INSTRUCTION BOOK

FOR

RADIO COMPASS SCR-242-B

MANUFACTURED BY

BENDIX RADIO CORPORATION

CHICAGO, ILLINOIS, U.S.A.

RESTRICTED

PUBLISHED BY AUTHORITY

OF

THE CHIEF SIGNAL OFFICER

ORDER No. 15075-NY-38 DATE: OCTOBER 23, 1937

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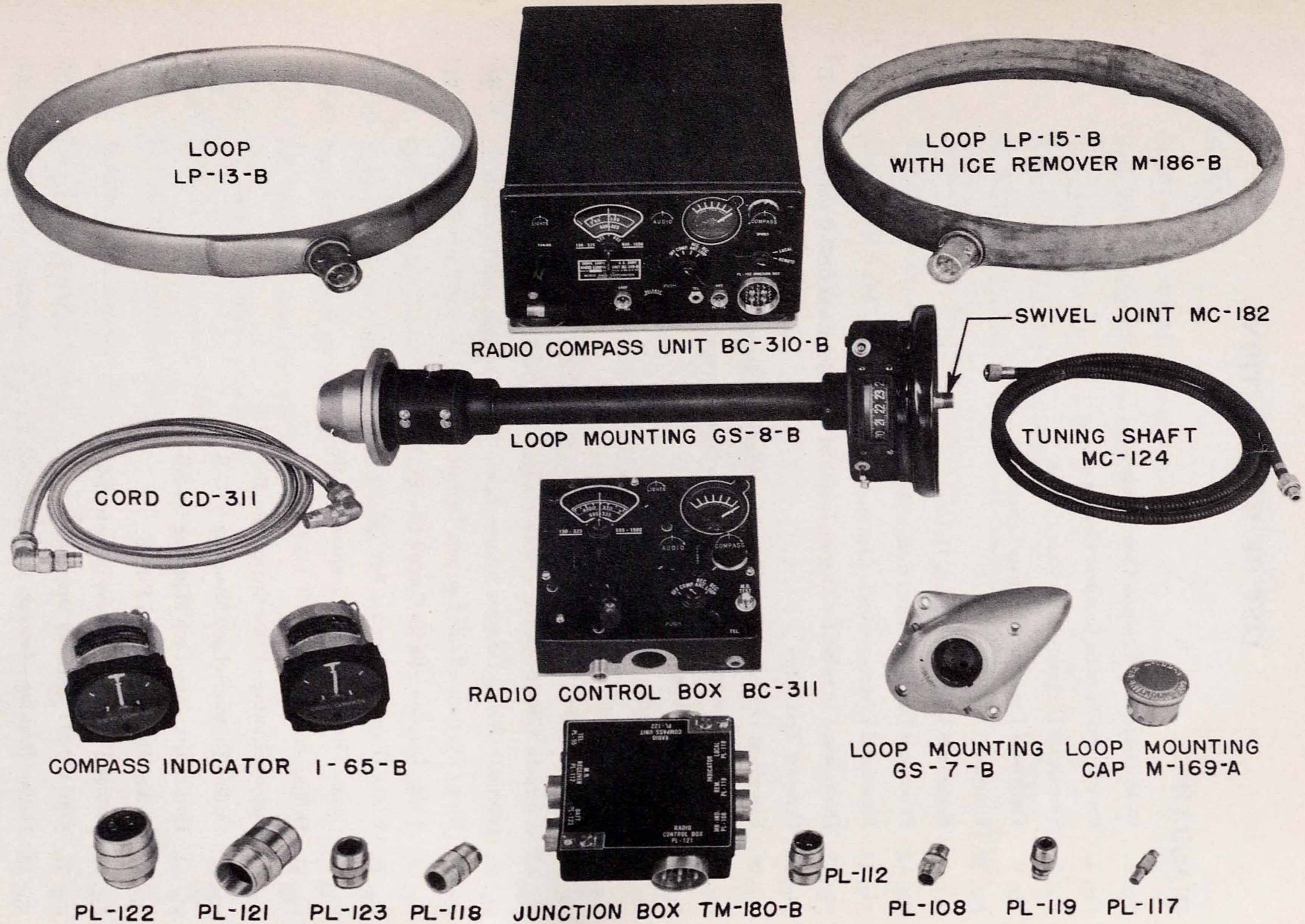


FIG. 1. RADIO COMPASS SCR-242-B, COMPONENTS

RADIO COMPASS SCR-242-B

1.0 GENERAL DESCRIPTION OF COMPLETE EQUIPMENT

1.1 RADIO COMPASS SCR-242-B

Radio Compass SCR-242-B was designed primarily for use in U. S. Army aircraft. This equipment is a 12 tube superheterodyne, with an intermediate frequency amplifier at 112.5 Kc. The equipment is capable of being locally or remotely controlled at the option of the local operator. The frequency range of the equipment is from 150 to 1500 Kc., which is covered in three bands calibrated in kilocycles, as follows: Band 1: 150 to 325 Kc., Band 2: 325 to 695 Kc., Band 3: 695 to 1500 Kc. Only the frequency band in use is visible. This equipment is manually tuned from either control position and the bands are switched electrically from the position having control. When used in conjunction with a suitable non-directional antenna, one or two headsets, a 12 to 14 volt direct current power supply and necessary interconnecting wiring, this radio compass is a complete operable unit capable of providing: (a) Visual, unidirectional, right-left indication of the arrival of radio frequency energy with respect to the plane of the loop and simultaneous "On Course" aural reception of modulated radio frequency energy. (b) Aural reception of modulated radio frequency energy using a non-directional antenna. (c) Aural reception of modulated radio frequency energy using a loop antenna, especially during periods of rain and snow static. (d) Aural-null directional indications of the arrival of modulated radio frequency energy with respect to the plane of the loop using a loop antenna, especially during periods of rain and snow static. A fixed loop mounting is supplied for visual or aural-null "homing." A rotable loop mounting is supplied for visual or aural-null homing and direction finding and for anti-rain or snow static reception. Ice removers are supplied for use on loops exposed to icing conditions. This equipment is intended primarily for use in aircraft with built-in connector panels but junction boxes and plug connectors can be obtained for aircraft without built-in connector panels. All component parts of this equipment having the same type number are interchangeable, viz.: radio compass units, loops, loop cords, loop mountings, indicators and control boxes. Radio Compass SCR-242-B was designed and built to U. S. Army Specification No. 71-849-A, dated August 11, 1937, by Bendix Radio Corporation, Chicago, Illinois, U. S. A., on Order No. 15075-NY-38, dated October 23, 1937.

1.2 COMPONENTS, DIMENSIONS AND WEIGHTS

The following components are required for a Radio Compass SCR-242-B installation in aircraft which are provided with a built-in radio compass junction box or connector panel: §

Description	Overall Size in Inches Including Projections	Weight
1—Radio Compass Unit BC-310-B□ including: 1—Mounting FT-145-B 1—Dynamotor DM-20 4—Lamps LM-32 1—Alignment Tool TL-138-B 1—Set Screw Wrench No. 8 5—Grid Shield Caps	20½ by 12 by 7¼*	45.3 lbs.*
1—Set of Vacuum Tubes, consisting of: 1—Tube VT-66 6—Tube VT-86 1—Tube VT-87 1—Tube VT-93 1—Tube VT-94 2—Tube VT-96	....	3.4 lbs.
1—Radio Control Box BC-311-B including: 4—Lamps LM-32 1—Set Screw Wrench No. 8 1—Control Box Base	7½ by 7½ by 3$^{15}/_{16}$	4.3 lbs.
1—Tuning Shaft MC-124	Length as required; $^{7}/_{16}$ diameter	0.18 lbs. per ft.
1—{Loop LP-13-B (without provision for ice remover)	23⅝ by 20⅞ by 2⅛	2.4 lbs.
OR		
Loop LP-15-B (with provision for ice remover)	23⅝ by 20⅞ by 2⅛	2.6 lbs.
1—Loop Ice Remover M-186-B (used only when Loop LP-15-B is used)	....	2.25 lbs.

1.2 (continued)

Description	Overall Size in Inches Including Projections	Weight
1—Loop Mounting GS-7-B (Fixed) OR	6 11/16 by 4 1/4 by 4 7/8	1.2 lbs.
Loop Mounting GS-8-B or GS-8-C (Rotatable)†, including: 1—Swivel Joint MC-182; 1—Lamp LM-32	22 7/8 by 8 by 7 1/2	8.4 lbs.
1—Tuning Unit MC-127 (Used only when Loop Mounting GS-8-B or GS-8-C is used)		
1—Cord CD-311, including:	72, 84 or 110 long	1.0 lbs.
2—Plugs PL-108	As required—1/2 O.D.	
2—Conduit Elbows FT-184		
1—Flexible Conduit Assembly		
1—Loop Mounting Cap M-169-A	2 1/4 by 2 1/4 by 1 5/8	0.2 lbs.
1 or 2—Compass Indicators I-65-B, each includes: 1—Lamp LM-32	3 1/4 by 3 1/4 by 1 5/8	1.7 lbs. each
1 to 3—Plugs PL-117 (lighting) (1 for each compass indicator and rotatable loop mounting)	1/2 diam. by 1 3/8 long	.02 lbs. each
1 or 2—Plugs PL-118 (1 for each compass indicator)	1 1/16 diam. by 1 1/2 long	.05 lbs. each
1—Plug PL-119 (Radio compass unit to antenna)	3/4 diam. by 1 3/8 long	.04 lbs.
1—Plug PL-122 (Radio compass unit to connector panel)	1 5/8 diam. by 2 1/2 long	.2 lbs.
2—Cord CD-307 ⊙	1/2 diam. and variable length	
1—Insulator IN-79 (Lead-in)	1 1/4 diam. by 3 1/8	.25 lbs.
‡Insulator IN-81 (1 1/2 " Stand-off)	1 1/4 diam. by 1 1/2	.06 lbs. each
‡Insulator IN-88 (Strain)	1 1/2 diam. by 2 3/4	.13 lbs. each
‡Wire W-106		.0045 lbs. per ft.

NOTES:

*When less Mounting FT-145-B size is 20 1/2 by 12 by 6 11/16 inches, and weight 42.25 lbs.

□Requires but does not include one set of vacuum tubes.

†Requires but does not include one Tuning Unit MC-127, weight 0.1 lb., for azimuth vernier drive. Loop Mounting GS-8-C is identical with GS-8-B except that it has inverted azimuth scale.

⊙One Cord CD-307 may be omitted for each aircraft position where headset extension cord of the radio set or interphone equipment is conveniently located for use also with the radio compass.

‡The number of stand-off and strain insulators and the length of antenna wire required will depend upon the individual installation. Refer to the applicable Air Corps installation drawings.

§In addition to the components listed above, there will be required one or two headsets with cord and plug, a suitable vertical antenna, a 12 to 14 volt DC power source, and suitable interconnecting wiring.

1.3 INSTALLATIONS USING SEPARATE JUNCTION BOX

For installations in aircraft which are not provided with a built-in radio compass junction box or connector panel, there will be required in addition to the above components:

Description	Overall Size in Inches Including Projections	Weight
1—Junction Box TM-180-B, including: 3-Fuses FU-28	6 1/4 by 5 5/8 by 2 1/2	1.5 lbs.
1—Plug PL-108 (Junction box to marker beacon indicator when used)	3/4 diam. by 1 3/8 long	.04 lbs.
1—Plug PL-112 (Junction box to marker beacon receiver when used)	1 1/16 diam. by 1 1/2 long	.06 lbs.
1 or 2—Plugs PL-118 (Junction box to each compass indicator)	1 1/16 diam. by 1 1/2 long	.05 lbs. ea.
1—Plug PL-121 (Junction box to radio control box	1 5/8 diam. by 2 1/2 long	.2 lbs.
1—Plug PL-122 (Junction box to radio compass unit)	1 5/8 diam. by 2 1/2 long	.2 lbs.
1—Plug PL-123 (Junction box to battery)	1 1/16 diam. by 1 1/2 long	.05 lbs.

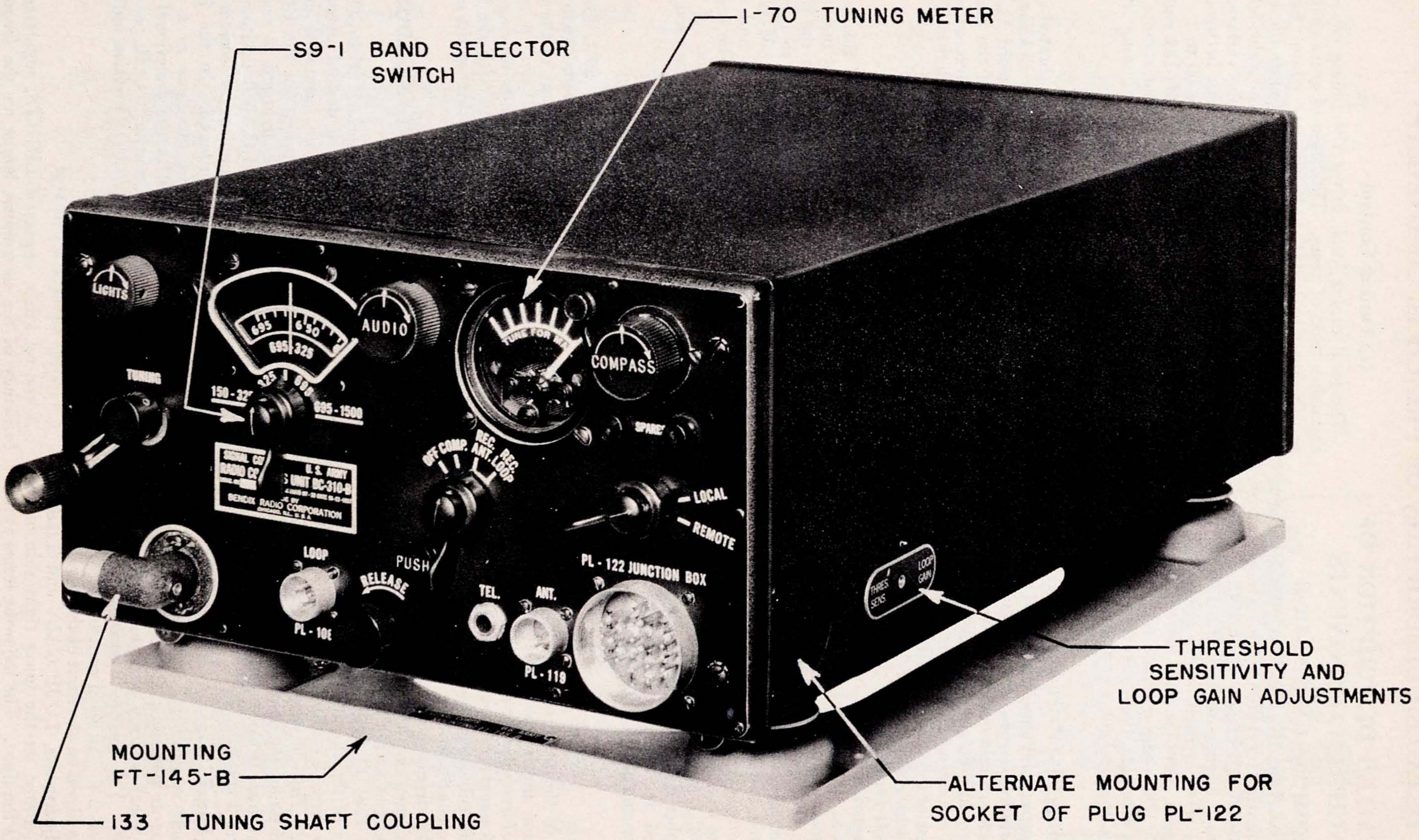


FIG. 2. RADIO COMPASS UNIT BC-310-B. ON MOUNTING

2.0 DETAILED DESCRIPTION OF PRINCIPAL COMPONENTS

2.1 RADIO COMPASS UNIT BC-310-B

Radio Compass Unit BC-310-B includes a cabinet, chassis and Mounting FT-145-B. The chassis contains Dynamotor DM-20, 4 Lamps LM-32 (2 in use, 2 mounted spares), Alignment Tool TL-138-B, No. 8 socket type set screw wrench, and 5 grid shield caps. This unit requires, but does not include, one set of vacuum tubes. The radio compass unit contains the compass circuit elements, the superheterodyne receiver circuit elements, the local controls and the high voltage power supply.

a—Mounting FT-145-B and Cabinet

The radio compass unit chassis is housed in a dust and spray proof cabinet formed of aluminum sheet and finished in black wrinkle enamel. Ganged snap-slide fasteners are provided on the bottom of the cabinet for attachment to Mounting FT-145-B. Stainless steel slides in the base of the cabinet permit easy withdrawal of the chassis, which is held securely in place by a captive through-bolt running from the front panel of the chassis to a riveted nut in the back of the cabinet. A cut-out section in the right side of the cabinet permits changing the location of the junction box cable plug receptacle from the front panel to the right side of the chassis for installations where this location is preferable. A plate attached to the chassis by two screws covers this section when the plug receptacle is normally mounted on the front panel. See Figure 2.

Mounting FT-145-B consists of an aluminum base plate, with rubber shock absorbers carrying snap slide studs, mounted in the four corners. For outline dimensional drawing and drilling diagram see Figure 51, appendix.

b—Chassis.

The chassis of the radio compass unit is formed of welded aluminum and is so constructed that it may be placed on any of five sides for servicing without damage to any part. A panel containing all of the local operating controls and cable terminations is attached to the front end of the chassis by four screws seated in riveted clinch nuts. All circuits are so shielded that when the equipment is aligned on the bench the chassis may be placed in its cabinet without changing the alignments. An Alignment Tool TL-138-B is mounted in clips on the upper right of the chassis, behind the front panel, and a set-screw wrench is clipped to the middle chassis cross member. The sub-assemblies and other components on and under the chassis deck are arranged to provide the optimum in accessibility for maintenance. Refer to Figures 3 and 4.

c—Local Panel Items and Controls.

This equipment is completely controlled from either the local or remote positions. The LOCAL-REMOTE switch at the local position determines the position having control. The remote controls are discussed under paragraph 2.3. All local controls are contained on the panel mounted on the front of the chassis. Two installation adjustments, LOOP GAIN and THRES. SENS., are mounted on the lower right side of the chassis towards the front. The following items appear on the front panel or side of the chassis. See Figure 2.

(1) Tuning Control

The local tuning knob drives the tuning capacitor through a train of gears. This train of gears connects to Tuning Shaft MC-124 through elbow fitting, Ref. 133. This elbow fitting is mounted at the lower left of the panel and may be turned to the right, left, or bottom of the chassis with provision for variation of 20 degrees in each position. The gear ratio between the tuning knob and the tuning capacitor is 60 to 1. The gear ratio between the Tuning Shaft MC-124 and the tuning capacitor is 120 to 1. The local and remote tuning controls are interconnected by Tuning Shaft MC-124.

(2) Dial

A radial disc type dial is used and is calibrated every 5 kilocycles from 150 to 330 kc. and every 10 kilocycles from 330 to 1500 kc.. A mark, with the word ALIGN is placed at the highest frequency end of the dial for aligning local and remote dials when interconnecting them with Tuning Shaft MC-124. The dial is illuminated by one Lamp LM-32. See Figure 31.

(3) Tuning Meter I-70

Due to the high degree of selectivity of this equipment, a tuning meter is provided to show, by maximum deflection of the pointer to the right, when the Radio Compass Unit BC-310-B is tuned exactly to the station. The meter is illuminated by a Lamp LM-32 and luminous paint is applied to the pointer and scale divisions as an aid during night flying. The pointer deflection is not necessarily an indication of field strength, therefore the meter should not be used as a distance meter.

(4) Band Switch

The frequency band selector switch, S9-1, located below the tuning dial, energizes the band switching motor and thus is capable of selecting any of the three bands, 150-325, 325-695, and 695-1500 kc. A mask, 136, attached to the switch shaft, permits viewing only that part of the tuning dial associated with the band selected. The band range in use is marked on the mask. See Figure 31.

(5) OFF-COMP-REC.ANT-REC.LOOP Switch

A four-position switch, S8, marked OFF-COMP-REC.ANT-REC.LOOP selects the desired operating function. In the OFF position no current is drawn from the low voltage power supply. In the COMP position the circuit elements are arranged to provide compass operation. In the REC.ANT position the equipment functions as a communication receiver connected to the non-directive antenna. In the REC. LOOP position the equipment functions as a communication receiver connected to the directional loop antenna. A mechanical stop, marked PUSH, prevents setting this switch in the REC.LOOP position until the stop is depressed. See Figure 2.

(6) LIGHTS Control

A control knob, engraved LIGHTS, regulates the brilliancy of the instrument lamps on the frequency calibrated dial and the tuning meter.

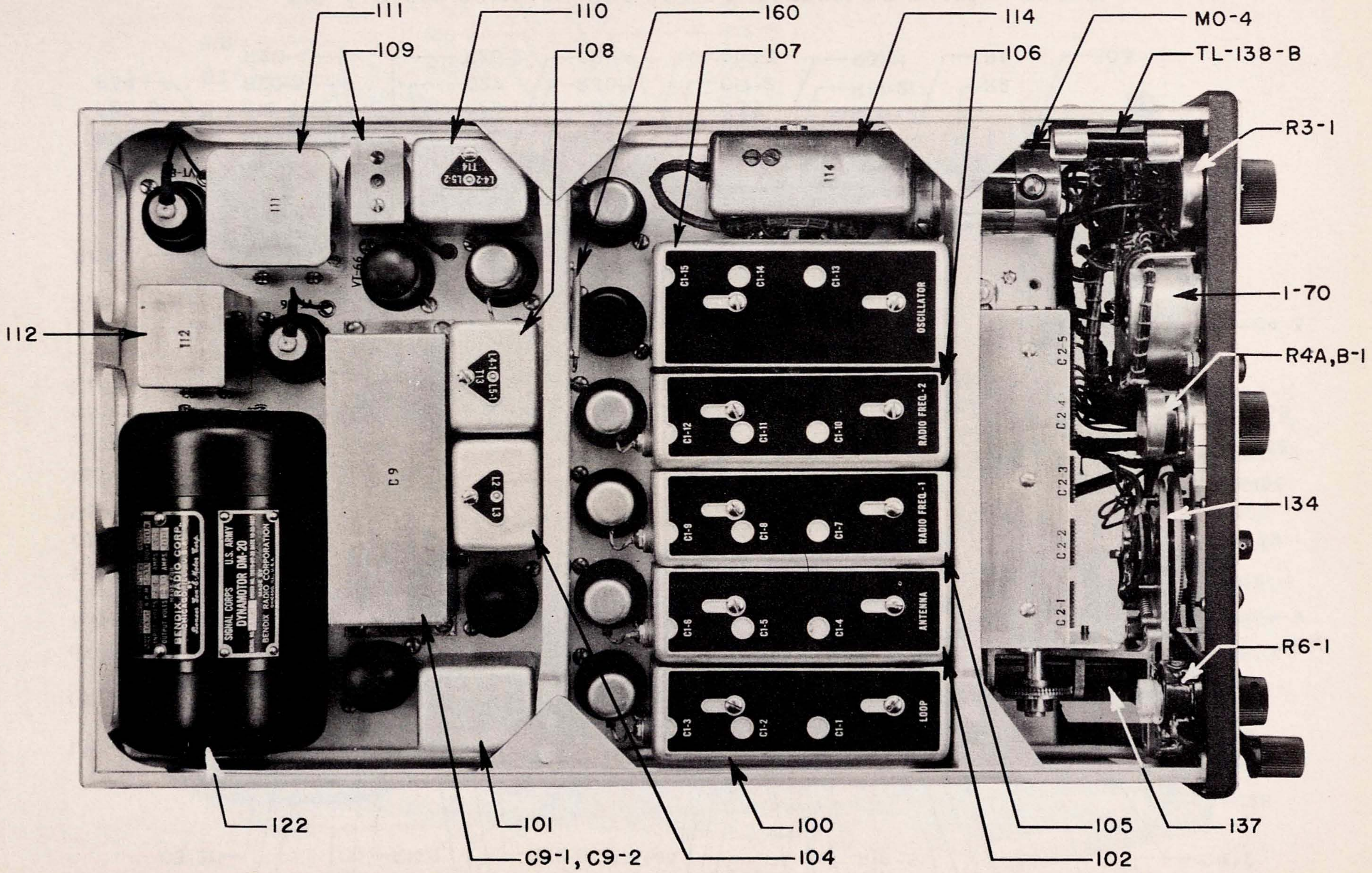


FIG. 3. RADIO COMPASS UNIT BC-310-B, TOP OF CHASSIS

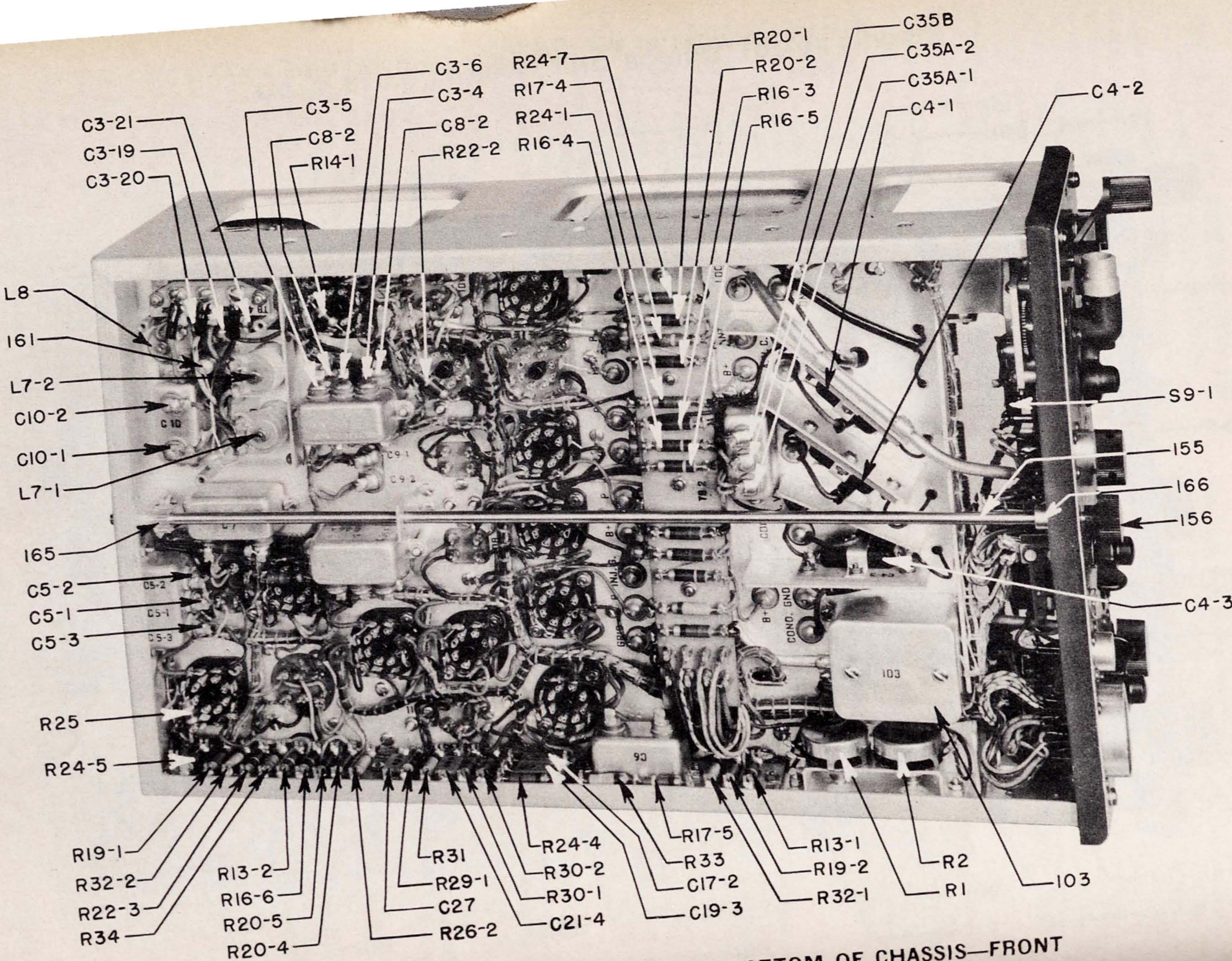


FIG. 4. RADIO COMPASS UNIT BC-310-B, BOTTOM OF CHASSIS—FRONT

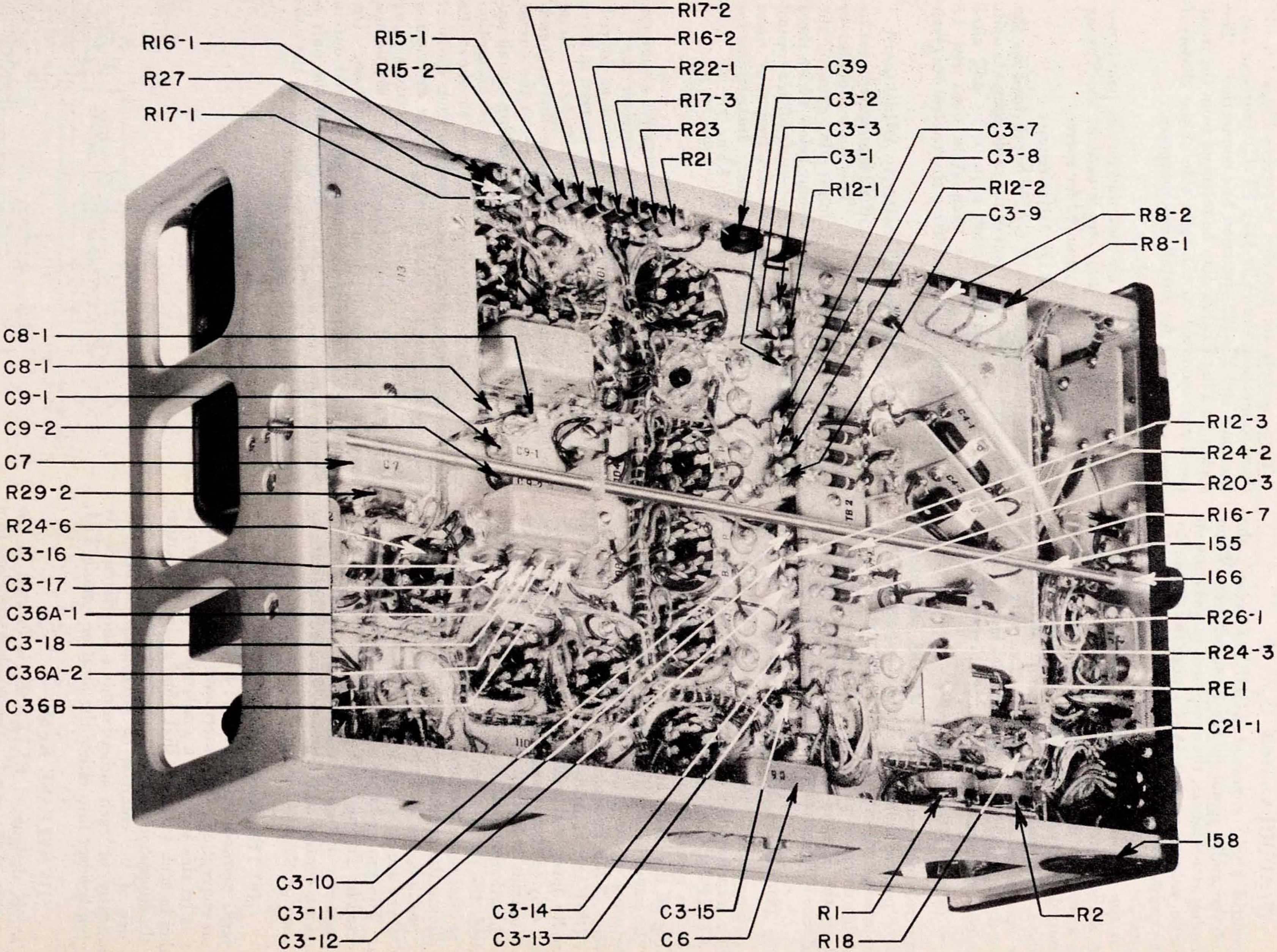


FIG. 5. RADIO COMPASS UNIT BC-310-B, BOTTOM OF CHASSIS—REAR

2.1 c (continued)

(7) AUDIO Control

A control knob, engraved AUDIO, regulates the level of the audio signal in the local headset. When functioning as a compass, the equipment is operating on automatic volume control (AVC) and this knob, by varying resistance in series with the headset circuit, determines the audio level at the local position only, the level at the remote position being determined by the remote audio control. When the equipment is functioning as a receiver, on either antenna or loop positions, this control knob varies the gain of the radio frequency amplifiers, to permit flying radio range courses. On receiver operation, at the local position, this AUDIO control determines the maximum audio level available at the local and remote positions. See Figure 13.

(8) COMPASS Control

A control knob, engraved COMPASS, regulates the indicator pointer deflection of the Compass Indicator I-65-B associated with the local position only. An adjustable detent is provided on the knob to facilitate resetting the control to a predetermined value in accordance with instructions of paragraph 4.2 **d.**

(9) LOCAL-REMOTE Switch

A two-position switch, S7, labelled LOCAL-REMOTE, transfers the functions of the band switch, OFF-COMP-REC.ANT-REC.LOOP switch, AUDIO control (in receiver position), and LIGHTS control (turning off the lamps at positions not having control) from the panel of the Radio Compass Unit BC-310-B to the panel of the Radio Control Box BC-311-B, or vice versa. When functioning as a compass, the AUDIO and COMPASS controls are not switched, therefore the audio level and indicator pointer deflection are subject only to their respective controls and the interphone obtains full output with no volume control. When functioning as a receiver, the AUDIO control is switched, the position having control determining the gain of the radio frequency amplifiers and thereby determining the maximum audio level at all jacks. In either position, the interphone remains connected provided there are no plugs in the local or remote TEL jacks. The tuning knobs at both positions are interconnected by Tuning Shaft MC-124 and turn together. The frequency dial mask is not changed at the position not having control and therefore does not indicate at that position the band in use.

(10) TEL Jack

A jack, marked TEL receives Plug PL-55 for the headset connection. The interphone connects through contacts on this jack and a similar jack at the remote position in such a manner that when a plug is in either jack the interphone circuit is disconnected. This permits use of the compass or interphone circuits, independently of each other without interference by plugging headset into either the local or remote TEL jacks.

(11) RELEASE Knob

A knob, designated RELEASE, is located in the lower center of the panel. This knob is attached to a captive throughbolt which holds the chassis securely in its cabinet. When turned counter clockwise this bolt withdraws and releases the chassis from its cabinet.

(12) Sockets

Three sockets are provided to receive Plugs PL-108 (loop connection, Cord CD-311), PL-119 (antenna connection), and PL-122 (junction box connection). The socket for Plug PL-122 may be removed from the front panel and mounted on the right side of the chassis if more convenient for installation purposes.

(13) Lamps LM-32

Four Lamps LM-32 are mounted on the panel; one is used at the tuning dial, one is used at the Tuning Meter I-70, and two are mounted for spares.

(14) LOOP GAIN Adjustment

A control marked LOOP GAIN is provided on the lower right side near the front of the radio compass unit. This control is an installation adjustment and after being set for a particular installation need not be touched. Instructions for setting this control are given in par. 4.2 **b.**

(15) Threshold Sensitivity Adjustment

A control marked THRES.SENS is mounted next to the LOOP GAIN adjustment. This control is also an installation adjustment and limits the gain of the radio frequency amplifiers to a point below which there will be no audible response. The setting of this control is determined by the average radio frequency noise interference inherent in each airplane. Instructions for setting this control are given in par. 4.2 **c.**

d—Circuits

(1) General

Radio Compass Unit BC-310-B comprises a compass circuit and a receiver circuit. The receiver may be operated on loop or non-directional antenna as desired. The frequency range (150-1500 Kc.) is covered in three bands (150-325, 325-695, and 695-1500 kc.). Band selection is accomplished by a motor driven band-change switch, the switches inserting into the circuit the coils for the desired band, and shorting out all unused coils, thereby preventing any resonance absorption circuits. The schematic diagram, Figure 45, shows the equipment being operated as a compass from the local position on Band 1. The following circuit description traces the circuit for Band 1 only. A corresponding description would apply to Bands 2 and 3 should the band switch be set to either of these positions. The important elements of the circuit are pointed out in Figures 4 and 5. The wiring diagram of the unit is shown in Figure 47. The wiring diagram of the sub-assemblies is shown in Figure 46.

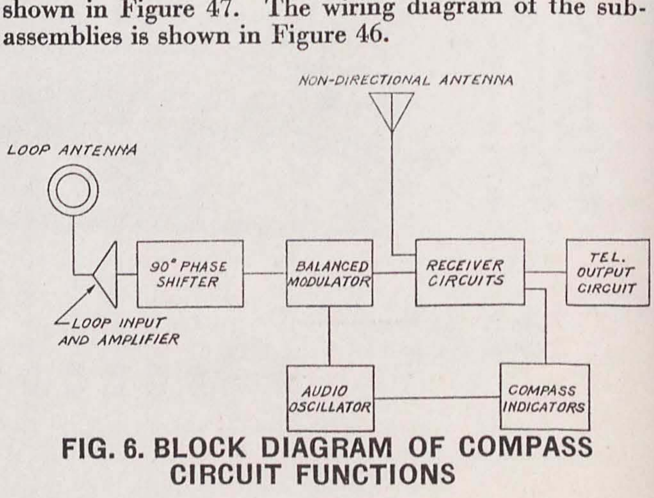


FIG. 6. BLOCK DIAGRAM OF COMPASS CIRCUIT FUNCTIONS

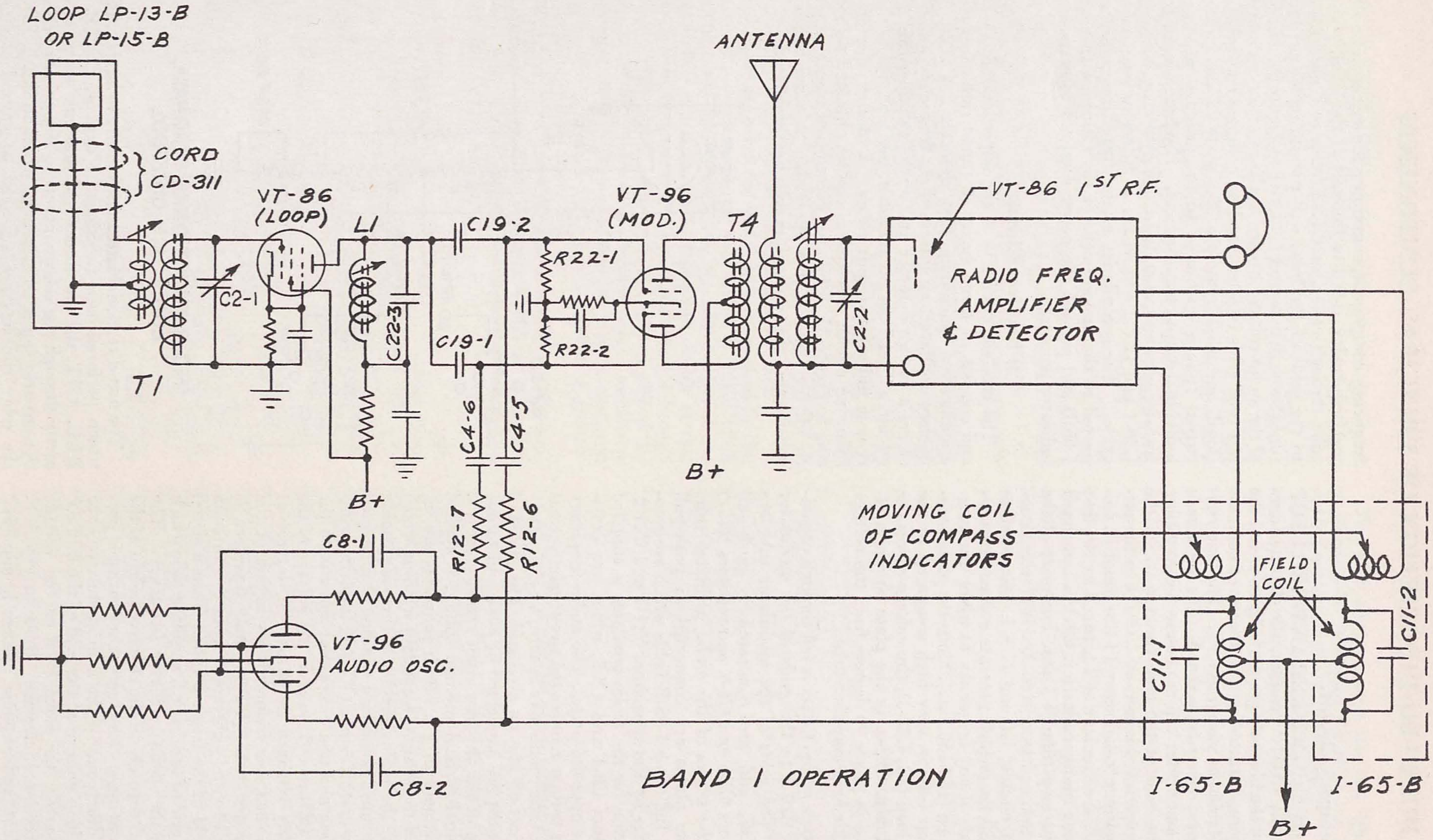


FIG. 7. SIMPLIFIED SCHEMATIC COMPASS CIRCUITS

2.1 d (continued)

(2) **Compass Circuit.**

When the OFF-COMP-REC.ANT-REC.LOOP switch is set to the COMP position, the circuits function as shown by the block diagram of Figure 6, and the schematic diagram, Figure 45. The theory of compass operation is explained in paragraph 5.1. The loop consists of a four-turn, center-tapped coil. The outer ends of the winding and center tap are connected to a plug receptacle at the base of the loop through which the loop output voltage is fed into Cord CD-311 to the primary of the loop input transformer T1 (for Band 1). Refer to Figure 7. The secondary of T1, tuned by the first section of the gang tuning capacitor, C2-1, is connected to the grid of the loop tube (VT-86). The plate of the loop tube is fed to the phaser (Ref. No. 101) which consists of a shunt circuit, L1 and C22-3, resonated to approximately 50 kc., which presents a capacitive reactance to signals of any frequency to which the compass may be tuned (150-1500 kc.). Since the plate resistance of the loop tube is very high compared to the reactance of its load (L1, C22-3), the voltage across the capacitive reactance, C22-3, in the plate circuit is effectively changed in phase 90 degrees from the voltage on the grid of this loop amplifier tube.

The R.F. voltage across C22-3 is fed through capacitors C19-1 and C19-2 to the grids of the modulator tube (VT-96). The grids of the modulator tube are biased to cut-off, and are connected in push-pull through capacitors C4-5 and C4-6, and resistors R12-6 and R12-7 to the plates of the audio oscillator tube (VT-96). These plates are connected in push-pull to the Compass Indicator I-65-B fields which are resonated at 48 cycles by the capacitors C11-1 and C11-2. The grid excitation for the audio oscillator is supplied through capacitors C8-1 and C8-2, which are cross-connected to the opposite plates. The audio frequency oscillator output voltage renders the two triode sections of the modulator tube conductive in turn, by alternately overcoming the cut-off bias on each grid. The plates of this modulator tube are connected in push-pull to one primary winding of the antenna input transformer T4. The non-directional vertical antenna voltage is applied to the second primary of T4. Both primaries are inductively coupled to the same secondary winding which is tuned by C2-2, the second section of the gang tuning capacitor. This tuned secondary winding is connected to the grid of the first r.f. stage (VT-86), applying voltages from the loop and non-directional antenna to the grid of this first r.f. tube. However, the voltage of the loop is alternately changed in phase 180 degrees at twice the audio oscillator frequency by action of the push-pull modulator tube (VT-96) and therefore is alternately added to and subtracted from the antenna voltage at the grid of the first r.f. tube. Thus a signal is applied to the grid of the first r.f. amplifier tube which is modulated at the audio oscillator frequency. The level of this signal depends on the effective height of the non-directional antenna. The loop gain control is provided to allow adjustment of the loop modulator tube gain so that the loop voltage at the grid of the first r.f. tube is approximately the same level as the voltage from the non-directional antenna. Refer to Figure 8. The combined loop and antenna voltage is amplified and detected by the receiver circuits and the audio frequency component, containing the signal and switching frequencies, is fed to the grid of the "Tel." output tube through capacitor C17-2 (refer to Figure 13) and to the grids of the local and remote indicator output tubes through capacitor C6 (refer to Figure 9). The level of the audio voltage applied to the local and remote output tube grids is determined by compass controls R3-1 (local) and R3-2 (remote). The plate of each indicator output tube is connected to the primary winding of individual output transformers. The primaries of these transformers are resonated to 48 cycles by condensers C28-1 and C28-2 and so act as filters to pass only 48 cycles. The secondaries of the transformers are connected to the moving coils of the Compass Indicators I-65-B and provide the power required to actuate the indicator pointers.

(3) **Receiver Circuit.**

The receiver circuit is of the superheterodyne type and consists of three stages of tuned radio frequency amplification (including first detector), a radio frequency oscillator, an intermediate frequency amplifier stage, a second detector and audio amplifier, an AVC circuit, a "Tel." output amplifier, and separate local and remote indicator output tubes. A clearer idea of the following circuit description can be obtained by referring to Figure 45. While the description traces only the circuit for Band 1, it is applicable to other bands by substituting the appropriate coils for those bands.

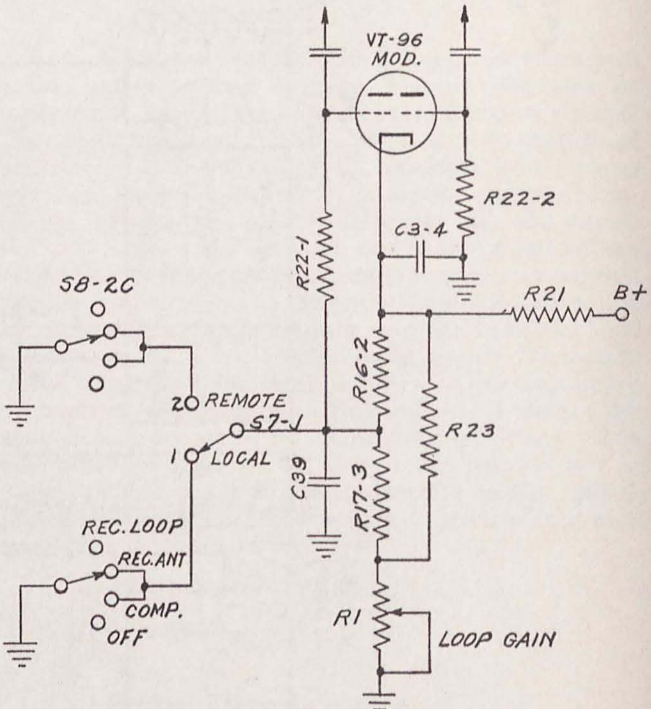


FIG. 8. FUNCTIONAL DIAGRAM, LOOP GAIN CONTROL

The non-directional antenna connects to a relay, RE1 which performs two functions: When on COMP. or REC. ANT. the non-directional antenna connects directly through the relay contacts to the primary of T4, the antenna input transformer; when on REC. LOOP the relay contacts are arranged to ground the non-directional antenna and to substitute a capacitor C21-1

2.1 d (3) (continued)

across the primary winding of T4, the antenna input transformer. A resistor, R18, connects directly to the antenna and permits electro-static charges to leak off to ground when the antenna is ungrounded. The capacitor C17-1 prevents damage to the antenna transformer when a d.c. voltage is applied to the antenna. The primary of T4 inductively couples to the secondary which is tuned by the second section of the gang tuning capacitor C2-2. The grid of the 1st RF tube connects to the secondary of the transformer. A small neon tube between the grid and ground protects the tube and circuit elements against high antenna voltages which may result from the operation of the airplane's transmitter or high electro-static charges on the antenna.

A coil, L2, in the cathode lead is resonated at 110 kc. by capacitor C16-1 and acts as a trap circuit to attenuate unwanted signals near the intermediate frequency.

The plate of the first RF tube couples through transformer T7-1 to the grid of the second RF tube, the secondary of the transformer T7-1 being tuned by the third section of the gang tuning capacitor C2-3. An I.F. trap circuit, (L3, C16-2), in the cathode lead of the second RF tube is tuned to 115 kcs. The plate of this tube connects to the primary of a transformer T7-2, the secondary of which is tuned by the fourth section of the gang tuning capacitor C2-4 and connects to the control grid of the third RF or first detector tube.

The injector grid of the first detector is excited by the output of a triode oscillator tube which is tuned 112.5 kcs. above the desired signal by the fifth section of the gang tuning capacitor C2-5. The plate circuit of this detector tube is tuned to 112.5 kcs. and couples through capacitor C26 which connects to the control grid of the first I.F. Tube VT-86 to a similarly tuned circuit. A coil, L6, in the cathode lead of this I.F. tube is resonated by a capacitor C15 at 122.5 kcs. to obtain a sharper I.F. response.

The plate circuit of this tube is tuned to 112.5 kcs. and couples through a capacitor C24-3 to a second tuned circuit, which connects to one diode rectifier plate of the second detector tube.

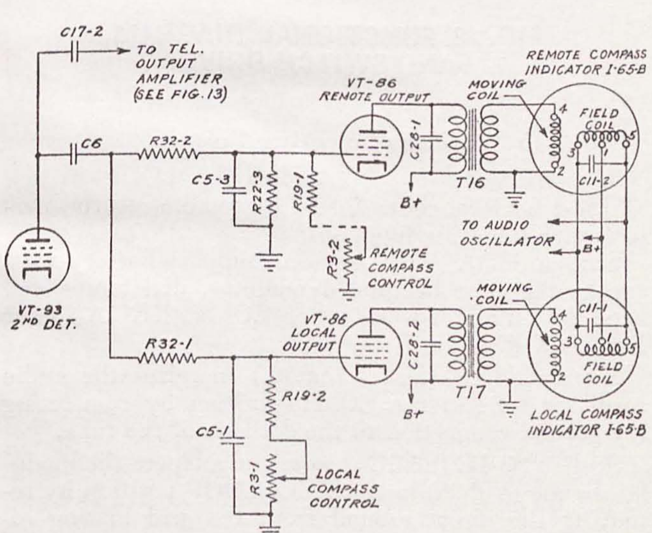


FIG. 9. FUNCTIONAL DIAGRAM, COMPASS CONTROL

The grid of the second detector tube receives the rectified audio frequency signal at the junction of the diode load resistors R14-4 and R28.

The second diode plate is fed from the plate circuit of the I.F. tube through capacitor C21-4, and supplies the AVC bias for the first and second RF amplifiers, the first detector and the I.F. tubes. The operation of this circuit is shown in Figure 10. The greater the amplitude of the received signal, the greater will be the voltage built up across the AVC load resistor R30-1 by the rectified carrier. Since the control grids of the preceding tubes are connected to the negative end of this resistor, the negative bias on them will be increased by a strong carrier, and because of their variable amplification characteristics, they will operate at reduced gain on such signals. Conversely, on weak signals the bias introduced by the AVC will be smaller and the tubes will operate at higher gain. This action tends, therefore, to maintain incoming signals at a constant level.

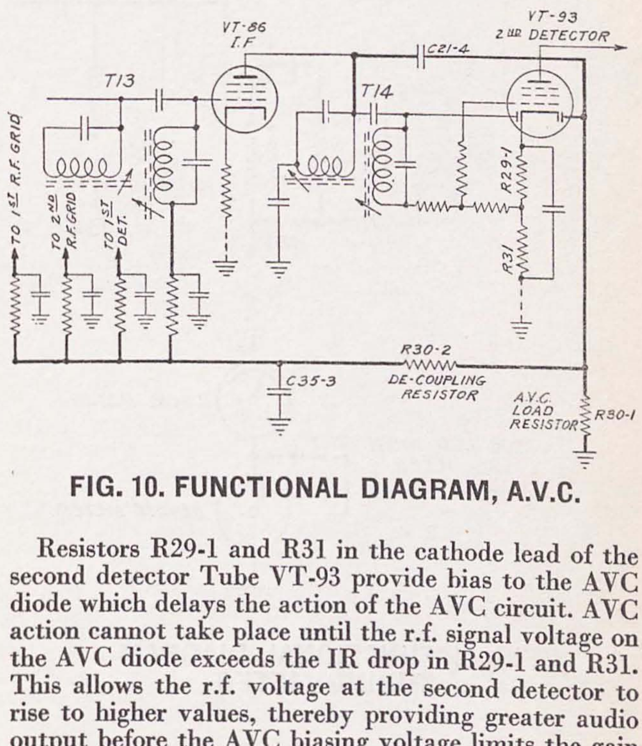


FIG. 10. FUNCTIONAL DIAGRAM, A.V.C.

Resistors R29-1 and R31 in the cathode lead of the second detector Tube VT-93 provide bias to the AVC diode which delays the action of the AVC circuit. AVC action cannot take place until the r.f. signal voltage on the AVC diode exceeds the IR drop in R29-1 and R31. This allows the r.f. voltage at the second detector to rise to higher values, thereby providing greater audio output before the AVC biasing voltage limits the gain of the amplifiers. The Tuning Meter I-70 is in series with the cathode lead of the second detector tube (VT-93). (See Figure 11). When no signal is being received the plate current of the triode section will be at a maximum since the only bias effective on the triode grid will be the voltage drop across R29-1. This triode plate current will cause a full scale left deflection on the tuning meter (the zero setting of the instrument being at the extreme right). When a signal is received some second detector diode current, depending on the signal intensity, will flow through the diode load resistors R14-4 and R28. Since R12-4 connects to the junction of these resistors, an additional negative bias, equal to the IR drop across R28 will be applied to the audio grid, serving to reduce the plate current and consequently cause the Tuning Meter I-70 deflection to swing toward the right. Since R29-1 has so small a

2.1 d (3) (continued)

resistance as compared to R28, its increased IR drop due to second detector diode current will be negligible. Since the bias voltage developed across R28 depends upon signal intensity at the second detector, the right hand deflection of the tuning meter, which measures this bias voltage, can be used to indicate exact tuning.

The plate of the second detector tube is resistance-capacity coupled to the grid of the "Tel" output tube (VT-66). The plate of this output tube is connected to the primary of the output transformer T15. The secondary of this transformer works into a low-pass filter network, consisting of L10, C37-1, C37-2, which is designed to attenuate frequencies above 2500 cycles. The output of the filter network is connected to the headset jacks J1 and J2. See Figure 13 for complete "Tel." output circuit.

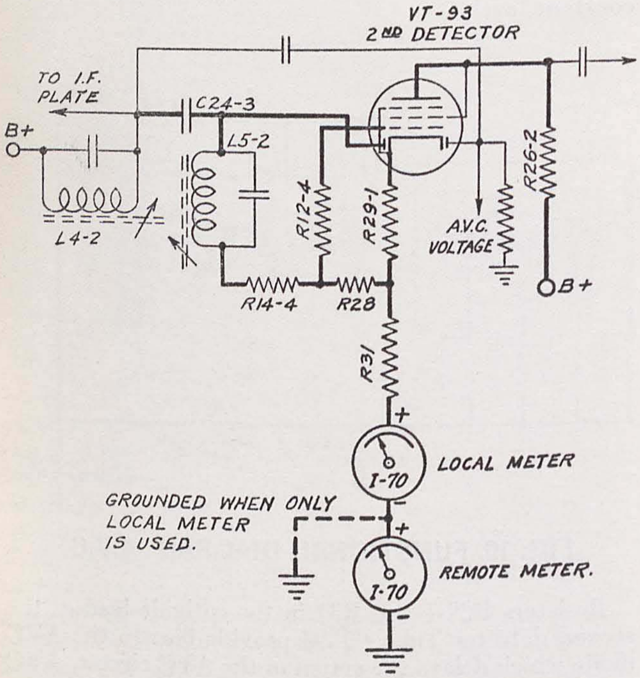


FIG. 11. FUNCTIONAL DIAGRAM, TUNING METER

(4) Band Change Circuit

Band changing is effected by switching the tuned circuits in the loop, first RF, second RF, first detector, and RF oscillator stages by means of motor-driven switches. The motor armature drives a worm gear which is ganged on a common shaft with the crank arm and locking cam, the control cam, switches S5B, and S5C, and the r.f. band change switches. The operation of the band switch drive mechanism is shown in Figure 12. When the band selector switch S9 (S9-1 for local control, S9-2 for remote control) is operated to select a different band, the band switch motor (MO-4) is energized by completing the circuit to ground through the contacts of S9 and S5B. The motor drives the crank arm through one or two complete revolutions which steps the Geneva disc until the motor is de-energized by the opening of S5B, which is on the same shaft as the Geneva disc and the switches that select the tuned circuits. Exact control of the positioning is obtained by the cam-operated switch S6. When the motor is at rest the arm of the switch S6 is on step 2 of the control cam, and all contacts are open. When the motor starts the arm is first raised by step 3 of the cam, closing the upper contacts, which at this time perform no function since the corresponding contact of S9 will be open. As the motor continues operating the arm of S6 will drop to step 1 of the cam, opening the upper contacts and closing the lower ones. The closing of the lower contacts provides an additional path to ground to keep the motor energized after the opening of S5B by the movement of the Geneva disc, and also grounds the audio output of the radio compass unit to prevent clicks while changing bands. When the crank arm has been driven past the Geneva disc, engaging the locking cam with the arc of the disc, the control cam raises the arm of S6 to step 2, opening all contacts, and the motor coasts to a stop. If it should coast past step 2, the upper contacts of S6 will be closed by the control cam and will now energize the reverse field of the motor through the contacts of S5C and S9 and the motor will reverse to the proper position until all contacts of S6 open.

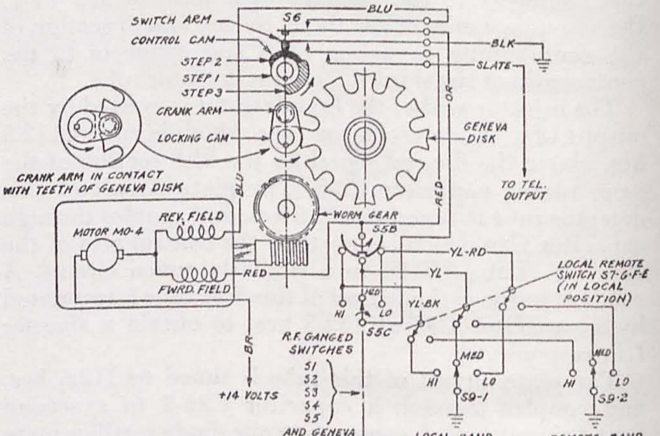


FIG. 12. FUNCTIONAL DIAGRAM, BAND SWITCH DRIVE

(5) Antenna Selecting Circuit

The OFF-COMP-REC.ANT-REC. LOOP Switch S8 (S8-1 for local control, S8-2 for remote control) performs the following functions:

Section S8-1A (S8-2A remote) supplies battery voltage to the tube heaters, dynamotor, dial lamps and band switch motor when set on COMP, REC.ANT, or REC.LOOP.

Section S8-1B (S8-2B remote) energizes the audio oscillator tube in the COMP position by completing the ground connection to the cathode of the tube.

Section S8-1C (S8-2C remote) unbalances the modulator tube (VT-96) in the REC. LOOP position by removing the direct ground from the grid biasing resistor R22-1, (See Figure 8), thereby applying a high negative bias to one of the grids of VT-96. VT-96 will then function as a simple single channel amplifier tube.

2.1 d (5) (continued)

Section S8-1D (S8-2D remote) (See Figure 13) shorts out section R4B-1 of the dual potentiometer (R4B-2 remote) in the COMP position, thus permitting the receiver r.f. circuits to operate at maximum gain, controlled by the AVC action only. In the LOCAL, REC. ANT and REC. LOOP positions section R4B-1 (R4B-2 remote, disconnected) is left in circuit and controls the audio output at both positions by regulating the cathode bias of the receiver r.f. circuits. In the REMOTE

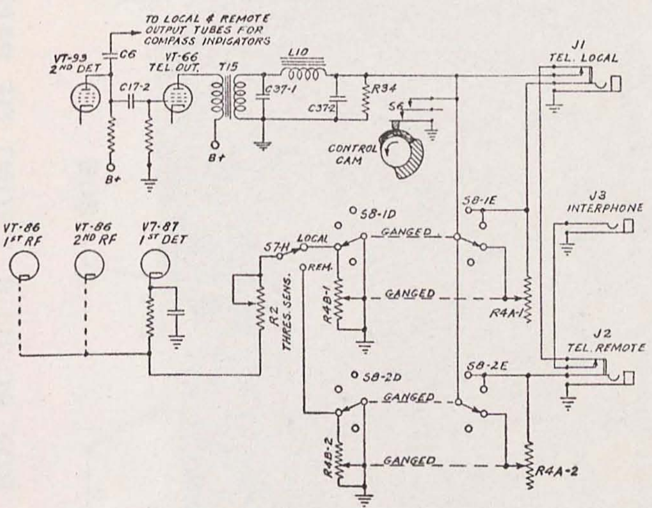


FIG. 13. FUNCTIONAL DIAGRAM, AUDIO CONTROL

position R4B-2 is connected in the circuit and R4B-1 disconnected, so R4B-2 controls the audio level at both positions.

Section S8-1E (S8-2E remote) (See Figure 13) when in the COMP position, connects section R4A of the dual potentiometer in series with the audio output circuit. The audio level, in this setting of S8, is therefore controlled independently at the local position by R4A-1 and at the remote position by R4B-1.

2.2 VACUUM TUBES

A complement of 12 tubes is required for Radio Compass SCR-242-B and all are used in Radio Compass Unit BC-310-B. Tubes may be replaced by removing the radio compass unit chassis from its cabinet.

a—Vacuum Tubes, Types and Characteristics

The following vacuum tubes are required:

Tube VT-86	Loop Amplifier
Tube VT-96	Modulator
Tube VT-96	Audio Oscillator
Tube VT-86	1st R.F. Amplifier
Tube VT-86	2nd R.F. Amplifier
Tube VT-87	1st Detector
Tube VT-94	R.F. Oscillator
Tube VT-86	I.F. Amplifier
Tube VT-93	2nd Det. and AVC
Tube VT-66	Tel. Output
Tube VT-86	Remote Output
Tube VT-86	Local Output

The characteristics of the vacuum tubes appear in the table below:

b—Lamps LM-32.

Lamp LM-32 requires 3 volts and 0.18 ± 0.02 amperes. A total of 11 lamps are required for Radio Compass SCR-242-B as follows:

Where Used	No. of Lamps LM-32
Radio Compass Unit BC-310-B	4 (2 in use, 2 spares)
Radio Control Box BC-311-B	4 (2 in use, 2 spares)
Compass Indicator I-65-B (Local)	1
Compass Indicator I-65-B (Remote)	1
Loop Mounting GS-8-B or GS-8-C (Rotable Loop)	1

2.3 RADIO CONTROL BOX BC-311-B

a—General.

Radio Control Box BC-311-B includes 4 Lamps LM-32 (2 in use and 2 mounted spares), 1 No. 8 socket type set screw wrench and 1 control box base. Radio Control Box BC-311-B contains all remotely operated controls for Radio Compass Unit BC-310-B and is constructed for mounting in a rigid conduit system (see Figure 14). This box is in two sections. The rigid conduit is attached to the radio control box base and the wires solder to terminal board TB10. Electrical connections are made from TB10 to the radio control box panel by means of a plug-in arrangement shown in Figure 15. The panel containing the controls is secured

Tube	VT-66	VT-86	VT-87	VT-93	VT-94	VT-96
Heater V.	6.3	6.3	6.3	6.3	6.3	6.3
Heater A.	0.7	0.3	0.3	0.3	0.3	0.8
Esg. V.	250.	100.	100.	125.	—	—
Ep. V.	250.	250.	250.	250.	250.	250.
Ecg. V.	—16.5	—3.	—3.*	—3.	—8.	—5.
Ip ma.	34.	7.	5.3	10.	9.	6.
Isg. ma.	6.5	1.7	5.5	2.3	—	—
Mu	200.	1,160.	880.	800.	20.	35.
Rp. ohms	80,000.	800,000.	800,000.	600,000.	7,700.	11,300.
Gm umhos	2,500.	1,450.	1,100.	1,325.	2,600.	3,100.

*Note: Voltage on control grid No. 1 and control grid No. 3.

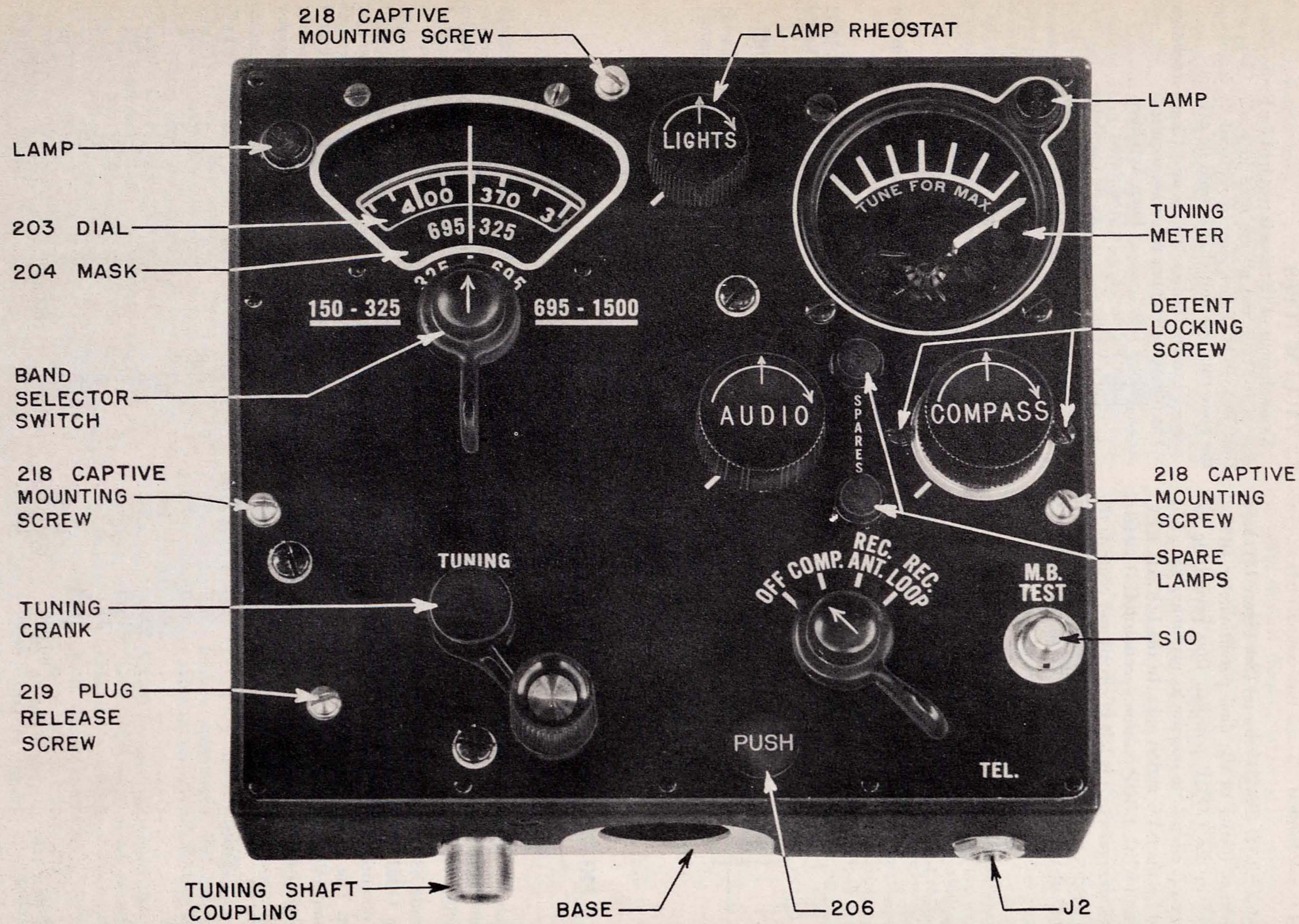


FIG. 14. RADIO CONTROL BOX BC-311-B, FRONT OF PANEL

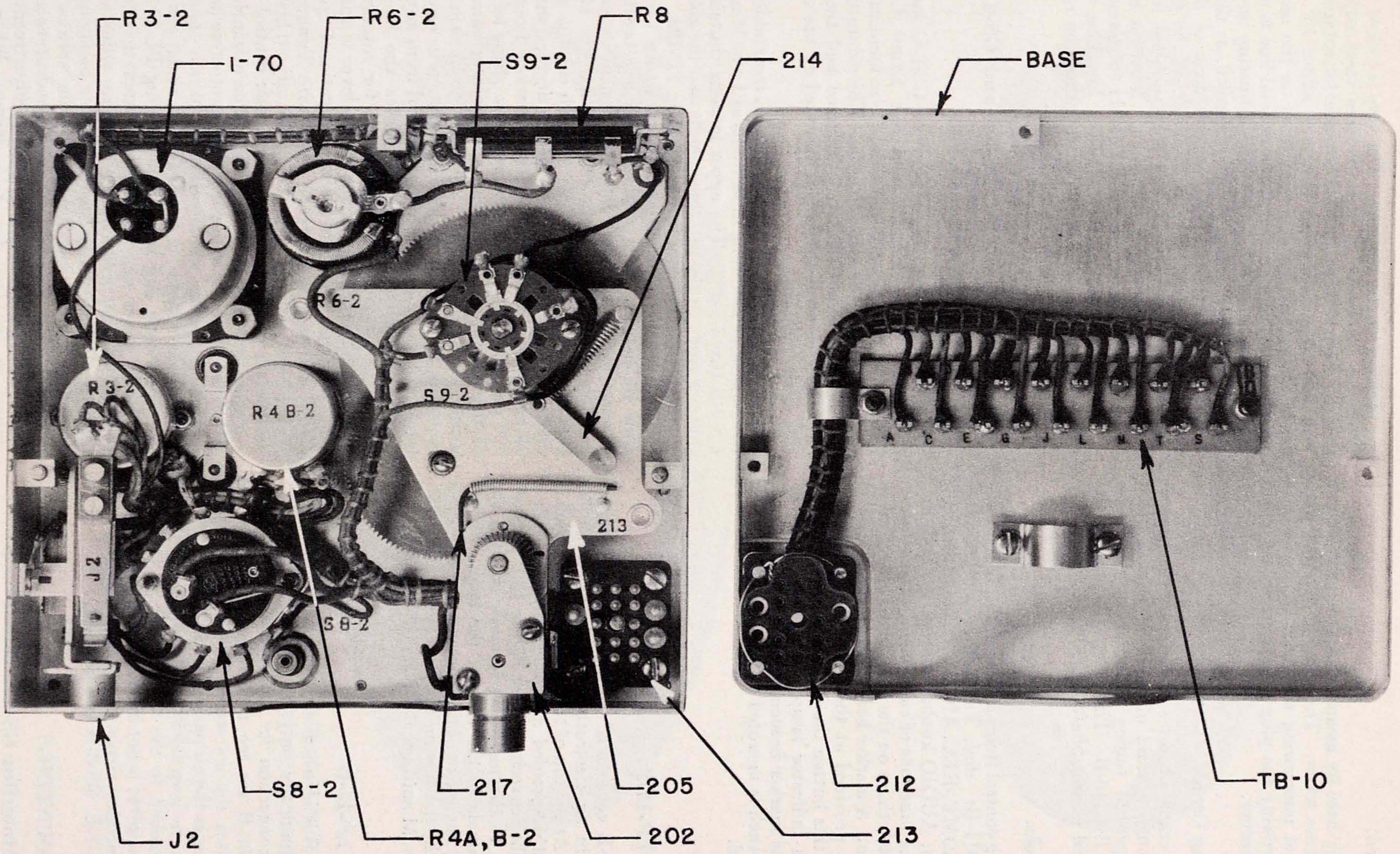


FIG. 15. RADIO CONTROL BOX BC-311-B, OPEN

2.3 a (continued)

to the mounting base by means of three captive screws and a plug release screw. The panel is removed from its base by first unscrewing the three captive screws and then unscrewing the plug release screw located in the lower left corner.

b—Tuning Crank.

The tuning crank operates the remote dial and is connected through a train of gears to Tuning Shaft MC-124 and ganged tuning capacitor in the Radio Compass Unit BC-310-B. The gear ratio between the remote knob and Tuning Shaft MC-124 is 1 to 2.

c—Controls.

The following control items appear in the Radio Control Box BC-311-B: dial; Tuning Meter I-70; band switch; OFF-COMP.-REC. ANT.-REC. LOOP switch; LIGHTS knob; AUDIO knob; COMPASS knob; and TEL jack. The functions of each one of these controls are identical with those on the local panel described in paragraph 2.1-c. A marker beacon test switch, marked M.B.TEST, is provided at the remote position only. By depressing this button the pilot is able to light the marker beacon indicator lamp and thereby test the operation of the marker beacon receiver if one is used. A set screw wrench is mounted on the gear drive plate inside the panel.

2.4 LOOPS

a—Loop LP-13-B

Loop LP-13-B consists of a 4 turn coil with center tap, enclosed in an electrostatic shield of streamline cross section. At the top of the shield is a gap which is insulated, weather-proofed and water-proofed with a vulcanized rubber covering. (See Figure 16.) Electrical connection to the mounting is made through the three pin terminals in the base of the loop. Proper positioning and alignment of the loop and the mountings is effected by the flat key on the loop base. Loop LP-13-B fits Loop Mountings GS-7-B, GS-8-B and GS-8-C.

b—Loop LP-15-B

Loop LP-15-B is identical electrically with LP-13-B. It differs mechanically only in that it contains the necessary air connection for attachment of Loop Ice Remover M-186-B for ice removal operation. The air which inflates the ice remover does not circulate around the wires as the air passage in the loop is entirely separated from the loop shield. The air tube in the ice remover is attached to the tapped hole in the loop. When the ice remover is not installed this hole is closed by the air connection cover. Loop LP-15-B fits Loop Mountings GS-7-B, GS-8-B and GS-8-C.

2.5 LOOP MOUNTINGS

a—Loop Mounting GS-7-B (Fixed Loop)

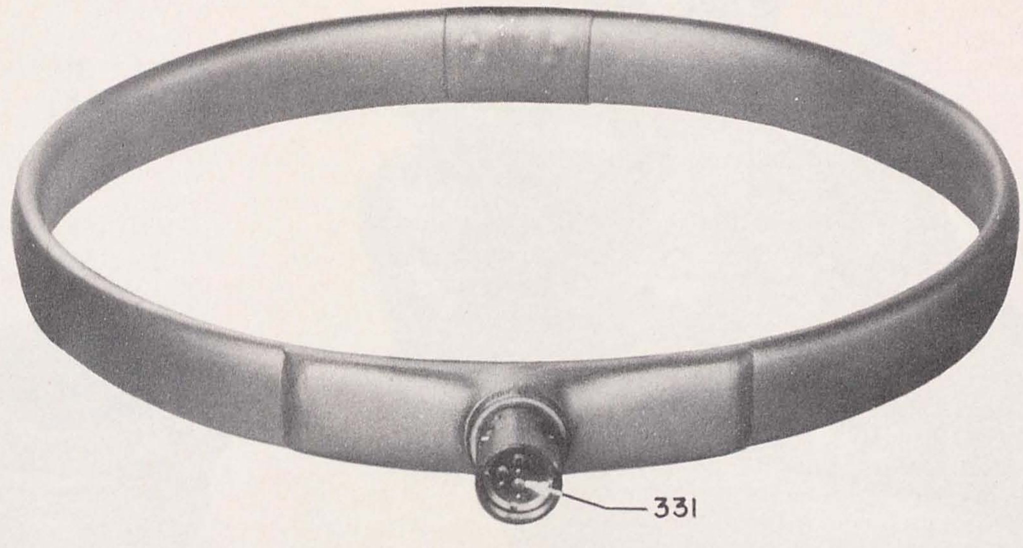
Loop Mounting GS-7-B provides a means of installing either Loop LP-13-B or Loop LP-15-B in the homing position on the airplane. The loop is locked in the mounting by means of two stainless steel adjusting screws. These screws provide a means for rotating the loop through a total angle of plus or minus 10°. The 5 and 10 degree points are engraved on the movable portion of the mounting and the fiducial line is on the fixed part. (See Figure 17.) This adjusting means is used only when the loop is being installed, as the loop is normally locked and fixed. Connection of the air line for ice removal operation is made at the tapped hole, which is closed with the plug supplied for use when the air line is not connected. A socket is provided for Plug PL-108 on Cord CD-311 for connection to Radio Compass Unit BC-310-B. Location of the four mounting holes is identical with those on rotable Loop Mountings GS-8-B and GS-8-C.

b—Loop Mountings GS-8-B and GS-8-C

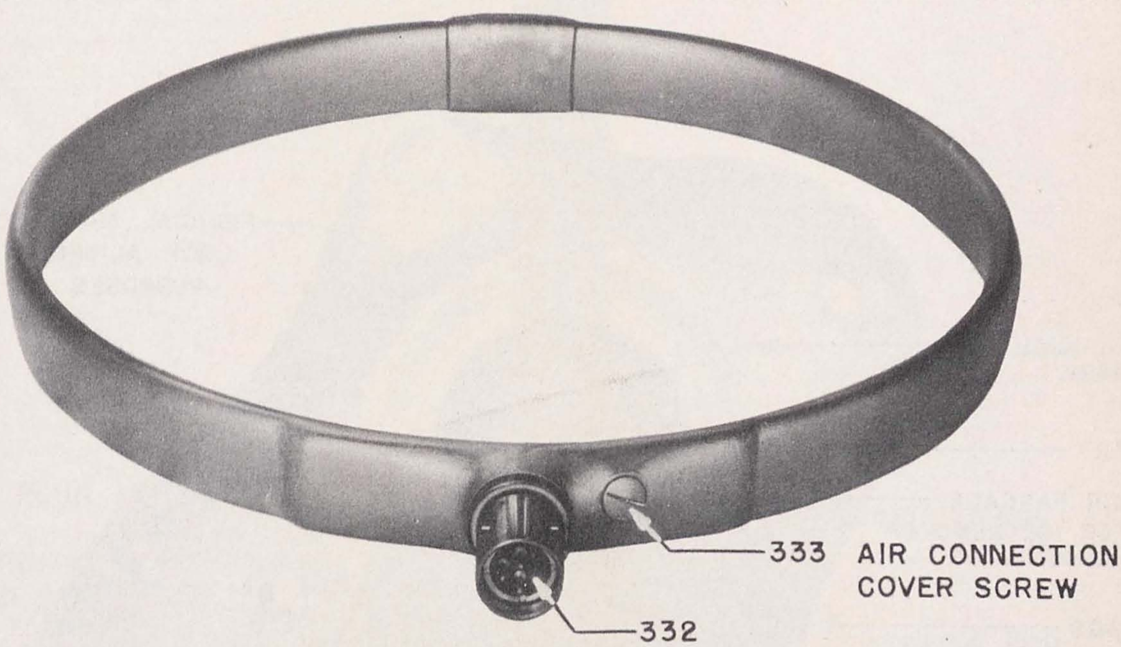
(Rotatable Loop)

Either Loop Mounting GS-8-B or GS-8-C includes one Swivel Joint MC-182 and one Lamp LM-32. Loop Mountings GS-8-B and GS-8-C are identical with the exception of the azimuth scale. The azimuth scale on Loop Mounting GS-8-C is inverted and therefore only readable when the loop is mounted on the underside of the aircraft.

Loop Mountings GS-8-B and GS-8-C (rotatable loop) have the same mounting dimensions as Loop Mounting GS-7-B (fixed loop). The upper housing contains the collector rings on the rotating spindle and the collector ring brushes wired to a socket for Plug PL-108. Cord CD-311 provides for connection to Radio Compass Unit BC-310-B. Each mounting permits continuous rotation of the loop and determination of its angular position with respect to the center line of the aircraft fuselage (See Figure 18). The azimuth scale is graduated in 1 degree steps from 0 to 360 degrees with the 10-degree graduations numerically marked from 0 to 350 degrees. When installed, rotation of the left side of the handwheel away from the operator causes an increase in scale readings. A clutch mechanism, lever operated, is provided for locking the loop in any position and may be conveniently operated from any position of the handwheel which rotates the loop. A vernier adjustment is also provided for rotating the loop and is operable when the clutch lever is engaged. This vernier adjustment has a gear ratio of approximately 120 to 1 and may be fitted with Tuning Unit MC-127 for vernier operation. An adjustable click mechanism prevents drift of the vernier control under vibration (see Figures 18, 24, 32). The azimuth scale and clutch assembly are inclosed in a protective housing containing a glass window through which the index and scale are visible. A Lamp LM-32, under control of a toggle switch and connected by Plug PL-117 to a 14.25-volt power source provides illumination for the scale. The index and azimuth scale are adjustable to any one of four equally spaced angular positions with respect to the loop in order to allow for various types of installations. In addition to this quadrature adjustment, the scale is capable of fine adjustment with respect to the loop for ±15 degrees. When Loop LP-13-B or LP-15-B is in place the loop is secured by a lock which may be operated by a screwdriver. The lock



LOOP LP-13-B



LOOP LP-15-B

FIG. 16. LOOPS LP-13-B AND LP-15-B

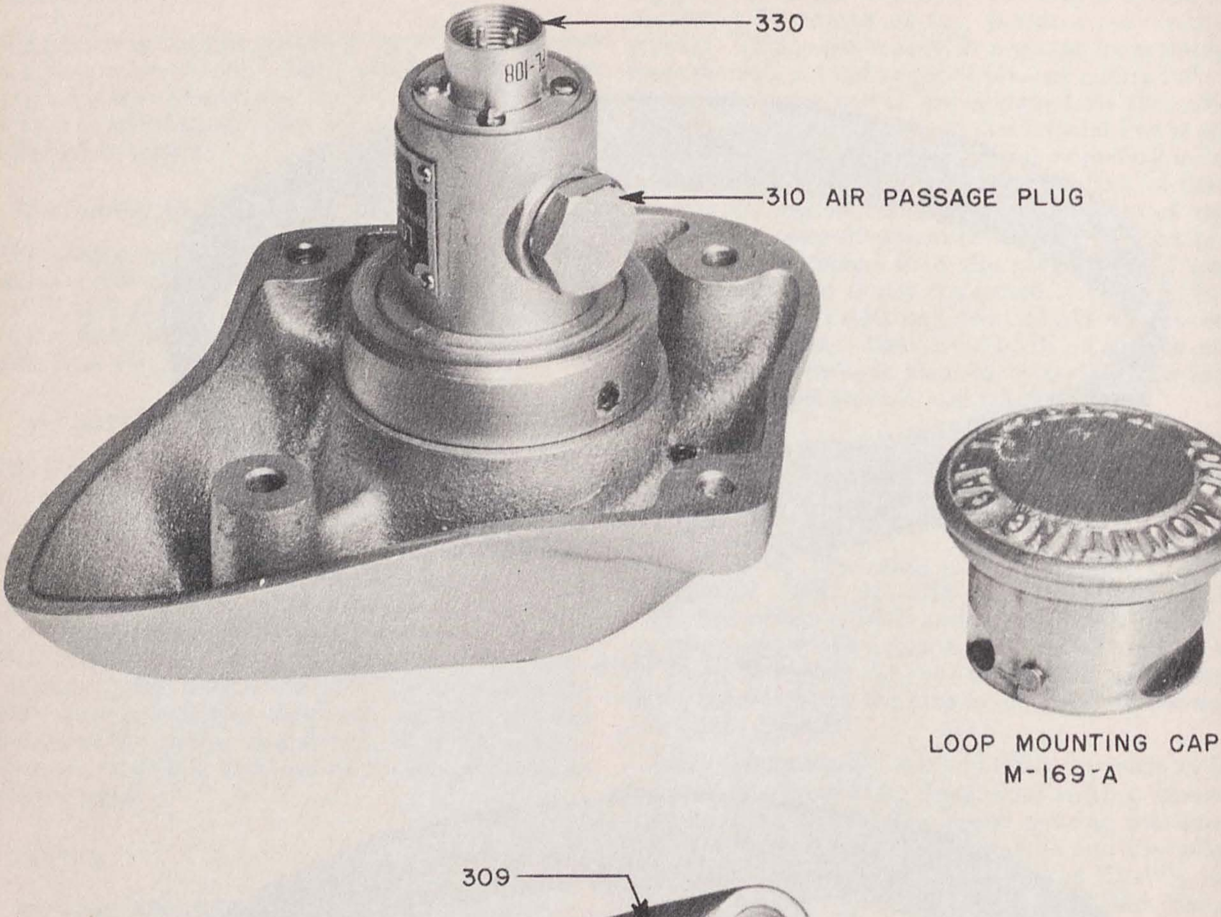


FIG. 17. LOOP MOUNTING GS-7-B AND LOOP MOUNTING CAP M-169-A

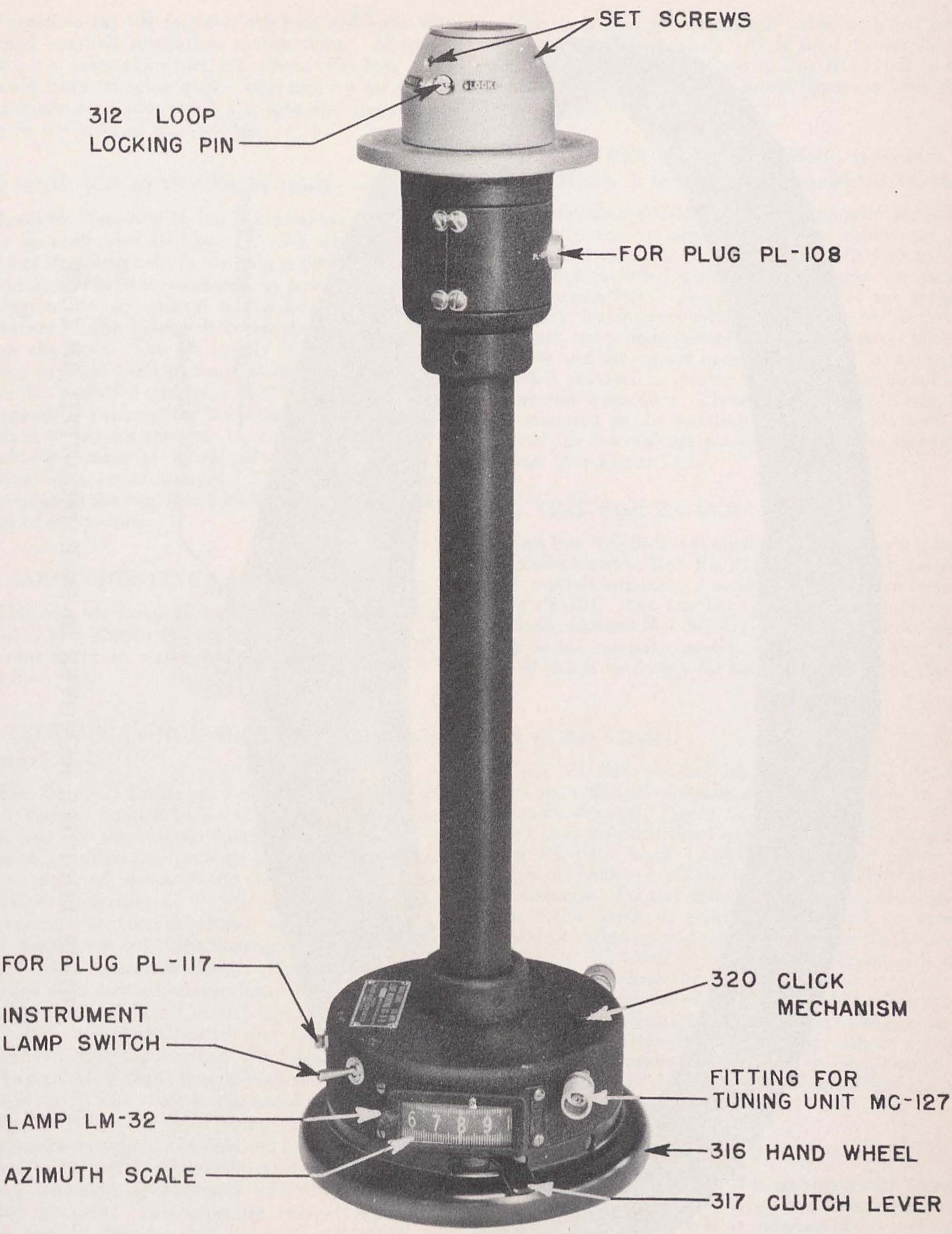


FIG. 18. LOOP MOUNTING GS-8-B

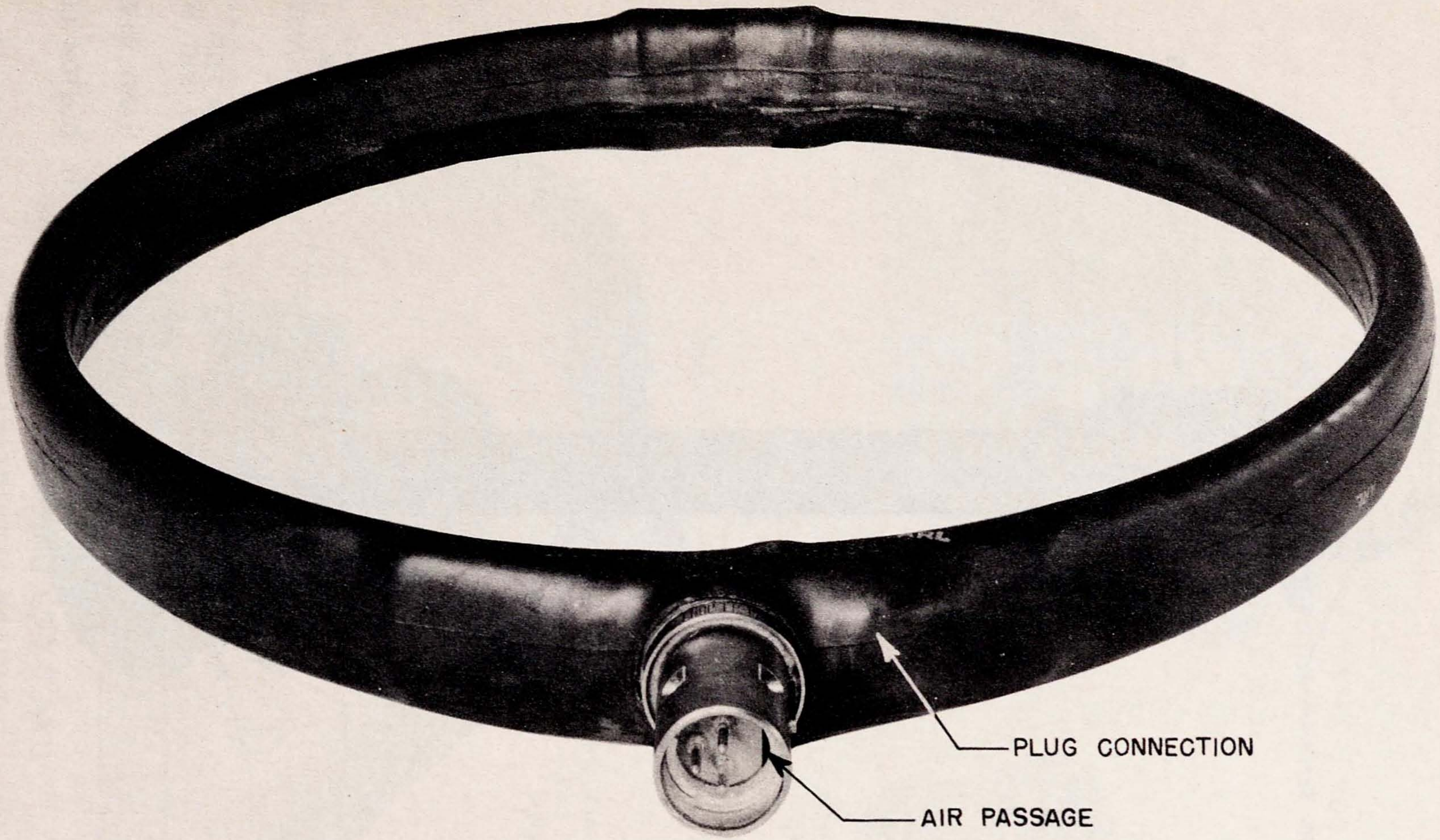


FIG. 19. LOOP ICE REMOVER M-186-B, MOUNTED ON LOOP

2.5 **b** (continued)

is turned to the left to insert the loop and locks when turned one-half revolution to the right. Additional locking is effected by two set screws. The lock is prevented from creeping under vibration by means of a spring-actuated pin which fits into the screw driver slot in the head of the lock pin.

2.6 LOOP ICE REMOVER M-186-B

Loop Ice Remover M-186-B is a rubber jacket which may be assembled on Loop LP-15-B when protection against ice formation on the loop is desired. The self-contained air tube is connected, by means of a threaded fitting, to the air passage in the loop. Inflation and deflation of this tube will break the accumulated ice from the loop. The air supply is the same as that which supplies the ice removers on other parts of the aircraft. Inflation will occur in 40 second cycles; about 8 seconds is required for inflation and deflation. The surface of the ice remover is coated with graphite, a conducting material which prevents puncture of the rubber from static charges. These charges are conducted off to the loop shield by four rivets in the trailing edge of the jacket.

2.7 LOOP MOUNTING CAP M-169-A

This cap fits Loop Mountings GS-7-B, GS-8-B and GS-8-C and should be inserted in the mountings to prevent entry of water and dirt when the loops are not installed.

2.8 COMPASS INDICATOR I-65-B (Includes one Lamp LM-32)

Two Compass Indicators I-65-B will usually be used with Radio Compass SCR-242-B, one for local operation and one for remote operation. No loss of performance will result, however, if one of the indicators is disconnected, and a 20,000 ohm resistance added as described in Section 3.3 f. The indicators are designed for instrument panel mounting, and must be individually shock mounted if the instrument panel is not provided with shock absorbers. The indicator dial is marked with a small conventionalized figure of an airplane to indicate "On Course" flight. The dial markings and pointer are coated with luminous paint for visibility during night flying. Rim lighting is provided by Lamp LM-32 through a lighting ring behind the rim of the case. The lamp is connected to the socket for Plug PL-117. The movement is of the iron-core dynamometer type. The field coil is center-tapped and serves as the plate inductance for the audio oscillator, being resonated by capacitor C11 which is mounted inside the case. This capacitor may be replaced by removing the dust cover of the indicator and the two mounting screws which hold it in place, and withdrawing it until the soldering lugs are accessible. Terminals 2 and 4 of the socket marked "PL-118" connect to the moving coil, and terminals 1, 3 and 5 to the field winding (See Figure 20).

2.9 TUNING SHAFT MC-124

This is a flexible mechanical cable with an inner flexible twisted-wire shaft. It is used to couple the tuning control of Radio Control Box BC-311-B to the tuning drive mechanism of Radio Compass Unit BC-310-B. (See Figure 22.)

2.10 JUNCTION BOX TM-180-B (Includes 3 Fuses FU-28, 1 in use and 2 mounted spares).

Junction Box TM-180-B is used primarily for interconnecting the various units of the equipment for testing, but may also be used for installations in airplanes not provided with a built-in connector panel. The junction box is provided with all of the sockets necessary for interconnecting the units of the radio compass, the primary power source, the marker beacon receiver and the marker beacon indicator. In addition, a jack is provided to receive Plug PL-55 for interphone connection when used. Three Fuses FU-28, 15 ampere, are mounted in the junction box, one in the positive side of the low voltage power lead and two mounted spares. (See Figure 21).

2.11 TEST BOX BX-18-B

Test Box BX-18-B is equivalent to the mounting base of Radio Control Box BC-311-B except that, instead of a conduit entrance, a socket is provided to receive Plug PL-121. The test box, plus the operating panel of Radio Control Box BC-311-B, functions in the same way as the normal complete Radio Control Box BC-311-B and is used only for test purposes. (See Figure 59.)

2.12 CORD CD-311

Cord CD-311 consists of three insulated flexible leads in a flexible metallic conduit as shown in the assembly drawing, Figure 57 and in Figure 22. It is fitted at each end with a Conduit Elbow FT-184 and a Plug PL-108. Cord CD-311 is furnished either 72 inches, 84 inches or 110 inches long for various aircraft installations. **Do not alter the length of this cord.** Where this length is greater than needed the excess should be coiled up and not cut off as the Radio Compass Unit BC-310-B is adjusted to operate with the capacitance of these three cord lengths as supplied. If longer cords are required, a report should be forwarded through proper channels. Fabrication of longer cords should not be attempted in the field without specific approval and engineering direction as any change in the capacitance of this cord will seriously affect the operation of the radio compass.

2.13 PLUGS

Radio Compass SCR-242-B is equipped with 8 types of plugs. None of these plugs are interchangeable. Some of the plugs are used at different places and may be inadvertently inserted in the wrong socket, however this will not damage the equipment. These plugs are complete except for conduit ferrule and ferrule coupling nut. The number of connectors, sizes of ferrule, ferrule coupling nut, and conduit are listed in the following table.

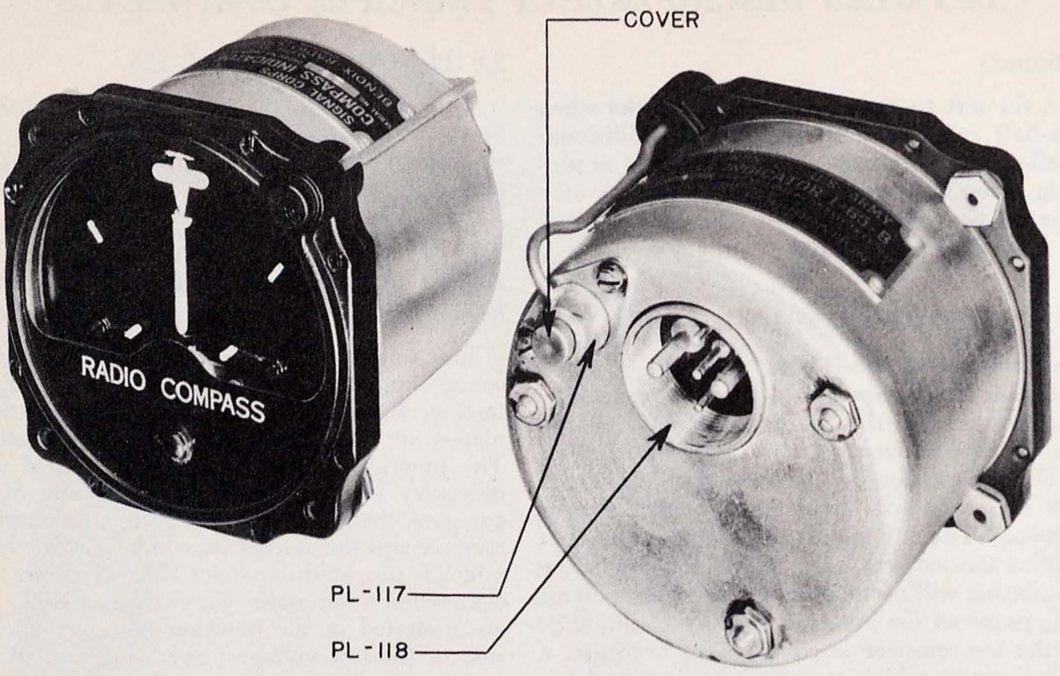


FIG. 20. COMPASS INDICATOR I-65-B

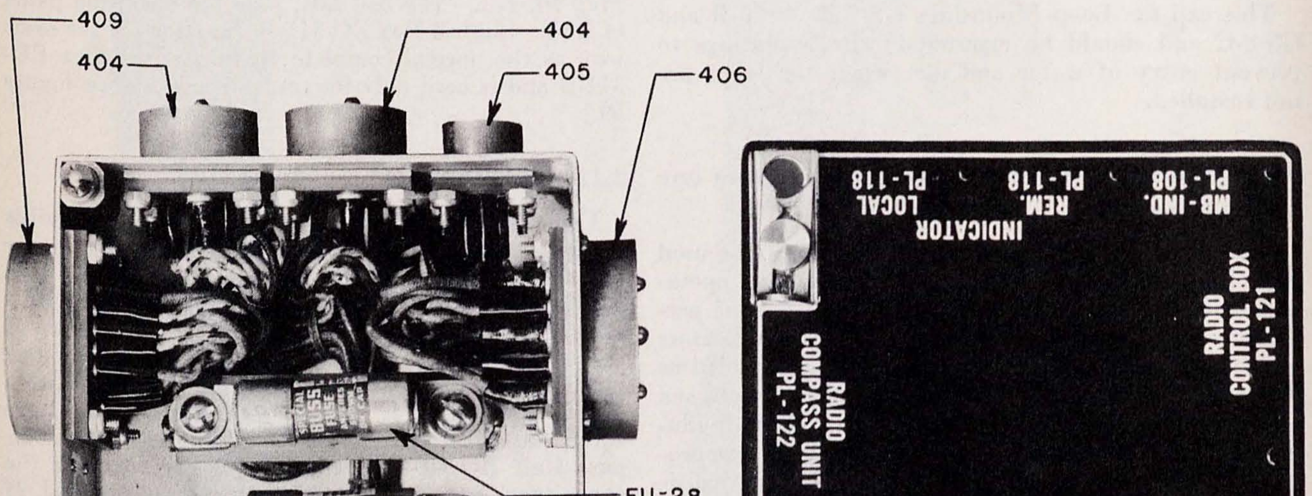


FIG. 21. JUNCTION BOX TM-180-B

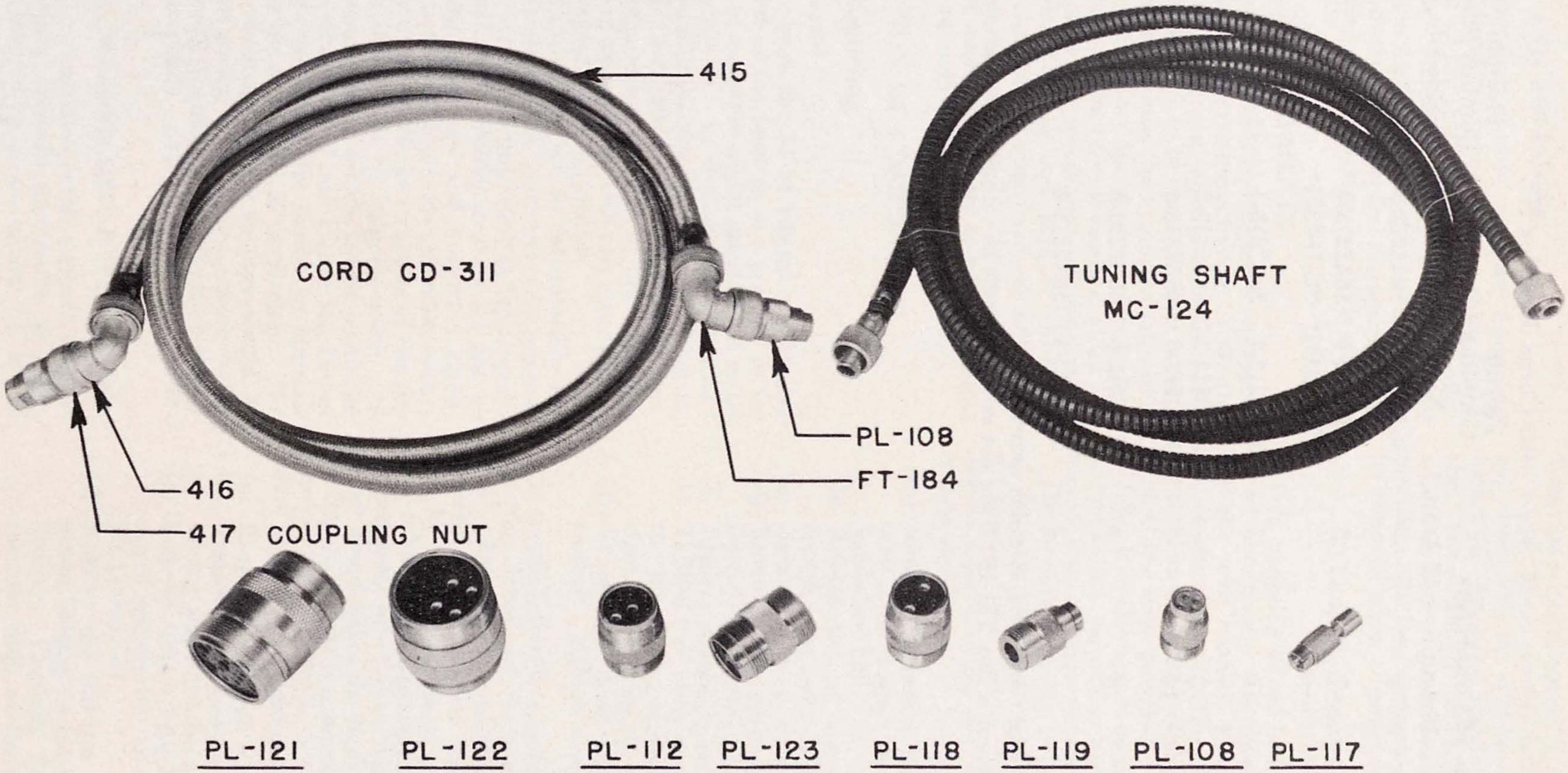


FIG. 22. CORD CD-311, TUNING SHAFT MC-124, AND PLUGS

2.13 (continued)

				Air Corps. Drawing No.			
	No. of Connectors			Ferrule Coupling		Flexible Conduit Size	Location
Plug No.	2 Amp.	10 Amp.	25 Amp.	Nut	Ferrule	(Inside Dia.)	of Plugs**
PL-108	—	4	—	36A2212-2	36A2213-2	3/8	2 at CD-311 1 at TM-180-B
PL-112	—	7	2	36A2212-4	36A2213-4	5/8	1 at TM-180-B
PL-117	1	—	—	SC-D-2331*	SC-D-2331*	1/8	1 at ea. I-65-B 1 at GS-8-B
PL-118	—	3	2	36A2212-4	36A2213-4	5/8	1 at ea. I-65-B 2 at TM-180-B
PL-119	—	2	—	36A2212-2	36A2213-2	3/8	1 at BC-310-B
PL-121	—	14	4	36A2212-6	36A2213-6	1	1 at BC-311-B 1 at TM-180-B
PL-122	—	18	4	36A2212-6	36A2213-6	1	1 at BC-310-B 1 at TM-180-B
PL-123	—	—	2	36A2212-4	36A2213-4	5/8	1 at TM-180-B

*Refers to Signal Corps plug assembly drawing.

**Plugs for Junction Box TM-180-B are not used if aircraft has a built-in connector panel.

3.0 INSTALLATION

3.1 BONDING AND SHIELDING

Satisfactory operation of radio receiving equipment in aircraft will depend upon the efficiency of the shielding and bonding of the ignition, generator and other electrical systems. The requirements for shielding and bonding set forth in Air Corps Technical Orders and the Handbook of Instructions for Airplane Designers should be exactly complied with in making any radio compass installation.

3.2 ANTENNA REQUIREMENTS

Radio Compass SCR-242-B is designed to operate in conjunction with a vertical antenna having an effective height of .03 to 0.6 meters, a capacitance of 50 to 200 mmf. and a resistance of 1 to 10 ohms. While it is desirable to use an antenna whose characteristics fall within the above limits, satisfactory operation may be obtained with other antennas. The type of antenna which will be used in any particular installation will be dictated by considerations of space and support structures available on the aircraft. In some instances a standard vertical mast (Air Corps Dwg. 31-189) may be used, while in others it may be necessary to use stub masts and a "T" type antenna.

3.3 INSTALLATION OF COMPONENTS

a—Loop Mountings

(1) General

The loop mountings should be located on the fore and aft center line of the fuselage in a position as far as practicable from sources of engine interference, metal masses and conductors. In determining the actual location of the mountings, consideration must be given the space available for both the loop and loop mountings, structural requirements, length of the Cord CD-311, the location of the compass unit and other factors incident to the normal use of the aircraft.

The type of mounting used will be determined by the requirements of the aircraft in which the radio compass is to be installed. Areas affecting safety in flight, operation of the aircraft and maintenance should not be obstructed by the mountings and associated equipment. It will be necessary to provide a suitable mounting plate securely attached to the structure of the aircraft to support either type of loop mounting. In locating the mounting holes, which are the same for both mountings (see Figure 53 and Figure 54), two of the diametrically opposite holes should be approximately parallel to the center line of the fuselage. The assembly of the mounting to the support should be such as to prevent water, oil, dirt, etc., from entering the fuselage. Loop Mountings GS-7-B, GS-8-B and GS-8-C are electrically and mechanically interchangeable.

(2) Loop Mounting GS-7-B (Fixed Loop)

This mounting, having no operable controls, may be installed in a position normally inaccessible in flight. The mounting is secured by means of four 1/4″ round head through bolts. The bolt heads may be covered with a plastic material to offer less air resistance. The broad nose of the mounting faces the front of the aircraft. Plug PL-108 on the Cord CD-311 is screwed into the socket provided on the bottom of the mounting. When ice removal operation of the loop is desired, the air supply line is screwed into the threaded hole normally closed with the plug provided. The hole is tapped with a 3/8″ American Standard Taper tap for 3/8″ pipe size. The air supply line should be no smaller than 3/8″ I.D. The air line connection may interfere with the 90° rotation of the loop during installation, and if so should be removed when aligning the loop.

(3) Loop Mounting GS-8-B or GS-8-C (Rotatable Loop)

This mounting should be installed so that the handwheel and vernier adjustment are readily accessible and the scale readable from the operator's position. For installations requiring the rotatable loop to be mounted on the bottom of the fuselage, Loop Mounting GS-8-C has been provided. This mounting is similar to GS-8-B in all respects except that it has an inverted azimuth scale, permitting the direct reading of bearing degrees from the inverted position.

The mounting may be installed on its support in any of the four quadrantal positions, as it is possible to rotate the lower housing assembly 90, 180, or 270 degrees relative to the loop and upper housing. This is done as follows:

(a) Remove handwheel, being careful not to damage scale, after unscrewing the two set screws in the handwheel hub.
(b) Release the set screw and unscrew the nut securing the outer tubing to the lower housing.
(c) Back out the positioning screw below the nut.
(d) Rotate the lower housing to the desired positioning hole (90-180-270 degrees).
(e) Replace positioning screw.
(f) Tighten nut using a spanner wrench. It is of the utmost importance that this nut be very tight. Lock with set screw.
(g) Reassemble handwheel to give desired scale reading. Tighten two set screws in hub.

As supplied, the distance between the bottom of the mounting flange and the bottom of the handwheel is 20 1/2″. In certain installations it may be necessary to decrease or to increase this dimension. This may be done by changing the length of the drive tube and the outer tubing. This alteration however is not authorized by personnel other than those of the Signal Corps Repair Shops and of the Signal Corps Radio Sections at Air Depots. A lathe is required to insure that the cut off is perpendicular with the axis of the tubing. The procedure for this modification follows: (See Figure 23.)

(a) Remove handwheel (see **3** (a) above).
(b) Remove lower housing after lower nut and positioning screw has been removed.
(c) Remove outer tubing from upper housing after upper squeeze nut and positioning screw have been removed.
(d) Remove the collector ring covers and the six screws holding the bearing retainer to the upper housing. Carefully lift the brushes over the collector rings as the entire rotating assembly and ball bearing are withdrawn from the upper housing.
(e) Remove the drive tube from the collector ring assembly and from the handwheel arbor after

3.3 a (3) (continued)

removing two screws, one bolt, and two taper pins.

(f) The disassembly is now complete. Refer next to Figure 23 which gives the detail dimensions of the drive tube and the outer tube which will be either shortened or, if the assembly is to be lengthened, replaced. The dimension "D" referred to is the desired distance between the lower side of the mounting flange and the bottom of the handwheel. "D" as the mounting is supplied is 20½". "D" cannot be less than 8$^{15}/_{16}$", nor should it exceed 36". The dimensions, tolerances, and materials specified must be closely adhered to.

(g) Assemble drive tube to collector ring spindle and handwheel arbor using glyptal cement. Assemble bolt and two screws and drill and ream new holes for taper pins. Carefully seal around bolt, screws, and taper pins with glyptal. The passage through the arbor, drive tube, and collector ring spindle should be practically air-tight (the air for the ice remover passes through this passage) hence the use of the cement.

(h) Slide rotating assembly into upper housing, being careful not to damage the brushes. Be sure the rubber gasket, which makes the water-tight seal under the bearing retainer, is in place. Assemble and stake the six screws in the top of the housing. Replace the collector ring covers.

(i) Replace the lower nut and the upper squeeze nut of the outer tubing. Assemble with upper housing and tighten positioning screw. The upper squeeze nut must be turned up very tight before locking with its set screw. Use a spanner wrench for this operation.

(j) Assemble lower housing in its desired position and tighten positioning screw. This screw must be tightened up hard. Lock with set screw.

(k) Reassemble handwheel.

When rotated in the slip stream the loop is subjected to severe stresses and vibrations. If the mounting is not securely fastened, these stresses become dangerous. In addition to the four bolts on the mounting flange the mounting must be further secured by a support clamped to the lower end of the outer tube. The support must be rigidly attached to the aircraft structure.

Plug PL-108 on the Cord CD-311 is assembled into the socket provided on the upper housing.

Plug PL-117, connected to the 14 volt instrument lighting line, is plugged into the socket so marked on the lower housing.

The vernier worm shaft is rotated by means of Tuning Unit MC-127 which is installed on the fitting provided. An additional fitting is provided for attaching a flexible shaft for remote control or azimuth indication.

If ice remover loop operation is required, the air line is connected to Swivel Joint MC-182 in the handwheel arbor. The swivel joint is threaded with an American Standard Taper die for ⅜-inch pipe size. The inside diameter of the air hose or tube should not be less than ⅜-inch.

Accurate setting of the loop with the azimuth scale reading can be made by loosening the four screws under the handwheel, adjusting the scale (it can be shifted plus or minus 15 degrees), and tightening up the screws.

Drift of the vernier shaft by vibration is prevented by the click mechanism provided. The compression of the spring regulating this action can be varied by adjusting the screw on the top of the lower housing.

b—Loops

In assembling Loop LP-13-B or Loop LP-15-B in the loop mountings the procedure below should be followed:

(1) Assembly in Loop Mounting GS-7-B

(a) Back out the two adjusting screws on the mounting all the way.

(b) Plug the loop in the mounting and rotate through 90° so that engraved figures line up with fiducial line on the side of the outer mounting. The air line connection, if attached, may interfere with this rotation.

(c) Carefully adjust the loop, by sighting, so that it is parallel to the fore and aft axis of the fuselage.

(d) Note the angular reading and rotate the loop back 90° to its normal position (leading edge in front).

(e) Press the loop all the way down in mounting and screw in the adjusting screws. Considerable pressure will be required to seat the loop as the air and weather seal of the loop in the mounting is made by compression of the rubber gasket in the mounting.

(f) Before the final adjustment is made, the adjusting screws should be backed all the way out and the exposed threads coated with glyptal cement. Then turn the adjusting screws until the angular reading noted above is obtained and tighten them firmly. The adjustments must be made and the screws tightened before the glyptal cement hardens.

(g) To remove the loop from the mounting, back out the adjusting screws. If the loop is removed, Loop Mounting Cap M-169-A should always be installed to prevent dirt and water from entering the mounting. The cap is locked in place by means of the two adjusting screws.

(2) Assembly in Loop Mountings GS-8-B and GS-8-C

(a) Push in the detent pin with a screw driver blade and rotate the locking pin in the mounting to the "Unlock" position. Back out the two set screws.

(b) Plug the loop in the mounting and push down all the way. While pushing down turn the locking pin with a wide thick-bladed screw driver 180° to the "Lock" position. The pin must be turned in a clockwise direction. Be sure the detent engages in the slot in the locking pin. Considerable pressure will be required to seat the loop as the air and weather seal of the loop in the mounting is made by compression of the rubber gasket in the mounting. Tighten the two set screws.

(c) To remove the loop, back out the set screws and rotate the locking pin 180° counter clockwise. If the loop is removed, Loop Mounting Cap M-169-A should always be assembled to prevent dirt and water from entering the mounting.

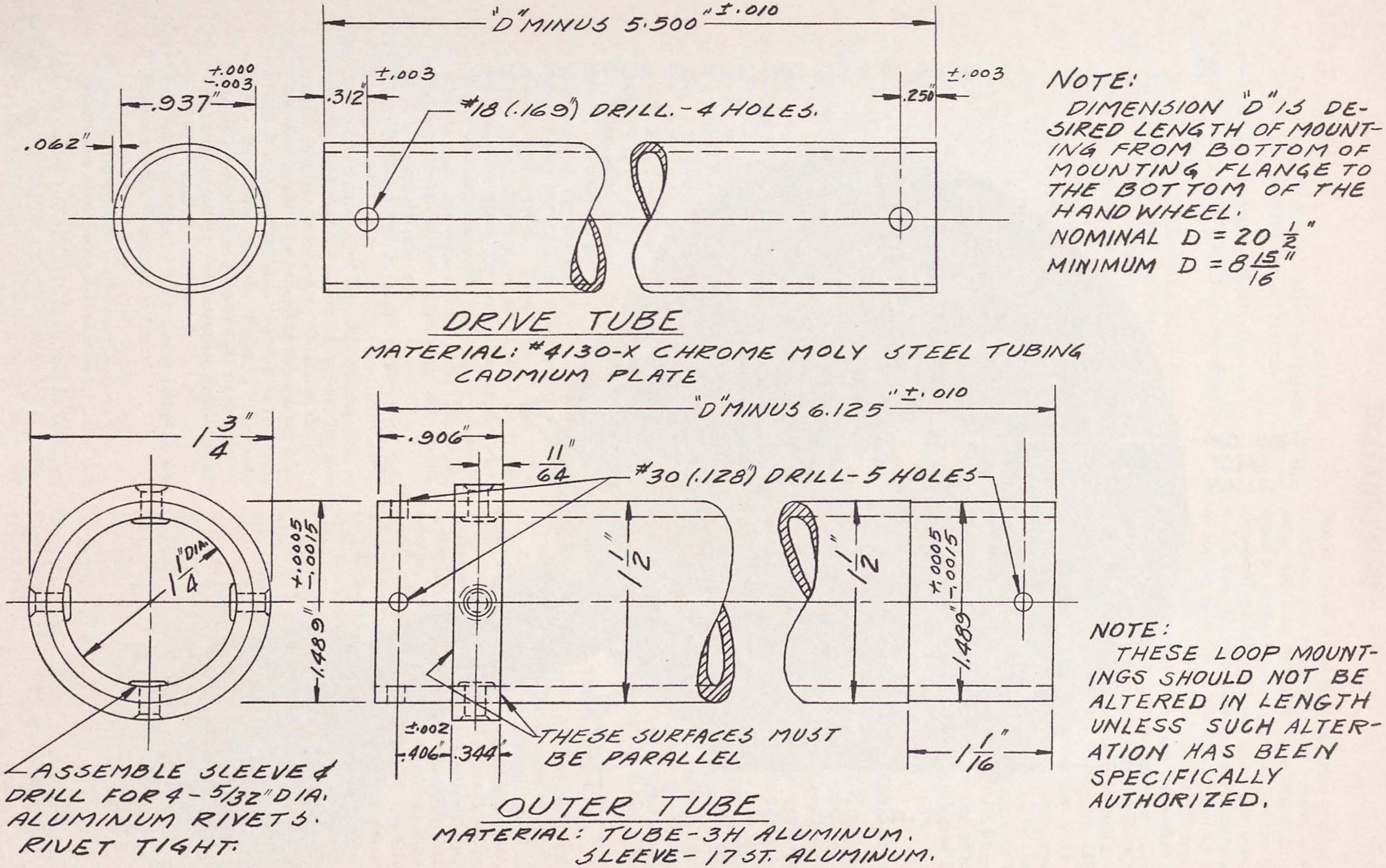


FIG. 23. DIMENSIONAL DRAWING FOR ALTERING LENGTH OF LOOP MOUNTINGS GS-8-B AND GS-8-C

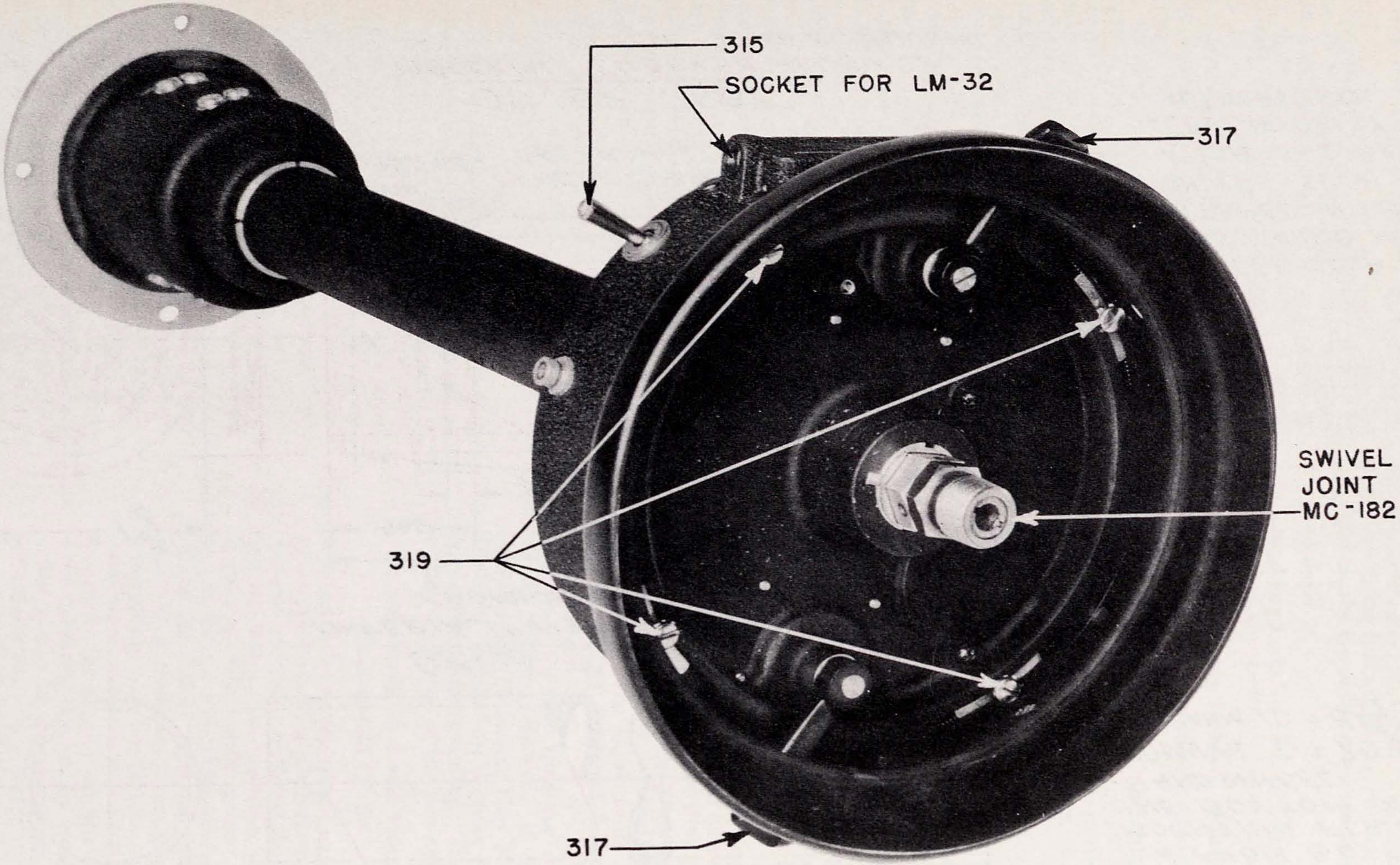


FIG. 24. LOOP MOUNTING GS-8-B, BASE

3.3 **b** (2) (continued)

The cap is locked in place by means of the locking pin and the two set screws.

c—Loop Ice Remover M-186-B

Loop Ice Remover M-186-B is assembled on Loop LP-15-B as follows:

(1) Remove the air connection cover from the loop. This cover is locked by means of a set screw.
(2) With "Talon" fasteners completely opened, screw the ice remover plug connection into the tapped hole in the loop until tight. Make this connection tight so that a bulge does not occur in the ice remover thereby preventing the zipper from closing. If the connection tightens beyond its normal operating position, remove the thin rubber gasket from the connection and tighten until normal position is reached. Moistening the washer with water or saliva will prevent its curling up or tearing when the connection is tightened.
(3) Stretch the ice remover over the base of the loop, adjusting the connection to suit.
(4) Stretch the jacket over the rest of the loop preparatory to closing.
(5) Using tire talc, dust the inside of the jacket between the loop and the rubber before closing.
(6) Engage the "Talon" slides. Make certain that the tongues at the end of the zipper are pushed as far as they will go into the end block before the sliders are started. Place safety wire through the forward hole in the slider. Then bear down on slider while pulling it forward. DO NOT FORCE. Form the rubber jacket around the loop by hand until the zipper chains are close together. The sliders must slide easily and freely. If they do not slide freely, inspect the edge of the zippers and inside of scoops and remove any particles of rubber over which the sliders must pass. When the sliders move freely bring sliders together at the base of the loop and tie them together with safety wire. When opening the slider put a piece of safety wire in the rear hole of the slider and while pushing down on the slider with the thumb exert a backward pressure.
(7) Clean fasteners and underside of flap with high test gasoline.
(8) Apply one coat of Air Corps #20-37-B cement to both the jacket and the flap. Avoid getting any surplus cement on fasteners. Allow to dry.
(9) Press flap in place by crowding the trailing edge of the jacket and the flap together at the same time. Roll down smooth. Figure 19 shows the completely assembled loop and ice remover.
(10) The air pressure at the mounting should be six to eight pounds.
(11) Test for punctures or air leaks in jacket in accordance with Paragraph 6.2 e.

d—Radio Compass Unit BC-310-B (Includes Mounting FT-145-B)

Radio Compass Unit BC-310-B should be installed so that the panel controls are accessible to the operator. Sufficient clearance must be allowed on all sides for free action of the shock absorbers, and for removing the unit from the mounting. Additional clearance should be provided on the right side of the cabinet toward the front to permit easy adjustment of the loop gain and threshold sensitivity controls. Provision is incorporated in the radio compass unit for changing the location of socket (150) from the front panel to the right side of the chassis. This operation is effected by removing the four screws which secure the socket and the four holding the socket hole cover plate (158) and interchanging the positions of these items. Care should be taken not to break the wires connected to the socket or damage the terminals. Mounting FT-145-B should be secured to the principal structure of the aircraft by eight No. 10 screws. Mounting dimensions are shown on Figure 50 and Figure 51. The mounting and chassis should be bonded to the metallic framework of the aircraft by lengths of copper braid long enough not to interfere with the action of the shock absorbers. The braid to the chassis may be soldered to a lug under a panel screw.

e—Radio Control Box BC-311-B

Radio Control Box BC-311-B should be located where the panel will be easily visible and the controls accessible to the operator. Consideration must be given to providing clearance for connection of Tuning Shaft MC-124 and the conduit in which the cable to the connector panel or junction box is carried.

No mounting holes are provided in the base of the control box since the requirements will vary with individual installations. In drilling such holes, care must be taken not to damage the wiring in the base, and to clean out carefully all metal chips to avoid the possibility of short circuits or fouled gears.

f—Compass Indicator I-65-B

Compass Indicator I-65-B is designed for standard 3¼-inch instrument panel mounting. Space is normally available on the instrument panel near the other flight instruments for the remote indicator. The local indicator should be located where it will be easily visible to the operator. If Loop Mounting GS-8-B or GS-8-C is used, the local indicator should be located near the rotator. Mounting dimensions for Compass Indicator I-65-B are shown in Figure 56. Clearance must be allowed for the installation of the connecting cables. It will not be necessary to shock-mount the compass indicators if the panel on which they are mounted is provided with shock absorbers. For other installations, shock-mounting must be provided. The lighting cable, which is terminated in Plug PL-117, should be connected to the 3-volt instrument lighting system. If such a system is not available, a 60-ohm 5-watt resistor must be connected in series with the 14 volt d.c. supply and the lighting cable to each indicator. When only one compass indicator is used, it will be necessary to connect a 20,000 ohm ½ watt resistor between terminals 3 and 5 of the unused plug socket in the junction box. If a junction box is not used the resistance is connected between terminals in the aircraft's junction box corresponding to terminals "W" and "V" of the schematic diagram. The addition of this resistance is necessary to maintain the audio oscillator output voltage at its proper value.

3.3 (continued)

g—Tuning Shaft MC-124

Sharp bends in this shaft should be avoided. Where bends are necessary, the radius of bend should be as large as practicable, and in no case should it be less than 6 inches. The shaft must be held firmly in place to prevent movement and must be well bonded. The right angle drive (133) in the radio compass unit, to which the tuning shaft is connected, may be rotated to any one of three positions by removing the two screws which hold it to the panel. Slotted screw holes permit a variation of ±20 degrees from any one of the three positions. Before connecting Tuning Shaft MC-124, the dials of the radio compass unit and radio control box must be set at the mark ALIGN which appears at the high frequency end of band.

h—Junction Box TM-180-B

Junction Box TM-180-B is primarily intended for use in connecting the units for testing. It may, however, be installed in aircraft not provided with a built-in junction box or connector panel. No mounting holes have been provided; these should be drilled at the time of installation. Three Fuses FU-28, 15 amp. rating, two of which are spares, should be mounted in the junction box.

i—Cord CD-311

This cord connects, by means of its terminal Plugs PL-108, the Radio Compass Unit BC-310-B and the loop mounting (GS-7-B, GS-8-B or GS-8-C). The sheath of the Cord CD-311 should be bonded to the metallic structure of the aircraft. **Do not alter the length of this cord.** If it is too long, the excess may be coiled wherever convenient. If it is too short a request for a longer cord should be forwarded through the proper channels.

j—Plugs and Wiring

Plugs and wiring (refer to Par. 2.13) should be in accordance with applicable installation drawings for the particular aircraft. The interconnecting cables should be run in rigid conduit if practicable. Where rigid conduit is not provided in the airplane, shielded flexible cables should be used. The conduit or shields must be bonded to the principal metallic structure of the aircraft. Refer to the Handbook of Instructions for Airplane Designers and to the applicable drawings.

The wires in the conduit should be bundled and taped or wrapped with cord for about 2 inches back from the plug. This prevents possible abrasion of the insulation by the conduit ferrule.

In soldering wires to the plug terminals the following method should be employed:

(1) Disassemble the plug by removing the spring retainer ring and withdrawing the plug body from the shell. Remove the slotted bakelite disc and withdraw the terminals from the plug body.

(2) Remove the insulation on the individual wires for a distance of 3/8-inch and tin the ends of the wires.

(3) Run all wires through the metal shell of the plug.

(4) Slip a 3/8-inch length of spaghetti tubing over each wire, leaving the tinned ends clear.

(5) Tin the cups of the terminals, being careful not to spill solder into the pin receptacle.

(6) Solder the terminals to the wire, using sufficient solder to fill the cups. Test each terminal to be sure that the joint is secure.

(7) Reassemble the plug body in the metal shell, making sure that each terminal is in its proper place in the plug body, and that the spaghetti tubing is pushed down over the soldered joint. The plug retaining ring should fit snugly around the groove in the plug shell. If the ring is bent away from the groove it may cause grounds on the socket pins.

k—Cooperation with Other Equipments

(1) Marker Beacon Receiving Equipment

Provision has been made to supply 14 and 220 volts direct current for operation of the above equipment. (See Figure 45). A push type toggle switch is provided at Radio Control Box BC-311-B so that a temporary ground may be applied to the screen of the marker beacon receiver tube. This causes the marker beacon indicator to flash, thus indicating the equipment is in operating condition.

(2) Interphone

The audio output of Radio Compass SCR-242-B may be connected to the input of the interphone at the junction box jack, or terminal. The output of Radio Compass SCR-242-B is satisfactory for a two-place interphone without amplification; if more than two headsets are used amplification will be required. Plugs must be removed from the jacks in the radio compass unit and radio control box in order to complete the connection from radio compass output to the interphone circuit.

4.0 PREPARATION FOR USE

4.1 TEST BEFORE INSTALLATION IN AIRCRAFT.

Considerable time and trouble will be saved if the components of Radio Compass SCR-242-B to be installed in aircraft are interconnected as shown in Figure 44 and tested before installation. If a standard transmission line test set-up, Fig. 25, is available, the performance of the equipment should be measured in accordance with paragraph 6.9. If the above test set-up is not available the components should be properly interconnected and tested as follows: Tune in several radio stations in each band. On each station operate the equipment on the COMP, REC.ANT., and REC. LOOP positions. When operating the equipment on COMP swing the loop right and left and note the degrees loop rotation required to produce full scale indicator deflection with the COMPASS control set on maximum. This should be less than 5 degrees. Note the "On Course" and "Reciprocal" bearings. The "On Course" bearings should check geographical bearings within 1 degree. From a knowledge of the distance, power, and direction of the station a rough check may be obtained of the performance of the equipment. These tests should be made in a frame test shack in an isolated spot free from electrical interference and at least 200 feet distant from large electrically conductive objects such as buildings, hills, power lines, railroads, etc. **Sensing or bearing accuracy checks can not be relied upon if made inside or close to buildings with metal structures or large electrically conductive objects** unless radio compass bearings check actual geographical bearings. The sensing of the radio compass should be such that the indicator pointer points to the station; that is, if the station is to the left of the axis of the loop (see Figure 25) the indicator should point left, if station is on the right the indicator should point right. The following inspection should be made prior to installation:

(1) Check list of parts and see that all parts are in good condition.
(2) Test all tubes in a tube tester and insert them in the radio compass unit, making sure that they are firmly seated in their respective sockets and that all grid clips and grid cap shields are pushed down tightly.
(3) Check safety wiring of dynamotor.
(4) Check all lamps and fuses, both operating and spares.
(5) Check operation of tuning drives and all controls for freedom of operation.
(6) Check operation of LOCAL-REMOTE switch and ascertain that the band switching mechanism is operating properly on local and remote positions.
(7) Allow the equipment to operate for at least one-half hour. Check operation of headset in local and remote TEL jacks. Vibrate or jar the equipment. Any clicks or increase in noise will require a thorough investigation and removal of the cause. Improper soldering of wires to the plugs and noisy vacuum tubes are the usual sources of trouble.
(8) If the equipment does not seem to be operating satisfactorily, the interconnecting leads and vacuum tubes should be rechecked and equipment known to be operating substituted for the faulty component. If the faulty component is a Signal Corps item it should be returned to the Signal Corps Repair Section at the appropriate Air Depot for repair or replacement.

4.2 ADJUSTMENTS AFTER INSTALLATION

After the radio compass has been installed in the aircraft, the following tests and adjustments should be made before placing the equipment in service.

a—Initial Checks

(1) Before turning on the radio compass, check the battery voltage and polarity at the fuse in the junction box. The fuse terminals should be +11 to +15 volts with respect to ground, regardless of engine speed.
(2) Check the vacuum tubes to ascertain that they are securely seated in their sockets, and that the grid clips and grid shield caps are making positive contact and are not shorting.
(3) Inspect the loop to see that it is firmly seated and that the locking screw in the loop mounting is turned with the arrows pointing toward "LOCK" and that the additional locking set screws are secure. The loop mounting and mounting screws should be water-proofed with Permatex No. 1 sealing compound, or equal. The screw holes of the loop mounting must be properly filled to provide optimum streamlining. Check the Loop LP-13-B or LP-15-B for cracks or damage which may admit moisture and thus impair the compass operation.
(4) If a Loop Mounting GS-8-B or GS-8-C (rotatable loop) is used, check for rotation both with the handwheel and with the azimuth vernier control.
(5) Test the operation of Tuning Shaft MC-124 and the connections at both local and remote positions. When properly connected, the align marks on both local and remote dials are in the same relative positions and the frequency calibrations coincide.
(6) Check the Mounting FT-145-B base screws. Safety wire the ganged snapslides of Radio Compass Unit BC-310-B through hole in slide and back of slide retaining block.
(7) Check Radio Control Box BC-311-B for tightness of mounting to aircraft structure, and check mounting screws on panel for tightness.
(8) Check the vertical antenna and see that the connections are properly and securely made.
(9) Be sure that Cord CD-311 is supported, taped, and bonded. Check tightness of ferrule couplings on the plugs.
(10) Check for presence and operation of instrument lights. Also check lamp controls.
(11) Using a Headset HS-18, check receiver operation on all three bands, then check compass operation and indicator response. Jar the compass unit to check for possible sources of noise.
(12) Switch the compass on and off and note whether or not the magnetic compass is affected.
(13) Check for effects of other radio equipment in the aircraft upon the communicational and navigational performance of the radio compass.

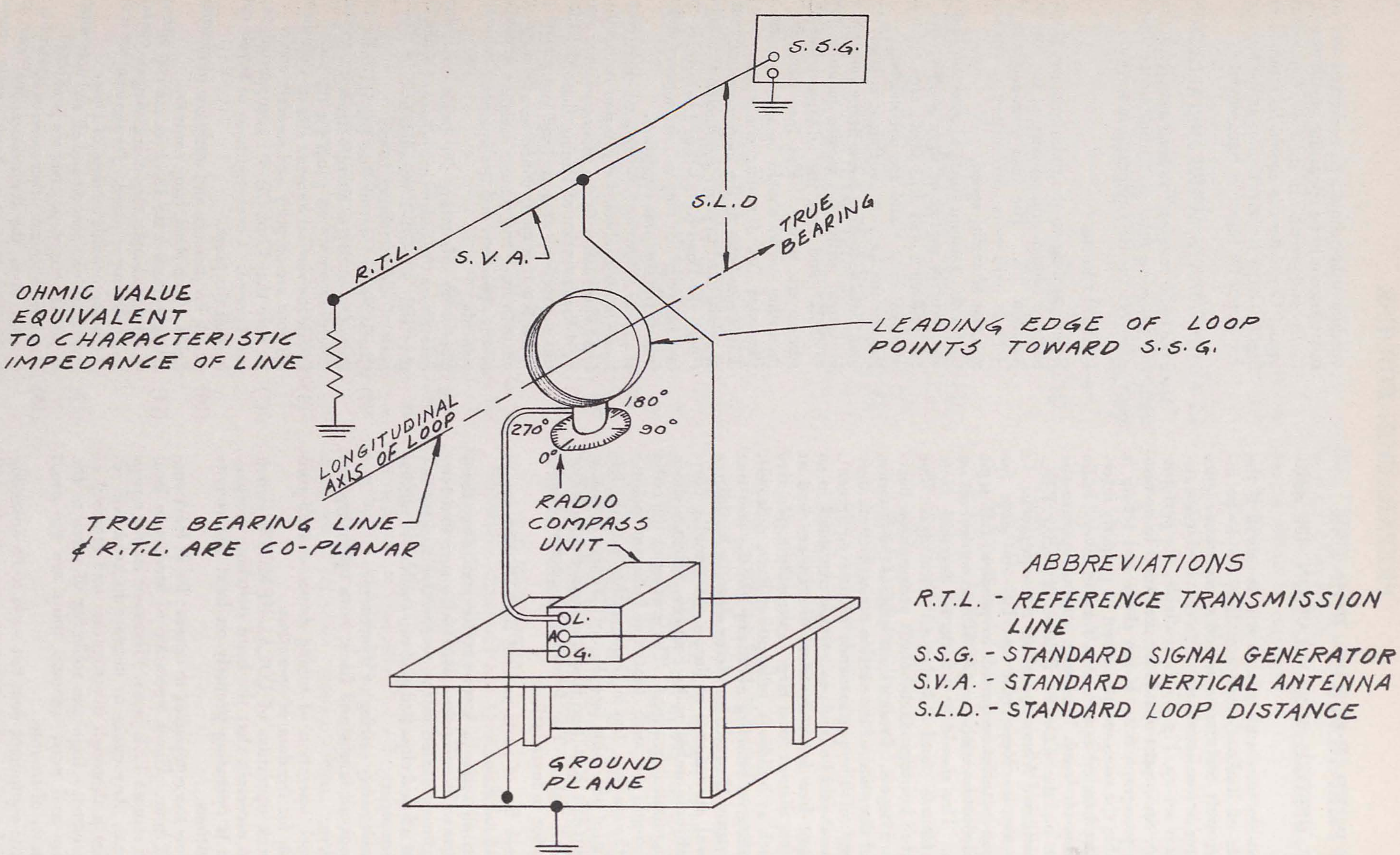


FIG. 25. COMPASS TEST SETUP

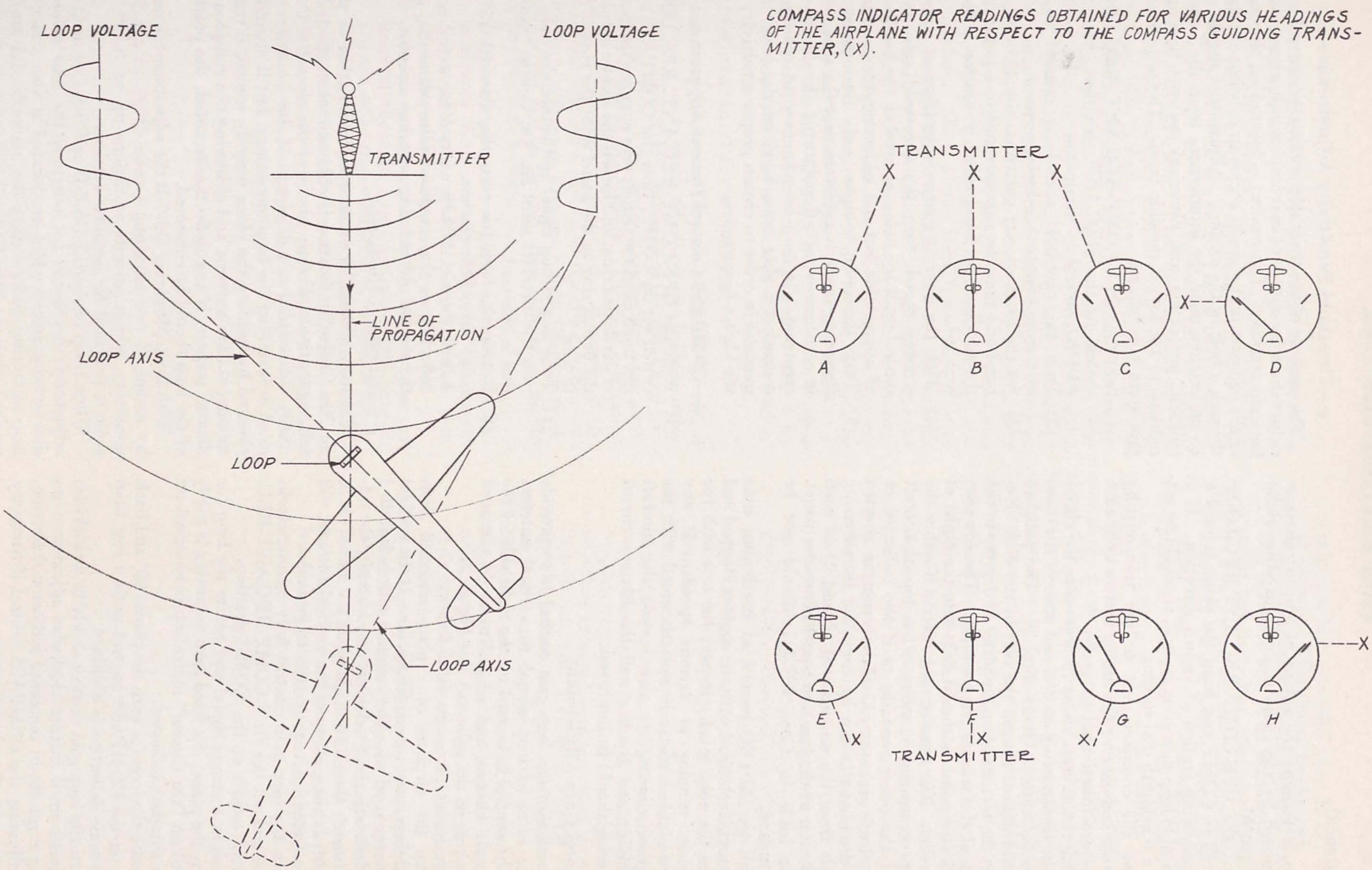


FIG. 26. FUNCTIONAL DIAGRAM—LOOP PICK-UP & INDICATOR DEFLECTION

4.2 a (continued)

Also, determine the extent of any interference produced by the radio compass in other radio equipment.

(14) Turn the OFF-COMP-REC.ANT-REC.LOOP switch to COMP and head the plane toward a transmitting station of known direction. If a rotatable loop mounting is used, it should be set for a 0 azimuth dial reading.

(15) Tune the compass unit to the transmitting station and observe the tuning meters to be sure they are functioning properly.

(16) Swing the aircraft about 15 degrees to the **right** of the transmitting station and observe the compass indicators. Refer Fig. 26. The pointers should deflect toward the **left** of the dial. Repeat the test, heading the plane 15 degrees to the **left** of the transmitting station. The compass indicator pointers should deflect to the **right** of the dial. The sensing may reverse if either the loop or antenna is mounted on top of aircraft and the other beneath, or if the indicator or loop leads are reversed. If the sensing is reversed to the above it can be corrected by reversing leads from the moving coil (2 and 4) of each indicator at the junction box or connector panel. The leads in Cord CD-311 should not be disturbed.

(17) With the AUDIO control at maximum, tune through each band with the engines stopped and note the noise level. Repeat the test with the engines running at various speeds. If any appreciable increase in noise is noted with the engines running at any speed, the aircraft shielding and bonding and the battery circuit filtering should be improved.

b—Loop Gain Adjustment

The function of the loop gain control is to provide the proper ratio of loop signal to vertical antenna signal. The control is located on the right side of the compass unit chassis and access to it is obtained through a hole in the cabinet. See Figure 2.

The adjustment procedure is as follows:

(1) Take the airplane to a place removed from buildings, power lines, fences, etc. If the vertical antenna used with the compass unit is installed underneath the fuselage of the aircraft, the adjustments should be made while the aircraft is in flight, as the pick-up of the vertical antenna will be affected by its proximity to ground.

(2) Turn the loop gain control fully counter-clockwise and set the OFF-COMP-REC.ANT-REC. LOOP switch at the COMP position.

(3) Tune in a strong signal and rotate the loop (or turn the plane, if a fixed loop mounting is used) until an "On Course" indication is obtained on the compass indicator.

(4) Rotate the loop (or turn the plane) 90° and back off on the COMPASS control until a less than full-scale deflection is obtained.

(5) Turn the loop gain control slowly in a clockwise manner until further clockwise adjustment no longer results in increased indicator deflection, readjusting the COMPASS control if necessary to prevent off-scale deflection.

c—Threshold Sensitivity Adjustment

The purpose of the threshold sensitivity control is to reduce the noise output of the compass unit when tuning between stations. The control is located on the right of the compass unit chassis, access to it being obtained through a hole in the cabinet. Adjustment should not be undertaken until the interference from the aircraft ignition, generating and electrical systems has been reduced to the lowest possible level. The adjustment procedure is as follows:

(1) Set the OFF-COMP-REC.ANT.-REC.LOOP switch to the REC.ANT. position, and the AUDIO control to maximum.

(2) Turn the threshold sensitivity control to its maximum counter-clockwise position.

(3) Set the band selector switch on the 325-695 kc. band and tune the compass unit to a point near the middle of the band where no station is being received.

(4) With the aircraft motors operating at normal cruising speed, turn the threshold sensitivity control until the noise received in the headset is of appreciable but not objectionable loudness.

(5) Tune the radio compass unit throughout its frequency range to ascertain that the sensitivity is satisfactory at all points of the frequency spectrum. It may be necessary to tolerate a somewhat higher noise level on the lower frequencies in order to obtain proper sensitivity on the higher frequencies.

d—COMPASS Control Detent Adjustment

(1) With the OFF-COMP-REC.ANT.-REC.LOOP switch set on COMP, turn the COMPASS control knob until the detent arm engages the notch in the detent ring, and loosen the screws securing the detent ring to the panel until the ring is free to turn.

(2) Tune in a strong signal and rotate the loop (or turn the aircraft) until an "On Course" indication is obtained.

(3) Rotate the loop (or turn the aircraft) 15° to either side of the station.

(4) Adjust the COMPASS control for a full scale deflection of the compass indicator needle, and tighten the detent ring securing screws.

e—Azimuth Adjustment

The loops should be set in each installation so that an "On Course" indication is obtained when the transmitting station is directly ahead of the aircraft. Ordinarily this condition will obtain if due care is exercised in installing the loop mountings, but it should be checked by heading the plane directly toward a transmitting station antenna and observing the compass indicator pointer. If any deflection is noted, the position of the loop should be corrected.

With Loop Mounting GS-7-B the adjustment is made by means of two adjusting screws (309) on the loop mounting, which permits variations up to ±10°. A scale is provided for accurate setting.

When Loop Mounting GS-8-B or GS-8-C is used the adjustment is effected by loosening the four azimuth dial securing screws which are located in slots under the loop mounting and rotating the azimuth dial until it reads 0 when an "On Course" indication is obtained.

4.2 e (continued)

Final installation should be inspected in accordance with Paragraph 6.1.

NOTE:—The accuracy of this radio compass is based on the accuracy of alignment of the axis of the loop (Figure 26) with the center line of the fuselage of the aircraft. An accurate alignment can be accomplished as follows: Select a test spot at least 200 feet and preferably one-half mile distant from buildings, power lines, hills, and other large electrically conductive objects which may distort the radio field. Determine the exact geographical bearing of a high powered, clear channel radio station located approximately fifty miles distant. The accuracy of this bearing should be checked against magnetic bearings and radio compass bearings taken by making a bench set-up of Radio Compass SCR-242-B at this spot. Lay out a line on the apron or ramp which, if extended, would pass through the radio station. Drop plumb bobs from the center of the nose and tail of the aircraft and move the aircraft over the line (flying position with nose headed toward radio station) until the plumb bobs center on the line. Adjust the loops, as described above, until on-course indications are obtained. This setting should be checked by flight test. If loop or antenna is mounted beneath the aircraft the loop will have to be aligned visually and the accuracy of alignment checked by flying the aircraft directly towards the radio station.

f—Quadrantal Error Calibration

When Loop Mounting GS-8-B or GS-8-C is used, it will be necessary to check the direction of side bearings which may result from distortion of the radio field pattern due to the wings, engines, propellors, antennas, and other parts of the aircraft. The final calibration should be accomplished in the air. However, if the loop and antenna are mounted on top of the plane there will be little difference between the calibrations made on the ground and in the air. The calibration should be accomplished as follows:

(1) Select a high powered clear channel radio station from 25 to 100 miles distant. The station should normally provide good bearings with slight fluctuations of the indicator pointer.

(2) Select a day when wind is less than 8 miles per hour in order to avoid excessive drift angles. Do not make the calibration at sunrise or sunset or when wide fluctuations of bearings are noted.

(3) Select a series of land marks which will provide a direct line towards the radio station. A road, railroad tracks, power lines, etc., make good reference lines provided they do not distort the radio path. This should be checked.

(4) With the aircraft in level flight fly directly over this reference line at an altitude low enough to avoid parallax effect. Set the directional gyro to zero and rotate the loop to obtain on-course bearings. When passing over some predetermined point on the reference line record the time and readings of the magnetic compass, directional gyro, and loop azimuth.

NOTE:—The reading of the loop azimuth should be zero if the loops are properly adjusted. However, a slight shift due to frequency may be present (about 2 degrees). If the azimuth scale is not on zero it can easily and quickly be adjusted in flight by loosening the four screws beneath handwheel, shifting azimuth scale to zero and tightening screws.

(5) Turn the aircraft and fly back across the predetermined point on the reference line at an angle of 15 degrees with the reference line. Again record the above readings as the aircraft passes over the predetermined point.

(6) Continue the above procedure until every 15 degrees of the loop azimuth is calibrated. At the end of the run, recheck 0 and 180 degree bearing and note precession error of directional gyro. The precession error of the directional gyro should be checked every 15 minutes or at end of run and the total error apportioned to each 15 degree bearing. The calibration can be made every 10 degrees if greater accuracy is desired.

(7) The greatest errors will be experienced at the highest frequencies so calibration should be made on at least one station in each band and on frequencies generally used. Extreme care should be taken to avoid parallax effect in reading of instruments and accurately caging the directional gyro as this can quite easily cause an error of 1 or 2 degrees.

(8) From data secured above fill in a form similar to Figure 60. By plotting the above data on coordinate paper, a chart can be made up showing each degree of loop azimuth and corresponding true bearing.

(9) If the quadrantal error curve is made on the ground it can be made at the same time the magnetic compass is calibrated. The aircraft should be in flying position. A station in each band can be quickly calibrated by switching bands and returning for each position of the aircraft.

5.0 OPERATION

5.1—GENERAL THEORY OF RADIO COMPASS OPERATION

In addition to its use as a radio communication receiver, the Radio Compass SCR-242-B may be used to guide the aircraft to a transmitting station at its destination, or may be used to take bearings on transmitting stations as an aid to navigation. While the equipment is being used as a radio compass the pilot can also hear the station signals and thus obtain weather reports or other flight information.

When the pilot wishes to fly the aircraft toward a transmitting station, that is, to use the equipment as a homing radio compass, the receiver is switched to COMP operation and the station tuned in. A fixed loop, mounted with its plane perpendicular to the axis of the aircraft, or a rotatable loop set and locked with the azimuth scale in zero position, provides the directional characteristic. The headset volume and the indicator response are then adjusted and the aircraft turned until the compass indicator points to the center.

The compass indicator will remain at the center as long as the aircraft is headed directly toward or directly away from the transmitter, however, the behavior of the indicator will determine whether the transmitter is ahead of, or behind the aircraft.

If the transmitter is ahead and the aircraft is turned from the true course the compass indicator will deviate from center. That is, when there is any departure from the true course the pilot can visualize the transmitter as being located on the side indicated by the pointer, and turning the aircraft in that direction will bring it back on course and the indicator back to center.

If the transmitter is behind the aircraft the indication is opposite, that is, if the indicator deviates from center and the aircraft is turned in the same direction, the deviation will increase and the pointer will not return to center until the aircraft is turned through 180 degrees and is headed toward the transmitter.

The indicator does not measure the course deviation in degrees, however, the indication is proportional to the deviation and shows upon which side the transmitter is located and remains at the center only when the transmitter is in line with the axis of the aircraft. The sensitivity of the compass indication is adjustable.

If the operator wishes to take a bearing upon a transmitter the loop is rotated until the compass indicator points center, in which case the bearing of the transmitter with respect to the axis of the aircraft is shown on the loop azimuth dial. The bearing of several transmitting stations may be taken in this manner in order to definitely establish the position of the aircraft. When bearings are thus taken the equipment functions as a radio direction finder.

In order to determine a position when a fixed loop is employed a transmitting station is tuned in and the aircraft headed toward the station. When the radio compass indicator points center the bearing of the transmitter can be read on the magnetic compass or directional gyro. By taking bearings on several transmitters the position of the aircraft can be charted.

As shown in Figure 6, the radio compass equipment consists of a loop antenna, a loop input and amplifier, a 90 degree phase shifter, a balanced modulator, an audio oscillator, a non-directional antenna, a sensitive and selective receiver, a compass indicator, and a telephone output circuit. The vertical antenna is non-directional or is equally sensitive to radio signals from any direction. The voltage induced in a vertical antenna is in phase with the flux of the radio wave.

The loop antenna is directional in that the voltage induced in the loop is maximum when an edge of the loop is turned toward the transmitter and is zero when the plane of the loop is perpendicular to the direction of travel of the radio wave from the transmitter. The resultant of the voltage induced in the loop is 90 degrees out of phase with the voltage induced in the vertical antenna and changes abruptly 180 degrees as the loop is rotated through the position of zero pick-up.

The voltage from the loop is amplified and shifted through 90 degrees so that it is either in phase with, or in phase opposition to the voltage induced in the vertical antenna, depending upon which edge of the loop is turned toward the transmitter.

The voltage from the loop amplifier is then impressed upon the grids of the balanced modulator tube which is actually two triodes combined into a single unit. The grids of the modulator tube are driven in phase opposition by the audio oscillator so that only one of the triode sections pass the loop signal at a time. Since the plates of the modulator tube are push-pull connected to the receiver circuits, they alternately add to and subtract from the voltage contributed by the vertical antenna. The addition of the loop signal to the signal from the non-directional antenna reverses in phase as the loop is rotated through a null position. The audio oscillator also provides the alternating current for the field of dynamometer type compass indicator.

The receiver circuit amplifies the combined signal which is modulated at the audio oscillator frequency proportionally to the voltage contributed by the loop, moreover, the phase of the modulation reverses as the loop is rotated through a null. The modulated signal is then detected, amplified, and impressed upon the moving coil of the compass indicator.

The compass circuits are arranged so that if the radio signal is coming from the left the modulation is such that the indicator pointer turns to the left and if the radio signal is from the right the pointer of the indicator turns to the right. When the signal is on the axis of the loop, the loop voltage is zero, there is no modulation of the carrier at the frequency of the audio oscillator, and the indicator pointer remains at center.

The operation of the various compass elements can be most easily followed by referring to the Simplified Compass Circuits, Figure 7.

The voltage induced in the loop by a radio wave from the transmitter is coupled to the loop amplifier tube, VT-86, through transformer T1. The parallel combination of L1 and C22-3 in the plate circuit of VT-86 has a capacitative reactance at the signal frequency so that the phase of the signal voltage is shifted 90 degrees when impressed upon the grids of the modulator tube (VT-96), through capacitors C19-1 and C19-2. Figure 27 shows the phase of the voltage induced in the loop for reception from either side and also the result of shifting the phase of the voltage 90 degrees.

The fixed coils of the dynamometer type compass indicators are tuned to resonance at 48 cycles per second and serve as the tuned circuit of the audio oscillator

5.1 (continued)

tube (VT-96). Since the compass indicators have an alternating magnetic field of 48 cycles per second, current in the moving coils at the same frequency, and in phase, will produce a deflection of the pointers toward one side of center. If the phase of the current in the moving coils is reversed the deflection of the pointers will also reverse. Voltage from the audio oscillator is impressed upon the grids of the modulator tube sections in phase opposition through resistances R12-7 and R12-6 and capacitors C4-5 and C4-6. Due to its characteristics and because of the magnitude of the audio oscillator voltage impressed upon its grids, the modulator tube functions as an electronic switch, permitting the loop voltage to pass through first one section and then the other. Since the plates of the modulator tube are push-pull connected to transformer T4, the amplified loop voltage is added to the non-directional antenna voltage when one section of the modulator tube is functioning and subtracted when the other section is functioning. The received signal is thus locally modulated at the frequency of the audio oscillator proportionately to the voltage induced in the loop.

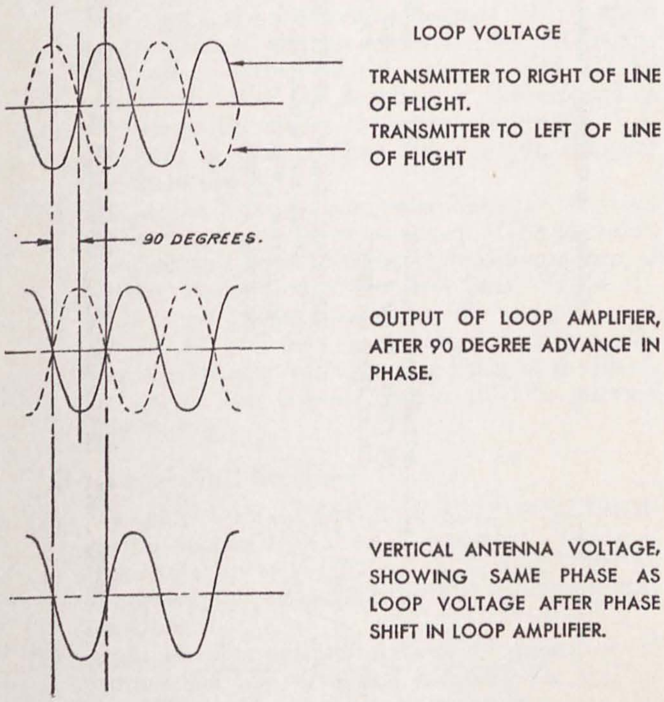


FIG. 27. PHASE RELATIONSHIP OF LOOP AND ANTENNA SIGNAL COMPONENTS

The signal is then amplified and the local modulation is detected and amplified to provide the 48 cycle per second energy for the moving coil of the compass indicators. The phase of the voltage induced in the loop and the phase of the local modulation reverse as the loop is rotated through a null. This, in turn, reverses the phase of the current in the moving coil of the compass indicator and changes the deflection of the pointer from one side of center to the other.

The phase of the voltages acting in the modulator circuit for reception from the right and left are shown in Figure 28. When the transmitter is located on the axis of the loop there is no voltage induced in the loop and consequently no local modulation of the received signal.

5.2—HOMING COMPASS OPERATION

The function of the Radio Compass SCR-242-B as a homing device is to indicate visually when the aircraft's heading should be altered to the left or to the right in order to approach or pass over a transmitting station located at the destination or along the line of flight. A small conventionalized figure of an airplane in the upper center of the compass indicator dial is used to indicate "On Course" flight. If this figure is thought of as representing the actual aircraft, then the needle of the indicator may be considered as pointing in the general direction of the transmitting station. Refer to Figure 26.

To use the radio compass for homing, proceed as follows:

(1) If a rotatable loop mounting is used, make sure that it is set and locked with the azimuth scale in the 0 position.

(2) Set the LOCAL-REMOTE switch to the position from which the compass is to be controlled.

(3) Turn the OFF-COMP-REC.ANT.-REC.LOOP switch to the COMP position.

(4) Set the band selector switch to the proper frequency band and tune in the desired station. Correct tuning is obtained at the point of greatest deflection of the tuning meter.

(5) Adjust the AUDIO control for a comfortable level. **Listen carefully for station identification to be sure that the correct station is being received.**

(6) Turn the COMPASS control until the detent finger on the control knob engages the notch in the detent ring. Observe the compass indicator. If the pointer deflects to the **right** side of the dial, the transmitting station is to the right of the aircraft's heading. If the pointer deflects to the **left**, the station is on the left.

(7) Turn the aircraft in the direction indicated by the pointer and continue the turn until the pointer shows "On Course" flight. The aircraft is now headed toward the transmitting station.

(8) In the event that the indicator pointer shows "On Course" flight when the station is first tuned in, turn the aircraft to either side until a marked deflection is obtained on the indicator. Observe the deflection and turn the aircraft to the side to which the pointer deflects, continuing the turn until an "On Course" indication is obtained. This precaution is necessary since "On Course" indication may be obtained both heading **toward** and **away** from a station. No errors will result, however, if the aircraft is always turned in the direction indicated by the pointer.

(9) Adjust the AUDIO control for the desired audio level. Operation of this control will not affect the deflection of the indicator needle.

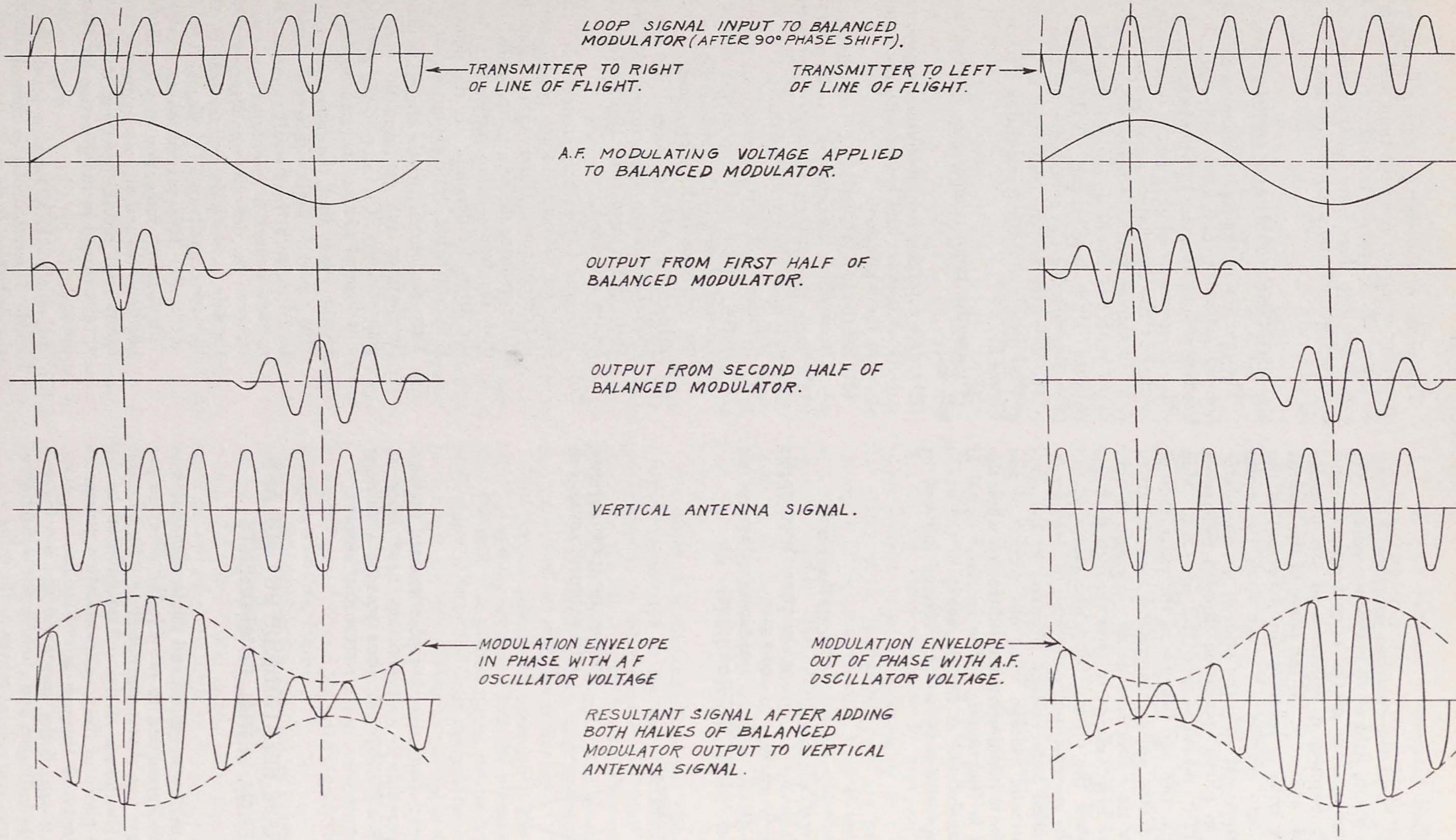


FIG. 28. BALANCED MODULATOR INPUT AND OUTPUT

5.3—DIRECTION FINDING COMPASS OPERATION

When a rotatable loop mounting is used, the radio compass may be employed to take bearings on a radio transmitter by either the visual, or the aural-null method.

a—Visual Method

(1) Set the OFF-COMP-REC.ANT.-REC.LOOP switch in the COMP position and tune in the desired station as described in paragraph 5.2 above.

(2) Observe the compass indicator pointer. If the pointer deflects toward the right, release the locking lever on the loop mounting and rotate the loop for an **increasing** loop azimuth dial reading, or if it deflects toward the left, for a **decreasing** reading, continuing rotation until an "On Course" indication is obtained. Set the locking lever and make a close adjustment by means of the azimuth vernier drive.

(3) Observe the reading of the loop azimuth dial and add or subtract the quadrantal error obtained by reference to the calibration chart. This corrected reading will show the relative bearing of the station in degrees with respect to the "nose" of the aircraft. To obtain the magnetic bearing of the station, add to the relative bearing the heading of the aircraft in degrees as shown by the magnetic compass. If the sum is greater than 360 degrees, subtract 360 from the sum.

(4) For a "fix" of position, take bearings on three stations and plot them on a map. The aircraft's position will be within the little triangle formed by the intersection of the three lines. If the aircraft is following a known radio range beacon course, a "fix" may be obtained with one side bearing, the aircraft's position being at the intersection of the beacon course and the plotted side bearing.

b—Aural Null Method

(1) Set the OFF-COMP-REC.ANT.-REC.LOOP switch in the REC.LOOP position. The mechanical stop to the left of this switch must be depressed to permit setting the switch in this position.

(2) Tune in the desired station as described in Section 5.2 above. When listening for station identification it may be necessary to rotate the loop to a maximum signal position in order to obtain a good, intelligible signal.

(3) When the station has been tuned in, release the locking lever on the loop mounting and rotate the loop until a sharp decrease is noticed in the headset volume. Set the locking lever and make a close adjustment by means of the Tuning Unit MC-127.

(4) Observe the reading of the loop azimuth dial and add the heading of the aircraft in degrees as shown by the magnetic compass to obtain the magnetic bearing of the station. It must be borne in mind that bearings obtained by this method will be subject to 180 degrees ambiguity; that is, two bearings, the true bearing and the reciprocal bearing, may be obtained on each station. The reciprocal bearing will be 180 degrees removed from the true bearing.

(5) Fixes of position may be obtained as by the visual method, except that in plotting the bearings on the map, it may be necessary to extend the reciprocal bearings because of the 180 degrees ambiguity.

5.4—RADIO RECEIVER OPERATION

When it is not desired to make use of the navigational functions of the Radio Compass SCR-242-B, such as when flying over familiar terrain, or when following a radio range beacon course, the compass may be used as a normal radio receiver. The non-directional antenna may be used under ordinary climatic conditions, or the loop during periods of rain or snow static if a rotatable loop mounting is used.

a—"REC.ANT"

Set the OFF-COMP-REC. ANT.-REC. LOOP switch to the REC.ANT position. Tune in the desired station as described in Section 5.2, and adjust the AUDIO control for a comfortable audio level.

b—"REC.LOOP"

Set the OFF-COMP.REC.ANT.-REC.LOOP switch to the REC.LOOP position. Tune in the desired station as described in Section 5.2. Release the locking lever and rotate the loop until a maximum signal is received in the headset. Reset the locking lever.

5.5—PRECAUTIONS DURING OPERATION

a—WHEN ONLY PILOT IS PRESENT: Set LOCAL-REMOTE switch to desired control position and loop azimuth to zero before take-off.

b—For aural reception of A-N signals operate the equipment on REC.ANT or REC.LOOP instead of COMP since the rapid action of the AVC in the COMP position will cause broad course indications.

c—For best definition of A-N signals on REC.ANT or REC.LOOP positions reduce AUDIO control, since the AVC circuits become operative after the audio signal becomes very loud. The AVC circuit operates to prevent overloading of the receiver, thereby preventing reversal of courses (N instead of A or vice versa).

d—For aural reception of A-N signals on interphone, turn interphone volume control on maximum and vary AUDIO control on compass equipment for best definition of radio range courses. Failure to do this may cause broad course indications.

e—To disconnect the radio compass from interphone system, plug the headset Cord CD-307 directly into local or remote jacks of compass equipment. This allows compass to be operated independently of interphone system, especially those which have the compass and another receiver on the same position.

f—During periods of rain and snow static operate on REC.LOOP and for best reception turn loop until a maximum signal is obtained.

g—When determining direction on REC.LOOP by the aural-null method there is a 180 degree ambiguity and the direction of the station may be 180 degrees

5.5 g (continued)

from the null obtained. The broadness of the null when aural-null direction finding depends on the strength of the signal. Strong fields produce very sharp nulls sometimes as small as one tenth (0.1) degree. Vary AUDIO control until null is of satisfactory width. The tuning meter may be used as a visual null indicator.

h—REC.LOOP Operation

A push button must be depressed to allow switch to be placed in this position. This prevents the operator from inadvertently placing the switch in this position for the following reasons:

(1) The loop may be in the null position causing signal to fade in and out and possibly be mistaken for a cone of silence.

(2) The cone of silence is not present on loop type radio range stations, when on REC.LOOP, instead the signal will increase in volume to a strong surge when directly over the station instead of the normal silent zone.

i—Select radio stations providing stable bearings. Tune equipment carefully. If an interfering signal is heard in the headset it is probably causing an error in bearing. To check, tune a few kilocycles either side of maximum. A change in bearing with tuning indicates an interfering signal. The compass indicator pointer must be held on course during this test and any change in bearing noted on the directional gyro. If station interference exists, select another station or proceed by other means of navigation until closer to the desired station. Care must be exercised when taking bearings on stations broadcasting the same program as they may be mistaken for another station. Avoid taking bearings on synchronized stations unless close to the desired station. If the radio station stops transmitting or fades, especially netted code stations, bearings might be taken on other stations of the same frequency, thus causing errors.

j—Check dial calibrations against actual station frequencies. If the calibration is wrong report the defect.

k—Fly aircraft with indicator pointer on-course or fluctuating equally slightly left and right of on-course. The compass indicator pointer deflection bears no relation to the degrees off-course. Flying aircraft with indicator pointer at a fixed deflection will result in a spiral course.

l—Do not operate COMPASS control on maximum as it will be very sensitive to the least yawing of the airplane. Reduce compass output control until 15 degree loop rotation produces full scale deflection.

m—Do not depend on tuning meter as a distance meter.

n—Do not disturb any internal adjustments.

o—Night effect, or reflection of the radio wave from the sky is always present. It may be recognized by a fluctuation in bearings. The remedy is (1) increase altitude thereby increasing the strength of the direct wave; (2) take an average of the fluctuations; or (3) select a lower frequency station. Night effect is worse at sunrise and sunset. Night effect is present on stations at 1500 Kcs. at distances greater than 20 miles; as the frequency decreases the distance increases until at 200 Kcs. the distance will be about 200 miles. Satisfactory bearings however will often be obtained at much greater distances than stated above.

p—When close to a station accurate bearings can not be taken with the aircraft in a steep bank. This is especially applicable to reception of signals from instrument landing trucks.

q—Only head-on bearings are entirely dependable. If side bearings are taken keep the wings horizontal and correct bearings from the quadrantal error correction curve.

r—Do not depend on two stations for a fix of location; at least three station bearings should be used which will plot as a triangle to give an average.

s—This equipment should provide compass bearings during conditions of moderate rain and snow static which interrupt normal reception. On occasions when severe rain or snow static is present, especially when discharges occur from parts of the aircraft surfaces, it will be necessary to operate on REC.LOOP position. In this position satisfactory reception and aural-null direction finding will be possible most of the time. The type of rain and snow static existing in air mass fronts at different temperatures can be avoided by crossing the air mass front at right angles and then proceeding on desired course instead of flying along the air mass front.

t—The loop ice remover is most effective at zero azimuth setting. In particularly heavy icing conditions requiring operation of the de-icing equipment the loop should be set to 0.

u—Accurate bearings cannot be obtained flying away from stations especially with side wind.

6.0 MAINTENANCE

NOTE—Adjustment, repair or disassembly of major components is not authorized to be done by personnel other than those of the Signal Corps Repair Shops and of the Signal Corps Radio Section at Air Depots. Repair and adjustment of circuits in Radio Compass Unit BC-310-B should not be attempted at the above repair shops and radio sections unless trained personnel and suitable laboratory equipment is available, such as signal generators, Test Set I-56-A, shielded room and standard compass test set-up.

6.1 OPERATIONAL INSPECTION OF COMPASS EQUIPMENT MOUNTED IN AIRCRAFT.

The inspection of Radio Compass SCR-242-B when mounted in aircraft should be sufficiently thorough to determine whether the equipment is in working order. This inspection should be made with the airplane at least 200 feet distant from hills, buildings, towers, telephone lines, power lines and other large conductive objects which are likely to distort the radio frequency field.

a—Check the mounting and safety wiring of Radio Compass Unit BC-310-B and Radio Control Box BC-311-B.

b—Inspect all plugs and mechanical couplings and make certain that they are securely seated and that the outer collar is tight enough to prevent movement of the flexible conduit or mechanical cable in the couplings. Check headset cords. Clean all headset plugs. (A three inch pencil eraser provides a simple means for cleaning these plugs.)

c—Make sure that loop is locked securely in its mounting. If Loop LP-15-B is installed without Loop Ice Remover M-186-B, ascertain that the air connection cover is tight and locked. If Loop Ice Remover M-186-B is installed, check for proper inflation, and breaks or punctures of the rubber jacket.

d—Check all instrument lamps.

e—Operate equipment as a receiver. Tune in different stations in each band. Select stations providing weak signals and check receiver sensitivity. Check the operation of all controls, both local and remote. Check noise in equipment. Check frequency calibration on local and remote dials.

f—Operate equipment as a compass. Check bearings of stations in each band against known bearings. Select stations providing weak signals and left and right bearings. Check both indicators for correct sensing. The indicator needle should point in the direction of the station. Check the deflection of the indicator against previously observed deflections.

g—Start aircraft motors. Repeat procedure of paragraph f above. Check for any increase in noise and instability of indicator pointer.

6.2 GENERAL INSPECTION AND OVERHAUL OF COMPASS EQUIPMENT.

NOTE:—Remove Radio Compass Unit BC-310-B, Radio Control Box BC-311-B, loop, loop mounting, Cord CD-311, and Compass Indicators I-65-B from the aircraft and return to the Signal Corps Radio Section at the proper Air Depot. Only the Signal Corps Radio Sections at Air Depots are authorized to make the above inspection or to disassemble, adjust or repair the above named units except when necessary certain limited repairs can be made at Signal Corps Repair Shops. This inspection should be conducted as follows:

a—General—Applicable to all parts

Inspect all nuts, bolts, and screws for looseness. Do not tighten or loosen glyptalled screws or nuts unless it is evident they are loose. In the event they are loose, remove screw or nuts, glyptal, replace and tighten. Remove loose solder, dirt and metallic chips. Clean equipment thoroughly and touch up scratched paint. Remove all traces of corrosion. Inspect soldered joints. Inspect wiring. If more than two strands are broken at soldered joint, cut off lead and resolder. If wires seem to be breaking from vibration, clamp a soldering lug to lead and resolder. Inspect all plug connectors and clean if necessary.

b—Radio Compass Unit BC-310-B

(1) Inspect unit as described in Par. 6.2 a but do not disturb alignment adjustment. Do not disturb wiring unless necessary.

(2) Check all tubes. If the tube plate current is less than 80% of normal plate current with 6.3 volts on heater replace the tubes. Replace all tubes used over 500 hours.

(3) Dynamotor DM-20. The dynamotor should be inspected after 500 hours of service or once a year, whichever period is shorter. Disassemble the dynamotor as described in Par. b of Section 6.4. Examine the brushes to see if they have worn properly and are free of hard spots. If such spots are apparent, renew the brush. Spotted brushes can be located by inspecting the commutator for grooves. Remove bearings from armature, clean with penetrating oil and carbon tetrachloride. Check bearings for tolerances and broken or chipped balls. Clean away all old grease. Relubricate with Air Corps Grade 375 or white vaseline. Wipe off dirt from commutator, end bells, armature and housing. If commutators do not have a smooth, even surface, place the armature in a lathe and rotate it. Polish the faulty commutator with piece of soap stone or take a very thin (.003 inch) cut using lathe. Do not use sandpaper as this causes deformation of the commutator bars. **Do not use emery cloth.** Remove all dust and dirt particles after polishing. A commutator should have a smooth polished surface free of dirt, grease or ridges. **A commutator having a smooth or polished surface should not be sanded or turned down simply because it is discolored.** Under normal conditions, the commutators should not require turning down before the expiration of 5,000 hours of service. After turning down, the commutator should be carefully examined to see if under cutting of mica is necessary. A small brush, such as a toothbrush, should be used to remove any foreign particles that remain between the commutator bars.

(4) Tuning Meter I-70. Visually inspect tuning meter. Do not open case. If unserviceable, replace the meter. Repair of meters should be done only by competent personnel designated by the Chief Signal Officer.

(5) Tuning Mechanism. Remove all dirt and old grease. Lubricate gears and tuning shaft coupling as specified in Par. 6.3.

(6) Tuning Capacitors. Inspect for dirt between

6.2 b (continued)

plates. Carefully clean with pipe cleaner. **Do not bend plates. Do not lubricate.** Do not blow out as air hose may contain water and air pressure will bend plates.

c—Radio Control Box BC-311-B

(1) Inspect as indicated in Par. 6.2 **a.** Clean and lubricate dial tuning mechanism and tuning shaft coupling as in Par. 6.3. Visually inspect Tuning Meter I-70. Do not open case. If unserviceable, replace the meter. Repair of meters should only be done by competent personnel designated by the Chief Signal Officer.

d—Loops LP-13-B and LP-15-B

Clean off all grease and dirt. Inspect connector pins for corrosion, clean if necessary. Inspect vulcanized seal at top of loop for breaks. Inspect fit of loop in mounting, if not tight add another felt washer in base of loop.

e—Loop Ice Remover M-186-B

Clean off oil and dirt by the use of neutral soap and water. If necessary, high test gasoline may be used to wipe off excess oil. If gasoline is used wipe off the surface immediately before gasoline penetrates the rubber. Do not scrub the surface as this may remove **the graphite coating.** Inspect surface, if graphite coating is damaged, repaint surface with the graphite loaded cement described in Par. 3.3 **c** (8). Inspect flap-over talon fastener and if loose, recement it. If rubber jacket seems aged, cracked, weak, or is punctured or torn, replace with a new ice-remover. Inflate to 8 pounds pressure and check for leaks. Small leaks in the tube area (not the thin elastic portion) may be patched.

f—Loop Mountings GS-7-B, GS-8-B, and GS-8-C

Inspect as per Par. 6.2 **a** and applicable paragraphs below. Disassemble Loop Mounting GS-8-B or GS-8-C (see Par. 6.4 **o**). Inspect spindle and socket, Ref. Nos. 311 and 327 for flaws or weakness. Clean all parts. Inspect any of the above mountings for air leakages as follows: Insert and lock Loop LP-13-B (without ice remover) in mounting. Apply air at 8 pounds pressure, through air gauge, to air tube connection, cut off air supply. If pressure falls to 4 pounds in less than 5 seconds, inspect for air leak. Seal leak with glyptal and allow to set for 24 hours. Retest. Check nameplate rivets on Loop Mounting GS-7-B for leaks. Loop LP-15-B with ice remover can be tested in same manner but be careful not to apply more than 8 pounds air pressure. When Loop Mounting GS-8-B or GS-8-C shaft is shortened, glyptal inside ends and assemble. Test for air leaks as described above.

g—Compass Indicators I-65-B

Inspect visually. Replace faulty indicators. Do not open inner case. A faulty capacitor can be replaced by removing outer case only. Repairs of indicators should only be done by competent personnel at authorized instrument repair sections.

h—Performance Test

Reassemble equipment and measure performance as described in Par. 6.9. Vibrate equipment and note any increase in noise or clicks with and without r.f. input. If equipment is noisy or fails to meet performance requirements, re-examine the equipment until the trouble is discovered.

i—Wiring

Inspect wiring at control box back and socket 212 for abrasion or possible shorts. Inspect bonding in aircraft. Inspect dynamotor safety wiring. Reassemble equipment and safety wire. Inspect antenna lead-in. Require replacement if necessary. Inspect Loop Mounting GS-8-B or GS-8-C for proper bracing. Inspect air hose connection and operation of ice remover.

j—Repeat Operational Inspection of Par. 6.1.

6.3 LUBRICATION

The following parts require lubrication after the hours of service indicated below:

Part	Time	Lubrication
Dynamotor DM-20	1000 hours	AC Grade 375 or Vaseline
Loop Mountings GS-8-B and GS-8-C, bearings	200 hours	Vaseline
Loop Mountings GS-8-B and GS-8-C, clutch mechanism	100 hours	Vaseline
Loop Mountings GS-8-B and GS-8-C, worm gear	100 hours	Gredag D-41-C
Loop Mountings GS-8-B and GS-8-C, worm shaft	100 hours	Vaseline
Loop Mountings GS-8-B and GS-8-C, collector ring	100 hours	Vaseline
Loop Mountings GS-8-B and GS-8-C, Swivel Joint MC-182	200 hours	Gredag D-41-C
Loop Mountings GS-8-B and GS-8-C, locking pin	200 hours	Vaseline
Radio Compass Unit BC-310-B, dial gear mechanisms, local	1000 hours	Socony Vacuum PD-287-A
Radio Control Box BC-311-B, dial gear mechanism, remote	1000 hours	Socony Vacuum PD-287-A
Tuning Shaft MC-124	As required	AC Grade 375
Tuning shaft couplings, Ref. No. 133	As required	Vaseline
Plug threads	As required	Thread lubricant

DO NOT LUBRICATE variable tuning capacitor, volume controls or dynamotor commutator. Band switching Motor MO-4 is permanently lubricated and will not require attention, unless it is disassembled, in which case the bearings should be repacked with a low temperature grease such as Socony Vacuum PD-287-A. If the dial gear mechanism is disassembled, the ball bearings should be repacked with low temperature grease.

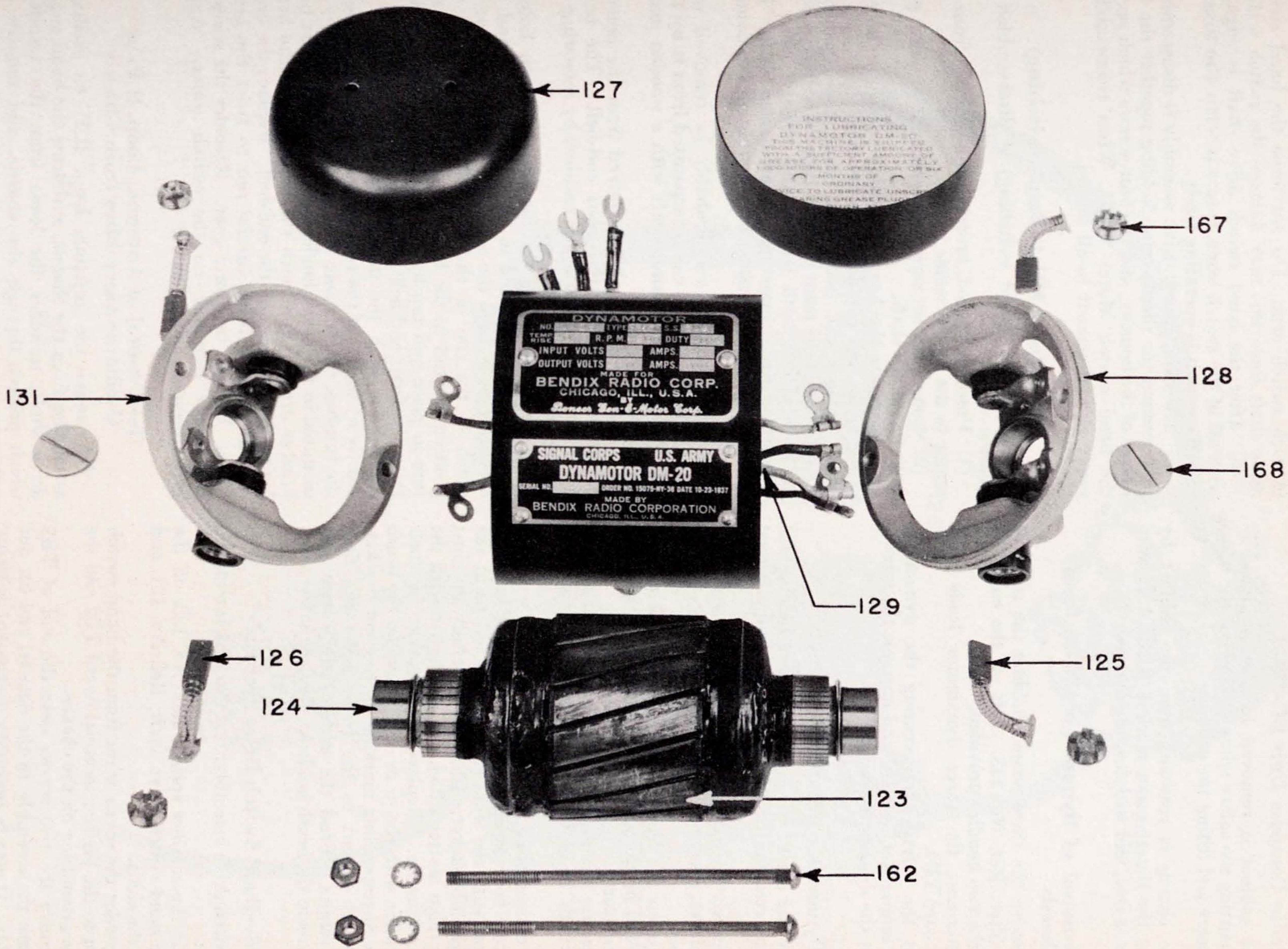


FIG. 29. DYNAMOTOR DM-20, EXPLODED VIEW

*6.4 DISASSEMBLY OF UNITS

a—Radio Compass Unit BC-310-B

(1) The cabinet is removed from Mounting FT-145-B by cutting the safety wires, pulling out the snap-slide fasteners and lifting the cabinet.

(2) The chassis is removed from the cabinet by unscrewing the thumb-screw marked RELEASE until the chassis is free, and withdrawing chassis.

b—Removal of Dynamotor DM-20 from Chassis

(1) Remove the three screws holding the cover of the hash filter, Ref. No. 113. Lift off the cover by means of the two handles provided.

(2) Disconnect the three dynamotor leads from terminal board TB4.

(3) Cut the safety wire securing the dynamotor mounting screws Ref. No. 161 and unscrew the screws. Do not let the dynamotor drop.

*c—Dynamotor DM-20 Disassembly

(1) Cut the safety wire on the screws holding the dust covers, remove the screws and slide off the dust covers.

(2) Remove the cotter pins from the castellated brush retainers, unscrew the brush retainers and remove the brushes.

(3) Unscrew the frame bolts, Ref. No. 162 and remove the end brackets, Ref. Nos. 128 and 131. Slide out the armature.

(4) Unscrew the field retaining screws and remove the fields. Be careful not to damage the wiring or insulation.

(5) In reassembling the dynamotor make sure that the armature is replaced in the proper position. The commutator with the wide segments should be at the low voltage end-bracket. Clean out carefully any dust or other foreign matter which might interfere with the armature clearance. Replace the brushes in their proper location with the + or — marking on the brush facing the corresponding marking on the end bracket. Apply glyptal cement to the frame bolts and field retaining screws. Bend the ends of the cotter pins into the slots in the brush holders. Replace safety wire.

*d—Band Switch Drive Assembly

Band switch drive assembly, Ref. No. 114, is removed as follows:

(1) Slide the retainer spring, Ref. No. 132, off the end of the band switch drive shaft, Ref. No. 121, and withdraw the shaft.

(2) Unsolder the seven wires from the band switch mechanism to the lugs on terminal board TB2 and the wire to the ground lug on the chassis.

(3) Remove the two screws near the end of TB2 which secure the assembly to the chassis, and lift out the assembly. It may be necessary to remove the lacing cord in order to push the wires through the hole in the chassis.

(4) When reassembling, make sure that the arm of each wafer switch is in the same relative position before attempting to reinsert the band switch drive shaft. This may be ascertained by sighting through the shaft hole and noting the location of the positioning cut-out in each switch arm. Do not force the band switch drive shaft since this may damage the switch wafers.

(5) After the band switch drive shaft is engaged with all of the switch arms, rotate it **with the fingers** to make sure it is operating freely.

(6) The band switch drive assembly is disassembled by removing the three screws holding together the two halves of the housing, and the four screws which secure the band switch Motor MO-4. When reassembling, apply glyptal cement to all screws.

*e—Motor MO-4 (Band Switching)

Motor MO-4 (band switching) is disassembled as follows:

(1) Unsolder the red, brown and blue wires from the motor to the switch wafer.

(2) Loosen the set screw and remove the worm gear from the motor shaft.

(3) Remove the brush retaining screw in the side of the motor and withdraw the brushes.

(4) Remove the two screws from the brush-bell. Tap the rim of the front end-bell **lightly** with a wooden mallet or block until it separates enough from the housing to permit inserting a screw driver blade. Pry the end-bell off the housing, being careful not to damage either.

(5) The armature will probably be removed with the end-bell, and if so can be separated from it by tapping lightly on the motor shaft with a wooden mallet or block.

(6) The rear end-bell is removed from the housing in the same way as the front end-bell. The brush holders are removed from the end-bell by removing the set screws that secure them.

(7) In reassembling the motor, the brush holders should first be mounted in the rear end-bell and the end-bell pressed onto the housing. Make sure that the notch in the rim of the end-bell registers with the positioning stud in the housing. Next, set the armature in place and tap lightly to seat the rear bearing. Press the front end-bell in place, with the notch in the rim in line with the positioning stud and draw up tightly by means of the two frame screws. Reassemble the brushes, making sure that the brush marked +, is mounted in the brush holder marked +, and that both brushes are mounted with the markings on the brush facing the markings on the end-bell. Replace the brush retaining screws being careful not to twist the brush wires. Replace the worm gear. Resolder the wires to the proper terminals on the switch wafer. Apply glyptal cement to all screws.

*f—Removal of Antenna, Loop, R.F. or Oscillator Assemblies from Chassis

To remove the antenna, loop, R.F. or oscillator assemblies from the chassis, withdraw the band switch drive shaft, unsolder the leads from the terminals which project through the chassis, and remove the

*Footnote:—The disassembly operations described in paragraphs 6.4 c to 6.4 n, inclusive, are not authorized to be done by personnel other than those of the Signal Corps Repair Shops and the Signal Corps Radio Sections at Air Depots.

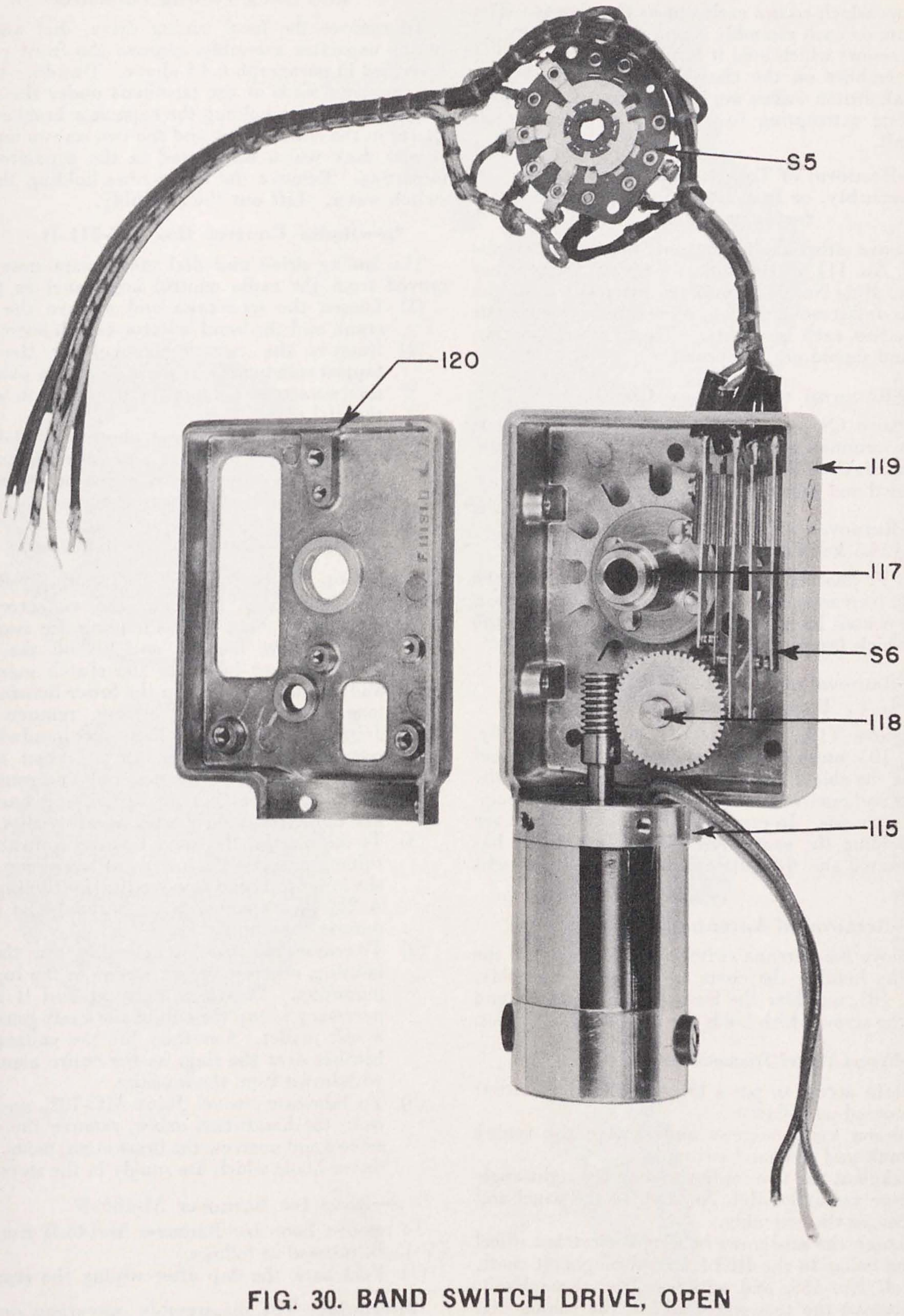


FIG. 30. BAND SWITCH DRIVE, OPEN

6.4 f (continued)

two screws which secure each can to the chassis. The cover plate on each assembly is removed by unscrewing the four screws which hold it in place. When replacing these assemblies on the chassis, make sure that the arms of all switch wafers are in the same relative position before attempting to reinsert the band switch drive shaft.

***g—Removal of Tel. Output Transformer Assembly, or Indicator Output Transformer Assembly**

To remove either the tel. output transformer assembly, Ref. No. 111, or the indicator output transformer assembly, Ref. No. 112, unsolder the leads from the terminals and remove the four screws under the chassis which secure each assembly. These assemblies are potted and should not be opened.

***h—Removal of C9 from Chassis**

To remove C9 from the chassis, unsolder the leads from the terminals and remove the four screws on top of the chassis deck which fasten the unit. This capacitor is sealed and should not be opened.

***i—Removal of R.F. Phasing Assembly, or 122.5 kc. Trap Assembly**

The R.F. phasing assembly, Ref. No. 101 and the 122.5 Kc. trap assembly, Ref. No. 109, can be removed from the chassis by removing the two screws under the chassis which fasten each item.

***j—Removal of T13, T14, or the I. F. Trap Assembly**

To remove T13, T14, or the I. F. trap assembly, Ref. No. 104, unscrew the nuts on the spade lugs and withdraw the shield can. Unsolder the leads from the terminals and remove the two screws holding the assembly to the chassis. In reassembling, do not tighten the screws holding the assembly until the shield can has been mounted and the nuts on the spade lugs brought up tight.

***k—Removal of Antenna Switching Relay**

To remove the antenna switching relay, take out the two screws holding the cover of the relay assembly, Ref. No. 103, unsolder the leads to the terminals and remove the screw which holds the relay to the bracket.

***l—Front Panel Disassembly**

To obtain access to parts located behind the front panel, proceed as follows:

(1) Loosen the set-screws and remove the tuning crank and the band switch lever.
(2) Take out the two screws holding the right-angle drive assembly, Ref. No. 133, to the panel and remove the assembly.
(3) Loosen the set-screws holding the ratchet wheel and collar to the RELEASE throughbolt shaft, Ref. No. 155, and withdraw the throughbolt.
(4) Remove the two screws above the tuning dial which secure the lamp socket and reflector assembly, Ref. No. 153, to the panel, and remove the four panel screws. Lay the panel forward, being careful not to damage the wiring.

***m—Removal of Local Tuning Drive, Dial and Gang Tuning Capacitor**

To remove the local tuning drive, dial and gang tuning capacitor assembly, remove the front panel as described in paragraph 6.4 l above. Unsolder the tuning capacitor leads at the terminals under the chassis. Remove the screw holding the capacitor bracket to the spacer in the chassis deck and the two screws under the chassis deck which are seated in the capacitor drive mounting. Remove the two screws holding the band switch wafer. Lift out the assembly.

***n—Radio Control Box BC-311-B**

The tuning drive and dial mechanism may be removed from the radio control box panel as follows:

(1) Loosen the set-screws and remove the tuning crank and the band selector switch lever.
(2) Remove the two screws holding the center tapped resistor R8 to the side of the panel, and the two screws holding the band switch wafer to the dial plate.
(3) Remove the two screws above the dial which secure the lamp socket and reflector assembly and the two larger screws which hold the tuning drive and dial assembly to the panel.
(4) Withdraw the assembly, being careful not to damage the wiring to the switch wafer.

o—Loop Mountings GS-8-B and GS-8-C

(1) To inspect or lubricate the collector rings, remove the eight screws holding the two covers to the upper housing and lift off the covers.
(2) To inspect or lubricate the clutch mechanism and the moving parts in the lower housing, or to inspect the dial light wiring, remove Swivel Joint MC-182 and unlock the handwheel by releasing the clutch handle. Loosen the two set screws in the handwheel hub and remove the handwheel. Do not pry off; if the handwheel fits tight, tap lightly with a soft mallet.
(3) To disassemble the lower housing from the outer tubing, unscrew the lower nut set screws, loosen the lower nut, and remove the positioning screw. A 2¼ inch spanner wrench should be used to remove these nuts.
(4) To remove the rotating assembly from the upper housing, unscrew the six screws in the top of the mounting. This is a tight fit and it may be necessary to tap the end of the shaft gently with a soft mallet. Carefully lift the collector ring brushes over the rings as the entire assembly is withdrawn from the housing.
(5) To lubricate Swivel Joint MC-182, unscrew it from the handwheel arbor, remove the two set screws and unscrew the brass stem, using a screw driver blade which fits snugly in the slots.

p—Loop Ice Remover M-186-B

To remove Loop Ice Remover M-186-B from Loop LP-15-B, proceed as follows:

(1) Fold back the flap after wiping the seam with

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*Footnote:—The disassembly operations described in paragraphs 6.4 c to 6.4 n, inclusive, are not authorized to be done by personnel other than those of the Signal Corps Repair Shops and the Signal Corps Radio Sections at Air Depots.

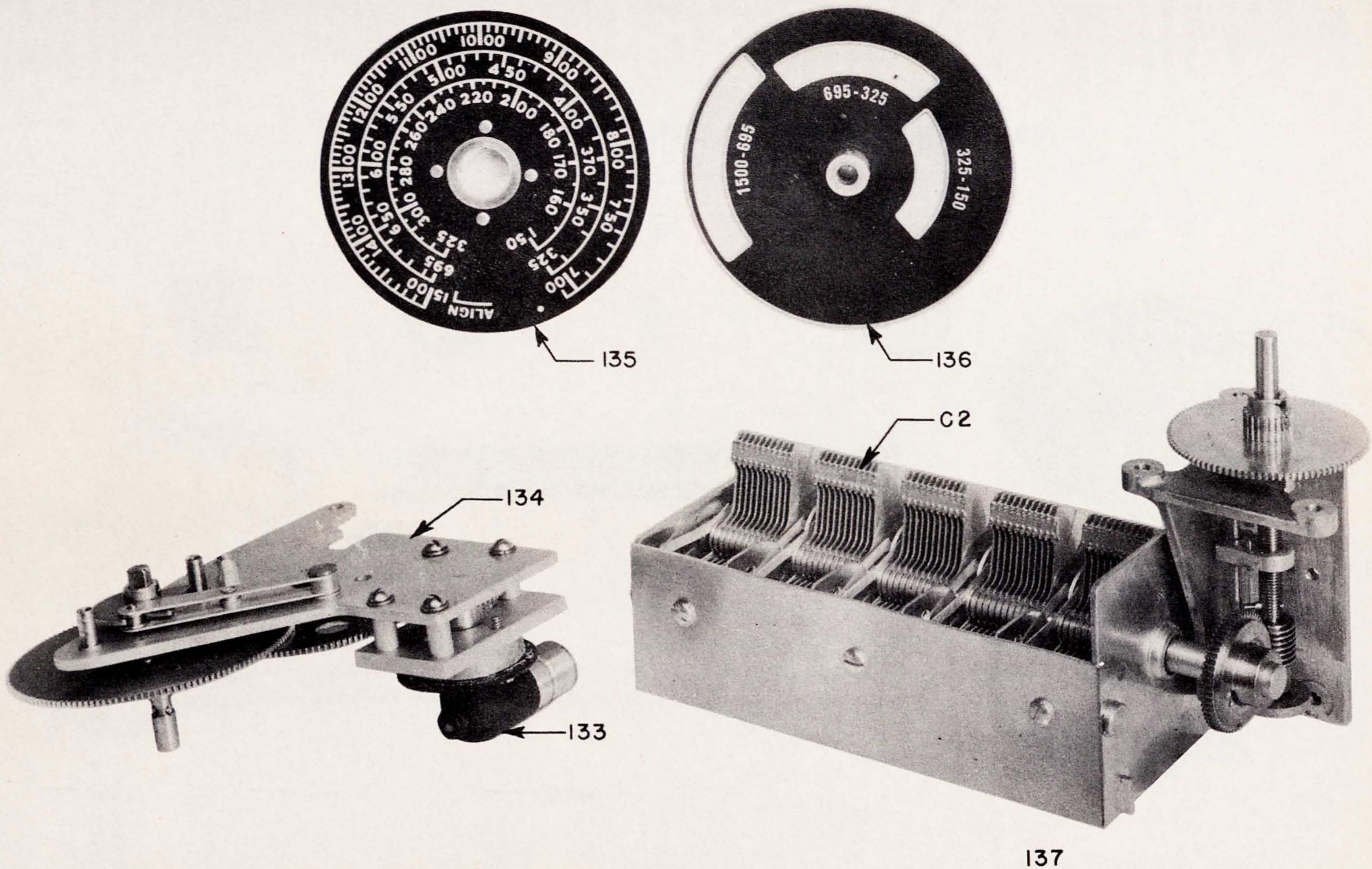


FIG. 31. TUNING DRIVE, DIAL AND DIAL MASK

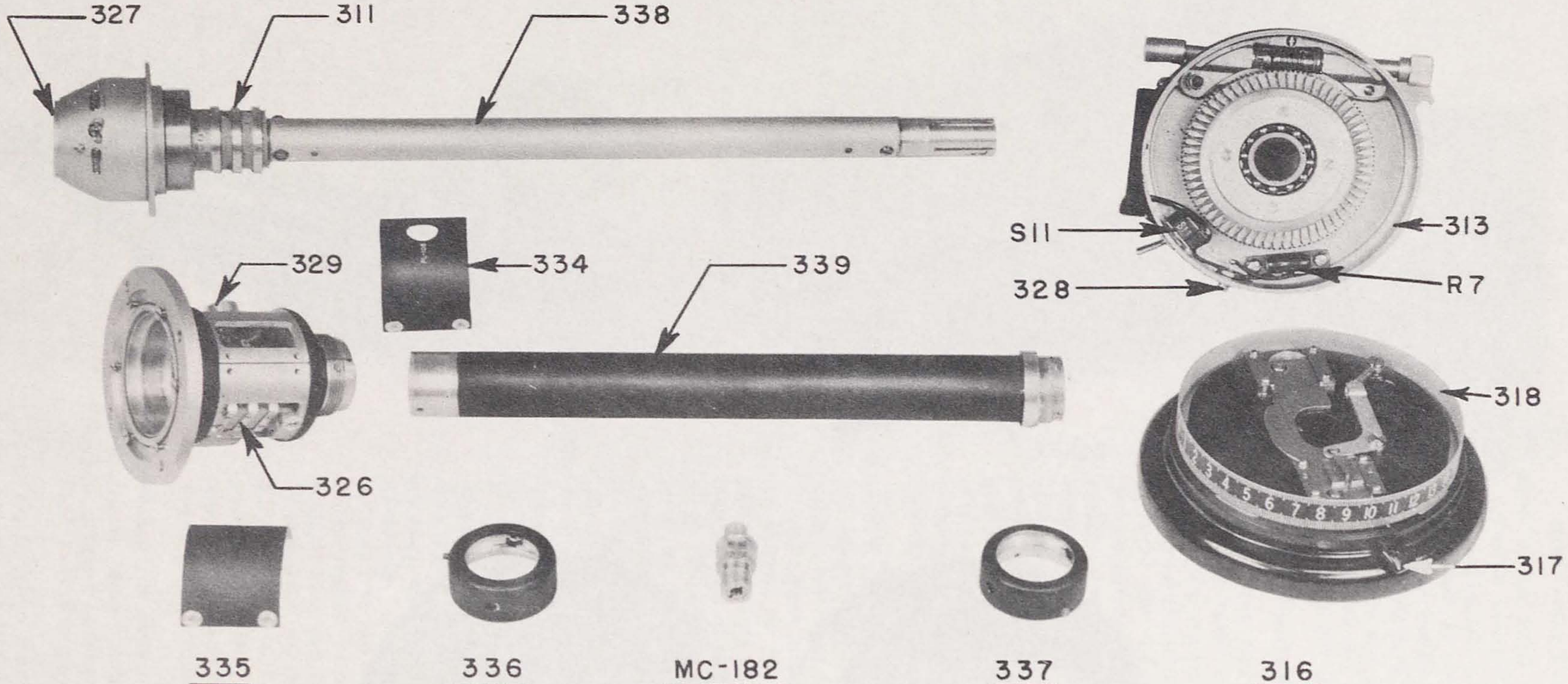


FIG. 32. LOOP MOUNTING GS-8-B, EXPLODED VIEW

6.4 **p** (continued)

high test gasoline to dissolve the cement.

(2) Remove the safety wire from the "Talon" slides. Insert a wire through the rear hole on the slides, press down on fastener with thumb, and at the same time open the fastener.

(3) Pull the rubber jacket over the edge of the loop and over the loop base.

(4) Unscrew the air connections, taking care not to damage the rubber.

(5) Replace and lock the air connection cover in Loop LP-15-B. This hole must always be closed to prevent water and dirt from entering the loop and mounting.

(6) Fold rubber jacket carefully, wrap with heavy paper and place in cool, dark, dry storage.

©6.5—TROUBLE LOCATION AND REMEDY

In locating the cause of unsatisfactory operation the procedure outlined graphically in Fig. 33 will facilitate rapid location of the source of the difficulty.

When one trouble has been found and remedied, check the equipment for proper operation. If unsatisfactory results are obtained, follow from the beginning the procedure outlined in the chart to locate further sources of trouble.

Before removing the equipment from the aircraft, make the following checks:

(1) Make sure that the LOCAL-REMOTE switch is properly set for the position from which operation is desired.

(2) Ascertain that the fuse in the junction box or fuse box is not burned out, and that the battery voltage is normal.

(3) See that a loop is installed and that all cables are connected.

(4) Make sure that the non-directional antenna and lead-in are not grounded or open.

(5) Make continuity test as indicated in Par. 6.7 **c.**

†6.6 TEST PROCEDURE

a—Low Compass Output—All Bands

(1) Test Receiver Output.—Operate the radio compass with the OFF-COMP.-REC.ANT.-REC. LOOP switch in the REC.ANT. position. Tune to stations in each band and note whether trouble is experienced on only one or two bands. If so, proceed as outlined in paragraph 6.6 **b.** If the equipment operates satisfactorily as a receiver on all bands, check REC.LOOP operation of the equipment. If the equipment operates satisfactorily under both conditions, the trouble must be associated with the compass circuits. Proceed as outlined in paragraph 6.6**a** (2). If, however, the REC.LOOP operation of the equipment is unsatisfactory, proceed as outlined in paragraph 6.6 **d.** If trouble is encountered on all bands, proceed as outlined in paragraph 6.6**c.**

(2) Normal Receiver Output (ant. or loop). When normal REC.ANT. and REC.LOOP operation is obtained on all bands, the trouble must lie in the compass circuits and the tests outlined in paragraphs 6.6 **a** (3), 6.6 **a** (4), and 6.6 **a** (5) should be made in sequence.

(3) Test AF Oscillator.—Disconnect one compass indicator and with a vacuum tube voltmeter measure the AC voltage between ground and terminals 3 and 5 (or V and W of socket for Plug PL-122) of Plug PL-118 to the other indicator. A .1 mfd. 400 volt capacitor should be connected in series with the voltmeter. If the AF Oscillator stage and the indicator which is connected are functioning properly, there will be an AC voltage of from 36 to 44 volts between ground and terminals 3 and 5 of Plug PL-118 (or terminals V and W of socket for Plug PL-122). Repeat the test with the other indicator disconnected.

(4) Test Compass AF Amplifiers.—Test the local and remote output tubes for emission and characteristics. Set the OFF-COMP.-REC. ANT.-REC.LOOP switch in the COMP. position. Measure the socket voltages on the above tubes and compare the readings obtained with the values given in the table in Section 6.7 **b.** If a considerable variation is noted from the typical values, check the wiring and components of the circuits associated with the tube elements. Disconnect the compass indicators, turn both the local and remote compass controls full on and apply a 1.5 volt 48 cycle signal from an audio oscillator between ground and the junction of C6 and R32-1 and TB1. Connect an output meter in turn between ground and terminals 4 and 8 of the indicator output transformer assembly, Ref. No. 112. If these stages are functioning properly it should be possible to obtain an output of at least 10 milliwatts from each. If either of the indicator output transformers are defective, the indicator output transformer assembly must be replaced. Check C6 for open or short circuit.

(5) Test Compass Indicators.—Check indicators and their associated cables for opens, shorts and poor contacts. If the tests outlined under paragraph 6.6a (4) show no voltage across the indicator field with the indicator connected, check the meter and C11-1 (or C11-2) for shorts. If the moving coil of the indicator is intact, check between indicator terminal 4 and indicator output transformer terminals 8 and 4 for open circuit. Proceed with tests outlined in Section 6.9.

b—Low REC.ANT. Output—1 or 2 Bands

If operation of the receiver is obtained on one or two bands, checking operation of I.F., 2nd Det., Audio, etc., circuits is unnecessary, as it is obvious that these stages must be functioning to permit operation of at least one band. Proceed to the tests outlined in paragraph 6.6c (10).

©**Footnote**:—The test operations described in paragraph 6.5 are authorized by using personnel but such personnel should not attempt those described in paragraph 6.6 **b.**

†**Footnote**:—The test operations described in paragraphs 6.6 **a** to 6.6 **d**, inclusive, are not authorized to be done by personnel other than those of the Signal Corps Repair Shops and the Signal Corps Radio Sections at Air Depots.

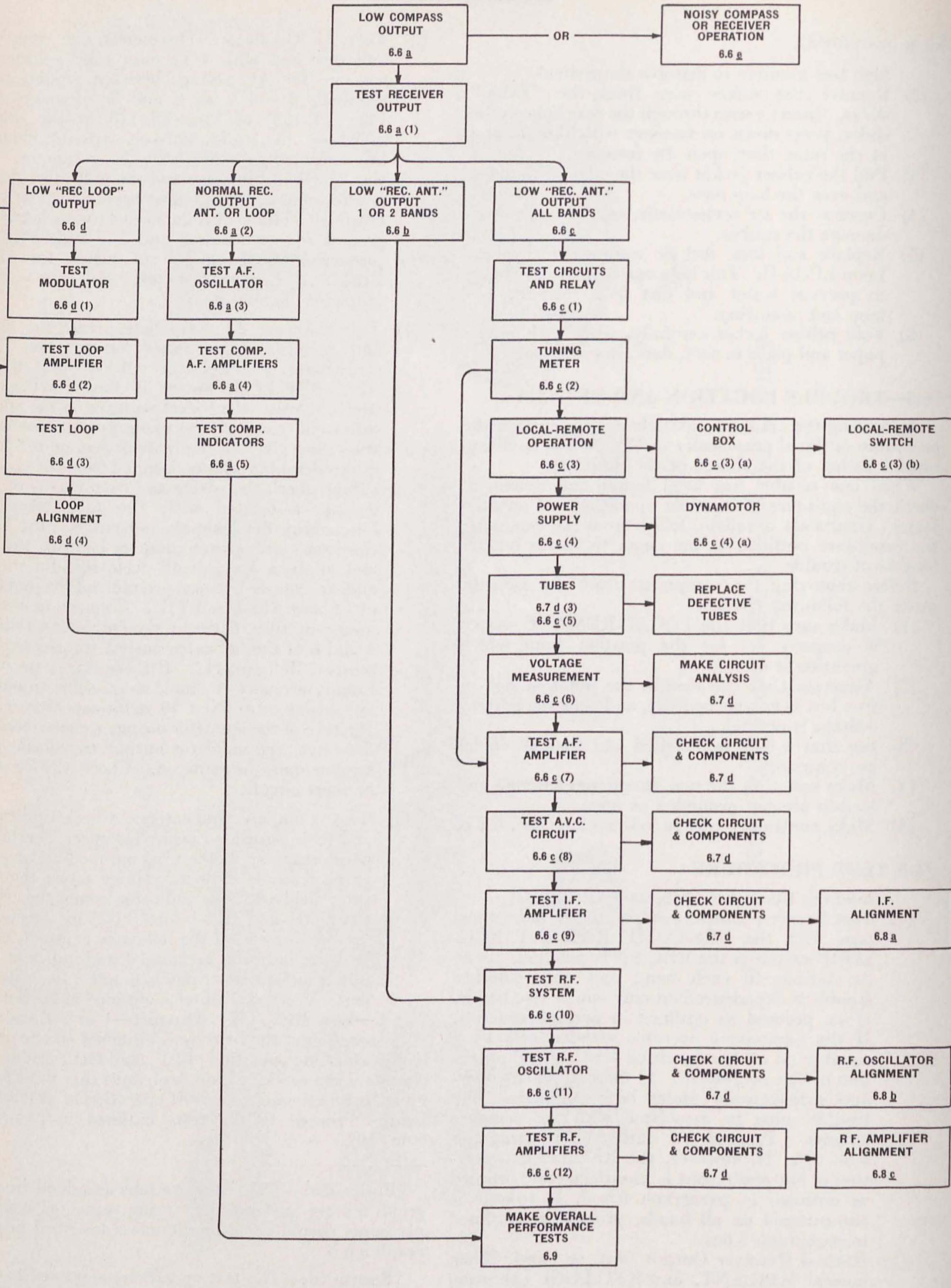


FIG. 33. TROUBLE LOCATION AND REMEDY CHART

6.6 (continued)

c—Low REC.ANT. Output—All Bands

(1) When both signal and noise output is low or absent first check all external cable connections, including antenna connections, power supply connections, fuses in junction box, and headphone connections. Also remove the cover of the antenna switching relay assembly and check operation of the relay, R18, C21-1, and the relay contacts.

(2) Tuning Meter.—With the OFF-COMP.-REC. ANT.-REC.LOOP switch in the REC.ANT. position, check the operation of the tuning meter, the pointer of which should swing over to the left side of the scale after an approximate 30 second warm up period. If there is no movement of the tuning meter pointer, short out the local and remote meters individually as an open winding in either will keep both from operating.

NOTE:—If Radio Compass Unit BC-310-B is operated without Radio Control Box BC-311-B, the negative terminal of the tuning meter must be grounded. If the tuning meter (or meters) respond by swinging to the left, and a relatively weak signal (5 or 10 microvolts) applied to the antenna terminal of the compass unit produces a counter swing to the right as the receiver is tuned to the resonance frequency (AUDIO control turned fully clockwise), but still no audio output is obtainable, proceed to tests outlined in paragraph 6.6 c (7). If there is no movement of the tuning meter pointer when the radio compass unit is turned on, proceed as outlined in paragraph (3) below.

(3) Local — Remote Operation. — The equipment should be checked with the LOCAL-REMOTE switch thrown to both of its positions. If the equipment operates with the switch in the LOCAL position, but will not operate when the switch is in the REMOTE position, the control box should be tested, paying particular attention to power circuits and sensitivity control. Make sure that the remote band switch, OFF-COMP.-REC.ANT.-REC.LOOP switch, and AUDIO control are properly set.

(a) Remove the control box from its base and check the wiring, components, and switch contacts for opens, shorts, and grounds. Continuity tests should be made back through the cable and junction box to Plug PL-122 at the compass unit.

(b) If no trouble is found in the control box circuits or cable, but the equipment still fails to operate when the LOCAL-REMOTE switch is in the REMOTE position, check the connections to the switch itself.

(4) Power Supply.—Failure of the primary power source may normally be detected by failure of the instrument lamps. The supply voltage (approximately 14 volts) should appear across the yellow and black leads under the hash filter cover, Ref. No. 113. If no supply voltage appears at this point, check the continuity of the wiring and the contacts of S7 and S8.

(a) If supply voltage is normal, approximately 200 volts should appear across the red and black leads under the hash filter cover. If this voltage is unreasonably low, check for short circuits in wiring or components associated with or connected to the high voltage supply. Lack of dynamotor output voltage, if the primary supply voltage is normal, indicates a defective dynamotor.

(5) Tubes.—Test all tubes for emission and other characteristics, described in paragraph 6.7 **d** (3). Any tubes not having characteristics within standard limits should be replaced.

(6) Voltage Measurements.—Socket voltages should be measured with the OFF-COMP.-REC.ANT.-REC. LOOP switch in the REC.ANT. position and compared to the values given in the table in Section 6.7. If any considerable variation from the typical values is noted, check all resistors, capacitors, and wiring in circuits associated with the tube elements.

(7) A.F. Amplifier Test.—Plug a headset into the TEL jack on the panel of the radio compass unit and while listening, touch the grid cap of the 2nd Detector tube. A loud click or whistle should be heard. If no sound is heard, measure the socket voltages of the Tel. Out. tube, VT-66, and the 2nd Det. tube, VT-93, and compare the readings obtained with the values given in the table in Section 6.7 **b**. If any considerable variation from the typical values is noted, check the wiring and components in the circuits associated with the tube elements. Apply a 400 cycle signal from an audio oscillator to the grid of the Tel. Output tube (socket terminal #5), plug an output meter into J1 and measure the audio oscillator voltage required for a "TEL" output of 50 milliwatts. If the stage is functioning properly, it will be possible to obtain this output with an audio oscillator voltage of less than 2.5 volts. Likewise, an audio oscillator voltage of approximately .05 volts applied to the grid of the 2nd Det. tube, VT-93, should give a "TEL" output of 50 milliwatts. If the output is low when feeding the audio oscillator into the grid of the 2nd Det., but normal when feeding into the grid of the Tel. Output tube, connect the audio oscillator through a .1 mfd. capacitor to the plate of the 2nd Det. tube (socket terminal #3). If satisfactory output is obtained when the audio oscillator is connected to the grid of the Tel. Output tube, but not when connected to the plate of the 2nd Detector tube, capacitor C17-2 is defective.

(8) AVC Circuit Tests.—Extreme insensitivity of the radio compass unit may be caused by failure of C4-1, C4-2, or C4-3. One of these capacitors opening up removes the R.F. ground from the grid return of the associated stage. If the AVC is inoperative, check C36-3 and C35-3 for short circuit. A defective Tube VT-93 in the 2nd Det. stage may also cause ineffective AVC operation.

(9) I.F. Amplifier Tests.—Apply a 112.5 Kc. signal, 30% modulated at 400 cycles, to the grid of the I.F. tube and plug an output meter into the TEL jack. Measure the signal generator voltage required to produce an output of 50 milliwatts. If this stage is functioning properly, a signal generator input of less than 55,000 microvolts will be required. If more than 55,000 microvolts is necessary, adjust L4-2 and L5-2 to determine whether or not the sensitivity is due to misalignment of T14. If satisfactory alignment can-

6.6 c (9) (continued)

not be obtained, remove T14 and check all wiring and components. If function of this stage is normal, remove the R.F. oscillator tube, VT-94, and apply a 112.5 Kc. signal, 30% modulated at 400 cycles from the signal generator to the grid of the 1st Det. tube. If this stage is functioning properly, an input of less than 600 microvolts will be necessary to produce an output of 50 milliwatts. If more than 600 microvolts is necessary, carefully check alignment of T13, alignment procedure for which will be found in Section 6.8 **a**. If satisfactory alignment and sensitivity of this stage cannot be obtained, remove T13 and check all wiring and components.

(10) R.F. System Tests.—Set the band switch on one of the bands on which trouble is encountered and set the tuning dial to the alignment frequency for that band as given in Section 6.8 **c**. Beginning at the grid cap of the 1st Detector tube, apply a 30% modulated (400 cycles) signal from the signal generator. 900 microvolts input to this stage from the signal generator should give approximately 50 milliwatt output from the A.F. amplifier. As the signal is fed successively into the grids of the 2nd R.F., 1st R.F. stages, etc., considerably less input from the signal generator should result in the same 50 milliwatt output. If a stage is reached where the signal necessary to produce 50 milliwatts output is greater than or only slightly less than it was for the preceding stage, that stage is faulty and tests outlined in paragraph 6.6 **c** (11) or 6.6 **c** (12) should be applied, as the case might be.

(11) R.F. Oscillator Tests.—If socket voltage measurements on the 1st Detector tube (See paragraph 6, this section) fail to reveal the source of trouble, set the band switch to one of the inoperative bands and rotate the tuning dial to the alignment frequency for that band, as given in Section 6.8, and apply a signal generator voltage of that frequency, 30% modulated at 400 cycles to the grid cap of the 1st Detector tube. Turn AUDIO and threshold sensitivity controls fully clockwise. It should be possible to obtain an output of 50 milliwatts at the TEL jack for an input of less than 900 microvolts from the signal generator. If these conditions can be met, the trouble is in one of the R.F. stages and the procedure outlined in paragraph (12) should be followed. If the conditions cannot be met, check the alignment of the R.F. oscillator, following the procedure given in Section 6.8 **b**. If satisfactory alignment is not obtainable, remove the R.F. oscillator assembly, Ref. No. 107, and check all wiring, contacts of S4, and all capacitors and resistances.

(12) R.F. Amplifier Tests.—If socket voltage measurements on the 1st and 2nd R.F. tubes (See paragraph 6, this section) fail to reveal the source of trouble, set the band switch to one of the inoperative bands and rotate the tuning dial to the alignment frequency for that band, as given in Section 6.8, and apply a signal generator voltage of that frequency, 30% modulated at 400 cycles, to the grid cap of the 2nd R.F. tube. It should be possible to obtain an output at the TEL jack of 50 milliwatts for an input of less than 120 microvolts from the signal generator. If these conditions cannot be met, check the alignment of the 2nd R.F. circuit, following the procedure given in Section 6.8 **c**

If satisfactory alignment is not obtainable, remove the 2nd R.F. assembly, Ref. No. 106, and check wiring, switch contacts, capacitors, and resistances. If satisfactory output is obtainable from the 2nd R.F. stage, the procedure outlined above should be repeated for the 1st R.F. stage. It should be possible to obtain an output of 50 milliwatts with an input of 20 microvolts to the grid of the 1st R.F. tube. If the 1st R.F. stage is functioning properly, apply a 5 microvolt signal to the antenna pin on the panel of the compass unit, and if 50 milliwatts (or more) output is not obtainable, check antenna relay contacts, R18, C21-1, and operation of the relay, Ref. No. 103. If normal operation is still unobtainable, remove antenna shield assembly, Ref. No. 102, and check wiring, switch contacts and capacitors associated with the antenna circuit and grid and antenna coils located in T4, T5, and T6.

d—Low REC.LOOP Output

Operate the radio compass with the OFF-COMP.-REC.ANT.-REC.LOOP switch in the REC.LOOP position. Tune to stations in each band, observing whether trouble is encountered on all bands or only on one or two bands. If the equipment is inoperative on all bands, proceed as outlined in paragraph 6.6 **d** (1) below. If, however, trouble is encountered on only one or two bands, remove the compass unit from the cabinet and set up on the test bench. Measure the voltage on the plates of the modulator tube, VT-96, for each setting of the band switch. If any considerable variation is noted from the values given in Section 6.7, remove the antenna shield assembly, Ref. No. 102, and check the contacts of S1-2 and the plate windings of T-4, T-5, and T-6 for open or short circuits. If the nature of the trouble encountered on only one or two bands is not apparent from the foregoing tests, proceed as outlined in paragraph 6.6 **d** (2).

(1) Modulator Test.—Measure the socket voltages of the modulator tube and compare with the values given in the table in Section 6.7. If any considerable variation from the typical values is noted, check the wiring and components of the circuits associated with the tube elements. With the OFF-COMP.-REC.ANT.-LOOP switch in the COMP position and the compass unit tuned to the aligning frequency (as given in Section 6.8) on any one of the faulty bands, set the loop gain, COMPASS and THRES.SENS. controls at maximum and ground grid No. 1 (socket terminal No. 4) of the modulator tube. Apply a 7 microvolt signal generator voltage of the aligning frequency to grid No. 2 (socket terminal No. 5) of the modulator tube and observe the compass indicators. If the modulator stage is functioning properly, the indicator pointers will deflect full scale to the **right.** Repeat the test, grounding grid No. 2 and applying the signal to grid No. 1. The indicator pointers should deflect full scale to the left.

(2) Loop Amplifier Test.—Measure the socket voltages of the loop tube and compare the readings obtained with the values given in the table in Section 6.7. If any considerable variations from the typical values are noted, check the wiring and components of the circuits associated with

6.6 d (2) (continued)

the tube elements. If all bands are inoperative, remove the loop phasing assembly, Ref. No. 101, and check all wiring and components for open or short circuits. If only one or two bands are inoperative, roughly check alignment of loop stage trimmers of the bands at fault. If proper alignment appears impossible remove the loop shield assembly, Ref. No. 100, and check all components, switch contacts and wiring.

(3) Loop Test.—Test loop, mounting (brushes and rings if rotatable mounting) and loop cable for open or short circuits or grounds. Also check for poor contact at plugs.

(4) Loop Alignment.—If it has been necessary to make any alteration in the settings of the loop stage trimmers, it will be necessary to completely realign this stage. The procedure outlined in Section 6.8, paragraph f should be followed.

e—Noisy Compass or Receiver Operation

To locate the cause of noisy operation, check the following components:

Check	For
Vacuum Tubes	Microphonic or defective units.
Dynamotor	Worn or arcing brushes.
Loop	Dirty or flattened pins.
Loop Mountings	Corroded sockets, dirty brushes or rings.
Cable Plugs	Poor contacts.
Bonding	Loose connections. Chassis not grounded. Poor bonding on Tuning Shaft MC-124.
Switches	Dirty contacts.
Variable Capacitors	Dirt between plates.
Power Source	Loose or corroded connections.
Circuits	Loose wires, defective capacitors or resistances.

6.7 TYPICAL OVERALL VOLTAGE MEASUREMENTS

a—Typical Circuit Voltages

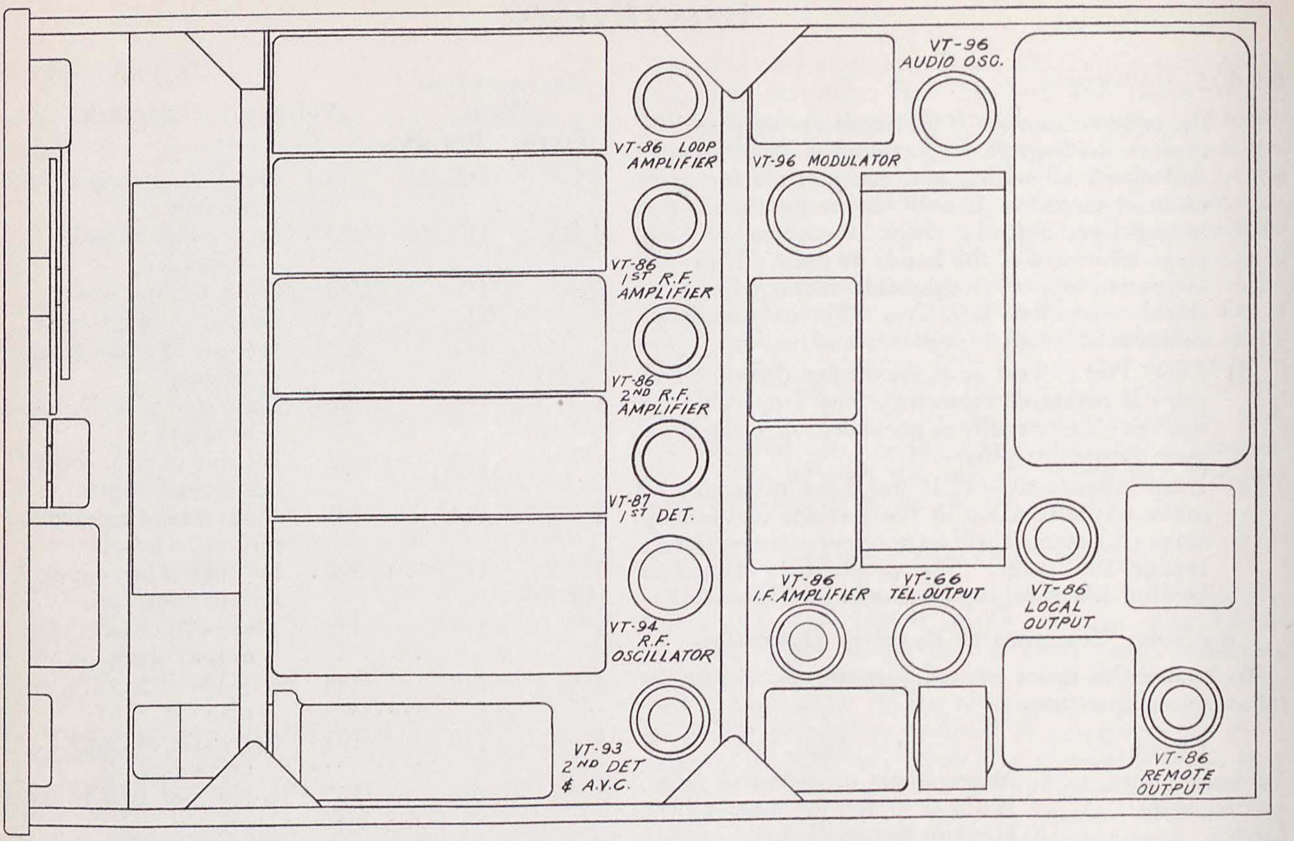
Voltages stated in the following tables apply for the following conditions. If values do not check within ± 10% of those stated, the associated circuits and components should be tested. The measurements should be made with a Western Model 665 Type 2 Analyzer, using the 250 volt scale for plate, screen, and dynamotor secondary voltages, and the 25 volt scale for primary supply voltages unless otherwise specified. Operate the equipment on LOCAL, COMP. Measure from the following measurement points to chassis unless otherwise stated.

TYPICAL CIRCUIT VOLTAGES

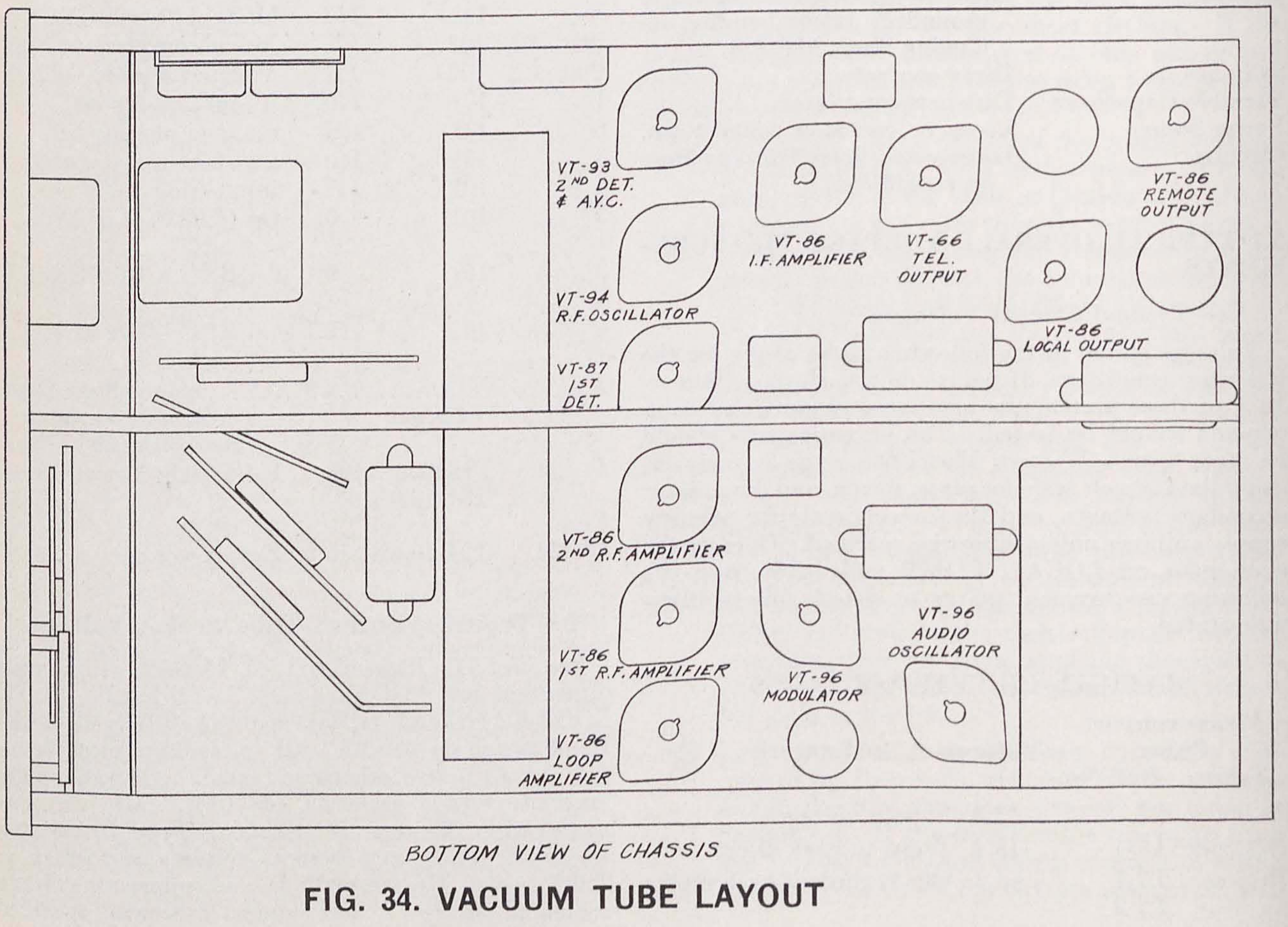
Measurement Point Term.	Ref. No.	Voltage	Remarks
E	PL-122	13.5	Supply voltage
Bat. side	L7-1	13.4	Input to hash filter
Between	L7-1 L7-2	13.2	One section of hash filter
+LV	DM-20	13.1	Dynamotor supply primary
+HV	DM-20	222.0	Dynamotor supply secondary
5	111	215	Input to filter choke
6	111	202	Output to filter choke
1	111	202	B+side of audio trans. primary.
2	111	190	Plate side of audio trans. primary.
1	112	202	B+side of rem. comp. output trans. pri.
2	112	185	Plate side of rem. comp. output trans. pri.
5	112	200	B+side of loc. comp. output trans. pri.
6	112	185	Plate side of loc. comp. output trans. pri.
4	110	163	B+side of 2nd I.F. trans. pri.
1	110	163	Plate side of 2nd I.F. trans. pri.
2	108	187	B+side of 1st I.F. trans. pri.
3	108	187	Plate side of 1st I.F. trans. pri.
B+	106	170	2nd R.F. transformer
B+	107	172	R.F. osc.
B+	102	127	Mod. plate coil C.T.
Plate #1	102	127	Modulator plate voltage
Plate #2	102	127	Modulator plate voltage
1	101	170	B+on phasing coil
6	101	169	Plate on phasing coil
3	101	146	Input from audio osc.
4	101	149	Input from audio osc.
5	101	0	On COMP. (Use 1V. scale)
5	101	0	On REC.ANT. (Use 1 V. scale)
5	101	0.1	On REC.LOOP (Use 1 V. scale)
4	VT-93 Socket	0.6	AVC diode voltage (Use 1.5 V. scale vacuum tube voltmeter)
J	PL-122 TM-180-B	198	B+marker beacon
Fuse FU-28	TM-180-B	13.5	Supply voltage

b—Typical Vacuum Tube Socket Voltages

See Fig. 34. Battery voltage, 14 volts. Equipment operating on LOCAL, COMP., THRES. SENS., LOOP GAIN, and AUDIO controls all fully clockwise. Band switch on Band 3. All voltages are measured to the chassis unless otherwise stated. Allowable tolerance of voltage variation, ± 10%. Measurements made with Western Model 665, Type 2 Selective Analyzer. Plate and screen voltages measured on 250 V. scale. Heater, cathode, and suppressor voltages measured on 10 V. scale unless otherwise specified.



TOP VIEW OF CHASSIS



BOTTOM VIEW OF CHASSIS

FIG. 34. VACUUM TUBE LAYOUT

6.7 b (continued)

Tube	Socket Term.	Element	Voltage	Remarks
VT-86 Loop	2 to 7	Heater	6.6	
	3	Plate	173.0	
	4	Screen	70.0	
	5	Suppressor	3.0	
	8	Cathode	3.0	
VT-86 1st R.F.	2 to 7	Heater	6.6	
	3	Plate	173.0	
	4	Screen	70.0	
	5	Suppressor	0	
	8	Cathode	3.0	
VT-86 2nd R.F.	2 to 7	Heater	6.6	
	3	Plate	173.0	
	4	Screen	70.0	
	5	Suppressor	0	
	8	Cathode	3.0	
VT-86 I.F.	2 to 7	Heater	6.5	
	3	Plate	163.0	
	4	Screen	110.0	
	5	Suppressor	0	
	8	Cathode	4.9	
VT-86 Remote Comp.	2 to 7	Heater	6.4	
	3	Plate	187.0	
	4	Screen	66	
	5	Suppressor	2.8	
	8	Cathode	2.8	
VT-86 Local Comp.	2 to 7	Heater	6.4	
	3	Plate	185.0	
	4	Screen	67.0	
	5	Suppressor	2.9	
	8	Cathode	2.9	
VT-96 Audio. Osc.	2 to 7	Heater	6.6	
	3	Plate (P2)	198.0	
	6	Plate (P1)	198.0	
	8	Cathode	1.1	
VT-96 Mod.	2 to 7	Heater	6.6	
	3	Plate (P2)	125.0	
	6	Plate (P1)	125.0	
	8	Cathode	8.4	
VT-87 1st Det.	2 to 7	Heater	6.55	
	3	Plate	187.0	
	4	Screen	85.0	
	8	Cathode	3.6	
VT-94 R.F. Osc.	2 to 7	Heater	6.55	
	3	Plate	58	
	8	Cathode	0	
VT-93 2nd Det.	2 to 7	Heater	6.5	
	3	Plate	82.0	
	6	Screen	82.0	
	8	Cathode	15.5	(Use 25 V. scale)
VT-66 Tel. Out.	2 to 7	Heater	6.4	
	3	Plate	190.0	
	4	Screen	200.0	
	8	Cathode	12.3	(Use 25 V. scale)

NOTE: When vacuum tube socket voltages are found to vary appreciably from the typical values given in the above table, the trouble can usually be located as described below:

(1) Heater Voltage High:—Heater burned out in one of the tubes in the same parallel connected group. See Fig. 45.

(2) Heater Voltage Low:—Dirty contacts on S7 or S8. Heater burned out in one of the tubes in the other parallel connected group.

(3) Plate Voltage High:—Shorted plate resistor. Open screen or cathode circuit.

(4) Plate Voltage Low:—Ground on plate lead. Defective screen or cathode bypass capacitor. Defective plate coupling capacitor.

(5) Screen Voltage High:—Shorted screen dropping resistor.

(6) Screen Voltage Low:—Defective screen or cathode bypass capacitor.

(7) Cathode Voltage High:—Open cathode resistor. R2 or R4-1B open. Poor contacts on S7. L2, L3 or L6 open.

(8) Cathode Voltage Low:—Defective cathode bypass capacitor or resistor.

c—Continuity Test of SCR-242-B

(1) Radio Compass Unit BC-310-B. Remove all vacuum tubes and PL-122 from BC-310-B. Plug Headset HS-18 into J1. Set front panel controls as follows:

Band Selector Switch to Band 1.

OFF-COMP.-REC.ANT.-REC.LOOP switch to COMP.

LIGHTS, AUDIO, and COMPASS to maximum clockwise positions.

LOCAL-REMOTE to LOCAL position.

THRES. SENS. and LOOP GAIN to maximum, clockwise positions.

Using Weston Model 665, Type 2 Analyzer, the following readings are typical for normal equipment. Readings are from terminal listed to chassis, unless otherwise stated:

PL-122 Socket Terminal	Operate and Return to Original Setting	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
A to ground	....	RX 1000	Open	C3-15 defective
B to ground	....	RX 10	230	Ref. No. 111, R34, J1, S6, S8-1E, or R4-1A defective.
B to ground	AUDIO Control	RX 100	810	
C to ground	....	RX 1000	Open	J1 defective
D to ground	....	RX 1000	Open	S7-C defective

6.7 c (continued)

PL-122 Socket Terminal	Operate and Return to Original Setting	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
E to ground	....	Direct	0.5	L7-1, L7-2, or DM-20 defective.
E to ground	Switch to OFF	RX 1000	Open	SB-1A defective
F to ground	....	Direct	0	Broken ground connection
G to ground	....	RX 1000	Open	S7-D defective.
G to ground	Switch to REMOTE	RX 10	82	Defective ant. relay coil.
H to ground	....	RX 1000	290,000	C5-3, R19-1, R22-3 defective.
J to ground	....	RX 100	580	Shorts or opens on B+ bus.
K to ground	Switch to REMOTE and LOOP GAIN to minimum setting	RX 1000 RX 1000	38,000 50,000	R1, R16-2, R21, R17-3, or R23 defective
L to ground	....	RX 1000	Open	S7-H defective
L to ground	Switch to REMOTE	RX 1000	175,000	C3-7, C3-10, C3-13, C3-14, R13-1, R26-1 or R2 defective
M to ground	....	RX 1000	Open	S7-G defective
M to ground	Switch to REMOTE	Direct	2.8	Band switch motor, S7-G, or S5-B defective
N to ground	....	RX 1000	Open	S7-F defective
N to ground	Switch to REMOTE	Direct	2.8	Defective S5-C
P to ground	....	RX 1000	Open	S7-E defective
P to ground	Switch to REMOTE	RX 1000	Open	S5-B, S5-C, or S6 defective
Q to ground	....	RX 1000	Open	S7-B defective
Q to ground	Switch to REMOTE	Direct	0.9	Hash filter or DM-20 defective
R to ground	....	RX 1000	Open	S7-A defective
R to ground	Switch to REMOTE	Direct	0.9	Hash filter or DM-20 defective
S to ground	....	RX 100	400	LB or DM-20 defective
T to ground	....	Direct	0.8	Hash filter or DM-20 defective
U to ground	....	RX 100	810	T16 defective
V to ground	....	RX 1000	Open	C3-6 or C8-2 defective
W to ground	....	RX 1000	Open	C3-5 or C8-1 defective
X to ground	....	RX 100	810	T17 defective

PL-108 Socket Terminal	Operate and Return to Original Setting	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
2 to ground	....	RX 1000	Open	Ground in wiring or S1-1A defective
3 to ground	....	Direct	0	Broken ground connection
4 to ground	....	RX 1000	Open	Ground in wiring or S1-1A defective

PL-119 Socket Terminal	Operate and Return to Original Setting	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
1 to ground	....	Direct	0	Broken ground connection
2 to ground	....	RX 1000	1 meg.	Ant. relay or R18 defective

(2) Radio Control Box BC-311-B. Set controls as follows:

Band Selector Switch to Band 1.

LIGHTS, COMPASS, and AUDIO to maximum clockwise positions.

Plug Headset HS-18 in J2.

OFF-COMP.-REC.ANT.-REC.LOOP switch on COMP.

Ref. No. 213 Plug Terminal	Operate and Return to Original Setting	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
A to ground	(Tuning meter will deflect full scale)	RX 100	0	Burned out tuning meter
B to ground	....	RX 10	143	S8-2E, R4-2A, or J2 defective
B to ground	AUDIO control off	RX 1000	100,000	R4-2A defective
B to ground	Switch to OFF	RX 1000	Open	S8-2E defective
C to S	....	RX 1000	Open	J2 defective
C to S	HS-1B removed from J2	Direct	0	J2 defective
D to ground	....	Direct	0	S8-2B defective

6.7 c (continued)

Ref. No. 213 Plug Terminal	Operate and Return to Original Setting	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
D to ground	Switch to OFF	RX 1000	Open	S8-2B defective
E to R	Switch to any operating position	Direct	0	S8-2A defective
E to R	Switch to OFF	RX 1000	Open	S8-2A defective
F to ground	....	Direct	0	Broken ground connection
G to ground	....	RX 1000	Open	S8-2C defective
G to ground	Switch to REC. ANT.	RX 1000	Open	S8-2C defective
G to ground	Switch to REC. LOOP	Direct	0	S8-2C defective
G to ground	Switch to OFF	RX 1000	Open	S8-2C defective
H to ground	....	Direct	0	R3-2 defective
H to ground	COMPASS Control	RX 1000	50,000	R3-2 defective
J to ground	....	RX 1000	Open	S10 defective
J to ground	MB TEST	Direct	0	S10 defective
K to ground	....	Direct	0	S8-2C defective
K to ground	Switch to REC. ANT.	Direct	0	S8-2C defective
K to ground	Switch to REC. LOOP	RX 1000	Open	S8-2C defective
K to ground	Switch to OFF	RX 1000	Open	S8-2C defective
L to ground	....	Direct	0	S8-2D defective
L to ground	AUDIO control off, switch to OFF, REC. ANT. or REC. LOOP	RX 1000	25,000	R4-2B defective
M to ground	....	RX 1000	Open	S9-2 defective
M to ground	Switch to Band 2	RX 1000	Open	S9-2 defective
M to ground	Switch to Band 3	Direct	0	S9-2 defective
N to ground	....	RX 1000	Open	S9-2 defective
N to ground	Switch to Band 2	Direct	0	S9-2 defective
N to ground	Switch to Band 3	RX 1000	Open	S9-2 defective
P to ground	....	Direct	0	S9-2 defective
P to ground	Switch to Band 2	RX 1000	Open	S9-2 defective
P to ground	Switch to Band 3	RX 1000	Open	S9-2 defective
R to ground — See "C"				
T to ground	....	Direct	30	1L1-3, 1L1-4, R8-3, R8-4, or R6-2 defective
T to ground	LIGHTS to off	Direct	Open	R6-2 defective

(3) Compass Indicator I-65-B. Remove Plug PL-118.

PL-118 Socket Terminal	Ohmmeter Scale Used	Resistance (Ohms)	Probable Cause of Incorrect Reading
2 to 4	RX 100	1950	Open moving coil
3 to 5	RX 100	1850	Open field coil or C11-1 defective
1 to 3	RX 100	925	One side of field coil open
1 to 5	RX 100	925	One side of field coil open
1-2-3-4-5 to ground	RX 1000	Open	Coils or wiring grounded

d—Circuit Analysis Using Test Set I-56-A

(1) General.—Before attempting to use Test Set I-56-A, the instructions should be carefully studied in the first five paragraphs of Detailed Tests on Radio Sets, Section III of the Instruction Book for Test Set I-56-A.

(2) Cable Tests.—If poor or erratic operation of the radio compass unit is noted, a continuity check on all plugs and connecting cables should first be made in accordance with paragraph 2 of the above reference.

(3) Tube Testing.—If all cable connections seem to be in good condition, the tubes should be tested on the Model 685 tube checker in accordance with paragraph 3 of the above reference and the following chart.

Tube Type	Filament Selector	Tube Selector	"IN" Position	2nd Plate
VT-66	6	41	BCD	–
VT-86	6	40	BCDE	–
VT-87	6	44	BCDE	–
VT-93	6	37	BEF (Pent. Sec.)	–
		0	C (Diode Sec.)	D
VT-94	6	41	BD	–
VT-96	6	41	BC	DF

(4) Voltage, Current and Resistance Measurements. If a test on all the tubes does not locate the trouble, voltage and current measurements should be made on the radio compass unit, using the Weston Model 665 Analyzer and Model 666 Socket Selector Unit. Set up the analyzer and socket selector block as indicated

6.7 d (4) (continued)

under paragraphs 3 and 4 of Section III of the Instruction Book for Test Set I56-A. The voltage, current and resistance values should check within 10% of those given in table 6.7 d (5), provided the following rules are observed:

Test Set I-56-A.—Place Model 666 Type 1B Socket Selector Block in pin jacks above the meter.

Keep AC-DC toggle switch on DC.

Place the other analyzer toggle switch on the "Volts-MA" position.

Connect short jumper cables from the selector block to the analyzer as indicated by the chart below.

Select proper meter scale, and read scale accurately.

Make all voltage measurements using the **outside** pin jacks of the selector block.

Insertion of a cable pin at the **inside** position produces an open circuit to provide for current measurements.

In general, it is more convenient to measure resistance values at the tube sockets. Resistance measurements are always made with the low voltage supply disconnected **and** the analyzer toggle switch in the "Ohms" position.

Radio Compass Unit.—Set up the radio compass unit without a vertical antenna or loop.

Use a supply voltage of 14 volts.

Set LOCAL-REMOTE switch in LOCAL position.

Set THRESH. SENS. control to the maximum clockwise position.

Set AUDIO control to the maximum clockwise position.

Set LOOP GAIN control to maximum clockwise position.

Set tuning controls at 150 Kc.; readings will deviate slightly when switching to other bands.

Slightly lower voltage values will be obtained with the LOCAL-REMOTE switch in the REMOTE position.

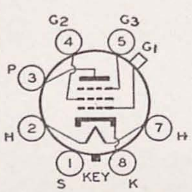
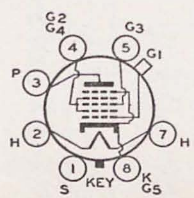
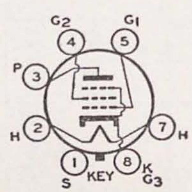
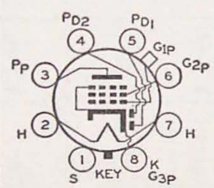
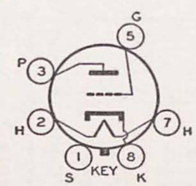
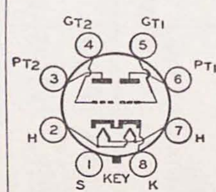
All plate and screen voltages are measured on the 250 V. scale.

All cathode voltages are measured on the scale indicated in the table below.

All current measurements are made on the lowest usable scale.

The metal tube shield connector of Test Set I-56-A must be grounded to chassis of the radio compass unit.

Tube Circuit Analysis Using Test Set I-56-A

TUBE TYPE	VT-86	VT-87	VT-66		VT-93		VT-94		VT-96	
	Block Term. Number	Connects to Analyzer Jacks	Block Term. Number	Connects to Analyzer Jacks	Block Term. Number	Connects to Analyzer Jacks	Block Term. Number	Connects to Analyzer Jacks	Block Term. Number	Connects to Analyzer Jacks
Plate Voltage	3 Gnd	+250 —V	3 Gnd	+250 —V	3 Gnd	+250 —V	3 Gnd	+250 —V	3 Gnd 6 Gnd	+250 —V +250 —V
Plate Current	3 outside 3 inside	+5 Ma —Ma	3 outside 3 inside	+25 Ma — Ma	3 outside 3 inside	+5 Ma — Ma	3 outside 3 inside	+5 Ma — Ma	3 outside 3 inside 6 outside 6 inside	+10 Ma — Ma +10 Ma — Ma
Screen Voltage	4 Gnd	+250 —V	4 Gnd	+250 —V	6 Gnd	+250 —V	....		....	
Screen Current	4 outside 4 inside	+1 Ma —Ma	4 outside 4 inside	+5 Ma — Ma	6 outside 6 inside	+2.5 Ma — Ma	....		....	
Cathode Voltage	8 Gnd	+5 —V	8 Gnd	+25 —V	8 Gnd	+25 —V	8 Gnd	+5 —V	8 Gnd	+10 —V
Diode Voltage	....		....		No Voltage with No Signal		....		....	
Diode Current	....		....		Static Current Too Low to Measure		....		....	
Base Diagram	 VT-86	 VT-87	 VT-66		 VT-93		 VT-94		 VT-96	

6.7 d (continued)

(5) Voltage, Current and Resistance Values Using Weston Mod. 666 Type 1B Socket Selector Block
(Part of Test Set I-56-A)

Tube Function	Type	Plate			Screen			Heater	Control Grid	Suppressor Grid		Cathode	
		Volts	MA.	Ohms	Volts	MA.	Ohms	Volts	Ohms	Volts	Ohms	Volts	Ohms
Loop Amp.	VT-86	170	4.6	5,800	74	.91	105,000	6.7	4.8	2.95	600	2.95	600
1st R.F.	VT-86	176	4.65	5,000	75	.94	105,000	6.8	1 Meg	0	0	3.1	600
2nd R.F.	VT-86	176	4.6	5,400	76	.94	105,000	6.8	1 Meg	0	0	3.1	620
I.F. Amp.	VT-86	185	3.0	5,500	157	1.3	50,000	6.7	1 Meg	0	0	2.2	600
Local Ind. Output	VT-86	190	4.5	3,200	68	.85	140,000	6.6	50,000	2.8	600	2.5	600
Remote Ind. Output	VT-86	190	4.8	3,200	68	.83	150,000	6.6	44,000	2.8	600	2.8	600
Audio Osc.	VT-96	202 202	5.3 5.5	2,800 2,800	..	..	...	6.7	49,000 48,000	..	..	1.05	Open
Mod.	VT-96	132 132	.08 .08	95,000 95,000	..	..	...	6.6	500,000 500,000	..	..	8.0	9,000
										Mixer	Grid		
Mixer	VT-87	190	3.3	5,500	90	3.65	22,500	6.6	1 Meg	..	52,000	3.75	630
R.F. Osc.	VT-94	80	2.5	50,000	..	..	...	6.6	50,000	..	..	0	0
2nd Det.	VT-93	83	3.75	25,500	83	1.05	25,500	6.6	400,000	Pin 4 Diodes Pin 5	1 Meg 300,000	15	*3,000
Audio O.P.	VT-66	188	22.0	1,000	198	3.4	500	6.3	350,000	..	..	12.2	500

*Use RX 1000 Scale on Ohmmeter to avoid damaging Tuning Meter.

6.7 **d** (continued)

(6) Inductance and Transformer Data

Ref. No.	Name	Part of Ref. No.	Winding Nos.	D.C. Res. Ohms	Tol. ±%	Inductance	Tol. ±%	Q	Tol. ±%	Measurement Frequency
L1	Loop Phaser	101	3-4	85	10%	20.5 mh	1%	78	5%	75 kc.
L2	I.F. Trap (1st R.F. Cathode)	104	3-4	1.2	10%	412 uh	1%	150	5%	112.5 kc.
L3	I.F. Trap (2nd R.F. Cathode)	104	3-4	1.0	10%	412 uh	1%	150	5%	112.5 kc.
L4-1	1st Det. Plate	108	3-4	25.0	10%	8940 uh	1%	132	5%	112.5 kc.
L4-2	I.F. Plate	110	3-4	25.0	10%	8940 uh	1%	132	5%	112.5 kc.
L5-1	I.F. Grid	108	3-4	25.0	10%	8940 uh	1%	132	5%	112.5 kc.
L5-2	2nd Det. Aud. Diode	110	3-4	25.0	10%	8940 uh	1%	132	5%	112.5 kc.
L6	122.5 kc. Trap (I.F. Cathode)	109	5-6	1.0	10%	82.2 uh	1%	128	10%	112.5 kc.
L7-1	R.F. Choke Dynamotor L.V.	113	..	.06	10%	40 uh	..	..	..	1000 c.p.s.
L7-2	R.F. Choke Dynamotor L.V.	113	..	.06	10%	40 uh	..	..	..	1000 c.p.s.
L8	R.F. Choke Dynamotor H.V.	113	..	40	10%	24.2 mh	..	..	..	1000 c.p.s.
L9	Filter Choke Dynamotor H.V.	111	5-6	160	5%	6 H at 100 ma.	..	..	..	1000 c.p.s.
L10	Low Pass Audio Filter	111	Refer T15							
T1	Loop Stage Trans. (150-325 kc)	100	4-5	0.2	10%	23 uh	5%	..	..	1000 c.p.s.
	(Secondary)	..	2-3	14.5	10%	2980 uh	1%	141	5%	150 kc.
T2	Loop Stage Trans. (325-695 kc)	100	4-5	0.2	10%	20 uh	5%	..	..	1000 c.p.s.
	(Secondary)	..	2-3	6.0	10%	664 uh	1%	152	5%	300 kc.
T3	Loop Stage Trans. (695-1500 kc)	100	2-3	0.2	10%	17 uh	5%	..	..	1000 c.p.s.
	(Secondary)	..	4-5	1.6	10%	145 uh	1%	212	5%	700 kc.
T4	Ant. Stage Trans. (150-325 kc)	102	3-5	0.5	10%	3 uh	5%	..	..	1000 c.p.s.
	(Secondary)	..	2-6	15.2	10%	2390 uh	1%	130	5%	150 kc.
	(Tertiary)	..	4-6	200.0	5%	49.5 mh	5%	35	..	50 kc.
T5	Ant. Stage Trans. (325-695 kc)	102	3-5	0.5	10%	4.5 uh	5%	..	..	1000 c.p.s.
	(Secondary)	..	1-2	5.5	10%	500 uh	1%	132	5%	300 kc.
	(Tertiary)	..	1-6	80	10%	11.5 mh	5%	48	..	75 kc.
T6	Ant. Stage Trans. (695-1500 kc)	102	2-4	1.6	10%	7 uh	5%	..	..	1000 c.p.s.
	(Secondary)	..	5-6	1.0	10%	109.6 uh	1%	195	5%	700 kc.
	(Tertiary)	..	1-6	33.0	10%	2257 uh	5%	78	10%	200 kc.
T7-1	1st R.F. Stage Trans. (150-325 kc)	105	4-5	130	5%	24.5 mh	5%	36	10%	50 kc.
	(Secondary)	..	2-3	11.2	10%	2370 uh	1%	137	5%	150 kc.
T7-2	2nd R.F. Stage Trans. (150-325 kc.)	106	Same as T7-1							

6.7 d (6) Inductance and Transformer Data—(continued)

Ref. No.	Name	Part of Ref. No.	Winding Nos.	D.C. Res. Ohms	Tol. ±%	Inductance	Tol. ±%	Q	Tol. ±%	Measurement Frequency
T8-1	1st R.F. Stage Trans.									
	(325-695 kc.)........	105	4-5	80	10%	12.7 mh	5%	46	10%	75 kc.
	(Secondary)..........	..	2-3	5.0	10%	499 uh	1%	122.5	5%	300 kc.
T8-2	2nd R.F. Stage Trans.									
	(325-695 kc.)........	106	Same as T8-1							
T9-1	1st R.F. Stage Trans.									
	(695-1500 kc.).......	105	2-3	34.0	10%	2546 uh	5%	58	10%	200 kc.
	(Secondary)..........	..	4-5	1.0	10%	109.5 uh	1%	215	5%	700 kc.
T9-2	2nd R.F. Stage Trans.									
	(695-1500 kc.).......	106	Same as T9-1							
T10	R.F. Osc. Trans.									
	(150-325 kc.)........	107	3-4	2.6	10%	105 uh	5%	..	..	1000 c.p.s.
		..	2-5	10.2	10%	1338 uh	1%	113	10%	200 kc.
T11	R.F. Osc. Trans.									
	(325-695 kc.)........	107	3-4	1.6	10%	50 uh	5%	..	..	1000 c.p.s.
		..	2-5	3.0	10%	373 uh	1%	112	10%	400 kc.
T12	R.F. Osc. Trans.									
	(695-1500 kc.).......	107	3-4	1.0	10%	25 uh	5%	..	..	1000 c.p.s.
		..	2-5	1.0	10%	96.2 uh	1%	93	10%	800 kc.
T13	I.F. Input Coupler.....	108	..	Refer to L4-1 and L5-1						
T14	I.F. Output Coupler....	110	..	Refer to L4-2 and L5-2						
T15	Tel. Output Trans......	111	1-2	400	5%	......	..	..	..	......
	(Secondary)..........	..	3-4	800	(Includes L10 and 8000 ohm shunt res.)					
T16	Remote Comp. Ind.									
	Output Trans........	112	1-2	2800	5%	......	..	..	..	......
	(Secondary)..........	..	3-4	780	5%	......	..	..	..	......
T17	Local Comp. Ind.									
	Output Trans........	112	5-6	2800	5%	......	..	..	..	......
		..	7-8	780	5%	......	..	..	..	......

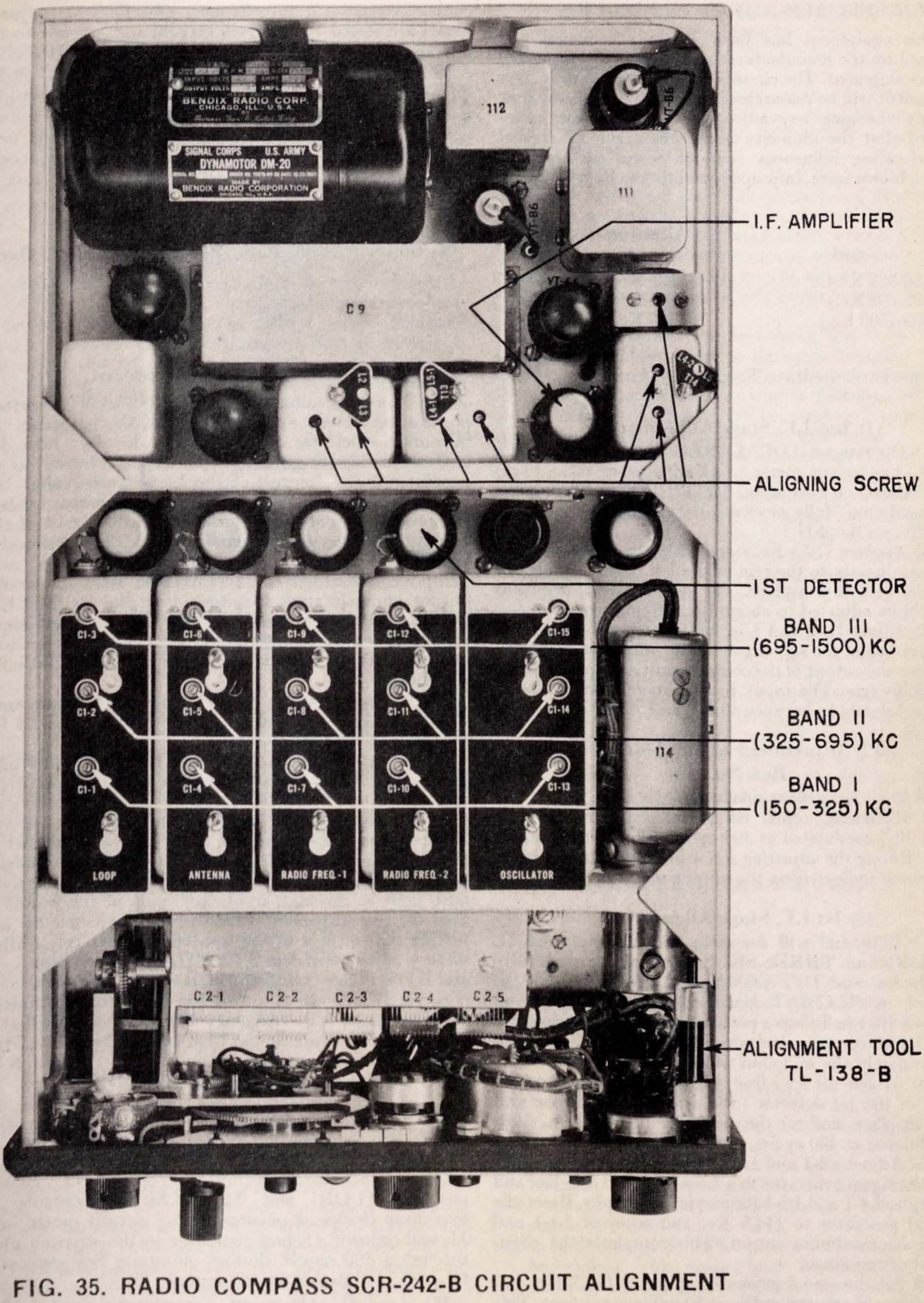


FIG. 35. RADIO COMPASS SCR-242-B CIRCUIT ALIGNMENT

6.8 CIRCUIT ALIGNMENT PROCEDURE

This equipment has been carefully adjusted and aligned by the manufacturer and thoroughly inspected before shipment. The circuits are designed so that their alignment will be maintained over long periods of time. Before changing any adjustments it must be ascertained that the difficulty is not the result of normal deteriorating influences such as worn out vacuum tubes, blown fuses, improper operating voltages, broken cords, external r.f. interference, etc. Factory adjustments are sealed with purple glyptal and are not to be altered unless absolutely necessary. **DO NOT CHANGE ANY COIL ADJUSTMENTS ON LOOP, R.F. OSCILLATOR, OR R.F. ASSEMBLIES.** Any questionable performance characteristics should be measured in accordance with Paragraph 6.9 before and after adjustment. All aligning adjustments are accessible from the top of the chassis (See Fig. 35) and are:

Band	Aligning Frequency	Loop	Antenna	First R.F.	Second R.F.	R.F. Osc.
(150-325 Kc.)	325 Kc.	C1-1	C1-4	C1-7	C1-10	C1-13
(325-695 Kc.)	695 Kc.	C1-2	C1-5	C1-8	C1-11	C1-14
(695-1500 Kc.)	1500 Kc.	C1-3	C1-6	C1-9	C1-12	C1-15

a—Intermediate Frequency Amplifier Alignment

(1) 2nd I.F. Stage Alignment

(a) Operate on LOCAL, REC. ANT., and plug a 4000 ohm output meter in J1 with other jacks open. Set AUDIO on maximum. Set THRES.SENS. control on maximum (fully clockwise). Set the tuning dial to 695 Kc. on Band II.

(b) Apply a 112.5 Kc. signal, 30% modulated at 400 cycles, directly to the grid of the I.F. tube, leaving the regular grid clip in place. The signal generator output should be adjusted to about 100,000 microvolts.

(c) Adjust L4-2 and L5-2 of T14 for maximum output, reducing the signal generator voltage as necessary to keep the output of the compass unit at approximately 50 milliwatts. The input to this stage when properly aligned should be between 40,000 and 50,000 microvolts.

(2) Adjustment of I.F. Sideband Trap, Ref. No. 109.

With all equipment connected the same as for 2nd I.F. Alignment, adjust the signal generator to 122.5 Kc., 30% modulated at 400 cycles, and an output of 1 volt. Rotate the adjusting screw in L6 until **minimum** output is indicated on the output meter.

(3) 1st I.F. Stage Alignment.

(a) With dial still tuned to 695 Kc. on Band II, AUDIO and THRES.SENS. controls turned fully clockwise, and OFF-COMP.-REC.ANT.-REC.LOOP switch on REC.ANT. position, first adjust the iron core of L4-1 in T13 to a position one revolution from its maximum counter clockwise rotation and L5-1 to approximately the midpoint of its rotation limits.

(b) Attach the lead from the signal generator to the grid of the 1st detector tube, leaving the regular grid clip in place, and set the generator to 114.5 Kc., 30% modulated at 400 cycles, and an output of 1000 microvolts. Adjust L4-1 and L5-1 for maximum output. Reset the signal generator to a frequency of 110.5 Kc. and readjust L4-1 and L5-1 for maximum output. Reset the signal generator to 114.5 Kc. and readjust L4-1 and L5-1 for maximum output. This completes the alignment of this stage.

(c) Set the signal generator again at 112.5 Kc. and check the input required for a 50 milliwatt output. This input should be approximately 500 microvolts.

b—R.F. Oscillator Alignment.

(1) Operate compass unit on REC.ANT. switch position; AUDIO and THRES.SENS. controls at maximum clockwise positions, plug headset into J1, and couple signal generator (hereafter referred to as generator No. 1) to grid of the 1st detector tube.

(2) Loosely couple a second signal generator, (hereafter referred to as generator No. 2) to the grid of the I.F. tube. Adjust to frequency of 112.5 Kc., unmodulated.

(3) Set generator No. 1 to 1500 Kc., 1000 microvolts output, unmodulated. Rotate tuning dial to 1500 Kc. on Band III and adjust generator No. 2 to sufficient output to cause a heterodyne beat note to become audible in the headphones. Rotate trimmer C1-15 for zero beat.

(4) Set generator No. 1 to 695 Kc. and compass unit dial to 695 Kc. on Band II. Adjust trimmer C1-14 for zero beat in the headphones.

(5) Set generator No. 1 to 325 Kc. and compass unit dial to 325 Kc. on Band I. Adjust trimmer C1-13 for zero beat in the headphones. NOTE: If subsequent sensitivity measurements indicate poor tracking at the low frequency ends of any of the bands, adjustment of the oscillator coil inductance on one or more bands will be necessary. The same equipment setup and procedure used at the high frequency ends of the bands is used for this alignment which is accomplished by adjusting the settings of the iron core screws (glyptalled factory adjustments) in T10, T11, or T12 (Bands I, II and III oscillator transformers, respectively) as the case may be. If any alteration of the oscillator coil inductance is made, it is necessary to repeat the oscillator alignment procedure at the high frequency ends of the band or bands in question, as outlined in Paragraph **b**, "R.F. Oscillator Alignment," of this section.

c—1st and 2nd R.F. Amplifier and Antenna Stage Alignment.

(1) Operate compass unit on REC.ANT. switch position, AUDIO and THRES.SENS. controls at maximum clockwise positions, plug output meter into J1, and connect a signal generator to the antenna plug through a 100 mmfd. dummy antenna. Set generator for 30% modulation at 400 cycles.

(2) Band III Alignment. Set compass unit tuning dial to 1500 Kc. on Band III, and adjust signal gen-

6.8 c (2) (continued)

erator to 1500 Kc. and whatever output is necessary to produce less than 50 milliwatts output. Adjust trimmers C1-12, C1-9 and C1-6 for maximum output, reducing the input from the signal generator as much as necessary to keep the output approximately 50 milliwatts. Set signal generator output at 10 microvolts and reduce the AUDIO control setting to the point at which slightly less than 50 milliwatts output is obtained and "touch up" trimmers C1-12, C1-9 and C1-6 for maximum output.

(3) Band II Alignment. Set compass unit tuning dial to 695 Kc. on Band II, reset AUDIO control to maximum clockwise setting, and adjust the signal generator to 695 Kc. and whatever output is necessary to produce less than 50 milliwatts output. Adjust trimmers C1-11, C1-8 and C1-5 for maximum output. Set signal generator output at 10 microvolts and reduce the AUDIO control setting to the point at which slightly less than 50 milliwatts output is obtained and "touch up" trimmers C1-11, C1-8 and C1-5 for maximum output.

(4) Band I Alignment. Set the compass unit tuning dial to 325 Kc. on Band I, reset AUDIO control to maximum clockwise setting, and adjust the signal generator to 325 Kc. and whatever output is necessary to produce less than 50 milliwatts output. Adjust trimmers C1-10, C1-7 and C1-4 for maximum output. Set signal generator output at 10 microvolts and reduce the AUDIO control setting to the point at which slightly less than 50 milliwatts output is obtained and "touch up" trimmers C1-10, C1-7 and C1-4 for maximum output.

d—Threshold Sensitivity Control Adjustment

Set the compass unit AUDIO control to its maximum clockwise position, band switch to Band I and tune from one end of the band to the other, first shorting the antenna terminal to ground through a 100 mmfd. capacitor. Note the amount of noise power output on the output meter. Adjust the THRES.SENS. control to the point at which the noise does not exceed 25 milliwatts at any point in Band I. Now check the low, middle and high frequency points of all three bands to see whether a signal of 5 microvolts or less introduced to the antenna terminal through a 100 mmfd. capacitor will produce an output of 50 milliwatts. If not, check the compass unit for excessive noise and after locating the cause, reset the THRES.SENS. control for 25 milliwatts maximum noise power output on Band I as outlined above.

e—Adjustment of I.F. Rejection Trap

Connect the signal generator to the compass unit antenna plug through a 100 mmfd. capacitor, set tuning dial to 150 Kc. on Band I, and adjust the signal generator to 150 Kc. 30% modulation at 400 cycles, attenuator at 4 microvolts. Adjust the audio control to the point at which 50 milliwatts output is obtained.

Reset the signal generator to 110.5 Kc. and adjust the input to 1 volt. Leaving the generator set, adjust the iron core L3, part of Ref. No. 104, until minimum output is obtained. Readjust the signal generator frequency to 114.5 Kc. and adjust the iron core L2 for minimum output. With these adjustments made as described there should not be over 30 milliwatts of power output with 1 volt of input.

f—Loop Alignment

(1) Set up the equipment as illustrated in Figure 25. Turn the loop parallel to the transmission line and set the OFF-COMP.-REC.ANT.-REC.LOOP switch to the REC.LOOP position.

(a) Tune the compass unit to 1500 Kc. on Band III and adjust the signal generator to the same frequency and for an input to the loop of approximately 100 microvolts per meter, 30% modulated at 400 cycles. Adjust C1-3 for maximum indication on the output meter (or maximum swing of the tuning meter), adjusting AUDIO control knob to maintain output meter reading below 50 milliwatts.

(b) Switch to Band II and set tuning dial at 695 Kc. Adjust the signal generator to the same frequency and an input to the loop of approximately 100 microvolts per meter. Adjust C1-2 for maximum indication on the output meter, adjusting AUDIO control knob to maintain output meter reading below 50 milliwatts.

(c) Switch to Band I and set the tuning dial to 325 Kc. Adjust the signal generator to the same frequency and an input to the loop of approximately 100 microvolts per meter. Adjust C1-1 for maximum indication on the output meter, adjusting AUDIO control knob to maintain output meter reading below 50 milliwatts.

(2) If the loop sensitivity is unsatisfactory at the low frequency end of any band or bands, it will be necessary to readjust the inductance of the loop coils, T1, T2 and T3. This may be accomplished by repeating the procedure outlined in 1 (a), (b) and (c) of this Section (6.8 f), adjusting the iron cores, which have been glyptalled in place at the factory, for maximum indication on an output meter. These adjustments should be made at the low frequency ends of the three bands (695 Kc., 325 Kc., and 150 Kc.). If it is necessary to change the settings of any of these core adjustments, it will be very important to readjust the loop trimmers C1-1, C1-2 and C1-3 as outlined in f (1)—(a), (b) and (c) above.

6.9—OVERALL PERFORMANCE TESTS

a—General

If at any time the operation of the equipment is questionable, its performance should be measured in accordance with this paragraph. After making any major repairs or adjustments, the performance should be remeasured to insure that the adjustments have been properly made.

b—Standard Test Conditions

For these tests the following conditions should be maintained unless otherwise stated:

Signal to Noise Ratio—4 to 1 in power, 2 to 1 in voltage. The noise output is 12.5 milliwatts when standard output is 50 milliwatts or 7 volts when standard output is 14.1 volts.

Standard Output: 50 milliwatts or 14.1 volts (signal and noise). This output may be obtained from either local, remote, or junction box jacks with plugs out of all other jacks. When operating at local position turn remote switch to "OFF" or if at

6.9 **b** (continued)

remote position turn local switch to "OFF." On receiver operation adjust AUDIO control for standard signal to noise ratio. On compass operation adjust AUDIO control for maximum output.

Artificial Antenna: Receiver, 100 mmf; Compass, 100 mmf. and one-half meter effective height.

Standard Modulated Signal 30% 400 cycles.

Warm up period—20 minutes.

Low voltage supply—14 volts.

c—Sensitivity REC.ANT.

Set threshold sensitivity maximum. Apply standard modulated signal to antenna terminal (Plug PL-119, Connector No. 2) through artificial antenna. Set input at approximately 5 microvolts. Tune radio compass unit carefully to resonance. Cut off modulation, leaving carrier on. Set AUDIO control to obtain 12.5 milliwatts average noise output. Turn modulation on and set input to value to give 50 milliwatts output. Remove modulation and reset AUDIO control to obtain 12.5 milliwatts average noise output. Repeat until 50 milliwatts output is obtained with modulation on and 12.5 milliwatts noise with modulation off. Repeat the above procedure for each test frequency. Record on form similar to that contained in paragraph 6.9 1.

d—Noise Level

Operate on REC.ANT. position, AUDIO control maximum, and with THRES.SENS. control adjusted as described in section 6.8 d. Connect antenna terminal (PL-119, Connector No. 2) to ground through artificial antenna. Care should be taken to shield the radio compass unit and artificial antenna connection against pickup. Tune equipment throughout frequency range. Record maximum noise level at frequencies contained in paragraph 6.9 1. Minimum noise level can be measured by operating on REC.ANT. and turning AUDIO control to minimum. Levels greater than 0.050 milliwatts indicate trouble in dynamotor, filtering, or 2nd detector and audio circuits.

e—Intermediate Frequency Rejection Ratio

Measure REC.ANT. sensitivity at desired test frequency. Set signal generator at point of greatest response near 112.5 Kc. and increase attenuator output until 50 milliwatts is obtained. The ratio of the attenuator setting at 112.5 Kc. and at test frequency is the rejection ratio. Record on form similar to that contained in paragraph 6.9 1 after dividing by 1000. NOTE: The harmonics of the signal will appear in the frequency range of the equipment (i.e. 225, 337.5 etc.). To avoid response from harmonics select a test frequency half way between the harmonics.

f—Image Rejection Ratio

Measure REC.ANT. sensitivity of equipment first at desired test frequency and again with signal generator set 225 Kc. above test frequency. Do not disturb tuning of equipment but vary signal generator frequency slightly until maximum response is obtained. Divide this ratio by 1000 and record on form similar to paragraph 6.9 1.

g—AVC Action

Operate on REC.ANT., AUDIO control maximum. Apply standard modulated signal to antenna terminal through 100 mmf. antenna. Record milliwatts output against microvolts input on form similar to paragraph 6.9 1. Test frequency generally used is 655 Kc.

h—Selectivity, REC. ANT.

Measure REC. ANT. sensitivity of equipment at test frequency. Increase signal generator attenuator so that output is 10, 100, 1000, and 10,000 times the sensitivity measured. For each increase in input vary signal generator frequency above and below resonance and record on form similar to paragraph 6.9 1. The worst selectivity will generally be at 1500 Kc.

i—Sensitivity, REC. LOOP

Mount loop beneath Reference Transmission Line. Operate on REC.LOOP position. Turn loop for maximum pickup. Adjust AUDIO control for signal to noise ratio of 4 to 1 as done for REC.ANT. sensitivity measurement of paragraph 6.9 (c). Record microvolts per meter field strength at center of loop for standard output on form similar to paragraph 6.9 1.

j—Compass Sensitivity Uniformity and Accuracy

Mount loop beneath Reference Transmission Line. Operate on COMP. Use 100 mmf., 0.5 meter, artificial antenna. Adjust COMPASS control so that 15 degrees rotation of loop produces full scale indicator deflection, with an input of 800 Kc. 1000-uv/m at center of loop. Without changing COMPASS control, record the degrees rotation of loop required to produce 0 and full scale right and left indicator pointer deflection, for 20, 100, 1,000, 100,000 microvolts per meter input at different test frequencies.

k—Input for Full Scale Indicator Deflection (F.S.I.D.)

This test requires a well shielded room. Mount loop beneath Reference Transmission Line. Turn loop to 90 degrees, COMPASS control on maximum. Record microvolts per meter at center of loop required for full scale indicator deflection on form similar to paragraph 6.9 1.

6.9 1—Normal Performance Characteristics. The Following Performance Characteristics are the Average of a Number of Production Tests. Any Equipment Whose Performance is as Stated Below is Considered Satisfactory.

Radio Compass SCR-242-B Ser. No. Dynamotor No. Testman Date

Ref. Par. No.	Test Point			1-L	1-M	1-H	2-L	2-M	2-H	3-L	3-M	3-H
	Test Freq. (Kc)			155	240	320	330	510	655	710	1100	1475
6.9 c	REC. ANT. Sensitivity (uv)			4.3	3.6	3.6	3.9	3.4	3.0	3.6	3.0	2.8
6.9 d	Noise Level (mw)			3.5	10.2	8.7	1.7	1.3	.4	0	0	0
6.9 e	I.F. Rej. Ratio (x1000)			*600	*600	*600	280	400	450	*600	*800	*800
6.9 f	Image Rej. Ratio (x1000)			*600	*600	*600	*600	*600	265	425	80	19
6.9 i	Loop Sens. (uv)			11.6	10.1	12.1	12.2	12.7	12.7	17.6	16.5	16.8
	Compass Sensitivity Uniformity Accuracy	20	0	0±1	0±1	0±1	0	0	0	0	0	0
			R	13.3	12.0	14.6	14.8	14.8	14.5	23.3	19.1	18.8
			L	13.1	12.1	15.2	15.3	15.3	15.1	22.9	19.5	19.5
		100	0	0	0	0	0	0	0	0	0	0
			R	11.7	9.7	11.8	11.8	12.1	11.9	16.3	16.3	16.2
			L	11.6	10.1	12.1	12.3	12.7	12.7	17.5	16.4	16.6
		1000	0	0	0	0	0	0	0	0	0	0
			R	10.1	8.8	10.7	10.7	10.9	10.3	15.1	14.6	14.3
			L	10.4	9.0	10.7	11.3	11.4	11.5	15.4	14.3	14.7
		100,000	0	0	0	0	0	0	0	0	0	0
			R	8.2	7.2	8.5	8.7	9.7	8.5	12.8	12.8	12.2
			L	8.6	7.4	9.0	9.1	10.3	9.6	12.8	12.7	12.5
6.9 k	Input for F.S.I.D. (uv)			1.2	1.0	2.3	1.7	2.2	1.6	1.4	1.7	1.5
6.9 g	AVC Action (uv)			2	5	8	10	100	1000	0.01 V	0.1 V	0.5 V
	Mod. 30% Test Freq. 655 (Kc) (mw)			35	100	130	150	230	305	400	515	580
6.9 h	REC. ANT. Selectivity			10 X LO	10 X HI	100 X LO	100 X HI	1000 X LO	1000 X HI	10000X LO	10000 X HI	
	(Test Freq. 655 Kc)			3.2	3.2	4.4	4.4	6.1	5.1	7.7	5.9	

Note: * Refers to "greater than"

6.9 m—Minimum Performance Characteristics. The tolerances stated herein are very broad to allow for error in measurements, noisy location and inaccuracies in test equipment. When equipment measures worse than the limits stated, the method of testing and test equipment should first be investigated. The next step is to investigate the trouble in the equipment as discussed in Par. 6.5, 6.6, 6.7, and 6.8.

Radio Compass SCR-242-B Serial No. Dynamotor No. Testman Date

Ref. Par. No.	Test Point			1-L	1-M	1-H	2-L	2-M	2-H	3-L	3-M	3-H
	Test. Freq (Kc)			155	240	320	330	510	655	710	1100	1475
6.9 c	REC. ANT. Sensitivity (uv)			Not worse than 10 microvolts								
6.9 d	Noise Level (mw)			Not worse than 50 milliwatts								
6.9 e	I.F. Rej. Ratio			Not less than 100,000 to 1								
6.9 f	Image Rej. Ratio			← Not less than 100,000 to 1 →							Not less than 5000/1	
6.9 i	Loop Sens. (uv)			Not worse than 50 microvolts								
6.9 j	Compass Sensitivity Uniformity Accuracy	20	0	Not more than ± 2 degrees								
			R L	Not more than 90 degrees loop rotation								
		100	0	Not more than ± 1 degree								
			R	Not more than 30 degrees loop rotation								
		1000	0	Not more than ± 1 degree								
			R L	Not more than 30 degrees loop rotation								
		100,000	0	Not more than ± 1 degree								
			R L	Not more than 30 degrees loop rotation								
6.9 k	Input for F.I.S.D. (uv)			Not worse than 20 microvolts								
6.9 g	AVC Action (uv) Mod. 30%			2	5	8	10	100	1000	0.01 V	0.1 V	0.5 V
	Test Freq. 655 (Kc) (mw)			*	*	*	150 ±50	230 ±50	305 ±75	400 ±100	515 ±125	580 ±150
6.9 h	REC. ANT. Selectivity Not Worse Than (Test Freq. 1475kc)			10 X LO 4	10 X HI 5.6	100 X LO 7	100 X HI 7	1000 X LO 8.0	1000 X HI 8.0	10000 X LO 9.5	10000 X HI 9.5	

*Due to the great effect of small variations in sensitivity, AVC limits are not properly applicable in this range of input signal strength.

7.0 APPENDIX

7.1 Reference List—Units and Parts of Units. Refer to Par. 7.3 Notes to Reference List

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
		RADIO COMPASS UNIT BC-310-B			AR-95218-1 AN90280-1 AN90281-1
C1-1	Loop Stage Trimmer Capacitor Band 1	6 to 25 mmf. ±10%, 500 volt, variable capacitor, part of Ref. No. 100			
C1-2	Loop Stage Trimmer Capacitor Band 2	Same as C1-1, part of Ref. No. 100			
C1-3	Loop Stage Trimmer Capacitor Band 3	Same as C1-1, part of Ref. No. 100			
C1-4	Ant. Stage Trimmer Capacitor Band 1	Same as C1-1, part of Ref. No. 102			
C1-5	Ant. Stage Trimmer Capacitor Band 2	Same as C1-1, part of Ref. No. 102			
C1-6	Ant. Stage Trimmer Capacitor Band 3	Same as C1-1, part of Ref. No. 102			
C1-7	1st R.F. Stage Trimmer Capacitor Band 1	Same as C1-1, part of Ref. No. 105	Hammarlund	Special	QB7751A-25
C1-8	1st R.F. Stage Trimmer Capacitor Band 2	Same as C1-1, part of Ref. No. 105			
C1-9	1st R.F. Stage Trimmer Capacitor Band 3	Same as C1-1, part of Ref. No. 105			
C1-10	2nd R.F. Stage Trimmer Capacitor Band 1	Same as C1-1, part of Ref. No. 106			
C1-11	2nd R.F. Stage Trimmer Capacitor Band 2	Same as C1-1, part of Ref. No. 106			
C1-12	2nd R.F. Stage Trimmer Capacitor Band 3	Same as C1-1, part of Ref. No. 106			
C1-13A	R.F. Osc. Trimmer Capacitor Band 1	Same as C1-1, part of Ref. No. 107			
C1-14A	R.F. Osc. Trimmer Capacitor Band 2	Same as C1-1, part of Ref. No. 107	Hammarlund	Special	QB7783A-25
C1-15A	R.F. Osc. Trimmer Capacitor Band 3	Same as C1-1, part of Ref. No. 107			
C2-1	Loop Stage Gang Tuning Capacitor				
C2-2	Ant. Stage Gang Tuning Capacitor	5 Section variable capacitor 400 mmf. per section, max. 20 mmf. per section, min. Tolerance per section ±0.3% of sum of max. +100 mmf. or min. +100 mmf.	R.C.C.	Special	QF8489H
C2-3	1st R.F. Stage Gang Tuning Capacitor				
C2-4	2nd R.F. Stage Gang Tuning Capacitor				
C2-5	H.F. Osc. Stage Gang Tuning Capacitor				
C3-1	Loop Amp. Cathode Bypass Capacitor				
C3-2	Loop Amp. Plate Bypass Capacitor	Three section oil filled paper capacitor with side terminals. .1 mfd., ±10% 400 volt, per section	Aerovox	Special	QE11347-1A
C3-3	Loop Amp. Screen Bypass Capacitor				

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
C3-4	Mod. Cathode Bypass Capacitor	Same as C3-1, C3-2, C3-3	Aerovox	Special	QE11347-1A
C3-5	Aud. Osc. Plate No. 1 Bypass Capacitor				
C3-6	Aud. Osc. Plate No. 2 Bypass Capacitor				
C3-7	1st R.F. Cathode Bypass Capacitor	Same as C3-1, C3-2, C3-3	Aerovox	Special	QE11347-1A
C3-8	1st R.F. Screen Bypass Capacitor				
C3-9	1st R.F. Plate Bypass Capacitor				
C3-10	2nd R.F. Cathode Bypass Capacitor	Same as C3-1, C3-2, C3-3	Aerovox	Special	QE11347-1A
C3-11	2nd R.F. Screen Bypass Capacitor				
C3-12	2nd R.F. Plate Bypass Capacitor				
C3-13	1st Det. Cathode Bypass Capacitor	Same as C3-1, C3-2, C3-3	Aerovox	Special	QE11347-1A
C3-14	1st Det. Screen Bypass Capacitor				
C3-15	2nd Det. Cathode Bypass Capacitor				
C3-16	I.F. Plate Bypass Capacitor	Same as C3-1, C3-2, C3-3	Aerovox	Special	QE11347-1A
C3-17	I.F. Screen Bypass Capacitor				
C3-18	1st Det. Plate Bypass Capacitor				
C3-19	L.V. Dynamotor R.F. Filter Capacitor	Same as C3-1, C3-2, C3-3	Aerovox	Special	QE11347-1A
C3-20	H.V. Dynamotor R.F. Filter Capacitor				
C3-21	H.V. Dynamotor R.F. Filter Capacitor				
C4-1	1st R.F. AVC Filter Capacitor	.05 mfd. ±10% 400 volt, fixed, paper	Micamold	Type 345	B7035-15-F
C4-2	2nd R.F. AVC Filter Capacitor	Same as C4-1			
C4-3	1st Det. AVC Filter Capacitor	Same as C4-1			
C4-5	Mod. Grid Coupling Capacitor, Low Freq.	Same as C4-1			
C4-6	Mod. Grid Coupling Capacitor, Low Freq.	Same as C4-1			
C5-1	Loc. Comp. Output Grid Capacitor	Three section, oil filled, paper, .1 mfd. per section ±10% 400 volt	Aerovox	Special	QE11346-2A
C5-2	Remote Comp. Output Screen Bypass Capacitor				
C5-3	Remote Comp. Output Grid Capacitor				

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
C6	Comp. Out. Grid Coupling Capacitor	.5 mfd. ±10% 400 volt, fixed, paper, oil filled	Aerovox	Special	QE11398A
C7	Tel. Out. Cathode Bypass Capacitor	5 mfd. 50 volt, fixed electrolytic	Aerovox	Special	QE11402A
C8-1	Aud. Osc. Grid Coupling Capacitor	Two section, .05 mfd. per section, ±5% 400 volt, side terminals	Aerovox	Special	QE11401A
C8-2	Aud. Osc. Grid Coupling Capacitor				
C9-1	H.V. Filter Capacitor	Two section, 12 mfd. per section ±10% 400 volt	Aerovox	Special	QE8895A
C9-2	H.V. Filter Capacitor				
C10-1	L.V. Filter Capacitor	Two section, .5 mfd. per section, ±10% 100 volt paper, oil filled	Aerovox	Special	QE11400A
C10-2	L.V. Filter Capacitor				
C12-1	Loop Stage Parallel Padder Capacitor	35 mmf. ±2% 400 volt, ceramic	Erie Resistor	N650-K or N680-K	QB15326-16-C
C12-2	1st R.F. Parallel Padder Capacitor	Same as C12-1			
C12-3	2nd R.F. Parallel Padder Capacitor	Same as C12-1			
C12-4	H.F. Osc. Stage Parallel Padder Capacitor	Same as C12-1			
C13-1	1st Audio R.F. Capacitor	50 mmf. ±2% 400 volt, ceramic	Erie Resistor	N650-K or N680-K	QB15326-5-C
C13-2	1st Audio Grid Bypass Capacitor	Same as C13-1			
C14	2nd Det. R.F. Bypass Capacitor	100 mmf. ±2% 400 volt, fixed, ceramic	Erie Resistor	N650-L or N680-L	QB15328-7-C
C15	I.F. Stage Trap Circuit Resonator Capacitor	Two capacitors, total capacity .02 mfd. ±2% 400 volt, mica, XM262 case	Aerovox	Type 1467	QE12140A-1
C16-1	1st R.F. Stage Trap Circuit Resonator Capacitor	.005 mfd. ±2% 400 volt, mica, XM262 case	Aerovox	Type 1467	QB15256-2
C16-2	2nd R.F. Stage Trap Circuit Resonator Capacitor	Same as C16-1			
C17-1	Ant. Coupling Capacitor	.001 mfd. ±10% 400 volt, mica, XM262 case	Aerovox	Type 1468	QB12138B-12
C17-2	Phone Output Grid Coupling Capacitor	Same as C17-1			
C18-1	2nd Det. Grid Circuit Resonator Capacitor	200 mmf. ±2% 400 volt, mica, XM262 case	Aerovox	Type 1468	QB12138B-8
C18-2	I.F. Grid Circuit Resonator Capacitor	Same as C18-1			
C18-3	1st Det. Plate Circuit Resonator Capacitor	Same as C18-1			
C19-1	Mod. Grid Radio Freq. Coupling Capacitor	250 mmf. ±5% 400 volt, mica, XM262 case	Aerovox	Type 1468	QB12138B-9
C19-2	Mod. Grid Radio Freq. Coupling Capacitor	Same as C19-1			
C19-3	Phone Output Audio Compensator Capacitor	Same as C19-1			

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
C20	Ant. Coupling Capacitor to 1st R.F. Grid	10 mmf. ±2% 400 volt, ceramic	Erie Resistor	N650-K or P120-K	QB15326-3-C
C21-1	Antenna Compensating Capacitor	100 mmf. ±5% 400 volt, mica, XM262 case	Aerovox	Type 1468	QB12138B-7
C21-2	1st R.F. Plate Resonator Capacitor Band 3	Same as C21-1			
C21-3	2nd R.F. Plate Resonator Capacitor Band 3	Same as C21-1			
C21-4	2nd Det. AVC Diode Coupling Capacitor	Same as C21-1			
C22-1	1st R.F. Plate Resonator Capacitor Band 1	300 mmf. ±5% 400 volt, fixed, XM262 case	Aerovox	Type 1468	QB12138B-10
C22-2	2nd R.F. Plate Resonator Capacitor Band 1	Same as C22-1			
C22-3	Loop Phase Circuit Resonator Capacitor	Same as C22-1			
C23-1	1st R.F. Plate Resonator Capacitor Band 2	75 mmf. ±5% 400 volt, fixed, XM262 case	Aerovox	Type 1468	QB12138B-6
C23-2	2nd R.F. Plate Resonator Capacitor Band 2	Same as C23-1			
C24-1	Coupling Capacitor on T9-1	5 mmf. ±2% 400 volt, ceramic	Erie Resistor	N650-K or P120-K	QB15326-2-C
C24-2	Coupling Capacitor on T9-2	Same as C24-1			
C24-3	2nd I.F. Coupling Capacitor	Same as C24-1			
C25	1st Det. Injector Grid Coupling Capacitor	15 mmf. ±10% 400 volt, mica, XM262 case	Aerovox	Type 1468	QB12138-B-5
C26	1st I.F. Coupling Capacitor	8.5 mmf. ±2% 400 volt, ceramic	Erie Resistor	N650-K or P120-K	QB15326-21-C
C27	2nd Det. Plate R.F. Bypass Capacitor	500 mmf. ±10% 400 volt, XM262 case	Aerovox	Type 1468	QB12138B-11
C28-1	Remote Comp. Out. Plate Resonator Capacitor	.1 mfd. ±10% 200 volt, part of Ref. No. 112	Micamold	Type 345	B7034-20-F
C28-2	Local Comp. Out. Plate Resonator Capacitor	Same as C28-1, part of Ref. No. 112			
C29	R.F. Osc. Grid Coupling Capacitor	25 mmf. ±10% 400 volt, XM262 case	Aerovox	Type 1468	QB12138B-4
C30	R.F. Osc. Series Padder Capacitor Band 1	2 capacitors mounted as a single unit, total capacity 625 mmf. ±0.5% 500 volt, mica XM262 case	Aerovox	Special	QE12140A-2
C31	R.F. Osc. Series Padder Capacitor Band 2	2 capacitors mounted as a single unit, total capacity 1286 mmf. ±0.5% 400 volt, mica XM262 case	Aerovox	Special	QE12140A-3
C32	R.F. Osc. Series Padder Capacitor Band 3	2 capacitors mounted as a single unit, total capacity 2514 mmf. ±0.5% 400 volt, mica XM262 case	Aerovox	Special	QE12140A-4

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
C35A-1	R.F. Osc. Plate Bypass Capacitor	.1 mfd. ±10%			
C35A-2	Mod. Plate Bypass	.1 mfd. ±10%	Three section, 400 volt, oil filled paper capacitors top term.	Aerovox	Special	QE11346-1A
C35B	AVC Filter Capacitor	.025 mfd. ±10%			
C36A-1	I.F. Cathode Bypass Capacitor	.1 mfd. ±10%			
C36A-2	Local Comp. Out. Screen Bypass Capacitor	.1 mfd. ±10% Three section, 400 volt, oil filled paper capacitors side term.	Aerovox	Special	QE11347-2A
C36B	I.F. AVC Bypass Capacitor	.025 mfd. ±10%			
C37-1	Low Pass Audio Filter Capacitor	.05 mfd. ±10% 400 volt; Part of Ref. No. 111 (Furnished in Audio Output Trans.Assy.)	Micamold	Type 345	B7035-15-F
C37-2	Low Pass Audio Filter Capacitor	.05 mfd. ±10% 400 volt			
C38	I.F. Plate Circuit Resonator Capacitor	185 mmf. ±2% 400 volt, mica, XM262 case	Aerovox	Type 1468	QB12138B-13
C39	Mod. Cathode Filter Capacitor	.1 mfd. ±10% 200 volt	Micamold	Type 345	B7034-20-F
C40	Antenna Parallel Padder Capacitor	25 mmf. ±2% 400 volt, ceramic	Erie Resistor	N650-K or N680-K	QB15326-4-C
DM-20	Dynamotor	14 volt input, 200 volt output	Pioneer	Special	QF15254C
I-70	Tuning Meter	2 ma zero right reading 5 ma full scale left reading dc. res. 36 ohms	Hickok	Special	QB12207
J1	Jack	For headset 1 break circuit	Yaxley	Special	QB4862A
L1	Loop Phaser Inductor	Part of Ref. No. 101	Bendix	Special	QAE11555-13D
L2	I.F. Trap Inductor (1st R.F. Cathode)	Part of Ref. No. 104	Bendix	Special	QAE11635-1
L3	I.F. Trap Inductor (2nd R.F. Cathode)	Part of Ref. No. 104	Bendix	Special	QAE11634-1
L4-1	1st Det. Plate Inductor	Part of Ref. No. 108	Bendix	Special	QAE11634-2
L4-2	I.F. Plate Inductor	Same as L4-1, part of Ref. No. 110			
L5-1	I.F. Grid Inductor	Part of Ref. No. 108	Bendix	Special	QAE11635-2
L5-2	2nd Det. Audio Diode Inductor	Part of Ref. No. 110 same as L5-1			
L6	122.5 Kc. Trap Inductor (I.F. Cathode)	Part of Ref. No. 109	Bendix	Special	QAE11555-14D
L7-1	R.F. Choke—(L.V.)	Part of Ref. No. 113	Bendix	Special	AB6859-1
L7-2	R.F. Choke—(L.V.)	Part of Ref. No. 113, same as L7-1			
L8	R.F. Choke—(H.V.)	Part of Ref. No. 113	Bendix	Special	AB6859-2
L9	Filter Choke	Part of Ref. No. 111	Bendix	Special	QE6719B
L10	Low-pass Audio Filter Choke				

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
LM-32	Lamp	Instrument dial illuminating, 3 volts, 0.18±0.02 amps.	P. Inst.	Special	QB15343
NE1	Neon Lamp	1/25 watt, 60 volt, unbased	G.E.	T2	B15347
R1	Loop Gain Control Potentiometer	15,000 ohm	I.R.C.	Special	QB15353A
R2	Threshold Sensitivity Control Potentiometer	2,000 ohm	I.R.C.	Special	QB15352A
R3-1	COMPASS Sensitivity Control Potentiometer	50,000 ohm	I.R.C.	Special	QB15351
R4A-1	AUDIO Volume Control Potentiometer	100,000 ohm Dual Action	I.R.C.	Special	QB15350A
R4B-1	Manual Sensitivity Control Potentiometer	25,000 ohm			
R6-1	Lamp Rheostat	50 ohm, 25 watt	Ohmite	Model H	QB15354
R8-1 R8-2	Lamp Voltage Dropping Resistor	100 ohm ±5%, 5 watts center tapped	I.R.C.	Type MW2	B15404-1
R9-1	Loop Stage R.F. Band 3 Compensator Resistor	3 ohm ±5%, ½ watt	I.R.C.	Type BW ½	B1754-112-E
R9-2	1st R.F. Stage Band 3 Compensator Resistor	Same as R9-1			
R9-3	2nd R.F. Stage Band 3 Compensator Resistor	Same as R9-1			
R10-1	1st R.F. Stage Band 2 Compensator Resistor	10 ohm ±5%, ½ watt	I.R.C.	Type BW ½	B1754-103-E
R10-2	2nd R.F. Stage Band 2 Compensator Resistor	Same as R10-1			
R11-1	1st R.F. Stage Band 1 Compensator Resistor	20 ohm ±5%, ½ watt	I.R.C.	Type BW ½	B1754-99-E
R11-2	2nd R.F. Stage Band 1 Compensator Resistor	Same as R11-1			
R12-1	Loop Stage Screen Dropping Resistor	100,000 ohm ±5%, ¼ watt	Erie	Special	QB15311-46-E
R12-2	1st R.F. Screen Dropping Resistor	Same as R12-1			
R12-3	2nd R.F. Screen Dropping Resistor	Same as R12-1			
R12-4	1st Audio Grid Resistor	Same as R12-1			
R12-5	I.F. AVC Filter Resistor	Same as R12-1			
R12-6	Audio Osc. Dropping Resistor	Same as R12-1			
R12-7	Audio Osc. Dropping Resistor	Same as R12-1			
R13-1	1st Det. Screen Voltage Divider Resistor	150,000 ohm ±5%, ½ watt	Erie	Special	QB15312-48-E
R13-2	Local Comp. Ind. Screen Dropping Resistor	Same as R13-1			

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
R14-1	AF Osc. Grid Leak Resistor	50,000 ohm ±5%, ¼ watt			
R14-2	1st Det. Inj. Grid Leak Resistor	Same as R14-1	Erie	Special	QB15311-41-E
R14-3	R.F. Osc. Grid Leak Resistor	Same as R14-1			
R14-4	1st Audio R.F. Filter	Same as R14-1			
R15-1	AF Osc. Plate Load Resistor	2,000 ohm ±5%, ½ watt	Erie	Special	QB15312-17-E
R15-2	AF Osc. Plate Load Resistor	Same as R15-1			
R16-1	AF Osc. Grid Leak Resistor	50,000 ohm ±5%, ½ watt			
R16-2	Mod. Cathode Biasing Resistor	Same as R16-1			
R16-3	1st R.F. AVC Filter Resistor	Same as R16-1			
R16-4	2nd R.F. AVC Filter Resistor	Same as R16-1	Erie	Special	QB15312-41-E
R16-5	1st Det. AVC Filter Resistor	Same as R16-1			
R16-6	I.F. Screen Dropping Resistor	Same as R16-1			
R16-7	R.F. Osc. Plate Dropping Resistor	Same as R16-1			
R17-1	AF Osc. Plate Dropping Resistor	100,000 ohm ±5%, ½ watt			
R17-2	AF Osc. Plate Dropping Resistor	Same as R17-1			
R17-3	Mod. Cathode Bias Resistor	Same as R17-1	Erie	Special	QB15312-46-E
R17-4	Mod. Plate Dropping Resistor	Same as R17-1			
R17-5	Audio Compensating Resistor	Same as R17-1			
R18	Antenna Static Leak Resistor	1 meg. ±5%, ¼ watt	Erie	Special	QB15311-56-E
R19-1	Remote Comp. Ind. Grid Resistor	1,000 ohm ±5%, ½ watt	Erie	Special	QB15312-14-E
R19-2	Local Comp. Ind. Grid Resistor	Same as R19-1			
R20-1	Loop Stage Plate Dropping Resistor	5,000 ohm ±5%, ½ watt			
R20-2	1st R.F. Plate Dropping Resistor	Same as R20-1			
R20-3	2nd R.F. Plate Dropping Resistor	Same as R20-1	Erie	Special	QB15312-23-E
R20-4	1st Det. Plate Dropping Resistor	Same as R20-1			
R20-5	I.F. Plate Dropping Resistor	Same as R20-1			

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
R21	Mod. Cathode Bleeder Resistor	200,000 ohms ±5%, ½ watt	Erie	Special	QB15312-49-E
R22-1	Mod. Grid Load Resistor	500,000 ohms ±5%, ½ watt	Erie	Special	QB15312-53-E
R22-2	Mod. Grid Load Resistor	Same as R22-1			
R22-3	Remote Comp. Out. Grid Resistor	Same as R22-1			
R23	Mod. Cathode Bias Resistor	10,000 ohm ±5%, ½ watt	Erie	Special	QB15312-29-E
R24-1	1st R.F. Cathode Bias Resistor	600 ohm ±5%, ½ watt	Erie	Special	QB15312-11-E
R24-2	2nd R.F. Cathode Bias Resistor	Same as R24-1			
R24-3	1st Det. Cathode Bias Resistor	Same as R24-1			
R24-4	I.F. Cathode Bias Resistor	Same as R24-1			
R24-5	Remote Comp. Out. Cathode Bias Resistor	Same as R24-1			
R24-6	Local Comp. Out. Cathode Bias Resistor	Same as R24-1			
R24-7	Loop Cathode Bias Resistor	Same as R24-1			
R25	Remote Comp. Out. Screen Dropping Resistor	150,000 ohm ±5%, ¼ watt	Erie	Special	QB15311-48-E
R26-1	1st Det. Screen Voltage Divider Resistor	25,000 ohm ±5%, ½ watt	Erie	Special	QB15312-37-E
R26-2	2nd Det. Plate Dropping Resistor	Same as R26-1			
R27	A.F. Osc. Cathode Bias Resistor	100 ohm ±5%, ½ watt	Erie	Special	QB15312-2-E
R28	1st Audio Grid Load Resistor	250,000 ohm ±5%, ¼ watt	Erie	Special	QB15311-50-E
R29-1	2nd Det. Cathode Bias Resistor	500 ohm ±5%, ½ watt	Erie	Special	QB15312-10-E
R29-2	Audio Output Cathode Bias Resistor	Same as R29-1			
R30-1	2nd Det. AVC Diode Resistor	1 meg. ±5%, ½ watt	Erie	Special	QB15312-56-E
R30-2	AVC Filter Resistor	Same as R30-1			
R31	2nd Det. Cathode Bias Resistor	3000 ohm ±5%, ½ watt	Erie	Special	QB15312-20-E
R32-1	Local Comp. Out. Grid Isolating Resistor	300,000 ohm ±5%, ½ watt	Erie	Special	QB15312-51-E
R32-2	Remote Comp. Out. Grid Isolating Resistor	Same as R32-1			
R33	Audio Compensating Resistor	350,000 ohm ±5%, ½ watt	Erie	Special	QB15312-86-E
R34	Audio Transformer Shunt Resistor	8,000 ohm ±5%, ½ watt	Erie	Special	QB15312-27-E

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
RE1	Antenna Relay	Part of Ref. No. 103, coil D.C. Res. 72 ohms	Kurman	15P32	QB7856A
S1-1A S1-1B	Loop Stage Band Selector Switch (Pri.)	Bakelite wafer	Oak	Special	QB9589-2C
S1-2A S1-2B	ANT. Band Selector Switch (Pri.)	Same as S1-1A			
S1-3A S1-3B S1-3C	1st R.F. Stage Band Selector Switch (Pri. and Sec.)	Same as S1-1A			
S1-4A S1-4B S1-4C	2nd R.F. Stage Band Selector Switch (Pri. and Sec.)	Same as S1-1A			
S2 (A,B)	Loop Stage Band Selector Switch (Sec.)	Bakelite wafer	Oak	Special	QB9589-1C
S3 (A,B) (C,D)	Ant. Band Selector Switch, (Pri. 2) Ant. Band Selector Switch, (Sec.)	Bakelite wafer	Oak	Special	QB9589-4B
S4 (A,B) (C,D)	H.F. Osc. Band Selector Switch	Bakelite wafer	Oak	Special	QB9589-3B
S5 (A) (B,C)	Tel. Out. Bias Selector Switch. Motor Positioning Switch	Bakelite wafer	Oak	Special	QB9589-5D
S6	Motor Control Switch	Cam operated	Kellogg	Special	QE10355B
S7 (A,B,C, D,E,F, G,H,J)	LOCAL-REMOTE Switch	Dual bakelite wafer	Oak	Special	QB6712A
S8-1A S8-1B S8-1C S8-1D S8-1E	OFF-COMP-REC.ANT. REC.LOOP Switch	Bakelite wafer	Oak	Special	QB6711A
S9-1	Band Selector Switch	Bakelite wafer	Oak	Special	QB6707
T1	Loop Stage Transformer (Band 1)	Part of Ref. No. 100	Bendix	Special	QAE11555-7D
T2	Loop Stage Transformer (Band 2)	Part of Ref. No. 100	Bendix	Special	QAE11555-8D
T3	Loop Stage Transformer (Band 3)	Part of Ref. No. 100	Bendix	Special	QAE11555-9D
T4	Ant. Stage Transformer (Band 1)	Part of Ref. No. 102	Bendix	Special	QAE11555-10D
T5	Ant. Stage Transformer (Band 2)	Part of Ref. No. 102	Bendix	Special	QAE11555-11D
T6	Ant. Stage Transformer (Band 3)	Part of Ref. No. 102	Bendix	Special	QAE11555-12D

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
T7-1	1st R.F. Transformer (Band 1)	Part of Ref. No. 105	Bendix	Special	QAE11555-1D
T7-2	2nd R.F. Transformer (Band 1)	Same as T7-1, part of Ref. No. 106	Bendix	Special	QAE11555-1D
T8-1	1st R.F. Transformer (Band 2)	Part of Ref. No. 105	Bendix	Special	QAE11555-2D
T8-2	2nd R.F. Transformer (Band 2)	Same as T8-1; part of Ref. No. 106	Bendix	Special	QAE11555-2D
T9-1	1st R.F. Transformer (Band 3)	Part of Ref. No. 105	Bendix	Special	QAE11555-3D
T9-2	2nd R.F. Transformer (Band 3)	Same as T9-1; part of Ref. No. 106	Bendix	Special	QAE11555-3D
T10	R.F. Osc. Transformer (Band 1)	Part of Ref. No. 107	Bendix	Special	QAE11555-4D
T11	R.F. Osc. Transformer (Band 2)	Part of Ref. No. 107	Bendix	Special	QAE11555-5D
T12	R.F. Osc. Transformer (Band 3)	Part of Ref. No. 107	Bendix	Special	QAE11555-6D
T13	I.F. Coupler Input Transformer	Ref. No. 108	Bendix	Special	AE10260-1
T14	I.F. Coupler Output Transformer	Ref. No. 110	Bendix	Special	AE10260-2
T15	Tel. Output Transformer	Part of Ref. No. 111	Bendix	Special	QE6719B
T16	Remote Comp. Ind. Output Transformer	Part of Ref. No. 112	Bendix	Special	QE6720C
T17	Local Comp. Ind. Output Transformer	Part of Ref. No. 112	Bendix	Special	QE6720C
TB1	Terminal Board	Under chassis, 48 lugs	Bendix	Special	AE12352E
TB2	Terminal Board	Under chassis, 34 lugs	Bendix	Special	AE12351B
TB3	Terminal Board	Under chassis, 22 lugs	Bendix	Special	AB12349A
TB4	Terminal Board	Part of Ref. No. 113, 3 lugs	Bendix	Special	AB11639
TB5-1	Terminal Board	Part of Ref. No. 105, 10 lugs	Bendix	Special	AB11117A
TB5-2	Terminal Board	Part of Ref. No. 106, same as TB5-1	Bendix	Special	AB11117A
TB6	Terminal Board	Part of Ref. No. 107, 9 lugs	Bendix	Special	AB11199B
TB7	Terminal Board	Part of Ref. No. 107, 3 lugs	Bendix	Special	AB11198A
TB8	Terminal Board	Part of Ref. No. 107, 2 lugs	Bendix	Special	AB11176A
TB9	Terminal Board	Part of Ref. No. 102, 6 lugs	Bendix	Special	AB11175A
VT-66	Tel. Output Vacuum Tube	Metal	Kenrad	6F6	B15355 (Sig. Corps. Spec. 71-766)

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
VT-86	Loop Stage Vacuum Tube	Metal	Kenrad	6K7	B15357 (Sig. Corps Spec. 71-786)
VT-86	1st R.F. Stage Vacuum Tube	Same as above			
VT-86	2nd R.F. Stage Vacuum Tube	Same as above			
VT-86	I.F. Stage Vacuum Tube	Same as above			
VT-86	Remote Comp. Out. Vac. Tube	Same as above			
VT-86	Local Comp. Out. Vacuum Tube	Metal			
VT-87	1st Detector Vacuum Tube	Metal	Kenrad	6L7	B15356 (Sig. Corps Spec. 71-787)
VT-93	2nd Detector Vacuum Tube	Metal	Kenrad	6B8	B15358 (Sig. Corps Spec. 71-793)
VT-94	R.F. Oscillator Vacuum Tube	Metal	Kenrad	6J5	B15359 (Sig. Corps. Spec. 71-794)
VT-96	A.F. Oscillator Vacuum Tube	Metal	Kenrad	6N7	B15360 (Sig. Corps Spec. 71-796)
VT-96	Modulator Vacuum Tube	Same as above			
100	Loop Tuning Assembly	Includes S1-1, S2, T1, T2, T3, C1-1, C1-2, C1-3, C12-1, R9-1	Bendix	Special	AF11115D
101	Loop Phasing Assembly	Includes L1, C4-5, C4-6, C19-1, C19-2, C22-3, R12-6, R12-7	Bendix	Special	AE10255A
102	Antenna Tuning Assembly	Includes S1-2, S3, T4, T5, T6, C1-4, C1-5, C1-6, C17-1, C20, C40, NE1, TB9	Bendix	Special	AF11116E
103	Antenna Switching Relay Assembly	Includes RE1, C21-1, R18	Bendix	Special	AB12369A
104	I.F. Trap Assembly	Includes L2, L3, C16-1, C16-2	Bendix	Special	AE10261C
105	1st R.F. Tuning Assembly	Includes S1-3, T7-1, T8-1, T9-1, C1-7, C1-8, C1-9, C12-2, C21-2, C22-1, C23-1, C24-1, R9-2, R10-1, R11-1, TB5-1	Bendix	Special	AF11113D
106	2nd R.F. Tuning Assembly	Includes S1-4, T7-2, T8-2, T9-2, C1-10, C1-11, C1-12, C12-3, C21-3, C22-2, C23-2, C24-2, R9-3, R10-2, R11-2, TB5-2. Same as Ref. No. 105	Bendix	Special	AF11113D
107	R.F. Osc. Tuning Assembly	Includes S4, T10, T11, T12, C1-13A, C1-14A, C1-15A, C12-4, C25, C29, C30, C31, C32, R14-2, R14-3, TB6, TB7, TB8	Bendix	Special	AF11114D
108	1st I.F. Transformer Assembly	Includes L4-1, L5-1, C18-2, C18-3, C26, R12-5	Bendix	Special	AE10260-1
109	Trap Assembly 122.5 Kc.	Unshielded; includes L6, C15	Bendix	Special	AB12328A

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
110	2nd I.F. Transformer Assembly	Includes L4-2, L5-2, C13-1, C13-2, C14, C18-1, C24-3, C38, R12-4, R14-4, R28	Bendix	Special	AE10260-2
111	Tel. Out. Transformer and Filter	Includes L9, L10, T15, C37-1, C37-2. Potted	Amertran	Special	QE6719B
112	Indicator Output Transformer Assembly	Includes T16, T17, C28-1, C28-2. Potted	Amertran	Special	QE6720C
113	Dynamotor Hash Filter	Includes L7-1, L7-2, L8, C3-19, C3-20, C3-21, C10-1, C10-2, TB4	Bendix	Special	AE10502A
114	Band Switch Drive Assembly	Includes S5, S6 and Ref. Nos. 115, 117, 118, 119, 120	Bendix	Special	AF10347B
115	Band Switch Motor MO-4 with Worm Assembly	Part of Ref. No. 114, includes Ref. No. 116	Bendix	Special	AB11496A
116	Band Switch Motor Brush Assembly	Part of Ref. No. 115	Bendix	Special	B15364
117	Geneva Disc and Hub Assembly	Part of Ref. No. 114	Bendix	Special	AB10346
118	Worm Gear Shaft Assembly	Part of Ref. No. 114	Bendix	Special	AB10344C
119	Right Side Housing	Part of Ref. No. 114	Bendix	Special	F11130C
120	Left Side Housing	Part of Ref. No. 114	Bendix	Special	F11131D
121	Band Switch Drive Shaft	Assembly	Bendix	Special	AB11502
123	Dynamotor Armature	Part of DM-20	Pioneer	Special	G-2568
124	Dynamotor Bearings	Part of DM-20	Pioneer	Special	B15521
125	H.V. Brush Assemblies	Part of DM-20, Pos. brush Part of DM-20, Neg. brush	Pioneer Pioneer	Special Special	G-2563 G-2564
126	L.V. Brush Assemblies	Part of DM-20, Pos. brush Part of DM-20, Neg. brush	Pioneer Pioneer	Special Special	G-2561 G-2562
127	Dynamotor Dust Cover	Part of DM-20	Pioneer	Special	G-2572
128	High Voltage End Bracket Assembly	Less brush assembly, part of DM-20	Pioneer	Special	G-2573
129	Field Coil Assembly	Part of DM-20	Pioneer	Special	G-2567-B
130	Dynamotor Pole Piece	Part of DM-20	Pioneer	Special	G-2443
131	Low Voltage End Bracket Assembly	Part of DM-20	Pioneer	Special	G-2436-A
132	Retaining Spring	For band switch drive shaft	Bendix	Special	B11010
133	Right Angle Drive Assembly	For connection of remote tuning shaft	Bendix	Special	AB10854A
134	Dial Drive Assembly	Includes Ref. Nos. 135 and 136	Bendix	Special	AE12033B
135	Dial Assembly	Part of Ref. No. 134	Bendix	Special	AB5626A
136	Dial Mask Assembly	Part of Ref. No. 134	Bendix	Special	AB10798C

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
137	Condenser Drive Assembly	Includes C2	Bendix	Special	AE12097A
138	Switch Lever	For S7, S8 and S9	Bendix	Special	B12297A
139	Knob (COMPASS)	For R3	Bendix	Special	AB11884
140	Knob (AUDIO)	For R4	Bendix	Special	B11821B
141	Knob (LIGHTS)	For R6	Bendix	Special	B12378C
142	Tuning Crank	For gang tuning capacitor	Bendix	Special	AB8917A
143	Release Button Assembly	Mechanical stop for S8	Bendix	Special	AB11857
144	Tube Socket	For VT-86	Cinch	Special	QB15265-2A
145	Tube Socket	For VT-96	Cinch	Special	QB15265-6A
146	Tube Socket	For VT-87	Cinch	Special	QB15265-3A
147	Tube Socket	For VT-94	Cinch	Special	QB15265-5A
148	Tube Socket	For VT-93	Cinch	Special	QB15265-4A
149	Tube Socket	For VT-66	Cinch	Special	QB15265-1A
150	Plug Socket	22-contact, for Plug PL-122	Bendix	Special	AB10058B
151	Plug Socket	4-contact, for Plug PL-108	Bendix	Special	AB9679A
152	Plug Socket	2-contact, for Plug PL-119	Bendix	Special	AB10073A
153	Light Socket and Reflector	Assembly	Bendix	Special	AB11885
154	Detent Ring	For COMPASS knob	Bendix	Special	B6646A
155	Lock Screw Shaft	Steel	Bendix	Special	B10720D
156	Lock Screw Knob	Aluminum, anodized	Bendix	Special	B10721
157	Receiver Case Assembly	Includes snapslide fastener	Bendix	Special	AF11748A
158	Cover Plate Assembly	For socket hole in case	Bendix	Special	AB12131
TL-138-B	Alignment Tool	For compass unit alignment	Bendix	Special	AB12439
160	Set Screw Wrench	For Allen set screws	Bendix	Special	B15447
161	Mounting Screw	For Dynamotor DM-20	Bendix	Special	B11636B
162	Frame Bolts	Part of Dynamotor DM-20	Pioneer	Special	B15368
163	Grid Shield Caps	For VT Grids	Cinch	Special	B15001
164	Screw	For band switch drive assembly (3 required)	Bendix	Special	B155A-32-A
165	Ratchet Gear	For lock screw shaft	Bendix	Special	QB15411
166	Collar	For lock screw shaft	Bendix	Special	B9319A
167	Brush Retainer	4 required, part of DM-20	Pioneer	Special	P-3256-B
168	Bearing Cover	2 required, part of DM-20	Pioneer	Special	P-3394-A

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
169	Tube Socket	For VT-86 (1st R.F.)	Cinch	Special	QB15714-2
170	Tube Socket	For VT-96 (Mod. tube)	Cinch	Special	QB15714-6
		RADIO CONTROL BOX BC-311-B			AN90282-1
I-70	Tuning Meter	2 ma. zero right reading, 5 ma. full scale left reading, dc. res. 36 ohms	Hickok	Special	QB12207
J2	Jack	For headset, 1 break circuit	Yaxley	X3A	QB15399
LM-32	Lamp	Instrument dial illuminating, 3 volts, 0.18 ±0.02 amps.	P. Inst.	Special	QB15343
R3-2	COMPASS Sensitivity Control Potentiometer	50,000 ohm potentiometer	I.R.C.	Special	QB15351
R4A-2	AUDIO Volume Control Potentiometer	100,000 ohm } Dual Action	I.R.C.	Special	QB15350A
R4B-2	Manual Sensitivity Control	25,000 ohm } Dual Action			
R6-2	Lamp Rheostat	50 ohms, 25 watts	Ohmite	Model H	QB15354
R8-3, R8-4	Lamp Voltage Dropping Resistor	100 ohm ±5%, 5 watt, center tapped	I.R.C.	Type MW2	B15404-1
S8-2A, S8-2B, S8-2C, S8-2D, S8-2E	OFF-COMP-REC. ANT.-REC.LOOP Switch	Bakelite wafer	Oak	Special	QB6711A
S9-2	Band Selector Switch	Bakelite wafer	Oak	Special	QB6707
S10	M.B. TEST	Push button, marker beacon test	H & H	No. 3391	QB15349
TB10	Terminal Board	Part of Ref. No. 200, 17 lugs	Bendix	Special	AB12486A
200	Mounting Base Assembly	Includes TB10 and Ref. No. 212	Bendix	Special	AF11971A
201	Dial Drive Assembly	Includes Ref. Nos. 202, 203, 204, 205	Bendix	Special	AF10841A
202	Cable Pinion Housing Assembly	Part of Ref. No. 201	Bendix	Special	AB8950
203	Dial Assembly	Part of Ref. No. 201	Bendix	Special	AB5626A
204	Dial Mask Assembly	Part of Ref. No. 201	Bendix	Special	AB10798C
205	Dial Gear Assembly	Part of Ref. No. 201	Bendix	Special	AB11956A
206	Release Button Assembly	Mechanical stop for S8, same as Ref. No. 143	Bendix	Special	AB11857
207	Tuning Crank	Same as Ref. No. 142	Bendix	Special	AB8917A

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
208	Knob (COMPASS)	For R3, same as Ref. No. 139	Bendix	Special	AB11884
209	Knob (AUDIO)	For R4, same as Ref. No. 140	Bendix	Special	B11821B
210	Knob (LIGHTS)	For R6, same as Ref. No. 141	Bendix	Special	B12378C
211	Switch Lever	For S8 and S9, same as Ref. No. 138	Bendix	Special	B12297A
212	Socket Assembly	17 contact for plug Ref. No. 213, part of Ref. No. 200	Bendix	Special	AB10032B
213	Plug Assembly	17 contact for socket Ref. No. 212	Bendix	Special	B10031C
214	Detent Arm Assembly	Used on band switch mechanism	Bendix	Special	AB11447
215	Band Switch Control	Assembly	Bendix	Special	AB11669A
216	Detent Ring	For COMPASS knob, same as Ref. No. 154	Bendix	Special	B6646A
217	Set Screw Wrench	For Allen set screws, same as Ref. No. 160	Bendix	Special	B15447
218	Mounting Screw	Panel	Bendix	Special	B10251-2
219	Plug Release Screw	For releasing Ref. No. 213	Bendix	Special	B10251-1
		LOOPS			
LP-13-B	Loop	Without provision for loop ice remover, inductance 46 microhenries, "A"—95 ±5%, at 2000 Kc. with tuning capacity of approximately 320 mmf. 4 turns of 81-No. 38 Litz D.W.S. wire	Kearfott	Special	AS-570-4-A
LP-15-B	Loop	With provision for loop ice remover M-186-B, electrical characteristics same as Loop LP-13-B	Kearfott	Special	AS-571-4-A
M-169-A	Loop Mounting Cap	Used with Loop Mountings GS-7-B, GS-8-B, GS-8-C	Kearfott	Special	AS-540-1-C
M-186-B	Loop Ice Remover	Used with Loop LP-15-B only	Kearfott	Special	AS-601-2
331	Loop Plug	For LP-13-B	Kearfott	Special	AS-488-1-H
332	Loop Plug	For LP-15-B	Kearfott	Special	AS-566-1-E
333	Air Connection Cover	For LP-15-B	Kearfott	Special	AS-603-1-B
		LOOP MOUNTING GS-7-B			
GS-7-B	Loop Mounting	Fixed	Kearfott	Special	AS-543-1-E
306	Support Assembly	Includes socket	Kearfott	Special	AS-542-1-H

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
307	Base Assembly		Kearfott	Special	AS-544-2-D
308	Support Lock Nut		Kearfott	Special	AS-469-1-D
309	Adjusting Screws	2 required	Kearfott	Special	AS-472-1-D
310	Plug	Air connection	Kearfott	Special	AS-583-1-B
327	Socket	For loop	Kearfott		B15586
330	Socket	For Plug PL-108	Kearfott		B15587

ROTATABLE LOOP MOUNTINGS

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
GS-8-B	Loop Mounting	Rotatable for overhead use	Kearfott	Special	AS-532-4-F
GS-8-C	Loop Mounting	Rotatable for floor use	Kearfott	Special	AS-615-4
LM-32	Lamp	Dial illuminating	P. Inst.	Special	QB15343
MC-182	Swivel Joint		Kearfott	Special	AS-596-1-B
R7	Resistor	Lamp voltage dropping	Kearfott	Special	AS-553-1-A
S11	Toggle Switch	For Lamp LM-32	Kearfott	Special	AS-552-1-A
311	Spindle and Collector Ring		Kearfott	Special	AS-510-4-E
312	Pin	Locking	Kearfott	Special	AS-410-1-C
313	Lower Housing	Assembly	Kearfott	Special	AS-511-4-E
314	Cam	Worm adjusting	Kearfott	Special	AS-506-1-A
316	Handwheel		Kearfott	Special	AS-419-4-E
317	Clutch Handle	For locking handwheel	Kearfott	Special	AS-445-1-B
318	Scale	Dial, used on GS-8-B only	Kearfott	Special	AS-559-2-B
319	Screws	Dial scale	Kearfott	S-90	B15575
320	Screw	Vernier detent adjusting	Kearfott	Special	AS-459-1-B
321	Screw	Lower drive tube	Kearfott	Special	AS-464-1-A
322	Screw	Toggle arm	Kearfott	Special	AS-501-1-B
323	Screw	Toggle support	Kearfott	Special	AS-454-1-C
324	Screw	Positioning	Kearfott	Special	AS-458-1-C
326	Brush and Holder	Assembly	Kearfott	Special	AS-530-1-B
327	Socket	For loop	Kearfott		B15586
328	Socket	Lamp, for Plug PL-117	Kearfott		AS-586-1-B
329	Socket	For Plug PL-108	Kearfott		B15588
334	Cover Plate	For collector ring housing, with socket hole	Kearfott		AS-475-1-G
335	Cover Plate	For collector ring housing, plain	Kearfott	Special	AS-476-1-F
336	Upper Squeeze Nut	Holds housing tube	Kearfott	Special	AS-545-1-F
337	Lower Squeeze Nut	Holds housing tube	Kearfott		AS-450-1-F

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
338	Drive Tube		Kearfott	Special	AS-449-1-B
339	Housing Tube		Kearfott	Special	AS-447-1-F
340	Scale	Dial, used on GS-8-C only	Kearfott	Special	AS-613-2

Note: All parts listed above are common to GS-8-B and GS-8-C with the exception of reference 318 and 340 as indicated.

CORD CD-311

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
CD-311	Cord	72 inch cord, capacity 140 uuf. ±5%	Bendix	Special	AB12708B
		84 inch cord, capacity 140 uuf. ±5%	Bendix	Special	AB12708B-2
		110 inch cord, capacity 140 uuf. ±5%	Bendix	Special	AB12708B-3
FT-184	Conduit Elbow	90° elbow	Bendix	Special	B10862B
PL-108	Plug	4-pin	Bendix	Special	AB9678B
415	Conduit	Flexible metallic			
		72-inch	Am. Brass	36B2284C3-72	B15348-1
		84-inch	Am. Brass	36B2284C3-84	B15348-2
		110-inch	Am. Brass	36B2284C3-110	B15348-3
416	Bushing	Part of FT-184	Bendix	Special	B10863
417	Nut	Coupling	Am. Brass	36A2212-2	B15403

MOUNTING FT-145-B

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
FT-145-B	Mounting	Part of Radio Compass Unit BC-310-B	Bendix	Special	AE11812C
411	Mounting	Shock absorbing	Lord	150-PH-8	B7140-1
412	Stud	Snapslide, used with Ref. No. 411	Bendix	Special	B10563A

TUNING SHAFT MC-124

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
MC-124	Tuning Shaft	Assembly	Bendix		AB12570 Sig. Corps SC-D-2035

COMPASS INDICATOR I-65-B

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
C11-1	Field Resonating Capacitor, Local Indicator	.5 mfd. ±2%, 400 volt	Aerovox	Special	QE11399B
C11-2	Field Resonating Capacitor, Remote Indicator	Same as C11-1	Aerovox	Special	QE11399B
I-65-B	Local Compass Indicator	Sensitivity 35 degrees defl. at 700 microamperes. Field coil inductance 39 ±0.8 henries at 60 cycles, 38 volts, d-c res. 1825 ±35 ohms. Moving coil inductance 0.20 ±.02 henries at 1000 cycles, 3.5 volts, d-c resistance 2130 ±40 ohms	Hickok	Special	QE12208

7.1 **Reference List** (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
LM-32	Lamp	Instrument dial illuminating, 3.0 volts, 0.18±0.02 amperes	P. Inst.	Special	QB15343
		TEST BOX BX-18-B			
441	Plug Socket	18-contact, for Plug PL-121	Bendix	Special	AB10132B
442	Plug Socket	17-contact, for for plug Ref. No. 213	Bendix	Special	AB10032B
		CABLE PLUGS			
PL-108	Plug	4-contact (Junction box to marker beacon indicator and for Cord CD-311)	Bendix	Special	AB9678B
PL-112	Plug	9-contact (Junction box to marker beacon receiver)	Bendix	Special	AB9601B
PL-117	Plug	1-contact, (For indicator and loop lamps)	Bendix	Special	AB9487B
PL-118	Plug	5-contact (Junction box to indicator)	Bendix	Special	AB9730B
PL-119	Plug	2-contact (Compass unit to antenna)	Bendix	Special	AB10072A
PL-121	Plug	18-contact (Junction box to control box)	Bendix	Special	AB10131B
PL-122	Plug	22-contact (Compass unit to junction box)	Bendix	Special	AB10057B
PL-123	Plug	2-contact (Junction box to battery)	Bendix	Special	AB9817B
		JUNCTION BOX TM-180-B			AL70869-1
FU-28	Fuse	Low voltage supply fuse, 15 amp. 250 volt	Bussman	2260	QB15250
J3	Jack JK-34	Interphone connection	Kellogg		B7778 U.S. Army Spec. 71-852
404	Plug Socket	For Plug PL-118, 5-contact	Bendix	Special	AB9731A
405	Plug Socket	For Plug PL-108, 4-contact	Bendix	Special	AB9679A
406	Plug Socket	For Plug PL-121, 18-contact	Bendix	Special	AB10132B
407	Plug Socket	For Plug PL-123, 2-contact	Bendix	Special	AB9818A
408	Plug Socket	For Plug PL-112, 9-contact	Bendix	Special	AB9602A

7.1 Reference List (continued)

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
409	Plug Socket	For Plug PL-122, 22-contact	Bendix	Special	AB10058B
460	Junction Box Cover	Assembled with snapslide	Bendix	Special	AE11985
461	Fuse Block	For Fuse FU-28	Bendix	Special	AB11983

7.2 Interchangeable Parts

Ref. No.	Name or Function	Description	Mfgr.	Mfgr. No.	Bendix Dwg. No.
105	1st R.F. Tuning Assembly	See Reference List. Identical except for lettering and etching	Bendix	Special	AF11113D
106	2nd R.F. Tuning Assembly				
135 203	Dial Assembly	See Reference List	Bendix	Special	AB5626A
136 204	Dial Mask Assembly	See Reference List	Bendix	Special	AB10798C
138 211	Switch Lever	See Reference List	Bendix	Special	B12297A
139 208	Knob (COMPASS)	See Reference List	Bendix	Special	AB11884
140 209	Knob (AUDIO)	See Reference List	Bendix	Special	B11821B
141 210	Knob (LIGHTS)	See Reference List	Bendix	Special	B12378C
142 207	Tuning Crank	See Reference List	Bendix	Special	AB8917A
143 206	Release Button Assembly	See Reference List	Bendix	Special	AB11857
150 409	Plug Socket	22-contact, for PL-122	Bendix	Special	AB10058B
151 405	Plug Socket	4-contact, for PL-108	Bendix	Special	AB9679A
154 216	Detent Ring	See Reference List	Bendix	Special	B6646A
160 217	Set Screw Wrench	See Reference List	Bendix	Special	B15447
441 406	Plug Socket	18-contact for PL-121	Bendix	Special	AB10132B
212 442	Plug Socket	17-contact for plug Ref. No. 213	Bendix	Special	AB10032B

7.3 Notes to Reference List

For identification purposes, all radio compass components are given Signal Corps type numbers. Parts of components are given Signal Corps type numbers or are marked by numbers or by letters and numbers. Generally, sub-assemblies and mechanical parts are marked numerically and individual parts are marked by letters and numbers, the letters indicating the electrical nature of the part, viz:

C—Capacitor	MO—Motor
DM—Dynamotor	R—Resistor
I—Meter	RE—Relay
J—Jack	S—Switch
L—Inductor	T—Transformer
LM—Lamp	TB—Terminal Board
NE—Neon Lamp	VT—Vacuum Tube

When not given a Signal Corps type number, the number following the letter indicates the physical and electrical characteristics and size of component or part. All parts with the same letter and number are interchangeable. Following the letter and number is a dash and an additional number which serves to show the exact (1) physical and electrical position, (2) use in equipment, and (3) location on drawings or diagrams. In all cases when replacing a defective component or part the marking, including the dash number, must agree exactly with that of the replaced part. This means that the radio repairman must stencil the dash number on all new replacement parts. Parts designated by a letter and an adjacent number (e.g. C7, C12-4, etc.) are assigned by the manufacturer for reference purposes in a particular equipment and are not to be confused with Signal Corps type numbers, which may be recognized by a dash number after the letter, e.g., I-70, DM-20, VT-86. Where parts assigned a Signal Corps type number have been used in this equipment, the type number assigned is used as the reference number. It should be noted in other than Signal Corps type numbers that the largest dash number following a specific letter and number indicates the total number of those identical parts which are contained in the radio compass, except when the part is a multiple unit. Hence C21-4 indicated there are four C21 capacitors used since capacitor C21 is a single unit. C3-21 indicates there are seven C3 capacitors used since C3 is a triple section unit. Interchangeable multiple section units with different values per section are identified as follows: C35A-1, C35A-2, C35B, or R4A-1, R4B-1, or S5A, S5B, S5C, S5D. Some switch sections have two or more groups of contacts which are indicated as follows: S1-1A, S1-1B. In all such cases the first letter and number completely describes the unit and indicates its interchangeability with units of like markings.

The following abbreviations have been used to indicate manufacturers of various parts:

Aerovox	Aerovox Corporation	Brooklyn, N. Y.
Am. Brass	American Brass Company	Waterbury, Conn.
Amertran	American Transformer Co.	Newark, N. J.
Bendix	Bendix Radio Corp.	Chicago, Ill.
Bussman	Bussman Mfg. Company	Chicago, Ill.
Cinch	Cinch Mfg. Corporation	Chicago, Ill.
Erie	Erie Resistor Corp.	Erie, Pa.
G.E.	General Electric Co.	Schenectady, N. Y.
H. & H.	Arrow-Hart and Hegeman	Hartford, Conn.
Hammarlund	Hammarlund Mfg. Corp.	New York, N. Y.
Hickok	Hickok Electrical Inst. Co.	Cleveland, Ohio
I.R.C.	International Resistance Co.	Philadelphia, Pa.
Kearfott	Kearfott Engineering Corp.	New York, N. Y.
Kellogg	Kellogg Switchboard & Supply Co.	Chicago, Ill.
Kenrad	Ken-Rad Tube and Lamp Corp.	Owensboro, Ky.
Kurman	Kurman Electric Co., Inc.	New York, N. Y.
Lord	Lord Mfg. Company	Erie, Pa.
Micamold	Micamold Radio Corp.	Brooklyn, N. Y.
Oak	Oak Mfg. Co.	Chicago, Ill.
Ohmite	Ohmite Mfg. Co.	Chicago, Ill.
P. Inst.	Pioneer Instrument Co.	Brooklyn, N. Y.
Pioneer	Pioneer Gen-E-Motor Corp.	Chicago, Ill.
R.C.C.	Radio Condenser Co.	Camden, N. J.
Yaxley	P. R. Mallory & Co., Inc.	Indianapolis, Ind.

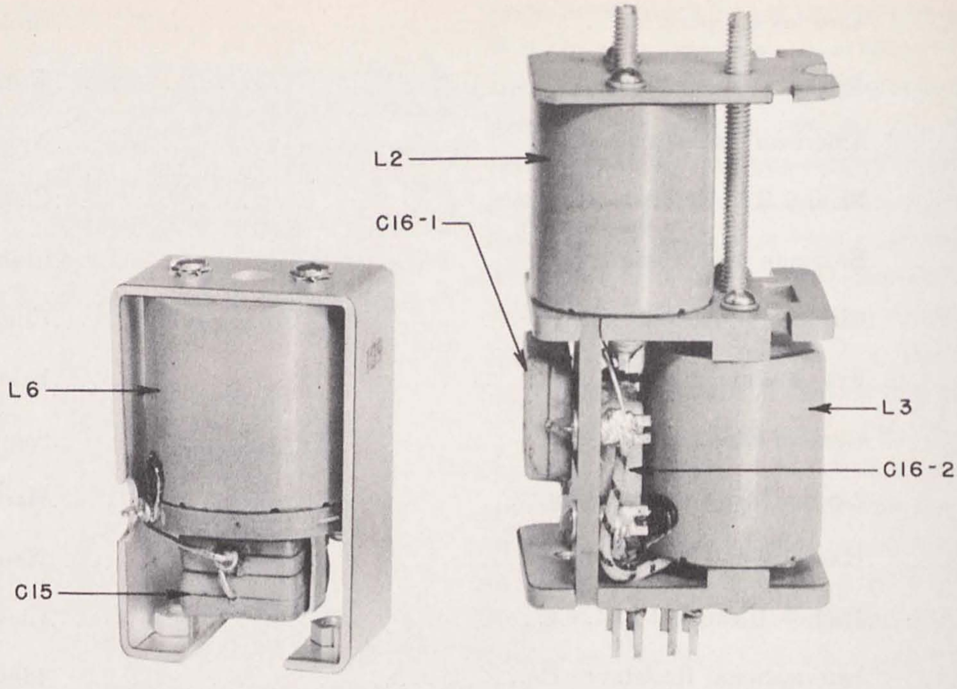


FIG. 36. TRAP ASSEMBLIES (109 AND 104)

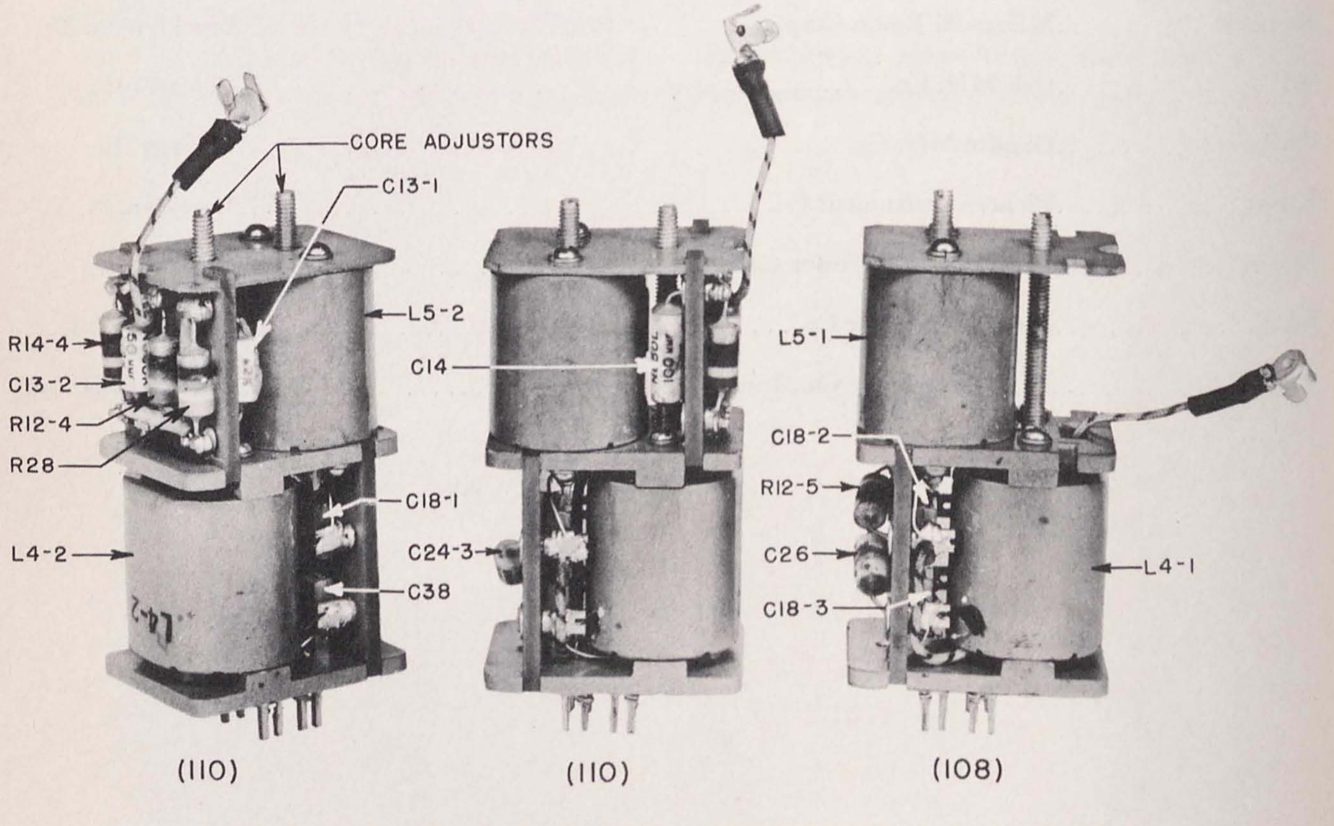


FIG. 37. I.F. TRANSFORMER ASSEMBLIES (110 AND 108)

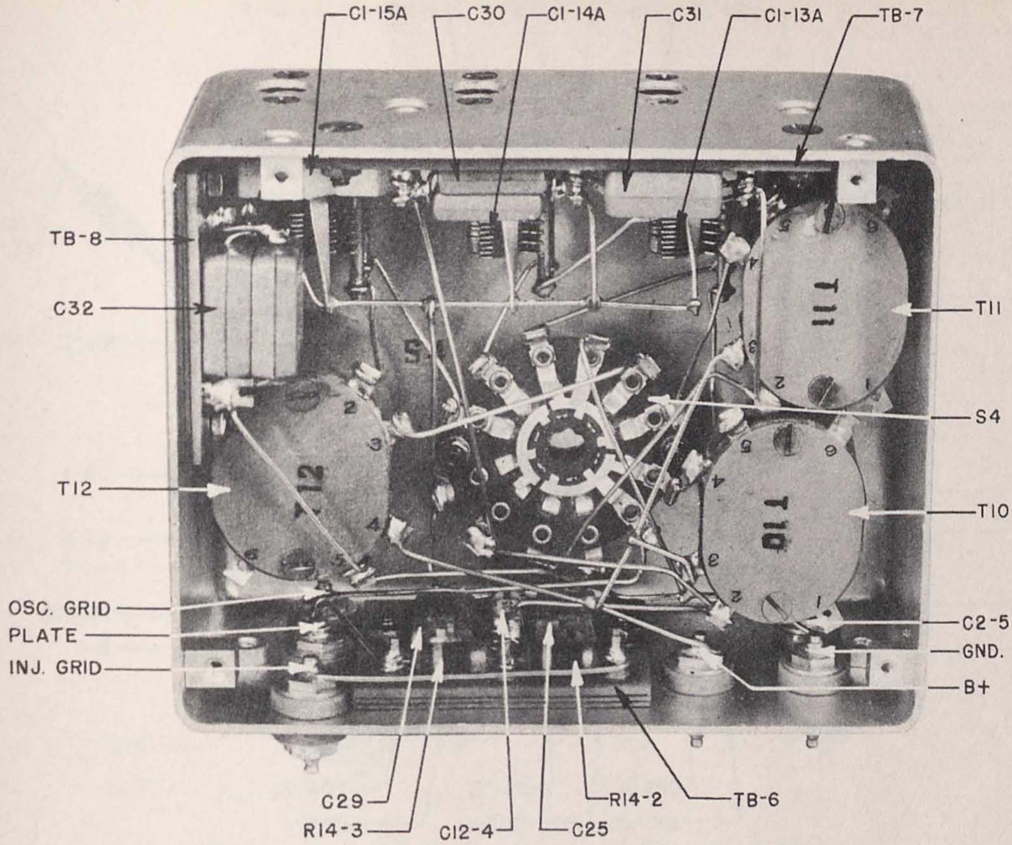


FIG. 38. R.F. OSCILLATOR TUNING ASSEMBLY (107)

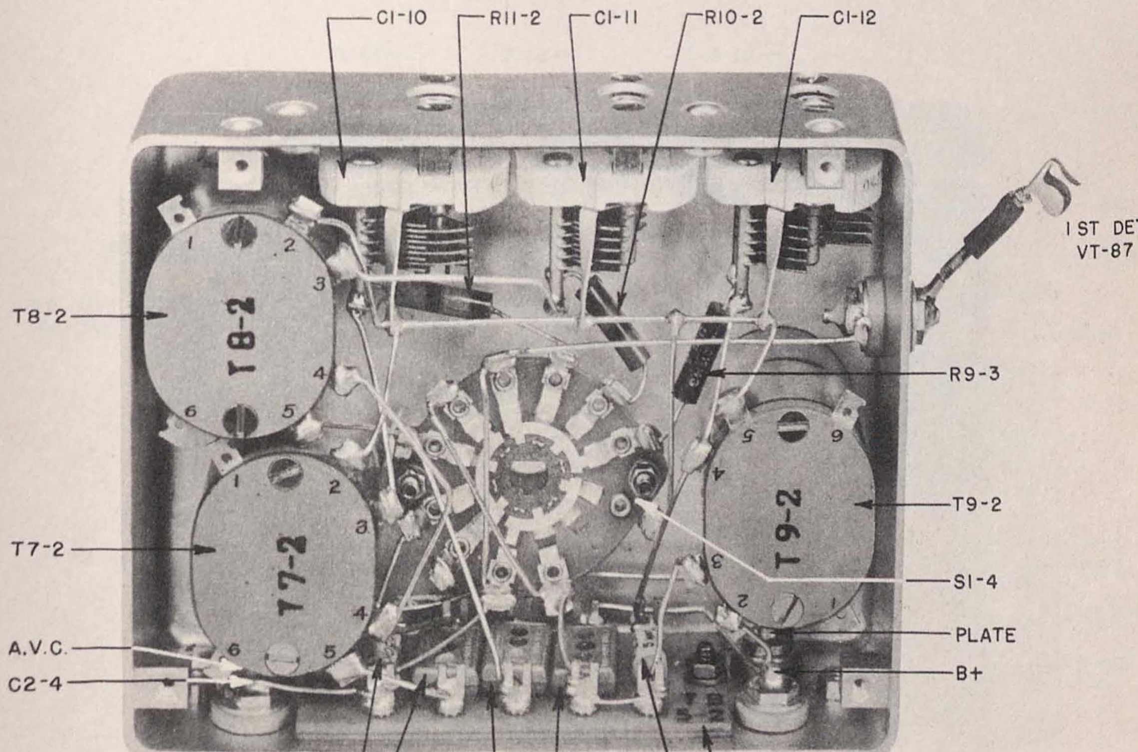


FIG. 39. 2ND R.F. TUNING ASSEMBLY (106)

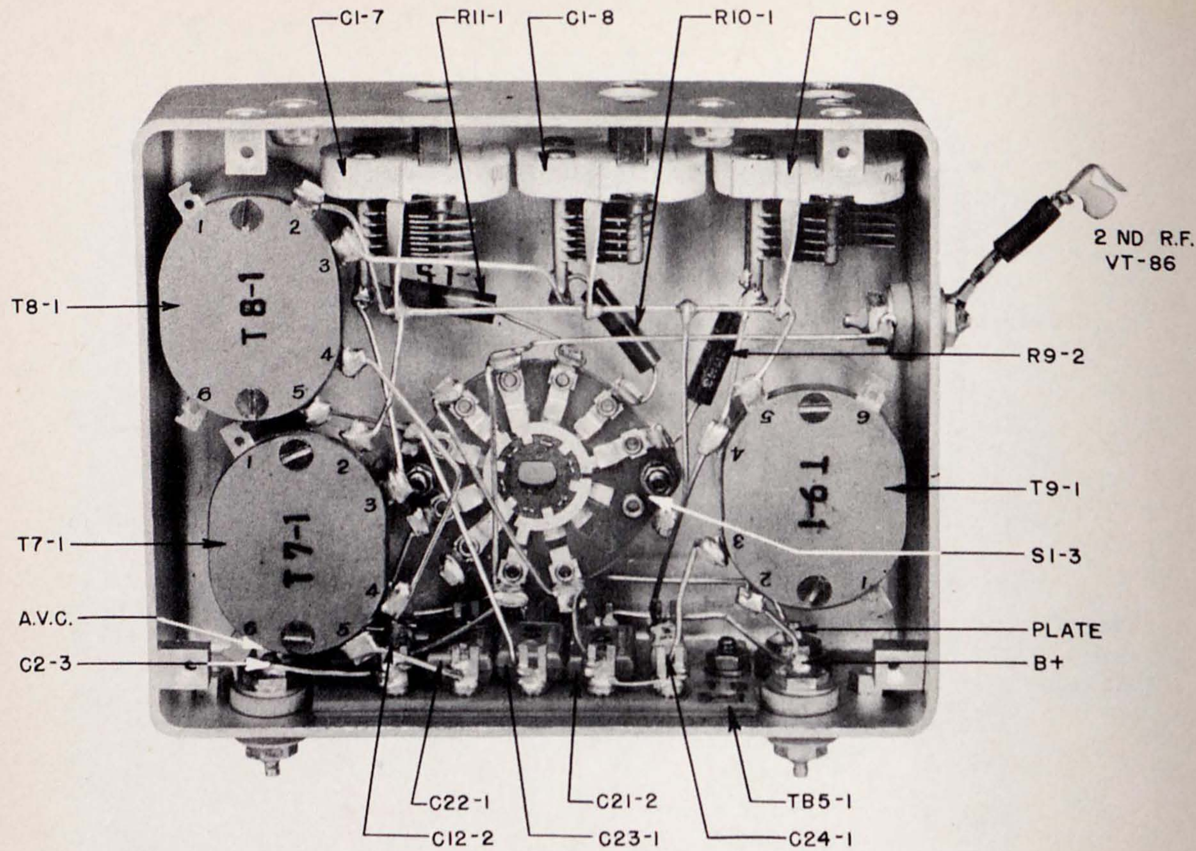


FIG. 40. 1ST R.F. TUNING ASSEMBLY (105)

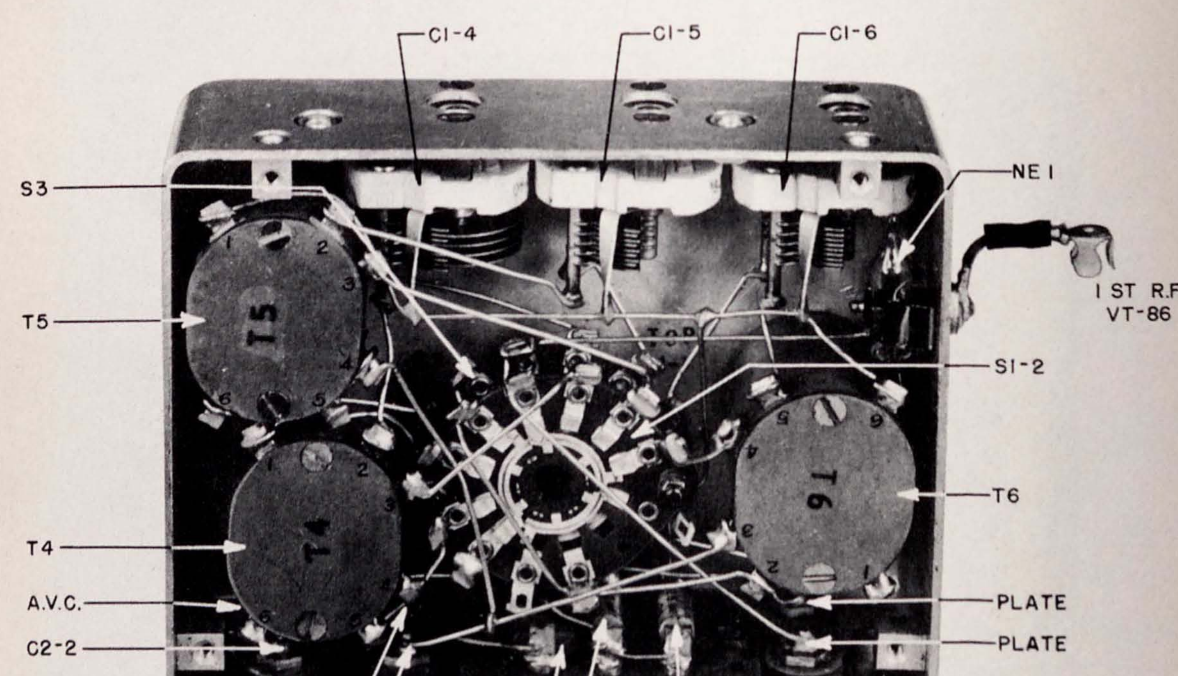


FIG. 41. ANTENNA TUNING ASSEMBLY (102)

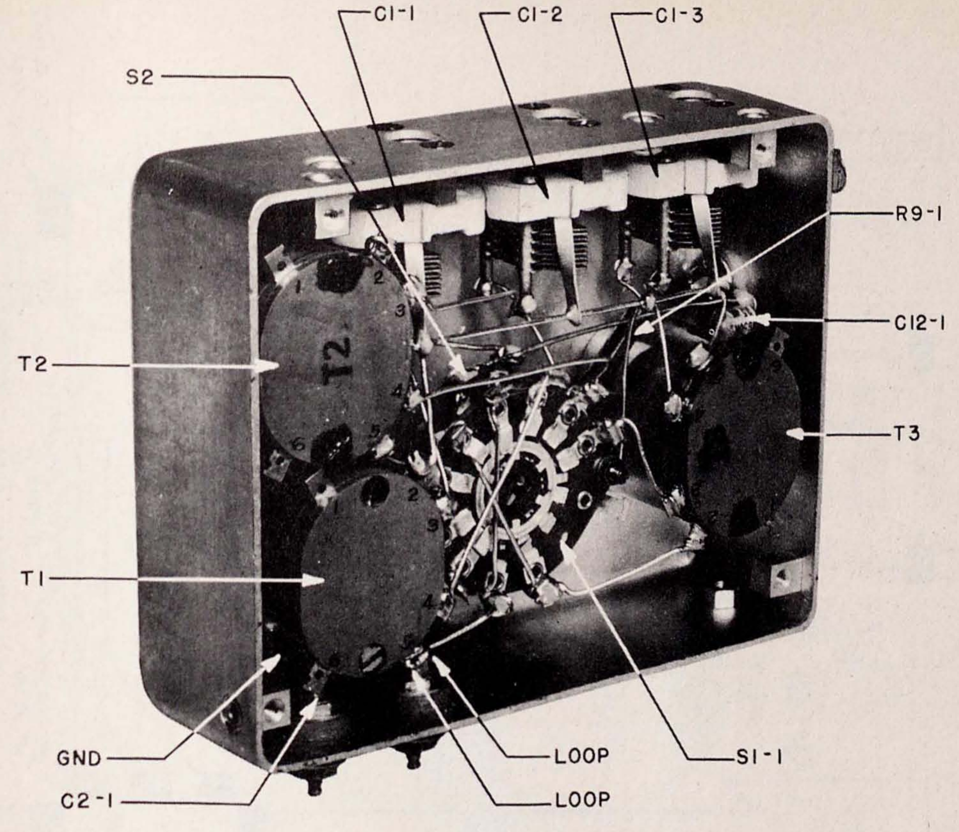
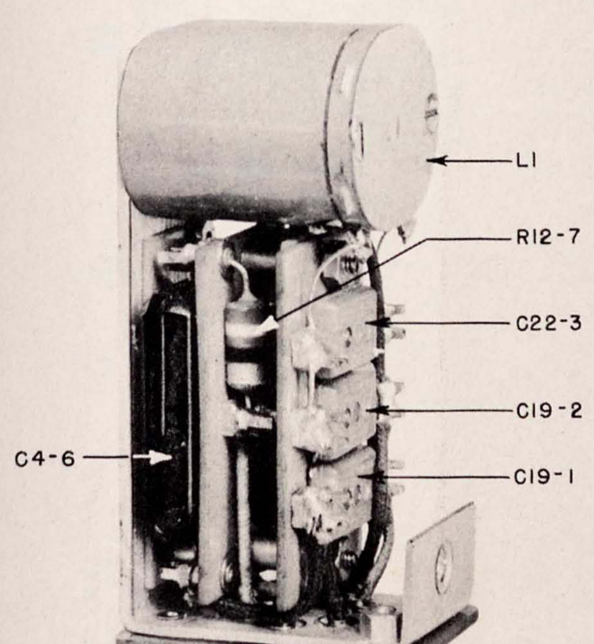


FIG. 42. LOOP TUNING ASSEMBLY (100)



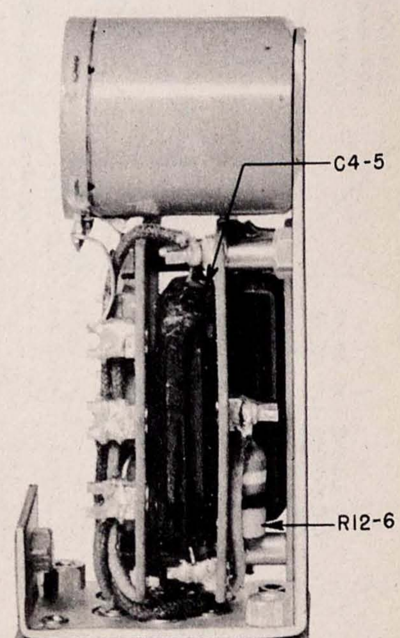


FIG. 43. LOOP PHASER ASSEMBLY (101)

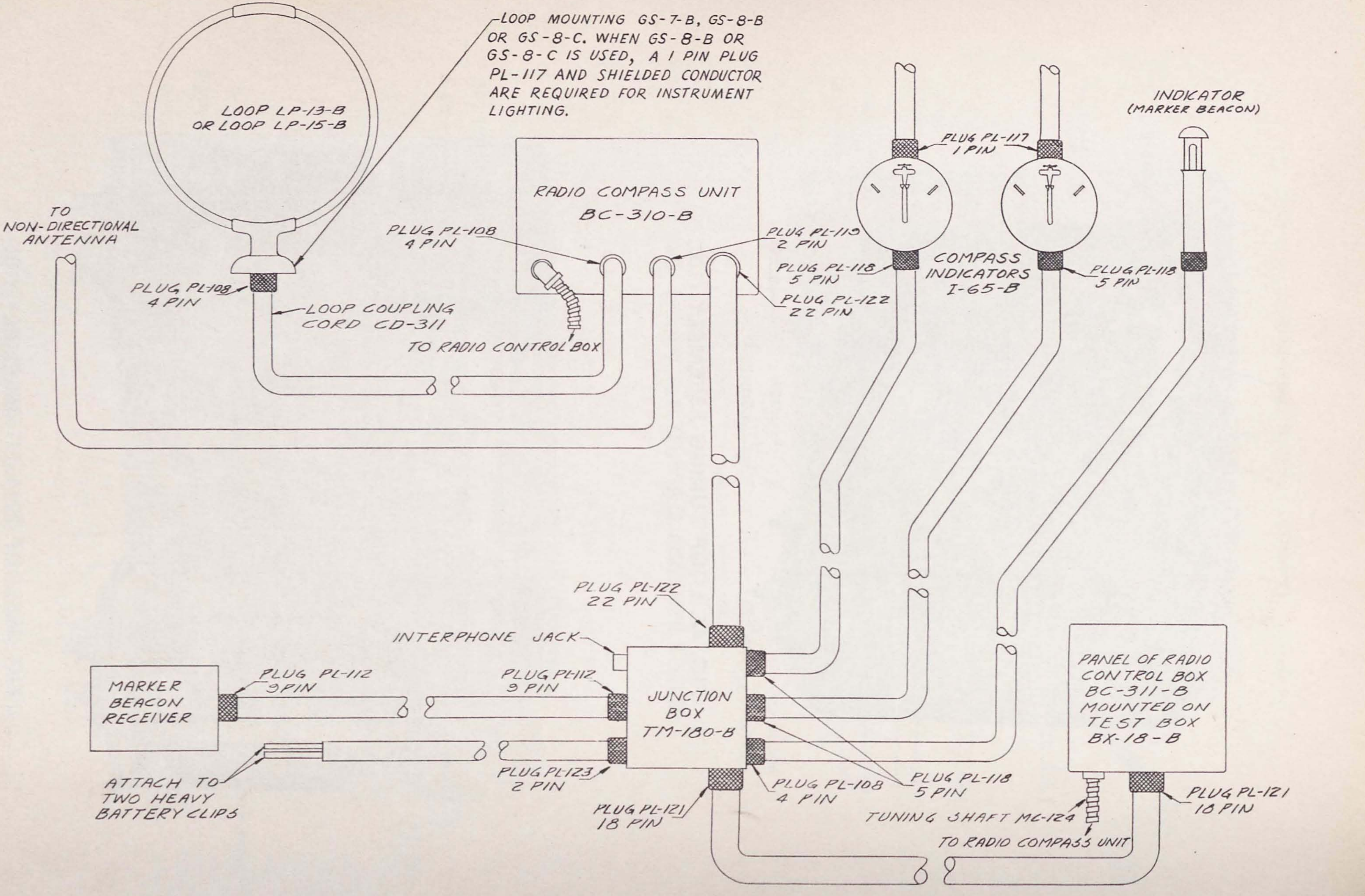
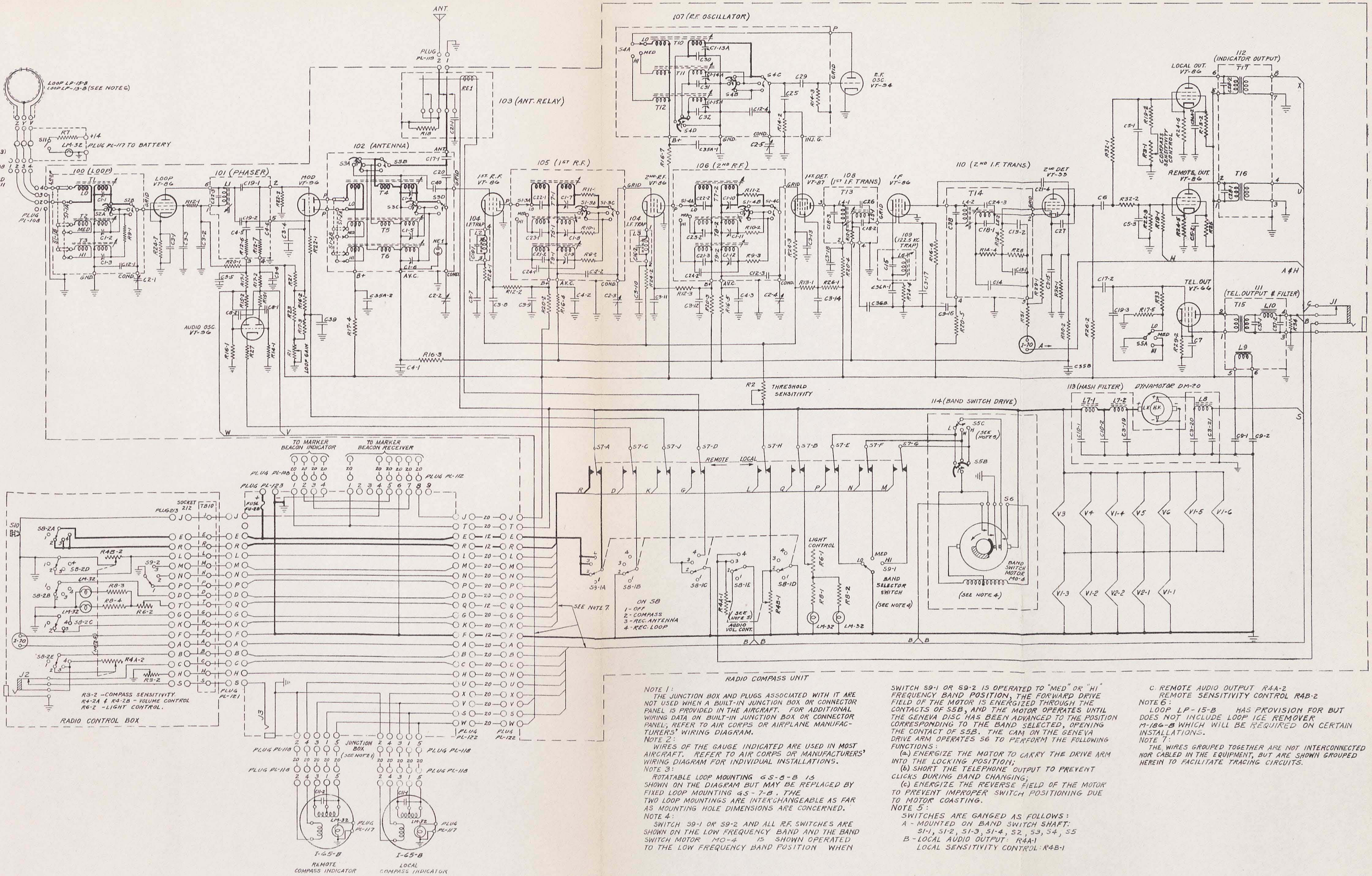


FIG. 44. TYPICAL CORDING DIAGRAM, RADIO COMPASS SCR-242-B



NOTE 1:
THE JUNCTION BOX AND PLUGS ASSOCIATED WITH IT ARE NOT USED WHEN A BUILT-IN JUNCTION BOX OR CONNECTOR PANEL IS PROVIDED IN THE AIRCRAFT. FOR ADDITIONAL WIRING DATA ON BUILT-IN JUNCTION BOX OR CONNECTOR PANEL, REFER TO AIR CORPS OR AIRPLANE MANUFACTURERS' WIRING DIAGRAM.

NOTE 2:
WIRES OF THE GAUGE INDICATED ARE USED IN MOST AIRCRAFT. REFER TO AIR CORPS OR MANUFACTURERS' WIRING DIAGRAM FOR INDIVIDUAL INSTALLATIONS.

NOTE 3:
ROTATABLE LOOP MOUNTING GS-8-B IS SHOWN ON THE DIAGRAM BUT MAY BE REPLACED BY FIXED LOOP MOUNTING GS-7-B. THE TWO LOOP MOUNTINGS ARE INTERCHANGEABLE AS FAR AS MOUNTING HOLE DIMENSIONS ARE CONCERNED.

NOTE 4:
SWITCH S9-1 OR S9-2 AND ALL R.F. SWITCHES ARE SHOWN ON THE LOW FREQUENCY BAND AND THE BAND SWITCH MOTOR MO-4 IS SHOWN OPERATED TO THE LOW FREQUENCY BAND POSITION WHEN SWITCH S9-1 OR S9-2 IS OPERATED TO "MED" OR "HI" FREQUENCY BAND POSITION, THE FORWARD DRIVE FIELD OF THE MOTOR IS ENERGIZED THROUGH THE CONTACTS OF S5B, AND THE MOTOR OPERATES UNTIL THE GENEVA DISC HAS BEEN ADVANCED TO THE POSITION CORRESPONDING TO THE BAND SELECTED, OPENING THE CONTACT OF S5B. THE CAM ON THE GENEVA DRIVE ARM OPERATES S6 TO PERFORM THE FOLLOWING FUNCTIONS:

(a.) ENERGIZE THE MOTOR TO CARRY THE DRIVE ARM INTO THE LOCKING POSITION;

(b.) SHORT THE TELEPHONE OUTPUT TO PREVENT CLICKS DURING BAND CHANGING;

(c.) ENERGIZE THE REVERSE FIELD OF THE MOTOR TO PREVENT IMPROPER SWITCH POSITIONING DUE TO MOTOR COASTING.

NOTE 5:
SWITCHES ARE GANGED AS FOLLOWS:

A - MOUNTED ON BAND SWITCH SHAFT:
S1-1, S1-2, S1-3, S1-4, S2, S3, S4, S5

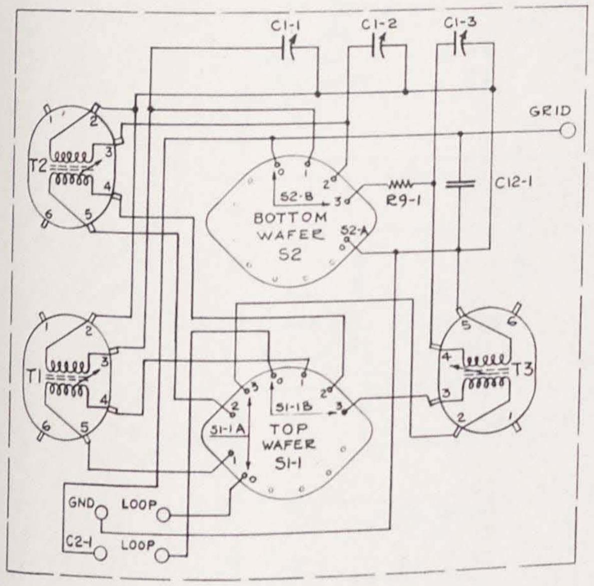
B - LOCAL AUDIO OUTPUT: R4A-1
LOCAL SENSITIVITY CONTROL: R4B-1

C. REMOTE AUDIO OUTPUT R4A-2
REMOTE SENSITIVITY CONTROL R4B-2

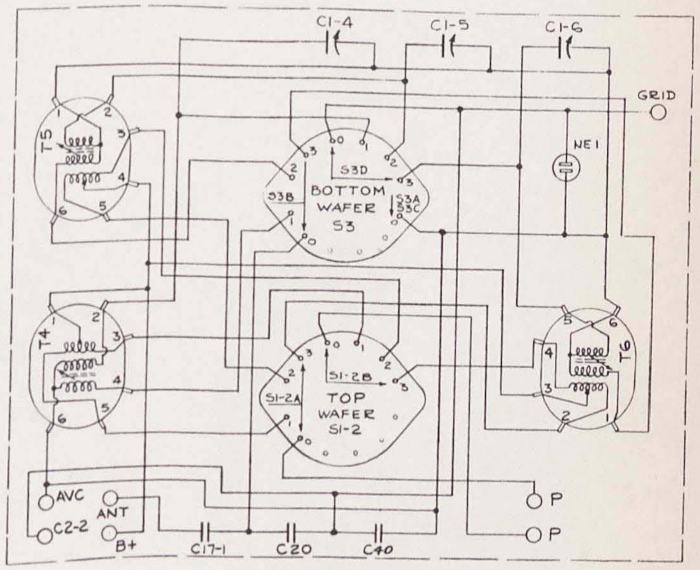
NOTE 6:
LOOP LP-15-B HAS PROVISION FOR BUT DOES NOT INCLUDE LOOP ICE REMOVER M-186-B WHICH WILL BE REQUIRED ON CERTAIN INSTALLATIONS.

NOTE 7:
THE WIRES GROUPED TOGETHER ARE NOT INTERCONNECTED NOR CABLED IN THE EQUIPMENT, BUT ARE SHOWN GROUPED HEREIN TO FACILITATE TRACING CIRCUITS.

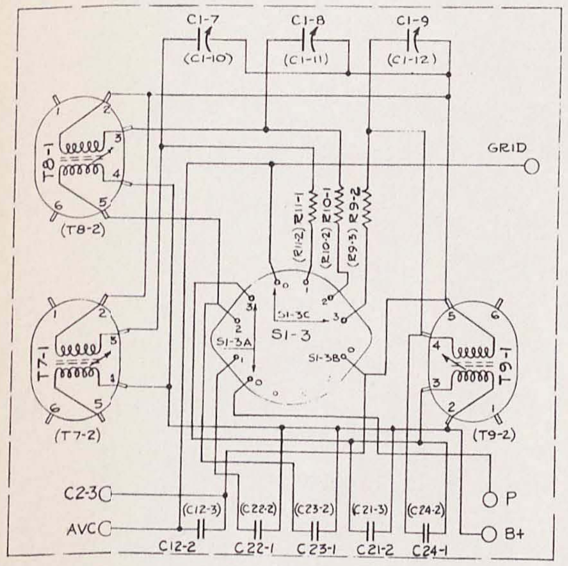
FIG. 45. SCHEMATIC CIRCUIT DIAGRAM—RADIO COMPASS SCR-242-B



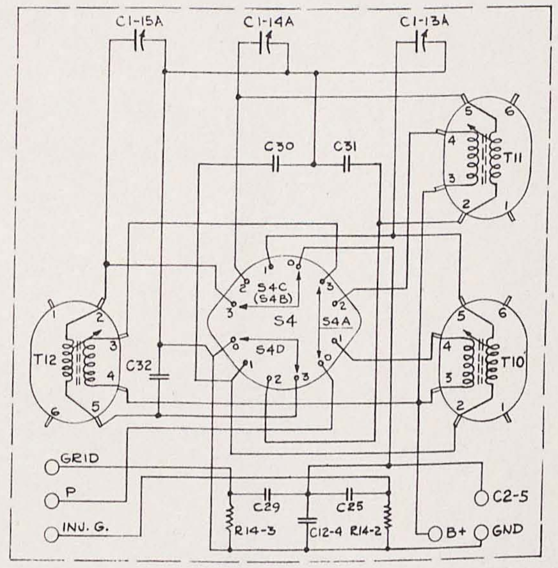
100
LOOP TUNING ASSEMBLY



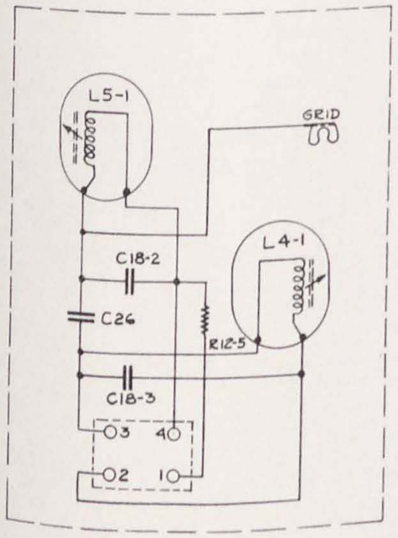
102
ANTENNA TUNING ASSEMBLY



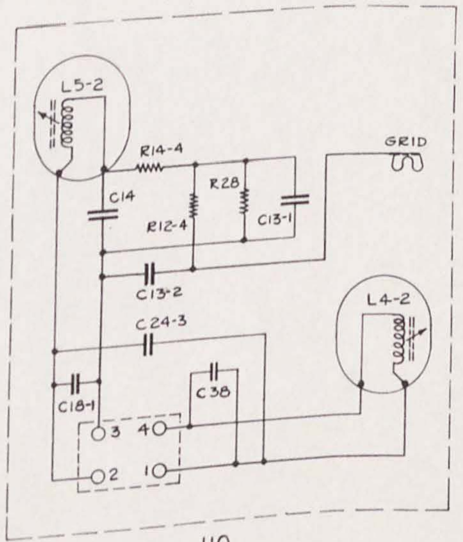
105
1ST R.F. TUNING ASSEMBLY
(VALUES IN PARENTHESIS ARE FOR 106 - 1ST R.F. T. ASS'Y)



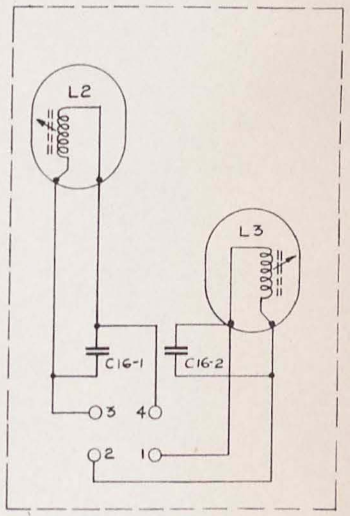
107
R.F. OSCILLATOR TUNING ASSEMBLY



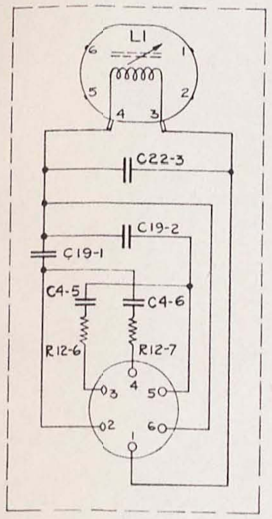
108
1ST I.F. TRANSFORMER



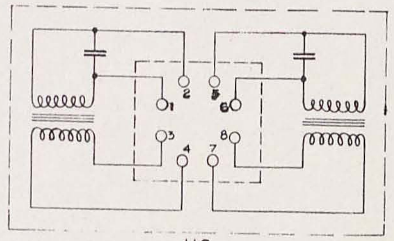
110
2ND I.F. TRANSFORMER



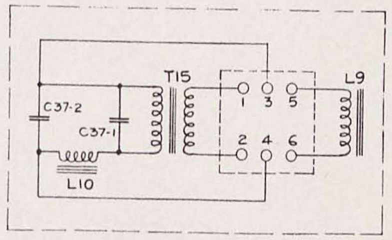
104
I.F. TRAP



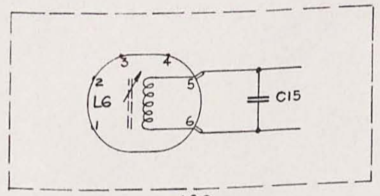
101
PHASE TRANSFORMER



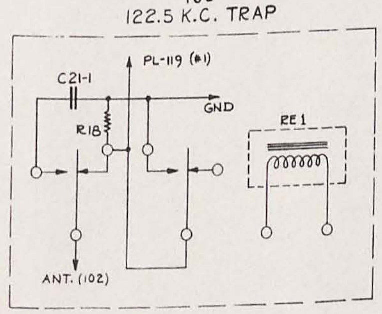
112
COMPASS OUTPUT TRANS.



111
PHONE OUTPUT TRANS. & CHOKE



109
122.5 K.C. TRAP



103
ANTENNA RELAY

FIG. 46. SCHEMATIC WIRING DIAGRAM SUBASSEMBLIES—RADIO COMPASS UNIT BC-310-B

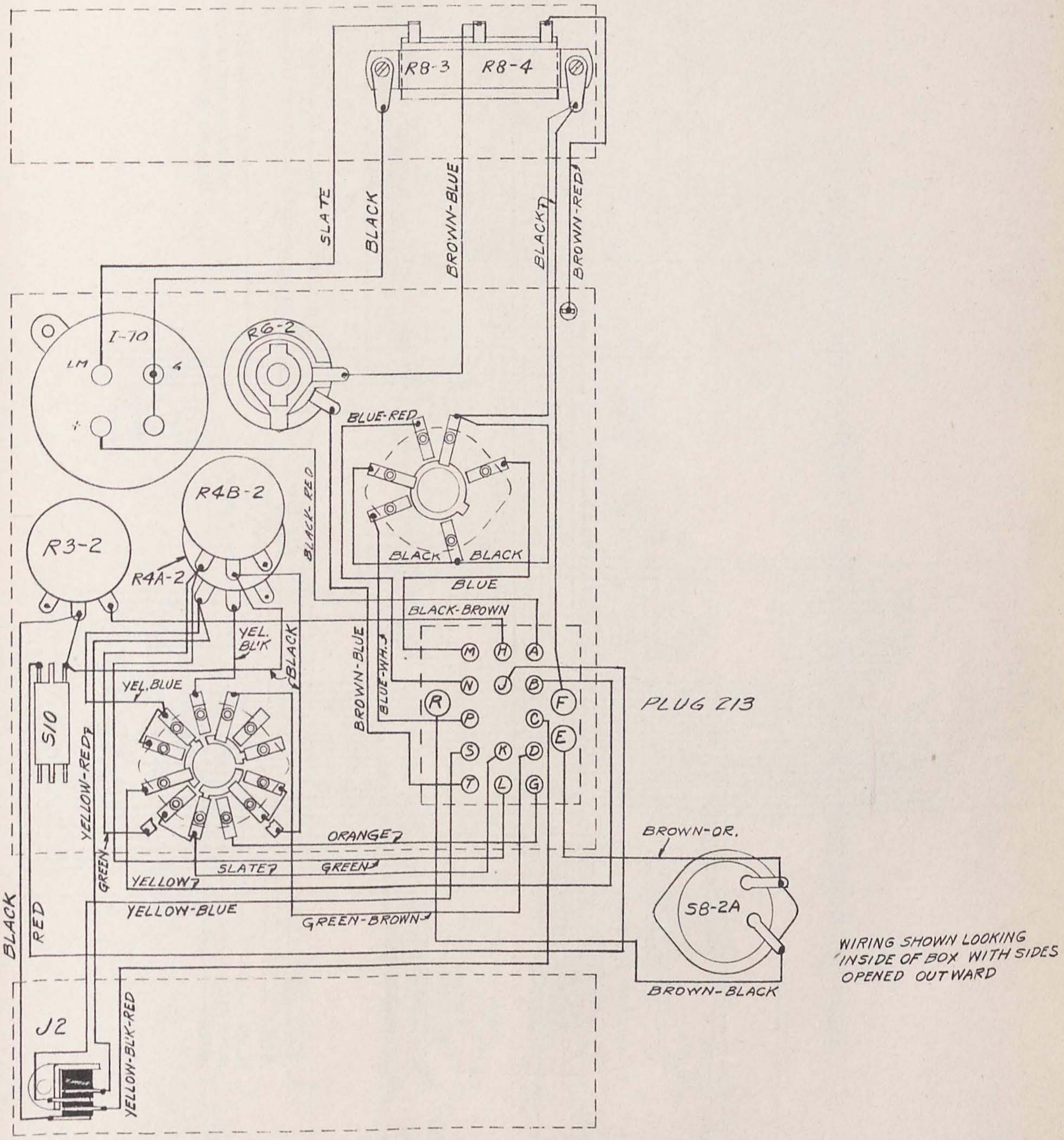


FIG. 48. WIRING DIAGRAM—RADIO CONTROL BOX BC-311-B

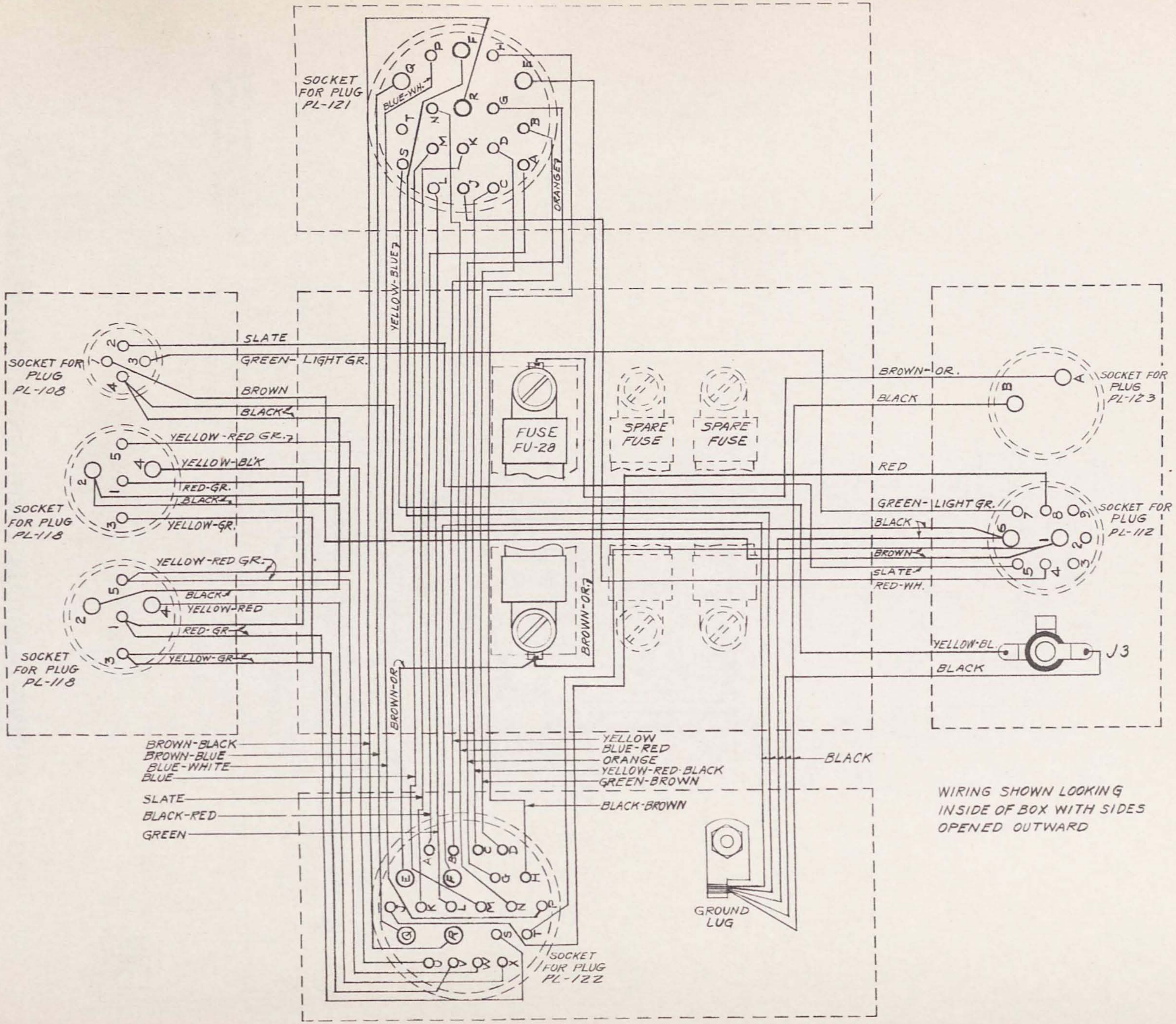


FIG. 49. WIRING DIAGRAM—JUNCTION BOX TM-180-B

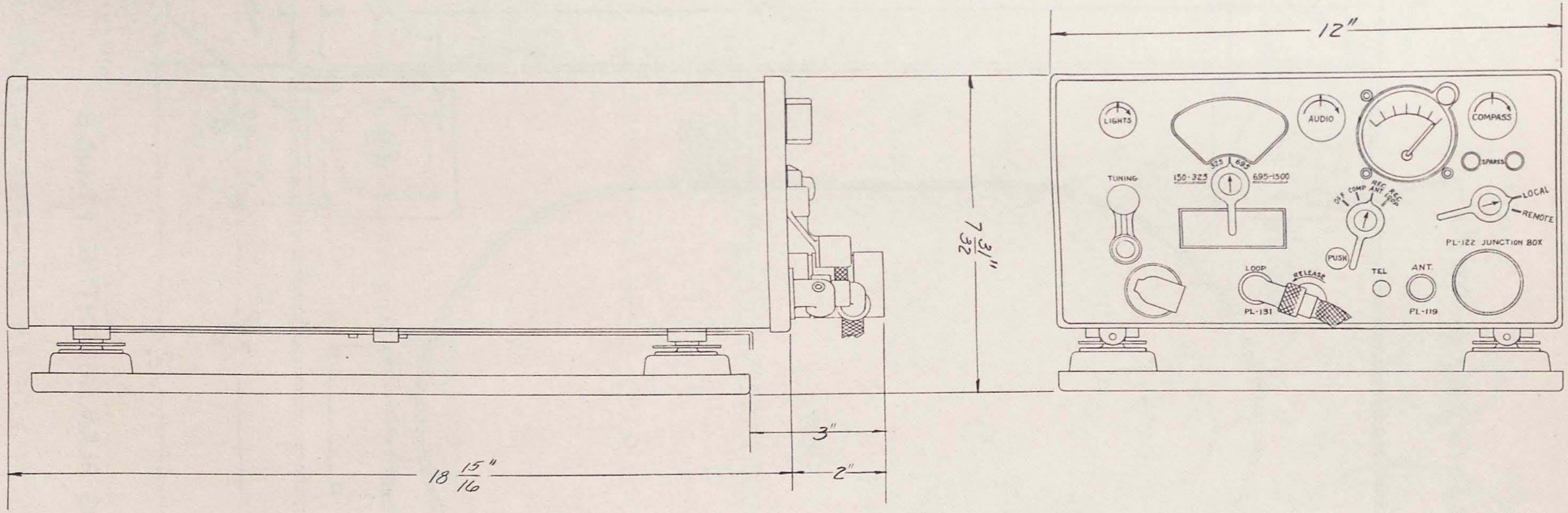


FIG. 50. OUTLINE DRAWING—RADIO COMPASS UNIT BC-310-B

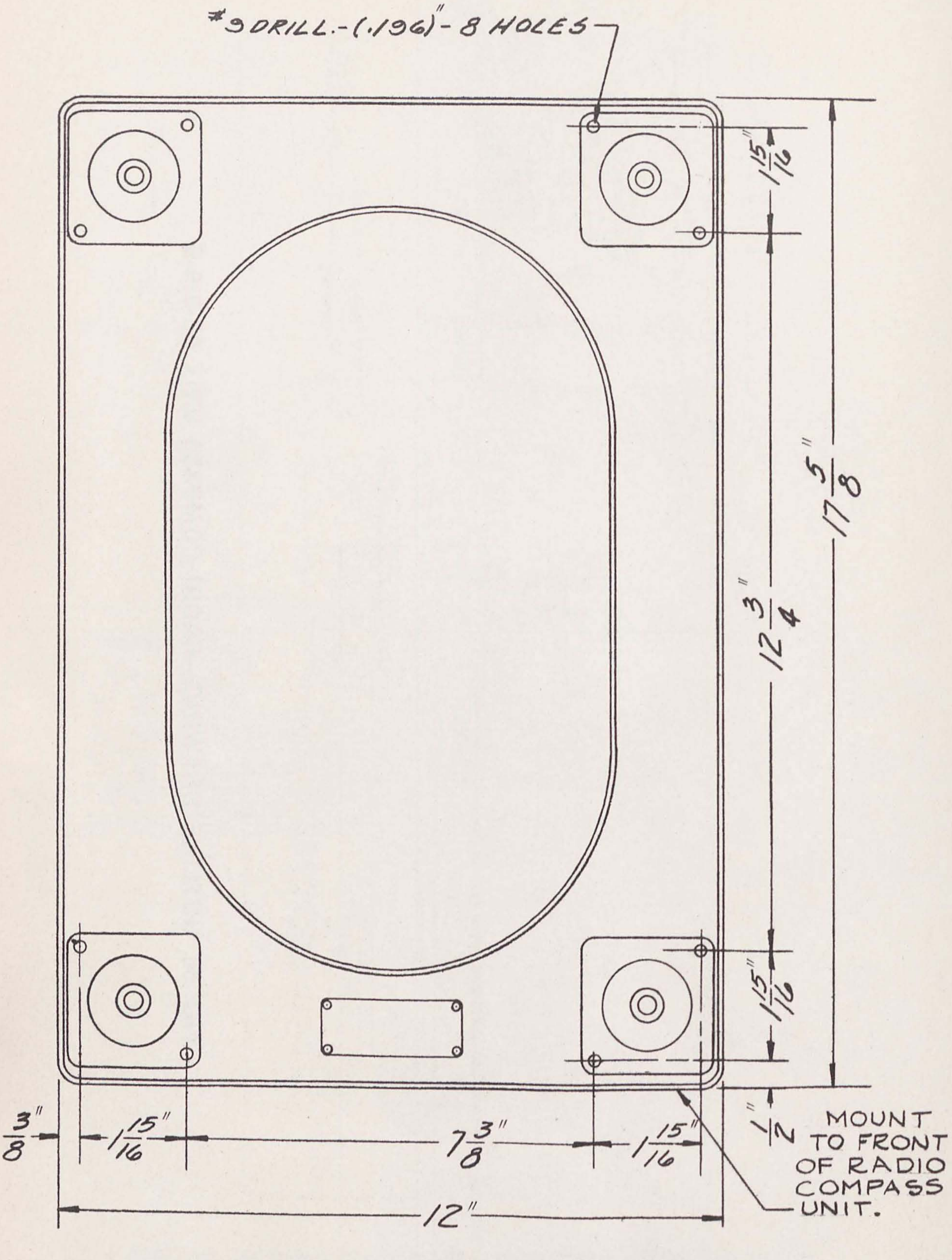


FIG. 51. DRILLING PLAN, MOUNTING FT-145-B

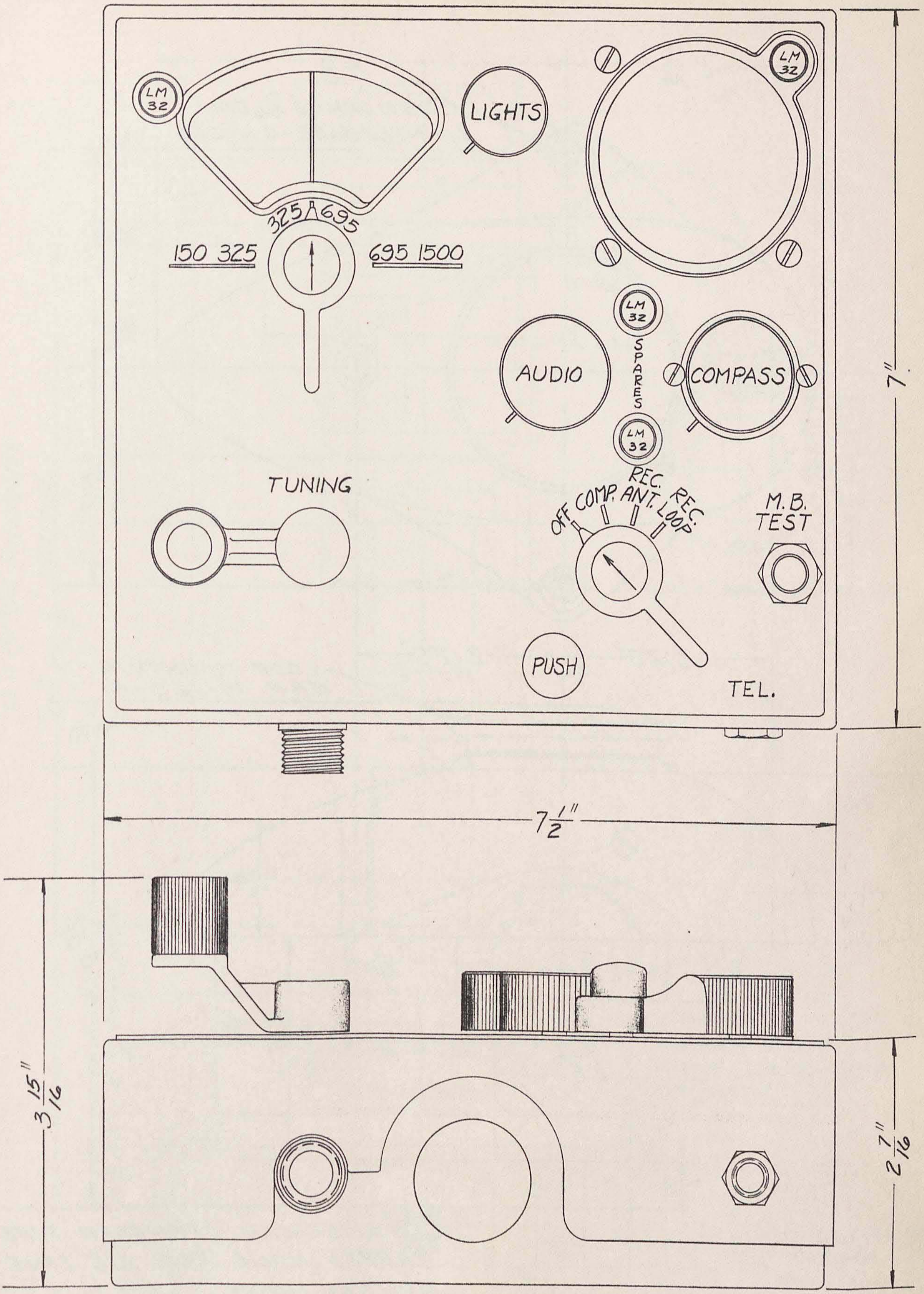


FIG. 52. OUTLINE DRAWING—RADIO CONTROL BOX BC-311-B

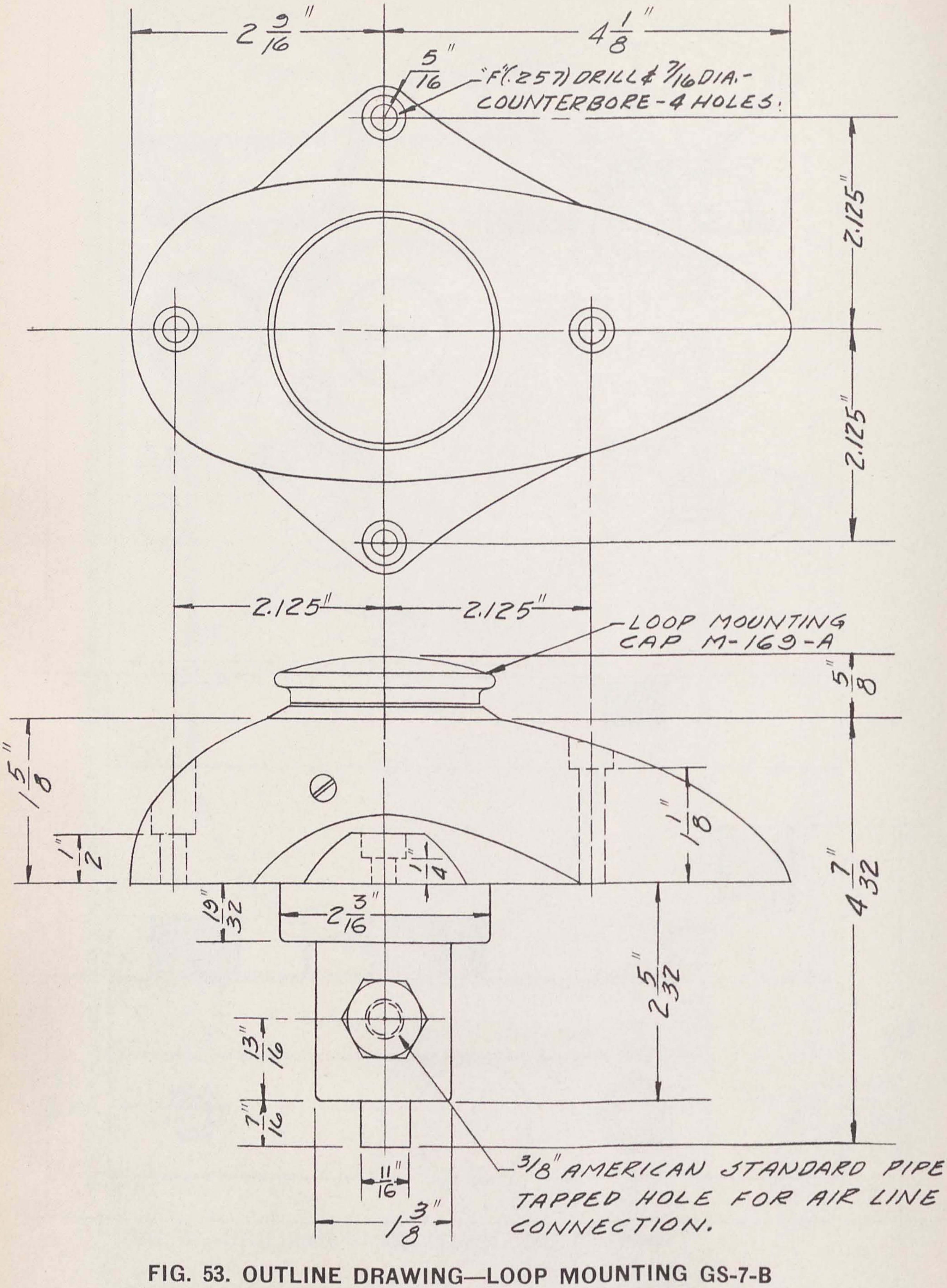


FIG. 53. OUTLINE DRAWING—LOOP MOUNTING GS-7-B

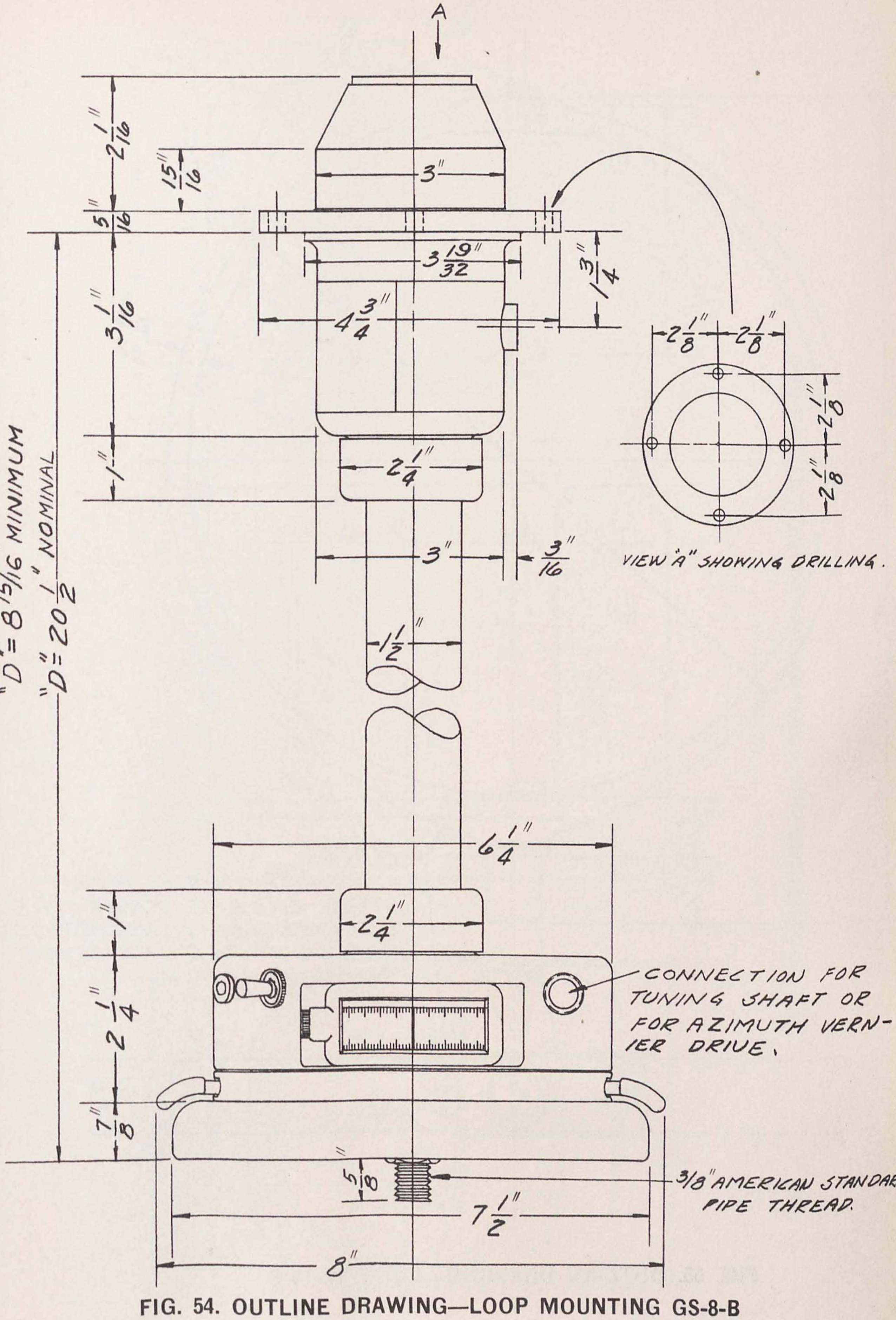


FIG. 54. OUTLINE DRAWING—LOOP MOUNTING GS-8-B

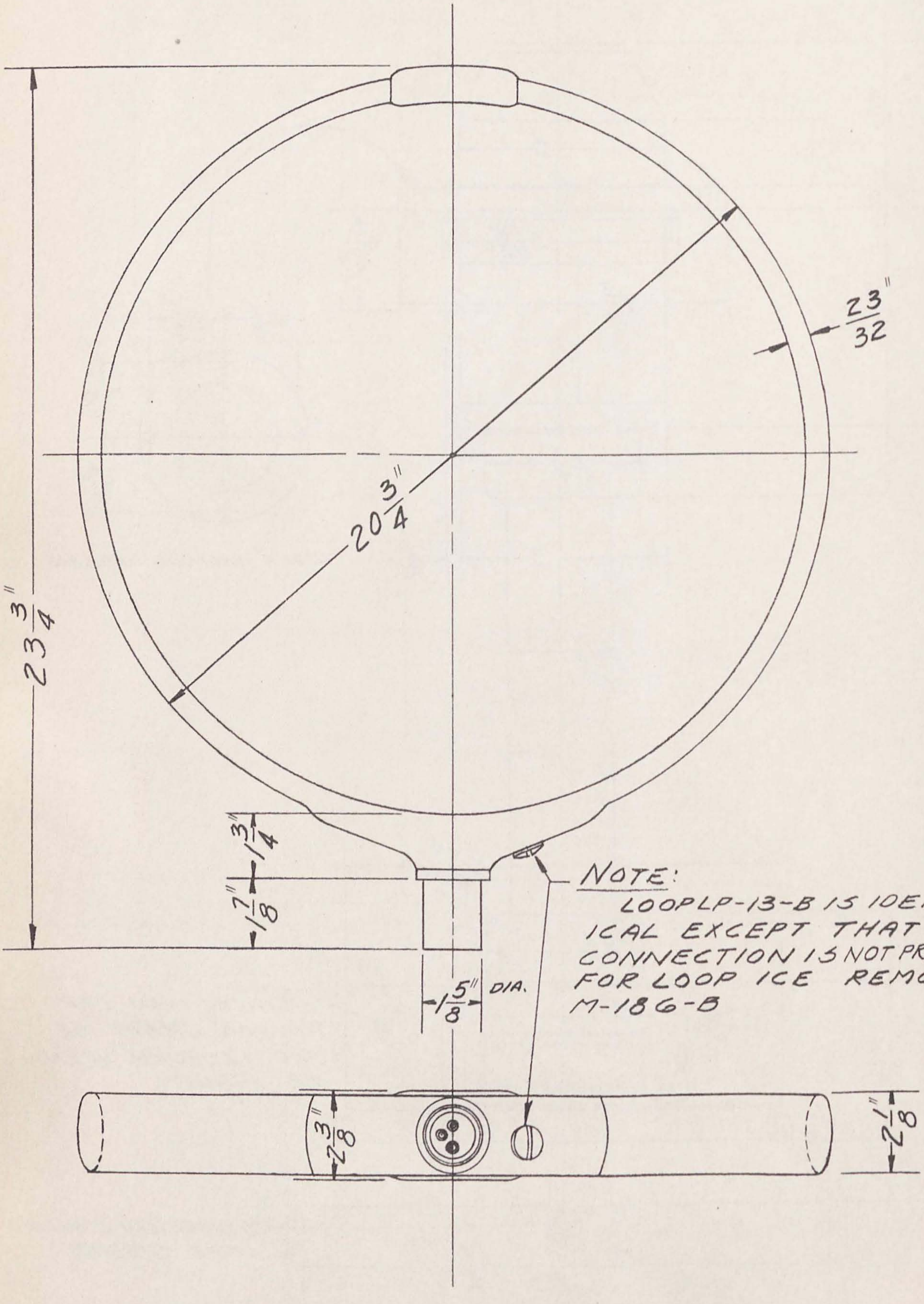


FIG. 55. OUTLINE DRAWING—LOOP LP-15-B

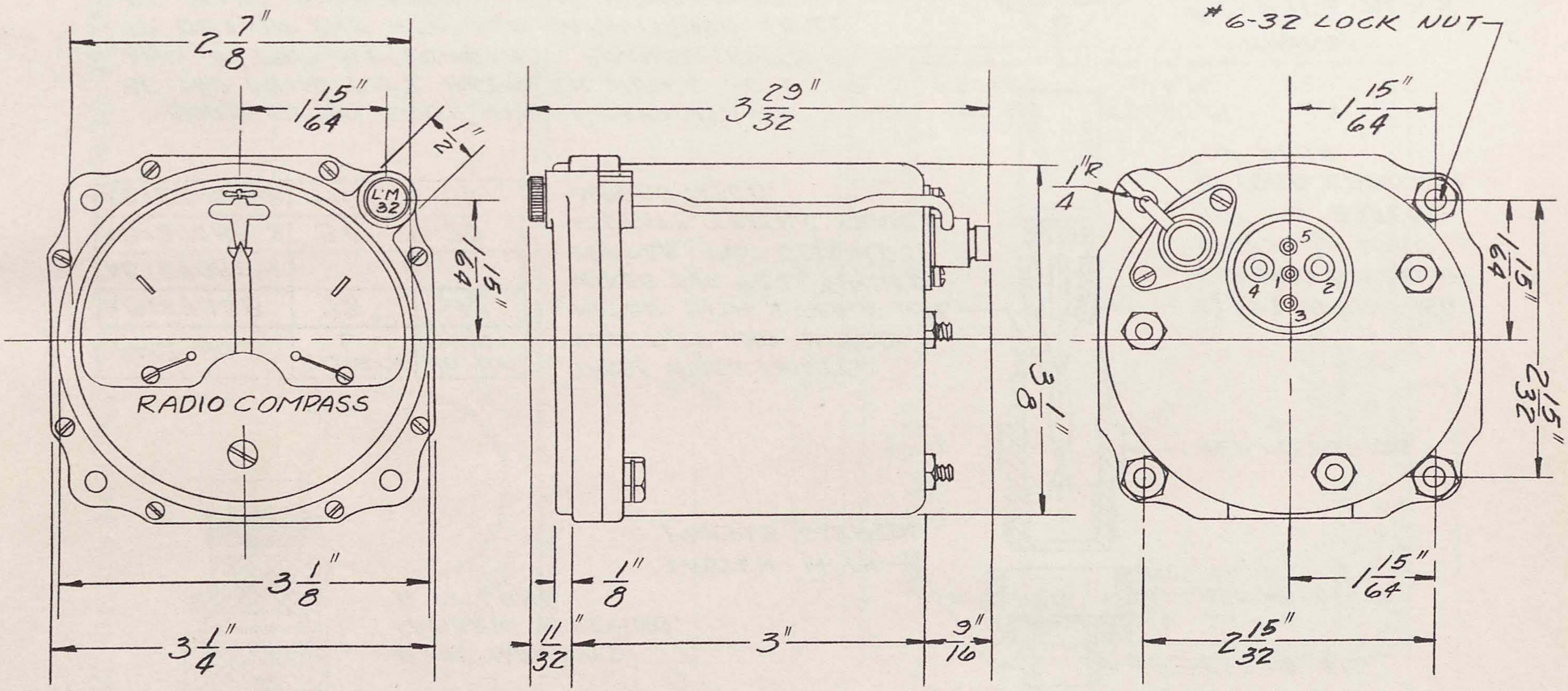
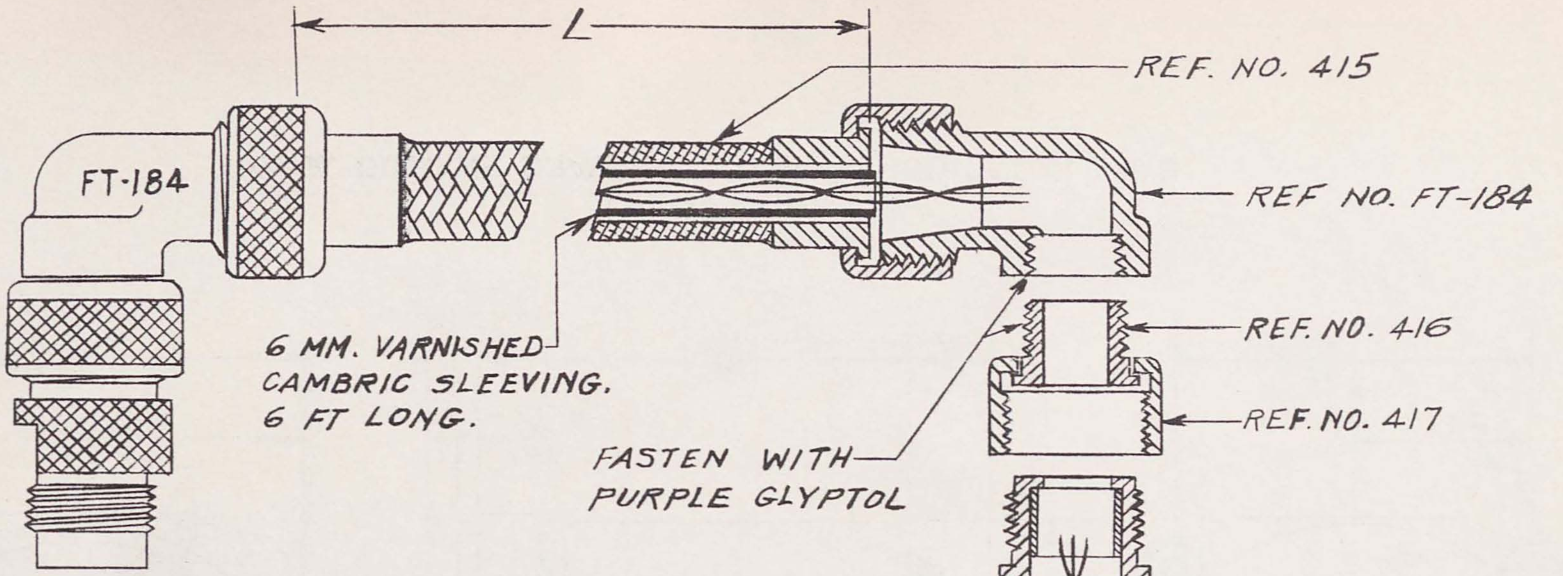
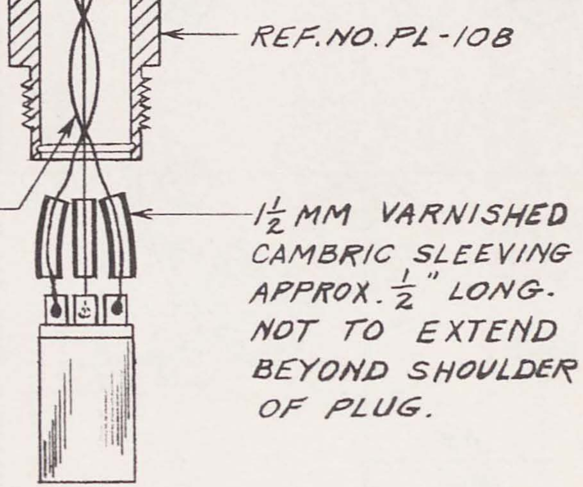


FIG. 56. OUTLINE DRAWING—COMPASS INDICATOR I-65-B

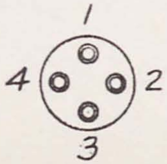




PART NO.	LENGTH L	NO. OF TWISTS
AB12708B	72"	110
AB12708B-1		
AB12708B-2	84"	70
AB12708B-3	110"	30

THREE WIRES TWISTED TOGETHER AND IMPREGNATED WITH SUPERLA WAX. WIRES ARE #22, TINNED COPPER, TWO CELLULOSE ACETATE TEXTILE BRAIDS, IMPREGNATED.

CORD CD-311 SHALL HAVE A CAPACITANCE OF 140 MMFD. ±5% BETWEEN WIRES NO. 2 AND 4 FOR ALL LENGTHS. ADJUSTMENTS TO OBTAIN THE REQUIRED CAPACITANCE SHALL BE MADE BY VARYING THE NUMBER OF TWISTS IN THE CORD.



WIRING:
#2 - WHITE - BLACK
#3 - BLACK
#4 - WHITE - BLUE

FIG. 57. CORD CD-311 ASSEMBLY DRAWING

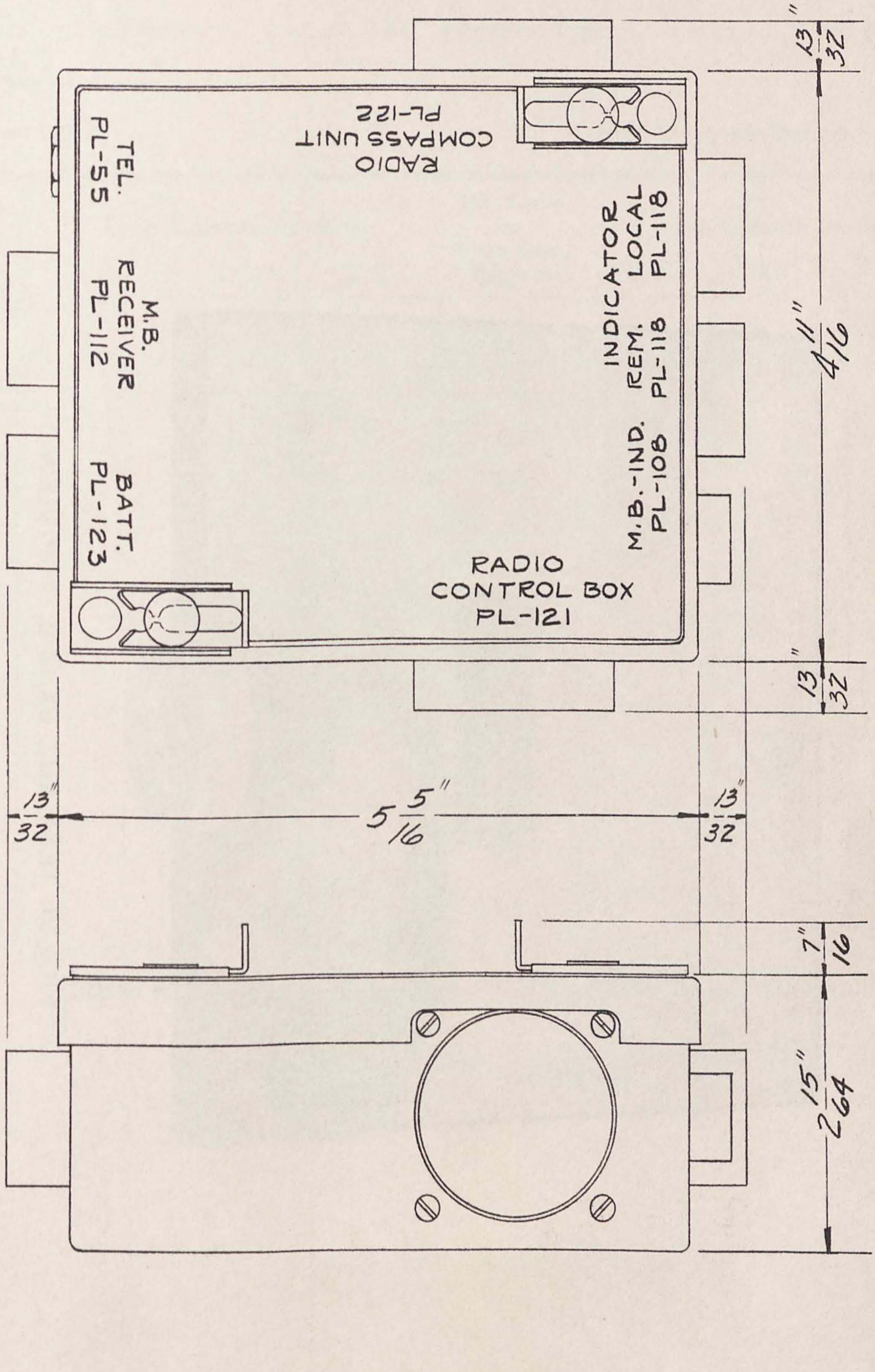


FIG. 58. OUTLINE DRAWING—JUNCTION BOX TM-180-B