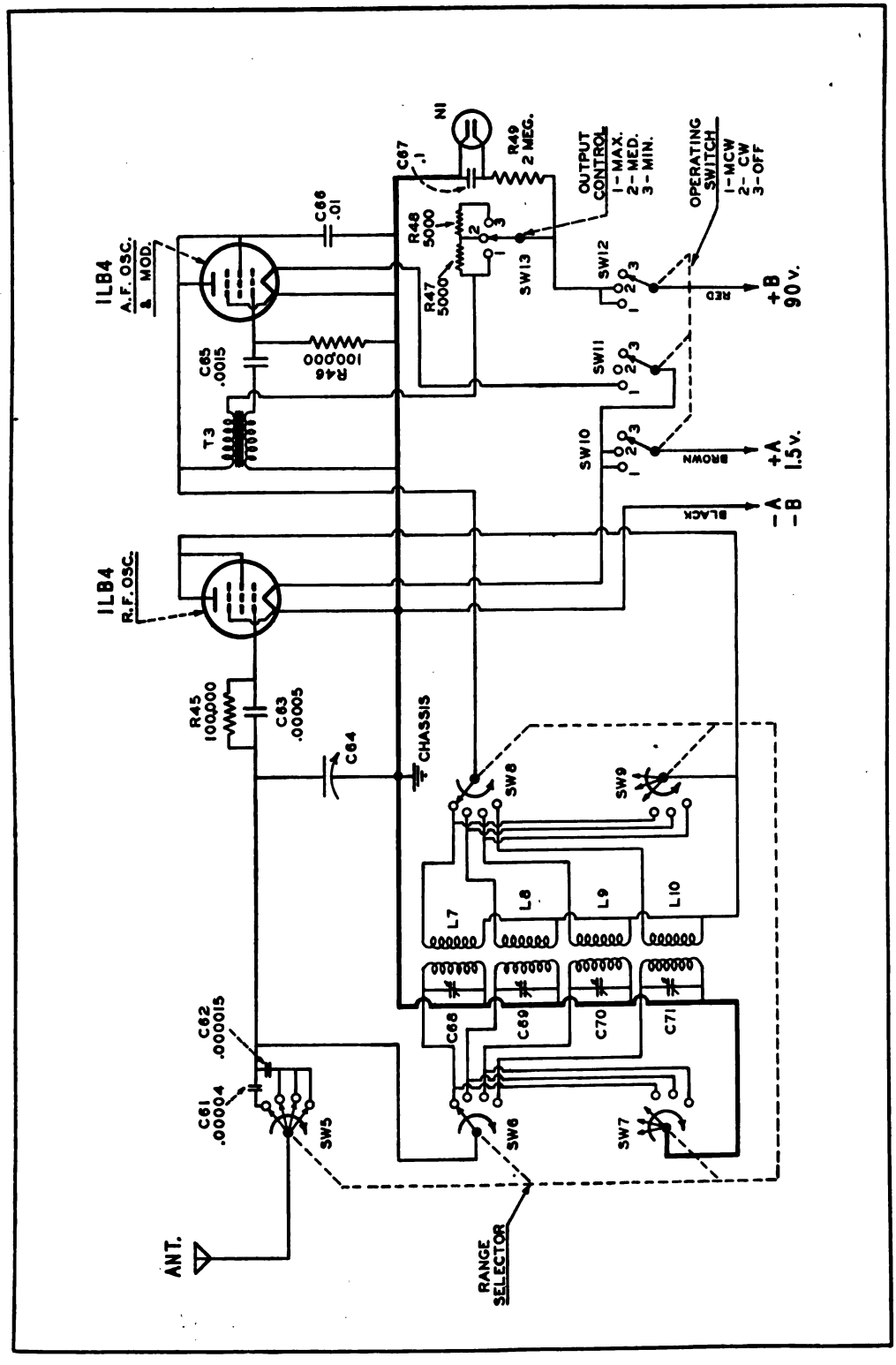


FIGURE 58

RADIO TRANSMITTER BC-904-A,—SCHEMATIC DIAGRAM

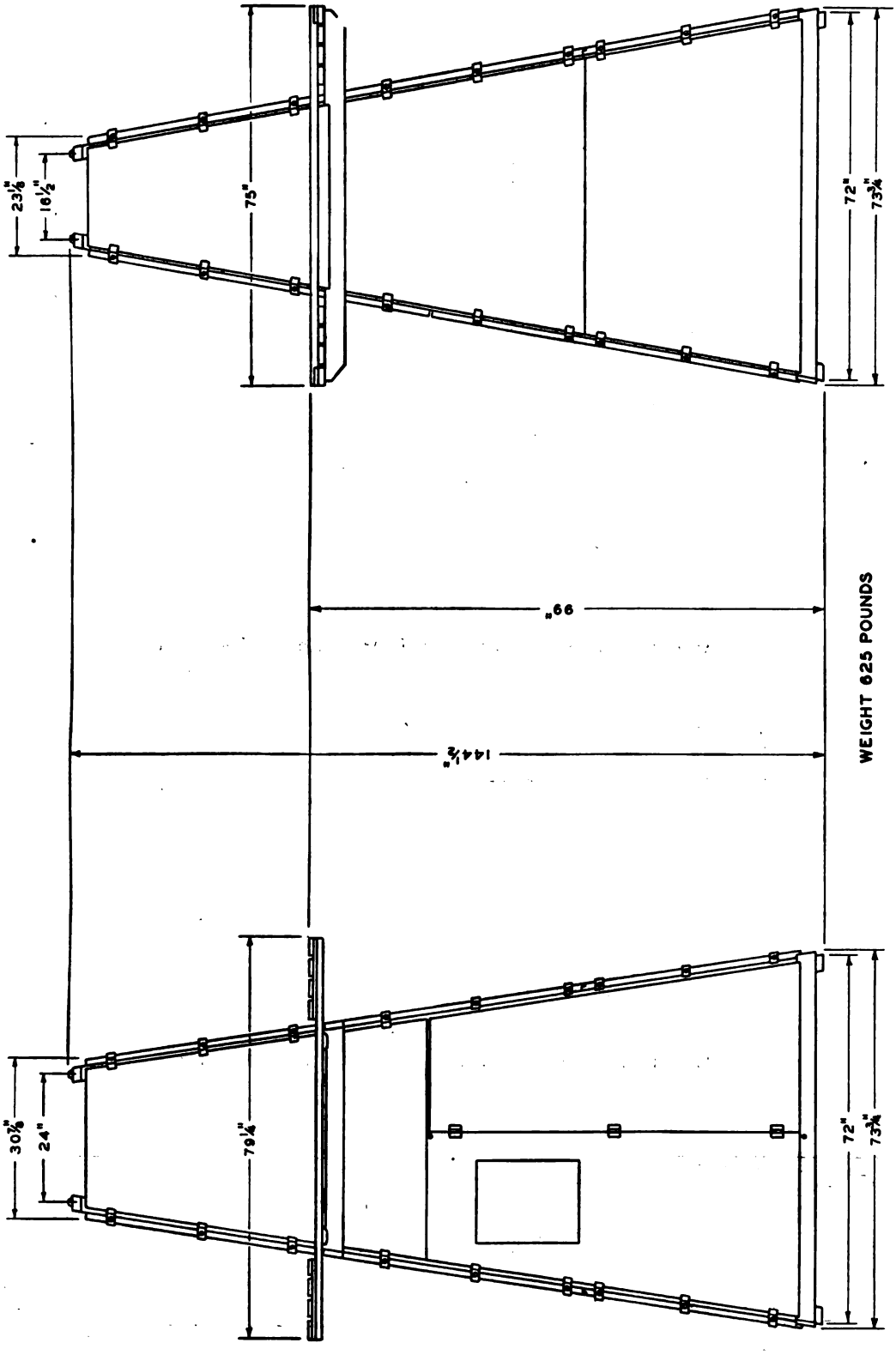
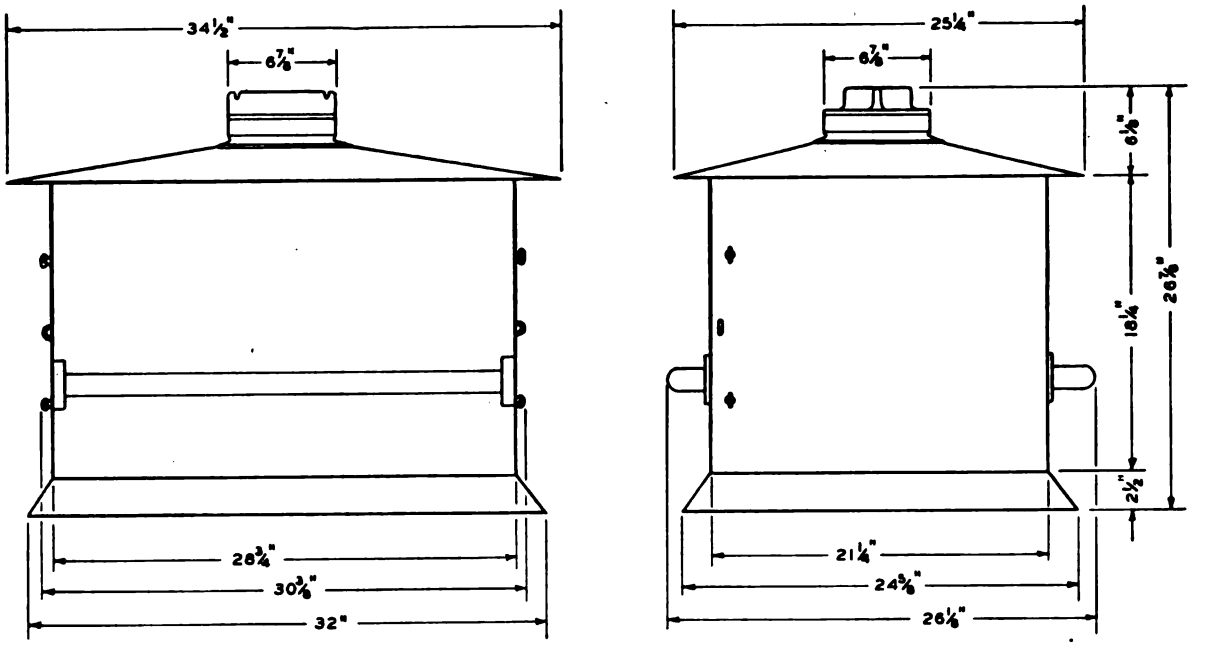


FIGURE 59

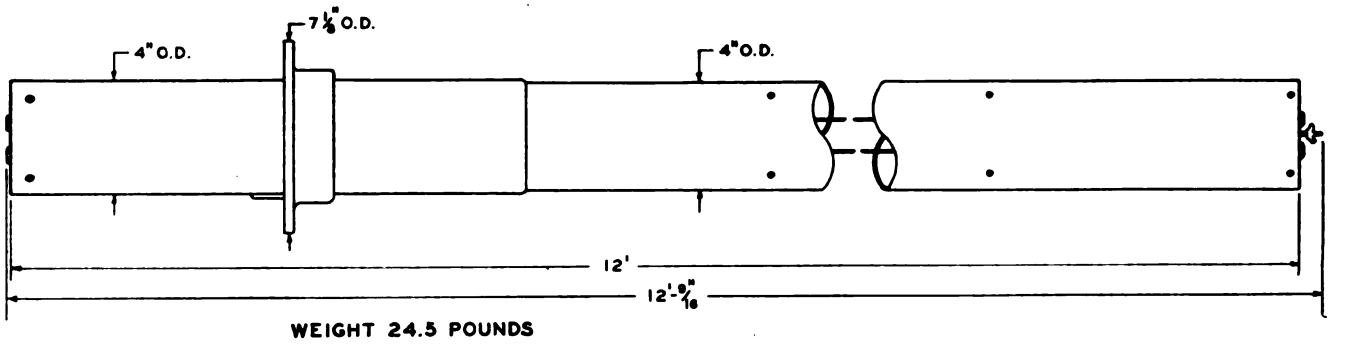
TOWER TR-19-A,—OUTLINE DIMENSIONAL DRAWING



WEIGHT 83 POUNDS

FIGURE 60

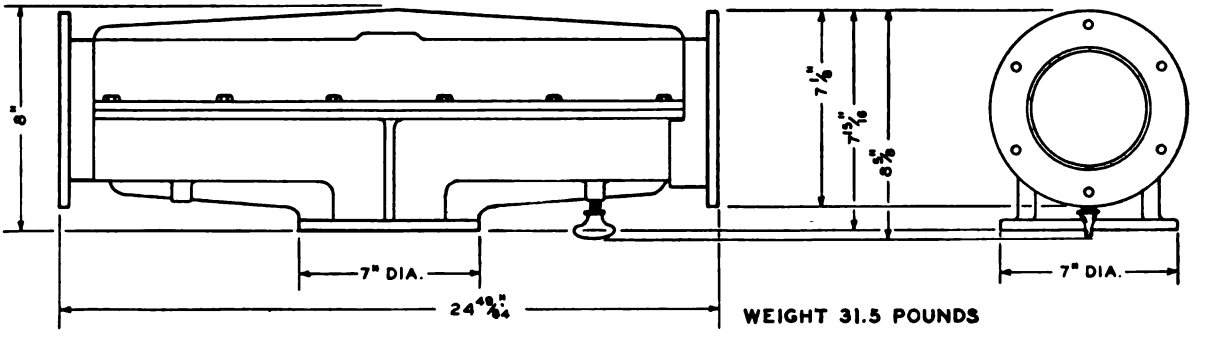
CABINET CS-95-A,—OUTLINE DIMENSIONAL DRAWING



WEIGHT 24.5 POUNDS

FIGURE 61

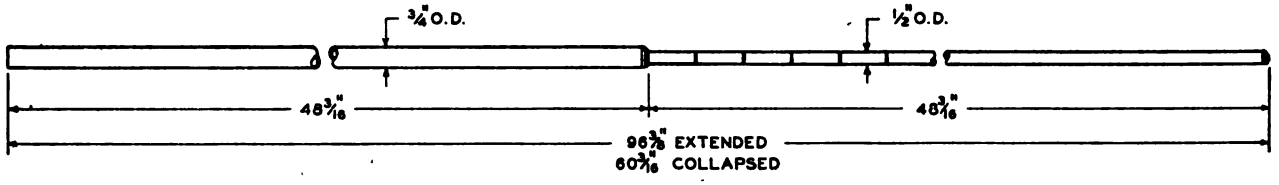
BEAM M-264-A,—OUTLINE DIMENSIONAL DRAWING



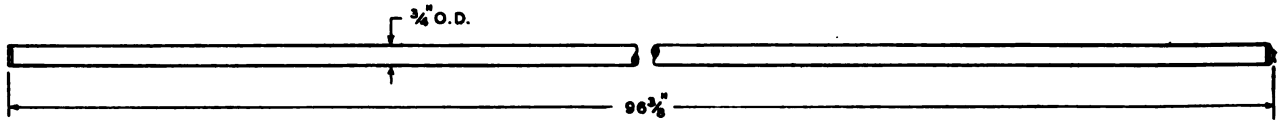
WEIGHT 31.5 POUNDS

BEAM SOCKET MC-263-A,—OUTLINE DIMENSIONAL DRAWING

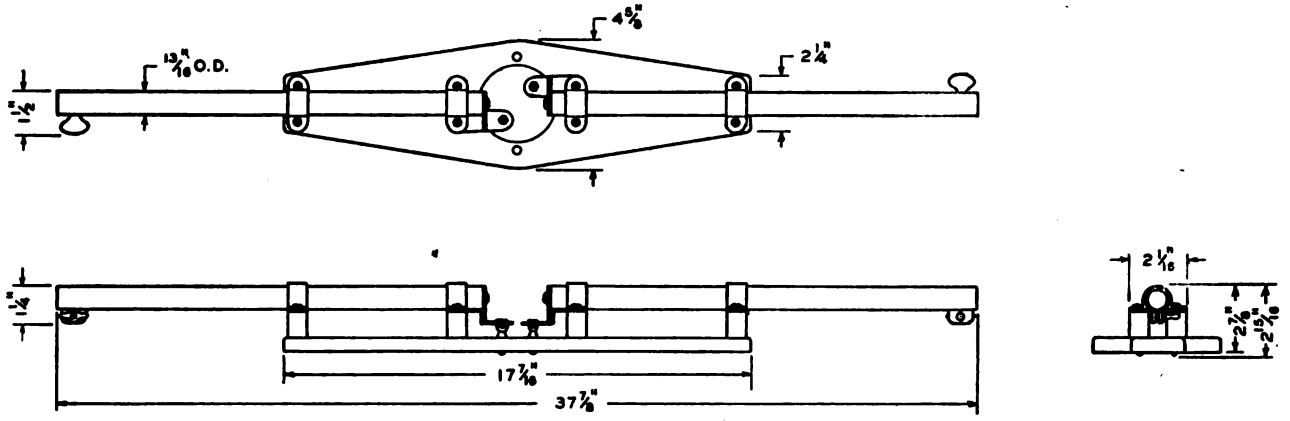
FIGURE 62



TELESCOPING DIPOLE REF. NO. 174 WEIGHT .72 POUNDS



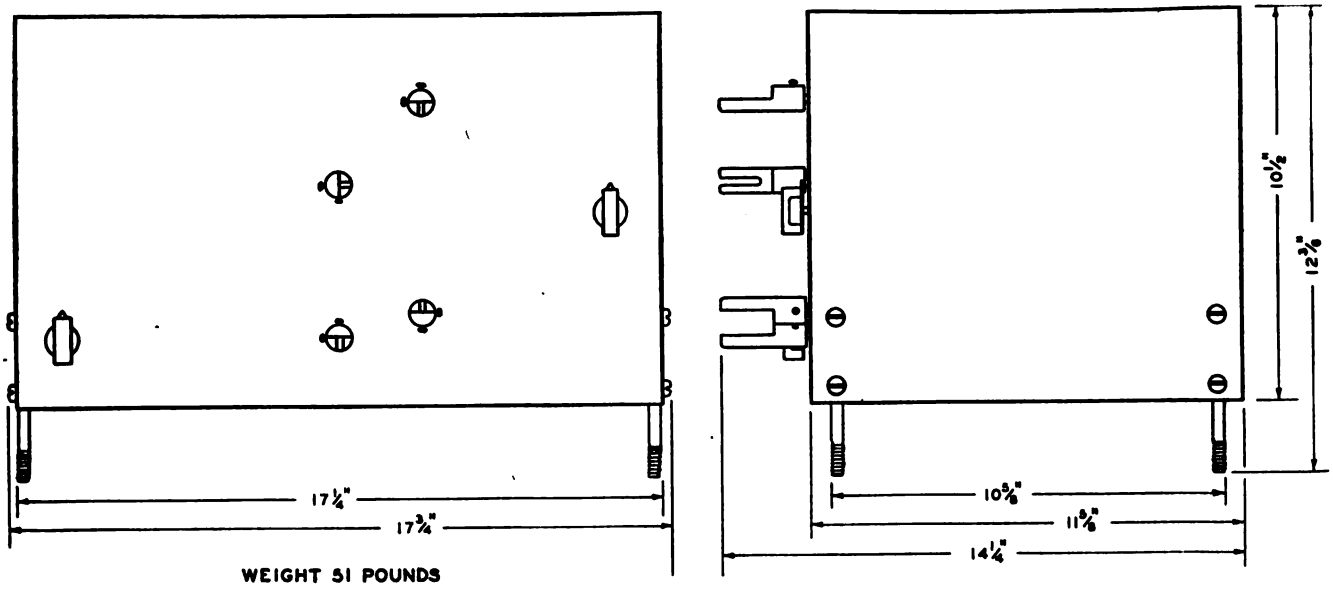
FIXED DIPOLE REF. NO. 175 WEIGHT .77 POUNDS



DIPOLE MTG. BASE ASSEM. REF. NO. 168 WEIGHT 3.25 POUNDS

FIGURE 63

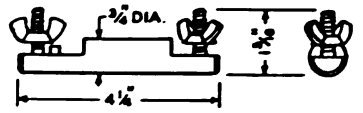
DIPOLE COLLECTOR AN-63-A,—OUTLINE DIMENSIONAL DRAWING



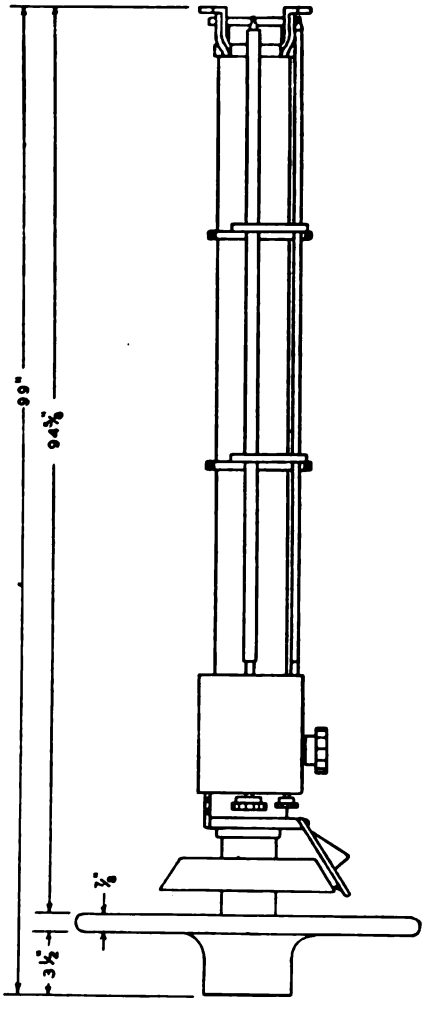
WEIGHT 51 POUNDS

FIGURE 64

RADIO RECEIVER BC-903-A,—OUTLINE DIMENSIONAL DRAWING



COUPLING LINK REF. NO. 236
WEIGHT .45 POUND



WEIGHT 50 POUNDS

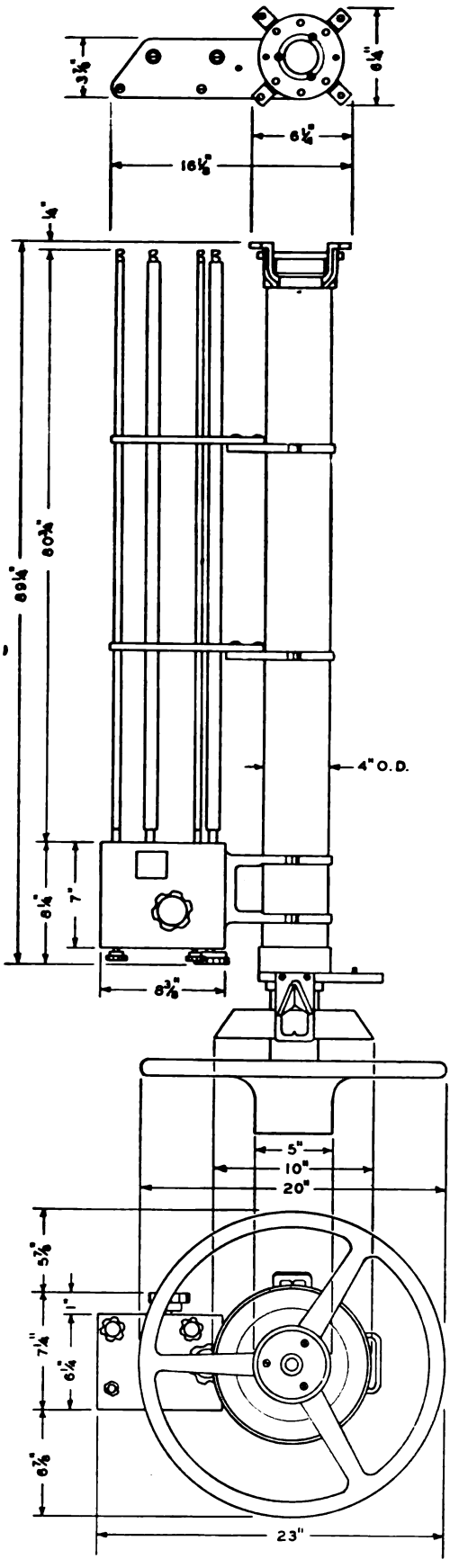


FIGURE 65

CONTROL UNIT MC-265-A,—OUTLINE DIMENSIONAL DRAWING

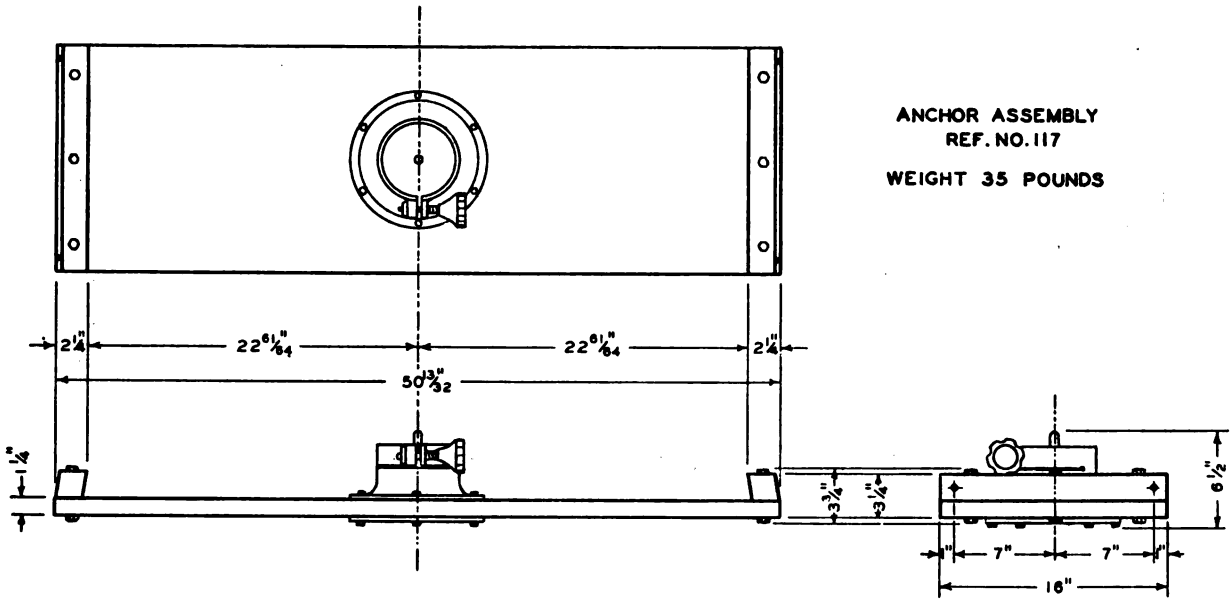


FIGURE 66

ANCHOR ASSEMBLY,—OUTLINE DIMENSIONAL DRAWING

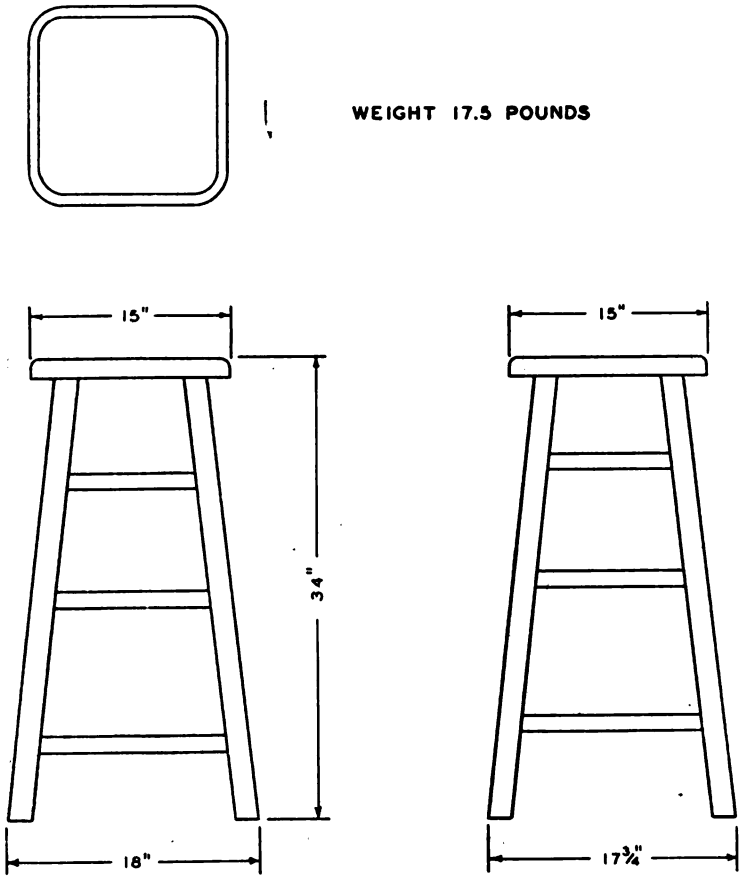


FIGURE 67

OPERATOR'S STOOL,—OUTLINE DIMENSIONAL DRAWING

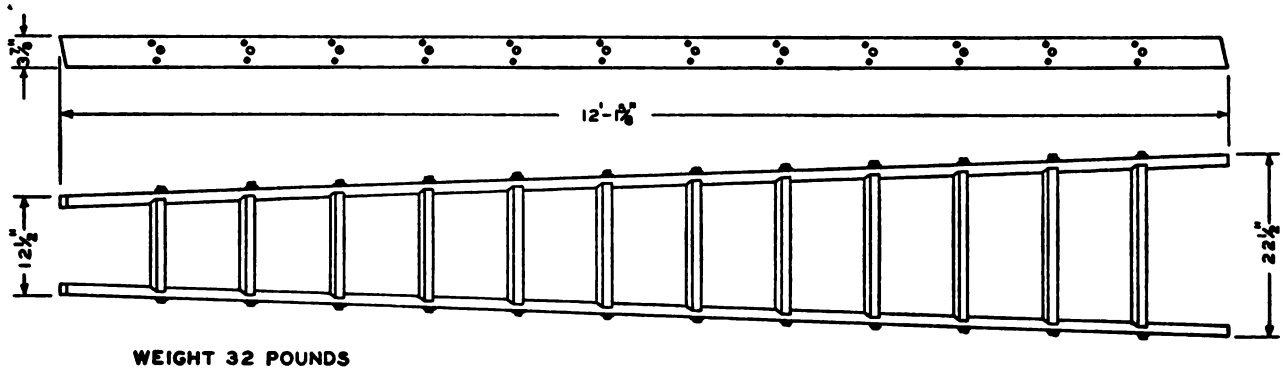


FIGURE 68

LADDER LC-55-A,—OUTLINE DIMENSIONAL DRAWING

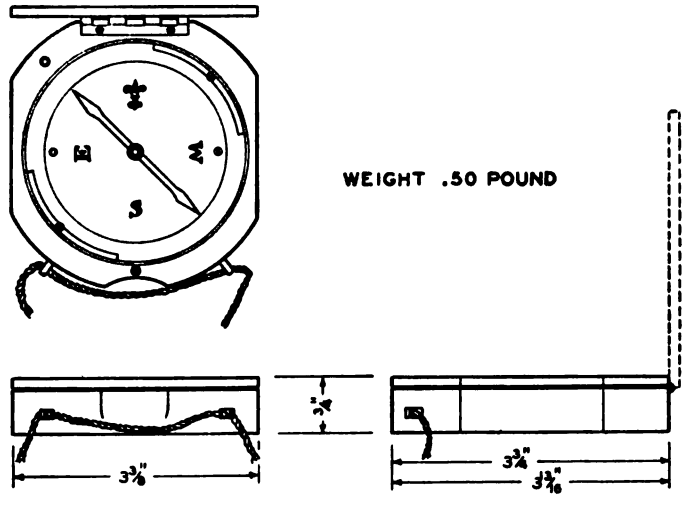


FIGURE 69

MAGNETIC COMPASS.—OUTLINE DIMENSIONAL DRAWING

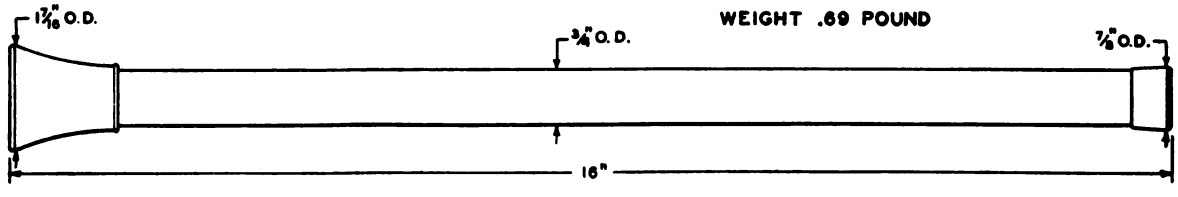
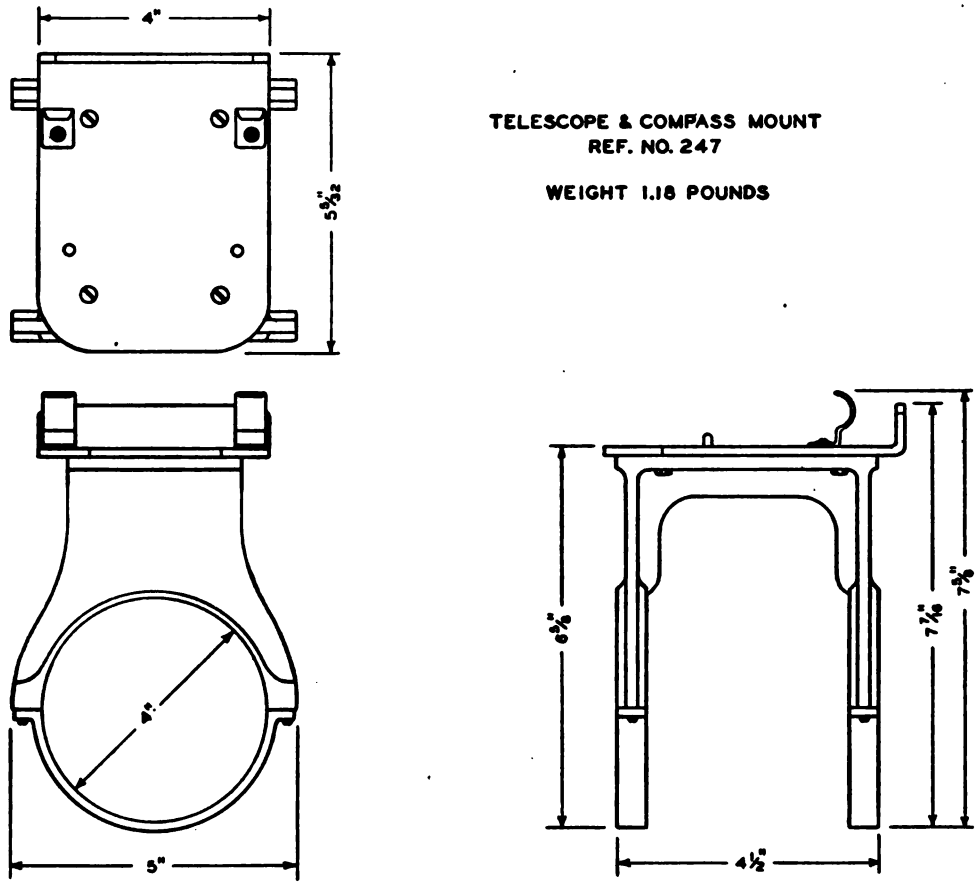


FIGURE 70

TELESCOPE,—OUTLINE DIMENSIONAL DRAWING

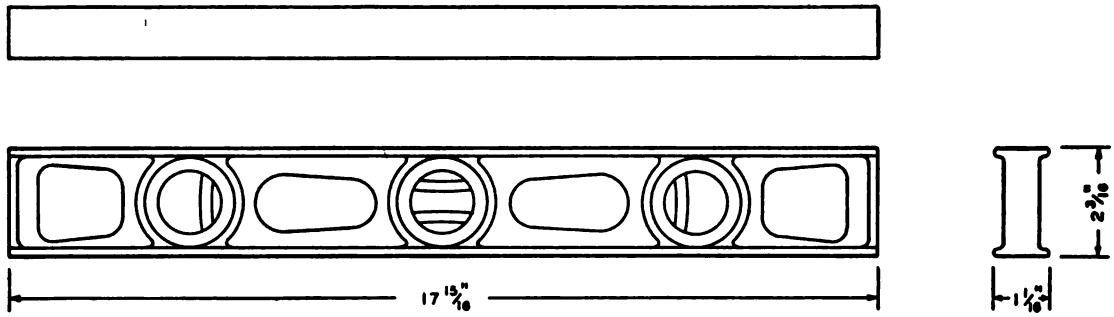


TELESCOPE & COMPASS MOUNT
REF. NO. 247

WEIGHT 1.18 POUNDS

FIGURE 71

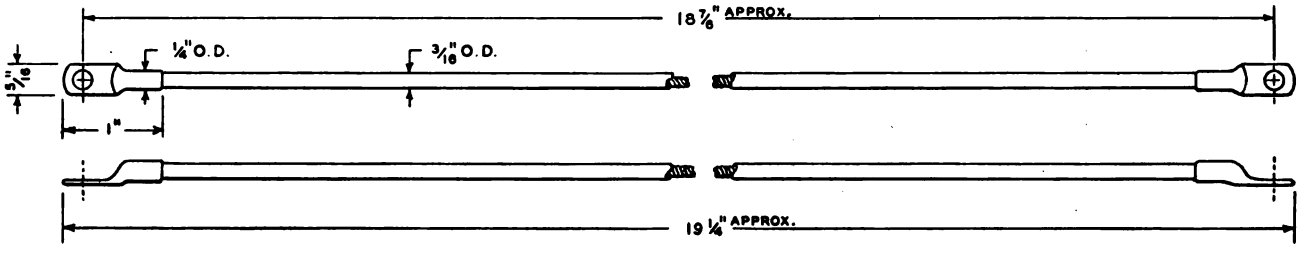
TELESCOPE AND COMPASS MOUNT,—OUTLINE DIMENSIONAL DRAWING



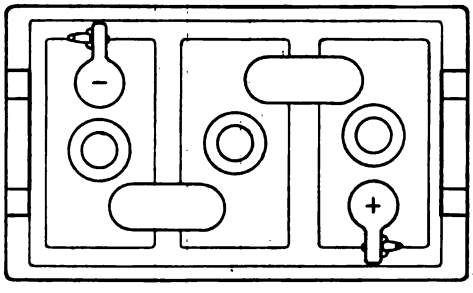
WEIGHT 1.56 POUNDS

FIGURE 72

SPIRIT LEVEL,—OUTLINE DIMENSIONAL DRAWING



BATTERY JUMPER LEAD REF. NO. 250 WEIGHT .13 POUND



STORAGE BATTERY
REF. NO. 249
WEIGHT 57.5 POUNDS

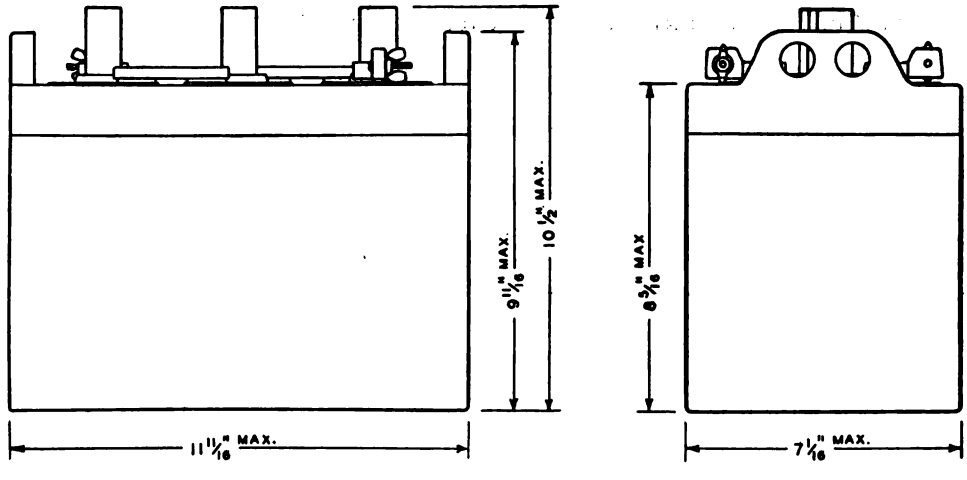
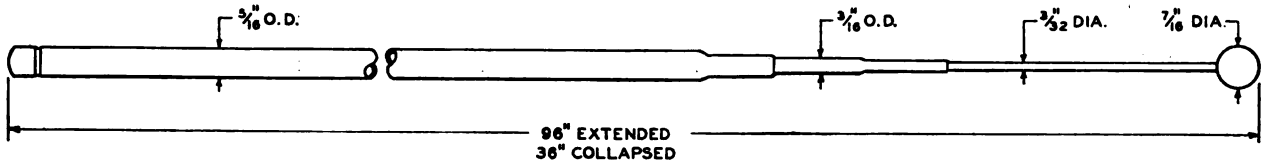


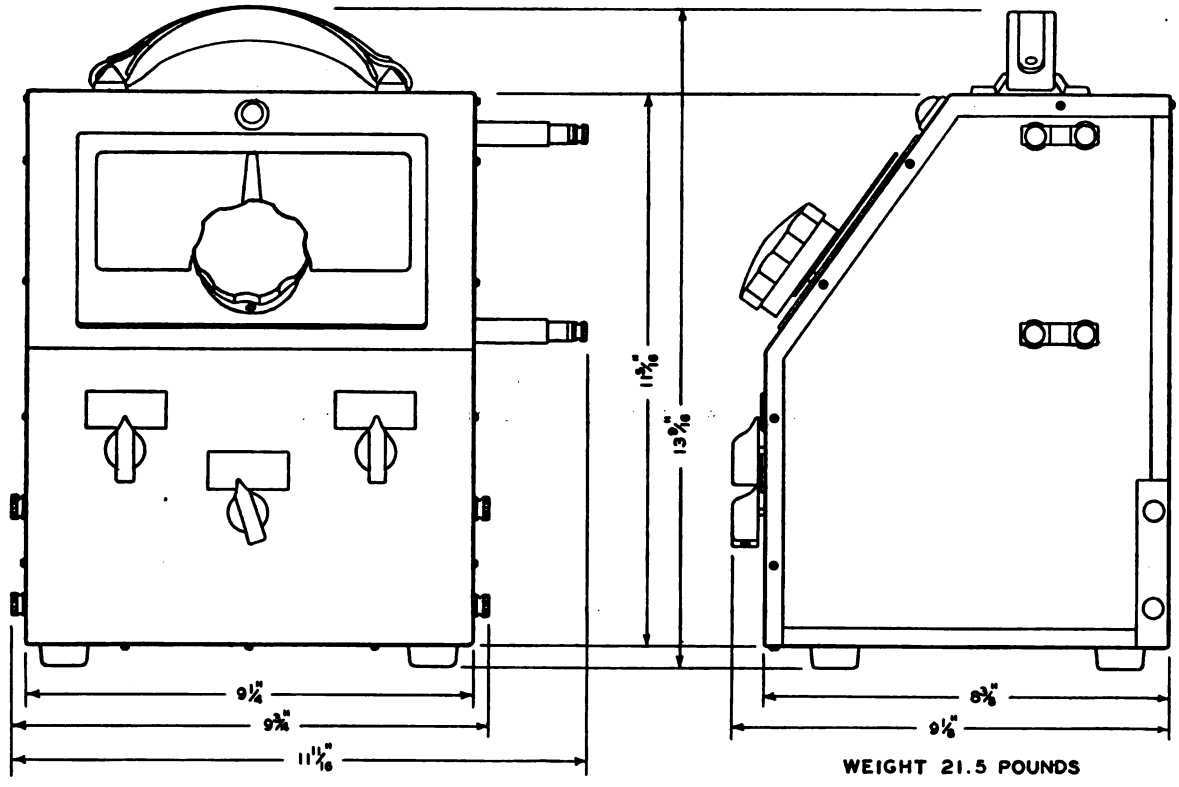
FIGURE 73

STORAGE BATTERY,—OUTLINE DIMENSIONAL DRAWING



TRANSMITTER ANTENNA REF. NO. 80

WEIGHT .50 POUND



WEIGHT 21.5 POUNDS

FIGURE 74

RADIO TRANSMITTER BC-904-A,—OUTLINE DIMENSIONAL DRAWING

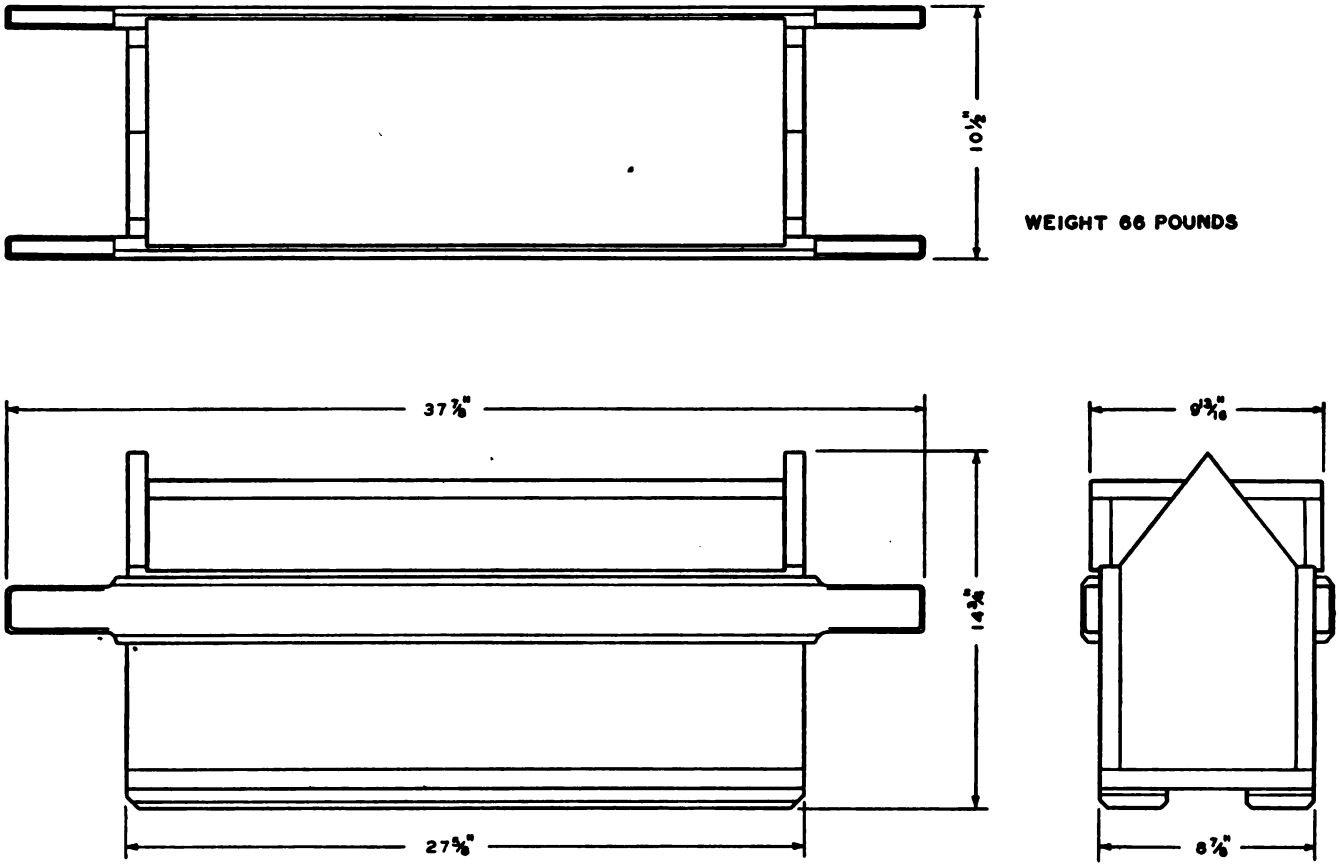


FIGURE 75

BOX BX-35-A,—OUTLINE DIMENSIONAL DRAWING

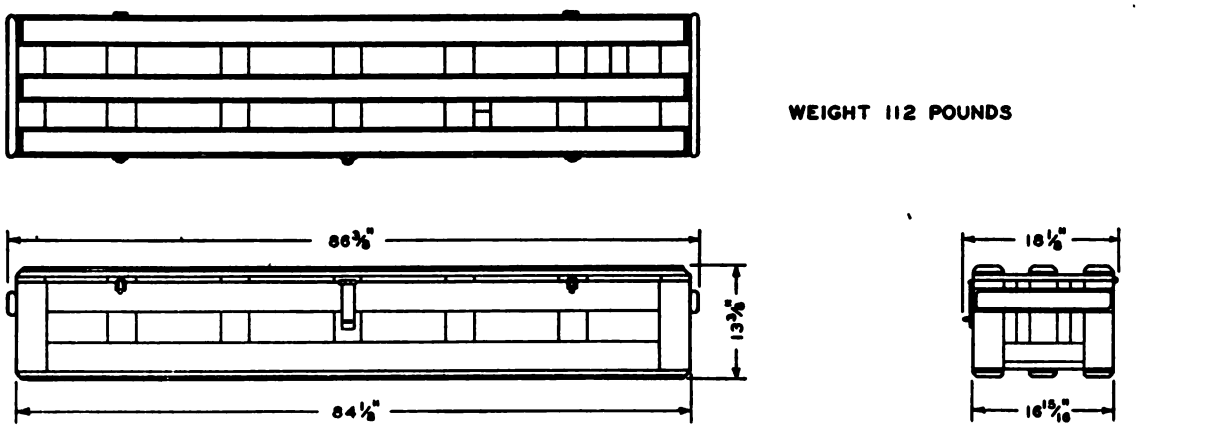


FIGURE 76

CHEST CH-91-A,—OUTLINE DIMENSIONAL DRAWING

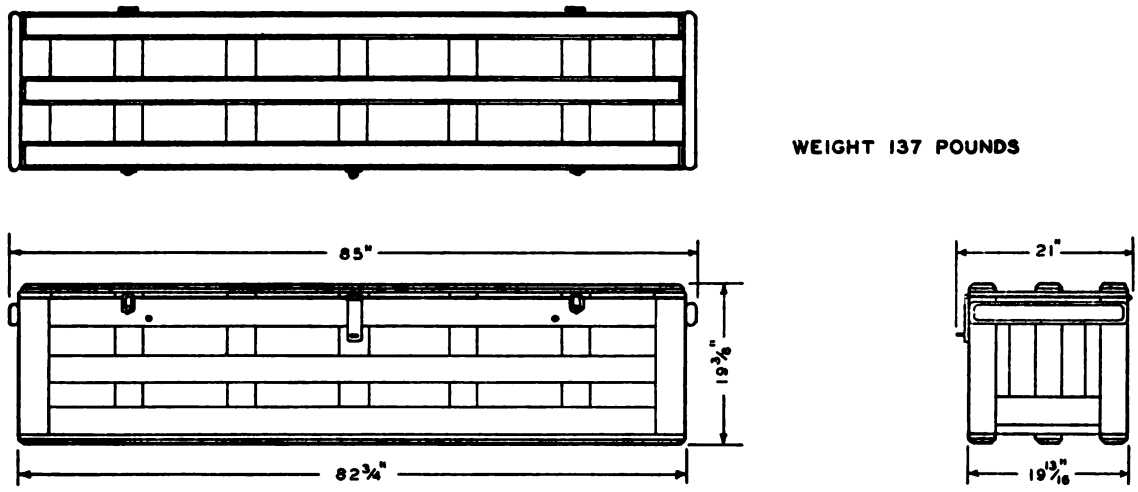


FIGURE 77

CHEST CH-82-A,—OUTLINE DIMENSIONAL DRAWING

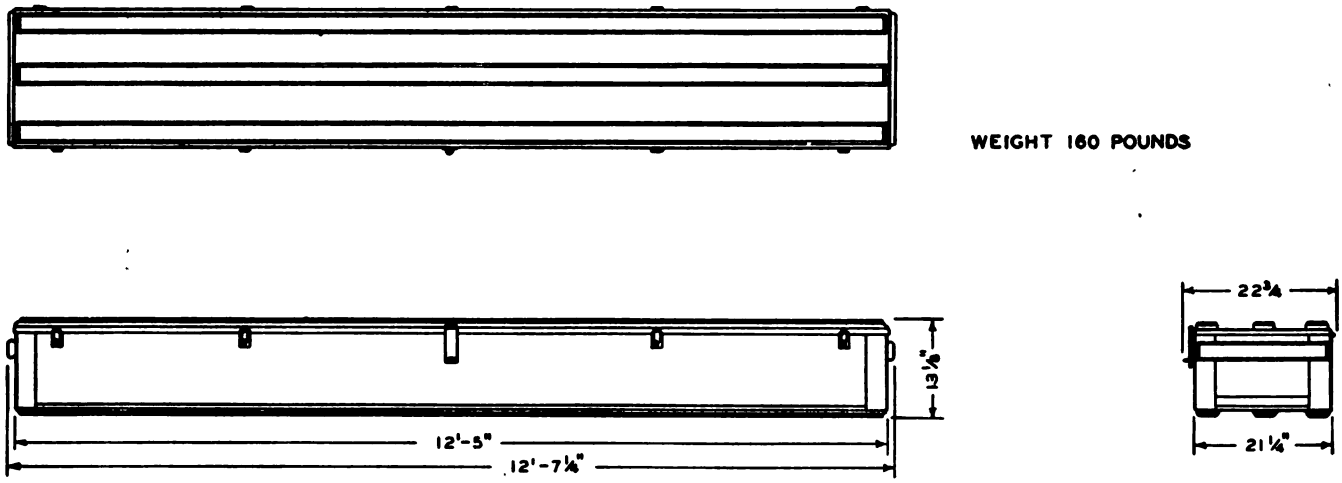


FIGURE 78

CHEST CH-83-A,—OUTLINE DIMENSIONAL DRAWING

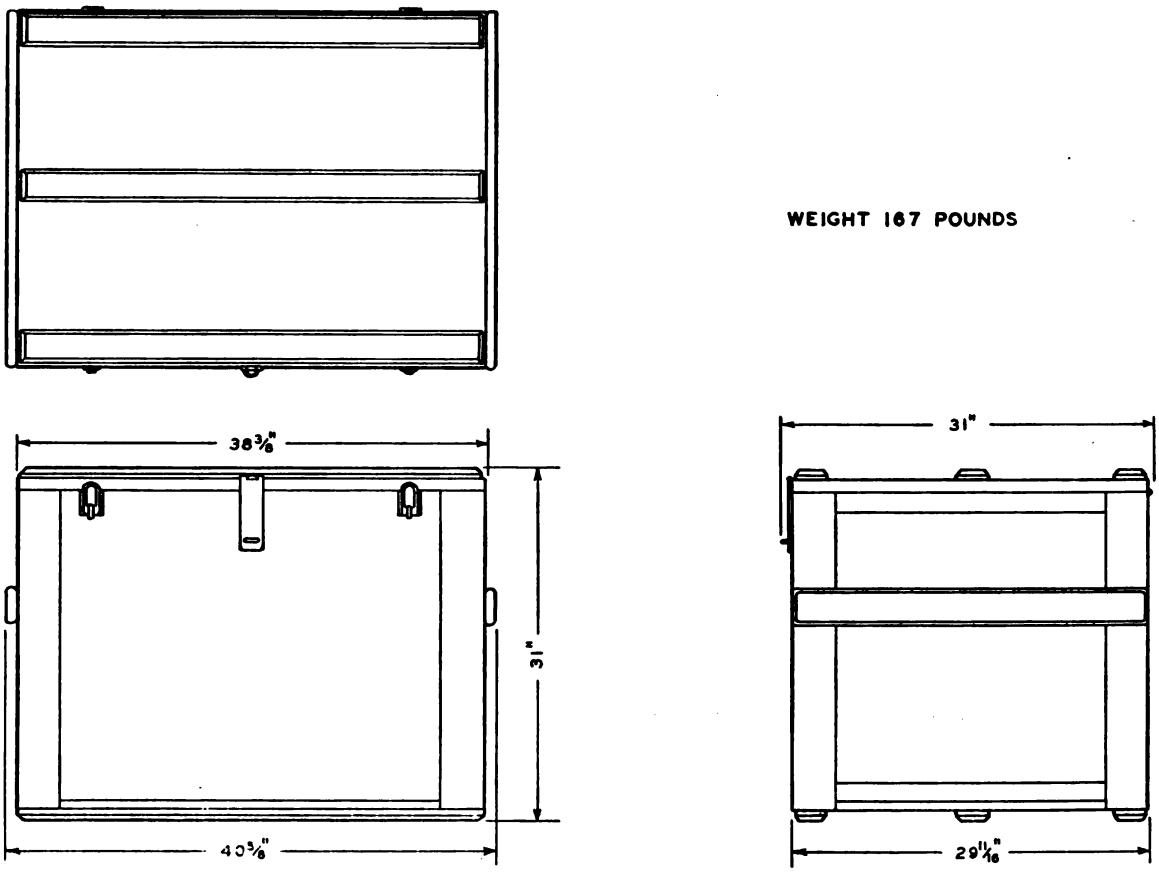


FIGURE 79

CHEST CH-84-A,—OUTLINE DIMENSIONAL DRAWING

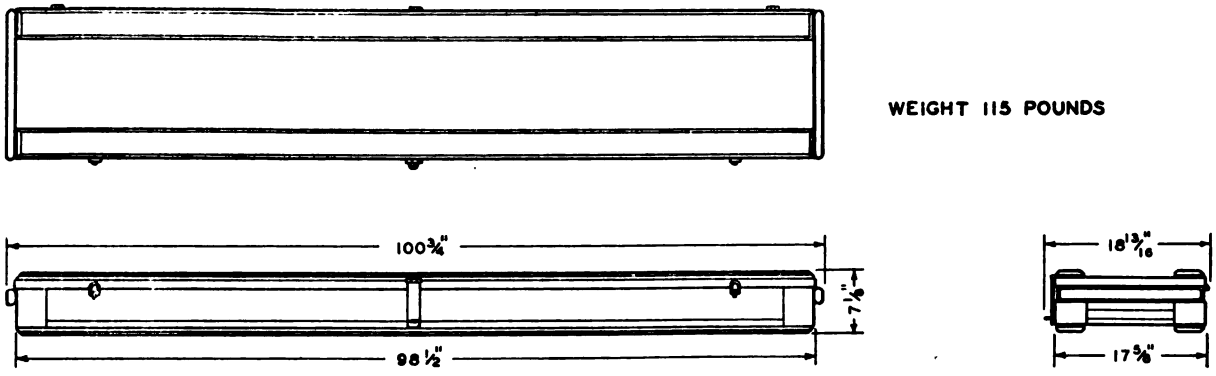


FIGURE 80

CHEST CH-85-A,—OUTLINE DIMENSIONAL DRAWING

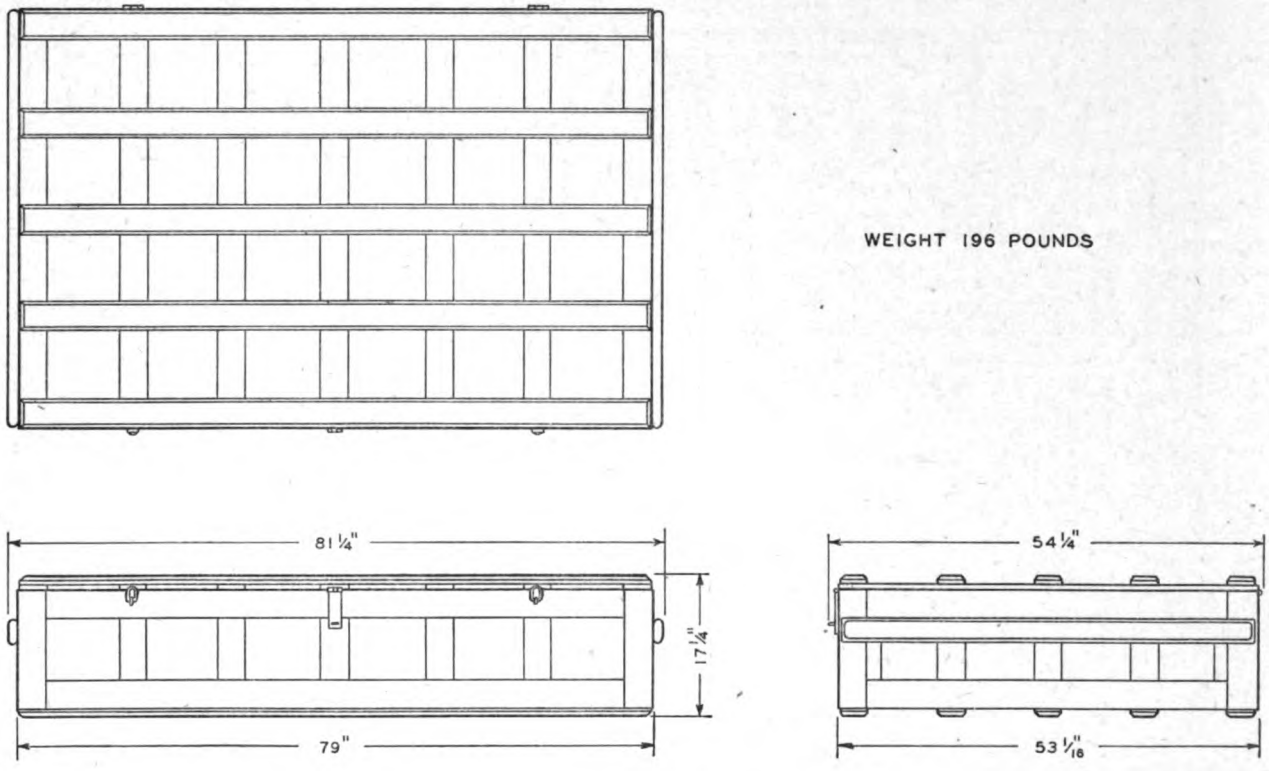


FIGURE 81

CHEST CH-86-A,—OUTLINE DIMENSIONAL DRAWING

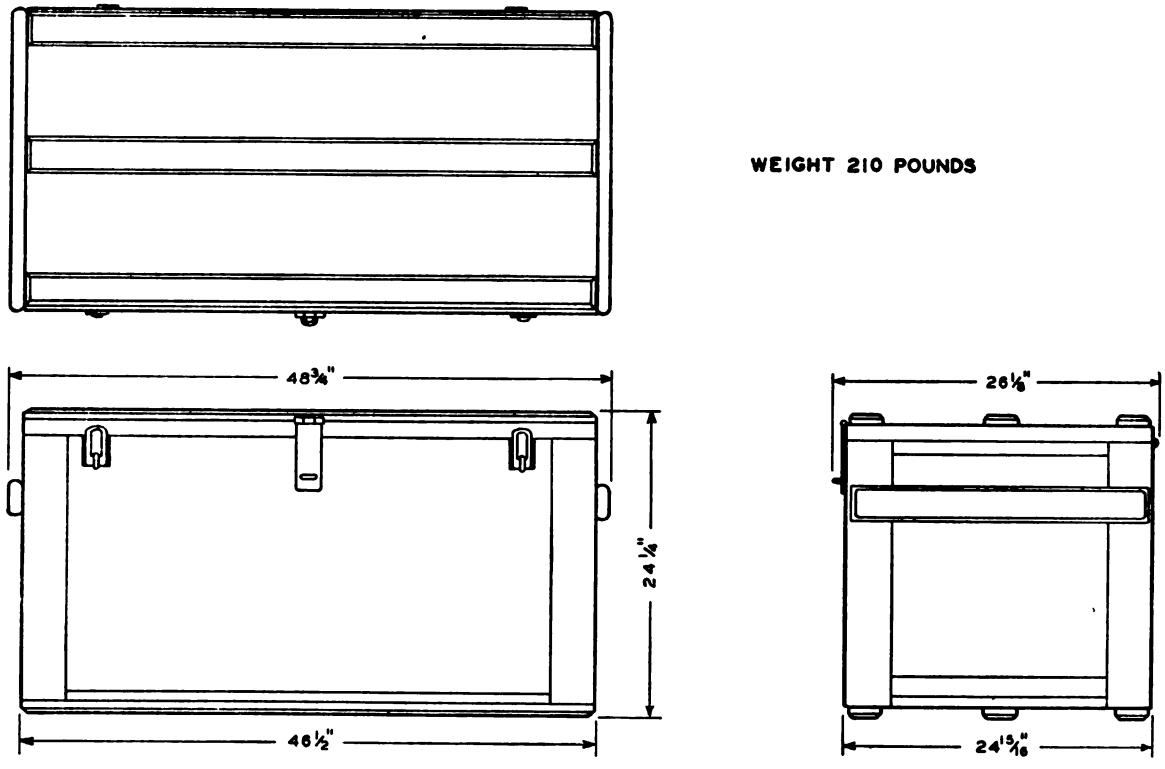


FIGURE 82

CHEST CH-90-A,—OUTLINE DIMENSIONAL DRAWING

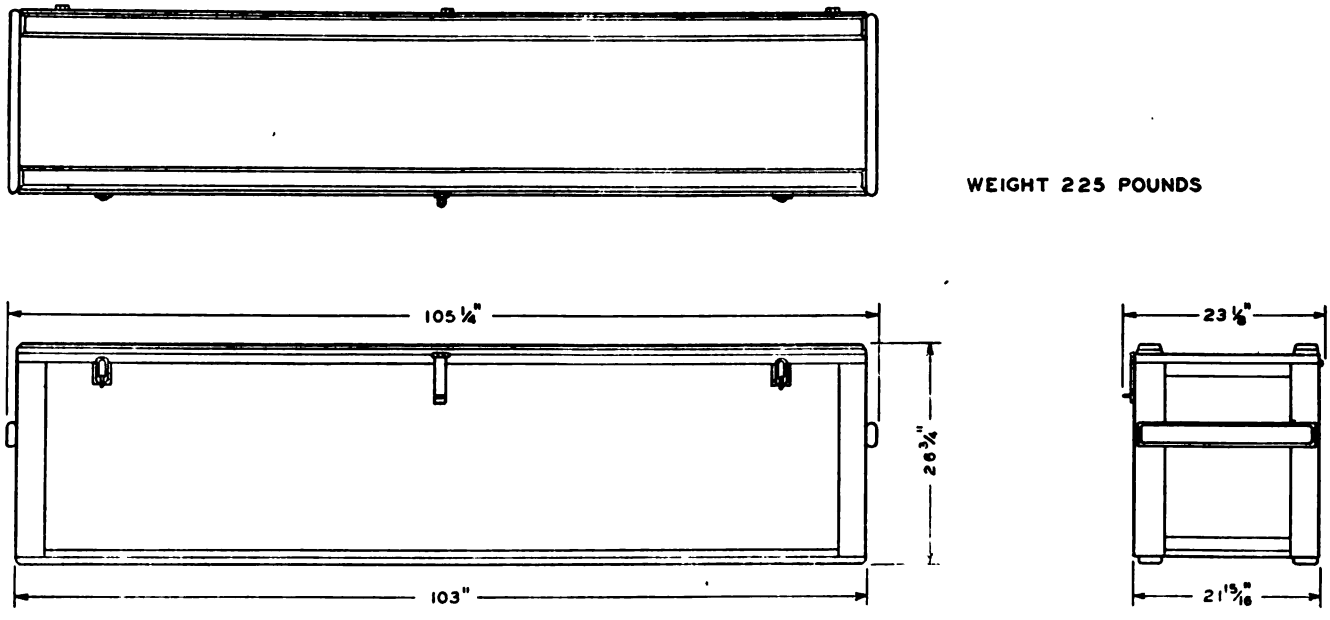


FIGURE 83

CHEST CH-91-A,—OUTLINE DIMENSIONAL DRAWING

SECTION V

APPENDIX

TABLE OF REPLACEABLE PARTS

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
			RADIO RECEIVER BC-903-A			
C1	3D9225V		Type NPW-D-161	r-f tuning		
C2	3D9225V	Capacitor	3 section variable air, 225 μμf,	1st detector tuning		2
C3	3D9225V		each section	h-f oscillator tuning		
C4		Capacitor	Refer to L1	r-f trimmer		2
C5		Capacitor	Refer to L2	1st det. trimmer		2
C6		Capacitor	Refer to L6	h-f osc. trimmer		2
C7	3DA5-25C	Capacitor	Type 1467 .005 μf, 300 volt, mica	r-f grid filter		4
C8	3DA100-30	Capacitor	Type 014AG .1 μf, 400 volt, paper	r-f cathode by-pass		3
C9	3DA100-30	Capacitor	Type 014AG .1 μf, 400 volt, paper	r-f screen by-pass		3
C10	3DA100-72	Capacitor	Type 016AG .1 μf, 600 volt, paper	r-f B+ by-pass		3
C11	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	r-f grid filter		3
C12	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	1st det. cathode by-pass		3
C13	3DA100-72	Capacitor	Type 016AG .1 μf, 600 volt, paper	1st det. B+ by-pass		3
C14		Capacitor	Refer to L3	1st i-f trimmer—primary		2
C15		Capacitor	Refer to L3	1st i-f trimmer—secondary		2
C16		Capacitor	Refer to L4	2nd i-f trimmer—primary		2
C17		Capacitor	Refer to L4	2nd i-f trimmer—secondary		2
C18		Capacitor	Refer to L5	2nd det. trimmer—primary		2
C19		Capacitor	Refer to L5	2nd det. trimmer—secondary		2
C20	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	1st i-f grid filter		3
C21	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	1st i-f cathode by-pass		3
C22	3DA100-72	Capacitor	Type 016AG .1 μf, 600 volt, paper	1st i-f B+ by-pass		3
C23	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	2nd i-f grid filter		3
C24	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	2nd i-f cathode by-pass		3
C25	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	2nd i-f screen by-pass		3
C26	3DA100-72	Capacitor	Type 016AG .1 μf, 600 volt, paper	2nd i-f B+ by-pass		3
C27	3DA50-10	Capacitor	Type 156AG .05 μf, 600 volt, paper	2nd det. plate by-pass		3
C28	3D9250-20	Capacitor	Type 1468 .00025 μf, 500 volt, mica	2nd det. cathode by-pass		4
C29	3D9250-20	Capacitor	Type 1468 .00025 μf, 500 volt, mica	No function due to circuit modification		4

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
C30	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	Tone control		3
C31-E	3D9350	Capacitor	Type 1468 .00035 μf, 500 volt, mica	Fixed osc. padder for range E		4
C31-D	3D9800-1	Capacitor	Type 1467 .0008 μf, 500 volt, mica	Fixed osc. padder for range D		4
C31-C	3DA1.36	Capacitor	Type 1467 .00136 μf, 500 volt, mica	Fixed osc. padder for range C		4
C31-B	3DA3.100-1	Capacitor	Type 1467 .0031 μf, 300 volt, mica	Fixed osc. padder for range B		4
C31-A	3D9980	Capacitor	Type 1467 .00098 μf, 500 volt, mica	Fixed osc. padder for range A		4
C32	3D9100-24	Capacitor	Type 1468 .0001 μf, 500 volt, mica	h-f osc. grid blocking		4
C33	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	h-f osc. coupling		3
C34	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	h-f osc. heater by-pass		3
C35	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	h-f osc. screen by-pass		3
C36	3D9085V	Capacitor	Type IF-O 85 μμf, variable air	c-w osc. trimmer		2
C37	3D9006V-2	Capacitor	Type UM 6 μμf, variable air	c-w osc. tuning		2
C38	3DA1-24	Capacitor	Type 1460 .001 μf, 500 volt, mica	c-w osc. grid blocking		4
C39	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	c-w osc. heater by-pass		3
C40	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	c-w osc. screen by-pass		3
C41	3D9002-6	Capacitor	Type B21 .000002 μf, 400 volt, phenolic	c-w osc. coupling		2
C42	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	No function due to circuit modification		3
C43	3D9050-8	Capacitor	Type 1468 .00005 μf, 500 volt, mica	No function due to circuit modification		4
C44	3DA100-72	Capacitor	Type 016AG .1 μf, 600 volt, paper	1st a-f output coupling		3
C45	3DA100-38	Capacitor	Type 014AG .1 μf, 400 volt, paper	No function due to circuit modification		3
C46	3DB1.284	Capacitor	Type 284 1.0 μf, 200 volt, paper	1st a-f cathode by-pass		4
C47	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	2nd det. output coupling		3
C48	3DA1-22	Capacitor	Type 1467 .001 μf, 500 volt, mica	Tone control		4
C49	3DA100-69	Capacitor	Type TVC-4P1-4 .1 μf, 400 volt, oil	Power supply input filter		8
C50	3DA500-38	Capacitor	Type R.F. 481 .5 μf, 50 volt, paper	Vibrator by-pass		12
C51	3DA10-81 or 3DA7.5	Capacitor	Type A-40980-2 .01 μf, 1600 volt, paper, or Type A-40980-3 .0075 μf, 1600 volt, as selected to match power transformer T1	Power supply buffer		12
C52	3DA50-25	Capacitor	Type TP-415 .05 μf, 600 volt, paper	Power supply output by-pass		12
C53	3DA100-70	Capacitor	Type TP-438 .1 μf, 200 volt, paper	Power supply output by-pass		12
C54	DB4-33	Capacitor	Type P8211 4.0 μf, 600 volt, oil or Type NAC-104 4.0 μf, 600 volt, oil	B+ filter by-pass		3 or 7

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
C55	3DB4	Capacitor	Type P8211 4.0 μf, 600 volt, oil or Type NAC-104 4.0 μf, 600 volt, oil	B+ filter by-pass		3 or 7
C56	3DB4-33	Capacitor	Type P8211 4.0 μf, 600 volt, oil or Type NAC-104 4.0 μf, 600 volt, oil	No function due to circuit modifications		3 or 7
C57	3DB4-33	Capacitor	Type P8211 4.0 μf, 600 volt, oil or Type NAC-104 4.0 μf, 600 volt, oil	Output cathode by-pass		3 or 7
C58	3DA10-80	Capacitor	Type 116AG .01 μf, 600 volt, paper	Phone jack coupling		3
C59	3DA10-82	Capacitor	Type 114AG .01 μf, 400 volt, paper	1st det. heater by-pass		3
C60	3DA1-24	Capacitor	Type 1460 .001 μf, 500 volt, mica	Output plate by-pass		4
L1	2C4529/C17	Coil	Type 29-E1, with C4	r-f for range E		2
L1	2C4529/C18	Coil	Type 28-D1, with C4	r-f for range D		2
L1	2C4529/C19	Coil	Type 100-C1, with C4	r-f for range C		2
L1	2C4529/C20	Coil	Type 100-B1, with C4	r-f for range B		2
L1	2C4529/C21	Coil	Type 100-A1, with C4	r-f for range A		2
L2	2C4529/T20	Coil	Type 29-E2, with C5	1st det. for range E		2
L2	2C4529/T11	Coil	Type 26-D2, with C5	1st det. for range D		2
L2	2C4529/T12	Coil	Type 100-C2, with C5	1st det. for range C		2
L2	2C4529/T13	Coil	Type 100-B2, with C5	1st det. for range B		2
L2	2C4529/T14	Coil	Type 100-A2, with C5	1st det. for range A		2
L3	2Z9729-2	Transformer	Type 21 air core, with C14 and C15	1st i-f 456 k-c.		2
L4	2Z9729-1	Transformer	Type 20 air core ,with C16 and C17	2nd i-f 456 k-c.		2
L5	2Z9729-3	Transformer	Type 20-D air core, with C18 and C19	2nd det. 456 kc.		2
L6	2C4529/C22	Coil	Type 27-E3, with C6	h-f osc. for range E		2
L6	2C4529/T6	Coil	Type 100-D3, with C6	h-f osc. for range D		2
L6	2C4529/T7	Coil	Type 100-C3, with C6	h-f osc. for range C		2
L6	2C4529/T8	Coil	Type 100-B3, with C6	h-f osc. for range B		2
L6	2C4529/T9	Coil	Type 100-A3, with C6	h-f osc. for range A		2
L7	2Z9730	Transformer	Type 11 air core, with C36 and C37	b-f-o 456 kc.		2
L8	3C326-80	Choke	Type 80, 17 H., 80 Ma.	Power supply audio filter		2
R1	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	r-f grid filter		5
R2	3Z6050-16	Resistor	Type 310 500 ohm ½ watt carbon	r-f cathode bias		5
R3	3Z6500-23	Resistor	Type 310 5,000 ohm ½ watt carbon	1st det. cathode bias		5

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
R4	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	1st i-f grid filter		5
R5	3Z6200-31	Resistor	Type 310 500-2,000 ohm ½ watt carbon	1st i-f cathode bias		5
R6	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	2nd i-f grid filter		5
R7	3Z6250-20	Resistor	Type 310 2,500 ohm ½ watt carbon	2nd i-f cathode bias		5
R8	3Z6700-22	Resistor	Type 310 100,000 ohm ½ watt carbon	2nd i-f screen voltage divider		5
R9	3Z6670-2	Resistor	Type 310 70,000 ohm ½ watt carbon	2nd i-f screen voltage divider		5
R10	3Z6100-26	Resistor	Type 310 1,000 ohm ½ watt carbon	2nd i-f plate filter		5
R11	3Z6200-14	Resistor	Type 310 2,000 ohm ½ watt carbon	2nd det. plate filter		5
R12	3Z6500-23	Resistor	Type 310 5,000 ohm ½ watt carbon	2nd det. i-f filter		5
R13	3Z6650-19	Resistor	Type 310 50,000 ohm ½ watt carbon	2nd det. load		5
R14	3Z6700-22	Resistor	Type 310 100,000 ohm ½ watt carbon	No function due to circuit modifications		5
R15	3Z6650-19	Resistor	Type 310 50,000 ohm ½ watt carbon	No function due to circuit modifications		5
R16	3Z6610-23	Resistor	Type E-9029-B 10,000 ohm wire wound, variable	Volume control		6
R17	3Z6650-19	Resistor	Type 310 50,000 ohm ½ watt carbon	Volume control bleeder		5
R18	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	r-f grid filter		5
R19	3Z6620-22	Resistor	Type 316 20,000 ohm 2 watt carbon	B+ voltage divider		5
R20	3Z6620-22	Resistor	Type 316 20,000 ohm 2 watt carbon	B+ voltage divider		5
R21	3Z6620-21	Resistor	Type 310 20,000 ohm ½ watt carbon	h-f osc. grid leak		5
R22	3Z6200-14	Resistor	Type 310 2,000 ohm ½ watt carbon	1st det. plate filter		5
R23	3Z6700-22	Resistor	Type 310 100,000 ohm ½ watt carbon	1st det. screen voltage dropping		5
R24	3Z6650-20	Resistor	Type 314 50,000 ohm 1 watt carbon	h-f osc. screen voltage divider		5

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
R25	3Z6700-22	Resistor	Type 310 100,000 ohm ½ watt carbon	h-f osc. screen voltage divider		5
R26	3Z6650-19	Resistor	Type 310 50,000 ohm ½ watt carbon	c-w osc. grid leak		5
R27	3Z6725-10	Resistor	Type 310 250,000 ohm ½ watt carbon	c-w osc. plate filter		5
R28	3Z6200-14	Resistor	Type 310 2,000 ohm ½ watt carbon	1st i-f plate filter		5
R29	3Z6700-22	Resistor	Type 310 100,000 ohm ½ watt carbon	c-w osc. screen voltage divider		5
R30	3Z6700-22	Resistor	Type 310 100,000 ohm ½ watt carbon	c-w osc. screen voltage divider		5
R31	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	No function due to circuit modifications		5
R32	3Z6150-9	Resistor	Type 316 1,500 ohm 2 watt carbon	No function due to circuit modifications		5
R33	3Z6100-27	Resistor	Type 316 1,000 ohm 2 watt carbon	No function due to circuit modifications		5
R34	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	No function due to circuit modifications		5
R35	3Z6805-4	Resistor	Type 310 5.0 megohm ½ watt carbon	No function due to circuit modifications		5
R36	3Z6035-6	Resistor	Type 316 350 ohm 2 watt carbon	No function due to circuit modifications		5
R37	3Z6200-14	Resistor	Type 310 2,000 ohm ½ watt carbon	1st a-f cathode bias		5
R38	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	1st a-f grid leak		5
R39	3Z6650-20	Resistor	Type 314 50,000 ohm 1 watt carbon	1st a-f plate load		5
R40		Resistor	LIMITER control shown in circuit diagram, but not used in set	No function due to circuit modifications		5
R41	3Z6750-16	Resistor	Type 62-106, 500,000 ohm composition, variable	Tone control		5
R42	3Z6560-7	Resistor	5,000 ohm ½ watt metalized	Power supply buffer		
R43	3Z6050-14	Resistor	Type 316 500 ohm 2 watt carbon	Output cathode bias		5
R44	3Z6750-11	Resistor	Type 310 500,000 ohm ½ watt carbon	Output grid leak		5
RFC1	2C4903A/C1	Choke	Type VP6-100, 3 ampere	Power supply r-f filter		2
RFC2	2C4903A/C2	Choke	Type A40784-4	Power supply r-f filter		12
RFC3		Choke	1 mh., 10 ohm	Power supply r-f filter	A40919-1	12

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
RFC4	[redacted]	Choke	1 m.h., 10 ohms	Power supply r-f filter	A40919-1	12
SW1	3Z8903	Switch	H & H type 1570-NJ toggle 3 amp. 250 volt	c-w oscillator		9
SW2	3Z8903	Switch	Type C-H toggle, ganged with R41	Low frequency tone control		5
SW3	3Z8903	Switch	H & H type, 1570-NJ toggle 3 amp. 250 volt	Power supply input		
SW4	3Z8903	Switch	H & H type 2099-2V toggle 3 amp. 250 volt	Pilot lamp		9
T1	2C4903A/T1	Transformer	Type B-44158-6	Power supply		12
T2	2C4903A/T2	Transformer	Type JEN-3048-C audio 7,000/2.8 ohms	Output		2
	3Z1925	Fuse	Type 3AG, glass, 5 amp.	Electrical circuit protection		11
	3Z3275	Fuse Container	Type 1075, enclosed	Fuse holder		11
	2C4903A/J1	Jack	Type 1J-101, one circuit, panel mount	Phone jack		10
	2C3010B/83	Socket	Type 6714, octal, phenolic	Vacuum tube socket		13
		Socket	Type X-15, 4 prong, phenolic	Vibrator socket		13
	2C4529/S1	Socket	Type C1R-8, octal, ceramic	Vacuum tube socket		2
	2V6C8G or 2T163	Radio tube	Tube VT-163, glass	2nd detector		14
	2V6F6G or 2T66A	Radio tube	Tube VT-66A, glass	Output		14
	2V6F8G or 2T198A	Radio tube	Tube VT-198A, glass	1st a-f		14
	2V6J7 or 2T91	Radio tube	Tube VT-91, metal	1st detector		14
	2V6J7 or 2T91	Radio tube	Tube VT-91, metal	c-w oscillator		14
	2V6J7 or 2T91	Radio tube	Tube VT-91, metal	h-f oscillator		14
	2V6K7 or 2T86	Radio tube	Tube VT-86, metal	r-f amplifier		14
	2V6K7 or 2T86	Radio tube	Tube VT-86, metal	1st i-f amplifier		14
	2V6K7 or 2T86	Radio tube	Tube VT-86, metal	2nd i-f amplifier		14
	2V6X5 or 2T126	Radio tube	Tube VT-126, metal	Rectifier		14
	2C4903A/V1	Vibrator	Type 626	Power supply primary circuit interrupter		12
			RADIO TRANSMITTER BC-904-A			
C61	3D9040-3	Capacitor	Type MO .00004 μf, 500 volt, mica	Antenna coupling	6.79	15
C62	3D9015-4	Capacitor	Type MO .000015 μf, 500 volt, mica	Antenna coupling	6.38B	15
C63	3D9050-12	Capacitor	Type MO .00005 μf, 500 volt, mica	r-f osc. grid blocking	6.70	15
C64	3D8981V	Capacitor	Variable, air	r-f osc. tuning	300-21	16

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
C65	3DA1.500	Capacitor	Type MW .0015 μf, 500 volt, mica	a-f osc. grid blocking	6.88	15
C66	3DA10-77	Capacitor	Type MWBW .01 μf, 300 volt, mica	a-f osc. tuning	300-41	15
C67	3DA100-68	Capacitor	Type MPW .1 μf, 200 volt "Domino"	Neon indicator by-pass	6.103	15
C68	3D9003-7	Capacitor	Type N-33-2, 3-30 μμf, mica insulation, compression, screw-driver adjust.	r-f osc. trimmer	78-2010	1
C69	3D9003-7	Capacitor	Type N-33-2, 3-30 μμf, mica insulation, compression, screw-driver adjust.	r-f osc. trimmer	78-2010	1
C70	3D9003-7	Capacitor	Type N-33-2, 3-30 μμf, mica insulation, compression, screw-driver adjust.	r-f osc. trimmer	78-2010	1
C71	3D90037	Capacitor	Type N-33-2, 3-30 μμf, mica insulation, compression, screw-driver adjust.	r-f osc. trimmer	78-2010	1
L7	3C349	Coil	550-1620 k-c	r-f osc. for range A	300-36	16
L8	3C349-1	Coil	1600 k-c—5.0 megacycles	r-f osc. for range B	300-37	16
L9	3C349-2	Coil	4.8 megacycles—13.0 megacycles	r-f osc. for range C	300-38	16
L10	3C349-3	Coil	12.8 megacycles—30.0 megacycles	r-f osc. for range D	300-39	16
N1	2Z5373	Neon Indicator	Type NE-7	B-battery indicator	300-42	16
R45	3Z6700-39	Resistor	100,000 ohm ½ watt carbon	r-f osc. grid leak	7.14	16
R46	3Z6700-40	Resistor	100,000 ohm ½ watt carbon	a-f osc. grid leak	7.14	16
R47	3Z6500-54	Resistor	5,000 ohm 1 watt carbon	Output voltage divider	7.29	16
R48	3Z6500-54	Resistor	5,000 ohm 1 watt carbon	Output voltage divider	7.29	16
R49	3Z6802-6	Resistor	2.0 megohm ½ watt carbon	Neon indicator timing resistor	7.105	16
SW5	3Z9827.18	Switch, Range Selector	Five section, three deck, 4 position rotary switch	Ant. coupling capacitor selection	300-22	16
SW6				r-f grid winding selection		
SW7				r-f grid winding shorting		
SW8				r-f plate winding selection		
SW9				r-f plate winding shorting		
SW10	3Z9826-1	Switch, Operating	Three section, single deck, 3 position rotary switch	Main filament control	16.20B	16
SW11				a-f filament control		
SW12				B voltage control		

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
SW13	3Z9826-2	Switch, Output	Single 3 position rotary switch	Output control	300-35	16
T3	2C6904A	Transformer		a-f oscillation	300-40	16
80	2A294	Antenna	Telescoping Whip type, 8 ft. extended length, 3 ft. collapsed length	Transmitter signal radiation	300-43	16
81	3A2	"B" Battery	Signal Corps type BA-2, 22½ volts	Plate voltage source	300-45	16
82	3A6	"A" Battery	Eveready type 6, 1½ volts, dry cell	Filament voltage source	300-46	16
	2V1LB4	Radio tube	Type 1LB4, glass	r-f oscillator		17
	2V1LB4	Radio tube	Type 1LB4, glass	a-f oscillator and modulator		17
	2A3459A		TOWER TR-19-A			
100	2A3459A/C1	End Casting	Cast alum., 2⅞" x 2$\frac{15}{32}$" x 2$\frac{15}{32}$"	Mounting for Cabinet CS-95-A	5PJ-110-2	1
100-1	6L7916-6-20	Screw	Brass ⅜"—16 x 1¼" flat head	Cabinet mounting	57-2214	1
100-2	6L50006A-16-2	Washer	Brass, ⅜" I.D., 1" O.D., ⅛" thick countersunk	Cabinet mounting	73-2108	1
101	2A3459A/R5	Top Tower Rung	Red oak, 28" x 2" x 1"	Tower TR-19-A	5PJ-110-19	1
102	2A3459A/U2	Top Upright	Red oak, 68$\frac{31}{32}$" x 3" x 3"	Tower TR-19-A	5PJ-110-6	1
103	2A3459A/U2	Top Upright	Red oak, 68$\frac{31}{32}$" x 3" x 3"	Tower TR-19-A	5PJ-110-7	1
104	2A3459A/R3	Platform Support Rail	Red oak, 74" x 4" x 4"	Tower TR-19-A	5PJ-110-9	1
105	2A3459A/R2	Platform Cross Rail	Red oak, 43$\frac{5}{16}$" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-10	1
106	2A3459A/C2	Splice Casting	Cast alum., 10" x 5" x 5"	Tower TR-19-A	5PJ-110-1	1
107	2A3459A/B2	Front Center Brace	Red oak, 42$\frac{13}{16}$" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-14	1
108	2A3459A/B4	Diagonal Brace	Red oak, 94$\frac{15}{32}$" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-8	1
109	2A3459A/B5	Diagonal Brace	Red oak, 95 63/64" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-11	1
110	2A3459A/U1	Lower Upright	Red oak, 80" x 3" x 3"	Tower TR-19-A	5PJ-110-3	1
111	2A3459A/U1	Lower Upright	Red oak, 80" x 3" x 3"	Tower TR-19-A	5PJ-110-4	1
112	2A3459A/R1	Base Rail	Red oak, 72 39/64" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-12	1
113	2A3459A/R1	Base Rail	Red oak, 72 39/64" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-13	1
114	2A3459A/S2	Anchor Plate Support	Red oak, 55 19/32" x 4" x 1⅛"	Tower TR-19-A	5PJ-110-48	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR
115	2A3459A/C5	Anchor Plate Cleat	Red oak, 16" x 2" x 1⅛"	Tower TR-19-A	5PJ-110-15	1
116	2A3459A/P9	Anchor Plate	Red oak, 50$\frac{3}{32}$" x 16" x 1¼"	Tower TR-19-A	5PJ-110-16	1
117	2A3459A/A1	Anchor Assembly	Includes items 115, 116, 118, 121, 122, 123, and 124	Tower TR-19-A	5PJ-110-53	1
118	2A3459A/A2	Anchor Base Assembly	Cast alum., 9½" base dia., 7⅜" sleeve dia., 5⅜" deep, with items 119 and 120, 121 and 122 attached.	Lower bearing and brake for antenna control	6PJ-110-98	1
119	2A3459A/L1	Brake Lining	Woven web, brass wire reinforced, 16" x 1½" x $\frac{3}{16}$"		6PJ-110-72	1
120	2A3459A/N1	Brake Nut	Brass, 1½" x ⅞" x ¼"		6PJ-110-95	1
121	2A3459A/K1	Brake Control Knob	Cast alum., 2½" dia., 1⅝" deep		6PJ-110-12	1
122	2A3459A/S1	Brake Equalizer Spring	Baumbach type LS22, ⅜" I.D., ⅝" O.D., $\frac{11}{16}$" long, capacity 295 lbs.		6PJ-110-74	1
123	2A3459A/R4	Anchor Base Clamp Ring	Cast alum., 7-25/64" I.D., 9½" O.D., ¼" thick	Anchor base mounting	6PJ-110-28	1
124	2A3459A/B1	Lower Bearing and Spindle	Marlin-Rockwell type MRC-CONV-3, ball bearing unit with stainless steel spindle ⅝" dia. x 4" long attached.		6PJ-110-99	1
125	2A3459A/P11	Platform	Red oak, 79" x 15¾" x 2⅛"	Tower TR-19-A	5PJ-110-21	1
126	2A3459A/P10	Platform	Red oak, 75" x 15¾" x 2⅛"	Tower TR-19-A	5PJ-110-22	1
127	2A3459A/B3	Hook Bolt	Brass, 6$\frac{13}{32}$" x ⅜"—16 thd.	Platform mounting	5PJ-110-20	1
128	2A3459A/P8	Top Panel (side)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 47⅞"h. x 36½"w. x 19$\frac{31}{32}$"w.	Tower shelter	5PJ-110-25	1
129	2A3459A/P6	Center Panel (side)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 48"h. x 55¼"w. x. 37⅞"w.	Tower shelter	5PJ-110-26	1
130	2A3459A/P3	Bottom Panel (side)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 39½"h. x 69½"w. x 55$\frac{5}{16}$"w.	Tower shelter	5PJ-110-27	1
131	2A3459A/P7	Top Panel (front and rear)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 45⅞"h. x 41½"w. x 27$\frac{13}{32}$"w.	Tower shelter	5PJ-110-29	1
132	2A3459A/P5	Center Panel (rear)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 48"h. x 57½"w. x 42¾"w.	Tower shelter	5PJ-110-30	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
133	2A3459A/P4	Center Panel	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 16"h. x 47$\frac{25}{32}$"w. x 42¾"w.	Tower shelter	5PJ-110-32	1
134	2A3459A/P2	Bottom Panel (rear)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 39¾"h. x 69$\frac{11}{16}$"w. x 57½"w.	Tower shelter	5PJ-110-28	1
135	2A3459A/P1	Bottom Panel (front)	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 71¾"h. x 36"w. x 25⅛"w. with item 135-1 attached		5PJ-110-31	1
135-1	2A3459A/W1	Window	$\frac{3}{32}$" sheet cellulose acetate 21" x 17"		5PJ-110-36	1
136	2A3459A/D1	Door	$\frac{3}{16}$" Plywood on 1⅛" sq. frame 71$\frac{9}{16}$"h. x 3⅝"w. x 22⅝"w.		5PJ-110-45	1
137	2A3459A/C3	Panel Clamp	Flat wire steel, 3½" x 1½" x ⅛", ends bent 45°		5PJ-110-49	1
138	2A3459A/C4	Panel Clamp	Flat wire steel, 3¼" x 1½" x ⅛", one end bent 45°, other end has two 90° bends		5PJ-110-50	1
	2Z574A		BEAM M-264-A (Assembly Drawing No. 3PJ-110-39)			
140	2Z574A/P1	Inner Jack Plate	Polystyrene 3.850" dia. x ⅜" thick	Banana mounting	3PJ-110-28	1
141	2Z574A/P3	Inner Jack Plate Holder	Cast alum., 3⅛" I.D. x 3.862" O.D. x ⅜" thick	Jack plate mounting	3PJ-110-7	1
142	2Z574A/P2	Outer Jack Plate	Polystyrene 3.850" dia. x ⅜" thick	Banana jack mounting	3PJ-110-20	1
143	2Z574A/P4	Outer Jack Plate Holder	Cast alum., 3⅛" I.D. x 3.862" O.D. x ⅜" thick	Jack plate mounting	3PJ-110-27	1
144	2Z5594.1	Outer Jack Assembly	Same as item 145, with tension adjusting lug brazed on		3PJ-110-50	1
145	2Z5594	Jack	Type 76, ⅞" x ⅜"—24 thd. (Same as 158)		93-2005	1
146	2A3459A/N2	Nut	⅜"—24 thd. hex.		48-2045	1
147	2Z573A/J2	Inner Jack Nut Assembly	Item 146 with tension adjusting lug brazed on (Same as 159)		3PJ-110-52	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
148	2A3459A/D2	Wire Spacer Disc	Polystyrene, 3.850" dia. x 3/8" thick	Transmission line spacing	3PJ-110-9	1
149	1A523	Transmission Line	22 ga. (.0286") music wire, silver plate over copper plate, cut to 14 ft. length		3PJ-110-35	1
150	2A3459A/S3	Transmission Line Tension Spring	5/16" dia. x 1½" long. Approx. tension 3 lbs. at 2¼", 1½ lbs. at 1¾"		3PJ-110-23	1
			BEAM SOCKET MC-263-A			
	2Z573A		(Assembly Drawing No. 3PJ-110-48)			
152	2Z573A/T1	Tee Casting	Cast alum. 22" x 7⅛" x 4⅜"	Lower section of housing for item 154	3PJ-110-1	1
153	2Z573A/T2	Tee Cap Casting	Cast alum. 22" x 7⅛" x 3⅝"	Upper section of housing for item 154		1
154	2Z573A/S4	Beam Sleeve	Brass tubing 4¼" I.D. x 4½" O.D. x 24¾" long, with cast alum. flanges attached.	For housing transmission line junction	3PJ-110-45	1
155	2Z7099	Beam Clamp Plate	Brass, 2¼" x 1½" x .093" thick, curved 2¼" radius, with locating stub attached.		3PJ-110-32	1
156	2Z573A/S7	Beam Clamp Wing Screw	Brass, 2 7/16" x 1 1/16" x 3/8"—16 thd.	For clamping 155 against 154	3PJ-110-6	1
157	2Z7097-5	Beam Socket Jack Plate	Polystyrene, 3 1/32" dia. x ¼" thick	Banana jack mounting	3PJ-110-5	1
158	2Z5594	Jack	Type 767/8" x 3/8"—24 thd. (Same as 145)		93-2005	1
159	2Z573A/J2	Jack Nut Assembly	Item 146 with tension adjusting lug brazed on. (Same as 147)		3PJ-110-52	1
160	2Z7097-12	Junction Plate	Polystyrene, 4¼" dia. x ¼" thick. Same as item 161 excepting mtg. hole locations	Banana spring plug mounting	3PJ-110-12	1
161	2Z7097-47	Junction Plate	Polystyrene, 4¼" dia. x ¼" thick. Same as item 160 excepting mtg. hole locations	Banana spring plug mounting	3PJ-110-47	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
162	2Z573A/S8	Junction Plate Mtg. Spacer	Aluminum bar 3" x ¾" x ⅜"		3PJ-110-18	1
163	1A523	Tranposed Transmission Line	22 ga. (.0286" music wire, silver plate over copper plate, cut to 12" length)		3PJ-110-49	1
164	2Z7249.1	Junction Plug Assembly	Type 77 banana spring plug with connector lug brazed on		3PJ-110-51	1
165	2Z573A/S9	Transmission Line Spacer	Type 196, 1½" x ½" x ¼", ceramic		3PJ-110-17	1
166	2Z573A/L1	Transmission Line Connector Lead	Flexible cable—63 strands No. 36 tinned copper wire, cut to 6" length		3PJ-110-25	1
167	2Z573A/B10	Insulator Bead	Type 73-2, Polystyrene		38-2020	1
	2A263A		DIPOLE COLLECTOR AN-63-A (Assembly Drawing No. 4PJ-110-1)			
168	2A263A/B1	Dipole Mtg. Base	Alum. ⅛" thick, 17$\frac{13}{32}$" x 4$\frac{9}{32}$" x ¾"		4PJ-110-14	1
169	3G1250-16.7	Insulator	Type 196, ¾" dia. x 1" long, ceramic		4PJ-110-13	1
170	2A263A/S1	Dipole Socket	Brass tubing, $\frac{13}{16}$" dia. x 17$\frac{13}{16}$" long, with wing-screw clamp attached		4PJ-110-4	1
171	2Z7249/M1	Plug Mtg. Bracket	Brass, 2⅜" x 2¼" x 1¾"	Mtg. for item 172	4PJ-110-10	1
172	2Z7249	Banana Spring Plug	Type 77		52-2194	1
173	2A263A/C1	Dipole Socket Clamp	Brass, .031" thick, 2$\frac{1}{16}$" x ¾" x ⅜", curved to $\frac{13}{32}$" radius		4PJ-110-7	1
174	2A263A/D2	Dipole, Telescoping	8 ft. long extended, 5 ft. collapsed, ¾" max. dia.		4PJ-110-5	1
175	2A263A/D1	Dipole, Fixed	8 ft. long x ¾" dia.		4PJ-110-6	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
			UPPER CENTRAL SHAFT ASSEMBLY OF CABINET CS-95-A (Assembly Drawing No. 1PJ-110-89)			
176	2Z1577-95A/S1	Upper Central Shaft	Phenolic tubing, 2¼" I.D. x 3" O.D. x 22 3/16" long		1PJ-110-32	1
177	2Z1577-95A/H1	Upper Central Shaft Housing	Alum. tubing, 5¾" I.D. x 6" O.D. x 20¾" long, with 3¼" dia. opening through side.		1PJ-110-31	1
178	2Z572	Beam Seat Flange Assembly	Cast alum. 7" dia. x 1 23/64" deep, with guide pins and threaded studs attached		1PJ-110-93	1
179	2Z1577-95A/P1	Tapered Screw Pin	Brass, 1" long x .277" dia., ¼"—20 thd. (Same as 198)		1PJ-110-4	1
180	2Z7097-6	Central Shaft Plug Plate	Polystyrene, 3 1/16" dia. x ¼" thick		1PJ-110-6	1
181	2Z7249.2	Plug Assembly	Type 77 banana spring plug with 22 ga. music wire silver plated over copper plate, cut to 12" length and brazed in end of plug		1PJ-110-102	1
	2Z573A/B6	Central Shaft Bearing Assembly	Includes items 182, 182-1, 184, 185		1PJ-110-91	1
182	2Z573A/B4	Ball Bearing Unit	Type MRS-XLS-3½			18
182-1	2Z573A/S5	Bearing Socket	Brass, 6" dia. x ⅞" deep		1PJ-110-1	1
183	2Z573A/R1	Grease Retainer	Grey felt, 3" I.D. x 4 1/16" O.D. x 1/16" thick		1PJ-110-3	1
184	2Z573A/S1	Grease Shield	Tagboard, 3 1/64" I.D. x 4 1/32" O.D. x .010	Inner Washer	1PJ-110-5	1
185	2Z573A/S2	Grease Shield	Brass, 3 1/16" I.D. x 5-47/64" O.D. x .040" thick	Outer washer	1PJ-110-2	1
186	2Z7857	Collector Ring	Brass, 3 9/32" I.D. x 4 5/16" O.D. x .121" thick		1PJ-110-10	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
187	2Z6783	Collector Ring Mtg. Strip	Polystyrene, 3" x ½" x ¼", ring slots .1875" deep (one used)		1PJ-110-8	1
188	2Z6783.1	Collector Ring Mtg. Strip	Polystyrene, 3" x ½" x ¼", ring slots .125" deep (two used)		1PJ-110-9	1
189	2Z573A/B9	Collector Brush	Brass, 1⅞" long, contact faces ground parallel		1PJ-110-79	1
190	2Z573A/L2	Antenna Connector Lead	18 ga. stranded tinned copper wire, rubber and cotton braid insulation, with tip and lug attached, 8¾" long overall		1PJ-110-81	1
191	2Z9475	Brush Terminal Strip	Polystyrene 4¼" x ¾" x ¼"	Collector brush mounting	1PJ-110-7	1
192	2Z6785	Upper Central Shaft Housing Base Mtg.	Cast alum., 8⅛" base dia., 6½" sleeve dia., $1\frac{5}{16}$" deep	For mounting shaft housing to cabinet floor	1PJ-110-15	1
193	2Z573A/C1	Central Shaft Coupling Flange	Cast alum., 5¾" base dia., 3½" sleeve dia., 1 19/64" deep, with guide pins and threaded studs attached	For coupling 176 to 195	1PJ-110-92	1
194	2Z1618	Protective Cap	Cast alum., 7" dia. x 2" deep	For covering exposed end of central shaft assembly during transportation or storage	1PJ-110-67	1

CONTROL UNIT MC-265-A

(Assembly Drawing No. 6PJ-110)

195	2Z3242A/S2	Lower Central Shaft	Phenolic tubing 2¼" I.D. x 3" O.D. x 96" long		6PJ-110-47	1
196	2Z3242A/H4	Lower Central Shaft Housing	Phenolic tubing 3¾" I.D. x 4" O.D. x 87" long		6PJ-110-76	1
197	2Z3295	Central Shaft Coupling	Cast alum., 5¾" base dia., 3⅝" sleeve dia., 1⅜" deep		6PJ-110-4	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
198	2Z1577-95A/P1	Tapered Screw Pin	Brass, 1" long x .277" dia., ¼"—20 thd. (Same as 179)		PJ-100-4	1
199	2Z7858	Central Shaft Retainer Ring	Brass, 3-1/64" I.D. x 4⅜" O.D. x .062" thick		6PJ-110-81	1
200	2Z7155	Plug PL-55	Signal Corps type	Loudspeaker connection		19
201	2Z3242A/H2	Battery Holder			6PJ-110-115	1
202	2Z6756	Lower Central Shaft Housing Mtg.	Cast alum., 8⅛" overall dia., 2$\frac{1}{16}$" overall depth, collar 4" I.D. x 4½" O.D.	For attaching Control Unit MC-265-A under side of Cabinet CS-95-A	6PJ-110-111	1
203	2Z3242A/B1	Pilot Light Battery			4-2006	1
205	2Z3242A/M1	Compass and Azimuth Index Mount	Cast. alum., 10⅛" x 5¼" x 2", collar 3¼" I.D., 4" O.D., base 3¼" I.D.		6PJ-110-108	1
206	2Z3242A/B2	Central Shaft Sleeve Bearing	Cast brass, 3" I.D., 3½" O. D., 1¼" deep		6PJ-110-33	1
207	2Z3242A/S3	Azimuth Scale	Cast alum., 10" dia. x 2" deep, with two engraved scales graduated 0-360° clockwise and counter-clockwise		6PJ-110-9	1
208	2Z3242A/H3	Azimuth Scale Hub	Cast alum., 3" I.D. x 4" O.D. x 1½" deep		6PJ-110-5	1
209	2Z3242A/C1	Azimuth Scale Bearing Collar	Cast brass, 3" I.D. x 4" O.D. x 1¼" deep		6PJ-110-6	1
210	2Z3242A/J1	Azimuth Index	Alum., 5⅜" x 3" x ⅛"			1
211	2Z3242A/S1	Pilot Light Shield	Alum., 2⅞" x 2" x 1"		6PJ-110-97	1
212	2Z3242A/S4	Azimuth Scale Set Screw	Hex. head ½" x 10-32 thd.		57-2229	1
213	2Z3242A/H1	Control Handwheel	Cast alum., 20" dia., 4⅜" deep	Antenna Rotation	6PJ-110-13	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
214	2Z3242A/S5	Volume Control Extension Shaft	Phenolic tube with brass couplings attached at both ends, 80¼" long x ⅝" dia.		6PJ-110-69	1
215	2Z3242A/S5	Operating Switch Extension Shaft	Same as 214.		6PJ-110-69	1
216	2Z3242A/S6	Tuning Control Extension Shaft	Phenolic tube with brass couplings attached at both ends, 80¼" long x 1" dia.		6PJ-110-84	1
217	2Z3242A/S7	Range Selector Extension Shaft	Same as 216, excepting hole size in upper coupling		6PJ-110-85	1
218	2Z3242A/B3	Tuning Control Box Assembly	Alum. Box, 8" x 7" x 7". Includes items 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233		6PJ-110-109	1
219	2Z3242A/D1	Reduction Drive Unit	Type PWO with D-103 modification		6PJ-110-46	1
220	2Z3242A/S10	Range Indicator Lead Screw	Brass, 2" long, ⅞" dia., 4.8 left hand sq. thds. per inch		6PJ-110-35	1
221	2Z3717	Frequency Dial Assembly	Cast alum. drum with etched alum. scale attached. 5¾" dia. x 2" deep. Five frequency ranges and one reference range indicated on scale		6PJ-110-106	1
222	2Z3761-OOA	Vernier Dial	Type NC-100-A, 4" dia. for ¼" shaft		6PJ-110-78	1
223	2Z3718	Volume Index Dial Assembly	Phenolic drum with etched alum. scale attached. 1⅝" dia. x ½" thick graduated 0-10		6PJ-110-105	1
224	2Z3716	Operating Switch Index Dial Assembly	Phenolic drum with etched alum. scale attached. 1⅝" dia. x ½" thick. Marked CW MVC OFF		6PJ-110-104	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
225	2Z7259	Range Pointer Assembly	Alum. pointer .062" thick, with brass bracket .062" thick attached 4½" x 3⅛" x 2"		6PJ-110-88	1
226	2Z3242A/D2	Frequency Dial Index and Range Scale Assembly	Alum. bracket .020" thick 3$\frac{1}{32}$" x 3½" x ¼" with alum. index scale .015" thick 2" x 1$\frac{13}{16}$" and phos. bronze dial pointer .016" thick, 2⅞" x 3/64" attached		6PJ-110-107	1
227	2Z6799	Pilot Light Mtg. Disc	Brass, snap plug button, 2$\frac{5}{16}$" dia. x 27/64" thk., with pilot light bracket attached		6PJ-110-92	1
	2Z8648	Pilot Light Socket	Type 1745, 1" x ¾", with 18" connector leads attached	Control box dial and azimuth scale illumination	62-2074	1
	2Z5896.3	Pilot Light Bulb	2.2 V. 0.25A. screw base, Mazda 223.	Control box dial and azimuth scale illumination	45-2007	1
228	2Z3242A/S9	Pilot Light Switch	S.P.S.T. Toggle Switch		66-1451	1
230	2Z5758	Knob—Tuning	Type 637-P, 2⅜" dia. x 1$\frac{1}{32}$" thk. for ¼" shaft		6PJ-110-44	1
231	2Z5758.1	Knob—Range Selector	Type 637-Q, 2⅜" dia. x 1$\frac{1}{32}$" thk., for ⅜" shaft		6PJ-110-45	1
232	2Z5757	Knob—Volume Control	Type 637-G (pointer removed) 1⅛" dia. for ¼" shaft		6PJ-110-82	1
233	2Z5757	Knob—Operating Switch	Type 637-G (pointer removed) same as item 232		6PJ-110-82	1
234	2Z3242A/M2	Control Box Mtg. Bracket	Cast alum. 5" x 4½" x 4$\frac{31}{32}$"		6PJ-110-10	1
235	2Z3242A/B4	Bracket Clamp Band	Cast alum. semi-circular band ½" x ⅛" x 5"		6PJ-110-7	1
236	2Z3242A/L1	Control Shaft Coupling Link	Brass, 4½" x ¾" dia., with two wing-nuts		6PJ-110-21	1
237	2Z3295-1	Receiver Shaft Coupling	Brass, 2¼" long x ¾" with slotted flat shank 1⅜" x ¾" x $\frac{5}{16}$" for ¼" shaft	Extension for tuning volume and switch controls on Radio Receiver BC-903-A	6PJ-110-14	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
238	2Z3295-2	Receiver Shaft Coupling	Same as item 237, excepting for ⅜" shaft	Extension for range selector control on Radio Receiver BC-903-A	6PJ-110-15	1
			MISCELLANEOUS			
239	2A3325	Ground Stake	Signal Corps type GP-25	Guying rope anchor		19
240	2A1340	Guying Rope	Weatherproofed ¾" Manila rope, 30' long	For guying Tower TR-19-A	14PJ-110	1
241	2B921	Headset	Signal Corps type P-21	Note: Two Headsets P-20 (stock No.		19
242	2Z6365	Loudspeaker Assembly	Special 5-inch permanent magnet dynamic type, 6 ohm voice coil dustproof spider, with cable and type PL-55 plug attached	2B920) or Headset HS-29 (stock No. 2B829) may also be used.	68-2084	1
243	6Q62055A	Ladder LC-55 A	Spruce, 12' 1" long, 22½" wide at base, 12½" wide at top, $3\frac{7}{16}$" thick		19PJ-110	1
244	4C9850	Operator's Stool	Red Oak, 34" high, 16" sq. at base, 15" sq. at top		12PJ-110	1
245	2Z3242A/C2	Magnetic Compass	Type 5600½, modified to provide mtg. features		11PJ-110-1	1
246	7A1770	Telescope	Type 7C			20
247	2Z574A/M1	Telescope and Compass Mount	Aluminum, 5⅛" x 5" x 7½"	For mounting telescope on Beam M-264-A	10PJ-110-4	1
248	6Q63155	Spirit Level	Type 313			21
249	3B98	Storage Battery	Type Radio 152-6, 11½" x 7" x 11½"	Power Source		22
250	3E3154-19.3	Jumper Leads				1
251	2Z2590A/P1	Shock Absorber Packer	Red Oak, $43\frac{9}{16}$" x 23" x 4¼"	Chest CH-90-A	26PJ-110-35	1
252	6D8255	Instruction Book	8½" x 11"	For Radio Set SCR-255 (Direction Finding)		1
			STANDARD BOLTS, NUTS, WASHERS, ETC.			
300	6L4905-12.18	Capscrew	$\frac{5}{16}$"—18 x ¾"	Hex. head with screwdriver slot.	57-2350	1
301	6L4905-20.18	Capscrew	$\frac{5}{16}$"—18 x 1¼"	Hex. head—plain.	57-2243	1
305	6L3505-18.1	Hex. Nut	$\frac{5}{16}$"—18		48-2028	1

REFERENCE NO.	STOCK NO.	NAME OF PART	DESCRIPTION	FUNCTION	MFR'S DWG. NO.	MFR.
306	6L3506-16.1	Hex. Nut	3/8"—16		48-2026	1
311	5B6618-10	Wing-Nut	10—32		48-2033	1
312	5B6618-1.4	Wing-Nut	1/4"—20		48-2036	1
313	5B6618-3.8	Wing-Nut	3/8"—16		48-2034	1
315	6L106-16	Carriage Bolt	3/8"—16 x 3"		57-2224	1
316	6L104-5.5	Carriage Bolt	1/4"—20 x 5 1/2"		57-2255	1
320	6L72210	Lockwasher	No. 10 shakeproof			
321	6L71005-2	Lockwasher	5/16" Shakeproof		73-2093	1
324	6L606-1.7H16	Bolt	3/8"—16 x 1 3/4" hex. head		57-2217	1
325	6L606-2.9H16	Bolt	3/8"—16 x 2 1/4" hex. head		57-2219	1
326	6L606-2.11H16	Bolt	3/8"—16 x 2 3/4" hex. head		57-2216	1
327	6L606-3.H16	Bolt	3/8"—16 x 3" hex. head		57-2227	1
329	6L606-3.15H16	Bolt	3/8"—16 x 3 3/4" hex. head		57-2218	1
330	6L606-4.19H16	Bolt	3/8"—16 x 4 3/4" hex. head		57-2215	1
335	6L606-2.9F16	Bolt	3/8"—16 x 1 3/4" flat head		57-2213	1
336	6L606-3.7F16	Bolt	3/8"—16 x 3 1/2" flat head		57-2212	1
337	6L606-4.9F16	Bolt	3/8"—16 x 4 1/2" flat head		57-2210	1
338	6L606-4.16F16	Bolt	3/8"—16 x 4 3/4" flat head		57-2211	1
350		Washer	1" O.D. flat		73-2099	1
351	2A246/S21	Machine Screw	5/16"—18 x 3/4" fillister head	Clamp screw for compass mount 205	57-2231	1
352		Set Screw	8-32 x 1/2" hex. head	Frequency dial set-screw	57-2238	1

LIST OF MANUFACTURERS

1—Wilcox-Gay Corporation	Charlotte, Michigan
2—National Company, Inc.	61 Sherman Street, Malden, Massachusetts
3—Sprague Products Company	North Adams, Massachusetts
4—Aerovox Corporation	New Bedford, Massachusetts
5—Central Radio Laboratories	900 E. Keefe Avenue, Milwaukee, Wisconsin
6—Clarostat Manufacturing Co., Inc.	285 N. 6th Street, Brooklyn, New York
7—Tobe-Deutschmann Corporation	Canton, Massachusetts
8—Cornell-Dubilier Elec. Corp.	South Plainfield, New Jersey
9—Arrow, Hart & Hegeman Elec. Co.	Hartford, Connecticut
10—Utah Radio Products Company	812 Orleans Street, Chicago, Illinois
11—Littlefuse, Inc.	4757 Ravenswood Avenue, Chicago, Illinois
12—P. R. Mallory & Company, Inc.	Indianapolis, Indiana
13—Cinch Manufacturing Corporation	2335 W. Van Buren Street, Chicago, Illinois
14—RCA Manufacturing Co., Inc.	Harrison, New Jersey
15—Solar Manufacturing Corp.	Bayonne, New Jersey
16—Ansley Radio Corporation	21-10 49th Avenue, Long Island City, New York
17—Hygrade Sylvania Corporation	Emporium, Pennsylvania
18—Marlin-Rockwell Corporation	Jamestown, New York
19—Signal Corps	
20—O. F. Mossberg & Sons, Inc.	131 St. John Street, New Haven, Connecticut
21—Stanley Works	New Britain, Connecticut
22—Willard Storage Battery Company	246-286 E. 131 Street, Cleveland, Ohio