SPERRY .50 CALIBRE MACHINE GUN TURRETS

SERVICE AND OVERHAUL MANUAL

PART I

UPPER LOCAL TURRET

INSTRUCTION NO. 14-231
(PART I)
JULY 1942

SPERRY GYROSCOPE COMPANY, INC., MANHATTAN BRIDGE PLAZA, BROOKLYN, NEW YORK

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GLOSSARY

AZIMUTH	-	Angular direction in the horizontal plane (right or left) with reference to the fore and aft line of the airplane. (Measured in mils or degrees.)
BORESIGHTING	-	Aligning the guns with each other and with the Computing Sight.
BUS BAR	-	A large copper bar, usually rectangular in shape, which is used to carry heavy electric currents. It provides a convenient means for connecting minor electrical circuits to the main supply circuit.
CHARGING	-	The action of forcing the first projectile into its firing position in the gun.
CLEVIS	-	A U-shaped bracket into which a tongue-shaped piece can be inserted and then bolted.
COLUMN SUPPORTS	-	The two "legs" which extend from the platform to the unit housing.
DOUBLE POWER UNIT	-	The motor and two variable speed transmissions which drive the turret in azimuth and guns in elevation.
ELASTIC STOP NUT	-	A nut made with a fiber insert that will jam on the threads of its bolt when screwed tight, thus fulfilling the additional function of a locknut.
ELEVATION	-	Angular direction in the vertical plane (up or down) with reference to the airplane when it is level. (Measured in mils or degrees.)
MIL	-	A unit of angular measure, like the degree. A full circle contains 6400 mils (360 degrees). One degree equals 17.8 mils.
PAWL, PAWL PIN	-	A metal tongue, usually pivoted at one end and sharpened at the other. The sharp end engages notches in a wheel or rack so that the wheel or rack can move in only one direction.

RELAY, - An electrically operated device consisting of a coil, contacts and an armature. The armature is normally held away from the contacts by a spring. When the main switch and the safety switch are closed in this turret, current flows through the coil and causes the armature to be attracted to the coil and contacts, closing the turret power contacts. The electrical power is thus "relayed" instead of being connected directly by a manually operating switch. This method provides a safer and more satisfactory means for handling the large current required by the turret power circuits.

SIGHT, COMPUTING - A device which automatically offsets the line of sight (to the moving target) from the line of the guns by necessary ballistic and prediction corrections to produce an accurate line of fire.

Boresighting Note: The azimuth dial is read through the circular window on the same side of the sight as the mounting pin lugs. The elevation dial is read through the circular window on the same side of the sight as the optic head. The reticles ("a system of lines in the focus of a lens") are seen as they are reflected on the slanting glass in the optic head.

SOLENOID - A coil of wire surrounding a movable metal plunger. The plunger moves at approximately the instant an electric current is forced through the coil, and back again when the current ceases.

TOGGLE SWITCH - A manually operated switch having "OFF" and "ON" positions. The toggle switch has a spring mechanism which causes it to "snap" rapidly when the switch lever is moved, thereby providing a quick "break" of the electrical circuit.

UNIT HOUSING - The structure which contains the upper assemblies of the turret and on which the dome is placed.

VARIABLE SPEED TRANSMISSION - A hydraulic device which provides variable and smooth rates of drive. There are two variable speed transmissions in the upper turret, one driving the guns in elevation and the other driving the turret in azimuth. A single motor is used to drive both of the transmissions.

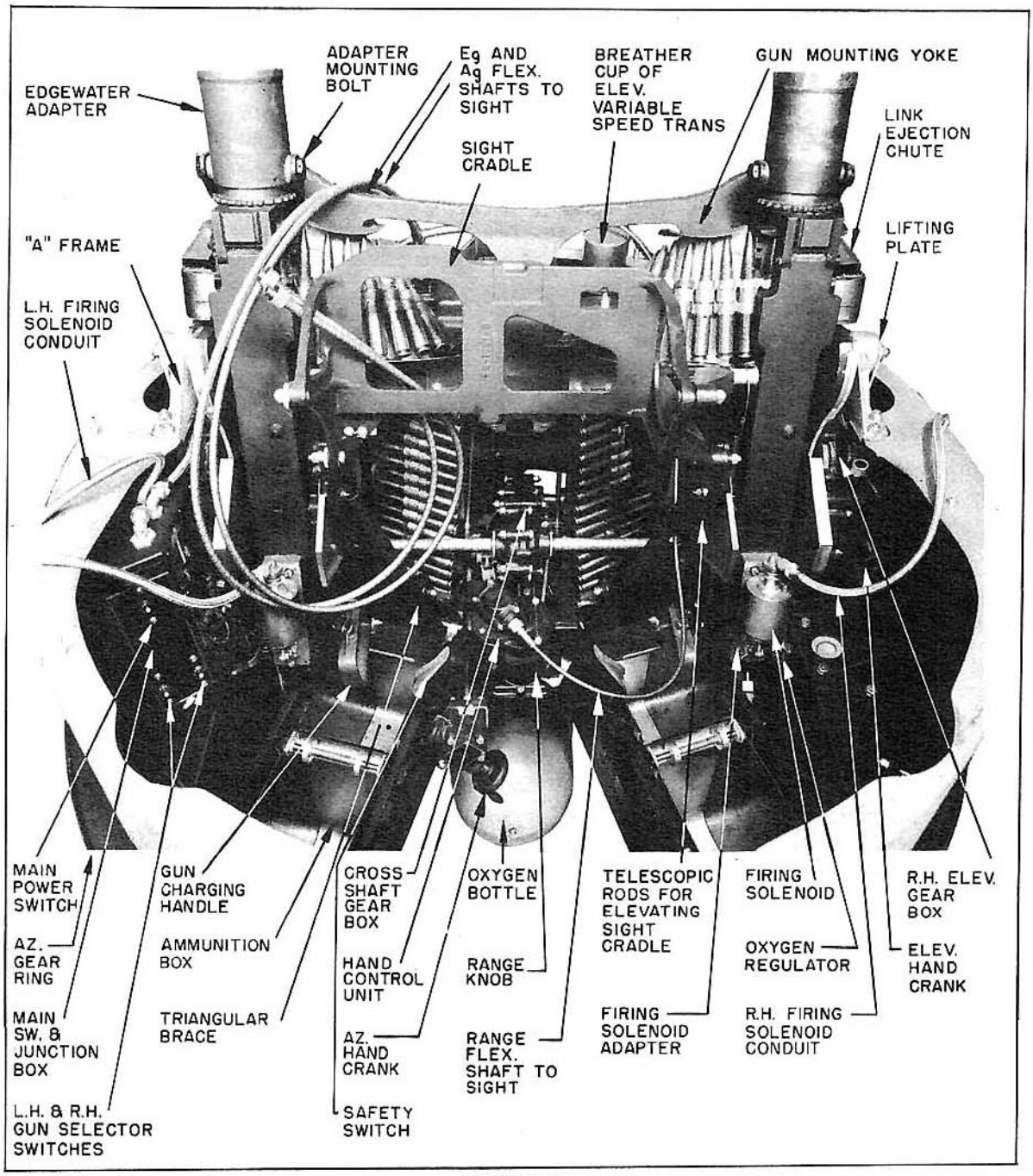


FIGURE 1

UPPER TURRET

TOP VIEW WITH DOME AND COMPUTING SIGHT REMOVED
GUNS SHOWN AT 85°

INTRODUCTION

This part has been prepared to provide service and overhaul instructions for the Sperry Upper Local Turret. Descriptive and operating instructions for the turret are covered separately in Part I of Sperry Instruction No. 14-230.

The information contained herein relates specifically to installation, maintenance, disassembly and reassembly of the turret and its various units. A complete illustrated parts list is included to facilitate identification of parts.

Service and overhaul instructions for the Sperry Automatic Computing Sight (Type K-3), which is used with the Upper Local Turret, are covered in Sperry instruction No. 14-226.

SECTION I

INSTALLATION

1. General. - a. The instructions in Section I cover the installation of the upper turret into the airplane and the subsequent installation of certain units inside the turret. It is assumed that the guns and their accessories have been properly installed in the turret as described in Section III. It is also assumed that the turret dome and sight have not been installed.

2. Ring Gear Into Airplane. - a. The ring gear must first be mounted in the airplane. Since the opening in the airplane for the turret is not large enough for the assembled flange and gear to pass through, it is necessary to remove the 2 opposite flanges of the ring before sliding it through the opening into the airplane.

b. After the ring gear has been passed through the opening, it should be reassembled and turned so that the zero azimuth point (marked Ag = 0) of the ring gear is on the center line of the airplane and forward within ±1°.

(1) Mark this point on the supporting structure of the airplane.

(2) Shim the ring gear so that it is level with respect to the airplane and then fasten securely to the supporting structure. (See Figure 50 for complete installation dimensions.)

3. Turret Into Airplane. - a. Fasten the hoisting cables to the lifting plates (see Figure 1) provided on opposite sides of the turret, using sling spreader T-44051.

b. Lift the turret above the opening and lower slowly into the airplane, carefully meshing the azimuth drive pinion (see Figure 17) and the ring gear.

c. While holding the turret with the hoisting cables, shim the thrust bearing mounting flange until the lower surface of the azimuth drive pinion is approximately 1/8" below the bottom surface of the ring gear.

(1) When shimming the thrust bearing mounting plate, be sure that the plate is perpendicular to the vertical axis of the turret. This can be done by checking the vertical position of the azimuth drive pinion with respect to the ring gear at several points around the ring.

(2) Bolt the mounting flange, through the shims, to the floor with six 3/8" bolts.

4. Electrical Connections to Turret. - a. Terminals are provided in the main switch and junction box (left side of unit housing) for connecting two jack cords. These jack cords are terminated in two jacks - one for the telephone head set and one for the microphone. The cords should be connected as shown in wiring diagram, Figure 48. Figure 34 also shows the connections for these cords.

b. Connect the positive pole of D.C. voltage (27.5 ±5% volts) from the airplane's power supply to the 5/16" screw marked DCG in the terminal box at the base of the turret. (See Figure 41.)

4. Electrical Connections to Turret (Cont'd.)

c. Connect the telephone and microphone leads from the main switch and junction box to the proper terminals in the terminal box at the base of the turret. All terminals are clearly marked for ease in making or checking the connections.

5. Oxygen Bottle.

a. General. - (1) All principal parts of the oxygen system were installed during assembly of turret in the test stand. (Refer to Section III, paragraph 4.j.(1).)

(2) The oxygen bottle should be placed, with its outlet forward, in the clamp ring structure which is fastened to the center rail. (See Figure 46.)

(a) Tighten the screws on the clamp ring and then connect the flexible tubing to the outlet valve on the bottle.

CAUTION: BE VERY CAREFUL TO KEEP FOREIGN MATTER FROM ENTERING THE OXYGEN SYSTEM.

6. Breather Cups. - a. Remove the 1/4" Allen plugs from the breather pipes on the azimuth and elevation variable speed transmissions of the double power unit and screw breather cup assemblies into place. (See Figure 38.)

b. Add clean Univis No. 40 oil (Air Corps Spec. No. AN-VV-O-336; formerly Air Corps Spec. 3580) until the breather cups are filled to one quarter of their capacity.

7. Guns.

a. General. - (1) In case the guns are to be installed in the turret after the turret has been installed in the airplane, refer to Section III, paragraph 4.h. for installation procedure and modifications of parts for new guns. In this case, it will be found more convenient to align the guns according to the following method, rather than the test stand procedure given in Section III, paragraph 4.h.(2).

(a) Adjust one gun to approximately the center of its lateral and vertical trunnion adjustment.

(b) Remove gun bolt and sight on a target at least 1000 yards distant.

(c) Adjust the rear trunnion of the other gun until the line of sight through its bore is on the same target.

(d) Tighten all adjusting screws and recheck the alignment.

CAUTION: THE FIRE CUT-OFF SETTING SHOULD BE CAREFULLY CHECKED WHEN THIS METHOD OF ALIGNMENT IS USED. (Refer to Section II, paragraph 1.e.)

8. Dome. - a. Attach collar connection plates (SG 1658, see Figures 2 and 3) to plexiglas gun shutter SG 1951, using 2 (10-32, 3/8" lg.) washer head screws. (Part numbers preceded by SG are numbers assigned by Steel Products Engineering Co., Springfield, Ohio.)

8. Dome (Cont'd.)

(1) Insert the above assemblies into the right and left gun slots.

b. Raise the guns to approximately 30° elevation and carefully insert gun barrels into collar connection plates, over the Edgewater adapters.

(1) Lower the dome on the studs on the unit housing, making sure that the weather gasket (SG 1893) is properly placed so that the adhesive portion is fixed to the unit housing on the outside of the stud ring. (Remove protective paper from gasket.)

(2) Carefully match studs to stud holes in dome and fasten the dome securely with 11 elastic stop nuts and washers.

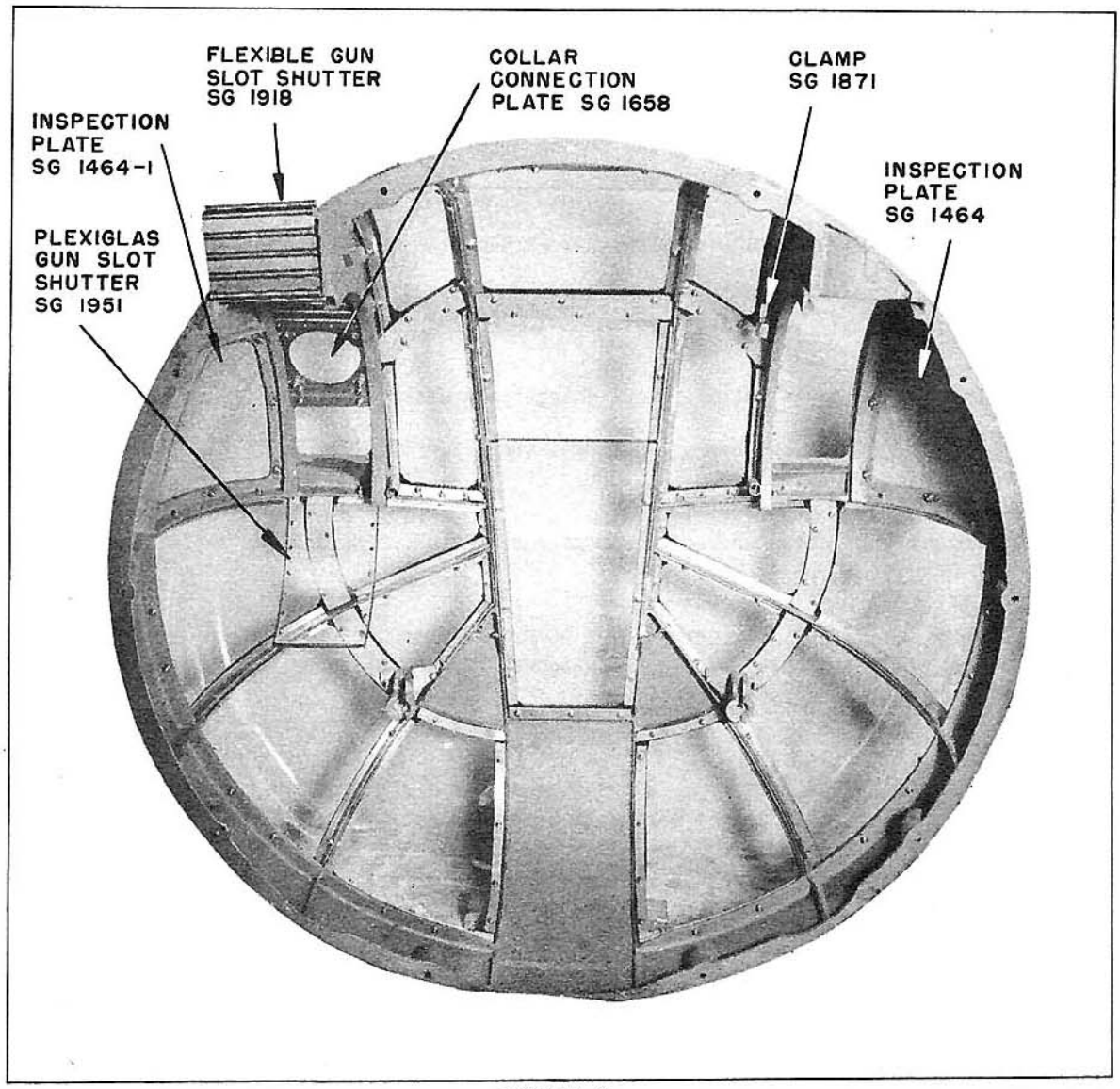


FIGURE 2
DOME ASSEMBLY

8. Dome (Cont'd.)

c. Insert flexible shutter (SG 965) into gun slot and fasten to collar connection plate with 2 washer head screws (10-32, 7/16").

d. To make plexiglas shutter accessible, remove inspection plates by taking out the 7 screws (8-36, 3/4"). (See Figure 2.) These inspection plates should not be replaced until the guns have been raised from 0° to 85° so that clearances between gun yoke and dome can be checked. There should be sufficient room allowed for free movement of the gun yoke.

(1) Replace the inspection plates and recheck for proper clearance by operating the guns by hand.

e. Insert azimuth and elevation flexible shafts to sight and sight electrical conduit in clamp (SG 1871) which is held to left side of the dome by one of the moulding screws. (See Figure 2.)

f. Attach pulley assembly (SG 942) to dome spring (SG 1325). Insert pulley (AN 210-1-A) into charger handle bracket (SG 979) and fasten with pin and cotter pin. (This procedure applies to both right and left hand assemblies.)

(1) Thread charging cable over pulley in charging handle bracket (SG 979).

(2) Then over idler pulley (SG 942).

(3) Then over anchor pulley in gun yoke.

(4) Then over large pulley in gun charger plate.

(5) Attach cable to clevis (SG 1102), (see Figure 49) on gun. Clevis is fastened with a pin and cotter pin.

g. Check charger cable for tension at zero elevation. The charger cable handle should seat easily in bracket.

h. Elevate guns to 85° and charge guns once, observing position of cam lever and charger plate. Bolt mechanism should be seated so that guns can be fired. Allow charger cable handle to snap back into bracket.

9. Computing Sight, Type K-3. - a. Remove the mounting pin from the mounting pin lugs on bottom of the sight by lifting the spring latch bar and pulling pin free.

b. Hold the sight in both hands and move it forward until the mounting pin and lugs straddle the yoke.

c. Move the sight forward and to the right until the mounting pin hook engages the right hand mounting pin on cradle.

d. Insert the left hand mounting pin through the holes in the yoke and the mounting pin lugs on the sight.

9. Computing Sight, Type K-3 (Cont'd.)

(1) When the mounting pin is fully and firmly against the yoke facing, push the latch pin in place.

e. After the sight has been installed according to paragraphs 9.a. to 9.d., the azimuth and elevation dials of the sight should be set before the azimuth and elevation flexible shafts are connected. This is necessary in order that the dials of the computing sight are synchronized with the turret position since the ballistic corrections in the sight are dependent on gun position. It is not possible to adjust the dials to the gun position after the flexible shafts are connected. Furthermore, damage to the sight elevation gear train may result if the guns are moved in elevation when the elevation sight dial is not synchronized with the gun position. By turning the range knob, the free end of the range shaft can be used to rotate the input pinions to the desired position.

NOTE: If boresighting adjustment is to be made, the setting of the dials can be made at that time.

(1) Connect free end of range shaft to elevation input of sight. (Marked red.)

(2) Position guns at zero elevation and turret at zero azimuth. Zero azimuth is indicated on the outside of the unit housing.

(3) Turn range knob until elevation dial, located on top of the sight, reads zero.

(4) Remove range shaft and connect elevation flexible shaft to elevation input of sight, meshing carefully to nearest tooth.

(5) Repeat steps (1) to (4) to obtain zero setting of azimuth dial, substituting azimuth for elevation references.

CAUTION: BE SURE THAT AZIMUTH AND ELEVATION FLEXIBLE SHAFTS ARE CONNECTED TO THEIR PROPER INPUTS ON SIGHT. ELEVATION FLEXIBLE SHAFT AND ELEVATION INPUT COUPLING ARE PAINTED RED.

(6) Connect flexible range shaft to range input of sight. No range setting is involved for this step.

(7) Connect the electrical conduit to the receptacle on the back of the sight.

10. Boresighting.

a. General. - (1) After complete installation of the turret and the sight, the original alignment of the guns should be checked and the sight aligned with the guns according to the following procedure:

(a) Remove gun bolts and, by using a mirror, sight through each gun bore at a test target at least 1000 yards distant.

NOTE: Boresighting tool T-44059 may be used in place of the mirror, in which case gun bolts will not have to be removed. (See paragraph 10.m. for alignment of boresighting tool.)

10. Boresighting (Cont'd.)

1. If the guns have retained their alignment as set in the test stand, very little or no adjustment will be required for both guns to be aligned on the same distant target.

2. Make necessary adjustments on the rear trunnions of the guns.

(b) Disconnect azimuth and elevation flexible shafts from the sight.

(c) Turn sight switch "OFF".

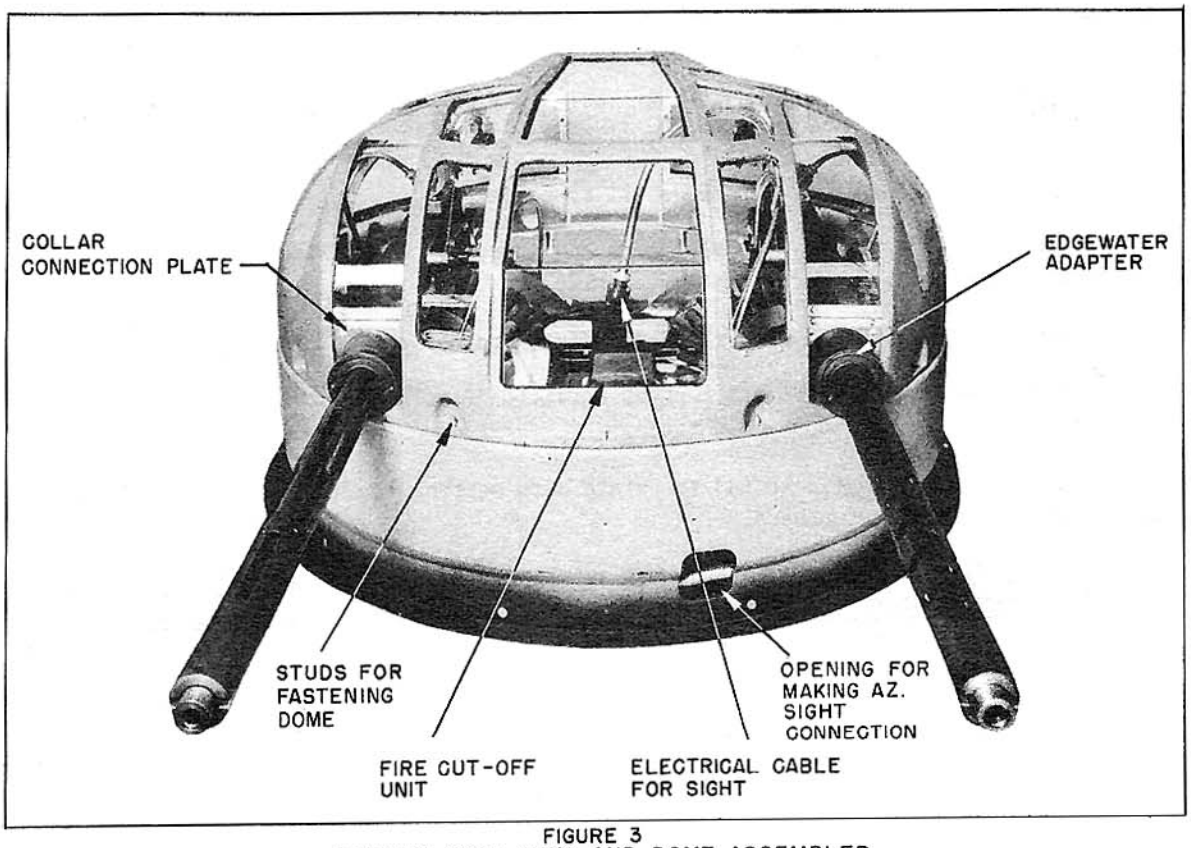


FIGURE 3
TURRET WITH GUNS AND DOME ASSEMBLED

(d) Remove lamp housing cover and lamp from sight and direct a light into the opening so that the reticles can be seen. An ordinary pocket flashlight may be used for this purpose. On bright days a black card with a pin hole in the center may be placed behind the optic head. This will provide a sufficient contrast to see the target and reticles.

(e) Set sight target dimension dial at 20 feet and set range dial at 1000 yards. The reticles will then appear as a slightly offset cross-hair.

(f) Remove cover over deflection dials on the right hand side of sight.

10. Boresighting (Cont'd.)

(g) Set the deflection dials at zero by disconnecting the flexible range input shaft from the sight and then connecting it alternately to the elevation and azimuth inputs of the sight, rotating the range knob in the proper direction to obtain zero reading on the deflection dials. (See Boresighting note in Glossary.)

(h) Sight through one of the gun bores at a target 1000 yards or more distant and adjust screws on the deflection shafts just above the dials until the sight reticles are centered on the same target.

CAUTION: BE SURE THAT DEFLECTION DIALS ARE RETURNED TO EXACTLY ZERO POSITION AFTER EACH ADJUSTMENT OF THE WORM SCREWS.

(i) Replace lamp, lamp housing, cover plate and gun bolts.

(j) Turn on sight switch and move turret to zero azimuth and zero elevation.

(k) The elevation and azimuth dials on the top and bottom, respectively, of the sight should now be made to read zero by alternately connecting the free end of the range flexible shaft to the elevation and azimuth connectors of the sight and rotating the range shaft.

(l) Attach the 3 flexible shafts to the proper input connectors on the sight as described in paragraph 9.

CAUTION: BE SURE THAT AZIMUTH AND ELEVATION FLEXIBLE SHAFTS ARE NOT INTERCHANGED. ELEVATION FLEXIBLE SHAFT COUPLING AND INPUT ON SIGHT ARE PAINTED RED.

(m) If boresighting tool T-44059 is used, it can be checked for proper alignment as follows:

1. Prepare a test target which has a small bull's-eye, and around the bull's-eye scribe a circle which has a radius equal to the distance between the center of the adjustable rod and center of the sighting tube.

2. With test target about 40 feet from the boresighting tool, adjust the tool so that the center of the adjustable rod lines up with the center of the bull's-eye.

3. When the tool is revolved around the axis of the adjustable rod, the cross lines of the sighting tube should center on the circle during the complete revolution.

4. If necessary, re-align boresighting tool by means of the adjusting screws provided.

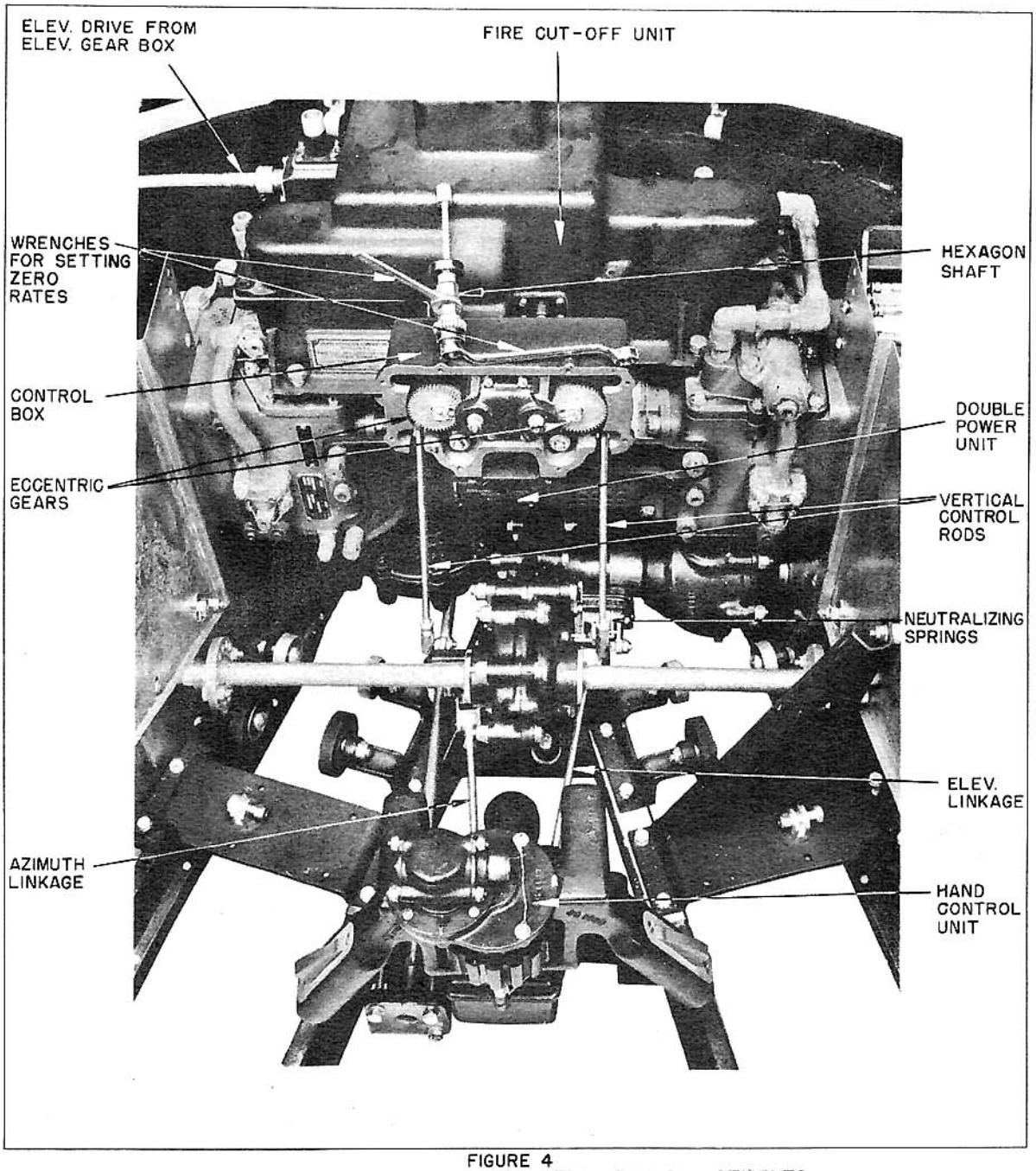


FIGURE 4
UPPER TURRET – SHOWING CONTROL BOX ADJUSTMENTS

SECTION II

MAINTENANCE

1. Adjustments and Tests.

a. General. - (1) The following instructions cover the adjustments and tests which are made after the turret is installed in the airplane. Some of the instructions are duplicated in slightly different form and order in Section III where the procedure is given for adjusting the turret and making a final check in the test stand after it has been overhauled.

(2) The adjustment instructions are arranged so that they can be made individually. That is, if it is obvious that only one adjustment is needed, the instructions for that particular adjustment can usually be followed without going through all of the other related adjustments.

b. Zero Rate Adjustments.

(1) General. - (a) To set the zero rates on the azimuth and elevation variable speed transmissions of the double power unit, the following instructions should be used. (See Figure 4.)

1. Remove covers from control box and fire cut-off and limit stop unit.

2. Loosen screw on elevation and azimuth clamps (see Figure 11). Turn on power to turret and turn azimuth and elevation rate shafts in fire cut-off unit until rates from both the elevation and azimuth variable speed transmissions are zero. Tighten elevation and azimuth clamps.

3. Loosen locknuts on front ends of pinion shafts in control box and set both eccentric gears so that their slots are horizontal. (See method and tool in Figure 4.)

4. Tighten locknuts securely. Turn on power and check for zero rates, with eccentric gears in horizontal position.

5. With the power off, hold vertical rods so that the slots in eccentric gears are still horizontal and then adjust joints on vertical rods so that the centralizing springs are in their vertical position. Turn on power and check for zero rates in both azimuth and elevation.

6. With the power off and the vertical rods and centralizing springs in the zero position, adjust the length of the linkage rods to the hand control unit (see Figure 7) so that the yoke of the hand control unit is in its vertical position and the handles are centered in azimuth. The center point of travel between the 2 stops should line up with the screw head on the rear of the unit.

7. Now turn on the power and check the overall adjustment for zero rates. The turret should not "creep" in azimuth and elevation if the adjustments have been properly made.

1. Adjustments and Tests (Cont'd.)

8. Replace the covers of the control box and the fire cut-off and limit stop unit.

c. Check of Turret Power Drive Mechanisms. - (1) With the sight and turret switches "ON" and the power clutches engaged, the turret and guns should operate smoothly when the hand control unit is moved in azimuth and elevation. The azimuth rates should be variable from 5 mils/sec. to 800 mils/sec. and the elevation rates should be variable from 5 mils/sec. to 500 mils/sec.

(2) When the control handles are released, the safety switches (see Figure 7) should open and all power mechanisms should cease to function. The turret should be operable when the switch on either control handle is closed.

(a) A check should be made to assure that the brushes on the collector rings (see Figure 42) make good contact during complete revolutions of the turret.

CAUTION: DO NOT OPERATE THE TURRET WITH THE SIGHT SWITCH "OFF".

d. Elevation Limit Stop Check and Adjustment. - (1) Check the elevation limit stops by raising and lowering the guns slowly under power to both extremes in elevation. Movement of the guns should cease automatically when they reach 0° or 85° (1511.1 mils on sight dial if the sight is installed and aligned).

NOTE: Be sure the power clutches are engaged and the handcranks are disengaged.

(2) If operation of the limit stop mechanism is not according to the above, readjust as follows:

(a) Remove cover of the fire cut-off and limit stop unit.

(b) Loosen the 3 retainer screws on the adjustable elevation worm wheel which moves the elevation rack. (See Figure 5.)

(c) Loosen the 3 retainer screws on the adjustable worm wheel of the elevation rate bracket assembly. (See Figure 11.)

(d) Run guns slowly to exactly zero elevation. Guns should clear the dome by about 1/4".

(e) Turn elevation rate shaft (in elevation rate bracket assembly) until double power unit just begins to move guns upward.

(f) Loosen the 3 screws on the limit stop adjustable flange and move the flange until the screws are at the extreme right of their slots, as in Figure 5.

(g) Move the worm wheel of the elevation bracket assembly in the direction of the front of the turret until it will move no farther. Referring to Figure 5, the top of the worm wheel should be moved toward the reader. Tighten screws on elevation rate bracket worm wheel.

1. Adjustments and Tests (Cont'd.)

(h) Move the guns up slowly until the cross shaft has turned 18 complete revolutions. Then raise the guns very slowly until the cross shaft has made 3/4 of a revolution more.

1. Since one revolution of the cross shaft, as indicated by the marking on the right hand coupling, equals 4-1/2° in elevation, 18-3/4 turns from zero elevation will be within the elevation travel limit of 1511 mils ±5 mils.

2. Tighten the 3 screws on the limit stop adjustable flange.

CAUTION: WHEN RAISING THE GUNS, BE VERY CAREFUL NOT TO PERMIT THE GUN BUTTS TO STRIKE THE CROSS SHAFT.

(i) Run guns up and down slowly to check the limit stop setting and, if necessary, make a further adjustment of the limit stop adjustable flange.

(j) Reset fire cut-off in accordance with paragraph e.(1)(c).

NOTE: Steps (f) and (h) are only necessary when the limit stop flanges require setting and ordinarily can be omitted.

e. Fire Cut-Off Check and Adjustment. - (1) The fire cut-off unit should be checked by pointing the guns (boresighting) at all parts of the airplane, or its accessories, which come within the field of fire. It should not be possible to operate the firing solenoid of either gun while the guns are pointed at any of the various cut-off areas.

(a) The best method of checking operation of the fire cut-off circuit is to observe the movement of the plunger of the firing solenoid. Be sure that the main power switch, safety switch and both fire selector switches are in their "ON" positions.

(b) When the firing key is operated, the firing solenoid plunger will move forward, if the firing circuit is closed.

(c) If either firing solenoid can be operated when either of the guns is pointed at any portion of the airplane or its accessories, it will be necessary to readjust the fire cut-off in the following manner (see Figure 5):

1. Remove cover of fire cut-off and limit stop unit, if not previously removed.

2. Remove the switch bracket assembly and lay it aside.

3. Swing cam pin lever back to allow access to cam and then loosen the 3 screws on the cam retainer.

4. Loosen the ring retainer screws on the elevation worm gear, thus permitting movement of the rack pinion without rotation of the elevation input shaft.

a. This worm gear is located on the same shaft with, and directly below, the rack pinion which positions the cam pin in elevation.

1. Adjustments and Tests (Cont'd.)

CAUTION: WHEN MOVING GUNS BY HAND IN ELEVATION, OBSERVE EFFECT OF GUN MOTION ON LIMIT STOP. DO NOT PERMIT FLANGES OF LIMIT STOP TO BE IN CONTACT. IF NECESSARY, PROCEED AS IN PARAGRAPH 1.d. TO MOVE LIMIT STOP TO A SECTOR WHERE IT IS INOPERABLE.

5. Position the guns at 0° azimuth and 9° (160 mils) elevation.

a. Zero azimuth is marked on the outside of the unit housing.

b. To determine 9° elevation, start with guns at 0° elevation and note scribe marks on cross shaft coupling (SG 169-2). (See Figure 37.) Rotate cross shaft exactly 3 revolutions to move guns up and then back exactly one revolution to take out backlash.

NOTE: One rotation of shaft equals 4-1/2° elevation.

6. Carefully seat the cam setting fixture in the hole in the cam (see Figure 5) and replace cam pin lever over the cam.

7. Applying light finger pressure on the cam pin lever, move the cam in azimuth and cam pin in elevation until cam pin tip is centered in the hole of the cam setting fixture.

8. Tighten cam retainer screws and check to see that the cam pin tip remains in the detent position. Then tighten the retainer screws on the elevation worm wheel, again checking the detent setting.

9. Move turret and guns by hand to drive cam in azimuth and cam pin in elevation until cam pin tip rests on the edge of the setting fixture, but NOT in the hole of the fixture.

10. Check cam pin for height by putting cam pin on 11° slope near edge of fixture and moving fixture under pin so that it travels up the slope, causing the switch contacts to open.

a. Use an electrical indicator to check operation of the switch, since click of the switch may not mean open contacts.

11. Adjust cam pin so that switch opens when cam pin is as near the top of the slope as is possible. The locknut on the cam pin is used for this adjustment.

a. The switch must have opened every time the cam pin reaches the top surface of the fixture.

12. When the setting is correct, remove the cam setting fixture and replace in spring clip on the switch bracket.

13. Replace switch bracket on mountings in the unit.

a. Recheck FCO by boresighting to tail assembly. If it is found that there is not at least 8 inches clearance of cut-out area above the tail during downward travel of the guns, lengthen the cam pin by loosening the locknut and screwing the pin out. Approximately 1/6 turn of the pin will give 2 inches additional FCO area. Tighten locknut securely. Replace bracket and recheck.

1. Adjustments and Tests (Cont'd.)

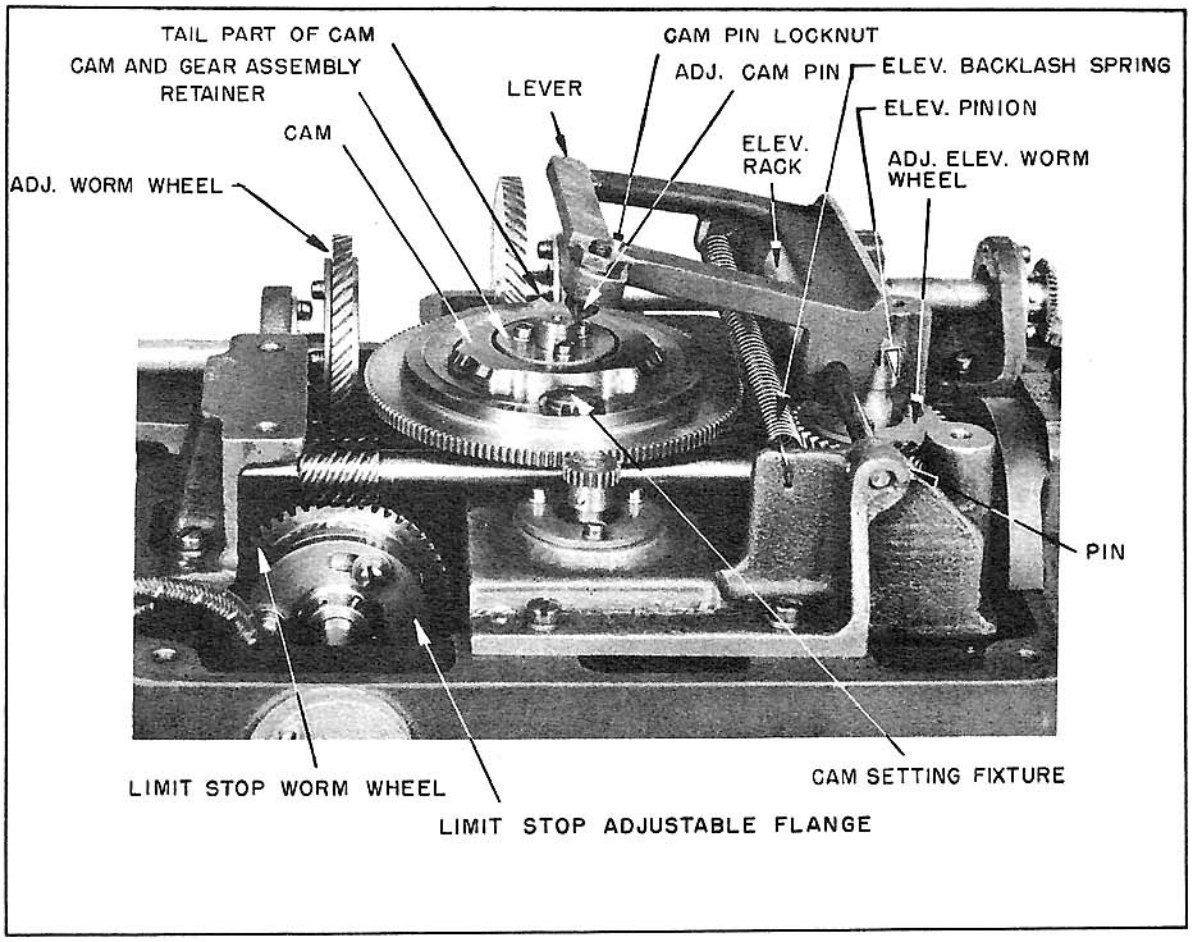


FIGURE 5
FIRE CUT-OFF AND LIMIT STOP UNIT - VIEW FOR ADJUSTMENTS

14. Replace cover on unit.

2. Troubles and Remedies. - a. Sluggish operation in one or both axes.

(1) Low oil level in double power unit = Refill breather cups to 1/4 of their capacity.

(2) Voltage supply low = Check voltage; should be 27.5 ±5% volts.

b. Dead spot in control handles.

(1) Low oil level in double power unit = Refill breather cups to 1/4 of their capacity.

(2) Low control pressure in double power unit = Test by removing 1/8" Allen plug located in gear pump. Connect pressure gauge by means of short length of copper tubing and suitable fittings. When unit is operating, pressure should read approximately 55 lbs. Turret will operate with pressures as low as 20 lbs. but the dead spot near the central

2. Troubles and Remedies (Cont'd.)

position of hand control unit will be appreciable and a slow and sluggish action will result. To increase pressure, remove acorn nut on gear pump and adjust spring loaded ball by means of screw. If pressure cannot be sufficiently increased by this method, remove gear pump by removing 4 cap screws and remove any metal chips or foreign material from the four ball check valves in the pump assembly.

(3) Hand control mechanisms have excessive backlash or loose couplings = Check hand control, centralizing springs and control box.

c. Power unit will not run when main switch is "ON" and safety switches are operated.

(1) Brush fails to make contact with slip ring = Check position and condition of DCG brush.

(2) Power relay not operating when safety switches are closed = Check for broken lead between power relay and hand control unit.

(3) Power relay operates correctly but power motor will not start = Check main fuse (120 ampere), replace if blown.

(4) Open circuit between power relay and power motor = Check continuity of leads with ohmmeter.

d. Gun solenoid will not operate when firing key is closed.

(1) Main power switch off, or power relay not operated = Operate safety switch and check to see that power relay operates.

(2) Either or both fire selector switches "OFF" = Move fire selector switches to "ON" position.

(3) Fuses blown = Check 120-ampere and 20-ampere fuses in main switch and junction box.

(4) Switch in fire cut-off and limit stop unit stuck open = Repair or replace switch.

(5) Gun is pointing at cut-off area = Move turret until sealed switch in fire cut-off and limit stop unit closes.

(6) With power relay operated, switches in correct position and fuses all right; firing solenoid still fails to operate = Check continuity of leads to fire cut-off and limit stop unit, hand control unit and firing solenoid.

e. Motor of computing sight does not operate.

(1) 15-ampere fuse blown in main switch and junction box = Replace fuse (spare fuse on cover of box).

(2) Sight switch "ON" when turret main switch was turned "ON" (motor on "dead" spot) = Turn sight switch "OFF" then "ON" again.

2. Troubles and Remedies (Cont'd.)

(3) Open circuit between main switch and junction box and the computing sight = Check continuity of leads with an ohmmeter.

(4) Computing sight motor does not operate after the preceding checks and any necessary corrections have been made = Refer to Sperry Instructions 14-226 for trouble and remedy chart for the computing sight.

f. Hydraulic Unit "whines", indicating overload.

(1) Power unit improperly aligned = Correct alignment.

(2) Guns striking aircraft structure = Limit stop improperly adjusted; make adjustment as outlined in paragraph 1.d.

3. Routine Maintenance.

a. Cleaning. - (1) Every effort should be made to prevent dust, dirt or other foreign matter from entering the turret mechanisms. All cover plates should be on except during necessary service operations.

(2) All switches, terminal blocks, slip rings, etc. should be cleaned regularly with carbon tetrachloride and a clean cloth.

(3) Be sure that excess oil or grease is removed after servicing operations.

(4) Particular care should be taken to prevent any foreign matter from getting into the double power unit system.

(a) If the breather cups are removed, be sure to put protective filler plugs into the bleeder pipes. Most of the double power units are provided with a removable filter in the cover of the control pump. The filter can be removed by unscrewing the 5/8" hexagon head stud and it should be cleaned with Varsol (Air Corps Spec. P-S-661), kerosene or benzine.

b. Oiling. - (1) While oiling is a necessary and important part of the maintenance of the upper turret, excess oil or grease must be avoided. All points of friction should be oiled with a few drops of Univis No. 48, but be careful not to over-oil.

(2) Use a hypodermic needle to put one drop of Univis No. 48 oil in each accessible bearing of the fire cut-off and limit stop unit.

(3) Beacon M-285 grease should be used when lubrication is required in the various gear boxes. Use only enough grease to provide proper lubrication.

(4) Keep the sight mounting pin lubricated with Alcoa thread lubricant.

(5) The breather cups of the azimuth and elevation variable speed transmission units should be inspected regularly and filled to 1/4 of their capacity with Univis No. 40 oil. Be sure that the oil is clean. Keep a quart can of the oil in the airplane so that the oil level can be maintained at proper level.

3. Routine Maintenance (Cont'd.)

c. Care of Oxygen System. - (1) The oxygen system should be kept entirely free of:

(a) Oil and grease - to avoid danger of spontaneous combustion and explosion when in contact with high pressure oxygen.

(b) Water - to prevent freezing of oxygen equipment at low temperatures.

(c) Other foreign matter - to prevent contamination of the breathing oxygen.

(2) No lubrication which is not approved by Air Corps (Spec. No. 40363) should be used anywhere in the oxygen system.

d. Precautions.

(1) Low Voltage. - (a) Do not operate the turret with low voltage. Low voltage may cause stalling of power motor and faulty operation of the power relay, with resultant burning off of relay contacts. It is advisable to operate the turret only when the ship's generator is running or when an auxiliary power source is connected. The ship's battery does not have sufficient rating to provide satisfactory power for operating the turret.

(2) Double Power Unit. - (a) Air is bled from the variable speed transmission units of the double power unit by high altitude flights. The oil level may go down because of the reduction in volume when air has escaped. Therefore, the level should be checked after each high altitude flight.

(b) If the level of oil in the breather cups is too high, the oil will overflow into the motor of the double power unit. This will cause excessive sparking and possibly serious damage to the commutator. Clean oil off thoroughly, and replace brushes if they are oil soaked. (Brushes are Sperry part number 194993.)

(c) The double power unit should be protected against water by covering turret during rain storms. If the unit becomes moisture soaked, it may be necessary to push fan blades on the motor in order to start it.

e. 50-Hour Inspection Routine. - (1) Clean dome panels.

(2) Check tightness of dome fastening studs on top of unit housing.

(3) Clean slip rings.

(4) Check condition of flexible conduits.

(5) Check tightness of Cannon plugs and receptacles.

(6) Clean points of relay in switch and junction box.

(7) Check to see that spare fuses are in clips on inside cover of main switch and junction box.

3. Routine Maintenance (Cont'd.)

(8) Check operation of communicating circuits.

(9) Clean fire cut-off and limit stop unit; put one drop of Univis No. 48 oil in each bearing.

(10) Check tightness of flexible shafts.

(11) Check guns for tightness in mounts.

(12) Check condition of guns and service as required.

(13) Check condition of charger cables (tape up frayed sections or replace cables if badly worn).

(14) Check charging operation.

(15) Check gun slot shutters and flexible shell case chutes for proper operation.

(16) Check condition of ammunition rollers.

(17) Check power gears for excess backlash (seven mils may be considered as the safe overall limit; this represents 1/4" movement in elevation or azimuth, measured at ends of the guns).

(18) Check voltage at turret (should be 27.5 volts $\pm$5% with double power unit under full load).

(19) Check oil level in breather cups of double power unit. (See paragraph 3.b.(5).) The mirror plate in the cover of the breather cup provides a convenient means for checking oil level.

(20) Check turret for satisfactory response and operation (by driving at minimum and maximum rates in azimuth and elevation).

(21) Check turret for creep, correcting if necessary. (See paragraph 1.b.)

(22) Check alignment of sight and guns (by boresighting at several different points). (See Section I, paragraph 10.).

(23) Check firing solenoid operation. (See paragraph 1.e.)

(24) Check fire cut-off operation. (See paragraph 1.e.)

(25) Check operation of oxygen system.

SECTION III

OVERHAUL

1. General.

a. Tools Required.

(1) Special Tools. - (a) In addition to the Hand Tools and General Shop Tools listed in (5), (6) and (7), the following special tools are useful in overhauling the Upper Turret. The T- numbers assigned are Sperry Part Numbers.

1. Spring tension wrench. (T-44036). Used to wind the centralizing springs. See III, 3.g.(7).

2. Fixture to hold slip ring commutator to casting while working on it. (T-44037). This fixture consists of a flat base with 2 uprights and 2 nuts.

3. Wrench for Norma-Hoffmann locknut. (T-44038). A specially designed wrench for this type of nut.

4. Wrench for thrust bearing lock. (T-44049). This wrench is used for thrust bearing locknut in base plate (SG 1002).

5. Gauge for tripping arm. (T-44050). This gauge is used to bend tripping arm to proper shape. (See III, 4.h.(1).

6. Sling spreader, used when hoisting turret into the airplane. (T-44051). (See I, 3.a.)

7. Backlash dial for fire cut-off and limit stop unit. (T-44053). This dial is graduated so that the amount of backlash in the fire cut-off and limit stop unit may be tested. (See III, d.(4)(e).)

8. Gun muzzle backlash gauge. (T-44054). This gauge consists of a stand, dial and pointer and is used to test the overall backlash of the gears in the turret. (See III, 5.c.)

9. Boresighting tool. (T-44059). This tool consists of an adjustable rod which fits into the muzzle of the gun and is then locked in place. A sighting tube is attached to the rod by means of a bracket so that the rod and tube are in exact alignment. At one end of the sighting tube is an eyepiece, while at the other end is a lucite disc with crosslines, thus providing a convenient and accurate means for sighting on a test target. (See I, 10.)

(2) Other Hand Tools. - (a) Figure 6 illustrates a group of special tools which may be easily made up by the overhaul personnel and will be useful in overhauling some of the individual units.

(3) Special Tools for Double Power Unit. - (a) In addition to the hand tools listed

1. General (Cont'd.)

(6) Double Power Unit Hand Tools. - (a) The list given below includes the hand tools desirable for overhaul of the double power unit.

DOUBLE POWER UNIT HAND TOOLS

AMT.	SIZE	NAME	AMT.	SIZE	NAME
1	5/16"	Hexagon Socket	1	6"	Needle Nose Plier
1	3/8"	Hexagon Socket	1	4-1/2"	Combination Plier
1	7/16"	" "	1	5"	Midget Plier
1	1/2"	" "	1	6"	Steel Rule
1	9/16"	" "	1	2-3/8"	Steel Scriber
1	5/8"	" "	1	1/16"	Center Punch
1	11/16"	" "	1	3/32"	" "
1	3/4"	" "	1		Bench Block
1	3"	Extension	2	1/16"	Nail Set
1	6"	"	1	3/32"	" "
1	7"	Ratchet	1	4-1/2"	Drift Punch
1	3/8"	Wrench, "TU-Type"	1	4-5/8"	" "
1	7/16"	" "	1	5"	" "
1	1/2"	" "	1	3-1/2 oz.	Ball Pein Hammer
1	9/16"	" "	1	1/4 lb.	Soft Face Hammer
1	5/16"&3/8"	Open End Wrench	1	1/2 lb.	" " "
1	7/16"&1/2"	" " "	1	3"	Screwdriver
1	3/8"&7/16"	Dwarf Boxocket Wrench	1	6"	"
1	1/2"&9/16"	" " "	1	4"	"
1	5/8"&3/4"	" " "	1	6"	"
1	8"	Adjustable Wrench	1		3 corner scraper in handle
1	6"	Combination Plier	1	1"	Box Wrench
1	6"	Diagonal Plier	1	Set	Allen Set Screw Wrenches

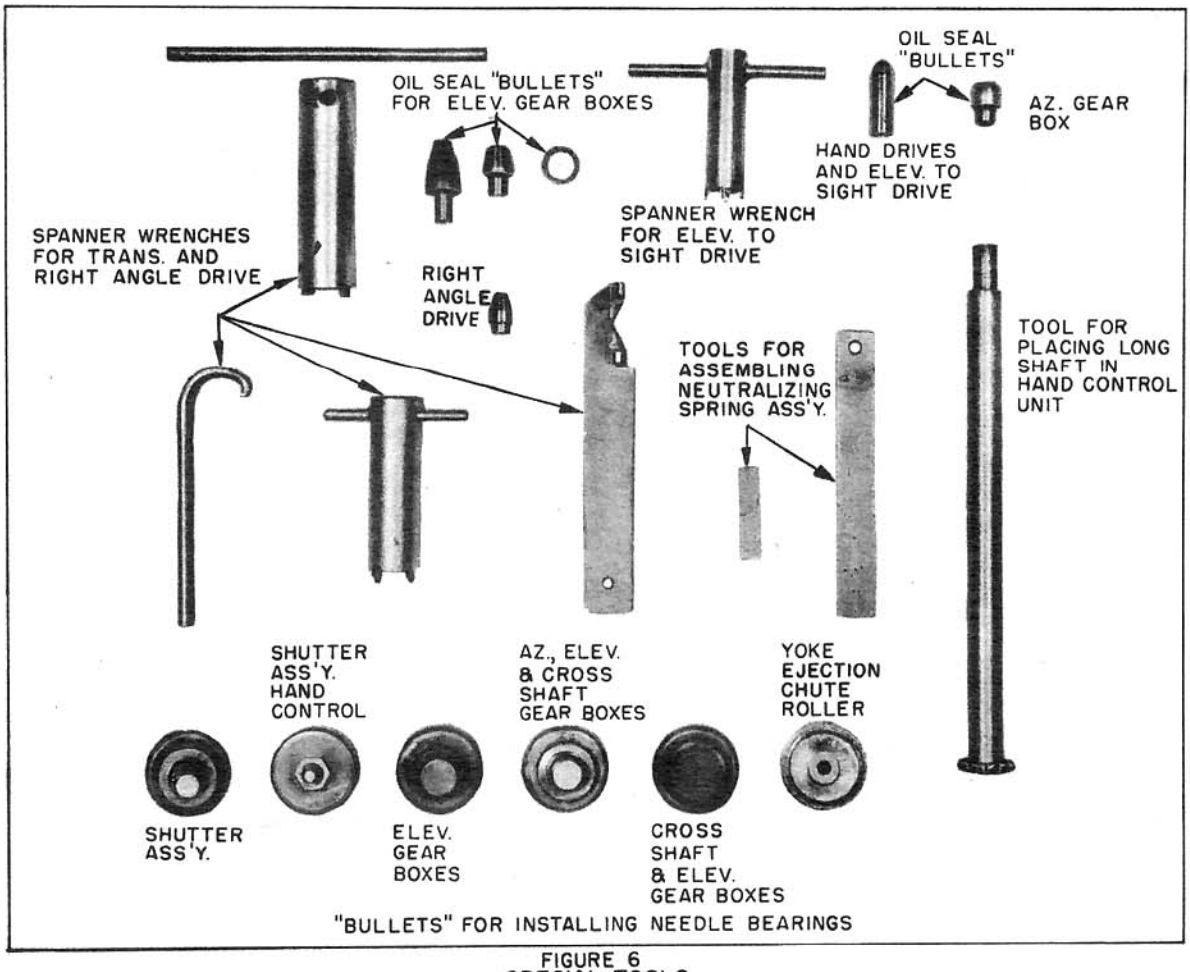


FIGURE 6
SPECIAL TOOLS

1. General (Cont'd.)

(7) General Shop Tools. - (a) The following list includes general shop tools that should be available if a large amount of overhaul work is to be undertaken. Tools used with Sperry .50 Calibre Automatic Computing Sight are contained in the list, as the Turret and the Sight are closely allied in action.

GENERAL SHOP TOOLS

AMT.	SIZE	NAME
4	1"x2"x12"	Parallels
3	1"	Micrometers
1	1" to 2"	Micrometers
1	2" to 3"	Micrometers
1	Set	Knife Edge Straight Edges
2	10"	Vernier Height Gauge
1	18"	Vernier Height Gauge
1	6" to 12"	Vernier Depth Gauge
2		Screw Ditch Gauge
2	Hard	Center Gauge
2	0 to 60	Twist Drill Gauge
2	61 to 80	Twist Drill Gauge
5	.001"	Dial Indicators
5	9"	Surface Gauges
3	.0001"	Dial Indicators
3		V. Blocks & Clamps
1		V. Blocks & Clamps
3		Toolmakers Vise
4	2-1/8"	Toolmakers Clamps
4	3-3/8"	Toolmakers Clamps
3 ea		Gun Type Machine Screw Taps 3-48 3-56 4-40 4-48 5-44 6-32 6-40 8-32 8-36 10-32
3 ea		Gun Taps 1/4" - 20 1/4" - 28 5/16" - 18 5/16" - 24 3/8" - 16 3/8" - 24 1/2" - 20
2 ea	13/16"	Dies 3-48 3-56 4-40 4-48 5-44 6-32 6-40 8-32 8-36 10-32
2 ea	1-5/16"	Dies 1/4"-20 1/4"-28 5/16"-18 5/16"-24 3/8"-16 3/8"-24 1/2"-20

AMT.	SIZE	NAME
2	4"	Dividers
2	4"	Calipers (Outside)
2	4"	Calipers (Inside)
1	36"	Steel Rule
1	Set	Small Hole Gauges
1	Set	Telescoping Gauges
3	1-3/4"	Tap Wrenches
3	2-1/16"	Tap Wrenches
2	3-1/16"	Tap Wrenches
2	5-3/4"	Tap Wrenches
2	9-1/16"	Tap Wrenches
2	12-5/8"	Tap Wrenches
1	12"	Bench Level
2		Hack Saw
2	600 in#	Torque Wrench 3/8" Drive
1	Set	Open End Wrenches
6 ea	Sets	Twist Drills 1 to 80 HSS
6 ea	Sets	Twist Drills 1/16"to1/4"HSS
3 ea	Sets	Twist Drills 17/64"to1/2"HSS
2 ea	Sets	Twist Drills A to Z HSS
2	13/16	Die Stock
2	1-5/16	Die Stock
6	A-1	Center Drills
6	C-2	Center Drills
6	0-1	Center Drills
6	E-2	Center Drills
6	6/0	Taper Pin Reamer
6	5/0	Taper Pin Reamer
2 ea	4/0 to 0	Taper Pin Reamer
3	82°	Center Reamer
3	60°	Center Reamer
2 ea	1/8"	Pipe Taps HSS
2 ea	1/4"	Pipe Taps HSS
2 ea	3/8"	Pipe Taps HSS
3	3/8"	100W Soldering Iron
2	1/2"	300W Soldering Iron
1	12"	Vernier Caliper
2	1/4"	Electric Hand Drills
1	1/2"	Electric Hand Drills

b. Test Equipment and Facilities Required. - (1) In order to test the turret in the depot, the following equipment is required:

(a) A test stand similar to Figure 46.

1. This stand will be used not only to test the turret but also to make its various parts accessible during overhaul. For the height of the platform which supports the azimuth ring and the diameter of the opening in the platform for the azimuth ring, refer to installation drawing Figure 50.

1. General (Cont'd.)

(b) A small spirit level to determine when the guns are aligned properly.

(c) A 27.5 volt ±5% D.C. power source capable of a continuous output of 75 amperes, minimum.

(d) A stop-watch for measuring turret speed in azimuth and elevation.

(e) A circuit analyzer for checking the electrical equipment of the turret.

2. Disassembly of Turret.

a. General. - (1) This procedure assumes that the turret has been removed from the airplane and is to be completely disassembled in the overhaul depot. The procedure is in outline form for simplification and where additional details are required, reference should be made to the reassembly instructions in paragraph 4., using the reverse order to that given.

(2) Since the turret has been removed from the airplane, the dome and computing sight have already been removed from the turret. The disassembly procedure which follows will start from that stage.

NOTE: Where duplicate parts are to be disassembled, the procedure for only one part is given unless the procedure is a difficult one. (Part numbers preceded by SG are numbers assigned by Steel Products Engineering Co., Springfield, Ohio. Part numbers preceded by V are those of Vickers Inc., Detroit, Michigan. All others are Sperry part numbers.)

b. Removal of Major Units.

(1) Guns and Gun Mounting Yoke Assembly (See Figure 44). - (a) Remove hand charger cables from clevis SG 1102 and the pulleys.

(b) Disconnect firing solenoid conduits from the solenoids (Figure 1).

(c) Remove bolt SG 1659 in rear trunnion SG 970. (See Figure 44, and line drawing of gun accessories, Figure 49.)

(d) Remove adapter mounting bolt SG 1406 from adapter yoke SG 1098 and then lift the guns out of the turret.

(e) Remove ejection chute rollers (Figure 45) from rear of gun yoke.

(f) Disconnect sight cradle support links from anchor clevises on sight link anchor brackets. (See Figures 1 and 44.)

(g) Detach elevation and azimuth sight flexible shafts where they are clamped to sight cradle. Disconnect elevation flexible shaft where it connects to the fire cut-off and limit stop (Figure 11) and the azimuth shaft where it connects to the azimuth gear box. (See Figure 17.) The azimuth connection may be reached through an opening in the

2. Disassembly of Turret (Cont'd.)

unit housing. (See Figure 3.) Remove the 2 shafts carefully, taking care not to bend them unduly as the shafts may jam and become inoperable. Lay the shafts straight and in a safe place.

(h) Remove the elastic stop nuts holding "A" frame SG 1080 to the unit housing. (See Figures 1, 35 and 41.) Lift out the yoke assembly, using lifting plates SG 1777 which are attached to the tops of the "A" frames.

(2) Control Units. - (a) Remove check nut on bell crank (SG 1355) of centralizing spring assembly SG 995 (see Figure 9) and slip off swivels (see Figure 9) which are on the azimuth and elevation horizontal control rods extending from the hand control unit (see Figure 7).

(b) Disconnect the flexible range shaft from the hand control unit (see Figure 1) and then remove the shaft carefully. Disconnect the electrical conduit and remove the hand control unit, which is attached to the center rail. (See Figure 4.)

(c) Disengage the vertical control rods from the centralizing spring assembly by removing the retainers from the ball and socket joints. (See Figure 9.)

(d) Remove the control box (SG 973) from its bracket, taking care to pull it forward so that the spline shafts connecting it to the fire cut-off and limit stop unit will be disengaged without being damaged. (See Figure 4.)

(e) Using a siphon, drain the oil from the 2 breather cups on the double power unit so that the cups can be removed without oil flowing on the other units. Then unscrew the breather cups from the unit and screw a 1/4" Allen plug into the breather lines. (See Figure 38.) Be very careful to prevent any foreign matter from getting into the lines.

(f) Disconnect elevation gear flexible shaft from fire cut-off and limit stop unit (see Figure 11) and remove the 4 cap screws which hold the fire cut-off and limit stop unit to the double power unit. Lift unit up and disconnect electrical conduit. Then remove the unit. Be sure to lift the unit straight up so that the 2 disc couplings to the double power unit and the coupling to the adapter gear box will not be forced from their adjusted positions. The fire cut-off and limit stop unit should be placed aside carefully, with the adapter coupling removed. (See Figure 13.)

(g) Take out elevation flexible shaft to elevation gear box. This connection can be reached through the opening in the unit housing.

(3) Ammunition and Protection Plate Assemblies. - (See Figures 39, 40 and 43.) (a) Remove the ejection chute roller (Figure 39) by taking out the bolt on inside ejection panel (R.H. SG 1411, L.H. SG 1411-1). This bolt is held to outside ejection panel by a nut plate.

(b) Remove 2 power unit shields and control box bracket. (See Figure 39.)

(c) Remove the 2 triangular braces. (See Figure 39.) Replace 2 bolts and spacers which hold triangular brace to inside ejection panel.

2. Disassembly of Turret (Cont'd.)

(d) Remove bolt holding panel deflector to inside ejection panel. (See Figure 40.)

(e) Remove 2 bolts which hold panel deflector to inside ejection chute.

(f) Remove 2 bolts holding inside ejection panel to double power unit.

(g) Remove 2 bolts holding inside ejection panel to panel shield.

(h) Remove screws holding inside ejection panel to gun slot shutter bracket.

(i) Remove gun slot shutter bracket from the unit housing. (See Figure 39.)

(j) Remove 2 screws holding panel shield to unit housing. Left hand panel shield is also attached to the double power unit by a cap screw.

(4) Gear Drive Assemblies. - (a) Break connections of 2 couplings on the elevation cross shafts. (See Figure 37.)

(b) Remove azimuth hand drive. Disengage and remove long shaft extending from right hand drive (Figures 14 and 39) to the azimuth hand drive.

(c) Next remove the cross shaft gear box (see Figure 15) which is mounted on the center rail. (See Figure 39.) Then remove the right angle drive from the azimuth gear assembly. (See Figure 14.)

(d) Remove elevation transmission support bracket. (See Figure 37.)

(e) Take out bolt from the clevis which holds the adjustable brace to the unit housing. (See Figure 39.) Remove cap screw holding the brace to double power unit.

(f) Now lift out the double power unit and associated gear assemblies, but be very careful not to damage the studs at the bottom of the azimuth gear box, the pinion gear, and the spline shaft connection. (See Figure 38.)

(g) Remove the 2 elastic stop nuts which attach outside ejection panel to the elevation gear box. (See Figure 39.) Remove bolt holding the panel to unit housing. On the left side it may be necessary to bend the panel back until the bolt head is accessible. The outside ejection panel can then be lifted out.

(h) Take out the 2 elevation gear boxes.

(5) Electrical Boxes and Conduits. - (a) Disconnect in the main switch and junction box (Figure 34) the electrical leads which come up through the unit housing support.

(b) Remove locknut from electrical fitting holding offset spacer bracket to the unit housing.

(c) Take out the bolt which holds the switch box at upper right hand corner. The switch box can then be lifted off its mounting.

2. Disassembly of Turret (Cont'd.)

(d) Remove conduits from clips and then take out the switch box.

(6) Unit Housing. - (a) Remove 4 castellated nuts from studs holding turret support to platform. (See Figure 46.) Remove pin from telephone bracket and slip the bracket off the telephone switch shaft.

(b) Using a hoist, lift upper portion of turret structure out of test stand. Be very careful not to damage electrical wires as they slide through the supports.

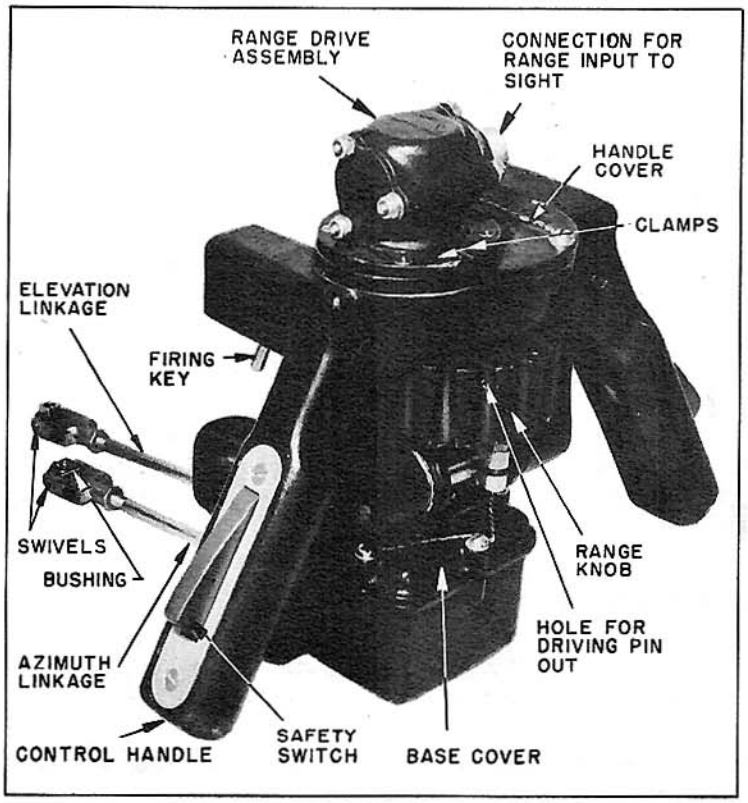


FIGURE 7
HAND CONTROL UNIT

(7) Lower Electrical Assemblies. - (a) Remove 4 elastic stop nuts from studs holding cover to brush holder box. (See Figure 42.) Remove bakelite insulator spacers from these same studs. Using stud driver, unscrew studs from platform casting. Disconnect wires from terminals and take off the box. Follow the same procedure for both boxes, referring to Figure 42.

(b) Remove 4 bolts holding bearing retainers to platform and carefully remove slip ring assembly. (See Figure 41.)

(8) The turret is now separated into its principal sub-assemblies. The overhaul procedure for the individual assemblies follows in paragraph 3.

3. Disassembly and Reassembly of Individual Units.

a. General. - (1) The overhaul information for individual units is given in outline form only, since detailed "step-by-step" instructions would result in a burdensome and confusing presentation. The numerous photographic illustrations will prove very useful in connection with the text material, but where detailed parts information is required, reference should be made to the assembly drawings and complete Parts List in Section IV.

(2) The following general instructions apply to all of the units to be overhauled. They should be kept in mind at all times by the personnel charged with this work.

(a) All parts for a particular unit being disassembled should be arranged carefully in the order in which they are disassembled, and should be kept separate from other disassemblies. The illustrations of disassembled parts are arranged in the correct manner to aid in the reassembly procedure.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

(b) When disassembling, be sure to note the direction in which all ball bearings and oil seals are facing so that they can be reassembled in the same direction.

(c) Do not drive or force any part or assembly sufficiently to injure it. For information on pinning, etc., reference should be made to the assembly drawings in Section IV.

(d) When a shaft must be pushed through an oil seal, always use a properly shaped "bullet".

(e) When replacing needle bearings, use a special tool designed for this purpose.

(f) Check the overall backlash of each gear assembly and, when necessary, replace worn gears to bring backlash within allowances. See paragraph 5.c. for backlash inspection. Also check gear trains for free running.

(g) New gaskets should be used when units are reassembled.

(h) After units are completely disassembled, wash all parts with carbon tetrachloride before reassembling.

(i) Apply grease to the moving parts only as specified for each unit. Do not use excess lubrication.

(j) When electrical connections are removed, be sure that an identification marker or tag is on the connection so that it can be replaced properly.

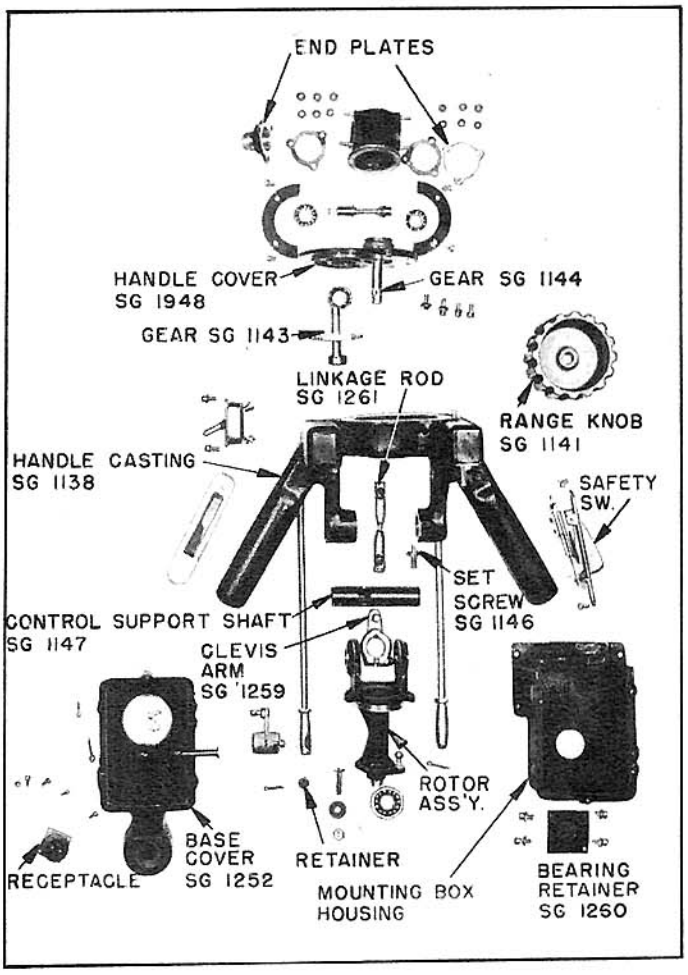


FIGURE 8
HAND CONTROL UNIT DISASSEMBLED

(k) Test insulation on all new wiring with a megger. Check continuity of circuits, using wiring diagram, Figure 48, as a guide. Pay particular attention to position of plugs during reassembly to assure proper connections.

(l) Standard Air Corps procedure should be followed in the use of washers, lockwashers, safety wiring, oxygen system precautions, etc.

b. Hand Control Unit.

(1) General. - (a) The hand control unit (see Figures 7 and 8) consists of several sub-assemblies, each of which may be removed separately.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

1. To remove the upper gear sub-assembly (SG 1949) for range drive to sight, take out the 4 fillister head screws which hold the clamps to the cover. When the sub-assembly is free, take off the 3 elastic stop nuts which fasten each end plate to the gear housing.

2. The range knob (SG 1141) may be removed after driving out the pin (5-0 taper, 5/8" long) which fastens it to the range shaft. This pin is reached through a hole in the knob, as shown in Figure 7.

3. Remove handle cover (SG 1948) by taking out the 4 fillister head screws, 2 of which are under the clamps. Be careful not to damage dowel pin when removing this cover.

4. All of the electrical switches may be removed for inspection by taking out their retaining screws. Be sure that the leads have tags or identification markers so that the proper reconnection will be made. Refer to wiring diagram, Figure 48.

5. To remove the rotor assembly from the mounting box housing, first remove the bearing retainer (SG 1260) on the bottom of the mounting box housing. Then remove the cotter pin and castellated nut which hold the rotor assembly to mounting box housing. Remove base cover (SG 1252) from mounting box housing. Release the electrical cable from its clamps by taking out the screw on top of base cover. Detach the electrical receptacle from the mounting box housing; pull the receptacle out and unsolder the wires. Next remove the control rod by taking out cotter pin and loosening retainer at ball and socket joint. After removing linkage rods (SG 1261) by taking off the retainer and disconnecting ball and socket joint on clevis arm (SG 1259), the rotor assembly can be removed.

6. Remove set screw from the handle casting and remove screw and elastic stop nut on clevis arm (SG 1259). Move clevis arm along shaft and remove key (SG 1149). Then detach wires from control support shaft (SG 1147) and handle casting. Carefully press control support shaft from handle and rotor. It is advisable to place a 1-3/8" spacer between the rotor in order to prevent damage to it.

7. Reassembly procedure is exactly the reverse of that given for disassembly. Take care not to injure electrical wires when they are drawn through the casting and control handles. When replacing cotter pins in ball and socket joints, be sure that they do not cause interference, particularly between the wires and the short elevation linkage rod (SG 1261). Assemble receptacle so that heavy pins are in the forward position. Safety wire the screws on the handle and base covers as in Figure 7.

c. Control Box. - (1) (See Figure 9.) Remove the cover and then the bearing support plate, taking care not to damage the dowel pins. Remove rocker arms (SG 1231) after taking out the 2 cotter pins on the pivot pins. Remove rocker arm spring and check for tension. If necessary, remove hexagon shafts by driving out the pins which fasten the spline couplings to the shafts.

(2) If ball bearings are replaced, be sure that the side on which the manufacturer's name is stamped is on the outside. Pack open bearings with Beacon M-285 or other approved equal, low temperature grease.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

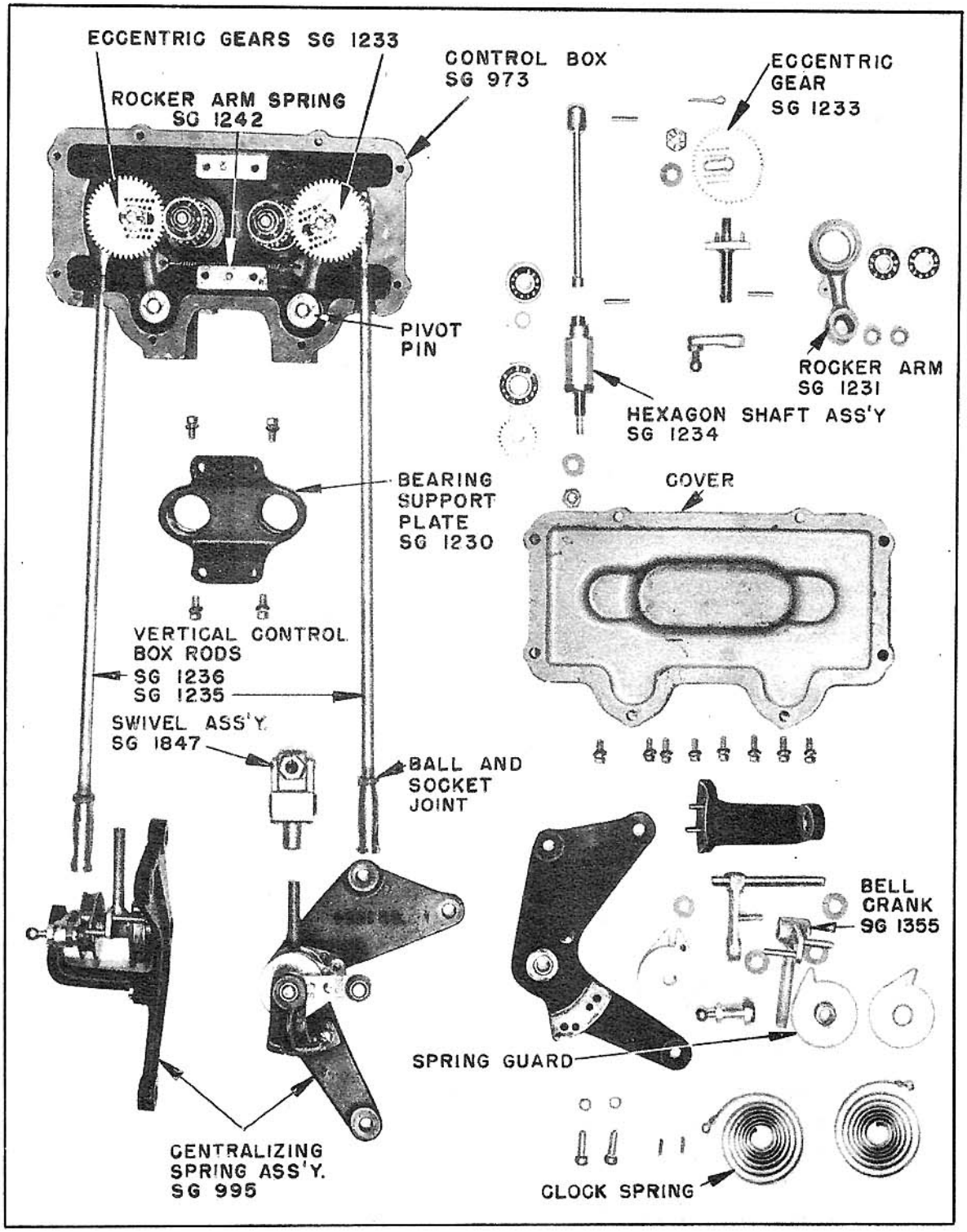


FIGURE 9
CONTROL BOX AND CONTROL LINKAGE DETAILS

3. Disassembly and Reassembly of Individual Units (Cont'd.)

(3) When reassembling the control box, check to see that there is clearance between the vertical control rods and the control box casting.

d. Fire Cut-Off and Limit Stop Unit.

(1) General. - (a) The fire cut-off and limit stop unit consists of 8 sub-assemblies, as follows:

1. Switch Bracket Assembly (Figure 10).
2. Rack Assembly (Figure 5).
3. Elevation Rate (or Control) Bracket Assembly (Figures 11 and 12).
4. Azimuth Rate (or Control) Bracket Assembly (Figure 11).
5. Fire Cut-Off Assembly (Figures 11 and 13).
6. Limit Stop Assembly (Figure 11).
7. Bearing Bracket Assembly (Figures 10 and 11).
8. Box Mounting Receptacle and Wires (Figure 10).

(b) Before proceeding with the disassembly of the unit, it will be helpful to refer to the illustrations of the assemblies for a general understanding of their location. For a gear schematic of the unit, See Figure 47.

(2) Disassembly. - (a) If not previously removed, take off the coupling to the azimuth gear train as the initial step in disassembly. (See Figure 13.) This coupling may be damaged if the unit is moved on the workbench while it is attached to the unit.

(b) Remove the cover.

(c) Disconnect the 2 wires marked FCO and DCP where they are connected to the switch terminals. (See Figure 10.)

(d) Remove the 4 screws and switch bracket assembly.

(e) To remove the rack assembly (see Figures 5 and 11), unhook the backlash spring from the fire cut-off assembly and unpin the shaft on which the lever and rack travel. This pin is located at "A" on Figure 11. The opposite end of the shaft is held in place at point "B" on Figure 11.

(f) The elevation rate bracket assembly is removed by unpinning the disc coupling that drives the elevation variable speed transmission of the double power unit. (See Figure 12.) Then take out the 4 screws which fasten the bracket to the case. Remove the assembly carefully by lifting it straight up to avoid damaging the elevation control shaft to double power unit which will come out with the assembly. Then remove the retainer and bearing.

(g) Remove the 3 screws and bearing bracket assembly. The long shaft which operates the limit stop worm wheel, the rack and the elevation drive shaft to the sight can then

3. Disassembly and Reassembly of Individual Units (Cont'd.)

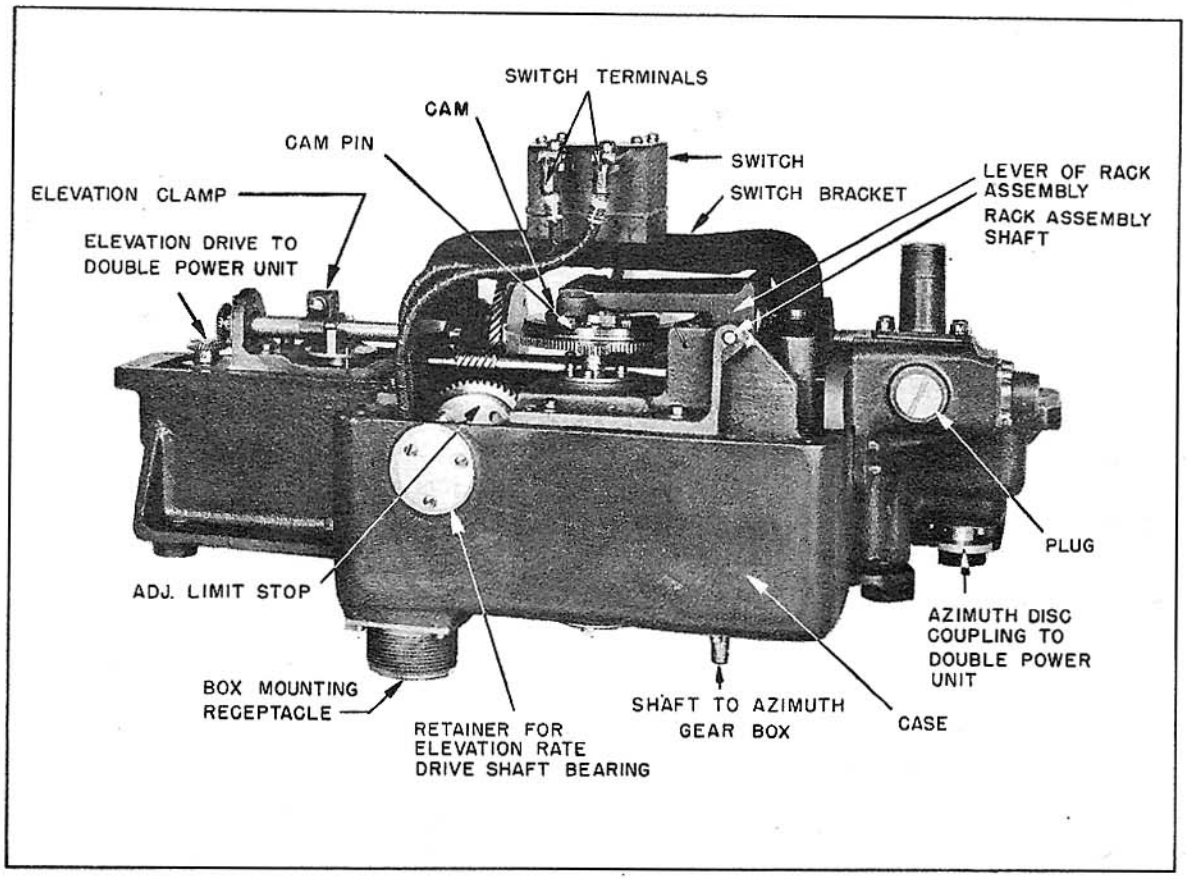


FIGURE 10
FIRE CUT-OFF AND LIMIT STOP UNIT WITH COVER REMOVED

be taken out. This shaft should be removed carefully to avoid burring the 2 worm gears and the bevel gear.

1. To remove the small splined shaft at the end of the long shaft, unpin the bevel gear. This pin holds both the bevel gear and the splined shaft in place.

2. The bearing bracket assembly is easily disassembled by removing the threaded flange. The splined shaft and spacer, bearing and bevel gear can then be taken out.

(h) To remove the fire cut-off assembly (see Figures 11 and 13) take out the 4 screws. This assembly has 3 spur gears which are driven through a coupling connection to the azimuth gear train and care should be taken to avoid burring them. The assembly should be placed in a safe location where there is no danger of the cam being damaged.

(i) To remove the wiring, first mark the position of the box mounting receptacle in relation to the case and then take out the 4 screws and receptacle, which is shown in

3. Disassembly and Reassembly of Individual Units (Cont'd.)

Figure 10. The wires should not be bent or twisted so that the soldered connections are broken.

(j) Remove the azimuth rate (control) bracket assembly by following the same procedure as for the elevation rate bracket. (See Figure 11.)

(k) Remove the threaded flange retainer at the end of the azimuth input shaft by taking out the 4 screws. Then carefully remove the splined shaft and worm gear, collar and bearing.

(l) For the final step in disassembly, remove the 3 screws and elevation input shaft bearing retainer (see Figure 10) and bearing. Remove the threaded flange at the other end of the shaft. Then slide the shaft back and then out.

(3) Reassembly. - (a) Clean both the cover and the case with filtered compressed air (no moisture). As the reassembly proceeds, clean each assembly thoroughly and oil all bearings with Univis No. 48. Clean all gears with Varsol (Air Corps Spec. P-S-661). It is good practice to brush the gear teeth after applying the solution; then use filtered compressed air. If bearings are replaced, the new bearings should be inserted so that the side on which the manufacturer's name appears is on the outside.

(b) Insert the elevation input shaft. (See Figure 11.) This is the shaft on which the limit stop is located. Put on the retainer and the threaded flange. There should be no more than .001" end play between the collar and the bearing. The collar and bearing are at the same end of the shaft as the retainer.

(c) Next put in the azimuth input shaft and worm. This is held by a threaded flange retainer and 4 screws. (See Figure 11.)

(d) Put on the azimuth rate (or control) bracket assembly and 4 screws. Carefully mesh the worm wheel of the assembly with the worm on the azimuth input shaft. Replace retainer and ball bearing and pin the disc coupling to the azimuth drive shaft. (See Figures 10 and 11.) The dimension between the bottom surface of the coupling and the bottom surface of the mounting pad on the case should be 1/2".

(e) The fire cut-off assembly, which is installed next, should be cleaned thoroughly. There should not be more than .001" end play in the cam shaft. (See Figure 13.) The assembly is held to the case by 4 screws.

(f) The elevation rate bracket assembly should now be installed, using 4 screws. Pin the disc coupling to the elevation control shafts in the same way as the azimuth coupling.

(g) Using the marks made to indicate correct position, attach the box mounting receptacle to the case with 4 screws. (See Figure 10.) The FCO and DCP wires will then connect with the switch without crossing or interfering with the limit stop mechanism.

(h) Next install the rack assembly. The lever and rack shaft is inserted into the bracket at "A" and "B" as shown in Figure 11. It is pinned at "A". Attach the backlash

3. Disassembly and Reassembly of Individual Units (Cont'd.)

spring as shown in Figure 5 and then check for free run of the lever and rack on the shaft.

(i) Put on 3 screws and bearing bracket, with elevation drive to sight assembly removed. Put in the long shaft which turns the limit stop worm wheel, rack and elevation drive to sight. Then put on the threaded flange. Since this shaft has 3 gears on it (2 worms and 1 bevel gear), it must be carefully fitted so that it moves freely without excess backlash. There should be a maximum backlash of .001".

(j) Unscrew the plug on the side of the bearing bracket (see Figure 10) and mesh the 30T bevel gear on the elevation drive shaft (to the sight) with the 32T bevel gear on the elevation drive shaft from the elevation gear box. This shaft and its associated parts should be fitted into the threaded flange retainer first. Then attach flange retainer to case and replace the plug.

(k) Put on the 4 screws and switch bracket assembly, but do not attach the FCO and DCP wires until after the unit has been tested.

(l) Test according to d.(4).

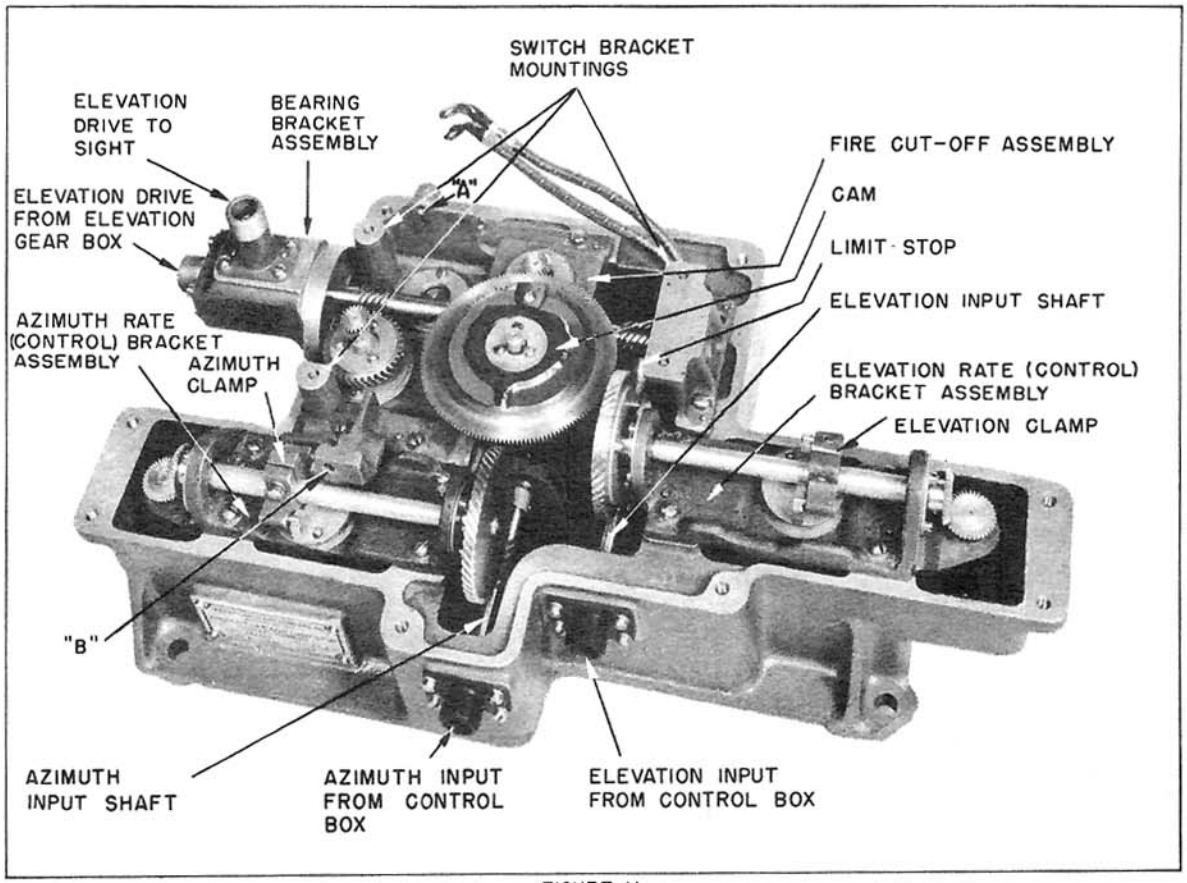


FIGURE 11
FIRE CUT-OFF AND LIMIT STOP UNIT WITH
SWITCH BRACKET AND RACK ASSEMBLIES REMOVED

3. Disassembly and Reassembly of Individual Units (Cont'd.)

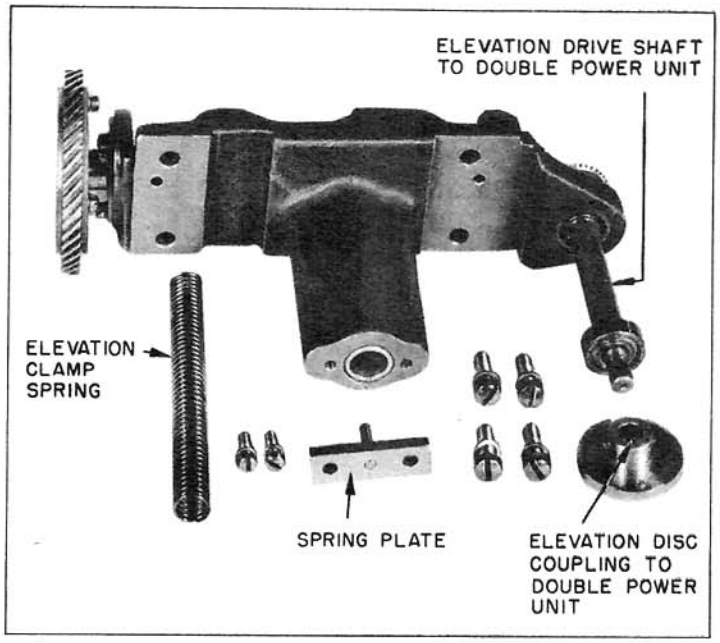


FIGURE 12
ELEVATION RATE BRACKET ASSEMBLY OF FIRE CUT-OFF AND LIMIT STOP UNIT

(4) Test.

(a) General. - 1. After the fire cut-off and limit stop unit has been overhauled, it should be tested according to the following procedure before it is re-installed in the turret. Figures 5 and 11 will provide a guide to the parts involved in the test.

(b) Fire Cut-Off Test. 1. With the cover of the unit and the coupling to the azimuth gear train removed, clamp the unit to T-50989.

2. Tighten the 3 screws on the cam retainer.

3. Loosen the screw on the elevation clamps so that the elevation rate bracket shaft is free to rotate.

4. Insert cam setting fixture in cam. (See Figure 5.) This fixture is attached to the switch bracket by a spring clip when not used for setting the cam pin.

5. With the cam pin centered in the hole in the cam setting fixture, attach 18° azimuth dial (T-56570) to the shaft from azimuth gear train and 320 mil elevation dial (T-56571) to splined shaft from elevation gear box. Set azimuth dial at zero and the elevation dial at 160 mils (+9° detent).

6. With FCO and DCP wires disconnected, connect test lamp leads to the 2 switch terminals.

7. Since the 72° and 80° azimuth settings involve the most difficult adjustment, a trial test should be made of the port (clockwise) and starboard (counter-clockwise) positions of these 2 settings.

a. To obtain the 72° setting, rotate the 18° azimuth dial 4 turns from the zero position. Then turn the elevation dial clockwise from the 160 mil position until the lamp turns off. The differential between the cut-off and the true cut-off (81.5 mils, see Inspection Check) should not exceed ±5 mils. If the difference exceeds this tolerance, adjust by raising cam pin by means of the locknut. If the reading is below the tolerance, lower the cam pin.

b. Continue to turn the elevation dial clockwise until the lamp turns on, thereby determining the cut-on reading. The differential between the cut-on and the

3. Disassembly and Reassembly of Individual Units (Cont'd.)

cut-off (not the true cut-off, but rather the cut-off as determined by the elevation dial) should not exceed 10 mils. If it does, the switch should be replaced and the test repeated.

c. Make a test similar to the port settings for the starboard settings.

8. Repeat the test for the 80° azimuth setting and adjust cam pin until both the 72° and 80° settings are within the tolerance of ±5 mils.

9. Next test the unit according to the settings of the Inspection Check.

NOTE: The port settings should be completed before the starboard settings are made.

10. The elevation settings in the lower part of the Inspection Check should be set-in next.

a. First turn the elevation dial from the 160 mil detent position to 97.5 mils and then turn the azimuth dial from zero until the lamp turns off. Subtract this reading from 180° to compute the cut-off. For example, assuming that the azimuth dial cuts off at 4.2°, the cut-off would be 180° -4.2° = 175.8°. Since the true cut-off is 176.0°, the error would be -0.2°.

NOTE: The cut-on is determined by rotating the elevation dial so that the cam pin moves back from the flat surface of the cam. The 10-mil differential between the cut-off and cut-on reading is also specified for the elevation settings.

(c) Elevation Clamp Setting. - 1. With the 3 screws on the limit stop adjustable flange loosened and elevation clamp screw loose, set the lever so that there is 1/4" clearance between the lever and mounting bracket "B". (See Figure 11.) Turn worm wheel on the elevation rate bracket assembly clockwise until it is stopped. (From the position in Figure 5, the top of the worm wheel should be turned directly toward the reader.) Holding lever and worm wheel in place, tighten the elevation clamp screw.

(d) Limit Stop Test and Setting. - 1. Move the limit stop adjustable flange so that the screws are at the extreme right, as in Figure 5.

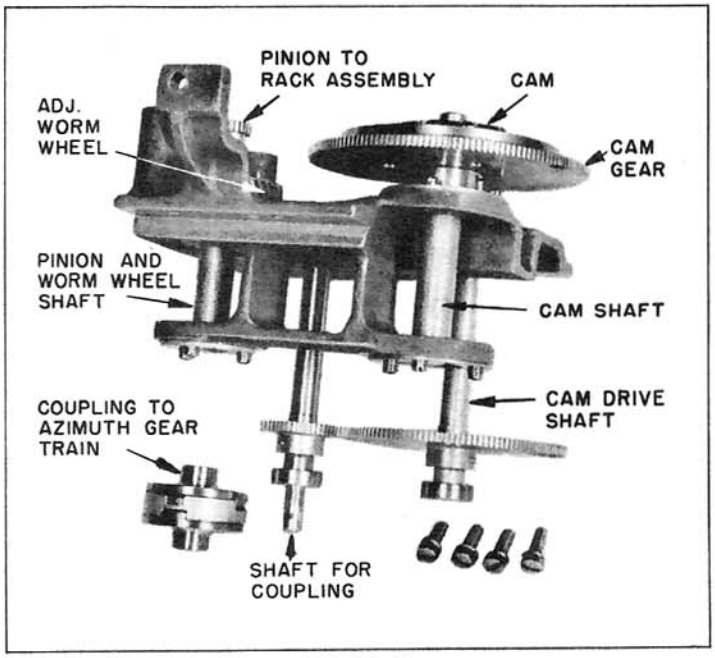


FIGURE 13
FIRE CUT-OFF ASSEMBLY OF
FIRE CUT-OFF AND LIMIT STOP UNIT

3. Disassembly and Reassembly of Individual Units (Cont'd.)

°Ag	Eg-Mils-Port			Eg-Mils-Starboard			Eg-Mils True
Set-In	Cut-Off	Error	Cut-On	Cut-Off	Error	Cut-On	Cut-Off
44							52.5
52							57.5
60							54.5
72							81.5
76							90.5
80							87.5
94							9.5
102							12.5
108							4.5
180							249.5
Eg	°Ag - Port			°Ag - Starboard			°Ag True
Set-In	Cut-Off	Error	Cut-On	Cut-Off	Error	Cut-On	Cut-Off
97.5							176.0
170.5							176.5
218.5							177.0
237.5							178.0

Detent Position 0° Azimuth, +9° Elevation (+160 mils)

Elevation Limit Stop Setting at Min. Elevation _____ Mils.

Elevation Limit Stop Setting at Max. Elevation _____ Mils.

Elevation Limit Stop Travel _____ Mils.

Elevation Limit Stop Travel True Value _____ Mils.

Error _____ Mils.

FIRE CUT-OFF AND LIMIT STOP UNIT INSPECTION CHECK

2. Attach pointer to elevation clamp and set at zero on the indicator.

3. Turn elevation dial clockwise until contact with the limit stop is made, at which point the pointer will move. Set elevation dial at zero.

4. Then turn the 320 mil elevation dial counter-clockwise 4 revolutions. Now turn the dial counter-clockwise until it reads 231 mils, or a total input of 1511 mils. Tighten the 3 screws on the adjustable flange.

5. Recheck the setting by turning the dial clockwise until it again reads zero, with the flanges in contact. Turn the dial counter-clockwise until the pointer moves. The dial should then indicate an input of 1511 mils ±5 mils.

NOTE: The cam pin must travel 160 mils from the detent setting.

6. Remove pointer and indicator.

7. Attach FCO and DCP wires to switch terminals and replace cover.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

8. Attach azimuth coupling.

(e) Backlash. - 1. Test the unit for overall backlash, using measuring dial T-44053.

e. Azimuth and Elevation Hand Drives (SG 967 and SG 943). - (1) (See Figures 14 and 19). The gears in these 2 units are easily reached by removing the covers.

(2) If spline shaft needs replacing, remove worm gear and shaft from ball bearing and then push spline out. On some of the earlier models this replaceable shaft was not provided. (See right angle drive paragraph 3.f.)

(3) Check spiral gear for damaged teeth and replace gear if necessary. Also check self-aligning bearing for satisfactory condition and operation, replacing it if necessary.

(4) If roller bearings require replacement, be sure that side of bearing with manufacturer's name on it is placed on the inside. Put a small amount of Beacon M-285 grease on the bearings and in the housing before attaching the cover.

f. Right Angle Drive. - (1) (See Figure 14.) This unit is attached to the unit housing at the bottom of the azimuth gear box. If a right angle drive is removed from a turret which is not being overhauled, it will be necessary to remove part of the flange of the drive. Before reassembling a right angle drive unit check gear box cover against detail drawing (PL. 4, Section IV) and remove left portion of flange (indicated as 96 on the drawing). This will permit easier disassembly and reassembly of the unit if there is a need to do so at a later date.

(2) To remove the miter driving gear (long shaft) in the right angle drive, take out set screw, using spanner wrench to remove locknut (see Figure 6 - "A").

(3) Unlock lug of lockwasher from locknut, using a smaller spanner wrench to remove small locknut. (See Figure 6 - "B".) The miter gear can then be easily replaced with a new part.

(4) To disassemble the end in which the azimuth hand drive spline shaft is inserted, remove cover (SG 1122). The shaft and gear disassembly follows the same procedure used for the miter gear.

(5) When reassembling the unit, put in a small amount of Beacon M-285 grease into the case. Be sure to use a "bullet" which is shaped properly so that the oil seal will not be damaged as the cover is replaced. (See Figure 6.)

g. Cross Shaft Gear Box. - (1) (See Figure 15). If it is necessary to remove the azimuth and elevation neutralizing units (SG 955), refer to Figure 9 for details of disassembly. The most probable cause for disassembly will be weakened springs. When replacing the springs be sure that there is no binding in the units, particularly between the springs and spring guards.

(2) Remove the left hand cover carefully so that the 2 dowel pins will not be

3. Disassembly and Reassembly of Individual Units (Cont'd.)

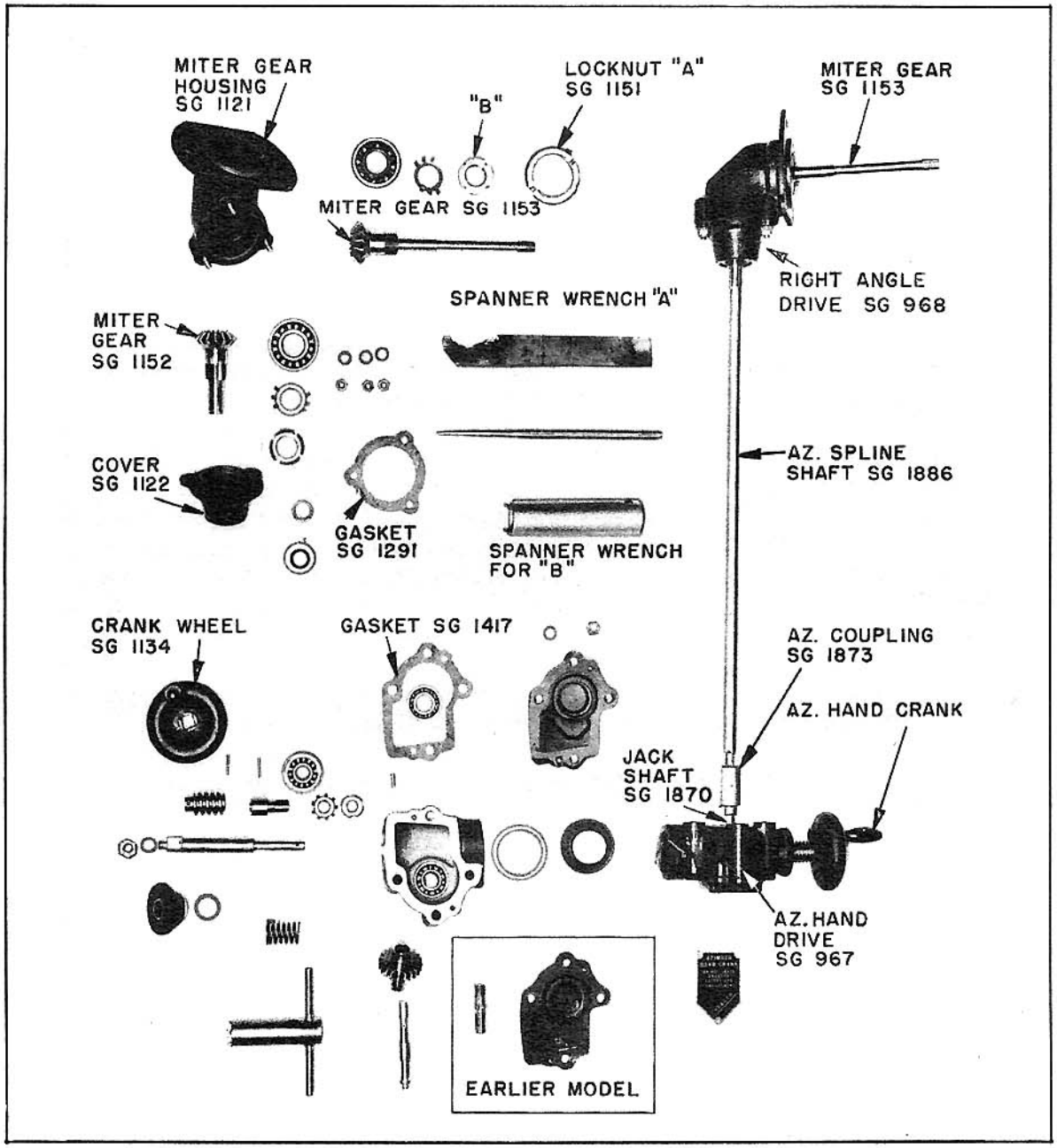


FIGURE 14
AZIMUTH HAND DRIVE AND RIGHT ANGLE DRIVE ASSEMBLY

3. Disassembly and Reassembly of Individual Units (Cont'd.)

damaged. Note that the 8 bolts are of varying lengths, as shown in Figure 15.

(3) Inspect oil seals, needle bearings and gears, replacing where necessary.

(4) In reassembly, be sure to place the washer spacers over the gear hubs.

(5) Pack the housing with Beacon M-285 grease.

(6) Insert gasket between cover and housing and attach the cover, using 2 washers and 1 elastic stop nut for each of the 8 bolts.

(7) If the azimuth and elevation bell crank and neutralizing units (SG 995) were removed, mount them to the gear box as shown in Figures 9 and 15. Spring tension wrench T-44036 will be useful for pre-winding the springs.

h. Elevation Transmission Gear Box. - (1) (See Figure 16.) Remove the bottom cover and then the front cover.

(2) The clutch gear is the part most likely to require replacement. The method of making this replacement will be evident by referring to Figure 16.

(3) Inspect ball bearings and oil seals and replace them where necessary.

(4) In reassembling the gear box it is important that the ball bearing and spacer (SG 139) are first placed on the small gear (SG 138); then insert this assembly into the gear box housing, finally putting in the lockwasher and locknut. Use spanner wrench "B", Figure 6, for locknut.

(5) Pack case with Beacon M-285 grease and put on the proper gaskets before attaching screws.

i. Azimuth Gear Box. - (1) (See Figure 17.) The lower cover plate can be removed by taking the 10 elastic stop nuts off the studs. Then remove the upper cover plate

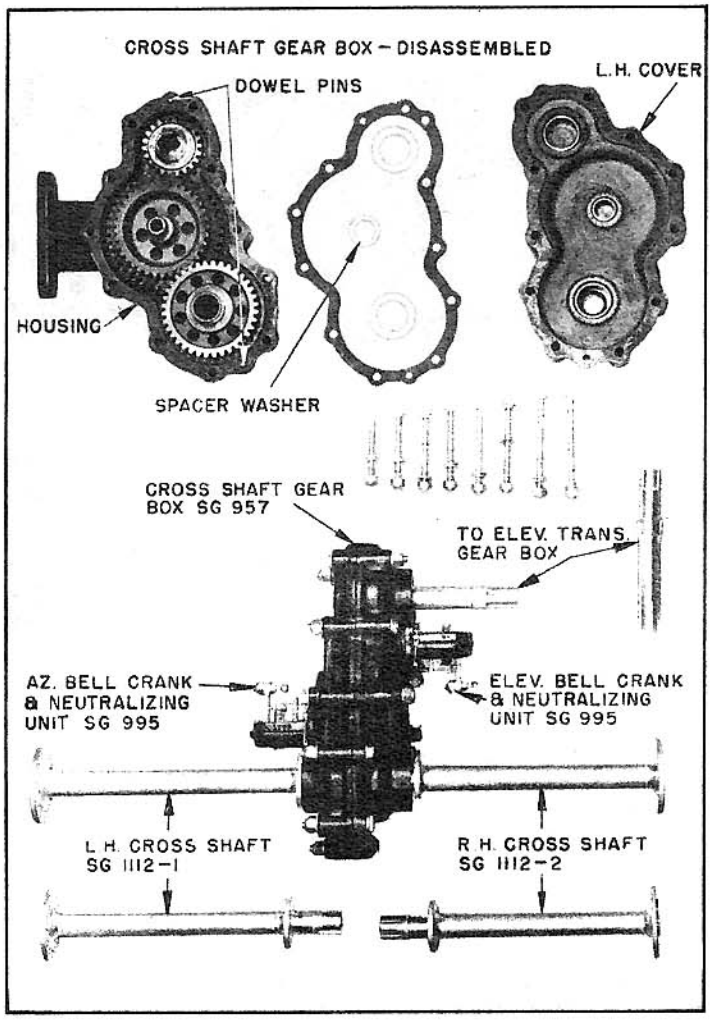


FIGURE 15
CROSS SHAFT GEAR BOX ASSEMBLED AND DISASSEMBLED

3. Disassembly and Reassembly of Individual Units (Cont'd.)

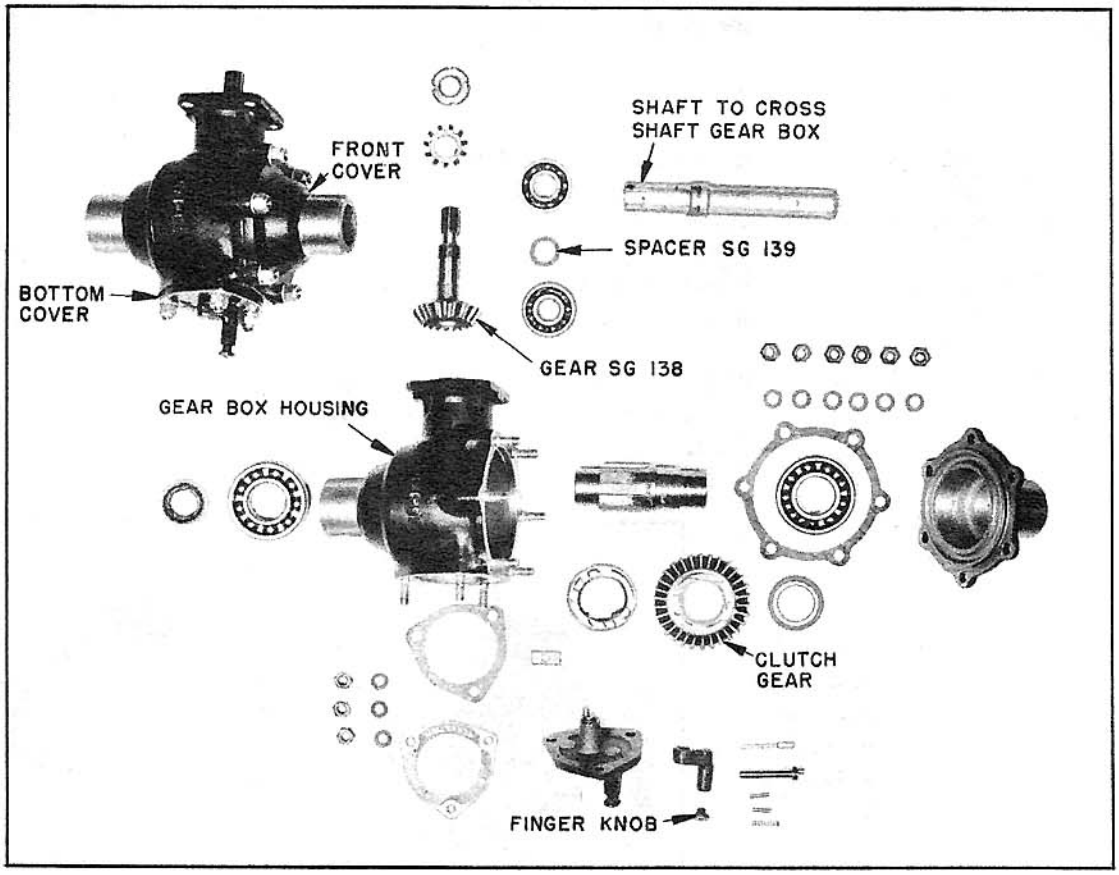


FIGURE 16
ELEVATION TRANSMISSION GEAR BOX

by taking off the 5 elastic stop nuts and 1 Allen set screw. Practically all parts will then be accessible and the replacement procedure for defective parts will be seen readily by referring to Figure 17.

(2) Inspect the ball bearings, needle bearings and oil seal for good condition and replace where necessary. Use the correct "bullet" for the oil seals and the proper needle bearing inserting tool. (See Figure 6.)

(3) Refer to Figure 16 for additional details on the clutch throw mechanism. The finger knob of the clutch is held to shaft by a 0.042" x 1/4" drill rod. Care should be taken to insert shoe at end of clutch throw.

(4) Be sure that the 6 spacer washers are in place on the gear hubs. Pack the lower part of the housing with Beacon M-285 grease. No grease is required in the upper portion.

(5) Place the gasket between the lower cover plate and the housing. Set the cover in place on the studs and place the azimuth gear guard over two of the studs as shown in Figure 17. Tighten down both cover plates with washers and elastic stop nuts.

(6) After the reassembly has been completed, mount adapter gear box (SG 958) to the unit, carefully meshing the gears.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

j. Elevation Gear Boxes. - (1) (See Figures 18 and 19.) The moving parts of the gear box will be accessible when the cover is removed. When lifting off the cover, take particular care not to injure the dowel pins. If the dowel pins are moved out of alignment, ream the holes and insert the next larger size dowel pins.

(2) Inspect the needle bearings and oil seals and replace where necessary.

(3) If the pinion drive gear is damaged, use a 1/4" rod through the hole in the gear shaft and push out needle bearing to expose the end of shaft. Press large gear from pinion. This gear is held to shaft by spline only. When reassembling, put 2 washers on either side of pinion gear to prevent injury in replacing.

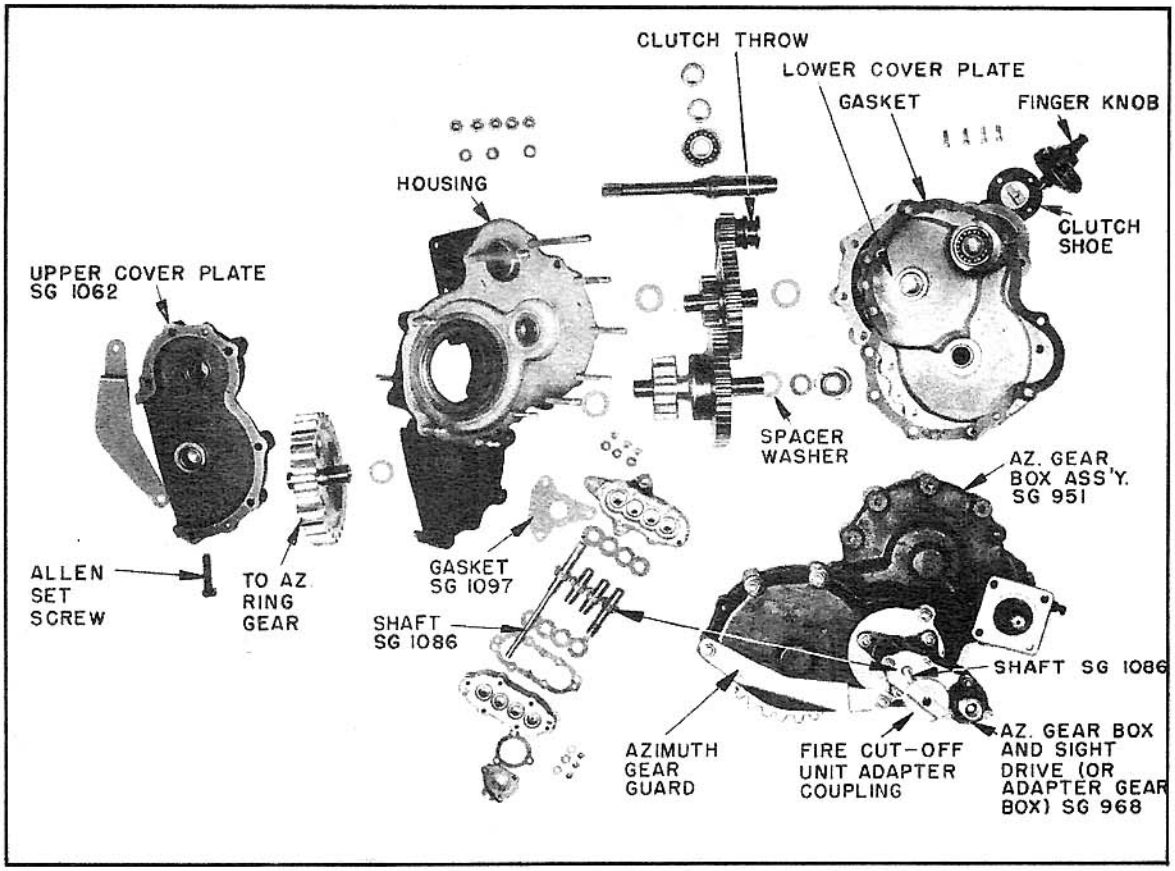


FIGURE 17
AZIMUTH GEAR BOX ASSEMBLIES

(4) Be sure that the 7 spacer washers are in place on the gear hubs.

(5) Pack the case with Beacon M-285 grease. Place a new gasket between case and cover and attach cover to case with 15 bolts, washers and elastic stop nuts.

(6) At this point, mount the additional assemblies which must be on the elevation gear boxes before they are installed in the turret.

(a) Mount the elevation hand drive assembly (Figure 19) on the 3 studs of the

3. Disassembly and Reassembly of Individual Units (Cont'd.)

right hand elevation gear box, carefully meshing the gears. Then fasten with 3 elastic stop nuts and washers.

(b) Mount the elevation to fire cut-off and limit stop unit gear box on the 3 studs of the left hand elevation box, again being careful in meshing the gears. Test for excess backlash. Fasten unit down as described in paragraph 3.k.

NOTE: For complete details on this unit, refer to paragraph 3.k.

k. Elevation to Fire Cut-Off Flexible Drive. - (1) (See Figure 19.) Remove adapter plate (SG 327) and then remove spline gear assembly (SG 1904). If it is necessary to take off the gear, remove ball bearing and pin.

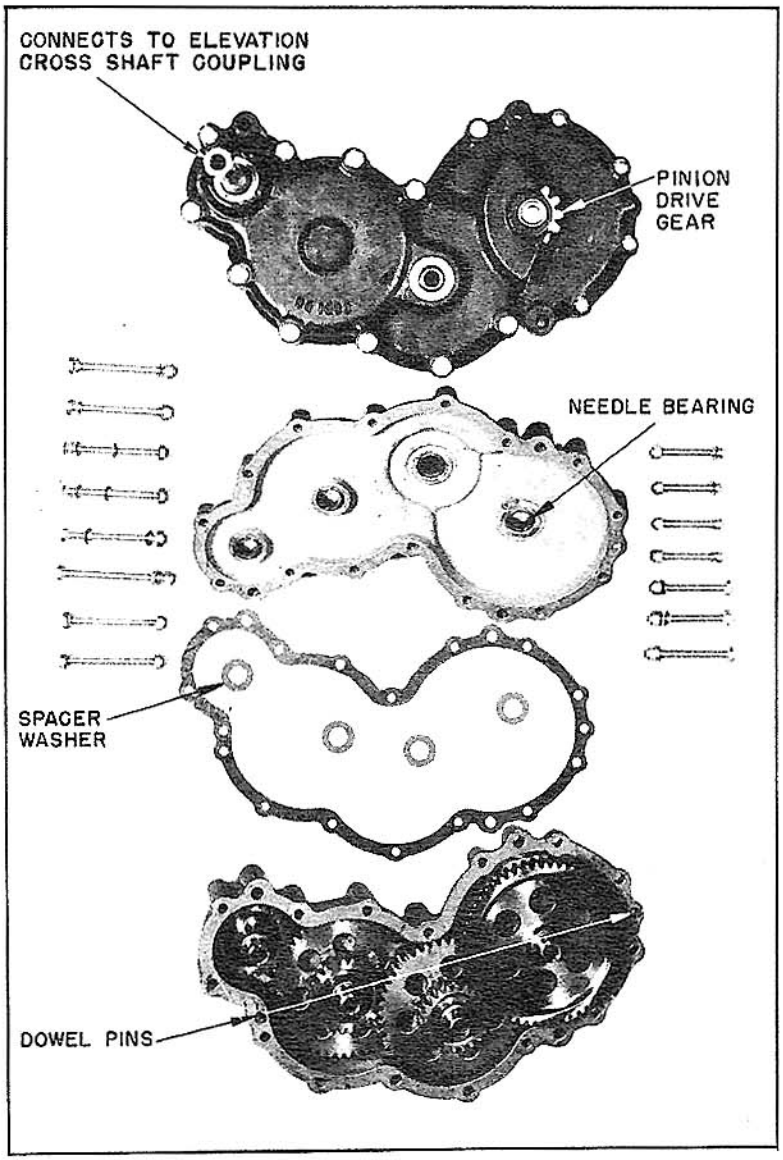


FIGURE 18
ELEVATION GEAR BOX
RIGHT HAND OR LEFT HAND

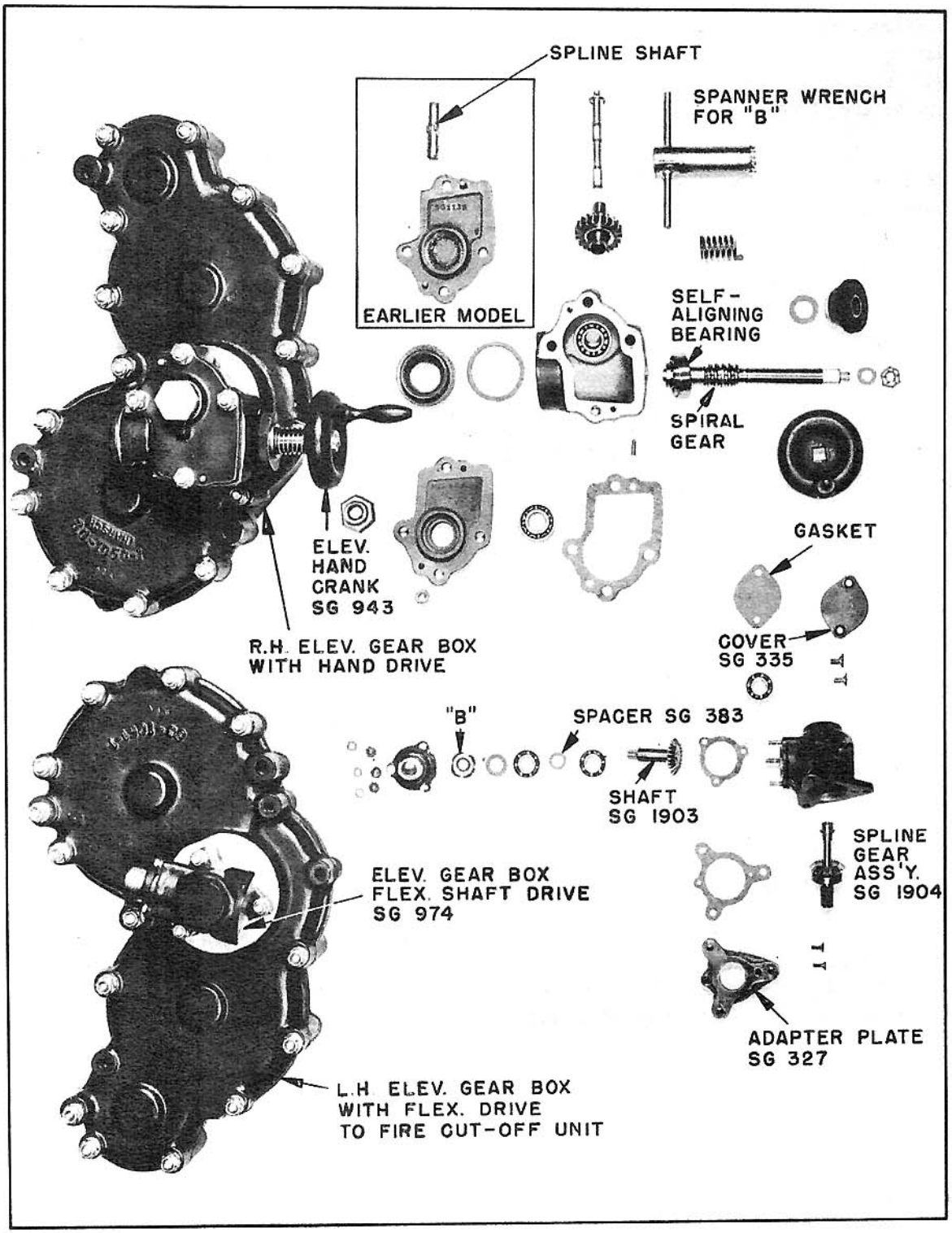


FIGURE 19
ELEVATION GEAR BOX ASSEMBLIES

3. Disassembly and Reassembly of Individual Units (Cont'd.)

(2) Remove cover plate (SG 335).

(3) To remove shaft assembly (SG 1903) which has the male spline for flexible shaft coupling, hold gear with a smooth flat tool and bend back lug of the Fafnir lockwasher. Remove the Fafnir locknut by using spanner wrench similar to that shown in Figure 6. Remove ball bearing and spacer and then take shaft out through other end of housing. Gear and male spline are pinned to shaft with 6-0 taper pins 3/8" long.

(4) When the unit is reassembled, it is very important that there is no backlash. If necessary, spacer (SG 383) can be modified, or a shim put in, so that backlash will be completely eliminated.

(5) The unit must be assembled completely with the Fafnir lockwasher and locknut.

(a) Select a lockwasher lug which is nearest to slot in locknut.

(b) Tighten locknut so that lug can enter slot.

(c) Mark the lug and then take off locknut and lockwasher.

(d) Carefully file off all other lugs on the lockwasher except the one which was marked. This is necessary because the flexible shaft coupling housing does not have sufficient space to clear the extra lugs on the locknut.

(6) Proceed with reassembly in the reverse order to that given for disassembly.

(7) Pack Beacon M-285 grease in this housing; and before attaching the covers, put on the gaskets.

1. Double Power Unit.

(1) General. - (a) The Double Power Unit consists of two variable speed transmissions and one electric motor. The two variable speed transmissions are identical and the same instructions apply to both. All numbered referenced refer to the figures which are specifically related to the particular descriptions. The illustrated parts list in Section IV should be used to determine the Manufacturer's Code number of the parts referred to.

(2) Disassembly

(a) Main Components (See Figure 20.) - 1. Remove the 4 nuts (1) which attach each variable speed transmission to the electric motor. The Double Power Unit can then be separated into its main sub-assemblies. Detailed disassembly instructions for the variable speed transmissions are given in the following paragraphs. No further disassembly of the electric motor is covered herein, since this unit is a common type of direct current, shunt wound motor and should be handled in accordance with the accepted practices for this type of electrical equipment.

(b) Variable Speed Transmission

1. General. - a. The following instructions and order of disassembly apply to either of the two identical variable speed transmissions used with the Double Power Unit. In disassembling, the parts for each transmission should be kept separately so that they do not become mixed since certain parts and assemblies, as described in paragraphs (3)(a)1.b.-(3)(a)1.e., are not interchangeable. "A" end refers to hydraulic pump end which is driven by electric motor; "B" end refers to hydraulic motor end which is used to drive turret.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

b. The following is the order of disassembly for either of the variable speed transmissions.

1. Rear Cover (Fig. 21)
2. Upper and Lower Pressure Line (Fig. 22)
3. Yoke Control Arm (Fig. 23)
4. Control Cylinder (Fig. 24)
5. Control Pump (Fig. 25)
6. "A" End Valve Plate (Fig. 26)
7. Pintles and Yoke (Fig. 27)
8. "A" End Rotating Assembly (Fig. 28)
9. "B" End Valve Plate (Fig. 29)
10. Side Cover (Fig. 30)
11. "B" End Rotating Assembly (Fig. 31)
12. Bearings and Retainer (Fig. 32 and 33)

2. Rear Cover (See Figure 21.) - a. Remove the safety wiring and 12 nuts (1) which hold the rear cover (2) to the main housing (3) and then lift the cover off.

3. Upper and Lower Pressure Lines (See Figure 22.) - a. Remove the 4 nuts (1) which hold the flange of the upper line (2) to the housing (3) . Remove the 4 nuts (1) which hold the flange of the lower line (4) to the housing. Loosen the swivel bolts (5) at the ends of the lines where they connect into the "B" end valve plate.

4. Yoke Control Arm (See Figure 23.) - a. Remove the yoke attaching screws (1) and loosen the other two set screws (2) (in the same holes) sufficiently for the yoke control arm (3) to be released from the yoke (6) . Pull out the pin (4) on the lower end of the yoke and lift the arm out of the housing.

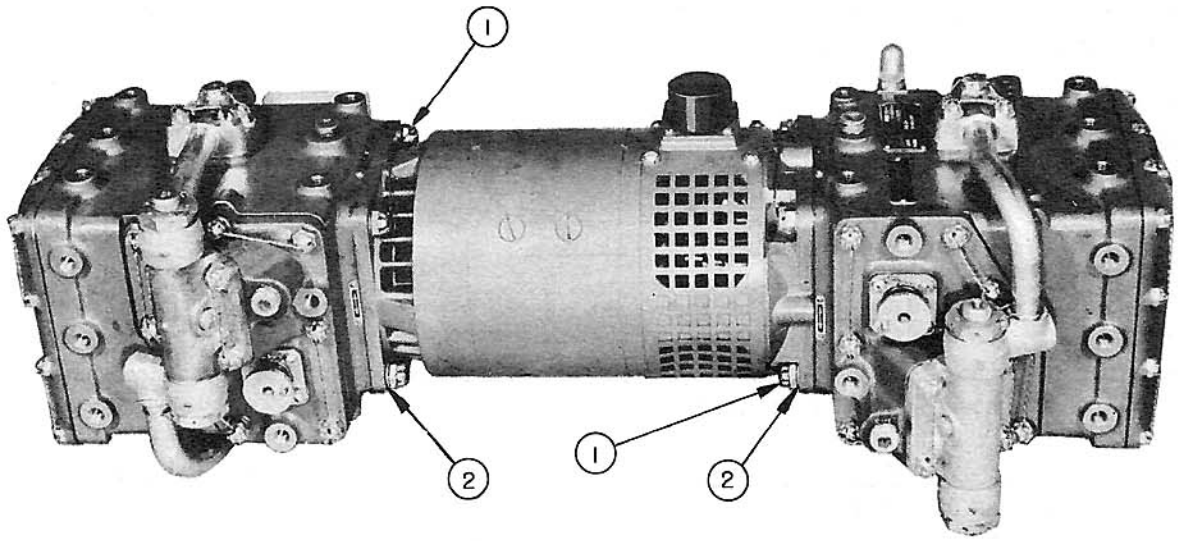


FIGURE 20
DOUBLE POWER UNIT

3. Disassembly and Reassembly of Individual Units (Cont'd.)

5. Control Cylinder (See Figure 24.) - a. Remove the two screws (1) which hold the Control Cylinder (2) to the housing. (There are 4 screws in the cover, but the other two screws (3) serve only to fasten the cover to the Control Cylinder). The Control Cylinder may now be lifted from the housing.

6. Control Pump (See Figure 25.) - a. Remove the two screws (1) which pass through the pump cover (2) into the pump body (3) . Remove the 4 nuts (4) which hold the pump cover (2) to the housing (5) . Lift off the cover, then replace the two screws (1) in the pump body so that they can serve to pull it evenly from the main housing.

7. "A" End Valve Plate (See Figure 26.) - a. Take out the two screws (1) the four screws (2) , and the one screw (3) which attach the valve plate (4) to the yoke, being careful to hold the valve plate down as the screws are removed. Place one of the screws (1) in the middle hole where screw (3) was removed and use this to press down on the "A" end rotating assembly as the valve plate is lifted off. Finally, remove the screws (1) and the valve plate can be lifted off, leaving the "A" end rotating assembly intact.

8. Pintles and Yoke (See Figure 27.) - a. Use a 3/8"-16 thread bolt to screw partially into each pintle (1) and then pull the pintle and bolt out. When both pintles are removed, the yoke (2) can be lifted from the housing. Be sure to remove the gaskets between the pintles and the housing.

9. "A" End Rotating Assembly (See Figure 28.) - a. Remove the screw (1) and retaining washer (2) which hold the "A" end rotating assembly (4) to the housing. The bearing and rotating assembly can now be pressed into the main housing by driving the "A" end shaft inward. Use a light hammer and a smooth metal rod, preferably one that has a male spline, for fitting into the "A" end shaft. DO NOT drive against the expansion plug.

10. "B" End Valve Plate (See Figure 29.) - a. Remove plug (1) in the "B" end valve plate (2) ; insert small pointed tool in hole in top of valve plate and press shaft down while removing pin, using long nose pliers. Remove the 4 nuts (4) which hold valve plate to main housing. Carefully lift the valve plate off, again using the small pointed tool inserted under the valve plate to hold the "B" end rotating assembly down as valve plate comes off.

CAUTION: BE CAREFUL AND DO NOT SCRATCH VALVING SURFACE OF THE CYLINDER BLOCK (5) WITH TOOL.

11. Side Cover (See Figure 30.) - a. Remove 7 nuts (1) and one nut (2) which hold the side cover (3) to the housing. Lift the cover up slowly, tapping it lightly on all four sides so that the side cover and control shaft sub-assembly (4) will come away from the main housing without distortion.

12. "B" End Rotating Assemby (See Figure 31.) - a. Remove screw (1) and retaining washer (2) which hold the "B" end assembly (3) in the housing. Drive the assembly out carefully using the same tools and methods described for the "A" end.

13. Bearings and Retainers (See Figure 32.) - a. Remove the "A" end bearing (1) and retainer (2) by removing the nuts (3) ; then screw in on opposite sides of the

3. Disassembly and Reassembly of Individual Units (Cont'd.)

bearing retainer, the two screws which are used to fasten the pump cover to its body. Turn one screw a small amount, then turn the other screw a like amount so that the bearing and retainer will be gradually and evenly forced out of the housing.

b. (See Figure 33.) In order to remove the "B" end bearing (1) and retainer (2) it is necessary to remove the 4 studs (3) . Then insert a screw driver alternately in the two slots provided on the retainer, and gradually pry the retainer out. On some of the first units the slots were not provided, and on these units it will be necessary to drive the retainer around so that one edge projects beyond the housing; it can then be driven out with a small hammer, using light blows to avoid injury to the part. The variable speed transmission unit is now completely disassembled into its sub-assemblies and parts. It is strongly recommended that no further disassembly be made.

(3) Reassembly of Double Power Unit

(a) Variable Speed Transmission

1. General. - a. No specific instructions are given herein for detail repairs since it is assumed that skilled personnel will ascertain and make only the repairs which are indicated as being necessary for the particular unit undergoing overhaul. In many cases, it may only be necessary to disassemble and thoroughly clean the unit before proceeding with reassembly. The figures which were used for the disassembly procedure will prove equally useful in carrying out the reassembly routine.

b. The "A" end and "B" end rotating assemblies are made of parts which have been individually fitted and worked in at the factory. It is recommended that when these assemblies are found defective, they be returned to the Vickers Inc. factory at Detroit, Michigan, for repair.

c. The side cover is individually fitted to its particular housing so that there will be no warping of the cover, with a resultant distortion of the "B" end valve plate and cylinder. If a new cover is used it should be "blued" and fastened on temporarily; then removed and machined or filed to fit.

d. The yoke is also individually fitted to its particular housing and pintles. If a new yoke is installed, care should be used in fitting it to the housing so that the yoke does not bind or is not excessively loose.

e. With the exception of the "Neoprene" gaskets, it is recommended that new gaskets be provided throughout when reassembling the unit. The parts list should be used in connection with the photographs for identification of the various gaskets, washers, plugs, screws, nuts, etc. which are used in reassembling.

f. Too much stress cannot be given to the importance of having each piece or assembly perfectly clean before starting reassembly. Before reassembling, wash all parts thoroughly with carbon tetrachloride (or an approved equivalent) and then blow out with dry air having a nozzle pressure of at least 50 pounds. UNIVIS #40 OIL (AIR CORPS SPECIFICATION AN-VV-O-366) IS THE ONLY OIL WHICH SHOULD BE USED.

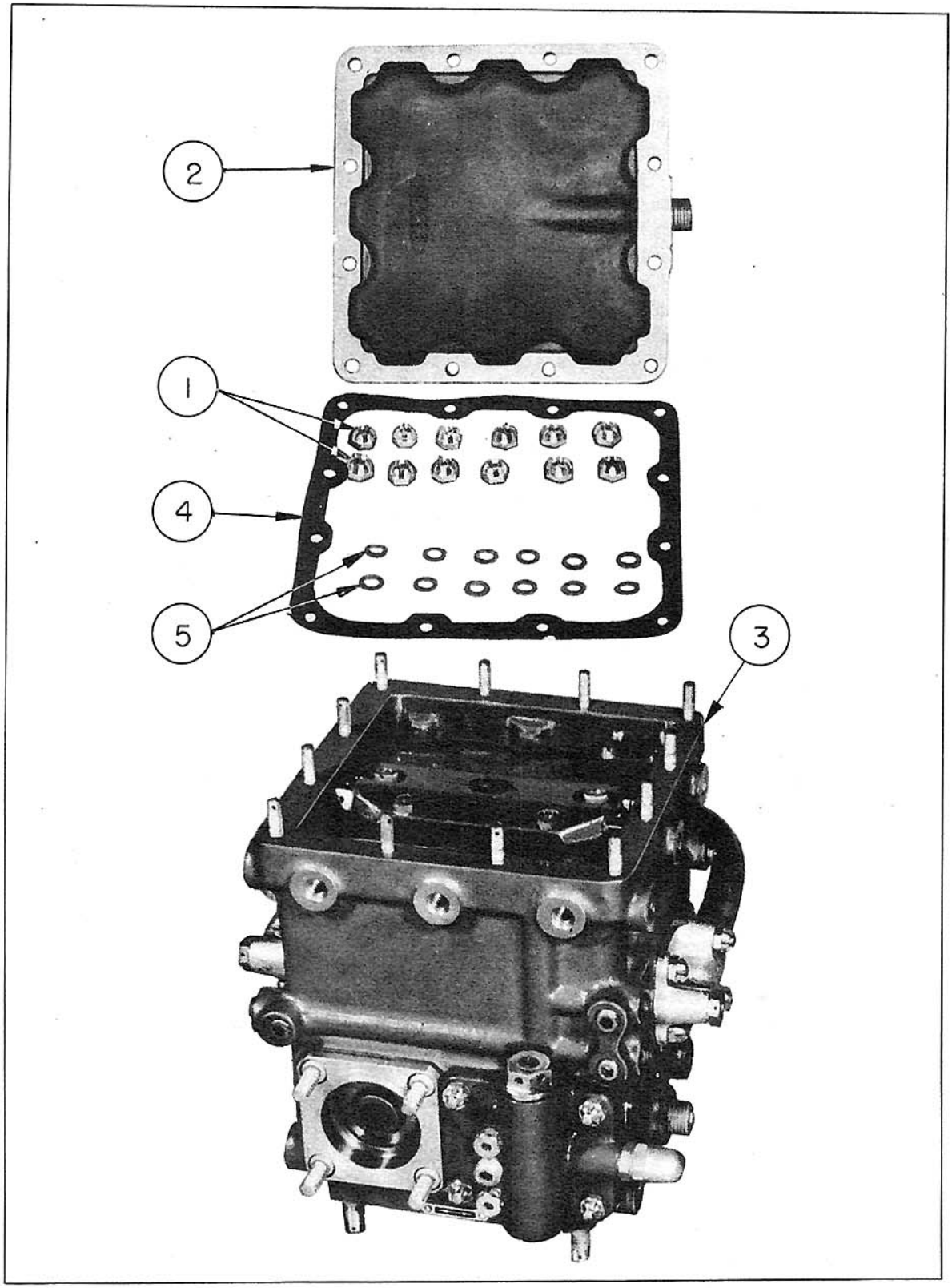


FIGURE 21
VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING REAR COVER

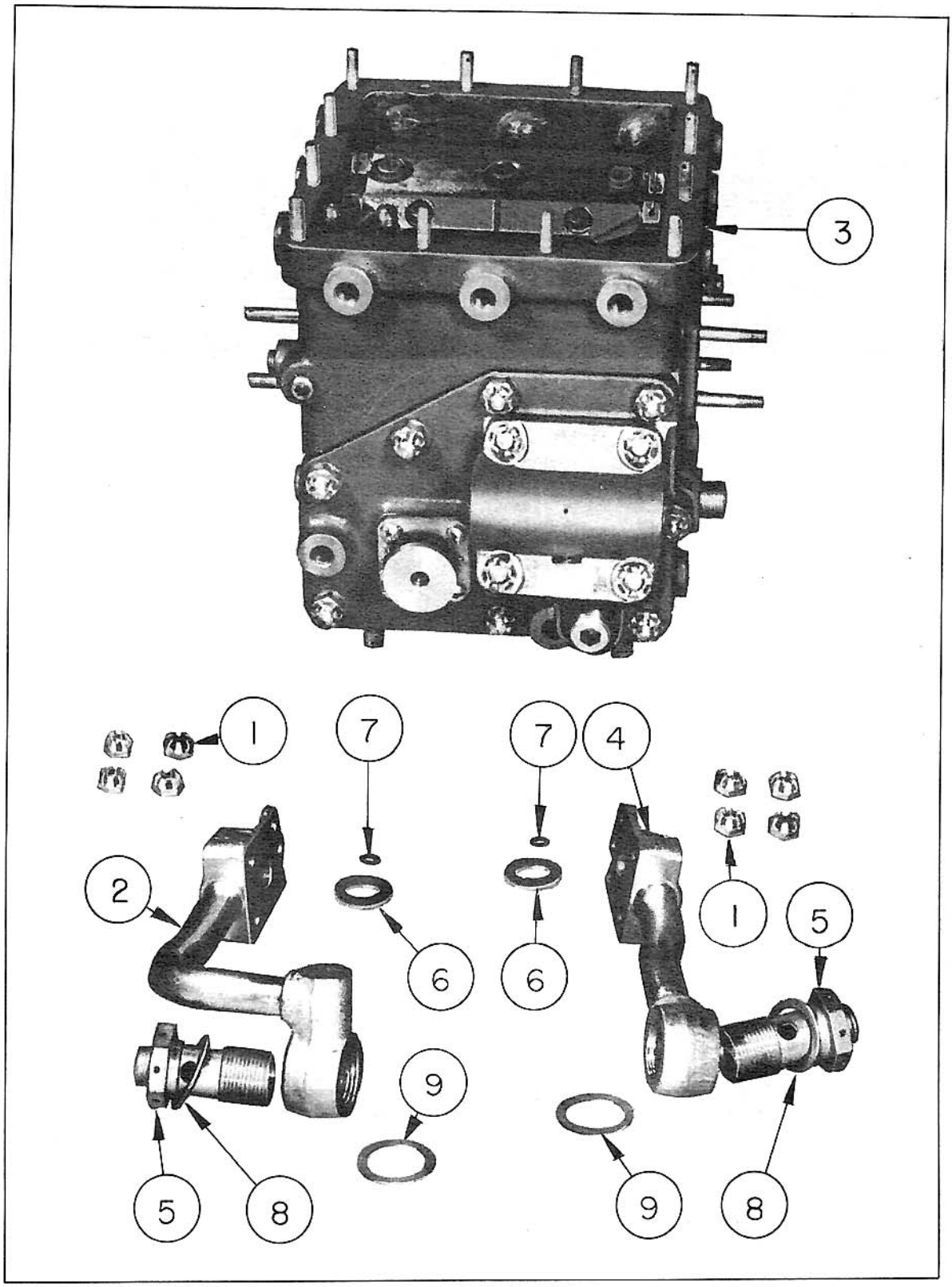


FIGURE 22

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING PRESSURE LINES

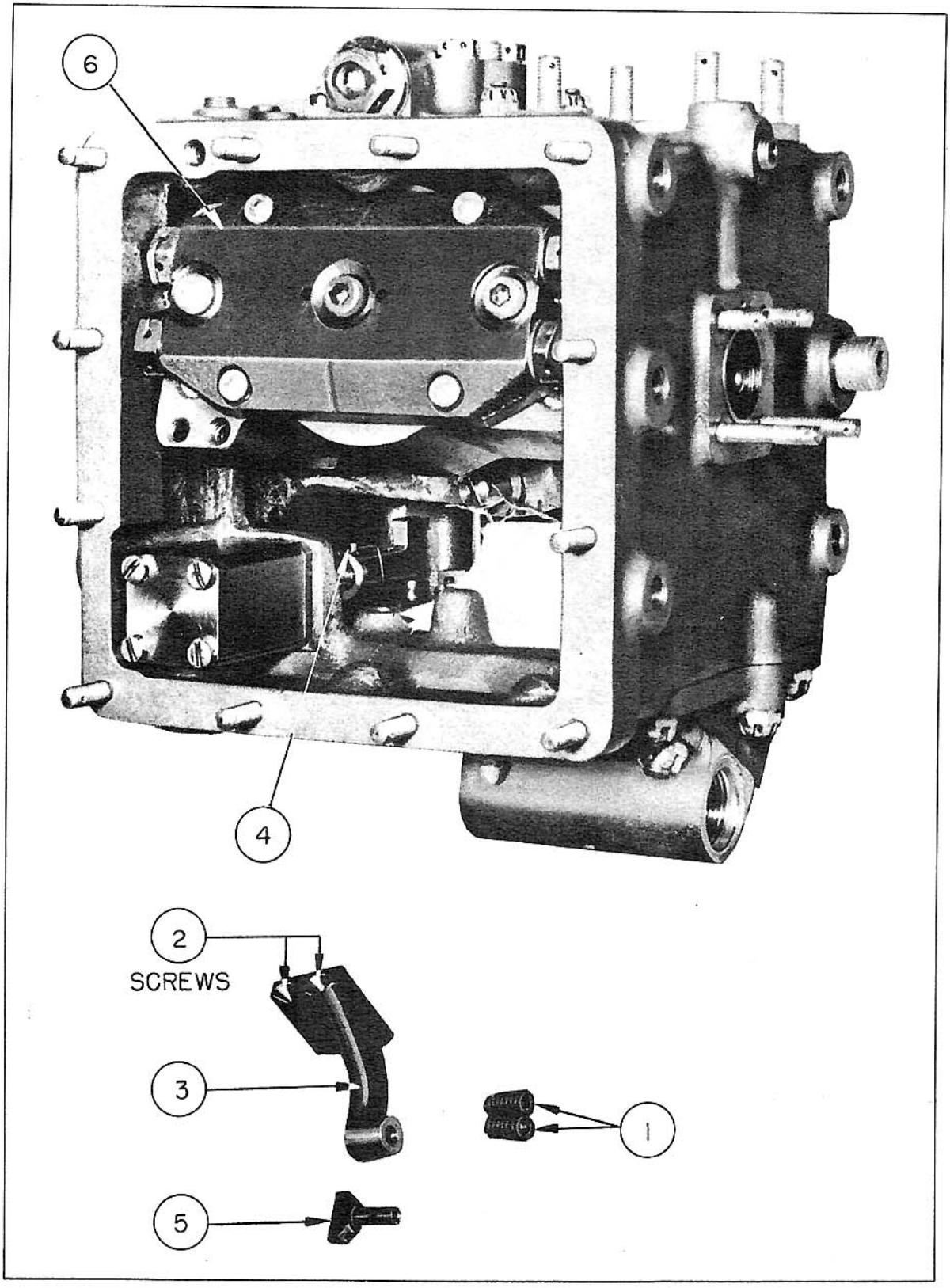


FIGURE 23

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING YOKE CONTROL ARM

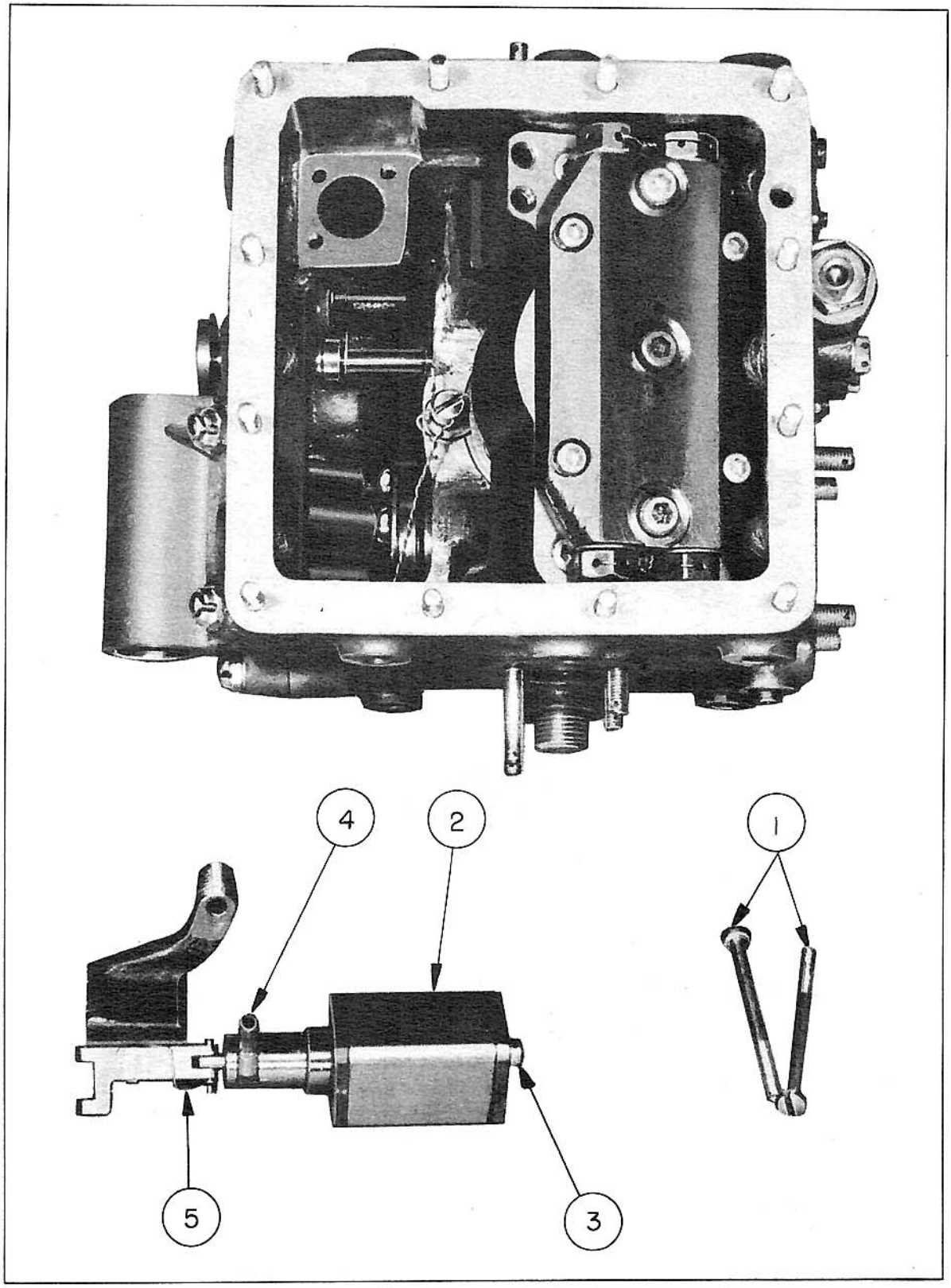


FIGURE 24

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING CONTROL CYLINDER

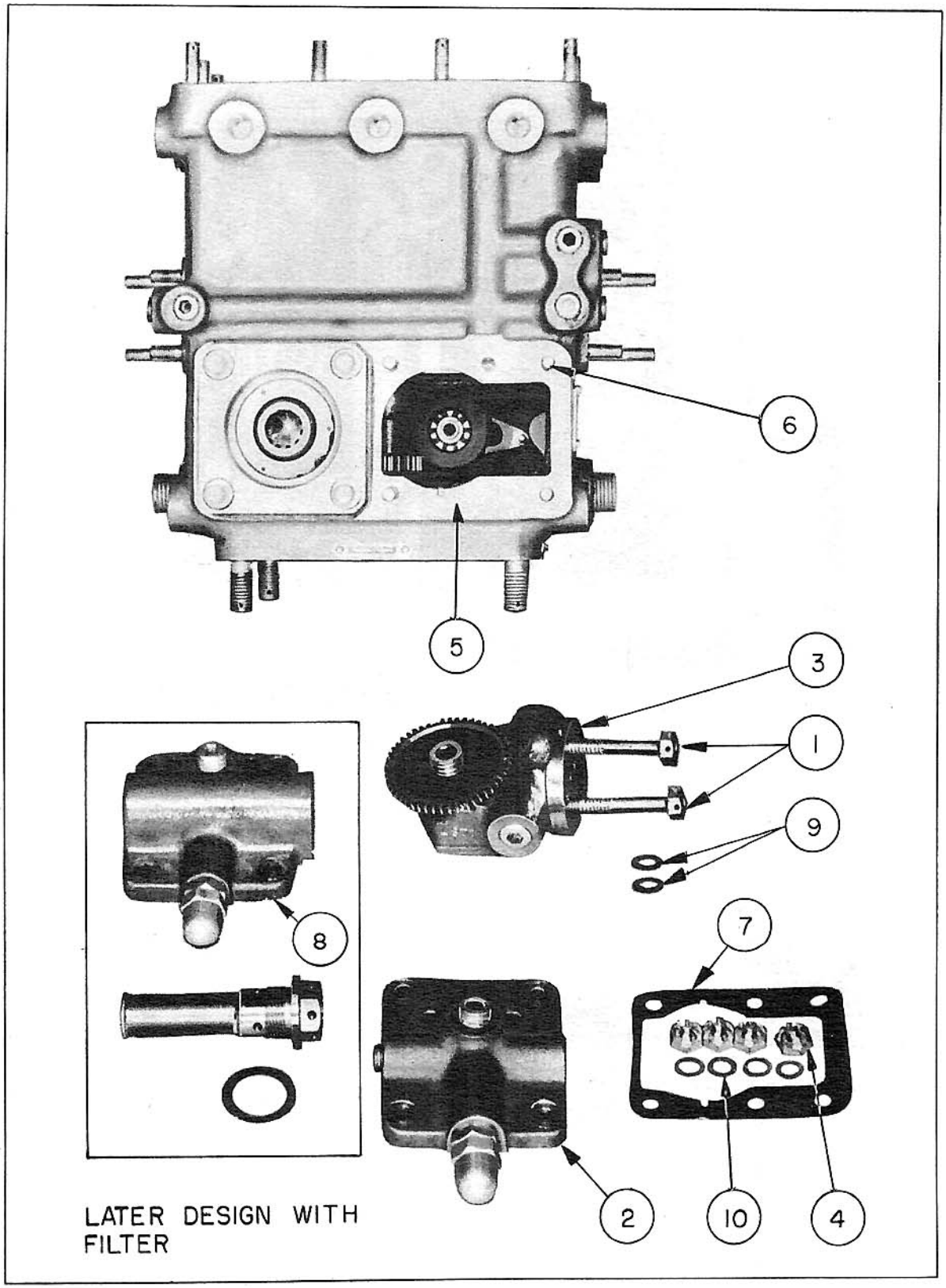


FIGURE 25
VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING CONTROL PUMP

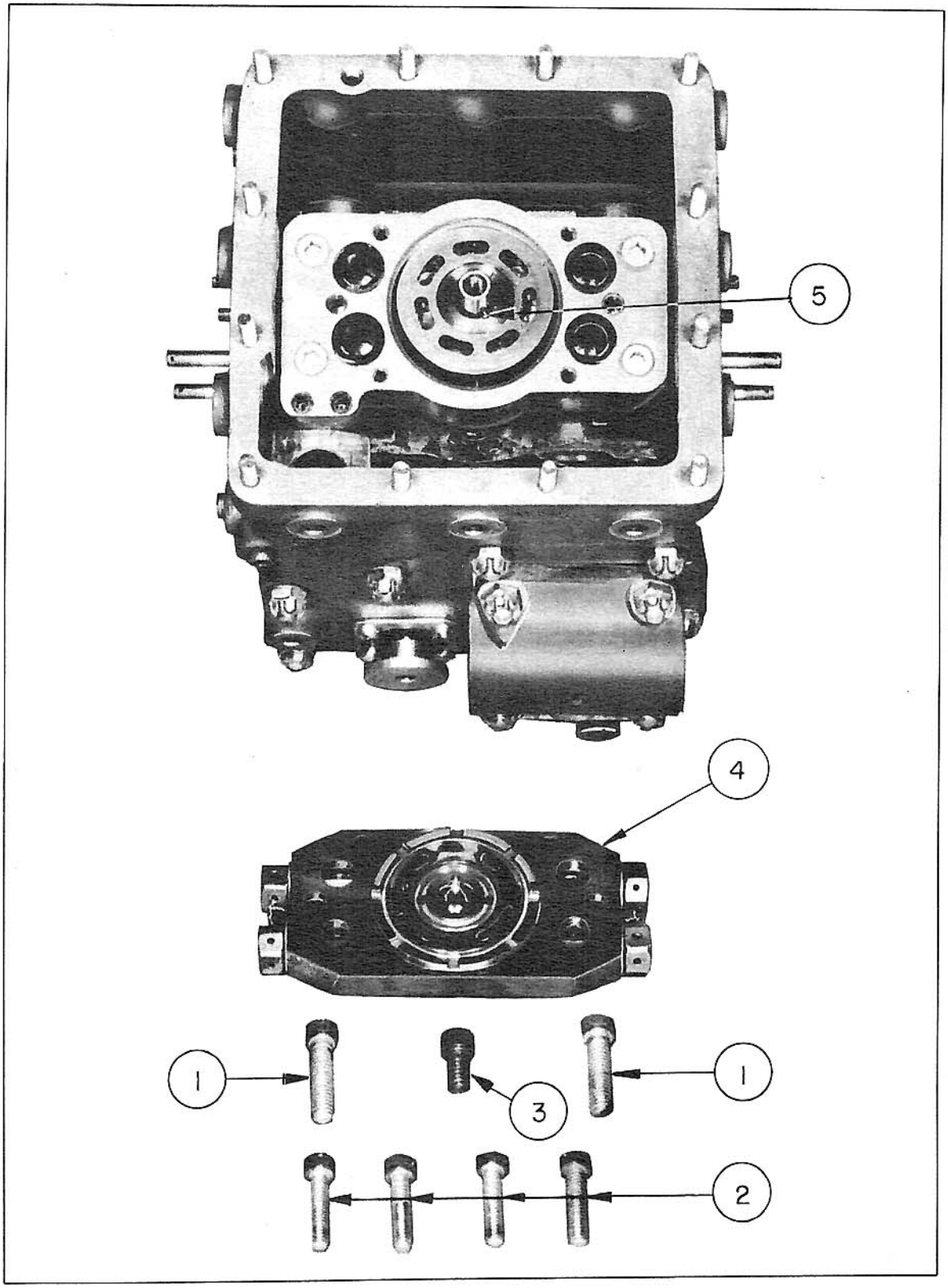


FIGURE 26
VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING "A" END VALVE PLATE

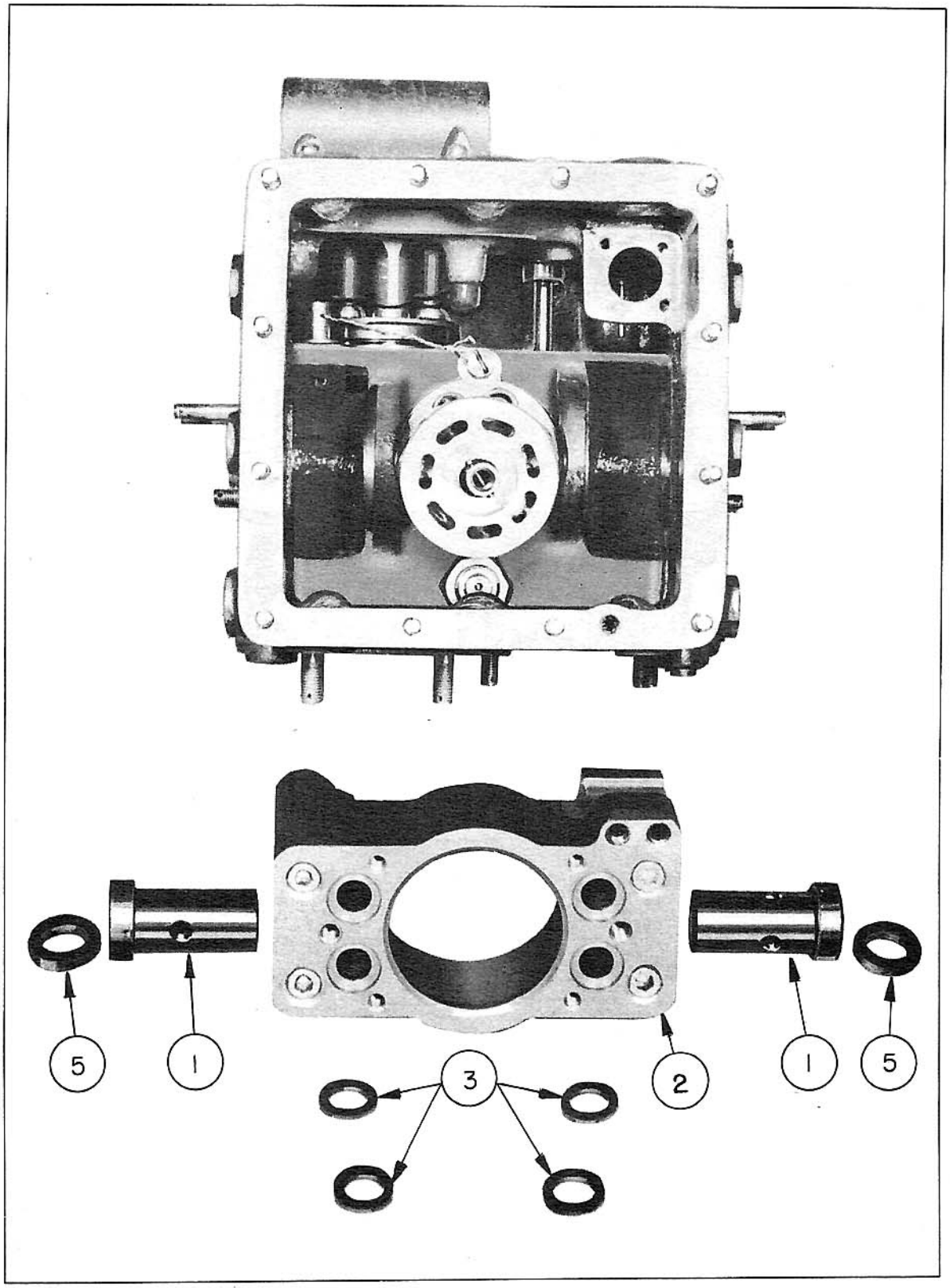


FIGURE 27

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING YOKE AND PINTLES

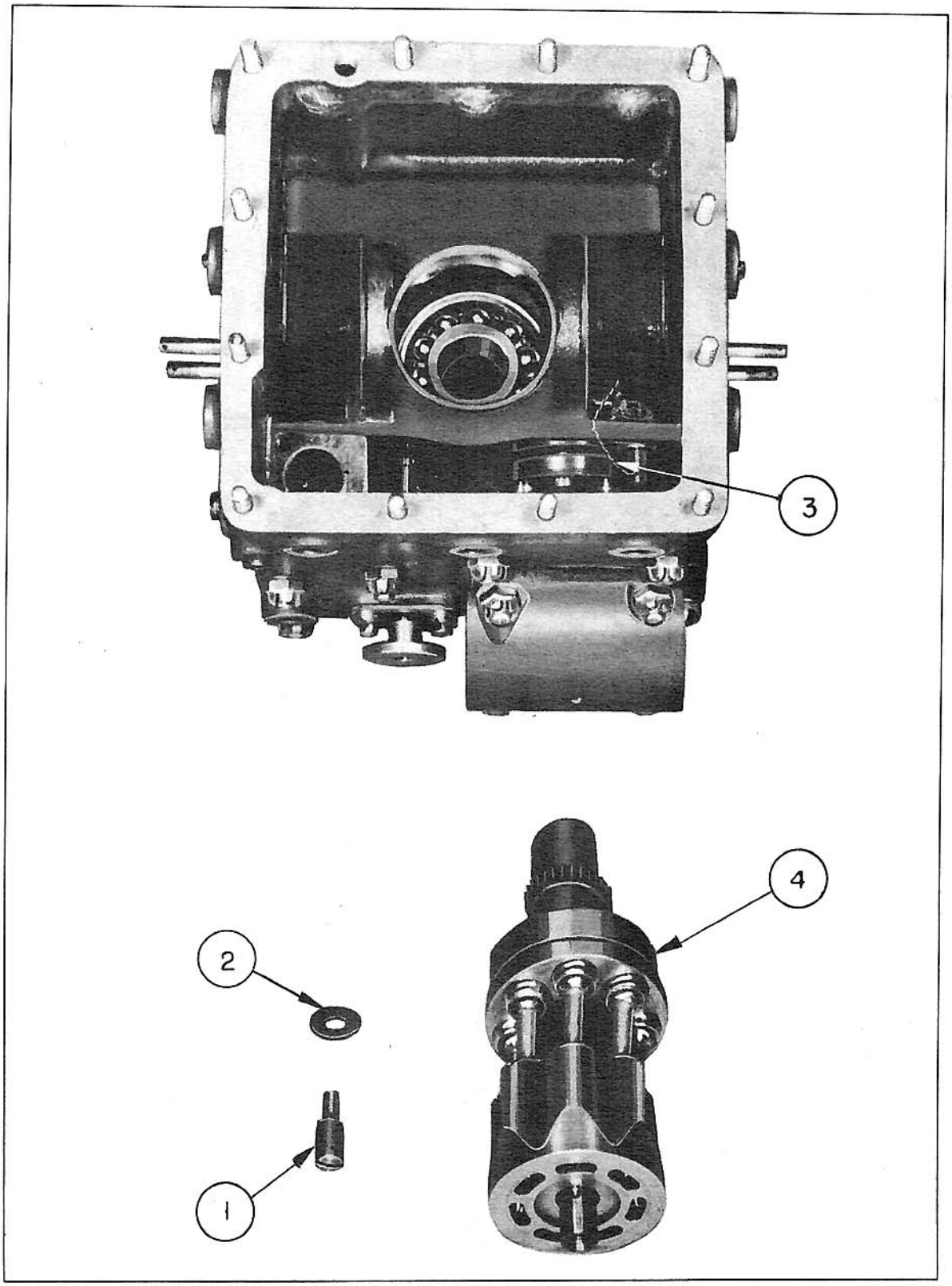


FIGURE 28

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING "A" END ROTATING ASSEMBLY

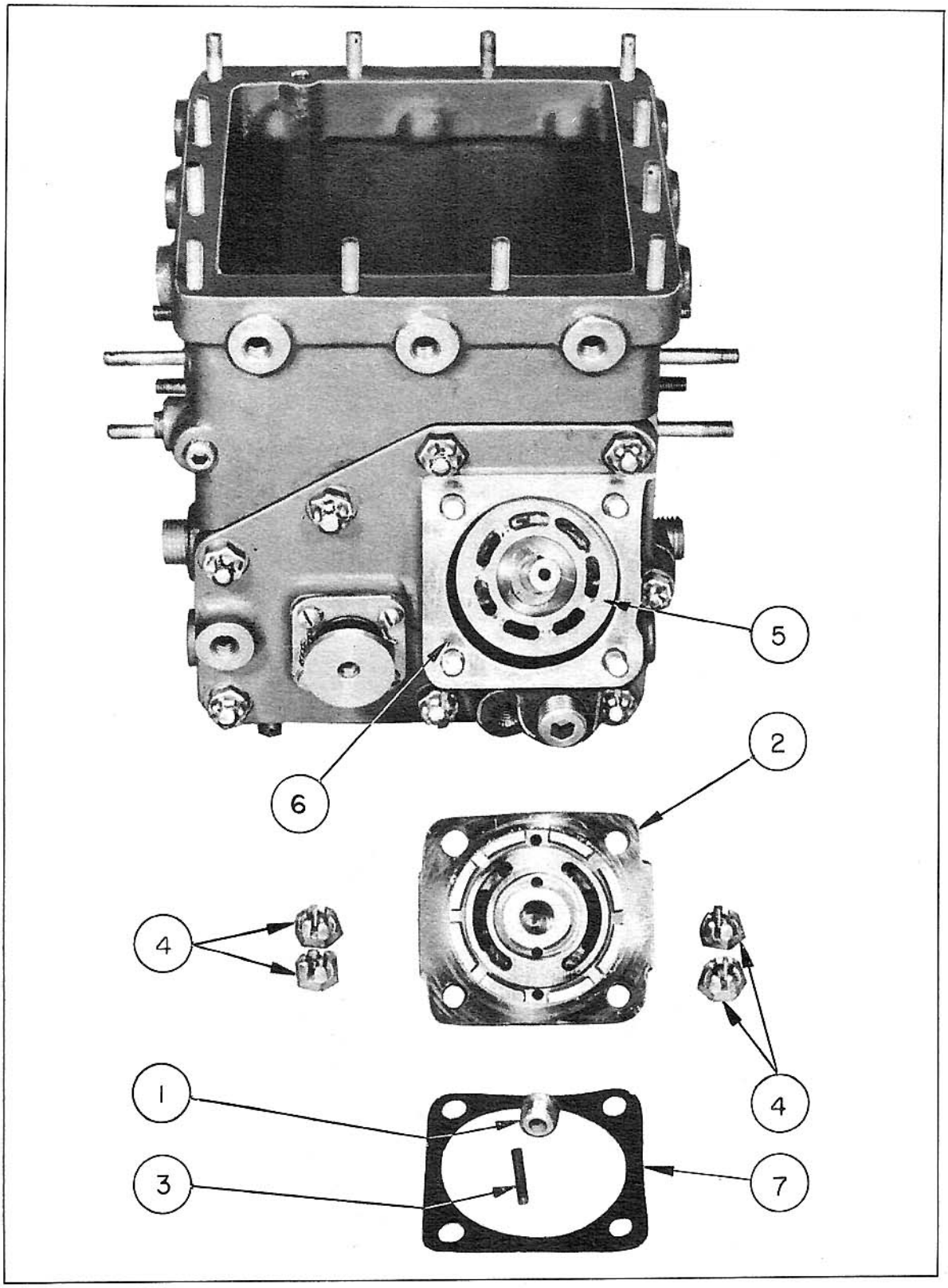


FIGURE 29
VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING "B" END VALVE PLATE

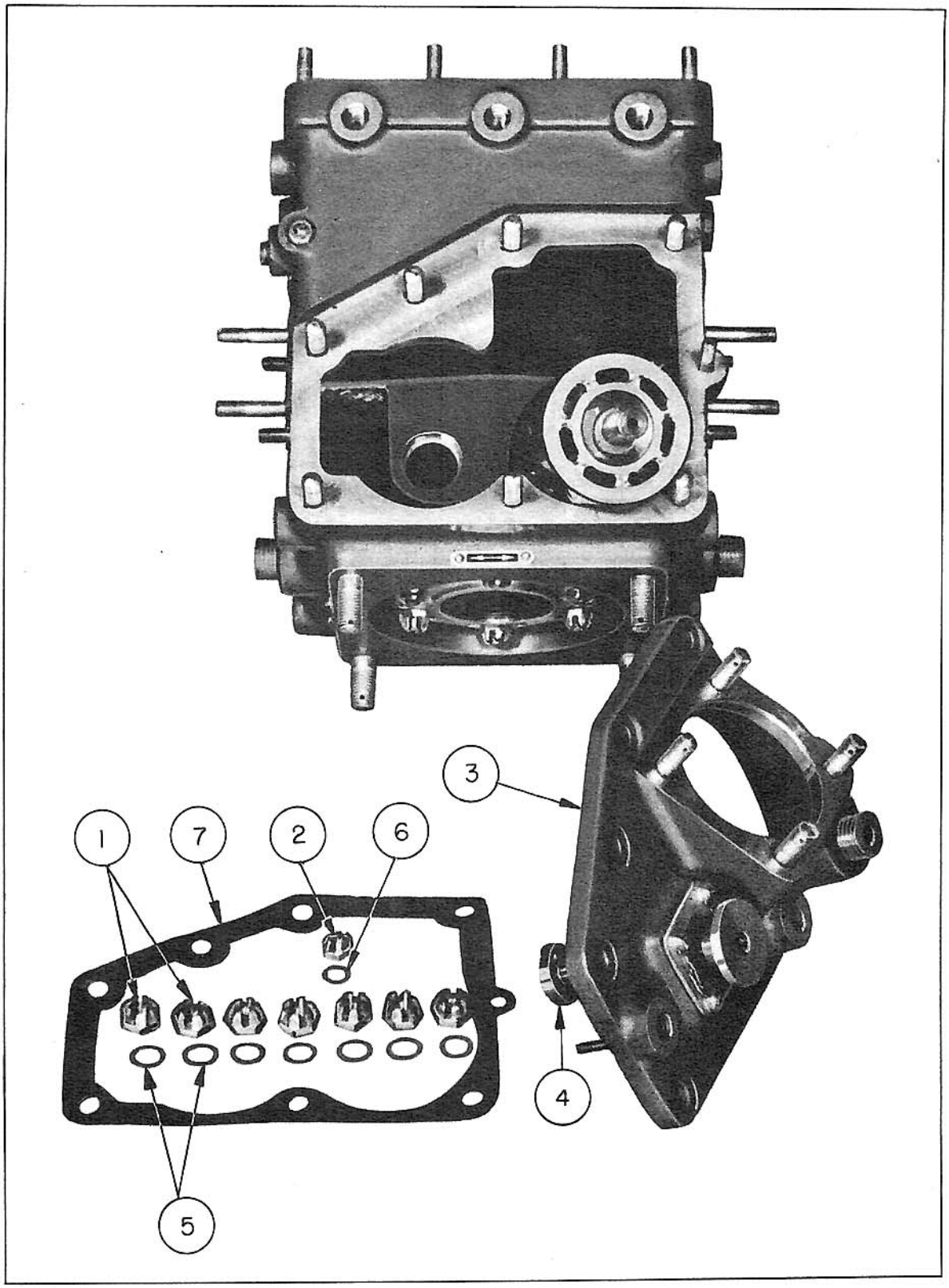


FIGURE 30
VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING SIDE COVER

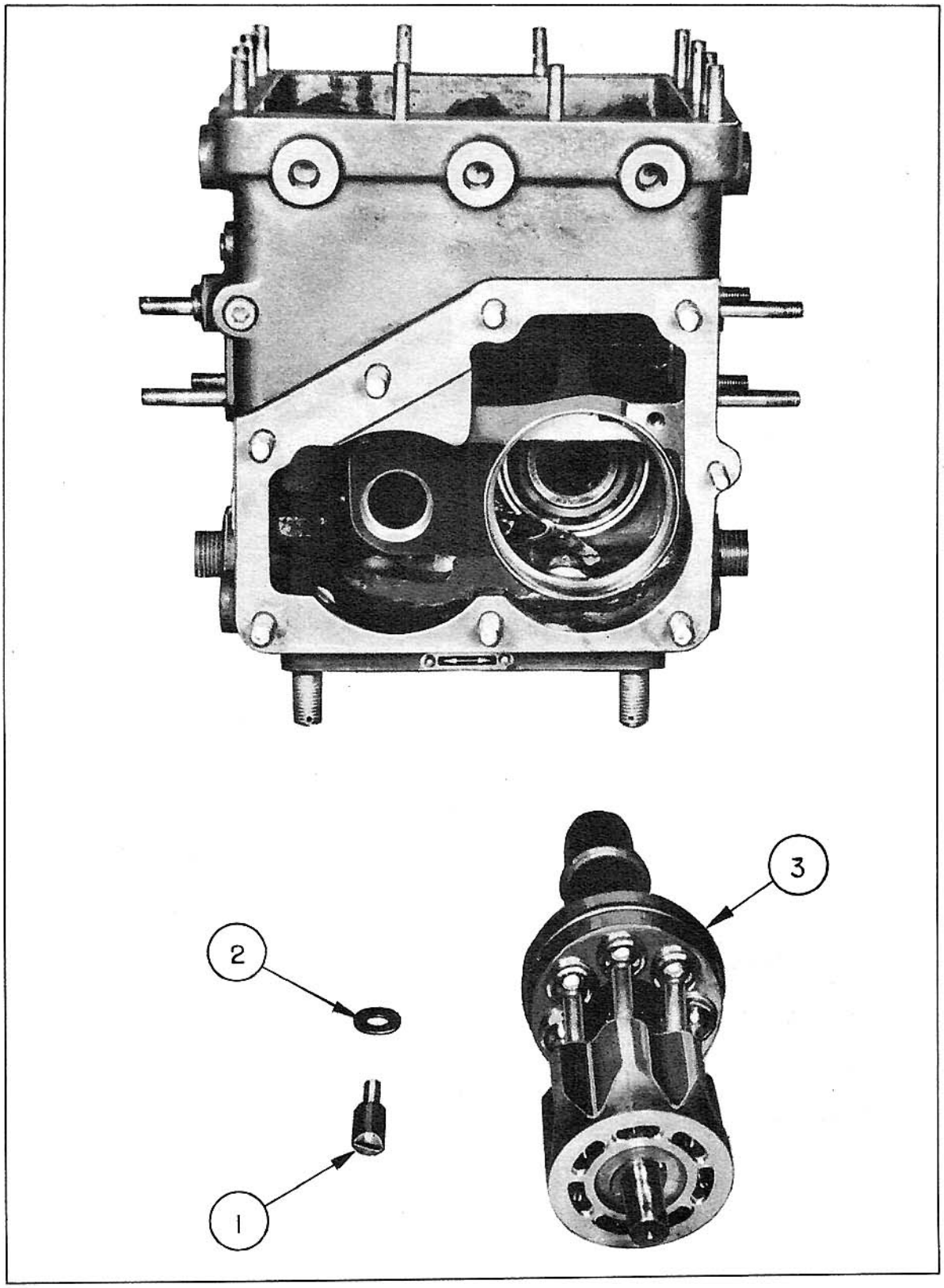


FIGURE 31

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING "B" END ROTATING ASSEMBLY

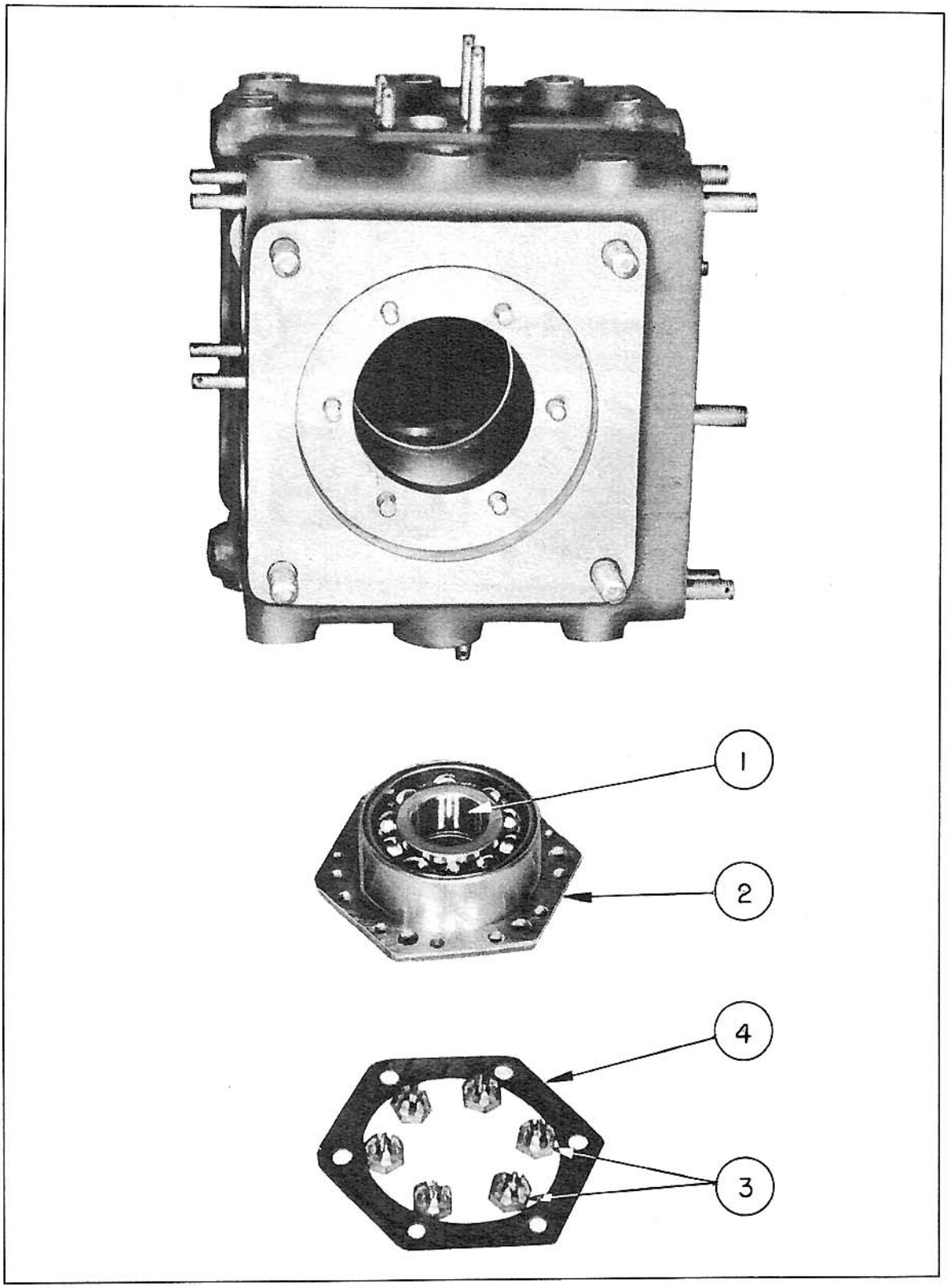


FIGURE 32

VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING "A" END BEARING

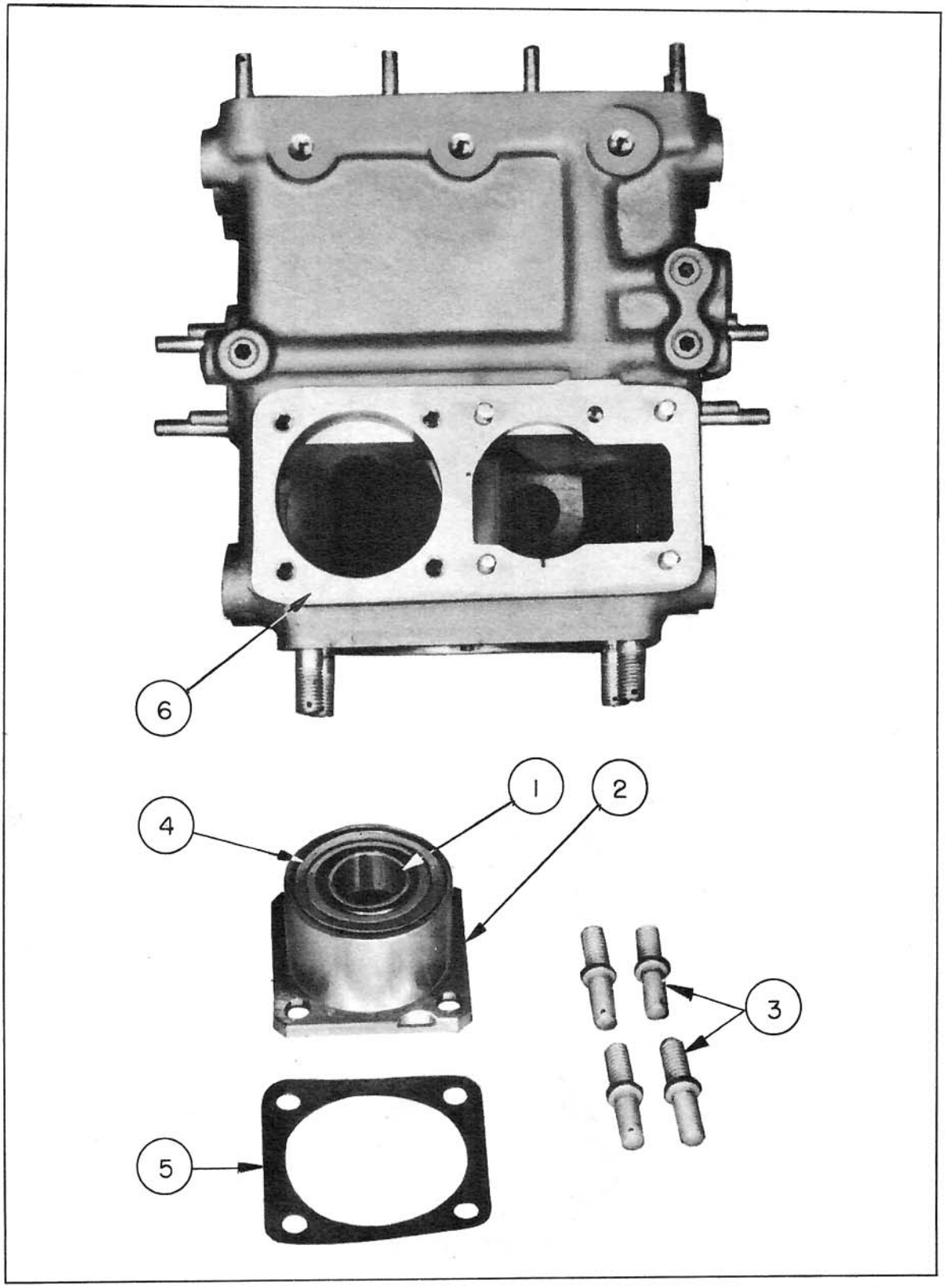


FIGURE 33
VARIABLE SPEED TRANSMISSION
PARTIAL ASSEMBLY
SHOWING "B" END BEARING

3. Disassembly and Reassembly of Individual Units (Cont'd.)

g. The order of reassembly of the unit is practically the reverse of that given for disassembly; the following order should be followed.

1. Bearings and Retainers (Fig. 32 and 33)
2. "B" End Rotating Assembly (Fig. 31)
3. Side Cover (Fig. 30)
4. "B" End Valve Plate (Fig. 29)
5. "A" End Rotating Assembly (Fig. 28)
6. Yoke and Pintles (Fig. 27)
7. "A" End Valve Plate (Fig. 26)
8. Control Pump (Fig. 25)
9. Control Cylinder (Fig. 24)
10. Yoke Control Arm (Fig. 23)
11. Upper and Lower Pressure Lines (Fig. 22)
12. Rear Cover (Fig. 21)

2. Bearings and Retainers (See Figure 33.) - a. Before placing the "B" end bearing (1) and the retainer (2) in place, be sure that the oil seal (4) is in place and in good condition. Place the gasket (5) in place between the housing (6) and the bearing retainer as it is forced into the housing. The slots in the retainer should be "up" and "down" (not facing the "control" pump opening). Replace the 4 studs (3) and screw down evenly and tightly. (See Figure 32.) The "A" end bearing (1) and retainer (2) are similarly forced into place after positioning the gasket (4) between the retainer and housing. Put on the six nuts (3) and safety wire them.

3. "B" End Rotating Assembly (See Figure 31.) - a. Slip a "bullet nose" over the end of the "B" end shaft (to prevent damage to the bearing oil seal). Place the rotating assembly (3) into position and force it into the bearing by means of special Vickers tool T-19151, driving lightly with a small hammer. Lock the "B" end in place with washer (2) and screw (1) . Start lockwire which will finally be fastened to the similar "A" end locking screw.

4. Side Cover (See Figure 30.) - a. Place the side cover gasket (7) between the side cover (3) and the housing. Put on the 7 washers (5) and 7 nuts (1) , also the washer (6) and nut (2) , screwing them down securely. (The side cover contains the control shaft sub-assembly (4) , and care should be used when placing the cover so as to fit the control shaft bearing properly in the housing.)

5. "B" End Valve Plate (See Figure 29.) - a. Place the gasket (7) between the valve plate and the housing (6) , fastening the valve plate down tightly with the 4 nuts (4) . Insert the cylinder locking pin (3) and replace the plug (1) . Safety wire the nuts.

6. "A" End Rotating Assembly (See Figure 28.) - a. Place a "bullet nose" on the "A" end shaft to prevent damage to the bearing oil seal; then force the "A" end assembly (4) into the bearing, using special Vickers tool T-19151 and a small hammer, striking light blows. Clamp the assembly down with washer (2) and screw (1) . Safety-wire with the lockwire (3) which has already been attached to the "B" end locking screw.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

7. Yoke and Pintles (See Figure 27.) - a. Set the yoke (2) into the housing (making sure that the 4 "Neoprene" gaskets (3) are in their holes in the yoke face, and that the leather gaskets are in place in the yoke bearings). Place a pintle gasket (5) on each pintle (1) and insert the pintles into the yoke sleeves. If there is more than .008" end play, insert an extra gasket on each pintle.

8. "A" End Valve Plate (See Figure 26.) - a. Turn the pin (5) in the "A" end shaft so that it runs straight across from A to B end in order that it will lay in the corresponding slot of the valve plate. Lay the valve plate in place, then rotate it while pushing down evenly and observe if the pin and shaft are rotating together. This is done to check proper positioning of the pin in the valve plate. Put in the 3 middle Allen screws first (2, (1) and 1, (3)) and after pulling the plate down evenly, put in the 4 screws (2) and safety wire the screws.

9. Control Pump (See Figure 25.) - a. Set the pump body (3) into place in the housing (5) . Place the gasket (7) between the pump cover (2) and the housing. Insert gaskets (9) and the two screws (1) , and partially screw down. Put the 4 nuts (4) with washers (10) on the studs (6) and tighten the cover down. Screw down the long screws and safety wire them. New type cover (8) is also shown and is assembled in same manner as described.

10. Control Cylinder (See Figure 24.) - a. Connect the follow valve link (4) and the follow valve link pin to the control cylinder (2) . Slip the pin locking spring (5) over the follow valve link pin to retain it in position. (A slotted "V" shaped screwdriver will facilitate placing the locking spring in place.) Place the control cylinder (2) into place in the housing, matching the 1/8" hole in the adapter with the 1/8" hole in the mounting seat of the housing. Insert the 2 screws (1) and safety wire them to the two screws (3)

11. Yoke Control Arm (See Figure 23.) - a. Insert the yoke control arm Tee (5) into its slot on the yoke control arm (3) . Place the yoke control arm into its housing seat, and at the same time, slide the yoke control arm Tee into the control cylinder and follow valve slot. Screw down the 2 set screws (2) , tightening the yoke control arm to the yoke, then lock the set screws in by means of the two set screws (1)

12. Upper and Lower Pressure Lines (See Figure 22.) - a. Put the 2 Neoprene gaskets (6) into position over the pintles, and the two Neoprene gaskets (7) over the check valve openings. Lay each pressure pipe into place to check for fit into the "B" end valve plate, fastening them loosely with the two swivel bolts (5) . It is extremely important that the lines be properly lined up at each end. Great care should be used not to force them into position for this may result in distortion which will cause faulty operation. When the lines are properly lined up, fasten down the 4 nuts (1) at the other ends of the lines. Place a gasket (8) on each swivel bolt (5) and after inserting gasket (9) between the line and the "B" end valve plate, tighten the bolt. Make sure that the bolt goes in freely without binding. Where the line pulls up too far, a thicker gasket must be used instead of (9) . Finally, safety wire the 4 nuts (1) at each end of the lines with lockwire. Since these pipes carry the high pressure oil (1250 lbs/sq. in. approx.), it is extremely important that they be properly aligned and securely fastened.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

13. Rear Cover (See Figure 21.) - a. Place the gasket (4) over the studs in the housing. Set the rear cover (2) into place then put on 12 washers (5) and tighten down with the 12 nuts (1) and safety wire them in pairs.

(b) Main Components (See Figure 20.) - 1. Two variable speed transmissions which have been completely assembled as described in the preceding paragraphs can now be fastened to the electric motor. Lay the two variable speed transmissions so that their control shafts are facing the assembler. Place the motor between them and turn it so that the Cannon plug is to the right and in the "Up" position. The proper meshing of the motor shaft splines to the female spline gear in the variable speed transmission can be made by inserting a small screw-driver through the perforations in the motor cover and turning the motor commutator until proper shaft position is obtained. Securely fasten each hydraulic transmission to the motor studs with 4 nuts (1) and washers (2) . Finally safety wire the nuts in pairs. This completes reassembly of the Double Power Unit.

(4) Final Test

(a) Hydraulic Fluid. - 1. Univis #40 oil (Air Corps Specification AN-VV-O-366) shall be used as the hydraulic medium in conducting this test.

(b) Static Leakage. - 1. Apply 1250 P.S.I. at a temperature of approximately 100°F to main hydraulic circuit through pressure gauge connection. Maximum allowable leakage into the open transmission case shall not exceed 200 cc/min., preferably this should be held below 100 cc/min.

(c) Run In. - 1. The unit should be run until rise above room temperature does not exceed 85° F with "A" end speed approximately 3600 R.P.M. "B" end full speed continuously, no load on "B" end. Adjust input voltage to exactly 24 volts for all running tests.

2. Check to see that "A" end and "B" end shafts rotate freely.

(d) Control Pressure. - 1. Adjust control pressure to 85 P.S.I. ±5 P.S.I. with "A" end speed approximately 3600 R.P.M., "B" end full speed and no load on "B" end. There should be no squealing or dancing of the relief ball on the seat.

2. Control pressure should not decrease more than 10 P.S.I. when a load of 8.8 pound-feet is applied to the "B" end shaft, with follow valve stationary.

(e) Speed. - 1. When the "A" end shaft is driven at approximately 3600 R.P.M. and the "A" end yoke is set for full speed, the "B" end shaft shall run unloaded at a speed approximately 30% (not less than 28.5% or more than 31.5%) of the "A" end speed. This requirement shall apply for "B" end rotation in either direction.

2. When the "B" end load is changed from zero to 8.8 pound-feet torque with "A" end yoke in full speed position, the resultant drop in "B" end speed (corrected for "A" end speed variation) shall not exceed 5%.

(f) Control Shaft Torque. - 1. With the "A" end shaft running at approximately 3600 R.P.M. and a torque load of 7 pound-feet applied to the "B" end shaft, the effort

3. Disassembly and Reassembly of Individual Units (Cont'd.)

required to rotate the control shaft at any position shall not exceed 6 ounce-inches on AA-16801-A or 9 ounce-inches on AA-16802-A and AA-16802-B.

(g) Backlash. - 1. With the "A" end shaft running at approximately 3600 R.P.M., the required angular displacement of the control shaft to change the static torque delivered by the "B" end shaft from 2 pound-feet in one direction to 2 pound-feet in the opposite direction shall not exceed one degree.

(h) Performance. - 1. The power required to drive the "A" end shaft at approximately 3600 R.P.M. with the control pressure adjusted as in paragraph (4)(d)1 and the "B" end shaft at a standstill shall not exceed 0.35 H.P.

2. The power required to drive the "A" end shaft at approximately 3600 R.P.M. with the control pressure adjusted as in paragraph (4)(d)1. and the "A" end yoke in full speed position with the "B" end shaft unloaded shall not exceed 0.70 H.P.

3. When sufficient torque load is applied to the "B" end shaft to cause a pressure of 1100 P.S.I. in the main hydraulic circuit, the product of the "B" end speed and torque shall be equal to or greater than 68% of the product of the "A" end speed and torque.

4. The requirements defined in paragraphs (4)(h)2. and (4)(h)3. shall apply for "B" end shaft rotation in either direction.

(i) External Leakage. - 1. During the conduct of the test defined herein, the total leakage from the unit shall not exceed one (1) cubic cm. in 10 minutes. This shall include not more than three (3) drops in two (2) minutes from points other than oil seals at shafts. Leakage from temporary connections made for purpose of test shall not be considered.

2. No one oil seal shall leak more than 5 drops in 10 min.

(j) Temperature Rise. - 1. When the transmission is operated at an "A" end shaft speed of approximately 3600 R.P.M. with the "A" end yoke in the full speed position and a load of 8.8 pound-feet on the "B" end shaft, the temperature of the oil in the transmission shall not rise more than 125° F above an ambient temperature in a period of 30 minutes. Test may be carried out in the open on the test floor.

3. Disassembly and Reassembly of Individual Units (Cont'd.)

m. Main Switch and Junction Box. - (1) (See Figure 34). Replacement of the main switch relay and the switches will probably be the only overhaul required for this unit.

(2) Remove the switch plate and the switch box cover.

(3) To inspect the relay, remove the 2 hexagon nuts from the bottom cover of the relay and lift off the relay cover.

(a) If the relay must be removed, take off the leads to the relay posts.

(b) Remove the large nut which fastens the DCG power lead to the right hand terminal post on bottom of relay.

(c) Remove the large nut which fastens the relay to the bus bar.

(d) Take out the 2 nuts which hold the relay to the relay mounting bracket.

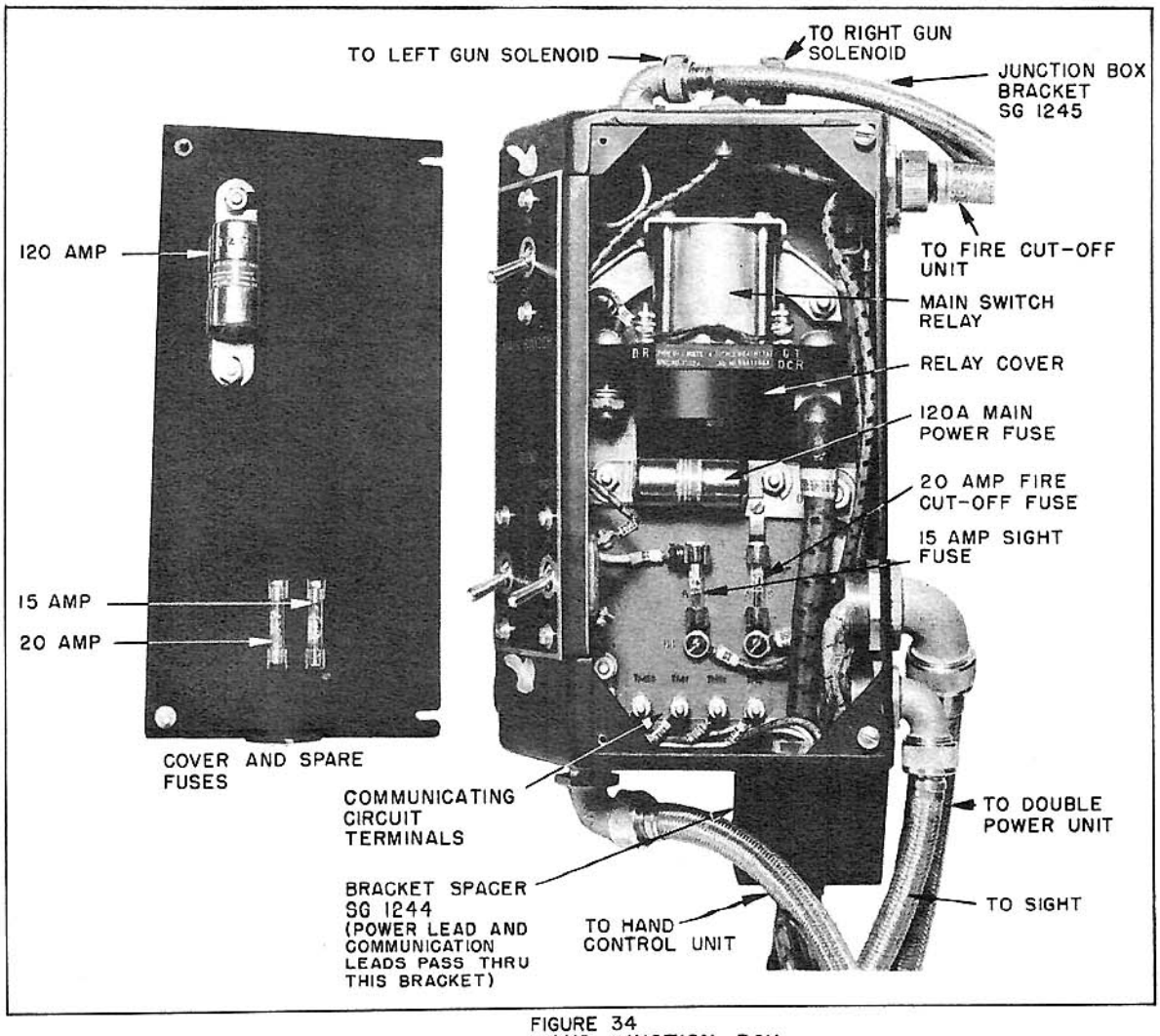


FIGURE 34
MAIN SWITCH AND JUNCTION BOX

3. Disassembly and Reassembly of Individual Units (Cont'd.)

(e) Remove the relay.

(4) To remove the toggle switches, disconnect the leads to the switches and take out the 2 screws which hold each switch to the switch plate. Be sure that all wires removed carry tags or identification markers so that they can be connected properly when relay or switches are replaced in the box. As an added precaution, check the wiring with wiring diagram, Figure 48.

(5) Be sure to check the 3 spare fuses which are attached to the back of the switch box cover.

4. Reassembly of Turret.

a. General. - (1) The following procedure covers complete reassembly of the overhauled units into the upper turret while it is in the test stand. Because the reassembly involves a sequence of steps which can be grouped conveniently, the procedure has been sub-divided into 9 stages.

b. Stage 1.

(1) Center Rail. - (a) Fasten center rail SG 1913 (Figures 35 and 36) to unit housing SG 1048 with 6 bolts (3/8"-24, 6-1/4" long), using 2 washers and an elastic stop nut on each bolt.

(2) Unit Housing Support. - (a) Fasten unit housing support to unit housing by means of 4 bolts (3/8"-24, 3-7/8") and 1 bolt (3/8"-24, 1-7/8"), with 2 washers and an elastic stop nut on each bolt. (See Figure 36.)

(3) 1" Electrical Coupling. - (a) Insert 1" electrical coupling into cord hole on left hand side of unit housing, as shown in Figure 35.

(4) Side Rails. - (a) Use 4 bolts (3/8"-24, 3-7/8") to hold rear end of left and right side rails (SG 1915 and SG 1916) and unit housing support to the unit housing. (See Figure 36.)

(b) Use 2 bolts (3/8"-24, 6-5/8") to hold front end of right side rail to unit housing.

(c) Use 2 bolts (3/8"-24, 5-3/8") to hold left side rail to unit housing. (See Figure 36.)

(d) Put 2 washers and 1 elastic stop nut on all bolts.

(5) Rollers. - (a) Fasten each of 10 rollers (Figure 35) to the unit housing, using 2 flat head screws (1/4"-28, 2") with washers and elastic stop nuts. If necessary, remove interference portions on 2 of the rollers (shown as "A" in Figure 35) to clear azimuth and elevation gear boxes.

4. Reassembly of Turret (Cont'd.)

(6) Shell Roller Brackets. (a) Mount a shell roller bracket (SG 1914) on each side rail, using 2 bolts (1/4"-28, 1-1/8") with 2 washers and an elastic stop nut. (See Figure 35.)

(b) Mount a shell roller bracket on the right and left sides of the center rail using 2 bolts (1/4"-28, 1-1/2") with 2 washers and an elastic stop nut.

1. These bolts also fasten the oxygen bottle bracket to the center rail.

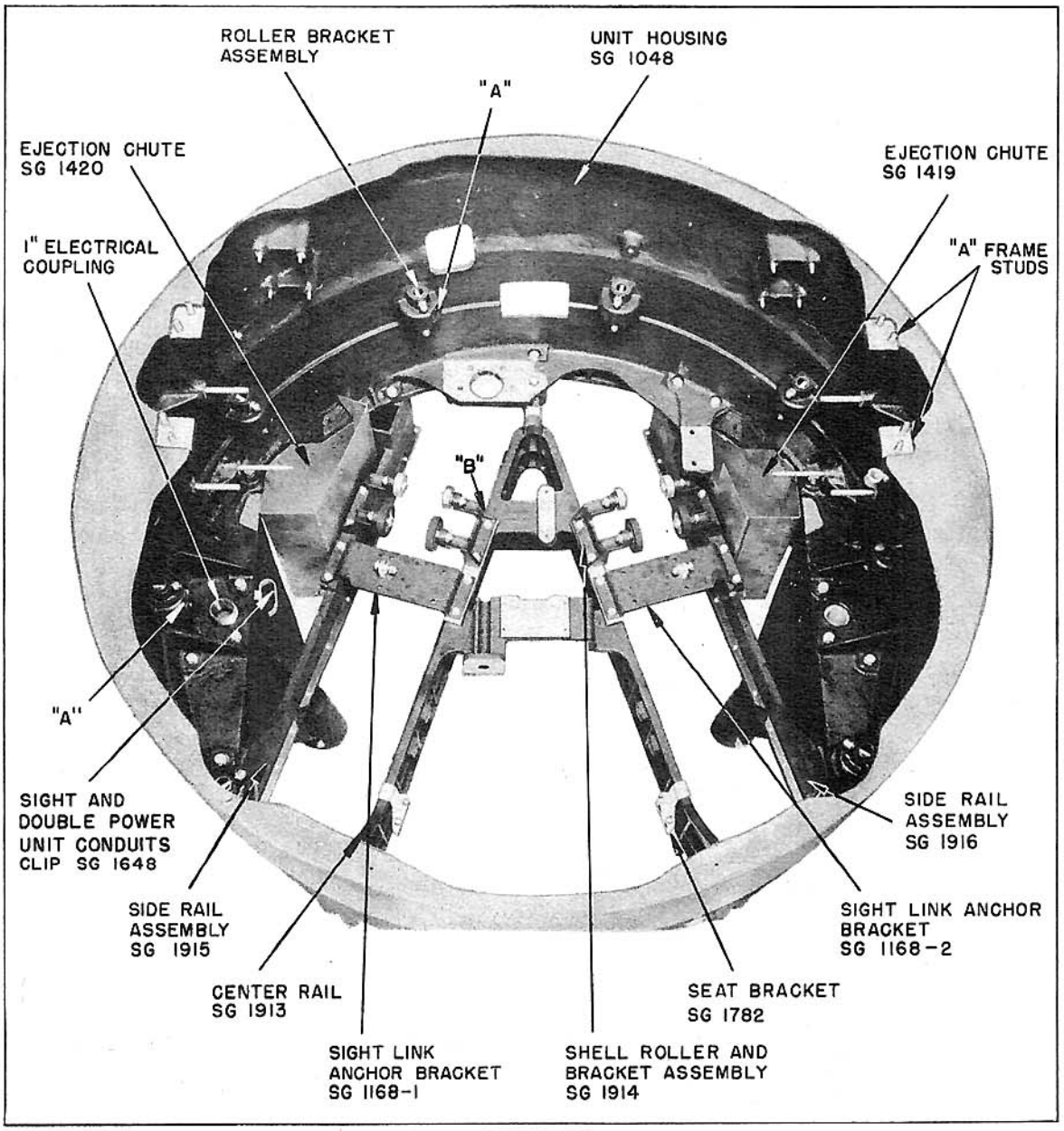


FIGURE 35
UPPER TURRET - PARTIAL ASSEMBLY

4. Reassembly of Turret (Cont'd.)

NOTE: It may be necessary to remove interference from left bracket if it touches azimuth spline shaft. (See surface "B" on Figure 35.)

(7) Shell and Clip Ejection Chutes. - (a) Attach the right and left shell and clip ejection chutes (SG 1419 and SG 1420) to the unit housing and side rails with 4 bolts (1/4"-20, 3/8") with washers, and safety wire the bolts. (See Figures 35 and 36.)

(8) Sight Link Anchor Brackets. - (a) The sight link anchor brackets (SG 1168-1 and SG 1168-2) are secured to the left and right side rails by 2 bolts (1/4"-28, 1-1/8"). See Figure 35. Two washers and an elastic stop nut are used for each bolt. Fasten brackets to the center rail, using 2 bolts (1/4"-28, 1-1/2") and 2 bolts (1/4"-28, 1-1/8") with 2 washers and elastic stop nut for each.

(9) Elevation Gear Boxes. - (a) Install left and right elevation gear boxes in the unit housing by means of 3 studs each. Secure each gear box on lower stud, using a washer and elastic stop nut. Be sure that elevation to sight and elevation hand drive units (Figure 19) are attached to the gear boxes. (See Figure 37.)

(10) Outside Ejection Panels. - (a) Mount left and right outside ejection panels (SG 1305-2 and SG 1305-1) to the upper 2 studs and secure panel and gear box with washer and elastic stop nut. (See Figures 35 and 39.)

(b) Fasten lower end of right and left outside ejection panels to unit housing by means of a bolt (1/4"-28, 1-1/8") with 2 washers and an elastic stop nut.

(11) Double Power Unit and Gear Boxes. - (a) The double power unit and gear box assemblies shown in Figure 38 should now be mounted in the unit housing.

1. Attach the complete assembly with the 4 stud bolts on the azimuth gear box passing through the unit housing and then through the right angle drive. A washer and elastic stop nut are used on each bolt.

NOTE: Breather cups should not be installed at this time.

(12) Support Bracket. - (a) Slip bracket (SG 1940) over the pilot on the elevation transmission gear box (SG 70).

(b) Mount support bracket to unit housing by means of 2 bolts (5/16"-24, 2-3/4") with 2 washers and an elastic stop nut. (See Figure 37.)

(13) Adjustable Brace. - (a) Anchor the adjustable brace assembly (SG 960) to the unit housing with a bolt (5/16"-18, 3/4") and safety wire.

(b) Fasten other end of brace to the double power unit with a bolt (5/16"-18, 3/4") and safety wire. (See Figure 39.)

WARNING: IN THIS AND ALL OTHER CONNECTIONS TO THE DOUBLE POWER UNIT BE SURE THAT THE SPECIFIED BOLT AND WASHER ARE USED. OTHERWISE THERE IS DANGER OF A BOLT PUNCTURING THE VARIABLE SPEED TRANSMISSION HOUSING.

4. Reassembly of Turret (Cont'd.)

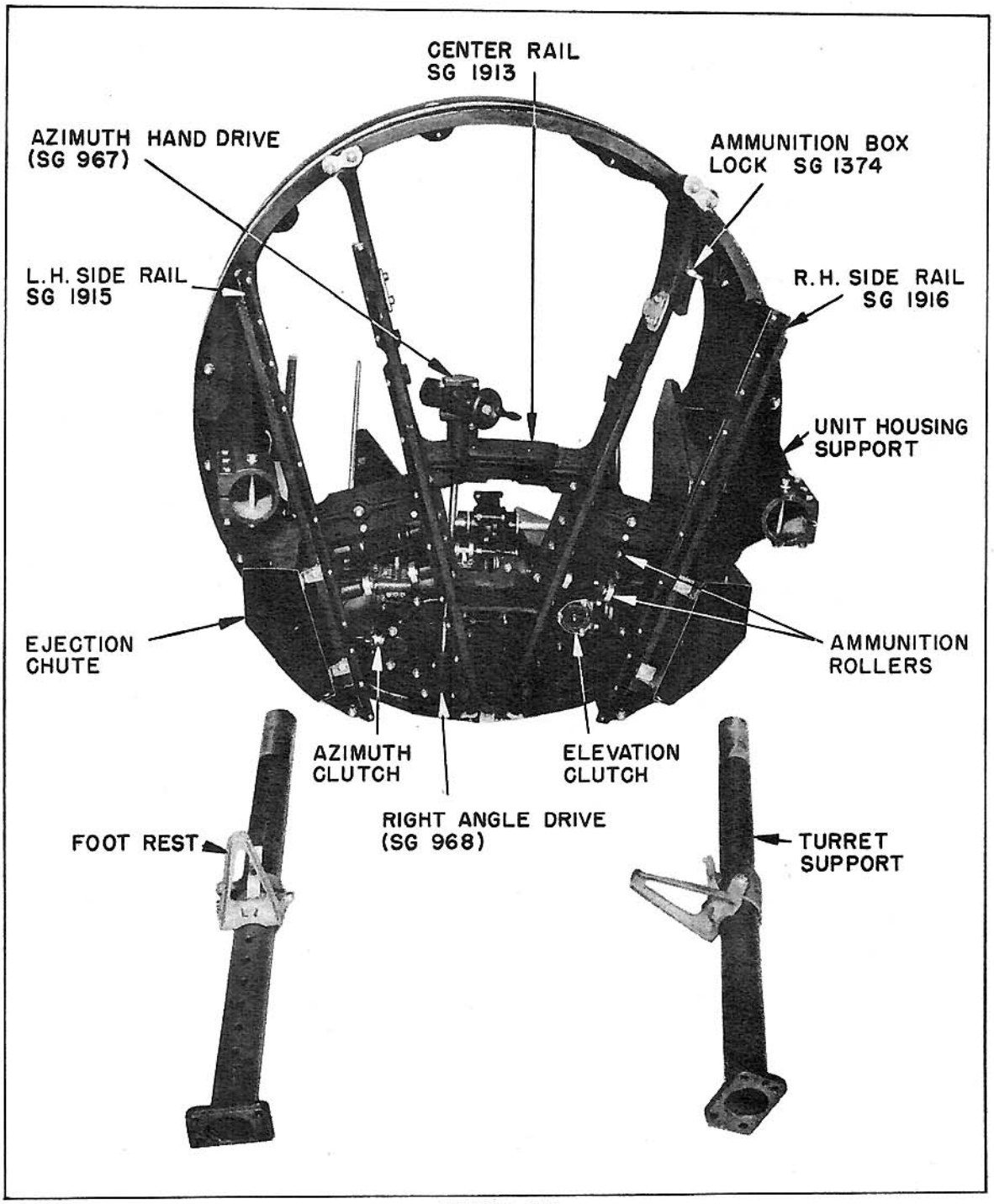


FIGURE 36
UPPER TURRET - PARTIAL ASSEMBLY

4. Reassembly of Turret (Cont'd.)

NOTE: Cross shaft gear box is not mounted at this stage of the reassembly.

c. Stage 2.

(1) Gun Slot Shutter Brackets. - (a) Fasten the left and right gun slot shutter brackets (SG 965 and SG 965-1) to the 4 studs in the unit housing, using a washer and elastic stop nut on each stud (see Figures 37 and 39).

(2) Inside Ejection Panels, Deflectors and Shields. - (a) Mount the right hand inside ejection panel (SG 1411) to the double power unit with 2 bolts (5/16"-18, 3/8") and safety wire. (See Figures 39 and 40.)

(b) Fasten upper portion of ejection panel to gun slot shutter bracket with 2 round head screws (10-24, 3/8") and lockwashers. (See Figures 39 and 40.)

1. These screws also hold the roller flange to the bracket.

(c) Fasten lower portion of ejection panel to panel deflector (SG 1414) with a bolt (10-22, 3/8"). (See Figure 40.)

(d) Fasten lower portion of panel deflector to ejection chute (SG 1419) with 2 bolts (10-32, 3/8") and elastic stop nuts. (See Figure 40.)

(e) Fasten lower portion of ejection panel (under double power unit) to inside ejection panel shield (SG 1412), using 2 bolts (10-32, 3/8") with elastic stop nuts. (See Figure 40.)

(f) The opposite end of the panel should be fastened to the unit housing with 2 fillister head screws (10-24, 1/4"). Safety wire the screws.

(g) Attach the front end of the inside ejection panel to triangular panel brace (SG 1416-1) with 2 flat head screws (10-32, 1-1/4"). (See Figure 39.) Place a 1/2" spacer between brace and shield before putting on washers and elastic stop nuts.

(h) Fasten other end of the triangular brace to sight link anchor bracket (SG 1168-2) with 2 bolts (10-32, 5/8"), using 2 washers and elastic stop nut on each. (See Figure 39.)

(i) Installation procedure for the left hand inside ejection panel duplicates that of the right hand panel, with this exception: the panel shield is also attached to the bottom of the double power unit by a bolt (5/16"-18, 3/8"). This bolt should be lockwired.

(3) Double Power Unit Shields and Control Box Bracket. - (a) Attach the right hand double power unit shield (SG 1628) and control box bracket (SG 1276) to the double power unit by means of a cap screw (5/16"-18, 7/8"). (See Figure 39.)

(b) The lower end of the shield is attached to the double power unit with a cap screw (5/16"-18, 7/8") and is then safety wired.

4. Reassembly of Turret (Cont'd.)

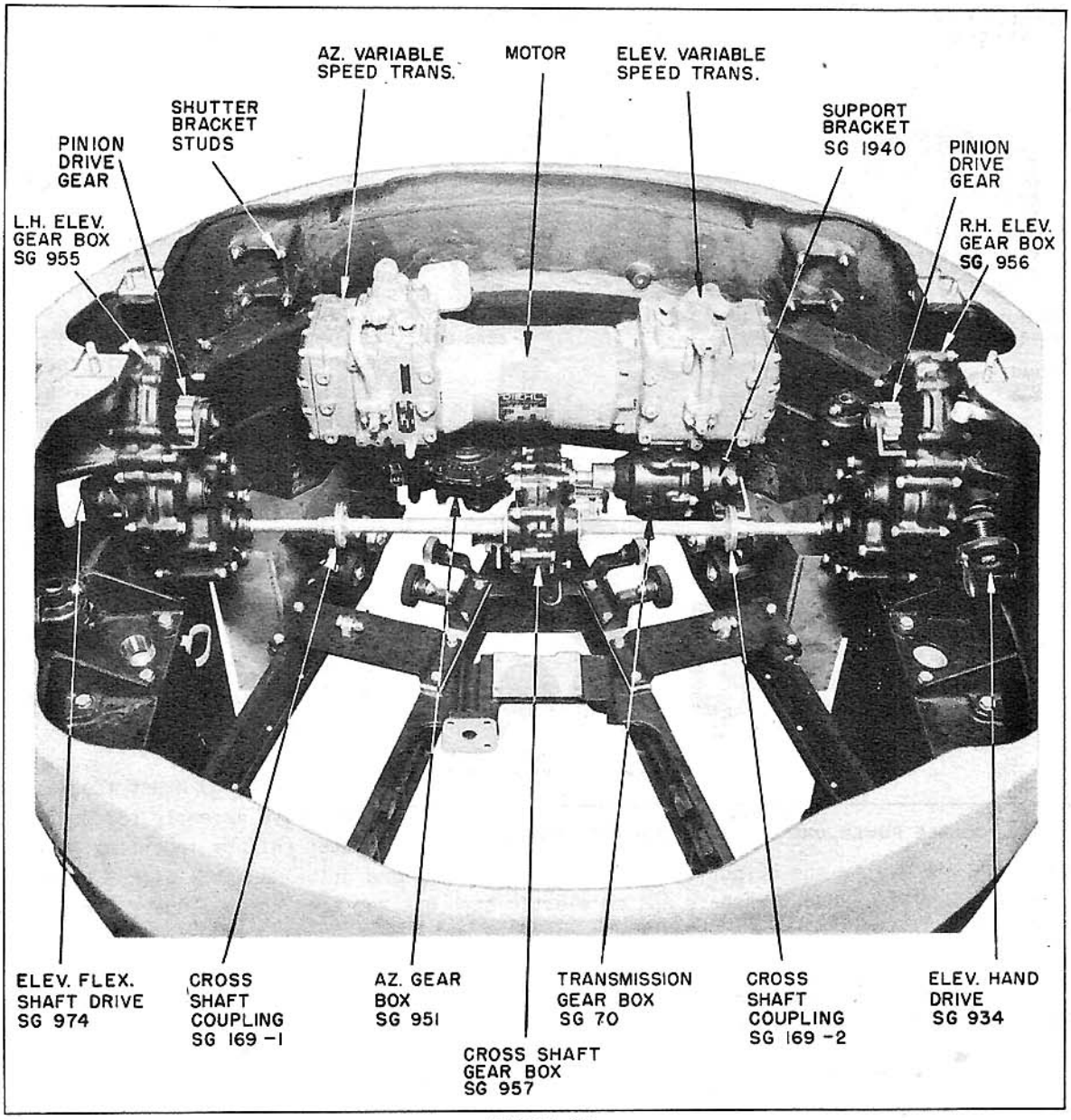


FIGURE 37
UPPER TURRET - PARTIAL ASSEMBLY

(c) The left hand power unit shield (SG 1740) and control box bracket are fastened to the double power unit with 2 cap screws (5/16"-18, 1") and are safety wired.

(4) Ejection Chute Rollers. - (a) Fasten the right hand ejection chute roller (SG 985-1) between the inside ejection panel (SG 1411) and the outside ejection panel (SG 1305-1) with a bolt (1/4"-28, 4-1/2"). (See Figures 39 and 45.)

1. This bolt passes through the dowel plate and inside ejection chute

4. Reassembly of Turret (Cont'd.)

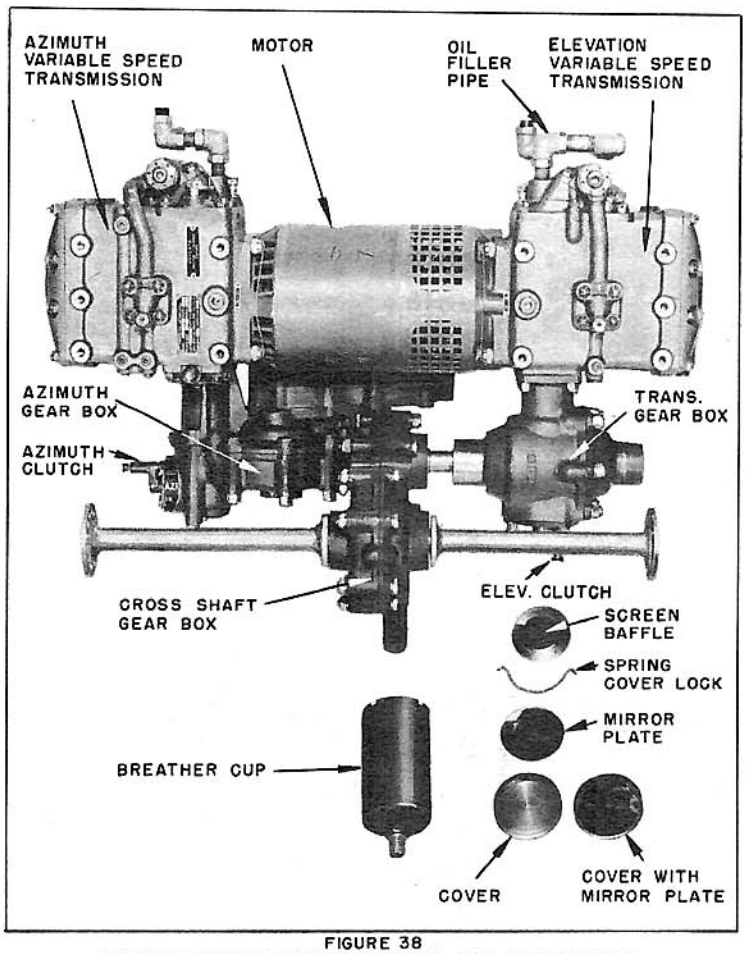


FIGURE 38
DOUBLE POWER UNIT AND GEAR BOX ASSEMBLIES

roller and threads into a nut plate fastened to the outside of the ejection panel.

2. Lockwire the bolt to the dowel plate, which is used to anchor the torsion spring of the ejection chute roller to the inside ejection panel. (See Figures 39 and 45.)

(g) The left hand ejection chute roller is fastened in exactly the same manner as described in the previous paragraph.

(5) Azimuth Spline Shaft and Hand Drive. - (a) Insert the azimuth spline shaft (SG 1886) into the right angle drive (SG 968) and then insert the other end of the shaft into azimuth coupling (SG 1873). (See Figures 14 and 39).

(b) Mount the azimuth hand drive assembly (SG 967) to center rail by inserting jack shaft (SG 1870) into the azimuth coupling and fastening hand drive assembly with 3 bolts (1/4"-28, 3-3/8"). Use 2 washers and an elastic stop nut for each bolt. (See Figures 14 and 39).

(6) Cross Shaft Couplings. - (a) Fit the right hand adjustable cross shaft coupling to the right hand elevation gear box shaft. (See Figure 37.)

(b) Fit the left hand adjustable cross shaft coupling to the left hand elevation gear box shaft.

(7) Cross Shaft Gear Box. - (a) Mount the cross shaft gear box assembly to the center rail, using 2 bolts (1/4"-28, 1-1/4") with 2 washers and an elastic stop nut. (See Figure 37.)

(b) Couple right hand cross shaft flange (SG 1112-2) to right hand cross shaft coupling with 2 bolts (1/4"-28, 5/8") and elastic stop nuts.

d. Stage 3.

(1) Slip Ring Assembly. - (a) As the first step in this stage of the reassembly,

4. Reassembly of Turret (Cont'd.)

which covers platform assembly and brush holders, insert slip ring assembly (SG 953) into small felt washer (SG 1011), brass washer (SG 1029), retainer ring (SG 1006), and base plate (SG 1002). (See Figure 41.)

(b) Fasten power lead to 3/8" brass bolt in slip ring assembly (see Figure 41) by means of a lug, lug insulator, plain washer, lockwasher and a 3/8" brass nut. Draw wires through terminal box axis hole.

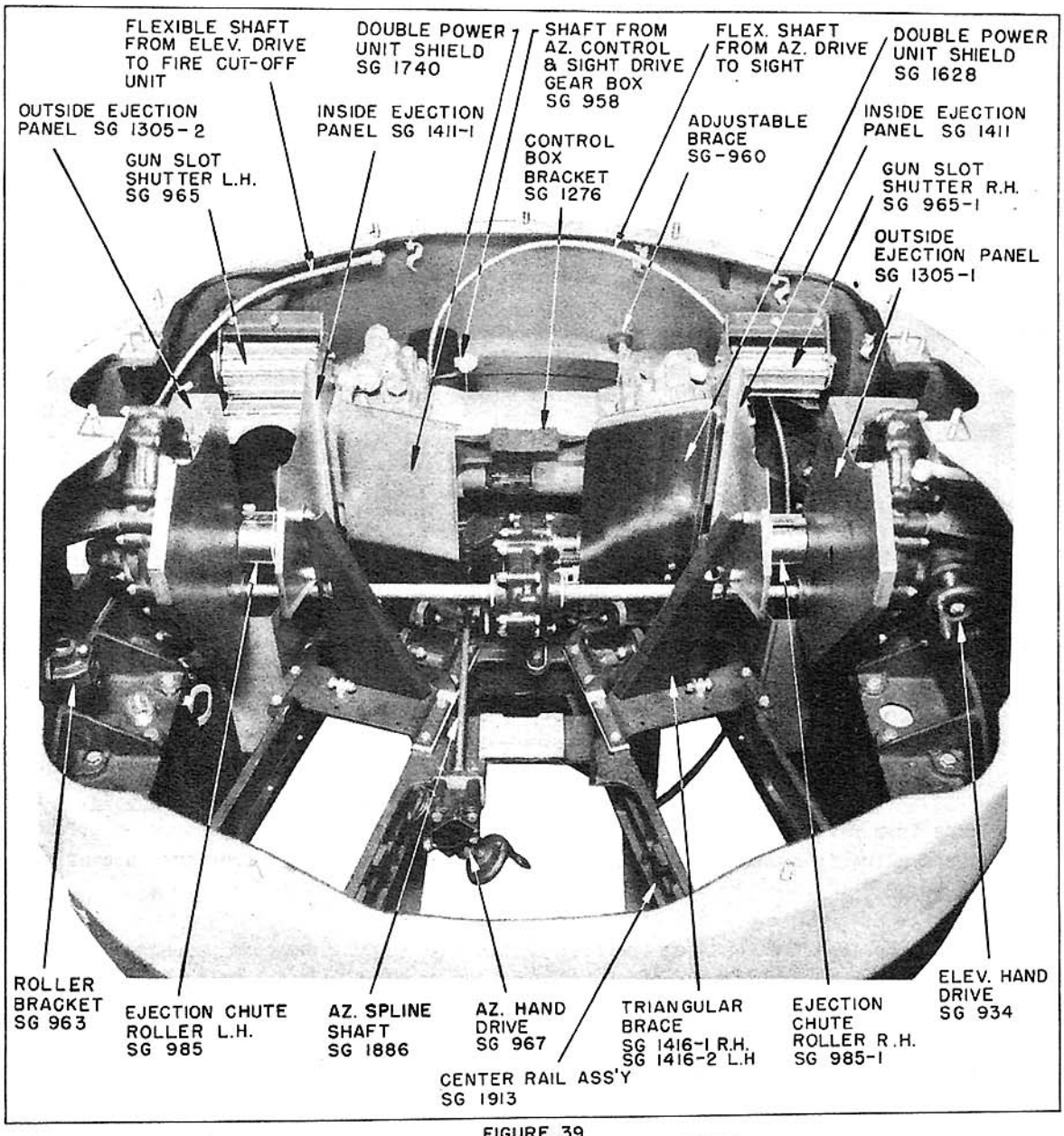


FIGURE 39
UPPER TURRET - PARTIAL ASSEMBLY

4. Reassembly of Turret (Cont'd.)

(2) Ground Lug. - (a) Insert ground wire lug into recess marked "GND" on base plate. (See Figure 41.)

(b) Place base plate cover (SG 1037) in cover recess and fasten with 3 flat head screws (10-32, 5/8").

1. Be sure that one of the screws passes through the ground lug, seating it securely against the base plate casting.

(c) Stake the screws.

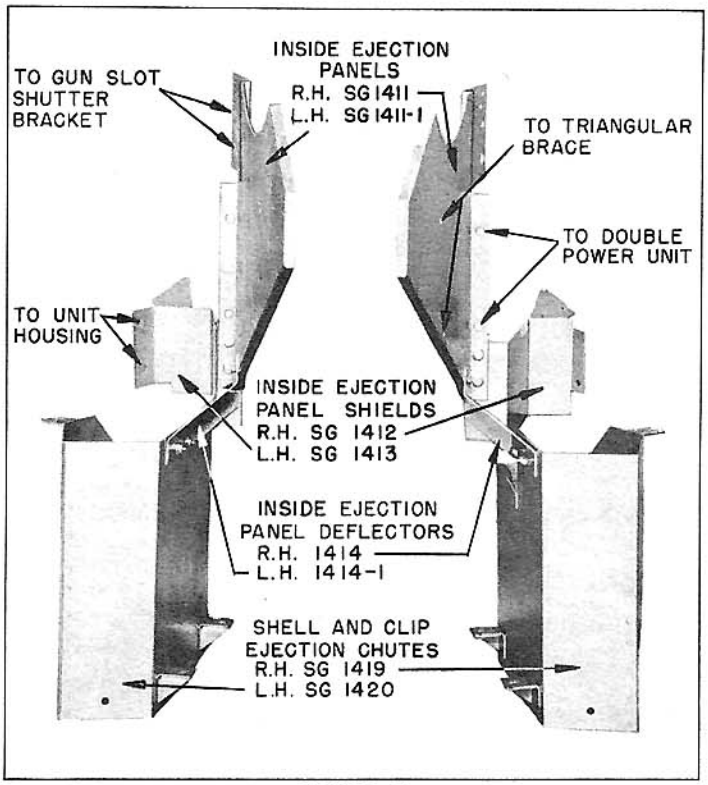


FIGURE 40
PANEL AND SHIELD ASSEMBLIES

(3) Terminal Box. - (a) Fasten terminal box (SG 952) to base plate, using 4 fillister head screws (10-32, 5/8") and lockwashers and nuts. (See Figures 41 and 42.)

(b) Connect wire in accordance with identification markers on wires and terminals. Refer also to wiring diagram, Figure 48.

(c) Be sure to ground shield of telephone cable to round head screw marked "GND" in terminal box casting. (See Figure 41.) Tighten screw securely.

(d) Place cover (SG 1038) on terminal box and fasten with 4 fillister head screws (8-32, 3/8") and washers.

(e) Lockwire the screws.

(4) Main Switch and Junction Box and Foot Switch Leads. - (a) Insert leads from main switch and junction box into left hand cord passageway of platform casting and allow free ends to come through one of the brush holder openings in casting. (See Figure 42.)

(b) Insert wires from the foot switch into right hand cord passageway and allow free ends to come through to the other brush holder opening in the casting.

(c) Fasten the conduit cover plate (SG 1003) at base of left hand column, using 4 round head screws (5-40, 1/4") and lockwashers.

(5) Slip Ring into Platform Casting. - (a) Referring to Figure 41, place insulator

4. Reassembly of Turret (Cont'd.)

bushing washer (SG 1017) on top of slip ring assembly and insert assembly into the steady bearing.

(b) Then insert complete assembly into platform casting (SG 1000) and fasten steady bearing (SG 1014) with 4 flat head screws (10-24, 3/8"). Stake the screws.

NOTE: Align steady bearing with cord opening in platform so that right hand brush box wiring can be passed through.

(6) Brush Holders. - (a) Distribute wires in casting which are marked THSI, TMI, XG and DCG to the left hand brush holder. (See Figure 42.)

(b) Mount left hand brush holder assembly (SG 950-1) by means of the 4 studs (SG 1389).

1. Be sure that a star washer is inserted between shoulder of stud and brush holder casting.

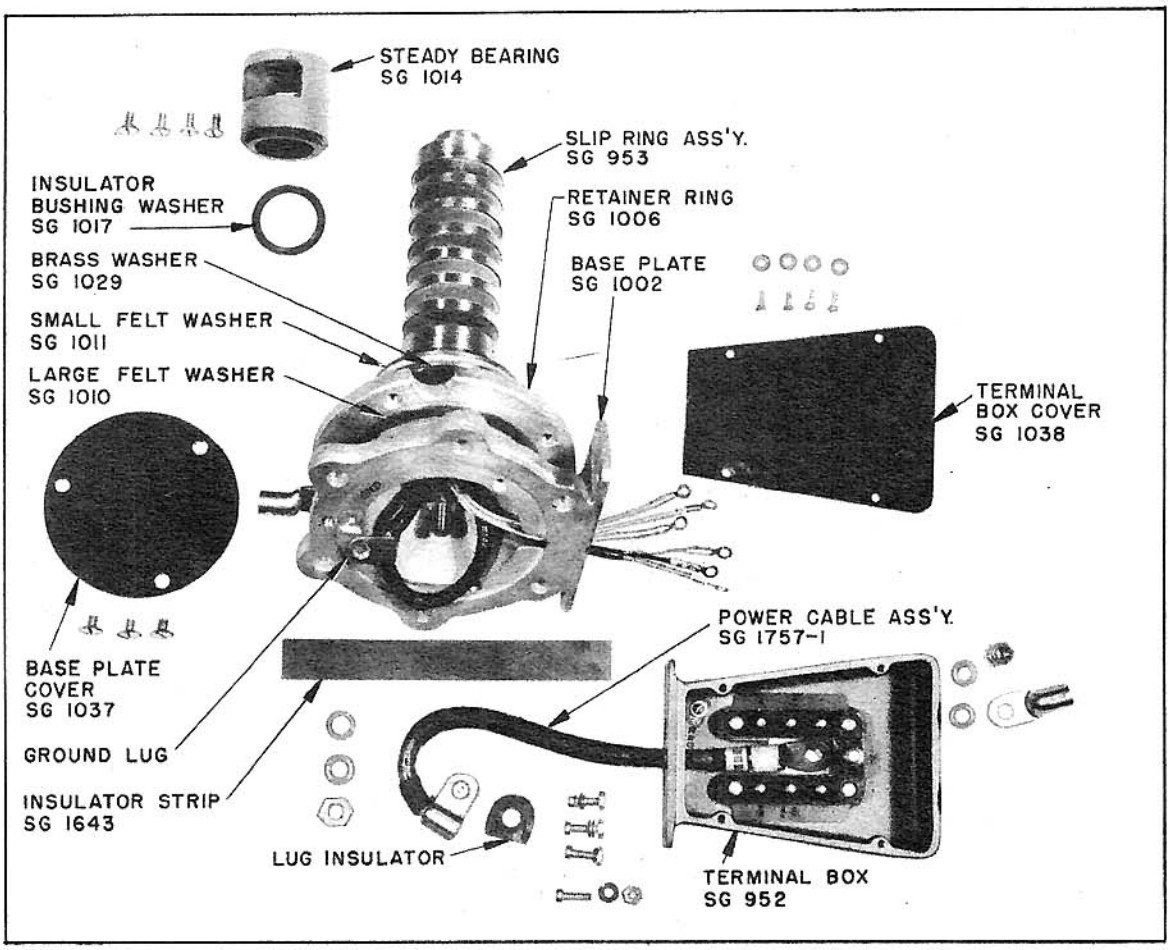


FIGURE 41
SLIP RING AND TERMINAL BOX ASSEMBLY

4. Reassembly of Turret (Cont'd.)

2. Use a stud driver to fasten the studs.

(c) Connect the wires to the terminals in accordance with the identification markers on each. Refer also to wiring diagram, Figure 48.

(d) Slip the 4 insulator spacers (SG 1025) over the brush holder studs. (See Figure 42.)

(e) Put brush holder cover (SG 1005) on brush holder assembly and fasten with 4 (10-32) elastic stop nuts and washers.

(f) Distribute wires THM, TM2 and DCG through opening in steady bearing (see Figure 41) to right hand brush holder opening.

(g) Make electrical connections, mount brush holder and put on cover of right hand brush holder, following the procedure described above.

e. Stage 4.

(1) Unit Housing. - (a) This stage covers the assembly of the turret in test stand, and for the first step mount ring gear assembly (SG 954) in test stand by means of at least 4 suitable bolts equally distributed around the ring.

(b) Set base plate on mounting pad.

(c) Using a sling cable and sling spreader T-44051, lift up the unit housing assembly, as shown in Figure 39, and set it on top of the test stand.

(d) Slip foot rests (SG 943) on the column supports (SG 1073). (See Figures 36 and 46.)

(2) Lead Wires. - (a) Insert lead wires from the main switch and junction box through left column support. (See Figure 36.)

(b) Next insert the wires into the left unit housing support.

NOTE: During this procedure the unit housing and assemblies are gradually lowered into the test stand.

(3) Column Supports. - (a) Insert left and right column supports into left and right housing supports. If necessary, separate split bearing to do this. (See Figure 36.)

(b) Align bolt holes and insert 2 bolts (5/16", 3-3/8"). Be careful not to injure the wires in the left column support.

(c) Tighten split bearings with a bolt (1/4"-28, 2-3/8"), using a washer and elastic stop nut.

(d) Continue to lower the assembly until mounting pads of the column supports

4. Reassembly of Turret (Cont'd.)

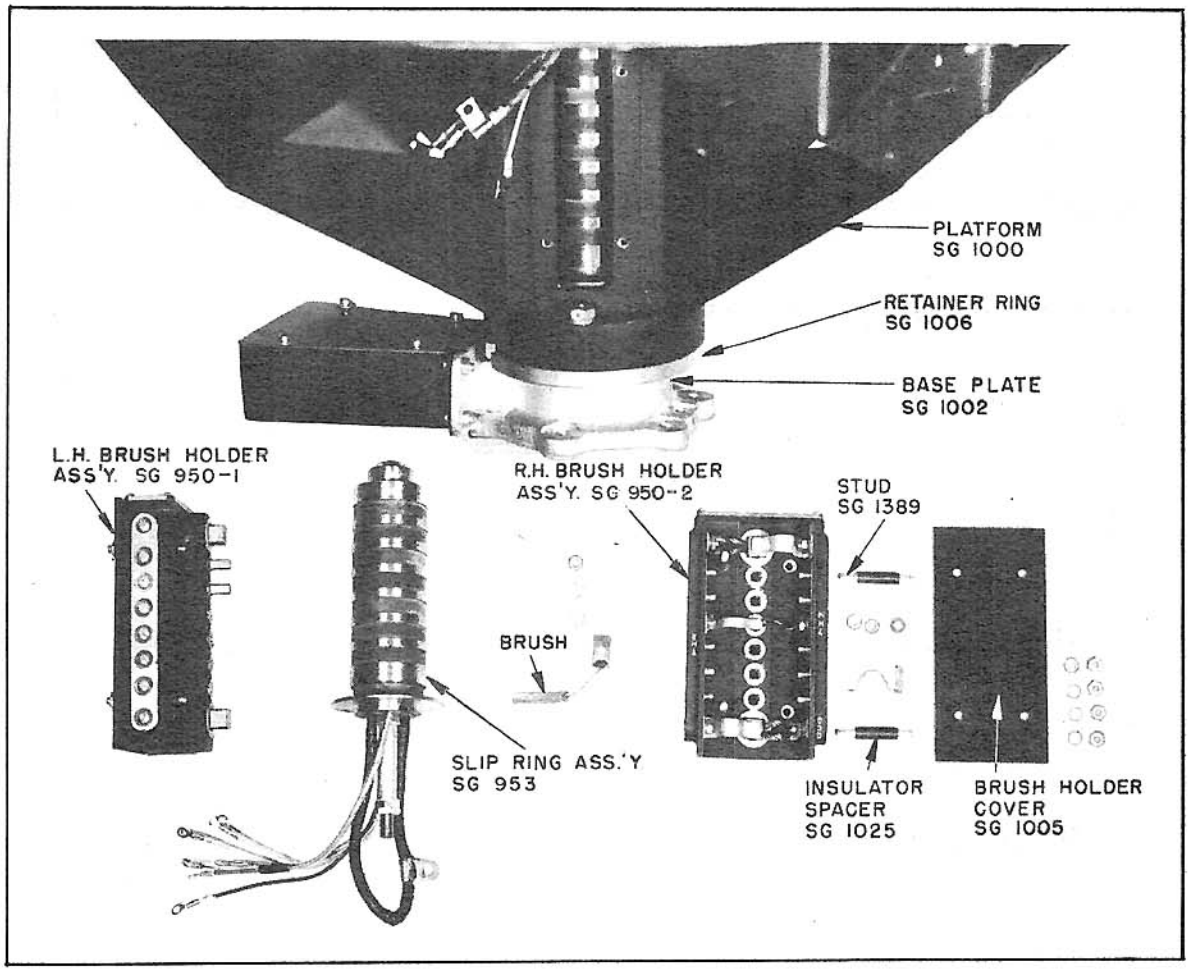


FIGURE 42
LOWER PORTION OF PLATFORM ASSEMBLY

touch the studs on the platform. Carefully guide studs into holes of column flanges while lowering assembly into place.

CAUTION: BE SURE TO CHECK PROPER MESHING OF THE AZIMUTH PINION GEAR AND THE RING GEAR.

(4) Bag Snap Clips. - (a) Insert bag snap clips (SG 1651) over outside, front stud and fasten with castellated nut and cotter key.

(b) Put on and tighten the other 3 (3/8"-24) castellated nuts with cotter keys.

(5) Azimuth Pinion Gear Alignment. - (a) Place necessary shims under base plate until the azimuth pinion gear (see Figure 17) and the ring gear are properly aligned.

1. The ring gear must be in the center of the face of the pinion gear and there must be sufficient space for the 1/8" displacement on each side of the ring gear.

4. Reassembly of Turret (Cont'd.)

NOTE: To allow for variations in aircraft dimensions, see outline drawing Figure 50 for all dimensions concerned.

(6) Foot Switch.

(a) Insert foot switch in mounting plate and secure with 2 round head screws (4-36, 1/4") with lockwashers. (See Section IV, Ref. Pl. I, Symbol - CC and Figure 46.)

(b) Insert switch operating shaft (SG 1615) into switch mounting plate and anchor torsional spring as shown on Ref. Pl. I, Symbol - CC.

(c) Secure mounting plate to platform casting with 4 round head screws (5-40, 1/4") and lockwashers.

(d) Pin clevis arm (SG 1614) and foot pedal (SG 1613) to shaft (SG 1615) with 00 taper pins, 5/16" long.

f. Stage 5.

(1) Routing of Electrical Conduits. - (a) Distribute the electrical conduits in the turret housing as shown in Figure 43.

NOTE: In this illustration assemblies normally in place have been removed to show the routing of the conduits.

(2) Support Leads to Main Switch and Junction Box. - (a) Insert leads from unit housing support through spacer and locknut into main switch and junction box (see Figure 34) and place switch box in position in the unit housing. (See Figure 43.)

1. Match connections in switch box with identification tags on the leads. Check connections with wiring diagrams, Figure 48.

(3) Conduits to Main Switch and Junction Box. - (a) Insert sight conduit into main switch and junction box and tighten locknut. (See Figure 34.)

(b) Insert power motor conduit and tighten locknut. Put double power unit and sight conduits in clip SG 1648, as shown in Figure 35.

(c) Insert the wires of the fire cut-off and limit stop unit conduit through the fitting in the switch box and tighten the conduit coupling.

(d) Insert wires and fittings of right and left gun solenoids and tighten locknut. Put right gun solenoid conduit in brackets around top of unit housing as shown in Figure 43. Clamp it to fire cut-off and limit stop unit conduit.

(e) Insert wire of hand control unit and tighten locknut.

(f) Attach all wires in the main switch and junction box, using identification markers provided. See Figure 48 for all wiring connections.

4. Reassembly of Turret (Cont'd.)

(4) Bracket Spacer. - (a) Tighten locknut on inside of bracket spacer (SG 1244).

(b) Fasten upper right corner of switch box to bracket (SG 1245) using a fillister head screw (1/4"-28, 1") and 2 washers, lockwasher and hexagon nut.

(5) Telephone Jack Leads. - (a) Insert leads to telephone jack into main switch and junction box through grommets on under side and attach wires in accordance with designations on them and on the terminals. (See Figure 34 and wiring diagram, Figure 48.)

g. Stage 6.

(1) Gun Mounting Yoke. - (a) Using lifting plates (SG 1777) which are located on the "A" frames, lower the gun mounting yoke assembly (SG 939) into place. (See Figures 1 and 44.)

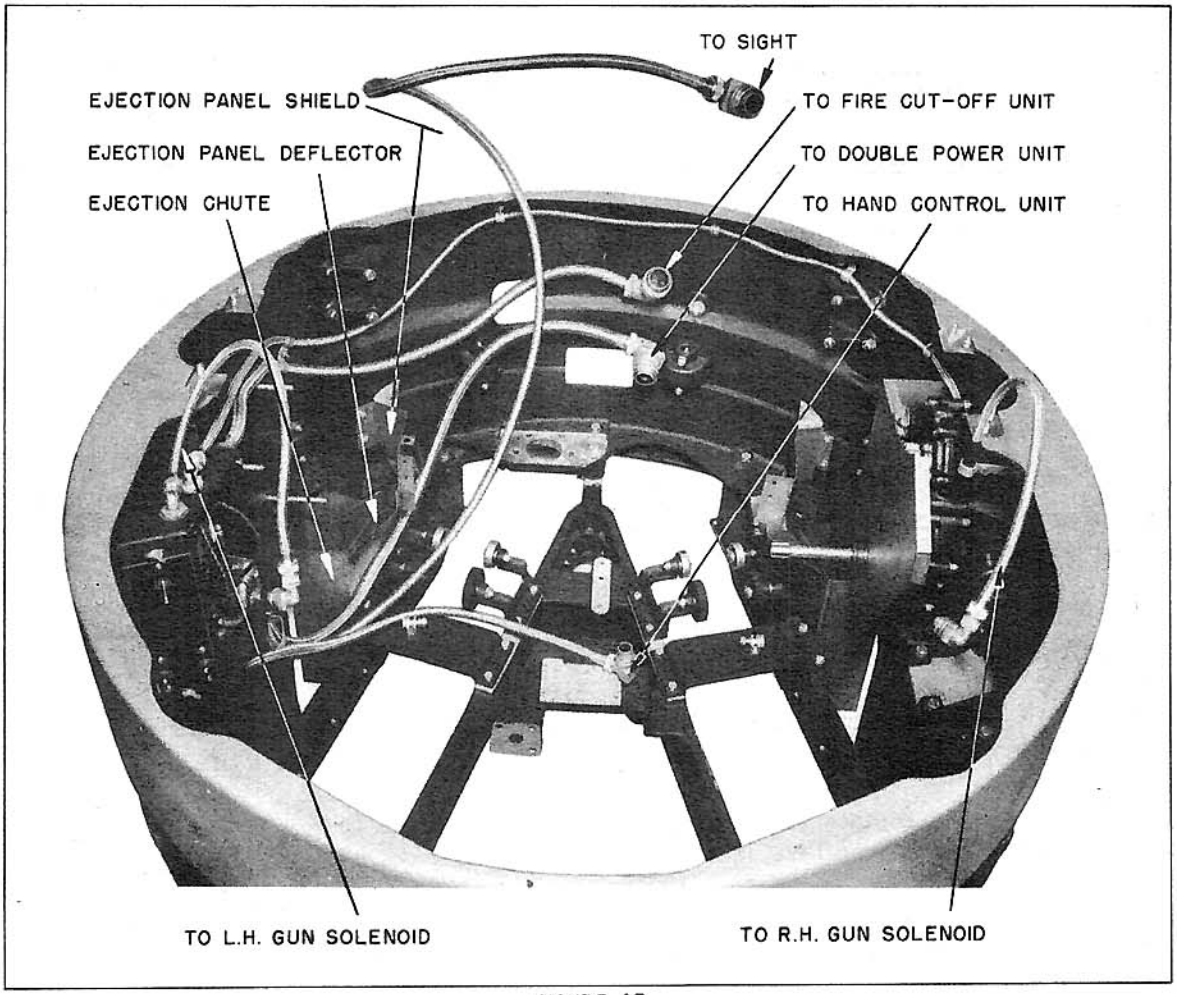


FIGURE 43
UPPER TURRET - PARTIAL ASSEMBLY
SHOWING FLEXIBLE CONDUIT LAYOUT

4. Reassembly of Turret (Cont'd.)

1. Carefully mesh segment gear (SG 1120) (see Figure 44) and pinion gear on elevation gear box (see Figure 18) and lower unit so that the studs holding the "A" frame to the unit housing will not be damaged.

NOTE: Be sure that the segment gear teeth are meshed at the same position, for otherwise it will not be possible to line up the guns.

(b) Secure "A" frame to the unit housing with four 5/16" elastic stop nuts. (See Figures 1, 35 and 44.)

(2) Support Links. - (a) Anchor left and right support links (SG 1273-1 and SG 1273-2) to anchor clevises (SG 1169) on sight link anchor brackets (SG 1168-1 and SG 1168-2) with 1/4" pivot bolts, washers and elastic stop nuts. (See Figures 1 and 44.)

h. Stage 7.

(1) Gun Accessories.

(a) General. - 1. The following gun accessories are mounted on each gun before it is installed in the turret. (See Figures 44 and 49.)

(b) Solenoid Adapter. - 1. Remove receiver top cover by taking out 3 screws.

2. Remove back plate and bolt group from gun.

3. Unlock and remove trigger bar pin lock from side plate and pull out trigger bar pin.

4. Place adapter casting on top of gun so that the ball end of the floating lever is inserted through 0.308" diameter hole in receiver top plate.

5. Place spring (SG 690) into well near clevis end of the tripping arm (SG 686). Insert arm so that spring is up and finger hooks over trigger bar. Clevis end of arm should be facing back toward butt of gun.

NOTE: If tripping arm is not the proper shape to fit, use gauge T-44050.

6. Insert ball of floating lever (SG 689) into clevis of arm and place clevis pin (SG 691) through clevis pin holes. Insert cotter pin clevis pin.

7. Replace trigger bar pin, but be sure that it goes through bearing of arm and bearing of trigger bar. Seat pin and rotate 90° upward to lock.

8. Replace cover plate (SG 687) on solenoid adapter box (SG 44) and secure with cap screws (SG 1779). Use a lockwasher under each cap screw and safety wire the screw heads.

9. Replace bolt group and backplate.

4. Reassembly of Turret (Cont'd.)

(c) Firing Solenoid. - 1. Remove nut and cotter pin from rear mounting bolt of solenoid.

2. Insert mounting bolt in rear slot of adapter plate.

3. Place solenoid on adapter, engaging mounting lug with forward slot of adapter cover plate.

4. Replace nut and cotter pin on rear mounting bolt.

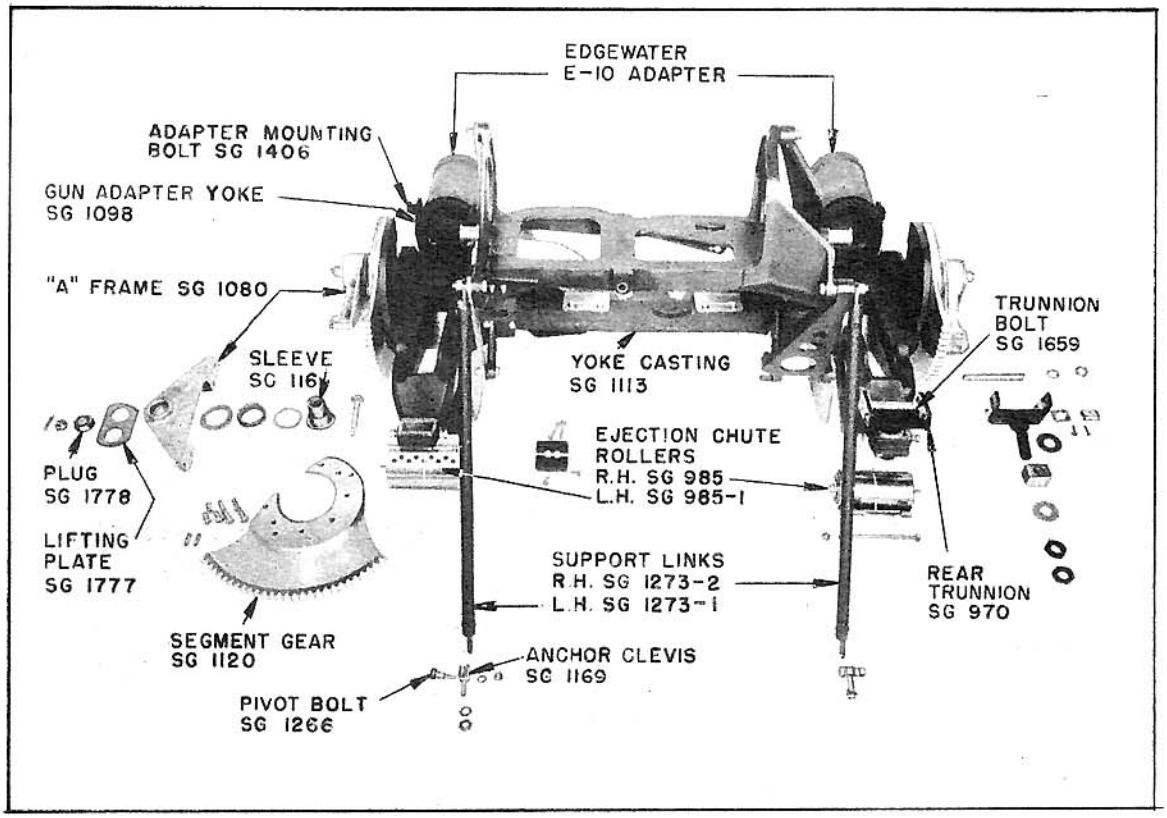


FIGURE 44
GUN MOUNTING YOKE ASSEMBLY

(d) Link Ejection Chute. - 1. Retract belt holding pawl pin and insert link ejection chute (SG 1723) between link stripper and ammunition stop, with tongue of link chute forward.

2. Replace belt holding pawl pin.

(e) Hand Charger - Modification and Installation. - 1. Remove 3 screws holding hand charger plate to gun.

2. Modify the standard charger plate by replacing the following GFE parts with Steel Products Engineering Co. parts, as follows: (See Figure 49.)

4. Reassembly of Turret (Cont'd.)

NOTE: It will only be necessary to make the modifications when a new gun is installed, or when parts are replaced.

a. Remove stud B 8993-1 and replace with cam screw SG 1103 and stake.

b. Remove charging lever stop A-13694-3 and replace with stop screw SG 1104 and stake.

c. Remove spring A-13692 and replace with SG 1631. On left hand gun use GFE spring A-13692.

d. Remove charging lever B-8989 and replace with SG 1101-2. On left hand gun, replace B-8989 with SG 1101-2.

e. Remove charging lever pivot stud B-8992 and replace with cam lever pivot screw 1105. Replace cotter pin and stake screw (SG 1105).

3. Place pulley bracket SG 1126-2 on charger plate, and mount both to gun. Use 3 bolts (SG 1667) and safety wire them.

4. Thread charger cable through pulleys as shown in Figure 49 and anchor cable in clevis SG 1102. Mount clevis to charger lever (SG 1101-2) by means of a clevis pin and cotter pin.

5. Unscrew bolt A-13683 from charging lever B 8989; remove grip A 13684-4.

6. Mount grip A-13684-4 in charging handle SG 1195, using a bolt and elastic stop nut.

(f) Edgewater Adapter. - 1. Remove front trunnion C-4052 and replace with Edgewater adapter, type E-10. (See Figure 44.) Be sure to retain shim B 8951 between adapter and seat. Lock adapter by allowing spring loaded front trunnion locking pin to seat.

(g) Ammunition Feed. - 1. The guns are normally assembled for left hand feed. The gun mounted in the left hand side of the turret must be corrected for right hand feed in accordance with Standard Instructions issued by the Ordnance Department.

(h) Cover Latch Shaft Lever. - 1. The guns can be assembled with the cover latch shaft lever at either the left or right hand side of the cover.

2. The lever should be attached to the side of the cover nearest to the center of the turret so that the gunner can open the cover without difficulty.

3. When a change in position of the lever is required, remove the cotter pin from the end of the latch pin, and withdraw the latch pin. Move the lever to the opposite side of the gun cover; insert the latch pin; and replace the cotter pin.

(i) Backplate Latch Lock. - 1. The latch lock on the backplate of the gun is

4. Reassembly of Turret (Cont'd.)

normally assembled so that the hinged portion protrudes from the right hand side of the gun. The latch lock should protrude from the gun on the side away from the center of the turret so that it will not interfere with the charging operation. This makes it necessary to change the latch lock on the gun installed in the left hand side of the turret.

2. Remove the backplate latch pin. This releases the backplate latch and spring.

3. Remove the 3 pins holding the latch lockplate and turn the latch lock through 180°. Insert the latch lock and pins.

4. Compress the cover latch spring with the cover latch and then insert the cover latch pin.

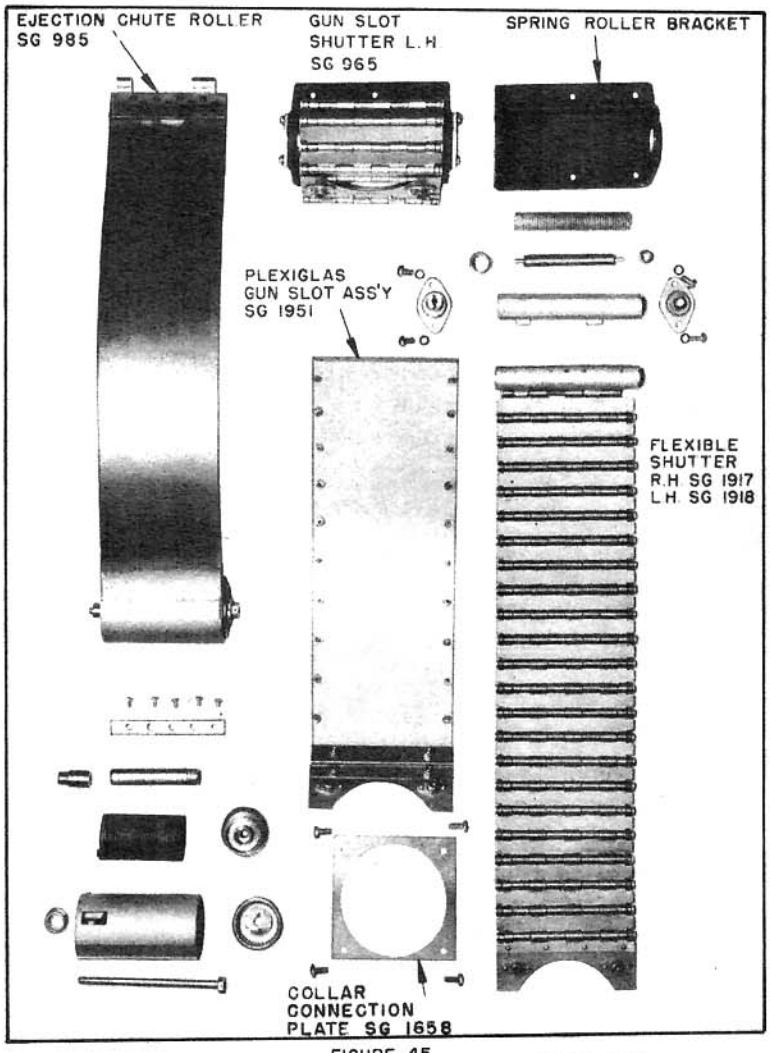


FIGURE 45
EJECTION CHUTE ROLLER, GUN SLOT SHUTTER AND PLEXIGLAS GUN SLOT ASSEMBLIES

(2) Installing and Aligning Guns. - (a) Set the guns in place and fasten the front trunnion screws.

(b) Bolt the rear trunnion in place with the bolt, nut and cotter key supplied for this purpose. (See Figure 44.)

(c) With the turret in the test stand, the guns may be conveniently and accurately aligned in the following manner:

1. Level the turret in the test stand, using the top rim of the unit housing as the base.

2. Level the guns in both directions by placing a spirit level on the top and side plates, respectively, of the guns.

3. Adjust at rear trunnions until the guns are level.

4. Reassembly of Turret (Cont'd.)

(d) If the guns are being aligned while the turret is in the airplane, refer to Section I, paragraph 7.

(3) Ejection Chute Roller Hinge. - (a) After rear trunnion has been adjusted, attach ejection chute roller hinge (SG 985 and SG 985-1) to rear of gun yoke by means of a bolt (1/4", 3-1/2") and washer and locknut (see Figure 45).

(4) Aligning Adjustable Couplings. - (a) Carefully flex left and right gun so that the yoke is not strained or twisted. In this manner place front and rear trunnion mountings in approximately the same plane and carefully align the adjustable cross shaft coupling (SG 169-1), see Figure 37) to the nearest 2 holes on the left hand cross shaft flange (SG 1112-1).

(b) Couple together with a bolt (1/4"-28, 5/8") and elastic stop nut.

i. Stage 8.

(1) Control Adjustments.

(a) Hand Control Unit. - 1. Attach hand control assembly (SG 986) to center rail (SG 1913) with 4 bolts (10-32, 1"), using 2 washers and an elastic stop nut for each bolt. (See Figure 4.)

(b) Swivel Assembly. - 1. Align swivel assembly (SG 1847) (see Figure 7) on control rods with bell crank (SG 1355) attached to centralizing spring (SG 995). (See Figure 9.)

2. Then attach by slipping bushing of swivel on to bell crank. The position of the swivel is determined at final adjustment of the turret. (See paragraph 5.b.)

3. Hold swivel in place with the nut and jam nut.

4. The above procedure applies to either azimuth or elevation assemblies.

(c) Azimuth Adapter Gear Box. - 1. Mount azimuth adapter gear box (SG 958) to azimuth gear box assembly (SG 951) by means of studs in the azimuth gear box. (See Figure 17.)

2. Place gasket (SG 1097) between azimuth gear box and the adapter gear box and secure with three 10-32 elastic stop nuts and washers.

3. Place fire cut-off and limit stop unit adapter coupling (see Figures 13 and 17) on shaft of the adapter gear box.

(d) Fire Cut-Off and Limit Stop Unit. - 1. Seat fire cut-off and limit stop unit on its 4 mounting pads, carefully fitting the couplings of the unit to the couplings of the double power unit and the adapter gear box coupling.

a. Adjust coupling on shaft (SG 1086) (Figure 17) so that there will

4. Reassembly of Turret (Cont'd.)

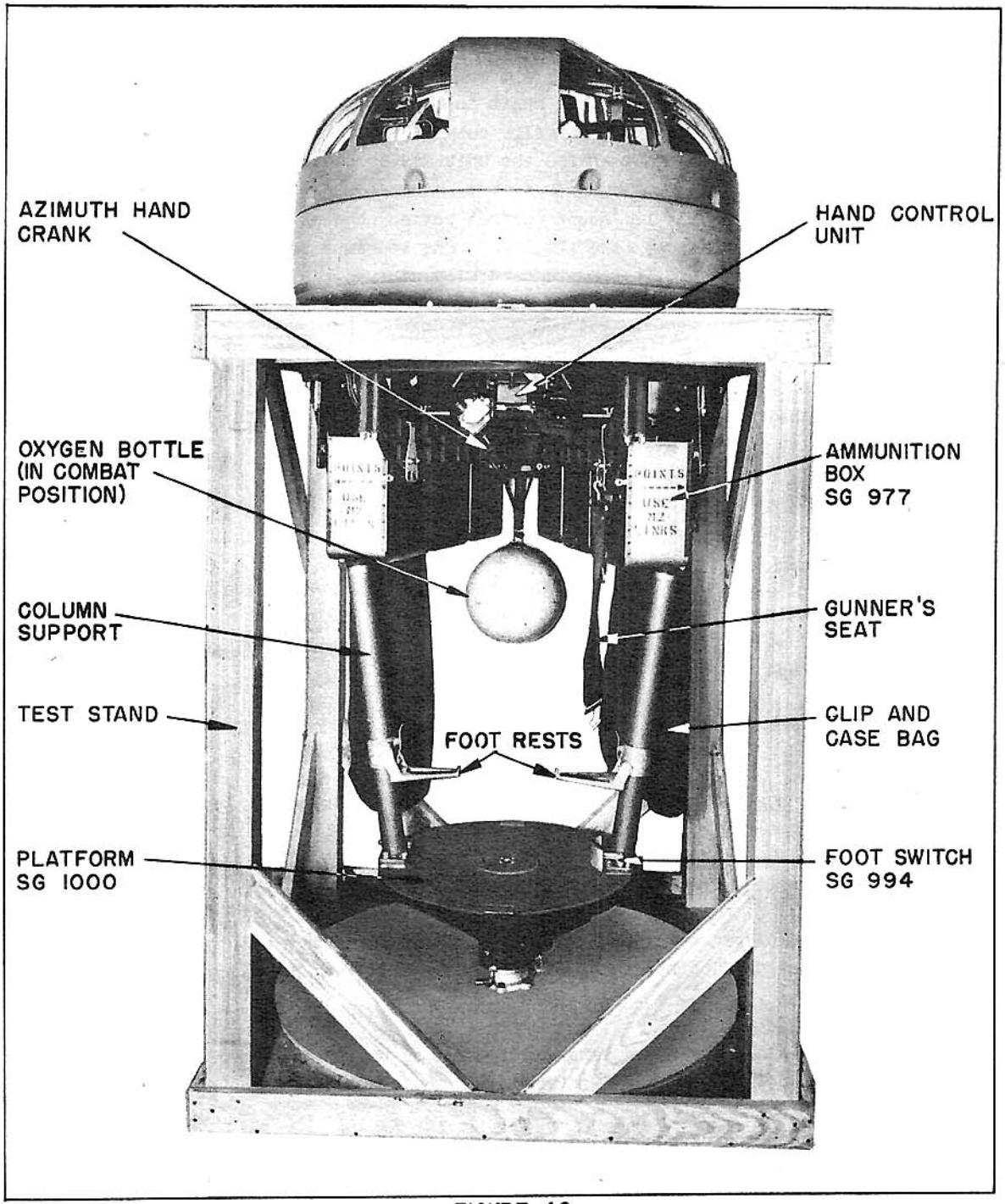


FIGURE 46
UPPER TURRET IN TEST STAND

4. Reassembly of Turret (Cont'd.)

be 1/64" clearance between the fire cut-off unit coupling and the adapter gear box coupling. Then pin the adapter gear box coupling to shaft (SG 1086).

b. Fasten the fire cut-off and limit stop unit to its mounting pads on the double power unit with 4 screws (5/16"-18, 5/8").

c. Connect flexible shaft to connection on elevation gear box (see Figure 19) but do not connect it to the fire cut-off and limit stop unit until the limit stop adjustment has been made. Otherwise the unit may be damaged.

(e) Control Box. - 1. Mount control box on control box bracket (SG 1276) by means of 4 fillister head screws (1/4"-20, 5/8") and lockwire them. (See Figure 4.) When mounting the control box, move it forward carefully so that the shafts to fire cut-off and limit stop unit will not be damaged.

2. Remove control box cover and loosen the 2 elastic stop nuts on the hexagon-shaped shafts in the control box. Then adjust both eccentric gears (see Figures 4 and 9) so that their slots are horizontal. The tools and method for making this adjustment are illustrated in Figure 4.

3. Align ball and socket joint on the vertical control rods with ball on centralizing spring assembly (SG 985). (See Figure 9.)

a. Secure ball in ball and socket joint with retainer and cotter pin.

NOTE: Do not tighten check nuts until final adjustment has been made. (See paragraph 5.b.)

j. Stage 9.

(1) Oxygen System. - (a) The yoke assembly for the oxygen system is fastened to the turret with 4 bolts (1/4"-28, 1-1/2"), using 2 washers and elastic stop nut for each bolt. Two of these bolts pass through the sight link anchor bracket, while the other 2 pass through the shell roller brackets, as described in paragraph 4.b.(6).

(b) The oxygen regulator bracket (SG 1448) is attached to the inside of the right hand unit housing support with 2 bolts (10-32, 3/4") and 2 washers and elastic stop nuts.

1. The oxygen regulator is mounted on the bracket with the 3 fillister head screws (6-32, 3/4") which are furnished with the regulator.

(c) Check the oxygen piping system for freedom from grease, oil and other foreign matter before assembly. To provide a rigid support, the oxygen piping system is fastened at 3 different places, as follows:

1. On the outside of the turret, at the filler valve junction, the piping

4. Reassembly of Turret (Cont'd.)

is clamped under bracket (SG 1447). The bracket is fastened to the right hand unit housing support with 2 bolts (10-32, 3/4") and 2 washers and elastic stop units.

2. On the inside of the turret the tubing is clamped under bracket (SG 755-5), which is fastened to the sight link anchor bracket with a fillister head screw (10-32, 1/2"). A washer nut and elastic stop nut are used for each screw.

3. On the inside of the turret the tubing is placed under clamp (SG 1465), which is fastened to one of the bolts which hold the yoke assembly to the "A" frame.

(d) After assembly all of the oxygen system shall be checked for leakage in accordance with approved specifications for a low pressure system (450 pounds).

CAUTION: ALL OF THE TUBING IS MADE OF ALUMINUM AND CARE SHOULD BE TAKEN NOT TO OVER-TIGHTEN THE JOINTS. THE JOINTS SHOULD BE LUBRICATED ONLY WITH AN AIR CORPS APPROVED LUBRICANT. IT IS BETTER TO USE NO LUBRICANT THAN TO USE THE WRONG LUBRICANT.

5. Final Adjustment in Test Stand.

a. General Precautions.

(1) General. - (a) The following precautions apply at any time the upper turret is in operation. While they are repeated at various stages of the operation, assembly and adjustment instructions, they are stated in this section before final adjustments are made as a general guide for personnel working on the turret.

1. Do not operate the turret under power unless the azimuth and elevation clutches are engaged and the handcranks are disengaged. Do not disengage until after the power clutches have been engaged.

2. Do not operate the guns in elevation with the flexible shaft input from the elevation gear box connected to the fire cut-off and limit stop unit unless the shaft is adjusted to the 0° to 85° elevation setting of the limit stop.

3. Do not run the guns beyond their limits in elevation.

4. When the sight is installed, do not operate the turret under power or by hand with the sight switch "off".

5. Be careful not to interchange the elevation and azimuth flexible shaft connections to the sight. The elevation flexible shaft coupling and input on sight are painted red.

6. Do not remove or replace any electrical connections in the main switch and junction box or the platform unless the main power input to the turret is disconnected.

7. Be sure that the breather cups on the double power unit are always 1/4

5. Final Adjustment in Test Stand (Cont'd.)

full of clean Univis No. 40 oil.

8. Take particular care not to permit any dirt or other foreign matter to enter the oxygen system or the double power unit.

b. Neutral Position.

(1) Hand Control Unit. - (a) Set the hand control unit so that it is in the neutral position in azimuth and elevation.

1. The neutral elevation position is determined by having the yoke in its vertical position.

2. The neutral azimuth position is determined by lining up the center of travel between the 2 stops with the screw head on the rear of the unit.

(2) Centralizing Springs. - (a) With the hand control in neutral position, adjust the lengths of the linkages from the hand control unit so that the bushings in the swivels on the linkages line up with the threaded arms of the centralizing springs. (See Figures 7 and 9.)

(b) Fit threaded arms through bushings in the swivels and tighten with 2 nuts and washers.

(c) Tighten locknuts on the linkages so that length adjustment will be held.

(3) Control Box. - (a) With hand control unit still in its neutral position, loosen the 2 elastic stop nuts in the control box and set both eccentric gears so that their slots are horizontal (see Figure 4). The parallel holes in the gear will be found an additional help in making the horizontal adjustment.

(b) Align ball sockets on control box rods with the ball shaped pins on the centralizing springs. (See Figure 9.)

(c) Tighten slotted screw to seat ball firmly without binding and then insert a cotter pin.

(4) Elevation Limit Stop Adjustment. - (a) Set according to Section II, 1. d.

NOTE: Before connecting the elevation flexible shaft to the fire cut-off unit, be sure that the 3 retainer screws on the adjustable elevation worm wheel which operates the lever assembly in the fire cut-off and limit stop unit are loosened. (See Figure 5.)

c. Backlash Inspection.

(1) General. - (a) The overall backlash of the power drives should not exceed 5 mils in azimuth or elevation.

(b) Check of overall backlash should be made after the turret has been com-

5. Final Adjustment in Test Stand (Cont'd.)

pletely assembled, according to the following procedure.

NOTE: Power clutches should be engaged and all power should be off.

1. Grasp guns at rear ends and push guns up and then down, measuring the travel of the guns at the barrel end. Gun muzzle backlash gauge T-44054 will be found useful in measuring the backlash.

CAUTION: DO NOT FORCE GUNS BEYOND NORMAL LIMITS OF TRAVEL.

2. The total distance traveled by the barrel should not be less than 1/16", nor more than 5/32".

3. If the backlash is not within the tolerances specified, loosen the screws in the "A" frame (see Figures 1 and 44) and move up or down to correct backlash error.

4. If the backlash cannot be corrected with the above method, the trouble must be corrected in the elevation gear box train.

5. Using the same procedure as for elevation, check the azimuth backlash by moving the guns to right and then to the left. The travel should be a minimum of 1/16" and a maximum of 5/32".

6. If the tolerances specified for azimuth backlash are exceeded, loosen 4 nuts on the studs holding right angle drive (Figure 14) to the unit housing. Then looser transmission gear box (Figure 16) and adjustable brace on double power unit (Figure 39) and shift entire assembly away from or against ring gear so that azimuth drive pinion (Figure 17) engages internal ring in a manner that will correct the backlash error. Then tighten all nuts which were loosened.

d. Inspection Check. - (1) Using Inspection Check (see paragraph 6.), make a general and functional check of the turret and its assemblies.

(a) Power consumption under Functional Inspection, paragraph 6., Item No. 1, should not exceed the following values of current at 27.5 volts:

No load - 40 Amps.
Azimuth Full Rate - 50 Amps.
Elevation Full Rate - 50 Amps.
Azimuth and Elevation Full Rate - 60 Amps.

(b) Under Item No. 2 the following minimum rates should be obtained:

(A) 45 Deg./Sec. = 8 Sec./Rev.
(B) 45 Deg./Sec. = 8 Sec./Rev.
(C) 30 Deg./Sec.
(D) 30 Deg./Sec.

e. Flexible Shafts for Sight. - (1) Connect elevation flexible shaft for sight to the coupling on the fire cut-off and limit stop unit. (See Figure 11). The coupling to sight is painted red.

(2) Connect azimuth flexible shaft to sight to the coupling on the azimuth gear box. (See Figure 17.)

6. INSPECTION CHECK

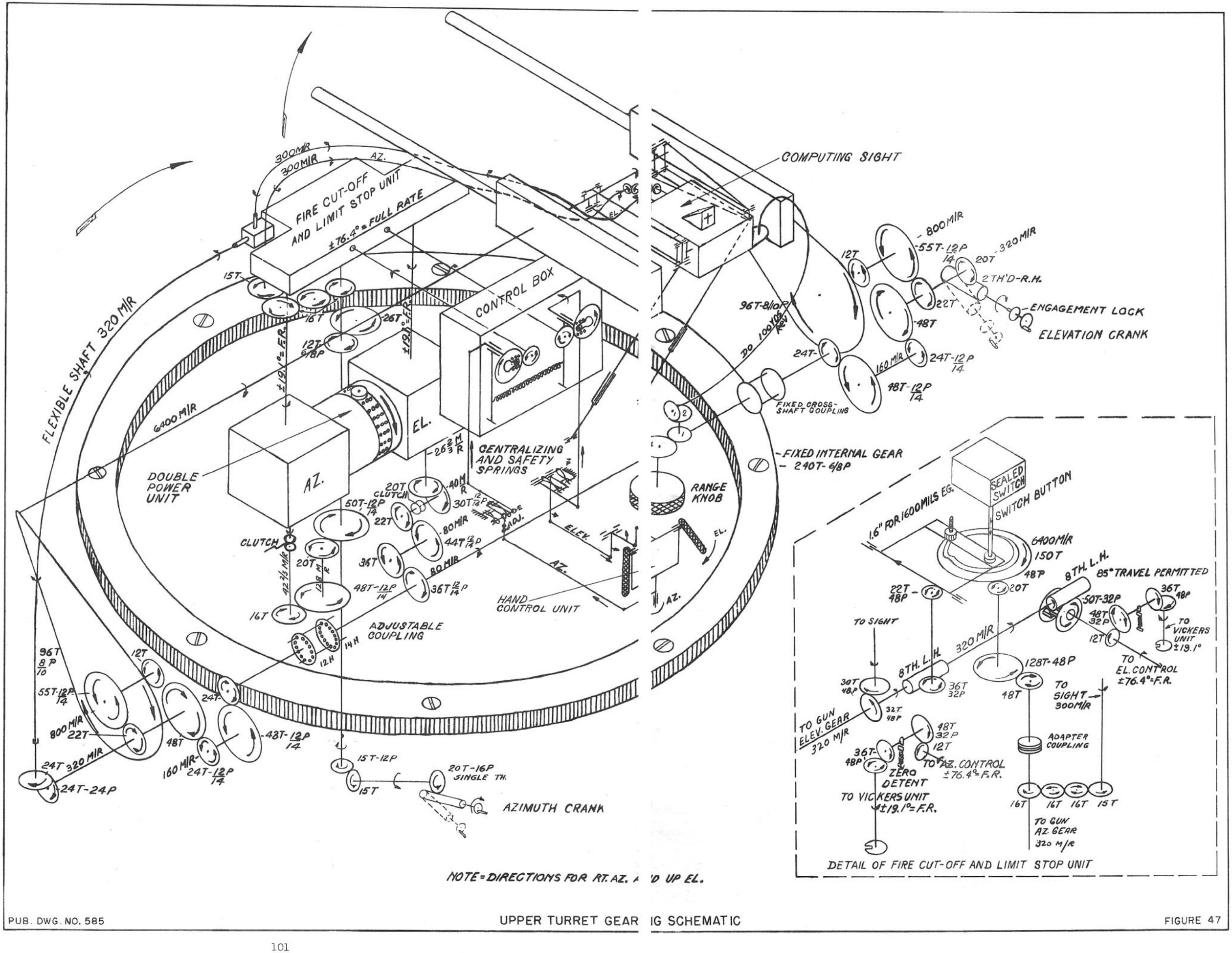
GENERAL INSPECTION

Following Items Checked for Completeness, General Workmanship, and Finish, all Bolts, Nuts, Covers, etc., to Determine whether Properly Wired, Keyed or Locked.

Item No.	Name
1	Turret Structure
2	Protective dome-shutters, mounting studs and nuts
3	Gun yokes and mountings
4	Ammunition boxes
5	Ammunition feed chutes, guides and ejection chutes
6	Firing solenoids and adapters
7	Hand charger, cable and pulleys
8	Electro-hydraulic power unit and gearing
9	Turn index marks for azimuth and elevation
10	Hand Control and firing keys
11	Mounting bracket for automatic sight
12	Fire cut-off and limit stop
13	Slip rings, junction boxes, conduits and terminals
14	Oxygen filler valve, mounting brackets and piping, oxygen valve and regulator
15	Telephone wiring, switch and jacks
16	Manual operation. Check operation of hand cranks and clutches in azimuth and elevation

FUNCTIONAL INSPECTION

Item No.	Name	
1	Power Consumption (No load)	V.
		A.
	Power Consumption (Azimuth)	V.
		A.
	Power Consumption (Elevation)	V.
		A.
	Power Consumption (Az.&Elev.) Combined Load	V.
		A.
2	(A) Speed of operation Az.-Deg./Sec. C.W.	
	(B) Speed of operation Az.-Deg./Sec. C.C.W.	
	(C) Speed of operation Deg./Sec. - Up	
	(D) Speed of operation Deg./Sec. - Down	
3	Limit of travel in elevation	Degs.
4	Functioning of parts, operating controls, switches, proper and smooth function of turret equipment	
5	Regularity of drive; check for detrimental over-run and creep	
6	Total backlash (azimuth)	
7	Total backlash (elevation)	



NOTE = DIRECTIONS FOR RT. AZ. A[illegible]'D UP EL.

PUB. DWG. NO. 585

UPPER TURRET GEAR [illegible]IG SCHEMATIC

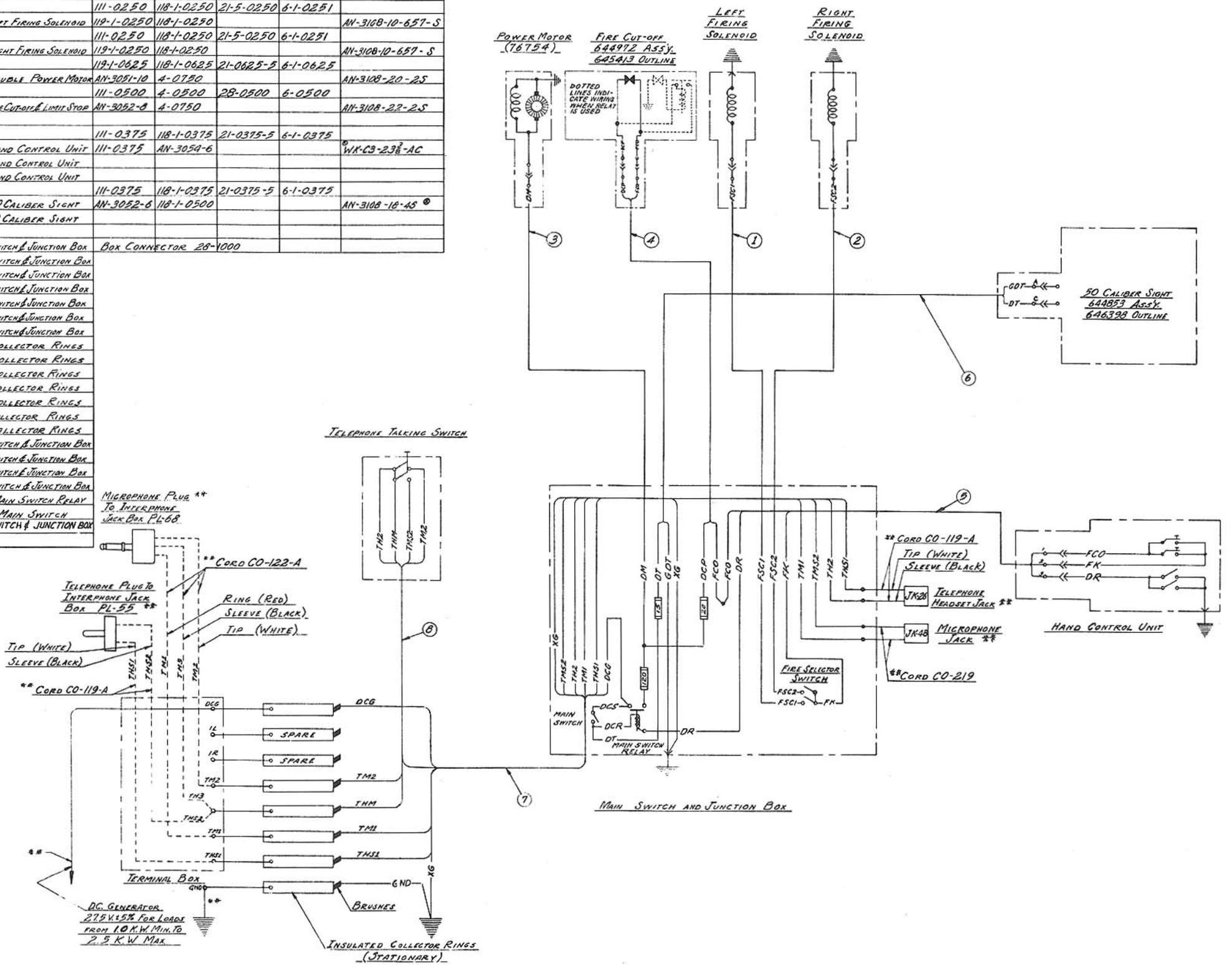
FIGURE 47

Cable No.	Wire Symbol	Wire Size	Eng. Contact No.	Conduit Size *	Conduit Length Inches	FROM	TO	Ferrule	Coupling Nut	Coupling	Lock-Nut	Plug
1	FSC1	16		101-0250	18	Switch & Junction Box		111-0250	118-1-0250	21-5-0250	6-1-0251	
							Left Firing Solenoid	119-1-0250	118-1-0250			AN-3108-10-657-S
2	FSC2	16		101-0250	78	Switch & Junction Box		111-0250	118-1-0250	21-5-0250	6-1-0251	
							Right Firing Solenoid	119-1-0250	118-1-0250			AN-3108-10-657-S
3	DM	2		101-0625	30	Switch & Junction Box		119-1-0625	118-1-0625	21-0625-5	6-1-0625	
							Double Power Motor	AN-3081-10	4-0750			AN-3108-20-2S
4	DCP	10	C	101-0500	33	Switch & Junction Box		111-0500	4-0500	28-0500	6-0500	
	FCO	10	B			Hand Control Unit Thru Switch & Junction Box	Fire Cut-off & Limit Stop	AN-3052-8	4-0750			AN-3108-22-2S
	Open		A									
5	FCO	10	1	101-0375	25	Thru Switch & Junction Box		111-0375	118-1-0375	21-0375-5	6-1-0375	
							Hand Control Unit	111-0375	AN-3054-6			⊛WK-C3-23⅜-AC
	FK	12	2			Switch & Junction Box	Hand Control Unit					
	DR	20	3			Switch & Junction Box	Hand Control Unit					
6	DT	16	C	101-0375	79	Switch & Junction Box		111-0375	118-1-0375	21-0375-5	6-1-0375	
							50 Caliber Sight	AN-3052-6	118-1-0500			AN-3108-16-4S ⊛
	GDT	16	A			Switch & Junction Box	50 Caliber Sight					
	Open		B									
7	THS1	20 Shielded		Turret Structure		Collector Rings	Switch & Junction Box	Box Connector 28-1000				
	TM1	20				Collector Rings	Switch & Junction Box					
	TMS2	20				Collector Rings	Switch & Junction Box					
	TH2	20				Collector Rings	Switch & Junction Box					
	DCG	0				Collector Rings	Switch & Junction Box					
8	TH2	20		None		Telephone Talking Switch	Switch & Junction Box					
	TMS2	20				Telephone Talking Switch	Switch & Junction Box					
	THM	20				Telephone Talking Switch	Collector Rings					
	TM2	20				Telephone Talking Switch	Collector Rings					
CO122A	TM2	20				Microphone Plug 68	Collector Rings					
	TM1	20				Microphone Plug 68	Collector Rings					
	TH3	20				Microphone Plug 68	Collector Rings					
CO119A	THS2	20				Telephone Plug 55	Collector Rings					
	THS1	20				Telephone Plug 55	Collector Rings					
CO-219	TMS2	20				Microphone Jack JK-48	Switch & Junction Box					
	TM1	20				Microphone Jack JK-48	Switch & Junction Box					
CO119A	TH2	20				Telephone Jack JK-26	Switch & Junction Box					
	THS1	20				Telephone Jack JK-26	Switch & Junction Box					
Main Switch	DCS	14				Main Switch	Main Switch Relay					
	DCR	14				Main Switch Relay	Main Switch					
7	XG	8		Turret Structure	76	Collector Rings	Switch & Junction Box					

NOTES:-

* All Conduits are "Breeze" Flex. Alum. with Copper Wire Braid
All Conduit Fitting Designations - Except "AN" are Breeze Catalog Numbers
⊛ Cannon Plug
⊗ Except Angle Plug Shell to be Replaced by Special Shell Drawing SG. #1663
** To be Furnished by Plane Manufacture

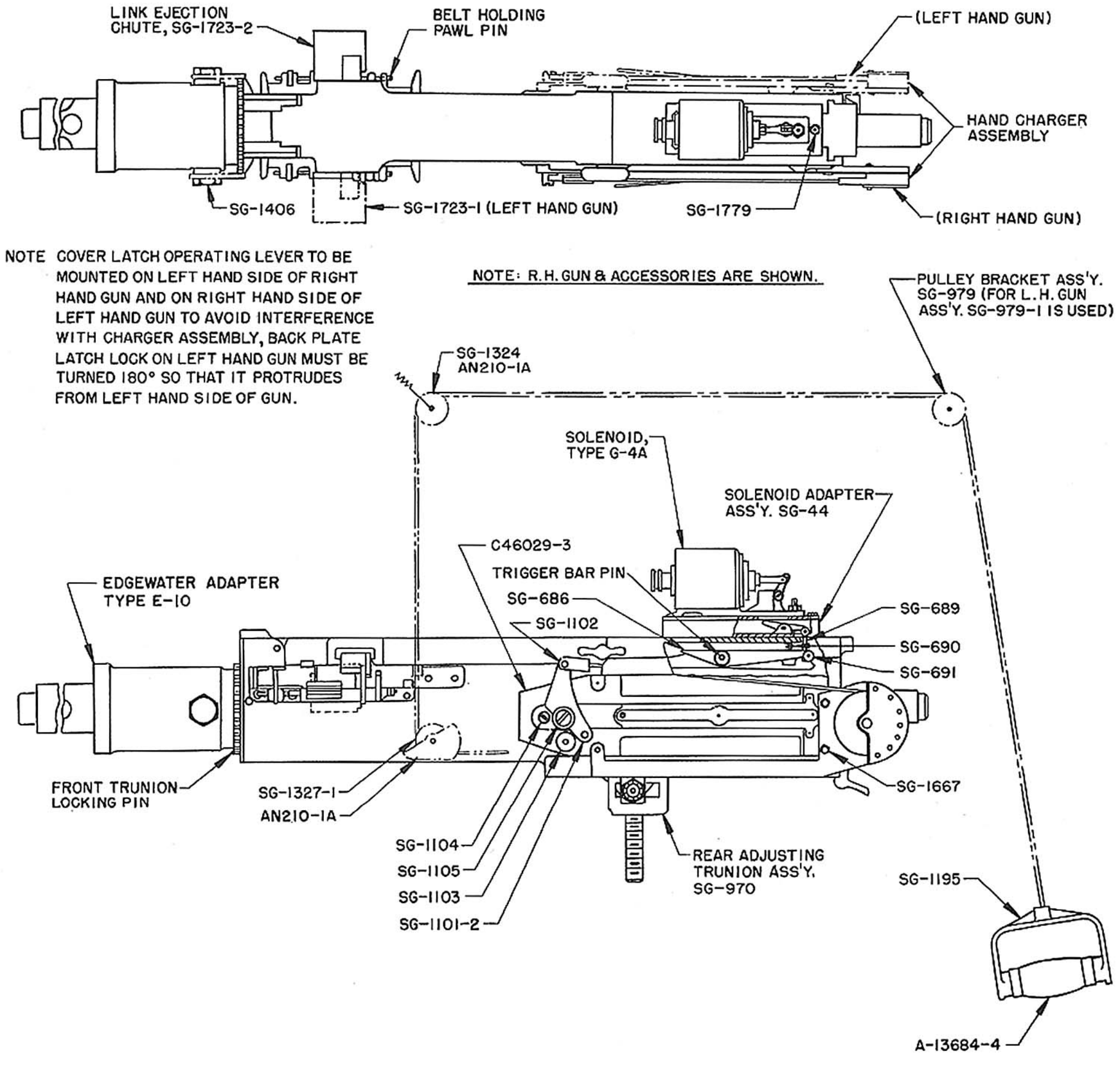
All Wires shall be Marked as shown using one turn of white adhesive tape on both ends of each wire and using a rubber stamp or india ink (free hand) to mark the wire designation. Protect the tape and marking with one coat of clear varnish or lacquer (avoid smearing ink). Apply Red Glyptal Lacquer to ends of all terminal Leads after wiring.



PUB. DWG. NO. 586

UPPER TURRET INSTALLATION WIRING DIAGRAM

FIGURE 48



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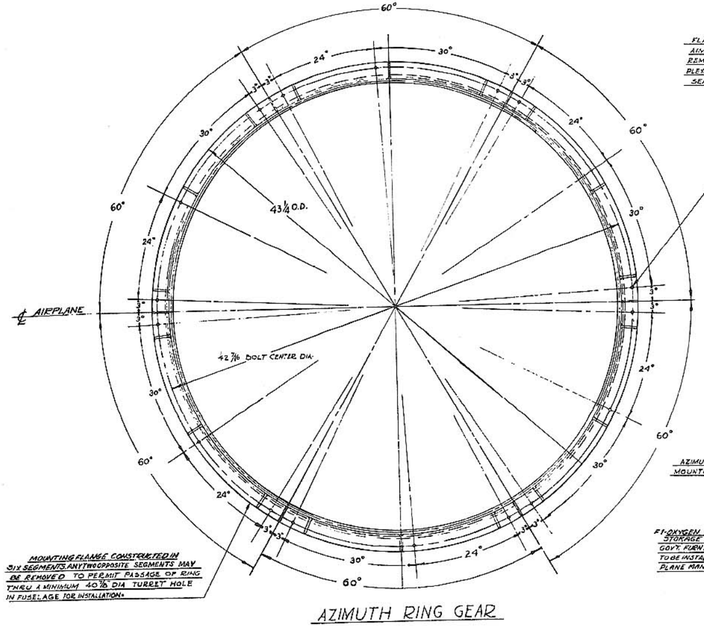
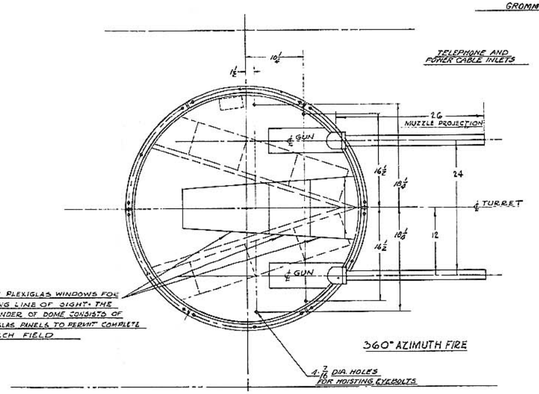
MOUNTING OF GUN ACCESSORIES

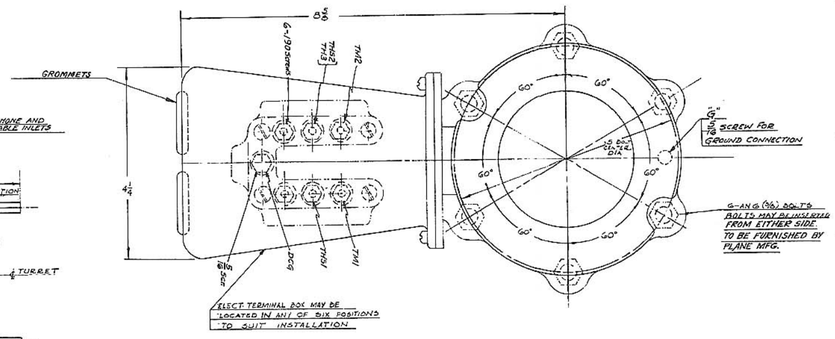
FIGURE 49

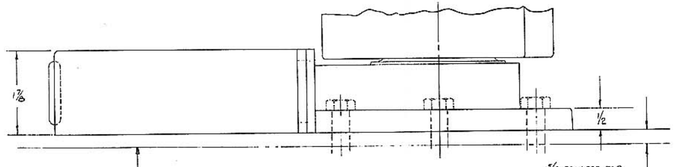


AZIMUTH RING GEAR

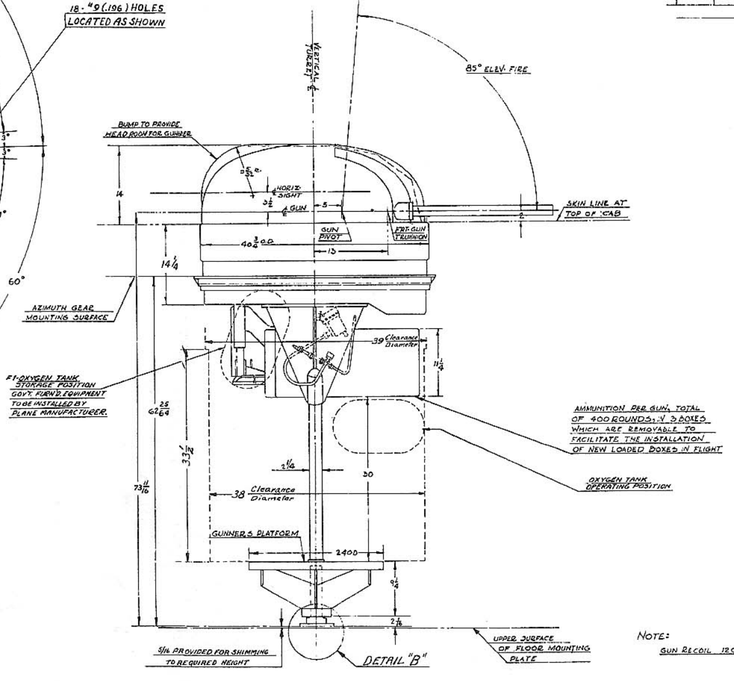


360° AZIMUTH FIRE



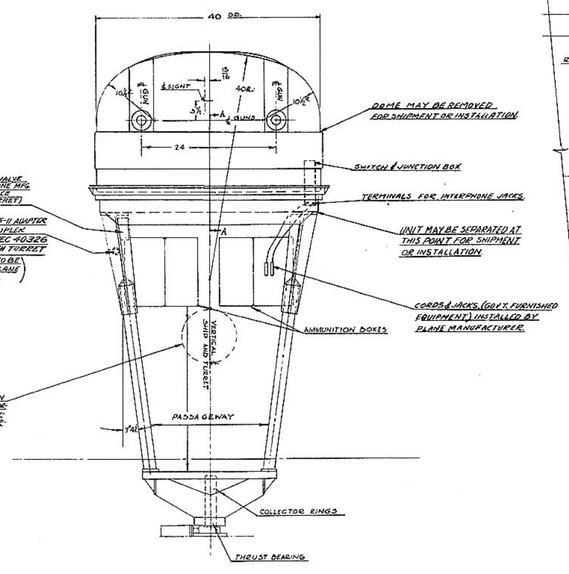


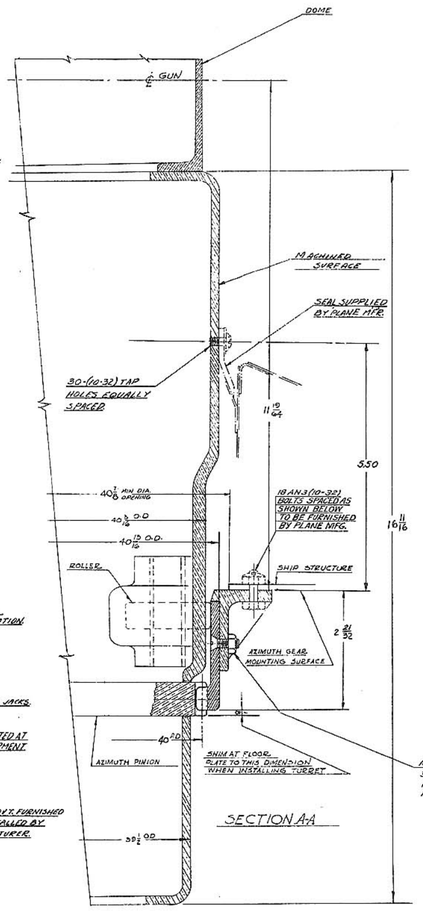
DETAIL "B"



DETAIL "B"

NOTE:
GUN RECOIL 1800 LBS PER GUN MAX.





SECTION A-A

WEIGHT 1015 #
(INCLUDING AMMUNITION)

PUB. DWG. NO. 464

INSTALLATION AND OUTLINE—UPPER LOCAL CONTROL TURRET

FIGURE 50

SECTION IV

PART LIST

FOR THE

SPERRY UPPER LOCAL TURRET

SPERRY GYROSCOPE COMPANY, Inc.
MANHATTAN BRIDGE PLAZA
BROOKLYN, NEW YORK

INTRODUCTION

This Parts List contains all the replaceable parts for the Sperry Upper Local Turret.

The parts are grouped by assembly and sub-assembly. A drawing of the assembly, and a list of parts giving the name, part number, and quantity required are included for each assembly. The system of indentation used throughout the Parts List shows the relationship of the detail parts to the sub-assemblies and assemblies, and the relationship of the sub-assemblies to the main assembly.

By means of a symbol each illustrated part is indentified with the assembly drawing and description of the part. THE SYMBOL IS TO BE USED ONLY FOR IDENTIFICATION OF THE CORRECT PART NUMBER AND DESCRIPTION. THE PART NUMBER AND DESCRIPTION MUST ALWAYS BE USED FOR INQUIRIES AND ORDERS. All part ordering numbers are Sperry Gyroscope Company except those prefixed by the letters V or SG as V-56663 or SG-956 which are respectively Vickers Incorporated, Detroit Michigan, and Steel Products Engineering Co., Springfield Ohio, part ordering numbers.

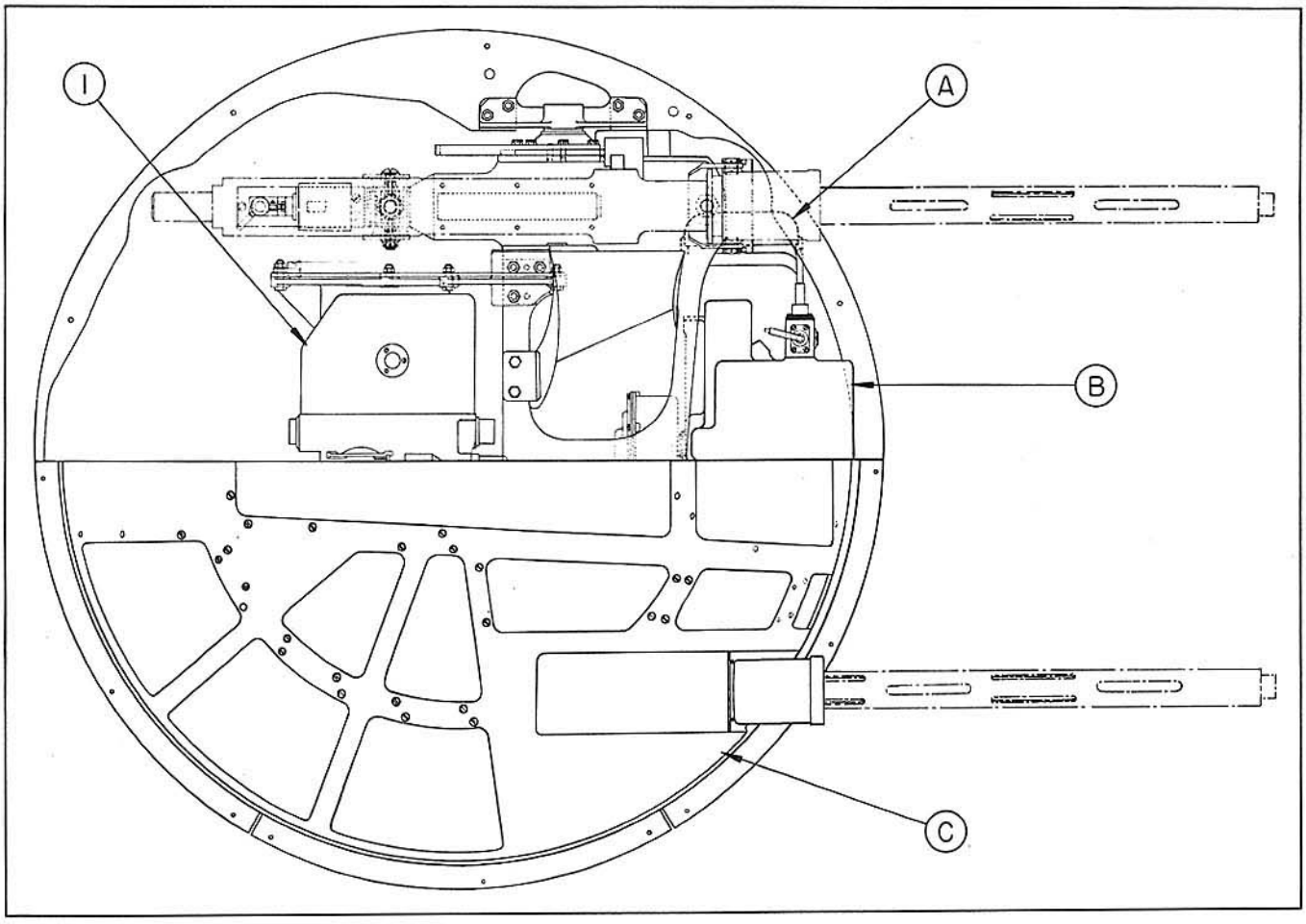
Letters are used as symbols in place of numerals where a separate drawing has been prepared. Double letters indicate the assembly appears on the same sheet. Single letters indicate the assembly is shown on a separate sheet. For list of assemblies and order of arrangement see the following sheet.

Standard size screws, nuts, lockwashers, washers, and pins are not assigned part numbers. On inquiries or orders the dimensions must always be given.

LIST OF ASSEMBLIES AND ORDER OF ARRANGEMENT

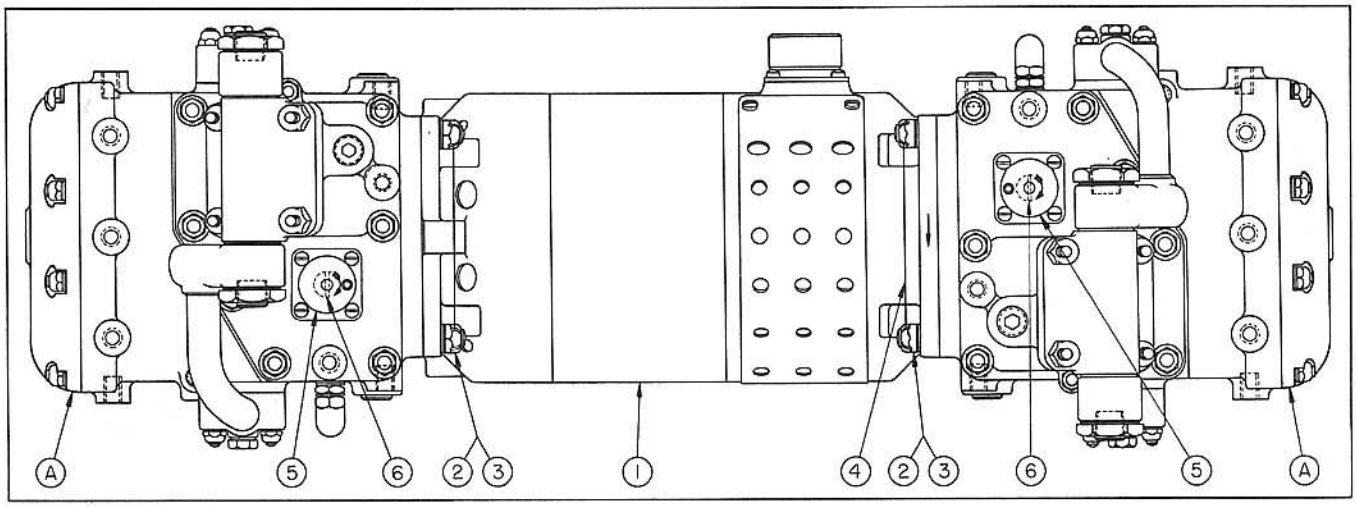
Part Number	Description (1 2 3 4)	Ref. Page No.
644961	Turret & Controls Ass'y., Upper Local	1-40
645167	Power Unit Ass'y., Double	1-6
645176	Transmission Ass'y.,Variable Speed	3-6
V-56583	Housing, Sleeves & Studs Ass'y.	3-5
V-56663	Pump Ass'y., Control	6
644972	Fire Cut-Off & Limit Stop Ass'y.	7-10
801825	Bracket Ass'y., Elevation Rate	7-9
802011	Bracket Ass'y., Azimuth Rate	7-9
78343	Bracket Ass'y., Switch	7-9
77052	Cut-Off Ass'y., Fire	10
644928	Turret Ass'y., Upper Local	11-40
SG-958	Box Ass'y.,Az.Control & Sight Drive Gear	11-20
SG-968	Drive Ass'y., Right Angle	11-20
SG-994	Switch Ass'y., Foot	11-20
SG-995	Crank & Neutralizing Unit Ass'y. Bell	11-20
SG-952	Box Ass'y., Terminal	11-20
SG-985	Roller Ass'y., Ejection Chute	11-20
SG-955	Box Ass'y., Elevation Gear (L.H.	21
SG-974	Drive Ass'y., Flexible Shaft	22
SG-956	Box Ass'y., Elevation Gear (R.H.	23
SG-967	Drive Ass'y., Azimuth Hand	24
SG-951	Case Ass'y., Azimuth Gear	25
SG-70	Box Ass'y., Transmission Gear	26
SG-957	Box Ass'y., Cross Shaft Gear	27
SG-934	Drive Ass'y., Elevation Hand	28
SG-973	Box Ass'y., Fire Cut-Off Control Unit	29
SG-986	Control Ass'y.,Az.,Elev.&Range Hand Control	30-31
SG-959	Dome Ass'y.	32-33
SG-953	Ring Ass'y., Slip	34
SG-939	Yoke Ass'y., Gun Mounting	35
SG-969	Box Ass'y., Junction	36-37
SG-1717	Panel Ass'y.	38-39
SG-1682	Conduit Ass'y., Power Unit	40
SG-1681	Conduit Ass'y., Gun Firing Solenoid	40
SG-1680	Conduit Ass'y., Gun Sight	40
SG-1683	Conduit Ass'y., Fire Cut-Off & Limit Stop	40
SG-1684	Conduit Ass'y., Hand Control	40

UPPER LOCAL TURRET AND CONTROLS ASS'Y. #644961-F



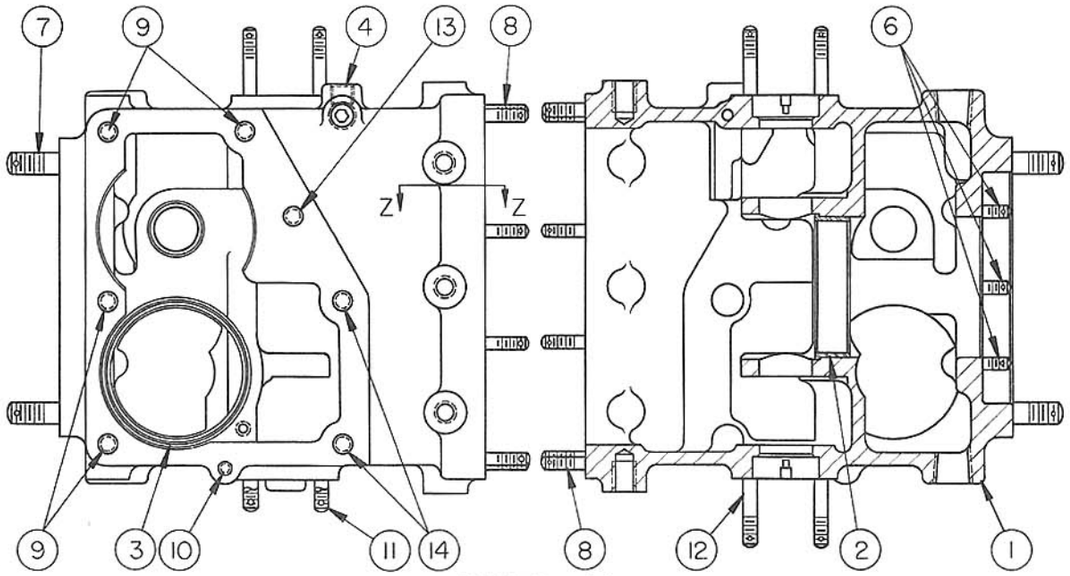
Symbol No.	Part Number	No. Req'd.	Description
-	644961-F	1	Turret & Controls Ass'y., Upper Local
A	645167-D	1	Power Unit Ass'y., Double (Vicker's Drawing No. 56412
B	644972-L	1	Switch Ass'y., Fire Cut-Off & Limit
C	644928-C	1	Turret Ass'y., Upper Local Control

DOUBLE POWER UNIT ASS'Y. #645167-D

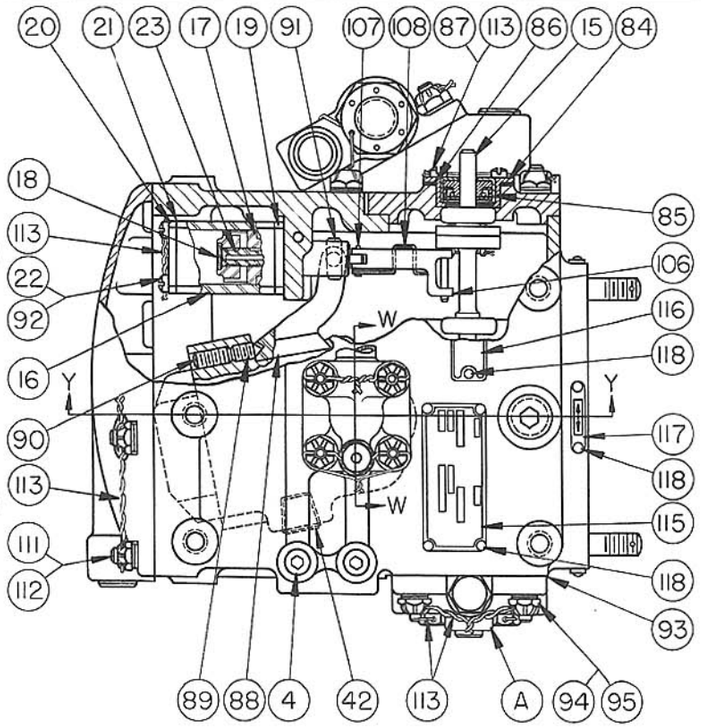


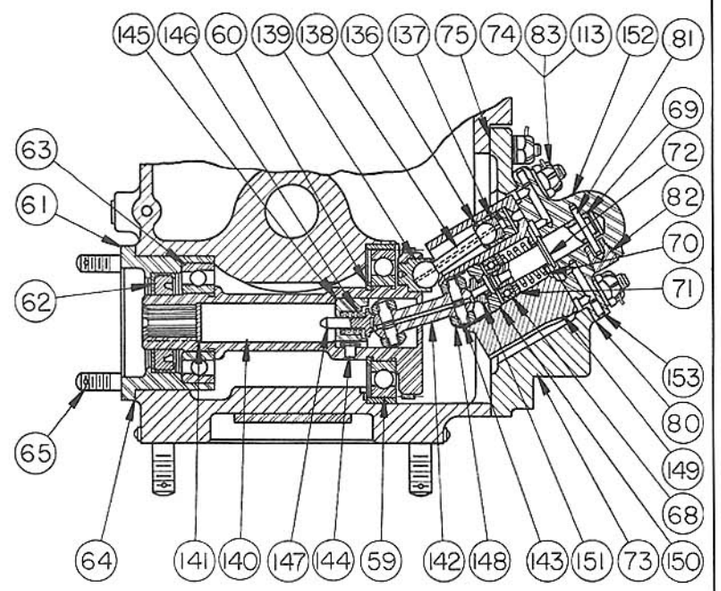
Symbol No.	Part Number	No. Req'd.	1	2	Description
-	645167-D				Power Unit Ass'y., Double
					(Vicker's Dwg.#56412
A	645176-E	2			Transmission Ass'y., V.S.
					(Vicker's #E-56413
1	76754	1			Motor, Double Spline Power
					(Diehl Type #DS-200, 2 H.P.
2		8			Nut(5/16"-24Hex.S.S.Castellated
3	54192	8			Washer
4					Lockwire(Use as Required
5	142267	2			Coupling Ass'y.
					Each Consisting of:
-	142268	1			Coupling
-	142269	1			Pin, Coupling
6		2			Pin, Taper (#6/0x1/2" S.S.

VARIABLE SPEED TRANSMISSION ASS'Y. #645176-E
(VICKERS DWG. #V-56413)

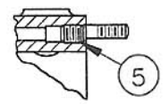


SYMBOL-AA

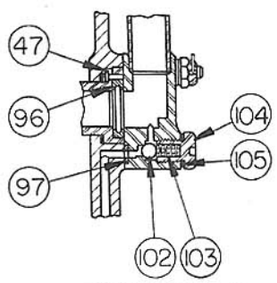




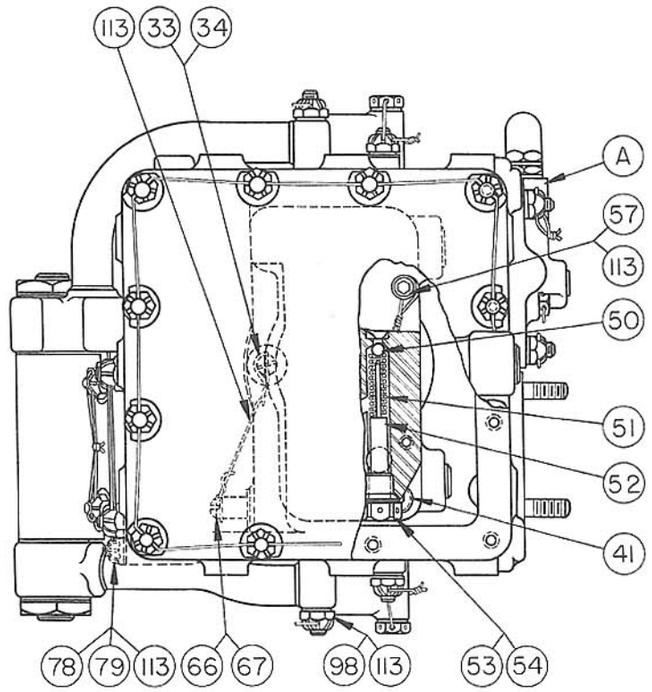
SECTION X-X

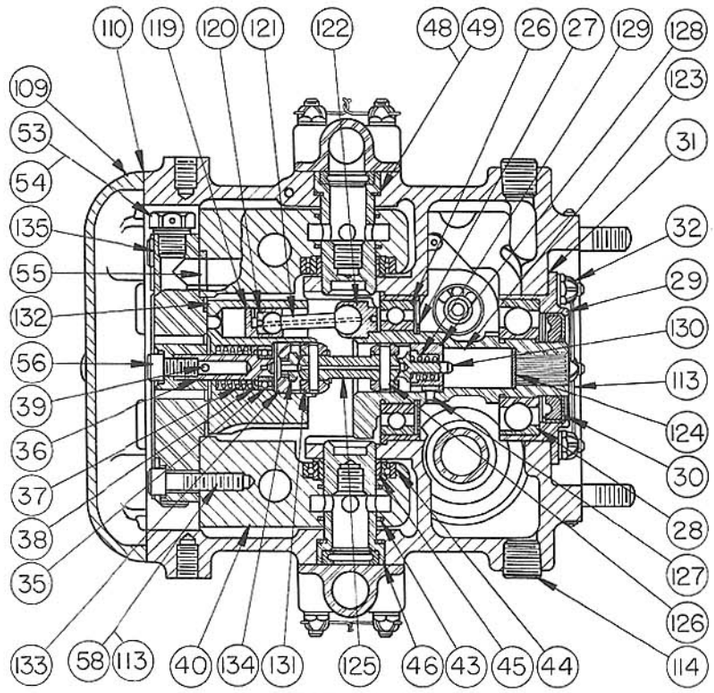


SECTION Z-Z

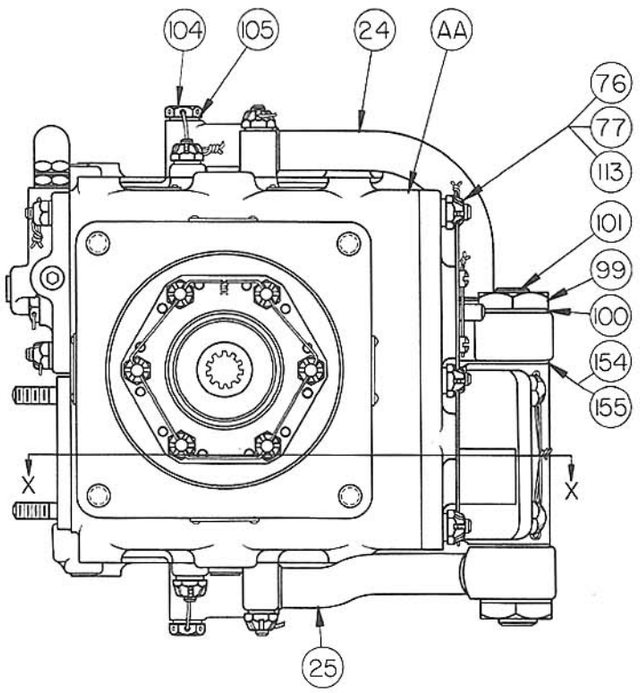


SECTION W-W





SECTION Y-Y



SECTION X-X

VARIABLE SPEED TRANSMISSION ASS'Y. #645176-E
(VICKERS DWG. #V-56413)
(CONTINUED)

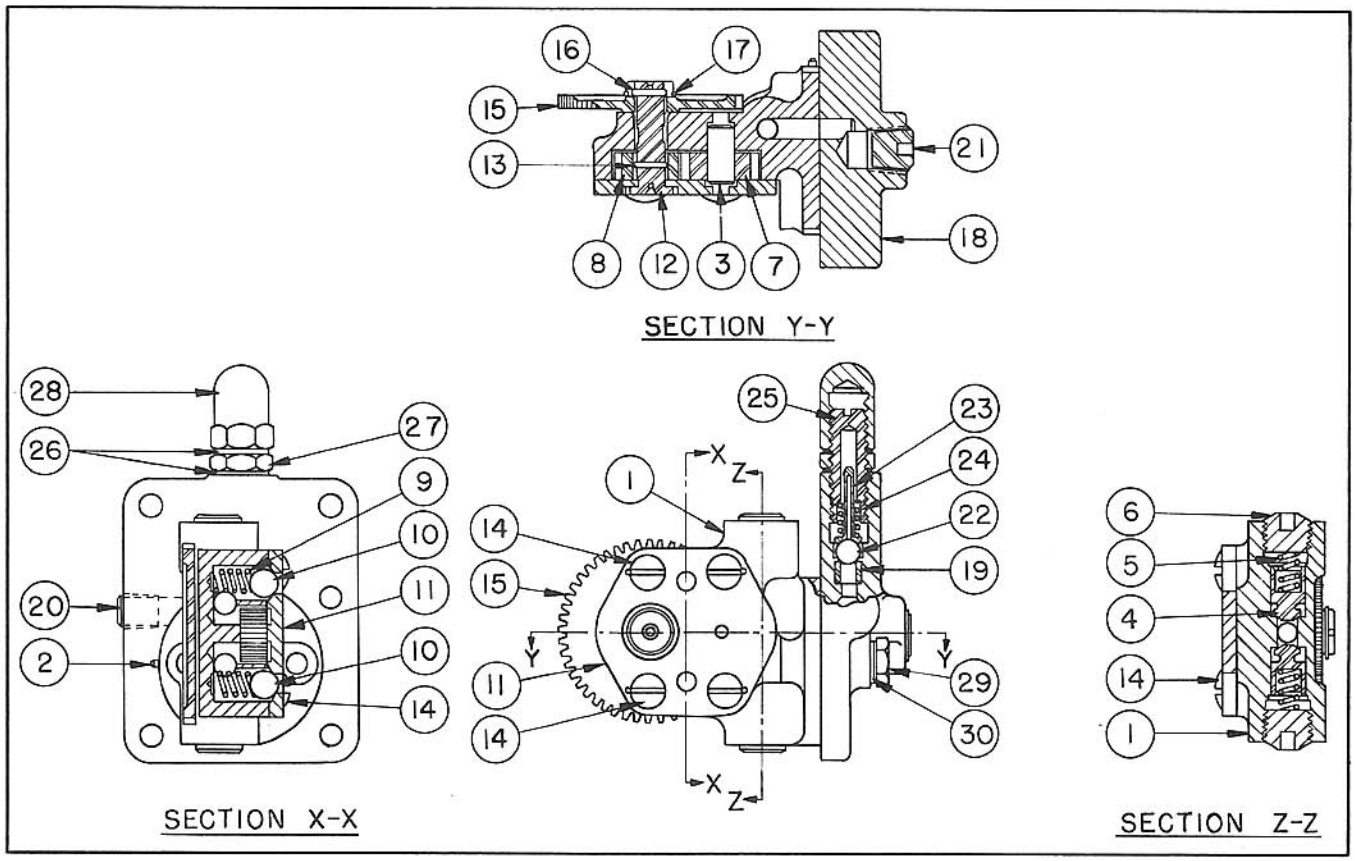
Symbol No.	Part Number	No. Req'd.	Description
			1 2 3 4
-	V-56413	1	Transmission Ass'y., V.S.
AA	V-56583	1	Housing, Sleeves & Studs Ass'y.
1	V-55717	1	Housing
2	V-51716	1	Sleeve, End Bearing
3	V-51717	1	Sleeve, End Bearing
4	V-41323	8	Plug
5	V-56234	1	Screw, Set
6	V-3X-51952	6	Stud, End Bearing Retainer
7	V-3X-56629	4	Stud, Mounting
8	V-3X51959	16	Stud
9	V-3X-51954	4	Stud, Side Cover
10	V-3X-56402	1	Stud, Side Cover
11	V-3X-56403	4	Stud, Flange (Short
12	V-3X-56401	4	Stud, Flange (Long
13	V-3X-59854	1	Stud, Side Cover
14	V-3X-63407	2	Stud, Side Cover
15	V-55146	1	Shaft Ass'y., Control
			Consisting of:
-	V-55144	1	Arm, Control Shaft Crank
-	V-55147	1	Pin, Crank Arm
-	V-55143	1	Shaft, Control
-	V-55145	3	Screw, Crank Arm
-	V-51636	1	Pin
-	V-48982	1	Lockwire(.0285"Dia.x2-1/2"lg.
-	V-39881	2	Bearing
A	V-56663	1	Pump Ass'y., Control
-	V-60754	1	Cylinder Ass'y., Control
16	V-60753	1	Cylinder, Control
17	V-56612	1	Piston, Control Cylinder
18	V-51840	1	Plug, Expansion
19	V-60752	1	Adapter, Control Cylinder
20	V-56327	1	Cover, Control Cylinder
21	V-56328	1	Gasket, Control CylinderCover
22	V-3X-56400	2	Screw
23	V-56613	1	Valve, Follow
24	V-3X-56484	1	Line Ass'y., Upper
			Consisting of:
-	V-56217	1	Flange
-	V-52430	1	Tube
-	V-56227	1	Fitting, Swivel
-	V-51479	1	Insert
25	V-3X-56483	1	Line Ass'y., Lower
			Consisting of:
-	V-56217	1	Flange
-	V-52431	1	Tube
-	V-56226	1	Fitting, Swivel
26	V-43626	1	Bearing, Drive Shaft
27	V-43603	1	Ring, Drive Shaft Snap
28	V-38571	1	Bearing, Drive Shaft

Symbol No.	Part Number	No. Req'd.	Description
			1 2 3 4
-			Transmission Ass'y., V.S.
29	V-51470	1	Retainer, Bearing
30	V-51756	1	Seal, "A" End Drive Shaft Oil
31	V-51554	1	Gasket, Bearing Retainer
32	V-3X-40665	6	Nut, Bearing Retainer Stud
33	V-56232	1	Screw, Bearing Retainer
34	V-56233	1	Washer, Bearing Retainer
35	V-42915	1	Bearing, Cylinder Block
36	V-51580	1	Pin, Cylinder Bearing
37	V-46750	1	Spring, Cylinder Bearing
38	V-46264	1	Retainer, Cylinder
			Bearing Spring
39	V-60391	1	Pin, Cylinder Bearing
			Pin Locking
40	V-51473	1	Yoke, Swivel
41	V-37829	4	Plug
42	V-38131	2	Plug
43	V-51593	4	Seal, Yoke
44	V-46488	2	Bearing, Pintle
45	V-51476	2	Sleeve, Pintle Bearing
46	V-56244	2	Pintle
47	V-56238	2	Pin, Pintle Locking
48	V-56240	2	Gasket, Pintle
49	V-64522		Gasket, Pintle(Use as req.
50	V-1649	2	Ball, Relief Valve
51	V-38259	2	Spring, Relief Valve
52	V-60281	2	Guide, Relief Valve Spring
53	V-66144	4	Plug, Valve Plate
54	V-53365	4	Gasket, Valve Plate Plug
55	V-66132	1	Gasket, Valve Plate
56	V-51579	1	Screw, Cylinder Bearing Pin
57	V-3X-51848	4	Screw, Valve Plate
58	V-3X-51849	2	Screw, Valve Plate
59	V-51181	1	Bearing, Drive Shaft
60	V-43603	1	Ring, Snap
61	V-51465	1	Retainer, Bearing
62	V-51737	1	Seal, "B" End Drive Shaft Oil
63	V-46168	1	Bearing, Drive Shaft
64	V-51559	1	Gasket, Bearing Retainer
65	V-3X-51960	4	Stud, Bearing Retainer
66	V-56233	1	Washer, Bearing Retainer
67	V-56232	1	Screw
68	V-42915	1	Bearing, Cylinder Block
69	V-46730	1	Pin, Cylinder Bearing
70	V-46750	1	Spring, Cylinder Bearing
71	V-46264	1	Retainer, Cylinder
			Bearing Spring
72	V-52951	1	Washer, "C"
73	V-51851	1	Cover, Side

VARIABLE SPEED TRANSMISSION ASS'Y.#645176-E
(VICKERS DWG. #V-56413)
(CONTINUED)

Symbol No.	Part Number	No. Req'd.	Description (1 2 3 4)
-			Transmission Ass'y., V.S.
74	V-3X46698	4	Stud, Valve Plate
75	V-56319	1	Gasket, Side Cover
76	V-3X51853	7	Washer, Side Cover Stud
77	V-3X34567	7	Nut, Side Cover Stud
78	V-3X51855	1	Washer, Side Cover Stud
79	V-3X40665	1	Nut, Side Cover Stud
80	V-46701	1	Gasket, Valve Plate
81	V-2464	1	Pin, Cylinder Bearing Pin Locking
82	V-3X41369	1	Plug, Locking Pin
83	V-3X34567	4	Nut, Valve Plate Stud
84	V-3X56231	1	Retainer, Oil Seal
85	V-53290	1	Seal, Control Shaft Oil
86	V-56230	1	Gasket, Oil Seal Retainer
87	V-3X56400	4	Screw, Oil Seal Retainer
88	V-56519	1	Arm, Yoke Control
89	V-17252	2	Screw, Set
90	V-51956	2	Screw, Set
91	V-56243	1	Tee, Yoke Control Arm
92	V-3X56399	2	Screw, Control Cylinder Mtg.
93	V-56326	1	Gasket, Control Pump Mtg.Cover
94	V-3X51855	4	Washer, Control Pump Stud
95	V-3X40665	4	Nut, Control Pump Stud
96	V-56215	2	Seal, Pintle
97	V-56214	2	Seal
98	V-3X40665	8	Nut, Flange
99	V-56248	2	Bolt, Swivel Fitting
100	V-49166	2	Gasket, Swivel Fitting
101	V-3X-7075	2	Plug
102	V-14371	2	Ball, Check Valve
103	V-56795	2	Spring, Check Valve
104	V-3X56246	2	Screw, Check Valve
105	V-56239	2	Gasket, Check Valve Screw
106	V-56635	1	Link, Follow Valve
107	V-56636	1	Pin, Follow Valve Link
108	V-56637	1	Spring, Pin Locking
109	V-56213	1	Cover, Rear
110	V-56249	1	Gasket, Rear Cover
111	V-3X51855	12	Washer, Rear Cover Stud
112	V-3X40665	12	Nut, Rear Cover Stud
113	V-48982	1	Lockwire(.0285"Dia.x120"lg.
114	V-38131	4	Plug
115	V-58552	1	Plate, Name
116	V-52948	1	Plate, Patent
117	V-56218	4	Plate, Rotation
118	V-44689	14	Screw, Plate

Symbol No.	Part Number	No. Req'd.	Description (1 2 3 4)
-			Transmission Ass'y., V.S.
-	V-67819	1	Group Ass'y.,"A" End Rotating
-	V-56607	1	Shaft & Pistons Ass'y.,"A" End
-	V-43586	7	Piston,Rod & Bearings Ass'y.
119	V-43595	1	Piston
120	V-43596	1	Bearing, Piston
121	V-43597	1	Piston, Rod
122	V-43598	1	Bearing, Piston Rod
123	V-56250	1	Shaft, Drive
124	V-41814	1	Plug, Expansion
-	V-43585	1	Link & Pins Ass'y., Universal
125	V-43593	1	Link, Universal
126	V-43594	2	Pin, Universal Link
127	V-42864	1	Key, Universal Link Retainer
128	V-46702	1	Retainer, Universal Link
129	V-49431	1	Spring, Universal Link
130	V-43600	1	Bearing, Universal Link (Flexible
131	V-43599	4	Knuckle, Universal Link
132	V-52126	1	Block, Cylinder
133	V-46261	1	Retainer, Universal Link
134	V-43601	1	Bearing, Universal Link
135	V-56252	1	Plate, Valve
-	V-67820	1	Group Ass'y., "B"End Rotating
-	V-68158	1	Shaft & Pistons Ass'y.,"B" End
-	V-43586	7	Piston,Rod&Bearings Ass'y.
136	V-43595	1	Piston
137	V-43596	1	Bearing, Piston
138	V-43597	1	Rod, Piston
139	V-43598	1	Bearing, Piston Rod
140	V-67536	1	Shaft, Drive
141	V-41814	1	Plug, Expansion
-	V-43585	1	Link & Pins Ass'y.,Universal
142	V-43593	1	Link, Universal
143	V-43594	2	Pin, Universal Link
144	V-42864	1	Key,Universal Link Retainer
145	V-46702	1	Retainer, Universal Link
146	V-49431	1	Spring, Universal Link
147	V-43600	1	Bearing,Universal Link(Flex.
148	V-43599	4	Knuckle, Universal Link
149	V-46260	1	Block, Cylinder
150	V-46261	1	Retainer, Universal Link
151	V-43601	1	Bearing,Universal Link(Fixed
152	V-56229	1	Plate, Valve
153	V-3X44190	2	Pin, Valve Plate
154	V-69143	1	Gasket
155	V-69144		Gasket (Use as req.

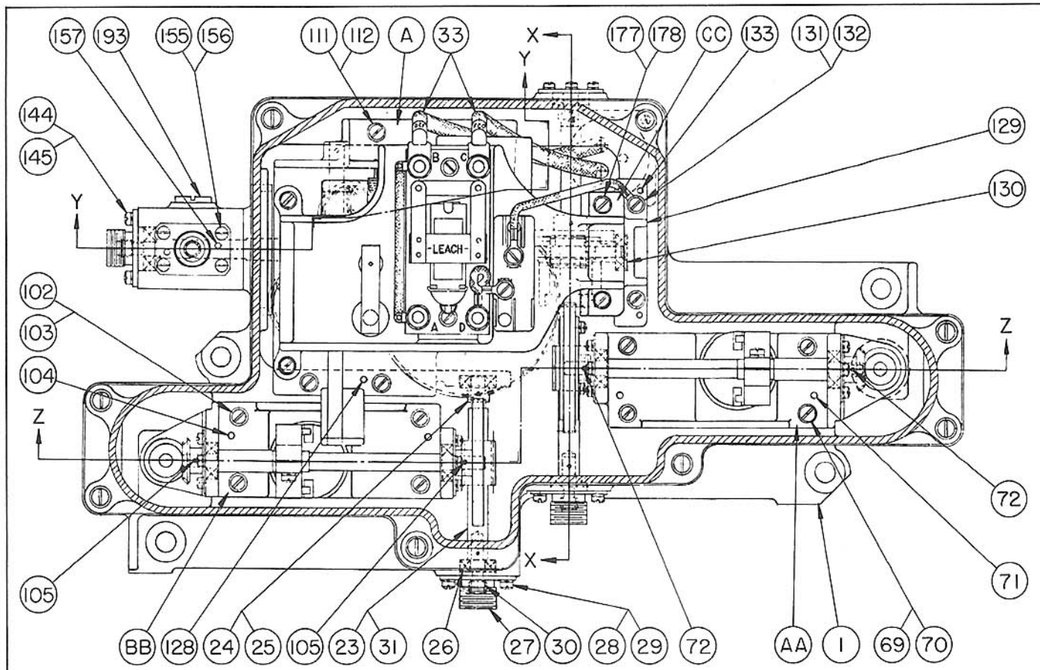


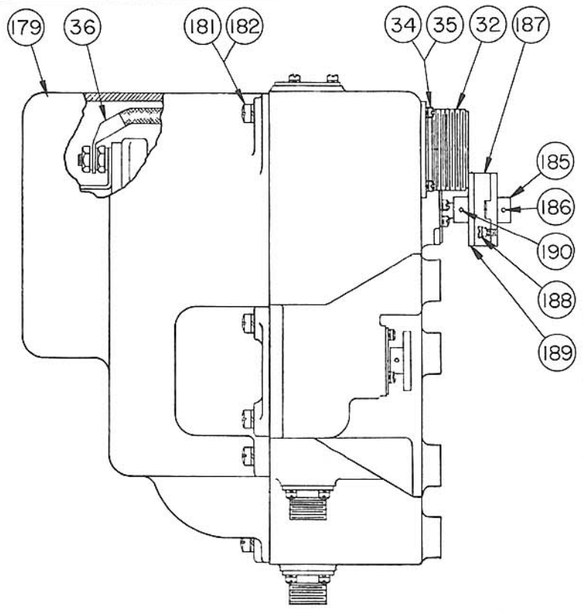
Symbol No.	Part Number	No. Req'd. 1 2	Description
-	V-56663	1	Pump Ass'y., Control
1	V-55721	1	Body, Control Pump
2	V-51494	1	Pin, Dowel
3	V-56591	1	Shaft, Driven Gear
4	V-56274	2	Valve, Outlet Check
5	V-56743	2	Spring, Outlet Check Valve
6	V-37829	2	Plug
7	V-51489	1	Gear, Driven
8	V-51487	1	Gear, Driving
9	V-56743	2	Spring, Inlet Check Valve
10	V-1650	2	Ball, Inlet Check
11	V-56241	1	Cover, Control Pump
12	V-56235	1	Shaft, Control Pump Drive
13	V-51486	1	Pin, Driving Gear
14	V-51693	4	Screw, Control Pump Cover
15	V-56236	1	Gear, Control Pump Drive
16	V-56237	1	Pin, Control Pump Drive Gear

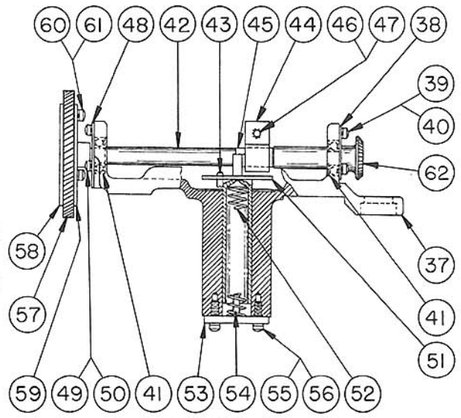
Symbol No.	Part Number	No. Req'd. 1 2	Description
-			Pump Ass'y., Control
17	V-56245	1	Ring, Snap
-	V-64467	1	Cover Ass'y., Control Pump Mtg.
18	V-56037	1	Cover, Control Pump Mtg.
19	V-51495	1	Seat, Relief Valve
20	V-41323	1	Plug
21	V-3X-7074	1	Plug
22	V-14371	1	Ball, Relief Valve
23	V-56325	1	Guide, Relief Valve Spring
24	V-51836	1	Spring, Relief Valve
25	V-56242	1	Screw, Relief Valve Adjusting
26	V-51850	2	Gasket, Adjusting Screw
27	V-56405	1	Nut, Locking
28	V-56404	1	Nut, Acorn
29	V-3X-56406	2	Screw, Mounting Cover
30	V-51852	2	Gasket

PARTS LIST

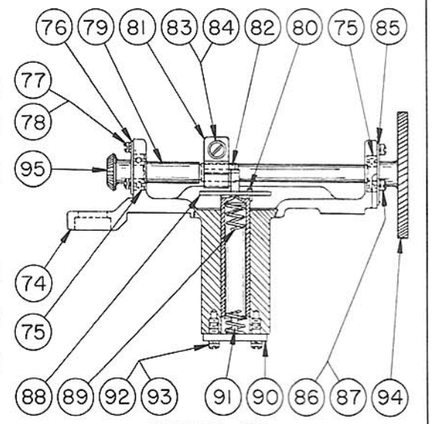
FIRE CUT-OFF AND LIMIT STOP ASS'Y. #644972-L



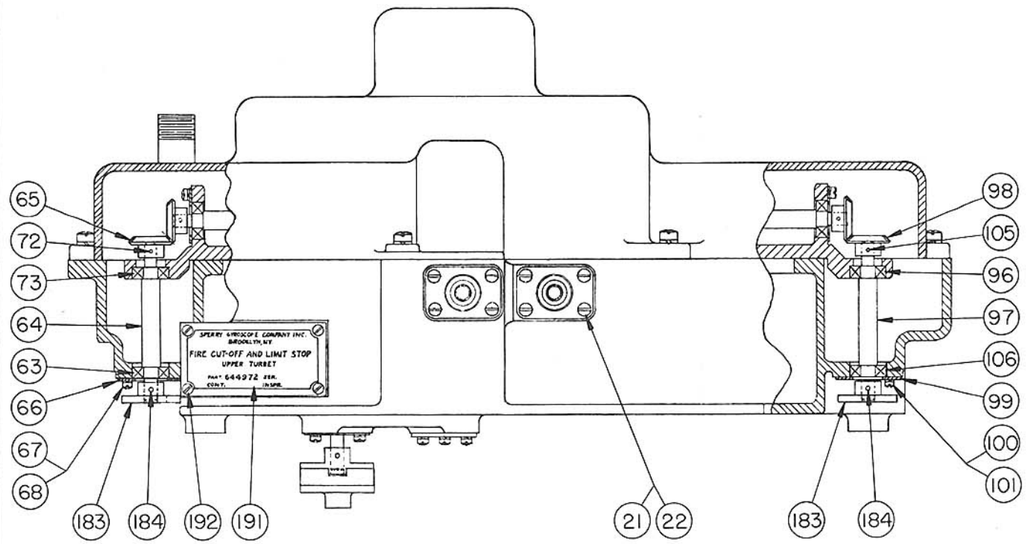




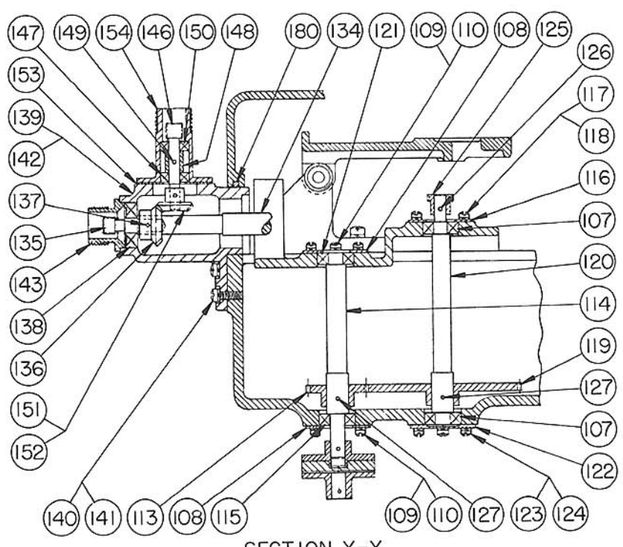
SYMBOL-AA



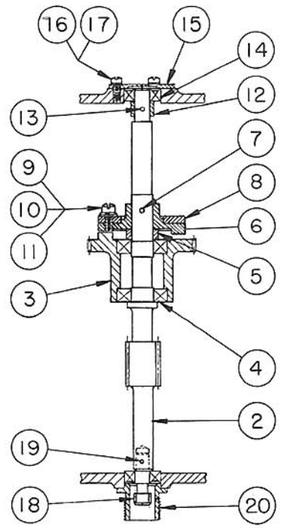
SYMBOL-BB



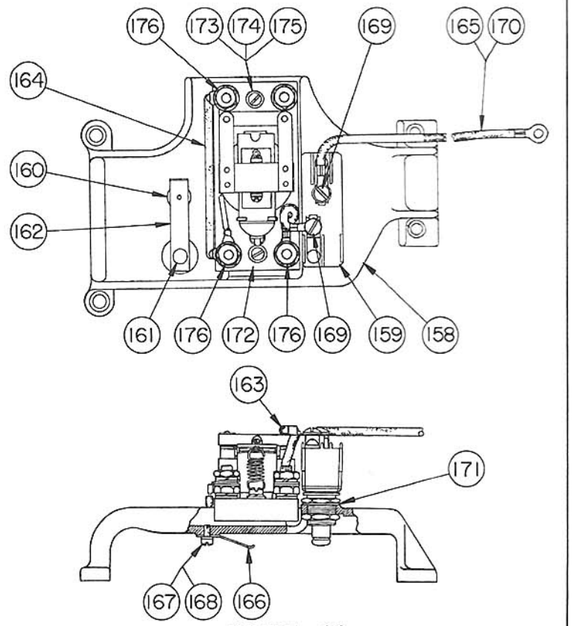
SECTION Z-Z



SECTION Y-Y



SECTION X-X



SYMBOL-CC

FIRE CUT-OFF AND LIMIT STOP ASS'Y. #644972-L
(CONTINUED)

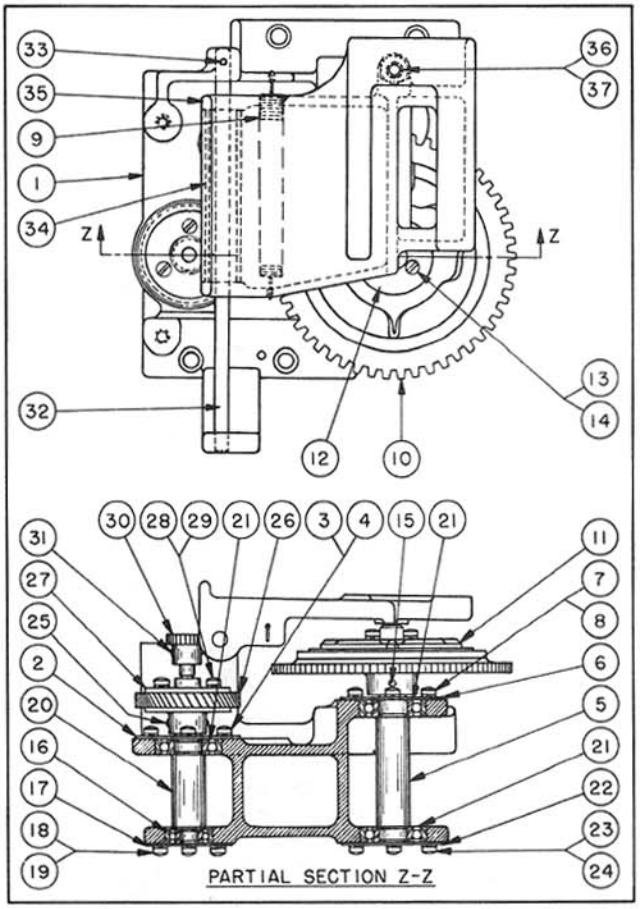
Symbol No.	Part Number	No. Req'd.	Description
			1 2 3
-	644972-L	1	Cut-Off & Limit Stop Ass'y., Fire
1	645399	1	Case (Mach.Cstg.
2	176482	1	Gear & Shaft, Spiral
3	176483	1	Wheel, Worm
4	200423	2	Bearing, Ball(Norma #S-3-R
5	176488	1	Spacer
6	187860	1	Coupling
7		1	Pin, Taper(#5/0x5/8" S.S.
8	187861	1	Flange
9		3	Screw(.138"-40x5/16"Fil.Hd.S.S.
10		3	Lockwasher (For.138" Screw
11	40951	3	Washer
12	137148	1	Collar
13		1	Pin, Taper(#6/0x7/16" S.S.
14	186466	2	Bearing, Ball(N.D. #7-R-4
15	176810	1	Retainer
16		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
17		3	Lockwasher(For.112" Screw
18	176445	1	Shaft, Pinion
19		1	Pin, Taper(#6/0x3/8" S.S.
20	174814	1	Flange
21		4	Screw(.138"-40x3/8"Fil.Hd.S.S.
22		4	Lockwasher(For.138"Screw
23	176804	1	Gear & Shaft, Spiral
24	137148	1	Collar
25		1	Pin, Taper(#6/0x7/16"S.S.
26	186466	2	Bearing, Ball(N.D.#7-R-4
27	174814	1	Flange
28		4	Screw(.138"-40x3/8"Fil.Hd.S.S.
29		4	Lockwasher(For.138"Screw
30	176445	1	Shaft, Pinion
31		1	Pin, Taper(#6/0x3/8" S.S.
32	173782	1	Receptacle, Box Mounting
33	P-69782	2	Cable(#10 A.W.G. - 8" lg.
34		4	Screw(.099"-56x3/8"Fil.Hd.S.S.
35		4	Lockwasher(For .099"Screw
36	200191	2	Lug
AA	801825-D	1	Bracket Ass'y., Elev. Rate
37	801991	1	Bracket (Mach.Cstg.
38	171399	1	Retainer
39		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
40		3	Lockwasher(For.112" Screw
41	173260	2	Bearing, Ball(N.D.#R-4
42	176473	1	Shaft
43		1	Pin (.110"Dia.x1/2" S.S.
-	170274	1	Clamp Ass'y.
44	176903	1	Clamp (Mach.Cstg.
45		2	Pin(.110"Dia.x5/8" S.S.
46		1	Screw(.164"-36x1/2"Fil.Hd.S.S.
47		1	Lockwasher(For.164"Screw
48	175350	1	Retainer
49		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
50		3	Lockwasher(For.112" Screw
51	176901	1	Shaft
52	176907	1	Spring
-	176919	1	Plate Ass'y.
53	176902	1	Plate
54		1	Pin(.110"Dia.x1/2" S.S.
55		2	Screw(.112"-48x3/8"Fil.Hd.S.S.
56		2	Lockwasher(For.112" Screw
-	176871	1	Wheel Ass'y., Worm
57	176872	1	Wheel, Worm
58	176874	1	Hub, Gear
59	176873	1	Clamp, Gear
60		3	Screw(.112"-48x5/16"Fil.Hd.S.S.
61		3	Lockwasher(For.112"Screw
62	168775	1	Gear, Bevel
63	170849	1	Bearing, Ball(N.D. #77-R-4
64	176787	1	Shaft
65	168775	1	Gear
66	175350	1	Retainer
67		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
68		3	Lockwasher (For. 112" Screw
69		4	Screw(.164"-36x1/2"Fil.Hd.S.S.
70		4	Lockwasher (For .164" Screw
71		2	Pin (.110"Dia.x7/16"S.S.
72		3	Pin, Taper (#6/0x1/2" S.S.
73	153736	1	Bearing, Ball(Norma #XA-134-R
BB	802011-D	1	Bracket Ass'y.,Azimuth Rate
74	801991	1	Bracket (Mach.Cstg.
75	173260	2	Bearing, Ball(N.D. #R-4
76	171399	1	Retainer
77		3	Screw (.112"-48x1/4"Fil.Hd.S.S.
78		3	Lockwasher(For.112"Screw
79	176473	1	Shaft
80		1	Pin(.110"Dia.x1/2" S.S.
-	170274	1	Clamp Ass'y.
81	176903	1	Clamp (Mach.Cstg.
82		2	Pin(.110"Dia.x5/8"S.S.
83		1	Screw (.164"-36x1/2"Fil.Hd.S.S.
84		1	Lockwasher(For.164"Screw
85	175350	1	Retainer
86		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
87		3	Lockwasher(For.112" Screw
88	176901	1	Shaft
89	176907	1	Spring
-	176919	1	Plate Ass'y.
90	176902	1	Plate
91		1	Pin(.110"Dia.x1/2" S.S.
92		2	Screw(.112"-48x3/8"Fil.Hd.S.S.

FIRE CUT-OFF AND LIMIT STOP ASS'Y. #644972-L
(CONTINUED)

Symbol No.	Part Number	No. Req'd.	Description
			1 2 3
-			Bracket Ass'y., Azimuth Rate
93		2	Lockwasher(For.112" Screw
94	176850	1	Wheel, Worm
95	168775	1	Gear, Bevel
96	153736	1	Bearing, Ball(Norma#XA-134-R
97	176787	1	Shaft
98	168775	1	Gear, Bevel
99	175350	1	Retainer
100		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
101		3	Lockwasher(For.112" Screw
102		4	Screw(.164"-36x1/2"Fil.Hd.S.S.
103		4	Lockwasher(For.164" Screw
104		2	Pin(.110"Dia.x7/16"S.S.
105		3	Pin, Taper(#6/0x1/2" S.S.
106	170849	1	Bearing, Ball(N.D. #77-R-4
A	77052-E	1	Cut-Off Ass'y., Fire
107	153736	2	Bearing, Ball(Norma #XA-134-R
108	175350	2	Retainer
109		6	Screw(.112"-48x1/4"Fil.Hd.S.S.
110		6	Lockwasher(For.112"Screw
111		4	Screw(.164"-36x1/2"Fil.Hd.S.S.
112		4	Lockwasher(For.164"Screw
113	176869	1	Gear
114	176867	1	Shaft
115	170849	1	Bearing, Ball(N.D. #77-R-4
116	175350	1	Retainer
117		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
118		3	Lockwasher(For.112"Screw
119	176870	1	Gear
120	176875	1	Shaft
121	153736	1	Bearing, Ball(Norma #XA-134-R
122	176810	1	Retainer
123		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
124		3	Lockwasher(For.112"Screw
125	176868	1	Gear
126		1	Pin, Taper(#6/0x3/8" S.S.
127		2	Pin, Taper(#6/0x5/8" S.S.
128		2	Pin(.110"Dia.x7/16"S.S.
129	176851	1	Bracket (Mach.Cstg.
130	186466	1	Bearing, Ball(N.D. #7-R-4
131		2	Screw(.164"-36x1/2"Fil.Hd.S.S.
132		2	Lockwasher(For.164"Screw
133		2	Pin (.110"Dia.x7/16"S.S.
134	176861	1	Shaft, Worm
135	177195	1	Shaft, Pinion
136	177194	1	Gear
137		1	Pin, Taper (#6/0x5/8" S.S.
138	153310	1	Bearing, Ball(Norma #S-1-R-P
139	802036	1	Bracket, Bearing
140		3	Screw(.138"-40x3/8"Fil.Hd.S.S.
141		3	Lockwasher(For.138" Screw
142		2	Pin (.110"Dia.x3/8" S.S.
143	173973	1	Flange (Mach.Cstg.
144		4	Screw(.138"-40x3/8"Fil.Hd.S.S.

Symbol No.	Part Number	No. Req'd.	Description
			1 2 3
-			Cut-Off & Limit Stop Ass'y., Fire
145		4	Lockwasher (For.138" Screw
-	177193	1	Pinion Ass'y.
146	171890	1	Shaft, Pinion
147	186464	1	Bearing, Ball(N.D.#7-R-3
148	177598	1	Spacer
149		1	Pin (.040"Dia.x3/8" S.S.
150	186464	1	Bearing, Ball(N.D.#7-R-3
151	172400	1	Gear
152		1	Pin, Taper (#6/0x3/8"S.S.
153	186448	1	Retainer
154	171897	1	Flange (Mach.Cstg.
155		4	Screw(.138"-40x3/8"Fil.Hd.S.S.
156		4	Lockwasher(For.138" Screw
157		2	Pin(.110"Dia.x3/8" S.S.
CC	78343-A	1	Bracket Ass'y., Switch
158	78342	1	Bracket, Switch(Mach.Cstg.
159	193879	1	Switch
160	177126	1	Fixture, Cam Setting
161	187608	1	Rivet
162	187609	1	Spring
163	P-69782	1	Cable(#18 A.W.G.-2-1/2"lg.
164	P-69782	1	Cable(#18 A.W.G.-3" lg.
165	P-69782	1	Cable(#18 A.W.G.-7" lg.
166	193878	1	Spring
167		2	Screw(.112"-48x1/4"Fil.Hd.S.S.
168		2	Lockwasher(For .112"Screw
169	200175	2	Terminal
170	200206	1	Terminal
171	193891	1	Lockwasher
172	193881	1	Relay
173		2	Screw(.138"-40x5/8"Fil.Hd.S.S.
174		2	Lockwasher (For.138" Screw
175	40951	2	Washer
176	92238	3	Terminal
177		4	Screw(.164"-36x7/16"Fil.Hd.S.S.
178		4	Lockwasher (For.164"Screw
179	645393	1	Cover (Mach.Cstg.
180		1	Seal, Cover (3/32"White Felt-3-7/8" lg.
181		8	Screw(.190"-32x5/8"Fil.Hd.S.S.
182		8	Lockwasher(For.190"Screw
183	162129	2	Coupling, Disc (Female
184		2	Pin, Taper (#6/0x1/2" S.S.
185	176877	1	Flange, Coupling
186		1	Pin, Taper (#6/0x1/2" S.S.
187	176876	1	Key, Coupling
188	169263	1	Screw
189	176878	1	Flange, Coupling
190		1	Pin, Taper (#6/0x1/2" S.S.
191	177321	1	Plate, Name
192		4	Screw(.112"-48x1/4"Fil.Hd.S.S.
193	171842	1	Plug
-	185817	1	Carton, Paper

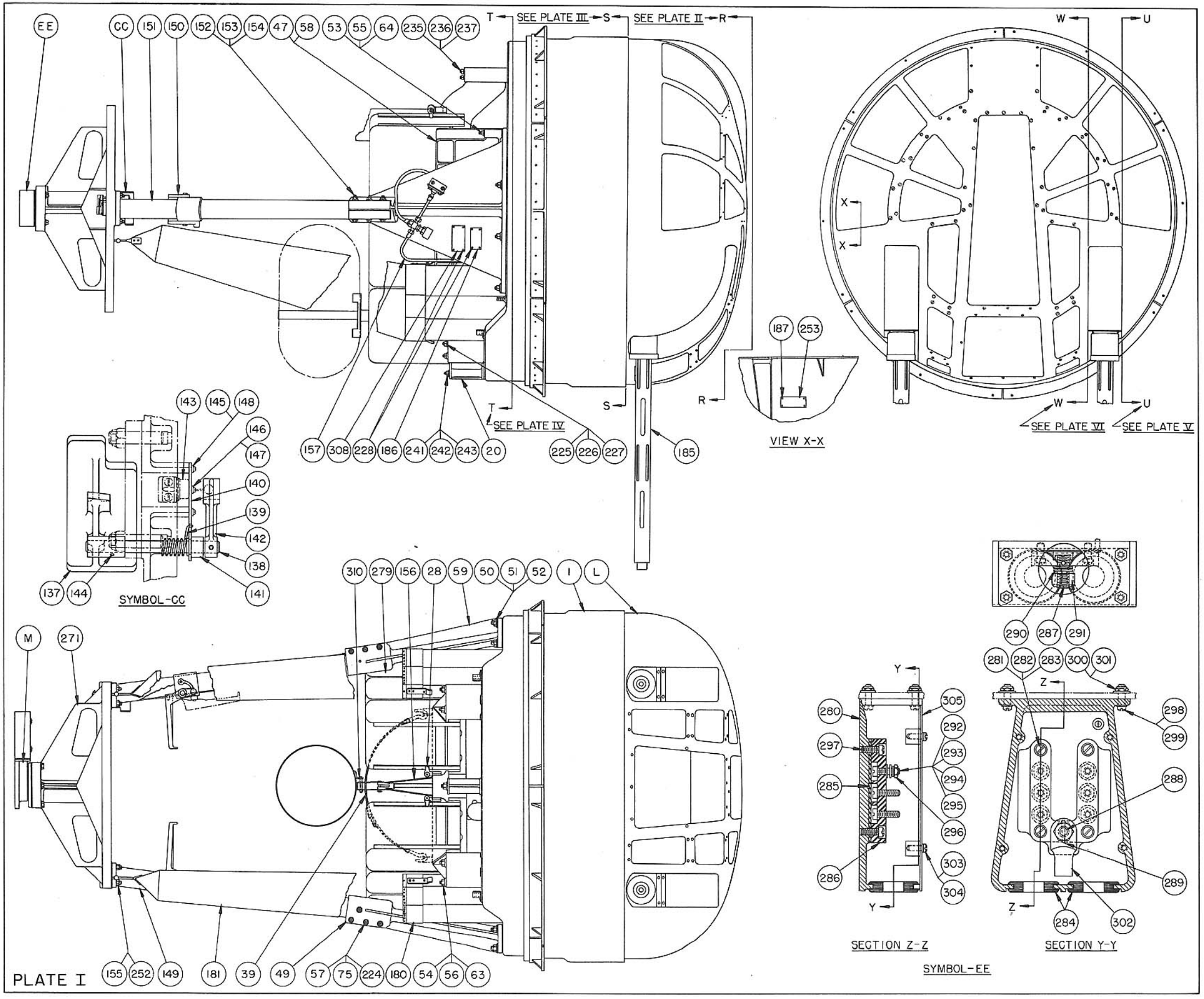
FIRE CUT-OFF ASS'Y. #77052-E



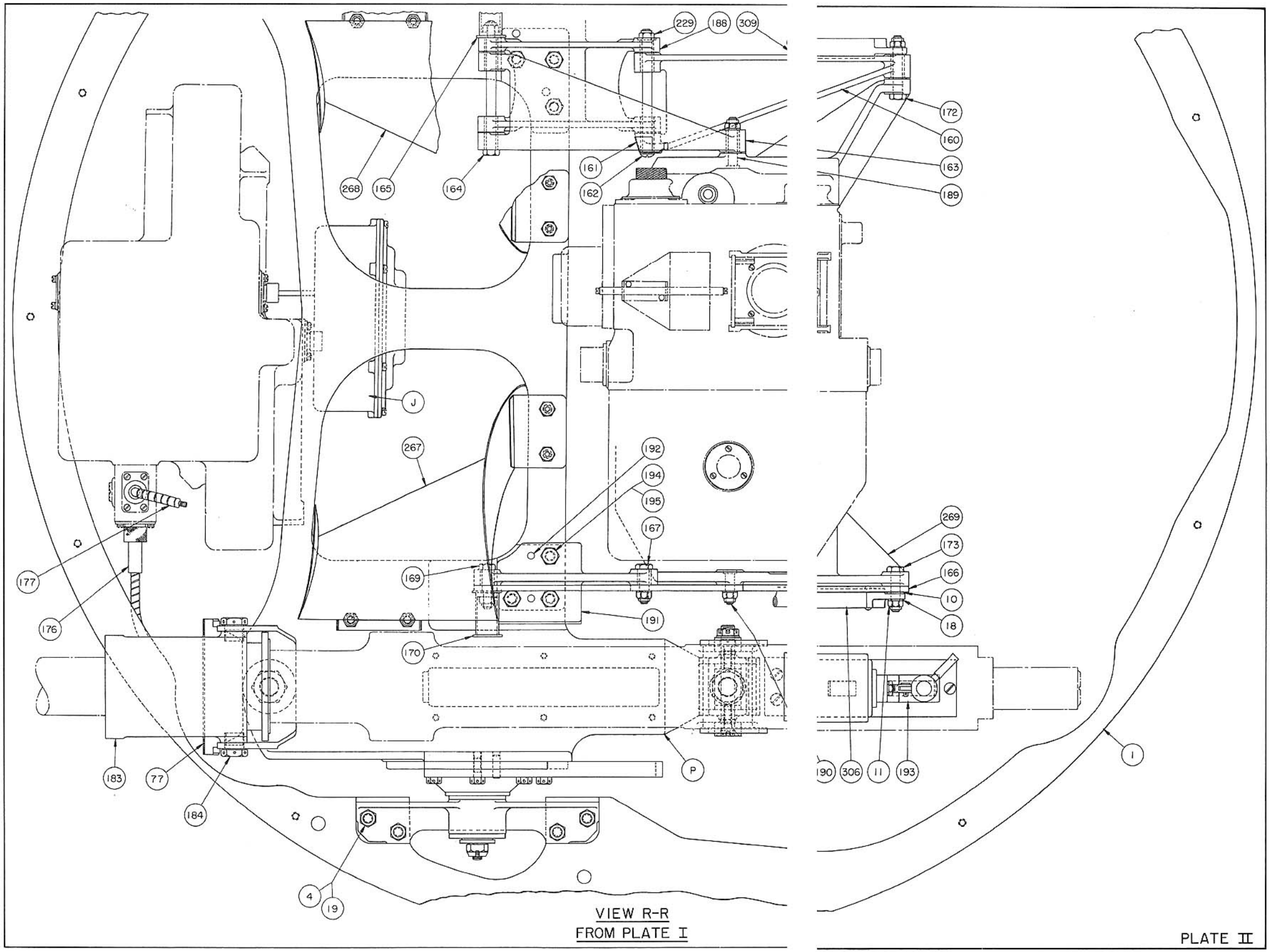
PARTIAL SECTION Z-Z

Symbol No.	Part Number	No. Req'd.	Description
		1 2	
-	77052-E	1	Cut-Off Ass'y., Fire
1	77050	1	Bracket (Mach.Cstg.
2	129959	2	Retainer
3		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
4		3	Lockwasher(For.112"Screw
5	176475	1	Shaft
6	130817	1	Retainer
7		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
8		3	Lockwasher(For.112"Screw
9	187030	1	Spring
-	176900	1	Cam & Gear Ass'y.
10	173961	1	Gear
11	176892	1	Cam
12	176895	1	Retainer
13		3	Screw(.112"-48x5/16"Fil.Hd.S
14		3	Lockwasher(For.112"Screw
15		1	Pin, Taper(#5/0x11/16"S.S.
16	153736	1	Bearing, Ball(Norma #XA-134-R
17	175350	1	Retainer
18		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
19		3	Lockwasher(For.112"Screw
20	176802	1	Shaft
21	200423	3	Bearing, Ball(Norma #S-3-R
22	129959	1	Retainer
23		3	Screw(.112"-48x1/4"Fil.Hd.S.S.
24		3	Lockwasher(For.112"Screw
-	176880	1	Gear Ass'y.
25	176805	1	Holder, Gear
26	176857	1	Gear
27	176770	1	Retainer
28		3	Screw(.112"-48x3/16"Fil.Hd.S
29		3	Lockwasher(For.112"Screw
30	176866	1	Gear
31		1	Pin, Taper(#6/0x7/16"S.S.
32	176879	1	Shaft
33		1	Pin, Taper(#6/0x1/2" S.S.
34	176756	1	Rack Ass'y.
			Consisting of:
-	176758	1	Blank, Gear
-	176757	2	Bushing
35	193880	1	Lever
36	176762	1	Pin, Cam
37		1	Nut (.190-32 Hex.S.S.

UPPER LOCAL TURRET ASS'Y. #644928-C
(STEEL PRODUCTS DWG. #SG 1-2-3-4-5-6)
(CONTINUED)



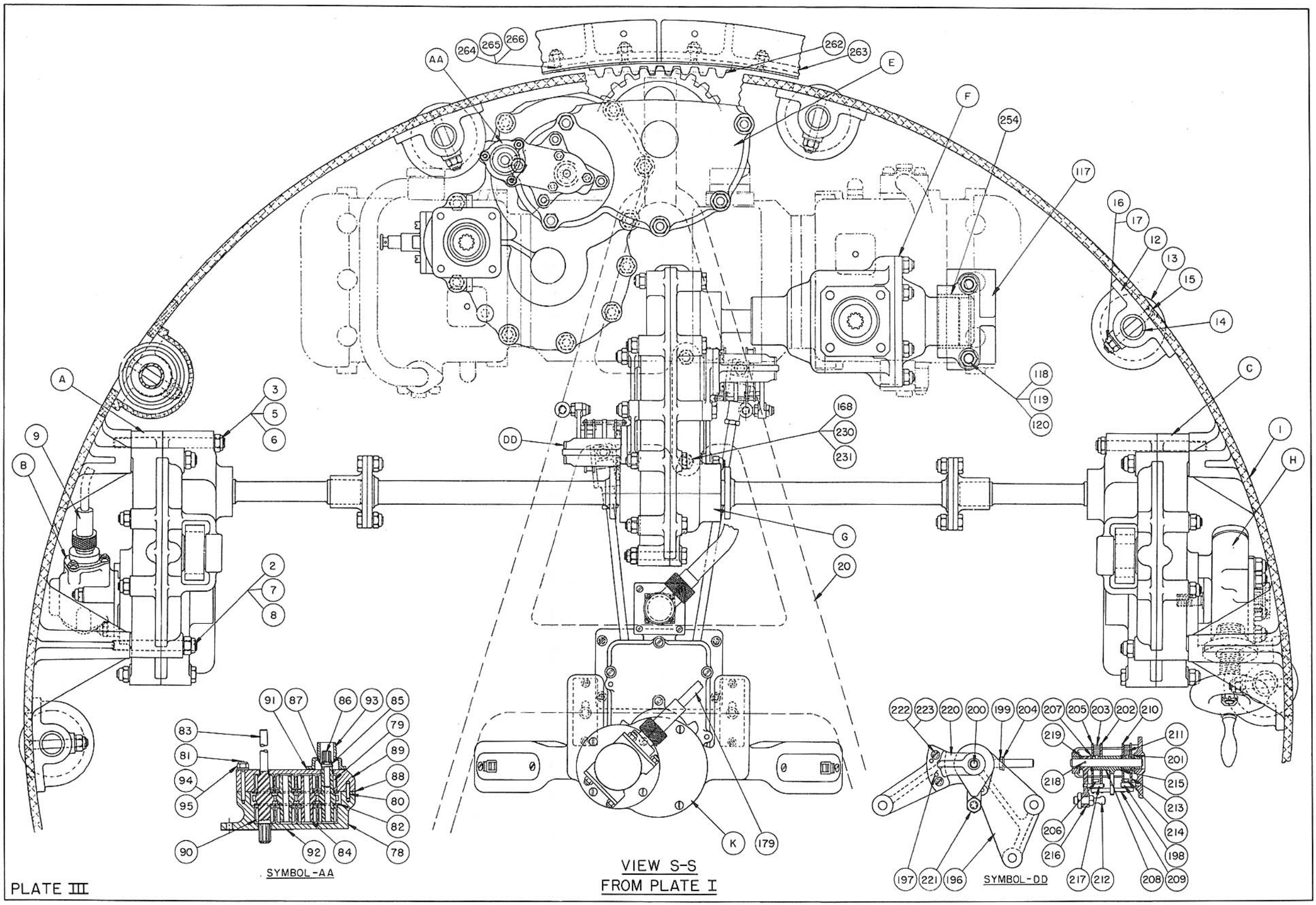
UPPER LOCAL TURRET ASS'Y. #644928-C
(STEEL PRODUCTS DWG.#SG 1-2-3-4-5-6)
(CONTINUED)



VIEW R-R
FROM PLATE I

PLATE II

UPPER LOCAL TURRET ASS'Y. #644928-C
(STEEL PRODUCTS DWG. #SG 1-2-3-4-5-6)
(CONTINUED)



VIEW S-S
FROM PLATE I

PLATE III

DO NOT USE SYMBOL NUMBERS WHEN ORDERING PARTS

UPPER LOCAL TURRET ASS'Y. # 644928-C
(STEEL PRODUCTS DWG. #SG 1-2-3-4-5-6)
(CONTINUED)

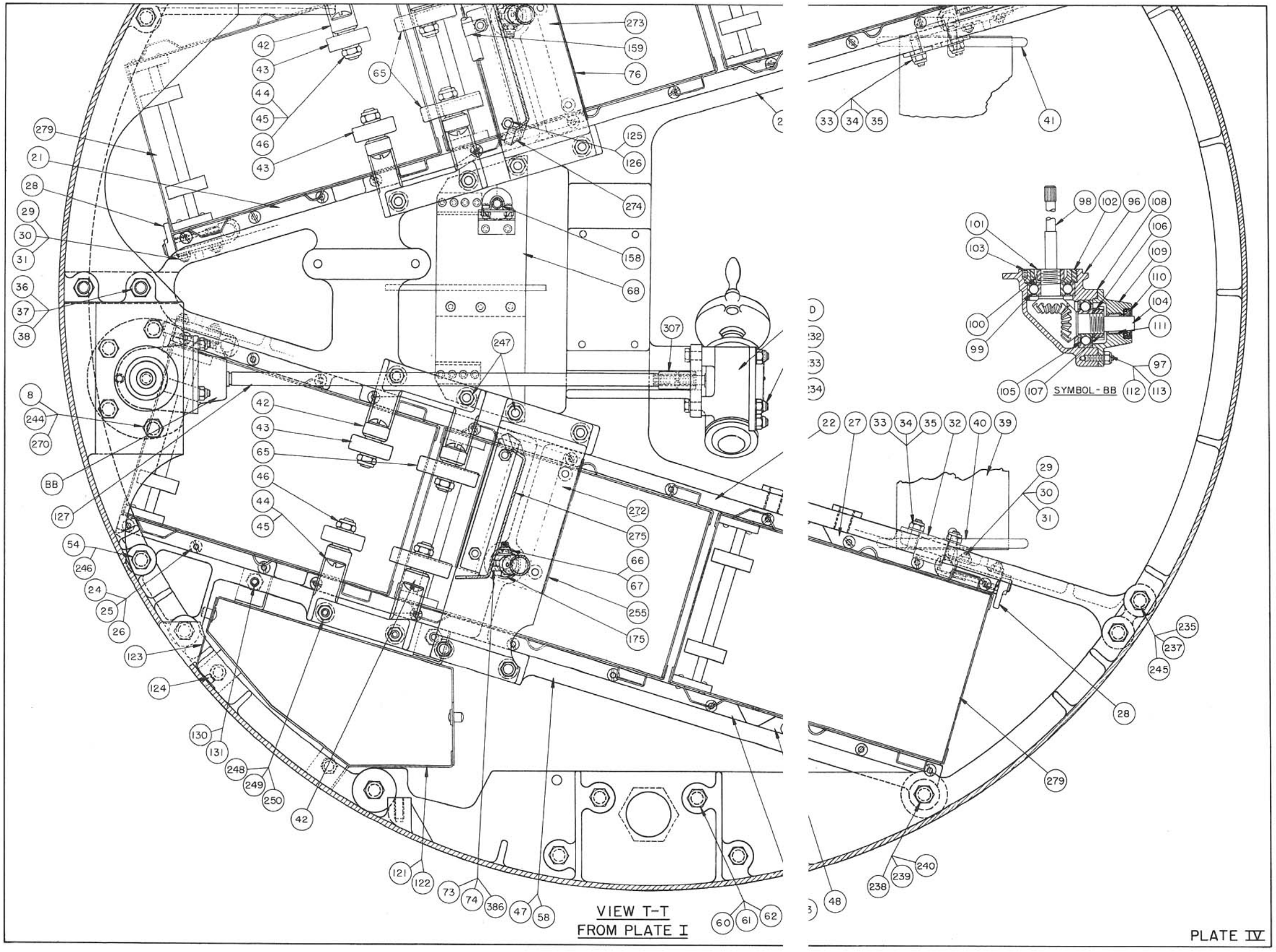
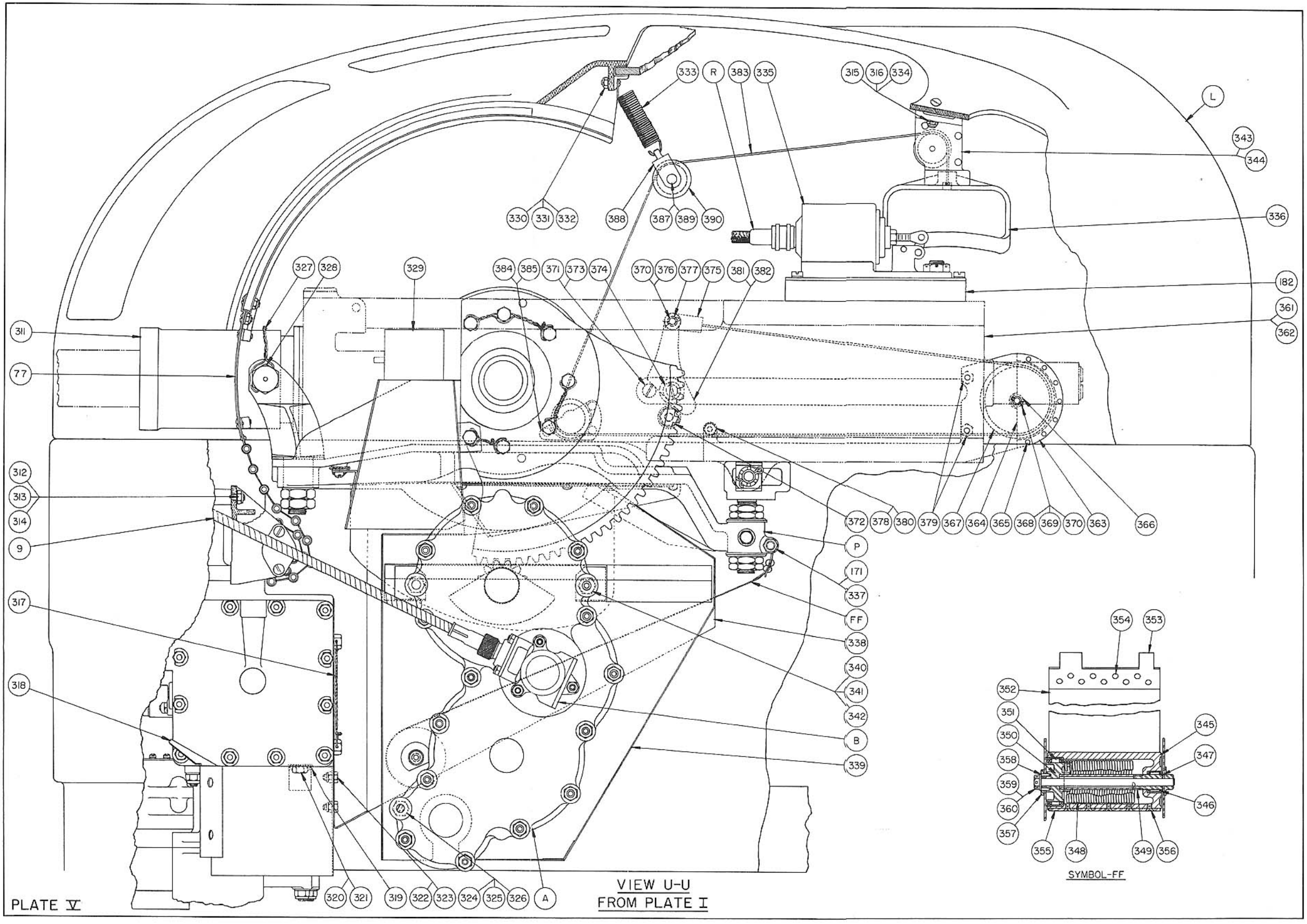


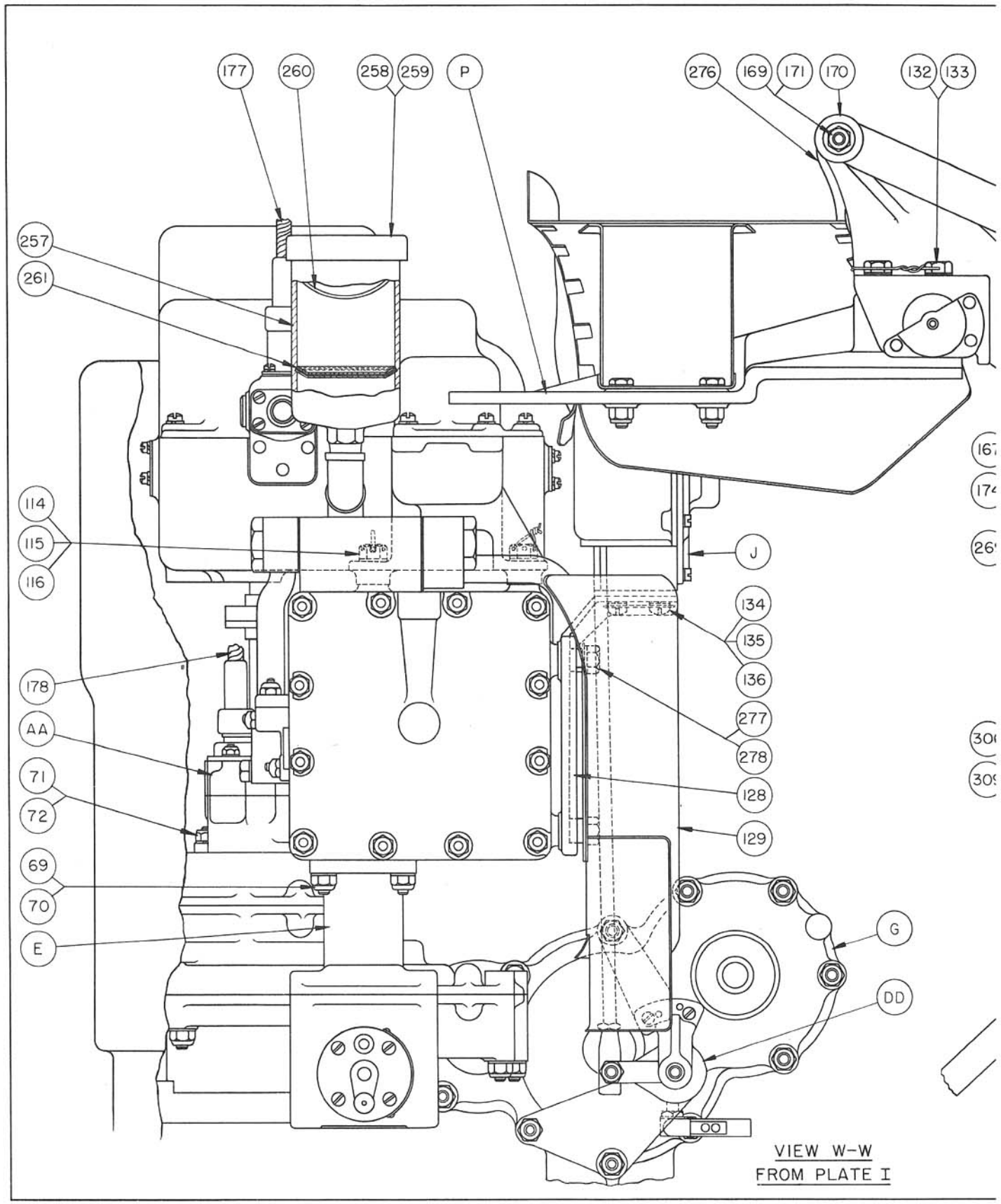
PLATE IV

UPPER LOCAL TURRET ASS'Y. #644928-C
(STEEL PRODUCTS DWG.#SG 1-2-3-4-5-6)
(CONTINUED)



DO NOT USE SYMBOL NUMBERS WHEN ORDERING PARTS

UPPER LOCAL TURRET ASS'Y. #644928-C
(STEEL PRODUCTS DWG. #SG 1-2-3-4-5-6)
(CONTINUED)



VIEW W-W
FROM PLATE I

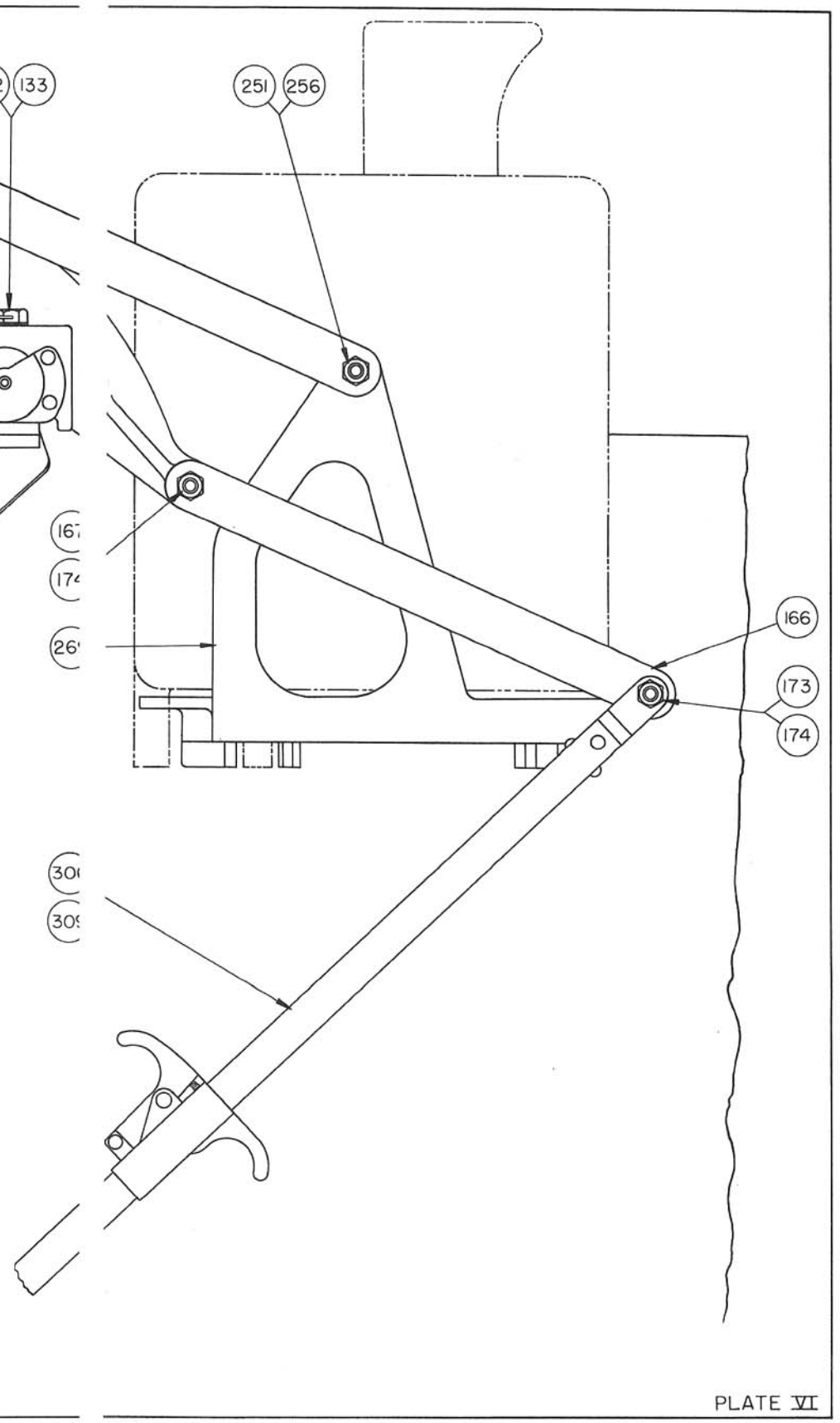


PLATE VI

UPPER LOCAL TURRET ASS'Y #644928-C
(STEEL PRODUCTS DWG. # SG 1-2-3-4-5-6)
(CONTINUED)

Symbol No.	Number	No. Req'd.	1 2 3 Description	Plate No.
-	644928-C	1	Turret Ass'y., Upper Local	
1	SG-1048	1	Housing	I,II,III
2	SG-1027	4	Stud(5/16"-24	III
3	SG-1028	2	Stud(5/16"-24	III
4	SG-1388	8	Stud(5/16"-24	II
A	SG-955	1	Box Ass'y.,Elev.Gear (L.H.	III,V
B	SG-974	1	Drive Ass'y.,Flexible Shaft	III,V
5	AN960C516L	2	Washer(5/16"x1/16"	III
6	AN364-524	2	Nut(5/16"-24 Hex.El.Stop	III
7	AN960C516L	4	Washer(5/16"x1/16"	III
8	AN365-524	8 (4)	Nut(5/16"-24 Hex.El.Stop	III,IV
9	SG-1167-4	1	Shaft,Flexible	III,V
C	SG-956	1	Box Ass'y.,Elev.Gear (R.H.	III
D	SG-967-D	1	Drive Ass'y.,Hand (Azimuth	IV
10	AN960C516L	8	Washer(5/16"x1/16"	II
11	AN365-428	7	Nut(1/4"-28 Hex.El.Stop	II
-	SG-963	10	Roller Ass'y., Turret	
12	SG-1079	1	Housing	III
13		1	Bearing,Ball(New Departure#88604	III
14	SG-1077	1	Shaft	III
15	AN51041632	2	Screw(1/4"-28x2"Flat Hd.	III
16	AN960C416	2	Washer(1/4"x1/16"	III
17	AN365-428	2	Nut(1/4"-28 Hex.El.Stop	III
18	AN960C416L	8	Washer(1/4"x1/16"	II
19	AN365-524	8	Nut,Stop	II
20	SG-1161	2	Rail, Center (Mach.Cstg.	I,III,IV
21	SG-1163	4	Plate	IV
22	SG-1165-1	1	Plate	IV
23	SG-1165-2	1	Plate	IV
24	AN510-6-10	1	Screw(.138"-40x5/8" Flat Hd.	IV
25		1	Washer(5/16"x1/32"	IV
26	AN365-640	1	Nut(.138"-40 Hex.El.Stop	IV
27	SG-1164-1	1	Plate	IV
28	SG-1374	4	Lock Ass'y.,Ammunition Box	I,IV
			Each Consisting Of:	
-	SG-1375	1	Bracket (Mach. Cstg.	
-	SG-1380	1	Seat, Spring	
-	SG-1379	1	Spring	
-	SG-1378	1	Plunger	
-	SG-1377	1	Shaft	
-	SG-1376	1	Lock	
-	AN365-30-5	1	Pin, Taper(#3/0x5/8"	
29	AN3-6A	8	Screw(.190"-32x3/4" Hex.Hd.	IV
30	AN960C10	8	Washer(.190"x1/32"	IV
31	AN3651032	8	Nut(.190"x32 Hex.El. Stop	IV
32	SG-1782	1	Plate, Support	IV
33	AN51041618	4	Screw(1/4"-28x1-1/8" Fil.Hd.	IV
34	AN960C416	4	Washer(1/4" x 1/16"	IV
35	AN365-428	4	Nut(1/4" -28 Hex.El.Stop	IV
36	AN6-62A	2	Screw(3/8"-24 x6-1/4" Hex.Hd.	IV
37	AN960C616	4	Washer(3/8"x1/16"	IV
38	AN365-624	2	Nut(3/8"-24 Hex.El.Stop	IV
39	SG-1785	1	Seat Ass'y.,Sling	I,IV
			Consisting Of:	
-		1	Strap(3-3/4" Olive Drab Web#6-185B-Type 2	
-		1	Buckle, Roller (1-1/2"Cadmium Plated	
-		1	Keeper (Canvas	
-		8	Eyelet(Stimson #A-170	
-		1	Tip, Strap (1-1/2"Web	
40	SG-1784	1	Hook, Seat (L.H.	IV
41	SG-1783	1	Hook, Seat (R.H.	IV
42	SG-1173	4	Bracket, Shell Roller(Mach.Cstg.	IV
43		4	Bearing,Ball(Fafnir #K-6	IV
44	AN26-22A	8	Screw(3/8"-24xl-3/8"	IV
45	AN960C616L	8	Washer(3/8"x1/64"	IV
46	AN364-624	8	Nut(3/8"-24 Hex.El. Stop	IV
47	SG-1162-1	2	Rail, Side (Mach.Cstg.(L.H.	I,IV
48	SG-1164-2	1	Plate	IV
49	SG-1074	1	Bracket (Mach.Cstg.(L.H.	I
50	AN6-17A	10	Screw(3/8"-24xl-7/8" Hex. Hd.	I
51	AN960C616	20	Washer(3/8"x1/16"	I
52	AN365-624	10	Nut(3/8"-24 Hex.El. Stop	I
53	AN6-37A	2	Screw(3/8"-24 x3-7/8" Hex.Hd.	I
54	AN6-53A	4	Screw(3/8"-24 x5-3/8" Hex. Hd.	I,IV
55	AN960C616	4	Washer(3/8" xl/16"	I
56	AN365-624	2	Nut(3/8" -24 Hex.El. Stop	I
57	AN960C516L	4	Washer(5/16" xl/16"	I
58	SG-1162-2	2	Rail, Side(Mach.Cstg.(R.H.	I,IV
59	SG-1074-1	1	Bracket (Mach. Cstg.(R.H.	I
60	AN6-17A	10	Screw(3/8"-24xl-7/8" Hex.Hd.	IV
61	AN960C616	20	Washer (3/8"x1/16"	IV
62	AN365-624	10	Nut(3/8"-24 Hex.El.Stop	IV
63	AN960C616	2	Washer(3/8"x1/16"	I
64	AN365-624	2	Nut(3/8"-24 Hex.El. Stop	I
65	SG-1677	4	Tire, Roller Bearing Rubber	IV
66	AN960C416	2	Washer (1/4" xl/16"	IV
67	AN364-428	2	Nut (1/4"-28 Hex.El. Stop	IV
68	SG-1430	1	Bracket Ass'y.,Oxygen Bottle Yoke	IV
			Consisting Of:	
-	SG-1431	1	Plate, Mtg.	

Symbol No.	Part Number	No. Req'd.	1 2 3 Description	Plate No.
-			Bracket Ass'y.,Oxygen Bottle Yoke	
-	SG-1432	1	Quadrant, Yoke	
-	SG-1433	2	Plate, Hinge	
-	SG-1465	1	Bracket, Flexible Hose	
-	AN435-6-6	3	Rivet(3/16"Dia.xl/2"Rd.Hd.	
-	AN435-4-6	10	Rivet(1/8"Dia.x7/16"Rd.Hd.	
-	AC750-6	1	Clip, Tube (3/8"	
-	AC501-8-6	2	Screw(.164"-36x3/8"Fil.Hd.	
-	AC365-836	2	Nut(.164"-36Hex.El.Stop	
69	AN960C416	4	Washer(1/4"x1/16"	VI
70	AN365-428	4	Nut(1/4"-28 Hex.El.Stop	VI
71 ←	AN960C10L	3	Washer(.190"x1/32"	VI
72 ←	AN365-1032	3	Nut(.190"-32 Hex.El.Stop	VI
73	SG-1169	2	Clevis, Sight Link	IV
74	AN364-624	2	Nut(3/8"-24 Hex.El.Stop	IV
75	AN365-524	2	Nut(3/8"-24 Hex.El.Stop	I
76	SG-1697	1	Shield,Sight Bracket	IV
77	SG-965-965-1	1	Shutter Ass'y.Gun(L.H.&R.H.	II,V
-			Each Consisting Of:	
-	SG-1174	1	Bracket(For use with 965 Only	
-	SG-1175	1	Bracket(For use with 965 Only	
-		1	Bearing,Needle(Torrington#B-45	
-	SG-1187	1	Spring, Torsion	
-	SG-1624	1	Rod, Torsion Spring Support	
-		1	Bearing,Needle(Torrington#B-88	
-	SG-1178	1	Plate,Hinge Connection	
-	AN366F1032	2	Nut(.190"-32 Steel	
-	AN420-3-3P	4	Rivet(3/32"Dia.x3/16"Iron	
-	SG-1658	1	Plate,Plexiglas Connection	
-	AN526-640-9	2	Screw	
-	AN435-3-3P	4	Rivet, Round Hd.	
-	AN525-10-7	4	Rivet	
-	SG-1657	1	Coupling	
-	AN420-3-3P	4	Rivet(3/32"Dia.x3/16"Iron	
-	AN366F1032	2	Nut(.190"-32 Steel	
-	SG-1179	1	Hinge, End	
-	SG-1180	22	Section, Hinge	
-	SG-1181	22	Pin, Hinge	
-	SG-1182	44	Roller, Hinge Pin	
-	SG-1183	46	Washer, Hinge Pin	
-	SG-1248	1	Pin	
-	SG-1176	1	Plexiglas, Gun Slot	
-	SG-1186	1	Flange, Bearing (Small	
-	AN515-10-6	4	Screw(.190"-24x3/8"Rd.Hd.	
-	AN935-10	4	Lockwasher(For .190" Screw	
-	SG-1185	1	Flange, Bearing (Large	
-	AN365-640	4	Nut(#6-40 Hex.El.Stop	
-	SG-1177	1	Clip, Connection	
-	AN450-C8-9	20	Rivet	
-	AN960-4	20	Washer	
-	AN526640-5	2	Screw	
-	SG-966	1	Roller Ass'y.,Spring	
E	SG-951-E	1	Case Ass'y.,Azimuth Gear	III,VI
F	SG-70-D	1	Box Ass'y.,Transmission Gear	III
G	SG-957-A	1	Box Ass'y.,Cross Shaft Gear	III,VI
← AA	SG-958-A	1	Box Ass'y.,Az. Control&Sight Drive Gear	III,VI
78	SG-1081	1	Housing (Mach.Cstg.	III
79		4	Bearing,Needle(Torrington#BH-68	III
80		2	Pin(3/16"Dia.xl/2"	III
81	SG-1087	6	Stud	III
82	SG-1088	2	Plate, Thrust	III
83	SG-1086	1	Gear	III
84	SG-1083	2	Gear	III
85	SG-1085	1	Gear	III
86	SG-392	1	Pinion	III
87	AN38560-3	1	Pin,Taper(#6/0x3/8"	III
88	SG-1084	1	Gasket	III
89	SG-1082	1	Cover(Mach.Cstg.	III
90		4	Bearing,Needle(Torrington#BH-68	III
91	SG-328	1	Gasket	III
92	SG-1097	1	Gasket	III
93	SG-204	1	Flange, Coupling	III
94	AN960C6	6	Washer(#6x1/32"	III
95	AN365-640	6	Nut(#6-40 Hex.El.Stop	III
BB	SG-968	1	Drive Ass'y.,Right Angle	IV
96	SG-1121	1	Housing(Mach.Cstg.	IV
97	SG-1049	3	Stud	IV
98	SG-1153	1	Gear	IV
99		1	Bearing,Ball(Fafnir#203-K	IV
100		1	Lockwasher(Fafnir#W-03	IV
101		1	Locknut(Fafnir#N-03,	IV
102	SG-1151	1	Locknut	IV
103	AN566A10-4	1	Screw,Set(.190"-24xl/4"Hdl.	IV
104	SG-1152	1	Gear	IV
105		1	Bearing,Ball(Fafnir#203-K	IV
106		1	Lockwasher(Fafnir#W-03	IV
107		1	Locknut(Fafnir#N-03	IV
108	SG-1291	1	Gasket	IV
109	SG-1122	1	Cover(Mach.Cstg.	IV
110		1	Seal,Oil(Victor#62004	IV
111		1	Bearing,Needle(Torrington#B-88	IV

UPPER LOCAL TURRET ASS'Y #644928-C
(STEEL PRODUCTS DWG. #SG 1-2-3-4-5-6)
(CONTINUED)

Symbol No.	Part Number	No. Req'd.	Description	Plate No.
-			1 2 3 Drive Ass'y.,Right Angle	
112	AN960C10L	3	Washer(.190"x1/32"	IV
113	AN3651032	3	Nut(.190"-32Hex.El.Stop	IV
114	AN75-A6	4	Screw(5/16"-18x3/4"Hex.Hd.	VI
115	AN960C516L	4	Washer(5/16"x1/32"	VI
116	AN995474	4	Lockwire(.047"x4"lg.	VI
117	SG-1075	1	Bracket,Support(Mach.Cstg.	III
118	AN5-26A	2	Screw(5/16"-24x2-3/4"Hex.Hd.	III
119	AN365-524	2	Nut(5/16"-24Hex.El.Stop	III
120	AN960C516L	2	Washer(5/16"x1/32"	III
121	SG-1420	1	Chute Ass'y., Shell & Clip Ejection(L.H.	IV
			Consisting OF:	
-	SG-1420-1	1	Panel, Chute	
-	SG-1420-2	1	Panel, Chute	
-	SG-1421	2	Bracket, Inside	
-	SG-1422	1	Bracket, Outside	
-	SG-1423	1	Bracket, Outside	
-	SG-1424	2	Pin, Latch	
-	AN960C416	2	Washer	
122	SG-1419	1	Chute Ass'y. Shell&Clip Ejection (R.H.	IV
			Consisting OF:	
-	SG-1419-1	1	Panel, Chute (.039"x1-5/16"x5-1/2"S.S.	
-	SG-1419-2	1	Panel, Chute (.039x11-7/8"x9-7/8"S.S.	
-	SG-1419-3	1	Brace (.039"x11-3/4"x9-7/8"S.S.	
-	SG-1421	2	Bracket, Inside	
-	SG-1422	1	Bracket, Outside	
-	SG-1423	1	Bracket, Outside	
-	SG-1424	2	Pin, Latch	
-	AN960C416	2	Washer(1/4"x1/16"	
123	SG-1413	1	Shield, Inside Ejection Panel(L.H.	IV
124	AN500A10-4	1	Screw(.190"-24x1/4"	IV
125	AN3-3A	4	Screw(.190"-32x3/8"Hex.Hd.	IV
126	AN3651032	4	Nut(.190"-32 Hex.El.Stop	IV
127	SG-1886	1	Shaft, Splined	IV
H	SG-934	1	Drive Ass'y.,Hand(Elevation	III
128	SG-1276	1	Bracket(Mach.Cstg.	VI
129	SG-1740	1	Shield Ass'y.(L.H.	VI
			Consisting Of:	
-	SG-1741	1	Shield	
-	SG-1742	1	Guard, Shield	
-	SG-1743	1	Bracket, Shield	
130	AN74A-3	8	Screw(1/4"-20x3/8"Hex.Hd.	IV
131	AN99547-4	8	Lockwire(.047"Dia.x3"lg.	IV
132	AN960C516L	6	Washer(5/16"x1/32"	VI
133	AN75-5	6	Screw(5/16"-18x5/8"Hex.Hd.	VI
J	SG-973	1	Box Ass'y., Fire Cut-Off	II,VI
134	AN960C416	4	Washer(1/4"x1/16"	VI
135	AN50341610	4	Screw(1/4"-20x5/8"Fil.Hd.	VI
136	AN995-47-3	2	Lockwire(.047"Dia.x3"lg.	VI
CC	SG-994-A	1	Switch Ass'y.,Foot	I
137	SG-1613	1	Pedal, Foot(Mach.Cstg.	I
138	SG-1615	1	Shaft,Switch Operating	I
139	SG-1618	1	Spring,Foot Pedal Switch	I
140	AG-1616	1	Plate, Mounting	I
141	SG-1617	1	Bearing, Ball	I
142	SG-1614	1	Lever,Swt.Operating(Mach.Cstg.	I
143		1	Switch(Cutler-Hammer#7528	I
144	AC365-20-5	2	Pin, Taper	I
145	AN935-C6	4	Lockwasher(#6x1/32"	I
146		2	Screw(#4-36x1/4"Rd.Hd.	I
147	AN935-C4	2	Lockwasher	I
148	AN515-5-4	4	Screw	I
149	SG-1073	1	Support, Housing(L.H.	I
			Consisting Of:	
-	SG-1073-2	1	Tube (X-4130 S.S. (2-1/4"O.D.x.095"x33-1/4"	
-	SG-1073-3	1	Flange(X-4130 (5/8"x3"x4-1/8"	
150	SG-943	1	Rest Ass'y., Foot	I
			Consisting Of:	
-	SG-1760	1	Sleeve (Mach. Cstg.	
-	SG-1764	1	Plunger, Foot Rest	
-	SG-1763	1	Spring,Foot Rest	
-	AN960C6	1	Washer(#6x1/32"	
-	AN435-4-16	1	Screw(#6-40x1/4"Rd.Hd.	
-	AN935-8	2	Lockwasher(#8x3/64"	
-	AN515-8-5	2	Screw(#8-32x5/16"Rd.Hd.	
-	SG-1759	1	Rest, Foot	
-		1	Pin(3/8"x3/4"	
-	SG-1762	1	Spring, Latch	
-		1	Ball, Bearing(5/16" Dia.	
-	SG-1761	2	Bushing	
-	AN960C516L	2	Washer (5/16"x1/32"	
-	AN935-516	2	Lockwasher(5/16"x1/16"	
-	AN75-A6	2	Screw(5/16"-18x3/4" Hex.Hd.	

Symbol No.	Part Number	No. Req'd.	Description	Plate No.
-			1 2 3 Turret Ass'y., Upper Local	
151	SG-1073-1	1	Support, Housing (R.H.	I
			Consisting Of:	
-	SG-1073-2	1	Tube(X-4130S.S. (2-1/4"O.D.x.095"x33-1/4"	
-	SG-1073-3	1	Flange(X-4130(5/8"x3"x4-1/8"	
152	AN4-25A	6	Screw(1/4"x28x2-3/8"	I
153	AN960-416	12	Washer(1/4"x1/16"	I
154	AN365-428	6	Nut(1/4"-26Hex.El.Stop	I
155	AN310-6	8	Nut(3/8"-23 Castle	I
156	SG-1429	1	Yoke Ass'y.,Oxygen Bottle	I
			Consisting Of:	
-	SG-1434-1	1	Yoke, Oxygen Bottle	
-	SG-1434-2	1	Yoke, Oxygen Bottle	
-	SG-1438	1	Brace, Yoke (Long	
-	SG-1439	1	Brace, Yoke (Short	
-	SG-1441	1	Bracket, Clevis	
-	AN430AD-4-6	6	Rivet(1/8"x3/8"Rd.Hd.	
-	AN425AD-4-6	6	Rivet(1/8"x3/8"C'sk.Hd.	
-	SG-1444	1	Plate,Oxygen Bottle	
-	AN420-6-8	2	Rivet(3/16"x1/2"C'sk.Hd.	
-	AN486-1	1	Clevis	
-	SG-1437	1	Rod, Latch	
-	AN380-2-2	1	Pin,Cotter(1/16"x1/2"	
-	SG-1436	1	Spring	
-	SG-1435	1	Yoke, Latch	
-	SG-1440	1	Handle,Release(Mach.Cstg.	
-	SG-106	1	Pin	
-	AN394-31	1	Pin(1/4"Dia.x31/32"	
-	AN380-2-2	1	Pin, Cotter	
-	SG-1442	1	Shaft,Yoke Hinge	
-	AN960-416	2	Washer(1/4"x1/16"	
-	AN380-2-2	2	Pin,Cotter(1/16"x1/2"	
-	SG-1895	1	Plate,Oxygen Bottle Pad	
157	SG-987	1	Piping Ass'y.,Oxygen Bottle	I
			Consisting Of:	
-		1	Cross(Parker#555-4 KOTD	
-		1	Valve(Bastian-Blessing#2159	
-	SG-1622	1	Valve,Tube Check	
-		8	Nut(Parker #5B-TD	
-		8	Sleeve (Parker#5T-CS	
-		1	Valve, Check (Schrader&Sons#1667	
-	SG-1447	1	Bracket, Check Valve	
-	AC501C1012	1	Screw(#10-32x3/4"Fil.Hd.	
-	AN960-C10'	4	Washer(#10x1/32"	
-	AC365-1032	1	Nut(#10-32 Hex.El.Stop	
-	AN3-6A	4	Screw(#10-32x3/4"Hex.Hd.	
-	AC365-1032	4	Nut(#10-32 Hex.El.Stop	
-		1	Ell(90°Street #695-1	
-		1	Adapter(Schrader&Sons#1968	
-	SG-1448	1	Bracket,Pressure Regulator	
-	AC501C6-12	3	Screw,Fil.Hd.	
-	SG-1451	1	Tube	
-		1	Fitting(Parker#2-1941-16	
-	SG-1450	1	Tube	
-	SG-1074-1	1	Bracket, Support	
158	SG-1452	1	Hose, Flexible	IV
159	AN755-5	1	Clip(5/16"Dia.Loop Type	IV
K	SG-986	1	Control Ass'y., Az., Elev. & Range Hand	III
160	SG-1166	1	Link (Mach.Cstg.(Lower	II
161	SG-1704	1	Shield, Stabilizer Link	II
162	SG-1709	1	Screw, Anchor Pivot	II
163	SG-1623	1	Link (Mach.Cstg.(Upper	II
164	SG-1266-4	1	Screw,Upper Pivot	II
165	SG-1696-1	1	Spool, Charging Cable	II
166	SG-1267	4	Link	II,VI
167	SG-1266-1	2	Screw	II,VI
168	AN365-428	2	Nut(1/4"-28Hex.El.Stop	III
169	SG-1266-5	2	Screw	II,VI
170	SG-1698	2	Spool, Charging Cable	II,VI
171	AN365-428	2	Nut(1/4"-28 Hex.El.Stop	V,VI
172	SG-1266-3	1	Screw	II
173	SG-1266-2	2	Screw	II,VI
174	AN365-428	2	Nut(1/4"-28 Hex.El.Stop	VI
175	SG-1266-0	2	Screw	IV
176	SG-1167-4	1	Shaft, Flexible	II
177	SG-1167-1	2	Shaft, Flexible	II,VI
178	SG-1167-2	1	Shaft, Flexible	VI
179	SG-1790	1	Shaft, Flexible	III
180	SG-992	1	Bag Ass'y.,Shell&Clip(R.H.	I
			Consisting Of:	
-	SG-1425-1	1	Holder, Bag (R.H.	
-	SG-1425-2	1	Holder, Bag (L.H.	
-	SG-1426	2	Latch, Bag Holder	
-	SG-1620	1	Bag, Shell & Clip	
-		28	Rivet(E.B.Simpson & Co. #D3048-A1411	
-		1	Snap, Harness(W.Bingham#532	

UPPER LOCAL TURRET ASS'Y. #644928-C
(STEEL PRODUCTS DWG. #SG 1-2-3-4-5-6)
(CONTINUED)

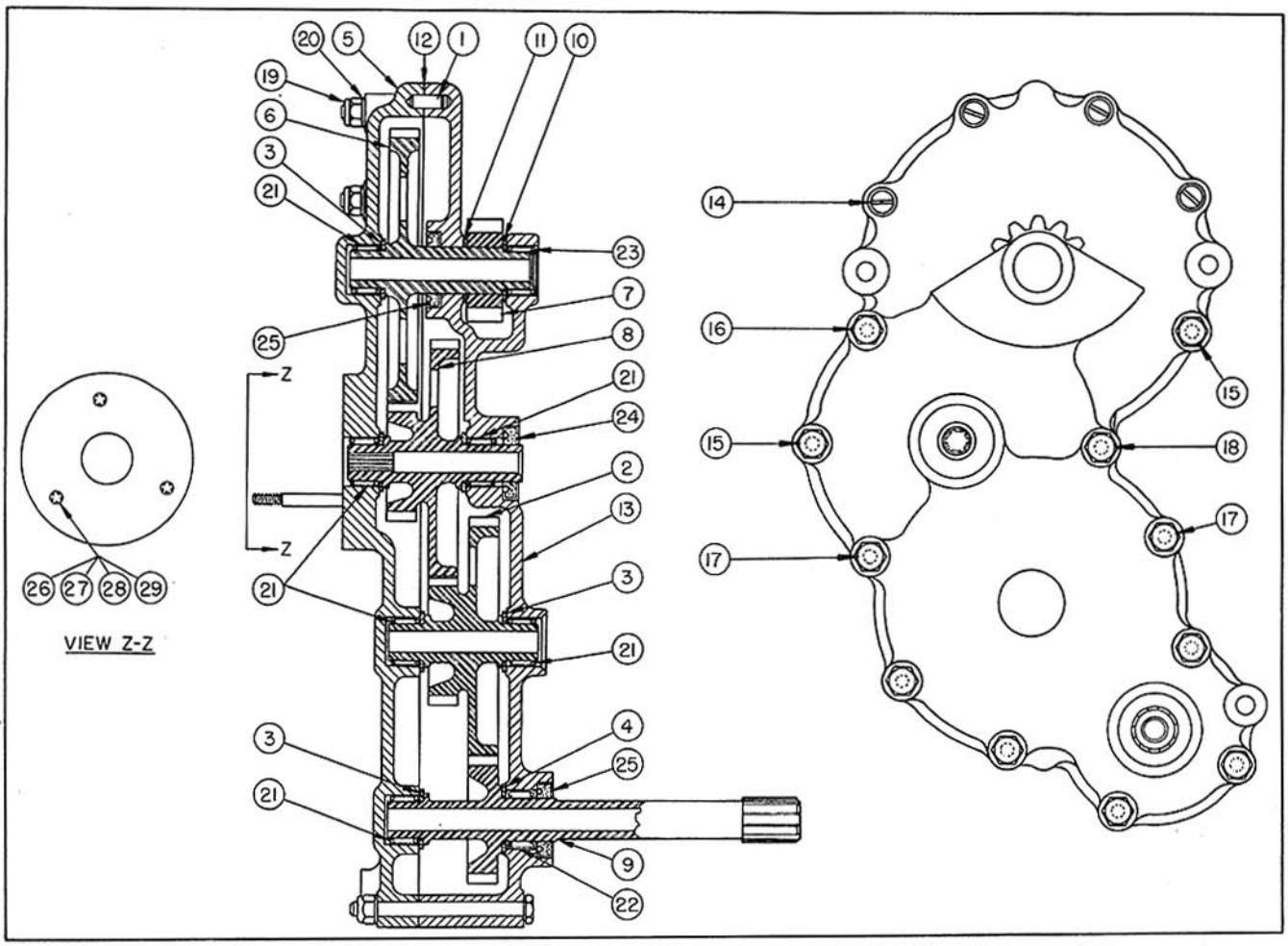
Symbol No.	Part Number	No. Req'd.	Description	Plate No.
-			Turret Ass'y.,Upper Local	
181	SG-1620	1	Bag, Case & Clip	I
182	SG-44	1	Adapter Ass'y.	V
			Consisting Of:	
-	SG-685	1	Box(Mach.Cstg.	
-		2	Pin (1/8"Dia.x3/8"Baumbach	
-	SG-688	1	Lever, Stationary	
-	SG-689	1	Lever, Floating	
-	AN393-11	1	Pin(3/16"Dia.x11/32"Flat Hd.	
-	AN380-2-2	1	Pin(1/16"Dia.x1/2"	
-	AN393-15	1	Pin(3/16"Dia.x15/32"Flat Hd.	
-	AN380-2-2	1	Pin,Cotter(1/16"Dia.x1/2"	
-	SG-687	1	Cover, Box	
-	AN5104416-10	1	Screw(1/4"-28x5/8"Flat Hd.	
-	SG-690	1	Spring, Arm Tripping	
-	SG-686	1	Arm, Tripping	
-	AN935-416	3	Lockwasher(1/4"x1/16"	
-	SG-1779	3	Screw	
183	X41B2679	1	Adapter(Edgewater Type E-10	II
184	SG-1406	1	Screw, Special	II
185		2	Gun(#50 Calibre-G.F.E.	I
186	SG-1135	1	Plate, Name	I
187		4	Screw(#6x1/4" P.K.D.	I
188	SG-1196	1	Bracket(Mach.Cstg.(R.H.	II
189	SG-1277-2	1	Screw, Flat Hd.	II
190	SG-1277-1	1	Screw, Flat Hd.	II
191	SG-1197	1	Bracket(Mach.Cstg.(L.H.	II
192		4	Pin(1/4"x3/4"	II
193	41-E3718	1	Solenoid (Type G-4A	II
194	AN75-5	6	Screw(5/16"-18x5/8"Hex.Hd.	II
195	AN960C516L	6	Washer(5/16"x1/32"	II
DD	SG-995-C	1	Bell Crank & Neutralizing Unit Ass'y.	III,VI
196	SG-1254	1	Bracket(Mach.Cstg.	III
197		2	Pin(1/8"Dia.x1/2"	III
198	SG-1350	1	Pin, Spring Disc	III
199	AN316-4R	1	Nut	III
200	SG-2190	1	Pin, Hand Control	III
201	AN960-B416	1	Washer(1/4"x1/16"	III
202	SG-1353	1	Spacer & Pin Ass'y.Spring Guard	III
			Consisting Of:	
-	SG-1349	1	Disc, Spring Guard	
-	SG-1352	1	Spacer	
-	SG-1356	1	Pin, Anchor	
203	SG-1357	1	Spring	III
204	AN960-C416L	1	Washer	III
205	SG-1354	1	Disc, Spring Guard	III
206	SG-1358	1	Pin, Coupling	III
207		1	Washer(MasterProducts Co.#302 (1/2"x17/64"	III
208	SG-1355A	1	Crank, Bell	III
209	SG-1351	2	Pin	III
210	SG-1353	1	Spacer &Pin Ass'y., Spring Guard	III
			Consisting Of:	
-	SG-1349	1	Disc, Spring Guard	
-	SG-1352	1	Spacer	
-	SG-1356	1	Pin, Anchor	
211	SG-1357	1	Spring	III
212	AN276-2	1	Joint, Ball(1/4"-28 Thd.	III
213	SG-1354	1	Disc, Spring Guard	III
214	SG-1358	1	Pin, Coupling	III
215		1	Washer(Master Products Co. #302 (1/2"x17/64"	III
216	SG-1289	1	Lever	III
217	SG-1350	1	Pin, Spring Disc	III
218	AN385-60-4	1	Pin, Taper(#6/0x1/2"	III
219	AN960-C416L	1	Washer(1/4"x1/16"	III
220	SG-1255	1	Bracket(Mach.Cstg;Small	III
221	AN364-428	1	Nut,Stop	III
222	AN935-8L	2	Lockwasher(#8x1/32"	III
223	AN503-8-8	2	Screw(#8-32x1/2" Fil.Hd.	III
224	AN5-33A	2	Screw	I
225	ANC-65A	2	Screw	I
226	AN365-624	2	Nut(3/8"-24Hex.El.Stop	I
227	AN960-C616	4	Washer(3/8"x1/16"	I
228	AN535-6-4	6	Screw	I
229	AN364-428	1	Nut, Stop	II
230	AN4-14A	2	Screw	III
231	AN960-C416	4	Washer (1/4" x1/16"	III
232	AN365-428	3	Nut(1/4"-28 Hex.El.Stop	IV
233	AN4-23A	3	Screw	IV
234	AN960-416L	3	Washer(1/4"x1/16"	IV
235	AN6-62A	8	Screw(3/8"-24x6-1/4"Hex.Hd.	I,IV
236	AN365-624	4	Nut(3/8"-24 Hex.El.Stop	I
237	AN960-C616	16	Washer(3/8"x1/16"	I,IV
238	AN6037A	2	Screw(3/8"-24x3-7/8"Hex.Hd.	IV
239	AN960-C616	12	Washer(3/8"x1/16"	IV
240	AN365-624	6	Nut(3/8"-24 Hex.El.Stop	IV
241	AN6-62A	2	Screw(3/8"-24x6-1/4" Hex.Hd.	I
242	AN365-624	2	Turret Ass'y., Upper Local	
243	AN960-C616	4	Nut(3/8"-24 Hex.El.Stop	I
244	AN960-516L	4	Washer(3/8"x1/16"	I
245	AN365-624	4	Washer(5/16"x1/16"	IV
246	AN6-65A	2	Nut(3/8"-24Hex.El.Stop	IV
247	AN4-14A	4	Screw	IV
248	AN4-13A	12	Screw	IV
249	AN960-C416	32	Screw	IV
250	AN365-428	16	Washer(1/4"x1/16"	IV
251	AN365-428	1	Nut(1/4"-28 Hex.El.Stop	
252	SG-1090	6	Nut(1/4"-28 Hex.El.Stop	VI
253	SG-1769	1	Stud	I
254	SG-1076	1	Plate, Name	I
255	SG-1697	1	Bushing, Support	III
256	SG-1277	1	Shield, Sight Bracket	IV
-	SG-981	2	Screw, Flat Hd.	VI
257	SG-1340	1	Breather Ass'y.	
258	SG-1341	1	Body, Breather	VI
259	SG-1342	1	Cover, Breather	VI
260	SG-1343	1	Plate, Breather Mirror	VI
261	SG-1805	1	Spring,Breather Cover Lock	VI
			Baffle Ass'y.,Screen	VI
-	SG-1737	1	Consisting Of:	
-	SG-1804	1	Baffle,Breather Body	
-	SG-954	1	Screen	
262	SG-1069	1	Gear Ass'y.,Internal Ring	
263	SG-1070	6	Gear, Internal Ring	
264	AN510-10-12	60	Segment, Flange	III
265	AN960-610L	60	Screw(.190"-32x3/4"Flat Hd.	III
266	AN365-1032	60	Washer(.190"x1/32"	III
L	SG-959	1	Nut(.190"-32 Hex.El. Stop	III
M	SG-953	1	Dome Ass'y.	I,V
267	SG-1720-1	1	Ring Ass'y., Slip	I
268	SG-1720-2	1	Guide, Ammunition	II
269	SG-1091	1	Guide, Ammunition	II
270	SG-1088	4	Cradle, Sight	II,VI
P	SG-939	1	Stud, Az.Gear Box	IV
271	SG-1000	1	Yoke Ass'y., Gun Mtg.	II,V,VI
272	SG-1168-1	1	Platform	I
273	SG-1168-2	1	Bracket, Sight Link (L.H.	IV
274	SG-1416-1	1	Bracket, Sight Link (R.H.	IV
			Brace, Ejection Panel Inside (R.H.	IV
275	SG-1416-2	1	Brace, Ejection Panel Inside (L.H.	IV
276	SG-1197	1	Bracket, Sight Link (L.H.	VI
277	AN75-A10	3	Screw	VI
278	AN935-516	3	Lockwasher	VI
279	SG-977	6	Box Ass'y.,Ammunition	I,IV
			Each Consisting Of:	
-	SG-1300	2	Slide	
-	SG-1301	2	Bearing, Roller Shaft	
-	SG-1303	1	Shaft, Roller	
-	SG-1304	2	Roller	
-	AN455AD4-6	8	Rivet (1/8"Dia.x1/2"Brazier Hd.	
-	SG-1461-A	2	Stop	
-	SG-1299	1	Box, Ammunition	
EE	SG-952-J	1	Box Ass'y.,Terminal	I
280	SG-1039	1	Box, Terminal	I
281	AN960-C6	1	Washer (#6x1/32"	I
282	AN935-6	1	Lockwasher(#6x1/32"	I
283	AN500-6-5	1	Screw(#6-32x5/16"	I
284	SG-1808	2	Grommet	I
285	SG-1036	1	Strip, Insulating	I
286	SG-1035	1	Block, Terminal	I
287	SG-640	1	Stud, Power Terminal	I
288	SG-643	1	Stud, Power Terminal	I
289	AN385-50-4	1	Pin, Taper(#5/0x1/2"	I
290	AN960-C516	2	Washer(5/16"x1/16"	I
291	AN365-B524	1	Nut(5/16"-24	I
292	AN500-10-10	6	Screw(#10-24x5/8"Fil.Hd.	I
293	AN960-B10	6	Washer(#10x1/16"	I
294	AN960-C10L	6	Washer(#10x1/32"	I
295	AN936-A10	6	Lockwasher(Shakeproof Style "A"	I
296	AN340-B10	6	Nut(#10-24 Hex.Br.	I
297	AN501-10-8	4	Screw(#10-32x1/2"Fil.Hd.	I
298	AN501-10-10	4	Screw(#10-32x5/8"Fil.Hd.	I
299	AN960-10L	4	Washer(#10x1/32"	I
300	AN935-10L	4	Lockwasher(#10x1/32"	I
301	AN315-3R	4	Nut(#10-32 Hex.	I
302	AN660-6	1	Terminal, Electrical	I
303	AN500-8-6	4	Screw(#8-32x3/8"Fil.Hd.	I
304	AN960-C8	4	Washer(#6x1/32"	I
305	SG-1038	1	Cover, Terminal Box	I
306	SG-1273	1	Link Ass'y.,Supporting (L.H.)	II,VI
			Consisting Of:	
-	SG-1270	2	Eye, Supporting Link	
-	AN435-4-14	6	Rivet(1/8"x7/8"Rd.Hd.	
-	AN393-15	1	Pin(3/16"x15/32"	
-	AN392-11	1	Pin(1/8"x11/32"	

UPPER LOCAL TURRET ASS'Y #644928-C
(STEEL PRODUCTS DWG.#SG 1-2-3-4-5-6)
(CONTINUED)

Symbol No.	Part Number	No. Req'd.	1 2 3 Description	Plate No.
-			Link Ass'y.,Supporting (L.H.	
-	AN390-2-2	2	Pin, Cotter(1/16"x1/2"	
-	SG-1269	1	Pin, Locating	
-	SG-1268	1	Lever, Locking	
-	SG-1271	1	Handle, Supporting Link Hoist	
-	SG-1273-2	1	Tube(1/2"O.D.x12"lg.	
-	SG-1273-3	1	Tube(5/8"O.D.x16-1/4"lg.	
-	SG-1273-4	1	Tube(5/8"O.D.x12-1/4"lg.	
307	SG-1673	1	Coupling Ass'y., Az. Hand Drive Shaft	IV
			Consisting Of:	
-	385-50-5	1	Pin, Taper	
-	SG-1672	1	Coupling	
308	SG-1674	1	Plate, Army Name	I
309	SG-1273-2	1	Link Ass'y.,Supporting(R.H.)	II,VI
			Consisting Of:	
-	SG-1270	2	Eye, Supporting Link	
-	AN435-4-14	6	Rivet(1/8"x7/8"Rd.Hd.	
-	AN393-15	1	Pin(3/16"x15/32"	
-	AN392-11	1	Pin(1/8"x11/32"	
-	AN380-2-2	2	Pin, Cotter(1/16"x1/2"	
-	SG-1269	1	Pin,Locating	
-	SG-1268	1	Lever, Locking	
-	SG-1271	1	Handle, Supporting Link Hoist	
-	SG-1273-2	1	Tube(1/2"O.D.x12"lg.	
-	SG-1273-3	1	Tube(5/8"O.D.x16-1/4"lg.	
-	SG-1273-4	1	Tube(5/8"O.D.x12-1/4"lg.	
310	SG-1443	1	Support	I
311		2	Adapter(A.C.Type#E-10	V
312	SG-1249	8	Stud	V
313	AN960-C10L	8	Washer(.190"x1/32"	V
314	AN364-1032	8	Nut(.190"-32 Hex.El.Stop	V
315	AN526103220	1	Screw	V
316	AN960-C10L	1	Washer	V
317	AN995-47-9	2	Lockwire	V
318	SG-1413	1	Shield(L.H.	V
319	AN995-47-2	2	Lockwire	V
320	AN75-A3	6	Screw	V
321	AN960-C516	6	Washer(5/16"x1/16"	V
322	AN3-3A	4	Screw(.190"-32x3/8"Hex.Hd.	V
323	AN365-1032	4	Nut,Stop(.190"x1/32"	V
324	SG-1028	2	Stud,Att.	V
325	AN960-C516	2	Washer(5/16"x1/16"	V
326	AN364-524	2	Nut,Stop	V
327	AN995-4714	2	Lockwire	V
328	SG-1406	4	Screw,Special	V
329	SG-1723-1	1	Chute, Clip	V
330	AN520-6-14	2	Screw	V
331	AN960-C6	2	Washer	V
332	AN365-640	2	Nut	V
333	SG-1325	2	Dome, Spring (R.H.	V
334	AN365-1032	1	Nut (.190"-32 Hex.El.Stop	V
335		2	Solenoid(Type G-4A	V
336	SG-1195	2	Handle, Charger	V
337	AN4-34A	2	Screw	V
338	SG-1411	1	Panel, Ejection	V
339	SG-1305	1	Panel,Ass'y., Ejection	V
			Consisting Of:	
-	SG-1305-1	1	Panel (R.H.	
-	SG-1398	1	Nut, Roller Retaining (For use with 1305-1 Only	
-	SG-1305-2	1	Panel (L.H.	
340	SG-1027	4	Stud, Att.	V
341	AN960-C516	4	Washer(5/16"x1/16"	V
342	AN364-524	4	Nut(5/16"-24Hex.El.Stop	V
343	SG-979	1	Bracket Ass'y., Pulley	V
344	SG-979-1	1	Bracket Ass'y., Pulley	V
			Each Consisting Of:	
-	SG-1321-1	1	Body, Pulley Br'kt. (For use with Sg-979-1 Only	
-	SG-1323-1	1	Body, Pulley Br'kt. (For use with Sg-979-1 Only	
-	SG-1321-2	1	Body, Pulley Br'kt. (For use with Sg-979 Only	
-	SG-1323-2	1	Body, Pulley Br'kt. (For use with Sg-979 Only	
-	SG-1773	2	Bushing, Pulley Bracket	
-	AN435-4-16	2	Rivet(1/8"Dia.x1"Rd.Hd.	
-	AN210-1	1	Pulley, Ball Bearing	
-	AN393-29	1	Pin (3/16"Dia.x1-5/64"	
-	AN380-2-2	1	Pin, Cotter(1/16"Dia.x1/2"	V
FF	SG-985-B	1	Roller Ass'y., Chute (L.H.	

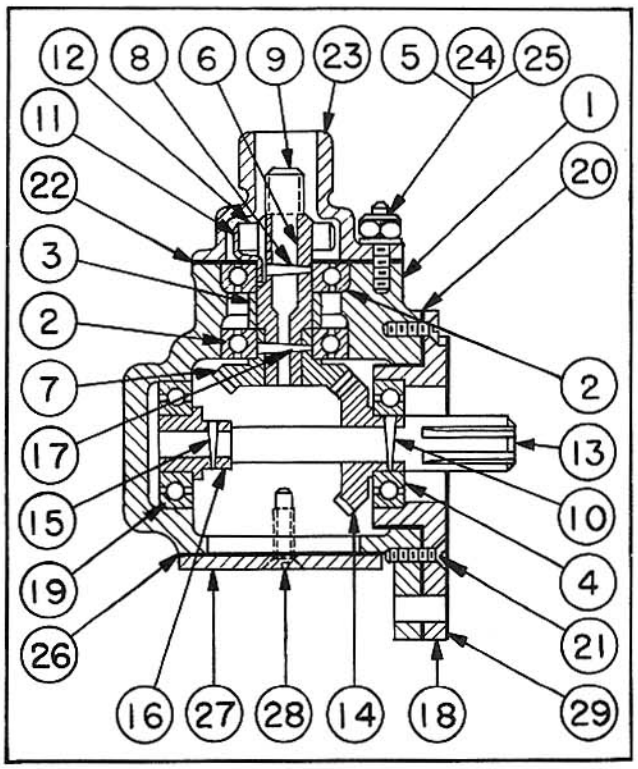
Symbol No.	Part Number	No. Req'd.	1 2 3 Description	Plate No.
-			Roller Ass'y.,Chute (L.H.	
345	SG-1392	1	Roller	V
346		1	Bearing,Needle(Torrington#B-88	V
347	SG-1397	1	Shaft,End (Small	V
348	SG-1399	1	Spring	V
349	SG-1396	1	Shaft, Intermediate	V
350	SG-1395	1	Shaft, End (Large	V
351		1	Bearing, Needle (Torrington #NB-11-X	V
352	SG-1400	1	Bottom, Rolling	V
353	SG-1401	1	Hinge, Bottom	V
354	AN435-4-4	9	Rivet(1/8"Dia.x1/4"Rd.Hd.	V
355	SG-1402	1	Plate	V
356	AN505-6-4	5	Screw(#6-32x1/4" Flat Hd.	V
357	SG-1394	1	Plate, Pin	V
358	SG-1393	2	Pin(.0935"Dia.x5/16"	V
359	AN74-44	1	Screw(1/4"-28x4-1/2"	V
360	AN995-47-2	1	Lockwire(.047"Dia.x2"lg.	V
R	SG-1681-B	1	Wire& Conduit Ass'y.(For details see Pg.40)	V
-	SG-962-1&2	1	Charger Ass'y.,Gun	
			Each consisting Of:	
361	SG-1126-1	1	Bracket(L.H. (For use with SG-962-1 only	V
362	SG-1126-2	1	Bracket (R.H.(For use with SG-962-2 only	V
363	SG-1129	1	Spacer	V
364	SG-1128	1	Shield	V
365	AN420-3-14	7	Rivet(3/32"Dia.x7/8"C'sk.Hd.	V
366	SG-1127	1	Spacer, Pulley	V
367	AN210-2A	1	Pulley	V
368	AN393-25	1	Pin(3/16"Dia.x25/32"Flat Hd.	V
369	AN960-C10L	1	Washer(#10x1/32"	V
370	AN380-2-2	2	Pin,Cotter(1/16"Dia.x1/2"	V
371	SG-1104	1	Screw, Stop	V
372	SG-1103	1	Screw, Cam	V
373	SG-1631	1	Spring,Handcharging Lever (L.H. (For use with SG-962-1 only	V
374	SG-1105	1	Screw, Pivot	V
375	SG-1102	1	Clevis,Charger Arm	V
376	AN393-9	1	Pin(3/16"Dia.x9/32"	V
377	AN960-C10L	1	Washer(#10x1/32" Thk.	V
378	AN935-10	3	Lockwasher(#10x3/64" Thk.	V
379	SG-1667-1	2	Screw	V
380	SG-1667-2	1	Screw	V
381	SG-1101-1	1	Primer, Cam Lever L.H. (For use with SG-962-1 only	V
382	SG-1101-2	1	Primer, Cam Lever R.H. (For use with SG-962-2 only	V
383		1	Cable, #7x7 (1/16"Dia.x5l-1/2"lg.	V
384	SG-1807	1	Bracket Ass'y. Pulley & Sight Link(L.H.	V
			Consisting Of:	
-	SG-1326-1	1	Spacer, Pulley	
-	SG-1327-1	1	Cover, Pulley	
-	AN393-15	1	Pin, Flat Hd.	
-	SG-1197	1	Bracket,Sight Link (L.H.	
-	AN210-1	1	Pulley	
-	AN380-2-2	1	Pin, Cotter(1/16"Dia.x1/2"	
-	AN435-4-10	1	Rivet(1/8"Dia.x5/8"	
-	AN435-4-8	2	Rivet(1/8"Dia.x1/2"	
385	SG-1806	1	Bracket Ass'y., Pulley & Sight Link (R.H.	V
			Consisting Of:	
-	SG-1326	1	Spacer, Pulley	
-	SG-1327-2	1	Cover, Pulley	
-	AN393-15	1	Pin, Flat Hd.	
-	SG-1196	1	Bracket,Sight Link (R.H.	
-	AN210-1	1	Pulley	
-	AN380-2-2	1	Pin,Cotter(1/16"Dia.x1/2"	
-	AN435-4-10	1	Rivet (1/8"Dia.x5/8"	
-	AN435-4-8	2	Rivet(1/8"Dia.x1/2"	
386	AN-960-C616	2	Washer (3/8"x1/16"	IV
-	SG-942	2	Pulley Ass'y., Idler	
			Each Consisting Of:	
387	A380-2-2	1	Pin, Cotter(1/16"Dia.x1/2"	V
388	SG-1324	1	Fork, Pulley	V
389	AN393-17	1	Pin, Flat Hd.	V
390	AN210-1	1	Pulley	V

ELEVATION GEAR BOX ASS'Y. #SG-955



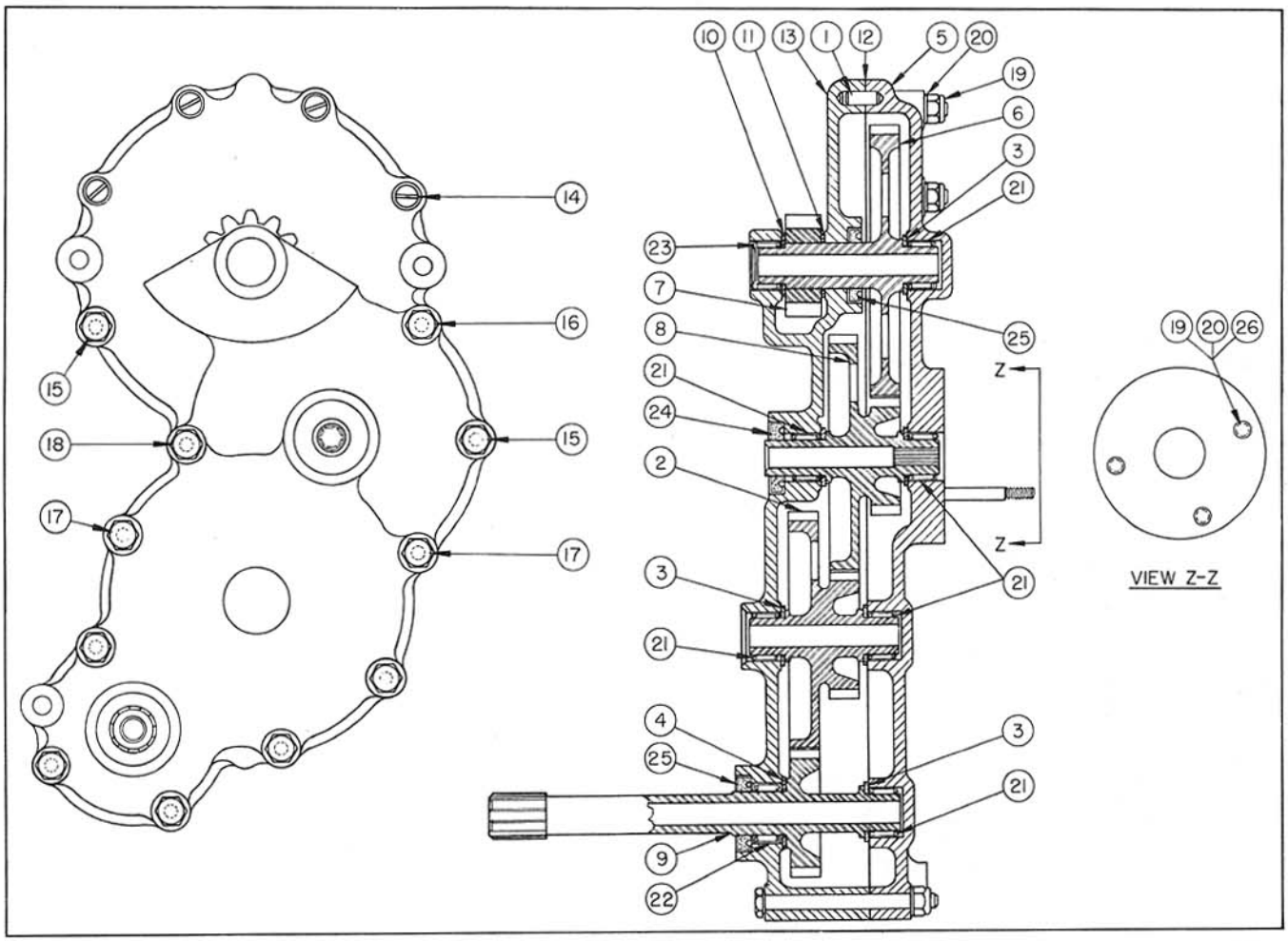
Symbol No.	Part Number	No. Req'd.	Description
-	SG-955	1	Box Ass'y.,Elev. Gear(L.H.
1	SG-106	2	Pin, Cover to Housing
2	SG-125	1	Gear, First Intermediate
3	SG-128	6	Spacer
4	SG-130	1	Spacer
5	SG-1051	1	Cover (Mach.Cstg.
6	SG-1052	1	Shaft, Gear Power
7	SG-1053	1	Gear, Power Drive
8	SG-1054	1	Gear, Second Intermediate
9	SG-1055	1	Gear, Drive
10	SG-1056	1	Spacer
11	SG-1057	1	Spacer
12	SG-1058	1	Gasket
13	SG-1059	1	Housing (Mach.Cstg.
14	AN50141628	4	Screw(1/4"-28x1-3/4"Fil.Hd.
15	AN4-21A	2	Screw(1/4"-28x2-1/8"Hex.Hd.
16	AN4-23A	1	Screw(1/4"-28x2-3/8"Hex.Hd.
17	AN4-27A	7	Screw(1/4"-28x2-7/8"Hex.Hd.
18	AN4-32A	1	Screw(1/4"-28x3-1/4"Hex.Hd.
19	AN365-428	15	Nut (1/4"-28 Hex.El.Stop
20	AN960C416L	26	Washer(1/4"x1/32"
21		6	Bearing,Needle(Torrington#B108
22		1	Bearing,Needle(Torrington#B128
23		1	Bearing,Needle(Torrington#M1081
24		1	Seal, Oil (Victoprene #62000
25		2	Seal, Oil (Victoprene #62012
26	SG-333	1	Stud (Short
27	SG-334	2	Stud (Long
28	AN365-1032	3	Nut
29	AN960-10L	3	Washer

FLEXIBLE SHAFT DRIVE ASS'Y. #SG-974



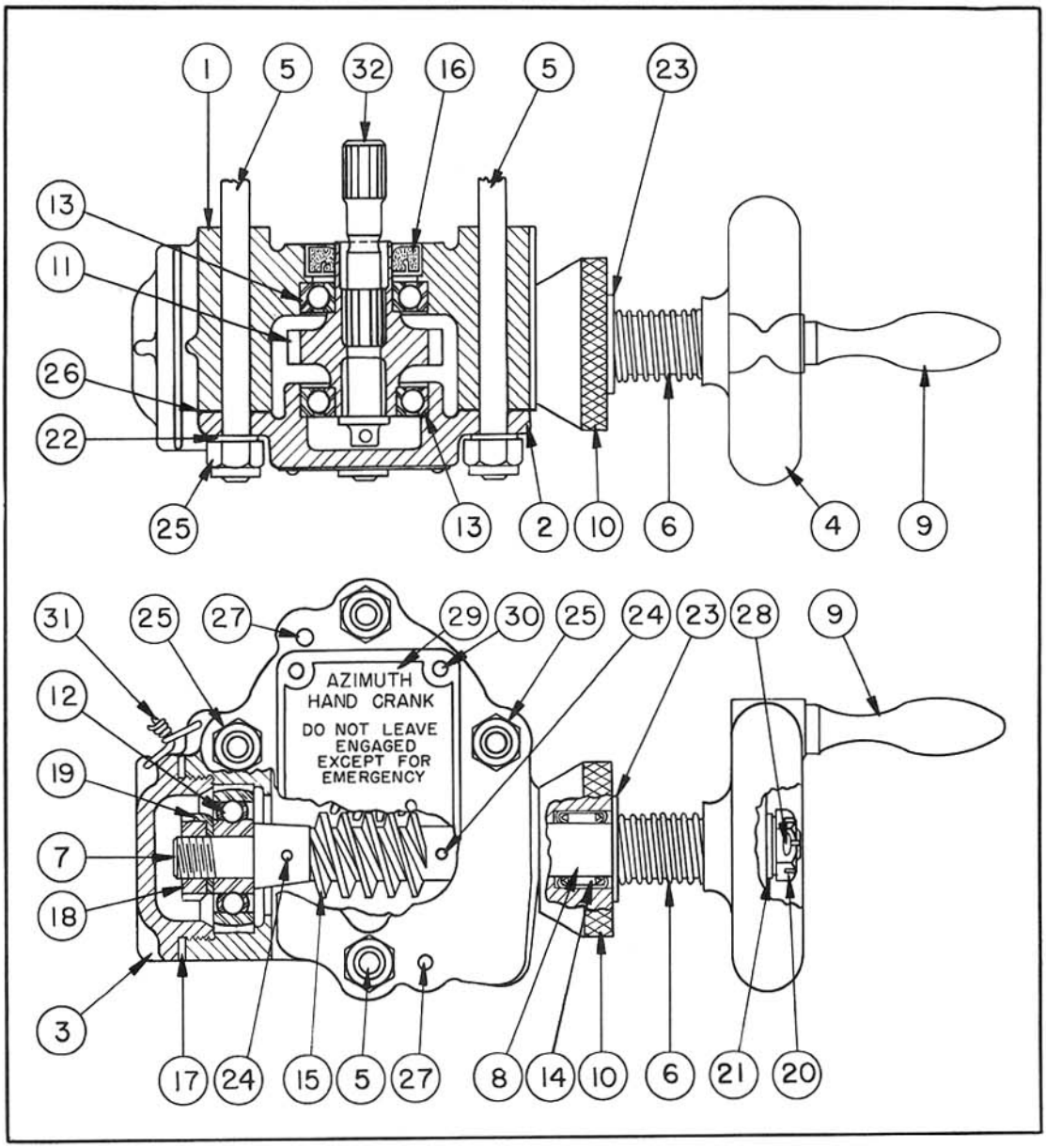
Symbol No.	Part Number	No. Req'd.	Description
			1 2
-	SG-974	1	Shaft Drive Ass'y., Flexible
-	SG-1902	1	Housing Ass'y.,Flex.Shaft Drive
1	SG-1250	1	Housing(Mach.Cstg.
2		2	Bearing,Ball(Fafnir #S-3
3	SG-338	1	Spacer, Bearing (S.A.E.#17-5
4		1	Bearing,Ball(Fafnir #S-3
5	SG-330	3	Stud(#6-40Thd.(S.A.E.#2330
-	SG-1903	1	Gear & Shaft Ass'y., Driven
6	SG-1283	1	Quill, Driven Gear
7	SG-1282	1	Gear
8	AN385-60-3	1	Pin, Taper (#6/0x3/8"
9	SG-203	1	Gear (Brass
10	AN385-60-3	1	Pin, Taper(#6/0x3/8"
11		1	Lockwasher(Fafnir#W-0
12		1	Locknut(Fafnir #N-0
-	SG-1904	1	Gear & Shaft Ass'y., Driving
13	SG-1284	1	Shaft, Pinion
14	SG-1282	1	Gear (Steel
15	AN385-60-3	1	Pin, Taper(#6/0x3/8"
16	SG-548	1	Bushing, Bearing(S.A.E.#1020
17	AN385-60-3	1	Pin, Taper (#6/0x3/8"
-	SG-1905	1	Adapter Ass'y., Housing
18	SG-327	1	Adapter(Mach.Cstg.(Alcoa#47
19		1	Bearing, Ball(Fafnir#S-3
20	SG-341	1	Gasket(1/64"Thk.Vellumoid
21	AN505-4-6	2	Screw(#4-40x3/8"Flat Hd.
22	SG-328	1	Gasket(1/64"Thk.Vellumoid
23	SG-204	1	Flange(S.A.E.#175
24	AN960C6	3	Washer,Plain (#6x1/32" Thk.
25	AN365-640	3	Nut, Stop (#6-40Hex.El. Self-Locking
26	SG-339	1	Gasket(1/64"Thk.(Vellumoid
27	SG-335	1	Cover, Bottom(A.C.#11066
28	AN505-8-6	2	Screw(#8-32x3/8"Flat Hd.
29	SG-340	1	Gasket

ELEVATION GEAR BOX ASS'Y. #SG-956



Symbol No.	Part Number	No. Req'd.	Description
1	SG-956	1	Box Ass'y., Elev. Gear (R.H.
1	SG-106	2	Pin, Cover to Housing
2	SG-125	1	Gear, First Intermediate
3	SG-128	6	Spacer
4	SG-130	1	Spacer
5	SG-1050	1	Cover (Mach.Cstg.
6	SG-1052	1	Shaft, Gear Power
7	SG-1053	1	Gear, Power Drive
8	SG-1054	1	Gear, Second Intermediate
9	SG-1055	1	Gear, Drive
10	SG-1056	1	Spacer
11	SG-1057	1	Spacer
12	SG-1058	1	Gasket
13	SG-1060	1	Housing (Mach.Cstg.
14	AN50141628	4	Screw(1/4"-28x1-3/4"Fil.Hd.
15	AN4-21A	2	Screw(1/4"-28x2-1/8"Hex.Hd.
16	AN4-23A	1	Screw(1/4"-28x2-3/8"Hex.Hd.
17	AN4-27A	7	Screw(1/4"-28x2-7/8"Hex.Hd.
18	AN4-32A	1	Screw(1/4"-28x3-1/4"Hex.Hd.
19	AN365-428	18	Nut(1/4"-28 Hex.El.Stop
20	AN960C416L	29	Washer (1/4"x1/32"
21		6	Bearing,Needle(Torrington#B-108
22		1	Bearing,Needle(Torrington#B-128
23		1	Bearing,Needle(Torrington#M-1081
24		1	Seal, Oil (Victoprene #62000
25		2	Seal, Oil (Victoprene #62012
26	SG-1225	3	Stud

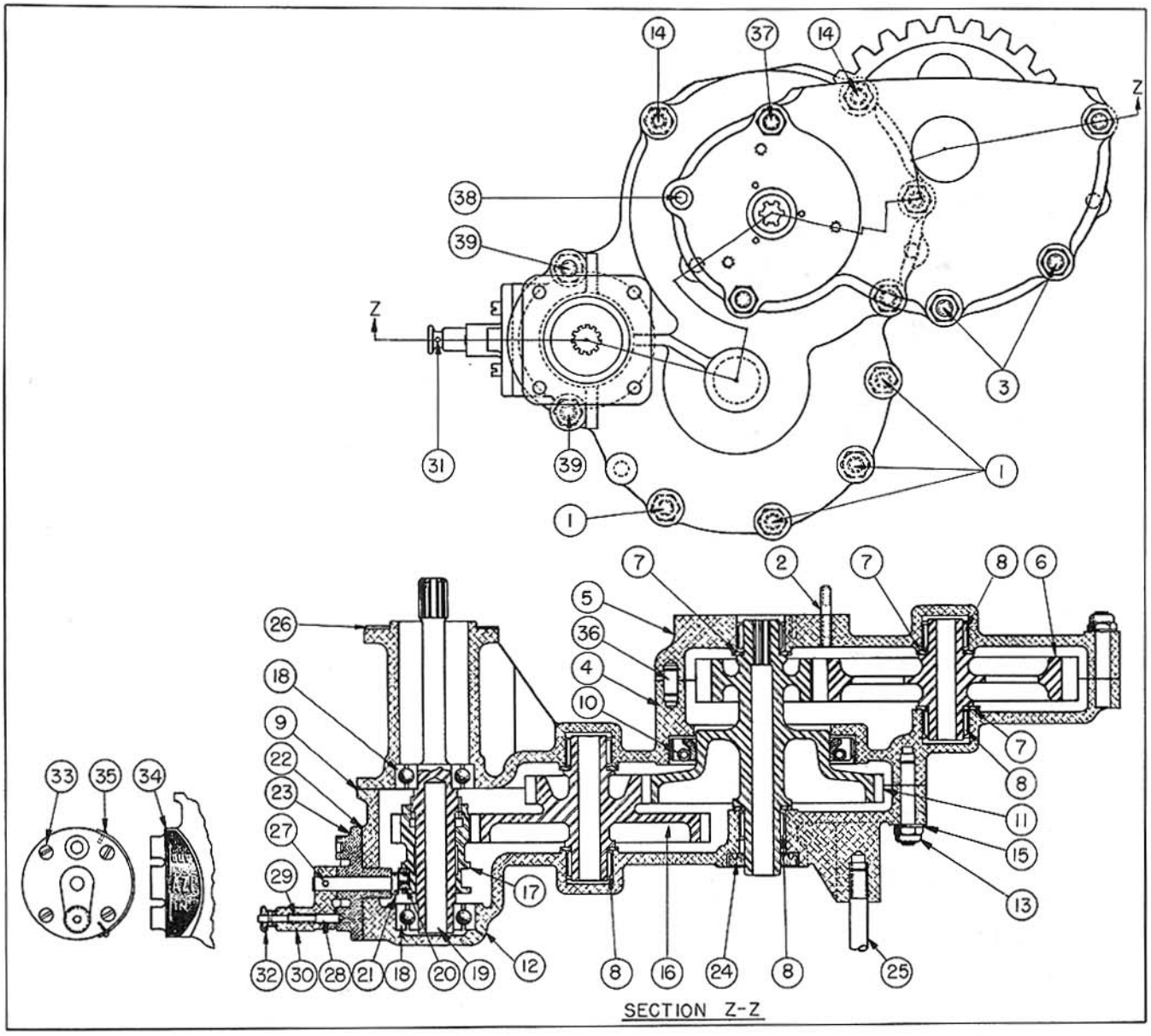
AZIMUTH HAND DRIVE ASS'Y. #SG-967-D



Symbol No.	Part Number	No. Req'd.	Description
-	SG-967-D	1	Drive Ass'y., Azimuth Hand
1	SG-1131	1	Housing(Mach.Cstg.(Alcoa #195-T4
2	SG-1132	1	Cover, Housing(Mach.Cstg.
3	SG-1133	1	Cap, Housing(Mach.Cstg.
4	SG-1134	1	Wheel, Crank(Mach.Cstg.
5	SG-1154	4	Stud (Cover to Housing
6	SG-1155	1	Spring, Retainer Plunger
7	SG-1156	1	Shaft, Bearing End
8	SG-1157	1	Shaft, Worm
9	SG-1158	1	Handle, Crank
10	SG-1159	1	Plunger, Locating
11	SG-1160	1	Gear, Worm (ANQQ-8-666
12		2	Bearing(Fafnir #200S
13		2	Bearing(Fafnir #S-5
14		1	Bearing,Needle(Torrington#B-88
15		1	Worm (Boston #HLVH
16		1	Seal,Oil(Victoprene #62004

Symbol No.	Part Number	No. Req'd.	Description
-		-	Drive Ass'y., Azimuth Hand
17	AN900-23	1	Gasket, Housing Cap
18		1	Locknut (Fafnir #N-00
19		1	Lockwasher(Fafnir #W-00
20	AN320-5	1	Nut, Worm Shaft
21	AN960-C516	1	Washer, Worm Shaft
22	AN960C416L	4	Washer, Stud
23	AN960-C816	1	Washer, Spring
24	AN385-40-4	2	Pin, Taper
25	AC365-428	4	Nut, Stud
26	SG-1417	1	Gasket
27	SG-1418	2	Pin (Cover to Housing
28	AN380-2-3	1	Pin, Worm Shaft Cotter
29	SG-1768	1	Plate, Azimuth Name
30	AN535-0-4	3	Screw(#00x1/8"P.K.D.
31	AN995-41-2	1	Lockwire(.041"Dia.x2"
32	SG-1870	1	Shaft, Splined

AZIMUTH GEAR BOX ASS'Y. #SG-951-E

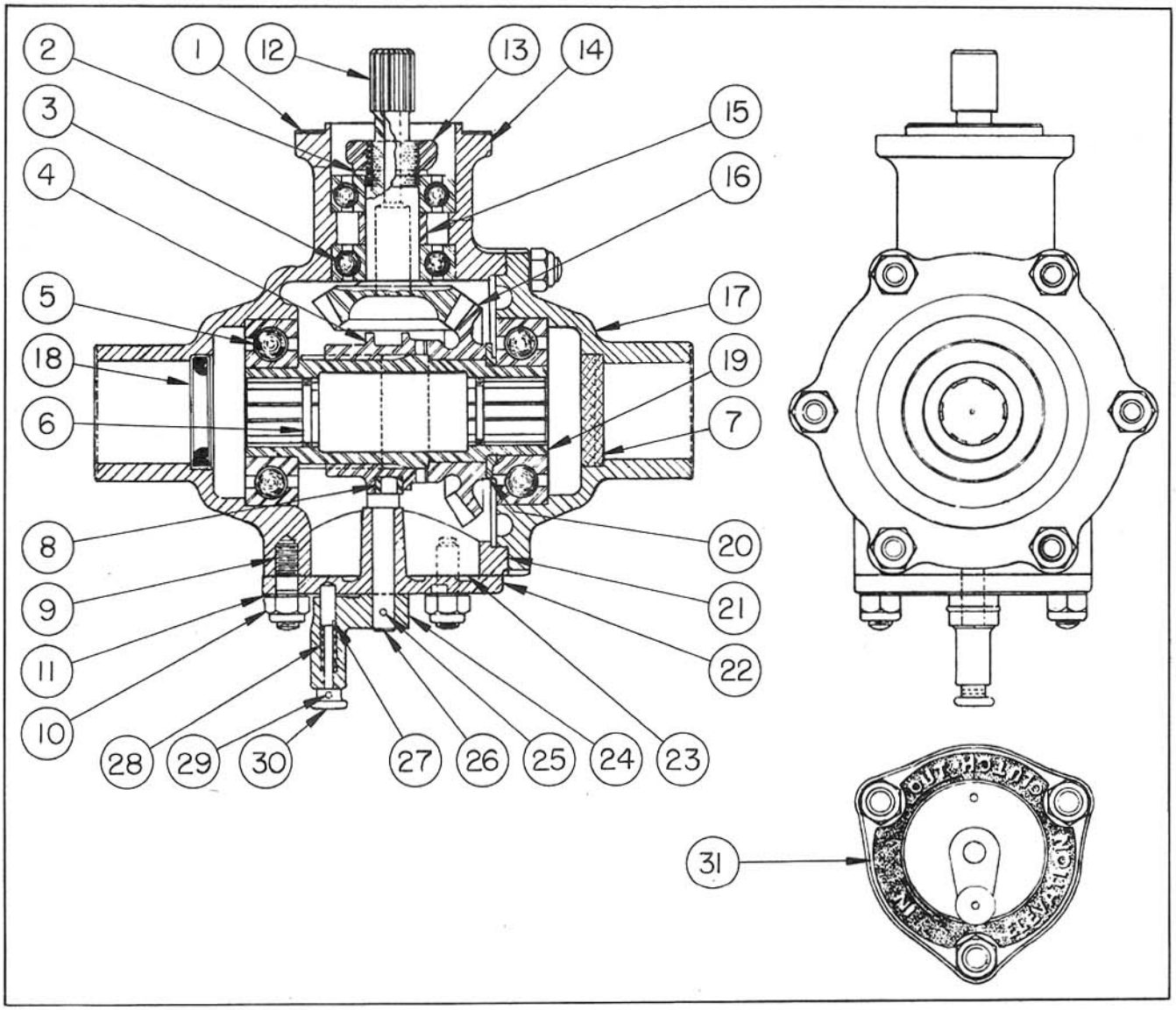


SECTION Z-Z

Symbol No.	Part Number	No. Req'd.	Description
-	SG-951-E	1	Box Ass'y., Azimuth Gear
1	SG-319	4	Stud (Medium
2	SG-1049	3	Stud
3	SG-317	3	Stud
4	SG-1061	1	Housing
5	SG-1062A	1	Cover
6	SG-156	1	Gear
7	SG-128	6	Spacer
8		6	Bearing, Needle (Torrington #B-108
9	SG-1067	1	Gasket
10		1	Seal, Oil (Victoprene (#60883
11	SG-1065	1	Gear
12	SG-1063-1	1	Cover
13	AN365-428	15	Nut, Self-Locking
14	SG-320	4	Stud (Short
15	AN960-C416L	15	Washer, Plain
16	SG-1064	1	Gear
17	SG-154	1	Gear
18		2	Bearing, Ball (Fafnir #202
19	SG-1066	1	Shaft, Clutch

Symbol No.	Part Number	No. Req'd.	Description
-	SG-951-E	1	Box Ass'y., Azimuth Gear
20	SG-145	1	Shoe, Clutch Throw-Out
21	SG-146	1	Crank, Clutch Throw-Out
22	SG-152	1	Gasket
23	SG-158	1	Cover, Clutch Throw-Out
24		1	Seal, Oil (Victoprene #62000
25	SG-1068	4	Stud
26	SG-164	1	Gasket
27	AN385-50-5	1	Pin, Taper
28	SG-147	1	Plunger
29	SG-148	1	Spring, Plunger
30	SG-151	1	Handle, Clutch Throw-Out
31		1	Pin (.045"dia.xl/4"Stubs #56
32	SG-149	1	Knob, Plunger
33	AN503-8-8	4	Screw, Fil.Hd.
34	SG-1766	1	Plate, Name
35		2	Screw (#00 x 1/8" P.K.D.
36	SG-106	4	Pin
37	SG-1099	2	Stud
38		1	Screw (1/4"-20xl-1/4" Socket Hd.
39	SG-318	2	Stud (Long

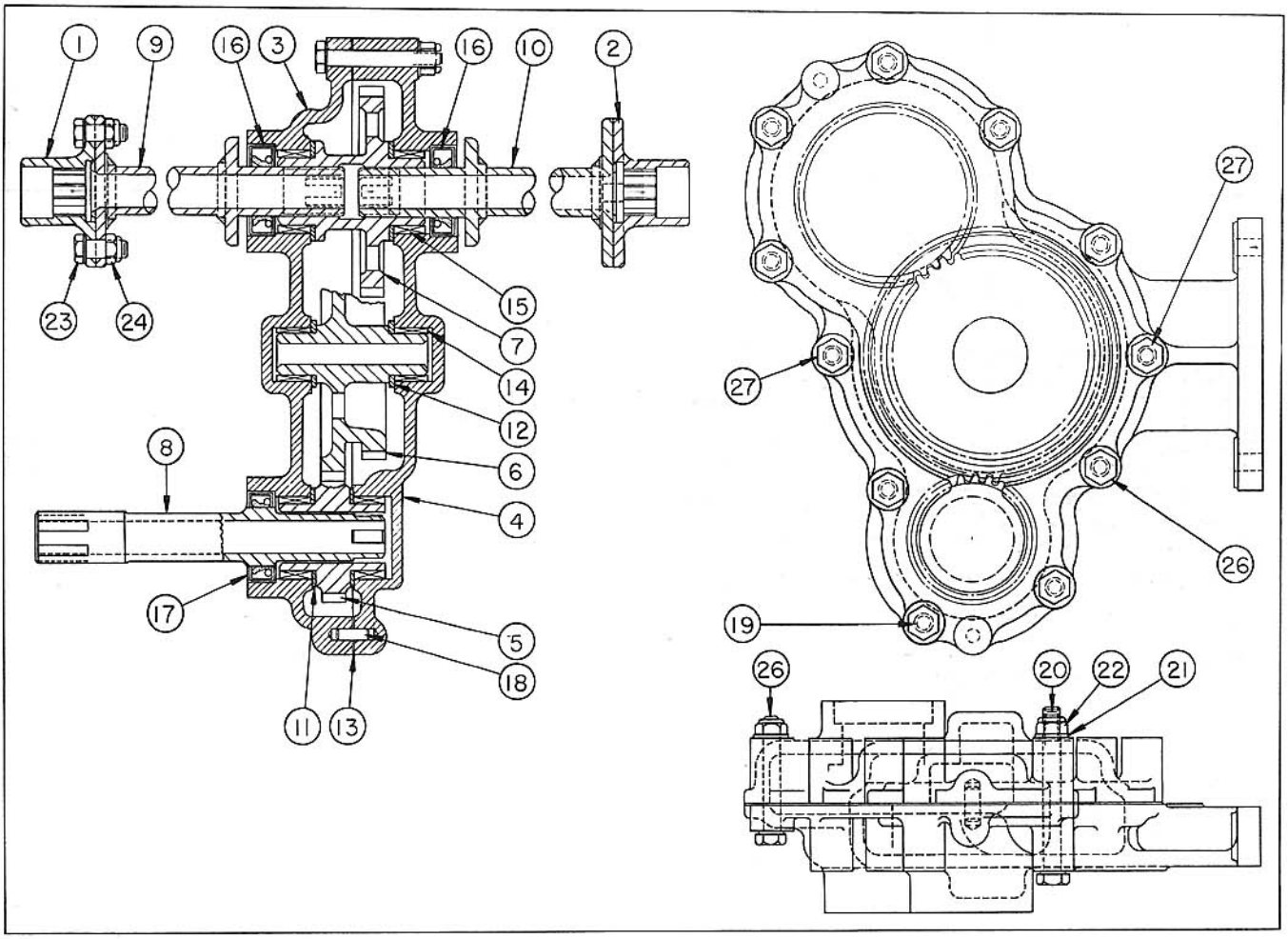
TRANSMISSION GEAR BOX ASS'Y. #SG-70-D



Symbol No.	Part Number	No. Req'd.	Description
-	SG-70-D	1	Box Ass'y.,Transmission Gear
1	SG-164	1	Gasket
2		1	Lockwasher (Fafnir #WO-2
3		2	Bearing, Ball (Fafnir #202
4	SG-1896	1	Clutch
5		2	Bearing, Ball (Fafnir #205
6	SG-144	1	Ring, Spring
7	SG-1040	1	Plug
8	SG-145	1	Shoe, Clutch
9	SG-153	9	Stud
10	AN365-428	9	Nut, Self-Locking
11	AN960-C416L	9	Washer, Plain
12	SG-138	1	Gear
13		1	Locknut (Fafnir #NO-2
14	SG-135	1	Box, Gear
15	SG-139	1	Spacer, Bearing
16	SG-1897	1	Gear

Symbol No.	Part Number	No. Req'd.	Description
-	SG-70-D	1	Box Ass'y.,Transmission Gear
17	SG-136	1	Cover (Front
18		1	Seal, Oil (Victor #W-62012
19	SG-141	1	Shaft, Clutch
20	SG-143	1	Spacer
21	SG-163	1	Gasket
22	SG-137	1	Cover, Box
23	SG-165	1	Gasket
24	SG-151	1	Handle, Clutch Throw-Out
25	AN385-50-5	1	Pin, Taper
26	SG-146	1	Crank, Clutch Throw-Out
27	SG-147	1	Plunger
28	SG-148	1	Spring, Plunger
29		1	Pin (.042" dia. x 1/4"
30	SG-149	1	Knob
31	SG-1767	1	Plate, Name

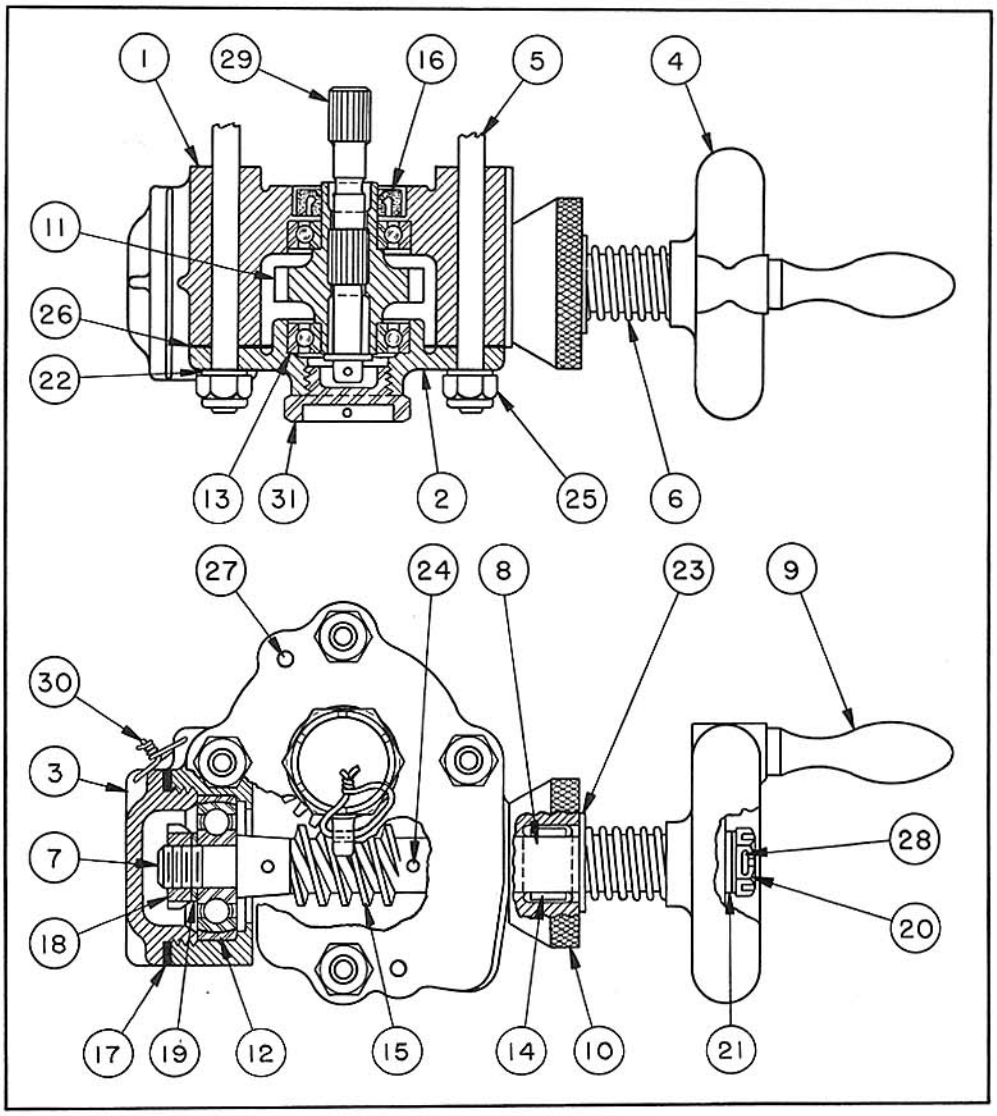
CROSS SHAFT GEAR BOX ASS'Y. #SG-957-A



Symbol No.	Part Number	No. Req'd.	Description
-	SG-957-A	1	Box Ass'y., Cross Shaft Gear
1	SG-169-1	1	Coupling, Cross Shaft(Left
2	SG-169-2	1	Coupling, Cross Shaft(Right
3	SG-1106	1	Housing, Gear Box (Mach.Cstg. (Alcoa #195-T-4
4	SG-1107	1	Cover, Gear Box (Mach.Cstg. (Alcoa #195-T4
5	SG-1108	1	Gear, Drive
6	SG-1109	1	Gear, Auxiliary
7	SG-1110	1	Gear, Driven
8	SG-1111	1	Shaft, Drive Gear (#57-180-1
9	SG-1112-1	1	Shaft, Cross (Left
10	SG-1112-2	1	Shaft, Cross (Right
11	SG-1114	4	Washer, Thrust
12	SG-1115	2	Washer, Aux. Gear Thrust
13	SG-1116	1	Gasket, Gear Box Cover

Symbol No.	Part Number	No. Req'd.	Description
-		-	Box Ass'y., Cross Shaft Gear
14		2	Bearing, Needle (Torrington #B-108"B"
15		4	Bearing, Needle (Torrington #B-168 "B"
16		2	Seal,Oil(Victoprene#60135,Type"H"
17		1	Seal, Oil (Victoprene #60193
18		2	Pin (3/16"x1/2" (Baumbach
19	AN4-22A	1	Screw, Gear Box
20	AN4-24A	2	Screw, Gear Box
21	AN960C416L	22	Washer, Gear Box
22	AN365-428	11	Nut, Elastic Stop
23	AN-4-5A	4	Screw
24	AN364-428	4	Nut, Elastic Stop
25	AN4-17A	4	Screw
26	AN4-26A	2	Nut
27	AN4-31A	2	Nut

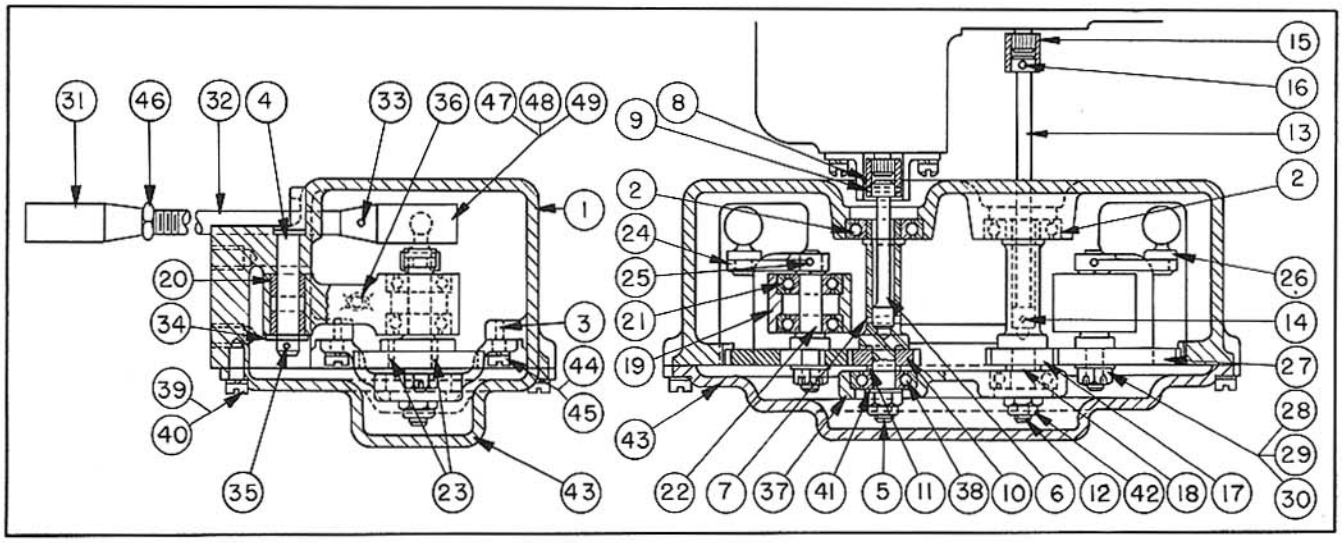
ELEVATION HAND DRIVE ASS'Y. #SG-934



Symbol No.	Part Number	No. Req'd.	Description
-	SG-934	1	Drive Ass'y., Elevation Hand
1	SG-1131	1	Housing (Mach.Cstg. (Alcoa #195-T-4
2	SG-1868	1	Cover, Housing
3	SG-1133	1	Cap, Housing (Mach.Cstg.
4	SG-1134	1	Wheel, Crank (Mach.Cstg.
5	SG-1154	4	Stud (Cover to Housing
6	SG-1155	1	Spring, Retainer Plunger
7	SG-1156	1	Shaft, Bearing End
8	SG-1157	1	Shaft, Worm
9	SG-1158	1	Handle, Crank
10	SG-1159	1	Plunger, Locating
11	SG-1160	1	Gear, Worm(ANQQ-8-666
12		2	Bearing, Ball(Fafnir #200S
13		2	Bearing, Ball(Fafnir #S-5
14		1	Bearing, Needle(Torrington #B-88
15		1	Worm(Boston Gear Wks. #HLVH
16		1	Seal, Oil(Victoprene #62004

Symbol No.	Part Number	No. Req'd.	Description
-			Drive Ass'y., Elevation Hand
17	AN900-23	1	Gasket, Housing
18		1	Locknut (Fafnir #N-00
19		1	Lockwasher (Fafnir #W-00
20	AN320-5	1	Nut, Worm Shaft
21	AN960-C516	1	Washer, Worm Shaft
22	AN960-C416L	4	Washer, Stud
23	AN960-C816	1	Washer, Retainer Plunger Spring
24	AN385-40-4	2	Pin, Taper
25	AC365-428	4	Nut, Stud
26	SG-1417	1	Gasket
27	SG-1418	2	Pin (Cover to Housing
28	AN380-2-3	1	Pin, Shaft Cotter
29	SG-1870	1	Shaft, Splined
30	AN995-41-2	2	Lockwire (.041"Dia.x2"
31	SG-1869	1	Plug, Cover Housing
-	SG-1769	1	Plate, Elev. Name
-	AN535-6-4	4	Screw

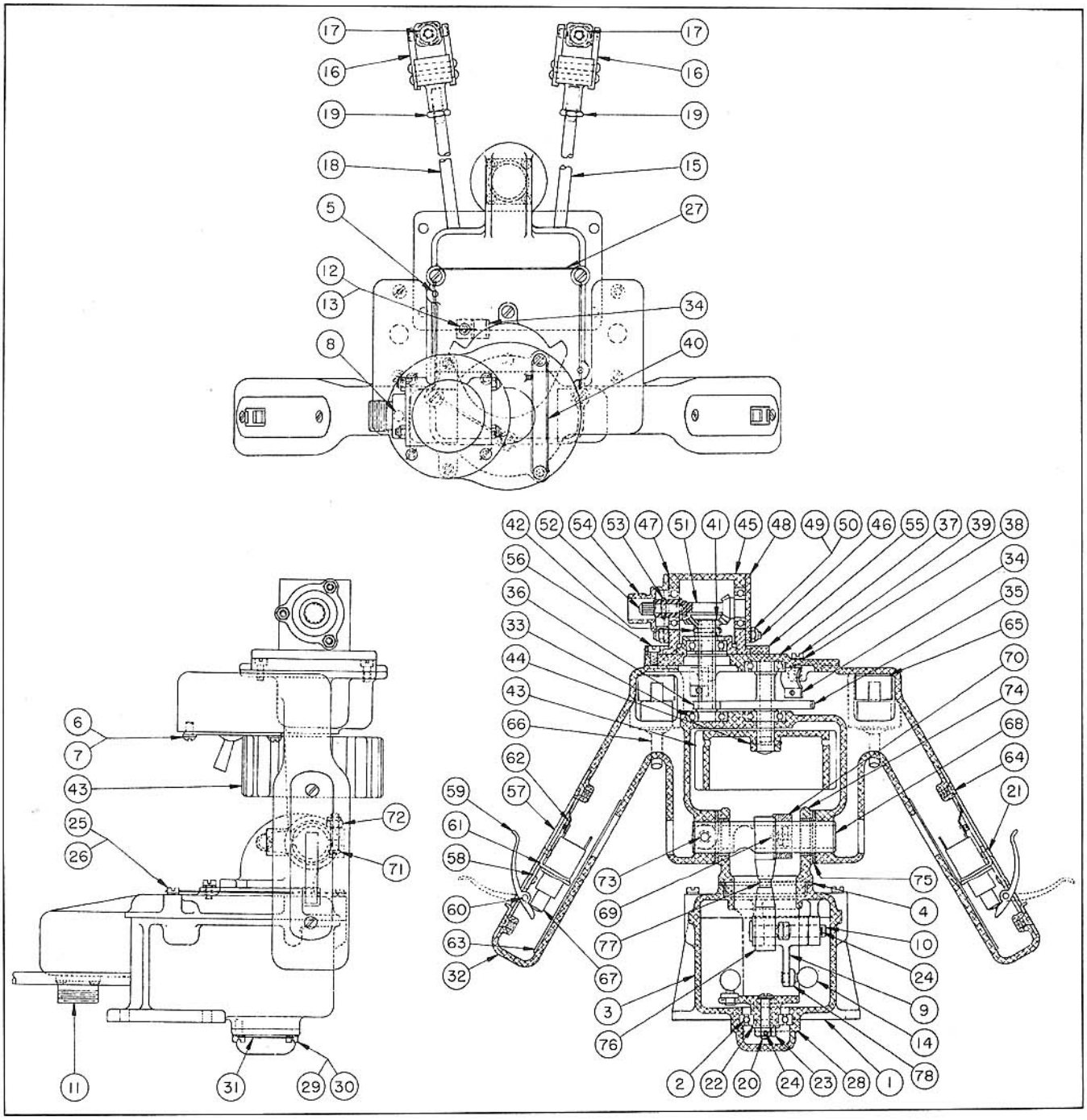
FIRE CUT-OFF UNIT CONTROL BOX ASS'Y. #SG-973-A



Symbol No.	Part Number	No. Req'd.	Description
		1	2
-	SG-973-A	1	Box Ass'y., Fire Cut-Off Control
-	SG-1943	1	Housing Ass'y.
1	SG-1229	1	Housing (Mach.Cstg. (Alcoa #195-T4 or Equiv.
2		2	Bearing, Ball (Fafnir #S-3
3	SG-1493	2	Pin
4	AN394-39	2	Pin (1/4"Dia.xl-7/32"Flat Hd.
5	SG-1234	1	Shaft,Driver Gear (S.A.E.#1020
6	SG-1236	1	Rod (Short (S.A.E.#1020
7	AN385-50-4	1	Pin, Taper (#5/0xl/2"
8	SG-391	1	Gear, Internal (Brass
9	AN385-50-4	1	Pin, Taper (#5/0xl/2"
10	SG-1233	1	Gear (Brass
11	SG-1241	1	Spacer,Drive Shaft(S.A.E.#1020
12	SG-1234	1	Shaft,Driver Gear (S.A.E.#1020
13	SG-1235	1	Rod (Long (S.A.E.#1020
14	AN385-50-4	1	Pin, Taper (#5/0xl/2"
15	SG-391	1	Gear, Internal (Brass
16	AN385-50-4	1	Pin, Taper (#5/0xl/2"
17	SG-1233	1	Gear (Brass
18	SG-1241	1	Spacer, Drive Shaft (S.A.E.#1020
19	SG-1231	2	Arm, Rocker (Mach.Cstg. (Alcoa #195-T4 or Equiv.
20	SG-1240	4	Bushing (S.A.E.#64
21		4	Bearing,Ball (Fafnir #S-1
22	SG-1237	2	Shaft (S.A.E.#1020
23	SG-1492	4	Pin for SG-1232 Gear
24	SG-1238A	2	Link (S.A.E.#64

Symbol No.	Part Number	No. Req'd.	Description
		1	2
-			Box Ass'y., Fire Cut-Off Control
25	AN385-50-4	2	Pin, Taper (#5/0xl/2"
26	SG-1239	2	Joint, Ball (AN276-2
27	SG-1232	2	Gear (Brass
28	AN960C10	2	Washer,Plain (#10xl/16" Thk.
29	AN320-3	2	Nut, Shear (#10-32 Hex.
30	AN380-2-2	2	Pin, Cotter (1/16"Dia.xl/2"
31	AN276-1	2	Adapter (1/4"-28 & 3/8"-24 Thd.
32	SG-1362	2	Rod, Vertical(S.A.E.#1020
33	AN385-50-4	2	Pin, Taper (#5/0xl/2"
34	AN960C416	2	Washer, Plain (1/4"xl/16"Thd.
35	AN380-2-2	2	Pin, Cotter (1/16"Dia.xl/2"
36	SG-1242	1	Spring (Spring Wire
37	SG-1230	1	Bearing,Support Plate(Mach.Cstg. (Alcoa #195-T4 or Equiv.
38		2	Bearing, Ball(Fafnir #S-1
39	AN935-8L	8	Lockwasher (#8xl/32" Thk.
40	AN500-8-6	8	Screw(#8-32x3/8"Fil.Hd.
41	AN960C10L	2	Washer, Plain (#10xl/32" Thk.
42	AN365-1032	2	Nut(#10-32 Hex.El.Self-Locking Stop
43	SG-1228	1	Cover(Mach.Cstg.(Alcoa#195-T4
44	AN935-8L	4	Lockwasher(#8xl/32" Thk.
45	AN500-8-6	4	Screw(#8-32x3/8"Fil.Hd.
46	AN316-4R	2	Nut, Check(1/4"-28Hex.
47	AN276-1	2	Adapter, Joint Socket (1/4"-28 Thd.&3/8"-24 Thd.
48	AN276-3	4	Bearing
49	AN276-4	4	Retainer

AZIMUTH, ELEVATION AND RANGE HAND CONTROL ASS'Y. #SG-986-D



Symbol No.	Part Number	No. Req'd.	Description
		1 2	
1	SG-986-D	1	Control Ass'y., Az.,Elev.&Rg.Hand
1	SG-1251	1	Housing (Mach.Cstg.
2		1	Bearing, Ball (Fafnir #S-5 or Equiv.
3	SG-1252	1	Cover (Mach.Cstg.
4	SG-1257	1	Bushing

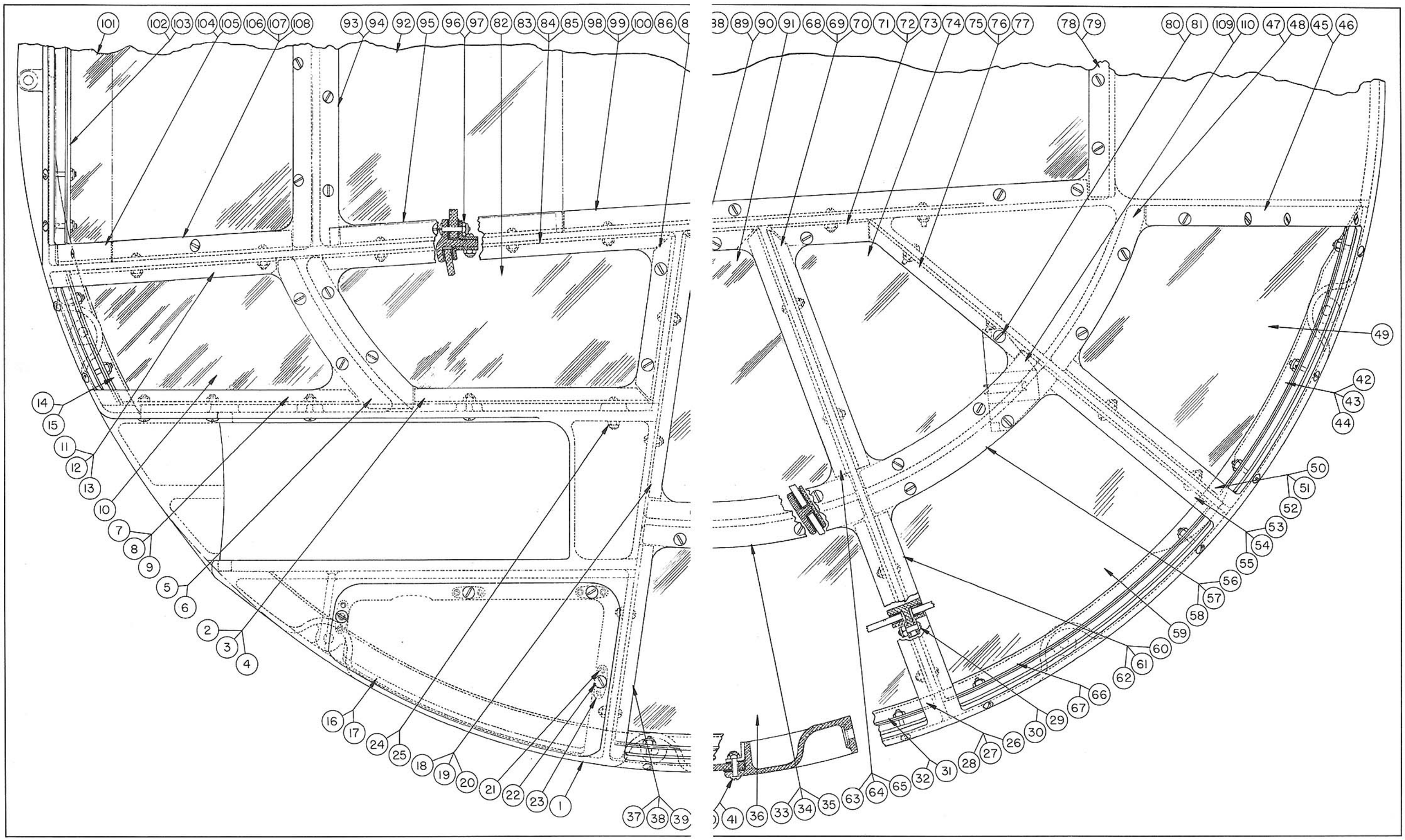
AZIMUTH, ELEVATION AND RANGE HAND CONTROL ASS'Y. #SG-986-D
(CONTINUED)

Symbol No.	Part Number	No. Req'd.	Description
			1 2
-		-	Control Ass'y.,Az.,Elev.&Rg. Hand
5		2	Pin (1/8"Dia.xl/2"
6	AN935-4	4	Lockwasher(#4xl/32"
7	AN515-4-5	4	Screw (#4-40x5/16"Rd.Hd.
8		1	Pin(3/16"Dia.xl/2"
9	SG-1862	1	Crank Ass'y., Bell
			Consisting of:
-	SG-1860	1	Crank, Bell
-	SG-1239	2	Screw, Ball & Socket Joint
-		2	Bearing,Needle(Torrington#B-47
10	SG-1861	1	Pin, Bell Crank to Cover
11		1	Plug, Elec.(Cannon #WK-C3-325
12	AN935-6	3	Lockwasher (#6xl/32"
13	AN500-6-5	3	Screw (#6-32x5/16"Fil.Hd.
14	AN276-1	2	Adapter
15	SG-1359	1	Rod, Horiz. Elev.
16	SG-1847	2	Swivel Ass'y., Elev. & Azimuth
			Each Consisting of:
-	SG-1288	1	Spacer, Swivel Plate
-	SG-1287	1	Swivel
-	SG-1364	2	Plate, Swivel
-	AN435-4-16	2	Rivet (1/8"Dia.xl"Rd.Hd.
17	SG-1494	2	Bushing
18	SG-1360	1	Rod, Horiz. Azimuth
19	AN316-4R	4	Nut, Check (1/4"-28 Hex.
20	AN23-14	1	Screw(#10-32x7/8"
21	AN425-AD44	8	Rivet
22	SG-1428	1	Washer, Rotor Bearing
23	AN320-3	1	Nut (#10-32 Hex.
24	AN380-2-2	3	Pin, Cotter (1/16"Dia.xl/2"
25	AN960-C8	6	Washer, Plain (#8xl/32"
26	AN503-8-14	5	Screw(#8-32x7/8"Fil.Hd.
27	AN995-31-15	1	Lockwire (.031"Dia.xl5"
28	SG-1260	1	Retainer, Bearing(Mach.Cstg.
29	AN960-C8	4	Washer, Plain (#8xl/32"
30	AN503-8-6	4	Screw (#8-32x3/8"Fil.Hd.
31	AN995-31-6	1	Lockwire (.031"Dia.x6"
32	SG-1138	2	Housing (Mach.Cstg.
33		6	Bearing, Ball (Fafnir #S-3
34	SG-1703	3	Clip, Wire
35	SG-1143	1	Gear
36	SG-1144	1	Gear
37	SG-1139	1	Cover (Mach.Cstg.
38	AN960-C8	2	Washer, Plain (#8xl/32"

Symbol No.	Part Number	No. Req'd.	Description
			1 2
-		-	Control Ass'y.,Az.,Elev.& Rg.Hand
39	AN503-8-6	4	Screw(#8-32x3/8"Fil.Hd.
40	AN995-31-6	1	Lockwire (.031"Dia.x6"
41	SG-1145	1	Gear, Bevel
42	AN365-50-4	1	Pin, Taper (#5/0xl/2"
43	SG-1141	1	Knob, Range (Mach.Cstg.
44	AN385-50-5	1	Pin, Taper (#5/0x5/8"
45	SG-1140	1	Cover (Mach.Cstg.
46	SG-330	1	Stud
47	SG-328	1	Gasket
48	SG-1427	1	Plate, Cover
49	AN960-C6	6	Washer, Plain (#6xl/32"
50	AC365-640	6	Nut (#6-40 Hex.El.Stop
51	SG-1142	1	Pinion
52	SG-392	1	Gear, Pinion
53	AN385-50-3	1	Pin, Taper (#5/0x3/8"
54	SG-204	1	Flange (Mach.Cstg.
55	SG-1148	1	Ring, Clamp (Half
56	AN500-8-4	4	Screw (#8-32xl/4"Fil.Hd.
57	SG-1347	2	Plate, Switch
58	SG-1345	2	Bracket, Lever
59	SG-1348	2	Lever, Switch
60	SG-1842	2	Pin
61	SG-1346	2	Bracket, Switch
62	SG-1665	2	Strap, Ground Copper
63	SG-1702	2	Insulator, Hand Control
64	AN505-8-5	8	Screw(#8-32x5/16"Flat Hd.
65	SG-1747	2	Insulator, Firing Switch
66		2	Switch(Cutler-Hammer #8211
67		2	Switch(Cutler-Hammer #8410
68	SG-1147	1	Shaft, Control Support
69	SG-1149	1	Key (1/8"
70	SG-1259	1	Arm, Clevis
71	AN501-8-14	1	Screw (#8-36x7/8"Fil.Hd.
72	AN365-836	1	Nut (#8-36 Hex.El.Stop
73	SG-1146	1	Screw, Lock Shaft
74	SG-1253	1	Rotor (Mach.Cstg.
75	SG-1150	1	Bushing
76	SG-1363	2	Adapter
77	SG-1261	1	Rod, Elev. Linkage (Short
78	SG-1239	2	Screw, Ball & Socket Joint
-	SG-1828	2	Wire Ass'y., Switch
-	SG-1829	1	Wire Ass'y., Switch

PARTS LIST

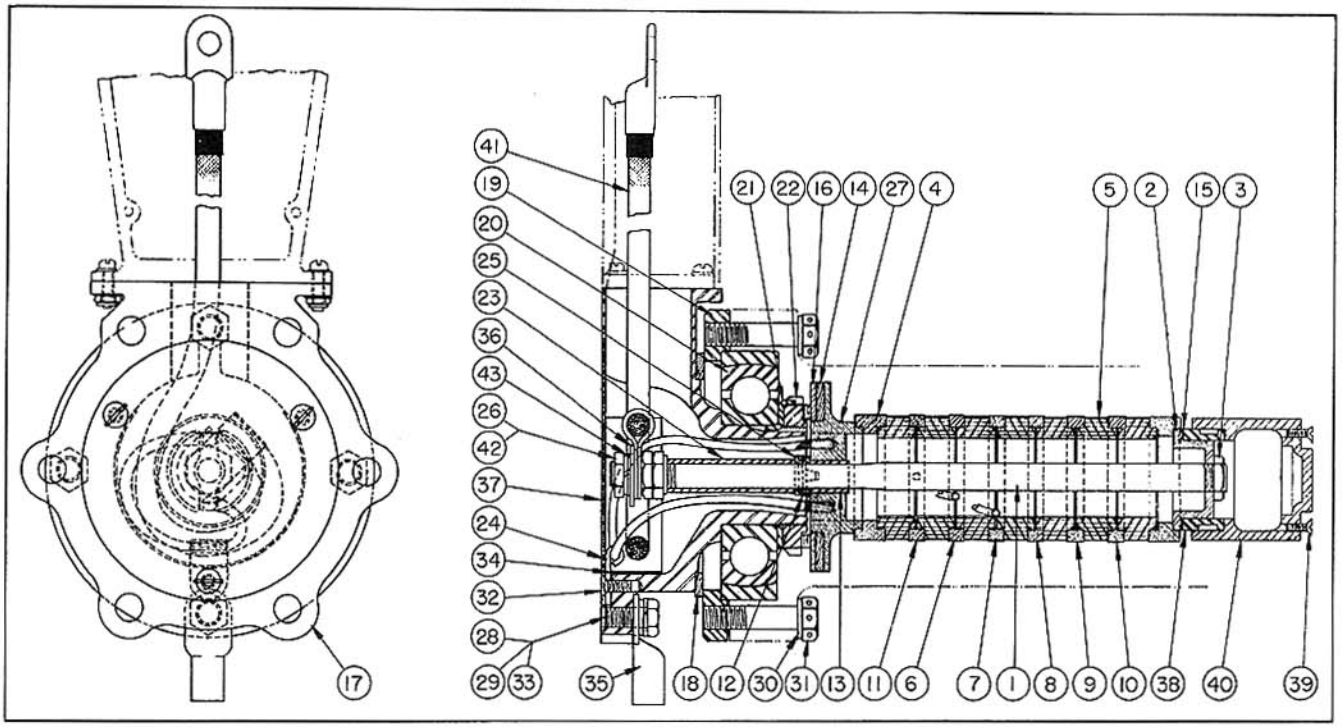
DOME ASS'Y. #SG-959-F



DOME ASS'Y. #SG-959-F
(CONTINUED)

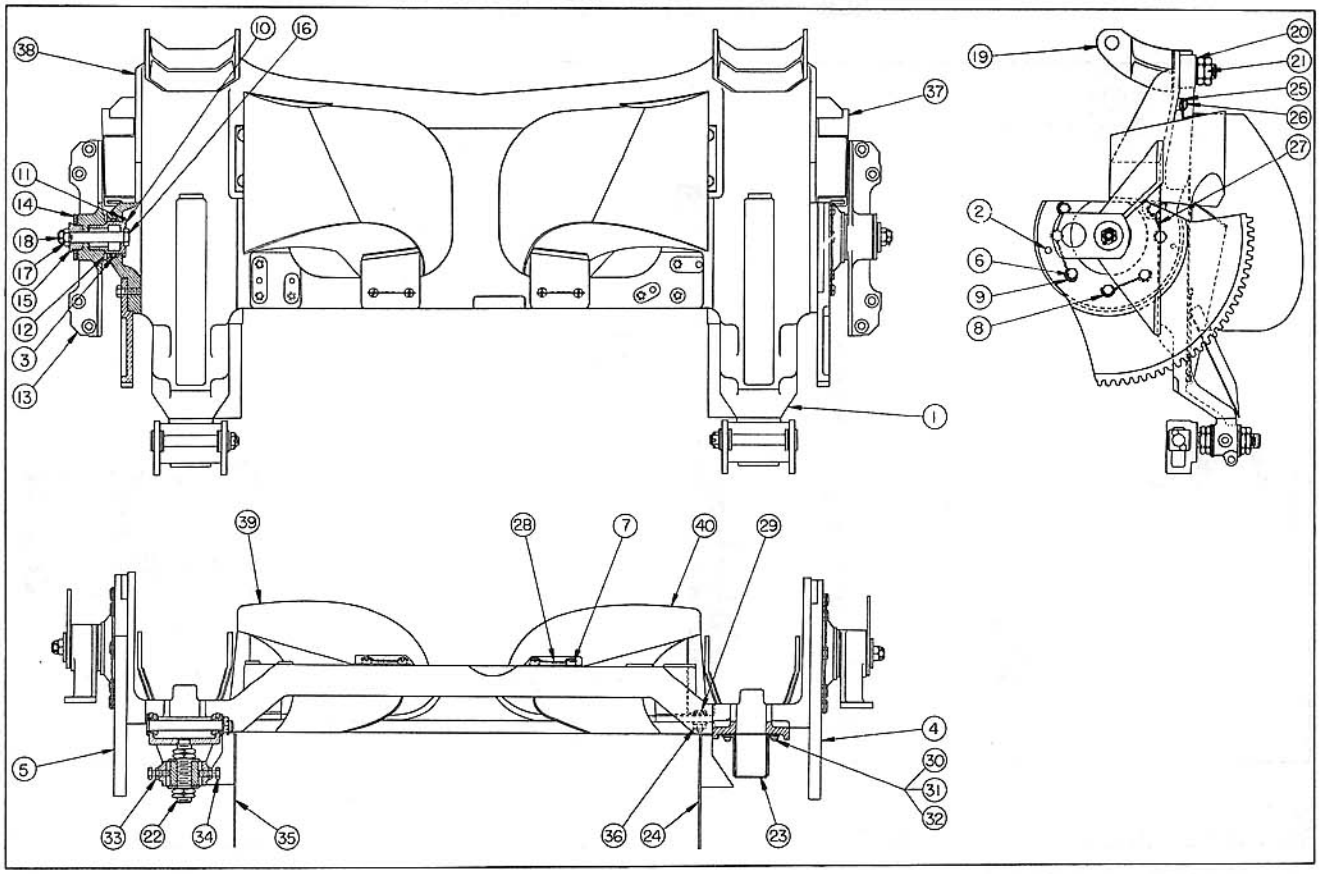
Symbol No.	Part Number	No. Req'd.	Description
		1 2	
-	SG-959-F	1	Dome Ass'y.
1	SG-1798	1	Body, Dome
2	SG-1570	1	Moulding, Gun Side
3	SG-1570-1	1	Moulding, Gun Side
4	SG-1545	3	Gasket
5	SG-1569	1	Moulding
6	SG-1544	2	Gasket
7	SG-1567	1	Moulding, Gun Side
8	SG-1567-1	1	Moulding, Gun Side
9	SG-1542	2	Gasket
10	SG-1796-8	1	Panel (L.H.
11	SG-1566	1	Moulding
12	SG-1566-1	1	Moulding
13	SG-1543	2	Gasket
14	SG-1564	1	Moulding (Lower
15	SG-1537	2	Gasket
16	SG-1464	1	Panel, Access
17	SG-1464-1	1	Panel, Access
18	SG-1580	1	Moulding, Side
19	SG-1580-1	1	Moulding, Side
20	SG-1556	2	Gasket
21	AN425AD-3-6	28	Rivet
22	AN526836-10	14	Screw, Button Hd.
23	AN366-DF836	14	Screw
24	AN520-6-14	2	Screw
25	AN365-640	2	Nut, Self-Locking
26	SG-1585	1	Moulding, Side
27	SG-1585-1	1	Moulding, Side
28	SG-1552	2	Gasket
29	AN520-6-10	40	Screw
30	AN365-640	40	Nut, Self-Locking
31	SG-1575	1	Moulding (Lower
32	SG-1553	2	Gasket
33	SG-1574	1	Moulding (Upper
34	SG-1559	2	Gasket
35	SG-1560	2	Gasket
36	SG-1796-10	1	Panel, Side (L.H.
37	SG-1561	1	Moulding, Side
38	SG-1561-1	1	Moulding, Side
39	SG-1552	2	Gasket
40	AN526640-12	68	Screw, Button Hd.
41	AN365-640	68	Nut, Self-Locking
42	SG-1579	1	Moulding (Lower
43	SG-1579-1	1	Moulding (Lower
44	SG-1541	3	Gasket
45	SG-1578	1	Moulding
46	SG-1550	3	Gasket
47	SG-1577	1	Moulding (Upper
48	SG-1551	3	Gasket
49	SG-1796-6	1	Panel, Head (L.H.
50	SG-1584	1	Moulding
51	SG-1584-1	1	Moulding
52	SG-1552	3	Gasket
53	SG-1585	1	Moulding
54	SG-1585-1	1	Moulding
55	SG-1552	2	Gasket
56	SG-1574	1	Moulding (Upper
57	SG-1559	2	Gasket
58	SG-1560	2	Gasket
59	SG-1796-11	1	Panel, Intermediate (L.H.
60	SG-1585	1	Moulding
61	SG-1585-1	1	Moulding
62	SG-1552	2	Gasket
63	SG-1580	1	Moulding, Side
64	SG-1580-1	1	Moulding, Side
65	SG-1556	2	Gasket
66	SG-1575	1	Moulding (Lower
67	SG-1553	2	Gasket
68	SG-1581	1	Moulding, Side
69	SG-1581-1	1	Moulding, Side
70	SG-1554	2	Gasket
71	SG-1583	1	Moulding (Upper
72	SG-1583-1	1	Moulding (Upper
73	SG-1557	2	Gasket
74	SG-1796-3	1	Panel, Rear (L.H.
75	SG-1582	1	Moulding, Side
76	SG-1582-1	1	Moulding, Side
77	SG-1555	2	Gasket
78	SG-1562	1	Moulding, Rear
79	SG-1535	3	Gasket
80	AN5261032-18	4	Screw, Button Hd.
81	AN365-1032	4	Nut, Self-Locking
82	SG-1796-7	1	Panel (L.H.
83	SG-1571	1	Moulding, Side
84	SG-1571-1	1	Moulding, Side
85	SG-1546	3	Gasket
86	SG-1573	1	Moulding (Upper
87	SG-1573-1	1	Moulding (Upper
88	SG-1549	2	Gasket
89	SG-1576	1	Moulding (Upper
90	SG-1558	2	Gasket
91	SG-1796-4	1	Panel (L.H.
92	SG-1794	1	Panel
93	SG-1572	1	Moulding (Upper
94	SG-1547	2	Gasket
95	SG-1588	1	Moulding (R.H.
96	AN526640-14	25	Screw, Button Hd.
97	AN365-640	25	Nut, Self-Locking
98	SG-1587	1	Moulding (L.H.
99	SG-1587-1	1	Moulding (L.H.
100	SG-1536	3	Gasket
101	SG-1795	1	Panel
102	SG-1563	1	Moulding (Lower
103	SG-1538	2	Gasket
104	SG-1589	1	Moulding
105	SG-1589-1	1	Moulding
106	SG-1586	1	Moulding
107	SG-1586-1	1	Moulding
108	SG-1539	2	Gasket
109	SG-979	1	Bracket Ass'y., Pulley (L.H.
			Consisting of:
-	AN435-4-16	3	Rivet(1/8"Dia.x1"Rd.Hd.
-	AN393-29	1	Pin (3/16"x1-5/64"
-	SG-1321-1	1	Body, Half
-	SG-1323-1	1	Body, Half
-	AN380-2-2	1	Pin, Cotter (1/16"x1/2"
-	SG-1773	2	Bushing
-	AN-210-1A	1	Pulley, Ball Bearing
110	SG-979-1	1	Bracket Ass'y., Pulley (R.H.
			Consisting of:
-	SG-1321-2	1	Body, Half
-	SG-1323-2	1	Body, Half
-	SG-1773	2	Bushing
-	AN-210-1A	1	Pulley, Ball Bearing
-	AN435-4-16	3	Rivet (1/8"Dia.x1"Rd.Hd.
-	AN393-29	1	Pin (3/16"Dia.x1-5/64"
-	AN380-2-2	1	Pin, Cotter (1/16"x1/2"

SLIP RING ASS'Y. #SG-953-D



Symbol No.	Part Number	No. Req'd.	Description
			1 2
-	SG-953-D	1	Ring Ass'y., Slip
1	SG-1033	1	Bar, Buss
2	SG-1013	1	Washer, Clamp
3	SG-1034	1	Nut, Buss Bar
4	SG-1009	1	Ring, Power
5	SG-1008	1	Ring, Insulator
6	SG-1811-2	1	Wire Ass'y., Slip Ring
			Consisting of:
-	SG-1015	1	Ring, Slip
-	95-27074-M	1	Wire (#20x13-1/4" lg.
-		1	Terminal (Sta-Kon #A-36
7	SG-1811-3	1	Wire Ass'y., Slip Ring
			Consisting of:
-	SG-1015	1	Ring, Slip
-	95-27074-M	1	Wire (#20 x 11" lg.
-		1	Terminal (Sta-Kon #A-36
8	SG-1811-4	1	Wire Ass'y., Slip Ring
			Consisting of:
-	SG-1015	1	Ring, Slip
-	95-27074-M	1	Wire (#20 x 11-1/4" lg.
-		1	Terminal (Sta-Kon #A-36
9	SG-1811-5	1	Wire Ass'y., Slip Ring
			Consisting of:
-	SG-1015	1	Ring, Slip
-	95-27074-M	1	Wire (#20 x 13-1/4" lg.
-		1	Terminal (Sta-Kon #A-36
10	SG-1811-6	1	Wire Ass'y., Slip Ring
			Consisting of:
-	SG-1015	1	Ring, Slip
-	95-27074-M	1	Wire (#20 x 14" lg.
-		1	Terminal (Sta-Kon #A-36
11	SG-1810-1	1	Wire Sub-Ass'y., Slip Ring
			Consisting of:
-	SG-1015	1	Ring, Slip
-	95-27273-E	1	Wire (#20 x 10" lg.
-		1	Tubing (#7(.148"I.D. (Irv-O-Lite XTE #106
-		1	Terminal (Sta-Kon #A-36
12	SG-1032	3	Washer, Bearing Ring
13	SG-1031	1	Bushing, Bearing Ring
14	SG-1011	1	Washer
15	SG-1017	1	Washer, Insulator Bushing
-		-	Ring Ass'y., Slip
16	SG-1029	1	Washer, Bearing Ring
17	SG-1002	1	Plate, Base
18	SG-1010	1	Washer, Felt
19	SG-1006	1	Retainer, Bearing
20		1	Bearing, Ball (Fafnir #308-KS
21		1	Lockwasher (Fafnir #W-08
22		1	Locknut (Fafnir #N-08
23	SG-1030	1	Spacer, Buss Bar
24	SG-1071	1	Lug, Ground
25	SG-1019	1	Washer, Thrust
26	SG-1018	3	Nut, Terminal
27	SG-1812	1	Wire Ass'y., Bearing Ring
			Consisting of:
-	SG-1001	1	Plate, Bearing Ring Base
-	SG-1841	1	Wire, Ground
-	SG-1071	1	Lug, Ground
-		1	Tape (3/8"x42" Split Varn. Cambric
-		1	Tape (3/8"x48" lg. Split Friction
28	AN960-C516	1	Washer (5/16"x1/16"
29	AN935-516	1	Lockwasher (5/16"x1/16"
30	AN960-C616	4	Washer (3/8"x1/16"
31	AN76-14	4	Screw (3/8"-24x1-1/2"
32	AN510-10-6	3	Screw, Flat Hd.
33	AN5-5A	1	Screw (5/16"-24x7/8"
34	SG-1643	1	Insulator, Base Plate
35	AN660-6	1	Terminal
36	SG-1858	1	Guard, Power Cable
37	SG-1037	1	Cover, Base Plate
38	SG-1016	1	Bushing
39	AN505-10-6	4	Screw
40	SG-1014	1	Bearing, Commutator
41	SG-1757-1	1	Cable Ass'y., Power
			Consisting of:
-	SG-1641	1	Lug, Power Cable
-	AN660-6	1	Terminal
-	AC95-27074	1	Cable (#2 x 13-3/4" lg.
42	AN935-616L	1	Lockwasher
43		1	Washer (Master Products #575TJ

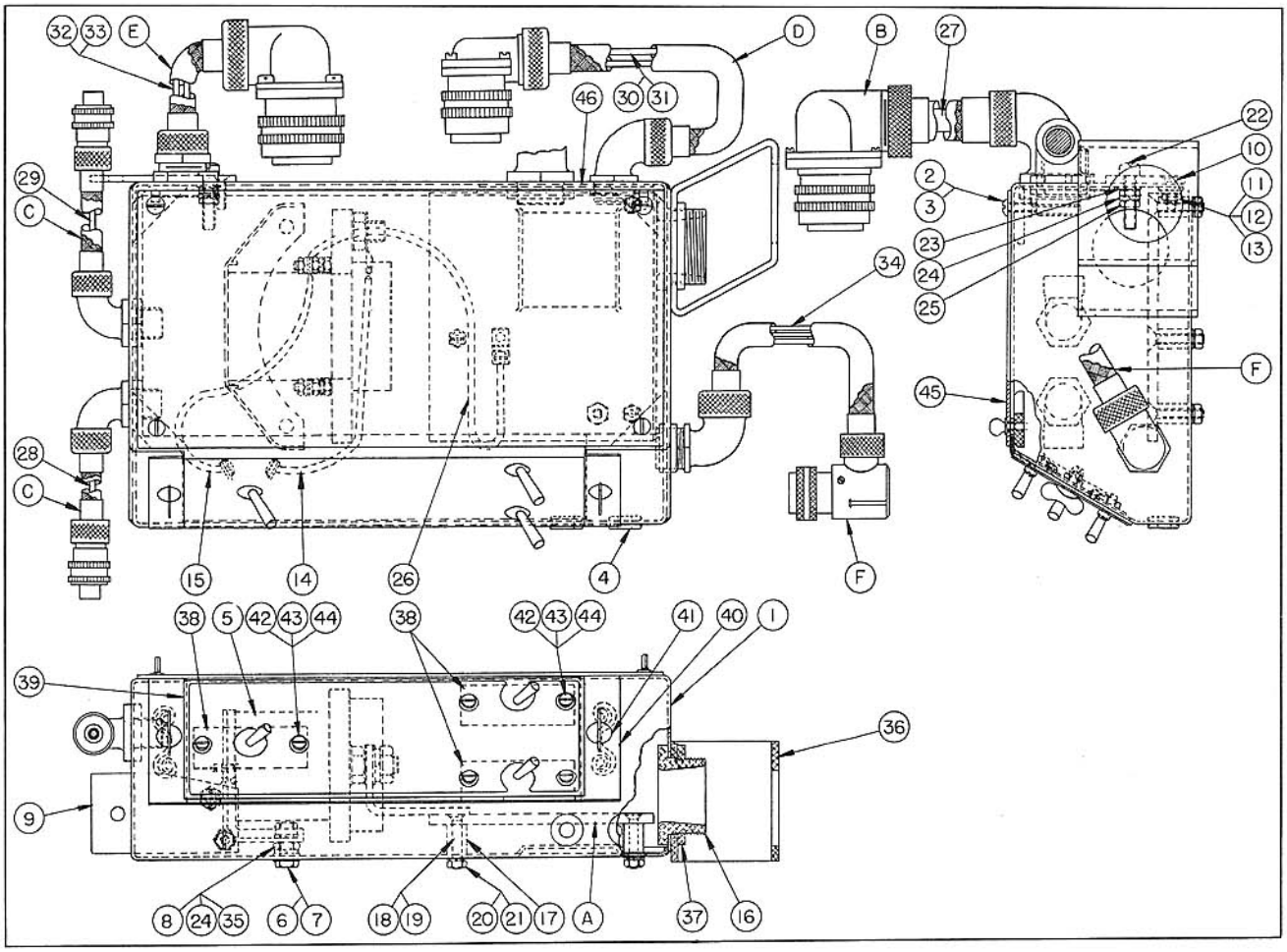
GUN MOUNTING YOKE ASS'Y. # SG-939



Symbol No.	Part Number	No. Req'd.	Description (1 2 3)
-	SG-939	1	Yoke Ass'y., Gun Mounting
1	SG-1113	1	Yoke, Gun Mtg.
2		4	Pin (.250"Dia.x3/4"
3		2	Bearing, Needle (Torrington #NB 11-x
4	SG-1120	1	Segment, Elev. Gear
5	SG-1120-1	1	Segment, Elev. Gear
6	AN74-5	14	Screw (1/4"-28x5/8"Hex.Hd.
7	AN501-A4167	4	Screw (1/4"-28x7/16"Fil.Hd.
8	AN995-47-5	2	Lockwire
9	AN995-47-10	2	Lockwire
10	SG-116	2	Sleeve, Fulcrum Bearing
11	SG-120	2	Washer, Bearing Sleeve
12	SG-121	2	Spacer, Bearing Sleeve
13	SG-1080	2	Frame "A"
14	SG-1777	2	Plate, Lifting
15	SG-1778	2	Plug, Lifting Plate
16	AN7-26	2	Screw (7/16"-20x2-3/4"Hex.Hd.
17	AN310-7	2	Nut (7/16"-20 Hex.
18	AN380-3-3	2	Pin, Cotter(3/32"Dia.x3/4"
19	SG-1098	2	Yoke, Gun Adapter
20	AN960-C1016	2	Washer (5/8"x1/16"
21	AN316-10R	4	Nut, Check (5/8"-18
22	SG-970	2	Trunnion Ass'y. (Rear
			Consisting of:
-	SG-1659	1	Screw
-	AN380-3-3	1	Pin, Cotter
-	AN320-7	1	Nut
-	AN960-C716	1	Washer
-	SG-1220	1	Bushing, Bracket
-	SG-1221	1	Plate, End
-	SG-1219	1	Bushing, Stem
-	SG-1630	2	Washer, Stem
-	SG-1223	1	Nut, Stem
-	AN420-4-10P	4	Rivet
-	SG-1224	1	Bracket & Stem Ass'y., Trunnion
-	SG-1218	1	Bracket, Trunnion
-	SG-1222	1	Stem,Trunnion Bracket

Symbol No.	Part Number	No. Req'd.	Description (1 2 3)
-		-	Yoke Ass'y., Gun Mounting
23	SG-1477	2	Guide, Case Ejection
24	SG-1687-1	1	Shield, Deflector (R.H.
25	AN995-32-2	2	Lockwire
26	AN501-A10-5	2	Screw (#10-32x5/16"Fil.Hd.
27	AN995-47-3	2	Lockwire
28	AN995-47-4	2	Lockwire
29	AN4-6A	4	Screw (1/4"-28x7/8"Hex.Hd.
30	AN501-A10-5	10	Screw, Fil.Hd.
31	AN995-32-12	2	Lockwire
32	AN995-32-8	2	Lockwire
33	AN316-4R	4	Nut, Check (1/4"-28
34	AC60-4-6	4	Screw (1/4"-28x3/4"Hex.Hd.
35	SG-1687-2	1	Shield, Deflector (L.H.
36	AC365-428	4	Nut (1/4"-28 Hex.El.Stop
37	SG-1688-1	1	Chute Ass'y., Clip (R.H.
			Consisting of:
-	SG-1689	1	Chute, Clip
-	SG-1690	1	Bracket, Rear
-	SG-1691	1	Bracket, Front
38	SG-1688-2	1	Chute Ass'y., Clip (L.H.
			Consisting of:
-	SG-1689	1	Chute, Clip
-	SG-1690	1	Bracket, Rear
-	SG-1691	1	Bracket, Front
39	SG-1720-1	1	Guide Ass'y.,Ammunition (L.H.
			Consisting of:
-	SG-1720-3	1	Guide, Main Plate
-	SG-1720-4	1	End (Small
-	SG-1720-5	1	End (Large
-	SG-1721	1	Bracket
-	SG-1722	1	Support, Guide
40	SG-1720-2	1	Guide Ass'y.,Ammunition(R.H.
			Consisting of:
-	SG-1720-3	1	Guide, Main Plate
-	SG-1720-4	1	End (Small
-	SG-1720-5	1	End (Large
-	SG-1721	1	Bracket
-	SG-1722	1	Support, Guide

JUNCTION BOX ASS'Y. #SG-969-G



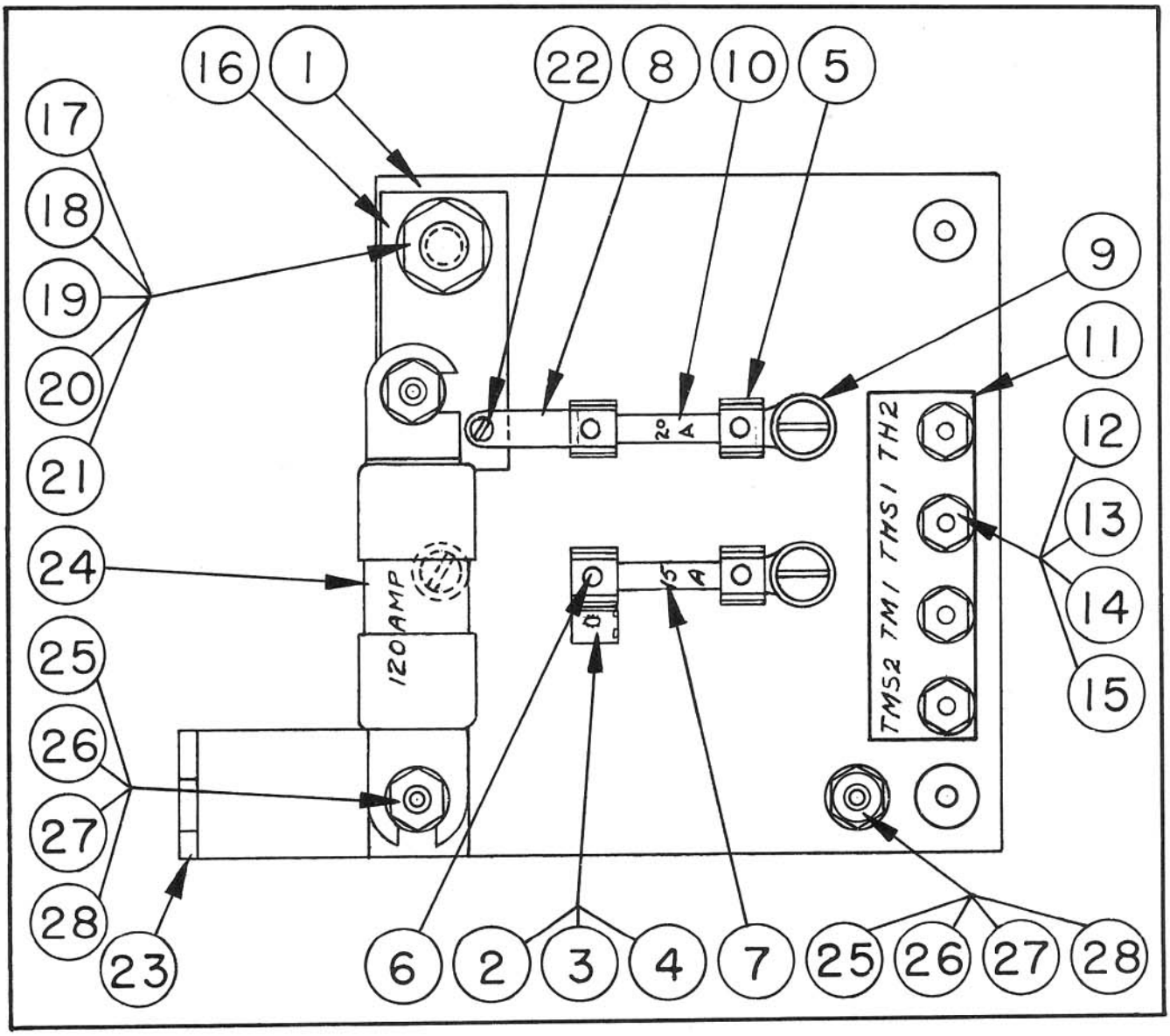
Symbol No.	Part Number	No. Req'd.	Description
			1 2 3
-	SG-969-G	1	Box Ass'y., Junction
1	SG-1792	1	Box Ass'y., Junction
			Consisting of:
-	SG-1210	1	Box, Junction
-	SG-1211	1	Plate, End (Upper
-	SG-1212	1	Plate, End (Lower
-	SG-1214	4	Block, Cover Anchor
-		2	Spring (Dzus #SB-4-2
-	AN425-4-4	4	Rivet
2	AN526632-8	2	Screw(#6-32x1/2"Button Hd.
3	AN365-632	2	Nut(#6-32 Hex.El.Stop
4		2	Grommet(Vitalic Rubber #3013
5	SG-1801	1	Relay, Special (Cutler-Hammer
			Type B-4, 200 amps.
6	AN60-4-6	2	Screw(1/4"-28x3/4"Hex.Hd.
7	AN960-C416L	4	Washer, Plain
8	AN315-4R	2	Nut (1/4"-28
9	SG-1640	1	Plate, Ground
10	AN510-10-10	1	Screw (#10-32x5/8"Flat Hd.
11	AN960-C10L	1	Washer, Plain(#10x1/32" Thk.
12	AN935-10	1	Lockwasher(#10x3/64" Thk.
13	AN345-10	1	Nut (#10-32 Hex.
14	SG-1838	1	Lead Ass'y., Power (DCS

Symbol No.	Part Number	No. Req'd.	Description
			1 2 3
-			Lead Ass'y., Power (DCS
			Consisting of:
-	AC9527074M	1	Wire(#14x9"
-		1	Terminal(Sta-Kon #C73
-		1	Terminal(Sta-Kon #B36
-		2	Tag, Ident.(Water-Pruf
			Adhesive Tape or Equiv.
15	SG-1839-1	1	Coil Ass'y., Power Relay(DCR
			Consisting of:
-	AC9527074M	1	Wire(#14x9"
-		2	Terminal(Sta-Kon #B-36
-		2	Tag, Ident.(Water-Pruf
			Adhesive Tape or Equiv.
16		1	Sleeve (Breeze #28-1000
A	SG-1717-F	1	Panel Ass'y., Junction Box
17	SG-1285	3	Spacer
18	AN505-8-16	3	Screw (#8-32x1"Flat Hd.
19	AN960-C8L	3	Washer, Plain(#8x1/32" Thk.
20	AN935-8L	3	Lockwasher (#8x1/32"Thk.
21	AN340-8	3	Nut (#8-32 Hex.
22	AN501416-16	1	Screw(1/4"-28x1" Fil.Hd.
23	AN960-C416	1	Washer, Plain (1/4"x1/16" Thk.
24	AN935-416	5	Lockwasher (1/4"x1/16"

JUNCTION BOX ASS'Y. #SG-969-G
(CONTINUED)

Symbol No.	Part Number	No. Req'd.	Description
-			Box Ass'y., Junction
25	AN345-416	2	Nut(1/4"-28Hex.
26	SG-1839-2	1	Coil Ass'y., Power (DT
			Consisting of:
-	AC9527074M	1	Wire (#14x9"
-		2	Terminal(Sta-Kon #B-36
-		2	Tag, Ident.(Water-Pruf
			Adhesive Tape or Equiv.
B	SG-1682-B	1	Conduit Ass'y., Power Unit
27	SG-1817	1	Wire Ass'y., Power Unit
			Consisting of:
-	AC9527074M	1	Wire (#2x47"
-	AN660-6	1	Terminal
C	SG-1681-B	2	Conduit Ass'y.,Gun Firing Solenoid
28	SG-1822-1	1	Wire Ass'y.,Gun Firing Solenoid
			Consisting of:
-	AC9527074M	1	Wire (#16x30"
-		1	Terminal(Sta-Kon #B-36
29	SG-1822-2	1	Wire Ass'y.,Gun Firing Solenoid
			Consisting of:
-	AC9527074M	1	Wire (#16x92"
-		1	Terminal(Sta-Kon #B-36
D	SG-1680-D	1	Conduit Ass'y., Gun Sight
30	SG-1815-1	1	Wire Ass'y., Gun Sight
			Consisting of:
-	AC9527074M	1	Wire (#16x80"
-		1	Terminal(Sta-Kon #C-71
31	SG-1815-2	1	Wire Ass'y., Gun Sight
			Consisting of:
-	AC9527074M	1	Wire (#16x76"
-		1	Terminal(Sta-Kon #B-36
E	SG-1683-A	1	Conduit Ass'y.,
			Fire Cut-Off & Limit Stop
32	SG-1816-1	1	Wire Ass'y.,
			Fire Cut-Off & Limit Stop
			Consisting of:
-	AC9527074M	1	Wire (#10x45"
-		1	Terminal(Sta-Kon #C-26
33	SG-1816-2	1	Wire Ass'y.,
			Fire Cut-Off & Limit Stop
-			Wire Ass'y.,
			Fire Cut-Off & Limit Stop
			Consisting of:
-	AC9527074M	1	Wire(#10x48"
-		1	Terminal(Sta-Kon #C-26
F	SG-1684-C	1	Conduit Ass'y., Hand Control
34	SG-1820	1	Wire Ass'y., Hand Control
			Consisting of:
-	AC9527074M	1	Wire(#12x32"
-	AC9527074M	1	Wire(#12x33"
-	AC9527074M	1	Wire(#18x39"
-		2	Terminal(Sta-Kon #C-26
-		1	Terminal(Sta-Kon #A-36
35	AN316-4R	2	Nut(1/4"-28 Hex.
36	SG-1245	1	Bracket, Junction Box
37		1	Nut(Breeze #6-1000 or Equiv.
-	SG-1881	1	Plate Ass'y., Switch
38		3	Switch(Cutler-Hammer #8201
39	SG-1654	1	Plate, Switch
40	SG-1877	1	Mounting, Plate Switch
41		2	Fastener(Dzus Cat. #AW4-25
42	AN500-8-6	6	Screw(#8-32x3/8"Fil.Hd.
43	AN936-A8	6	Washer
44	AN340-8	6	Nut(#8-32 Hex.
45	SG-1788	1	Cover Ass'y., Junction Box
			Consisting of:
-	SG-1213	1	Cover
-	SG-1216	2	Screw, Thumb
-	SG-1215	2	Washer, Special
-		4	Clip, Fuse(Little Fuse #1011
-		4	River (1/8"x1/8"Tubular Br.
			(Chicago Type #R-3232
-		1	Fuse(15 amp.(Little Fuse #1400
-		1	Fuse(20 amp.(Little Fuse #1400
-		1	Fuse(120 amp.(Little Fuse#1401
-	AN520-10-6	2	Screw(#10-32x3/8"Rd.Hd.
-	AN960-C10L	2	Washer(#10x1/32" Thk.
-	AN936-A10	2	Lockwasher(#10x.022" Thk.
-	AN345-B10	2	Nut(#10-32 Hex.Br.
46	SG-1686	1	Plate, Reinforcing

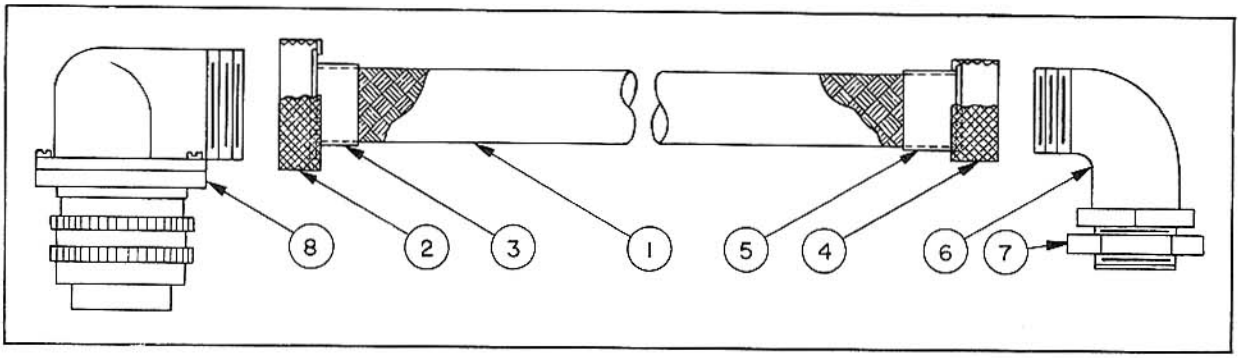
JUNCTION BOX PANEL ASS'Y. #SG-1717-F



Symbol No.	Part Number	No. Req'd.	Description
-	SG-1717-F	1	Panel Ass'y., Junction Box
1	SG-1286	1	Panel
2		1	Clip, Fuse(HB Jones#51
3		1	Terminal(HB Jones#1001
4	AN936A6	1	Lockwasher(#6x1/32" Thk.
5		3	Clip, Fuse(Little #1011
6	AN505-8-5	2	Screw(8-32x5/16"Flat Hd.
7		1	Fuse(15 Amp.(Little #1400
8	SG-1634	1	Link, Fuse Connection
9		2	Terminal &Screw(Little #196-2
10		1	Fuse (20 Amp.(Little #1400
11	SG-1656	1	Tab, Indentification (Marked TMS2-TM1-THS1-TH2
12	AN520-6-16	4	Screw(#6-40x3/4"Rd.Hd.
13	AN960-C6	12	Washer, Plain (#6x1/32" Thk.
14	AN935-6L	12	Lockwasher(#6x1/32" Thk.

Symbol No.	Part Number	No. Req'd.	Description
-			Panel Ass'y., Junction Box
15	AN345-6	12	Nut (#6-40 Hex.
16	SG-1632	1	Bar, Service
17	AN501516-16	1	Screw (5/16"-24 Fil.Hd.
18	AN960C516L	1	Washer, Plain (5/16"x1/32"
19	AN935-516	1	Lockwasher (5/16"x1/16"
20	AN315-5R	1	Nut, Plain (5/16"-24 Hex.
21	AN315-5R	1	Nut, Check (5/16"-24
22	AN500-6-6	1	Screw,Fil.Hd.
23	SG-1644	1	Link, Fuse Connector(Copper
24		1	Fuse (120 Amp.(Little #1401
25	AN501-10-12	3	Screw(#10-32x3/4"Fil.Hd.
26	AN960C10L	4	Washer, Plain(#10x1/32" Thk.
27	AN935-10L	3	Lockwasher (#10x1/32" Thk.
28	AN345-B10	4	Nut, Brass(#10-32 Hex.
-		2	Rivet,Continental Screw #R-3307

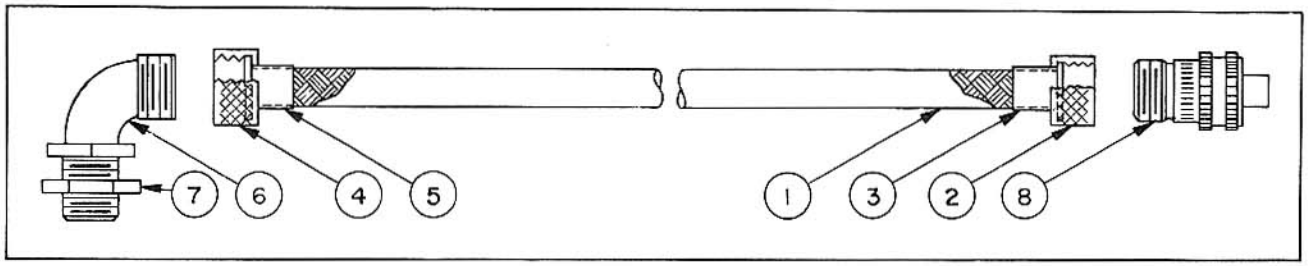
POWER UNIT CONDUIT ASS'Y. #SG-1682-B



Symbol No.	Part Number	No. Req'd.	Description
-	SG-1682-B	1	Conduit Ass'y., Power Unit
1		1	Conduit,Flex.(Breeze #101-0625
2		1	Nut (Breeze #4-0750
3	AN3051-10	1	Ferrule (Phenolic
4		1	Nut (Breeze #118-1-0625

Symbol No.	Part Number	No. Req'd.	Description
-		-	Conduit Ass'y., Power Unit
5		1	Ferrule (Breeze #119-0625
6		1	Connector (Breeze #21-0625-5
7		1	Locknut (Breeze #6-1-0625
8	AN3108-20-25	1	Plug (Phenolic

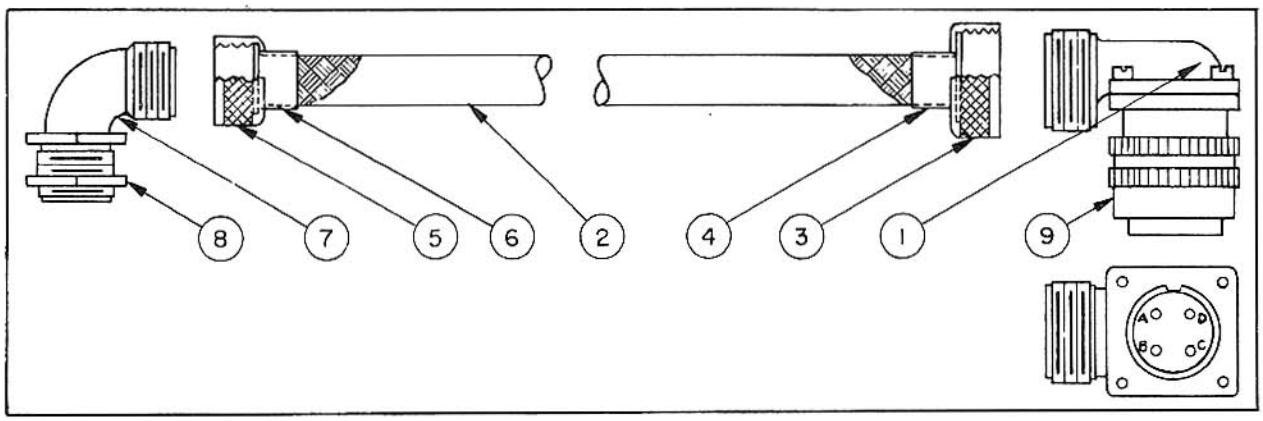
GUN FIRING SOLENOID CONDUIT ASS'Y. #SG-1681-B



Symbol No.	Part Number	No. Req'd.	Description
-	SG-1681-B	1	Conduit Ass'y., (Gun Solenoid (L.H.
1		1	Conduit, Flexible (Breeze #101-0250-18" lg.
1		1	Conduit, Flexible (Breeze #101-0250-6'8" lg.
2		1	Nut (Breeze #118-1-0250

Symbol No.	Part Number	No. Req'd.	Description
-		-	Conduit Ass'y., Gun Solenoid (L. H.
3		1	Ferrule (Breeze #119-1-0250
4		1	Nut, Coupling (Breeze #118-1-0250
5		1	Ferrule (Breeze #111-0250
6		1	Connector (Breeze #21-0250-5
7		1	Locknut (Breeze #6-1-0250
8	AN3106106578	1	Plug (Phenolic

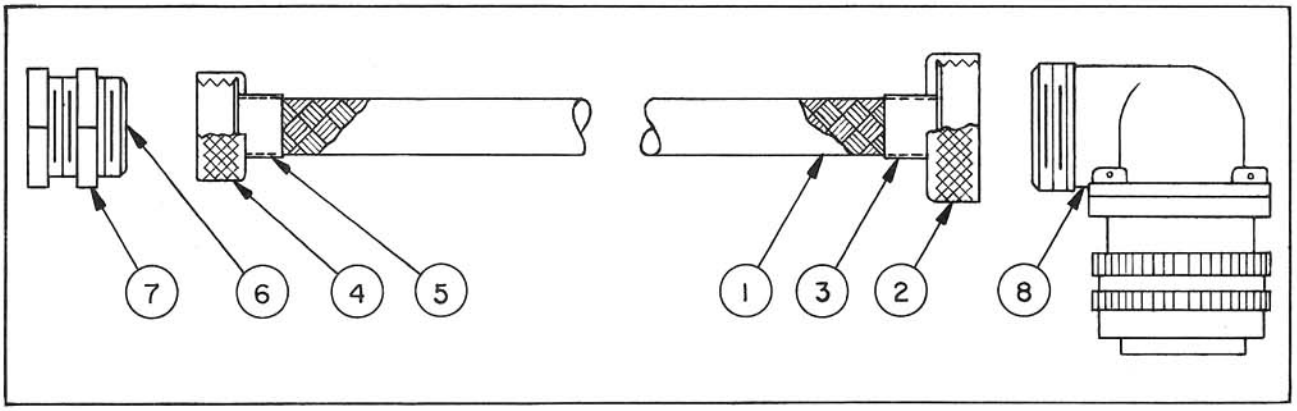
GUN SIGHT CONDUIT ASS'Y. #SG-1680-D



Symbol No.	Part Number	No. Req'd.	Description
-	SG-1680-D	1	Conduit Ass'y., Gun Sight
1	SG-1663	1	Shell, Angle Plug (Mach.Cstg.
2		1	Conduit, Flex. (Breeze #101-0375
3		1	Nut (Breeze #118-1-0500
4		1	Ferrule (Breeze #119-3-0375

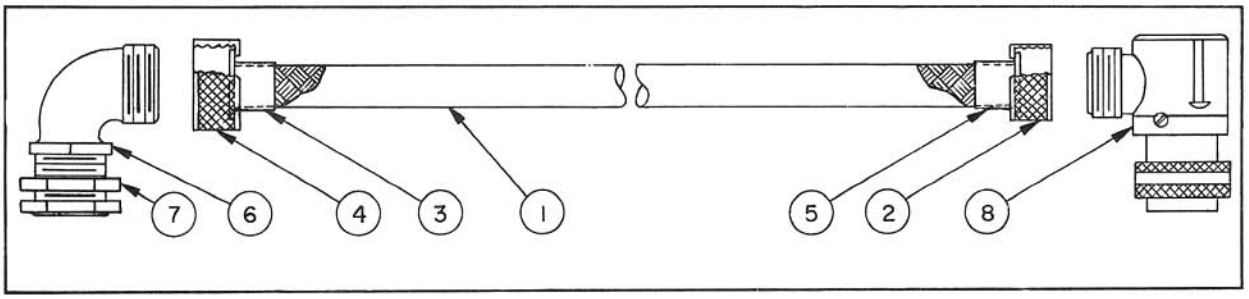
Symbol No.	Part Number	No. Req'd.	Description
-		-	Conduit Ass'y., Gun Sight
5		1	Nut,Coupling(Breeze#118-1-0375
6		-	Ferrule (Breeze #111-0375
7		1	Connector (Breeze (#21-0375-5
8		1	Locknut (Breeze #6-1-0375
9	AN310818-45	1	Plug (Phenolic

FIRE CUT-OFF AND LIMIT STOP CONDUIT ASS'Y. #SG-1683-A



Symbol No.	Part Number	No. Req'd.	Description
-	SG-1683-A	1	Conduit Ass'y.,Fire Cut-Off &Limit Stop
-		1	Conduit, Flexible (Breeze #101-0500
2		1	Nut (Breeze #4-0750
3	AN3052-8	1	Ferrule (Phenolic
4		1	Nut (Breeze #4-0500 .
5		1	Ferrule (Breeze #111-0500
6		1	Connector (Breeze #28-0500
7		1	Locknut (Breeze #6-0600
8	AN31082225	1	Plug (Phenolic

HAND CONTROL CONDUIT ASS'Y. #SG-1684-C



Symbol No.	Part Number	No. Req'd.	Description
-	SG-1684-C	1	Conduit Ass'y., Hand Control
1		1	Conduit,Flexible(Breeze#101-0375
2	AN3054-6	1	Nut (Phenolic -
3		1	Ferrule(Breeze #111-0375
4		1	Nut, Coupling(Breeze#118-1-0375
5		1	Ferrule (Breeze #111-0375
6		1	Connector (Breeze#21-0375-5
7		2	Locknut (Breeze #51-1-0375
8		1	Plug(Cannon WK-C 3-23-3/8" AC