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ERECTION AND MAINTENANCE INSTRUCTIONS

FOR

ARMY MODEL **PQ-8A**

NAVY MODEL **TDC-2**

AIRPLANES

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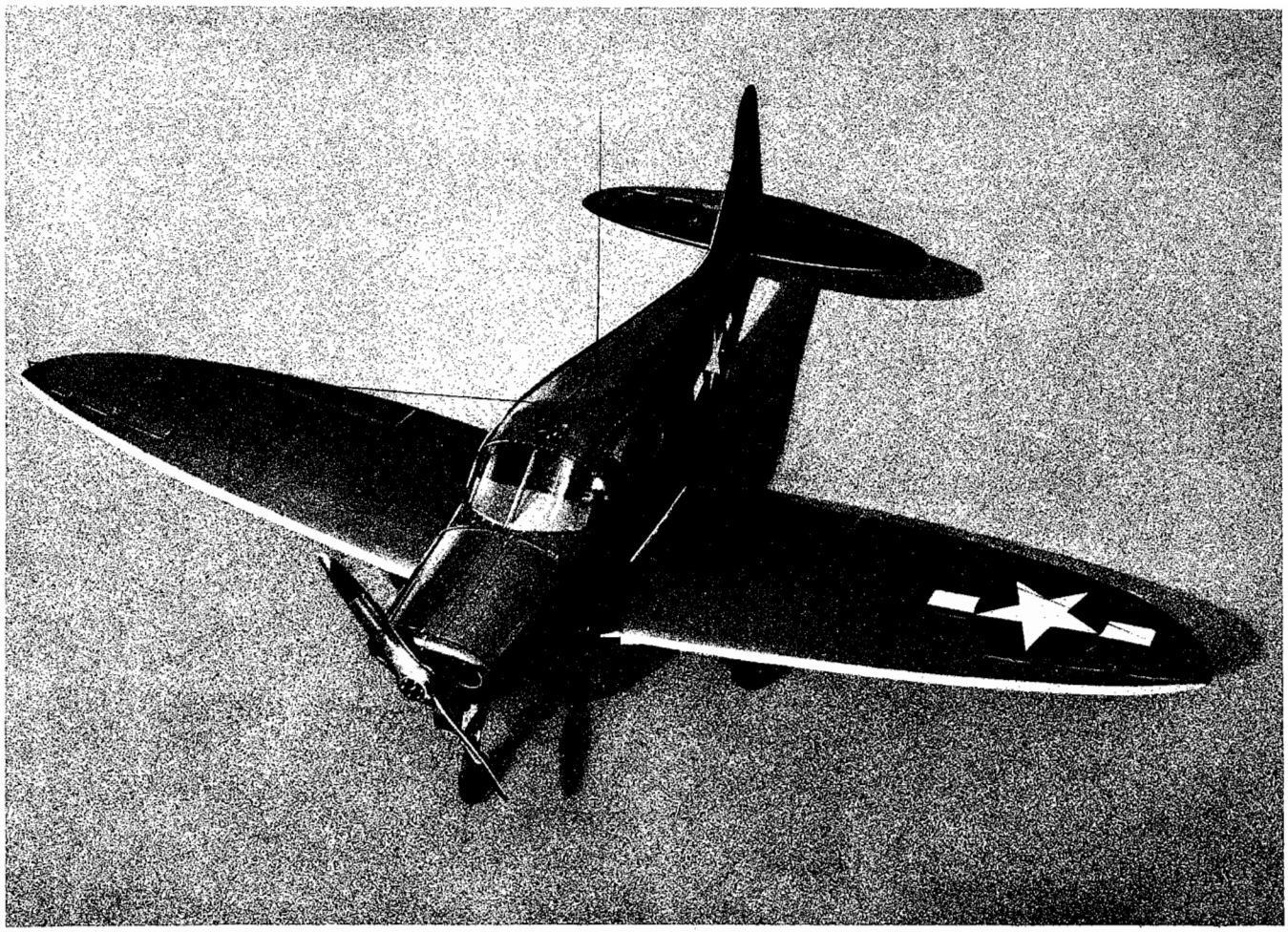
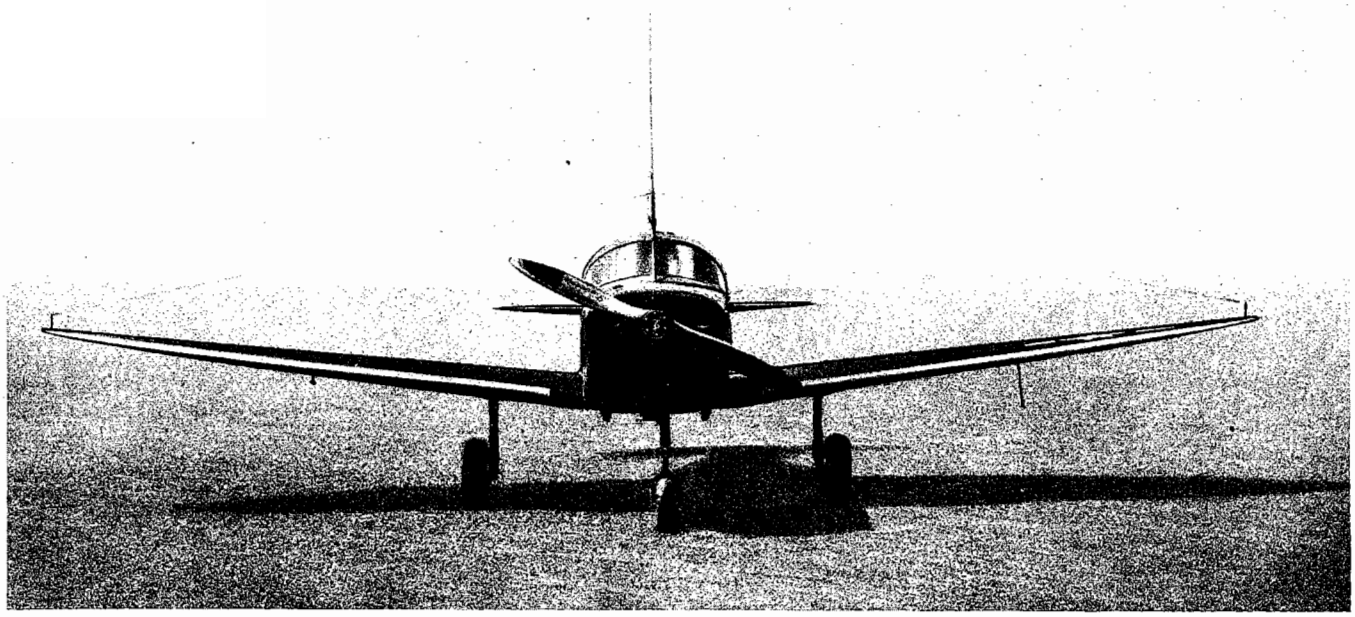


Figure 1—Three-Quarter Left Front View of Airplane Target



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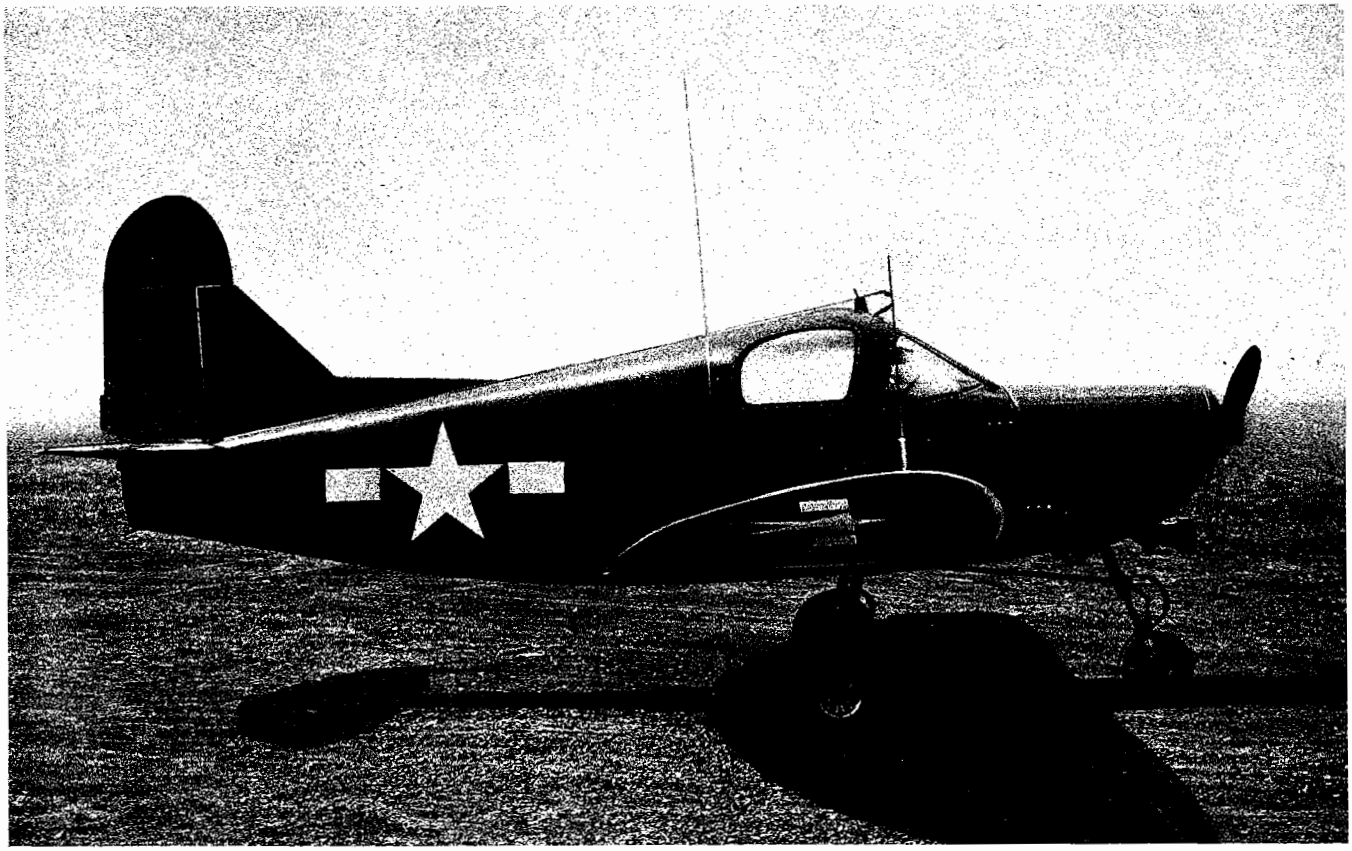

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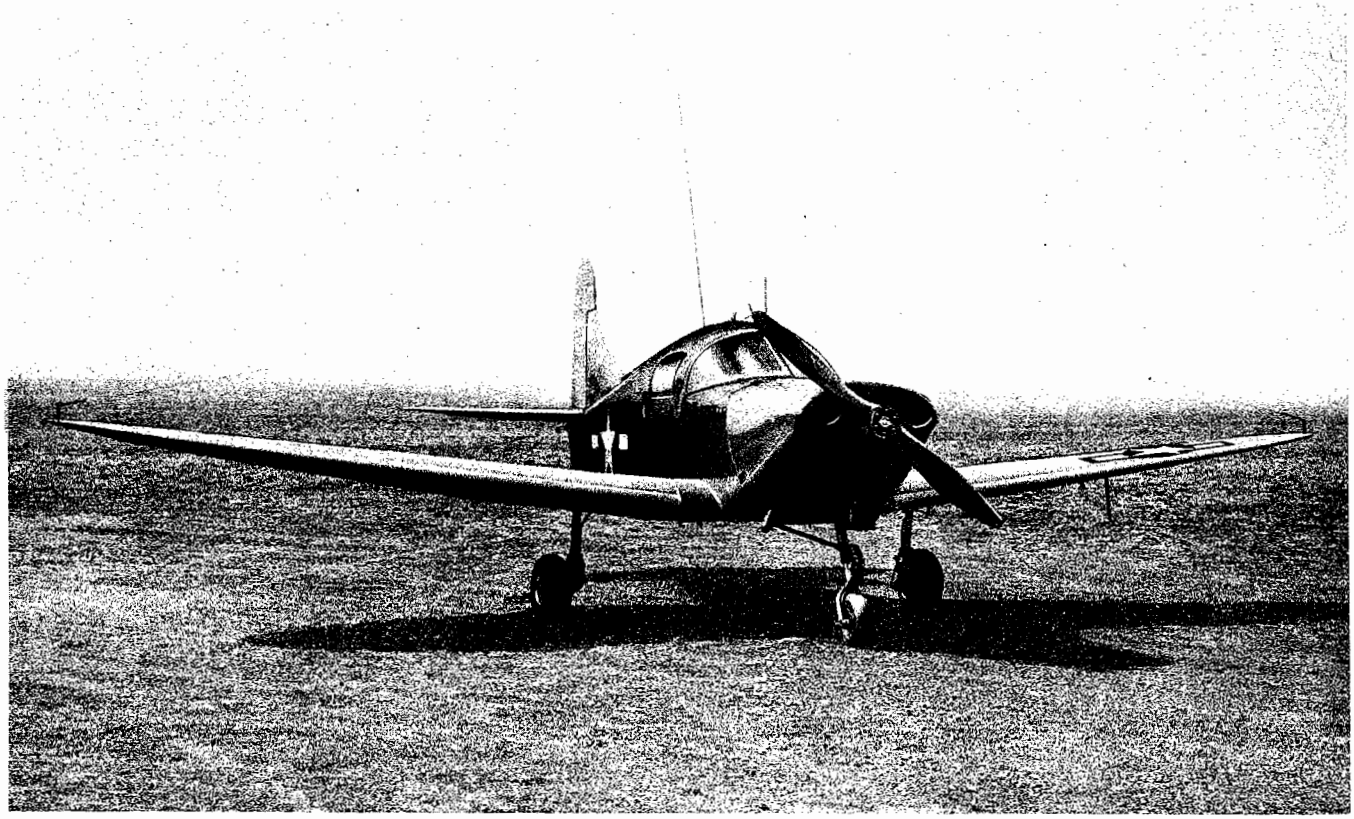


Figure 4—Three-Quarter Right Front View of Airplane Target

Figure 5—Three-Quarter Right Rear View of Airplane Target

INTRODUCTION

The Army Model PQ-8A (Navy Model TDC-2) Airplane Target is manufactured by Culver Aircraft Corporation, Wichita, Kansas, under Army Contract W 535 ac-32100 and Navy Contract NOa(s)242.

In this Handbook are covered all maintenance instructions for minor adjustments, tests, inspections, assembly, disassembly, and repair. Structural repair is covered separately in Handbook of Structural Repair, AN 09-5FB-3.

Instructions have been described in such a manner that anyone with a limited amount of mechanical ingenuity and ability can erect and maintain the airplane satisfactorily.

Methods of shipment, erection, ground handling, maintaining, servicing, lubricating, inspecting, and reconditioning of the airplane are described.

The Army Model PQ-8A and the Navy Model TDC-2 differ in the following details: The servo unit is a different type, is located differently, and requires different plumbing. The servo sump tank on the Model PQ-8A is located back of the pilot's seat and on the Model TDC-2 on the engine mount. The radio communications equipment is located aft of the pilot's seat on the Model TDC-2 and forward of the instrument panel on the Model PQ-8A. The Model PQ-8A has a carbon tetrachloride fire extinguisher on the floor of the pilot's compartment, while the Model TDC-2 has a carbon dioxide fire extinguisher on the bulkhead aft of the pilot's seat.

The Model PQ-8A has a starter, and the Model TDC-2 does not. The two models have different types of antennae. The Model PQ-8A has an external power plug while the Model TDC-2 does not. The Model PQ-8A has a finer carburetor air screen than the Model TDC-2. The elevator up travel on the Model PQ-8A is 11 degrees and on the Model TDC-2 is 15 degrees.

SECTION 1

DESCRIPTION, DIMENSIONS AND LEADING PARTICULARS

1. DESCRIPTION.

a. GENERAL.—The models TDC-2 and PQ-8A airplane targets are low-wing, single-engined, monoplanes of wood, metal, and fabric construction. The airplanes are equipped for radio control with provisions for a ferry pilot or a safety pilot. The differences between these two models are in the servo control system and details of equipment as referred to throughout this Handbook. The basic design is identical.

b. WING.—The wing is full-cantilever type and is constructed of wood and tubular torque trusses. It is completely covered with fabric. The left and right panel to the wing are joined in the fuselage by an interconnection truss. The ailerons consist of a metal frame covered with fabric.

c. EMPENNAGE.—The horizontal and vertical stabilizers are all-wood, stressed-skin construction attached in fixed alignment to the fuselage. The rudder and elevator are fabric-covered metal frames. The rudder is statically balanced. The elevator is equipped with a trim tab controllable from the pilot's seat. The rudder and right aileron are equipped with ground-adjustable trim tabs.

d. FUSELAGE. — The fuselage construction consists of wood longerons and bulkheads with stressed plywood skin. The pilot's enclosure includes a metal frame with transparent cellulose acetate windows.

e. ALIGHTING GEAR. — The alighting gear is a fixed tricycle gear. Each unit is mounted independently of the others. The main gear is installed in the inboard torque truss of each wing panel. Each wheel is mounted on a spring-oil type shock-absorbing strut. Goodyear hydraulic brakes are installed on each main gear and are controlled by toe pedals. The nose gear swivels in a support tube that is integral with the engine mount. The wheel is mounted on a spring-oil type shock-absorber strut. No brake is used on the nose gear. The nose wheel may be rotated a total of 35 degrees for the TDC-2 and 20 degrees for the PQ-8A for steering purposes through linkage with the rudder pedals. A mud wiper is installed for propeller protection.

f. POWER PLANT.—The airplane is powered with one Lycoming O-290-1 engine.

g. PROPELLER.—The propeller is a Sensenich fixed pitch. The Model 72 EB 66 is used for engines having six-bolt propeller flanges and the Model 72 EC 66 is used for eight-bolt propeller flanges.

h. FUEL SYSTEM.—The fuel system consists of one fuel tank mounted in the fuselage so located as to provide a gravity feed system. One shut-off valve, one drain valve, one fuel strainer in the feed line, and one finger strainer in the tank are included in this system. The fuel tank has a capacity of 25 U. S. (20¾ Imperial) gallons.

i. OIL SYSTEM.—The oil system is a wet-sump type with a capacity of 2 U. S. (1⅔ Imperial) gallons.

j. HYDRAULIC SYSTEM.—The servo control unit is operated by one engine-driven hydraulic pressure pump.

k. VACUUM SYSTEM.—One engine-driven vacuum pump operates the vacuum-operated components of the servo unit.

l. FLIGHT CONTROLS. — The conventional stick and rudder pedal flight controls are provided for the safety pilot. The servo flight controls are connected in unison with the safety pilot controls and are provided with overpowering devices permitting the safety pilot to take over quickly without disengaging the servo control in the event of a servo failure.

m. ELECTRICAL SYSTEM.—The electrical installation is a single-circuit 12-volt ground system. One AN-315234 ampere-hour battery is installed in the fuselage and one type E-7A generator is installed on the engine. (See figure 6.)

n. RADIO EQUIPMENT.—The radio equipment is mounted on a frame located to the right of the pilot's seat.

o. FIRE EXTINGUISHER.—The 1-quart fire extinguisher is installed on station 46 bulkhead back of the pilot's seat for check pilot flight only on the Model TDC-2. On the Model PQ-8A the fire extinguisher is mounted in the center of the floor board.

p. SPECIAL EQUIPMENT. — An oleo strut piston head wrench, Culver part No. 3005, is furnished for removing the piston head from the oleo piston tubes. Covers for the engine and propeller are furnished for storage purposes. Their Culver part Nos. are 3461 and 3460.

2. DIMENSIONS AND LEADING PARTICULARS.

(See figure 7.)

(Aircraft in level flight position unless otherwise stated.)

a. PRINCIPAL DIMENSIONS.

(1) GENERAL.

Span	26 ft 11 in.
Length (over-all)	18 ft ¾ in.
Height	7 ft 11¼ in.

(2) WINGS.

Airfoil section (curve identification)	NACA-3408-3414
Chord at root	66 in.
Chord near tip (143 in. from fuselage center line)	32⅞ in.
Incidence	1½°
Dihedral (measured on top face of main spar)	5°
Sweepback	0°

(3) STABILIZER.

Span	9 ft 0 in.
Maximum chord	18 in.
Incidence	$-4\frac{1}{2}°$
Dihedral	0°

(4) FUSELAGE.

Width (maximum)	38 in.
Height (maximum)	$46\frac{9}{32}$ in.
Length (without engine mount)	171 in.
Length (with engine mount)	$181\frac{11}{64}$ in.

b. AREAS.

Wing (less ailerons)	111.17 sq ft
Ailerons (total)	9.22 sq ft
Stabilizer (including elevator)	17.66 sq ft
Elevator (including tab)	5.53 sq ft
Elevator trim tabs (total)	.58 sq ft
Fin	9.962 sq ft
Rudder	5.7915 sq ft
Rudder trim tab	.0625 sq ft

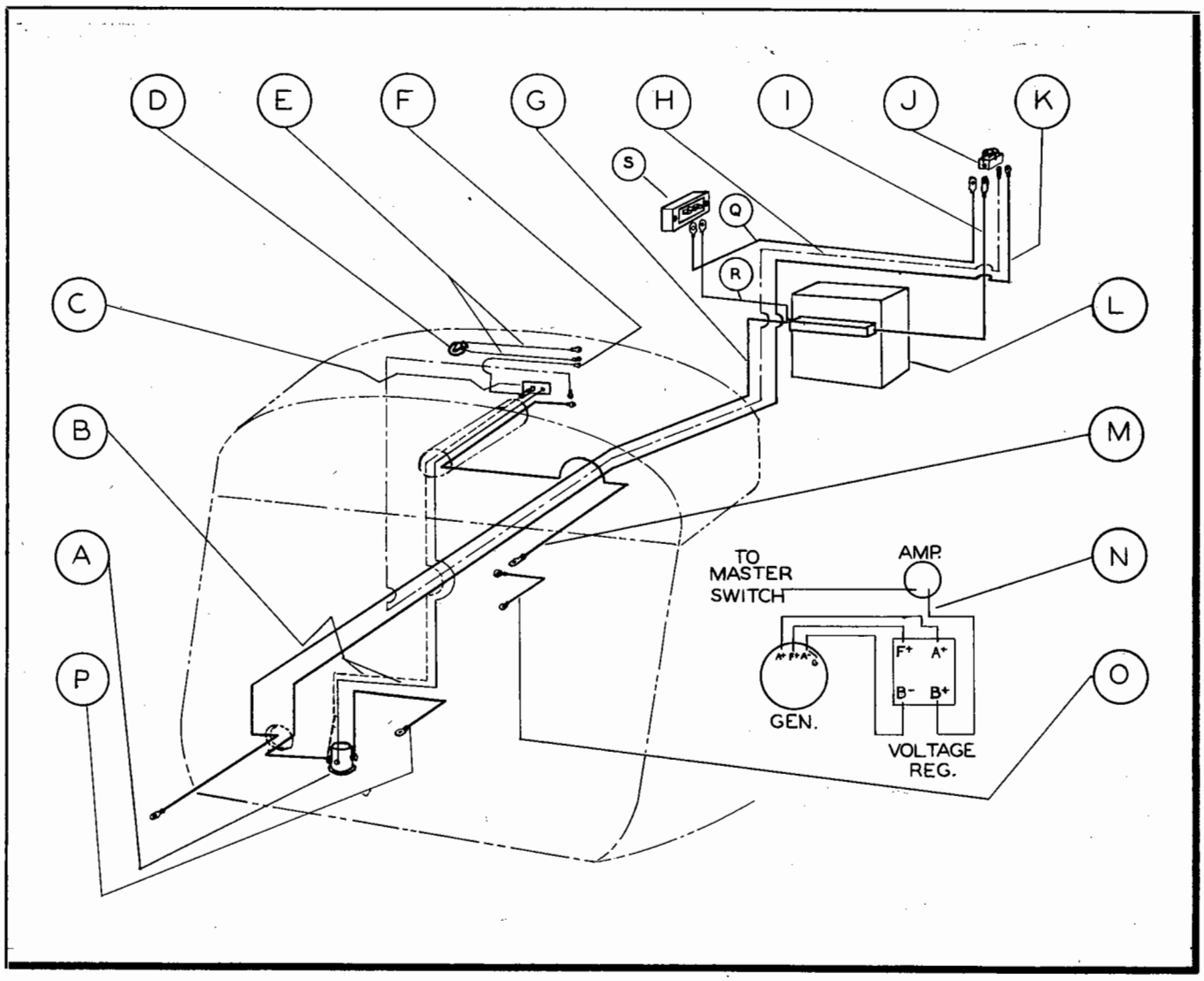


Figure 6—Electrical System Diagram

Key to Figure 6

Letter	*Title*	*Part No.*	*No. Req.*
A	Starter Solenoid	4517	1
B	Double Wire Solenoid to Starter	3472-2	1
C	Starter Button	4518	1
D	Fuel Gage Sending Unit	2867	1
E	Ground Wire and Fuel Gage	3472-1	1
F	Cable to Fuel Gage	3171-3	1
G	Battery Cable Assembly (to ground)	2928-3	1
H	To Ammeter Cable Assembly	3470-1	1
I	Battery Cable Assembly	2928-2	1
J	Cutler-Hammer Master Switch	8781	1
K	To Master Switch	2928-2	1
L	Battery		1
M	Cable to Voltage Regulator	3470-2	1
N	Schematic Wiring Diagram	3596	1
O	Generator Connecting Assembly Wire	3470-3	1
P	To Starter Motor	2928-1	1
Q	Power Plug Cable (to switch)	3912	1
R	Power Plug Cable (to battery)	3913	1
S	Power Plug	4543	1

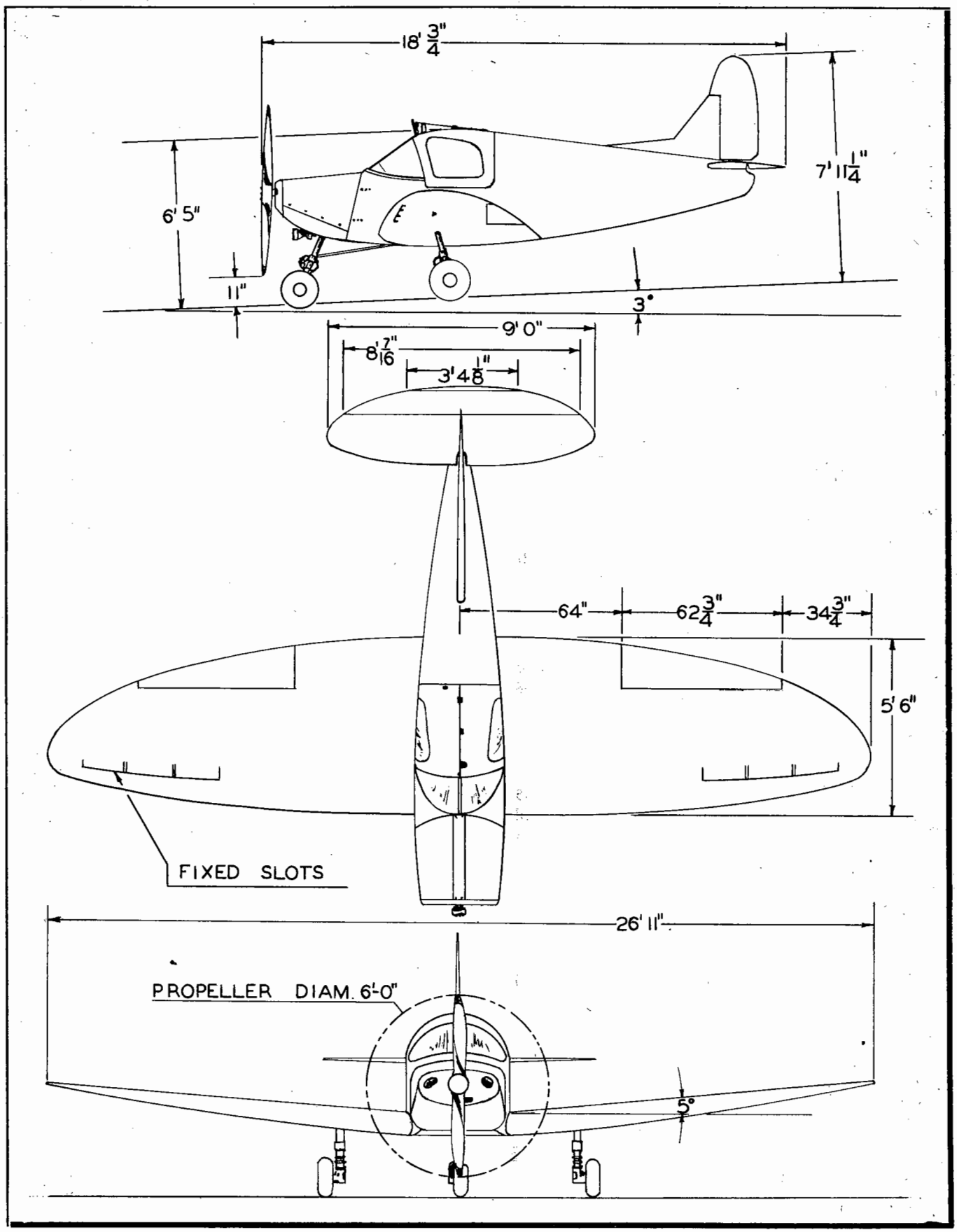


Figure 7—General Dimensions

c. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES.
(Movements measured in degrees and inches.)

	Degrees	Inches
Stabilizer (total)	4½	1.46
Fin, offset (measured from fuselage center line)	¾ Left	0.39
Ailerons — up (from neutral)	15 ± 1½	4.33
down (from neutral)	13	3.89
Elevator — up (from streamline with stabilizer) PQ-8A	11 ± ¼	2.38
TDC-2	15 ± ¼	3.28
Elevator — down (from streamline with stabilizer)	30 ± 2	6.58
Rudder — right (from streamline with fin)	31 ± 1	10.36
Rudder—left (from streamline with fin)	31 ± 1	10.36
Trim Tabs		
Elevator — up (from elevator trailing edge)	12 ± 1	0.66
down (from elevator trailing edge)	25 ± 1	1.34

d. ALIGHTING GEAR.

(1) MAIN ALIGHTING GEAR.
Type ..... Nonretractable
Tread (width from center of tire to center of tire) ..... 7 ft. 11¾ in.
Shock struts (main)
Type ..... Spring-oil
Maker and part number ..... Culver 3086
Fluid required—Specification No. AN-VV-O-366
Wheels (main)
Type ..... Goodyear No. 95-1555
Tire ..... Goodyear 6.00x6, 4-ply
Tire pressure ..... 25 lb./sq. in.
Brakes
Type—single disc hydraulic ..... Goodyear No. 95-1811

(2) NOSE WHEEL UNIT.
Type ..... Nonretractable
Shock struts
Type ..... Spring-oil
Maker and part number ..... Culver 3087
Fluid required—Specification No. AN-VV-O-366
Wheel
Type ..... Hayes D-3-143 Less brake
Tire 5.00x4, 6-ply
Tire pressure ..... 25 lb./sq. in.

e. ENGINE.
No. ..... One
Designation ..... Army 0-290-1 Navy 0-290-1
Gear ratio ..... Direct drive
Fuel — Specification No. AN-VV-F-761
Oil — Specification No. AN-VV-O-446

f. PROPELLER.
Manufacturer ..... Sensenich
Type ..... Fixed pitch
Diameter ..... 72 in.
Pitch setting—at ¾ radius ..... 21½°

g. TANK CAPACITIES.

	Gallons (each)
Fuel tank	25 U. S. (20.8 Imperial)
Oil (wet-sump engine)	2 U. S. (1.67 Imperial)

SECTION II

SHIPMENT AND ERECTION PROCEDURE

1. SHIPMENT OF AIRCRAFT.

a. SHIPMENT.—The shipment of one airplane can be accomplished by any form of freight.

b. NUMBER.—One compact crate has been designed to contain all items of one airplane. (See figure 8.)

c. SIZE.—The length of the crate is 18¼ feet or 219 inches. The width is 4½ feet or 54 inches. The height is 6 feet, 10 inches, or 82 inches.

d. WEIGHT.—The weight empty is 2325 pounds and loaded 3590 pounds.

e. VOLUME.—The volume of the crate is 561.5 cubic feet outside measurements and 484.5 cubic feet inside measurements.

f. MAXIMUM CAPACITY.—Capacity of the crate is one complete airplane: Fuselage and engine section, both wing panels, main gear and nose gear, propeller and empennage. All bolts for assembly are to be sacked.

g. PREPARATION FOR SHIPMENT.

(1) SURFACE CONTROLS.—Check rudder and tab cables for condition of rust-protective coating and renew as required. Coat all exposed metal surfaces with rust preventive, Specification No. AN-C-52.

(2) HYDRAULIC SYSTEM.—Fill system with

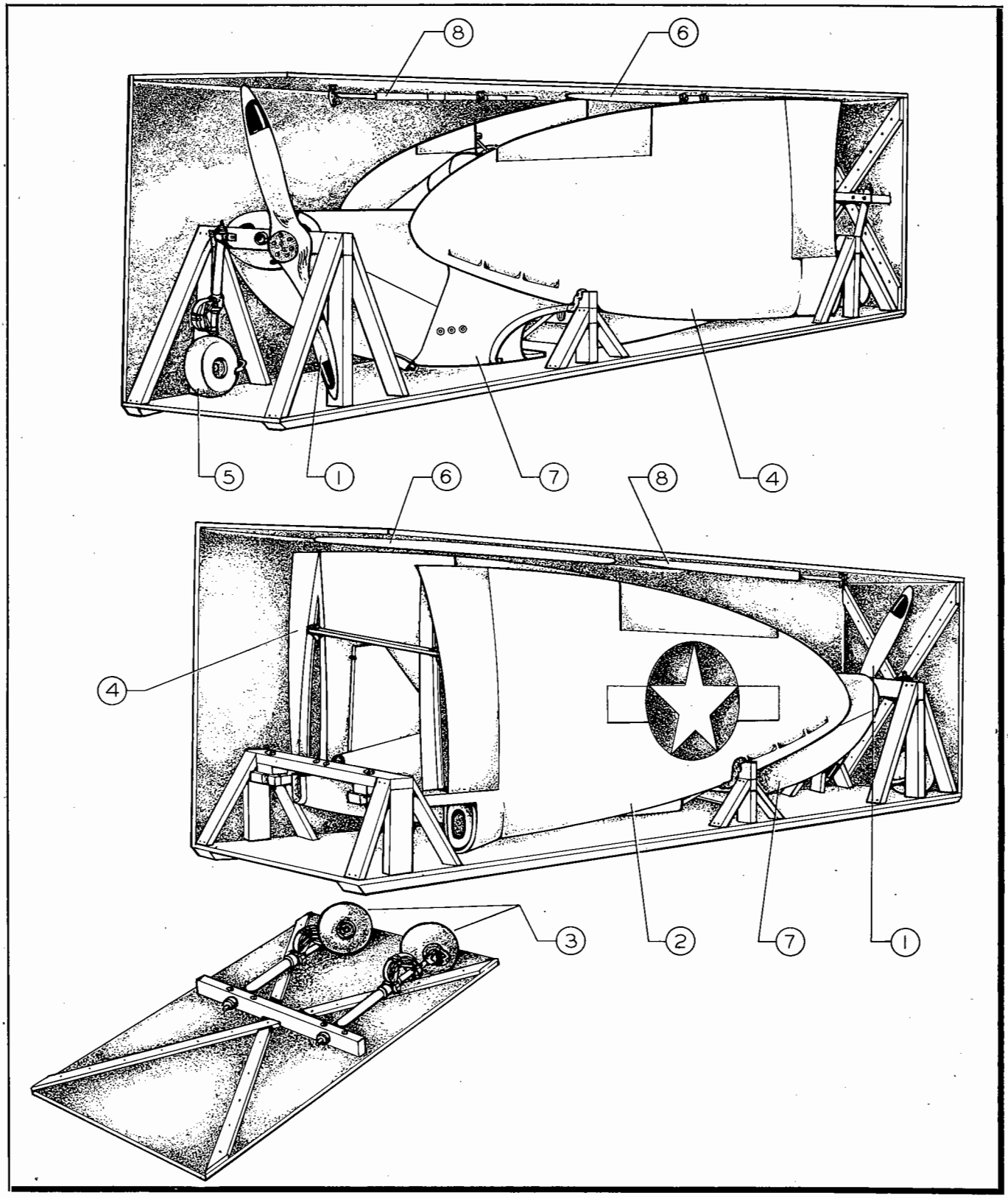


Figure 8—Crating Diagram

Key to Figure 8

1. Propeller
2. Left Wing
3. Main Gear
4. Right Wing
5. Nose Gear
6. Stabilizer, Elevator, and Elevator Tab
7. Fuselage
8. Rudder

hydraulic fluid, Specification No. AN-VV-O-366. Close all vents and plug lines where detached from units. All leaks must be repaired. Coat exposed parts of piston rods with mineral oil and wrap with cloth or heavy paper.

(3) ALIGHTING GEARS.—Place blocks under axle sockets to remove weight from tires. Inflate tires to about 10 pounds pressure.

(4) EQUIPMENT.

(a) Remove and store radio equipment.

(b) Remove and store battery.

(c) Plug the pitot lines and identify all leads to aid reassembly.

b. SUITABLE CRATING PROCEDURE. — The standard for the propeller shaft should be placed so it will take the weight of the front end. Another standard should be made to go through the interconnection truss to hold the center of the fuselage stable. Bolts can be put through this standard and through the interconnection truss. Another built-up section near the tail of the fuselage is so constructed that it will keep the tail of the fuselage in place. Two bolts can be run through the stabilizer mounting holes and through the built-up construction. Various arrangements can be built up to hold the main gear, nose gear, and tail surfaces in place as shown in the diagram. (See figure 9.)

i. DISASSEMBLY OF CRATE.—Take off either side and remove the wing on that particular side. Then remove stabilizer and rudder from the top section. Take off the other sections and remove contents of box.

j. PREPARATION OF AIRPLANE FOR SERVICE.

(1) Remove wrapping from shock struts, repack wheel bearings with grease, AAF Specification No. 3560, medium grade, check and service shock struts, wash brake discs in gasoline. Inflate tires to 25 pounds pressure. Service and adjust brakes as required.

(2) Remove protective wrappings from servo hydraulic units.

(3) Check operation of all surface and engine controls.

(4) Reinstall all instruments, battery, and radio equipment; adjust, and service as required.

2. ERECTION PROCEDURE.

a. WING ATTACHMENT PROCEDURE. — The fuselage is placed upon two horses, one near the front and the other near the rear. Three men are required to

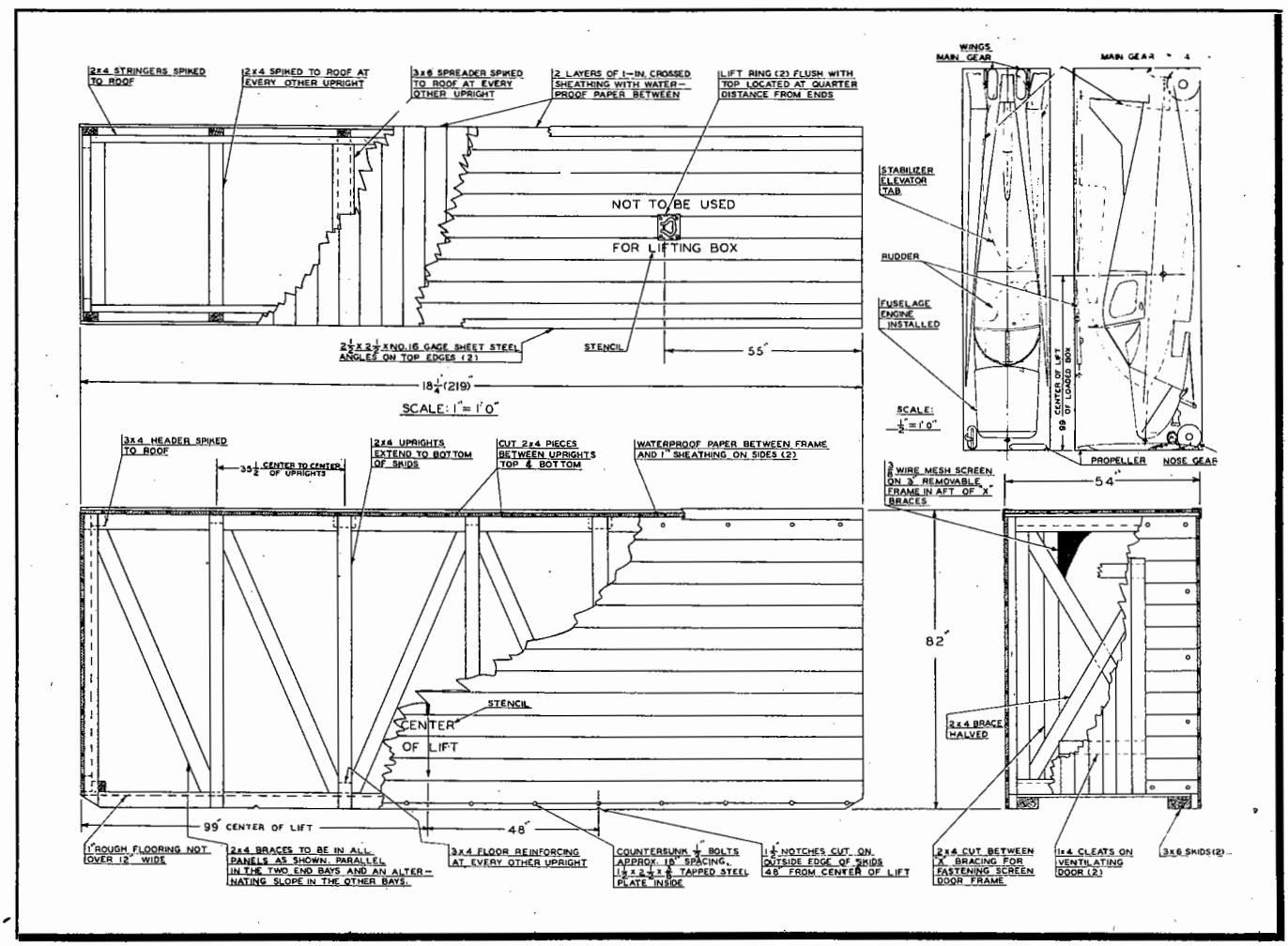


Figure 9—Crating Procedure

install the left wing. One man is stationed at the tip, another at the trailing edge near the root, and the other man at the leading edge near the wing root. The main spar is placed in the interconnection truss, and two bolts are then placed through them.

The auxiliary spar is connected by one bolt through the brackets at station 46. The aileron push-pull tube is connected to the control stick tube by means of a bolt, nut, and cotter key. The pitot lines are placed in the rubber tubes about 1 inch and wrapped three turns with safety wire. Connect the brake lines by tightening the brake line connections. Cover the gap on the under part of the wing between the fuselage and wing, back of the spar. This is done by doping a 4-foot by 6-inch pinked piece of fabric and placing it over the gap. The wing root cover is next installed with sheet metal

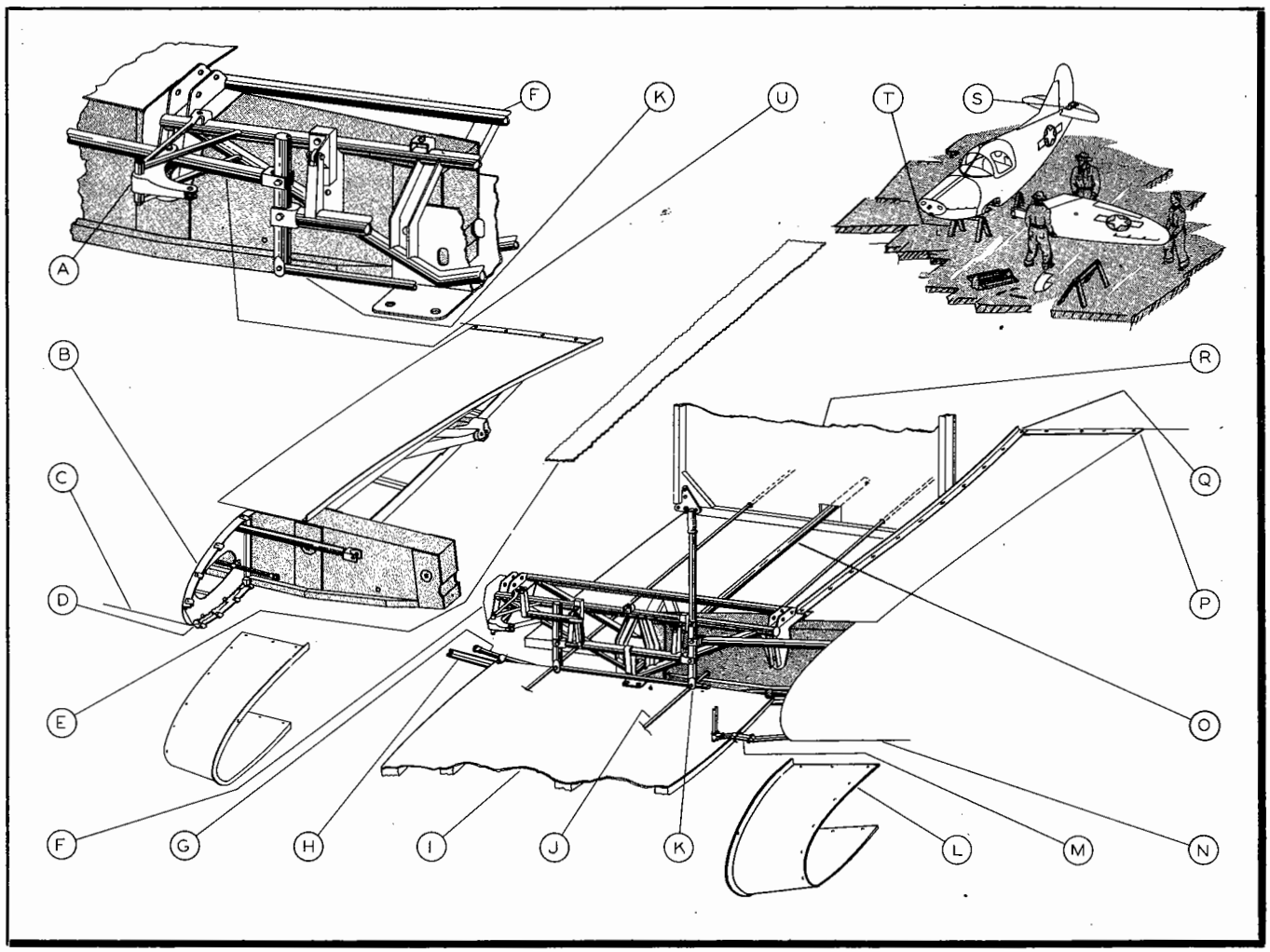


Figure 10—Wing Installation

Key to Figure 10

Letter	Title	Part No.	No. Req.
A	Servo Bell Crank Connecting Aileron Push-Pull to Servo Hookup	1744	1
B	Bracket—Station 26—Top Fillet (Left)	1447-2	1
	Bracket—Station 26—Top Fillet (Right)	1447-4	1
C	Wing Assembly Complete	2647	1
D	Bracket—Station 26—Lower Fillet (Left)	1447-1	1
	Bracket—Station 26—Lower Fillet (Right)	1447-3	1
E	Cover Cloth—Pinked (Left and Right)	4'6"x6"	2
F	Wing Interconnection Truss	2774	1
G	Right Floor Board Brake Line (Left not pointed to)	4088	2
H	Bracket Rear Fillet	4064	2
I	Floor Board	2983	1
J	Rear Rudder Cables	3258	2
K	Elevator and Aileron Torque Tube Assembly	2130	1
L	Wing Root Cover (Left)	1448	1
	Wing Root Cover (Right)	1449	1
M	Pitot Line Connections Wrap with tape, tie with wire, shellac	6" Synthetic Tubing	2
N	Wing Assembly Complete, Left	2646	1
O	Elevator Front Link	610	1
P	Walkway Molding (Trailing) (Left)	3465	1
	Walkway Molding (Trailing) (Right)	3466	1
Q	Walkway Molding (Inboard) (Left)	3463	1
	Walkway Molding (Inboard) (Right)	3464	1
R	Bulkhead Station 46	2665	1
S	100 lbs. Sandbags on either side of Stabilizer		
T	Horses under Fire Wall and under Bulkhead	46	
U	Aileron Link Assembly (Right)	502	1

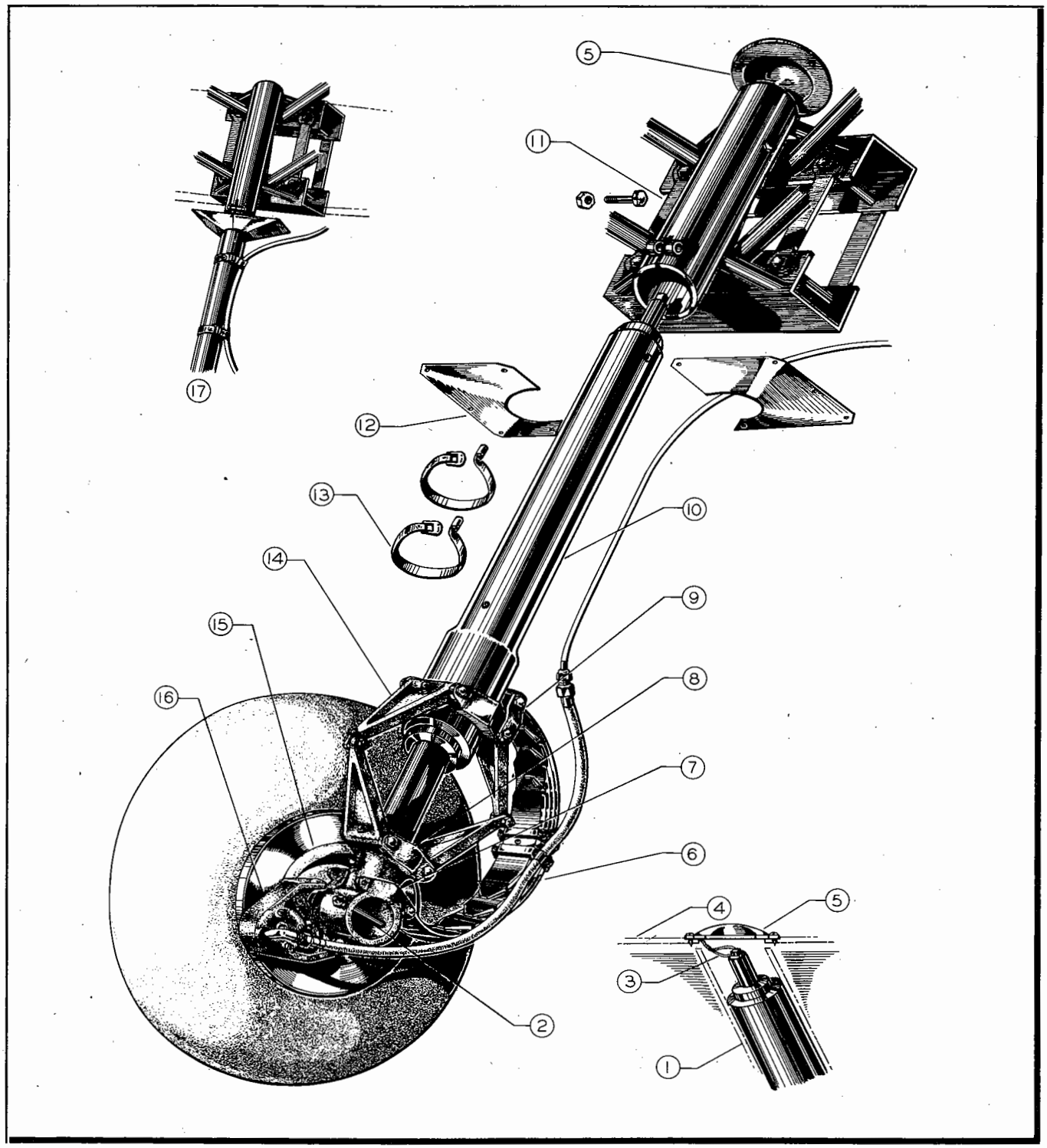


Figure 11—Main Gear Installation

Key to Figure 11

1. Landing Gear Assembly
2. Main Gear Axle
3. Safety Wire
4. Top of Wing
5. Oleo Cover Plate
6. Landing Gear Oleo Spring
7. Main Gear Oleo Axle Socket
8. Brake Unit Auxiliary Attachment Lug
9. Spring Shackle and Main Gear Spring Shackle
10. Oleo Shock Strut
11. Wing Torque Truss, Station 17 to Station 67
12. Main Gear Inspection Plate
13. Wrap Lock Clamp
14. Torque Links
15. Dust Shield
16. Brake Unit
17. Main Gear Installed

screws. Special attention should be given while installing the push-pull tube to see that the oil hole in the swivel is placed up. It may be necessary to use shims between the wing spar and the interconnection truss. When inserting the wing spar, be sure that the spar, brake lines, aileron push-pull tube, fuselage skin, longeron, or pitot lines are not damaged. Place another horse under the wing spar at station 64 to keep the plane from tipping.

The same procedure is used for installing the right wing with the addition of placing a bolt through the aileron servo bell crank. Tighten and fasten securely with nut and cotter key. (See figure 10.)

The rear bottom cover plate is installed with sheet metal screws to complete the wing installation.

b. MAIN GEAR INSTALLATION PROCEDURE.—Install the main gear by placing the oleo shock strut in the wing torque truss located at station 43. Place the proper bolt through the truss and oleo cylinder. Securely tighten the nut and install cotter key. Tighten the clamp bolt near the bottom of the truss. Before installing the oleo plate on the top of the wing, start one screw, wrap safety wire around screw and through oleo plug, remove screw, and install plate, placing one screw through the loop formed and the other screws in their proper places. The main gear cover plates are next installed. Sheet metal screws are used to place the plates on the lower side of the wing. Connect brake lines at connection. (See figures 11, 12, and 13.)

c. NOSE GEAR INSTALLATION PROCEDURE.—Place airplane on jacks, using the jacking points at station 91 on each wing. Place a padded horse under station 111 and place 180 pounds of sand bags on the stabilizer. Needle bearings are pressed into cylinder and are not easily removed. Take the nose wheel assembly and place a thrust bearing on the top of it with the bearing retainer down. Then place this assembly in the nose wheel support tube. Another thrust bearing is then put on with the bearing retainer up. Be sure that these thrust bearings are installed properly. Then the bearing retainer nut is installed and the safety wire put through one of the holes in the bearing retaining

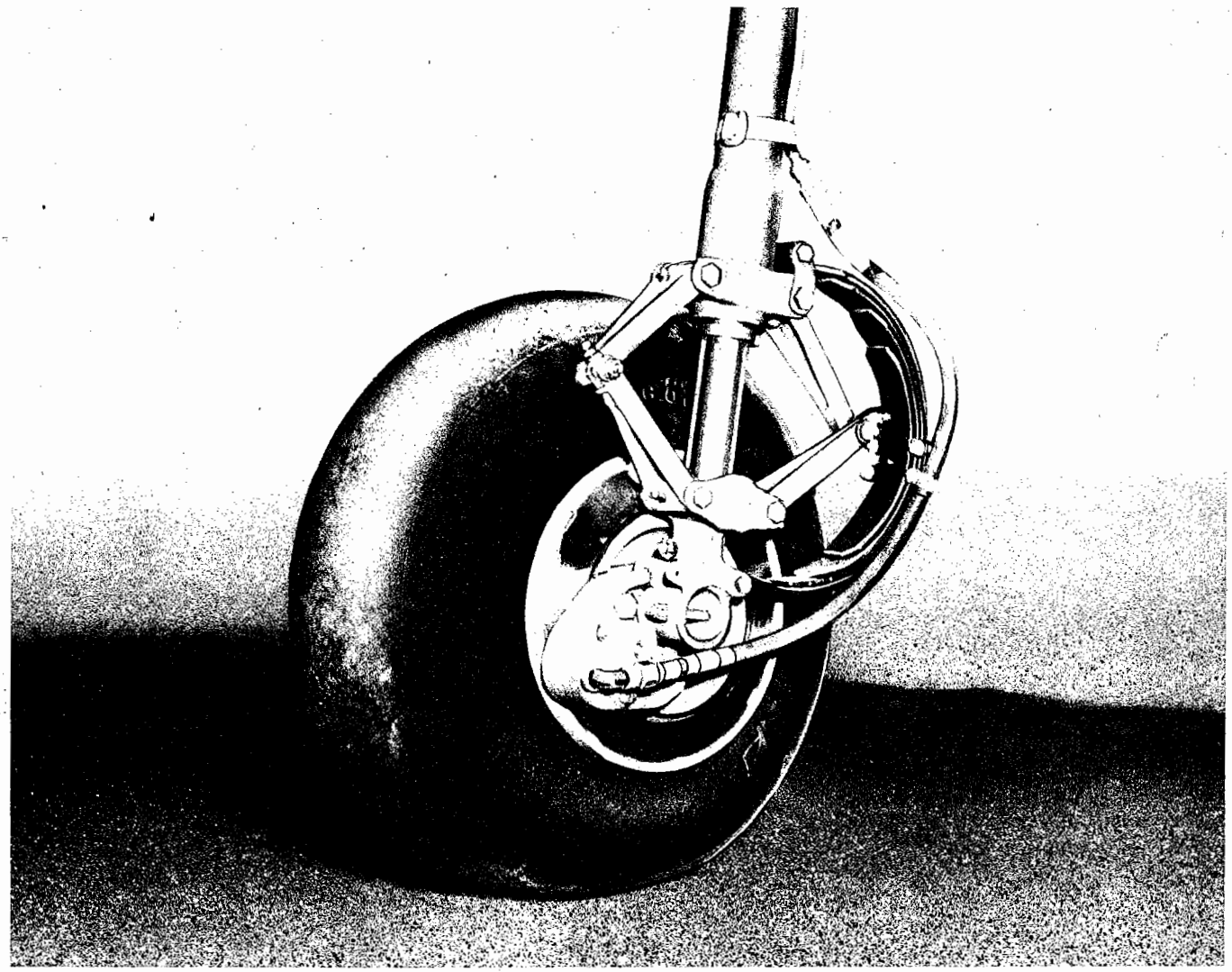


Figure 12—Main Gear

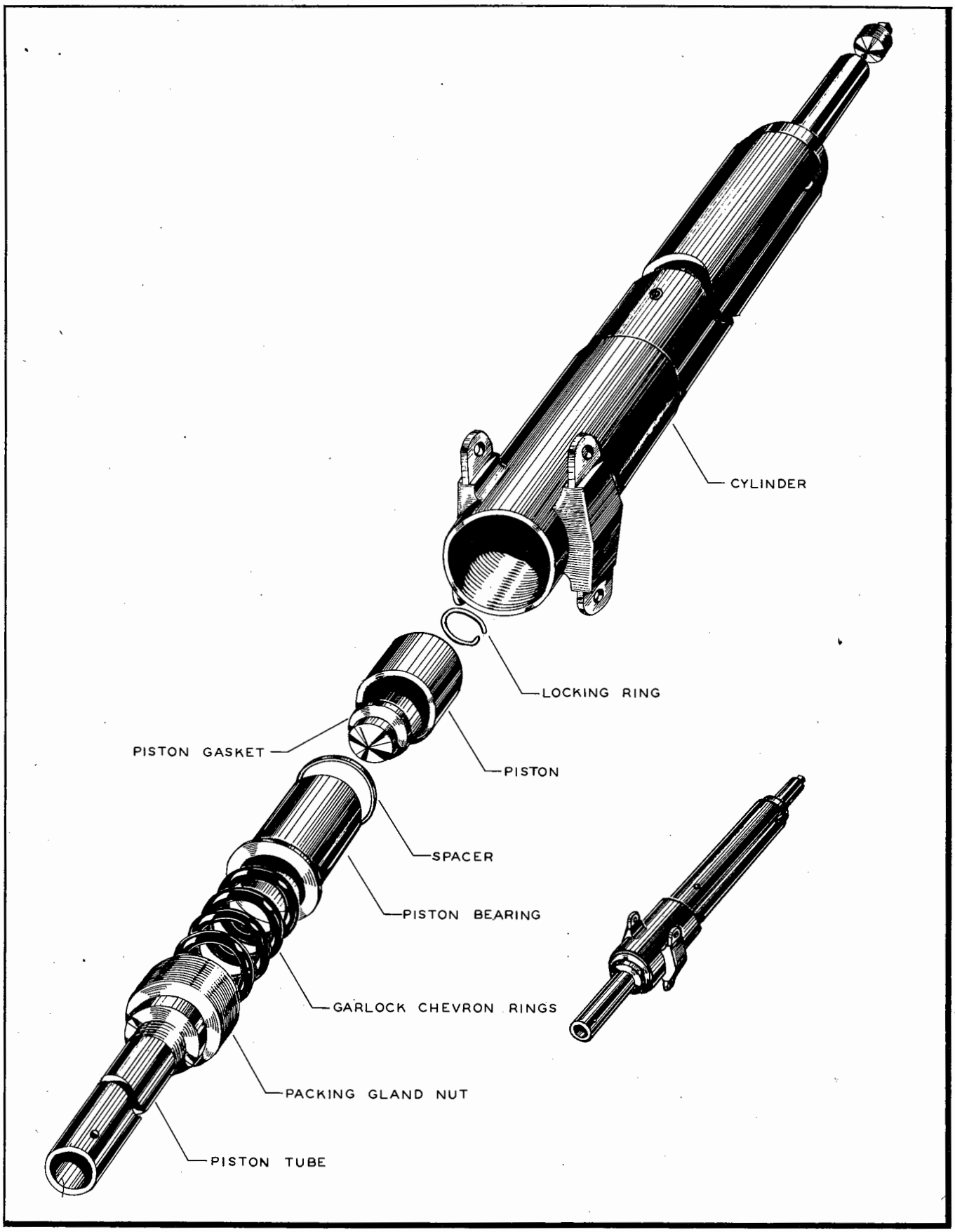


Figure 13—Main Gear Shock Strut

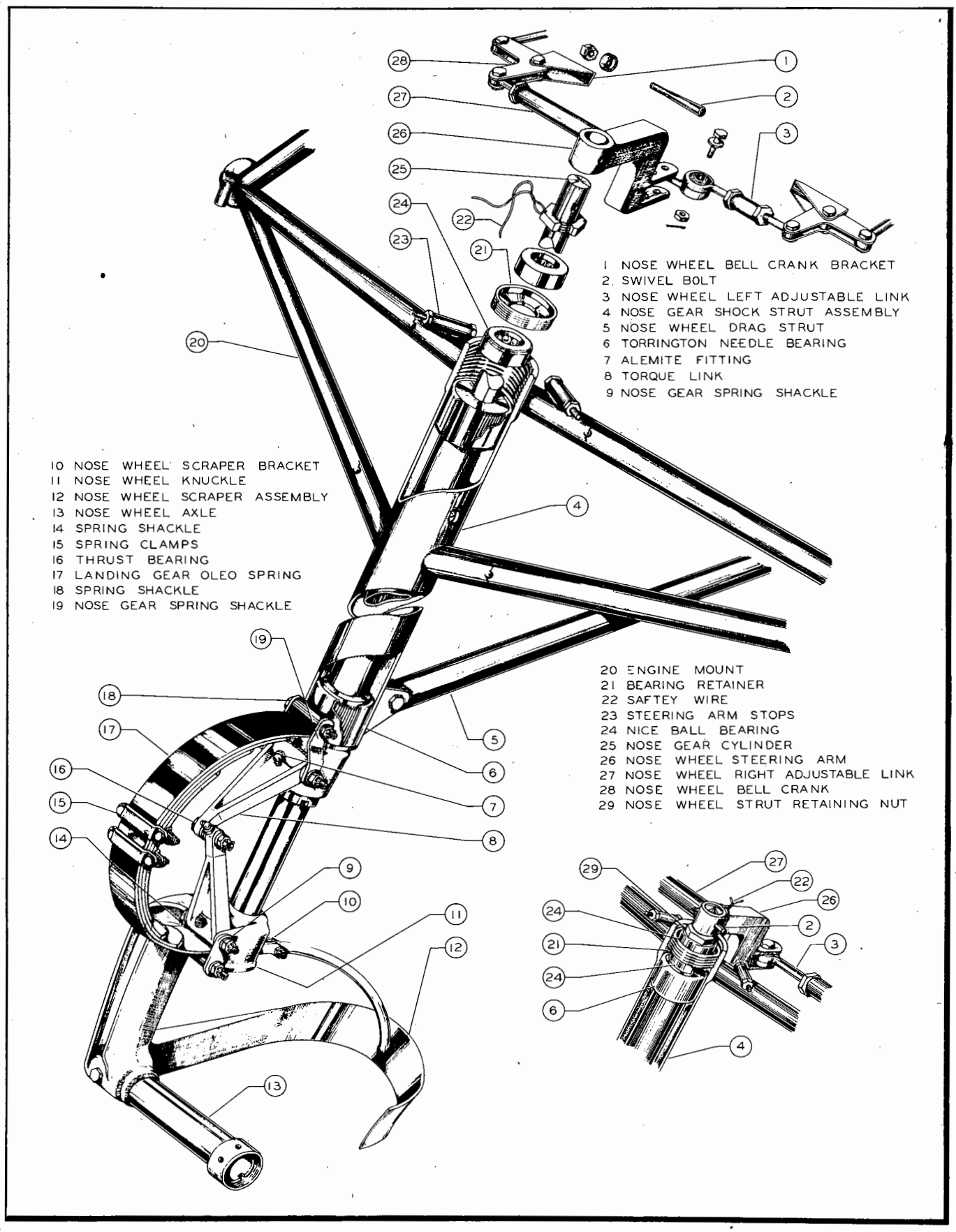


Figure 14—Nose Gear Installation

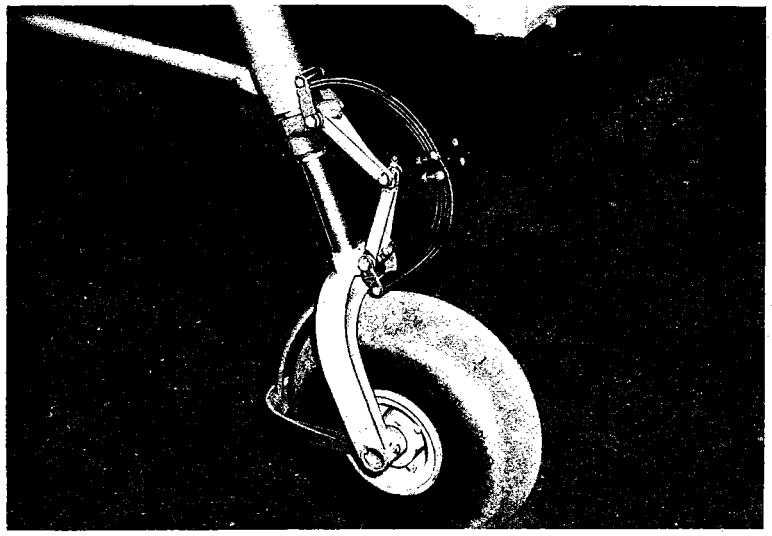


Figure 15—Nose Gear

nut. Place the nose wheel steering arm on the extended portion of the nose wheel assembly and install the threaded taper pin. Wrap the safety wire around the nose wheel steering arm and twist in place. Connect the steering system push-pull tubes to the steering arm and install the bottom engine cowl. (See figures 14, 15, and 16.)

d. TAIL SURFACE INSTALLATION PROCEDURE.

(1) RUDDER INSTALLATION.

NOTE

The stabilizer must always be off before the rudder can be installed.

(a) Install the upper and lower hinge bolts.

(b) Connect the rudder cables to the rudder horn. (See figure 17.)

(2) STABILIZER INSTALLATION.—Install the four mounting bolts through the fuselage longeron and the front and rear stabilizer brackets. Install the leading edge cover plates. (See figure 17.)

(3) ELEVATOR INSTALLATION.

(a) Install the three hinge bolts.

(b) Place the tab-actuating unit in the elevator. This is held in place by two bolts through the tab-actuating unit and the elevator frame.

(c) Place the tab unit cover plates on the top and bottom surfaces of the elevator.

(d) Dope a piece of tape over the gap between the stabilizer and elevator. This tape should be about 3 inches wide with pinked edges and doped down the length of the gap for the TDC-2 and halfway across for the PQ-8A. (See figure 17.)

(e) Connect the elevator push-pull tube to the elevator horn.

(4) TAB INSTALLATION.

(a) Place the tab spar in the elevator hinge settings.

(b) Install the 10 hinge screws that hold the tab to the spar.

(c) Connect the push-pull tube to the ball socket on the tab. (See figure 17.)

(5) ADJUSTMENT OF STABILIZER AND FIN.—The settings of the stabilizer and fin are fixed at the factory, and no further adjustment is necessary.

e. SETTINGS AND RANGES OF MOVEMENTS OF CONTROL SURFACES.

Dihedral—wing (measured on top face of front beam from center line of airplane to tip of wing)	5°	12.1247 in.
Incidence—wing	1½°	
Elevator movement—		
up (Model PQ-8A)	11°	
up (Model TDC-2)	15°	
down	30°	
Stabilizer (fixed)	–4½°	
Rudder movement—		
right	31°	
left	31°	
Aileron movement—		
up	15°	
down	13½°	
Tensions in surface controls		
Aileron—push-pull tubes	No tension	
Elevator—push-pull tubes	No tension	
Rudder cable	15 lb	
Tab cable	2 lb	
Trim tab movements—		
Elevator—		
up	12°	
down	25°	
Rudder	Fixed as neces'y	
Aileron	Fixed as neces'y	

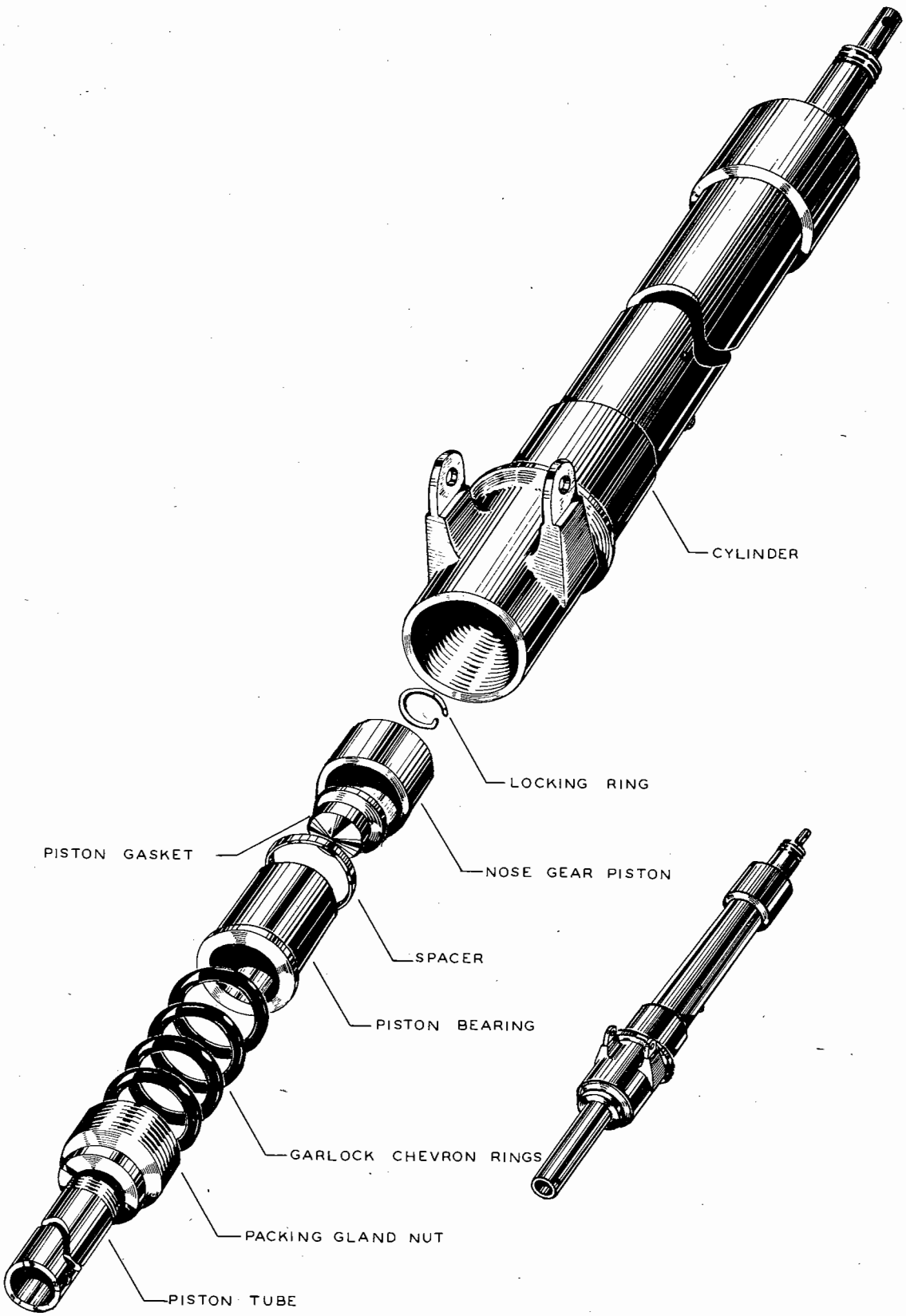


Figure 16—Nose Gear Shock Strut

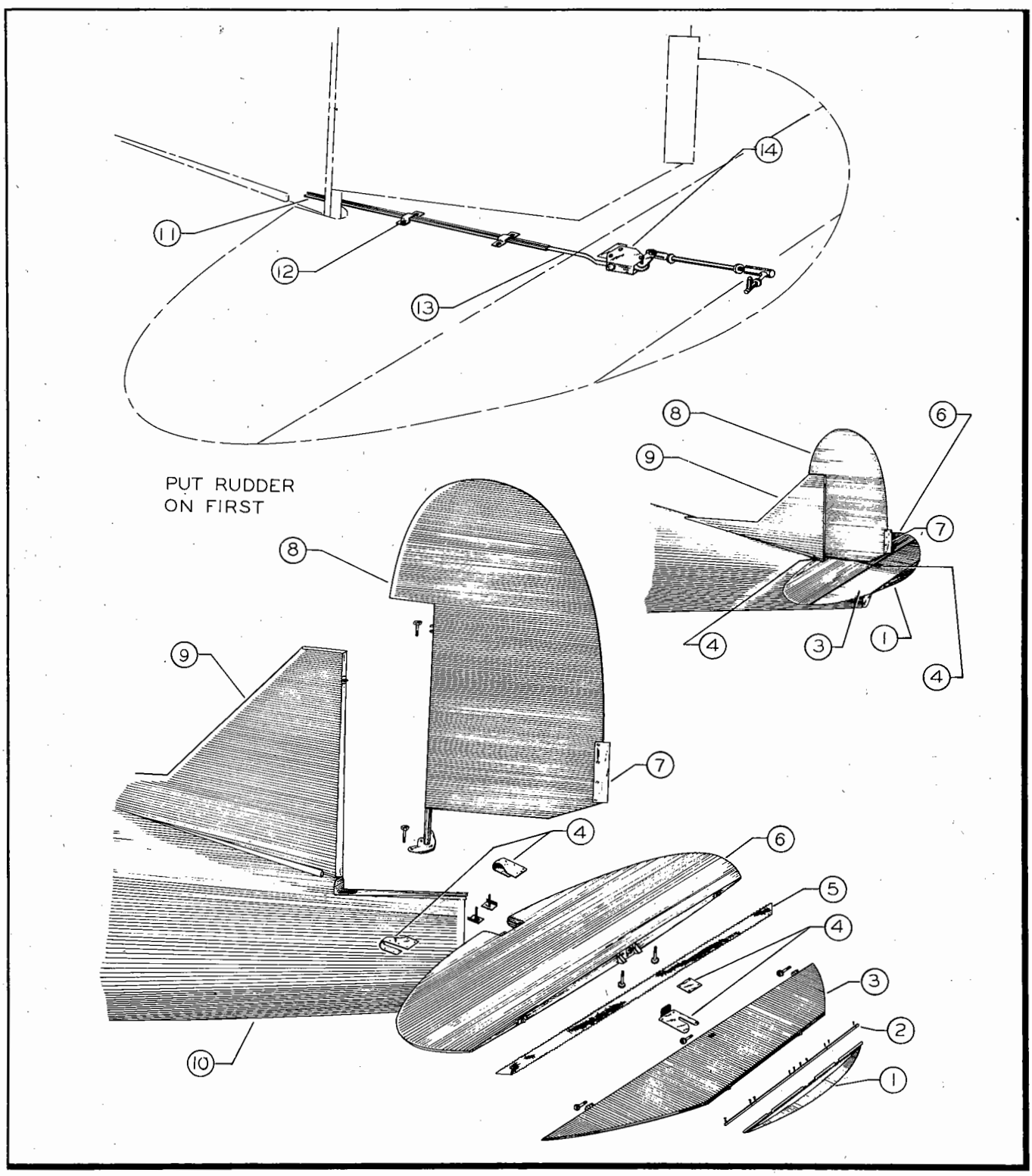


Figure 17—Empennage Assembly

Key to Figure 17

1. Tab
2. Tab Spar
3. Elevator
4. Cover Plates
5. Pinked Tape
6. Stabilizer
7. Fixed Tab
8. Rudder
9. Fin
10. Fuselage
11. Cable Fair-leads
12. Cable Clips
13. Tab Cables
14. Tab Actuating Assembly

SECTION III

HANDLING AND GENERAL MAINTENANCE INSTRUCTIONS

1. ACCESS AND INSPECTION PROVISIONS.

(See figure 18.)

a. COVER PLATES.—The cover plates consist of the oleo cover which is located on the wing directly above the main gear oleo strut. The tab top and bottom cover plates are located near the front spar of the elevator. The stabilizer fairing plates are installed on the leading edge of the stabilizer, one on the left and one on the right of the rudder. The wing root cover plates are installed on the leading edge of the wing on each side of the fuselage. The rear bottom fuselage cover plate is located under the wing interconnection truss. The front bottom fuselage cover plate is located under the floor board.

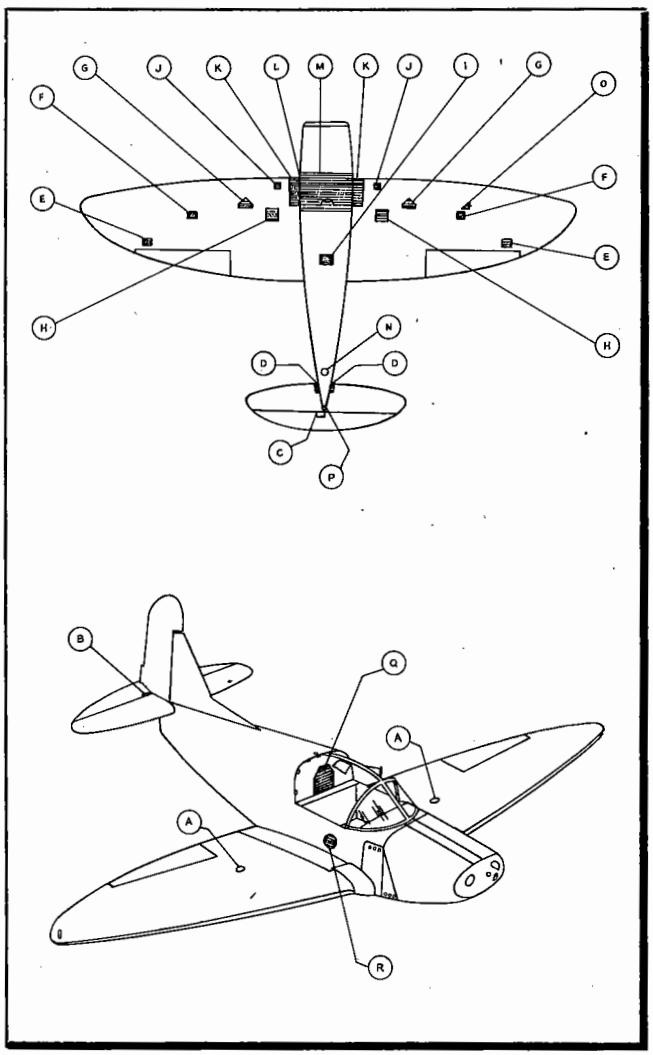


Figure 18—Inspection Windows and Cover Plate Diagrams

b. INSPECTION FRAMES.—There are two inspection frames located on each wing. They are in line with and in front of the ailerons and are for 100-hour inspections.

c. INSPECTION PLATES.—There are two alighting gear inspection plates for each main gear. They are located on the bottom of the wing at station 43. The fuselage front bottom inspection plate is installed on the bottom of the fuselage just back of station 46. The servo inspection plate is located on the right side of the fuselage below the cabin panel. (See figure 19.)

d. INSPECTION WINDOWS. — The aileron "L" crank inspection window is installed at station 67 in front of the main spar on the lower part of the wing. Another inspection window is located on the bottom of the wing near the leading edge. A fuselage rear bottom inspection window is installed near the tail of the plane. The pitot tube inspection window is located in the bottom of the left wing near station 91.

e. TAIL CONE.—The fuselage tail cone is installed on the tail of the fuselage.

f. WALKWAYS.

(1) Walkways have been installed on each wing next to the fuselage. The walking area is surfaced with black grit on fabric cemented to the wing. The wing walks are the only places on the airplane where it is permissible to step. Do not put more than 200 pounds of weight on the trailing edge of the walkway.

Key to Figure 18

Letter	*Title*	*Part No.*	*No. Req.*
A	Oleo Cover Plate	2934	1
B	Elevator Tab Top Cover Plate	646-2	1
C	Elevator Tab Bottom Cover Plate	646-1	1
D	Stabilizer Fairing Cover Plate (Right)	3253	1
	Stabilizer Fairing Cover Plate (Left)	3252	1
E	Inspection Frame	3892	1
F	Inspection Cover Plate	3892	1
G	Aileron "L" Crank Inspection Window	2696	1
H	Landing Gear Inspection Plate (Left)	3025	1
	Landing Gear Inspection Plate (Right)	2891	1
I	Fuselage Front Bottom Inspection Plate	3932	1
J	Station 40 Inspection Window		
K	Wing Root Cover Plate (Left)	1448-1	1
	Wing Root Cover Plate (Right)	1448-2	1
L	Rear Bottom Fuselage Cover Plate	694	1
M	Front Bottom Fuselage Cover Plate	695	1
N	Fuselage Rear Bottom Inspection Window	3933	1
O	Pitot Tube Inspection Window	2974	1
P	Fuselage Tail Cone	3278	1
Q	Station 46 Bulkhead Porthole Plate	3947	1
R	Servo Inspection Plate	1825	1

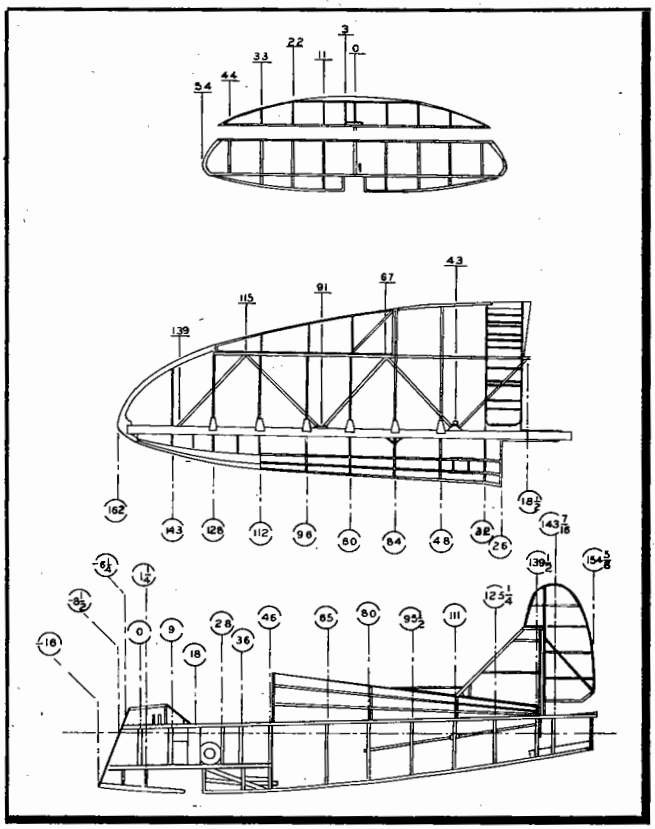


Figure 19—Station and Frames Diagram

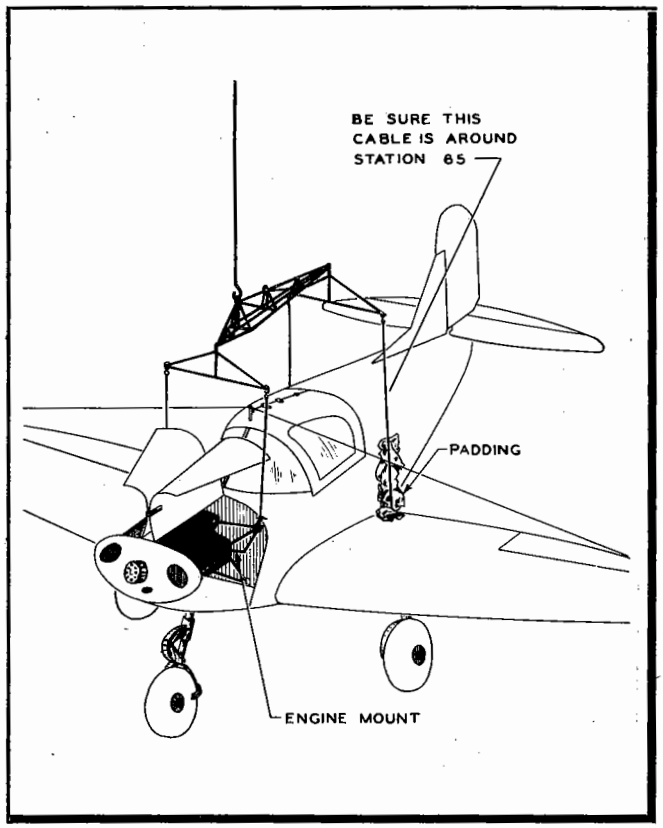


Figure 20—Hoisting Method

2. GROUND HANDLING.

a. HOISTING PROVISIONS.
(See figures 20 and 21.)

(1) AIRPLANE.—The airplane is not provided with hoisting rings or attachments. However, the airplane may be hoisted, if necessary, as follows:

(a) Raise both right and left engine cowls and clip or tie in position.

(b) Pass a sling consisting of a double strand of 1/2-inch rope or 1/8-inch 7x19 control cable under the top engine mount attachments on the fire wall.

(c) Pass a similar sling around the fuselage near the trailing edge of the wing. Be sure to place padding between sling and fuselage and have sling at a bulkhead.

(d) Be sure that hoists are directly above and in line with the plane and raise hoist simultaneously to prevent airplane from shifting on the slings. (See figure 20.)

(2) ENGINE.

The engine may be hoisted as follows:

(a) Remove propeller.

(b) Remove all cowling.

(c) Disconnect all lines and controls at fire wall.

(d) Pass a sling consisting of a 1/2-inch or 1/8-inch 7x19 cable under the prop shaft and the starter, or rear section if engine is not equipped with hoisting eyes.

(e) Attach sling to hoist just enough to take up all slack on sling.

(f) Remove the four engine mount attachment bolts. Engine should swing free.

CAUTION

Do not attempt to hoist front end of airplane in this way.

b. JACKING ARRANGEMENT.

(1) NOSE WHEEL.—To raise nose wheel only, place chocks in front of and behind main wheels and place a low padded stand or pad the floor beneath the friction shoe at the back of the fuselage. Pull tail of ship down until it rests on padded stand or padded floor. Weight tail down with about 180 pounds of lead or sand bags placed on the horizontal stabilizer on each side of the rudder as close as possible to the fuselage.

(2) MAIN GEARS.—To raise main gears, place a tall padded stand under friction shoe at the end of the fuselage and weight tail as directed in the preceding paragraph. The fuselage should rest on a padded stand in flight position. The airplane may be raised with jacks placed under the jacking points attached to the wing structure at station 91. Jack both sides simultaneously to prevent the airplane from shifting on its supports. Do not let airplane rest on jacks for extended periods of time or while it is unattended. (See figure 22.)

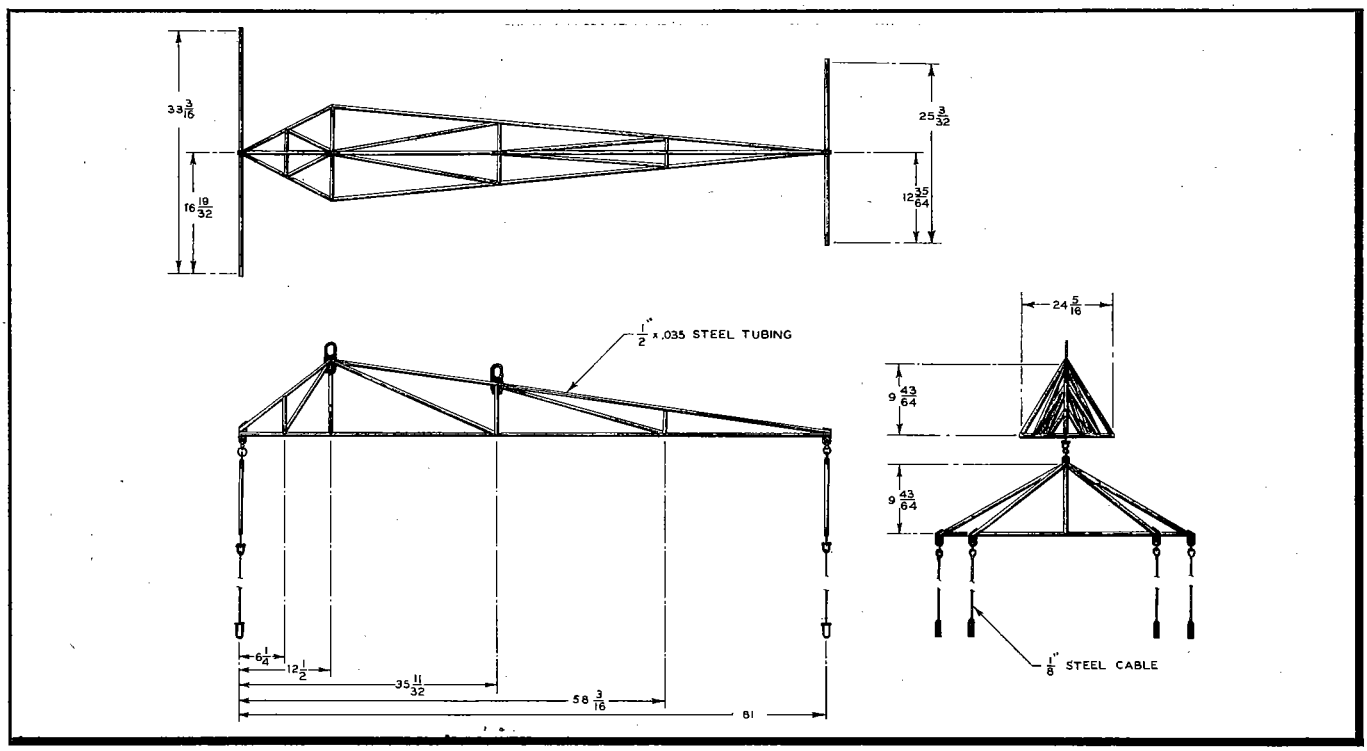


Figure 21—Hoisting Sling Detail

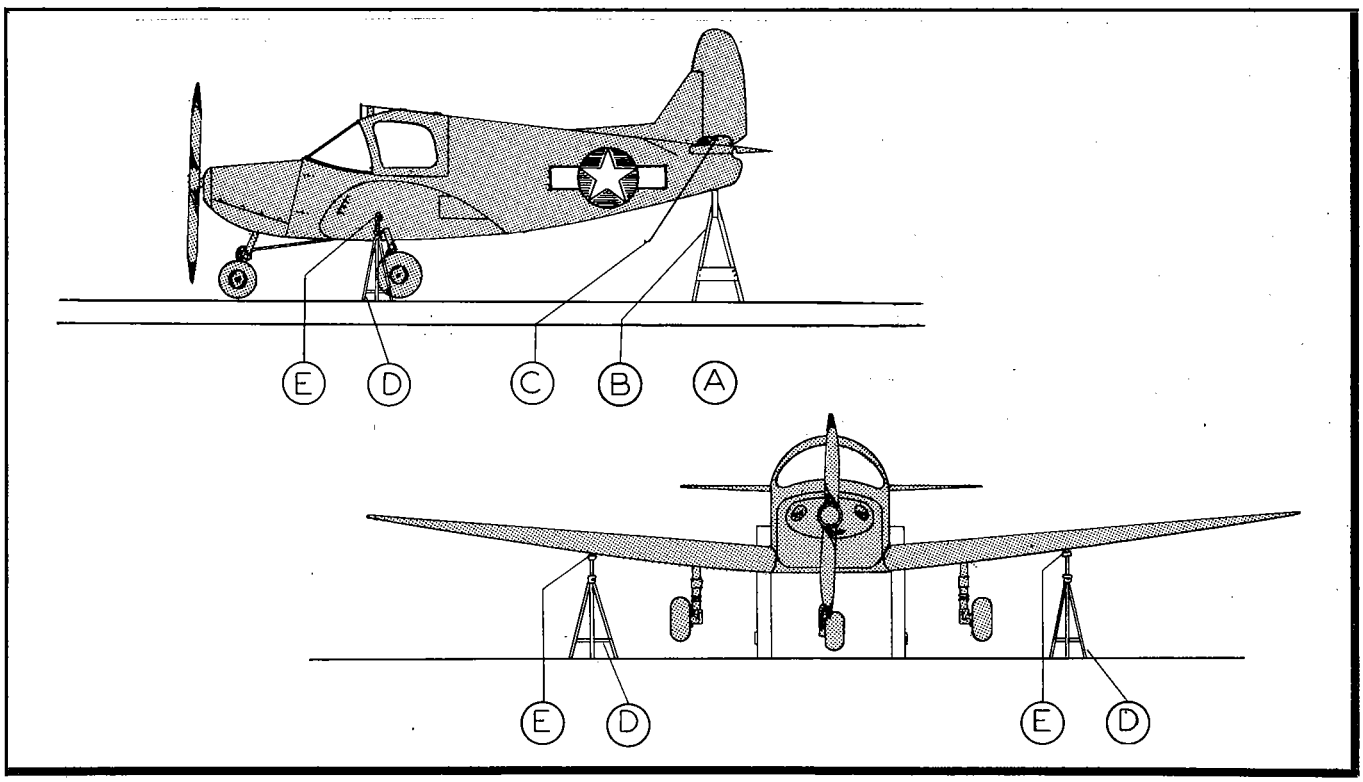


Figure 22—Jacking Diagram

Key to Figure 22

Letter	*Title*
A	Place Support Under Airplane at Abrasion Shoe, First. No Pad Needed
B	Saw Horse or Suitable Equivalent
C	75 lbs. Sand or Shot Bags on each side of rudder on Stabilizer
D	Jack
E	Jack Point (Points Suitable for Air Corps Jack)

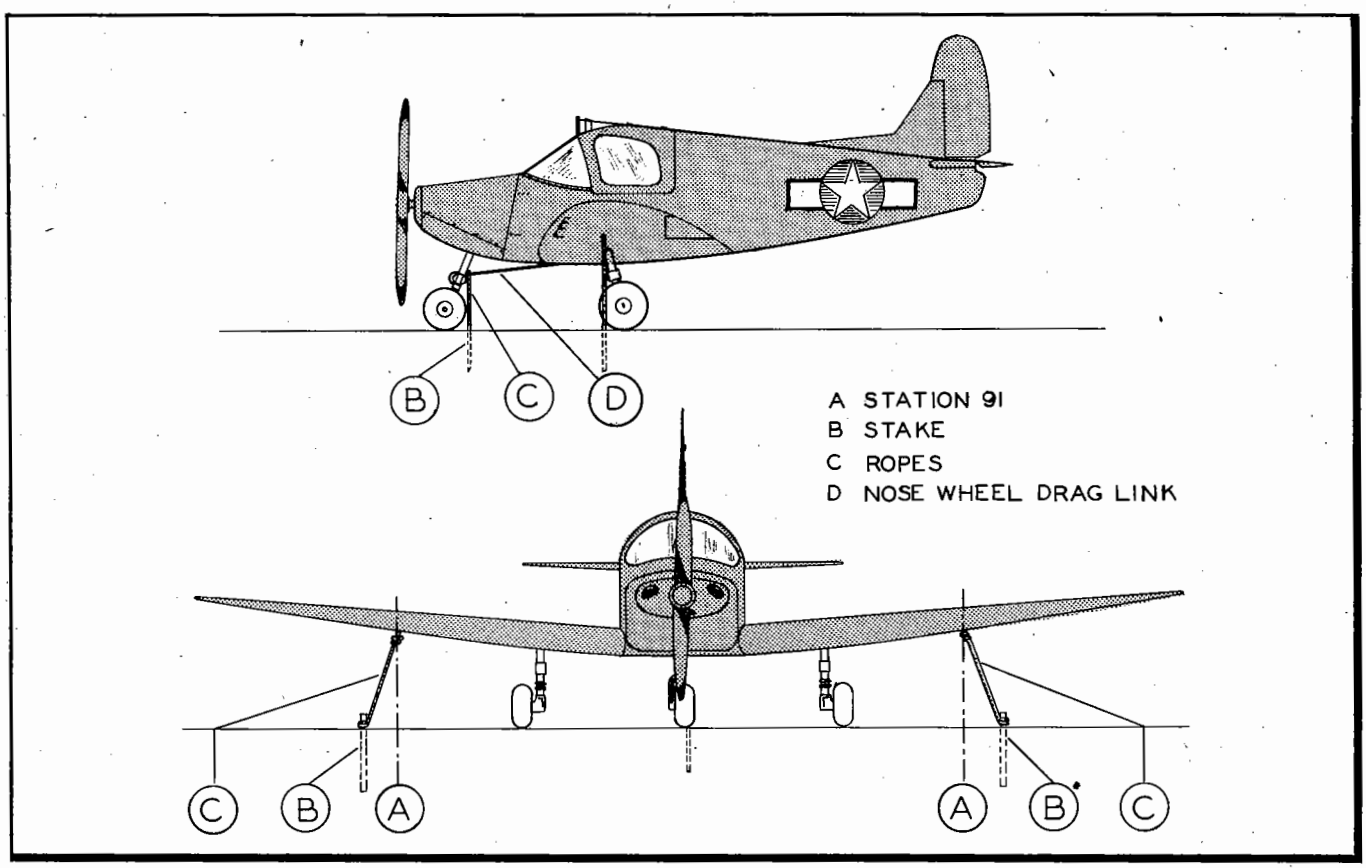


Figure 23—Mooring Diagram

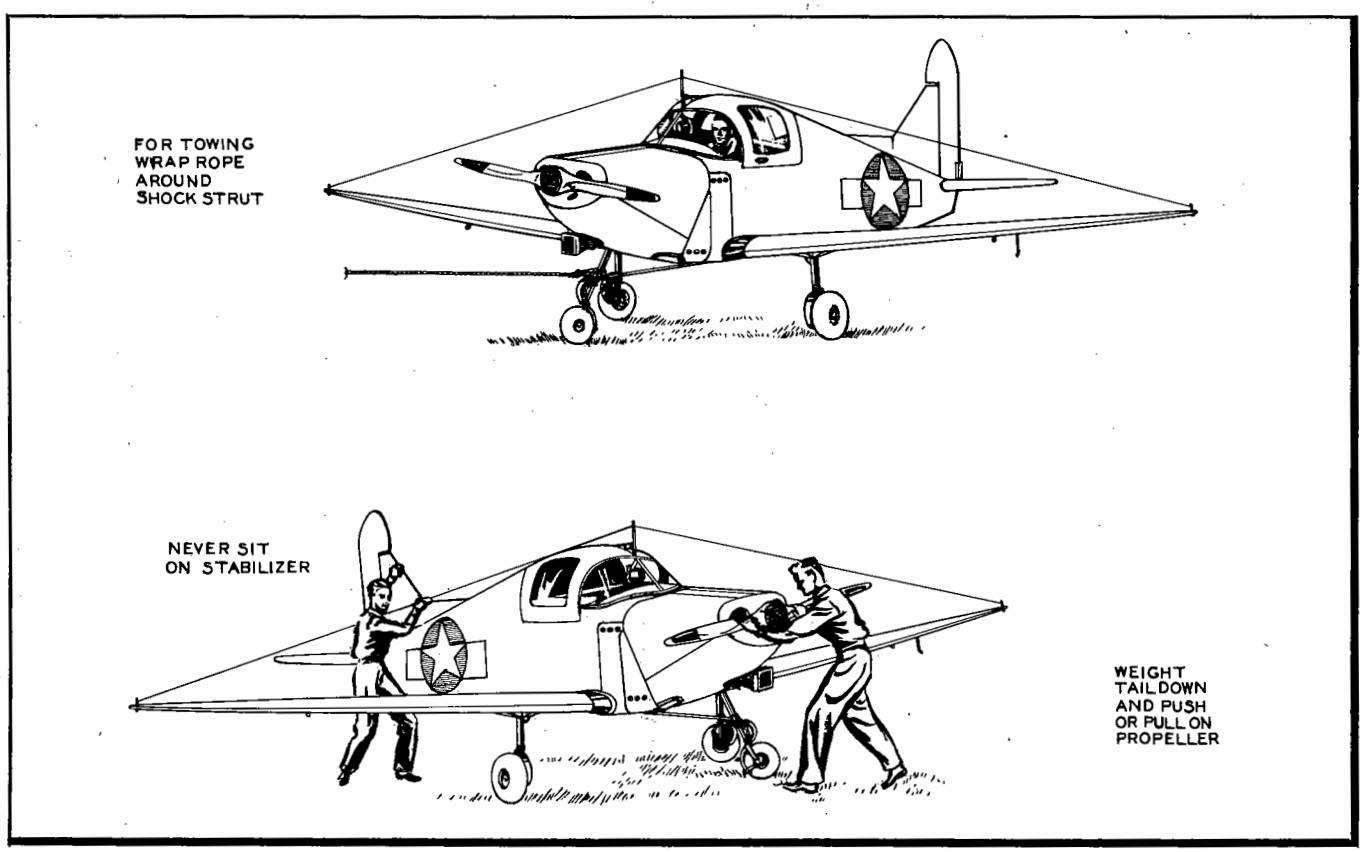


Figure 24—Towing Procedures

c. LEVELING.—The ship may be leveled longitudinally by placing a long level on the bolt heads which are located on the right side of the airplane at stations 9 and 28 marked "Leveling." The ship may be leveled laterally by placing a long level on the bolt heads located on station 46 bulkhead marked "Leveling."

d. TIE-DOWN—PARKING AND MOORING. — Mooring rings have been attached to the wing spar at station 91. The airplane shall be moored to stakes driven in the ground slightly outboard and to the rear of the wing mooring points and as close as possible to the nose wheel knuckle. Head the ship into the wind before mooring and lock the control stick by placing the pin provided through the aileron stick links and into the floor board. (See figure 23.)

e. TOWING.—The airplane may be towed by tying a rope around the nose wheel shock strut above the drag link coupling. One man shall be stationed in the cockpit to operate the brakes and steer the plane. Use extreme care in towing this plane over rough ground. Keep the towline clear of propeller at all times. Do not attempt to move the airplane by pushing on the empennage. (See figure 24.) The airplane may be moved by having one man weight down the fin and another man push or pull the airplane by the propeller hub to the desired location. When moving the airplane do not grip propeller blades as they will be pulled out of track.

NOTE

Never push or lift on the tips of the stabilizer. Never step on the wing root cover plate. Never place more than 200 pounds on the wing walk. Never sit on any part of the stabilizer. Jack supports are located on the bottom of each wing at station 91. There are no handgrips provided.

f. PARKING BRAKES AND CONTROL LOCKS.—This airplane is not equipped with parking brakes. If the airplane is to be parked outside of the hangar for any reason regardless of weather conditions, the wheels should be chocked and the control stick locked by passing the pin provided for this purpose through the aileron stick link and into the floor board. (See figure 25.) See the placarded instructions in the cockpit above the instrument panel. No lock is included in the rudder system since it is connected to the nose wheel.

g. SERVICE.

(1) OIL, FUEL, AND BATTERY.

(a) OIL.—The oil is carried in the crankcase. To check the oil level, lift the right cowl engine hood and remove the oil filler cap located on top of the crankcase between the right cylinders. The oil level is indicated on the dip stick attached to the filler cap. Always check the oil level after adding oil. Use oil, grade 1100, Specification No. AN-VV-O-446, for temperatures above 4°C (40°F) and grade 1080 for consistent temperatures below 10°C (50°F).

(b) FUEL.—The gasoline is carried in the tank in front of the instrument panel and is filled from the

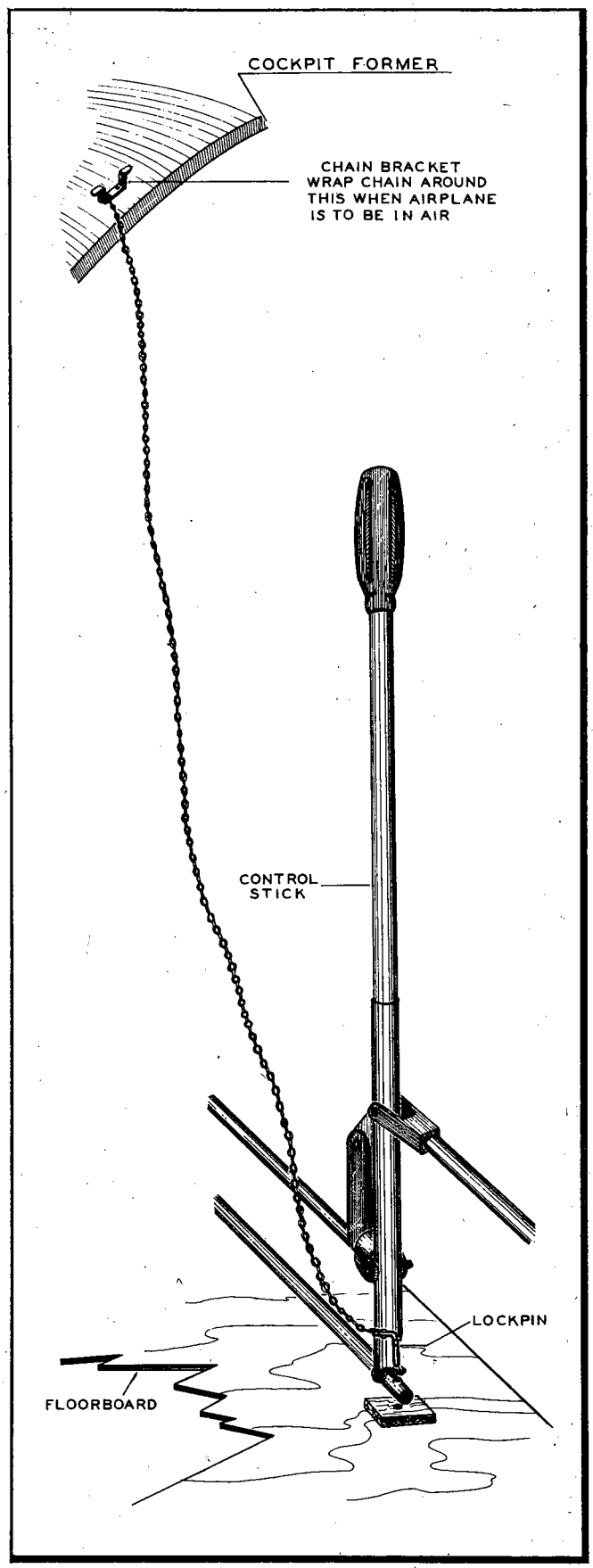


Figure 25—Control Surface Lock

right side of the plane. Remove cap labeled "25 gal. 73 Octane Only" for refueling. The gas gage is located on the instrument panel. Use grade 73, Specification No. AN-V V-F-761, gasoline. In an emergency a higher grade fuel may be used. Filling and draining of the fuel tank should be done out-of-doors if possible to reduce fire hazard.

3. GROUND OPERATING INSTRUCTIONS.

a. COLD ENGINE.

(1) Check fuel and oil level.

(2) Turn propeller three to five complete revolutions by hand to see that no oil or fuel has collected in the cylinders.

(3) If engine is extremely cold, operate priming pump two or three strokes. Be careful to lock the primer after operating. Lock by turning primer to the right one-half turn. The exact amount of prime will vary with different fuels and conditions.

WARNING

Do not prime a warm engine. Do not pump the throttle. Always lock the primer pump. Leakage from an unlocked primer pump may cause rough engine operation.

(4) On the model TDC-2:

(a) Open throttle about one-tenth and turn the ignition switch to "BOTH."

(b) Whirl the propeller.

(5) On the model PQ-8A:

(a) Set throttle about one-tenth open.

(b) Engage the starter.

(c) As engine passes the first compression stroke, turn ignition switch to "BOTH."

(6) If engine does not start, prime half the original amount and repeat paragraphs (4) and (5), preceding. If this fails to start the engine, turn the switch off and slowly move the throttle to wide-open position, rotate the propeller backward through 8 or 10 revolutions, close the throttle, switch on, and whirl to start. If engine still fails to start, some abnormal condition exists and must be found and corrected before engine will operate properly.

(7) After the engine starts, set the throttle for fast idle (700-800 rpm).

NOTE

If oil pressure is not indicated in 30-seconds running, stop engine and determine trouble. As soon as the engine is firing evenly, increase the rpm to 1000 and run at this speed until the throttle can be opened rapidly without spitting or missing. The engine is now ready for flight. Immediately prior to flight the throttle may be opened to 1800 rpm to check

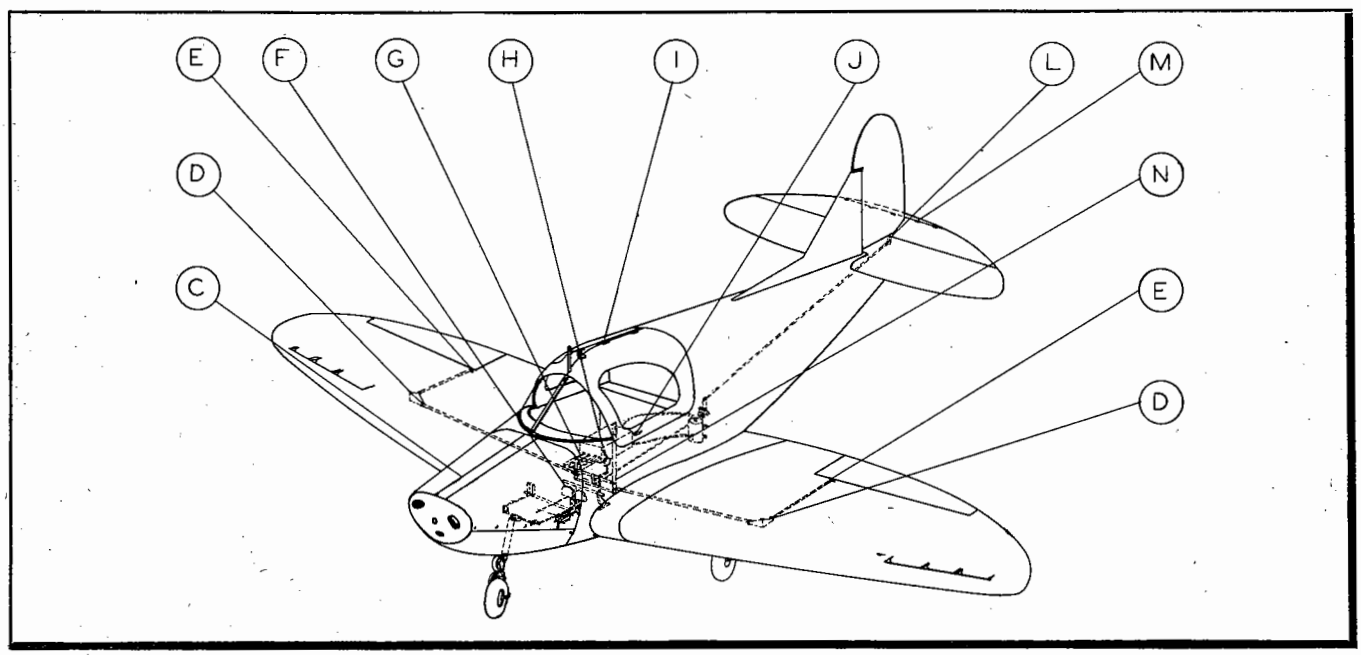


Figure 26—Lubrication Diagram

Key to Figure 26

Letter	Part	Spec. No.	Period
C	Engine Cowling	VV-O-496	25 hr.
D	Aileron and Bell Crank	VV-O-496	25 hr.
E	Aileron Horn	VV-O-496	25 hr.
F	Rudder Pedal Bearings	VV-O-496	25 hr.
G	Servo Connection and Control Arms	VV-O-496	25 hr.
H	Throttle and Moving Connections to Engines	VV-O-496	25 hr.
I	Hatch Door and Safety Door Release	VV-O-496	25 hr.
J	Door Handle	VV-O-496	25 hr.
L	Elevator Horn Connections	VV-O-496	25 hr.
M	Tab Hinges	VV-O-496	25 hr.
N	Stick, Aileron and Torque Tube Connections	VV-O-496	25 hr.

drop-off on each magneto (drop-off should be even and should not exceed 100 rpm), oil pressure and smooth operation of engine. Magneto check should not exceed 30 seconds.

b. WARM ENGINE.—Same procedure is used as for the cold engine with one exception. Never prime a warm engine.

c. ENGINE WARM-UP.

NOTE

Engine will not be left running unless a pilot or a qualified mechanic is seated in the cockpit. Except in an emergency the engine will not be run on the ground for warming up or testing unless chocks are placed in front of the main wheels.

(1) As soon as the engine is firing evenly, increase the rpm to 1000 and run at this speed until the throttle can be opened rapidly without spitting or missing. The engine is now ready for flight.

(2) If icing conditions are encountered, use carburetor heat control.

CAUTION

Never attempt take-off with the carburetor heat control in the "ON" position.

4. LUBRICATION REQUIREMENTS.

(See figure 26.)

a. ANTIFRICTION BEARINGS. — Antifriction bearings are installed at all control servo hinges and at the control stick attached to the wing interconnection truss. These bearings have been grease-packed and sealed by the manufacturer and need no further attention. Any further attempt to lubricate them will dissolve the factory sealed lubricant and will reduce the life of the bearing.

b. PLAIN BEARINGS.—Plain bearings are installed throughout the surface controls and steering systems. These are lubricated at assembly and should require little attention between overhauling periods. If any portion of the control system is removed for any reason between overhaulings, all plain bearings except as otherwise directed herein should be cleaned in solvent and regreased with Specification No. AN-G-4 grease.

c. TAB UNIT.—Put a drop or two of grade 1080 engine oil on worm gear at each 25-hour inspection period.

d. ALIGHTING GEAR.—Each set of torque links is provided with three Alemite fittings. Grease these at 25-hour inspection periods with Specification No. AN-G-5. The taper roller bearings in the wheels should be inspected at 100-hour intervals and repacked if necessary with grease, AAF Specification No. 3560, medium grade. (See figure 27.)

5. SPECIAL TOOLS.

a. SPECIAL TOOL.—In case of worn oleo piston head, special wrench No. 3005 is used to remove it. Do not use any other wrench in removing or installing the head.

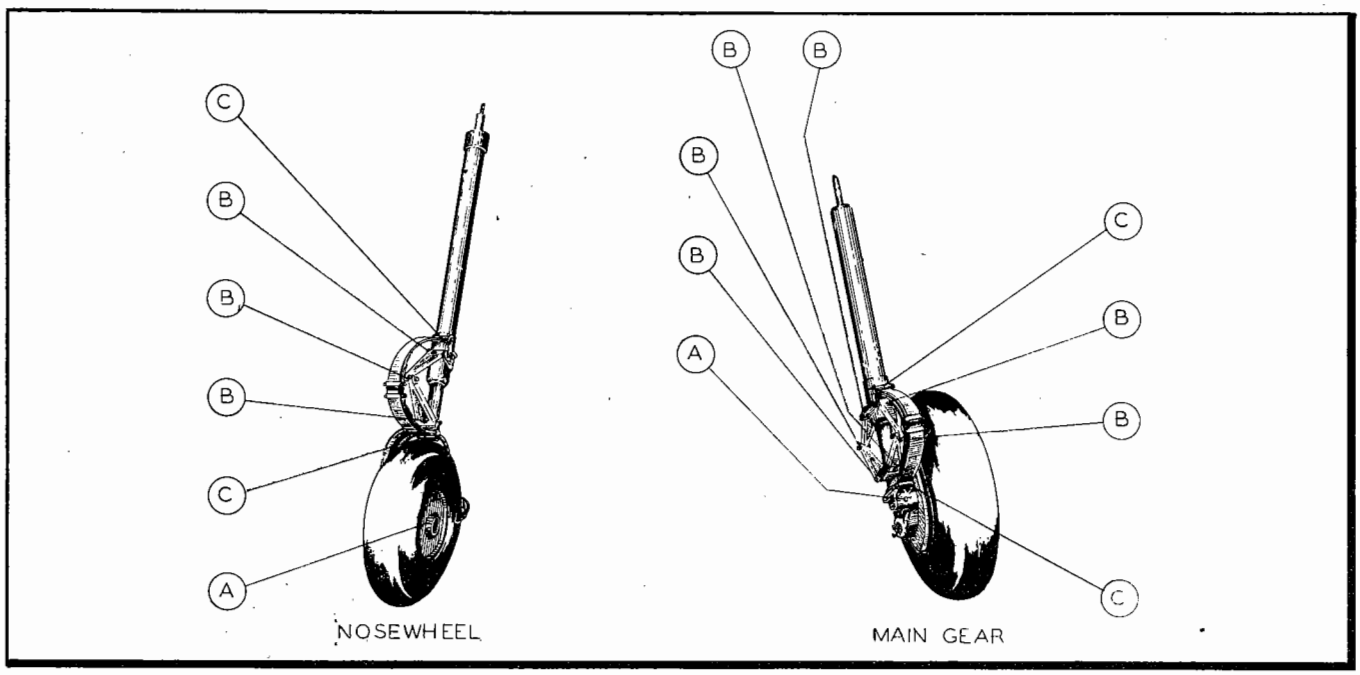


Figure 27—Landing Gear Lubrication

Key to Figure 27

Letter	*Part*	*Spec. No.*	*Period*
A	Axle Bearings.....	AAF Spec. 3560	50 hrs. to 100
B	Torque Links.....	AAF Spec. 3560	25 hrs.
C	Spring.....	AN-VV-O-446	25 hrs.

SECTION IV
MAJOR COMPONENT PARTS AND INSTALLATIONS

1. WING.

(See figures 28 and 29.)

a. DESCRIPTION.

(1) STRUCTURE.—The wings are of full-cantilever, single-spar, torsion-truss construction, built in two panels and divided at the fuselage center line. The main spar is a built-up "I" section beam made with mahogany or sweet gum plywood web and spruce flanges. The auxiliary spar is of solid spruce. The torque trusses are of welded-steel tubing. The leading edge and tip are reinforced by a plywood skin and completely covered with fabric. Three fixed slots are incorporated on each wing tip extending from station 112 to station 143. The attachment of the wing to the fuselage is described in section II, paragraph 2. *a.*

(2) AILERON.—The aileron structure consists of a steel tube spar with sheet steel ribs. The structure is completely covered with fabric. The gap between the aileron and wing is sealed on top. The aileron is hinged to the auxiliary spar and extends back to the trailing edge of the wing. The length of the aileron extends from station 64 to station 128. (See figure 30.)

b. REMOVAL AND DISASSEMBLY.

(1) REMOVAL.

(a) WINGS. — Remove the main gear as described in section VI, paragraph 5. *a.* (2). Place the fuselage upon two horses one just back of the fire wall and the other under station 90. Place 50 pounds of sand bags on the stabilizer and 25 pounds on each side of the rudder. The rear bottom cover plate must be removed. Disconnect the aileron push-pull tube from the control stick, take off the wing root cover from the leading edge of the wing and unwrap the safety wire from the rubber tugs that connect the pitot lines. Disconnect the brake lines at the connection fittings located in the front wing root gap. Pull the gap tape off from

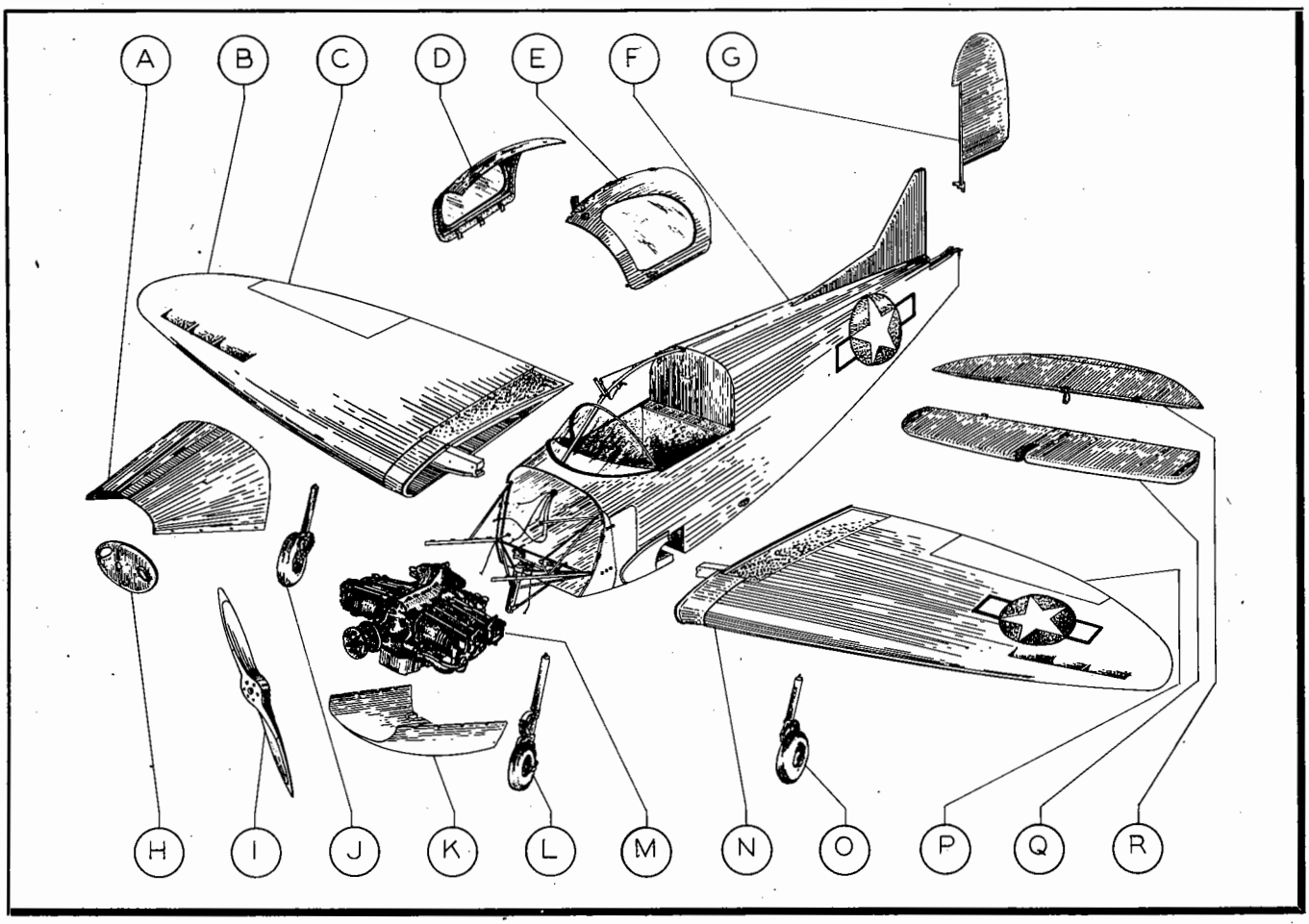


Figure 28—Major Component Assemblies

the under part of the wing and fuselage. Disconnect the bolt from the auxiliary spar bracket at station 46. Two bolts are then removed from the main spar and the interconnection truss. Three men are required to remove one wing panel. One man is stationed at the trailing edge near the wing root, another man at the leading edge near the wing root, and the other man at the wing tip. By rocking the tip of the wing slowly up and down and at the same time pulling away from the fuselage, the wing spar is dislodged from the interconnection truss. When removing the wing, be sure that the spar, brake line, aileron push-pull tube, longerons, or pitot lines are not damaged. While removing one wing, the other wing should have a horse or jack under it to keep the plane from tipping. The same procedure is used in removing both wings with the exception of one bolt through the right aileron push-pull tube and the servo bell crank. A wing hoist is not necessary as three men can remove it satisfactorily.

b. AILERON.—Cut the aileron gap tape along the top of the aileron and then disconnect the push-pull tube at the control horn and remove the two hinge bolts. The aileron is now completely disconnected from the wing and can easily be removed by one man. (See figure 31.)

c. DISASSEMBLY. — Disassembly of the wing and aileron constitute a major break-down and is not recommended unless major repairs are necessary.

d. MAINTENANCE REPAIRS. — Repairs of structural parts such as spars, torque trusses, or alighting gear attachments are major repairs and are made only at repair bases. Torn fabric may be repaired as follows:

(1) SMALL RIPS.—Sew torn parts together with well-waxed thread and dope on a cover patch extending 2 inches past the damaged area on all sides. Brush on two coats of clear dope, sand between each coat, and finish with two coats of pigmented dope.

(2) BADLY FRAYED RIPS. — Cut away the frayed edges and sew a preshaped patch onto the place. Dope surface tape over the seams. Finish as described

Key to Figure 28

Letter	*Title*	*Part No.*	*No. Req.*
A	Cowling Top Complete	2691	
B	Wing Assembly (Right)	2647	1
C	Aileron Assembly (Right)	3274	1
D	Right Cabin Panel Assembly	3207	1
E	Left Door Assembly	3209	1
F	Fuselage Assembly Complete	3000	1
G	Rudder Assembly Complete	2655	1
H	Cowling Nosepiece Complete	3268	1
I	Propeller—Sensenich Model 72EB66 or 72EB—72EC66 or 72EC—	P-10066	1
J	Main Landing Gear (Right)	2680	1
K	Cowling Bottom Complete	2690	1
L	Nose Landing Gear Assembly	2670	1
M	Lycoming-0-290-1 Lycoming	60212	1
N	Wing Assembly (Left)	2646	1
O	Main Landing Gear (Left)	2675	1
P	Aileron Assembly (Left)	3273	1
Q	Horizontal Stabilizer Assembly Complete	342	1
R	Elevator Assembly Complete	381-5	1

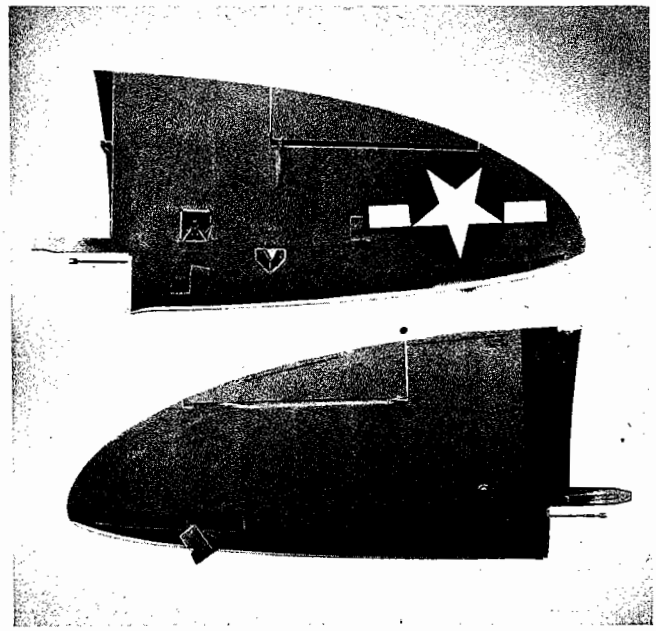


Figure 29—Left and Right Wings

in the preceding paragraph. If damaged area is large, cut fabric away to nearest rib and lockstitch patch to ribs. Sew patch to fabric, dope surface, tape seams, and finish as described above. Use rejuvenator to soften old dope before applying surface tape if necessary.

e. REPLACEMENTS.—Replacement of a damaged wing or aileron rather than repair is recommended if the damage is too great to maintain strength.

f. ASSEMBLY AND INSTALLATION.—Install aileron on wing by installing the two hinge bolts. The aileron should swing freely on its hinges throughout its entire travel before the hinge bolts are safetied. Connect the push-pull tubes to the control horn. The aileron should be rigged with ¼-inch droop at the trailing edge when the control stick is neutral. Limit the up travel to 15 degrees and the down travel to 13½ degrees. Safety all bolts. Replace gap seal as follows:

> Soften the dope where gap is to be applied with rejuvenator. Remove ravelings and pieces of old gap tape still adhering to the surfaces. Dope a 3-inch strip of pinked tape across the gap while the aileron is in neutral position. Brush on two additional coats of clear dope, sand lightly between coats, and spray on two coats of pigmented dope. The wing can be installed by referring to section II, paragraph 2. *a.* and proceeding as described.

g. FINAL TEST AFTER ASSEMBLY.—Check to see that the aileron works freely from the control stick and that it has the desired travel. Check to see that the main spar fits snugly in the interconnection truss.

h. MAJOR OVERHAUL.

(1) RECOVERING OF WINGS.—Sand the cover surface down smooth. Cut out pieces of fabric to fit the walls of the slots and dope them down to the walls

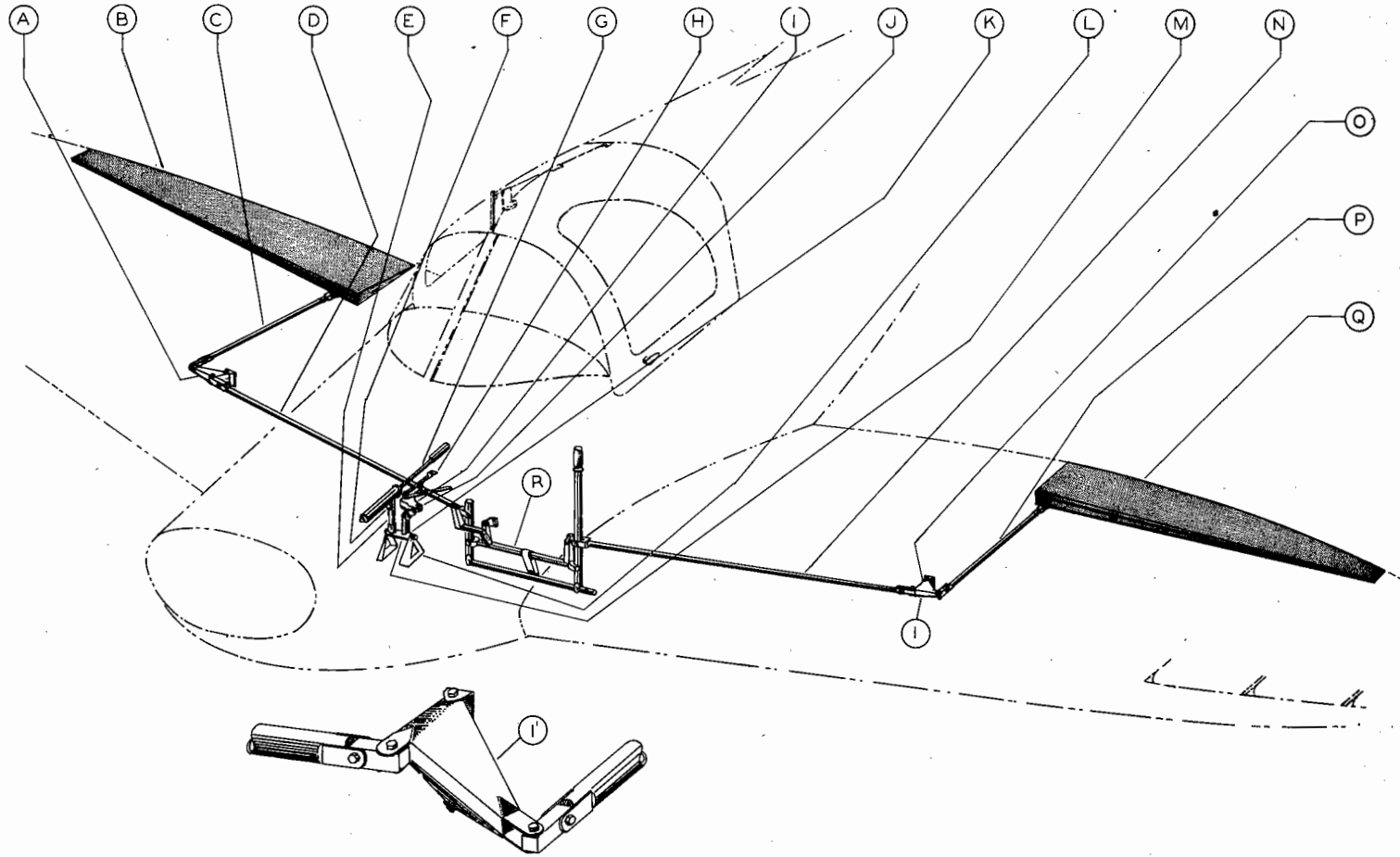


Figure 30—Aileron Servo System—PQ-8A

Key to Figure 30

Letter	Title	Part No.	No. Req.
A	Aileron "L" Crank	254-2	1
B	Aileron, Right	3274	1
C	Aileron Connecting Link	259	1
D	Aileron Link Assembly	502	1
E	Fork Arm	1738	1
F	Fork	2027	1
G	Aileron Servo Overpower Cylinder Assembly	2070	1
H	To Wing Attachment Truss	3136	1
I	Bell Crank	1744	1
J	Short Link	1726	1
K	Bushing	1782	1
L	Bracket (Stamping)	1762	2
M	Aileron Torque Tube	2847	1
N	Aileron Link Assembly	258	1
O	Aileron "L" Crank	254-1	1
P	Aileron Connecting Link	259	1
Q	Left Aileron Assembly	3273	1
R	Elevator and Aileron Torque Tube Assembly	2130	1
I'	Detail of "I"		

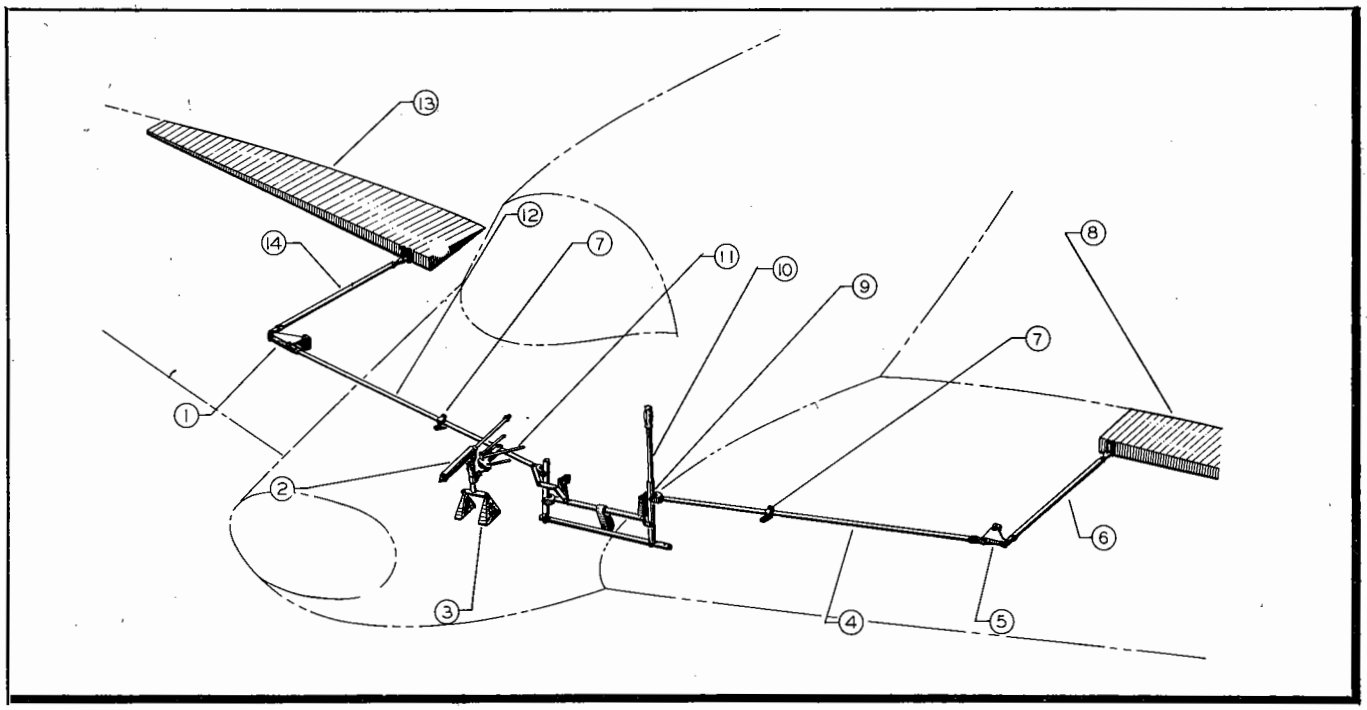


Figure 31—Aileron Servo System—TDC-2

Key to Figure 31

1. Right Aileron "L" Crank
2. Servo Cylinder
3. Aileron Servo Linkage
4. Link Assembly
5. Left Aileron "L" Crank
6. Connecting Link
7. Aileron Push-Pull Tube Guide
8. Left Aileron
9. Main Torque Tube
10. Control Stick
11. Attached to Wing Interconnection Truss
12. Right Link Assembly
13. Right Aileron
14. Connecting Link

of the slots. Also trim pieces of fabric to fit the bottom side of the forward portion of the slots and dope to the slots.

Take two pieces of fabric 69 inches wide and 150 inches long and sew along the long edge 55 inches. Place the fabric on the top of the wing with seam along the trailing edge and use five spring clamps to clamp the fabric to the trailing edge from station 18½ to station 64. Pull the fabric to the leading edge from station 26 to station 64 and tack so the tacks may be removed easily when the dope is dry. Back of the main spar to the trailing edge of the wing along the wing root the tacks should also be set so that they can be removed easily. From the spar to the leading edge along the wing root the tacks should be driven in permanently. Pull the fabric to the tip. Tack it from the tip around the trailing edge to station 128. Dope this section down securely. In the aileron section, cut the fabric diagonally from each corner and tack it to the lower portion of the auxiliary spar and ribs. Then pull the fabric to the leading edge and set the tacks from station 64 to the tip. Dope the fabric down on all the skin surfaces. Tack ½-inch reinforcing tape over all ribs that are not covered with the plywood skin.

Set the wing up vertically with the leading edge down. Lockstitch the fabric to the top cap strip of each rib starting 3 inches behind the spar. Turn the wing bottom side up. Remove tacks, trim the leading edge around the tip to station 128. Pull the bottom fabric to the leading edge and set tacks from station 26 to 64. Tack the fabric permanently to the wing root. Pull the fabric to the tip and set tacks from the tip around the trailing edge to station 128. Cut the fabric diagonally from each corner in the aileron cut-out. Tack it permanently to the top of the auxiliary spar and ribs. Pull the fabric to the leading edge and set tacks from station 64 to the tip. Dope the leading edge of the tip. Be sure to rub out all the dope bubbles around the slot. Tack ½-inch reinforcing tape on all the ribs that are not covered by the plywood skin.

Set the wing up vertically with the leading edge down. Start the first stitch as close to the spar as possible. Stitch bottom skin to bottom cap strip of each rib with a 3-inch space using a lockstitch. This is done by pushing the needle through both bottom and top skins, then returning needle through same hole in top skin back through the bottom skin on the other side of the cap strip from which it entered. Turn the wing top side up and pull out the tacks around the leading edge and tip. Trim the fabric to match the lower fabric around the lower leading edge and tip so there is little gap between the two covers.

Brush on a coat of unthinned dope on the surface. Cut the fabric around the sides and front of the slots and dope it down inside the slot. Crawl underneath the wing and cut the fabric along the sides of the slots

on the bottom and trim it to meet the fabric on the top side of the slot. Using 1-inch pinked edge tape, cover the joint made by the two pieces of fabric inside the slot. Cover all seams inside the slot with 1-inch pinked edge tape. Using 2-inch tape, cut lengths slightly longer than each rib and center the tape on each rib and dope it down to the fabric. As the wing is being taped, a second coat of unthinned dope is brushed on. Cut a piece of 2-inch tape slightly longer than the full length of the slots and dope it to the trailing edge of the slat with approximately one-half of it hanging over the slot. Cut out the tape over the ribs and dope it to the bottom side of the slat. Cut a 2-inch tape slightly longer than the aileron cut-out and dope it to the fabric with approximately one-half of it extending past the auxiliary spar. Cut out for the aileron hinges and dope the remainder to the auxiliary spar. Cut a piece of 2-inch tape extending from station 18½ to station 64 and dope it to the trailing edge with one-half of it extending past the trailing edge. Dope another piece along the wing walk with one-half of it folding to the underneath side.

Turn the wing over with the bottom side up. Brush a coat of unthinned dope on all surfaces that have not previously been doped. Make cut-outs for inspection windows approximately ½-inch inside the frame. Cut the corners diagonally so the fabric will lay down. Dope and tack the edges to the inside of the frame. Tape the bottom of the ribs the same as the top. Dope the trailing edge tape to the bottom of the wing. Put on the two 100-hour inspection frames at the designated locations and dope the streamline patch to line up with the aileron hinge at station 64. Cement 10 drain grommets near the trailing edge at each drain section. The drain grommets should be placed just forward of the trailing edge and of the auxiliary spar on the outboard side of each rib. Turn the wing right side up. Take a piece of 2-inch tape, long enough to reach from station 26 along the leading edge and around the tip to station 128 on the trailing edge at the wing root and dope it to the leading edge and around the tip to station 128. Dope the oleo strut inspection patch to the top of the wing at the designated location. Prepare the opening as described above for inspection holes. Brush on two coats of thinned dope. Turn the wing upside down and apply two coats of thinned dope. Sand with 3/0 sandpaper before the final coat is applied. Three coats of yellow are sprayed on the leading edge. Then the yellow leading edge strip is masked off and two cross-coats of insignia red are sprayed on the entire wing surface. "Thinner rub" the entire wing with a wet thinner rag. The wing walks are then glued on. The decals and stenciled lettering are put on to finish the wing covering.

2. TAIL GROUP.

(See figure 32.)

a. STABILIZER.

(1) DESCRIPTION.—The horizontal stabilizer is constructed entirely of wood. It has nine wooden ribs and two spars, front and rear. The stabilizer is covered completely with a stressed plywood skin.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.—To remove the stabilizer, the leading edge cover plates must be taken off. Remove the tab cable clips from the stabilizer. Remove the tab-actuating unit. Wrap safety wire around cables to keep them from twisting. Then the four mounting bolts through the fuselage longerons and the front and rear stabilizer brackets must be removed. Any further disassembly is not recommended because it constitutes a major overhaul.

(3) ASSEMBLY AND INSTALLATION.—Install the four mounting bolts that go through the fuselage longeron and the front and rear stabilizer brackets. Install the leading edge cover plates. (See figure 17.)

(4) FINAL TEST AFTER ASSEMBLY.—Check to see that the stabilizer fits on the longeron firmly.

b. ELEVATOR. *(See figures 33 and 34.)*

(1) DESCRIPTION.—The elevator is of welded-steel tube construction with metal ribs and is fabric-covered. Three ball-bearing hinges attach the elevator to the stabilizer. A push-pull type control system operates the elevator.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.—The elevator horn must be disconnected from the elevator push-pull tube. The gap tape must be removed from the stabilizer and elevator gap. The tab unit cover plates must be removed from the top and bottom surfaces of the elevator. Take out the two bolts that hold the tab-actuating unit in the elevator frame. Wrap safety wire around the tab cables. Lift out the tab-actuating unit up through the top of the elevator. Take out the three hinge bolts that hold the elevator on the stabilizer.

(3) REPLACEMENTS.—Replacement of a damaged elevator rather than repair is recommended if the damage is too great to maintain both strength and balance. If any repairs are made, the original balance of the elevator should never be destroyed.

(4) ADJUSTMENTS.—The only adjustment necessary is to have the up movement 15 degrees on the model TDC-2 and 11 degrees on the model PQ-8A and the down movement 30½ degrees.

(5) ASSEMBLY AND INSTALLATION.—Install the three hinge bolts. Place the tab-actuating unit in the elevator. This is held in place by two bolts through the actuating unit and the elevator frame. Place the two tab cable clips on the stabilizer to hold the tab cable wires in place. Place the tab unit cover plates on the top and bottom surfaces of the elevator. Dope a piece of gap tape over the gap between the stabilizer and elevator. This tape should be about 3 inches wide with pinked edges and doped down the length of the gap for the model TDC-2 and from the

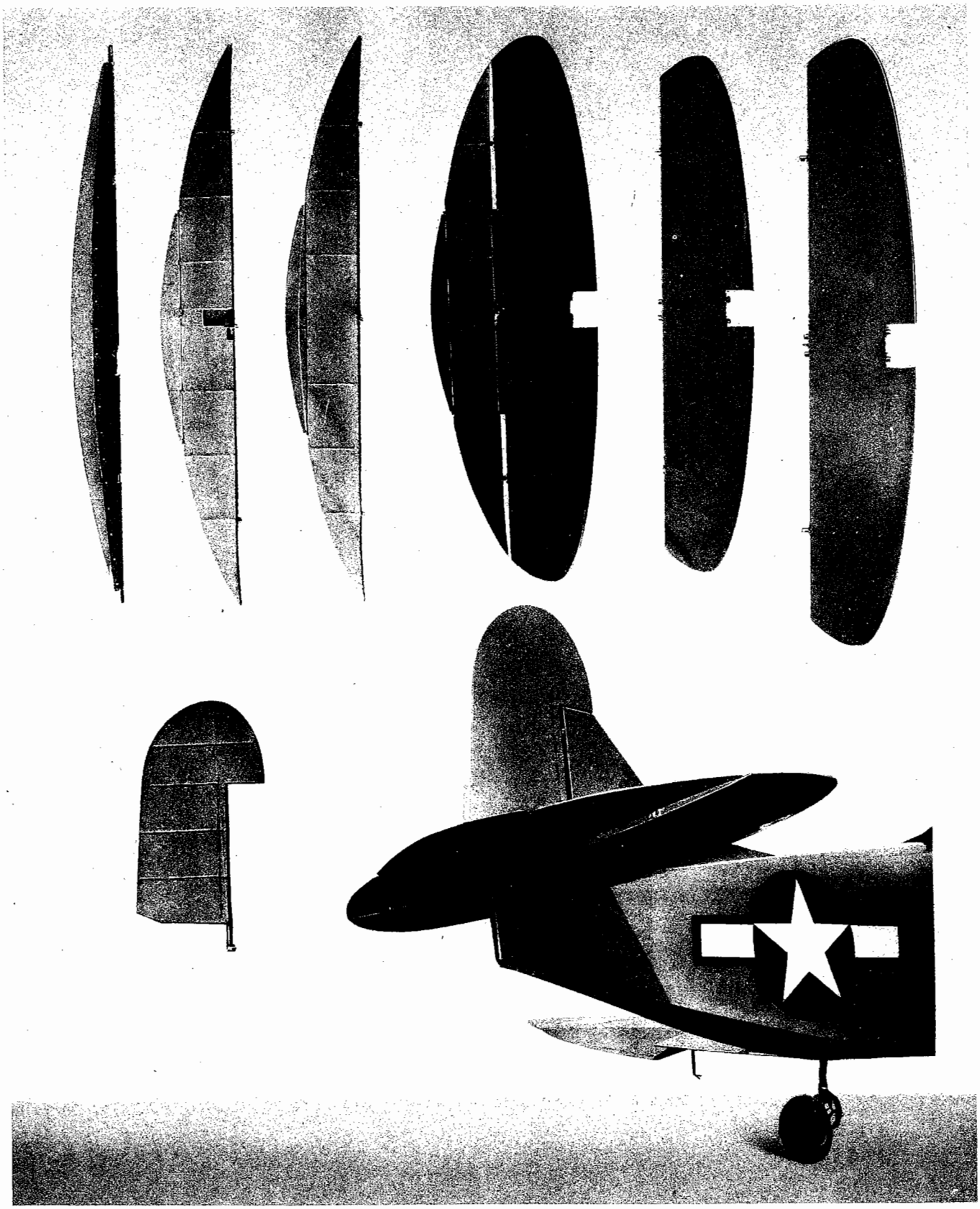


Figure 32—Empennage Assembly

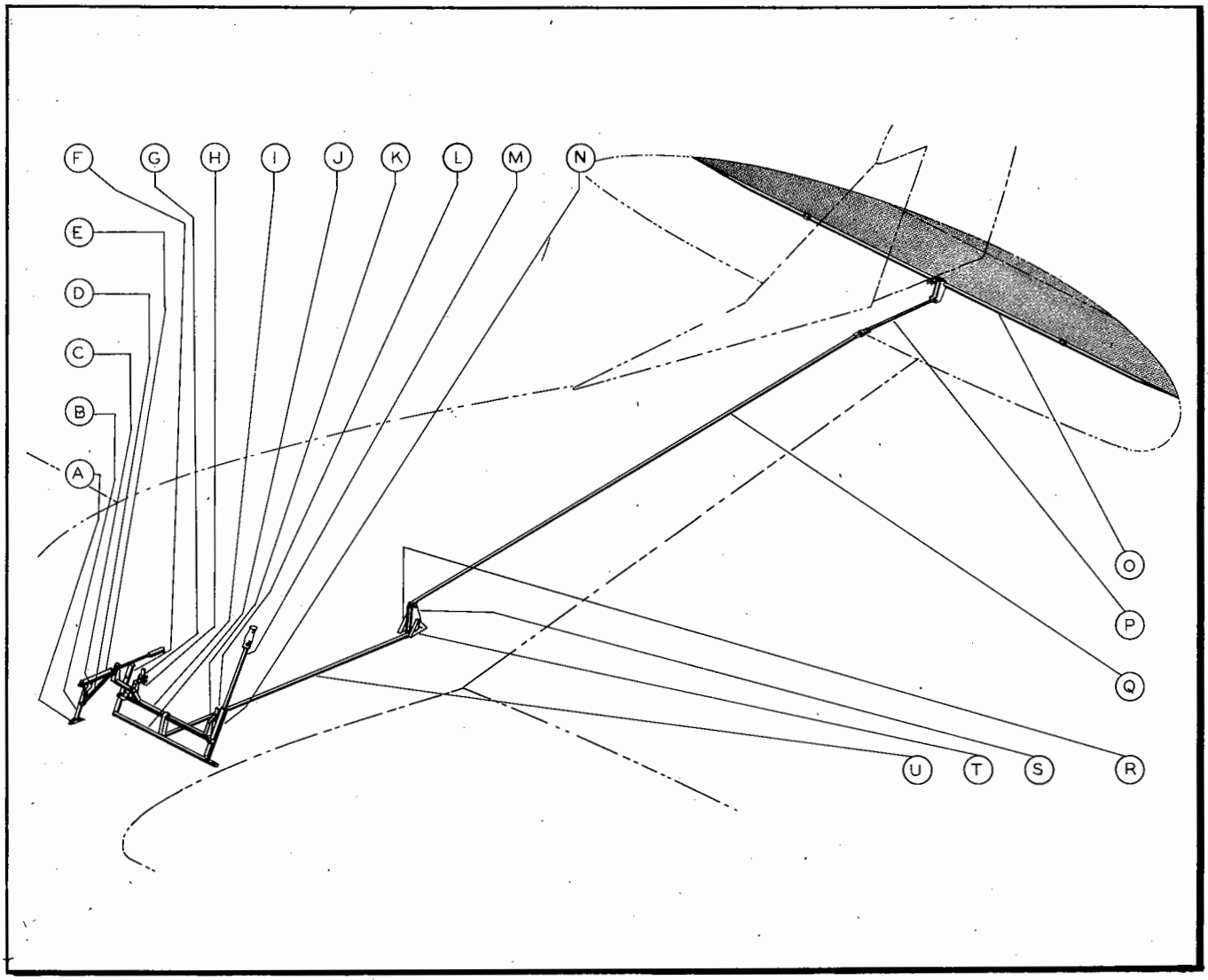


Figure 33—Elevator Control System—PQ-8A

Key to Figure 33

Letter	*Title*	*Part No.*	*No. Req.*
A	Stamping	2028	1
B	Walking Beam	2043	1
C	Stamping	2048	1
D	Elevator System Link Assembly	2050	1
E	Elevator Servo Overpower Unit Installation	2130	1
F	Elevator and Aileron Walking Beam	2659	1
G	Elevator and Aileron Torque Stick Hinge Spacer (Right)	451-2	1
H	Elevator and Aileron Torque Stick Hinge (Right)	248-1	1
I	Elevator and Aileron Torque Tube	2130	1
J	Elevator and Aileron Torque Stick Link	234	1
K	Elevator and Aileron Torque Stick Hinge (Left)	248-2	1
L	Elevator and Aileron Torque Stick Hinge Spacer (Left)	451-1	1
M	Elevator and Aileron Stick	663	1
N	Elevator and Aileron Stick Socket	2661	1
O	Elevator Complete	2091	1
P	Elevator Rear Link	253	1
Q	Elevator Middle Link	252	1
R	Elevator Walking Beam Bracket (Right)	666-2	1
S	Elevator Walking Beam	250	1
T	Elevator Walking Beam Bracket (Left)	666-1	1
U	Elevator Front Link	610	1

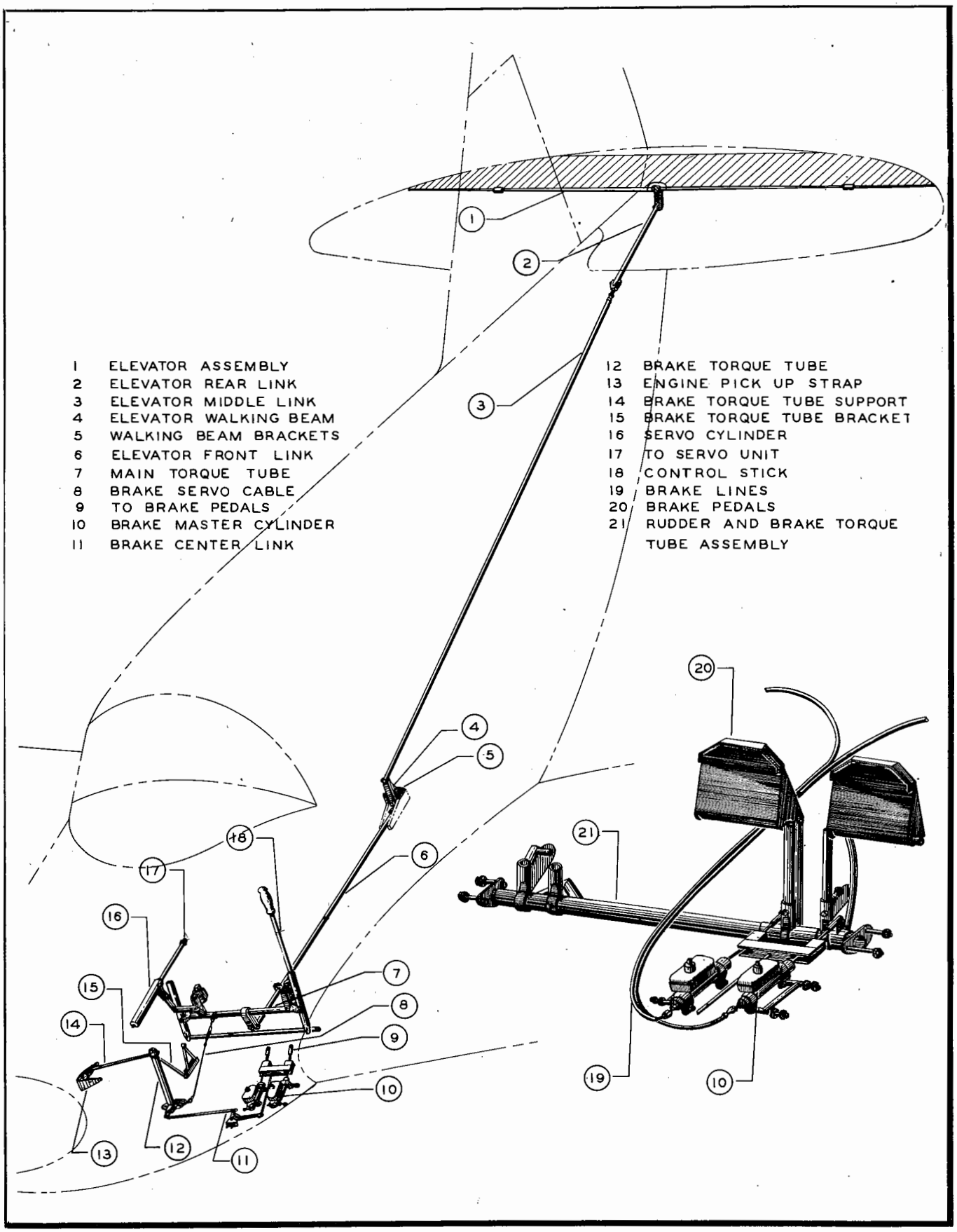


Figure 34—Brake and Elevator Servo System—TDC-2

elevator station 16 left to station 16 right for the model PQ-8A. (See figure 19.)

(6) FINAL TEST AFTER ASSEMBLY.—Inspect to see that the elevator works freely and that the necessary travel is met.

c. TAB.

(1) DESCRIPTION.—The tab consists of a steel tube spar and aluminum skin. It is hinged to the leading edge of the elevator at five points and is held in place by machine screws through the spar. The tab is operated by a cable-controlled worm gear unit mounted inside of the elevator.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.—Take out 10 hinge screws that hold the tab to the spar. Pull out the spar that hinges the tab to the elevator fittings. Disconnect the push-pull tube from the ball socket on the tab.

(3) REPLACEMENTS.—Replacement of a damaged tab is recommended if the damage is too great to maintain strength and balance.

(4) ADJUSTMENTS.—Adjust the elevator tab so that the up travel will be 12 degrees and the down travel 25 degrees.

(5) ASSEMBLY AND INSTALLATION.—Replace the tab spar and aileron hinge fittings. Install the 10 hinge screws that hold the tab to the spar. Connect the push-pull tube to the ball socket on the tab. (See figure 35.)

(6) FINAL TEST AFTER ASSEMBLY.—Check to see that the cables work freely and that the travel meets specifications.

d. RUDDER. *(See figures 36 and 37.)*

(1) DESCRIPTION.—The rudder is of welded-steel tube construction with metal ribs and is fabric-covered. Two ball-bearing hinges attach the rudder to the fin. Two rudder cables connect to the rudder horn and actuate the rudder.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.—The rudder can not be removed until the stabilizer is removed. Disconnect the rudder cables from the rudder horn. Tie a wire to each cable so that they will not be lost in the fuselage. Take out the two rudder hinge bolts. The rudder can then be removed.

(3) REPLACEMENTS.—Replacement of a damaged rudder is recommended if the damage is too great to maintain both strength and balance.

(4) ADJUSTMENTS.—Adjust the rudder movements to 31 degrees left and 31 degrees right.

(5) ASSEMBLY AND INSTALLATION.—In order to make the installation the stabilizer must be removed. Install the upper and lower hinge bolts. Connect the rudder cables to the rudder horn. Adjust the cables when in neutral position to 15 pounds tension.

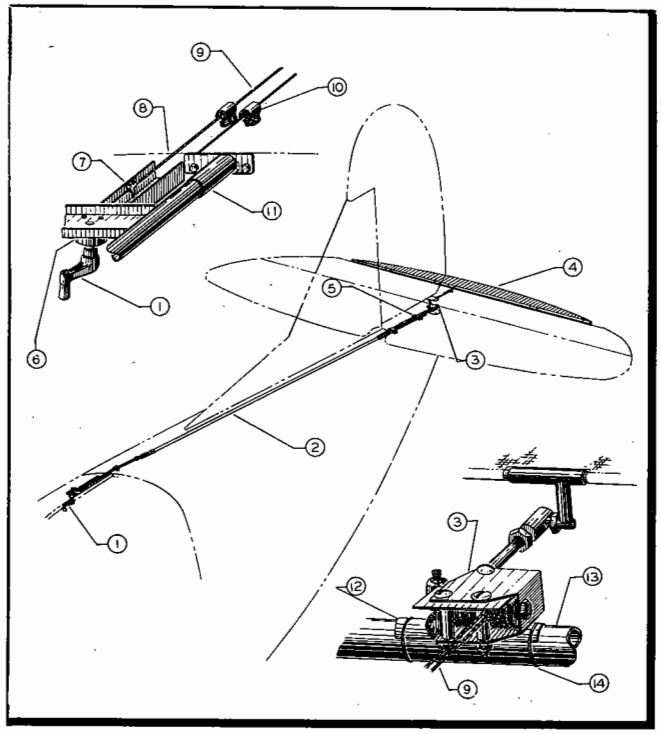


Figure 35—Tab Control System

Key to Figure 35

No.	*Title*	*Part No.*	*No. Req.*
1.	Tab Handle—Majestic Handle Co. No. 64280-C	P-10041	1
2.	Tab Cable Assembly	3239	1
3.	Tab Actuating Assembly	3974	1
4.	Tab Assembly	3794	1
5.	Fair-lead Clip	4117	1
6.	Drum Housing	4015	1
7.	Tab Position Indicator	358	1
8.	Station 46 Bulkhead		
9.	Tab Cable	3239	1
10.	Tab Stop	369	2
	Tube Clamp	AN 741-4P	2
11.	Hatch Frame	3269	1
12.	Fiber		
13.	Elevator Spar		
14.	Safety Wire		

(6) FINAL TEST AFTER ASSEMBLY.—Check to see that the rudder moves freely 31 degrees left and 31 degrees right.

3. BODY GROUP.

a. FUSELAGE. *(See figure 38.)*

(1) DESCRIPTION.—The fuselage is a semimonocoque wood structure with spruce longeron, spruce and mahogany plywood bulkheads, and stressed skin of mahogany or sweet gum plywood. A steel tube interconnection truss is provided for the attachment of the wing panel. This truss is located at station 18. The fire wall is a stainless steel sheet with a backing of fireproof insulating material. Both the fire wall and backing of insulating material are attached to the front bulkhead. The seat is an integral part of the fuselage with provisions for the safety pilot on the left side and the servo control unit on the right. The windshield

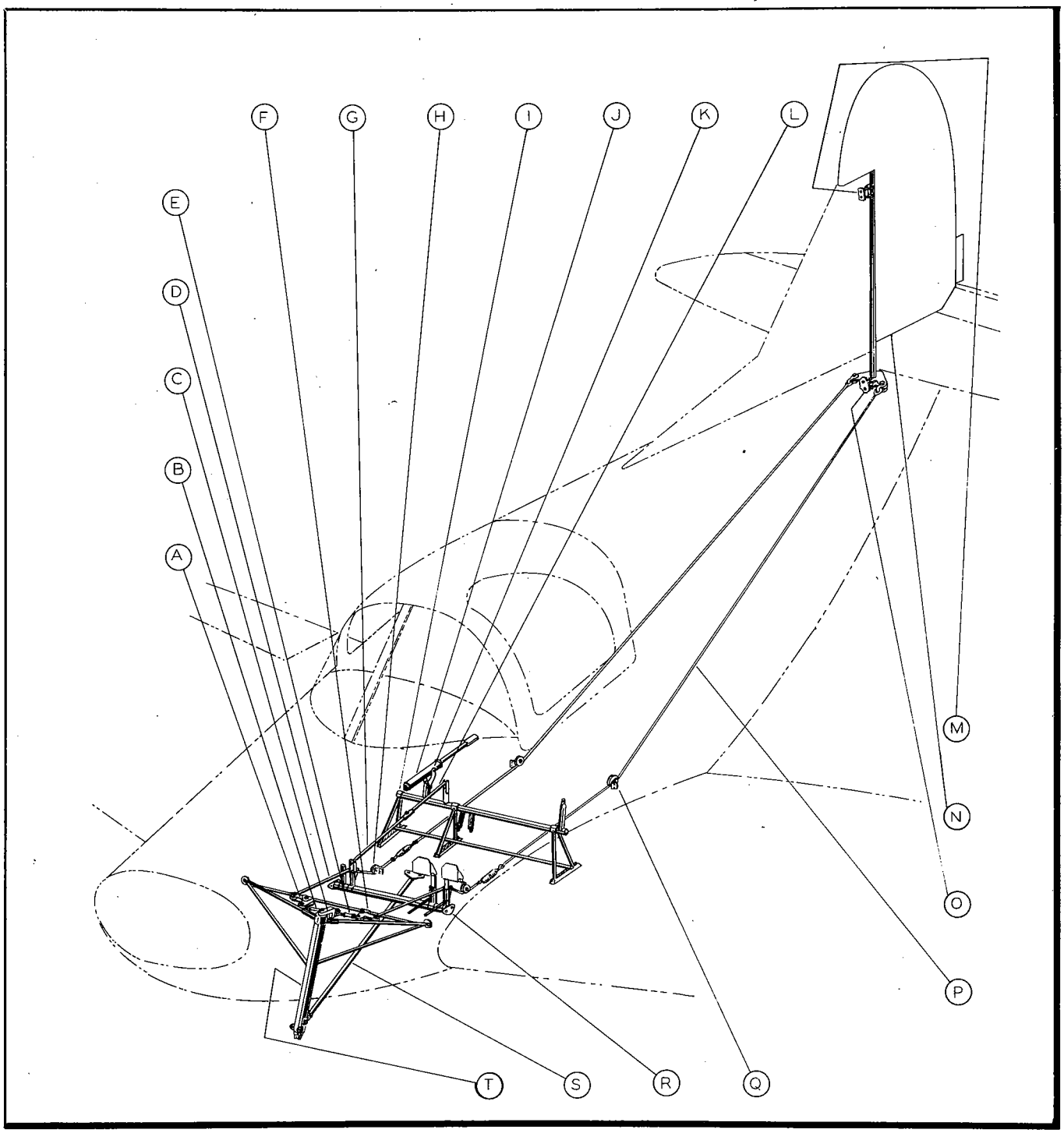


Figure 36—Rudder and Nose Wheel Steering System—PQ-8A

Key to Figure 36

Letter	Title	Part No.	No. Req.
A	Bell Crank	2860	2
B	Right Connecting Link	2855	1
C	Nose Wheel Steering Arm	2865	1
D	Nose Wheel Steering Push-Pull Tube	2720	2
E	Left Connecting Link	2868	1
F	Bell Crank	2856	2
G	Rudder Push Rod	2068	1
H	Front Pulley and Bracket	4867	2
I	Throttle Torque Tube	3068	1
J	Rudder Servo Overpower Cylinder Assembly	2140	1
K	Cylinder Fork Arm	2078	1
L	Tube	2235	1
M	Hinge Bracket	196-2	1
N	Rudder	2655	1
O	Lower Rudder Hinge Bracket	350	1
P	Rear Rudder Cable Left and Right	3258	2
Q	Rear Rudder Pulley Assembly	3257	2
R	Rudder Torque Tube Assembly	2948	1
S	Nose Wheel Drag Strut	3636	1
T	Engine Mount Nose Wheel Socket	3220	1

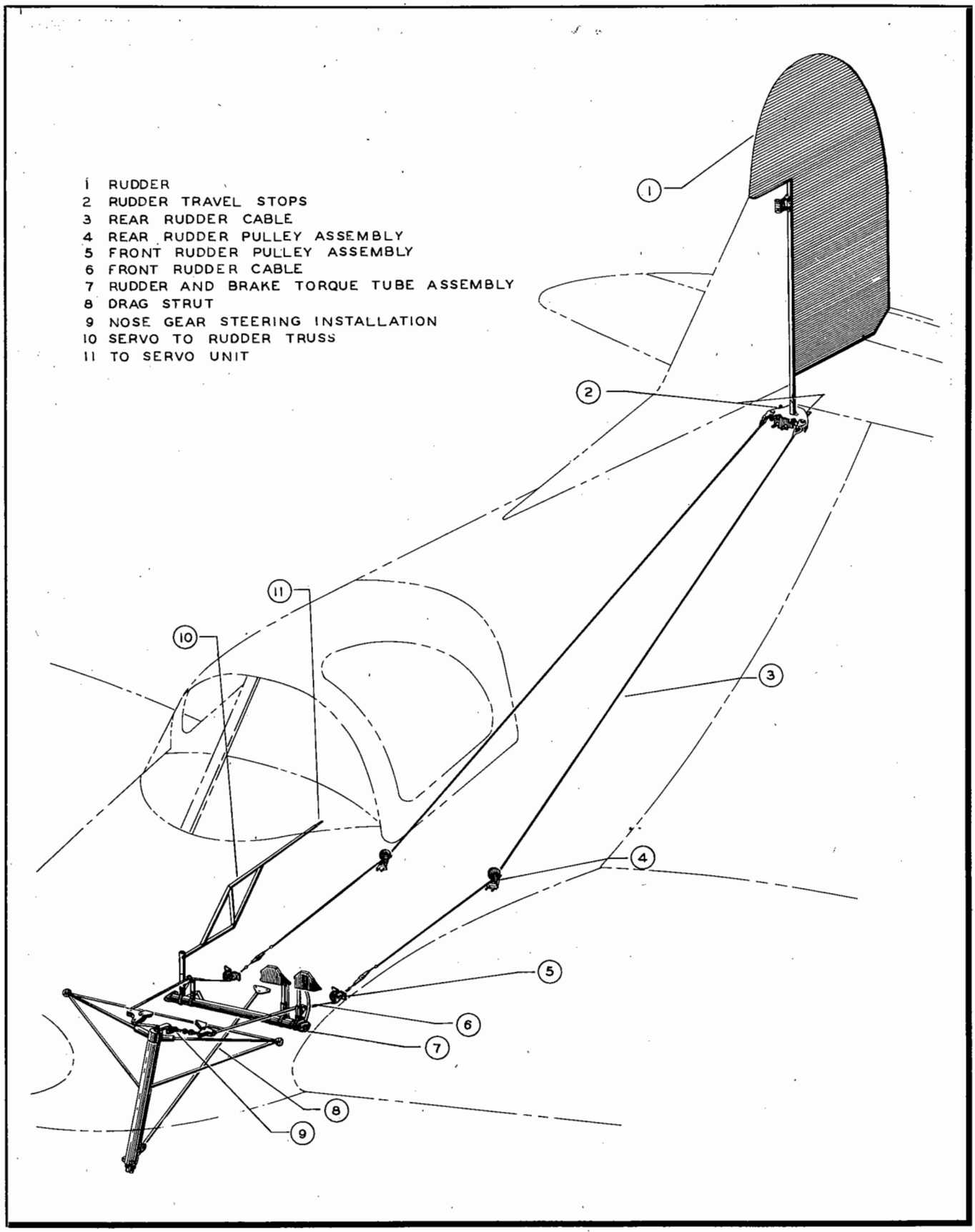


Figure 37—Rudder and Nose Wheel Servo Installation—TDC-2

and windows are of cellulose acetate sheeting material. One door with an emergency release is provided on the left side for the entry and exit of the safety pilot. The emergency door release handle is located on the top center of the pilot's hatch near the windshield. The right cabin panel is attached to the fuselage with panel fasteners and can be easily removed for servicing and adjusting the servo unit. The hatch frame is a welded-steel tube structure bolted to the fuselage.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.—To remove the cabin enclosure:

(a) CABIN DOOR.—The latch is labeled for proper operation. In order to remove the door, unlatch the door first then pull the safety release handle. The safety release handle is located in the center of the cabin enclosure just back of the windshield.

(b) CABIN HATCH PANEL.—Undo the panel fasteners around the edges of the panel. Lift the panel up and off.

(c) WINDSHIELD. — Remove the machine screws around the edge of the molding which holds the windshield to the hatch frame and fuselage.

(d) HATCH FRAME.—After doors and windshield have been removed from the frame, remove the bolts which attach the frame to the fuselage. These bolts are located in the center front and rear, and also on the sides.

(e) WINDOWS AND WINDSHIELD.—The windows can be removed by removing the small rivets that attach it to the door. The windshield can be removed from the bottom molding by pulling the windshield out of its channel and by removing the sheet metal screws from the upper molding.

(3) MAINTENANCE REPAIRS *(other than structural)*.—Since the fuselage is constructed almost entirely of wood, there will be very few parts that will be likely to require replacement. The welded steel tube hatch frame can be straightened if bent and the door and cabin panel hammered out if they are dented or damaged. If the windows or windshield become discolored replacement is necessary.

CAUTION

Use only soap and water or kerosene, to clean the surfaces of the windsheld and windows.

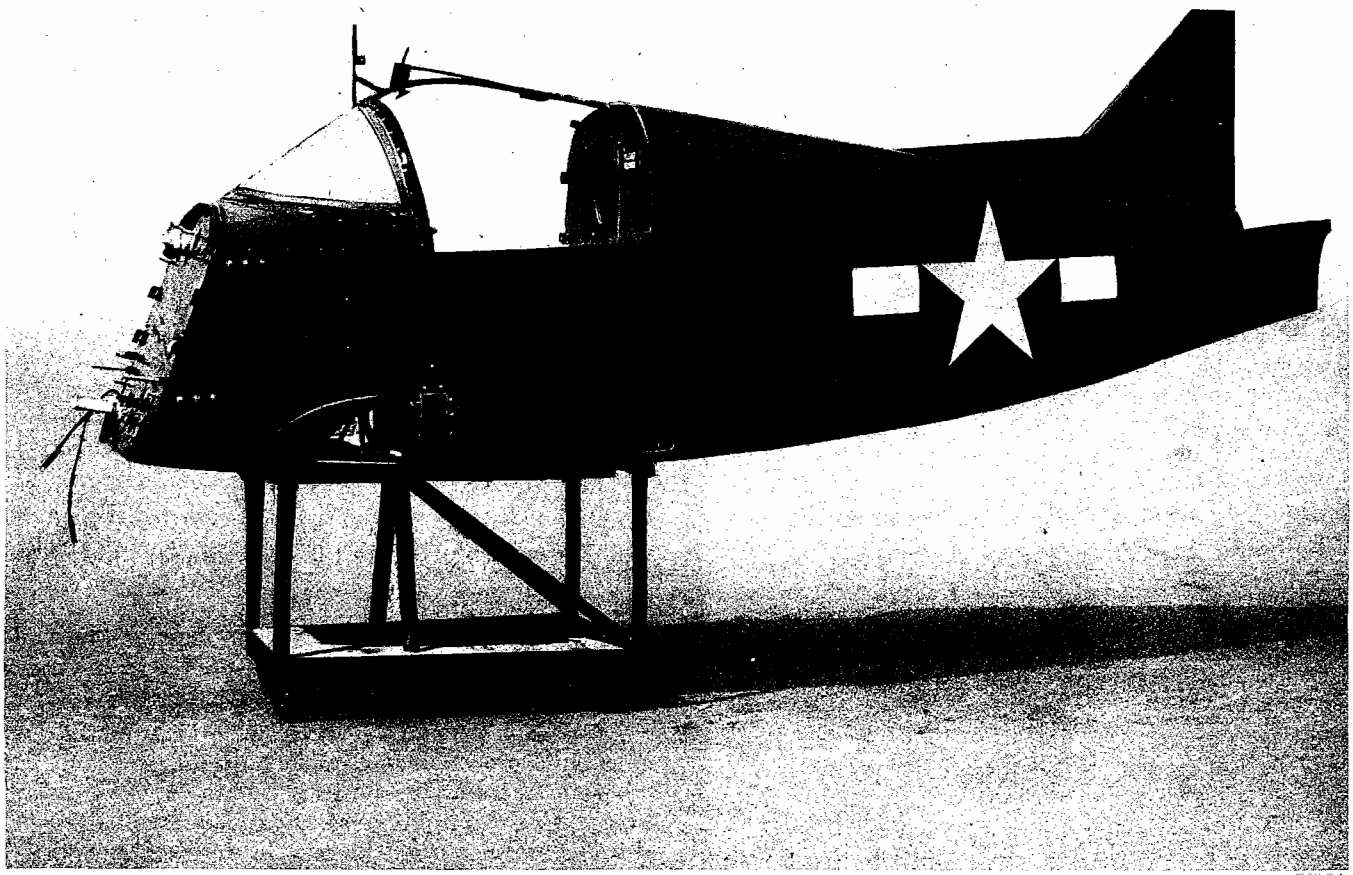


Figure 38—Fuselage

DO NOT USE ACETONE, BENZENE, LACQUER THINNER, OR ABRASIVE CLEANERS.

(a) REPAIR OF DAMAGED SKIN.—When the plywood skin on the fuselage becomes punctured or torn, one of three methods may be used to repair the damage. (See figures 39 and 40.)

1. If the hole does not exceed 3 square inches it may be patched by trimming the edges and doping or cementing fabric over the opening.

2. The fabric is for temporary repair only and should be replaced with a plywood patch.

3. If the damaged area is extensive or lies over a structural member, the repair should be made by replacing the entire plywood panel from one structural member to the next. The replacement of a whole panel would constitute a major repair, so will not be discussed here.

4. If the damaged area does not lie over any structural member, the repair may be made by using one of eight methods of repair.

a. FRACTURED AREA.—When the skin becomes fractured, a reinforcement block is glued to the back of the fractured area. The block should extend about ½ inch beyond the fractured area and be as thick as, or thicker than the original plywood. Clean surface the size of block, glue, and hold in place with batten strips.

b. CRACKED AREA.—Clean area around cracks and glue a block on the inside of the fuselage and use the same method as for repairing a fractured area.

c. SMALL HOLE.—Trim the edges of the damaged section away so there will be no splinters or cracks left. The hole should be square or rectangular to make the repair easier. Clean the inside of the fuselage of all grease, varnish, or any dirt. The bare wood must show, or a good glue joint will not be possible. Scarf the edges back 10 times the thickness of the plywood. Fit another plywood block into this hole with scarfed edges. Glue in place. Then glue another block on the inside of this 1½ inches larger than the hole on each side. This block should be at least the thickness of the original material or double the thickness.

d. SMALL BROKEN-OUT AREA NEXT TO STRUCTURAL MEMBER.—Cut square or rectangular hole. Scarf the edges back 10 times the thickness of the original material. Finish repair similar to method explained in paragraph c., preceding.

NOTE

Glue block close to structural member.

e. CRACK NEXT TO AND PARALLEL TO A STRUCTURAL MEMBER.—Clean cracked area and glue a reinforcing plate 1 inch larger than the cracked area on three sides but not on the side of the structural member. Use method for finishing repair as explained in paragraphs c. and d., preceding.

f. CRACK NEXT TO AND PERPENDICULAR TO A STRUCTURAL MEMBER.—Use same method as explained in paragraph e., preceding.

g. CRACK TO UNREINFORCED EDGE.—Use similar method as in paragraph e., preceding, and run the block to edge of original plywood.

(b) FINISHING OF DAMAGED SKIN.—The only repairs other than structural will be the refinishing of the plywood skin. If the wood is new, two coats of liquid wood sealer should be applied. It is allowed to dry 4 hours. The repaired skin is then sanded and washed with a rag dipped in thinner. Apply a cross-coat of surfacer and let dry 3 or 4 hours. Sand down to the wood and spray a cross-coat combination of one-half surfacer and one-half enamel. Let this coat dry 5 or 6 hours. Scuff it off and wash with thinner. Spray on one coat of enamel. The inside of the fuselage in front of station 46 is scraped, and one coat of enamel is sprayed on.

(4) REPLACEMENTS.—If the damage is too great to maintain strength of the fuselage, a new fuselage is recommended. However, longeron and skin repairs are successful if they are not damaged too greatly. A damaged floor board can be repaired if it is not damaged too greatly, or a new floor board can be installed.

(5) ASSEMBLY AND INSTALLATION.—The only assembly and installation to be made on the fuselage is the installation of the cabin enclosure. The installation of the hatch frame is made by installing the bolts that connect the hatch frame to the fuselage. The windshield and windshield molding may be installed by connecting them to the fuselage and hatch frame with the screws and bolts necessary. Sealer should be used around the edges of the windshield where it attaches to the molding to prevent moisture from entering the cabin enclosure. Sealer is also used around the windows on the doors. The cabin panel may be installed by placing the clips under the right longeron and turning the fasteners. The cabin door is installed by replacing the emergency hinge pins into the hinges. Then replace the emergency release handle in the clip provided for it.

(6) FINAL TEST AFTER ASSEMBLY.—Inspect to see that the hatch frame is secure and that the windshield and windshield molding fit properly. See that the cabin panel and cabin door fit the contour of the fuselage and hatch frame.

4. ALIGHTING GEAR.

a. MAIN LANDING GEAR. *(See figure 41.)*

(1) DESCRIPTION.—The main landing gear is of the cantilever non-retracting type. One unit is mounted in each wing panel at station 43 and consists of a spring-type oleo shock strut, axle, and a 6.00-6 size low-pressure tire. The wheels are of formed spot-welded steel sheet and a single disc-type hydraulically operated brake unit is mounted on the form.

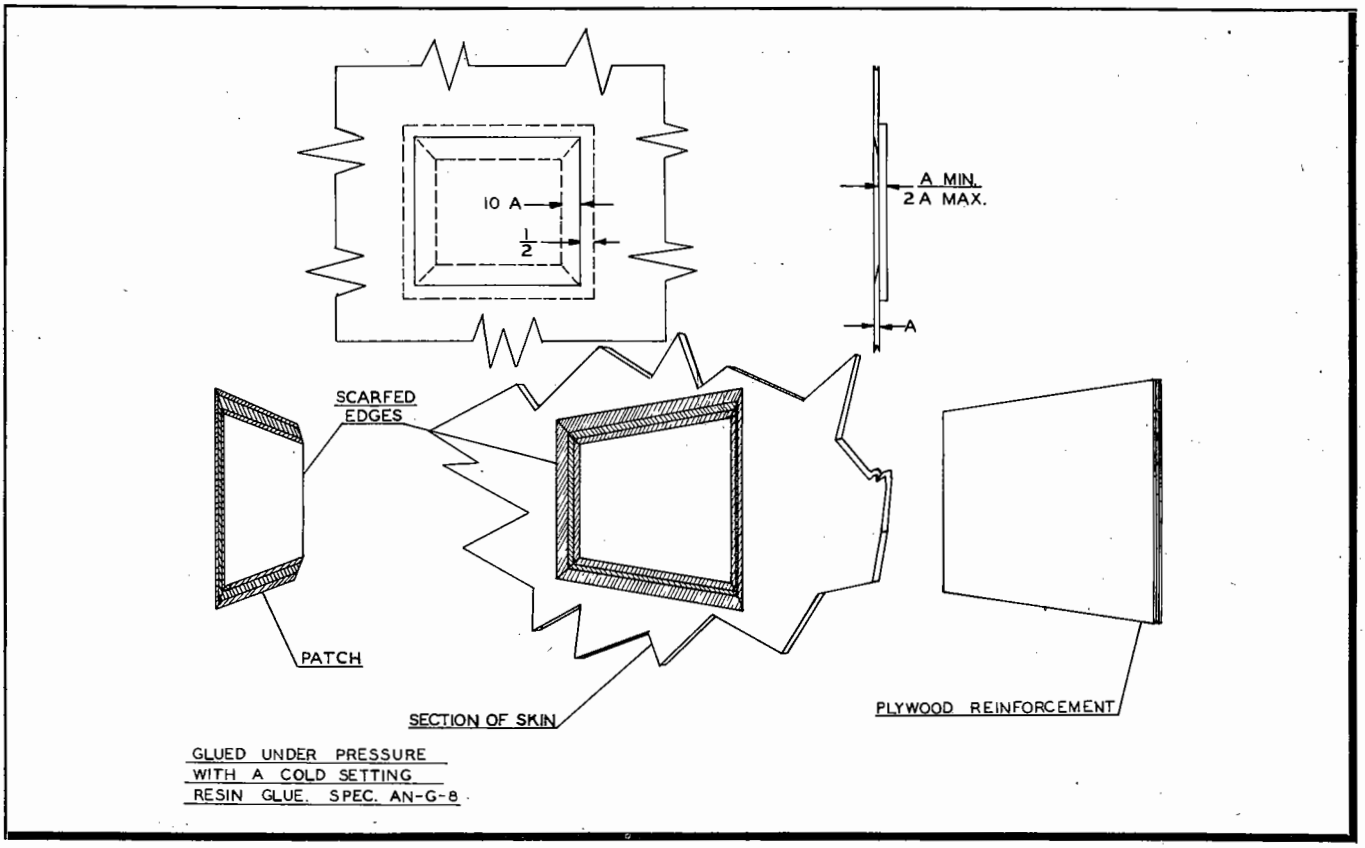


Figure 39—Typical Skin Repair

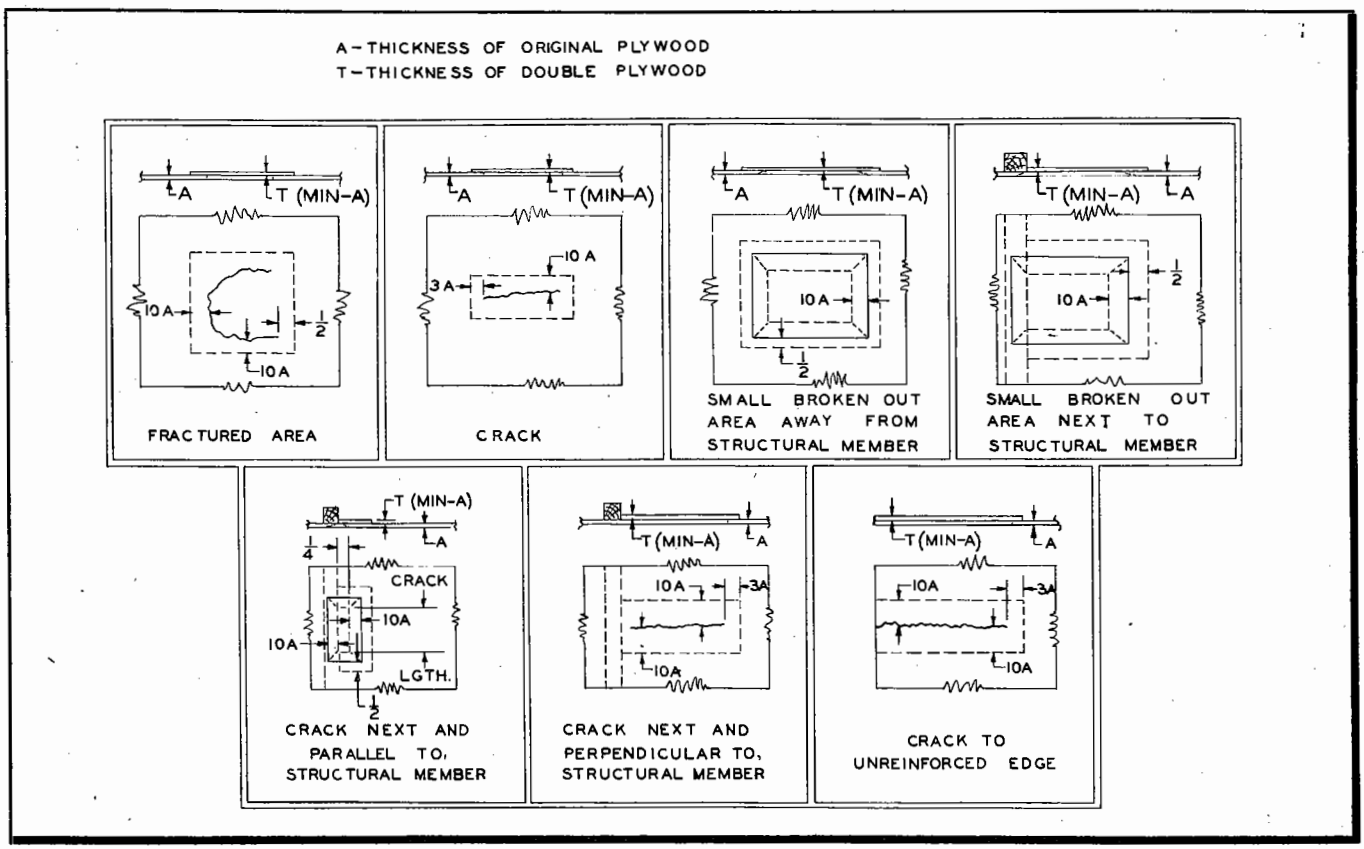


Figure 40—Repair of Small Cracks and Breaks

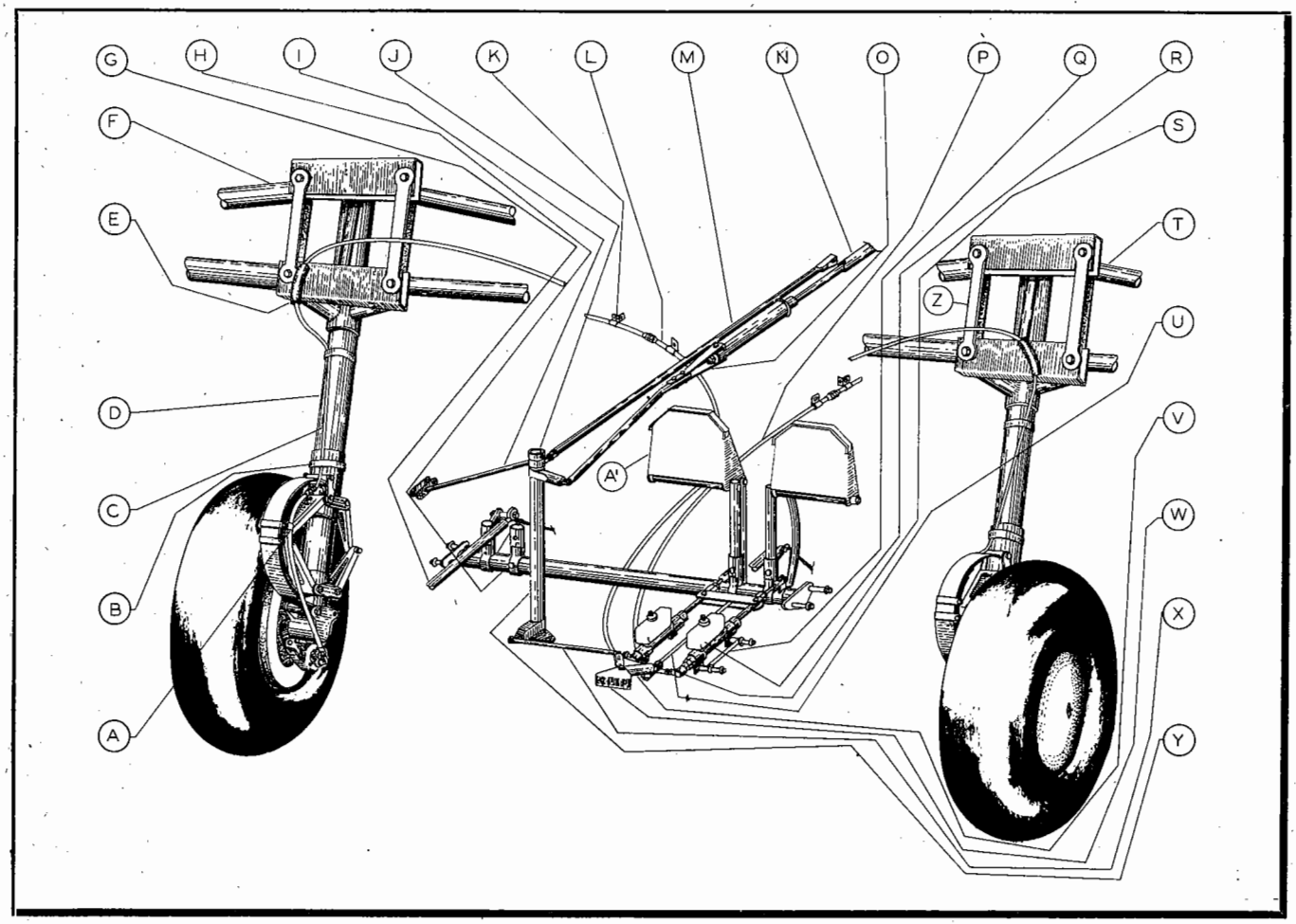


Figure 41—Brake Servo System

Key to Figure 41

Letter	Title	Part No.	No. Req.
A	Clamp	4241	2
	Brake Line—Alternate	AC755-8	
B	Wrap Lock		4
C	Brake Line	4089	2
D	Right Main Gear Assembly	2680	1
E	Hose (Chafing)	AN 884-4-8	2
F	Wing Torque Truss	3095	1
G	Nose Wheel Steering Push-Pull Tube, Right	2720	2
H	Rudder and Torque Tube Assembly	2948	1
I	Brake Torque Tube Support	3289	1
J	Brake Torque Retaining Collars	493	1
K	Clip-Brake Line	3044	4
L	Right Brake Line with Fittings	4087	1
M	Brake Torque Tube Bracket	3881	1
N	Brake Cylinder Assembly (Servo Overpower)	2079	1
O	Brake Cylinder Fork	1740	1
	Connecting Link	2085	1
P	Left Brake Line	4088	1
Q	Brake Master Cylinder Bracket	2845	2
R	Brake Master Cylinder	3090	2
S	Imperial Brass Company		
	Reducer—110-B	⅛x¼ Pipe Th'd	2
	Elbow—94-W-45°	⅛x¼	2
	Nut—41-W	¼	2
T	Wing Torque Truss	2914	1
U	Brake Tension Link	3891	1
V	Brake Bell Crank	452	1
W	Brake Bell Crank Bracket	3787	1
X	Brake Cylinder Link	3287	1
Y	Brake Torque Tube	3288	1
	Brake Torque Tube Lower Bracket	3882	1
		466-1	2
		466-2	2
Z	Tension Straps	467-2	2
		467-1	2
A'	Rudder Pedals	3137	1
		3138	1

(a) SHOCK STRUT.—The shock strut consists of the following parts: Piston tube, piston head, packing gland nut, piston bearing, piston rings, oleo cylinder, torque links and bushings, and taxi spring.

(b) CYLINDER.—The cylinder is divided into an upper and lower chamber interconnected by a metering orifice drilled in the partition between chambers. Oil, Specification No. AN-VV-O-366, is forced from one chamber to the other through the metering orifice by the piston in the lower chamber as the shock strut compresses with the impacts of landing and taxying. The spring keeps the shock strut extended when no load is applied to the landing gear and carries the weight of the airplane on the ground.

(c) TORQUE LINKS.—The torque links prevent rotation of the piston in the cylinder. A packing

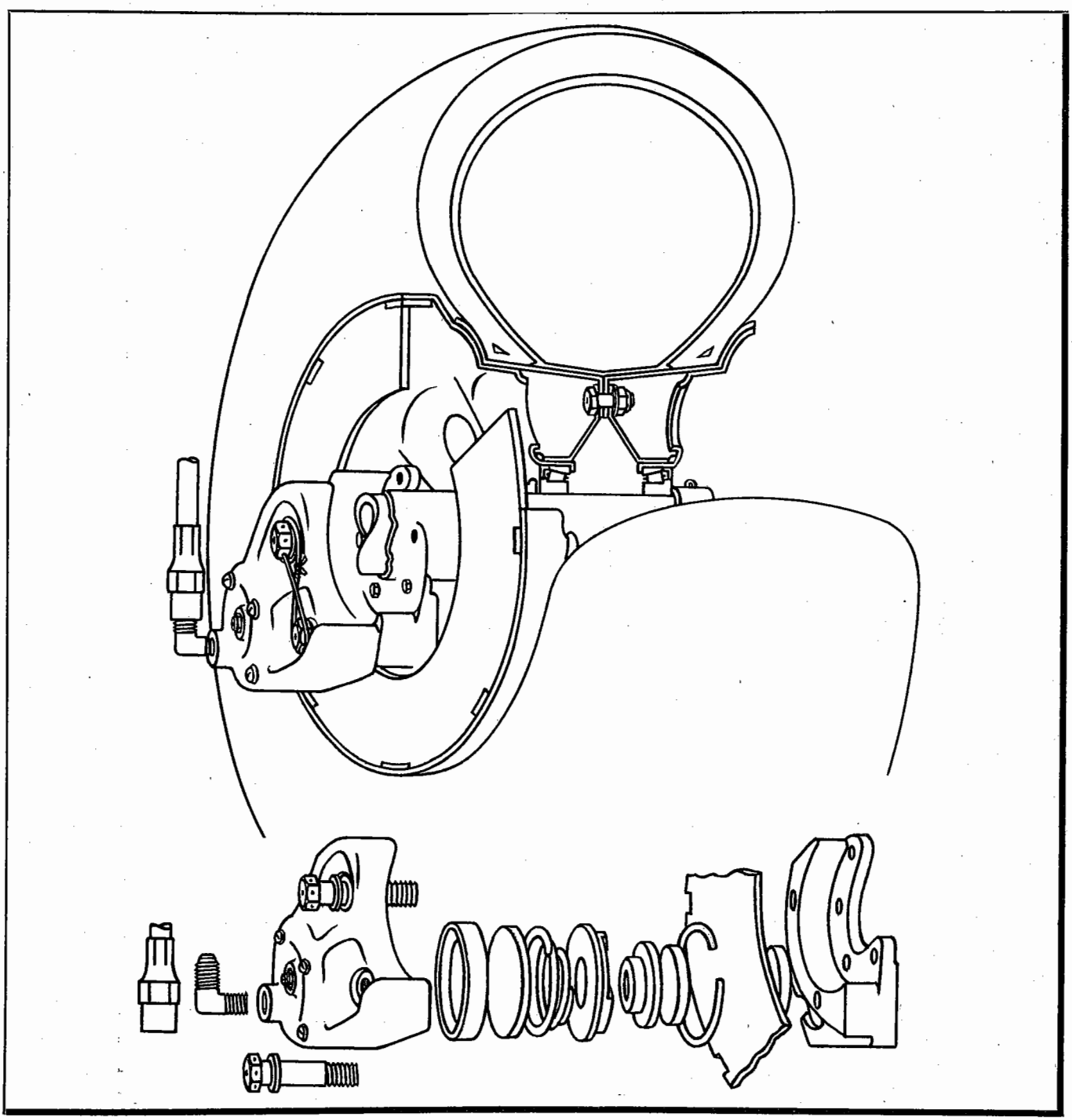


Figure 42—Brake Unit

gland nut and packing rings keep the piston in the cylinder and prevent seepage of oil out of the bottom of the strut. An oil filler opening is provided at the top and an oil level plug on the side.

(d) WHEEL.—The wheel consists of two spot-welded sheet steel halves. One-half has a wider flange on the rim with provisions for a floating brake disc. The halves are held together with six bolts through the center. The conventional tapered roller bearings and grease seals are incorporated. The brake unit is cast-aluminum structure, hydraulically operated, with two small circular brake shoes capable of exerting great pressure on the floating disc. The unit itself is held in place by four bolts through the axle-piston socket. (See figure 42.)

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.

(a) MAIN GEAR.

1. Place airplane on jacks as directed in Sec-

tion II, paragraph 2. *c.*

2. Remove oleo strut fairing and inspection plates.

3. Disconnect brake line at bleeder fitting and drain brake fluid.

4. Remove the wrap locks holding the brake line to the shock strut.

5. Loosen the oleo socket clamp fitting just below the lower wing surface.

6. Remove the throughbolt near the top of the oleo socket.

7. Slide the entire landing-gear assembly down and out of socket.

(b) SHOCK STRUT.

1. Remove cotter pin, unscrew wheel lock nut, and slide wheel from axle.

2. Drain oil from shock strut by removing filler plug at top and turning shock strut upside down.

3. Remove spring and torque links.

4. Remove brake unit by taking loose the four bolts attaching the brake unit to the torque flange on the axle-piston socket.

5. Unscrew and remove the packing gland nut using a spanner wrench.

6. Use the axle as a handgrip and pull the piston out of the cylinder. All internal parts of the strut will remain on the piston.

7. Remove the locking spring, then unscrew the piston head with special wrench, Culver part No. 3005. Slide all internal parts from piston.

(c) WHEEL.

1. Deflate the tire.

2. Remove the six bolts holding the two halves of the wheel together.

3. Pry the halves apart; be careful not to tear the valve stem.

(d) BRAKE.

1. Remove brake unit from shock strut. (See Section V, paragraphs *c.*, (1), *(d).*)

2. Remove the two studs holding the halves of the clamp unit together.

3. The unit should come apart easily.

(3) MAINTENANCE AND REPAIRS.

(a) Clean all parts carefully and inspect carefully for signs of wear or damage.

(b) Replace the brake lining and the synthetic rubber seal as needed.

(4) REPLACEMENTS.—Replace such parts as needed.

(5) ADJUSTMENTS.

(a) Tighten packing nut until no leakage occurs.

(b) Tighten or loosen setscrew on the brake unit to adjust the tension spring. The tension should not be too great because the wheel must turn freely when the brake pedals are in "OFF" position.

(6) INSPECTION.—Check for oil leakage. Be sure the wheel turns freely.

(7) ASSEMBLY AND INSTALLATION.—To assemble the shock strut reverse the order of disassembly with the following precautions:

(a) PACKING RINGS.—Be sure the packing rings mate with the adapter ends of the piston bearings.

(b) PISTON HEAD LOCKING SPRING.—To install the piston head locking spring, select a hole in the dural plug in the piston and just outside a shoulder in the clover-leaf cut-out in the piston head. Press turned-down end into the hole and force the spring past corners allowing it to spring out in the chamfered recess under the clover-leaf cut-out in the piston head.

(c) CYLINDERS.—Slide the packing rings one at a time past the threads in the end of the cylinders. Be sure rings are pliable. If stiff, soak in warm hydraulic oil until soft.

(d) PACKING GLAND NUT.—Tighten the packing gland nut until the piston begins to tighten. The packing gland nut must be tightened periodically as the packing rings "wear in."

(e) TO FILL THE SHOCK STRUT.

1. The landing spring must be disconnected. Unscrew the filler opening at the top and the check hole opening at the side. Start filling with shock strut in compressed position and extend slowly while filling. Pump strut up and down very slowly several times after oil appears at check hole level. Oil should be at check hole level when strut is extended. Shock strut may be filled while mounted on the airplane or lightly clamped in a vise. Use oil, Specification No. AN-VV-O-366.

(f) TO FILL THE BRAKE CYLINDER.

1. To fill and bleed the brake system: Because of the small travels of the master cylinder pistons, it is preferable to fill and bleed the brake system at the wheel. Open the master cylinder filler caps and the bleeder screws at the wheel unit. Attach the filler unit to the lower bleeder screw and fill the unit with fluid, Specification No. AN-VV-O-366, until fluid runs out at the upper bleeder screw. Tighten the bleeder screw and continue to fill system until fluid runs out at master cylinder filler opening. Close master cylinder filler opening, remove the filler unit, and close the bleeder opening. A pump must be used to force the fluid up into the brake master cylinder.

2. Another method of filling the brake master cylinder is to open the cylinder plug on top of the cylinder and pour fluid in the cylinder. The brake pedals must be worked to force the fluid into the hose. Open the bleeder screw on the brake unit. The line

may be full of air, and foam will come out of the brake unit hole, however, when this stops and a steady stream of fluid comes out of the brake cylinder the lines are full. Close bleeder hole by inserting screw on brake unit and replace plug on brake master cylinder.

(g) TO BLEED BRAKE SYSTEM. — The brake system may be bled through the master cylinder if necessary. Open the lower bleeder screw, pump the brake pedal, close the bleeder screw, release the pedal, and repeat until clear, bubble-free fluid begins to drain from the bleeder opening. Keep the master cylinder filled during the bleeding operation.

(h) ASSEMBLY.—Reverse the order of disassembly. Install wheel on axle and tighten wheel lock nut until wheel bearings begin to bind slightly. Back lock nut off about one-quarter turn or until safetying holes in axle and lock nut line up.

(8) FINAL TEST AFTER ASSEMBLY.—Check all nuts and bolts to see if they are secure. Check fluid level. Work the brake pedals to be sure there is pressure in the lines. A short test run is advisable for the purpose of insuring proper brake action. Be sure the cover plates are installed.

b. NOSE GEAR.

(1) DESCRIPTION.—The nose gear consists of a nonretractable oleo-spring shock strut, 5.00-4 low-pressure tire, cast or aluminum wheel without brake, and knuckle-axle assembly. A steel tube truss attaches the nose gear to the fuselage in such a way that it may be swiveled through a push-pull hook-up with the rudder pedals. A mud scraper is provided to prevent the wheel from throwing mud and pebbles into the propeller.

(a) SHOCK STRUT.—The shock strut consists of the following parts: Piston tube, piston head, packing gland nut, piston bearing, packing rings, oleo cylinder, torque links and bushings, and spring.

(b) CYLINDER.—The cylinder is divided into an upper and lower chamber interconnected by a metering orifice drilled in the partition between chambers. Oil, Specification No. AN-VV-O-366, is forced from one chamber to the other through the metering orifice by the piston in the lower chamber as the shock strut compresses with the impacts of landing and taxying. The spring keeps the shock strut extended when no load is applied to the landing gear, and carries the weight of the airplane on the ground.

(c) TORQUE LINKS.—The torque links prevent rotation of the piston in the cylinder. A packing gland nut and packing rings keep the piston in the cylinder and prevent seepage of oil out of the bottom of the strut. An oil filler opening is provided at the side and an oil level plug on the side.

(d) WHEEL.—The wheel consists of two cast-magnesium or aluminum halves. The halves are held together with four bolts through the center. The conventional tapered roller bearings and grease seals are incorporated.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS. *(See figure 43.)*

(a) Place airplane on jacks as directed in Section III, paragraph 2. *c.* (2).

(b) Remove the engine cowling.

(c) Disconnect the steering system at the steering horn and remove the steering horn by taking out the threaded taper pin at the top of the cylinder.

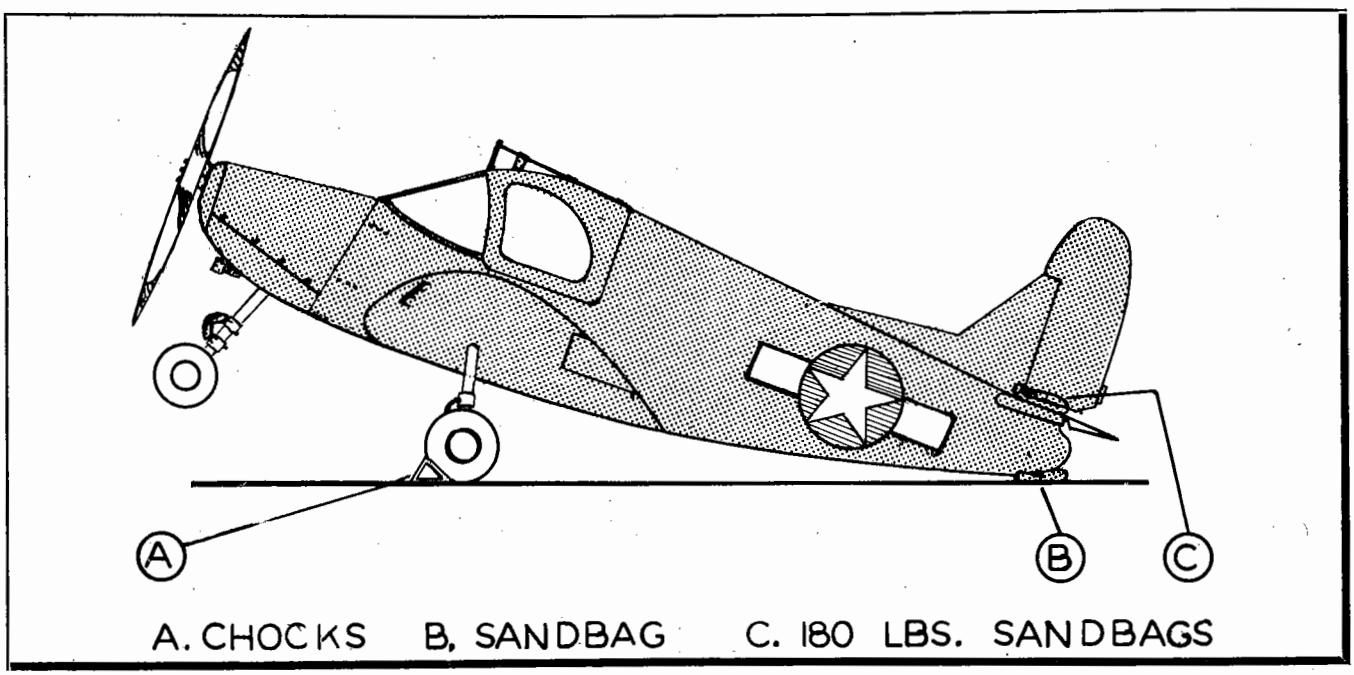
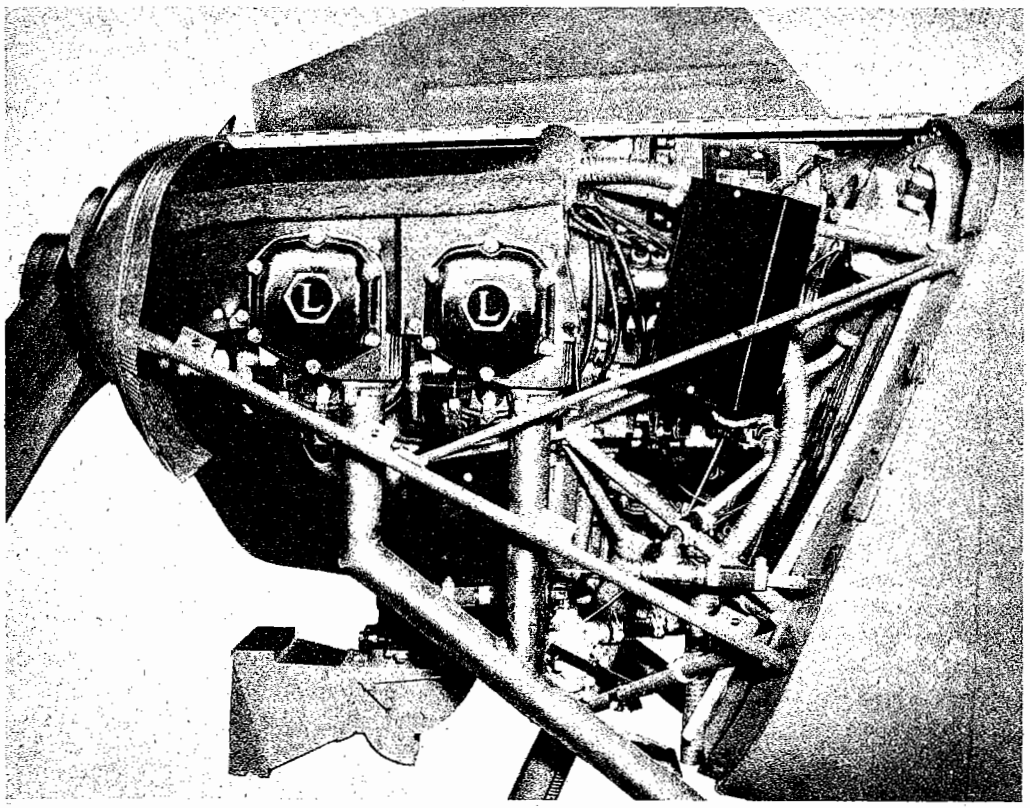


Figure 43—Nose Wheel Removal



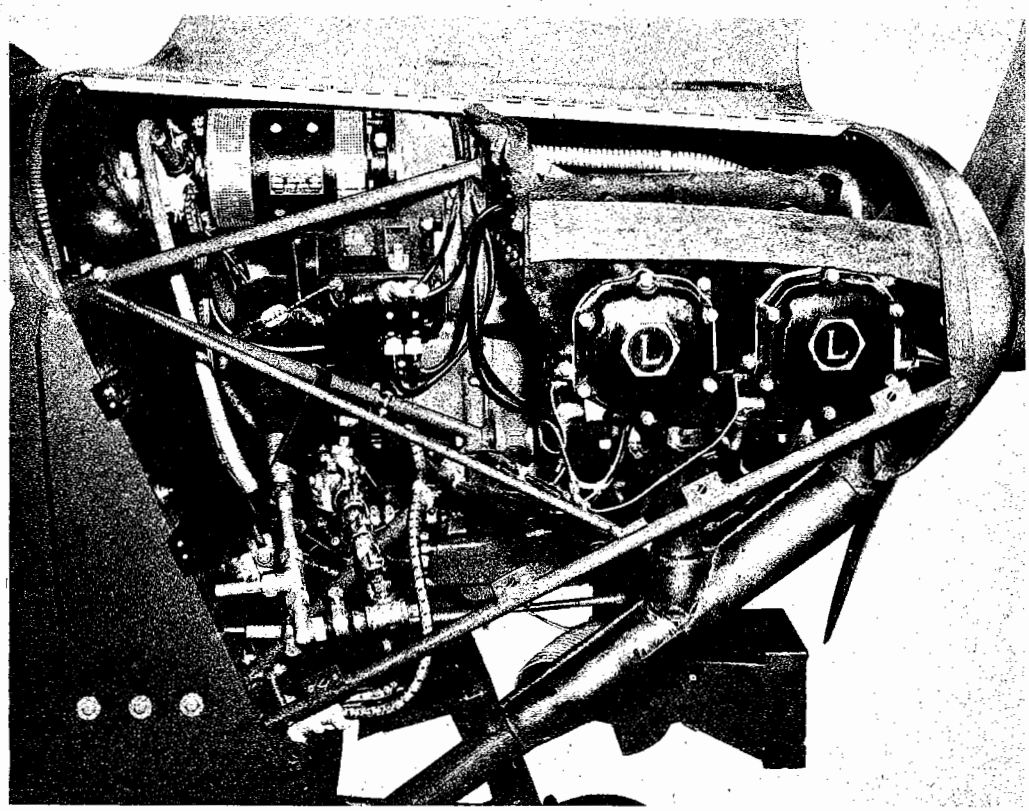


Figure 44—Left and Right View of Engine—PQ-8A

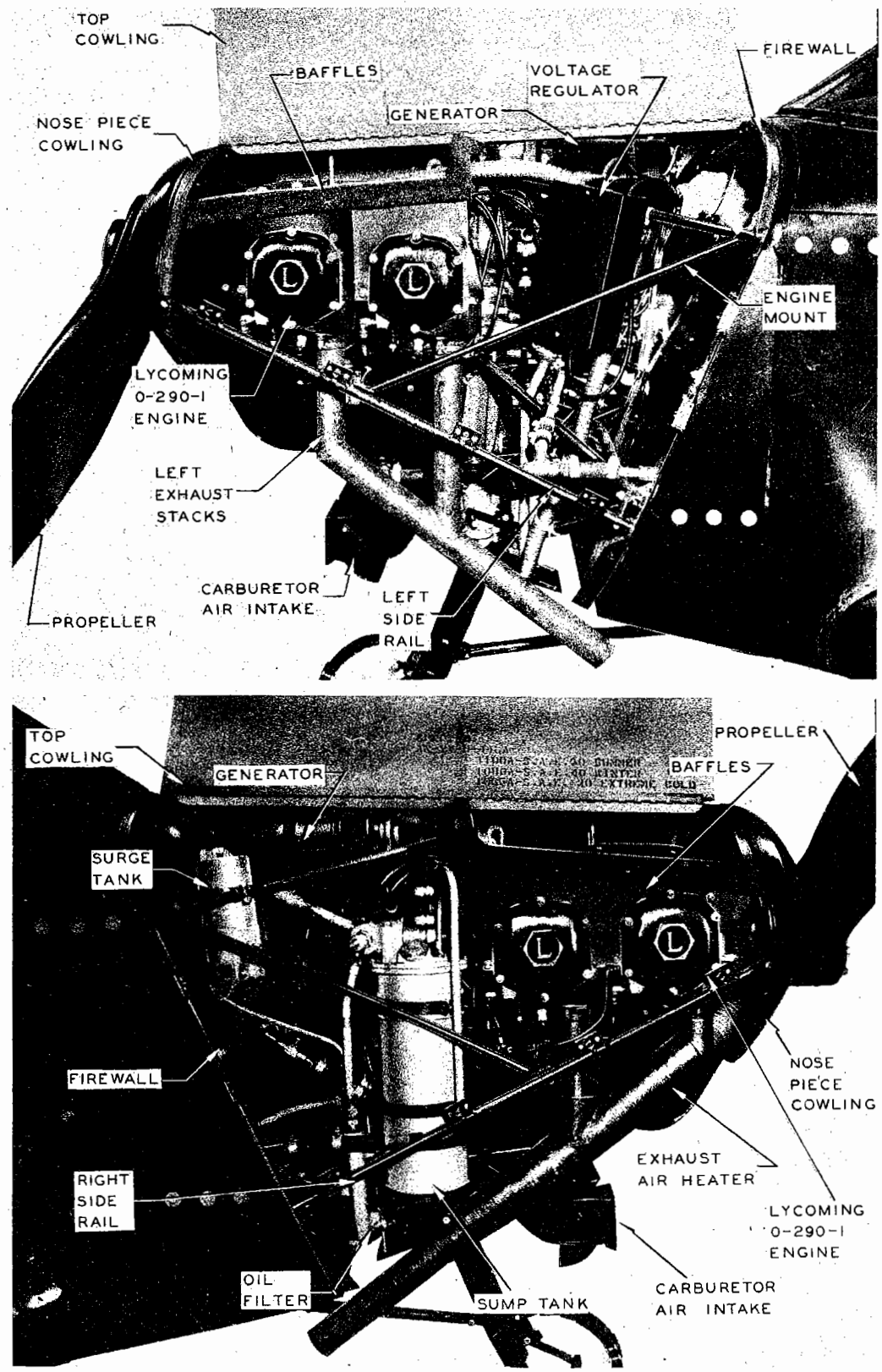


Figure 45—Left and Right View of Engine—TDC-2

(d) Remove the retaining nut and the top thrust bearing and slide the entire nose gear assembly out of its socket.

(e) Drain and disassemble the shock strut.

1. Remove cotter pin, unscrew wheel lock nut, and slide wheel from shock strut.

2. Drain oil from shock strut by removing filler plug at top and turning strut upside down.

3. Remove spring and torque links.

4. Remove brake unit by taking loose the four bolts attaching the brake unit to the torque flange on the axle-piston socket.

5. Unscrew and remove the packing gland nut using a spanner wrench.

6. Use the axle as a handgrip and pull the piston out of the cylinder. All internal parts of the strut will remain on the piston.

7. Remove the locking spring and unscrew the piston head with special wrench, Culver part No. 3005; slide all internal parts from piston.

(f) WHEEL.

1. Deflate the tire.

2. Remove the four bolts that hold the two halves of the rim together.

3. Pry the halves apart; be careful not to tear the valve stem.

(3) MAINTENANCE REPAIRS.—Clean all parts carefully and inspect for signs of wear or damage.

(4) REPLACEMENTS.—Replace such parts as needed.

(5) ADJUSTMENTS.—Tighten packing nut until no leakage occurs.

(6) ASSEMBLY AND INSTALLATION.—To assemble the shock strut reverse the order of disassembly with the following precautions:

(a) Be sure the packing rings mate with the adapter ends of the piston bearings.

(b) To install the piston head-locking spring, select a hole in the dural plug in the piston end just outside a shoulder in the clover-leaf cut-out in the piston head which would be against rotation. Press turned-down end into the hole and force the spring past corners allowing it to spring out in the chamfered recess under the clover-leaf cut-out in the piston head.

(c) Slide the packing rings one at a time past the threads in the end of the cylinders. Be sure rings are pliable. If stiff, soak in warm engine oil until soft.

(d) Tighten the packing gland nut until the piston begins to bind. The packing gland nut must be tightened periodically as the packing rings "wear in."

(e) To fill the shock strut, the landing spring must be disconnected. Unscrew the filler opening at the top, the check hole opening at the side. Start filling with shock strut in compressed position and extend slowly while filling. Pump strut up and down very slowly several times after oil appears at check hole level. Oil should be at check hole level when strut is extended. Shock strut may be filled while mounted on the airplane or lightly clamped in a vise. Use oil, Specification No. AN-VV-O-366.

(7) FINAL TEST AFTER ASSEMBLY.—Check to see that the oil level is at the proper height and that the rings do not leak.

5. POWER PLANT GROUP.

a. ENGINE. *(See figures 44 and 45.)*

(1) DESCRIPTION.—This airplane is equipped with a Lycoming 0-290-1 engine. The complete power plant section consists of the engine, engine mount, and accessories. The engine mount is of welded-steel tube construction to which the engine is attached by rubber shock mountings. Accessories include the generator, vacuum pump, and hydraulic pump. Fuel and hydraulic lines in the engine compartment are considered part of their respective systems and are detachable at the fire wall. The power plant section may be handled as a detachable unit.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.—The following instructions are given for the removal of the complete power plant and the accessories attached to it:

(a) Remove propeller.

(b) Remove all engine cowling.

(c) Disconnect fuel system.

(d) Drain oil and disconnect oil thermometer.

(e) Disconnect throttle control. (See figure 46.)

(f) Disconnect carburetor air heater control. (See figure 47.)

(g) Disconnect hydraulic lines.

(h) Disconnect connections to vacuum pump.

(i) Disconnect tachometer connection.

(j) Disconnect generator connections.

(k) Disconnect battery ground cable.

(l) Attach sling to engine by hoisting rings. If engine is not equipped with hoisting rings, hoist the engine in the following manner:

1. Remove all cowling and propeller.

2. Disconnect all lines and controls at fire wall.

3. Pass a sling consisting of a 1/2-inch rope or 1/8-inch 7x19 cable under the propeller shaft and the starter.

4. Attach sling to hoist just enough to take up all slack on sling.

5. Remove the four engine mount attachment bolts. Engine should swing free.

CAUTION

Do not attempt to hoist front end of airplane in this way.

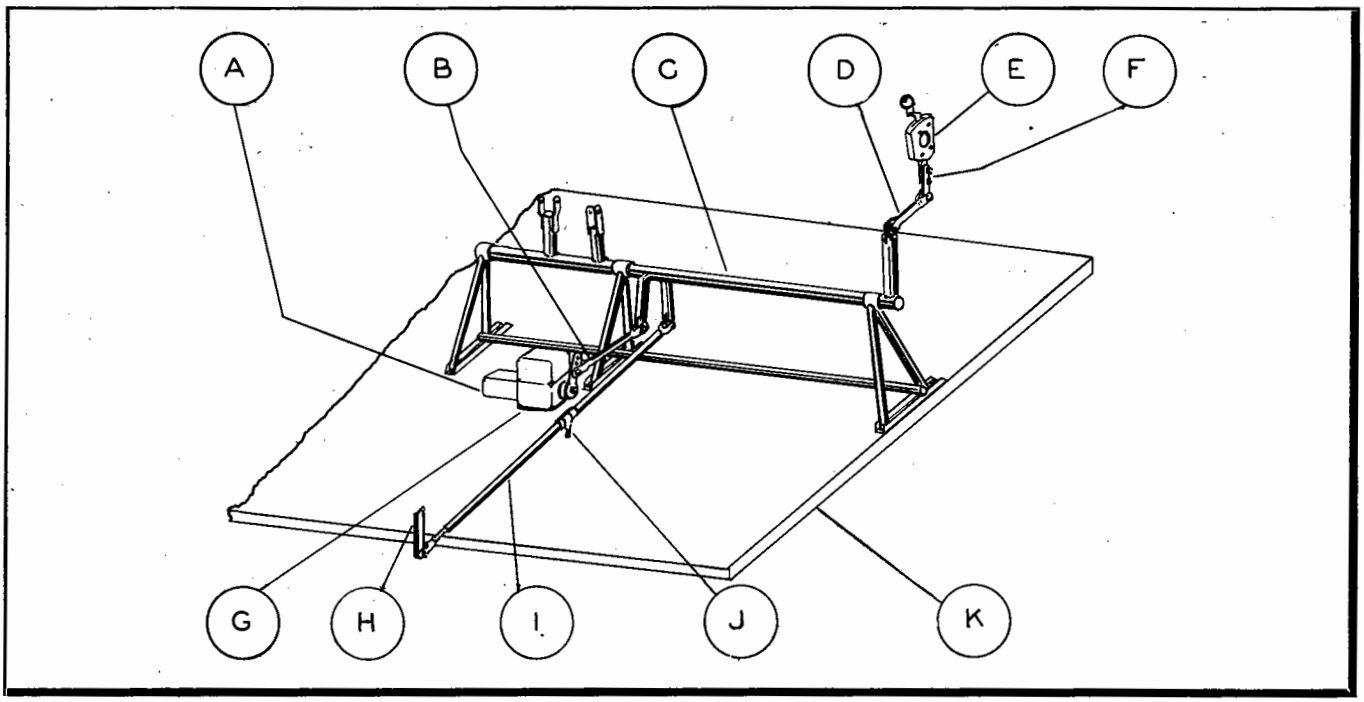


Figure 46—Throttle System

Key to Figure 46

Letter	Title	Part No.	No. Req.
A	Electric Motor	G.F.E.	1
B	Throttle Connecting Link	2138	1
C	Throttle Torque Tube	3068	1
D	Throttle Connecting Link	618	1
E	Army Type Throttle Control		1
F	Throttle Lever Extension	619	1
G	Throttle Motor Base Plate	3578	1
H	Throttle Arm		1
I	Throttle Push Rod	3445	1
J	Push-Pull Tube Guide Bracket	962	1
K	Floor Board	2983	1

(3) MAINTENANCE AND REPAIR OF ENGINE.

(a) LOCATION OF TROUBLE.

1. FAILURE OF ENGINE TO START.

a. Improper starting procedure.

b. Lack of fuel. Examine fuel tanks, fuel line connections, shut-off cocks and strainers. As a final check remove the plug from bowl of carburetor. With fuel supply turned "ON," a steady stream of fuel should run from drain plug opening. (Subject model not equipped with fuel pump.)

c. Overpriming or Insufficient Priming.

(1) Insufficient priming is usually indicated by a tendency of the engine to kick back when starting. Overpriming is usually indicated by a muffled hollow explosion from the exhaust or by excess fuel dripping from the carburetor drain or coming out of the exhaust in a vapor form.

d. Incorrect throttle opening; throttle should be approximately one-tenth open until engine begins to fire.

e. Ignition wiring; examine wiring for wear, cracks, or incorrect connections.

f. Spark plugs; remove spark plugs and inspect for cleanliness and correct gap setting. Pressure test spark plugs in a spark plug tester.

g. Water in carburetor.

h. Magneto breaker points.

(1) Check points for cleanliness and proper adjustment.

(2) Inspect cam and breaker cup for excessive oil. Felt should contain just enough lubricant so that oil appears when felt is squeezed.

i. Timing; check magnetos to see that timing is at 25 degrees BTC.

(b) LOW OIL PRESSURE.

1. Lack of oil; after oil has been drained, always check immediately before starting the engine to be certain that oil has been refilled.

2. Dirt in oil screens; remove, inspect, and clean oil screens.

3. Leak in oil lines; check engine for evidence of oil leakage and check connection between crankcase and oil sump for tightness and condition of gasket.

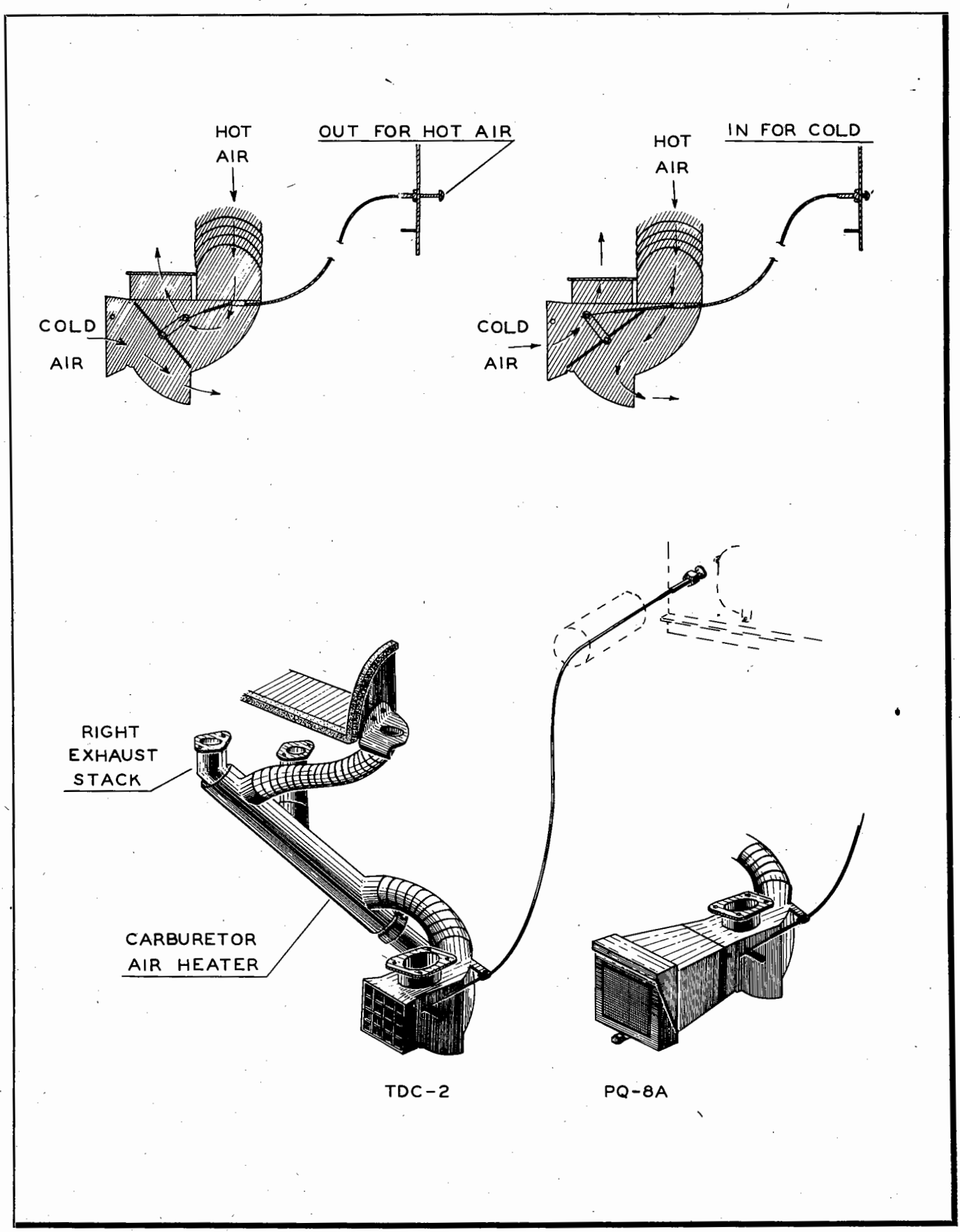


Figure 47—Carburetor Air Control

4. Oil-pressure relief valve; remove and inspect oil-pressure relief valve; see that valve is not sticking open and that seat is free from any foreign matter that might prevent the valve from seating.

5. Worn bearings; an excessively worn bearing surface may reduce the oil pressure. This is usually indicated by a gradual drop over a long period of operation unless some abnormal condition has caused sudden bearing failure.

(c) UNEVEN RUNNING AND LOW POWER.

1. Incorrect mixture; uneven running, caused by too rich a mixture is evidenced by black smoke from the exhaust.

2. Leakage in induction system; leakage at joints or other parts of the induction system causes too lean a mixture and in many cases a leak will be indicated by a whistling sound at low engine speed.

3. Spark plugs; inspect plugs for cleanliness and proper gap clearance. Pressure check spark plugs in a spark plug tester.

4. Ignition harness; check ignition wiring for broken, cracked, or burned cables, poor connections, and damaged insulation.

5. Valve gear; check compression in all four cylinders to be certain that valve is not being held open.

6. Magneto; check magneto breaker points for fitting, proper adjustment, and timing. Inspect distributor section of magneto for cleanliness and breaks in the insulation.

7. Fuel; insure that grade 73 fuel is being used and that it is free from all foreign matter.

8. Carburetor air heater; insure that the control is being used properly according to recommendations.

(d) ROUGH RUNNING.

1. Defective propeller; rough operation and lack of performance can often be traced to a propeller that has been damaged or that has warped because of climatic conditions. If this trouble is suspected, try another propeller that is known to operate satisfactorily.

(e) EXCESSIVE OIL TEMPERATURE.

1. Improper operation of cooling system; any deformation of the gill in lower rear section of the engine compartment may prevent hot air from inside the cowl from getting out.

2. Insufficient supply of lubricating oil; crankcase supply must never go below 4 quarts.

3. Inferior grade of lubricating oil.

4. Foreign matter and carbon particles in oil. Remove, inspect, clean, and replace oil strainers. Incorrect bearing clearance may cause overheating. This is sometimes accompanied by knocking or pounding in the case of loose bearings or by binding of tight bearings.

(4) REPLACEMENTS.—Make necessary replacements as noted under maintenance and repairs. Replace all damaged and worn parts that are beyond repair.

(5) ADJUSTMENTS AND TESTS.

(a) VALVE CLEARANCES.—This engine is equipped with hydraulic tappets, and routine valve adjustments are unnecessary. Malfunctioning of the tappet unit is indicated by extremely noisy operation and is apt to cause damage to the valve mechanism and should be corrected at once. This may be due to:

1. Leaky check valve in tappet.

2. Sticking of tappet plunger caused by dirt or foreign matter in the oil.

3. Clogging of oil passages supplying oil to tappets.

4. Remove faulty tappets. Clean thoroughly in kerosene by working plunger up and down while holding check valve unseated. Check to see that no binding exists and that check valve does not leak.

5. After assembly of tappet in valve mechanism the valve clearance should be checked at from .038 to .080 with tappets collapsed. Install longer or shorter push rods as required to meet this clearance.

CAUTION

The individual parts of a hydraulic tappet assembly are not interchangeable with the corresponding parts of another assembly and will be kept together at all times.

(b) MAGNETO TIMING.

1. Rotate engine till No. 1 cylinder is on compression stroke (both valves closed). Timing mark on rear propeller flange should be exactly in line with crankcase dividing line.

2. Rotate drive gear of magneto until marked tooth on distributor gear aligns with pointer, visible in window at top of magneto. Mount magneto in this position on engine and tighten nuts by hand.

3. Remove breaker cover at rear of magneto and insert cellophane between both sets of breaker points. Rotate magneto through angle provided by mounting slots until breaker points begin to open as indicated by the cellophane being released. Lock magneto in this position by tightening mounting bolts.

4. Back crankshaft up 45 degrees and insert cellophane between both sets of breaker points. Rotate crankshaft in direction of engine rotation until cellophane is released simultaneously just as timing mark on propeller flange lines up with crankcase dividing.

5. Clean breaker points to remove any trace of oil or cellophane.

(c) TABLE OF CLEARANCES

Spark plug gap	.012
Valve clearance (lifter compressed)	.038-.080
Spark occurs	25° BTC

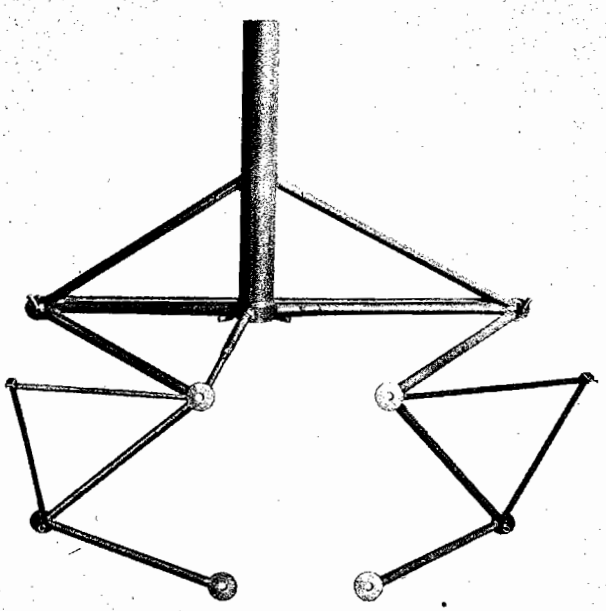


Figure 49—Engine Mount

hold the engine mount to the fire wall and front bulkhead.

(3) MAINTENANCE REPAIRS. — Inspect the rubber vibration absorber for signs of failure or disintegration. Replace as needed. Inspect engine mount members for cracks and repair or replace engine mount if necessary.

(4) REPLACEMENTS.—It is advisable to install a new engine mount whenever it is damaged beyond minor repair.

(5) ADJUSTMENTS.—A secure tight fitting is necessary.

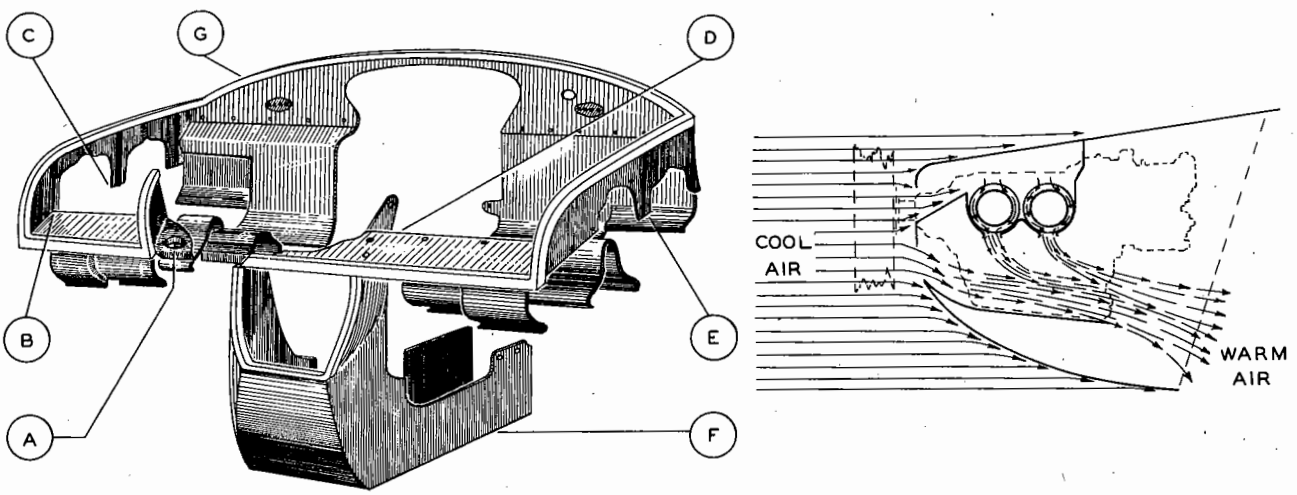
(6) ASSEMBLY AND INSTALLATION. — Put on the rubber vibration absorber and install the four mounting bolts.

(7) FINAL TEST AFTER ASSEMBLY.—Be sure all vibration absorbers have been installed and the mounting bolts are secure.

e. COOLING SYSTEM.

(1) DESCRIPTION.

(a) The pressure-type cooling system is employed on this installation. Air to cool the cylinders is



A-4121 AIR HEATER INLET TUBE BRACKET
B-4263 RIGHT FRONT BAFFLE
C-3233 RIGHT CYLINDER BAFFLE
D-3230 LEFT FRONT BAFFLE
E-3232 LEFT CYLINDER BAFFLE
F-3231 OIL SUMP BAFFLE
G----- INSTALLED ON ENGINE

Figure 50—Cooling System

admitted through intake openings in front of both banks of cylinders and is directed over the cylinders in the proper manner by the baffle system. The air to cool the oil is admitted through a hole near the center of the bottom nosepiece cowling. The carburetor cold-air intake is located under the center of the bottom cowling. (See figure 50.) The warm air is admitted through the major baffle cowling holes.

(b) The edges of the baffles are padded with felt to provide a good seal against the cowling and to prevent wear.

(2) REMOVAL AND DISASSEMBLY. — The baffles may be removed in the following manner:

(a) Remove engine cowling.

(b) Disconnect spark plug wires at plugs and pull back through holes in baffles.

(c) Remove primer lines at cylinders.

(d) Remove baffles in sections.

(3) MAINTENANCE REPAIRS. — Dented or bent baffles should be straightened to prevent air from escaping. Holes can be repaired by riveting a suitable patch in place.

(4) REPLACEMENTS.—Install new baffles or new felt whenever the parts fail to direct the cooling properly.

(5) ASSEMBLY AND INSTALLATION. — Put on baffles in sections. Connect primer at cylinders. Pull spark plug wires through baffle holes and connect to spark plug.

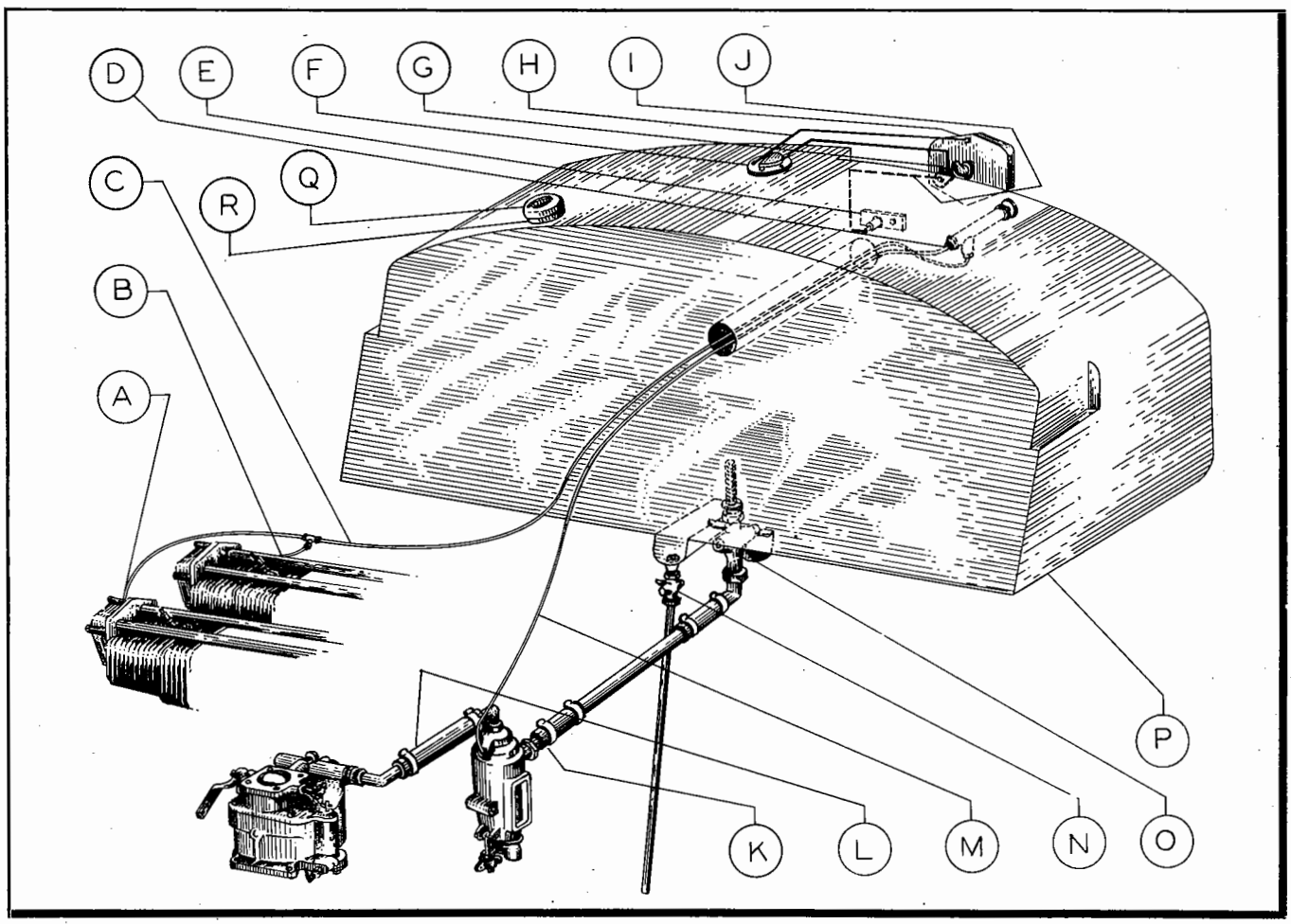


Figure 51—Fuel System Diagram—PQ-8A

Key to Figure 51

Letter	*Title*	*Part No.*
A	No. 1 Cylinder Primer Line	3475-3
B	No. 3 Cylinder Primer Line	3475-4
C	Primer Pump Outlet Line	3475-2
D	Primer Pump	3479
E	Starter Button Mounting Plate	580
F	Fuel Tank Sending Unit	2867
G	Fuel Gage	3028
H	Tank Unit Wires	3472-1
I	Instrument Group Unit	3028
J	Fuel Gage Jumper Wire	3471-4
K	Fuel Strainer Intake Line (with fittings)	3478
L	Carburetor Intake Line (with fittings)	3477
M	Primer Pump Intake Line	3475-1
N	Drain Line Fuel System	3476
O	Fuel Outlet Assembly	3295
P	Fuel Tank	3293
Q	Fuel Tank Cap	3294
R	Fuel Gage Flange	3127

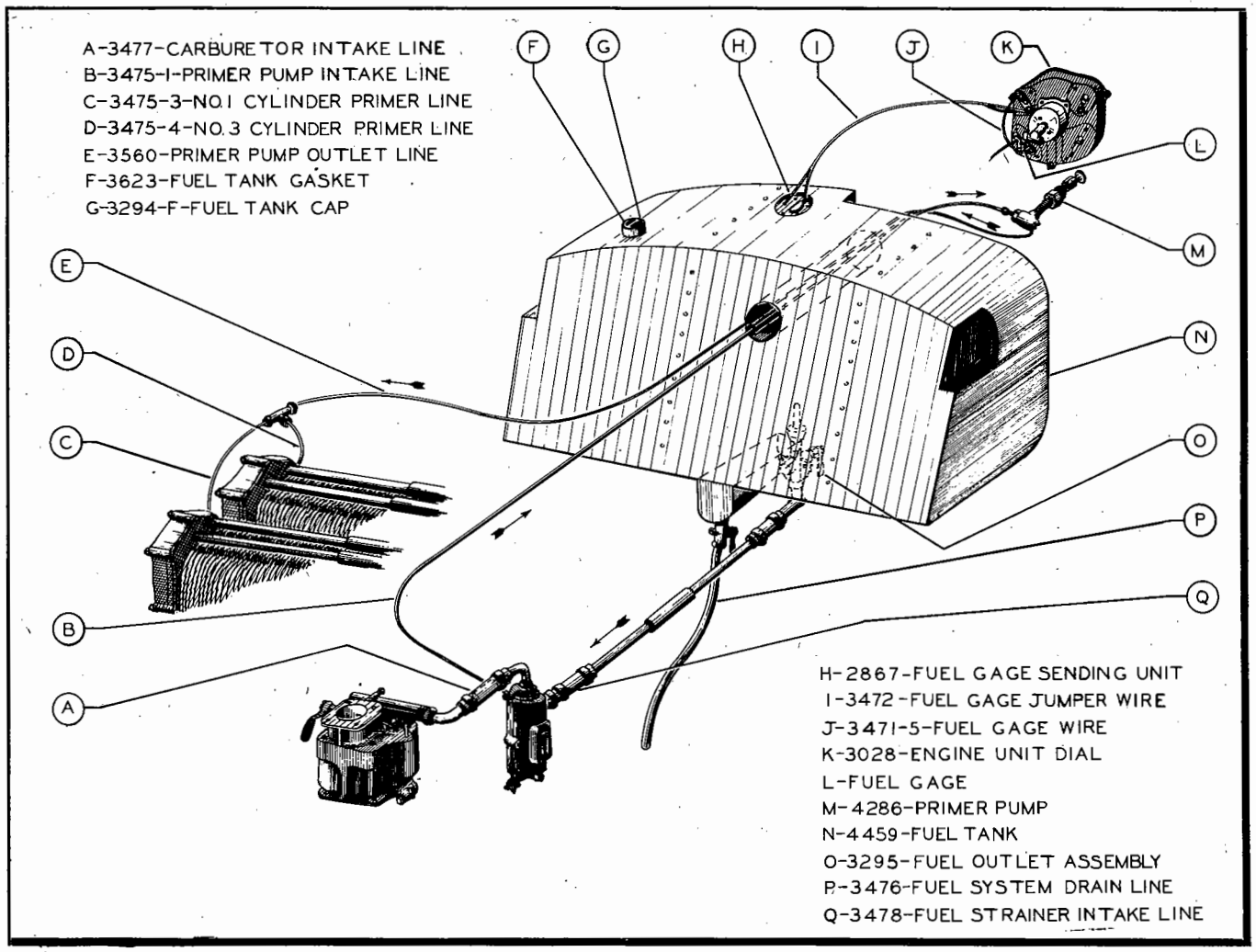


Figure 52—Fuel System Diagram—TDC-2

(6) FINAL TEST AFTER ASSEMBLY.—Check all nuts and bolts and screws for proper installation.

f. FUEL SYSTEM.

(1) DESCRIPTION.—The fuel system is of the gravity feed type, and consists of a 25 U. S. (20.8 Imperial) gallon tank, fuel shut-off valve, strainer, drain, and primer. The tank is mounted immediately aft of the fire wall and is retained by metal straps padded with composition material. The tank is equipped with an electric-type Stewart-Warner fuel gage. It is located in the instrument assembly along with the tachometer, oil pressure, oil temperature, and ammeter. The fuel shut-off valve is located on the bottom of the tank. When the handle of the fuel shut-off valve is turned in a horizontal plane and points to the right, the flow of fuel is stopped. When the handle is in a vertical plane with the handle pointing down, the gasoline flows through a ½-inch copper line through the fire wall where it is connected by means of a hose connection to the strainer and sediment trap. The strainer is mounted by a bracket to one of the engine mount members. The strainer and sediment trap are connected to the carburetor by means of a hose connection and clamps. The drain cock is in the off position when the handle is in a horizontal position and pointing to the right. The drain cock handle should be safetied in the off position with safety wire. The primer is located on the instrument panel near the center of the airplane and receives its gasoline through a ⅛-inch copper tube from the discharge side of the strainer. The primer pump discharges through a ⅛-inch copper tube which runs through the fire wall and divides by means of a T-fitting. One line goes to the right front cylinder and the other line to the right rear cylinder. (See figures 51 and 52.)

(2) REMOVAL AND DISASSEMBLY.—The gas tank can be removed as follows:

(a) Pull stick out of socket.

(b) Remove throttle quadrant from side of plane.

(c) Disconnect engine controls and all electrical connections to panel.

(d) Remove any radio equipment, servo, and servo controls that will interfere with the removal of the panel or tank.

(e) Remove instrument panel.

(f) Drain gasoline from tank.

(g) Disconnect primer lines, gasoline outlet line, and drain line from tank.

(h) Remove tank hanger supports.

(i) Take off gas tank filler cap.

(j) Pull gas tank out.

(3) MAINTENANCE REPAIRS.—Keep sediment trap clean. All connections should be checked for leaks and tightened or replaced with new connections.

(4) REPLACEMENTS AND ADJUSTMENTS.—Install new connections, fittings, or hose whenever they need replacing.

(5) TESTS.—A check should be made for all worn connections, leaks, dents, and deep scratches.

(6) ASSEMBLY AND INSTALLATION.

(a) Put the gas tank on.

(b) Install gas tank filler cap.

(c) Replace tank hanger supports.

(d) Connect primer lines, gasoline outlet lines, and drain line on tank.

(e) Install instrument panel.

(f) Install any radio equipment, servo, or servo controls that were disconnected in the removal of the tank.

(g) Connect the engine controls and all the electrical connections to the panel.

(h) Replace throttle quadrant to the side of the plane.

(i) Place control stick in control stick socket.

6. FIXED EQUIPMENT GROUP.

a. NAVIGATION INSTRUMENTS.

(1) DESCRIPTION. *(See figures 53, 54 and 55.)*

(a) INSTRUMENTS.—The plywood instrument panel is attached directly to the fuselage. A subpanel is affixed to the main panel and may be removed to give access to the back of the panel. The following instruments and equipment are mounted on the panel:

1. Air-speed indicator.

2. Altimeter.

3. Engine instrument unit consisting of tachometer, fuel gage, oil-temperature and oil-pressure gages, and ammeter.

4. Ignition switch.

5. Starter switch on PQ-8A.

6. Carburetor air heater control.

7. Primer pump.

8. The compass is mounted on the hatch frame structure along the center of the windshield.

(b) POWER PLANT CONTROLS.

1. The throttle control is located conveniently on the pilot's left.

2. The ignition switch is located on the left side of the instrument panel. It has "OFF," "LEFT," "RIGHT," "BOTH" positions.

3. The primer control is in the center of the instrument panel.

4. The fuel shut-off valve is located in the center of the cockpit below the instrument panel and under the gas tank.

5. The carburetor heat control is located in the center of the instrument panel. FULL OUT for hot air, FULL IN for cold air.

(2) REMOVAL AND DISASSEMBLY INSTRUCTIONS.

NOTE

All switches and power must be "OFF" when working on electrical instruments.

(a) INSTRUMENT PANEL.

1. Remove bolts of mountings and take the instrument panel out.

2. Disconnect all attaching lines and wires. Each line or wire should be tagged to facilitate correct reassembly.

(b) INSTRUMENT.

1. Individual instruments may be removed for adjustment, repair, or replacement without removing the instrument panel. Except for those in the engine instrument unit any instrument then may be removed by taking out the mounting screws and disconnecting it.

2. The engine instrument unit is removable by taking out the screws holding it in place. The individual instruments then may be removed by disconnecting the instruments and taking out the mounting screws.

(3) MAINTENANCE REPAIRS.

(a) COMPASS COMPENSATION.

1. Ground swinging of the airplane may be accomplished by means of a magnetic bearing swinging base, or a master compass.

2. Using the magnetic bearing swinging base, place the longitudinal axis of the plane parallel to the N-S line. If the compass does not indicate north (0 degrees), adjust the N-S compensator. Then with engines running at sufficient rpm to show the maximum charge on the ammeter, recheck compass, and readjust, if necessary.

3. Head the airplane east (90 degrees) and repeat the above process, adjusting the E-W compensator, if necessary. If no change is noted in the compass indication as a result of running the engine, it will not be necessary to keep it running during the remaining periods of compensation.

4. Head the airplane south (180 degrees) and

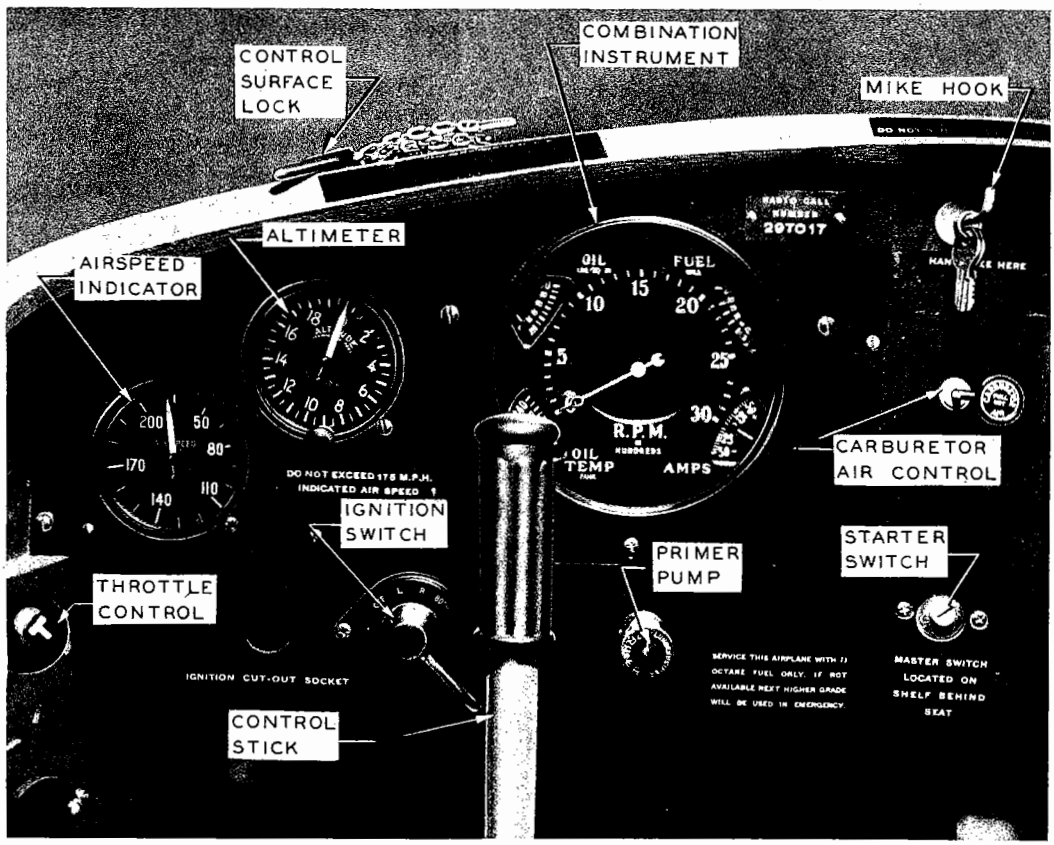


Figure 53—Instrument Panel—PQ-8A

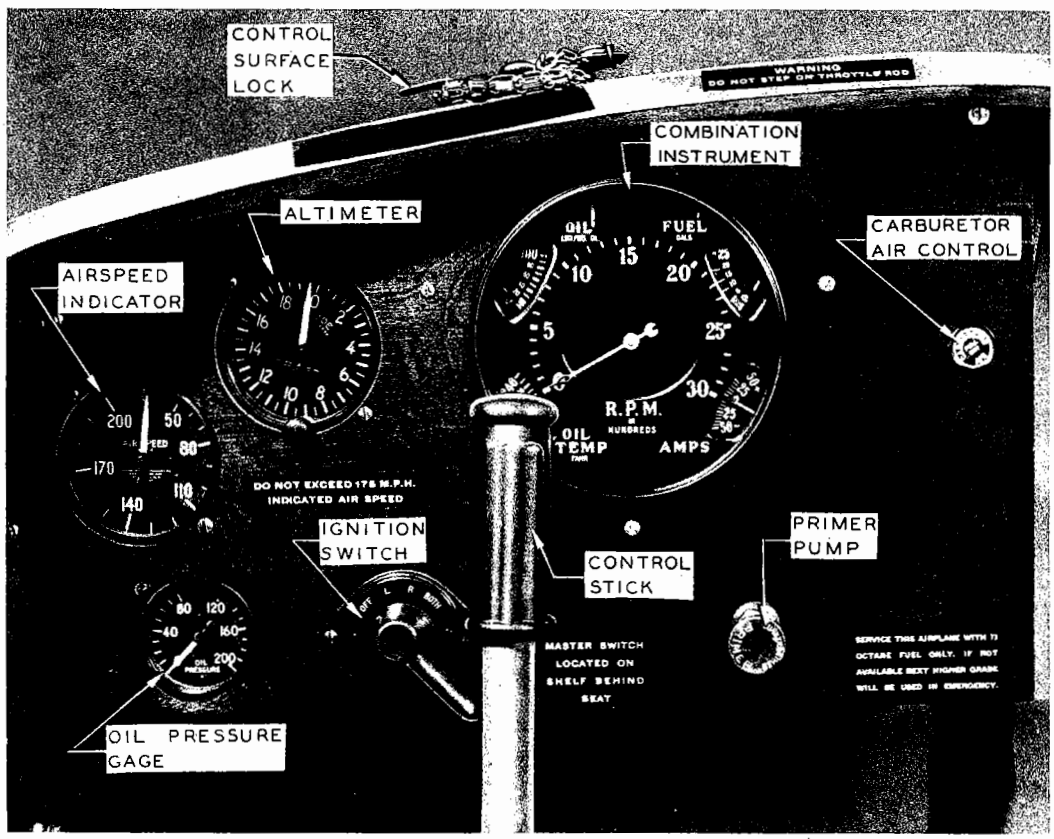


Figure 54—Instrument Panel—TDC-2

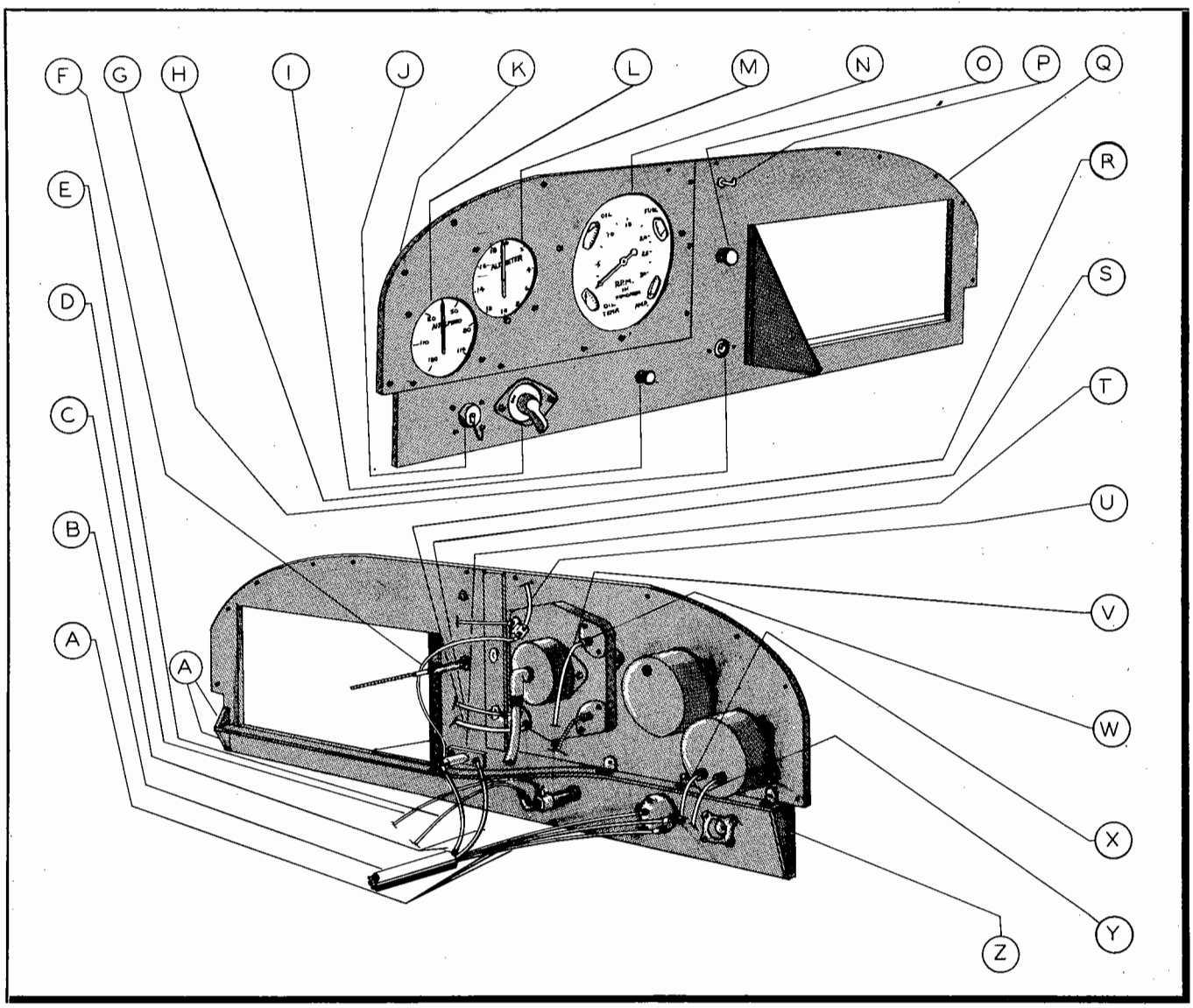


Figure 55—Instrument Panel

Key to Figure 55

Letter	Title	Part No.	No. Req.
A	Hookup Wire Assembly Ignition Switch	3471-1	3
B	Conduit Through Fuel Tank	4126	1
C	Generator Cable Assembly	3472-2	1
D	Primer Line Inlet Complete	3475-1	1
E	Primer Line Outlet Complete	3475-1	1
F	Hookup Wire Assembly Fuel Gage	3471-3	1
G	Ford Starter Button		1
H	Lunkenheimer (see drawing for number) or Shakespeare Primer: 3-A-52	3479	1
I	Briggs and Stratton Ignition Switch	C Type A 7 Switch	1
J	Engine Shut-off Cap (for Radio operation)	G.F.E.	1
K	Instrument Panel	2840	1
L	Air Speed Aeromarine 540N		1
M	Altimeter Aeromarine 520N		1
N	Stewart-Warner Instrument Unit 542 MJ	3028	1
O	Richland R-21 Carburetor Air Control		1
P	Mike Hook	1414	1
Q	Instrument Panel Right Section	4122	1
R	Generator Cable Assembly	3470-2	1
S	To Master Switch from Ammeter	3171-3	1
T	Starter Mounting Plate	580	1
U	Ground Wire and Fuel Gage	3472-1	1
V	Oil Pressure Line Assembly	4270	1
W	Fitting Imperial 68-F for Air Speed Lines		1
X	Air-speed Lines	4166-3	1
Y	Air-speed Lines	4166-4	1
Z	Reinforcing Blocks	4417	1
AA	Reinforcing Blocks	4419	2
	Reinforcing Blocks	4417	1

if the compass does not indicate south, adjust the N-S compensator to eliminate one-half of the error. Then head the airplane west (270 degrees) and eliminate one-half the error if any, by adjusting the E-W compensator.

5. The airplane should next be swung on each successive 15-degree heading, and the readings recorded in the "Radio Off" space on the compass correction card. Then with the radio receiver in the "ON" position the airplane should again be swung on each 15-degree heading and the readings recorded in the "Radio On" space on the compass correction card.

6. To swing the airplane using a master com-

pass, the same procedure will apply, except that a serviceable, noncompensated compass will be used to determine the positioning of the airplane.

(b) Worn wiring, connections, and fittings must be repaired.

(c) Pitot lines may become damaged. They should be kept in good repair.

(4) REPLACEMENTS.—All damaged instruments replaced. Worn wires and connections usually should be replaced with new units.

(5) ADJUSTMENTS.—Compass adjustment is the only adjustment necessary.

(6) TESTS.—Check tachometer, air-speed indicator, and fuel gage for accuracy.

(7) ASSEMBLY AND INSTALLATION.—Installations can be made by reversing the removal procedures.

(8) FINAL TEST AFTER ASSEMBLY.—Check all instrument installations and wirings.

(9) MAJOR OVERHAUL.—All damaged instruments should be sent back to factory for repairs.

b. SERVO CONTROL SYSTEM.

(1) DESCRIPTION. *(See figures 56 to 60.)*

(a) The servo control system consists essentially of a receiver and selector which, through a system of selector valves, divert oil under pressure to servo cylinders. These servo cylinders contain oil-actuated pistons which, when connected by an actuating rod to the control horns, furnish the force to manipulate the controls that is ordinarily furnished by the pilot.

(b) The hydraulic pump supplies the power for the oil servo system and is located on the rear of the engine to the right-hand side. The vacuum pump is located just to the left of the hydraulic pump, and furnishes the vacuum necessary to operate the gyroscopes in the servo unit. The oil separator is also included in the vacuum system, on the PQ-8A only, and serves the purpose of removing oil from the air and returning it to the engine sump. A vacuum relief valve regulates the vacuum which operates the gyroscope and is adjusted to 3.75 to 4.25 inches Hg. The oil pressure in the servo unit is regulated by a relief valve which can be set to a maximum of 160 pounds per square inch at full throttle. In the TDC-2 a sump tank is located in the engine compartment and is to the right of the engine. In the PQ-8A the sump tank is located behind the seat. It has a capacity of 5 quarts including expansion space. (See figure 61.)

(c) Starting at the right on the TDC-2 servo unit, servo piston No. 1 operates the ailerons, No. 2 piston operates the elevator and brakes, and No. 3 piston operates the rudder and nose wheel.

(d) Starting at the right on the PQ-8A servo unit, servo piston No. 1 operates the ailerons, No. 2

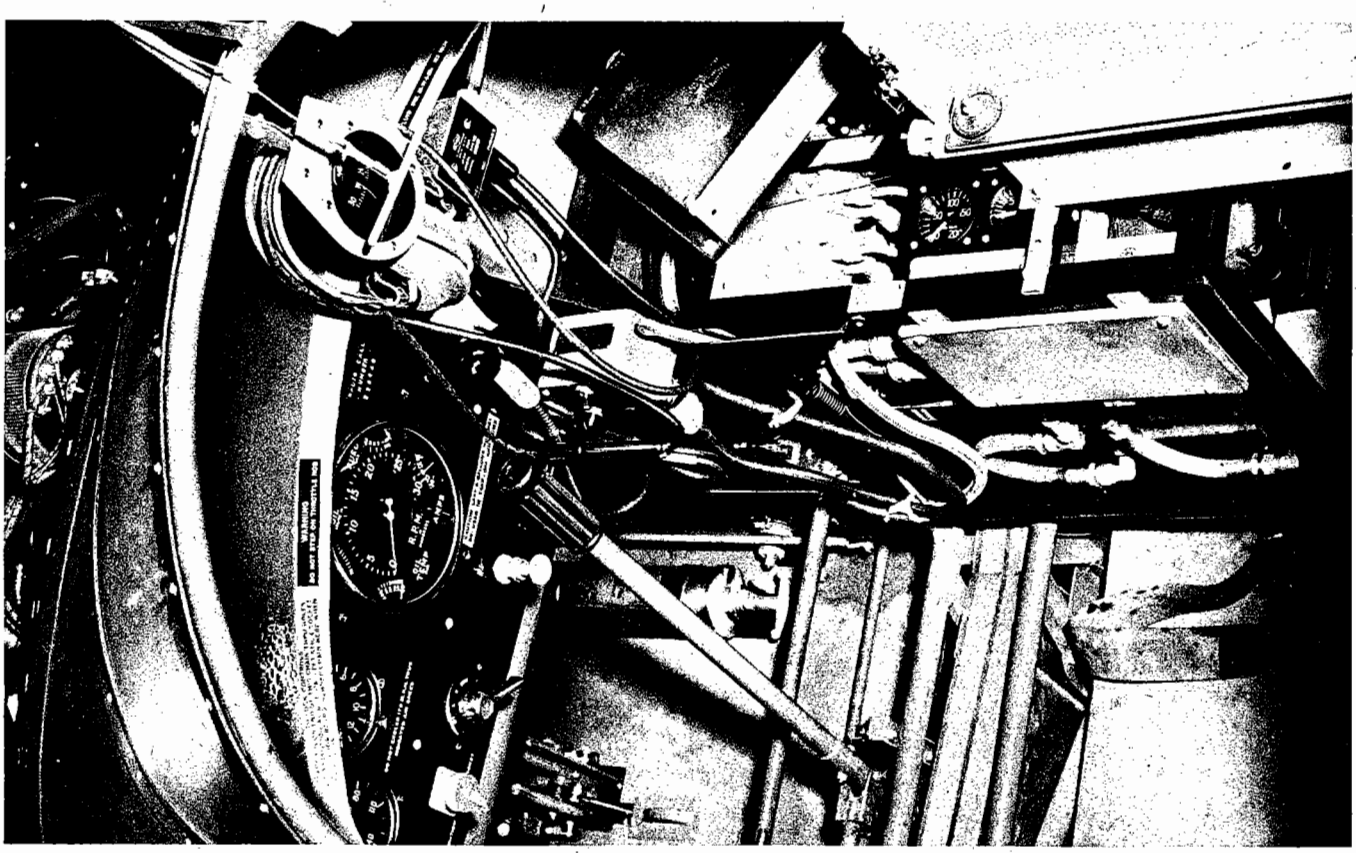


Figure 56—Pilot's Cockpit—PQ-8A

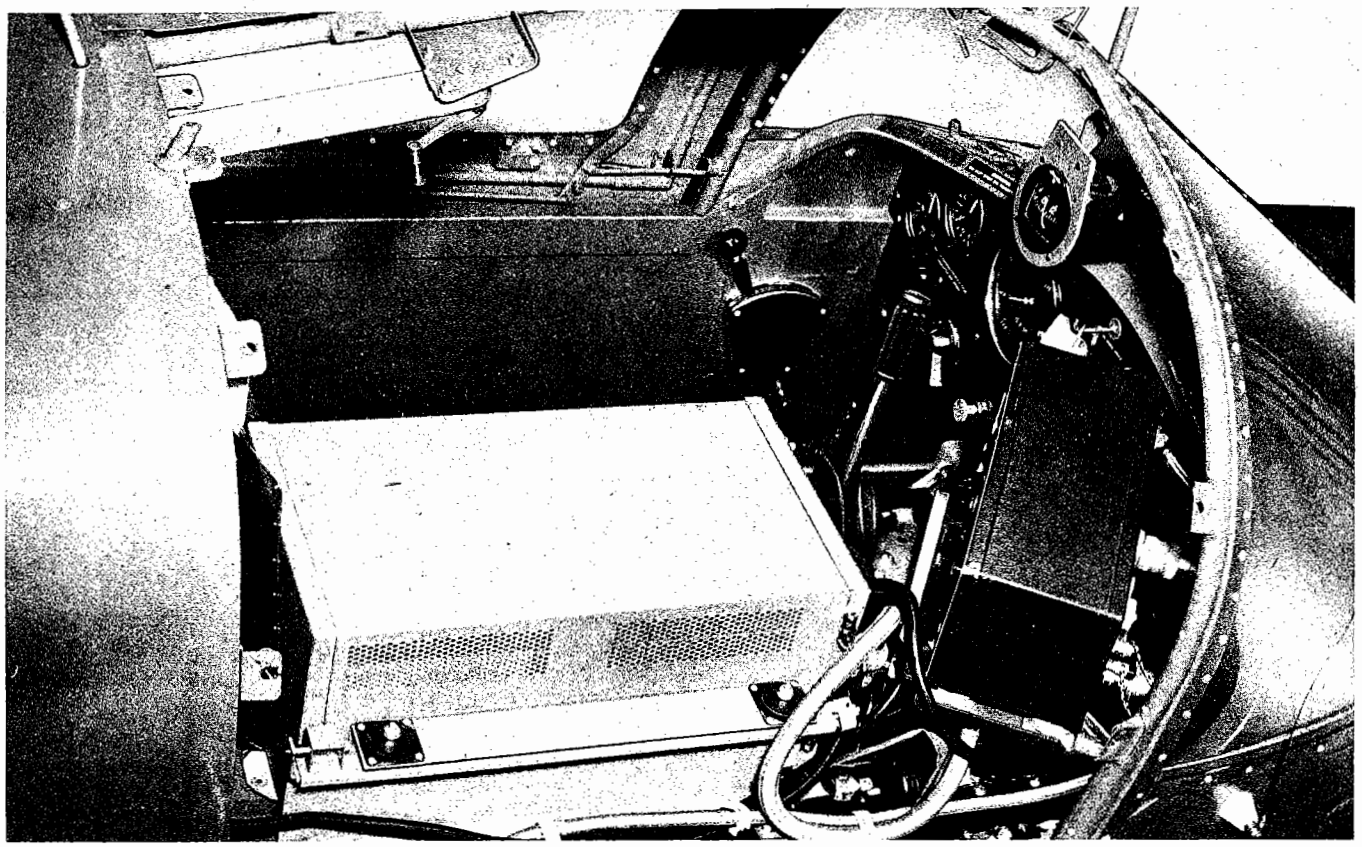


Figure 57—Left View Cockpit—PQ-8A

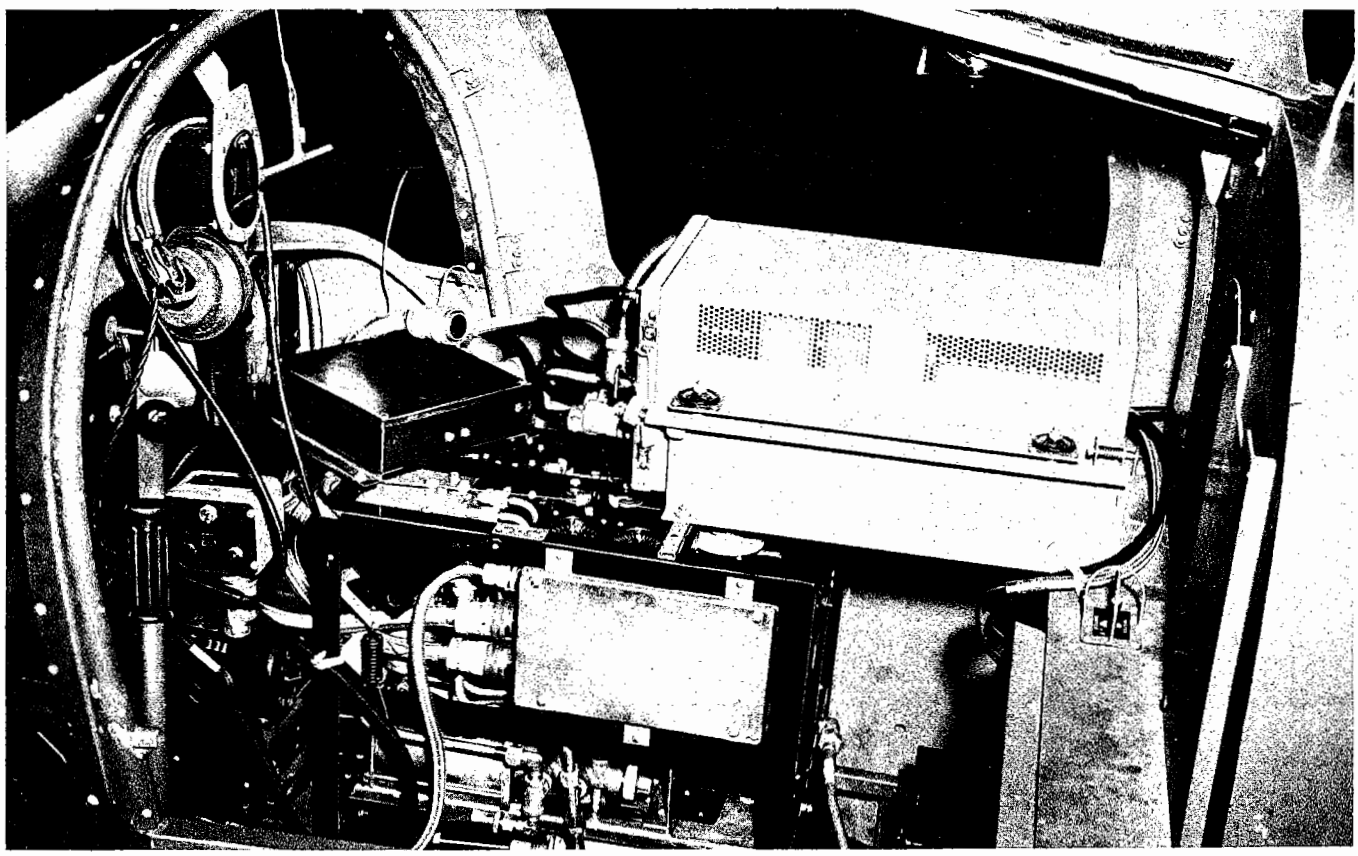


Figure 58—Right View of Cockpit—PQ-8A

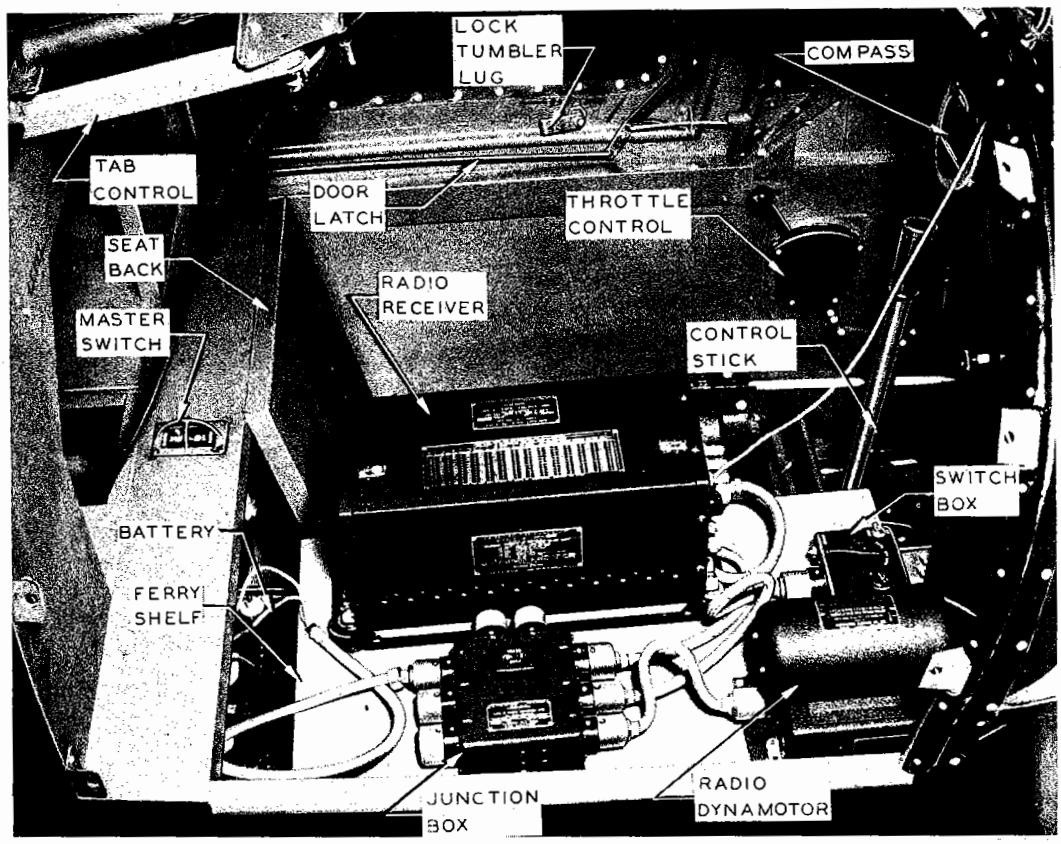


Figure 59—Left Side of Cockpit—TDC-2

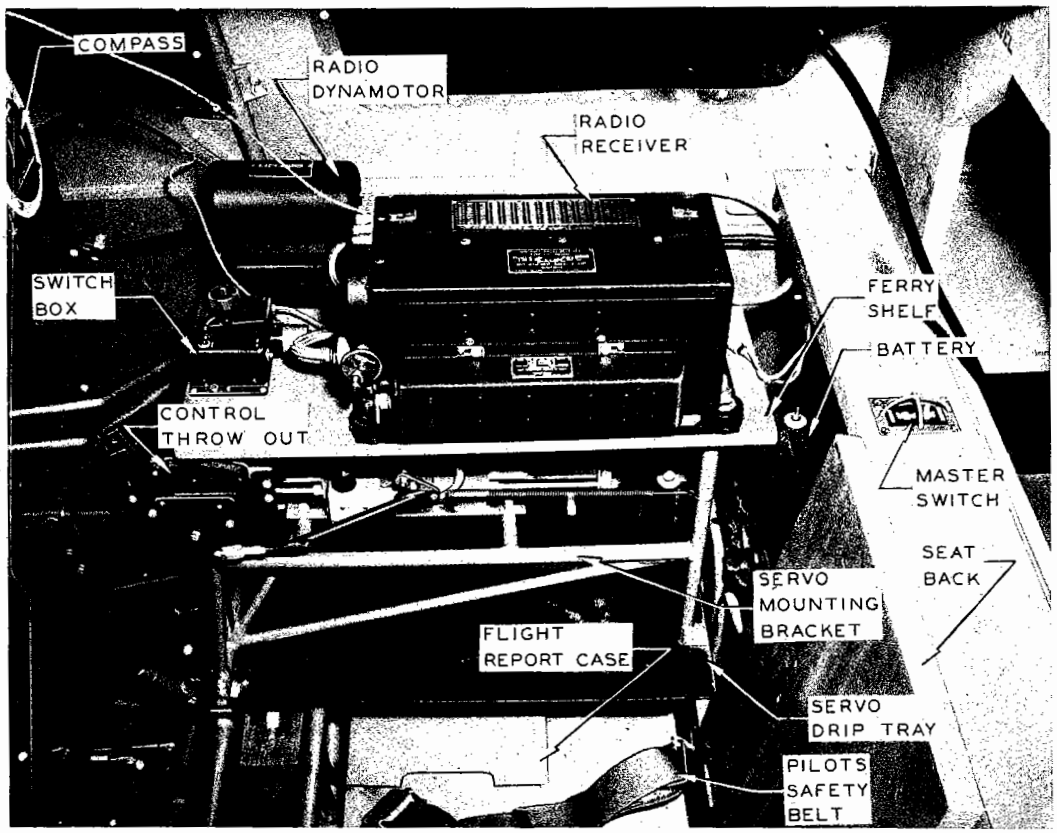


Figure 60—Right Side of Cockpit—TDC-2

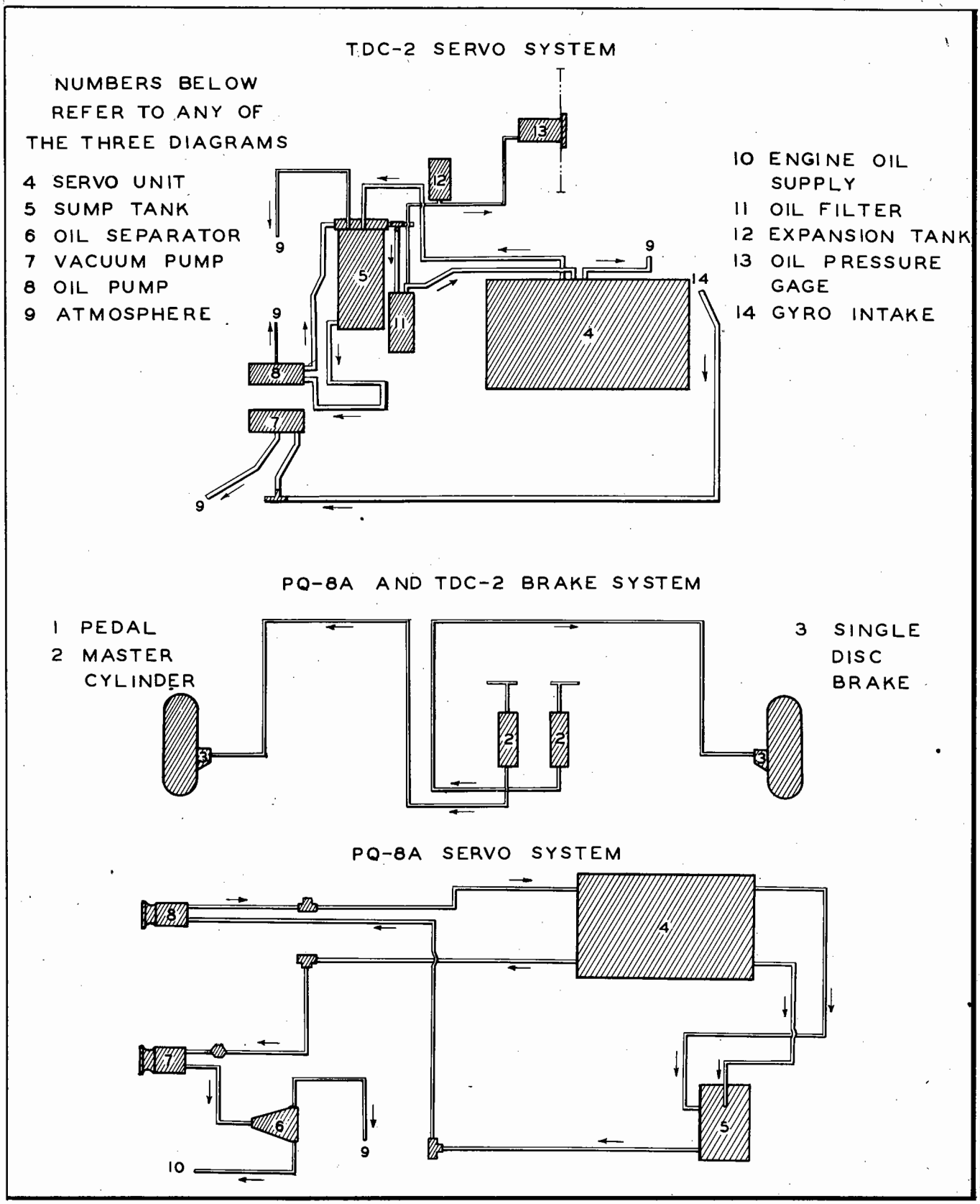


Figure 61—Hydraulic and Servo System

piston operates the elevator, No. 3 piston operates the brakes, and No. 4 piston operates the rudder and nose wheel. The throttle motor operates the throttle.

(e) The small lever located on the side of the unit operates the main oil valve which puts the servo unit in and out of operation.

(2) ANTENNA.

(a) GENERAL. — The antenna extends from wing tip to wing tip and is suspended from stub mast above the pilot's compartment. It is insulated on four points. The PQ-8A airplane is equipped for a whip antenna. No whip antenna is provided on the TDC-2.

(b) REMOVAL.—Remove the antenna wire tips and take out two screws to remove the stub mast. Undo all connections necessary to perform the particular removal operation.

(3) REMOVAL OF TDC-2 SERVO EQUIPMENT.

(a) RECEIVER UNIT (RADIO RECEIVING SET, FOR FERRYING PURPOSES ONLY).—Remove the four sheet metal screws from the ferrying shelf and servo unit. Disconnect the ground wire from the hatch frame on right side of plane. Remove the ground wire from the junction block. Remove the hot wire from the junction block. Disconnect the antenna wire which hooks to the receiver. Remove the ferry shelf. The dynamotor, switch box, junction box, radio receiver, coil set, and shock mount may be removed from the ferry shelf by slipping the slide fasteners and lifting them from the shelf.

(b) SERVO UNIT.—Remove the two connection lines located on the right side of the cabin enclosure. One line leads to the oil filter and the other to the sump tank. Remove the two bolts from the mounting tube and overpowering cylinder. Remove cotter keys that mount the overpowering cylinder in the fork. Loosen the lock nut that attaches the overpowering cylinder to the servo unit and unscrew the overpowering unit from the servo unit. Remove the aileron, elevator, and throttle cylinders in this way.

1. RUDDER SERVO CONTROL.—Remove the clevis pin that connects onto the rudder dummy pedals. Disconnect the wire that leads from the servo unit to the junction box. Loosen the lock nuts that attach the rudder servo unit, turn the arm to remove it from the servo unit.

2. AUTOMATIC AND MANUAL THROWOUT CONTROL.—Remove the clevis pin from the automatic and manual throwout and loosen the four bolts that hold the servo unit to the mounting base. Take out the four bolts that connect the manual and automatic control to the servo mounting frame.

3. SERVO MOUNTING BRACKET. — Disconnect control cables in the mounting base. Remove four bolts that hold the mounting base to the seat bulkhead and the interconnection truss. The servo mounting bracket and drip tray are then removed.

4. OIL FILTER.—Disconnect three lines that lead from the oil filter to the sump tank, servo unit, and the expansion tank. Remove the two bolts that hold the oil filter on the oil servo sump tank bracket. Disconnect the clamp bolt, expand the clamp, and remove the bracket.

5. SERVO SUMP TANK.—Disconnect oil-pressure line. Disconnect the outlet line, drain line, servo unit line, and intake line. Remove clamp bolts from servo sump tank brackets and expand brackets to remove tank. Also the clamps can be disconnected from the engine mount.

6. HYDRAULIC PUMP.—Remove the hydraulic pump if the plane is to be flown without the servo unit. The hydraulic pump is removed by taking out the four mounting bolts that mount it to the engine and a plate is installed in place of the pump.

(4) INSTALLATION OF TDC-2 SERVO EQUIPMENT.—The installation is accomplished by reversing the removal procedure. Be sure the oil lines and wires are hooked up correctly and make good connections in every case.

(5) REMOVAL OF PQ-8A SERVO EQUIPMENT.

(a) RADIO.—Remove the radio by taking out the four mounting bolts from the servo mounting rails and the shelf back of the pilot's seat. Remove three cables. One runs from the dynamotor to the receiver-selector. The dynamotor is in front of the servo unit. Another cable runs from the receiver-selector to the master switch. The master switch is found in the center of the shelf back of the pilot's seat. Another cable runs from the receiver-selector to the relay box. Disconnect the ground cable and aerial wire from the dynamotor. Remove the two panel fasteners from the front of the radio receiver.

(b) COMMUNICATION EQUIPMENT.—Disconnect three cables from the dynamotor to the master switch, radio, and relay unit. Disconnect the three cables from the junction box to the gyro, relay unit, and to the throttle motor.

(c) MOUNTING BASE.—Take out the four mounting bolts.

(d) DYNAMOTOR.—Pull out the spring fasteners and lift the front end of the dynamotor up and slip it forward. Be sure all wires are disconnected.

(e) OVERPOWERING CYLINDERS. — Remove the two bolts from the mounting arm and overpowering cylinder. Remove cotter keys that mount the overpowering cylinder to the servo unit and unscrew the overpowering unit from the servo unit.

(f) SERVO UNIT.—Disconnect the two front

lines that lead to the hydraulic pump. Disconnect the two lines from the back of the servo unit. They are the vacuum and drain lines. Both ends of these lines have to be disconnected. Remove the two Elastic stop nuts in front on the servo unit frame and the two bolts in back. Then the servo unit and also the drain pan can be taken out. To remove the servo sump, remove the inspection plate back of station 46 and take out the four bolts.

(g) THROTTLE MOTOR.—Remove the four mounting bolts and disconnect the control arm.

(6) INSTALLATION OF PQ-8A SERVO EQUIPMENT.—The installation is accomplished by reversing the removal procedure. Be sure the oil lines and wires are hooked up correctly and make good connections in every case.

SECTION V
COLD WEATHER MAINTENANCE

1. STORAGE BATTERY.

CAUTION

Never allow the specific gravity of the battery electrolyte to fall below 1.225 during cold weather operation. The battery charge decreases proportionately with the temperature, and freezing results quickly when the specific gravity is low.

2. PROTECTIVE COVERS.

Each airplane is provided with engine and propeller covers. Slip the propeller covers over the blades and tie at the hub. Then slip engine cover into place and fasten. The engine cover is equipped with a duct connection for use with a portable heater. (See figure 62.)

3. GENERAL.

Inspect all hinges, gaps, and moving parts to be sure no ice or mud has been lodged and frozen in them to prevent proper operation.

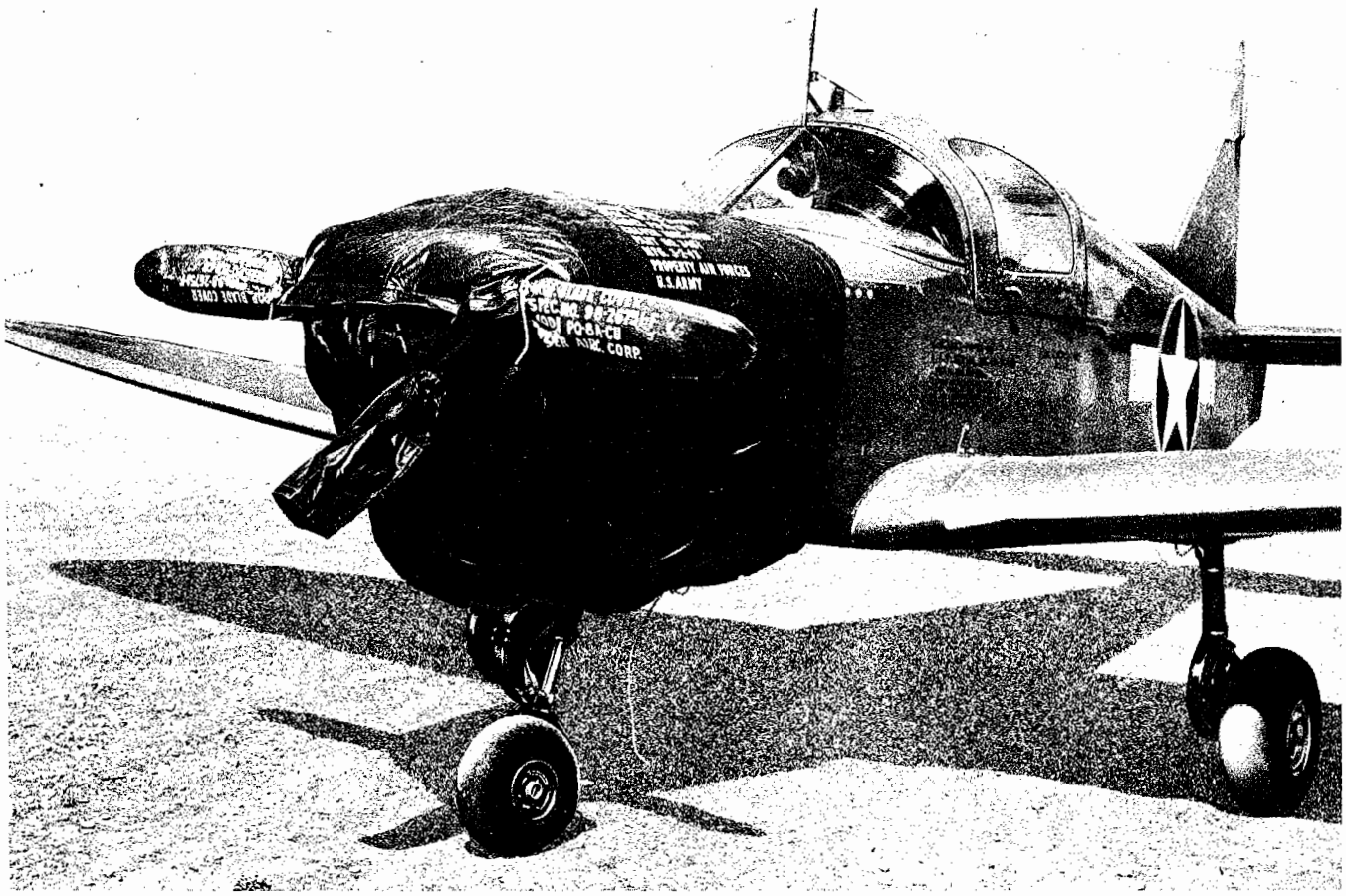


Figure 62—Protective Coverings

SECTION VI
MATERIALS OF CONSTRUCTION

1. METALS.

X4130—used in engine mount, interconnection truss, wing torque truss, miscellaneous structural brackets, and landing gear.

H/T Normal	Ultimate Stress	Yield Stress	Modulus Elasticity
150,000	90,000 to 95,000	70,000 to 75,000	29,000,000
180,000	150,000	135,000	29,000,000
	180,000	165,000	29,000,000

1010-1025—used in control surface ribs, miscellaneous nonstructural brackets.

1010	42,000	27,000	
1025	55,000 to 45,000	36.000	28,000,000

17 S.T.—used in landing gear.

17 S.T.	50,000 to 55,000	32,000	10,500,000

2. WOOD.

Plywood	*For*
Mahogany	Fuselage
Poplar	Spar
	Wing
Birch	Fuselage (only)

Straight Grain	*For*
Spruce	Longerons
	Laggings
	Uprights
	Stringers
Basswood	Laggings
Black Walnut	Bearing Blocks

SECTION VII
FINISH SPECIFICATIONS

1. FABRIC-COVERED SURFACES.

a. Brush on one coat of unthinned dope and let dry for about 30 minutes.

b. Brush on two coats of thinned dope and let dry about 15 minutes after each coat.

NOTE

Three coats of yellow are sprayed on the leading edge of the wing if it is being refinished.

c. "Thinner rub" the entire surface with a wet thinner rag.

d. Two cross-coats of insignia red are sprayed on.

e. If the wings are being finished the wing walks are glued on.

f. The decals and stenciled lettering are put on to complete the finishing.

2. EXTERIOR WOOD SURFACES.

a. Dip the surface in liquid wood sealer for 8 minutes and wipe the sealer off immediately after the 8 minutes. Let the sealer dry for 4 hours.

b. Dip again, wipe, and let dry 3 hours.

c. The surface is then sanded and washed with a rag dipped in thinner.

d. Apply a cross-coat of surfacer and let dry 3 or 4 hours.

e. Sand down to the wood and spray a cross-coat combination of one-half surfacer and one-half enamel. Let this coat dry 5 or 6 hours.

f. Scuff the surface off and wash with thinner.

g. Spray on one coat of synthetic enamel.

NOTE

The inside of the fuselage in front of station 46 is scraped and one coat of enamel is sprayed on.

3. METAL FINISH.

a. SANDBLASTING.

(1) GENERAL.—Sandblasting is a process of removing scale and other corrosion from metal objects by the abrasive action of a stream of fine sand particles directed by air pressure against the surface to be cleaned.

This process of cleaning is frequently used as a substitute for pickling with large steel parts but must not be used for small steel parts or those having thin sections; for springs, due to the danger of failure from sandblasting scratches; or for aluminum articles due to their comparative softness.

The proper sand to use for this process will pass through a No. 24 screen but not through a No. 40 screen; is at least 98 percent silica, and must be free of iron or steel particles and other foreign material.

Sandblasted parts should be given a final protective coating as quickly as possible after blasting, as steel in this condition will begin to corrode very quickly if neglected.

b. ZINC-CHROMATE PRIMER.

(1) GENERAL.—Painting may be used in the case of steel as the only corrosion protection on the material. Where paint is used the part is generally sandblasted first, then primed with zinc-chromate primer and painted with lacquer or synthetic enamel. Painting may be used on aluminum and magnesium parts after they have been given the protective treatment listed below, depending upon the degree of corrosion resistance required. For land planes it is, in general, not necessary to use any paint on aluminum parts after anodizing or alumiliting. It is difficult, if not impossible, to get satisfactory adherence between paint and cadmium plating on steel, and for this reason cadmium-plated parts are generally left bare or dipped in varnish.

(2) All wing torque trusses are zinc-chromate primed. The engine mount is primed and lacquered.

SECTION VIII—TUBING CHARTS

1. DESCRIPTION.

(See figures 63 to 68.)

a. Each tube assembly listed is identified with a cross-reference letter showing its location on the master tube system diagram.

NOTE

Tubing cut in lengths for replacement purposes shall be 10 percent longer than the actual length required. The extra length is for margin of bending and end fitting.

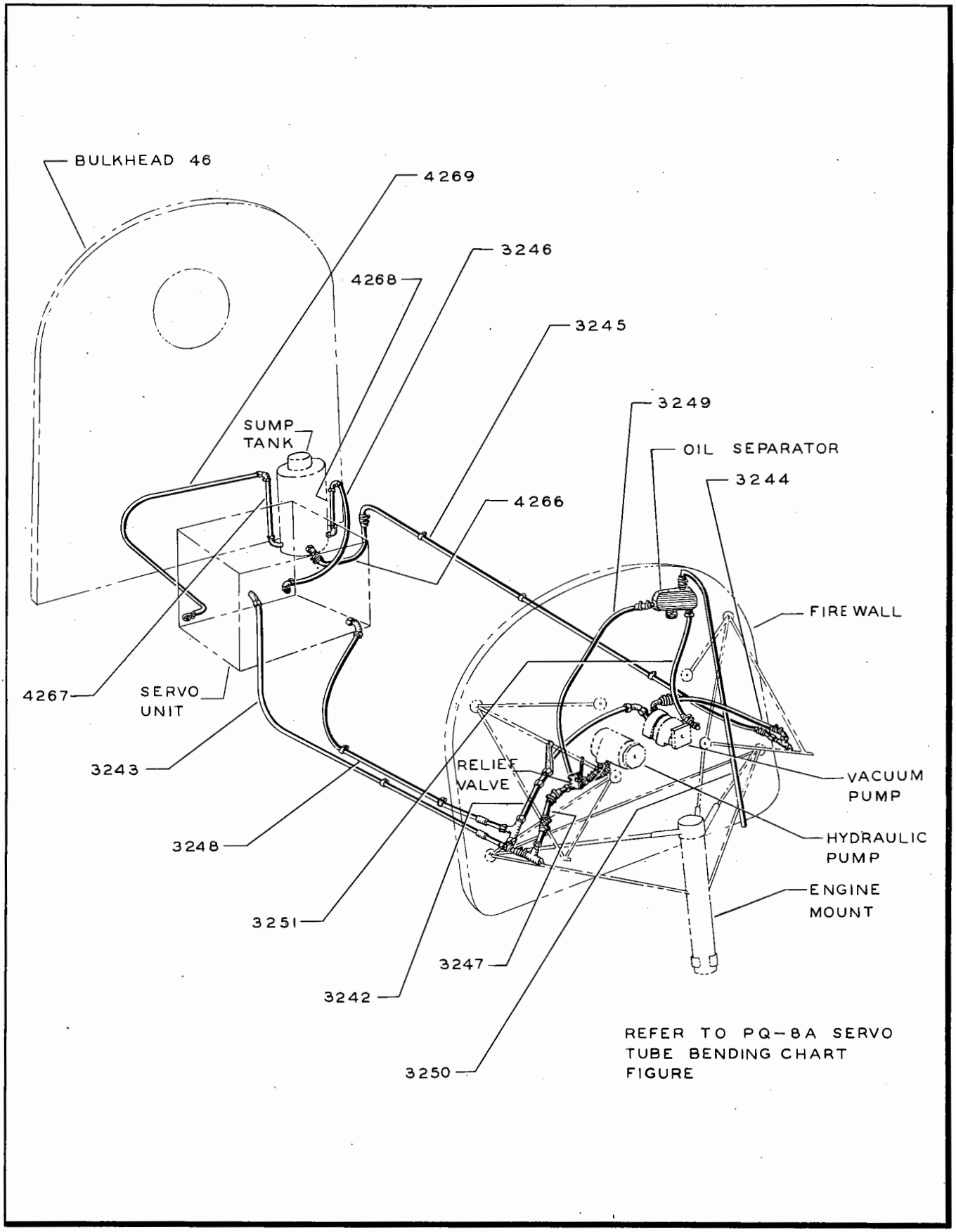


Figure 63—Servo Piping Diagram—PQ-8A

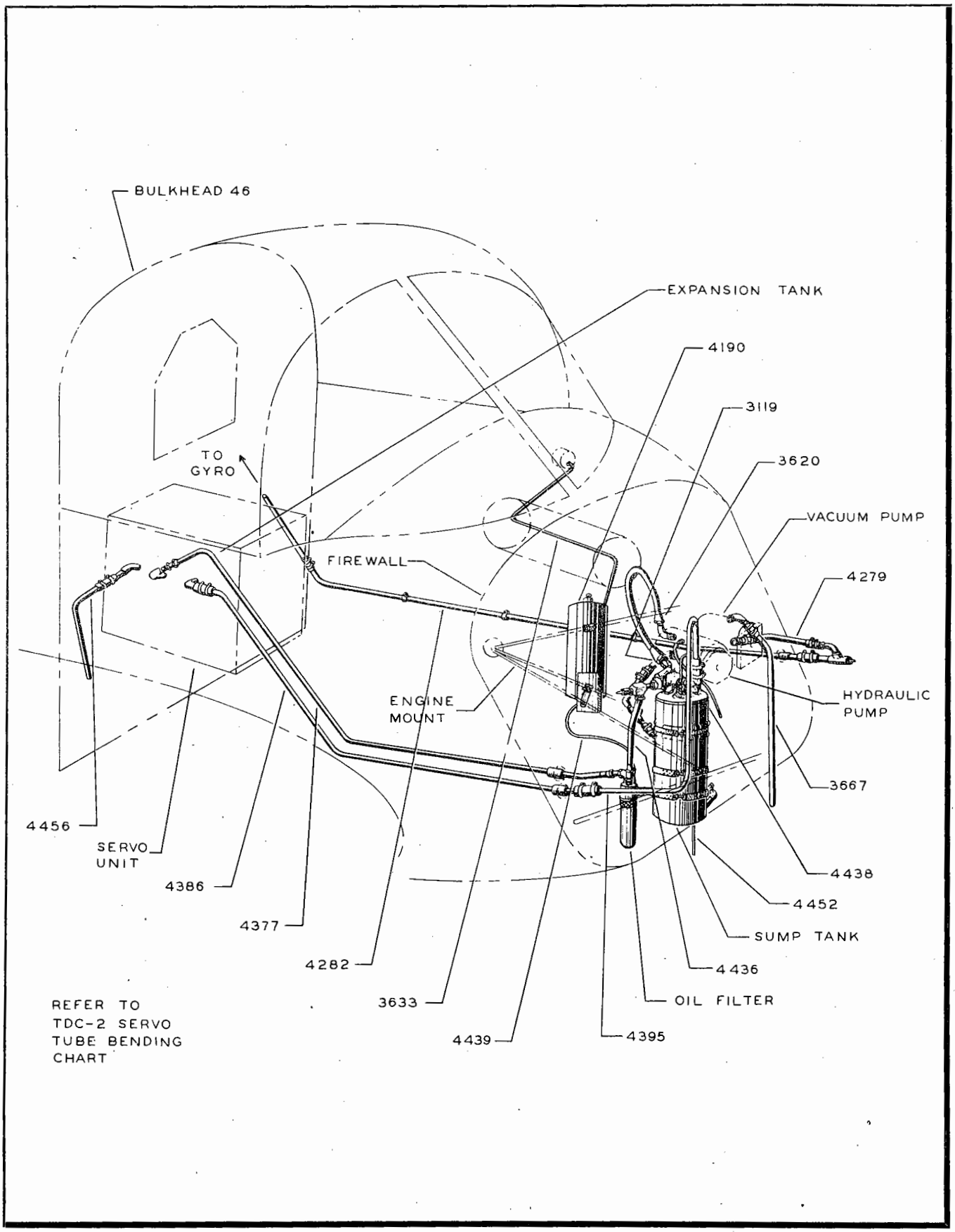


Figure 67—Servo Piping Diagram—TDC-2

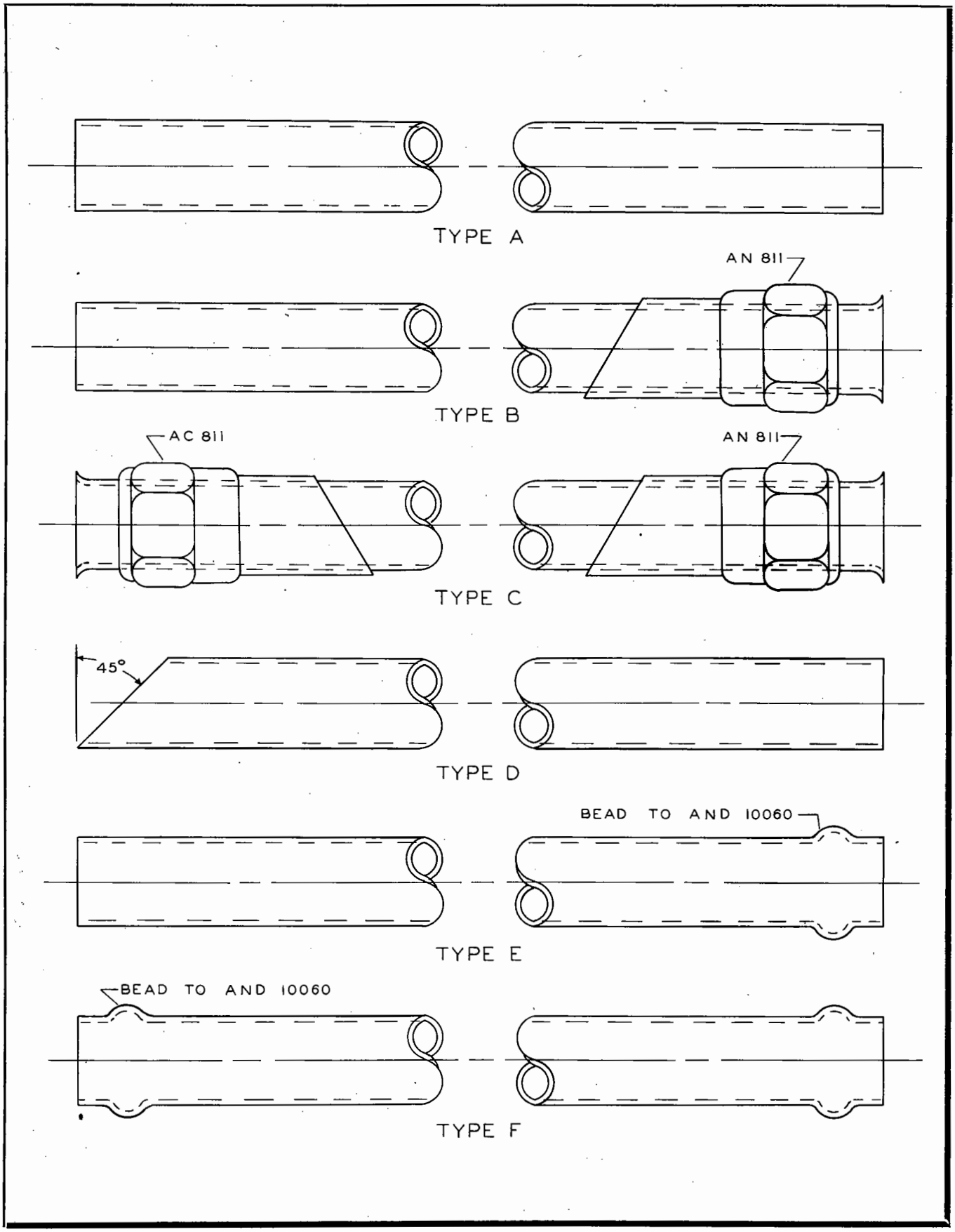


Figure 68—Tube Types

SECTION IX
CHARTS AND TABLES

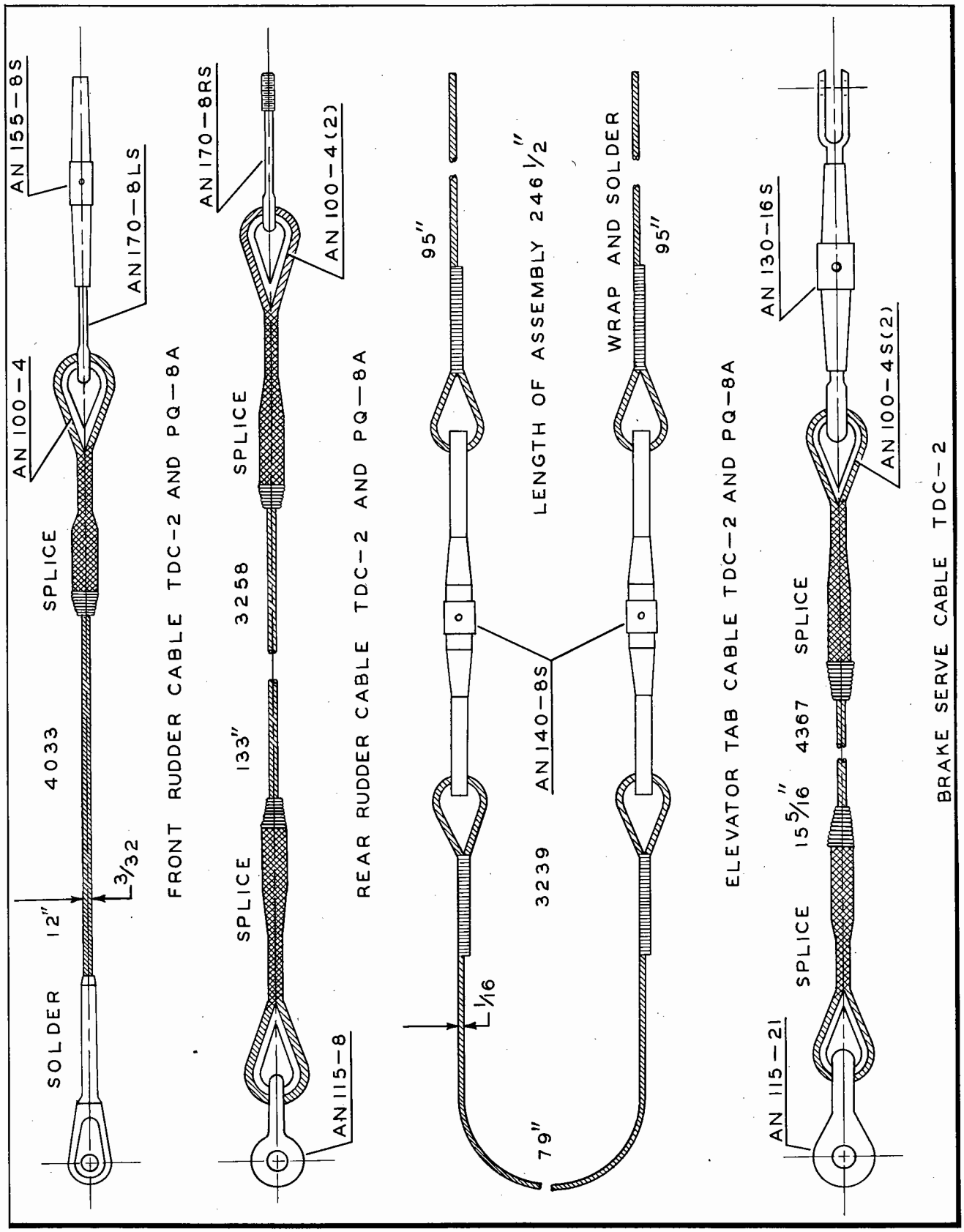


Figure 69—Flexible Cable Chart—TDC-2 and PQ-8A

SECTION X
SERVICE INSPECTION

PREFLIGHT

(To be performed prior to the first flight of the day.)

Col. 10

GENERAL

Examine the flight report. If it is incomplete, make the necessary entries to make it complete. Note whether routine inspections are due. If so, make them or if that is impossible, make the proper entries in the flight report to indicate the omission of such inspection.

AIRPLANE

Inspect all surfaces, wings, controls, fuselage, etc., for breaks or damage.

Check all flight controls for ease of operation. See that there is nothing in the cockpit to interfere with the proper operation of the controls. Set the trim tab in neutral.

Col. 10

Inspect the alighting gears for obvious signs of damage such as distorted rim flanges, torque links, springs and attachments, cuts and bruises on tires, and faulty shock strut packing. Check all nuts, bolts, and cotter pins carefully. Tires must be inflated to 25 pounds pressure.

Check operation of brakes, fill system, and bleed as required. (See section IV, paragraph 5. *a.* (7) *(f).*) (See figure 70.)

Clean windows and windshield. See that door latches and hinges operate properly. Check the emergency door release mechanism. See that all cowling, inspection plates, and covers are properly fastened and safetied and that no loose equip-

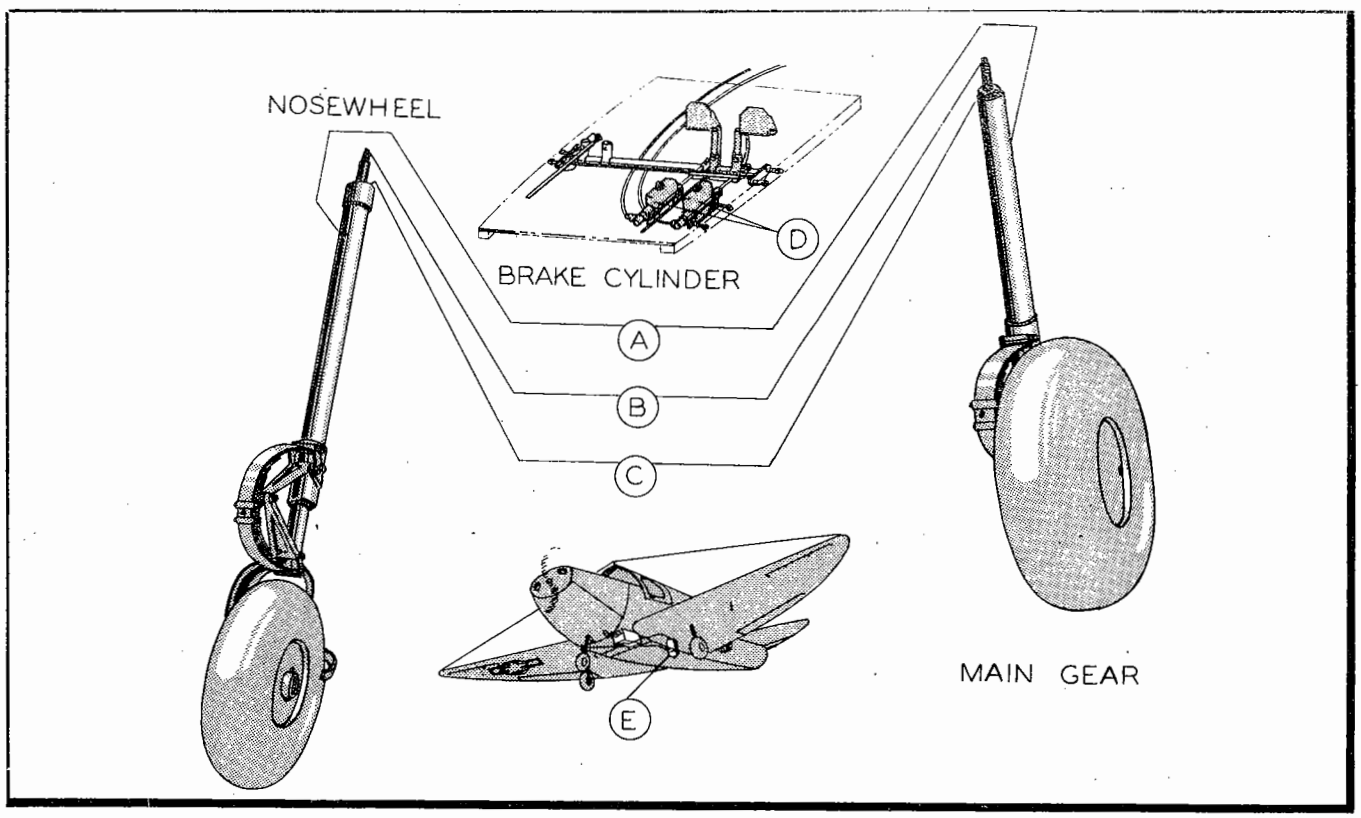


Figure 70—Hydraulic System Filling

Key to Figure 70

Letter	*Title*	*Spec. No.*	*Period*	*Check*
A	Oleo Oil Level			5 hrs.
B	Shock Absorber Filler	AN-VV-O-366	25 hrs.	
C	Swivel and Thrust Bearings	AAF Spec. 3560	100 hrs.	50 hrs.
D	Brake Master Cylinder	AN-VV-O-366	25 hrs.	
E	Fill Servo Sump Tank, Lift out seat back	AN-VV-O-366		5 hrs.

Col. 10 ment is left in the cockpit to interfere with operation of controls.

ENGINE

Check fuel and oil level and see that filler caps are secure. (See section III, paragraph 2. *g.* (1) *(a)* and *(b).*)

Check engine controls for free operation through full range of travel.

Inspect propeller for nicks and other damage.

Refer to the Pilot's Flight Operating Instruction Handbook for starting procedure.

Chock the wheels and start the engine to check the following:

Engine instruments.

Operation of each magneto individually.

Engine idling.

Immediately prior to flight, open the throttle and check rpm drop when switching from "BOTH" to either "RIGHT" or "LEFT" (should be equal and engine running smoothly on each magneto). Also check oil pressure and smooth operation of engine.

Engine should idle smoothly at 550 rpm with throttle closed after a short warm-up.

Check engine instruments for excessive oscillation and indications consistent with operating conditions. Clean all cover glasses with soft cloth.

Col. 10

PROPELLER

See that flange bolts on hub are tight and properly safetied.

Check all parts of the prop for nicks, cracks, and other evidence of failure.

If vibration is noted during warm-up or operation, check the tracks of each blade.

FLIGHT INSTRUMENTS

Check for loose cover glasses. Check and renew all markings on cover glasses indicating operating limits. Clean cover glasses with a soft cloth. Check compass fluid for discoloration and bubbles.

COMMUNICATIONS EQUIPMENT

Determine the general condition of radio equipment. Check mike, headphone cords, and attachments. Perform operation check.

SERVO HYDRAULIC EQUIPMENT

Check the fluid level in the reservoir. Fill as required with hydraulic fluid, Specification No. AN-VV-O-366.

The vacuum pump should deliver from 3.75 to 4.25 inches Hg at 1000 rpm.

AFTER FLIGHT INSPECTION

(To be performed after completion of 1 day's operation)

Col. 10 Raise the cowling to check for fuel and oil leaks and failures of engine mount attachments and exhaust manifolding.

Col. 10 Fill fuel tank, check oil level, and add oil as needed.

Check battery: add distilled water as needed. Recharge if necessary.

PERIODIC INSPECTIONS

Col. 20

25-HOUR INSPECTION

NOTE

Perform the checks listed under the preflight inspection procedure.

Engine Controls

Inspect entire engine control system for full movement without binding, bent controls, and loose and worn connections.

Clean and lubricate all moving parts.

See that all controls have sufficient friction to prevent creeping.

Col. 29

Power Plant

Check fuel system for evidence of leaks or clogged screens. Drain carburetor bowl.

Inspect all wiring for faulty insulation and security of connections.

Inspect exhaust manifold for looseness, corrosion, and cracks.

Check complete engine installation for loose bolts and locking devices.

Give particular attention to the mounting bolts and engine mount rubber mounting bushings.

Col. 33

Control Surfaces and Control System

Inspect all surface controls giving special attention to hinge fittings and bearings, control horn attachments, and safetying of bolts.

Inspect control system giving special attention to rudder control cables and pulleys. Remove cable from pulleys and check for broken strands. Renew rust-preventive coating as needed. Inspect pulleys for cracks and replace as needed.

Inspect aileron and elevator push-pull control tubes carefully for worn bearings, bent tubes, and loose brackets.

Inspect tab control system. Look for frayed cable at the drum unit in the elevator and at the cockpit control. Check the tab unit in the elevator for worn parts and mounting.

All controls must operate smoothly and freely through their ranges of travel with no lost motion or "slopping" of controls.

Col. 37

Alighting Gear

To check fluid level in shock strut, jack entire airplane as directed in section III, paragraph 2. *c.* Uncouple spring and extend shock strut fully. (Spring should pull strut to extended position unless it has been deformed, in which case it should be replaced.) Unscrew filler cap and check hole plug. Fill strut until oil begins to run out at check hole using oil, Specification No. AN-VV-O-366.

Check fluid level, Specification No. AN-VV-O-366, in brake system. Adjust brake liner clearances so that wheels spin freely with brakes in "off" position. Bleed brakes if necessary as directed in section IV, paragraph 4.*a.*(7)*(g)*.

Check nose wheel steering linkage for worn hinge bolts, loose brackets, and bent members.

Col. 40

Fuselage

Inspect safety belt and buckle. If belt has not been tested in previous 6-month period, remove and test it or install a properly tested belt in its place.

Check and lubricate door latch and emergency release mechanism.

Inspect windshield and windows for scratches and cracks. Remove scratches by polishing lightly with rubbing compound or replace panel if badly cracked.

Check all brackets and attachments to see that none have vibrated loose.

Check the fire extinguisher to see that it is properly filled.

Col. 46

Battery

Add distilled water and recharge if necessary. Check cable at terminals: tighten if necessary and remove any evidence of corrosion.

50-HOUR INSPECTION

Col. 29

Power Plant

Proceed as with 25-hour check.

Give special attention to cylinder base and crankcase bolts.

Repair and replace damaged baffling.

Col. 37

Alighting Gear

Proceed as with 25-hour check.

Tighten packing gland nut until piston begins to bind or if this is impossible, replace packing rings.

Col. 43

Airplane

Complete all checks as directed for preflight and 25-hour checks.

Inspect wing structure giving special attention to wing fittings for security of attachment, elongated bolt holes, and split or cracked spars at fittings.

Inspect fuselage for cracked longerons, pulled fittings, loose bolts, brackets, engine mount attachments, condition of skin, finish, and protective coating on metal fittings.

Inspect stabilizer and fin attachments to fuselage.

Col. 44

Navigation Instruments

Compensate compass if necessary.

Inspect all lines and leads to instruments for kinks, security of attachment, and condition of insulation.

100-HOUR INSPECTION

Proceed as with 50-hour inspection for airplane.

Col. 29

Power Plant

Check all items listed under 50-hour check.

Wash engine down with noninflammable solvent. Clean and adjust spark plugs.

Remove magneto breaker cover, clean breaker parts of excess oil, adjust breaker clearances.

CAUTION

Inspect cam and breaker cup for excessive oil. Felt should contain just enough lubricant so that oil appears when felt is squeezed.

Check engine mount carefully for cracks.

GLOSSARY OF NOMENCLATURE—U.S.A.-BRITISH

U.S.A.	*British*
Airfoil	Aerofoil
Airplane	Aeroplane
Angle of incidence	Angle of wing setting
Angle of stabilizer setting	Tail-setting angle
Antenna	Aerial
Axis, vertical	Normal axis
Bar, suspension	Trapeze bar
Battery, storage	Accumulator
Bearing, antifriction	Ball bearing or roller bearing
Cam	Cam or snail
Camber, mean	Center line camber
Carburetor	Carburettor or Carburetter
Chord	Chord line
Clevis	Fork joint, knuckle joint end
Controls	Flying controls
Cylinder, hydraulic	Hydraulic jack
Duct, air	Interconnecting sleeve or trousers
Empennage	Tail unit
Engine	Aero-engine
Engine section	Power plant or power egg
Exit	Egress
Filter, air	Air cleaner
Fuel gage	Fuel contents gage or fuel level indicator
Fuel	Petrol or fuel
Gasket	Joint, washer, or gasket
Gasoline	Petrol
Gear, alighting	Alighting gear, undercarriage or chassis
Generator	Dynamo
Head, air-speed	Pressure head
Inverter	Motor generator
Lean mixture	Weak mixture
Left	Port
Mast, radio	Rod Aerial
Nut, spanner	Ring nut
Pan, oil	Crankcase sump
Pin, cotter	Split pin
Pin, knuckle	Wrist pin or anchor pin
Pin, wrist	Gudgeon pin
Plug, spark	Sparking plug
Pressure, manifold	Boost pressure or boost
Prime	Prime or dope
Right	Starboard
Rings, mooring	Picketing rings
Screw, cap	Set screw
Screw, flathead	Countersunk head screw
Seal, valve	Jam pot cover
Setscrew or headless setscrew	Grub screw
Spanner	C-spanner
Stabilizer	
horizontal	Tail plane
vertical	Fin
Stack	Pipe
Tube	Valve
Wall, fire	Fireproof bulkhead
Washer, lock	Spring washer
Window, inspection	Inspection port
Windshield	Windscreen
Wing	Main plane
Wrench, socket	Box spanner

ALPHABETICAL INDEX

(* Denotes Illustration)

ADDITIONAL COPIES of this publication may be secured on requisition, AAF Form 102, as prescribed in AAF Regulations 15-102. Submit requisition to: Commanding General, Air Service Command, Patterson Field, Fairfield, Ohio. Also, see T. O. No. 00-25-3 for details on distribution of Technical Orders. (Requests from Naval activities shall be submitted to: Chief of the Bureau of Aeronautics, Navy Department, Washington, D. C.)

NAME	PART NO.	NO. REQ. PER ASS'Y	NO. REQ. PER AIR-PLANE	NEXT ASS'Y	MATERIAL	MATERIAL FEDERAL SPEC.	SIZE O.D.	SIZE GAGE	SIZE TUBE TRUE LENGTH	FIRST FITTINGS	BEND NO. 1 DISTANCE FROM END TO BEND 1	BEND NO. 1 R.	BEND NO. 1 BEND R. OR L. IN DEG.	BEND NO. 2 DISTANCE BETWEEN BEND 1 & 2	BEND NO. 2 ROTATION R. OR L. IN DEG.	BEND NO. 2 R.	BEND NO. 2 BEND R. OR L. IN DEG.	BEND NO. 3 DISTANCE BETWEEN BEND 2 & 3	BEND NO. 3 ROTATION R. OR L. IN DEG.	BEND NO. 3 R.	BEND NO. 3 BEND R. OR L. IN DEG.	BEND NO. 4 DISTANCE BETWEEN BEND 3 & 4	BEND NO. 4 ROTATION R. OR L. IN DEG.	BEND NO. 4 R.	BEND NO. 4 BEND R. OR L. IN DEG.	DISTANCE FROM LAST BEND TO END	SECOND FITTINGS	ACT. WT.	COLOR CODE	TUBE TYPE	REMARKS
HYDRAULIC PUMP TO SERVO LINE	3243	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	28 1/4	AC 811 BT-8D AC 811 T-8D	5 3/4	1 1/4	L. 43°													2 1 9/16		4 OZ.	LT. BLUE YELLOW LT. BLUE	B	
HYDRAULIC PUMP CONNECTION	3244	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	10		3	1 1/4	L. 35°													6 15/64		6 OZ.		A	
SERVO PUMP RETURN LINE	3245	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	63 11/32		5 3/4	1 1/4	L. 90°													55 5/8	AC 811 BT-5D AC 811 T-5D	6 OZ.	LT. BLUE YELLOW LT. BLUE	A	
SERVO REAR CONNECTION	3246	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	5/16	.035	13 1/2	AC 811 BT-5D AC 811 T-5D	2 1/2	1 1/4	L. 35°	0	L. 90°	1 1/4	L. 30°	6 47/64	0	1 1/4	L. 25°					2 61/64	AC 811 BT-8D AC 811 T-8D	1 1/2 OZ.	WHITE LT. GREEN	C	
VACUUM LINE REDUCER	3247	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2 5/8	.032	1 5/8 1 1/4																		1 OZ.	WHITE LT. GREEN	E E	WELDED ASSEMBLY
SERVO VACUUM LINE	3248	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	40 15/64		30 1/8	1 1/4	L. 85°													8 1/4		6 OZ.		B	
VACUUM PUMP TO OIL SEPARATOR LINE	3249	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	5/8	.035	27 15/64		4 7/8	1 1/2	L. 83 1/2°	10 1/8	L. 90°	1 1/2	L. 26°	0	R. 90°	1 1/2	R. 12°	5 1/16	L. 90°	1 1/2	L. 88°	2		3 OZ.		A	
OIL SEPARATOR BREATHER	3250	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	5/8	.035	30 1/16 1 7/16		27 3/4	1 1/2	L. 75°															4 OZ.		D D	WELDED ASSEMBLY
OIL SEPARATOR TO ENGINE LINE	3251	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	13 1/16		2	1 1/4	R. 55°	7	L. 90°	1 1/4	L. 40°									2		1 OZ.	YELLOW	A	
SUMP TANK HYDRAULIC LINE CONNECTOR	4266	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	9 1/2		3 3/4	1 1/4	L. 65°													4 11/32		1 OZ.		A	
SUMP TANK CONNECTION	4267	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	7 1/2	AC 811 BT-8D AC 811 T-8D																	AC 811 BT-8D AC 611 T-8D	2 OZ.		C	
SUMP TANK CONNECTION	4268	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	5/16	.035	6	AC 811 BT-5D AC 811 T-5D																	AC 811 BT-5D AC 811 T-5D	1 OZ.		C	
SERVO REAR CONNECTION	4269	1	1	3241	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	WW-T-787	1/2	.035	15 3/8	AC 811 BT-8D AC 811 T-8D	3	1 1/4	L. 25°													11 53/64	AC 811 BT-8D AC 811 T-8D	4 OZ.		C	

Figure 64—Servo Piping Tube Bending Chart—PQ-8A

NAME	PART	NO. REQ. PER ASS'Y	NO. REQ. PER AIR-PLANE	NEXT ASS'Y	MATERIAL	MATERIAL SPEC.	SIZE O.D.	SIZE GAGE	SIZE TUBE TRUE LENGTH	FIRST FITTINGS	BEND NO. 1 DISTANCE FROM END TO BEND 1	BEND NO. 1 R.	BEND NO. 1 BEND R. OR L. IN DEG.	BEND NO. 2 DISTANCE BETWEEN BEND 1 & 2	BEND NO. 2 ROTATION R. OR L. IN DEG.	BEND NO. 2 R.	BEND NO. 2 BEND R. OR L. IN DEG.	BEND NO. 3 DISTANCE BETWEEN BEND 2 & 3	BEND NO. 3 ROTATION R. OR L. IN DEG.	BEND NO. 3 R.	BEND NO. 3 BEND R. OR L. IN DEG.	BEND NO. 4 DISTANCE BETWEEN BEND 3 & 4	BEND NO. 4 ROTATION R. OR L. IN DEG.	BEND NO. 4 R.	BEND NO. 4 BEND R. OR L. IN DEG.	DISTANCE FROM LAST BEND TO END	SECOND FITTINGS	ACT. WT.	COLOR CODE	TUBE TYPE	REMARKS
CHECK VALVE TO HOSE LINE	3119	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	3 1/2	AC 811 BT-8D AC 811 T-8D																	AC 811-BT-8D AC 811-T-8D	1 1/2 OZ.	LT. BLUE YELLOW LT. BLUE	C	
SUMP TANK TO HYDRAULIC PUMP LINE	3620	1	1	3684	52S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	5 5/8																			1 OZ.		E	
SURGE TANK TO PRESSURE GAGE LINE	3833	1	1	3684	COPPER TUBING	A.A.F SPEC. 10235	1/8 1/4	.035	44 3/4 2	4539																	AC 811T-4CS AC 811BT-4D	3 OZ.		A D	BEND TO SHAPE UPON ASSEMBLY
VACUUM PUMP DISCHARGE LINE	3667	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	5/8	.035	13		4	1 1/2	R. 20°													8 9/16		2 1/2 OZ.	LT. BLUE LT. GREEN	E	
STATION 40 TO GYRO LINE	4190	1	1	3684	52S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	32		19	1 1/4	L. 60°													11 11/16		6 OZ.	WHITE LT. GREEN	E	
FIREWALL TO VACUUM PUMP LINE	4279	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	6 1/8																			1 OZ.	WHITE LT. GREEN	F	
FIREWALL TO STATION 40 VACUUM LINE	4282	1	1	3684	52S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	46 15/64		36 1/8	1 1/4	L. 85°													8 1/4		6 1/2 OZ.	WHITE LT. GREEN	F	
OIL FILTER SERVO LINE	4377	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	42 13/16		3 3/8	1 1/4	R. 16 1/2°	21 1/8	R. 52 1/2°	1 1/4	L. 38°	7 7/8	L. 77°	1 1/4	R. 14°	4 7/8	0	1 1/4	R. 78°	2 3/8	AC 811 T-8D AC 811 BT-8D	5 1/2 OZ.	LT. BLUE YELLOW LT. BLUE	C	
FORWARD SERVO TO SUMP TANK LINE	4385	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	28 3/4		6 3/4	1 1/4	R. 90°	12 5/8	L. 57°	1 1/4	L. 90°	1 7/8	0	1 1/4	L. 90°					1 5/8		3 OZ.	LT. BLUE YELLOW LT. BLUE	F	
REAR SERVO SUMP TANK LINE	4386	1	1	3684	52S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	33 1/2		23 1/8	1 1/4	L. 27°	6 11/16	L. 90°	1 1/4	R. 22°	2 1/8	0	1 1/4	R. 22°	0	L. 90°	1 1/4	R. 7 1/2°	2 1/2		4 OZ.	LT. BLUE YELLOW LT. BLUE	F	
CHECK VALVE TO OIL FILTER LINE	4436	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	7 3/4	AC 811 BT-8D AC 811 T-8D	4 7/8	1 1/4	R. 12°													2 3/4	AC 611 BT-8D AC 811 T-8D	2 OZ.	LT. BLUE YELLOW LT. BLUE	C	
HYDRAULIC PUMP VENT LINE	4438	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	14 1/4		11 13/16	1 1/8	R. 39°													2	AC 811 BT-8D AC 811 T-8D	1 OZ.	RED BLACK	B	
OIL FILTER TO SURGE TANK LINE	4439	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/4	.035	14	AC 811 BT-4D AC 811 T-4D	2 25/32	2 1/8	R. 60°	4	R. 90°	2 1/8	R. 90°									1 43/64	AC 811 BT-4D AC 811 T-4D	1 1/2 OZ.	LT. BLUE YELLOW LT. BLUE	C	
SUMP TANK VENT LINE	4452	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/4	.035	29 27/64	AC 811 BT-4D AC 811 T-4D	1 1/2	1 1/8	L. 90°	2 1/2	0	1 1/8	L. 90°	10 3/8	0	1 1/8	R. 14°	9 1/4	0	1 1/8	L. 22°	1 1/2		1 1/2 OZ.	RED BLACK	B	
SERVO VENT LINE	4456	1	1	3684	52S-0, 2S-0 OR 3S-0 ALUM. TUBING	FED. SPEC. WW-T-787	1/2	.035	6 55/84		3 1/4	1 1/4	R. 85°													1 3/4		1 1/2 OZ.	RED BLACK	A	

Figure 65—Servo Piping Tube Bending Chart—TDC-2

NAME	PART NO.	NO. REQ. PER ASS'Y	NO. REQ. PER AIRPLANE	NEXT ASS'Y	MATERIAL	A.A.F. MATERIAL SPEC.	SIZE O.D.	SIZE GAGE	SIZE TUBE TRUE LENGTH	BEND NO. 1 DISTANCE FROM END TO BEND 1	BEND NO. 1 R.	BEND NO. 1 BEND R. OR L. IN DEG.	BEND NO. 2 DISTANCE BETWEEN BEND 1 & 2	BEND NO. 2 ROTATION R. OR L. IN DEG.	BEND NO. 2 R.	BEND NO. 2 BEND R. OR L. IN DEG.	BEND NO. 3 DISTANCE BETWEEN BEND 2 & 3	BEND NO. 3 ROTATION R. OR L. IN DEG.	BEND NO. 3 R.	BEND NO. 3 BEND R. OR L. IN DEG.	FITTINGS	ACT. WEIGHT	TUBE TYPE	REMARKS
RIMER LINE	3475-1	1	1	3291	ANNEALED COPPER	10235	1/8	.035	56													3 OZ.	A	
RIMER LINE	3475-2	1	1	3291	ANNEALED COPPER	10235	1/8	.035	55													3 OZ.	A	FOR AIRPLANES EQUIPPED WITH SHAKESPEARE PRIMER, LINE IS COMPLETE AS SHOWN. FOR AIRPLANES EQUIPPED WITH LUNKENHEIMER PRIMERS REFER TO 3560 FOR FITTINGS REQUIRED.
RIMER LINE	3475-3	1	1	3291	ANNEALED COPPER	10235	1/8	.035	12													1 OZ.	A	
RIMER LINE	3475-4	1	1	3291	ANNEALED COPPER	10235	1/8	.035	8													1 OZ.	A	
UEL DRAIN LINE	3476	1	1	4155	ANNEALED COPPER	10235	3/8	.035	14													3 OZ.	A	
ARBURETOR INTAKE INE	3477	1	1	3291	ANNEALED COPPER	10235	1/2	.035	3 1/2													1 OZ.	A	
UEL INTAKE LINE	3478	1	1	3291	COPPER	10235	1	.035	17 3/4	6 1/2	1 1/4	L. 21 3/4°	6 3/4	L. 90°	1 1/4	R. 9 1/2°	0	R. 90°	1 1/4	R. 9 1/2°		5 OZ.	A	
RIMER OUTLET TUBE	3500	1	1	3291	ANNEALED COPPER	10235			55 11/32												AN-800-2 AN-805-2	3 OZ.	A	SOLDER OR SWEAT FITTINGS TO END OF TUBE.

Figure 66—Fuel System Tube Bending Chart—PQ-8A and TDC-2