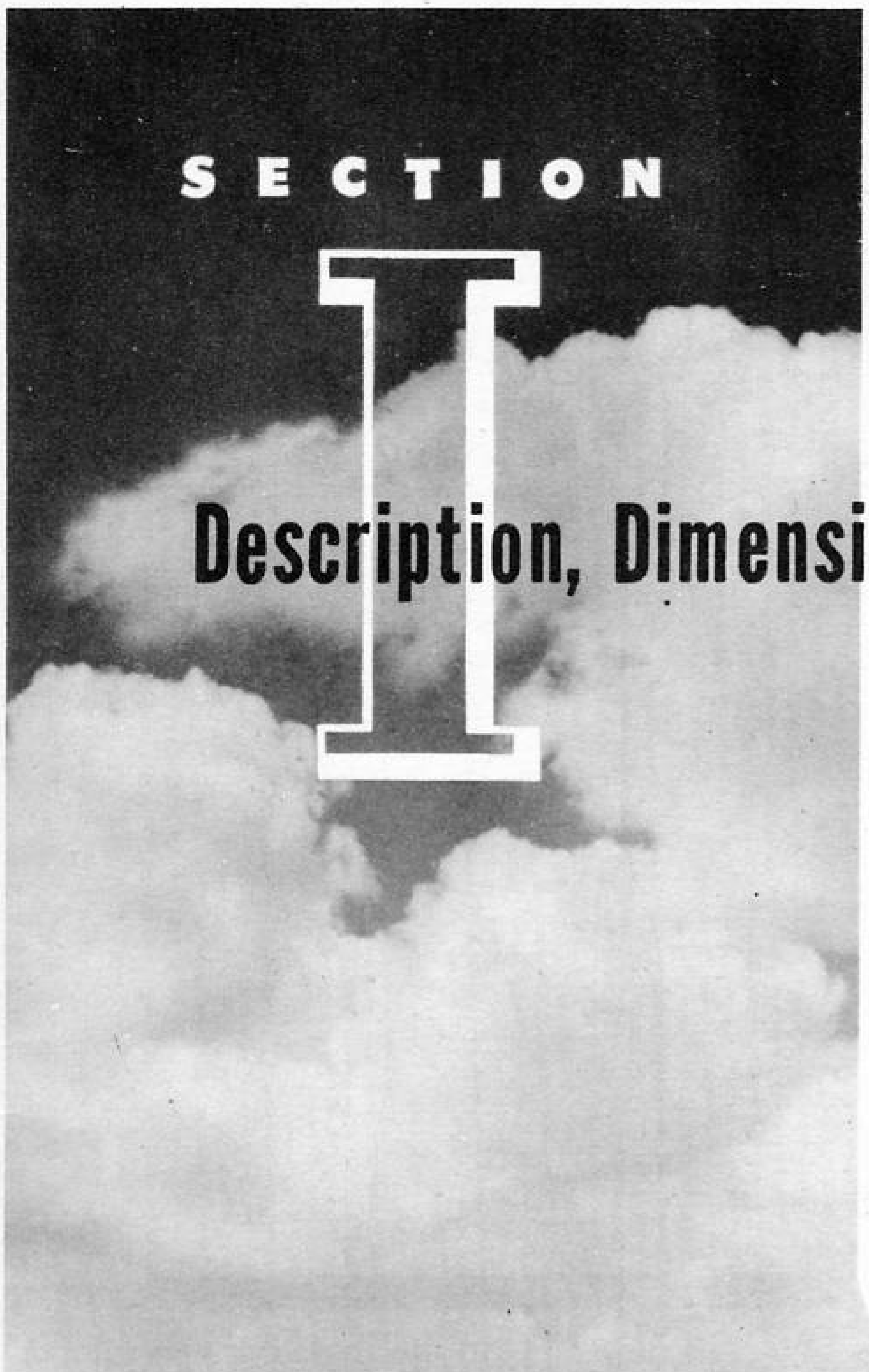
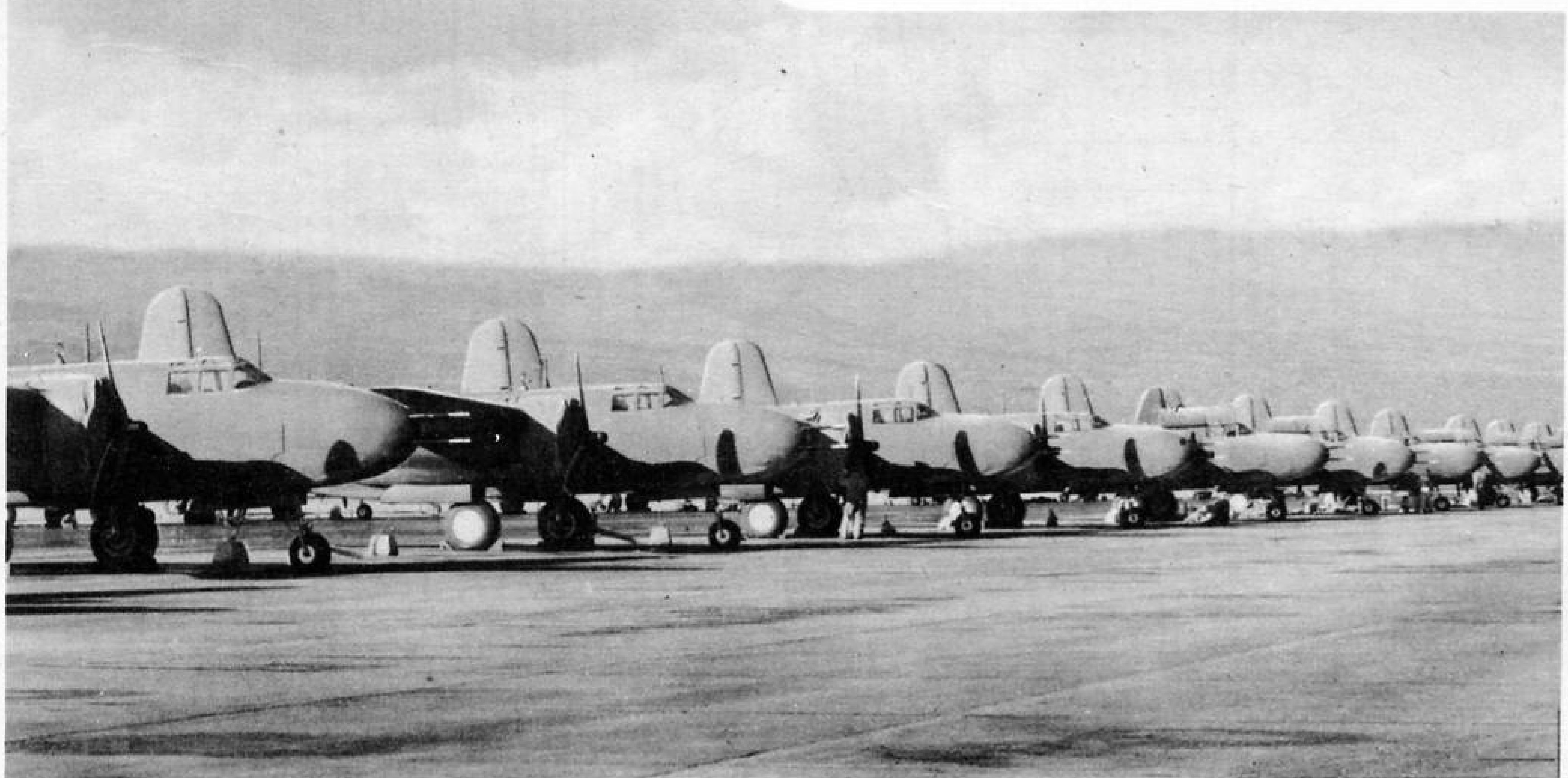
SECTION I



Description, Dimensions and Leading Particulars

1. DESCRIPTION.

a. The Douglas model A-20G attack bomber is a twin-engined, all-metal, midwing monoplane, incorporating a tricycle landing gear. The airplane has an over-all span of 61 feet 4 inches, an over-all length of 47 feet 4 inches, and an over-all height at rest of 18 feet 1 inch. It is designed as an attack bomber, and provisions are made for a crew of three: pilot, upper rear gunner, and lower rear gunner.



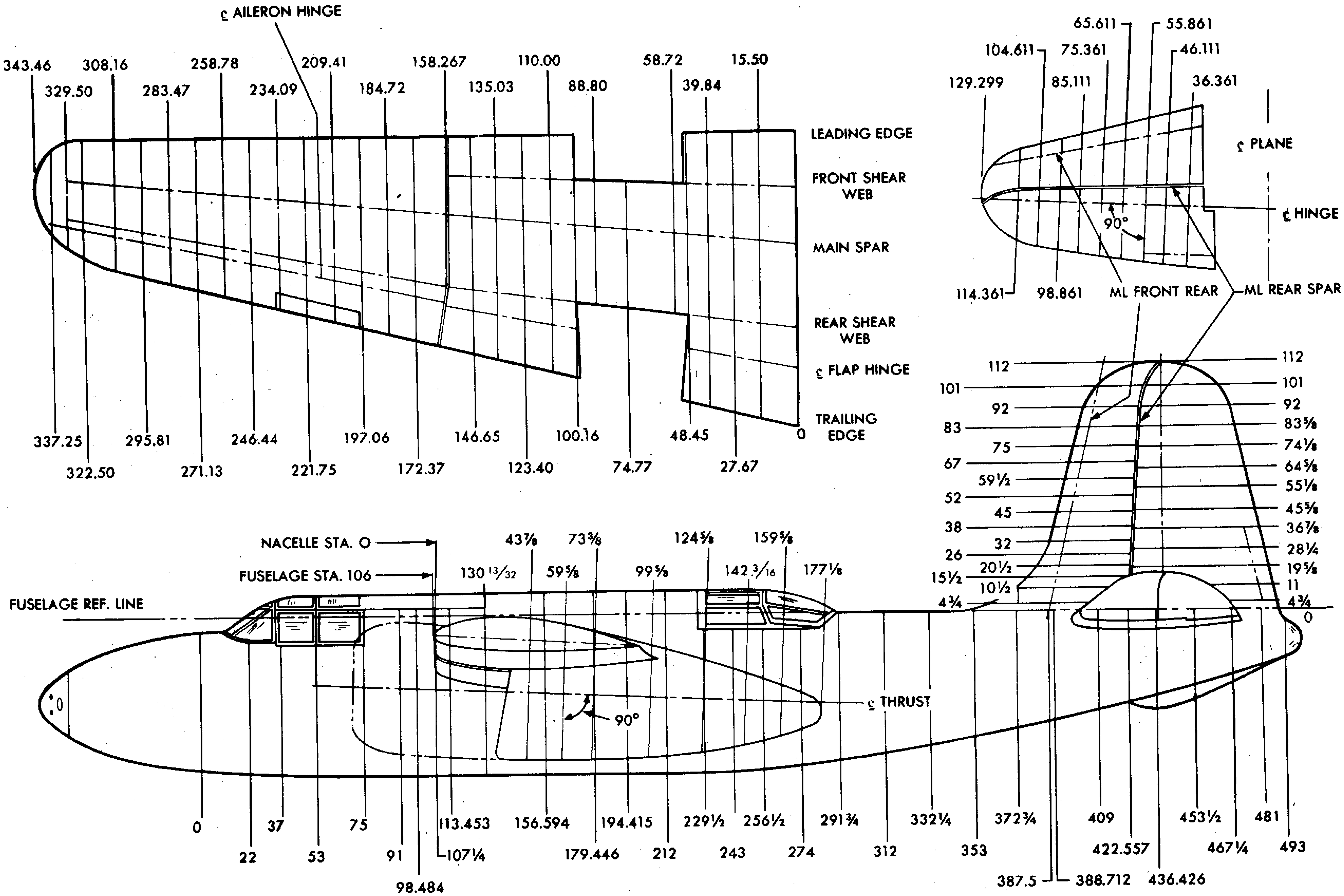


Figure 7 - STATION DIAGRAM

2. DIMENSIONS.

a. PRINCIPAL DIMENSIONS. - (Aircraft in level flight position unless otherwise stated.)

Span	61 ft 4 in.
Length over-all	47 ft 4 in.
Height over-all (at rest)	217 in.
Height propeller hub (at rest)	82-1/2 in.
Clearance - propeller tips to ground	15 in.
propeller tips to fuselage	9 in.
Fuselage	
Length over-all	47 ft 4 in.
Height	82 in.
Width	49 in.
Inboard wing flap	
Area aft of hinge center line	5.85 sq ft
Area of balance	1.41 sq ft
Area of split-type section	2.35 sq ft
Total area	9.61 sq ft
Outboard wing flap	
Area aft of hinge center line	8.31 sq ft
Area of balance	1.76 sq ft
Total area	10.07 sq ft
Horizontal stabilizer (tail plane)	
Area less fuselage area	81.70 sq ft
Total area (including elevators and fuselage)	100.00 sq ft
Elevators (each)	
Area aft of hinge center line (including tab)	15.14 sq ft
Area of balance	4.44 sq ft
Total area	19.58 sq ft
Trim tab area	1.12 sq ft
Vertical stabilizer (fin)	
Total area (including rudder, tab and fairing)	63.35 sq ft
Area less fairing but including rudder	59.90 sq ft
Area of fin (less rudder and fairing)	24.81 sq ft
Rudder	
Area aft of hinge center line (including tab)	27.36 sq ft
Area of balance	7.72 sq ft
Total area	35.08 sq ft
Trim tab area	2.55 sq ft
Wing	
Airfoil section - root	NACA 23018
tip, modified	NACA 23010
Chord - root	138.5 in.
tip	43.9 in.
Taper ratio	3.2
Incidence - inner wing	$+3^{\circ}$
outer wing - root	$+3^{\circ}$
outer wing - tip	-1°
Dihedral (leading edge)	4° 7 min
Sweepback (leading edge)	0°
Horizontal stabilizer (tail plane)	
Span	21 ft 2 in.
Chord (maximum)	80.75 in.
Incidence (fixed setting)	$+2^{\circ}$
Dihedral	10°

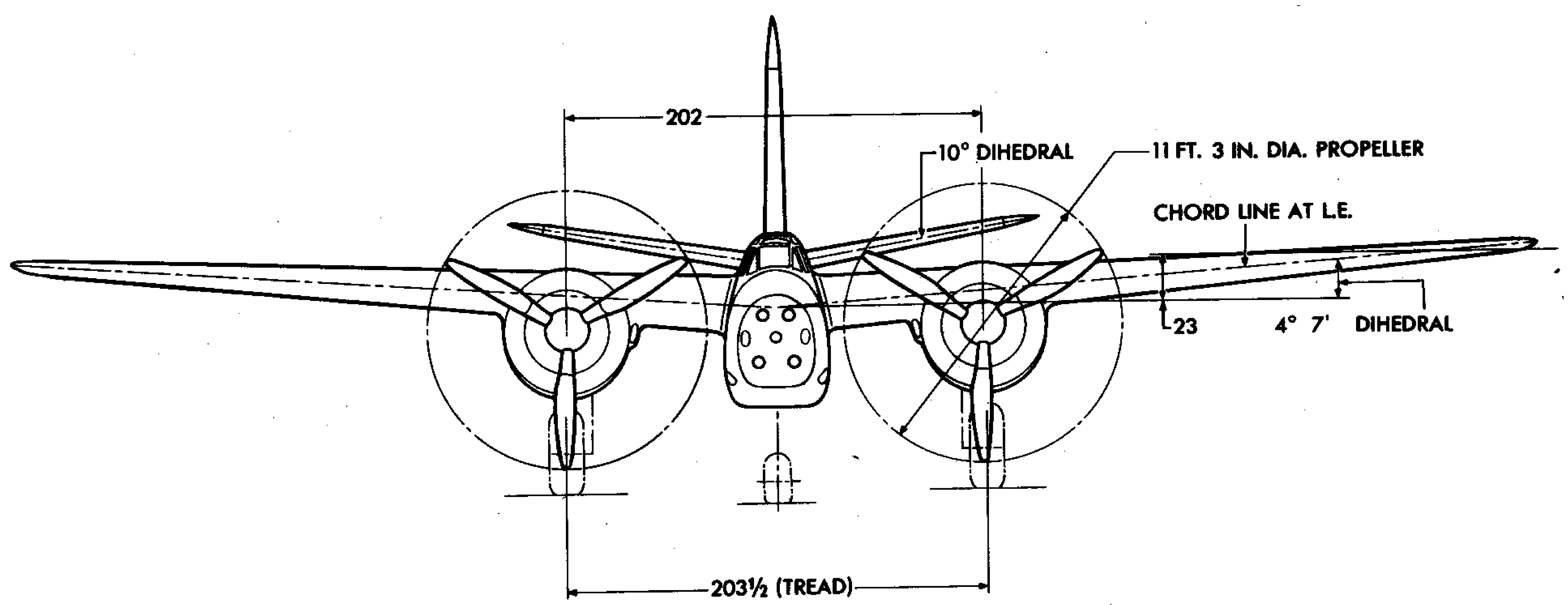


Figure 8 - FRONT VIEW, SHOWING PRINCIPAL DIMENSIONS

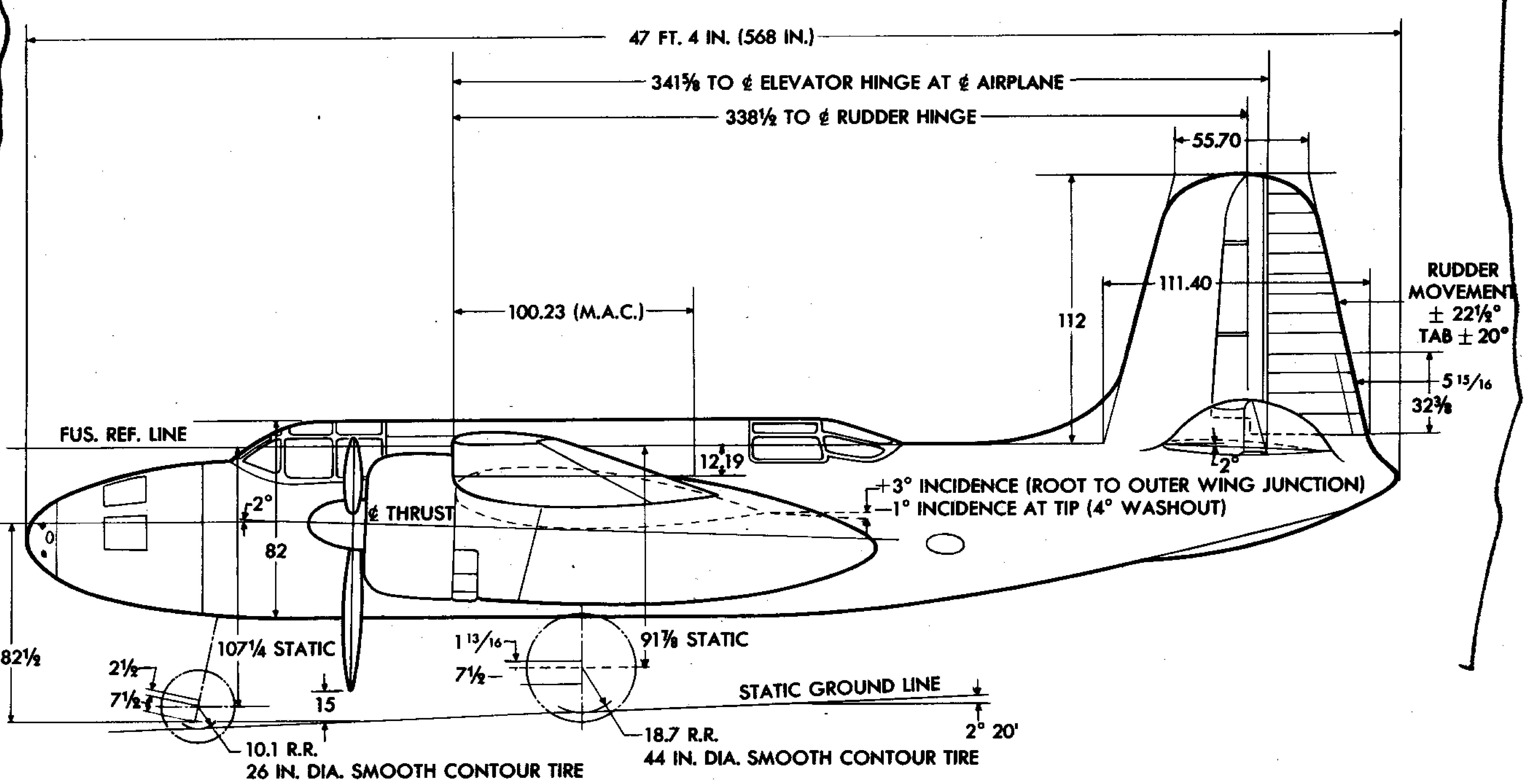


Figure 9 - SIDE VIEW, SHOWING PRINCIPAL DIMENSIONS

Vertical stabilizer (fin)

Span	9 ft 4 in.
Chord (maximum)	9 ft 3 in.
Incidence (fixed setting)	0°

b. AREAS.

Wing

Total area (including ailerons and flaps)	464.8 sq ft

Ailerons

Area aft of hinge center line (including tab)	16.49 sq ft
Area of balance	4.57 sq ft
Total area	42.1 sq ft
Trim tab area	1.32 sq ft

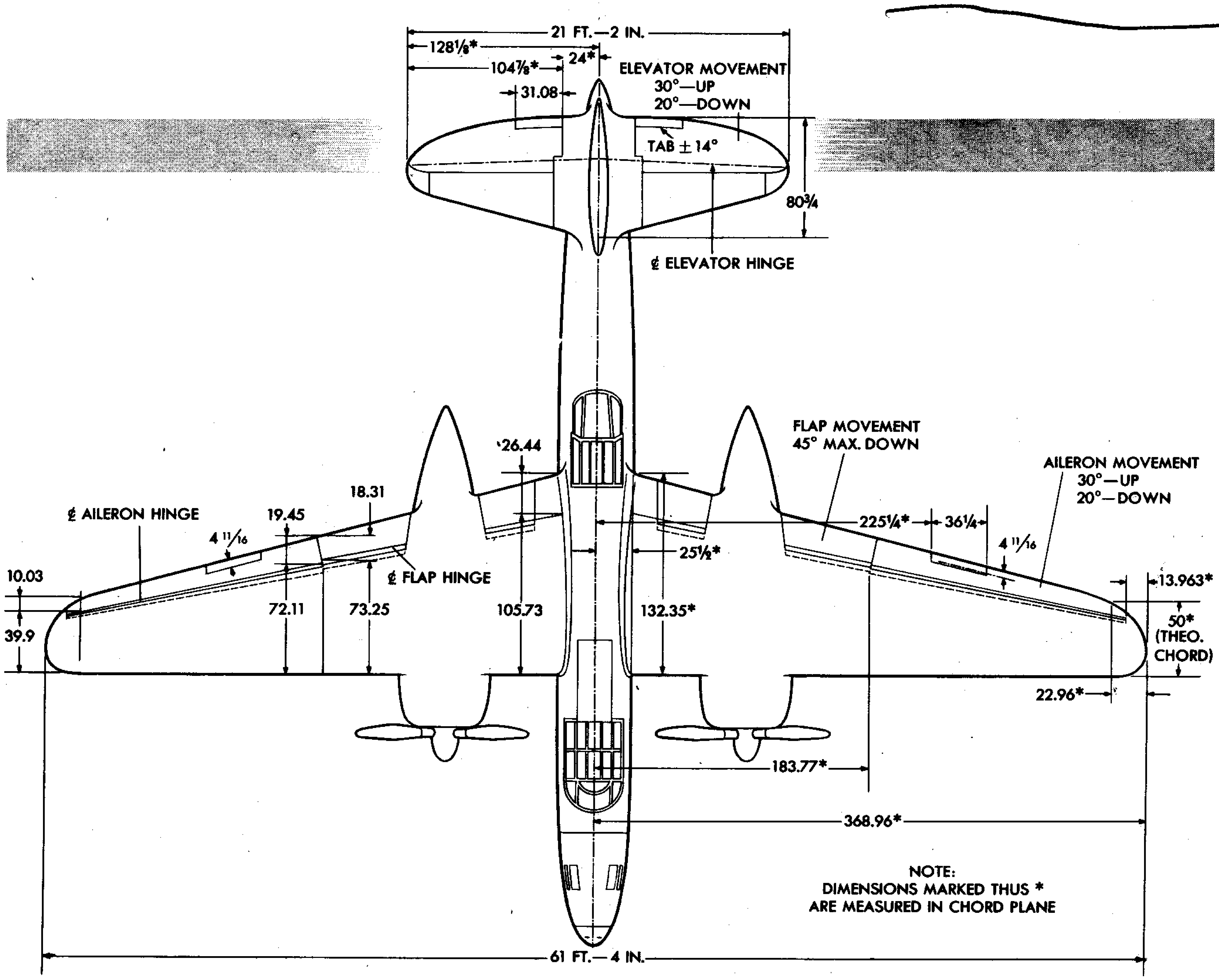


Figure 10 - PLAN VIEW, SHOWING PRINCIPAL DIMENSIONS

ITEM NO.	PART NUMBER	ASSEMBLY NAME (1 OF EACH REQUIRED)	NO. REQ.
1.	5090812	STABILIZER, VERTICAL	
2.	5062450-1	TAB, ELEVATOR—R.H.	
3.	5062449-1	ELEVATOR, COVERED—R.H.	
4.	5090810	STABILIZER, HORIZONTAL—R.H.	
5.	5167341-18	DOOR, UPPER FLEXIBLE GUN—L.H.	
	5167341-19	DOOR, UPPER FLEXIBLE GUN—R.H.	
6.	5176988	ENCLOSURE, REAR COCKPIT FIXED	
7.	5069790	ENCLOSURE, GUNNER'S SLIDING	
8.	5065826	TRUSS, FUSELAGE STA. 25 TO 229½	
9.	5090913	ENCLOSURE, BOMB BAY (AIRPLANES AF 42-53535 THROUGH AF 42-54144)	
	5090913-500	ENCLOSURE, BOMB BAY (AIRPLANES AF 42-54145 AND UP)	
10.	5069761	DOOR, PILOT'S ENCLOSURE	
11.	5062435-1	FLAP, INBOARD LANDING—R.H.	
12.	5062434	FLAP, OUTBOARD LANDING—R.H.	
13.	5090807-1	WING, COMPLETE INNER—R.H. (AIRPLANES AF 42-53535 THROUGH AF 42-53784)	
	5090807-517	WING, COMPLETE INNER—R.H. (AIRPLANES AF 42-53785 THROUGH AF 42-54144)	
	5090807-519	WING, COMPLETE INNER—R.H. (AIRPLANES AF 42-54145 AND UP)	
14.	5064718-1	TAB, AILERON—R.H.	
15.	5062415-1	AILERON—R.H.	
16.	5090805-1	PANEL, WING TIP—R.H.	
17.	5090802-503	WING, COMPLETE OUTER—R.H.	
18.	5062497-508	GEAR, MAIN LANDING—R.H.	
19.	4068443-1	RING, ANTIDRAG—R.H.	
20.	5090849-501	NACELLE—R.H.	
21.	5068149-1	DOOR, NACELLE OUTBOARD—R.H.	
22.	5068148-1	DOOR, NACELLE INBOARD—R.H.	
23.	5065394-500	MOUNT, ENGINE—R.H.	
24.	5065334-1	FRAME, LANDING GEAR SUPPORT—R.H.	
25.	5169243	FLOOR, PILOT'S CENTER	
26.	5167582	CAP, REMOVABLE NOSE	
27.	5167278	NOSE, ATTACK	
28.	5173152	ENCLOSURE, PILOT'S	
29.	5090815	STRUCTURE, FUSELAGE	
30.	5093678	PANEL, CENTER—STATION 0	
31.	5062451-502	GEAR, NOSE WHEEL	
32.	5068009	PANEL—STATION 75 TO 130	
33.	5063871	FRAME, LOWER CROSS TIE FUSELAGE MAIN	
34.	5063889	FRAME, UPPER CROSS TIE FUSELAGE MAIN	
35.	5065430	TIE, FUSELAGE CROSS—STA. 108½	
36.	4168443	RING, ANTIDRAG—L.H.	
37.	5065331	TIE, FUSELAGE CROSS—STA. 193.125	
38.	5065394	MOUNT, ENGINE—L.H.	
39.	5090849-500	NACELLE—L.H.	
40.	5068148	DOOR, NACELLE INBOARD—L.H.	
41.	5068149	DOOR, NACELLE OUTBOARD—L.H.	
42.	5065334	FRAME, LANDING GEAR SUPPORT—L.H.	
43.	5062497-508	GEAR, MAIN LANDING—L.H.	
44.	5090802-502	WING, COMPLETE OUTER—L.H.	
45.	5090805	PANEL, WING TIP—L.H.	
46.	5062415	AILERON—L.H.	
47.	5064718	TAB, AILERON—L.H.	
48.	5062434	FLAP, OUTBOARD LANDING—L.H.	
49.	5090807	WING, COMPLETE INNER—L.H. (AIRPLANES AF 42-53535 THROUGH AF 42-53784)	
	5090807-516	WING, COMPLETE INNER—L.H. (AIRPLANES AF 42-53785 THROUGH AF 42-54144)	
	5090807-518	WING, COMPLETE INNER—L.H. (AIRPLANES AF 42-54145 AND UP)	
50.	5062435	FLAP, INBOARD LANDING—L.H.	
51.	5090810	STABILIZER, HORIZONTAL—L.H.	
52.	5062449	ELEVATOR, COVERED—L.H.	
53.	5062450	TAB, ELEVATOR—L.H.	
54.	5090822-500	CONE, FUSELAGE TAIL	
55.	5114526	TAB, RUDDER	
56.	5062452	RUDDER, COVERED	

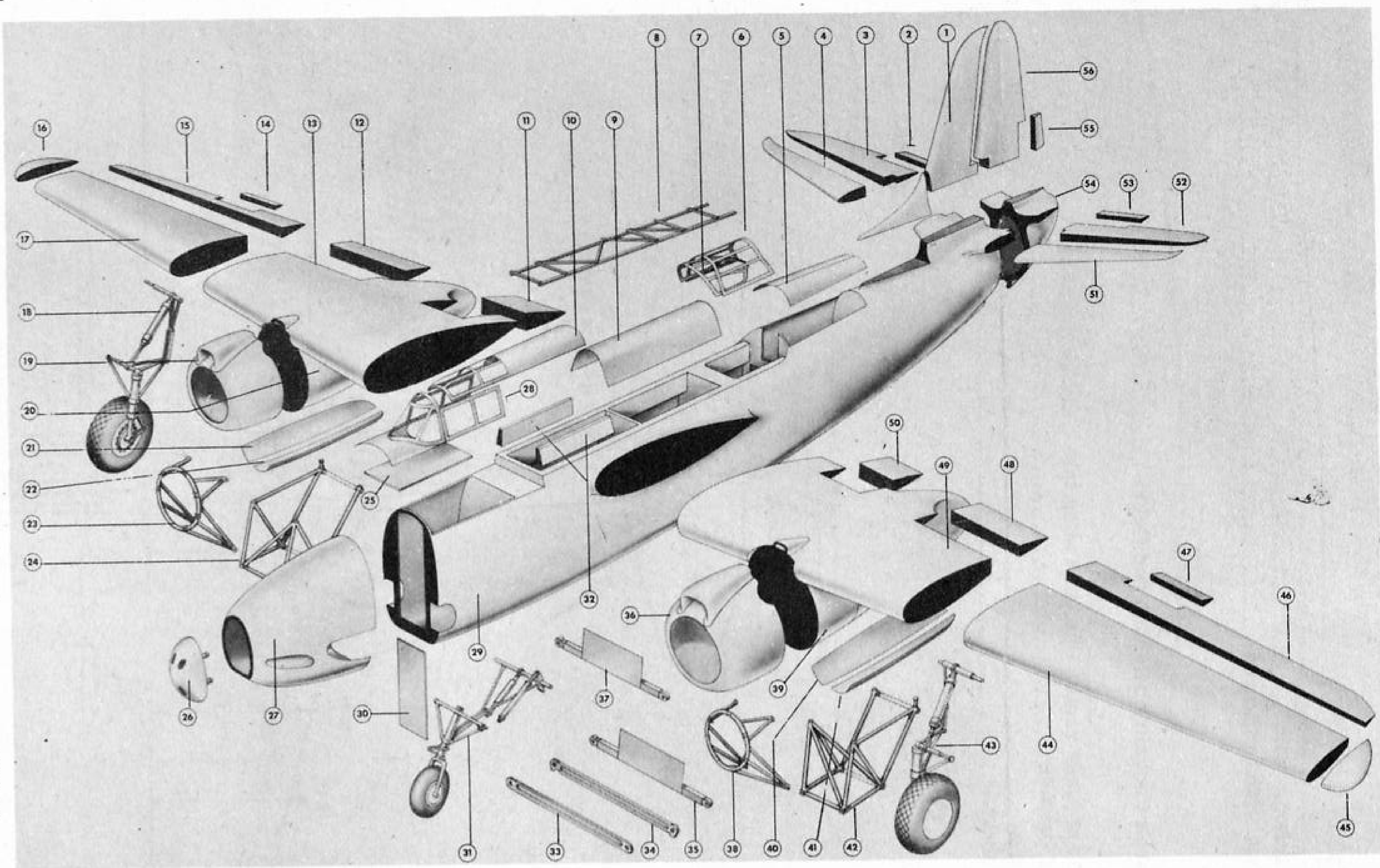


Figure 11 - EXPLODED VIEW OF MAJOR ASSEMBLIES

3. LEADING PARTICULARS.

a. GENERAL.

Name	Douglas A-20G-1DO airplane
Duty	Attack bombardment
Type	Three-place, two-engine, land monoplane

b. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES.

Stabilizers	Fixed
Fin	Fixed
Ailerons	
UP travel	$30^{\circ} \pm 2^{\circ}$ or 9-11/16 in. ± 5/8 in.
DOWN travel	$20^{\circ} \pm 2^{\circ}$ or 6-1/2 in. ± 5/8 in.
Droop	0° or 0 in.
Aileron tabs	
UP travel	$9^{\circ} \pm 1\text{-}1/2^{\circ}$ or 11/16 in. ± 1/8 in.
DOWN travel	$9^{\circ} \pm 1\text{-}1/2^{\circ}$ or 11/16 in. ± 1/8 in.
Elevators	
UP travel	$30^{\circ} \pm 1^{\circ}$ or 14-1/8 in. ± 15/16 in.
DOWN travel	$20^{\circ} \pm 1^{\circ}$ or 9-7/16 in. ± 5/16 in.
Elevator tab	
UP travel	$8^{\circ} \pm 1\text{-}1/2^{\circ}$ or 3/4 in. ± 5/32 in.
DOWN travel	$14^{\circ} \pm 1\text{-}1/2^{\circ}$ or 1-11/32 in. ± 5/32 in.
Rudder	
RIGHT travel	$22\text{-}1/2^{\circ} \pm 1^{\circ}$ or 19-1/2 in. ± 7/8 in.
LEFT travel	$22\text{-}1/2^{\circ} \pm 1^{\circ}$ or 19-1/2 in. ± 7/8 in.
Rudder tab	
RIGHT travel	$10^{\circ} \pm 1\text{-}1/2^{\circ}$ or 1-3/4 in. ± 1/4 in.
LEFT travel	$10^{\circ} \pm 1\text{-}1/2^{\circ}$ or 1-3/4 in. ± 1/4 in.
Wing flaps	
Inboard	$45^{\circ} \pm 2^{\circ}$ or 17-3/4 in. ± 3/4 in.
Outboard	$45^{\circ} \pm 2^{\circ}$ or 16-7/16 in. ± 11/16 in.

c. ALIGHTING GEAR.

Main landing gear	
Type	Two individual, retractable single oleo leg and wheel units
Shock absorber struts	Bendix oleo-pneumatic
Wheels and brakes	
Type	Goodyear 731851
Tires	44-inch smooth contour, non-skid
Air pressure of tires	42 pounds per square inch
Tread	16 ft. 11-1/2 in.
Axle center line aft of wing leading edge (along nacelle center line)	4 ft. 6 in.
Nose wheel gear	
Type	Retractable, single oleo leg and wheel unit
Shock absorber strut	Bendix oleo-pneumatic
Wheel	
Type	Hayes G-3-53M, type II
Tire	26-inch smooth contour
Air pressure of tire	53 pounds per square inch
Axle center line to center line of main wheel axle	13 ft 7-3/4 in.
Axle center line to nose of airplane	5 ft 3-3/4 in.

d. ENGINES.

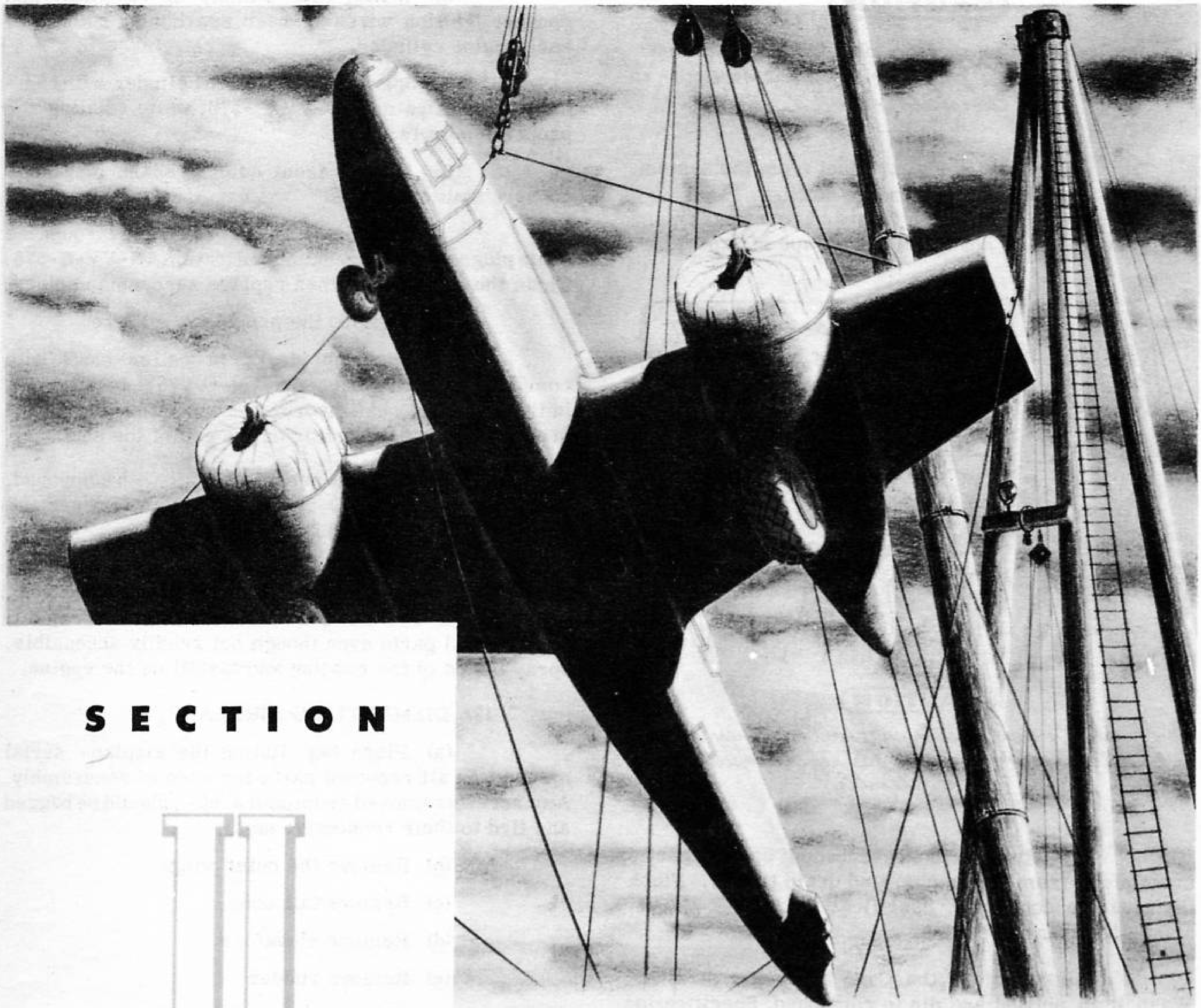
Name	Wright Cyclone GR-2600-23
Type	Supercharged, geared, air-cooled radial
Direction of rotation, propeller shaft	Clockwise (view from aft end)
Fuel	Not less than 90 octane, Specification AN-F-28.
Oil	Specification AN-VV-O-446a, grade 1120

e. PROPELLERS.

Name	Hamilton standard hydromatic
Type	3-bladed, constant-speed, full-feathering
Diameter	11 ft 3 in.
Pitch (measured at 42-in. station)	
Low pitch setting	27°
Full-feathered position	88°

f. TANK CAPACITIES.

Fuel containers	
Inboard wing fuel containers (each)	136 U.S. gallons (113 Imperial gallons)
Outboard wing fuel containers (each)	64 U.S. gallons (53 Imperial gallons)
Bomb bay (fuselage) self-sealing fuel containers (total)	144 U.S. gallons (120 Imperial gallons)
Total capacity (6 fuel containers)	544 U.S. gallons (452 Imperial gallons)
Optional equipment:	
4 bomb bay steel fuel containers (replacing self-sealing fuel containers) (total)	676 U.S. gallons (564 Imperial gallons)
Belly fuel container	342 U.S. gallons (285 Imperial gallons)
Hopper type oil containers (each)	23 U.S. gallons (19 Imperial gallons)
Total capacity (2 oil containers)	46 U.S. gallons (38 Imperial gallons)
Hydraulic reservoir	3.6 U.S. gallons (3 Imperial gallons)
Propeller anti-icer fluid container	3 U.S. gallons (2-1/2 Imperial gallons)
Carburetor anti-icer fluid container	10 U.S. gallons (8.3 Imperial gallons)



SECTION II

Shipment, Erection, and Storage Procedure

1. SHIPMENT OF AIRPLANE.

a. FERRYING. - The A-20G attack bomber can be equipped with auxiliary fuel containers providing sufficient range to be flown to destination.

b. PREPARATION FOR SHIPMENT.

(1) ENGINES AND PROPELLERS.

(a) Clean exterior of the engines and accessories with an approved solvent, and dry with an air blast.

(b) Drain leaded fuel from all fuel containers, then connect a fuel container, free of leaded fuel, directly to the carburetors. Run the engines at least 15 minutes at 1000 rpm on an unleaded fuel such as 73 octane, Specification AN-VV-F-761 (clear), to prevent corrosion. In a tropical zone or near tidewater, operate the engine on the unleaded fuel within 12 hours after any previous run on leaded fuel. Before stopping the engine, make sure that cylinder head temperatures have cooled. Stop the engine by moving the mixture control into the IDLE CUT-OFF position and then turn the ignition switch OFF.

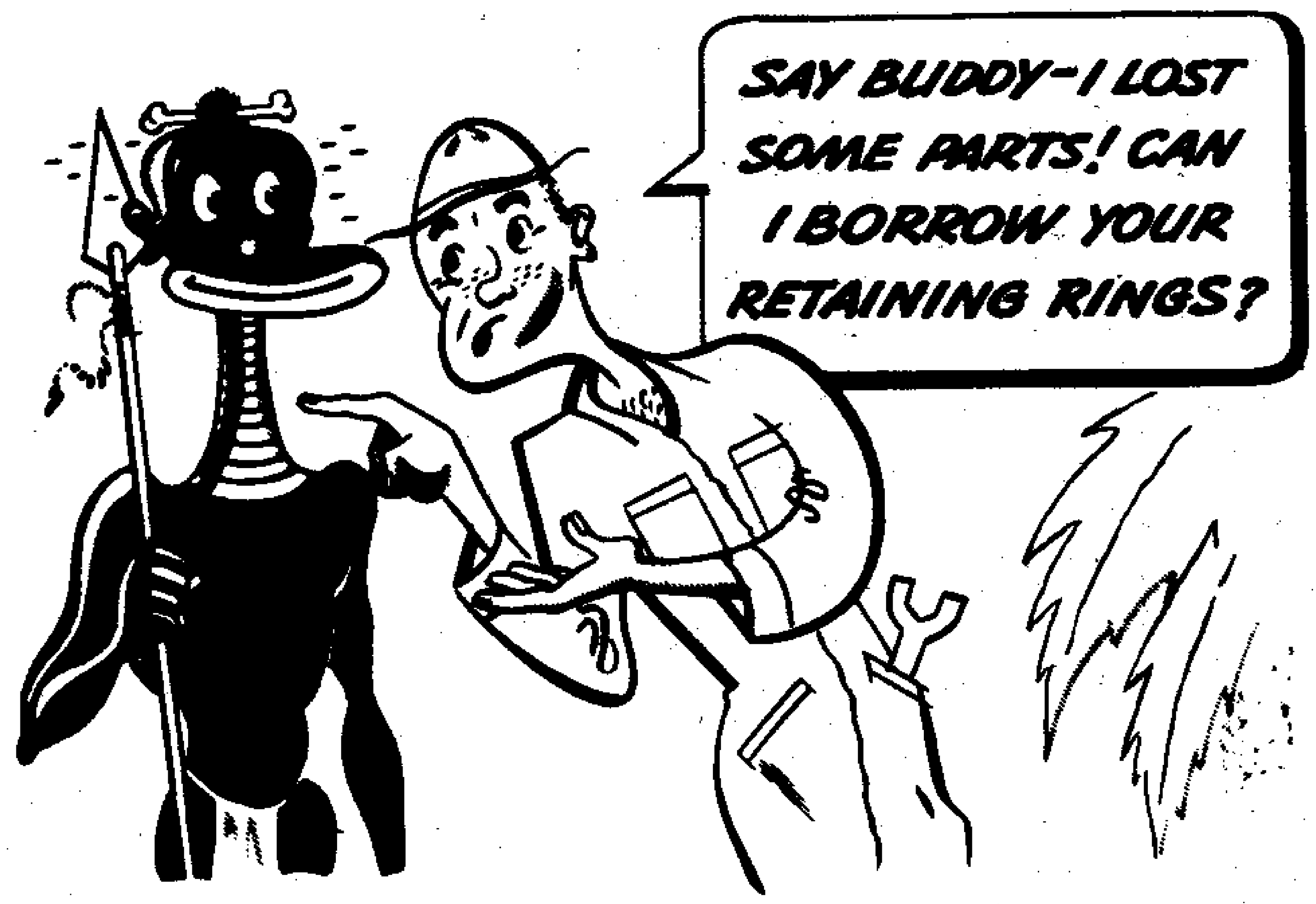
CAUTION

Do not stop the engine by running out of fuel. Do not turn the propeller until the engine has thoroughly cooled.

(c) Drain remaining fuel from the system.

(d) Remove all engine cowling.

(e) Remove both front and rear spark plugs while the engine is hot to permit escape of vapors.



CAUTION

Handle small parts carefully, as they are not always available for replacement at reassembly!

(f) Remove both screened and magnetic drain plugs from the sumps, and drain the oil. Flush the plugs in compound, Specification AN-VV-C-576, and reinstall in the sumps.

(g) Remove the Cuno automatic strainer. Wash it in solvent and dip in compound, Specification AN-VV-C-576. Spray the compound through the cut-away portion of the Cuno cavity. Spray through each opening. Turn the crankshaft slowly by hand during this operation. Replace the Cuno strainer.

(h) Remove inlet line to the fuel pump. Attach a funnel to the inlet and fill the funnel with a pint of compound, Specification AN-VV-C-576, and drain into the pump, turning the crankshaft several revolutions. Drain excess compound by turning the crankshaft in the opposite direction to normal rotation. Do not use fuel line for this operation as the compound would damage the line. Replace fuel lines.

(i) Slush the carburetor with spindle oil.

(j) Remove rocker box covers. Wash valve rocker assembly and spray with compound, Specification AN-VV-C-576.

(k) Install rear dummy spark plugs and connect ignition wires in rear spark plug bushing of each engine cylinder.

(l) Spray inside of each cylinder with compound, Specification AN-VV-C-576, while rotating the propeller slowly.

(m) Install front dummy spark plugs and connect ignition wires.

(n) Fog inside of the crankcase through the drain plugs with compound, Specification AN-VV-C-576. Clean the oil screens, then replace screens and plugs.

(o) Remove the propeller.

(p) Spray inside of propeller shaft with compound, Specification AN-VV-C-576. Install plug in the propeller shaft hydro-oil connection and install propeller thread protector on the end of the shaft.

(q) Coat the propeller shaft with compound, Specification AN-VV-C-576; wrap with wax paper and cover with oilcloth securely tied.

(r) Spray the complete engine section and accessories forward of the fire wall with compound, Specification AN-VV-C-576. Be sure to spray all bright metal parts even though not readily accessible. Spray inside of the cowling and install on the engine.

(2) DISMANTLING AIRPLANE.

(a) Place tag, listing the airplane serial number, on all removed parts for ease of reassembly. Any screws removed from doors, etc., should be bagged and tied to their respective units.

(b) Remove the outer wings.

(c) Remove tail cone.

(d) Remove elevators.

(e) Remove rudder.

(f) Remove horizontal stabilizers.

(g) Remove vertical stabilizer and reinstall rudder tab fairing.

(h) Remove nose wheel doors.

(i) Remove main landing gear nacelle doors.

(j) Remove antennas.

(k) Remove rubber door seals from magnesium retainer strips around main and nose wheel compartments.

(l) Install landing gear locks and remove landing gear bungee cords. Wrap the bungees to protect them from moisture; tag and store in their respective wheel nacelles.

(m) Remove bead sight.

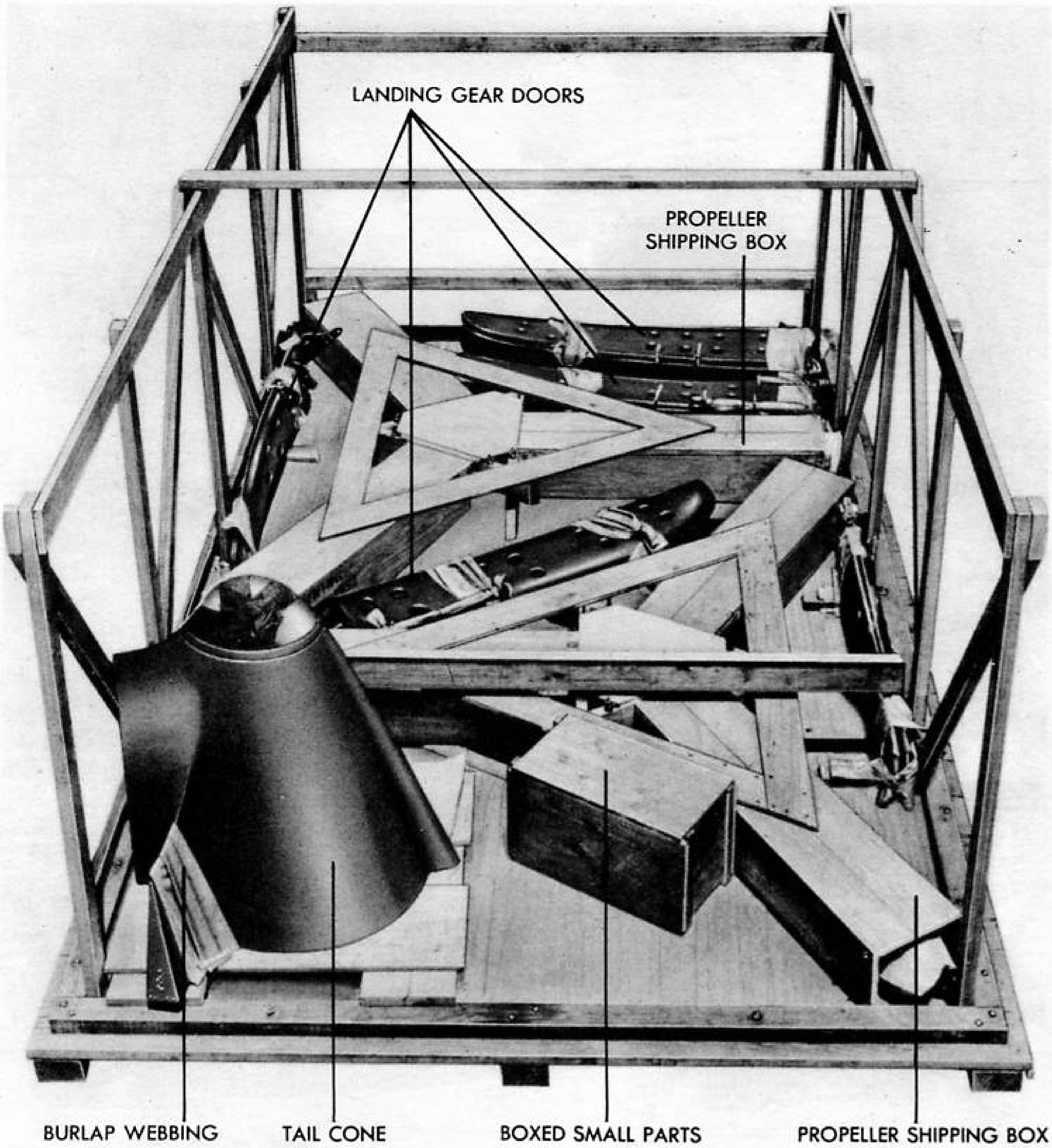


Figure 12 - WING BOX CRATING - FIRST LAYER

(3) PREPARING AND PACKING WINGS AND OTHER REMOVED PARTS.

(a) To save time, pack the wing box as it is constructed. When finished it should contain wings, propellers, horizontal stabilizers, vertical stabilizer, elevators, rudder, tail cone, actuating arms of landing gear doors, main landing gear nacelle doors, nose landing gear doors, spark plugs, radio antennas, bead sight, and one set of self-sealing fuel lines (fuel lines lashed to boards to prevent bending). Before packing, clean these parts with naphtha and spray all bare metal surfaces with Paralketone, Specification AN-VV-C-576. Coat all surfaces of the propeller with compound. Specification AN-VV-C-576. Seal propeller hub and dome openings with oilcloth and waxed paper. Then pack the propeller in a propeller-shipping box. (See figure 12.) Coat each spark plug contact with compound, Specification AN-VV-C-576. Install brass threaded protector cap, wrap each individual plug in waxed paper, and pack in a cardboard container marked with the engine serial number and number of the airplane.

(b) Construct and pack the wing box as follows:

1. Nail 2- by 8-inch flooring to three 6- by 6-inch skids.

2. Build an inner crate of 2- by 4-inch studding and bracing.

3. Pack all large parts except tail cone in the horizontal position. Securely attach the tail cone to the bottom of the wing box as follows: Cut 1- by 6-inch wooden blocks to the inside contour of the base

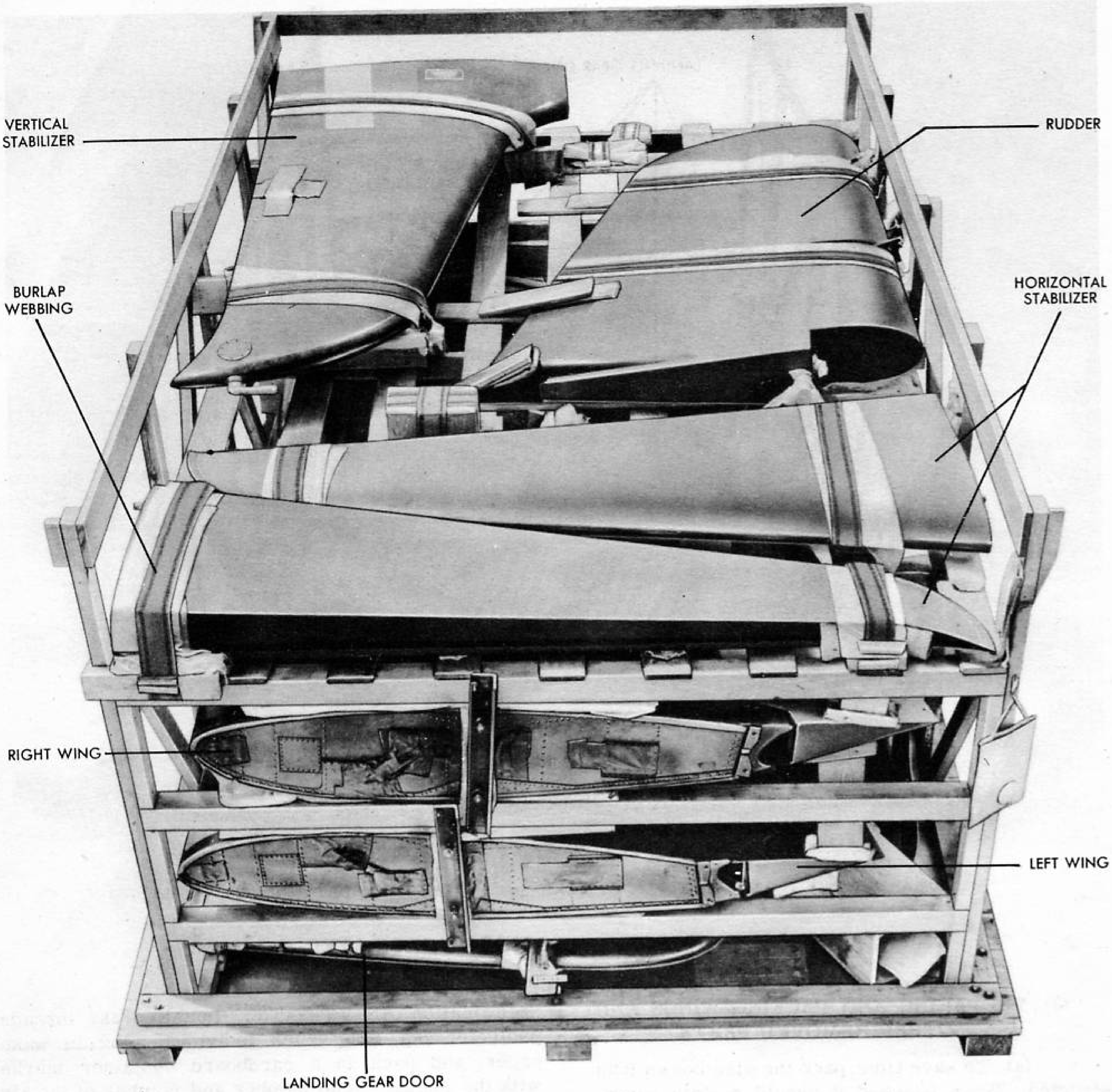


Figure 13 - WING BOX CRATING-TOP VIEW

of the tail cone. Bolt the blocks to the bottom of the wing box and attach the tail cone to the blocks with screws protected with fiber washers. Secure the tail cone to the bottom of the case with burlap webbing. (See figure 12.) Do not brace the tail cone against the side or end of the wing box. Pack the parts in layers: propellers, landing gear doors, spark plugs, etc., in the first layer; right wing in the second layer; left wing in the third layer; etc. (See figure 13.)

4. Complete the sides and ends of the box with 2- by 4-inch frames lined with waterproof paper (370 square feet required) and with 1- by 6-inch sheathing on the outside.

5. Construct the top of 2- by 4-inch frame with two layers of 1- by 6-inch laid at a 90-degree angle to each other with 55-pound roofing paper between the first and second layers of the sheathing. Cement all seams of the roofing paper.

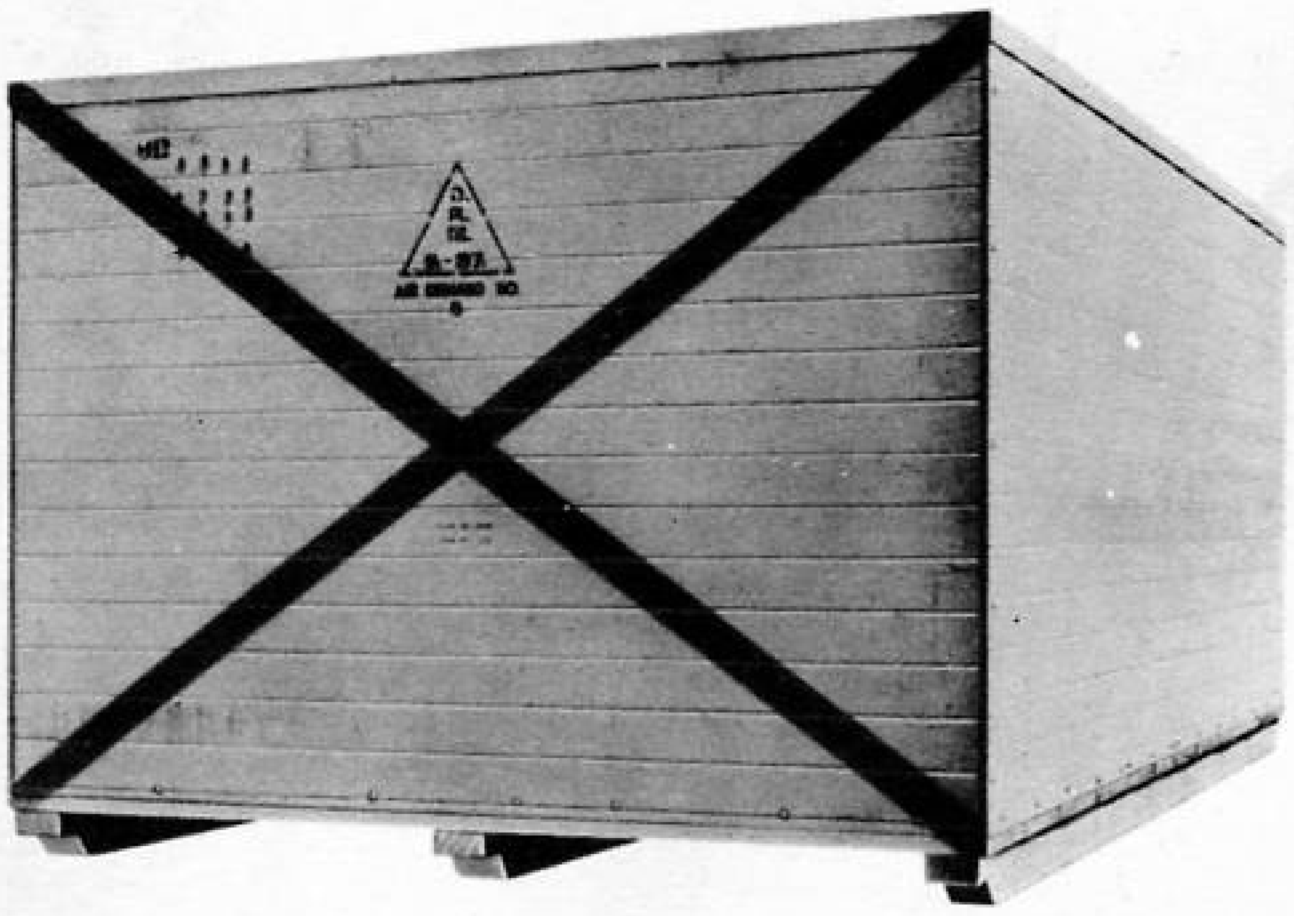


Figure 14 - WING BOX

6. Bolt together the sides, ends, and top of the box.

7. Cut a 16- by 22-inch hinged door for ventilation in one end of the box. Before the door is installed, place a heavy-mesh galvanized screen over the door opening. Close the door with a 4 1/2-inch safety-type hasp.

8. To prevent slipping of the hoisting slings, notch the outside box skids to a depth of 1 1/2-inch near the corners.

9. Paint and label the box.

(4) PREPARING FUSELAGE.

(a) Remove the nose guns.

(b) Clean fuselage with naphtha and touch up with paint where necessary.

(c) Secure all loose cables and controls to prevent movement.

(d) Pack within the fuselage all loose items such as tool kits, engine cover plates, and spare assembly parts.

(e) Coat the exterior of each engine cowling with compound, Specification AN-VV-C-576, and cover with oilcloth aft to the leading edge of the wing, and tape in place. Then install a waterproof engine cover. Lace the cover at the bottom, coat the lacing with RB cement, or equivalent, and then cover it with waterproof adhesive tape. Tape the rear of the engine cover to protect from moisture.

(f) Cover the openings of the engine exhaust tail pipes with waterproof plywood, then with oilcloth tied in place. Tape over the openings in the nacelle fairing and the tail pipes.

(g) Remove the main landing gear and the nose wheel nacelle doors, and wire waterproof plywood covers in place.

(h) Leave batteries in the airplane and clean the batteries. Check each battery for water content and fill if necessary. Disconnect and clean both battery cables. Tie battery cables clear of the battery to prevent contact with terminals. Clean each battery post, and coat with compound, Specification AN-VV-C-576. Be sure that battery plugs and vents are unobstructed to allow escape of gases from the battery container.

(i) Clean wheel assemblies and touch up with paint where necessary. Spray with two heavy coats of compound, Specification AN-VV-C-576. Apply compound, Specification AN-VV-C-576, to the interior surface. Use masking tape to keep the compound away from the brake disk assemblies on the wheel. Clean tires with naphtha after spraying the wheels.

(j) Seal with shipping tape all exterior openings on the fuselage and inner wings.

(k) Cover the outboard ends of the inner wings with waxed paper, then with oilcloth. Seal edges of the oilcloth to the outer surface of the wing with shipping tape. Paint the oilcloth an olive-drab color.

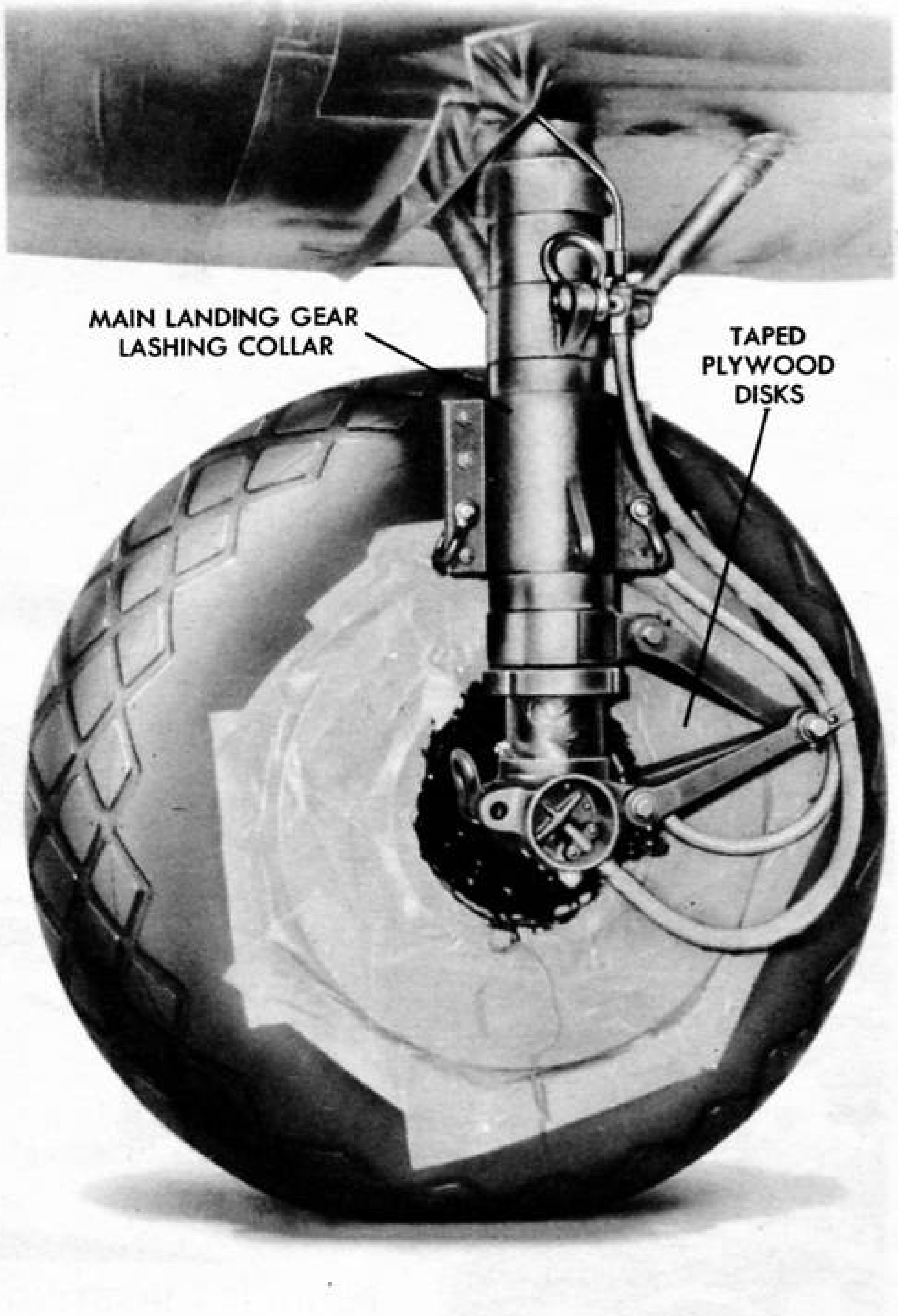


Figure 15 - PLYWOOD DISKS INSTALLED ON WHEEL

Figure 16 - HOISTING FUSELAGE ON BOARD SHIP

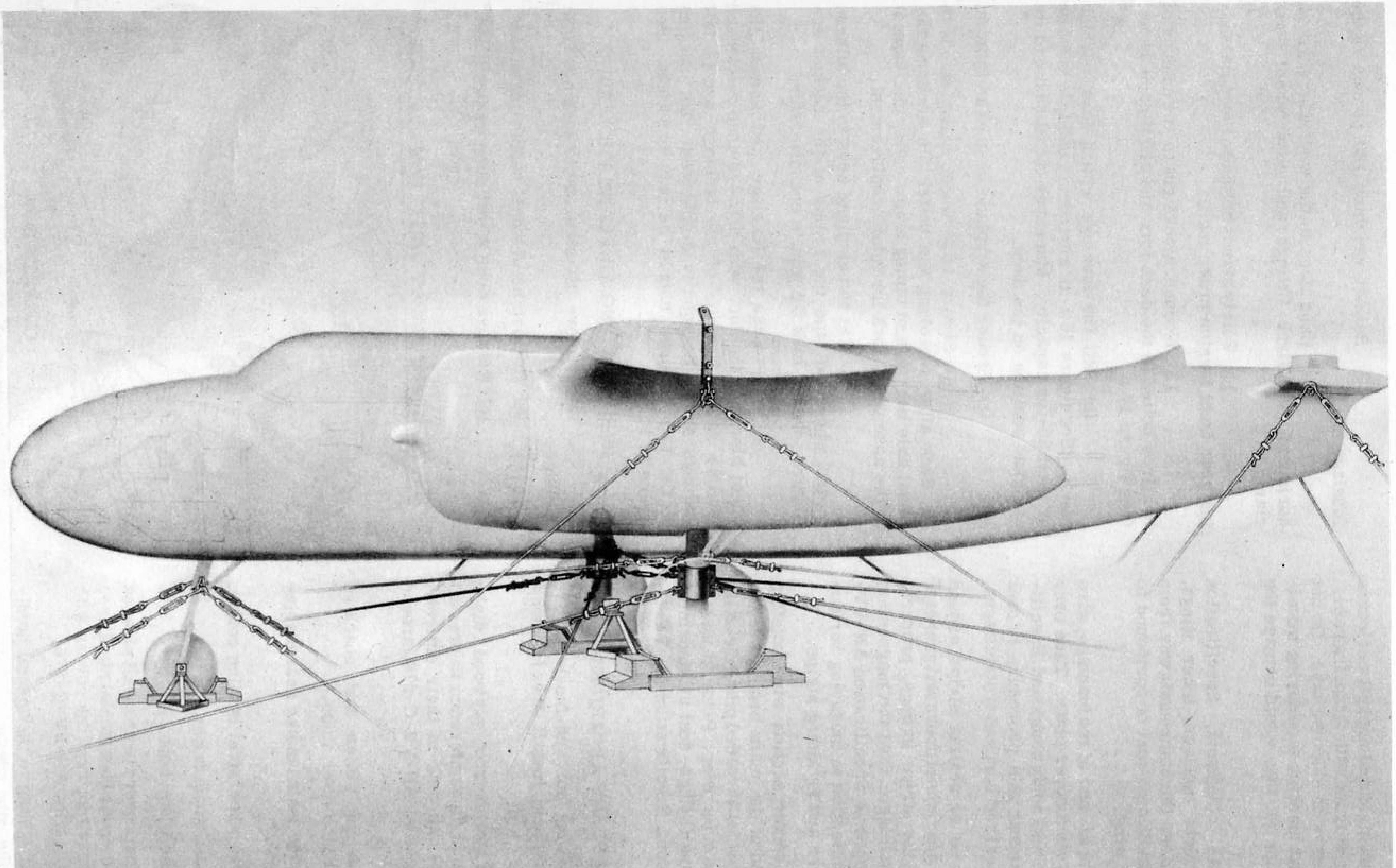


Figure 17 - METHOD OF LASHING FUSELAGE TO DECK OF SHIP

(l) Clean windshield and cockpit enclosure glass, and cover exterior surface with wrapping paper. Seal all exterior surfaces with shipping tape. Do not hold the paper in place with masking tape during installation of the shipping tape as this would damage the glass.

(m) Coat with compound, Specification AN-VV-C-576, the complete fuselage, inner wings, and landing gear struts. Keep the compound away from rubber parts. Apply an additional coat of compound to top of fuselage and inner wing.

(n) To seal the aft end of the fuselage, wire in place a waterproof plywood cover plate. Tape over the entire outside surface and apply compound, Specification AN-VV-C-576. Repeat this procedure to seal the openings for the vertical and horizontal stabilizers.

(o) Remove rubber sealing strips around the nose and main landing gear wheel doors and gunners' lower exit door. Wrap the strips in bags, properly labeled, and stow in the fuselage. Coat the magnesium retaining strips with compound, Specification AN-VV-C-576, paying particular attention to the faying surface between airplane structure and retaining strips.

(p) Attach a center section wing hoisting plate to each outboard end of the main center section wing spar, using the two special threaded pins originally required for attaching the outer wing. Prior to installation of the wing hoisting fittings, coat all unpainted steel surfaces with compound, Specification AN-VV-C-576.

(5) STOWING AIRPLANE ABOARD SHIP

(a) After the wing box and fuselage have been transported to the dock, install the following material:

1 Halved waterproof plywood disks equaling the main wheel in circumference to prevent exposure. Tape the wheel and disk in their entirety. Apply compound, Specification AN-VV-C-576, around the axle. (See figure 15.)

2 Two lashing plates and shackles attached to the horizontal stabilizer stubs.

3 Two space main landing gear lashing collars (one right, one left).

4 One nose wheel strut lashing collar.

5 Two main wheel boots.

6 One nose wheel boot.

7 Individual covers (with small sleeves for lashing cables) over the ends of horizontal stabilizer stubs. After the final inspection, seal the covers with tape and compound, Specification AN-VV-C-576.

8 A hoisting sling to the special hoisting plates on the ends of the wing spars.

9 Ballast weighing 150 pounds in the fuselage tail.

10 Hand lines to the wing sling fittings, horizontal stabilizer fittings and nose wheel strut clamp.

11 Safety stands bolted to the main landing gear front torsion brace lugs.

12 Wooden blocks cut to the contour of the tires bolted to the deck fore and aft of each wheel. (See figure 17.)

(b) Lift the fuselage with a long derrick boom. (See figure 16.) If a barge is used, it must be at least 30-ton capacity. Maneuver the airplane to its assigned position on the deck.

(c) Secure the airplane on deck as follows:

1 Secure nose wheel safety stands to the deck after removing the cotter pin securing the wheel axle bearing and taping a new cotter pin (tagged) to the nose wheel fork for future replacement.

2 Tie the airplane keys to the aileron control wheel and tape the seams of the cockpit enclosure. Do not lock the pilot's cockpit cover.

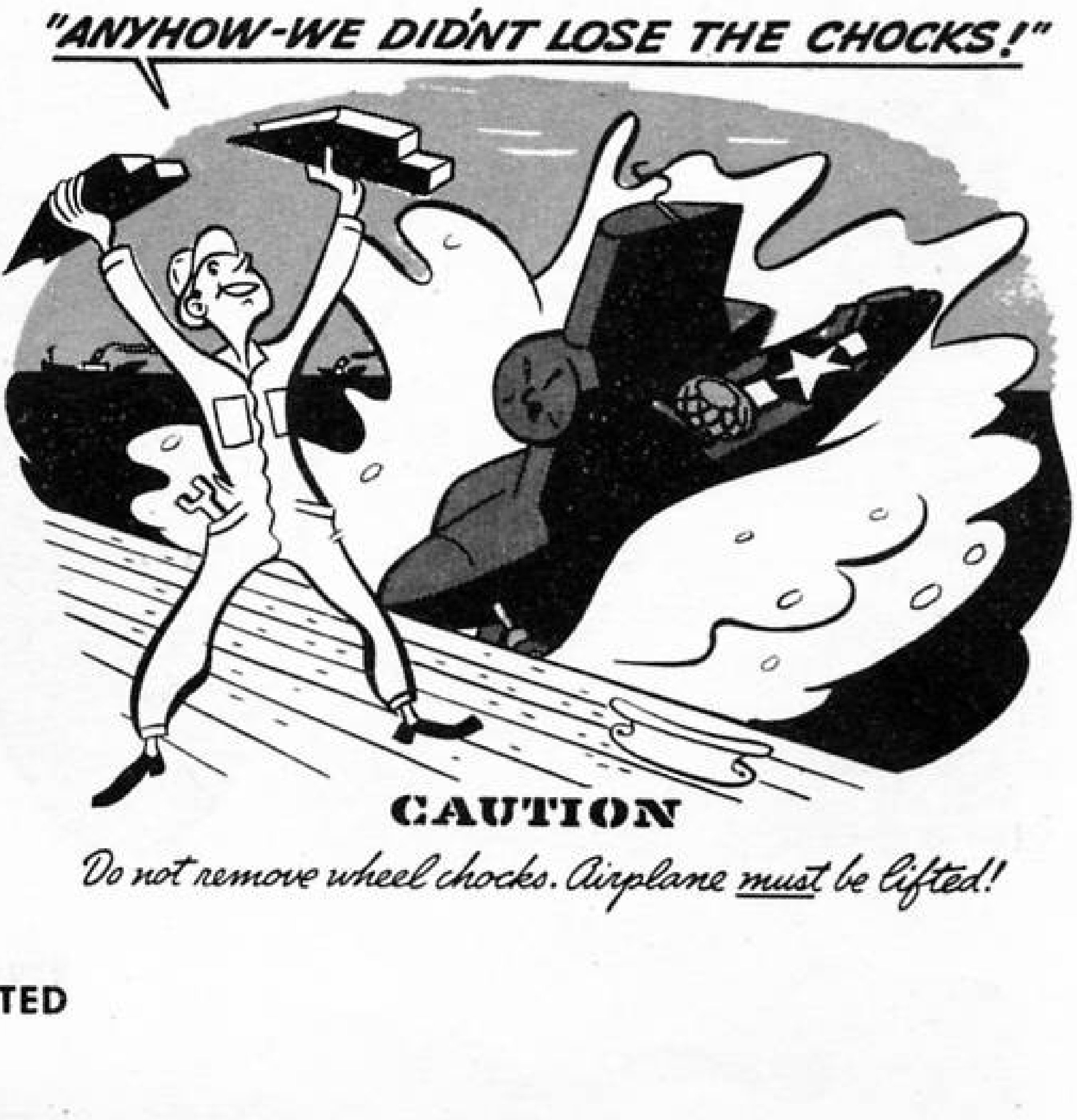
3 Lash the fuselage and secure the wheel blocks to the deck with new 3/8-inch galvanized flexible cable. Tension of all lashings except tail lashings should be equally distributed. Turnbuckles of the tail lashings should be only handtight. (See figure 17.)

(6) UNLOADING AIRPLANE FROM SHIP.

(a) Remove all steel cable lashings from fuselage.

(b) Remove main wheel supporting stands.

(c) Remove nose wheel supporting stands.



(d) Attach weight ballast bucket to rear fuselage tie-down fitting, and install 150 pounds of ballast.

(e) Attach hoisting sling to outboard wing hoist fittings.

(f) Attach a hand line to each outboard wing hoisting fitting, each tail tie-down fitting, and to nose wheel strut assembly.

(g) Remove wheel covers.

(h) Remove shipping tape from pilot's cockpit enclosure and release the brakes.

(i) Hoist the fuselage with a derrick boom and place on dock.

(j) Inflate landing gear struts prior to towing.

2. ERECTION.

a. OUTER WING ATTACHMENT. - Install the self-alining outer wings. Be sure to thread fuel lines, electrical cables, aileron and tab cables through openings provided for the purpose. Order of operations follows: Install top and lower main spar wing attaching bolt nuts and leading edge bolt, all fingertight. Install and tighten the two rear shear web wing attaching bolts. Tighten main spar wing attaching bolt nuts to 800 foot-pounds. Tighten leading edge bolt. Connect electrical plug and fuel lines. Install aileron and tab. Connect aileron and tab cables. Remove tape from control drum. Install wing tip.

b. LANDING GEAR ATTACHMENT. - Install landing gear bungee cords. Install rubber door seals on magnesium strips around main landing gear nacelle doors and nose wheel doors. Install landing gear nacelle doors and nose wheel doors. Test operation of doors and landing gear. Adjust as outlined in Section 4, paragraph 6, this handbook.

c. EMPENNAGE ATTACHMENT. - Install the self-alining vertical stabilizer and horizontal stabilizers. Install rudder and elevators. Attach rudder, elevator, and tab cables. Remove tape from control drums. Install tail cone.

d. ELEVATOR MOVEMENT. - Adjust elevators for an UP travel of 14-1/8 ± 15/16 inches, DOWN travel of 9-7/16 ± 15/16 inches.

e. STABILIZER ADJUSTMENT. - Stabilizers are fixed and self-alining. Incidence and dihedral of horizontal stabilizers are plus two degrees and ten degrees, respectively.

f. RUDDER MOVEMENT. - Adjust rudder for RIGHT travel of 19-1/2 ± 7/8 inches, LEFT travel of 19-1/2 ± 7/8 inches.

g. AILERON MOVEMENT. - Adjust ailerons for an UP travel of 9-11/16 ± 5/8 inches, DOWN travel of 6-1/2 ± 5/8 inches.

h. TENSIONS IN SURFACE CONTROLS. - Adjust surface control cables to proper tensions which are dependent on the temperature. Refer to figure 335 to determine the proper adjustment for current or anticipated temperature.

i. WING FLAP MOVEMENT. - Adjust inboard wing flaps for 17-3/4 ± 3/4 inches movement. Adjust outboard wing flaps for 16-7/16 ± 11/16 inches movement.

j. TRIM TAB MOVEMENT. - Adjust trim tabs as follows (refer to Section 4, paragraph 15, this handbook, for details):

Aileron tabs

UP travel	11/16 ± 1/8 inch
DOWN travel	11/16 ± 1/8 inch

Elevator tabs

UP travel	3/4 ± 5/32 inch
DOWN travel	1-11/32 ± 5/32 inches

Rudder tab

RIGHT travel	1-3/4 ± 1/4 inches
LEFT travel	1-3/4 ± 1/4 inches

k. POWER PLANT PREPARATION. - Install the propellers. Refer to paragraph 4, this section, for preparation of engines for use after storage.

3. STORAGE.

a. GENERAL. - Whenever the airplane is to be inactive for an indefinite period, keep it as dry and well-protected as possible. Where adequate housing is available, store in a hangar or other suitable building.

b. ENGINES.

(1) UNDER FAVORABLE CLIMATIC CONDITIONS. - If the airplane is kept in dry storage not to exceed six months, do not remove engines unless special storage conditions indicate. When not removed, treat engines as follows:

(a) Remove spark plugs. Spray exhaust valves with corrosion-preventive compound, Specification AN-VV-C-576, spraying through the exhaust ports, or through the spark plug holes, with the exhaust valves fully opened.

(b) Turn crankshaft at least four revolutions to work corrosion-preventive into valve guides.

(c) Reinstall spark plugs.

(d) Remove sump drain plugs and drain oil. Wire plugs to engines (do not reinstall). Place suitable container under sump to catch oil that may drip.

(e) Keep installed propellers coated with engine lubricating oil, and all external unpainted engine parts coated with petrolatum, Specification AN-VV-P-236.

(f) Repeat the spray treatment (substep (a) above) in 30 days.

(g) If the period of idleness reaches 60 days, treat the engines as follows:

1 Fill oil containers with oil sufficient for 1/2-hour operation and run engines for that length of time at approximately 1000 rpm.

2 Prepare engines for storage as specified in step (2) below, but leave engines in airplane.

3 Disconnect all fuel lines and the carburetor. Flush several times with lubricating oil, Specification AN-VV-O-446a, grade 1120. Operate throttle and mixture controls while the carburetor is filled with oil. Drain carburetor of lubricating oil and reinstall all plugs. Leave fuel lines disconnected, and openings in carburetor and fuel lines closed with suitable neoprene plugs.

4 Disconnect oil-in and oil-out lines and plug lines with suitable neoprene plugs. Plug lines as quickly as possible to keep to a minimum the amount of oil that escapes from the system.

5 Replace serviceable spark plugs with shipping plugs.

6 Enclose magnetos in a waterproof paper or oilcloth covering.

7 If stored outside, cover exhaust pipe outlet and carburetor air intake scoops on installed engines with a double thickness of oilcloth.

8 If propellers are to be removed and stored separately, plug hydraulic connections of the propeller shaft and spray both interior and exterior of shaft with melted rust-preventive compound, Specification AN-C-52. Protect threads of the propeller shaft with a threaded propeller cap and wrap the shaft in an oil-saturated cloth. Cover with oilcloth and secure with tape. If propellers are to remain installed, spray exposed parts of propeller shaft with rust-preventive compound, Specification AN-C-52, and coat propeller thoroughly with clean engine oil.

9 Remove engine covers and accessory section cowling bimonthly on warm bright days to allow condensed moisture to evaporate.

(2) UNDER UNFAVORABLE CLIMATIC CONDITIONS. - Remove engines from airplanes which are stored under unfavorable conditions, and in all cases when the storage period exceeds six months. Before removal of engines:

(a) Run approximately one quart of either corrosion-preventive compound, Specification AN-VV-C-576, or engine oil through the induction system. Spray oil as close as possible to the carburetor throttle valves with engine operating at a speed just sufficient to prevent stalling. Do not induce vaporized oil into the induction system through the carburetor air intake stacks of installed engines, as the oil will cling to the walls of the air intake pipe and collect dirt.

(b) After engine has stopped firing, remove rocker box covers and spark plugs to allow vapors to escape.

(c) Remove oil sump plugs and oil screens or strainers.

(d) Remove, drain, and clean carburetors. Fill float chamber through the fuel inlet connection with lubricating oil, Specification AN-VV-O-446a, grade 1120. Invert the carburetor to allow oil to cover internal parts. Operate the throttle several times to force oil through the accelerating pump. Remove drain plugs and allow bowl to drain. Reinstall drain plugs. Lock throttles in full open position.

(e) Replace spark plugs with shipping plugs.

(f) Cover all unattached ignition cable ends with friction tape or suitable protective covering. Secure to prevent damage.

(g) Treat magnetos by lightly coating the cam, springs, and other steel parts of the breaker mechanism with melted Petrolatum, Specification AN-VV-P-236.

(h) Spray accessory drive gear section, power section and reduction gear section through available openings while rotating the engine crankshaft. Use Specification AN-VV-C-576, corrosion-preventive compound. Spray for 15 seconds through each opening.

Following this treatment, remove the thrust bearing cover plate. Spray the bearing with Specification AN-VV-C-576, corrosion-preventive compound. Replace cover plate, dip oil sump plugs and oil screens in corrosion-preventive and reinstall.

(i) While engine crankshaft is being rotated, admit one-half cup of grade 1120 lubricating oil, Specification AN-VV-O-446a, at the suction side of the fuel pump. If pump is not installed, rotate shaft by hand while admitting oil. If engine is installed in an airplane, disconnect fuel line prior to this treatment. After treatment, close the suction side of fuel pump and the open fuel line with suitable neoprene plugs.

(j) If the vacuum pump is installed, introduce a small amount of lubricating oil, Specification AN-VV-O-446a, into the suction side while the engine crankshaft is being rotated. Then turn the engine backward in order to drain off any excess lubricant, and reinstall or plug vacuum lines.

(k) Clean rocker boxes, springs, rocker arms, and valve stems. While the crankshaft is being rotated, spray with corrosion-preventive compound, Specification AN-VV-C-576.

(l) Spray the inside of each cylinder through the front spark plug hole with corrosion-preventive compound, Specification AN-VV-C-576, placing each piston on bottom dead center of the stroke before spraying. Allow 10 to 15 seconds for nozzle of spray gun to reach the bottom to ensure spraying lower portion of cylinder walls and top of piston. Spray a small quantity of corrosion-preventive compound into each exhaust port (through the spark plug holes), with the exhaust valve in fully opened position so that each exhaust valve will be coated. Next, rotate the engine crankshaft at least two complete revolutions. Respray the cylinder space above each piston with 1/16 pint of corrosion-preventive compound without revolving the engine further.

(m) Respray valve springs, rocker arms, and valves after treatment of cylinders, then reinstall rocker box covers.

(n) Apply a thin coating of melted Petrolatum, Specification AN-VV-P-236, either by brush or spray, to all external unpainted steel parts.

(o) Close all disconnected fuel and oil lines, cylinder ports and other openings with neoprene plugs, covers, etc. Clean all Petrolatum, oil, corrosion-preventive compound, and dirt from exposed rubber or painted parts. Close threaded openings with threaded plugs wherever practicable. When wooden or neoprene taper stoppers are used, they must be constructed so that they cannot be accidentally pushed or driven completely into the opening. Attach a set of new exhaust flange gaskets to each new or overhauled engine. Never install old gaskets under exhaust flanges or exhaust port cover plates. Exhaust flanges, installed, must be removed and placed in stock.

(p) Plug the hydro-oil connections of the propeller shaft and spray both the interior and exterior of the shaft with melted rust-preventive compound, Specification AN-C-52. Protect threads with a propeller shaft threaded cap, and wrap the shaft in an oil-saturated cloth. Cover with oilcloth and tape securely.

(q) Attach to the engine an Army Air Forces Form No. 83 identification tag with the following note: "Prepared for Storage," followed by the date. Also record on this form each time the engines are given further treatment.

c. LUBRICATING SYSTEM. - Drain the entire lubricating system. Remove oil sumps, clean, and replace. Then fill entire oil system with oil, Specification AN-VV-O-446a, grade 1120. If the airplane is stored with the engine installed, run the engine until oil pressure is obtained. Do not run engine more than is absolutely necessary to fill the circulating system. Clean and coat the exterior of oil containers and oil temperature regulators with rust-preventive compound, Specification AN-C-52. When the airplane is stored with the engines removed, plug all open oil lines to retain the oil used to fill the system.

d. FUEL SYSTEM. - Drain all fuel containers, strainers, and other parts of the fuel system. Take particular care to remove all water. Place a quantity of light oil, SAE 20, Federal Specification VV-O-496, in each fuel container and work through the entire fuel system by operating the hand pump. Spray inside of fuel containers with this oil.

e. AIRPLANE PARTS AND ASSEMBLIES.

(1) STRUCTURES AND SURFACES. - Apply rust-preventive compound, Specification AN-C-52, to all unpainted metal surfaces. This must include exterior surfaces of the alclad skin covering on wings, fuselages, and control surfaces.

(2) CONTROLS.

(a) SURFACE CONTROLS. - Grease the control cable with rust-preventive compound, Specification AN-C-52, or with a mixture of white lead and tallow. The latter may be prepared by melting tallow and mixing it with white lead in the proportion of two pounds of tallow to one pound of white lead. Warm mixture slightly for application.

(b) HYDRAULIC CONTROLS.

1 Check entire hydraulic system for leaks. Repair any leaks and fill the system with hydraulic fluid, Specification AN-VV-O-366a. Cover all vents.

2 Cover all exposed sliding piston surfaces with castor oil, Specification AN-JJJ-O-316, and wrap with clean cloth or heavy paper.

3 Cover all other exposed metal parts with rust-preventive compound, Specification AN-C-52, except as noted below for bearing surfaces.

(3) BEARING SURFACES. - Coat all exposed bearing surfaces of movable parts, such as hinges, slides, etc., with petrolatum, Specification AN-VV-P-236.

(4) WHEELS AND BRAKES.

(a) LANDING GEAR WHEELS.

1 If the airplane has been in service, remove wheels, bearings, and grease seals. Clean the wheel bearing cavity, grease seals with gasoline, and dry with an air blast. Clean bearings and replace lubricant. On new airplanes perform this operation only when the airplane is removed from storage.

2 Clean the braking surface of the drum with solvent. If the surface is unplated, apply a coat of metal, oil base, primer to prevent corrosion. Allow primer to dry and attach a tag to the outside of the wheel, stating that this coating must be removed with solvent when the airplane is returned to service.

3 Except on friction and bearing surfaces, apply a protective coating to wheels. Parts that have this protective coating chipped off, worn through or removed in any manner, should be recoated immediately with aircraft enamel, Specification AN-E-3 aluminum enamel), obtained by mixing 1-1/2 to 2 pounds of aluminum bronze powder per gallon of spar varnish. Use one or two coats depending on condition of old paint. If it is necessary to completely refinish the surface, apply one light coat of oil base primer or zinc chromate primer, Specification AN-TT-P-656a, followed by two coats of enamel. Clean the surface before application of the primer. Remove the old finish with acetone or paint remover. Do not use wheels that are corroded on the inside.

4 After treating brakes and axles as outlined in the following paragraphs, reinstall the wheels for storage. Upon completion of storage period, clean and relubricate bearings, and remove the drum protective coating before wheels are again placed in service. The following mixture is suggested for removing the primer coating:

Benzol	3 parts
Acetone	1 part
Denatured alcohol	1 part

(b) BRAKES AND BRAKE SYSTEMS. - Check brake system for leaks. Repair any leaks and completely fill the hydraulic system with fluid, Specification AN-VV-O-366a. Cover all vents.

(c) AXLES. - Clean bearing seats on axles with solvent and apply a light coating of the same lubricant used for wheel bearings. Reinstall wheels.

(d) NOSE WHEEL. - Treat nose wheel the same as main landing gear wheels. (See step (a) above.)

(e) NOSE WHEEL KNUCKLES.

1 Remove knuckles from housing. Clean bearings and housing with gasoline and apply new grease, Specification AAF-3560, to bearings. Do not put grease on friction elements.

2 Clean both upper and lower spindle bearing seats on the knuckle, and apply a light coating of the same grease used on bearings. Reinstall the nose wheel.

(5) TIRES AND TUBES.

(a) Clean tires and rub with glycerin.

(b) Maintain recommended pressures to deflection markers (approximately 53 pounds in nose wheel tire and 42 pounds in main landing gear tires).

(c) Avoid high temperature if possible.

(d) Block up to remove weight, or roll tires slightly at 60-day intervals to change supporting point.

(6) RUBBER HOSE AND HOSE CONNECTIONS.

(a) Keep clean and free from oil on the outside surface.

(b) Avoid high temperatures if possible.

(7) LANDING GEAR AND SHOCK STRUTS.

(a) Cover all bearing surfaces with grease and apply rust-preventive compound, Specification AN-C-52, to all other unpainted metal surfaces.

(b) Fill struts with hydraulic fluid, Specification 3580-M. Do not inflate with air but leave struts in the fully collapsed position. Have the packing in place, but not tightened. Do not screw packing nut down against packing. Wrap exposed portion of the piston tube with clean cloth or heavy paper. When preparing the airplane for service after storage, be sure to tighten packing nut.

(8) ELECTRICAL EQUIPMENT.

(a) Remove all components of installed radio equipment from the airplane and store properly.

(b) Do not remove starters and generators from engine.

(c) Remove storage batteries and store in battery room.

(d) Leave all other electrical equipment with the airplane except as noted for instruments.

(9) INSTRUMENTS.

(a) Remove all instruments and navigation equipment, and pack for placing in Army Air Forces stock. Remove the pitot air-speed head and store.

(b) Plug ends of all tubes left open by the removal of instruments or any other parts.

(c) No special treatment of the inside of vacuum or other tubes is necessary except that oil pressure lines must be treated as a part of the oil system.

(10) MISCELLANEOUS AND CLOTHING. - Remove and store life rafts, flotation bags, parachutes, and similar articles subject to deterioration.

4. PREPARATION OF ENGINES FOR SERVICE AFTER TREATMENT.

a. Serviceable engines which have been treated for extended storage, as outlined in paragraph 3 b (2), must be prepared for service as follows at the time of installation:

(1) Remove all plugs, covers, etc., from openings and wipe Petrolatum from external steel parts.

(2) Wipe off the breaker mechanism of magnetos to remove melted Petrolatum. No relubrication of the magnetos is necessary.

(3) Remove oil screens, clean in gasoline, and reinstall.

(4) Remove shipping plugs from spark plug holes while engine is on the shipping stand. Before installing spark plugs, slowly rotate the crankshaft four or five revolutions and observe for proper operation of valve mechanism. Check for excessive corrosion-preventive in cylinders. Remove any excess compound with a hand pump or by draining. Lubricate stems of sticking valves with a mixture of gasoline and lubricating oil. Turn the engine over by hand until all evidence of sticking valves has been eliminated. If the mixture of gasoline and lubricating oil does not free all valves, make necessary repairs before the engine is placed in service.

(5) Drain any oil in the blower section into the lower intake pipes for at least 24 hours at a room temperature of at least 15.6 degrees C (60 degrees F) before operating the engine. To do this, place the airplane in flying position during the installation; or suspend the engine with the crankshaft horizontal prior to installation; or, if the engine is in a shipping box, turn the box so the oil will drain into the lower intake pipes with the crankshaft in a horizontal position. However, in all cases before the crankshaft is rotated (following this drainage), remove the three lowermost intake pipes and inspect for excess oil collections. If excess oil is found, examine the intake pipes adjacent to those removed. Continue this inspection toward the top cylinders until intake pipes are found free of excess oil.

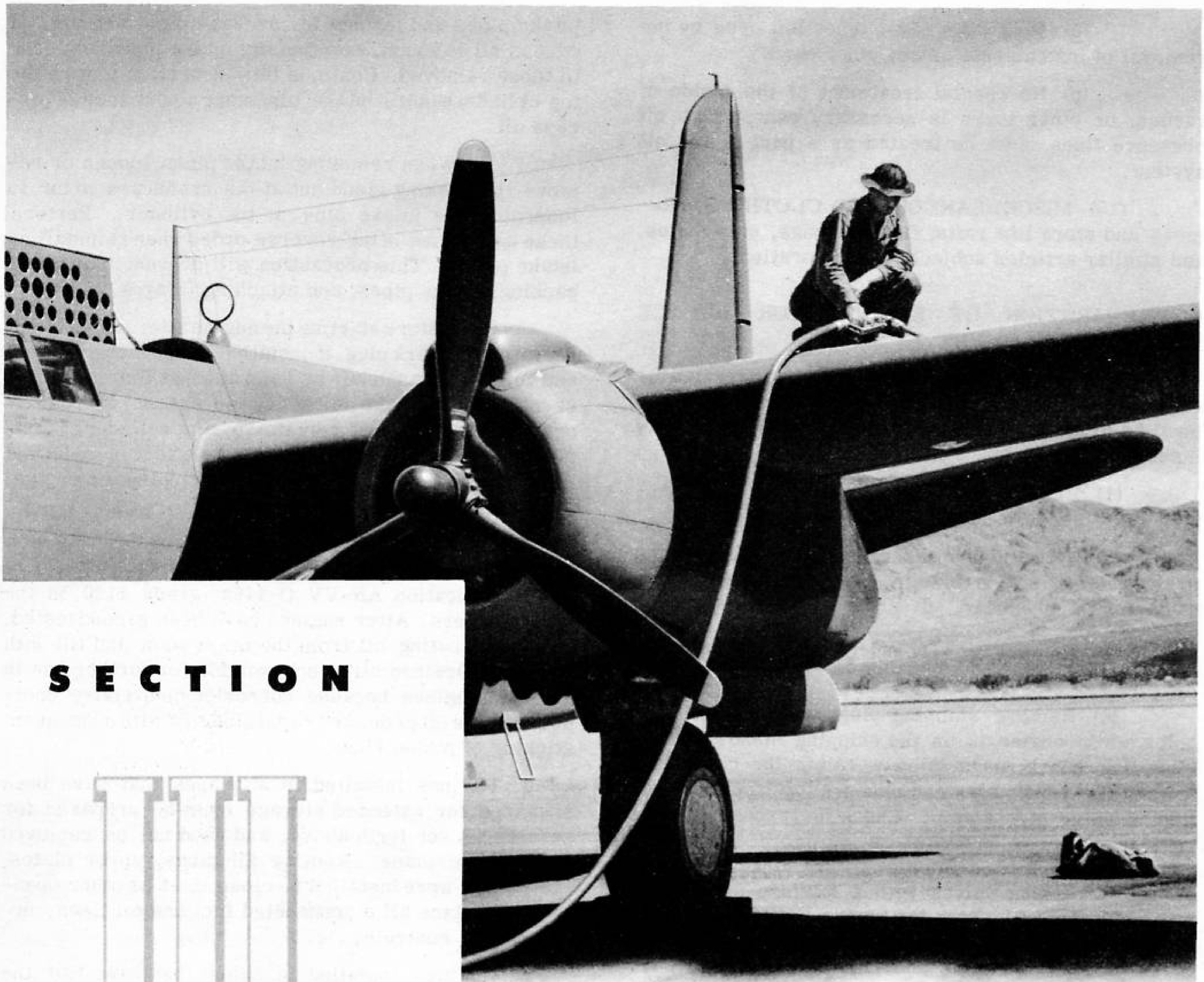
(6) When removing intake pipes, loosen or remove the packing gland nut at the crankcase prior to loosening the intake pipe at the cylinder. Perform these operations in the reverse order when reinstalling intake pipes. This precaution will prevent damage to packing, intake pipes, and attaching flanges.

(7) Before starting the engine after installation, remove one spark plug, if installed, from each cylinder, and turn the crankshaft by hand at least four complete revolutions to make sure that no excess corrosion-preventive compound remains in any cylinder. Corrosion-preventive has a detrimental effect on paint and if spilled on any painted part of the airplane or engine, wipe it off immediately.

(8) Prior to ground testing engines, place a minimum of 12 U.S. gallons (10 Imperial gallons) of oil, Specification AN-VV-O-446a, grade 1120, in the oil containers. After engines have been ground tested, drain lubricating oil from the oil system and fill with new oil. Drained oil is not suitable for further use in airplane engines because corrosion-preventive compound in the oil promotes rapid sludging with consequent sticking of piston rings.

b. Engines installed in airplanes that have been prepared for extended storage must be prepared for service as set forth above, and need not be removed from the airplane. Remove all plugs, cover plates, etc., which were installed to close lines or other openings. Replace all disconnected fuel and oil lines, instruments, controls, etc.

c. Engines installed in ships that have had the valves and valve mechanisms treated for temporary periods of idleness (paragraph 3 b (1)), can be placed in service immediately, as the light oil on the valves is soon burned away. Prior to starting the engine, inspect for presence of oil in the blower section. Oil may have drained into the lower intake pipes and, if present, should be removed. Rotate propeller slowly by hand to see that cylinders are free from water, oil or fuel, and that valves operate freely. In the case of sticking valves, treat as directed in step (4) above, before operating the engine. If the spark plugs are fouled from excessive engine oil, remove and wash with acetone.



SECTION III

Handling and General Maintenance Instructions

1. ACCESS AND INSPECTION PROVISIONS.

a. Easily removed inspection plates are located on the fuselage, empennage, wings, and nacelles. This permits access to parts needing periodic inspection, adjustment, or servicing. (See figures 18 and 19.)

2. GROUND HANDLING.

a. HOISTING AND JACKING. - Location of hoisting and jacking points is given in figure 20. Allowable applied loads and angularities of attachment are indicated in the same figure. Typical tools and supports are shown in figures 23 and 24.

b. LEVELING. - The airplane may be transversely and longitudinally leveled by placing a spirit level on the three level lugs under pilot's walkway. A convenient means of adjusting the level of the airplane is to inflate and deflate landing gear shock strut. Do not press valve to deflate. Back out the valve body enough to allow air to escape. See figure 21 for location of valves.

c. TRICING ARRANGEMENTS. - Methods of hoisting the assembled ship are indicated in the table, figure 20. The same arrangement applies when the airplane is partially disassembled.

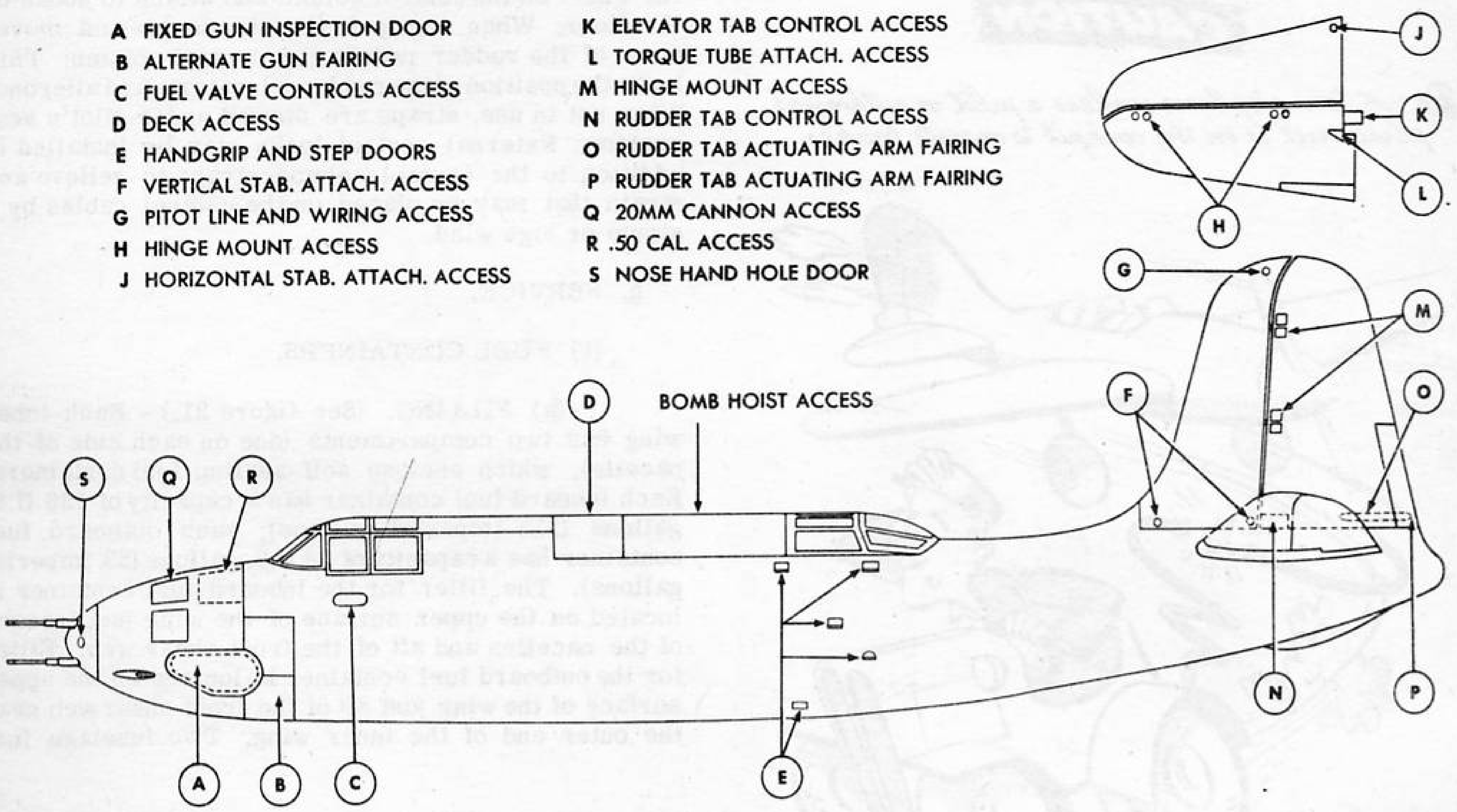


Figure 18 - FUSELAGE AND EMPENNAGE ACCESS DOORS

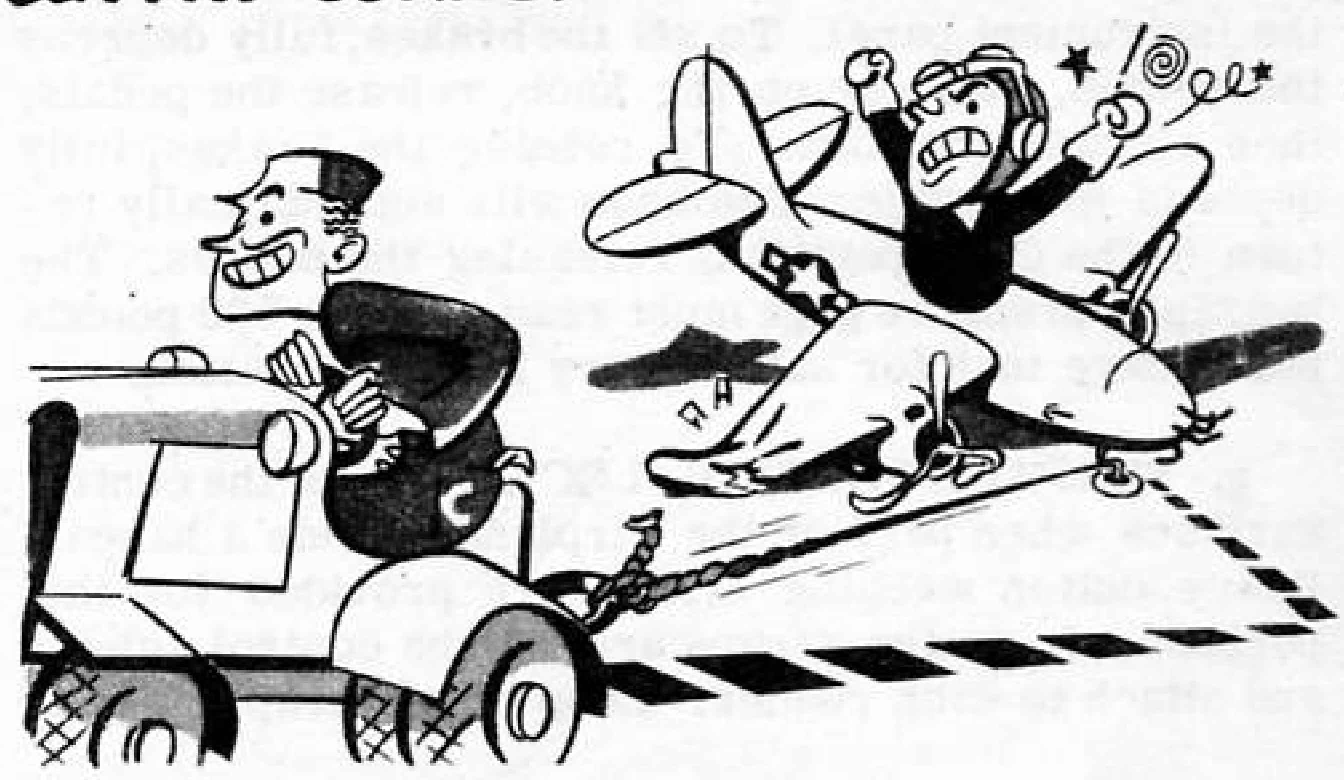
d. TIE-DOWN - PARKING INSTRUCTIONS

(1) The eyes at the lower end of the main landing gear shock struts are used for towing as well as tie-down rings. A retractable tie-down ring is located midway of each outer wing, adjacent to the main spar Landing gear rings are used to take up the main load while those on the outer wings are used only to keep the airplane level.

(2) Where no fixed mooring anchorage is provided, employ the type D-1 mooring kit furnished with the airplane. Screw the anchor rod into the arrow. Then slip the driving rod over the anchor rod into the socket of the arrow, with the cam on the driving rod turned so that the arrow prongs will not spread while driving. If the ground is hard, break the surface by using the ground-breaking pin. Aline the rod with the point of attachment on the airplane and drive the arrow into the ground until the driving rod handle is about three inches from the ground. Rotate the handle about 90 degrees and strike the driving rod a sharp blow to spread the arrow prongs. Turn the driving rod back and withdraw it from the ground. Attach the eye assembly and tie one end of the mooring rope to it. Pull upward sharply to set the arrow. Then secure the rope to the mooring fitting on the airplane. To withdraw the rod, unscrew it, leaving the arrow buried in the ground.

e. TOWING. - The airplane may be towed by the eyes at the lower end of the main landing gear shock struts, or by the eyes on the forward side of the nose wheel fork. The nose wheel towing bar is installed (figure 19) by placing it between the eyes on the nose wheel and inserting the hinge pin. Pull out the nose wheel release pin and turn it 90 degrees to the right. This will hold the pin in released position, allowing the nose wheel to caster 360 degrees. Be sure to install the attached safety pin when the nose wheel release pin is reinstalled.

CUTTIN' CORNERS FOR UNCLE SAM (?)



CAUTION

When towing the airplane by the nose wheel fork, avoid sharp turns, sudden starts or stops, and rough terrain.

CAUTION

Do not tow airplane unless a pilot or authorized personnel is in the cockpit to operate brakes.

CAUTION

In case towing gear should break, operator of the towing tug should rapidly drive out of the way of the airplane to avoid possible collision.

f. PARKING BRAKES. - Parking brakes are operated by applying toe pressure to the rudder pedals and pulling out on the knob located at the lower center of the instrument panel. To set the brakes, fully depress the pedals, pull out on the knob, release the pedals, then release the knob. To release the brakes, fully depress the pedals. The knob will automatically return to the OFF position, releasing the brakes. The hydraulic pressure gage must read at least 500 pounds per square inch for satisfactory brake operation.

g. SURFACE CONTROL LOCKS. - Lock the control surfaces when parking the airplane outside a hangar. Heavy cotton webbing straps are provided for this purpose. Loop the straps around the control column and attach to each rudder. Loop other straps through the wheel on the control column and attach to hooks on the floor. When engaged, the straps prevent movement of the rudder pedals and control column. This locks the position of the rudder, elevators, and ailerons. When not in use, straps are stowed under pilot's seat cushion. External control locks may be installed in addition to the control column straps to relieve any strain that may be placed on the control cables by a storm or high wind.

h. SERVICE.

(1) FUEL CONTAINERS.

(a) FILLING. (See figure 21.) - Each inner wing has two compartments (one on each side of the nacelle), which enclose self-sealing fuel containers. Each inboard fuel container has a capacity of 136 U.S. gallons (113 Imperial gallons); each outboard fuel container has a capacity of 64 U.S. gallons (53 Imperial gallons). The filler for the inboard fuel container is located on the upper surface of the wing just inboard of the nacelles and aft of the front shear web. Filler for the outboard fuel container is located on the upper surface of the wing just aft of the front shear web near the outer end of the inner wing. Two fuselage fuel

WARNING

Before refueling, release static electricity from the wing and filler hose nozzle with a grounded wire brush. Be sure to ground both the wing and the filler nozzle during the entire refueling process to prevent building up more static electricity.

containers are located in the bomb bay. Total capacity of these two fuel containers is 140 U.S. gallons (117 Imperial gallons). Fuselage fuel containers are filled through a single filler casting located in the forward fuel container and accessible by raising the bomb bay enclosure.

CAUTION

Do not use less than 90 octane fuel. Specification AN-F-28 fuel is recommended.

WARNING

Be sure to replace the gasoline tank cap. Failure can cause immediate fire when engine is started.

(b) DRAINING. - To drain the inboard wing fuel container, open access door (A-figure 19) adjacent to the main spar of the inner wing next to the fuselage. Remove the finger screen and drain cock. Clean the screen with compressed air if dirty. Drain the outboard fuel container in a similar manner through access door (K-figure 19) near the main spar of the inner wing outboard of the nacelle. Drain bomb bay fuel containers by opening the drain cock on the rear bomb bay fuel container sump adjacent to the booster pump.

(2) OIL CONTAINERS.

(a) FILLING. (See figure 21.) - A hopper type self-sealing oil container is installed in the compartment located between the main spar of the wing and the front shear web on the center line of each nacelle. Each oil container has a capacity of approximately 23 U.S. gallons (19 Imperial gallons) and three gallons additional capacity for foam space. A one-gallon reserve collects in a sump which is a part of the main outlet fitting on the bottom of each oil container. This gallon reserve is accessible only to the propeller feathering system and provides oil to feather the propeller if the engine is stopped for lack of oil. The cover plate for the filler neck is located on the inboard side of the carburetor air scoop fairing just aft of the front shear web.

(b) DRAINING. - Open access door (O-figure 19) on outboard side of the nacelle. Remove the lock wire which keeps the oil Y-drain handle from turning. Open the valve.

(3) FILLING HYDRAULIC SYSTEM. (See figure 21.) - The fluid reservoir for the hydraulic system is in the forward end of the front bomb bay. Its filler neck is accessible through the cover plate at the right side of the fuselage just aft of the pilot's seat on the fuselage deck. The capacity of the reservoir alone is approximately 3.6 U.S. gallons (3 Imperial gallons) while the complete system contains approximately 8.4 U.S. gallons (7 Imperial gallons). Fill with fluid, Specification AN-VV-O-366a.

(4) FILLING PROPELLER ANTI-ICER. (See figure 21.) - The anti-icer fluid container is located in the upper left corner of the rear bomb bay compartment. It is reached through the enclosure just forward of the gunners' compartment. The fluid container has a capacity of 3 U.S. gallons (2-1/2 Imperial gallons). It should be kept filled with iso-propyl alcohol, AAF Specification 14082A. A fluid level measuring rod is located just aft of the tank vent line connections.

(5) FILLING AND DRAINING CARBURETOR ANTI-ICER. (See figure 21.) - A carburetor anti-icer fluid container of 10 U.S. gallons (8.3 Imperial gallons) capacity and a one-gallon expansion space is located in the aft end of the nose wheel tunnel. Fill the fluid container with alcohol through the filler located on the upper forward face of the container. To drain the fluid container, remove the lower portion of the alcohol filter situated in the line from the fluid container outlet to the pump inlet. A stick gage is provided on the top of the fluid container for measuring the quantity of fluid in the container.

(6) TIRE INFLATION. - For hard runway operation, inflate the main landing gear tires to the deflection mark. This is approximately 42 pounds per square inch. Inflate the nose wheel tire to 54 pounds per square inch. Use a standard tire gage for checking pressures. Where the runway is soft enough to leave a track, reduce pressures by six pounds per square inch.

(7) INFLATING SHOCK STRUTS. - Landing gear shock struts are inflated through a valve located near the tops of the struts. (See figure 21.) Inflate strut until following dimensions are obtained with airplane loaded for take-off:

(a) Main landing gear strut - 4-13/16 inches from center of bolt holes on wheel fork to lower end of shock strut cylinder.

(b) Nose landing gear shock strut - 2-7/8 inches of piston extended from end of shock strut cylinder.

3. GROUND OPERATING INSTRUCTIONS.

a. ON ENTERING PILOT'S COCKPIT.

(1) STANDARD CHECK FOR ALL FLIGHTS.

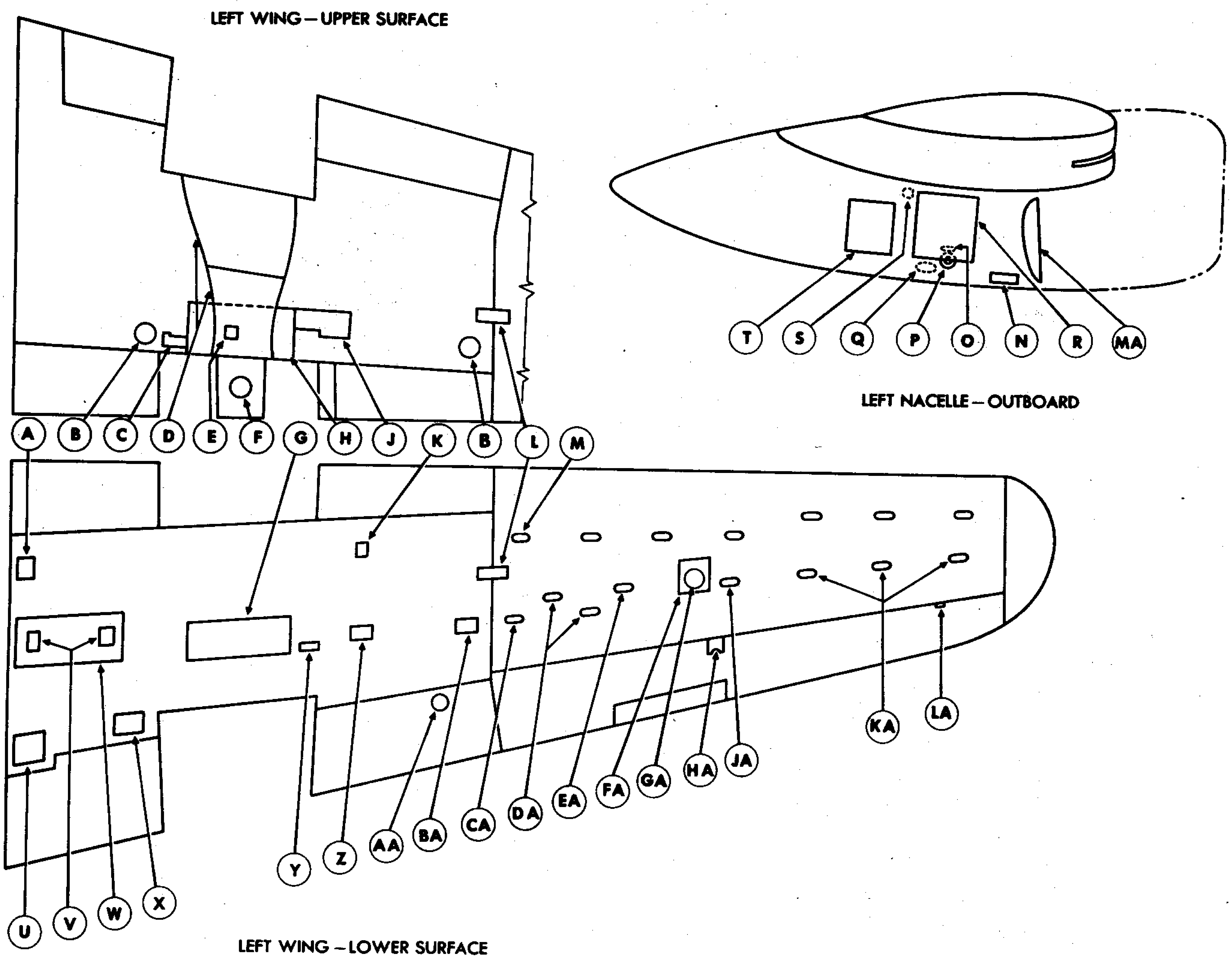
(a) Ignition - OFF.

(b) Surface control locks - RELEASED.

(c) Landing gear hydraulic control - DOWN.

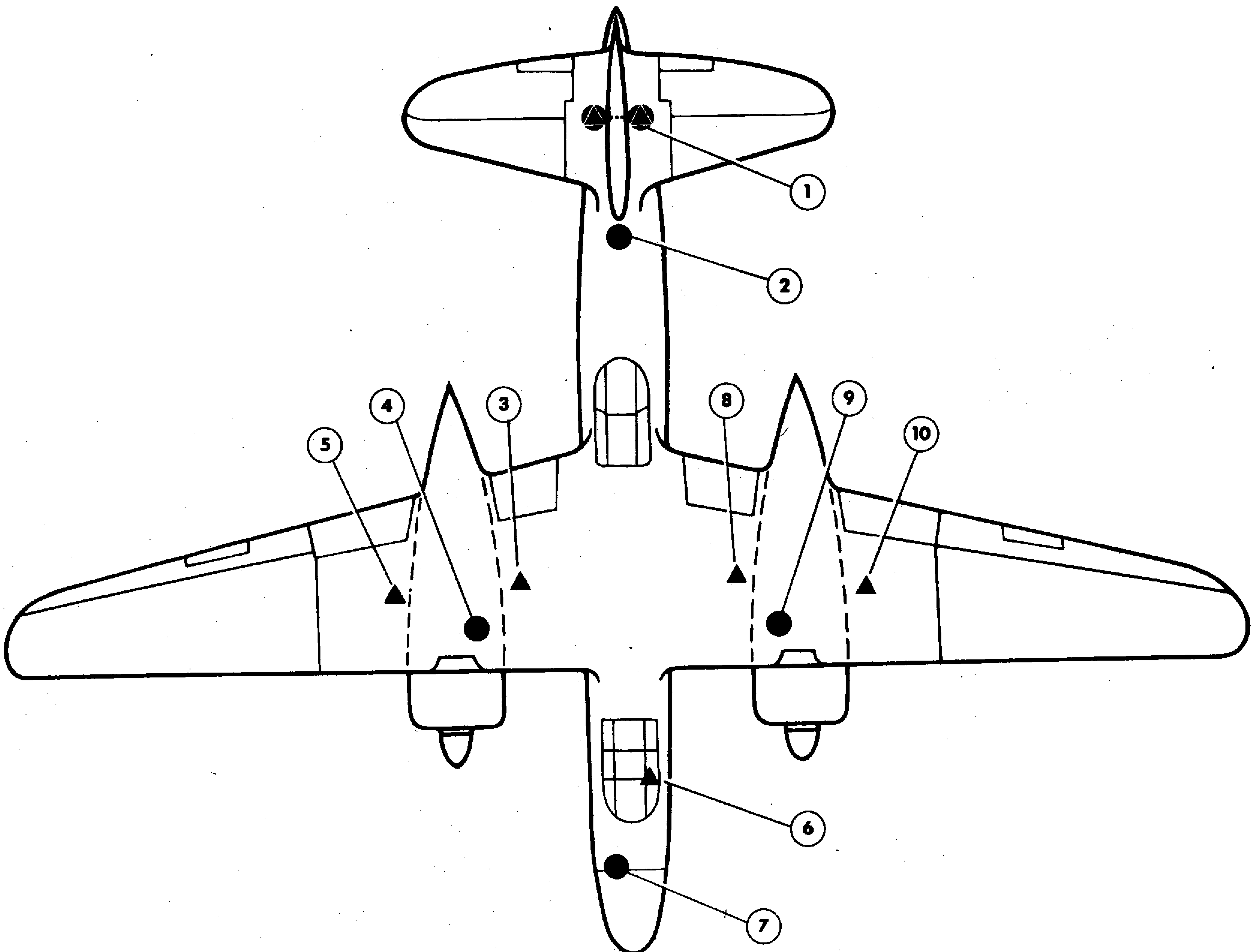
(d) Master battery switch - ON.

(e) Landing gear indicator light - ON.



A FUEL TANK DRAIN (INBOARD)
B FUEL TANK FILLER NECK ACCESS
C FUEL LINES AND LEADING EDGE ATTACHMENT BOLT ACCESS (OUTBOARD)
D CARBURETOR AIR SCOOP FAIRING
E OIL TANK FILLER NECK ACCESS
F CARBURETOR AIR SCOOP ACCESS
G CONDUIT LINE AND CABLES ACCESS
H OIL TANK COVER
J FUEL LINES AND LEADING EDGE ATTACHMENT BOLT ACCESS (INBOARD)
K FUEL TANK DRAIN
L WING ATTACHMENT BOLT ACCESS
M WING STRUCTURE ACCESS (NO. 5 DOORS)
N FUEL STRAINER ACCESS
O OIL COOLER DRAIN ACCESS
P LANDING GEAR PIN ACCESS (INBOARD)
Q LANDING GEAR PIN ACCESS (OUTBOARD)
R OIL COOLER ACCESS
S LANDING GEAR PIN ACCESS
T OIL COOLER DUCT FLAP
U CONDUIT AND HYDRAULIC LINES ACCESS
V CONDUIT, LINES AND CABLES ACCESS
W CONDUIT, LINES AND CABLES ACCESS
X CONDUIT AND HYDRAULIC LINES ACCESS
Y FUEL LINES ACCESS
Z CONDUIT AND HYDRAULIC LINES ACCESS
AA FLAP HINGE COVER
BA AILERON AND TAB PULLEY BRACKET
CA OUTER WING ELEC. DISC. ACCESS (NO. 1 DOOR)
DA AILERON AND TAB FAIRLEADS ACCESS (NO. 3 DOORS)
EA AILERON AND TAB TURNBUCKLES ACCESS (NO. 1 DOOR)
FA AILERON DIFFERENTIAL ACCESS
GA AILERON DIFFERENTIAL ACCESS
HA AILERON HINGE COVER (INBOARD)
JA AILERON TAB DRUM ACCESS (NO. 3 DOOR)
KA WING TIP LIGHT CONDUIT ACCESS
LA AILERON HINGE COVER (OUTBOARD)
MA COOLER AIR FLOW SCOOP

Figure 19 - WING AND NACELLE ACCESS DOORS



PNT. NO.	TOOL USED	MAX. ALLOW. APPLIED LOAD
1	LIFT BAR	2,670
2	HOIST	1,820
3	JACK	11,600
4	HOIST	10,400
5	JACK	7,770
6	JACK	6,480
7	HOIST	4,600
8	JACK	11,500
9	HOIST	10,400
10	JACK	9,230

OPERATION	METHODS
TO RAISE NOSE GEAR	1. HOIST AT 7 OR 2. JACK AT 6 OR 3. PULL DOWN ON 1
TO RAISE LEFT WHEEL (SIMILAR FOR RIGHT)	1. JACK AT 10 OR 2. JACK AT 8 OR 3. HOIST ON 9
TO RAISE FUS. ONLY	1. HOIST ON 2 AND 7
TO RAISE ENTIRE SHIP	1. HOIST 4 AND 9 AND 2 AND 7 2. JACK AT 3 AND 8 AND 6 OR 3. JACK AT 5 AND 10 AND 6 OR 4. JACK AT 3 AND 10 OR 8 AND 5 AND 6

Figure 20 - HOISTING AND JACKING POINTS

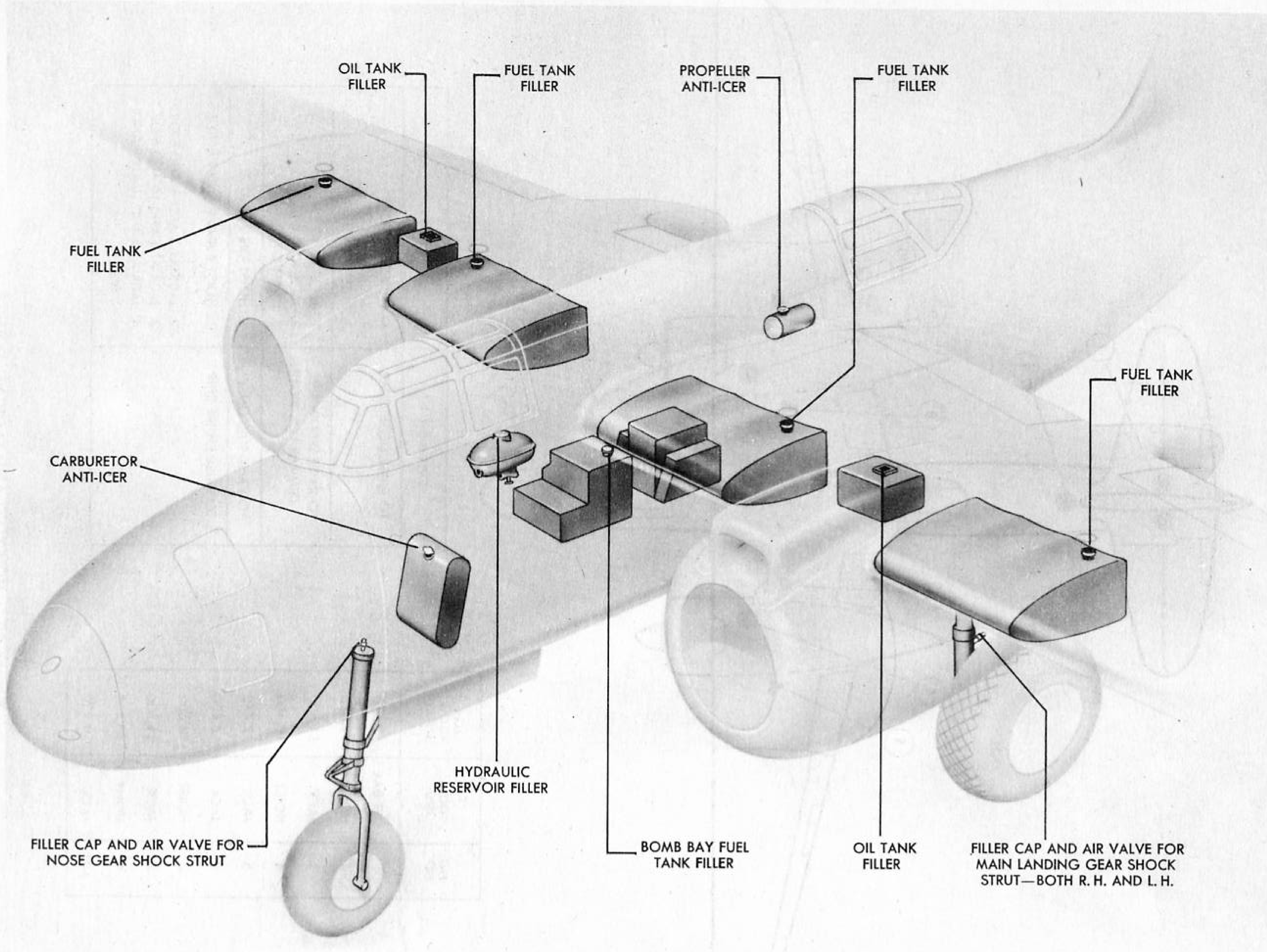


Figure 21 - FILLER CAP DIAGRAM

NOTE

If the green indicator light is ON, and hydraulic pressure is assured, remove the main landing gear safety pins and nose wheel gear safety clamp.

(f) Nose wheel snubbing pin - ENGAGED.

(g) Wheels - CHOCKED.

(h) Parking brake - ENGAGED.

(i) Check controls for free and full movement.

(j) Wing flaps - UP.

(k) Check contents of fuel and oil containers.

(2) SPECIAL CHECK FOR NIGHT OPERATION.

(a) Compass light switch - ON.

(b) Cockpit lights switch - ON.

(c) Adjust the rheostats for the compass light, engine instrument lights, and flight instrument lights so that all instruments can be easily read.

(d) Navigation lights switch - ON.

(e) Set altimeter for standard atmosphere pressure at sea level or for pressure at the field altitude.

(f) Gyro horizon - UNCAGED.

(g) Set directional gyro, and uncage..

(h) Extend the landing lights and test the operation. To conserve bulb life and to avoid heavy current load on the battery when the engines are not running, use landing lights only when necessary. An external power source must be used when the lights are being tested.

(i) Test-operate identification lights.

b. STARTING ENGINES.

NOTE

When available use an external source of power to start the engines.

(1) With ignition switches OFF, manually pull propeller through two or three revolutions.

CAUTION

If resistance is met, do not try to force the propeller through. Check for liquid in lower cylinders by removing lower spark plugs.

(2) Set the right fuel tank selector to 4 - MAIN - when starting the right engine. Set left fuel tank selector to 3 - MAIN - when starting the left engine. Normally the right engine is started first, so that hydraulic pump on the right engine can be checked. (See step d (3) below.) If the left engine is started first, it should be stopped first so the hydraulic pumps on both engines can be checked - one when starting engines, the other when stopping engines.

(3) Cross feed - OFF.

(4) Supercharger - LOW.

(5) Carburetor air temperature - COLD.

CAUTION

*Never start the engine with the carburetor air temperature controls in the **HOT** position. Serious damage and fire may result from backfire. During icing conditions, start the engine in the **COLD** position, then move the control to **HOT**.*

(6) Upper and lower cowl flaps - OPEN. If there is no hydraulic system pressure, operate the hydraulic hand pump until cowl flaps are open, then return control to NEUTRAL. Before operating the hand pump, ensure that all other hydraulic controls are in NEUTRAL, except the landing gear control which should be left in the DOWN position. Oil cooler flaps will open with the lower cowl flaps.

(7) Propellers - LOW PITCH.

(8) Throttles - 1/4 OPEN.

(9) Mixture - IDLE CUT-OFF.

(10) Ignition - BOTH ON - master switch - ON.

(11) Fuel pressure - 10 to 16 pounds per square inch. (Maintain pressure with wobble pump.)

(12) If the engine is cold, pump the primer five to ten strokes and lock primer OFF.

WARNING

Do not prime an engine that is warm from previous running.

(13) Starter energizing switch - ON.

(14) When starter comes up to speed, mesh switch - ON.

(15) Mixture - TAKE-OFF AND CLIMB.

(16) Operate wobble pump. If engine does not fire after 15 seconds, stop pumping and return mixture control to IDLE CUT-OFF. If flooding is indicated by a discharge of fuel from the blower drain, clear the engine out by turning it through several revolutions

(throttle OPEN). If engine starts during clearing, immediately move the mixture control to TAKE-OFF AND CLIMB, partially closing the throttle. If engine does not start, repeat the original procedure.

CAUTION

Do not crank the engine with the electric starter for a period longer than 30 seconds. If engine does not start, allow starter to cool three minutes before repeating. This will avoid booster coil and meshing solenoid failure.

c. HAND CRANKING ENGINE.

(1) Open cover from crank hole on lower right side of accessory cowling.

(2) Insert crank through hole and bracket into female socket in starter.

(3) Revolve crank clockwise until maximum speed is obtained.

(4) Remove crank.

(5) Either pull hand meshing lever adjacent to crank bracket or close starter meshing switch in pilot's cockpit.

d. ENGINE WARM-UP.

(1) Idle engine at 800 rpm. If oil pressure does not come up to at least 40 pounds per square inch within one-half minute after starting, stop engine and check oiling system.

(2) Increase engine speed from 1000 to 1200 rpm.

(3) Note hydraulic pressure, lower and raise wing flaps and return control lever to NEUTRAL. After operation, the hydraulic pressure should recover to 850 ± 25 pounds per square inch, indicating that the right engine hydraulic pump is operating properly.

e. ENGINE AND ACCESSORIES GROUND TEST.

(1) Run engines at 1000 to 1200 rpm with the oil pressure normal and the oil temperature at least 40 degrees C (104 degrees F); in colder weather, until a temperature rise of 10 degrees C (18 degrees F) is noted.

(2) Open throttle to 30 inches Hg manifold pressure, check oil pressure and temperature as follows:

(a) Oil pressure - 80 to 85 pounds per square inch.

(b) Oil temperature - 50 degrees to 70 degrees C (122 degrees to 158 degrees F).

CAUTION

A drop in the oil pressure when the throttle is open indicates that further warming up is required.

(3) Check magnetos: In switch from BOTH magnetos to ONE, the normal drop-off is 50 to 70 rpm, and usually does not exceed 100 rpm. Do not run engine on one magneto more than thirty seconds.

WARNING

Do not run at high manifold pressures longer than is necessary. Cooling of the cylinder heads, barrels, and ignition harness is usually insufficient for prolonged periods on the ground above 1400 RPM, and should be avoided. Stationary engine running should be made with the airplane headed into the wind to aid cooling. Do not exceed 232 degrees C (446 degrees F) cylinder head temperature.

(4) Check supercharger: With propeller controls in the INCREASE (low pitch) position, close the throttle in idling rpm, move the supercharger control to HIGH position, then reopen the throttle sufficiently to obtain not over 30 inches Hg manifold pressure. When the engine speed has stabilized, observe the manifold pressure and shift the supercharger to LOW without moving the throttle. A sudden decrease in manifold pressure is an indication that the two-speed supercharger is operating properly. When changing the supercharger ratios, the control should be moved quickly between one extreme of the control position to the other.

(5) Check propeller pitch controls: With the engine speed above 1500 rpm, move propeller pitch controls toward DECREASE position until a drop in rpm is shown, then return control to INCREASE (low pitch) position. Minimum governing rpm is 1200.

(6) Check fuel pressure:

(a) Desired - 14 to 16 pounds per square inch.

(b) Maximum - 16 pounds per square inch.

(c) Idling - 12 to 16 pounds per square inch.

(7) Pitot head heater - ON (if icing conditions prevail).

(8) Cockpit hood and enclosure - SECURED.

(9) Fuselage step - RETRACTED.

f. TAXIING INSTRUCTIONS.

(1) Before taxiing out, ensure that the nose wheel safety clamp and the main landing gear and surface control safety clamps have been removed. Be sure that the snubbing pin on the nose wheel is engaged.

CAUTION

It is not safe to move the airplane under its own power with the nose wheel snubbing pin disengaged.

(2) Rolling motion is a necessity before nose wheel castering can be accomplished. With even power applied to both engines, release the brakes and begin the roll. Changing direction may then be done by differential braking. Abrupt and sharp turns will cause uneven tire wear if the turn is attempted beyond the nose wheel turning limits.

(3) Once the airplane has begun to roll on level ground, it can be stopped only by wheel braking or by cutting both engines, as the thrust of the idling propeller is sufficient to overcome rolling friction.

(4) Forward speed should be at a minimum over soft, rough terrain. With the slightest sinking of the nose wheel, the center of gravity moves forward correspondingly, tending to increase the nose load and subject the nose wheel struts to undue loads. Avoid field obstructions such as rocks, boards, or ditches. Forward loads may be minimized by full UP elevators and minimum braking. The pilot's attention, therefore, should be focused on the terrain to be traversed by the nose wheel.

(5) The taxiing speed is limited only by the precautions noted above. When the speed is increased, nose wheel action and control are stabilized. With this rolling characteristic, ground looping is impossible. After the forward roll has been started, normal methods of directional control are present, and the taxiing direction is left open for the use of the rudder, differential engines, brakes, or a combination of the three. Use the first two whenever possible to minimize wear on brakes.

(6) To stop rolling, apply the brakes evenly. The slower the rolling speed, the greater will be the nose wheel castering. As the airplane approaches a standstill, reduce braking gradually. This will allow even hydraulic cylinder action and reduce nose pitch.

g. STOPPING ENGINES.

(1) Park the airplane by pulling out the parking brake control and depressing brake pedals.

(2) With propeller pitch controls in INCREASE (low pitch) position, idle the engine at 800 to 1000 rpm for approximately five minutes. This will allow the crankcase to be scavenged of oil, and the head temperatures to drop to 150 degrees C (302 degrees F).

(3) Stop the right engine first so that the hydraulic pump on the left engine can be checked. While the left engine is still running, note the hydraulic pressure and operate the wing flaps. The hydraulic pressure should then recover to 850 ± 25 pounds per square inch.

NOTE

To ensure that both hydraulic pumps are operating properly, check the right engine hydraulic pump during starting procedure.

(4) Move mixture controls to IDLE CUT-OFF at any idling rpm and gradually open the throttles. This will give a clear cut-off with no backfiring.

(5) When engines have stopped, turn ignition switch OFF (master switch OFF).

NOTE

When a cold weather start is anticipated, stop the engines in the normal manner. But while the engines are idling at 800 rpm and when cylinder temperatures fall below 150 degrees C (302 degrees F) and oil temperature below 50 degrees C (120 degrees F), hold the oil dilution switches ON for one to five minutes, depending upon expected low temperatures and the grade and amount of oil in the system. Stop engines by turning ignition switches - OFF. Let stand for five to 15 minutes and start engines and repeat oil dilution procedure if weather conditions warrant.

h. BEFORE LEAVING PILOT'S COMPARTMENT. Before leaving the pilot's compartment, adhere to the following instructions:

(1) Have wheels chocked if possible.

(2) Fuel valves - OFF.

(3) All lights - OFF.

(4) Radio - OFF.

(5) Main battery switch - OFF.

(6) All cowl flaps closed when engine cylinder head temperatures drop below 120 degrees C (248 degrees F).

(7) All hydraulic controls in NEUTRAL except the landing gear, which should be left - DOWN.

(8) Surface controls - LOCKED.

(9) If dusty air conditions prevail, set the carburetor air temperature controls to HOT to close the intake scoops.

(10) Cover pitot head.

(11) Entrance doors - CLOSED and LOCKED.

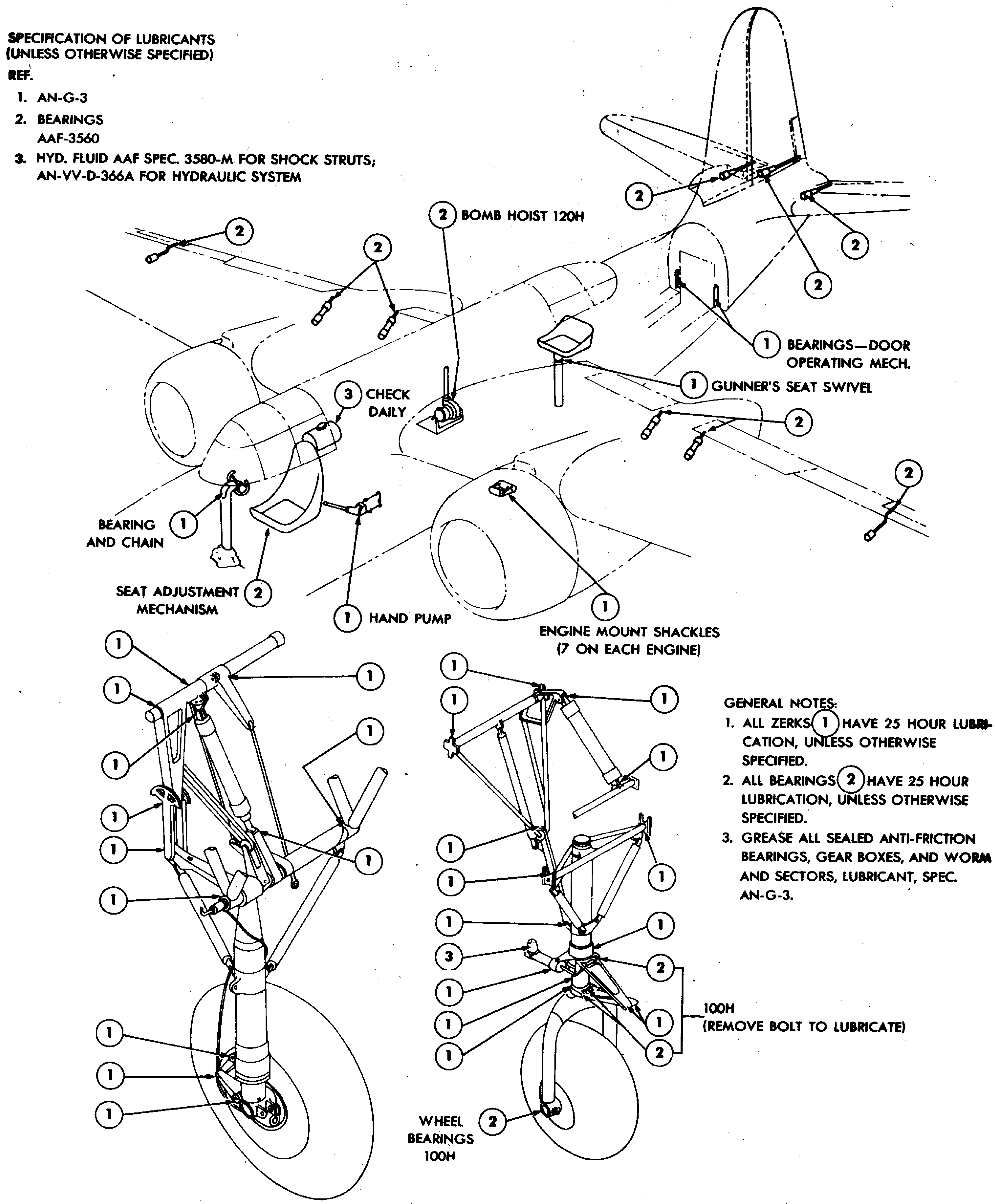


Figure 22 - LUBRICATION CHART

4. LUBRICATING REQUIREMENTS.

a. GENERAL. - Main points of lubrication and types of lubricant to be used are indicated in figure 22. All control system pulleys and push-pull rods have sealed bearings which require no lubrication. Moving parts not noted in the figure, such as piano-type hinges, control cable clevis connections, sliding enclosure tracks, etc., may be lubricated with engine oil. Fittings require attention as noted in figure 22. Wheel bearings, socket joints and other heavily loaded parts of the landing gear must be lubricated for extreme low temperature operation only prior to flights which involve a take-off or landing at temperatures below minus 40 degrees C (minus 40 degrees F).

b. SPECIFICATIONS FOR LUBRICANTS. - Lubrication recommendations of the manufacturer:

Where Used	How Often (Hours)	Specification	Grade	Lubricant	Manufacturer
Bomb hoist mechanism	120	AAF-3560	Med	PD-433B	Socony-Vacuum
Engine mount shackles	100 or Major	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.
Control system activating and adjusting screws	500 or Major	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.
Control column chain	500 or Major	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.
Control system universal joints.	500 or Major	AN-G-3	-	Beacon Lubricant, M-285, or equivalent.	Standard Oil Co. of N.J.
Pivot bearings of landing lights	500 or Major	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.
Wheel bearings	100	AAF-3560	Med	PD-433B	Socony-Vacuum
Nose wheel torque links	25	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.
Landing gear latches and lever locks	25	USA-2-64-A	-	Graphite — cake or powdered, or equivalent	Commercially available
Landing gear bearing fittings - other than above	See figure 23	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.
Landing gear down latch shaft bearing	25	AN-VV-O-446a	-	Engine oil	
Seat swivels and slides	25	-	-	Permalube, or equivalent	Andrew Brown Co. Los Angeles, Cal.
Seat chain adjustment sprockets and sprocket bearings	25	AN-G-3	-	Beacon Lubricant, M-285, or equivalent	Standard Oil Co. of N.J.

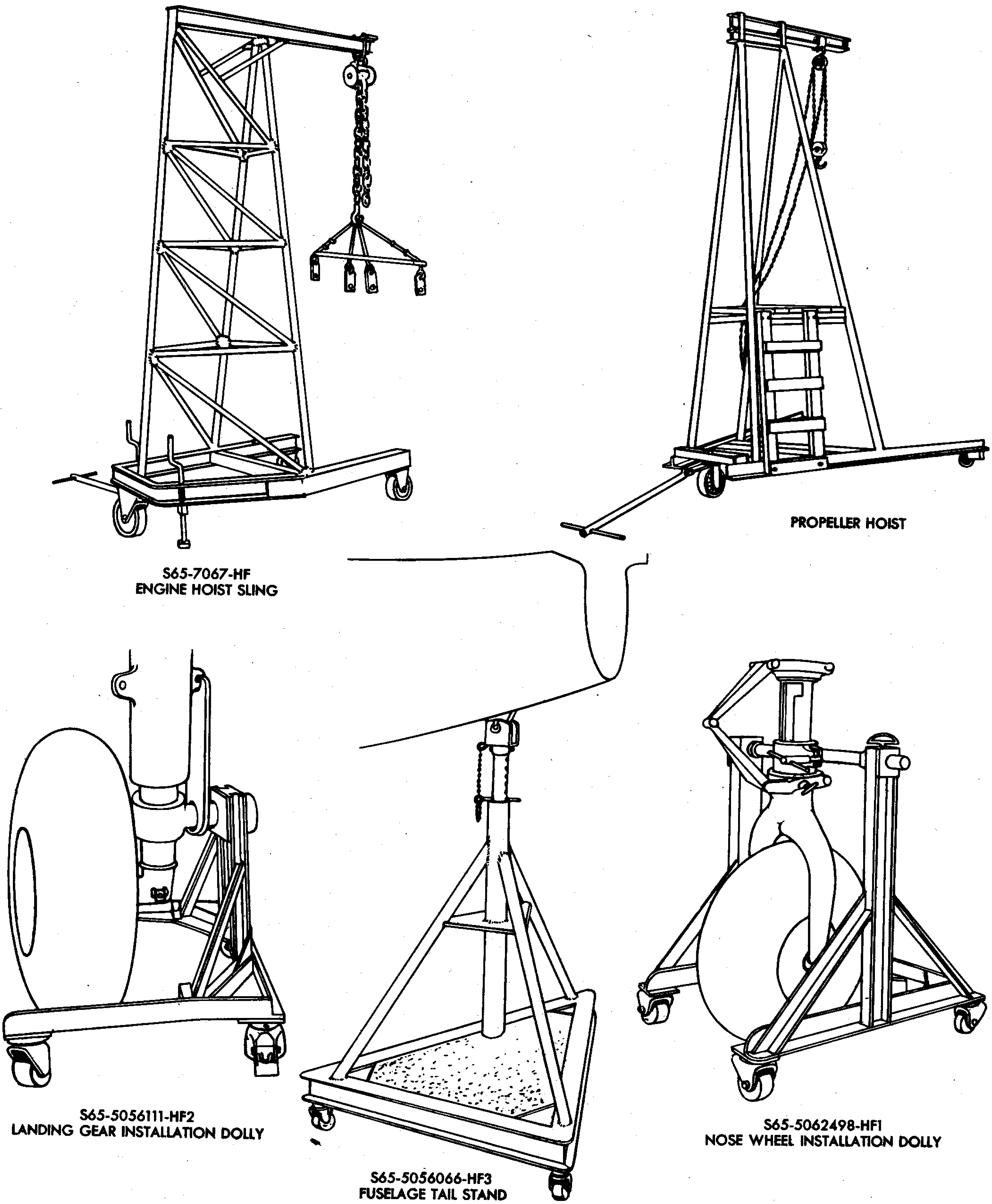


Figure 23 - HANDLING FIXTURES

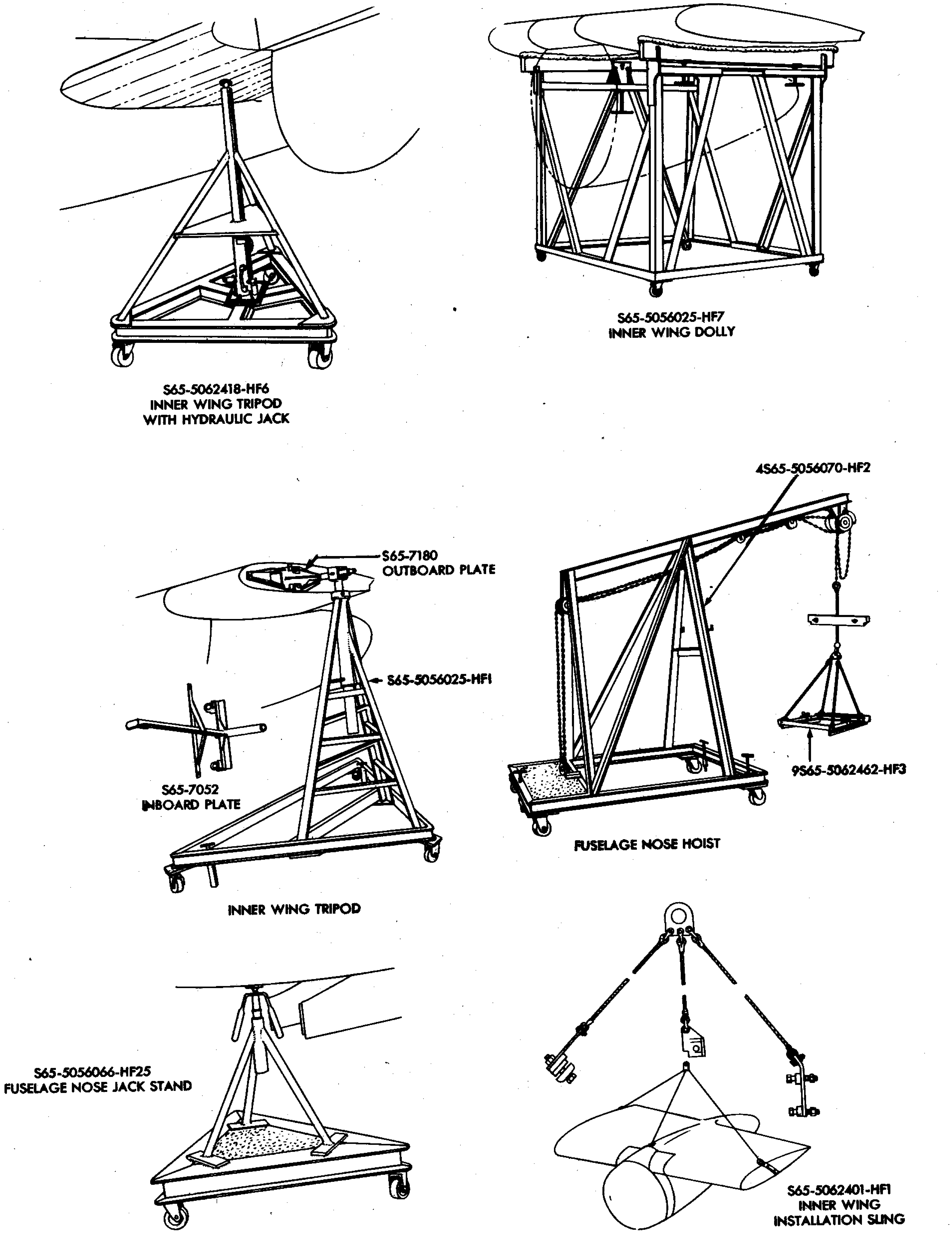


Figure 24 - HANDLING FIXTURES

K21514	Wrench, Crowfoot, O.E. Square Drive 1-3/16"
K21515	Wrench, Crowfoot, O.E. Square Drive 1-1/4"
K21518	Wrench, Crowfoot, O.E. Square Drive 1-5/16"
K21520	Wrench, Crowfoot, O.E. Square Drive 1-7/16"
K21521	Wrench, Crowfoot, O.E. Square Drive 1-1/2"
K21522	Wrench, Crowfoot, O.E. Square Drive 1-9/16"
K21523	Wrench, Crowfoot, O.E. Square Drive 1-5/8"
K21526	Wrench, Crowfoot, O.E. Square Drive 1-11/16"
K21527	Wrench, Crowfoot, O.E. Square Drive 1-3/4"
K21529	Wrench, Crowfoot, O.E. Square Drive 1-15/16"
K21530	Wrench, Crowfoot, O.E. Square Drive 2"
K21531	Wrench, Crowfoot, O.E. Square Drive 2-1/4"
K21528	Wrench, Crowfoot, O.E. Square Drive 1-7/8"
K21519	Wrench, Crowfoot, O.E. Square Drive 1-3/8"
K12201	Sling, Quick Change Engine Unit
K12301	Sling, Inner Wing
K12401	Stand, Fuselage Tail

b. INNER WING TRIPOD WITH HYDRAULIC JACK. (See figure 24.) - Be sure jack is placed under proper jacking point before supporting the weight of the plane on the jack. (See figure 20.)

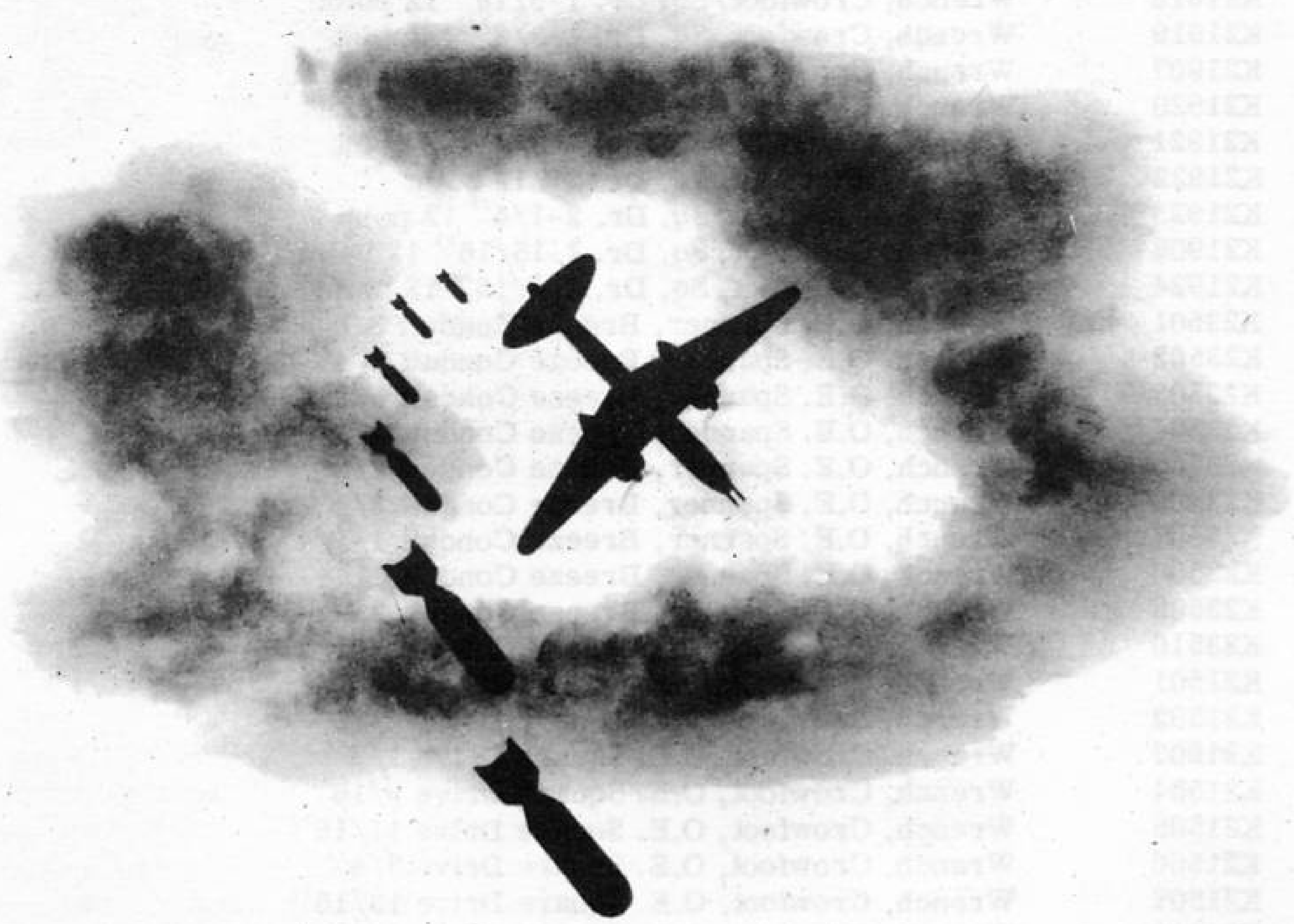
c. INNER WING DOLLY. (See figure 24.) - Jack the airplane to the proper height to install the wing dolly.

d. FUSELAGE NOSE JACK STAND. (See figure 24.) - When repairing main landing gear, use both the fuselage nose jack stand and the inner wing tripod.

e. INNER WING TRIPOD. (See figure 24.) - Use to support either the outboard or inboard end of the inner wing. When used on the outboard end, it is to be equipped with S65-7180 outboard plate; and when used on the inboard end, it is to be equipped with S65-7052 inboard plate.

If necessary, two inner wing tripods, one equipped with an outboard plate and the other equipped with an inboard plate, can support the entire inner wing section while repairs are being made.

f. FUSELAGE TAIL STAND. (See figure 23.) - Be sure to insert the pin through the clevis and eye connection of the airplane tail section as soon as the dolly has been placed.



SECTION IV

Major Component Parts and Installations

1. GENERAL.

a. This section covers the description, removal and disassembly, repair (other than structural) and adjustment, tests, assembly and installation for the major component parts of the airplane.

2. WING GROUP.

a. DESCRIPTION.

(1) GENERAL. - Each wing consists of an inner and outer wing. The inner wings are secured to the fuselage and outer wings are attached to the inner wings. The engine nacelles are an integral part of the inner wings. Two landing flaps are secured to the trailing edges of the outer wings. (See figure 25.) Access doors and cover plates are located throughout the wings to provide for inspection and maintenance. (See figure 19.)

(2) WING TIPS. - The wing tip (figure 25) forms the outboard end of each wing and is formed of alclad sheet ribs, extruded angle longitudinals of aluminum alloy and alclad covering. Formation signal lights are located on the top and bottom sides of the wing tips. Each tip weighs slightly over five pounds.

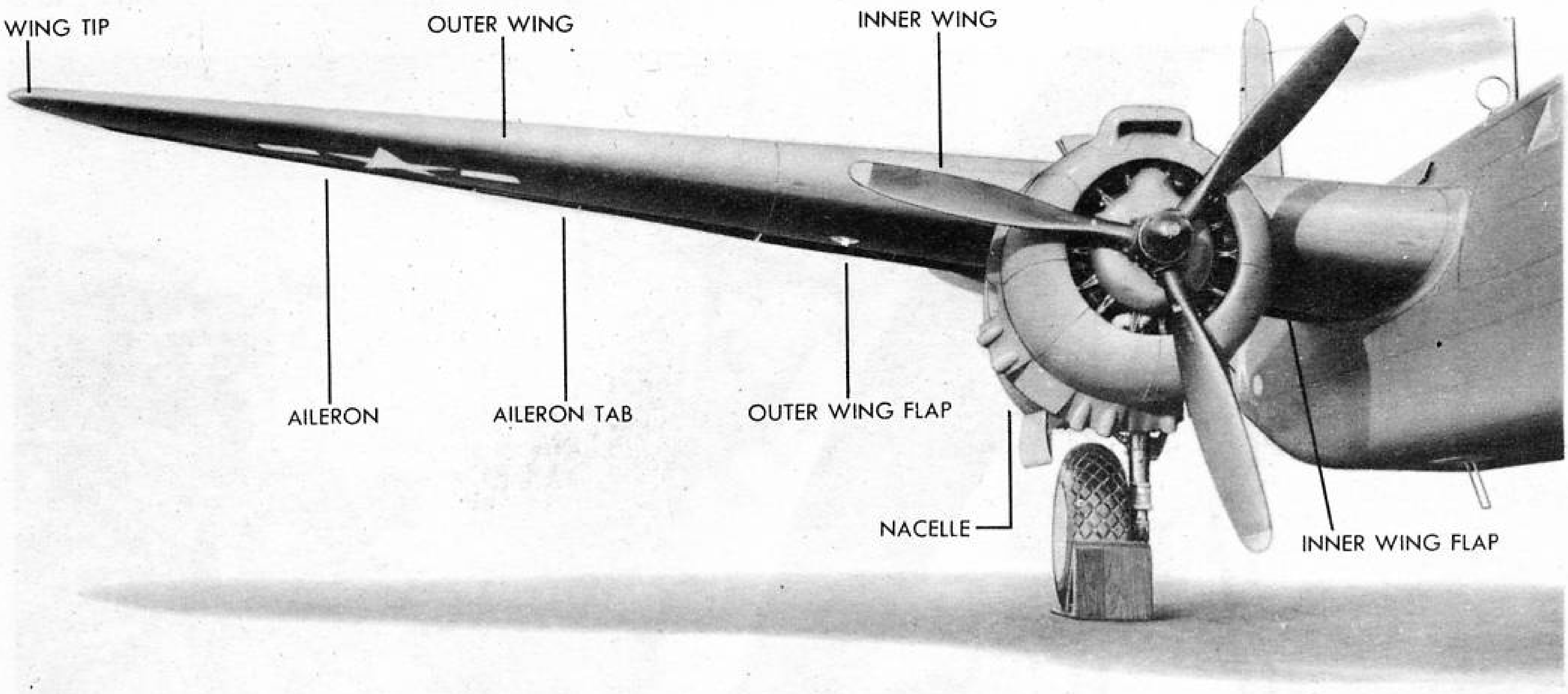


Figure 25 - INSTALLED WING

(3) AILERONS AND AILERON TABS. - The aileron (figure 25) incorporates a main spar and an auxiliary spar for the tab to be fastened upon, with ribs spaced at approximately 12-inch intervals throughout the span. Sheet alclad is used for construction of the leading edge of the aileron to which are attached lead weights for static balance. These weights are secured to the alclad sheeting by flathead screws and elastic stop nuts or self-locking fiber insert nuts. Then the entire surface of the aileron is covered with fabric. The aileron tab is constructed of sheet alclad and, while it is part of the aileron, it may be operated with, or independently of, the aileron to control balance of the airplane in flight. The aileron is mounted on three hinging brackets at the rear shear web of the outer wing. Removal and assembly of the aileron and tab may be performed without removing the outer wing from the airplane. Each aileron weighs about 44 pounds.

(4) OUTER WINGS. - The outer wing (figure 25) incorporates a main spar and rear shear web with ribs spaced at approximately 12-inch intervals throughout the span. The assembly is made up of the wing, aileron, aileron tab, and wing tip.

(5) OUTBOARD WING FLAPS. - The flaps (figure 25) are hydraulically operated by actuating struts and serve as air brakes to decrease landing speed. The flaps are of all metal construction similar to the wing. Each of the two outboard wing flaps is hinged to the rear shear web of the inner wing outboard of the engine nacelle. A single wing flap weighs approximately 17 pounds.

(6) INBOARD WING FLAPS. - The inboard wing flaps (figure 25) are the same construction as the outboard flaps and operate the same. Each of the two inboard flaps is hinged to the rear shear web of the inner wing inboard of the engine nacelle.

(7) INNER WINGS. - Each of the two inner wings (figure 25) is of all-metal cantilever construction with an engine nacelle permanently attached. A single spar forms the basic structural unit. The front and rear shear webs provide additional strength. Each wing incorporates two flaps, a retractable landing light, and a detachable leading edge to provide access to the self-sealing fuel containers. An inner wing weighs approximately 2200 pounds without engine or landing gear.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Restricted movement or binding.	Faulty controls. Broken or worn hinge or horn.	See paragraph 15, this section. Repair or replace broken or worn parts.
Surface warped.	Ribs loose from spar.	Replace assembly and send to depot for repairs.

SYMPTOM	CAUSE	REMEDY
	Broken ribs.	Replace assembly and send to depot for repairs.
Torn or weakened covering.	Accident or age.	Repair or replace covering.
	Internal structural defect.	Replace assembly and send to depot for repairs.
Loose rivets or tears around rivets.	Internal structural defect.	Replace assembly and send to depot for repairs.
	Excessive vibration.	Locate cause of vibration and eliminate. Replace assembly and return to depot for repairs.
	Accident or age.	Replace assembly and send to depot for repairs.
Bent or broken horn or hinge.	Accident or structural defect.	Replace defective parts.
Loosened horn, hinge, or hinge pin.	Safety wire broken or missing.	Tighten and safety loose part.
	Rivets pulled.	Replace rivets.
Excessive vibration of surface.	Internal structural defect.	Replace assembly and send to depot for repairs.
	Attaching parts loosened.	Tighten and safety attaching parts.
	Faulty controls.	See paragraph 15, this section.

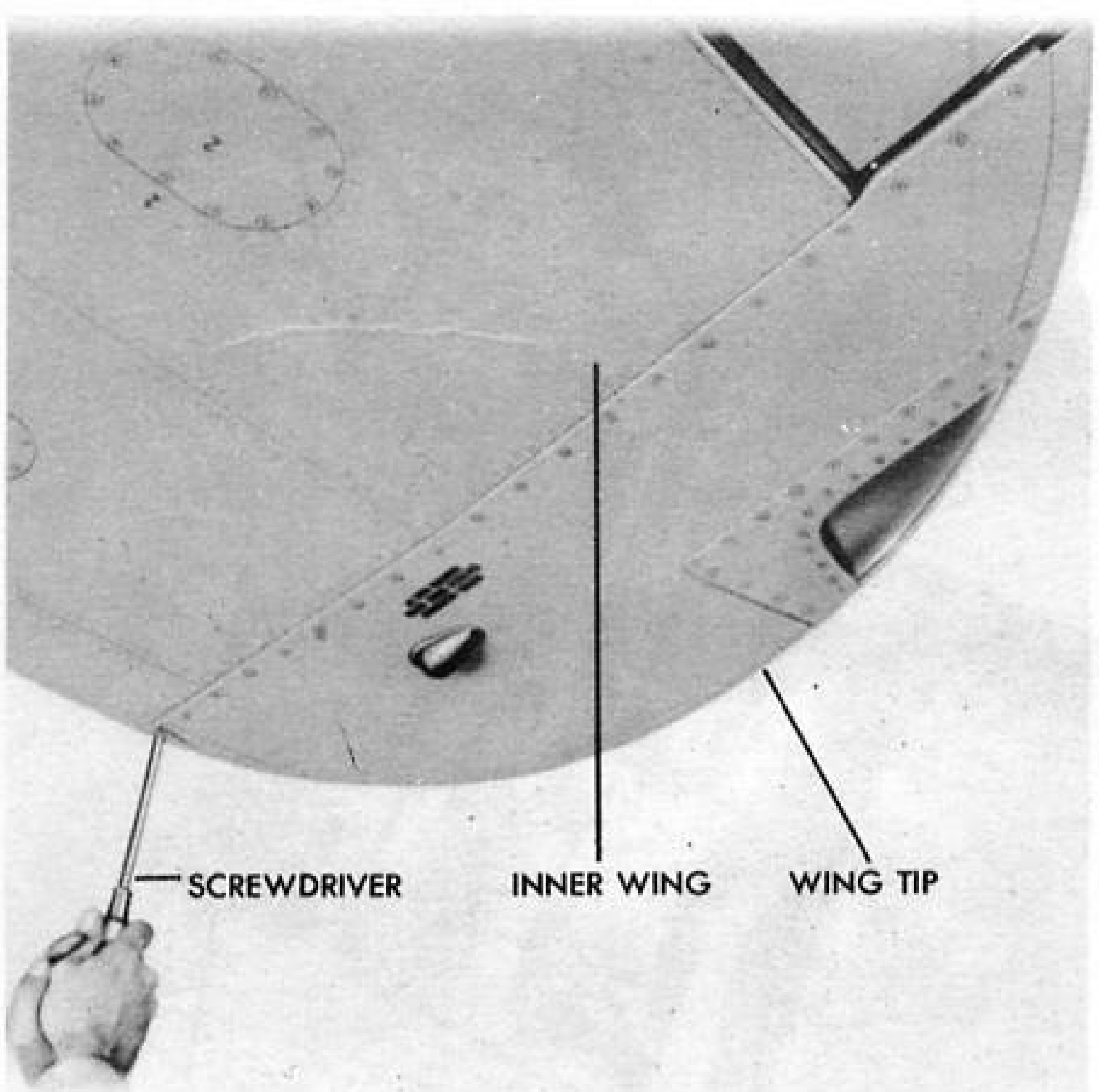


Figure 26 - REMOVING WING TIP

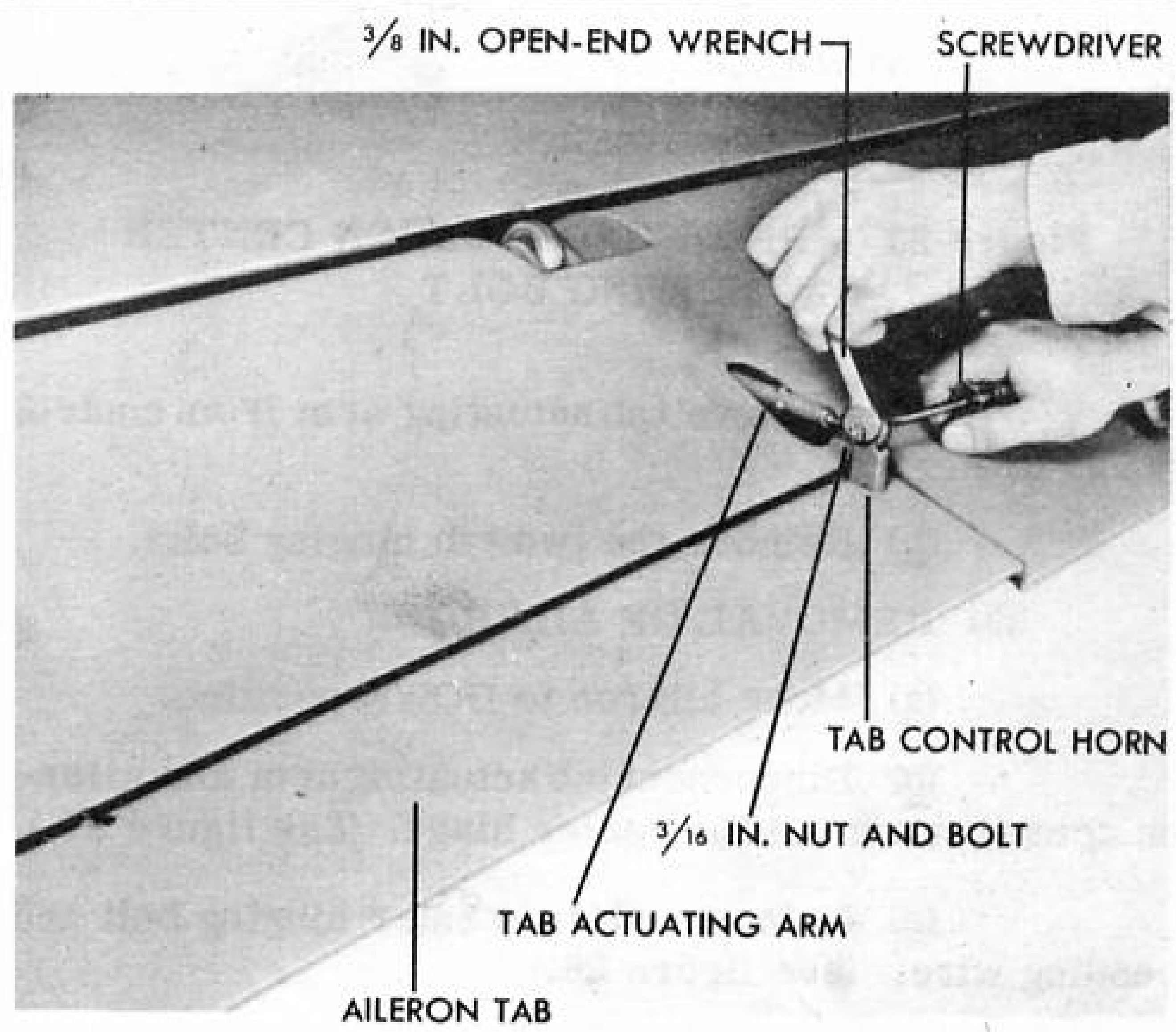


Figure 27 - DISCONNECTING AILERON TAB ACTUATING ARM

c. REMOVAL.

(1) REMOVAL OF WING TIP. (See figure 26.)

(a) Remove the flathead screws which secure the wing tip to the outboard end of the wing.

(b) Pull wing tip outward.

(c) Disconnect at the cannon plug the flexible cable leading to the formation light.

(2) REMOVAL OF AILERON TAB. (See figure 27.)

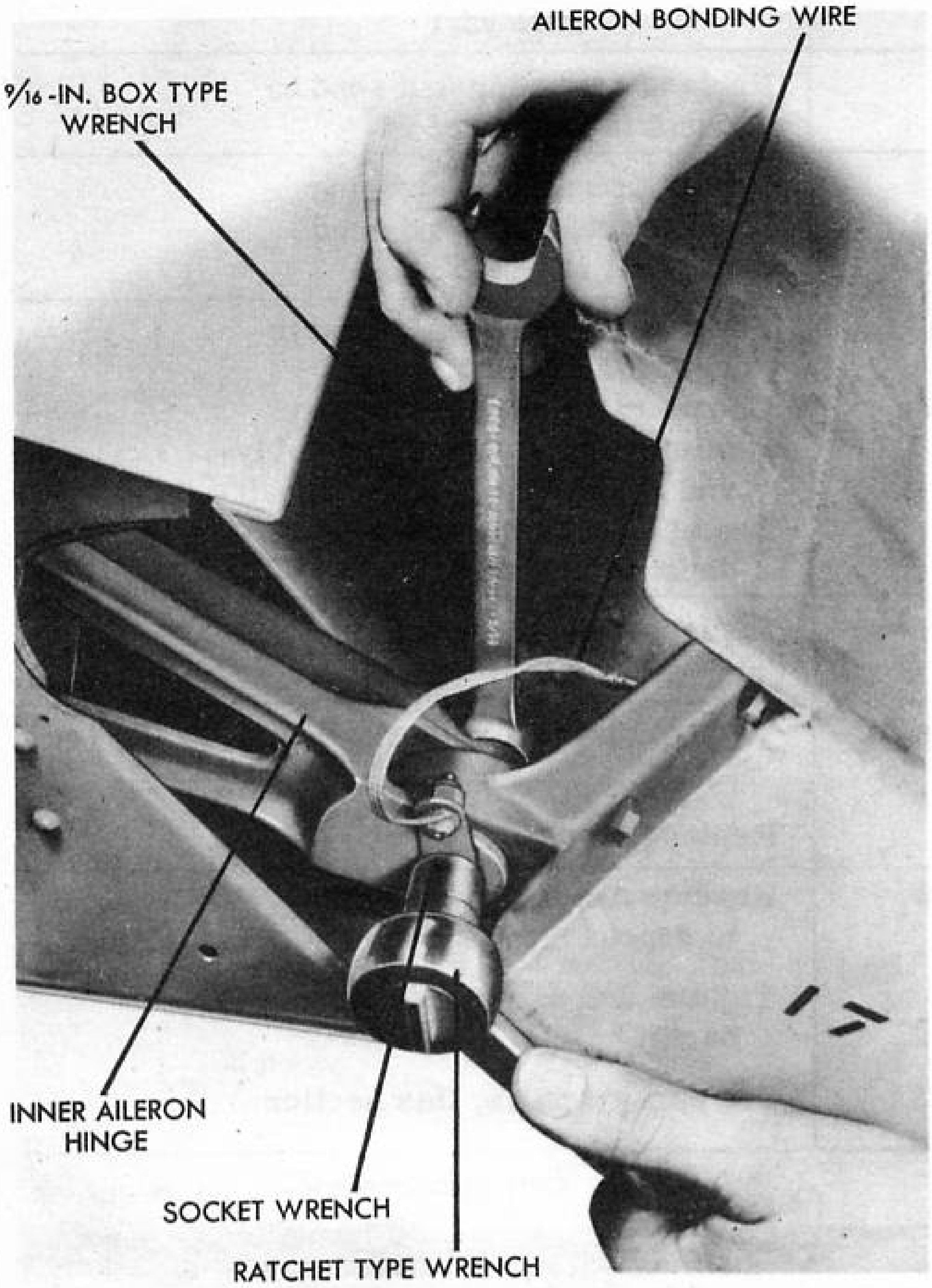


Figure 28 - REMOVING AILERON CENTER HINGING BOLT

(a) Remove tab actuating arm from control horn.

(b) Remove the two tab hinging bolts.

(3) REMOVAL OF AILERON.

(a) Move aileron to DOWN position.

(b) Disconnect tab actuating arm and aileron actuating arm at the center hinge. (See figure 27.)

(c) Remove aileron center hinging bolt and bonding wire. (See figure 28.)

(d) Remove aileron outer hinging bolt.

(e) Swing aileron to UP position.

(f) Remove aileron inner hinging bolt. (See figure 28.)

(4) REMOVAL OF OUTER WING.

(a) Drain outboard and inboard fuel containers by removing drain plugs through access doors (A) and (Z). (See figure 19.)

(b) Disconnect aileron cables through outboard access door (DA). (See figure 19.)

(c) Remove access door (JA). (See figure 19.)

(d) Tape aileron tab drum to prevent unwinding.

(e) Tape aileron cockpit control drum to prevent unwinding at indicator bracket.

(f) Disconnect tab control cable through access door (JA). (See figure 19.)

(g) Disconnect electrical connections through access door (CA). (See figure 19.)

(h) Remove access door (M). (See figure 19.)

(i) Disconnect main and vent gas lines.

(j) Remove leading edge wing attaching bolt through access door (M) of outer wing. (See figure 19.)

(k) Remove the two rear shear web wing attaching internal wrenching bolts after lowering the outboard flap on the inner wing and the aileron on the outer wing.

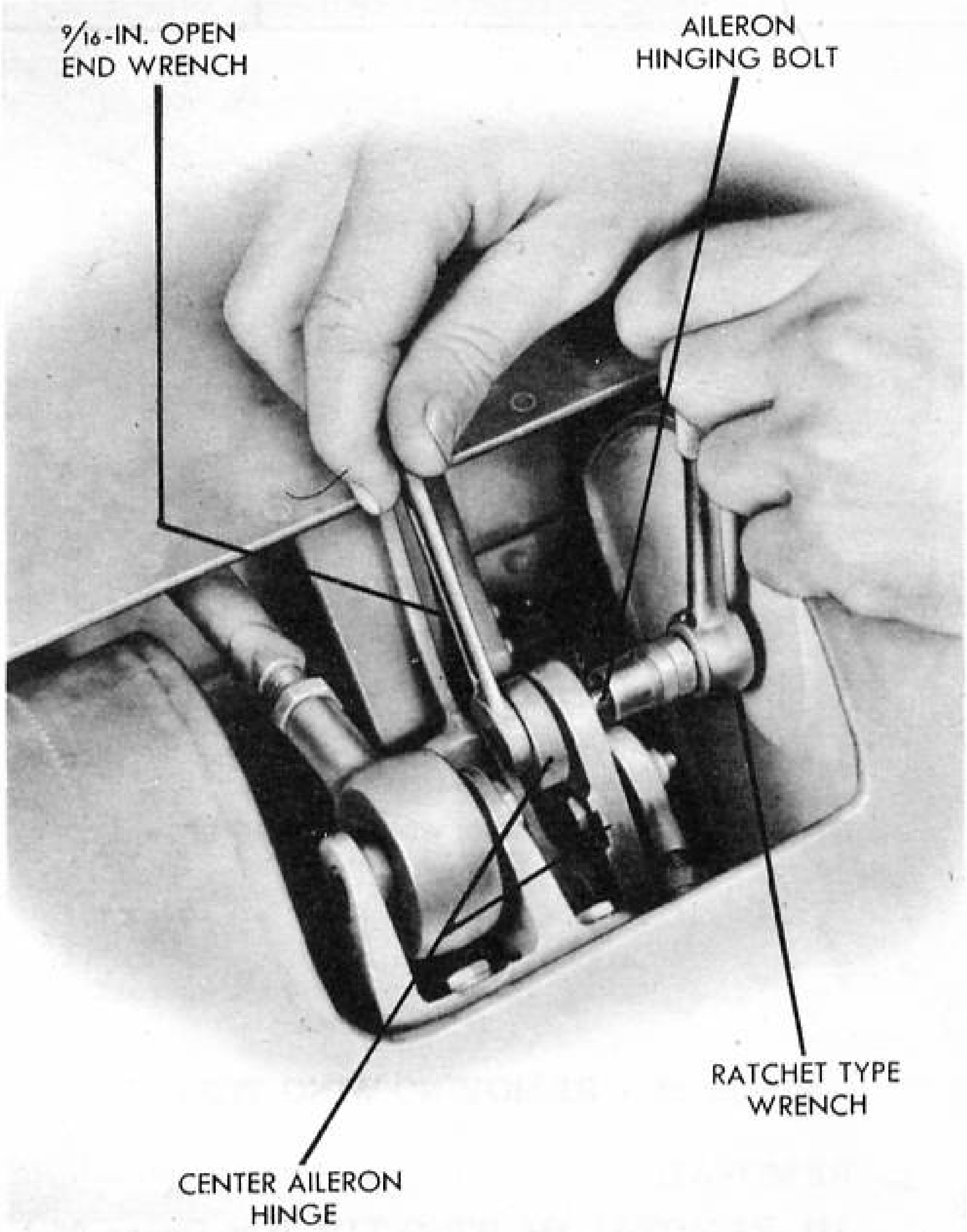


Figure 29 - REMOVING AILERON INNER HINGING BOLT

Figure 30 - REMOVING NUT FROM MAIN SPAR WING ATTACHING BOLT

(l) Remove the main spar top and bottom wing attaching bolt nuts through the spar fittings access opening (L). (See figures 20 and 36.)

(m) Lower the wing flap and raise the aileron.

(n) Move outer wing to the rear and off the main spar wing attaching bolts. This wing weighs about 250 pounds and requires four men to handle it manually. It can be handled easily by the use of a dolly.

(5) REMOVAL OF OUTBOARD WING FLAP. (See figure 37.)

(a) Remove flap hinge access door cover (AA). (See figure 20.)

(b) Remove center actuating arm hinge pin from flap at the nacelle, watching the bushing shim to prevent its loss.

(c) Remove pivot arm below cylinder connection at the nacelle.

(d) Remove outboard hinge bolt through the outboard lightening hole in the end of the flap through access door (AA). (See figure 20.)

(6) REMOVAL OF INBOARD WING FLAP.

(a) Lower flap to approximate HALF-DOWN position.

(b) Remove cylinder actuating arm hinge pin from flap in nacelle, watching bushing and shim to prevent their loss.

(c) Remove pivot arm bolt below cylinder connection, watching bushing and shim to prevent their loss.

(d) Remove hinge bolt at the outboard end of flap through the lightening hole.

(7) REMOVAL OF INNER WING.

(a) Remove outer wing, outboard wing flap, and inboard wing flap.

(b) Place jacks at jacking points 1, 6, and 3 or 8. (See figure 21.)

(c) Drain oil tank at left side of the accessory section of the engine nacelle at the Y valve.

(d) Remove the propeller, and then remove the engine.

(e) Remove landing gear wheel.

(f) Remove landing gear.

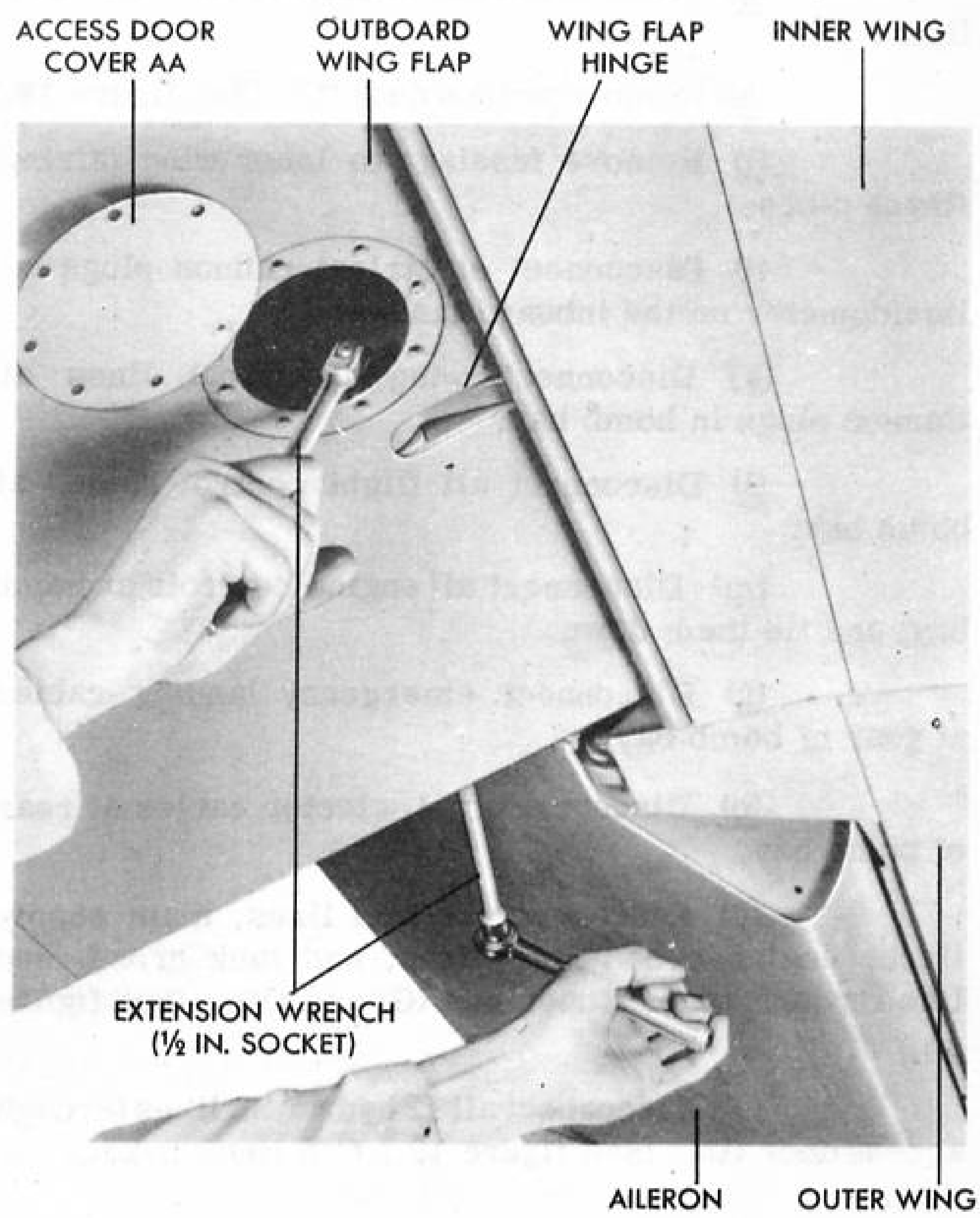


Figure 31 - REMOVING OUTBOARD WING FLAP

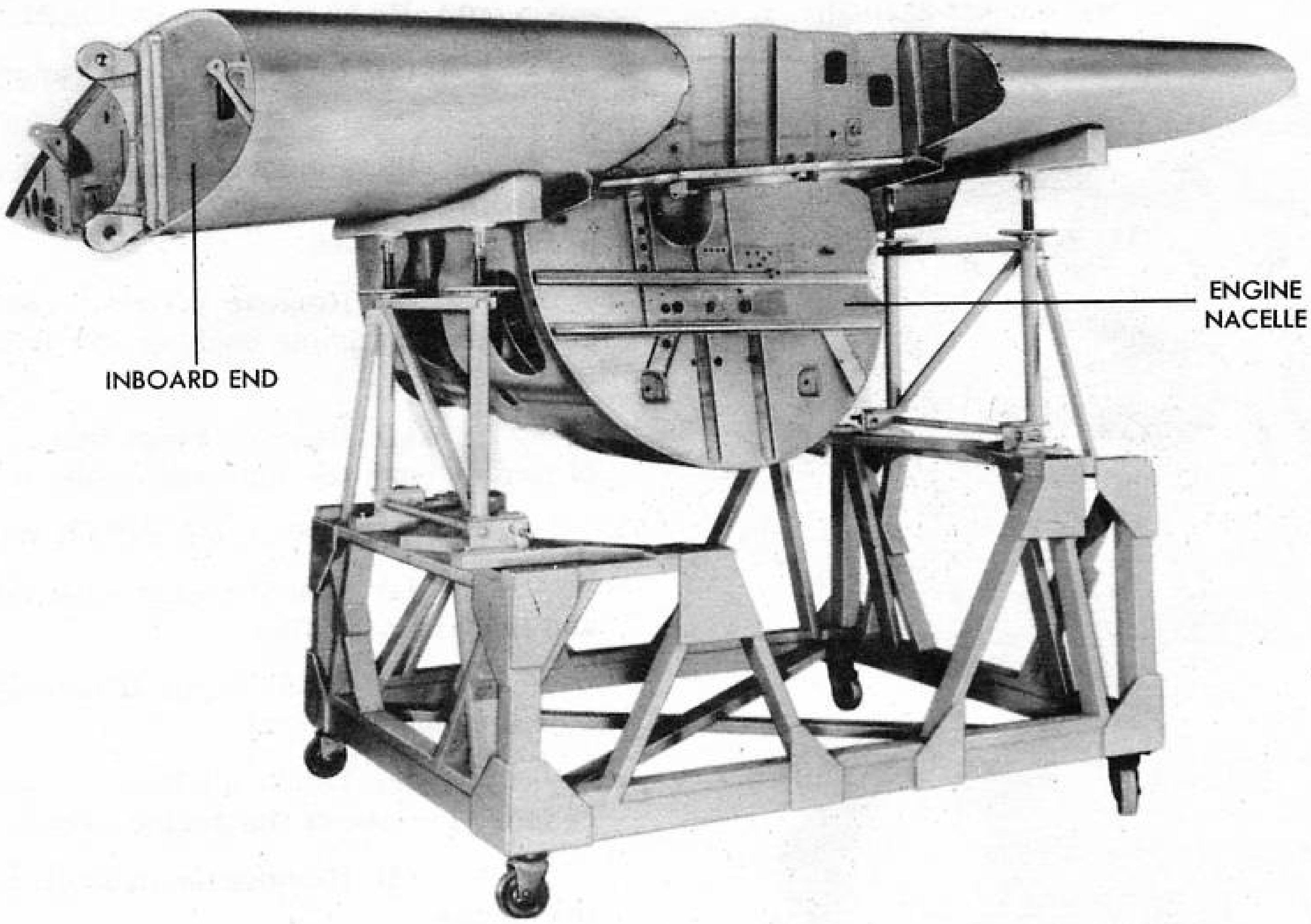


Figure 32 - INNER WING

(g) Remove access doors (V) and (U). (See figure 19.)

(h) Remove access door (G). (See figure 19.)

(i) Remove fuselage to inner wing fairing (three pieces).

(j) Disconnect electrical cannon plugs at liquidometer on the inboard tank.

(k) Disconnect wing electrical lines at Cannon plugs in bomb bay.

(l) Disconnect all flight control cables at bomb bay.

(m) Disconnect all engine controls at bomb bay, and tie them down.

(n) Disconnect emergency landing cables at rear of bomb bay.

(o) Disconnect fuel selector cables at rear of bomb bay.

(p) Disconnect all fuel lines, main supply lines, engine cross-feed lines, and tank cross-feed line through access openings (G) and (V). (See figure 19.)

(q) Disconnect all 12 hydraulic lines through access door (U). (See figure 19.) Cap lines to keep out dirt.

(r) Disconnect oil pressure line through access door (U). (See figure 19.)

(s) Disconnect fuel pressure through access door (U). (See figure 19.)

(t) Disconnect vacuum suction lines through access door (U). (See figure 19.)

(u) Disconnect manifold pressure lines through access door (U). (See figure 19.)

(v) Disconnect leading and trailing edge brackets.

(w) Install inner wing installation sling, special tool, S65-5062401-HF1 (figure 25), if available. When not available, the wing can be supported by a chainfall (not less than 1 1/2-ton capacity) or by block and tackle made of 3/8-inch or heavier manilla rope, or by a sling cradle made of heavy manilla rope. When using a sling cradle, the outboard end of the wing tends to raise too fast and bind the bolt. To overcome this trouble, cinch tightly the two inboard hoist lines and allow the outboard line to be slightly slack.

(x) Remove nut and washer from top center attaching bolt on outside of fuselage. Then remove the bolt after weight of the wing is just supported or equalized. This can be determined when the bolt is relieved of all drag by tapping the bolt head with a lead mallet. The sling must be jockeyed until the bolt is free. To remove the bolt use Douglas tool, S65-14041-G-DET-110, if available; otherwise use any bolt with threads that fit the female threads cut in the head of the attaching bolt.

(y) In a similar manner, remove lower center attaching bolt on inside bomb bay at Station 156. (See figure 7.)

(z) Hoist the wing and remove to suitable support such as inner wing dolly, Douglas tool, S65-5056025-HF7. (See figure 25.)

d. INSTALLATION.

(1) INSTALLATION OF INNER WING.

(a) Install special lifting sling, S65-5062401-HF1, if available. When not available the wing can be supported by a chainfall, block and tackle, or a sling cradle.

(b) Maneuver the wing into place at the fuselage, keeping the outboard edge of wing high enough to prevent the lower fitting from engaging. Line up main attaching bolt holes on upper fitting at the main spar.

(c) Install top center main attaching bolt, using either lead mallet or Kirksite mallet to drive the pin. Be sure bolt goes in from fore to aft.

(d) Line up lower center main attaching bolt by lowering outboard end of the wing.

(e) Install lower center main attaching bolt (goes in from aft to fore).

(f) Install leading edge and trailing edge bracket bolts inside of bomb bay (bolts go in from fore to aft).

(g) Tighten top center, lower center, leading and trailing edge bracket bolts securely and install cotter keys.

CAUTION

When tightening castellated nuts never back off to aline cotter key hole. Always tighten to the next castellation.

(h) Connect all electrical connection plugs and install safety wires at rear of bomb bay.

(i) Connect electric Cannon plugs at the liquidometer on the inboard tank.

(j) Connect all flight control cables.

(k) Connect all engine control cables.

(l) Connect emergency landing control cables.

(m) Connect gasoline selector cables.

(n) Connect main gasoline supply line, engine cross-feed line, and tank cross flow line through access doors (G) and (V). (See figure 19.)

(o) Connect all hydraulic lines through access door (U). (See figure 19.)

(p) Connect oil pressure line through access door (U). (See figure 19.)

(q) Connect the two fuel pressure lines through access door (U). (See figure 19.)

(r) Connect vacuum suction lines through access door (U). (See figure 19.)

(s) Connect manifold pressure lines through access door (U). (See figure 19.)

(t) Install power plant.

(u) Install propeller.

(v) Fill gasoline tanks.

(w) Fill oil tank.

(x) Fill hydraulic system tank.

(y) Check all gasoline, oil, and hydraulic lines for leaks.

(z) Install inboard wing flap.

(aa) Install outboard wing flap.

(bb) Install outer wing.

(cc) Adjust all flight control cables to proper tension, and proper distance of travel.

(dd) Adjust tab control cables for proper travel.

(ee) Adjust engine control cables to proper tension.

(ff) Adjust emergency landing gear cables to proper tension.

(gg) Adjust gas selector valve cables to proper tension.

(hh) Check hydraulic system leads and bleed the system.

(ii) Install access doors. Access doors (G) and (V) (figure 19) are stress plates. Be sure they are well secured and no screws missing.

(2) INSTALLATION OF INBOARD WING FLAP.

(a) Install pivot arm being careful to locate bushing and spacer.

(b) Install hinge bolt through the lightening hole in the outboard end of the flap.

(c) Connect hydraulic actuating arm to the flap, carefully alining the bushing and shim.

(d) Adjust actuating arm to give the proper travel DOWN, 17-3/4 inches - 3/4 inch.

(3) INSTALLATION OF OUTBOARD WING FLAP. (See figure 31.)

(a) Install inboard pivot arm through lightening hole while lifting outboard end into position. Be

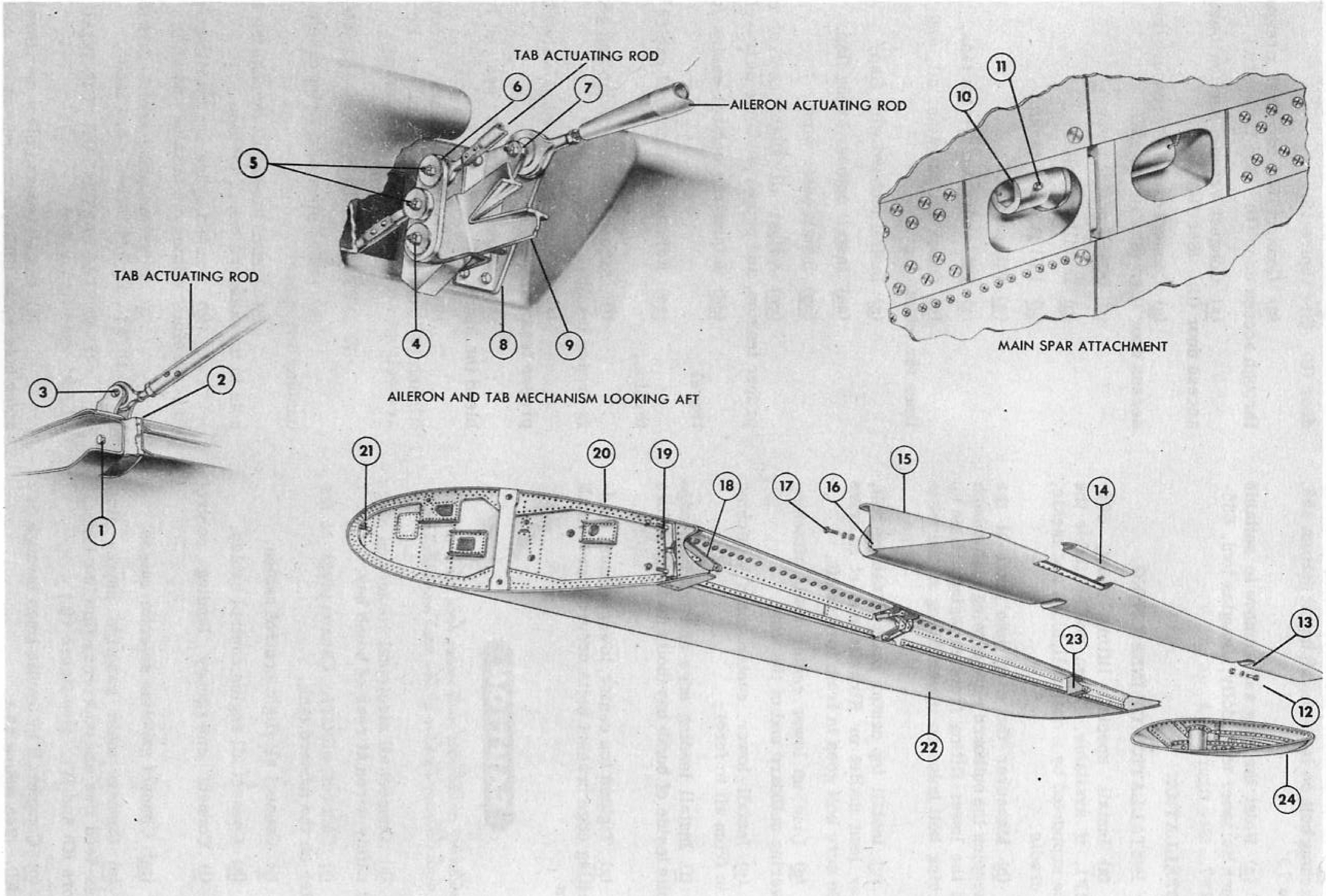
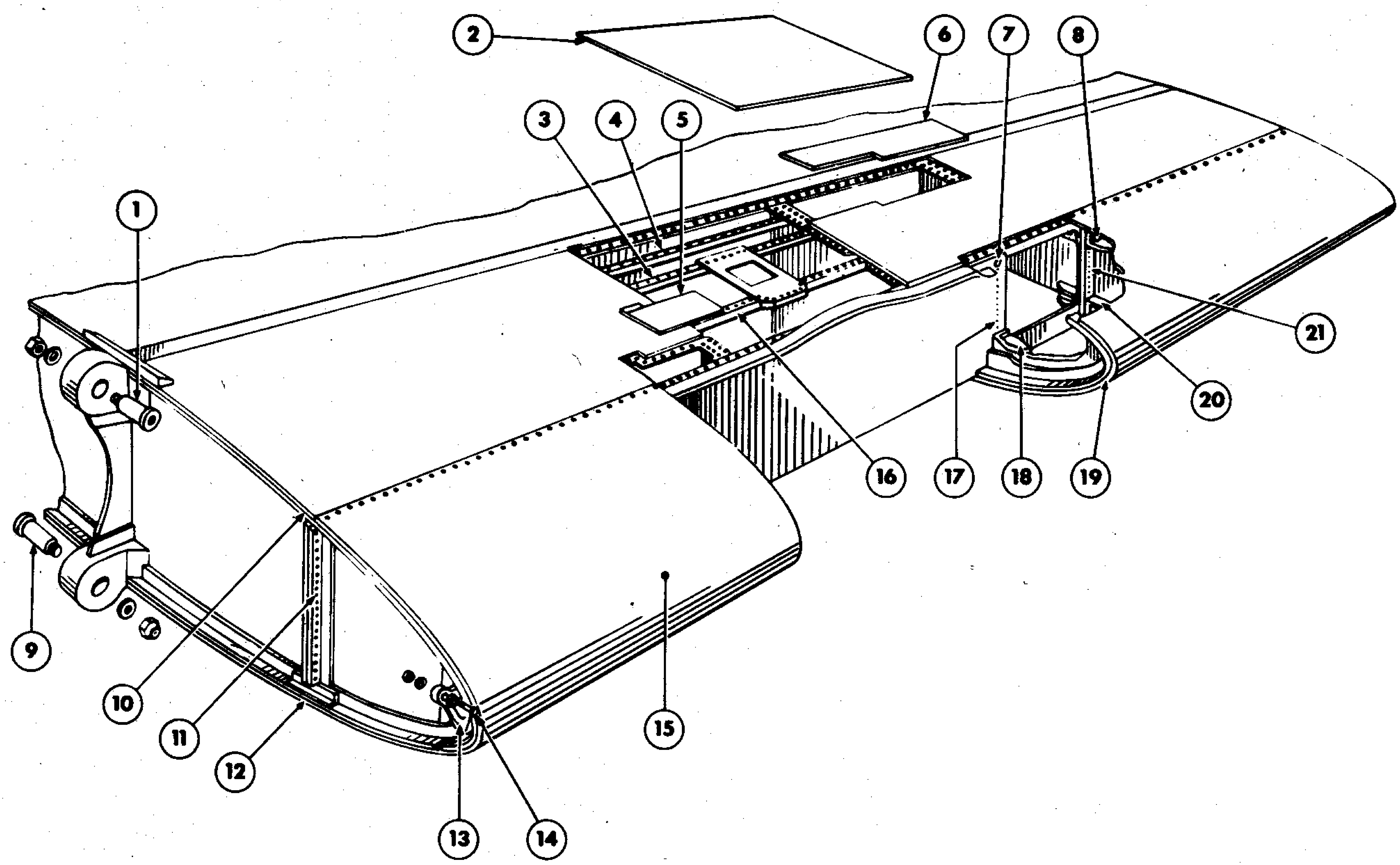


Figure 33 - OUTER WING ASSEMBLY AND INSTALLATION

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AN3-7	BOLT	2
	AN310-3	NUT	2
2.	1069225	BRACKET ASSEMBLY, AILERON TAB HINGE	2
	AN3-4A	BOLT	8
	AC365-1032	NUT	8
3.	AN23-12	BOLT	1
	AN320-3	NUT	1
4.	AN4-24	BOLT	1
	1131365-4	RETAINER, AILERON TRIM TAB MECHANISM BEARING	1
	AN310-4	NUT	1
5.	AN3-10	BOLT	2
	1131365-2	RETAINER, AILERON TRIM TAB MECHANISM BEARING	2
	AN310-3	NUT	2
6.	1068327	ARM ASSEMBLY, TAB ROCKER—L.H.	1
	1068327-1	ARM ASSEMBLY, TAB ROCKER—R.H.	1
7.	AN4-17	BOLT	1
	AN310-4	NUT	1
8.	4069054	SUPPORT ASSEMBLY, AILERON—L.H.	1
	4069054-1	SUPPORT ASSEMBLY, AILERON—R.H.	1
	AN3-5A	BOLT	6
9.	4061655	BRACKET, AILERON HINGE—L.H.	1
	4061655-1	BRACKET, AILERON HINGE—R.H.	1
	AN4-7A	BOLT	4
	AC365-428	NUT	4
10.	1066286	PIN, OUTER WING MAIN SPAR UPPER FITTING	2
	1066287	PIN, OUTER WING MAIN SPAR LOWER FITTING	2
	143908-1160068-094	WASHER	4
	1066285-2	NUT, OUTER WING MAIN SPAR UPPER AND LOWER FITTING	4
	1066285-4	NUT, OUTER WING MAIN SPAR UPPER AND LOWER FITTING	4
11.	1145346	PIN, OUTER WING MAIN SPAR FITTING NUT SAFETY	4
12.	AN5-14	BOLT	1
	AN310-5	NUT	1
13.	2068485	SUPPORT, AILERON HINGE OUTBOARD	1
	AN3-4A	BOLT	1
14.	5066471	TAB ASSEMBLY, AILERON—L.H.	1
	5066471-1	TAB ASSEMBLY, AILERON—R.H.	1
15.	5062415	AILERON ASSEMBLY, COVERED—L.H.	1
	5062415-1	AILERON ASSEMBLY, COVERED—R.H.	1
16.	4069026	SUPPORT, AILERON HINGE INBOARD	1
	AN3-5A	BOLT	6
17.	AN5-15	BOLT	1
	AN310-5	NUT	1
18.	4061650	BRACKET, INBOARD AILERON HINGE—L.H.	1
	4061650-1	BRACKET, INBOARD AILERON HINGE—R.H.	1
	AN4-7A	BOLT	2
	AN4-10A	BOLT	1
	AC365-428	NUT	3
	2064215	SUPPORT, INBOARD AILERON HINGE BRACKET	1
	AN4-7A	BOLT	1
	AC365-428	NUT	1
19.	2076907-21	BOLT, 7/16" x 20, HOLLOW HEX. HEAD	2
	1075888-7A	WASHER, HOLLOW HEX. HD. BOLT	2
	2032517-720	NUT, INTERNAL WRENCHING ELASTIC STOP	2
20.	1067500-13800	STRIP, NEOPRENE SEALING	2
21.	132100-10-33A	BOLT, SPECIAL	1
22.	5090802	PANEL ASSEMBLY, OUTBOARD WING COMPLETE—L.H.	1
	5090802-1	PANEL ASSEMBLY, OUTBOARD WING COMPLETE—R.H.	1
23.	2062147	BRACKET, AILERON HINGE—L.H.	1
	2062147-1	BRACKET, AILERON HINGE—R.H.	1
	AN4-7A	BOLT	2
	AC365-428	NUT	2
24.	5090805	TIP ASSEMBLY, WING—L.H.	1
	5090805-1	TIP ASSEMBLY, WING—R.H.	1
	1087510-10-9	SCREW, 100° RECESSED FLAT HEAD	42

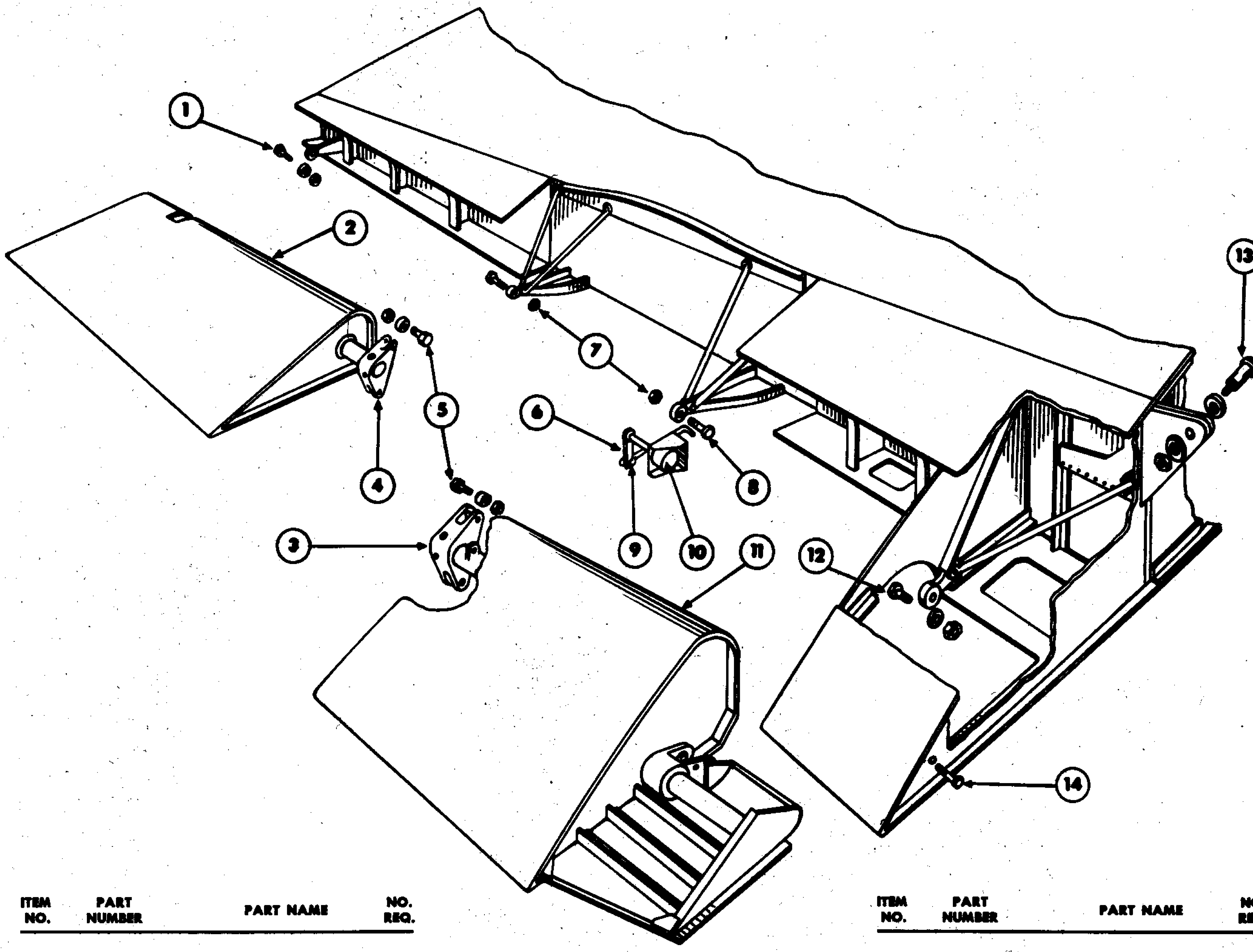


ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2064982-2	PIN, FUSELAGE AND WING ATTACHING	1
	1066831	WASHER, FUSELAGE AND WING ATTACHING PIN	1
	AN310-14	NUT	1
2.	5106819	STRUCTURE ASSEMBLY, INBOARD WING PANEL SHEAR WEB TO SPAR—L.H.	1
	5106819-1	STRUCTURE ASSEMBLY, INBOARD WING PANEL SHEAR WEB TO SPAR—R.H.	1
	1029421-10-8	SCREW, 100° RECESSED FLAT HEAD	10
	1029421-10-10	SCREW, 100° RECESSED FLAT HEAD	115
	1029421-10-12	SCREW, 100° RECESSED FLAT HEAD	2
3.	5106819	LONGITUDINAL, INBOARD WING PANEL	1
	2067906-16	BOLT	2
	1075888-6A	WASHER, HOLLOW HEX. HEAD BOLT	2
	1108468	NUT, FITTING ATTACHING, ⅜"	2
	146142-187-109	PIN, NUT LOCK	2
4.	5106819	LONGITUDINAL, INBOARD WING PANEL	1
	2067906-16	BOLT	2
	1075888-6A	NUT, HOLLOW HEX. HEAD	2
	146142-187-109	PIN, NUT LOCK	2
5.	5106819-180	PLATE, INBOARD WING COVER—L.H.	1
	5106819-181	PLATE, INBOARD WING COVER—R.H.	1
	1029421-10-8	SCREW, 100° RECESSED FLAT HEAD	9
	1029421-10-10	SCREW, 100° RECESSED FLAT HEAD	34
	1029421-10-12	SCREW, 100° RECESSED FLAT HEAD	1
6.	5106819-104	PLATE, INBOARD WING COVER—L.H.	1
	5106819-105	PLATE, INBOARD WING COVER—R.H.	1
	1029421-10-8	SCREW, 100° RECESSED FLAT HEAD	15
	1029421-10-10	SCREW, 100° RECESSED FLAT HEAD	41
7.	2076908-23	BOLT, ½" x 20 HOLLOW HEX. HEAD	1
	1075888-8A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1109099	NUT, FITTING ATTACHING, ½"	1
	146142-187-208	PIN, NUT LOCK	1
	4108738-2	FITTING ASSEMBLY, STATION 100.16 UPPER FRONT ATTACHING—L.H.	1
	4108738-3	FITTING ASSEMBLY, STATION 100.16 UPPER FRONT ATTACHING—R.H.	1
	AN5-17A	BOLT—TWO AFT HOLES	2
	AN5-6A	BOLT—TWO FORWARD HOLES	2
	AN6-7A	BOLT—CENTER HOLE	1
	AC365-524	NUT	4
	AC365-624	NUT	1
	AN960-10L	WASHER	1
	4109025	FITTING, INNER WING STATION 100.16 UPPER ATTACHING—L.H.	1
	4109025-1	FITTING, INNER WING STATION 100.16 UPPER ATTACHING—R.H.	1
	1029421-516-13	SCREW, 100° RECESSED FLAT HEAD	2

Figure 34 - UPPER SURFACE OF FRONT SECTION OF INNER WING

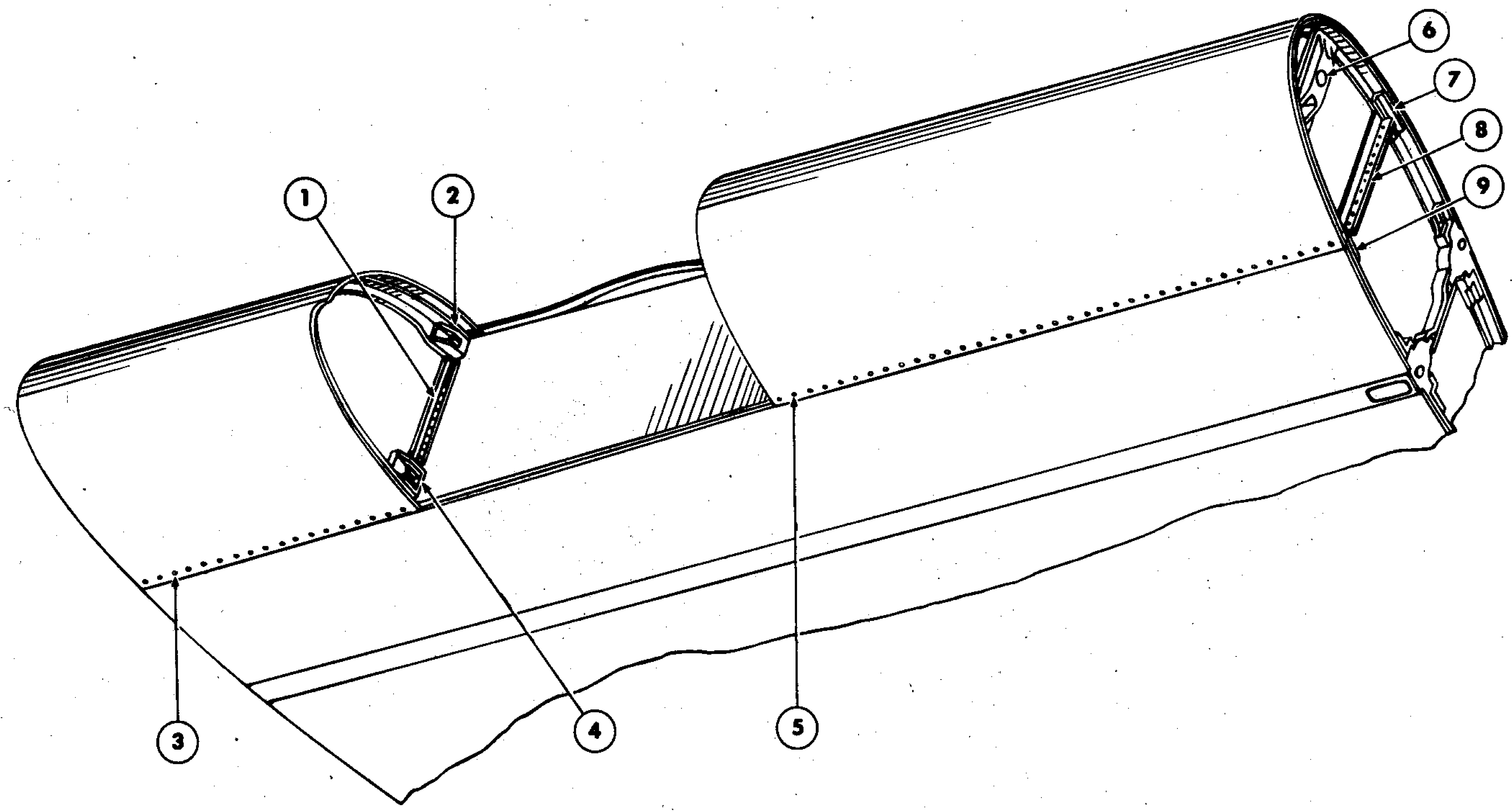
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
	AC365-524	NUT	2
	1029421-416-13	SCREW, 100° RECESSED FLAT HEAD	2
	AC365-428	NUT	2
	AN4-7A	BOLT, REAR ATTACHMENT TO RIB	2
	AC365-428	NUT	2
	AN3-5A	BOLT, ATTACHMENT TO BRACKET	2
	AN365-1032	NUT	2
8.	2076905-15	BOLT, 5/16" x 24 HOLLOW HEX. HEAD	1
	1075888-5A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1108337	NUT, FITTING ATTACHING	1
	146142-125-105	PIN, NUT LOCK	1
9.	2064982-4	PIN, FUSELAGE AND WING ATTACHING	1
	1066831	WASHER, FUSELAGE AND WING ATTACHING PIN	1
	AN310-14	NUT	1
10.	2108986	ANGLE, STATION 0 TOP SPLICE—L.H.	1
	2108986-1	ANGLE, STATION 0 TOP SPLICE—R.H.	1
	AN3-10A	BOLT	4
	AN960-10	WASHER	4
	1029421-10-12	SCREW, 100° RECESSED FLAT HEAD	6
	AC365-1032	NUT	6
11.	AN3-5A	BOLT	14
	AN960-10	WASHER	14
12.	2108987	ANGLE, STATION 0 BOTTOM SPLICE—L.H.	1
	2108987-1	ANGLE, STATION 0 BOTTOM SPLICE—R.H.	1
	AN3-10-A	BOLT	4
	AN960-10	WASHER	4
	1029421-10-12	SCREW, 100° RECESSED FLAT HEAD	6
	AC365-1032	NUT	6
13.	4061683	FITTING, INNER WING FRONT SHEAR ATTACHING	1
	AN5-11A	BOLT, FITTING ATTACHING	6
	AN960-516	WASHER	12
	2076906-20	BOLT, 3/8" x 24 HOLLOW HEX. HEAD	1
	1075888-6A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1075888-6	WASHER, HOLLOW HEX. HEAD BOLT	1
	1108468	NUT, FITTING ATTACHING, 3/8"	1
	AN3-20	BOLT, NUT LOCK	1
	AN310-3	NUT	1
	AN960-10L	WASHER	1
	2076907-20	BOLT, 7/16" x 20 HOLLOW HEX. HEAD	1
	1075888-7A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1075888-7	WASHER, HOLLOW HEX. HEAD BOLT	1
	1109069	NUT, FITTING ATTACHING, 7/16"	1
	AN3-20	BOLT, NUT LOCK	1
	AN310-3	NUT	1
	AN960-10L	WASHER	1
14.	1060306	BOLT, WING TO FUSELAGE ATTACHING	1
	AC975-8	WASHER	1
	AN960-816	WASHER	1
	AN320-8	NUT	1
15.	5107290-500	STRUCTURE ASSEMBLY, INBOARD WING PANEL INBOARD—L.H.	1
	5107290-501	STRUCTURE ASSEMBLY, INBOARD WING PANEL INBOARD—R.H.	1
16.	5106819	LONGITUDINAL, INBOARD WING	1
	2067906-16	BOLT	1
	1075888-6A	NUT, HOLLOW HEX. HEAD BOLT	1
	146142-187-109	PIN, NUT LOCK	1
17.	AN3-6A	BOLT	11
	AN960-10	WASHER	11
	AC365-1032	NUT	11
18.	2076908-22	BOLT, 1/2" x 20 HOLLOW HEX. HEAD	1
	1075888-8A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1109099	NUT, FITTING ATTACHING, 1/2"	1
	146142-187-204	PIN, NUT LOCK	1
	4107356-2	FITTING ASSEMBLY, STATION 100.16 LOWER FRONT ATTACHING—L.H.	1
	4107356-3	FITTING ASSEMBLY, STATION 100.16 LOWER FRONT ATTACHING—R.H.	1
	AN5-17A	BOLT—TWO AFT HOLES	2
	AN5-6A	BOLT—TWO FORWARD HOLES	2
	AN6-7A	BOLT—CENTER HOLE	1
	AC365-524	NUT	4
	AC365-624	NUT	1
	AN960-10L	WASHER	1
	4108993	FITTING, INNER WING STATION 100.16 LOWER ATTACHING—L.H.	1
	4108993-1	FITTING, INNER WING STATION 100.16 LOWER ATTACHING—R.H.	1
	1029421-416-13	SCREW, 100° RECESSED FLAT HEAD	1
	AN4-6A	BOLT	2
	AN960-416L	WASHER	1
	AC365-428	NUT	3
	AN3-5A	BOLT—ATTACHMENT TO BRACKET	1
	1029421-10-9	SCREW, 100° RECESSED FLAT HEAD	1
	AN960-416L	WASHER	2
	AC365-1032	NUT	2
19.	5108183-500	STRUCTURE ASSEMBLY, INBOARD WING OUTBOARD—L.H.	1
	5108183-501	STRUCTURE ASSEMBLY, INBOARD WING OUTBOARD—R.H.	1
20.	2076905-15	BOLT, 5/16" x 24 HOLLOW HEX. HEAD	1
	1075888-5A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1108337	NUT, FITTING ATTACHING	1
	146142-125-105	PIN, NUT LOCK	1
	2108219	FITTING, STATION 110 LOWER REAR—L.H.	1
	2108219-1	FITTING, STATION 110 LOWER REAR—R.H.	1
	AN4-6A	BOLT	2
	1029421-416-13	SCREW, 100° RECESSED FLAT HEAD	1
	AN960-416	WASHER	4
	AC365-428	NUT	3
	2108220-2	FITTING ASSEMBLY, STATION 110 INNER WING LOWER FORWARD—L.H.	1
	2108220-3	FITTING ASSEMBLY, STATION 110 INNER WING LOWER FORWARD—R.H.	1
	AN4-6	BOLT	3
	AC365-428	NUT	3
21.	AN3-5A	BOLT	10
	AN960-10	WASHER	10

LEGEND FOR FIGURE 34



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AN5-14A	BOLT, HINGE	1
	AN310-5	NUT	1
	AN960-516	WASHER	1
2.	5062434	FLAP ASSEMBLY, OUTBOARD LANDING—L.H.	1
	5062434-1	FLAP ASSEMBLY, OUTBOARD LANDING—R.H.	1
3.	4061651	ARM, FLAP OPERATING	1
	AC386-3-18A	PIN, TAPER	1
	AC386-3-19A	PIN, TAPER	1
	AC364-428	NUT	2
	AC975-4	WASHER	2
4.	4061651-2	ARM, FLAP OPERATING	1
	AC386-3-18A	PIN, TAPER	1
	AC386-3-19A	PIN, TAPER	1
	AC364-428	NUT	2
	AC975-4	WASHER	2
5.	AN4-15	BOLT, HINGE	2
	AN310-4	NUT	2
	1026614-4	SPACER (.018) O.D. BEARING	2
6.	1029951	LEVER, PLATE	1
7.	AN310-8	NUT	2
8.	AN8-21	BOLT	2
	AN960-10	WASHER	2
	AN380-2-2	COTTER	2
9.	AN393-11	PIN	1
10.	TYPE TJ-9	TRANSMITTER, G. E.	1
	AN515-8-16	SCREW	4
	AC365-832	NUT	4
11.	5062435	FLAP ASSEMBLY, INBOARD LANDING—L.H.	1
	5062435-1	FLAP ASSEMBLY, INBOARD LANDING—R.H.	1
12.	AN5-24	BOLT, HINGE	1
	AN960-516	WASHER	1
	AN310-5	NUT	1
13.	1060306	BOLT, WING TO FUSELAGE ATTACHING	1
	AC975-8	WASHER	1
	AN960-816	WASHER	1
	AN320-8	NUT	1
14.	AN4-11A	BOLT	2
	AC365-428	NUT	2
	AN960-416	WASHER	2

Figure 35 - UPPER SURFACE OF REAR SECTION OF INNER WING



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AN3-5A	BOLT, FLANGE ATTACHING	14
	AN960-10	WASHER	14
2.	2076906-20	BOLT, 3/8" x 24 HOLLOW HEX. HEAD	1
	1076888-6A	WASHER, HOLLOW HEX. HEAD BOLT	1
	1108468	NUT, FITTING ATTACHING, 3/8"	1
	146142-187-114	PIN, NUT LOCK	1
	2108996	FITTING, STATION 48.45 INNER WING UPPER AFT ATTACHING—L.H.	1
	2108996-1	FITTING, STATION 48.45 INNER WING UPPER AFT ATTACHING—R.H.	1
	1029421-516-13	SCREW, 100° RECESSED FLAT HEAD	1
	1029421-516-15	SCREW, 100° RECESSED FLAT HEAD	2
	AN960-516	WASHER	3
	AC365-524	NUT	3
	1029421-416-19	SCREW, 100° RECESSED FLAT HEAD	1
	AN960-516	WASHER	1
	AC365-428	NUT	1
	1029421-10-18	SCREW, 100° RECESSED FLAT HEAD	2
	AN960-516	WASHER	2
	AC365-1032	NUT	2
	AN5-6A	BOLT—ATTACHMENT TO BRACKET	2
	AN960-516	WASHER	2
	AC365-524	NUT	2
	2109100-2	FITTING, STATION 48.45 INNER WING UPPER FORWARD ATTACHING	6
	AN5-7A	BOLT	6
	AC365-524	NUT	6
	AN960-516	WASHER	6
3.	1029421-10-10	SCREW, 100° RECESSED FLAT HEAD	98
4.	2076906-20	BOLT, 3/8" x 24 HOLLOW HEX. HEAD	2
	1075888-6A	WASHER, HOLLOW HEX. HEAD BOLT	2
	1108468	NUT, FITTING ATTACHING, 3/8"	2
	146142-187-204	PIN, NUT LOCK	1
	1029421-516-14	SCREW, 100° RECESSED FLAT HEAD	6
	AN960-516	WASHER	6
	AC365-524	NUT	6
	4107523-2	FITTING ASSEMBLY, INNER WING STATION 48.45 FORWARD—L.H.	1
	4107523-3	FITTING ASSEMBLY, INNER WING STATION 48.45 FORWARD—R.H.	1
	4107524	FITTING ASSEMBLY, INNER WING STATION 48.45 AFT—L.H.	1
	4107524-1	FITTING ASSEMBLY, INNER WING STATION 48.45 AFT—R.H.	1
	1029421-516-13	SCREW, 100° RECESSED FLAT HEAD	6
	AN960-516	WASHER	6
	AC365-524	NUT	6
5.	1029421-10-10	SCREW, 100° RECESSED FLAT HEAD	114
6.	1107832	FITTING, WING ATTACHING NUT PLATE SHORT	1
	AN510-10-20	SCREW	2
	AC365-1032	NUT	2
7.	1107867	DOUBLER, STA. 157.11 LEADING EDGE TO FORWARD SECTION, UPPER—L.H.	1
	1107867-1	DOUBLER, STA. 157.11 LEADING EDGE TO FORWARD SECTION, UPPER—R.H.	1
	AN3-7A	BOLT	4
	1029421-10-12	SCREW, 100° RECESSED FLAT HEAD	4
	AN960-10	WASHER	4
	AC365-1032	NUT	4
8.	AN3-5A	BOLT, FLANGE ATTACHING	11
	AN960-10	WASHER	11
	AC365-1032	NUT	11
9.	1108029	DOUBLER, STA. 157.11 LEADING EDGE TO FORWARD SECTION, LOWER—L.H.	1
	1108029-1	DOUBLER, STA. 157.11 LEADING EDGE TO FORWARD SECTION, LOWER—R.H.	1
	AN3-7A	BOLT	4
	1029421-10-12	SCREW, 100° RECESSED FLAT HEAD	4
	AN960-10	WASHER	4
	AC365-1032	NUT	4

Figure 36 - LOWER SURFACE OF FRONT SECTION OF INNER WING

careful to properly locate the bushing and alining spacer at the actuating arm and bearing in the nacelle.

(b) Connect hydraulic actuating arm to flap. Aline bushing to prevent binding.

(c) Install outboard bolt through lightening hole in the outboard end of the flap through access door (AA). (See figure 19.)

(d) Adjust actuating arm control to give the flap proper travel DOWN, 16-7/16 inches ± 11/16 inch.

(e) Install access door cover (AA). (See figure 19.)

(4) INSTALLATION OF OUTER WING.

(a) As wing is placed in position, thread the fuel lines, electrical cables, aileron and tab cables through proper holes.

(b) Install top main spar wing attaching bolt nut, but do not tighten it.

(c) Install lower main spar wing attaching bolt nut, but do not tighten it.

(d) Install the leading edge bolt through access door (M) (figure 19) into the inner wing attaching nut that is secured in the outboard fuel container cover nose cap.

(e) Install the two rear shear web wing attaching internal wrenching bolts.

(f) Tighten the top and lower main spar attaching bolts with a torque wrench to 800 foot-pounds.

(g) Tighten the leading edge bolt.

(h) Connect electrical Cannon plug and use No. 20 copper wire to lock nut to bolt.

(i) Connect the fuel lines (main, overflow, and vent).

(j) Connect aileron and tab control cables and safety wire through access door (DA). (See figure 19.)

(k) Remove tape from tab drum through access door (JA) (figure 19), and remove tape from aileron cockpit control drum.

(l) Fill fuel containers.

(5) INSTALLATION OF AILERON.

(a) With aileron in UP position, install inner aileron hinging bolt through the spacer. (See figure 29.) Install the bonding wire.

(b) Move aileron to DOWN position, and install center aileron hinging bolt and bonding wire and the lower end of tab actuating arm. (See figure 28.)

(c) Connect tab actuating arm and aileron actuating arm at center hinge.

(d) Install outer aileron hinging bolt and bonding wire.

(e) Adjust the aileron control cables to allow angular movement of the aileron: UP position, 9-11/16 inches ± 5/8 inch; DOWN position, 6-1/2 inches ± 5/8 inch.

(6) INSTALLATION OF AILERON TAB. (See figure 27.)

(a) Hold aileron tab hinging brackets in place and install the two hinging bolts and safety lock.

(b) Connect tab actuating arm to control horn.

(c) Be sure that center controls agree with indicator, and adjust tab control arm to allow UP and DOWN movement from flight line or neutral positions as follows: UP, 11/16 inch ± 1/8 inch; DOWN, 11/16 inch ± 1/8 inch.

(7) INSTALLATION OF WING TIP. (See figure 26.)

(a) Connect the formation light flexible cable at the Cannon plug and safety the Cannon plug.

(b) Place the wing tip in position on the outboard end of the wing and line up screw holes.

(c) Install screws by starting at leading edge and finishing at trailing edge.

e. INSPECTION AFTER INSTALLATION.

(1) INSPECTION OF OUTER WING AFTER INSTALLATION.

(a) Check fuel connections and fittings for leaks.

(b) Inspect aileron and tab for correct direction of travel and distance of travel up and down in inches.

(c) Install all access door covers.

3. EMPENNAGE.

a. DESCRIPTION.

(1) GENERAL. - The empennage (figure 37) consists of a cantilever vertical stabilizer and horizontal stabilizer bolted in fixed alinement to the fuselage. Elevators and rudder are hinged to the horizontal and vertical stabilizers respectively. Trim tabs are hinged to the elevators and rudder. The purpose of the empennage is to aid in the control of the attitude of the airplane in flight.

(2) ELEVATOR TRIM TABS. - The elevator tabs (figure 37) have formed spars, ribs, and coverings of alclad sheet. They are of spot-welded construction and are hinged to the trailing edge of the elevators.

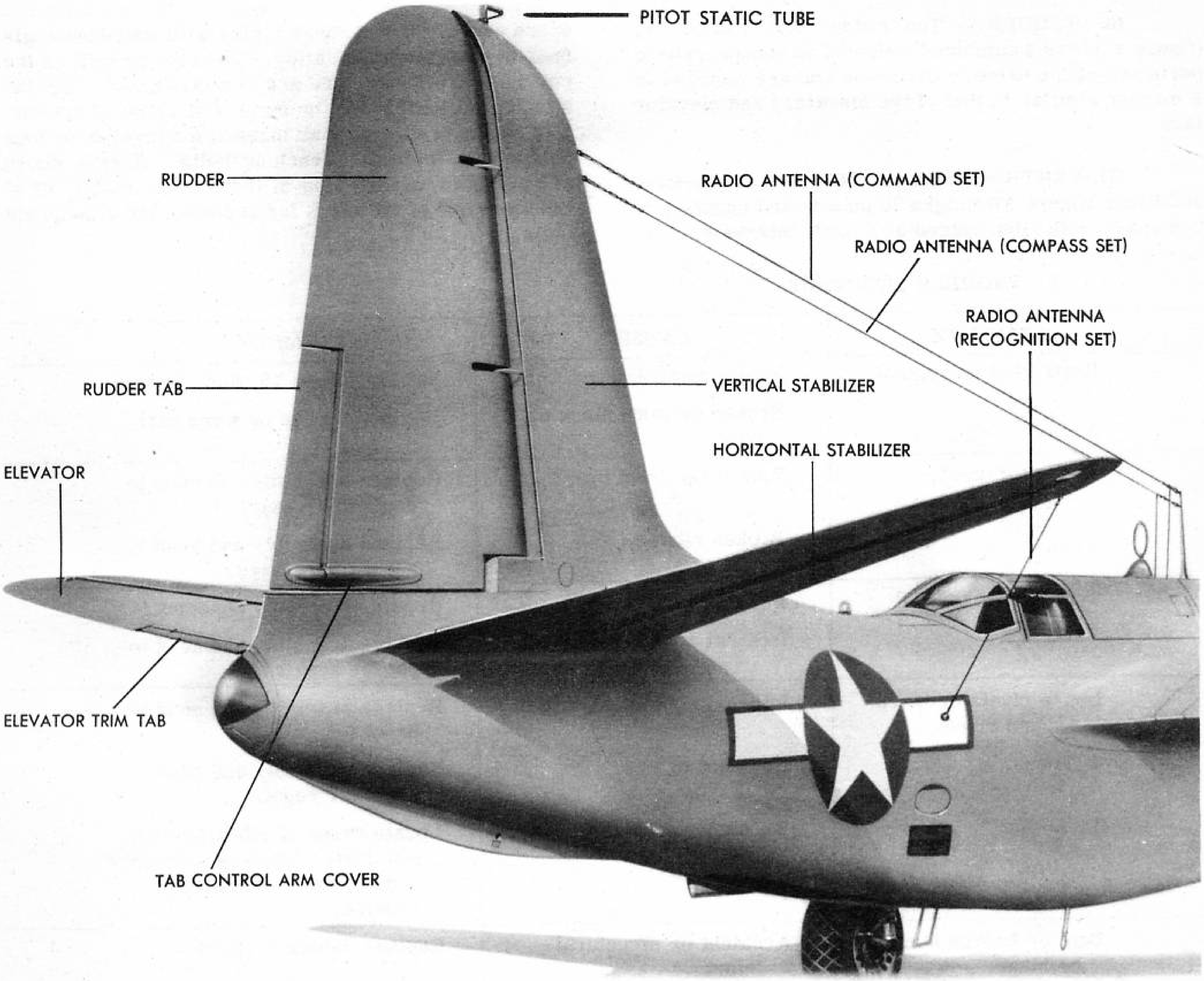


Figure 37 - EMPENNAGE

(3) ELEVATORS. - Each of the two elevators (figure 37) weighs 35 pounds and consists of a single spar of flange alclad sheets with ribs formed of the same material. The leading edge is covered with alclad sheet, and the complete assembly is covered with fabric. Each elevator is hinged to the horizontal stabilizer at two points. A trim tab is attached to the trailing edge of each elevator by two hinges and its actuating rod. A torque tube which incorporates a control horn for attaching the cables is attached to the inboard end of each elevator and connects the elevators to the universal joint at the center line of the fuselage. Design of the elevators is such that the right-hand and left-hand elevators may be interchanged in an emergency.

(4) HORIZONTAL STABILIZER. - Each half of the horizontal stabilizer (figure 37) weighs 42 pounds and is made up of two spars with ribs spaced at intervals of approximately five inches. The spars are made of formed sheet alclad with extruded angle cap strips of aluminum alloy. Ribs and covering are of alclad sheet. The tip assembly attaches at Station 114 (figure 7) with flathead machine screws. The complete assemblies are attached to the fuselage at four points with 1/2-inch bolts of the internal wrenching type. The upper attachment holes are drilled 1/2 inch for a snug fit while the lower ones are drilled 9/16 inch to give a loose fit. In this type connection, the upper bolts take the shear and the lower bolts take the tension.

(5) RUDDER TAB. - The rudder tab (figure 37) is hinged to the trailing edge of the rudder. Its construction is the same as the elevator trim tabs.

(6) RUDDER. - The rudder and rudder tab (figure 37) have a combined weight of 83 pounds. These parts are of the same construction and are mounted in a manner similar to that of the elevators and elevator tabs.

(7) VERTICAL STABILIZER. - The vertical stabilizer (figure 37) weighs 70 pounds and consists of two spars with ribs spaced at 6-inch intervals. The spars are of formed sheet alclad with extruded angle spar caps of aluminum alloy. The ribs as well as the covering of the structure are of alclad sheet. The tab attaches at Station 92 (figure 7) with flathead screws. The complete assembly attaches to the fuselage at four points with internal wrenching bolts. Access doors are provided on each side of the vertical stabilizer at the lower end of the spars for access to the attachment bolts.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Restricted movement.	Faulty controls.	See paragraph 15, this section.
	Broken or worn hinge or horn.	Replace broken or worn part.
Surface warped.	Ribs loose from spar.	Replace assembly and send to depot for repairs.
	Broken ribs.	Replace assembly and send to depot for repairs.
Torn or weakened covering.	Accident or age.	Repair or replace covering.
	Internal structural defect.	Replace assembly and send to depot for repairs.
Loose rivets or tears around rivets.	Internal structural defect.	Replace assembly and send to depot for repairs.
	Accident or age.	Replace assembly and send to depot for repairs.
	Excessive vibration.	Locate cause of vibration and eliminate. Replace assembly and return to depot for repairs.
Bent or broken horn or hinge.	Accident or structural defect.	Replace defective parts.
Loosened horn, hinge, or hinge pin.	Safety wire broken or missing.	Tighten and safety loose parts.
	Rivets pulled.	Replace rivets.
Excessive vibration of surface.	Internal structural defect.	Replace assembly and send to depot for repairs.
	Attaching parts loosened.	Tighten and safety attaching parts.
	Faulty controls.	See paragraph 15, this section.

c. REMOVAL.

(1) REMOVAL OF ELEVATOR TRIM TAB. (See figure 38.)

(a) Disconnect control arm.

(b) Remove hinge bolt at each hinge bracket.

(c) Remove tab from the elevator.

(2) REMOVAL OF ELEVATOR. (See figure 39.)

(a) Remove triangular access door cover (L) at the elevator inboard end.

(b) Remove elevator torque tube bolts through the triangular access door (L).

(c) Disconnect the tab control arm. (See figure 38.)

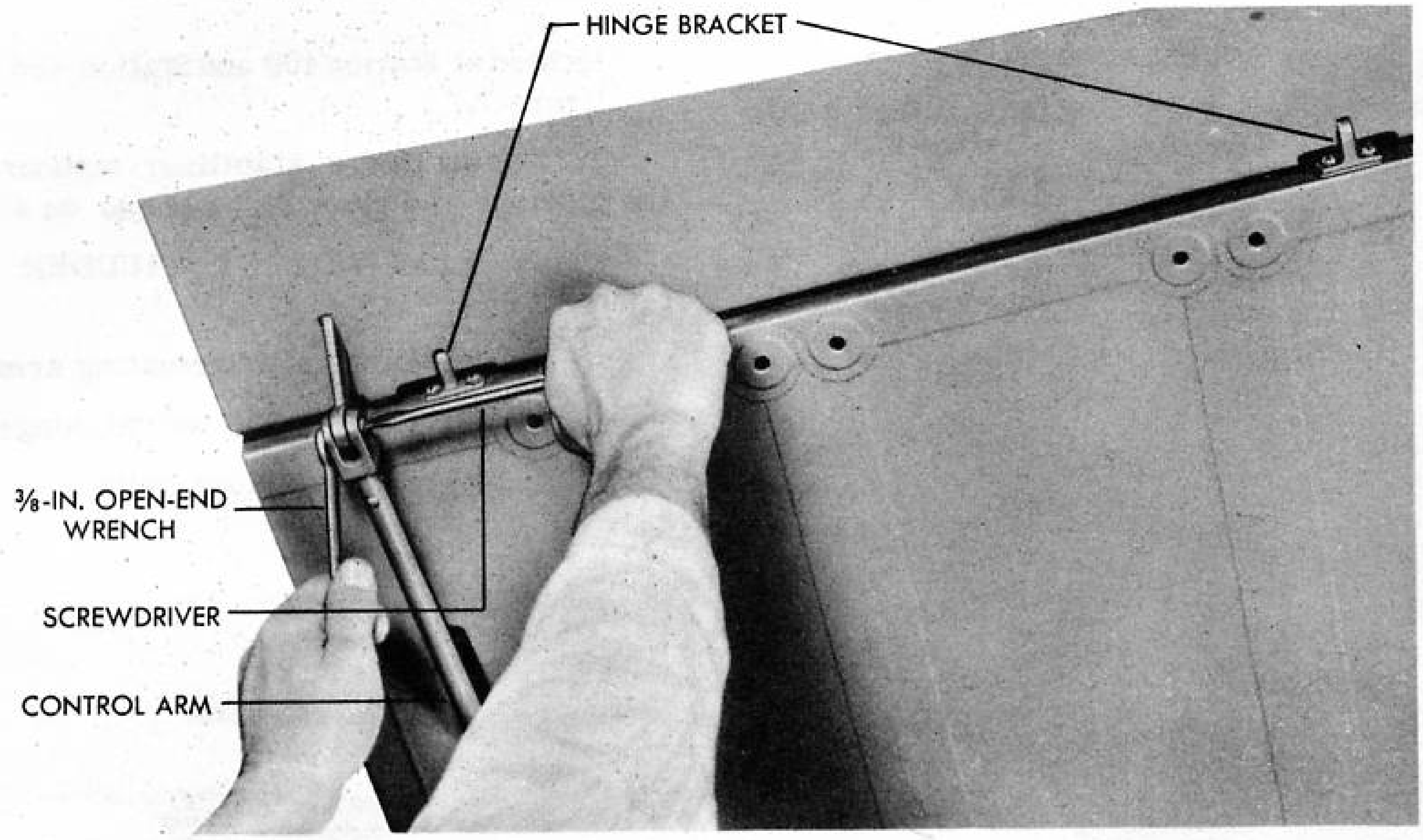


Figure 38 - REMOVING ELEVATOR TRIM TAB

(d) Remove outboard access door (H).

(e) Remove outboard hinge attaching bolts through outboard access door (H).

(f) Remove inboard access door (H).

(g) Remove inboard hinge attaching bolt through inboard access door (H).

(h) Move elevator down away from hinge and out from elevator torque tube in a horizontal position.

(3) REMOVAL OF HORIZONTAL STABILIZER. (See figure 40.)

(a) Remove elevator.

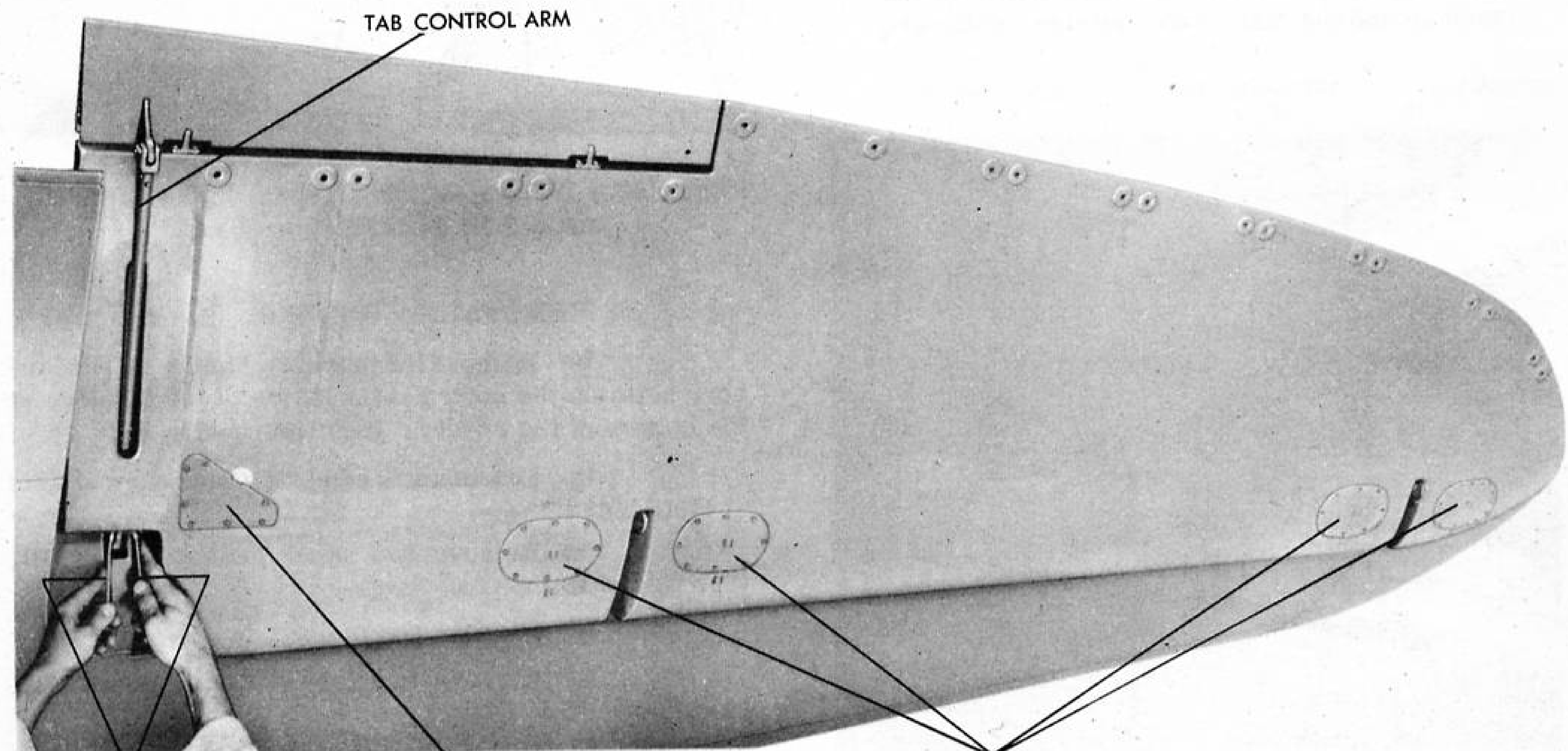


Figure 39 - REMOVING ELEVATOR

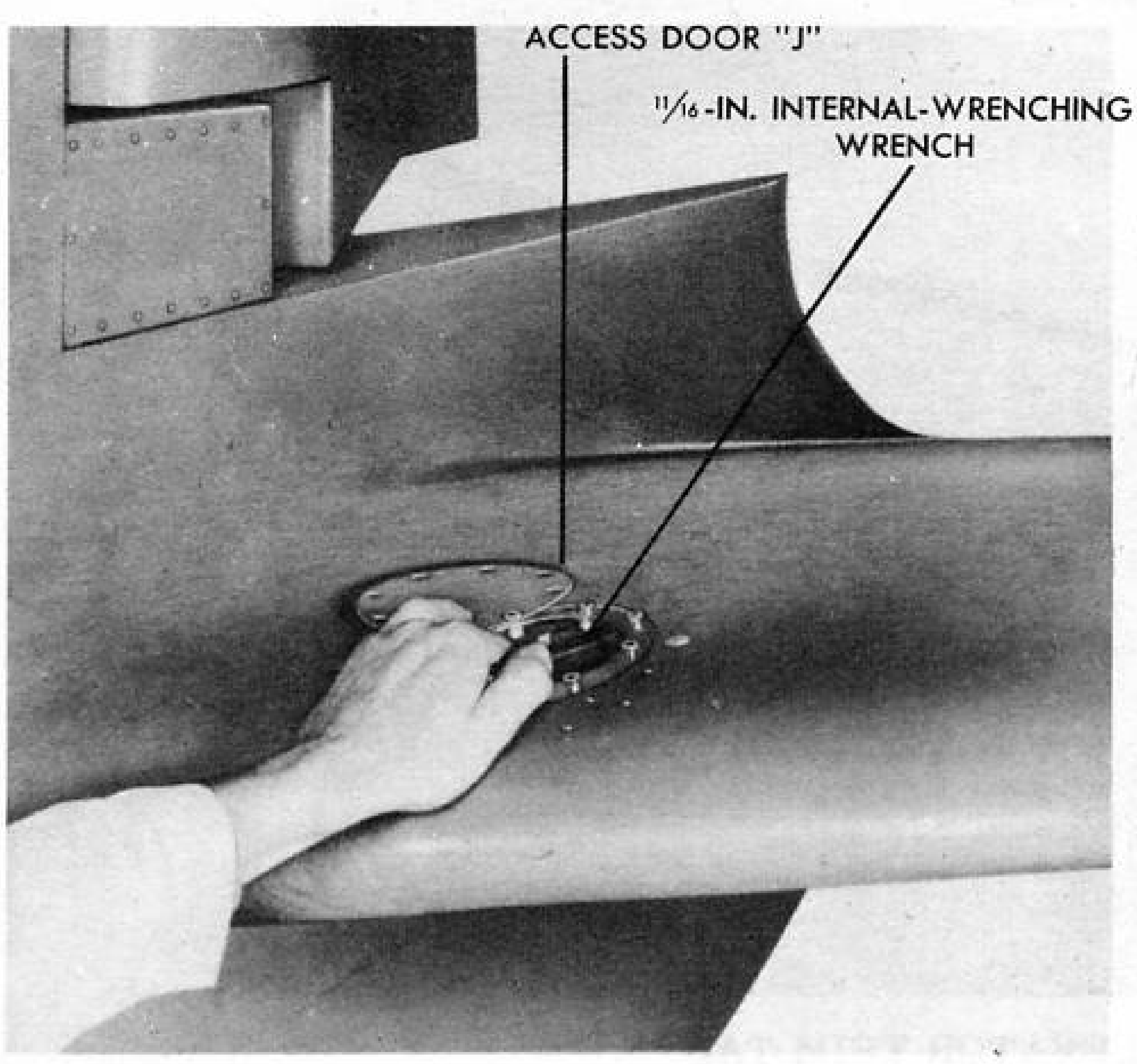


Figure 40 - REMOVING HORIZONTAL STABILIZER

(b) Remove access door (J) at leading edge of the horizontal stabilizer.

(c) Remove the two leading edge internal wrenching bolts and the two trailing edge internal wrenching bolts.

NOTE

This operation requires one man inside of the fuselage and one man on the outside. Bolts are located at Station 409 and Station 436 rear. (See figure 7.)

(d) Move stabilizer outboard away from the fuselage and place in a rack or on a padded bench.

(4) REMOVAL OF RUDDER TAB. (See figure 41.)

(a) Disconnect actuating arm.

(b) Remove the two tab hinge strips.

(c) Remove hinge bolts.

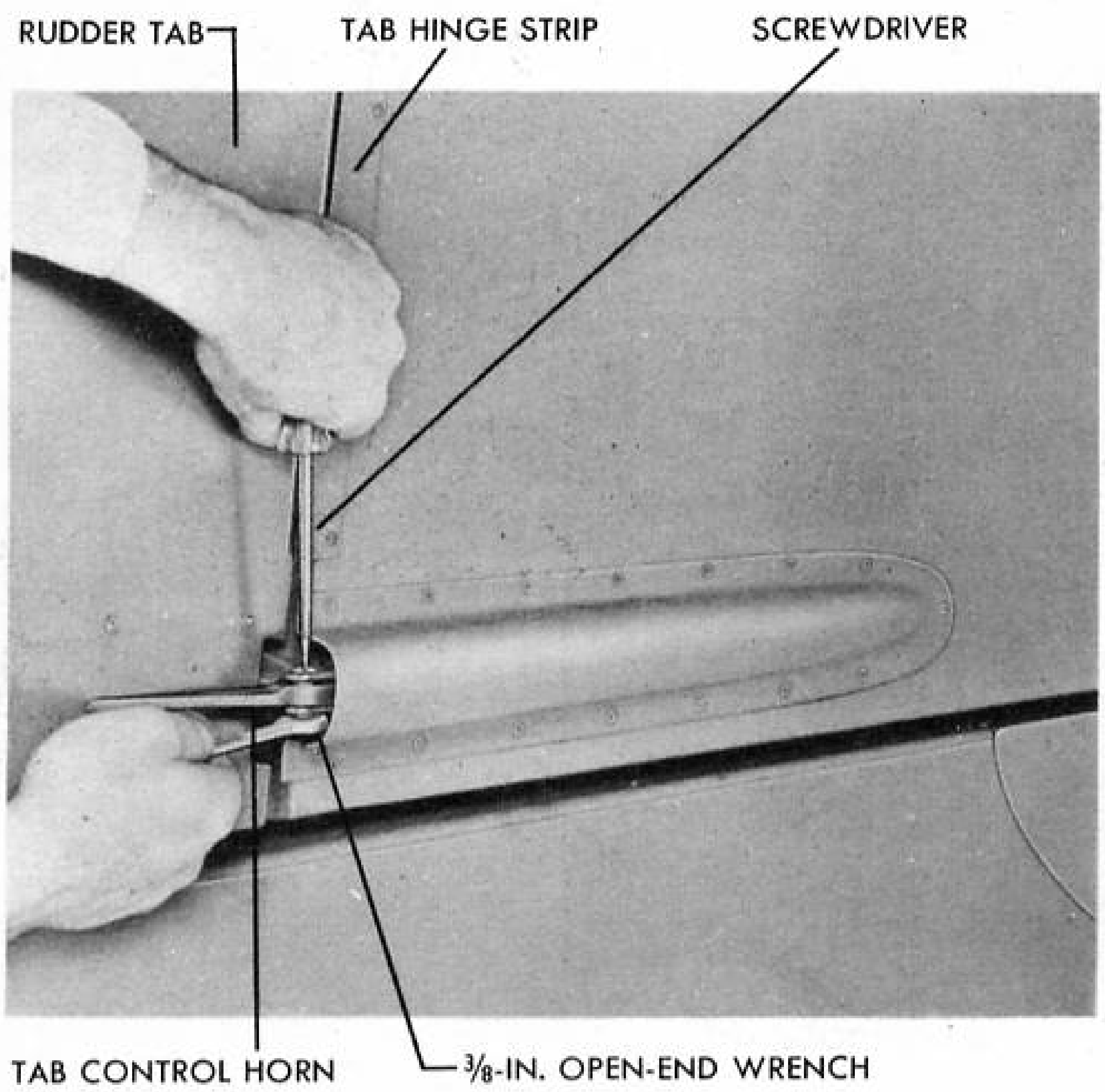


Figure 41 - REMOVING RUDDER TAB

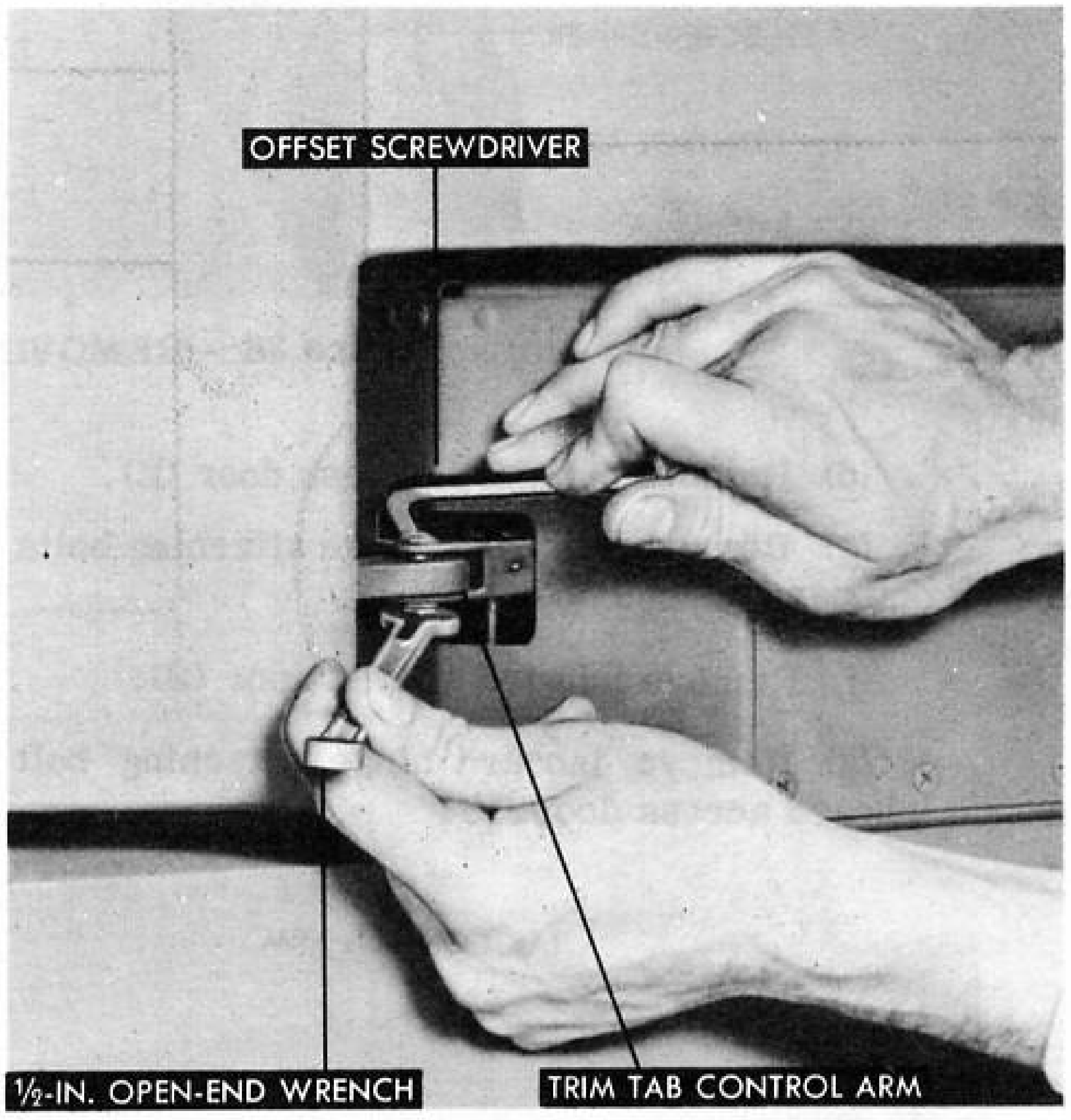


Figure 42 - DISCONNECTING TRIM TAB CONTROL ARM FOR RUDDER REMOVAL

(5) REMOVAL OF RUDDER. (See figure 42.)

(a) Remove the four attachment-to-rudder-horn bolts on the control arm inside of the fuselage at the bottom of the rudder. (See figure 47.)

(b) Disconnect rudder trim tab control arm at Station 436.

(c) Remove two upper access doors (M). (See figure 18.)

(d) Remove upper hinge bolt.

(e) Remove two lower access doors (M). (See figure 18.)

(f) Remove lower hinge bolt.

(g) Lift rudder out and up at a 10-degree angle to either the right or left in order that the collar of the torque tube will clear the opening in the fuselage.

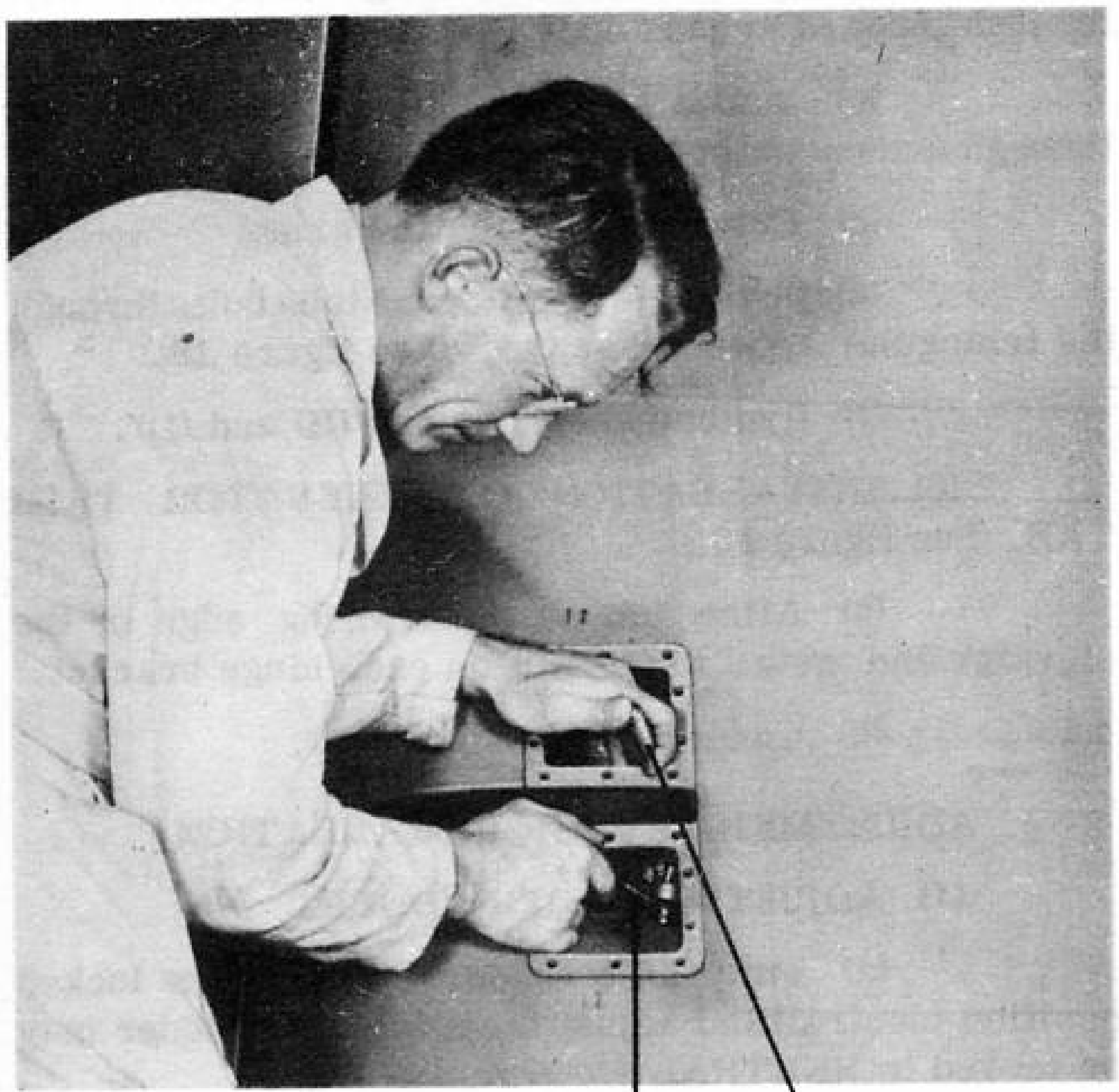


Figure 43 - REMOVING RUDDER LOWER HINGE BOLT

(h) Place rudder in a rack or on a padded bench.

(6) REMOVAL OF VERTICAL STABILIZER. (See figure 44.)

(a) Remove rudder.

(b) Remove trim tab drum covers at Station 425 held in place by screws. (See figure 7.)

(c) Disconnect pitot lines at Station 400. (See figure 7.)

(d) Disconnect electrical connection at junction box Station 380. (See figure 7.)

(e) Remove the access door cover (F) (figure 18) on each side of the stabilizer, front.

(f) Remove the access door cover (F) (figure 18) on each side of the stabilizer, rear.

(g) With one man inside of the fuselage and one man outside, remove the two bolts at the front of the vertical stabilizer and the two bolts at the rear of the vertical stabilizer.

(h) Lift stabilizer straight up and away from the fuselage to clear the pitot static tubes located at the base of the stabilizer. Place in rack or stand on leading edge.

d. INSTALLATION.

(1) INSTALLATION OF VERTICAL STABILIZER. (See figure 44.)

(a) Place stabilizer in position on the fuselage.

(b) With one man inside of the fuselage and one man outside, install two attaching bolts at rear of stabilizer through rear access doors (f). (See figure 18.)

(c) Install the two attaching bolts at the front of the stabilizer through front access doors (F). (See figure 18.)

(d) Install front and rear access door covers (F) (figure 18) on right and left sides of stabilizer.

(e) Connect electrical connections at junction box at Station 380. (See figure 7.)

(f) Connect pitot plugs at Station 400. (See figure 7.)

(g) Install trim tab drum cover held in place by screws at Station 425. (See figure 7.)

(h) Install rudder.

(2) INSTALLATION OF RUDDER. (See figure 47.)

(a) Insert rudder control shaft and aline hinges.

(b) Install lower hinge bolt.

(c) Install upper hinge bolt.

(d) Install the four attachment-to-rudder-horn bolts on the control arm inside of the fuselage, at the bottom of the rudder.

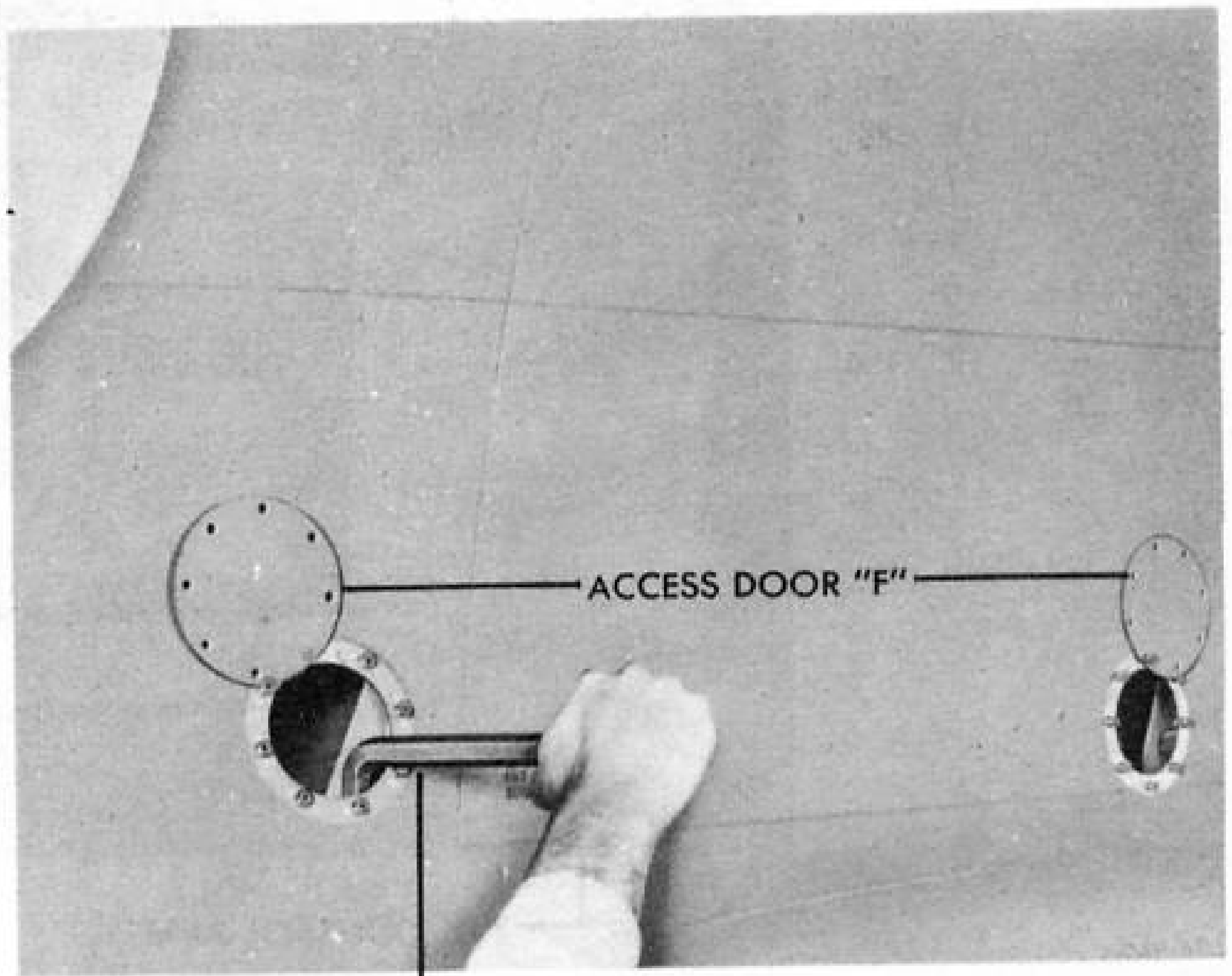


Figure 44 - REMOVING VERTICAL STABILIZER

(e) Connect trim tab control arm.

(f) Install two lower access doors (M). (See figure 18.)

(g) Install two upper access doors (M). (See figure 18.)

(3) INSTALLATION OF RUDDER TAB. (See figure 41.)

(a) Install upper hinge bolt.

(b) Install lower hinge bolt.

(c) Connect actuating arm.

(d) Install the two tab hinge strips on trailing edge of rudder.

(4) INSTALLATION OF HORIZONTAL STABILIZER. (See figure 40.)

(a) Move stabilizer into position.

(b) Install internal wrenching bolts at Station 409 and Station 436. (See figure 7.) Two men (one inside fuselage and one outside) are required to perform this operation.

(c) Install elevators.

(d) Install access doors.

(5) INSTALLATION OF ELEVATOR. (See figure 39.)

(a) Aline elevator hinges.

(b) Install inboard hinge attaching bolt through inboard access door (H). (See figure 18.)

(c) Install outboard hinge attaching bolt through access outboard door (H). (See figure 18.)

(d) Connect tab actuating arm.

(e) Install elevator torque tube bolts through the triangular access door (L). (See figure 18.)

(f) Replace access doors (H) and (L).

(6) INSTALLATION OF ELEVATOR TRIM TAB. (See figure 38.)

(a) Aline tab on the trailing edge of the elevator and install hinge bolt on each hinge bracket.

(b) Connect tab control arm.

e. ADJUSTMENT AFTER INSTALLATION.

(1) ADJUSTMENT OF RUDDER.

(a) Put pilot's rudder pedals in the locked position (neutral) and adjust turnbuckle so rudder may be moved to NEUTRAL.

(b) Adjust stops for pilot's rudder pedal torque tube horns, accessible through a cover plate on the side of the fuselage for rudder movement of 22-1/2 degrees to the right and left, or a distance of 19-1/2 - 7/8 inch measured from the lower corner of the rudder tab trailing edge (tab in neutral) to the empennage stub rudder fairing.

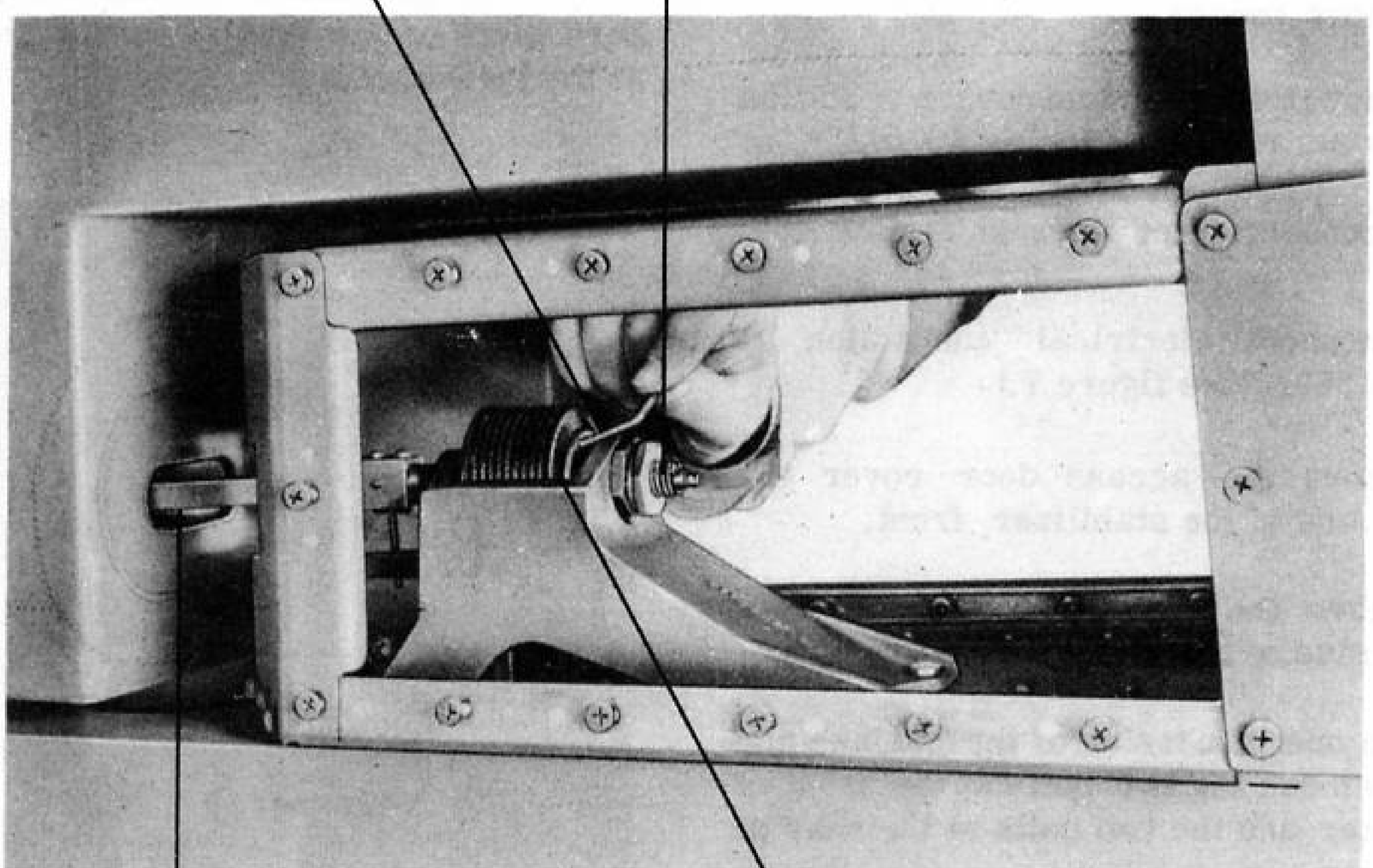
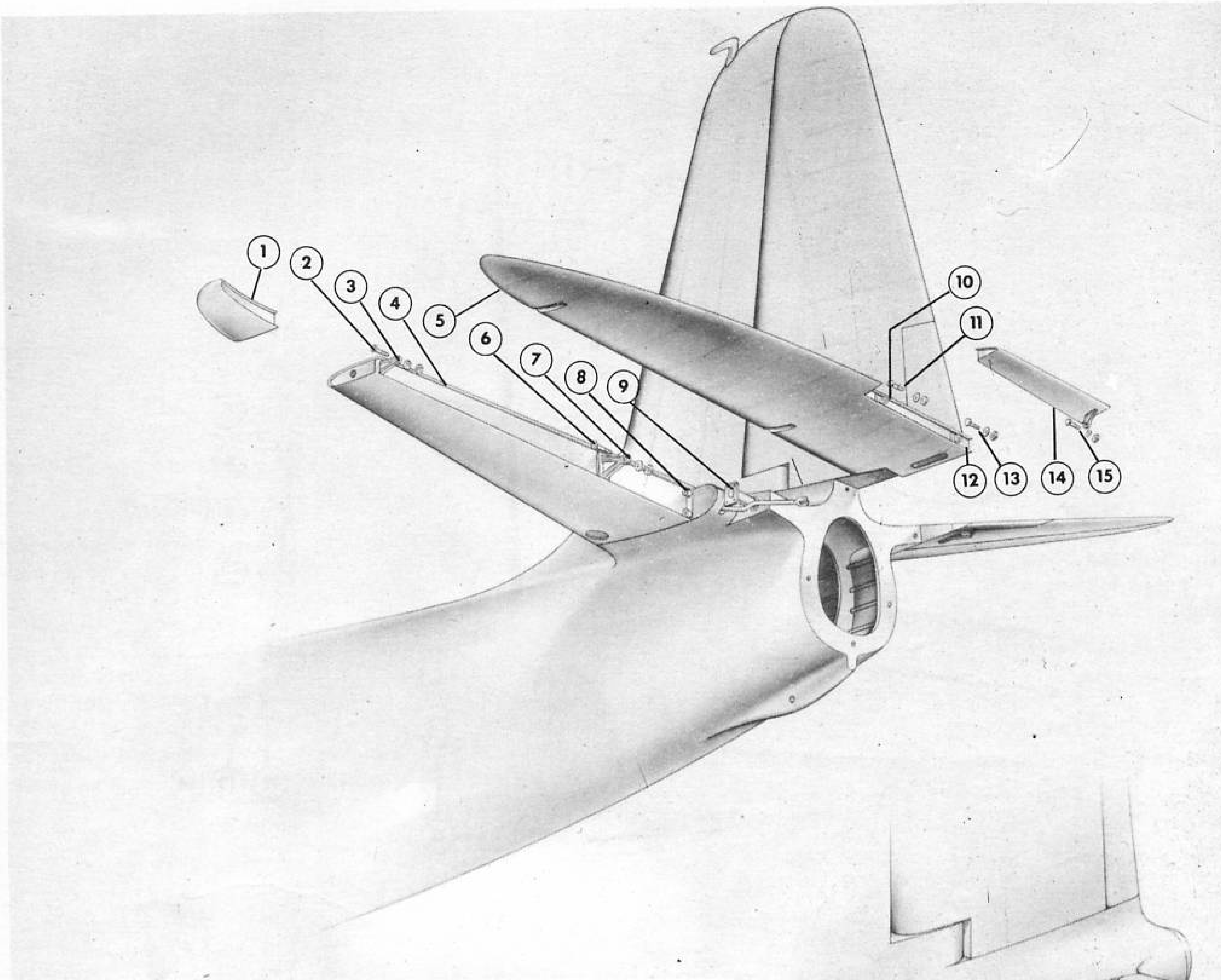
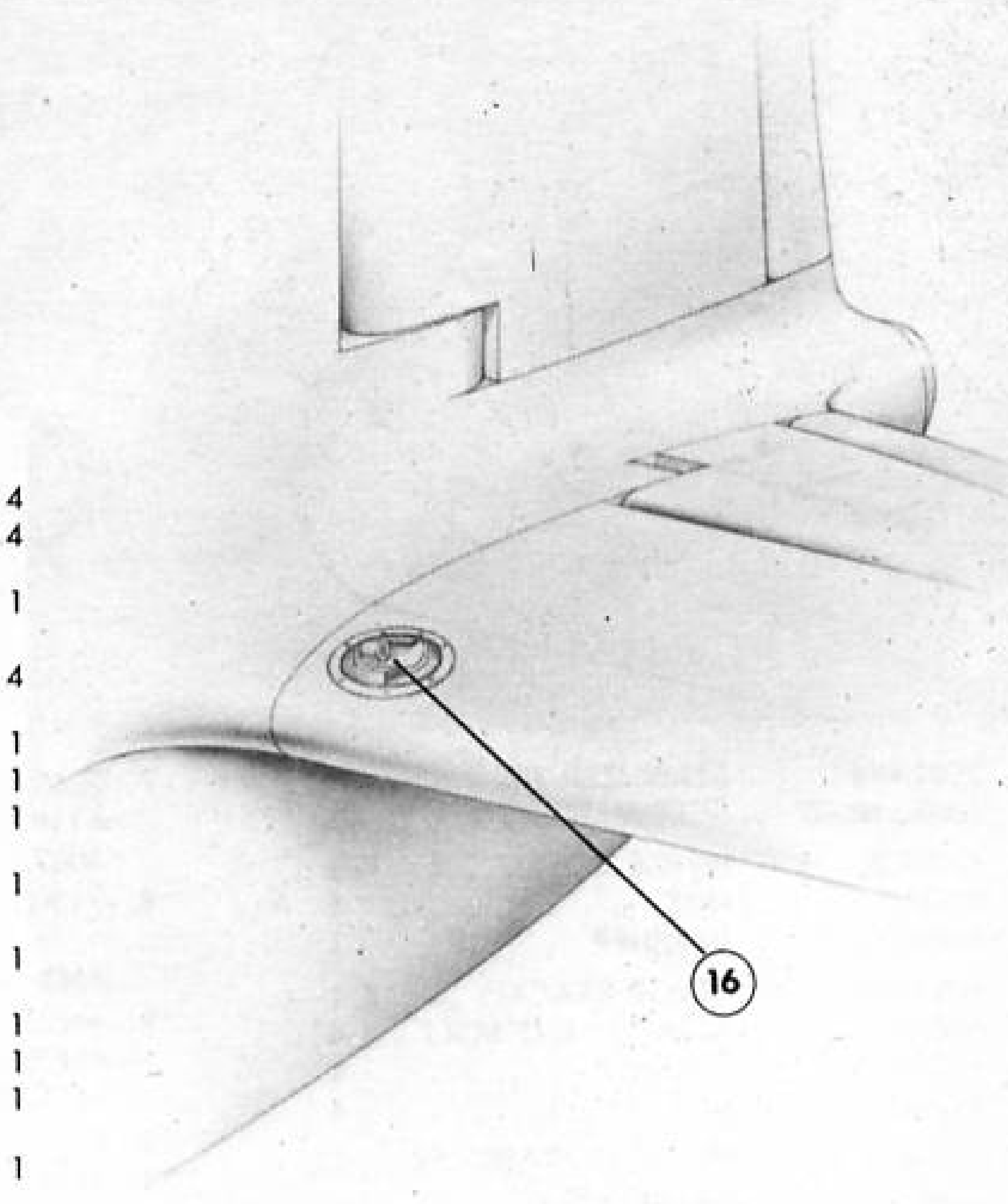


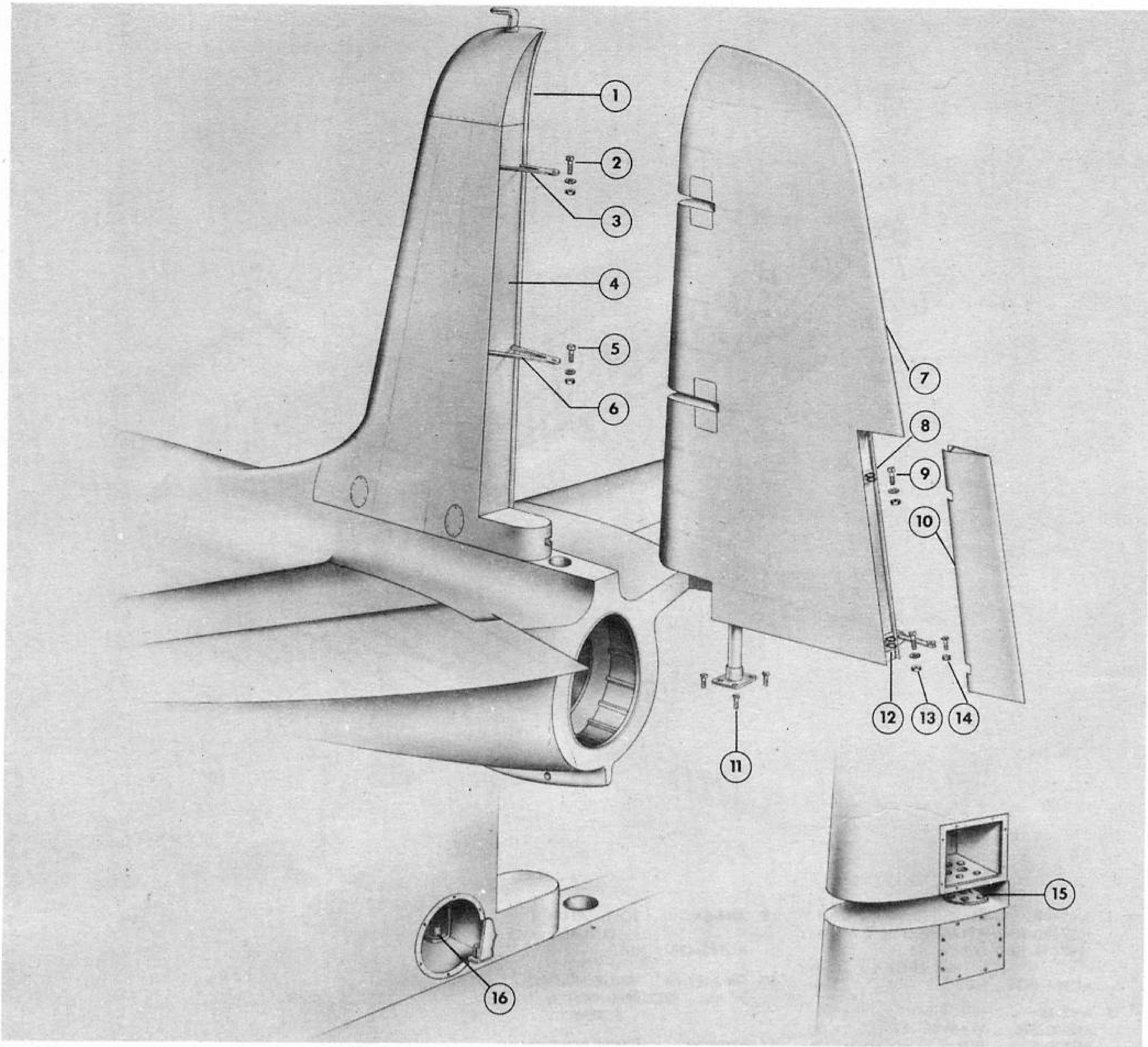
Figure 45 - ADJUSTING RUDDER TAB





1.	5062438	STABILIZER TIP	1
	1087510-10-8	ATTACHING SCREW	16
	1087510-10-7	SCREW AT TRAIL EDGE	4
	AC364-1032	NUT	4
2.	AN5-15	HINGE BOLT	1
	AN960-516	WASHER	1
	AN310-5	NUT	1
3.	4057794	HINGE BRACKET	1
	132100-5-10A	ATTACHMENT BOLT	8
	AC365-524	NUT	8
4.	5090810	STABILIZER (INCLUDES ITEM 1)	1
5.	5062449	ELEVATOR (INCLUDES ITEM 10)	1
6.	AN5-15	HINGE BOLT	1
	AN960-516	WASHER	1
	AN310-5	NUT	1
7.	4057795	HINGE BRACKET	1
	132100-5-10A	ATTACHMENT BOLT	8
	AC365-524	NUT	8
8.	2076909-27	ATTACHMENT BOLT	2
	1075888-9	WASHER	2
	2032517-918	NUT	2
9.	AN4-6A	BOLT—ATTACH TO TUBE	4
	AC365-428	NUT	4
10.	5062449-70	HINGE BRACKET	1
	⅝" LG.—1032	REED PRINCE SCREW	4
11.	AN23-12	HINGE BOLT	1
	AN960-10	WASHER	1
	AN320-3	NUT	1
12.	5062449-70	HINGE BRACKET	1
	⅝" LG.—1032	REED PRINCE SCREW	1
13.	AN23-12	HINGE BOLT	1
	AN960-10	WASHER	1
	AN320-3	NUT	1
14.	5062450 & -1	L.H. AND R.H. TAB	1
15.	AN23-12	BOLT	1
	AN960-10	WASHER	1
	AN320-3	NUT	1
16.	2076908-26	ATTACHMENT BOLT	2
	1075888-8	WASHER	2
	2032517-820	NUT	2

Figure 46 - HORIZONTAL TAIL INSTALLATION



1.	5062444	STABILIZER TIP	1
	1087510-10	SCREW	42
2.	AN5-16	HINGE BOLT	1
	AN310-5	NUT	1
	AN960-516	WASHER	1
3.	4061724	HINGE BRACKET	1
	AN5-7A	ATTACHMENT BOLT	4
	AN960-516	WASHER	4
	AC365-524	NUT	4
4.	5090812	VERTICAL STABILIZER	1
5.	AN5-16	HINGE BOLT	1
	AN960-516	WASHER	1
	AN310-5	NUT	1
6.	4061725	HINGE BRACKET	1
	132100-5-17A	ATTACHMENT BOLT	4
	AN960-516	WASHER	4
	AC365-524	NUT	4
7.	5062452	RUDDER ASSEMBLY	1
	4114249	FAIRING	1
	1087510-8-7	SCREW	15
8.	2130238	UPPER HINGE BRACKET	1
	AN3-5A	BOLT	4
9.	AN24-17	HINGE BOLT	1
	AN960-416	WASHER	1
	AN320-4	NUT	1
10.	5114526	TRIM TAB ASSEMBLY	1
11.	AN4-12A	BOLTS—ATTACHMENT TO RUDDER HORN	4
	AN960-416	WASHER	4
	AC365-428	NUT	4
12.	2130239	LOWER HINGE BRACKET	1
	AN3-5A	ATTACHMENT BOLT	2
	AN4-6A	ATTACHMENT BOLT	1
13.	AN24-17	HINGE BOLT	1
	AN960-416	WASHER	1
	AN320-4	NUT	1
14.	AN24-17	ACTUATING ROD ATTACHMENT BOLT	1
	AN960-416	WASHER	1
	AN320-4	NUT	1
15.	1067651	HINGE BOLT MOUNT	4
	AN3-4A	ATTACHMENT BOLT	20
	AC365-1032	NUT	20
16.	2076909-27	REAR ATTACHMENT BOLT	2
	1075888-9	WASHER	2
	2032517-918	NUT	2
	2076909-30	FORWARD ATTACHMENT BOLT	2
	1075888-9	WASHER	2
	2032517-918	NUT	2

Figure 47 - VERTICAL TAIL INSTALLATION

(c) Adjust rubber bumpers in tail section so that they just touch horns with pedals depressed to limits.

(d) Adjust all turnbuckles to tension indicated on cable rigging tension chart, Section 8, this handbook.

(e) Safety all turnbuckles.

(2) ADJUSTMENT OF RUDDER TAB. (See figure 45.)

(a) Disconnect tab control arm. With tab indicator in the cockpit at ZERO, the cables should come off center of drum at surface. If they do, no adjustment is needed; otherwise, proceed with following steps:

1 Loosen jam nut on tab control center shaft.

2 Cut safety wire from adjustment nut and loosen nut until 1/4-inch play is obtained.

3 Slide threaded washer free of dowel pins at the opposite end of the center control shaft. Turn the threaded washer right or left until cables come off drum at center with indicator at ZERO.

4 Tighten adjusting nut until play does not exceed 1/32 inch.

5 Tighten and safety jam nut on tab control center shaft and connect tab control arm.

6 Check for proper throw in inches which should be 1-3/4 inches - 1/4 inch to right and left of center.

(3) ADJUSTMENT OF ELEVATOR.

(a) Be sure all elevator control cables are properly seated in the grooves of the pulleys and that no slack is present in the cables.

(b) Adjust the stops at the torque horns to allow the elevators to move UP, 14-1/8 inches ± 5/16 inch; and DOWN, 9-7/16 inches ± 5/16 inch, measured at root.

(4) ADJUSTMENT OF ELEVATOR TRIM TAB. (See figure 45.)

(a) To check for proper travel, first disconnect tab control arm. Tab indicator in cockpit should be at zero, and cables should come off center of drum at surface.

(b) Loosen the jam nut on tab control center shaft.

(c) Cut the safety wire off the adjustment nut.

(d) Loosen adjusting nut until 1/4-inch play is obtained.

(e) Slide threaded washer free of the dowel pins on the tab drums at the opposite end of the center control shaft. If the tab is down from neutral flight position, lengthen the shaft to the desired position at neutral by turning threaded washer counterclockwise looking aft. Shorten the shaft, if the tab is in UP position from neutral to the desired position at neutral by turning clockwise looking aft.

(f) Tighten the adjusting nut to eliminate end play. Play must not exceed 1/32 inch.

(g) Tighten locking nut. Safety the adjusting nut.

(h) Reinstall the tab control arm.

(i) Check for proper throw in inches which should be 3/4 inch ± 5/32 inch UP, and 1-11/32 inch ± 5/32 inch DOWN. If throw is not within these limits, repeat steps (e) through (i).

4. FUSELAGE.

a. DESCRIPTION.

(1) GENERAL. (See figure 48.) - The fuselage is an all-metal semi-monocoque structure made up of formed alclad sheet frames, extruded aluminum alloy longitudinals, and an alclad covering. It has five divisions: attack nose, pilot's cockpit, bomb bay, gunners' compartment, and tail compartment. The skin is attached to the frames and longitudinals with rivets.

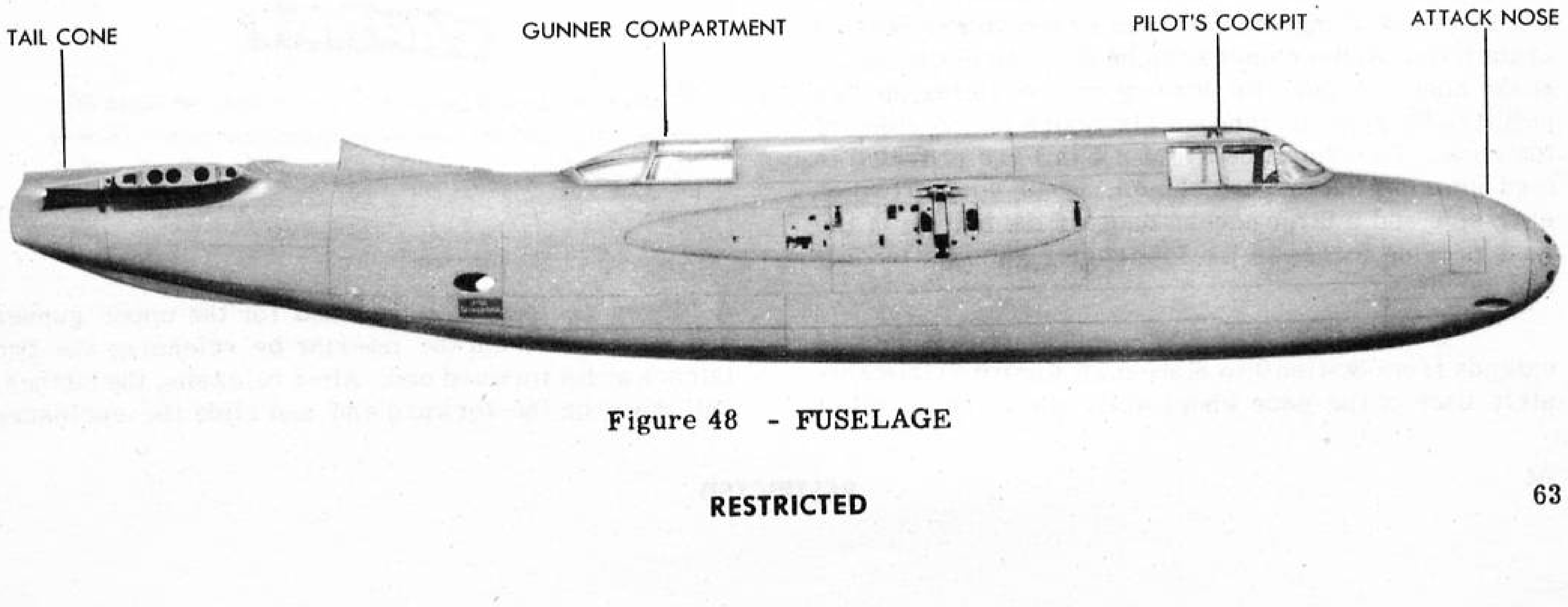
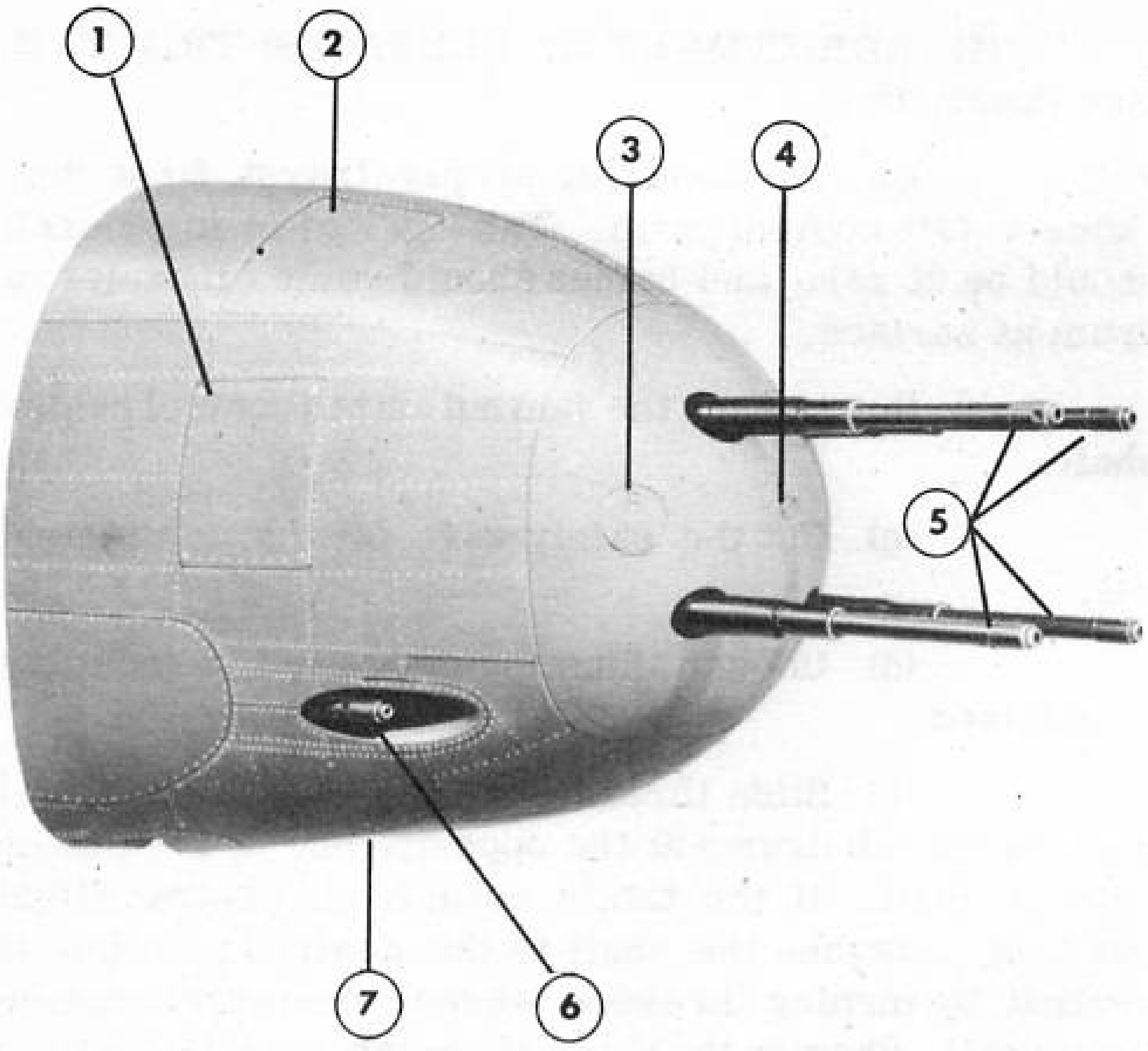


Figure 48 - FUSELAGE



1. LOWER ACCESS DOOR R.H.
2. UPPER ACCESS DOOR R.H.
3. ATTACK NOSE TIP ACCESS DOOR
4. GUN CAMERA DOOR
5. 20-MM CANNON
6. .50 CALIBER GUN
7. LOWER ACCESS DOOR

Figure 49 - ATTACK NOSE

Lap joints are used, with the vertical laps either joggled to make a smooth contour or beveled along the edge of the outer sheet. The enclosures are composed of formed aluminum alloy extrusions, which support panels of Plexiglas and shatterproof glass. Access doors and cover plates are located throughout the fuselage for inspection and maintenance, as shown in figure 18. Frames and bulkheads are located by measuring in inches from the zero datum line which is the front face of the frame to which the nose section is attached. (See figure 7.) Points aft of the datum line are referred to with positive dimensions, and those forward with negative dimensions.

(2) ATTACK NOSE. (See figure 49.) - The attack nose section (figure 49) forms the compartment for the forward armament of the airplane and attaches to the fuselage with ten internal-wrenching bolts at Station 0. (See figure 7.) Six fixed forward-firing guns are mounted in the attack nose. Ammunition boxes are installed alongside each gun in the center portion of the nose. A gun camera can be mounted in the center of the nose. Access for loading and servicing the two caliber .50 guns is through six doors in the sides of the nose. Two small doors (4 x 4 in.) are provided to feed ammunition through chutes. Four doors, two on each side and a large access door on the bottom of the nose provide access to the four center guns for loading and servicing.

(3) PILOT'S COCKPIT. - The pilot's cockpit extends from Station 0 to Station 56 (figure 7) immediately back of the nose wheel well, and contains all of the equipment necessary for normal and emergency operation of the airplane. Entrance must be made through the upper hatch which extends from Station 37 to Station 130 (figure 7) and has its outside latch handle located in the left rear corner. Steps and handholes are provided in the side of the fuselage just aft of the left wing trailing edge for access to the wing walkway and the pilot's cockpit. The lower (retractable) step may be extended by pushing the release button located just above the wing trailing edge in the side of the fuselage. The step must be retracted by pushing it into the fuselage from the outside or pulling it up from within the gunners' compartment. To close the hatch from the interior, the knee of the rear brace must be broken by pulling down on the handle located above the pilot's head on the center line of the hatch. The interior latch control handle is installed to the left of the rear brace control handle. The hatch is also used as the emergency exit for the pilot. To release, pull forward on the handle located at the rear of the transparent section. Pulling this handle removes the hinge pins from the right side and disconnects the latches on the left. Push the hatch clear of the airplane and the air stream will carry it away.

30 (4) BOMB BAY. - The bomb bay is in two sections, fore and aft, and extends from Station 75 to Station 229. (See figure 7.) Doors which extend the full length of the bay are hinged at the sides of the fuselage and are hydraulically actuated. The lower portion of each section of the bomb bay is equipped with supports for two bomb racks. The oxygen system is installed in the upper portion of the forward bomb bay, and the radio equipment is installed in the upper portion of the rear bomb bay. The truss along the top of this section extends from the pilot's to the gunners' compartment, and supports the heating and ventilating unit.

(5) GUNNERS' COMPARTMENT. - The gunners' compartment extends from Station 229 to Station 372 (figure 7) with the entrance door located in the bottom of the fuselage at the rear of the compartment. The latch lever in the center of the door is used during normal entrance and exit. A crank mechanism at the right side of the compartment may be used to open the door from the interior and hold it in open position.

CAUTION

Before the door is opened by the crank, be sure the latch lever at the center of the door is raised. Raising the latch lever "breaks" the knee in the actuating linkage to prevent bending the linkage when the crank is operated.

A hinged enclosure is provided for the upper gunner and is opened from the interior by releasing the two latches at its forward end. After releasing the latches, pull down on the forward end and slide the enclosure forward until it engages the catches which hold it in stowed position. The enclosure can be opened from the exterior only if the upper right latch has been disengaged from within the compartment. To open the enclosure from the exterior, tear through the fabric patch which covers the access hole of the upper left latch. Release the latch, push down on the forward end of the enclosure and slide the section forward. When the sliding enclosure and the lower entrance door are used as emergency exits, they are operated in the same manner as for normal entrance and exit. A gun tunnel equipped with doors is located just aft of the hinged enclosure and encloses the barrels of the guns when they are in the stowed position. For removing or stowing the guns, the doors are operated by a crank mounted on the left side of the compartment near the floor. The truck on which the upper guns are mounted rolls on a semicircular track bolted to the fuselage. Provision is made for mounting five box-type ammunition magazines on each side of the compartment to supply the upper guns. The lower gun is mounted just forward of the entrance door on a transverse arm which hinges upward and to the left for stowage. Provision is made on the left side of the compartment for mounting five drum-type ammunition magazines to supply the lower gun.

(6) TAIL CONE. - The tail cone (figure 54) is attached to the fuselage at Station 454 (figure 7) by six 3/8-inch internal-wrenching bolts. A formation signal light is installed in the tip of the cone and is enclosed by a cover of molded Plexiglas. Weight of the cone is 27 pounds.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Presence of corrosion.	Protective coating damaged.	Clean corroded part and cover with suitable protective coating such as paint, oil, etc.
	Battery fumes attacking metal parts.	Inspect and repair battery ventilating system. Service battery sump.
	Cracked battery case allows acid to drop onto metal parts.	Replace battery. Remove corrosion and apply suitable protective coating, such as paint or lubricant.
Distorted or ruptured skin. Excessive vibration.	Structural failure due to accident or defect.	Repair or replace bent or broken parts.
	Loose bolts.	Tighten and safety loose bolts.
	Pulled or loosened rivets.	Replace rivets. Replace sheet metal through which rivets have pulled.
Bent structural members, longerons, or braces.	Accident.	Replace damaged parts.

c. REMOVAL.

(1) REMOVAL OF ATTACK NOSE.

(a) Open the access doors (figure 18) on the right and left sides. These doors are held in closed position by a spring loaded lock. By pushing on the side marked PUSH, the lock springs open and the access door may be swung open.

(b) Remove the attack nose tip which is held in place by six winged clip spring fasteners easily reached through access door on side of tip. Slide the tip forward over the gun barrels. (See figure 50.)

(c) Remove armament from attack nose. This permits access to the eight internal wrenching bolts which hold the nose to the fuselage at Station 0. (See figure 7.)

(d) Remove ten internal wrenching bolts from the nose through the access doors and move the nose away from the airplane. Weight of the nose is approximately 400 pounds. About six men are required to handle it manually.

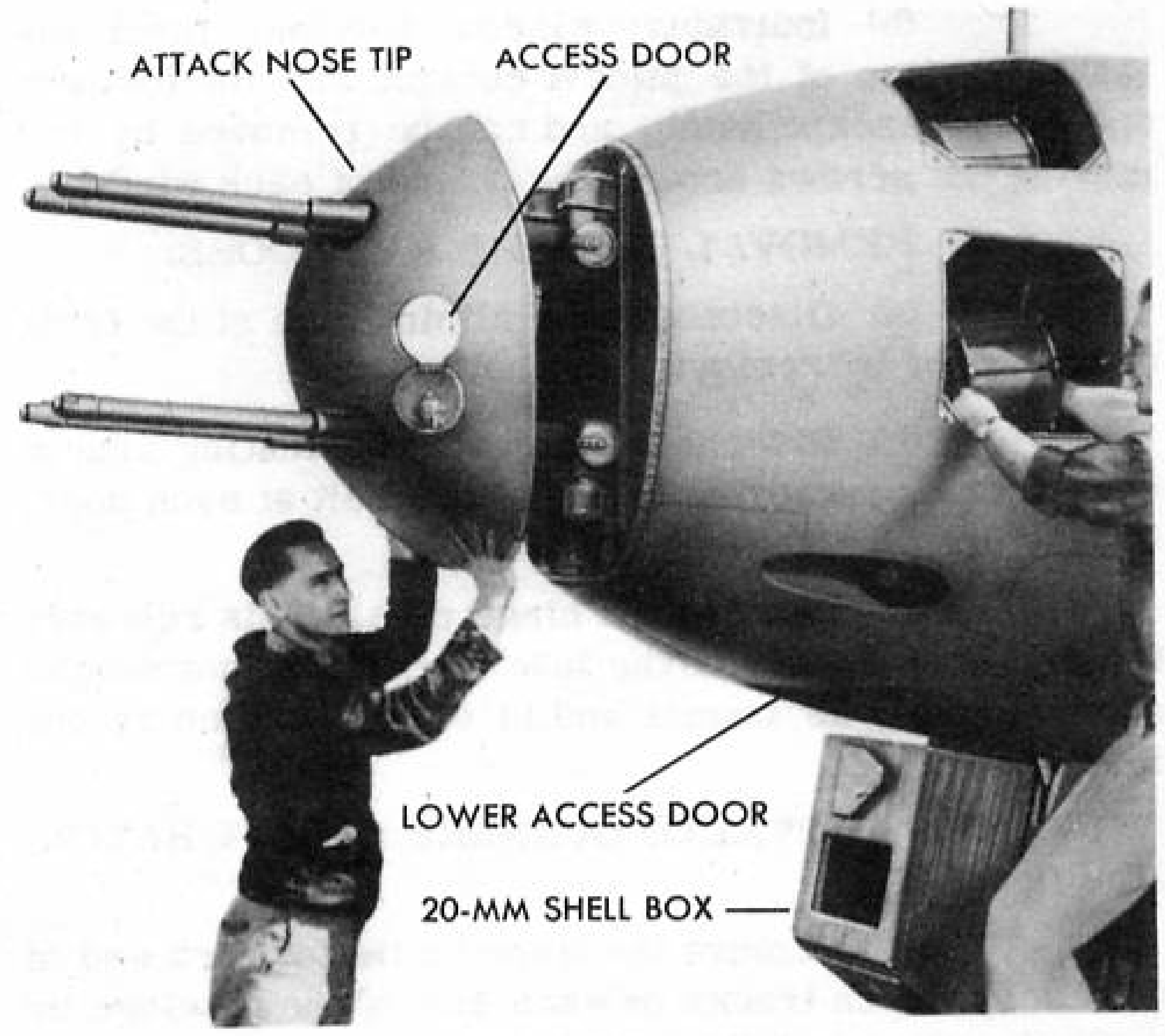


Figure 50 - REMOVING ATTACK NOSE TIP

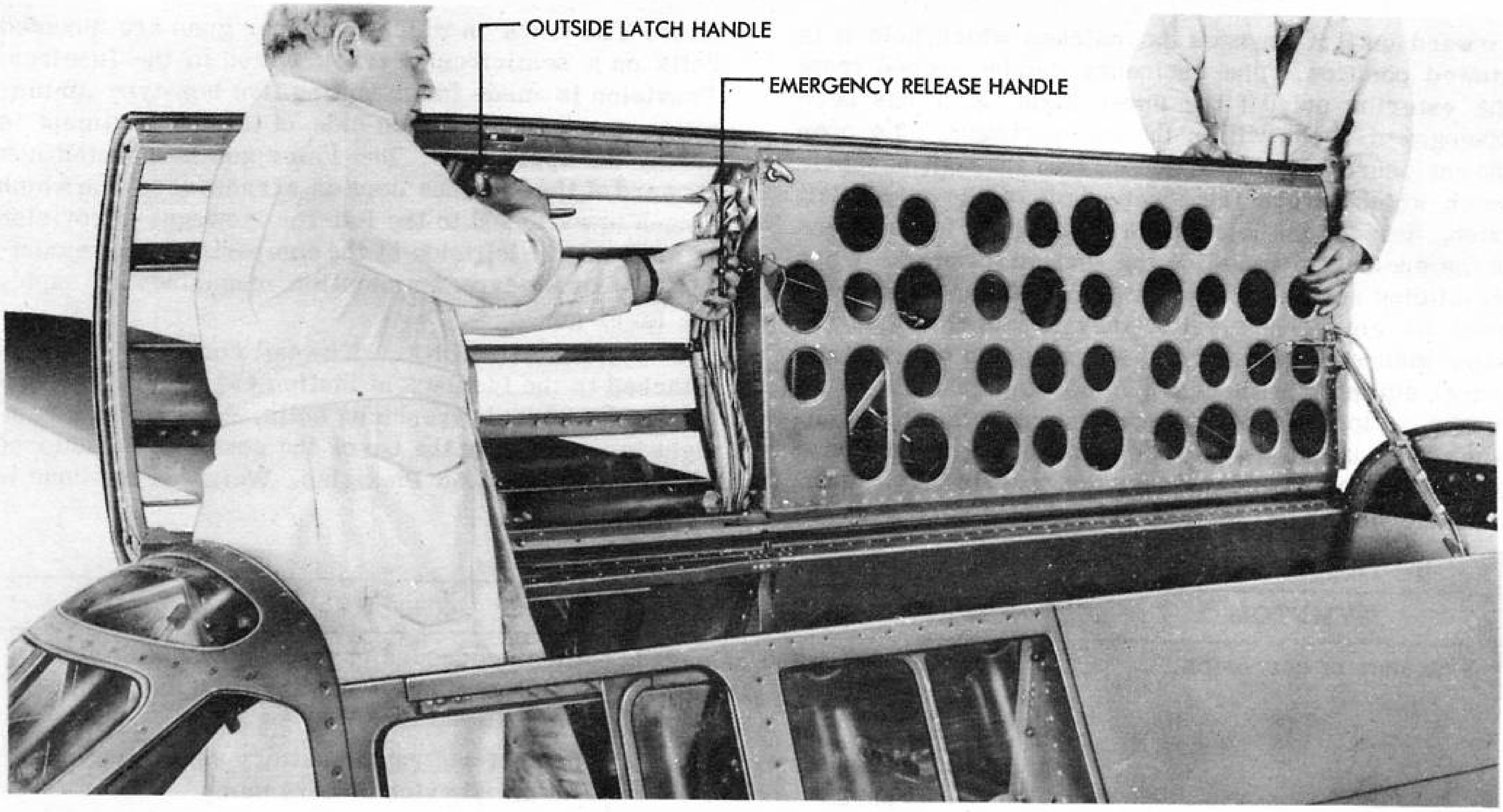


Figure 51 - REMOVING PILOT'S ESCAPE HATCH

(2) REMOVAL OF PILOT'S ESCAPE HATCH. (See figure 51.)

(a) Lift outside latch handle located on the left side of the door. Swing the door upward and to the right. Pull the emergency release handle which is located aft of the transparent panel. This will release the hinge pins, and escape hatch may be removed. Its weight is slightly less than 40 pounds and it can easily be handled by one or two men.

(b) Individual window sections form the vision section of the pilot's cockpit and the forward end of the escape hatch, and can be removed by removing the screws around the frame of each window.

(3) REMOVAL OF BOMB BAY DOORS.

(a) Disconnect the alining arm at the front of each door by removing the bolt.

(b) Disconnect the center actuating arm at each door by removing the 1/4-inch bolt at each door. (See figure 52.)

(c) Remove all hinge pins. This releases the bomb bay door from the fuselage. Each door weighs approximately 23 pounds and is easily handled by one man.

(4) REMOVAL OF GUNNERS' ESCAPE HATCH. (See figure 53.)

(a) Remove the stops on the forward end of the escape hatch tracks on each side of the fuselage by removing the two 3/16-inch bolts from each stop.

(b) Slide the escape hatch forward and remove from the airplane. The hatch weighs a little less than 32 pounds and can be easily handled by one man.

(c) Remove the screws from the three brackets on each side of the fuselage and the screws

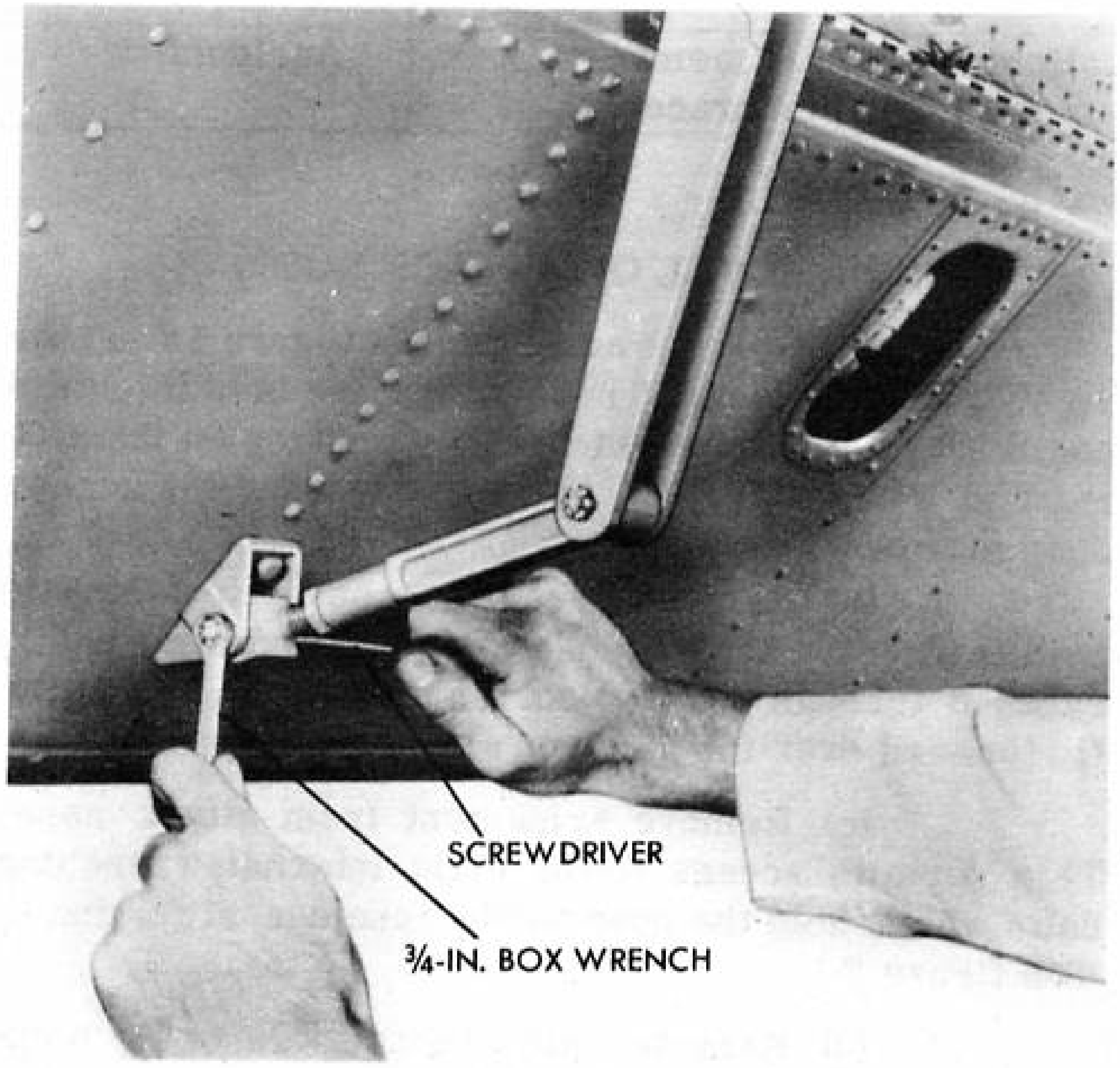


Figure 52 - DISCONNECTING BOMB BAY DOOR ACTUATING ARM

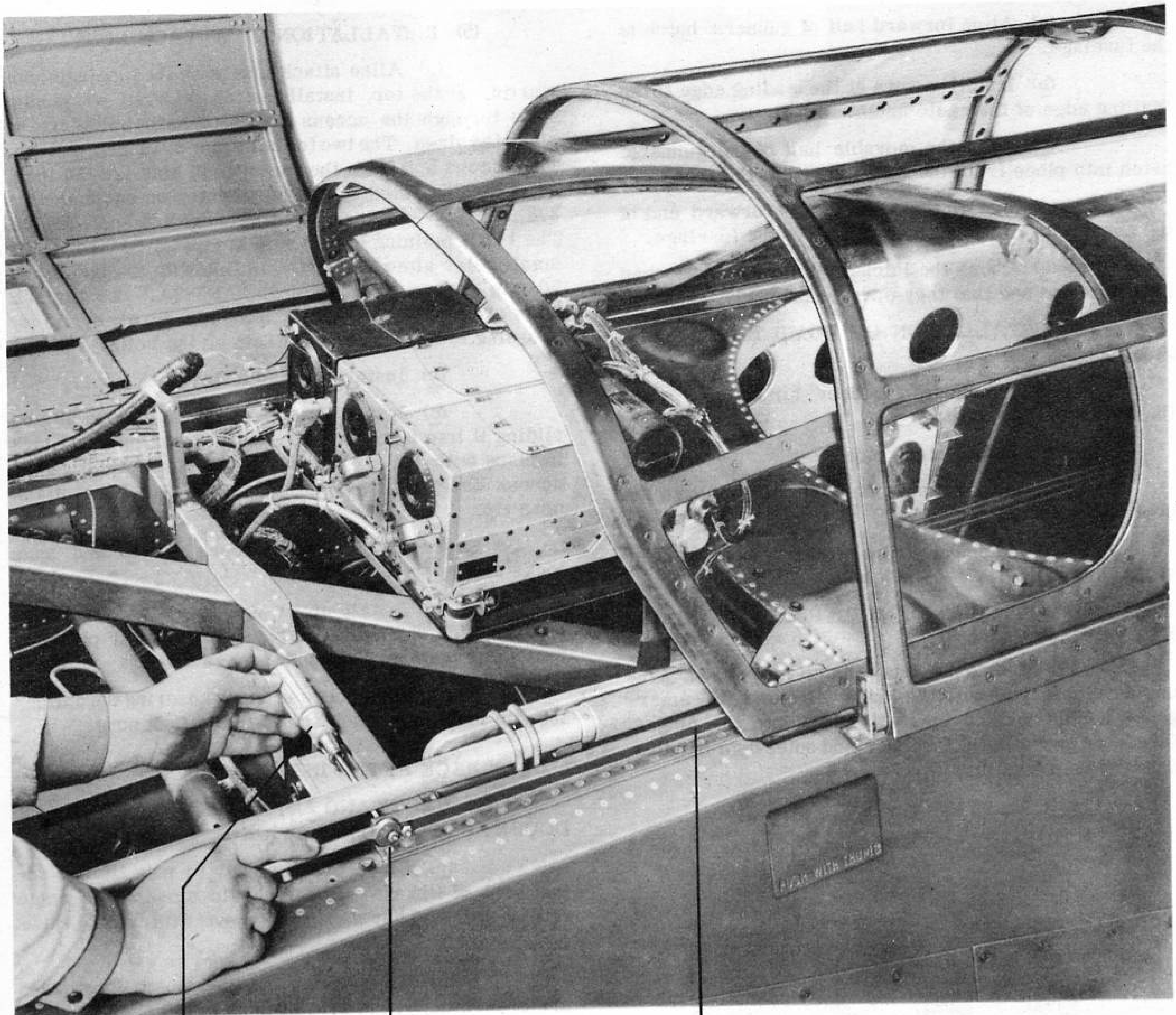


Figure 53 - REMOVING GUNNERS' ESCAPE HATCH

from the leading edge of the gunners' compartment to the trailing edge of the radio hatch. Remove the forward stationary half of the gunners' hatch.

(5) REMOVAL OF TAIL CONE.

(a) Disconnect the formation and running light wires at the junction box just ahead of Station 453-1/2 - inside of the fuselage.

(b) Remove the six bolts which attach the tail cone to the fuselage at Station 453-1/2. This is done from the inside of the fuselage.

(c) Move the tail cone away from the fuselage. One man can lift it easily.

d. INSTALLATION.

(1) INSTALLATION OF TAIL CONE.

(a) Move tail cone into position at Station 453.

(b) Install the six bolts that hold the tail cone to the fuselage, starting at the top. Tighten securely.

(c) Connect the electric wires at the junction box just ahead of Station 453-1/2. (See figure 7.)

(2) INSTALLATION OF GUNNERS' ESCAPE HATCH. (See figure 53.)

(a) Aline forward half of gunners' hatch at the fuselage.

(b) Install screws at the leading edge to the trailing edge of the radio hatch.

(c) Slide the movable half of the gunners' hatch into place from the forward end of the track.

(d) Install the stop on the forward end of the escape hatch track on each side of the fuselage.

(e) Check the latches in stowed and locked positions and see that they operate properly.

(3) INSTALLATION OF BOMB BAY DOORS. (See figure 52.)

(a) Lubricate the door hinges and aline them with the fuselage.

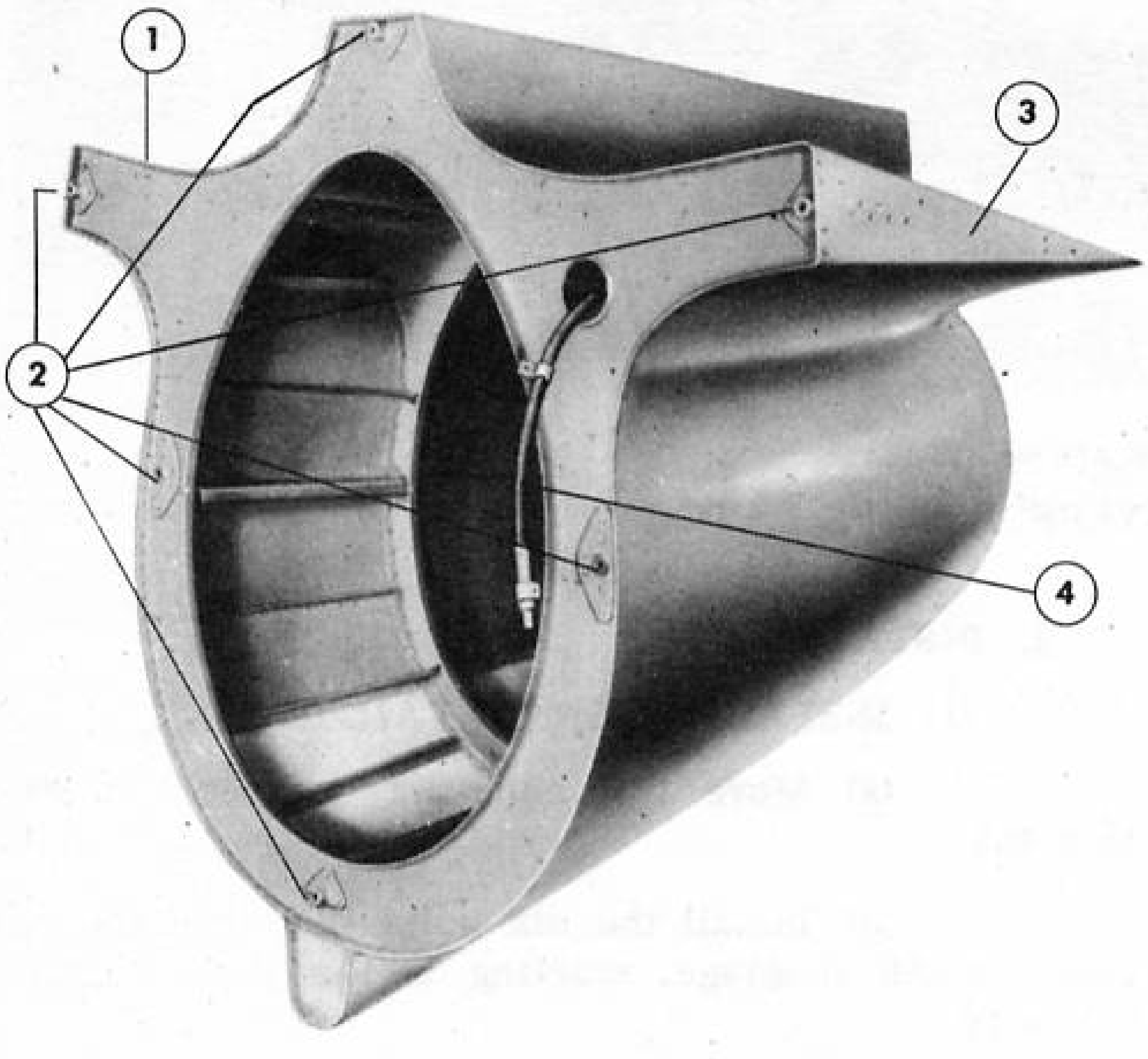
(b) Install hinge pins.

(c) Attach the center actuating arm to the door with one 1/4-inch bolt.

(d) Attach the front alining arm to the front of the door with one 1/4-inch bolt.

(4) INSTALLATION OF PILOT'S ESCAPE HATCH. (See figure 51.)

(a) Place the escape hatch in position. Line up the release pins with the hinges. Release the emergency handle and the pins will slide into the hinges. Check the operation of the inner and outer door handles. Safety-wire hinge pins.



1. ELEVATOR FAIRING
2. ATTACHING BOLT HOLES
3. ELEVATOR FAIRING
4. RUNNING LIGHTS AND FORMATION SIGNAL LIGHT ELECTRIC CABLE

Figure 54 - TAIL CONE REMOVED

(5) INSTALLATION OF ATTACK NOSE.

(a) Aline attack nose with the fuselage and, starting at the top, install the ten internal wrenching bolts through the access doors. These bolts are of assorted sizes. The two top bolts are 5/16 inch, AN-15. The second bolt from the top on each side is 5/16 inch, AN-17. The third bolt from the top on each side is 3/8 inch, AN-20. The bottom bolts are 3/8 inch, AN-22. The two remaining bolts which are installed through the small holes almost directly in line with the two lower 20-mm cannon are 3/16 inch, AN3-7A. See that all bolts are started, then tighten them securely by criss-crossing to minimize any strain on the bolts.

(b) Install armament in attack nose.

(c) Install attack nose tip figure 50 by sliding it into position over the forward guns and lock in place with the six clip spring fasteners through the access doors on the right and left sides of the attack nose tip.

(d) Close access doors on tip and snap locks shut.

(e) Install upper and lower access doors on each side of the nose. These are held in place by four Dzus fasteners on each access door.

(f) Install access doors covering the caliber .50 gun located on each side of the attack nose.

e. CHECK AFTER INSTALLATION.

(1) CHECK AND ADJUSTMENT OF BOMB BAY DOORS AFTER INSTALLATION.

(a) Close doors slowly to note fit and adjustment of linkage. Doors should close at the same rate of speed. They should not move with control valve in neutral.

(b) If necessary to adjust bomb door cross arms, turn the cross arm eyebolt to the right or left.

(c) Tighten check nut after adjustment has been made.

5. ENGINE COWLING.

a. DESCRIPTION.

(1) GENERAL. (See figure 55.) - Engine cowling consists of a flap bow ring, lower movable flaps, upper movable flaps, fixed flaps and nose fillets, diaphragm (inner cowl ring), antidrag ring, accessory cowling sheets, dishpan cover (used on winterized airplanes only), and the carburetor air scoop. Main purposes of the cowling are to provide a smooth contour covering the engine, which fairs into the nacelle and wing, and to control air passing through the engine and into the carburetor. The cowling is constructed for quick installation and removal, permitting access to all parts of the engine.

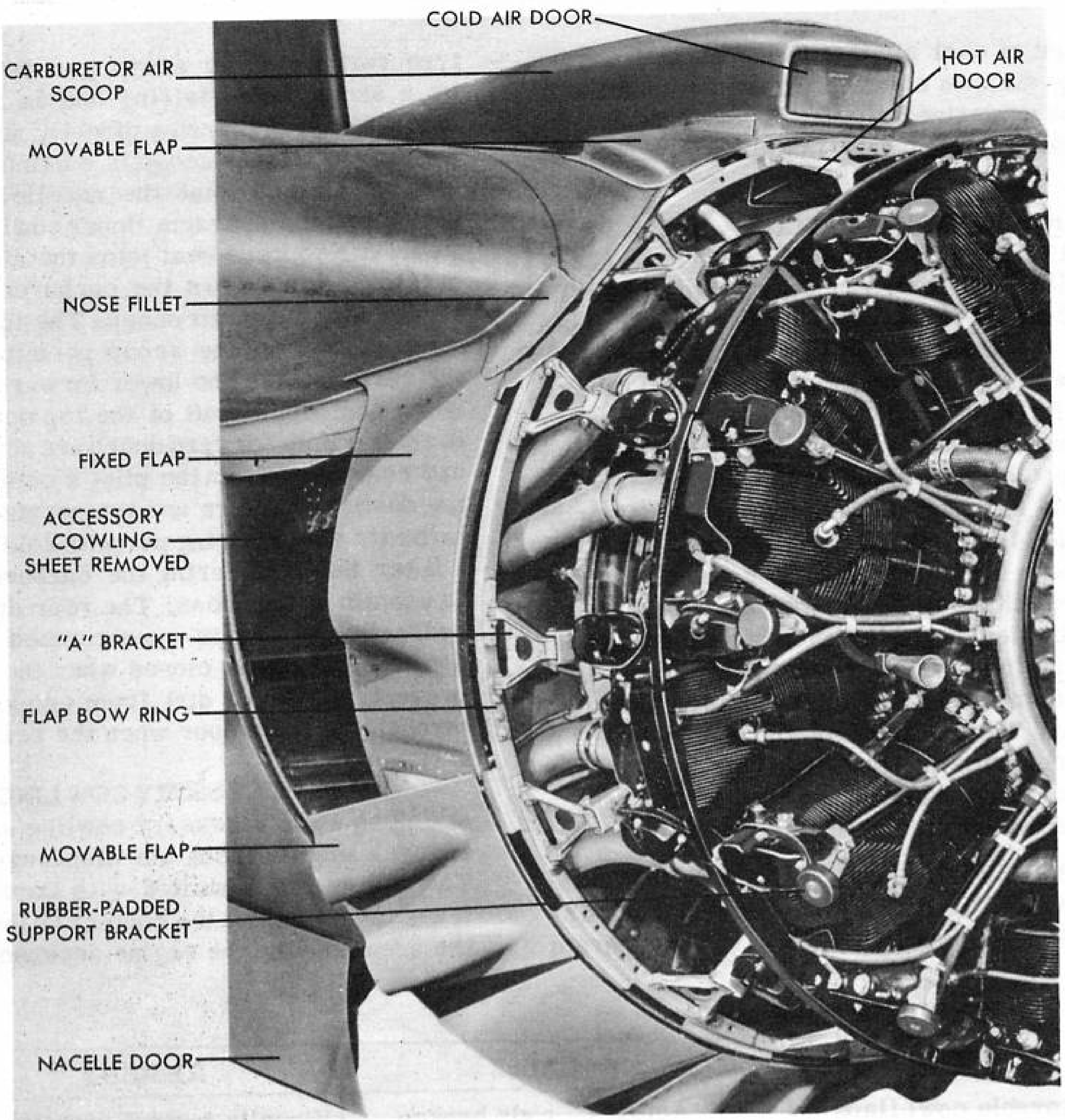


Figure 55 - ENGINE COWLING

(2) FLAP BOW RING. (See figure 55.) - The flapbow ring is constructed of aluminum alloy, installed on the engine by 14 "A" brackets using 1/4-inch bolts and castellated nuts. The ring is electrically bonded by four flexible metal straps spaced equally around the ring.

(3) MOVABLE COWL FLAPS. (See figure 55.) The five lower movable flaps are sheet alclad, hinged to the flap bow ring by clevis bolts. The two upper movable flaps are sheet alclad and are hinged in a similar manner but must be cut and formed to fit each airplane. All seven movable flaps are actuated hydraulically and controlled by the pilot.

(4) FIXED COWL FLAPS. (See figure 55.) - There are two sheet alclad fixed flaps (one inboard, one outboard), which are a continuation of the lower movable flaps. The leading edge of each fixed flap is attached to the engine mount by rods. The trailing edge is secured to the diaphragm by screws. A nose fillet is attached to the upper end of each fixed flap and extends to the leading edge of the wing.

(5) DIAPHRAGM. (See figure 56.) - The diaphragm (inner cowl ring) is of stainless steel and attaches to the engine mount. On the forward face of the diaphragm are mounted the exhaust ejector stacks. On the aft face of the diaphragm is the mechanism for actuating the movable flaps. The entire engine mount and diaphragm assembly is attached to the engine by seven dynamic suspensors.

(6) ANTIDRAG RING. (See figure 8.) - The antidrag ring is formed of sheet alclad in three sections and covers that part of the engine between the propeller and the flap bow ring. To the aft end of the antidrag ring are attached lugs which hook over the flap bow ring and overcome a tendency of the antidrag ring to pull forward. The antidrag ring is additionally attached by trunnion bolts and Dzus fasteners, which secure the forward end of the ring to 14 rubber-padded support brackets mounted on the cylinder heads.

(7) DISHPAN COVER. (See figure 57.) - The alclad dishpan cover slips over the propeller shaft and covers the engine block and propeller governor, cutting

down the amount of cool air that flows around engine cylinders. The dishpan cover is in two segments. It is used only on winterized airplanes and attaches to the engine block by permanently installed fasteners on the cover.

(8) CARBURETOR AIR SCOOP, RAM TYPE (USED ON AIRPLANE AF 42-53535 TO AF 42-53834 INCLUSIVE). (See figure 55.) - On airplanes AF 42-53535 to AF 42-53834 inclusive there is a sheet alclad filter housing mounted on top of the antidrag ring. There is an opening but no door on the forward face of the housing. In flight cold air enters this opening, passes up through the filter (a screen assembly) and through the top (cold air) door of the carburetor air scoop. The cold air door of the scoop is actuated by cables controlled from the pilot's compartment. Hot air enters through the lower opening of the air scoop. The hot air is not filtered. The hot air door is actuated by cables controlled from the pilot's compartment. The air scoop is constructed of aluminum alloy casting, sheet alclad and stainless steel and is mounted on top of the wing. The exterior of the scoop forms a continuous contour with the filter housing. A Neoprene seal joins the scoop to the carburetor. Four carburetor anti-icer lines are connected to the aft end of the scoop.

(9) CARBURETOR AIR SCOOP, NONRAM TYPE (USED ON AIRPLANES AF 42-53835 TO AF 42-54284 INCLUSIVE). (See figure 55.) - The nonram type carburetor air scoop is a dural casting covered by a sheet alclad fairing and is mounted on the top leading edge of the wing directly above the carburetor. Contour of the air scoop is continued by a fairing that extends aft and joins the nacelle. The air scoop is bolted to the diaphragm (inner cowl ring) and the shear web. A Neoprene seal joins the air scoop to the carburetor. Air enters the carburetor from any of the three doors in the air scoop. The top door on the upper forward face of the scoop permits cold air to enter the carburetor. The lower forward door (directly beneath and slightly aft of the top door) permits hot air to enter. Both forward doors are actuated hydraulically and controlled from the pilot's compartment to secure the desired mixture and temperature. The rear door in the air scoop fairing permits cold air to pass through a filter before entering the carburetor and this entry is used in dusty areas. The rear door is also actuated hydraulically and is synchronized with the top front door so that one is closed when the other is open, thus preventing dust or dirt from entering the carburetor through the front door when the rear door is open.

(10) ACCESSORY COWLING SHEETS. - Three stainless steel accessory cowling sheets are installed on each engine from the diaphragm to the fire wall. The sheets are installed with Dzus and air-lock fasteners and continue the contour of the nacelle and cover the area housing the engine accessories.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Movable cowl flaps fail to open or close.	Actuating rods broken or disconnected.	Visually inspect actuating rods for damage and proper attachment. Replace rods if damaged.
	Leak in hydraulic line.	Visually inspect hydraulic lines leading to actuating struts. Inspect all connections. Repair all lines found to be leaking.
	Selector valve or valves inoperative.	Replace selector valve.
Cowl flaps remain partially open when selector valve control handle is moved to "closed" position.	Actuating rods improperly adjusted.	Adjust actuating rods (1/4-in. clearance between exhaust stacks and cowling when fully closed).
Cowl flaps vibrate excessively.	Actuating rod or rods disconnected.	Visually inspect actuating rods for proper attachment.
	Clevis bolts loose or missing.	Visually inspect cowling for proper attachment.

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF FLAP BOW RING. (See figure 55.)

(a) Remove 1/4-inch bolts in the 14 "A" brackets and slide the ring forward.

NOTE

If propeller is installed, split the ring by removing four 1/4-inch bolts on the inboard side.

(b) If the movable flaps have not been removed previously, the complete assembly of the flaps and the flap bow ring may be removed by disconnecting the actuating rods to the flaps, removing the 14 quarter-inch bolts and sliding the ring forward on the engine.

(2) REMOVAL OF MOVABLE COWL FLAPS (five lower and two upper). (See figure 55.)

(a) Open cowl flaps.

(b) Disconnect actuating rods at flap.

(c) Remove clevis bolts from two hinges on each flap.

(3) REMOVAL OF FIXED COWL FLAPS. (See figure 55.)

(a) INBOARD FIXED FLAPS.

1 Remove nose fillet by removing four screws.

2 Remove flap by removing 15 screws.

(b) OUTBOARD FIXED FLAPS.

1 Remove nose fillet by removing four screws.

2 Remove flap by removing 10 screws and spacer bolts.

NOTE

There are two spacer bolts on the left-hand engine and one spacer bolt on the right-hand engine

(4) REMOVAL OF DIAPHRAGM (inner cowl ring). (See figure 56.)

(a) Complete removal of the diaphragm and engine mount assembly requires previous removal of the engine. Then disconnect all control cables and hydraulic lines. Remove bolts from the seven dynamic suspensors and pull off the diaphragm and engine mount.

(b) The diaphragm is constructed in four segments. Each segment may be removed without removing the engine as follows:

1 Disconnect any control cables or hydraulic lines attached to the segment.

2 Remove exhaust ejector stacks attached to the segment.

3 Remove all screws attaching segment to the engine mount and to other segments. Pull segment out.

(5) REMOVAL OF ANTIDRAG RING. (See figure 8.)

(a) Cut safety wires and loosen trunnion bolts.

(b) Unlock Dzus fasteners.

(c) Lift off ring in three segments.

(6) REMOVAL OF DISHPAN COVER. (See figure 57.) - Unlock fasteners and pull cover off.

(7) REMOVAL OF CARBURETOR AIR SCOOP (ram type). (See figure 55.)

(a) Remove cover plates on both sides of scoop.

(b) Remove exit fairings for upper cowl flaps from wing, both sides of scoop.

(c) Disconnect air temperature bulb from middle of back of scoop.

(d) Disconnect four carburetor anti-icer lines from back of scoop.

(e) Remove cover from top of air scoop fairing.

(f) Remove five cap screws under air scoop fairing.

(g) Remove six Phillips head screws from air scoop fairing.

(h) Remove 10 remaining cap screws that hold sides of air scoop to the venturi ring.

(i) Disconnect control cables.

(j) Loosen the lower clamp on the Neoprene collar that connects the scoop to the carburetor.

(k) Lift the air scoop off.

(8) REMOVAL OF CARBURETOR AIR SCOOP (non-ram type). (See figure 55.)

(a) It is not necessary to remove the top flaps, but their removal will provide better access to the scoop.

(b) In the engine accessory section, disconnect hot and cold air door control cables, air scoop temperature bulb, carburetor anti-icer lines and Neoprene adapter seal.

(c) In the air scoop duct, disconnect synchronizing rod between the two cold air intake doors.

(d) Directly on top of the wing remove the air scoop access door (identified by six Carr fasteners) and the two side panels. Then remove the inner duct by disconnecting two clamps and removing four bolts.

(e) Remove bolts attaching the scoop to the forward shear web of the wing. Remove bolts attaching scoop to the diaphragm around the engine.

(f) Lift air scoop off.

(9) REMOVAL OF ACCESSORY COWLING SHEETS. - Loosen Dzus fasteners and remove the sheets. There are 15 fasteners on the inboard sheet, 17 fasteners on the outboard sheet and 12 fasteners on the lower sheet. The sheets may be removed in any sequence.

d. MAINTENANCE REPAIRS.

(1) MAINTENANCE REPAIR OF FLAP BOW RING. - Close all gaps between the "Z" section on bow ring and the movable flaps.

(2) MAINTENANCE REPAIR OF MOVABLE COWL FLAPS. - Straighten or replace any bent rods.

(3) REPAIR OF FIXED COWL FLAPS AND NOSE FILLET, WHICH ARE CONSTANTLY DAMAGED BY VIBRATION.

(a) Tighten loose screws.

(b) Inspect continually for cracked screw holes and splits. Small cracks may be prevented from enlarging by drilling a No. 50 or 60 stop hole at the far end of the crack; that is, the end farthest from the screw hole. Repair larger cracks or splits with a reinforcing doubler or a patch, either spot welded or riveted to the surface.

(c) Replace damaged Neoprene seal on leading edge of flap.

(d) If Neoprene rub strip on upper end of flap has slipped out of place, cement and rivet in correct location and fair the flap into the wing.

(e) Repair or arrest any cracks in nose fillet. Close all gaps between fillet and wing. Leading edge of fillet must not be above trailing edge of antidrag ring.

(4) REPAIR OF DIAPHRAGM. - Repair splits or cracks in the diaphragm by spot welding or riveting suitable reinforcements.

(5) REPAIR OF ANTIDRAG RING.

(a) Burnish scratches on the exterior surface.

(b) Patch all bullet holes on other abrasions, cracks or splits.

(c) If there are any gaps along the seal strips at segment joints, close the gaps with a fiber or wooden wedge.

(6) REPAIR OF CARBURETOR AIR SCOOP (ram type). - Remove and clean filter as follows:

(a) Remove filter by loosening nine airlock fasteners and remove the forward section of the filter housing. Then slide the filter out of the housing.

(b) Clean filter by washing in gasoline or other suitable volatile cleaning fluid, agitating to ensure removal of dirt from inner part of the element. Then dry thoroughly. Immerse filter in oil, Specification AN-VV-O-446a, grade 1120. Drain off excess oil prior to installation. Ordinarily 12 hours are required for complete drainage.

(7) REPAIR OF CARBURETOR AIR SCOOP (nonram type). - Remove and clean air filter as follows:

(a) Open the rear doors and slide the filter out.

(b) Wash in gasoline or other suitable volatile cleaning fluid, agitating to ensure removal of dirt from inner part of the element.

(c) Dry thoroughly.

(d) Immerse filter in oil, Specification AN-VV-O-446a, grade 1120. Drain off excess oil prior to installation. Ordinarily 12 hours are required for complete drainage.

(8) REPAIR OF ACCESSORY COWLING SHEETS. - Close gaps on all overlapping edges.

e. REPLACEMENTS.

(1) REPLACEMENT OF FLAP BOW RING PARTS.

(a) Replace worn or damaged Lord mounts on "A" brackets.

(b) Replace any broken electrical bonding straps.

(2) REPLACEMENT OF DIAPHRAGM PARTS. - Check for cracks in U-bolts and brackets attaching diaphragm to engine mount. Replace damaged parts.

(3) REPLACEMENT OF ANTIDRAG RING PARTS.

(a) Replace broken Dzus spring by riveting new spring in place.

(b) Replace broken Dzus fastener as follows:

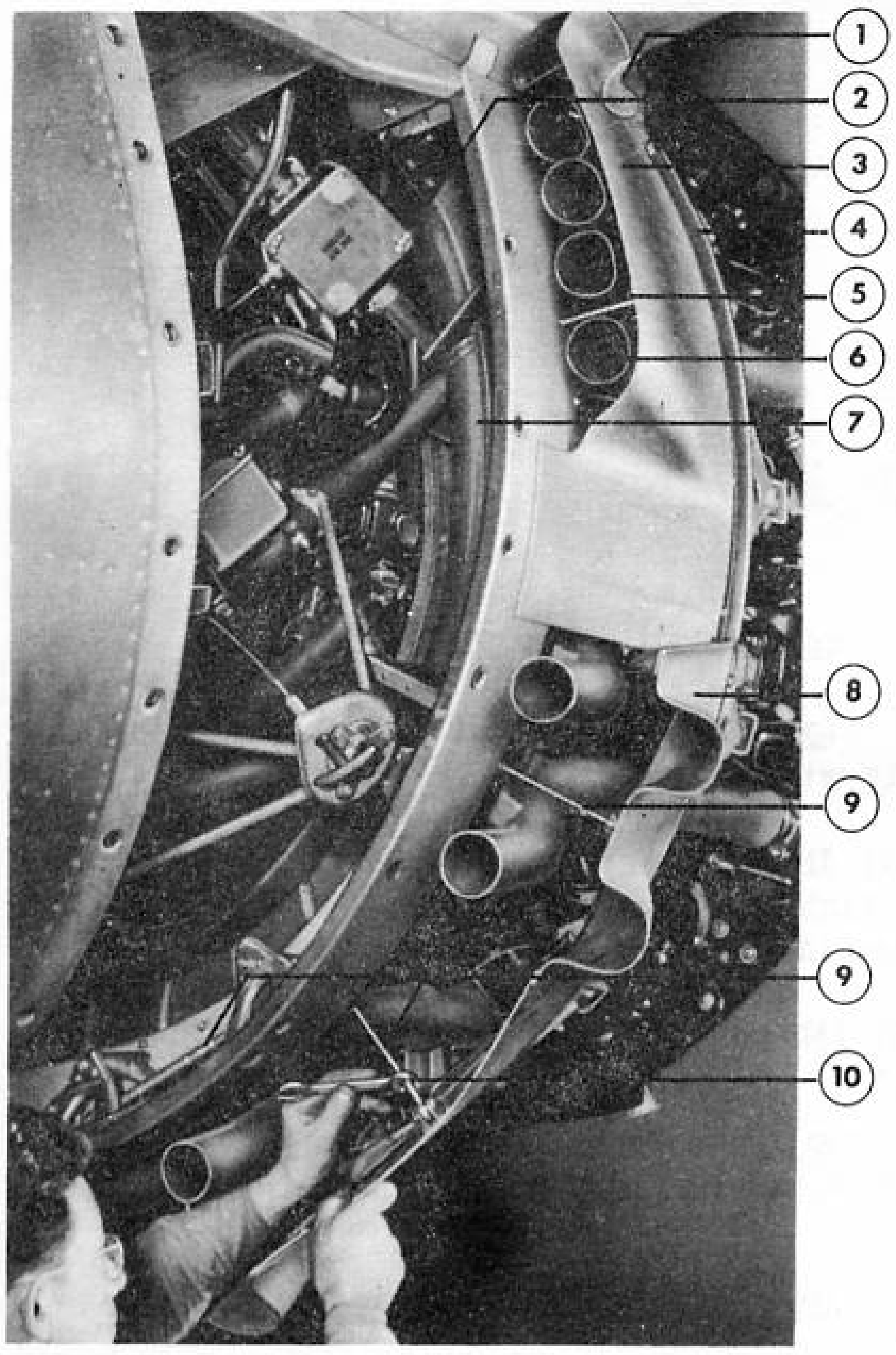
1 Remove broken fastener, using a Dzus remover or by cutting the grommet off with diagonal pliers.

2 Install new fastener, using a Dzus installation tool.

(4) REPLACEMENT OF CARBURETOR AIR SCOOP (ram type) PARTS.

(a) Replace any worn or frayed cables.

(b) Inspect for hole in Neoprene Collar and replace collar if damaged.



1. NOSE FILLET
2. ENGINE ACCESSORY SECTION, COWLING REMOVED
3. FIXED FLAP
4. NEOPRENE SEAL
5. SPACER BAR
6. EXHAUST EJECTOR STACKS
7. DIAPHRAGM
8. MOVABLE FLAP
9. ACTUATING ROD
10. 5/8" OPEN END WRENCH

Figure 56 - ADJUSTING LOWER COWL FLAPS

(c) Inspect for collapsed anti-icer line and replace any damaged line.

(5) REPLACEMENT OF ACCESSORY COWLING SHEET PARTS. - Replace any broken Dzus springs, Dzus fasteners, Carr fasteners and air-locks.

f. ADJUSTMENTS.

(1) ADJUSTMENT OF MOVABLE COWL FLAPS. (See figure 56.)

(a) Adjust lower flaps for the following clearances:

1 One-quarter inch between flap and exhaust stack and/or diaphragm in closed position (1/8 inch on winterized airplanes).

2 Dovetail must overlap adjacent flap by at least 1/8 inch.

3 There must be a 1/16-inch preload where the movable flap meets the fixed flap.

(b) Adjust upper flaps for a minimum overlap of 3/8 inch on both rub strips. Then adjust upper flaps for a 1/16-inch preload.

NOTE

Adjust all movable flaps by removing the bolts from one end of the actuating rod and by turning the rod bearing. Turning clockwise will shorten the rod and turning counterclockwise will lengthen the rod.

(2) ADJUSTMENT OF FIXED COWL FLAP. - Minimum clearance between fixed flap and exhaust ejector stacks is 1/8 inch and preferred clearance is 1/4 inch. Adjust with special tool, Douglas No. A633-5166050-SF2 (stack bending bar). If stacks are in correct position and flap is still too close to the stacks, use fiber wedge and a rawhide mallet to form flap for proper clearance. If this hammering breaks the spot weld on the bead doublers, remove the flap and install 1/8-inch rivets every 3/4 inch.

(3) ADJUSTMENT OF CARBURETOR AIR SCOOP (nonram type). - Check adjustment of hot and cold air doors to assure that doors close tightly. Be sure the hot air door locks (passes over center) in both open and closed positions. Adjust aft cold air door to closed position without preload by turning the eyebolts on the cylinder IN or OUT. Hook up the long rod of the master bell crank to the crank on the jackshaft. Hook up the center rod from jackshaft to the front door bell crank. Then adjust front door to a slight preload, using the short rod for adjustment. Be sure front door in open position is in full UP position.

g. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF ACCESSORY COWLING SHEETS. - Place each sheet in position and tighten the Dzus fasteners. There are 15 fasteners on the inboard sheet, 17 fasteners on the outboard sheet, and 12 fasteners on the lower sheet. The sheets may be installed in any sequence.

(2) INSTALLATION OF CARBURETOR AIR SCOOP (nonram type). (See figure 55.)

(a) It is not necessary to remove the upper cowl flaps, but their removal will provide easier access to the scoop.

(b) Directly on top of the wing install the inner duct in the scoop by installing four bolts and connecting two clamps. Then install the air scoop access door (identified by six Carr fasteners) and the two side panels.

(c) In the air scoop duct connect the synchronizing rod between the two cold air intake doors.

(d) In the engine accessory section connect hot and cold air door control cables, air scoop temperature bulb, carburetor anti-icer lines and Neoprene adapter seal.

(3) INSTALLATION OF CARBURETOR AIR SCOOP (ram type). (See figure 55.)

(a) Before installing, safety hot air door in the COLD position and tape the cable to hold it on the pulley.

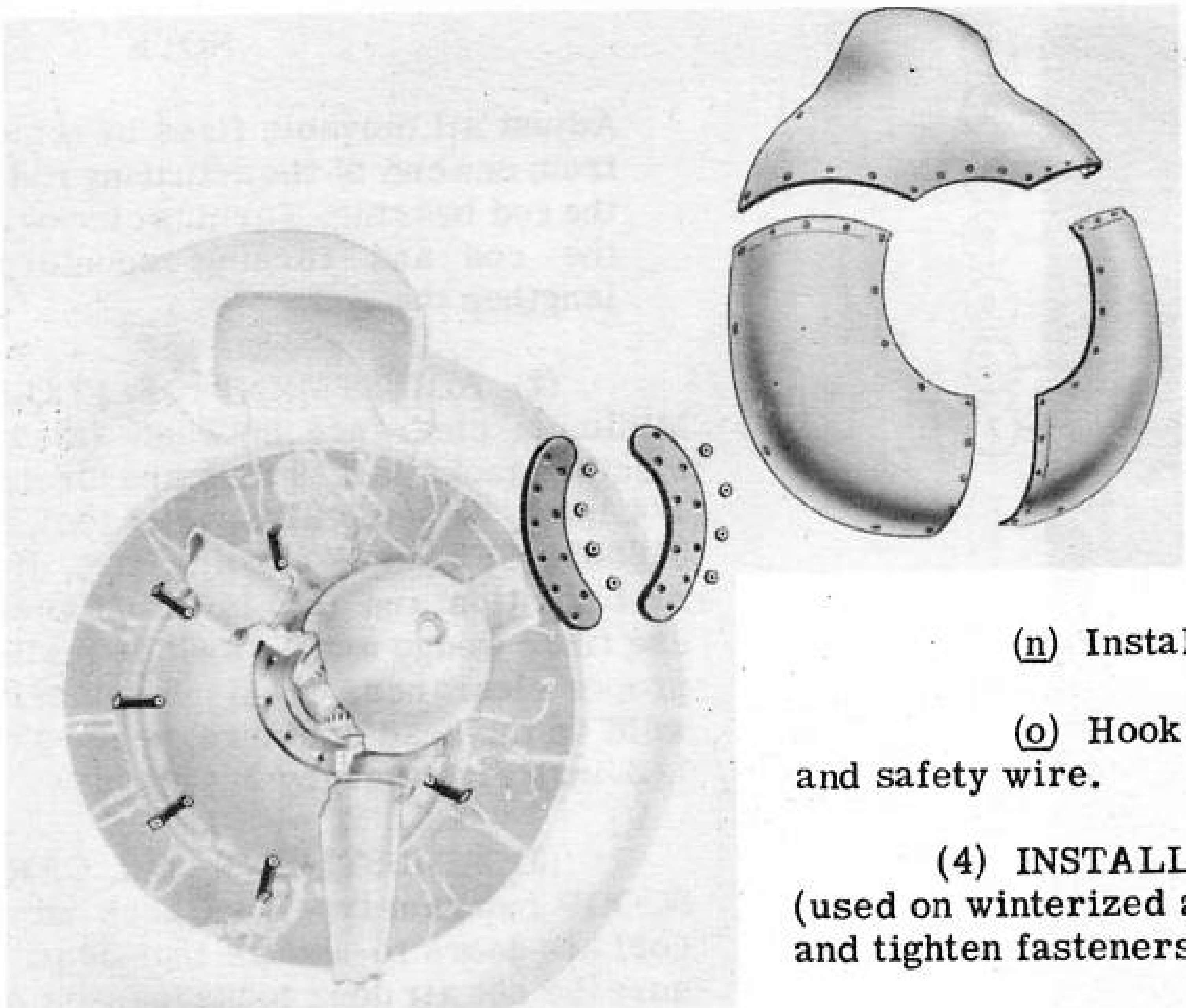


Figure 57
DISH-PAN COVER - EXPLODED VIEW

(b) Before installing, assure that the Neoprene collar is clamped securely to the air scoop; place the other clamp around the Neoprene collar and roll it back (like a cuff) over both clamps.

(c) Lower air scoop into position.

(d) Unroll Neoprene collar. It will thereby fit itself to the carburetor air scoop adapter.

(e) Push the loose clamp down until it fits around the bottom of the Neoprene collar.

NOTE

If the clamp will not go down in front, remove the inspection plates at the sides of the air scoop.

(f) Tighten the lower clamp with a flat screwdriver.

(g) Install ten cap screws along the sides of the air scoop into the venturi ring. Be careful not to force any of the cap screws. If screws will not start easily, drill sheet metal out to 1/4-inch diameter.

(h) Install five cap screws under air scoop fairing.

(i) Replace cover on air scoop fairing.

(j) Install six Phillips head screws in air scoop fairing.

(k) Connect four anti-icer lines to back of air scoop.

(l) Connect electric plug to air temperature bulb on back of air scoop.

(m) Install exit fairings for upper cowl flaps.

(n) Install cover plates on wing.

(o) Hook up control cables, removing tape and safety wire.

(4) INSTALLATION OF DISHPAN COVER (used on winterized airplanes only). - Place cover ON and tighten fasteners. (See figure 57.)

(5) INSTALLATION OF ANTIDRAG RING. (See figure 8.)

(a) The ring is in three segments, which may be installed one at a time. Place the segment in position.

(b) Tighten Dzus fasteners.

(c) Tighten trunnion bolts with Douglas special tool, RS-1618 wrench.

(d) Install safety wires.

(6) INSTALLATION OF DIAPHRAGM (inner cowl ring).

(a) Installation of the diaphragm and complete engine mount assembly requires previous removal of the engine and the carburetor air scoop. Then place the assembly in position and install bolts in the seven dynamic suspensors. Connect all control cables and hydraulic lines. Install carburetor air scoop.

(b) The diaphragm is constructed in four segments. Each segment may be installed without removing the engine as follows:

1 Place segment in position and install all screws attaching segment to engine mount and to other segments.

2 Install exhaust ejector stacks on the segment.

3 Connect control cables and hydraulic lines.

(7) INSTALLATION OF FIXED COWL FLAPS. (See figure 55.)

(a) INBOARD FIXED FLAPS.

1 Place flap in position and install 15 screws.

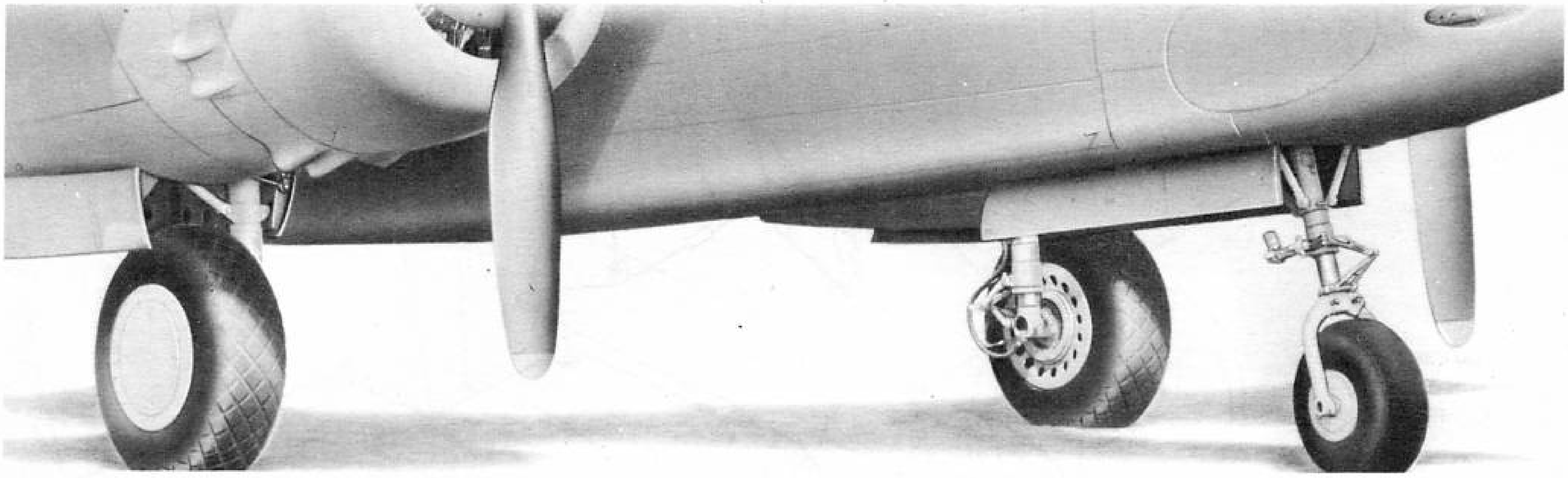


Figure 58 - ALIGHTING GEAR

2 Install nose fillet by installing four screws.

(b) OUTBOARD FIXED FLAPS.

1 Place flap in position by installing screws and spacer bolts.

2 Install nose fillet by installing four screws.

NOTE

There are two spacer bolts on the left-hand engine and one spacer bolt on the right-hand engine.

(8) INSTALLATION OF MOVABLE COWL FLAPS (five lower and two upper). (See figure 55.) - Install clevis bolts in the two hinges on each flap and connect the actuating rod to each flap.

(9) INSTALLATION OF FLAP BOW RING. (See figure 55.)

(a) Slide the ring over the engine and in place.

(b) Install 1/4-inch bolts in the 14 "A" brackets.

NOTE

If propeller is installed, split the ring by removing four 1/4-inch bolts on the inboard side and four on the outboard side.

(c) If the movable flaps have not been previously removed from the ring, the complete assembly of the flaps and the flap bow ring may be installed by installing the 14 quarter-inch bolts in the "A" brackets and connecting the actuating rods to the flaps. If the propeller is installed, split the ring as directed above.

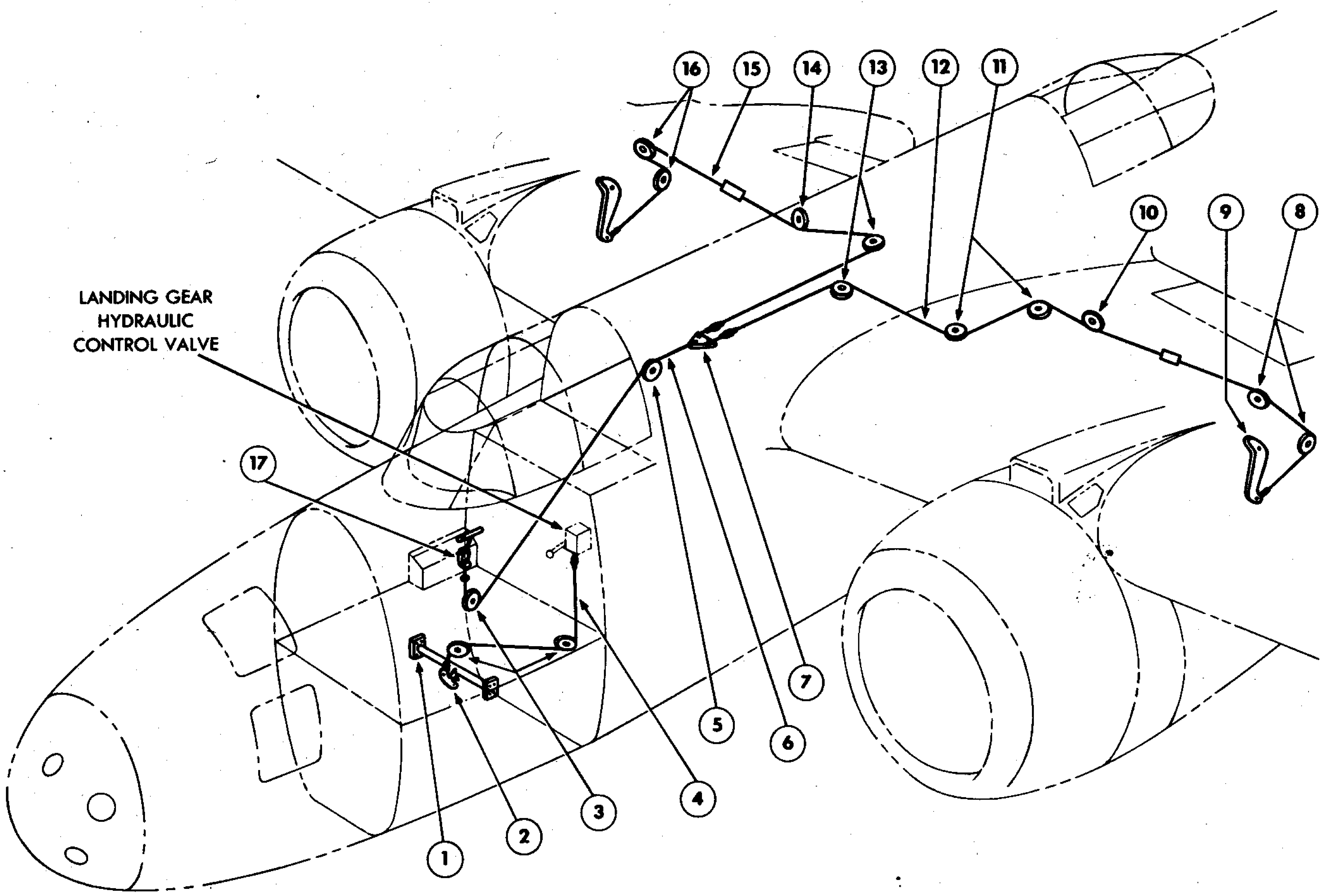
6. ALIGHTING GEAR.

a. DESCRIPTION.

(1) GENERAL. - The alighting gear consists of three separate units, a main unit mounted in each engine nacelle and a nose wheel unit mounted just aft of the fuselage Station 0. (See figure 58.) The gear is actuated hydraulically and controlled by a lever on the panel at the left side of the pilot's seat. (See figure 60.) An emergency release handle, located to the right of the pilot's seat near the floor (figure 60) is used to extend the main gear in the event of hydraulic system failure. The emergency release disconnects the main gear latches allowing the bungees to extend the gear. To release the nose wheel latch, move the alighting gear control lever to the DOWN position. When the alighting gear is retracted each unit is completely enclosed by doors operated by linkages connected to the gear.

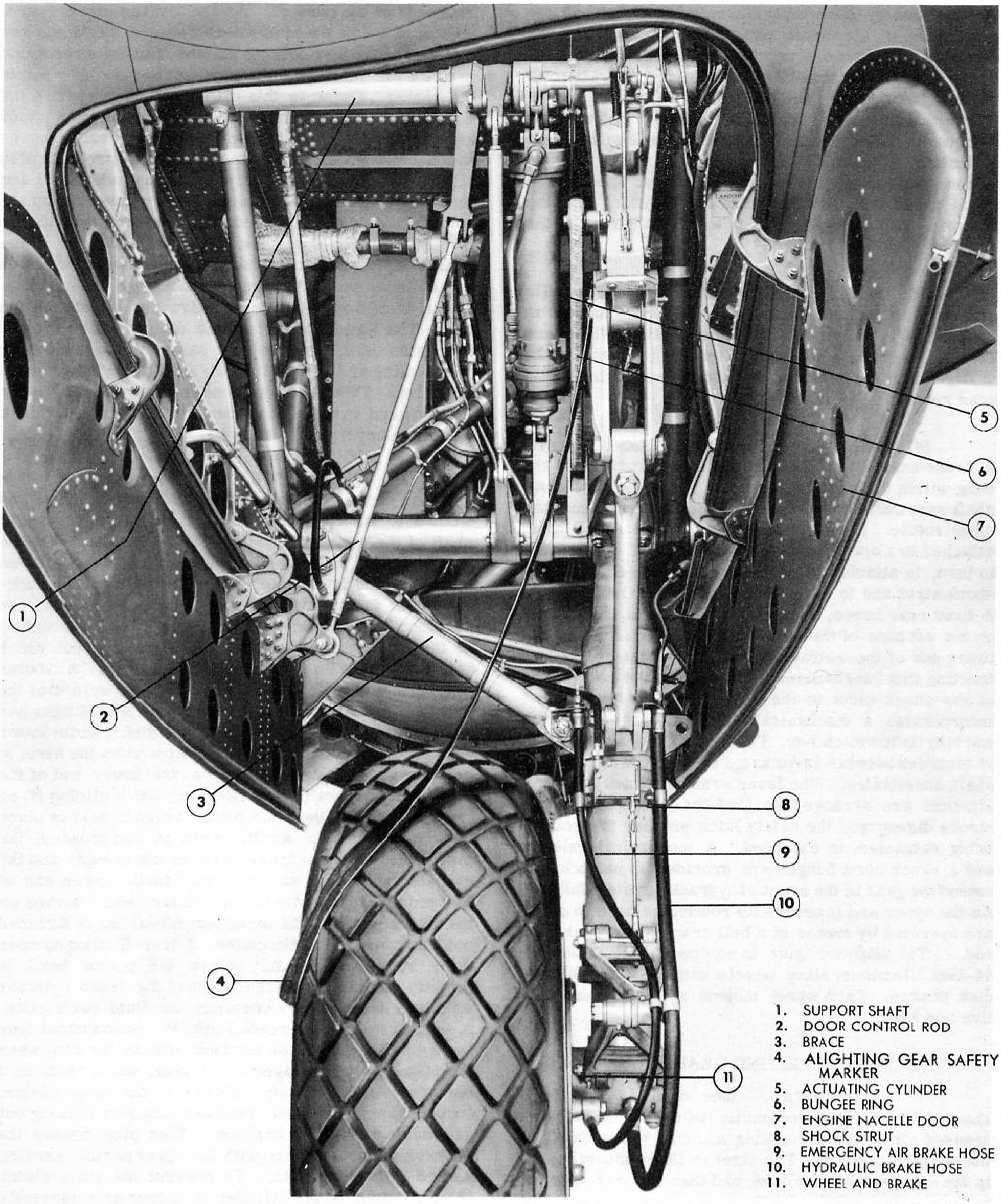
(2) SIGNAL SYSTEMS. - An indicator located in the lower left corner of the pilot's instrument panel shows the position of the alighting gear at all times. A warning horn, mounted on the deck immediately aft of the pilot's seat, sounds whenever the throttles are closed to less than 1/4 segment and the gear is in any position other than full down and locked. The horn may

Figure 59 - ALIGHTING GEAR CONTROLS



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2063154	BEAM	1
	AN3-4	BOLT	8
	AN960-10	WASHER	8
	AC365-1032	NUT	8
2.	1063612	HOOK	1
	AN502-10-16	BOLT, ADJUSTMENT	1
	AN315-3R	NUT, ADJUSTMENT	1
	2033901-10S-323-028	SPACER	2
	1026614G5-012	SPACER	1
	1063611	SPRING	1
	124682-5814-065	WASHER	2
	AN5-26	BOLT	1
	AN320-5	NUT	1
	AN380-2-3	COTTER	1
3.	AN210-2A	PULLEY	3
4.	2064974-6	CABLE ASSEMBLY (40 INCHES)	1
	AN160-85	FORK	1
	AN155-8S	BARREL	1
5.	AN210-2A	PULLEY	1
6.	2069407	CABLE ASSEMBLY (99⅜ INCHES)	1
7.	1059861	LINK	1
	AN23-9	BOLT	3
	AN320-3	NUT	3
8.	AN210-2A	PULLEY	2
9.	1069221	LEVER	2
10.	AN210-1A	PULLEY	1
11.	AN210-2A	PULLEY	2
12.	2068537-2	CABLE ASSEMBLY (170¼ INCHES)	1
13.	AN210-2A	PULLEY	2
14.	AN210-1A	PULLEY	1
15.	2068537-1	CABLE ASSEMBLY (133⅜ INCHES)	1
16.	AN210-2A	PULLEY	2
17.	AN520-416-8	SCREW	2

Figure 60 - LANDING GEAR MECHANICAL RELEASE



1. SUPPORT SHAFT
2. DOOR CONTROL ROD
3. BRACE
4. ALIGHTING GEAR SAFETY LOCK MARKER
5. ACTUATING CYLINDER
6. BUNGEE RING
7. ENGINE NACELLE DOOR
8. SHOCK STRUT
9. EMERGENCY AIR BRAKE HOSE
10. HYDRAULIC BRAKE HOSE
11. WHEEL AND BRAKE

Figure 61 - MAIN ALIGHTING GEAR

be silenced by operating the release switch on the pilot's upper electrical panel or by reopening the throttles. If the horn is silenced by the switch, the horn circuit is automatically reset for operation as soon as the throttles are opened. At all times, other than when the gear is down and locked, a red warning light on the pilot's upper electrical panel will be ON, indicating an "unsafe" landing position. When the gear is down and locked, the green light on the upper electrical panel will be ON, indicating a "safe" landing position. A dimming switch is located adjacent to the lights.

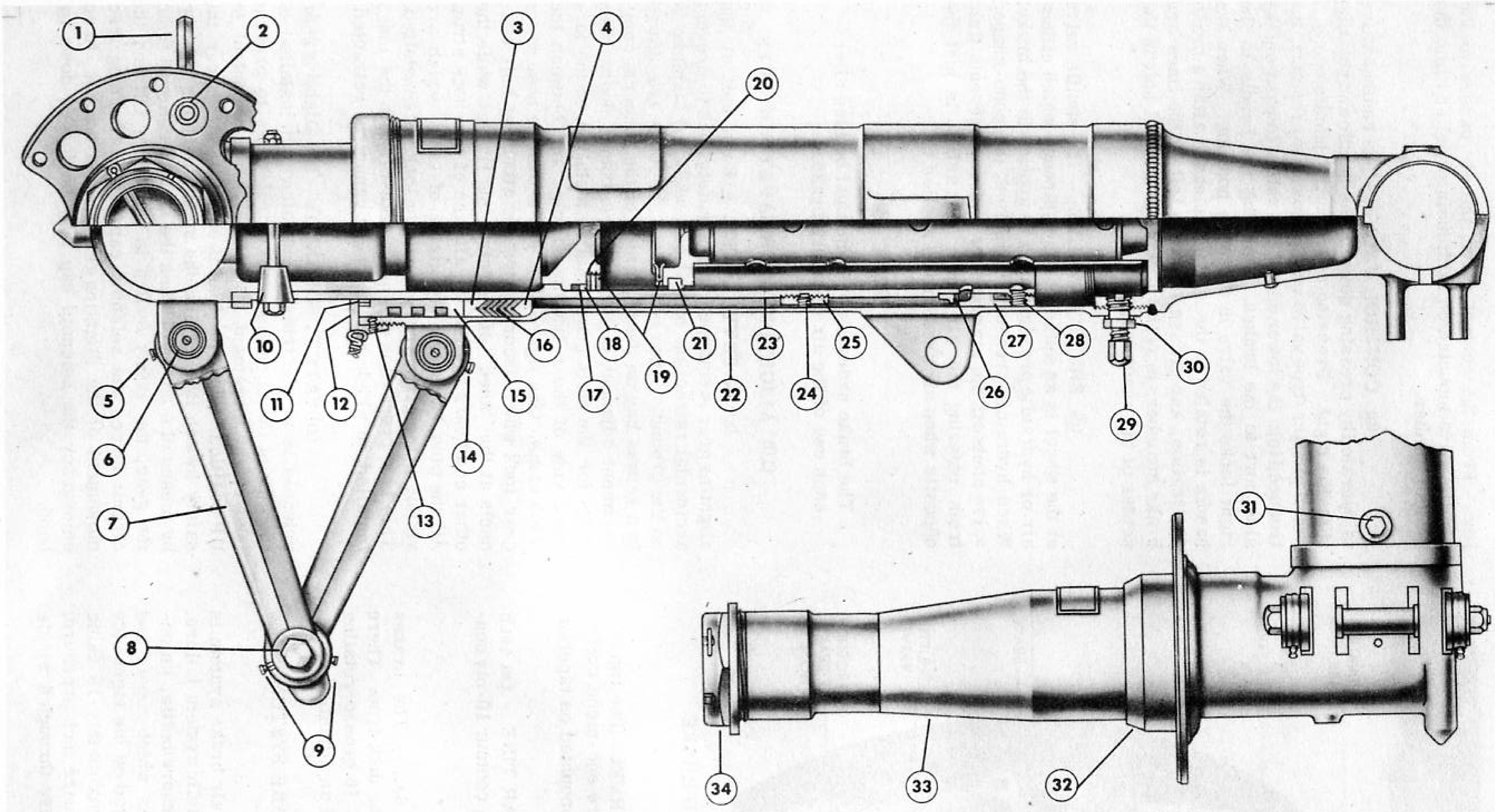
(3) NACELLE DOORS - Doors of the nacelle are made of formed sheet alclad and are attached to the nacelle at four points with hinge bolts. The doors completely enclose the main alighting gear unit while in flight, and are operated by linkages connected to the gear retracting mechanism.

(4) MAIN ALIGHTING GEAR. (See figure 61.) A truss assembly, bolted to the lower surface of the wing within the nacelle, supports the upper and lower shaft assemblies about which the gear and its mechanism rotate. Each wheel is mounted on a stub axle, attached to a braced oleo-pneumatic shock strut which, in turn, is attached to a collar near the center of the shock strut and to the outboard end of the lower shaft. A fixed rear brace, composed of two links, is mounted on the aft side of the shock strut and attaches to the lower end of the retracting link mechanism. The retracting link mechanism extends from the rear brace of the shock strut to the upper shaft assembly and incorporates a mechanical latch, a bungee, and the warning light switch box. The hydraulic actuating strut is installed between lever arms on the upper and lower shaft assemblies. The lever arms to which the strut attaches are arranged so that the first part of the stroke disengages the safety latch whether the gear is being retracted or extended. A mechanical release and a shock cord bungee are provided to unlatch and extend the gear in the event of hydraulic system failure. As the upper and lower shafts rotate, the nacelle doors are operated by means of a bell crank and a push-pull rod. The alighting gear is equipped with Goodyear 44-inch aluminum alloy wheels with 16-inch multiple disk brakes. Each wheel mounts a 44-inch non-skid tire and tube.

(5) MAIN ALIGHTING GEAR SHOCK STRUT.

(a) GENERAL. (See figure 62.) - Each shock strut is oleo-pneumatic in action, with compressed air as the energizing medium, and with oil as the damping medium. The strut is filled with oil while in the compressed position, and then inflated with air to the desired point. On the compression stroke, the piston forces oil through the opening at the lower end of the plunger, and then through the openings in the side wall of the plunger. As the strut is compressed, the space below the piston head between the piston and cylinder walls increases in volume, causing a reduction in pressure relative to the increase in pressure within the piston. Owing to this difference in pressure the fluid is drawn through the openings in the piston wall and the damper valve. Since the damper valve moves to its lower position on the compression stroke, it also allows passage of fluid between the cylinder wall and its outer edge. After a shock has been absorbed by air compression and restricted displacement of fluid, the compressed air energizes the outward stroke of the piston. As the piston extends, the oil between the piston and cylinder walls is forced back through the openings in the free-floating damper valve and in the piston wall. The flow of oil raises the damper valve against the piston head, cutting off the passage around the edge of the valve and restricting the flow to the openings in the valve. This restriction of the flow tends to slow the outward movement of the piston, thus ensuring a smooth recovery from a shock.

(b) CONSTRUCTION. (See figure 62.) - The cylinder of the strut has a conical fitting threaded and welded to its upper end for attachment to the lower shaft of the main alighting gear. An air inflation valve is installed at the upper end of the cylinder and a piston packing gland is installed at the lower end. The packing gland is composed of five chevron packings, two packing rings, a bronze retainer ring which also serves as the lower piston bearing, and a packing nut which is threaded onto the lower end of the cylinder. A tubular plunger, with a plug at its lower end, is welded to the fitting at the upper end of the cylinder. The plunger has openings in its side walls and in the plug at its lower end, for restriction of the fluid flow when the strut is being compressed. The plug at the lower end of the plunger incorporates a piston ring with a sliding fit on the inner wall of the main piston which is held in place by a retainer nut. As the strut is compressed, the piston slides in the space between the plunger and the cylinder. A wheel axle is bolted to the lower end of the main piston, and a bronze collar, which serves as the piston head and the upper piston bearing, is threaded onto the upper end of the piston. A free-floating damper valve ring, immediately below the piston head, is slightly smaller in diameter than the inner cylinder wall and incorporates openings for fluid restriction. A second collar is threaded onto the piston about four inches below the piston head and acts as the stop when the piston is fully extended. A plug, which rests on a shoulder approximately midway of the main piston, incorporates a packing, retainer ring and packing nut assembly to hold it in place. This plug divides the piston into two sections, with the upper portion serving as the fluid reservoir. To prevent the main piston from rotating in the cylinder, a torque arm assembly is connected to the lower end of the cylinder and to the axle fitting.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	65324	EYE, TOWING	1
2.	65322	SHAFT, TOWING	1
3.	66846	RING, PACKING	1
4.	65329	RING, PACKING	1
5.	65406	FITTING, ZERK	1
6.	120-S-315	BOLT	2
	121-S-5	NUT	
	65314	SLEEVE	
	65311	SPACER	
7.	65321	ARM ASSEMBLY, TORQUE	2
8.	120-S-521	BOLT	1
	121-S-7	NUT	1
	65316	WASHER	1
	65310	LUG	1
	65309	SPACER	1
	65316	BUSHING	1
	65311	SPACER	1
	65366	WASHER	2
9.	65406	FITTING, ZERK	2
10.	54026	BUSHING, TAPER	1
11.	65327	PACKING	1
12.	65326	RING, PACKING	1
13.	66876	SETSCREW	1
14.	65406	FITTING, ZERK	1
15.	65328	RING, RETAINER	1
16.	185-S-56	PACKING, CHEVRON	5
	65460	FILLER, PACKING	1
17.	64044	PACKING	1
18.	65043	RING, RETAINER	1
19.	65045	NUT, PACKING	2
20.	65337	PLUG	1
21.	65348	RING, PISTON	1
22.	65359	PLUNGER ASSEMBLY, CYLINDER	1
23.	65338	PISTON, MAIN	1
24.	65330	SETSCREW	1
25.	65331	STOP, PISTON	1
26.	65332	RING, DAMPER VALVE	1
27.	65333	HEAD, PISTON	1
28.	65323	SETSCREW	1
29.	53027	VALVE ASSEMBLY	1
30.	53050	GASKET	1
31.	120-S-211	BOLT	1
	121-S-2	NUT	1
32.	56698	COLLAR, AXLE	1
33.	65367	AXLE ASSEMBLY	1
34.	110-S-5	NUT, RETAINER	1

Figure 62 - Main Alighting Gear Shock Strut Assembly

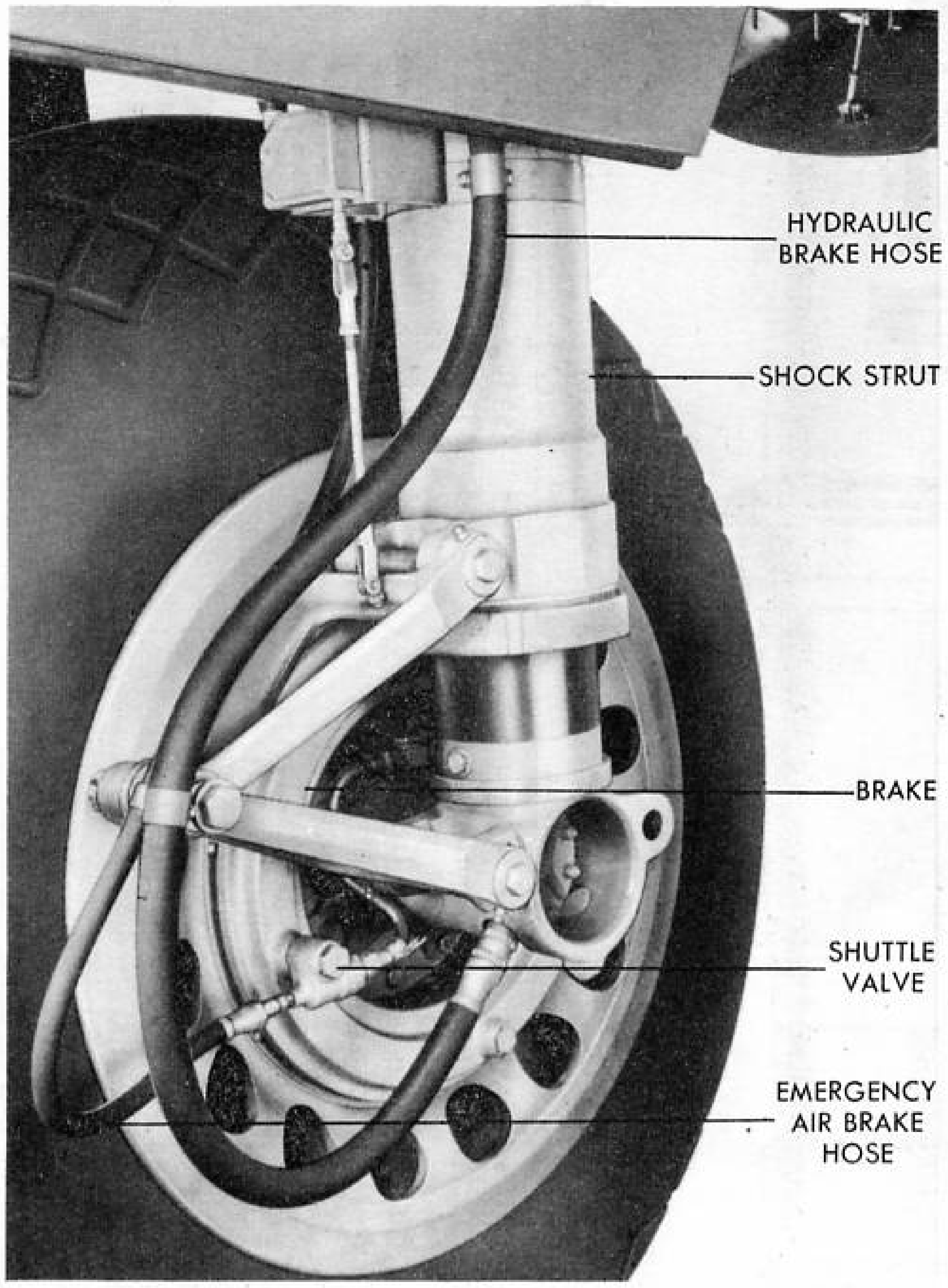


Figure 63 - WHEEL AND BRAKE

(6) MAIN ALIGHTING GEAR WHEEL. (See figure 63.) - Wheels of the alighting gear are one-piece castings of aluminum alloy. They are mounted on tapered roller bearings.

(7) MAIN ALIGHTING GEAR TIRE - On each wheel is mounted a 44-inch smooth contour 10-ply non-skid diamond tread tire and tube.

(8) BRAKES. (See figure 63.) - The brakes are hydraulically operated and of the disk type. There are 17 steel stationary plates and 16 bronze rotating plates. Adjustment is by means of an adjusting ring.

(9) EMERGENCY AIR BRAKE SYSTEM. (See figure 64.)

(a) GENERAL. - The air brake system is for emergency use in case of hydraulic system failure. The air brake incorporates a pressure bottle, an on-off control valve and shuttle valves which supply and control the air. The bottle, located on the right side of the nose wheel well, holds approximately 18 cubic inches of air at 400 pounds per square inch pressure, which is supplied to the on-off valve through a single line. From the control valve the air passes to the shuttle valve mounted on each main wheel and into the brake chamber.

(b) CONTROL VALVE. - The control valve is operated by pressing down on the handle and rotating it to the right. Pressing down on the handle opens a small plunger-type valve which allows air pressure, introduced into the lower end of the valve, to pass out the side port to the brakes. Rotating the handle to the right locks the valve in the open position. When the handle is rotated to the left and released after a brake application, any pressure that is left in the lines and brake chambers is relieved through a small hole in the center of the handle shaft.

(c) SHUTTLE VALVE - The shuttle valve at the wheel is an automatic unit through which either air or hydraulic pressure may be applied to the brake. When hydraulic pressure is applied, the cone-shaped valve shuts off the air pressure port and prevents fluid from entering the air line. The action is just the opposite when air pressure is applied.

NOTE

The brake hydraulic system must be bled after each use of the air pressure brake.

(10) ALIGHTING GEAR SAFETY DEVICES.

(a) SAFETY LOCKS. - Each unit of the alighting gear is equipped with a safety lock to prevent accidental retraction of that unit while the airplane is on the ground. When not in use, the locks are stowed in a canvas bag on the right side of the gunners' compartment adjacent to the lower entrance door. The locks for the main gear must be installed on the forward side of the retracting linkage and between the latch cams. (See figure 65.) The end of the nose wheel gear lock which incorporates the attaching bolt connects at the "knee" of the retracting linkage while the other end bears against the aft face of the shock strut. All the pins have long red strips of cloth, which are visible to the ground crew when the locks are installed. This is a precaution against a take-off with the locks installed, in which case the gear cannot be retracted.

(b) SAFETY SOLENOID. - The alighting gear solenoid is an electrically operated unit installed to the side of the alighting gear control valve to prevent inadvertent movement of the alighting gear control to UP position. When any load is on the alighting gear, the safety switch is OFF and the solenoid cap is held up by means of a spring. When the load is relieved from the gear, the safety switch is moved to ON and the circuit forces the solenoid cap down, affording free movement of the alighting gear control handle. In an emergency the solenoid cap may be forced down by hand.

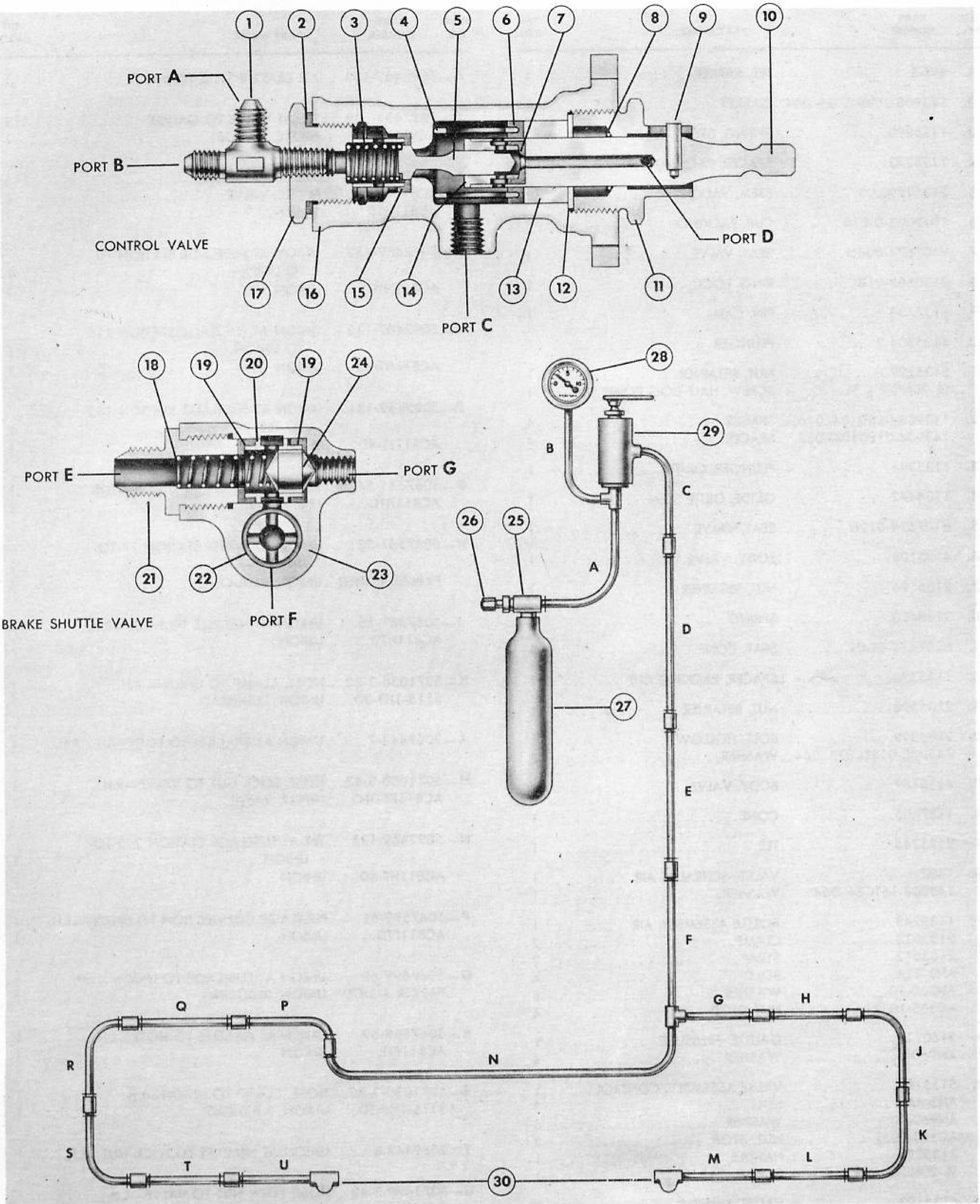


Figure 64 - EMERGENCY AIR-BRAKE SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4RT-S	TEE, PARKER	1
2.	143908-.030TC106-.064	GASKET	1
3.	1135290	SPRING, STEM	1
4.	1135293	SPACER, PACKING	1
5.	2135289	STEM, VALVE	1
6.	1049003-D-018	CUP, PACKING	1
7.	H107674-006N	SEAT, VALVE	1
8.	2130662-018C	RING, LOCK	1
9.	1137736	PIN, CAM	1
10.	4135304-2	PLUNGER	1
11.	2135299	NUT, RETAINER	1
	¼-20NC-2 x ⅜	SCREW, HALF DOG POINT SET	1
12.	143908-018D104-.016	SPACER	4
	143908-018D104-.032	SPACER	4
13.	1135294	PLUNGER, OILITE	1
14.	1135472	GUIDE, OILITE STEM	1
15.	H107674-012N	SEAT, VALVE	1
16.	4135108	BODY, VALVE	1
17.	2135196	NUT, RETAINER	1
18.	2135400	SPRING	1
19.	H107674-014N	SEAT, CONE	2
20.	1135396	SPACER, PACKING CUP	1
21.	2135398	NUT, RETAINER	1
22.	2135399	BOLT, HOLLOW	1
	143908-018TC026-.064	WASHER	2
23.	4135157	BODY, VALVE	1
24.	1137405	CONE	1
25.	2135245	TEE	1
26.	7607	VALVE, SCHRADER AIR	1
	143908-16TC24-.064	WASHER	1
27.	4135243	BOTTLE ASSEMBLY, AIR	1
	2133013	CLAMP	2
	2133012	STRAP	2
	AN3-22A	BOLT	4
	AN960-10	WASHER	8
	AC365-1032	NUT, STOP	4
28.	2160117	GAUGE, PRESSURE	1
	AN960-6	WASHER	4
29.	5135194	VALVE ASSEMBLY, CONTROL	1
	AN3-6A	BOLT	3
	AN960-10	WASHER	6
	AC365-1032	NUT, STOP	3
	2135298	HANDLE	1
	¼-20NC-2 x ⅞	SCREW, CAP	1
30.	4135193	VALVE, SHUTTLE	2

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
A—	5092469-138	AIR BRAKE BOTTLE TO VALVE	1
B—	5092469-139	TEE AT VALVE TO GAUGE	1
	AC811FT-4NS	NIPPLE, GAUGE	1
C—	5092469-137	VALVE TO UNION	1
	AC811FT-4NS	NIPPLE, VALVE	1
	AC811HTD	UNION	1
D—	5092469-132	UNION AT FUSELAGE STATION 70 TO UNION	1
	AC811HTD	UNION	1
E—	5092469-133	UNION AT FUSELAGE STATION 115 TO UNION	1
	AC811HT-4D	UNION	1
F—	5092469-134	UNION AT FUSELAGE STATION 165 TO TEE	1
	AC811JT-4D	TEE	1
G—	5067561-54	TEE AT FUSELAGE TO UNION—R.H.	1
	AC811HTD	UNION	1
H—	5067561-53	UNION AT WING STATION 27 TO UNION—R.H.	1
	PARKER 4-3HTD	UNION, REDUCING	1
J—	5067561-55	UNION AT NACELLE TO HOSE—R.H.	1
	AC811HTD	UNION	1
K—	5071030-3-20	HOSE, CLAMP TO UNION—R.H.	1
	3115-1HT-3D	UNION, BULKHEAD	1
L—	2069443-7	UNION AT BRACKET TO LOCK NUT—R.H.	1
M—	5071030-3-42	HOSE, LOCK NUT TO VALVE—R.H.	1
	AC811FT-3NS	NIPPLE, VALVE	1
N—	5092469-135	TEE AT FUSELAGE STATION 200 TO UNION	1
	AC811HT-4D	UNION	1
P—	5067599-61	FUSELAGE CONNECTION TO UNION—L.H.	1
	AC811FTD	UNION	1
Q—	5067599-60	UNION AT FUSELAGE TO UNION—L.H.	1
	PARKER 4-3HTD	UNION, REDUCING	1
R—	5067599-59	UNION AT NACELLE TO HOSE—L.H.	1
	AC811FTD	UNION	1
S—	5071030-3-20	HOSE, CLAMP TO UNION—L.H.	1
	3115-1HT-3D	UNION, BULKHEAD	1
T—	2069443-8	UNION AT BRACKET TO LOCK NUT—L.H.	1
U—	5071030-3-42	HOSE, LOCK NUT TO VALVE—L.H.	1
	AC811FT-3NS	NIPPLE, VALVE	1

LEGEND FOR FIGURE 64

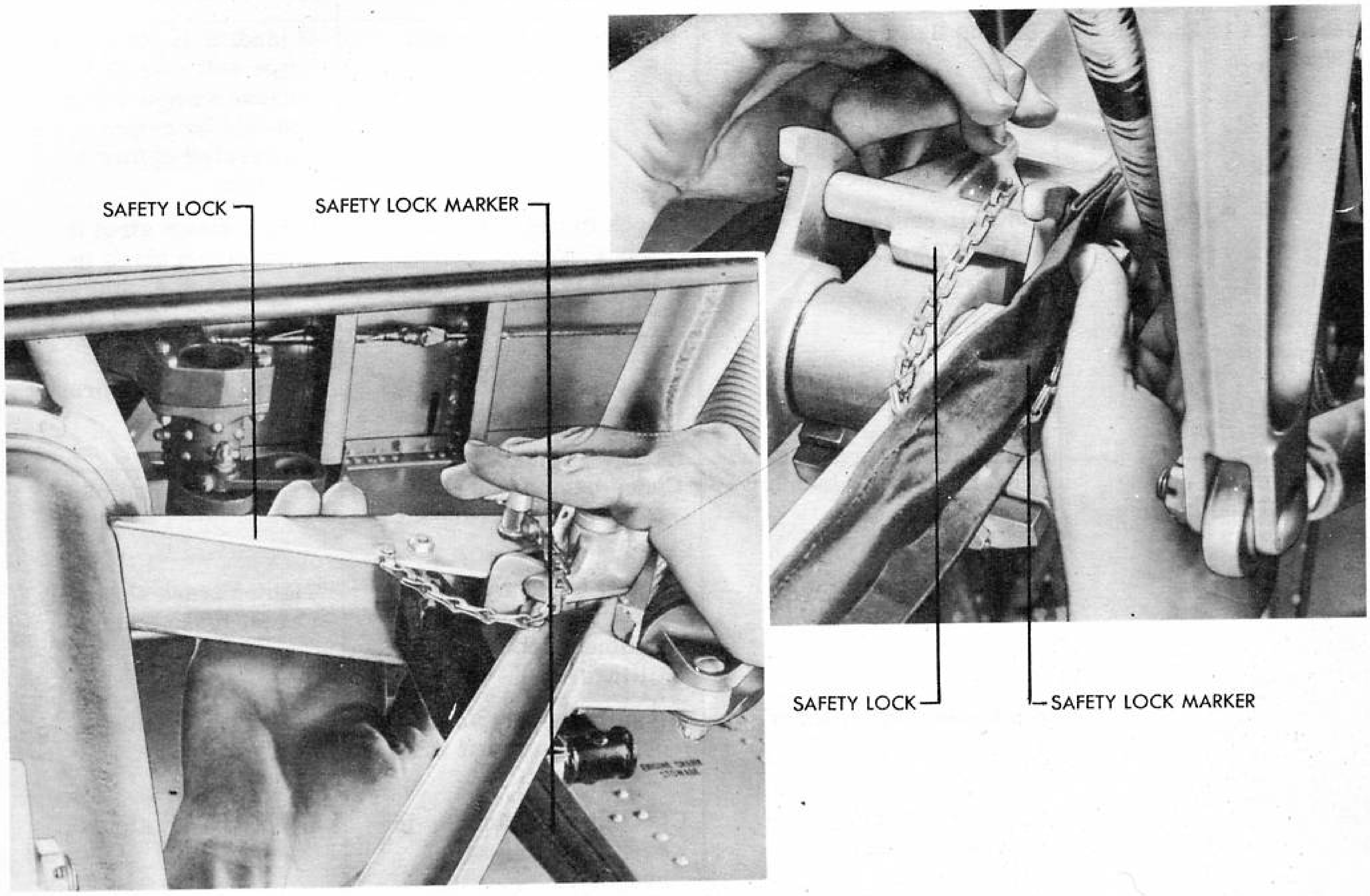


Figure 65 - INSTALLING ALIGHTING GEAR SAFETY LOCK

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	ISOLATION	REMEDY
Gear fails to extend or retract when operated hydraulically.	Lack of lubrication.	Visually inspect mechanism to determine if in need of lubricant.	Lubricate as required.
	Broken hydraulic line in landing gear system.	Loss of fluid and failure of pumps to maintain 850 ± 25 pounds per square inch pressure as long as control valve is in the DOWN position will indicate broken line.	Repair or replace hydraulic line. Replace fluid.
	No hydraulic pressure.		See Section 4, paragraph 16, this handbook.
	Improper adjustment of latch assembly.	Check latch assembly and see if it is operating properly.	Make correct adjustment.
Gear fails to extend when test-operated by emergency release (airplane on jacks).	Emergency cable disconnected.	Check to see if cable has become disconnected.	Connect cable and adjust.

SYMPTOM	CAUSE	ISOLATION	REMEDY
Gear fails to absorb shocks.	Soft or flat tire.	Inspect tire for proper air pressure.	If landing is made with tire soft enough to cause symptom, tire should be removed and inspected before inflation.
	Low air pressure in shock strut.	Check to see if length of shock strut piston showing is in accordance with paragraph 4, this section.	Inflate shock strut to dimension given in paragraph 4, this section.
	Lack of fluid in shock strut.	Remove valve assembly slowly and check fluid level.	Fill with fluid to proper level.
Gear vibrates during take-off and landing.	Wheel and tire assembly out of balance.	Check balance marker locations with respect to wheel.	Replace tire and tube.
	Loose truss assembly.	Inspect truss assembly at all attaching points for tightness, condition of fittings, etc.	Tighten truss assembly at all loose points.
	Bent actuating cylinder.	Visually inspect actuating cylinder to see if it is bent.	Replace actuating cylinder.
	Improper adjustment of latch assembly.	Check latch assembly to see if it is operating properly.	Make correct adjustment.
	Binding in actuating link mechanism.	Visually inspect retracting link mechanism and determine if it is operating freely.	Repair or make replacements where necessary.
	Frozen bearings.	Inspect bearings.	Replace bearings.
	Binding in packing.	Inspect retainer nut to determine if it is too tight.	Release air pressure. Remove retainer nut, check packing and tighten retainer nut by hand.
Shock strut remains depressed when weight is taken off gear.	Fluid lost its lubricating properties and caused piston bearings to score.	Inspect piston bearings to determine if they are scored.	Replace bearings.
	Bent shock strut.	Visually inspect shock strut to see if it is bent.	Replace shock strut.
Shock strut leaking.	Shock strut pitted by rocks, small stones, etc., from propeller blast.	Inspect shock strut for pitting.	Replace shock strut.
	Worn or incorrectly tightened packings.	Release air pressure. Remove and inspect packing.	Replace packings and adjust packing ring.
Wheel fails to rotate freely.	Brakes dragging.	Inspect brakes for proper adjustment.	Adjust brakes.

SYMPTOM	CAUSE	ISOLATION	REMEDY
	Wheel bearings too tight.	Remove wheel cover plate and inspect axle nut for correct tightness.	Readjust bearing nut.
Wheel emits grinding noise during towing operation.	Axle nut loose.	Check axle nut for tightness.	Tighten and safety axle nut.
	Worn wheel bearings.	Remove wheel and inspect bearings for wear.	Replace bearings.
	Bearings not installed properly.	Remove wheel and inspect bearings for proper installation.	Install bearings properly.
Brakes fail to operate on hydraulic system.	Broken hydraulic line.	Loss of fluid and failure of pumps to maintain 850 ± 25 pounds per square inch pressure while brake pedals are depressed will indicate broken brake line.	Repair or replace broken line. Replace fluid.
	Defective power brake control valve.	See Section 4, paragraph 16, this handbook.	Replace if defective.
Brake operation not uniform.	Brake valve out of adjustment.	Check brake valve for proper adjustment.	Adjust properly.
Brake operation spongy.	Air in hydraulic lines.	Check to determine if air is present in hydraulic lines.	Bleed lines.
Position indicator in pilot's cockpit fails to indicate position of alighting gear.	Burnt-out signal bulb.	Inspect bulb.	Replace bulb if burnt out.
	Faulty wiring.	Inspect wiring for breaks or cuts in the insulation.	Locate and repair circuit.
Throttle controlled warning horn not operating.	Faulty wiring.	Inspect wiring for breaks or cuts in the insulation.	Locate and repair circuit.
	Short circuit in horn.	Remove horn and test for operation.	Replace horn if internal wiring is defective.
Down latch fails to operate.	Lack of lubrication.	Inspect shaft bearing to determine if lubricant is needed.	Lubricate shaft bearing by squirting with engine oil. (NOTE: This bearing should be lubricated once every 25 hours in a like manner.)
Emergency air brake handle is pulled. The brakes respond, but the indicated air pressure continues to fall as long as the brake handle is held in OPEN position.	External leakage in air system.	Paint fittings with Kelite No. 2A bubble fluid, ivory soap and water solution or equivalent and look for air bubbles.	Repair or replace parts and fittings where leakage appears.
	Air leakage through the hydraulic system.	Remove and inspect the shuttle valve for damaged valve seat or fittings.	Disassemble, repair, or replace parts where necessary.

SYMPTOM	CAUSE	ISOLATION	REMEDY
No pressure is indicated by the air pressure gage.	No air under pressure in the emergency brake bottle.	Inflate bottle to 850 pounds per square inch pressure as directed, and observe pressure gage for evidence of leakage in air brake valve.	Remove, disassemble, and repair air brake valve if leaking.
Alighting gear does not respond to operation of the pilot's control handle, and the indicated hydraulic pressure remains constant.	Faulty adjustment of, or mechanical failure in the cable system from the pilot's control to the alighting gear valve.	Inspect the cable system between the control handle and the alighting gear control valve.	Replace or adjust parts where necessary.

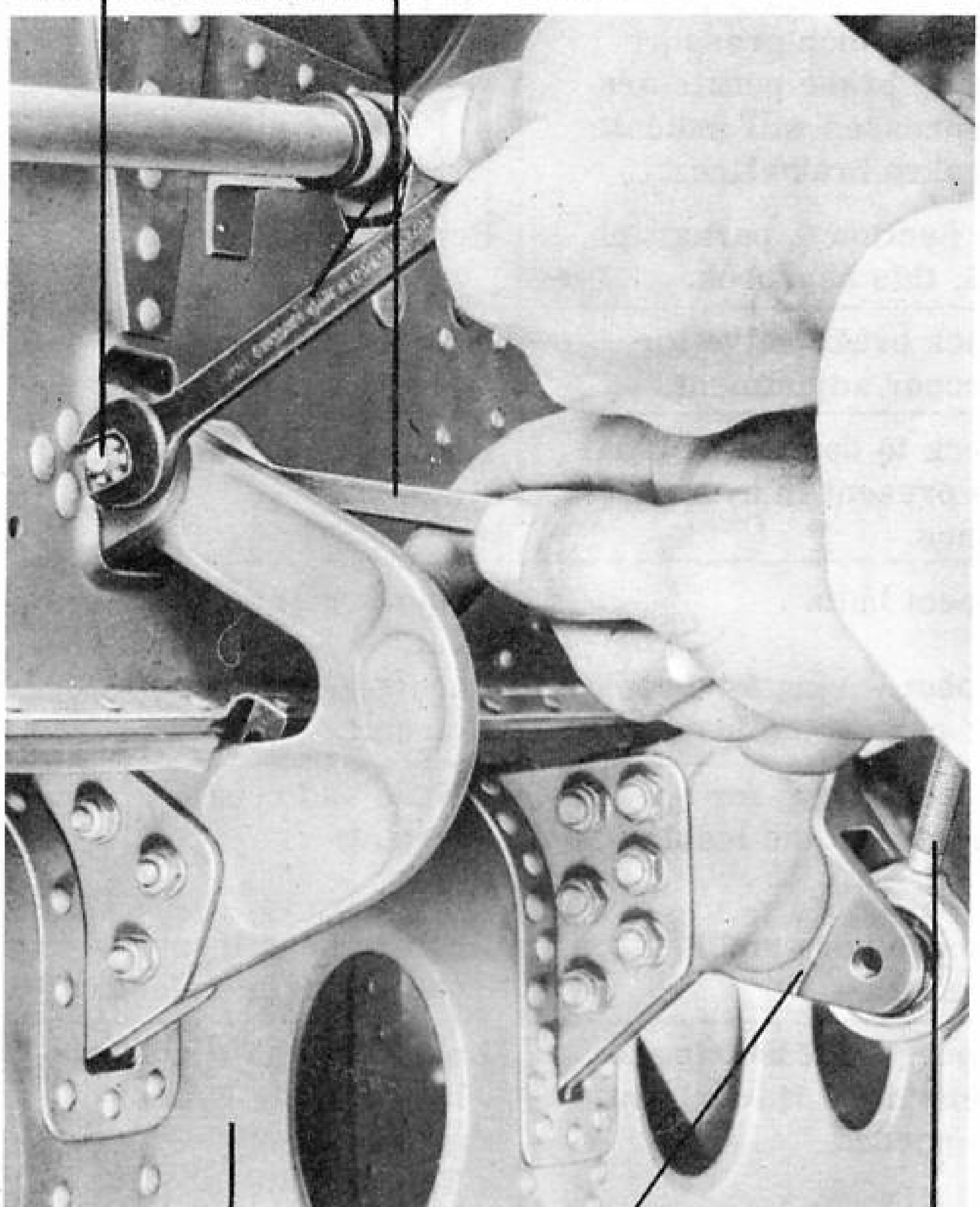
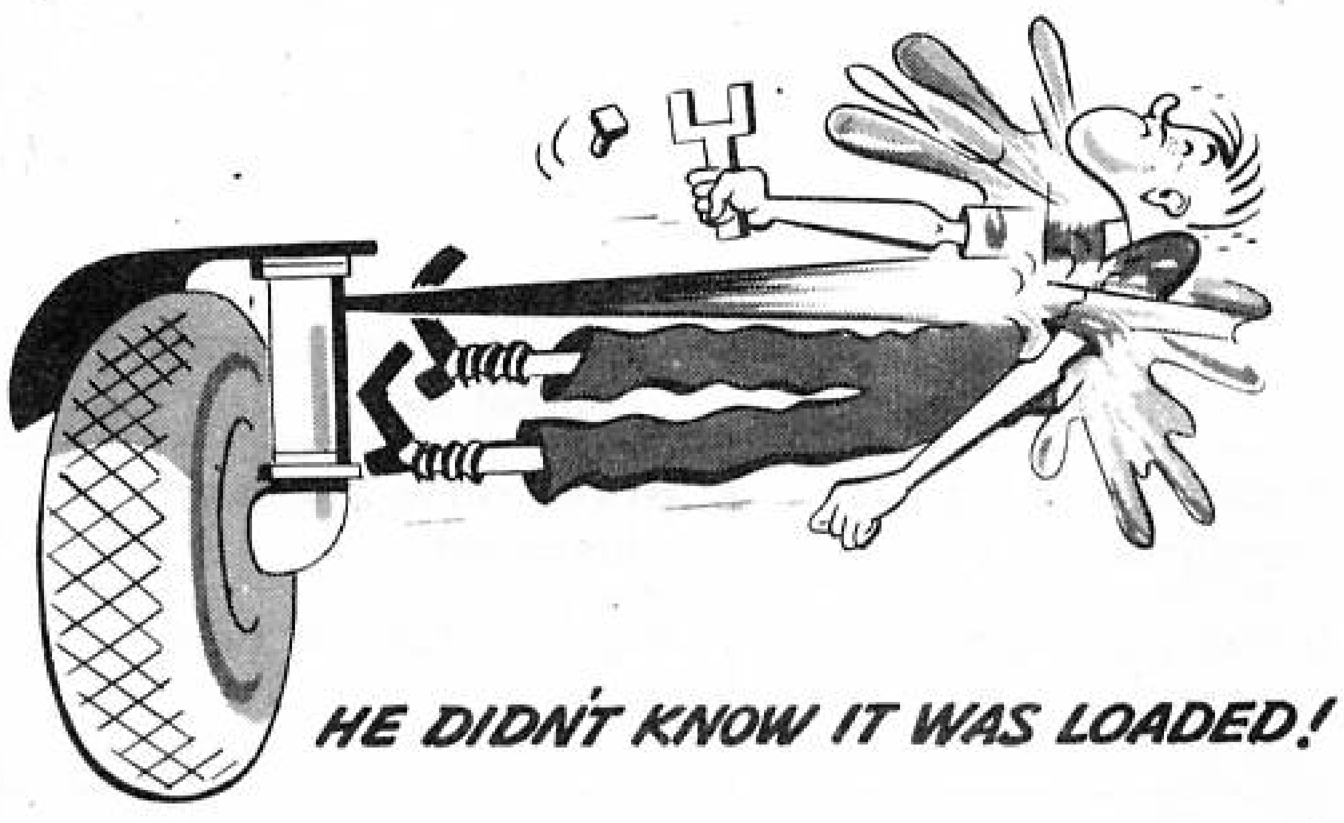


Figure 66 - REMOVING NACELLE DOOR



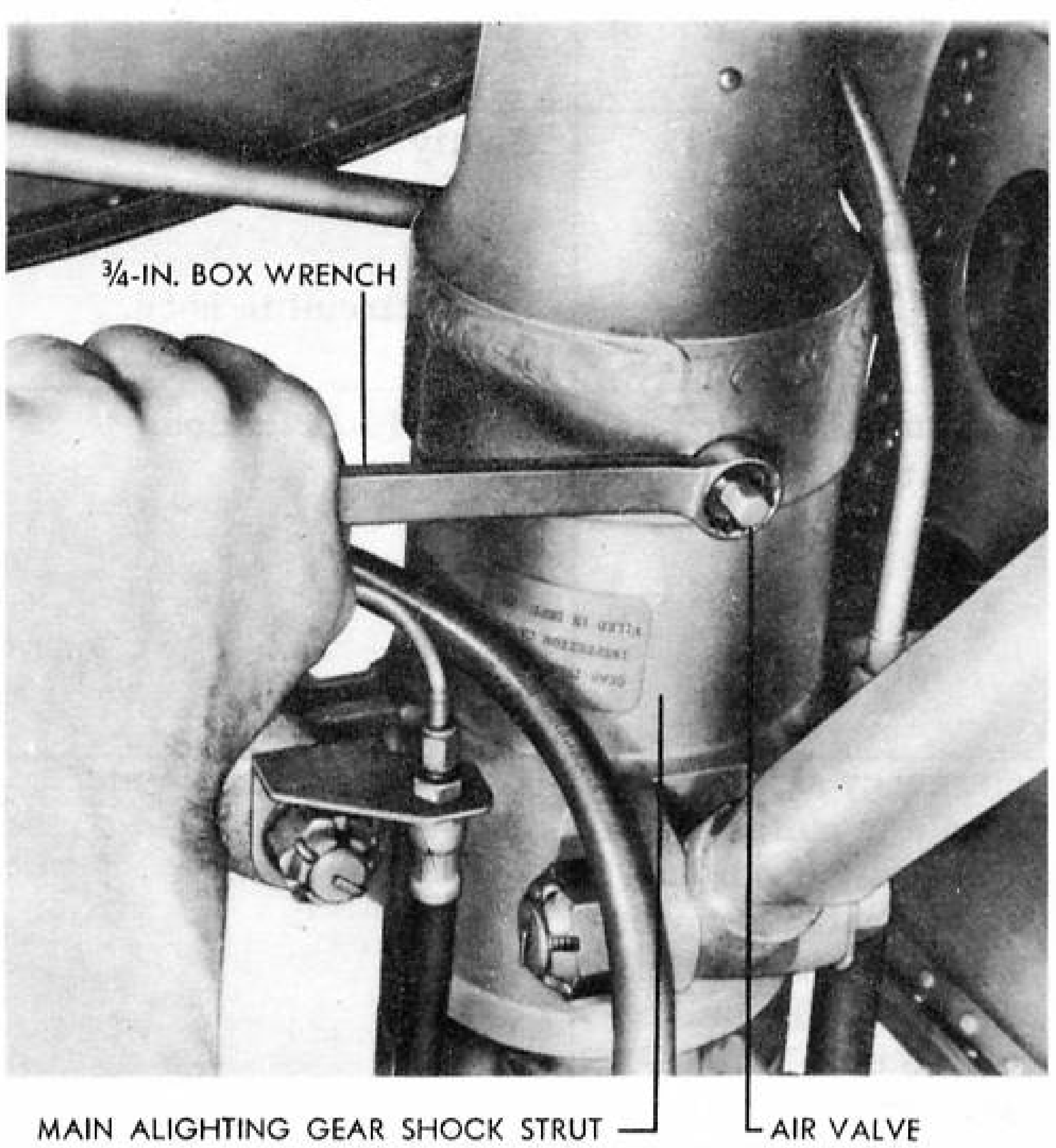


Figure 67 - LOOSENING SHOCK STRUT AIR VALVE BODY

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF NACELLE DOORS. (See figure 66.)

(a) Disconnect actuating link at bell crank on outboard door.

(b) Remove cross link at front of nacelle doors.

(c) Remove hinge bolts and release doors from nacelle.

(2) REMOVAL OF MAIN ALIGHTING GEAR. - In the following procedure all the item numbers referred to are shown in figure 78.

(a) Support the airplane on tripod stands and relieve the air pressure in the shock strut by slowly backing off the air valve body. DO NOT REMOVE FILLER PLUG UNTIL ALL AIR HAS ESCAPED. Do not depress the valve core. (See figure 67.)

(b) Remove the interconnecting rod at the forward end of the enclosure doors. Disconnect the actuating rod at the outboard door. (See figure 68.) Remove hinge bolts and release door from nacelle. Remove doors. Relieve pressure in the hydraulic system by operating the wing flaps until the pressure gage reads "zero." Disconnect and plug the alighting gear hydraulic lines.

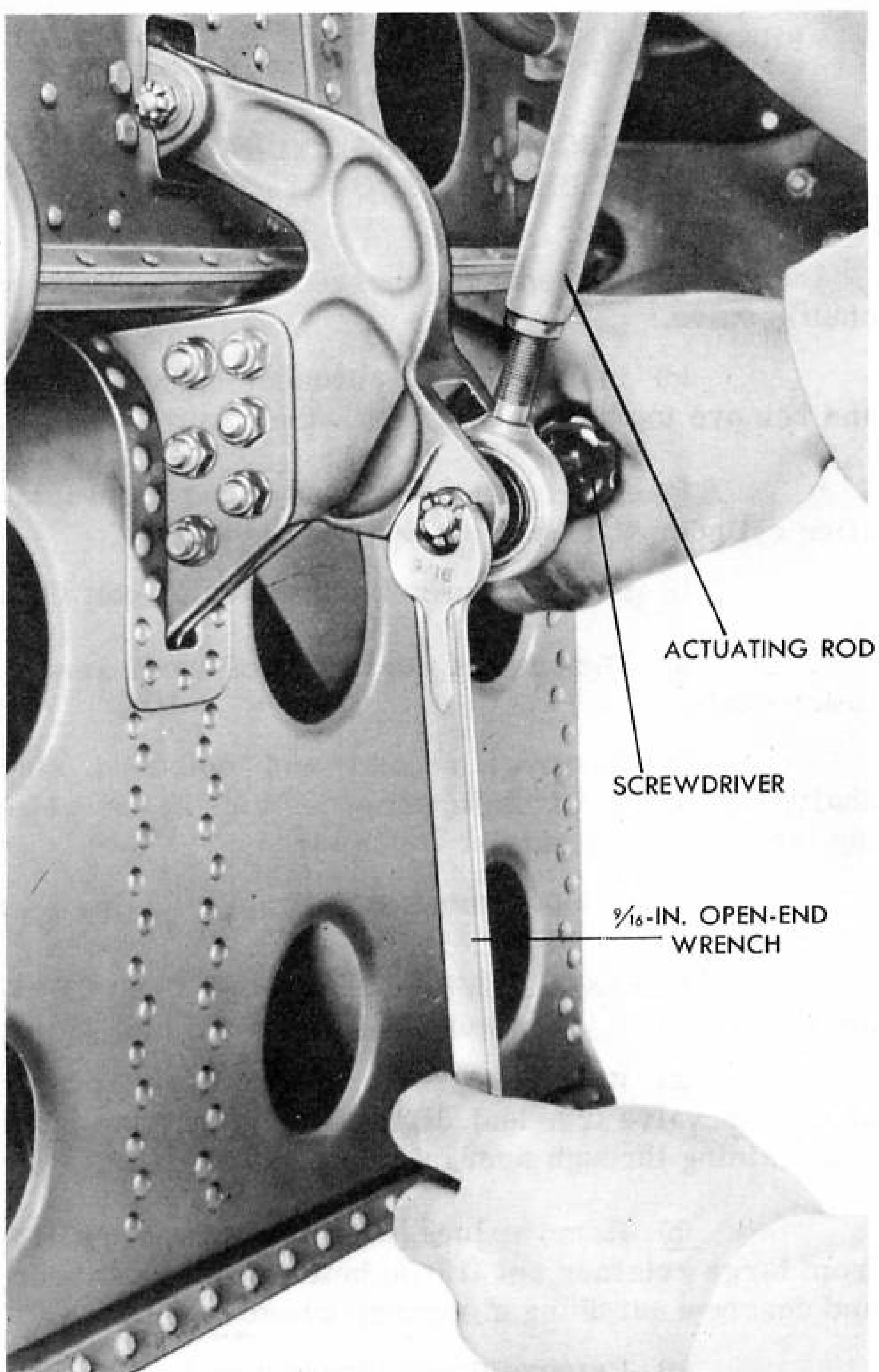


Figure 68 - DISCONNECTING ALIGHTING GEAR DOOR ACTUATING ROD

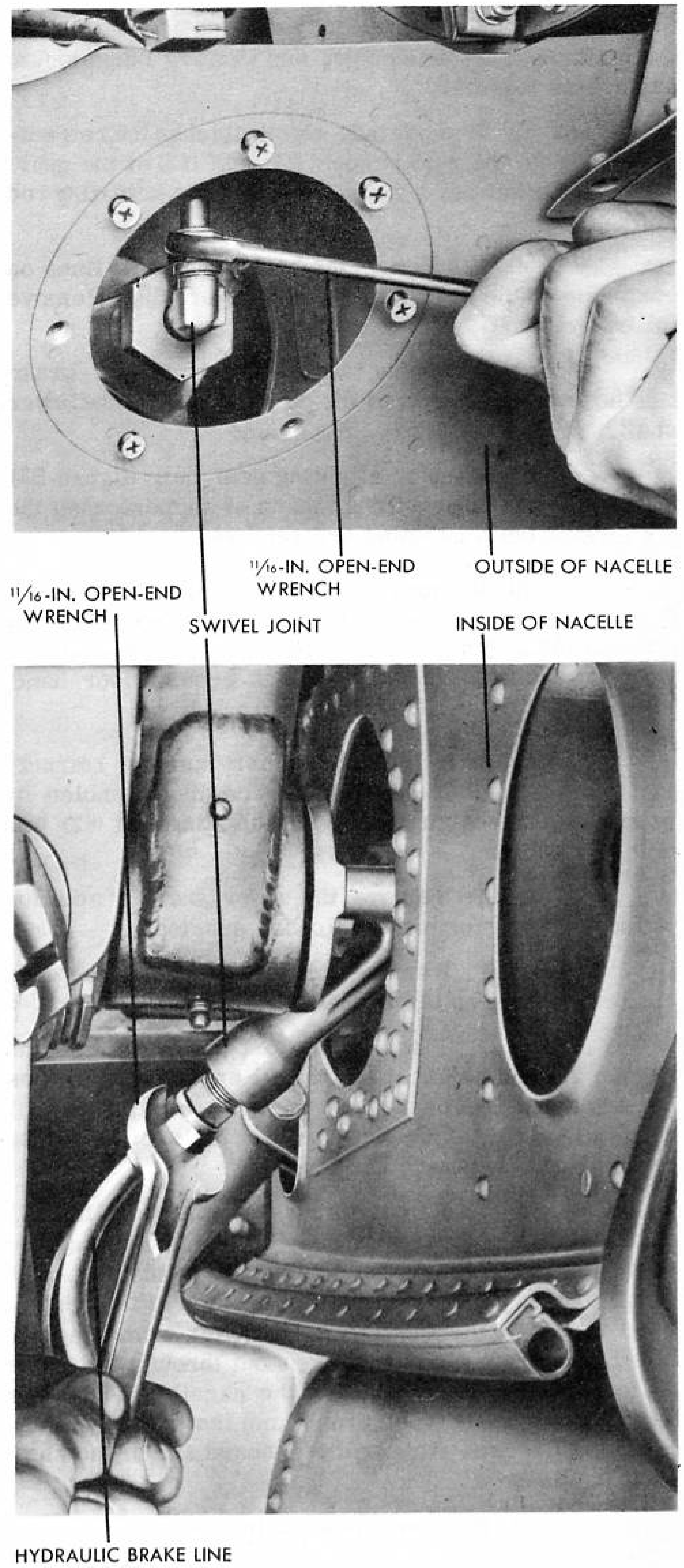


Figure 69 - DISCONNECTING BRAKE HYDRAULIC LINES

(c) Insert a bungee spreader between the pulleys of the bungee unit. (See figure 76.) Adjust it to relieve the load on the spool mounting bolts. Remove the bolts holding two spools, and remove bungee (20) and spools together.

(d) Remove bolt which attaches the retracting linkage to the rear braces (11) and (13) of the gear. Remove the actuating strut (19) and door actuating rod (12).

(e) Disconnect the brake hydraulic lines on each side of the swivel joint. (See figure 69.) Remove the swivel joint.

(f) Disconnect the emergency air brake line hose at the aft side of the outboard end of the lower shaft.

(g) Place an alighting gear dolly (figure 23) under the gear to provide a means of support when the pin locking bolts and pins are removed.

(h) Remove nuts and washers (36) and (55) from each end of the shaft and the pin locking bolts (47) and (54). Using an alighting gear pin puller remove the pins by working through access door hand holes (P) and (Q). (See figure 19.)

(i) The latch mechanism and the retracting links (32), (34) and (35) may be disassembled by removing the bearing cap (63), actuating rod (62) and bolts (4) and (7).

(j) To remove the upper shaft in addition to the gear, perform the following substeps:

1 Remove bolt (44) that holds the door crank retaining collar in place.

2 Place a support under the engine (figure 23) and adjust it so that all engine weight is on the support and not on the alighting gear truss. This will relieve loads on the rear attaching bolts of the truss during their removal.

3 Remove truss attaching bolts (31) and (46). The outboard bolt may be reached through the hole in the rear shear web directly aft of the bolt. The large access hole in the lower surface of the wing is used to reach the inboard bolt. After removing the bolts, the shaft may be driven out through the cover plate on the outboard side of the nacelle. The upper retracting link, the door crank, and the door crank retaining collar will slide off the inboard end of the shaft as it is removed.

(k) Remove the alighting gear.

(3) REMOVAL OF MAIN ALIGHTING GEAR SHOCK STRUT. (See figure 78.)

(a) Remove wheel and brake.

(b) Disconnect hydraulic brake line at upper end and then at the axle, and cap the openings. (See figure 70.)

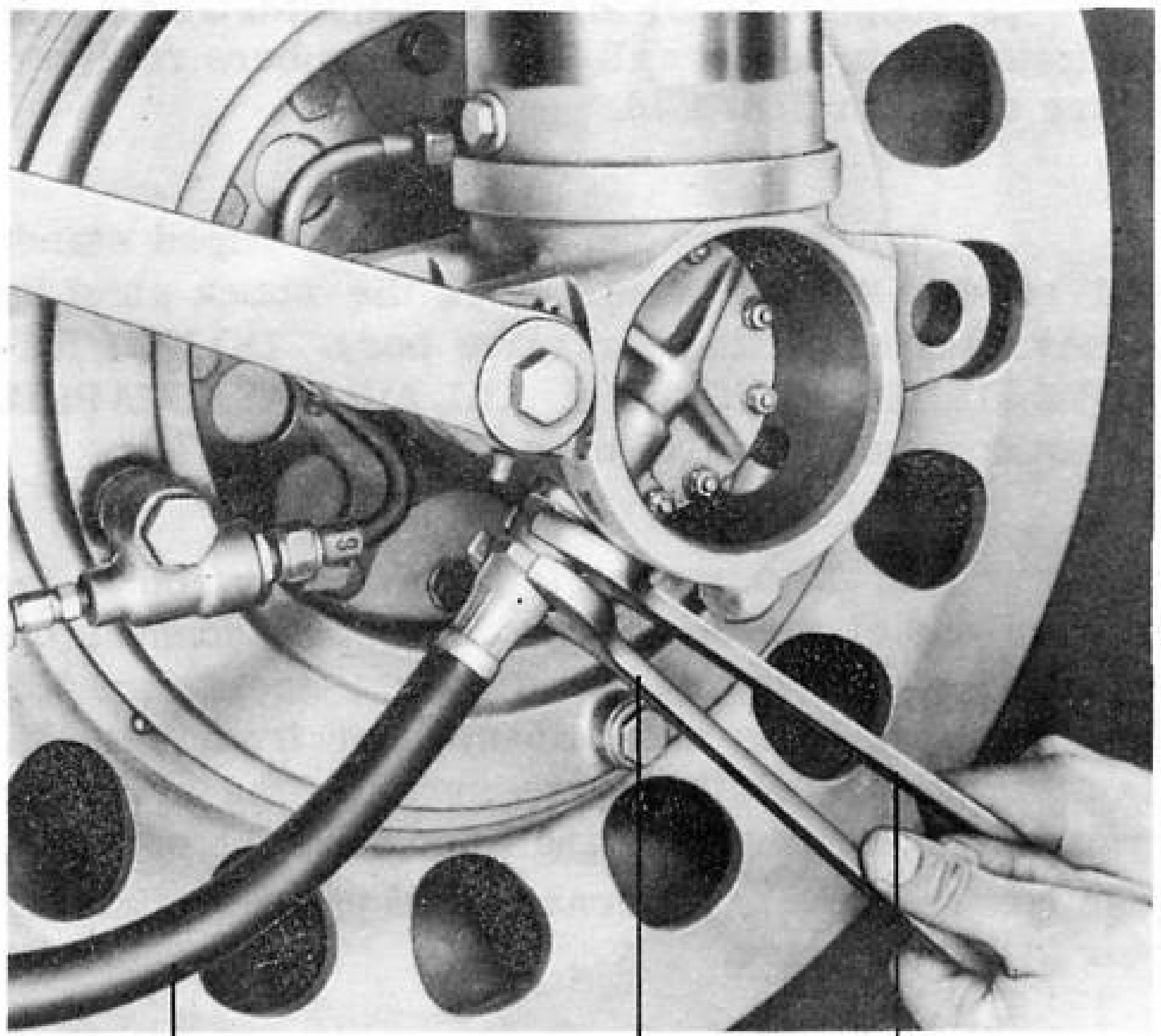


Figure 70 - DISCONNECTING HYDRAULIC LINE AT BRAKE DEBOOSTER

(c) Disconnect emergency air brake from shuttle valve.

(d) Install bungee spreader in bungee (20) and remove top bungee spool (2). (See figure 76.)

(e) Disconnect lower end of hydraulic actuating cylinder (19) by removing lower eyebolt.

(f) Remove lower latch attaching bolt (9).

(g) Disconnect actuating rod from arm on lower shaft.

(h) Remove inboard and outboard stub shafts (38) and (56) from lower cross tube by unscrewing the castellated nuts at both ends.

(i) Remove shock strut from alighting gear.

(4) DISASSEMBLY OF MAIN ALIGHTING GEAR SHOCK STRUT. (See figure 62.)

(a) Relieve all air pressure in shock strut at the air valve (29) and drain oil by inverting strut and draining through hydraulic inlet fitting hole.

(b) Remove lock wire and set screw (13) from large retainer nut (12) on bottom of the cylinder, and unscrew nut using a spanner wrench.

(c) Remove lower torque arm bolt (6).

(d) Replace the air valve body and slowly inflate the strut BY HAND or with hydraulic pressure, to a fully extended position. Increase the pressure enough to force the piston assembly out of the cylinder. It may be necessary to use a slight bumping action to break packing rings loose.

(e) Remove the set screws (28) and unscrew the bronze piston head (27).

(f) Remove the damper valve ring (26).

(g) Remove set screws (24) from bronze piston stop (25) and unscrew stop from piston.

(h) Remove the packing ring (4), five chevron packings (16), packing ring (3), retainer ring (15), large bronze piston bearing and packing nut (12) from the upper end of the piston.

(5) REMOVAL OF MAIN ALIGHTING GEAR WHEEL. (See figure 71.)

(a) Remove cover plate from the wheel by taking out fasteners. Pull the hub cap from the axle.

(b) Remove cotter pin, castellated nut, and washer from axle.

(c) Remove wheel assembly by sliding outward until free. Do not allow the wheel bearings to fall from the wheel when it is being removed.

(d) Place wheel and tire assembly on floor with brake side up as wheel seal ring extends slightly beyond tire line and may become damaged if placed face down.

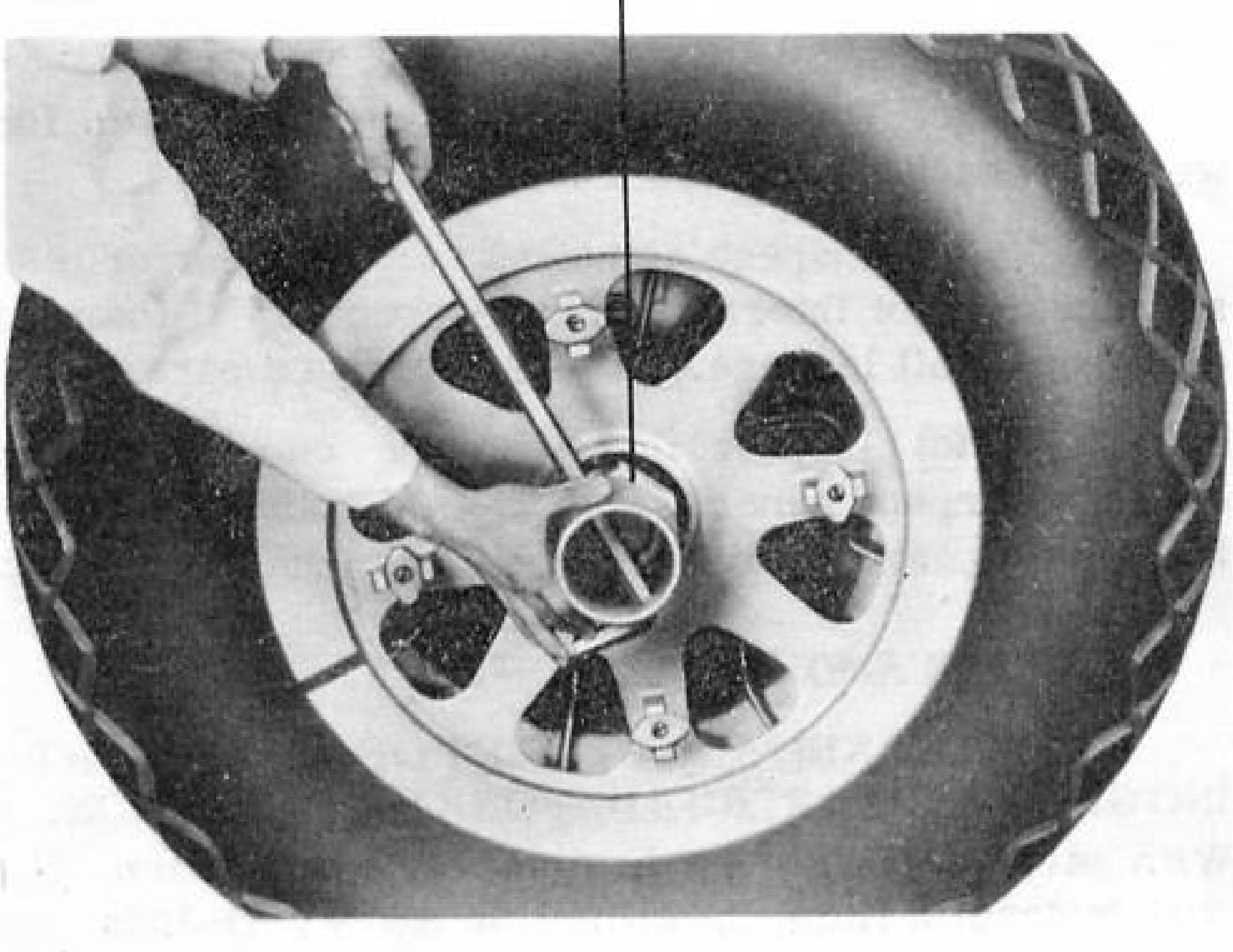


Figure 71 - REMOVING MAIN ALIGHTING GEAR WHEEL

(6) REMOVAL OF MAIN ALIGHTING GEAR TIRE.

(a) Remove the valve core and deflate tube completely. Remove any accessories that may be holding the stem.

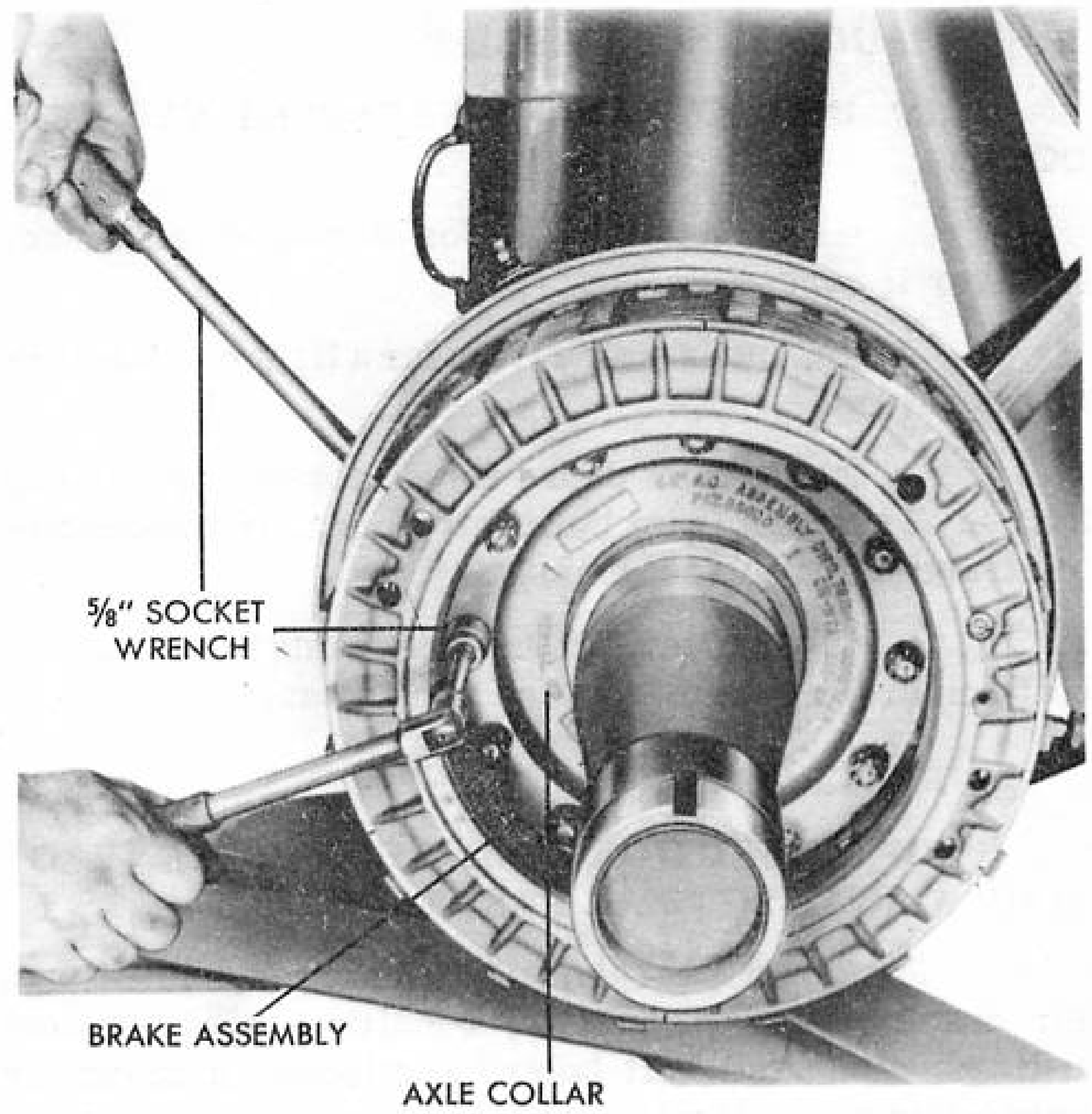


Figure 72 - REMOVING BRAKE

(b) Force outer bead from the bead seat by any suitable means that will not injure the tire or tube.

(c) Insert two irons under the outer bead (about two or three inches apart) and force the bead over the flange at the valve; at the same time force the bead into a well at a point opposite the valve.

(d) Using one iron, work the rest of the outer bead over the flange a little at a time.

(e) Break the inner bead from the bead seat in the same manner as outer bead.

(7) REMOVAL OF BRAKES. (See figure 72.)

(a) Remove wheel.

(b) Disconnect emergency air brake hose from shuttle valve.

(c) Remove the 12 bolts which secure the brake assembly to the axle collar.

(8) DISASSEMBLY OF BRAKES. (See figure 63.)

(a) Remove lock screw from adjustment ring. Remove ring by turning it counterclockwise.

(b) Remove plates.

(c) Remove asbestos heat transfer ring.

(d) Remove the six finger springs.

(e) Remove the cup retainer ring.

(f) Remove the Neoprene cup.

d. MAINTENANCE REPAIRS,

(1) INSPECTION AND REPAIR OF NACELLE DOORS.

(a) Inspect doors for damaged covering. Recover if necessary.

(b) Inspect all rivets for a tight fit. Replace rivets if loose.

(c) Inspect doors for distortion or twist in excess of preload twist built into doors. If impossible to straighten, replace doors.

(d) Inspect all attaching points for elongated bolt holes. Repair or replace if necessary.

e. REPLACEMENTS.

(1) INSPECTION AND REPLACEMENT OF MAIN ALIGHTING GEAR PARTS.

(a) Inspect shock strut, braces, and fittings for cracks, bends, security, condition of attachment fittings, elongated bolt holes, and loose, missing, or unsafetied nuts. Replace damaged parts.

(b) Inspect latches for distortion or cracks. Replace if necessary.

(c) Inspect all shafts and braces to determine if they are bent. Replace if they cannot be straightened.

(d) Check fit of all pins, bolts, and shafts in their respective holes. Replace parts necessary to assure a free running fit.

(2) INSPECTION AND REPLACEMENT OF MAIN ALIGHTING GEAR SHOCK STRUT PARTS.

(a) Inspect the five chevron packings (16), two packing rings (3) and (4), bronze retainer ring (15), and packing (11) for wear and pitting. Replace if damaged.

(b) Inspect piston for wear, pitting, or flat spots. Replace if damaged.

(c) Inspect cylinder walls for wear and pitting. Replace if damaged.

(d) Inspect cylinder walls for being out-of-round with a dial indicator or inside micrometers. Lap inside of piston if necessary and thoroughly clean.

(e) Inspect cylinder for cracks or flaws in the metal. Replace if defective.

(f) Inspect piston to see if it is bent. Replace if bent.

(3) INSPECTION AND REPLACEMENT OF MAIN ALIGHTING GEAR WHEEL PARTS.

(a) Inspect wheel for cracks and distorted rim flanges and rims. Replace wheel if cracked or distorted.

(b) Inspect wheel bearing cups to determine if they are properly seated in wheel. Check for pitting. Replace if damaged.

(c) Clean wheel bearings in solvent and examine bearing rolls for wear, flatness, and pitting. Replace bearing if worn or damaged.

(d) Inspect bearing surfaces of axle for roughness and pitting. Resurface axle and use undersize bearings or replace axle if roughened.

(e) Replace felt grease retainer for inboard bearing.

(4) INSPECTION AND REPLACEMENT OF MAIN ALIGHTING GEAR TIRE. - Inspect the tires for breaks in the casing and inspect the beads for breaks and cuts. Inspect side walls inside and out for breaks, cuts, blisters and loose cords. Inspect tread for cuts through the fabric. Test the tubes for leaks and any sign of deterioration. Inspect tube for bad wrinkles. Replace a tire with any break in the fabric, tread cuts through into the fabric, or with damage on the contour line where flexing occurs. Replace badly wrinkled or cracked tubes.

(5) INSPECTION AND REPLACEMENT OF BRAKE PARTS.

(a) Inspect bronze and steel plates for wear, warping, or cracks. Replace if worn, warped, or broken.

(b) Replace asbestos heat transfer ring if worn or damaged.

(c) Check splines on hub and wheel for wear or cracks. Replace worn or broken parts.

(d) Inspect actuating cup for wear or disarrangement of internal spring, especially if there is evidence of oil leakage. Replace damaged parts.

(e) Inspect the Neoprene cup for nicked edges, wear, and general condition. Be sure the backbone springs are in alinement. Replace damaged parts.

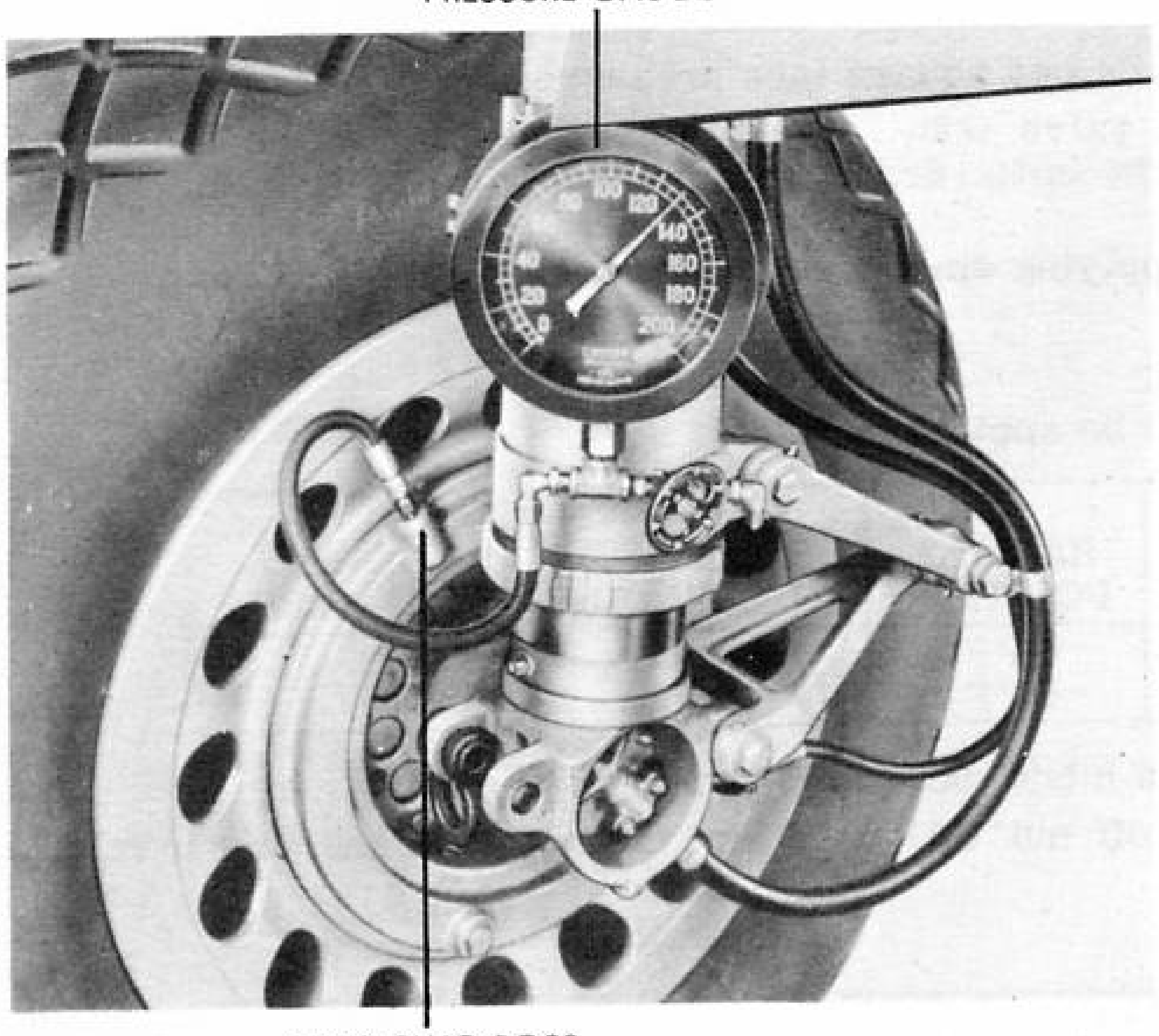
f. TESTS AND ADJUSTMENTS.

(1) TEST AND ADJUSTMENT OF MAIN ALIGHTING GEAR SHOCK STRUT BEFORE INSTALLATION. - With strut vertical and in compressed position, fill with hydraulic fluid, Specification AN-VV-O-366a, up to the filler plug hole and replace the valve assembly. Inflate with air to extended position, then release the air. Attempt to collapse the oleo by hand. If unsuccessful, the piston is not operating freely and the packing nut must be adjusted.

(2) ADJUSTMENT OF BRAKES.

(a) BRAKE UNIT.

1 Remove wheel.



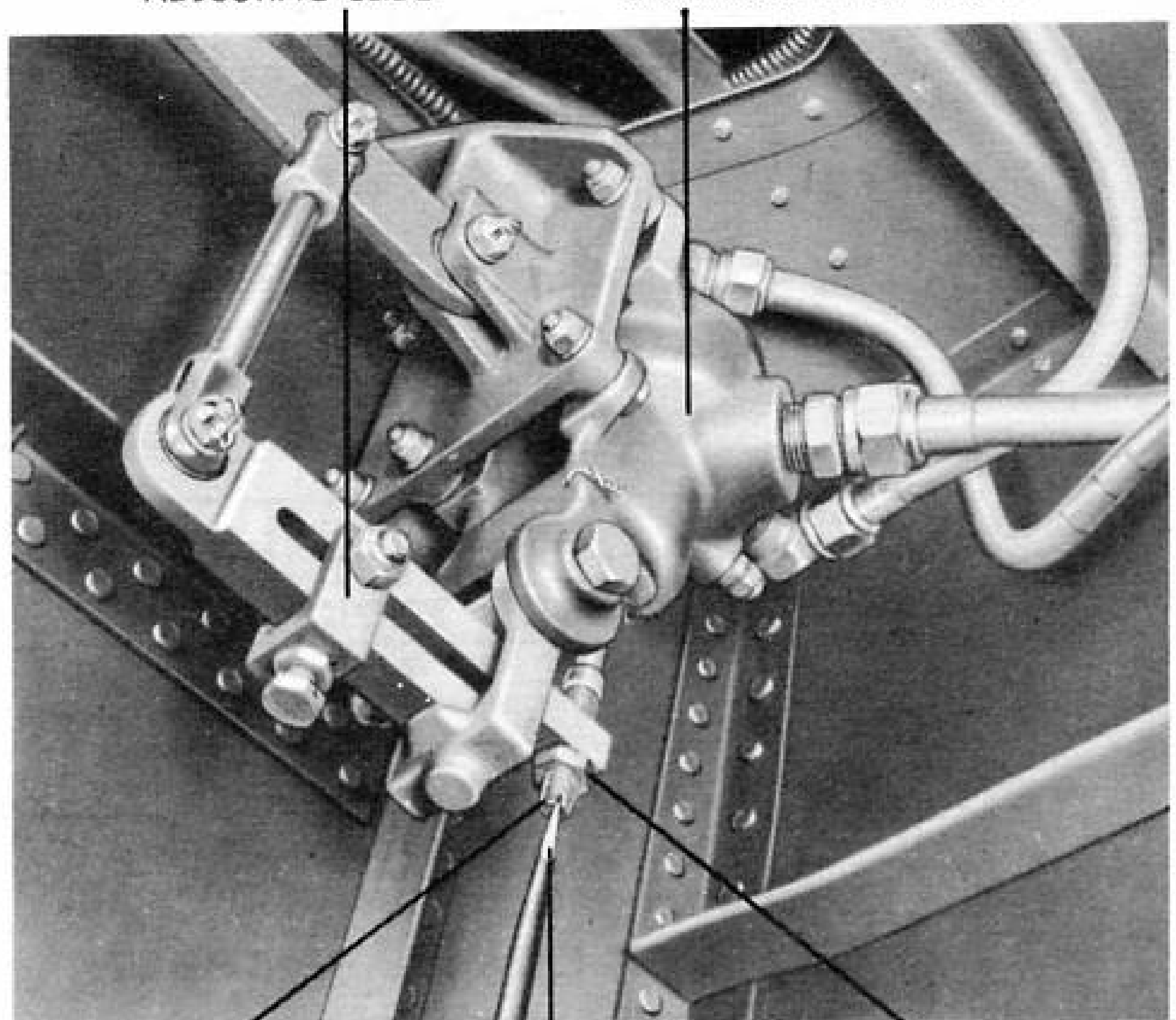


Figure 73 - ADJUSTING BRAKES

2 Tighten the retaining ring until snug, then back off to give a total clearance (between all the disks) of 0.112 ± 0.005 inch. Continue to back the ring off until the next lock position is reached.

3 If feeler gages are not available, the above adjustment may be made on the basis that one complete turn of the retainer ring gives 0.060-inch clearance.

4 Install and safety the lock screw.

5 Install wheel.

(b) BRAKE CONTROL VALVE.

1 Remove bleed plug at brake and install 200 pounds per square inch pressure gage. (See figure 73.)

2 Have man in cockpit pump up accumulator to 850 pounds per square inch.

3 With brakes OFF, loosen adjusting screw nut at brake control valve (one in each upper forward corner of the nose wheel well) and tighten adjusting screw until 20 pounds per square inch is reached on the gage, then loosen adjusting screw until gage reads zero. Repeat up to 20 back to zero a few times until exact zero point is determined. Then back off adjusting screw an additional 1/2 turn and tighten adjusting screw lock nut. (See figure 73.) Be sure man in cockpit maintains 850 pounds per square inch in accumulator while above adjustment is made.

4 Have man in cockpit kick brake full ON. Gage at brake should read 130 to 135 pounds per square inch pressure. If it does not, release brake and move adjusting slide fore or aft until 130 to 135 is reached with brake full ON, then safety. (See figure 73.) Moving aft decreases pressure. Moving forward increases pressure. Be sure man in cockpit maintains 850 pounds per square inch pressure in accumulator while above adjustment is made.

5 After adjusting both brake control valves apply parking brake. Pressure should not drop below 100 pounds per square inch. If it does, adjustment of parking linkage is necessary.

6 Remove gages and watch fluid level. It should not drop and there should be no bubbles.

7 Reinstall bleed plug and bleed screw.

8 Kill pressure in system, return hand pump bypass valve to SYSTEM position and recheck fluid level in hydraulic reservoir. Add fluid, Specification AN-VV-O-366a, if necessary.

(3) BLEEDING BRAKES. (See figure 74.) - Remove the screw from the bleeder port nut and install a bleeder hose, placing the free end of the hose in a fluid container. Inspect to see that the fluid reservoir is full and that the system pressure is up to approximately 150 pounds per square inch. Unscrew the bleeder port about 1/2 turn. Apply brakes and allow the fluid to escape until it is free of any evidence of air bubbles. With the end of the hose immersed in oil, slowly release the brakes and wait 30 seconds before tightening the bleeder port nut.

(4) TESTS OF EMERGENCY AIR BRAKE SYSTEM. (See figure 64.)

(a) COMPLETE SYSTEM.

1 Inflate bottle (27) to 400 (+50, -0) pounds per square inch pressure.

2 With foot brakes off, operate control valve (29). Maintain pressure for three minutes. If pressure gage (28) shows decrease in pressure after the initial drop, check fittings with soapy water. Repair leaks.

3 Bleed hydraulic brake system after applying emergency air brakes.

(b) CONTROL VALVE ASSEMBLY.

NOTE

In following tests, air must be applied suddenly.

TEST PORT	PORTS PLUGGED	TEST FLUID	PRESSURE (POUNDS PER SQUARE INCH)	HANDLE POSITION	LEAKAGE ALLOWABLE	TIME (MINUTES)
B	A	Air	800	OFF	None	3
B	A and C	Air	800	OFF	None	3

1 Plunger assembly should begin to open intake port 1/16 inch before end of travel.

2 After making above adjustment, back off nut (11) until slot indexes with one hole in valve body (16). Lock with set screw.

(c) SHUTTLE VALVE ASSEMBLY.

TEST PORT	PORTS PLUGGED	TEST FLUID	PRESSURE (POUNDS PER SQUARE INCH)	LEAKAGE ALLOWABLE	TIME (MINUTES)
E	F	Oil	900	None	1
G	F	Air	800	None	3
E	F	Oil	100	None	3

g. ASSEMBLY AND INSTALLATION.

(1) ASSEMBLY OF BRAKES. (See figure 75.)

(a) Replace the Neoprene cup.

(b) Install the retainer ring, lining up pin with center of any spline.

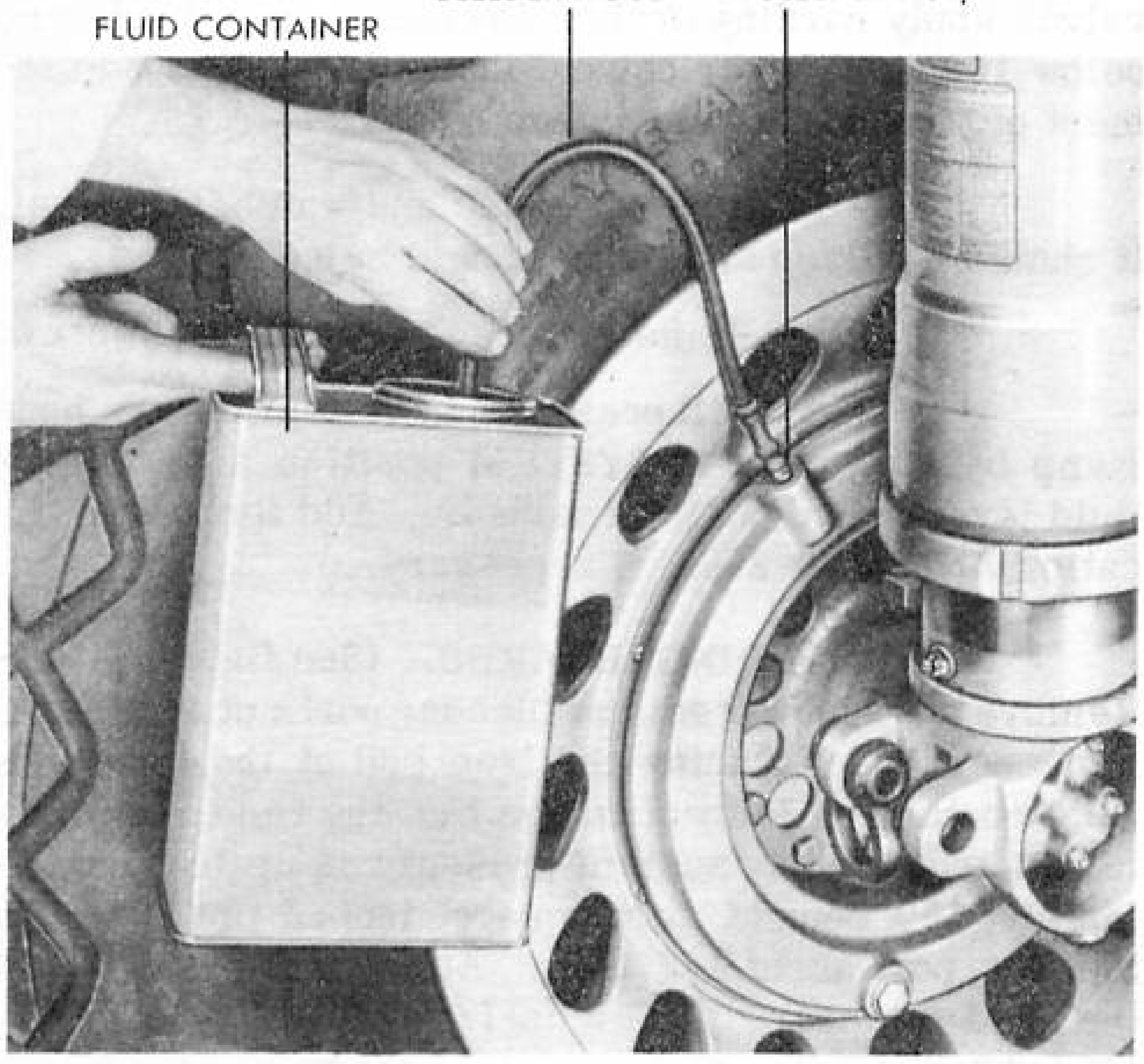


Figure 74 - BLEEDING BRAKES

(c) Install finger springs, being careful to have ends rest on steel insert buttons.

(d) Install asbestos heat transfer ring, lining up pin with hole.

(e) Assemble plates, beginning with a steel stationary plate and alternating steel and bronze plates. There are 17 steel plates and 16 bronze plates (steel at each end against the insulator disk and the retainer ring).

(f) Install adjustment ring, turning clockwise. Tighten until snug, then back off until 0.112 ± 0.005-inch clearance between ring and plates is reached. Check clearance at three points simultaneously (use three gages). One revolution of the ring equals 0.060 inch. Line up lock screw hole at point nearest correct adjustment.

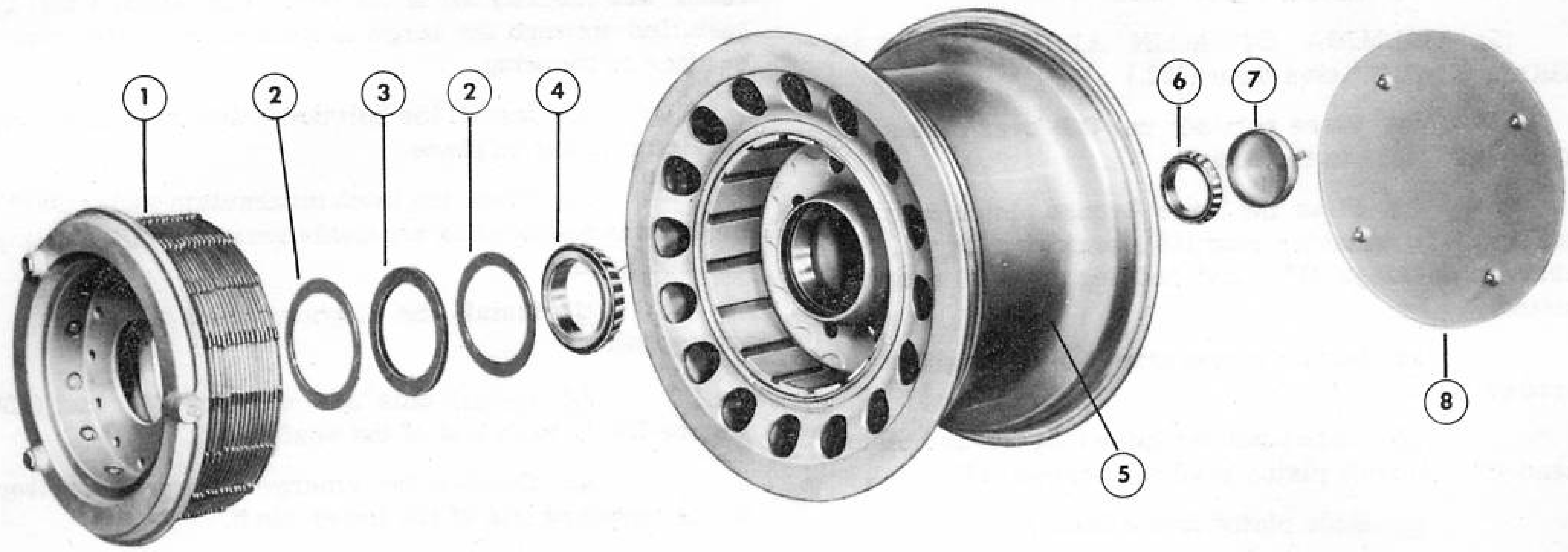
(g) Install and safety the lock screw. Line up splines.

(2) INSTALLATION OF BRAKES.

(a) Secure brake assembly to axle collar with the eight bolts.

(b) Install shuttle valve and connect emergency air-brake hose. (See figure 75.)

(c) Install wheel after adjusting brake unit.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	731946	BRAKE ASSEMBLY	1
2.	218349-4	RING, BEARING CLOSURE	2
3.	218350-4	WASHER, BEARING CLOSURE FELT	1
4.	42375	BEARING, ROLLER	1
5.	731944	WHEEL SUBASSEMBLY	1
6.	34300	BEARING, ROLLER	1
7.	218627	CAP ASSEMBLY, HUB	1
8.	218628	FAIRING ASSEMBLY	1

Figure 75 - WHEEL AND BRAKE - EXPLODED VIEW

(3) INSTALLATION OF MAIN ALIGHTING GEAR TIRE.

(a) Insert the tube into tire with the heavy spot of the tube marked with a 1/2-inch by 2-inch colored bar in line with the light spot on the tire which is marked with a colored dot. Inflate slightly to round out the tire.

(b) Mount tire from the outside of the wheel (the side which has the valve hole), forcing the first bead over the flange by hand as much as possible. Then use a tire iron to force a little of the bead at a time and to force into the well that portion of the bead which is already over the flange.

(c) Line up valve in tube with valve hole in wheel by rotating the tire and tube on the wheel. Keep balance marks exactly in line.

(d) Force tube over flange by using hand pressure at one point and then work the rest of the tube over the flange.

(e) Start valve through valve hole and apply a valve stem extension or other suitable means to hold the valve in place while the second bead is being applied.

(f) Force the second bead over the flange, starting at a point directly opposite the valve and working bead in the same manner as the first bead.

(g) Adjust tire and wheel to be as concentric as possible. Then inflate tube and force beads of tire onto bead seat and against the flange.

(h) After tire beads have been seated, permit tube to readjust all strains by deflating completely.

(i) Inflate to the deflection markers, approximately 42 pounds per square inch (approximately 36 pounds for operation on soft airport surfaces) with airplane loaded normally.

(4) INSTALLATION OF MAIN ALIGHTING GEAR WHEEL. (See figure 75.)

(a) Line up the keyways in all the bronze brake disks with a straightedge. Apply brakes to hold the disks in position.

(b) Cover inner bearing with a light coating of grease, Specification AN-G-5, and install in wheel.

(c) Install inner washers in wheel.

(d) Install wire lock ring.

(e) Slide the wheel on the axle and over the brake. Be sure the keyways in the wheel line up with the keys of the disks and that the wheel engages the last disk.

(f) Cover the outer bearing with a light coating of grease, Specification AN-G-5, and slide over ends of axle.

(g) Install outer washer and castellated nut and tighten nut as far as possible with wrench. Back off until free. Turn up until finger tight. Then turn one castellation more and install cotter.

(h) Install hub cap.

(i) Install cover plate.

(5) ASSEMBLY OF MAIN ALIGHTING GEAR SHOCK STRUT. (See figure 62.)

(a) Place retainer nut (12) over piston and allow it to slide to the bottom.

(b) Place the large bronze piston bearing, packing (11), retainer ring (15), packing ring (3), five chevron packings (16), and packing ring (4) over the piston.

(c) Install piston stop (25) and tighten set screws (24).

(d) Install damper valve ring (26) and piston head (27). Install piston head set screws (28).

(e) Slide piston into cylinder.

(f) Assemble retainer nut (12) to the cylinder. Nut is tightened handtight only.

(g) Tighten safety lock screws (13) in retainer nut (12).

(h) Install lower torque arm bolt (6).

(6) INSTALLATION OF MAIN ALIGHTING GEAR SHOCK STRUT. (See figure 62.)

(a) Place shock strut in position in respect to the remainder of the alighting gear.

(b) Connect the inboard and outboard stub shafts (38) and (56) to the lower cross tube. Screw the castellated nuts on both ends of the shafts and safety the nuts.

(c) Install the lower large attaching bolt.

(d) Connect the lower end of the hydraulic actuating cylinder (19) by means of the eyebolt.

(e) Install top bungee spool (2) and remove bungee spreader from bungee (20).

(f) Uncap hydraulic line and fittings and install the hose. (See figure 67.)

(g) Connect emergency air-brake hose to shuttle valve.

(h) Connect actuating strut.

(i) Install brake and wheel.

(7) INSTALLATION OF MAIN ALIGHTING GEAR. (See figure 78.)

(a) Place the alighting gear in position in airplane and slide the door crank retaining collar, door crank and upper retracting link to the inboard end of the shaft.

(b) Install the shaft through the cover plate on the outboard side of the nacelle.

(c) Install the truss attaching bolts. The outboard bolt is installed through the hole in the rear shear web directly aft of the bolt. The inboard bolt is installed through the large access hole in the lower surface of the wing.

(d) Install the bolt that holds the door crank retaining collar in place.

(e) Place the latch mechanism and retracting links in position and assemble bearing cap, actuating rod and bolts.

(f) Install the alighting gear pin and pin locking bolts.

(g) Install nuts and washers (36) and (55) (figure 58) to each end of the shaft.

(h) Connect the emergency air-brake line to the outboard end of the lower shaft.

(i) Install the brake hydraulic swivel joint and connect the brake hydraulic lines to each side of it.

(j) Install the door actuating rod and the actuating strut.

(k) Install the bolt that attaches the retracting linkage to the line brake (11) and (13) (figure 78) of the gear.

(l) Install the bungee and spools and remove the bungee spreader. (See figure 76.)

(m) Connect the alighting gear hydraulic lines to the actuating strut.

(n) Install the nacelle alighting gear doors. After adjusting gear (step h (1), below, connect the

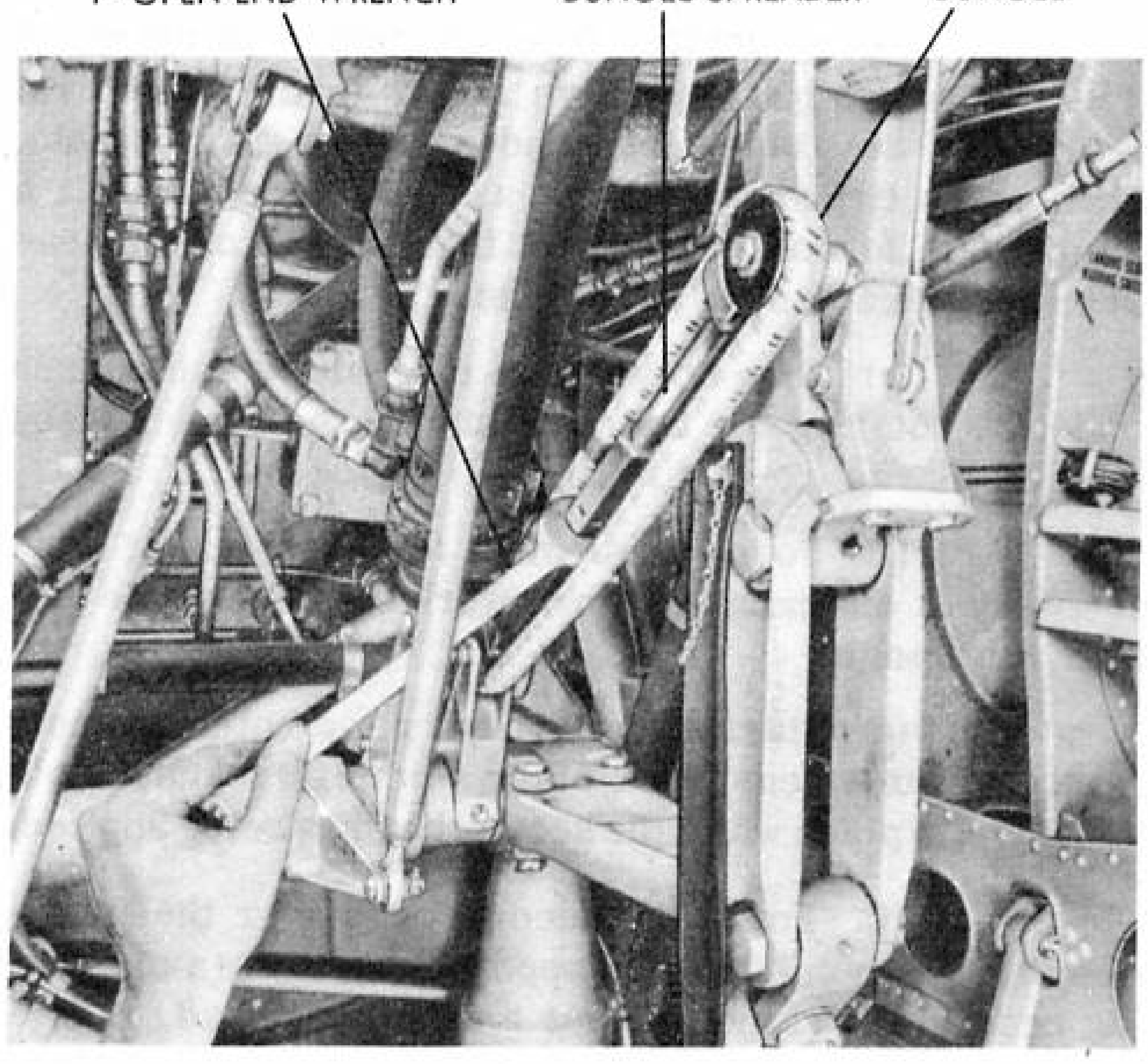


Figure 76 - INSTALLING MAIN ALIGHTING GEAR BUNGEE

actuating rod at the outboard door. Assemble the interconnecting rod at the forward end of the doors.

(8) INSTALLATION OF NACELLE DOORS.

(a) Hold door in DOWN position, install hinge bolts, castellated nuts and cotter pins. Install other door in same manner.

(b) Connect outboard door actuating rod, leaving check nuts loose.

h. FINAL TEST AFTER ASSEMBLY.

(1) TEST AND ADJUSTMENT OF MAIN ALIGHTING GEAR WHEEL AFTER INSTALLATION. - Rotate wheel to determine if any drag is present. Loosen axle nut if necessary. Remove wheel if binding is present. Inspect the parts to determine cause. If felt washer appears to have been responsible, reinstall the wheel correctly using the same parts. If any other part appears to have been at fault, replace the part.

(2) TEST AND ADJUSTMENT OF MAIN ALIGHTING GEAR SHOCK STRUT AFTER INSTALLATION.

(a) Relieve any air pressure that may be present in the strut by slowly backing off the body of the inflation valve. Do not depress the valve core. After the pressure is relieved, remove the valve and fill the strut with hydraulic fluid through the valve hole.

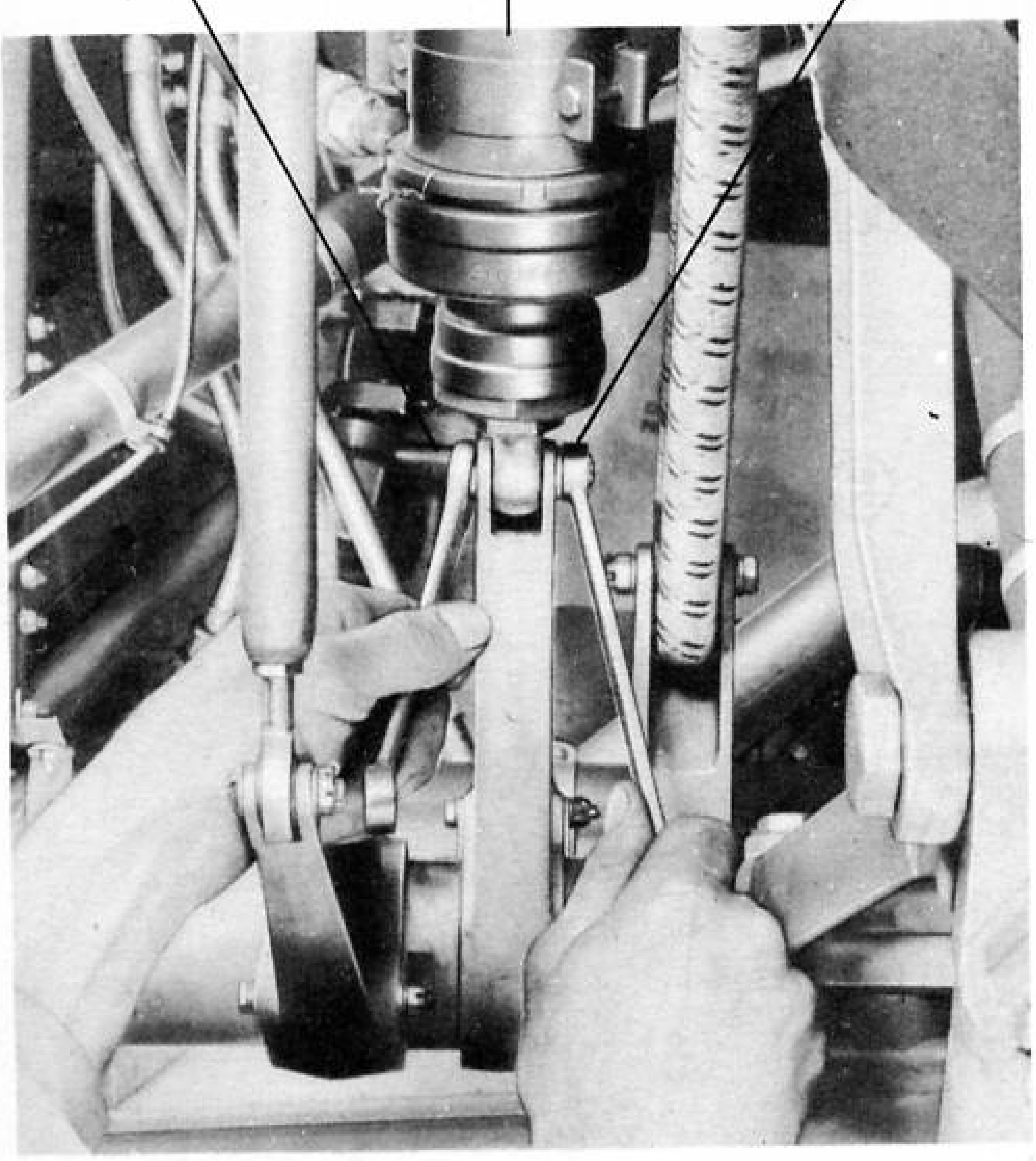


Figure 77 - DISCONNECTING ALIGHTING GEAR ACTUATING STRUT AT LOWER END

(b) Insert the valve loosely. Fully extend and compress the strut to eliminate any air traps. Remove the valve and recheck the fluid level, making additions of fluid if necessary.

(c) With the airplane in a standing position, inflate the strut through the air valve to give the following dimension: measuring from the center of the bolt holes on the torque arm to the lower end of the shock strut cylinder, 4-13/16 inches, loaded for take-off. Use an air bottle containing 2000 pounds per square inch pressure. Rock the airplane fore and aft while inflating the strut to overcome packing friction so that a correct dimension may be read.

(d) If there is evidence of fluid or air leakage at the packing gland relieve the air pressure in the strut and tighten the packing nut by hand. If normal hand tightening does not stop the leakage replace the packing and make a general check of other parts.

(3) TEST AND ADJUSTMENT OF MAIN ALIGHTING GEAR AFTER INSTALLATION. (See figure 78.)

(a) All tests and adjustments are made with nacelle doors disconnected. Start with the gear in DOWN position to assure correct operation of the gear.

(b) Adjust the two bolts (33) at the lower end of the upper retracting link (32) so that the centerlines of bolts (7) and (9) and the upper shaft are in line within 0.010 inch.

(c) Move lug (17) full forward against its rollers by pulling down on the latch actuating rod (62) and thus rotating the latch shaft (65). The small lever at the outboard end of the shaft should hold the lug against the rollers and, at the same time, the two ears which support the emergency release lever should just touch the lower surface of the clamp on the upper link (32). If, when rotating the shaft, the ears contact the clamp before the small lever moves the lug against its rollers, file the inner radius of the ears to correct this condition.

(d) Adjust the length of the latch actuating rod to give a minimum of 5/16-inch latch engagement over the end of the cam segment. Move the lug (17) full aft against the rollers, and in this position, the latch cap (6) should clear the cam by 1/16 inch (+ 1/16, - 0) measured radially.

(e) Shim the latch cap to give 0.005-inch to 0.015-inch clearance with the end of the cam segment in the latched position.

(f) With the bottoming cap of the actuating strut backed full out and locked, disconnect the strut at its lower end. (See figure 77.) Apply 850 pounds per square inch DOWN pressure and then adjust the piston eyebolt to match the hole in the lever arm (21) and insert the bolt.

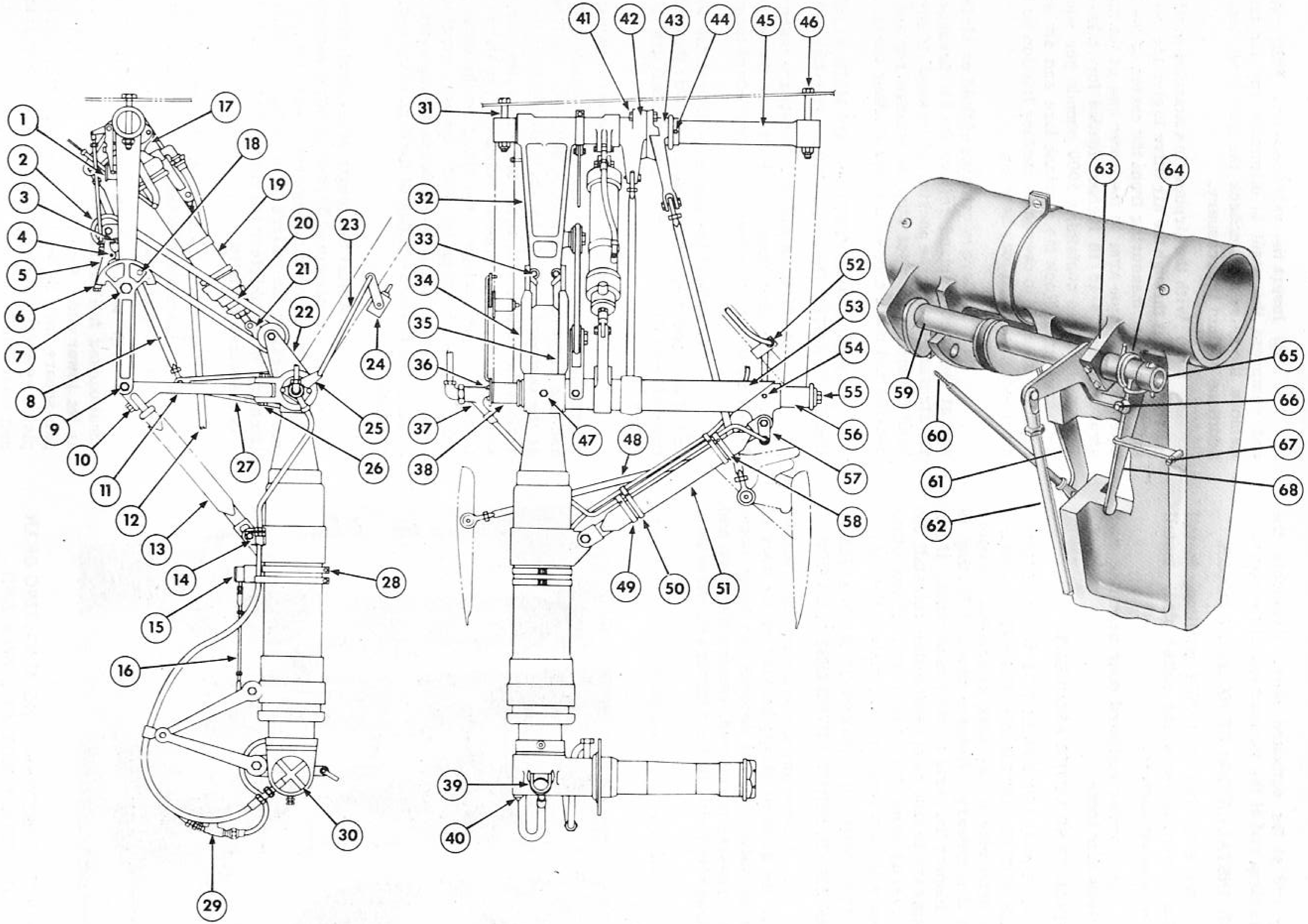


Figure 78 - MAIN ALIGHTING GEAR ASSEMBLY AND INSTALLATION

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4093687	SWITCH, WARNING	1
2.	1066230	SPOOL, BUNGEE	2
	AN6-21	BOLT	1
	AN6-25	BOLT	1
	AN310-6	NUT	2
	187048-6S-102	SPACER	2
3.	1066896	SPRING	2
4.	111904-6-228	BOLT	1
	1026614G-6-116	SPACER	1
	AN320-6	NUT	1
5.	4066549	LATCH ASSEMBLY	1
6.	1066886	CAP, LATCH	1
	1067676	BOLT	2
7.	1066980	BOLT, RETRACTING LINK	1
	AN320-12	NUT	1
8.	2067390	ROD ASSEMBLY, ACTUATING	1
9.	111904-14-330	BOLT	1
	AN320-14	NUT	2
10.	AN-14-50	BOLT	1
	AN310-14	NUT	1
11.	5065931	BRACE ASS'Y. CONNECTING	1
12.	2067389	ROD ASSEMBLY, NACELLE DOOR ACTUATING	1
13.	4065569	BRACE ASSEMBLY DRAG	1
	AN14-35	BOLT	1
	AN310-14	NUT	1
14.	2069455	BRACKET, BRAKE LINE	1
15.	RN-11-TYPE H03	SWITCH HOUSING	1
	WZR-31	SWITCH, MICRO	1
	AN515-8-8	SCREW	5
16.	4136946	ROD ASSEMBLY, SAFETY SWITCH	1
17.	1066938	LUG ASSEMBLY, ACTUATING CYLINDER ANCHOR	1
	1057947	ROLLER	2
	177213-375-436-781	SPACER	2
	AN6-21	BOLT	2
	AN310-6	NUT	2
18.		HOLE FOR INSERTING SAFETY PIN	
19.	5062530	CYLINDER ASSEMBLY, LEFT-HAND ACTUATING	1
	5062530-1	CYLINDER ASSEMBLY, RIGHT-HAND ACTUATING	1
	AN7-15	BOLT	1
	AN7-22	BOLT	1
	AN310-7	NUT	2
	1058080	SPACER	2
20.	2103185	RING, BUNGEE	1
21.	4104414	ARM, RETRACTING	1
	1068204	KEY	1
	1057917	KEY PLATE	2
	AN4-21	BOLT	1
	AN310-4	NUT	1
22.	4065568	BRACKET, BUNGEE	1
	AN6-41	BOLT	1
	AN310-6	NUT	1
23.	2092538	LINK ASSEMBLY, INDICATOR	1
24.	8TJ9PXAL	TRANSMITTER	1
25.	4067868	BRACKET ASSEMBLY, LEFT-HAND SWIVEL JOINT	1
	4067952	BRACKET ASSEMBLY, RIGHT-HAND SWIVEL JOINT	1
	AN320-12	NUT	1
	AC503-8-18	SCREW	2
26.	111904-9-307	BOLT	1
27.	4067878	CRANK, NACELLE DOOR ACTUATING	1
	1068205	KEY	1
	1057917	KEY PLATE	2
	AN4-25	BOLT	1
	AN310-4	NUT	1
28.	5148778	BRACKET ASSEMBLY, SAFETY SWITCH	1
29.	4135193	VALVE ASSEMBLY, BRAKE LINE SHUTTLE	1
30.	5073568	DEBOOSTER	1
31.	2076910-25	BOLT, WRENCHING	1
	2032517-1018	NUT	1
32.	5066434	LINK, LEFT-HAND UPPER RETRACTING	1
	5066434-1	LINK, RIGHT-HAND UPPER RETRACTING	1
33.	110242-6-15HB	BOLT	2
	AN315-6R	NUT	2
34.	4066534	LINK, LEFT-HAND LOWER RETRACTING OUTBOARD	1
	4066534-1	LINK, RIGHT-HAND LOWER RETRACTING OUTBOARD	1
35.	4067472	LINK, LEFT-HAND LOWER RETRACTING INBOARD	1
	4067472-1	LINK, RIGHT-HAND LOWER RETRACTING INBOARD	1
36.	2064936	NUT, SUPPORT SHAFT	1
37.	4067911	JOINT ASSEMBLY, LEFT-HAND BRAKE SWIVEL	1
	4067911-1	JOINT ASSEMBLY, RIGHT-HAND BRAKE SWIVEL	1
	AC503-8-18	SCREW	4
38.	2064922	PIN, INBOARD	1
39.	65324	EYE, TOWING	
40.		POINT, JACKING	
41.	AN8-23A	BOLT	2
	AC365-820	NUT	2
42.	4067877	ARM, NACELLE DOOR ACTUATING BELL CRANK INBOARD	1
43.	4067936	CRANK, LEFT-HAND NACELLE DOOR ACTUATING	1
	4067936-1	CRANK, RIGHT-HAND NACELLE DOOR ACTUATING	1
44.	AN4-27	BOLT	1
45.	4061712	SHAFT, LANDING GEAR RETRACTING LINK	1
46.	2076910-25	BOLT, WRENCHING	1
47.	AN6-41	BOLT	1
48.	2067391	ROD ASSEMBLY, NACELLE INBOARD DOOR ACTUATING	1
	AN6-21	BOLT	1
	AN76-21	BOLT	1
49.	755-3-2-6	CLIP, ADEL	4
	AN515-8-10	SCREW	4
	AC365-8-32	NUT	4
	AN960-8	WASHER	4
50.	AC755-8	CLIP	8
	AC755-26	CLIP	1
	AC755-28	CLIP	2
	AC755-32	CLIP	1
	AN515-8-8	SCREW	8
	AC365D832	NUT	8
51.	4065570	BRACE ASSEMBLY, CROSS	1
	AN12-30	BOLT	2
	AN310-12	NUT	2
52.	2135608	CLAMP, AIR BRAKE SHORT HOSE SUPPORT	2
53.	5066427	SHAFT ASSEMBLY, LEFT-HAND	1
	5066427-1	SHAFT ASSEMBLY, RT.-HAND	1
54.	AN8-30	BOLT	1
	AN310-8	NUT	1
55.	AN320-12	NUT	1
56.	2064925	PIN, OUTBOARD	1
57.	2135717	BRACKET, LEFT-HAND HOSE SUPPORTING	1
	2135717-1	BRACKET, RIGHT-HAND HOSE SUPPORTING	1
58.	AC735-30	CLAMP	4
59.	4067423	SHAFT ASSEMBLY, LATCH RELEASE	1
60.		CABLE, PILOT'S EMERGENCY RELEASE	1
61.	1069221	LEVER, EMERGENCY RELEASE	1
62.	278130-1815	ROD ASSEMBLY	1
63.		BEARING	1
64.	1066936	SPRING, LEFT-HAND WARNING SWITCH LEVER	1
	1066936-1	SPRING, RIGHT-HAND WARNING SWITCH LEVER	1
65.	1066937	COLLAR, WARNING SWITCH LEVER	1
	AN515-8-16	SCREW	1
66.	AC501-10-14	SCREW	1
	AN315-3R	NUT	1
67.	AC501-10-16	SCREW	1
	AN315-3R	NUT	1
68.	4067442	LEVER, LEFT-HAND WARNING SWITCH	1
	4067442-1	LEVER, RIGHT-HAND WARNING SWITCH	1

LEGEND FOR FIGURE 78

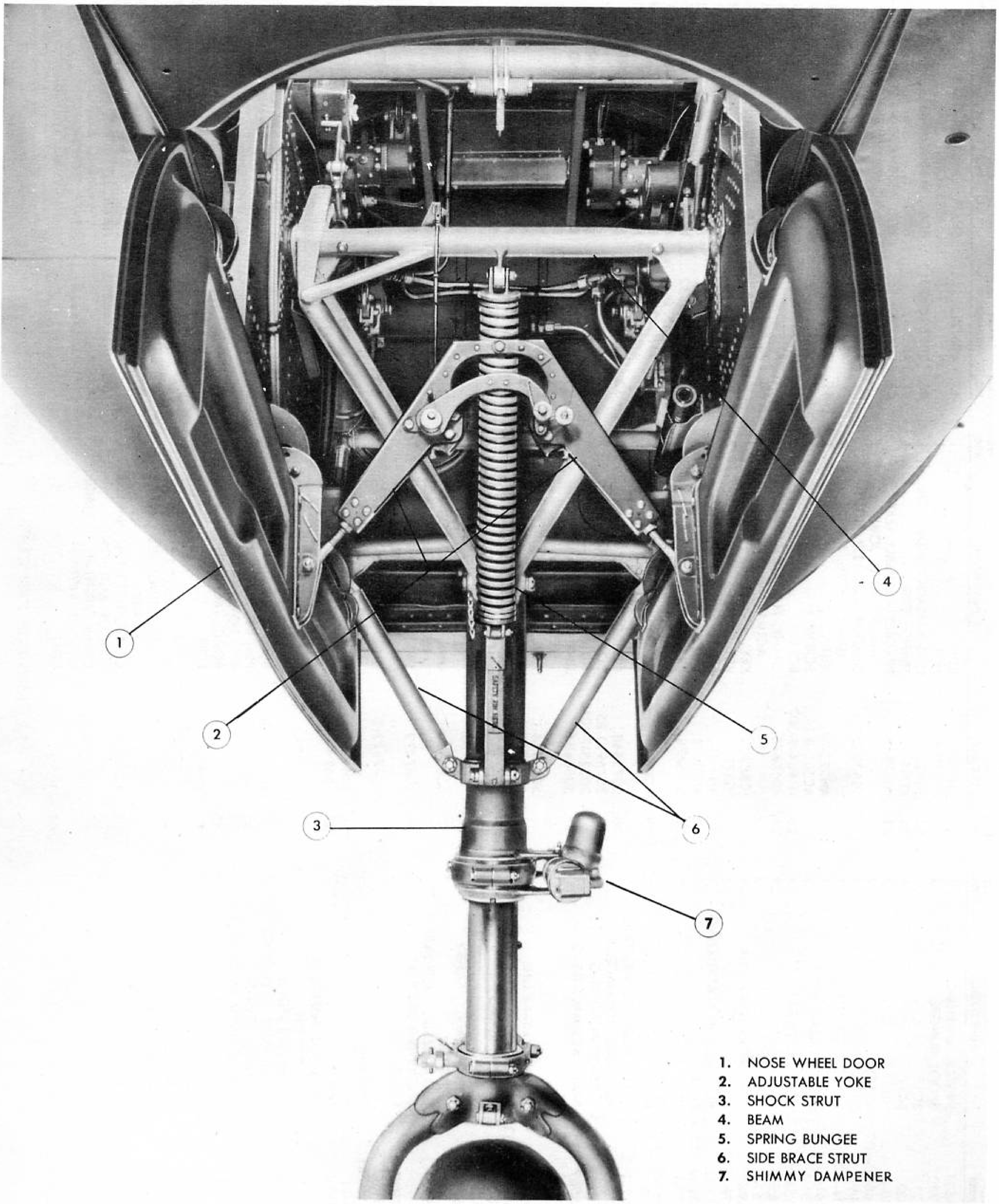


Figure 79 - NOSE ALIGHTING GEAR

(g) Check 5/16-inch minimum latch engagement, and 0.005-inch - 0.015-inch clearance between latch cap and end of radial segment.

(h) With gear latched down, back off set screw (66) until the toggle on the switch box (1) is depressed by the arm (68) to a point 1/16 inch from the end of its travel. This tolerance is sufficient to prevent binding or breaking of the toggle during normal operation.

(i) Using hand pump, fully retract the gear. Stop pumping immediately when gear latches. Measure the distance from the bottoming cap to cylinder. Then install the alighting gear safety lock.

(j) Relieve the hydraulic pressure and disconnect the actuating strut at the piston end. Apply 850 pounds per square inch UP pressure to the strut and then adjust the piston eyebolt to give 1/16 inch (+ 1/32, - 0) longer measurement than that in step (i) preceding.

(k) Relieve the pressure, reconnect the strut and remove the alighting gear safety latch. Allow the gear to drop a few inches, then retract it slowly to the point where it latches. Then make a measurement as before. Apply full 850 pounds per square inch pressure to the strut and recheck the measurement which should now be 1/16 inch longer.

(l) Check 5/16-inch minimum latch engagement. Check 0.005-inch - 0.015-inch clearance.

(m) With the gear in the UP position, adjust the set screw (67) so that there is 1/8-inch clearance between the lever arm and the toggle on the switch box.

(n) Check emergency release. With the alighting gear down, pull the release. The alighting gear should then drop into safe landing position.

(o) Extend the gear to the normal DOWN position and relieve hydraulic pressure. Adjust the bottoming cap to give 1/16 inch (+ 1/32, - 0) between the cap and the end of the cylinder. Be certain to tighten the bottoming cap lock nut. This gap should close and open with the application and release of pressure.

(p) Operate the gear and check to see that the position indicator gives a correct reading for all alighting gear positions. The main battery switch must be ON, or an outside source of power must be plugged in at the ground battery socket in the nose wheel well to make the indicator operative. Correct any error by adjusting the position of the lever arm on the transmitter shaft which is located on the inboard side of the truss.

(q) With the nacelle door interconnecting rod detached and the outboard door actuating rod (12) connected and check nuts loose, retract the gear about 30° or until the actuating rod and the arm are in line.

(r) In this position, adjust the long actuating rod to give the maximum door opening without interference with the nacelle skin.

(s) While retracting the gear, attach and adjust the door interconnecting rod to give 3/4-inch maximum clearance with the tire. It may be necessary to shorten the long rod (12) and lengthen the short rod (8) in the ratio of 2 to 1 to obtain the proper tire clearance.

(t) Slowly retract the gear and make adjustments of the short rod (8) to get the proper preload on doors.

(4) TEST AND ADJUSTMENT OF NACELLE DOORS AFTER INSTALLATION.

(a) Retract gear slowly until long actuating rod and arm are lined up (gear about 30 degrees from DOWN position). Adjust actuating rod to give door maximum out movement without interfering with nacelle skin.

(b) Continue to retract gear slowly and adjust the actuating rod to give 3/4-inch maximum clearance between door and tire.

(c) Take gear to FULL UP position. Lower slowly and check clearances.

(d) Connect door interconnecting rod and, with gear retracted, adjust for equal door preload.

(e) Lower gear and check inspection holes in rods for proper thread engagement. Lock check nuts and install cotter pins.

7. NOSE ALIGHTING GEAR.

a. DESCRIPTION.

(1) NOSE WHEEL DOORS. - Two nose wheel doors constructed of sheet alclad enclose the nose gear in flight. They are attached to the bottom of the fuselage with hinge bolts. Armor plate is attached by machine screws to the forward exterior surface of the doors. Interior edges of the doors are covered with bulb rubber seal.

(2) NOSE ALIGHTING GEAR. (See figure 79.) - The nose wheel is mounted in a fork on a braced oleo-pneumatic strut, hinged on a shaft assembly at Station 0. (See figure 7.) The nose gear is operated simultaneously with the main alighting gear by a hydraulic actuating strut. Two side braces for the shock strut are connected to a collar on the strut and to the ends of the shaft assembly. The retracting mechanism consists of two link assemblies, including a spring type bungee and the actuating strut. A mechanical latch locks the gear in the UP position. The latch is connected by cables to the alighting gear control in the pilot's cockpit and is released when the control is moved to the DOWN position. A snubber is mounted on the shock strut just above the fork and limits the castering of the wheel to

approximately 30 degrees each side of neutral. The wheel may be made to caster 360 degrees by pulling out on the lock pin located just above the fork on the left side of the strut. As the nose gear retracts, the shock strut engages the yoke mechanism which, in turn, closes the doors.

(3) NOSE ALIGHTING GEAR SHOCK STRUT. (See figure 86.) - Operation and general arrangement of the nose wheel shock strut is the same as that of the main gear except that the damper valve ring does not have small openings for fluid restriction.

(4) NOSE WHEEL SNUBBER. (See figure 87.) - The nose wheel snubber is a double-acting strut. Its function is to prevent shimmy (unnecessary castering) of the nose wheel during taxiing operations.

(5) NOSE WHEEL. (See figure 85.) - The nose landing gear uses a Hayes 10-inch wheel consisting of a main aluminum alloy casting with removable flange and dust covers for the bearings. This Hayes wheel is interchangeable with the Goodyear nose alighting gear wheel (used on A-20C, P-70 and F-3 airplanes) when the collar on the axle is changed.

(6) NOSE ALIGHTING GEAR TIRE. - The nose wheel mounts a 26-inch smooth casing, self-earthing, and a 26-inch non-cactus proof smooth contour tube.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	ISOLATION	REMEDY
Nose gear fails to extend when operated by emergency release.	Nose wheel door mechanism not allowing nose gear to extend.	Visually inspect shock struts for extension and torque links for freedom of operation.	Clean, lubricate, and/or replace torque link bearings.
		Check door mechanical adjustment.	Adjust door mechanism for retracting.
Nose wheel fork hard to turn.	Snubber assembly binding.	Inspect snubber piston for pitting, or binding of the piston rod.	Repair or replace snubber assembly.
	Shock strut piston binding due to improper packing adjustment.	Disassemble shock strut and inspect for wear or other damage.	Replace damaged parts, or parts excessively worn.

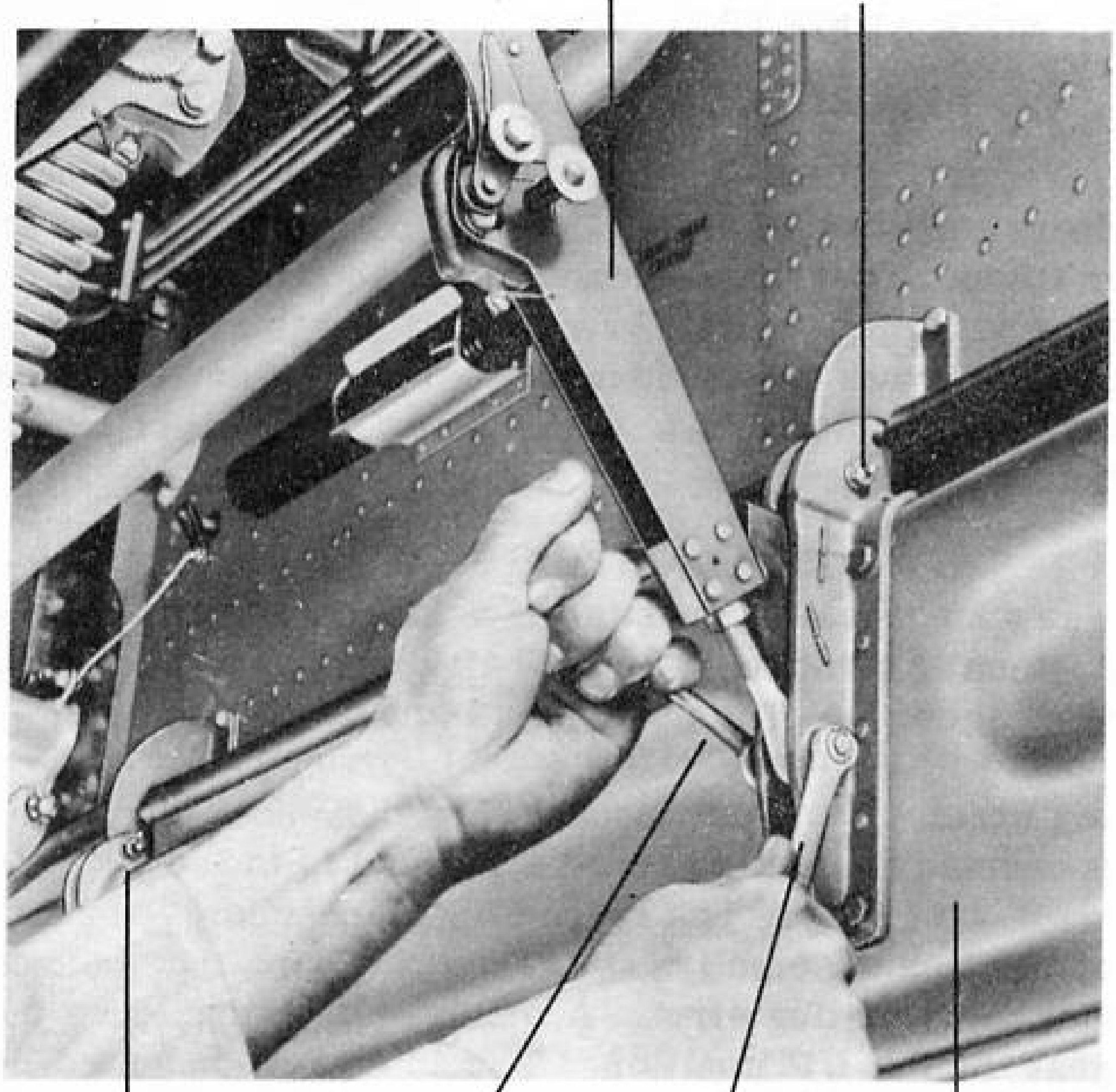


Figure 80 - REMOVING NOSE WHEEL DOOR

NOTE

Trouble shooting data, except that applying exclusively to brakes, given in paragraph 6, this section, also applies to the nose gear.

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF NOSE WHEEL DOORS. (See figure 80.)

(a) Disconnect adjustable yoke from doors.

(b) Remove the three attaching hinge bolts, first removing the cotter pin secured through each castellated nut.

CAUTION

Do not remove the door attaching brackets from the fuselage.

(2) REMOVAL OF NOSE ALIGHTING GEAR AND NOSE ALIGHTING GEAR SHOCK STRUT. - All item numbers referred to are on figure 85.

(a) Remove the nose wheel doors.

(b) Support the airplane on tripod stands and relieve the air pressure in the shock strut by slowly backing off the air valve body.

(c) Partially retract the gear. While the spring bungee (17) is extended, bind it with heavy steel wire. Fully extend the gear and remove the bungee assembly.

(d) Relieve the hydraulic system pressure by operating the wing flaps until the pressure gage reads zero. Disconnect and plug the hydraulic lines at the actuating strut (9). Remove the actuating strut.

(e) Arrange a support to carry the weight of the gear assembly.

(f) Disconnect the rear brace arm at the shock strut and then remove the retracting linkage as follows: Remove the taper pins which hold the main mounting pins (10) in place. Remove the nuts which attach the pins to the fuselage structure. These may be reached through the large access doors in the side walls of the nose wheel well. Free the unit for removal by driving the mounting pins into the tubular shaft. The pins may be pulled out after the unit has been taken out of the airplane.

(g) Remove the gear assembly in an identical manner to that of the retracting mechanism. The nuts which attach the mounting pins to the fuselage structure are accessible through the fixed gun access openings.

(h) The attaching bolts for the tube which supports the lower end of the actuating strut may be reached through the fixed gun access openings. If it is desired to remove the tube on which the latch hook is mounted, the attaching bolts may be reached through the access doors in the side walls of the nose wheel well.

(3) DISASSEMBLY AND TEST OF NOSE ALIGHTING GEAR SHOCK STRUT. (See figure 86.)

(a) Remove wheel.

(b) Remove cross beam assembly and side braces from strut.

(c) Remove snubber from shock strut.

(d) Remove or disconnect torque arm assembly (28) from shock strut piston.

(e) Slowly release all air pressure at valve (1).

(f) Remove valve assembly (1) and drain oil.

(g) Remove safety (18) and unscrew retainer nut (19). Be careful not to roughen or tear feather edge on packing ring.

(h) Remove piston assembly, using a slight bumping action if necessary to loosen packing.

(i) Remove safety screws (6) from piston head (5). Remove piston head (5). Do not damage threads.

(j) Remove collar (3) and damper valve ring (4) from piston head (5).

(k) Loosen set screws and remove piston stop (8) from piston.

(l) Remove packing ring (9) from piston.

(m) Remove chevron packing (10) from piston.

(n) Remove packing ring (11) from piston.

(o) Remove retaining ring (16) from piston.

(p) Slide retainer nut (19) from piston.

(4) REMOVAL OF NOSE WHEEL SNUBBER. (See figure 87.)

(a) Remove the two drilled studs which attach the cylinder end (10) to the alighting gear.

(b) Remove the bolt which attaches piston rod (12) to alighting gear.

(5) DISASSEMBLY OF NOSE WHEEL SNUBBER (See figure 87.)

(a) Remove plug (22) and drain fluid from snubber.

(b) Unscrew nut from reservoir end of tube (20).

(c) Remove bolts (4) attaching reservoir (21) to cylinder head (3) and remove reservoir from cylinder (8).

(d) Remove head lock nut (6).

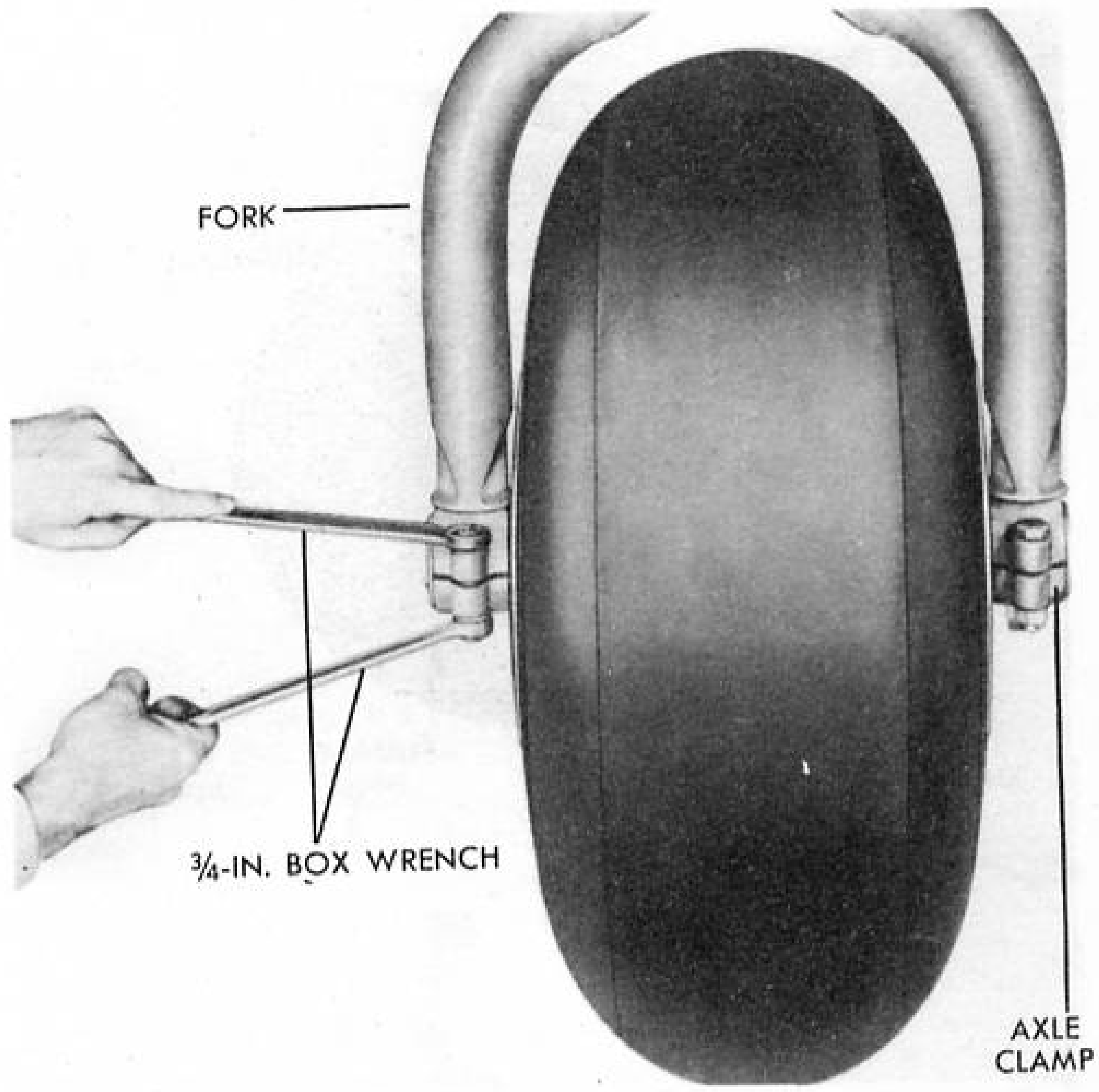


Figure 81 - - REMOVING NOSE WHEEL

(e) Unscrew and remove cylinder head (3) and washer (5).

(f) Unscrew nut from end of piston rod (12) and slide out rod.

(g) Remove piston (7) from cylinder (8).

(h) Remove packing nut (11), packing (13), packing ring (14), packing and packing ring (15) from cylinder end (10).

(i) Unscrew fitting which attaches tube (20) to cylinder end (10). Remove tube (20), fitting, and washer (19) from cylinder end (10).

(j) Remove valve plug (16), washer (18), and valve from cylinder end (10).

(6) REMOVAL OF NOSE WHEEL. (See figure 81.)

(a) Remove bolts from axle clamps on lower end of fork.

(b) Remove clamps and slide wheel assembly from fork.

(7) REMOVAL OF NOSE ALIGHTING GEAR TIRE. (See figure 82.)

(a) Remove valve core and allow tire to deflate.

(b) Remove fairing snap ring and fairing.

(c) Remove flange snap ring and flange pins.

(d) Lift removable flange from wheel.

(e) Remove tire from wheel.

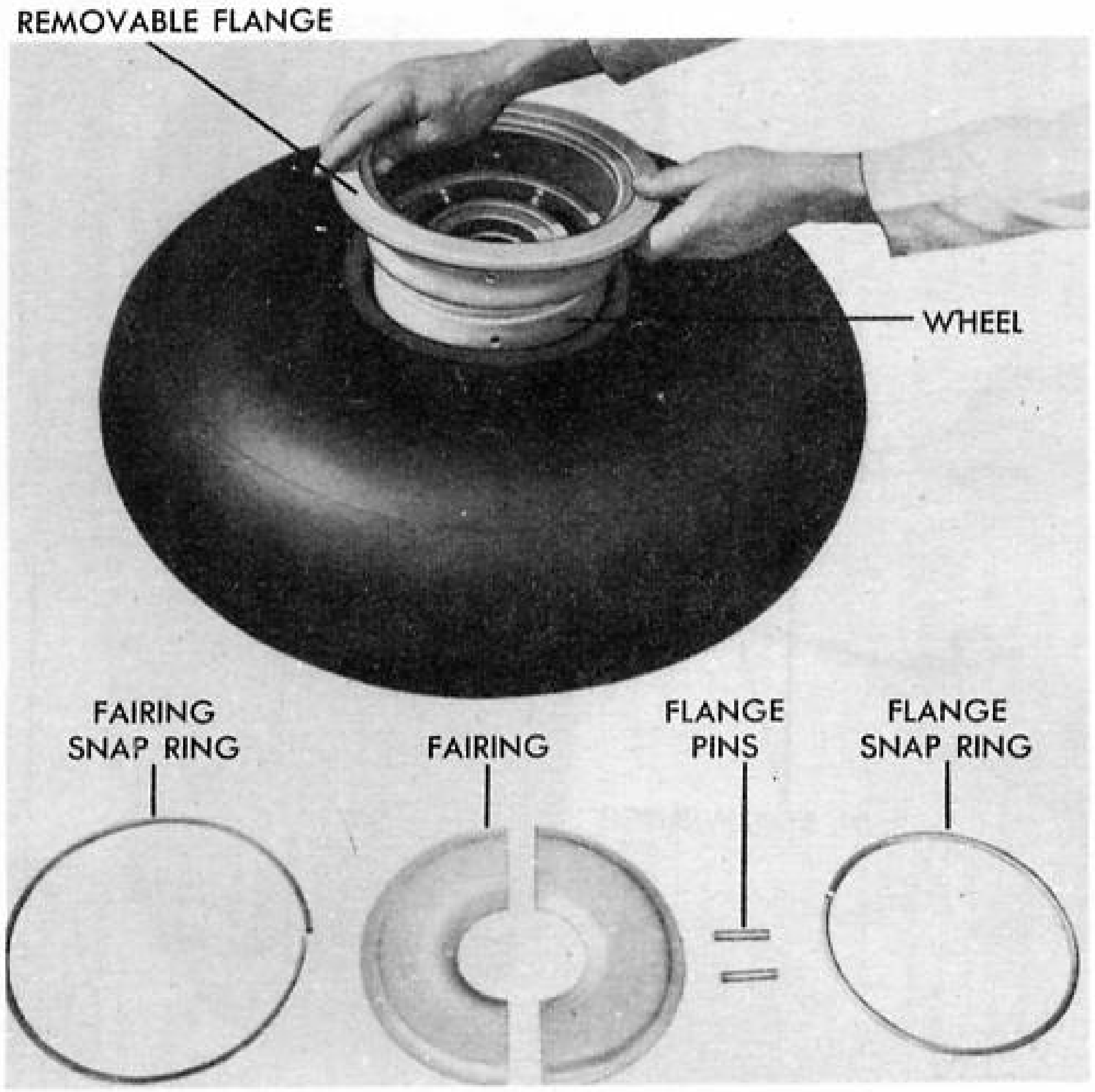


Figure 82 - REMOVING NOSE WHEEL TIRE

d. REPLACEMENTS.

(1) INSPECTION AND REPAIR OF NOSE WHEEL DOORS.

(a) Examine the bulb rubber seal around the doors and replace when necessary. This rubber deteriorates from normal use and from contact with hydraulic fluid. Replace if deteriorated or damaged.

(b) Inspect doors to see if they are bent or torn. Replace if damaged.

(2) INSPECTION AND REPLACEMENT OF NOSE ALIGHTING GEAR PARTS.

(a) Inspect shock strut, snubber, fork, braces and fittings for cracks, bends, security, condition of attachment fittings, elongated bolt holes, and loose, missing, or unsafetied nuts. Replace damaged parts.

(b) Inspect latches for distortion or cracks. Replace if necessary.

(c) Inspect all shafts and braces to determine if they are bent. Replace if they cannot be straightened.

(d) Check fit of all pins, bolts, and shafts in their respective holes. Replace worn or damaged parts.

(3) INSPECTION AND REPLACEMENT OF NOSE ALIGHTING GEAR SHOCK STRUT PARTS.

(a) Clean all metal parts in solvent and dry with an air blast.

(b) Inspect piston and cylinder for scored, roughened, or out-of-round condition. Replace if any of these defects are present.

(c) Inspect feather edge lip of the retainer nut. Replace ring if lip is roughened or torn.

(d) Replace all packing.

(e) Inspect all remaining metal parts. Replace any that are worn or damaged.

(4) INSPECTION AND REPLACEMENT OF NOSE WHEEL SNUBBER PARTS.

(a) Inspect all metal parts for being worn, bent, pitted, or scored. Inspect valve spring to see if it has lost its resiliency. Replace damaged parts.

(b) Replace all gaskets and packings.

(5) INSPECTION AND REPLACEMENT OF NOSE WHEEL PARTS. - Inspect wheel for cracks, distorted rim flanges, pitted or improperly seated bearing cups, worn or broken bearings, and roughened bearing surface on axle. Replace worn, broken, or damaged parts.

(6) INSPECTION AND REPLACEMENT OF NOSE ALIGHTING GEAR TIRE. - Replace tire if it has

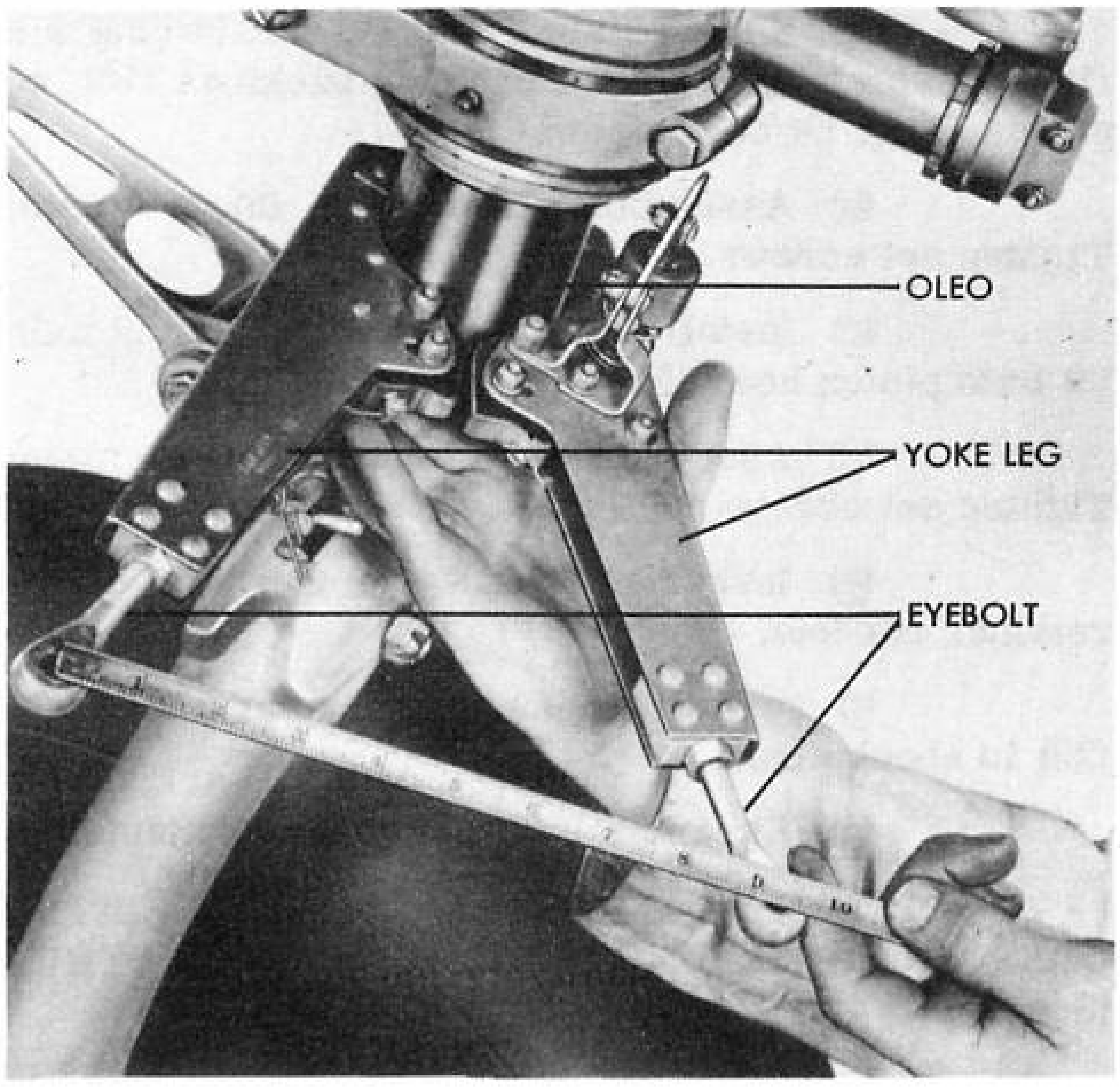


Figure 83 - ADJUSTING NOSE WHEEL DOORS

cord breaks, deep cuts, large blisters, loose cords, broken or cut bead, or if badly worn. Replace tube if wrinkled or cracked.

e. ADJUSTMENTS.

(1) ADJUSTMENT OF NOSE WHEEL DOORS. (See figure 83.)

(a) Adjust eyebolts in yoke legs for 2-5/8 inches dimension from center of eyebolt hole to butt of yoke leg.

(b) Place yoke around nose gear oleo and attach jig to eyebolts so that eyebolt holes are nine inches apart. (See figure 85.)

(c) Check clearance of yoke around oleo. Inside diameter of yoke should be approximately 1/16 inch greater than oleo outside of diameter.

(d) Install yoke and set guide blocks at roughly 2-15/16 inches. (See figure 85.)

(e) Retract nose gear and adjust yoke eyebolts for correct door closing preload.

(f) Extend gear and set cam, part No. 1135737, to accommodate latch, part No. 2063174, when distance from yoke eyebolt hole center to opposite eyebolt hole center is exactly 17 inches. Use jig for this dimension. (See figure 85.)

(g) Adjust guide blocks so that 2-15/16-inch jig block will slip firmly between them.

(h) Attach cable to bell crank, part No. 1135728, and rig so that pin, part 1135729, protrudes 27/32 inch ± 1/32 inch when nose gear is down.

f. TESTS.

(1) TEST OF NOSE ALIGHTING GEAR SHOCK STRUT BEFORE INSTALLATION. - With strut in compressed position fill with hydraulic fluid, Specification 3580-M, and replace the valve assembly. Inflate with air (300 pounds) to extended position. Test for leakage with soap solution. Release the air. Now the oleo must be collapsible by hand. If not, the piston is not operating freely and the packing nut must be adjusted or the cause of the trouble found and remedied.

(2) TEST OF NOSE WHEEL SNUBBER BEFORE INSTALLATION. (See figure 87.)

(a) Fill the reservoir to the bottom of the filler neck boss with fluid, Specification AN-VV-O-366a.

(b) Apply 500 pounds (plus 140 pounds per square inch maximum packing friction pressure) at the piston rod. It should take 4-1/2 ± 1 seconds to extend the piston rod and 5-1/2 ± 1 seconds to retract it.

(c) Extend piston rod and apply 250 pounds per square inch pressure at the reservoir. There must be no leakage at any point.

(d) Safety the filler plug.

g. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF NOSE ALIGHTING GEAR TIRE. (See figure 82.)

(a) Insert tube in tire and inflate slightly.

(b) Slide tire and tube onto wheel with valve through valve hole in wheel.

(c) Place removable flange in position on wheel and install flange pins and flange snap ring.

(d) Inflate tire carefully to 53 (+2-0) pounds per square inch. Tap flange snap ring lightly during inflation to ensure correct seating.

(e) Install fairing and fairing snap ring.

(2) INSTALLATION OF NOSE WHEEL. (See figure 81.)

(a) Be sure valve stem is on opposite side of the snubber.

(b) Install wheel with two axle clamps and four axle clamp bolts. Safety the bolts.

(3) ASSEMBLY OF NOSE WHEEL SNUBBER. (See figure 87.)

(a) Install valve, washer (18), and plug (16) into cylinder end (10).

(b) Insert washer (19) into its opening in cylinder end (10). Connect tube (20) to cylinder end (10).

(c) Wipe all parts clean and apply thread lubricant on all threads.

(d) Install packing ring (15), new packing, packing ring (14), packing (13) and packing nut (11) in cylinder end (10).

(e) Insert piston (7) into cylinder (8).

(f) Insert piston rod (12) through cylinder end (10) and piston (7). Install lock washer and nut on end of piston rod.

(g) Install washer (5) and cylinder head (3).

(h) Install head lock nut (6).

(i) Place reservoir (21) in position, using a new gasket (1). Install bolts and nuts (4).

(j) Safety the packing nut (11) and valve plug (16) if removed.

(4) INSTALLATION OF NOSE WHEEL SNUBBER (See figure 87.)

(a) Place snubber in position on alighting gear.

(b) Install the two drilled studs which attach the cylinder end (10) to alighting gear.

(c) Install the bolt which attaches piston rod (12) to alighting gear.

(d) Lubricate the three Zerk fittings at points of attachment.

(5) ASSEMBLY OF NOSE WHEEL SHOCK STRUT. (See figure 86.)

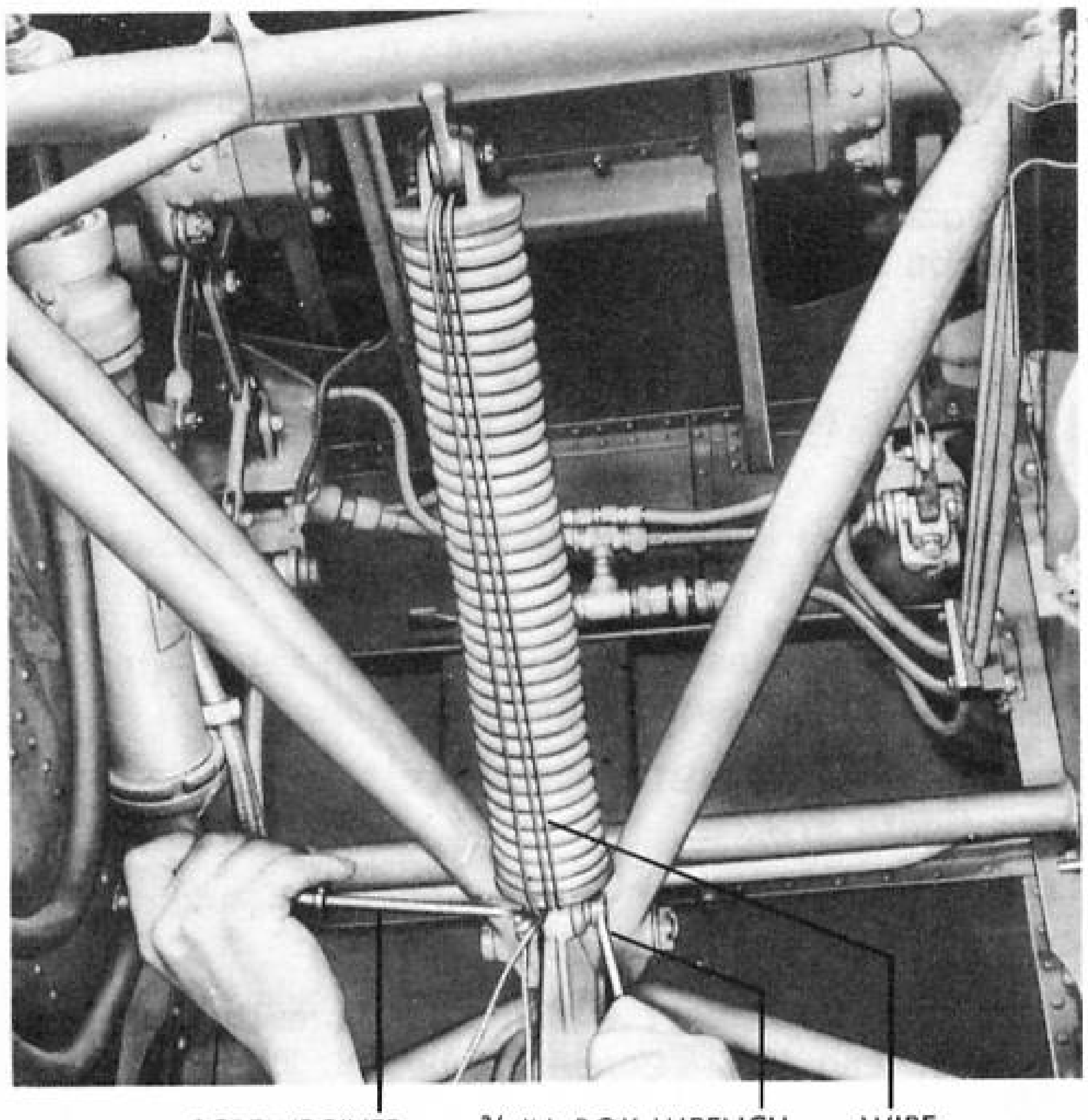


Figure 84 - INSTALLING NOSE LANDING GEAR BUNGEE

(a) Slide retainer nut (19), retaining ring (16), packing ring (11), five chevron packings (10), and packing ring (9) onto piston.

(b) Assemble piston stop (8) to piston. Tighten set screws.

(c) Install damper valve ring (4) and collar (3) onto piston head (5).

(d) Assemble piston head (5) to piston. Tighten set screws (6).

(e) Insert piston in cylinder and tighten retainer nut (19).

(f) Install or connect torque arm assembly (28) to shock strut.

(g) Assemble snubber to shock strut.

(6) INSTALLATION OF NOSE ALIGHTING GEAR AND NOSE ALIGHTING GEAR SHOCK STRUT. (See figure 85.)

(a) Place the unit in position in airplane. Drive the mounting pins into position. Assemble the nuts to the pins.

(b) Drive in taper pins which hold the mounting pins in place.

(c) Install the actuating strut.

(d) Unplug the hydraulic lines and attach to the actuating strut.

(e) With the gear fully extended, install the bungee. (See figure 84.)

(f) Install the nose wheel doors.

(7) INSTALLATION OF NOSE WHEEL DOORS.

(a) Install the three attaching hinge bolts and be sure that spacers are in place on each hinge.

(b) Safety each castellated nut with a cotter pin.

(c) Connect and adjust the adjustable yoke.

h. FINAL TEST AFTER ASSEMBLY.

(1) TEST AND ADJUSTMENT OF NOSE WHEEL AFTER INSTALLATION. - Turn the wheel and determine that bearings are not too loose or too tight. If wheel shakes, wobbles, or binds, bearings must be adjusted.

(2) TEST AND ADJUSTMENT OF NOSE ALIGHTING GEAR SHOCK STRUT AND SNUBBER AFTER INSTALLATION.

(a) Fill the completely collapsed strut through filler plug opening with hydraulic fluid, Specification 3580-M. Replace filler plug.

(b) With the airplane in a static position and loaded for take-off, inflate the strut through the air valve until the length of the visible portion of the shock strut piston is 2-7/8 inches. Use an air bottle containing 2000 pounds per square inch pressure. Rock the airplane fore and aft while the strut is being inflated to overcome packing friction so that a correct dimension may be read.

(c) Inspect for leaks.

(d) If the snubber has been removed from the nose wheel gear, perform the following test upon installation:

1. With the reservoir partially full, loosen the packing nut and operate the piston until fluid seeps by the packings. Actuate the piston back and forth by turning the wheel and, at the same time, tightening the packing nut until the piston binds to ensure that the packings are seated. Back off the packing nut until the piston is just free, then retighten it approximately one-quarter turn and lock.

2. Remove the reservoir cap and, with the wheel hard over to the right (piston retracted), fill the reservoir with fluid, Specification AN-VV-O-366a.

3. Bleed the snubber by turning the nose wheel to the limit of its travel in both directions 10 to 20 times, then refill the reservoir with the piston in the retracted position.

4. Move the wheel so the piston is fully extended, then plug the reservoir.

(3) TEST AND ADJUSTMENT OF NOSE ALIGHTING GEAR AFTER INSTALLATION.

(a) Back the bottoming cap on the actuating strut full out, and with the flat side down tighten the lock nut securely. Apply 850 pounds per square inch DOWN pressure, then back off the eyebolt lock nut and adjust the eyebolt to aline with the bolt hole in the retracting arm. Install the attaching bolt, making certain the grease fitting of the eyebolt is on top.

(b) By use of hydraulic hand pump, slowly retract the gear until the latch yoke on the aft face of the shock strut just touches the latch hook. Adjust the set screw on the hook so the latch yoke touches the hook 1/4 inch up the rear incline from the point of the hook.

(c) Resume operation of the hand pump until the gear latches in the UP position.

(d) With the gear in this position and the alighting gear control valve in neutral, adjust the latch release cable so it is tight but does not pull the hook adjustment screw away from the latch support tube.

(e) Stand clear of the gear and have the landing gear control moved slowly toward the DOWN position. The latch hook should disengage the yoke on the shock strut before the gear starts to drop. If the sustaining pressure of the gear relieves before the latch hook is disengaged, the cables and the hook adjustment screw should be readjusted to correct this condition.

(f) Relieve the hydraulic system pressure, then back off the eyebolt lock nut. By rotating the piston, adjust the length of the actuating strut so the gear just latches in the UP position. Give the piston an additional 1/2 turn and then tighten the lock nut and stake the lock washer.

(g) With the gear locked in the UP position, relieve the hydraulic system pressure. Move the control handle to the DOWN position and check to see that the gear drops free.

(h) With the gear in the normal full DOWN position and with no pressure in the hydraulic system, adjust the bottoming cap to give 1/16 inch (+ 1/32, - 0) clearance between the cap and the actuating strut. Be sure to have the large flat side of the bottoming cap on the bottom. Tighten the lock nut.

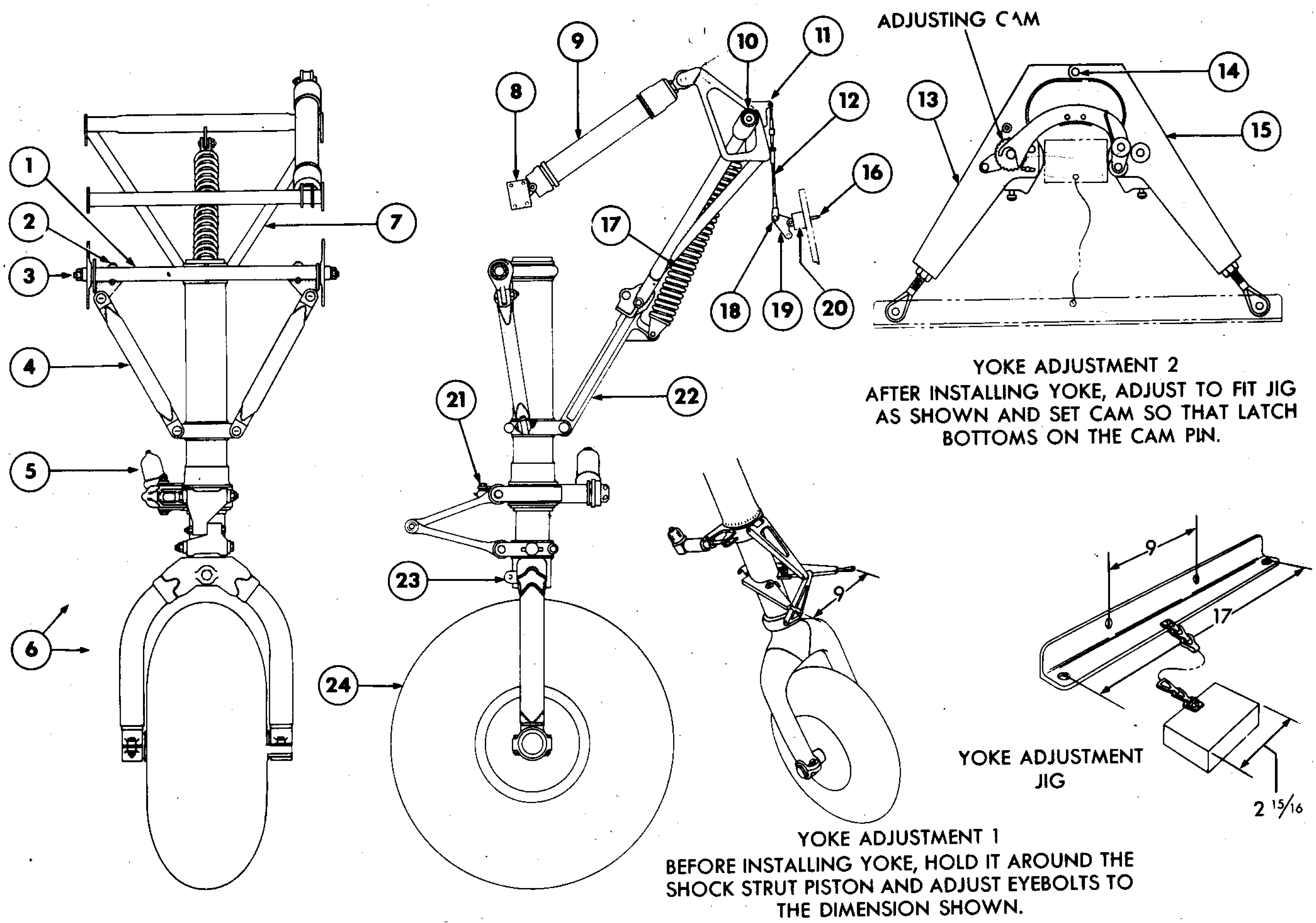
(i) Regulate the nose wheel warning switch with the gear DOWN by turning the adjustment screw until the toggle on the switch box is depressed to a point 1/16 inch from the end of its travel. This tolerance is sufficient to prevent bending or breaking of the toggle during normal operation.

(j) Place the yoke around the shock strut piston (figure 85) and adjust the eye ends so they measure nine inches from center to center. Put the yoke in position between the door brackets and insert the attaching bolts loosely, then assure that the distance from center to center of the bolts is 17 inches, using a spacer bar similar to that shown in figure 73.

(k) Leave the spacer in position and loosen the locking bolts and adjusting screws of the bearing blocks at the center of the yoke arms. Adjust the bearing blocks to give a snug 2-15/16-inch clearance, which is the diameter of the shock strut piston. (See figure 85.) Safety the adjusting screws.

(l) Adjust the eccentric stop on the left yoke arm so the notch in the end of the latch lever will "bottom" on it, then tighten the bolts. Install the lock pin actuating cable and tighten the turnbuckle (finger tightness is sufficient).

(m) Retract the gear and check to see that the doors close tightly and evenly. Make necessary adjustments on the eyebolts of the door yoke.

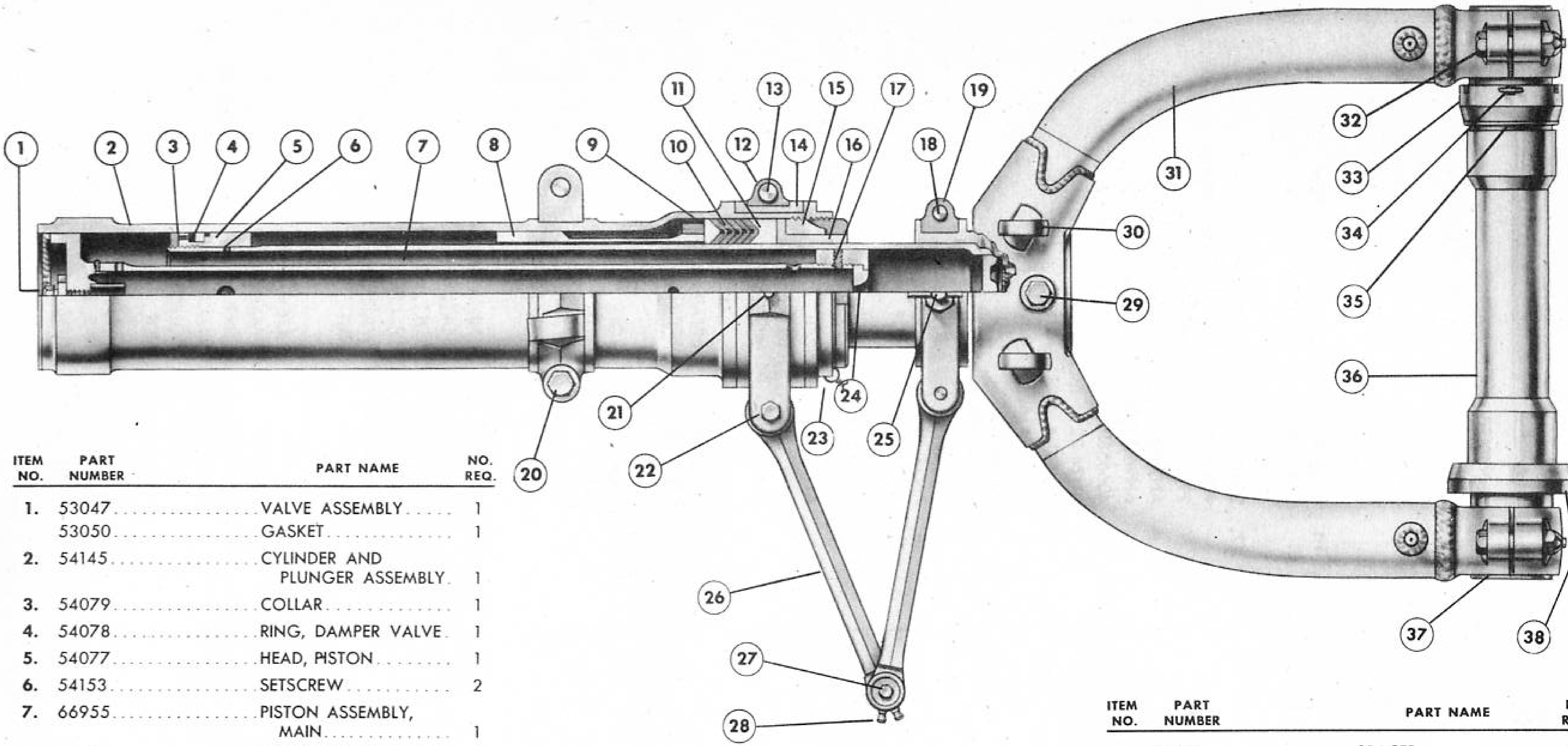


ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5057531	BEAM ASSEMBLY, WELD	1
	1054841	KEY, CROSS BEAM	1
2.	386-4-13	PIN, TAPER	2
	AN975-5	WASHER	2
	AN320-5	NUT	2
	124681-S11-125	DISK	2
3.	1057233	PIN, CROSS BEAM	2
	1057258	WASHER, CROSS	2
	AN320-10	NUT	2
4.	4057030	STRUT, SIDE BRACE	2
	AN28-24	BOLT	4
	AN320-8	NUT	4
5.	5069115	SNUBBER ASSEMBLY	1
	501A10-6	SETSCREW	2
6.	5062541-500	GEAR ASSEMBLY	1
7.	5057661	LINK ASSEMBLY	1
8.	5057501	SUPPORT, CYLINDER	1
	AN4-5A	BOLT	4
	365-428	NUT, STOP	4
	AN960-416	WASHER	4
	AN3-4A	BOLT	2
	365-1032	NUT, STOP	2
	AN960-10	WASHER	2
9.	5062532	STRUT, ACTUATING	1
	AN6-21	BOLT, UPPER	1
	AN6-14	BOLT, LOWER	1
	AN310-6	NUT	2
	1059608-375-624-749	SPACER	2
	AN960-616	WASHER	2

Figure 85 - NOSE WHEEL ASSEMBLY AND INSTALLATION

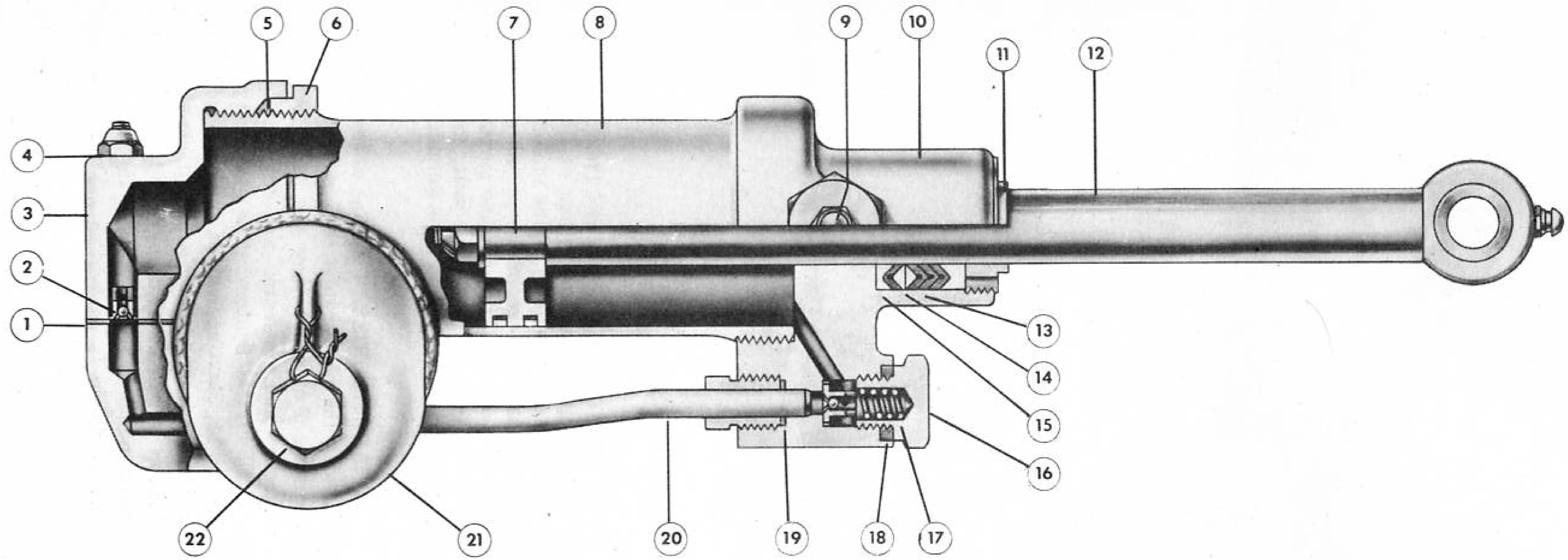
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
10.	1057271-4	PIN, DETRACTING LINK	2
	AN320-10	NUT, PIN	2
	143908-022S116-125	WASHER	2
	AN5-16A	BOLT	2
	AN960-516	WASHER	2
	365-524	NUT, STOP	2
11.	2135735	CLAMP ASSEMBLY, SAFETY CATCH	1
	AN3-5A	BOLT	2
	AN960-10	WASHER	4
	365-1032	NUT, STOP	2
12.	2135731	CABLE ASSEMBLY, SAFETY CATCH	1
	AN155-8S	BARREL	1
	AN160-8S	FORK	1
	AN23-11	BOLT, CLEVIS	1
	AN310-3	NUT	1
	AN960-10L	WASHER	1
	117425-3S-004	WASHER	1
13.	4135917	ARM ASSEMBLY, LEFT-HAND (includes 13, 17 and 20)	1
	1063593	GUIDE	1
	AN4-11A	BOLT, GUIDE	1
	AN960-416	WASHER	1
	365-428	NUT, STOP	1
	AN3-10A	BOLT, CLAMP	1
	AN960-10	WASHER	3
	365-1032	NUT, STOP	3
	1135738	LOCK, SAFETY CATCH CAM	1
	AN3-11A	BOLT	1
	1135737	CAM, SAFETY CATCH	1
	AN3-17A	BOLT	1
	AN502-10-22	SCREW, ADJUSTING	1
	1063595	EYEBOLT	1
	AN315-6R	NUT, CHECK	1
14.	AN4-11	BOLT	1
	AN310-4	NUT	1
	1026614-4-022	SPACER	1
15.	4062282	ARM ASSEMBLY, RIGHT-HAND	
	2063174	LATCH	1
	AN4-17A	BOLT	1
	124682-4S14-062	WASHER	1
	1026614-4-027	SPACER	1
	1063589	SPRING, LATCH	1
	AN960-416	WASHER	1
	365-428	NUT, STOP	1
	1063593	GUIDE	1
	AN3-10A	BOLT, CLAMP	1
	AN960-10	WASHER	2
	365-1032	NUT, STOP	1
	AN502-10-22	SCREW	1
	1063595	END	1
	AN315-6R	NUT, CHECK	1
16.	1135729	PIN, SAFETY CATCH	1
	1135730	BUSHING, SAFETY CATCH	1
17.	2064946	BUNGEE, SPRING	1
	4066588	TUBE, BUNGEE LOWER	1
	2109561	SPRING, INNER	1
	AN960-1016	WASHER, UPPER	1
	AN960-1216	WASHER, LOWER	1
	4066589	TUBE, BUNGEE UPPER	1
	AN24-22	BOLT	2
	AN320-4	NUT	2
	AN960-416	WASHER	2
	1059608-250-500-625	SPACER	2
18.	AN23-10	BOLT, CLEVIS	1
	AN310-3	NUT	1
19.	1135728	BELL CRANK, SAFETY CATCH	1
	AN23-11	BOLT	2
	AN310-3	NUT	2
	AN960-10L	WASHER	2
20.	1135733	RETAINER, SAFETY CATCH SPRING	1
	1135732	SPRING	1
21.	AN5-17	BOLT	1
	AN310-5	NUT	1
	AN960-516	WASHER	1
	1026614G5-100	SPACER	1
22.	4065522	LINK ASSEMBLY	1
	AN29-60	BOLT, UPPER	1
	AN29-36	BOLT, LOWER	1
	1026614G9-108	SPACER	2
	AN960-916	WASHER	2
	AN320-9	NUT	2
23.	2169550	LATCH, FORK	1
	1066935	WASHER	1
	AN25-24	BOLT	1
	1026614-5-024	SPACER	1
	1114907	ROLLER	1
	AN320-5	NUT	1
24.	36547	TIRE, SMOOTH, 26-INCH	1
	26550	TUBE, NON-CACTUS PROOF	1

LEGEND FOR FIGURE 85



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	53047	VALVE ASSEMBLY	1
	53050	GASKET	1
2.	54145	CYLINDER AND PLUNGER ASSEMBLY	1
3.	54079	COLLAR	1
4.	54078	RING, DAMPER VALVE	1
5.	54077	HEAD, PISTON	1
6.	54153	SETSCREW	2
7.	66955	PISTON ASSEMBLY, MAIN	1
8.	65029	STOP, PISTON	1
9.	65463	RING, PACKING	1
10.	185-S-39 (AN6225-40)	PACKING, CHEVRON	5
11.	65462	RING, PACKING	1
12.	65375	FITTING, UPPER TORQUE	1
13.	120-S-678 (AN6-25)	BOLT	1
	121-S-3 (AN310-6)	NUT	1
14.	54172	BUSHING	1
15.	65499	NUT, RETAINER	1
16.	54074	RING, RETAINING	1
17.	53097	SETSCREW	1
18.	121-S-3 (AN310-6)	NUT	1
	120-S-678 (AN6-25)	BOLT	1
19.	65373	FITTING, LOWER TORQUE	1
20.	120-S-678 (AN6-25)	BOLT	1
	121-S-3 (AN310-6)	NUT	1
21.	54043	PIN	1
22.	120-S-309 (AN8-52)	BOLT	2
	121-S-5 (AN310-8)	NUT	2
	54097	SLEEVE	2
23.	66064	WIRE, LOCK	1
24.	67079	DISK, ORIFICE	1
25.	54090	LOCK, PLUNGER	1
	67121	NUT, LOCK	1
	54088	SPRING	1
26.	65405	ARM ASSEMBLY, TORQUE	2
27.	120-S-679 (AN6-27)	BOLT	1
	121-S-3 (AN310-6)	NUT	1
	53763	SLEEVE	1
	53801	SPACER	2
28.	65406	FITTING, ZERK	2
29.	120-S-139 (AN8-44)	BOLT	1
	121-S-5 (AN310-8)	NUT	1
	2169550	LATCH ASSEMBLY	1
	AN960-816	WASHER	1
30.	54437	EYE, TOWING	2
	121-S-5 (AN310-8)	NUT	2
31.	65377	FORK ASSEMBLY	1
32.	120-S-692 (AN8-21)	BOLT	4
	121-S-5 (AN310-8)	NUT	4
33.	56501	NUT, ADJUSTMENT	1
34.	112-S-83	COTTER	1
35.	110-S-17 (AN7503-3)	SPACER	1
36.	56498	AXLE	1
37.	54179	CLAMP, AXLE	2
38.	56502	COLLAR	1

FIGURE 86 - NOSE ALIGHTING GEAR SHOCK STRUT ASSEMBLY



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1090030	GASKET	1
2.	1090027	VALVE	2
3.	4090961	HEAD, CYLINDER	1
4.	AN3-20A	BOLT	2
	AN365-1032	NUT	2
5.	143908-128 SR 202-093	WASHER	2
6.	1066165	NUT, HEAD LOCK	1
7.	1090020	PISTON	1
	1133497	RING, PISTON	2
	AN310-6	NUT	1
8.	2064871	CYLINDER	1
9.	1069912	STUD	2
10.	4090962	END, CYLINDER	1
11.	1057177	NUT, PACKING	1
12.	2069482	ROD, PISTON	1
13.	5135865-3-020	PACKING, CHEVRON	4
14.	1012954-D020-006	RING, PACKING, END	2
15.	1012953-D020-006	RING, PACKING, CENTER	2
16.	1138459	PLUG, VALVE	1
17.	1138467	SPRING	
18.	1138504	WASHER	1
19.	143908-008 SR 012-093	WASHER	6
20.	5069115-2	TUBE	1
	PARKER 4B	NUT	2
21.	2069574	RESERVOIR	1
22.	2117859	PLUG	1
	1138517	WASHER	1

Figure 87 - NOSE WHEEL SNUBBER ASSEMBLY

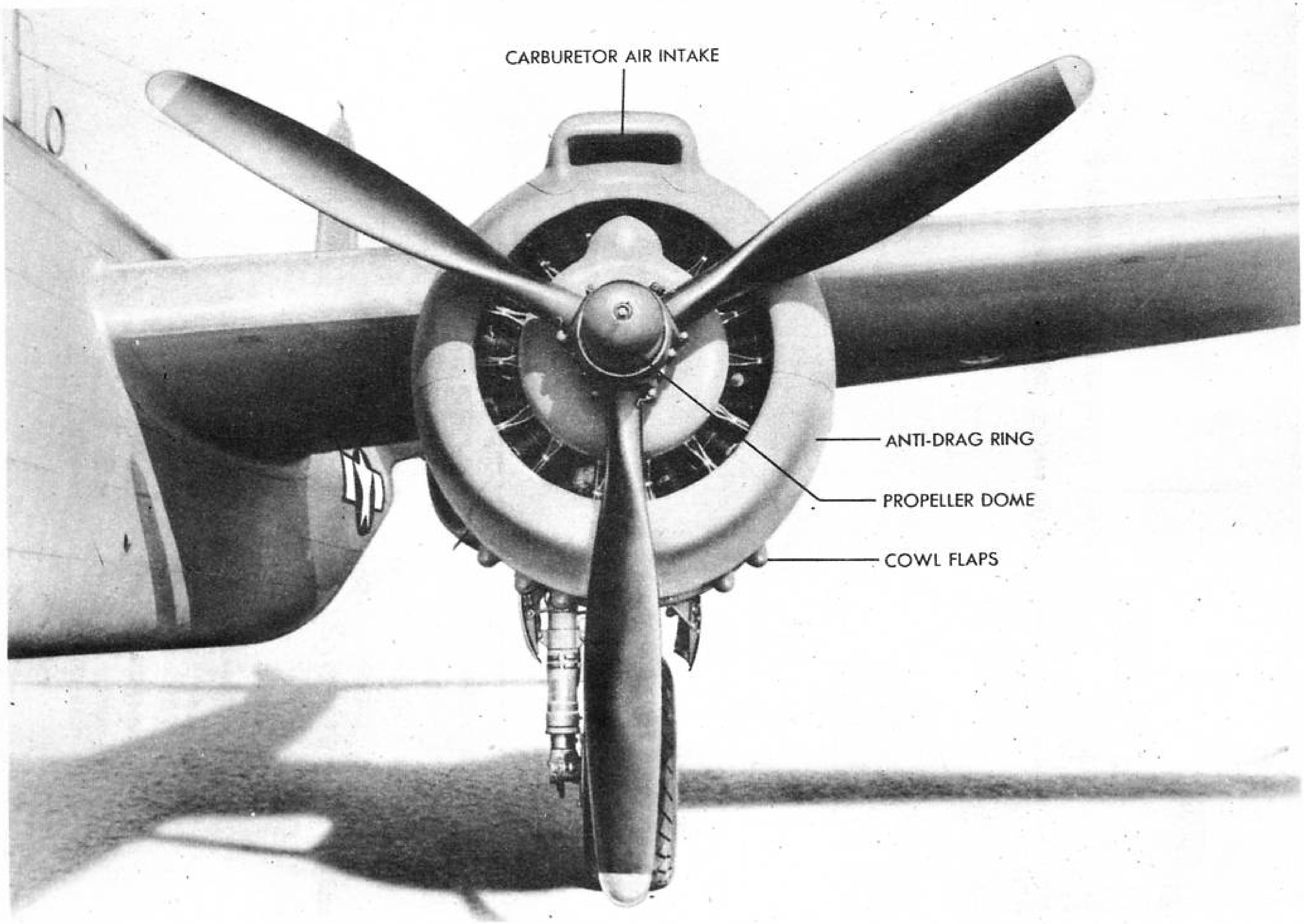


Figure 88 - FRONT VIEW OF POWER PLANT

8. POWER PLANT.

a. DESCRIPTION.

(1) GENERAL. - This airplane is equipped with two 14-cylinder Wright Model R-2600-23 engines, each weighing 1950 pounds. Each engine produces 1600 brake horsepower at sea level take-off at 2400 rpm. The engines are of the radial, air-cooled, double-row cylinder type. One engine is mounted on the front of each engine nacelle by a welded tube engine mount which attaches at two points on the nacelle fire wall and at two points on the front shear web. (See figure 89.) The ring section of the mount carries the engine which is attached at seven points. Each engine is housed by an antidrag ring formed of sheet aluminum alloy. Immediately behind the antidrag ring are the cowl flaps which open to permit engine cooling. An engine accessories cowling covers the space between the cowl flaps and the fire wall.

(2) COMPLETE ENGINE SECTION. (See figure 90.) - The complete engine section of the nacelle is composed of the engine and the engine mount and everything attached to them except the propeller and antidrag ring. The nacelle is designed so that the complete engine section forward of the fire wall, including fuel and oil lines, may be handled as a quickly detachable unit.

(3) ACCESSORIES. - Engine accessories are treated under the paragraphs of this section dealing with the system of which they are part. For example, magnetos and generator are covered in paragraph 17, Electrical System. The starter is treated in paragraph 11, Starting System. The carburetor and fuel pump are covered in paragraph 13, Fuel System. The oil pump is treated in paragraph 12, Oil System; the vacuum pump in paragraph 14, Instruments; and the hydraulic pump in paragraph 16, Hydraulic System.

(4) SPECIFICATIONS.

(a) GENERAL.

Make	Wright
Model	R-2600-23
Type	Static Radial, Air-Cooled, Double Row
Number of Cylinders	14
Bore	6.125 in.
Stroke	6.312 in.
Piston Displacement	2603 cu. in.
Compression Ratio	6.30:1
Blower Gear Ratio	7.134 and 10.04:1
Blower Diameter	11.00 in.
Rated rpm of Crankshaft	2300
Rated B.H.P./rpm at Sea Level	1275/2300
Rated B.H.P./rpm at 5500 ft (7.14:1 Blower)	1350/2300
Rated B.H.P./rpm at 12000 ft (10:1 Blower)	1275/2300
Take-off B.H.P./rpm	1600/2400
Rotation of Crankshaft (from anti-prop. end)	Clockwise
Rotation of Propeller (from anti-prop. end)	Clockwise
Propeller Reduction Gear Ratio (crankshaft to propeller)	16:9
Average Weight of Engine	1950 lb
Over-all Length of Engine	62.06 in.
Position of Center of Gravity of Engine	
Distance aft of thrust nut front face	20.61 in.
Distance forward of rear face of mounting bosses	14.75 in.
Distance above center line of crankshaft	0.30 in.
Diameter of Mounting Bolt Circle - Plain Mount	25 in.
Diameter of Trunnion Bolt Circle - Dynamic Mount	30.26 in.
Number of Mounting Bolts - Plain Mount	7
Diameter of Mounting Bolts - Plain Mount	0.625 in.
Over-all Diameter of Engine	55.00 in.

(b) IGNITION.

Magneto Type	Scintilla SF-14L-4
Rotation of Magneto Drive (from anti-prop. end)	Clockwise
Magneto Drive Shaft Speed Ratio to Crankshaft	0.875:1
Spark Plug Type	AC-LS 85
Spark Plug Gap	0.012 in.
Spark Timing on No. 1 Cylinder	
Left magneto (rear plugs) - Deg. B.T.C.	20^{o}
Right magneto (front plugs) - Deg. B.T.C.	20^{o}

(c) VALVES AND TIMING.

Intake Opens - Deg. B.T.C.	20^{o}
Intake Closes - Deg. A.B.C.	50^{o}
Exhaust Opens - Deg. B.B.C.	65^{o}
Exhaust Closes - Deg. A.T.C.	40^{o}
Intake Remains Open - Crankangle Degrees	250^{o}
Exhaust Remains Open - Crankangle Degrees	285^{o}
Valve Lift	0.562 in.
Valve Rocker Clearance - Cold	0.015 in.
Timing Clearance	0.070 in.
Running Clearance	0.070 in.

(d) FUEL SYSTEM.

Carburetor Type	Bendix-Stromberg PD-12K1
Fuel Specification	AN-F-28

Octane	100
Fuel Inlet Conn. Thread	0.750-in. std. pipe tap
Fuel Pressure - lb/sq in.	12 to 17
Supercharger Drain Valve Conn. Thread	0.250-in. std. pipe tap
Priming System Inlet Conn. Thread	0.125-in. std. pipe tap

(e) LUBRICATING SYSTEM.

Grade of Oil Desired in Flight - Specification AN-VV-O-446	Grade 1120
Oil Pump Drive Shaft Speed Ratio to Crankshaft	1.125:1
Rotation of Oil Pump Drive Shaft (facing drive)	Counterclockwise
Oil Pump Inlet Flange Conn. Thread	1.5 in.
Oil Pump Outlet Flange Conn. Thread	1.25 in.
Flange Attachment to Oil Pump Inlet - three 5/16-24 U.S.F. studs - 120° apart on 2.313-in. diam. circle Outlet - three 5/16-24 U.S F studs - 120° apart on 2.313-in. diam. circle Above studs project 0.70 in. from pump body	
Oil Tank Vent Conn. (Two) Thread	0.375-in. std. pipe tap
Crankcase Breather Nipple	1.50 in O.D.

(f) ACCESSORY DRIVES.

Dual Accessory Drive	
Upper mount	Four 1/4-28 U.S F. studs 0.78-in. high, spaced 1.875 in. x 1.875 in.
Upper drive	12 stub tooth involute spline 0.600-in. P.D.
Upper Drive Speed Ratio to Crankshaft	1.5:1
Upper Drive Rotation (facing drive)	Counterclockwise
Lower Drive Mount	Four 5/16-24 U.S.F. studs 0.82 in. high, equally spaced on 5-in. diam. circle
Lower Drive	12 stub tooth involute spline 0.600-in. P.D.
Lower Drive Speed Ratio to Crankshaft	1.5:1
Lower Drive Rotation (facing drive)	Counterclockwise
Fuel Pump Mount	Four 5/16-24 U.S.F. studs 0.88 in. high, spaces 2 in. x 2 in.
Fuel Pump Drive	11 tooth involute spline 0.4583-in. pitch diam.
Fuel Pump Speed Ratio to Crankshaft	1:1
Fuel Pump Rotation (facing drive)	Counterclockwise
Generator Mount	6 3/8-24 U.S.F. studs 0.94 in. high, equally spaced on 5-in. diam. circle
Generator Drive	16 tooth involute spline 0.800-in. pitch diam.
Generator Drive Speed Ratio to Crankshaft	1.5:1
Generator Drive Rotation (facing drive)	Clockwise
Propeller Governor Mount	Four 5/16-24 U.S.F. studs 0.94-in. high, spaced 2.125 in. x 2.125 in.
Propeller Governor Drive	12 tooth involute spline 0.600-in. pitch diam.
Propeller Governor Drive Speed Ratio to Crankshaft	1:1
Propeller Governor Drive Rotation (facing drive)	Clockwise
Propeller Hub Spline Size	S.A.E. No. 50-16 splines

Starter Mount	Six 3/8-24 U.S.F. studs 0.94-in. high, equally spaced on 5-in. diam. circle
Starter Drive	Three-jaw detachable dog
Starter Speed Ratio to Crankshaft	1:1
Starter Rotation (facing rear of engine)	Clockwise
Tachometer Connection - Thread	7/8-18 U.S.F.
Tachometer Drive	Two shafts, 27° apart
Tachometer Shafts - Speed Ratio to Crankshaft	0.500:1
Tachometer Drive Shaft Rotation (Drive Conns. to Rear)	
Upper (facing drive)	Counterclockwise
Lower (facing drive)	Clockwise

(g) INSTRUMENT CONNECTIONS.

Air Scoop Pressure Connection, Carburetor	
Top flange - thread	0.125-in. std. pipe tap
Fuel Pressure Connection, Carburetor - Thread	0.125-in. std. pipe tap
Manifold Pressure Connection- LH Side	
Front Supercharger Housing	
Thread	0.125-in. std. pipe tap
Fitting	Must have No. 50 drilled opening only
Oil Pressure Connections	
Engine, prop. end (gov. pump inlet) thread	0.250-in. std. pipe tap
Engine, Tailshaft - Thread	0.125-in. std. pipe tap
Governor pump outlet - thread	0.125-in. std. pipe tap
Supercharger high ratio clutch - thread	0.125-in. std. pipe tap
Oil Inlet and Outlet Thermometer Conns. - Thread	5/8-18 U.S.F.
Thermocouple, Spark Plug Type - Thread	No. 12-28 U.S.F.

(5) ACCESSORIES AND WEIGHTS.

Carburetor and Carburetor Adapter	42.00 lb
Magnetos	36.40 lb
High-tension Ignition Wiring, Breeze Shielding	35.00 lb
Spark Plugs	7.50 lb
Tachometer and Fuel Pump Drives	2.40 lb
Priming System Installed on the Engine	2.00 lb
Exhaust Flanges and Gaskets, per set	5.50 lb
Cylinder Air Baffles	30.00 lb
Dual Accessory Drive	8.00 lb
Propeller Speed Governor Drive	5.00 lb
Total Dry Weight	1950.00 lb

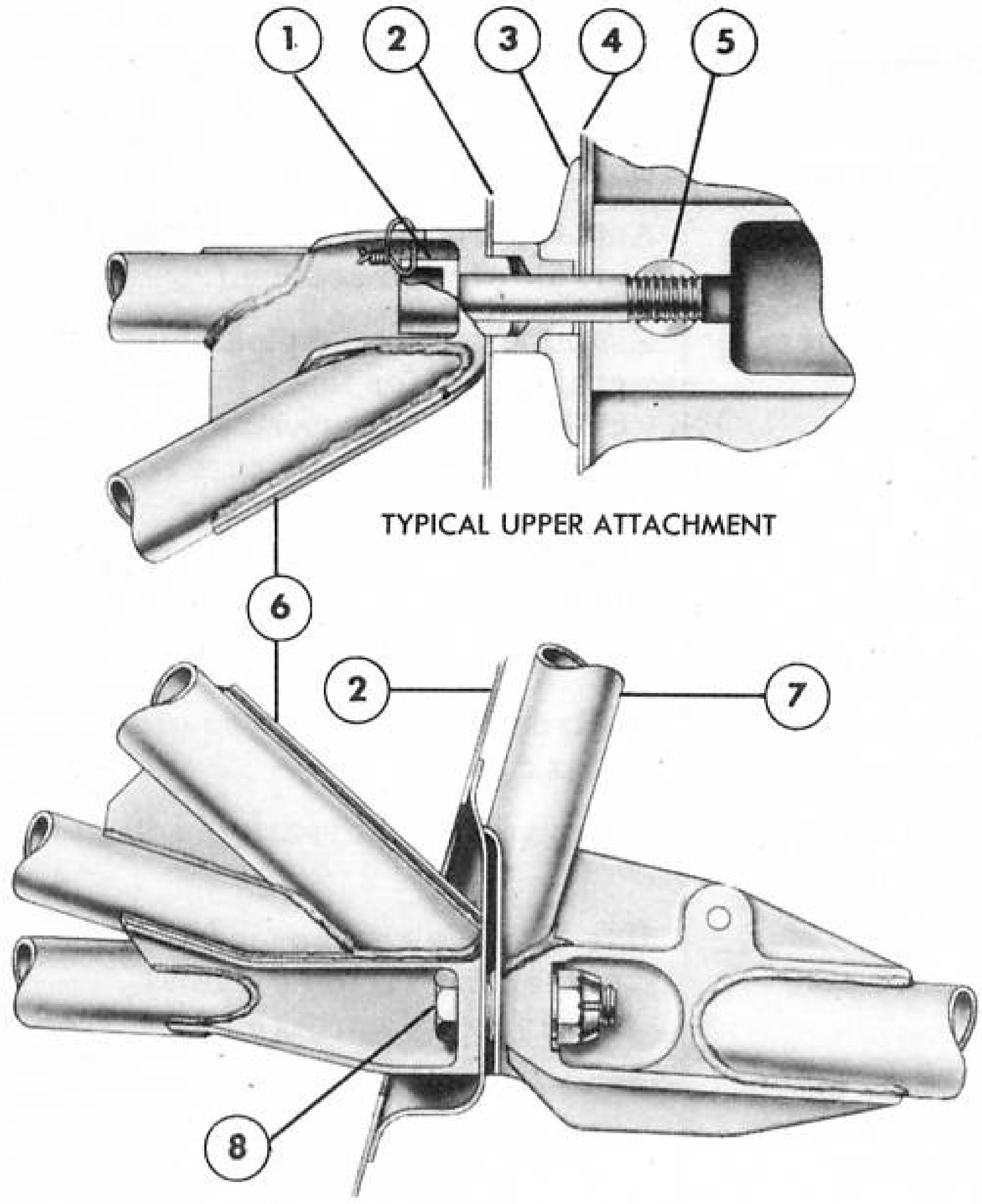
b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Engine fails to start.	Lack of fuel.	Fill fuel tanks. Check selector valve controls for position. Check fuel pump pressure.
	Underpriming.	Prime the engines.
	Overpriming.	Allow engines to stand for a few minutes. Clear out by cranking over with throttle wide open. Set mixture to IDLE CUT-OFF before attempting to start.
	Booster magneto defective.	Replace booster coil.
	Throttle opening incorrect.	Close the throttle so that the starting engine speed will be about 1000 rpm.

SYMPTOM	CAUSE	REMEDY
	Mixture control improperly used.	See starting instructions (Section 3, paragraph 3, this handbook).
	Defective ignition wire.	Examine ignition wiring for wear, breaks, and incorrect connections. Correct the fault.
	Dirty spark plugs.	Check the spark plugs. Clean and set gaps to 0.012-in. (0.305-mm).
	Incorrect valve clearance.	Check and set valve clearance.
	Incorrect timing.	Check the valve and ignition timing. Time properly.
	Water in carburetor.	Remove the plug to drain off the gasoline and water.
	Congealed oil.	With the ignition switches off, turn the engine over by hand. If it is very stiff, drain and heat the oil before starting. Engine will be hard to pull if oil has collected in lower cylinders; remove spark plugs and let oil run out.
	Magneto breaker points defective.	Replace and adjust magneto breaker points.
	Magneto breaker points dirty or out of adjustment.	Clean magneto breaker points by sliding a piece of paper between them, and not by using a file. If points are badly worn, replace with new ones.
Low manifold pressure and uneven running.	Carburetor mixture too rich or too lean.	Adjust the carburetor. (See paragraph 13, this section.)
	Leaks in induction system.	Examine the intake pipes for cracks and for leaks at the cylinder and crankcase connections. Examine the carburetor and intake manifold flanges for tightness. Make necessary repairs.
	Spark plugs fouled and out of adjustment.	Clean and adjust spark plugs.
	Wrong type of spark plugs.	Replace the spark plugs with the proper type.
	Spark plugs in service for over 100 hours.	Replace the spark plugs.
	Valve and valve gear trouble.	Check the valve clearance springs, washers, rockers, and push rods. Check the valves for sticking. Make necessary repairs.
	Poor fuel.	Use only the recommended grade of fuel and see that it flows freely to the carburetor.

SYMPTOM	CAUSE	REMEDY
	Defective magneto breaker points.	Replace and adjust magneto breaker points.
	Magneto breaker points dirty and out of adjustment.	Clean and adjust magneto breaker points.
	Ignition wire deteriorated or burned.	Replace defective wiring.
	Ice forming in carburetor.	Move carburetor air control to HOT.
Engine overheating.	Improper cowl flap opening.	Open cowl flaps wider.
	Carburetor out of adjustment.	Adjust carburetor. (See paragraph 13, this section.)
	Leaks in the induction system.	Examine the intake pipes for cracks and for leaks at the cylinder and crankcase connections. Examine the carburetor and intake manifold flanges for tightness. Make necessary repairs.
	Spark plugs defective.	Replace spark plugs.
	Wrong type of spark plugs.	Replace with proper type of spark plugs.
	Spark plugs dirty and out of adjustment.	Clean and adjust spark plugs.
	Poor fuel.	Use only the recommended grade of fuel and see that it flows freely to the carburetor.
Loss of power in stormy weather.	Change in mixture ratio too rich or lean, causing formation of ice.	Start carburetor anti-icer pump, and pre-heat.
	Decrease in venturi area due to ice formation.	Start carburetor anti-icer pump, and pre-heat.
	Water lodging in fuel passages, causing mixture to become extremely lean or the fuel flow to stop entirely.	Drain fuel system.
Low or no oil pressure.	Excessive bearing clearance.	Replace bearings.
	Oil system malfunction.	See Oil System Trouble Shooting, paragraph 12, this section.
Oil accumulation in crankcase.	Lack of priming in scavenging pump.	Disconnect the main discharge pipe from the pump and put on a short length of clean hose. Turn the engine backward and feed oil into the hose until a quart or so has been sucked in.
	Stoppage or failure of oil pump or strainer.	Replace defective assembly.
Excessive oil temperature and high oil consumption.	Overheated bearings.	Replace bearings.
	Worn piston rings.	Replace piston rings.

SYMPTOM	CAUSE	REMEDY
	Piston rings incorrectly installed.	Install piston rings correctly.
	Clogged oil lines, strainers, or coolers.	Remove obstruction.
	Malfunction of oil system.	See Oil System Trouble Shooting, paragraph 12, this section.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2076910-31	BOLT, OUTBOARD	1
	2076910-45	BOLT, INBOARD	1
2.	5090850	FIRE WALL ASSEMBLY—L.H. NACELLE	1
	5090851	FIRE WALL ASSEMBLY—R.H. NACELLE	1
3.	2062143	PAD ASSEMBLY, ENGINE MOUNT SUPPORT—OUTBOARD	1
	4061646	SUPPORT ASSEMBLY, ENGINE MOUNT ATTACHMENT—INBOARD	1
4.	5106862-14	WEB, WING FRONT SHEAR—INBOARD—L.H.	1
	5106862-15	WEB, WING FRONT SHEAR—INBOARD—R.H.	1
5.	1064717	PLUG, ENGINE MOUNT FITTING	2
6.	5065394	MOUNT ASSEMBLY, ENGINE	1
7.	5065334	FRAME ASS'Y., LANDING GEAR SUPPORT—L.H.	1
	5065334-1	FRAME ASS'Y., LANDING GEAR SUPPORT—R.H.	1
8.	AN10-20	BOLT	2
	AN310-10	NUT	2
	AN960-1016	WASHER	6

Figure 89 - ENGINE MOUNT ATTACHMENT

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF ENGINE.

(a) Remove propeller.

(b) Remove antidrag ring. (See figure 88.)

(c) Remove accessory cowling.

(d) Drain the oil at the Y drain (figure 91); or if no suitable oil container is available, unscrew Wittek clamps at the engine, slide hose aft on oil line, and quickly insert a wooden plug in the hose. Although a pint of oil may be lost, time is saved and the oil, since it is left in the airplane, cannot get dirty.

(e) Wire the throttle butterfly valve at the carburetor in closed position.

(f) Break the engine control rigging at the turnbuckles in the accessory section. (See figure 93.) Remove fair-lead holder cover on venturi ring and pull propeller governor control cables forward through the venturi ring. (See figure 96.)

(g) Remove the carburetor air scoop as follows:

1 Remove cover plates on both sides of scoop.

2 Remove exit fairings for upper cowl flaps from wing on both sides of scoop.

3 Disconnect air temperature bulb connection from middle of back of scoop.

4 Disconnect four carburetor anti-icer lines from back of scoop.

5 Remove cover from top of air scoop fairing.

6 Remove five cap screws under air scoop fairing.

7 Remove six Phillips head screws from air scoop fairing.

8 Remove ten remaining cap screws that hold sides of air scoop to the venturi ring.

9 Disconnect control cables.

10 Loosen the lower clamp on the Neoprene collar that connects the scoop to the carburetor.

11 Lift the air scoop off.

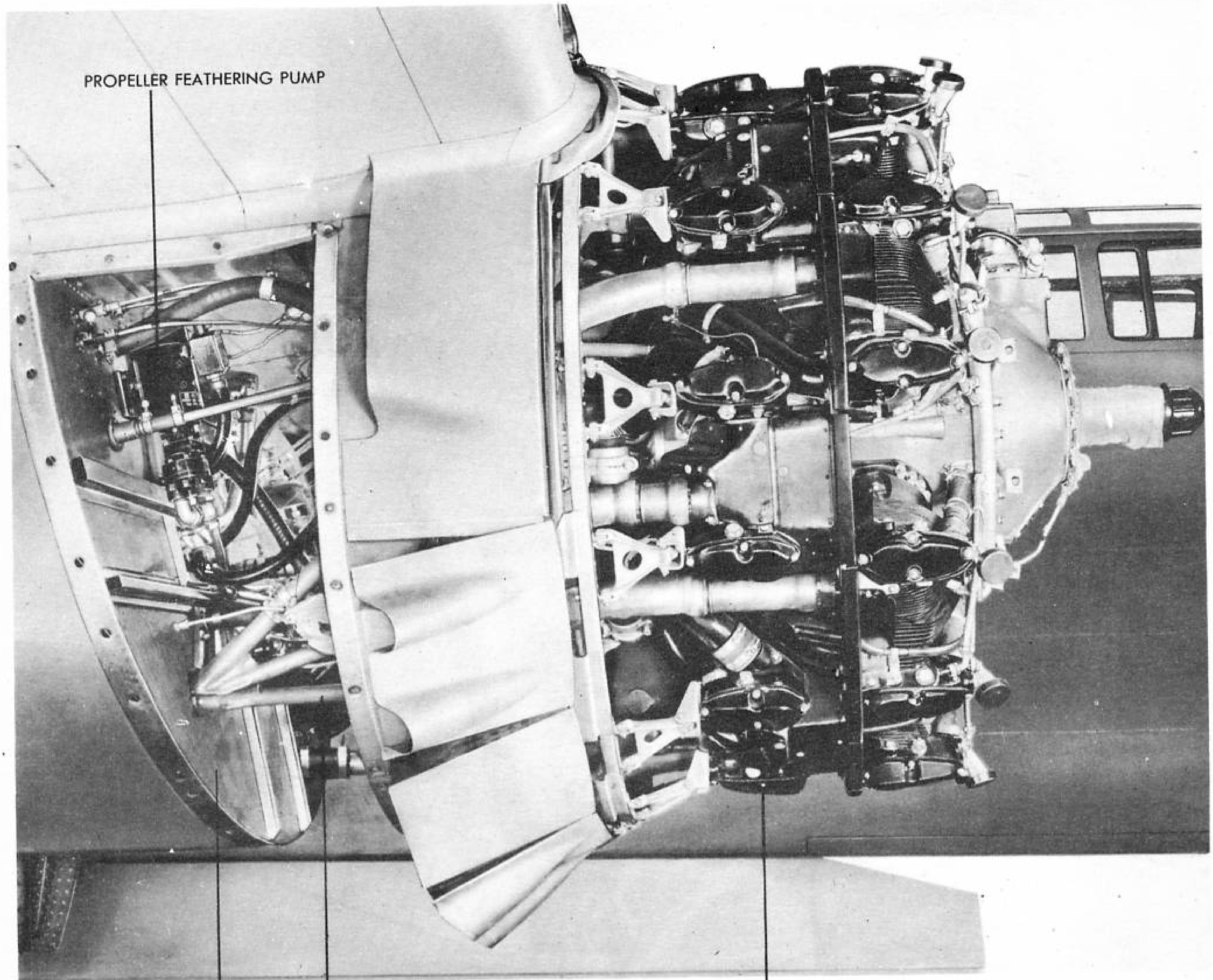


Figure 90 - COMPLETE ENGINE SECTION

(h) Remove the main fuel line and cross-feed line from the fuel pump and fire wall. (See figure 92.)

(i) Remove the carburetor.

(j) Disconnect the instrument lines at the step in the fire wall. (See figure 92.) The fuel pressure gage and fuel pressure vent line need not be disconnected at fire wall, but only at the carburetor.

(k) Remove the fuel pump from the engine. (See figure 92.)

(l) Remove the tachometer generator from the engine. (See figure 92.)

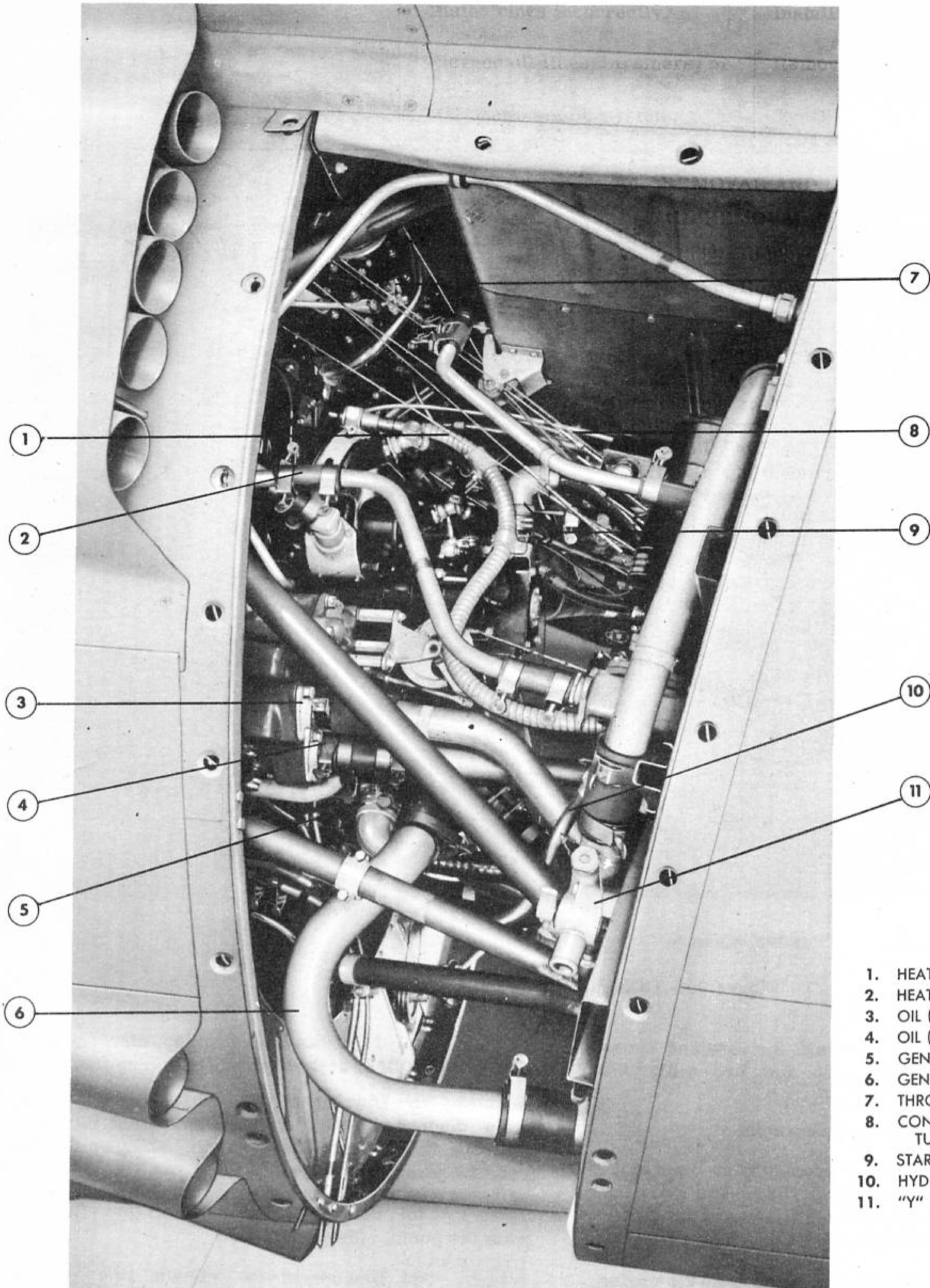
(m) If oil has been drained, disconnect the oil IN and OUT lines at the engine fitting. (See figure 91.)

(n) Disconnect the hydraulic suction line at the disconnect valve on the fire wall to eliminate air locks in the rest of the system. Remove the line from the pump. (See figure 92.)

(o) Disconnect the hydraulic pressure line from the pump. (See figure 92.)

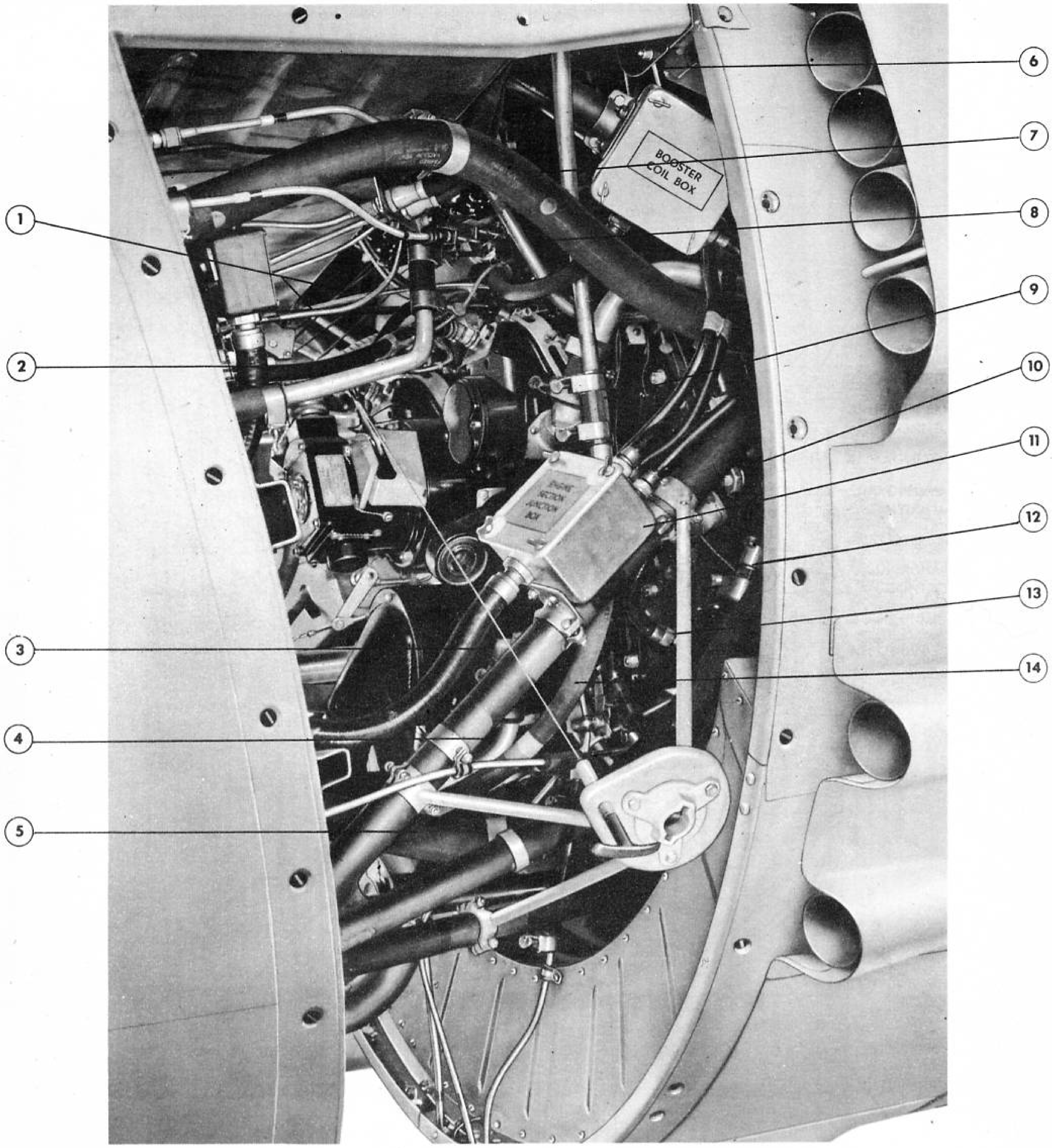
(p) Disconnect the vacuum line and the pressure line from the vacuum pump. (See figure 92.)

(q) Disconnect the hose connection midway between fire wall and engine on the heater intake, and



1. HEATER EXHAUST LINE
2. HEATER INTAKE LINE
3. OIL (IN) LINE
4. OIL (OUT) LINE
5. GENERATOR CANNON PLUG
6. GENERATOR BLAST TUBE
7. THROTTLE VALVE
8. CONTROL RIGGING TURNBUCKLES
9. STARTER CANNON PLUG
10. HYDROMATIC LINE
11. "Y" DRAIN

Figure 91 - LEFT-HAND VIEW OF ENGINE ACCESSORY SECTION - COWLING REMOVED



1. INSTRUMENT LINES
2. MAGNETO CABLE
3. HYDRAULIC PRESSURE LINE
4. HYDRAULIC SUCTION LINE
5. MAIN FUEL LINE
6. OIL FOAM LINE
7. CROSS FEED LINE
8. OIL SEPARATOR DRAIN LINE
9. DE-ICER LINE
10. FUEL PUMP
11. ENGINE JUNCTION BOX
12. TACHOMETER MAGNETO
13. TACHOMETER MAGNETO ELECTRICAL CONNECTION
14. VACUUM LINE

Figure 92 - RIGHT-HAND VIEW OF ENGINE ACCESSORY SECTION - COWLING REMOVED

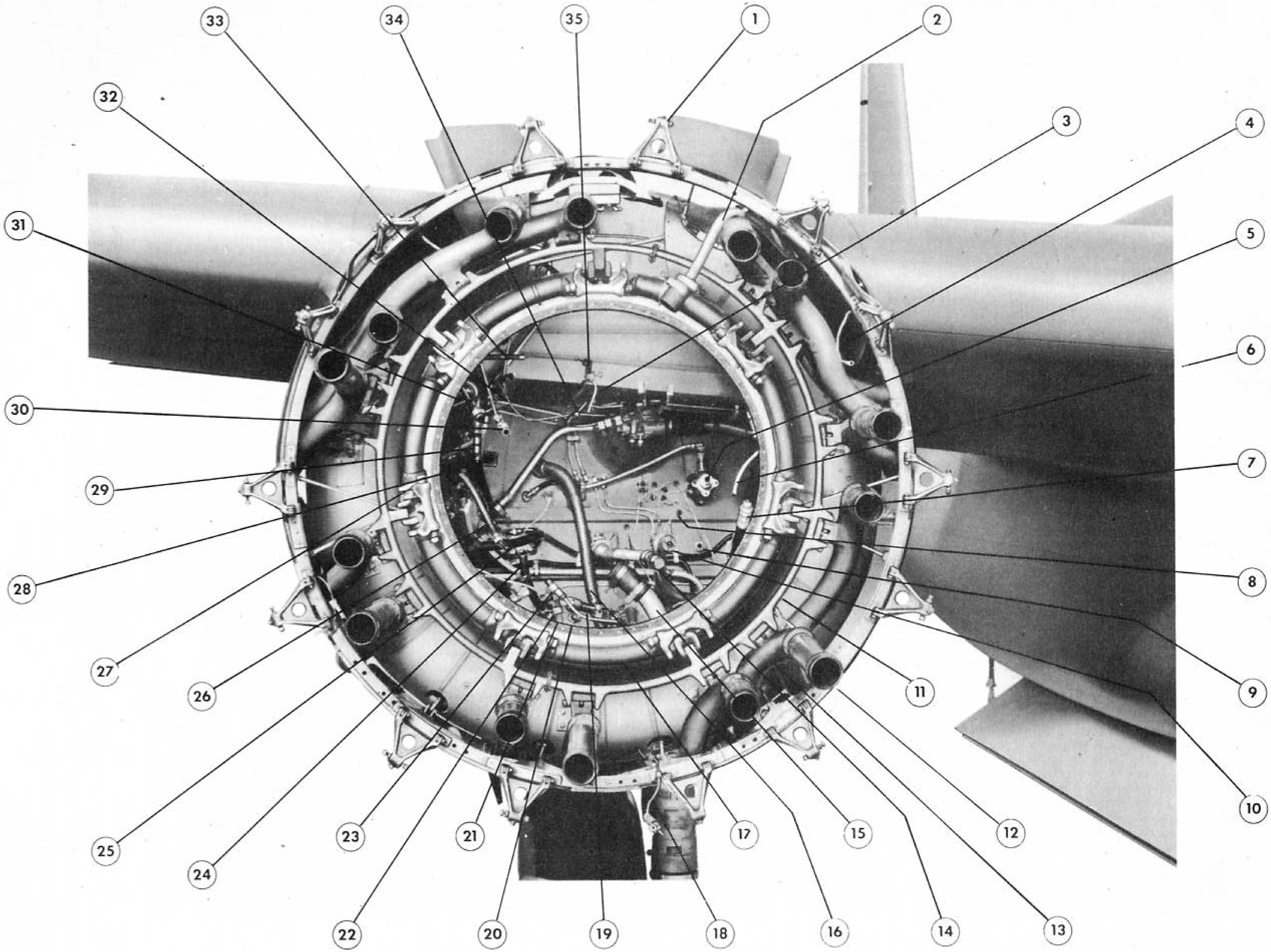
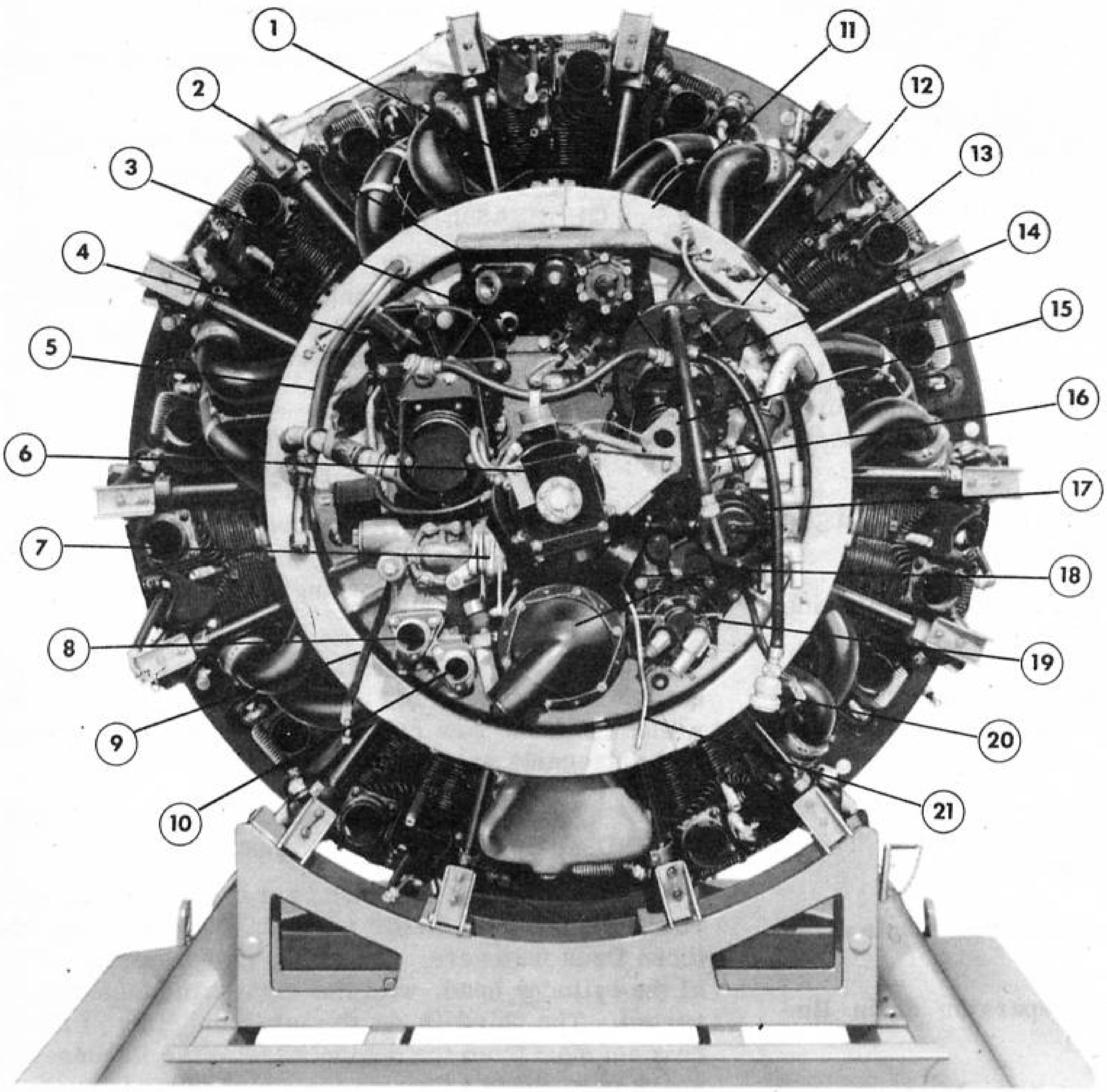


Figure 93 - NACELLE ENGINE CONNECTIONS - ENGINE REMOVED

LEGEND FOR FIGURE 93

1. ANTI-DRAG RING BRACKET
2. CRANKCASE BREATHER LINE
3. MANIFOLD PRESSURE GAUGE LINE
4. BONDING STRAP
5. HEATER CUT-OUT SWITCH
6. OIL FOAM LINE—L. H.
7. PROPELLER GOVERNOR HYDRAULIC LINE
8. FAIR LEAD FOR ENGINE CONTROL CABLES
9. HEATER EXHAUST FITTING
10. OIL IN LINE
11. EXHAUST STACK RING
12. EXHAUST TUBE
13. EXHAUST STACK
14. OIL SCAVENGER LINE
15. GENERATOR BLAST TUBE
16. GENERATOR CONDUIT
17. ENGINE MOUNT RING
18. NO. 9 CYLINDER DRAIN LINE
19. HYDRAULIC PUMP PRESSURE LINE
20. DISCONNECT VALVE FOR HYDRAULIC SUCTION LINE
21. FUEL PUMP DRAIN LINE
22. STARTER DRAIN LINE
23. SUPERCHARGER DRAIN LINE
24. VACUUM SUCTION LINE
25. STARTER CONDUIT
26. TACHOMETER MAGNETO CONDUIT
27. LORD DYNAFOCAL MOUNT
28. MAGNETO CANNON PLUG CONNECTION
29. VACUUM PUMP DISCHARGE LINE
30. OIL SEPARATOR DRAIN LINE
31. OIL FOAM LINE—R. H.
32. FUEL PRESSURE GAUGE STATIC LINE
33. PROPELLER FEATHERING CONDUIT
34. OIL PRESSURE GAUGE LINE
35. FUEL PRESSURE LINE



1. LORD DYNAFOCAL MOUNT
2. CARBURETOR ADAPTER
3. HEATER EXHAUST CONNECTION
4. MAGNETO
5. PROPELLER GOVERNOR HYDROMATIC LINE
6. STARTER
7. SUPERCHARGER CONTROL BRACKET
8. OIL PUMP INLET
9. BONDING STRAP
10. OIL PUMP OUTLET
11. FIRE SEAL
12. PROPELLER ANTI-ICER LINE
13. PRIMER LINE
14. MAGNETO
15. STARTER HAND ENGAGING MECHANISM
16. BOOSTER COIL CABLE
17. VACUUM PUMP
18. GENERATOR
19. HYDRAULIC PUMP
20. MAGNETO CONDUIT
21. STARTER DRAIN LINE

Figure 94 - REAR VIEW OF REMOVED ENGINE

disconnect exhaust lines at the fire wall, letting them hang down from the engine. (See figure 91.)

(r) Disconnect the propeller feathering hydromatic line at the inner baffle, or the forward end of the hose. (See figure 91.)

(s) Disconnect the generator cable at the generator Cannon plug. (See figure 91.)

(t) Disconnect the starter cable at the starter Cannon plug. (See figure 91.)

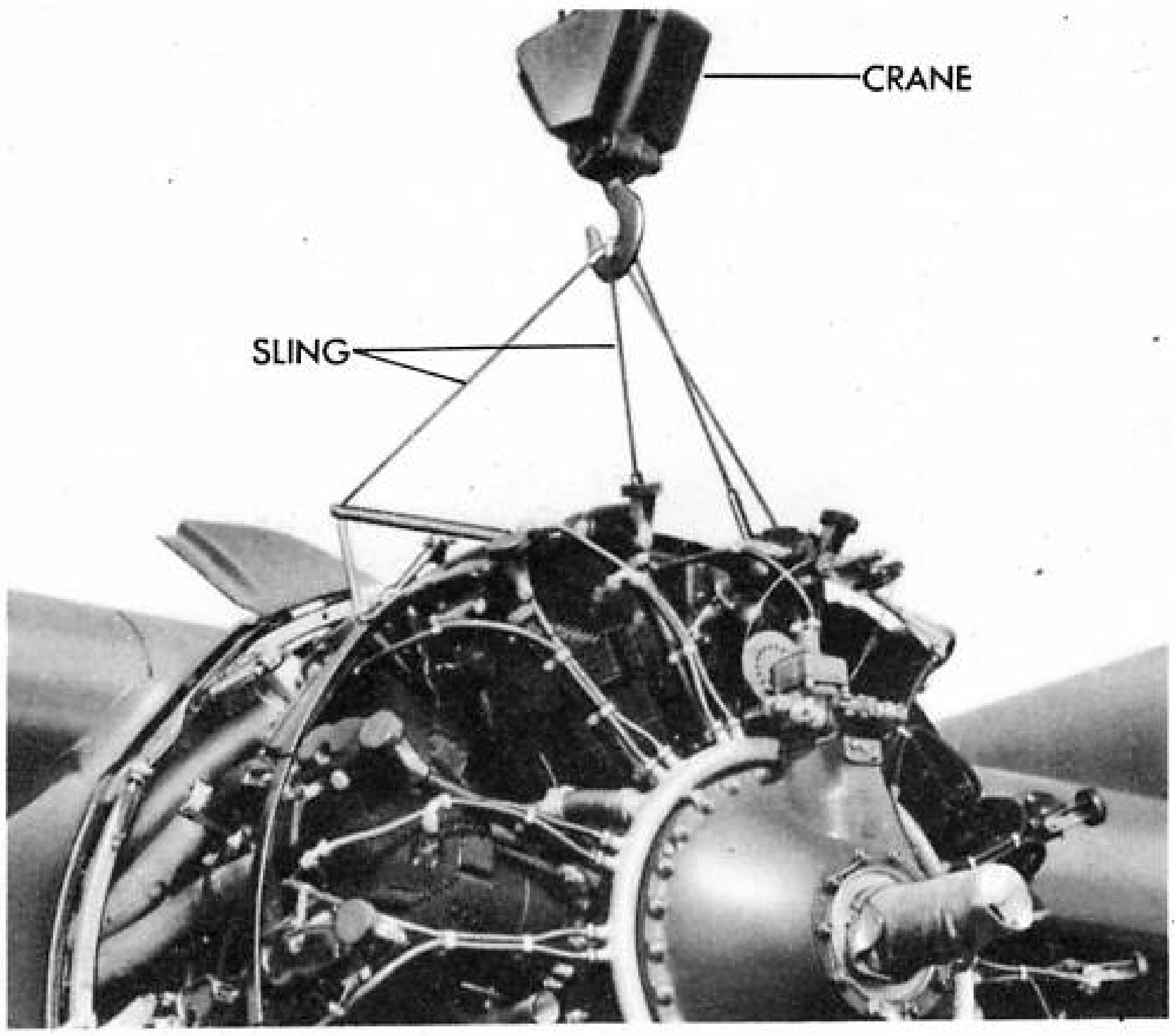


Figure 95 - CRANE ENGAGED FOR ENGINE REMOVAL

(u) Disconnect the magneto Cannon plug on the fire wall. (See figure 92.)

(v) Unsolder propeller governor cutout switch wire at the governor on airplanes with serial numbers below AF 42-53884.

(w) Disconnect the cowl flap support ring at the engine cylinder brackets. (See figure 93.)

(x) Disconnect the No. 9 cylinder drain line at the BT nut on the cylinder. (See figure 94.)

(y) Remove the right-hand breather line and cap (figure 93), and remove the left-hand breather line.

(z) Disconnect the propeller cutout switch at engine junction box (figure 92 on airplanes with serial numbers 42-53884 and above.

(aa) Disconnect the two thermocouple wires at the fire wall.

(bb) Disconnect oil separator drain line from the engine. (See figure 92.)

(cc) Remove both oil foam lines, one on each side of the engine. (See figure 92.)

(dd) Disconnect the engine-to-mount electrical bonding strap. (See figure 94.)

(ee) Disconnect the generator blast tube. (See figure 91.)

(ff) Support the tail of the airplane with a tail stand.

(gg) Install a removal sling to the rocker arm bolts nearest vertical center line of engine on cylinders No. 2 and 14. Install another removal sling, equipped with a spacer bar, to similar rocker arm bolts on cylinders No. 3 and 13. (See figure 95.) Attach sling by putting nuts on backwards.

(hh) Hook a crane to the two removal slings and support the engine weight with the crane. (See figure 95.)

(ii) Remove the Lord Dynafocal mount. (See figure 93.)

(jj) To facilitate engine installation, mark on the ground the location of the crane.

(kk) Pull the engine forward.

(ll) Lower engine into engine stand. (See figure 96.)

(mm) Plug all openings with paper to prevent foreign matter from entering engine.

(2) DISASSEMBLY OF ENGINE.

(a) GENERAL. - The following instructions are limited to "top overhaul" of engines, including removal and replacement of parts. Where it is ascertained that internal parts of the engine have been damaged, replace the engine.

(b) REMOVAL OF PARTS.

NOTE

Remove cotter pins, safety wire, and palnuts as required from parts being disassembled. Remove all sections of cowling which would interfere with the work.

1 GENERAL. - Rear row cylinder baffles consist of three detachable parts per cylinder, while the front row cylinder baffles are composed of five detachable parts each.

2 REMOVAL OF SINGLE REAR ROW CYLINDER HEAD BAFFLES. (See figure 96.)

a. Detach rear segment of the rear row cylinder head baffle assembly by detaching the three Dzus fasteners. Two Dzus fasteners are on top of the cylinder head, with the right-hand fastener inverted. The third is on the left-hand side. Lift the rear segment from the engine, passing the disconnected spark plug conduit through the spark plug air duct.

b. Remove the front segment of the same baffle after detaching its four Dzus fasteners.

3. REMOVAL OF COMPLETE REAR ROW CYLINDER HEAD BAFFLE ASSEMBLY. (See figure 96.)

a. Detach the three Dzus fasteners in the continuous wall section, and the fourth fastener in the right-hand cylinder barrel baffle.

1. REAR ROW CYLINDER HEAD BAFFLE ASSEMBLY
2. FRONT ROW CYLINDER HEAD BAFFLE
3. CYLINDER BARREL BAFFLE
4. SPARK PLUG
5. VALVE PUSH ROD COVER
6. PROPELLER GOVERNOR CONTROL CABLES
7. PROPELLER GOVERNOR CUT-OUT SWITCH

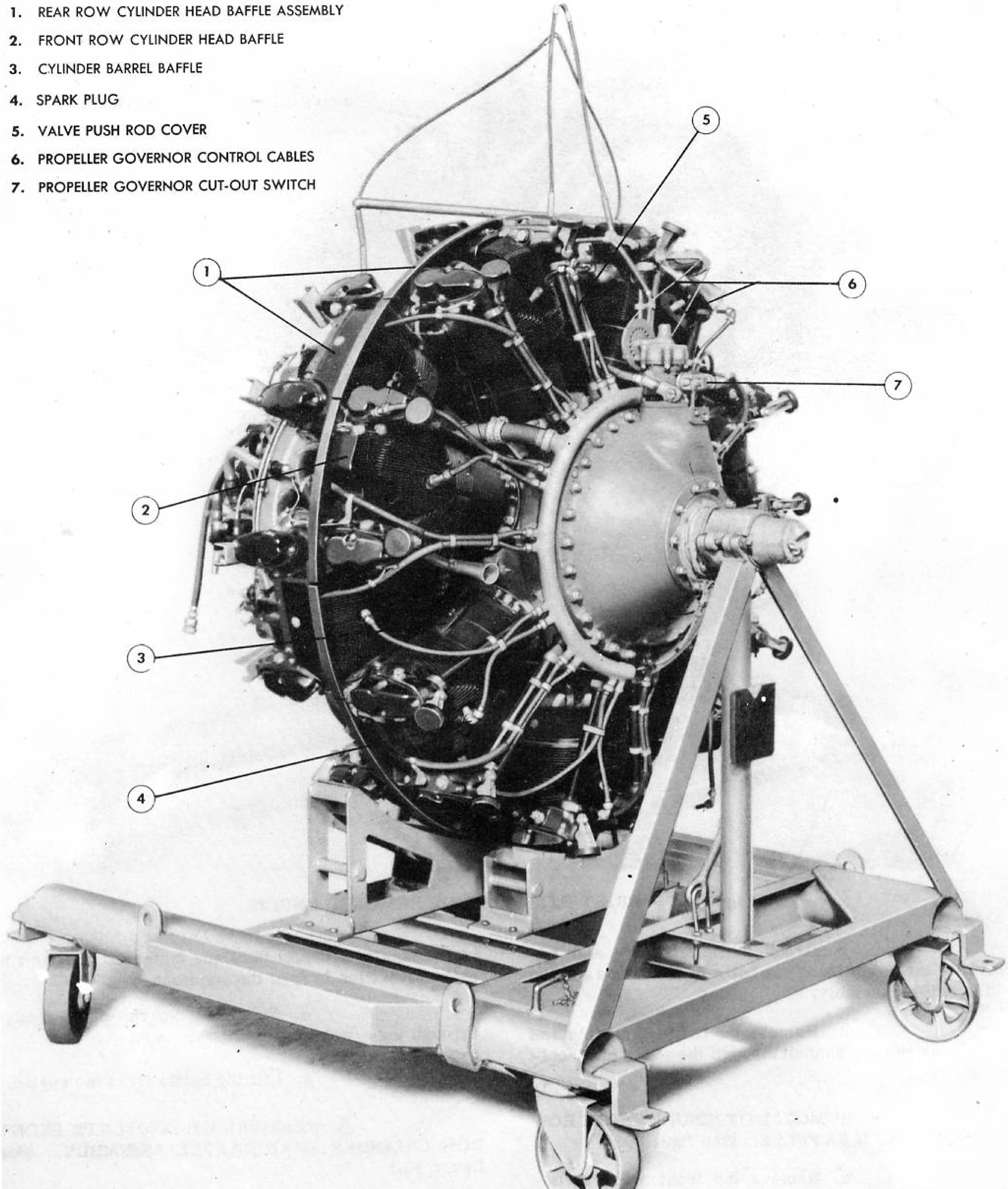


Figure 96 - LEFT FRONT VIEW OF REMOVED ENGINE

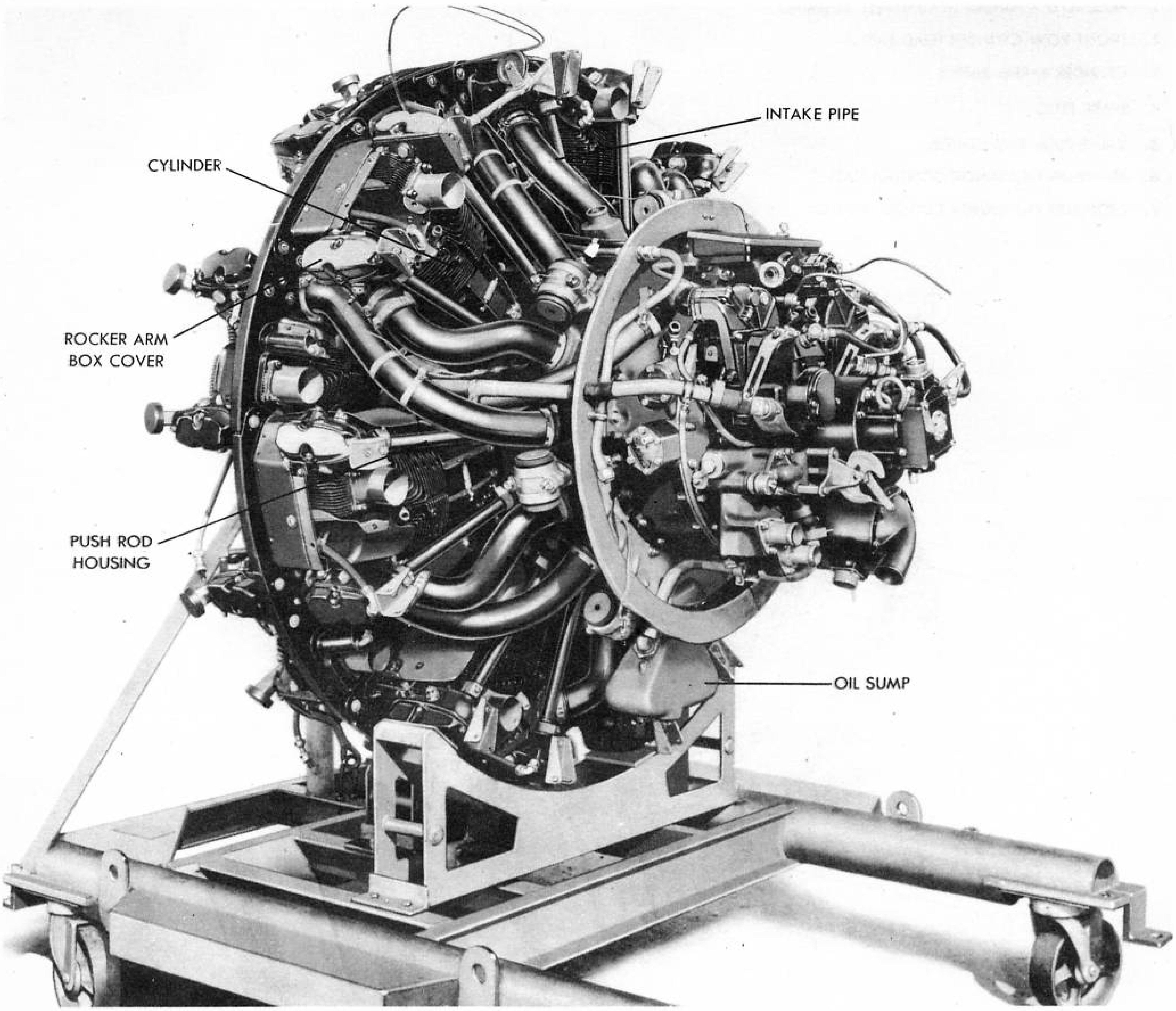


Figure 97 - RIGHT REAR VIEW OF REMOVED ENGINE

b. Break the safety wire and remove the three attaching capbolts in the frame section of the baffle assembly.

c. Remove the baffle assembly and pull the spark plug conduit through the spark plug cooling air duct.

4. REMOVAL OF SINGLE FRONT ROW CYLINDER HEAD BAFFLES. (See figure 96.)

a. Remove the front baffle by detaching the two Dzus fasteners.

b. Detach the five Dzus fasteners through the wall section of the rear segment. It may be necessary to detach the Dzus fasteners of rear row cylinder baffles to free the segment.

c. Pull the spark plug conduit through the spark plug cooling air duct.

d. Lift the baffle from the engine.

5. REMOVAL OF COMPLETE FRONT ROW CYLINDER HEAD BAFFLE ASSEMBLY. (See figure 96.)

a. Detach the three Dzus fasteners which attach each front row cylinder cowl supporting wall section to the adjacent rear row cylinder cowl supporting wall section.

b. Break the safety wire and remove the three gusset attaching cap screws having a plain washer under the head of each.

c. Remove the intake pipe flange attaching cap screw which holds the short steel strap. It may be necessary to detach a few Dzus fasteners of adjacent rear row cylinders to remove the front row cylinder head baffle assembly.

d. Withdraw the spark plug conduit from the spark plug cooling air duct when the baffle unit is free from the cylinder head.

6. REMOVAL OF CYLINDER BARREL BAFFLES. (See figure 96.) - Cylinder baffles on both front and rear row cylinders are similar, but not interchangeable. The rear bank cylinder baffles are reinforced with leather padding at their leading edges where they make contact with the adjacent front bank cylinder baffles. All cylinder baffle assemblies are made up of four parts - consisting of two curved plate deflectors, a semicircular sheet steel clamp, and a spring-loaded latch bolt which holds the rear edges of the deflectors together. On either row of cylinders, the barrel baffles may be removed by the following procedure, although it may be necessary to remove an intake pipe to reach a front row cylinder barrel.

a. Break the lock wire and remove the attaching cap bolt and plain washer in the cylinder head exhaust rocker box.

b. Detach the adjacent Dzus fastener which holds the front and rear row cylinder barrel baffles together.

c. Spring the threaded end of the spring-loaded latch bolt out of its seat in the right-hand baffle. Do not loosen the lock nuts for this operation, as they have been adjusted at the initial assembly of the engine to give the desired spring tension.

d. Remove the right-hand baffle from the hooked end of the steel clamp and lift from engine. Swing the clamp outwards on the bolt which hinges it to the left-hand baffle, and remove the left-hand baffle from the engine. On the front row cylinders, the clamp may be sprung toward the crankcase to clear the push rod housings.

NOTE

Due to the close clearance next to the oil sump, cylinders No. 7 and No. 9 do not have a bolt holding the cylinder baffle clamp, but utilize a steel strap and a short clamp which are hooked into slots in the baffles. Upon removal of the latch bolt, all parts may be withdrawn readily. Study the alinement of clamp before removal to assure proper reinstallation.

7. REMOVAL OF INTAKE PIPES. (See figure 98.)

a. Intake pipes of the upper eight cylinders support the priming system. When removing one of these intake pipes, remove the attaching nuts from each end of the individual priming tube. Disconnect the attaching clips on intake pipe and remove the priming tube.

b. Loosen the packing nut at the crankcase end of the intake pipe to avoid damaging the intake pipe and clamps.

c. To remove an intake pipe from a front row cylinder, it is necessary to remove the three flange attaching cap bolts in the cylinder head. The cylinder head baffle attaching strap will have to be moved to one side to permit withdrawing the intake pipe and flange. The packing nut and packing may be left in the supercharger front housing. Plug the openings to prevent entry of foreign matter.

d. To remove an intake pipe from a rear row cylinder after the packing nut has been loosened, loosen the two hose connection clamps at the cylinder head with a screwdriver. Slide the hose connection along the intake pipe until the assembly can be withdrawn. Leave the loosened packing nut in the supercharger front housing. Plug the openings.

8. REMOVAL OF OIL SUMP. (See figure 97.))

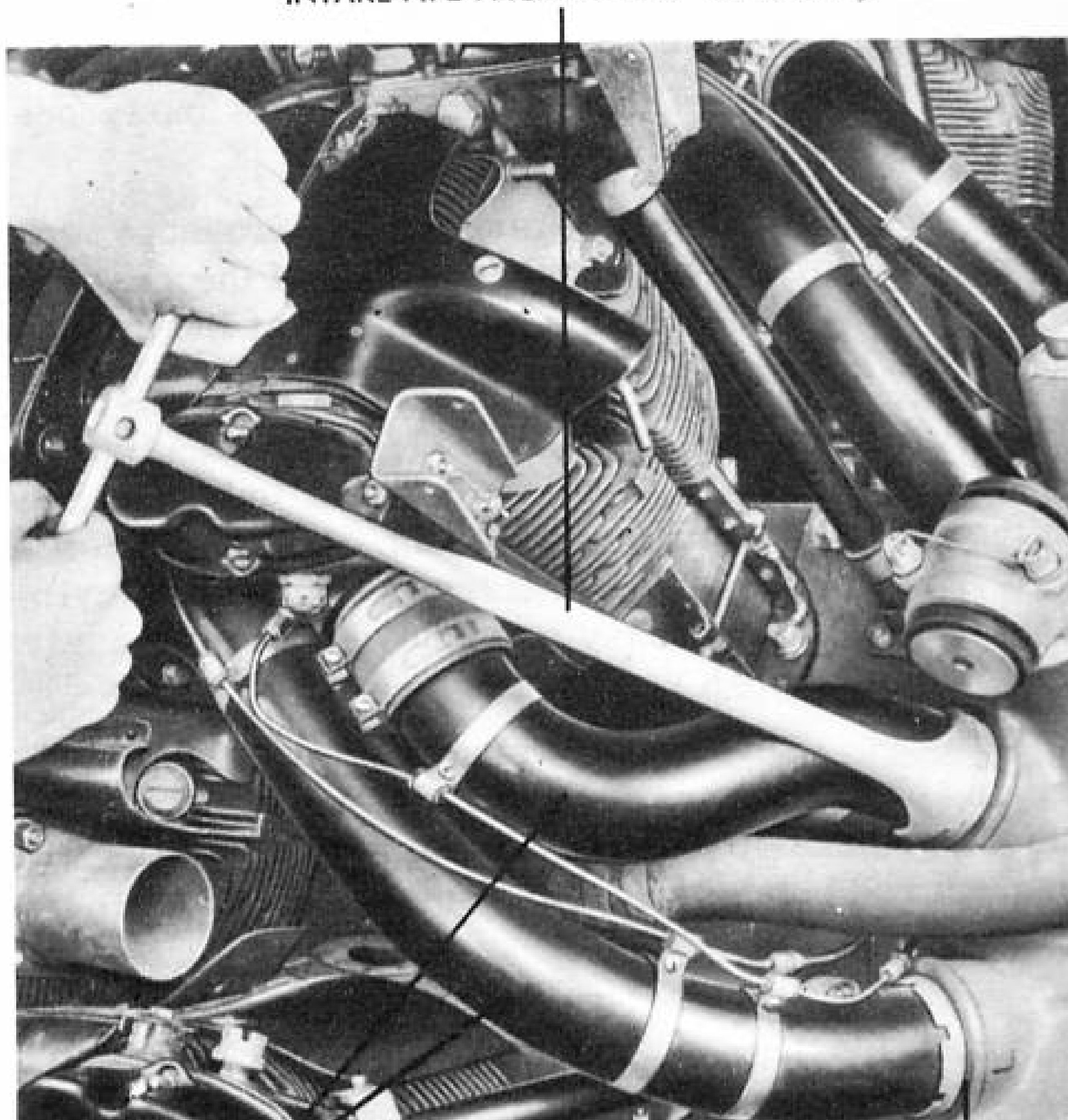


Figure 98 - REMOVING INTAKE PIPES

a. Remove the intake pipes from cylinders No. 8 and No. 9. Plug the openings.

b. Remove the long front segment of the external scavenging tube.

c. Remove the palnuts, nuts, and washers from the two drain tube attaching studs at the front end of the sump between No. 7 and No. 8 cylinders.

d. Break the safety wire and remove the four cap bolts and spherical washers at the rear main crankcase sump attaching pad. Similarly, remove the three cap bolts and spherical washers at the supercharger front housing pad.

e. Break the safety wire and remove the long through bolt extending from the bottom of the sump into the supercharger housing.

f. Withdraw the sump to the rear. Remove gaskets from the parting surfaces and steel breather check valve from inside of sump.

g. Remove the palnuts, nuts, and washers from the two drain tube attaching studs in the front main crankcase. Remove the drain tube assembly. Loosen the hose connection clamps and pull both sections of the drain tube out of the hose connections.

9. REMOVAL OF PUSH RODS AND VALVE TAPPETS. (See figure 97.)

a. The following procedure is given for cases in which it is desired to remove a push rod without removing the rocker arm hub bolt or disturbing the torque fitting which has previously been applied to the rocker bolt nut.

(1) Loosen the two hose connection clamps at the crankcase end of the push rod housing. Loosen the single hose clamp at the cylinder end of the housing.

(2) Slide the crankcase and hose connection along the push rod housing until the bead on the end of the housing is visible. Use engine oil to relieve the binding, if necessary. On front row cylinders it will be necessary to remove the ignition wire clips from the push rod housings.

(3) Remove the nuts, lock washers and plain washers from the four rocker box cover attaching studs in the rocker box which indexes with the push rod being removed. Remove the rocker box cover.

(4) Loosen the rocker arm clamp and locking cap bolt and unscrew the valve clearance adjusting screw tubing.

(5) Screw a push rod removing tool on the extended threads of the valve clearance adjusting screw. Insert the handle to serve as a lever to compress the valve spring.

(6) Remove the push rod through the slot in the tappet guide, taking the housing and hose connections with it.

NOTE

If a special rod removing tool is not available, it will be necessary to remove the rocker arm before the push rod can be withdrawn. The procedure is as follows: Remove the rocker box cover. Remove the cotter pin from the rocker bolt. Unscrew the nut. Move the crankshaft so that the valve is seated and so that a clearance exists between the rocker roller and the valve stem. Push or drive out the rocker bolt. Be careful of the threads. Remove the spherical set washer at each end. Lift out the rocker arm and withdraw the push rod by the ball end. Loosen the hose clamps and slide the clamp along the housing. Remove the push rod housing.

b. Remove the valve tappet guide.

(1) Remove the loose fitting valve tappet ball socket and mating spring. Move the crankshaft, if necessary, to push the tappet within reach of the fingers.

(2) Remove the palnuts, nuts, and washers from the two tappet guide attaching studs. Withdraw the tappet guide and tappet assembly as one unit from the crankcase. Be careful not to pull tappet assembly from guide. It may drop into the engine. If a guide cannot be pulled out by hand, use a tappet guide puller. Remove the gasket from under the guide flange.

c. Separate tappet and guide assembly.

(1) Insert the hooked end of the valve tappet circlet removing tool under the retaining circlet, and remove the circlet. Do not attempt to make the circlet jump out of its groove by striking the end of the tappet. Be careful not to lose small parts which will be freed when the circlet is removed.

(2) Withdraw the tappet from its guide.

(3) Push the floating pin out of the slotted end of the tappet and remove the roller and bushing.

10. REMOVAL OF CYLINDER. (See figure 97.)

a. Remove the four bronze exhaust stack flange attaching nuts.

b. Disconnect the front and rear spark plug ignition terminals. Remove the cylinder head baffle.

c. Remove the intake pipe, and plug the opening in the supercharger front housing. For accessibility, remove the adjacent intake pipe.

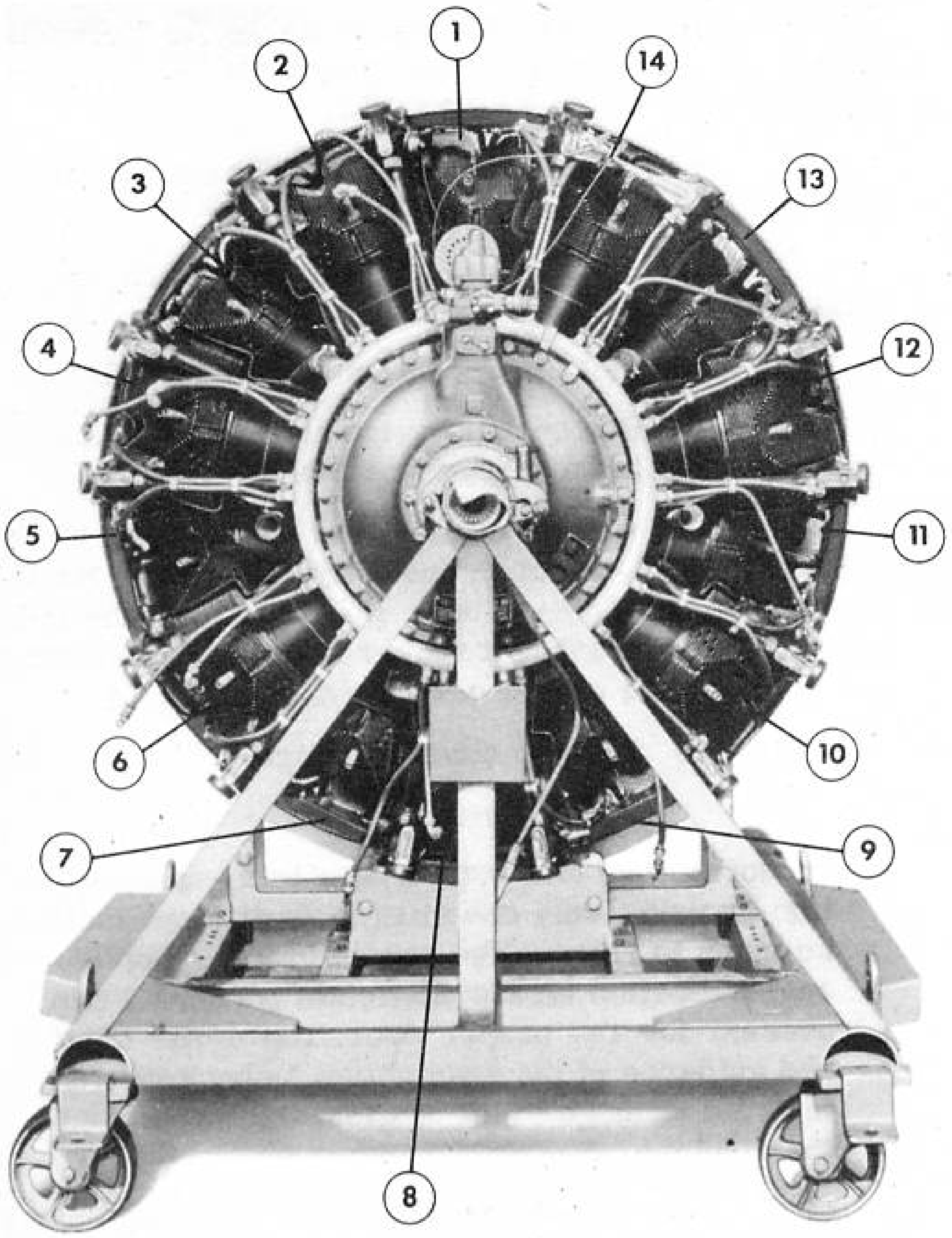


Figure 99 - CYLINDER NUMBERING SCHEME

d. Remove the rocker box covers, rocker arms, push rods, and housing. Remove the rocker box ignition wire clip, leaving the clip on the shield.

e. Disconnect the cylinder barrel baffles and remove.

f. To remove cylinders adjacent to the two main radio shielded ignition units, it will be necessary to loosen the conduit attaching yokes and shielding couplings to render the cylinder hold-down nuts accessible.

g. Remove the sump to remove cylinders No. 7, 8, and 9. (See figure 99.)

h. Remove both spark plugs.

i. Move the crankshaft until the piston in the cylinder being removed is at the top of its stroke. Break the safety wire through the 16-cylinder hold-down nuts and remove the nuts. Remove the spherical washers under the nuts and pull the cylinder straight outward clear of the piston. If the cylinder is to be reused, install fin protecter around the lower fins of the cylinder head.

11. REMOVAL OF PISTON. (See figure 102.)

a. Extract both piston pin retainers, using the special removing tool. Insert the spade-shaped end of the tool between any two spring coils. Turn the handle 90 degrees to engage the coils with the shoulders of the spade. Pry the piston pin retainer spring from its groove in the piston, resting the curved leg of the tool against the side of the piston. Place one hand over the piston pin bore on the piston to catch the retainer spring when it snaps out.

b. Push the loose fitting piston pin out of the piston with the fingers, holding the piston from falling. If the piston pin is stuck, force it out with the piston pin removing tool. Encircle the piston with a felt-lined stirrup and screw the shoulder drift into the piston pin. Remove the piston and pin from the engine and prevent the connecting rod from striking the crankcase by installing a connecting rod guide over the cylinder hold-down studs. Plug the hole in the crankcase to prevent foreign matter from entering.

12. REMOVAL OF VALVE. (See figures 100 and 101.)

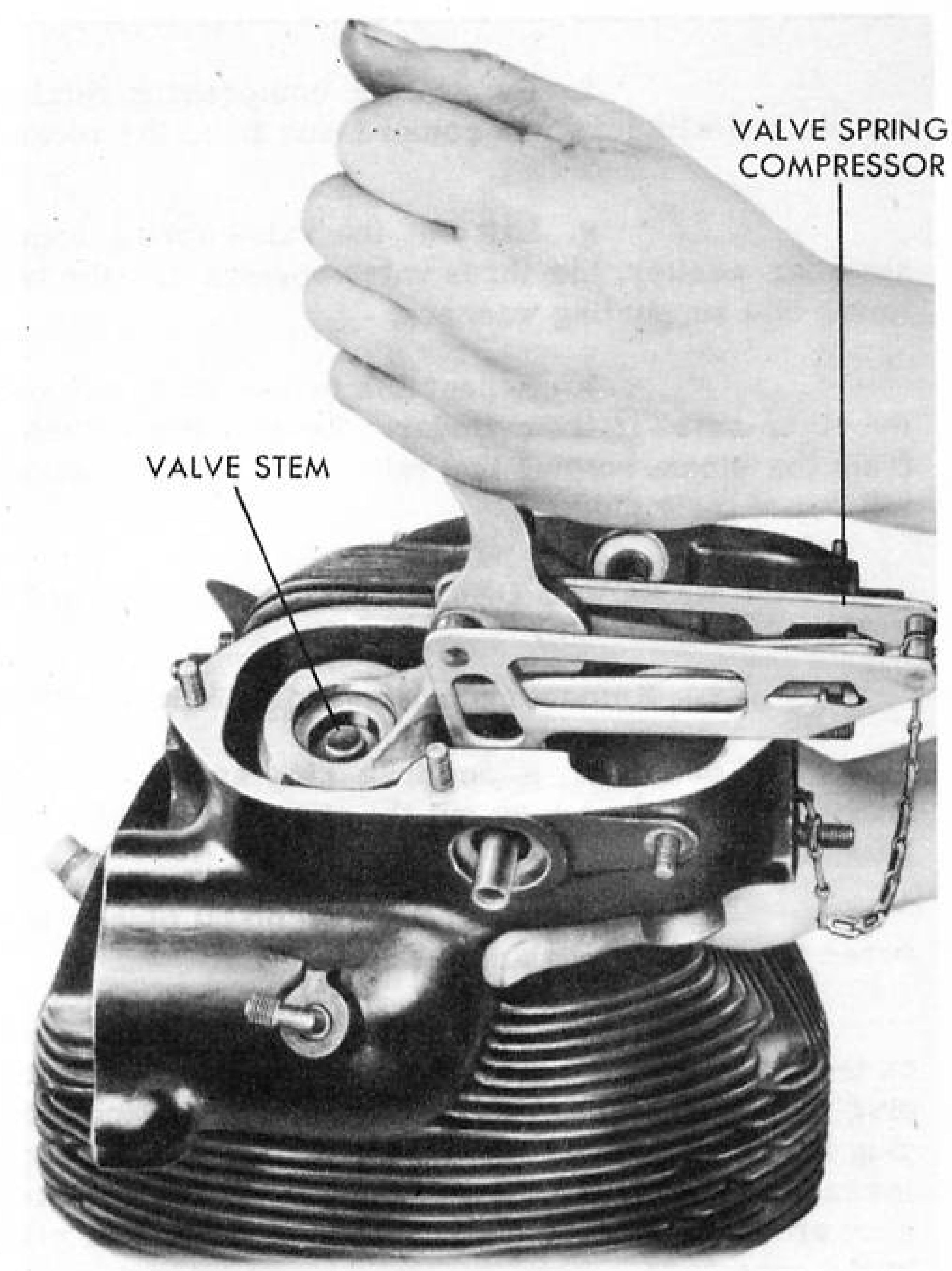


Figure 100 - COMPRESSING VALVE SPRING FOR REMOVAL

a. Place the cylinder, which has been stripped of all parts except valves and springs, on a valve assembly wooden block.

b. Install a valve spring compressor in position in one of the rocker boxes. Insert the retaining pin through the rocker bolt holes in the cylinder head. Insert a strip of fiber or aluminum between the steel frame of the compressor and the rocker box parting surface.

c. Before attempting to compress the spring, hold the lever down snugly against the valve spring washer and strike it directly over the valve spring washer and strike it directly over the valve spring washers with a mallet. This will prevent sticking between the split locks and the valve spring washer.

d. Move the lever to its extreme downward position to relieve the valve springs. Be careful that the slotted compressing lever does not bind on the cover attaching stud at the push rod end of the rocker box.

e. Remove the two split locks now exposed and release the compressor lever slowly.

f. Remove the compressor retaining pin and withdraw the compressor from the rocker box.

g. Lift out the valve spring upper shoulder washer, the three valve springs and the two lower thin supporting washers.

h. Repeat this procedure to remove the other valve in the cylinder. Remove the cylinder from the block, holding the valves so that they do not fall out of their guides.

(3) REMOVAL OF COMPLETE ENGINE SECTION. (See figure 90.)

(a) Remove propeller and cap engine shaft.

(b) Remove antidrag ring and accessory section cowling by taking out the attaching screws and Dzus fasteners.

(c) Disconnect all sheet metal pieces between the venturi ring and the wing.

(d) Drain oil through the "Y" drain cock on the lower forward side of the fire wall, through the plug in the oil sump on the engine, and through the plug in the oil cooler; or, if no suitable oil container is available, unscrew Wittek clamps at the engine, slide hose aft on oil line, and quickly insert a wooden plug in the hose.

(e) Disconnect both propeller feathering lines at the pump and drain oil from lines.

(f) Relieve the pressure in the hydraulic system by operating the wing flaps until the hydraulic pressure gage reads ZERO.

(g) Disconnect, drain and cap oil, hydraulic, fuel, and de-icer lines at the fire wall.

(h) Disconnect and cap all other engine section piping at the fire wall.

(i) Pull all Cannon plugs at fire wall.

(j) Disconnect engine and propeller cables at turnbuckles in the engine section.

(k) Attach engine rear bank sling to the exhaust rocker bolt of cylinder No. 13, and to the intake rocker bolt of cylinder No. 3. Attach the front bank sling to the exhaust rocker bolt of cylinder No. 2 and to the intake rocker bolt of cylinder No. 14.

(l) Take up slack in slings.

NOTE

Do not attempt to hoist the complete engine section by using only one sling. No attempt shall be made to remove the engine or the complete engine section unless sufficient personnel are present for the proper operation of the hoist and guidance of the assemblies being removed to avoid damage to the engine, the mount, and the airplane.

(m) Loosen the four bolts attaching the engine mount to the nacelle structure, but do not remove bolts.

(n) After checking to see that everything has been disconnected and that the hoist sling is tight, remove the four mounting bolts and swing the engine section clear.

d. MAINTENANCE REPAIRS.

(1) CLEANING. - Clean all parts, subassemblies, and accessories, except the starter, generator, magnetos and ignition wiring, with an approved dry-cleaning solvent. Do not use water-mixed compounds containing soap or caustic soda.

(2) MARKING. - Extreme care must be exercised in marking parts. Part failures can frequently be traced to improper marking methods. Use of an approved rubber stamp etching fluid is recommended.

(3) INSPECTION. - Inspect the following parts for the conditions as specified.

(a) SPARK PLUGS - Excessive carbon, cracked porcelain, burned electrodes.

(b) CYLINDER HEAD BAFFLES - Dents, bending, loose blast tubes.

(c) CYLINDER BARREL BAFFLES - Dents, bending, loose blast tubes.

(d) INTAKE PIPES - Dents, cracks, holes.

(e) OIL SUMP - Dirt, magnetism of drain plug, cracks.

(f) PUSH RODS - Straightness, wear on ball ends, security of ball ends.

(g) VALVE TAPPETS - Improper fit of valve adjusting screws, restricted movement of inner race in ball bearing, cracks, wear.

(h) VALVE SPRINGS - Breaks, inadequate pressure, rust, improper height.

(i) VALVES - Stretching, drawing, poor seating surface, corrosion.

(j) CYLINDERS - Scored barrels, cracked heads, worn valve inserts, excessive carbon deposits, worn rocker arm shaft bushings, mutilated spark plug bushings, worn or damaged valve guides.

(k) PISTONS - Cracked heads and skirts, broken ring lands, scored piston pin holes, excessive carbon deposits, broken rings, worn rings, rings seized in grooves due to excessive carbon, scored skirts.

e. REPLACEMENTS.

(1) Replace spark plugs after 100 hours of service or before that time in case of failure. Visual inspection of the spark plugs upon removal may reveal some condition responsible for the apparent spark plug failure.

(a) Electrodes heavily coated with carbon indicate the cylinder is passing oil.

(b) Clean, but discolored, electrodes indicate that the engine has been running hot. This could be caused by use of poor fuel, excessive manifold pressure, or by a loose core.

(c) White powder on the electrodes, after operating with tetraethyl lead fuel, means the plug is running hot.

(d) A coating of fresh oil indicates the plug is not firing.

(2) Do not stone gear teeth faces to remove chipped, pitted, or scuffed conditions. Stoning alters tooth profile which causes wear and possible gear failure. Replace gears if chipped, pitted, or scuffed.

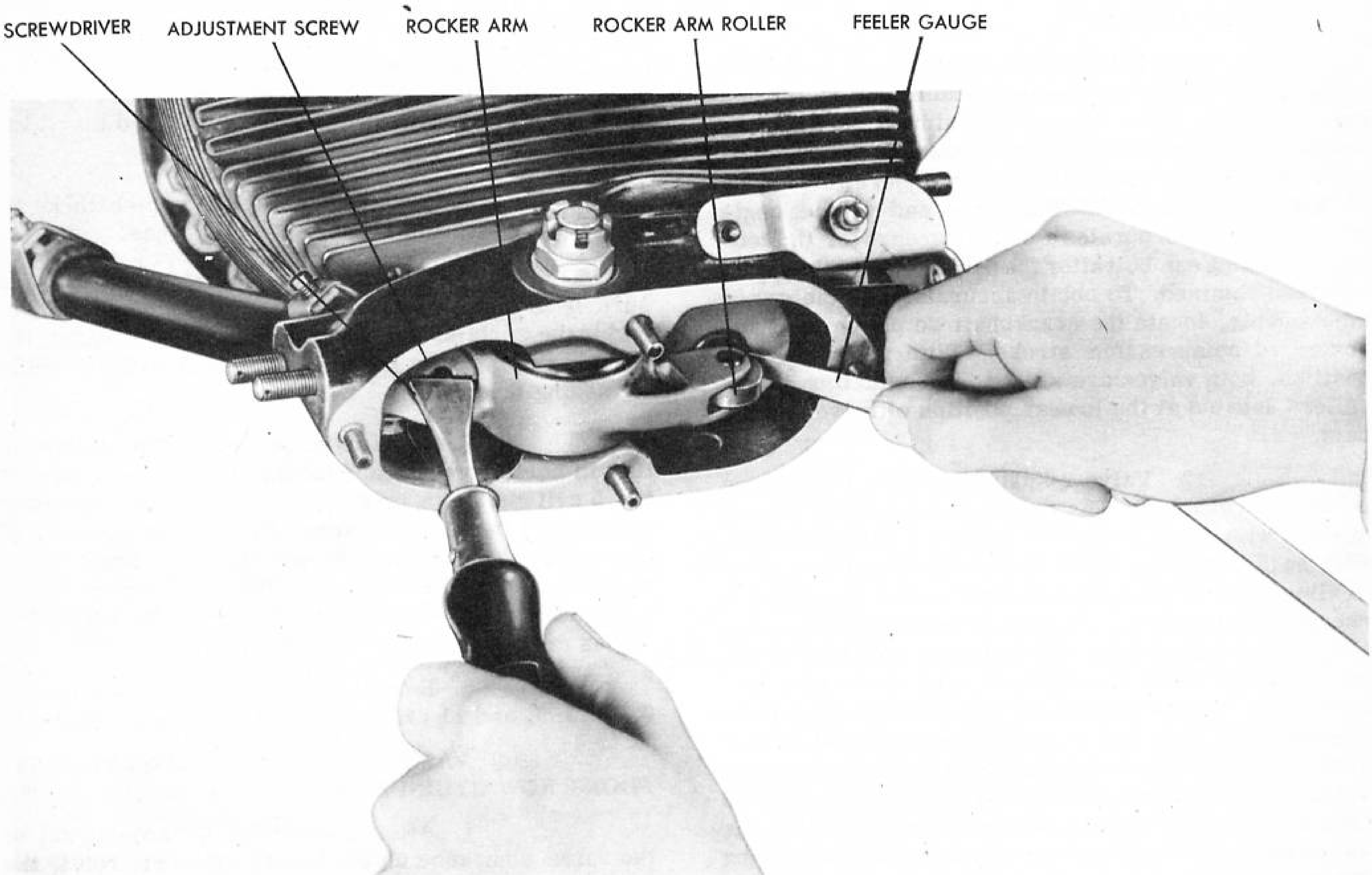


Figure 101 - ADJUSTING VALVE CLEARANCE

(3) Replace studs which are damaged or have loose threads.

(4) Remove slight scratches from bushings with crocus cloth. Replace scored bushings.

(5) Remove nicks, burs, or galled areas from bushings by light stoning. Polish with crocus cloth. Replace bushing if badly damaged.

(6) Clean all surfaces of oil seal ring sleeves to ensure that the grooves are clean and smooth. Check the contact of the flanged end of the sleeve to the shoulder of the shaft. Tap if unsatisfactory. Replace if scored.

(7) Clean the inside diameter of oil seal sleeves with crocus cloth. Remove burs from the spacer by stoning. Replace if scored.

(8) Replace all worn parts.

(9) Replace all packing.

(10) Replace all gaskets.

f. ADJUSTMENTS.

(1) ADJUSTMENT OF VALVE CLEARANCE. (See figure 101.)

(a) GENERAL.

1. Valve tappet clearance is measured with a feeler gage between the rocker arm roller and the tip of the valve stem. Adjustment is made by screwing the slotted adjustment screw on the push rod end of the rocker arm with a special screwdriver or an angle screwdriver. The other end of the angle screwdriver incorporates a socket wrench for tightening the locking cap bolt after the desired valve clearance has been obtained. To obtain accurate valve clearance adjustments, locate the crankshaft so piston is at top center of compression stroke. With piston in this position, both valves are seated, and actuating tappet rollers located at the lowest position of travel on the cam.

2. Valve adjusting screws have three oil pressure holes. The screw is marked on the top surface with three 1/16-inch diameter circles in line with the three drilled oil passages. If one of these holes is alined with the clamp joint of the rocker arm, oil will escape into the rocker box without properly lubricating the rocker arm bearing. Care must be exercised when adjusting the valve clearance in order to ensure that none of the drilled holes in the adjusting screw line up to within 3/32 of an inch to the clamp joint in the rocker arm. If, after adjusting the valve to the desired value, the oil pressure hole is found to be closer than 3/32 inch to the nearest edge of the clamp joint, turn the adjusting screw in the shortest direction that will bring the mark within the required limits, and tighten the locking screw. However, if the oil pressure hole is in line with the clamp joint, the valve clearance should be increased rather than decreased. The maximum error in the desired valve clearance caused by the above procedure is approximately 0.002 inch, which will in no way affect engine operation. The six lower rocker arms of each bank of cylinders are not pressure lubricated. Therefore, this precaution can be ignored when adjusting these clamps.

(b) VALVE CLEARANCE ADJUSTMENT, REAR ROW CYLINDERS.

1. With the propeller shaft turning hub, rotate the crankshaft until the rocker arms of No 1 cylinder are stationary. Move the crankshaft back and forth slightly until the intake rocker arm of cylinder No. 13 at the left of No. 1 cylinder is in the approximate midpoint of its opening stroke and the exhaust rocker arm of cylinder No. 3 at the right of No. 1 cylinder is at the approximate midpoint of its closing stroke. (See figure 99.)

2. Screw in the adjusting screw on each rocker arm in No. 1 cylinder until the rocker roller bears against the valve stem tip and the valve tappet spring is fully compressed.

3. Tap the adjusting screw end of the rocker arm lightly to make sure the tappet bolt socket is seated.

4. Turn the adjusting screws in the opposite direction until 0.015-inch clearance (engine cold) exists between the rocker roller and the valve stem tip.

5. Tighten the cap bolt which locks an adjusting screw, and recheck the clearance.

6. Check the adjusting screw to make sure it is tightly locked with the proper adjustment, and make certain that the new lock washer under the locking cap bolt has not been broken or cracked while tightening the bolt.

7. Turn the propeller shaft in the direction of normal rotation until the valve mechanism of No. 5 cylinder is in proper position for adjustment of valve clearance. Make sure the relative position of the rocker arms of the adjacent cylinders are similar to that described for setting the valve clearance of No. 1 cylinder. Repeat steps b through f to adjust the valves of this cylinder. (See figure 99.)

8. Repeat the procedure for cylinders 9, 13, 3, 7, and 11 respectively. (See figure 99.)

(c) VALVE CLEARANCE ADJUSTMENT, FRONT ROW CYLINDERS.

1. After completing the adjustment of the valve clearance on the No. 11 cylinder, rotate the propeller shaft opposite to the direction of normal rotation for approximately 90 degrees to place the valve mechanism of No. 12 cylinder in the proper position for

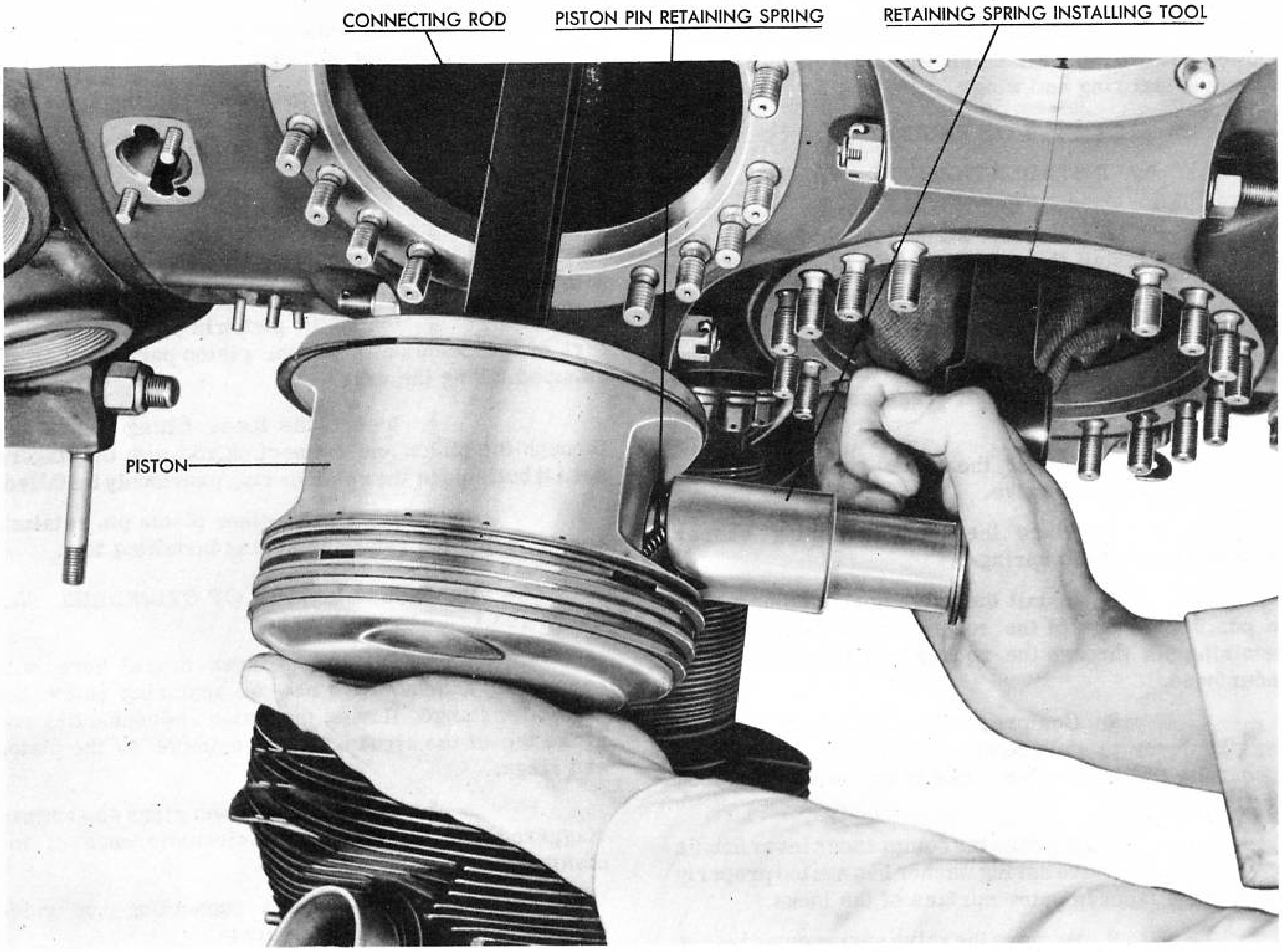


Figure 102 - INSTALLING PISTON PIN LOCK

adjustment of its valve clearance. Move the crankshaft back and forth until a position is obtained where the intake rocker arm of cylinder No. 10 (at the left of cylinder No. 12) is in the approximate midpoint of its opening stroke and the exhaust rocker arm of cylinder No. 14 (at the right of cylinder No. 12) is at the approximate midpoint of its closing stroke. (See figure 99.)

2. Adjust the valve clearance of No. 12 cylinder as previously explained.

3. Turn the propeller shaft in the direction of normal rotation to place the valve mechanism of the No. 2 cylinder in proper position for adjustment of valve clearances, and adjust its valve clearance.

4. In a like manner, adjust the valve clearance of cylinders No. 6, 10, 14, 4, and 8 respectively. (See figure 99.)

g. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF COMPLETE ENGINE SECTION. (See figure 90.)

(a) Hoist the completely assembled engine section into position on the forward end of the nacelle. Install the four bolts to secure the engine mount to the nacelle (1,200 inch-pound torque).

(b) Remove the hoist from the sling and remove sling from the engine.

(c) Connect the engine and propeller cables at turnbuckles in the engine section.

(d) Connect all electrical connections at the Cannon plugs on the fire wall.

(e) Remove the caps from the lines and connect all engine section piping at the fire wall.

(f) Install the propeller.

(g) Connect the two propeller feathering lines to the pump.

(h) Check to see that the engine has oil and that the de-icer and hydraulic lines are functioning. Check all systems for leaks.

(i) Ground-test the engine.

(j) Install the antidrag ring and accessory section cowling, and attach all sheet metal pieces between venturi ring and wing.

(2) ASSEMBLY OF ENGINE.

(a) INSTALLATION OF VALVE. (See figure 101.)

1 Oil valve stems and guides with engine oil and install the valves in the cylinder head.

2 Holding the valves from falling out, place the cylinder on the wooden valve assembly block.

3 Install the two flat valve spring supporting washers in their recesses around each valve guide.

4 Install the three concentric valve springs around each valve.

5 Place the upper retaining washer loosely on top of the springs.

6 Install the valve spring compressor in position in one of the rocker boxes and insert its retaining pin through the rocker bolt hole in the cylinder head.

7 Compress the valve springs by pushing the lever to its extreme downward position and insert the two split valve locks in the valve stem lock groove.

8 Release the compressor lever handle slowly until the valve spring washer has seated properly against the tapered outer surface of the locks.

9 Remove the valve spring compressor and repeat the procedure to install the remaining valves.

(b) INSTALLATION OF PISTONS. (See figure 102.

1 Install a new piston pin retaining spring in the rear side of each piston. To install a coil spring piston pin retainer in the groove on the rear side of the piston, place retaining spring in the installing tool with the spring joint approximately 90 degrees either side of the cutout in the tool and operate as follows:

a. Install the piston pin in the piston with the large diameter of the chamfer on the pin flush with the inner edge of the groove on the piston.

b. Insert the end of the installing tool in the piston pin from the side of the piston in which the retainer is to be installed, with the cutout surface of the tool at the top of the piston pin hole. While performing this operation, locate the top section of the retaining spring in the top section of the groove.

c. Install the adapter in the opposite end of the piston pin and, while holding the pin in position with one hand, apply pressure on the installing tool with the other hand and force the retainer into its seat in the retainer groove.

d. Remove the installing tools and piston pin.

2 Turn the crankshaft so that the connecting rod is at the top of its stroke.

3 Oil the piston pin, connecting rod piston pin bushing, and piston pin holes in the piston with engine oil.

4 Install the piston in position with that part of the dome on which the piston part number is stamped facing the rear.

5 Insert the loose fitting piston pin through the piston and connecting rod with the fingers until it bottoms in the retainer ring previously installed.

6 Install the other piston pin retainer spring, using the retaining spring installing tool.

(c) INSTALLATION OF CYLINDERS. (See figure 103.)

1 Oil the cylinder barrel bore with engine oil, and install a new oil seal ring below the hold-down flange. Having the piston and connecting rod at the top of the stroke, apply engine oil to the piston and rings.

2 Position the piston rings so gaps are staggered equally around the circumference of the piston.

3 Remove the connecting rod guide from the cylinder hold-down studs.

4 Make sure the cylinder flange surface and crankcase are clean and dry.

5 Compress the upper piston rings with a flexible piston ring clamp, and slide the cylinder over the piston.

6 As soon as the compression and oil control rings have entered the cylinder, remove the clamp and make sure that both piston pin retainers are located correctly.

7 Compress the lower ring with the clamp, and slide the cylinder into its location on the crankcase.

8 Install the two special locating cylinder hold-down nuts on opposite sides of the cylinder, and tighten with an offset box-socket wrench equipped with a torque indicating handle, to a torque of approximately 300 inch-pounds.

9 Lubricate the regulating hold-down nuts with engine oil and install fingertight with spherical seat washers on the remaining 14 hold-down studs. Place the thermocouple and radio shielding clips in

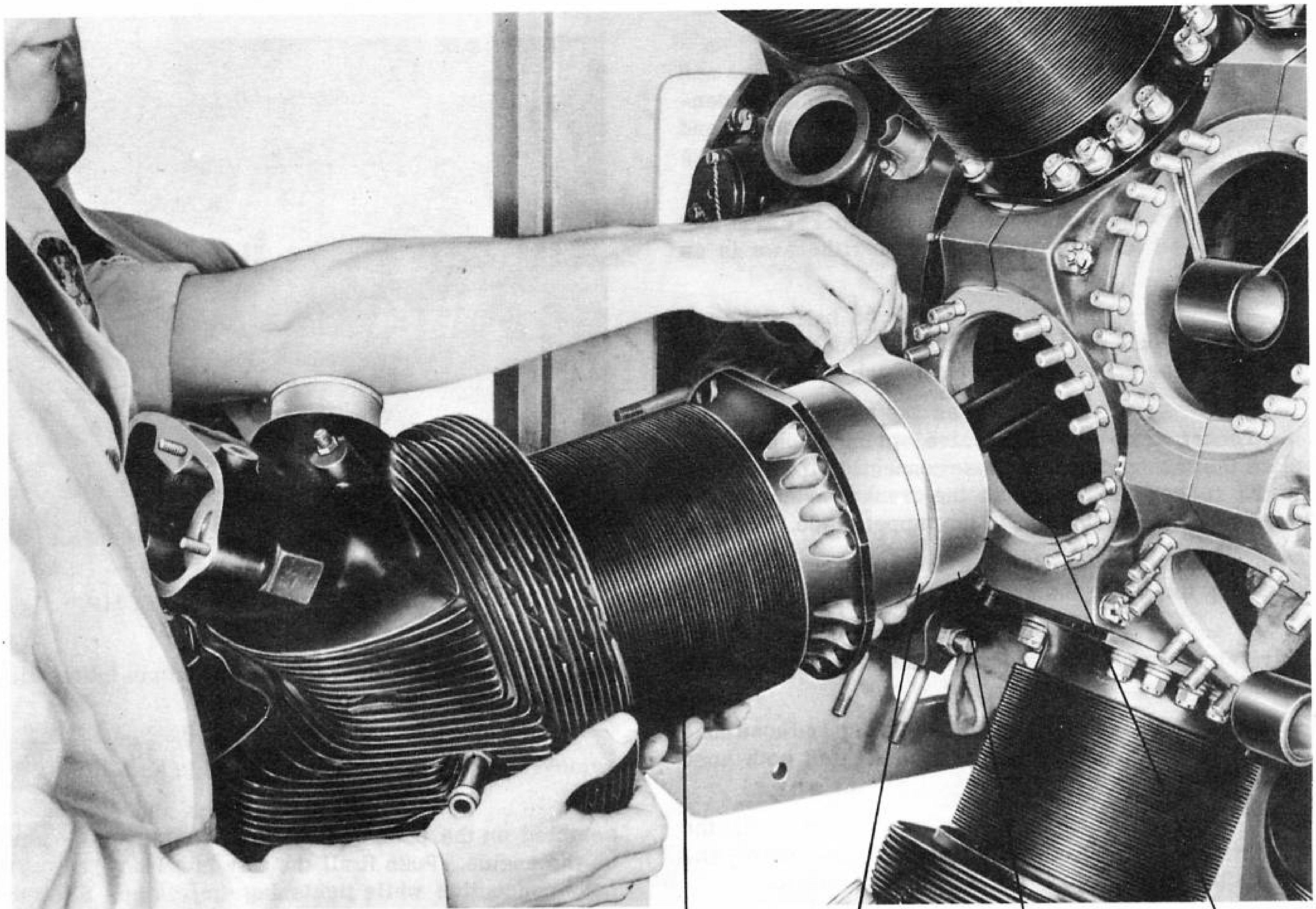


Figure 103 - INSTALLING CYLINDER

their proper locations. Install only the clips, washers, or brackets supplied with the engine to the cylinder hold-down nuts.

10 Using a torque of approximately 300 inch-pounds, tighten two nuts on opposite sides of the cylinder and approximately 90 degrees from each of the special locating nuts.

11 Using the same torque, tighten two more nuts on opposite sides of the cylinder and approximately 45 degrees from the special locating nuts.

12 Proceed in this manner until all nuts are tightened.

13 Remove the special locating nuts, and replace with standard nuts and washers, using approximately 300 inch pounds torque.

14 Tighten all the nuts consecutively around the cylinder, using torque of 400 to 450 inch-pounds.

(d) ASSEMBLY AND INSTALLATION OF PUSH RODS AND VALVE TAPPETS.

1 Place the tappet roller equipment, with its bronze supporting bushing, in the slotted end of the tappet, and insert the floating pin.

2 Slide the tappet and roller into the tappet guide, and install the retaining circlet with the installing tool.

3 Install new gasket under the tappet guide flange, and insert into crankcase.

4 Install a plain washer, nuts, and palnut on each of the two attaching studs.

5 Insert the coil spring and valve tappet ball socket into the tappet.

6 Oil all parts with engine oil.

7 Install the short hose connection and one clamp on the rocker box end of the push rod housing

identified by the location of the beading being approximately 3/8 inch from the end.

8 Install the long hose connection and two clamps on the crankcase end of the housing identified by the location of the beading directly on the end of the housing. Engine oil wiped on the push rod housing will relieve any binding of the hose connection.

9 Procedure when the rocker arm was not removed when the push rod was withdrawn is as follows:

a. Oil the push rod ball ends and insert the push rod in its housing. Push hose connection at the crankcase end back flush with the bead.

b. Compress the valve spring with the rocker arm. With the valve spring compressed, slide the push rod housing hose connection into position at the rocker box, and push the crankcase end of the push rod through the slot in the tappet guide.

c. Remove the valve spring compressing tool from the rocker arm.

d. Push the push rod housing all the way into its rocker box hose connection, and tighten the hose clamp.

e. Slide the crankcase end hose connection over the tappet guide, and tighten both hose clamps.

f. Move the crankshaft until the piston is on top dead center of its firing stroke and adjust the valve clearance.

g. Apply engine oil to the rocker arm and install the rocker box cover and gaskets. On any upper cylinder, fill the rocker boxes with engine

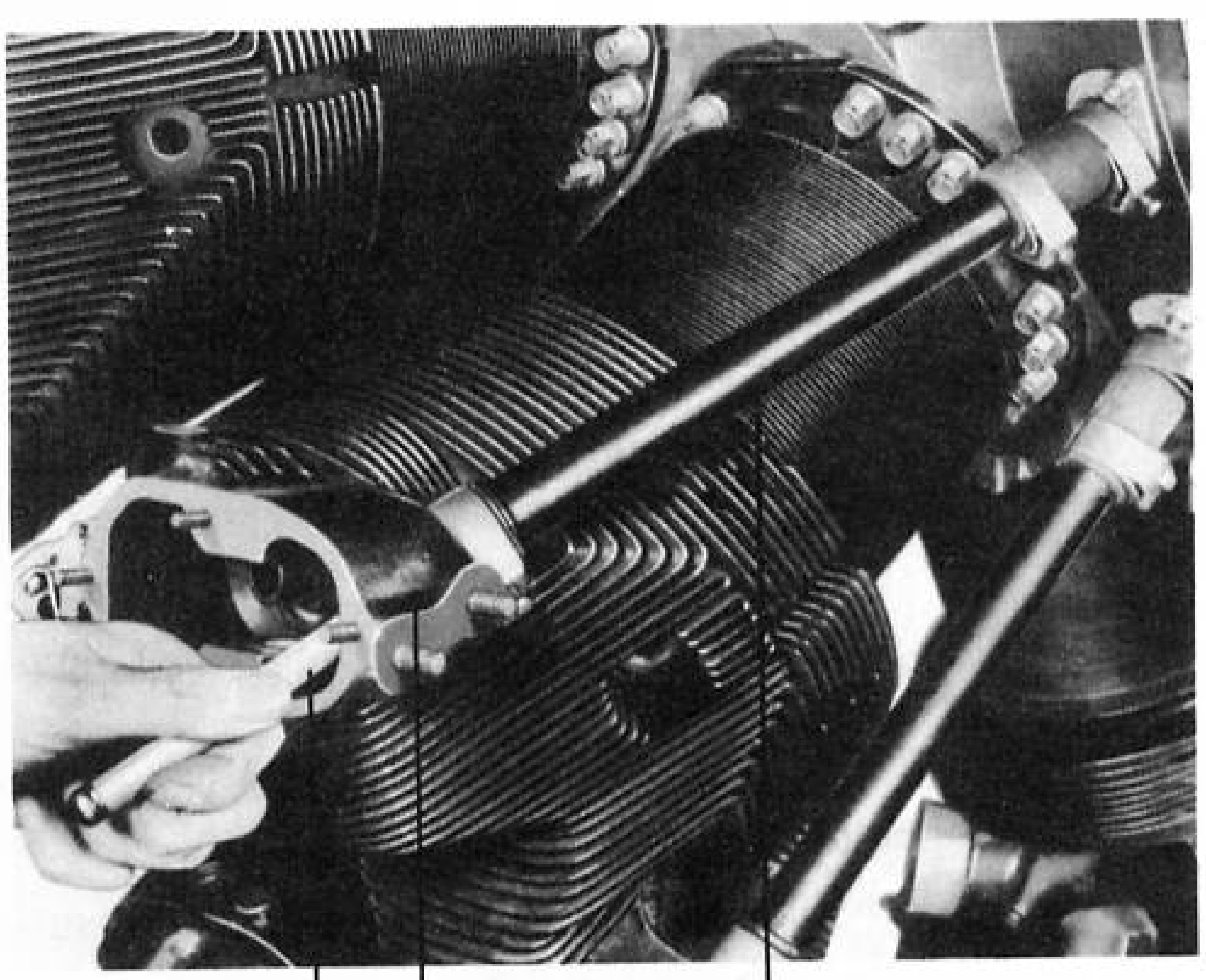


Figure 104 - INSTALLING PUSH ROD

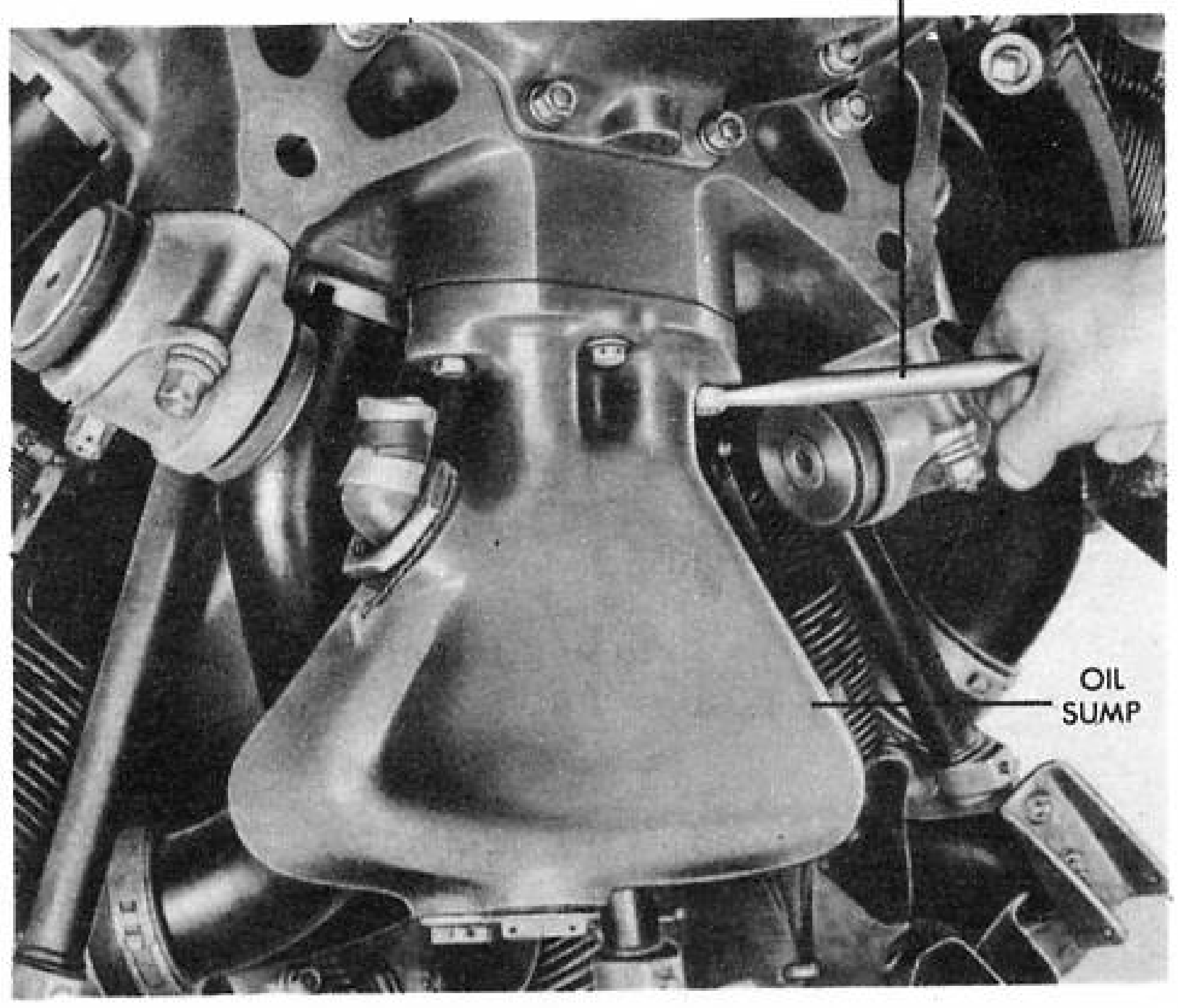


Figure 105 - INSTALLING OIL SUMP

oil before installing cover to assure ample lubrication when the engine is first started.

10 . Procedure if the rocker arm was removed at removal of the push rod is as follows:

a. With the hoses and clamps assembled on the push rod housing, install the housing on the engine. Push it all the way into its rocker arm hose connection while tightening the clamp. Slide the hose connection over the tappet guide, and tighten both clamps.

b. Oil the push rod ball sockets with engine oil, and insert in push rod housing through the rocker box. (See figure 104.)

c. Install the rocker arm and insert the rocker bolt through its hub. Interchangeable spherical seating washers and oil seal rings are used on both ends of the rocker bolt. Insert the bolt with the head on the inboard side of the rocker box next to the cylinder head.

d. Check the end clearance between the binding inner race and the rocker box. If it is in excess of 0.005 inch, remove the bolt and install shim.

e. Tighten the rocker bolt nut to a torque value of 250 to 325 inch-pounds. If excessive torque is necessary to line up the cotter pin hole, remove the nut and substitute a new washer.

f. Move the crankshaft until the piston is on top dead center of its firing stroke and adjust the valve clearance. (See step (e) following.)

g. Apply engine oil to the rocker arm and install the rocker box cover and gasket. On any upper cylinder, fill the rocker boxes with engine oil to assure lubrication upon starting the engine.

h. On front row cylinders, attach the ignition wire clips to the push rod housing.

(e) INSTALLATION OF OIL SUMP. (See figure 105.)

1 Install new gaskets on the attaching pads.

2 Install the external oil scavenge tube adapter.

3 Install new copper-asbestos gasket under the head of the long check valve guide bolt, and insert the bolt through the bottom of the sump.

4 Place the sump in position on the engine, and loosely screw the long check valve guide bolt into the supercharger front housing.

5 Install spherical washers and four cap bolts in the rear main crankcase attaching pad and three spherical washers and cap bolts in the supercharger front housing pad. Install the strip steel support for the front external scavenge tube under the extreme left-hand bolt of the three rear attaching cap bolts, between the spherical washer and a flat washer.

6 Tighten all bolts evenly and secure with safety wire after the correct position for the external scavenge tube support has been established.

7 Install the rear portion of the drain tube on the front end of the sump, using a new gasket under the attaching flange.

8 Install plain flat washers, nuts, and palnuts on the two attaching studs.

9 Slide the hose connection and clamps on the front end of the tube, using engine oil to relieve binding.

10 Install the front portion of the drain tube on the front main crankcase using a new gasket under the attaching flange, and install plain flat washers, nuts, and palnuts on the two attaching studs.

11 Slide hose connection so that it covers equal parts of each tube. Tighten both clamps.

12 Install the front segment of the external scavenge tube.

13 Install the intake pipes on the No. 8 and No. 9 cylinders.

(f) INSTALLATION OF INTAKE PIPES. (See figure 98.)

1 Install a new rubber packing ring dipped in oil, and loosely install the packing nut in the intake pipe crankcase connection.

2 Install a new rubber packing ring and gasket under the cylinder attaching flange of a front row cylinder intake pipe, and insert the intake pipe.

3 Secure the flange with the three attaching cap bolts having a plain washer and shakeproof lock washer under the head of each. One cap screw secures the cylinder head air deflector attaching strap.

4 Tighten the packing nut in the supercharger front housing with the special crowfoot wrench.

5 Install the hose connection and two clamps over the cylinder end of a rear row cylinder intake pipe. Use a light coating of engine oil to relieve binding.

6 Insert the intake pipe into the front supercharger housing. Slide the hose connection up the pipe until it covers equal portion of the pipe and the cylinder head hose connection sleeve.

7 Tighten the hose clamp screws.

8 Tighten the packing nut in the supercharger front housing with the crowfoot wrench.

9 On any of the upper eight intake pipes, connect the primer tube at the cylinder head and primer distributor ends, and attach the supporting clips to the intake pipe.

(g) INSTALLATION OF FRONT AND REAR ROW CYLINDER BARREL BAFFLES. (See figure 96.)

1 If the baffle assembly was not disassembled after removal from the engine, it will be unnecessary to loosen the latch bolt nuts. Proceed as follows to assemble a new replacement baffle assembly.

a. Install the spring under the head of the latch bolt.

b. Insert one of the drilled tubular fittings in the loops on the trailing edge of the left-hand baffle. Pass a bolt through the drilled hole in the fitting with the coiled spring between the head of the bolt and the pivoting fitting.

c. Install the other tubular fitting over the threaded end of the bolt, followed by a washer and two nuts.

d. Install the drilled end of the semicircular clamp in the bracket near the front of the left-hand baffle. Install the short attaching bolt, castellated nut, and cotter pin.

e. Swing the clamp outward on this bolt for installation on cylinder.

f. Place the left-hand baffle and clamp in position on the cylinder barrel, with the clamp located in the 19th space between fins. Count the wide space between the lower flange on the cylinder head and the first fin on the cylinder barrel as No. 1 space. It may be necessary to remove an intake pipe to make a front row cylinder accessible for baffle installation.

g. Install the right-hand baffle in position with the slot at the front edge over the hinged clamp hooked end.

h. Loosely install the cap bolt and plain washer, attaching the baffle to the exhaust rocker box.

i. Attach the adjacent Dzus fastener which holds the front end rear row cylinder barrel baffles together.

j. If the latch bolt spring tension has been previously adjusted, snap the bolt into its seat in the right-hand baffle. Tighten the attaching cap bolt in the rocker box, and safety-wire it securely. In case of a new replacement cylinder barrel baffle assembly, the latch bolt should be swung into its seat and one nut screwed up until the baffles are held snugly and yet allow easy disassembly and assembly. Maintain the desired tension by tightening the second nut on the first. Cylinder baffles on No. 7 and No. 9 cylinders do not have hinged clamps due to interference with the oil sump. In installing baffles on these cylinders, it is to be noted that the short baffles are installed on the side of the cylinder barrel adjacent to the sump. The curved steel strap which rests on the cylinder barrel fins is hooked to the short baffle by a hook clamp which is located on the 19th space between the cylinder barrel fins.

(h) INSTALLATION OF FRONT ROW CYLINDER HEAD BAFFLES. (See figure 106.)

Figure 106 - INSTALLING FRONT ROW CYLINDER HEAD BAFFLES

1 If the entire front row cylinder head baffle assembly has been removed, reassemble the five component parts before installation as follows:

a. Bolt the steel strap to the right-hand gusset, but do not tighten until the proper angle is determined when the entire baffle assembly is installed on the cylinder head. Use a plain nut and lock washer on the attaching cap bolt.

b. Attach the right-hand gusset to the front face of cowl supporting wall section with the two Dzus fasteners.

c. Install the left-hand gusset to the under side of the front baffle with the Dzus fastener.

d. Attach the front baffle and the left-hand gusset assembly to the cowl supporting section with the Dzus fastener through the right-hand gusset.

2 Pass the ignition wire through the spark plug cooling air duct. Place the front row cylinder head baffle assembly in position on the cylinder head, working the Dzus fasteners into their mating holes but not connecting them to their lock springs. The cowl supporting wall section must be in front of the adjacent rear row cylinder wall sections.

3 Install the three cylinder head attaching cap screws and washers loosely. One bolt is located at each of the two cylinder head rocker boxes, and the other at the rear of the exhaust rocker box.

4 Install loosely the intake pipe flange attaching cap bolt, shakeproof lock washer, and plain washer through the short steel strap.

5 Attach the three Dzus fasteners through the continuous cowl supporting wall section. Tighten the four cap bolts. Safety-wire the three smaller bolts. The Dzus fasteners adjacent to the cap bolt in the exhaust rocker box rear end may be detached for accessibility.

6 Tighten the nut on the bolt attaching the steel strap to the right-hand gusset. Install the cotter pin.

(i) INSTALLATION OF REAR ROW CYLINDER HEAD BAFFLES. (See figure 96.)

1 If the entire rear row cylinder head baffle assembly has been removed, assemble the three component parts prior to installation as follows:

a. Place the front segment on the intermediate frame section, followed by the rear segment.

b. Attach the three Dzus fasteners to hold the assembly together. Two of the fasteners are on top of the rear segment and the third is at the left-hand side.

2 Pass the spark plug conduit through the spark plug cooling air duct.

3 Place rear row cylinder head baffle assembly in position on the cylinder head.

4 Work the Dzus fasteners into their mating holes, but do not attach to the lock springs. The cowl supporting rim section must be to the rear of the adjacent front row cylinder cowl supporting section.

5 Install the three attaching cap bolts and plain washers loosely. One cap bolt is in each of the two cylinder head rocker boxes, and the third is in the intake pipe box.

6 Attach the four Dzus fasteners. Three are attached to the adjacent cowl supporting rim sections. The fourth is attached to the right cylinder barrel baffle.

7 Tighten the three attaching cap bolts, and install safety wire.

(j) INSTALLATION OF SPARK PLUGS. (See figure 96.) - Install the spark plugs with a spark plug torque wrench to 450 to 500 inch-pounds. Attach the spark plug wires to the spark plugs.

(3) INSTALLATION OF ENGINE.

(a) Hoist the engine into position on engine nacelle. (See figure 95.)

(b) Insert Lord Dynafocal mount bolts. (See figure 94.) The left-hand top bolt is inserted from the bottom; all other bolts are inserted from the top.

(c) Install Lord Dynafocal mount bolt nuts and remove the slings and crane. (See figure 95.)

(d) Connect the engine-to-mount electrical bonding straps. (See figure 94.)

(e) Connect both oil foam lines, one on each side of engine. (See figure 92.)

(f) Connect oil separator drain line to the engine. (See figure 92.)

(g) Insert the propeller governor control cables (figure 96) back through the venturi ring and install the fair-lead holder cover.

(h) Connect the two thermocouple wires at the fire wall.

(i) Thread the propeller governor cutout switch wire through the conduit from the inner baffle to the governor, and resolder wire to governor plug.

(j) Install the right-hand breather cap and both lines.

(k) Connect the No. 9 cylinder drain line at the BT nut on the cylinder. (See figure 94.)

(l) Connect the cowl flap support at the antidrag ring bracket.

(m) Connect magneto Cannon plug on the fire wall. (See figure 92.)

(n) Connect starter cable at starter Cannon plug. (See figure 91.)

(o) Connect generator cable at the generator Cannon plug. (See figure 91.)

(p) Connect the propeller feathering line at the inner baffle (or the forward end of the hose). (See figure 91.)

(q) Connect the hose connection on the heater intake and connect exhzust lines. (See figure 91.)

(r) Connect the vacuum line and pressure line to the vacuum pump. (See figure 92.)

(s) Connect the hydraulic suction line first to the hydraulic pump and then to the disconnect valve on the fire wall. Check to see if there is a slight seepage of oil on the pressure side before connecting pressure line to pump. (See figure 92.)

(t) Connect the hydraulic pressure line to the hydraulic pump. (See figure 92.)

(u) Connect the oil IN and OUT lines at the engine fitting. (See figure 91.)

(v) Install the tachometer generator. (See figure 92.)

(w) Install the fuel pump. (See figure 92.)

(x) Connect the manifold pressure and oil pressure instrument lines at the step in the fire wall. (See figure 92.)

(y) Install the carburetor. Bleed the carburetor to make sure there are no air locks in the system.

(z) Connect the main fuel line and the cross feed line to the fuel pump and at the fire wall. (See figure 92.)

(aa) Install the carburetor air scoop as follows:

1 Before installing, safety hot-air door in the "cold" position and tape the cable to hold it on the pulley.

2 Before installing, see that the Neoprene collar is clamped securely to the air scoop; place the other clamp around the Neoprene collar and roll the Neoprene collar back (like a cuff) over both clamps.

3 Lower air scoop into position.

4 Unroll Neoprene collar. It will thereby fit itself to the carburetor air scoop adapter.

5 Push the loose clamp down until it fits around the bottom of the Neoprene collar.

NOTE

If the clamp will not go down in front, remove the inspection plates at the sides of the air scoop.

6 Tighten the lower clamp, using a flat screwdriver.

7 Install ten cap screws along the sides of the air scoop into the venturi ring. Be careful not to force any of the cap screws. If screws will not start easily, drill sheet metal out to 1/4-inch diameter.

8 Install five cap screws under air scoop fairing.

9 Replace cover on air scoop fairing.

10 Install six Phillips head screws in air scoop fairing.

11 Connect four anti-icer lines to back of air scoop.

12 Connect electric plug to air temperature bulb on back of air scoop.

13 Install exit fairings for upper cowl flaps.

14 Install cover plates on wing.

15 Hook up control cables, removing tape and safety wire.

(bb) Connect the engine control rigging. (See figure 91.)

(cc) Connect the generator blast tubes. (See figure 91.)

(dd) Fill the oil containers with oil, Specification AN-VV-O-446a, grade 1100A.

(ee) Install the propeller.

(ff) Ground-test the engine.

(gg) Install the antidrag ring. (See figure 88.)

(hh) Install the accessory cowling.

h. FINAL TEST AFTER ASSEMBLY.

(1) GROUND RUN-IN OF ENGINES.

(a) GENERAL. - After general replacement of internal wearing parts (bearings, bushings, pistons, rings, and similar parts), test-run engines to ensure proper functioning. Block-test engines if equipment is available. Otherwise, when running-in and testing of engines are necessary, operate the engines when installed in the airplane, using the regular airplane instruments for determining proper operation. To obtain maximum cooling, remove the cowling and keep the propeller in low pitch.

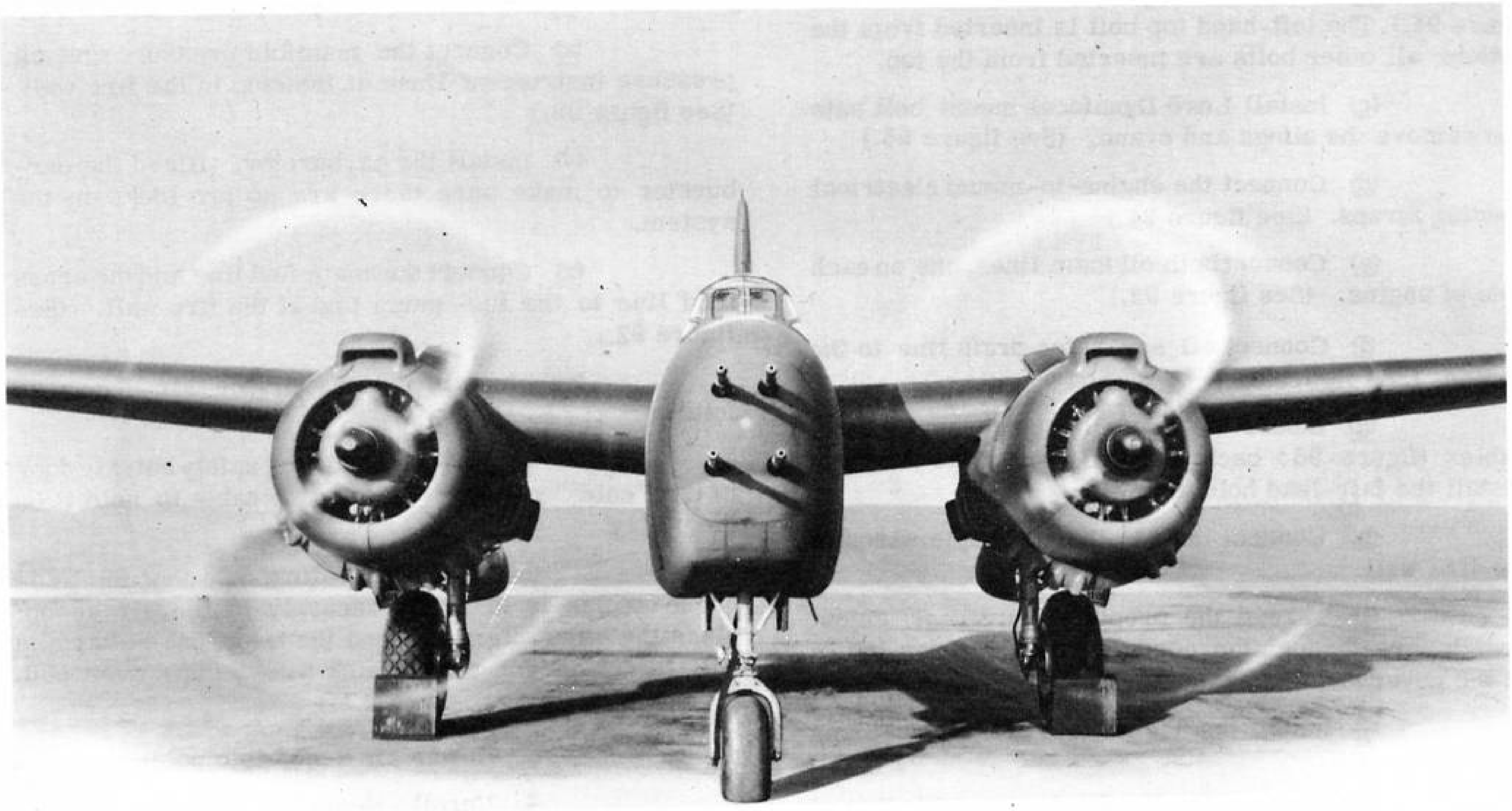


Figure 107 - RUNNING-IN ENGINES

(b) DURATION OF TESTING. - The time periods specified in step (e) below are minimum. Extend them when necessary. In case of failure or malfunctioning requiring replacement of internal wearing parts during test, disregard the accumulated running time and begin the test anew. If the parts replaced are not such that a wear-in is essential, resume the test where it was stopped. If parts are replaced at the completion of the run, run the engine for two hours at one-half throttle to ensure all parts being properly assembled. In case the cylinder head, cylinder base, or oil IN temperature are above normal, repeat the last four test periods until normal functioning results.

(c) FUEL.

1 OCTANE. - Use 100 octane fuel for the test except for the 11th period. During the 11th period, use 65 to 73 octane unleaded fuel.

2 TOP-OILING. - During the first four and the eleventh periods of the run-in, provide for top-oiling by adding lubricating oil, Specification AN-9532, grade 1065, to the fuel, one-half pint of oil to each gallon of fuel. If this grade oil is not available, use the lightest available grade of new aircraft engine lubricating oil. Thoroughly mix the oil with the fuel, either by spraying the oil into the fuel tank under pressure, or by mixing before the fuel is put into the tank.

3 FUEL PRESSURE. - Maintain fuel pressure at approximately 15 pounds per square inch. Set the automatic mixture control in the AUTO-RICH position for the full duration of the test.

(d) OIL.

1 GRADE. - Use oil, Specification AN-VV-O-446a, grade 1100A.

2 PRE-OILING. - Prior to starting the run-in, fill the engine oil system with oil to eliminate the momentary lag in flow from the oil pump. Connect an electrically driven oil pump to the 1/4-inch pipe plug adjacent to oil pump check valve. Install a pressure gage between the pump and the engine, and operate the pump until oil begins to flow out of the sump drain hole. Rotate the crankshaft slowly backward by hand during the pre-oiling operation.

3 PRESSURE. - Maintain oil pressure of 75 to 90 pounds per square inch with an oil IN temperature of 60 degrees to 70 degrees C (140 degrees to 158 degrees F).

4 CONSUMPTION. - Record oil consumption at the end of each run-in period. If it is found to be excessive, continue the run-in at the same speed until the oil consumption reaches normal for that speed. Oil consumption should never exceed 0.035 pounds per brake horsepower per hour. If the oil consumption is excessive, even though below the maximum allowable, and cannot be corrected by additional running, disassemble the engine and inspect piston, rings, and cylinder walls for scoring.

5 TEMPERATURE. - Hold oil temperature between 55 and 75 degrees C (131 and 167 degrees F). Maximum cylinder head temperature (spark plug gasket thermocouple) - 260 degrees C (500 degrees F). Maximum cylinder base temperature (flange thermocouple) - 160 degrees C (320 degrees F).

(e) RUN-IN PERIODS.

DURATION	SPEED % RATED	MAXIMUM PRESSURE % RATED
10 minutes	45	50
10 minutes	58	55
30 minutes	67	60
30 minutes	74	65
30 minutes	79	70
30 minutes	84	75
30 minutes	88	80
30 minutes	91	85
90 minutes	95	90
30 minutes	100*	100*
15 minutes	52**	53**

* Do not exceed maximum rpm of 2550 (+0, -50) and manifold pressure of 40-1/2 (+0, -1-1/2) Hg. for the tenth period.

** Use 65 or 73 OCTANE UNLEADED FUEL for the eleventh period.

(f) ANTICORROSION TREATMENT. - After the engine has completed the run-in time specified above, run it for a period of from three to five minutes at speeds between 1000 and 1200 rpm on UNLEADED gasoline mixed with oil as prescribed for top-oiling in step (c) 2 above; then stop the engine by cutting the switch and opening the throttle wide.

(g) RECORDING TEST DATA. - During the testing of the engine, record all essential data pertaining to that test.

1 Rpm for each test period.

2 Oil and fuel pressures.

3 Oil IN and oil OUT temperature.

4 Oil consumption for each test period.

5 Manifold pressures.

6 Cylinder barrel and head and carburetor air intake temperatures.

(h) CLEANING OF SCREENS. - Clean all removable oil screens at the end of the first and fifth hours and all removable fuel and oil screens at the completion of the run-in.

Figure 108 - INSTALLED ENGINE CONTROLS

9. ENGINE AND PROPELLER CONTROLS.

a. DESCRIPTION (See Figures 108, 110, 111, and 112.)

(1) GENERAL. - Engine and propeller controls are grouped on the left side of the pilot's cockpit. Cables attached to control handle pulleys provide the means of adjusting the engine and propeller controls. From the control handle pulleys, the cables run aft to the main spar in the fuselage, outboard to the left-hand side of their respective nacelles, and down to the differential pulley beam aft of the fire wall. Cables provide the operation of the controls forward of the fire wall. All control cables are of 3/32 inch 7 by 7 preformed flexible steel wire. For identification, colored bands of paint will be found on all cables.

(2) ENGINE COWL AND OIL COOLER FLAP CONTROLS. (See figure 109.) - The engine cowl flaps are actuated by hydraulic pressure and are controlled by valves located on the panel at the right side of the pilot's seat. Upper cowl flaps for each engine are controlled in unison by a single valve handle. Lower cowl flaps for each engine are controlled by individual valve handles. The oil cooler flaps are connected by cables to the lower cowl flap mechanism and operate simultaneously with the lower cowl flaps. To open the cowl flaps, move the respective control to OPEN position; when the flaps are open as desired, return the control to NEUTRAL position. To avoid buffeting, the upper cowl flaps should be closed at all times in flight and opened only while the engines are running on the ground.

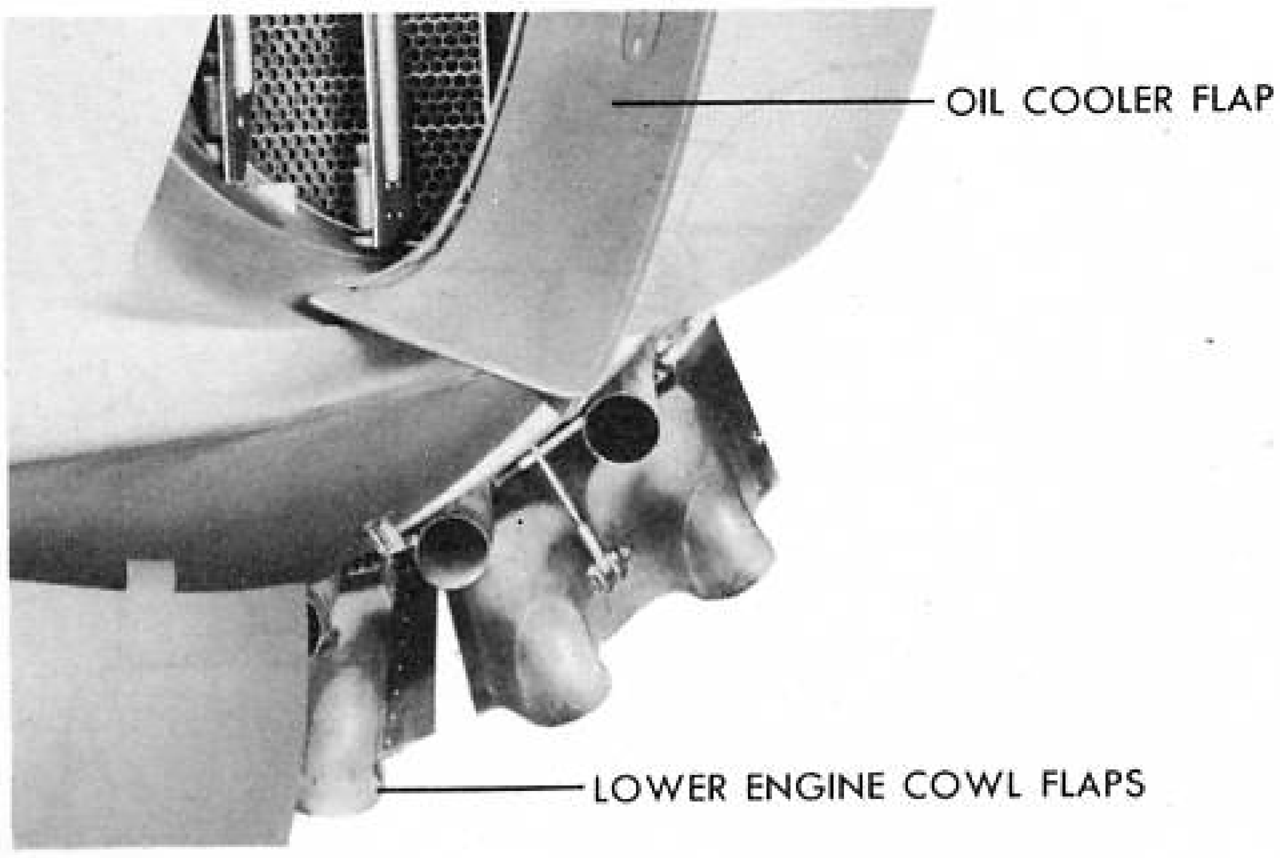
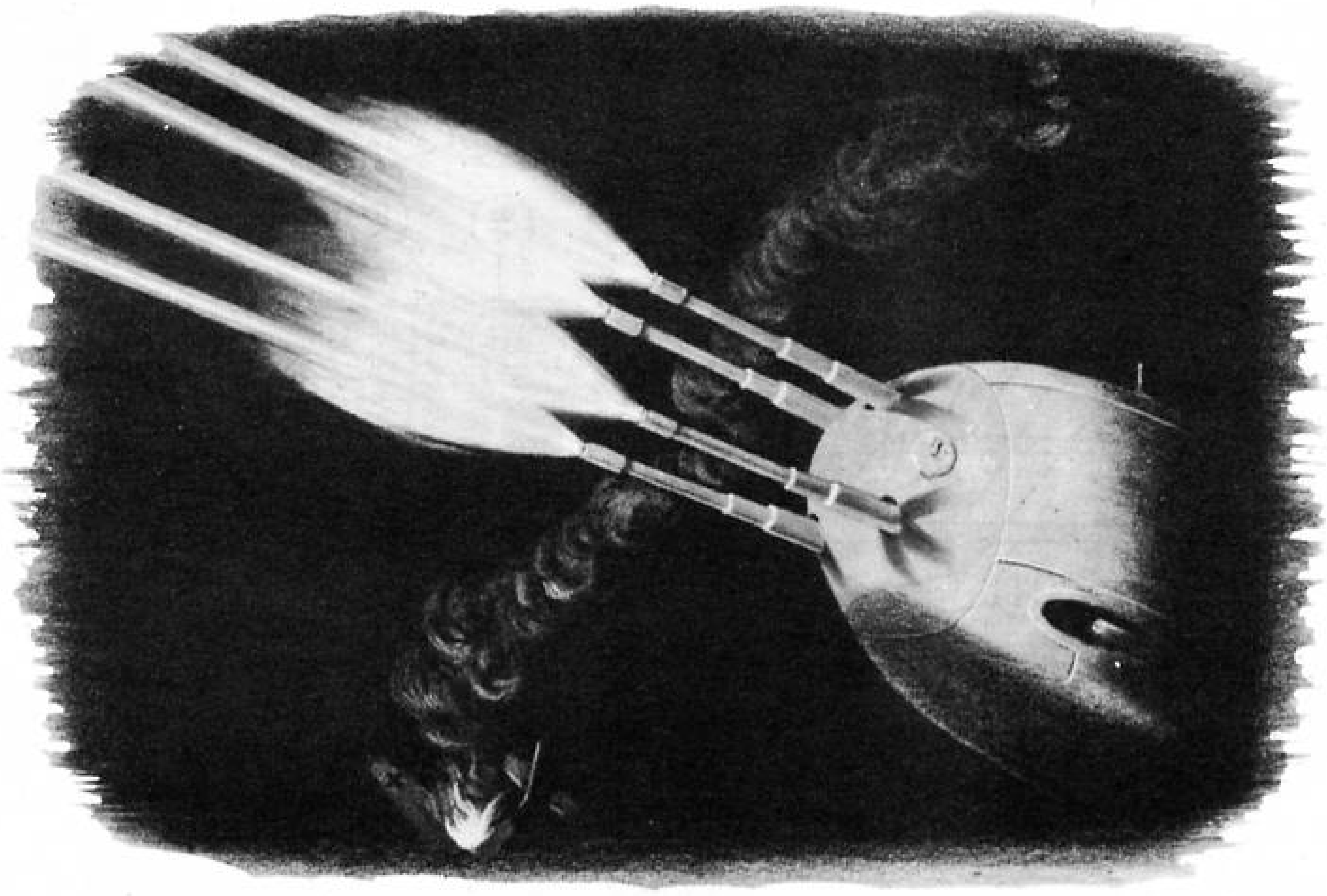


Figure 109 - ENGINE COWL AND OIL COOLER FLAPS

b. RIGGING. - Rigging the engine and propeller controls consists of adjusting the cable turnbuckles so that the control handles in the cockpit and the stops in the engine section reach their fore and aft stops at the same time. The rigging tension of the cables should be 60 percent of the amounts noted on the Cable Rigging Tensions Chart, Section 8, this handbook. If in adjusting any of the controls a "spring-back" is noted at either end of the control quadrant, readjust the system to equalize the amount of "spring-back" at each end of the quadrant.

c. REPLACEMENT OF CABLES. - When replacing a cable, check the length and location of the stop on the new cable against the old cable, as well as the dimensions noted on Engine Control Data Chart, Section 8. All replacement cables should be proof-loaded to 552 pounds before installation. A thread line soldered to the end of the cable will facilitate installation.



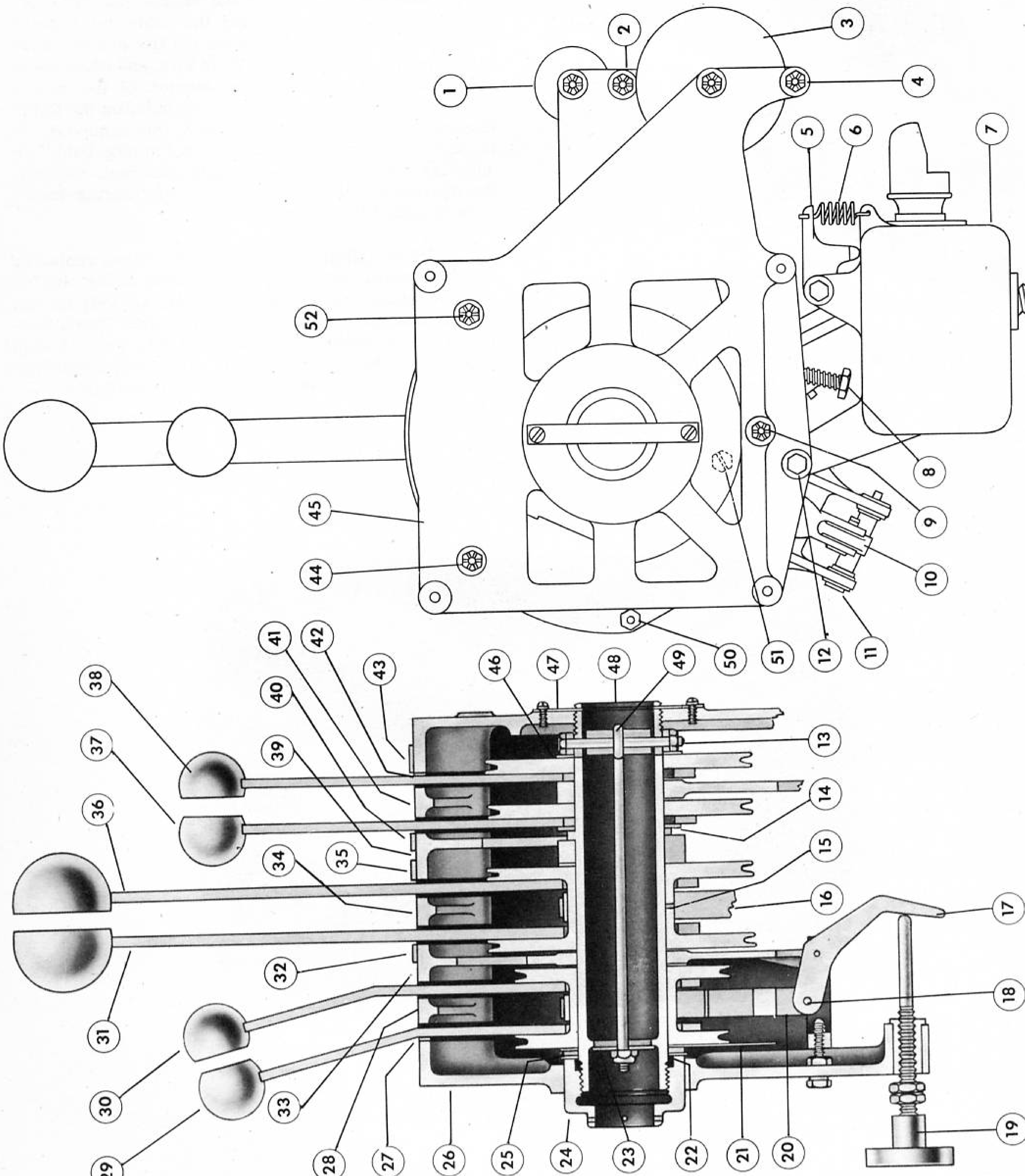


Figure 110 - PILOT'S ENGINE CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AN210-1A	PULLEY	2
	1068270-6	SPACER, QUADRANT	1
	S176000-3S-25AE-208	BOLT	1
	AN310-3	NUT	1
	AN960-10	WASHER	1
2.	132100-3-23A	BOLT, SPECIAL	1
	1068270-6	SPACER, QUADRANT	1
	AN960-10	WASHER	1
3.	AN210-2A	PULLEY	10
	AN3-67	BOLT	1
	AN310-3	NUT	1
	1068270-1	SPACER, QUADRANT	1
	1068270-3	SPACER, QUADRANT	1
	1068270-4	SPACER, QUADRANT	1
	AN960-10	WASHER	1
4.	AN3-67	BOLT	1
	AN310-3	NUT	1
	1068270-5	SPACER, QUADRANT	1
	AN960-10	WASHER	1
5.	2068493-2	LEVER, SWITCH OPERATING	1
	2068493-4	LEVER, SWITCH OPERATING	1
	1026614G3-208	SPACER	1
	AN3-33	BOLT	1
	AN310-3	NUT	1
	AN960-10	WASHER	1
6.	1068224	SPRING, SWITCH LEVER	2
7.	4067939	BOX ASSEMBLY, SWITCH	1
8.	1068224	SPRING, THROTTLE SWITCH	2
	176000-3-S11-ND-00	BOLT	2
	AC365-1032	NUT	2
9.	AN3-67	BOLT	1
	AN310-3	NUT	1
	1068270-7	SPACER, QUADRANT	1
	1068270-8	SPACER, QUADRANT	1
	AN960-10	WASHER	1
10.	1068210	LEVER, BRAKE	1
	AN393-19	PIN	1
11.	AN393-59	PIN	1
	1067755	LINK	1
	1068270-10	SPACER, QUADRANT	2
	176000-3-S10-ND-006	BOLT	1
	AN960-10	WASHER	1
	AN345-10	NUT	1
12.	AN3-444	BOLT	1
13.	AN3-21A	BOLT	1
	AC365-1032	NUT	1
	1068270-9	SPACER, QUADRANT	2
	106774	SPACER, SHAFT	1
14.	143908-116-B-204	WASHER	1
15.	143908-116-S-123	WASHER	1
16.	2069451	BRAKE ASSEMBLY, THROTTLE	1
17.	1068210	LEVER, BRAKE	1
	AN393-19	PIN	1
18.	AN393-59	PIN	1
	1067755	LINK	1
	1068270-10	SPACER, QUADRANT	2
	176000-3-S10-ND-006	BOLT	1
	AN345-10	NUT	1
	AN960-10	WASHER	1
19.	1067740	SCREW, PROPELLER PITCH LOCK	1
	1067741	SCREW, THROTTLE LOCK	1
	AN316-5R	NUT	4
20.	2069452	BRAKE	1
21.	1067776	SHIM, FRICTION	1
22.	143908-116-S204	SHIM (.050)	1
23.	1067762	SPRING	1
	AC365-1032	NUT	1
24.	1067742	NUT, SPECIAL	1
25.	143908-117-LR200	WASHER (.125)	1
26.	5068083	PLATE ASSEMBLY, END	1
27.	1068229	SHIM, PROPELLER QUADRANT	4
28.	1068226	QUADRANT, PROPELLER	1
29.	2068413	PULLEY ASSEMBLY, PROPELLER—R.H.	1
30.	2068412	PULLEY ASSEMBLY, PROPELLER—L.H.	1
31.	4131361	PULLEY ASSEMBLY, THROTTLE	1
32.	2092569-1	STOP	2
	1027301-8-6	SCREW	2
33.	4067864	PLATE ASSEMBLY	1
34.	1068227	QUADRANT, THROTTLE	1
35.	2092569	STOP	2
	1027301-8-6	SCREW	2
36.	4067953	PULLEY ASSEMBLY, THROTTLE—L.H.	1
37.	4067951	PULLEY ASSEMBLY, MIXTURE—R.H.	1
38.	4067949	PULLEY ASSEMBLY, MIXTURE—L.H.	1
39.	2067343	QUADRANT, PULLEY SUPPORT	1
40.	2094119-1	STOP	1
	1027301-8-6	SCREW	2
41.	1068228	QUADRANT, MIXTURE	1
42.	1068307	SHIM, THROTTLE AND MIXTURE	8
43.	2092569	STOP	1
	1027301-8-6	SCREW	2
44.	132100-3-43A	BOLT, SPECIAL	1
	1068270-1	SPACER, QUADRANT	3
	1068270-2	SPACER, QUADRANT	1
	AN960-10	WASHER	1
45.	4067831	PLATE ASSEMBLY, UNIT MOUNTING	1
46.	143908-116-B204	WASHER (.032)	6
47.	1068225	LOCK, SHAFT	1
	AN515-6-6	SCREW	2
	AN960-6	WASHER	2
48.	2131292	SHAFT	1
49.	1067773	HOOK	1
50.	AN3-26	BOLT	1
	AN310-3	NUT	1
	1068270-1	SPACER, QUADRANT	2
	AN960-10	WASHER	1
51.	176000-3-S23A204	BOLT	1
52.	AN3-67	BOLT	1
	AN310-3	NUT	1
	1068270-1	SPACER, QUADRANT	3
	1068270-2	SPACER, QUADRANT	1
	AN960-10	WASHER	1

LEGEND FOR FIGURE 110

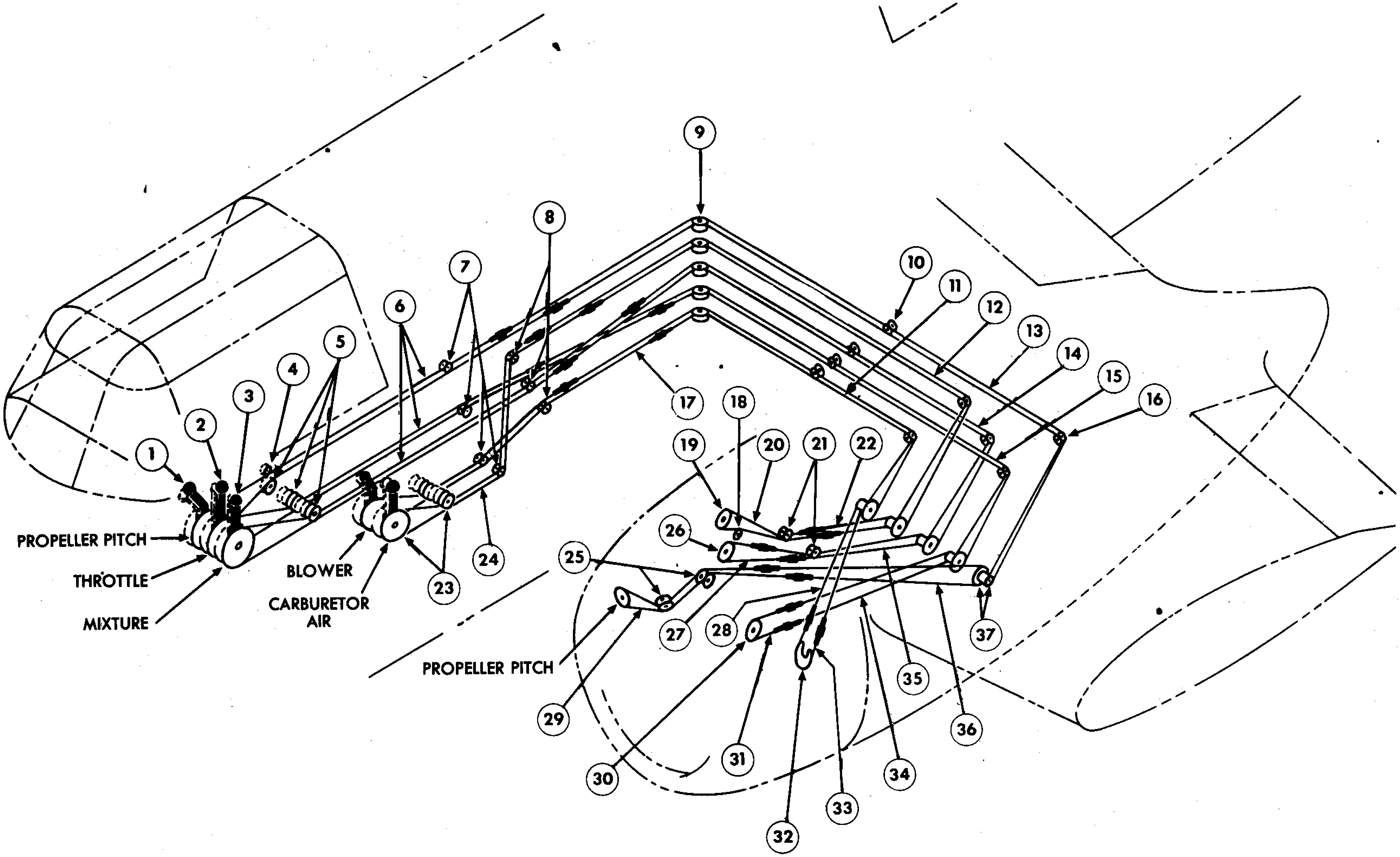


Figure 111 - LEFT-HAND ENGINE AND PROPELLER CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2068412	PULLEY ASSEMBLY, PROPELLER PITCH	1
2.	4067953	PULLEY ASSEMBLY, THROTTLE	1
3.	4067949	PULLEY ASSEMBLY, MIXTURE	1
4.	AN210-1A	PULLEY	1
5.	AN210-2A	PULLEY	5
6.	5175889-4	CABLE ASSEMBLY	3
7.	AN210-1A	PULLEY (STATION 98)	8
8.	AN210-1A	PULLEY (STATION 156)	6
9.	AN210-2A	PULLEY (STATION 156)	14
10.	AN210-1A	PULLEY (STATION 48)	8
11.	4106788-6	CABLE ASSEMBLY, BLOWER	1
12.	4106788-2	CABLE ASSEMBLY, CARBURETOR AIR	1
13.	4106788-10	CABLE ASSEMBLY, PROPELLER PITCH	1
14.	5175889-18	CABLE ASSEMBLY, MIXTURE	1
15.	5175889-6	CABLE ASSEMBLY, THROTTLE	1
16.	AN210-2A	PULLEY (STATION 74 TO 89)	10
17.	517889-2	CABLE ASSEMBLY, BLOWER	2
18.	AN210-1A	PULLEY	1
19.	4066522	PULLEY, CARBURETOR AIR	1
20.	4106860-20	CABLE ASSEMBLY, CARBURETOR AIR	1
21.	AN210-1A	PULLEY	4
22.	4106788-18	CABLE ASSEMBLY, CARBURETOR AIR	1
23.	123969	UNIT, PILOT'S CONTROL	1
24.	5175889-2	CABLE ASSEMBLY, CARBURETOR AIR	2
25.	AN210-2A	PULLEY	4
26.	4092120	PULLEY, MIXTURE	1
27.	4106860-52	CABLE ASSEMBLY, MIXTURE	1
28.	4106788-18	CABLE ASSEMBLY, BLOWER	1
29.	2064967-26	CABLE ASSEMBLY, PROPELLER PITCH	1
30.	4066520	PULLEY, THROTTLE	1
31.	4106860-56	CABLE ASSEMBLY, THROTTLE	1
32.	4066523	PULLEY, BLOWER	1
33.	4106788-18	CABLE ASSEMBLY, BLOWER	1
34.	4106788-18	CABLE ASSEMBLY, THROTTLE	1
35.	4106788-18	CABLE ASSEMBLY, MIXTURE	1
36.	4106788-20	CABLE ASSEMBLY, PROPELLER PITCH	1
37.	4066524	DRUM ASSEMBLY, DIFFERENTIAL	5

LEGEND FOR FIGURE 111

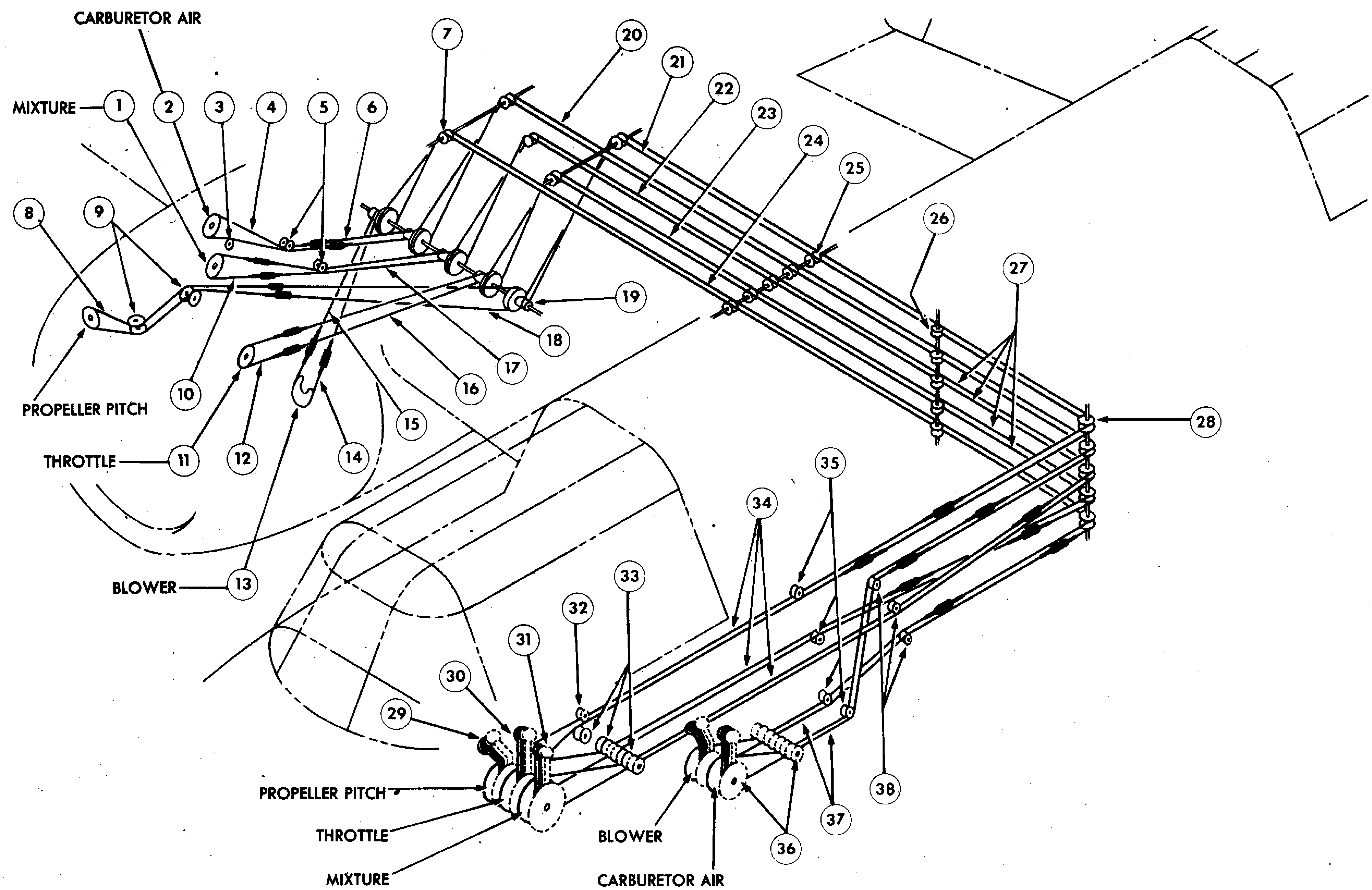


Figure 112 - RIGHT-HAND ENGINE AND PROPELLER CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4092120	PULLEY, MIXTURE	1
2.	4066522	PULLEY, CARBURETOR AIR	1
3.	AN210-1A	PULLEY	1
4.	4106788-4	CABLE ASSEMBLY, CARBURETOR AIR	1
5.	AN210-1A	PULLEY	4
6.	4106788-32	CABLE ASSEMBLY, CARBURETOR AIR	1
7.	AN210-2A	PULLEY (STATION 59 AND 74)	10
8.	4106788-40	CABLE ASSEMBLY, PROPELLER PITCH	1
9.	AN210-2A	PULLEY	4
10.	4106860-54	CABLE ASSEMBLY, MIXTURE	1
11.	4106788-32	PULLEY, THROTTLE	1
12.	4106860-56	CABLE, THROTTLE	1
13.	4066523	PULLEY, BLOWER	1
14.	4106860-8	CABLE ASSEMBLY, BLOWER	1
15.	4106788-40	CABLE ASSEMBLY, BLOWER	1
16.	4106788-32	CABLE ASSEMBLY, THROTTLE	1
17.	4106788-32	CABLE ASSEMBLY, MIXTURE	1
18.	4106788-34	CABLE ASSEMBLY, PROPELLER PITCH	1
19.	4066524	DRUM ASSEMBLY, DIFFERENTIAL	5
20.	4106788-4	CABLE ASSEMBLY, CARBURETOR AIR	1
21.	4106788-12	CABLE ASSEMBLY, PROPELLER PITCH	1
22.	4106860-50	CABLE ASSEMBLY, MIXTURE	1
23.	4106860-8	CABLE ASSEMBLY, THROTTLE	1
24.	4106788-8	CABLE ASSEMBLY, BLOWER	1
25.	AN210-1A	PULLEY (STATION 48)	10
26.	AN210-1A	PULLEY (STATION 156)	10
27.	2064972-4	CABLE ASSEMBLY	4
28.	AN210-2A	PULLEY (STATION 156)	14
29.	2068413	PULLEY ASSEMBLY, PROPELLER PITCH	1
30.	4131361	PULLEY ASSEMBLY, THROTTLE	1
31.	4067951	PULLEY ASSEMBLY, MIXTURE	1
32.	AN210-1A	PULLEY	1
33.	AN210-2A	PULLEY	5
34.	4106860-4	CABLE ASSEMBLY	3
35.	AN210-1A	PULLEY (STATION 98)	8
36.	123969	UNIT, PILOT'S CONTROL	1
37.	4106860-2	CABLE ASSEMBLY, BLOWER AND CARBURETOR AIR	2
38.	AN210-1A	PULLEY (STATION 113)	6

LEGEND FOR FIGURE 112

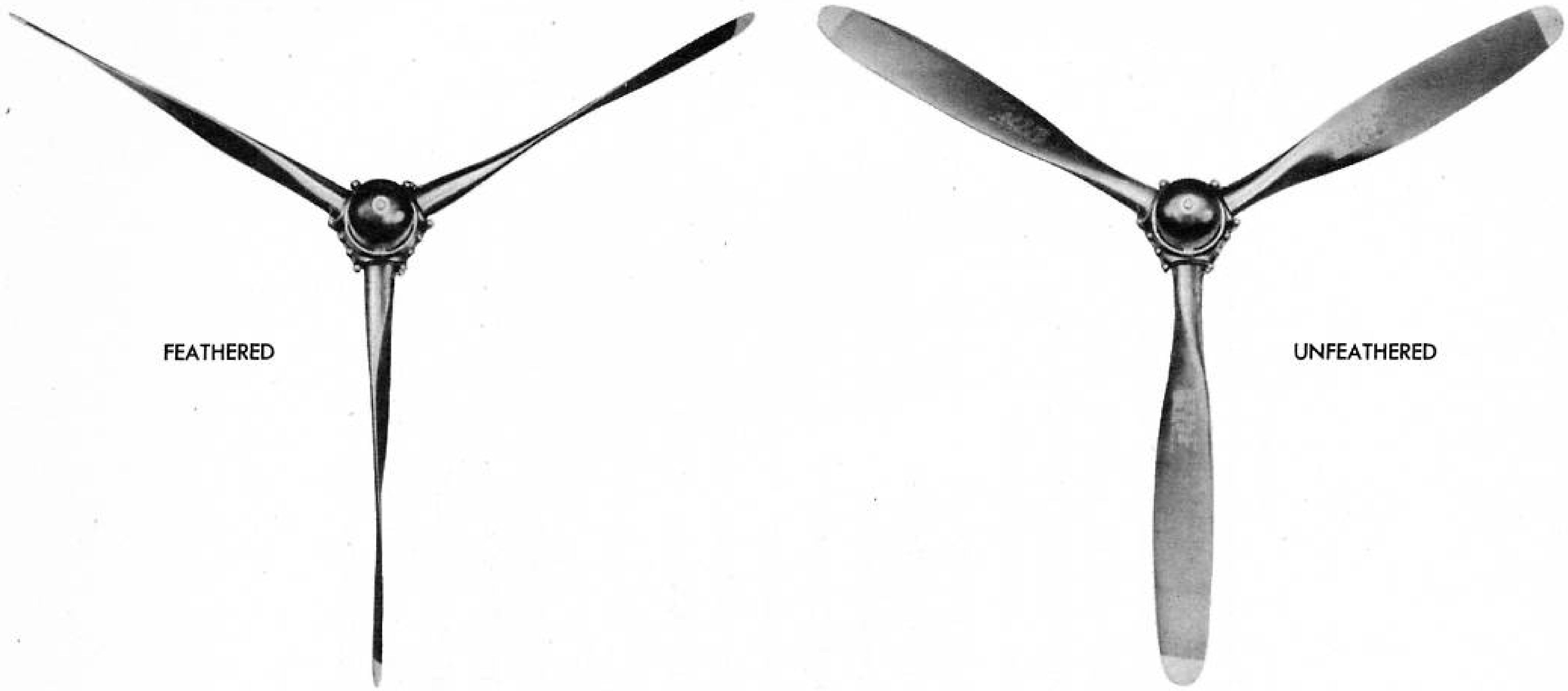


Figure 113 - PROPELLERS FEATHERED AND UNFEATHERED

10. PROPELLERS.

a. DESCRIPTION.

(1) GENERAL. (See figure 113.) - Each engine is equipped with a Hamilton Standard, hydromatic, full-feathering propeller. The nominal diameter of each propeller is 11 feet 4 inches. Each propeller consists of a 23E50 hub and three 6353A-21 blades. A propeller anti-icer system is provided.

(2) FEATHERING SYSTEM. (See figure 121.) - Fluid for operating the propeller feathering system in each nacelle is provided by the engine oil container in each inner wing panel. A sump at the bottom of the oil container provides a one-gallon oil supply which is available to the propeller feathering system only. From this sump the oil is directed to an electrically operated pump which forces the oil under pressure to a cable controlled propeller governor mounted on the front section of the engine. The pressure of the oil between the pump and the governor may range up to 500 pounds per square inch for feathering and to 600 pounds per square inch for unfeathering the propeller. A switch is provided for each propeller. After pushing the respective switch for the propeller to be feathered, the switch will automatically release when the propeller blades reach their full feathered position. To unfeather the propeller, push in the switch and hold until the engine windmills at 600 to 800 rpm. Then release the switch.

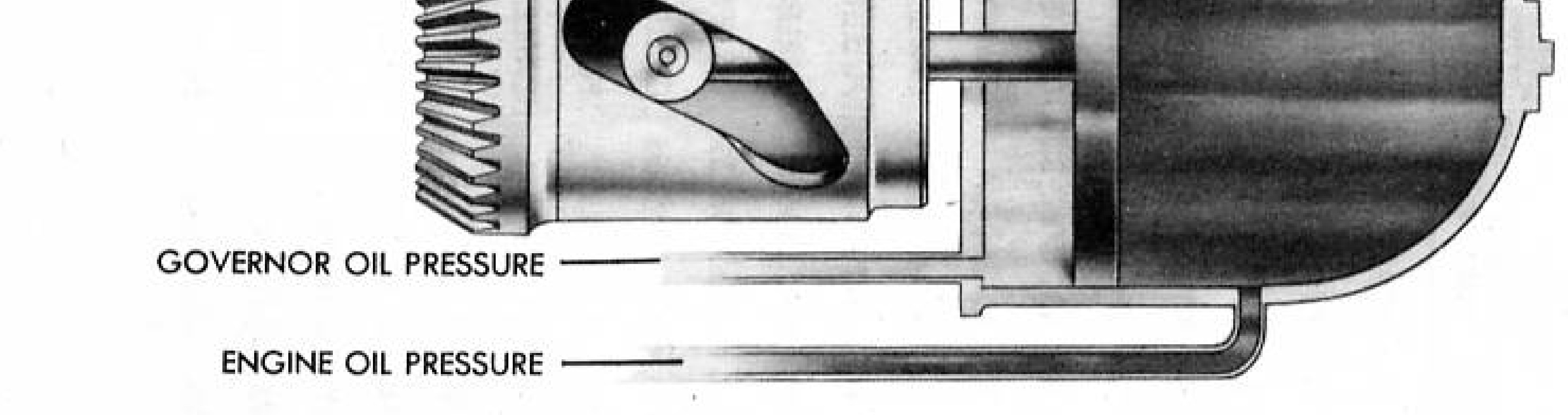


Figure 114 - PROPELLER CONTROL FORCES

(3) PROPELLER GOVERNOR. (See figure 114.) - Each propeller is controlled by a self-contained governor mounted on the engine nose case. The governors are the Hamilton Standard Hydromatic double capacity type. They maintain constant speed of the hydromatic propeller by causing changes in the propeller blade angle to meet changed conditions of altitude, throttle setting, etc. The change of blade angle is accomplished by regulating the flow of oil to the propeller. The unit consists of a gear type booster pump which boosts the engine oil from engine pressure to higher pressures required to operate the propeller pitch changing mechanism. A pilot valve controls the flow of oil to and from the propeller, and is actuated by the same spring-balanced flyballs. The minimum limit of the governing range of the unit is set by the low rpm adjusting screw in the speed adjustment rack inside the governor head. A transfer valve has been provided in the base of the unit through which passes the high-pressure oil for the feathering and unfeathering operations of the propeller.

(4) HIGH RPM STOP. - The high rpm stop is incorporated in the control pulley and cover of the Model 4 governor head. The stop consists of a pin which can be located in any one of the 18 holes in the control pulley. The pulley travel is limited when the pin rests against the adjustable screw which is threaded into the boss cast integral with the cover. The jam nut and tab lock washer hold the screw in the desired position after the adjustment is made. When installing a replacement governor which has been set for take-off rpm, if it is necessary to shift the pulley to a different position on the shaft "hex," care must be taken to shift the stop pin the proper number of holes in the pulley.

b. TROUBLE SHOOTING

SYMPTOM	CAUSE	REMEDY
Propeller vibrates.	Bent or damaged blade.	Replace damaged parts.
	Loosened blade.	Replace propeller.
	Improper blade angle setting.	Check and correct blade angle setting. If necessary, check the track of each blade.
	Loose retaining nut.	Tighten retaining nut. If repeated tightening is necessary, remove the propeller to ascertain and correct the cause.
Oil leaks from propeller hub.	Dome or dome plug loose.	Tighten loose parts.
	Gasket defective.	Replace gasket.
Oil leaks from around propeller governor base.	Loose governor.	Tighten governor.
	Defective gasket.	Replace gasket.
Propeller does not respond properly to controls.	Lost motion or play in controls.	Inspect control system. Replace defective cables, pulleys, or fairleads. Tighten loose cables.
	Propeller governor insecurely mounted.	Tighten and safety mounting of governor.
	Oil supply low.	Replenish oil supply.
	Propeller governor out of adjustment.	Adjust propeller governor.
	Oil leakage from system.	Check oil lines, dome, governor base, and feathering pump for leaks. Stop leakage by tightening (replacing if necessary) offending part.
	Propeller governor defective.	Replace propeller governor and send to depot for overhaul.

SYMPTOM	CAUSE	REMEDY
	Improper governor gasket.	Replace gasket.
	Propeller feathering pump inoperative.	Test operation of pump with 24-volt current. If pump remains inoperative, replace the unit. If pump operates in test, trace the circuit with a trouble lamp. Replace defective part.
Slow increase in rpm during flight.	Oil supply low.	Stop engine immediately. Feather propeller. Replenish oil supply before again starting engine.

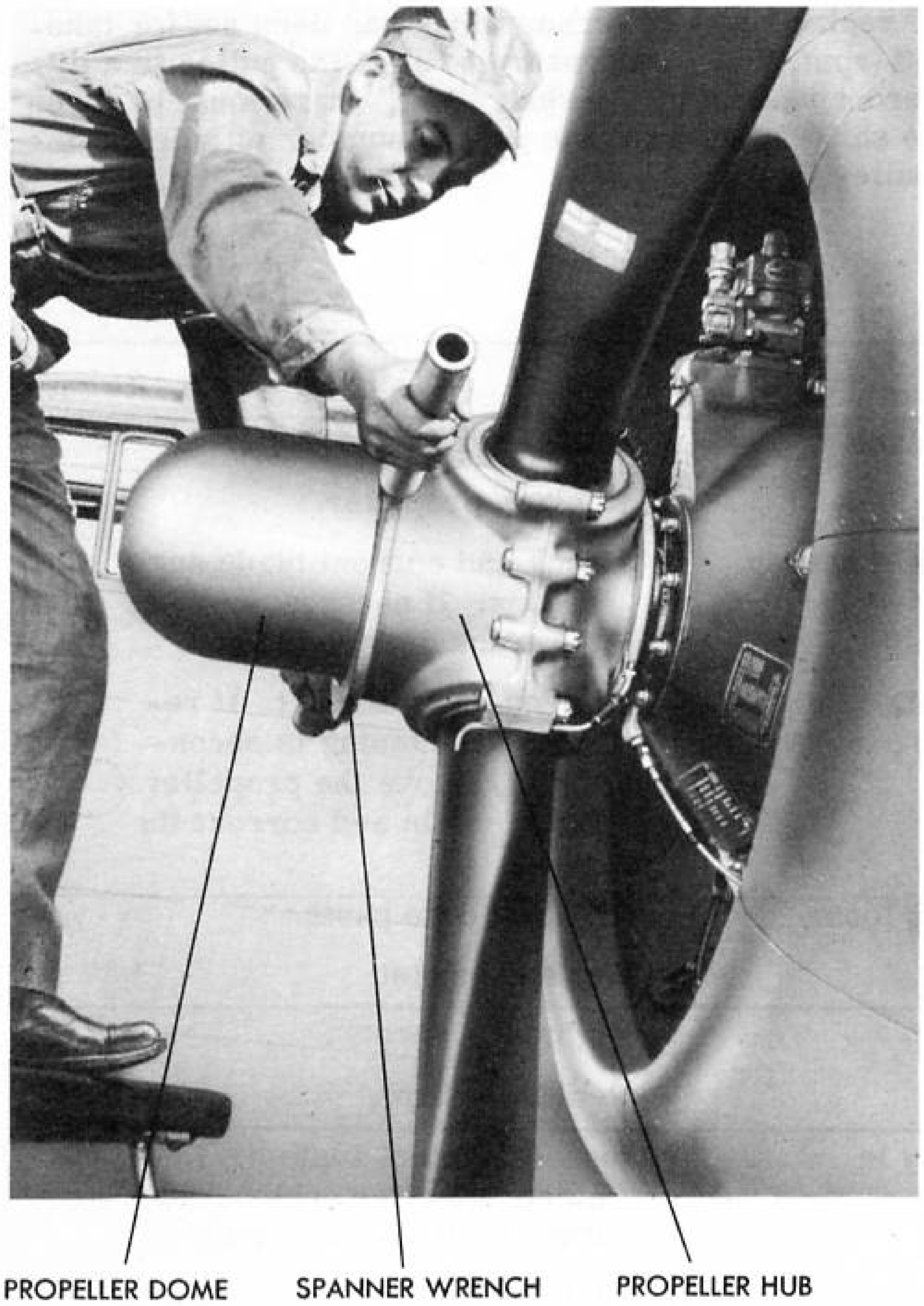


Figure 115 - REMOVING PROPELLER

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF PROPELLER. (See figure 115.)

(a) Remove the propeller dome plug from the front of the propeller dome.

(b) Remove the propeller dome with a spanner wrench.

NOTE

Use heavy duty installation and removal tools if available. If not, use the composite propeller wrench in the airplane tool kit.

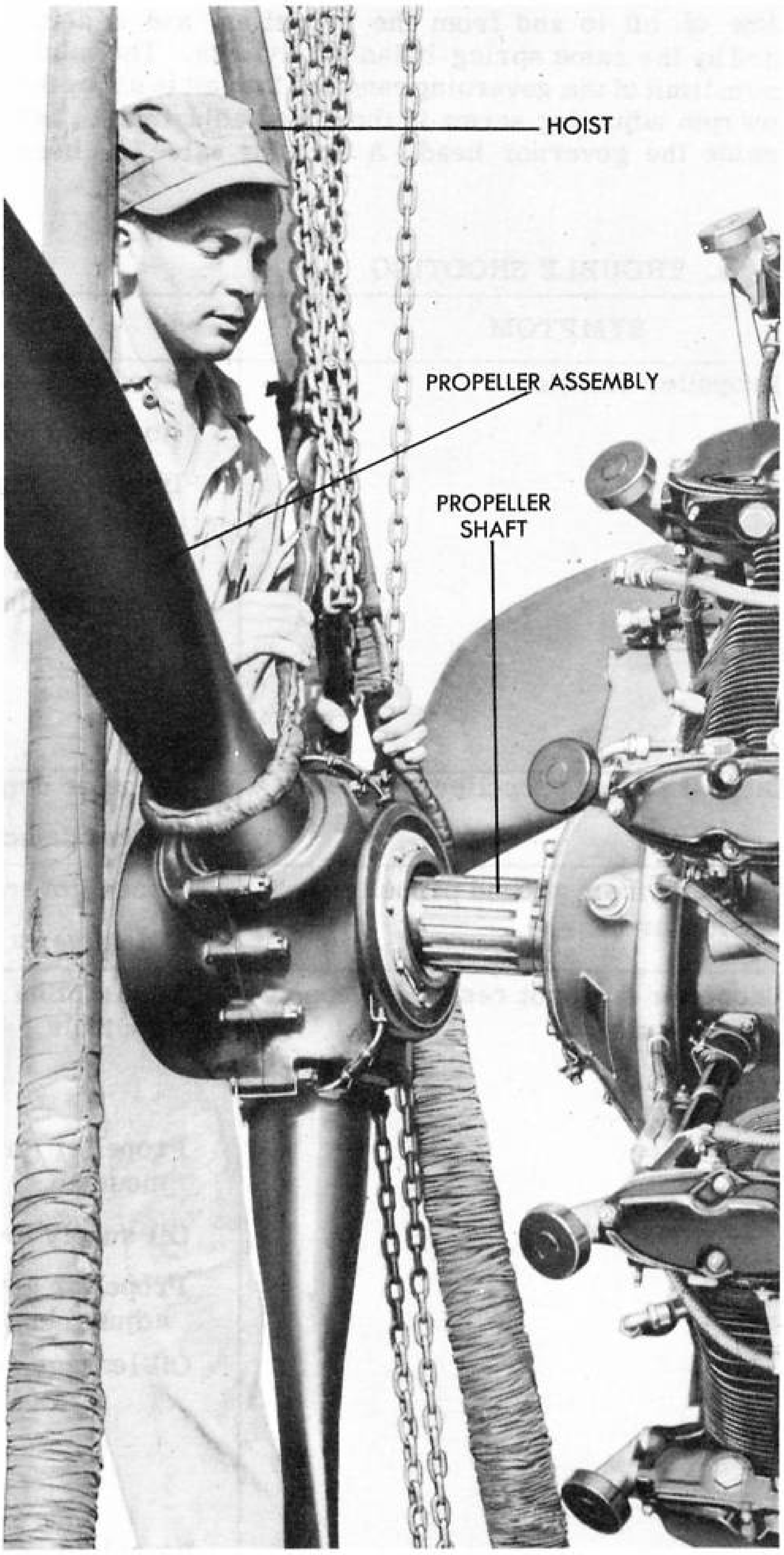


Figure 116 - LIFTING PROPELLER FROM SHAFT

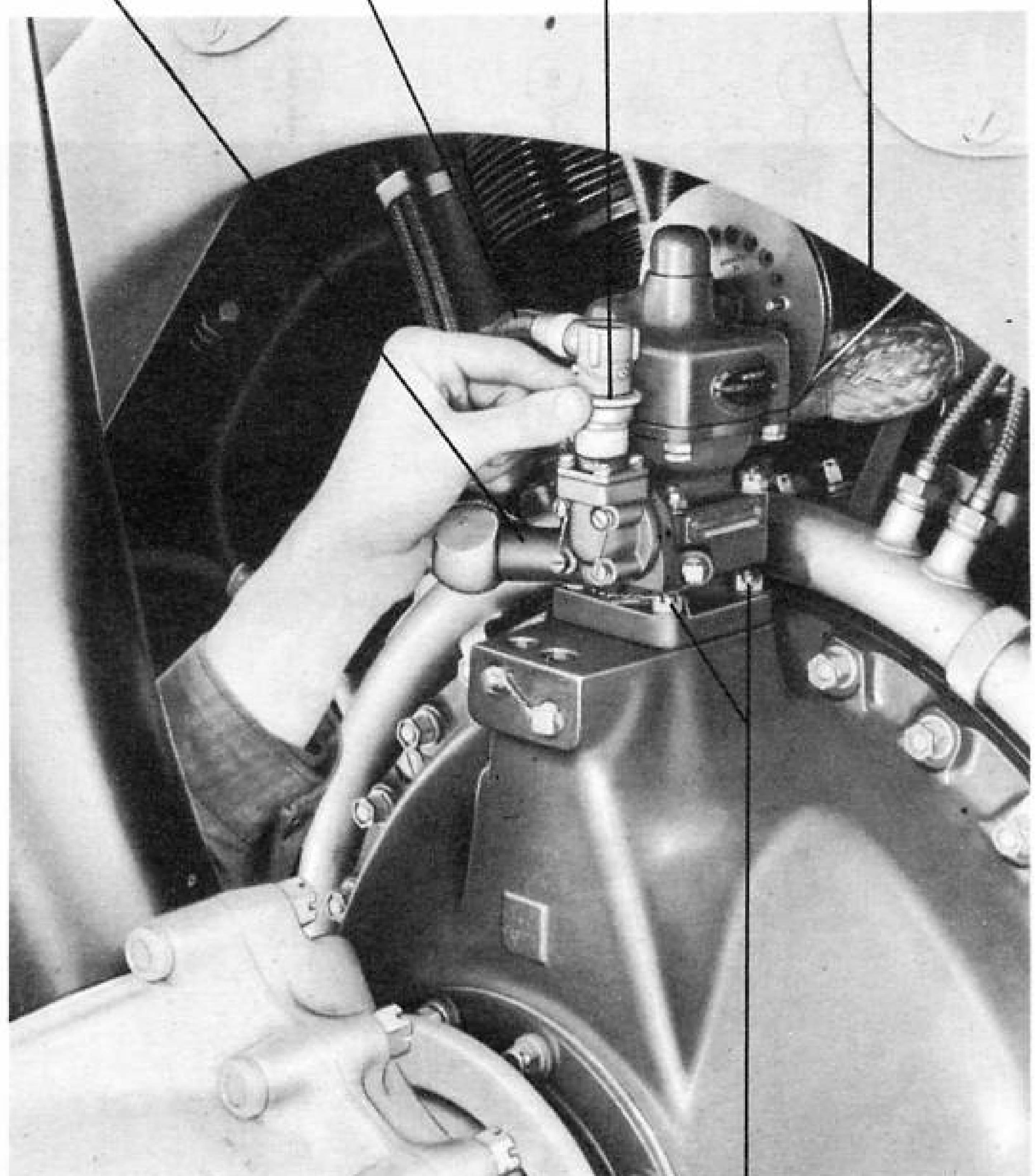


Figure 117 - REMOVING PROPELLER GOVERNOR

(c) Remove the retaining nut lock wire. (See figure 118.)

(d) Loosen the propeller retaining nut on the shaft. (See figure 118.)

(e) Unscrew the distributor valve assembly from the shaft. (See figure 123.)

CAUTION

Be sure retaining nut lock wire has been removed before turning distributor valve, as otherwise the locking splines in the valve housing will be mutilated.

(f) Unscrew retaining nut completely.

(g) Remove the propeller from the shaft, protecting the threads from damage. (See figure 116.)

(2) REMOVAL OF PROPELLER GOVERNOR. (See figure 117.)

(a) Disconnect the electric cable from the governor at the Cannon plug on the cut-out switch.

(b) Disconnect the feathering oil line from the governor.

(c) Disconnect the control cable from the governor by loosening the cable and removing the pulley.

(d) Remove the four castellated mounting stud nuts which secure the governor to the engine.

(e) Lift the governor from the engine nose case.

d. MAINTENANCE REPAIRS.

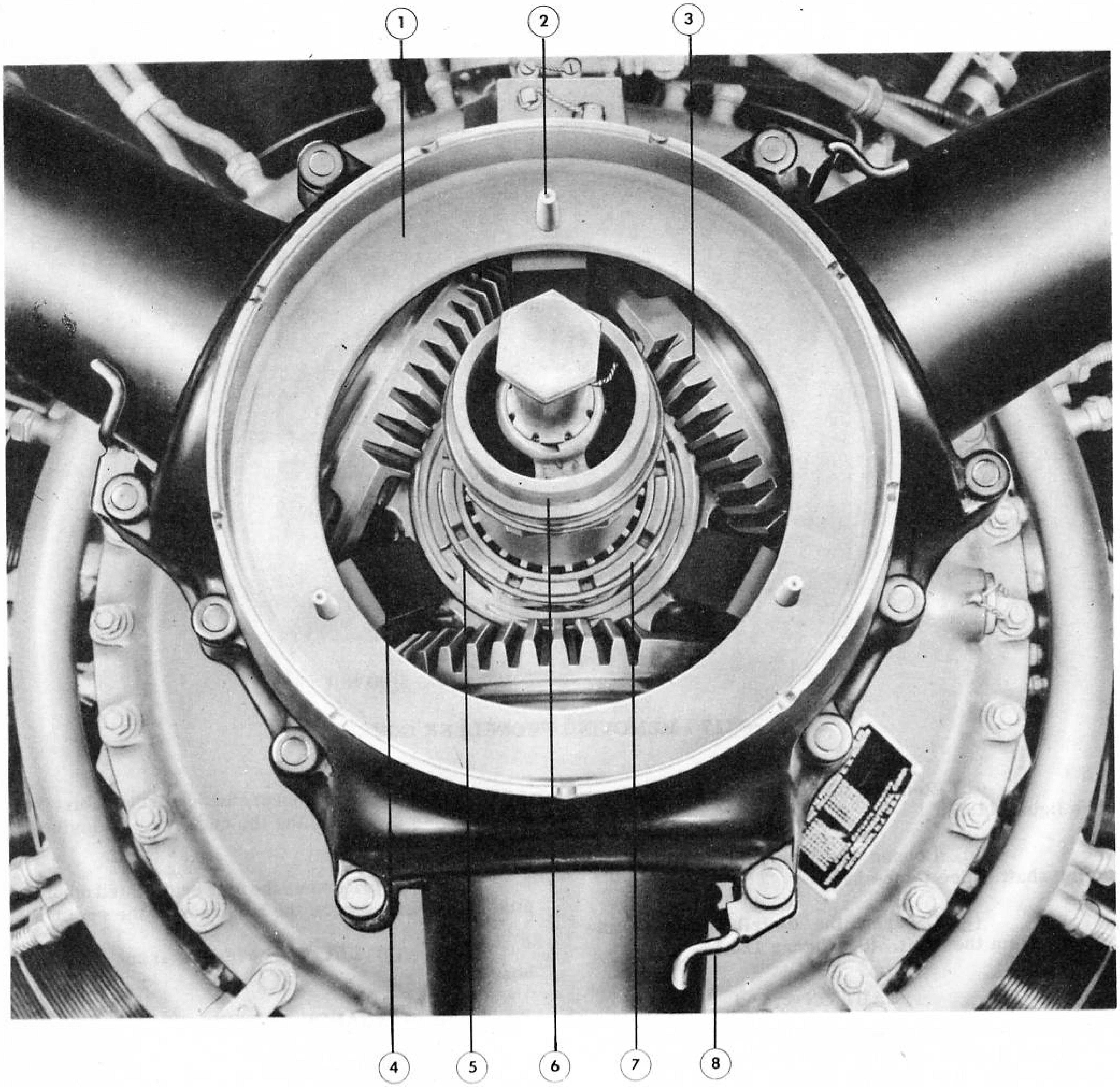
(1) PROPELLERS.

(a) COATING WITH OIL. - Coat all unprotected surfaces of the blades and hub with clean engine oil after the last flight of the day.

(b) CLEANING BLADES. - Clean propeller blades with gasoline.

(c) CLEANING PROPELLER HUB. - Clean steel hubs with gasoline or kerosene, and suitable cloth or brushes.

(d) USE OF CAUSTIC MATERIAL. - Except for etching, caustic materials must not be used. Use solvents such as approved paint and varnish removers to remove paint and varnish.



1. OUTBOARD BARREL HALF
2. FIXED CAM LOCATING DOWEL
3. BLADE GEAR SEGMENT
4. BARREL SUPPORT
5. RETAINING NUT LOCK WIRE
6. DISTRIBUTOR VALVE ASSEMBLY
7. PROPELLER RETAINING NUT
8. ANTI-ICER NOZZLE

Figure 118 - PROPELLER - DOME REMOVED

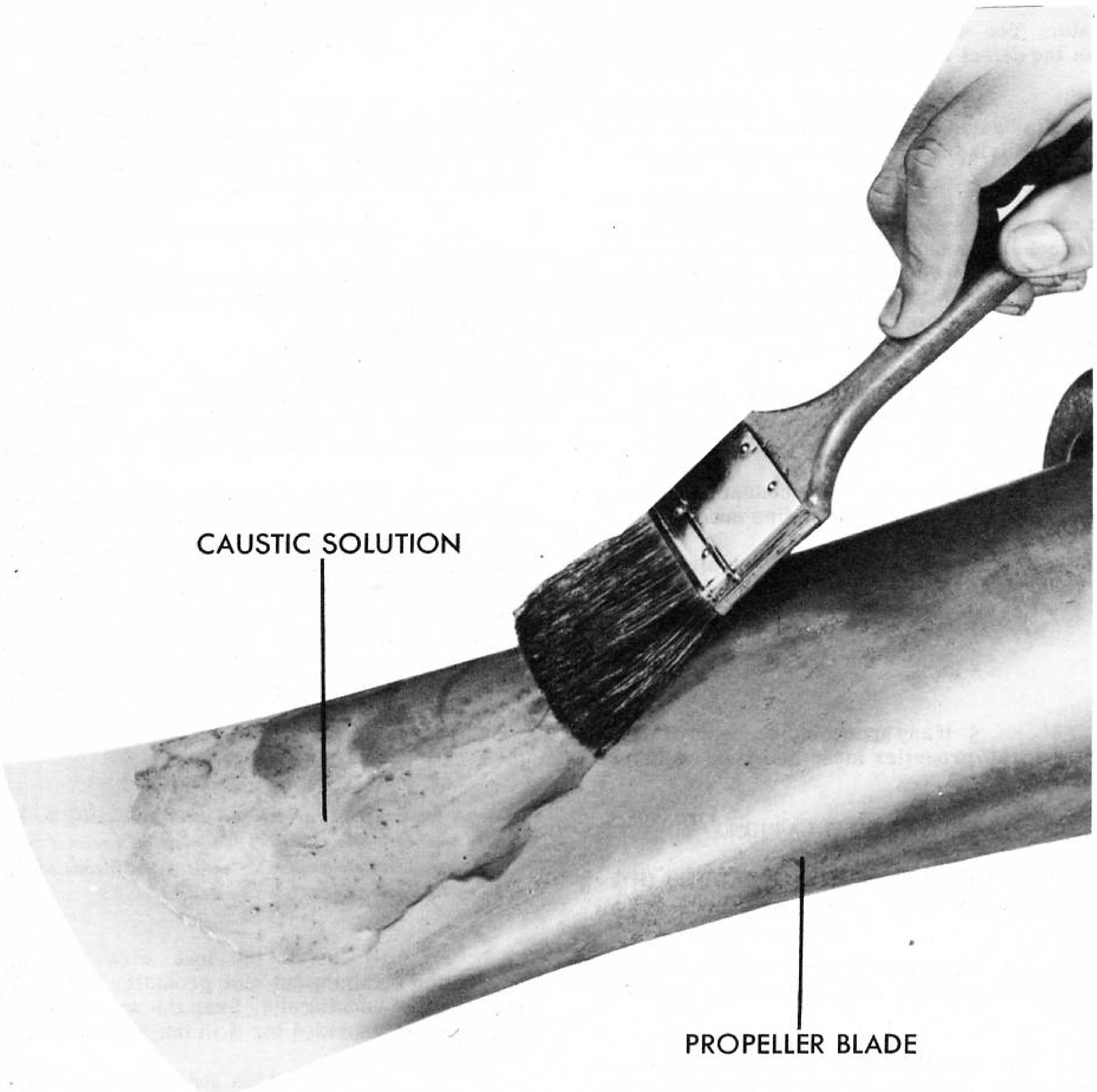


Figure 119 - ETCHING PROPELLER

(e) REMOVAL OF CLEANING SUBSTANCES. - All cleaning substances must be entirely removed after use. Dry all surfaces and coat with oil.

(f) REMOVAL OF SALT. - As soon as possible after being subjected to salt water, flush off all traces of salt from the propeller, and coat with oil.

(g) LOCAL ETCHING. (See figure 124.)

1 PURPOSE. - Local etching is employed for the following purposes:

a. To determine whether visible lines are cracks or merely scratches.

b. To determine, with a minimum removal of metal, when shallow cracks and doubled-back edges of metal have been fully removed.

c. To provide a simple means of accomplishing this work without removing or disassembling the propeller.

2 PREPARATION OF CAUSTIC. - Caustic solution is prepared locally by adding to one gallon of water one pound of commercial caustic soda.

3 PROCEDURE.

a. Clean the area to be etched with emery cloth. Apply caustic solution with a brush or swab.

b. After the area is well darkened, wipe it off with a clean cloth dampened with clean water. Too much water may remove the solution from the defect and spoil the check.

c. Presence of a crack or defect will be indicated by a black line or mark. Small bubbles may be visible through a magnifying glass.

d. Several applications of the solution may be necessary to determine when all the shallow cracks and doubled-back edges of metal have been removed. Upon completion of the final check, remove all caustic with nitric acid solution of one part nitric acid to five parts water. Remove the acid with water. Coat the area with oil.

(h) PROPELLER BLADE REPAIR. - Remove small cracks, cuts, scars, scratches, etc., from blades as follows:

1 Remove the necessary amount of metal with suitable emery cloth or fine cut files.

2 Check with local etching at intervals to avoid dressing of excessive amounts of metal.

3 Finish surface with No. 00 emery cloth.

4 If any appreciable amount of metal was removed, the propeller must be balanced before it is used.

e. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF PROPELLER GOVERNOR. (See figure 117.)

(a) Place the governor in position on the engine nose case, making sure the correct gasket is used.

(b) Install the four castellated stud nuts which secure the governor to the engine and tighten evenly.

(c) Connect the control cable to the governor.

(d) Connect the feathering oil line to the governor.

(e) Connect the electric cable to the governor at the Cannon plug.

(2) INSTALLATION OF PROPELLER. (See figures 115 and 116.)

(a) Coat engine shaft and front cone with engine oil. Protect the shaft threads from damage.

(b) Install the propeller hub and blade assembly on the propeller shaft. Install spider and shaft ring, oil seal, and expander. Slide the propeller back only far enough at first to engage the threads of the propeller retaining nut with the threads of the shaft.

(c) Assemble front cone around retaining nut.

(d) Start the propeller retaining nut on by hand. Tighten nut, applying 180 pounds at the end of three-foot bar (four foot radius). Align a slot in the nut with a hole in the shaft.

(e) Install snap ring.

(f) Check to be sure the 1/32-inch copper gasket is in place against the adapter flange inside the propeller shaft.

(g) Check the valve housing oil transfer plate on the base of the distributor valve assembly to be sure that it is in its proper place, with the 1/32-inch copper gasket between it and the valve housing.

(h) Oil the threads of the valve assembly. Screw it into the shaft and tighten it, applying approximately 100 pounds at the end of a one-foot bar. While maintaining this force on the wrench, strike the bar near the wrench one light blow with a hammer weighing not over 2-1/2 pounds. If a locking slot in the valve housing is not aligned with the hole in the propeller shaft and the slot in the nut, repeat this tightening operation until the slots and holes are in alignment.

CAUTION

Never back off the valve housing, even slightly, to obtain slot and hole alinement. If alinement cannot be obtained, use a new gasket or reduce the thickness of the original gasket by lapping it.

(i) Install the lock wire with the pin through the retaining nut slot, propeller shaft hole and into the valve housing slot. Snap the wire into position in the groove provided for it in the retaining nut.

(j) Check high and low angle settings in dome, and turn the cam to high angle position against the stop.

(k) Turn blades to feathered position against stops in barrel supports.

(l) Align arrow by the dowel on the propeller with arrow by dowel hole on dome.

(m) Install the propeller dome, making sure seal is in place.

(n) Tighten dome retaining nut, applying a torque of 720 foot-pounds (180 pounds at 4 foot radius).

(o) Install dome retaining lock screw and safety with a 1/16-inch by 1/2-inch steel cotter pin.

(p) Install dome plug and safety.

(q) Unfeather propeller, using blade paddles, and check installation to make sure that all three blades are at the same angle.

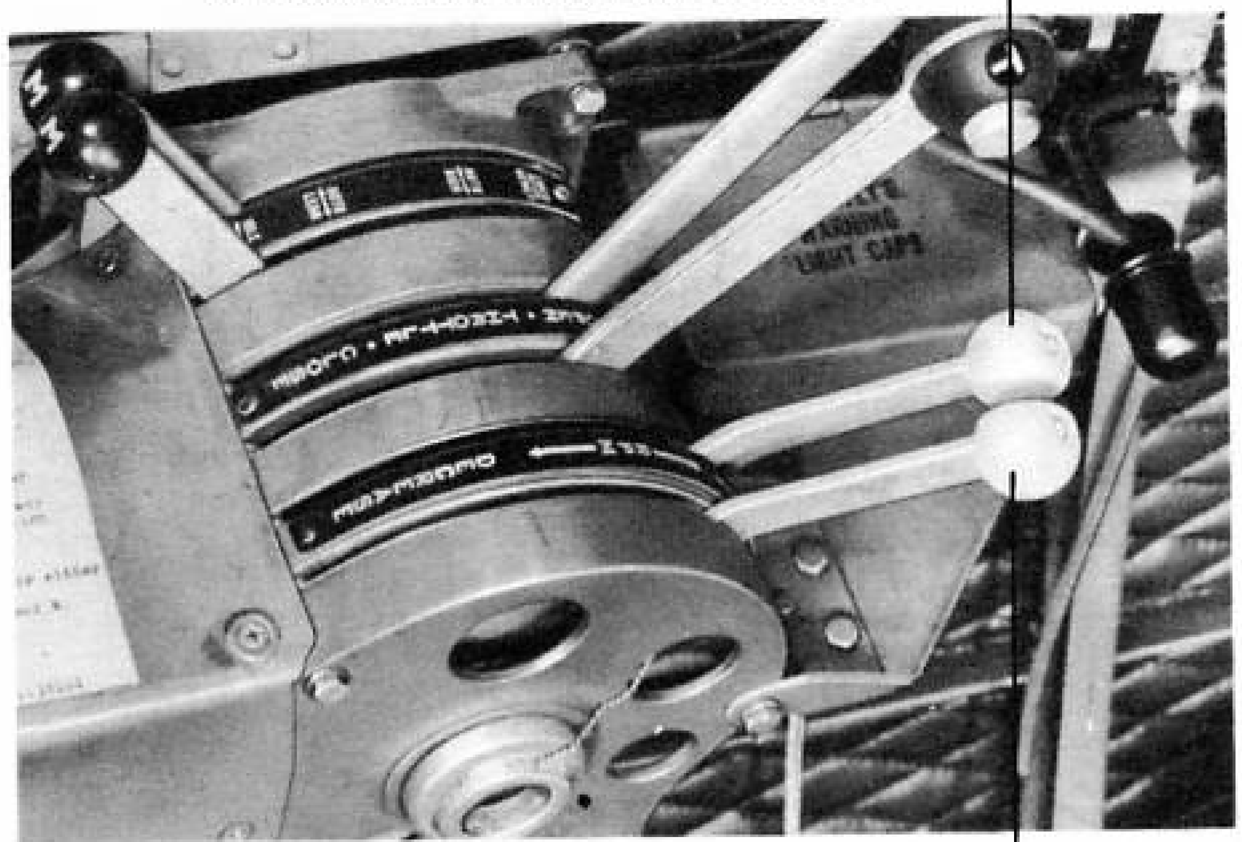


Figure 120 - PROPELLER PITCH CONTROLS

f. FINAL TEST AND ADJUSTMENT AFTER INSTALLATION.

NOTE

Governors will be set for take-off rpm on a governor test stand if available before installation. If it is necessary to make adjustments on the airplane, the following procedure will be used:

(1) TRIAL SETTING OF PROPELLER GOVERNOR. For the trial setting, place the cockpit lever approximately 1/8 inch from the forward end of its full travel. Turn the pulley attached to the governor control shaft in a clockwise direction until the rack bottoms in the cover. Rotate the control shaft counterclockwise approximately 90 degrees. With the control shaft held in this position, connect the linkage between the cockpit control lever and the governor. This setting should give approximately the take-off rpm and permit sufficient movement of the cockpit control lever to obtain minimum rpm.

(2) GROUND-TEST OF PROPELLER GOVERNOR.

(a) If, with the cockpit control full forward, more than take-off rpm is obtained at run-up, the propeller is in full low pitch and the constant-speed control is set to govern at higher than take-off rpm. To correctly adjust the linkage system between the cockpit lever and the constant-speed unit, follow the procedure outlined below:

1 Pull the cockpit lever slowly back until the tachometer indicates a drop in rpm. At this point, the governor is set to govern at the indicated rpm. Move the cockpit lever so the tachometer reads take-off rpm and shut down the engine. Without disturbing the cockpit lever, regulate the adjustable stop at the constant speed unit to limit the rotation of the control shaft to this exact angular position, shifting the stop in the pulley holes, if necessary.

2 Readjust the linkage system so that the cockpit lever is approximately 1/8 inch of its full forward position when the governor pulley is held against the adjustable stop.

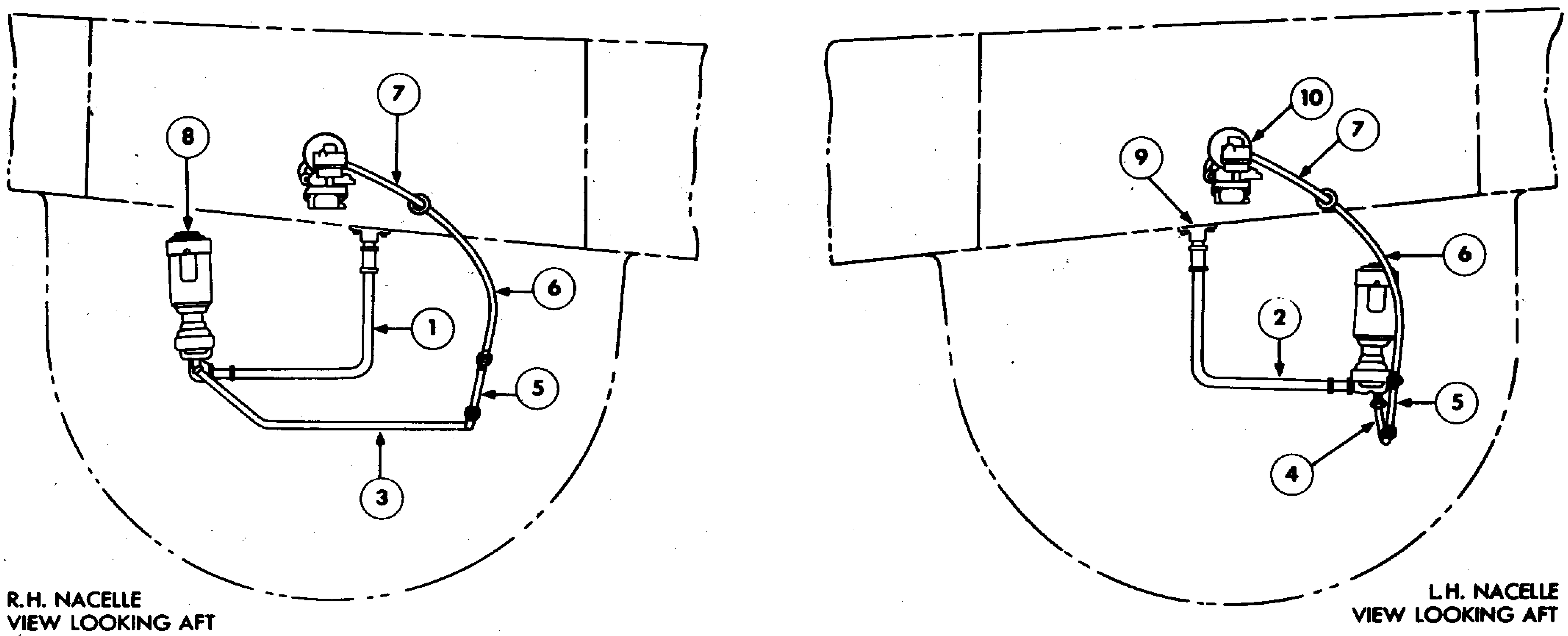
(b) If, with the cockpit control full forward (see figure 120), the take-off rpm is not obtained at run-up, vary the manifold pressure slightly.

1 If the rpm remains constant, the governor setting is too low. The stop on the governor, the control linkage on both, must be readjusted to permit the pulley to rotate further in a counterclockwise direction until take-off rpm is obtained. Adjust as required until at take-off rpm the pin in the governor pulley is against the stop screw and the cockpit control is approximately 1/8 inch from the full forward position.

2 If the rpm varies as the manifold pressure is changed, the blades are against the low pitch stop and are not being controlled by the governor. Check the low angle setting of the blades. Loss of engine power can also cause this condition.

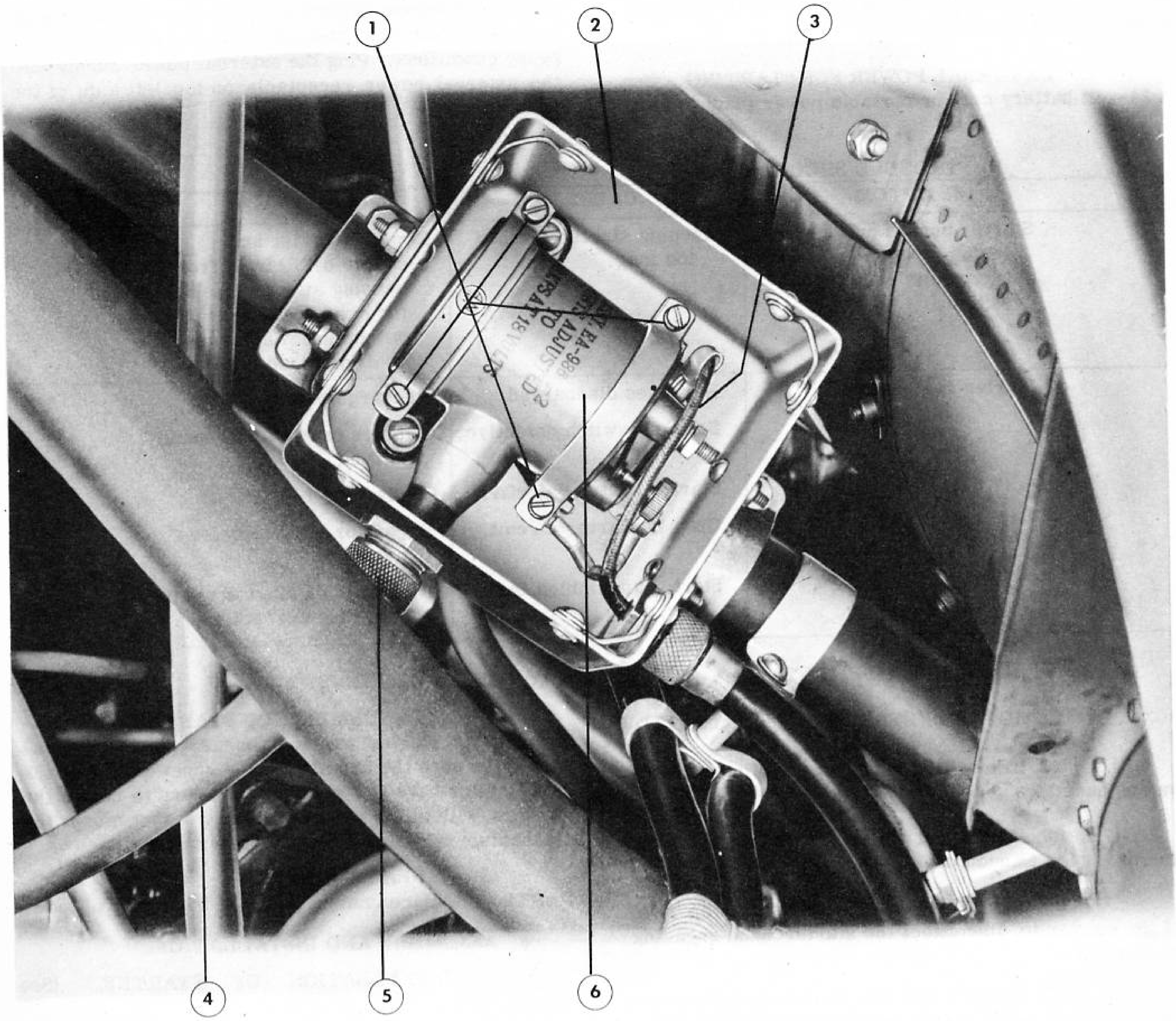
CAUTION

No attempt will be made to correct this condition by readjusting the governor as this may lead to overspeeding in flight.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
		FLUID SUPPLY LINES	
1.	4092464-10	OIL TANK HOPPER OUTLET SUMP ASSEMBLY TO PROPELLER FEATHERING SYSTEM OIL PUMP—R.H.	1
	AAF-835-16	NIPPLE, HOSE	2
	AAF-895-5	ELBOW, STREET	1
	14 WITTEK G.T.	CLAMP	4
	AAF-895-B74	PLUG	1
2.	4092464-9	OIL TANK HOPPER OUTLET SUMP ASSEMBLY TO PROPELLER FEATHERING SYSTEM OIL PUMP—L.H.	1
	AAF-835-16	NIPPLE, HOSE	1
	AAF-850-16-90°	ELBOW, HOSE	1
	AAF-884-16-11	HOSE	2
	42A11615	CLAMP	4
	AAF-895-B74	PLUG	1
		PRESSURE LINES	
3.	4092464-3	PROPELLER FEATHERING SYSTEM OIL PUMP TO PROPELLER FEATHERING SYSTEM HOSE —R.H.	1
	AAF-895-86	BUSHING	1
	AAF-811-CT45°-10NS	ELBOW	1
4.	4092464-4	PROPELLER FEATHERING SYSTEM OIL PUMP TO PROPELLER FEATHERING SYSTEM HOSE —L.H.	1
	AAF-895-86	BUSHING	1
	AAF-811-CT45°-10NS	ELBOW	1
5.	2086069-4	HOSE, PROPELLER FEATHERING SYSTEM	1
	275765	NUT, CHECK	1
	1106195	BRACKET	1
	AN960-1416	WASHER	1
	AN3-10A	BOLT	2
	AAF-365-1032	NUT	2
	AN960-10	WASHER	4
6.	4092464-8	PROPELLER FEATHERING SYSTEM HOSE TO FIRE SEAL	1
	2031701-10-18SS	CONNECTOR	1
	1031662-10SS	NUT	1
	AN960-1416	WASHER	1
	755-10-2-8	CLIP, ADEL	1
	AN520-10-10	SCREW	1
	AAF-365-1032	NUT	1
	143908-028S104-063	WASHER	1
	AN960D-10	WASHER	1
	AN960-10	WASHER	1
7.	4092464-12	FIRE SEAL TO PROPELLER FEATHERING SYSTEM GOVERNOR	1
	AAF-811-CT45-10NS	ELBOW	1
	1044085	CLIP	1
	2109287	BRACKET	1
	AN520-10-10	SCREW	1
	AAF-365-1032	NUT	1
	AN960-10	WASHER	2
8.	280BH	PUMP, PROPELLER FEATHERING SYSTEM OIL	1
	2064935	CLAMP, PUMP	1
	1066114	BASE, PUMP CLAMP	1
	1687510-10-16	SCREW	2
	AAF-365-1032	NUT	2
	AN76-17A	BOLT	4
	AN960-10	WASHER	2
9.	5171315	SUMP ASSEMBLY, OIL TANK HOPPER OUTLET—L.H.	1
	5171315-1	SUMP ASSEMBLY, OIL TANK HOPPER OUTLET—R.H.	1
	2067251	GASKET	1
	AC365-428	NUT	16
	4106687	FITTING, OIL TANK OUTLET ADAPTER	1
	1066875	GASKET	1
	AC365-428	NUT	6
	1066943	BAR	1
	AN43-7	EYEBOLT	2
	AN393-25	PIN	2
	AN960-10	WASHER	2
	AN310-4	NUT	2
	AN-960-416	WASHER	2
	2106959	RING, TANK RETAINER	1
	AN505-10-26	SCREW	16
	2067263	COVER, OIL TANK SUMP	1
	1066876	GASKET	1
	AN770-1	COCK, DRAIN	1
10.	4G8-15D	GOVERNOR, HAMILTON STANDARD PROPELLER FEATHERING SYSTEM	1

Figure 121 - PROPELLER FEATHERING SYSTEM



1. BOOSTER COIL MOUNTING SCREWS
2. JUNCTION BOX
3. PRIMARY CIRCUIT WIRE
4. HIGH TENSION CABLE
5. HIGH TENSION CABLE LOCK NUT
6. BOOSTER COIL

Figure 122 - BOOSTER COIL

11. STARTING SYSTEM.

a. DESCRIPTION.

(1) STARTERS. (See figure 123.) - Each engine is equipped with a type JH-5AD combination electric inertia and direct cranking starter. The starters are mounted on the center of the accessory sections of the engines. Energizing and meshing switches in the pilot's electrical panel operate the starters. A crank is furnished for manual operation.

(2) BOOSTER COILS. (See figure 122.) - Each engine is equipped with a booster coil mounted in a shielded case. Flexible conduit is provided to shield the leads from the case to one of the magnetos. The coils are controlled through the engine starter meshing

switches. Function of the coils is to intensify the spark while starting the engine.

(3) EXTERNAL POWER FOR STARTING. - Use a 24-volt battery cart or portable power plant to start engines whenever possible. This will aid in keeping batteries charged at take-off and adequate for emergency conditions. Plug the external power supply into the external power receptacle on the left side of the nose wheel well.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Starter burned out due to fusing together of contact points on solenoid switch.	Keeping starter meshed too long.	Replace starter and solenoid. Refrain from keeping starter meshed for over 45 seconds without allowing it to cool for three minutes.
Starter inoperative.	Batteries discharged.	Recharge battery.
	Solenoid switch defective.	Replace or repair solenoid switch.
	Starter switch defective.	Replace or repair switch.
	Open in starter circuit.	Repair or replace defective part.
	Starter assembled incorrectly.	Disassemble starter and assemble correctly.

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF STARTER. (See figure 123.)

(a) Remove the accessory cowling from the engine nacelle.

(b) Disconnect the starter cables from the starter at the Cannon plug.

(c) Remove the clevis pin on the top rear of the starter to disconnect the starter hand engaging mechanism.

(d) Remove the six starter-flange-to-accessory-case palnuts, stud nuts and flat washers. Use starter wrench Douglas, S65-14853-2GTX.

(e) Lift starter and gasket from accessory case.

(2) REMOVAL OF BOOSTER COIL. (See figure 122.)

(a) Screw the high tension cable locking nut from the booster coil junction box. Pull the high tension cable from the booster coil.

(b) Remove the four booster coil mounting screws and remove the booster coil from the junction box.

(c) Disconnect the primary circuit wire from the booster coil.

d. REPLACEMENTS.

(1) REPLACEMENT OF STARTER PARTS. - Replace the starter motor if burned out. Upon assembly be sure the two slotted cap screws on the back of the motor have flat washers. Failure to install the washers will allow the screws to press against the mechanism of the starter and cause failure.

(2) REPLACEMENT OF BOOSTER COIL PARTS. - Replace contact points if burned or pitted.

e. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF STARTER. (See figure 123.)

(a) Place the starter gasket in position on the studs in the accessory case.

(b) Turn the starter so the hand engaging mechanism is on top center. Place the starter in position upon the studs in the accessory case.

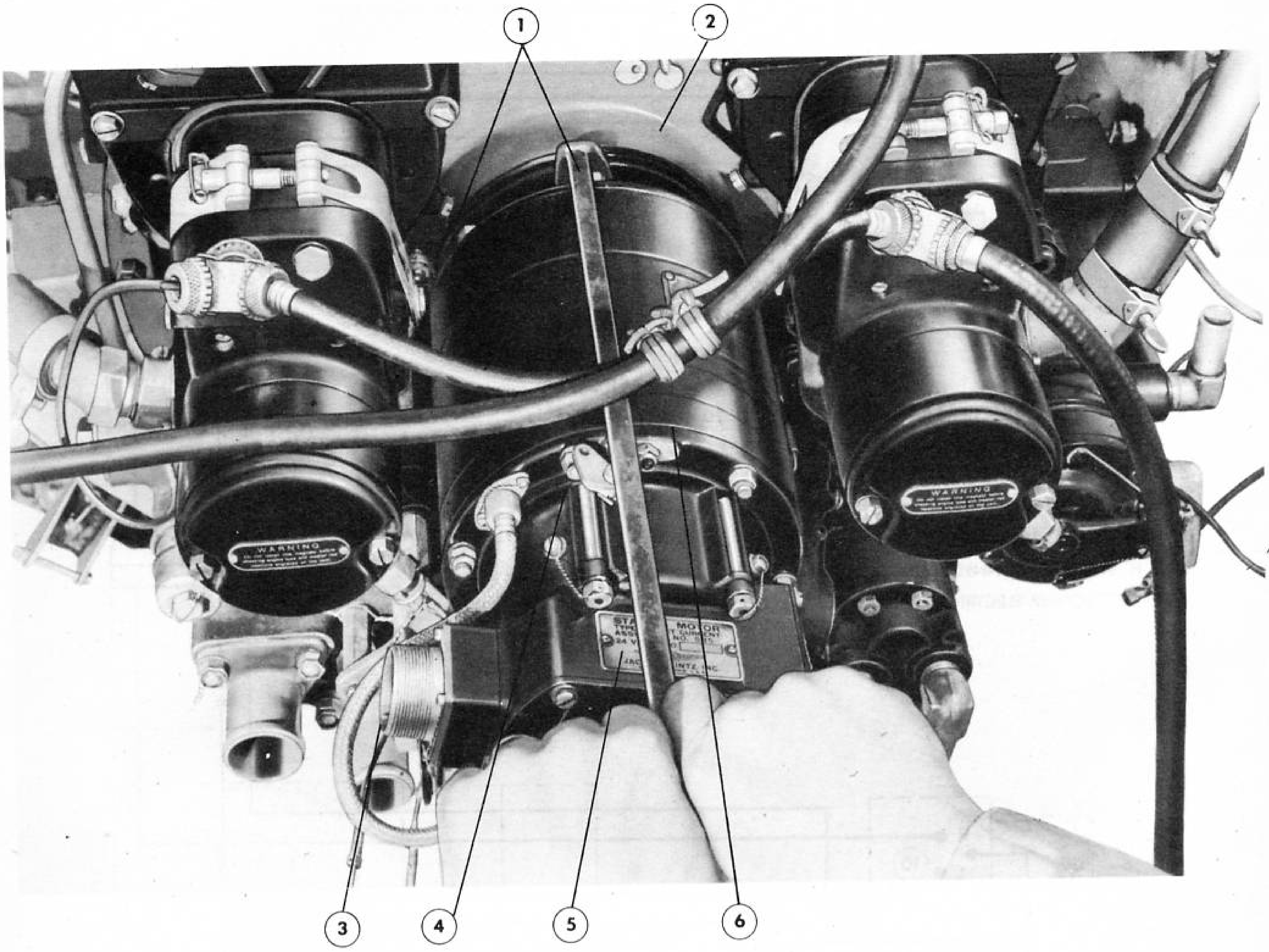
(c) Install the six starter-flange-to-accessory-case flat washers, stud nuts and palnuts.

(d) Connect the starter hand engaging mechanism.

(e) Connect the Cannon plug.

(f) Test the operation of the starter with the battery and with the hand crank.

(g) Install the accessory cowling.



1. STARTER FLANGE TO ACCESSORY CASE STUD NUT
2. ACCESSORY CASE
3. CANNON PLUG SOCKET
4. STARTER HAND ENGAGING MECHANISM
5. STARTER WRENCH —S65-14853-2GTX
6. STARTER

Figure 123 - REMOVING STARTER

(2) INSTALLATION OF BOOSTER COIL. (See figure 122.)

(a) Connect primary circuit coil wire to the terminal on the booster coil.

(b) Place the booster coil in the junction box so the receptacle for the high tension cable is alined with the opening for the high tension cable in the junction box.

(c) Install the four booster coil mounting screws.

(d) Insert the high tension cable into its receptacle in the booster coil and screw the high tension cable locking nut onto the boss in the junction box.

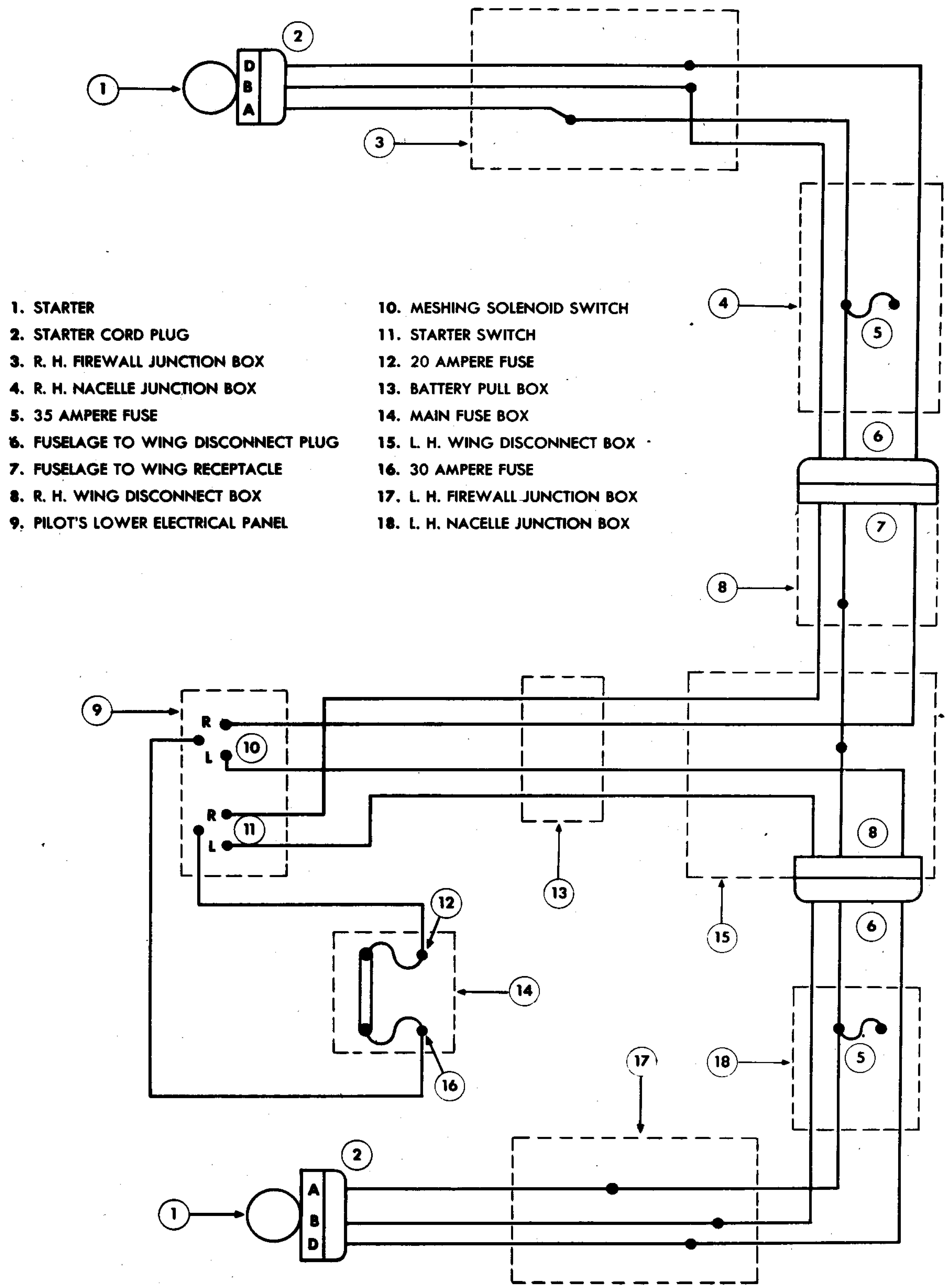


Figure 124 - STARTER CIRCUIT

1. FILLER CAP OVERFLOW
2. TANK TOP VENT
3. FILLER CAP
4. HOPPER
5. SUPPLY TANK
6. VENT
7. DIVIDED CHANNEL STANDPIPE
8. SUMP ADAPTER
9. OIL SEPARATOR
10. LINE TO ATMOSPHERE
11. VACUUM PUMP
12. SUCTION RELIEF VALVE
13. FLAPPER VALVE
14. TURN AND BANK RELIEF VALVE
15. SUCTION GAUGE
16. OIL PRESSURE GAUGE
17. OIL TEMPERATURE GAUGE
18. PROP FEATHERING GOVERNOR
19. GYRO-COMPASS
20. TURN AND BANK INDICATOR
21. ARTIFICIAL HORIZON
22. MASTER RELIEF VALVE
23. FILLER CAP OVERFLOW
24. ELECTRIC MOTOR PROP FEATHERING PUMP
25. "Y" DRAIN
26. OIL TEMPERATURE BULB
27. OIL DILUTION SOLENOID VALVE
28. LINE FROM CARBURETOR
29. OIL PRESSURE LINE
30. OVERFLOW TO ENGINE SUMP
31. VISCOSITY VALVE REGULATING SCREW
32. VISCOSITY VALVE
33. SHUTTER
34. OIL COOLER
35. SUMP PLUG
36. COOLING TUBES
37. PRESSURE REGULATING SCREW
38. ENGINE OIL PUMP
39. SCAVENGER LINE TO ENGINE SUMP

NOTE:
PART NUMBERS ARE GIVEN IN THE LEGEND FOR FIGURE 137

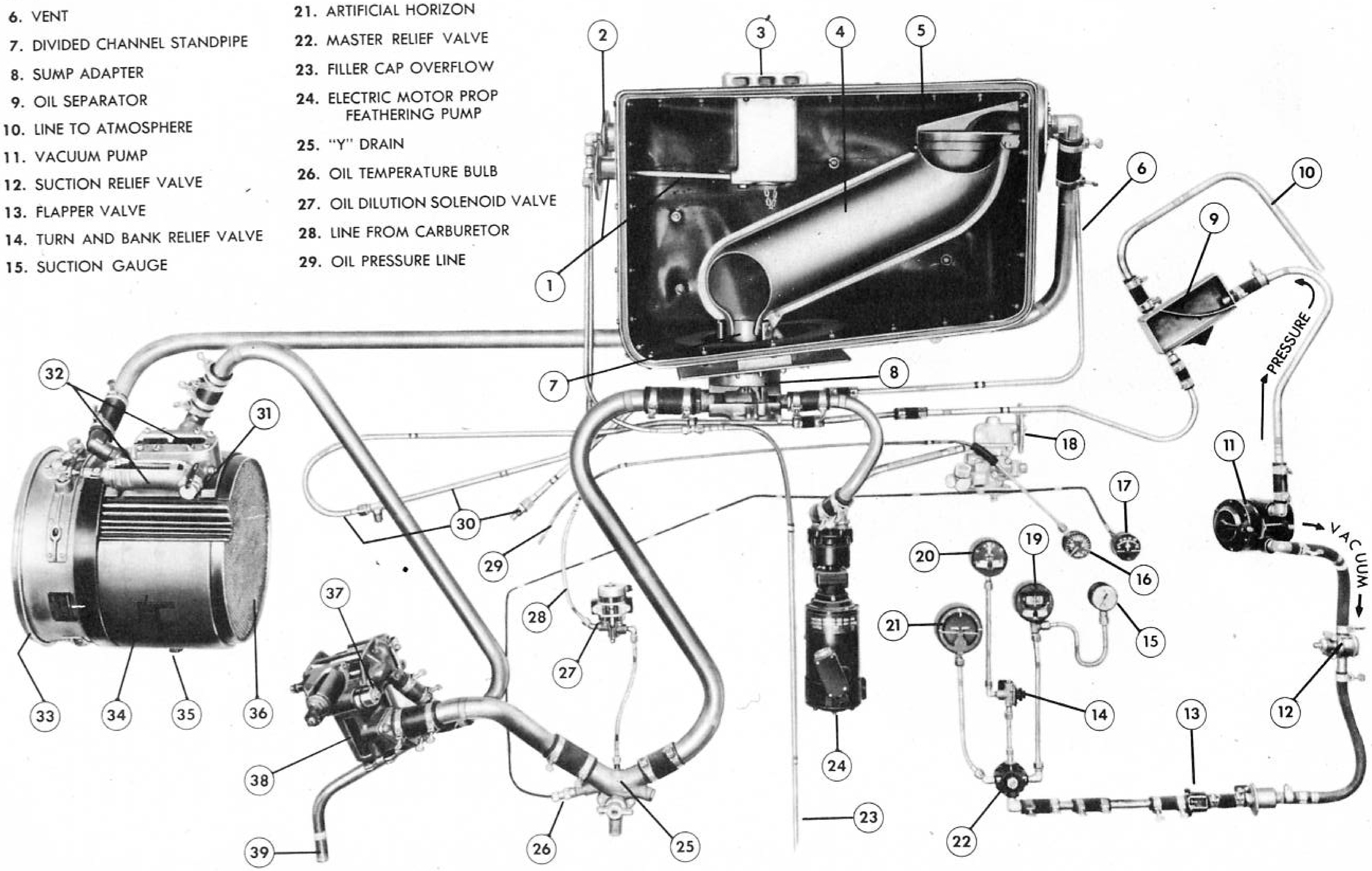
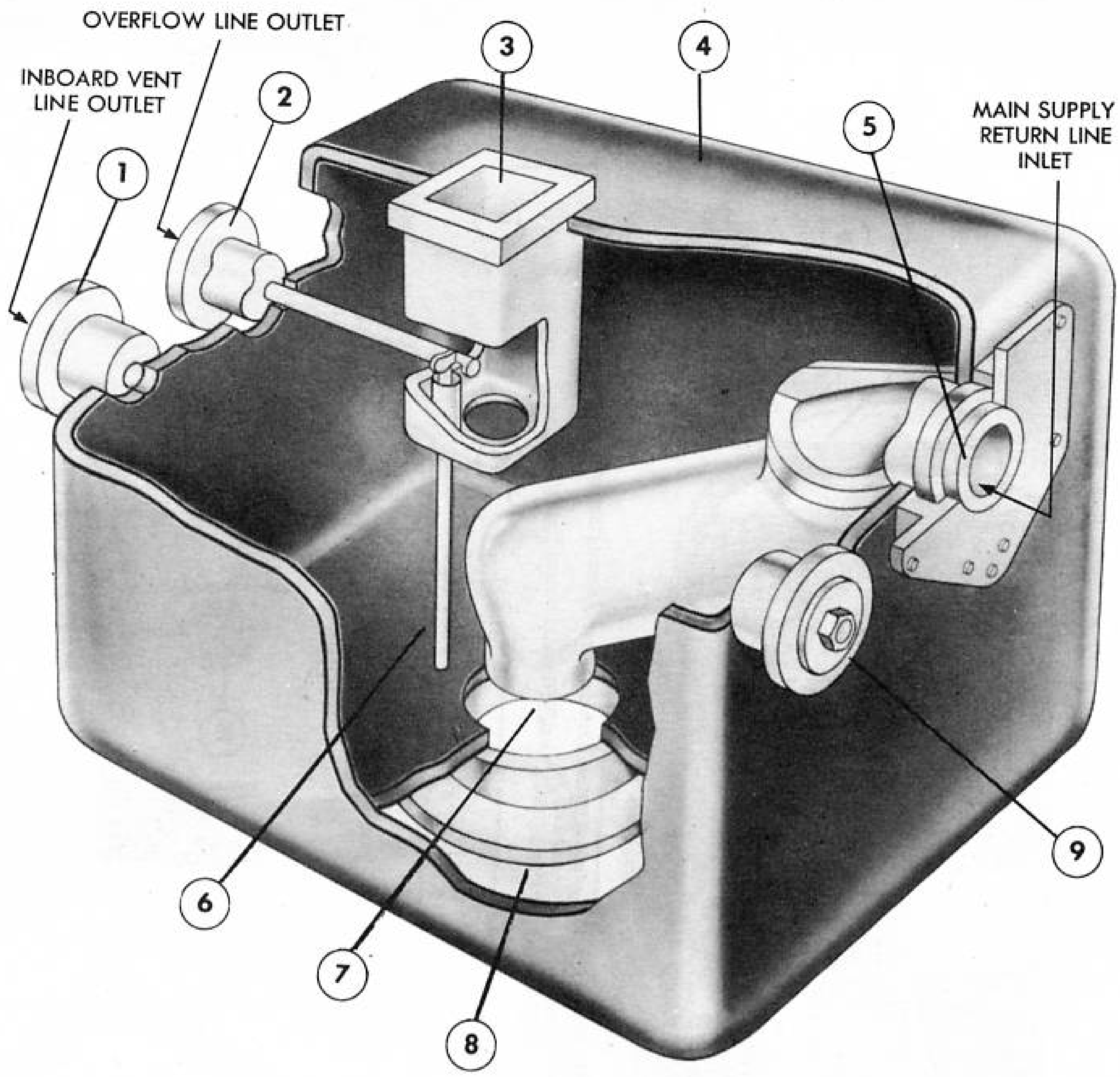


Figure 125 - OIL SYSTEM MOCK-UP



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2106957	OUTLET, OIL TANK VENT STATION 59.72—L.H. & R.H.	1
	1106953	GASKET, OIL TANK VENT—L.H. & R.H.	1
2.	2109523-6	TUBE ASSEMBLY, FILLER CAP OVERFLOW—L.H. & R.H.	1
	AC811T6D	SLEEVE—L.H. & R.H.	1
	AC811ET6D	ELBOW—L.H. & R.H.	1
3.	5106684	FILLER ASSEMBLY, OIL TANK—L.H.	1
	5106684-1	FILLER ASSEMBLY, OIL TANK—R.H.	1
	AN505-10-24	SCREW—L.H. & R.H.	12
	42B3581	CAP ASSEMBLY, FILLER—L.H. & R.H.	1
4.	5174352	CONTAINER ASSEMBLY, OIL—L.H.	1
	51174352-1	CONTAINER ASSEMBLY, OIL—R.H.	1
5.	5106685	SUPPORT RETURN NECK AND HOPPER—L.H. & R.H.	1
	1106952	GASKET, OIL TANK INLET FITTING—L.H. & R.H.	1
	AC365-428	NUT—L.H. & R.H.	8
6.	2109298	STICK ASSEMBLY, OIL GAUGE MEASURING—L. H. & R.H.	1
	2109299	TUBE ASSEMBLY, OIL GAUGE—L.H. & R.H.	1
7.	5109133	HOPPER ASSEMBLY, OIL TANK—L.H. & R.H.	1
	2135563	SUPPORT, HOPPER OIL TANK HINGE—L.H. & R.H.	1
	2135563-1	SUPPORT, HOPPER OIL TANK HINGE—L.H. & R.H.	1
	2133073	HINGE ASSEMBLY, OIL TANK HOPPER SUPPORT—L.H. & R.H.	1
	1029679P8-10	SCREW—L.H. & R.H.	2
	1029679P8-9	SCREW—L.H. & R.H.	2
	AC365-832	NUT—L.H. & R.H.	4
	AN960-A8	WASHER—L.H. & R.H.	4
	AN3-5A	BOLT—L.H. & R.H.	1
	AC365-1032	NUT—L.H. & R.H.	1
	AN960-D10	WASHER—L.H. & R.H.	1
8.	5171315	SUMP ASSEMBLY, OIL TANK HOPPER OUTLET—L.H.	1
	5171315-1	SUMP ASSEMBLY, OIL TANK HOPPER OUTLET—R.H.	1
	2067251	GASKET, OIL TANK SUMP—L.H. & R.H.	1
	AC365-428	NUT—L.H. & R.H.	16
	4106687	FITTING, OIL TANK OUTLET ADAPTER—L.H. & R.H.	1
	1066875	GASKET, OIL TANK OUTLET ADAPTER—L.H. & R.H.	1
	AC365-428	NUT—L.H. & R.H.	6
	1066943	CLAMP, OIL TANK SUMP COVER—L.H. & R.H.	1
	AN43-7	EYEBOLT—L.H. & R.H.	2
	AN393-25	PIN—L.H. & R.H.	2
	AN960-10	WASHER—L.H. & R.H.	2
	AN310-4	NUT—L.H. & R.H.	2
	AN960-416	WASHER—L.H. & R.H.	2
	2067263	COVER, OIL TANK SUMP—L.H. & R.H.	1
	1066876	GASKET, OIL TANK SUMP COVER—L.H. & R.H.	1
	AN770-1	COCK, DRAIN—L.H. & R.H.	1
9.	2106958	OUTLET, OIL TANK VENT STATION 89.80—L.H. & R.H.	1
	1106953	GASKET, OIL TANK VENT—L.H. & R.H.	1

Figure 126 - OIL SUPPLY CONTAINER

12. OIL SYSTEM.

a. DESCRIPTION.

(1) GENERAL. (See figures 125 and 137.) - Each engine and its propeller has an independent pressure feed oil system. Two oil supply containers are located in the inner wings forward of the main spar on the center line of the nacelle. Filling, removal, and installation of the oil supply containers are accomplished through access doors and cover plates on the upper wing surface. Supply lines to the engine pump and to the propeller feathering pump lead from a sump adapter which is attached to the bottom of the oil supply container. The sump adapter protrudes beneath the wing and is accessible forward of the fire wall. The oil container filler cap is so constructed that it regulates the ratio of oil supply to air space. A baffled hopper reduces oil foaming and minimizes the turbulence of flow. The hopper also vents air in oil returning from the engine. Pressures set up in the oil container by the foaming of return oil, or by volatilized gases due to oil dilution or burned oil are released by vent lines. Vents lead from both the inboard and outboard upper walls of the supply container to the engine, and assure venting while the oil container is inclined. Excess of oil in the filler neck overflows by line to atmosphere. An engine pump supplies oil under pressure to each engine, and filters and returns the oil through the cooler to the supply container. An oil temperature regulator, referred to as the oil cooler, is mounted in each nacelle, inboard. An electrically driven pump supplies oil at proper pressures directly from the supply container to a propeller feathering governor. For cold starts a solenoid operated valve controls injection of gasoline into the oil at the "Y" drain leading to the engine supply.

(2) OIL CONTAINERS. (See figure 126.) - Containers are of the self-sealing type. Each is attached to the inner wing structure at six points and has a capacity of 23 U.S. gallons (19 Imperial gallons) oil supply and about three gallons foaming space. Use only AAF Specification AN-VV-O-446a, grade 1120, oil. Access to the filler cap for filling and checking oil is made through hinged access door (E) (figure 19), which is a part of fairing plate (D) (figure 19), located on the upper wing surface. A bayonet type oil gage rests in a tube leading from the filler cap downward into supply container and is removable for inspection through the filler neck. A filler neck overflow line (figures 125 and 126) leads from filler neck through oil container wall and to atmosphere, where it may be identified on the inboard side of the nacelle at frame Station 43 (figure 7). As this line leads horizontally from the lower portion of the filler cap, which itself extends well down into the container, filling of containers above this level is rendered impossible. Therefore, provision is made for air and foaming space and for the release through vents of the gases mixed with oil returning from engine. Oil pressures formed in the engine by burned gases or by oil dilution are relieved by vents from the rear engine case. The vents empty at a point near the trailing edge of the upper cowl flaps. Foaming oil carried over in the vent lines with the gases from the supply container to the engine sump is scavenged and returned to supply by the scavenge side of the engine pump. A hopper (figures 125 and 126) within the container and through which the return oil feeds as it enters oil container, is provided with four baffles which quiet the flow of oil. The hopper also incorporates three vents at its head to release into the air space at top of oil container any gases mixed with the return oil. The head of the hopper is designed so that oil enters the hopper in a manner to avoid foaming. Oil returning from the engine through the cooler unit enters the upper wall of the container directly into the hopper. It flows downward through the baffles and is released into the container supply from an opening in the bottom of the hopper. A standpipe (figure 126) extending upward into the container above the sump, supplies at all times approximately a gallon of oil to the propeller feathering pump. This assures a means of feathering the propeller even in an emergency such as severance of the main oil line leading from oil container supply to the "Y" drain and engine. The oil container may be drained by means of a drain cock at the bottom of the "Y" drain. Before opening cock, attach suitable length of clean hose to catch oil.

(3) SUMP ADAPTER. (See figures 125 and 127.) - A sump casting is assembled to the bottom of the oil container and a sump adapter is attached by six bolts to the casting. The sump adapter will catch and

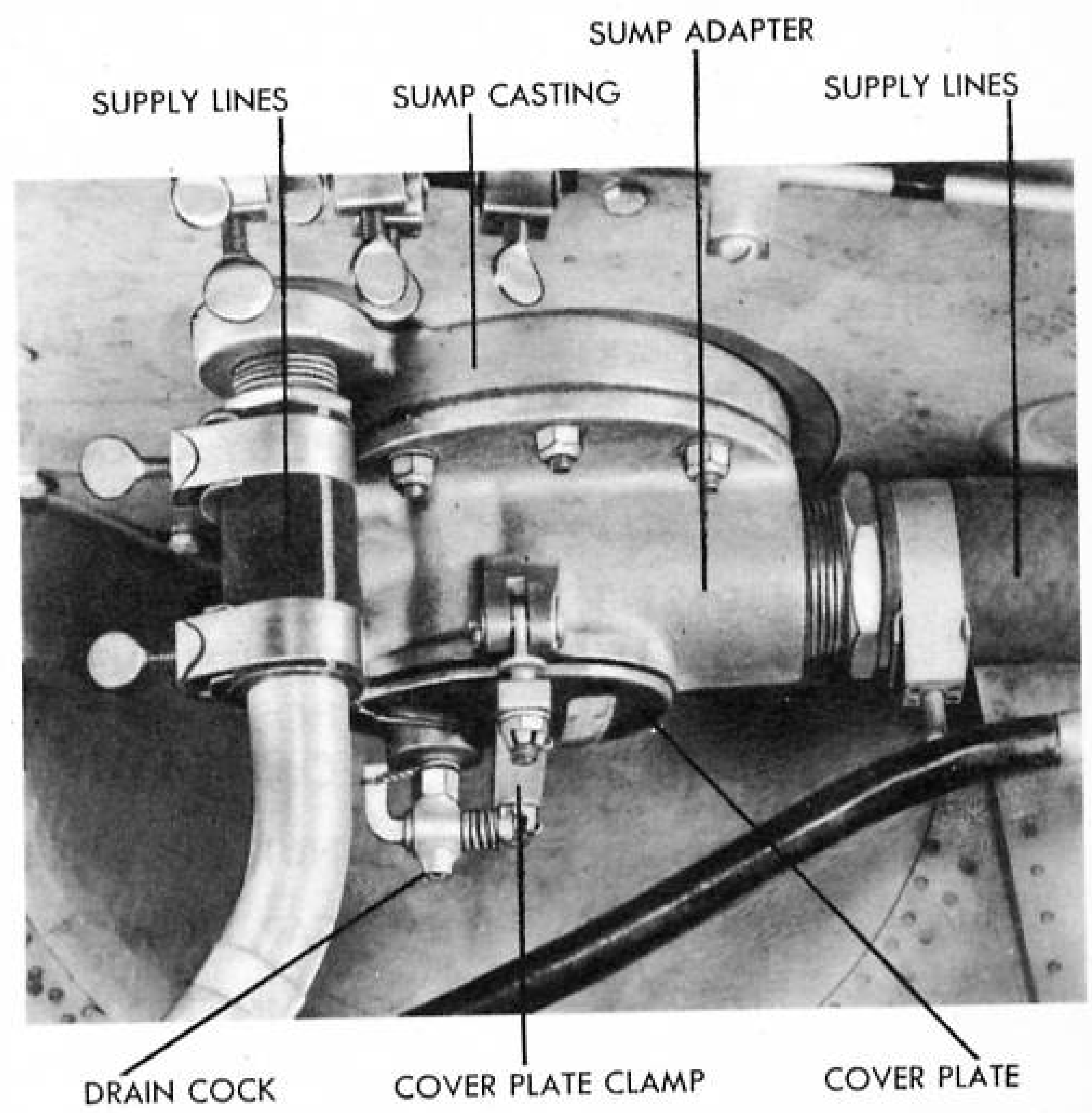
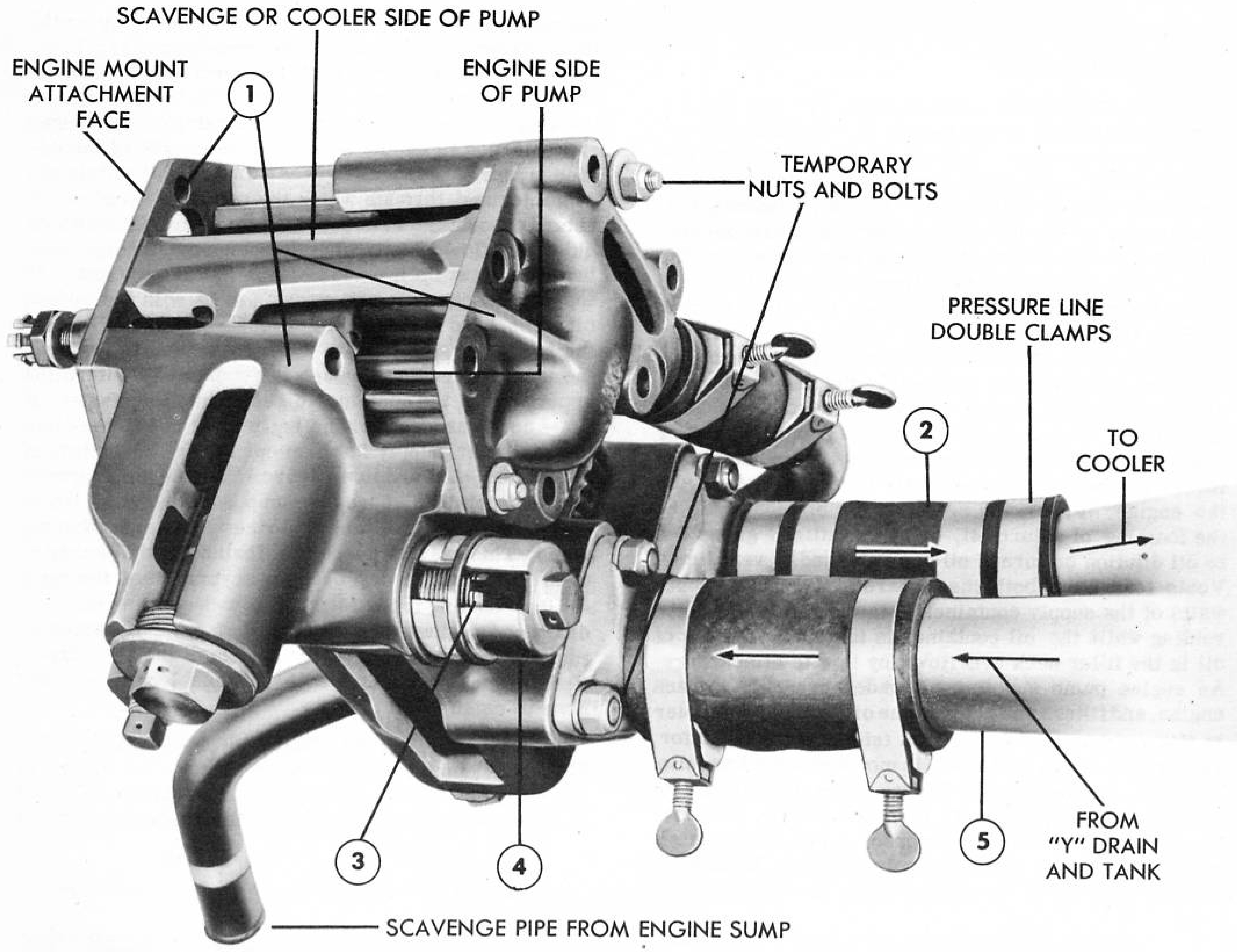
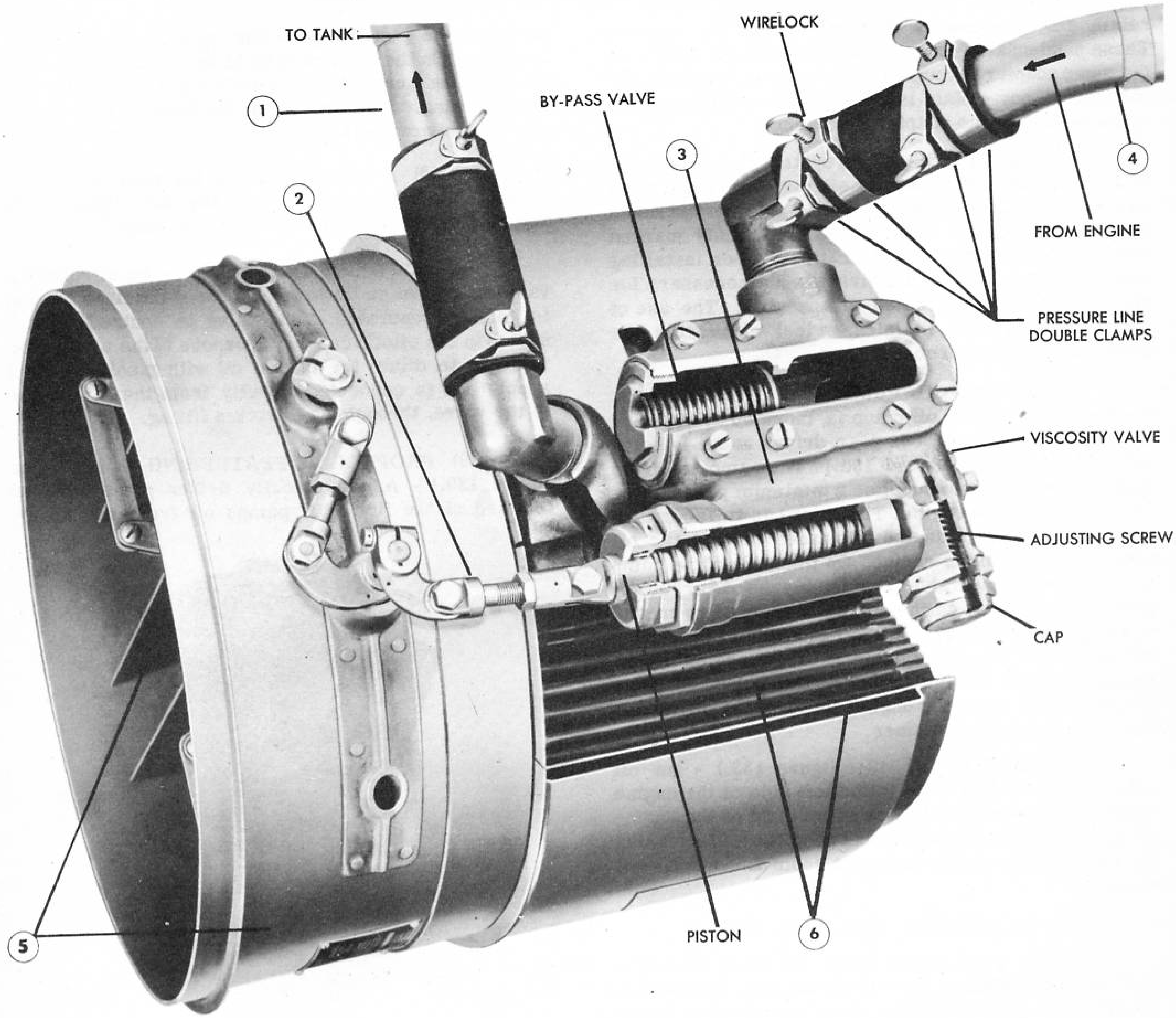


Figure 127 - INSTALLED OIL CONTAINER SUMP ADAPTER



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	414689	BODY ASSEMBLY, OIL PUMP (Includes body, end plate, cover, bushings and studs. Body, end plate and cover not replaceable separately.)	1
2.	5110121-3	RETURN LINE, ENGINE TO FIRE WALL—L.H.	1
	5110121-4	RETURN LINE, ENGINE TO FIRE WALL—R.H.	1
	AC882-20-16	HOSE—L.H. & R.H.	2
	42A 11615	CLAMP, HOSE—L.H. & R.H.	8
3.	65853	NUT, OIL PRESSURE RELIEF VALVE ADJUSTING	1
4.	65852	CAP, OIL PRESSURE RELIEF VALVE	1
5.	5110121-1	MAIN FEED LINES, Y DRAIN TO ENGINE—L.H. & R.H.	1
	AC882-24-14	HOSE—L.H. & R.H.	2
	42A 11615	CLAMP, HOSE—L.H. & R.H.	4

Figure 128 - ENGINE OIL PUMP — CUTAWAY VIEW



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5109969-17	RETURN LINE, COOLER TO HOSE—L.H.	1
	5109970-17	RETURN LINE, COOLER TO HOSE—R.H.	1
	AC882-20-18	HOSE—L.H. & R.H.	2 L.H. 1 R.H.
	42A 11615	CLAMP, HOSE—L.H. & R.H.	8 L.H. 4 R.H.
	A755-20-2-10	CLIP, ADEL—L.H. & R.H.	2
	AN520-10-10	SCREW—L.H.	1
	AC365-1032	NUT—L.H. & R.H.	1
	117425-30-016	SPACER—L.H.	1
	42A 11615	CLAMP, HOSE—R.H.	1
	AN520-10-8	SCREW—R.H.	1
2.	3A-220	CLEVIS	1
	3A-259-1	BOLT, CLEVIS	1
	AN316-6R	NUT, CHECK	1
3.	IC-179	VALVE ASSEMBLY	1
4.	5109969-16	RETURN LINE, FIRE WALL TO COOLER—L.H.	1
	5109970-16	RETURN LINE, FIRE WALL TO COOLER—R.H.	1
	AC853-20	ELBOW, 45° HOSE—L.H.	1
	AC882-20-18	HOSE—L.H. & R.H.	2
	42A 11615	CLAMP, HOSE—L.H. & R.H.	8
	A755-20-2-10	CLIP, ADEL—L.H. & R.H.	1
	117425-30-020	SPACER—L.H.	1
	AN520-10-26	SCREW—L.H.	1
	AN520-10-8	SCREW—R.H.	1
	AC365-1032	NUT—R.H.	1
5.	1E315	SHUTTER ASSEMBLY	1
6.	1E171	OIL COOLER	1

Figure 129 - OIL COOLER – CUTAWAY VIEW

retain any condensates flowing through the system. These condensates can be removed from the bottom of the sump adapter through a drain cock provided for the purpose. A cover plate is held in place over the opening in the bottom of the adapter by clamps.

(4) OIL LINES. - All oil system lines are made from aluminum alloy, except oil pressure gage lines which are made of copper. All have an outer diameter of 1/4 inch to 1-1/2 inch. Lines are plainly marked with a yellow band for identification. When installing new oil lines or making repairs it is not necessary for the lines to be heat-treated or annealed. The use of corrosion-resistant stainless steel eliminates the necessity of either process.

(5) ENGINE OIL PUMP. (See figure 128.) - A double-acting engine oil pump is mounted at the rear of each engine where it is gear driven as an integral unit. (See figures 128 and 132.) The pump is of the meshed gear type and supplies a minimum pressure of 70-75 pounds to the engine. The pump has two actuating sides. On the left side the oil passes through the oil filter, and then to the engine. On this side of the pump a spring regulating valve provides means of varying oil pressure. Tension on the spring is changed by means of an adjusting screw. On the right side of the engine oil pump the scavenge pump is incorporated as an integral part of the entire unit. The scavenge pump forces the oil from the engine through the oil cooler and back to the oil container.

(6) OIL FILTER. (See figure 133.) - An oil filter is attached by bolts to the left side of the engine accessory section and is located forward of the engine oil pump. Engine oil passes between the self-cleaning oil filter disks under pressure from the engine oil pump.

(7) OIL COOLER. (See figure 129.)

(a) Each engine is served by an oil cooler located on the inboard side of the nacelle. Two straps around the cooler and bolts along the forward flange ring attach the unit to the nacelle structure. The oil cooler is composed of three major assemblies, oil cooler, assembly valve, and the shutters.

(b) Of honeycomb tube construction, the cooler serves to dissipate heat from oil flowing through it. A sleeve or muff encloses the radiator assembly. Air flow is provided by a scoop in the nacelle forward of the cooler. On the bottom of the unit is a drain plug. This permits removal of condensates if the cooler becomes clogged.

(c) The combination valve serves two purposes: One side of the valve directs oil flow through the cooler or bypasses it around the outer muff directly to the oil tank. The other side houses a piston which actuates the shutters. Cold oil, too thick to pass through the cooler tubes, applies a back pressure which operates the piston, opens the valve, and closes the shutters. On the inboard side of the viscosity valve is an adjusting screw which controls the tension of the valve spring. It is pre-set at the factory and should not be tampered with.

(d) A flap, located to the rear of the oil cooler, acts as a rear door to the air scoop. It is actuated by cable from the lower cowl flaps.

(8) OIL DILUTION VALVE. - An oil dilution valve is located on the forward side of the fire wall and is solenoid operated. The valve is controlled by a switch in the pilot's cockpit. Purpose of the oil dilution valve is to dilute the engine oil with gasoline. Fuel supply line is connected directly from the carburetor to the valve, through a restricted fitting.

(9) PROPELLER FEATHERING PUMP. (See figure 130.) - An electrically driven pump mounted forward of the fire wall pumps oil from the supply

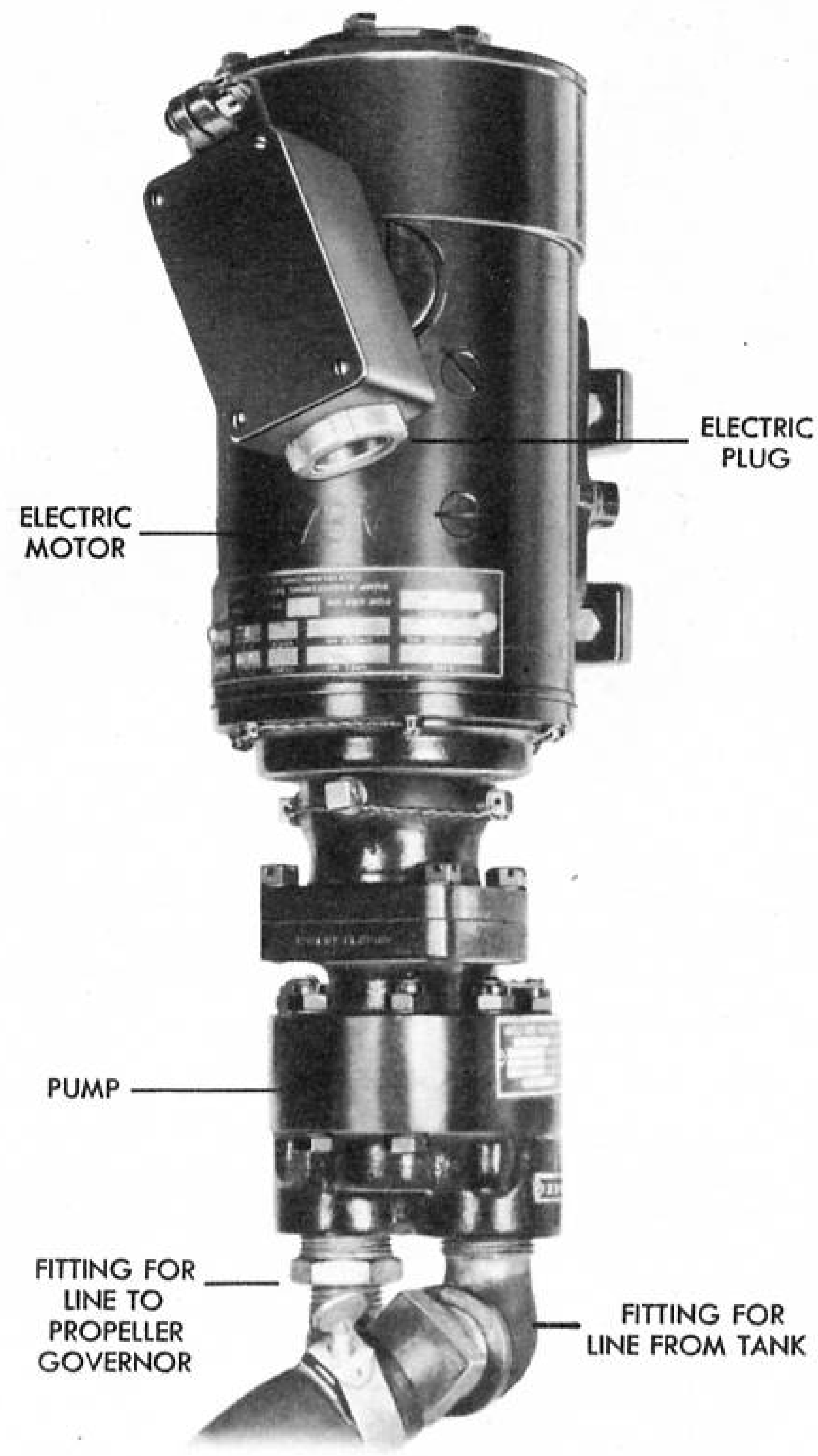


Figure 130 - PROPELLER FEATHERING PUMP

container to the propeller feathering governor. The pump supplies a pressure of up to 500 pounds per square inch to feather the propeller, and a pressure of 600 pounds per square inch to unfeather the propeller. Approximately a gallon of oil is reserved for the operation of the pump by a separate oil stand pipe in the sump beneath the oil containers. Should the main gravity feed line from the supply container to the "Y" drain be damaged, there will remain sufficient oil to feather the propeller.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Low oil pressure.	Lack of priming.	Prime pump, turn engine over by hand until oil is sucked into pump.
	Leak in suction lines.	Check line for leaks and repair.
	Dirt in oil screen.	Remove and clean oil screen.
	Air pocket in relief valve.	Remove and replace relief valve.
	Improper setting of oil pressure relief valve.	Adjust oil pressure relief valve.
	Excessive bearing clearance.	Overhaul engine.
	High oil temperature.	Check oil cooler and shutters. Replace if faulty.
	Low outside temperature, causing oil to congeal.	Operate oil dilution system while running or starting engine.
	Foaming oil supply container.	Fill oil containers.
High oil pressure.	Low outside temperature, causing oil to congeal.	Operate oil dilution system while running or starting engine.
	Improper setting of oil pressure relief valve.	Adjust oil pressure relief valve.
Oil accumulation in crankcase.	Lack of priming in scavenge pump.	Prime scavenge pump. Disconnect main discharge line from the engine and put on a short length of clean hose while turning engine backwards. Feed oil into this hose until a quart or so has been sucked into the pump.
	Dirt in oil screen.	Remove and clean oil screen.
	Stoppage in oil line.	Remove oil and clean lines.
Excessive oil temperature and high oil consumption.	Insufficient oil cooling.	Check oil cooler and oil cooler shutters. Secure adequate air flow to oil cooler.

SYMPTOM	CAUSE	REMEDY
	Dirty oil filter.	Remove oil filter and clean.
	Low oil supply.	Fill oil containers.
	Low grade oil.	Drain oil system and refill with proper grade oil.
	Scavenge pump not operating.	Remove pump and repair or replace.
	Overheated bearings.	Overhaul engine.
	Dirt in oil.	Drain oil system and refill with clean oil.
	Worn piston rings.	Overhaul engine.
	Piston rings incorrectly installed.	Install rings correctly.
	Clogged oil lines, strainers, or coolers.	Drain oil from system. Remove obstruction and refill with clean oil.
	Kinks in core tube of cooler caused by excessive pressure.	Remove cooler and replace defective tube.
Oil leaking from vent line leading from top of oil separator to atmosphere.	Oil trapped in separator.	Remove hose connections. Clean and flush separator.
Lack of oil supply to the propeller feathering pump.	Clogged sump adapter.	Remove clamp plate from bottom of sump adapter and clean adapter.
Fluctuation of the suction gage indicator.	Loss of suction.	Remove and clean suction relief valve.
Oil dilution valve leaks in excess of ten drops per minute into the oil line at Y drain.	Dirt in oil dilution valve.	Remove valve and clean.
	Valve worn.	Replace valve.

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF OIL CONTAINERS. (See figure 131.)

(a) Drain all oil from system.

(b) Remove fairing plate (D), cover plate (H), and cover plates (C) and (J) on the upper wing surface and the three stress bars. (See figure 19.)

(c) Disconnect flange connections at six points: 1, 2, 3, 5, 8, and 9. (See figure 126.)

(d) Remove oil container from wing.

(e) Remove hopper from inside of oil container through the sump opening at the bottom.

(2) REMOVAL AND DISASSEMBLY OF SUMP ADAPTER. (See figure 127.)

(a) Drain all oil from system.

(b) Disconnect the hose connections at the sump adapter on the two supply lines that lead from the engine pump (38) and the propeller feathering pump (24). (See figure 125.)

(c) Remove the six nuts which fasten the adapter to the sump casting.

(d) Remove clamp bolts and drain cock from sump adapter.

(3) REMOVAL OF OIL LINES. - Always use proper size wrench to prevent damaging connections. Cap lines when disconnected to keep out foreign matter.

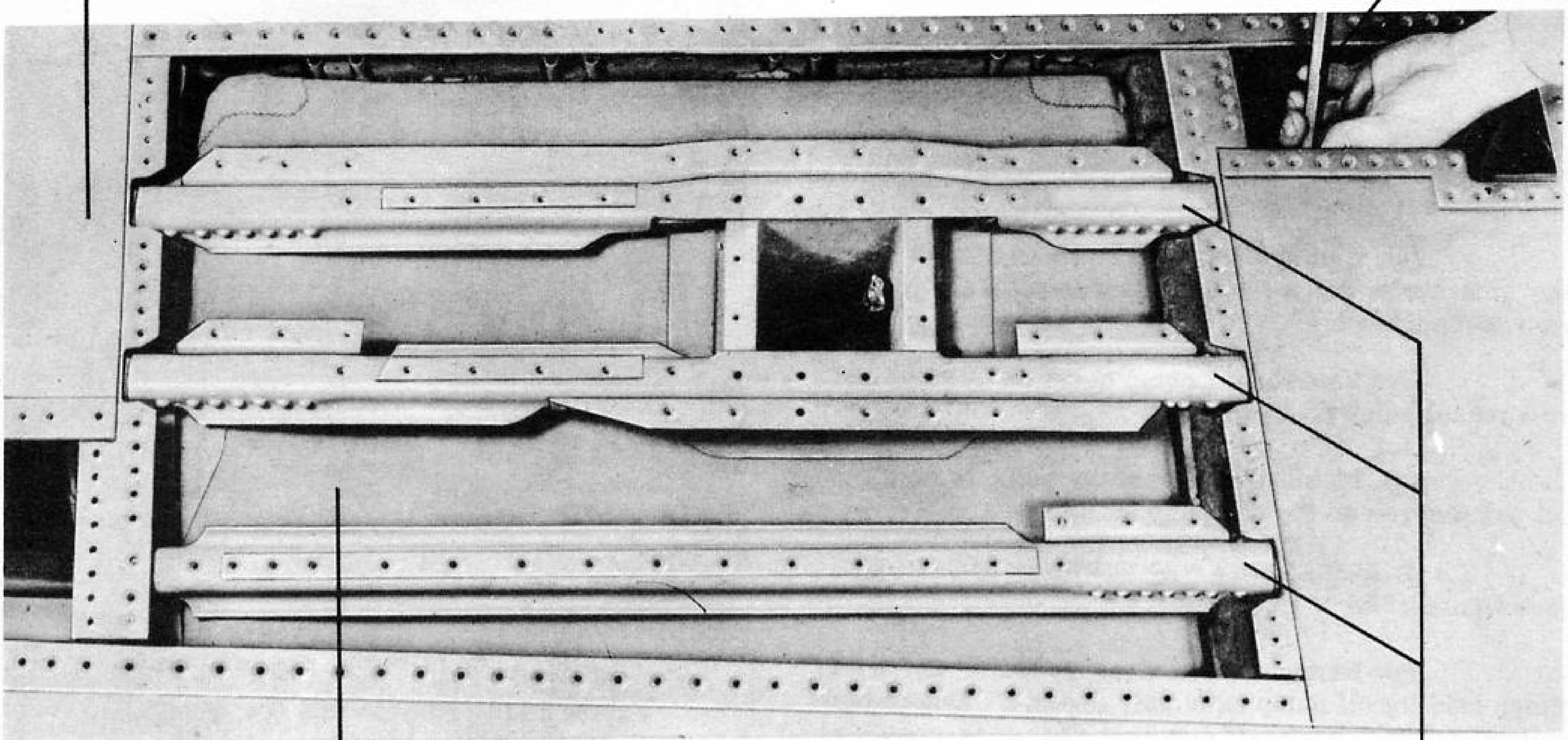
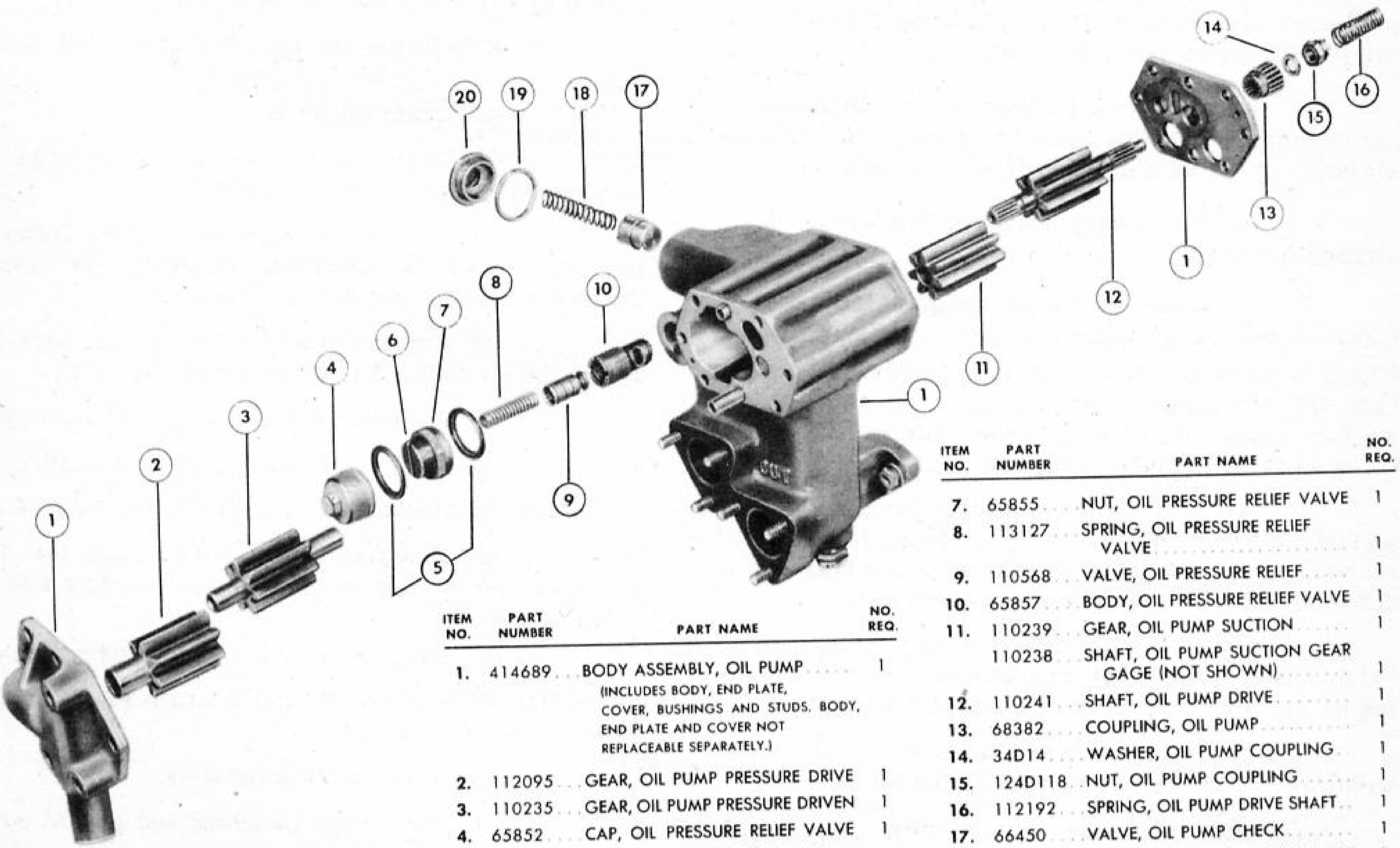


Figure 131 - REMOVING OIL CONTAINER



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	414689	BODY ASSEMBLY, OIL PUMP (INCLUDES BODY, END PLATE, COVER, BUSHINGS AND STUDS. BODY, END PLATE AND COVER NOT REPLACEABLE SEPARATELY.)	1
2.	112095	GEAR, OIL PUMP PRESSURE DRIVE	1
3.	110235	GEAR, OIL PUMP PRESSURE DRIVEN	1
4.	65852	CAP, OIL PRESSURE RELIEF VALVE	1
5.	65858	WASHER, OIL PRESSURE RELIEF VALVE	2
6.	65853	NUT, OIL PRESSURE RELIEF VALVE ADJUSTING	1
7.	65855	NUT, OIL PRESSURE RELIEF VALVE	1
8.	113127	SPRING, OIL PRESSURE RELIEF VALVE	1
9.	110568	VALVE, OIL PRESSURE RELIEF	1
10.	65857	BODY, OIL PRESSURE RELIEF VALVE	1
11.	110239	GEAR, OIL PUMP SUCTION	1
	110238	SHAFT, OIL PUMP SUCTION GEAR GAGE (NOT SHOWN)	1
12.	110241	SHAFT, OIL PUMP DRIVE	1
13.	68382	COUPLING, OIL PUMP	1
14.	34D14	WASHER, OIL PUMP COUPLING	1
15.	124D118	NUT, OIL PUMP COUPLING	1
16.	112192	SPRING, OIL PUMP DRIVE SHAFT	1
17.	66450	VALVE, OIL PUMP CHECK	1
18.	68865	SPRING, OIL PUMP CHECK VALVE	1
19.	66453	RING, OIL PUMP CHECK VALVE	1
20.	66451	RETAINER, OIL PUMP CHECK VALVE	1

Figure 132 - EXPLODED VIEW OF ENGINE OIL PUMP

(4) REMOVAL OF ENGINE OIL PUMP. (See figure 128.)

(a) Drain oil from system.

(b) Disconnect all tubing and hose connections from the pump. Cap the tubing to prevent entry of dirt.

(c) Remove the safety wire and nuts from the nine studs which secure the pump to the engine accessory mount.

(d) Hold the oil pump cover on by hand and remove oil pump from engine.

(e) Install two temporary bolts to hold the oil pump cover on the oil pump until disassembly.

(5) DISASSEMBLY OF ENGINE OIL PUMP. (See figure 132.)

(a) Remove the temporary bolts and nuts which hold the oil pump assembly together. Due to the splined pump drive shaft coupling gear it is possible to slide off the oil pump body leaving the oil pump drive shaft coupling gear and drive shaft attached to the front end plate. During this disassembly care must be taken not to drop the scavenge pump idler gear if this is removed with the oil pump drive shaft.

(b) Remove the cotter pin, castellated nut, and washer from the oil pump drive shaft and separate the coupling, drive shaft, and front end plate.

(c) Remove the scavenge pump gears if not already removed.

(d) Remove the rear end plate from the two hollow dowels which aline the plate to the pump body. It may be necessary to tap the plate lightly with a rawhide or fiber mallet. Do not use a screwdriver or similar implement to loosen the plate as the use of these tools may damage the plate and body.

(e) Remove the pressure pump drive gear and its mating pressure pump idler gear. Note that the oil pump drive gear shaft is splined on its rear end to accommodate the pressure pump drive gear.

(f) To disassemble the oil pressure relief valve, remove the cap, bronze washer, lock nut, adjusting nut, spring, piston, valve body, and washer.

(g) Remove the oil check valve cap nut and withdraw the spring and valve with the oil seal ring.

(6) REMOVAL OF OIL FILTER. (See figure 138.)

(a) Remove safety wire from the three stud nuts that attach the oil filter to the engine accessory section. Remove nuts.

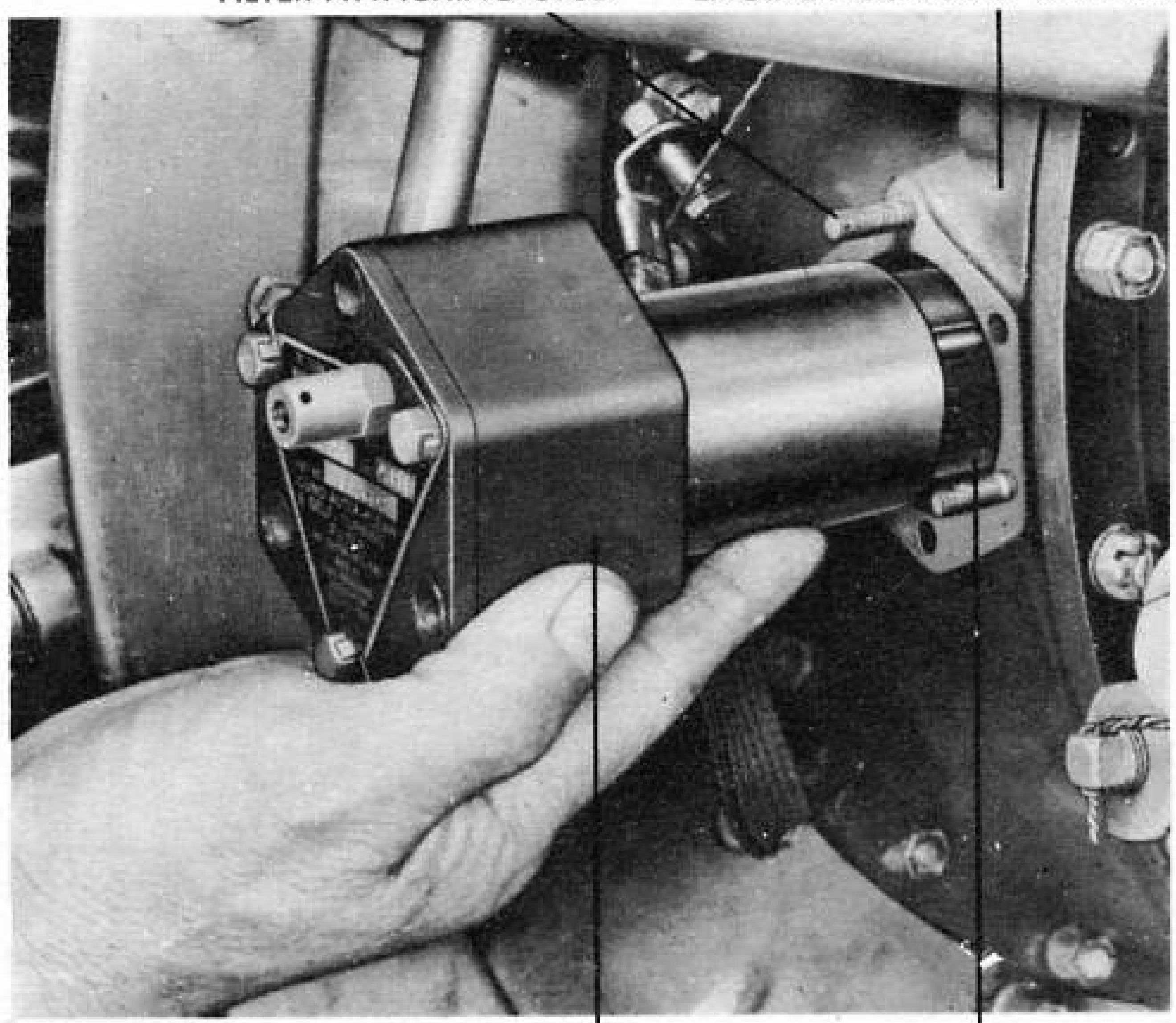


Figure 133 - REMOVING OIL FILTER

(b) Slide oil filter from its case, being careful to protect the disk assembly from damage caused by rubbing the accessory case.

(7) REMOVAL OF OIL COOLER. (See figure 134.)

(a) Drain oil from system.

(b) Drain oil from oil cooler jacket by removing plug from bottom of cooler.

(c) Disconnect the hose clamps from the main oil supply line and from the supply line leading to the engine oil pump at the oil cooler.

(d) Remove the nine flange ring bolts that attach the oil cooler to the forward flange ring.

(e) Remove the four strap bolts and straps.

(f) Remove oil cooler from its cradle.

(8) REMOVAL OF OIL DILUTION VALVE.

(a) Remove safety wire from the four screws on the bottom of the oil dilution valve and remove screws.

(b) Remove the valve piston and valve seat.

(9) REMOVAL OF PROPELLER FEATHERING PUMP. (See figure 135.)

(a) Drain oil from system.

(b) Disconnect all tubing and hose at pump.

(c) Disconnect electrical connection at junction box attached to pump motor.

(d) Remove four stud nuts that attach propeller feathering pump to the fire wall. Remove pump.

d. MAINTENANCE REPAIRS.

(1) INSPECTION AND REPAIR OF OIL CONTAINERS.

(a) Inspect exterior of container for cuts or breaks. Replace if cut or damaged.

(b) Inspect six flange connections 1, 2, 3, 5, 8 and 9 (figure 126) for security of attachment to the container.

(c) Clean inside of oil container through the sump opening at the bottom of the container.

(2) INSPECTION AND REPAIR OF OIL COOLER.

(a) Remove the valve from the cooler.

(b) Clean the outside of the oil cooler and the outside and inside of the valve by immersing in separate tanks and rotating the parts by hand.

(c) Remove oil cooler and valve from the cleaning tanks and drain. Dry with compressed air.

(d) Test the oil cooler for leaks at 100 pounds per square inch air pressure by submerging the cooler in warm water. Repair any leaks found.

e. REPLACEMENTS.

(1) INSPECTION AND REPLACEMENT OF SUMP ADAPTER PARTS.

(a) Clean sump adapter carefully with solvent.

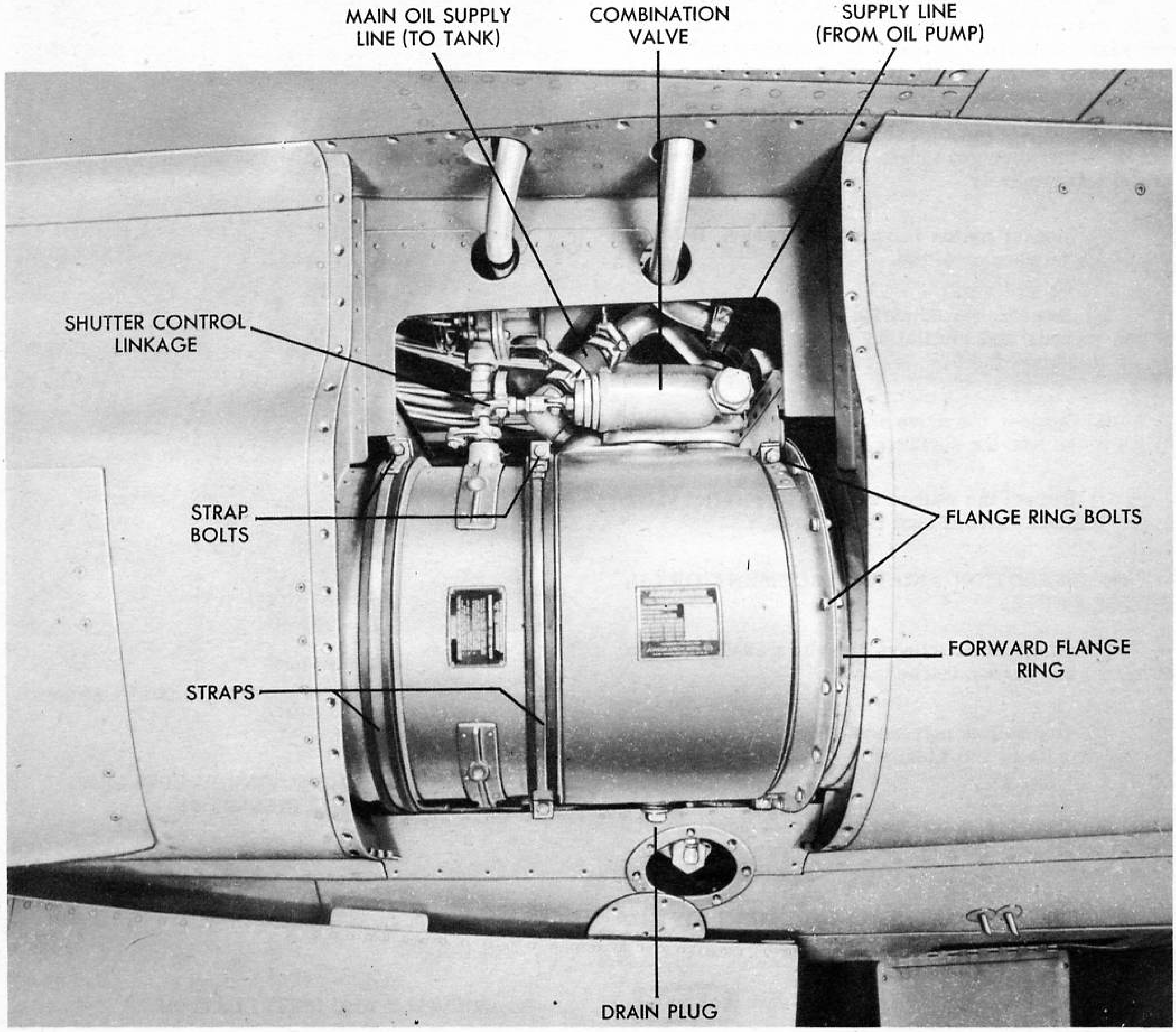


Figure 134 - INSTALLED OIL COOLER

(b) Inspect for any cracks or defects in the metal. Replace defective parts.

(c) Install new gasket.

(2) INSPECTION AND REPLACEMENT OF ENGINE OIL PUMP PARTS.

(a) Clean all finished surfaces of the oil pump with crocus cloth and gasoline.

(b) Inspect the oil pump body for cracks and condition of the finished surfaces. Replace if cracked.

(c) Inspect the threads in the tapped holes for nicks or burs. Remove all burs and nicks by retapping.

(d) Inspect the end plate for cracks, condition of the finished surfaces and check the drive shaft hole for wear. Replace if cracked or if drive shaft hole is excessively worn. (Shaft should not have more than 0.015-inch clearance.)

(e) Inspect the idler shaft gear for cracks, wear, and fit on the idler gear shaft. Replace gear if cracked or worn excessively.

(f) Inspect piston for pitting or wear. Replace if surface is worn or pitted.

(g) Inspect the adjusting screw for condition of the threads and mutilation of the slots. Replace screw if damaged.

(h) Inspect the drive shaft for cracks and condition of the bearing surfaces. Replace if cracked.

(i) Inspect the seat in the pressure relief valve body. Replace valve if seat is damaged.

(3) INSPECTION AND REPLACEMENT OF OIL FILTER PARTS.

(a) Clean filter thoroughly with a 50-50 solution of benzol and carbon tetrachloride.

(b) Dry with compressed air and check for any breaks or cuts in the cleaner body. Replace if damaged.

(c) Examine disks for burring or bending sufficient to prevent rotation of disks. Replace if damaged.

(4) INSPECTION AND REPLACEMENT OF OIL DILUTION VALVE PARTS.

(a) Clean valve piston and valve seat thoroughly.

(b) Inspect piston and valve seat for wear. Replace if worn.

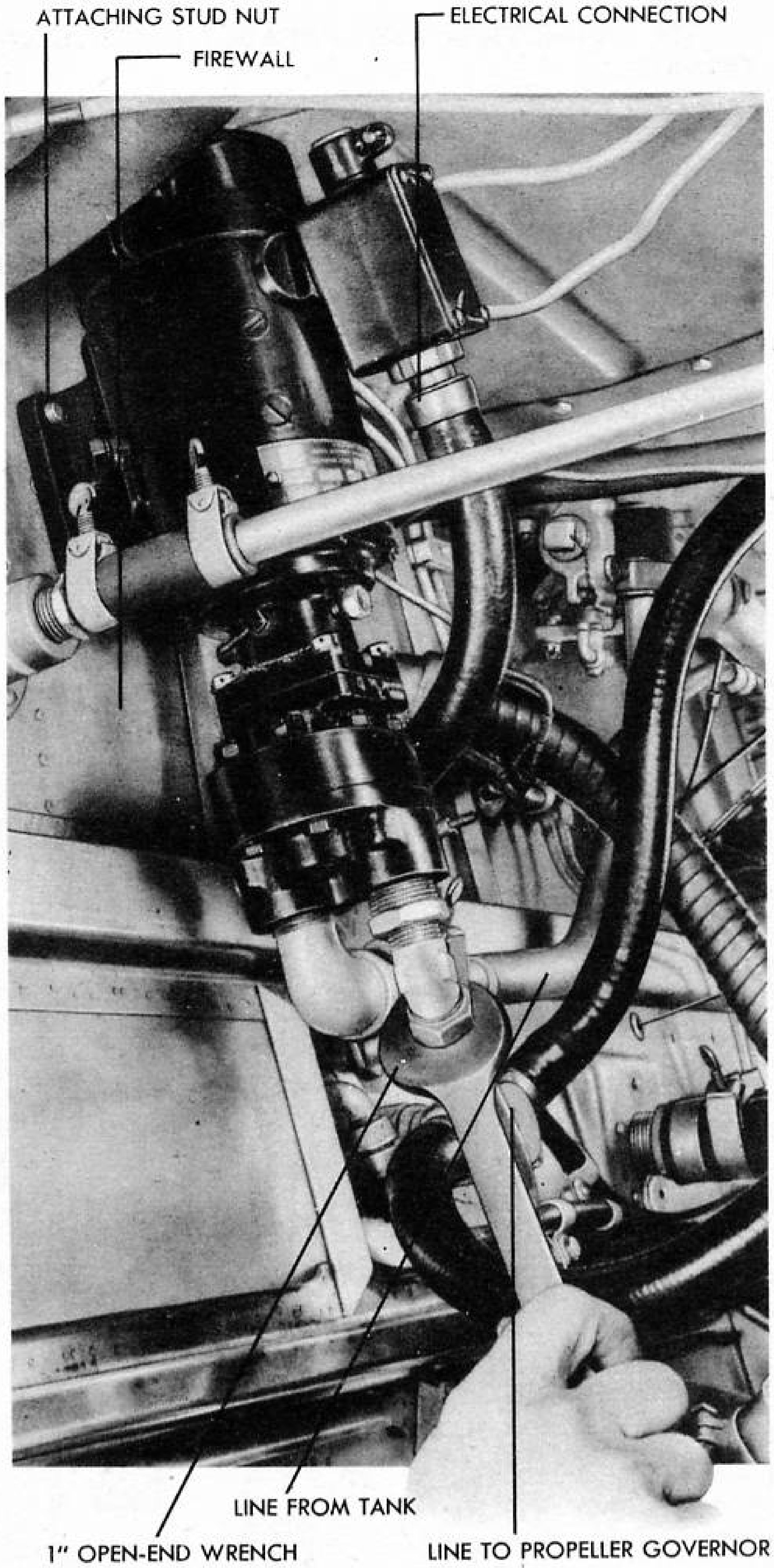


Figure 135 - REMOVING PROPELLER FEATHERING PUMP

f. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF THE PROPELLER FEATHERING PUMP. (See figure 135.)

(a) Assemble the pump body in the pump and replace cover. Tighten cover bolts.

(b) Place pump in position on forward end of fire wall and install four attaching stud nuts. Tighten nuts securely.

(c) Connect all tubing and hose at pump.

(d) Connect electrical connection at junction box.

(e) Check pump and connections for security and absence of leakage.

(2) INSTALLATION OF OIL DILUTION VALVE.

(a) Install valve seat and valve piston in valve.

(b) Install four screws to bottom of oil dilution valve. Tighten screws and safety.

(3) INSTALLATION OF OIL COOLER. (See figure 134.)

(a) Place oil cooler in its cradle.

(b) Install the two oil cooler straps and secure with four strap bolts tightened to 50 inch pounds torque.

(c) Install the nine flange ring bolts and tighten.

(d) Connect the main oil supply line and the oil line leading to the engine oil pump at the cooler.

(e) Install drain plug in bottom of cooler.

(4) INSTALLATION OF OIL FILTER. (See figure 133.)

(a) Slide filter into position on its attaching studs.

(b) Install three stud nuts in filter cover, tighten and safety.

(5) ASSEMBLY OF ENGINE OIL PUMP. (See figure 132.)

(a) Install the integral pump drive shaft and scavenge gear in the front end of the pump, having the threaded end of the shaft outside the pump body.

(b) Slide the mating scavenge pump idler gear over its bronze shaft.

(c) Install the splined pressure pump drive gear on the rear end of the splined oil pump drive shaft and integral scavenge gear followed by the mating pressure pump idler gear. The longest of the two journals on this idler gear is inserted inside the pump body.

(d) Install gaskets over the hollow alining dowels extending from front and rear ends of the oil pump body.

(e) Oil both sets of gears and their supporting holes in the front and rear end plates and tap the end plates in place over the hollow alining dowels. Revolve the oil pump drive shaft to check the freeness of the gears.

(f) Install the splined coupling over the mating splines of the front end of the drive shaft and retain with a plain washer, castellated nut, and cotter pin.

(g) Place a new gasket over the two external scavenge tube adapter studs, followed by the adapter, having its nipple pointed downward. Secure with washers, nuts, and palnuts.

(h) Assemble the oil inlet check valve in the pump body by inserting the piston and ring in the bronze check valve body, compressing the ring to gain entrance.

(i) Place the coiled spring into the hollow piston and screw the retainer on the outside diameter of the bronze body over the extended end of the spring, having a new copper asbestos gasket under the head of the retainer. Lock-wire the retainer to the adjacent plug in the oil pump body.

(j) Assemble the oil pressure relief valve in the pump body. Install the bronze body in the pump body. Insert the hollow piston type valve in the bronze body and place the coiled spring inside the piston. Screw the adjusting screw on the outside diameter of the bronze body over the extended end of the coiled spring. Install the lock nut and its shouldered copper gasket loosely on the adjusting screw. Set the adjusting screw to give the desired engine oil pressure, tighten the lock nut, and install the steel cap and its gasket on the adjusting screw.

(6) INSTALLATION OF ENGINE OIL PUMP. (See figure 128.)

(a) Place an oil pump mounting pad gasket over the eight oil pump attaching studs in the supercharger rear housing cover making sure the oil vent hole for oil pump relief valve drain passage is not blocked.

(b) Coat the oil pump drive shaft coupling with a good grade of petrolatum and install the pump over the attaching studs, meshing the coupling with the splined end of the drive shaft in the supercharger rear housing cover.

(c) Install plain washers and castellated nuts on each of the eight attaching studs spaced around the rear end plate on the upper section of the pump. Lock-wire the nuts together.

(d) Uncap and connect all tubing and hose connections to pump.

(e) Connect the line leading from the oil cooler to the engine pump at the pump.

(7) INSTALLATION OF OIL LINES. - When installing oil lines use the proper size wrench to prevent damaging the connections. When replacing lines, be sure they do not make contact with other lines, control cables, brackets, or structural members. Breaks are sometimes caused by rubbing and wear due to vibration if the lines lack clearance. When connecting the main feed lines to the "Y" drain and from the pump to the cooler be sure the former is 1-1/2-inch tubing and the latter is 1-1/4-inch tubing. Tighten tubing connections securely. Check for leaks after installation.

(8) ASSEMBLY AND INSTALLATION OF SUMP ADAPTER. (See figure 127.)

(a) Assemble the drain cock and clamp bolts to the adapter. Do not tighten excessively. There is danger of bending the plate and causing a leak.

(b) Place the gasket in position on the sump adapter and install the adapter. Tighten the six nuts that secure the adapter to the casting.

(c) Connect the hose connections of the engine pump line and the propeller pump line at the sump adapter.

(d) Fill the oil container.

(9) INSTALLATION OF OIL CONTAINERS. (See figure 131.)

(a) Install hopper in oil container through the sump opening at the bottom of the container.

(b) Apply a light coating of cement, Specification AAF 26544-A, to all surfaces which come in contact with attaching fittings 1, 2, 3, 5, 8, and 9. (See figure 126.)

(c) Place oil container in position in inner wing.

(d) Connect and tighten the six flange connections 1, 2, 3, 5, 8, and 9. (See figure 126.)

(e) Attach the three stress bars and cover plates (C), (J), and (H) and fairing plate (D) to the upper wing surface. (See figure 19.)

g. FINAL TEST AFTER ASSEMBLY

(1) TEST OF OIL DILUTION VALVE AFTER INSTALLATION. - Turn ON fuel container to engine mixture control idle cut-off. Remove line fitting at valve on "Y" drain side. Plug "Y" drain line. Turn ON main battery switch and master switch. Depress dilution valve switch for one minute, noting number of drops at valve fitting. Ten drops per minute is permitted.

(2) TEST OF OIL COOLER AFTER INSTALLATION.

(a) Fill the oil container with oil, Specification AN-VV-O-446a, grade 1120.

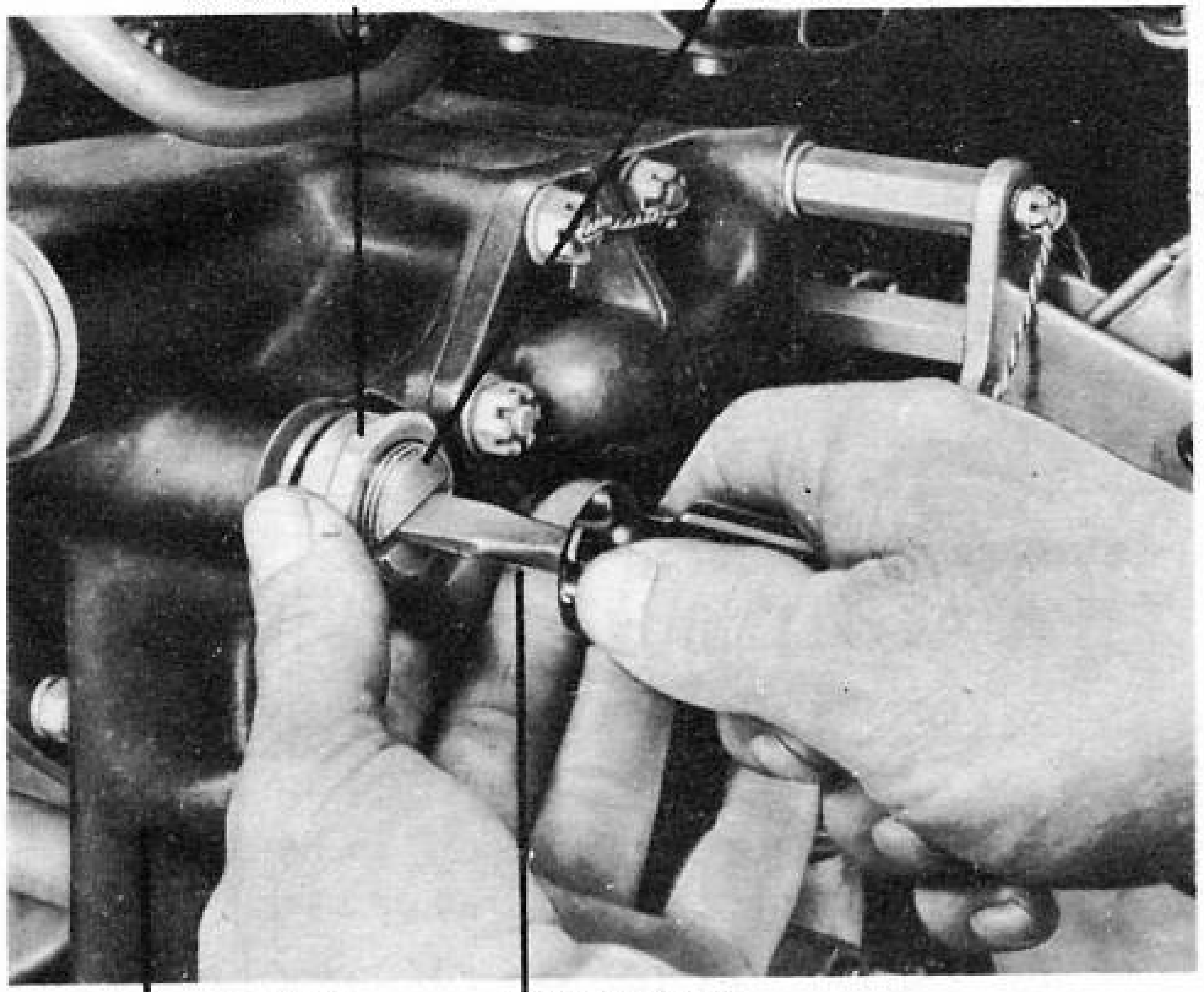


Figure 136 - ADJUSTING OIL PRESSURE RELIEF VALVE

(b) Start engine and visually check cooler and adjacent tubing for oil leaks.

(c) For temperature check, head ship into wind with cowling on before changing adjustments.

(3) TEST AND ADJUSTMENT OF ENGINE OIL PUMP AFTER INSTALLATION. (See figure 136.)

(a) Fill system with oil.

(b) Start engine and check all attaching points for leaks. Tighten connections if leaking.

OLD HOT SHOT-HE FORGOT

CAUTION

Always shut down the engine before removing the screw cap over the adjusting screw, or hot oil will squirt from an internal venthole.

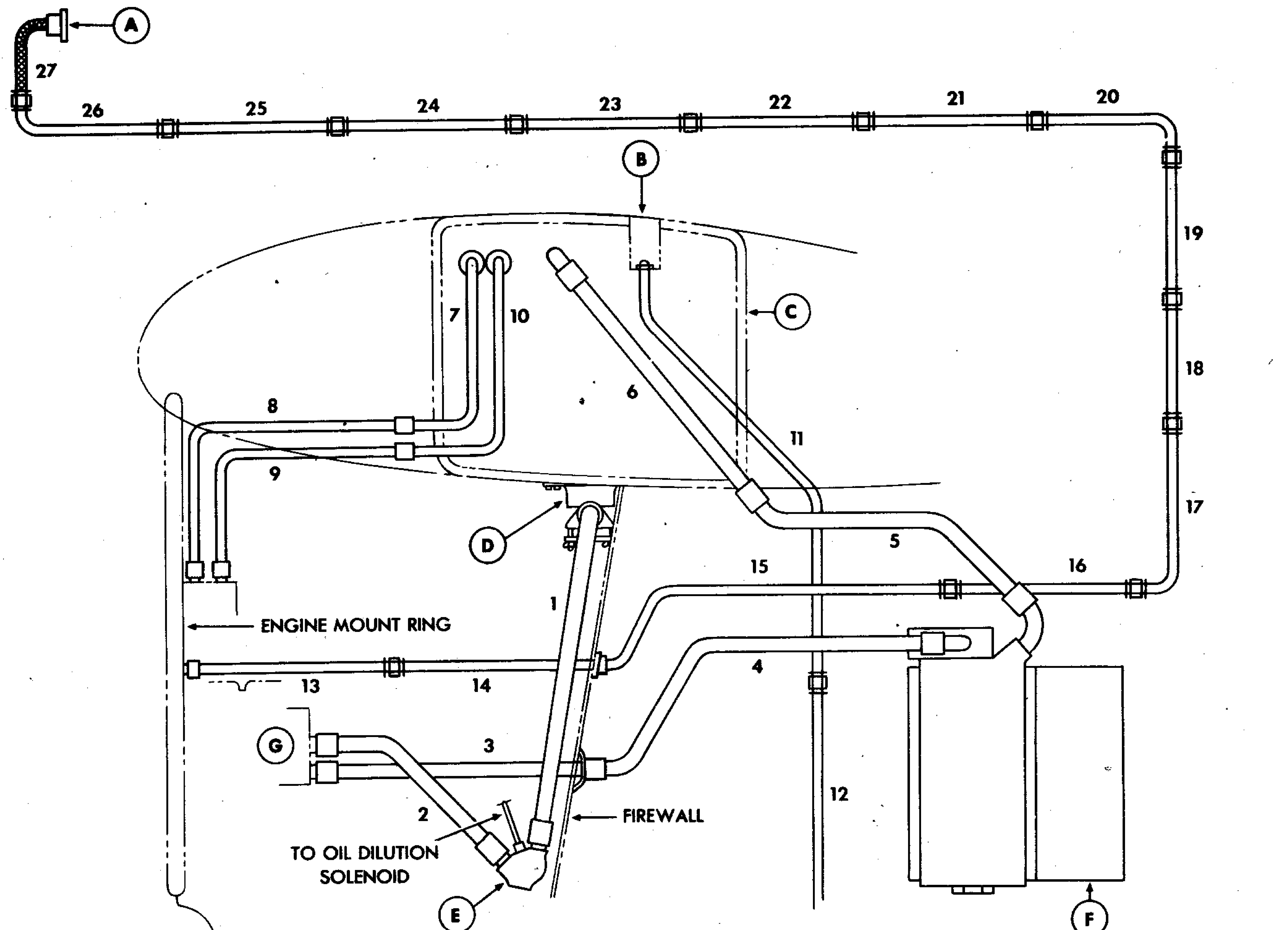
(c) With engine running at 2,000 rpm, and 60 degrees C (140 degrees F) oil inlet temperature, check oil pressure gage, which should read 85, + 15, -5 per square inch. It may be necessary to loosen lock nut and adjust pressure adjusting screw until gage registers 85 pounds. (See figure 136.) One revolution of the screw approximates 12 pounds pressure. Turning screw clockwise increases pressure. Tighten lock nut and install safety after adjustment.

(4) TEST OF SUMP ADAPTER AFTER INSTALLATION.

(a) Check hose connections for leaks. Tighten clamps if leak is noticed. Do not exceed 25 inch pounds torque when tightening clamps.

(b) Check for leaks around sump casting. Tighten all nuts if connection leaks. If leaking continues, remove sump adapter and install new gasket.

(5) TEST OF OIL CONTAINERS AFTER INSTALLATION. - Fill oil containers with oil and check all attaching points for leaks. Tighten connections if oil seepage is noticed.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
A.	AC SPEC. 94-27919 TYPE B-8	GAUGE, OIL PRESSURE—L.H. AND R.H.	1
B.	5106684	FILLER ASSEMBLY, OIL TANK—L.H.	1
	5106684-1	FILLER ASSEMBLY, OIL TANK—R.H.	1
	AN505-10-24	SCREW—R.H. AND L.H.	12
	42B3581	CAP ASSEMBLY, FILLER—R.H. AND L.H.	1
C.	5174352	CONTAINER ASSEMBLY, OIL—L.H.	1
	5174352-1	CONTAINER ASSEMBLY, OIL—R.H.	1
D.	5171315	SUMP ASSEMBLY, OIL TANK HOPPER OUTLET—L.H.	1
	5171315-1	SUMP ASSEMBLY, OIL TANK HOPPER OUTLET—R.H.	1
	2067251	GASKET, OIL TANK SUMP—L.H. AND R.H.	1
	AC365-428	NUT—L.H. AND R.H.	16
	4106687	FITTING, OIL TANK OUTLET ADAPTER—L.H. AND R.H.	1
	1066875	GASKET, OIL TANK OUTLET ADAPTER—L.H. AND R.H.	1
	AC-365-428	NUT—L.H. AND R.H.	6
	1066943	CLAMP, OIL TANK SUMP COVER—R.H. AND L.H.	1
	AN43-7	EYEBOLT—L.H. AND R.H.	2
	AN393-25	PIN—L.H. AND R.H.	2
	AN960-10	WASHER—L.H. AND R.H.	2
	AN310-4	NUT—L.H. AND R.H.	2
	AN960-416	WASHER—L.H. AND R.H.	2
	2067263	COVER, OIL TANK SUMP—L.H. AND R.H.	1
	1066876	GASKET, OIL TANK SUMP COVER—L.H. AND R.H.	1
	AN770-1	COCK, DRAIN—L.H. AND R.H.	1
E.	U-1050-A3	DRAIN, Y—L.H. AND R.H.	1
	AN3-27A	BOLT—L.H. AND R.H.	2
	AC365-1032	NUT—L.H. AND R.H.	2
	AC905B10	PLUG—L.H. AND R.H.	1
F.	1E-223	"AIRESEARCH" OIL COOLER ASSEMBLY—L. H. AND R. H.	1
G.	414692	PUMP, ENGINE OIL—L.H. AND R.H.	1

Figure 137 - OIL SYSTEM DIAGRAM

MAIN FEED LINES

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5109969-1	TANK TO Y DRAIN—L.H.	1
	5109970-1	TANK TO Y DRAIN—R.H.	1
	AC835-24	NIPPLE, HOSE—L.H. AND R.H.	1
	AC882-24-14	HOSE—L.H. AND R.H.	2
	42A 11615	CLAMP, HOSE—L.H.	4
	A755-24-2-10	CLIP, ADEL—L.H. AND R.H.	1
	AN960-10L	WASHER—L.H. AND R.H.	2
	117425-3S-102	SPACER—L.H. AND R.H.	1
	AN-520-10-10	SCREW—L.H.	1
	AC-365-1032	NUT—L.H.	1
	42A 11615	CLAMP, HOSE—R.H.	4
	AN520-10-28	SCREW—R.H.	1
2.	5110121-1	Y DRAIN TO ENGINE—L.H. AND R.H.	1
	AC882-24-14	HOSE—L.H. AND R.H.	2
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	4

RETURN LINES

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
3.	5110121-3	ENGINE TO FIRE WALL—L.H.	1
	5110121-4	ENGINE TO FIRE WALL—R.H.	1
	AC882-20-16	HOSE—L.H. AND R.H.	2
	AN746-13 42A 11615	CLAMP, HOSE—L.H. AND R.H.	8
4.	5109969-16	FIRE WALL TO COOLER—L.H.	1
	5109970-16	FIRE WALL TO COOLER—R.H.	1
	AC853-20	ELBOW, 45° HOSE—L.H.	1
	AC882-20-18	HOSE—L.H. AND R.H.	2
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	8
	A755-20-2-10	CLIP, ADEL—L.H. AND R.H.	1
	117425-30-020	SPACER—L.H.	1
	AN520-10-26	SCREW—L.H.	1
	AN520-10-8	SCREW—R.H.	1
	AC365-1032	NUT—R.H.	1
5.	5109969-17	COOLER TO HOSE—L.H.	1
	5109970-17	COOLER TO HOSE—R.H.	1
	AC882-20-18	HOSE—L.H. AND R.H.	2 L.H. 1 R.H.
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	8 L.H. 4 R.H.
	A755-20-2-10	CLIP, ADEL—L.H. AND R.H.	2
	AN520-10-10	SCREW—L.H.	1
	AC365-1032	NUT—L.H. AND R.H.	1
	117425-30-016	SPACER—L.H.	1
	42A 11615	CLAMP, HOSE—R.H.	1
	AN520-10-8	SCREW—R.H.	1
6.	5109969-4	HOSE TO TANK—L.H.	1
	5109970-2	HOSE TO TANK—R.H.	1
	AC852-20	ELBOW, HOSE—L.H. AND R.H.	1
	AC882-20-18	HOSE—L.H. AND R.H.	1 L.H. 2 R.H.
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	4 L.H. 8 R.H.
	AN520-10-10	SCREW—L.H.	1
	AC365-1032	NUT—L.H. AND R.H.	1 L.H. 2 R.H.
	AN520-10-8	SCREW—R.H.	2
	A755-20-2-10	CLIP, ADEL—R.H.	2

VENT LINES

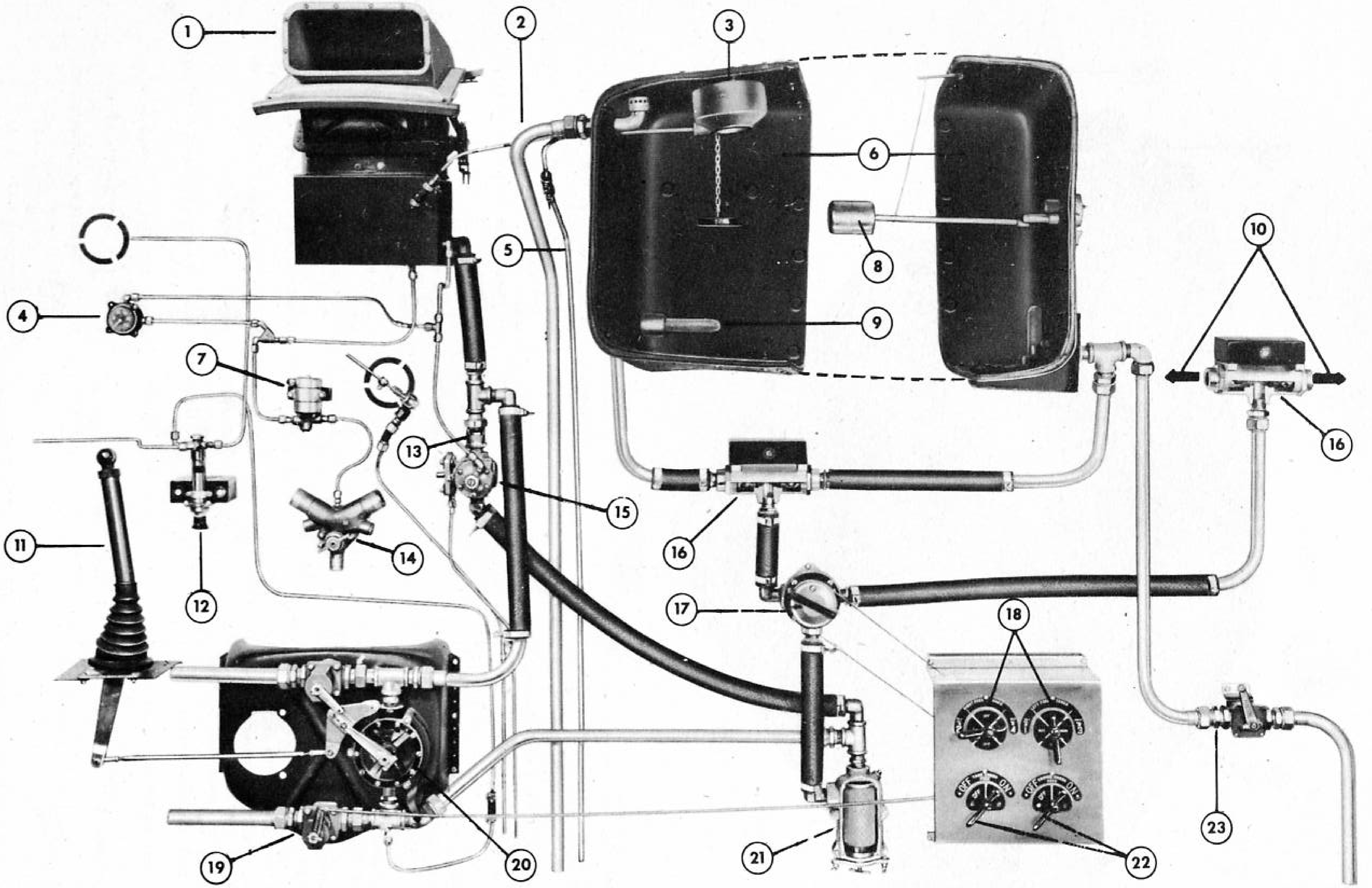
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
7.	5109969-6	TANK TO SHIELDING—OUTBOARD—L.H.	1
	5109970-6	TANK TO SHIELDING—OUTBOARD—R.H.	1
	AC882-8-8	HOSE—L.H. AND R.H.	1
	AC811CT45-8	ELBOW—L.H. AND R.H.	1
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	1
8.	5110121-5	SHIELDING TO ENGINE—OUTBOARD—L.H.	1
	5110121-6	SHIELDING TO ENGINE—OUTBOARD—R.H.	1
	AC882-8-9	HOSE—L.H. AND R.H.	2
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	4
9.	5110121-7	SHIELDING TO ENGINE—INBOARD—L.H.	1
	5110121-8	SHIELDING TO ENGINE—INBOARD—R.H.	1
	AC882-8-9	HOSE—L.H. AND R.H.	2
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	4
10.	5109969-5	TANK TO SHIELDING—INBOARD—L.H.	1
	5109970-7	TANK TO SHIELDING—INBOARD—R.H.	1
	AC882-8-8	HOSE—L.H. AND R.H.	1
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	1
	AC811CT45-8	ELBOW—L.H. AND R.H.	1

LEGEND FOR FIGURE 137

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
		OVERFLOW LINES	
11.	5109969-12	FILLER WELL ELBOW TO UNION—L.H.	1
	5109970-12	FILLER WELL ELBOW TO UNION—R.H.	1
	A755-6-2-8	CLIP, ADEL—L.H.	1
	AN520-10-10	SCREW—L.H.	1
	AC365-1032	NUT—L.H.	1
	A755-6-2-6	CLIP, ADEL—R.H.	1
	AN515-8-8	SCREW—R.H.	1
	AC365-832	NUT—R.H.	1
12.	5109969-13	UNION TO ATMOSPHERE—L.H.	1
	5109970-13	UNION TO ATMOSPHERE—R.H.	1
	AC811HT6D	UNION—L.H. AND R.H.	1
	A755-5-2-8	CLIP, ADEL—L.H. AND R.H.	2
	AN520-10-10	SCREW—L.H. AND R.H.	2
	AC365-1032	NUT—L.H. AND R.H.	2
	AN931-6-10	GROMMET—L.H. AND R.H.	1
		PRESSURE GAGE LINES	
13.	5110121-9	ENGINE TO SHIELDING—L.H.	1
	5110121-10	ENGINE TO SHIELDING—R.H.	1
	AC882-6-14	HOSE—L.H. AND R.H.	2
	42A 11615	CLAMP, HOSE—L.H. AND R.H.	8
14.	5109969-10	SHIELDING TO FIRE WALL—L.H.	1
	5109970-11	SHIELDING TO FIRE WALL—R.H.	1
	1066299	CLAMP #176—L.H. AND R.H.	2
	AN520-10-24	SCREW—L.H. AND R.H.	4
15.	5109969-14	FIRE WALL TO STATION 52—L.H.	1
	5109970-14	FIRE WALL TO STATION 52—R.H.	1
	AC811HT-6D	UNION—L.H. AND R.H.	1
16.	5109969-9	STATION 52 TO REAR WEB—L.H.	1
	5109970-10	STATION 52 TO REAR WEB—R.H.	1
	AC811HT6D	UNION—L.H. AND R.H.	1
	1067664	CLAMP #185—L.H. AND R.H.	2
	AN520-10-24	SCREW—L.H. AND R.H.	4
	AC365-1032	NUT—L.H. AND R.H.	4
	AN960-10	WASHER—L.H.	4
17.	5109969-8	REAR WEB TO STATION 35—L.H.	1
	5109970-9	REAR WEB TO STATION 39—R.H.	1
	AC811HT6D	UNION—L.H. AND R.H.	1

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
18.	5109969-7	STATION 35 TO STATION 7—L.H.	1
	5109970-8	STATION 39 TO STATION 7—R.H.	1
	AC811HT6D	UNION—L.H. AND R.H.	1
19.	5109969-15	STATION 7 TO FUSELAGE CONNECTION —L.H.	1
	5109970-15	STATION 7 TO FUSELAGE CONNECTION —R.H.	1
	AC811HT6D	UNION—L.H. AND R.H.	1
20.	5067583-65	FUSELAGE CONNECTION TO STATION 191—L.H.	1
	5067583-30	FUSELAGE CONNECTION TO STATION 179—R.H.	1
	AC811ET-6D	ELBOW—L.H. AND R.H.	1
	AC811HT-6D	UNION—L.H.	1
21.	5067583-64	STATION 191 TO STATION 165—L.H.	1
	AC811HT-6D	UNION—L.H.	1
22.	5067583-63	STATION 165 TO STATION 130—L.H.	1
	5067583-29	STATION 179 TO STATION 113—R.H.	1
	AC811HT6D	UNION—L.H. AND R.H.	1
23.	5067583-62	STATION 130 TO STATION 91—L.H.	1
	5067583-28	STATION 113 TO STATION 91—R.H.	1
	AC811HT-6D	UNION—L.H. AND R.H.	1
24.	5067583-61	STATION 91 TO STATION 40—L.H.	1
	5067583-27	STATION 91 TO STATION 53—R.H.	1
	AC811HT-6D	UNION—L.H. AND R.H.	1
25.	5067583-60	STATION 40 TO STATION 22—R.H.	1
	5067583-26	STATION 53 TO STATION 22—R.H.	1
	AC811HT-6D	UNION—L.H. AND R.H.	1
26.	5067583-59	STATION 22 TO STATION 10—L.H.	1
	5067583-25	STATION 22 TO STATION 10—R.H.	1
	AC811HT-6D	UNION—L.H. AND R.H.	1
27.	39B3481-614	HOSE, STATION 10 TO GAGE — L.H. AND R.H.	1
	PARKER FT6-2	NIPPLE—L.H. AND R.H.	1

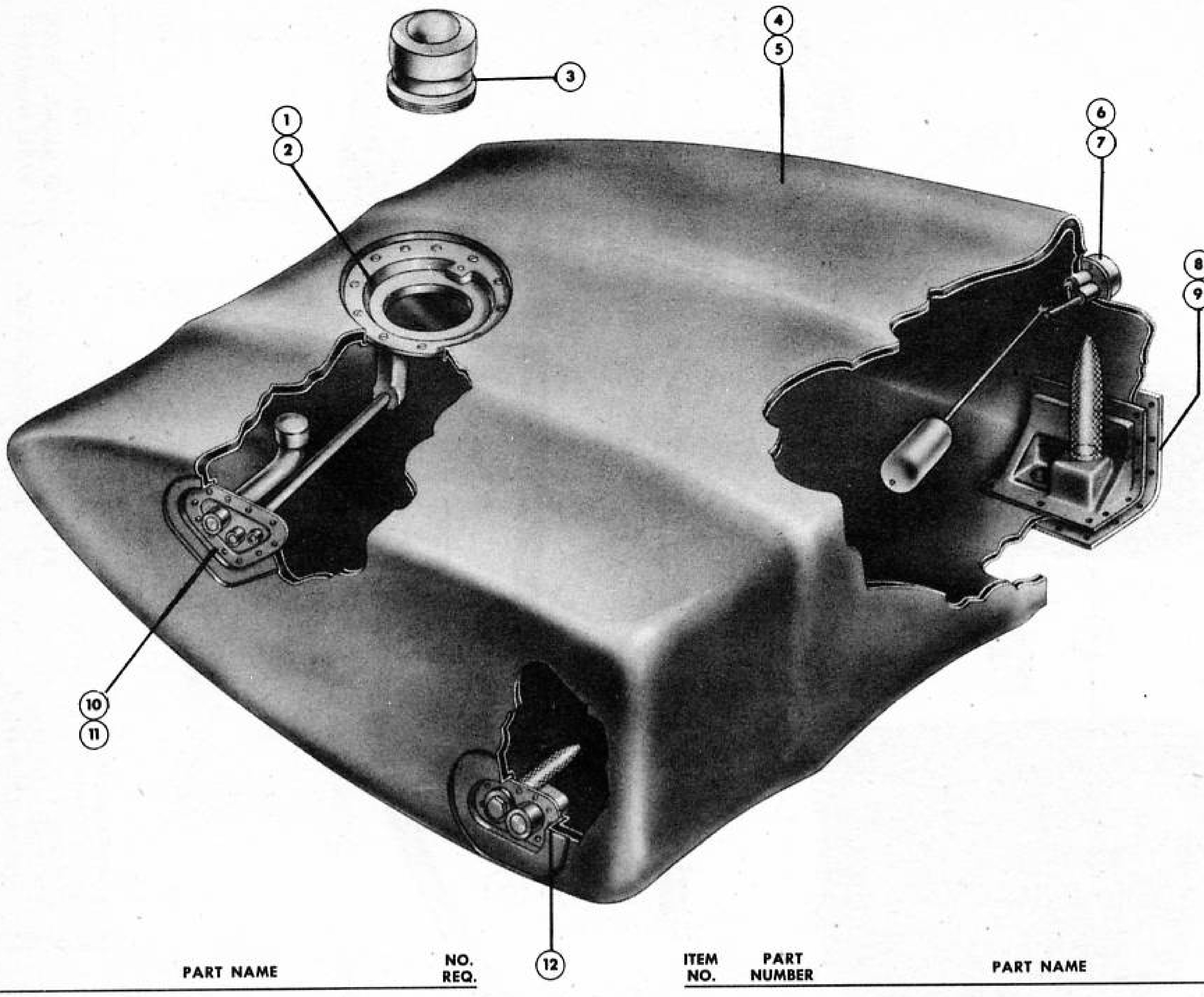
LEGEND FOR FIGURE 137



1. CARBURETOR AIR SCOOP
2. FUEL TANK OVERFLOW
3. FILLER CAP
4. FUEL PRESSURE GAUGE
5. FILLER CAP OVERFLOW
6. R.H. INBOARD FUEL TANK
7. SOLENOID OIL DILUTION VALVE
8. LIQUIDOMETER TANK UNIT
9. STRAINER
10. TO R.H. OUTBOARD FUEL TANK
11. WOBBLE PUMP HANDLE
12. PRIMEF PUMP
13. FLAPPER VALVE
14. OIL "Y" DRAIN
15. FUEL PUMP
16. BALL CHECK VALVES
17. TANK SELECTOR VALVE
18. SELECTOR VALVE CONTROLS
19. CROSS FEED VALVE
20. WOBBLE PUMP
21. STRAINER
22. CROSS FEED CONTROLS
23. DUMP VALVE

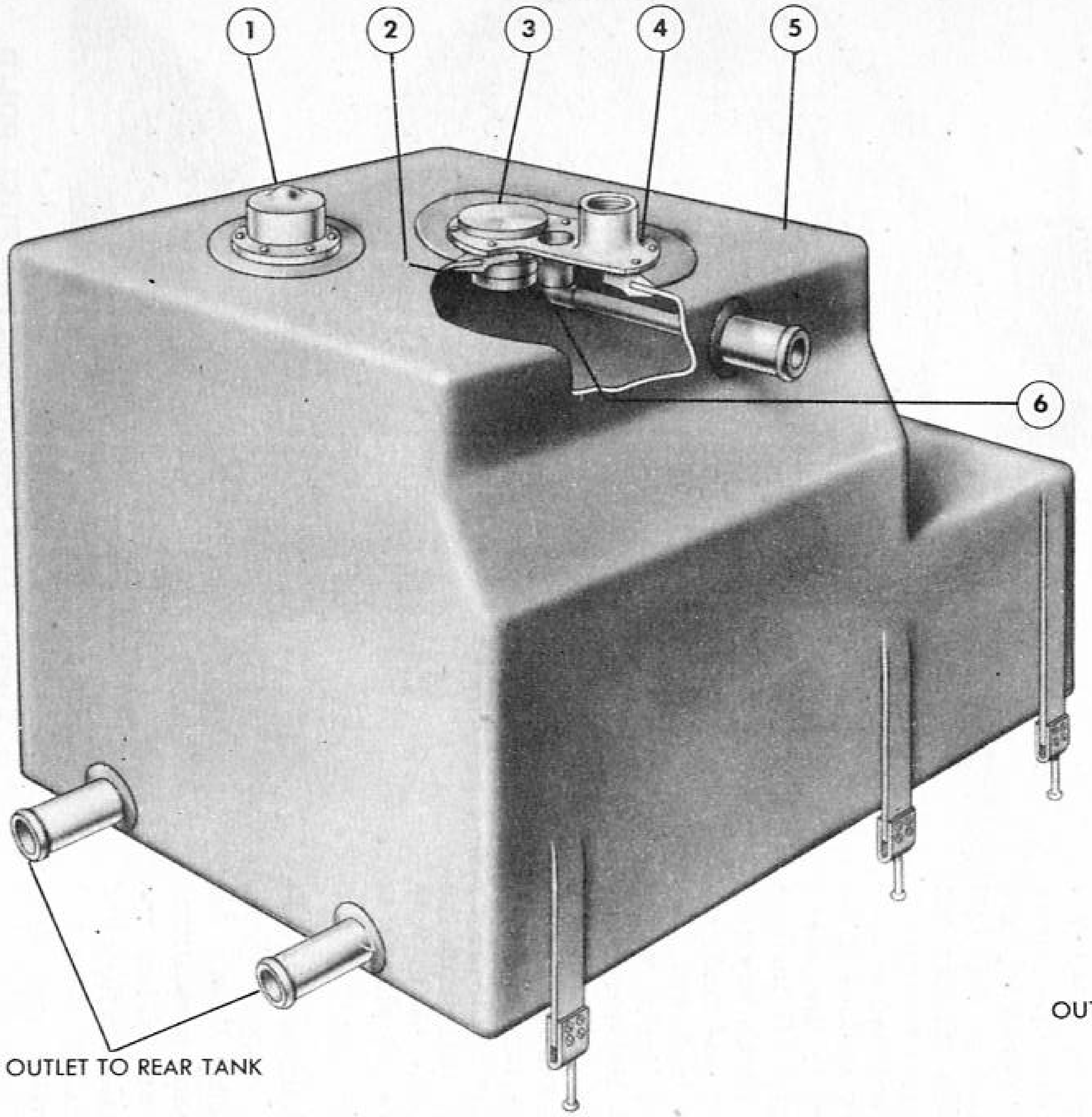
NOTE:
SEE FIGURE 158 FOR PARTS NUMBERS

Figure 138 - FUEL SYSTEM MOCK-UP

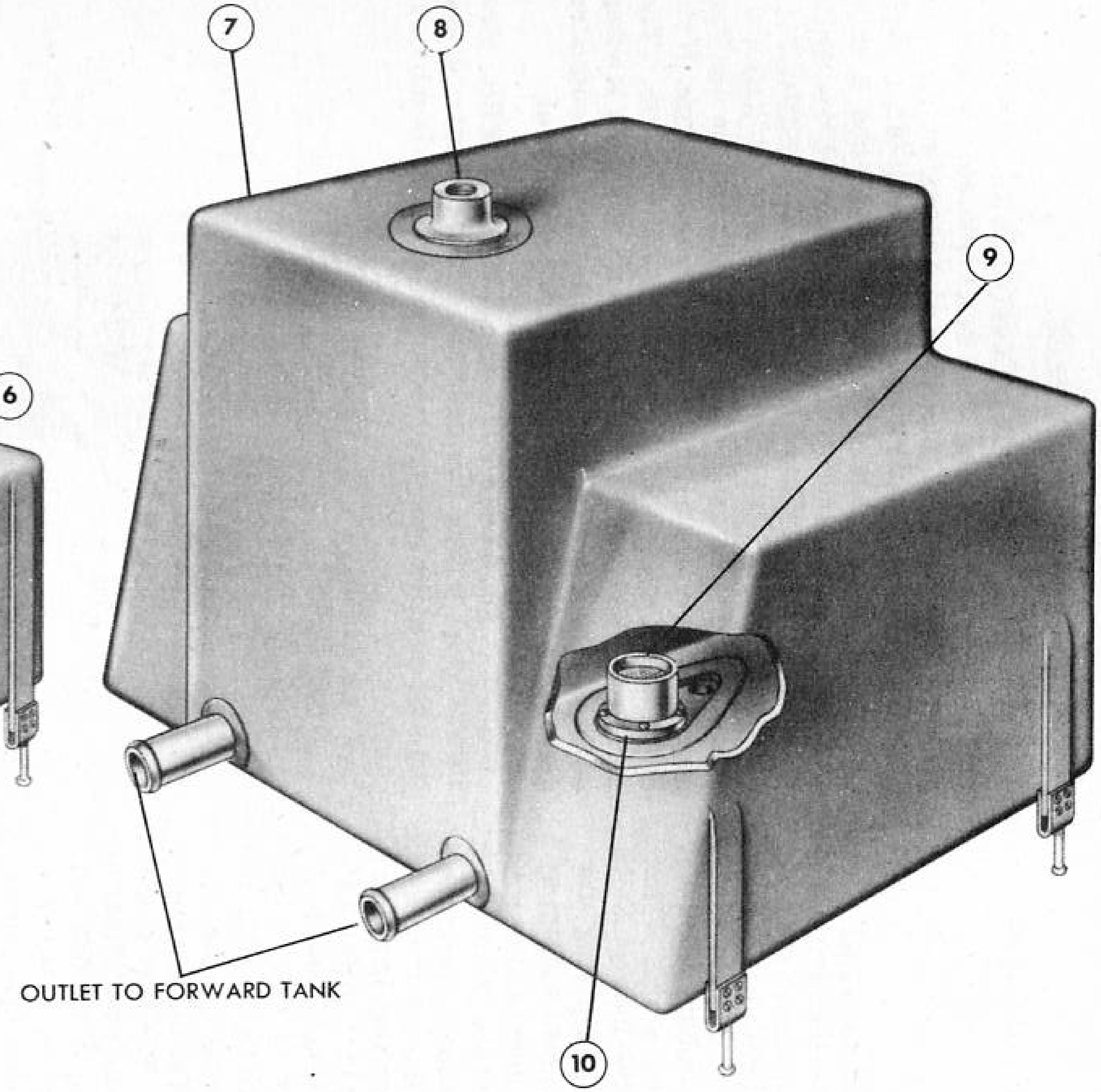


ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4137686-3	FILLER ASSEMBLY, INBOARD FUEL TANK	1
	2110035	GASKET, INBOARD FUEL TANK FILLER	1
	AN73A6	BOLT	12
2.	4137687-500	FILLER ASSEMBLY, OUTBOARD FUEL TANK—L.H.	1
	4137687-501	FILLER ASSEMBLY, OUTBOARD FUEL TANK—R.H.	1
	2107962	GASKET, OUTBOARD FUEL TANK FILLER	1
	AN73A6	BOLT	8
3.	1137783	CAP, FUEL FILLER	1
4.	5108314	CONTAINER ASSEMBLY, INBOARD FUEL—L.H.	1
	5108314-1	CONTAINER ASSEMBLY, INBOARD FUEL—R.H.	1
5.	5108315	CONTAINER ASSEMBLY, OUTBOARD FUEL—L.H.	1
	5108315-1	CONTAINER ASSEMBLY, OUTBOARD FUEL—R.H.	1
6.	4062365	UNIT, INBOARD FUEL TANK GAUGE	1
	AC500-10-10	SCREW	8
	1105393	GASKET, FUEL TANK LIQUIDOMETER UNIT	1
7.	4062359	UNIT, OUTBOARD FUEL TANK GAUGE	1
	AC500-10-10	SCREW	8
	1105393	GASKET, FUEL TANK LIQUIDOMETER UNIT	1
8.	5074489	FITTING, INBOARD FUEL TANK OUTLET, STATION "O" REMOVABLE—L.H.	1
	5074489-1	FITTING, INBOARD FUEL TANK OUTLET, STATION "O" REMOVABLE—R.H.	1
	2108420	GASKET, FUEL TANK REMOVABLE FITTING	1
	AN74A6	BOLT	8
	2064912	STRAINER ASSEMBLY, RESERVE FUEL FINGER	1
	AN900-20	GASKET	1
	AC895-B70	PLUG	1
	4215-¾-45°	ELBOW, PARKER STREET	1
	AN771-2	COCK, DRAIN	1
9.	4106682	FITTING, OUTBOARD FUEL TANK OUTLET, STATION 110 REMOVABLE—L.H.	1
	4106682-1	FITTING, OUTBOARD FUEL TANK OUTLET, STATION 110 REMOVABLE—R.H.	1
	1106879	GASKET, OUTBOARD FUEL TANK REMOVABLE FITTING	1
	AN74A6	BOLT	10
	2064912	STRAINER ASSEMBLY, RESERVE FUEL FINGER	1
	AN900-20	GASKET	1
	AN771-2	COCK, DRAIN	1
10.	4131373	FITTING ASSEMBLY, INBOARD FUEL TANK, OVERFLOW—L.H.	1
	4131373-1	FITTING ASSEMBLY, INBOARD FUEL TANK, OVERFLOW—R.H.	1
	2109640	GASKET, INBOARD FUEL TANK FITTING	1
	AN73A6	BOLT	11
	2109523-2	TUBE ASSEMBLY, INBOARD FILLER CAP OVERFLOW	1
11.	4131374	FITTING ASSEMBLY, OUTBOARD FUEL TANK, OVERFLOW—L.H.	1
	4131374-1	FITTING ASSEMBLY, OUTBOARD FUEL TANK, OVERFLOW—R.H.	1
	1107965	GASKET, MULTIPLE FITTING	1
	AN73A6	BOLT	7
	1118833	TUBE ASSEMBLY, OUTBOARD FILLER CAP OVERFLOW	1
12.	4105741	FITTING, FUEL OUTLET, STATION 48.45 REMOVABLE	1
	1106972	GASKET, FUEL TANK REMOVABLE FITTING	1
	AN73A6	BOLT	7
	2107546	STRAINER ASSEMBLY, FUEL FINGER, STATION 48.45	1
	AN900-20	GASKET	1

Figure 139 - WING FUEL CONTAINER



FORWARD BOMB BAY FUEL CONTAINER



AFT BOMB BAY FUEL CONTAINER

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4147504-1	GAGE ASSEMBLY, TOP MOUNT FLOAT TYPE LIQUID	1
	AC500A10-10	SCREW	8
2.	2147973-4	ADAPTER ASSEMBLY, FUEL TANK FILLER	1
3.	AC39B5435	CAP	1
4.	4148672	FITTING, FORWARD BOMB BAY TANK FILLER AND OUTLET	1
	AN73-A5	BOLT	17
5.	5147501	TANK ASSEMBLY, BOMB BAY FUEL, FORWARD	1
6.	2146801-4	FITTING ASSEMBLY, NACELLE FUEL FILLER OVERFLOW	1
	1109909-8	GASKET, ANNULAR ALUMINUM ASBESTOS	1

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
	1146857	NUT, NACELLE FUEL FILLER OVERFLOW FITTING	1
7.	5147502	TANK ASSEMBLY, BOMB BAY FUEL, AFT	1
8.	2147680	FITTING, BOMB BAY FUEL TANK VENT	1
	AC500A10-10	SCREW	8
9.	2138501	SCREEN ASSEMBLY, FUEL BOOSTER PUMP	1
	AC500A10-7	SCREW	4
10.	4148868	ADAPTER ASSEMBLY, FUEL BOOSTER PUMP	1
	AN73-5A	BOLT	12
	AN960-10L	WASHER	12

Figure 140 - BOMB BAY FUEL CONTAINERS

NOTE

(This information applies only to airplanes AF42-53535 through AF42-54284.)

13. FUEL SYSTEM.

a. DESCRIPTION.

(1) GENERAL. (See figures 138 and 158.) - A pressure fuel system is incorporated in the airplane. It consists of the following: Two fuel containers in each inner wing, two fuel containers in the bomb bay, feed lines, cross-feed lines and controls, strainers, tank selectors, fuel pumps, primer pump, wobble pumps, dump valves, blower drains, and carburetors. The wing fuel system normally functions as two independent units with the left-hand fuel containers supplying the left engines and the right-hand fuel containers supplying the right engines. Main supply lines connect at the inboard and outboard ends of each container joint to a common outlet through a ball valve as shown on figure 138, thus permitting fuel to be supplied from either end of the container. When the airplane is banking in either direction, the fuel is always drawn from the lower end of the containers by means of the action of the ball valve, thus assuring a constant supply of fuel to the engine. A single line extends from the ball valve to the tank selector located within the wing on the inboard side of each nacelle which directs the fuel through the strainer to the engine driven pump. The fuel pump maintains a minimum pressure of 12 pounds per square inch (14 pounds per square inch desired, 16 pounds per square inch maximum) at the carburetor. Two vent lines are attached to each carburetor. One line allows the carburetor to vent directly back to each inboard fuel container, and the other vents back to the fuel pump. A line from each pump extends through the engine section cowling, allowing each pump to drain to the atmosphere. An overflow line is connected to each tank filler neck and extends to the lower surface of the inboard wing. Vent lines are attached to the upper position of each fuel container and extend aft through the nacelle to the atmosphere. Two bomb bay fuel containers function as one independent unit and are used when the left-hand, right-hand, or both wing fuel container systems are inoperative. A main supply line connected to an electric driven booster pump located on the aft face of the bulkhead at Station 70 leads fuel from the fuel container to the suction cross-feed line and directly to either engine. A fuselage tank selector control is located on the left side of the pilot's compartment and permits selection of fuel from the bomb bay fuel container to either engine or to both engines. Total capacity of the six fuel containers is 540 U.S gallons (449 Imperial gallons).

(2) FUEL LINES. - There are three different types of lines used in the fuel system: copper lines, dural tubing lines, and bulletproof rubber lines. All fuel lines are plainly marked by a red band to facilitate identification. Sizes of fuel lines are main system and cross-feed lines, 1-inch O.D.; filler neck overflow and blower chain lines, 3/8-inch O.D.; primer line, fuel pressure line, oil dilution line and static vent line, 1/4-inch O.D.

(3) FUEL CONTAINERS.

(a) WING FUEL CONTAINERS. (See figure 139.) - Four self-sealing wing fuel containers are provided to carry a total fuel load of approximately 400 U.S. gallons (333 Imperial gallons). Each inner wing incorporates an inboard container which has a fluid capacity of approximately 136 U.S. gallons (113 Imperial gallons) and an outboard container with a capacity of approximately 64 U.S. gallons (53 Imperial gallons). The inboard container is located between the leading edge of the wing and the main spar and extends from the inboard side of the nacelle to the root rib. The outboard container is located between the wing leading edge and the main spar and extends from the outboard side of the nacelle to the outer wing panel joint.

(b) BOMB BAY FUEL CONTAINERS. (See figure 140.) - The two bomb bay fuel containers are the self-sealing type and are installed in the bomb bay.

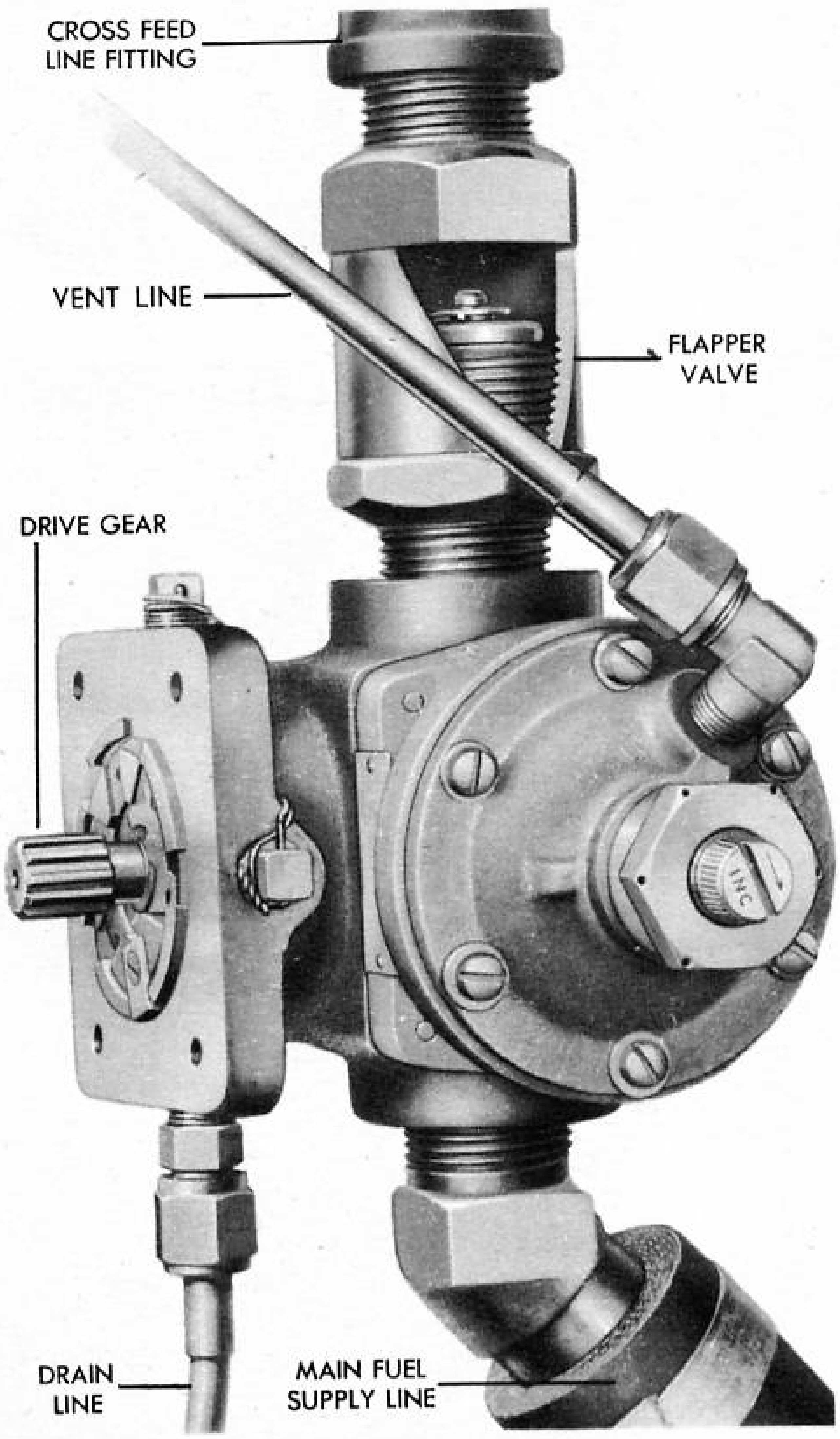


Figure 141 - ENGINE DRIVEN FUEL PUMP

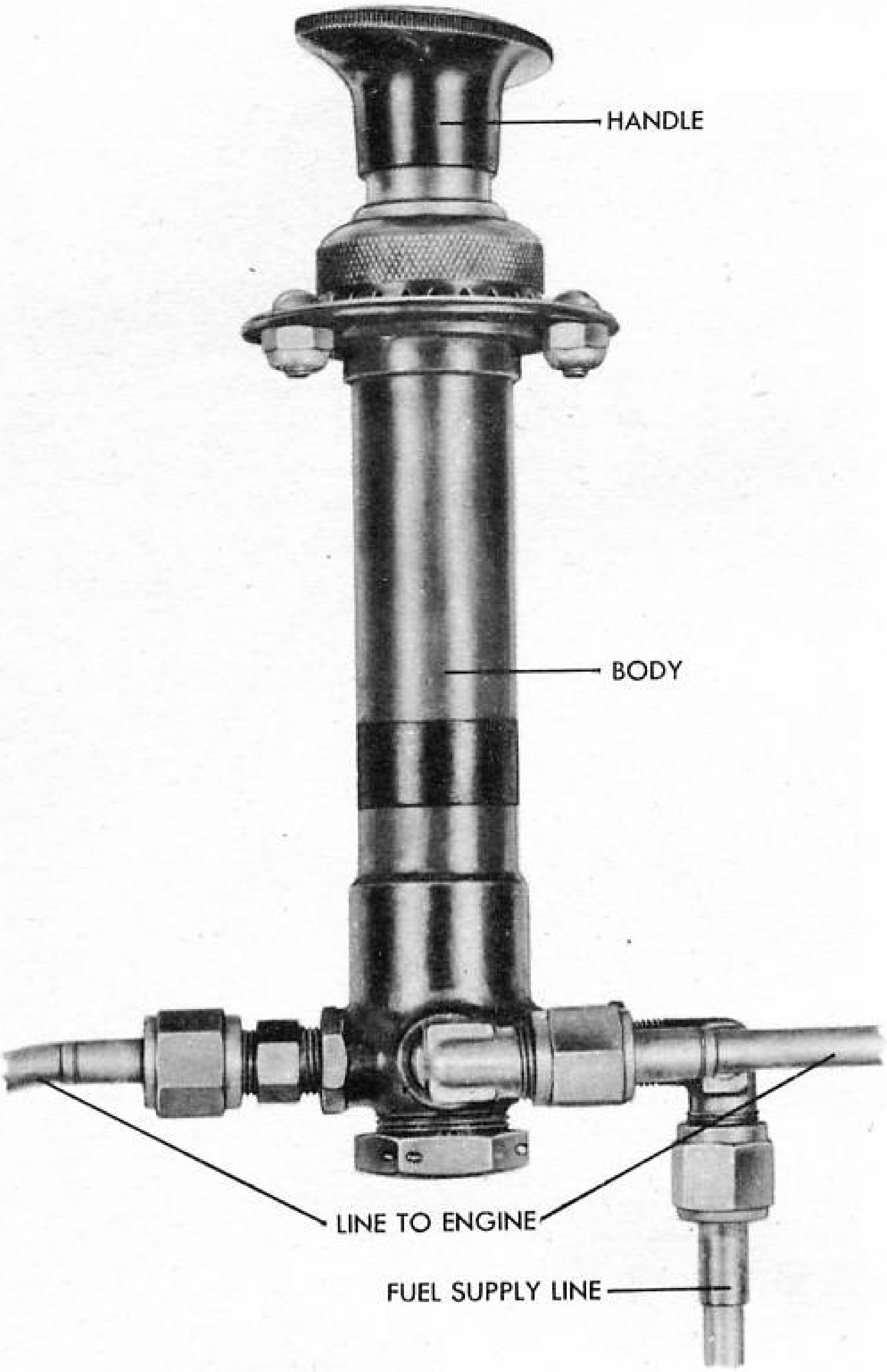


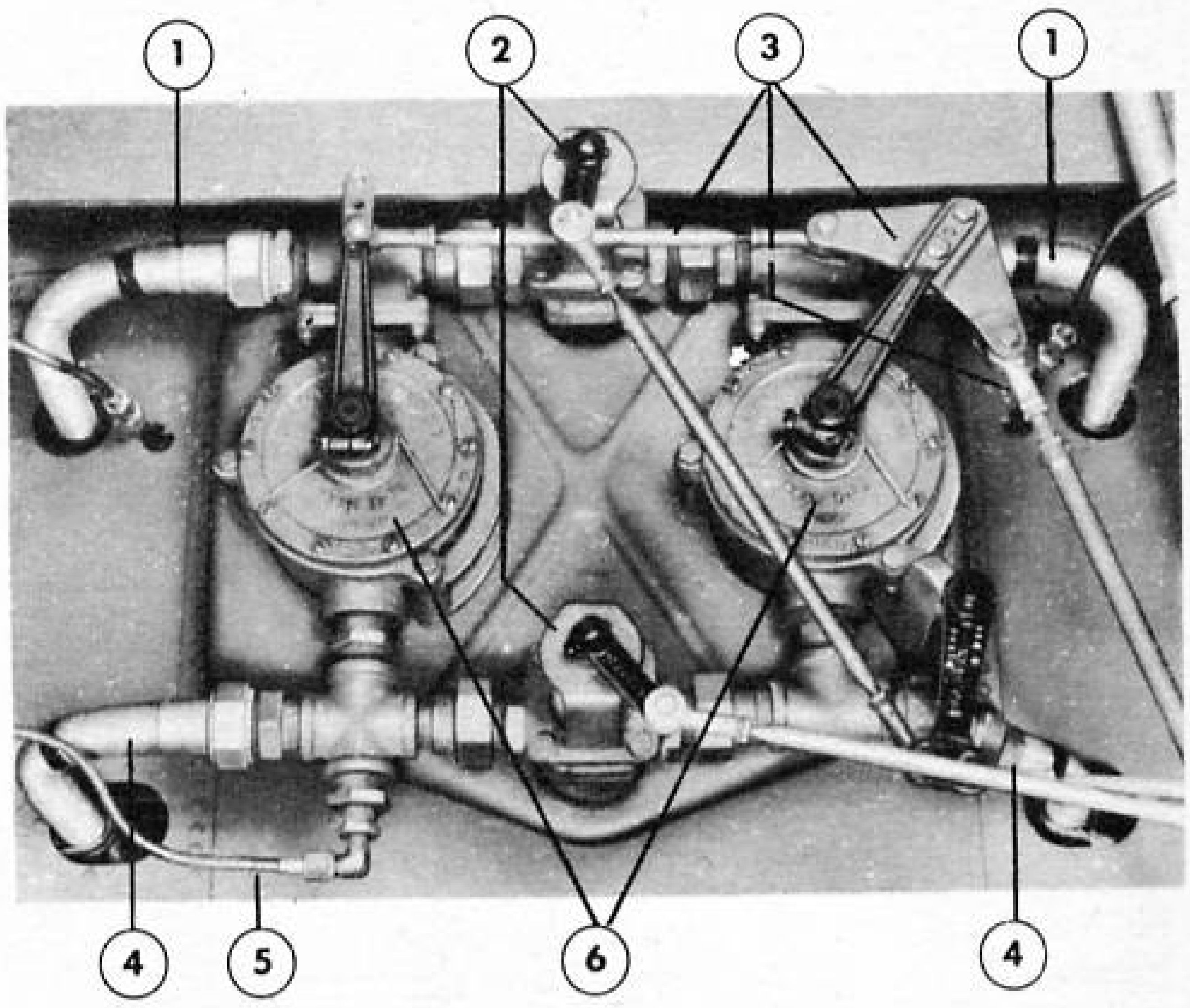
Figure 142 - PRIMER PUMP

one on each side of the bulkhead at Station 156. (See figure 7.) Fuel is supplied to the main system by an electrically driven booster pump at the bottom of the rear fuel container, through the tank selector valve in the left-hand inner wing. Bomb bay fuel containers have a total capacity of 140 U.S. gallons (117 Imperial gallons). Fuel level is maintained by two hoses which interconnect the fuel containers. A quantity gage float unit is mounted in the forward fuel container and indicates the quantity of fuel on position No. 5 of the quantity gage at the right side of the pilot's instrument panel. The filler neck, located at the top side of the forward fuel container, is provided with an overflow line which empties through the bottom of the fuselage. A vent line interconnecting both fuel containers is routed overboard through the bottom of the fuselage. A drain line from the booster pump and a tank drain line empty through the bottom of the fuselage to the atmosphere.

(4) ENGINE DRIVEN FUEL PUMPS. (See figure 141.) - Each engine drives a fuel pump of the rotary-vane, positive displacement type which maintains a pressure of 15 pounds per square inch at the carburetor. The pump consists essentially of a body containing a liner having a noncircular bore in which a rotor with three pairs of sliding blades is driven by a self-alining coupling. The special contour of the liner bore in combination with the number of blades and spacing of the ports produces a pulsationless flow. A metallic fuel seal prevents leakage around the rotor shaft.

(5) PRIMER PUMP. (See figure 142.) - A primer pump is located at the upper end of the fixed gun charging control panel on the right side of the pilot's cockpit, and is manually operated. Fuel supply for the primer is taken from the bottom of the left-hand wobble pump. Two lines extend from the primer. One line runs down each side of the fuselage, into the adjacent inner wing and thence through the nacelle and fire wall to the engine. (See figure 158.)

(6) WOBBLE PUMPS. (See figure 143.) - The two wobble pumps are manually operated auxiliary fuel pumps located on a bulkhead forward of Station 156. Both pumps are operated simultaneously by a handle which extends upward from the floor at the left side of the pilot's seat. (See figure 156.) Push-pull rods connect the pilot's control handle to the actuating linkage at Station 156. The tie rods to the pump cranks hold the right-hand wobble pump crank (looking forward) in an upright position and the left-hand pump crank at 45 degrees to the left of vertical when the pilot's operating handle is midway of its stroke (figure 159) or vertical. On airplanes No. 42-53535 to 42-54284 another control



1. ENGINE CROSS-FEED LINES
2. CROSS-FEED VALVES
3. OPERATING LINKAGE
4. FUEL CONTAINER CROSS-FEED LINES
5. PRIMER LINE
6. WOBBLE PUMPS

Figure 143 - INSTALLED WOBBLE PUMPS

handle for the wobble pumps is located in the gunners' cockpit.

(7) CROSS-FEED CONTROL SYSTEM.

(a) GENERAL. (See figure 158.) - Cross-feed fuel control, operating both by pressure and suction, and in conjunction with the tank selector valve, allows fuel to be drawn from any fuel container for either or both engines. The pressure cross-feed lines tee into the main supply line on the pressure side of each fuel pump. From this tee they pass through the fire wall, through each nacelle and inner wing to the bulkhead at fuselage Station 156, where they attach to a cross-feed valve. (See figure 121.) The suction cross-feed lines tee into each main fuel supply line between the fire wall and the strainer. The lines extend through the inner wing to the fuselage and connect to a cross-feed valve. A check valve is located at each side of the control valve in the pressure cross-feed system. A tee and cross are located at each side of the control valve in the suction cross-feed system. These fittings interconnect the two systems through the wobble pumps for manual operation of cross-feeding. (See figure 159.)

(b) CABLE CONTROLS. (See figure 159.) - Two cross-feed cable controls, leading to the cross-feed valves, are located on the fuel valve control panel installed on the left side of the pilot's cockpit. The engine cross-feed control operates the pressure cross-feed system and the tank cross-feed operates the suction cross-feed system. Push-pull rods and 3/32-inch cables connect the actuating handles in the pilot's cockpit to the valves mounted on the bulkheads at Station 156. The clevis arrangement incorporated in the shaft assembly of each valve can be used to determine the position of the valves for coordination with the control handle positions. When the slot of the clevis is horizontal, the valve is OFF; and when the slot is vertical, the valve is ON. Valve movements can be checked by observing that the control handle "clicks" into each designated position.

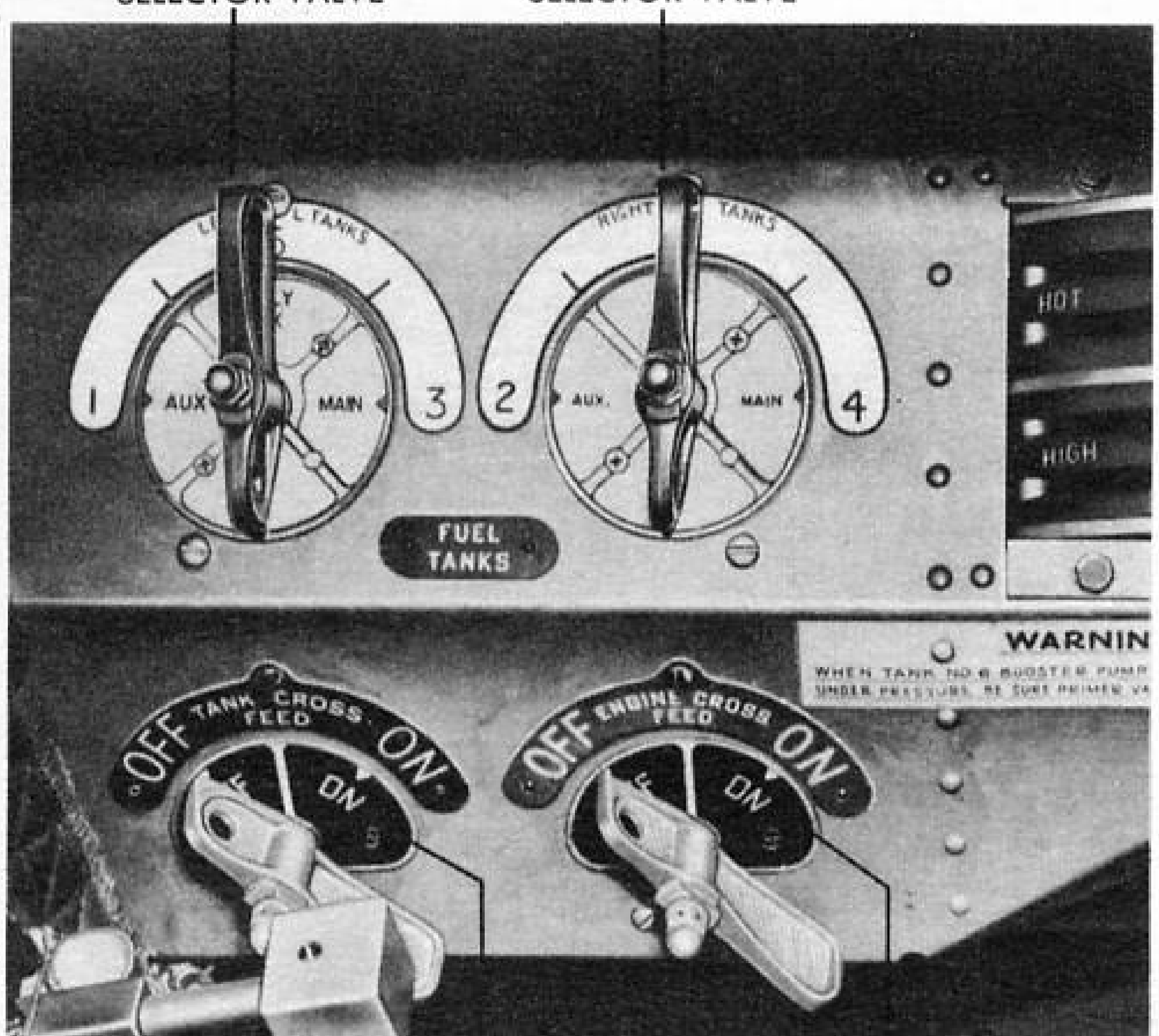


Figure 144 - FUEL SYSTEM SELECTOR VALVE AND CROSS-FEED CONTROLS

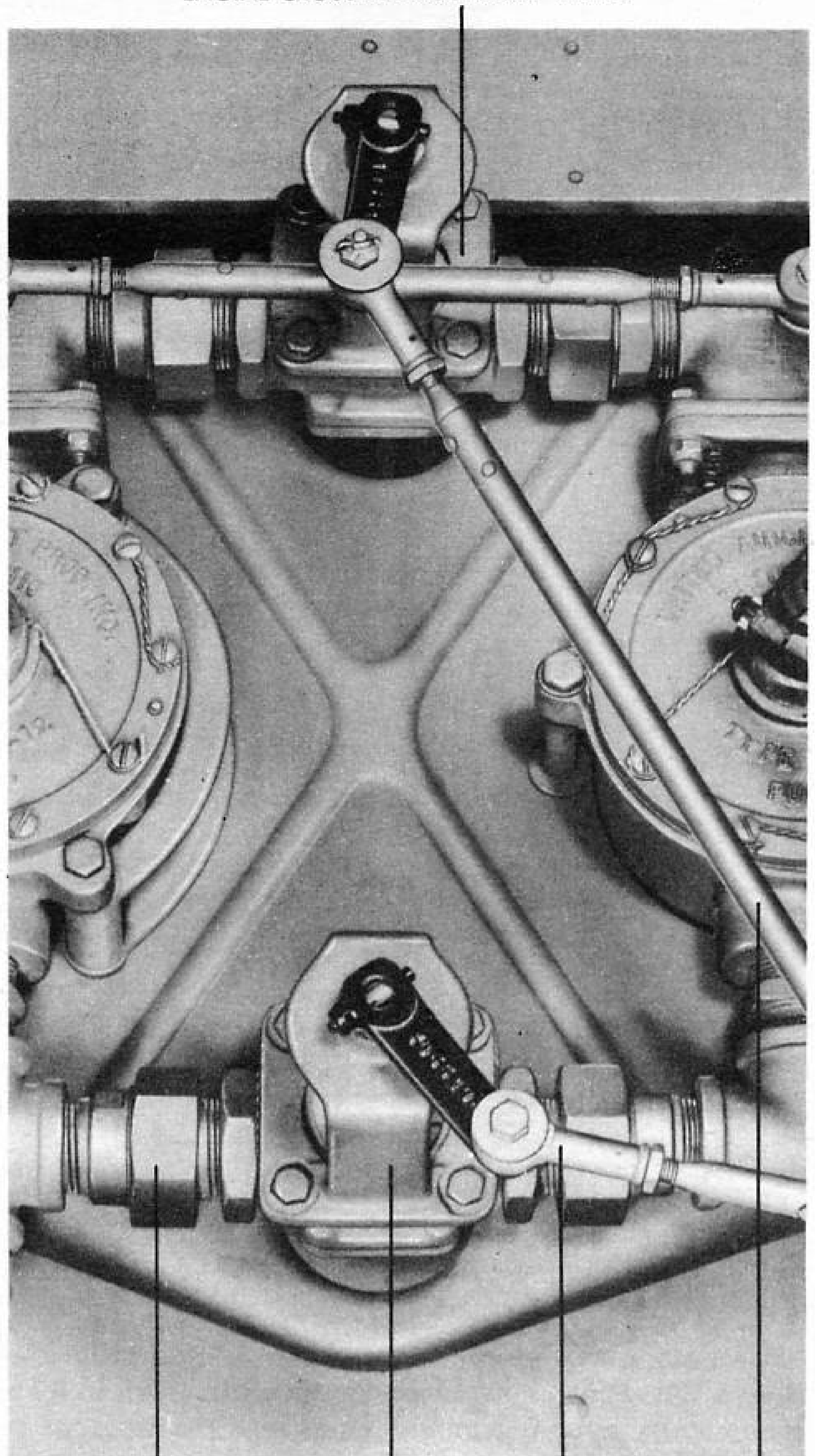


Figure 145 - INSTALLED CROSS-FEED CONTROL VALVES

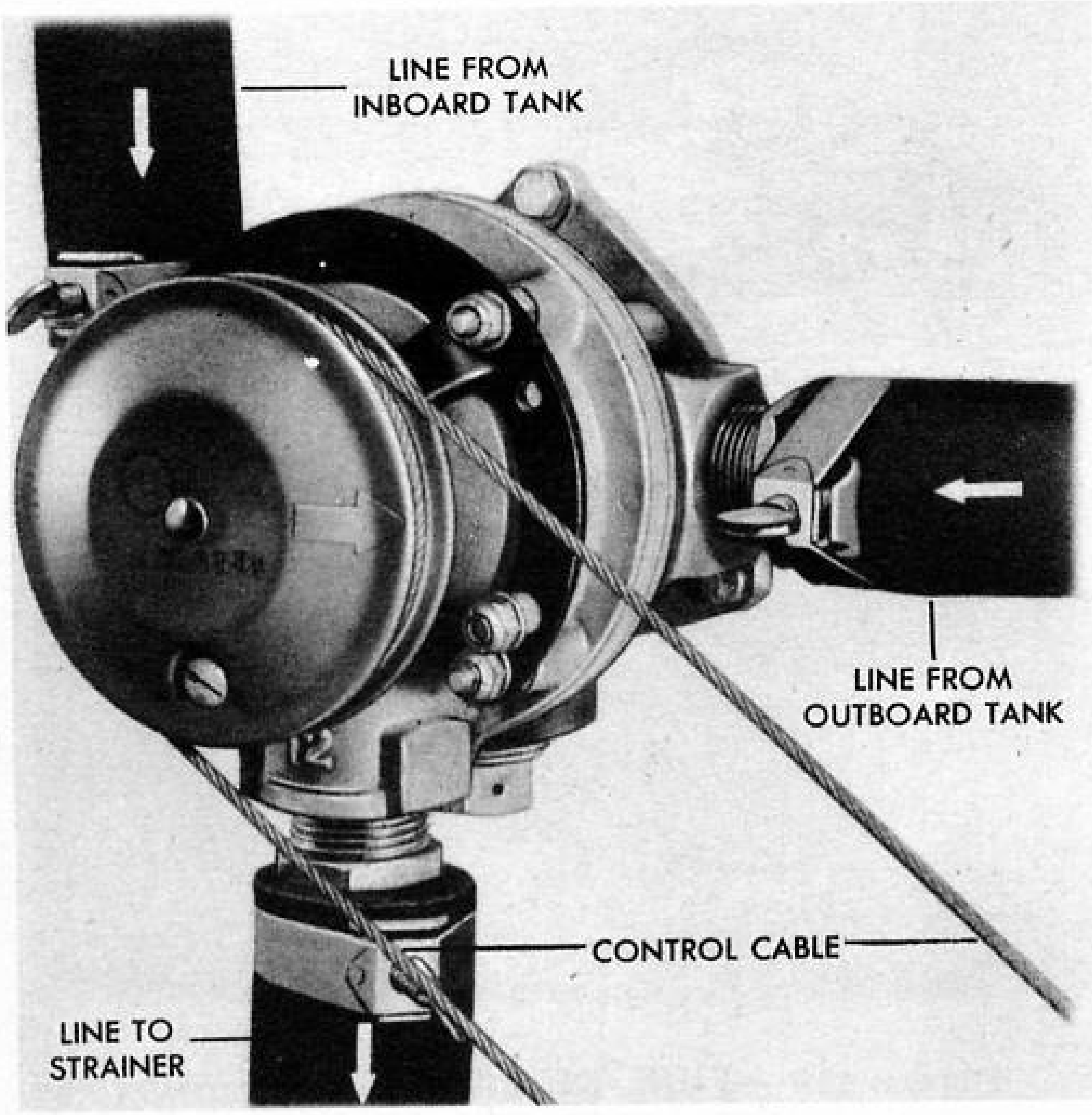
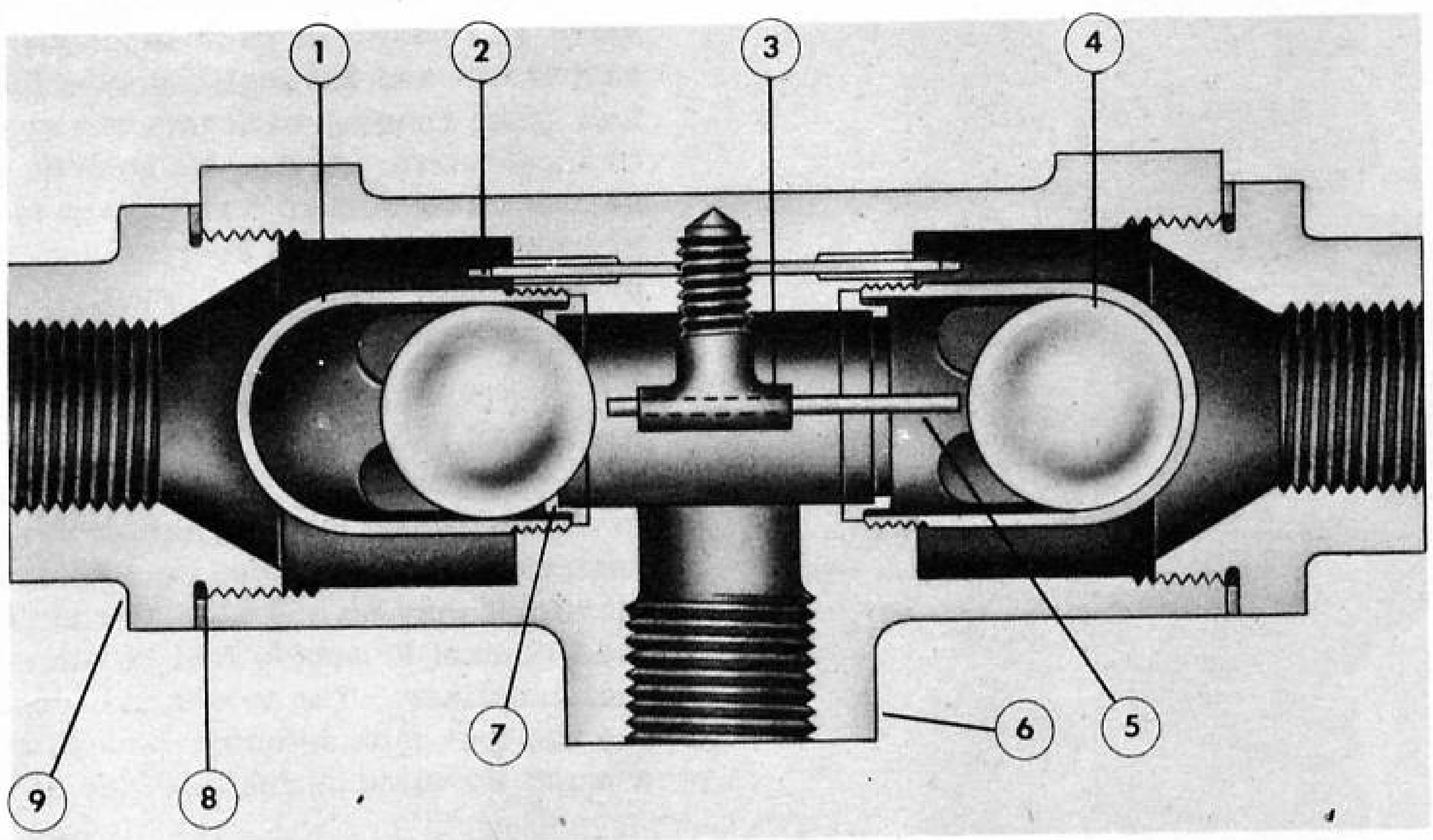


Figure 146 - FUEL TANK SELECTOR VALVE

NOTE

All replacement cables should be proof-loaded to 552 pounds before installation.

(c) OPERATION OF CROSS-FEED CONTROL SYSTEM. (See figure 144.) - During normal operation both the pressure and suction cross-feed valve control handles in the pilot's cockpit are in the OFF position. The tank selector valve control handles may be at either the AUX. or MAIN position. This allows each engine to be supplied with the fuel from either fuel container in its respective wing. If fuel supply to the left-hand engine from a left-hand wing fuel container is cut off due to pump failure, turn the tank selector valve control handle for the left-hand fuel containers to the OFF position. Turn the tank selector valve control handle for the right-hand fuel container to the desired fuel container. Turn the pressure cross-feed control handle to the ON position. The fuel flows from the tee on the pressure side of the right-hand fuel pump, through the pressure cross-feed valve and enters the supply line for the left-hand engine at the tee on the left-hand fuel pump. To supply fuel to the right-hand engine from the left-hand fuel container in case of



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	295013	GUIDE, BALL	2
2.	294008	PIN, LOCK	1
3.	295016	GUIDE, SPACER	1
4.	294001	BALL	2
5.	294003	PIN, SPACER	1
6.	295011	BODY	1
7.	288290	SEAT, BALL	2
8.	294002	GASKET	2
9.	295012	CAP	2

Figure 147 - FUEL BALL CHECK VALVE - CROSS SECTION

failure of the right-hand fuel pump, reverse the settings of the tank selector valves. If it becomes necessary to feed both engines from fuel containers in one wing due to a cause other than pump failure, the gravity (suction) cross-feed may be used.

(8) CROSS-FEED CONTROL VALVES. (See figure 145.) - Two manually operated cylindrical cross-feed control valves are mounted near the wobble pumps on the aft bombbay bulkhead at Station 156. One valve is installed in the engine (pressure) cross-feed line and the other is installed in the tank (suction) cross-feed line. These valves are interchangeable. The valves are controlled through a system of cables and rods from a dial and handle assembly mounted with the fuel tank selector valve controls on the panel on the left side of the pilot's cockpit.

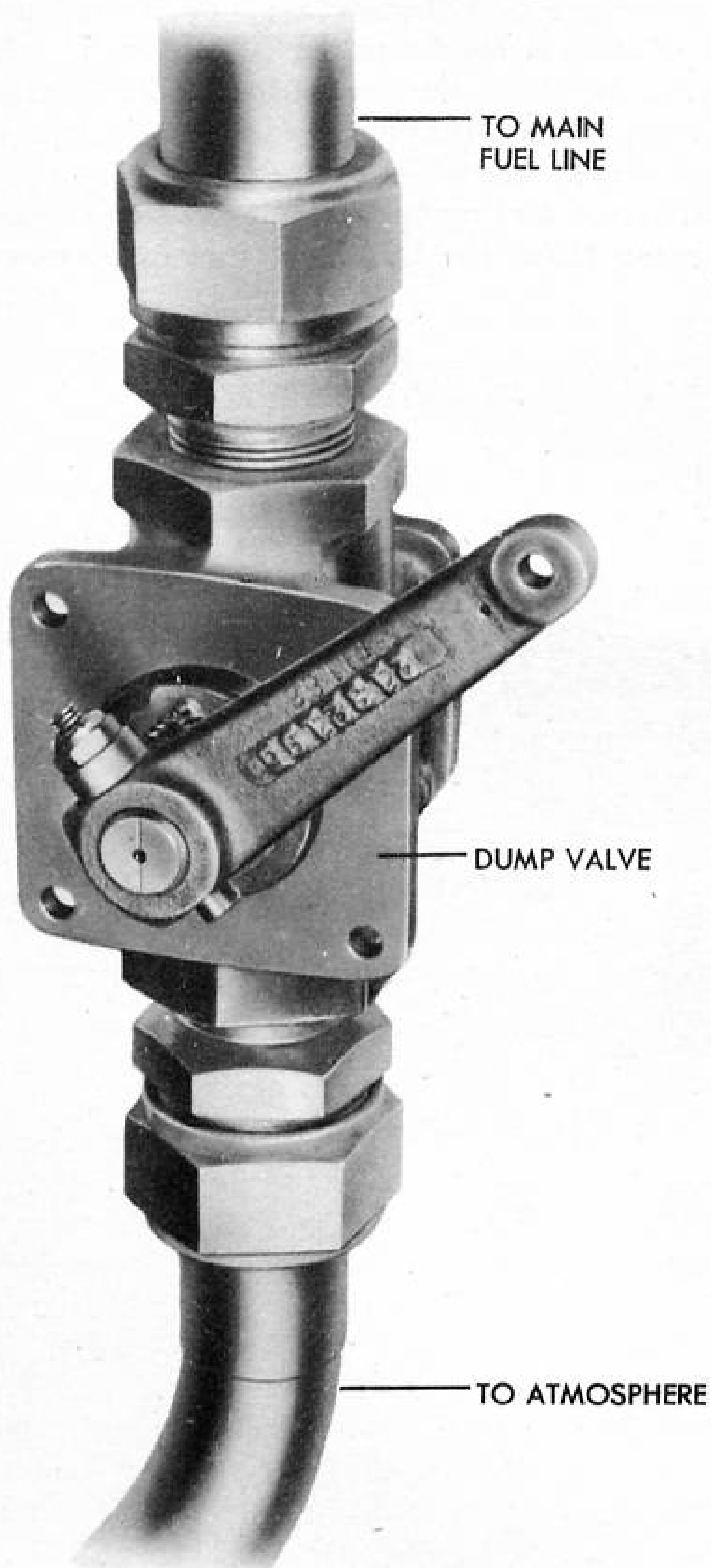


Figure 148 - FUEL DUMP VALVE

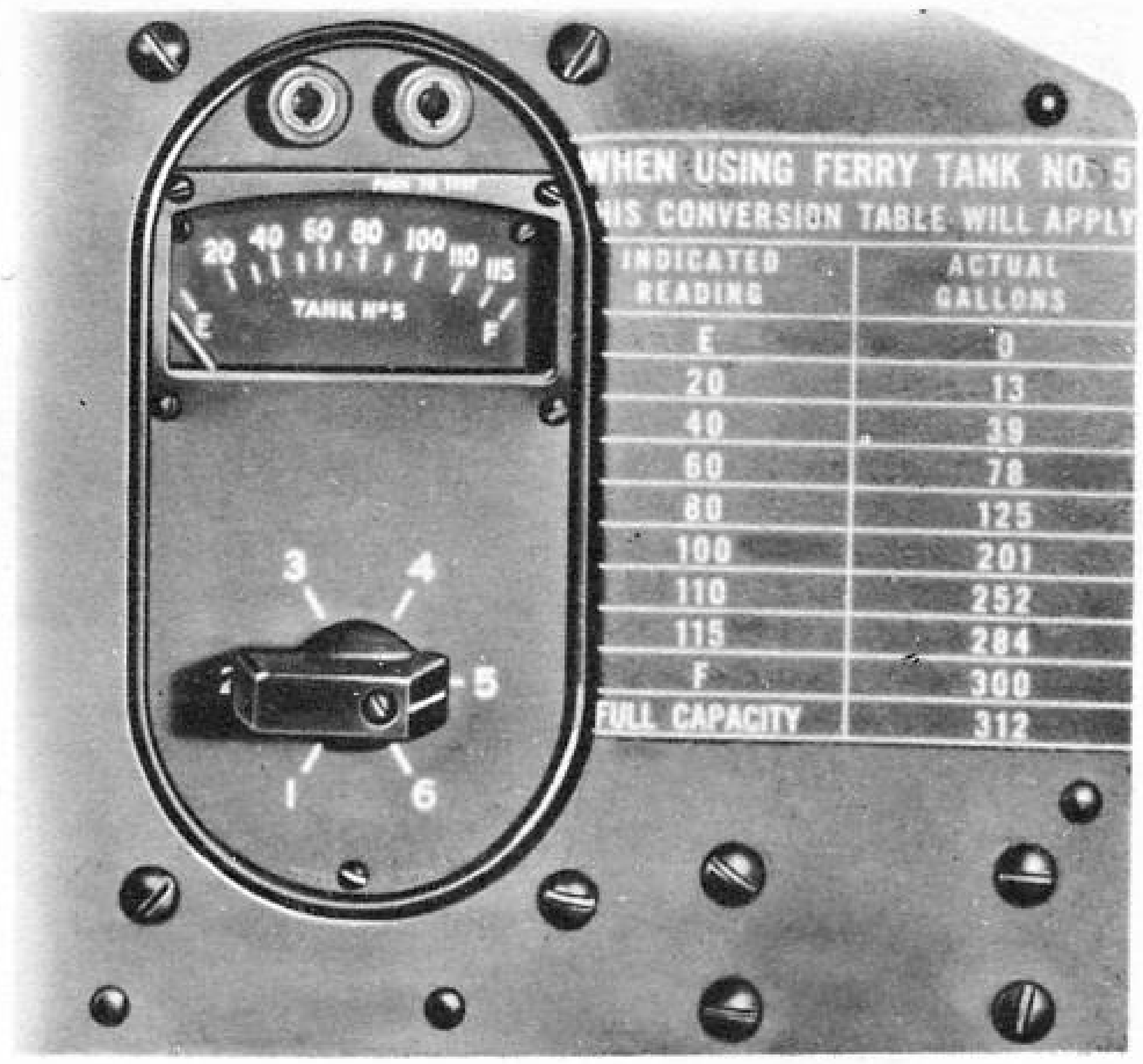


Figure 149 - FUEL QUANTITY GAGE AND SELECTOR SWITCH

(9) CHECK VALVES. - A flapper type check valve is located in each main fuel line between the carburetor and the engine driven fuel pump to prevent fuel from running back into the system when a pump is inoperative. A No. 60 hole is provided inside of seat to allow enough fuel to flow to the pump below to prevent vanes from scoring and overheating during priming operations, and to eliminate vapor troubles while operating on pressure cross-feed.

(10) FUEL TANK SELECTOR VALVES. (See figure 146.) - A tank selector valve is located within the wing on the inboard side of each nacelle. It is used to select either fuel container for fuel supply to the engine-driven fuel pump on the same side of the airplane. It may be operated in conjunction with cross-feed control to supply fuel to either engine from any fuel container. The valves are connected by cable to the two fuel tank selector manual controls located on a panel installed on the left side of the pilot's cockpit.

(11) FUEL BALL CHECK VALVES. (See figure 147.) - A ball check valve connects both main fuel supply lines from each self-sealing fuel container to a common outlet. A ball and pin arrangement in the valve operates automatically so that one side of the valve is opened while the other side is closed. Therefore, when the airplane is banking in either direction, the fuel is always drawn from the lower end of the fuel container due to the action of the ball valve. This assures a smooth uninterrupted flow of fuel to the engines. There are four fuel ball check valves on the airplane located in the main line - one below each wing fuel container. These valves, part No. 295010, are

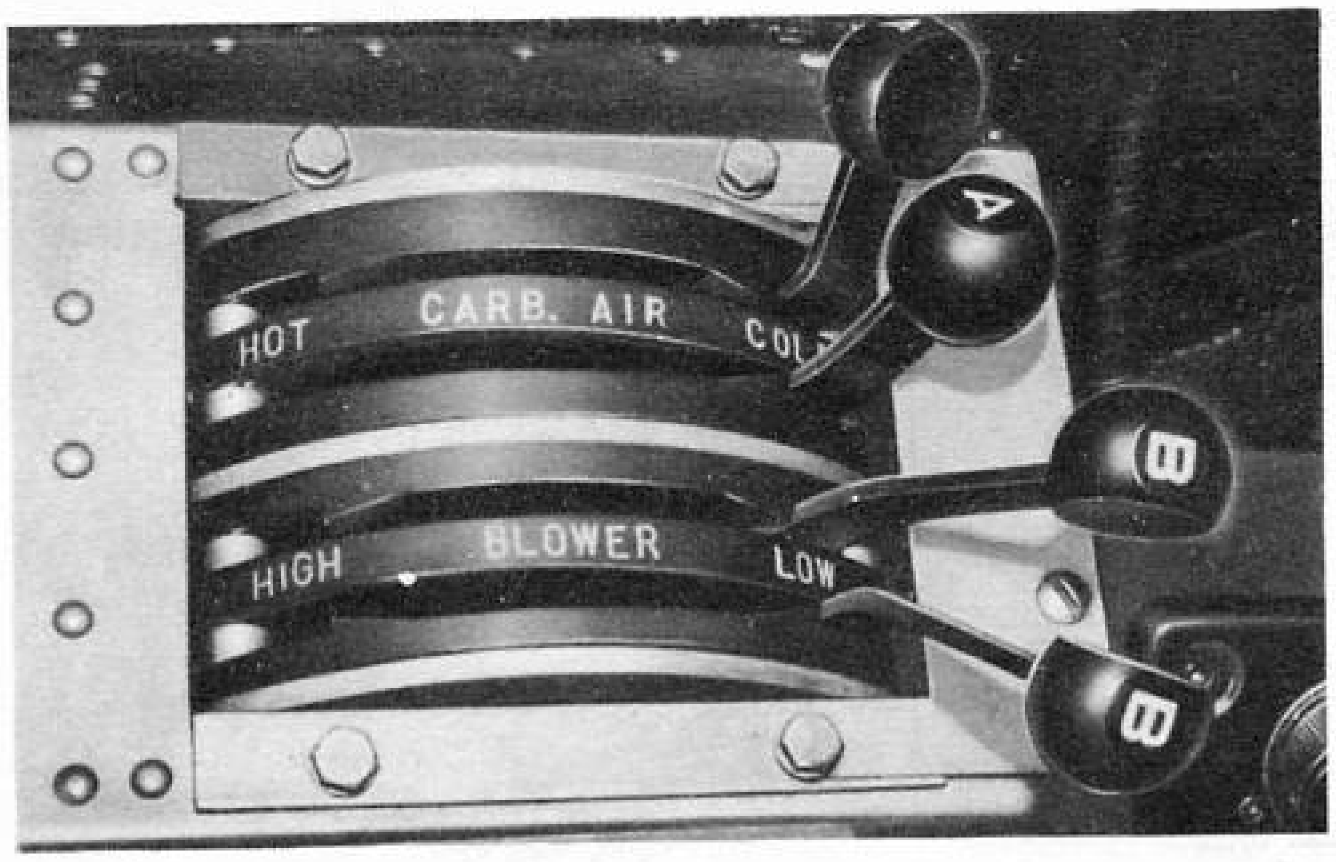


Figure 150 - CARBURETOR AND BLOWER CONTROLS

interchangeable. The inboard side fittings, however, are different from the outboard because of the positions in which the valves are installed in the wing spars.

(12) FUEL DUMP VALVE SYSTEM.

(a) GENERAL. (See figure 148.) - The fuel dump system is provided for emergency destruction of the airplane on the ground as well as emergency dumping of the fuel in flight. The system consists of a gate-type dump valve installed in the main fuel line leading from each inboard fuel container. These valves are located on the aft face of the bulkhead at Station 156 1/2, and have an outlet on each side of the fuselage just aft of that Station. The valves are linked together and must be safetied down at all times by a 24-gage copper wire.

(b) OPERATION OF FUEL DUMP VALVES. - The dump valves are controlled by a single ball type handle on the right side of the cockpit floor. This handle is painted red and marked "DESTRUCTION VALVE." When the control handle is pulled both valves are opened. The pilot has no way of closing them again.

(13) FUEL QUANTITY GAGE.

(a) SELECTOR SWITCH. (See figure 149.) The selector switch is mounted on the pilot's instrument panel and is an integral part of the indicator. The indicator hand on the dial always shows the quantity of fuel in the fuel container for which the selector switch is set. The selector switch connects the indicating mechanism with the liquidometer unit in the tank chosen. The selector switch points are:

No. 1 - Left auxiliary (outboard) fuel container.

No. 2 - Right auxiliary (outboard) fuel container.

No. 3 - Left main (inboard) fuel container.

No. 4 - Right main (inboard) fuel container.

No. 5 - Bomb bay (fuselage) fuel containers.

(b) LIQUIDOMETER TANK UNITS. (See figure 139.) - The EA-15 tank unit consists of a circular housing with AC-35A4269 socket. To the housing is attached a supporting member on which a float arm pivots. Within the housing are a resistance strip (with provision for adjusting stroke and end position) and a movable contact arm connected by leverage to the float arm. A metal bellows mounted on the housing prevents fuel leakage. The tank unit operates automatically by means of a float which is governed by the amount of liquid in the fuel container. The position of the float is transferred by a linkage system to a contact arm on a very low resistance in the housing. The fuel is sealed from electrical parts by the metal bellows. A tank unit of the same type (EA-15W) is installed in each wing tank and adjusted to each particular fuel container. Whenever a tank unit is installed, it must be adjusted to the fuel container.

(14) FUEL STRAINERS. - A type C-4 strainer is located in each main fuel line between the fuel pump and the selector valve. The interior of the strainer is constructed in the shape of a cone. The strainer is the lowest point in the fuel system.

(15) BLOWER DRAIN. - The blower drain is a 3/8-inch dural line running from the bottom of the blower case to the trailing edge of the lower cowl flaps. The exposed end has a pressure cut. Where the line joins the case there is a metal disk that opens and closes a vent, thereby acting as a valve. It is closed when the engine is running. When the engine is being stopped, the vent opens to allow any liquid to drain from the carburetor. If this disk type valve fails to open when the carburetor is bled, fuel will run into the lower intake tubes, and structural failure or serious damage to the engine may result when the engine is started. In normal operation, failure of the valve could be caused only by presence of oil or another sticky substance in the fuel.

(16) CARBURETORS. (See figures 155 and 156.) - Each engine is equipped with a single Stromberg injection type carburetor. A vapor vent line is connected from the carburetor screen chamber to the inboard fuel tank. A balance vent line is connected from the top deck of the carburetor to the siphon chamber of the fuel pump. This line is also connected to the air vent fitting on the fuel pressure gage. Two pressure gages are mounted on the pilot's instrument panel and are connected so that the readings are taken at the point where the fuel enters the carburetors.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Loss of pressure.	Empty fuel containers.	Fill fuel containers. (See Section 3, this handbook.)
	Clogged strainer or finger-screen.	Remove strainer or finger-screen and wash in gasoline to remove collected sediment. This should be done at least once every 25 hours.
	Obstruction in fuel container vent line.	Remove obstruction from line.
	Shut-off valve OFF when control says ON.	Rig shut-off valve.
	Obstruction in fuel line.	Remove suspected line and inspect for and remove obstruction.
	Obstruction in fuel pump relief valve.	Remove and clean relief valve.
	Sheared fuel pump shaft.	Remove and repair fuel pump.
	Broken diaphragm or leak in fuel pump.	Remove and repair fuel pump.
Error of fuel level gage at empty or full position.	Improper range adjustment.	Adjust fuel level gage range adjustment.
	Excessive friction and wear.	Repair or replace fuel level gage
	Dirt or corrosion in gage or fuel container unit.	Remove and clean gage or fuel container unit.
	Unbalanced resistance in gage.	Make correction in rheostat and stroke adjustment box.
Fuel pressure gage shows excessive error at ZERO.	Pointer loose on shaft.	Tighten pointer onto shaft and calibrate gage.
	Excessive over-pressure.	Reset pointer and calibrate gage.
Excessive pointer oscillation of fuel pressure gage.	Improper damping or rough relief valve.	Adjust or replace relief valve.
Carburetor floods when filling.	Carburetor needle valve stuck or damaged.	Tap carburetor lightly to reseat needle in valve. Remove and repair if necessary.
	Dirt in carburetor causing fuel intake to stay open.	Remove carburetor and clean.
	Carburetor float stuck.	Remove carburetor and clean.
Engine loses power or sputters while running.	Water lodging in fuel passages, causing mixture to become extremely lean.	Drain all sumps in all fuel tanks. About 1/2 pint of liquid should be drained from each fuel container each day.

SYMPTOM	CAUSE	REMEDY
	Vapor lock in system.	Turn ON engine cross-feed valve. Let engine resume normal running. Then slowly turn cross-feed OFF until eight pounds per square inch pressure is obtained. Vapor locked pump will gradually pump out the gas vapor. Shut engine cross-feed OFF when 15 pounds per square inch pressure is resumed.
Fuel container collapses as fuel is consumed.	Dirt in vent line filter.	Replace fuel container. Clean the filter in the vent line every 25 hours.
Fuel siphons from fuel container during flight.	Crack in connection of 3/8-inch overflow line to filler cap at top of fuel container.	Replace or repair defective parts. Inspect sweat fit of line to cap when fueling airplane to prevent recurrence of fuel loss.
	Filler cap lost.	Replace filler cap. Be sure filler caps are installed properly after fueling airplane.
Primer pump fails to function.	Air in primer pump.	Turn ON tank cross-feed valves. Operate wobble pump. Air will be forced from primer pump.

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF INBOARD FUEL CONTAINER. (See figure 139.)

(a) Drain inboard fuel container through access door (A). (See figure 19.)

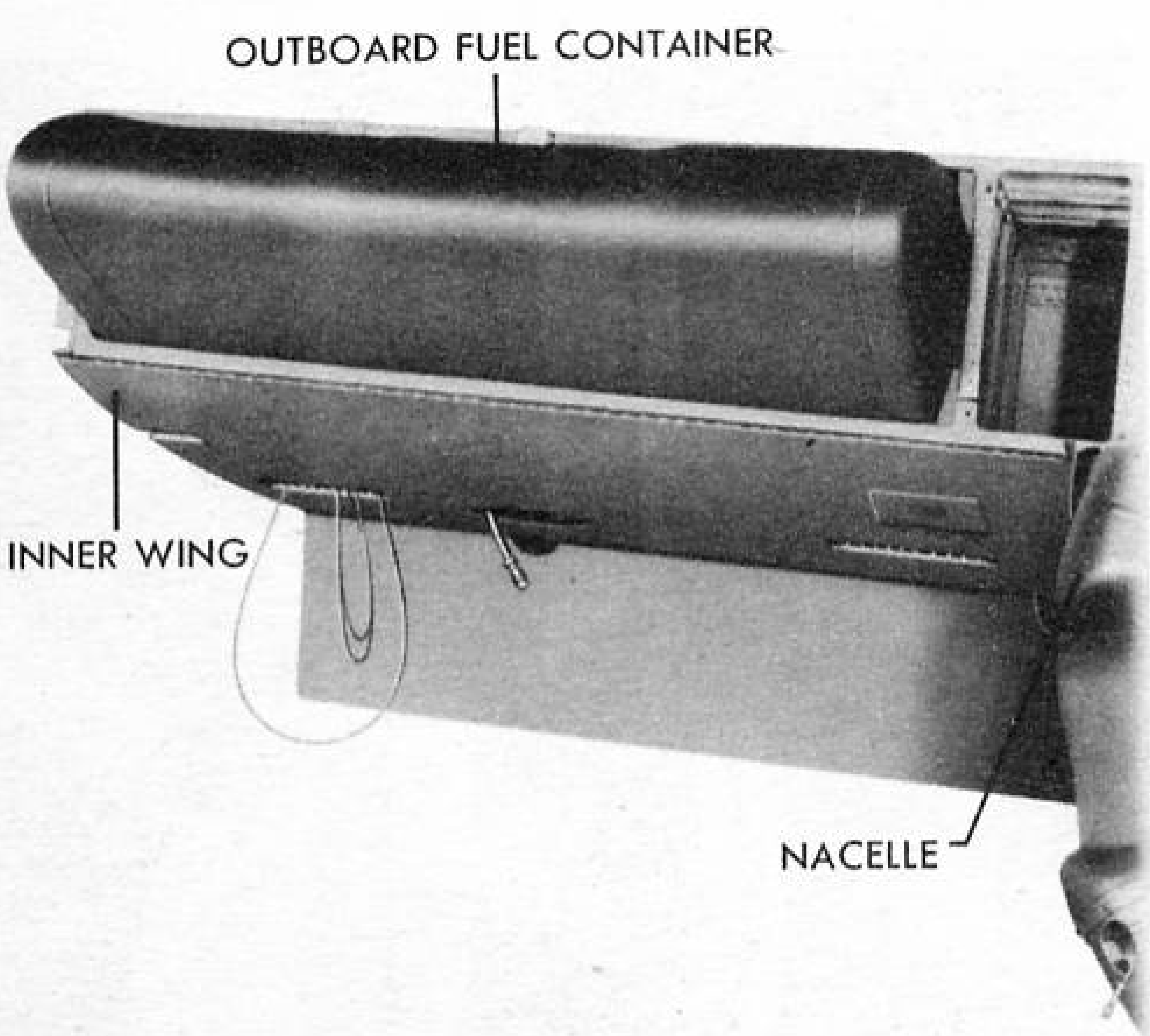


Figure 151 - REMOVING OUTBOARD FUEL CONTAINER

(b) Remove inner wing panel to fuselage fairing.

(c) Remove nacelle to wing fillet

(d) Remove leading edge of inner wing.

(e) Remove screws from the outlet, vent, and overflow fittings.

(f) Remove screws from the liquidometer mounting ring.

(g) Remove fuel container fittings. Loosen all zinc chromate glue around them.

(h) Remove screws which secure anti-collapsing tabs from the exposed split of the wing structure.

(i) Remove fuel container, being careful not to collapse or tear it.

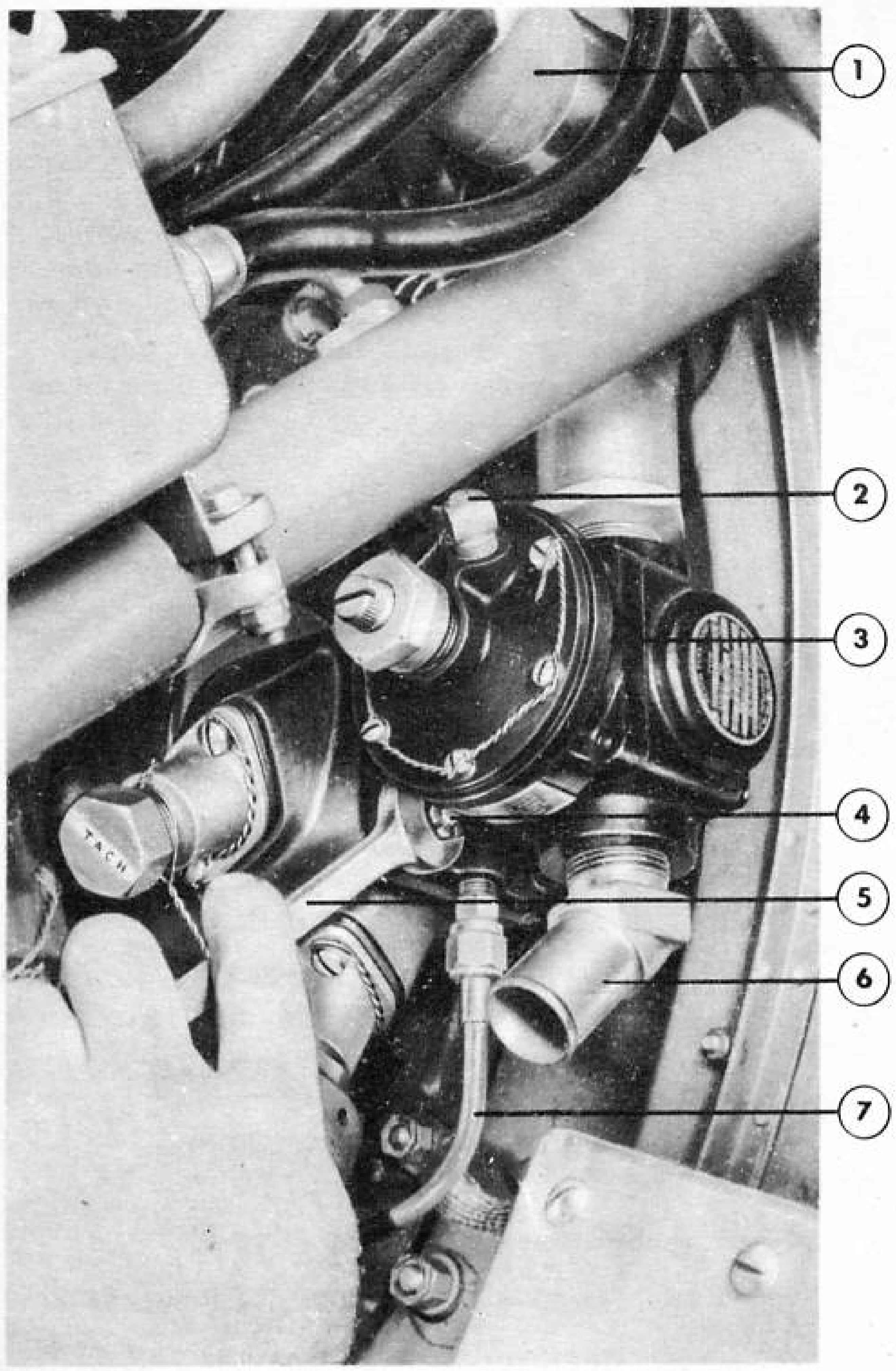
(2) REMOVAL OF OUTBOARD FUEL CONTAINER. (See figure 151.)

(a) Drain the outboard fuel container through access door (K). (See figure 19.)

(b) Remove the outer wing.

(c) Remove the leading edge of the inner wing outboard of the nacelle.

(d) Remove screws that secure the anti-collapsing tabs to the wing.



1. CROSS-FEED LINE
2. SUPERCHARGER CONNECTION
3. FUEL PUMP
4. PUMP ATTACHING NUT
5. ½-IN. OPEN-END WRENCH
6. MAIN FUEL SUPPLY LINE FITTING
7. DRAIN LINE

Figure 152 - REMOVING ENGINE DRIVEN FUEL PUMP

(e) Disconnect all fittings from the fuel container.

(f) Remove six screws that attach fuel container to outboard edge of wing.

(g) Carefully pry the fuel container loose from the structural part of the wing.

(3) REMOVAL OF BOMB BAY FUEL CONTAINER. (See figure 140.)

NOTE

Fuel containers and supports are removed through the bottom of the fuselage. The forward fuel container and support weigh approximately 134 pounds and the rear fuel container and support weigh approximately 122 pounds.

(a) Drain fuel by opening drain cock at bottom of rear fuel container.

(b) Disconnect vent line and overflow lines at the fuel container.

(c) Disconnect main fuel line, pump drain line and tank drain line at the booster pump and adapter. Remove booster pump and adapter from fuel container after disconnecting pump wiring.

(d) Disconnect electrical conduit at the top of the forward fuel container. Disconnect fuel container from floor at the strap hold-downs.

(e) Remove support attaching bolts at fuselage. Raise fuel container, remove floor panel. Remove fuel container.

(4) REMOVAL OF FUEL PUMP. (See figure 152.)

(a) Remove the accessory cowling on the right side of the nacelle.

(b) Disconnect the main supply line from the bottom of the pump and the cross-feed line from the top of the pump.

(c) Disconnect fuel pump drain line.

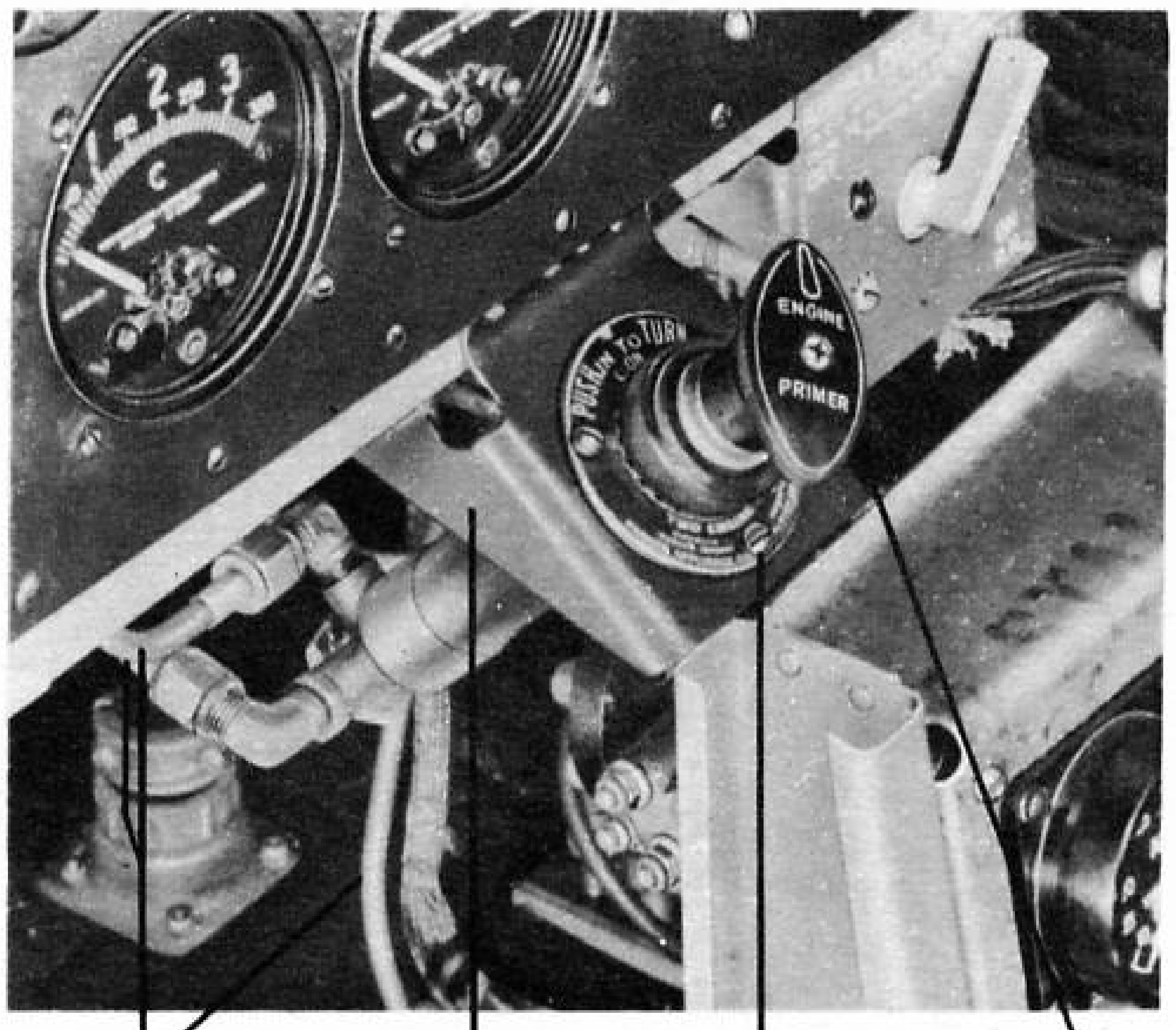
(d) Disconnect sylphon vent line at pump.

(e) Remove castellated nuts at pump base.

(f) Remove pump.

(5) REMOVAL OF PRIMER PUMP. (See figure 153.)

(a) Disconnect the three fuel lines from the under side of the primer.



FUEL LINES LOWER PANEL ATTACHING SCREW HANDLE

Figure 153 - INSTALLED PRIMER PUMP

(b) Remove primer handle.

(c) Remove the three screws that hold the primer to the lower panel in the cockpit.

(d) Lower the primer down through the panel.

(6) DISASSEMBLY OF PRIMER PUMP. - Remove primer cover and plunger.

(7) REMOVAL OF WOBBLE PUMP. (See figure 143.)

(a) Set all control valves in OFF position.

(b) Disconnect operating linkage rods at wobble pumps.

(c) Disconnect fuel tank cross-feed, engine cross-feed, and primer lines at the pumps.

(d) Disconnect linkage to cross-feed valves.

(e) Remove pump support screws on each side. Lift pumps out.

(f) Remove all fuel fittings.

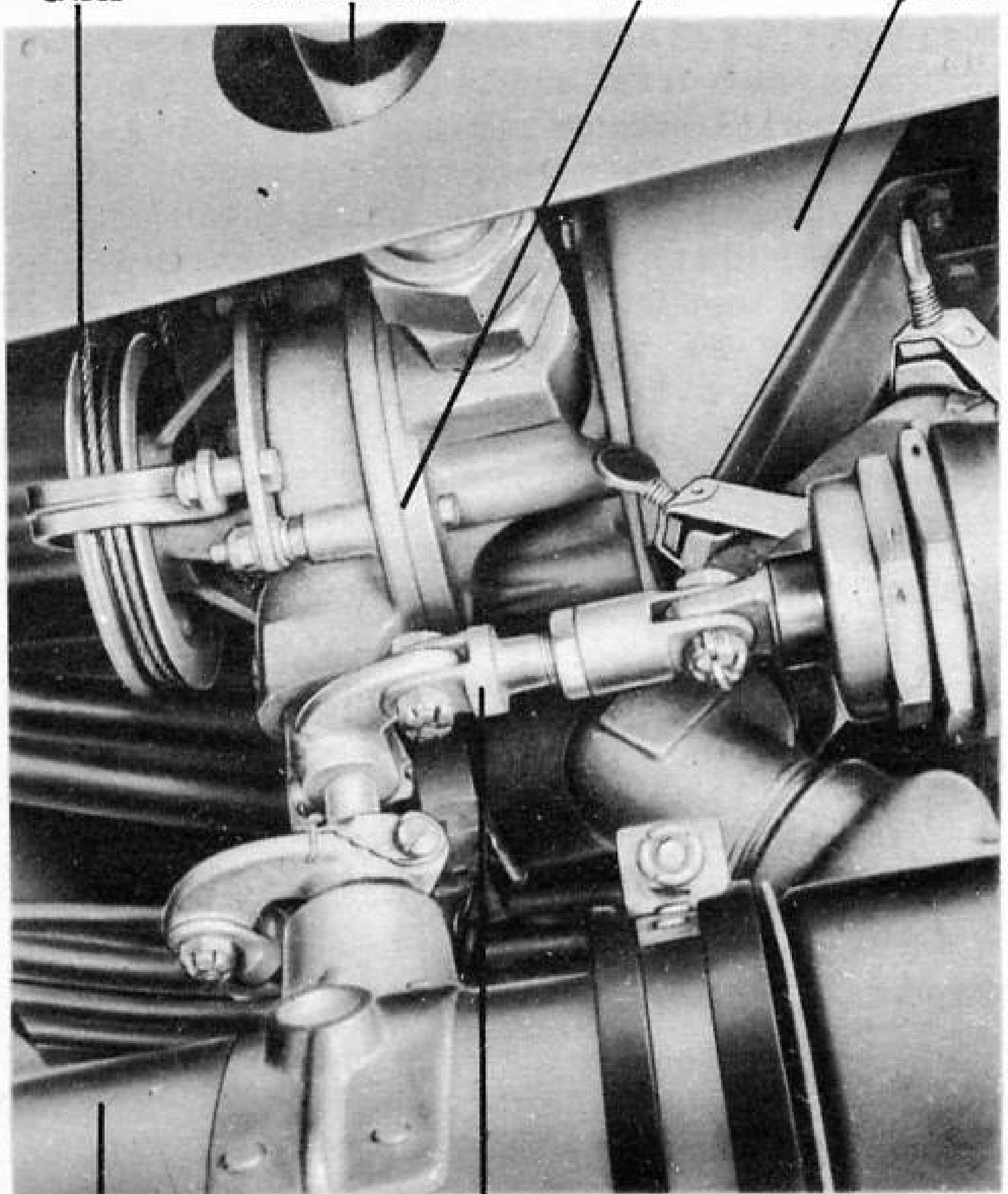


Figure 154 - INSTALLED FUEL TANK SELECTOR VALVE

(8) DISASSEMBLY OF WOBBLE PUMP.

(a) Remove screws from top cap and remove cap.

(b) Remove cap gasket.

(c) Remove steel disk.

(d) Remove inner pump wing.

(e) Remove intake and discharge valve.

(f) Loosen safety nut and remove adjusting screw and spring.

(g) Remove sylphon.

(9) REMOVAL OF CROSS-FEED CONTROL VALVE. (See figure 145.)

(a) Loosen the two nuts which attach the valve to the cross-feed line.

(b) Disconnect the actuating rod leading to the valve and remove the valve from the dural line.

(10) REMOVAL OF CHECK VALVE. - Disconnect fuel lines and unscrew the valve assembly.

(11) DISASSEMBLY OF CHECK VALVE. - Unscrew the valve cap and remove the Neoprene seal.

(12) REMOVAL OF FUEL TANK SELECTOR VALVE. (See figure 154.)

(a) Drain fuel containers which supply fuel to valve being removed.

(b) Remove oil cooler fairing on the inboard side of engine nacelle. (See figure 19, item 0.)

(c) Loosen selector cable in bomb bay.

(d) Wrap cable on drum to prevent unwinding. Remove the drum.

(e) Disconnect drain and cap all fuel lines at the selector valve.

(f) Remove the bolts that secure the selector valve to the bracket.

(g) Remove oil cooler shutter actuating linkage.

(h) Lift the selector valve out over top of the oil cooler.

(13) DISASSEMBLY OF FUEL TANK SELECTOR VALVE.

(a) Remove mounting case.

(b) Remove pulley retainer and remove pulley.

(c) Remove valve housing.

(d) Remove drive shaft pin.

(e) Remove four body bolts for final disassembly of valve.

(14) REMOVAL OF FUEL BALL CHECK VALVE.

(a) With cross-feed valves in OFF position drain the fuel container which supplies fuel to the valve to be removed.

(b) Disconnect lines from the valve and remove it by taking out the attachment bolts.

(15) DISASSEMBLY OF FUEL BALL CHECK VALVE. (See figures 147 and 157.)

(a) Unscrew and remove set screw, plug, and lock screw.

(b) Unscrew and remove end caps and gaskets.

(c) Unscrew and remove ball guides, steel balls, ball seats, and Neoprene washers.

(d) Remove spacer pin from spacer guide.

(e) Drive out spacer pin locking spacer guide to body.

(f) Unscrew and remove spacer guide.

(16) REMOVAL OF LIQUIDOMETER TANK UNIT. (See figure 139.) - Disconnect the electrical conduit at the unit and remove the bolts which mount the unit in the fuel container.

(17) REMOVAL OF FUEL STRAINER. - Loosen the butterfly nut on the bottom of the strainer housing, and the hinged support will fall away allowing the strainer and the strainer cap to fall out.

CAUTION

Always observe the blower drain when the carburetor is bled and be sure that fuel is running out the drain.

(18) REMOVAL OF BLOWER DRAIN.

(a) Remove the 3/8-inch dural line.

(b) Unscrew the valve assembly from the blower case.

(19) DISASSEMBLY OF BLOWER DRAIN - Remove the cap screw and the small parts will automatically become separated. Slush in gasoline or an approved solvent.

(20) REMOVAL OF CARBURETOR. (See figure 155.)

(a) Turn selector valve in pilot's cockpit to OFF position.

(b) Remove the antidrag ring cowl.

(c) Remove the carburetor air scoop fairing as follows: Remove cover plates both sides of

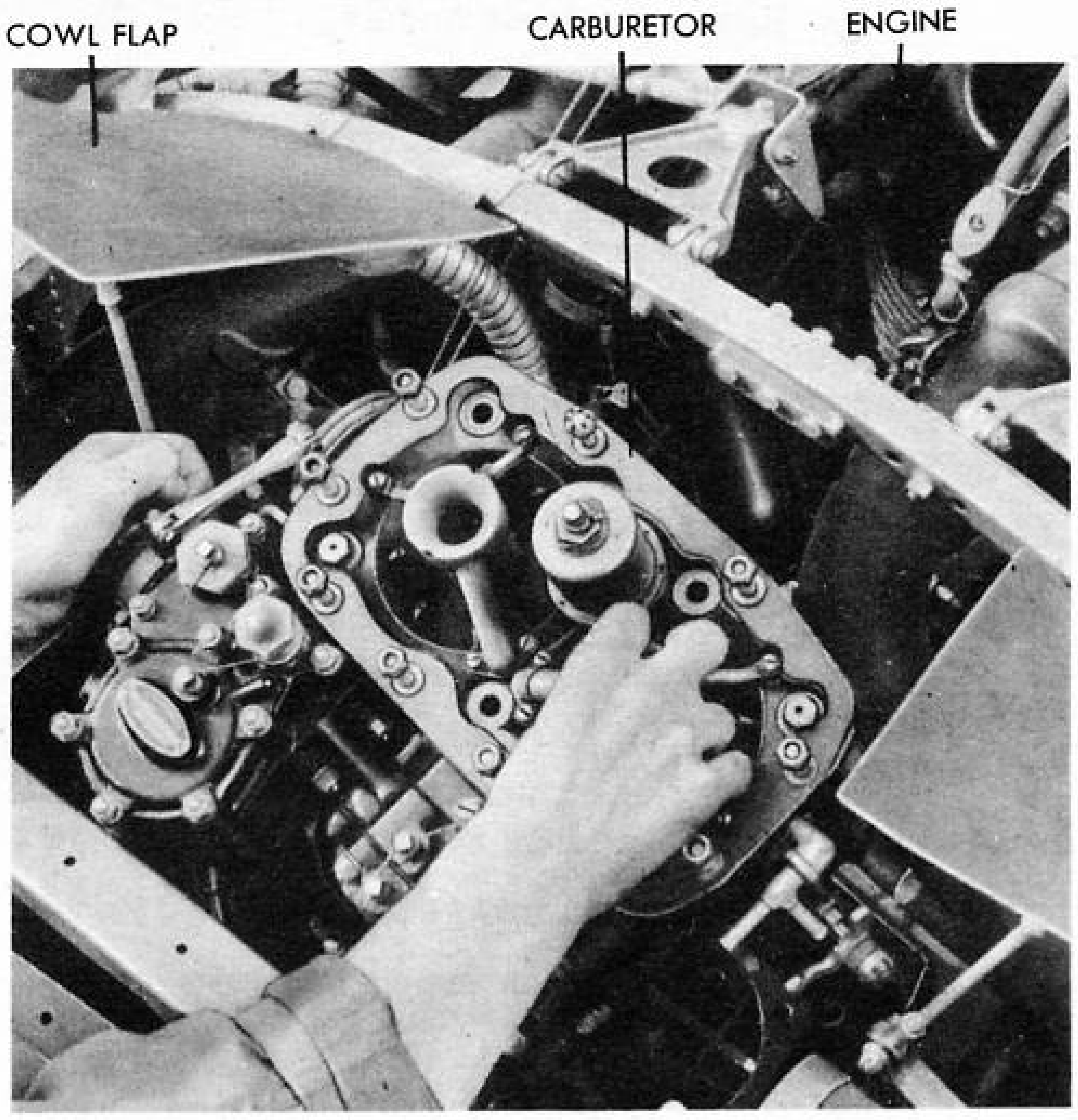


Figure 155 - REMOVING CARBURETOR

scoop. Remove exit fairings for upper cowl flaps from wing both sides of scoop. Disconnect air temperature bulb connection from middle of back of scoop. Disconnect four carburetor anti-icer lines from back of scoop. Remove cover from top of air scoop fairing. Remove five cap screws under air scoop fairing. Remove six Phillips head screws from air scoop fairing. Remove ten remaining cap screws that hold sides of air scoop to the venturi ring. Disconnect control cables. Loosen the lower clamp on the Neoprene collar that connects the scoop to the carburetor. Lift off the air scoop.

(d) Disconnect the carburetor control cables from the carburetor. Tag them to aid assembly.

(e) Cut safety wire on the seven body bolts which secure the carburetor to the carburetor adapter. Remove nuts.

(f) Remove discharge nozzle line which runs from the carburetor body to carburetor adapter.

(g) Lift carburetor from the carburetor adapter.

(h) Remove the eight carburetor adapter hold-down stud nuts. Lift the carburetor adapter from the rear supercharger housing.

CAUTION

Do not drop bolts, washers, or tools into rear supercharger housing.

d. MAINTENANCE REPAIRS.

(1) MAINTENANCE REPAIR OF FUEL CONTAINERS.

(a) GENERAL. - Several types of repairs can be performed on self-sealing fuel containers, depending on the amount of time and material available.

(b) TEMPORARY REPAIR. - In emergency cases a small cut or rupture may be repaired by the compression plug method or by an application of glycerin and animal glue. The procedure follows:

1 Drain and dry the damaged container. Clean slushing compound or dirt from the liner.

2 Mix water and glycerin and heat to 66 degrees C (150 degrees F). Add the glue, stirring constantly.

3 Heat the mixture to 100 degrees C (212 degrees F). Do not boil.

4 While the material is still hot apply a heavy coat to the damaged area and force well into the ruptured liner, smoothing over with a spatula.

5 Remove any excess material by scraping with a putty knife and washing with warm water.

(c) UNIVERSAL REPAIR. - A universal type of repair as used by sub-depots and outlying stations may be performed as follows:

1 Drain and dry the damaged container. Clean slushing compound or dirt from the liner.

2 Buff the damaged area thoroughly until the fabric cords are exposed.

3 Mix 10 parts of accelerator (Minnesota Mining and Mfg. Company) by weight to 100 parts of 3MEX55257 synthetic rubber dough by weight.

4 Place the mixture over the injury on the interior of the container. Force the mixture into the injury and build the repair 1/8 inch deep, extending 1/2 inch in all directions.

5 Cut a patch from a roll of repair gum, extending 3 inches in all directions from the injury and buff one side to remove all the gloss.

6 Clean the buffed patch and the container surface with solvent No. 2. Allow to dry. Apply one medium coat of cement No. EC-570 to the injured area and the buffed surface of the patch. Allow to dry 10 or 15 minutes. Swab lightly with solvent No. 2 to make the surface tacky.

7 Center the patch over the injured area and, using a 1/4-inch steel hand roller, start at one end of the patch and roll the edges and center down thoroughly.

8 Allow the patch to set for 1/2 hour, then place on coat of cement No. EC-570 on the patch and the buffed area surrounding the patch. Allow tank to dry 24 hours before filling with fuel.

NOTE

Repairs to the exterior of the containers are the same as for the interior.

(2) REPAIRS TO FUEL STRAINER. - Slush with an approved solvent; and if this does not thoroughly clean the screen, pick out particles with a fine brush or wire.

(3) REPAIRS TO LIQUIDOMETER TANK UNIT.

(a) Assure that all electrical connections are clean and tight.

(b) Examine all bearings for wear and repair if badly worn. Clean the bearings.

(c) Assure that there is sufficient contact between contact shoe and resistance winding and between adjustment lever and resistance winding - also between contactor and contact arm.

(4) MAINTENANCE REPAIR OF CARBURETOR. - Carburetor repairs are normally made at the depot. However, when the carburetor fails to shut off at IDLE CUT-OFF, labor of removal and installation frequently can be saved as follows:

(a) Work the mixture control lever back and forth rapidly. This may clear the mixture control and correct the condition.

(b) If the fault is still present, check the control stops on the carburetor for correct position or condition of mixture control plate. Adjust or replace if necessary. If condition is still faulty:

1 Remove the mixture control plate casting. It is located behind the throttle pulley and is attached to the carburetor body with screws.

2 Inspect the plate for dirt or warping. Clean if dirty. Replace if warped.

e. REPLACEMENTS.

(1) INSPECTION AND REPLACEMENT OF FUEL PUMP PARTS.

(a) Inspect the pump body for cracks or defects in the metal. Replace pump if damaged.

(b) If any major repairs are needed, send the pump to a repair base for complete overhaul and install a new pump.

(2) INSPECTION AND REPLACEMENT OF WOBBLE PUMP PARTS.

(a) Inspect all parts for excessive wear or defects in the material.

(b) Replace all packings.

(c) Inspect pump shaft. Replace if scored.

(3) INSPECTION AND REPLACEMENT OF FUEL TANK SELECTOR VALVE PARTS.

(a) Inspect drive shaft for wear or pitting or scored surfaces. Replace drive shaft if any of these defects is noticed.

(b) Inspect all threaded parts for burs or roughness of the threads. Rethread or retap if necessary.

(c) Inspect valve body for cracks or defects in the metal. Replace body if defective.

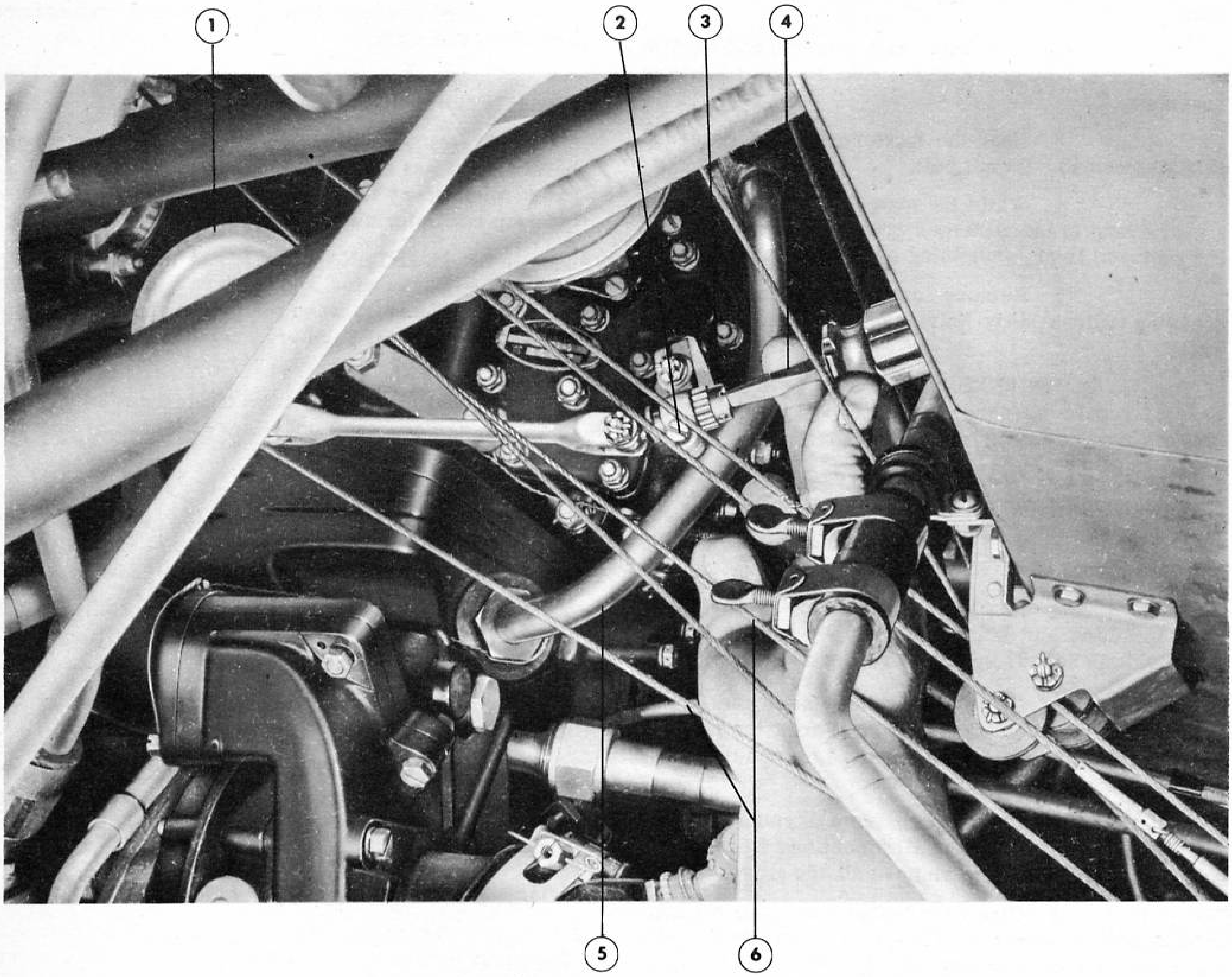
(4) INSPECTION AND REPLACEMENT OF FUEL BALL CHECK VALVE PARTS. - In normal operation the Neoprene washers are the only parts of the fuel ball check valves subject to deterioration or excessive wear. When these washers are worn, the valve will leak and the washers must be replaced.

f. ADJUSTMENTS.

(1) ADJUSTMENT OF CARBURETOR.

(a) First determine whether the mixture is too rich or too lean as follows:

1 Indications of too lean mixture:



1. CARBURETOR THROTTLE CONTROL PULLEY
2. IDLE ADJUSTING KNOB SET SCREW
3. IDLE ADJUSTING KNOB
4. SCREWDRIVER
5. DISCHARGE NOZZLE LINE
6. CARBURETOR CONTROL CABLES

Figure 156 - ADJUSTING IDLE MIXTURE OF CARBURETOR

a. Cylinder exhaust stacks pop and crack with short bursts of white smoke.

b. Engine backfires when throttle is opened to run up engine.

CAUTION

Lean mixture can be caused by conditions external to the carburetor; for example, loose induction pipes, loose intake valve guide, defective seal rings in supercharger drive housing.

2 Indications of too rich mixture:

a. Exhaust smoke in extreme cases.

b. Slight smoky odor in engine section.

c. Manifold pressure sometimes surges slowly.

d. Tachometer surges slowly with throttle position stationary.

(b) ADJUST IDLE MIXTURE.

1 Remove safety wire from idle adjusting knob set screw on lower left-hand side of carburetor. (See figure 156.)

2 Loosen idle adjusting knob set screw. (See figure 156.)

3 Turn knurled idle adjusting knob (figure 156) on lower left-hand side of carburetor, to right, to enrich mixture; to left, to make mixture leaner. Never turn knob over three notches at a time.

4 Tighten idle adjusting knob set screw. (See figure 156.)

5. Run engine at 500 to 550 rpm. Fifteen to seventeen inches manifold pressure should be indicated. Lowest steady manifold pressure indicates correct adjustment. Repeat steps 2 through 5 until satisfactory idle adjustment is obtained.

(c) SET RPM ADJUSTMENT. - With correct rpm adjustment the engine will normally idle at 600 rpm. The procedure for adjustment follows:

1 Insert a screwdriver through the adjusting hole in the carburetor throttle control pulley. (See figure 156.)

2 Turn the eccentric cam to the right or left to increase or decrease the idling speed.

g. TESTS.

(1) TEST OF PRIMER PUMP BEFORE INSTALLATION. - Hook a short length of tubing to the inlet side of the primer pump. With the end of the tubing in solvent, or gasoline, operate the pump several times by hand. If the fluid does not go through the pump, tighten or replace the pump plunger gasket and repeat the test.

NOTE

The primer pump may be tested generally from the cockpit by grasping the pump during engine run with engine idling. If the primer itself is cold, approximately 4 degrees C (40 degrees F), the check valves are leaking fuel. On the other hand, it is possible to pull air past plunger with no temperature change. This will cause rough engine idling. Best check for a suspected air leak is to disconnect and plug the primer line at fire wall. If engine smooths out, primer trouble is evident. With line nut still loose, hold momentarily in fitting and then pull away rapidly, noting change in temperature of line in hand, and noting fuel at fitting. If temperature change is noted, and if engine idle changes, primer pump is leaking. The condition of primer must be checked before attempting carburetor mixture adjustment.

(2) TEST OF WOBBLE PUMP BEFORE INSTALLATION.

(a) Hook a short length of hose to the intake line of the wobble pump and submerge the free end in a can of gasoline.

(b) Hook a short length of hose or tube on the discharge line of the wobble pump and attach a tee at the free end of the hose.

(c) Connect a pressure gage at the straight side of the tee and shut-off valve at the tee right angle.

(d) Work the wobble pump handle several times to force fuel through the pump. Turn the shut-off valve to the OFF position. Then take a reading on the pressure gage which should register not less than 14 pounds pressure per square inch.

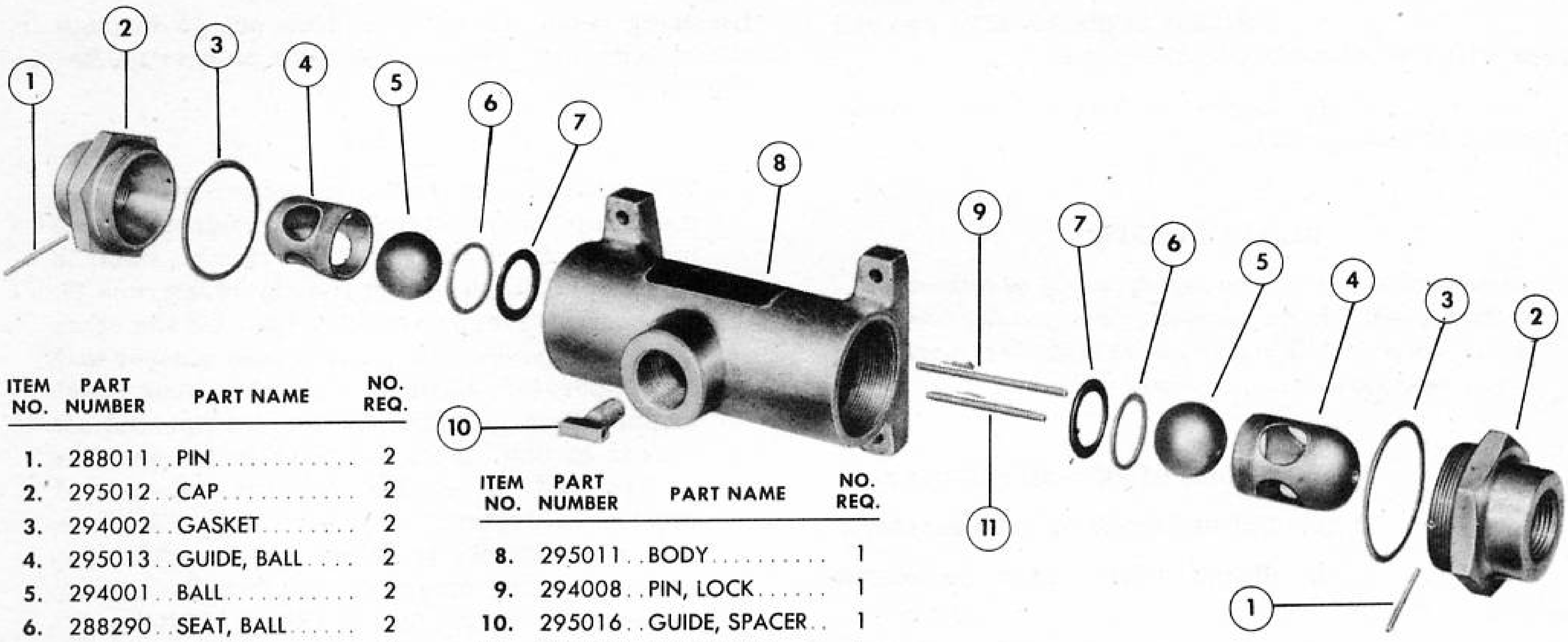
(3) TEST OF FUEL TANK SELECTOR VALVE BEFORE INSTALLATION. - Turn the selector switch OFF. Attempt to force air through the valve on the inlet side. If air cannot be forced through the valve it is an indication that the valve is in good operating condition.

(4) TEST OF CHECK VALVE BEFORE INSTALLATION. - Attempt to blow air through the valve. Be sure bleed hole in seat is plugged for test. Replace the valve if air passes through it.

h. ASSEMBLY AND INSTALLATION.

(1) INSTALLATION OF CARBURETOR. (See figure 155.)

(a) Place the carburetor adapter in position on the rear supercharger housing. Use a new gasket if necessary.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	288011	PIN	2
2.	295012	CAP	2
3.	294002	GASKET	2
4.	295013	GUIDE, BALL	2
5.	294001	BALL	2
6.	288290	SEAT, BALL	2
7.	294004	GASKET	2
8.	295011	BODY	1
9.	294008	PIN, LOCK	1
10.	295016	GUIDE, SPACER	1
11.	294003	PIN, SPACER	1

Figure 157 - FUEL BALL CHECK VALVE - EXPLODED VIEW

(b) Install the four nuts, washers, and palnuts on the outside adapter hold-down studs. Install the four castellated nuts, washers, and safety wire on the inside adapter hold-down studs.

(c) Using a new gasket, place the carburetor in position on the carburetor adapter. Install the seven body bolts which secure the carburetor to the adapter. Safety-wire the nuts.

(d) Install discharge nozzle line which runs from carburetor body to the carburetor adapter.

(e) Connect main fuel line to the carburetor.

(f) Connect carburetor control cables to the carburetor.

(g) Install carburetor air scoop fairing as follows: Safety hot air door in the "cold" position and tape the cable to hold it on the pulley. See that the Neoprene collar is clamped securely to the air scoop; place the other clamp around the Neoprene collar and roll the Neoprene collar back (like a cuff) over both clamps. Lower air scoop into position. Unroll Neoprene collar. It will thereby fit itself to the carburetor air scoop adapter. Push the loose clamp down until it fits around the bottom of the Neoprene collar. If the clamp will not go down in front, remove the inspection plates at the sides of the air scoop. Tighten the lower clamp, using a flat screwdriver. Install ten cap screws along the sides of the air scoop into the venturi ring. Be careful not to force any of the cap screws. If screws will not start easily, drill sheet metal out to 1/4-inch diameter. Install five cap screws under air scoop fairing. Replace cover on air scoop fairing. Install six Phillips head screws in air scoop fairing. Connect four anti-icer lines to back of air scoop. Connect electric plug to air temperature bulb on back of air scoop. Install exit fairings for upper cowl flaps. Install cover plates on wing. Hook up control cables, removing tape and safety wire.

(h) Install antidrag ring cowl.

(2) ASSEMBLY OF BLOWER DRAIN. - Insert the small parts and install the cap screw.

(3) INSTALLATION OF BLOWER DRAIN.

(a) Install the valve assembly in the blower case.

(b) Install the 3/8-inch dural line leading from blower drain to trailing edge of the cowl flaps.

(4) INSTALLATION OF FUEL STRAINER.

(a) Insert the screen assembly and the cap into the housing with the tip of the cone pointing up. Secure them in place with the hinged support and tighten the butterfly nut.

(b) Before starting engine, expel air trapped in lines to the fuel pump, the selector valve, and the tank cross-feed valve as follows: Remove the 1/4-inch plug on top of the strainer. Turn on the selector valves. As soon as the lines are full, fuel will run out of the 1/4-inch hole in the strainer. Then replace the plug. Air also becomes trapped in the line underneath the pump. Therefore, remove the line from the fitting on the bottom of the pump and turn on the selector valve. While fuel is running from this line, replace the line back into the pump fitting.

(5) INSTALLATION OF LIQUIDOMETER TANK UNIT. (See figure 139.)

(a) Apply cement, Specification AAF-26544-B, to both sides of the sealing gasket. Install the bolts which mount the unit in the fuel container. Connect the electrical conduit.

(b) Adjust the unit to the gage.

(6) ASSEMBLY OF FUEL BALL CHECK VALVE. (See figure 167.)

(a) Install the spacer guide lock pin and spacer pin.

(b) Install ball seat washers, ball seats, steel balls, and ball guides.

(c) Install the gaskets and end caps.

(7) INSTALLATION OF FUEL BALL CHECK VALVE.

(a) Place the valve in the fuel line and install the attachment bolts.

(b) Connect lines to the valve.

(8) ASSEMBLY OF FUEL TANK SELECTOR VALVE.

(a) Hold the valve in proper position and install four body bolts.

(b) Install drive shaft pin.

(c) Install valve housing.

(d) Install pulley and pulley retainer.

(e) Install mounting base.

(9) INSTALLATION OF FUEL TANK SELECTOR VALVE (See figure 154.)

(a) Enter the selector valve over top of oil cooler.

(b) Install the bolts that attach the valve to the bracket.

(c) Install oil cooler shutter actuating linkage.

(d) Connect all fuel lines at the selector valve.

(e) Install the control cable to the drum and selector valve. Assure that aligning marks on the drum and shaft are lined up.

(f) Tighten the control cable in the bomb bay.

(g) Operate the cockpit selector valve and check operation for accuracy as follows: Coordinate the control handle positions with valve positions by observing the location of the cable locking screw on the selector valve control pulley. The valves can be seen from within the nacelles. The port to which the valve is set is always 90 degrees clockwise from cable locking screw position. In airplanes where the control pulley is marked with a red arrow, the arrow indicates the port to which the valve is set. Check valve movements by adjusting so that the control handles "click" into each designated position.

(h) Fill fuel containers and check all connections for leaks.

(i) Install the oil cooler fairing.

(10) ASSEMBLY OF CHECK VALVE - Install the Neoprene seal and the valve cap.

(11) INSTALLATION OF CHECK VALVE.

(a) Install the valve assembly.

(b) Connect fuel lines.

(12) INSTALLATION OF CROSS-FEED CONTROL VALVE. (See figure 145.)

(a) Place valve in position in the cross-feed line and install the two nuts which attach the valve to the cross-feed line.

(b) Connect the cable at the valve.

(13) ASSEMBLY OF WOBBLE PUMP.

(a) Install sylphon, adjusting spring and screw and tightening safety nut.

(b) Install discharge and intake valve.

(c) Install wobble pump wing.

(d) Install steel disk.

(e) Install pump cap gasket.

(f) Install pump cap and pump cap screws.

(14) INSTALLATION OF WOBBLE PUMP. (See figure 143.)

(a) Install pump on the pump base.

(b) Install fuel fittings on pump.

(c) Install pump and base to the fuselage.

(d) Connect cross-feed valve linkage.

(e) Connect tank cross-feed, engine cross-feed, and primer lines to pump.

(f) Connect operating linkage rods to the wobble pump.

(g) Turn all cross-feed valves to ON position.

(15) ASSEMBLY OF PRIMER PUMP.

(a) Install plunger in plunger cylinder.

(b) Install primer cover.

(16) INSTALLATION OF PRIMER PUMP. (See figure 153.)

(a) Install the primer by raising it upward through the hole in the panel.

(b) Install the three screws that hold the primer to the panel.

(c) Install primer handle.

(d) Connect the three fuel lines to the under side of the primer.

(17) INSTALLATION OF FUEL PUMP. (See figure 152.)

(a) Install pump on studs on the engine.

(b) Install castellated nuts and safeties.

(c) Connect sylphon vent line at the pump.

(d) Connect fuel pump drain line.

(e) Connect main gasoline supply line at the bottom of the pump and the cross-feed line at the top of the pump.

(18) INSTALLATION OF INBOARD FUEL CONTAINER. (See figure 139.)

(a) Use powdered soap or several pieces of thin fabric on the training edge of the fuel container at the wing to facilitate installation.

(b) Push fuel container back into wing section. Be careful not to collapse or damage it.

(c) Pull the anticollapsing tabs upward and install screws that secure them to the edge of the split in the wing structure.

(d) Install the fittings on the fuel container.

(e) Install the leading edge to the wing.

(f) Install bolts and screws that attach leading edge to the wing. Tighten securely.

(g) Install nacelle to wing fillet.

(h) Install fairing, inner wing to fuselage.

(19) INSTALLATION OF OUTBOARD FUEL CONTAINER. (See figure 151.)

(a) Place the fuel container in position in the wing.

(b) Install six screws that attach fuel container to outboard edge of wing.

(c) Connect all fittings to the fuel container, using zinc chromate as a sealing agent.

(d) Install screws that secure the anti-collapsing tabs to the wing.

(e) Install the leading edge of the wing.

(f) Install the outer wing. (See paragraph 2, this section.)

(20) INSTALLATION OF BOMB BAY FUEL CONTAINER. (See figure 140.)

(a) Locate fuel container in correct position in bomb bay and slide floor support into place under the fuel container.

(b) Install support attaching bolts at fuselage.

(c) Connect fuel container to floor at strap hold-downs.

(d) Connect the electrical conduit at the top of the forward fuel container.

(e) Install booster pump and adapter and connect pump wiring.

(f) Connect the main fuel line and pump drain line at the booster pump.

(g) Connect tank drain line at booster pump adapter.

(h) Connect vent and overflow lines at the fuel container. Fill fuel containers. Check all connections for leaks.

i. FINAL TEST AFTER ASSEMBLY.

(1) TEST OF FUEL CONTAINERS AFTER INSTALLATION.

(a) INBOARD FUEL CONTAINER.

1 Fill fuel container.

2 Inspect all fittings and attaching points for leaks.

3 Inspect fuel container for security of mounting.

4 Install access doors.

(b) OUTBOARD FUEL CONTAINER.

1 Fill fuel container.

2 Inspect all fittings and attaching points for leaks.

3 Inspect fuel container for security of mounting.

(c) BOMB BAY FUEL CONTAINER.

1 Fill fuel container.

2 Inspect all fittings and attaching points for leaks.

3 Inspect fuel container for security of mounting.

(2) TEST OF FUEL PUMP AFTER INSTALLATION.

(a) With engines running, check all connections for leaks.

(b) Check fuel pressure gage to see if it registers 15 pounds per square inch pressure.

(c) Install accessory cowling on right side of engine nacelle.

NOTE

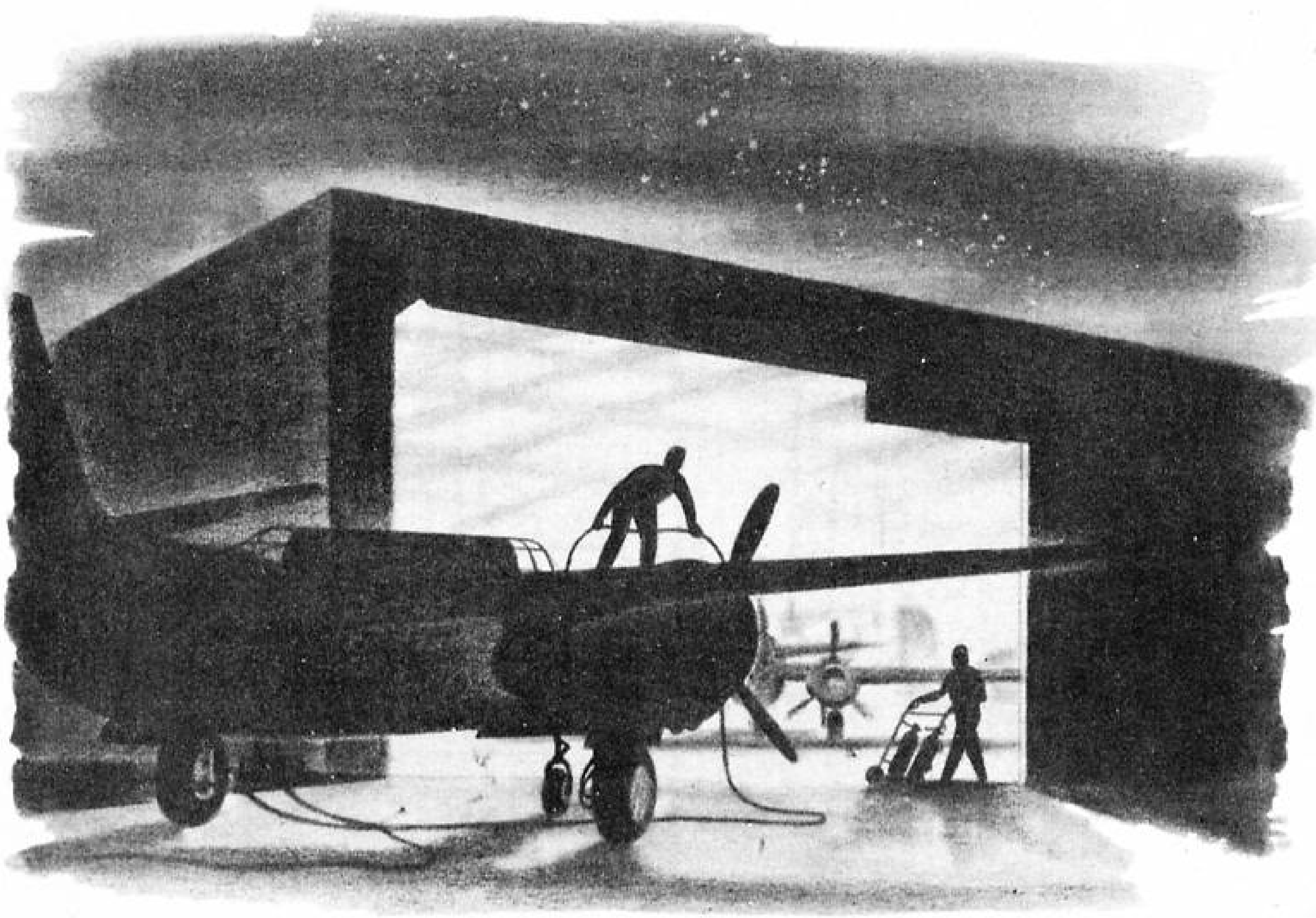
If there is an air leak in sylphon vent line, it will cause high fuel pressure gage reading and low-pressure output at pump.

(3) TEST OF WOBBLE PUMP AFTER INSTALLATION. - Operate the wobble pump. Adjust the pressure to 14 pounds per square inch by turning the adjusting valve on the back of each pump. Pressure adjustment on the pump is reached through a hole in the bulkhead aft of Station 156 in the rear bomb bay.

(4) TEST OF FUEL TANK SELECTOR VALVE AFTER INSTALLATION. - With tank selector OFF and mixture control AUTO. RICH, operate the wobble pumps. A small amount of gasoline will probably come from the blower drain, but if the fuel continues to flow through the blower drain the selector valve is leaking.

(5) TEST OF FUEL BALL CHECK VALVE AFTER INSTALLATION. - Place approximately five gallons of fuel in the fuel container for which the check valve functions. Tilt the airplane and run the engine from that container.

(6) TEST OF LIQUIDOMETER TANK UNIT AFTER INSTALLATION. - Check gage reading when tank is empty, then put a given amount of fuel in each fuel container. Turn the selector switches ON to the various fuel containers and note the amount of fuel in each container. Finally, check for full tank capacity. If these amounts correspond to the known fuel supply in each container, the liquidometer tank unit is operating correctly.



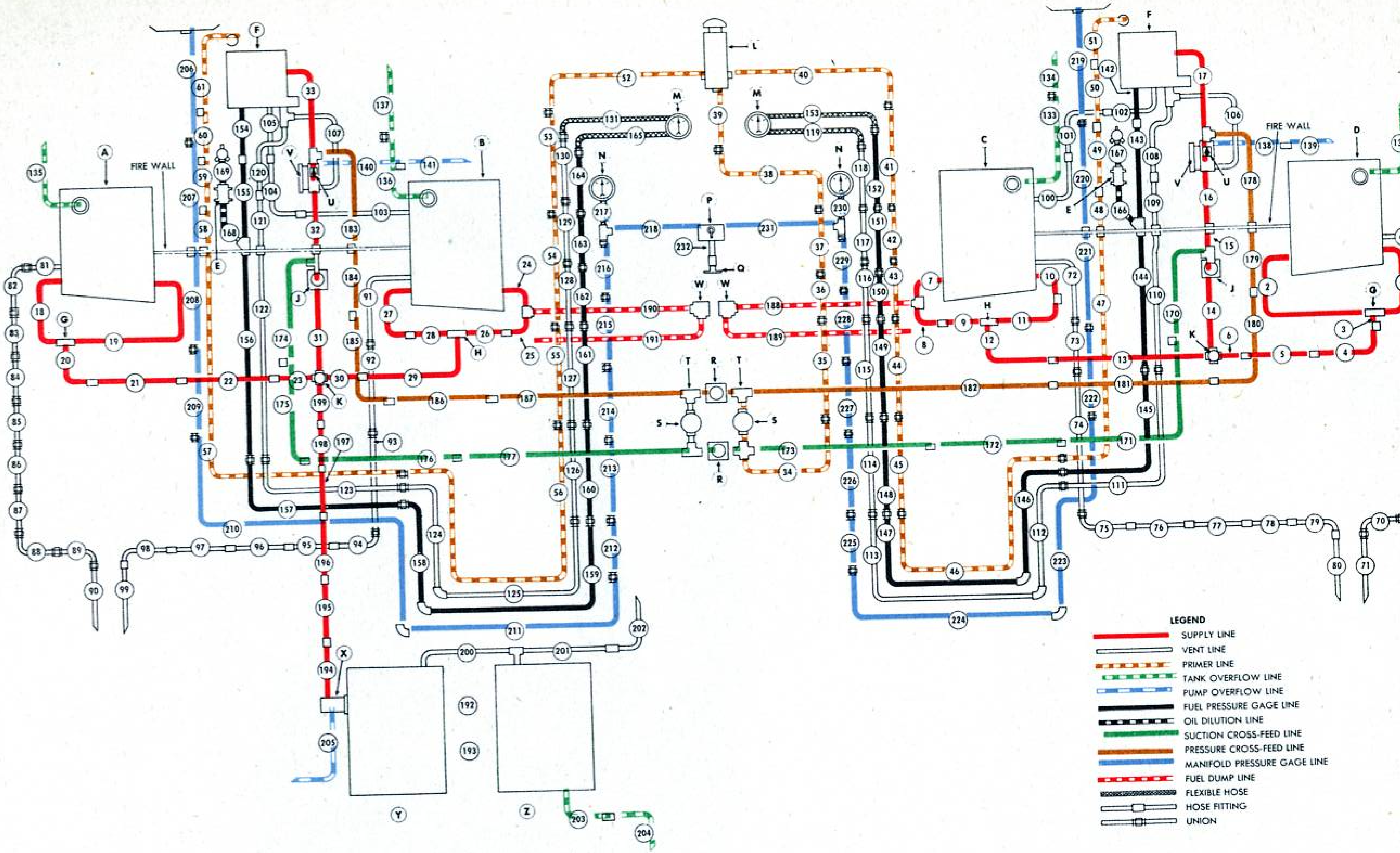


Figure 158 - FUEL SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
A	5108315	CONTAINER ASS'Y, OUTBOARD FUEL—L.H.	1
B	5108314	CONTAINER ASS'Y, INBOARD FUEL—L.H.	1
C	5108314-1	CONTAINER ASS'Y, INBOARD FUEL—R.H.	1
D	5108315-1	CONTAINER ASS'Y, OUTBOARD FUEL—R.H.	1
E	UNITED AIRCRAFT U1070A	SOLENOID, OIL DILUTION	2
F	STROMBERG PD12K1	CARBURETOR, INJECTION	2
G	4135445	VALVE, BALL—INBOARD	2
H	4135446	VALVE, BALL—OUTBOARD	2
J	AC37D3491 TYPE C-4	STRAINER	2
K	2064948 TYPE G	VALVE ASSEMBLY, FUEL SELECTOR	2
L	PARKER P4CA-2A	PRIMER, ENGINE	1
M	AAF94-27919 TYPE B-8A	GAGE, FUEL PRESSURE	2
N	U.S. GAGE AW-2314-14F	GAGE, MANIFOLD PRESSURE	2
P	AC765-31	COCK, SHUT-OFF	1
Q	2068551	VENT, MANIFOLD	1
	AC882-4-8	HOSE	1
	42A 11615	CLAMP, HOSE	2
R	2175092	VALVE ASSEMBLY, FUEL CROSS FEED	2
S	93935 TYPE D-12	PUMP, WOBBLE	2
T	4132798	VALVE, FUEL CHECK	2
U	1117625	VALVE, ENGINE CROSS FEED CHECK	2
V	PESCO 12-600-CWT TYPE G-9	PUMP, FUEL	2
W	4132229	VALVE ASSEMBLY, FUEL DUMP	2
X	4148898	PUMP ASSEMBLY, FUEL SYSTEM BOOSTER	1
Y	5147502	TANK ASSEMBLY, BOMB BAY FUEL—AFT	1
Z	5147501	TANK ASSEMBLY, BOMB BAY FUEL—FORWARD	1
1.	5135645-1	OUTBOARD TANK TO BALL VALVE—R.H.	1
	42A 11615	CLAMP, HOSE	2
	AC835-16	NIPPLE, HOSE	1
2.	5135645-2	OUTBOARD TANK TO BALL VALVE—R.H.	1
	42A 11615	CLAMP, HOSE	2
3.	5135645-20	BALL VALVE AT WING STATION 105 TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2
4.	5135645-19	HOSE FITTING AT WING STATION 102 TO HOSE FITTING—R.H.	1
5.	5135645-3	HOSE FITTING AT WING STATION 98 TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2
6.	5135645-4	HOSE FITTING AT WING STATION 60 TO SELECTOR VALVE—R.H.	1
7.	5067583-85	SUPPLY TANK TO TEE	1
	AC811FT-16-12	NIPPLE	1
	AC811JT-16D	TEE	1
8.	5109558-79	TEE AT FUSELAGE STATION 156 TO HOSE FITTING—R.H.	1
9.	5135645-12	HOSE FITTING AT WING STATION 3 TO BALL VALVE—R.H.	1
	42A 11615	CLAMP, HOSE	2
10.	5135645-21	INBOARD TANK TO HOSE FITTING—R.H.	1
	AC811FT-16-12	NIPPLE	1
11.	5135645-13	HOSE FITTING AT WING STATION 53 TO BALL VALVE—R.H.	1
	42A 11615	CLAMP, HOSE	2
12.	5135645-14	BALL VALVE AT WING STATION 20 TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2
13.	5135645-15	HOSE FITTING AT WING STATION 43 TO SELECTOR VALVE—R.H.	1
14.	5135645-17	SELECTOR VALVE AT WING STATION 53 TO FUEL STRAINER—R.H.	1
	42A 11615	CLAMP, HOSE	2
15.	5135645-18	FUEL STRAINER TO COUPLING—R.H.	1
	42A 11615	CLAMP, HOSE	2
16.	5169574-29	FUEL STRAINER TO FUEL PUMP—R.H.	1
17.	5169574-27	FUEL PUMP TO CARBURETOR—R.H.	1
	AC851-16	FITTING	1
	AC850-16	ELBOW, HOSE	1
	AN880-16-11	HOSE	2
	42A 11615	CLAMP, HOSE	4
	AC835-16	NIPPLE, HOSE	1
	AC895-34	TEE	1
18.	5135489-2	OUTBOARD TANK TO BALL VALVE—L.H.	1
	42A 11615	CLAMP, HOSE	2
19.	5135489-1	OUTBOARD TANK TO BALL VALVE—L.H.	1
	42A 11615	CLAMP, HOSE	2
20.	5135489-18	BALL VALVE AT WING STATION 105 TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
21.	5135489-19	HOSE FITTING AT WING STATION 102 TO HOSE FITTING—L.H.	1
22.	5135489-3	HOSE FITTING AT WING STATION 98 TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
23.	5135489-4	HOSE FITTING AT WING STATION 60 TO SELECTOR VALVE—L.H.	1
24.	5067583-86	SUPPLY TANK TO TEE—L.H.	1
	AC811FT16-12	NIPPLE	1
	AC811JT16D	TEE	1
25.	5109557-77	TEE AT WING STATION 156 TO HOSE FITTING—L.H.	1
26.	5135489-12	HOSE FITTING AT WING STATION 3 TO BALL VALVE—L.H.	1
	42A 11615	CLAMP, HOSE	2
27.	5135489-20	INBOARD TANK TO HOSE FITTING—L.H.	1
28.	5135489-13	HOSE FITTING AT WING STATION 53 TO BALL VALVE—L.H.	1
	42A 11615	CLAMP, HOSE	2
29.	5135489-14	BALL VALVE AT WING STATION 20 TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
30.	5135489-15	HOSE FITTING TO SELECTOR VALVE—L.H.	1
31.	5135489-17	SELECTOR VALVE TO FUEL STRAINER—L.H.	1
	42A 11615	CLAMP, HOSE	2
32.	5169574-29	FUEL STRAINER TO FUEL PUMP—L.H.	1
33.	5169574-27	FUEL PUMP TO CARBURETOR—L.H.	1
	AC851-16	FITTING	1
	AC850-16	ELBOW, HOSE	1
	AN880-16-11	HOSE	2
	42A 11615	CLAMP, HOSE	4
	AC835-16	NIPPLE, HOSE	1
	AC895-34	TEE	1
34.	5067583-6	CROSS FEED LINES TO UNION	1
35.	5067583-5	UNION AT STATION 132 TO UNION—R.H. SIDE OF FUSELAGE	1
	AC811HT-4	UNION	1

LEGEND FOR FIGURE 158

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
36.	5067583-4	UNION AT STATION 115 TO UNION—R.H. SIDE OF FUSELAGE	1
	AC811HT-4	UNION	1
37.	5067583-3	UNION AT STATION 90 TO UNION—R.H. SIDE OF FUSELAGE	1
	AC811HT-4	UNION	1
38.	5067583-2	UNION AT STATION 52 TO UNION—R.H. SIDE OF FUSELAGE	1
	AC811HT-4	UNION	1
39.	5067583-1	UNION AT STATION 20 TO PUMP—R.H. SIDE OF FUSELAGE	1
	AC811HT-4	UNION	1
40.	5067583-7	PRIMER PUMP TO UNION—R.H.	1
	AC811HT-4	UNION	1
41.	5067583-8	UNION AT FUSELAGE STATION 19 TO UNION—R.H.	1
	AC811HT-4	UNION	1
42.	5067583-9	UNION AT FUSELAGE STATION 50 TO UNION—R.H.	1
	AC811HT-4	UNION	1
43.	5067583-10	UNION AT FUSELAGE STATION 90 TO UNION—R.H.	1
	AC811HT-4	UNION	1
	AC811FT-4	NIPPLE	1
44.	5067583-11	UNION AT FUSELAGE STATION 115 TO UNION—R.H.	1
	AC811HT-4	UNION	1
45.	5067583-12	UNION AT FUSELAGE STATION 132 TO UNION—R.H.	1
	AC811HT-4	UNION	1
46.	2067356-7	UNION AT FUSELAGE STATION 156 TO UNION—R.H.	1
47.	5135645-53	UNION AT WING STATION 40 TO FIRE WALL—R.H.	1
	AC811HT-4	UNION	1
48.	5109557-65	FIRE WALL TO HOSE FITTING—R.H.	1
	AC882-4-9	HOSE	1
	42A 11615	CLAMP, HOSE	2
49.	5169574-37	HOSE FITTING TO HOSE FITTING—R.H.	1
50.	5169574-36	HOSE FITTING TO SHIELDING—R.H.	1
	1017755-4	CONNECTOR	1
	141708-4	NUT, CHECK	1
	AC884-4-9	HOSE	3
	AN746-4	CLAMP, HOSE	6
51.	5169574-17	SHIELDING TO ENGINE—R.H.	1
	AC811CT-4	ELBOW	1
52.	5067583-40	PRIMER PUMP TO UNION—L.H.	1
	AC811HT-4	UNION	1
53.	5067583-41	UNION AT FUSELAGE STATION 20 TO UNION	1
	AC811HT-4	UNION	1
54.	5067583-42	UNION AT FUSELAGE STATION 50 TO UNION	1
	AC811HT-4	UNION	1
55.	5067583-79	UNION AT FUSELAGE STATION 115 TO UNION	1
	AC811HT-4	UNION	1
56.	2067356-8	UNION AT FUSELAGE STATION 156 TO UNION—L.H.	1
57.	5135489-49	UNION AT WING STATION 26 TO FIRE WALL—L.H.	1
	AC811HT-4	UNION	1
58.	5109558-67	FIRE WALL TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
	AC882-4-9	HOSE	1
59.	5169574-38	HOSE FITTING TO HOSE FITTING—L.H.	1
60.	5169574-36	HOSE FITTING TO SHIELDING—L.H.	1
	1017755-4	CONNECTOR	1
	141708-4	NUT, CHECK	1
	AC884-4-9	HOSE	3
	AN746-4	CLAMP, HOSE	6
61.	516574-17	SHIELDING TO ENGINE—L.H.	1
	AC811CT4	ELBOW	1
62.	5109822-5	OUTBOARD SUPPLY TANK TO UNION—R.H.	1
	AC811FT-10	NIPPLE	1
	AC811HT-10D	UNION	1
63.	5109822-8	UNION AT WING STA. 175 TO UNION—R.H.	1
	AC811HT-10D	UNION	1
64.	5109822-10	UNION AT WING STA. 168 TO UNION—R.H.	1
65.	5109557-18	UNION AT WING STA. 157 TO UNION—R.H.	1
	AC811HT-10D	UNION	1
66.	5109557-19	UNION AT WING STA. 130 TO UNION—R.H.	1
	AC811HT-10D	UNION	1
67.	5109557-20	UNION AT WING STA. 115 TO UNION—R.H.	1
	AC811HT-10D	UNION	1
68.	5109557-59	UNION AT WING STA. 100 TO UNION—R.H.	1
	AC811HT-10D	UNION	1
69.	5109557-66	UNION AT SHEAR WEB TO UNION—R.H.	1
	AC811HT-10D	UNION	1
70.	5109557-67	UNION AT NACELLE TO UNION—R.H.	1
	AC811HT-10D	UNION	1
71.	5109557-68	UNION TO ATMOSPHERE—R.H.	1
	AC811HT-10D	UNION	1
72.	5109557-22	INBOARD SUPPLY TANK TO UNION—R.H.	1
73.	5109557-23	UNION AT WING STA. 55 TO UNION—R.H.	1
	AC811HT-16D	UNION	1
74.	5109557-24	UNION AT WING STA. 45 TO UNION—R.H.	1
	AC811HT-16D	UNION	1
75.	5109557-25	UNION AT WING STA. 23 TO UNION—R.H.	1
	AC811HT-16D	UNION	1
76.	5109557-69	UNION AT WING STATION 0 TO HOSE FITTING—L.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
77.	5109557-70	HOSE FITTING AT WING STATION 20 TO HOSE FITTING—R.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
78.	5109557-71	HOSE FITTING AT WING STATION 43 TO HOSE FITTING—R.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
79.	5109557-72	HOSE FITTING AT NACELLE TO HOSE FITTING—R.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
80.	5109557-73	HOSE FITTING AT TAIL CONE TO ATMOSPHERE—R.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
81.	5109822-4	OUTBOARD TANK TO UNION—L.H.	1
	AC811FT-10	NIPPLE	1
	AC811HT-10D	UNION	1
82.	5109822-3	UNION AT WING STA. 175 TO UNION—L.H.	1
	AC811HT-10D	UNION	1
83.	5109822-9	UNION AT WING STA. 168 TO UNION—L.H.	1

LEGEND FOR FIGURE 158

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
84.	5109558-17	UNION AT WING STA. 157 TO UNION—L.H.	1
	AC811HT-16D	UNION	1
85.	5109558-18	UNION AT WING STA. 135 TO UNION—L.H.	1
	AC811HT-10D	UNION	1
86.	5109558-19	UNION AT WING STA. 110 TO UNION—L.H.	1
	AC811HT-10D	UNION	1
87.	5109558-57	UNION AT WING STA. 100 TO UNION—L.H.	1
	AC811HT-10D	UNION	1
88.	5109558-68	UNION AT REAR SHEAR WEB TO NACELLE—L.H.	1
	AC811HT-10D	UNION	1
89.	5109558-69	NACELLE TO TAIL CONE—L.H.	1
	AC811HT-10D	UNION	1
90.	5109558-70	TAIL CONE TO ATMOSPHERE—L.H.	1
	AC811HT-10D	UNION	1
91.	5109558-25	INBOARD TANK TO UNION—L.H.	1
	AC811HT-16D	UNION	1
92.	5109558-24	UNION AT WING STA. 55 TO UNION—L.H.	1
	AC811HT-16D	UNION	1
93.	5109558-23	UNION AT WING STA. 48 TO UNION—L.H.	1
	AC811HT-16D	UNION	1
94.	5109558-22	UNION AT WING STATION 27 TO HOSE FITTING—L.H.	1
95.	5109558-71	HOSE FITTING AT WING STATION 0 TO HOSE FITTING—L.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
96.	5109558-72	HOSE FITTING AT WING STATION 20 TO HOSE FITTING—L.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
97.	5109558-73	HOSE FITTING AT REAR SHEAR WEB TO HOSE FITTING—L.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
98.	5109558-74	HOSE FITTING AT NACELLE TO HOSE FITTING—L.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
99.	5109558-75	HOSE FITTING AT TAIL CONE TO ATMOSPHERE—L.H.	1
	AC882-16-11	HOSE	1
	42A 11615	CLAMP, HOSE	2
100.	5109557-49	INBOARD TANK TO HOSE FITTING—R.H.	1
	AC882-4-9	HOSE	1
	42A 11615	CLAMP, HOSE	2
101.	5169574-25	HOSE FITTING AT SHEAR WEB TO HOSE FITTING—R.H.	1
	AC882-4-9	HOSE	1
	42A 11615	CLAMP, HOSE	2
102.	5169574-23	HOSE FITTING TO CARBURETOR—R.H.	1
	AC851-4	ELBOW, HOSE	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
103.	5109558-50	INBOARD TANK TO HOSE FITTING—L.H.	1
	AC811FT-4	NIPPLE	1
	AC882-4-9	HOSE	1
	42A 11615	CLAMP, HOSE	1
104.	5169574-26	HOSE FITTING AT SHEAR WEB TO HOSE FITTING—L.H.	1
	AC882-4-9	HOSE	1
	42A 11615	CLAMP, HOSE	2
105.	5169574-24	HOSE FITTING TO CARBURETOR—L.H.	1
	AC851-4	ELBOW, HOSE	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
106.	5169574-13	PUMP TO CARBURETOR—R.H.	1
	PARKER 3141-3-4	TEE, HOSE	1
	AC895-1	ELBOW, STREET	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
107.	5169574-13	PUMP TO CARBURETOR—L.H.	1
	PARKER 3141-3-4	TEE, HOSE	1
	AC895-1	ELBOW, STREET	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
108.	5169574-9	CARBURETOR TO HOSE FITTING—R.H.	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
109.	5109557-50	HOSE FITTING AT SHIELDING TO FIRE WALL—R.H.	1
110.	5109557-32	FIRE WALL TO SHEAR WEB—R.H.	1
	AC811HT-4D	UNION	1
111.	5109557-29	SHEAR WEB TO UNION—R.H.	1
	AC811HT-4D	UNION	1
112.	5109557-63	UNION AT WING STA. 0 TO ELBOW—R.H.	1
	AC811HT-4D	UNION	1
113.	5067583-18	ELBOW AT FUSELAGE TO UNION—R.H.	1
	AC811ET-4D	ELBOW	1
114.	5067583-17	UNION AT FUSELAGE STATION 170 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
115.	5067583-16	UNION AT FUSELAGE STATION 115 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
116.	5067583-15	UNION AT FUSELAGE STATION 90 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
117.	5067583-14	UNION AT FUSELAGE STATION 50 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
118.	5067583-13	UNION AT FUSELAGE STATION 20 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
119.	39B3481-414	HOSE AT FUEL PRESSURE GAGE—R.H.	1
	AC811FT-4	NIPPLE	1
120.	5169574-10	CARBURETOR TO HOSE FITTING—L.H.	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
121.	5109558-48	HOSE FITTING AT SHIELDING TO FIRE WALL—L.H.	1
122.	5109558-41	FIRE WALL TO UNION—L.H.	1
	AC811HT-4D	UNION	1
123.	5109558-39	UNION AT SHEAR WEB TO UNION—L.H.	1
124.	5109558-56	UNION AT WING STA. 0 TO ELBOW—L.H.	1
	AC811HT-4D	UNION	1
125.	5067583-82	ELBOW AT FUSELAGE TO UNION—L.H.	1
	AC811ET-4D	ELBOW	1
126.	5067583-49	UNION AT FUSELAGE STATION 170 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
127.	5067583-48	UNION AT FUSELAGE STATION 130 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
128.	5067583-47	UNION AT FUSELAGE STATION 90 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
129.	5067583-46	UNION AT FUSELAGE STATION 40 TO UNION—L.H.	1
	AC811HT-4D	UNION	1

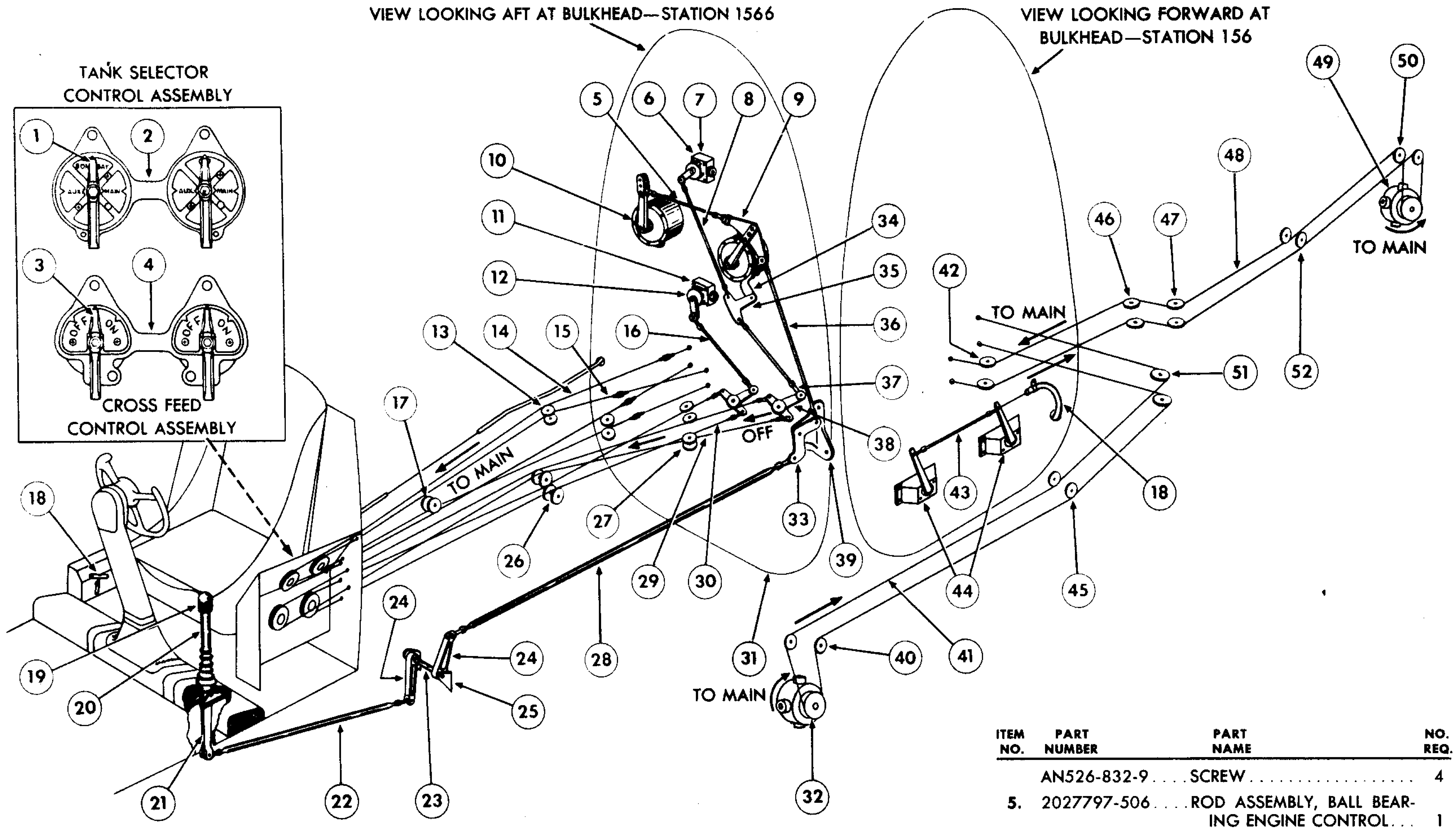
LEGEND FOR FIGURE 158

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
130.	5067583-45	UNION AT FUSELAGE STATION 20 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
131.	39B3481-414	HOSE AT FUEL PRESSURE GAGE—L.H.	1
	AC811FT-4	NIPPLE	1
132.	5109822-7	OUTBOARD TANK TO ATMOSPHERE—R.H.	1
133.	5109557-27	INBOARD TANK TO UNION—R.H.	1
134.	5109557-28	UNION TO ATMOSPHERE—R.H.	1
	AC811HT-6D	UNION	1
135.	5109822-6	OUTBOARD TANK TO ATMOSPHERE—L.H.	1
136.	5109558-45	INBOARD TANK TO UNION—L.H.	1
	AC811HT-6D	UNION	1
137.	5109558-46	UNION TO ATMOSPHERE—L.H.	1
138.	5169574-15	FUEL PUMP TO HOSE FITTING—R.H.	1
	AC811FT-4	NIPPLE	1
	AC882-4-9	HOSE	1
	42A 11615	HOSE, CLAMP	2
139.	5169574-16	HOSE FITTING TO ATMOSPHERE—R.H.	1
140.	5169574-15	FUEL PUMP TO HOSE FITTING—L.H.	1
	AC811FT-4	NIPPLE	1
	AC882-4-9	HOSE	1
	42A 11615	CLAMP, HOSE	2
141.	5169574-16	HOSE FITTING TO ATMOSPHERE—L.H.	1
142.	5169574-7	CARBURETOR TO HOSE FITTING—R.H.	1
	AC851-4	NIPPLE, HOSE	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
143.	5109557-51	HOSE FITTING SHIELDING TO TEE—R.H.	1
144.	5109557-38	TEE AT FIRE WALL TO UNION—R.H.	1
	AC811HT-4D	UNION	1
145.	5109557-35	UNION AT WING STA. 48 TO UNION—R.H.	1
	AC811HT-4D	UNION	2
146.	5109557-62	UNION AT WING STA. 0 TO ELBOW—R.H.	1
	AC811HT-4D	UNION	1
147.	5067583-24	ELBOW AT FUSELAGE TO UNION—R.H.	1
	AC811ET-4D	ELBOW	1
148.	5067583-23	UNION AT FUSELAGE STATION 165 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
149.	5067583-22	UNION AT STATION 115 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
150.	5067583-21	UNION AT FUSELAGE STATION 90 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
151.	5067583-20	UNION AT FUSELAGE STATION 506 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
152.	5067583-19	UNION AT FUSELAGE STATION 20 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
153.	39B3481-414	HOSE, UNION TO FUEL PRESSURE GAGE —R.H.	1
	AC811FT-4	NIPPLE	1
154.	5169574-8	CARBURETOR TO HOSE FITTING—L.H.	1
	AC851-4	NIPPLE, HOSE	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
155.	5109558-49	HOSE FITTING AT SHIELDING TO TEE—L.H.	1
	37AC3528	FITTING, RESTRICTED	1
156.	5109558-35	TEE AT FIRE WALL TO UNION—L.H.	1
	AC811HT-4D	UNION	1
157.	5109558-33	UNION AT WING STA. 50 TO UNION—L.H.	1
158.	5109558-65	UNION AT WING STA. 0 TO ELBOW—L.H.	1
	AC811HT-4D	UNION	1
159.	5067583-83	UNION AT FUSELAGE STATION 90 TO UNION—L.H.	1
	AC811ET-4D	ELBOW	1
160.	5067583-56	UNION AT FUSELAGE STATION 160 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
161.	5067583-55	UNION AT FUSELAGE STATION 130 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
162.	5067583-54	UNION AT FUSELAGE STATION 90 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
163.	5067583-53	UNION AT FUSELAGE STATION 40 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
164.	5067583-52	UNION AT FUSELAGE STATION 20 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
165.	39B3481-414	HOSE, UNION TO FUEL PRESSURE GAGE—L.H.	1
	AC811FT-4	NIPPLE	1
166.	5109557-64	FIRE WALL TO OIL SOLENOID—R.H.	1
	AC811CT-45-4	ELBOW	1
167.	5109970-5	OIL SOLENOID TO Y DRAIN—R.H.	1
168.	5109558-63	FIRE WALL TO OIL SOLENOID—L.H.	1
	AC811CT45-4	ELBOW	1
169.	5109969-11	OIL SOLENOID TO Y DRAIN—L.H.	1
170.	5135645-8	STRAINER TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2
171.	5135645-6	HOSE FITTING AT NACELLE TO HOSE FITTING—R.H.	1
172.	5135645-5	HOSE FITTING AT WING STATION 50 TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2
173.	2067356-11	HOSE FITTING AT WING STATION 0 TO CROSS—R.H.	1
174.	5135489-8	STRAINER TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
175.	5135489-6	HOSE FITTING AT NACELLE TO HOSE FITTING—L.H.	1
176.	5135489-5	HOSE FITTING AT WING STATION 50 TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
177.	2067356-12	HOSE FITTING AT WING STA. 0 TO TEE—L.H.	1
178.	5169574-32	FUEL PUMP TO FIRE WALL—R.H.	1
	AC851-16	ELBOW, 45° HOSE	1
	42A 11615	CLAMP, HOSE	2
179.	5135645-11	FIRE WALL TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2
180.	5135645-10	HOSE FITTING AT WING STATION 89 TO HOSE FITTING—R.H.	1
181.	5135645-9	HOSE FITTING AT WING STATION 80 TO HOSE FITTING—R.H.	1
	42A 11615	CLAMP, HOSE	2

LEGEND FOR FIGURE 158

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
182.	2067356-13	HOSE FITTING AT WING STATION 0 TO FUEL UNIT—R.H.	1
183.	5169574-31	FUEL PUMP TO FIRE WALL—L.H.	1
	AC851-16	ELBOW, 45° HOSE	1
	42A 11615	CLAMP, HOSE	2
184.	5135489-11	FIRE WALL TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
185.	5135489-10	HOSE FITTING AT WING STATION 89 TO HOSE FITTING—L.H.	1
186.	5135489-9	HOSE FITTING AT WING STATION 80 TO HOSE FITTING—L.H.	1
	42A 11615	CLAMP, HOSE	2
187.	2067356-14	HOSE FITTING AT FUSELAGE STATION 0 TO FUEL UNIT—L.H.	1
188.	4132248-2	FROM TEE TO VALVE—R.H.	1
189.	4132248-5	VALVE TO OVERBOARD—R.H.	1
190.	4132248-1	FROM TEE TO VALVE—L.H.	1
191.	4132248-3	VALVE TO OVERBOARD—L.H.	1
192.	4147588-1	FORWARD TANK TO REAR TANK	1
	AN746-15	CLAMP	2
193.	4147588-2	FORWARD TANK TO REAR TANK	1
194.	4147588-15	BOOSTER PUMP TO CONNECTION	1
	AN746-13	CLAMP	2
195.	4147588-5	CONNECTION AT STATION 151 TO CONNECTION	1
196.	4147588-3	CONNECTION AT STATION 159 TO CONNECTION	1
197.	4147588-14	CONNECTION AT WING STATION 0 TO CONNECTION	1
198.	4147588-4	CONNECTION AT WING STATION 3 TO CONNECTION	1
	AN746-13	CLAMP	2
199.	4147588-6	CONNECTION AT WING STATION 45 TO SELECTOR VALVE	1
200.	4147588-7	REAR TANK TO TEE	1
201.	4147588-16	TEE AT FORWARD TANK TO CONNECTION	1
	AC882-16-11	HOSE	1
	AN746-11	CLAMP	2
202.	4147588-12	CONNECTION AT STATION 154 TO OUTSIDE	1
	AC882-16-11	HOSE	1
	AN746-11	CLAMP	2
203.	4147588-17	FORWARD TANK TO CONNECTION	1
	AC882-6-11	HOSE	1
	AN746-6	CLAMP	3
204.	4147588-13	CONNECTION AT STA. 154 TO OUTSIDE	1
	AC882-6-11	HOSE	1
	AN746-6	CLAMP	2
205.	4147588-10	BOOSTER PUMP TO OUTSIDE	1
206.	5169574-12	ENGINE TO HOSE FITTING	1
	148779-851-4-50	ELBOW, RESTRICTED 45° HOSE	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
207.	5109558-32	HOSE FITTING TO UNION—L.H.	1
208.	5109558-31	FIRE WALL TO REAR SHEAR WEB—L.H.	1
	AC811HT-4D	UNION	1
209.	5109558-29	REAR SHEAR WEB TO WING STA. 0—L.H.	1
210.	5109558-64	WING STATION 0 TO FUSELAGE CONNECTION—L.H.	1
	AC811HT-4D	UNION	1
211.	5067583-84	FUSELAGE CONNECTION TO UNION—L.H.	1
	AC811ET-4D	ELBOW	1
212.	5067583-71	UNION AT FUSELAGE STATION 168 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
213.	5067583-70	UNION AT FUSELAGE STATION 129 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
214.	5067583-69	UNION AT FUSELAGE STATION 90 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
215.	5067583-68	UNION AT FUSELAGE STATION 43 TO UNION—L.H.	1
	AC811HT-4D	UNION	1
216.	5067583-67	UNION TO TEE—L.H.	1
	AC811HT-4D	UNION	1
217.	39B3480-414	HOSE, TEE TO GAGE	1
	PARKER 3156-7T-4	ADAPTER	1
	AC811JT-4D	TEE	1
218.	5067583-74	TEE TO DRAIN COCK—L.H.	1
	AC811CT-4	ELBOW	1
219.	5169574-11	ENGINE TO HOSE FITTING	1
	148779-851-4-50	ELBOW, RESTRICTED 45° HOSE	1
	AC882-4-9	HOSE	2
	42A 11615	CLAMP, HOSE	4
220.	5109557-44	WING SHIELDING TO FIRE WALL—R.H.	1
221.	5109557-43	FIRE WALL TO REAR SHEAR WEB—R.H.	1
	AC811HT-4D	UNION	1
222.	5109557-41	REAR SHEAR WEB TO WING STA. 0—R.H.	1
	AC811HT-4D	UNION	1
223.	5109557-61	WING STATION 0 TO FUSELAGE CONNECTION—R.H.	1
	AC811HT-4D	UNION	1
224.	5067583-37	FUSELAGE CONNECTION TO UNION—R.H.	1
	AC811ET-4D	ELBOW	1
225.	5067583-36	UNION AT FUSELAGE STATION 168 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
226.	5067583-35	UNION AT FUSELAGE STATION 115 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
227.	5067583-34	UNION AT FUSELAGE STATION 91 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
228.	5067583-33	UNION AT FUSELAGE STATION 50 TO UNION—R.H.	1
	AC811HT-4D	UNION	1
229.	5067583-31	UNION TO TEE—R.H.	1
	AC811HT-4D	UNION	1
230.	39B3480-414	TEE TO GAGE—R.H.	1
	PARKER 3156-7T-4	ADAPTER	1
	AC811JT-4D	TEE	1
231.	5067583-39	TEE TO DRAIN COCK—R.H.	1
	AC811CT-4	ELBOW	1
232.	5067583-38	DRAIN COCK TO VENT	1
	AC811CT-45-4	ELBOW	1

LEGEND FOR FIGURE 158



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5166752-A-55-210	DIAL AND HANDLE ASSEMBLY	2
	1087510-6-10	SCREW	4
2.	4063990	SUPPORT ASSEMBLY, FUEL TANK SELECTOR VALVE CONTROL	1
	AN526-832-8	SCREW	4
3.	5166752-A-2-103	DIAL AND HANDLE ASSEMBLY	2
	1087510-6-10	SCREW	4
	2059207	PULLEY, FUEL CROSS FEED VALVES	2
	124604-30-9	PIN, THREADED TAPER	2
	AC365-440	NUT	2
	AC960-4	WASHER	2
	1058277	SHAFT, FUEL CROSS FEED VALVES	2
	AN435-4-12	PIN, SHAFT	2
4.	4058341	SUPPORT ASSEMBLY, FUEL CROSS FEED VALVES	1
	AN526-832-9	SCREW	4
5.	2027797-506	ROD ASSEMBLY, BALL BEARING ENGINE CONTROL	1
	AN970-3	WASHER	1
	148535	BOLT, ¼" SHOULDER	1
	AN3-11	BOLT	1
	AN310-3	NUT	2
	AN316-4R	NUT	2
6.	2064917	DRIVE ASSEMBLY, ENGINE FUEL CROSS FEED VALVE	1
	AN3-6A	BOLT	4
	AC365-1032	NUT	4
7.	2175092	VALVE ASSEMBLY, FUEL CROSS FEED (ENGINE)	1
8.	2027797-812	ROD ASSEMBLY, BALL BEARING ENGINE CONTROL	1
	AN970-3	WASHER	1

Figure 159 - FUEL SYSTEM CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
	AN3-11	BOLT	2
	AN310-3	NUT	2
	AN316-4R	NUT	2
9.	2067258	PLATE, WOBBLE PUMP DRIVE	1
	AN4-7A	BOLT	2
	AC365-428	NUT	2
10.	93935	PUMP, HAND FUEL, TYPE D-12	2
	738112	HANDLE, PUMP	2
11.	2175092	VALVE ASSEMBLY, FUEL CROSS FEED (TANK)	1
12.	2064916	DRIVE ASSEMBLY, TANK FUEL CROSS FEED VALVE	1
	AN3-6A	BOLT	4
	AC365-1032	NUT	4
13.	AN210-1A	PULLEY	2
14.	2064967-12	CABLE ASSEMBLY	1
	AN155-8S	BARREL	2
	AN23-10	SCREW	1
	AN960-D10	WASHER	1
	AN320-3	NUT	1
15.	2064967-24	CABLE ASSEMBLY	1
	AN155-8S	BARREL	2
	AN23-10	SCREW	1
	AN960-D10	WASHER	1
	AN320-3	NUT	1
16.	2027797A13-28	ROD ASSEMBLY, BALL BEARING ENGINE CONTROL	1
	AN3-11	BOLT	1
	AN320-3	NUT	1
	AN23-15	BOLT	1
	124682-3S12-.065	WASHER	2
	AN310-3	NUT	1
17.	AN210-1A	PULLEY	2
18.	3132262	CABLE ASSEMBLY, FUEL DUMP VALVE	1
	AN520-416-8	SCREW	2
19.	4130107	EXTENSION ASSEMBLY, PILOT'S WOBBLE PUMP CONTROL	1
20.	4119997	TUBE, WOBBLE PUMP HANDLE	1
	AN3-16A	BOLT	1
	AC365-1032	NUT	2
	AN23-27A	BOLT	1
21.	4119999	CRANK ASSEMBLY, PILOT'S WOBBLE PUMP CONTROL HANDLE	1
22.	2064988	TUBE ASSEMBLY, PILOT'S WOBBLE PUMP	1
	AN3-11	BOLT	2
	AN310-3	NUT	2
23.	4066586	TUBE ASSEMBLY, PILOT'S WOBBLE PUMP TORQUE	1
	AN310-4	NUT	2
24.	4066546	BELL CRANK, PILOT'S WOBBLE PUMP CONTROL TORQUE SHAFT	2
	124604-2-13	PIN, THREADED TAPER	4
	AC365-832	NUT	4
	AN960-8	WASHER	4
25.	4066545	BRACKET ASSEMBLY, PILOTS, WOBBLE PUMP CONTROL TORQUE SHAFT (L.H.)	1
	4066545-1	BRACKET ASSEMBLY, PILOT'S WOBBLE PUMP CONTROL TORQUE SHAFT (R.H.)	1
	AN3-5A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4
26.	AN210-1A	PULLEY	4
27.	AN210-1A	PULLEY	6
28.	2064378-3	ROD ASSEMBLY, 5/8" DIAMETER, CONTROL	1
	AN3-11	BOLT	2
	AN310-3	NUT	2
29.	2064967-8	CABLE ASSEMBLY	1
	AN23-9	BOLT	1
	AN320-3	NUT	1
30.	2064967-10	CABLE ASSEMBLY	1
	AN23-9	BOLT	1
	AN320-3	NUT	1
31.		BULKHEAD AT STATION 156	1
32.	2064948	VALVE ASSEMBLY, TYPE "G" FUEL SELECTOR (L.H.)	1
33.	4066508	BELL CRANK, FUSELAGE STATION 156 WOBBLE PUMP	1
	AN4-25	BOLT	1
	AN310-4	NUT	1
34.	4067473	SUPPORT, FUEL CROSS FEED VALVE	1
	AN4-31A	BOLT	2
	124682-4D12-.128	WASHER	4
	AC365-428	NUT	2
35.	2064888	LINK, FUEL CROSS FEED VALVE	1
	AN3-17	BOLT	1
	AN960-10	WASHER	3
	AN310-3	NUT	1
	AN970-3	WASHER	1
36.	2067309	ROD ASSEMBLY, WOBBLE PUMP	1
	AN3-11	BOLT	2
	AN310-3	NUT	2
37.	2027797-A806	ROD ASSEMBLY, BALL BEARING ENGINE CONTROL	1
	AN3-11	BOLT	1
	AN320-3	NUT	1
	AN23-15	BOLT	1
	AN960-10	WASHER	2
	AN310-3	NUT	1
	124682-3S12-.065	WASHER	1
38.	2067291	BELL CRANK ASSEMBLY, CROSS FEED VALVE	2
	AN4-21	BOLT	1
	AN310-4	NUT	1
39.	5067050	SUPPORT, FUSELAGE STA. 156 WOBBLE PUMP BELL CRANK	1
	AN3-7A	BOLT	3
	AN3-10A	BOLT	1
	AC364-1032	NUT	4
40.	AN210-2A	PULLEY	2
41.	2064968-8	CABLE ASSEMBLY	1
	AN23-11A	BOLT	1
	AC365-1032	NUT	1
	AN960-D10	WASHER	1
	2057110	PULLEY ASSEMBLY, FUEL VALVE NEEDLE BEARING	1
42.	AN210-2A	PULLEY	2
43.	2032516-B3-3-1402	ROD ASSEMBLY, BALL BEARING ENGINE CONTROL	1
	AN23-13	BOLT	1
	AN23-15	BOLT	1
	AN320-3	NUT	2
44.	4132229	VALVE ASSEMBLY, FUEL PUMP, COMPLETE	2
	AN3-6A	BOLT	8
	AC365-1032	NUT	8
45.	AN210-2A	PULLEY	2
46.	AN210-2A	PULLEY	2
47.	AN210-2A	PULLEY	2
48.	2064968-10	CABLE ASSEMBLY	1
	AN23-11A	BOLT	1
	AC365-1032	NUT	1
	AN960-D10	WASHER	1
	2057110-1	PULLEY ASSEMBLY, FUEL VALVE NEEDLE BEARING	1
49.	2064948	VALVE ASSEMBLY, TYPE "G" FUEL SELECTOR (R.H.)	1
50.	AN210-2A	PULLEY	2
51.	AN210-2A	PULLEY	2
52.	AN210-2A	PULLEY	2

LEGEND FOR FIGURE 159

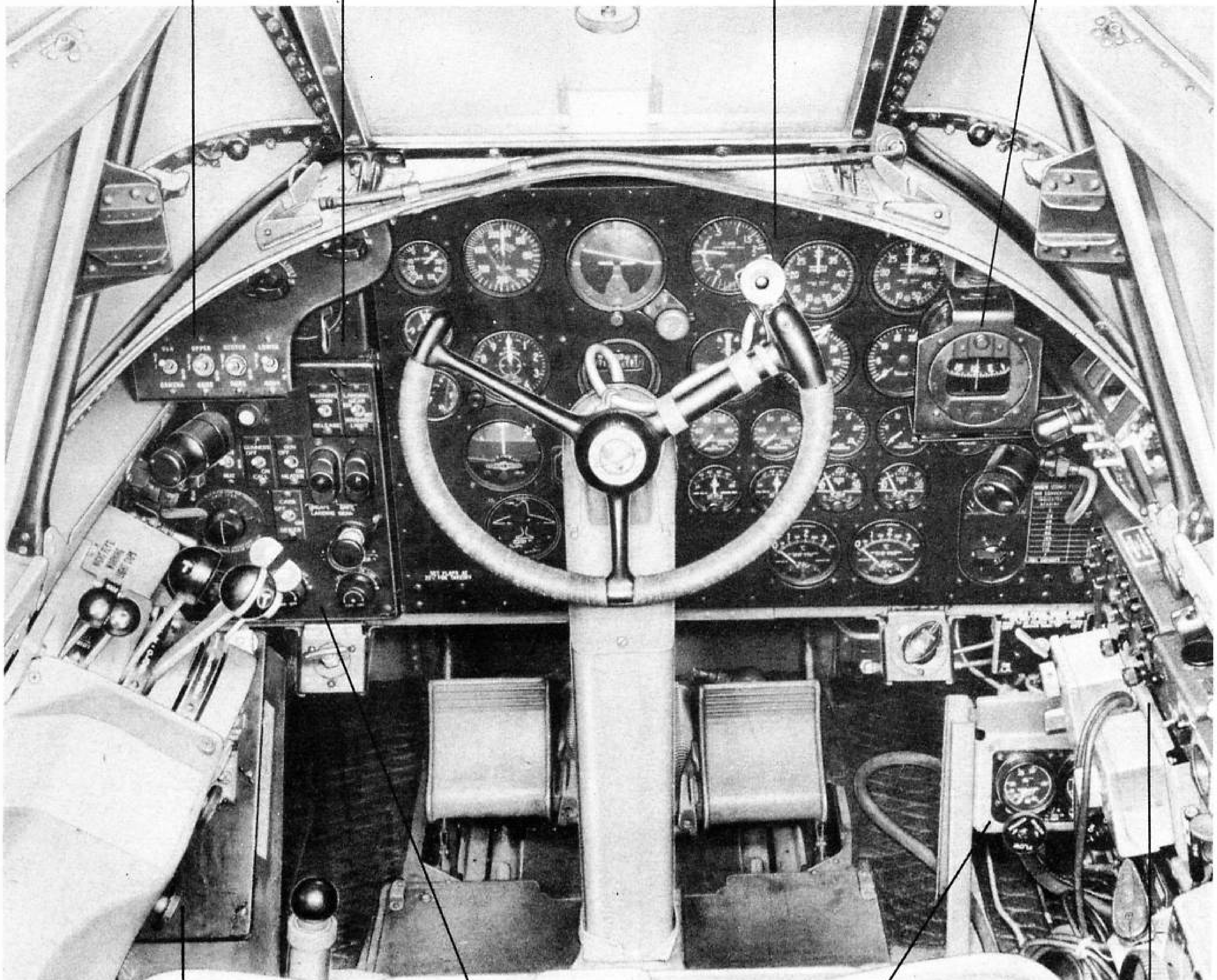


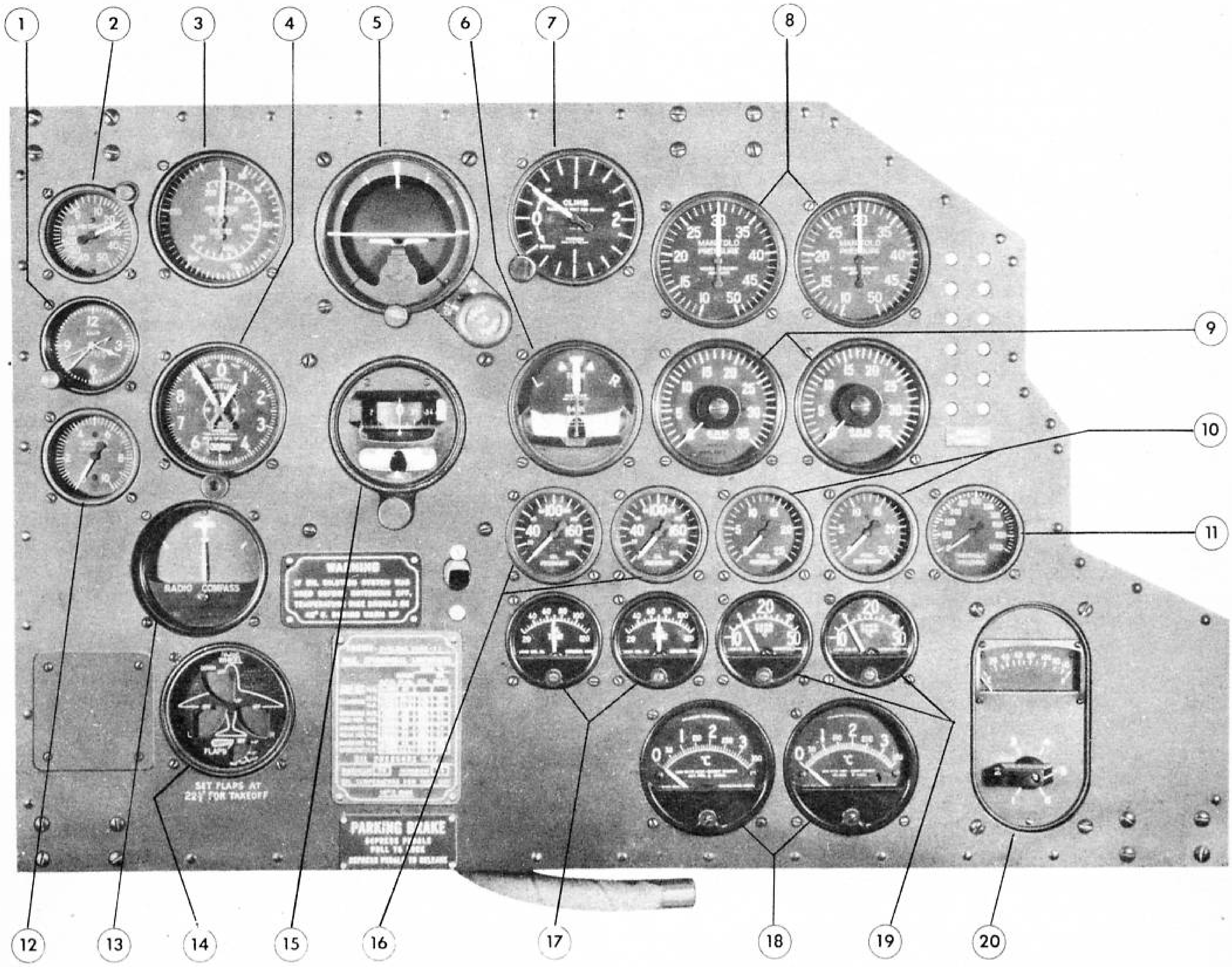
Figure 160 - PILOT'S COMPARTMENT

14. INSTRUMENTS.

a. DESCRIPTION.

(1) GENERAL. - All instruments are fluorescent lighted. The following are mounted on a shockproof instrument panel located in the pilot's compartment. (See figures 160 and 161.)

Air-speed indicator	Pioneer, 1426-4T
Altimeter	Pioneer, 1582-2M
Carburetor mixture temperature indicators (two)	Lewis, 47ACX
Clock	AAF Specification 94-27970, type A-11
Compass	IN-4A
Engine temperature indicators (two)	Lewis, 17AT7K
Flight indicator	AN-5736-2 (Sperry 647900)
Fuel pressure gages (two)	AAF Specifications 94-27919 type C-13
Fuel quantity indicator	EA47W-6
Hydraulic pressure gage	AAF Specification 94-27922, type E-4
Indicator unit for landing wheels and flaps	G.E., 8DJ4PBX



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AAF SPEC. 94-27970 TYPE A-11	CLOCK	1
2.	U. S. GAUGE AW-1⅞-20CG	THERMOMETER, OUTSIDE AIR	1
3.	PIONEER 1426-4T	INDICATOR, AIR-SPEED	1
4.	PIONEER 1555-2L	ALTIMETER	1
5.	AN-5736-2 (SPERRY 647900)	INDICATOR, FLIGHT	1
6.	AAF SPEC. 27348 TYPE A-11	INDICATOR, TURN AND BANK	1
7.	PIONEER 1634-1M	INDICATOR, RATE OF CLIMB	1
8.	U. S. GAUGE AW-2¾-14F	GAUGE, MANIFOLD PRESSURE	2
9.	WESTON MODEL 545 TYPE 56L	TACHOMETER	2
10.	AAF SPEC. 94-27917 TYPE B-8A	GAUGE, FUEL PRESSURE	2
11.	AAF SPEC. 94-27922 TYPE E-4	GAUGE, HYDRAULIC PRESSURE	1
12.	AAF SPEC. 94-27336 TYPE E-4	GAUGE, SUCTION	1
13.	IN-4A	COMPASS, RADIO	1
14.	GE8DJ4PBX	INDICATOR, LANDING GEAR AND FLAP POSITION	1
15.	AN5735-2 (SPERRY 647910)	INDICATOR, TURN	1
16.	AAF SPEC. 94-27917 TYPE B-8	GAUGE, OIL PRESSURE	2
17.	LEWIS 47AC2J	INDICATOR, OIL TEMPERATURE	2
18.	LEWIS 17AT7K	INDICATOR, ENGINE TEMPERATURE	2
19.	LEWIS 47ACX	INDICATOR, CARBURETOR MIXTURE TEMPERATURE	2
20.	EA47W-6	INDICATOR, FUEL QUANTITY	1

Figure 161 - INSTRUMENT PANEL

Manifold pressure gages (two)	U.S. Gage, AW-2 3/4-14F
Oil pressure gages (two)	AAF Specification 94-27917, type B-8A
Oil temperature indicators (two)	Lewis, 47AC2J
Outside air thermometer	U.S. Gage, AW-1 7/8-20-CG
Rate of climb indicator	Pioneer, 1634-1M
Suction gage	AAF Specification 94-27336, type F-4
Tachometers (two)	Weston model, 545, type 56P
Turn and bank indicator	AAF Specification 27348, type A-11
Turn indicator	AN-5735-2 (Sperry 647910)

(2) INSTRUMENT PANEL. (See figure 161.) - A shockproof instrument panel is mounted in the pilot's compartment and held in place by four bolts that are inserted through rubber shock mountings.

(3) PITOT AND VACUUM SYSTEMS. (See figure 169.)

(a) A pitot static and a pitot pressure line extend from a pitot head at the top of the vertical stabilizer along the left side of the fuselage to tees behind the pilot's instrument panel. A line from each tee connects to the air-speed indicator and altimeter on the panel. A drain tee is installed in each line aft of Station 75.

(b) The vacuum system consists of lines which extend from vacuum pumps on each engine through the nacelle and inner wing to a "Y" fitting at the right side of the fuselage. From this point they continue forward along the right side of the fuselage to the suction regulator behind the instrument panel. Three lines extend from the regulator to the throttle valve, flight indicator and turn indicator, respectively. The bank and turn indicator and suction gage obtain vacuum from the throttle valve and flight indicator, respectively.

(4) COMPASSES. - There are two compasses in the pilot's compartment. One is the magnetic type and the other is a radio compass. See paragraph 22, this section, for information on the radio compass.

(5) TACHOMETER GENERATOR (See figure 164.) - A small generator mounted on the fuel pump accessory drive on the rear of the engine supplies the necessary electrical current to actuate the tachometer.

(6) VACUUM PUMP. (See figure 162.) - To supply vacuum for the operation of gyroscopically actuated instruments, a vane-type vacuum pump operates in the oil system. The vacuum pump takes its small oil requirements from the engine accessory section on which it is mounted by four stud bolts. The pump is gear driven as an engine accessory. Incorporated in the vacuum line to the instruments are four valves. A suction relief valve is located at the engine accessory section forward of the fire wall on the inside of the nacelle. It controls flow in one direction in the event of backfire of the engine. A master relief valve

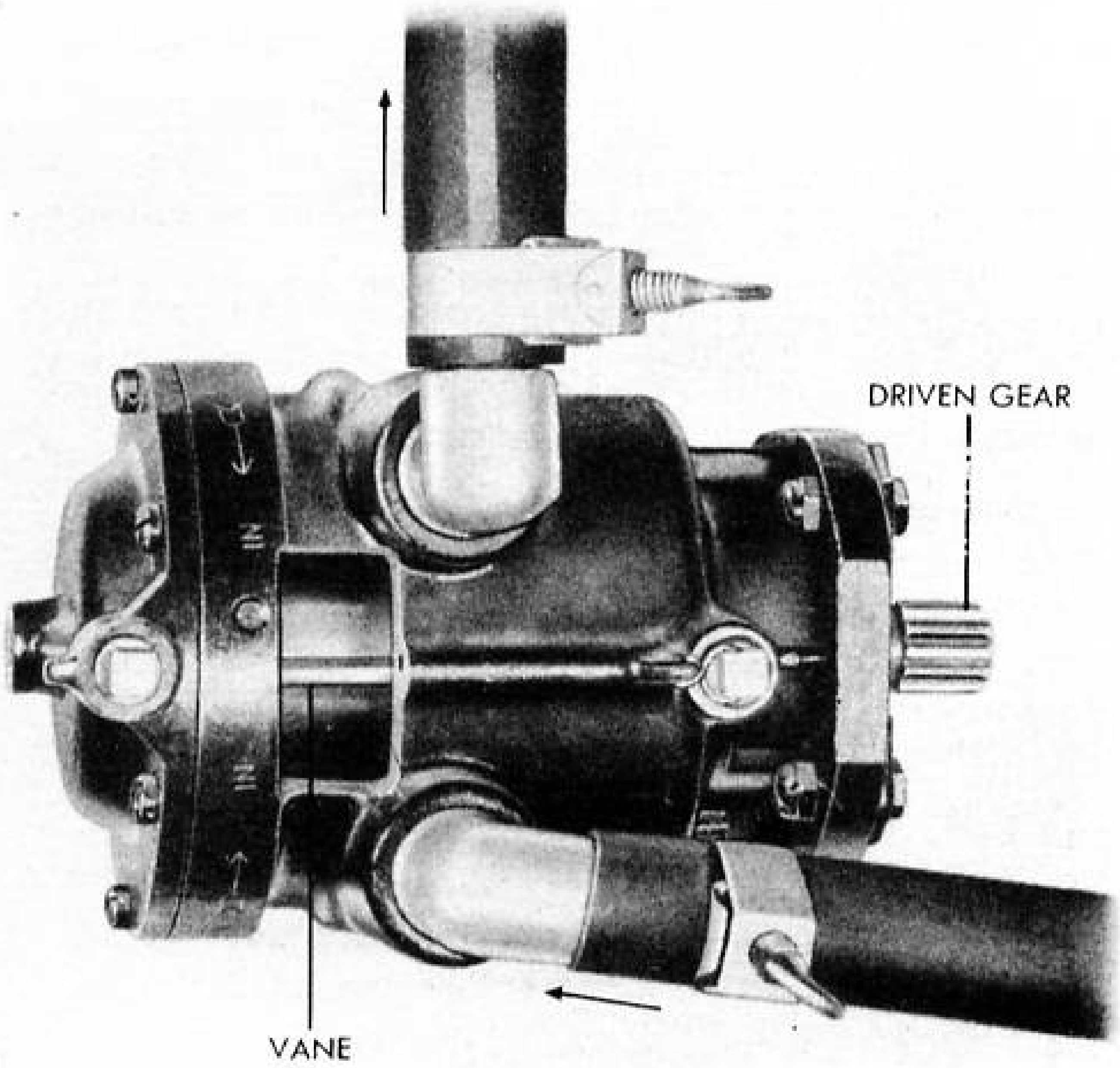


Figure 162 - VACUUM PUMP - CUTAWAY VIEW

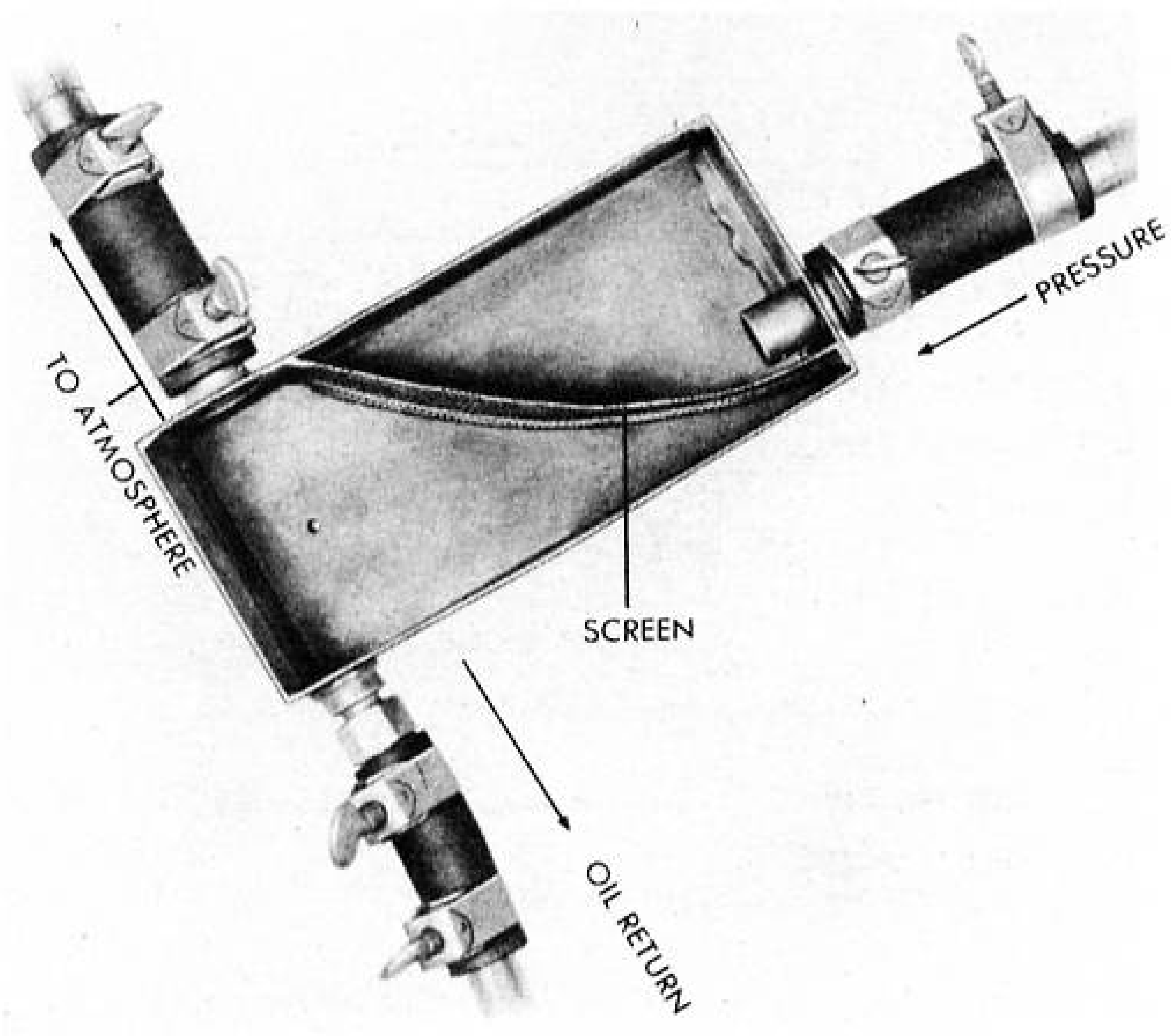


Figure 163 - OIL SEPARATOR - CUTAWAY VIEW

is located forward of the instrument panel, and set at 4.2 inches mercury vacuum. Finally a relief valve for the turn and bank indicator is located close to the master relief valve and is set at two inches mercury vacuum. The instruments which depend on the vacuum pump are the flight indicator, the gyro-compass, the turn and bank indicator and the suction gage.

(7) OIL SEPARATOR. (See figure 163.) - An oil separator is mounted forward of the fire wall of each engine. The separator is of the centrifugal type through which the exhaust air returning under pressure from the vacuum pump is freed of any oil particles. In the separator, pressure is vented to the atmosphere and the oil returned to the supply.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
AIR-SPEED INDICATOR.		
Pointer fails to respond.	Dynamic pressure connection not connected properly to dynamic pressure line from pitot static tube.	Check tubing and connections for leaks.
	Dynamic or static pressure line from pitot static tube clogged.	Disconnect dynamic and static pres^ure lines from all instruments. Open pet cock or drain at lowest point of each tube line Blow through tubing to remove obstruction.
Ball on inclinometer does not center.	Instrument out of alinement on panel.	Correct alinement of instrument.
Instrument fails on bench test.	Defective internal mechanism.	Replace instrument.
TURN INDICATOR.		
Excessive drift of card.	Improper suction, excessive vibration.	Check and adjust suction. Check mounting panel shock absorbers. Replace if defective. If trouble still persists, replace instrument.
Caging mechanism works hard.	Lack of lubrication or corrosion around shaft.	Lubricate external part of shaft with instrument oil.
Instrument lacks sensitivity.	Insufficient speed of gyro rotor, dirty screens.	Clean screens and check suction.
Loose or broken cover glass.	Excessive vibration.	Replace instrument and check instrument panel shock mountings.
Broken inclinometer tube.	Excessive vibration.	Replace instrument and check instrument panel shock mountings.
	Defective indicator mechanism.	Replace instrument.
Pointer indicates incorrectly.	Leak in tubing from pitot static tube or in connection.	Check lines to pitot static tube for leaks.
	Leak in indicator case.	Replace instrument.
Pointer does not set on zero when airplane is on the ground.	Defective indicator mechanism.	Replace instrument.
Pointer vibrates.	Excessive vibration of instrument board.	Check instrument board. If excessive vibration is apparent, replace worn or deteriorated load mounting units.
	Excessive vibration of tubing.	Check flexibility of tubing between indicator and each rigid line.

SYMPTOM	CAUSE	REMEDY
Pointer oscillates.	Leak in tubing from pitot static tube or in connections.	Disconnect lines from air-speed indicator. Check lines to pitot static tube for leaks.
	Leak in indicator case.	Replace instrument.
	Leak in rate of climb indicator or altimeter installations.	Check lines for leaks. If instrument is at fault replace instrument.
ALTIMETER.		
Excessive scale error.	Improper calibration adjustment.	Replace instrument.
Excessive pointer oscillation.	Defective mechanism.	Replace instrument.
High reading.	Improper venting.	Eliminate leak in static line and check alinement of static head.
Inner reference knob fails to move when setting knob is rotated.	Out of engagement.	Replace instrument.
Barometric scale and reference markers out of synchronism.	Slippage in mating parts.	Replace instrument.
Barometric scale and reference markers out of synchronism with pointers.	Slippage in mating parts.	Reset pointers.
CARBURETOR MIXTURE TEMPERATURE INDICATOR.		
No reading with panel switch ON.	Panel switch defective. Poor connection at switch terminals.	Replace defective switch. Clean and tighten terminals.
	Break in battery lead.	Repair or replace battery lead.
	Break in ground lead.	Repair or replace ground lead.
	Open or short circuit in indicator.	Replace indicator.
Reading off scale at low temperature end.	Short circuit in leads to resistance bulb. Ground in lead from resistance bulb to "R" post of indicator.	Repair or replace leads to resistance bulb. Repair or replace lead from resistance bulb to "R".
	Short circuit in resistance bulb.	Replace resistance bulb.
	Open or short circuit in indicator.	Replace indicator.
Reading off scale at high temperature end.	Break in leads to resistance bulb.	Repair or replace leads to resistance bulb.
	Open circuit in resistance bulb.	Replace resistance bulb.
	Open or short circuit in indicator.	Replace indicator.
Low or high reading, either permanent or intermittent.	Battery low.	Replace or recharge battery.
	Poor connections in leads to battery.	Repair or replace leads.
	Poor connections in lead to panel switch.	Clean and tighten terminals.

SYMPTOM	CAUSE	REMEDY
	Poor connection in panel switch.	Clean and tighten terminals.
	Poor connection in leads from indicator to resistance bulb.	Clean and tighten terminals.
	Zero connector off adjustment.	Open battery circuit. Reset indicator by means of zero adjusting to balance point. Close battery circuit.
	Poor connection in indicator.	Replace indicator.
	Poor connection in resistance bulb.	Replace resistance bulb.
	Dull pivots in indicator.	Replace indicator.
Excessive error in mechanical zero.	Improper adjustment.	Correct with adjusting screw.
CLOCK.		
Clock fails to start when wound.	Excessive friction or congealed oil.	Jar violently. If trouble persists, replace instrument.
Loose or cracked cover glass.	Excessive vibration or sudden jar.	Replace cover glass. Check panel shock mounts.
Winding knob turns.	Main spring broken.	Replace instrument.
Hands not moving when clock is wound.	Hands loose on shaft.	Reset hands on shaft.
NAVIGATION COMPASS.		
Excessive card error.	Compass not properly compensated.	Compensate instrument.
	External magnetic interference.	Locate magnetic interference and eliminate.
Excessive card oscillation.	Insufficient liquid.	Remove instrument and fill with liquid.
	Excessive vibration of instrument mount.	Remove excessive vibration of instrument mount.
Card element not level.	Leaking float chamber.	Replace instrument.
	Card magnets detached from card.	Replace instrument.
Card sluggish.	Weak card magnets.	Replace instrument.
	Excessive pivot friction or broken jewel.	Replace instrument.
	Instrument heavily compensated.	Remove excessive compensation.
Liquid leakage.	Loose bezel screws.	Tighten bezel screws.
	Broken cover glass or case.	Replace instrument.
	Defective sealing gaskets.	Replace instrument.
ENGINE TEMPERATURE INDICATOR (thermocouple thermometer).		
No reading, either permanent or intermittent.	Break in leads.	Replace or repair leads.
	Break in indicator or switch.	Replace instrument or switch.

SYMPTOM	CAUSE	REMEDY
Low reading, either permanent or intermittent.	High resistance caused by loose connections or poor contacts at terminals.	Clean terminals and tighten connections.
	Short circuit in leads.	Replace or repair leads.
	Short circuit at thermocouple.	Repair insulation on wires at thermocouple or replace defective part.
	Zero corrector shifted.	Reset zero corrector.
Excessive scale error.	Incorrect adjustment.	Break circuit and adjust cold junction compensator.
Excessive pointer oscillation.	Broken leads or loose connections.	Check leads. Replace if broken. Clean and tighten if loose.
Loose or cracked cover glass.	Excessive vibration.	Replace glass. Check panel shock mountings.
FLIGHT INDICATOR.		
Sluggish operation.	Insufficient vacuum.	Check and adjust vacuum.
	Dirty screens.	Clean screens.
	Case leaks.	Replace instrument.
Failure of horizon bar to settle.	Excessive vibration.	Check panel shock mountings.
	Fouled vanes in rotor.	Replace instrument.
	Gimbals out of balance.	Replace instrument.
	Worn points or bearings.	Replace instrument.
	Insufficient suction.	Check and adjust vacuum.
Horizon bar oscillates or shimmies continuously.	Excessive vibration.	Check panel shock mountings.
	Vacuum too high.	Check and adjust vacuum.
	Worn rotor pivots or bearings.	Replace instrument.
Horizon bar does not agree with flight attitude.	Instrument out of alinement on panel.	Correct alinement of instrument on panel.
Horizon bar and banking indicator not perpendicular to each other.	Mechanism out of alinement.	Replace instrument.
Instrument fails on bench test.	Defective internal mechanism.	Replace instrument.
FUEL PRESSURE GAGE.		
Excessive error at zero.	Pointer loose on shaft.	Reset pointer and calibrate.
	Excessive overpressure.	Reset pointer and calibrate.
Excessive scale error.	Excessive pressure.	Calibrate and adjust.
	Excessive vibration.	Calibrate and adjust.
	Improper calibration adjustment.	Make proper adjustment.
Excessive pointer oscillation.	Improper damping, or rough relief valve.	Disconnect line and drain. Reconnect, making sure there are no leaks. If trouble persists, work on relief valve.

SYMPTOM	CAUSE	REMEDY
FUEL QUANTITY INDICATOR.		
Excess error at empty or full position.	Improper range adjustment.	Make correction at tank unit.
Broken wire in winding of tank rheostat.	Excessive friction and wear.	Replace rheostat assembly.
Excessive scale error.	Unbalanced resistance.	Check empty and full positions and adjust tank unit.
Excessive range error.	Potentiometer out of adjustment (tank end).	Make adjustment in tank unit.
HYDRAULIC PRESSURE GAGE.		
Excessive error at zero.	Pointer loose on shaft.	Reset pointer and calibrate gage.
	Excessive overpressure.	Adjust and calibrate gage.
	Seasoning of bourdon tube.	Adjust and calibrate gage.
Excessive pointer oscillation.	Improper clamping.	Disconnect and drain line to instrument. Reconnect line and make sure there are no leaks.
Excessive scale error.	Improper calibration.	Adjust and calibrate gage.
MANIFOLD PRESSURE GAGE.		
Excessive error at existing barometric pressure.	Pointer shifted.	Reset pointer to "zero" position (existing manifold pressure).
Excessive error when engine is running.	Case leaks.	Test case and reseal.
	Line leaks.	Tighten line connections. Be sure drain cock is closed when test for leak is made.
Sluggish pointer movement.	Improper clamping adjustment.	Adjust clamping screws.
Broken or loose cover glass.	Vibration.	Replace glass and reseal case. Check chock mounts on panel.
OIL PRESSURE GAGE.		
Excessive error at zero.	Pointer loose on shaft.	Reset pointer and calibrate gage.
	Excessive overpressure.	Reset pointer and calibrate gage.
	Seasoning of bourdon tube.	Reset pointer and calibrate gage.
Excessive scale error.	Improper calibration adjustment.	Adjust and calibrate gage.
Excessive pointer oscillation.	Improper clamping or rough relief valve.	Disconnect line and drain. Reconnect, making sure there are no leaks. If trouble still persists, clean and adjust relief valve.
Sluggish operation of pointer.	Low temperature of fluid in line.	Drain line and refill with a light grade of oil.
OUTSIDE AIR THERMOMETER.		
Instrument fails to show any reading.	Broken or damaged capillary.	Replace instrument.

SYMPTOM	CAUSE	REMEDY
Excessive scale error.	Improper calibration adjustment.	Calibrate and adjust instrument.
Excessive operation error.	Bulb not properly exposed.	Relocate bulb.
Broken or loose cover glass.	Excessive vibration.	Replace glass and check instrument panel shock mounts.
Sluggish pointer movement.	Restricted capillary.	Replace instrument.
RATE-OF-CLIMB INDICATOR.		
Pointer does not set on zero.	Incorrectly adjusted.	Reset pointer to zero by means of setting knob. Tap instrument while resetting. Disconnect all instruments connected to static line, and blow line clear.
	Defective mechanism.	Replace instrument.
Pointer indicates inaccurately.	Leaks in static line.	Disconnect all instruments connected to static line. Check line for leaks. Check individual instruments for leaks.
	Defective mechanism.	Replace instrument.
Pointer oscillates.	Leaks in static line.	Disconnect all instruments connected to static line. Check line for leaks. Check individual instruments for leaks. Reconnect instruments to static line and test for leaks.
	Restriction plug not installed.	Install restriction plug.
	Defective mechanism.	Replace instrument.
SUCTION GAGE.		
Excessive error at zero.	Loose pointer.	Reset pointer and calibrate gage.
	Excessive over suction.	Reset pointer and calibrate gage.
	Seasoning of diaphragm.	Reset pointer and calibrate gage.
Excessive scale error.	Improper calibration.	Adjust and calibrate gage.
Excessive pointer oscillation.	Rough relief valve seat.	Adjust or replace relief valve.
TACHOMETER.		
Excessive error at zero.	Vibration.	Make correction with adjusting screw. Check shock mounts.
Excessive scale error.	Weak magnets in generator.	Replace tachometer generator and indicator.
Instruments out of synchronism.	Tachometer generators putting out different voltage at same rpm.	Remove tachometer generators and synchronize on bench test tachometer stand.
Pointer moves backwards.	Reversed polarity.	Change leads at terminals on tachometer generator.
No reading on indicator, either permanent or intermittent.	Break or short circuit in leads.	Repair or replace broken leads.
	Poor connections at indicator or tachometer generator terminals.	Clean and tighten terminals.

SYMPTOM	CAUSE	REMEDY
	Break in circuit inside indicator or tachometer generator.	Replace indicator and tachometer generator.
Low reading on indicator, either permanent or intermittent.	Poor connections at indicator or tachometer generator terminals.	Clean and tighten terminals.
	Zero corrector screw out of adjustment on indicator.	Disconnect leads and set pointer to zero. Connect leads.
	Tachometer generator brushes worn.	Replace brushes. Clean commutator.
	Defective indicator pivots.	Replace indicator and tachometer generator.
High reading on indicator, either permanent or intermittent.	Zero corrector screw off adjustment on indicator.	Disconnect lead and reset pointer to zero. Connect lead.
	Indicator resistance off adjustment.	Replace indicator and generator.
TURN AND BANK INDICATOR.		
Pointer does not set on zero; otherwise smooth pointer operation.	Gimbel and rotor assembly out of balance.	Replace instrument.
	Pointer incorrectly set on its staff.	Replace instrument.
	Sensitivity spring adjustment pulls pointer off zero.	Replace instrument.
Incorrect sensitivity.	Vacuum too high or too low.	Examine tubing, connections, control valve, etc., for leaks or stoppage.
	Air inlet cap or air inlet screen clogged.	Remove cap or screen. Clean and replace.
	Misadjustment of sensitivity spring.	Adjust sensitivity by means of screw on right side of instrument.
Vibrating pointer.	Excessive vibration.	Check instrument board for excessive vibration and correct the cause.
	Damping screw misadjustment.	Adjust damping screw on left side of instrument.
	Lack of oil in instrument.	Lubricate instrument through plug on right side of instrument.
Pointer sluggish in returning to zero, erratic pointer operation.	Oil or dirt between damping piston and cylinder.	Replace instrument.
	Excessive clearance between rotor and rotor pivots.	Replace instrument.

c. REMOVAL.

(1) REMOVAL OF INSTRUMENTS.

NOTE

All power must be OFF when working on electrical instruments. Flight indicators and turn and bank indicators must be caged when handled.

(a) Remove access doors located between stations 0 and 14 from top of fuselage.

(b) Disconnect tubing (if any) from the instrument. Cap tubing to prevent entry of dirt.

(c) Disconnect wires attached to unit.

(d) Remove mounting screws and lift the instrument from the panel.

(2) REMOVAL OF INSTRUMENT PANEL.

(a) Remove access doors located between stations 0 and 14 from top of fuselage.

(b) Disconnect all attaching wires and lines. Tag the wires and lines as they are disconnected to facilitate assembly. Cap tubing to prevent entry of dirt.

(c) Remove the center bolts of the shock mountings.

(d) Remove the panel from the cockpit.

(3) REMOVAL OF TACHOMETER GENERATOR. (See figure 164.)

(a) Disconnect the electrical wiring at the Cannon plug on lower end of the generator.

(b) Cut the safety wire on the large union nut.

(c) Remove union nut and release generator from the accessory drive.

(4) REMOVAL OF VACUUM PUMP. (See figure 162.)

(a) Disconnect hose leading from fire wall to pump at pump.

(b) Disconnect hose leading from oil separator to vacuum pump at pump.

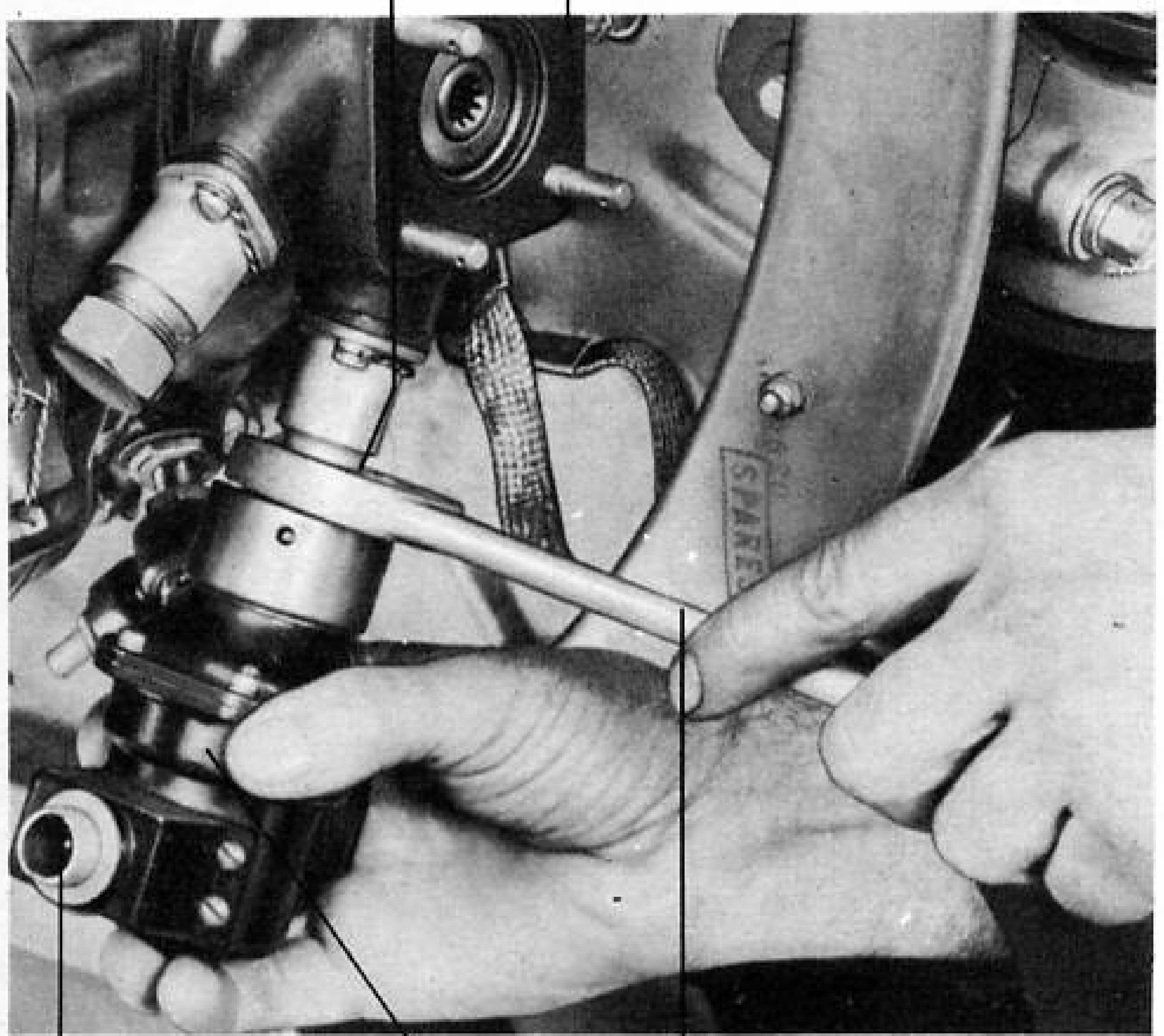


Figure 164 - REMOVING TACHOMETER GENERATOR

(c) Remove four bolts that attach vacuum pump to crankcase.

(5) REMOVAL OF OIL SEPARATOR. (See figure 163.)

(a) Disconnect line leading from vacuum pump to oil separator at oil separator.

(b) Disconnect line leading from crankcase to oil separator at oil separator.

(c) Disconnect hose leading from fire wall to oil separator at oil separator.

(d) Remove two cotter pins, castellated nuts and bolts that attach oil separator to its bracket.

d. MAINTENANCE REPAIRS.

(1) MARKING INSTRUMENTS. - When installing any aircraft instrument, always be sure the instrument is marked. If not marked, mark each instrument to identify its purpose either by plate, name data, or drawing number. Make all markings neat and not over 1/16 inch wide. Use aircraft enamel, Specification AN-E-3, or lacquer, Specification AN-TT-L-51. Apply enamel with a finely pointed brush and lacquer with a drafting pin. Use a compass to make arc-shaped marks on instrument glasses and apply masking tape in the center of the glass to prevent slippage of compass points. Use colors as follows:

(a) Insignia red line to indicate MAXIMUM PERMISSIBLE.

(b) Willow green arc to indicate OPERATING RANGE.

(c) White line for reference line. Apply to both edges of instrument case and cover glass so that alinement of marks indicates the glass is properly positioned.

(2) INSPECTION AND REPAIR OF VACUUM PUMP.

(a) Clean pump thoroughly in solvent.

(b) Inspect pump to see if any of the vanes have broken away. If this condition is found, clean all parts thoroughly and examine the line to the separator for particles of broken metal. Clean the line well.

e. REPLACEMENTS.

(1) INSPECTION AND REPLACEMENT OF INSTRUMENT PARTS.

(a) Inspect instrument for broken or loose cover glass. Replace glass if broken.

(b) Inspect instrument for discolored or chipped luminous markings. Replace instrument if chipped or discolored.

(c) Inspect threads of instrument for burs or stripping. Rethread if damaged.

(d) Check case of instrument for cracks or points of leakage. Replace if damaged.

(2) INSPECTION AND REPLACEMENT OF INSTRUMENT PANEL PARTS.

(a) Inspect all instruments for security of mounting. Tighten if loose.

(b) Inspect the four shock absorber units on the panel and replace if damaged.

(c) Inspect panel for any cracks or breaks in its surface. Replace if cracked or broken.

(3) INSPECTION AND REPLACEMENT OF OIL SEPARATOR.

(a) Clean oil separator thoroughly in gasoline.

(b) Inspect oil separator for any external defects. Replace if damaged.

f. ADJUSTMENTS.

(1) CHECKING ZERO ADJUSTMENT OF ALTIMETER: (See figure 165.)

(a) Take a portable altimeter, part No. 37D3341, to the control tower and set pointers to read the surveyed elevation of the station altimeter above sea level. Vibrate the instrument before taking the reading. The pressure scale of the portable altimeter should read the existing "altimeter setting." If it does not, loosen the zero setting adjustment screw just to the left of the setting knob and displace it to the left. Do not remove screw. Then with the pointers still reading the elevation, read the existing altimeter setting. Check the reading carefully and vibrate the instrument. The portable altimeter now reads correctly for the existing altimeter setting and the scale correction is zero for this pressure.

(b) Carry the portable altimeter to the altimeter in the airplane. Be sure to leave the pressure scale on the portable altimeter set to the existing altimeter setting. Set the reference markers on the airplane altimeter to zero, read the pointer indication and determine the scale correction for this pressure altitude. Now vibrate and read the portable altimeter and subtract the correction, which has just been determined for the airplane altimeter, from this reading. Next set the pointers of the airplane altimeter to read this value, tapping the instrument sufficiently to remove all friction. The pressure scale of the airplane altimeter should read the existing altimeter setting as set on the pressure scale of the portable altimeter.

(c) If, after this procedure, the airplane altimeter does not indicate the existing altimeter setting, loosen the adjusting screw to the left of the knob (do not remove screw), and displace it to the left. Then pull out on the knob and turn until the pressure scale does read the existing altimeter setting, keeping the pointers on the corrected reading determined in the preceding paragraph. Tap the altimeter during this procedure to remove the friction. If the pointers read properly and the pressure scale reads the existing altimeter setting, move the screw back to the right and tighten. The airplane altimeter is now set to the proper correction on its scale correction card, and all the other corrections appearing thereon should be applicable for other altitudes.

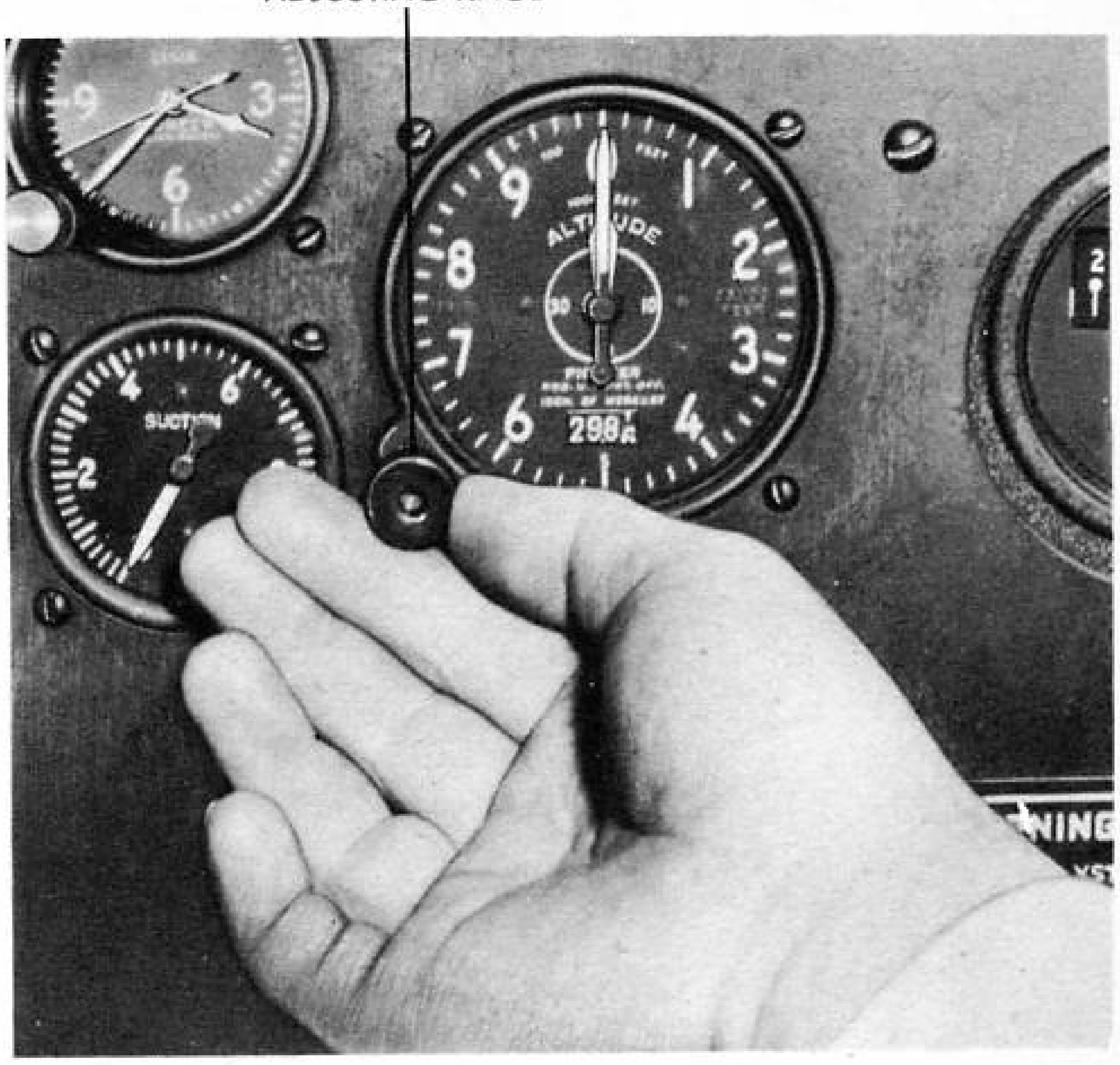


Figure 165 - ADJUSTING ALTIMETER

NOTE

This check should not be made until at least 12 hours after the airplane has been flown.

(2) SWINGING COMPASS. - If the compass is suspected of being in error it should be checked and compensated if necessary. The procedure to compensate or swing the compass is as follows:

(a) Remove compensating drawer or assembly, or set compensator assembly for zero effect by matching the dots on the compensator screws with those on the instrument case.

(b) Head the airplane to Magnetic North (see figure 166), Magnetic East, Magnetic South, and Magnetic West and read the airplane's compass on the four headings.

(c) Enter the magnetic headings and compass readings in their appropriate spaces under "Compensating Swing," on AAF Form No. 57. Subtract the compass readings from the corresponding magnetic headings to obtain the deviations and enter the deviations and their signs in the next column.

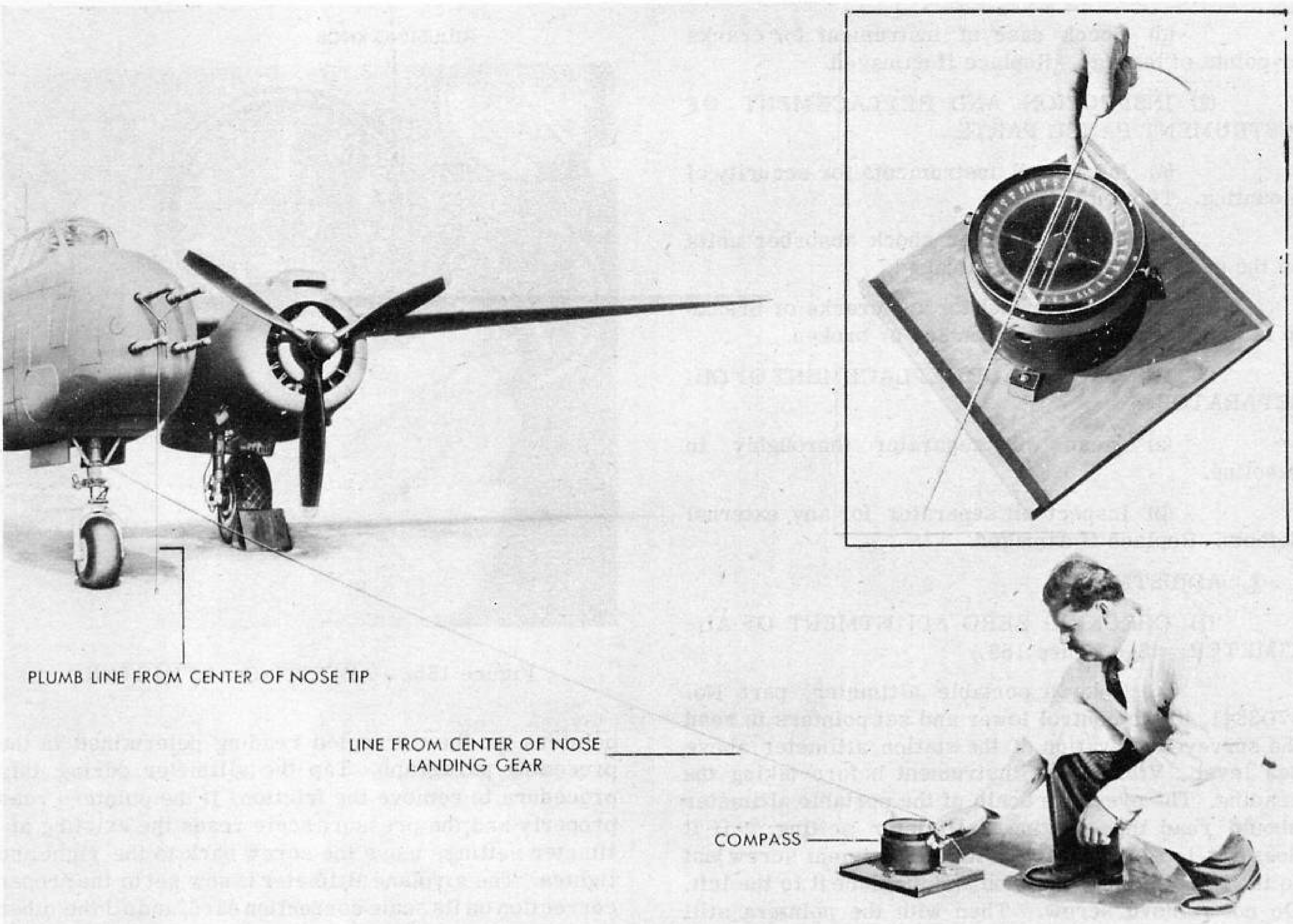


Figure 166 - HEADING AIRPLANE NORTH FOR COMPASS ADJUSTMENT

(d) Using the recorded deviations, calculate the coefficients A, B, and C, according to the formulae, on the lower part of the form.

NOTE

All calculations are algebraic, that is,

Multiplication	Addition	Subtraction	Division
+ (+) = +	+ (+) + = +	+ (-) - = +	+ ÷ + = +
+ (-) = -	- (+) - = -	+ (-) + = ±	- ÷ - = -
- (+) = -	+ (+) - = ±	- (-) + = -	+ + - = -
- (-) = +		- (-) - = ±	- ÷ + = -

(e) With the airplane's head on Magnetic North, add coefficient C algebraically to the compass reading on that heading to determine what the instrument should indicate when compensated. Replace the compensator and make the compass indicate the compensated value by adjusting the N-S (see figure 167) compensating screw (use nonmagnetic screwdriver) or by inserting magnets in that chamber of the compensating drawer at right angles to the compass needle (the lateral chamber).

(f) With the airplane's head on Magnetic East, add coefficient B algebraically to the compass reading on that heading to determine what the instrument should indicate when compensated. Make the compass indicate the compensated value by adjusting (see figure 167) the E-W compensating screw (use nonmagnetic screwdriver) or by inserting magnets in that chamber of the compensating drawer at right angles in the compass needle (the longitudinal chamber).

NOTE

If the compensation on North is inadvertently altered when the airplane's head is Magnetic East, step 5 must be redone. Before repeating step 5, reset the N-S compensator for zero effect.

(g) With the airplane on any heading, add coefficient A algebraically to the reading of the compass reading on that heading to determine what the

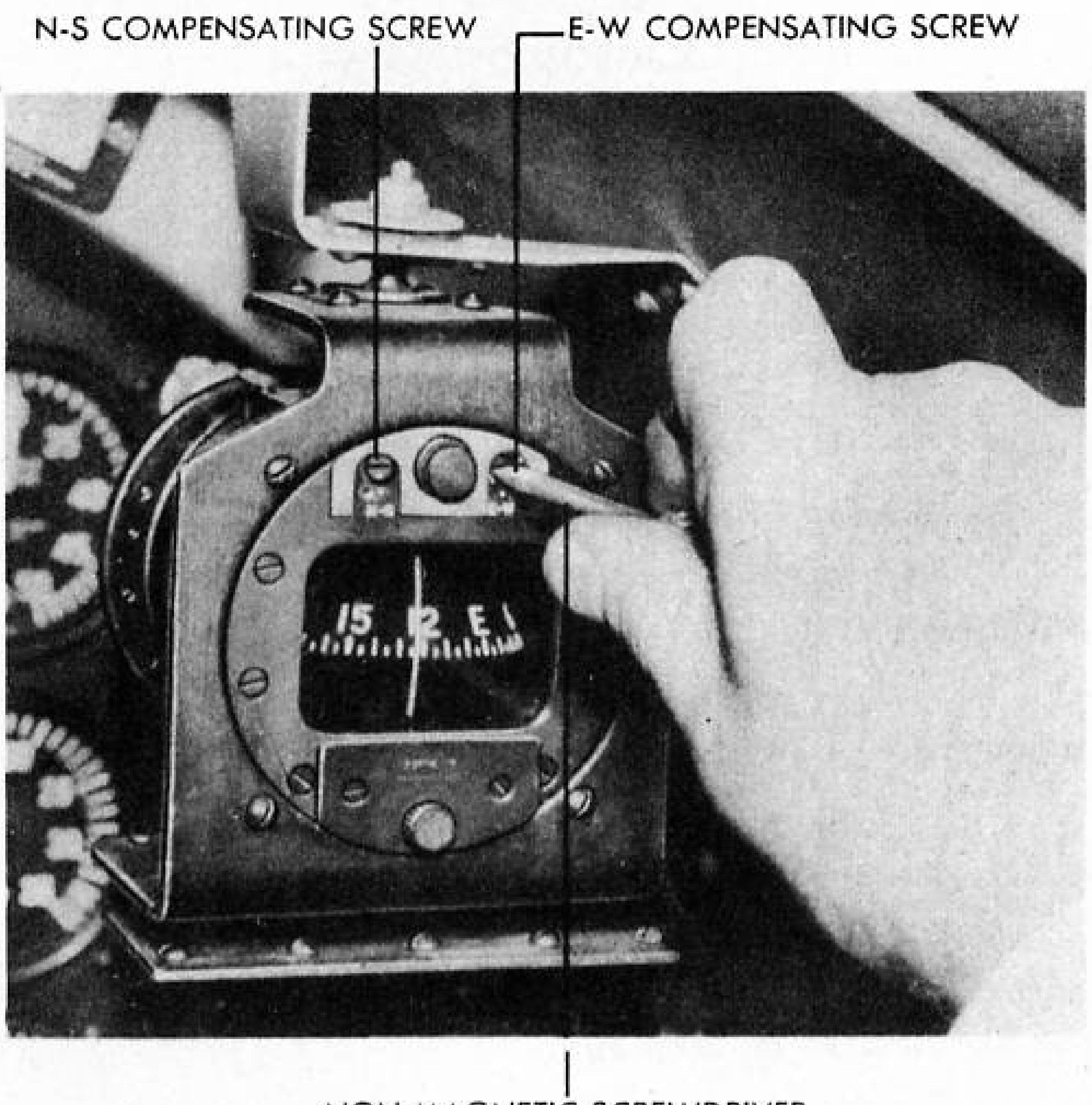


Figure 167 - ADJUSTING COMPASS

instrument should read when compensated. Make the compass indicate the compensated value by rotating it bodily, clockwise if coefficient A is positive, or counter-clockwise if coefficient A is negative. Secure the compass. This completes the actual compensation of the compass.

(h) Place the airplane's head on the cardinal and quadrantal magnetic headings (East, Southeast, South, Southwest, West, Northwest, North, and Northeast) and enter the magnetic headings and the corresponding compass readings in their proper spaces on AAF Form No. 57 under "Residual Swing."

(i) Complete AAF Form No. 57, according to the subtractions indicated at the bottom of the last two blank columns, and tear off the compass card and place it in the compass card holder in the airplane. File the remainder of the card as a permanent record.

g. INSTALLATION.

(1) INSTALLATION OF OIL SEPARATOR. (See figure 163.)

(a) Place oil separator in position on its bracket and install two bolts, castellated nuts, and cotter pins.

(b) Connect line leading from fire wall to oil separator.

(c) Connect line leading from vacuum pump to oil separator at oil separator.

(d) Connect line leading from engine crank-case to oil separator at oil separator.

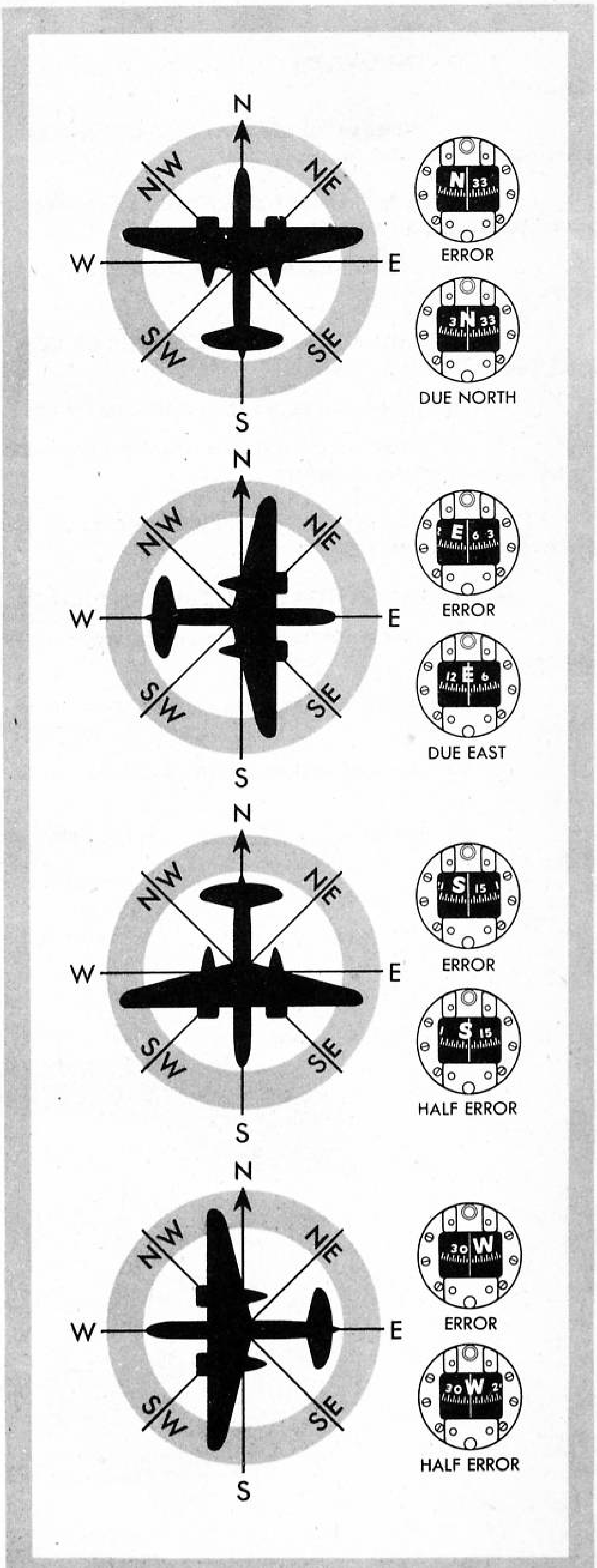


Figure 168 COMPASS COMPENSATION

(2) INSTALLATION OF VACUUM PUMP. (See figure 162.)

(a) Place pump in position on engine crankcase and install four bolts.

(b) Connect hose leading from oil separator to vacuum pump at vacuum pump.

(c) Connect hose leading from fire wall to pump at vacuum pump.

(3) INSTALLATION OF TACHOMETER GENERATOR. (See figure 164.)

(a) Place generator in position on its base.

(b) Install union nut that attaches generator to the accessory drive safety.

(c) Connect the electrical wiring at the lower end of the generator.

(4) INSTALLATION OF INSTRUMENT PANEL.

(a) Place instrument panel in position in cockpit.

(b) Install center bolts of the shock mountings.

(c) Connect all wires and lines to instruments.

(d) Replace access doors on top of fuselage.

(5) INSTALLATION OF INSTRUMENTS.

(a) Place instrument in position on panel.

(b) Install mounting screws.

(c) Uncap and connect tubing (if any) to instrument. Use thread lubricant, Specification 3590, on all threads.

(d) Connect wiring (if any) to instrument.

h. FINAL TEST AFTER ASSEMBLY.

(1) INSPECTION OF INSTRUMENT AFTER INSTALLATION.

(a) Inspect instrument for security of mounting.

(b) Inspect all lines for tightness, flexibility, and anchorage.

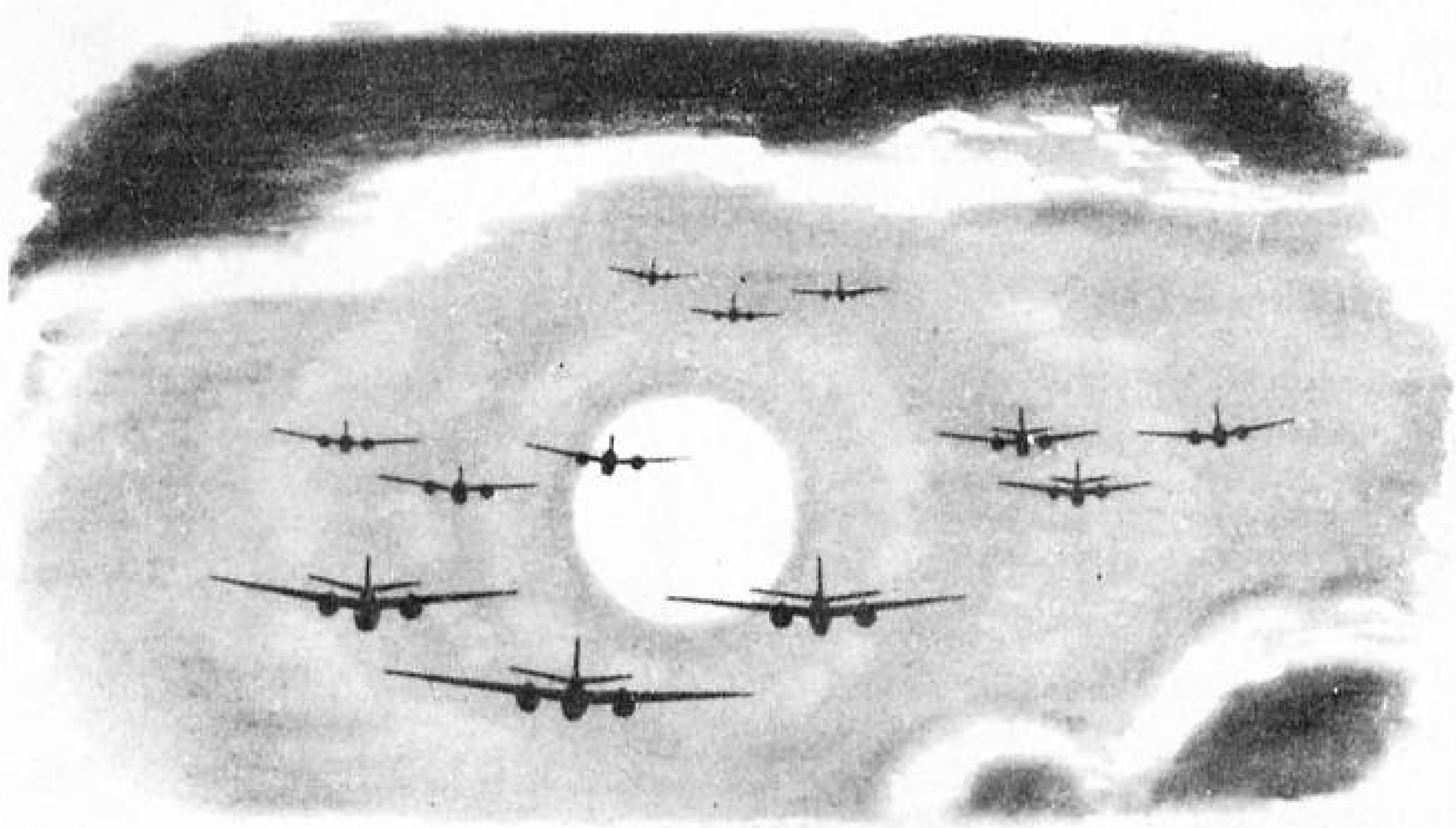
(c) If checking an engine instrument, start engines and check to determine if it is consistent with the attitude of the airplane.

(2) TEST OF VACUUM PUMP AFTER INSTALLATION.

(a) Inspect pump for security of mounting.

(b) Inspect all connections and lines for tightness, flexibility, and anchorage.

(c) With engines running, check all gages connected to the vacuum system for readings consistent with the attitude of the airplane.



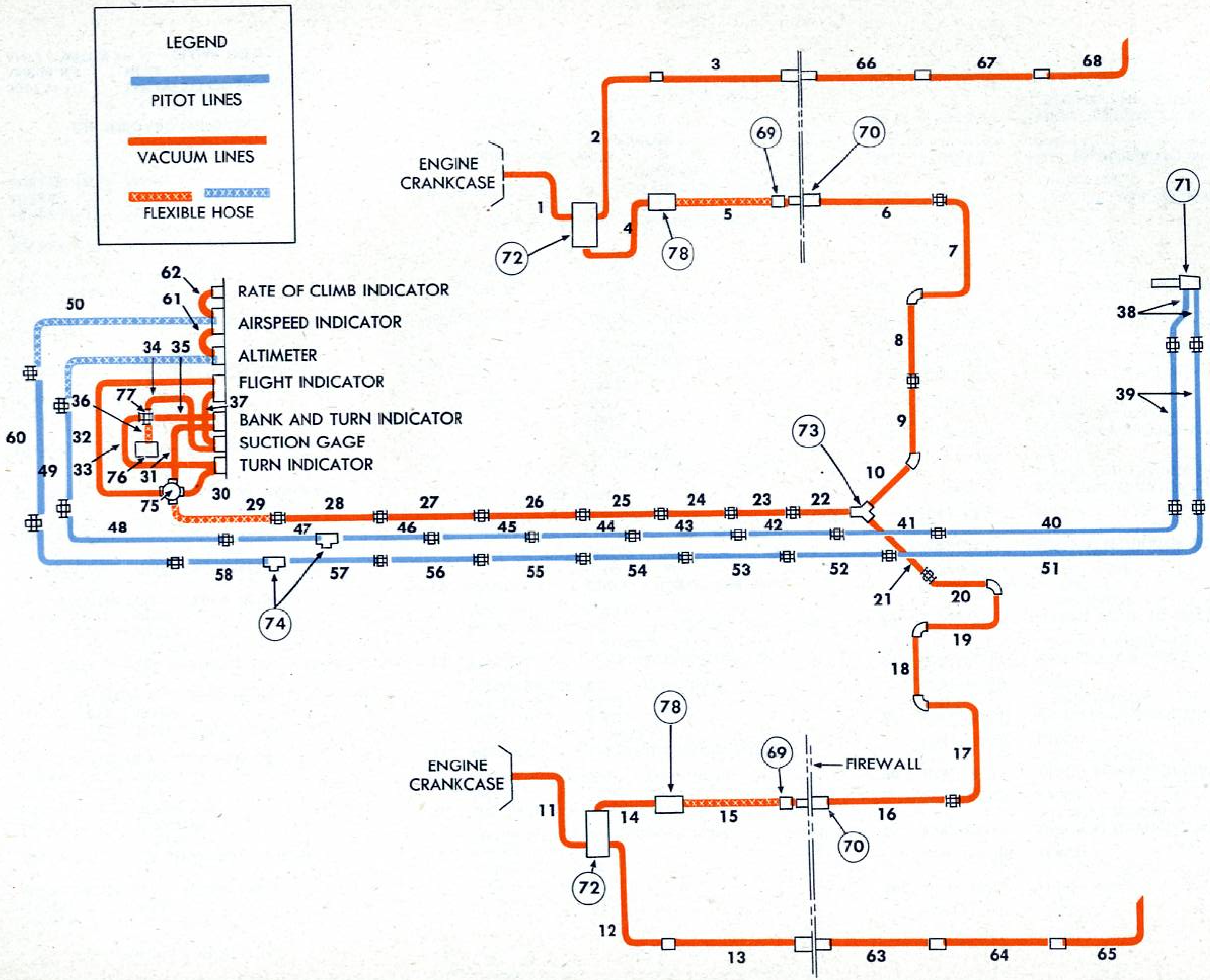


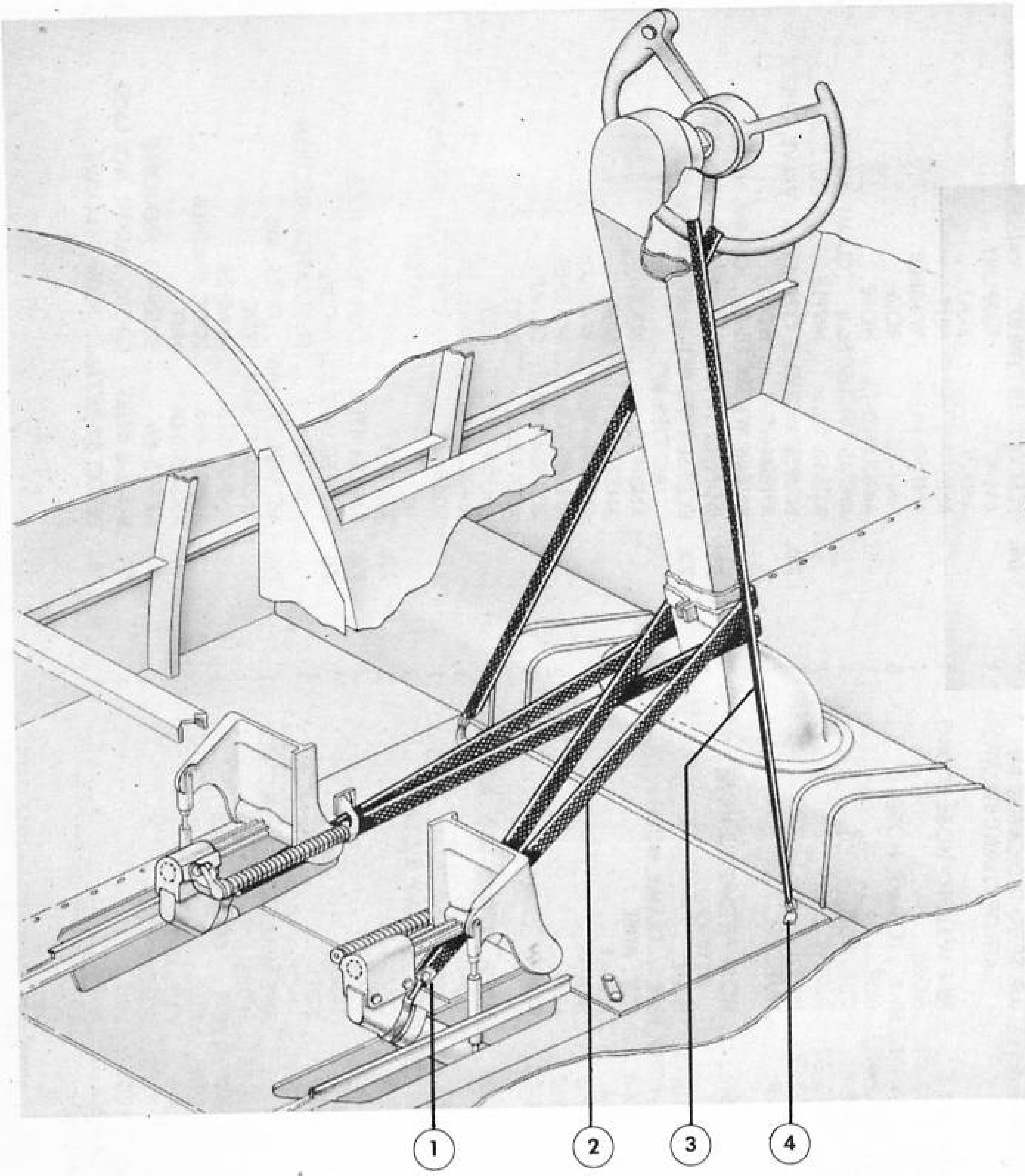
Figure 169 - INSTRUMENT PITOT AND VACUUM SYSTEMS

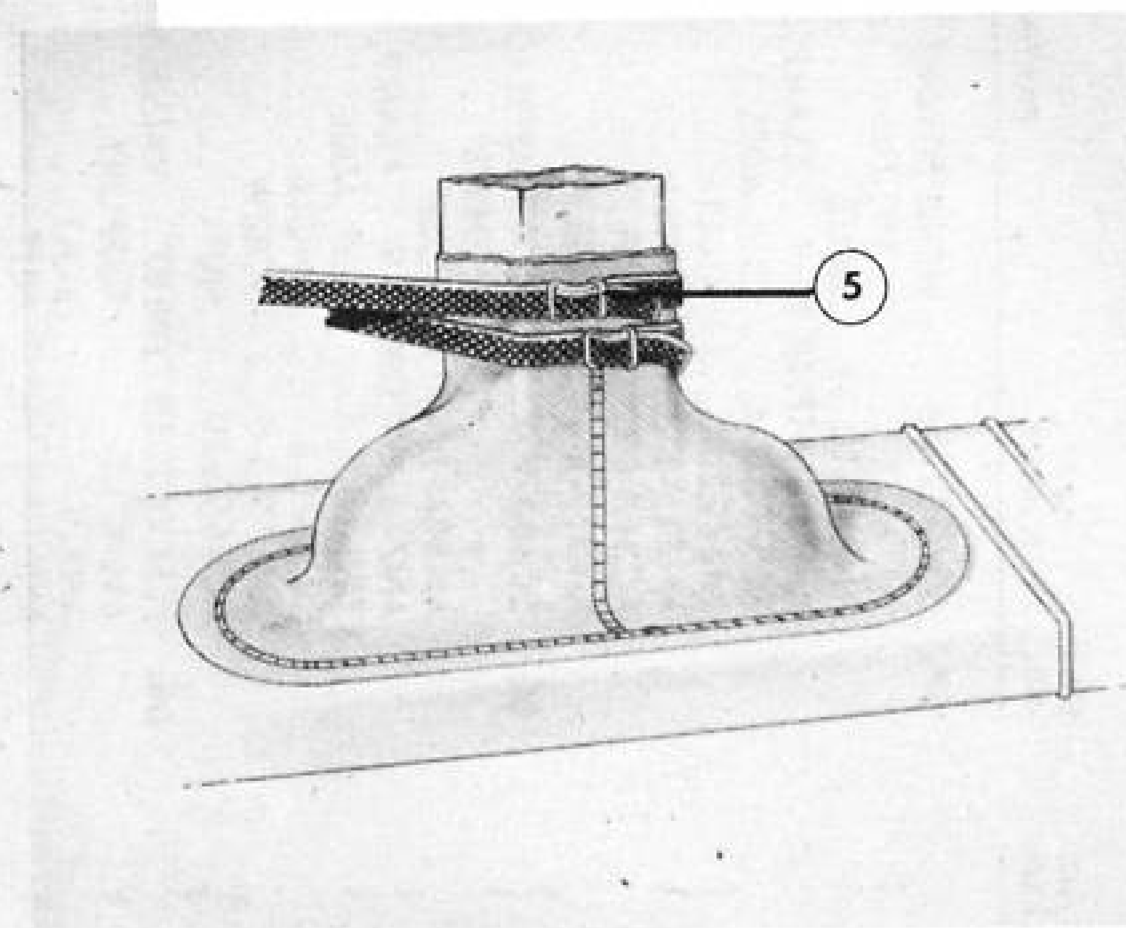
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
		R.H. INBOARD WING LINES	
1.	5067347-3	ENGINE TO OIL SEPARATOR	1
	AN884-8-9	HOSE	2
	AN746 WITTEK FB-6	CLAMP, HOSE	4
2.	5067347-5	OIL SEPARATOR TO HOSE FITTING	1
	AN755-10-2-8	CLIP, ADEL	1
	AN520-10-8	SCREW	1
	AC365-1032	NUT	1
	AN884-10-11	HOSE	2
	AN746 WITTEK FB-8	CLAMP, HOSE	4
3.	5067347-11	HOSE FITTING TO FIRE WALL	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
4.	5067347-2	OIL SEPARATOR TO VACUUM PUMP	1
	AC850-10	ELBOW	1
	AN884-10-11	HOSE	2
	AN746 WITTEK FB-8	CLAMP, HOSE	4
5.	1118666	HOSE, VACUUM PUMP TO RELIEF VALVE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	AC850-10	ELBOW	1
6.	5068374-4	CHECK VALVE AT FIRE WALL UNION	1
7.	5068374-3	UNION AT WING STATION 69 TO ELBOW	1
	AC81HT-10D	UNION	1
	HC811ET-10D	ELBOW	1
8.	5068374-2	ELBOW AT WING STATION 56 TO UNION	1
9.	5068374-1	UNION AT WING STATION 18 TO ELBOW	1
	AC811HT-10D	UNION	1
	755-10-2-8	CLAMP, ADEL	1
10.	4092498-17	ELBOW AT FUSELAGE TO VACUUM "Y"	1
	AC882-10-11	HOSE	1
	AN746-5	CLAMP, HOSE	2
	AC811ET-10	ELBOW	1
		L.H. INBOARD WING LINES	
11.	5067347-3	ENGINE TO OIL SEPARATOR	1
	AN884-8-9	HOSE	2
	AN746 WITTEK FB-6	CLAMP, HOSE	4
12.	5067347-6	OIL SEPARATOR TO HOSE FITTING	1
	A755-10-2-6	CLAMP, ADEL	1
	243492-5	CLIP	1
	AN515-8-8	SCREW	1
	AC365-832	NUT	1
	AN884-10-11	HOSE	2
	AN746 WITTEK FB-8	CLAMP, HOSE	4
13.	5067347-12	HOSE FITTING TO FIRE WALL	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
14.	5067347-2	OIL SEPARATOR TO VACUUM PUMP	1
	AC850-10	ELBOW	1
	AN884-10-11	HOSE	2
	AN746 WITTEK FB-8	CLAMP, HOSE	4
15.	1118666	HOSE, VACUUM PUMP TO RELIEF VALVE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	AC850-10	ELBOW	1
16.	5068395-3	CHECK VALVE AT FIRE WALL TO UNION	1
	AC811HT-10D	UNION	1
17.	5068395-4	UNION AT WING STATION 59 TO ELBOW	1
	AC811-ET-10D	ELBOW	1
18.	5068395-2	ELBOW AT WING STATION 56 TO ELBOW	1
	755-10-2-8	CLIP, ADEL	1
	AN515-8-8	SCREW	1
	AC365-832	NUT	1
	10ET 45°D	ELBOW	1
19.	5068395-1	ELBOW AT WING STATION 13 TO ELBOW	1
20.	4092498-19	ELBOW AT FUSELAGE TO UNION	1
	AC811HT-10	UNION	1
	AC811ET-10	ELBOW	1
		FUSELAGE AND EMPENNAGE LINES	
21.	4092498-18	UNION AT FUSELAGE STATION 20 TO VACUUM "Y"	1
	AC882-10-11	HOSE	1
	AN746-5	CLAMP, HOSE	2
	AC811HT-10	UNION	1
22.	4092498-16	VACUUM "Y" TO UNION	1
	AC882-10-11	HOSE	1
	AN746-5	CLAMP, HOSE.	2
	AC811HT-10	UNION	1
23.	4092498-49	UNION AT FUSELAGE STATION 168 TO UNION	1
	AC811HT-10	UNION	1
24.	4092498-15	UNION AT FUSELAGE STATION 152 TO UNION	1
	AC811HT-10	UNION	1
25.	4092498-14	UNION AT FUSELAGE STATION 110 TO UNION	1
	AC811HT-10	UNION	1
26.	4092498-13	UNION AT FUSELAGE STATION 87 TO UNION	1
	AC811HT-10	UNION	1
27.	4092498-12	UNION AT FUSELAGE STATION 52 TO UNION	1
	AC811HT-10	UNION	1
28.	4092498-11	UNION AT FUSELAGE STATION 20 TO FLEXIBLE HOSE	1
29.	1110822	FLEXIBLE HOSE, TO SUCTION REGULATOR	1
	PARKER 10-HLC-6	ELBOW	1
	AN746-7	CLAMP, HOSE	2
30.	4092498-1	SUCTION REGULATOR TO TURN INDICATOR	1
	AC811CT-6	ELBOW	1
31.	4092498-5	SUCTION REGULATOR TO BANK AND TURN INDICATOR	1
	AC811CT-4	ELBOW	1
32.	4092498-51	SUCTION REGULATOR TO FLIGHT INDICATOR	1
	AC811CT-6	ELBOW	1
33.	5167346-2	CROSS TO TURN INDICATOR	1
34.	5167346-3	CROSS TO SUCTION GAGE	1
35.	5167346-1	CROSS TO BANK AND TURN INDICATOR	1
36.	1053736-10-1500	FLEXIBLE HOSE, CROSS TO AIR FILTER	1
	AN746-7	CLAMP, HOSE	2
	AC851-10	ELBOW, HOSE	1
	AC850-10	ELBOW, HOSE	1
37.	4092498-7	SUCTION GAGE TO FLIGHT INDICATOR	1
38.	1068336-1	PITOT STATIC HEAD TO UNION	2
	AC811HT-4D	UNION	2
39.	1068336-2	UNION VERTICAL STABILIZER STATION 110 TO UNION	2
40.	4092498-39	UNION FUSELAGE STATION 415 TO UNION	1
	AC811HT-4	UNION	1

LEGEND FOR FIGURE 169

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
41.	4092498-37	UNION AT FUSELAGE STATION 380 TO UNION	1
	AC811HT-4	UNION	1
42.	4092498-35	UNION AT FUSELAGE STATION 315 TO UNION	1
	AC811HT-4	UNION	1
43.	4092498-33	UNION AT FUSELAGE STATION 282 TO UNION	1
	AC811HT-4	UNION	1
44.	4092498-31	UNION AT FUSELAGE STATION 228 TO UNION	1
	AC811HT-4	UNION	2
45.	4092498-29	UNION AT FUSELAGE STATION 180 TO UNION	1
	AC811HT-4	UNION	1
46.	4092498-27	UNION AT FUSELAGE STATION 129 TO TEE	1
	AC811HT-4	UNION	1
47.	4092498-25	TEE AT FUSELAGE STATION 83 TO UNION	1
	AC811JT-4	TEE	1
48.	4092498-23	UNION AT FUSELAGE STATION 40 TO UNION	1
	AC811HT-4	UNION	1
49.	4092498-21	UNION TO FLEXIBLE HOSE	1
	AC811HT-4	UNION	1
50.	83136-A-414	FLEXIBLE HOSE, TO ALTIMETER AND AIR-SPEED INDICATOR	2
	AC811HT-4	UNION	2
51.	4092498-40	UNION AT FUSELAGE STATION 415 TO UNION	1
	AC811HT-4	UNION	1
52.	4092498-38	UNION AT FUSELAGE STATION 380 TO UNION	1
	AC811HT-4	UNION	1
53.	4092498-36	UNION AT FUSELAGE STATION 315 TO UNION	1
	AC811HT-4	UNION	1
54.	4092498-34	UNION AT FUSELAGE STATION 282 TO UNION	1
	AC811HT-4	UNION	1
55.	4092498-32	UNION AT FUSELAGE STATION 220 TO UNION	1
	AC811HT-4	UNION	2
56.	4092498-30	UNION AT FUSELAGE STATION 175 TO UNION	1
	AC811HT-4	UNION	1
57.	4092498-28	UNION AT FUSELAGE STATION 129 TO TEE	1
	AC811HT-4	UNION	1
58.	4092498-26	TEE AT FUSELAGE STATION 83 TO UNION	1
	AC811JT-4	TEE	1
59.	4092498-24	UNION AT FUSELAGE STATION 40 TO UNION	1
	AC811HT-4	UNION	1
60.	4092498-22	UNION TO FLEXIBLE HOSE	1
	AC811HT-4	UNION	1
61.	4092498-5	ALTIMETER TO AIR-SPEED INDICATOR	1
62.	4092498-6	AIR-SPEED INDICATOR TO RATE OF CLIMB INDICATOR	1
63.	5068395-5	FIRE WALL TO HOSE FITTING	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	126480-29H	CLIP	1
	755-10-2-6	CLIP, ADEL	1
	AN515-10-12	SCREW	1
	AC365-1032	NUT	1
	AN345-10	NUT	1
64.	5068395-6	HOSE FITTING TO HOSE FITTING	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	755-10-2-6	CLIP, ADEL	1
	243492-4	ANGLE	1
	AN515-8-8	SCREW	1
	AC365-832	NUT	2
	AN515-8-10	SCREW	1
65.	5068395-7	HOSE FITTING TO ATMOSPHERE	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	755-10-2-6	CLIP, ADEL	2
	243492-4	ANGLE	2
	AN515-8-8	SCREW	4
	AC365-832	NUT	4
66.	5068374-5	FIRE WALL TO HOSE FITTING	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	126480-29H	CLIP	1
	755-10-2-6	CLIP, ADEL	1
	AN515-10-12	SCREW	1
	AC365-1032	NUT	1
	AN345-10	NUT	1
67.	5068374-6	HOSE FITTING TO HOSE FITTING	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	755-10-2-6	CLIP, ADEL	1
	243492-4	ANGLE	1
	AN515-8-8	SCREW	1
	AC365-832	NUT	2
	AN515-8-10	SCREW	1
68.	5068374-7	HOSE FITTING TO ATMOSPHERE	1
	AN884-10-11	HOSE	1
	AN746 WITTEK FB-8	CLAMP, HOSE	2
	755-10-2-6	CLIP, ADEL	2
	243492-4	ANGLE	2
	AN515-8-8	SCREW	4
	AC365-832	NUT	4
69.	PESCO 215B TYPE B7	VALVE, VACUUM RELIEF	2
	4104715	SUPPORT	2
	AN3-5	BOLT	4
	AN310-3	NUT	8
	AN960-10	WASHER	8
	AN3-20	BOLT	4
	AN884-10-11	HOSE	2
	AN746 WITTEK FB-8	CLAMP, HOSE	4
	AC835-10	NIPPLE	2
70.	ECLIPSE MODEL 2 TYPE 557	VALVE, CHECK	2
	AN884-10-9	HOSE	4
	AN746 WITTEK FB-8	CLAMP, HOSE	8
71.	PIONEER 3219-3S	HEAD, PITOT STATIC	1
72.	ECLIPSE TYPE 561-1	SEPARATOR, OIL (AC TYPE B7)	2
	AN3-11	BOLT	4
	AN310-3	NUT	4
	AN960D-10L	WASHER	4
	AN960-10L	WASHER	4
	2001587-20	CLAMP	2
	AN3-13A	BOLT	4
	AN365-1032	NUT	4
	AN960D-10	WASHER	8
	5068641	BRACKET, OIL SEPARATOR SUPPORT	2
73.	1103911	"Y"	1
74.	PARKER 4FNT	CAP, TRIPLE TUBE	2
75.	ECLIPSE TYPE 551 MODEL 2 STYLE A	REGULATOR, SUCTION	1
76.	AC SPEC. 27366	FILTER, AIR	1
	AN520-416-12	SCREW	2
	AN960-416	WASHER	2
	AN935-416	LOCK WASHER	2
	AN315-D4R	NUT	2
	AC895-86	BUSHING, REDUCING	1
77.	2-4-8-8 KOST	CROSS, PARKER NO. 1600	1
78.	PESCO 3P-207JA	PUMP, VACUUM	2

LEGEND FOR FIGURE 169





ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1B6688	SNAP, HARNESS	2
2.	2AAF-6-185C TYPE IIB	STRAP, RUDDER AND ELEVATOR	2
3.	AAF-6-185C TYPE IIB	STRAP, AILERON	2
4.	1B6687	SNAP, HARNESS	2
5.	NORTH AND JUDD 105-1¼	BUCKLE, MAIL BAG	2

Figure 170 - SURFACE CONTROL LOCKS

15, SURFACE CONTROLS.

a. DESCRIPTION.

(1) GENERAL. - The rudder, elevators, and ailerons are operated by cables and controlled from the pilot's position by a control column and wheel, and rudder pedals. The tab for each control surface, also cable-operated, is controlled from the tab control unit mounted on the right side of the pilot's cockpit. All main control cables are 3/16-inch, 7 by 19, extra flexible, preformed steel. All tab cables are 3/32-inch, 7 by 7, flexible preformed steel. The cables are routed by a series of fair-leads and pulleys. The pulleys are the lubricated type sealed at the factory. Turnbuckles are provided at intervals to facilitate removal, installation, and adjustment of the control system. The wing flaps are operated hydraulically and controlled by a unit in the instrument panel.

(2) SURFACE CONTROL LOCKS. (See figure 170.) - A locking arrangement consisting of four heavy cotton straps is provided to lock the surface controls when the airplane is parked. Two strap assemblies, looped around the bottom of the control column and clipped to the rudder pedals, prevent movement of the rudder. Elevator and aileron movement is locked by two straps looped through the control wheel and clipped to armor plate bolts on the left and right sides of the cockpit floor. When not in use, the straps may be stowed under the pilot's seat cushion.

(3) CONTROL COLUMN AND WHEEL. (See figure 171.) - The control column in the pilot's cockpit and the control wheel at the top of the column provide for longitudinal and lateral control of the airplane. Forward and aft movement of the column lowers and raises the nose. Conventional movement of the wheel provides lateral balance.

(4) ELEVATOR CONTROLS. (See figure 176.) - The elevator control cables attach to the control column torque tube horns, and run forward around pulleys, then aft, following the same route as the rudder cables. Elevator travel is limited by the elevator

torque tube horns striking adjustable stops attached to the fuselage structure and the adjustable stops attached to the control column horns.

(5) AILERON CONTROLS. (See figure 177.) - The aileron cables attach to a short section of chain which passes over a sprocket on the control wheel shaft. The end links of the chain in the control column head are shaped to engage lugs on the interior of the column, thereby serving as stops for the aileron controls. From the ends of the chain, the cables pass over two pulleys mounted in the lower end of the column and extend along the torque tube and control horn assembly to the sides of the fuselage. The cables continue along the sides of the fuselage to a drum assembly at the inboard end of each wing, then are directed to a pulley and link assembly in the outer wings. Push rods transmit control movements from the pulleys to the aileron.

(6) RUDDER CONTROLS. (See figure 178.) - The rudder is operated by movement of the pilot's rudder pedals which are connected directly to the horn on the rudder torque tube. Both pedals are mounted on splined shafts which may be adjusted fore and aft to suit pilots of varying statures. Each pedal is mounted on an individual torque tube and bell crank assembly hinged on ball bearings beneath the floor of the cockpit. An adjustable stop is attached to the lower surface of the floor directly behind each of the rudder pedal control horns. Toe pressure applied to the rudder pedals operates the main wheel brakes, as the pedals are connected to the brake control valves by push rods.

(7) TRIM TAB CONTROLS. (See figures 179, 180, and 181.) - The trim tabs (also known as servo-trim or booster tabs) on surface controls are operated from the tab control unit on the right side of the pilot's cockpit. The tab control unit has three knobs, one each for ailerons, elevators, and the rudder. Each operating system consists of a drum within the pilot's control unit and a drum mounted on a threaded shaft adjacent to the tab. These drums are interconnected by cables so they operate simultaneously, and so the airplane will turn in the direction of rotation of any of the knobs. The tabs are actuated by push-pull rods, attached to the tab on one end and the drum on the other. The indicator arm on each of the control knobs has a pin on the end opposite the pointer which rides in a spiral groove on the rear side of the knob. As the knob is rotated, it indicates the tab position in degrees. The elevator and rudder tab control knobs are provided with friction type brakes which may be adjusted to prevent "creeping." The total movement of each of the tab control systems is permanently set at the factory by rivets placed in the spiral groove on the back side of the knob. These rivets act as stops. The operating linkage on each of the trim tabs is so arranged that there is a servo motion of the tab with any movement of its respective main surfaces.

(8) WING FLAP CONTROLS. - Wing flaps are actuated by hydraulic pressure. The control is located on the instrument panel on the left side of the pilot's seat. Movement of the wing flaps is governed by the total travel of the actuating cylinder pistons, which is a fixed distance.

b. TROUBLE SHOOTING.

SYMPTOM	CAUSE	REMEDY
Lost motion present in system.	Cables incorrectly rigged.	Rig cables.
	Pulley or pulley bracket broken.	Replace broken part and rig cables.
	Frayed or stretched cables.	Replace and rig cables.
	Loose or broken turnbuckle.	Tighten and safety or replace turnbuckle. Rig cables.
	Loose attaching bolts or nuts on rudder pedals, control column or tab drums.	Tighten and safety loose bolts.
Restricted movement or binding of controls.	Improperly stowed fuselage equipment, fouling cables.	Remove equipment.
	Lack of lubrication or use of improper lubricant.	Lubricate. (See section 3.)
	Broken, bent, loose or misalined pulleys, pulley brackets or fair-leads.	Replace broken parts. Aline or tighten other parts.
	Frayed cables.	Replace and rig cables.
	Structural damage to airplane impairing operation of cables, pulleys or surfaces.	Repair structural defect.
Surface out of neutral position but control in neutral.	Improperly rigged cables.	Rig cables.
	Bent actuating arm, horn, bracket or hinge.	Replace or repair damaged part.

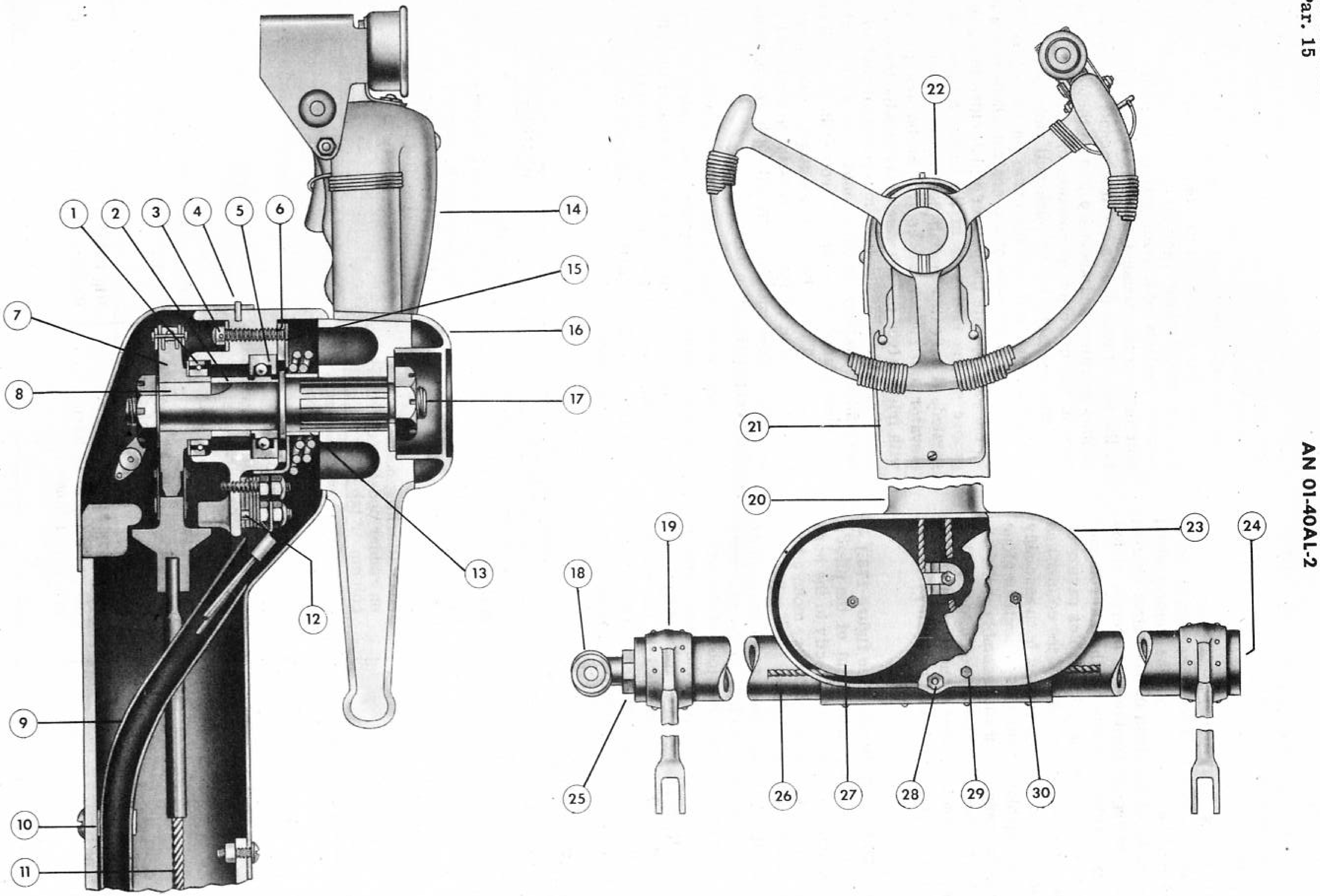


Figure 171 - CONTROL COLUMN

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	B541	BEARING, CONTROL COLUMN SHAFT AFT	1
	143908-102D-115-032	WASHER	1
2.	117425-12D-021	SPACER	1
3.	AN502-10-14	SCREW	3
	AN960-10	WASHER	3
4.	146142-125-010	PIN	1
5.	AN201-K12A	BEARING, CONTROL COLUMN SHAFT FORWARD	1
6.	1056773	RETAINER, CONTROL WHEEL BEARING	1
7.	1056772	SPROCKET, CONTROL WHEEL	1
8.	1061541	KEY, CONTROL COLUMN SPROCKET	1
9.	2057059	CONDUIT, CONTROL COLUMN	1
10.	AC 755-8	CLAMP	2
	AN526-832-9	SCREW	2
	AC 365-832	NUT	2
11.	3092442	CABLE ASSEMBLY, AILERON CONTROL FRONT	1
12.	1056798	BLOCK ASSEMBLY, CONTROL WHEEL TERMINAL	1
	1056799	PLATE, CONTROL WHEEL TERMINAL	1
	AN505-6-8	SCREW	2
13.	1026614-14-019	SPACER	1
14.	5160918	WHEEL ASSEMBLY, CONTROL COLUMN	1
15.	2067257	INSULATION, CONTROL WHEEL WIRING	1
16.	2069556	CAP ASSEMBLY, CONTROL COLUMN WHEEL HUB	1
17.	1062980	SHAFT, CONTROL COLUMN	1
	AC945-8	WASHER	2
	AN320-8	NUT	2
18.	AC37B4767-3	ELBOW	1
19.	4066548	HORN ASSEMBLY, FRONT ELEVATOR CONTROL—L.H.	1
	4066548-1	HORN ASSEMBLY, FRONT ELEVATOR CONTROL—R.H.	1
	AC386-2-22	PIN	2
	AC975-3	WASHER	2
	AN320-3	NUT	2
	AN515-8-8	SCREW	4
	AN935-8	WASHER, LOCK	4
20.	5063350	COLUMN, PILOT'S CONTROL	1
21.	4055178	COVER, CONTROL COLUMN HEAD LOWER	1
	AN526-832-9	SCREW	1
22.	4055177	COVER, CONTROL COLUMN HEAD UPPER	1
	AN526-832-9	SCREW	2
23.	2062122	COVER ASSEMBLY, CONTROL COLUMN LOWER	1
24.	1066827	PLUG, CONTROL COLUMN—L.H.	1
	1057254	PLUG, CONTROL COLUMN—R.H.	1
25.	AC37A4769-3	NUT	2
26.	2062159	TUBE, CONTROL COLUMN TORQUE	1
27.	AN210-5A	PULLEY	2
28.	AN5-40-A	BOLT	1
	AN960-516	WASHER	1
	AC365-524	NUT	1
29.	AC386-2-20	PIN, TAPER	2
	AC975-3	WASHER	2
	AN320-3	NUT	2
30.	AN6-17	BOLT	2
	AN960-616	WASHER	2
	AN310-6	NUT	2

LEGEND FOR FIGURE 171

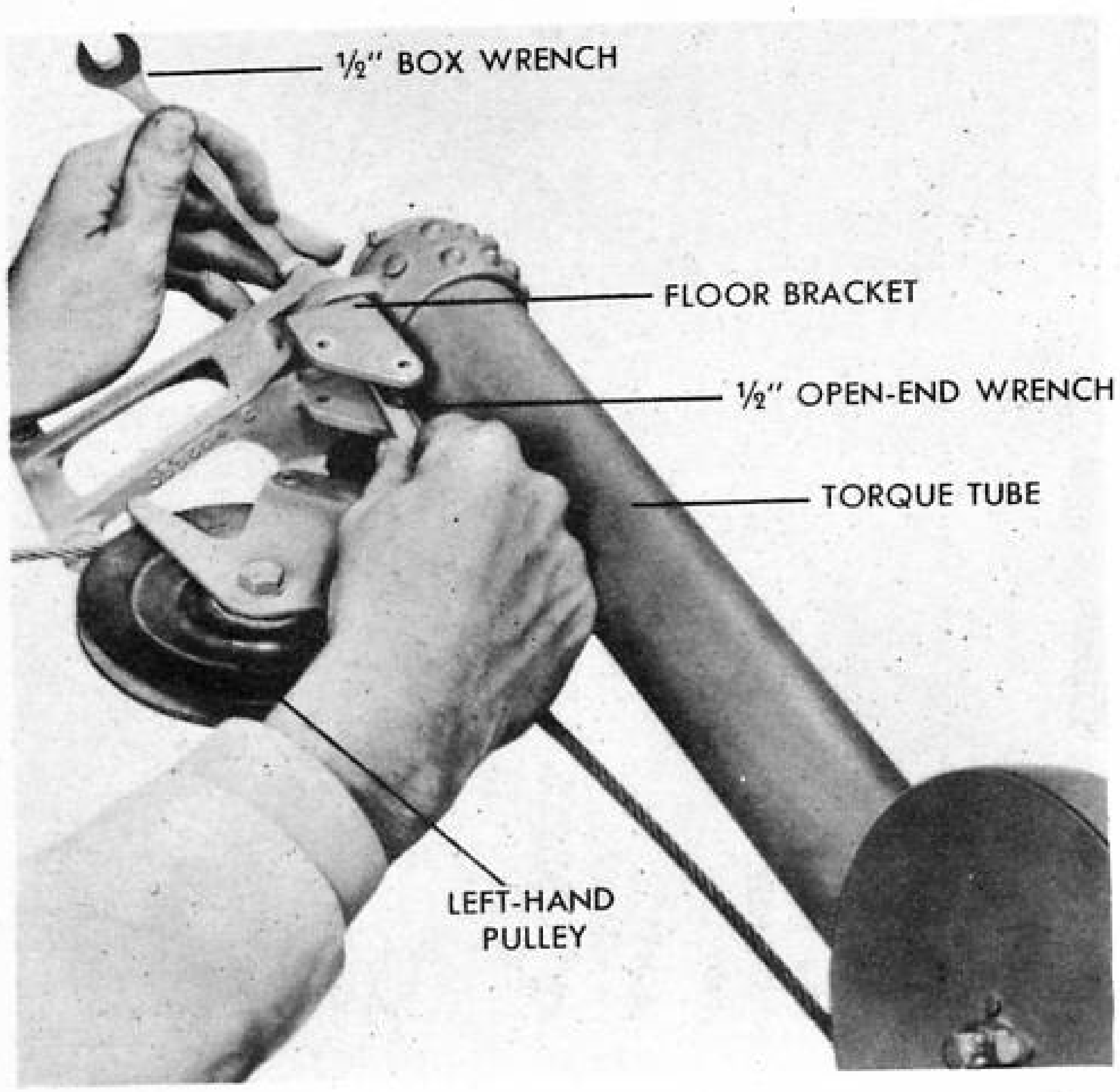


Figure 172 - REMOVING CONTROL COLUMN

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF CONTROL COLUMN. (See figure 172.)

(a) Break the rigging on the four elevator cables at the turnbuckles.

(b) Remove two bolts attaching the cable counterweights and remove the right-hand and left-hand weights from the nose wheel well.

(c) In the forward bomb bay break down the two aileron control cables and remove them from the pulleys alongside of the battery cases.

(d) Enter the cockpit and remove the two covers from the torque tube assembly.

(e) Remove the two pulleys on the ends of the torque tube (one right-hand; one left-hand).

(f) Remove the two hinging bolts attaching the torque tube to the floor bracket.

(g) Remove electrical connections that control guns and bomb release.

1. Remove the cover plate (facing aft) on the control column under the wheel. (See figure 173.) Remove the two electrical wires from the terminals. At the left side of the torque tube unscrew the breeze fitting and pull out the wires.

2. On the forward face of the control column are the wires that control releasing the bombs. Disconnect the wires inside the bomb control panel and pull them out.

(h) Lift out control column.

(2) DISASSEMBLY OF CONTROL COLUMN.

(a) Remove three nuts from the lower column cover plate (facing aft) and pry off the plate.

(b) Push out the bolts and remove the two pulleys in the bottom of the column.

(c) Remove the two bolts attaching cables to linkage at top of the column and remove the cables from the column.

(d) Remove the cover plate (facing forward) at the top of the column. (See figure 173.)

(e) Lift chain off sprocket and pull it out through the cover plate opening under the wheel.

(f) Pry off the name plate from the wheel.

(g) Unsafety and remove bolt and washers and pull the wheel off the splined shaft.

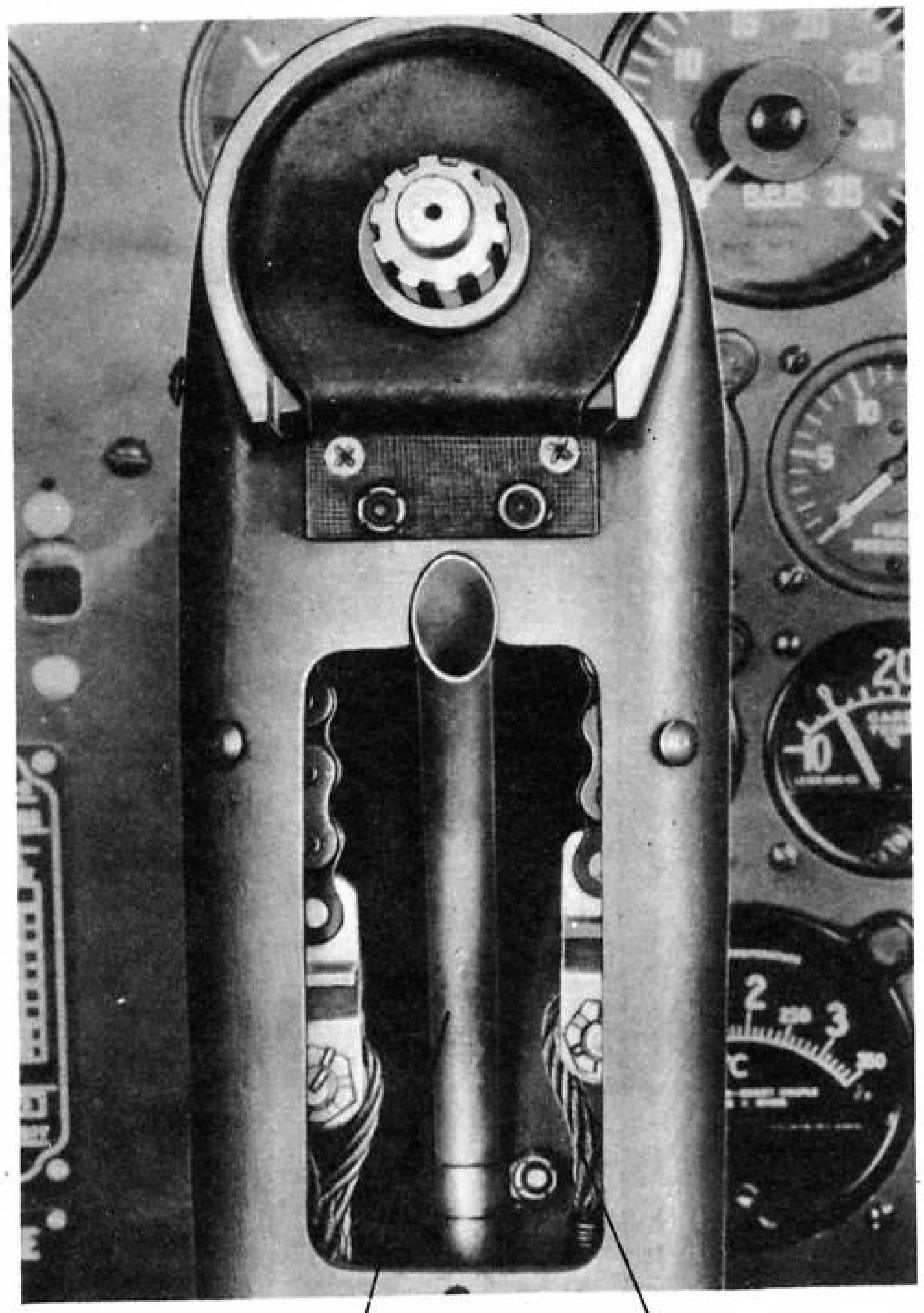


Figure 173 - CONTROL COLUMN - TOP COVER PLATE AND WHEEL REMOVED

(h) Disconnect the two trigger wires at the head of the control column.

(i) To remove the wheel shaft, unsafety and remove the nut and the washer and pull the sprocket forward.

(j) Remove the splined shaft.

(k) Tap out the two sealed bearings.

d. REPLACEMENTS.

(1) REPLACEMENT OF CABLES - All cables of the control system are readily removed by disconnecting turnbuckles and by removing the connecting bolts at the control unit, or at their respective surfaces.

NOTE

When removing a cable, it is advisable to attach a feeder line (use heavy string) to assist in rethreading the new cable through the fair-leads and pulleys. In some cases the pulley bracket assembly will have to be disassembled to allow the cable ends to pass through. Before replacement, check the dimensions of the new cable against the old cable and against the dimension given on "Cable rigging and replacement data" chart, Section 8, this handbook.

Whenever a new cable assembly is made up, whethe of the swaged or braided-end type, load-test the assembly before installation according to the following specifications:

7 by 7-3/32 inch Flexible Preformed Steel ... 552 Lbs.
7 by 19-3/16 inch Flexible Preformed Steel .. 2520 Lbs.

NOTE

Cable rigging charts are given in Section 8, this handbook.

(2) INSPECTION AND REPLACEMENT OF CONTROL COLUMN PARTS. - Replace the wheel if the gun trigger is not operating properly.

(a) Inspect wheel for distortion or cracks. Replace if damaged.

(b) Inspect splined shaft for dirt or rust, burs and damage to the splines. Clean shaft thoroughly and remove all burs by hand honing. Replace shaft if splines are damaged.

(c) Inspect sprocket chain for twist, and loose links. Replace damaged links.

(d) Inspect sprocket for broken teeth. Replace sprocket if any teeth are broken.

(e) Inspect the two sealed bearings for any visible signs of damage or wear. Replace if damaged or excessively worn.

(f) Slide control wheel over the splined shaft and note fit. No play should be present. Replace wheel, shaft or both, if play is present.

e. ADJUSTMENTS.

(1) RIGGING ELEVATOR CONTROLS.

(a) Check the control column for full 23 degrees forward: The full forward position is controlled by adjustable stops in the nose wheel well on each side and aft of the counterweight. Move the control column forward, leaving 3-1/4 inches clearance between the instrument panel and the back of the control column. Hold the column in this position and run the aft stops out until they come in contact with the arms at the end of the control column torque tube. Then tighten the lock nuts.

(b) Bring elevator cables in the bomb bay to tension: There are two sets of elevator cables resulting in two cables on each side of the fuselage. The two lower cables have one turnbuckle each. The two upper cables have one turnbuckle. By means of the turnbuckles adjust the tension on the cables (125 pounds at 70 degrees F).

(c) Adjust down throw with the turnbuckles: After tension has been set on the cables, check the down throw of the elevators (9-7/16 inches). To increase the down throw, let off a number of turns on the upper turnbuckles and take up the same number of turns on the lower turnbuckles. This will increase the down throw without changing the tension.

(d) Adjust up throw with the stops in the nose section: To get the correct amount of up throw on the elevators it will be necessary to adjust the stops in the nose wheel well forward of the two counterweights. Turning them in will increase the throw and turning them out will decrease the throw. Correct up throw is 14-1/8 inches.

(2) RIGGING AILERON CONTROLS.

(a) Lock the wheel in neutral: The wheel is in neutral position when the two fixed stops connecting the cable to the chain are oppostte each other, Remove the inspection plate at the head of the control column to check these stops.

(b) Take up the tension on the two cables in the forward bomb bay: Check the tension chart (see section 26). Have a man in the cockpit turn the wheel completely to the right (or left) and check the equalizer rod for clearance at both ends. If the equalizer rod strikes the pulley casting at either end, adjust the turnbuckles in the forward bomb bay until the rod clears.

(c) Adjust ailerons to neutral: By means of the turnbuckles located in the outer wing bring the cables to tension (125 pounds at 70 degrees F). With the landing flaps in the full UP position and the wheel in neutral, adjust the ailerons to neutral by means of the adjustment on the push-pull rod. An aileron is in neutral when the trailing edge of the aileron is in alinement with the trailing edge of the flap.

(d) Check and adjust the UP throw: Check the UP throw for 9-7/16 inches. If not correct, lock the wheel in neutral again and adjust the turnbuckles in the wings to raise the aileron approximately two degrees above neutral. Bring the aileron back to neutral by means of the push-pull rod. Measure the throw again. Make this adjustment until the correct throw is obtained. When the up throw is properly adjusted, the DOWN throw (6-1/2 inches) automatically will be set.

(3) TOE PEDAL ADJUSTMENT OF RUDDER CONTROLS.

(a) Rotate the latch levers located on the inboard side of each rudder pedal toward the center line of the airplane in order to release the pedals for adjustment.

(b) Move the pedal to the desired position.

(c) Re-engage the latch lever in the holes of the splined shaft.

(4) RIGGING RUDDER CONTROLS.

(a) Lock the pedals in neutral position. Wooden blocks placed in front and behind the pedals and held by means of a clamp will hold the pedals in neutral position.

(b) Bring the cables to proper tension: The rudder has only two cables, one on each side of the fuselage. Each cable has one turnbuckle. Bring both cables to tension by turning each turnbuckle up the same amount (125 pounds at 21 degrees C or 70 degrees F).

(c) Adjust the rudder to neutral: With the pedals locked in neutral the rudder should be in neutral. The rudder is adjusted to neutral with the turnbuckles in the bomb bay. Let off a number of turns on the right turnbuckle and take up the same number of turns on the left one to move the rudder to the right. Let off a number of turns on the left turnbuckle and take up the same number of turns on the right one to move the rudder to the left. Repeat until the rudder lines up with the vertical stabilizer (neutral).

(d) Adjust the rudder throw: Adjust the correct throw of the rudder by means of the stops located one on each side of the nose section directly in back and above the machine guns. Turn the stops in for more throw and out for less throw. Correct throw is 19-1/2 inches right and left.

(5) REWINDING TAB DRUMS. (See figure 174.)

(a) Do not attempt to rewind the drum while it is installed. Remove the drum by removing the Zerk fitting from the end of the actuating rod, loosening the thrust nut, separating the adjusting wheel from the drum and revolving the adjusting wheel until the rod comes out. Then lift out the drum.

(b) Begin wrapping one strand of cable on the drum in the direction in which it naturally falls until half of the drum is wrapped.

(c) Wrap other strand of cable in the opposite direction. When finished, there should be the same number of turns on each side.

(d) Tape drum and cable to prevent unwinding.

(e) Install drum and bring cables to tension.

(f) Remove the tape.

NOTE

When rewinding the elevator tab drums, follow the procedure outlined above, with the following exception: There should be 3-1/2 turns on the aft side of the drum and 4-1/2 turns on the forward side of the drum.

(6) ADJUSTING TABS TO NEUTRAL. - Set the indicator in the cockpit on neutral, or zero. Loosen the two nuts on the end of the casting (the actuating drum at the surface) and turn outward. Pry the adjusting wheel away from the drum and turn in one direction or the other depending upon whether the tab is to be raised or lowered. After neutral is obtained, tighten the nuts again just enough to prevent end play in the drum. Before breaking down any of the tab cables be sure to clamp the cables in the forward bomb bay at the pulleys to prevent cables from coming off the drums in the cockpit.

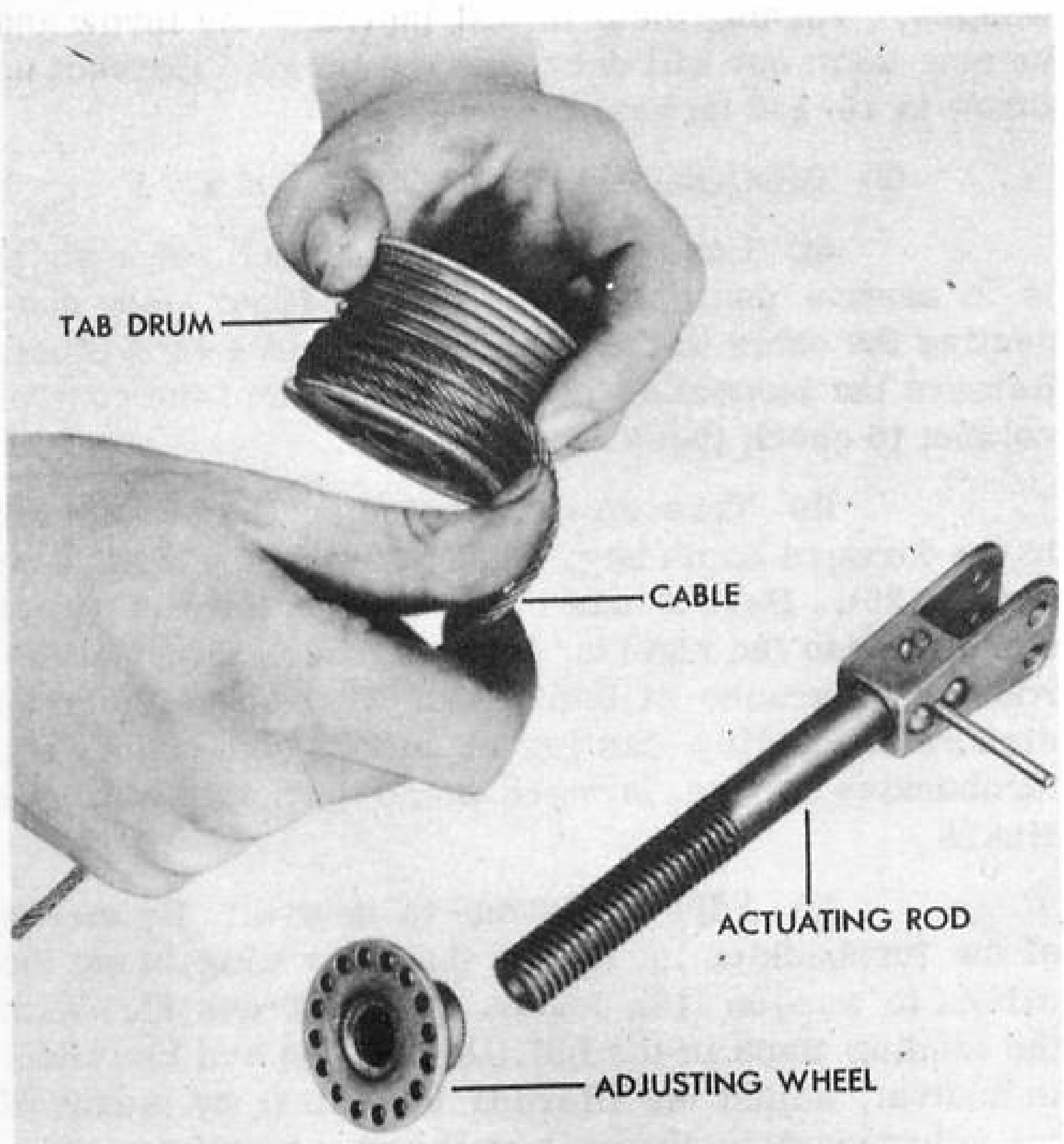


Figure 174 - REWINDING TAB DRUM

(7) RIGGING WING FLAP CONTROLS. - Rigging consists of adjusting the eyebolts of the piston rods to give the correct full UP position (until the trailing edge of the flap is in line with the trailing edge of the wing). After making adjustments, be sure the position indicator reads correctly. To make this test, either the master battery and ignition switches must be ON, or an outside electrical supply must be plugged in at the ground battery connection in the nose wheel well. The indicator reading may be varied by adjusting the length of the push rod which connects the transmitter to the torque tube of the left inboard flap.

f. ASSEMBLY AND INSTALLATION.

(1) ASSEMBLY OF CONTROL COLUMN.

(a) Install the two sealed bearings for the wheel.

(b) Install the splined shaft.

(c) Install the sprocket and shaft and safety the nut.

(d) Connect the two trigger wires at the head of the control column.

(e) Mount the wheel on the splined shaft. Install washers and bolt. Safety the bolt.

(f) Press the name plate on the wheel.

(g) Install the chain on the sprocket through opening at the top of the column.

(h) Install the cover plate (facing forward) at the top of the column. (See figure 173.)

(i) Install the two bolts attaching the cables to the linkage at the top of the column.

(j) Install the two pulleys at the bottom of the column.

(k) Install the cover plate (facing aft) on the lower end of the column.

(2) INSTALLATION OF CONTROL COLUMN (See figure 172.)

(a) Place the control column in position.

(b) Connect the electrical wires that control the guns and the bomb release.

1. Inside the bomb control panel, connect the wires which control releasing the bombs.

2. At the left side of the torque tube install the breeze fitting and connect the two (forward gun) electrical wires to the terminals. Install the cover plate (facing aft) on the control column under the wheel.

(c) Install the two hinging bolts attaching the torque tube to the floor bracket.

(d) Install the two pulleys on the ends of the torque tube (one right-hand; one left-hand).

(e) Install the two covers on the torque tube assembly.

(f) In the forward bomb bay connect the two aileron control cables and rig the cables.

(g) In the nose wheel well install the right-hand and left-hand counterweights.

(h) Connect the four elevator cables at the turnbuckles and rig the cables. (See subparagraph e.)

(i) Lubricate the control column. (See Section 3, this handbook).

g. FINAL TEST AFTER ASSEMBLY.

(1) TEST AND ADJUSTMENT OF CONTROL COLUMN AFTER INSTALLATION.

(a) Move the control column forward and aft and be sure the elevators move in correct respective positions. Turn the wheel right and left and be sure ailerons move in their correct respective positions.

(b) Rig elevator controls and aileron controls. (See subparagraph e.)

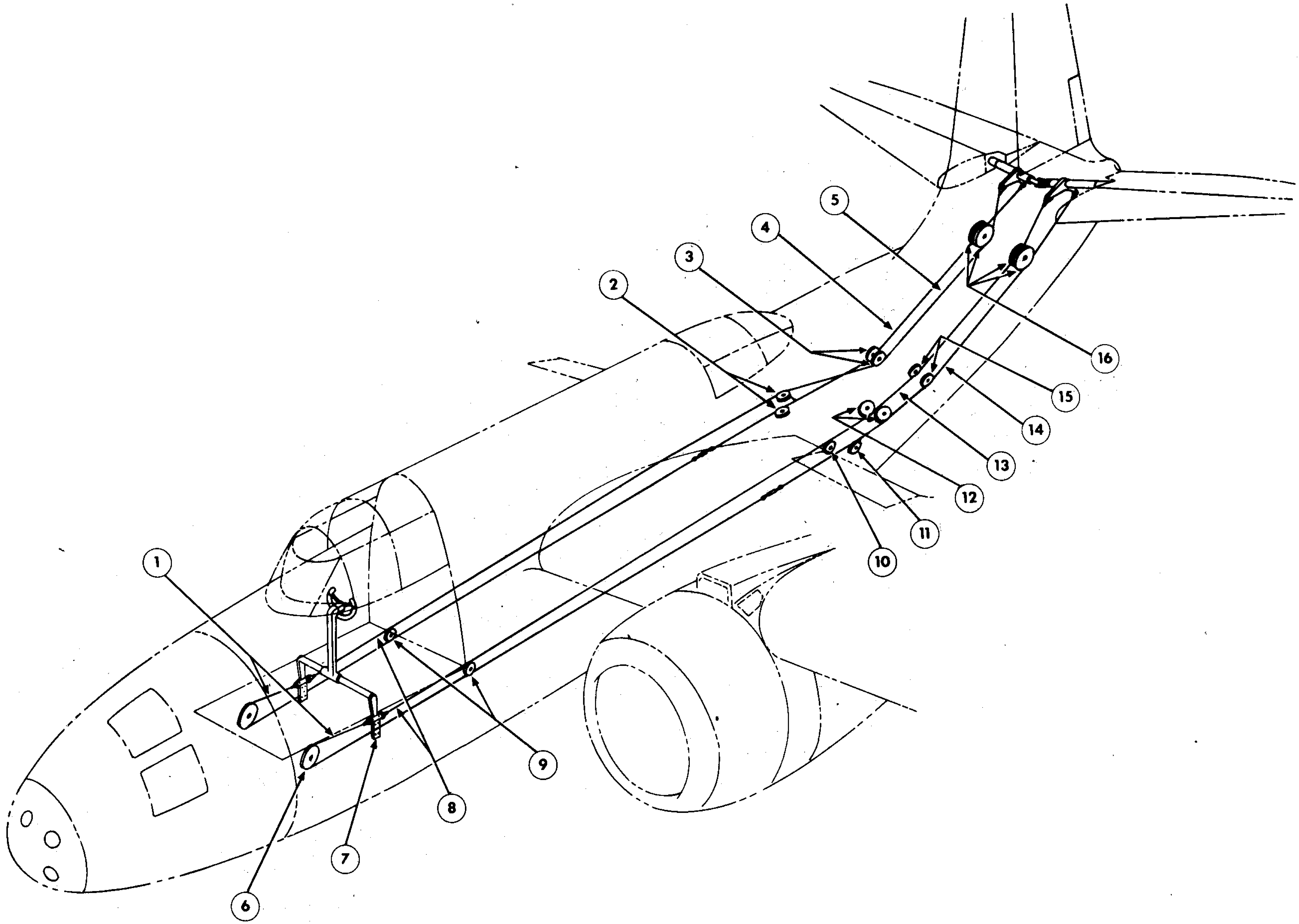
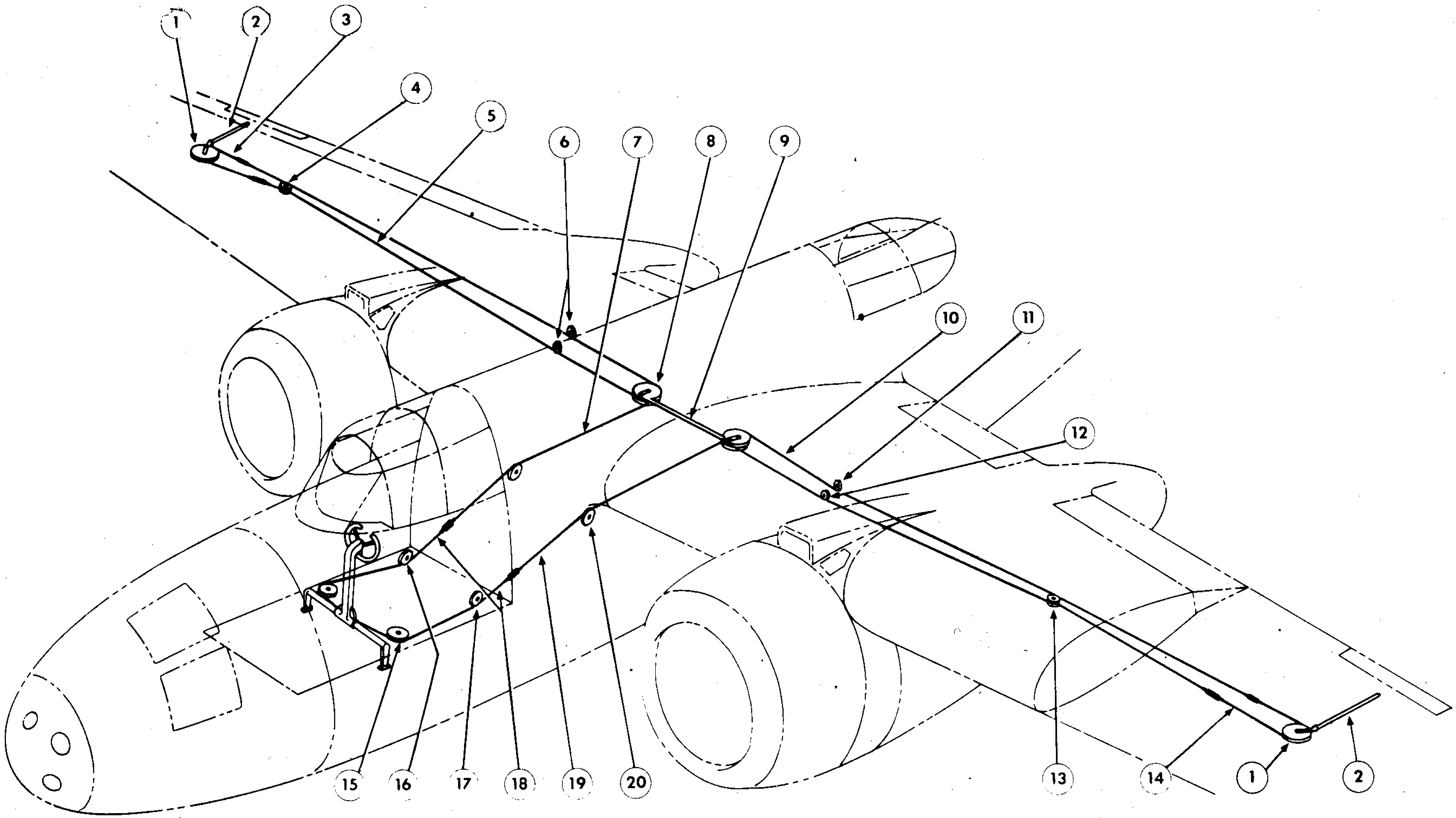


Figure 175 - ELEVATOR CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2064976-8	CABLE ASSEMBLY, 3/16" BALL BEARING END AND PLAIN END	2
	AC150-46L	TURNBUCKLE ASSEMBLY	2
	AN25-14	BOLT	2
	AN320-5	NUT	2
2.	AN210-3A	PULLEY	2
	AN4-15	BOLT	2
	AN960-416	WASHER	2
	AN310-4	NUT	2
	143358-100	PIN, PULLEY GUARD	2
	5067098	BRACKET, STATION 291 ¾" ELEVATOR AND RUDDER PULLEY	1
3.	AN210-3A	PULLEY	2
	AN4-20	BOLT	1
	AN310-4	NUT	1
	143358-116	PIN, PULLEY GUARD	1
	5067143	BRACKET, FUSELAGE STATION 353 R.H. ELEVATOR AND RUDDER PULLEY	1
	AN3-7A	BOLT	2
	AN3-6A	BOLT	2
	AC365-1032	NUT	4
4.	2064976-12	CABLE ASSEMBLY, 3/16" BALL BEARING END AND PLAIN END	1
	AN5-13	BOLT	1
	AN960-D516	WASHER	1
	AN310-5	NUT	1
5.	2168597-6	CABLE ASS'Y, 3/16" BALL BEARING END AND SWAGED END	1
	AN5-13	BOLT	1
	AN960-D516	WASHER	1
	AN310-5	NUT	1
6.	AN210-6A	PULLEY	2
	AN6-17	BOLT	2
	AN960-D616	WASHER	2
	AN310-6	NUT	2
	2059232	GUARD ASSEMBLY, ELEVATOR BUS PULLEY	2
7.	4092495	BALANCE ASSEMBLY, CONTROL COLUMN—L.H.	1
	4092495-1	BALANCE ASSEMBLY, CONTROL COLUMN—R.H.	1
	AN5-24	BOLT	8
	AN960-516	WASHER	16
	AN310-5	NUT	8
8.	2168597-2	CABLE ASS'Y, 3/16" BALL BEARING END AND SWAGED END	2
	AN155-46L	TURNBUCKLE, BARREL	2
9.	AN210-3A	PULLEY	2
	AN4-21	BOLT	2
	AN310-4	NUT	2
	143358-116	PIN, PULLEY GUARD	2
	4118580	BRACKET, STA. 75 ELEVATOR AND RUDDER CONTROL—L.H.	1
	4118580-1	BRACKET, STA. 75 ELEVATOR AND RUDDER CONTROL—R.H.	1
	AN3-6A	BOLT	8
	AN960-D10	WASHER	8
	AC365-1032	NUT	8
10.	AN210-3A	PULLEY	1
	AN4-14	BOLT	1
	AN310-4	NUT	1
	143358-100	PIN, PULLEY GUARD	1
	4067403	BRACKET ASSEMBLY, STATION 256 ½" L.H. ELEVATOR PULLEY	1
	AN3-4A	BOLT	4
	AN960-D10	WASHER	4
11.	AN210-3A	PULLEY	1
	117425-4D-100	SPACER	1
	AN4-30	BOLT	1
	AN310-4	NUT	1
	4067404	BRACKET, STATION 274 L.H. ELEVATOR AND RUDDER PULLEY	1
12.	AN210-3A	PULLEY	2
	AN4-20	BOLT	1
	AN310-4	NUT	1
	143358-118	PIN, PULLEY GUARD	1
	5067155	BRACKET, STATION 312 L.H. ELEVATOR AND RUDDER PULLEY	1
13.	2168597-4	CABLE ASS'Y, 3/16" BALL BEARING END AND SWAGED END	1
	AN5-13	BOLT	1
	AN960-D516	WASHER	1
	AN310-5	NUT	1
14.	2064976-10	CABLE ASSEMBLY, 3/16" BALL BEARING END AND PLAIN END	1
	AN5-13	BOLT	1
	AN960-D516	WASHER	1
	AN310-5	NUT	1
15.	AN210-3A	PULLEY	2
	AN4-21	BOLT	1
	AN310-4	NUT	1
	143358-116	PIN, PULLEY GUARD	1
	5067122	BRACKET, STATION 353 L.H. ELEVATOR AND RUDDER PULLEY	1
	AN3-6A	BOLT	4
	AC365-1032	NUT	4
16.	AN210-6A	PULLEY	4
	AN6-23	BOLT	2
	AN960-D616	WASHER	2
	AN310-6	NUT	2
	143358-124	PIN, PULLEY GUARD	6
	5068000	BRACKET, STATION 436 ELEVATOR PULLEY—L.H.	1
	5068000-1	BRACKET, STATION 436 ELEVATOR PULLEY—R.H.	1
	AN3-6A	BOLT	4
	AN3-5A	BOLT	8
	AN960-D10	WASHER	12
	AC365-1032	NUT	12

LEGEND FOR FIGURE 175



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4066431	PULLEY ASSEMBLY, AILERON DIFFERENTIAL COMPLETE	2
	1060409	SPACER, AILERON PULLEY ASSEMBLY	2
	D-5	BEARING	2
	AN5-34	BOLT	2
	AN960-D516	WASHER	2
	AN310-5	NUT	2
	143358-019	PIN, PULLEY GUARD	4
	143358-213	PIN, PULLEY GUARD	4
2.	2058632	LINK ASSEMBLY, AILERON CONTROL	2
	AN4-17	BOLT	2
	AN960-416	WASHER	2
	AN310-4	NUT	2
	1060325	END ASSEMBLY, AILERON CONTROL TUBE ADJUSTING	2
	AN316-6R	NUT	2
	AN24-38	BOLT	2
	AN960-416	WASHER	2
	AN320-4	NUT	2
3.	2064977-18	CABLE ASSEMBLY, BUSHING END	2
	AN25-14	BOLT, CLEVIS	2
	AN960-D516	WASHER	2
	AN320-5	NUT, SHEAR	2
	124682-5S14-065	WASHER	2
	AC150-46L	TURNBUCKLE ASSEMBLY	2
	AN25-14	BOLT	4
	AN960-D516	WASHER	4

Figure 176 - AILERON CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4173687	BRACKET, PARKING BRAKE PULLEY	1
	AN392-25	PIN	2
	AN210-1A	PULLEY	1
	AN3-12	BOLT	1
	AN960-10	WASHER	1
	AN310-3	NUT	1
2.	5064525-500	REST ASSEMBLY, PILOT'S ADJUSTABLE FOOT—L.H.	1
	5064525-501	REST ASSEMBLY, PILOT'S ADJUSTABLE FOOT—R.H.	1
	AN4-20A	BOLT	8
	AN960-D416	WASHER	8
	AC365-428	NUT	8
3.	1059796	BRACKET ASSEMBLY, PARKING BRAKE TORQUE TUBE	2
	AN3-6A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4
4.	2059296	TUBE ASSEMBLY, PARKING BRAKE TORQUE	1
5.	4090758	TUBE ASSEMBLY, PILOT RUDDER CONTROL TORQUE	2
6.	2059232	GUARD ASSEMBLY, ELEVATING BUS PULLEY	2
	AN210-6A	PULLEY	2
	AN6-17	BOLT	2
	AN960-D616	WASHER	2
	AN310-6	NUT	2
7.	AN5-17	BOLT	2
	AN960-D516	WASHER	2
	AN310-5	NUT	2
8.	AN3-11A	BOLT	2
	AN960-D10	WASHER	2
	AC365-1032	NUT	2
9.	AN6-24	BOLT	2
	1026614-6-016	SPACER, O.D. BEARING	2
	131079-1	BUSHING, RUDDER PEDAL BEARING ADJUSTING	2
	AN310-6	NUT	2
10.	4058349	SUPPORT, BRAKE VALVE—L.H.	1
	4058349-1	SUPPORT, BRAKE VALVE—R.H.	1
	AN3-6A	BOLT	4
	AN3-20A	BOLT	4
	AN960-D10	WASHER	8
	AC365-1032	NUT	8
11.	1058297	LEVER ASSEMBLY, BRAKE	2
	AN3-12	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
12.	1005381	LINK, BRAKE OPERATING TORQUE ARM TO CYLINDER LEVER CONNECTING	2
	AN3-7	BOLT	4
	AN960-D10	WASHER	4
	AN310-3	NUT	4
13.	AN3-7A	BOLT	6
	AN960-D10	WASHER	6
	AC365-1032	NUT	6
14.	4104934	SUPPORT ASSEMBLY, BRAKE ROD STOP	2
15.	1005593	CLEVIS, BRAKE TORQUE TUBE STOP	2
	AN316-5R	NUT	2
	AN3-7	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
16.	1058298	PLATE, PARKING BRAKE STOP —L.H.	1
	1058298-1	PLATE, PARKING BRAKE STOP —R.H.	1
17.	1031312	BUSHING, BRAKE TORQUE TUBE LOCK STOP	2
	AN4-13	BOLT	2
	124682-4S14-063	WASHER	6
	AN960-D416	WASHER	2
	AN310-4	NUT	2
18.	110242-4-22H	BOLT, THREADED TO HEAD, STANDARD	2
	AN960-D416	WASHER	4
	AN316-4R	NUT	2
	AC365-428	NUT	2
19.	5063329	SUPPORT, PILOT'S RUDDER CONTROL—L.H.	1
	5063329-1	SUPPORT, PILOT'S RUDDER CONTROL—R.H.	1
	AN4-21A	BOLT	4
	AN960-D416	WASHER	4
	AC365-428	NUT	4
	1029421-416-18	SCREW, 100 DEGREE RECESSED FLATHEAD	4
	AN960-D416	WASHER	4
	AC365-428	NUT	4
	AN4-7A	BOLT	2
	AN4-6A	BOLT	2
	AN960-D416	WASHER	4
	AN365-428	NUT	4
20.	1012494	SPRING, PARKING BRAKE STOP PLATE	2
21.	2027797B3-4-714	ROD ASSEMBLY, BALL BEARING ENGINE CONTROL	2
	AN393-11	PIN	2
	AN393-17	PIN	2
22.	1059853	ROD ASSEMBLY, RUDDER PEDAL BRAKE	2
	AN3-7	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
23.	2064974-14	CABLE ASSEMBLY, 3 32 SWEATED TURNBUCKLE END AND CLEVIS	1
	AN155-8S	BARREL	1
	1059865	END, 6.40 TURNBUCKLE CLEVIS SPECIAL	1
	AN393-9	PIN	1
	AN393-15	PIN	1
24.	2059311	HANDLE ASSEMBLY, PARKING BRAKE	1
25.	AN210-5A	PULLEY	2
	132100-6-14A	BOLT, SPECIAL	2
	AN960-D616	WASHER	2

LEGEND FOR FIGURE 177

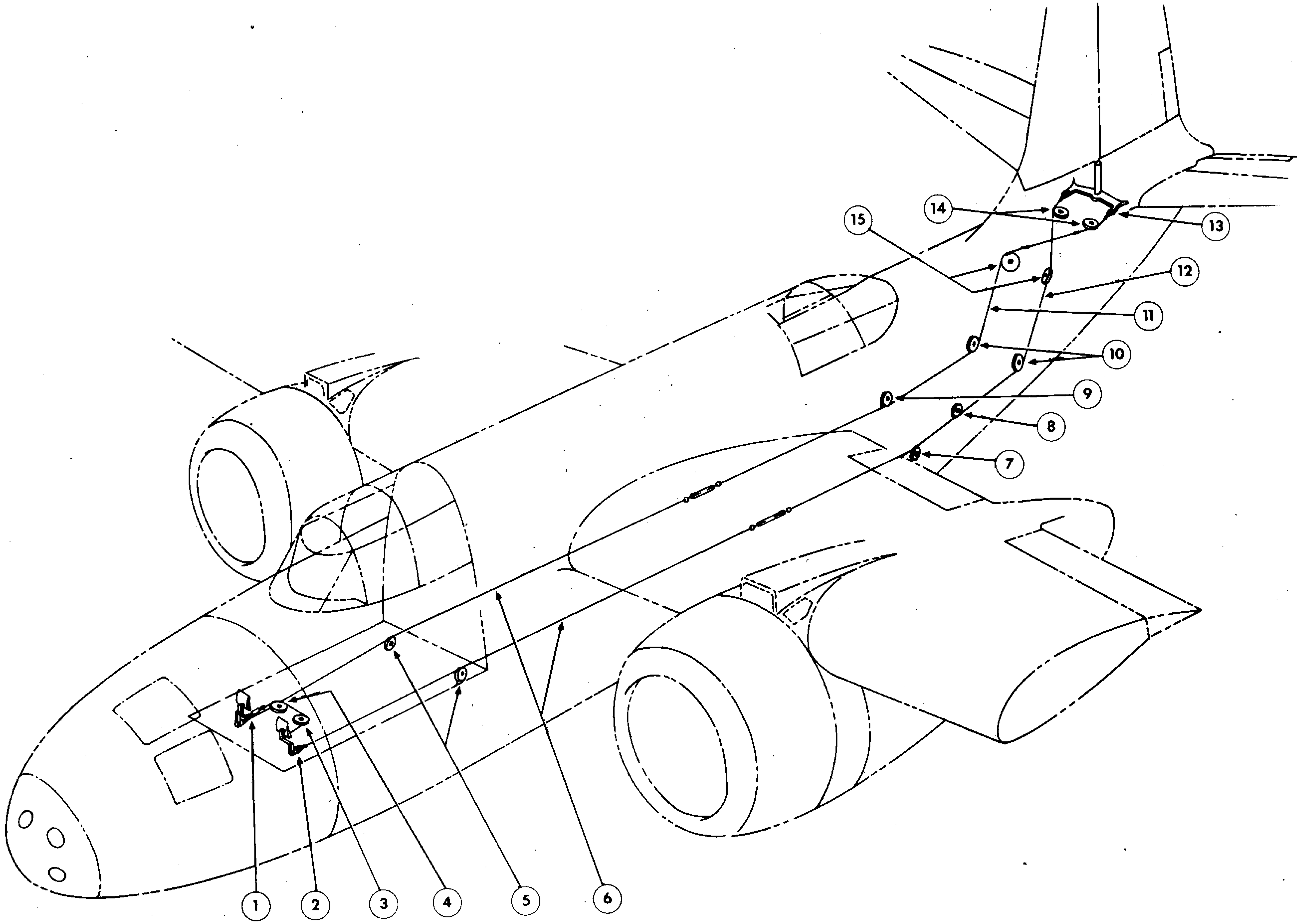


Figure 178 - RUDDER CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AN155-46L	BARREL, TURNBUCKLE	1
	AC161-46LL	FORK, TURNBUCKLE	1
	1058136	END ASSEMBLY, K5 BEARING TURNBUCKLE	1
	AN5-14	BOLT	1
	AN310-5	NUT	1
2.	1114626	LINK, RUDDER CONTROL CABLE	2
	AN4-13	BOLT	2
	AN960-D416	WASHER	2
	AN310-4	NUT	2
3.	AN210-5A	PULLEY	2
	132100-14A	BOLT, SPECIAL	2
	AN960-D616	WASHER	2
4.	2064976-20	CABLE ASSEMBLY, 3/16" BALL BEARING END AND PLAIN END	1
	AN5-17	BOLT	1
	AN25-14	BOLT	1
	AN320-5	NUT	1
	AN960-D516	WASHER	1
	AN310-5	NUT	1
5.	AN210-3A	PULLEY	2
	AN4-20	BOLT	2
	AN960-D416	WASHER	4
	AN310-4	NUT	2
	143358-112	PIN, PULLEY GUARD	2
	4118580	BRACKET, STA. 75 ELEVATOR AND RUDDER CONTROL—L.H.	1
	4118580-1	BRACKET, STA. 75 ELEVATOR AND RUDDER CONTROL—R.H.	1
	AN3-6A	BOLT	8
	AN960-D10	WASHER	8
	AC365-1032	NUT	8
6.	2168597-8	CABLE ASS'Y, 3/16" BALL BEARING END AND SWAGED END	2
	AN155-46L	TURNBUCKLE, BARREL	2
	AN5-13	BOLT	2
	AN5-7	BOLT	2
	AN960-D516	WASHER	4
	AN310-5	NUT	4
7.	AN210-3A	PULLEY	1
	117425-4D-100	SPACER	1
	AN4-30	BOLT	1
	AN310-4	NUT	1
	4067404	BRACKET, STATION 274 L.H. ELEVATOR AND RUDDER PULLEY	1
8.	AN210-3A	PULLEY	1
	AN4-15	BOLT	1
	AN310-4	NUT	1
	143358-100	PIN, PULLEY GUARD	1
	5067155	BRACKET, STATION 312 L.H. ELEVATOR AND RUDDER PULLEY	1
9.	AN210-3A	PULLEY	1
	AN4-16	BOLT	1
	AN960-416	WASHER	1
	AN310-4	NUT	1
	143358-116	PIN, PULLEY GUARD	1
	5067098	BRACKET, STATION 291 3/4 ELEVATOR AND RUDDER PULLEY	1
10.	AN210-4A	PULLEY	2
	AN4-15	BOLT	2
	AN310-4	NUT	2
	143358-100	PIN, PULLEY GUARD	4
	5067122	BRACKET, STATION 353 L.H. ELEVATOR AND RUDDER PULLEY	1
	AN3-6A	BOLT	4
	AC365-1032	NUT	4
	5067143	BRACKET, FUSELAGE STATION 353 R.H. ELEVATOR AND RUDDER PULLEY	1
	AN3-7A	BOLT	2
	AN3-6A	BOLT	2
	AC365-1032	NUT	4
11.	2168597-12	CABLE ASS'Y, 3/16" BALL BEARING END AND SWAGED END	1
12.	2168597-10	CABLE ASS'Y, 3/16" BALL BEARING END AND SWAGED END	1
13.	5065366	HORN ASSEMBLY, RUDDER CONTROL	1
	AN6-30	BOLT	1
	1105420	SPACER, RUDDER HORN ATTACHING	1
	AN960-D616	WASHER	1
	AN310-6	NUT	1
14.	AN210-4A	PULLEY	2
	AN4-20	BOLT	2
	AN960-416	WASHER	2
	AN310-4	NUT	2
	143358-1-12	PIN, PULLEY GUARD	4
	5067156	BRACKET, FUSELAGE STATION 422 9/16" RUDDER PULLEY	1
	AN3-10A	BOLT	2
	AN3-7A	BOLT	2
	AN3-6A	BOLT	2
	AN960-D10	WASHER	6
	AC365-1032	NUT	6
15.	AN210-5A	PULLEY	2
	AN6-16	BOLT	2
	AN960-616	WASHER	2
	AN310-6	NUT	2
	143358-104	PIN, PULLEY GUARD	4
	5067188	BRACKET, STATION 409 RUDDER PULLEY—L.H.	1
	5067189	BRACKET, STATION 409 RUDDER PULLEY—R.H.	1
	AN3-6A	BOLT	4
	AN3-7A	BOLT	6
	AN960-10	WASHER	10
	AC365-1032	NUT	10

LEGEND FOR FIGURE 178

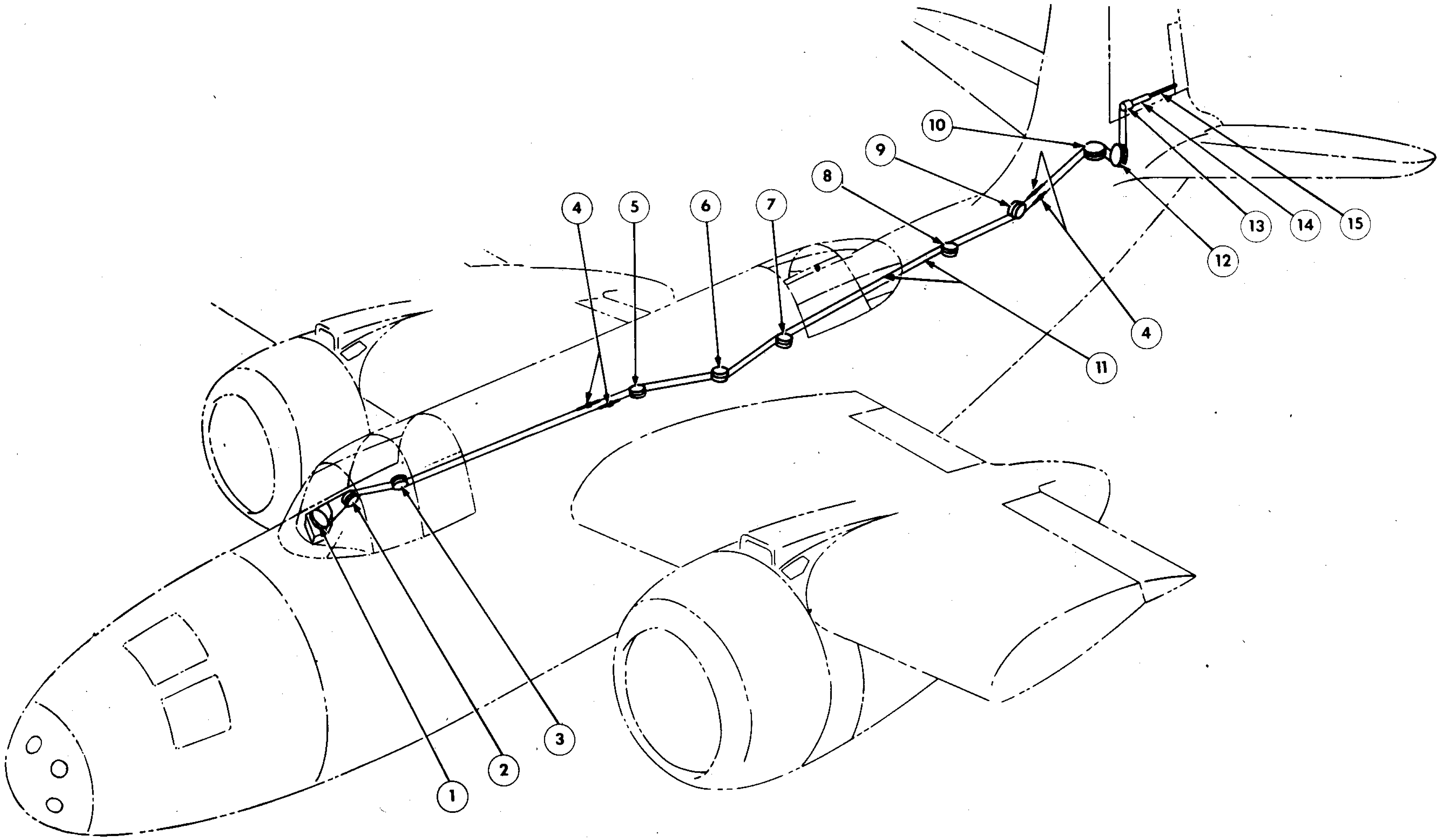


Figure 179 - RUDDER TAB CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2055476-8	DRUM ASSEMBLY, TRIM TAB CONTROL UNIT	1
2.	AN210-1A	PULLEY	2
	AN3-12	BOLT	1
	AN3-15	BOLT	1
	AN960-D10	WASHER	2
	AN310-3	NUT	1
	AN320-3	NUT	1
	143358-028	PIN, PULLEY GUARD	1
	1059872-028	GUARD, SPECIAL PIN TYPE PULLEY	1
	4067883	BRACKET, FUSELAGE STATION 53 RUDDER TRIM TAB	1
3.	AN210-1A	PULLEY	2
	117425-3D-015	SPACER, BOLT	1
	AN3-22	BOLT	1
	AN310-3	NUT	1
	143358-119	PIN, PULLEY GUARD	1
	5068177	BRACKET, FUSELAGE STATION 75 TRIM TAB CABLE PULLEY	1
	AN3-6A	BOLT	7
	AN960-D10	WASHER	7
	AC365-1032	NUT	7
4.	AN155-8S	TURNBUCKLE, BARREL	4
5.	AN210-1A	PULLEY	2
	AN3-22	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	143358-123	PIN, PULLEY GUARD	1
	4067853	BRACKET, FUSELAGE STATION 179 TRIM TAB PULLEY	1
6.	AN210-1A	PULLEY	2
	AN3-30	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	143358-215	PIN, PULLEY GUARD	1
	2067339	BRACKET, FUSELAGE STATION 212 TRIM TAB	1
7.	AN210-1A	PULLEY	2
	AN3-22	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	4067869	BRACKET, FUSELAGE STATION 243 TRIM TAB PULLEY	1
8.	AN210-1A	PULLEY	2
	AN3-23	BOLT	1
	AN310-3	NUT	1
	117425-3S-013	SPACER	1
	117425-3S-012	SPACER	1
	2067279	BRACKET, FUSELAGE STATION 353 TRIM TAB PULLEY	1
	AN3-4A	BOLT	1
	AC365-1032	NUT	1
	143358-130	PIN, PULLEY GUARD	1
9.	AN210-1A	PULLEY	2
	AN3-23	BOLT	1
	AN310-3	NUT	1
	117425-3S-013	SPACER	1
	117425-3S-014	SPACER	1
	2067248	BRACKET, STATION 388 TRIM TAB CABLE PULLEY	1
	143358-202	PIN, PULLEY GUARD	1
10.	AN210-2A	PULLEY	2
	AN3-17	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	117426-3S-005	SPACER	2
	5067116	BRACKET, FUSELAGE STATION 436 $^{13}/_{32}$" RUDDER TRIM TAB PULLEY	1
	143358-120	PIN, PULLEY GUARD	1
	143358-113	PIN, PULLEY GUARD	1
	AN3-6A	BOLT	4
	AN3-10A	BOLT	1
	AN960-D10	WASHER	5
	AC365-1032	NUT	5
11.	2064969-4	CABLE ASSEMBLY, $^{3}/_{32}$" SWEATED L.H. AND R.H. TURNBUCKLE END	2
12.	AN210-2A	PULLEY	2
	AN3-17	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	4067411	BRACKET, FUSELAGE STATION 436 RUDDER TAB INBOARD PULLEY	1
	AN3-12A	BOLT	1
	AN3-13A	BOLT	1
	AN960-D10	WASHER	2
	AC365-1032	NUT	2
13.	2055475-10	DRUM ASSEMBLY, TRIM TAB CONTROL	1
	5114429	SUPPORT ASSEMBLY, RUDDER TRIM TAB MECHANISM	1
	AN3-5A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4
14.	2114407	SHAFT ASSEMBLY, RUDDER TRIM TAB CONTROL DRUM	1
	1050978	NUT, 0.166 LEAD TAB CONTROL ADJUSTING	1
	1059054	NUT	1
	131557	NUT	1
	AN960-816	WASHER	1
15.	4114212	TUBE ASSEMBLY, RUDDER TRIM TAB PUSH AND PULL	1
	AN24-17	BOLT, CLEVIS	2
	AN960-416	WASHER	2
	AN320-4	NUT, SHEAR	2

LEGEND FOR FIGURE 179

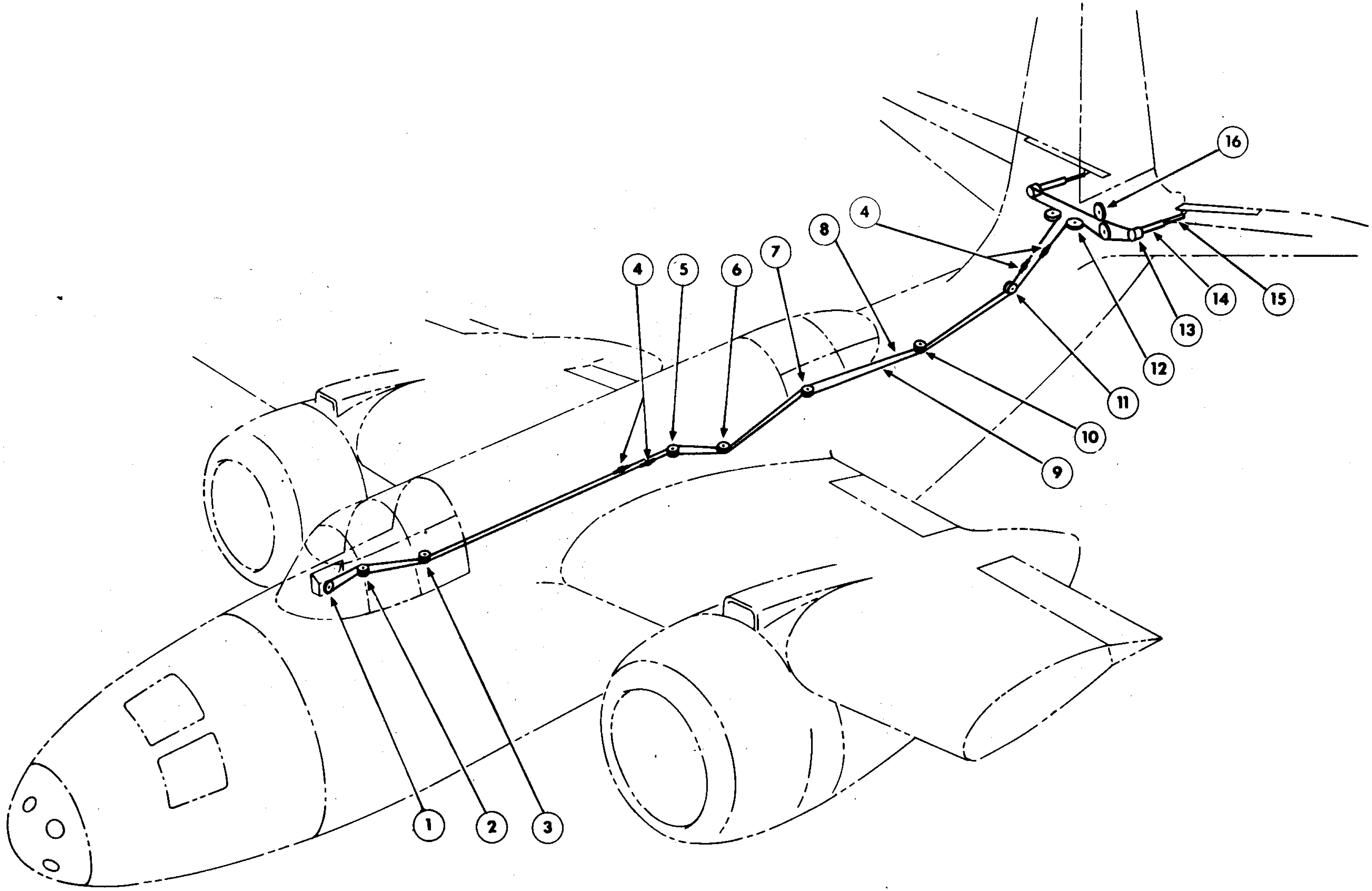


Figure 180 - ELEVATOR TAB CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2055475-6	DRUM ASSEMBLY, TRIM TAB CONTROL	1
2.	AN210-1A	PULLEY	2
	AN3-10	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	175332	BRACKET	2
	AN4-14A	BOLT	2
	AN960-D416	WASHER	2
	AC365-428	NUT	2
	4067880	BRACKET, FUSELAGE STATION 53 TRIM TAB CABLE PULLEY	1
	AN3-5A	BOLT	1
	AN960-D10	WASHER	1
	AC365-1032	NUT	1
	1069940	CLIP	1
3.	AN210-1A	PULLEY	2
	117425-3D-015	SPACER, BOLT	1
	AN3-20	BOLT	1
	AN310-3	NUT	1
	143358-125	PIN, PULLEY GUARD	1
	5068177	BRACKET, FUSELAGE STATION 75 TRIM TAB CABLE PULLEY	1
	AN3-6A	BOLT	7
	AN960-D10	WASHER	7
	AC365-1032	NUT	7
4.	AN155-8S	TURNBUCKLE, BARREL	4
5.	AN210-1A	PULLEY	2
	AN3-22	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	143358-123	PIN, PULLEY GUARD	1
	4067853	BRACKET, FUSELAGE STATION 179 TRIM TAB PULLEY	1
6.	AN210-1A	PULLEY	2
	AN3-30	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	143358-215	PIN, PULLEY GUARD	1
	2067339	BRACKET, FUSELAGE STATION 212 TRIM TAB	1
7.	AN210-1A	PULLEY	2
	AN3-22	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	4067869	BRACKET, FUSELAGE STATION 243 TRIM TAB PULLEY	1
8.	2064969-6	CABLE ASSEMBLY, 3/32" SWEATED L.H. AND R.H. TURNBUCKLE END	1
9.	2064969-2	CABLE ASSEMBLY, 3/32" SWEATED L.H. AND R.H. TURNBUCKLE END	1
10.	AN210-1A	PULLEY	2
	AN3-23	BOLT	1
	AN310-3	NUT	1
	117425-3S-013	SPACER	1
	117425-3S-012	SPACER	1
	2067279	BRACKET, FUSELAGE STATION 353 TRIM TAB PULLEY	1
	AN3-4A	BOLT	1
	AC365-1032	NUT	1
	143358-130	PIN, PULLEY GUARD	1
11.	AN210-1A	PULLEY	2
	AN3-23	BOLT	1
	AN310-3	NUT	1
	117425-3S-013	SPACER	1
	117425-3S-014	SPACER	1
	2067248	BRACKET, STATION 388 TRIM TAB CABLE PULLEY	1
	143358-202	PIN, PULLEY GUARD	1
12.	AN210-2A	PULLEY	2
	AN3-14	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	143358-104	PIN, PULLEY GUARD	4
	5067117	BRACKET, FUSELAGE STATION 436 13/32" ELEVATOR TRIM TAB PULLEY	1
	AN3-6A	BOLT	4
	AN3-10A	BOLT	1
	AN960-D10	WASHER	5
	AC365-1032	NUT	5
13.	2067233	DRUM ASSEMBLY, ELEVATOR TRIM TAB CONTROL	1
	4065557	SUPPORT, ELEVATOR AND RUDDER TRIM TAB MECHANISM	2
	AN3-5A	BOLT	6
	AN3-6A	BOLT	2
14.	1066117	SHAFT ASSEMBLY, ELEVATOR TRIM TAB CONTROL DRUM	2
	1052068	NUT	2
	1059054	NUT	2
	131557	NUT	2
	124682-8S14-063	WASHER	2
	1068299	PIN, ELEVATOR AND RUDDER TRIM TAB CONTROL DRUM SHAFT	2
15.	4066516	TUBE ASSEMBLY, ELEVATOR TRIM TAB PUSH AND PULL	2
	AN23-12	BOLT	2
	AN23-17	BOLT	2
	AN960-D10	WASHER	4
	AN320-3	NUT	4
16.	AN210-2A	PULLEY	2
	AN3-14	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	143358-021	PIN, PULLEY GUARD	1
	143358-102	PIN, PULLEY GUARD	1
	4066552	BRACKET, FUSELAGE STATION 436 ELEVATOR TAB BUS PULLEY	1
	AN3-6A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4

LEGEND FOR FIGURE 180

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2055476-10	DRUM ASSEMBLY, TRIM TAB CONTROL UNIT	1
	AN155-8S	BARREL, TURNBUCKLE	2
	AN160-8S	FORK, TURNBUCKLE	2
2.	AN210-1A	PULLEY	2
	AN3-10	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	175332	BRACKET	2
	AN4-14A	BOLT	2
	AN960-D416	WASHER	2
	AC365-428	NUT	2
	4067880	BRACKET, FUSELAGE STATION 53 TRIM TAB CABLE PULLEY	1
	AN3-5A4	BOLT	1
	AN960-D10	WASHER	1
	AC365-1032	NUT	1
	1069940	CLIP	1
3.	AN210-1A	PULLEY	2
	117425-3D-027	SPACER, BOLT	1
	AN3-25	BOLT	1
	AN310-3	NUT	1
	143358-204	PIN, PULLEY GUARD	1
	5068177	BRACKET, FUSELAGE STATION 75 TRIM TAB CABLE PULLEY	1
	AN3-6A	BOLT	7

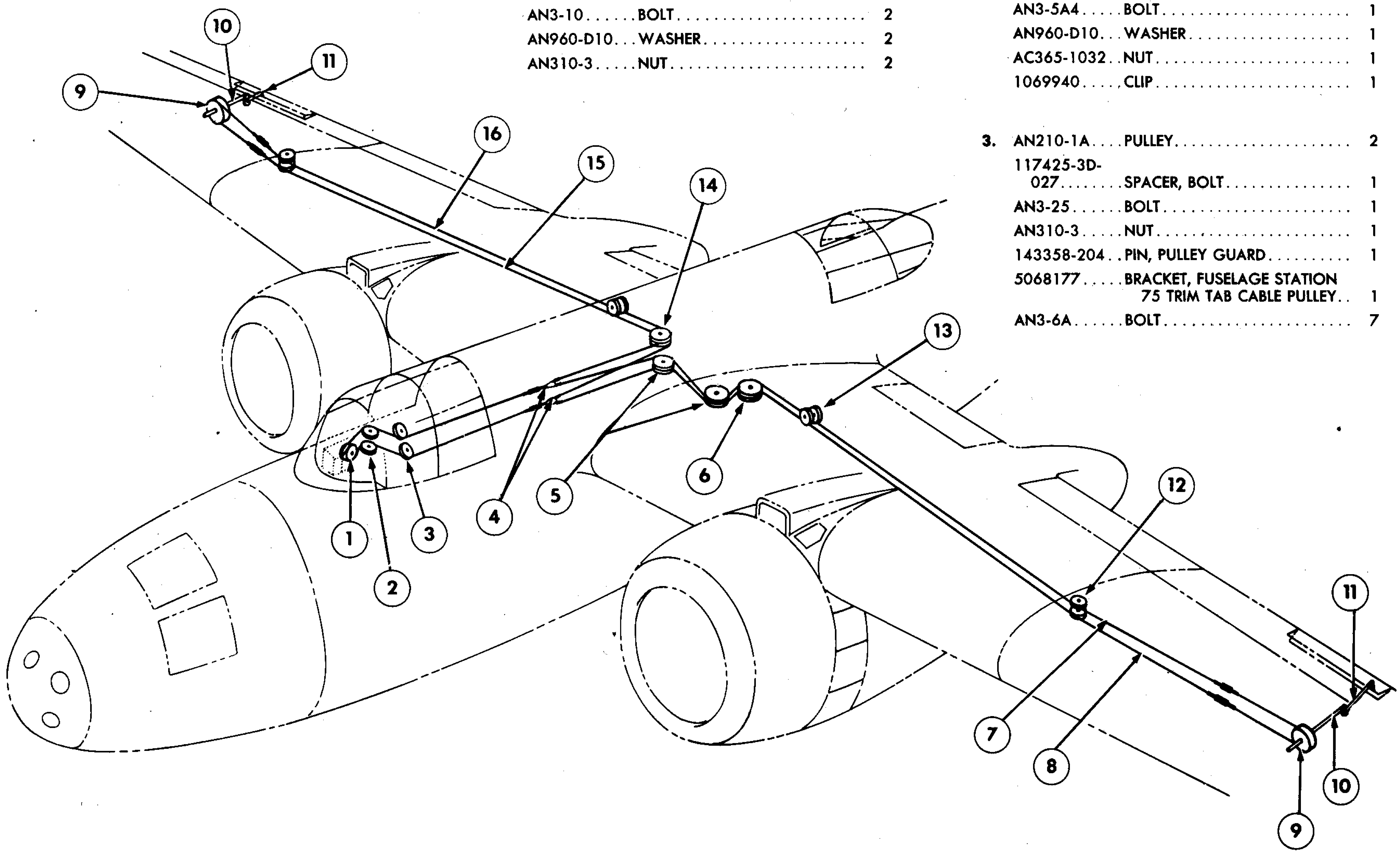
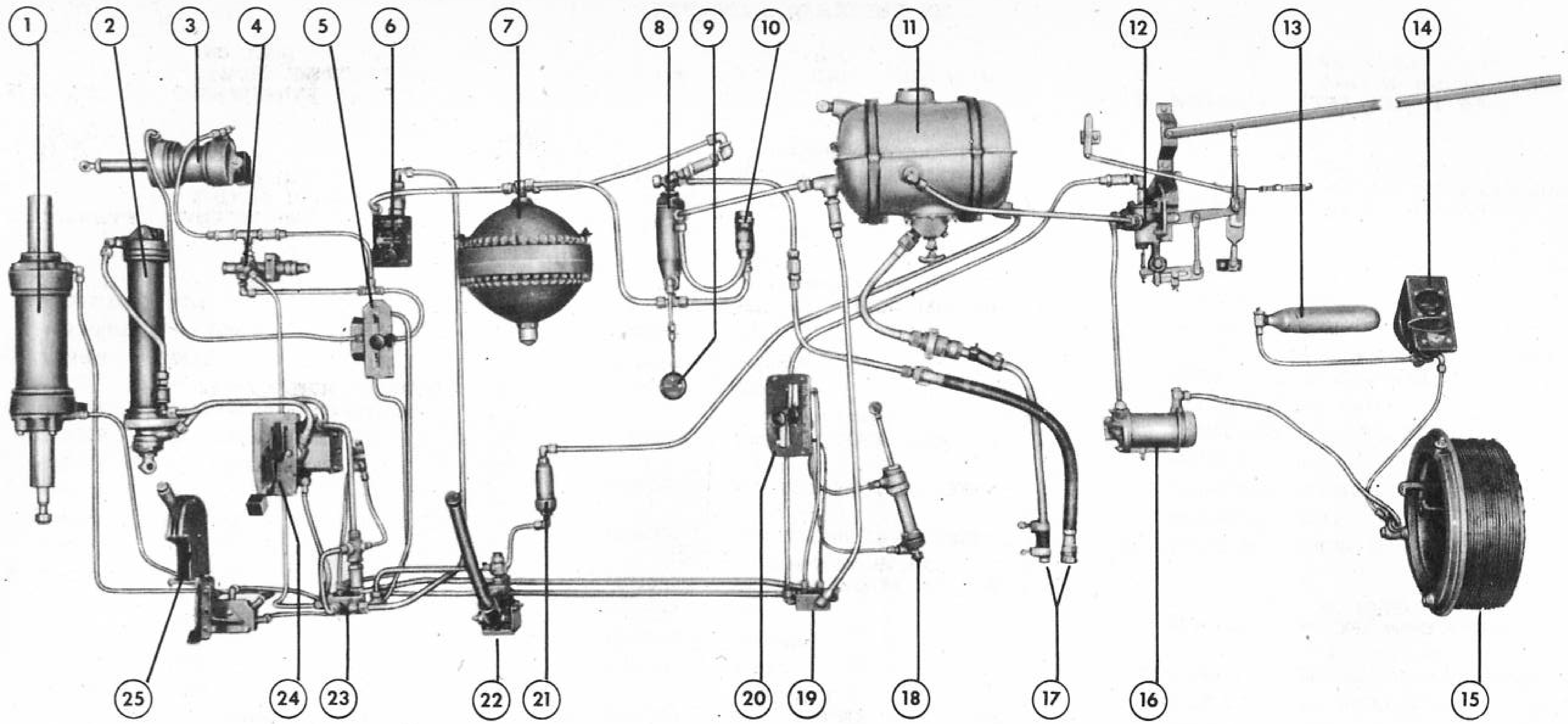


Figure 181 - AILERON TAB CONTROLS

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
	AN960-D10	WASHER	7
	AC365-1032	NUT	7
4.	1059861	LINK, CONTROL CABLE	2
	AN23-9	BOLT	6
	AN320-3	NUT	6
5.	AN210-2A	PULLEY	4
	AN3-33	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	1066255	SPACER, PULLEY	2
	143358-229	PIN, PULLEY GUARD	4
	143358-307	PIN, PULLEY GUARD	2
	4065542	BRACKET, FUSELAGE STATION 156 AILERON TAB PULLEY	2
	AN3-5A	BOLT	8
	AC365-1032	NUT	8
6.	AN210-2A	PULLEY	2
	AN3-36	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	143358-305	PIN, PULLEY GUARD	1
	143358-317	PIN, PULLEY GUARD	2
	4067466	BRACKET, FUSELAGE STATION 179.446 AILERON TAB PULLEY	1
	AN3-6A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4
7.	2064974-8	CABLE ASSEMBLY, 3/32" SWEATED TURNBUCKLE END AND CLEVIS	1
8.	2064974-10	CABLE ASSEMBLY, 3/32" SWEATED TURNBUCKLE END AND CLEVIS	1
9.	2055475-8	DRUM ASSEMBLY, TRIM TAB CONTROL	2
	169358	NUT	2
	143908-017S106-.063	WASHER	2
	131557	NUT	2
	1059054	NUT, AILERON TAB CONTROL ADJUSTING	2
	4067487	BRACKET ASSEMBLY, AILERON TAB CONTROL SUPPORT—L.H.	1
	4067487-1	BRACKET ASSEMBLY, AILERON TAB CONTROL SUPPORT—R.H.	1
	AN3-6A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4
	AN155-8S	TURNBUCKLE, BARREL	4
10.	2058598	ROD ASSEMBLY, AILERON TAB CONTROL	2
	AN3-10	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	1131365-2	RETAINER, AILERON TRIM TAB MECHANISM BEARING	2
	1068327	ARM ASSEMBLY, TAB ROCKER—L.H.	1
	1068327-1	ARM ASSEMBLY, TAB ROCKER—R.H.	1
	1110270	BUSHING, AILERON HINGE BOLT STATION 234.09	2
	AN4-24	BOLT	2
	AN960-416	WASHER	4
	AN310-4	NUT	2
	1131365-4	RETAINER, AILERON TRIM TAB MECHANISM BEARING	2
	AN3-10	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	1131365-2	RETAINER, AILERON TRIM TAB MECHANISM BEARING	2
11.	2130074	ROD ASSEMBLY, AILERON TAB ACTUATING	2
	AN23-12	BOLT	2
	AN960-10	WASHER	2
	AN310-3	NUT	2
12.	AN210-1A	PULLEY	4
	AN3-14	BOLT	2
	AN960-D10	WASHER	2
	AN310-3	NUT	2
	143358-104	PIN, PULLEY GUARD	2
	2067296	BRACKET, WING STATION 157.11 AILERON TAB PULLEY—L.H.	1
	2067296-1	BRACKET, WING STATION 157.11 AILERON TAB PULLEY—R.H.	1
13.	AN210-1A	PULLEY	4
	AN3-16	BOLT	2
	AN960-10	WASHER	2
	AN310-3	NUT	2
	143358-104	PIN, PULLEY GUARD	2
	5066419	BRACKET, WING STATION 15 ½" PULLEY—L.H.	1
	5066419-1	BRACKET, WING STATION 15 ½" PULLEY—R.H.	1
14.	AN210-2A	PULLEY	2
	AN3-36	BOLT	1
	AN960-D10	WASHER	1
	AN310-3	NUT	1
	143358-305	PIN, PULLEY GUARD	1
	143358-312	PIN, PULLEY GUARD	1
	4067466	BRACKET, FUSELAGE STATION 179.446 AILERON TAB PULLEY	1
	AN3-6A	BOLT	4
	AN960-D10	WASHER	4
	AC365-1032	NUT	4
15.	2064974-2	CABLE ASSEMBLY, 3/32" SWEATED TURNBUCKLE END AND CLEVIS	1
16.	2064974-4	CABLE ASSEMBLY, 3/32" SWEATED TURNBUCKLE END AND CLEVIS	1

LEGEND FOR FIGURE 181



1. BOMB BAY DOOR ACTUATING STRUT
2. LANDING GEAR ACTUATING STRUT
3. WING FLAP ACTUATING STRUT
4. WING FLAP RELIEF VALVE
5. WING FLAP SELECTOR VALVE
6. HAND PUMP SELECTOR VALVE
7. PRESSURE ACCUMULATOR
8. PRESSURE REGULATOR
9. PRESSURE GAGE
10. PRESSURE REGULATOR RELIEF VALVE
11. FLUID RESERVOIR
12. BRAKE CONTROL VALVE
13. EMERGENCY AIR BRAKE BOTTLE
14. BRAKE CONTROL VALVE AND PRESSURE GAGE
15. BRAKE
16. SHUTTLE VALVE
17. TO ENGINE DRIVE PUMP
18. UPPER COWL FLAP ACTUATING STRUT
19. R. H. MANIFOLD BLOCK
20. UPPER COWL FLAP SELECTOR VALVE
21. FLUID STRAINER
22. HAND PUMP
23. L. H. MANIFOLD BLOCK
24. LANDING GEAR SELECTOR VALVE
25. BOMB BAY DOOR SELECTOR VALVE

Figure 182 - HYDRAULIC SYSTEM MOCK-UP

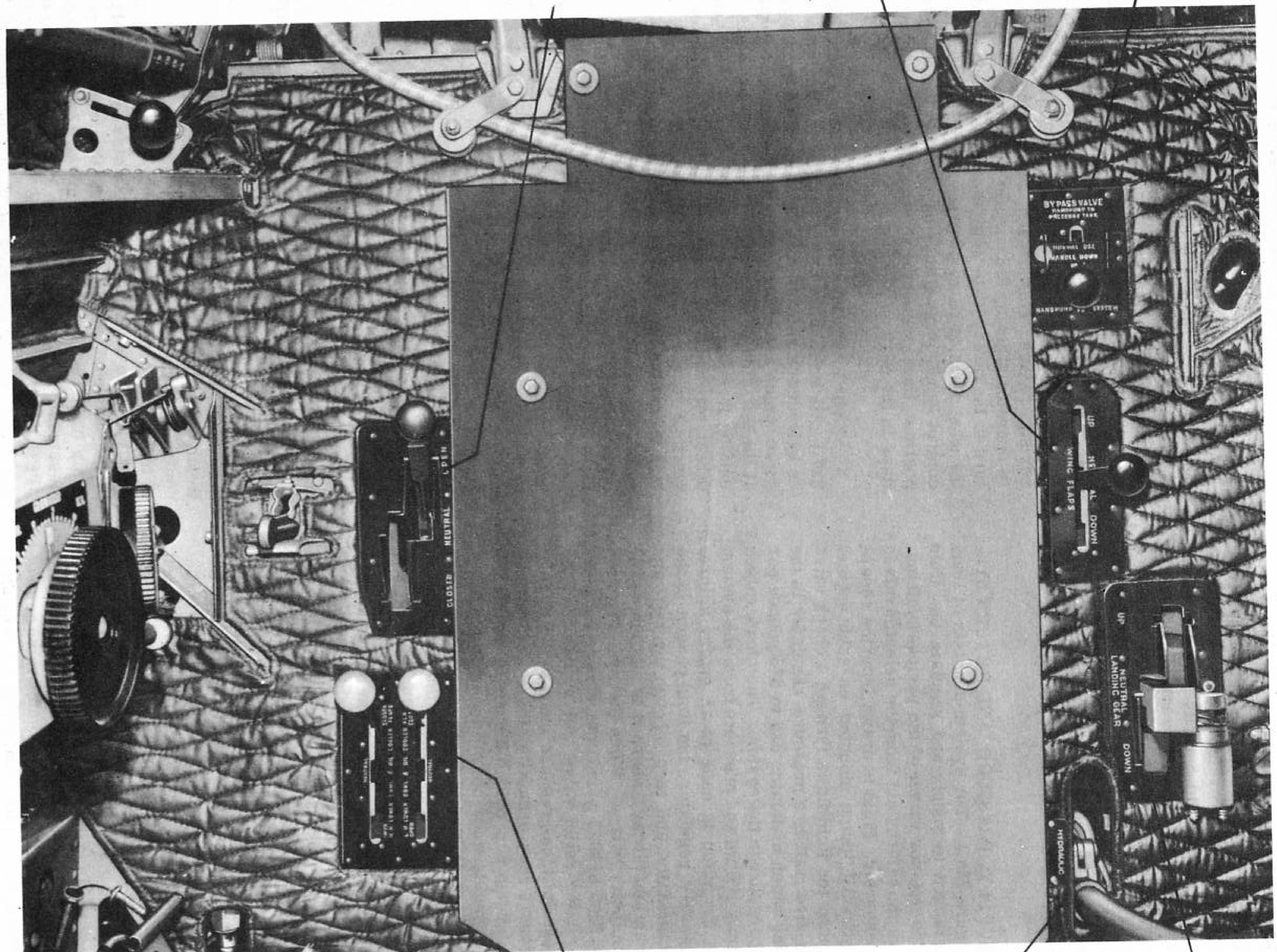


Figure 183 - HYDRAULIC SYSTEM CONTROL VALVES

16. HYDRAULIC SYSTEM.

a. DESCRIPTION

(1) GENERAL. (See figures 182 and 224.) - The complete hydraulic system contains approximately seven gallons of fluid, Specification AN-VV-O-366a, and operates the landing gear, bomb doors, brakes, wing flaps, and cowl flaps. On airplanes AAF42-53834 through AAF42-54284, the carburetor air filter doors are also operated hydraulically. In normal operation two engine-driven pumps supply the fluid pressure for the operation of the complete hydraulic system.

(2) SUPPLY, PRESSURE, AND RETURN SYSTEM. (See figure 225.) - The system consists of lines and units arranged to supply and regulate the fluid pressure to the selector valves of the various systems. It also conveys the return fluid from the selector valves back to the reservoir. Fluid is drawn from the reservoir by a hydraulic pump mounted on each engine. From each pump the fluid flows through a check valve just aft of the fire wall to a pressure regulator in the front bomb bay which maintains 825 to 875 pounds per square inch pressure in the system. The check valves prevent the loss of fluid and pressure from the system back through the pump in case of an engine failure. From the pressure regulator, the fluid passes to the pressure accumulator and then through the left- and right-hand manifold blocks, where it is distributed to the various selector valves. When the system pressure exceeds 1000 to 1050 pounds per square inch, the pressure regulator relief valve will bypass the fluid to the reservoir until the pressure drops to 900 to 1000 pounds per square inch permitting the relief valve to close. A hand pump is provided for use in testing the system during maintenance operations or in the event of hydraulic system failure in flight. The hand pump may be used to build up the pressure in the accumulator or to operate any of the units, depending upon the position to which the hand pump bypass valve is set. Fluid for the hand pump is taken from the reservoir and passed through a filter before reaching the pump.

(3) WING FLAP SYSTEM. (See figure 226.) - Operation of the wing flaps is controlled by a selector valve (figure 183) located on the panel to the left of the pilot's seat. Two actuating lines extend aft along the left-hand side of the fuselage. A tee in the DOWN line directs the fluid through two lines, one of which attaches to the side of the relief valve, while the other continues along the left-hand side of the fuselage to the aft bomb bay. At this point a tee diverts the lines into each inner wing section along the rear shear web. The lines terminate in flexible hoses at the points of attachment to the actuating struts. When the selector valve control handle is moved to the UP position, pressure is applied to the aft port of each actuating strut, forcing the piston forward, and displacing the fluid forward of piston. Constant flow valves have been installed in wing flap system to prevent erratic movement of flaps during process of lowering and raising them. The displaced fluid flows out of the port in the forward end of the strut, and through the selector valve, to the reservoir. When the selector valve control handle is placed in the DOWN position, the normal flow of fluid is through the selector valve and relief valve to the forward port on the actuating strut. Should an attempt be made to lower the wing flaps with the air speed in excess of 180 mph, the air pressure on the flaps builds up the fluid pressure in the DOWN line from 200 to 250 pounds per square inch. This causes the wing flap relief valve to operate, allowing the excess fluid pressure to return to the reservoir through the manifold block. After the wing flaps have been extended or retracted, the control handle must always be moved to the NEUTRAL position, thus locking the fluid in the lines, holding the flaps in the desired position.

(4) LANDING GEAR SYSTEM. (See figure 227.) - All three units of the tricycle landing gear may be extended or retracted at the same time by actuating struts which are controlled by a selector valve located at the left side of the pilot's seat. The two lines extending from the selector valve incorporate tees, which direct two lines aft along the right-hand side of the fuselage to the bomb bay. In the aft bomb bay, two tees divert the lines out through the inner wing to the actuating struts located in the engine nacelles. All lines terminate in flexible hoses at points of attachment to the actuating struts. When the hydraulic system is in operation and the selector valve control handle is moved to the UP position, pressure is applied to the ports at the upper ends of the main landing gear and the nose gear actuating struts. This causes the pistons to move down displacing the fluid below them. The displaced fluid flows out of the lower ports of the struts and back to the reservoir through the selector valve as the gear retracts. When the selector valve control handle is moved to the DOWN position, the action of the fluid is exactly opposite to that described above. After the gear has been retracted, the control handle should be returned to NEUTRAL After the gear has been lowered, the control should be left in the DOWN position.

(5) BOMB DOOR SYSTEM. (See figure 228.) - Bomb doors have a hydraulic actuating strut which is controlled by a selector valve located at the left side of the pilot's control column. Two lines run from the selector valve along the left-hand side of the fuselage to the bulkhead which separates the front and rear bomb bays where they attach to the actuating strut. Movement of the selector valve control handle to the OPEN position allows pressure to be applied to the upper port of the actuating strut forcing the piston to expand. As the piston extends, it displaces the fluid below it, forcing that fluid out of the lower port of the

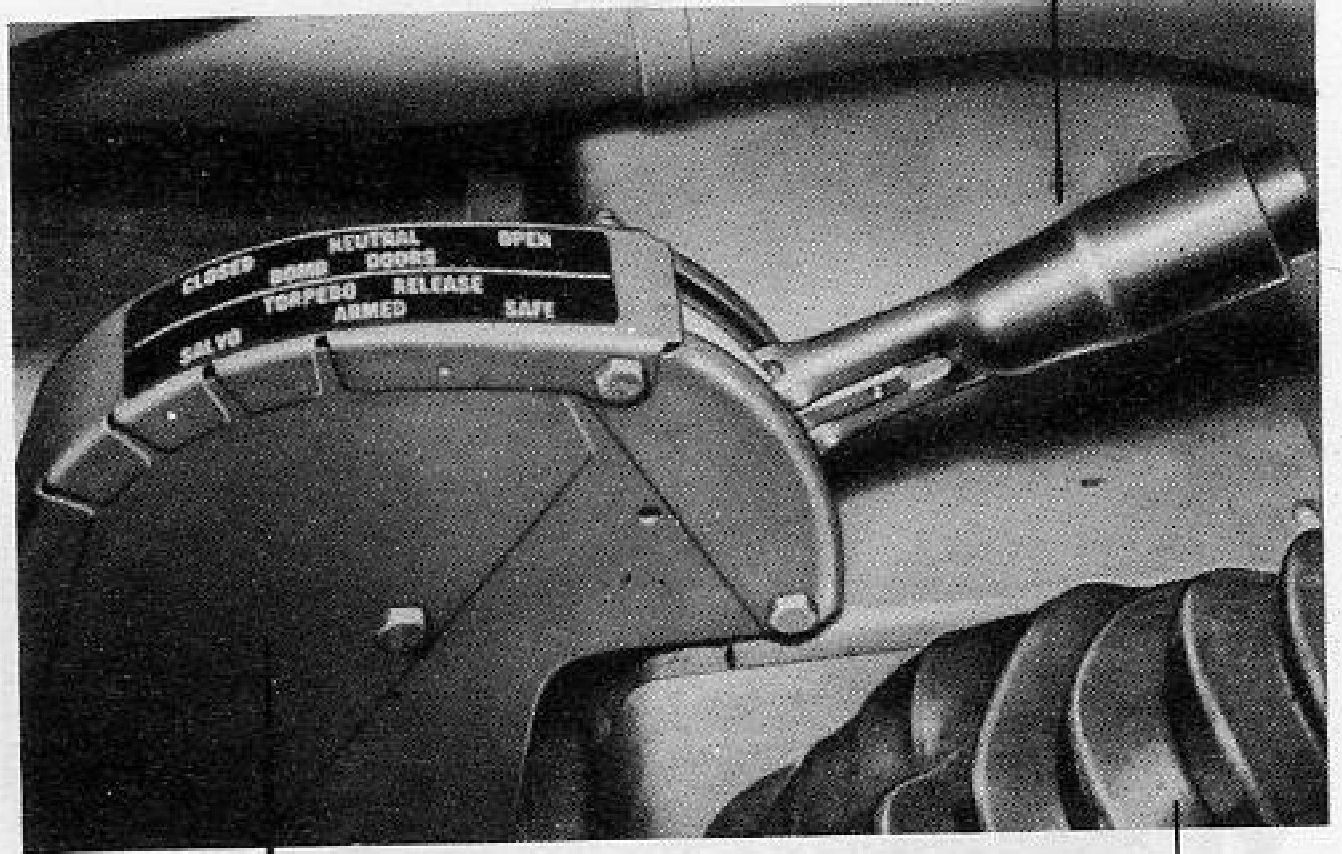


Figure 184 - BOMB DOOR SELECTOR VALVE

strut and back to the reservoir through the selector valve. When the selector valve control handle is moved to the CLOSE position, the action of the fluid is opposite to that described above. In all cases the selector valve should be moved to NEUTRAL after the desired operation is completed.

(6) COWL FLAP SYSTEM. (See figure 228.) - Upper cowl flaps of each engine section are operated simultaneously by a single selector valve while each of the lower cowl and oil cooler flaps is operated independently by a separate selector valve. (See figure 183.)

NOTE

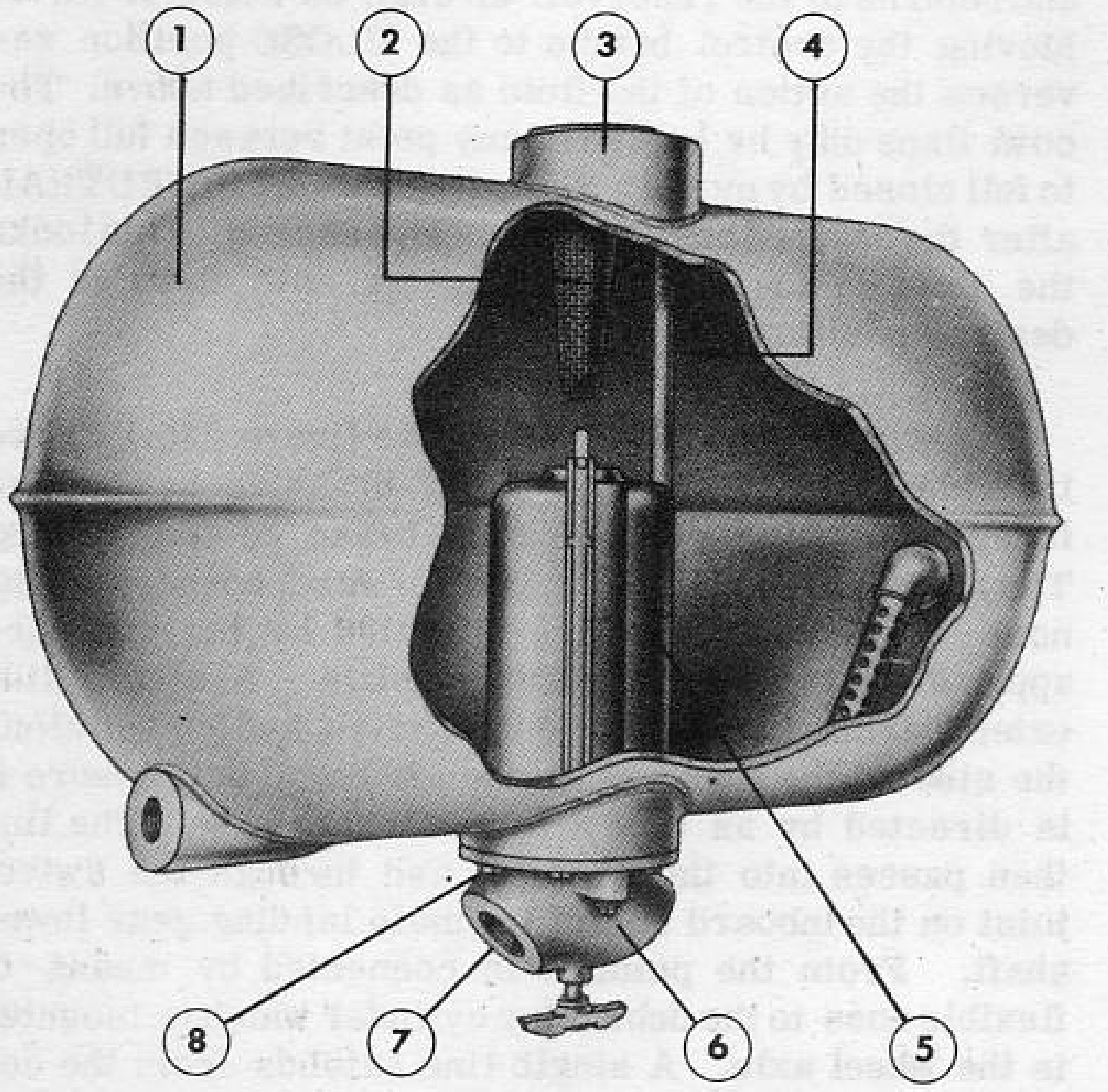
Upper cowl flaps should not be used in flight but may be operated for use during the engine ground run.

All three selector valves are located on the panel at the right side of the pilot's seat. Two lines extend from each selector valve, and pass down the right-hand side of the fuselage to the aft bomb bay. At this point the lines leading to the lower cowl flap actuating struts are directed by elbows into each inner wing panel. The lines leading to the upper cowl flap actuating struts intersect tees which direct two lines into each inner wing panel, following along the same route as the lower cowl flap lines. All lines in each inner wing pass into the nacelle and through the fire wall where they terminate in flexible hoses at points of attachment to the actuating struts. When the control handle of any one of the three selector valves is moved to the OPEN position, pressure is applied to the piston end of the actuating strut, forcing the piston back, and displacing the fluid ahead of it. The displaced fluid flows through the port in the opposite end of the strut and returns to the reservoir through the selector valve. Moving the control handle to the CLOSE position reverses the action of the fluid as described above. The cowl flaps may be locked at any point between full open to full closed by moving the control handle to NEUTRAL after the desired position has been reached. This locks the fluid in the lines, holding the cowl flaps in the desired position.

(7) BRAKE SYSTEM. (See figure 230.) - Two individual systems allow either brake to be applied independently by the hydraulic brake control valves. They are situated in the upper forward corners of the nose wheel well, and are operated by toe pressure applied on the pilot's rudder pedals. A single line extends from each brake control valve, and passes along the side of the fuselage to the aft bomb bay, where it is directed by an elbow to the inner wing. The line then passes into the nacelle, and through the swivel joint on the inboard end of the main landing gear lower shaft. From the point it is connected by means of flexible hose to the debooster cylinder which is mounted in the wheel axle. A single line extends from the debooster to the shuttle valve at each main wheel. Depression of the rudder pedals opens the pressure port on the top of the valve. The system pressure then flows through the valve to the debooster cylinder. In the debooster cylinder, the system operating pressure is reduced to 135 pounds per square inch before being applied to the brakes. As the toe pressure on the pedals is relieved, the fluid from the brakes is allowed to flow back into the large chamber of the debooster while the spring in the debooster forces the fluid in the small chamber through the brake control valve and back to the reservoir.

(8) FLUID RESERVOIR. (See figure 185.) - A fluid reservoir is mounted in the right forward corner of the front bomb bay, just below the fuselage deck. The capacity is 3.1 U.S. gallons (2.7 Imperial gallons). A measuring rod is located in the filler neck for determining the fluid level. A filter screen in the filler opening filters the fluid poured into the reservoir. A filter on the bottom of the reservoir filters the fluid going to the engine pumps.

(9) PRESSURE ACCUMULATOR. (See figure 186.) - A pressure accumulator is mounted in the left forward corner of the front bomb bay, just below the fuselage deck. The accumulator is divided into upper and lower halves by a diaphragm. During ordinary operating conditions, the upper half contains fluid around 850 pounds per square inch pressure. This acts against the air pressure in the lower half. An air pressure of 300 $\pm$ 25 pounds per square inch is preloaded in the accumulator before it is installed. The air pressure on the lower side of the diaphragm serves

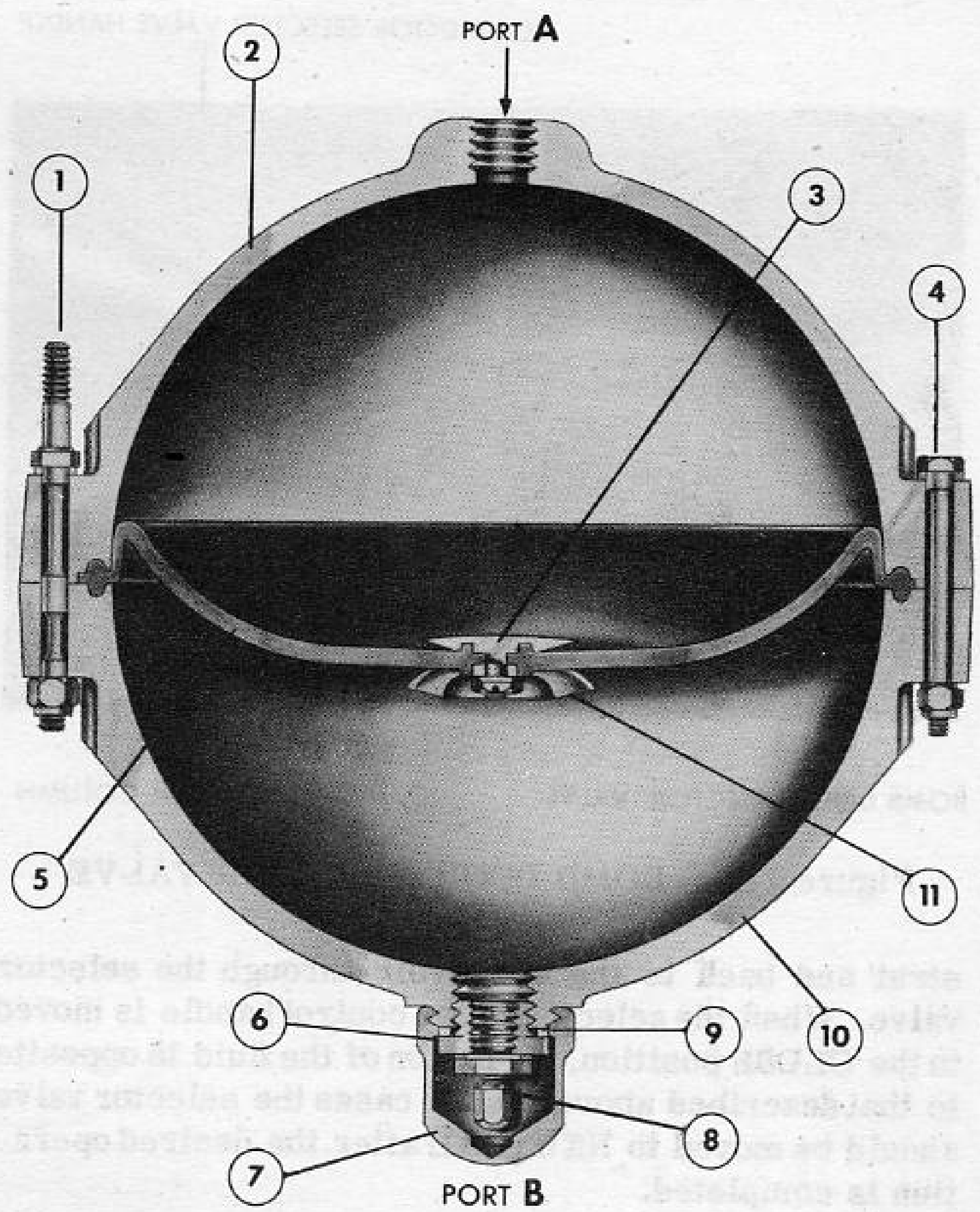


ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5065486-6	TANK ASSEMBLY, HYDRAULIC RESERVOIR	1
2.	1064742	STRAINER ASSEMBLY, HYDRAULIC RESERVOIR FILLING	1
3.	1064712	CAP, HYDRAULIC RESERVOIR FILLING	1
	143908-115SR-124-093	WASHER	1
4.	1064739	ROD ASSEMBLY, HYDRAULIC RESERVOIR MEASURING	1
	143908-010SR016-032	WASHER	1
5.	4067820	FILTER ASSEMBLY, HYDRAULIC RESERVOIR	1
	1130488	FITTING, HYDRAULIC RESERVOIR OUTLET PACKING	1
6.	AN895-70	PLUG	1
7.	4065538	OUTLET, HYDRAULIC RESERVOIR	1
	2064872	GASKET, HYDRAULIC RESERVOIR OUTLET	1
	AC895-71	PLUG	1
8.	1066974	STUD, HYDRAULIC RESERVOIR	8
	AC365-1032	NUT	8

Figure 185 - HYDRAULIC FLUID RESERVOIR

to cushion the fluid surges which are present when the system is in operation, and furnishes fluid under pressure when it is needed in an amount which the pumps cannot provide.

(10) PRESSURE REGULATOR. (See figure 187.) - The hydraulic system pressure regulator is a cylindrical shaped unit. It has a pressure port at the top, a relief port in the side wall, and gage and pressure ports at the lower end. Pressure lines from the



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1059752	STUD, HYDRAULIC PRESSURE TANK	4
	AN960-516	WASHER	8
	AC365-524	NUT	4
2.	4046363	DOME, 9-INCH SPHERICAL HYDRAULIC PRESSURE TANK, UPPER	1
3.	1046469	VALVE, 9-INCH SPHERICAL HYDRAULIC PRESSURE TANK, UPPER	1
	AN320-3	NUT	1
4.	1046452	BOLT, 9-INCH SPHERICAL HYDRAULIC PRESSURE TANK	36
	AN960-516	WASHER	72
	AC365-524	NUT	36
5.	4046365	DIAPHRAGM, 9-INCH SPHERICAL HYDRAULIC PRESSURE TANK	1
6.	1046451	BUSHING, SPHERICAL HYDRAULIC PRESSURE TANK	1
7.	1049695	NUT, SPHERICAL PRESSURE TANK FILLER CAP	1
8.	AN809-1	CORE	1
	AN812-1	BODY	1
	AN813-1	CAP	1
	AN901-5A	GASKET	1
9.	143908-024C102-032	WASHER	1
10.	4046364	DOME, 9-INCH SPHERICAL HYDRAULIC PRESSURE TANK, LOWER	1
11.	1046470	VALVE, 9-INCH SPHERICAL HYDRAULIC PRESSURE TANK, LOWER	1

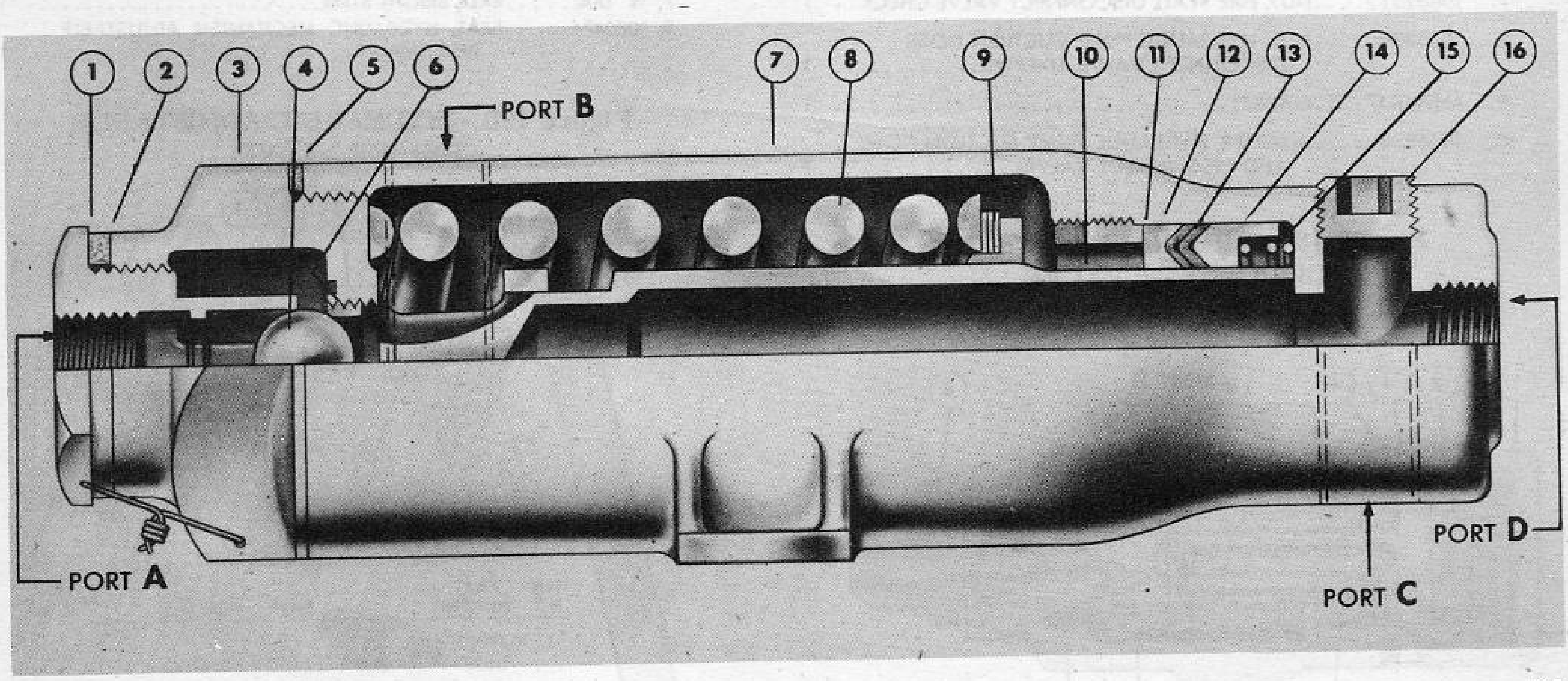
Figure 186 - PRESSURE ACCUMULATOR

two engine driven pumps connect to a side outlet tee in the top port. The pressure accumulator and the pressure regulator relief valve lines connect to the tee at the lower end. The relief port in the side is connected to the reservoir by a line. A check valve in the side outlet tee at the top of the regulator allows fluid from the pumps to flow to the tee on the pressure accumulator, then back to the bottom of the regulator. When there are no hydraulic units in operation, the system pressure builds up above normal. The pressure on the bottom of the regulator forces the spring loaded piston upward, unseating the ball check at the top. This will allow the pressure at the top port to be relieved through the port in the side wall of the regulator.

(11) DISCONNECT VALVES. (See figure 188.) - Fluid supply lines to the engine driven pumps have a disconnect valve at the fire wall of each engine section. The purpose of the valve is to allow the lines to be disconnected without excessive loss of fluid from the system.

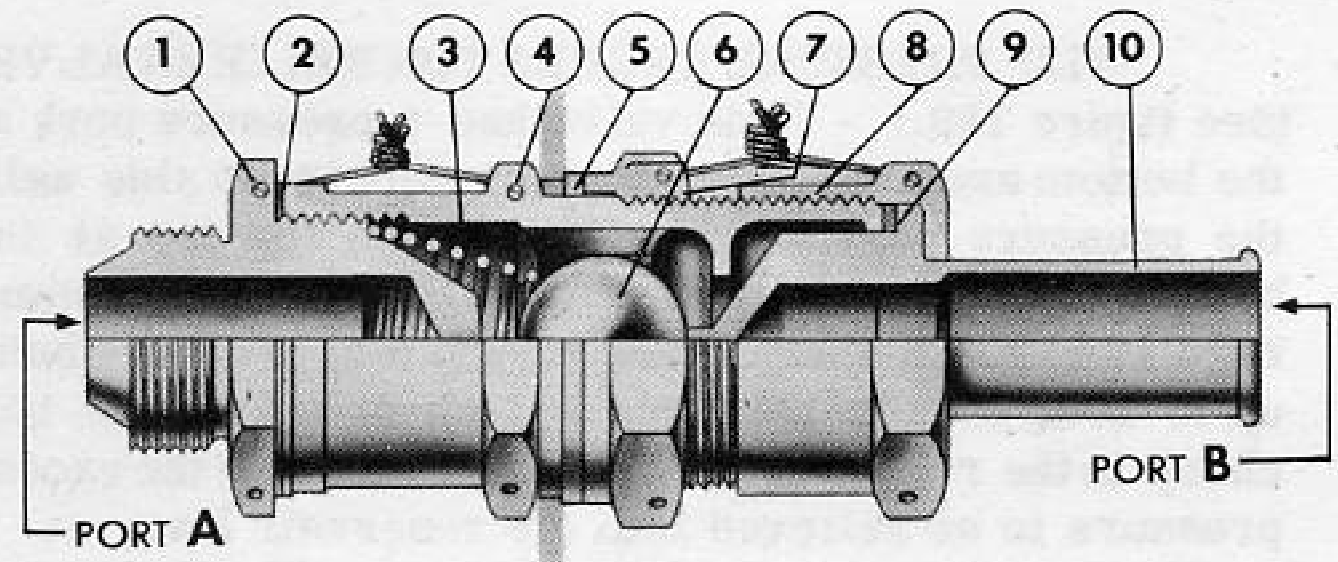
(12) PRESSURE REGULATOR RELIEF VALVE. (See figure 189.) - This valve has a pressure port at the bottom and a reservoir return port in its side wall, the pressure port being connected to the tee at the bottom of the pressure regulator. Should the pressure regulator fail to operate and the system pressure build up to 1000 pounds per square inch or more, the ball check in the relief valve will unseat allowing the excess pressure to be relieved into the reservoir line.

(13) ADJUSTABLE RELIEF VALVE. (See figure 190.) - This valve is of the ball check type, having a pressure port at one end and a reservoir return port in its side wall. The pressure port is connected to the pressure side of the left-hand manifold block, while the other port connects to the fluid return side of the same manifold block. The valve relieves the excess pressures in the system which are caused by expansion of the fluid at high temperatures, or by excessive operation of handpump with the bypass valve in the SYSTEM position.



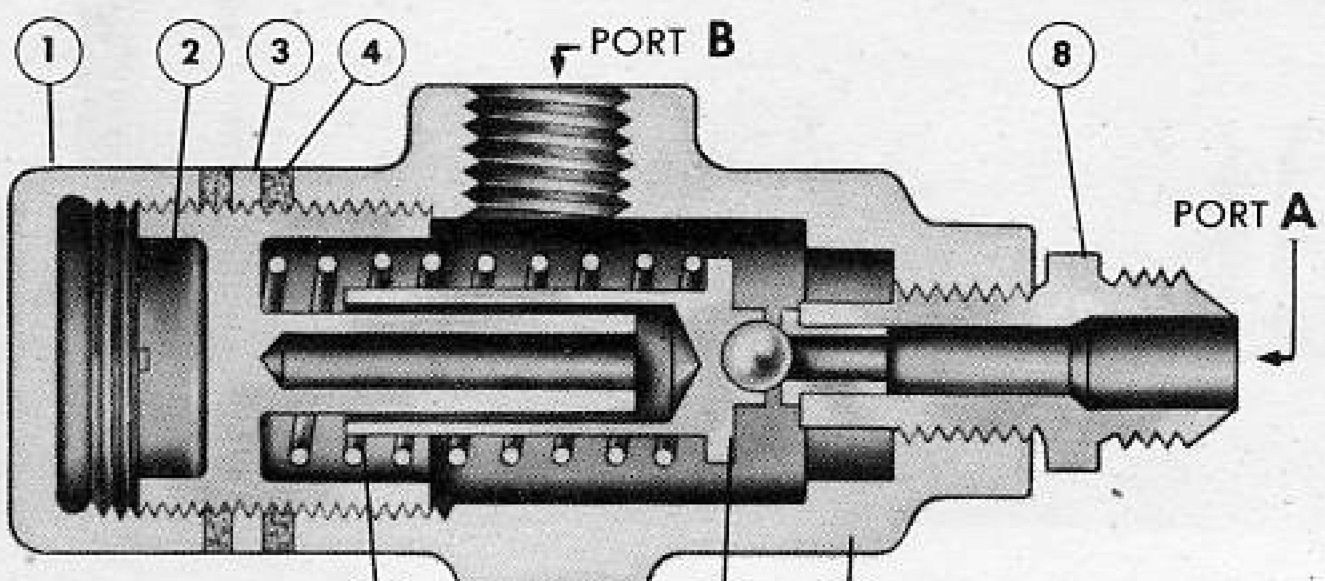
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2005429	BUSHING, HYDRAULIC PRESSURE REGULATING VALVE	1
2.	AN900-18	GASKET	1
3.	2005427	END, HYDRAULIC PRESSURE REGULATING VALVE	1
4.	9/16" DIA.	BALL, BRIGHT STEEL	1
5.	AN900-31	GASKET	1
6.	1066288	SEAT, NO. 8 BALL VALVE	1
7.	4005433	HOUSING, HYDRAULIC PRESSURE REGULATING VALVE	1
8.	1005430	SPRING, HYDRAULIC PRESSURE REGULATING VALVE	1
9.	143908-104RT16-010	WASHER	8
10.	1005410	PISTON, HYDRAULIC PRESSURE REGULATING VALVE	1
11.	1072037	NUT, HYDRAULIC PRESSURE REGULATING VALVE	1
12.	1070625	SPACER, HYDRAULIC PRESSURE REGULATING VALVE PACKING	1
13.	5135865-4N-030	PACKING, HYDRAULIC CHEVRON	2
14.	1072036	SPACER, HYDRAULIC PRESSURE REGULATING VALVE, INNER	1
15.	1070624	SPRING, HYDRAULIC PRESSURE REGULATING VALVE PACKING	1
16.	AC895-102	PLUG	1

Figure 187 - HYDRAULIC PRESSURE REGULATOR



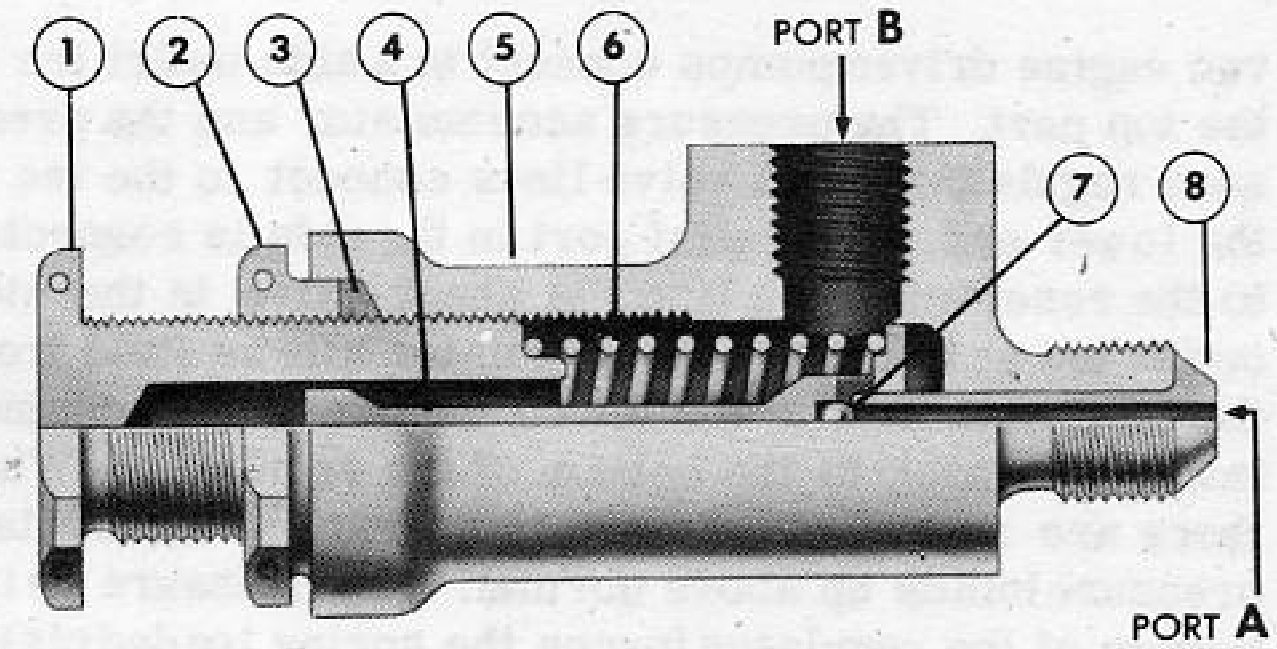
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1024789	UNION, HYDRAULIC PUMP SUCTION LINE DISCONNECT	1
2.	AN900-20	GASKET	1
3.	1007293	SPRING, HYDRAULIC PUMP SUCTION LINE DISCONNECT	1
4.	2007297	BODY, HYDRAULIC PUMP SUCTION LINE DISCONNECT	1
5.	143908-112S122-109	WASHER	1
6.	13 16 DIA.	BALL, STEEL	1
7.	1068251	NUT, FIRE WALL DISCONNECT VALVE CHECK	1
8.	1066829	NUT, HYDRAULIC PUMP SUCTION HOSE DISCONNECT VALVE ADAPTER	1
9.	AN900-17	GASKET	1
10.	1066830	ADAPTER, HYDRAULIC PUMP SUCTION HOSE AND DISCONNECT VALVE	1

Figure 188 - HYDRAULIC SYSTEM DISCONNECT VALVE



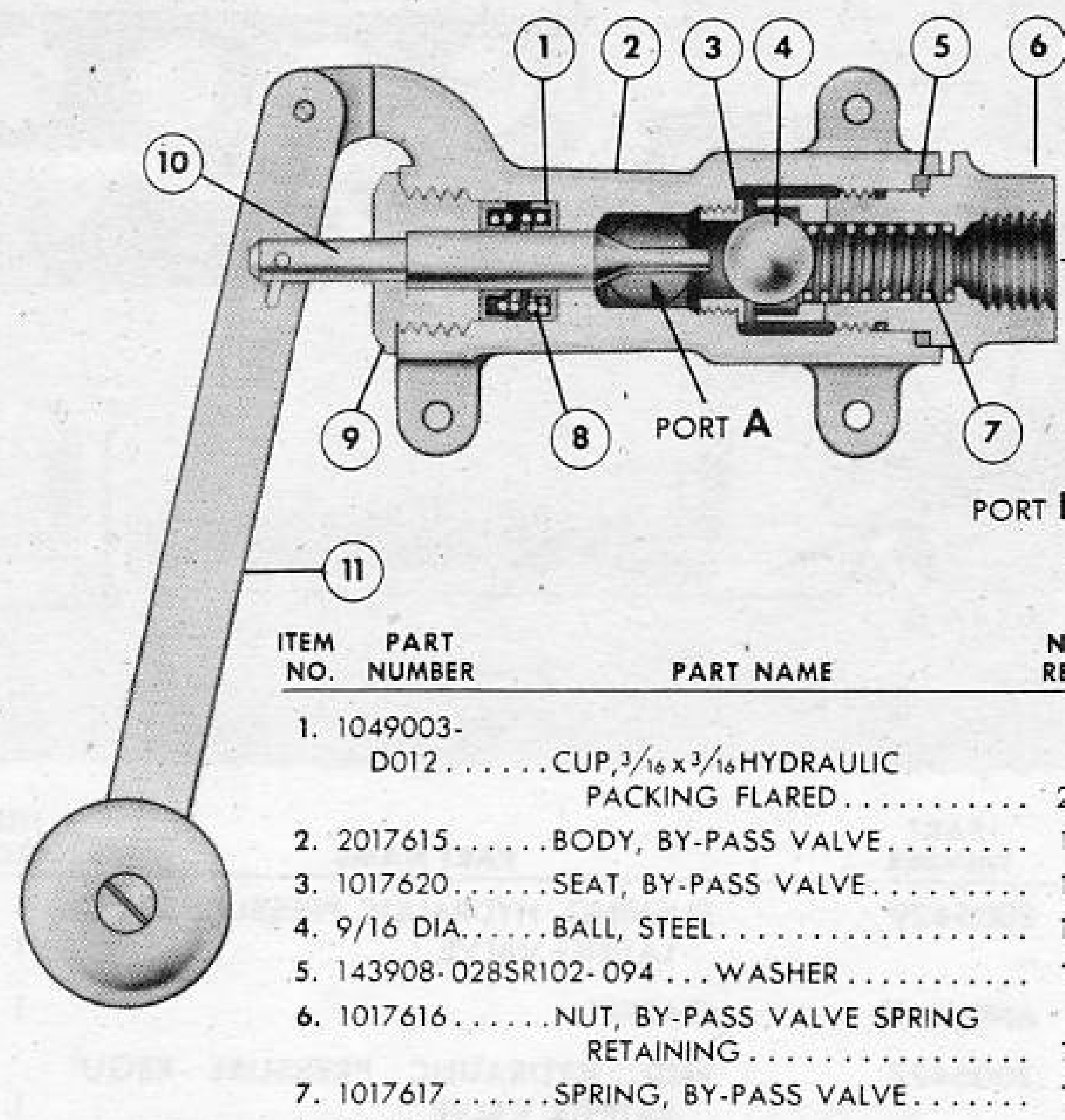
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	147113	CAP, HYDRAULIC RELIEF VALVE	1
2.	138758	GUIDE, HYDRAULIC RELIEF VALVE	1
3.	138759	NUT, HYDRAULIC RELIEF VALVE LOCK	1
4.	1161144-20	GASKET, HYDRAULIC FITTING FIBER	2
5.	138757	SPRING, HYDRAULIC RELIEF VALVE	1
6.	1000859	STEM ASSEMBLY, HYDRAULIC RELIEF VALVE	1
7.	238754-1	HOUSING, HYDRAULIC RELIEF VALVE	1
8.	1047738	SEAT ASSEMBLY, HYDRAULIC SYSTEM RELIEF VALVE	1

Figure 189 - HYDRAULIC PRESSURE REGULATOR RELIEF VALVE



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1085705	SCREW, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
2.	1085707	NUT, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
3.	143908-020SR026-093	WASHER	1
4.	2085703	STEM, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
5.	2085701	BODY, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
6.	1085704	SPRING, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
7.	1/8" DIA.	BALL, BRIGHT STEEL	1
8.	1086474	SEAT, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1

Figure 190 - HYDRAULIC ADJUSTABLE RELIEF VALVE



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1049003-D012	CUP, 3/16 x 3/16 HYDRAULIC PACKING FLARED	2
2.	2017615	BODY, BY-PASS VALVE	1
3.	1017620	SEAT, BY-PASS VALVE	1
4.	9/16 DIA.	BALL, STEEL	1
5.	143908-028SR102-094	WASHER	1
6.	1017616	NUT, BY-PASS VALVE SPRING RETAINING	1
7.	1017617	SPRING, BY-PASS VALVE	1
8.	1000028	SPRING	1
9.	1017619	NUT, BY-PASS VALVE PACKING.	1
10.	1055358	PLUNGER, HYDRAULIC BY-PASS VALVE	1
11.	1064741	LEVER ASSEMBLY, HYDRAULIC BY-PASS VALVE	1
	AN392-11	PIN	1
	AN393-21	PIN	1
	AN960-10	WASHER	1
	AN960-6	WASHER	1

Figure 191 HAND PUMP BYPASS VALVE

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	B8148	HANDLE ASSEMBLY, HYDRAULIC HAND PUMP	1
2.	AN24-20	BOLT	1
	AN960-416L	WASHER	1
	AN320-4	NUT	1
3.	A8116	LINK, HYDRAULIC HAND PUMP	1
4.	AN24-15	BOLT	1
	AN960-416L	WASHER	1
	AN320-4	NUT	1
5.	A8114	PISTON ASSEMBLY, HYDRAULIC HAND PUMP	1
6.	A8149	SEAT, HYDRAULIC HAND PUMP	1
7.	S303-8A	WASHER, HYDRAULIC HAND PUMP SEAT	1
8.	7/16" DIA.	BALL, STEEL	1
9.	A8113	SPRING, HYDRAULIC HAND PUMP SEAT	1
10.	B8150	BODY ASSEMBLY, HYDRAULIC HAND PUMP	1
11.	A8110	RING, HYDRAULIC HAND PUMP PACKING	1
12.	AC40B629-9-026	PACKING, HYDRAULIC HAND PUMP CHEVRON	2
13.	A8115	WASHER, FELT	1
14.	A8093	NUT, HYDRAULIC HAND PUMP RETAINING	1
15.	A8117	BOLT	1
	AN960-516L	WASHER	1
	AN310-5	NUT	1

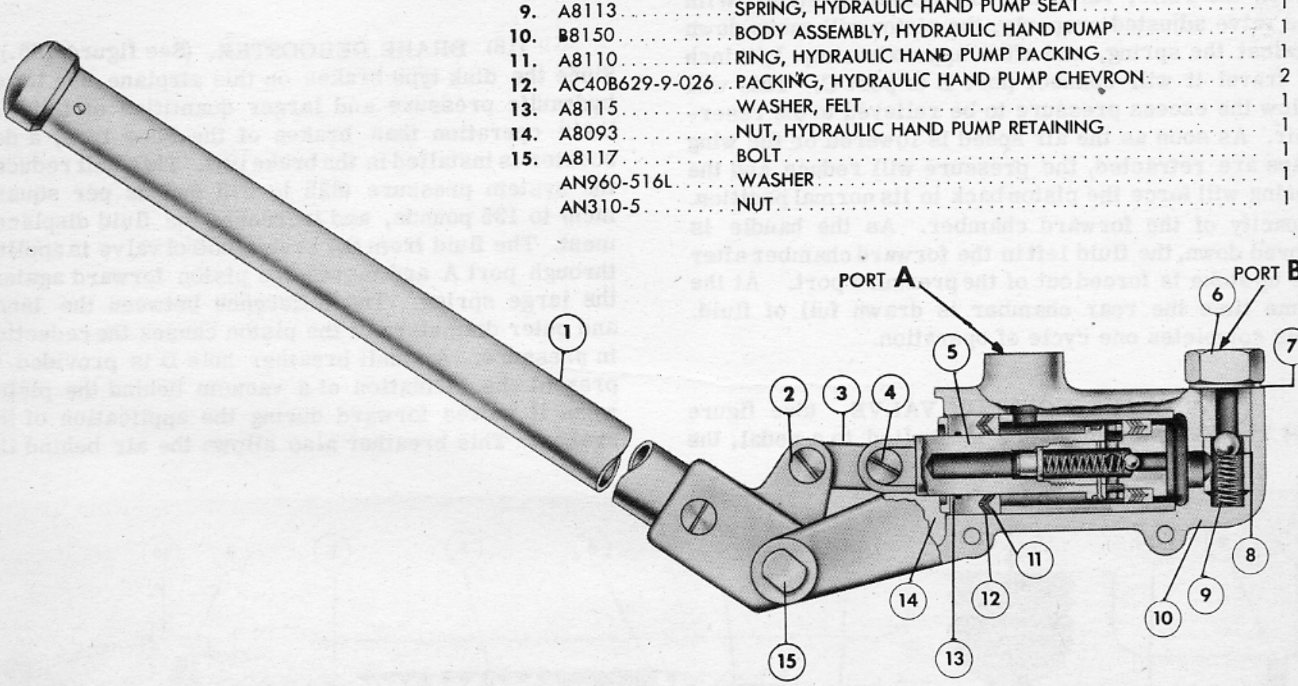


Figure 192 - HYDRAULIC HAND PUMP

(14) HAND PUMP BYPASS VALVE. (See figure 191.) - The hand pump bypass valve is a ball type valve mounted so that its control handle extends through the pilot's compartment aft bulkhead at the left side of the seat. It is assembled in the main pressure line from the pressure accumulator to the left-hand manifold block. The fluid normally flows into the side port and out the end port. The valve control handle should be kept in the SYSTEM position so that when a unit must be operated by the hand pump, the pressure will be applied directly to that unit and not to the complete system. When the valve control is in the SYSTEM position, the ball is seated, preventing any pressure built up by the hand pump from reaching the pressure accumulator and the pressure regulator units. In the case of system pressure failure during flight, the desired operation may be accomplished in much less time than building up pressure in the complete system. Movement of the control handle to TANK position allows the hand pump pressure to be stored in the pressure accumulator, registering on the system pressure gage.

(15) HYDRAULIC HAND PUMP. (See figure 192.) - The hand pump is mounted just aft of the pilot's compartment rear bulkhead, with the handle extending forward into the pilot's compartment along the left side of the seat. The pump has an intake port at its aft end and a pressure port at its forward end. Assuming the handle to be in the UP position, the chamber forward of the piston head to be full of fluid, the operation is as follows: As the handle moves down, the chamber aft of the piston is drawn full of fluid, and the fluid in the chamber on the forward side of the piston will be forced out of the pressure port. The maximum

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	B8148	HANDLE ASSEMBLY, HYDRAULIC HAND PUMP	1
2.	AN24-20	BOLT	1
	AN960-416L	WASHER	1
	AN320-4	NUT	1
3.	A8116	LINK, HYDRAULIC HAND PUMP	1
4.	AN24-15	BOLT	1
	AN960-416L	WASHER	1
	AN320-4	NUT	1
5.	A8114	PISTON ASSEMBLY, HYDRAULIC HAND PUMP	1
6.	A8149	SEAT, HYDRAULIC HAND PUMP	1
7.	S303-8A	WASHER, HYDRAULIC HAND PUMP SEAT	1
8.	7/16" DIA.	BALL, STEEL	1
9.	A8113	SPRING, HYDRAULIC HAND PUMP SEAT	1
10.	B8150	BODY ASSEMBLY, HYDRAULIC HAND PUMP	1
11.	A8110	RING, HYDRAULIC HAND PUMP PACKING	1
12.	AC40B629-9-026	PACKING, HYDRAULIC HAND PUMP CHEVRON	2
13.	A8115	WASHER, FELT	1
14.	A8093	NUT, HYDRAULIC HAND PUMP RETAINING	1
15.	A8117	BOLT	1
	AN960-516L	WASHER	1
	AN310-5	NUT	1

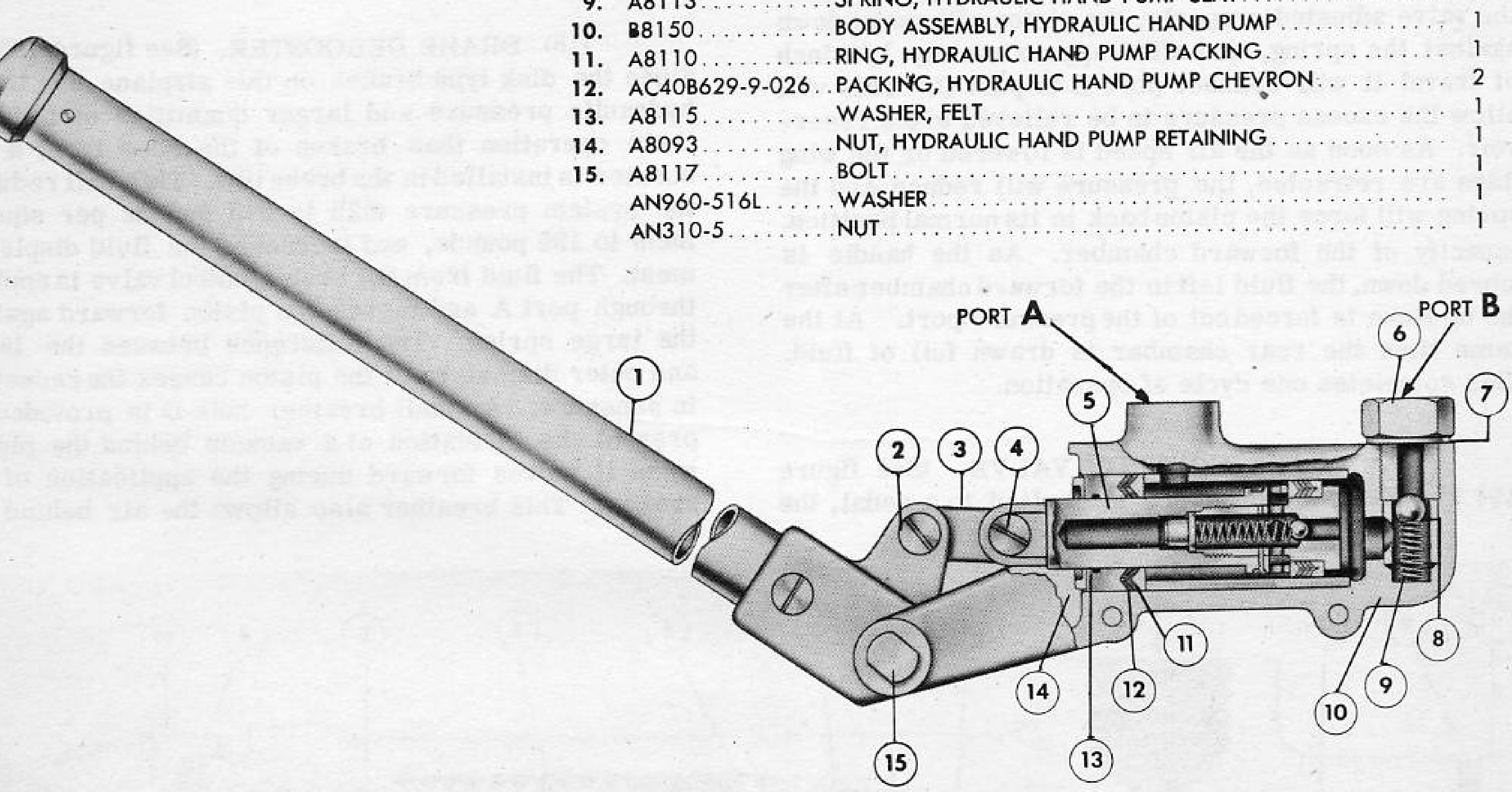


Figure 192 - HYDRAULIC HAND PUMP

(14) HAND PUMP BYPASS VALVE. (See figure 191.) - The hand pump bypass valve is a ball type valve mounted so that its control handle extends through the pilot's compartment aft bulkhead at the left side of the seat. It is assembled in the main pressure line from the pressure accumulator to the left-hand manifold block. The fluid normally flows into the side port and out the end port. The valve control handle should be kept in the SYSTEM position so that when a unit must be operated by the hand pump, the pressure will be applied directly to that unit and not to the complete system. When the valve control is in the SYSTEM position, the ball is seated, preventing any pressure built up by the hand pump from reaching the pressure accumulator and the pressure regulator units. In the case of system pressure failure during flight, the desired operation may be accomplished in much less time than building up pressure in the complete system. Movement of the control handle to TANK position allows the hand pump pressure to be stored in the pressure accumulator, registering on the system pressure gage.

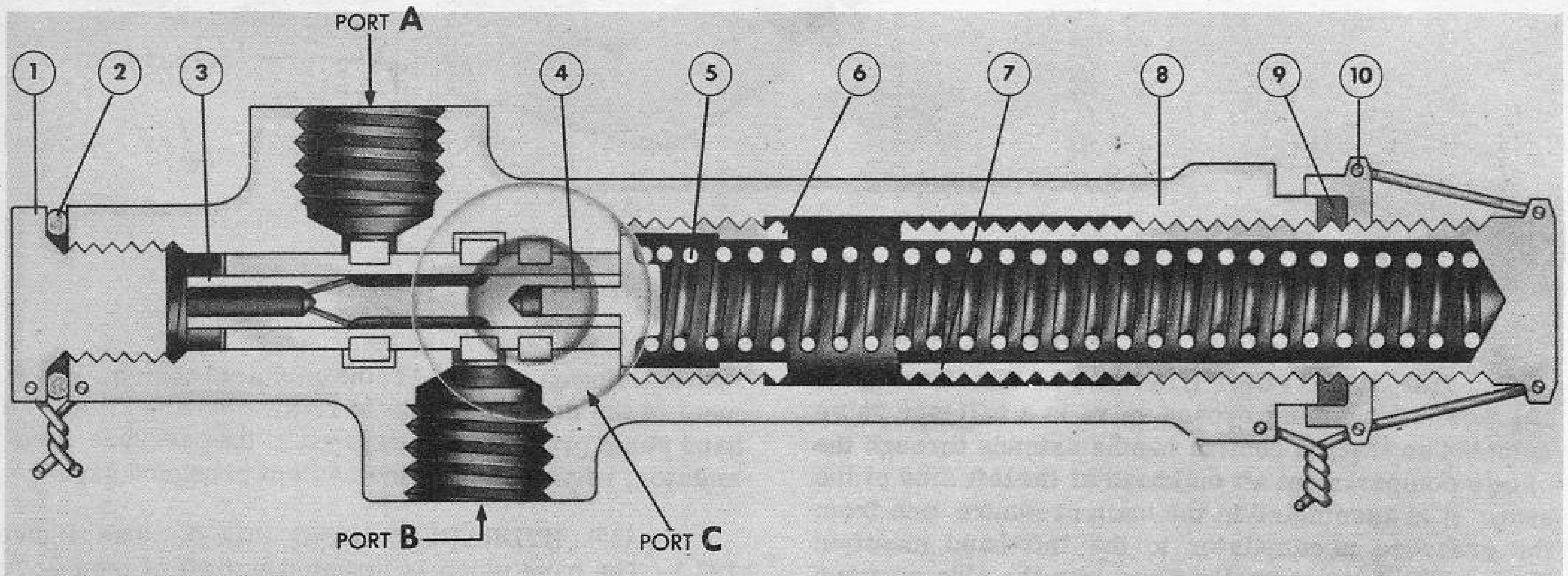
(15) HYDRAULIC HAND PUMP. (See figure 192.) - The hand pump is mounted just aft of the pilot's compartment rear bulkhead, with the handle extending forward into the pilot's compartment along the left side of the seat. The pump has an intake port at its aft end and a pressure port at its forward end. Assuming the handle to be in the UP position, the chamber forward of the piston head to be full of fluid, the operation is as follows: As the handle moves down, the chamber aft of the piston is drawn full of fluid, and the fluid in the chamber on the forward side of the piston will be forced out of the pressure port. The maximum

capacity of the forward chamber (piston in aft position) is only one-half that of the rear chamber (with piston in forward position); therefore, when the handle is moved up, and the fluid in the aft chamber is displaced through the piston check valve, half of it is forced out of the pressure port, due to the smaller

(16) WING FLAP RELIEF VALVE. (See figure 193.) - Pressure is applied at port A and normally flows through the valve and out port B to the actuating strut. Operation of the wing flaps above a speed of 180 miles per hour will cause a back pressure greater than 225 ± 25 pounds per square inch in the line between the relief valve and the actuating strut. With the valve adjusted properly, the piston will move down against the spring, and after approximately 1/4 inch of travel it will connect port B to port C. This will allow the excess pressure to be relieved to the reservoir. As soon as the air speed is lowered or the wing flaps are retracted, the pressure will reduce and the spring will force the piston back to its normal position. capacity of the forward chamber. As the handle is moved down, the fluid left in the forward chamber after the up stoke is forced out of the pressure port. At the same time the rear chamber is drawn full of fluid. This completes one cycle of operation.

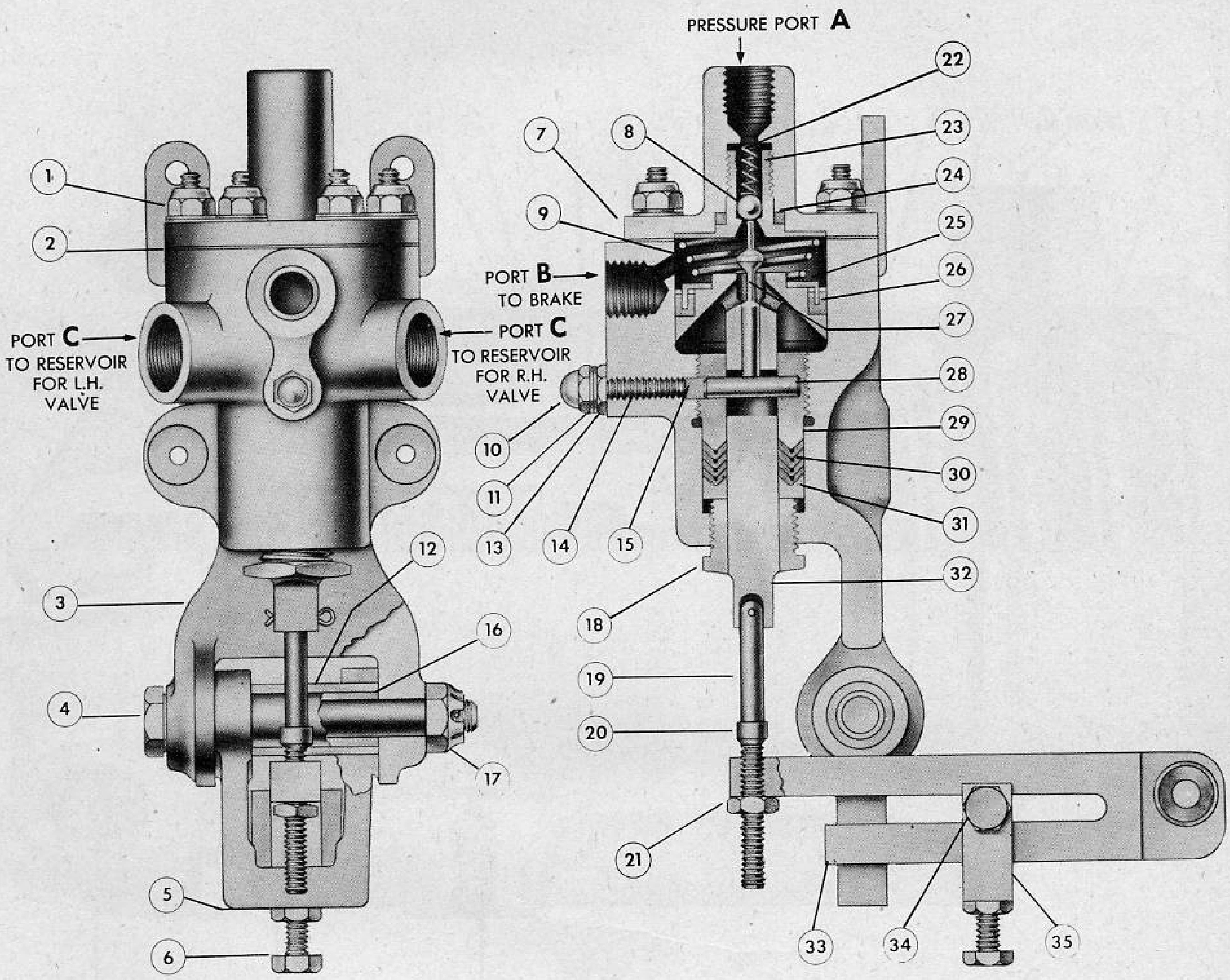
(17) BRAKE CONTROL VALVE. (See figure 194.) - When toe pressure is applied to a pedal, the piston seats with the piston valve and both move upward unseating the ball, allowing the hydraulic system pressure to enter the valve at port A and be diverted into the brake line. When the pressure in the brake line and the upper side of the piston becomes greater than the load applied to the pedals, the piston will move down until the ball is seated. If the pressure is still too great, the piston will continue to move downward until the piston valve is raised off its seat by coming in contact with the cross pin. This allows the excess pressure to be relieved through the piston head and out port C. If the pedals are fully released, all the fluid pressure will be relieved.

(18) BRAKE DEBOOSTER. (See figure 195.) - Since the disk type brakes on this airplane use lower hydraulic pressure and larger quantities of fluid in their operation than brakes of the shoe type, a debooster is installed in the brake line. This unit reduces the system pressure (825 to 875 pounds per square inch) to 135 pounds, and increases the fluid displacement. The fluid from the brake control valve is applied through port A and moves the piston forward against the large spring. The difference between the inner and outer diameters of the piston causes the reduction in pressure. A small breather hole D is provided to prevent the formation of a vacuum behind the piston when it moves forward during the application of the brakes. This breather also allows the air behind the



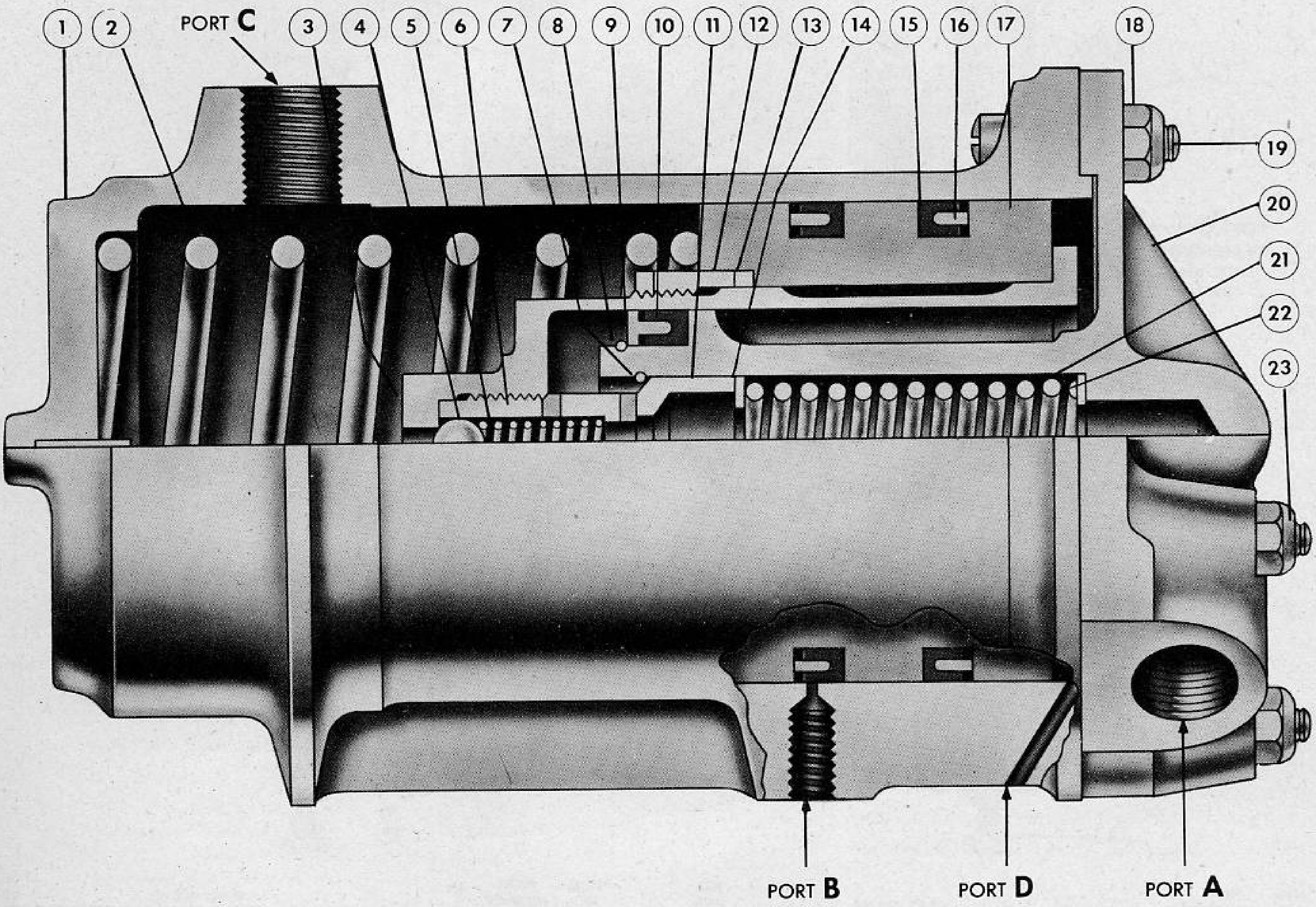
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1011656	PLUG, HYDRAULIC FLAP RELIEF VALVE PISTON	1
2.	AN900-8	GASKET	1
3.	1064176	PISTON, HYDRAULIC FLAP RELIEF VALVE	1
4.	1047880	GUIDE, HYDRAULIC FLAP RELIEF VALVE SPRING	1
5.	1077312	SPRING, HYDRAULIC FLAP RELIEF VALVE	1
6.	1047881	STOP, HYDRAULIC FLAP RELIEF VALVE	1
7.	1047882	PLUG, HYDRAULIC FLAP RELIEF VALVE SPRING ADJUSTING	1
8.	4061713	BODY ASSEMBLY, HYDRAULIC FLAP RELIEF VALVE	1
9.	143908-024SR030-125	WASHER	1
10.	1047883	NUT, HYDRAULIC FLAP RELIEF VALVE	1

Figure 193 - WING FLAP RELIEF VALVE



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AN310-4	NUT	6
	AN960-416	WASHER	6
2.	1059761	GASKET, POWER BRAKE CONTROL COVER	1
3.	5059485	HOUSING ASSEMBLY, POWER BRAKE CONTROL VALVE—L.H.	1
	5059485-1	HOUSING ASSEMBLY, POWER BRAKE CONTROL VALVE—R.H.	1
4.	AN6-30	BOLT	1
5.	AN316-4R	NUT	1
6.	110242-4-5AH	BOLT, SPECIAL FULL THREADED	1
7.	1059760	COVER, POWER BRAKE CONTROL HOUSING	1
8.	1/4" DIA.	BALL, BRIGHT STEEL	1
9.	1007337	SPRING, POWER BRAKE CONTROL VALVE MAIN	1
10.	10-32	NUT, BRASS CAP	1
11.	143908-006TC-012-040	WASHER	2
12.	2033900-10D049-24	TUBE	1
13.	AN315-3R	NUT	1
14.	1007693	SCREW, POWER BRAKE CONTROL VALVE ADJUSTING NUT LOCK	1
15.	5068111-102	PLUG	1
16.	1073362	SPACER, BRAKE VALVE FORK	1
17.	AN310-6	NUT	1
18.	1007329	NUT, POWER BRAKE CONTROL VALVE PACKING	1
19.	1007965	LINK, POWER BRAKE CONTROL VALVE PISTON OPERATING	1
20.	1005307	SCREW, POWER BRAKE CONTROL VALVE OPERATING LEVER ADJUSTING	1
21.	AN316-5R	NUT	1
22.	1007336	SPRING, POWER BRAKE CONTROL VALVE	1
23.	1024864	SEAT, POWER BRAKE CONTROL VALVE	1
24.	143908-016TC020-064	WASHER	1
25.	1024866	SPACER, POWER BRAKE CONTROL VALVE SPRING	1
26.	1044344-G-104	CUP, 3/16" x 3/16" HYDRAULIC PACKING WIDE BASE	1
27.	1024865	PIN, POWER BRAKE CONTROL VALVE OPERATING	1
28.	1007332	PIN, POWER BRAKE CONTROL VALVE GUIDE	1
29.	1007331	NUT, POWER BRAKE CONTROL VALVE ADJUSTING	1
30.	5135865-4X-016	PACKING, HYDRAULIC CHEVRON	4
31.	1007330	SPACER, POWER BRAKE CONTROL VALVE PACKING	1
32.	1024867	PISTON, POWER BRAKE CONTROL VALVE	1
33.	2007339	LEVER ASSEMBLY, POWER BRAKE CONTROL VALVE LIGHT OPERATING	1
34.	1074050	BOLT, BRAKE LEVER CLAMP	1
	AC365-428	NUT	1
35.	1072046	CLAMP, POWER BRAKE LEVER FULCRUM	1

Figure 194 - **BRAKE CONTROL VALVE**



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4073961	HOUSING ASSEMBLY, BRAKE DEBOOSTER	1
2.	1073371	SPRING, DEBOOSTER PISTON RETURN	1
3.	2073889	CYLINDER, BRAKE DEBOOSTER INNER	1
4.	9/32" DIA.	BALL, STEEL	1
5.	1073372	SPRING, DEBOOSTER EQUALIZING VALVE	1
6.	1074551	GUIDE, DEBOOSTER EQUALIZING VALVE	1
7.	1073370	RETAINER, DEBOOSTER SPRING STOP	1
8.	1073399	RETAINER, DEBOOSTER CUP SPACER	1
9.	1073398	SPACER, DEBOOSTER INNER CUP	1
10.	1049003-D-100	CUP, 3/16" x 3/16" HYDRAULIC PACKING FLARED	1
11.	1073369	STOP, DEBOOSTER RELIEF SPRING	1
12.	1073374	NUT, BRAKE DEBOOSTER GASKET	1
13.	143908-120SR126-094	WASHER	1
14.	1074550	WASHER, DEBOOSTER RELIEF SPRING	*4
15.	1049003-D-204	CUP, 3/16" x 3/16" HYDRAULIC PACKING FLARED	2
16.	1073397	SPACER, DEBOOSTER OUTER CAP	2
17.	2073896	PISTON, BRAKE DEBOOSTER	1
18.	AC365-10L	NUT	8
	AN960-10L	WASHER	8
19.	AN502-10-16	SCREW	6
20.	2073880	COVER, BRAKE DEBOOSTER	1
21.	1073373	SPRING, DEBOOSTER RELIEF	1
22.	AN960-D516	WASHER	*1
23.	AN502-10-26	SCREW	2

*Use as necessary.

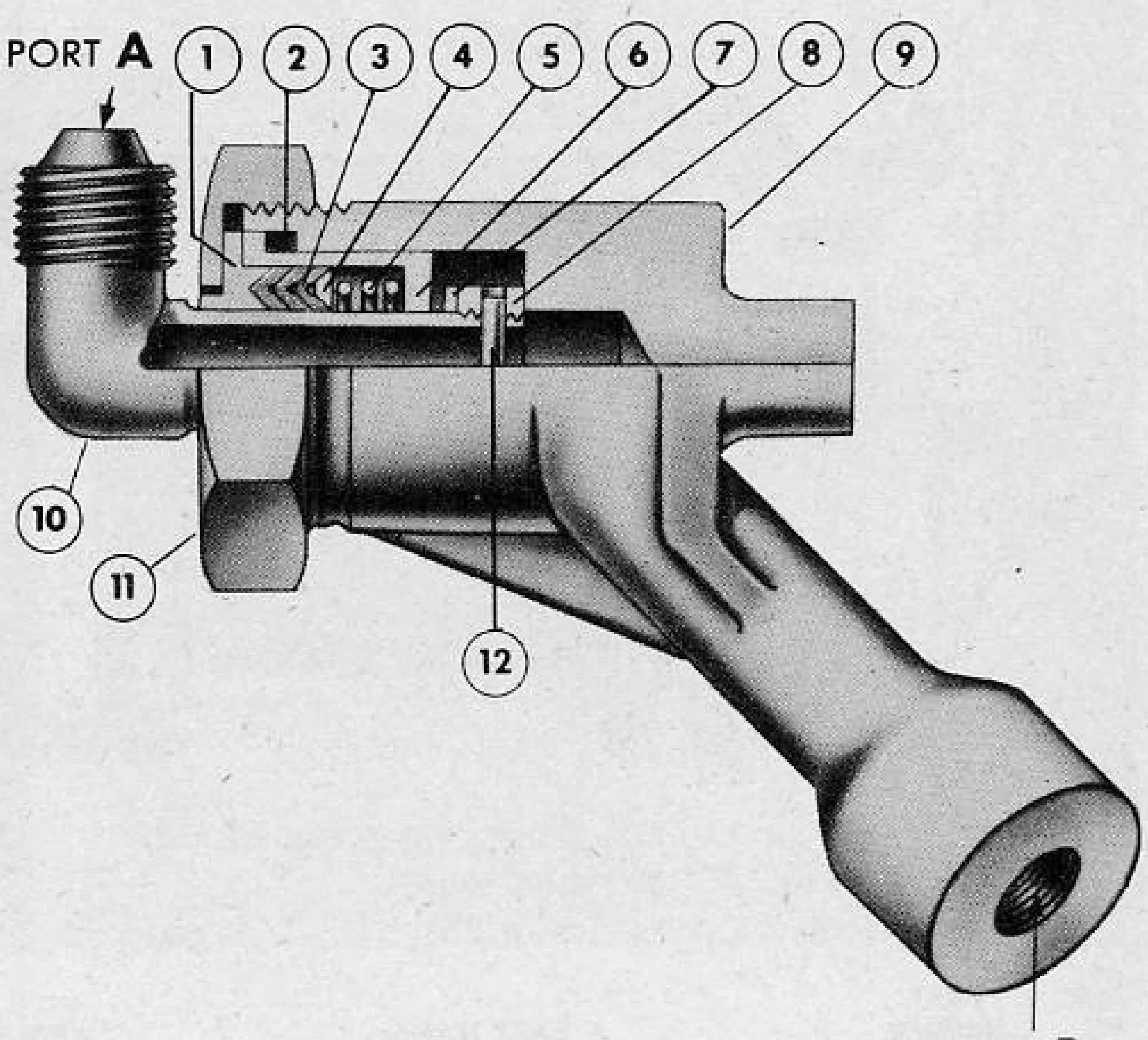
Figure 195 - BRAKE DEBOOSTER

piston to escape quickly when the piston moves back during the release of brakes. In normal operation the fluid pressure at port A is prevented from entering the large chamber outside the piston by the ball check valve in the head of the piston. Should the quantity of fluid in the large chamber diminish due to a leak while the brakes are applied, the pressure at port A will force the piston forward, further compressing the large spring. If the leak continues until the piston gets to the end of its stroke, the small pin in the end of the de-booster housing will unseat the piston ball check and allow the fluid from port A to replenish the large chamber. When the pressures on each side of the valve become equalized, the ball will reseat. Thermal expansion of the fluid in the large chamber is relieved through the bleed hole B in the lower side of the de-booster housing. The bleed hole is normally covered by the pressure sealing cup, but if the fluid in the large chamber continues to expand and the piston reaches the end of its stroke, the bleed hole is uncovered and the excess fluid will seep out.

(19) BRAKE LINE SWIVEL JOINT. (See figure 196) - A swivel joint is incorporated in each brake line at the inboard end of the lower shaft of each main landing gear assembly. Placing it at the point of landing gear rotation eliminates the necessity for using flexible hose to allow for movement of the gear.

(20) ACTUATING STRUTS. (See figure 197.)

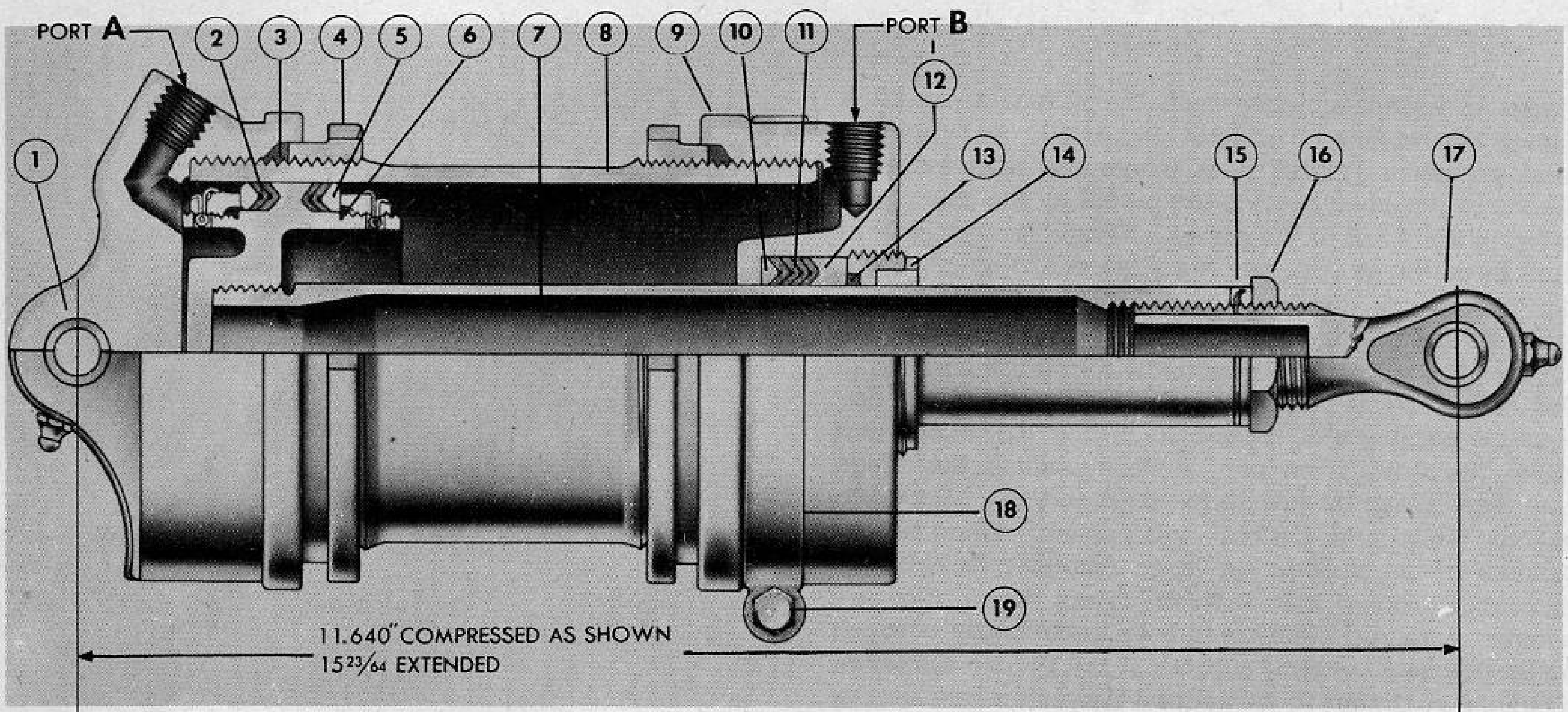
(a) GENERAL. - All the actuating struts incorporated in this airplane, except the nose wheel and main landing gear actuating struts, are identical in their arrangement and operation. The only difference is the variance of diameter and length of stroke of each strut to suit its particular need. The cylinder assembly of each strut consists of a tubular steel sleeve with aluminum alloy fittings threaded over each end and held in place by lock rings. The fitting which forms the cylinder head has a lug on the end through which a bolt may be inserted for mounting the strut in the airplane. The fitting which forms the piston end of the strut incorporates a chevron type piston packing gland that is held in place by packing rings and a retainer nut. Since the piston of the bomb door strut extends beyond the ends of the cylinder, the strut has two ends of the piston type. In all cases, each end fitting has a port for attaching a hydraulic line. The piston assembly consists of a tubular steel piston rod threaded and



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1058024	COVER, HYDRAULIC BRAKE SWIVEL JOINT	1
2.	143908-029SR102-093	WASHER	1
3.	135865-3G-014C	RING, CHEVRON PACKING	3
4.	179261-014-026	RING, CENTER PACKING	1
5.	1058130	SPRING, HYDRAULIC BRAKE SWIVEL JOINT PACKING	1
6.	1058025	CUP, HYDRAULIC BRAKE SWIVEL JOINT	1
7.	143908-014B020-062	WASHER	1
8.	1058026	NUT, HYDRAULIC BRAKE SWIVEL JOINT	1
9.	4067910	BODY, HYDRAULIC BRAKE SWIVEL JOINT —L.H.	1
	4067910-1	BODY, HYDRAULIC BRAKE SWIVEL JOINT —R.H.	1
10.	1058028	ELBOW, HYDRAULIC BRAKE SWIVEL JOINT	1
11.	1058023	CAP, HYDRAULIC BRAKE SWIVEL JOINT	1
12.	4067911-2	PIN, HYDRAULIC BRAKE SWIVEL JOINT	1

Figure 196 - BRAKE LINE SWIVEL JOINT

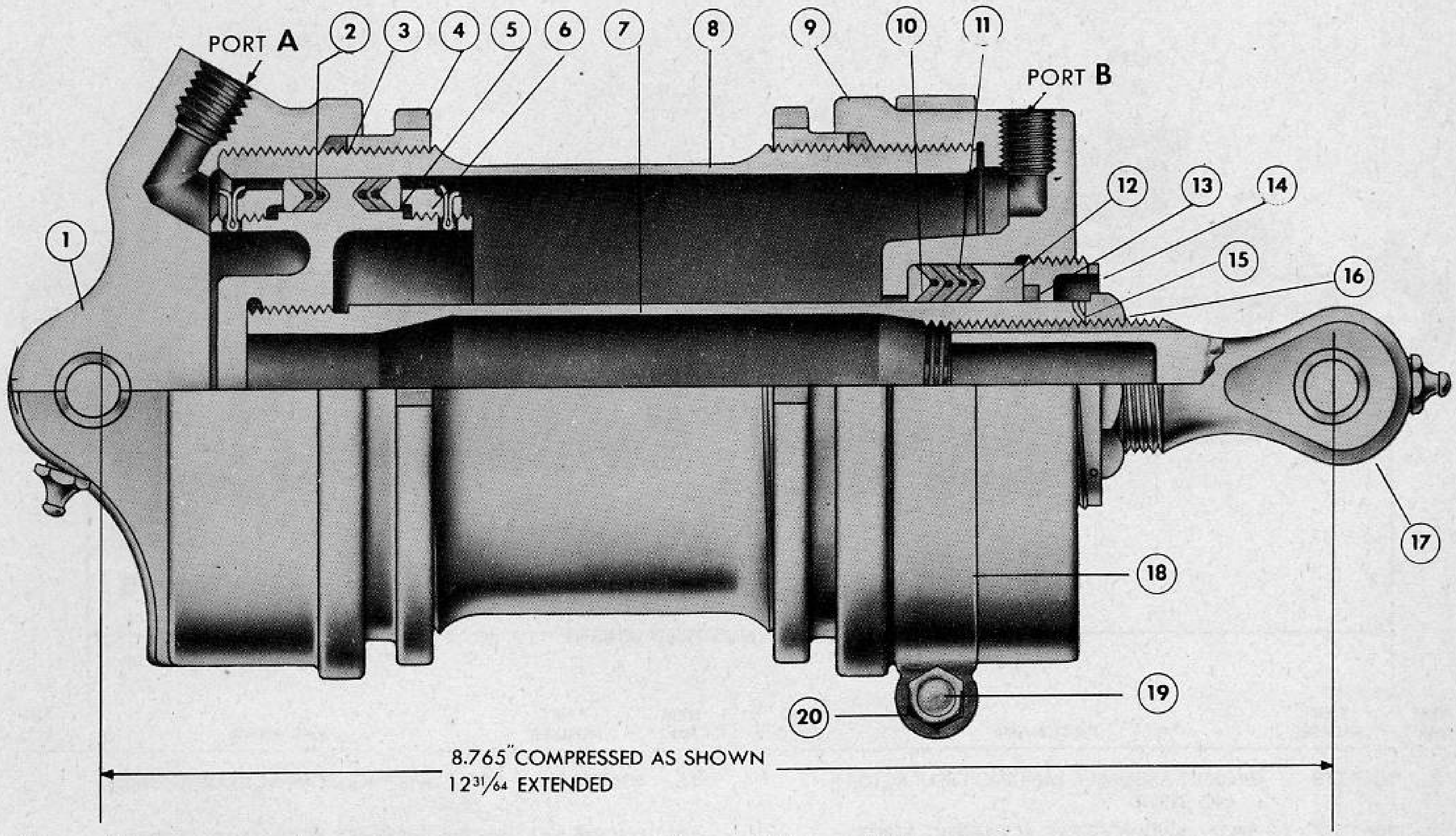
sweat soldered into a bronze piston head. The piston head incorporates two sets of chevron type packings similar to those in the piston end of the cylinder, both units being held in place by packing rings (which keep the packings in shape) and retainer nuts. The operation of an actuating strut is as follows: When pressure is



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4067891	END ASSEMBLY, WING FLAP ACTUATING STRUT	1
2.	5135865-4X-212	PACKING, HYDRAULIC CHEVRON	4
3.	1111908-308-314-187	GASKET, EXTERNAL SEAL RING	2
4.	2067361	RING, WING FLAP ACTUATING STRUT PACKING SEAL	2
5.	1012954-B212-008	RING, END PACKING	2
6.	2103292	NUT, WING FLAP ACTUATING STRUT PACKING ADJUSTING	2
7.	2119378-2	PISTON ASSEMBLY, WING FLAP ACTUATING STRUT	1
8.	2103293	BARREL, WING FLAP ACTUATING STRUT	1
9.	4067892	HEAD, WING FLAP ACTUATING STRUT	1
10.	1012954-B104-008	RING, END PACKING	1
11.	5135865-4X-104	PACKING, HYDRAULIC CHEVRON	4
12.	1067761	RING, WING FLAP ACTUATING CYLINDER	1
13.	126221-2-18-22	WASHER, PACKING	1
14.	1056350	NUT, WING FLAP ACTUATING STRUT PACKING	1
15.	1074187	WASHER, WING FLAP ACTUATING STRUT LOCK	1
16.	1074186	NUT, WING FLAP ACTUATING STRUT CLEVIS LOCK	1
17.	2069472	BOLT ASSEMBLY, WING FLAP ACTUATING STRUT EYE	1
18.	2068410	CLAMP ASSEMBLY, WING FLAP ACTUATING STRUT	1
19.	AN3-13A	BOLT	1
	AC364-1032	NUT	1

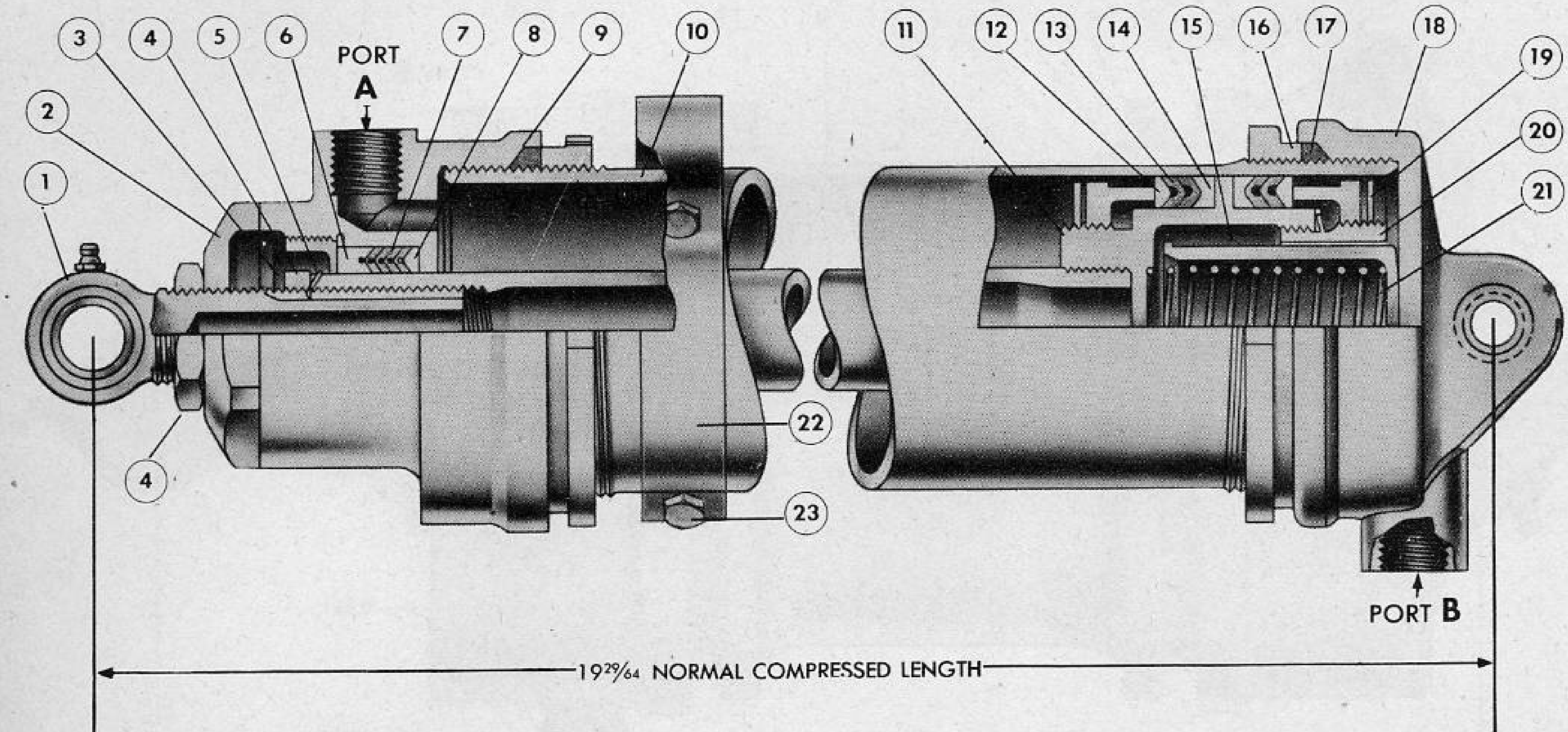
Figure 197 - INBOARD WING FLAP ACTUATING STRUT

applied to a port at one end of the strut, the piston moves toward the opposite end forcing the fluid that is ahead of it back through the selector valve to the reservoir. When the selector valve is moved to the opposite position, the same action takes place, only the piston moves in the other direction. For removal, disassembly, test, and installation of these various units, see paragraphs following.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4067891	END ASSEMBLY, WING FLAP ACTUATING STRUT	1
2.	5135865-4X-212	PACKING, HYDRAULIC CHEVRON	4
3.	1111908-308-314-187	GASKET, EXTERNAL SEAL RING	2
4.	2067361	RING, WING FLAP ACTUATING STRUT PACKING SEAL	2
5.	1012954-B212-008	RING, END PACKING	2
6.	2103292	NUT, WING FLAP ACTUATING STRUT PACKING ADJUSTING	2
7.	2119378-4	PISTON ASSEMBLY, WING FLAP ACTUATING STRUT	1
8.	2103293	BARREL, WING FLAP ACTUATING STRUT	1
9.	4067892	HEAD, WING FLAP ACTUATING STRUT	1
10.	1012954-B104-008	RING, END PACKING	1
11.	5135865-4X-104	PACKING, HYDRAULIC CHEVRON	4
12.	1067761	RING, WING FLAP ACTUATING STRUT	1
13.	126221-2-18-22	WASHER, PACKING	1
14.	1056350	NUT, WING FLAP ACTUATING STRUT PACKING	1
15.	1074187	WASHER, WING FLAP ACTUATING STRUT LOCK	1
16.	1074186	NUT, WING FLAP ACTUATING STRUT CLEVIS LOCK	1
17.	2069472	BOLT ASSEMBLY, WING FLAP ACTUATING STRUT EYE	1
18.	2068410	CLAMP ASSEMBLY, WING FLAP ACTUATING STRUT	1
19.	AN3-13A	BOLT	1
20.	AC364-1032	NUT	1

Figure 198 - OUTBOARD WING FLAP ACTUATING STRUT



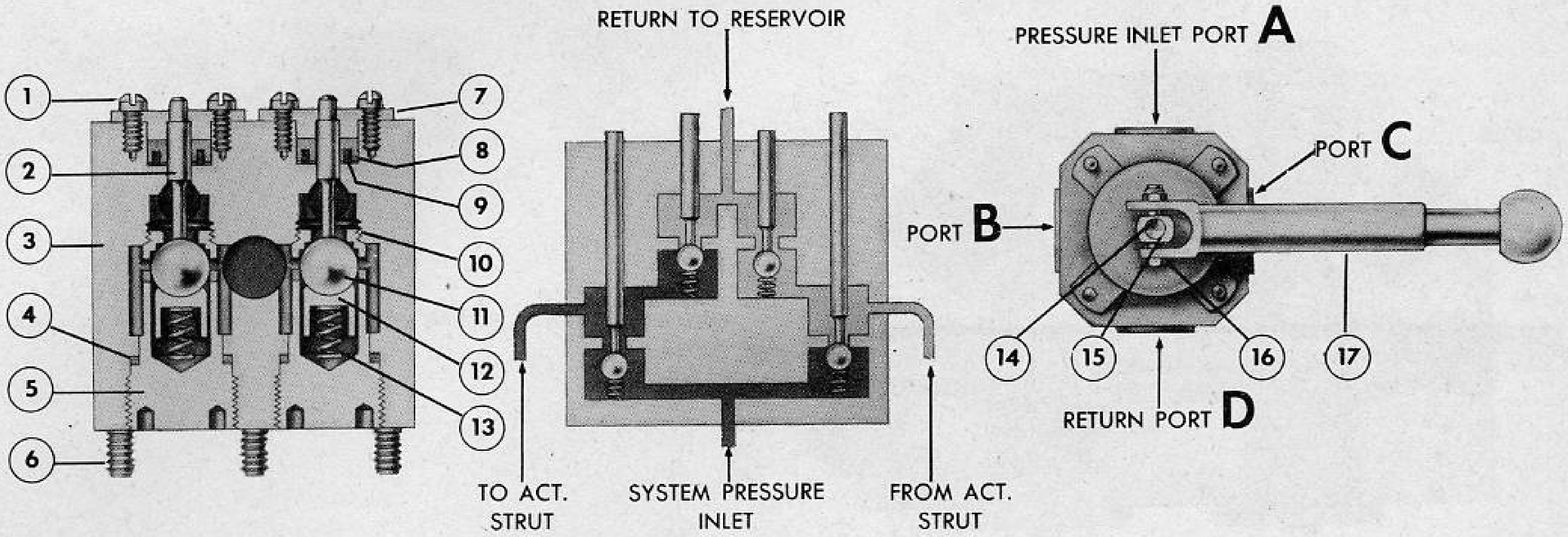
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	2067378	EYEBOLT ASSEMBLY, LANDING GEAR ACTUATING STRUT	1
2.	2067357	STOP, LANDING GEAR ACTUATING STRUT PISTON	1
3.	2067359	GLAND, LANDING GEAR ACTUATING STRUT	1
4.	1067677	NUT, CHECK	2
5.	1067764	WASHER, LANDING GEAR ACTUATING STRUT LOCK	1
6.	1067761	RING, LANDING GEAR ACTUATING STRUT	1
7.	5135865-4X-104	PACKING, HYDRAULIC CHEVRON	4
8.	179261-104-120	RING, CENTER PACKING	1
9.	4067825	END, LANDING GEAR ACTUATING STRUT	1
10.	4067803	BARREL, LANDING GEAR ACTUATING STRUT	1
11.	2067299	PISTON ASSEMBLY, LANDING GEAR ACTUATING STRUT	1
12.	179261-204-224	RING, CENTER PACKING	2
13.	5135865-5X-204	PACKING, HYDRAULIC CHEVRON	4
14.	1012953-B204-010	RING, CENTER PACKING	2
15.	2067317	DASH-POT, LANDING GEAR ACTUATING STRUT	1
16.	2067284	RING, LANDING GEAR ACTUATING STRUT SEAL	2
17.	1111908-304-310-187	GASKET, EXTERNAL SEAL RING	2
18.	4067826	HEAD ASSEMBLY, LANDING GEAR ACTUATING STRUT	1
19.	2067329	NUT, LANDING GEAR ACTUATING STRUT PACKING	2
20.	2067330	RETAINER, LANDING GEAR ACTUATING STRUT DASH-POT	1
21.	2067331	SPRING, LANDING GEAR ACTUATING DASH-POT	1
22.	2068414	STRAP ASSEMBLY, LANDING GEAR ACTUATING STRUT	1
	AN3-13A	BOLT	1
	AN960-10	WASHER	1
	AC365-1032	NUT	1
	1068252	BLOCK, LANDING GEAR ACTUATING STRUT STRAP	2
23.	AN3-14A	BOLT	1
	AN960-10	WASHER	1
	AC365-1032	NUT	1

Figure 199 - MAIN ALIGHTING GEAR ACTUATING STRUT

(b) ALIGHTING GEAR ACTUATING STRUTS (See figure 199.) -The main landing gear and nose wheel gear actuating struts have a dash-pot unit in the piston head. The dash-pot comes into operation at the end of the LANDING GEAR DOWN stroke, its purpose being to ease the impact at the end of the stroke by retarding the movement of the gear. When the piston of the actuating strut is extended, LANDING GEAR UP, the dash-pot is extended about one inch by a spring, and the chamber under the dash-pot is filled with fluid. As the piston reaches the end of the LANDING GEAR DOWN stroke the dash-pot is compressed against the end of the cylinder, and the fluid beneath it is forced through its slides. This restriction of the escaping fluid impedes the motion of the piston.

(21) FOUR-WAY SELECTOR VALVES.

(a) GENERAL. (See figure 200.) - All of the four-way selector valves, except the bomb door



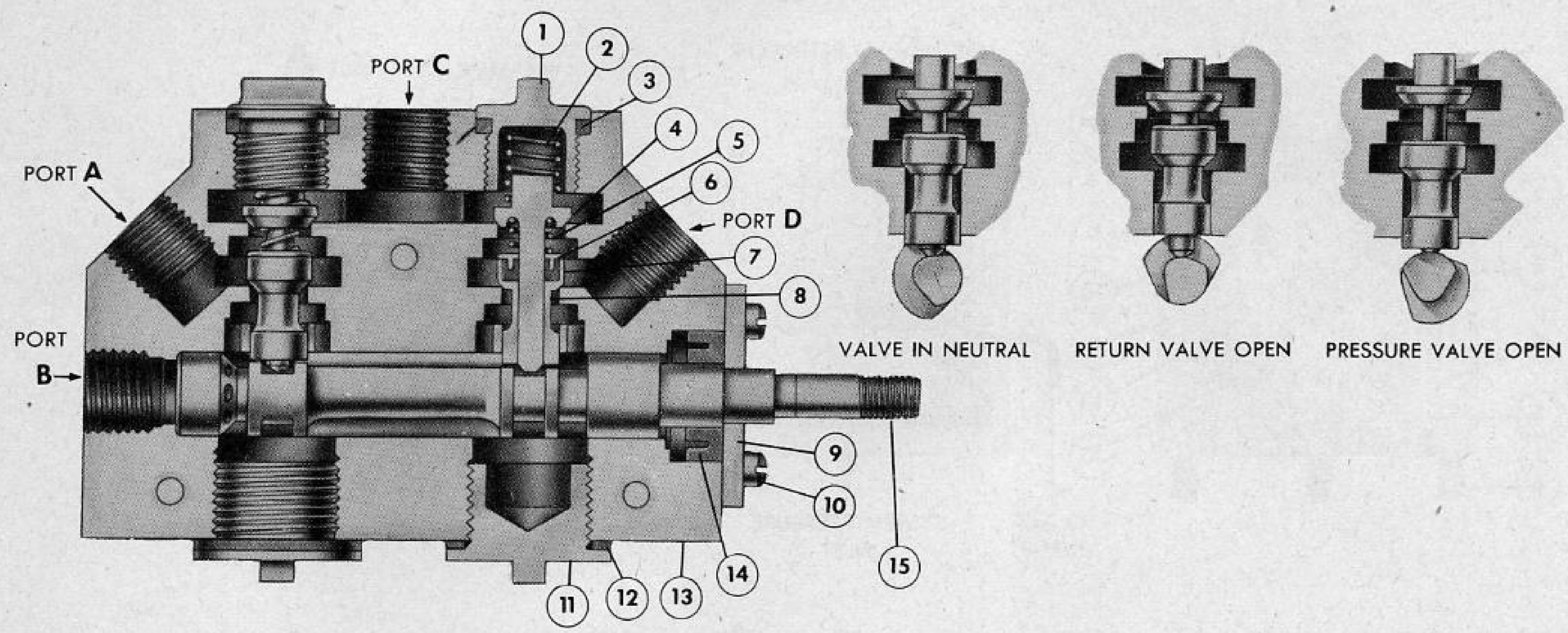
ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AC503-8-6	SCREW	8
2.	1056227	PLUNGER, HYDRAULIC SELECTOR VALVE	4
3.	4065505	BODY, COWL FLAP HYDRAULIC SELECTOR VALVE	1
	1063678	PLUG, HYDRAULIC SELECTOR VALVE BODY DRILL HOLE	1
	143908-008TC-016-064	WASHER	1
	AC895-B-100	PLUG	3
4.	143908-026SR-100-093	WASHER	4
5.	1056225	NUT, HYDRAULIC SELECTOR VALVE	4
6.	1056232	STUD, HYDRAULIC SELECTOR VALVE TWO-WAY	4
7.	1056228	GLAND, HYDRAULIC SELECTOR VALVE	4
8.	1049003-D-008	CUP, 3/16 x 3/16 HYDRAULIC PACKING FLARED	4
9.	163768-008-010	SPACER, HYDRAULIC PACKING CUP	4
10.	1064795	SEAT, NO. 6 BALL	4
11.	5/16 DIA.	BALL, BRIGHT STEEL	4
12.	1056253	RETAINER, SELECTOR VALVE	4
13.	1056230	SPRING, HYDRAULIC SELECTOR VALVE	4
14.	1056224	SHAFT, HYDRAULIC SELECTOR VALVE	1
	143908-016B022-002	WASHER	*6
	143908-016S022-030	WASHER	1
15.	2055537	CAM ASSEMBLY, SELECTOR VALVE	1
	143908-012B020-005	WASHER	*5
16.	AN3-13	BOLT	1
	AN960-10	WASHER	1
	AC310-3	NUT	1
	178166-190-249-014	SPACER	2
17.	2064907	LEVER ASSEMBLY, UPPER COWLING FLAP HYDRAULIC VALVE	1
	1056229	SPRING, LEVER	1

*Use as necessary

Figure 200 - FOUR-WAY SELECTOR VALVE

valve, incorporate four spring-retained ball checks which, when operated by the control handle, direct the flow of fluid. The valve control handle incorporates a round disk with the back face machined in the form of a cam with two high points opposite each other, and two low points also opposite each other, all four points being equidistant about the periphery. As the handle is rotated to any position, the high points of the cam depress two of the plungers which, in turn, unseat their respective ball checks. By depressing opposite ball checks in this manner, one line from the actuating strut is connected to the pressure side of the system, while the other is connected to the reservoir.

(b) **BOMB DOOR SELECTOR VALVE.** (See figure 201.) - This four-way selector valve consists of a housing with two poppet valve assemblies which are operated by the camshaft beneath them. Each valve assembly has an upper poppet that connects the pressure inlet chamber to a distribution port, and a lower poppet which connects the distribution port to the cam shaft chamber which acts as the relief port. In each valve assembly, the stem of the upper poppet extends down through the tubular stem of the lower poppet with each stem riding on its respective lift on the camshaft. When the handle is moved to either operating position, the upper poppet of one valve assembly and the lower poppet of the other are raised off their seats while the other two poppets remain seated. When the handle is moved to the other operating position, the reverse condition is true.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	A9101	CAP, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	2
2.	A9109	SPRING, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE UPPER	2
3.	S304-A-685-566-0375	WASHER, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE CAP	2
4.	A9104	STEM, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	2
5.	A9105	SPRING, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE LOWER	2
6.	A9106	SPACER, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	2
7.	A9107	CUP, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	2
8.	A9108	GUIDE, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE STEM	2
9.	A9114	RETAINER, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	1
10.	AC503-6-6	SCREW	4
11.	A9616	PLUG, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	2
12.	S303-8A	WASHER, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE PLUG	2
13.	G9117	BODY, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	1
14.	39113-D-012	CUP, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE SHAFT	1
15.	B9115	SHAFT, HYDRAULIC BOMB BAY DOOR SELECTOR VALVE	1

Figure 201 - BOMB DOOR SELECTOR VALVE

b. TROUBLE SHOOTING PROCEDURE

TROUBLE	POSSIBLE CAUSE	REMEDY
REGULATING VALVE OPERATES TOO FREQUENTLY	External leakage in power system.	Inspect all lines, fittings and hydraulic units for signs of leakage. Replace faulty fittings.
	Internal leakage in wing flap system	Remove, disassemble and repair or replace four-way selector valve.
	Leakage in cowl flap, alighting gear, carburetor air filter or bomb bay door systems	Remove and repair or replace defective units.
	Leakage in system relief valve, alighting gear relief valve or brake control valve	Remove and repair or replace defective valves
EXCESSIVE PRESSURE DROP WHEN ALIGHTING GEAR CONTROL IS OPERATED	External leakage in alighting gear system.	Repair or replace parts where leakage occurs.
	Leakage past piston packings in actuating struts	Disassemble actuating strut and replace packing.

TROUBLE	POSSIBLE CAUSE	REMEDY
COWL OR WING FLAPS FAIL TO RESPOND TO PILOT'S CONTROL	Internal or external leakage	Remove, disassemble and repair faulty unit.
BOMB DOORS FAIL TO RESPOND	External leakage.	Repair or replace.
	Leakage in actuating strut.	Remove, disassemble and repair.
	Leakage in control valve	Remove and repair or replace.
EMERGENCY AIR BRAKE PRESSURE FAILS WHEN BRAKE HANDLE IS HELD IN OPEN POSITION	External leakage in air system.	Repair or replace parts where leakage occurs.
	Air leakage through hydraulic system.	Remove and inspect shuttle valve for damaged valve seat or fittings. Replace if necessary.
NO PRESSURE INDICATED BY AIR BRAKE SYSTEM GAGE	No air under pressure in emergency brake bottle	Inflate bottle to 400 pounds per square inch pressure and observe pressure gage for evidence of leaks.
	Defective air brake valve	Remove, disassemble and repair or replace
OPERATION OF REGULATING VALVE ACCOMPANIED BY NOISE AND EXTREME VARIATIONS OF PRESSURE GAGE.	Leakage through pressure accumulator	Remove and disassemble. Replace parts where necessary.
HYDRAULIC PRESSURE CONTINUES TO DROP WHEN BRAKES ARE PARKED	External leakage.	Repair or replace faulty parts.
	Leakage through brake control valve.	Plug return line at brake valve. If fluid issues from valve, indicating leakage, remove, disassemble and repair.
PRESSURE FLUCTUATES WHEN BRAKES ARE APPLIED	Leakage	No external leakage indicates trouble in brake control valve. Remove, disassemble and repair.
BRAKES DO NOT RESPOND	Faulty adjustment or mechanical failure between pedals and control valve.	Repair, replace or adjust mechanical parts where necessary.
HAND PUMP WILL NOT OPERATE	Too rapid manipulation of pump handle. Check valves do not have time to open and close.	Use steady, full strokes allowing sufficient time for check valves to operate.
	Air leak in suction line.	Tighten or replace fittings where leakage occurs.
	Intake check valve is stuck open.	Disassemble, repair or replace faulty parts where necessary.

TROUBLE	POSSIBLE CAUSE	REMEDY
LOSS OF PRESSURE	No fluid to pump.	Fill reservoir to proper level.
	Line failure	Repair or replace any lines or fittings found to be leaking on visual inspection.
	External leak at one of the units.	Remove, disassemble and repair or replace any unit found to be leaking.
	Clogged filter.	Disassemble and clean filter.

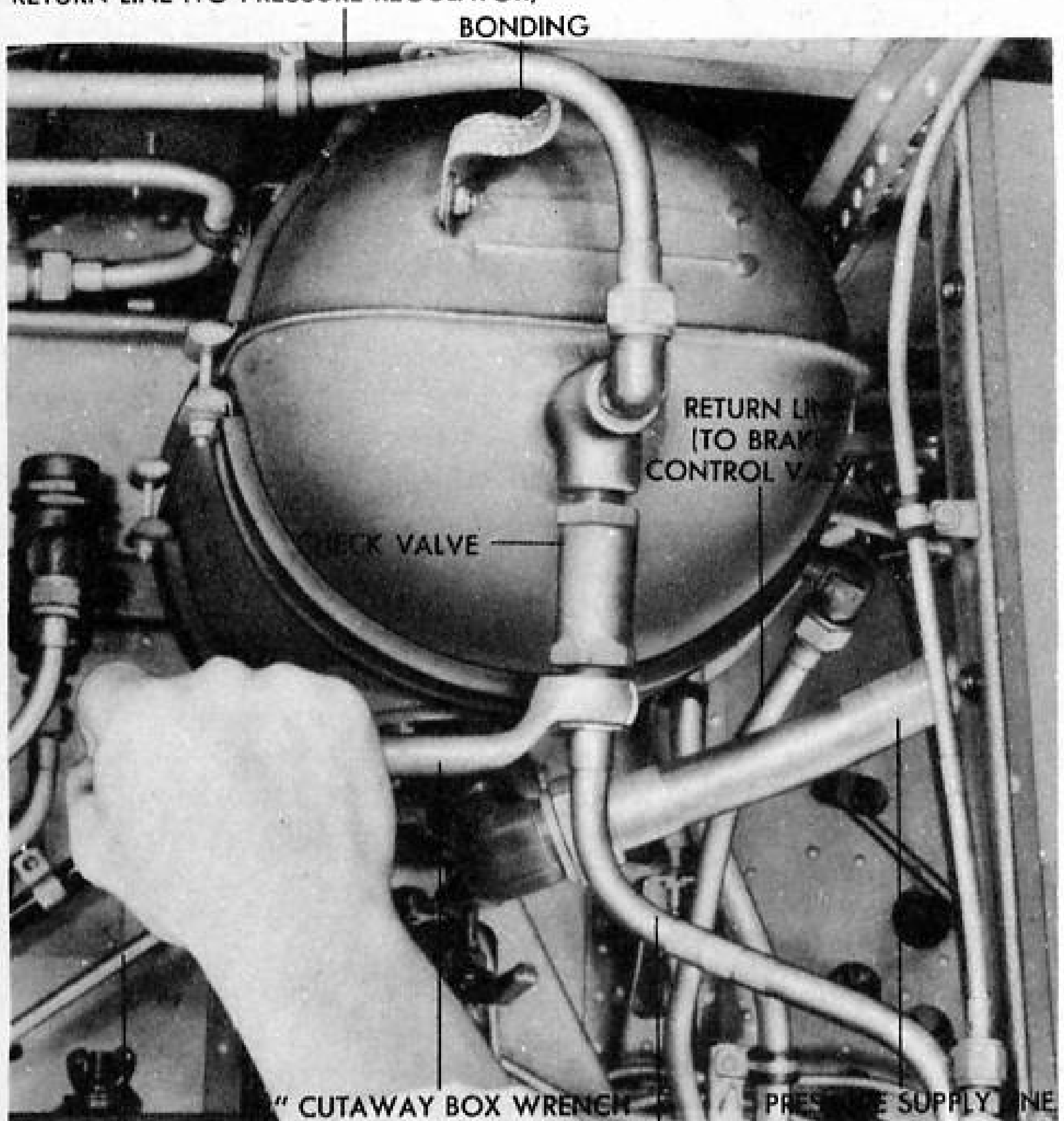


Figure 202 - REMOVING HYDRAULIC FLUID RESERVOIR

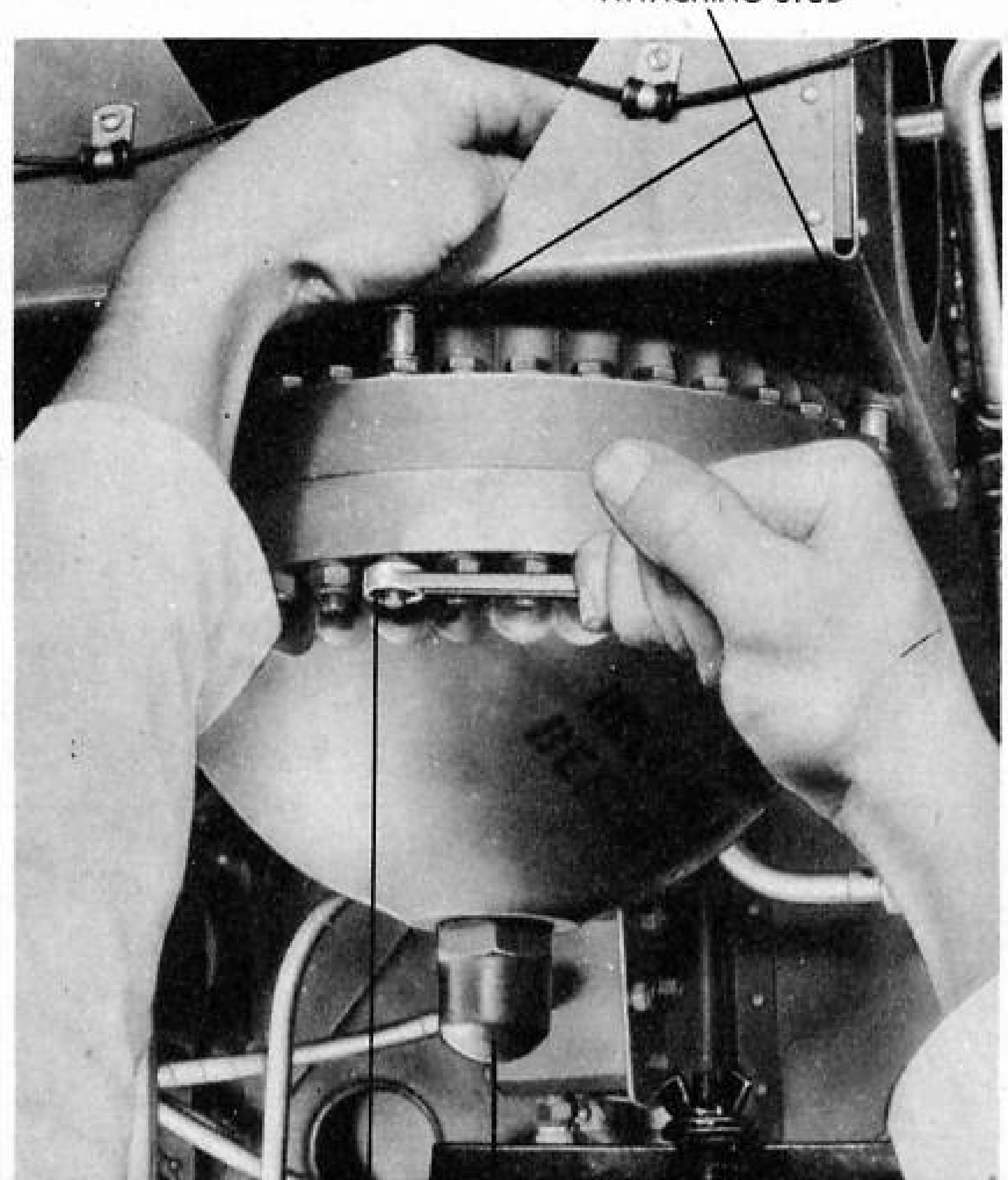


Figure 203 - REMOVING HYDRAULIC PRESSURE ACCUMULATOR

c. REMOVAL AND DISASSEMBLY.

(1) REMOVAL OF FLUID RESERVOIR. (See figure 202.)

(a) Relieve the pressure in the complete system by operating wing flaps up and down until the hydraulic pressure gage reads zero.

(b) Remove the drain plug in the bottom of the reservoir. Drain the reservoir.

(c) Disconnect and cap all lines.

(d) Remove the reservoir attaching bolts and remove reservoir.

(2) DISASSEMBLY OF FLUID RESERVOIR. (See figure 185.)

(a) Remove fluid gage rod.

(b) Remove the filler cap and strainer.

(c) Remove the fluid filter assembly.

(3) REMOVAL OF PRESSURE ACCUMULATOR. (See figure 203.)

(a) Relieve the pressure in the complete system by operating the wing flaps up and down until the hydraulic pressure gage reads zero.

(b) Relieve air pressure in the accumulator by loosening the valve assembly.

CAUTION

Loosen valve sufficiently to permit the air to escape slowly. Do not attempt to remove the valve assembly until the air pressure has been completely released.

(c) Disconnect and cap all lines.

(d) Remove attaching bolts and remove accumulator from airplane.

(4) DISASSEMBLY OF PRESSURE ACCUMULATOR. (See figure 186.)

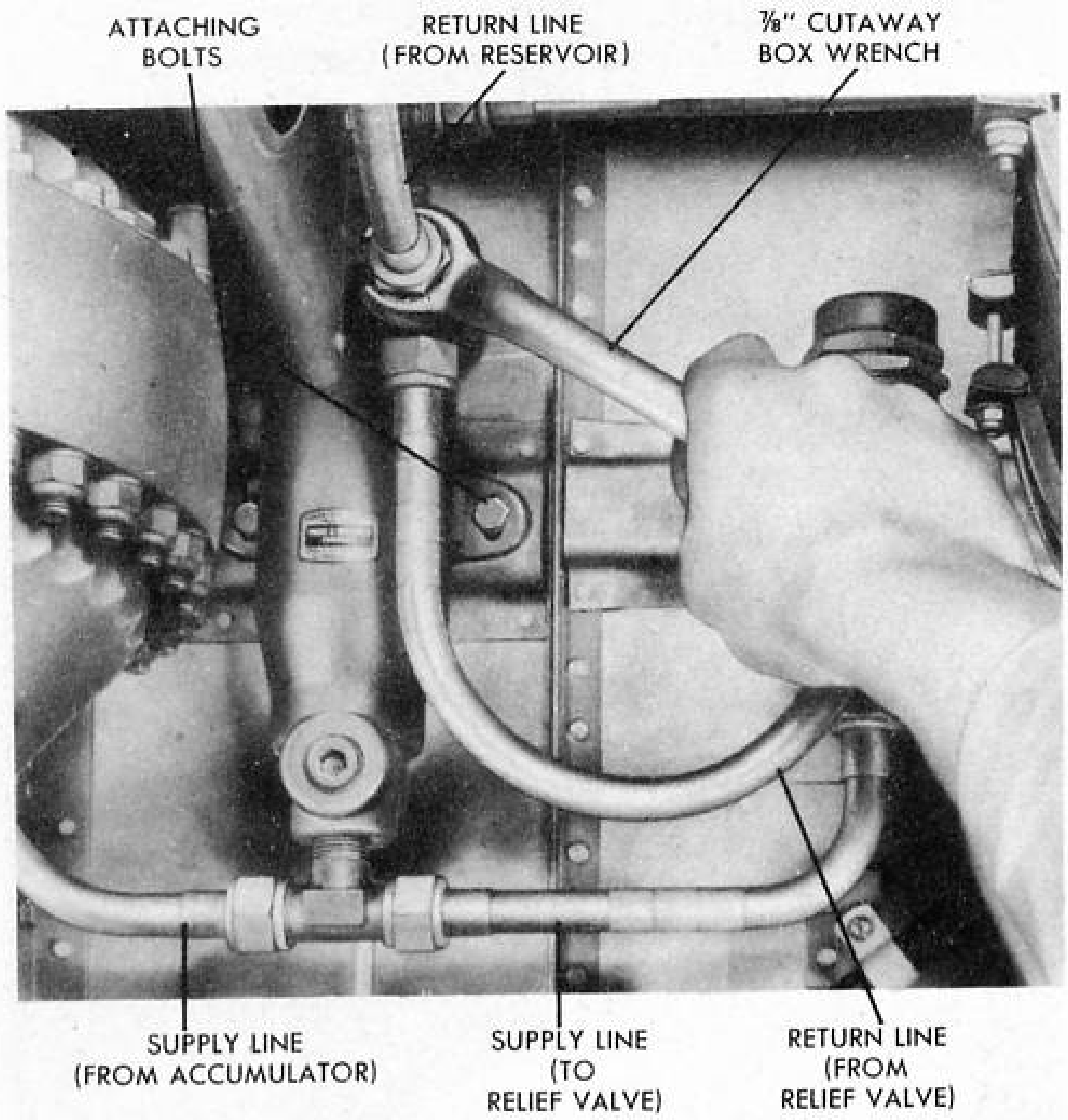
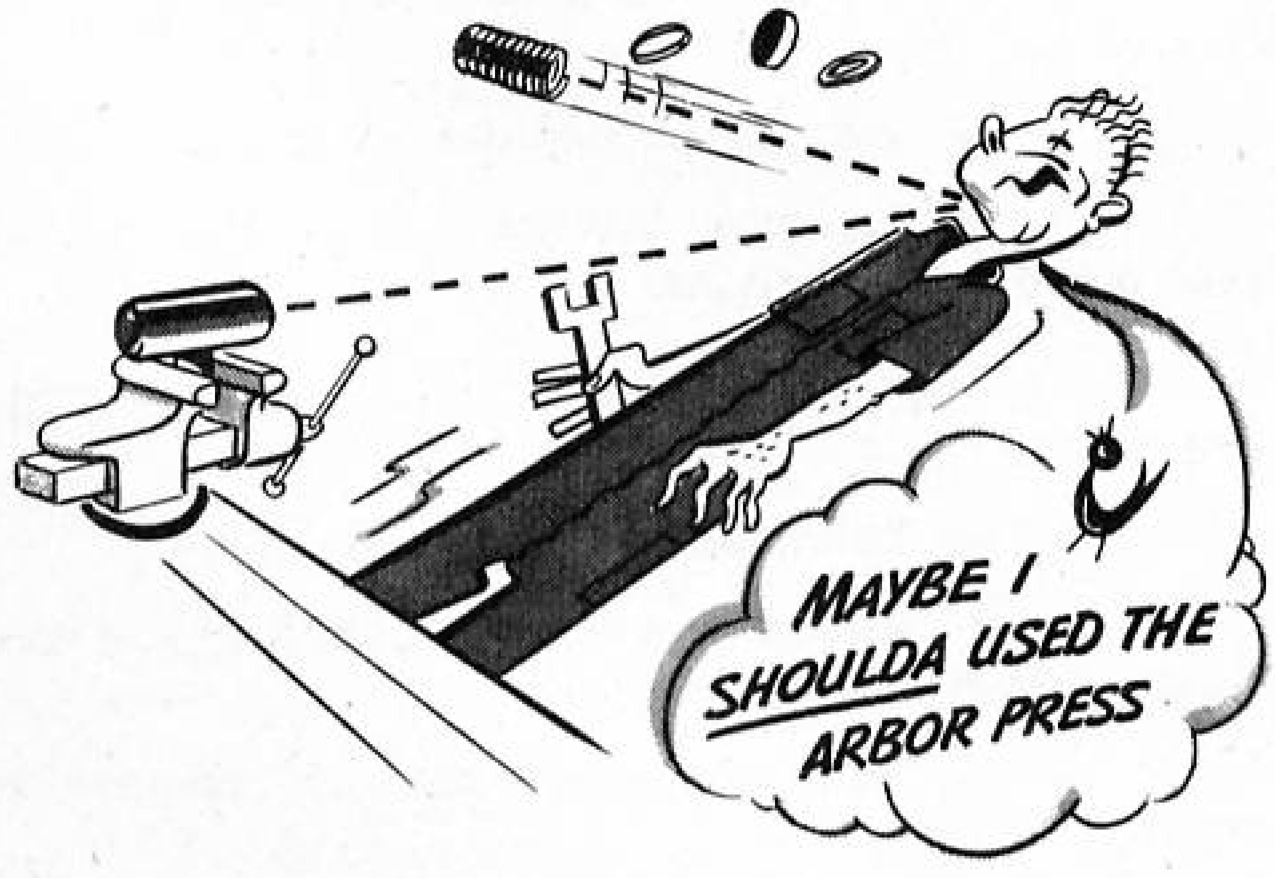


Figure 204 - REMOVING PRESSURE REGULATOR

(a) Remove valve cap nut and valve cap assembly.

(b) Remove cap nuts from studs and bolts connecting the two halves of the accumulator.

(c) Remove the two halves of the accumulator and the diaphragm.



WARNING

When disassembling the valve, take care in removing spring. It is loaded to approximately 415 pounds. Carelessness in this operation may result in serious injury to you. The valve must be held in an arbor press while unscrewing the end.

(5) REMOVAL OF PRESSURE REGULATOR. (See figure 204.)

(a) Relieve pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove the two attaching bolts on left pressure regulator.

(6) DISASSEMBLY OF PRESSURE REGULATOR. (See figure 187.)

(a) Place valve in an arbor press and unscrew the end.

(b) Pull out the piston, spring, and shims from body.

(c) Unscrew the packing nut, and remove packing and packing spring.

(7) REMOVAL OF DISCONNECT VALVES.

(a) Relieve the pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Cut lock wire and unscrew adapter nut. Remove adapter and adapter gasket (see figure 192).

(d) Remove lock nut (see figure 198) and lift valve from fire wall.

(8) DISASSEMBLY OF DISCONNECT VALVES. (See figure 188.)

(a) Cut lock wire and unscrew union from body.

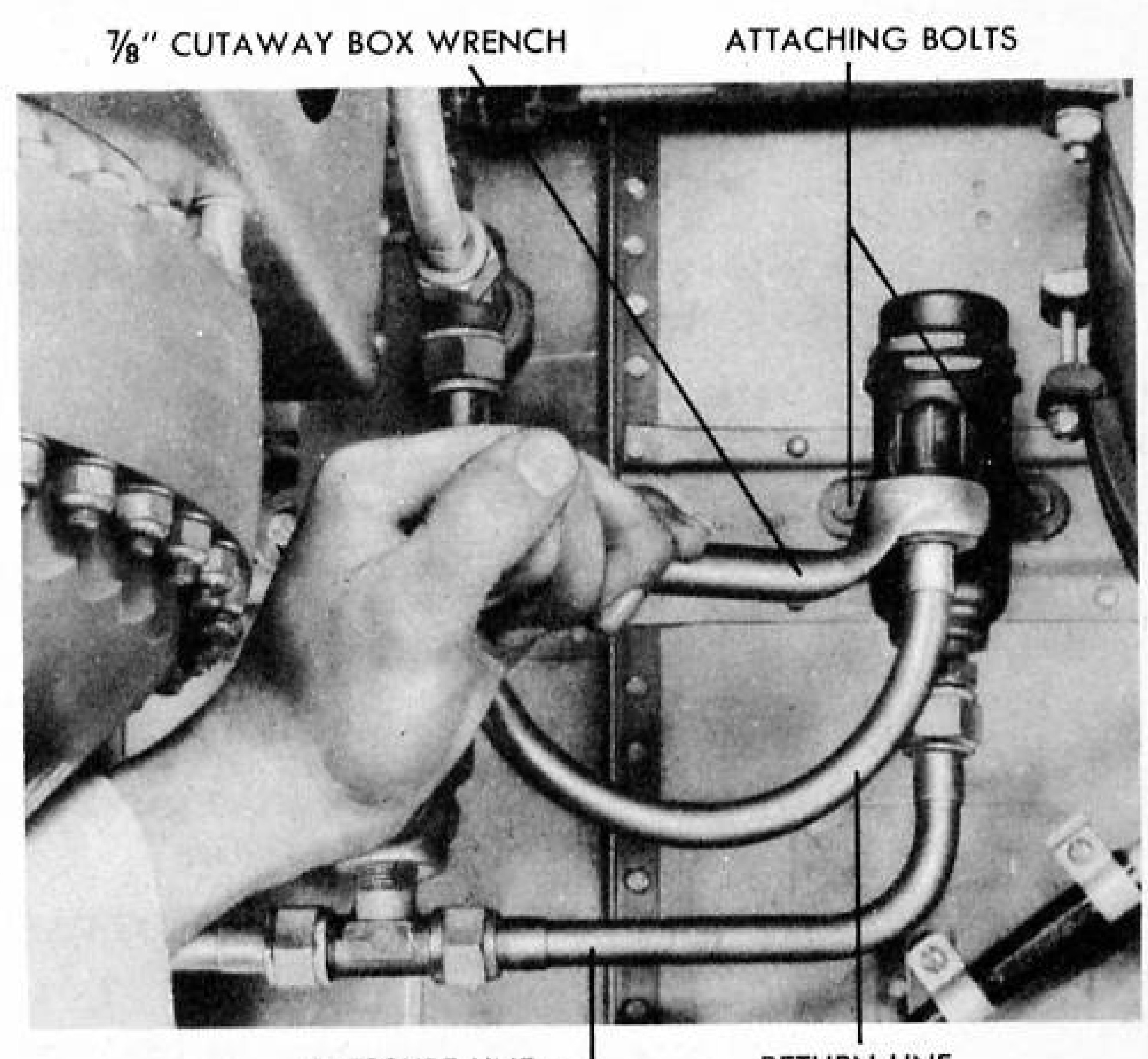


Figure 205 - REMOVING PRESSURE REGULATOR RELIEF VALVE

(b) Lift gaskets, spring, and ball from body.

(9) REMOVAL OF PRESSURE REGULATOR RELIEF VALVE. (See figure 205.)

(a) Relieve the pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove attaching bolts and remove valve.

(10) DISASSEMBLY OF PRESSURE REGULATOR RELIEF VALVE. (See figure 189.)

(a) Remove cap, gasket, and lock nut.

(b) Remove adjusting nut, permitting spring and guide to slide out.

(c) Remove seat fitting.

(11) REMOVAL OF ADJUSTABLE RELIEF VALVE.

(a) Relieve the pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove attaching bolts from valve and remove from airplane.

(12) DISASSEMBLY OF ADJUSTABLE RELIEF VALVE. (See figure 190.)

(a) Cut lock wires and loosen lock nut.

(b) Unscrew adjustment screw from body. Lift out seal from body. Remove lock nut from adjustment screw.

(c) Lift stem and steel ball assembly from body.

(d) If it is necessary to remove steel ball from stem, drill a small hole in center of stem and back of ball. Knock out ball.

(e) Remove ball seat from body.

(13) REMOVAL OF HAND PUMP BYPASS VALVE.

(a) Relieve the pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove attaching bolts from valve and remove valve from airplane.

(14) DISASSEMBLY OF HAND PUMP BYPASS VALVE. (See figure 191.)

(a) Disconnect and remove handle assembly.

(b) Unscrew spring retaining nut and lift seal, spring, and steel ball from body.

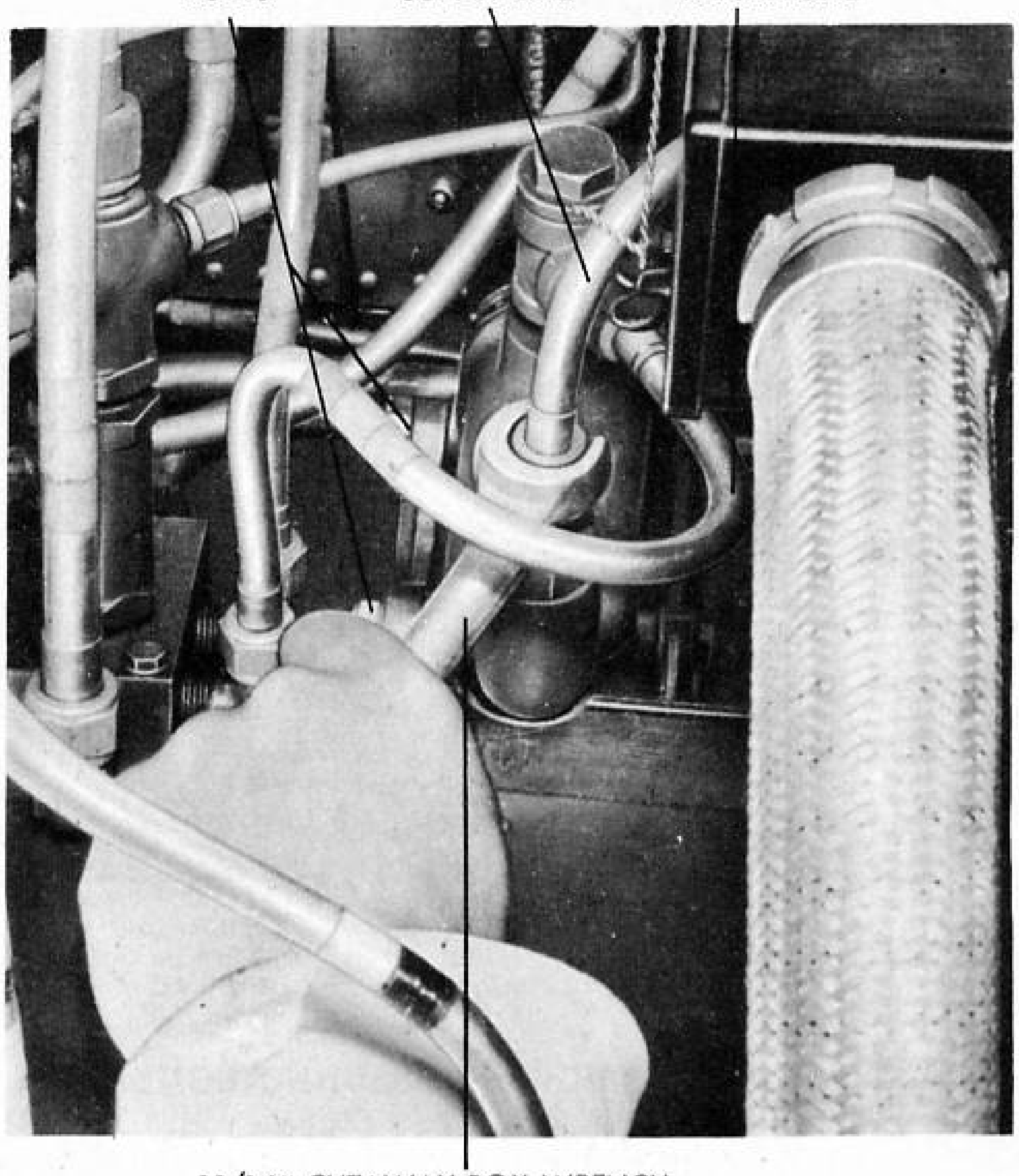


Figure 206 - REMOVING HAND PUMP

(c) Remove retainer nut and lift out plunger, spring, and cup packing.

(15) REMOVAL OF HAND PUMP. (See figure 206.)

(a) Relieve pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove attaching bolts and remove hand pump from airplane.

(16) DISASSEMBLY OF HAND PUMP. (See figure 192.)

(a) Disconnect handle assembly.

(b) Unscrew cylinder retaining nut from inside of body. Slide out piston.

(c) Unscrew piston head and remove cup packing.

(d) Remove check seat and lift out ball check and spring.

(17) REMOVAL OF WING FLAP RELIEF VALVE. (See figure 207.)

(a) Relieve pressure in the complete system.

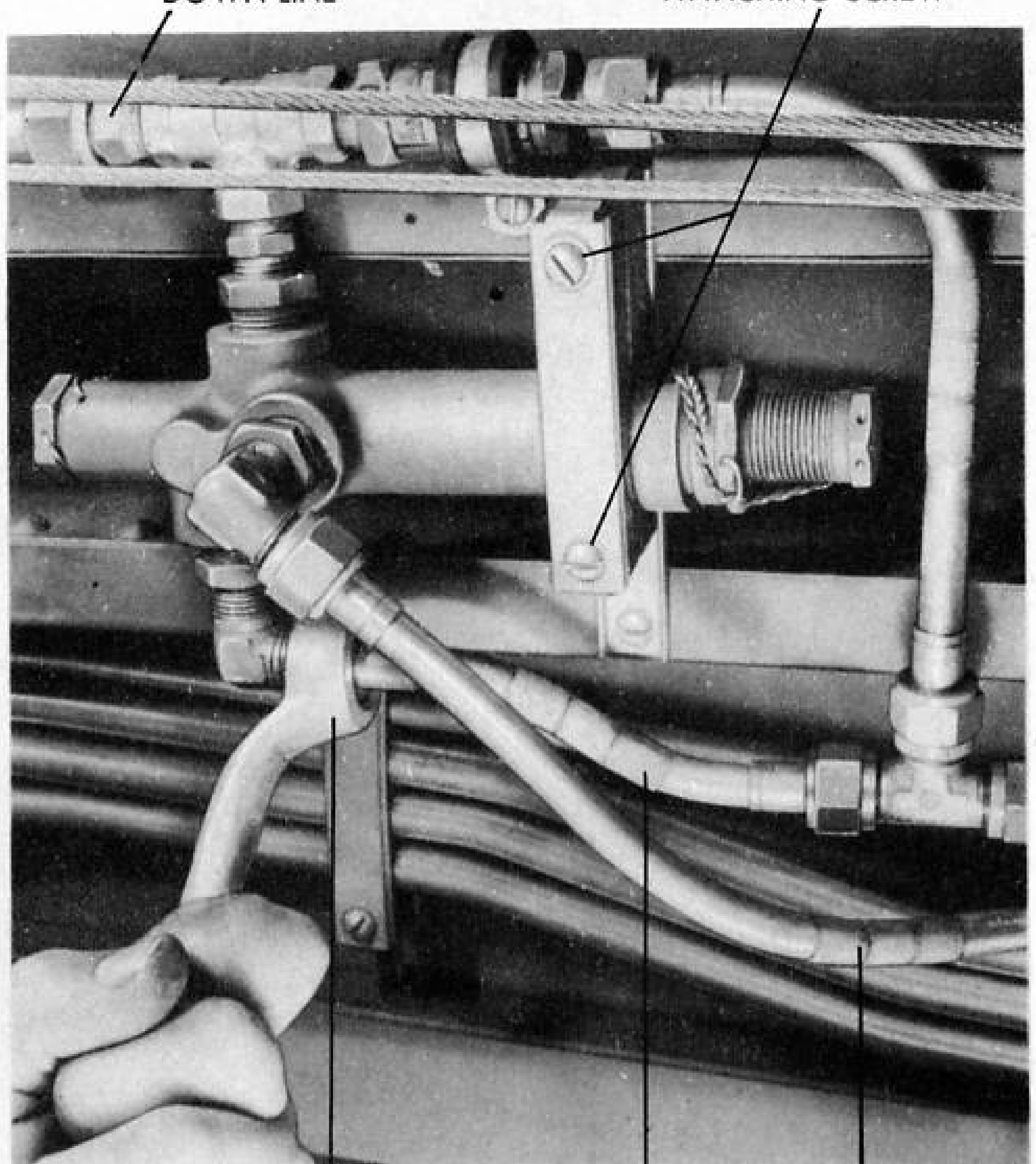


Figure 207 - REMOVING WING FLAP RELIEF VALVE

(b) Disconnect and cap all lines.

(c) Remove valve from airplane.

(18) DISASSEMBLY OF WING FLAP RELIEF VALVE. (See figure 193.)

(a) Loosen lock nut, unscrew plug, and remove spring. Remove lock nut from plug.

(b) Remove seal and spring.

(c) Remove piston stop.

(d) Slide guide and piston from body.

(e) Remove guide from piston.

(19) REMOVAL OF BRAKE CONTROL VALVE. (See figure 208.)

(a) Relieve pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove attaching bolts.

(d) Remove valve from airplane.

(20) DISASSEMBLY OF BRAKE CONTROL VALVE. (See figure 194.)

(a) Remove the nut from screw through the lever arm and loosen the lever.

(b) Remove the cotter pin which holds the link to the piston and remove link.

(c) Remove the lock nut from the base of housing.

(d) Remove the nuts which secure the cover to the housing. Lift the cover and gasket from the housing. Screw the seat from the cover and lift out the spring, steel ball, and washer.

(e) Lift spring and valve from head of piston.

(f) Remove the piston locking screw from the face of the valve housing.

(g) Screw the piston and packing nut from the top of the housing, using a wrench on the square base of the piston. Slide the pin from its slot in piston shaft and internal packing nut. Pull piston shaft from packing nut.

(h) Remove the spacer and packing from the top of the piston.

(i) Remove the packing and packing ring from the housing.

(21) REMOVAL OF BRAKE DEBOOSTER.

(a) Relieve pressure in the complete system.

(b) Disconnect and cap all lines at the valve.

(c) Remove valve from axle.

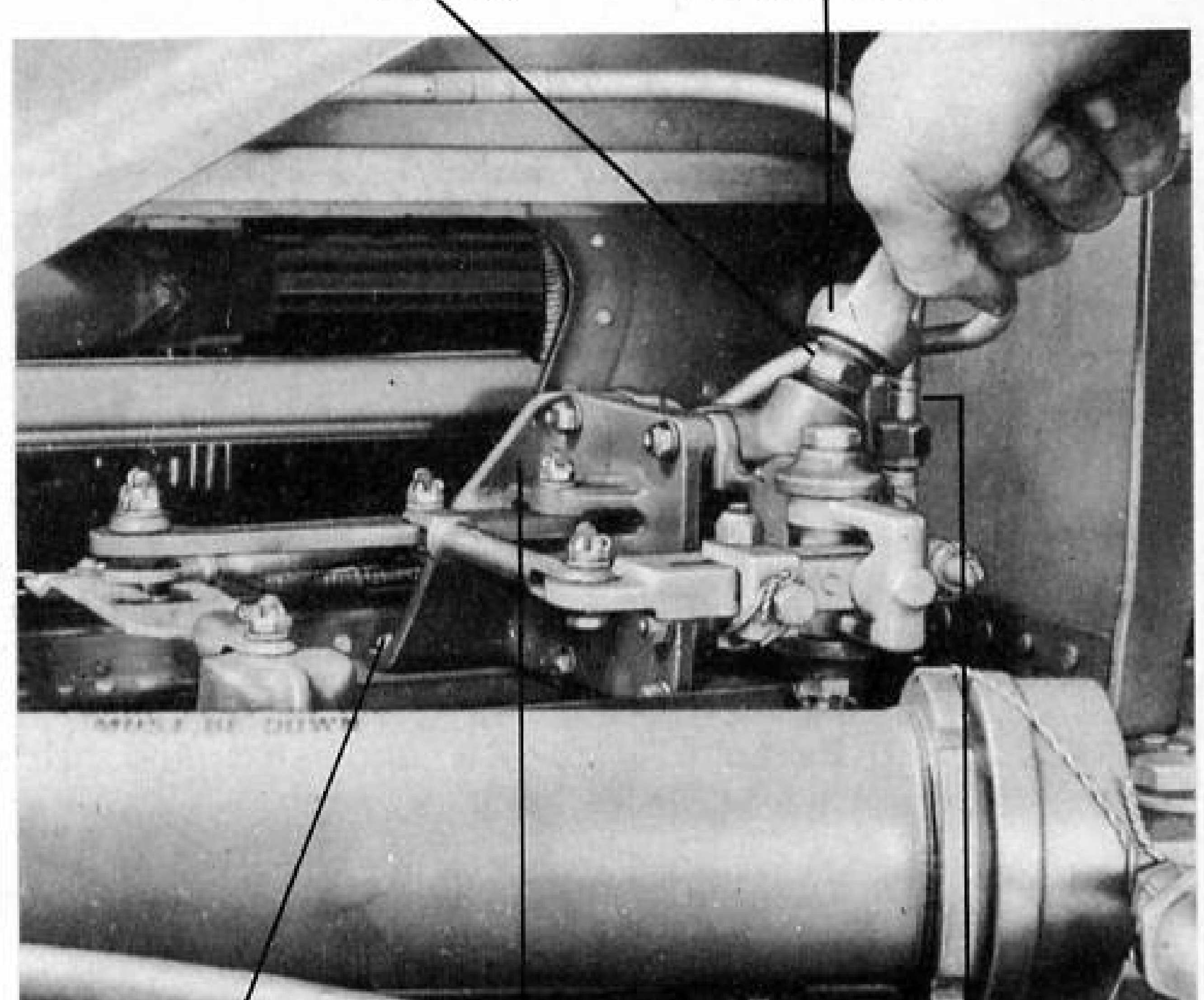


Figure 208 - REMOVING BRAKE CONTROL VALVE

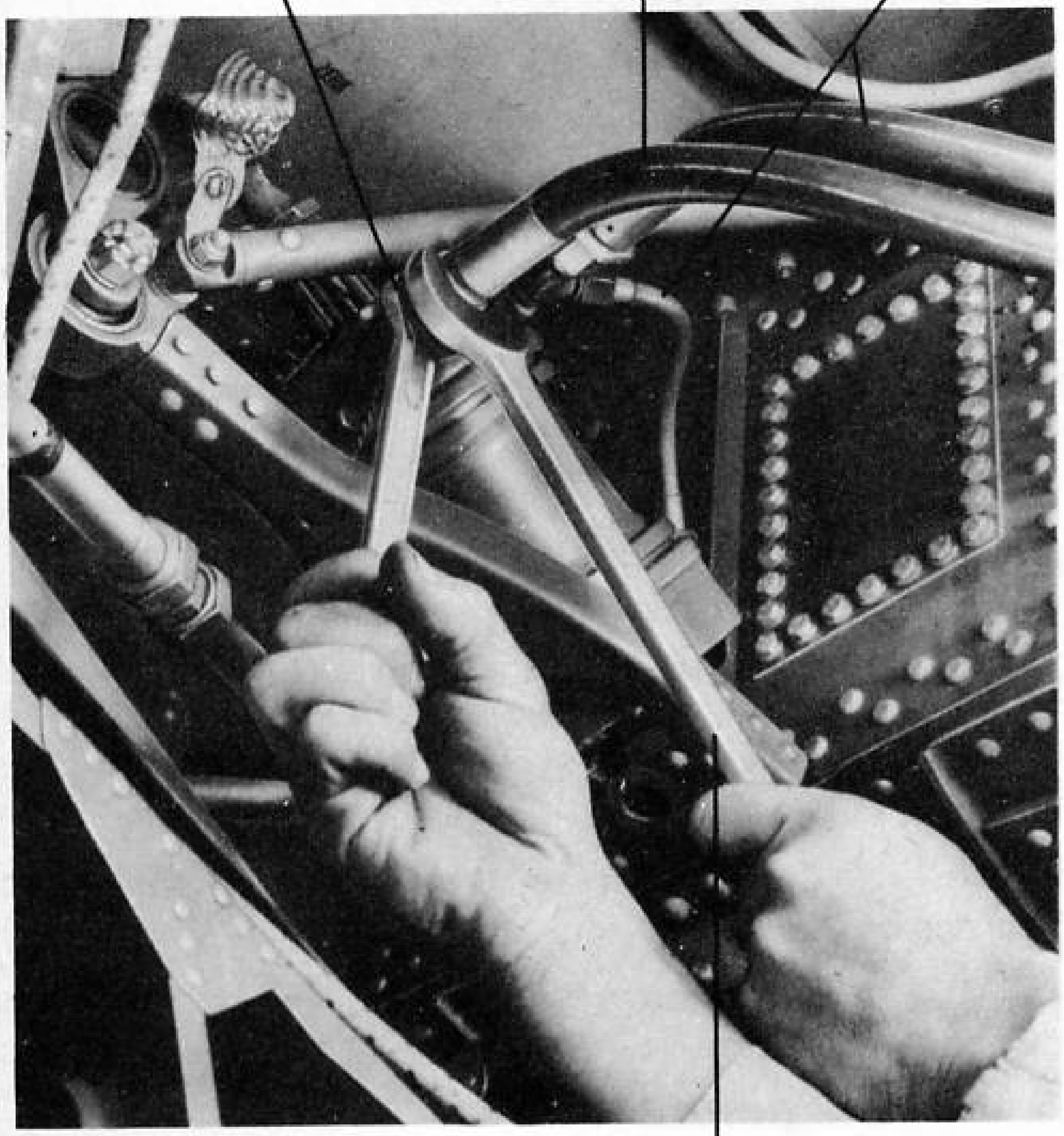


Figure 209 - REMOVING OUTBOARD WING FLAP ACTUATING STRUT

(22) DISASSEMBLY OF BRAKE DEBOOSTER. (See figure 195.)

(a) Remove bolts and cover from body.

CAUTION

Pull cover straight out until the inner chamber has been removed from body.

(b) Remove retainer, spacer, and cup from cover.

(c) Remove retainer, spring, washers, and stop from inner chamber.

(d) Slide piston assembly and spring from chamber.

(e) Remove lock nut and seal and slide piston from cylinder.

(f) Remove spring guide and ball check from the cylinder.

(23) REMOVAL OF BRAKE LINE SWIVEL JOINT.

(a) Relieve pressure in the system.

(b) Disconnect and cap all lines at the joint.

(c) Remove joint.

(24) DISASSEMBLY OF BRAKE LINE SWIVEL JOINT. (See figure 196.)

(a) Unscrew packing nut and remove elbow assembly from body.

(b) Drive out pin and remove check nut, washer, cup, spring, seal, chevron packing, and packing ring from elbow.

(c) Lift off packing nut from elbow.

(25) REMOVAL OF OUTBOARD AND INBOARD WING FLAP ACTUATING STRUTS. (See figure 209.)

(a) Relieve pressure in complete system.

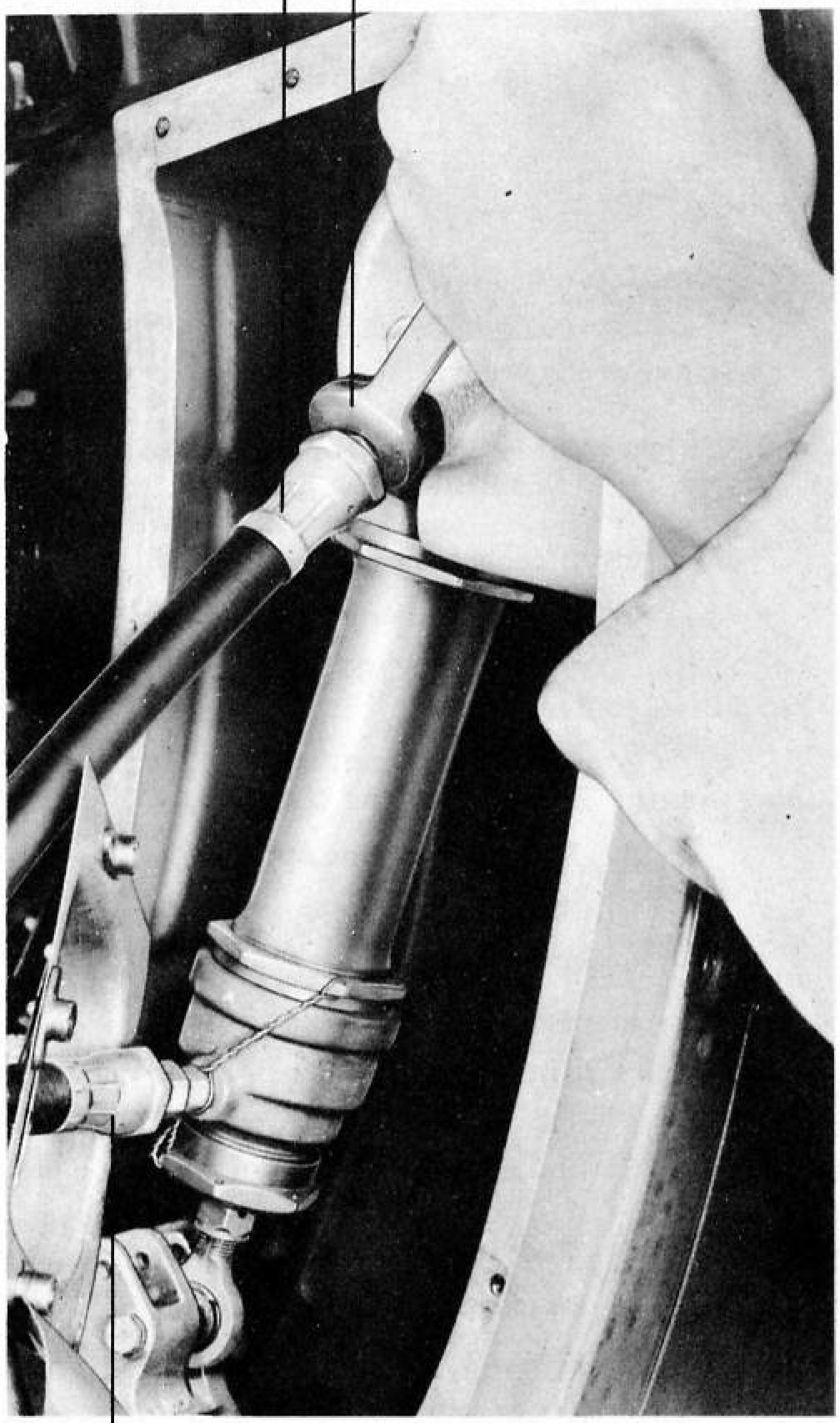
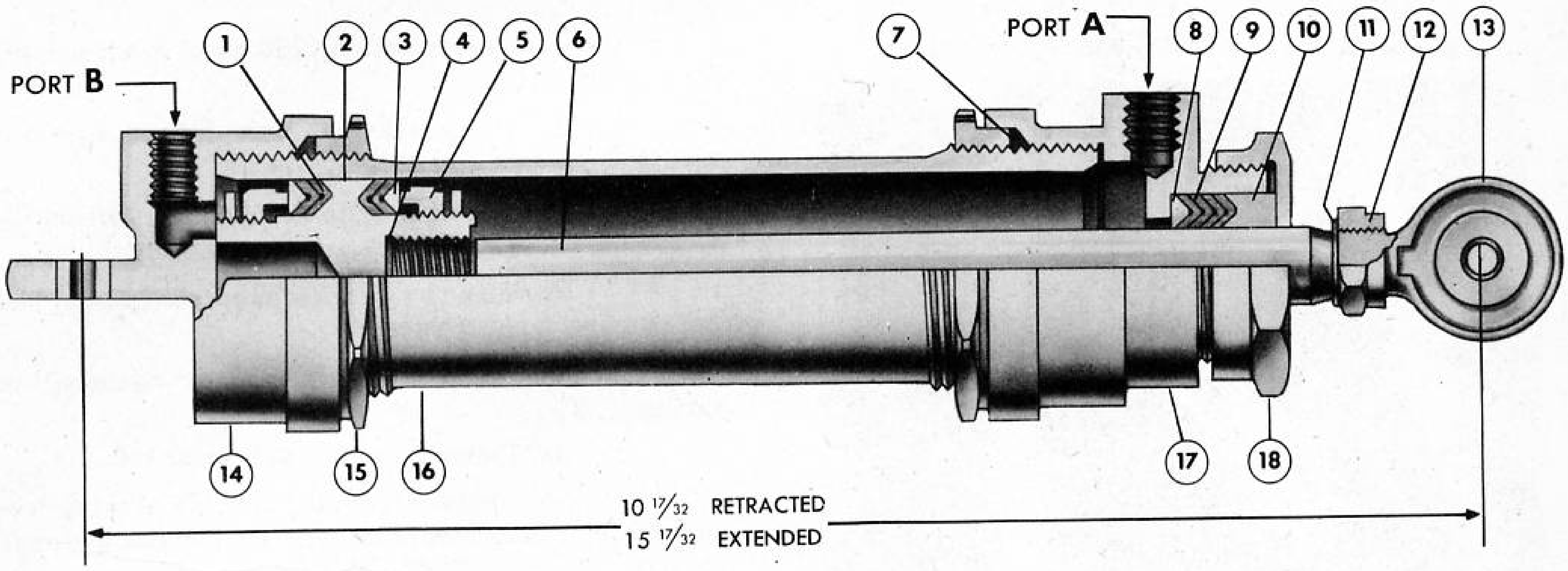


Figure 210 - REMOVING LOWER COWL FLAP ACTUATING STRUT



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5135865-4X-030	PACKING, HYDRAULIC CHEVRON	4
2.	2086171	PISTON, COWLING FLAP OPERATING STRUT CYLINDER	1
3.	1012954-D030-008	RING, END PACKING	2
4.	146142-095-024	PIN	1
5.	1086230	NUT, COWLING FLAP OPERATING STRUT CYLINDER PISTON PACKING	2
6.	2086177	ROD, COWLING, FLAP OPERATING STRUT CYLINDER PISTON	1
7.	1111908-124-130-187	GASKET, EXTERNAL SEAL RING	2
8.	1012954-D018-007	RING, END PACKING	1
9.	5135865-3½X-018	PACKING, HYDRAULIC CHEVRON	4
10.	1086455	RING, COWLING FLAP OPERATING STRUT CYLINDER PISTON ROD PACKING	1
11.	1086454	WASHER, COWLING FLAP OPERATING STRUT CYLINDER PISTON ROD LOCK	1
12.	1086453	NUT, COWLING FLAP OPERATING STRUT CYLINDER PISTON ROD LOCK	1
13.	2138695	END ASSEMBLY, COWLING FLAP OPERATING STRUT CYLINDER PISTON	1
14.	2137342	HEAD ASSEMBLY, COWLING FLAP OPERATING STRUT CYLINDER	1
15.	1086147	GLAND, COWLING FLAP OPERATING STRUT CYLINDER PACKING	2
16.	2086095	CYLINDER, COWLING FLAP OPERATING STRUT	1
17.	2086096	END, COWLING FLAP OPERATING STRUT CYLINDER	1
18.	1086148	NUT, COWLING FLAP OPERATING STRUT PACKING	1

Figure 211 - LOWER COWL FLAP ACTUATING STRUT

(b) Disconnect and cap all lines.

(c) Remove strut assembly from airplane.

(26) DISASSEMBLY OF OUTBOARD AND INBOARD WING FLAP ACTUATING STRUTS. (See figures 197 and 198.)

(a) Loosen head lock nut at piston end.

(b) Back off cylinder end.

(c) Remove piston assembly and cylinder end.

(d) Remove lock nut and lock washer.

(e) Remove packing nut and seal.

(f) Slide off cylinder end and packing.

(g) Remove piston head.

(h) Remove cotters, two packing nuts, and packing from piston head.

(i) Remove eyebolt from piston.

(j) Remove lock nut and seal from cylinder head and unscrew cylinder head.

(27) REMOVAL OF UPPER AND LOWER COWL FLAP ACTUATING STRUTS. (See figure 210.)

(a) Relieve pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove cylinder from airplane.

(28) DISASSEMBLY OF UPPER AND LOWER COWL FLAP ACTUATING STRUT. (See figures 219 and 211.)

(a) Loosen cylinder end lock nut and Neoprene seal.

(b) Remove cylinder end assembly, and slide this and piston assembly out.

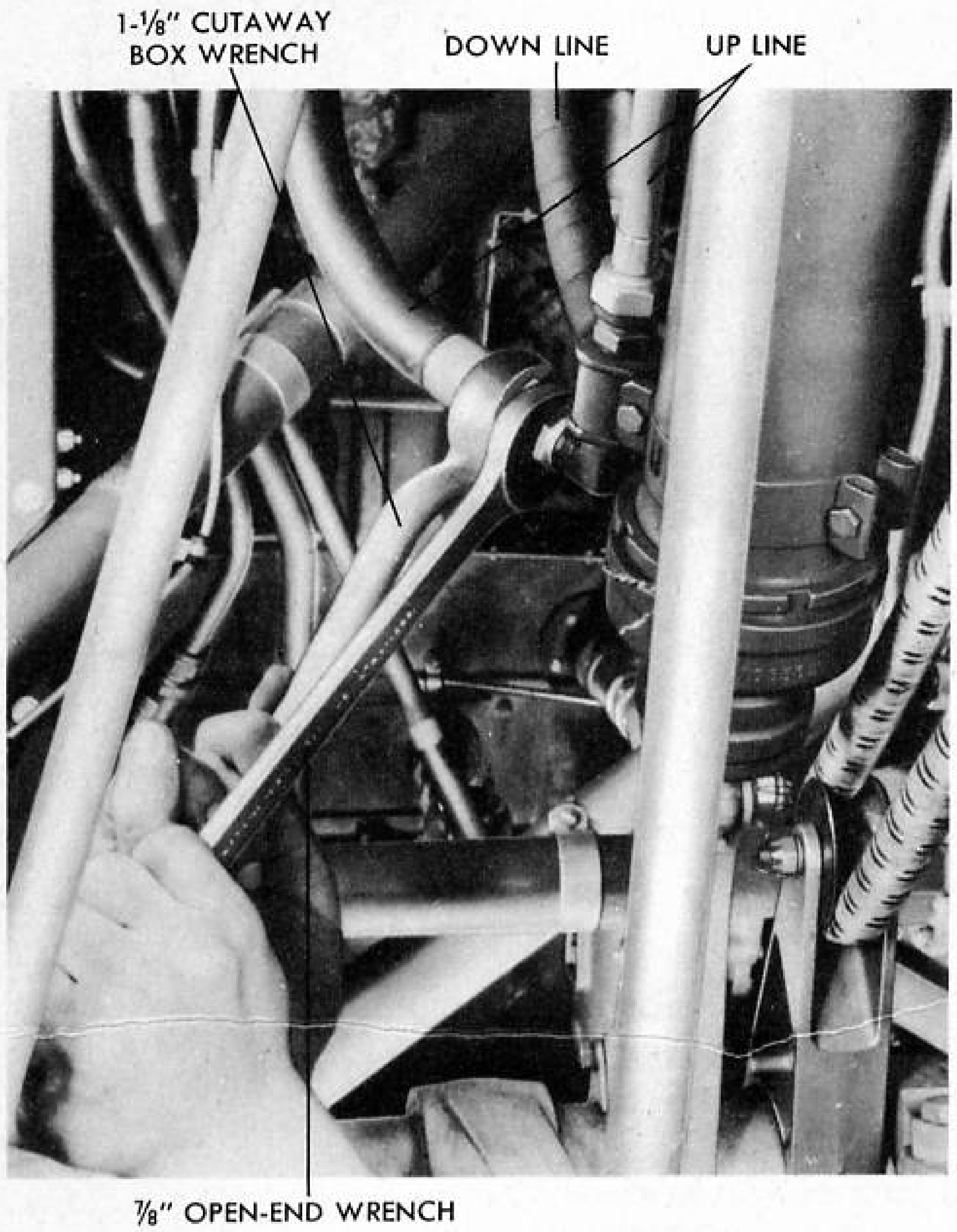


Figure 212 - REMOVING MAIN ALIGHTING GEAR ACTUATING STRUT

(c) Loosen cylinder head lock nut and seal, and remove cylinder head.

(d) Remove piston head lock nut, packing, and piston head.

(e) Slide piston rod out of cylinder end.

(f) Remove cylinder end packing nut and packing.

(g) Loosen eyebolt lock nut and remove eyebolt from piston rod.

(29) REMOVAL OF MAIN LANDING GEAR ACTUATING STRUT. (See figure 212.)

(a) Relieve the hydraulic operating pressure with the landing gear control lever in the DOWN position.

(b) Attach ground safety latch to retracting linkage.

(c) Disconnect and cap all lines.

(d) Disconnect and remove entire strut from airplane.

(30) DISASSEMBLY OF MAIN LANDING GEAR ACTUATING STRUT. (See figure 199.)

(a) Remove clamp and rigid hydraulic line from cylinder.

(b) Loosen the end lock nut and Neoprene seal at the piston end of the cylinder.

(c) Unscrew cylinder end and slide out the piston assembly.

(d) Unscrew packing nuts from piston head and remove packing assembly.

(e) Remove retaining nut, dashpot, and spring.

(f) Remove piston head from rod.

(g) Remove cylinder end and packing from piston rod. Disassemble cylinder end packing and packing nut.

(h) Loosen lock nut and lock washer on piston rod.

(i) Unscrew and remove eyebolt and adjusting nut.

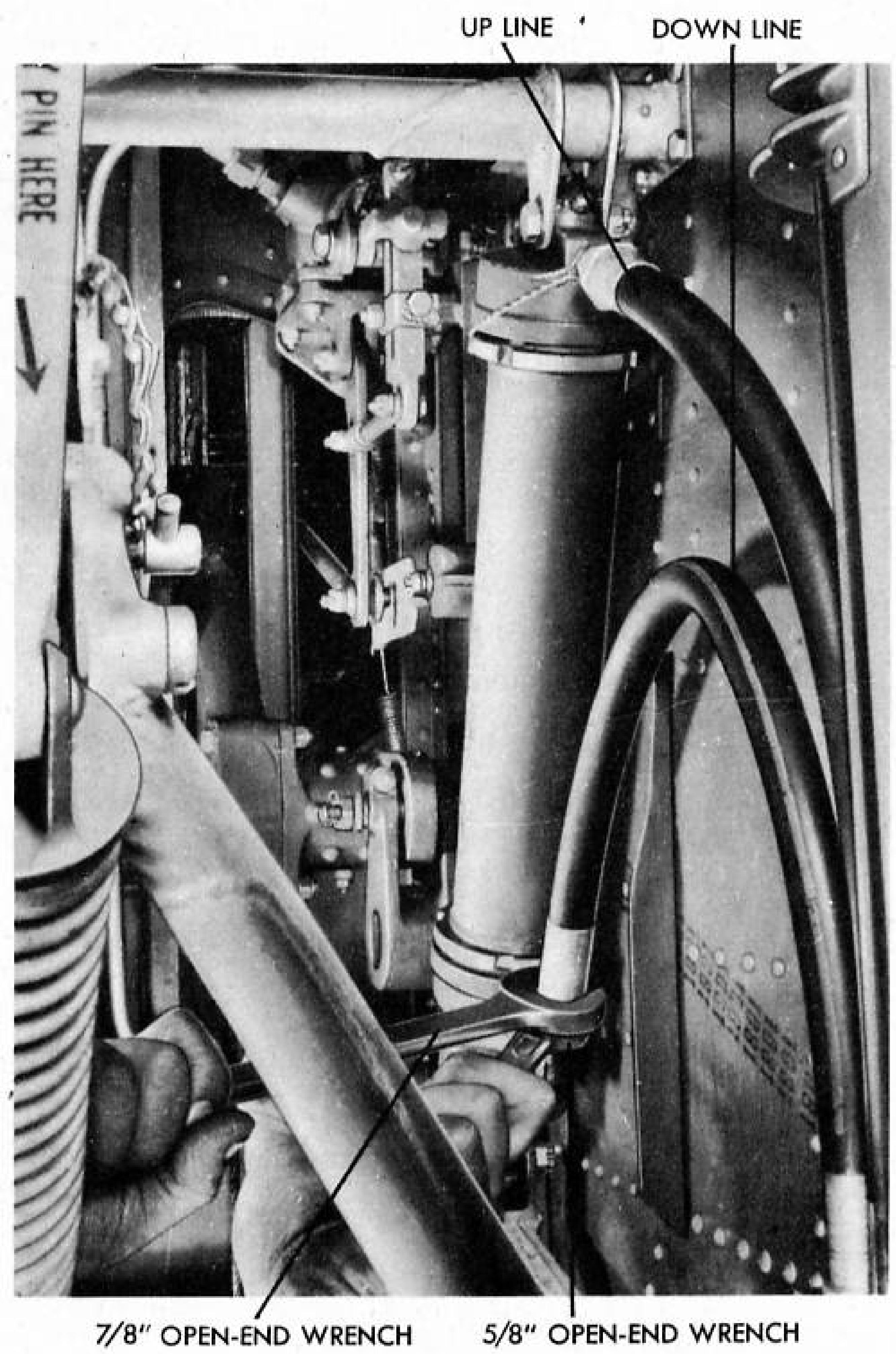
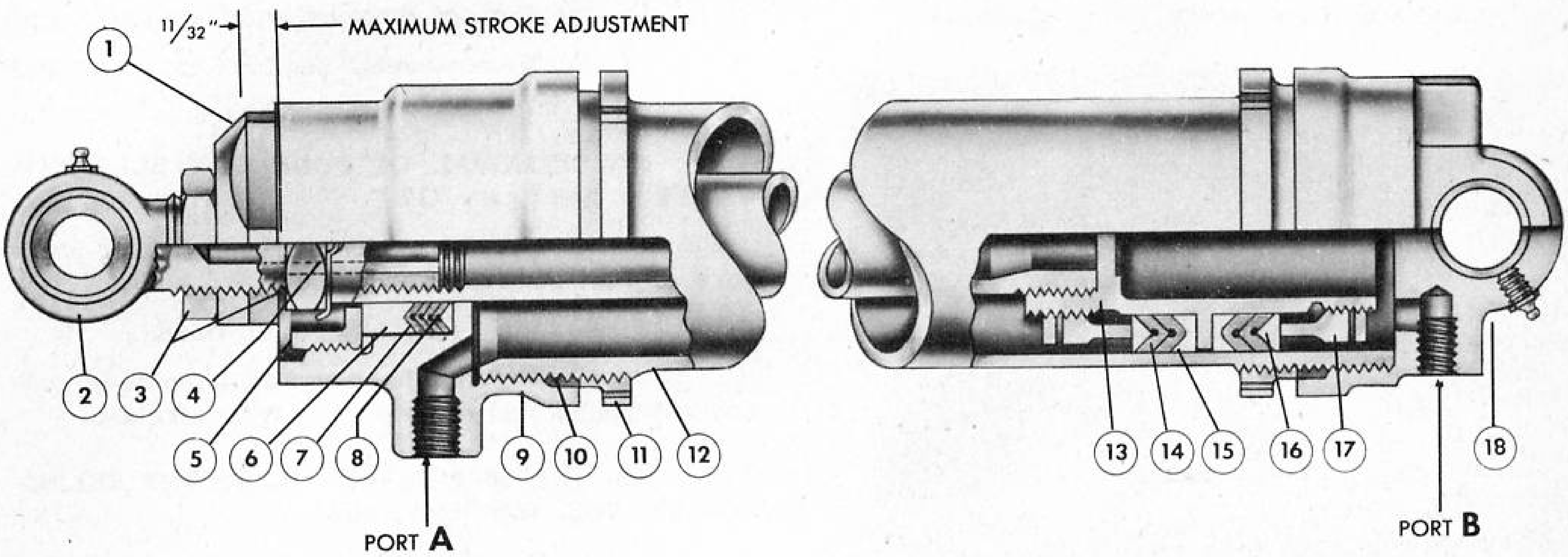


Figure 213 - REMOVING NOSE GEAR ACTUATING STRUT



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4067834	CAP, NOSE WHEEL ACTUATING STRUT	1
2.	2067267	BOLT ASSEMBLY, NOSE WHEEL ACTUATING STRUT EYE	1
3.	1058216	NUT, NOSE WHEEL ACTUATING STRUT CHECK	2
4.	1067769	WASHER, NOSE WHEEL ACTUATING STRUT LOCK	1
5.	1067661	NUT, NOSE WHEEL ACTUATING STRUT ROD PACKING	1
6.	1067712	RING, NOSE WHEEL ACTUATING STRUT PACKING	1
7.	5135865-4X-100	PACKING, HYDRAULIC CHEVRON	4
8.	1012954-B100-008	RING, END PACKING	1
9.	4067497	HEAD, NOSE WHEEL ACTUATING STRUT	1
10.	1111908-210-216-187	GASKET, EXTERNAL SEAL RING	2
11.	1066995	RING, NOSE WHEEL ACTUATING STRUT SEAL	2
12.	4067479	BARREL, NOSE WHEEL ACTUATING STRUT	1
13.	2068409	PISTON ASSEMBLY, NOSE WHEEL ACTUATING STRUT	1
14.	5135865-5X-112	PACKING, HYDRAULIC CHEVRON	4
15.	1012953-B112-010	RING, CENTER PACKING	2
16.	1012954-B112-010	RING, END PACKING	2
17.	1067669	NUT, NOSE WHEEL ACTUATING STRUT PISTON PACKING	2
18.	4067492	END ASSEMBLY, NOSE WHEEL ACTUATING STRUT	1

Figure 214 - NOSE GEAR ACTUATING STRUT

(j) Remove cylinder head from cylinder and remove Neoprene seal.

(31) REMOVAL OF NOSE GEAR ACTUATING STRUT (See figure 213.)

(a) Relieve the hydraulic pressure with the landing gear control lever in DOWN position.

(b) Attach ground safety latch retracting linkage.

(c) Disconnect and cap all lines.

(d) Disconnect and remove cylinder from airplane.

(32) DISASSEMBLY OF NOSE GEAR ACTUATING STRUT. (See figure 214.)

(a) Loosen end lock nut and Neoprene seal at the piston end of the cylinder.

(b) Unscrew cylinder end and slide out piston assembly.

(c) Unscrew packing nut from piston rod end and remove packing assembly.

(d) Loosen lock nuts and lock washer on eyebolt.

(e) Unscrew and remove eyebolt and adjusting nut.

(f) Remove adjusting nut and lock nut from eyebolt.

(g) Slide cylinder end assembly from piston rod.

(h) Unscrew packing nut from piston head, and remove nut and packing.

(i) Unscrew piston head from piston rod, and remove packing and packing nut.

(j) Remove packing nut and packing assembly from cylinder.

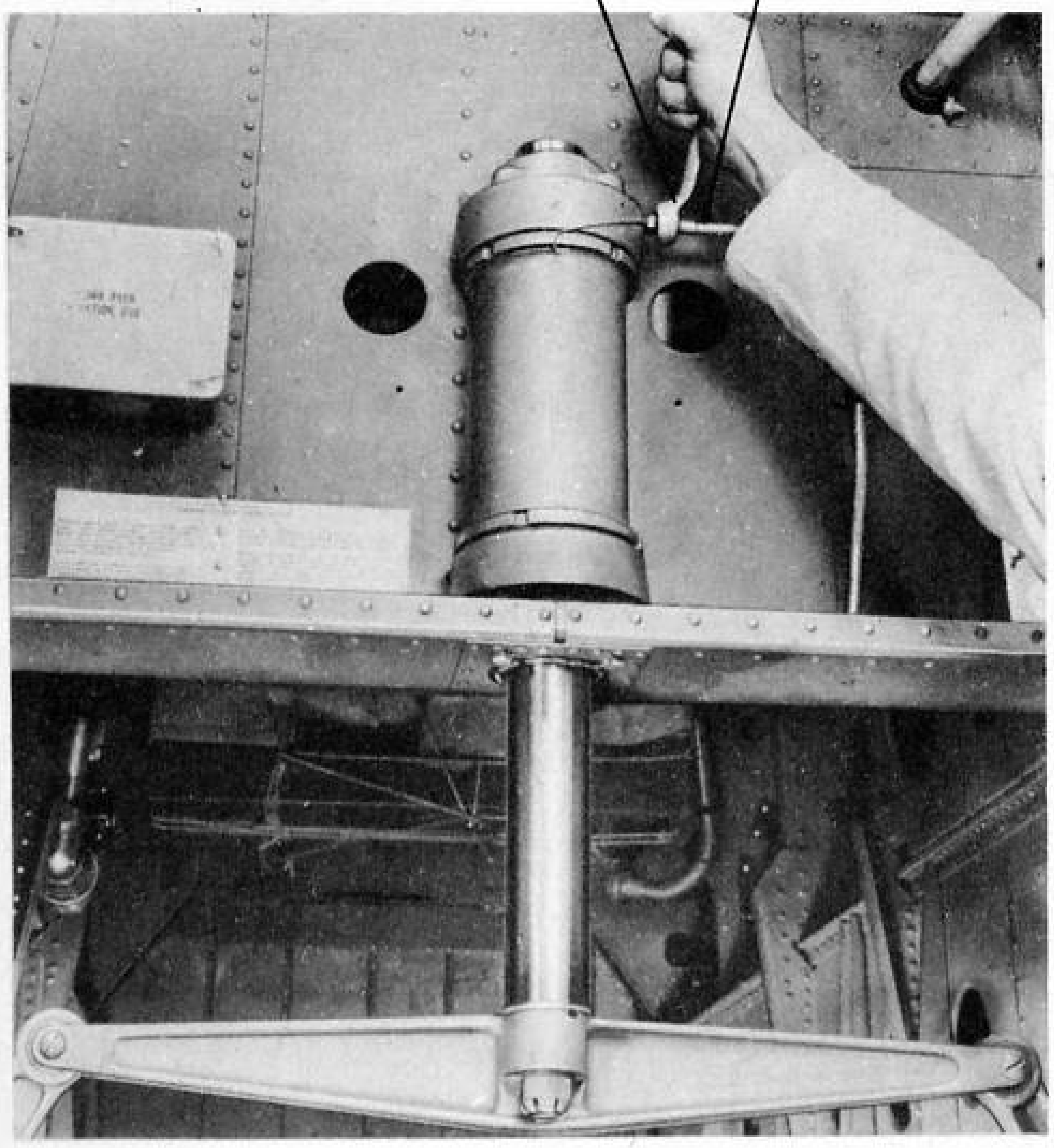


Figure 215 - REMOVING BOMB BAY DOOR ACTUATING STRUT

(k) Loosen head lock nut and seal at cylinder head.

(l) Remove cylinder head seal, and nut from cylinder.

(33) REMOVAL OF BOMB BAY DOOR ACTUATING STRUT. (See figure 215.)

(a) Relieve the hydraulic pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove complete strut from airplane.

(34) DISASSEMBLY OF BOMB BAY DOOR ACTUATING STRUT. (See figure 216.)

(a) Loosen seal lock nuts and Neoprene seals at both cylinder heads.

(b) Unscrew and remove cylinder heads, and slide out piston assembly.

(c) Remove snap rings and washers from cylinder heads.

(d) Unscrew glands and remove packing.

(e) Unscrew packing nuts from piston, and remove packing.

(f) Remove piston from piston rod.

(g) Remove threaded end from piston rod.

(h) Remove seals and lock nuts from cylinder.

(35) REMOVAL OF FOUR-WAY SELECTOR VALVES. (See figure 217.)

(a) Relieve the hydraulic operating pressure with the control lever in the DOWN position.

(b) Disconnect and cap all lines.

(c) Remove attaching nuts from valve, disconnect handle, and remove valve from airplane.

(36) DISASSEMBLY OF FOUR-WAY SELECTOR VALVES. (See figure 200.)

(a) Unscrew retainer nuts from bottom of valve and remove springs, retainers, ball checks, plungers, and seal.

(b) Remove seats.

(c) Remove screws from top of valve and slide out the retainers, cup packing, and rings.

(37) REMOVAL OF BOMB DOOR SELECTOR VALVE.

(a) Relieve hydraulic pressure in the complete system.

(b) Disconnect and cap all lines.

(c) Remove valve from airplane.

(38) DISASSEMBLY OF BOMB DOOR SELECTOR VALVE. (See figure 201.)

(a) Remove caps and cap seals.

(b) Remove springs and valve assemblies.

(c) Disassemble valves, springs, spacers, and cups.

(d) Remove screws holding retainer and remove retainer.

(e) Remove shaft from body.

(f) Remove cup and seal from shaft.

(g) Remove plugs from body.

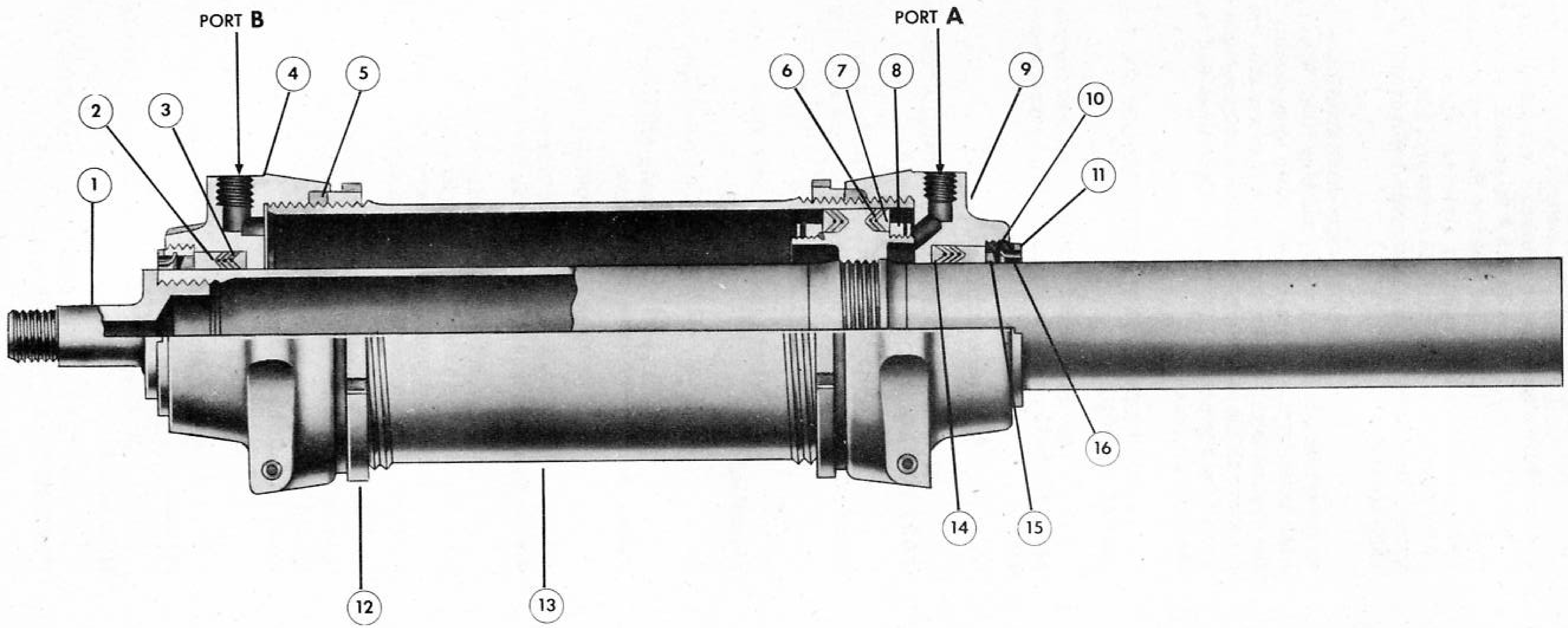
d. REPLACEMENTS.

(1) GENERAL.

(a) Clean all parts with hydraulic fluid and wipe dry with a clean cloth.

(b) Inspect all metal parts for wear or breakage. Pay particular attention to balls and ball seats, valves and valve seats, springs, and to threaded parts. Replace worn or broken parts.

(c) Replace all packings.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4066510	PISTON ASSEMBLY, BOMB BAY DOOR ACTUATING STRUT	1
2.	1059854	RING, BOMB BAY DOOR ACTUATING STRUT PACKING	2
3.	5135865-5X-204	PACKING, HYDRAULIC CHEVRON	6
4.	4065573	HEAD, BOMB BAY DOOR ACTUATING STRUT	1
5.	1111908-412-418-187	GASKET, EXTERNAL SEAL RING	2
6.	5135865-6X-308	PACKING, HYDRAULIC CHEVRON	4
7.	179261-308-400	RING, CENTER PACKING	2
8.	2064893	NUT, BOMB BAY DOOR ACTUATING STRUT PACKING	2
9.	4065558	END, BOMB BAY DOOR ACTUATING STRUT	1
10.	1066206	RING, BOMB BAY DOOR ACTUATING STRUT FELT PACKING	2
11.	2064894	GLAND, BOMB BAY DOOR ACTUATING STRUT PACKING	2
12.	2064896	NUT, BOMB BAY DOOR ACTUATING STRUT SEAL	2
13.	4066543	BARREL, BOMB BAY DOOR ACTUATING STRUT	1
14.	179261-204-224	RING, CENTER PACKING	2
15.	126221-3-34-40	WASHER, PACKING	2
16.	1066205	RING, BOMB BAY DOOR ACTUATING STRUT SNAP	2

Figure 216 - BOMB BAY DOOR ACTUATING STRUT

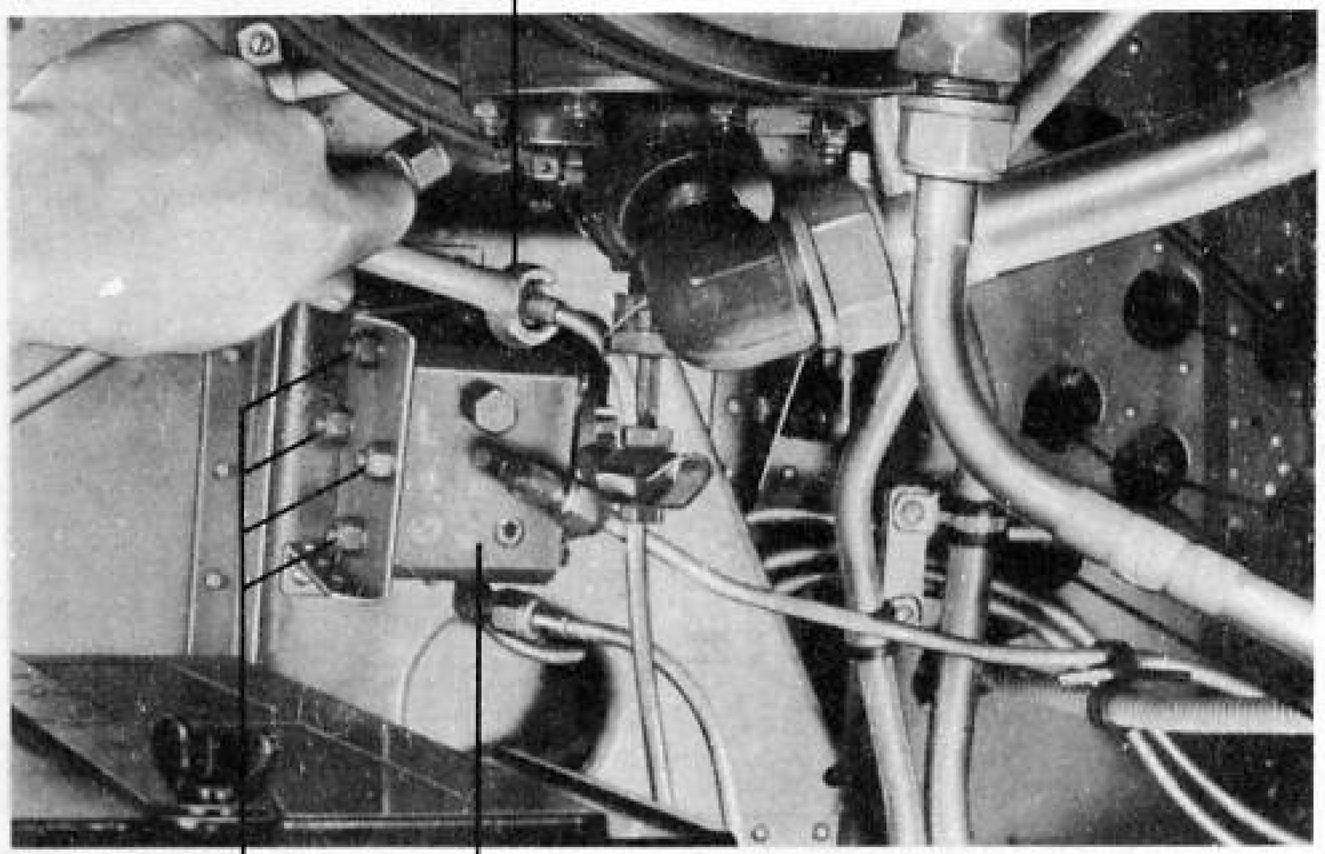


Figure 217 - REMOVING FOUR-WAY SELECTOR VALVE

e. TESTS.

(1) HYDRAULIC SYSTEM TEST PROCEDURE.

(a) GENERAL. - Following are the steps for testing the hydraulic system after a unit has been removed and reinstalled in the airplane, to ensure its correct operation. Refer to figure 182 for the relative location of the units of the system and the routing of the connecting lines.

(b) PROCEDURE.

1 Disconnect the main pressure line from the manifold block, and plug the line. This line runs from the hand pump bypass valve to the left-hand manifold block.

2 Install a 2000 pound per square inch pressure gage in the port of manifold block. Build up pressure by use of the hand pump.

3 Apply 1200 ± 50 pounds per square inch pressure so that the landing gear relief valve will operate.

4 With airplane supported on jacks, apply 1100 pounds pressure to each main system (landing gear, wing flaps, cowl flaps, etc.) then operate the actuating strut to the full limit of its travel in both directions, checking for proper clearance, adjustments, and fluid leaks.

5 Remove the test gage from the left-hand manifold block and reconnect the main pressure line.

6 Open the bypass valve and apply 1025 ± 25 pounds per square inch pressure so that the main system relief valve will operate and check for leaks.

7 Connect an outside source of fluid and pressure supply to the pressure and suction lines at either fire wall, and apply 825 ± 25 pounds per square inch pressure. Check for leaks in the pump pressure lines just before the regulator relieves. Operate each of the systems at normal fluid pressure, checking for proper fluid level in the reservoir before and after each operation.

8 Disconnect right-hand manifold block to reservoir line at reservoir, and plug line. With the hand pump bypass valve closed, build up pressure in the system with the hand pump. Operate any unit until pressure in the return system reaches 200 pounds per square inch pressure. Check all return lines and connections for leaks.

(2) TEST OF FLUID RESERVOIR BEFORE INSTALLATION.

(a) Plug outlet openings and test complete assembly to 15 pounds per square inch hydraulic pressure.

(b) Check for leaks.

(3) TEST OF PRESSURE ACCUMULATOR BEFORE INSTALLATION. (See figure 186.)

(a) With air valve removed, apply 450 pounds per square inch hydraulic pressure to port B.

(b) Check for fluid leaks.

(c) Release pressure and repeat above operations twice.

(d) Drain all fluid from accumulator.

(e) With port B open, apply 450 pounds per square inch air pressure at air valve.

(f) Submerge the accumulator in water.

(g) Check for air leaks. There must be no drop in the air pressure after the tank has set 48 hours.

(h) With the lower portion of the accumulator filled with 450 pounds per square inch air pressure, apply 1500 pounds per square inch hydraulic pressure to upper portion of accumulator.

(i) Repeat this operation three times, releasing the pressure after each application. There should be no drop in the original air pressure in the lower half of the accumulator.

(j) Check each time for air or fluid leakage.

(k) Carefully release the air from the lower portion.

(l) Check for oil in air. Oil in air indicates leakage of the diaphragm.

(4) TEST OF PRESSURE REGULATOR BEFORE INSTALLATION. (See figure 187.)

(a) Apply and relieve the following pressures at port A:

1 850 ± 25 pounds per square inch.

2 5 to 7 pounds per square inch.

3 1300 ± 25 pounds per square inch.

Leakage past the ball seat must not exceed one drop per hour for any of the above pressures.

(b) With port C plugged, apply and relieve the following pressures at port D:

1 850 ± 25 pounds per square inch.

2 5 to 7 pounds per square inch.

3 1300 ± 25 pounds per square inch.

Leakage past the chevron packing must not exceed one drop per hour for any of the above pressures.

(c) With port A plugged, apply 125 ± 10 pounds per square inch at port B. No leakage is allowable.

(5) TEST OF DISCONNECT VALVES BEFORE INSTALLATION. (See figure 188.)

(a) With all ports open, apply five pounds per square inch pressure to port A. The maximum leakage is 10 drops per hour.

(b) With all ports open, apply 800 pounds per square inch pressure to port B. The maximum leakage is 10 drops per hour past ball. No other leakage is allowable.

(6) TEST OF PRESSURE REGULATOR RELIEF VALVE BEFORE INSTALLATION. (See figure 189.)

(a) Apply 115 pounds pressure per square inch at port B. The maximum leakage at port A should not exceed 10 drops per hour.

(b) Apply 1000 ± 50 pounds per square inch pressure to port A; valve should be open.

(c) Reduce pressure to 950 ± 50 pounds per square inch pressure to port A; valve should close.

(d) Allowable leakage at port B with valve closed should not be more than one drop per hour.

(e) To adjust the valve, remove the cap and loosen the lock nut. Turn the adjusting nut clockwise to increase the pressure, and counterclockwise to decrease the pressure.

(7) TEST OF ADJUSTABLE RELIEF VALVE BEFORE INSTALLATION. (See figure 190.)

(a) Apply 450 pounds pressure to port B. The maximum leakage at this pressure should not be more than 10 drops per hour at port A. No other leakage is permissible.

(b) Apply 1200 ± 50 pounds per square inch pressure to port A; valve should be open. Adjust as per step (d) following.

(c) Reduce pressure to 1140 ± 50 pounds per square inch pressure; valve should close. Adjust as per step (d) following.

(d) To adjust valve: Back off lock nut. Turning the adjusting screw clockwise increases relief pressure. Turning screw counterclockwise decreases relief pressure. Tighten lock nut.

(8) TEST OF HAND PUMP BYPASS VALVE BEFORE INSTALLATION. (See figure 191.)

(a) Plug port B and apply five to seven pounds per square inch pressure to port A. With the handle in any position, the maximum leakage should not be more than two drops in 12 hours past cups.

(b) Increase pressure to 1300 ± 50 pounds per square inch and again check for leakage. With the handle in any position, the maximum leakage should not be more than two drops in 12 hours past cups.

(9) TEST OF HAND PUMP BEFORE INSTALLATION. (See figure 192.)

(a) With port A plugged and port B connected to a reservoir of oil, pull handle toward UP position with 60-pound handle load (piston extended). Check for leaks. Two drops in 12 hours is the maximum external leakage, one inch per hour is maximum handle creep.

(b) Operate handle toward DOWN position (piston retracted). Check for leaks. Two drops in 12 hours is the maximum external leakage, one inch per hour is maximum handle creep.

(10) TEST OF WING FLAP RELIEF VALVE BEFORE INSTALLATION. (See figure 193.)

(a) Plug port A; and with port C open, slowly apply and release 175 pounds per square inch pressure at port B. Do this twice. Internal leakage is allowable only at port C, 1/2 cubic inch per minute minimum.

(b) Plug A and B. Apply 120 pounds per square inch pressure at C. No leakage is allowed.

(c) Plug B. Apply 1200 pounds per square inch pressure at A. Ten cubic inches per minute minimum leakage at C is allowable maximum.

(d) Gage at B. Apply 850 pounds per square inch pressure at A. Ten cubic inches per minute is maximum allowable leakage at C. Pressure at B should be 200 to 225 pounds per square inch. Adjust plug, if necessary, to obtain this pressure.

(11) TEST AND ADJUSTMENT OF BRAKE CONTROL VALVE BEFORE INSTALLATION. (See figure 194.)

(a) Apply 200 pounds per square inch pressure to port A.

(b) Adjust valve by turning piston until ball valve opens and fluid flows from ports B and C.

(c) Back off piston until fluid flow stops, then back off an additional one-eighth turn, and lock with piston lock screw on face of valve.

(d) Adjust packing nut and lock.

(e) With ports B and C open, apply 1500 pounds per square inch pressure to port A. With piston in free position, the maximum leakage past ball is one drop per hour.

(f) With port B plugged, apply 900 pounds per square inch pressure to port A. With piston in UP position, the maximum leakage past valve and packing is one drop per hour.

(g) With ports A and B plugged, apply 180 pounds per square inch pressure to port C. With piston in free position, the maximum leakage past packing is two drops in 12 hours.

(12) TEST OF BRAKE DEBOOSTER BEFORE INSTALLATION. (See figure 195.)

(a) With all ports open, apply two pounds per square inch pressure to port C. This is minimum pressure at which ball must unseat. Increase pressure to five pounds per square inch. This is maximum pressure at which ball must unseat.

(b) With all ports open, apply sufficient pressure to unseat ball to port A. After ball unseats, apply pressure at port C, until 550 pounds per square inch pressure is reached at port A. Maintain this pressure at port A by slowly bleeding port A. Oil must relieve out of port B at 160 + 50 -0 pounds per square inch pressure, measured at port C.

(c) Fill low chamber through port C and plug the port. Apply 1275 pounds per square inch pressure to port A. Allowable maximum leakage at ports B and D is one drop per hour.

(d) Plug port C with sight gage. Apply 120 ± 10 pounds per square inch pressure to port A. Slowly drop pressure at port A 15 pounds per square inch pressure. Fluid level must drop in sight gage.

(e) Plug port B and apply maximum pressure at port A without unseating ball. Plug port C with a vacuum gage. Completely release pressure at port A. After 15-minute interval there must be some remaining vacuum at port C.

(13) TEST OF BRAKE LINE SWIVEL JOINT BEFORE INSTALLATION. (See figure 196.)

Plug port B. Apply 1300 pounds per square inch pressure to port A. There should be no leakage at any place in the joint.

(14) TEST OF OUTBOARD AND INBOARD WING FLAP ACTUATING STRUT BEFORE INSTALLATION. (See figures 197 and 198.)

(a) With piston fully extended, apply 1300 pounds per square inch pressure to port A. The maximum allowable leakage is two drops in 12 hours external, and 10 drops per hour internal.

(b) With piston retracted, apply 1300 pounds per square inch pressure to port B. The maximum allowable leakage is two drops in 12 hours external, and 10 drops per hour internal.

(c) Packing friction at both ports is 25 pounds per square inch pressure. This packing friction pressure is the amount of hydraulic pressure necessary to move the piston under a zero external load. If this pressure is exceeded, loosen the packing retaining nuts. When the friction pressure must be exceeded, to prevent leakage, replace the packings.

(15) TEST OF UPPER AND LOWER COWL FLAP ACTUATING STRUTS BEFORE INSTALLATION. (See figures 219 and 211.)

(a) With piston fully extended, apply 1300 pounds per square inch pressure to port A. The maximum allowable leakage is two drops in 12 hours external, and ten drops per hour internal.

(b) With piston retracted, apply 1300 pounds per square inch pressure to port B. The maximum allowable leakage is two drops in 12 hours external, and ten drops per hour internal.

(c) Packing friction at both ports is 25 pounds per square inch pressure. This packing friction pressure is the amount of hydraulic pressure necessary to move the piston under a zero external load. If this pressure is exceeded loosen the packing retaining nuts. When the friction pressure must be exceeded to prevent leakage, replace the packings.

(16) TEST OF MAIN LANDING GEAR ACTUATING STRUT BEFORE INSTALLATION. (See figure 199.)

(a) With piston fully extended apply 1500 pounds per square inch pressure to port A. The maximum allowable leakage is two drops in 12 hours external and ten drops per hour internal.

(b) With piston retracted apply 1500 pounds per square inch pressure to port B. The maximum allowable leakage is two drops in 12 hours external and ten drops per hour internal.

(c) Packing friction at both ports is 25 pounds per square inch pressure. This packing friction pressure is the amount of hydraulic pressure necessary to move the piston under a zero external load. If this pressure is exceeded, loosen the packing retaining nuts. When the friction pressure must be exceeded to prevent leakage, replace the packings.

(17) TEST OF NOSE GEAR ACTUATING STRUT BEFORE INSTALLATION. (See figure 214.)

(a) With piston fully extended, apply 1500 pounds per square inch pressure to port A. The maximum allowable leakage is two drops in 12 hours external, and ten drops per hour internal.

(b) With piston retracted, apply 1500 pounds per square inch pressure to port B. The maximum allowable leakage is two drops in 12 hours external, and 10 drops per hour internal.

(c) Packing friction at both ports is 25 pounds per square inch pressure. This packing friction pressure is the amount of hydraulic pressure necessary to move the piston under a zero external load. If this pressure is exceeded, loosen the packing retaining nuts. When the friction pressure must be exceeded to prevent leakage, replace the packings.

(18) TEST OF BOMB BAY DOOR ACTUATING STRUT BEFORE INSTALLATION. (See figure 216.)

(a) With piston fully extended, apply 1500 pounds per square inch pressure to port A. The maximum allowable leakage is two drops in 12 hours, and 10 drops per hour internal.

(b) With piston retracted, apply 1500 pounds per square inch pressure to port B. The maximum allowable leakage is two drops in 12 hours external, and 10 drops per hour internal.

(c) Packing friction at both ports is 25 pounds per square inch pressure. This packing friction pressure is the amount of hydraulic pressure necessary to move the piston under a zero external load. If this pressure is exceeded, loosen the packing retaining nuts. When the friction pressure must be exceeded to prevent leakage, replace the packings.

(19) TEST OF FOUR-WAY SELECTOR VALVES BEFORE INSTALLATION. (See figure 200.)

(a) With port A plugged, apply 80 ± 20 pounds per square inch pressure to port B. With handle in neutral position, the maximum allowable leakage past balls is one drop per hour. Increase pressure to 1300 ± 50 pounds per square inch pressure. With handle in neutral position, the maximum allowable leakage past cups is two drops in 12 hours.

(b) Check the valve in the same manner as described above, except apply the pressure to port C.

(c) With test ports A, B, and C plugged, and with handle in neutral position, apply 80 ± 20 pounds per square inch pressure to port D. Maximum allowable leakage past cups is two drops in 12 hours.

(d) With all ports open and handle in neutral position, apply 80 ± 20 pounds pressure to port A. Gradually increase pressure to 1300 ± 50 pounds pressure. The maximum allowable leakage past balls is one drop per hour.

(20) TEST OF BOMB DOOR SELECTOR VALVE BEFORE INSTALLATION. (See figure 201.)

(a) With all ports open, apply 1500 pounds per square inch pressure to port C. With handle in neutral position, the maximum allowable leakage is one drop per hour.

(b) With port C plugged, apply 1500 pounds per square inch pressure to port D. With handle in neutral position, the maximum allowable leakage is 10 drops per hour.

(c) With port C plugged, apply 1500 pounds per square inch pressure to port A. With handle in neutral position, the maximum allowable leakage is 10 drops per hour.

(d) With ports C, A, and D plugged, apply 125 pounds per square inch pressure to port B. With handle in neutral position and turned both ways, the maximum allowable leakage is two drops in 12 hours.

f. ASSEMBLY AND INSTALLATION.

(1) ASSEMBLY OF BOMB DOOR SELECTOR VALVE. (See figure 201.)

(a) Wipe all parts clean. Use ample approved thread lubricant on all threads.

(b) Insert plugs in body.

(c) Place cup and seals on shaft and insert shaft in body.

(d) Install retainer and screws.

(e) Assemble valves, inner springs, spacers, and cups.

(f) Install valves in body.

(g) Insert upper springs, and install cap seals and caps.

(2) INSTALLATION OF BOMB DOOR SELECTOR VALVE.

(a) Assemble valve in place in ship.

(b) Uncap and connect all lines. Use approved thread lubricant on all threads.

(3) ASSEMBLY OF FOUR-WAY SELECTOR VALVES. (See figure 218.)

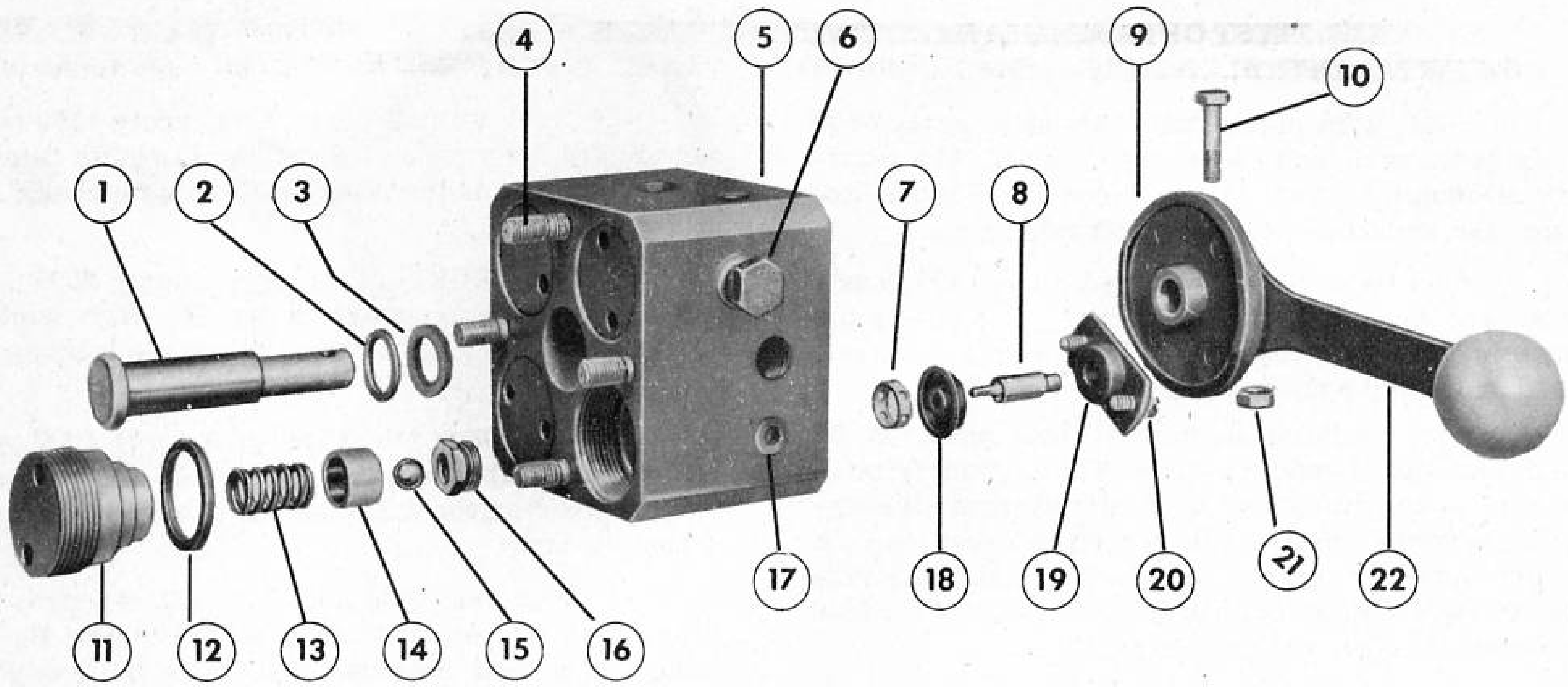
(a) Wipe all parts clean, and use ample approved thread lubricant on all threads.

(b) Assemble rings, cup packing, and retainers in body.

(c) Attach retainers with screws.

(d) Assemble seats.

(e) Assemble seals, plungers, ball checks, retainers, springs, and retainer nuts to bottom of valve.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1056224	SHAFT, HYDRAULIC SELECTOR VALVE	1
2.	143908-016S022-030	WASHER	1
3.	143908-016B022-002	WASHER	*6
4.	1056232	STUD, HYDRAULIC SELECTOR VALVE TWO-WAY	4
5.	4065505	BODY, COWL FLAP HYDRAULIC SELECTOR VALVE	1
6.	1063678	PLUG HYDRAULIC SELECTOR VALVE BODY DRILL HOLE	1
	143908-008TC016-064	WASHER	1
7.	163768-008-010	SPACER, HYDRAULIC PACKING CUP	4
8.	1056227	PLUNGER, HYDRAULIC SELECTOR VALVE	4
9.	2055537	CAM ASSEMBLY, SELECTOR VALVE	1
	143908-012B020-005	WASHER	*5
10.	AN3-13	BOLT	1
	AN960-10	WASHER	1
	178166-190-249-014	SPACER	2
11.	1056225	NUT, HYDRAULIC SELECTOR VALVE	4
12.	143908-026SR-100-093	WASHER	4
13.	1056230	SPRING, HYDRAULIC SELECTOR VALVE	4
14.	1056253	RETAINER, SELECTOR VALVE	4
15.	5 16" DIA.	BALL, BRIGHT STEEL	4
16.	1064795	SEAT, NO. 6 BALL VALVE	4
17.	AC895-B-100	PLUG	3
18.	1049003-D-008	CUP, 3/16" x 3/16" HYDRAULIC PACKING FLARED	4
19.	1056228	GLAND, HYDRAULIC SELECTOR VALVE	4
20.	AC503-8-6	SCREW	8
21.	AC310-3	NUT	1
22.	2064907	LEVER ASSEMBLY, UPPER COWLING FLAP HYDRAULIC VALVE	1
	1056229	SPRING, LEVER	1

*Use as necessary

Figure 218 - FOUR-WAY SELECTOR VALVE - EXPLODED VIEW

(4) INSTALLATION OF FOUR-WAY SELECTOR VALVES. (See figure 217.)

(a) Connect handle and install valve in ship.

(b) Uncap and connect all lines. Use approved thread lubricant on all threads.

(5) ASSEMBLY OF BOMB BAY DOOR ACTUATING STRUT. (See figure 216.)

(a) Wipe all parts clean. Use an approved thread lubricant on all threads.

(b) Assemble packing and glands to cylinder heads.

(c) Assemble washers and snap rings to cylinder heads.

(d) Assemble packing and packing nuts to piston heads.

(e) Install piston head and threaded end to piston rod.

(f) Install Neoprene seals and lock nuts on cylinder.

(g) Assemble one cylinder head to cylinder and tighten lock nut.

(h) Slide piston assembly into place.

(i) Assemble second cylinder head, and tighten lock nut.

(6) INSTALLATION OF BOMB BAY DOOR ACTUATING STRUT. (See figure 215.)

(a) Install complete strut in airplane.

(b) Uncap and connect all lines. Use approved thread lubricant on all threads.

(7) ASSEMBLY OF NOSE GEAR ACTUATING STRUT. (See figure 214.)

(a) Wipe all parts clean and use ample approved thread lubricant on all threads.

(b) Place Neoprene seal and lock nut in position on cylinder, and assemble cylinder head.

(c) Assemble eyebolt, lock nuts, lock washer, and adjusting nut to piston rod.

(d) Slide packing and nut onto piston shaft.

(e) Slide cylinder end onto piston rod.

(f) Assemble packing and nut to cylinder end.

(g) Assemble packing and packing nuts to piston head.

(h) Screw piston head on piston rod.

(i) Install Neoprene seal on the piston end of the cylinder.

(j) Slide piston assembly into cylinder, and tighten cylinder end and lock nut.

(8) INSTALLATION OF NOSE GEAR ACTUATING STRUT. (See figure 213.)

(a) Install complete strut in position in airplane.

(b) Uncap and connect all lines. Use approved thread lubricant on all threads.

(c) Remove ground safety latch retracting linkage.

(9) ASSEMBLY OF MAIN LANDING GEAR ACTUATING STRUT. (See figure 199.)

(a) Wipe all parts clean, and use ample approved thread lubricant on all threads.

(b) Assemble Neoprene seal, head lock nut, and cylinder head to cylinder.

(c) Assemble packing assembly to cylinder end and screw on packing nut.

(d) Assemble adjusting nut, lock nut, and eyebolt.

(e) Assemble lock washer and lock nut, and attach eyebolt to piston rod.

(f) Slide cylinder end onto piston rod.

(g) Attach packing and packing nut to piston head, and screw piston head to piston rod.

(h) Assemble dashpot spring, dashpot, and retaining nut.

(i) Assemble packing assembly to head of piston and screw on packing nut.

(j) Place cylinder end lock nut and seal on cylinder.

(k) Slide piston assembly into cylinder and assemble cylinder end.

(l) Tighten the head lock nut.

(m) Connect rigid hydraulic line to cylinder and assemble clamp.

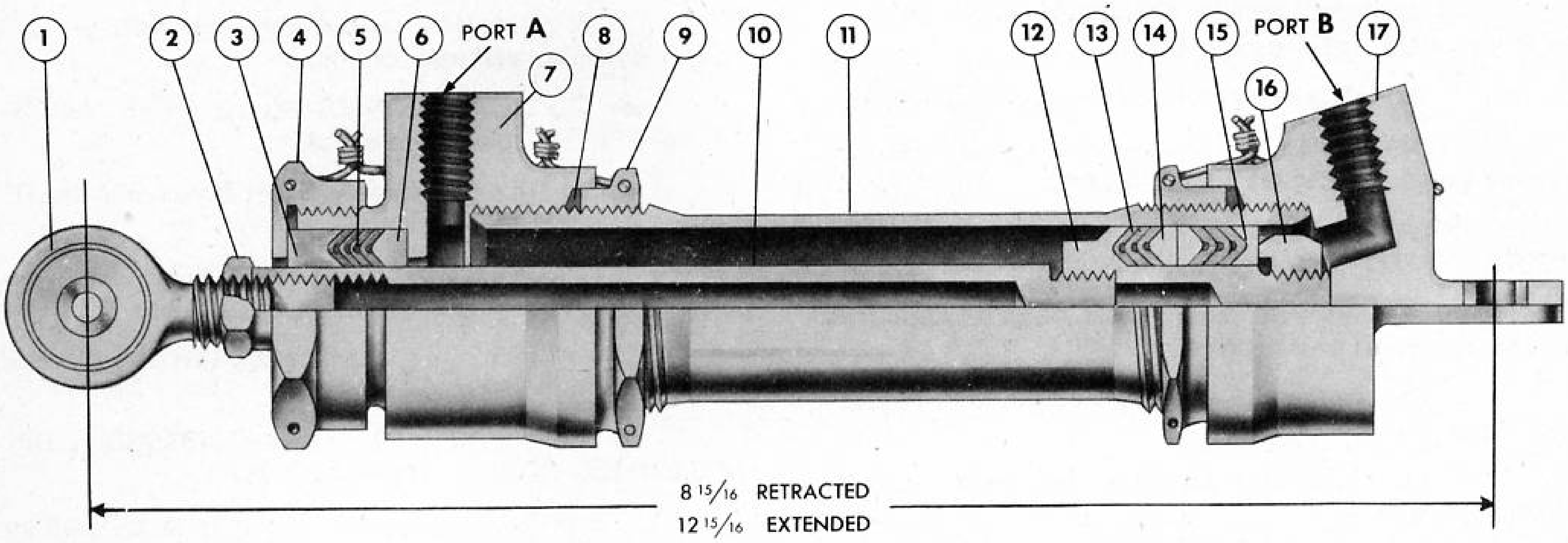
(10) INSTALLATION OF MAIN LANDING GEAR ACTUATING STRUT. (See figure 212.)

(a) Install complete strut in position on ship.

(b) Uncap and connect all lines. Use an approved thread lubricant on all threads.

(c) Remove ground safety latch retracting linkage.

(11) ASSEMBLY OF UPPER AND LOWER COWL FLAP ACTUATING STRUT. (See figures 219 and 211.)



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1066951	END ASSEMBLY, UPPER COWLING FLAP ACTUATING STRUT	1
2.	AN316-6R	NUT	1
3.	1066986	RING, UPPER COWLING FLAP ACTUATING STRUT PACKING	1
4.	1066932	NUT, UPPER COWLING FLAP ACTUATING STRUT PACKING	1
5.	5135865-4X-016	PACKING, HYDRAULIC CHEVRON	4
6.	1012954-B016-008	RING, END PACKING	1
7.	2067204	HOUSING, UPPER COWLING FLAP ACTUATING STRUT	1
8.	1111908-108-114-094	GASKET, EXTERNAL SEAL RING	2
9.	1066931	NUT, UPPER COWLING FLAP ACTUATING STRUT SPECIAL	2
10.	1066950	ROD, UPPER COWLING FLAP ACTUATING STRUT PISTON	1
11.	2067239	STRUT, UPPER COWLING FLAP ACTUATING	1
12.	1066933	HEAD, UPPER COWLING FLAP ACTUATING STRUT PISTON	1
13.	5135865-4X-016	PACKING, HYDRAULIC CHEVRON	6
14.	1012954-B016-008	RING, END PACKING	2
15.	1012953-B016-008	RING, CENTER PACKING	1
16.	1066169	NUT, UPPER COWLING FLAP ACTUATING STRUT CASTLE	1
17.	2067238	HEAD ASSEMBLY, UPPER COWLING FLAP ACTUATING STRUT	1

Figure 219 - UPPER COWL FLAP ACTUATING STRUT

(a) Wipe all parts clean, and use ample approved thread lubricant on threads.

(b) Assemble eyebolt and lock nut to piston rod.

(c) Slide piston end packing nut, packing, and cylinder end onto piston rod.

(d) Attach piston head to rod and place packing in position. Install packing nut.

(e) Assemble cylinder head, seal, and lock nut on cylinder.

(f) Install cylinder end seal and lock nut.

(g) Insert piston assembly in cylinder and screw on cylinder end.

(h) Tighten lock nuts against seal.

(12) INSTALLATION OF UPPER AND LOWER COWL FLAP ACTUATING STRUTS. (See figure 218.) - Install strut in airplane. Use approved thread lubricant on all threads.

(13) ASSEMBLY OF OUTBOARD AND INBOARD WING FLAP ACTUATING STRUT. (See figures 197 and 198.)

(a) Wipe all parts clean, and use ample thread lubricant on all threads.

(b) Assemble packing, packing ring, and packing nuts in piston head. Replace cotter pins.

(c) Assemble packing, wiper, and packing nut to cylinder head assembly.

(d) Slide cylinder end assembly onto shaft. (See figures 197 and 198.)

(e) Assemble eyebolt, lock washer, and nut to piston shaft.

(f) Assemble cylinder head, seal, and lock nut to cylinder.

(g) Slide piston into cylinder and assemble cylinder end.

(h) Assemble Neoprene seal and head lock at the piston end.

(14) INSTALLATION OF OUTBOARD AND INBOARD WING FLAP ACTUATING STRUTS. (See figure 209.)

(a) Install strut in airplane.

(b) Uncap and connect all lines. Use approved thread lubricant on all threads.

(15) ASSEMBLY OF BRAKE LINE SWIVEL JOINT. (See figure 196.)

(a) Wipe all parts clean and use ample approved lubricant on all threads.

(b) Place lock nut, packing rings, and chevron packing, spring and cup onto elbow.

(c) Put washer and check nut on elbow and insert pin.

(d) Put seal in position on body.

(e) Slide elbow assembly into body.

(f) Tighten lock nut sufficiently to prevent leaks, but not enough to bind operation of joint.

(16) INSTALLATION OF BRAKE LINE SWIVEL JOINT.

(a) Place joint in position in airplane.

(b) Uncap and attach all lines to swivel joint. Use approved thread lubricant on all threads.

(17) ASSEMBLY OF BRAKE DEBOOSTER. (See figure 220.)

(a) Wipe all parts clean and use ample approved thread lubricant on all threads.

(b) Assemble spring guide and ball check to cylinder.

(c) Slide piston onto cylinder and install seal and lock.

(d) Place spring over piston, and slide into chamber.

(e) Assemble stop, washer, spring and retainer into inner chamber of cover.

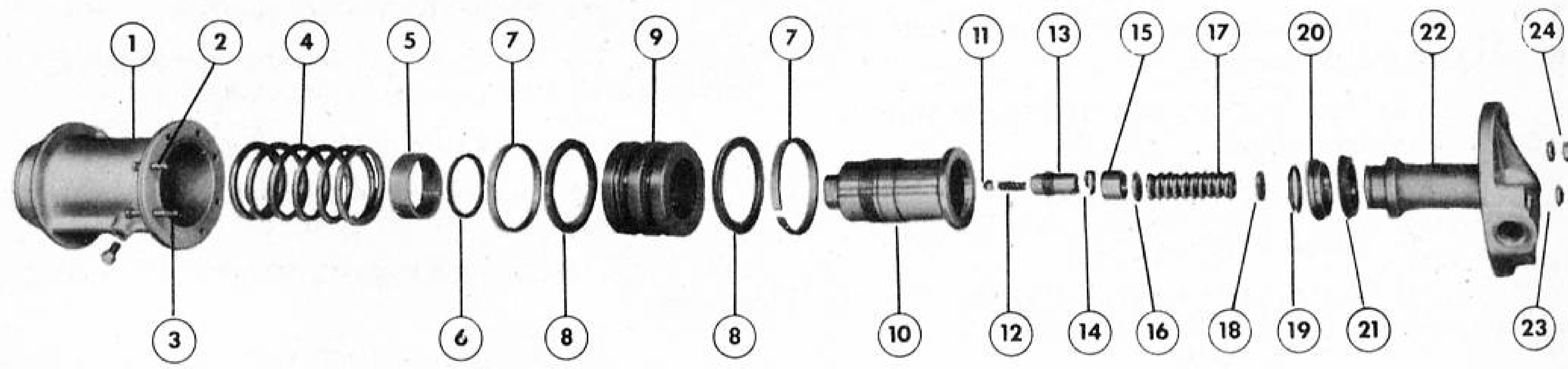
(f) Install cup, spacer, and retainer on cover.

(g) Assemble cover to body, being careful to assemble straight in until inner chamber has fully entered body. Add nuts and tighten.

(18) INSTALLATION OF BRAKE DEBOOSTER.

(a) Assemble debooster to axle.

(b) Uncap and connect all lines to debooster. Use approved thread lubricant on all threads.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	4073961	HOUSING ASSEMBLY, BRAKE DEBOOSTER	1
2.	AN502-10-16	SCREW	6
3.	AN502-10-26	SCREW	2
4.	1073371	SPRING, DEBOOSTER PISTON RETURN	1
5.	1073374	NUT, BRAKE DEBOOSTER GASKET	1
6.	143908-120SR126-094	WASHER	1
7.	1073397	SPACER, DEBOOSTER OUTER CUP	2
8.	1049003-D-204	CUP, 3/16 x 3/16 HYDRAULIC PACKING FLARED	2
9.	2073896	PISTON, BRAKE DEBOOSTER	1
10.	2073889	CYLINDER, BRAKE DEBOOSTER INNER	1
11.	9/32 DIA.	BALL, STEEL	1
12.	1073372	SPRING, DEBOOSTER EQUALIZING VALVE	1
13.	1074551	GUIDE, DEBOOSTER EQUALIZING VALVE	1
14.	1073370	RETAINER, DEBOOSTER SPRING STOP	1
15.	1073369	STOP, DEBOOSTER RELIEF SPRING	1
16.	1074550	WASHER, DEBOOSTER RELIEF SPRING	*4
17.	1073373	SPRING, DEBOOSTER RELIEF	1
18.	AN960-D516	WASHER	*1
19.	1073399	RETAINER, DEBOOSTER CUP SPACER	1
20.	1073398	SPACER, DEBOOSTER INNER CUP	1
21.	1049003-D-100	CUP, 3/16 x 3/16 HYDRAULIC PACKING FLARED	1
22.	2073880	COVER, BRAKE DEBOOSTER	1
23.	AN960-10L	WASHER	8
24.	AC365-10L	NUT	8

*Use as necessary.

Figure 220 - BRAKE DEBOOSTER - EXPLODED VIEW

(19) ASSEMBLY OF BRAKE CONTROL VALVE. (See figure 221.)

(a) Wipe all parts clean. Use ample approved thread lubricant on all threads.

(b) Insert packing ring and packing into the housing.

(c) Install packing and spacer on top of the piston.

(d) Insert the piston shaft through the internal packing nut and slide the pin into its' slot in the piston and nut. Screw the assembled piston and packing nut into the housing from the top. Use a wrench on the square base of the piston.

(e) Install the piston locking screw into its orifice on the face of the housing.

(f) Place the valve and spring in position on the head of the piston.

(g) Place the washer, steel ball and spring in position and screw the seat into the cover. Place the gasket and cover in position on the housing and install the nuts which hold the cover in place.

(h) Install the lock nut in the base of the housing.

(i) Assemble the link to the base of the piston shaft with a cotter pin.

(j) Tighten the lever to the screw with the nut provided for the purpose.

(20) INSTALLATION OF BRAKE CONTROL VALVE. (See figure 208.)

(a) Place valve in airplane.

(b) Install attaching bolts.

(c) Uncap and connect all lines. Use an approved thread lubricant on all threads.

(21) ASSEMBLY OF WING FLAP RELIEF VALVE. (See figure 193.)

(a) Wipe all parts clean and use ample approved thread lubricant on all threads.

(b) Place guide in piston and slide guide and piston assembly into body.

(c) Assemble piston stop.

(d) Place spring into position, assemble lock nut to plug. Place seal in position and assemble plug and lock nut to body. Tighten lock nut.

(22) INSTALLATION OF WING FLAP RELIEF VALVE. (See figure 207.)

(a) Place in position in airplane.

(b) Uncap all lines and attach to valve. Use ample approved thread lubricant on all threads.

(23) ASSEMBLY OF HAND PUMP. (See figure 192.)

(a) Wipe all parts clean, and use ample approved thread lubricant on all threads.

(b) Place ball check and spring in position. Assemble check seat.

(c) Assemble cup packing, spring, ball, and piston head to piston.

(d) Slide piston into body, assemble packing, and screw cylinder retaining nut to body.

(24) INSTALLATION OF HAND PUMP. (See figure 206.)

(a) Place pump in position and secure with attaching bolts.

(b) Uncap all lines and attach to pump. Use ample approved thread lubricant on all threads.

(25) ASSEMBLY OF HAND PUMP BYPASS VALVE. (See figure 191.)

(a) Wipe all parts clean, and use ample approved thread lubricant on all threads.

(b) Assemble cup packing, spring, cup, packing, plunger, and retainer nut to handle end of the valve.

(c) Place steel ball in position on seat.

(d) Place seal over spring retaining nut and assemble spring to the inside of nut.

(e) Assemble nut to body.

(f) Assemble and connect handle to body and plunger.

(26) INSTALLATION OF HAND PUMP BYPASS VALVE.

(a) Place in position in airplane and secure with attaching bolts.

(b) Uncap all lines and attach to valve. Use approved thread lubricant on all threads.

(27) ASSEMBLY OF ADJUSTABLE RELIEF VALVE. (See figure 222.)

(a) Wipe all parts clean before assembly. Use ample approved thread lubricant on all threads.

(b) Assemble ball seat to body.

(c) If steel ball has been removed from stem, place ball in position on stem. Tap lightly with a block of wood or soft hammer until properly seated.

(d) Place stem and ball in body.

(e) Place spring in body.

(f) Run lock nut up on adjusting screw.

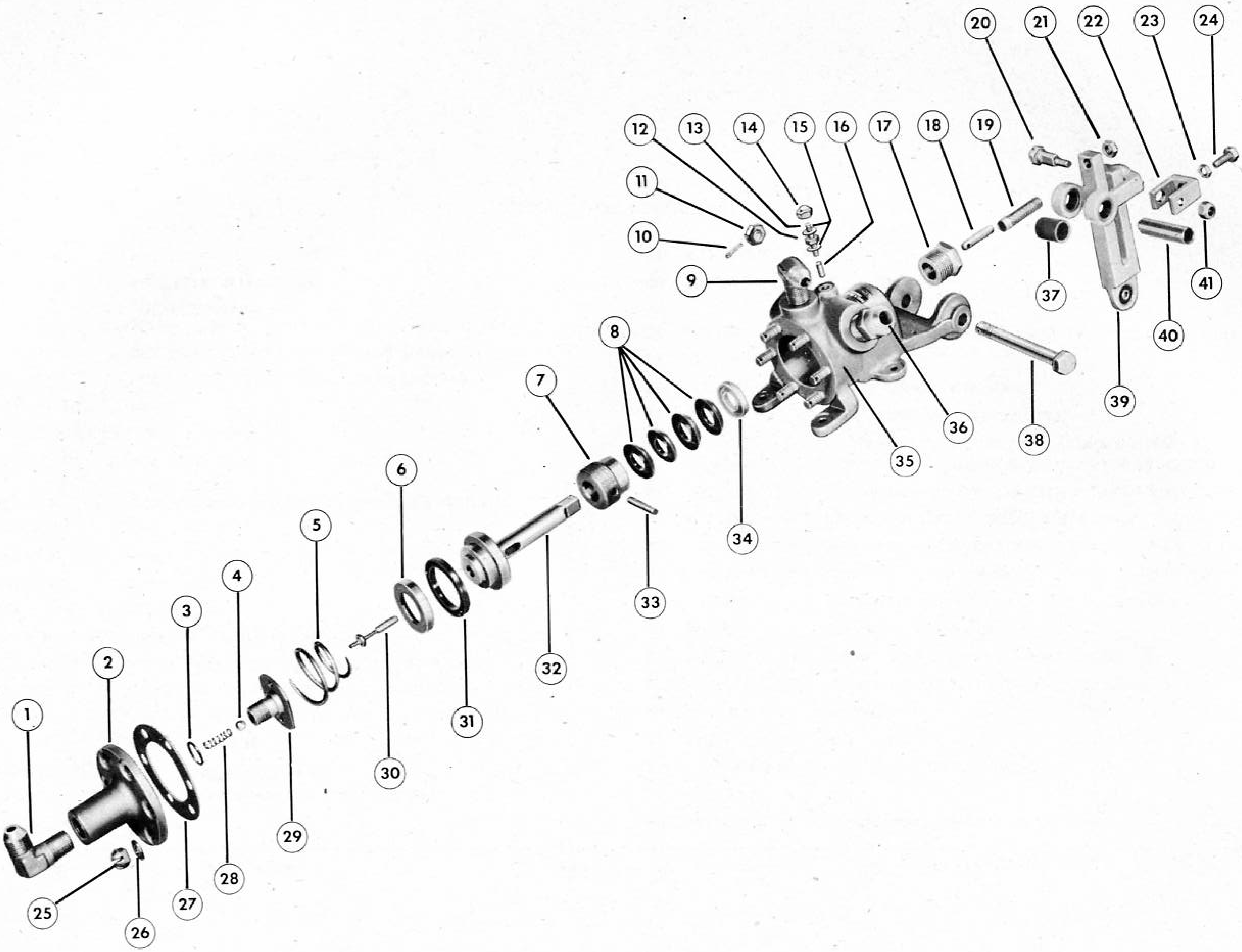


Figure 221 - BRAKE CONTROL VALVE - EXPLODED VIEW

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AC811CT-6NS	ELBOW	1
2.	1059760	COVER, POWER BRAKE CONTROL HOUSING	1
3.	143908-016TC020-064	WASHER	1
4.	¼" DIA.	BALL, BRIGHT STEEL	1
5.	1007337	SPRING, POWER BRAKE CONTROL VALVE MAIN	1
6.	1024866	SPACER, POWER BRAKE CONTROL VALVE SPRING	1
7.	1007331	NUT, POWER BRAKE CONTROL VALVE ADJUSTING	1
8.	5135865-4X-016	PACKING, HYDRAULIC CHEVRON	4
9.	AC811CT-6	ELBOW	1
10.	AN380-33	PIN, COTTER	1
11.	AN310-6	NUT	1
12.	AN315-3R	NUT	1
13.	1007693	SCREW, POWER BRAKE CONTROL VALVE ADJUSTING NUT LOCK	1
14.	10-32	NUT, BRASS CAP	1
15.	143908-006TC-012-040	WASHER	2
16.	5068111-102	PLUG	1
17.	1007329	NUT, POWER BRAKE CONTROL VALVE PACKING	1
18.	1007965	LINK, POWER BRAKE CONTROL VALVE PISTON OPERATING	1
19.	1005307	SCREW, POWER BRAKE CONTROL VALVE OPERATING LEVER ADJUSTING	1
20.	1074050	BOLT, BRAKE LEVER CLAMP	1
21.	AN316-5R	NUT	1
22.	1072046	CLAMP, POWER BRAKE LEVER FULCRUM	1
23.	AN316-4R	NUT	1
24.	110242-4-5AH	BOLT, SPECIAL FULL THREADED	1
25.	AN310-4	NUT	6
26.	AN960-416	WASHER	6
27.	1059761	GASKET, POWER BRAKE CONTROL COVER	1
28.	1007336	SPRING, POWER BRAKE CONTROL VALVE	1
29.	1024864	SEAT, POWER BRAKE CONTROL VALVE	1
30.	1024865	PIN, POWER BRAKE CONTROL VALVE OPERATING	1
31.	1044344-G-104	CUP, 3/16" x 3/16" HYDRAULIC PACKING WIDE BASE	1
32.	1024867	PISTON, POWER BRAKE CONTROL VALVE	1
33.	1007332	PIN, POWER BRAKE CONTROL VALVE GUIDE	1
34.	1007330	SPACER, POWER BRAKE CONTROL VALVE PACKING	1
35.	5059485	HOUSING ASSY., POWER BRAKE CONTROL VALVE—L.H.	1
	5059485-1	HOUSING ASSY., POWER BRAKE CONTROL VALVE—R.H.	1
36.	AC811FT-8D	NIPPLE (USED ON 5059485 ONLY)	1
37.	1073362	SPACER, BRAKE VALVE FORK	1
38.	AN6-30	BOLT	1
39.	2007339	LEVER ASSEMBLY, POWER BRAKE CONTROL VALVE LIGHT OPERATING	1
40.	2033900-10D-49-24	TUBE	1
41.	AC365-428	NUT	1

LEGEND FOR FIGURE 221

(g) Place seal in position in body and screw adjusting screw up to its approximate position.

NOTE

The position of this screw is determined during tests.

(28) INSTALLATION OF ADJUSTABLE RELIEF VALVE.

(a) Install valve in place.

(b) Install attaching bolts.

(c) Uncap lines and attach to valve. Use approved thread lubricant on all threads.

(29) ASSEMBLY OF PRESSURE REGULATOR RELIEF VALVE. (See figure 189.)

(a) Wipe all parts clean and use ample approved thread lubricant on all threads.

(b) Assemble seat fitting, guide, and spring.

(c) Assemble adjusting nut.

(d) Assemble lock nut, gasket, and cap to body.

(30) INSTALLATION OF PRESSURE REGULATOR RELIEF VALVE. (See figure 205.)

(a) Install valve in place in airplane with its two attaching bolts.

(b) Uncap and connect all lines. Use approved thread lubricant on all threads.

(31) ASSEMBLY OF DISCONNECT VALVES. (See figure 188.)

(a) Wipe all parts clean and use ample approved thread lubricant on all threads.

(b) Place ball and spring in position in body.

(c) Install new gasket and screw union into body.

(32) INSTALLATION OF DISCONNECT VALVES.

(a) With a new gasket in position, place valve through fire wall.

(b) Assemble adapter with new gasket in place to body.

(c) Assemble adapter nut.

(d) Lock nuts in position with lock wire.

(e) Uncap and connect all lines. Use approved thread lubricant on all threads.

(33) ASSEMBLY OF PRESSURE REGULATOR. (See figure 223.)

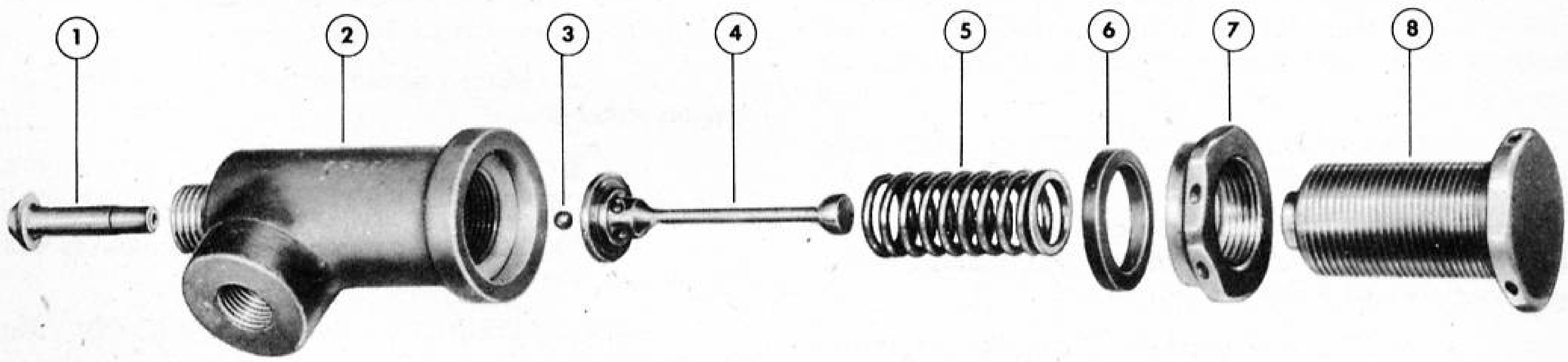
(a) Wipe all parts clean and use ample approved thread lubricant on all threads.

(b) Assemble plug, tee, reducer bushing, and elbow to top end of housing.

(c) Assemble packing spring, packing ring, two chevron packings, packing ring, and packing nut to inside of housing.

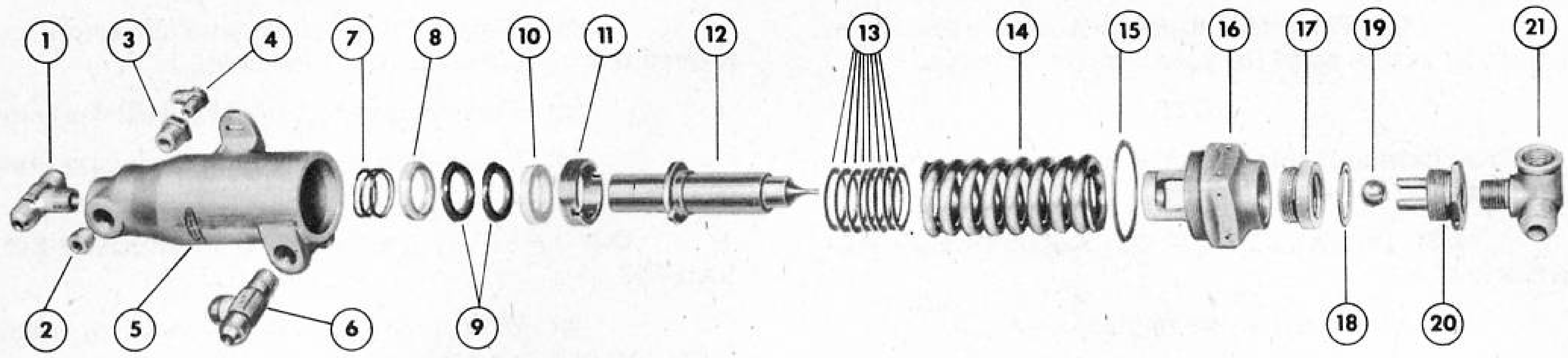
(d) Place piston, shims, and piston spring in position in housing.

(e) Place housing and end in an arbor press, and assemble end to housing, using a new gasket.



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	1086474	SEAT, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
2.	2085701	BODY, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
3.	⅛ DIA.	BALL, BRIGHT STEEL	1
4.	2085703	STEM, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
5.	1085704	SPRING, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
6.	143908-020SR026-093	WASHER	1
7.	1085707	NUT, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1
8.	1085705	SCREW, HYDRAULIC MECHANISM ADJUSTABLE RELIEF VALVE	1

Figure 222 - HYDRAULIC ADJUSTABLE RELIEF VALVE - EXPLODED VIEW



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	AC811ST-8	TEE	1
2.	AC895-102	PLUG	1
3.	AC895-D81	BUSHING, REDUCING	1
4.	AC811CT-4D	ELBOW	1
5.	4005433	HOUSING, HYDRAULIC PRESSURE REGULATING VALVE	1
6.	AC811RT-8	TEE	1
7.	1070624	SPRING, HYDRAULIC PRESSURE REGULATING VALVE PACKING	1
8.	1072036	SPACER, HYDRAULIC PRESSURE REGULATING VALVE, INNER	1
9.	5135865-4N-030	PACKING, HYDRAULIC CHEVRON	2
10.	1070625	SPACER, HYDRAULIC PRESSURE REGULATING VALVE PACKING	1
11.	1072037	NUT, HYDRAULIC PRESSURE REGULATING VALVE	1
12.	1005410	PISTON, HYDRAULIC PRESSURE REGULATING VALVE	1
13.	143908-104R116-010	WASHER	8
14.	1005430	SPRING, HYDRAULIC PRESSURE REGULATING VALVE	1
15.	AN900-31	GASKET	1
16.	2005427	END, HYDRAULIC PRESSURE REGULATING VALVE	1
17.	1066288	SEAT, NO. 8 BALL VALVE	1
18.	AN900-18	GASKET	1
19.	9/16" DIA.	BRIGHT STEEL BALL	1
20.	2005429	BUSHING, HYDRAULIC PRESSURE REGULATING VALVE	1
21.	2104186	TEE, SPECIAL NO. 8 SIDE OUTLET	1

Figure 223 - HYDRAULIC PRESSURE REGULATOR - EXPLODED VIEW

(f) Place steel ball in position and assemble bushing to housing, using a new gasket.

(g) Assemble three-way elbow to bushing.

(34) INSTALLATION OF PRESSURE REGULATOR. (See figure 204.) - Place pressure regulator in position. Install the two attaching bolts. Uncap and connect lines. Use approved thread lubricant on all threads.

(35) ASSEMBLY OF PRESSURE ACCUMULATOR. (See figure 186.)

(a) Wipe all parts clean. Put approved thread lubricant around rim of diaphragm and its seat on the upper and lower domes.

(b) Place diaphragm in position on lower dome and put upper dome in place.

(c) Assemble bolts and studs to upper and lower domes, installing nuts loosely by hand.

(d) Select any three bolts or studs 120 degrees apart. Mark each one for identification. Measure the length of each of the selected bolts or studs with a micrometer.

(e) Tighten nuts on these studs or bolts evenly, until the bolts have lengthened 0.0065 inch, minus 0.001 inch. Use a torque wrench. Observe the torque required when nuts are tightened.

(f) Continue with balance of nuts until all are tightened to the torque required in step (5).

(g) Assemble washer and valve assembly to lower dome.

(36) INSTALLATION OF PRESSURE ACCUMULATOR. (See figure 203.)

(a) Place accumulator in position and attach with bolts.

(b) Uncap lines and attach to accumulator. Use ample approved thread lubricant on all threads.

(c) Fill lower portion of accumulator with 300 pounds per square inch air pressure.

(37) ASSEMBLY OF FLUID RESERVOIR. (See figure 185.)

(a) Assemble filter to reservoir, using a new gasket. Use an approved thread lubricant on threads.

(b) Assemble strainer and filler plug.

(c) Install fluid gage rod.

(38) INSTALLATION OF FLUID RESERVOIR. (See figure 202.)

(a) Install reservoir in position in airplane.

(b) Install reservoir attaching bolts.

(c) Uncap lines and connect to reservoir.

Use an approved thread lubricant on all threads.

(d) Fill reservoir with fluid, Specification AN-VV-O-366a.

g. FINAL TEST AFTER ASSEMBLY.

(1) GENERAL. - After installing any unit, test the entire system as outlined in subparagraph e, this paragraph.

(2) TEST OF PRESSURE ACCUMULATOR AFTER INSTALLATION.

(a) After the accumulator has been installed, build up the hydraulic pressure by moving the hand pump bypass valve to TANK position. Operate the hand pump until the pressure on the gage registers 500 pounds per square inch.

(b) Operate the wing flaps slowly and note the pressure gage reading.

(c) The last reading before the indicator suddenly falls to zero is the air pressure in the accumulator. This should be 300 pounds per square inch pressure.

(3) TEST OF PRESSURE REGULATOR AFTER INSTALLATION. - Pump up pressure until the regulator relieves. Observe the pressure at this point, and again when the valve has seated. Repeat the procedure three times. The valve must relieve at 850 ± 25 pounds per square inch, and reseat at 650 pounds per square inch or higher. After the valve has reseated, there must be no leakage at port B up to 850 ± pounds per square inch. Relief valve pressure is adjusted by the number of shims between the retainer spring and the shoulder of the piston. Increasing the number of shims raises the pressure, and reducing the number of shims lowers the pressure.

(4) TEST OF BRAKE CONTROL VALVE AFTER INSTALLATION. (See figure 194.)

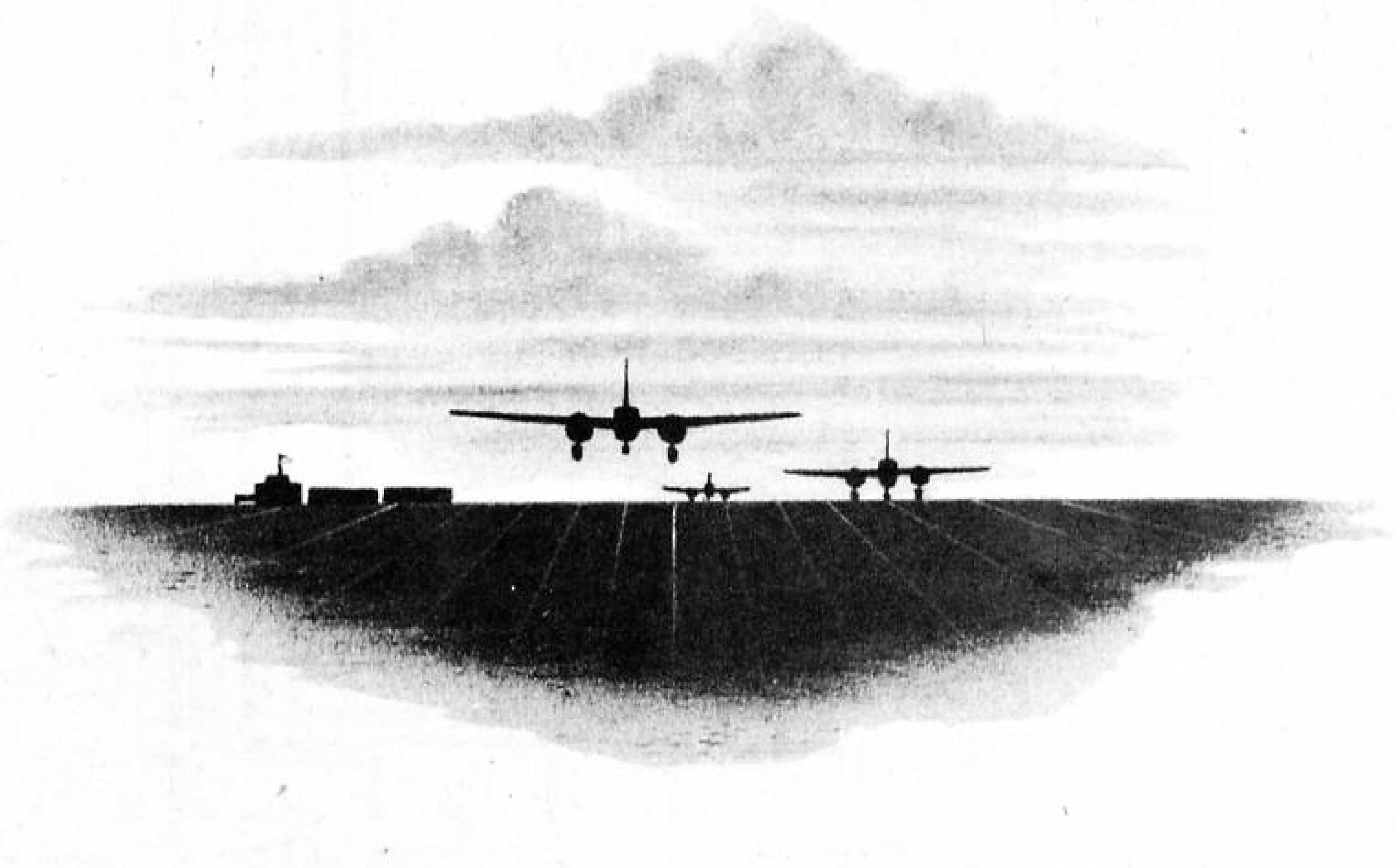
(a) Install a gage that will register 200 pounds per square inch at each brake. With the brakes off and the system at normal pressure, adjust the low pressure screw to give a gage reading of 50 pounds per square inch. Then, back off the adjustment screw one turn quickly so that the gage reaches a static position (reading approximately 5 pounds). Then back it off an additional one-eighth turn and tighten the lock nut.

NOTE

High-pressure adjustment clamp should be about 3/4 inch from the bottom of the slot for the above adjustment.

(b) Adjust the maximum operating pressure by varying the position of the adjustment clamp on the lever until the gages read 135 - 5 pounds per square inch with the brakes applied and the system at normal pressure.

(c) After the clamp adjustment, the gages should read not less than 100 pounds per square inch when the parking brakes are applied.



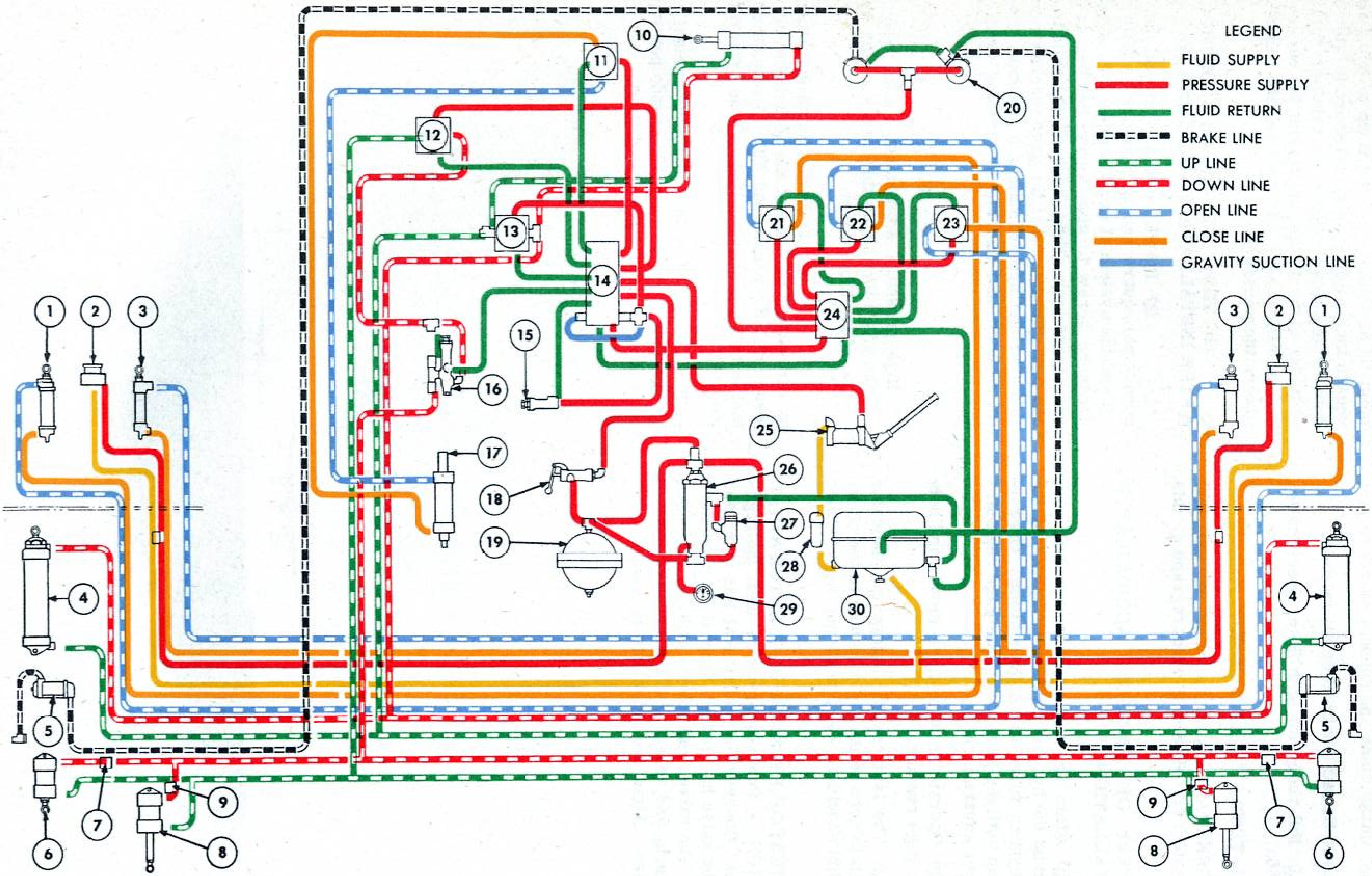


Figure 224 - HYDRAULIC SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5063971-500	STRUT, LOWER COWL FLAP ACTUATING—L.H. AND R.H.	2
	1026614-4-018	SPACER (UPPER)	2
	AN4-26	BOLT (UPPER)	2
	AN960-416L	WASHER	2
	AN960-D416	WASHER	4
	AN310-4	NUT	2
2.	PESCO 1P203W	PUMP, HYDRAULIC	2
	PARKER #12HLC8-NS	ELBOW (SUCTION) ½″ PIPE THREAD	2
	AC811-CT8-NS	ELBOW (PRESSURE) ⅜″ PIPE THREAD	2
3.	4067452-500	STRUT, UPPER COWL FLAP ACTUATING—L.H.	1
	4067452	STRUT, UPPER COWL FLAP ACTUATING—R.H.	1
	AN3-10	BOLT (UPPER)	2
	AN310-3	NUT	2
	AN4-12	BOLT (LOWER)	2
	AN310-4	NUT	2
	AN960-D10	WASHER	4
	AN960-D416	WASHER	2
4.	5062530	STRUT, MAIN LANDING GEAR ACTUATING—L.H.	1
	5062530-1	STRUT, MAIN LANDING GEAR ACTUATING—R.H.	1
	1058080	SPACER	4
	AN7-16	BOLT	2
	AN7-21	BOLT	2
	AN960-716	WASHER	4
	AN310-7	NUT	4
5.	5073568	CYLINDER ASSEMBLY, HYDRAULIC BRAKE DEBOOSTER—L.H.	1
	5073568-1	CYLINDER ASSEMBLY, HYDRAULIC BRAKE DEBOOSTER—R.H.	1
6.	5063964	STRUT, WING FLAP ACTUATING, OUTBOARD—L.H.	1
	5063964-1	STRUT, WING FLAP ACTUATING, OUTBOARD—R.H.	1
	1026614-G4-020	SPACER	2
	AN4-16	BOLT	2
	AN960-416	WASHER	2
	AN310-4	NUT	2
	147983	CLIP	4
7.	4165074	VALVE ASSEMBLY, CONSTANT FLOW	2
	AN3-32A	BOLT	4
	AN960-10L	WASHER	8
	AC364-1032	NUT	4
8.	5063963	STRUT, WING FLAP ACTUATING, INBOARD—L.H.	1
	5063963-1	STRUT, WING FLAP ACTUATING, INBOARD—R.H.	1
	1026614-G4-020	SPACER	2
	AN4-16	BOLT	2
	AN960-416	WASHER	2
	AN310-4	NUT	2
	147983	CLIP, BONDING—L.H.	1*
		—R.H.	2
9.	4165074-500	VALVE ASSEMBLY, CONSTANT FLOW	2
10.	5062532	STRUT, NOSE WHEEL ACTUATING	1
11.	4092182	VALVE ASSEMBLY, BOMB BAY DOOR HYDRAULIC SELECTOR	1
12.	4061768	VALVE ASSEMBLY, WING FLAP HYDRAULIC	1
13.	4062358-500	VALVE ASSEMBLY, LANDING GEAR HYDRAULIC	1
14.	4065511	BLOCK ASSEMBLY, HYDRAULIC MANIFOLD—L.H.	1
15.	4085700-2	VALVE ASSEMBLY, HYDRAULIC MECHANISM ADJUSTABLE RELIEF	1
16.	4063978	VALVE ASSEMBLY, HYDRAULIC FLAP RELIEF	1
17.	5066413	STRUT, BOMB BAY DOOR ACTUATING	1
18.	4062368	VALVE ASSEMBLY, BYPASS	1
19.	5063977	ACCUMULATOR ASSEMBLY, HYDRAULIC PRESSURE	1
	AN365-428	NUT	4
	AN960-416	WASHER	8
	117425-4D-018	SPACER	4
20.	5068111	VALVE ASSEMBLY, POWER BRAKE CONTROL—L.H.	1
	5068111-1	VALVE ASSEMBLY, POWER BRAKE CONTROL—R.H.	1
21.	4065508	VALVE ASSEMBLY, LOWER COWL FLAP HYDRAULIC SELECTOR—L.H.	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
22.	4065507	VALVE ASSEMBLY, UPPER COWL FLAP HYDRAULIC SELECTOR	1
23.	4065567	VALVE ASSEMBLY, LOWER R.H. COWL FLAP HYDRAULIC SELECTOR	1
24.	4065512-500	BLOCK ASSEMBLY, HYDRAULIC MANIFOLD—R.H.	1
25.	5065865	PUMP ASSEMBLY, EMERGENCY HYDRAULIC HAND	1
26.	5065496	VALVE ASSEMBLY, HYDRAULIC PRESSURE REGULATING	1
27.	2063291	VALVE ASSEMBLY, HYDRAULIC PRESSURE RELIEF	1
28.	2113539	FILTER ASSEMBLY, HAND PUMP LINE	1
29.	AAF SPECIFICATION 94-27922 TYPE E-4	GAGE, HYDRAULIC PRESSURE	1
30.	5065486	RESERVOIR ASSEMBLY, HYDRAULIC	1

*One additional required on airplanes AAF 42-53535 through AAF 42-53984.

LEGEND FOR FIGURE 224

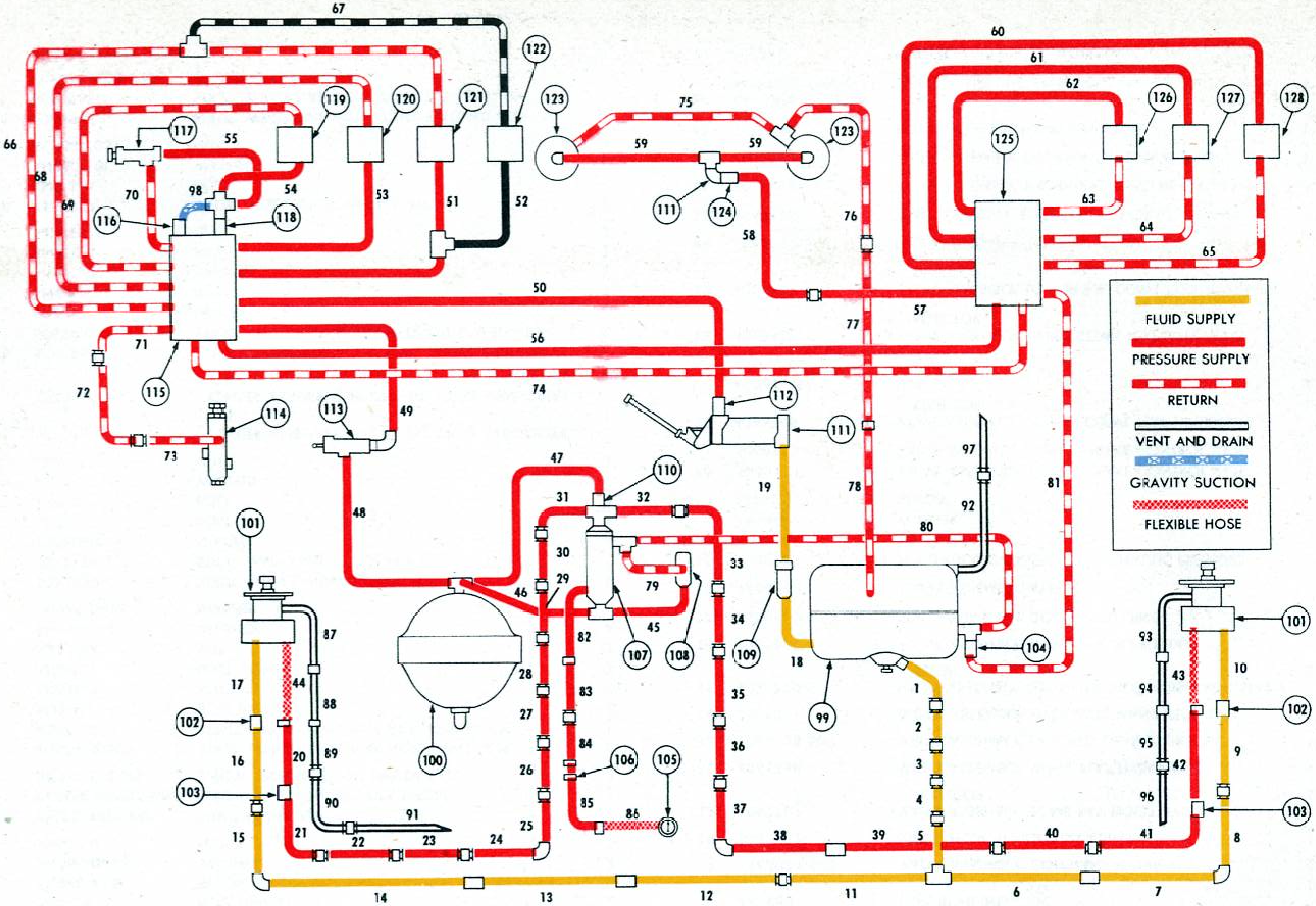


Figure 225 - HYDRAULIC SUPPLY, PRESSURE AND RETURN SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5092469-53	LINE, 1" SUCTION—TO PUMPS	1
	AC811HT-16D	UNION	1
2.	5092469-55	LINE, 1" SUCTION—TO PUMPS	1
	AC811HT-16D	UNION	1
3.	5092469-57	LINE, 1" SUCTION—TO PUMPS	1
	AC811HT-16D	UNION	1
4.	5092469-59	LINE, 1" SUCTION—TO PUMPS	1
	AC811HT-16D	UNION	1
5.	5092469-60	LINE, 1" SUCTION—TO PUMPS	1
	AC811FT-16-12D	NIPPLE	1
6.	5067561-1	LINE, ¾" SUCTION—TO R.H. PUMP	1
	AC811MT-12D	TEE	1
7.	5067561-20	LINE, ¾" SUCTION—TO R.H. PUMP	1
	PARKER 12ET-4-5D	ELBOW, 45°	1
8.	5067561-43	LINE, ¾" SUCTION—TO R.H. PUMP	1
	AC811ET-12D	ELBOW	1
9.	5067561-29	LINE, ¾" SUCTION—TO R.H. PUMP	1
	AC811HT-12D	UNION	1
10.	5066797-2	LINE, ¾" SUCTION—TO R.H. PUMP	1
	AN884-12-11	HOSE, SUCTION	2
	AN746-8	CLAMP, HOSE	4
	1066830	ADAPTER, DISCONNECT VALVE	1
	1066829	NUT, DISCONNECT VALVE	1
	AN900-17	GASKET	1
11.	5062469-106	LINE, ¾" SUCTION—TO L.H. PUMP	1
12.	5092469-68	LINE, ¾" SUCTION—TO R.H. PUMP	1
	AC811HT-12D	UNION	1
13.	5067599-4	LINE, ¾" SUCTION—TO L.H. PUMP	1
	AC811ET-12D	ELBOW	1
14.	5067599-20	LINE, ¾" SUCTION—TO L.H. PUMP	1
	PARKER 12-12ET45D	ELBOW, 45°	1
15.	5067599-37	LINE, ¾" SUCTION—TO L.H. PUMP	1
	AC811ET-12D	ELBOW	1
16.	5067599-43	LINE, ¾" SUCTION—TO L.H. PUMP	1
	AC811HT-12D	UNION	1
17.	5066797-2	LINE, ¾" SUCTION—TO L.H. PUMP	1
	AN884-12-11	HOSE, SUCTION	2
	AN746-8	CLAMP, HOSE	4
	1066830	ADAPTER, DISCONNECT VALVE	1
	1066829	NUT, DISCONNECT VALVE	1
	AN900-17	GASKET	1
18.	5068001-22	LINE, ⅜" SUPPLY—RESERVOIR TO FILTER	1
19.	5068001-23	LINE, ⅜" SUPPLY—FILTER TO HAND PUMP	1
20.	5067599-44	LINE, ½" PRESSURE—FROM L.H. PUMP	1
21.	5067599-47	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
22.	5067599-38	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
23.	5067599-19	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
24.	5067599-1	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811ET-8D	ELBOW	1
25.	5092469-99	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
26.	5092469-93	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
27.	5092469-87	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
28.	5092469-10	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
29.	5092469-4	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
30.	5092469-108	LINE, ½" PRESSURE—FROM L.H. PUMP	1
	AC811HT-8D	UNION	1
31.	5068001-13	LINE, ½" PRESSURE—FROM L.H. PUMP	1
32.	5068001-18	LINE, ½" PRESSURE—FROM R.H. PUMP	1
33.	5092469-54	LINE, ½" PRESSURE—FROM R.H. PUMP	1
34.	5092469-56	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
35.	5092469-58	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
36.	5092469-107	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
37.	5092469-61	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
38.	5067561-2	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811ET-8D	ELBOW	1
39.	5067561-19	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
40.	5067561-44	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
41.	5067561-47	LINE, ½" PRESSURE—FROM R.H. PUMP	1
	AC811HT-8D	UNION	1
42.	5067561-30	LINE, ½" PRESSURE—FROM R.H. PUMP	1
43.	4062376-21	HOSE, FLEXIBLE	1
	1031662-8S	NUT, PRESSURE BULKHEAD	1
	AN960-1216	WASHER	1
44.	4062376-21	HOSE, FLEXIBLE	1
	1031662-8S	NUT, PRESSURE BULKHEAD	1
	AN960-1216	WASHER	1
45.	5068001-2	LINE, ½" PRESSURE—REGULATOR TO RELIEF VALVE	1
46.	5068001-3	LINE, ½" PRESSURE—ACCUMULATOR TO REGULATOR	1
47.	5068001-4	LINE, ½" PRESSURE—CHECK VALVE TO ACCUMULATOR	1
48.	5068001-11	LINE, ½" PRESSURE—ACCUMULATOR TO BYPASS VALVE	1
49.	5068001-1	LINE, ½" PRESSURE—BYPASS VALVE TO L.H. MANIFOLD BLOCK	1
50.	5068001-28	LINE, ⅜" PRESSURE—HAND PUMP TO L.H. MANIFOLD BLOCK	1

LEGEND FOR FIGURE 225

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
51.	5092469-40*	LINE, 3/8" PRESSURE—TO BOMB DOOR SELECTOR VALVE	1
	5092469-157**	LINE, 3/8" PRESSURE—TO BOMB DOOR SELECTOR VALVE	1
	PARKER 6-64JT-D**	TEE	1
	5092469-153**	LINE, 3/8" PRESSURE—TO BOMB DOOR SELECTOR VALVE	1
52.	5092469-155**	LINE, 1/4" PRESSURE—AIR FILTER SELECTOR VALVE	1
53.	5068061-4	LINE, 3/8" PRESSURE—TO WING FLAP SELECTOR VALVE	1
54.	5068061-5	LINE, 1/2" PRESSURE—TO LANDING GEAR SELECTOR VALVE	1
55.	5068061-9	LINE, 1/4" PRESSURE—CHECK VALVE TO RELIEF VALVE	1
56.	5068001-19	LINE, 1/2" PRESSURE—L.H. MANIFOLD BLOCK TO R.H. MANIFOLD BLOCK	1
57.	5092469-27	LINE, 3/8" PRESSURE—TO BRAKE VALVES FITTING TO MANIFOLD	1
58.	5092469-23	LINE, 3/8" PRESSURE—TO BRAKE VALVE	1
	AC811HT-6D	UNION	1
59.	5092469-18	LINE, 3/8" PRESSURE—TO L.H. BRAKE VALVE	1
	5092469-19	LINE, 3/8" PRESSURE—TO R.H. BRAKE VALVE	1
	AC811OT-6D	TEE	1
	AC895-91	NIPPLE, HEX.	1
60.	5067552-10	LINE, 1/4" PRESSURE—TO R.H. LOWER COWL FLAP SELECTOR VALVE	1
61.	5067552-11	LINE, 1/4" PRESSURE—TO UPPER COWL FLAP SELECTOR VALVE	1
62.	5067552-9	LINE, 1/4" PRESSURE—TO L.H. LOWER COWL FLAP SELECTOR VALVE	1
63.	5067552-8	LINE, 1/4" RETURN—FROM L.H. LOWER COWL FLAP SELECTOR VALVE	1
64.	5067552-12	LINE, 1/4" RETURN—FROM UPPER COWL FLAP SELECTOR VALVE	1
65.	5067552-7	LINE, 1/4" RETURN—FROM R.H. LOWER COWL FLAP SELECTOR VALVE	1
66.	5092469-41*	LINE, 3/8" RETURN—FROM BOMB DOOR SELECTOR VALVE	1
	5092469-154**	LINE, 3/8" RETURN—FROM BOMB DOOR SELECTOR VALVE	1
	PARKER 6-64JT-D**	TEE	1
	5092469-158**	LINE, 3/8" RETURN—FROM BOMB DOOR SELECTOR VALVE	1
67.	5092469-156**	LINE, 1/4" RETURN—FROM AIR FILTER VALVE	1
68.	5068061-7	LINE, 3/8" RETURN—FROM WING FLAP SELECTOR VALVE	1
69.	5068061-6	LINE, 1/2" RETURN—FROM LANDING GEAR SELECTOR VALVE	1
70.	5068061-8	LINE, 1/4" RETURN—FROM RELIEF VALVE	1
71.	5068001-21	LINE, 3/8" RETURN—FROM WING FLAP RELIEF VALVE	1
	AC811HT-6D	UNION	1
72.	5092469-3	LINE, 3/8" RETURN—FROM WING FLAP RELIEF VALVE	1
	AC811HT-6D	UNION	1
73.	5092469-9	LINE, 3/8" RETURN—FROM WING FLAP RELIEF VALVE	1
74.	5068001-20	LINE, 1/2" RETURN—L.H. MANIFOLD BLOCK TO R.H. MANIFOLD BLOCK	1
75.	5092469-20	LINE, 1/2" BRAKE RETURN—TO RESERVOIR	1
76.	5092469-22	LINE, 1/2" BRAKE RETURN—TO RESERVOIR	1
	AC811HT-8D	UNION	1
77.	5092469-26	LINE, 1/2" BRAKE RETURN—TO RESERVOIR	1
	3115-1ET-8D	COUPLING	1
	11-1039-1-10D	NUT, LOCK	1
78.	5068001-14	LINE, 1/2" BRAKE RETURN—TO RESERVOIR	1
79.	5068001-1	LINE, 1/2" RETURN—REGULATOR TO RELIEF VALVE	1
80.	5068001-16	LINE, 1/2" RETURN—REGULATOR TO RESERVOIR	1
81.	5068001-15	LINE, 1/2" GENERAL RETURN—R.H. MANIFOLD BLOCK TO RESERVOIR	1
82.	5068001-6	LINE, 1/4" PRESSURE—TO HYDRAULIC PRESSURE GAUGE	1
	3115-1ET-4D	COUPLING	1
	11-1039-1-3D	NUT, LOCK	1
83.	5092469-39	LINE, 1/4" PRESSURE—TO HYDRAULIC PRESSURE GAUGE	1
	AC811HT-4D	UNION	1
84.	5092469-36	LINE, 1/4" PRESSURE—TO HYDRAULIC PRESSURE GAUGE	1
85.	5092469-21	LINE, 1/4" PRESSURE—TO HYDRAULIC PRESSURE GAUGE	1
86.	2049589	HOSE, HYDRAULIC PRESSURE GAUGE	1
87.	5066797-11	LINE, 1/4" DRAIN—FROM L.H. PUMP	1
	AC851-4	NIPPLE, HOSE (AT PUMP)	1
	AN884-4-9	HOSE	1
	AN746 WITTEK FB-2	CLAMP	2
88.	5066797-12	LINE, 1/4" DRAIN—FROM L.H. PUMP	1
	AN884-4-9	HOSE	1
	AN746-4-9	HOSE	1
	AN746 WITTEK FB2	CLAMP	2
	126480-24	CLAMP, 1 1/2" DIA.	1
	ADEL 755-4-2-8	CLAMP	1
	AN520-10-10	SCREW	1
	AC365-1032	NUT	1
	AN960-D10	WASHER	1
89.	5067599-48	LINE, 1/4" DRAIN—FROM L.H. PUMP	1
	AC811HT-4D	UNION	1
90.	5067599-46	LINE, 1/4" DRAIN—FROM L.H. PUMP	1
	PARKER 3115-1HT-4D	UNION, BULKHEAD	1
	PARKER 11- 1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
91.	5067599-45	LINE, 1/4" DRAIN—FROM L.H. PUMP	1
	AC811HT-4D	UNION	1
92.	5068001-17	LINE, 5/8" VENT—FROM RESERVOIR	1
	AC811HT-10D	UNION	1

*Airplanes AAF 42-53536 through AAF 42-53834 **Airplanes AAF 42-53835 through AAF 42-54284

LEGEND FOR FIGURE 225

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
93.	5066797-11	LINE, ¼" DRAIN—FROM R.H. PUMP	1
	AC851-4	NIPPLE, HOSE (AT PUMP)	1
	AN884-4-9	HOSE	1
	AN746 WITTEK FB-2	CLAMP	2
94.	5066797-12	LINE, ¼" DRAIN—FROM R.H. PUMP	1
	AN884-4-9	HOSE	1
	AN746 WITTEK FB-2	CLAMP	2
	126480-24	CLAMP, 1½" DIA.	1
	ADEL 755-4-2-8	CLAMP	1
	AN520-10-10	SCREW	1
	AC365-1032	NUT	1
	AN960-D10	WASHER	1
95.	5067561-45	LINE, ¼" DRAIN—FROM R.H. PUMP	1
	PARKER 3115-1HT-4D	UNION, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
96.	5067561-46	LINE, ¼" DRAIN—FROM R.H. PUMP	1
	AC811HT-4D	UNION	1
97.	5092469-25	LINE, ⅝" VENT—FROM RESERVOIR	1
98.	5068061-10	LINE, ⅜" PRESSURE BYPASS—FOR LANDING GEAR	1
99.	5065486	RESERVOIR ASSEMBLY, HYDRAULIC	1
100.	5063977	ACCUMULATOR ASSEMBLY, HYDRAULIC PRESSURE	1
	AN365-428	NUT	4
	AN960-416	WASHER	8
	117425-4D-018	SPACER	4
101.	PESCO 1P203W	PUMP, HYDRAULIC	2
	PARKER 12HLC 8-NS	ELBOW (SUCTION), ½" PIPE THREAD	2
	AC811-CT8-NS	ELBOW (PRESSURE), ⅜" PIPE THREAD	2
102.	2024790	VALVE ASSEMBLY, HYDRAULIC PUMP SUCTION LINE DISCONNECT	2
	1068251	NUT, FIRE WALL DISCONNECT VALVE CHECK	2
	143908-1125122-109	WASHER—L.H.	1
	143908-1125112-108	WASHER—R.H.	1
103.	2085650	VALVE ASSEMBLY, NO. 8 UNION CHECK	2
104.	2067311	VALVE, NO. 8 PARKER TO PIPE CHECK	1
105.	AAF Spec. 94-27922 TYPE E-4	GAGE, HYDRAULIC PRESSURE	1
106.	2086555	SNUBBER ASSEMBLY, HYDRAULIC GAGE	1
107.	5065496	VALVE ASSEMBLY, HYDRAULIC PRESSURE REGULATING	1
	AN3-5A	BOLT	2
108.	2063291	VALVE ASSEMBLY, HYDRAULIC PRESSURE RELIEF	1
	AN3-5A	BOLT	2
109.	2113539	FILTER ASSEMBLY, HAND PUMP LINE	1
110.	2064928	VALVE ASSEMBLY, FEMALE PIPE TO MALE PIPE STRAIGHT CHECK	1
	AC895-3	ELBOW, STREET	1
	AC895-D92	NIPPLE, HEX.	1
	AC811-GT-8D	CONNECTOR	1
111.	5065865	PUMP ASSEMBLY, EMERGENCY HYDRAULIC HAND	1
	4065510	SUPPORT, HYDRAULIC HAND PUMP	1
	AN4-34A	BOLT	2
	AC365-428	NUT	2
	AN960-D416	WASHER	2
	AN3-6A	BOLT	3
	AN3-7A	BOLT	1
	AC365-1032	NUT	4
	AN960-D10	WASHER	4
112.	2064850	VALVE, HYDRAULIC HAND PUMP CHECK	1
113.	4062368	VALVE ASSEMBLY, BYPASS	1
	AN3-5A	BOLT	3
	AN960-D10	WASHER	3
	AC365-1032	NUT	3
114.	4063978	VALVE ASSEMBLY, HYDRAULIC FLAP RELIEF	1
115.	4065511	BLOCK ASSEMBLY, HYDRAULIC MANIFOLD—L.H.	1
116.	2067265	VALVE ASSEMBLY, NO. 6 PARKER TO PIPE CHECK	1
117.	4085700-2	VALVE ASSEMBLY, HYDRAULIC MECHANISM ADJUSTABLE RELIEF	1
	AC811FT-4 CONN.	FITTING	1
	ADEL 755-14-2-8	CLAMP	1
	AN520-10-10	SCREW	1
	AC365-1032	NUT, STOP	1
118.	2067312	VALVE ASSEMBLY, PIPE TO PIPE STRAIGHT CHECK	1
119.	4062358-500	VALVE ASSEMBLY, LANDING GEAR HYDRAULIC	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
120.	4061768	VALVE ASSEMBLY, WING FLAP HYDRAULIC	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
121.	4092182	VALVE ASSEMBLY, BOMB DOOR HYDRAULIC SELECTOR	1
122.	4168436	VALVE ASSEMBLY, AIR FILTER HYDRAULIC CONTROL	1
123.	5068111	VALVE ASSEMBLY, POWER BRAKE CONTROL—L.H.	1
	5068111-1	VALVE ASSEMBLY, POWER BRAKE CONTROL—R.H.	1
	AN3-10A	BOLT	8
	AC365-1032	NUT	8
	AN960-D10	WASHER	10
	AN3-7	BOLT	2
	AN310-3	NUT	2
124.	2067264	VALVE ASSEMBLY, NO. 6 PIPE TO PARKER CHECK	1
	AC895-D11	ELBOW, PIPE	1
	ADEL 755-13-2-8	CLIP	1
	AN520-10-8	SCREW	1
	AC365-1032	NUT	1
	AN960-D10	WASHER	1
125.	4065512-500	BLOCK ASSEMBLY, HYDRAULIC MANIFOLD—R.H.	1
126.	4065508	VALVE ASSEMBLY, LOWER COWL FLAP HYDRAULIC SELECTOR—L.H.	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
127.	4065507	VALVE ASSEMBLY, UPPER COWL FLAP HYDRAULIC SELECTOR	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
128.	4065567	VALVE ASSEMBLY, LOWER R.H. COWL FLAP HYDRAULIC SELECTOR	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4

LEGEND FOR FIGURE 225

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5068061-1	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811HT-6D	UNION	1
2.	5092469-1	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811HT-6D	UNION	1
3.	5092469-7	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811JT-6D	TEE	1
4.	5092469-84	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811CT-6D	ELBOW	1
5.	5092469-83	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
6.	5092469-144	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811HT-6D	UNION	1
7.	5092469-91	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811HT-6D	UNION	1
8.	5092469-97	LINE, 3/8" PRESSURE DOWN—TO WING FLAPS	1
	AC811JT-6D	TEE	1
9.	5067599-14	LINE, 3/8" PRESSURE DOWN—TO L.H. WING FLAPS	1
	AC811HT-6D	UNION	1
10.	5067599-21	LINE, 3/8" PRESSURE DOWN—TO L.H. WING FLAPS	1
	AC811HT-6D	UNION	1
11.	5067599-64	LINE, 3/8" PRESSURE DOWN—TO L.H. WING FLAPS	1
	PARKER No. 6-5-JT-D	TEE	1
12.	5067599-66	LINE, 5/16" PRESSURE DOWN—TO L.H. INBOARD WING FLAP	1
13.	5067599-67	LINE, 5/16" PRESSURE DOWN—TO L.H. INBOARD WING FLAP	1
14.	4062375-16	HOSE, FLEXIBLE	1
	1031662-5S	NUT	1
	AN960-816	WASHER	1
15.	5067599-65	LINE, 5/16" PRESSURE DOWN—TO L.H. OUTBOARD WING FLAP	1
16.	5067599-68	LINE, 5/16" PRESSURE DOWN—TO L.H. OUTBOARD WING FLAP	1
17.	4062375-16	HOSE, FLEXIBLE	1
	1031662-55	NUT	1
	AN960-816	WASHER	1
18.	5092469-102	LINE, 3/8" PRESSURE DOWN—TO R.H. WING FLAPS	1
	AC811HT-6D	UNION	1

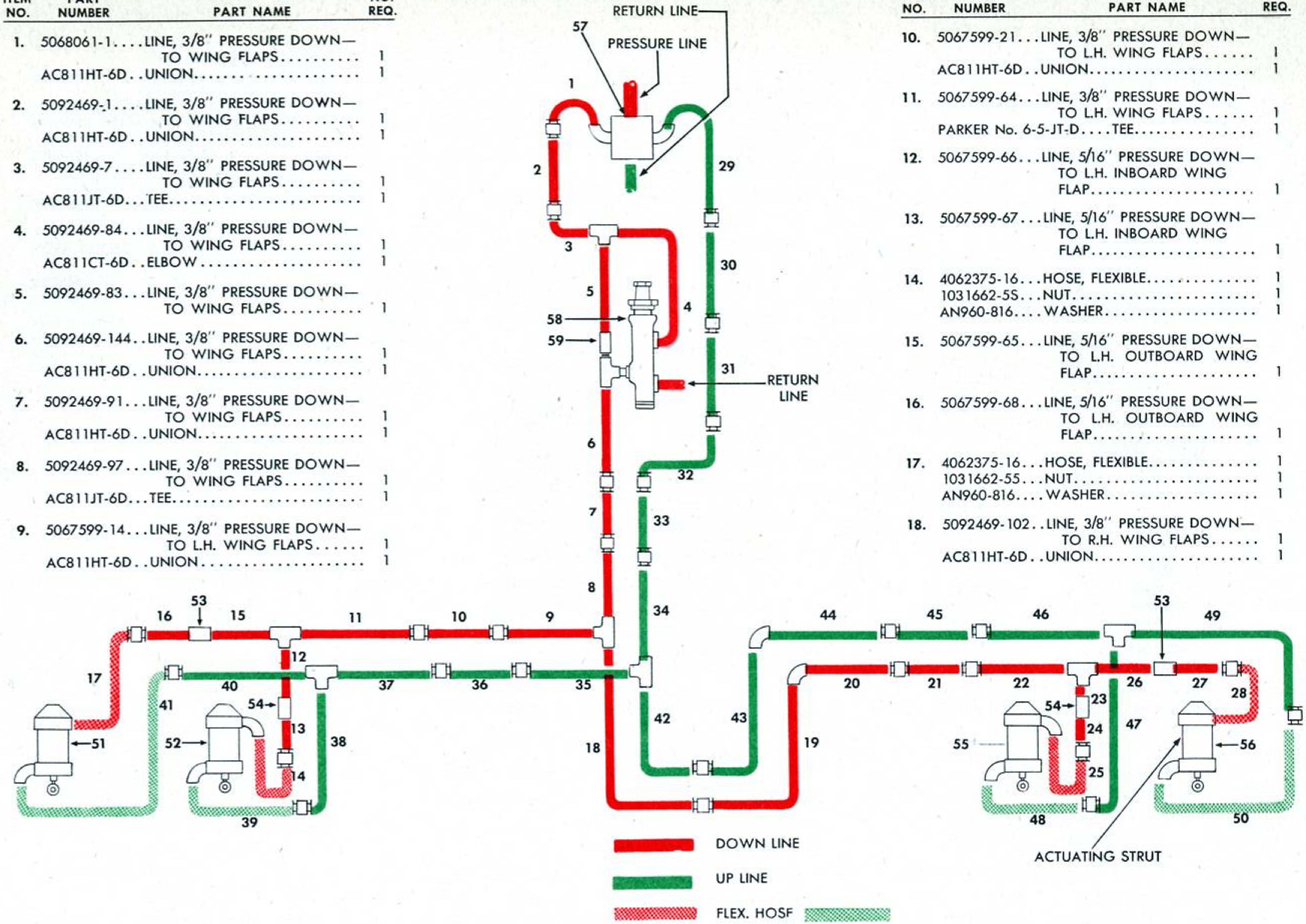


Figure 226 - WING FLAP HYDRAULIC SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
19.	5092469-70	LINE, 3/8" PRESSURE DOWN—TO R.H. WING FLAPS	1
	AC811ET-6D	ELBOW	1
20.	5067561-4	LINE, 3/8" PRESSURE DOWN—TO R.H. WING FLAPS	1
	AC811-HT-6D	UNION	1
21.	5067561-21	LINE, 3/8" PRESSURE DOWN—TO R.H. WING FLAPS	1
	AC811-HT-6D	UNION	1
22.	5067561-58	LINE, 3/8" PRESSURE DOWN—TO R.H. WING FLAPS	1
	PARKER 46-5-5-JT-D	TEE	1
23.	5067561-60	LINE, 5/16" PRESSURE DOWN—TO R.H. INBOARD WING FLAP	1
24.	5067561-61	LINE, 5/16" PRESSURE DOWN—TO R.H. INBOARD WING FLAP	1
25.	4062375-16	HOSE, FLEXIBLE	1
	1031662-5S	NUT	1
	AN960-816	WASHER	1
26.	5067561-59	LINE, 5/16" PRESSURE DOWN—TO R.H. OUTBOARD WING FLAP	1
27.	5067561-62	LINE, 5/16" PRESSURE DOWN—TO R.H. OUTBOARD WING FLAP	1
28.	4062375-16	HOSE, FLEXIBLE	1
	1031662-5S	NUT	1
	AN960-816	WASHER	1
29.	5068061-2	LINE, 3/8" PRESSURE UP—TO WING FLAPS	1
	AC811HT-6D	UNION	1
30.	5092469-2	LINE, 3/8" PRESSURE UP—TO WING FLAPS	1
	AC811HT-6D	UNION	1
31.	5092469-8	LINE, 3/8" PRESSURE UP—TO WING FLAPS	1
	AC811HT-6D	UNION	1
32.	5092469-98	LINE, 3/8" PRESSURE UP—TO WING FLAPS	1
	AC811HT-6D	UNION	1
33.	5092469-92	LINE, 3/8" PRESSURE UP—TO WING FLAPS	1
	AC811HT-6D	UNION	1
34.	5092469-98	LINE, 3/8" PRESSURE UP—TO WING FLAPS	1
	AC811JT-6D	TEE	1
35.	5067599-15	LINE, 3/8" PRESSURE UP—TO L.H. WING FLAPS	1
	AC811HT-6D	UNION	1
36.	5067599-22	LINE, 3/8" PRESSURE—TO L.H. WING FLAPS	1
	AC811HT-6D	UNION	1
37.	5067599-28	LINE, 3/8" PRESSURE UP—L.H. WING FLAPS	1
	PARKER NO. 6-5-5-JT-D	TEE	1
38.	5067599-41	LINE, 5/16" PRESSURE UP—TO L.H. INBOARD WING FLAP	1
39.	4062375-18	HOSE, FLEXIBLE	1
	1031662-55	NUT	1
	AN960-816	WASHER	1
40.	5067599-39	LINE, 5/16" PRESSURE UP—TO L.H. OUTBOARD WING FLAP.	1
41.	4062375-18	HOSE, FLEXIBLE	1
	1031662-55	NUT	1
	AN960-816	WASHER	1
42.	5092469-103	LINE, 3/8" PRESSURE UP—TO R.H. WING FLAPS	1
	AC811HT-6D	UNION	1
43.	5092469-73	LINE, 3/8" PRESSURE UP—TO R.H. WING FLAPS	1
	AC811ET-6D	ELBOW	1
44.	5067561-3	LINE, 3/8" PRESSURE UP—TO R.H. WING FLAPS	1
	AC811HT-6D	UNION	1
45.	5067561-41	LINE, 3/8" PRESSURE UP—TO R.H. WING FLAPS	1
	AC811HT-6D	UNION	1
46.	5067561-22	LINE, 3/8" PRESSURE UP—TO R.H. WING FLAPS	1
	PARKER 46-5-5-JT-D	TEE	1
47.	5067561-32	LINE, 5/16" PRESSURE UP—TO R H. INBOARD WING FLAP	1
48.	4062375-18	HOSE, FLEXIBLE	1
	1031662-5S	NUT	1
	AN960-816	WASHER	1
49.	5067561-24	LINE, 5/16" PRESSURE UP—TO R.H. OUTBOARD WING FLAP	1
50.	4062375-18	HOSE, FLEXIBLE	1
	1031662-5S	NUT	1
	AN960-816	WASHER	1
51.	5063964	STRUT, WING FLAP ACTUATING—OUTBOARD	1
	1026614-G4-020	SPACER	1
	AN4-16	BOLT	1
	AN960-416	WASHER	1
	AN310-4	NUT	1
	147983	CLIP, BONDING	2
52.	5063963	STRUT, WING FLAP ACTUATING—INBOARD	1
	1026614-G4-020	SPACER	1
	AN4-16	BOLT	1
	AN960-416	WASHER	1
	AN310-4	NUT	1
	147983	CLIP, BONDING	*1
53.	4165074	VALVE ASSEMBLY, CONSTANT FLOW	2
	AN3-32A	BOLT	4
	AN960-10L	WASHER	8
	AC364-1032	NUT	4
54.	4165074-500	VALVE ASSEMBLY, CONSTANT FLOW	2
55.	5063963-1	STRUT, WING FLAP ACTUATING—INBOARD	1
	1026614-G4-020	SPACER	1
	AN4-16	BOLT	1
	AN960-416	WASHER	1
	AN310-4	NUT	1
	147983	CLIP, BONDING	2
56.	5063964-1	STRUT, WING FLAP ACTUATING—OUTBOARD	1
	1026614-G4-020	SPACER	1
	AN4-16	BOLT	1
	AN960-416	WASHER	1
	AN310-4	NUT	1
	147983	CLIP, BONDING	2
57.	4061768	VALVE ASSEMBLY, WING FLAP HYDRAULIC	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
58.	4063978	VALVE ASSEMBLY, HYDRAULIC FLAP RELIEF	1
	AC895-91	NIPPLE, HEX	1
59.	2067265-6FT	VALVE ASSEMBLY, NO. 6 PARKER TO PIPE CHECK	1
	PARKER NO. 4211	TEE	1
	AC811FT-6D	NIPPLE	1

*One additional required on airplanes AAF 42-53835 through AAF 42-54284.

LEGEND FOR FIGURE 226

DOWN LINES

1. FITTING AT VALVE TO TEE
2. TEE AT STATION NO. 65 TO COUPLING
3. COUPLING AT STATION NO. 70 TO UNION
4. UNION AT STATION NO. 22 TO NOSE WHEEL ACTUATING STRUT
5. TEE AT STATION NO. 65 TO UNION
6. UNION AT STATION NO. 81 TO UNION
7. UNION AT STATION NO. 100 TO UNION
8. UNION AT STATION NO. 125 TO UNION
9. UNION AT STATION NO. 166 TO UNION
10. UNION AT STATION NO. 186 TO TEE
11. TEE AT STATION NO. 200 TO UNION
12. UNION AT STATION NO. 219 TO ELBOW
13. ELBOW AT STATION NO. 204 TO ELBOW
14. ELBOW AT WING STATION NO. 14 TO UNION
15. UNION AT WING STATION NO. 57 TO UNION
16. UNION AT WING STATION NO. 69 TO R.H. ACTUATING STRUT
17. TEE AT STATION NO. 200 TO ELBOW
18. ELBOW AT WING STATION NO. 10 TO UNION
19. UNION AT WING STATION NO. 60 TO UNION
20. UNION AT WING STATION NO. 68 TO L.H. ACTUATING STRUT

UP LINES

21. FITTING AT VALVE TO TEE
22. TEE AT STATION NO. 65 TO COUPLING
23. COUPLING AT STATION NO. 70 TO UNION
24. UNION AT STATION NO. 22 TO NOSE WHEEL ACTUATING STRUT
25. TEE AT STATION NO. 65 TO UNION
26. UNION AT STATION NO. 80 TO UNION
27. UNION AT STATION NO. 100 TO UNION
28. UNION AT STATION NO. 124 TO UNION
29. UNION AT STATION NO. 166 TO UNION
30. UNION AT STATION NO. 186 TO TEE
31. TEE AT STATION NO. 200 TO UNION
32. UNION AT STATION NO. 220 TO ELBOW
33. ELBOW AT STATION NO. 204 TO ELBOW
34. ELBOW AT WING STATION NO. 14 TO UNION
35. UNION AT WING STATION NO. 57 TO UNION
36. UNION AT WING STATION NO. 69 TO ELBOW
37. ELBOW AT ACTUATING STRUT TO R.H. ACTUATING STRUT
38. TEE AT STATION NO. 200 TO ELBOW
39. ELBOW AT WING STATION NO. 9 TO UNION
40. UNION AT WING STATION NO. 59 TO UNION
41. UNION AT WING STATION NO. 68 TO ELBOW
42. ELBOW AT ACTUATING STRUT TO ACTUATING STRUT

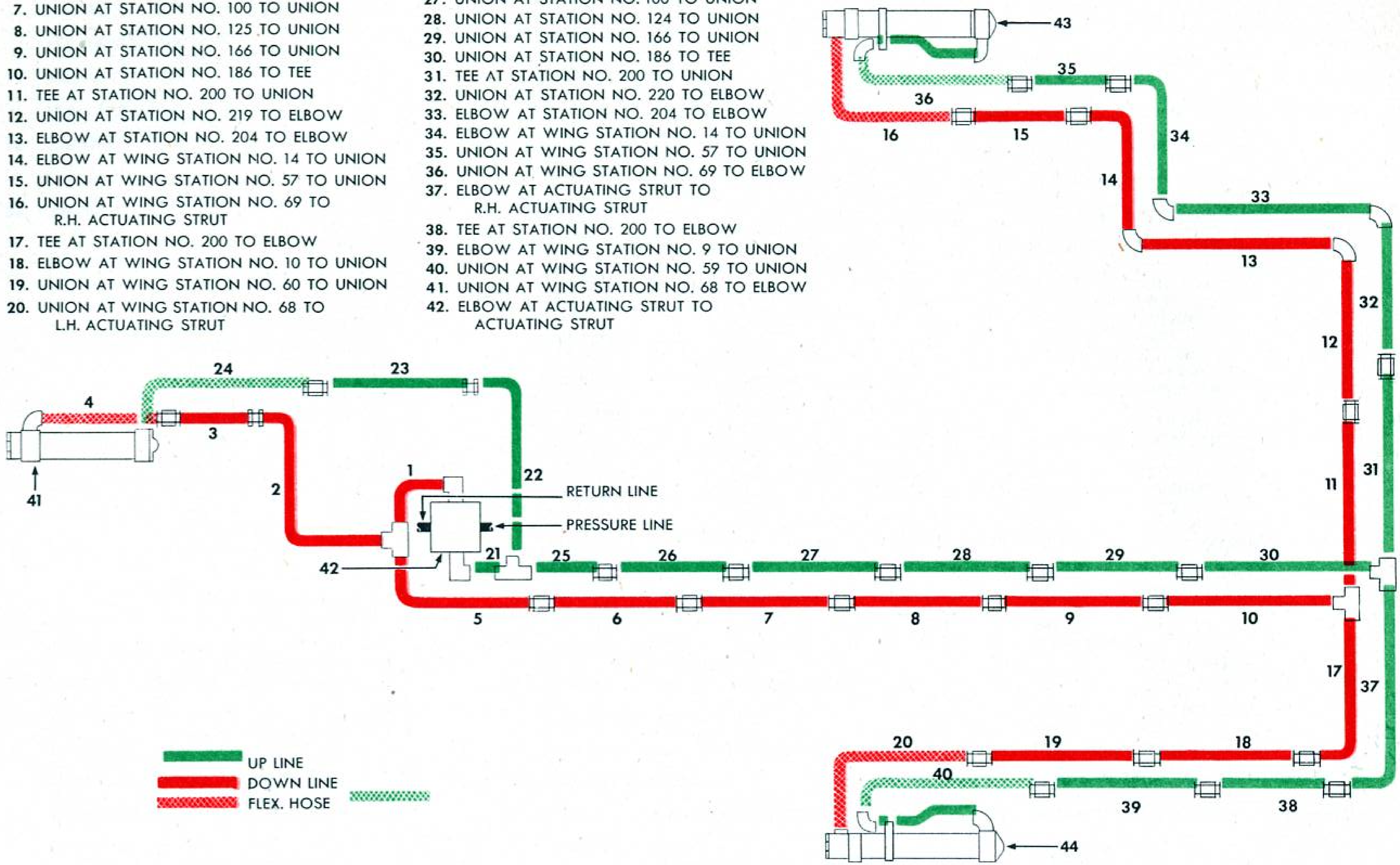
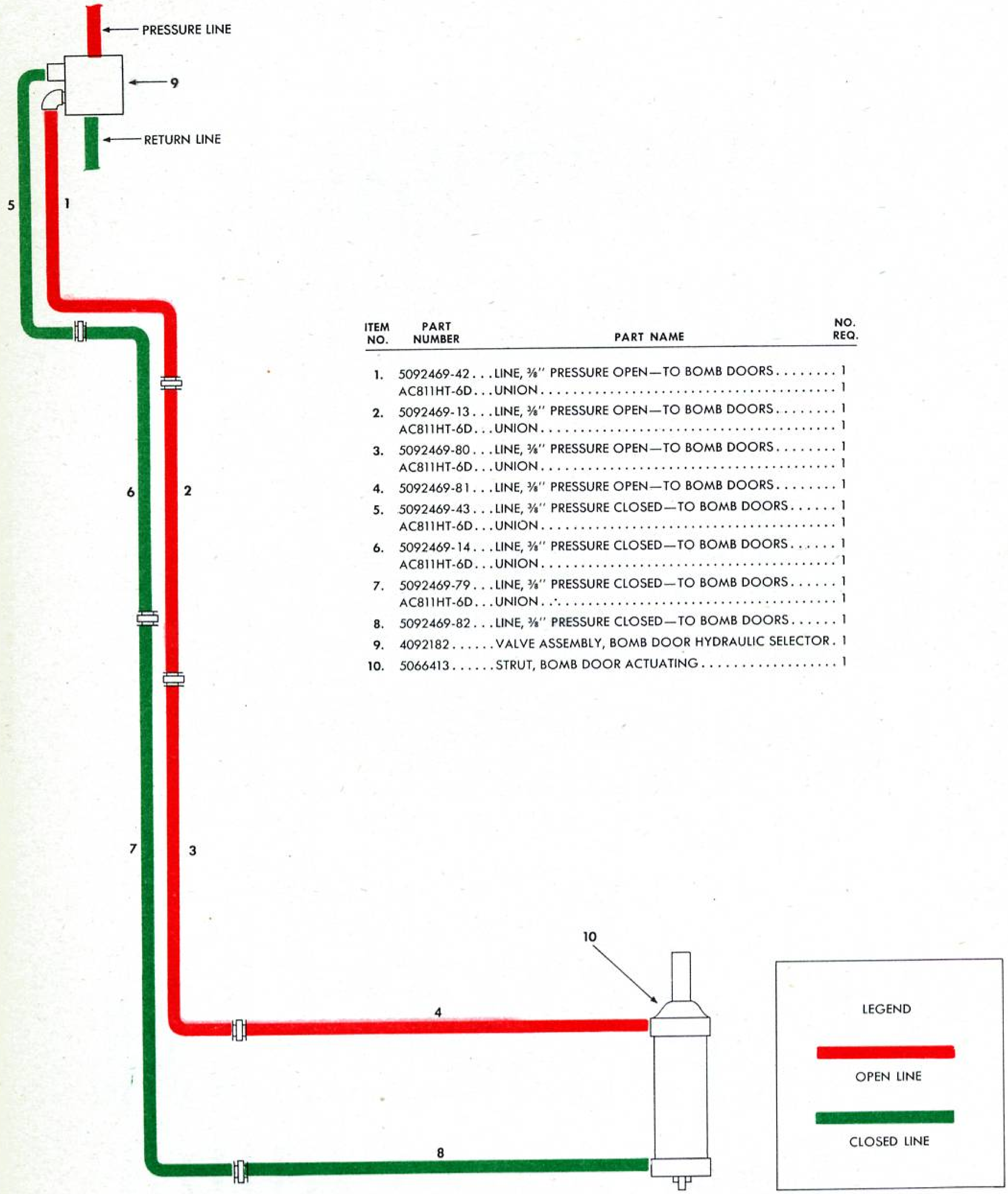


Figure 227 - ALIGHTING GEAR HYDRAULIC SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5068001-10	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC8110T-8D	TEE	1
2.	5068001-9	LINE, 5/16" PRESSURE DOWN—TO NOSE WHEEL	1
	AC895-D81	BUSHING, REDUCING	1
	AC811FT-5D	NIPPLE	1
3.	5092469-37	LINE, 5/16" PRESSURE DOWN—TO NOSE WHEEL	1
	3115-1ET-5D	COUPLING	1
	11-1039-1-4D	NUT, LOCK	1
4.	4062375-21	HOSE, FLEXIBLE	1
	1031662-5	NUT, CHECK	1
5.	5092469-110	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
6.	5092469-6	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
7.	5092469-12	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
8.	5092469-89	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
9.	5092469-95	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
10.	5092469-101	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811JT-8D	TEE	1
11.	5092469-105	LINE, ½" PRESSURE DOWN—TO R.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
12.	5092469-76	LINE, ½" PRESSURE DOWN—TO R.H. LANDING GEAR	1
	AC811ET-8D	ELBOW	1
13.	5067561-6	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	PARKER 8ET-4-5D	ELBOW, 45°	1
14.	5067561-17	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
15.	5067561-35	LINE, ½" PRESSURE DOWN—TO LANDING GEAR	1
16.	4062376-24	HOSE, FLEXIBLE DOWN—TO LANDING GEAR ACTUATING STRUT	1
	1031662-8S	NUT	1
	AN960-1216	WASHER	1
17.	5067599-3	LINE, ½" PRESSURE DOWN—TO L.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
18.	5067599-17	LINE, ½" PRESSURE DOWN—TO L.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
19.	5067599-35	LINE, ½" PRESSURE DOWN—TO L.H. LANDING GEAR	1
20.	4062376-24	HOSE, FLEXIBLE	1
	1031662-8S	NUT	1
	AN960-1216	WASHER	1
21.	5068061-3	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC8110T-8D	TEE	1
22.	5068001-8	LINE, 5/16" PRESSURE UP—TO NOSE WHEEL LANDING GEAR	1
	AC895-D81	BUSHING, REDUCING	1
	AC811CT45°-5D	NIPPLE	1
23.	5092469-38	LINE, 5/16" PRESSURE UP—TO NOSE WHEEL	1
	3115-1ET-5D	COUPLING	1
	11-1039-1-4D	NUT, LOCK	1
24.	4062375-18	HOSE, FLEXIBLE	1
	1031662-5	NUT, CHECK	1
25.	5092469-109	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
26.	5092469-5	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
27.	5092469-11	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
28.	5092469-88	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
29.	5092469-94	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC811HT-8D	UNION	1
30.	5092469-100	LINE, ½" PRESSURE UP—TO LANDING GEAR	1
	AC811JT-8D	TEE	1
31.	5092469-104	LINE, ½" PRESSURE UP—TO R.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
32.	5092469-75	LINE, ½" PRESSURE UP—TO R.H. LANDING GEAR	1
	AC811ET-8D	ELBOW	1
33.	5067561-5	LINE, ½" PRESSURE UP—TO R.H. LANDING GEAR	1
	PARKER 8ET-4-5D	ELBOW, 45°	1
34.	5067561-18	LINE, ½" PRESSURE UP—TO R.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
35.	5067561-36	LINE, ½" PRESSURE UP—TO R.H. LANDING GEAR	1
36.	4062376-21	HOSE, FLEXIBLE	1
	1031662-8S	NUT	1
	AN960-1216	WASHER	1
37.	5067599-2	LINE, ½" PRESSURE UP—TO L.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
38.	5067599-18	LINE, ½" PRESSURE UP—TO L.H. LANDING GEAR	1
	AC811HT-8D	UNION	1
39.	5067599-36	LINE, ½" PRESSURE UP—TO L.H. LANDING GEAR	1
40.	4062376-21	HOSE, FLEXIBLE	1
	1031662-8S	NUT	1
	AN960-1216	WASHER	1
41.	5062532	STRUT ASSEMBLY, NOSE WHEEL ACTUATING	1
42.	4062358-500	VALVE ASSEMBLY, LANDING GEAR HYDRAULIC	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
43.	5062530-1	STRUT ASSEMBLY, LANDING GEAR ACTUATING—R.H.	1
	1058080	SPACER	2
	AN7-16	BOLT	1
	AN7-21	BOLT	1
	AN960-716	WASHER	2
	AN310-7	NUT	2
44.	5062530	STRUT ASSEMBLY, LANDING GEAR ACTUATING—L.H.	1
	1058080	SPACER	2
	AN7-16	BOLT	1
	AN7-21	BOLT	1
	AN960-716	WASHER	2
	AN310-7	NUT	2

LEGEND FOR FIGURE 227



ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5092469-42	LINE, ⅜" PRESSURE OPEN—TO BOMB DOORS	1
	AC811HT-6D	UNION	1
2.	5092469-13	LINE, ⅜" PRESSURE OPEN—TO BOMB DOORS	1
	AC811HT-6D	UNION	1
3.	5092469-80	LINE, ⅜" PRESSURE OPEN—TO BOMB DOORS	1
	AC811HT-6D	UNION	1
4.	5092469-81	LINE, ⅜" PRESSURE OPEN—TO BOMB DOORS	1
5.	5092469-43	LINE, ⅜" PRESSURE CLOSED—TO BOMB DOORS	1
	AC811HT-6D	UNION	1
6.	5092469-14	LINE, ⅜" PRESSURE CLOSED—TO BOMB DOORS	1
	AC811HT-6D	UNION	1
7.	5092469-79	LINE, ⅜" PRESSURE CLOSED—TO BOMB DOORS	1
	AC811HT-6D	UNION	1
8.	5092469-82	LINE, ⅜" PRESSURE CLOSED—TO BOMB DOORS	1
9.	4092182	VALVE ASSEMBLY, BOMB DOOR HYDRAULIC SELECTOR	1
10.	5066413	STRUT, BOMB DOOR ACTUATING	1

Figure 228 - BOMB DOOR HYDRAULIC SYSTEM

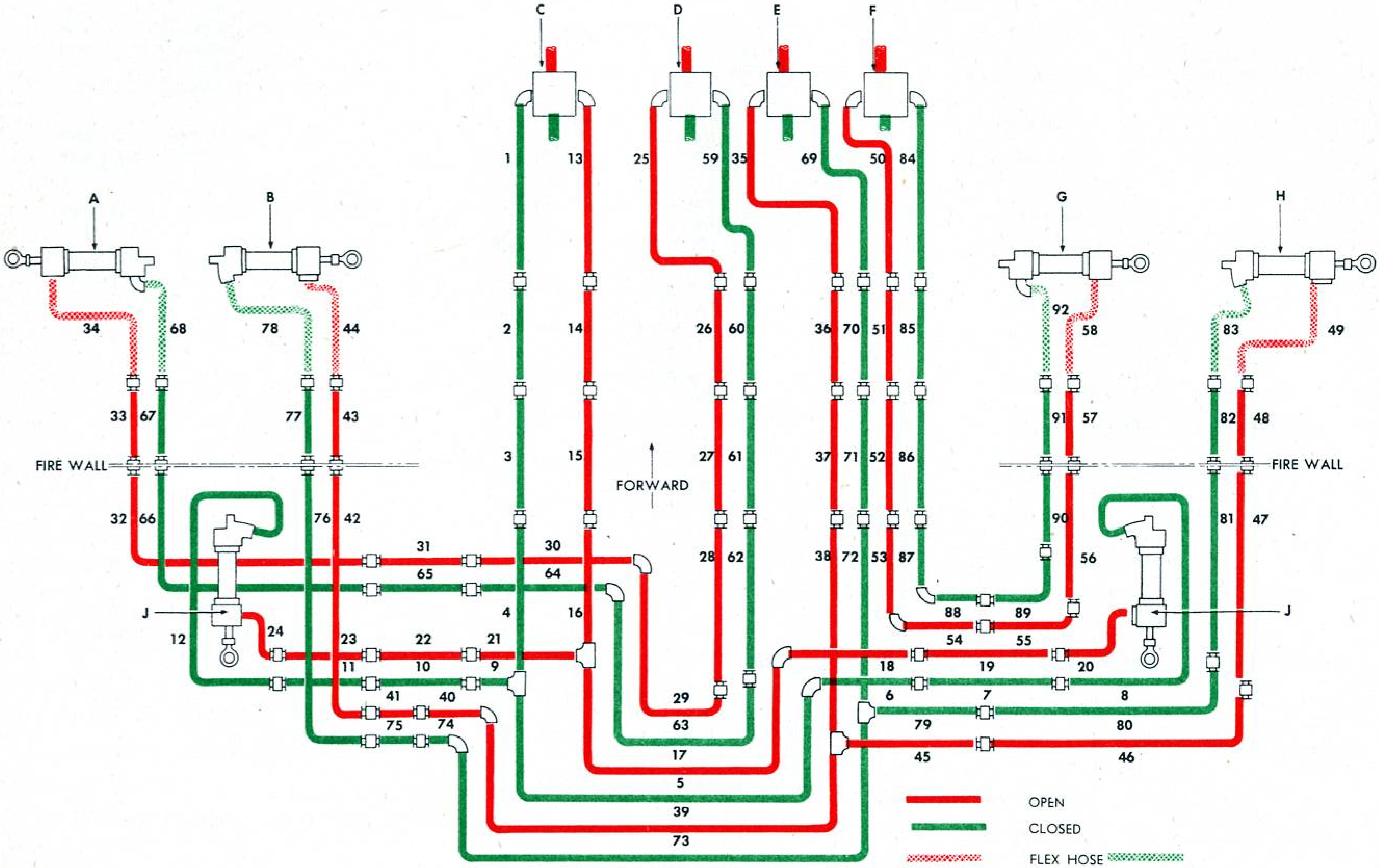


Figure 229 - COWL FLAP HYDRAULIC SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
A	5063971-500	STRUT, LOWER COWL FLAP ACTUATING	1
	1026614-4-018	SPACER (UPPER)	1
	AN4-26	BOLT (UPPER)	1
	AN960-416L	WASHER	1
	AN960-D416	WASHER	2
	AN310-4	NUT	1
B	4067452-500	STRUT ASSEMBLY, UPPER COWL FLAP ACTUATING	1
	AN3-10	BOLT (UPPER)	1
	AN310-3	NUT	1
	AN4-12	BOLT (LOWER)	1
	AN310-4	NUT	1
	AN960-D10	WASHER	2
	AN960-D416	WASHER	1
C	4168436	VALVE ASSEMBLY, AIR FILTER HYDRAULIC CONTROL	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
D	4065508	VALVE ASSEMBLY, LOWER COWL FLAP HYDRAULIC SELECTOR—L.H.	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
E	4065507	VALVE ASSEMBLY, UPPER COWL FLAP HYDRAULIC SELECTOR	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
F	4065567	VALVE ASSEMBLY, LOWER R.H. COWL FLAP HYDRAULIC SELECTOR	1
	AC365-428	NUT	4
	AN960-D416	WASHER	4
G	5063971-500	STRUT, LOWER COWL FLAP ACTUATING	1
	1026614-4-018	SPACER (UPPER)	1
	AN4-26	BOLT (UPPER)	1
	AN960-416L	WASHER	1
	AN960-D416	WASHER	2
	AN310-4	NUT	1
H	4067452	STRUT ASSEMBLY, UPPER COWL FLAP ACTUATING	1
	AN3-10	BOLT (UPPER)	1
	AN310-3	NUT	1
	AN4-12	BOLT (LOWER)	1
	AN310-4	NUT	1
	AN960-D10	WASHER	2
	AN960-D416	WASHER	1
J	4067452	STRUT ASSEMBLY, UPPER COWL FLAP ACTUATING	2
	1059608-190-249-281	SPACER	2
	AN3-3	BOLT	2
	AN3-6	BOLT	2
	AN320-3	NUT	4
1.**	5092469-146	LINE, ¼" PRESSURE CLOSED—TO AIR FILTERS	1
	AC811HT-4D	UNION	1
2.**	5092469-147	LINE, ¼" PRESSURE CLOSED—TO AIR FILTERS	1
	AC811HT-4D	UNION	1
3.**	5092469-148	LINE, ¼" PRESSURE CLOSED—TO AIR FILTERS	1
	AC811HT-4D	UNION	1
4.**	5092469-150	LINE, ¼" PRESSURE CLOSED—TO AIR FILTERS	1
	AC811JT-4D	TEE	1
5.**	5092469-152	LINE, ¼" PRESSURE CLOSED—TO R.H. AIR FILTER	1
	AAF 811ET-4D	ELBOW	1
6.**	5067561-66	LINE, ¼" PRESSURE CLOSED—TO R.H. AIR FILTER	1
	AC811HT-4D	UNION	1
7.**	5067561-66	LINE, ¼" PRESSURE CLOSED—TO R.H. AIR FILTER	1
	AC811HT-4D	UNION	1
8.**	5067561-68	LINE, ¼" PRESSURE CLOSED—TO R.H. AIR FILTER	1
9.**	5092469-160	LINE, ¼" PRESSURE CLOSED—TO L.H. AIR FILTER	1
	AC811HT-4D	UNION	1
10.**	5067599-73	LINE, ¼" PRESSURE CLOSED—TO L.H. AIR FILTER	1
	AC811HT-4D	UNION	1
11.**	5067599-74	LINE, ¼" PRESSURE CLOSED—TO L.H. AIR FILTER	1
	AC811HT-4D	UNION	1
12.**	5067599-76	LINE, ¼" PRESSURE CLOSED—TO L.H. AIR FILTER	1
13.**	5092469-145	LINE, ¼" PRESSURE OPEN—TO AIR FILTERS	1
	AC811HT-4D	UNION	1
14.**	5092469-147	LINE, ¼" PRESSURE OPEN—TO AIR FILTERS	1
	AC811HT-4D	UNION	1
15.**	5092469-148	LINE, ¼" PRESSURE OPEN—TO AIR FILTERS	1
	AC811HT-4D	UNION	1
16.**	5092469-149	LINE, ¼" PRESSURE OPEN—TO AIR FILTERS	1
	AC811JT-4D	TEE	1
17.**	5092469-151	LINE, ¼" PRESSURE OPEN—TO R.H. AIR FILTERS	1
	AAF 811ET-4D	ELBOW	1
18.**	5067561-66	LINE, ¼" PRESSURE OPEN—TO R.H. AIR FILTER	1
	AC811HT-4D	UNION	1
19.**	5067561-66	LINE, ¼" PRESSURE OPEN—TO R.H. FILTER	1
	AC811HT-4D	UNION	1
20.**	5067561-67	LINE, ¼" PRESSURE OPEN—TO R.H. AIR FILTER	1

**Used only on airplanes AAF 42-53835 through AAF 42—54284

LEGEND FOR FIGURE 229

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
21.**	5092469-159	LINE, ¼" PRESSURE OPEN—TO L.H. AIR FILTER	1
	AC811HT-4D	UNION	1
22.**	5067599-73	LINE, ¼" PRESSURE OPEN—TO L.H. AIR FILTER	1
	AC811HT-4D	UNION	1
23.**	5067599-74	LINE, ¼" PRESSURE OPEN—TO L.H. AIR FILTER	1
	AC811HT-4D	UNION	1
24.**	5067599-75	LINE, ¼" PRESSURE OPEN—TO L.H. AIR EILTER	1
25.	5067552-5	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	1138025	UNION, RESTRICTOR	1
26.	5092469-34	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
27.	5092469-49	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
28.	5092469-67	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
29.	5092469-74	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	AC811ET-4D	ELBOW	1
30.	5067599-56	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
31.	5067599-23	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
32.	5067599-33	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
	PARKER 3116-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
33.	5066797-7	LINE, ¼" PRESSURE OPEN—TO L.H. LOWER COWL FLAPS	1
34.	4062378-18	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
35.	5067552-1	LINE, ¼" PRESSURE OPEN—TO UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
36.	5092469-29	LINE, ¼" PRESSURE OPEN—TO UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
37.	5092469-44	LINE, ¼" PRESSURE OPEN—TO UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
38.	5092469-62	LINE, ¼" PRESSURE OPEN—TO UPPER COWL FLAPS	1
	AC811JT-4D	TEE	1
39.	5092469-69	LINE, ¼" PRESSURE OPEN—TO L.H. UPPER COWL FLAPS	1
	AC811ET-4D	ELBOW	1
40.	5067599-53	LINE, ¼" PRESSURE OPEN—TO L.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
41.	5067599-26	LINE, ¼" PRESSURE OPEN—TO L.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
42.	5067599-30	LINE, ¼" PRESSURE OPEN—TO L.H. UPPER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
43.	5066797-3	LINE, ¼" PRESSURE OPEN—TO L.H. UPPER COWL FLAPS	1
44.	4062378-18	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
45.	5067561-7	LINE, ¼" PRESSURE OPEN—TO R.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
46.	5067561-37	LINE, ¼" PRESSURE OPEN—TO R.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
47.	5067561-25	LINE, ¼" PRESSURE OPEN—TO R.H. UPPER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
48.	5066797-5	LINE, ¼" PRESSURE OPEN—TO R.H. UPPER COWL FLAPS	1
49.	4062378-16	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
50.	5067552-4	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	1138025	UNION, RESTRICTOR	1
51.	5092469-32	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
52.	5092469-47	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
53.	5092469-65	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	AC811ET-4D	ELBOW	1
54.	5067561-10	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
55.	5067561-40	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
56.	5067561-28	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1

**Used only on airplanes AAF 42-53835 through AAF 42—54284

LEGEND FOR FIGURE 229

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
57.	5066797-9	LINE, ¼" PRESSURE OPEN—TO R.H. LOWER COWL FLAPS	1
58.	4062378-18	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
59.	5067552-6	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	1138025	UNION, RESTRICTOR	1
60.	5092469-33	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
61.	5092469-48	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
62.	5092469-66	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
63.	5092469-72	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	AC811ET-4D	ELBOW	1
64.	5067599-55	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
65.	5067599-24	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
66.	5067599-32	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
67.	5066797-8	LINE, ¼" PRESSURE CLOSED—TO L.H. LOWER COWL FLAPS	1
68.	4062378-16	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
69.	5067552-2	LINE, ¼" PRESSURE CLOSED—TO UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
70.	5092469-30	LINE, ¼" PRESSURE CLOSED—TO UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
71.	5092469-45	LINE, ¼" PRESSURE CLOSED—TO UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
72.	5092469-63	LINE, ¼" PRESSURE CLOSED—TO UPPER COWL FLAPS	1
	AC811JT-4D	TEE	1
73.	5092469-71	LINE, ¼" PRESSURE CLOSED—TO L.H. UPPER COWL FLAPS	1
	AC811ET-4D	ELBOW	1
74.	5067599-54	LINE, ¼" PRESSURE CLOSED—TO L.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
75.	5067599-25	LINE, ¼" PRESSURE CLOSED—TO L.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
76.	5067599-31	LINE, ¼" PRESSURE CLOSED—	1
		TO L.H. UPPER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
77.	5066797-4	LINE, ¼" PRESSURE CLOSED—TO L.H. UPPER COWL FLAPS	1
78.	4062378-21	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
79.	5067561-8	LINE, ¼" PRESSURE CLOSED—TO R.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
80.	5067561-38	LINE, ¼" PRESSURE CLOSED—TO R.H. UPPER COWL FLAPS	1
	AC811HT-4D	UNION	1
81.	5067561-26	LINE, ¼" PRESSURE CLOSED—TO R.H. UPPER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
82.	5066797-6	LINE, ¼" PRESSURE CLOSED—TO R.H. UPPER COWL FLAPS	1
83.	4062378-14	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1
84.	5067552-3	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	1138025	UNION, RESTRICTOR	1
85.	5092469-31	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
86.	5092469-46	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
87.	5092469-64	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	AC811ET-4D	ELBOW	1
88.	5067561-9	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
89.	5067561-39	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	AC811HT-4D	UNION	1
90.	5067561-27	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
	PARKER 3115-1ET-4D	ELBOW, BULKHEAD	1
	PARKER 11-1039-1-3D	NUT, LOCK	1
	AN960-716	WASHER	1
91.	5066797-10	LINE, ¼" PRESSURE CLOSED—TO R.H. LOWER COWL FLAPS	1
92.	4062378-21	HOSE, FLEXIBLE	1
	AN960-716	WASHER	1
	AN361-7R	NUT, CHECK	1

LEGEND FOR FIGURE 229

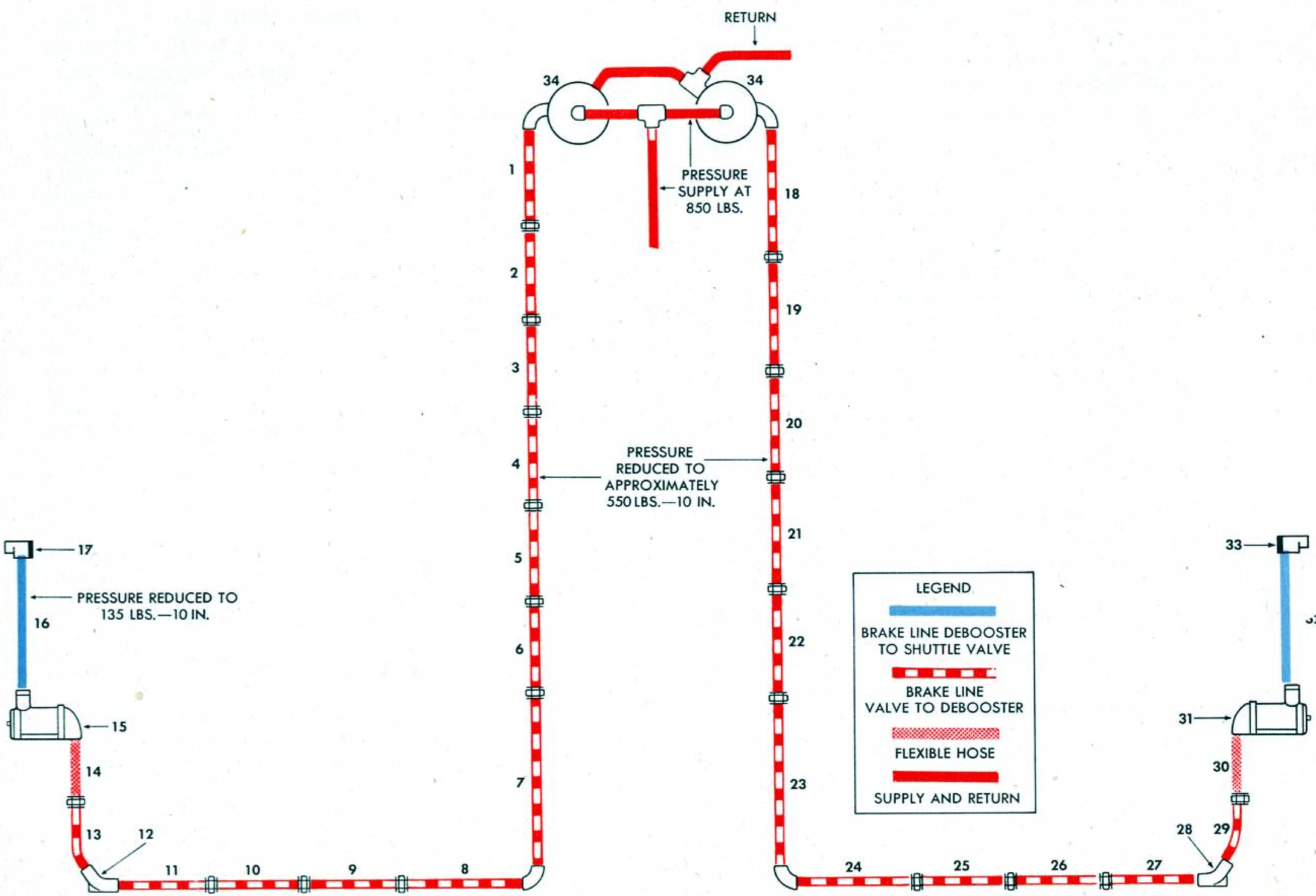


Figure 230 - BRAKE HYDRAULIC SYSTEM

ITEM NO.	PART NUMBER	PART NAME	NO. REQ.
1.	5092469-35	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
2.	5092469-77	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
3.	5092469-111	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
4.	5092469-15	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
5.	5092469-78	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
6.	5092469-90	LINE, ⅜ PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
7.	5092469-113	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811ET-6D	ELBOW	1
8.	5067599-9	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
9.	5067599-16	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
10.	5067599-27	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	AC811HT-6D	UNION	1
11.	5067599-34	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
	126480-29H	CLIP	2
	ADEL 755-6-2-8	CLIP	2
	AN520-10-10	SCREW	2
	AC365-1032	NUT	2
	AN960-D10	WASHER	2
12.	4067911	JOINT ASSEMBLY, HYDRAULIC BRAKE SWIVEL	1
13.	2069443-4	LINE, ⅜" PRESSURE—TO L.H. BRAKE	1
14.	4062379-46	HOSE FLEXIBLE	1
	2069442	ADAPTER, MAIN LANDING GEAR BRAKE LINE	1
15.	5073568	CYLINDER ASSEMBLY, HYDRAULIC BRAKE DEBOOSTER	1
	1069358	VALVE, MAIN LANDING GEAR BRAKE LINE	1
	AC936A416	WASHER	1
	2069446	BOLT, MAIN LANDING GEAR SWIVEL FITTING	1
	2069445	FITTING, MAIN LANDING GEAR BRAKE LINE SWIVEL	1
	1080930-138093-014	TUBE	1
	143908-018-TC026-032	WASHER	2
16.	2069443-6	LINE, ⅜" BRAKE	1
17.	4135193	VALVE ASSEMBLY, BRAKE LINE SHUTTLE	1
18.	5092469-24	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
19.	5092469-28	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
20.	5092460-112	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
21.	5092469-50	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
22.	5092469-141	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
23.	5092469-142	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811ET-6D	ELBOW	1
24.	5067561-11	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
25.	5067561-12	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
26.	5067561-34	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	AC811HT-6D	UNION	1
27.	5067561-31	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
	126480-29H	CLIP	2
	ADEL 755-6-2-8	CLIP	2
	AN520-10-10	SCREW	2
	AC365-1032	NUT	2
	AN960-D10	WASHER	2
28.	4067911-1	JOINT ASSEMBLY, HYDRAULIC BRAKE SWIVEL	1
29.	2069443-3	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
30.	4062379-46	HOSE	1
31.	5073568-1	CYLINDER ASSEMBLY, HYDRAULIC BRAKE DEBOOSTER	1
	1069358	VALVE, MAIN LANDING GEAR BRAKE LINE	1
	AC936-A416	WASHER	1
	2069446	BOLT, MAIN LANDING GEAR SWIVEL FITTING	1
	2069445	FITTING, MAIN LANDING GEAR BRAKE LINE SWIVEL	1
	1080930-138093-014	TUBE	1
	143908-018-TC026-032	WASHER	2
32.	2069443-5	LINE, ⅜" PRESSURE—TO R.H. BRAKE	1
33.	4135193	VALVE ASSEMBLY, BRAKE LINE SHUTTLE	1
34.	5068111	VALVE ASSEMBLY, BRAKE CONTROL—L.H.	1
	5068111-1	VALVE ASSEMBLY, BRAKE CONTROL—R.H.	1
	AN3-10A	BOLT	8
	AC365-1032	NUT	8
	AN960-D10	WASHER	10
	AN3-7	BOLT	2
	AN310-3	NUT	2

LEGEND FOR FIGURE 230

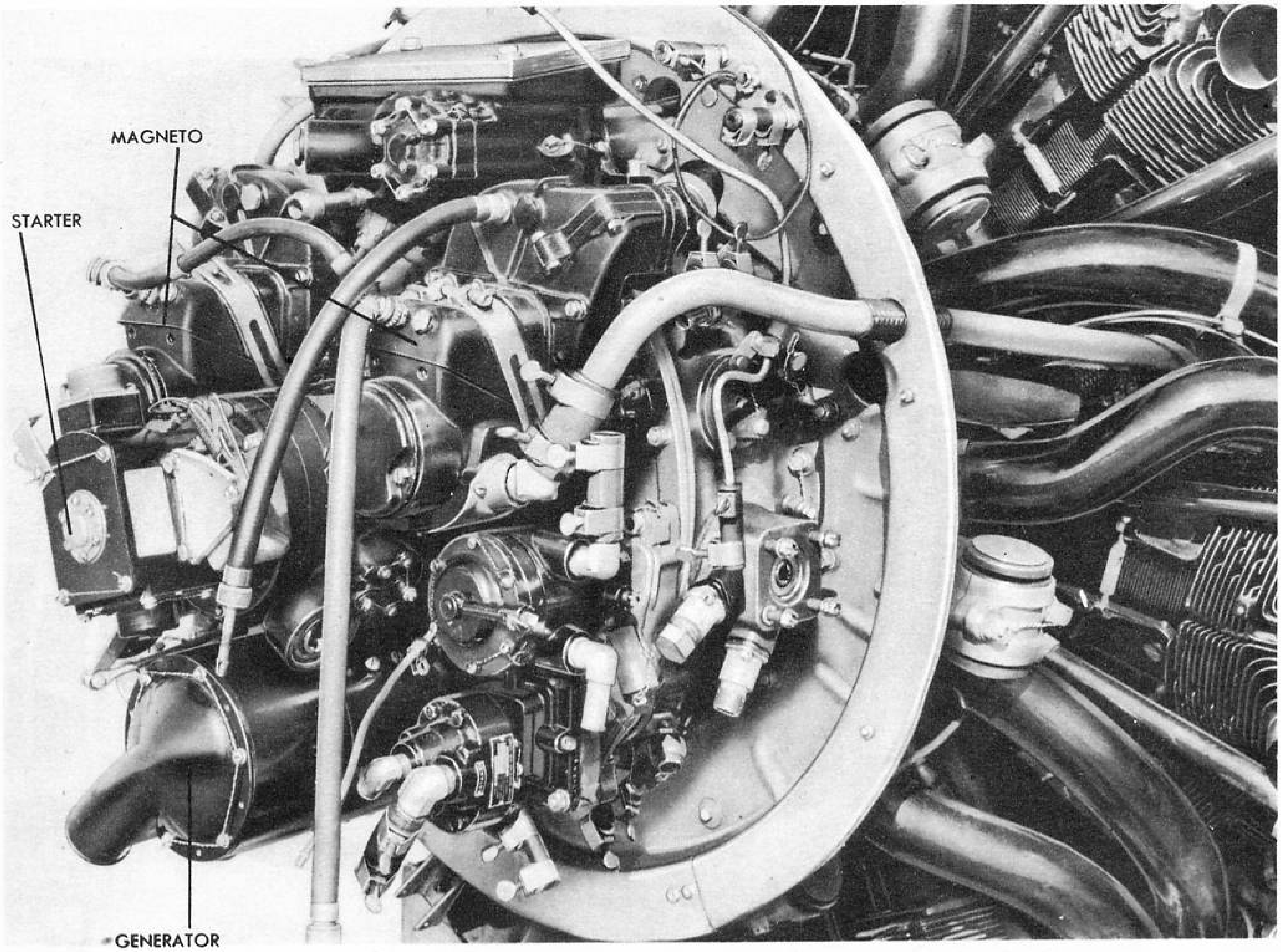


Figure 231 - ENGINE ELECTRICAL ACCESSORIES

17. ELECTRICAL SYSTEM

a. DESCRIPTION.

(1) GENERAL. - A single wire, 28-volt, grounded type, partially shielded electrical system is provided. Conventional in plan, the electrical system consists of the engine ignition and starter circuits, the generator and battery circuits, and the lighting and auxiliary circuits. A two-wire system is used in the bomb release circuits. Much vital equipment such as propellers, radios, and instruments depend upon the electrical system. Therefore the system must be in complete operating condition before take-off. There is sufficient capacity in generators and batteries so that all equipment necessary to flight may be operated with one of the generators "out". The batteries are adequate for a short flight if the generators fail, and all electrically operated equipment not essential to flight is turned OFF to conserve battery power.

(2) GENERATORS AND BATTERIES.

(a) GENERAL. - Each engine has a 28-volt generator (figure 120) whose output is controlled by a voltage regulator and reverse current relay. Two 12-volt batteries connected in series serve to start the engines in the absence of an outside source of power.

(b) GENERATORS. (See figure 231.) - Type 0-1 28-volt generators are used. A reverse current relay switch (sometimes called "generator cut-out" or "line switch") and ammeter shunt are installed in each nacelle. The voltage regulators and a panel containing two generator ON-OFF switches, two ammeters, a voltmeter, and a voltmeter selector switch are located to the right of the upper gunner's position The generators carry the load after the engines are started. Therefore the ammeters merely show the amount of current supplied to the system. The continuous electrical load is comparatively low in relation to the

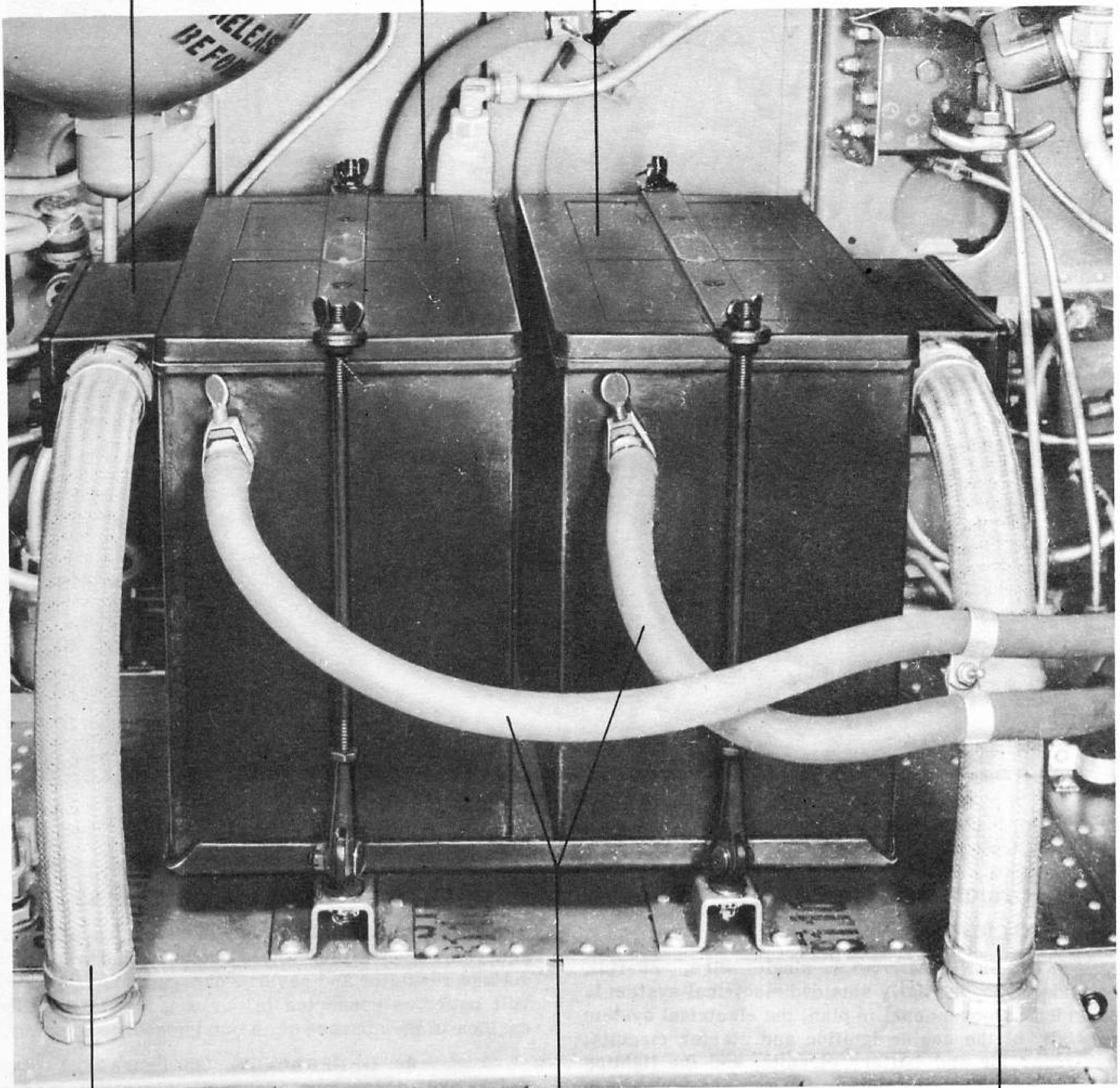


Figure 232 - INSTALLED BATTERIES

generator capacity. This additional capacity is necessary to care for emergency conditions. During long flights where the batteries become fully charged and there is little load on the electrical system the ammeter readings for the generator may be low. This is a normal condition and does not indicate that the generator, regulator, or relay switch is faulty. If the generator shows approximately normal voltage on the voltmeter in the gunner's cockpit, the voltage regulator and the generator are in working condition. During normal flight all generator switches should be ON so the generator capacity will be available immediately when required. No advantage is gained by having switches OFF.

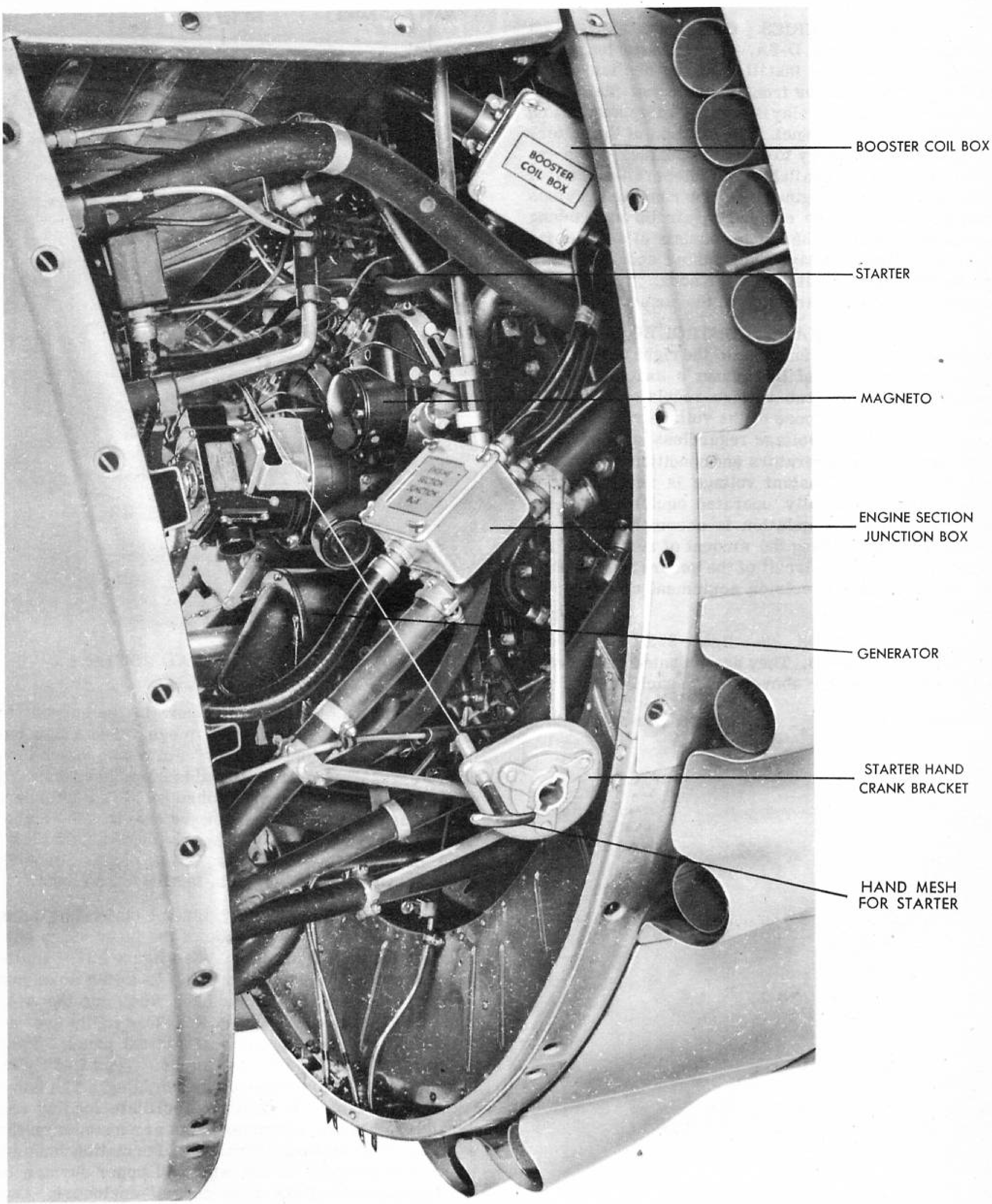


Figure 233 - ELECTRICAL EQUIPMENT ON REAR OF INSTALLED ENGINE

(c) BATTERIES. (See figure 232.) - Two 68 ampere-hour type D-6A, 12-volt batteries, connected in series, are installed in the section of the fuselage forward of the front bomb bay at Station 75. A battery disconnect relay is controlled by a switch on the pilot's electrical panel. The function of the batteries is to furnish energy to start the engines (when external power is not available) and to operate electrical circuits while the engines are not running. Fumes from the batteries are carried by air through tubing to a battery sump. The sump consists of a glass jar filled with alternate layers of baking soda and felt. The fumes are neutralized by the soda. The sump is located on the right-hand side of the nose wheel well.

(d) GENERATOR CONTROL BOX. - Mounted on the inside of the fuselage to the right of the upper gunner just forward of the gunner's switch box is a metal box containing two voltage regulators (one for each generator). Purpose of the voltage regulators is to maintain constant voltage regardless of variations in the speed of the generators and conditions of varying electrical loads. Constant voltage is necessary for much of the electrically operated equipment on the airplane. Voltage regulation is accomplished automatically by controlling the amount of resistance inserted into the field circuit of the generator. A voltage regulator is a precision equipment and must be handled with care.

(3) MAGNETOS. (See figure 233.) - Each engine has two magnetos. They are mounted on the rear of the engine slightly above and to each side of the

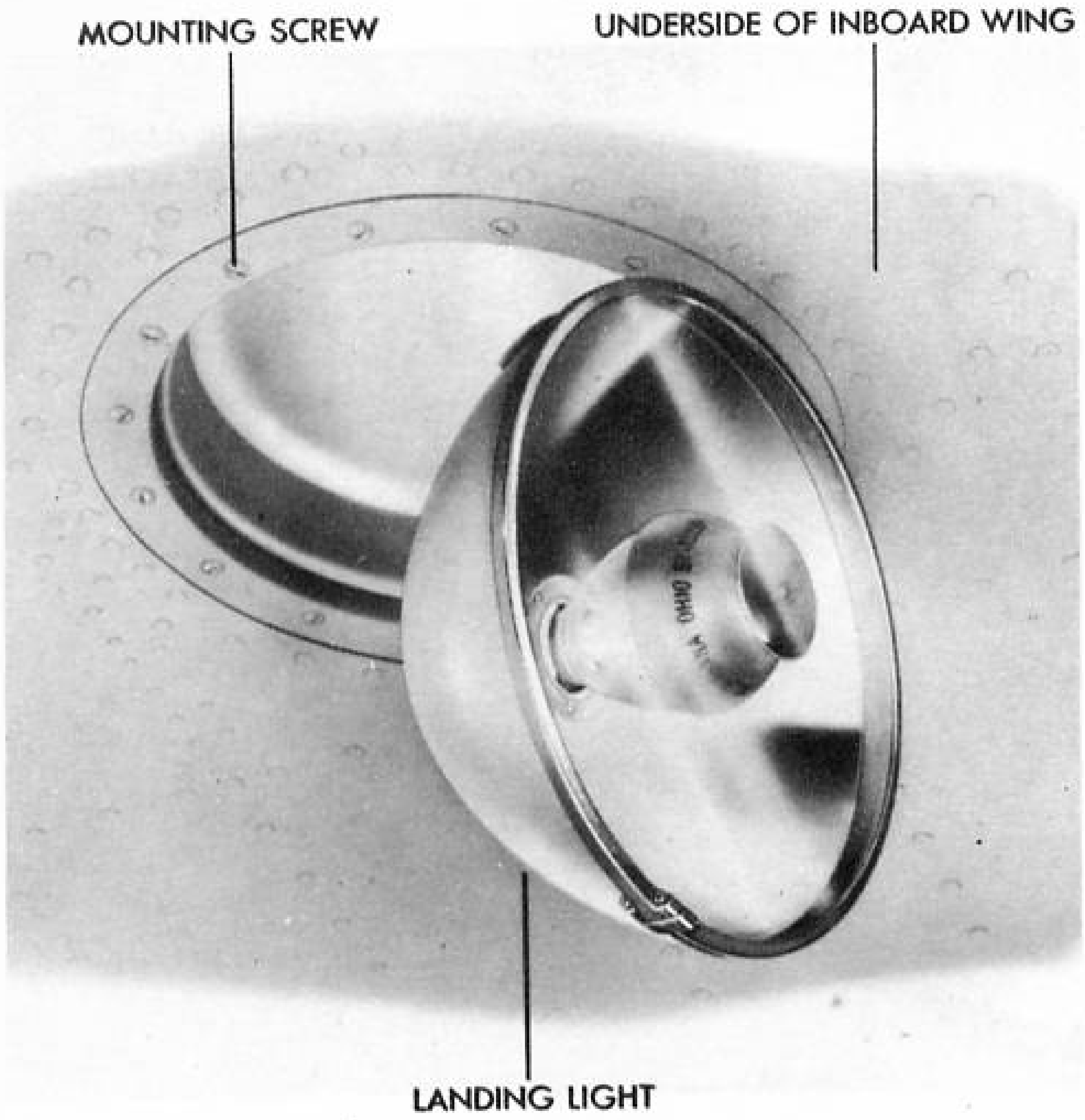


Figure 234 - LANDING LIGHT EXTENDED

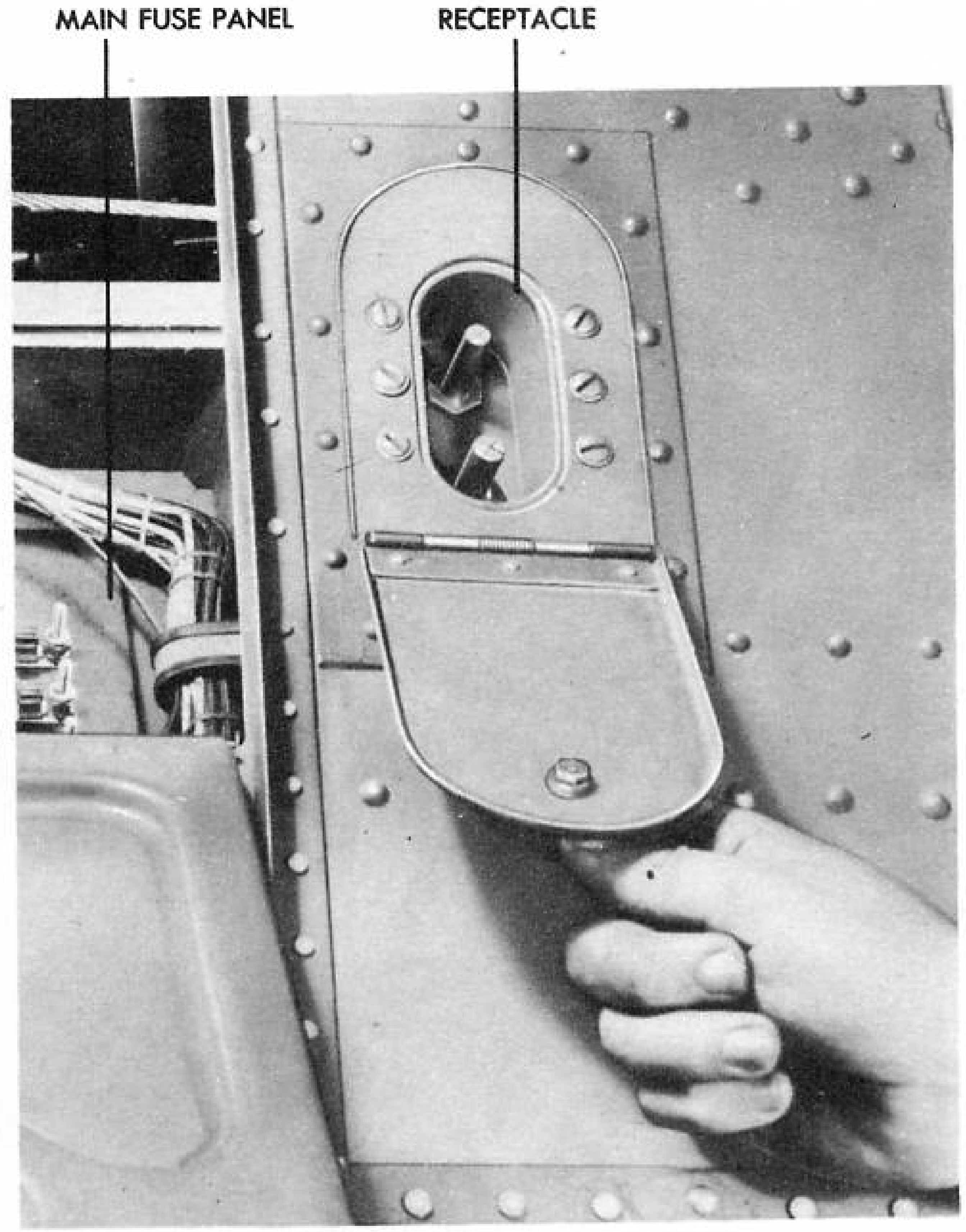


Figure 235 - EXTERNAL POWER RECEPTACLE

starter. Their function is to generate the current to furnish the spark to the spark plugs. The magnetos incorporate eight lobe breaker cam points which turn at 7/8 crankshaft speed. Pivotless type breakers are used. Both magnetos are timed on No. 1 cylinder, after which they operate with fixed timing. The right-hand magneto fires the front spark plugs and the left-hand magneto fires the rear spark plugs. Booster coils, mounted on the engines, facilitate starting.

(4) LIGHTS. - Two ST-1220AF-24 landing lights are installed on the under side of the inner wings outboard of the engine nacelles. (See figure 234.) Built-in drive motors cause these lights to swing down and forward when turned ON and back flush into the wing when OFF. Control switches for these lights are installed on the pilot's upper electrical panel. Each cockpit is lighted by type A-6 lights. Type C-5 lights are used for the instrument panel lighting. The bomb racks have extension lights to facilitate loading and servicing. Type A-8 running lights are mounted on the wing tips and vertical stabilizer. Formation keeping lights are mounted on the wing and upper surface of the fuselage aft of the rear cockpit enclosure. One upward and three downward recognition lights are mounted on the fuselage. They are operated from a control box in the pilot's cockpit. They are wired so

that any combination of downward lights may be selected. Wiring to the tail navigation light allows it to be used both as a navigation and "resin" light. Alternate red, green, and clear lenses are provided. An access door permits changing of the lens.

(5) EXTERNAL POWER FOR STARTING ENGINES AND FOR CHECKING EQUIPMENT. - To ensure that batteries will be charged at take-off so they will be adequate for emergency conditions, use an external electrical supply such as a battery cart or portable 28-volt power plant to start the engines. Plug the external power supply into the external power receptacle on the left side of the nose wheel well. (See figure 235.) If an external power supply is not available, an energizer may be used to start the engines. If a portable power plant is used, it may be connected to the airplane a short time before take-off and the main line and battery switches turned on so the batteries will charge. Use external power for checking of electrically operated equipment on the ground. If an external power supply is being used, all electrically controlled units in the airplane may be operated with the main battery switch and the master ignition switch OFF. To start the engines on the external power supply, the master ignition switch must be ON. When changing over from the external power supply to the airplane's batteries with the engines running, the main battery switch must be ON before the external supply plug is disconnected.

(6) SWITCHES.

(a) GENERAL. (See figure 236.) - Mounted on the left side of the pilot's cockpit, the ignition switch is separately shielded from other electrical equipment. Most other circuits are controlled by standard Army Air Forces toggle switches. All switches are OFF in the UP position except those which control the emergency alarm bell and the jettison of the small bombs container.

(b) MAIN BATTERY SWITCH. - Conventional operation of the main battery switch on the pilot's lower electrical panel controls the circuit from the airplane's batteries by operating a master relay located on a box below the batteries at Station 75. (See figure 237.) If the batteries are used as a source of power, both the main battery switch and the master ignition switch must be ON before any of the electrically controlled units can be used.

(c) IGNITION SWITCH. - The ignition switch is located in the upper left corner of the pilot's instrument panel. (See figure 236.) The ignition switch unit incorporates a master ignition switch and two individual engine switches as follows:

1 MASTER IGNITION SWITCH. - The master ignition switch has two positions controlling circuits as follows:

OFF. - All magneto circuits are closed (grounded) and the circuits to all electrically controlled units in the airplane are open (magnetos and all electrically controlled units are inoperative).

ON. - All magneto circuits are open (ungrounded) and the circuits to all electrically controlled units are closed (magnetos and all electrically controlled units are operative).

2 INDIVIDUAL ENGINE SWITCHES. - Each individual engine switch controls the ignition of one engine and has four positions controlling circuits as follows:

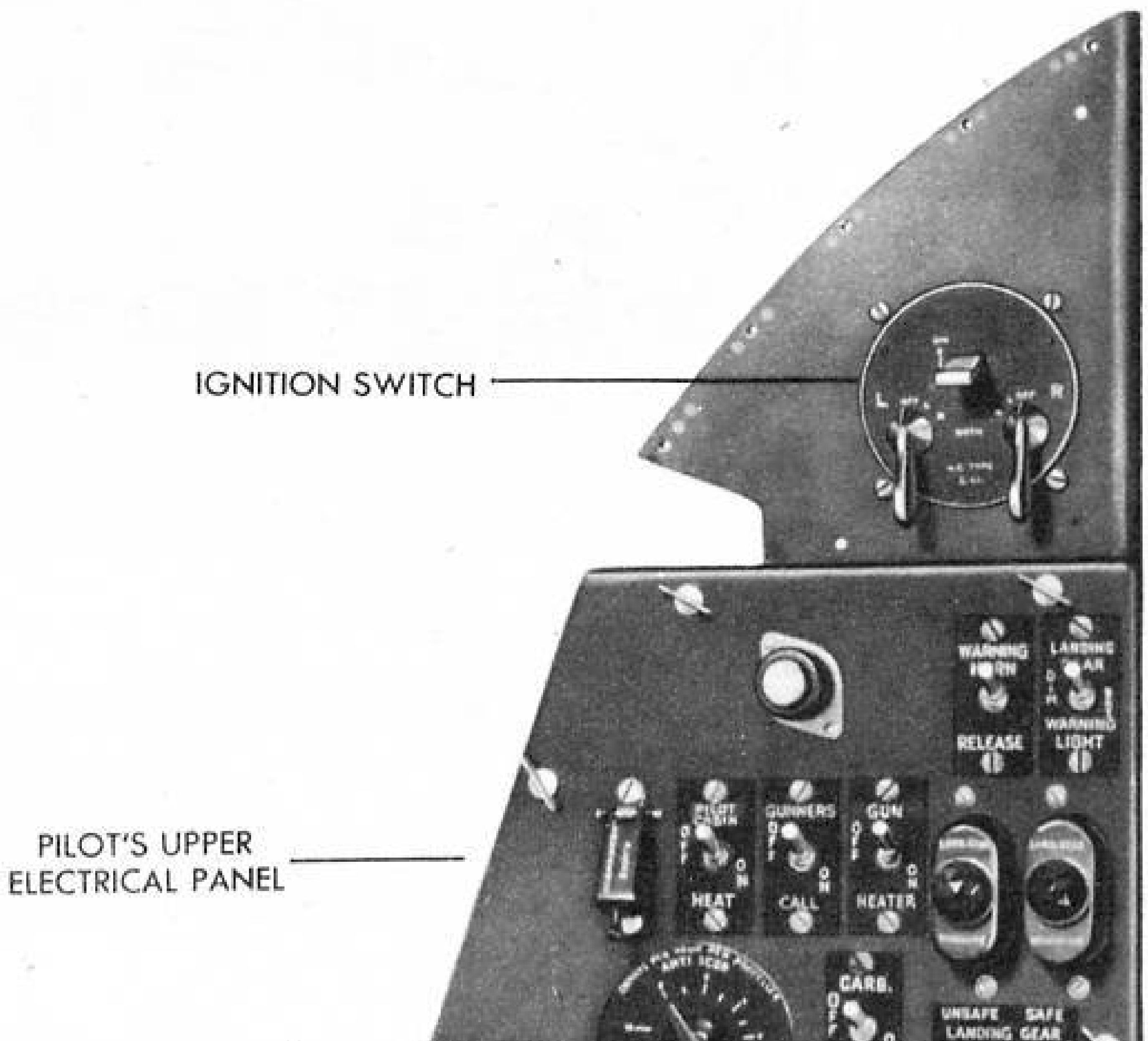


Figure 236 - PILOT'S ELECTRICAL CONTROLS

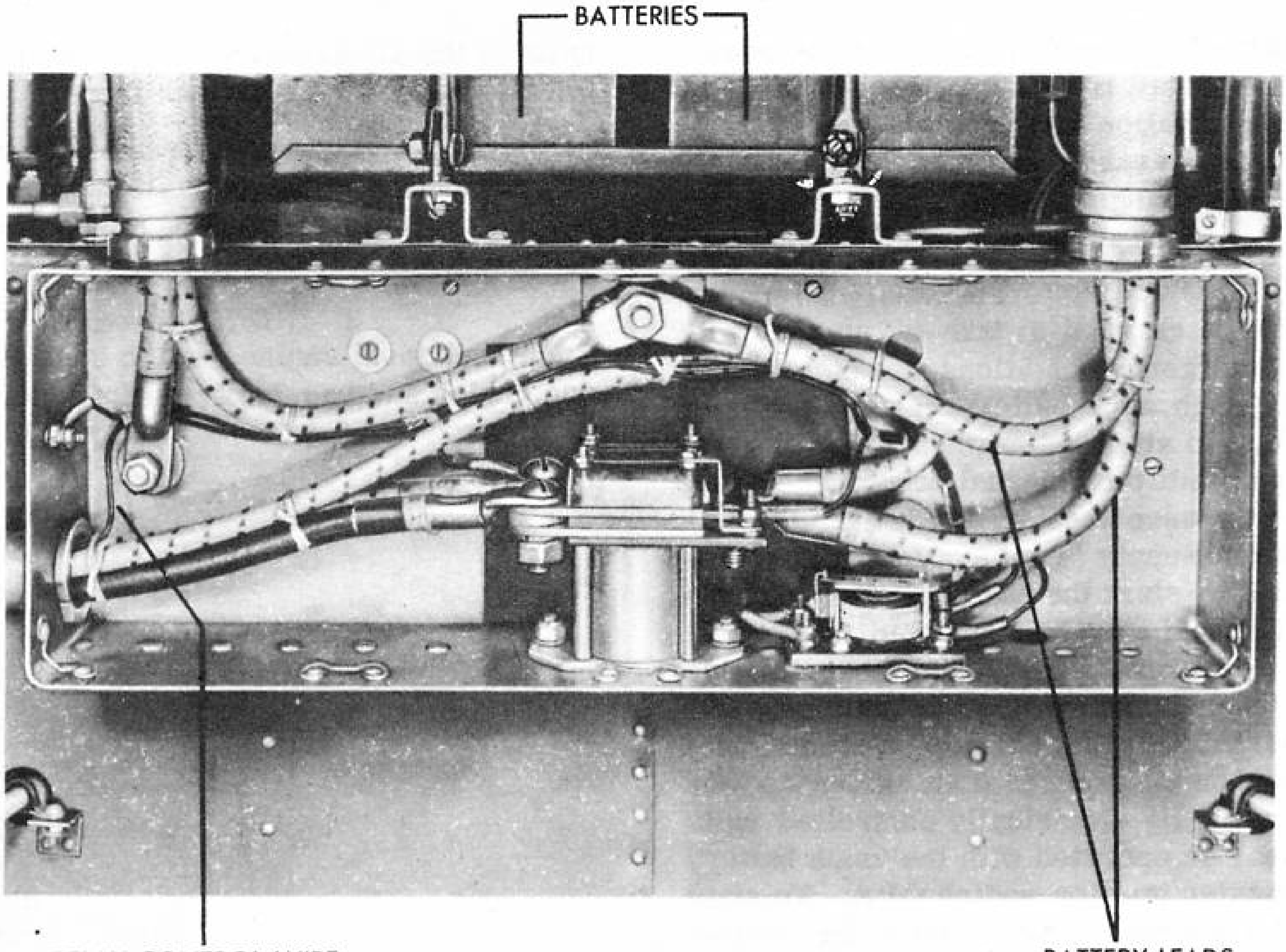


Figure 237 - MASTER BATTERY SWITCH BOX

OFF. - Both magneto circuits are closed (both magnetos inoperative) with the master switch ON or OFF.

L. - The left magneto circuit is open (left magneto operative) and the right magneto circuit is closed (right magneto inoperative) with the master switch ON.

R. - The right magneto circuit is open (right magneto operative) and the left magneto circuit is closed (left magneto inoperative) with the master switch ON.

BOTH. - Both magneto circuits are open (both magnetos operative) with the master switch ON.

(d) SWITCHES ON PILOT'S UPPER ELECTRICAL PANEL; (See figure 238.)

1 WARNING HORN RELEASE SWITCH. - The warning horn release switch is provided to silence the horn if it is desired to close the throttles when the landing gear is not latched in landing position. The horn circuit is automatically reset after operation of the release switch opening the throttles, and if the throttles are again closed, the horn will sound until the horn release switch is operated.

NOTE

If only one throttle is closed with the landing gear not latched in landing position, the warning horn release switch will silence the horn for only an instant. To quiet the horn, the throttle must be opened beyond the horn operating position.

2 LANDING GEAR WARNING LIGHTS SWITCH. - A green signal light is provided to indicate that the landing gear is down and latched in landing position. A red signal light will show at all other times. These lights may be made dim or bright by operation of the warning lights switch.

3 GUNNER CALL LIGHT SWITCH. - Conventional operation of the gunner call light switch will illuminate the call light on the gunner's electrical panel.

4 HEATING SYSTEM SWITCH. - Conventional operation of the switch will energize the fuel ignition plug of the heating and vent system heating unit.

5 PROPELLER FEATHERING SWITCHES. - A switch is provided for each propeller and is operated by pushing the respective switch for the propeller to be feathered. The switch will automatically release when the propeller blades reach the

full feathered position. To unfeather the propeller, push in on the switch and hold until the engine windmills at 600 to 800 rpm. Then release the switch.

6 PROPELLER ANTI-ICER RHEOSTAT. - Operating this rheostat (on the left-hand side of the pilot's instrument panel) turns on and regulates the anti-icer fluid pump so that fluid may be supplied to each propeller. A supply of two to four quarts per hour is considered satisfactory for normal operation under icing conditions.

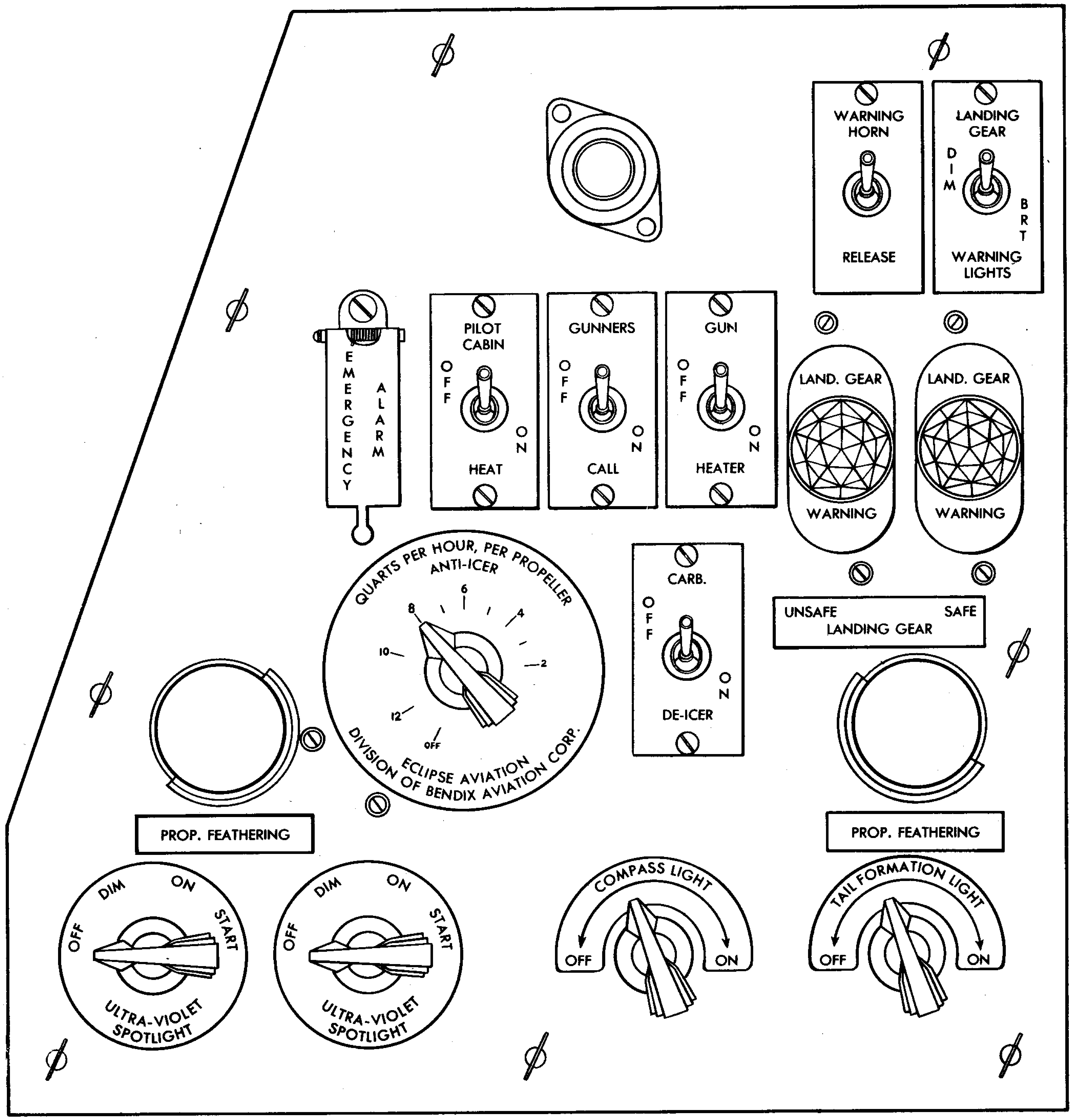


Figure 238 - PILOT'S UPPER ELECTRICAL PANEL

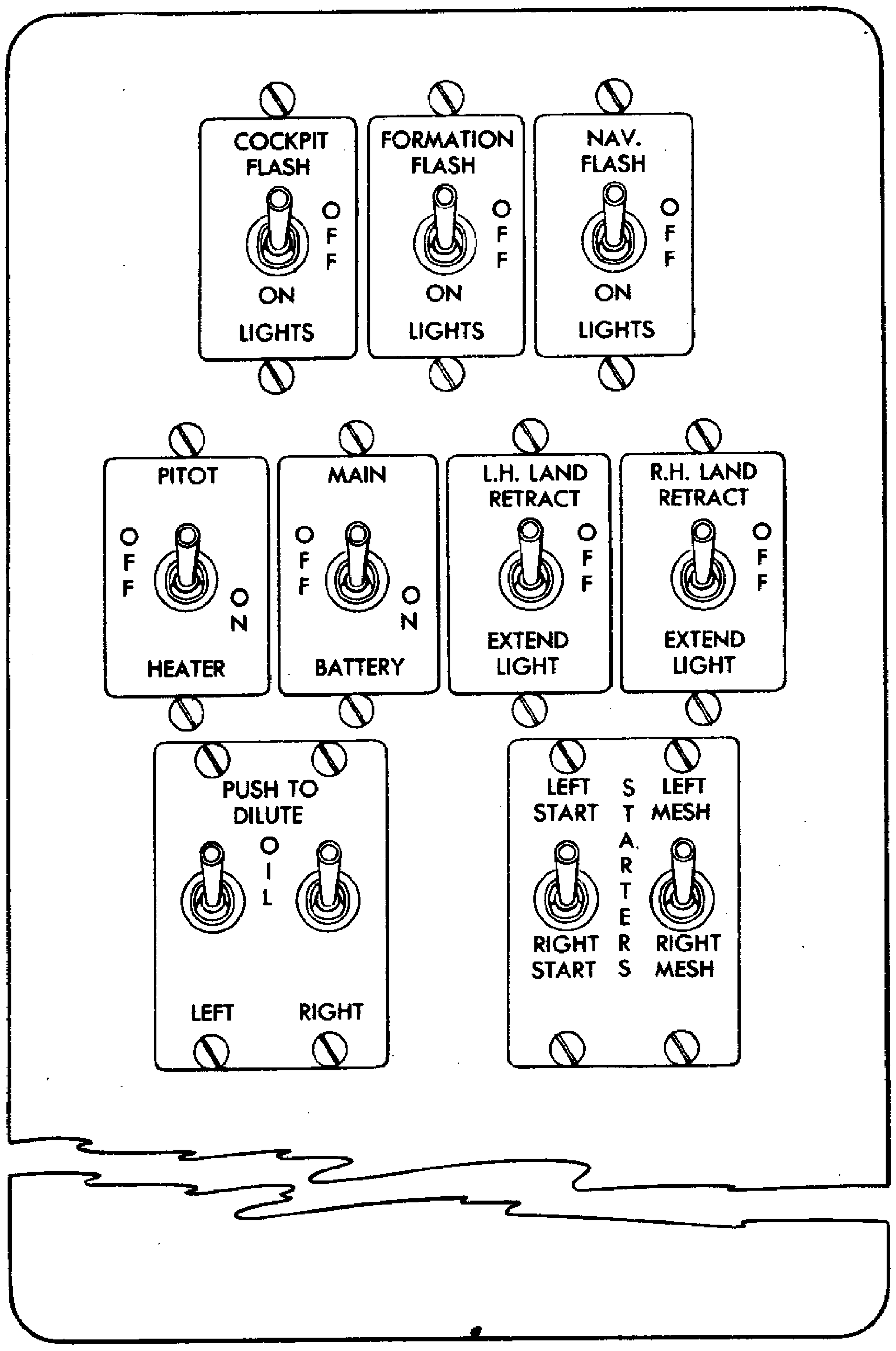


Figure 239 - PILOT'S LOWER ELECTRICAL PANEL

7 INSTRUMENT LIGHTING CONTROLS. - The upper panel also incorporates a compass light switch and rheostat, tail formation light switch and rheostat, and control switches for the fluorescent lights.

(e) SWITCHES ON THE PILOT'S LOWER ELECTRICAL PANEL. (See figure 239.) - The pilot's lower electrical panel is located on the left side of the cockpit just below the upper electrical panel. In addition to the main battery switch previously described, the lower panel contains the following:

1 LANDING LIGHT SWITCHES. - Switches are provided to control the extension and retraction of the landing lights in the lower surface of the inner wing. To extend light, hold the respective switch in the EXTEND position until the light is fully lowered (approximately 12 seconds time is required). A cut-off switch in the operating mechanism will automatically stop the actuating motor when the light reaches its fully extended position. When the light has lowered approximately 10 degrees from its flush (up) position, a switch in the lamp will automatically turn on the light. To retract the light, hold the switch in the RETRACT position until the light is fully retracted. The cut-off switch will automatically stop the actuating motor when the light reaches its fully retracted position. The switch in the lamp unit will automatically turn off the light when it has raised within 10 degrees of its retracted position. The retraction or extension of the landing lights may be stopped at any position between full UP and full DOWN by releasing the operating switches.

2 OIL DILUTION SWITCHES. - An individual switch is provided to operate the oil dilution system of each engine. The switches are normally operated during the engine stopping procedure when a subsequent cold weather start is anticipated.

3 ENGINE STARTER SWITCHES. - Two switches are provided for engine starting. The starter is energized by the START switch and engaged by the MESH switch. In starting the right engine, depress the START switch, and when the inertia wheel is up to speed (about 30 seconds), depress the MESH switch (not over 45 seconds), still keeping the START switch depressed. In starting the left engine, lift up the switches while proceeding in a similar manner as when starting the right engine.

4 MISCELLANEOUS SWITCHES. - The lower panel also contains switches for cockpit lights, formation keeping lights, navigation lights, and pitot heater.

(f) RECOGNITION LIGHT SWITCHES. - The recognition lights are controlled by a Morse key switch and a color selecting switch just aft of the instrument panel on the right side of the pilot's cockpit. A master switch controls the circuit in the recognition lights system. Three indicator lights adjacent to the control switches illuminate simultaneously with the external lights.

(g) PILOT'S EXTENSION LIGHT SWITCH. - A conventionally operated switch is mounted on the extension light box, which is installed in the right rear corner of the pilot's cockpit.

(h) BOMB RELEASE SWITCHES. - Release of bombs is controlled electrically by means of selector switches on the right side of the cockpit, a push button switch on the wheel and a quadrant release switch in the pilot's compartment. Two jettison switches are provided for emergency release of bombs.

(i) FIXED GUN CONTROL SWITCHES.

1 SELECTOR SWITCHES. - Mounted on the cowling in the left-hand side of the cockpit are three selector switches for the six forward firing fixed guns. One switch controls the upper pair of guns, one switch the center pair, and one switch the lower pair.

2 TRIGGER SWITCH. - The fixed forward guns are electrically fired (selector switches must be ON) by a trigger switch on the control wheel. This switch operates a relay controlling the gun firing solenoids.

(j) FUEL QUANTITY GAGE SELECTOR SWITCH. - The airplane is equipped with a fuel quantity gage selector switch. This switch enables the pilot to connect the fuel indicator to the liquidometer unit in any gasoline tank.

(k) RELAY SWITCHES (sometimes called generator cut-out). - A relay switch is mounted in a metal box in each nacelle on the aft side of the fire wall above and left of the fire wall junction box. The relay switches connect the generators to the airplane electrical system when the generator voltage is sufficiently high. However, the relays will close only when the generator switches (in the gunners' cockpit) are closed. The relay switches open automatically in case the generator voltage becomes lower than the system voltage causing a reverse current to flow.

CAUTION

Never close the reverse current relay manually by pressing the contacts together as serious damage may result to the relay, the electrical system and to the person.

Relays on the A-20G airplane are in accordance with AAF Spec. 94-32278 and are either General Electric (Model 3GTR72A1A), Westinghouse (Part 1240224) or Leece-Neville (Part 24552). These three types are interchangeable but wherever possible a relay should be replaced by one of the same brand.

(l) GUNNERS' SWITCH BOX (sometimes called the junction box). - Mounted on the inside of the fuselage to the right of the upper gunner aft of the generator control box is a metal box which comprises the main electrical control panel. On the cover are mounted two ON-OFF generator switches, two ammeters, one voltmeter, a voltmeter selector switch, and pilot to gunners' call lights.

(7) MAIN FUSE PANEL. (See figure 240.) - Mounted on the left side of the fuselage in the nose wheel well between Stations 37 and 75 is the main fuse panel. Access to the area is through a hinged cover on the inside of the nose wheel well. Its cover is attached by Dzus fasteners.

(8) MISCELLANEOUS ELECTRICAL EQUIPMENT.

(a) EMERGENCY ALARM. - An emergency alarm bell is installed at the upper rear gunner's station. It is controlled by a switch in the pilot's compartment.

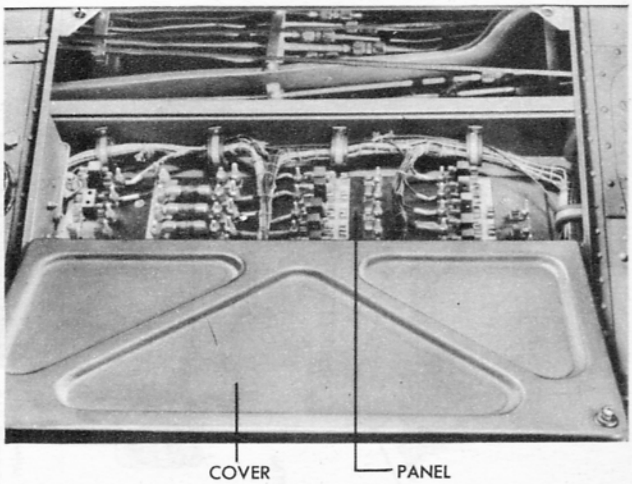


Figure 240 - MAIN FUSE PANEL

(b) ELECTRIC DRIVES. - Electric drives are used for extending and retracting the landing lights, and for operating the fuselage fuel tank booster pump and the propeller feathering pumps.

(c) CONDUIT, FITTINGS, PLUGS, RECEPTACLES, AND FUSES. - Conduit is used in the engine sections and in the ignition circuit and where mechanical protection of wiring is required. Standard fittings are used to attach conduit to junction boxes and control panels. AN-735 and AN-755 clamps are used where intermediate support and bonding to the airplane is required. Standard Army Air Forces and Cannon quick disconnect plugs are provided forward of the fire wall, the wing joint, and other locations where easy removal

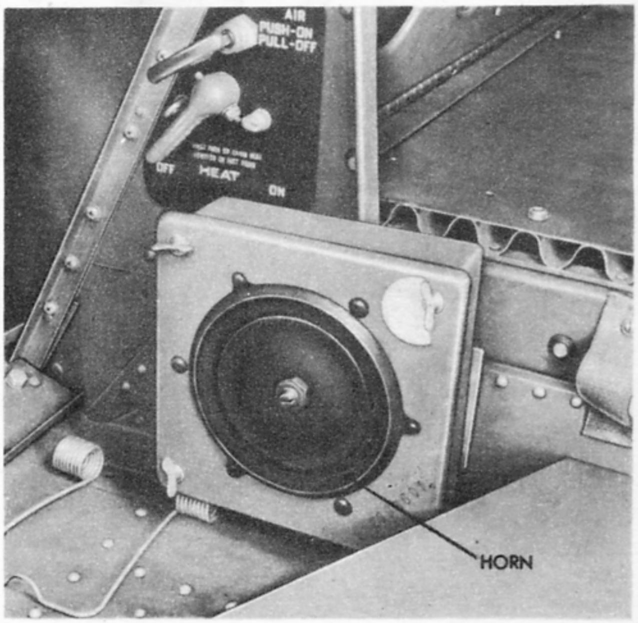


Figure 241 - ALIGHTING GEAR WARNING HORN