2-36. INSTALLATION.

a. Install attaching screws.

b. Install servo cover.

c. Connect electrical plug.

2-37. TESTING.

a. Turn on a-c power, then turret power.

b. Turret will come into alignment with sight and should follow sight smoothly.

c. Check turret for proper direction of rotation in following gun sight.

d. Check synchronizing through large angles by turning off turret power, moving sight 90° and then restoring power to turret. The turret should align with sight within two seconds after first crossing the corresponding position.

e. Check for static accuracy by sighting on distant objects and comparing with boresights in guns.

f. Exert a force on the gun barrels and check for vibration and stiffness. A force of 100 pounds should not deflect the boresight more than about 10 mils (1/2 degree).

g. Check limit switches, fire interrupter, transfer switches and other details associated with specific system.

2-38. SIGHTING STATION. (See figure 2-12.)

2-39. DESCRIPTION. A General Electric sighting station, with upper and lower periscopic heads, is installed in the gunner's compartment located midway between the turrets. Vision in elevation is obtained by manually rotating the elevation sighting handles located on the unit. The central casting of the station contains one fixed and one rotating prism. The changeover prism is rotated 90° by the changeover motor so as to change the line of sight from the upper head to the lower head or vice-versa. A 10° angle of over-travel on either side of the horizontal is provided in order to eliminate the necessity of repeated changes of upper or lower sights. The action switch, when depressed, closes the control and firing circuits; the firing trigger starts the ammunition booster motor and fires the guns. All system wires are brought into the sight through an electrical connector on the unit.

2-40. REMOVAL.

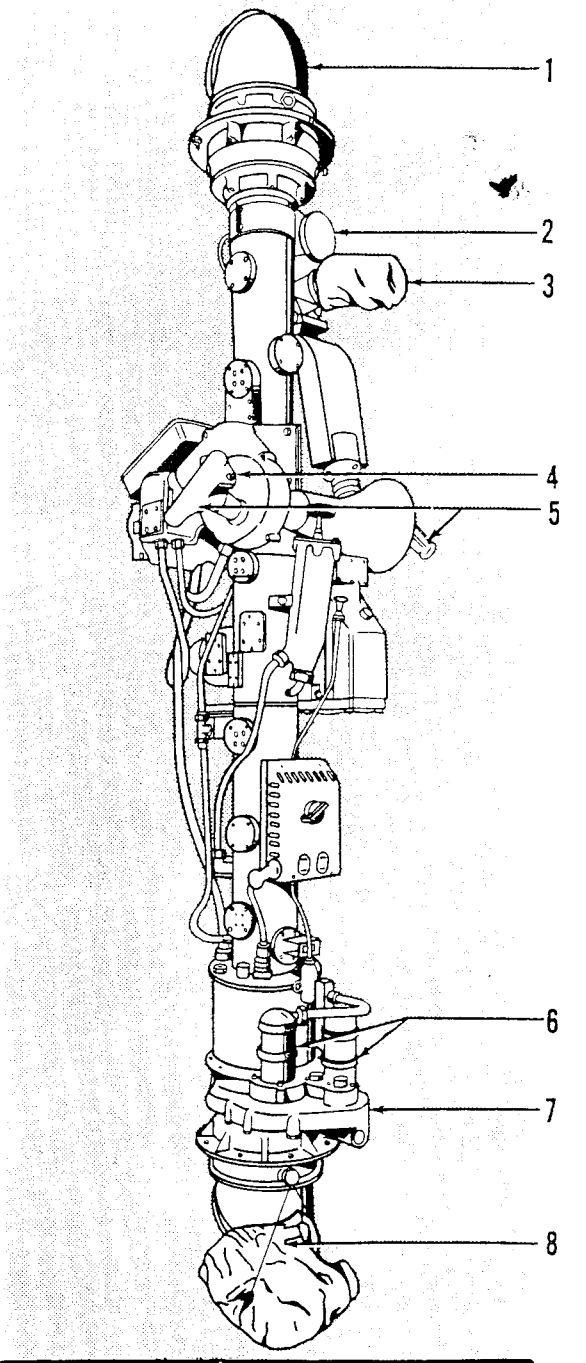
a. Remove gunner's compartment plexiglas enclosure.

b. Remove upper attaching bolts. (See figure 2-13.)

c. Attach lifting fixture to sighting station.

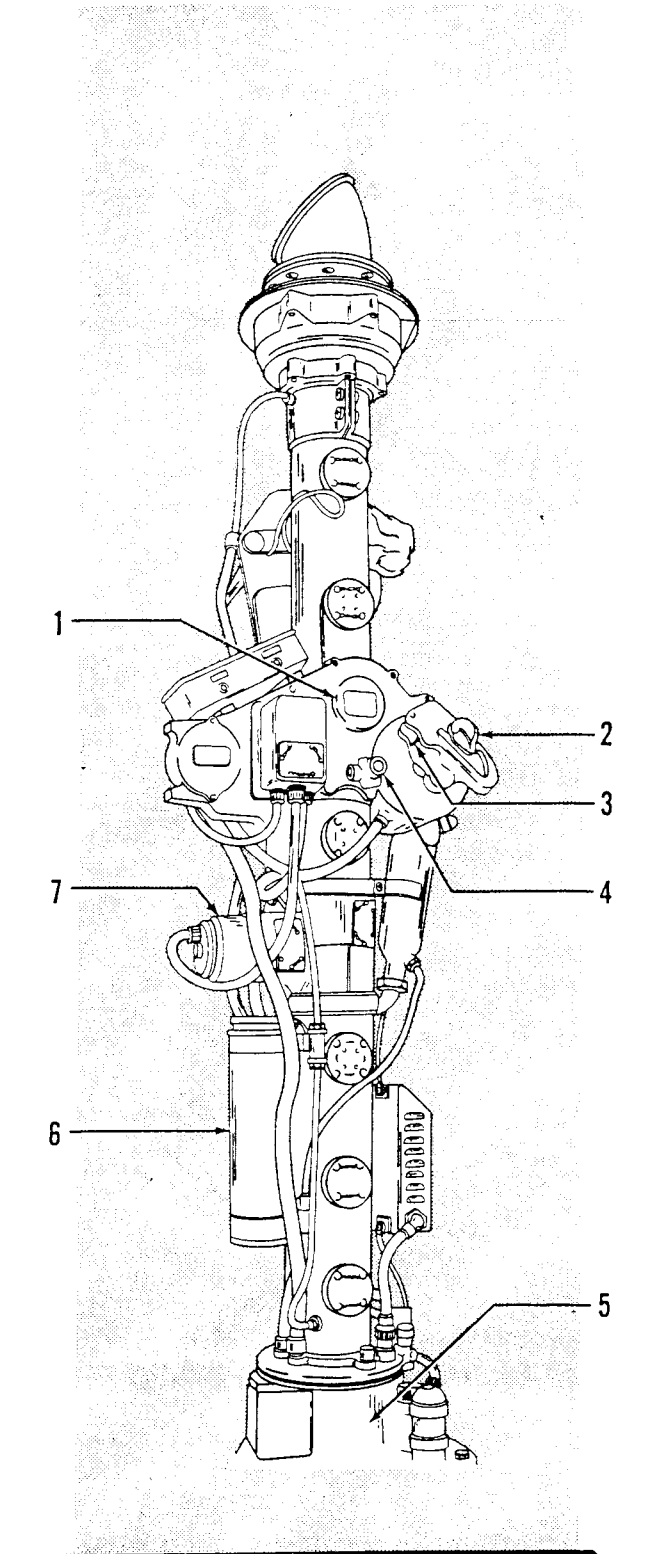
d. Remove lower attaching bolts.

e. Remove electrical connector.



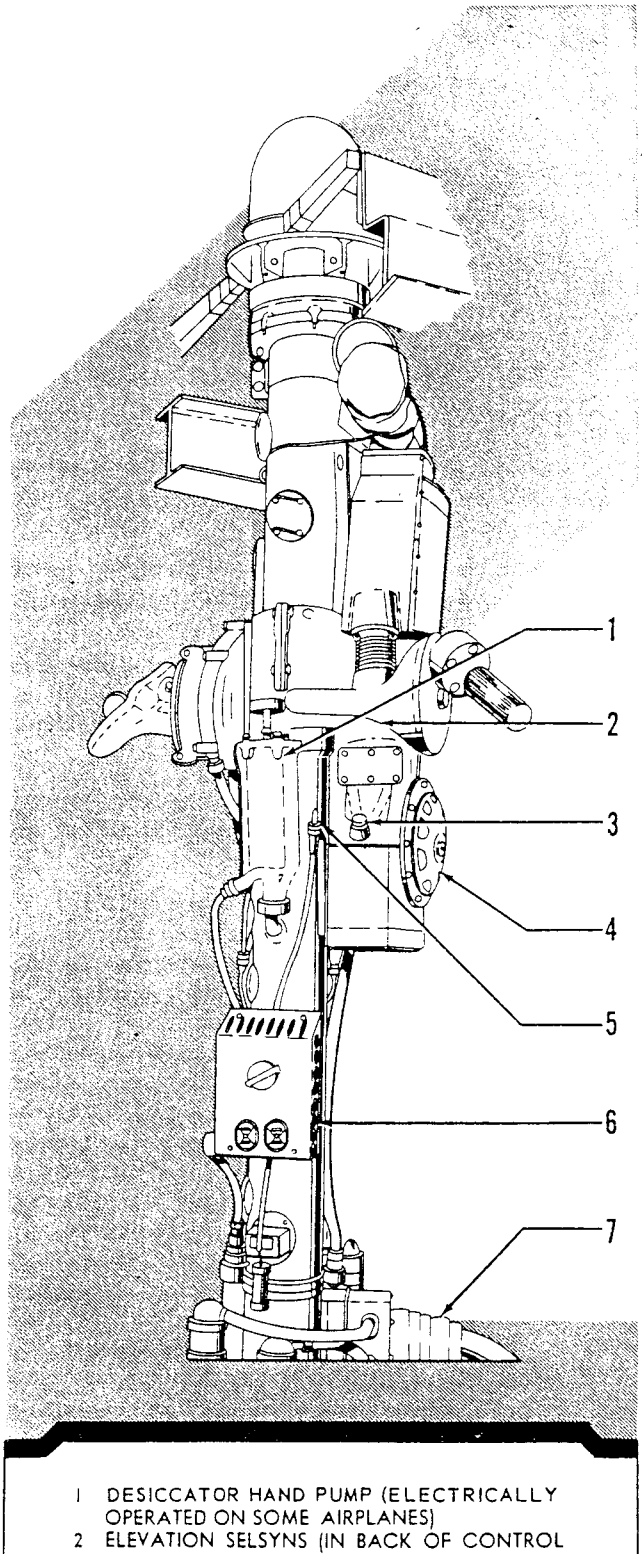
1 UPPER PERISCOPE HEAD
2 GUNNER'S HEAD PAD
3 EYE PIECE
4 GUNNER'S MICROPHONE SWITCH
5 CONTROL HANDLES
6 AZIMUTH SELSYNS
7 AZIMUTH GEAR BOX
8 LOWER PERISCOPE HEAD

Figure 2-12. Turret Sighting Station (View 1 of 3)



1 ELEVATION UNIT
2 ACTION SWITCH
3 TURRET GUNS FIRING TRIGGER
4 ELEVATION GEAR LOCK
5 COLLECTOR ASSEMBLY
6 DESICCATOR JAR
7 CHANGE-OVER MOTOR

Figure 2–12. Turret Sighting Station (View 2 of 3)



1 DESICCATOR HAND PUMP (ELECTRICALLY OPERATED ON SOME AIRPLANES)
2 ELEVATION SELSYNS (IN BACK OF CONTROL HANDLE)
3 RETICLE LAMP RHEOSTAT
4 OPTICAL FILTER CONTROL
5 AZIMUTH GEAR LOCK
6 GUNNER'S SUIT HEAT RHEOSTAT
7 CONNECTOR

Figure 2–12. Turret Sighting Station (View 3 of 3)

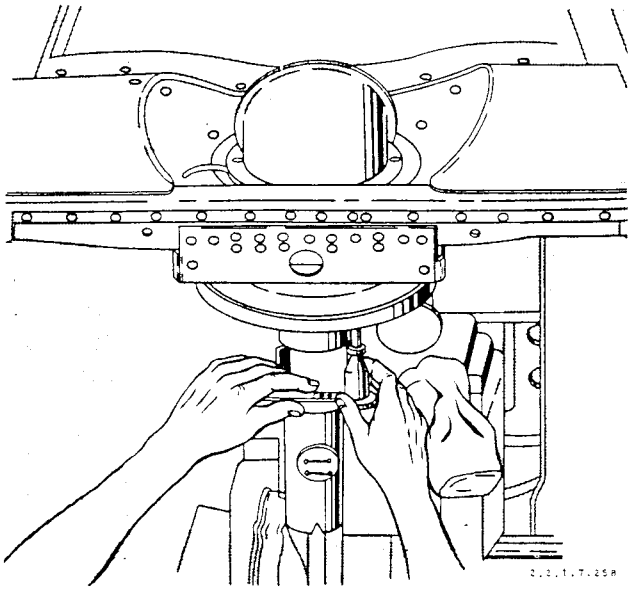


Figure 2-13. Removing Sighting Station Upper Attaching Bolts

f. Hoist the sighting station out of gunner's compartment.

Note

Keep the station upright at all times and exercise extreme care that it is not bumped.

2-41. MINOR REPAIR. Replacement rather than repair will be necessary.

2-42. INSTALLATION.

a. Bolt anti-rotation bar to sighting station and to bracket provided beneath gunner's compartment floor. An access cover may be removed to reach bar.

b. Adjust bar at bracket until sighting station index point is aligned with forward index point on structure.

c. With lifting fixture attached (figure 2-14), carefully hoist sighting station into gunner's compartment.

d. Place seal around lower part of station (on compartment floor).

e. With unit in perpendicular position, install lower attaching bolts.

f. Place gunner's compartment plexiglas enclosure in position over upper periscope head.

g. Install upper and lower rubber seals.

h. Install upper attaching bolts.

i. Install lower attaching bolts. (See figure 2-15.)

j. Connect electrical connector.

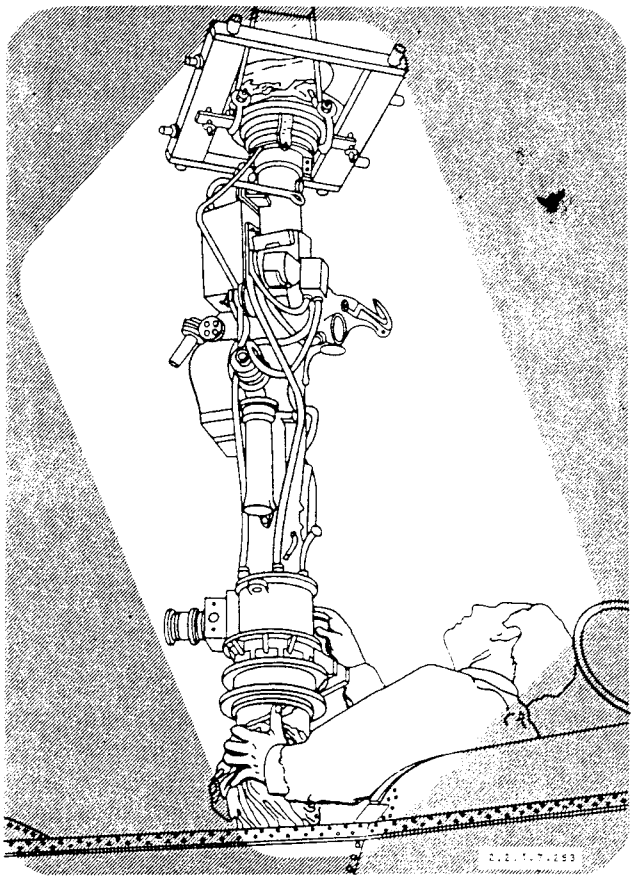


Figure 2-14. Lowering Sighting Station into Position

2-43. UPPER TURRET ASSEMBLY. (See figure 2-16.)

2-44. DESCRIPTION. The upper turret assembly consists of a ring assembly, drive assembly, collector ring assembly, fire interrupter assemblies, limit stops and switches and a contour follower. An indicator lamp with amber lens is mounted on the pilot's electrical control panel and lights up when the upper turret is in the locked forward position.

2-45. REMOVAL. (See figure 2-17.)

a. Remove dome.

b. Attach hoist sling to attaching points.

c. Remove 24 bolts securing turret.

d. Disconnect electrical connections.

e. Hoist turret from airplane.

2-46. MINOR REPAIR.

a. Adjust contour-follower. (Refer to paragraph 2-63.)

b. Replace a damaged turret mounting ring. Ring must be leveled with the plane.

Figure 2–15. Installing Sighting Station Lower Attaching Bolts

2–46A. LUBRICATION UPPER TURRET ASSEMBLY.

a. Apply a thin coat of grease, Specification MIL-G-7118, to elevation gear sector. Do not lubricate in dusty climates.

b. Apply a thin coat of grease, Specification MIL-G-7118, to ring and input gears. Do not lubricate in dusty climates.

c. Apply a drop of oil, Specification MIL-L-7870, to slider gun mount.

d. Apply a drop of oil, Specification MIL-L-7870, on jack for lower ejection doors.

e. Lubricate sighting station stowing pins with a few drops of oil, Specification MIL-L-7870.

2–46B. LUBRICATION ARCTIC OPERATION. When turrets are to be operated in low temperatures lubricate as follows:

a. Grease, Specification MIL-G-3278, should be used on turret motor and amplidyne bearings. Grease, Specification MIL-L-7711, is used in dynamotors.

Note

If doubt arises concerning the lubricant previously used, remove all traces of the lubricant by approved practices.

b. Apply a thin coat of grease, Specification MIL-G-3278, to elevation gear sector.

c. Lubricate ring and input gears with grease, Specification MIL-G-3278.

d. Service turret air compressor oil reservoir with oil, Specification MIL-O-6081, grade 1010.

e. For heavily-loaded gears use grease, Specification MIL-G-7118.

f. Prior to an operating mission, check all components for proper operation.

2–47. INSTALLATION.

a. With turret dome removed, place guns in a horizontal position.

b. Attach hoist sling to attaching points on turret.

c. Lower turret into position and install six attachment bolts equi-distant around turret circumference.

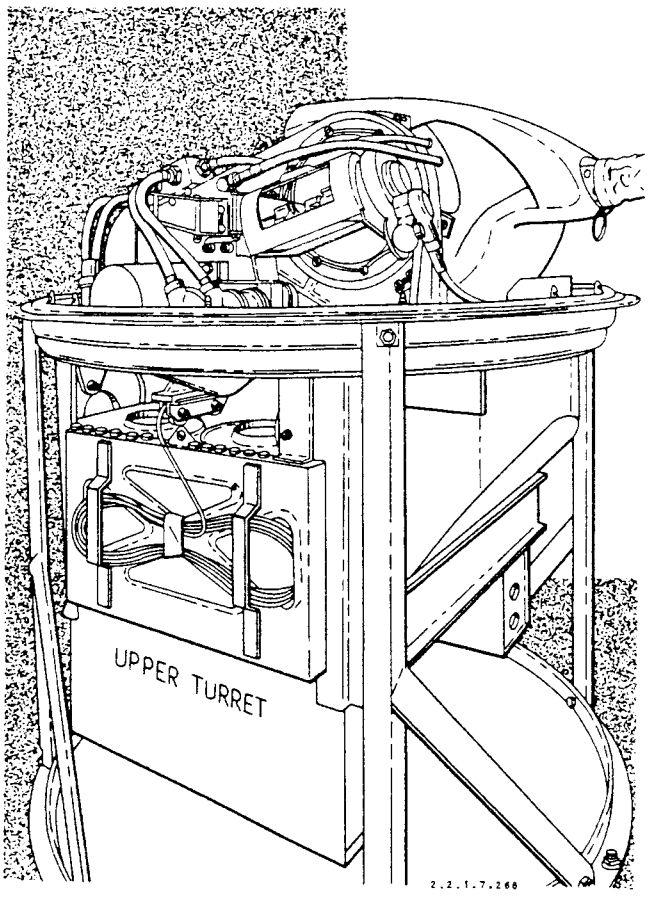


Figure 2–16. Upper Turret Assembly

Note

Be sure to align the point marked FORE on the turret with its forward matching point on the airplane.

d. Install one star washer under one of the mounting bolts for bonding purposes.

e. Tighten 24 mounting bolts.

f. Connect electrical connections.

2-48. RING ASSEMBLY. The ring assembly supports the turret and allows movement of the complete unit in azimuth. The saddle supports hold the guns and make possible gun movement in elevation.

2-49. DRIVE ASSEMBLY. Power for rotating the turret in azimuth is obtained from the azimuth drive assembly, a similar drive assembly being provided to move the guns in elevation. Each drive assembly consists of a drive motor, a one-speed and a 31-speed selsyn, a latching solenoid and the necessary gearing. A latching solenoid assembly prevents movement of the turret in azimuth with turret power off; this latch can be operated manually and is shown in figure 2-18. The latching solenoid has a tapered detent pin which drops into the hole in the intermediate gear when turret power is on. The latching solenoid holds the turret in the stowed or strafing position. A similar solenoid (figure 2-19) on the elevation gearing locks the elevation power gear when the guns are in the stowed position and turret power is off. The elevation drive assembly is essentially the same as the azimuth drive assembly, except for the addition of a clutch assembly designed to protect the gear train from excessive shock, such as that which occurs when the gears reach their limits of travel in elevation or depression.

2-50. DRIVE MOTOR. The General Electric drive motors (figure 2-20) are mounted on each turret, one for each gun position (azimuth and elevation). The turret assembly is mounted inside the stationary outer

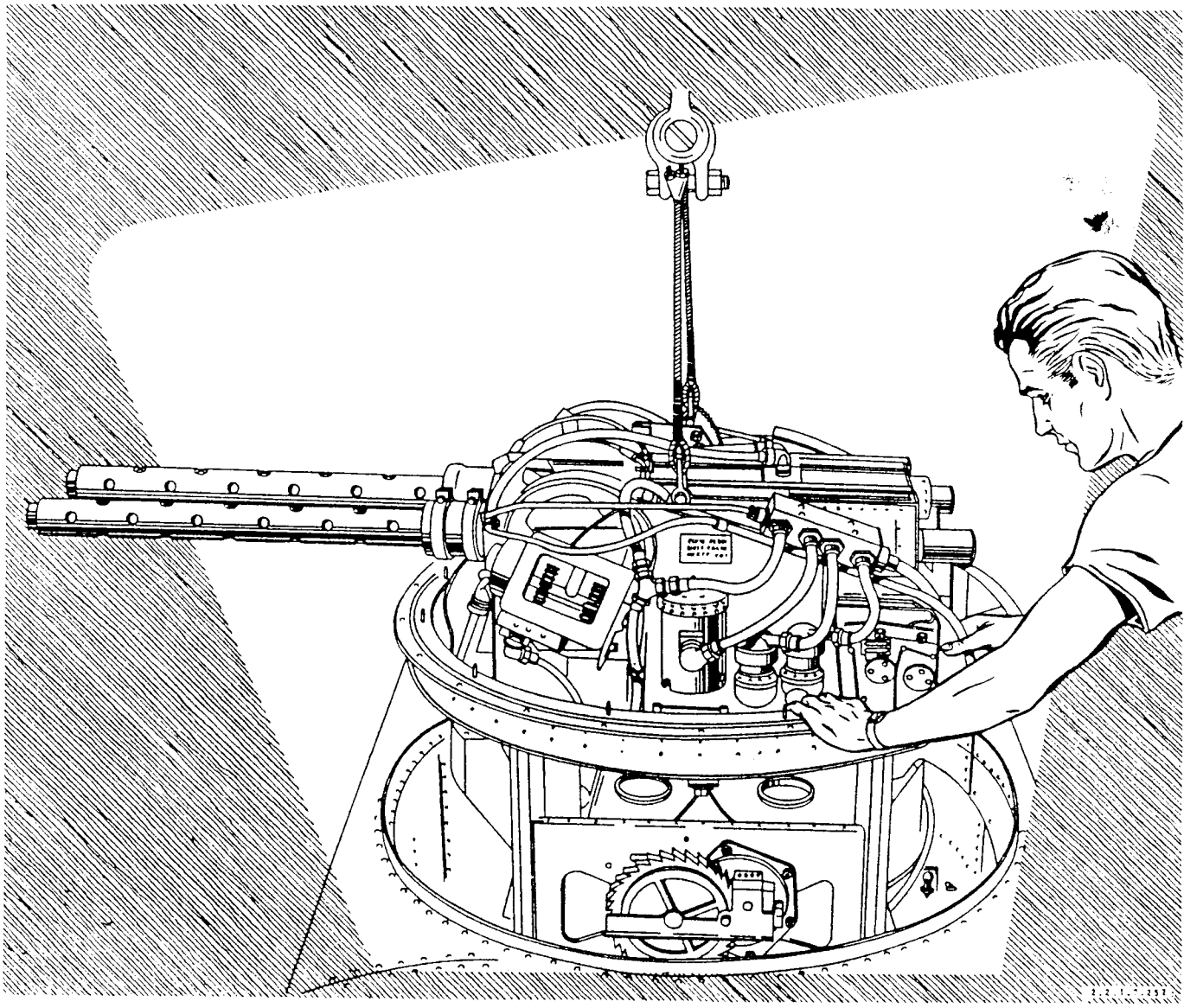


Figure 2-17. Hoisting Upper Turret

ring gear track; rotation of the azimuth drive motor causes rotation of the turret assembly inside the outer ring. The pinion gear driven by elevation drive motor is mated with a gear sector on the saddle; rotation of the elevation drive motor causes the guns to elevate or depress, depending on the direction of rotation. The motor is composed of a stator assembly, rotor assembly, brush rigging assembly, commutator and shield, pulley and shield, connectors and cover. The field of the motor is connected to the 24-volt, d-c airplane electrical system and the armature is connected to the d-c output of the amplidyne generator. As long as there is an error voltage between the sighting station and the turret selsyns, the amplidyne produces an output to energize the drive motor armature and produce a change in the gun position. To remove the drive motor, disconnect the electrical plug and remove attaching screws.

2-51. MINOR REPAIR.

2-52. REPLACING MOTOR BRUSHES.

Note

Brushes should be changed when worn to within 1/16-inch of metal brush holder.

a. Cut safety wire, remove screws and remove old brushes.

b. Install new brushes.

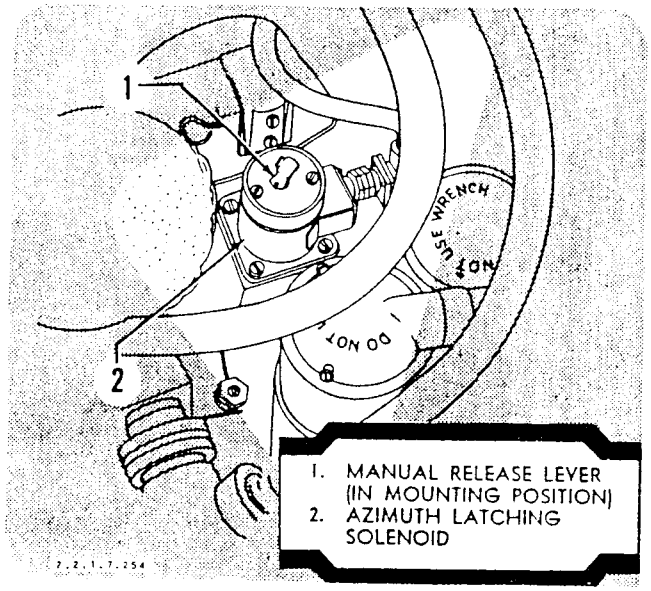


Figure 2–18 Azimuth Latching Solenoid

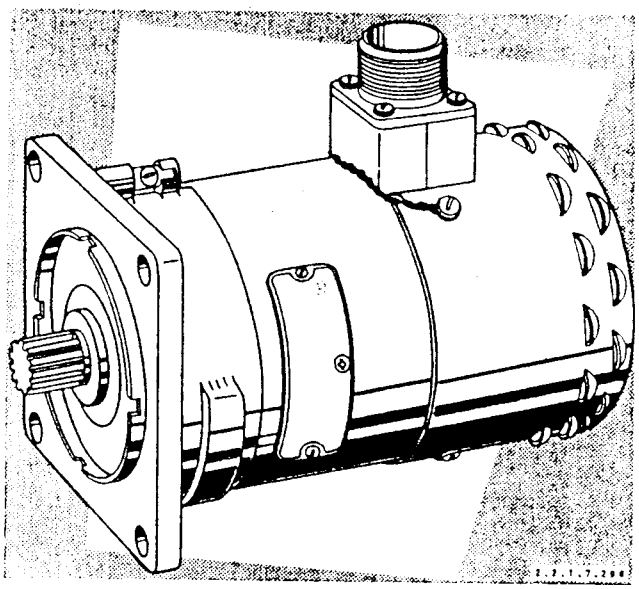


Figure 2–20. Turret Drive Motor

c. Adjust washer shims so that when screws are tightened safety wire holes will be suitably aligned for a safety wire.

CAUTION

Do not overtighten screws or brushes will break.

d. Paint heads of screws with glyptol insulating varnish, Specification MIL-V-1137.

e. Apply a strip of No. 0000 sandpaper to commutator with water-soluble glue.

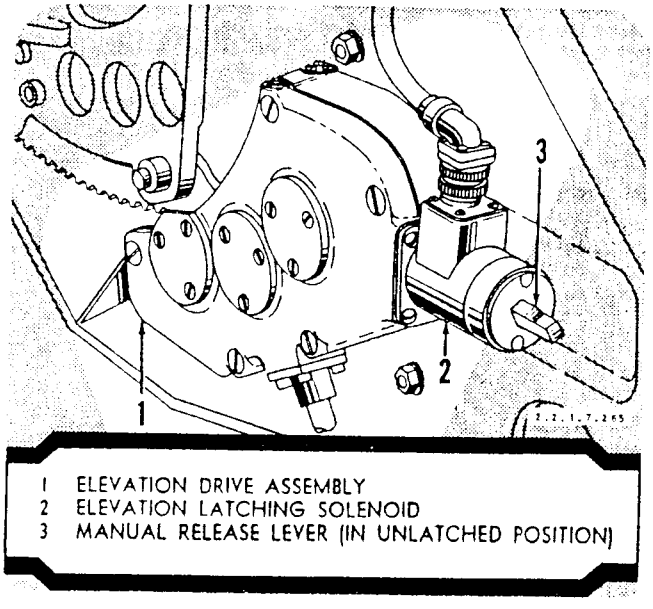


Figure 2–19. Elevation Latching Solenoid

f. Reassemble armature to end shield and turn armature until brushes are sanded to 70 percent contact.

g. Remove sandpaper and glue with damp cloth.

h. Thoroughly clean armature, commutator, brush riggings and motor frame with carbon tetrachloride and air.

2–53. SETTING BRUSHES. If brush yoke has not been removed, it should not be necessary to set a new brush position. If no means of loading the motor is available, the brushes may be set by "flashing". This consists of placing a milliammeter across the armature terminals, applying rated voltage to the motor field, and quickly breaking the field connection, noting the deflection of the milliammeter. The brushes should be adjusted until this "flashing" gives no deflection on the meter. This will be the best brush setting.

2–54. DRIVE MOTOR COMMUTATOR. Do not oil or lubricate commutator. It may be necessary to clean the commutator by sanding lightly with No. 0000 sandpaper. Do not use emery cloth. If the commutator is badly scarred or burned, it is permissible to take a light lathe cut. After this it will be necessary to undercut the mica 1/32-inch between segments.

Note

Commutator sparking under load should not cause alarm unless it is excessive. Turret drive motors are built to produce pinpoint sparking, but streamer sparking should not be tolerated.

2–55. DRIVE MOTOR BEARINGS. The motor bearings are sealed and are not to be lubricated during the life of the machine. If bearings are found to be binding,

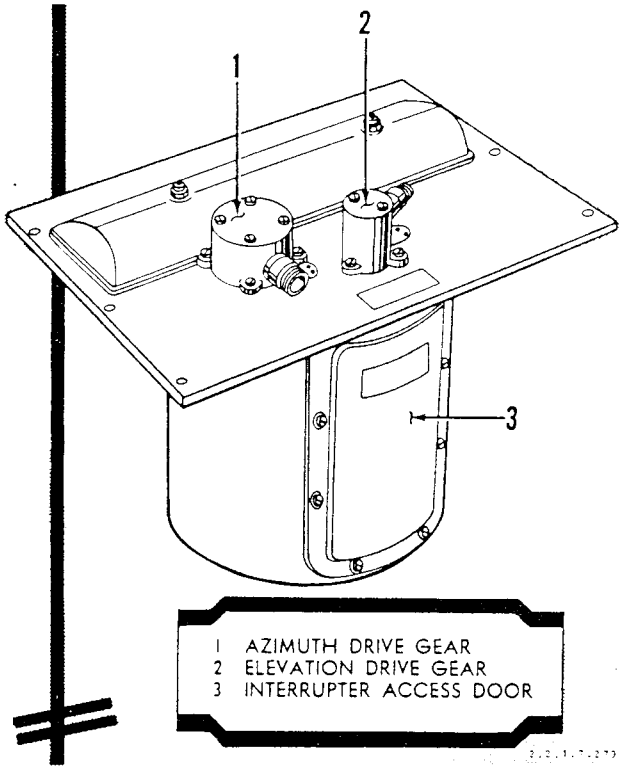


Figure 2–21 Fire Interrupter and Collector Ring Assembly

remove with a bearing puller and replace. When pressing on a new bearing, exert all force on the inner race.

2–56. DRIVE MOTOR COILS. Rewinding of the field or armature coils is not recommended. The assemblies should be replaced.

2–57. COLLECTOR RING ASSEMBLY. Control current is transmitted to the rotating turret by means of a collector ring assembly (figure 2–21), which consists of 26 slip rings, a top plate, brush holders, brushes and the necessary windings. Reverse gearing works against the drive gearing, causing the collector case and brushes to stand still while the slip rings rotate with the turret. The bottom plate of the collector case has one electrical connector, which is the only external electrical connection to the turret. The top plate has electrical connectors to supply power to other turret units.

2–58. FIRE INTERRUPTER ASSEMBLY. Interruption of machine gun fire in areas of wing and empennage surfaces and propeller arcs is accomplished by a fire interrupter assembly (figure 2–21) built around the collector ring. The interruptor consists of a drum with cams (patterns of the areas to be protected) on the outer surface and a moving support which carries two switches. One switch is wired in series with the firing solenoid of each gun. The switches are arranged to move with the cam drum in direct proportion to the movement of the guns in azimuth and elevation. This makes it possible to interrupt individually the fire of each gun.

2–59. CALIBRATING THE FIRE INTERRUPTER.

a. Move turret in azimuth so that index arrow on inner ring is opposite word FORWARD on outer ring.

b. Move guns in elevation to horizontal or ZERO position by placing index mark on elevation saddle support opposite zero degree mark engraved on saddle casting.

c. Lock turret and guns with solenoid latches on gear drives.

d. Remove access door on collector and interrupter assembly. (See figure 2–21.)

e. Check cross marked FORWARD on drum and make sure that it is centered in sight hole of switch carriage.

f. If not centered, disconnect flexible drive shafts from azimuth collector driver and elevation interrupter driver. (See figure 2–22.)

g. Rotate shafts until sight hole and cross marked FORWARD are aligned.

h. Connect flexible drive shafts to azimuth and elevation interrupter drivers without changing position of guns or of collector drum and switch carriage.

i. Unlatch solenoids on elevation and azimuth gear drives and move the guns in elevation and turret in azimuth.

j. Return guns to FORWARD point and ZERO degree elevation point.

k. Check cross mark on drum and sight hole on switch carriage to make sure they are properly centered. If not, repeat complete calibrating procedure.

l. Attach access door when adjustment is correct.

Note

This same procedure can be followed with the guns in the aft position if for any reason it is impossible or undesirable to use the forward position. If aft position is used, the sight hole in the switch carriage should align with a cross on the opposite side of the drum which is marked AFT.

2–60. ADJUSTMENT OF FIRE-INTERRUPTER SWITCHES. If switches fail to open and close properly when the switch actuators come into contact with the drum surface cams, make the following adjustments.

a. Position switch actuator on top of steel cam surface.

b. Loosen adjusting nut until switch is closed.

c. Tighten nut until switch just opens and then tighten an additional 1/3 turn.

Note

The closing or opening of the switch is audible and can be determined easily by ear.

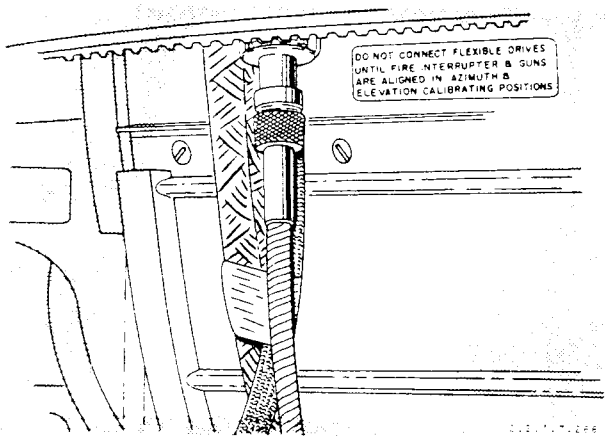


Figure 2–22. Azimuth Interrupter Flexible Drive Shaft

2–61. LIMIT STOPS AND SWITCHES. Two limit stop assemblies which limit the travel of the guns in elevation are mounted on the right saddle support. (See figure 2–23.) The two stops are mounted in a fixed position and are engaged by a third stop which is mounted on the right-hand side of the saddle. The stop on the saddle rotates as the guns are moved in elevation. An electrical limit switch mounted on the left saddle support operates to cut down 75 percent of the elevation drive motor power and to open the firing circuit whenever guns are moved below horizontal. The switch, operated by a cam on the left-hand side of the saddle, removes approximately 75 percent of the power applied to the elevation drive motor. The remaining power is of the proper polarity to hold the guns depressed against the stop.

2–62. CONTOUR-FOLLOWER. Both upper and lower turrets are provided with contour-follower assemblies (figure 2–24) which prevent the guns from touching or damaging any part of the airplane structure as they are moved in azimuth or elevation. In addition, the contour-followers are provided with a built-in maneuver switch which interrupts the fire of guns and reduces the elevation motor power approximately 9/10 when the guns approach the airplane structure. Only enough power is provided to prevent the guns from being moved by the pressure of the air stream. On the upper turret the contour-follower prevents the guns, both forward and aft, from touching the structure by forcing them up. On the lower turret, the contour-follower prevents the guns from touching the structure by forcing the guns down in the forward direction only.

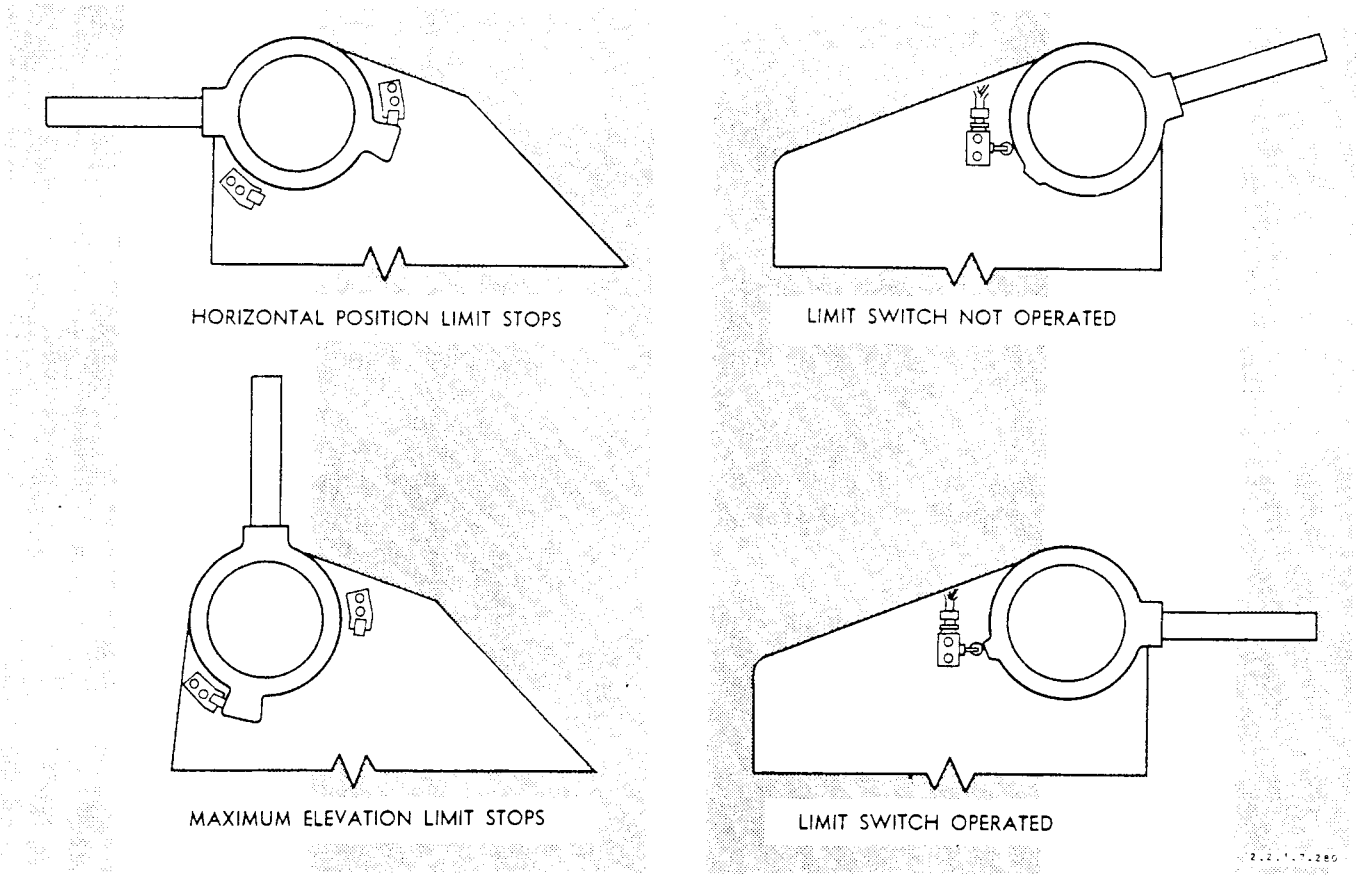


Figure 2–23. Limit Stops and Switches

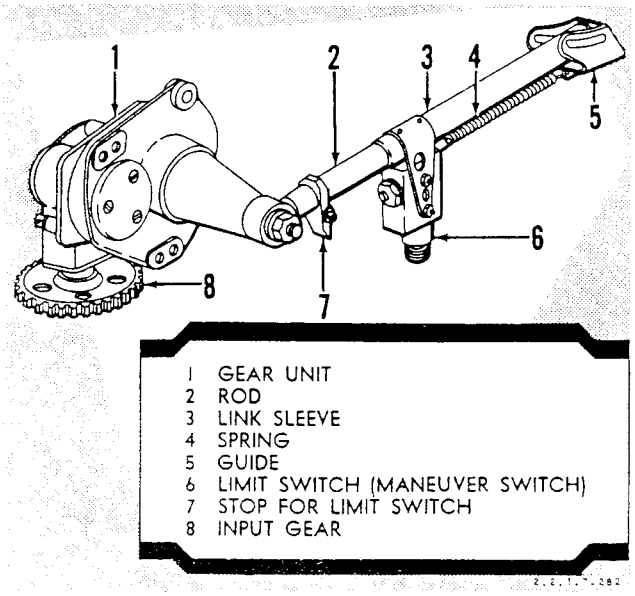


Figure 2–24. Contour-Follower Assembly

2–63. CALIBRATING THE CONTOUR-FOLLOWER. If the contour-follower has been properly calibrated, the crank arm should be centered towards the muzzle of the guns when the upper turret is in the FORWARD or AFT index position and the guns are in the horizontal or ZERO degree position. The crank arm for the lower turret should be in the same position, with the turret in the FORWARD position only and the guns at an elevation of 28°. If necessary, the following adjustments can be made.

a. With turret at FORWARD index point and the guns at ZERO degrees elevation (upper turret) or 28° elevation (lower turret) unbolt azimuth input gear. (See figure 2–24.)

b. With this gear and azimuth ring gear unmeshed, move crank arm to center position.

c. Engage input gear and azimuth ring gear. Replace and tighten bolt that holds this gear in place.

d. Check contour-follower by moving turret, then returning it to position noted above.

e. Check lower turret contour-follower operation by rotating turret manually in maximum elevation. The gun should clear structure if contour-follower operates properly.

2–64. LOWER TURRET ASSEMBLY. The lower turret is substantially the same as the upper turret with the following exceptions.

a. Ejection chute extension and door assembly. Empty cases and links for lower turret guns are disposed of through an opening in the gun enclosure. A door assembly, which is bolted to the bottom of the saddle, opens automatically when the guns begin to fire and close as soon as firing is stopped. The door assembly is operated by compressed air from the same bottle that operates the gun chargers. A slot enclosure assembly acts as a baffle to guide the empty cases and links from the door assembly down through the opening in the slot.

b. Saddle assembly. In order to permit the guns to be installed the lower turret saddle must be inverted in the saddle support. The elevation gear sector is on the left-hand side of the saddle.

c. Contour-follower. Link rod lengths for the lower turret contour-follower are different because of the different contour followed. Lower turret guns may be elevated five degrees above horizontal except in the forward position where the guns are depressed to 28° below horizontal.

d. Collector assembly. The lower turret collector assembly is different from that of the upper turret in that it does not have an interrupter switch carriage, an elevation drive, or an interrupter drum or cam, but has a slightly smaller cover.

2–65. REMOVAL.

a. Remove turret dome.

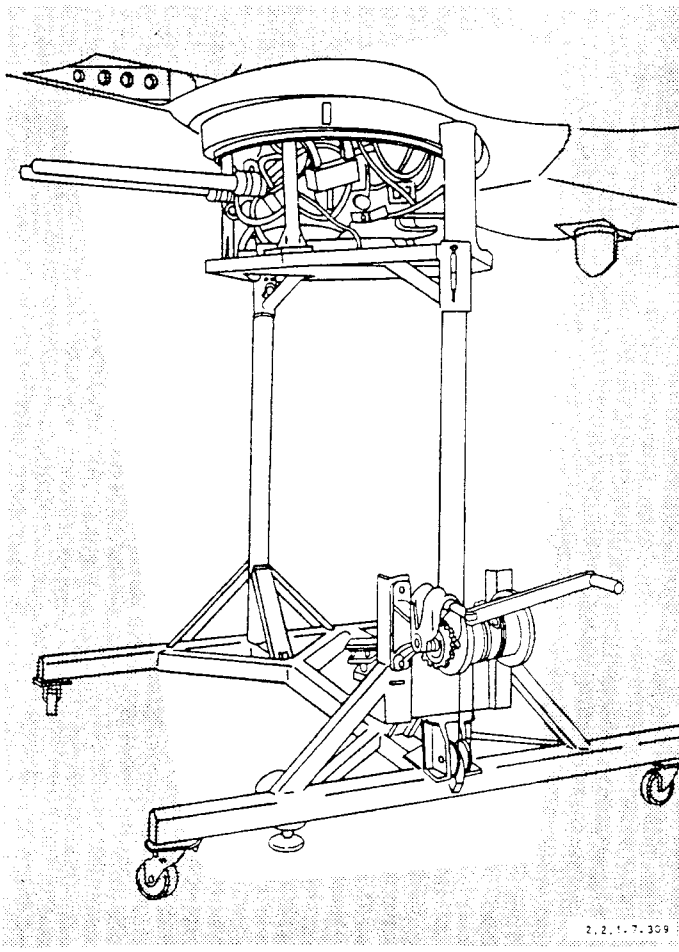


Figure 2–25. Lower Turret Raised Into Position

b. Place turret stand in position supporting turret.

c. Remove bolts which attach turret to mounting wing.

d. Remove turret by lowering lift. (See figure 2–25.)

2–66. MINOR REPAIR.

a. Adjustment to contour-follower. (Refer to paragraph 2–63.)

b. If turret mounting ring has been damaged, remove and install a new ring by attaching it to three mounting bosses. (See figure 2–26.)

Note

If this is done, the ring must be leveled with the plane of the upper turret.

c. For lubrication of lower turret, refer to paragraphs 2–46A and 2–46B.

2–67. INSTALLATION.

a. With turret dome removed, place guns in a horizontal position.

b. Raise turret into position. (See figure 2–25.)

Note

Be sure that the FORE point marked on the turret is in the forward position.

c. Install a star washer under head of one attaching bolt for bonding purposes.

d. Install bolts which attach turret to mounting ring.

Note

Always tighten bolts from lower head side.

2–68. TURRET GUNS.

2–69. DESCRIPTION. Two .50 caliber machine guns, type M-2, are installed in each turret. Ammunition is fed to each gun from an ammunition box having a capacity of 500 rounds. Ammunition is fed to the upper turret guns by an ammunition booster. A tell-tale indicator is installed to operate in conjunction with the turret guns.

2–70. PRECAUTIONS PRIOR TO REMOVAL AND INSTALLATION.

a. All power must be off.

b. Remove ammunition belts from guns.

c. Check gun chamber for live rounds.

WARNING

The above precautions will be strictly adhered to. Failure to do so may result in injury to personnel.

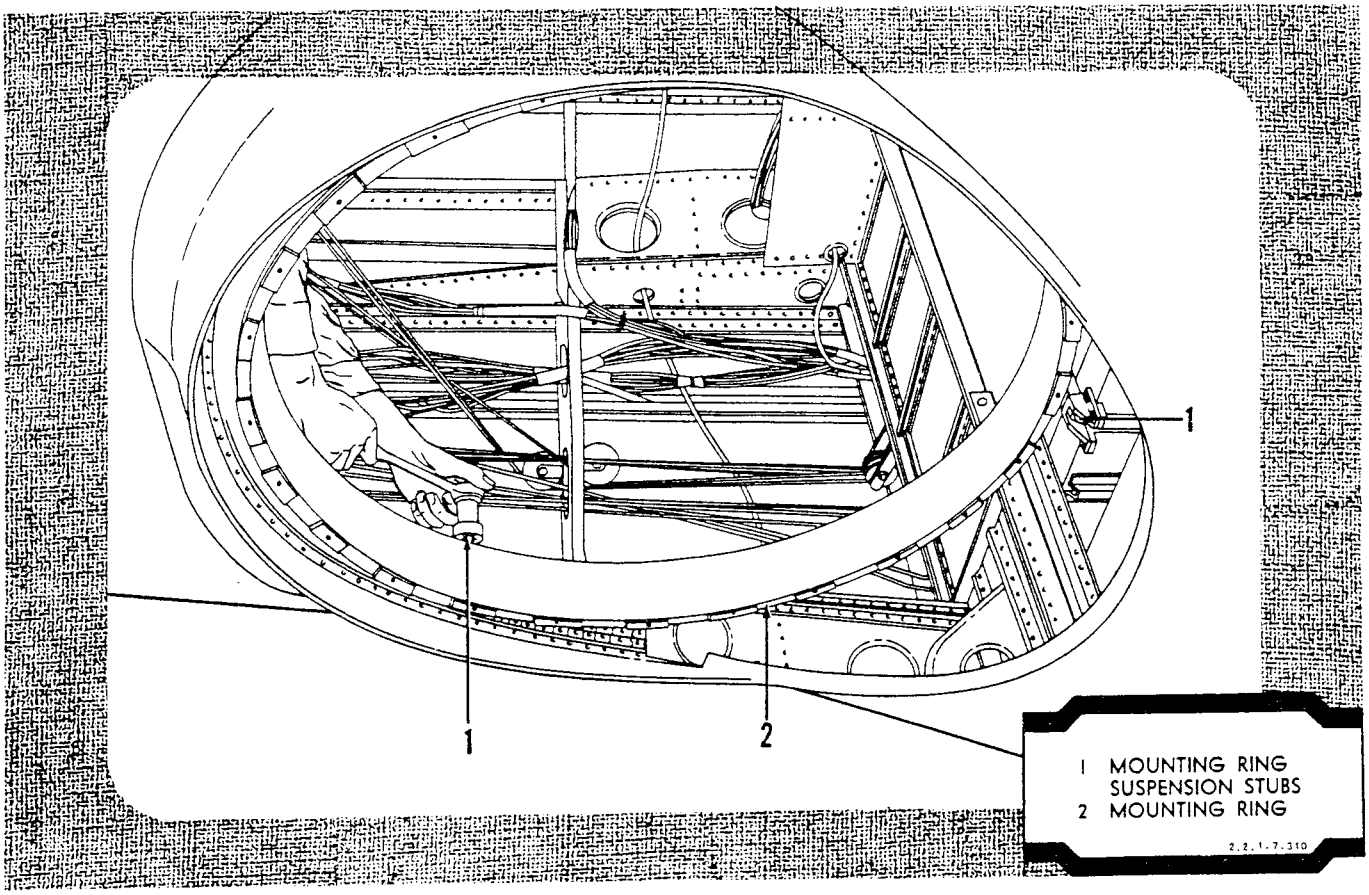


Figure 2–26. Installation Lower Turret Mounting Ring