signal, and then use the CRYSTAL VERNIER control to obtain a peak output.

19. C-W Reception

a. Code reception (c-w) is very similar to radiophone reception. However, a beat signal within the receiver must be supplied in order to hear the c-w signal.

b. The procedure for listening to c-w reception with either vfo or crystal operation is the same as the procedure used in receiving radiophone reception, except for the following differences:

(1) Turn the CW-MODULATION switch to the CW position.
(2) Adjust the BFO PITCH control to obtain the desired tone.
(3) Place the AGC-MANUAL switch in the MANUAL or AGC position.
(4) The SELECTIVITY control can be set to the position giving the clearest signal with the least interference. When using the crystal positions, the CRYSTAL PHASING control will further adjust the band width and tune out unwanted signals or interference. In the CRYSTAL-SHARP position, the CRYSTAL PHASING control is very critical.
(5) The other controls can be adjusted in the same manner used for radiophone reception.

20. Stopping Procedure

To stop operation of the receiver, turn the RF GAIN-AC control fully counterclockwise until a click is heard. This is the OFF position of the a-c power switch, S7.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

21. General

The operation of Radio Receiver R–274/FRR may be difficult in regions where extreme cold, heat, humidity and moisture, sand conditions, etc., prevail. In the following paragraphs, instructions are given on procedures for minimizing the effect of these unusual operation conditions.

22. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the efficient operation of equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. If the receiver is not in a heated enclosure, construct an insulated box for the receiver. Turn the RF GAIN-AC control clockwise until a click is heard. Leave it in this position for several minutes as a time to allow the tube filaments to warm up the inside of the receiver. If necessary, the receiver should be left on continuously with the RECEIVE-SEND switch, S6, in the SEND position.

c. Wear a knitted woolen cap over the earphones when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber earcaps since this action may render them useless. If water gets into the receivers, or if moisture condenses within them, it may impede the actuation of the diaphragm. When this happens, remove the bakelite cap and remove the ice and moisture from the receiver.

d. When equipment which has been exposed to the cold is brought into a warm room, it will start to sweat and will continue to do so until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also arises when equipment warms up during the day after exposure during a cold night.

23. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground and when it is set up in swampy areas, moisture conditions are more acute than normal in the tropics. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the ambient air. To minimize this condition, place lighted electric bulbs under the equipment.

24. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem which arises with equipment operation in desert areas is the large amount of sand or dust and dirt which enters the moving parts of radio equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of the tent with sand to prevent flapping in the wind.

c. Never tie power cords, signal cords, or other wiring connections to either the inside or the outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful that the equipment is as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Pay close attention to the condition of the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

25. Tools Supplied with Equipment

Most of the repair or maintenance may be made with the tools found in the average tool kit. Only two additional tools are supplied to supplement the necessary tools; these tools are Allen wrenches for use with No. 8–32 and No. 6–32 Allen screws. They may be used when it is necessary to tighten the BAND SELECTOR knob or make adjustments of the shaft couplings or gears. The wrenches are held by clips near the top of the chassis partition on the r-f stage side of the receiver.

26. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair, since its object is to prevent certain troubles from occurring (AR 750–5).

27. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) Clean all parts, except electrical contacts, with a cloth or brush moistened with solvent, dry cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a cloth.

(3) To clean turret contacts, insert a piece of clean paper while turning the turret to the next position. Then pull the paper from between the contacts. Do this for all six bands.

c. If available, dry compressed air may be used at line pressures not exceeding 60 pounds per square inch to remove dust from nonaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on prevention maintenance techniques, refer to TB SIG 178.

28. Performing Preventive Maintenance

There are certain items which must be checked periodically. The following lists indicate hov often the items are to be checked and what you should look for.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken. Be especially careful of any screws which screw into a plastic or bakelite material, since the threads may be stripped easily in this material.

DAILY

What to check	How to check
1. Exterior of receiver	1. Keep free of dirt and grease.
2. Dial lights (E5 and E6)	2. Should operate with receiver on.
3. CARRIER LEVEL meter (M1).	3. Receiver power off, needle is resting at the line at the extreme left of the scale.
4. Knobs	4. Check for tightness.

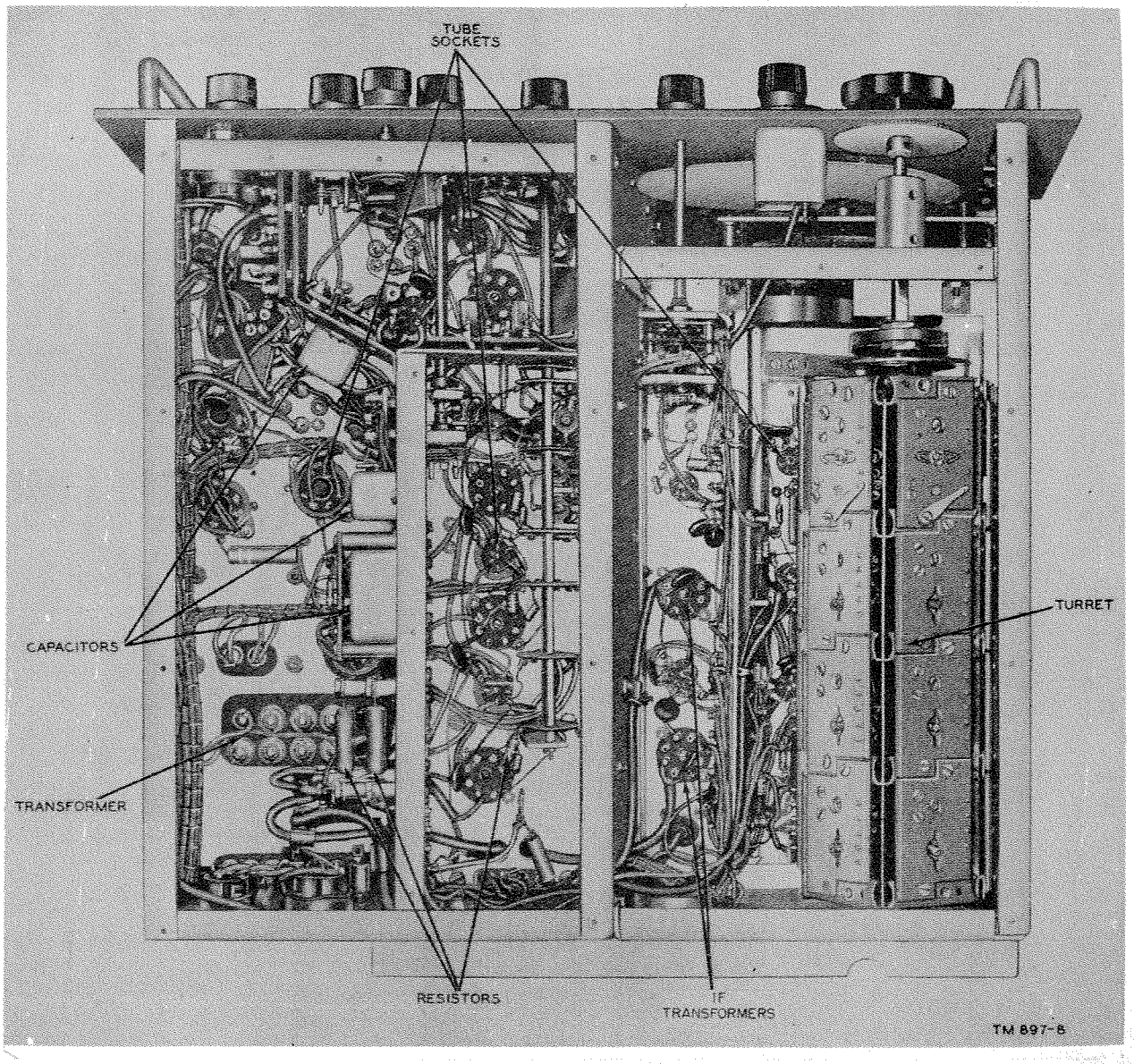

Figure 8. Radio Receiver R–274/FRR, bottom view showing typical preventive maintenance items.

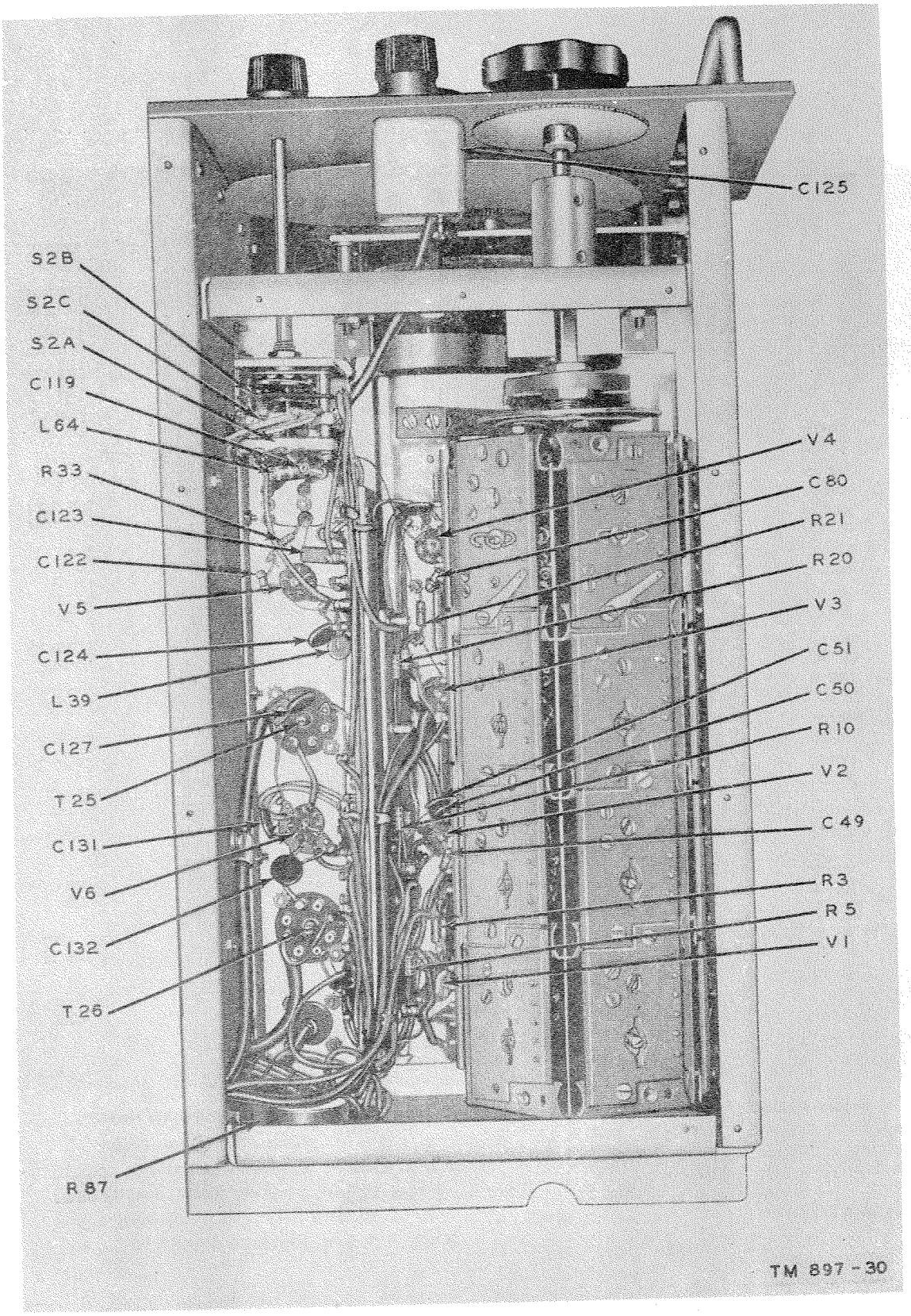

Figure 9. Radio Receiver R-274/FRR, top view showing typical preventive maintenance items.

WEEKLY

Caution: Disconnect power from receiver before making the following checks. Upon completion, reconnect power and check for satisfactory operation.

What to check	How to check
1. Exterior of receiver	1. Clean front panel and outside of chassis inclosure.
2. Filter capacitors C192 and C193.	2. Look for signs of heating and for leaking of dielectric.
3. Power transformer T34 and filter choke L61.	3. Feel for excessive heating.
4. Fuse F1 and fuse holder	4. Check for corrosion, cracks, and proper tension on contacts.
5. CARRIER LEVEL meter (M1).	5. Check for bent needle and adjustment to line.

MONTHLY

Visually inspect the following. Tighten and clean if necessary.

What to check	How to check
1. Tubes, crystals, and their sockets.	1. Look for loose contacts or pins, dirt and corrosion, or cracked glass. Replace vacuum tubes if necessary. Be careful not to bend the small pins on the miniature tubes.
2. Primary taps on power transformer T34.	2. Look for looseness or corrosion on connections.

MONTHLY—Continued

What to check	How to check
3. Resistors	3. Look for blistering, cracks, discoloration or other evidence of overheating.
4. Switches S1 through S7.	4. Look for dirt, corrosion, loose contacts and poor mechanical action.
5. Wires and cables	5. Look for cracked, cut, and frayed insulation.
6. Terminal boards	6. Look for cracks, dirt, and loose terminal connections.
7. Potentiometers R82, R83, and R94.	7. Look for unsatisfactory electrical and mechanical operation.
8. Mountings, machine screws, and nuts.	8. Look for mechanical looseness.
9. All visible terminals	9. Inspect for loose connections and corrosion.
10. MFP coatings	10. Look for breaks. (Retouch with a brush, if necessary.)
11. Painted finish	11. Inspect for scratches and bare spots. (Retouch, if necessary.)
12. Unshielded variable capacitors C1, C2, and C22.	12. Look for dirt, corrosion, and damaged plates.
13. R-f turret contacts	13. Look for corrosion and wear. Clean with soft cloth or replace strip of section that is faulty.
14. Chokes L39, L64, and L65.	14. Inspect for dirt, corrosion, and damaged turns.
15. Feed through capacitors and insulators.	15. Look for cracks and dirt.
16. Relay contacts of K1	16. Inspect for pits and build-ups and for improper alinement.

Section II. LUBRICATION

29. General Lubrication Instructions

a. Several factors determine the frequency that parts in the receiver need to be lubricated. These factors are as follows:

(1) After a certain length of time most lubricants become waxy and cake up in spots so that they will not give the proper lubrication. In these cases, the old lubricant should be cleaned off and new lubricant should be applied.

(2) The receiver may be operated in a location where extreme temperature changes occur so that the lubricant will be hard due to low temperatures when the receiver is not in operation and extremely soft or liquid when the receiver is operating and the temperature rises. Where the temperature change is great, the condition of the lubricants must be inspected frequently.

(3) Some locations where the receiver may be installed might not be protected from foreign material carried by air currents. The foreign materials present in the air may be dirt, sand, smoke, metal filings, or gases which will mix with the lubricant and form a grit or decompose the lubricant. If grit is formed, it will act as an abrasive and cause serious wear. Here

the old lubricant should be cleaned away thoroughly with solvent (SD) and fresh lubricant should be applied.

(4) Although the receiver is protected against humidity, a certain amount of moisture may enter and injure the moving parts. A tendency toward gathering of moisture is especially noted at times when the temperature drops quickly and the relative humidity is high. If the receiver is not operating during this period, the moisture will condense on the parts of the receiver and may penetrate where proper lubrication procedure is not practiced. If such a condition occurs near an ocean or salty body of water, upon evaporation of the moisture a salt will be left which will cause corrosion.

b. The amount of lubricant applied is very important. Excessive lubrication may cause just as much harm as not enough lubrication. Lubricating material may drip or spread to portions of the receiver where it can cause poor electrical contact and instability of operation. Sometimes, a lubricant cannot be forced between two moving parts. To apply a lubricant to these parts, it is necessary to disassemble, lubricate, and then reassemble the parts. The best time to do this is when the parts are being reassembled after repairs or when they are being replaced. Common sense and experience will indicate the best lubrication procedures for the type of installation and location being used.

30. Parts to be Lubricated

a. Dial Mechanism. Figure 10 shows a cutaway view of the dial mechanism and indicates the places to be lubricated and the types of lubricant to be used. To lubricate the mechanism properly, the gear teeth should be evenly coated with grease (GL). To do this, it is best to rotate the tuning shaft and apply the lubricant (with an instrument, such as the blade of a screw driver) to the moving teeth to obtain the desired results. Be sure to lubricate all the teeth.

b. R-F Turret. The detent of the turret, which stops the turret in each of six positions, may be lubricated without removing the turret. Enough lubricant should be placed on the edge of the detent to allow the detent roller to ride smoothly when the turret is turned. Apply a small amount of grease (GL) to the shaft of the detent roller. To lubricate the shaft bearings on the turret, the turret must be removed from the chassis (par. 78*e*). After the turret is removed, apply a light coating of grease (GL) to the surface which is in contact with the bearing, then replace the turret.

Caution: Do not apply any lubricant to the turret contacts in the process of lubrication. If lubricant does get on these contacts, remove it with a soft cloth moistened with solvent (SD).

c. Gang Switches. Figure 11 shows the points on the gang switches to be lubricated. Apply just enough grease (GL) to make the switches operate smoothly.

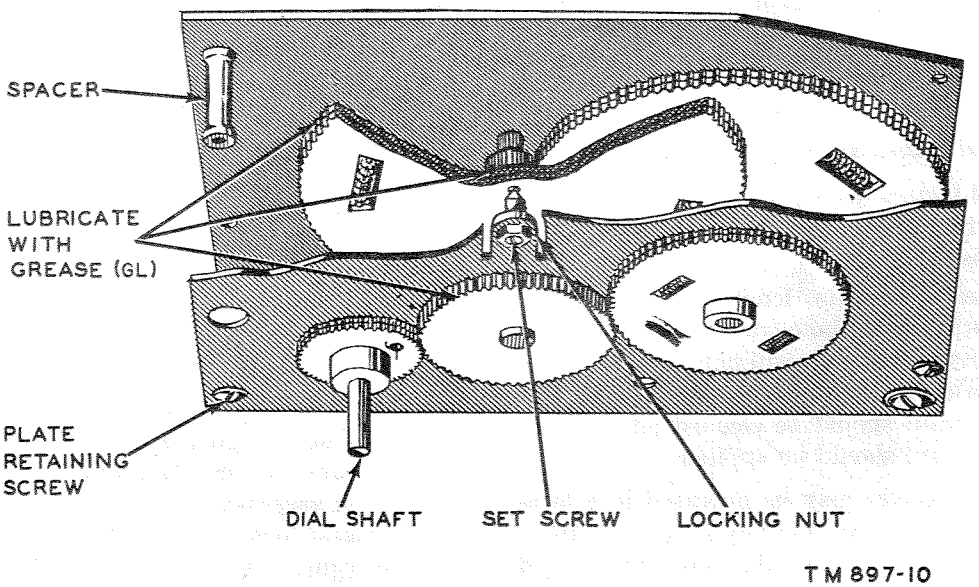

Figure 10. Lubrication of dial drive mechanism.

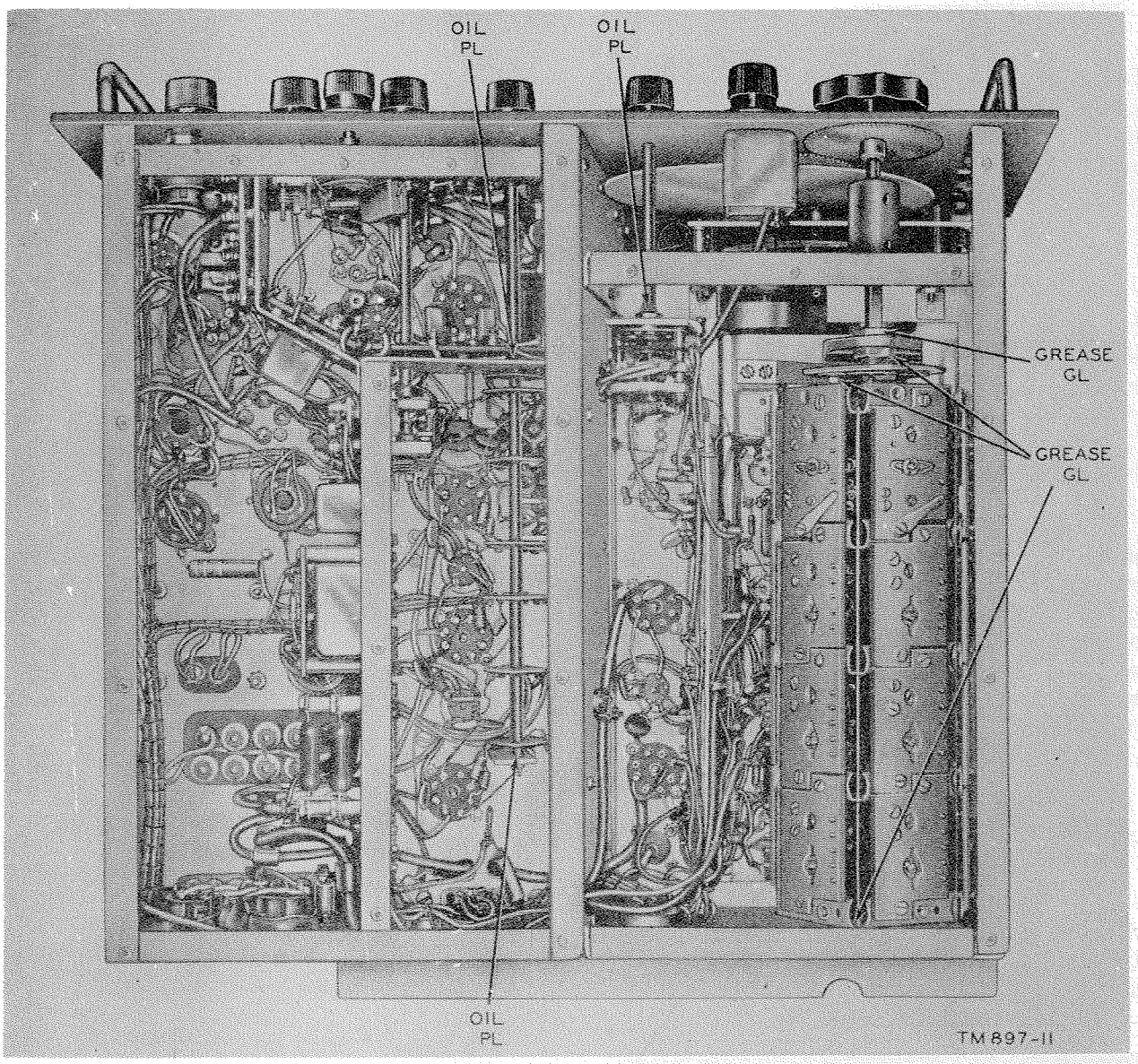

Figure 11. Lubrication of shafts, bottom of chassis.

d. Gang Tuning Capacitors. The bearings of tuning capacitors C1 and C2 require frequent lubrication, since they are probably the most used parts in the receiver. Figure 12 is a top view of the chassis, showing the points to be lubricated with grease. Dirt in these bearings may possibly cause noisy operation of the receiver.

31. Lubrication under Unusual Conditions

a. Arctic Regions. Lubricants which are satisfactory at moderate temperatures stiffen and solidify at subzero temperatures; as a result, moving parts bind or become inoperative. Consult the key on the lubrication order for the proper grade of lubricant for operating the equipment in arctic regions. When preparing the equipment for low-temperature operation, see that lubricants used for moderate temperatures are thoroughly removed. Even small amounts of such lubricants, if allowed to remain, may impair the operation of moving parts. Be sure to use the lubricant specified for low-temperature operation.

b. Tropical Regions. High temperatures and moisture due to rain, condensation, etc., may cause lubricants which are normally satisfactory

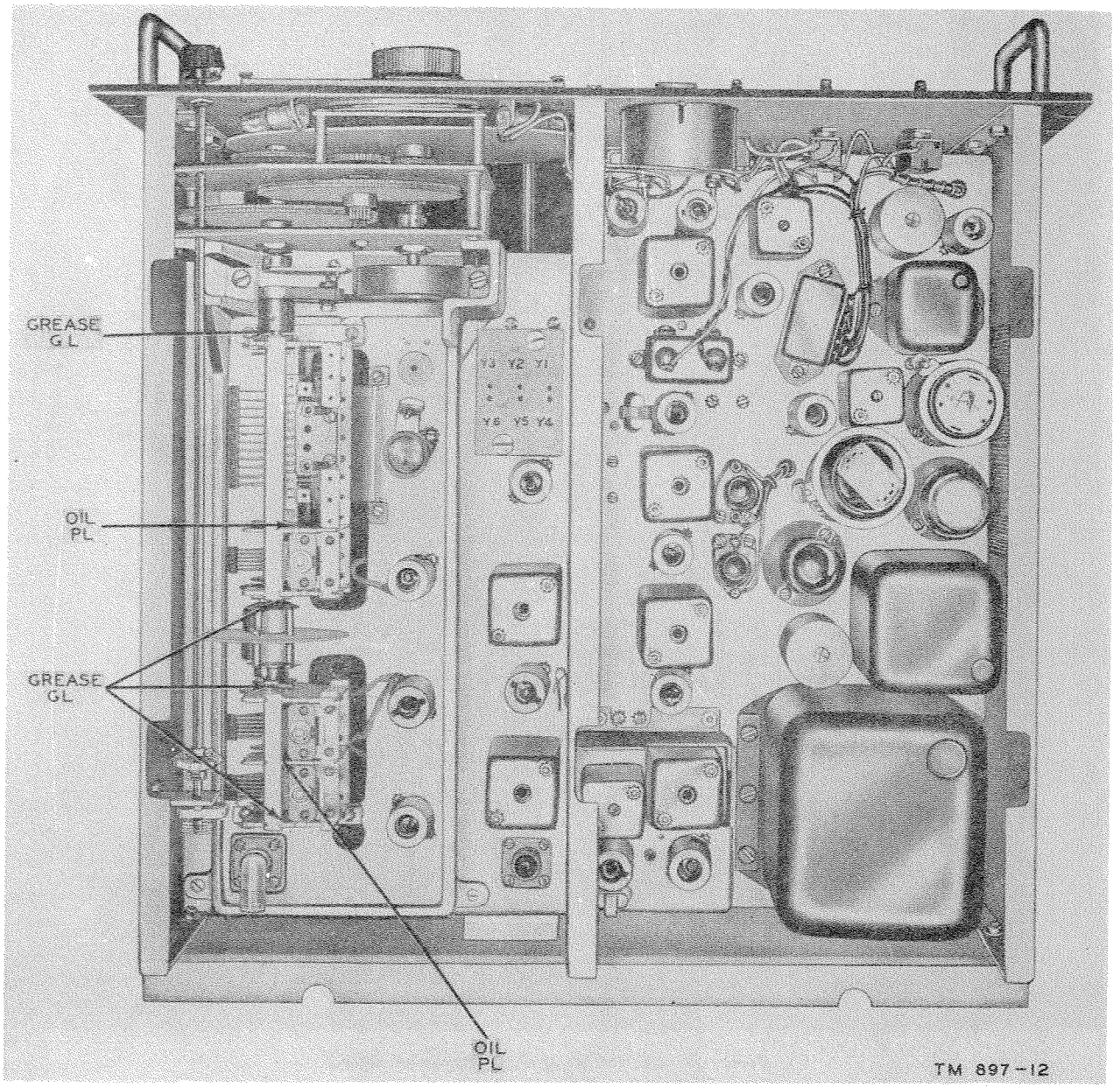

Figure 12. Lubrication of shafts, top of chassis.

to flow from moving parts and other surfaces. These bearing surfaces will wear excessively, and hinges, fasteners, and other parts will be damaged or destroyed by rust and corrosion. Inspect the equipment daily and lubricate it as required to insure efficient operation, using lubricants suitable for high temperatures.

c. Desert Regions. Dust and sand infiltration into the equipment causes grit in the lubricants which will seriously impair and damage the moving parts of the set. Hot, dry temperatures cause the lubricants to flow from the moving parts, and conditions similar to those described in *b* above will result. Use lubricants suitable for high temperatures. Inspect and clean the equipment daily.

Section III. WEATHERPROOFING

32. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture-profing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat. Refer to paragraphs 29–31 for detailed instructions.

33. Rustproofing and Painting

a. A badly scarred or damaged front panel may be touched up so that its bared surface will not corrode. To clean the panel down to the bare metal use No. 00 or No. 000 sandpaper; obtain a smooth metallic finish.

Caution: Do not use steel wool. Minute particles may enter the receiver and cause harmful internal shorting or grounding of circuits.

b. Apply the touch-up paint to the surface with a small brush. Before doing so, remove any rust or corrosion from the metal surface by cleaning with solvent (SD). In severe cases, it may be necessary to use solvent (SD) and sandpaper to soften and remove the rust before the metal may be painted. Paint used will be authorized and consistent with existing regulations.

Section IV. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

34. Scope

a. The trouble shooting and repair work that can be performed at the organizational maintenance level (operators and repairmen) is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, cracked insulators, etc.

b. The paragraphs which follow in this section help in determining which of the stages is defective and in localizing the fault in that stage to the defective item, such as a tube or fuse.

35. Visual Inspection

a. Equipment troubles may be caused by one or more of the following conditions:

(1) Loose or unconnected power source cable.
(2) Worn, broken, or disconnected condition of cable plugs.
(3) Burned-out fuse.
(4) Shorted antenna input.
(5) Defective tubes.
(6) Inactive (dirty or cracked) crystal. (Check by switching to vfo operation.)
(7) Improper connections to primary power transformer (par. 14).

b. When a failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the component parts of the receiver. If possible obtain information from the operator of the equipment regarding performances at the time the trouble occurred.

c. Check anything that seems to have an abnormal color which may have been caused by overheating or corrosion.

36. Trouble Shooting, Using Equipment Performance Checklist

a. General. The equipment performance checklist (par. 37) will help the operator to locate trouble in the equipment. The list gives the item to be

checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the operator can take. *In using this list, perform the checks in the sequence indicated.*

b. Action or condition. For some items, the information given in the action or condition column consists of various switch and control settings under which the item is to be checked. For other items it represents an action that must be taken to check the normal indication given in the normal indications column.

c. Normal indications. The normal indications listed include the visible and audible signs that the operator should perceive when he checks the items. If the indications are not normal, the operator should apply the recommended corrective measures.

d. Corrective measures. The corrective measures listed are those the operator can make without turning in the equipment for repairs. A reference in the table to chapter 5 indicates that the trouble cannot be corrected during operation and that trouble shooting by an experienced repairman is necessary. If the set is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the set is not completely inoperative, the operator must maintain the set in operation as long as it is possible to do so.

37. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indication	Corrective measure
PREPARATORY	1	Antenna	Lead-in wire or wires connected.		
	2	Loudspeaker	Speaker cord connected to terminals 1 and 5 of E4 strip. Short across terminals 2 and 4. (Match to 600 ohms.)		
	3	Line cord	Line cord W1 connected to receiver and power source.		
	4	RECEIVE-SEND switch.	Set at RECEIVE position.		
	5	CW-MODULATION	Set at MODULATION position.		
	6	ANL-OFF	Set at OFF position.		
	7	RF GAIN-AC	Set at OFF position.		
	8	BFO PITCH	Set at 0.		
	9	CRYSTAL PHASING	Set at a center position.		
	10	SELECTIVITY	Set at NORMAL MED.		
	11	VFO-CRYSTAL	Set at VFO.		
	12	CRYSTAL VERNIER.	Set at a center position.		
	13	AUDIO GAIN	Set at 5.		
	14	AGC-MANUAL	Set at AGC position.		
START	15	RF GAIN-AC	Turn fully clockwise	Dial lamps light	Check fuse F1 on rear of chassis. Check line cord connections. Check tap connections of power transformer for correct voltage setting.
				Rushing noise or signal heard in speaker.	Check tubes in receiver. Check speaker cord and connections.

37. Equipment Performance Checklist—Con.

	Item No.	Item	Action or condition	Normal indication	Corrective measure
EQUIPMENT PERFORMANCE	16	TUNING	Set the BAND SELECTOR at any desired position. Tune across entire band by rotating TUNING control. Use dial lock to hold TUNING control in place after once set.	Signals heard in loudspeaker. CARRIER LEVEL meter shows relative strength of signals.	Signals are received normally, but CARRIER LEVEL meter indication is abnormal, trouble shooting is necessary. If signals are not obtained, or if they are weak, check the antenna connections at the antenna terminals of the receiver. When a long wire antenna is in use, be sure that one of the terminals is connected to ground. Check the tubes in the receiver.
	17	ANT ADJ	Adjust for maximum reading on CARRIER LEVEL meter.	Signal strength will vary with adjustment.	Signals are received normally, but CARRIER LEVEL meter indication is abnormal, trouble shooting is necessary. If signals are not obtained or if they are weak, check the antenna connections at the antenna terminals of the receiver. When a long wire antenna is in use, be sure that one of the terminals is connected to ground. Check the tubes in the receiver.
	18	BAND SELECTOR	Check each of the tuning ranges. Use procedure given in step 16 above.	CARRIER LEVEL meter will indicate a maximum when TUNING and CRYSTAL VERNIER controls are properly adjusted.	Check crystal oscillator tube V5. Check crystals Y1 through Y6. Refer to chapter 5.
	19	VFO-CRYSTAL switch.	Turn control from VFO to one of six crystal positions that contains a frequency where a signal can be received. Turn the BAND SELECTOR to the correct range. Tune to the proper frequency with the TUNING control.		

37. Equipment Performance Checklist—Con.

	Item No.	Item	Action or condition	Normal indication	Corrective measure
EQUIPMENT PERFORMANCE	20	CRYSTAL VERNIER	Use this control for crystal tuning with operation as indicated in step 19 above.	Signal can be tuned by rotating control in either one direction or the other.	Refer to chapter 5.
	21	PHONES jack	Insert phone plug into PHONES jack.	Signals heard in loudspeaker are audible in phones.	Check phones, cord, and plug.
	22	RF GAIN–AC control.	Tune in any signal by rotating the TUNING control. Rotate the RF GAIN control in either direction.	Strength of signal increases or decreases.	Refer to chapter 5.
	23	AUDIO GAIN control.	Rotate control in either direction.	Strength of signal increases or decreases.	Refer to chapter 5.
	24	RECEIVE-SEND	Turn to the SEND position. (When check is completed, return to RECEIVE position.)	No sound is heard in loudspeaker or in phones.	Refer to chapter 5.
	25	AGC-MANUAL switch	Turn to MANUAL position.	Strength of signal may or may not increase. CARRIER LEVEL meter becomes inoperative.	Refer to chapter 5.
	26	SELECTIVITY control.	Tune receiver to a modulated signal and then rotate SELECTIVITY control from the NORMAL MED position to the NORMAL, SHARP, and BROAD positions, and also to the CRYSTAL positions (SHARP, MED, and BROAD).	The tuning is broader in the broad and medium positions, and the high-frequency response (audio) increases in the broad position. Tuning is very sharp in the crystal positions, and CRYSTAL SHARP cuts off most of the audio above a few hundred cycles.	Check crystal Y8. Refer to chapter 5.
	27	CRYSTAL PHASING	Normal position is at 0. Turn the control in either direction.	Turning either direction when SELECTIVITY control is in crystal position will vary bandwidth.	Refer to chapter 5.
	28	ANL-OFF switch	Man-made interference may be present. Turn switch to ANL position.	Noise peaks are reduced in amplitude.	Refer to chapter 5.
	29	CW-MODULATION	Turn switch to CW and tune in a c-w carrier.	Beat-frequency audio signal is heard in loudspeaker or phones.	Check bfo tube V14.
	30	BFO PITCH control	Obtain a beat note of c-w carrier as explained in step 29 above. Rotate the BFO PITCH control on either side of 0.	A change in the pitch of the audio tone is noted.	Refer to chapter 5.
STOP	31	RF GAIN-AC control	Turn counterclockwise to OFF position.	Dial lamps go out. No noise or signals are heard in loudspeaker.	